Electronic Shelf Label Profile (ESLP)

***Bluetooth*® Test Suite**

- **Revision:** ESLP.TS.p2
- **Revision Date:** 2025-02-18
- **Prepared By:** Electronic Shelf Label Working Group
- **Published during TCRL:** TCRL.2025-1

Contents

1 Scope

This Bluetooth document contains the Test Suite Structure (TSS) and test cases to test the implementation of the Bluetooth Electronic Shelf Label Profile 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], [2], and [3].

[1] Bluetooth Core Specification, Version 5.4 or later

[2] Test Strategy and Terminology Overview

[3] Electronic Shelf Label Profile, Version 1.0

[4] Electronic Shelf Label Service, Version 1.0

[5] ICS Proforma for Electronic Shelf Label Profile (ESLP)

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

[7] GATT Test Suite, GATT.TS

[8] Object Transfer Profile Specification, Version 1.0 or later

[9] Object Transfer Service Specification, Version 1.0 or later

2.2 Definitions

In this Bluetooth document, the definitions from [1], [2], and [3] apply.

2.3 Acronyms and abbreviations

In this Bluetooth document, the definitions, acronyms, and abbreviations from [1], [2], and [3] apply.

3 Test Suite Structure (TSS)

3.1 Overview

The Electronic Shelf Label Profile requires the presence of GAP, SM, ATT, L2CAP, and GATT. This is illustrated in Figure 3.1.

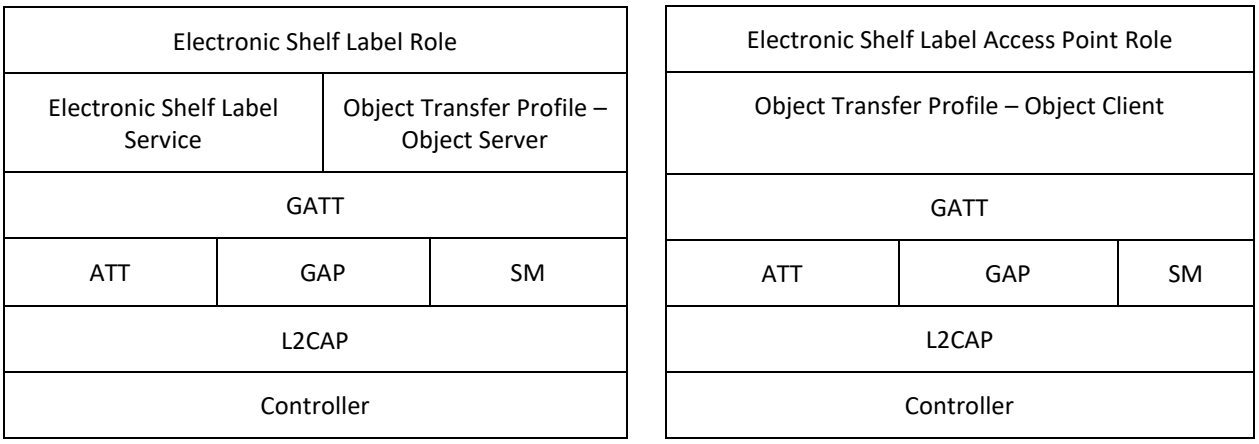

Figure 3.1: Electronic Shelf Label Profile test model

3.2 Test Strategy

The test objectives are to verify functionality of the Electronic Shelf Label Profile 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. A number of tests require two Lower Testers to verify IUT behavior when bonded with a Lower Tester.

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.

3.3 Test groups

The following test groups have been defined:

- Generic GATT Integrated Tests
- ESL Synchronized state
- AP Procedures

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>**
ESLP	Electronic Shelf Label Profile
Identifier Abbreviation	**Role Identifier <IUT role>**
AP	Access Point
ESL	Electronic Shelf Label
Identifier Abbreviation	**Reference Identifier <GGIT test group>**
CGGIT	Client Generic GATT Integrated Tests
Identifier Abbreviation	**Reference Identifier <GGIT class>**
CHA	Characteristic
SER	Service
Identifier Abbreviation	**Feature Identifier <feat>**
CFG	Configuring State
ECP	ESL Control Point
PAIR	ESL Pairing
PROC	Procedure
SP	Service Procedure
SYNC	Synchronized state
UNS	Unsynchronized state
UPD	Updating state

Table 4.1: ESLP 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 may be referred to to establish specific conditions in test cases within this document.

4.2.1 ATT Bearer on LE Transport

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 EATT Bearer on LE Transport

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 Enter Synchronized state

1. The Upper Tester orders the IUT to synchronize with the Lower Tester.
2. The IUT starts advertising synchronization packets.
3. When the IUT has synchronized with the Lower Tester, the ACL connection is terminated by the Lower Tester.

4.2.4 Setup ESL Address preamble

- Test Purpose

  The IUT configures the ESL Address for the Lower Tester device.

  The IUT is in an AP role, and the Lower Tester is in an ESL role.

- Test Procedure

  1. The IUT executes the GATT Write Characteristic Value sub-procedure to the Lower Tester for the ESL Address characteristic with a valid ESL_ID and Group_ID.

4.3 Generic GATT Integrated Tests

Execute the Generic GATT Integrated Tests defined in Section 6.4, Client Test Procedures (CGGIT), in [7] using Table 4.2 below as input:

TCID	Service / Characteristic / Descriptor	Reference	Properties	Value Length (Octets)
ESLP/CL/CGGIT/SER/BV-01-C [Service GGIT – Electronic Shelf Label]	Electronic Shelf Label	[3] 2	Mandatory	-
ESLP/CL/CGGIT/SER/BV-02-C [Service GGIT – Object Transfer]	Object Transfer Service	[3] 2.2.3	-	-
ESLP/CL/CGGIT/SER/BV-03-C [Service GGIT – Device Information]	Device Information Service	[3] 2.2.2	-	-
ESLP/CL/CGGIT/CHA/BV-01-C [Characteristic GGIT – ESL Address]	ESL Address Characteristic	[3] 4.2.1.1	Mandatory: 0x08 (Write)	2
ESLP/CL/CGGIT/CHA/BV-02-C [Characteristic GGIT – AP Sync Key Material]	AP Sync Key Material Characteristic	[3] 4.2.1.2	Mandatory: 0x08 (Write)	24
ESLP/CL/CGGIT/CHA/BV-03-C [Characteristic GGIT – ESL Response Key Material]	ESL Response Key Material Characteristic	[3] 4.2.1.3	Mandatory: 0x08 (Write)	24
ESLP/CL/CGGIT/CHA/BV-05-C [Characteristic GGIT – ESL Current Absolute Time]	ESL Current Absolute Time Characteristic	[3] 4.2.1.4	Mandatory: 0x08 (Write)	4
ESLP/CL/CGGIT/CHA/BV-06-C [Characteristic GGIT – ESL Display Information]	ESL Display Information Characteristic	[3] 4.2.1.5	Mandatory: 0x02 (Read)	Skip
ESLP/CL/CGGIT/CHA/BV-07-C [Characteristic GGIT – ESL Image Information]	ESL Image Information Characteristic	[3] 4.2.1.6	Mandatory: 0x02 (Read)	2
ESLP/CL/CGGIT/CHA/BV-08-C [Characteristic GGIT – ESL Sensor Information]	ESL Sensor Information Characteristic	[3] 4.2.1.7	Mandatory: 0x02 (Read)	1
ESLP/CL/CGGIT/CHA/BV-09-C [Characteristic GGIT – ESL LED Information]	ESL LED Information Characteristic	[3] 4.2.1.8	Mandatory: 0x02 (Read)	Skip
ESLP/CL/CGGIT/CHA/BV-10-C [Characteristic GGIT – ESL Control Point]	ESL Control Point Characteristic	[3] 4.2.1.9	Mandatory: 0x1C (Write Without Response, Write, Notify)	Skip

Table 4.2: Input for the GGIT Client test procedure

4.4 GATT Characteristic

4.4.1 Read Long Characteristic, Length > ATT_MTU

- Test Purpose

  Verify that an AP uses the GATT Read Long Characteristic Value sub-procedure to read a characteristic with a length greater than ATT_MTU.

