

Voice Assistant Service (VAS)

Bluetooth® Test Suite

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1 Scope

This Bluetooth document contains the Test Suite Structure (TSS) and test cases to test the implementation of the Bluetooth Voice Assistant 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] Voice Assistant Service Specification, Version 1.0
- [4] ICS Proforma for Voice Assistant Service
- [5] Characteristic and Descriptor descriptions are accessible via the [Bluetooth SIG Assigned Numbers](#)
- [6] GATT Test Suite, GATT.TS
- [7] Document Naming and Marking Document

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 Overview

The Voice Assistant Service specification [3] requires the presence of GAP, SM, L2CAP, and GATT. This is illustrated in Figure 3.1.

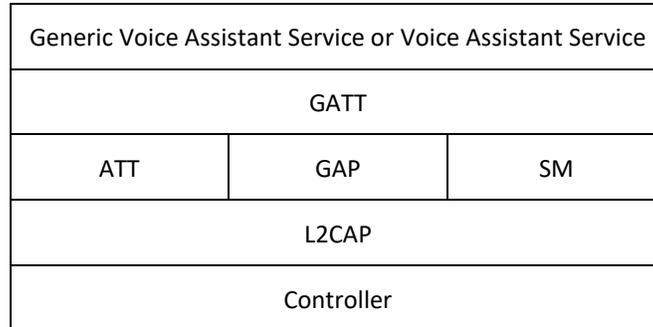


Figure 3.1: Voice Assistant Service test model

3.2 Test Strategy

The test objectives are to verify the functionality of the Voice Assistant 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 catalogued specification requirements that were logically grouped and assessed for testability enabling coverage in defined test purposes.

The Voice Assistant Service specification defines two services—Generic Voice Assistant Service (GVAS) and Voice Assistant Service (VAS)—and declares any requirements and descriptions for VAS in the specification also apply to GVAS unless explicitly stated otherwise. As a result, this Test Suite contains separate tests for both GVAS and VAS. GVAS is the representation of the IUT's default Voice Assistant while VAS would represent any other Voice Assistants on the IUT.

3.3 Test groups

The following test groups have been defined:

- Generic GATT Integrated Tests
- VAS/GVAS Characteristic Operations
- Voice Assistant Session Operations
- Service Procedure 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 [6] 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>
GVAS	Generic Voice Assistant Service
VAS	Voice Assistant Service
Identifier Abbreviation	Role Identifier <IUT role>
SR	Server
Identifier Abbreviation	Reference Identifier <GGIT test group>
SGGIT	Server Generic GATT Integrated Tests
Identifier Abbreviation	Reference Identifier <GGIT class>
CHA	Characteristic
SER	Service
Identifier Abbreviation	Features and Behaviors Identifier <feat>
SPE	Service Procedure Error Handling
VASO	Voice Assistant Session Operations
VCO	VAS/GVAS Characteristic Operations

Table 4.1: VAS TC feature naming conventions

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 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 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, then the outcome of the test is a Fail verdict.

4.2 Setup preambles

The procedures defined in this section are used to achieve specific conditions on the IUT and the test equipment within the tests defined in this document. The preambles here are commonly used to establish initial conditions.

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.
 3. Establish an encrypted connection between the IUT and the Lower Tester.

4.2.2 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 L2CAP channel (for ATT bearers) with EATT PSM (as defined in Assigned Numbers) between the IUT and the Lower Tester over that LE transport.

4.2.3 Transition Voice Assistant Session State to Session Reset State

- Preamble Purpose

This preamble procedure specifies the steps necessary to transition the Voice Assistant Session State on the IUT to the Session Reset state.

- Reference

[3] 3.6.2.2



- Preamble Procedure
 1. Perform either alternative 1A or 1B:
 - Alternative 1A:
 - 1A.1. The Upper Tester orders the IUT to set the GVAS or VAS instance to the Session Reset state.
 - Alternative 1B:
 - 1B.1. The IUT and Lower Tester disconnect and reconnect.
 - 1B.2. If necessary, the Lower Tester reconfigures the VAS Control Point and Voice Assistant Session State characteristics for Notifications.

4.2.4 Transition Voice Assistant Session State to Session Ready State

- Preamble Purpose

This preamble procedure specifies the steps necessary to transition the Voice Assistant Session State on the IUT to the Session Ready state.
- Reference

[3] 3.6.2.3
- Preamble Procedure
 1. The Lower Tester executes the GATT Read Characteristic Value sub-procedure with the Voice Assistant Session State characteristic.
 2. If the Voice Assistant Session State is set to 0x00 (Session Reset):
 - a. The Lower Tester executes the GATT Write Without Response sub-procedure with the VAS Control Point characteristic with Opcode set to 0x00 (Initialize VA Session).
 - b. The IUT sends a notification of the VAS Control Point characteristic with Opcode set to 0x00 (Response Code) and Parameter set to 0x01 (Success) and a notification of the Voice Assistant Session State characteristic with the VA Session State set to 0x02 (Session Ready) to the Lower Tester in any order. The IUT may also send a multiple handle value notification with the VAS Control Point characteristic, the Voice Assistant Session State characteristic, and their values.
 3. If the Voice Assistant Session State is set to 0x03 (Session Active):
 - a. The Lower Tester executes the GATT Write Without Response sub-procedure with the VAS Control Point characteristic with Opcode set to 0x02 (Stop VA Session).
 - b. The IUT sends a notification of the VAS Control Point characteristic with Opcode set to 0x00 (Response Code) and Parameter set to 0x01 (Success) and a notification of the Voice Assistant Session State characteristic with the VA Session State set to 0x02 (Session Ready) to the Lower Tester in any order. The IUT may also send a multiple handle value notification with the VAS Control Point characteristic, the Voice Assistant Session State characteristic, and their values.

