Environmental Sensing Service (ESS)

***Bluetooth*® Test Suite**

- **Revision:** ESS.TS.p3
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- **Group Prepared By:** BTI

Contents

1 Scope

This Bluetooth document contains the Test Suite Structure (TSS) and test cases to test the implementation of the Bluetooth Environmental Sensing 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, by dated or undated reference, provisions from other publications. 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] Test Strategy and Terminology Overview

[2] Bluetooth Core Specification, Version 4.0 or later

[3] Environmental Sensing Service Specification, Version 1.0

[4] ICS Proforma for Environmental Sensing Service, ESS.ICS

[5] GATT Test Suite, GATT.TS

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

[7] Environmental Sensing Service Implementation eXtra Information for Test, ESS.IXIT

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 Environmental Sensing Service requires the presence of GAP, ATT, and GATT. Where the LE transport is used, SM is also required. Where the BR/EDR transport is used, SDP is also required. This is illustrated in Figure 3.1.

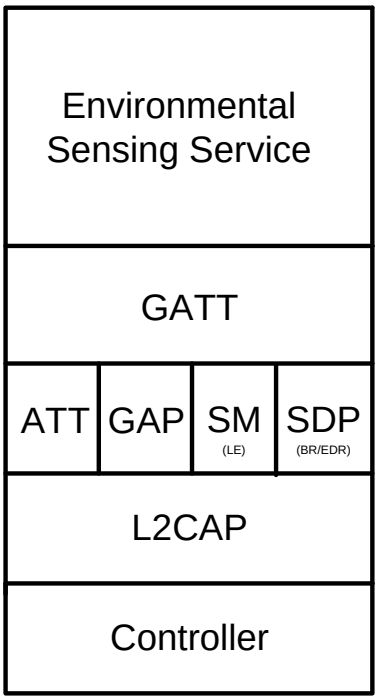

Figure 3.1: Environmental Sensing Service test model

3.2 Test Strategy

The test objectives are to verify functionality of the Environmental Sensing Service within a Bluetooth Host and enable interoperability between Bluetooth Hosts on different devices. The testing approach is to cover mandatory and optional requirements in the specification and to match 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.

3.3 Test groups

The following test groups have been defined:

- Characteristic Declaration
- Generic GATT Integrated Tests
- Characteristic Descriptors and Read
- Characteristic Read
- Characteristic Descriptor Write
- Configure Notification
- Configure Indication
- Characteristic Notification
- Characteristic Indication
- Service Procedure – General 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 [1]. 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 [5] referred to as Generic GATT Integrated Tests (GGIT); when used, the GGIT tests 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>**
ESS	Environmental Sensing Service
Identifier Abbreviation	**Role Identifier <IUT role>**
SEN	Environmental Sensor Role
Identifier Abbreviation	**Reference Identifier <GGIT test group>**
SGGIT	Server Generic GATT Integrated Tests
Identifier Abbreviation	**Reference Identifier <GGIT class>**
CHA	Characteristic
SDP	Validate SDP Record
SER	Service
Identifier Abbreviation	**Feature Identifier <feat>**
CI	Characteristic Indication
CN	Characteristic Notification
CON	Configure Indication or Notification
CR	Characteristic Read
DEC	Characteristic Declaration
DES	Characteristic Descriptor Declaration and Read
DW	Characteristic Descriptor Write
SPE	Service Procedure – Error Handling

Table 4.1: Environmental Sensing Service TC feature naming convention

4.1.2 Conformance

When conformance is claimed for a particular specification, all capabilities are to be supported in the specified manner (process-mandatory). 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 Launch Studio, with the test case as described in the test suite, or with the test system utilized, the member is required to notify the responsible party via an erratum request such that the issue may be addressed.

4.1.3 Pass/Fail verdict conventions

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

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

4.2 Setup preambles

The procedures defined in this section are provided for information, as they are used by test equipment in achieving the initial conditions in certain tests.