- 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 Section 4.2.2 if using EATT over an LE transport.
  - The Lower Tester's Characteristic specified in Table 4.3 has a length greater than ATT_MTU.

- Test Case Configuration

TCID	Reference [3]	Characteristic
ESLP/AP/SYNC/BV-01-C [Read Long Characteristic, Length > ATT_MTU, ESL Display Information Characteristic]	4.2.1.5	ESL Display Information Characteristic
ESLP/AP/SYNC/BV-02-C [Read Long Characteristic, Length > ATT_MTU, ESL Sensor Information Characteristic]	4.2.1.7	ESL Sensor Information Characteristic
ESLP/AP/SYNC/BV-03-C [Read Long Characteristic, Length > ATT_MTU, ESL LED Information Characteristic]	4.2.1.8	ESL LED Information Characteristic

Table 4.3: Read Long Characteristic, Length > ATT_MTU test cases

- Test Procedure

  1. The Upper Tester orders the IUT to read the Characteristic specified in Table 4.3.
  2. The IUT executes the GATT Read Characteristic Value sub-procedure for the Characteristic specified in Table 4.3.
  3. The Lower Tester sends an ATT response to the IUT with a length of ATT_MTU + 1.
  4. The IUT executes the GATT Read Long Characteristic Value sub-procedure for the Characteristic specified in Table 4.3.
  5. The Lower Tester sends an ATT response to the IUT with the content of the Characteristic specified in Table 4.3.

- Expected Outcome

  Pass verdict

  In Step 4, the IUT executes the GATT Read Long Characteristic Value sub-procedure to read the Characteristic specified in Table 4.3.

4.5 ESL Configuring state

ESLP/ESL/CFG/BI-01-C [Fail Characteristic GATT Procedures, LE Security Mode 1 Level 1]

- Test Purpose

  Verify that an ESL IUT rejects GATT Procedures when connected to a Lower Tester AP using LE security mode 1, level 1.

- Reference

  [3] 8.1

- Initial Condition

  - The IUT is connected to the Lower Tester using LE security mode 1, level 1.

- Test Procedure

  1. The Lower Tester executes the GATT Write Characteristic Value sub-procedure for the ESL Address characteristic with a valid ESL_ID and Group_ID.
  2. The IUT sends an ATT_ERROR_RSP PDU to the Lower Tester with Error Code set to Insufficient Encryption.
  3. The Lower Tester executes the GATT Write Characteristic Value sub-procedure for the ESL Control Point characteristic with the Ping opcode.
  4. The IUT sends an ATT_ERROR_RSP PDU to the Lower Tester with Error Code set to Insufficient Encryption.

- Expected Outcome

  Pass verdict

  In Steps 2 and 4, the IUT returns an Insufficient Encryption error.

4.6 ESL Synchronized state

Verify the correct implementation of the Synchronized state on the ESL.

4.6.1 Common parameters

4.6.1.1 Default Periodic Advertising with Responses parameters

Parameter	Value
Number of Subevents	128
Subevent Interval	125 ms (0x64)
Response Slot Delay	25 ms (0x14)
Response Slot Spacing	1.25 ms (0x0A)
Number of Response Slots	20 (0x14)

Table 4.4: Periodic Advertising with Responses parameters

4.6.1.1.1 Command Process Sequence

- Test Purpose

  Verify that an ESL IUT completes the commands received in the synchronization packet from the AP in the order received in the payload.

- Reference

  [3] 3.1.3

- Initial Condition

  - The IUT is in the Synchronized state with the Lower Tester using the preamble in Section 4.2.3.
  - The ESL IUT has been previously configured with an ESL Address, AP Sync Key Material, and ESL Response Key Material.

- Test Case Configuration

TCID	Number of commands	TLV addressed to the IUT	Response slot
ESLP/ESL/SYNC/BV-01-C [Command Process Sequence, Single Command]	2	1	1
ESLP/ESL/SYNC/BV-02-C [Command Process Sequence, Multiple Commands]	5	2 and 4	4
ESLP/ESL/SYNC/BV-03-C [Command Process Sequence, Multiple Commands]	16	3, 6, 10, and 13	13

Table 4.5: Command Process Sequence test cases

- Test Procedure

  1. The Lower Tester sends a PAwR synchronization packet containing the number of command TLVs specified in Table 4.5 and Group_ID. The command numbers for the IUT specified in Table 4.5 are set to be the Ping command with the IUT ESL_ID. The remaining commands are set to a random ESL_ID that does not match the IUT ESL_ID and a random command.
  2. The IUT sends a Basic State response for each command in Step 1 addressed to the IUT in the response slot specified in Table 4.5.

- Expected Outcome

  Pass verdict

  In Step 2, the IUT only sends the response packet in the response slot as specified in Table 4.5.

ESLP/ESL/SYNC/BV-04-C [Reject Bond to Additional APs]

- Test Purpose

  Verify that an ESL IUT does not bond to an additional AP when associated with an AP.

- Reference

  [3] 2.4

- Initial Condition

  - The IUT is bonded with the Lower Tester 1 AP.
  - The IUT is not bonded with the Lower Tester 2 AP.

- Test Procedure

  1. Lower Tester 2 initiates the bonding process.
  2. The IUT does not exchange bonding information with the Lower Tester 2 AP.

- Expected Outcome

  Pass verdict

  The ESL IUT does not bond to another AP.

ESLP/ESL/SYNC/BI-01-C [Ignore Factory Reset in Synchronized State]

- Test Purpose

  Verify that an ESL IUT ignores a Factory Reset command received in the Synchronized state.

- Reference

  [3] 5.3.1.3.1

- Initial Condition

  - The Lower Tester AP is in the Synchronized state with the IUT using the preamble in Section 4.2.3.
  - The ESL has been previously configured with an ESL Address, AP Sync Key Material, and ESL Response Key Material.

- Test Procedure

  1. The Lower Tester sends a PAwR synchronization packet to the IUT with the Group_ID and ESL_ID set to the IUT ESL_ID for the Factory Reset opcode (0x03).
  2. The IUT sends an “Invalid State” Error response.
  3. The Lower Tester sends a PAwR synchronization packet to the IUT for the Ping opcode (0x00).
  4. The IUT sends a Basic State response in the proper PAwR response slot.

- Expected Outcome

  Pass verdict

  In Step 2, the IUT sends an “Invalid State” Error.

  In Step 4, the IUT sends a Basic State notification to the Lower Tester.

ESLP/ESL/SYNC/BI-02-C [Invalid Synchronization Packet]

- Test Purpose

  Verify that an ESL IUT properly handles an invalid synchronization packet from the AP.

- Reference

  [3] 5.3.1

- Initial Condition

  - The IUT is in the Synchronized state with the Lower Tester AP using the preamble in Section 4.2.3.
  - The ESL has been previously configured with an ESL Address, AP Sync Key Material, and ESL Response Key Material.