4.2.5 Transition Voice Assistant Session State to Session Active State

- Preamble Purpose

This preamble procedure specifies the steps necessary to transition the Voice Assistant Session State on the IUT to the Session Active state.
- Reference

[3] 3.6.2.4



- Preamble Procedure
 1. The Lower Tester executes the GATT Read Characteristic Value sub-procedure with the Voice Assistant Session State characteristic.
 2. If the Voice Assistant Session State is set to 0x00 (Session Reset):
 - a. The Lower Tester executes the GATT Write Without Response sub-procedure with the VAS Control Point characteristic with Opcode set to 0x00 (Initialize VA Session).
 - b. The IUT sends a notification of the VAS Control Point characteristic with Opcode set to 0x00 (Response Code) and Parameter set to 0x01 (Success) and a notification of the Voice Assistant Session State characteristic with the VA Session State set to 0x02 (Session Ready) to the Lower Tester in any order. The IUT may also send a multiple handle value notification with the VAS Control Point characteristic, the Voice Assistant Session State characteristic, and their values.
 - c. The Lower Tester executes the GATT Write Without Response sub-procedure with the VAS Control Point characteristic with Opcode set to 0x01 (Start VA Session).
 - d. The IUT sends a notification of the VAS Control Point characteristic with Opcode set to 0x00 (Response Code) and Parameter set to 0x01 (Success) and a notification of the Voice Assistant Session State characteristic with the VA Session State set to 0x03 (Session Active) to the Lower Tester in any order. The IUT may also send a multiple handle value notification with the VAS Control Point characteristic, the Voice Assistant Session State characteristic, and their values.
 3. If the Voice Assistant Session State is set to 0x02 (Session Ready):
 - a. The Lower Tester executes the GATT Write Without Response sub-procedure with the VAS Control Point characteristic with Opcode set to 0x01 (Start VA Session).
 - b. The IUT sends a notification of the VAS Control Point characteristic with Opcode set to 0x00 (Response Code) and Parameter set to 0x01 (Success) and a notification of the Voice Assistant Session State characteristic with the VA Session State set to 0x03 (Session Active) to the Lower Tester in any order. The IUT may also send a multiple handle value notification with the VAS Control Point characteristic, the Voice Assistant Session State characteristic, and their values.

4.3 Generic GATT Integrated Tests

Execute the Generic GATT Integrated Tests defined in Section 6.3, Server test procedures (SGGIT), in [6] using Table 4.2 below as input:

TCID	Service / Characteristic	Reference	Properties	Value Length (Octets)	Service Type
GVAS/SR/SGGIT/SER/BV-01-C [Service GGIT - Generic Voice Assistant]	Generic Voice Assistant Service	[3] 2.1	-	-	Primary Service, Unique
GVAS/SR/SGGIT/CHA/BV-01-C [Characteristic GGIT - Voice Assistant Name]	Voice Assistant Name characteristic	[3] 3.1	0x12 (Read, Notify)	1-512	Unique
GVAS/SR/SGGIT/CHA/BV-02-C [Characteristic GGIT - Voice Assistant UUID]	Voice Assistant UUID characteristic	[3] 3.2	0x12 (Read, Notify)	16	Unique
GVAS/SR/SGGIT/CHA/BV-03-C [Characteristic GGIT - VAS Control Point]	VAS Control Point characteristic	[3] 3.3	0x14 (Write Without Response, Notify)	Skip	Unique
GVAS/SR/SGGIT/CHA/BV-04-C [Characteristic GGIT - Installed Location]	Installed Location characteristic	[3] 3.4	0x02 (Read)	Variable	Unique
GVAS/SR/SGGIT/CHA/BV-05-C [Characteristic GGIT - Installed Location, Notify]	Installed Location characteristic	[3] 3.4	0x12 (Read, Notify)	Variable	Unique
GVAS/SR/SGGIT/CHA/BV-06-C [Characteristic GGIT - Content Control ID (CCID)]	Content Control ID (CCID) characteristic	[3] 3.5	0x12 (Read, Notify)	1	Unique
GVAS/SR/SGGIT/CHA/BV-07-C [Characteristic GGIT - Voice Assistant Session State]	Voice Assistant Session State characteristic	[3] 3.6	0x12 (Read, Notify)	1	Unique
GVAS/SR/SGGIT/CHA/BV-08-C [Characteristic GGIT - Voice Assistant Session Flag]	Voice Assistant Session Flag characteristic	[3] 3.7	0x12 (Read, Notify)	1	Unique