4.2.1 ATT Bearer on LE Transport

- Preamble Procedure

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

4.2.2 ATT Bearer on BR/EDR Transport

- Preamble Procedure

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

4.3 Generic GATT Integrated Tests

Execute the Generic GATT Integrated Tests defined in [5] Section 6.3, Server Test Procedures, using Table 4.2 as input:

TCID	Service / Characteristic / Descriptor	Reference	Properties	Value Length (Octets)	Service Type
ESS/SEN/SGGIT/SER/BV-01-C [Service GGIT – Environmental Sensing Service]	Environmental Sensing Service	[3] 2	-	-	Primary or Secondary Service
ESS/SEN/SGGIT/SDP/BV-01-C [Validate SDP Record – Environmental Sensing Service]	Environmental Sensing Service	[3] 4	-	-	-
ESS/SEN/SGGIT/CHA/BV-01-C [Characteristic GGIT – Descriptor Value Changed]	Descriptor Value Changed	[3] 3.2	0x20 (Indicate)	Skip	-

Table 4.2: Input for the GGIT Server test procedure

4.4 Characteristic Declaration

- Test Purpose

  Verify that the characteristic property field of each characteristic declaration meets the requirements of the service. The verification is performed one property at a time, as enumerated in the test cases in Table 4.3, using this generic test procedure.

- Reference

  Table 4.3

- Initial Condition

  - The handle range of the service has been previously discovered by the Lower Tester in test case ESS/SEN/SGGIT/SER/BV-01-C [Service GGIT – Environmental Sensing Service] if using an LE transport or ESS/SEN/SGGIT/SDP/BV-01-C [Validate SDP Record – Environmental Sensing Service] if using a BR/EDR transport.
  - Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.

- Test Case Configuration

Test Case	Characteristic Property Requirements
ESS/SEN/DEC/BV-02-C [Characteristic Declaration – ESS Characteristics]	0x02 (Read only) or 0x12 (Read + Notify) or 0x82 (Read + Extended Properties) or 0x92 (Read + Notify + Extended Properties) [3] Table 3.1

Table 4.3: Characteristic Declaration test cases

- Test Procedure

  ESS/SEN/DEC/BV-02-C [Characteristic Declaration – ESS Characteristics] is executed for each ESS Characteristic identified in the ICS [4].

  1. The Lower Tester executes the GATT Discover All Characteristics of a Service sub-procedure.
  2. For a discovered characteristic that is listed in Table 4.3, verify that the characteristic properties field of the characteristic declaration meets the requirements of the service. Where the term “ESS Characteristic” is used, this is intended to generically represent any of the family of ESS Characteristics which are discovered by the Lower Tester.

- Expected Outcome

  Pass verdict

  The characteristic is discovered, and the characteristic properties field of the characteristic declaration meets the requirements of the service.

4.5 Characteristic Descriptor Declaration and Read

- Test Purpose

  Verify that the characteristic descriptors meet the requirements of the service. The verification is done one descriptor at a time, as enumerated in the test cases in Table 4.4, using this generic test procedure.

  A test case to verify the reading of a long value from a characteristic descriptor is included in ESS/SEN/DES/BV-09-C [Read Long Characteristic User Description Descriptor].

- Reference

  Table 4.4

- Initial Condition

  - The handle range of each characteristic referenced in the test cases below has been previously discovered by the Lower Tester during the test procedure in Section 1 or is known to the Lower Tester by other means.
  - Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.

- Test Case Configuration

Test Case	Value and Format Requirements
ESS/SEN/DES/BV-01-C [ESS Characteristics – Client Characteristic Configuration Descriptor]	Value: 0x0000 or 0x0001 Format: Defined in [6]. [3] 3.1
ESS/SEN/DES/BV-02-C [ES Measurement Descriptor]	Value: Flags: 0x00 Sampling Function: 0x00 – 0x07 Measurement Period: 0x000000-0xFFFFFF Update Interval: 0x000000-0xFFFFFF Application: 0x00 – 0x21 Measurement Uncertainty: 0x00 – 0xFF Format: Defined in [3] 3.1.2.1.
ESS/SEN/DES/BV-03-C [ES Trigger Setting Descriptor]	1 to 3 descriptors are present. Value: 0x00 – 0x09 Format: Defined in [3] 3.1.2.2.
ESS/SEN/DES/BV-04-C [ES Configuration Descriptor]	Value: 0x00 or 0x01 (AND or OR) Format: Defined in [3] 3.1.2.3.
ESS/SEN/DES/BV-05-C [Characteristic User Description Descriptor]	Value: Any valid UTF8S string value. Format: Defined in [6]. [3] 3.1.2.4
ESS/SEN/DES/BV-06-C [Extended Properties Descriptor]	Value: 0x0002 (Writable Auxiliaries) Format: Defined in [6]. [3] 3.1.2.4
ESS/SEN/DES/BV-07-C [Valid Range Descriptor]	Value: ‘Lower inclusive value’ is less than or equal to 'Upper inclusive value’. Format: Defined in [6]. Format of ‘Lower inclusive value’ and 'Upper inclusive value’ fields follows the same format as the ESS Characteristic that it describes. [3] 3.1.2.5