- Test Procedure

  Repeat Steps 1 and 2 for each round in Table 4.6.

  1. The Lower Tester sends a PAwR synchronization packet containing a command specifically addressed to the IUT with the parameter set to the invalid value specified in Table 4.6, and all other parameters are valid values.
  2. The IUT ignores the synchronization packet sent in Step 1 and does not respond.

Round	Parameter	Invalid value
1	ESL Payload	Different Group ID
2	MIC	A random value that is not the AES-CCM of the ESL payload

Table 4.6: Invalid Synchronization Packet rounds

- Expected Outcome

  Pass verdict

  In Step 2, the IUT does not respond to the Lower Tester.

ESLP/ESL/SYNC/BV-05-C [Reject Broadcast Address]

- Test Purpose

  Verify that an ESL IUT rejects a command that is a broadcast address.

- Reference

  [3] 3.1.4

- Initial Condition

  - The Lower Tester is in the Synchronized state with the IUT using the preamble in Section 4.2.3.
  - The ESL has been previously configured with an ESL Address, AP Sync Key Material, and ESL Response Key Material.

- Test Procedure

  1. The Lower Tester executes the GATT Write Characteristic Value sub-procedure for the ESL Address characteristic with the ESL_ID field set to 0xFF.
  2. The IUT sends an ATT Error response to the Lower Tester with the error code Value Not Allowed (0x13).

- Expected Outcome

  Pass verdict

  In Step 2, the IUT sends an ATT Error response with the Value Not Allowed error code.

4.6.2 ESL Response

- Test Purpose

  Verify that an ESL IUT responds to the opcode from the Lower Tester AP with the proper Response Data Type in the proper response slot.

- Reference

  [3] 4.1, 5.3.1

- Initial Condition
  - The ESL has been previously configured with an ESL Address, AP Sync Key Material, and ESL Response Key Material.
  - The IUT is synchronized with the Lower Tester acting as the AP using the preamble in Section 4.2.3.
  - The subframe interval is defined by the TSPX_subframe_interval IXIT entry.
  - The response slot spacing is defined by the TSPX_response_slot_spacing IXIT entry.
- Test Case Configuration

Test case	Opcode	Opcode parameters	Response data type	Response parameters
ESLP/ESL/SYNC/BV-06-C [State Response, Read Sensor Data]	Read Sensor Data	ESL_ID Sensor_Index	Sensor Value	Sensor_Index Sensor_Data
ESLP/ESL/SYNC/BV-07-C [State Response, LED Control]	LED Control	ESL_ID LED_Index Color_Red Color_Green Color_Blue Brightness Flashing_Pattern Repeat_Type Repeats_Duration	LED State	LED_Index
ESLP/ESL/SYNC/BV-08-C [State Response, LED Timed Control]	LED Timed Control	ESL_ID LED_Index Color_Red Color_Green Color_Blue Brightness Flashing_Pattern Repeat_Type Repeats_Duration Absolute_Time	LED State	LED_Index
ESLP/ESL/SYNC/BV-09-C [State Response, Display Image]	Display Image	ESL_ID Display_Index Image_Index	Display State	Display_Index Image_Index
ESLP/ESL/SYNC/BV-10-C [State Response, Display Timed Image]	Display Timed Image	ESL_ID Display_Index Image_Index Absolute_Time	Display State	Display_Index Image_Index
ESLP/ESL/SYNC/BV-11-C [State Response, Ping]	Ping	ESL_ID	Basic State	N/A

Table 4.7: ESL Response test cases

- Test Procedure

  1. The Lower Tester sends a PAwR synchronization packet to the IUT with three TLVs. The first two TLVs have an ESL_ID other than the IUT ESL_ID and a random command. TLV_3 has the opcode with the parameters specified in Table 4.7 and the IUT ESL_ID and Group_ID.
  2. The IUT responds to the Lower Tester in response slot 3 with the parameters specified in Table 4.7. If the IUT responds with the Retry error response, then repeat Step 1.
  3. The Lower Tester sends a PAwR synchronization packet to the IUT with five TLVs. TLVs 1, 3, and 5 contain a random command and an ESL_ID different from the IUT ESL_ID. TLV2 includes the opcode and specific parameters outlined in Table 4.7, along with the IUT ESL_ID and Group_ID. TLV4 contains the Ping command, along with the IUT ESL_ID and Group_ID.
  4. The IUT responds to the Lower Tester in response slot 4 of the same subframe interval in Step 3. The subframe contains an ESL payload with a Response Data Type and parameters specified in Table 4.7 followed by a Basic State response. If the IUT responds with the Retry error response, then repeat Step 3.

- Expected Outcome

  Pass verdict

  In Step 2, the IUT sends the Retry error response or the ESL response to the Lower Tester in subframe 3 in the allocated response slot.

  In Step 4, the IUT sends a Retry error response or an ESL response to the Lower Tester in subframe 4 with two responses in the ESL payload. The first response is with the data type and parameters specified in Table 4.7. The second response is the Basic State response.

ESLP/ESL/SYNC/BV-12-C [Synchronize with the Subevent Equal to the Group ID]

- Test Purpose

  Verify that an ESL IUT synchronizes with the Lower Tester with the subevent equal to the Group ID field in the ESL Address.

- Reference

  [3] 5.3.1.3

- Initial Condition

  - The IUT is connected to the Lower Tester in the Configuring state.

- Test Procedure

  1. The Lower Tester executes the GATT Write Characteristic Value sub-procedure for the ESL Address characteristic with a valid ESL_ID and Group_ID set to 3.
  2. The Lower Tester executes the GATT Write Characteristic Value sub-procedure for the ESL AP Sync Key Material characteristic with the AP Synchronization Key.
  3. The Lower Tester executes the GATT Write Characteristic Value sub-procedure for the ESL Response Key Material characteristic with the ESL Response Key Material.
  4. The Lower Tester executes the GATT Write Characteristic Value sub-procedure for the ESL Current Absolute Time characteristic with a current time of 10000 ms.
  5. The Lower Tester starts advertising ADV_EXT_IND, AUX_ADV_IND with the SyncInfo field referring to AUX_SYNC_SUBEVENT_IND PDUs with an ACAD type set to valid values. The Lower Tester sends five subevents with AUX_SYNC_SUBEVENT_IND PDUs.
  6. The Upper Tester commands the IUT to synchronize with the Lower Tester.
  7. The IUT synchronizes with the Lower Tester on subevent 3.

- Expected Outcome

  Pass verdict

  In Step 7, the IUT synchronizes on subevent 3.

4.7 ESL Unsynchronized state

ESLP/ESL/UNS/BV-01-C [Transition to Updating State from Unsynchronized State]

- Test Purpose

  Verify that an ESL transitions to the Updating state after connecting to an AP in the Unsynchronized state.

- Reference

  [3] 5.5

- Initial Condition

  - The ESL IUT is associated with the AP Lower Tester and is in the Unsynchronized state.

- Test Procedure

  1. The Upper Tester orders the IUT to begin sending connectable advertising packets.
  2. The Lower Tester initiates a connection to the IUT.

- Expected Outcome

  Pass verdict

  The ESL IUT in the Unsynchronized state successfully transitions to the Updating state after successfully connecting with the Lower Tester.

4.8 ESL Updating state

ESLP/ESL/UPD/BV-02-C [Update Complete command, Synchronized]

- Test Purpose

  Verify that an ESL in the Updating state entered from the Synchronized state handles receiving the Update Complete command. The IUT will disconnect with the Lower Tester and confirm that it maintains synchronization by responding to a Ping command.