TCID	Service / Characteristic	Reference	Properties	Value Length (Octets)	Service Type
GVAS/SR/SGGIT/CHA/BV-09-C [Characteristic GGIT - Voice Assistant Supported Languages]	Voice Assistant Supported Languages characteristic	[3] 3.8	0x12 (Read, Notify)	Variable	Unique
GVAS/SR/SGGIT/CHA/BV-10-C [Characteristic GGIT - Voice Assistant Supported Features]	Voice Assistant Supported Features characteristic	[3] 3.9	0x12 (Read, Notify)	1	Unique
VAS/SR/SGGIT/SER/BV-01-C [Service GGIT - Voice Assistant]	Voice Assistant Service	[3] 2.1	-	-	Primary Service
VAS/SR/SGGIT/CHA/BV-01-C [Characteristic GGIT - Voice Assistant Name]	Voice Assistant Name characteristic	[3] 3.1	0x12 (Read, Notify)	1-512	Unique
VAS/SR/SGGIT/CHA/BV-02-C [Characteristic GGIT - Voice Assistant UUID]	Voice Assistant UUID characteristic	[3] 3.2	0x12 (Read, Notify)	16	Unique
VAS/SR/SGGIT/CHA/BV-03-C [Characteristic GGIT - VAS Control Point]	VAS Control Point characteristic	[3] 3.3	0x14 (Write Without Response, Notify)	Skip	Unique
VAS/SR/SGGIT/CHA/BV-04-C [Characteristic GGIT - Installed Location]	Installed Location characteristic	[3] 3.4	0x02 (Read)	Variable	Unique
VAS/SR/SGGIT/CHA/BV-05-C [Characteristic GGIT - Installed Location, Notify]	Installed Location characteristic	[3] 3.4	0x12 (Read, Notify)	Variable	Unique
VAS/SR/SGGIT/CHA/BV-06-C [Characteristic GGIT - Content Control ID (CCID)]	Content Control ID (CCID) characteristic	[3] 3.5	0x12 (Read, Notify)	1	Unique
VAS/SR/SGGIT/CHA/BV-07-C [Characteristic GGIT - Voice Assistant Session State]	Voice Assistant Session State characteristic	[3] 3.6	0x12 (Read, Notify)	1	Unique
VAS/SR/SGGIT/CHA/BV-08-C [Characteristic GGIT - Voice Assistant Session Flag]	Voice Assistant Session Flag characteristic	[3] 3.7	0x12 (Read, Notify)	1	Unique



TCID	Service / Characteristic	Reference	Properties	Value Length (Octets)	Service Type
VAS/SR/SGGIT/CHA/BV-09-C [Characteristic GGIT - Voice Assistant Supported Languages]	Voice Assistant Supported Languages characteristic	[3] 3.8	0x12 (Read, Notify)	Variable	Unique
VAS/SR/SGGIT/CHA/BV-10-C [Characteristic GGIT - Voice Assistant Supported Features]	Voice Assistant Supported Features characteristic	[3] 3.9	0x12 (Read, Notify)	1	Unique

Table 4.2: Input for the GGIT Server test procedure

4.4 VAS/GVAS characteristic operations

4.4.1 Characteristic Read, Installed Location

- Test Purpose

Verify that the IUT sets the Installed Location characteristic to an empty value when the Upper Tester has not configured the characteristic prior to the connection with the Lower Tester.

- Reference

[3] 3.4

- Initial Condition

- The Lower Tester and IUT have established a Bearer connection as described in Section 4.2.1, if using ATT over an LE transport, or Section 4.2.2, if using EATT over an LE transport.
- The Lower Tester has discovered and cached all instances of the service specified in Table 4.3 and its characteristic handles (e.g., by running the test procedures in Section 4.3).
- The IUT contains an instance of the service specified in Table 4.3 where the Upper Tester has not configured the Installed Location characteristic to any value.

- Test Case Configuration

Test Case	Service
GVAS/SR/VCO/BV-02-C [Characteristic Read, Installed Location]	GVAS
VAS/SR/VCO/BV-02-C [Characteristic Read, Installed Location]	VAS

Table 4.3: Characteristic Read, Installed Location test cases

- Test Procedure

1. The Lower Tester and IUT establish a Bearer connection as described in Section 4.2.1, if using ATT over an LE transport, or Section 4.2.2, if using EATT over an LE transport.
2. The Lower Tester discovers the service specified in Table 4.3 and its characteristics.
3. The Lower Tester executes the GATT Read Characteristic Value sub-procedure with the Installed Location characteristic.

- Expected Outcome

Pass verdict

The Installed Location characteristic for the service specified in Table 4.3 is discovered and is an empty value.

4.4.2 Characteristic Read, Voice Assistant Session Flag

- Test Purpose

Verify that the IUT sets the Voice Assistant Session Flag characteristic value to 0x00 in all Voice Assistant Session States other than Session Active.

- Reference

[3] 3.7.2



- 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 Section 4.2.2, if using EATT over an LE transport.
 - The Lower Tester has discovered and cached the service specified in Table 4.4 and its characteristic handles (e.g., by running the test procedures in Section 4.3).

- Test Case Configuration

Test Case	Service
GVAS/SR/VCO/BV-03-C [Characteristic Read, Voice Assistant Session Flag]	GVAS
VAS/SR/VCO/BV-03-C [Characteristic Read, Voice Assistant Session Flag]	VAS

Table 4.4: Characteristic Read, Voice Assistant Session Flag test cases

- Test Procedure

Execute Steps 1–7 on an instance of the service specified in Table 4.4:

1. Execute the Preamble in Section 4.2.3 to bring the Voice Assistant Session State to Session Reset state.
2. The Lower Tester executes the GATT Read Characteristic Value sub-procedure with the Voice Assistant Session Flag characteristic.
3. Execute the Preamble in Section 4.2.4 to bring the Voice Assistant Session State to Session Ready.
4. The Lower Tester executes the GATT Read Characteristic Value sub-procedure with the Voice Assistant Session Flag characteristic.
5. The Upper Tester informs the IUT that the VA is unable to provide service for the service instance.
6. The IUT sends a notification of the Voice Assistant Session State characteristic to the Lower Tester with the VA Session State set to 0x01 (Session Unavailable).
7. The Lower Tester executes the GATT Read Characteristic Value sub-procedure with the Voice Assistant Session Flag characteristic.

- Expected Outcome

Pass verdict

The Voice Assistant Session Flag characteristic is 0x00 after each GATT Read Characteristic Value sub-procedure executed by the Lower Tester.

4.4.3 Characteristic Notifications

- Test Purpose

Verify that the IUT sends notifications to the Lower Tester when characteristic values are changed.

- Reference

[3] 3

- Initial Condition

- The Lower Tester and IUT have established a Bearer connection as described in Section 4.2.1, if using ATT over an LE transport, or Section 4.2.2, if using EATT over an LE transport.