Table 4.4: Characteristic Descriptor test cases

- Test Procedure

  All test cases except for ESS/SEN/DES/BV-05-C [Characteristic User Description Descriptor] and ESS/SEN/DES/BV-06-C [Extended Properties Descriptor] are executed for each ESS Characteristic identified in the ICS [4] that include the specified descriptor.

  1. The Lower Tester executes the GATT Discover All Characteristic Descriptors sub-procedure. The IUT returns at least one handle-UUID pair.
  2. The Lower Tester sends an ATT_Read_Request to the IUT to read a characteristic descriptor value found in step 1.
  3. The IUT sends an ATT_Read_Response to the Lower Tester.
  4. Verify that the properties, format and, where specified, the value of the characteristic descriptor meet the requirements of the service.

- Expected Outcome

  Pass verdict

  The characteristic descriptor is discovered, and the properties, format, and value (where specified) meet the requirements of the service.

ESS/SEN/DES/BV-09-C [Read Long Characteristic User Description Descriptor]

- Test Purpose

  Verify that the Server IUT supports the reading of a value of a Characteristic User Description descriptor of an ESS Characteristic successfully when the length of the value to be read requires the GATT Read Long procedure to be used.

- Reference

  [3] 1.4, 3.1.2.4

- Initial Condition

  - The test value to be read from the Characteristic User Description descriptor is a valid UTF-8 string that has been stored in the IUT. The length of the value used in this test case is such that it is sufficiently long that it cannot be read in its entirety using the GATT Read Characteristic Descriptors sub-procedure when the default ATT_MTU size is used, thus requiring the GATT Read Long Characteristic Descriptors sub-procedure to be used. The test value to be used is declared via the IXIT [7] so that the Lower Tester can compare this with the value it reads.
  - The handle of the Characteristic User Description descriptor that is to be read has been previously discovered by the Lower Tester during the test procedure in Section 1 or is known to the Lower Tester by other means.
  - Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.
  - For the purposes of this test case, the Lower Tester does not permit an ATT_MTU size larger than the default ATT_MTU size for LE to be negotiated.
  - If IUT permissions for the characteristic descriptor require a specific security mode or security level, establish a connection meeting those requirements.
  - If the IUT requires a bonding procedure, it performs a bonding procedure.

- Test Procedure

  1. The Lower Tester reads the value of the Characteristic User Description descriptor by executing the GATT Read Long Characteristic Descriptor sub-procedure.

- Expected Outcome

  Pass verdict

  The Lower Tester receives the expected value of the Characteristic User Description descriptor, in its entirety.

4.6 Characteristic Read

- Test Purpose

  Verify that the characteristic values required by the service are compliant and can be read. The verification is done one value at a time, as enumerated in the test cases in Table 4.5, using this generic test procedure.

- Reference

  Table 4.5

- Initial Condition

  - The handle of each ESS Characteristic that is declared as supported in the ICS [4] has been previously discovered by the Lower Tester during the test procedure in Section 1 or is known to the Lower Tester by other means. Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.
  - If IUT permissions for the characteristic require a specific security mode or security level, establish a connection meeting those requirements.
  - If the IUT requires a bonding procedure it performs a bonding procedure.

- Test Case Configuration

Test Case	Value and Format Requirements
ESS/SEN/CR/BV-01-C [Characteristic Read – ESS Characteristics]	A valid value and format as defined in [6], [3] 3.1

Table 4.5: Characteristic Read Value test cases

- Test Procedure

  For each ESS Characteristic that is declared as supported in the ICS [4]:

  1. The Lower Tester sends an ATT_Read_Request to the IUT to read the characteristic value.
  2. The IUT sends an ATT_Read_Response to the Lower Tester.
  3. Verify that the characteristic value and format meet the requirements of the service.