- Reference

  [3] 5.4

- Initial Condition

  - The ESL IUT is bonded with the AP Lower Tester and is in the Synchronized state.

- Test Procedure

  1. The Lower Tester starts to execute the GAP Periodic Advertising Connection procedure.
  2. The IUT and the Lower Tester create a connection.
  3. The IUT enters Updating state.
  4. The Lower Tester sends an Update Complete command to the IUT.
  5. Perform either alternative 5A or 5B depending on the IUT synchronization status.

Alternative 5A (The IUT does not maintain synchronization in Updating state):

5A.1 The IUT synchronizes with the Lower Tester.
5A.2 The IUT disconnects the ACL connection with the Lower Tester.

Alternative 5B (The IUT maintains synchronization in Updating state):

5B.1 The IUT disconnects the ACL connection with the Lower Tester.

6. The Lower Tester sends a PAwR synchronization packet with the Ping command.
7. The IUT sends a Basic State response to the Lower Tester.

- Expected Outcome

  Pass verdict

  In Step 5A.2 or 5B.1, the IUT disconnects from the Lower Tester.

  In Step 7, the IUT responds to the Lower Tester with a Basic State response.

ESLP/ESL/UPD/BV-03-C [Update Complete command, Unsynchronized]

- Test Purpose

  Verify that an ESL in the Updating state with one AP properly handles receiving the Update Complete command. The IUT will wait for synchronization to be established with the Lower Tester before disconnecting with the Lower Tester.

- Reference

  [3] 5.4

- Initial Condition

  - The ESL IUT is bonded with the AP Lower Tester and is in the Updating state.
  - The ESL IUT is not synchronized with the Lower Tester.

- Test Procedure

  1. The Lower Tester sends an Update Complete command to the IUT.
  2. The Lower Tester starts advertising ADV_EXT_IND, AUX_ADV_IND with the SyncInfo field referring to AUX_SYNC_SUBEVENT_IND PDUs with an ACAD type set to valid values. The Lower Tester sends five subevents with AUX_SYNC_SUBEVENT_IND PDUs.
  3. The IUT synchronizes with the Lower Tester.
  4. The IUT disconnects the ACL connection with the Lower Tester.
  5. The Lower Tester sends a PAwR synchronization packet with the Ping command.
  6. The IUT sends a Basic State response to the Lower Tester.

- Expected Outcome

  Pass verdict

  In Step 4, the IUT disconnects from the Lower Tester.

  In Step 6, the IUT responds to the Lower Tester with a Basic State response.

4.9 ESL Service Procedure – Object Transfer

ESLP/ESL/SP/BV-01-C [Write Images]

- Test Purpose

  Verify that the ESL IUT can receive images from the AP Lower Tester and write the images to the Object Store using the Object ID and the Object Transfer Service. The Lower Tester iterates through each uploaded image on the display.

- Reference

  [3] 4.2.1.6, 4.4, 6.2.2

- 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 Section 4.2.2 if using EATT over an LE transport.

- Test Procedure

  1. The IUT executes the GATT Read Characteristic Value sub-procedure for the Image Information characteristic to retrieve the Max_Image_Index.

  Repeat Steps 2–3 for each ImageIndex from 0 to Max_Image_Index.

  2. The Lower Tester reads the Object properties.
  3. Perform either alternative 3A or 3B depending on the Object properties.

     Alternative 3A (Write property is set to True):

     3A.1 The Lower Tester writes an image to the IUT with ObjectID set to 0x000000000100 + ImageIndex and ImageLength set to the length of the image.

     3A.2 The Lower Tester executes the GATT Write Characteristic Value sub-procedure for the ESL Control Point with the Display Image opcode with Display_Index set to 0 and Image_Index set to ImageIndex.

     Alternative 3B (Write property is set to False):

     3B.1 The Lower Tester executes the GATT Write Characteristic Value sub-procedure for the ESL Control Point with the Display Image opcode with Display_Index set to 0 and Image_Index set to ImageIndex.

- Expected Outcome

  Pass verdict

  In Step 3, the IUT sets the image on the display with display index 0.

4.10 ESL Pairing

ESLP/ESL/PAIR/BV-01-C [Reject Pairing Request]

- Test Purpose

  Verify that an ESL bonded with one AP rejects a pairing request from a different AP.

- Reference

  [3] 5.4

- Initial Condition
  - The ESL IUT is bonded with AP Lower Tester 1.
  - The ESL IUT is not bonded with AP Lower Tester 2.
- Test Procedure

  1. Lower Tester 2 initiates a connection to the IUT.
  2. Perform either alternative 2A or 2B depending on the IUT response to the connection request.

     Alternative 2A (The IUT rejects the connection request):

     2A.1 The test ends with a Pass verdict.

     Alternative 2B (The IUT accepts the connection request):

     2B.1 Lower Tester 2 and the IUT are connected.
     2B.2 Lower Tester 2 initiates the pairing request with the IUT.
     2B.3 The IUT rejects the pairing request from Lower Tester 2.

- Expected Outcome

  Pass verdict

  In Step 2A.1, the IUT rejects the connection request.

  In Step 2B.3, the ESL IUT rejects the pairing request.

4.11 Service Procedure – ESL Control Point

- Test Purpose

  Verify that the AP IUT can write the specified opcode to the ESL Control Point and verify the response type when provided.

- Reference

  [3] 4.2.1.9

- 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 Section 4.2.2 if using EATT over an LE transport.
- Test Case Configuration

Test Case	Opcode	Response
ESLP/AP/ECP/BV-01-C [ESL Control Point – Ping]	Ping	Basic State
ESLP/AP/ECP/BV-02-C [ESL Control Point – LED Control]	LED Control	LED State
ESLP/AP/ECP/BV-03-C [ESL Control Point – LED Timed Control]	LED Timed Control	LED State
ESLP/AP/ECP/BV-04-C [ESL Control Point – Display Image]	Display Image	Display State
ESLP/AP/ECP/BV-05-C [ESL Control Point – Display Timed Image]	Display Timed Image	Display State

Test Case	Opcode	Response
ESLP/AP/ECP/BV-06-C [ESL Control Point – Unassociate from AP]	Unassociate from AP	Basic State
ESLP/AP/ECP/BV-07-C [ESL Control Point – Read Sensor Data]	Read Sensor Data	Sensor Value
ESLP/AP/ECP/BV-08-C [ESL Control Point – Refresh Display]	Refresh Display	Display State
ESLP/AP/ECP/BV-09-C [ESL Control Point – Factory Reset]	Factory Reset	None

Table 4.8: Service Procedure – ESL Control Point test cases

- Test Procedure

  1. The Upper Tester orders the IUT to write to the ESL Control Point with the opcode listed in Table 4.8 with valid parameters.
  2. The IUT sends the GATT Write Without Response sub-procedure or GATT Write Characteristic Value sub-procedure for the ESL Control Point with the opcode and parameters received in Step 1.
  3. The Lower Tester sends the IUT the response listed in Table 4.8.

- Expected Outcome

  Pass verdict

  The IUT successfully writes the specified opcode to the ESL Control Point and verifies the response type when provided.

4.12 AP procedures

Verify that the AP can perform the necessary procedures.

ESLP/AP/PROC/BV-01-C [Discover and Connect to an Unassociated ESL]

- Test Purpose

  Verify that an AP IUT discovers ESLs in the Unassociated state and initiates a connection.