- The Lower Tester has discovered and cached all instances of the service specified in [Table 4.5](#) and its characteristic handles (e.g., by running the test procedures in [Section 4.3](#)).
 - The Lower Tester has configured the service's characteristic specified in [Table 4.5](#) for notifications.
 - The IUT and the Lower Tester have bonded.
- Test Case Configuration

Test Case	Service	Characteristic
GVAS/SR/VCO/BV-09-C [Characteristic Notification, Voice Assistant Name]	GVAS	Voice Assistant Name
GVAS/SR/VCO/BV-10-C [Characteristic Notification, Voice Assistant UUID]	GVAS	Voice Assistant UUID
GVAS/SR/VCO/BV-04-C [Characteristic Notification, Installed Location]	GVAS	Installed Location
GVAS/SR/VCO/BV-11-C [Characteristic Notification, Content Control ID]	GVAS	Content Control ID
GVAS/SR/VCO/BV-12-C [Characteristic Notification, Voice Assistant Session Flag]	GVAS	Voice Assistant Session Flag
GVAS/SR/VCO/BV-05-C [Characteristic Notification, Voice Assistant Supported Languages]	GVAS	Voice Assistant Supported Languages
GVAS/SR/VCO/BV-06-C [Characteristic Notification, Voice Assistant Supported Features]	GVAS	Voice Assistant Supported Features
VAS/SR/VCO/BV-04-C [Characteristic Notification, Voice Assistant Name]	VAS	Voice Assistant Name
VAS/SR/VCO/BV-05-C [Characteristic Notification, Voice Assistant UUID]	VAS	Voice Assistant UUID
VAS/SR/VCO/BV-06-C [Characteristic Notification, Installed Location]	VAS	Installed Location
VAS/SR/VCO/BV-10-C [Characteristic Notification, Content Control ID]	VAS	Content Control ID
VAS/SR/VCO/BV-11-C [Characteristic Notification, Voice Assistant Session Flag]	VAS	Voice Assistant Session Flag
VAS/SR/VCO/BV-07-C [Characteristic Notification, Voice Assistant Supported Languages]	VAS	Voice Assistant Supported Languages
VAS/SR/VCO/BV-08-C [Characteristic Notification, Voice Assistant Supported Features]	VAS	Voice Assistant Supported Features

Table 4.5: Characteristic Notifications test cases

- Test Procedure
 1. The Upper Tester changes the service's characteristic specified in [Table 4.5](#) to a new valid value.
 2. The IUT sends a notification of the service's characteristic specified in [Table 4.5](#) to the Lower Tester with the value in Step 1.
 3. The Lower Tester and the IUT disconnect.
 4. The Upper Tester changes the service's characteristic specified in [Table 4.5](#) to a new valid value.
 5. The Lower Tester and the IUT reconnect.
 6. The IUT sends a notification of the service's characteristic specified in [Table 4.5](#) to the Lower Tester with the value in Step 4.

- Expected Outcome

Pass verdict

The IUT sends a notification to the Lower Tester of the service's characteristic specified in [Table 4.5](#) when the value is changed while connected with the Lower Tester.

The IUT sends a notification after reconnection to the Lower Tester of the service's characteristic specified in [Table 4.5](#) when the value is changed while disconnected.

4.4.4 Content Control ID Persistence

- Test Purpose

Verify that the Content Control ID (CCID) characteristic value persists across connections.

- Reference

[3] 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 [Section 4.2.2](#), if using EATT over an LE transport.
- The Lower Tester has discovered and cached the service specified in [Table 4.6](#) and its characteristic handles (e.g., by running the test procedures in [Section 4.3](#)). An instance of the service exists where the Voice Assistant Session State characteristic is in the Session Reset state.

- Test Case Configuration

Test Case	Service
GVAS/SR/VCO/BV-07-C [Content Control ID Persistence]	GVAS
VAS/SR/VCO/BV-09-C [Content Control ID Persistence]	VAS

Table 4.6: Content Control ID Persistence test cases

- Test Procedure

Execute Steps 1–6 on the service instance specified in [Table 4.6](#) in the Session Reset state:

1. The Lower Tester configures the VAS Control Point and the Voice Assistant Session State characteristics for Notifications.
2. Execute the Preamble in [Section 4.2.5](#) to bring the Voice Assistant Session State characteristic to the Session Active state.
3. The Lower Tester executes the GATT Read Characteristic Value sub-procedure with the Content Control ID (CCID) characteristic.
4. The Lower Tester disconnects and reconnects with the IUT.
5. The Lower Tester executes the GATT Read Characteristic Value sub-procedure with the Voice Assistant Session State characteristic.
6. Repeat Steps 1–3.

- Expected Outcome

Pass verdict

The Content Control ID (CCID) characteristic values in Step 2 are identical.



The Voice Assistant Session State characteristic after reconnection is set to 0x00 (Session Reset).

GVAS/SR/VCO/BV-08-C [Default VA Provider Change Behavior]

- Test Purpose

Verify that the IUT successfully sends sets the Voice Assistant Session State value to Session Reset when the default VA provider is changed.

- Reference

[3] 3.6.2.2

- 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 Section 4.2.2, if using EATT over an LE transport.
- The Lower Tester has discovered and cached the GVAS service and characteristic handles (e.g., by running the test procedures in Section 4.3). The GVAS Voice Assistant Session State characteristic is in the Session Reset state.
- The Voice Assistant Name, Voice Assistant UUID, VAS Control Point, and Voice Assistant Session State characteristics are configured for notifications for the GVAS service instance.