- Expected Outcome

  Pass verdict

  The characteristic is successfully read, and the characteristic value and format meet the requirements of the service.

4.7 Characteristic Descriptor Write

- Test Purpose

  Verify that the characteristic descriptor values required by the service are compliant and can be written. The verification is done one value at a time, as enumerated in the test cases in Table 4.6, using this generic test procedure for each. These test cases verify a successful write but not specific behavior that might be triggered by the write.

  A test case to verify the writing of a long value to a characteristic descriptor is included in ESS/SEN/DW/BV-04-C [Write Long Characteristic User Description Descriptor].

- Reference

  Table 4.6

- Initial Condition

  - The handle of each characteristic descriptor has been previously discovered by the Lower Tester during the test procedures in Section 4.5 or is known to the Lower Tester by other means. Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.
  - If IUT permissions for the characteristic descriptor require a specific security mode or security level, establish a connection meeting those requirements.
  - If the IUT requires a bonding procedure, it performs a bonding procedure.

- Test Case Configuration

Test Case	Value (Requirements)
ESS/SEN/DW/BV-01-C [Descriptor Write – ES Trigger Setting]	Write valid values as defined in [3] 3.1.2.2. If writing condition values 0x00 or 0x03, then write condition field only. If writing condition values 0x01 or 0x02, then write condition field and UINT24 operand. Otherwise, write operand field associated with format defined by ESS Characteristic. [3] 3.1.2.2
ESS/SEN/DW/BV-02-C [Descriptor Write – ES Configuration]	Write either 0x00 (AND) or 0x01 (OR) [3] 3.1.2.3
ESS/SEN/DW/BV-03-C [Descriptor Write – Characteristic User Description]	Write any valid UTF8S string value. [3] 3.1.2.4

Table 4.6: Descriptor Write Value test cases

- Test Procedure

  All test cases except for ESS/SEN/DW/BV-03-C [Descriptor Write – Characteristic User Description] are executed for each ESS Characteristic identified in the ICS [4] that include the specified descriptor.

  1. The Lower Tester sends an ATT_Write_Request to the IUT to write the characteristic value.
  2. The IUT sends an ATT_Write_Response to the Lower Tester.
  3. The Lower Tester sends an ATT_Read_Request to the IUT to read the characteristic value.
  4. The IUT sends an ATT_Read_Response to the Lower Tester.

- Expected Outcome

  Pass verdict

  The descriptor is successfully written, and the value returned when read is consistent with the value written.

ESS/SEN/DW/BV-04-C [Write Long Characteristic User Description Descriptor]

- Test Purpose

  Verify that the Server IUT supports the writing of a value to the Characteristic User Description descriptor of an ESS Characteristic successfully when the length of the value to be written requires the GATT Write Long procedure to be used.

- Reference

  [3] 1.4, 3.1.2.4

- Initial Condition

  - The test value to be written to the Characteristic User Description descriptor is a valid UTF-8 string. The length of the value used in this test case is such that it is sufficiently long that it cannot be written in its entirety using the GATT Write Characteristic Descriptors sub-procedure when the default ATT_MTU size is used, thus requiring the GATT Write Long Characteristic Descriptors sub-procedure to be used. A test value meeting these criteria that is compatible with the IUT is specified via the IXIT [7].
  - The handle of each writable Characteristic User Description descriptor that is supported has been previously discovered by the Lower Tester during the test procedure in Section 1 or is known to the Lower Tester by other means.
  - Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.
  - For the purposes of this test case, the Lower Tester does not permit an ATT_MTU size larger than the default ATT_MTU size for LE to be negotiated.
  - If IUT permissions for the characteristic descriptor require a specific security mode or security level, establish a connection meeting those requirements. The Lower Tester is authenticated by the IUT.
  - If the IUT requires a bonding procedure, it performs a bonding procedure.