- Reference

  [3] 5.1, 5.2

- Initial Condition

  - The IUT is not associated with the Lower Tester.

- Test Procedure

  1. The Upper Tester orders the IUT to start scanning for ESLs.
  2. The IUT discovers the Lower Tester using the GAP General Discovery procedure.
  3. The IUT initiates a connection to the Lower Tester.

- Expected Outcome

  Pass verdict

  In Step 3, the IUT initiates a connection to the Lower Tester.

  After the connection is completed, the IUT is in a Configuring state.

ESLP/AP/PROC/BV-02-C [Configure an ESL]

- Test Purpose

  Verify that an AP IUT can configure an ESL by reading and writing characteristics.

- Reference

  [3] 5.2

- Initial Condition

  - The Lower Tester acting as an ESL and is in the Unassociated state and advertising.
  - The Lower Tester has its ESL Display Information characteristic set to the TSPX_display_information IXIT value
  - The Lower Tester has its ESL Image Information characteristic set to the TSPX_image_information IXIT value
  - The Lower Tester has its ESL Sensor Information characteristic set to the TSPX_sensor_information IXIT value
  - The Lower Tester has its ESL LED Information characteristic set to the TSPX_led_information IXIT value

- Test Procedure

  1. The Upper Tester orders the IUT to start scanning for ESLs in the Unassociated state.
  2. The Lower Tester accepts the connection request and bonds with the IUT.

  Steps 3–10 can be executed in any order.

  3. The IUT executes the GATT Characteristic Value Read procedure to the Lower Tester for the ESL Display Information characteristic.
  4. The IUT executes the GATT Read Characteristic Value sub-procedure to the Lower Tester for the ESL Image Information characteristic.
  5. The IUT executes the GATT Characteristic Value Read procedure to the Lower Tester for the ESL Sensor Information characteristic.
  6. The IUT executes the GATT Characteristic Value Read Characteristic Value sub-procedure to the Lower Tester for the ESL LED Information characteristic.
  7. The IUT executes the GATT Write Characteristic Value sub-procedure to the Lower Tester for the ESL Address characteristic with an ESL Address.
  8. The IUT executes the GATT Write Characteristic Value sub-procedure to the Lower Tester for the AP Synchronization Key Material characteristic with an AP Synchronization Key.
  9. The IUT executes the GATT Write Characteristic Value sub-procedure to the Lower Tester for the ESL Response Key Material characteristic with an ESL Response Key.
  10. The IUT executes the GATT Write Characteristic Value sub-procedure to the Lower Tester for the ESL Current Absolute Time characteristic with a valid time.

- Expected Outcome

  Pass verdict

  The AP can successfully configure an ESL by reading and writing the characteristics.

ESLP/AP/PROC/BV-03-C [Reconfigure an ESL in the Updating State]

- Test Purpose

  Verify that an AP IUT can reconfigure an ESL in the Updating state.

- Reference

  [3] 5.3.2, 5.4

- Initial Condition

  - The Lower Tester and the IUT have already been configured and are currently in the Updating state.

- Test Procedure

  1. The IUT initiates the connection to the Lower Tester and secures the connection using the LTK established during bonding.

  Steps 2–9 can be executed in any order.

  2. The IUT executes the GATT Characteristic Value Read procedure to the Lower Tester for the ESL Display Information characteristic.
  3. The IUT executes the GATT Read Characteristic Value sub-procedure to the Lower Tester for the ESL Image Information characteristic.
  4. The IUT executes the GATT Characteristic Value Read procedure to the Lower Tester for the ESL Sensor Information characteristic.
  5. The IUT executes the GATT Characteristic Value Read procedure to the Lower Tester for the ESL LED Information characteristic.
  6. The IUT executes the GATT Write Characteristic Value sub-procedure to the Lower Tester for the ESL Address characteristic.
  7. The IUT executes the GATT Write Characteristic Value sub-procedure to the Lower Tester for the AP Synchronization Key Material characteristic with an AP Synchronization Key.
  8. The IUT executes the GATT Write Characteristic Value sub-procedure to the Lower Tester for the ESL Response Key Material characteristic with an ESL Response Key.
  9. The IUT executes the GATT Write Characteristic Value sub-procedure to the Lower Tester for the ESL Current Absolute Time characteristic with a Time.

- Expected Outcome

  Pass verdict

  The AP IUT successfully transitions the ESL Lower Tester to the Updating state and, after initiating the connection, secures the connection using the LTK established during bonding.

  The AP IUT successfully updates the configuring characteristics of the Lower Tester and transitions the ESL Lower Tester to the Synchronized state.

ESLP/AP/PROC/BV-04-C [Update Stored Image on ESL]

- Test Purpose

  Verify that an AP IUT can update an image on an ESL in the Configuring state using Object Transfer Profile [8].

- Reference

  [3] 6.1.2

- 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 Section 4.2.2 if using EATT over an LE transport.
- Test Procedure
  1. The Upper Tester orders the IUT to read the ESL Image Information characteristic.
  2. The IUT executes the GATT Read characteristic Value sub-procedure to the Lower Tester for the ESL Image Information characteristic.
  3. The Upper Tester orders the IUT to write an image to the Max_Image_Index from Step 2.
  4. The IUT writes an image with the OTP Write Object procedure to the Lower Tester with ObjectID set to 0x000000000100 + Index set to the index from Step 3, and Length set to the length of the image and Offset set to 0.
- Expected Outcome

  Pass verdict

  In Step 4, the IUT writes the image to the Lower Tester using OTP.

ESLP/AP/PROC/BV-05-C [Broadcast to Multiple ESLs]

- Test Purpose

  Verify that an AP can broadcast a command with the ESL_ID set to 0xFF in the Synchronized state.
- Reference

  [3] 5.3.1.3
- Initial Condition
  - The Lower Tester acting as an ESL and the AP IUT have already been configured and are currently in the Synchronized state.
  - The IUT has set the ESL Address of the Lower Tester using the preamble in Section 4.2.4.
- Test Procedure
  1. The Upper Tester orders the IUT to send a Ping broadcast command to the Lower Tester's Group ID.
  2. The IUT sends a PAwR subframe packet in the first slot of the subframe with the Group ID set to the value from Step 1 and ESL_ID set to 0xFF.
  3. The Lower Tester verifies that it received the Ping command with ESL_ID set to 0xFF.
- Expected Outcome

  Pass verdict

  The IUT successfully broadcasts the Ping command with ESL_ID set to 0xFF in the Synchronized state.

ESLP/AP/PROC/BV-06-C [Control LED in the Updating State]

- Test Purpose

  Verify that an AP IUT can control the state of the LED on an ESL in the Updating state.

- Reference

  [3] 6.1.3

- Initial Condition

  - The Lower Tester, acting as an ESL, is in the Updating state.
  - The Lower Tester is configured to have three LEDs, each supporting a multi-color LED.
  - The IUT has set the ESL Address of the Lower Tester using the preamble in Section 4.2.4.

- Test Procedure

  Repeat Steps 1–2 for each round specified in Table 4.9.

  1. The Upper Tester orders the IUT to execute the GATT Write Characteristic Value sub-procedure for the ESL Control Point with the LED Control opcode (0xB0) with the parameters specified in Table 4.9 and ESL_ID set to the least significant 8 bits of the Lower Tester's ESL address.
  2. The Lower Tester sends a GATT Characteristic Value Notification for the ESL Control Point with the Basic State opcode response.