- Test Procedure

Execute Steps 1–3 for each round in Table 4.7 on the GVAS service instance:

1. Execute the preamble in Table 4.7 to place the IUT in the Voice Assistant Session State required for the round. If Session Unavailable is the Voice Assistant Session State required for the round, the Upper Tester informs the IUT that the VA is unable to provide service for the service instance and the IUT sends a notification of the Voice Assistant Session State characteristic to the Lower Tester with the VA Session State set to 0x01 (Session Unavailable).
2. The Upper Tester informs the IUT that the default VA provider has changed and has a new Voice Assistant Name and Voice Assistant UUID.
3. The IUT sends notifications to the Lower Tester regarding the Voice Assistant Session State characteristic with the VA Session State set to 0x00 (Session Reset) except in Round 2, the new Voice Assistant Name, and the new Voice Assistant UUID.

Round	Voice Assistant Session State Required	Preamble
1	Session Unavailable	N/A
2	Session Reset	Section 4.2.3
3	Session Ready	Section 4.2.4
4	Session Active	Section 4.2.5

Table 4.7: Default VA Provider Change Behavior rounds

- Expected Outcome

Pass verdict

In every round, the IUT sends notifications to the Lower Tester regarding the Voice Assistant Session State characteristic with the VA Session State set to 0x00 (Session Reset) except in Round 2, the new Voice Assistant Name, and the new Voice Assistant UUID.



4.5 VA Session Operations

4.5.1 Client Initiated VA Session

- Test Purpose

Verify that the IUT successfully updates the Voice Assistant Session State characteristic and Voice Assistant Session Flag characteristic, if supported, after establishing a connection with the Lower Tester and receiving VAS Control Point writes from the Lower Tester.

- Reference

[3] 3.3.3.1, 3.3.3.2, 3.3.3.3

- Test Case Configuration

Test Case	Service	Voice Assistant Session Flag
GVAS/SR/VASO/BV-01-C [Client Initiated VA Session]	GVAS	No
GVAS/SR/VASO/BV-02-C [Client Initiated VA Session with Voice Assistant Session Flags]	GVAS	Yes
VAS/SR/VASO/BV-01-C [Client Initiated VA Session]	VAS	No
VAS/SR/VASO/BV-02-C [Client Initiated VA Session with Voice Assistant Session Flags]	VAS	Yes

Table 4.8: Client Initiated VA Session test cases

- Test Procedure

1. The Lower Tester and IUT establish a Bearer connection as described in Section 4.2.1, if using ATT over an LE transport, or Section 4.2.2, if using EATT over an LE transport.
2. The Lower Tester discovers the GVAS service and, if applicable, all VAS service instances and characteristics.
3. For each instance discovered by the Lower Tester in Step 2: The Lower Tester executes the GATT Read Characteristic Value sub-procedure with the Voice Assistant Name, Voice Assistant UUID, Voice Assistant Supported Features, and, if present, the Installed Location, Voice Assistant Session Flag, or Voice Assistant Supported Languages characteristics.

Execute Steps 4–16 on an instance of the service specified in Table 4.8:

4. The Lower Tester configures the VAS Control Point, the Voice Assistant Session State, and, if present, the Voice Assistant Session Flag characteristics for Notifications.
5. The Lower Tester executes the GATT Read Characteristic Value sub-procedure with the Voice Assistant Session State characteristic.

If the Voice Assistant Session State is set to 0x00 (Session Reset), proceed to Step 6. If the Voice Assistant Session State is set to 0x01 (Session Unavailable), the Lower Tester restarts from Step 4 with another instance of the service specified in Table 4.8. If no other instance of the service exists or if the Voice Assistant Session State value is not 0x00 (Session Reset) or 0x01 (Session Unavailable), the test ends in a Fail verdict.

6. The Lower Tester executes the GATT Write Without Response sub-procedure with the VAS Control Point characteristic with Opcode set to 0x00 (Initialize VA Session).
7. The IUT sends a notification of the VAS Control Point characteristic with Opcode set to 0x00 (Response Code), Parameter set to 0x01 (Success), and a notification of the Voice Assistant Session State characteristic with the VA Session State set to 0x02 (Session Ready) to the Lower



Tester in any order. The IUT may also send a multiple handle value notification with the VAS Control Point characteristic, the Voice Assistant Session State characteristic, and their values.

8. The Lower Tester executes the GATT Write Without Response sub-procedure with the VAS Control Point characteristic with Opcode set to 0x01 (Start VA Session).
9. The IUT sends a notification of the VAS Control Point characteristic with Opcode set to 0x00 (Response Code), Parameter set to 0x01 (Success), and a notification of the Voice Assistant Session State characteristic with the VA Session State set to 0x03 (Session Active) to the Lower Tester in any order. The IUT may also send a multiple handle value notification with the VAS Control Point characteristic, the Voice Assistant Session State characteristic, and their values.

Execute Steps 10–12 if Voice Assistant Session Flag support is indicated in [Table 4.8](#):

10. The Upper Tester informs the IUT that the VA is listening and the IUT sends a notification of the Voice Assistant Session Flag characteristic to the Lower Tester with the value set to 0x01 (Listening Now).
11. The Upper Tester informs the IUT that the VA is processing the request and the IUT sends a notification of the Voice Assistant Session Flag characteristic to the Lower Tester with the value set to 0x02 (Processing Now).
12. The Upper Tester informs the IUT that the VA is responding to the request and the IUT sends a notification of the Voice Assistant Session Flag characteristic to the Lower Tester with the value set to 0x04 (Playback Now).
13. The Lower Tester executes the GATT Write Without Response sub-procedure with the VAS Control Point characteristic with Opcode set to 0x02 (Stop VA Session).