Round	Red	Green	Blue	Brightness	Flashing Pattern	Repeat type	Repeats duration	LED_Index
1	0b00	0b00	0b00	0b11	0x00000000	0b1	0x0	0
2	0b11	0b11	0b11	0b11	0xFFFFFFFF	0b1	0b0	1
3	0b10	0b10	0b10	0b11	0xFFFFFFFF	0b0	0x0	0
4	0b01	0b10	0b01	0b10	0x55AA55AA	0b0	0b0	2

Table 4.9: Control LED in the Updating State rounds

- Expected Outcome

  Pass verdict

  The AP IUT can successfully control the state of an LED of the ESL in the Updating state.

ESLP/AP/PROC/BV-07-C [Control Timed LED in the Updating State]

- Test Purpose

  Verify that an AP IUT can control the state of a timed LED on the ESL in the Updating state.

- Reference

  [3] 6.1.3

- Initial Condition

  - The Lower Tester, acting as an ESL, is in the Updating state.
  - The Lower Tester is configured to have three LEDs, each supporting a multi-color LED.
  - The IUT has set the ESL Address of the Lower Tester using the preamble in Section 4.2.4.

- Test Procedure

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

  1. The Upper Tester orders the IUT to execute the GATT Write Characteristic Value sub-procedure for the ESL Control Point with the LED Control opcode (0xB0) with parameters specified in Table 4.10 and:
     - ESL_ID set to the least significant 8 bits of the Lower Tester's ESL address
     - Color_Red, Color_Green, and Color_Blue set to 0b00
     - Flashing_Pattern set to 0xFFFFFFFF
     - Bit_Off_Period set to 0xFA (500 ms)
     - Bit_On_Period set to 0xFA (500 ms)
     - Repeat_Type set to 0b1
     - Repeats_Duration set to 0x0
  2. The Lower Tester sends a GATT Characteristic Value Notification for the ESL Control Point with the Basic State opcode response.

Round	Brightness	Absolute Time (ms)	LED Index
1	3	2000	1
2	1	5000	0
3	0	10000	2

Table 4.10: Control Timed LED in the Updating State rounds

- Expected Outcome

  Pass verdict

  The AP IUT can successfully change the state of a timed LED on an ESL in the Updating state.

ESLP/AP/PROC/BV-08-C [Transition to the Synchronized State]

- Test Purpose

  Verify that an AP IUT can transition to the Synchronized state and that the connection to the ESL is no longer established.

- Reference

  [3] 6.1.6

- Initial Condition

  - The Lower Tester, acting as an ESL, is in the Configuring state.

- Test Procedure

  1. The Upper Tester orders the IUT to sync with the Lower Tester.
  2. The IUT starts advertising synchronization packets.
  3. When the IUT has synchronized with the Lower Tester, the ACL connection is terminated by the Lower Tester.

- Expected Outcome

  Pass verdict

  In Step 3, the IUT transmits synchronization packets to the Lower Tester.

ESLP/AP/PROC/BV-09-C [ESL Synchronized State Status]

- Test Purpose

  Verify that an AP IUT can check the Synchronized state of an associated ESL.

- Reference

  [3] 6.2.4

- Initial Condition

  - The Lower Tester, acting as an ESL, is in the Synchronized state.
  - The IUT has set the ESL Address of the Lower Tester using the preamble in Section 4.2.4.

- Test Procedure

  1. The Upper Tester orders the IUT to execute the Ping opcode (0x00), and ESL_ID is set to the least significant 8 bits of the Lower Tester's ESL address.
  2. The IUT sends a PAwR synchronization packet to the Lower Tester with the Group_ID and ESL_ID set to the value from Step 1 for the Ping opcode (0x00).
  3. The Lower Tester sends a "Basic State" response.

- Expected Outcome

  Pass verdict

  The AP IUT receives a valid response from the synchronized ESL.

ESLP/AP/PROC/BV-10-C [Control LED in the Synchronized State]

- Test Purpose

  Verify that an AP IUT can control the state of an LED on the ESL in the Synchronized state.

- Reference

  [3] 6.2.1

- Initial Condition

  - The Lower Tester, acting as an ESL, is in the Synchronized state.
  - The IUT has set the ESL Address of the Lower Tester using the preamble in Section 4.2.4.

- Test Procedure

  Repeat Steps 1–3 for each round specified in Table 4.9.

  1. The Upper Tester orders the IUT to send an LED Control opcode (0xB0) to the synchronized Lower Tester with the parameters specified in Table 4.9 and ESL_ID set to the least significant 8 bits of the Lower Tester's ESL address.
  2. The IUT sends a PAwR subframe packet in the first slot to the Lower Tester for the LED Control opcode with the parameters in Step 1. The payload is encrypted using Encrypted Advertising Data.
  3. The Lower Tester sends an LED State response in the proper PAwR response slot with LED_Index set to the value in Step 1.

- Expected Outcome

  Pass verdict

  In Step 2, the IUT sends an LED Control command to the Lower Tester in the first slot with the parameters in Table 4.9, encrypted advertising data, and with a payload length ≤48 octets. The ESL_ID is set to the least significant 8 bits of the Lower Tester's ESL address.

ESLP/AP/PROC/BV-11-C [Control Timed LED in the Synchronized State]

- Test Purpose

  Verify that an AP IUT can control the state of a timed LED on the ESL in the Synchronized state.

- Reference

  [3] 6.2.1

- Initial Condition

  - The Lower Tester, acting as an ESL, is in the Synchronized state.
  - The IUT has set the ESL Address of the Lower Tester using the preamble in Section 4.2.4.

- Test Procedure

  Repeat Steps 1–3 for each round specified in Table 4.10.

  1. The Upper Tester orders the IUT to send an LED Timed Control opcode (0xF0) to the synchronized Lower Tester with parameters specified in Table 4.10 and ESL_ID set to the least significant 8 bits of the Lower Tester's ESL address.
  2. The IUT sends a PAwR subframe packet in the first slot to the Lower Tester for the Control Timed LED opcode with the parameters in Step 1.
  3. The Lower Tester sends an LED State response in the proper PAwR response slot with LED_Index set to the value in Step 1.

- Expected Outcome

  Pass verdict

  In Step 2, the IUT sends an LED Timed Control command to the Lower Tester in the first slot with the parameters in Table 4.10, encrypted advertising data, and with a payload length ≤48 octets. The ESL_ID is set to the least significant 8 bits of the Lower Tester's ESL address.

ESLP/AP/PROC/BV-12-C [Transition to the Unassociated State]

- Test Purpose

  Verify that an AP IUT can transition an ESL from the Updating state to the Unassociated state. Also verify that the AP IUT can handle the Retry error response.

- Reference

  [3] 6.1.4

- Initial Condition

  - The Lower Tester, acting as an ESL, is in the Updating state.
  - The IUT has set the ESL Address of the Lower Tester using the preamble in Section 4.2.4.

- Test Procedure

  1. The Upper Tester orders the IUT to Unassociate from the Lower Tester with ESL_ID set to the value from the initial condition.
  2. The IUT executes the GATT Write Characteristic Value sub-procedure for the ESL Control Point with the Unassociate from AP opcode (0x01) with ESL_ID set to the least significant 8 bits of the Lower Tester's ESL address.
  3. The Lower Tester sends a GATT Characteristic Value Notification for the ESL Control Point with the Error opcode response with the Retry (0x0A) error code.
  4. The IUT executes the GATT Write Characteristic Value sub-procedure for the ESL Control Point with the Unassociate from AP opcode (0x01) with ESL_ID set to the least significant 8 bits of the Lower Tester's ESL address.
  5. The Lower Tester sends a GATT Characteristic Value Notification for the ESL Control Point with the Basic State opcode response.
  6. The Upper Tester verifies that the bonding information and AP Sync Key Material are not stored in the IUT's internal storage.