Steps 14–16 can be sent in any order and may be sent as a multiple handle value notification:

14. The IUT sends a notification of the VAS Control Point characteristic to the Lower Tester with Opcode set to 0x00 (Response Code) and Parameter set to 0x01 (Success).
15. If Voice Assistant Session Flag is supported as indicated in [Table 4.8](#), the IUT sends a notification of the Voice Assistant Session Flag characteristic to the Lower Tester with the value set to 0x00.
16. The IUT sends a notification of the Voice Assistant Session State characteristic to the Lower Tester with the VA Session State set to 0x02 (Session Ready).

- Expected Outcome

Pass verdict

In Step 3, the IUT returns the Voice Assistant Supported Features characteristic value as 0x01 if Voice Assistant Session Flag support is indicated in [Table 4.8](#); otherwise, the value is 0x00 or the characteristic is not present. If the Voice Assistant Supported Features characteristic is 0x00 or not present, the IUT does not send any Voice Assistant Session Flag notifications.

In Step 5, the Voice Assistant Session State characteristic is set to 0x00 (Session Reset).

After every VAS Control Point Write Without Response sub-procedure by the Lower Tester, the IUT sends a VAS Control Point notification with Opcode set to 0x00 (Response Code), Parameter set to 0x01 (Success), and a Voice Assistant Session State notification with the Voice Assistant Session State value listed to the Lower Tester.

If Voice Assistant Session Flag support is indicated in [Table 4.8](#):

- In Step 3, the IUT returns the Voice Assistant Session Flag value as 0x00.



- In Steps 10–12 and 15, the IUT sends the Voice Assistant Session Flag notifications to the Lower Tester with the values listed.
- The IUT does not send Voice Assistant Session Flag notifications outside of Steps 10–12 and 15.

Fail verdict

In Step 5, the Voice Assistant Session State characteristic is set to 0x02-0xFF.

4.5.2 VA Unavailable

• Test Purpose

Verify that the IUT successfully sets the Voice Assistant Session State characteristic to 0x01 (Session Unavailable) after the VA becomes unavailable and changes the characteristic to 0x00 (Session Reset) after the VA becomes available.

• Reference

[3] 3.6.2.1

• 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 Section 4.2.2, if using EATT over an LE transport.
- The Lower Tester has discovered and cached the service specified in Table 4.9 and its characteristic handles (e.g., by running the test procedures in Section 4.3). An instance of the service specified in Table 4.9 exists where the Voice Assistant Session State characteristic is in the Session Reset state.
- The VAS Control Point and Voice Assistant Session State characteristics are configured for notifications for the service instance specified in Table 4.9 in the Session Reset state.

• Test Case Configuration

Test Case	Service
GVAS/SR/VASO/BV-03-C [VA Unavailable]	GVAS
VAS/SR/VASO/BV-03-C [VA Unavailable]	VAS

Table 4.9: VA Unavailable test cases

• Test Procedure

Execute Steps 1–5 for each Round in Table 4.10 on the service instance specified in Table 4.9 configured for notifications:

1. Execute the Preamble for the round in Table 4.10 if specified.
2. The Upper Tester informs the IUT that the VA is unable to provide service for the service instance in Step 1.
3. The IUT sends a notification of the Voice Assistant Session State characteristic to the Lower Tester with the VA Session State set to 0x01 (Session Unavailable).
4. The Upper Tester informs the IUT that the VA is available now for the service instance in Step 1.
5. The IUT sends a notification of the Voice Assistant Session State characteristic to the Lower Tester with the VA Session State set to 0x00 (Session Reset).

Round	Preamble	Voice Assistant Session State after Preamble Execution
1	N/A	N/A



Round	Preamble	Voice Assistant Session State after Preamble Execution
2	Section 4.2.4	0x02 (Session Ready)
3	Section 4.2.5	0x03 (Session Active)

Table 4.10: VA Unavailable rounds

- Expected Outcome

Pass verdict

The IUT sends a notification of the Voice Assistant Session State characteristic to the Lower Tester with the VA Session State set to 0x01 (Session Unavailable) when the VA is unable to provide service.

The IUT sends a notification of the Voice Assistant Session State characteristic to the Lower Tester with the VA Session State set to 0x00 (Session Reset) when the VA is available again.

4.5.3 Initialize VA Session Anytime

- Test Purpose

Verify that the IUT enters the Session Ready state after receiving the Initialize VA Session opcode in the Session Ready or Session Active state.

- Reference

[3] 3.3.3.1

- 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 Section 4.2.2, if using EATT over an LE transport.
- The Lower Tester indicates support for Multiple Handle Value Notifications in the Client Supported Features characteristic.
- The Lower Tester has discovered and cached the service specified in Table 4.11 and its characteristic handles (e.g., by running the test procedures in Section 4.3). An instance of the service specified in Table 4.11 exists where the Voice Assistant Session State characteristic is in the Session Reset state.
- The VAS Control Point and Voice Assistant Session State characteristics are configured for notifications for the service instance specified in Table 4.11 in the Session Reset state.

- Test Case Configuration

Test Case	Service
GVAS/SR/VASO/BV-04-C [Initialize VA Session Anytime]	GVAS
VAS/SR/VASO/BV-04-C [Initialize VA Session Anytime]	VAS

Table 4.11: Initialize VA Session Anytime test cases

- Test Procedure

Execute Steps 1–7 on the service instance specified in Table 4.11 configured for notifications:

- Execute the Preamble in Section 4.2.4 to bring the Voice Assistant Session State to Session Ready.



2. The Lower Tester executes the GATT Write Without Response sub-procedure with the VAS Control Point characteristic with Opcode set to 0x00 (Initialize VA Session).
 3. The IUT sends a notification of the VAS Control Point characteristic to the Lower Tester with Opcode set to 0x00 (Response Code) and Parameter set to 0x01 (Success).
 4. Execute the Preamble in Section 4.2.5 to bring the Voice Assistant Session State to Session Active.
 5. The Lower Tester executes the GATT Write Without Response sub-procedure with the VAS Control Point characteristic with Opcode set to 0x00 (Initialize VA Session).
 6. The IUT sends a notification of the VAS Control Point characteristic with Opcode set to 0x00 (Response Code), Parameter set to 0x01 (Success), and a notification of the Voice Assistant Session State characteristic with the VA Session State set to 0x02 (Session Ready) to the Lower Tester in any order. The IUT may also send a multiple handle value notification with the VAS Control Point characteristic, the Voice Assistant Session State characteristic, and their values.
- Expected Outcome

Pass verdict

After Step 2 occurs, the IUT does not send a Voice Assistant Session State notification to the Lower Tester.

In Steps 3 and 6, the IUT sends the VAS Control Point notification to the Lower Tester with Opcode set to 0x00 (Response Code) and Parameter set to 0x01 (Success).

In Step 6, the IUT sends a Voice Assistant Session State notification to the Lower Tester with the VA Session State set to 0x02 (Session Ready).

4.6 Service procedure error handling

4.6.1 Opcode Not Supported Error and CCCD Not Configured

- Test Purpose

Verify that the IUT successfully sends the “Opcode Not Supported” Response Code Value when receiving a VAS Control Point write with an RFU opcode and ignores the VAS Control Point Write Without Response request when the Lower Tester has not configured the VAS Control Point for notifications.
- Reference

[3] 3.3.3
- 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 Section 4.2.2, if using EATT over an LE transport.
 - The Lower Tester has discovered and cached the service specified in Table 4.12 and its characteristic handles (e.g., by running the test procedures in Section 4.3). An instance of the service specified in Table 4.12 exists where the Voice Assistant Session State characteristic is in the Session Reset state.
 - The Voice Assistant Session State characteristic is configured for notifications for the service instance specified in Table 4.12 in the Session Reset state. The VAS Control Point is not configured for notifications for the service instance in the Session Reset state.



- Test Case Configuration

Test Case	Service
GVAS/SR/SPE/BI-01-C [Opcode Not Supported Error and CCCD Not Configured]	GVAS
VAS/SR/SPE/BI-01-C [Opcode Not Supported Error and CCCD Not Configured]	VAS

Table 4.12: Opcode Not Supported Error and CCCD Not Configured test cases

- Test Procedure

Execute Steps 1–5 on the service instance specified in [Table 4.12](#) configured for Voice Assistant Session State notifications:

1. The Lower Tester executes the GATT Write Without Response sub-procedure with the VAS Control Point characteristic with Opcode set to 0x00 (Initialize VA Session).
2. The IUT does not send a notification of the Voice Assistant Session State characteristic with the VA Session State set to 0x02 (Session Ready) to the Lower Tester.
3. The Lower Tester configures the VAS Control Point for notifications.
4. The Lower Tester executes the GATT Write Without Response sub-procedure with the VAS Control Point characteristic with Opcode set to any RFU value.
5. The IUT sends a notification of the VAS Control Point characteristic to the Lower Tester with Opcode set to 0x00 (Response Code) and Parameter set to 0x02 (Opcode Not Supported).

- Expected Outcome

Pass verdict

After Step 1, the IUT ignores the Write Without Response request and does not send a notification of the Voice Assistant Session State characteristic with the VA Session State set to 0x02 (Session Ready) to the Lower Tester.

In Step 5, the IUT sends a VAS Control Point notification to the Lower Tester with Opcode set to 0x00 (Response Code) and Parameter set to 0x02 (Opcode Not Supported).

4.6.2 Invalid Session State Error

- Test Purpose

Verify that the IUT successfully sends the “Invalid Session State” Response Code Value to the Lower Tester after receiving an invalid state transition VAS Control Point write.

- Reference

[\[3\]](#) 3.3.3.1, 3.3.3.2, 3.3.3.3

- 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 [Section 4.2.2](#), if using EATT over an LE transport.
- The Lower Tester has discovered and cached the service specified in [Table 4.13](#) and its characteristic handles (e.g., by running the test procedures in [Section 4.3](#)). An instance of the service specified in [Table 4.13](#) exists where the Voice Assistant Session State characteristic is in the Session Reset state.
- The VAS Control Point and Voice Assistant Session State characteristics are configured for notifications for the service instance specified in [Table 4.13](#) in the Session Reset state.



- Test Case Configuration

Test Case	Service
GVAS/SR/SPE/BI-02-C [Invalid Session State Error]	GVAS
VAS/SR/SPE/BI-02-C [Invalid Session State Error]	VAS

Table 4.13: Invalid Session State Error test cases

- Test Procedure

Execute Steps 1–3 for each round in [Table 4.14](#) on the service instance specified in [Table 4.13](#) configured for notifications:

- Execute the preamble in [Table 4.14](#) to place the IUT in the Voice Assistant Session State required for the round. If Session Unavailable is the Voice Assistant Session State required for the round, the Upper Tester informs the IUT that the VA is unable to provide service for the service instance and the IUT sends a notification of the Voice Assistant Session State characteristic to the Lower Tester with the VA Session State set to 0x01 (Session Unavailable).
- The Lower Tester executes the GATT Write Without Response sub-procedure with the VAS Control Point characteristic with Opcode set to the value for the round in [Table 4.14](#).
- The IUT sends a notification of the VAS Control Point characteristic to the Lower Tester with Opcode set to 0x00 (Response Code) and Parameter set to 0x04 (Invalid Session State).