- Expected Outcome

  Pass verdict

  The IUT can successfully transition an ESL to the Unassociated state.

ESLP/AP/PROC/BV-13-C [Control an Image in the Synchronized State]

- Test Purpose

  Verify that an AP IUT can control an image on an ESL in the Synchronized state.

- Reference

  [3] 6.2.2

- Initial Condition

  - The Lower Tester, acting as an ESL, is in the Synchronized state.
  - The IUT has set the ESL Address of the Lower Tester using the preamble in Section 4.2.4.
  - The Lower Tester contains three displays and five image storage locations. Image locations 0 and 4 have unique images.

- Test Procedure

  Repeat Steps 1–3 for each round specified in Table 4.11.

  1. The Upper Tester orders the IUT to send a Display Image opcode (0x20) to the synchronized Lower Tester with:
     - ESL_ID set to the least significant 8 bits of the Lower Tester's ESL address
     - Display_Index set to the value in Table 4.11
     - Image_Index set to the value in Table 4.11
  2. The IUT sends a PAwR subframe packet in the first response slot to the Lower Tester for the Display Image opcode with the parameters in Step 1.
  3. The Lower Tester sends a Display State response in the proper PAwR response slot with Display_Index and Image_Index set to the value in Step 1.

Round	Display Index	Image Index
1	0	4
2	2	0
3	0	0
4	2	4

Table 4.11: Control an Image in the Synchronized State rounds

- Expected Outcome

  Pass verdict

  In Step 2, the IUT sends a Display Image command to the Lower Tester in the first slot for the Display Image opcode with the parameters in Table 4.11, encrypted advertising data, and with a payload length ≤48 octets. The ESL_ID is set to the least significant 8 bits of the Lower Tester's ESL address.

ESLP/AP/PROC/BV-14-C [Control a Timed Image in the Synchronized State]

- Test Purpose

  Verify that an AP IUT can control a timed image on an ESL in the Synchronized state.

- Reference

  [3] 6.2.2

- Initial Condition

  - The Lower Tester, acting as an ESL, is in the Synchronized state.
  - The IUT has set the ESL Address of the Lower Tester using the preamble in Section 4.2.4.
  - The Lower Tester contains three displays and five image slots. Each image slot has a unique image.

- Test Procedure

  1. The Lower Tester executes the GATT Write Characteristic Value sub-procedure for the ESL Current Absolute Time characteristic with a value of 30000.

  Repeat Steps 2–4 for each round specified in Table 4.12.

  2. The Upper Tester orders the IUT to send a Display Timed Image opcode (0x60) to the synchronized Lower Tester with:
     - ESL_ID set to the least significant 8 bits of the Lower Tester's ESL address
     - Display_Index set to the value in Table 4.12
     - Image_Index set to the value in Table 4.12
     - Absolute_Time set to the value in Table 4.12
  3. The IUT sends a PAwR subframe packet in the allocated response slot to the Lower Tester for the Display Timed Image opcode with the parameters in Step 2.
  4. The Lower Tester sends a Display State response in the proper PAwR response slot with Display_Index and Image_Index set to the value in Step 3.

Round	Display Index	Image Index	Absolute Time
1	0	4	35000
2	2	0	40000
3	0	0	50000
4	2	4	90000

Table 4.12: Control a Timed Image in the Synchronized State rounds

- Expected Outcome

  Pass verdict

  In Step 3, the IUT sends a Display Timed Image command to the Lower Tester in the allocated response slot for the Display Timed Image opcode with the parameters in Table 4.12, encrypted advertising data, and with a payload length ≤48 octets. The ESL_ID is set to the least significant 8 bits of the Lower Tester's ESL address.

ESLP/AP/PROC/BV-15-C [Read Sensor Data in the Synchronized State]

- Test Purpose

  Verify that an AP IUT can read the sensor data on an ESL in the Synchronized state.

- Reference

  [3] 6.2.3

- Initial Condition

  - The Lower Tester, acting as an ESL, is in the Synchronized state.
  - The IUT has set the ESL Address of the Lower Tester using the preamble in Section 4.2.4.
  - The IUT has discovered the Lower Tester's Sensor Index by performing the test procedure in Section 4.3 or is known to the IUT by other means.

- Test Procedure

  1. The Upper Tester orders the IUT to send a Read Sensor Data opcode (0x10) to the synchronized Lower Tester with:
     - ESL_ID set to the least significant 8 bits of the Lower Tester's ESL address
     - Sensor_Index set to the value from the initial condition
  2. The IUT sends a PAwR subframe packet in the allocated response slot to the Lower Tester for the Read Sensor Data opcode with the parameters in Step 1.
  3. The Lower Tester sends a Sensor Value response in the proper PAwR response slot with Sensor_Index set to the value in Step 1 with the Sensor_Data.

- Expected Outcome

  Pass verdict

  In Step 2, the IUT sends a Read Sensor Data command to the Lower Tester in the allocated response slot for the Read Sensor Data opcode with the parameters in Step 1, encrypted advertising data, and with a payload length ≤48 octets. The ESL_ID is set to the least significant 8 bits of the Lower Tester's ESL address.

ESLP/AP/PROC/BV-16-C [Transition from the Synchronized State to the Updating State]

- Test Purpose

  Verify that an AP IUT can transition an ESL from the Synchronized state to the Updating state using the GAP Periodic Advertising Connection procedure.

- Reference

  [3] 6.2.5

- Initial Condition

  - The Lower Tester, acting as an ESL, is in the Synchronized state.
  - The IUT has set the ESL Address of the Lower Tester using the preamble in Section 4.2.4.

- Test Procedure

  1. The Upper Tester orders the IUT to execute the GAP Periodic Advertising Connection procedure.
  2. The IUT and the Lower Tester create a connection.

- Expected Outcome

  Pass verdict

  A connection has been created between the IUT and the Lower Tester.

4.12.1 Send Factory Reset Command

- Test Purpose

  Verify that an AP IUT sends a Factory Reset command to an ESL in the state specified in Table 4.13.

- Reference

  [3] 5.3.1.3.1

- Initial Condition

  - The Lower Tester, acting as an ESL, is set to the state in Table 4.13.
  - The IUT has set the ESL Address of the Lower Tester using the preamble in Section 4.2.4.

- Test Procedure

  1. The Lower Tester executes the GATT Write Characteristic Value sub-procedure for the ESL Address characteristic with a valid ESL_ID and Group_ID.
  2. The Upper Tester orders the IUT to execute the GATT Write Characteristic Value sub-procedure for the ESL Control Point with the Factory Reset opcode (0x02) and ESL_ID set to the least significant 8 bits of the Lower Tester's ESL address.

- Test Case Configuration

Test Case	State
ESLP/AP/PROC/BV-17-C [Send Factory Reset Command, Configuring State]	Configuring
ESLP/AP/PROC/BV-18-C [Send Factory Reset Command, Updating State]	Updating

Table 4.13: Send Factory Reset Command test cases

- Expected Outcome

  Pass verdict

  The AP IUT sends a Factory Reset command to an ESL Lower Tester in the state specified in Table 4.13.