Round	Voice Assistant Session State Required	Preamble	Opcode
1	Session Unavailable	N/A	Initialize VA Session (0x00)
2	Session Reset	Section 4.2.3	Start VA Session (0x01)
3	Session Active	Section 4.2.5	Start VA Session (0x01)
4	Session Unavailable	N/A	Start VA Session (0x01)
5	Session Reset	Section 4.2.3	Stop VA Session (0x02)
6	Session Ready	Section 4.2.4	Stop VA Session (0x02)
7	Session Unavailable	Section 4.2.5	Stop VA Session (0x02)

Table 4.14: Invalid Session State Error rounds

- Expected Outcome

Pass verdict

In every round, the IUT sends a VAS Control Point notification to the Lower Tester with Opcode set to 0x00 (Response Code) and Parameter set to 0x04 (Invalid Session State).

5 Test case mapping

The Test Case Mapping Table (TCMT) maps test cases to specific requirements in the ICS. The IUT is 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 Voice Assistant Service [4].

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 are 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)
VAS 0/1	Generic Voice Assistant Service and Error Handling	GVAS/SR/SGGIT/SER/BV-01-C GVAS/SR/SPE/BI-01-C GVAS/SR/SPE/BI-02-C
VAS 3/1	Voice Assistant Name characteristic and notifications	GVAS/SR/SGGIT/CHA/BV-01-C GVAS/SR/VCO/BV-09-C
VAS 3/3	Voice Assistant UUID characteristic and notifications	GVAS/SR/SGGIT/CHA/BV-02-C GVAS/SR/VCO/BV-10-C
VAS 3/4	VAS Control Point characteristic and VA Sessions without Voice Assistant Session Flag	GVAS/SR/SGGIT/CHA/BV-03-C GVAS/SR/VASO/BV-01-C
VAS 3/5	Installed Location characteristic read	GVAS/SR/VCO/BV-02-C
VAS 3/5 AND NOT VAS 3/7	Installed Location characteristic	GVAS/SR/SGGIT/CHA/BV-04-C
VAS 3/5 AND VAS 3/7	Installed Location characteristic with notifications	GVAS/SR/SGGIT/CHA/BV-05-C GVAS/SR/VCO/BV-04-C
VAS 3/8	Content Control ID (CCID) characteristic and notifications	GVAS/SR/SGGIT/CHA/BV-06-C GVAS/SR/VCO/BV-07-C GVAS/SR/VCO/BV-11-C
VAS 3/9	Voice Assistant Session State characteristic	GVAS/SR/SGGIT/CHA/BV-07-C GVAS/SR/VCO/BV-08-C GVAS/SR/VASO/BV-03-C GVAS/SR/VASO/BV-04-C
VAS 3/10	Voice Assistant Session Flag characteristic, read, and notifications	GVAS/SR/SGGIT/CHA/BV-08-C GVAS/SR/VCO/BV-03-C GVAS/SR/VCO/BV-12-C
VAS 3/11	Voice Assistant Supported Languages characteristic	GVAS/SR/SGGIT/CHA/BV-09-C GVAS/SR/VCO/BV-05-C

Item	Feature	Test Case(s)
VAS 3/13	Voice Assistant Supported Features characteristic	GVAS/SR/SGGIT/CHA/BV-10-C GVAS/SR/VCO/BV-06-C
VAS 3/4 AND VAS 3/10	VA Sessions with Voice Assistant Session Flag	GVAS/SR/VASO/BV-02-C
VAS 0/2	Voice Assistant Service and Error Handling	VAS/SR/SGGIT/SER/BV-01-C VAS/SR/SPE/BI-01-C VAS/SR/SPE/BI-02-C
VAS 12/1	Voice Assistant Name characteristic and notifications	VAS/SR/SGGIT/CHA/BV-01-C VAS/SR/VCO/BV-04-C
VAS 12/3	Voice Assistant UUID characteristic	VAS/SR/SGGIT/CHA/BV-02-C VAS/SR/VCO/BV-05-C
VAS 12/4	VAS Control Point characteristic and VA Sessions without Voice Assistant Session Flag	VAS/SR/SGGIT/CHA/BV-03-C VAS/SR/VASO/BV-01-C
VAS 12/5	Installed Location characteristic read	VAS/SR/VCO/BV-02-C
VAS 12/5 AND NOT VAS 12/7	Installed Location characteristic	VAS/SR/SGGIT/CHA/BV-04-C
VAS 12/5 AND VAS 12/7	Installed Location characteristic with notifications	VAS/SR/SGGIT/CHA/BV-05-C VAS/SR/VCO/BV-06-C
VAS 12/8	Content Control ID (CCID) characteristic and notifications	VAS/SR/SGGIT/CHA/BV-06-C VAS/SR/VCO/BV-09-C VAS/SR/VCO/BV-10-C
VAS 12/9	Voice Assistant Session State characteristic	VAS/SR/SGGIT/CHA/BV-07-C VAS/SR/VASO/BV-03-C VAS/SR/VASO/BV-04-C
VAS 12/10	Voice Assistant Session Flag characteristic, read, and notifications	VAS/SR/SGGIT/CHA/BV-08-C VAS/SR/VCO/BV-03-C VAS/SR/VCO/BV-11-C
VAS 12/11	Voice Assistant Supported Languages characteristic	VAS/SR/SGGIT/CHA/BV-09-C VAS/SR/VCO/BV-07-C
VAS 12/13	Voice Assistant Supported Features characteristic	VAS/SR/SGGIT/CHA/BV-10-C VAS/SR/VCO/BV-08-C
VAS 12/4 AND VAS 12/10	VA Sessions with Voice Assistant Session Flag	VAS/SR/VASO/BV-02-C

Table 5.1: Test case mapping

6 Revision history and acknowledgments

Revision History

Publication Number	Revision Number	Date	Comments
0	p0	2025-12-16	Approved by BTI on 2025-11-24. VAS v1.0 adopted by the BoD on 2025-12-15. Prepared for initial publication.

Acknowledgments

Name	Company
Dejan Berec	Bluetooth SIG, Inc.