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 Electronic Shelf Label Profile [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 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)
ESLP 13/1 AND ESLP 1/1	Electronic Shelf Label Service, ESL	ESLP/ESL/SYNC/BV-11-C ESLP/ESL/UNS/BV-01-C
ESLP 1/2	Electronic Shelf Label Service, AP	ESLP/CL/CGGIT/SER/BV-01-C
ESLP 13/2	Object Transfer Service	ESLP/CL/CGGIT/SER/BV-02-C
ESLP 13/3	Device Information Service	ESLP/CL/CGGIT/SER/BV-03-C
ESLP 32/1	ESL Address Characteristic	ESLP/CL/CGGIT/CHA/BV-01-C
ESLP 32/2	AP Sync Key Material Characteristic	ESLP/CL/CGGIT/CHA/BV-02-C
ESLP 32/3	ESL Response Key Material Characteristic	ESLP/CL/CGGIT/CHA/BV-03-C
ESLP 32/4	ESL Current Absolute Time Characteristic	ESLP/CL/CGGIT/CHA/BV-05-C
ESLP 12/4 AND ESLP 1/1	ESL Display Information Characteristic, ESL	ESLP/ESL/SYNC/BV-09-C ESLP/ESL/SYNC/BV-10-C
ESLP 32/5 AND ESLP 1/2	ESL Display Information Characteristic, AP	ESLP/CL/CGGIT/CHA/BV-06-C ESLP/AP/SYNC/BV-01-C
ESLP 32/6	ESL Image Information Characteristic	ESLP/CL/CGGIT/CHA/BV-07-C
ESLP 12/7 AND ESLP 1/1	ESL Sensor Information Characteristic, ESL	ESLP/ESL/SYNC/BV-06-C
ESLP 32/7 AND ESLP 1/2	ESL Sensor Information Characteristic, AP	ESLP/CL/CGGIT/CHA/BV-08-C ESLP/AP/SYNC/BV-02-C
ESLP 12/10 AND ESLP 1/1	ESL LED Information Characteristic, ESL	ESLP/ESL/SYNC/BV-07-C ESLP/ESL/SYNC/BV-08-C
ESLP 32/8 AND ESLP 1/2	ESL LED Information Characteristic, AP	ESLP/CL/CGGIT/CHA/BV-09-C ESLP/AP/SYNC/BV-03-C
ESLP 32/9	ESL Control Point Characteristic	ESLP/CL/CGGIT/CHA/BV-10-C

Item	Feature	Test Case(s)
ESLP 1/1	ESL Role	ESLP/ESL/CFG/BI-01-C ESLP/ESL/PAIR/BV-01-C ESLP/ESL/UPD/BV-02-C ESLP/ESL/UPD/BV-03-C ESLP/ESL/SP/BV-01-C
ESLP 12/1	Synchronized State, ESL	ESLP/ESL/SYNC/BV-01-C ESLP/ESL/SYNC/BV-02-C ESLP/ESL/SYNC/BV-03-C ESLP/ESL/SYNC/BV-04-C ESLP/ESL/SYNC/BI-01-C ESLP/ESL/SYNC/BI-02-C ESLP/ESL/SYNC/BV-05-C ESLP/ESL/SYNC/BV-12-C
ESLP 33/1	Ping, AP	ESLP/AP/ECP/BV-01-C
ESLP 33/10	LED Control, AP	ESLP/AP/ECP/BV-02-C
ESLP 33/11	LED Timed Control, AP	ESLP/AP/ECP/BV-03-C
ESLP 33/8	Display Image, AP	ESLP/AP/ECP/BV-04-C
ESLP 33/9	Display Timed Image, AP	ESLP/AP/ECP/BV-05-C
ESLP 33/2	Unassociate From AP, AP	ESLP/AP/ECP/BV-06-C
ESLP 33/5	Read Sensor Data, AP	ESLP/AP/ECP/BV-07-C
ESLP 33/6	Refresh Display, AP	ESLP/AP/ECP/BV-08-C
ESLP 33/4	Factory Reset, AP	ESLP/AP/ECP/BV-09-C
ESLP 34/1	Discover ESLs	ESLP/AP/PROC/BV-01-C
ESLP 34/3	Configure an ESL	ESLP/AP/PROC/BV-02-C ESLP/AP/PROC/BV-03-C
ESLP 34/4	Update Stored Image on ESL	ESLP/AP/PROC/BV-04-C
ESLP 1/2	AP Role	ESLP/AP/PROC/BV-05-C
ESLP 34/5	Control LED, Updating State	ESLP/AP/PROC/BV-06-C ESLP/AP/PROC/BV-07-C
ESLP 34/6	Transition to the Synchronized State	ESLP/AP/PROC/BV-08-C
ESLP 34/7	ESL Synchronized State Status	ESLP/AP/PROC/BV-09-C
ESLP 34/8	Control LED, Synchronized State	ESLP/AP/PROC/BV-10-C ESLP/AP/PROC/BV-11-C
ESLP 34/9	Transition to the Unassociated State	ESLP/AP/PROC/BV-12-C
ESLP 34/10	Control Image, Synchronized State	ESLP/AP/PROC/BV-13-C ESLP/AP/PROC/BV-14-C
ESLP 34/11	Read Sensor Data, Synchronized State	ESLP/AP/PROC/BV-15-C
ESLP 34/12	Transition from Synchronized to Updating State	ESLP/AP/PROC/BV-16-C
ESLP 33/4	Factory Reset	ESLP/AP/PROC/BV-17-C ESLP/AP/PROC/BV-18-C

Table 5.1: Test case mapping

6 Revision history and acknowledgments

Revision History

Publication Number	Revision Number	Date	Comments
0	p0	2023-04-04	Approved by BTI on 2023-03-15. ESLP v1.0 adopted by the BoD on 2023-03-28. Prepared for initial publication.
	p1r00	2023-08-09 – 2023-08-15	TSE 22892 (rating 1): Added “ESL” to the beginning of relevant characteristic names in the Input for the GGIT Client Test Procedure table, in the test case configuration table for ESLP/AP/SYNC/BV-01-I – -03-I, in the initial condition and test procedure for ESLP/AP/PROC/BV-02-I, and in the test procedure for ESLP/AP/PROC/BV-03-I and -04-I. Updated the TCIDs for ESLP/CL/CGGIT/CHA/BV-06-I – -09-I and ESLP/AP/SYNC/BV-01-I – -03-I and updated the TCMT accordingly. TSE 23415 (rating 1): Converted all -I tests to -C tests. Updated the TCMT accordingly.
1	p1	2024-07-01	Approved by BTI on 2024-04-21. Prepared for TCRL 2024-1 publication.
	p2r00–r05	2024-10-02 – 2024-12-02	TSE 24794 (rating 4): Updated ESLP/ESL/UPD/BV-02-C to rewrite test procedure. TSE 25421 (rating 2): Updated ESLP/ESL/SP/BV-01-C to rewrite test procedure and expected outcome. TSE 25550 (rating 2): Updated the TCMT to address incorrect test case mappings. TSE 25614 (rating 1): Added a test case identifer to the ESLP TC feature naming conventions table. Moved ESLP/ESL/UPD/BV-01-C from the ESL Updating state section to the new ESL Pairing section and renamed it ESLP/ESL/PAIR/BV-01-C. Renamed the Service Procedure – Object Transfer section to the ESL Service Procedure – Object Transfer section. Updated the TCMT accordingly.
2	p2	2025-02-18	Approved by BTI on 2024-12-23. Prepared for TCRL 2025-1 publication.

Acknowledgments

Name	Company
Gene Chang	Bluetooth SIG, Inc.