- Test Procedure

  1. The Lower Tester writes the test value to the writable Characteristic User Description descriptor of an ESS Characteristic in the IUT by executing the GATT Write Long Characteristic Descriptors sub-procedure.
  2. The Lower Tester reads back the value of the Characteristic User Description descriptor by executing the GATT Read Long Characteristic Descriptor sub-procedure.

- Expected Outcome

  Pass verdict

  The IUT acknowledges the ATT_Prepare_Write_Request command(s) and the ATT_Execute_Write_Request received from the Lower Tester.

When the Lower Tester reads back the value of the Characteristic User Description descriptor, it receives the expected value consistent with the value written, in its entirety.

4.8 Configure Indication and Notification

- Test Purpose

  Verify compliant operation in response to enabling and disabling characteristic indication or notification. The verification is done one value at a time, as enumerated in the test cases in Table 4.7, using this generic test procedure.

- Reference

  Table 4.7

- Initial Condition

  The handle of the client characteristic configuration descriptor of each characteristic referenced in the test cases below has been previously discovered by the Lower Tester during the test procedure in Section 4.5 or is known to the Lower Tester by other means.

- Test Case Configuration

Test Case	Value Requirements
ESS/SEN/CON/BV-01-C [Configure Notification – ESS Characteristic]	Client Characteristic Configuration Descriptor Value: 0x0001 [3] 3.1
ESS/SEN/CON/BV-02-C [Configure Indication – Descriptor Value Changed]	Client Characteristic Configuration Descriptor Value: 0x0002 [3] 3.2

Table 4.7: Configure Indication and Notification test cases

- Test Procedure

  ESS/SEN/CON/BV-01-C [Configure Notification – ESS Characteristic] is executed for each ESS Characteristic that is declared as supported in the ICS [4] and that supports notification.
  ESS/SEN/CON/BV-02-C [Configure Indication – Descriptor Value Changed] is executed for the Descriptor Value Changed characteristic.

  1. Disable indication and notification by writing value 0x0000 to the client characteristic configuration descriptor of the characteristic.
  2. If the test case is for notification, enable notification by writing value 0x0001 to the client characteristic configuration descriptor of the characteristic.
  3. Otherwise, if the test case is for indication, enable indication by writing value 0x0002 to the client characteristic configuration descriptor of the characteristic.
  4. The Lower Tester reads the value of the client characteristic configuration descriptor.

- Expected Outcome

  Pass verdict

  The characteristic descriptor is successfully written, and the value returned when read is consistent with the value written.

4.9 Characteristic Notification

ESS/SEN/CN/BV-01-C [ESS Characteristic Notifications – Trigger Settings Not Writable]

- Test Purpose

  Verify that the IUT can send notifications of supported ESS Characteristics that can be notified for the case where the ES Trigger Setting descriptor is not writable.

- Reference

  [3] 3.2

- Initial Condition

  - The ESS Characteristic is configured for notification.
  - Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.
  - If IUT permissions for the ESS Characteristic require a specific security mode or security level, establish a connection meeting those requirements.
  - If the IUT requires a bonding procedure it performs a bonding procedure.

- Test Procedure

  The following test procedure is executed for all ESS Characteristics that support notifications, where the ES Trigger Setting descriptor(s) and, if present, the ES Configuration descriptor are not writable by the Client:

  1. The Lower Tester reads the value of the ES Trigger Setting Descriptor(s) and, if present, the ES Configuration descriptor for an ESS Characteristic.
  2. Perform an action that will cause the trigger condition to be met.
  3. The Lower Tester receives one or more ATT_Handle_Value_Notifications from the IUT containing the ESS Characteristic handle and value.
  4. Verify that the characteristic value meets the requirements of the service.
  5. Repeat steps 2-4 until the Lower Tester receives one or more additional notifications.
  6. The Lower Tester disables notification by writing value 0x0000 to the Client Characteristic Configuration descriptor of the ESS Characteristic.
  7. Repeat step 2 with notifications disabled.
  8. Verify that the Lower Tester does not receive an ATT_Handle_Value_Notification from the IUT containing the ESS Characteristic.

- Expected Outcome

  Pass verdict

  The IUT sends two or more notifications of the ESS Characteristic.

  The notifications are as expected according to the value of the ES Trigger Setting descriptor(s) and ES Configuration descriptor (if present).

  The value of each field of the characteristic meets the requirements of the service.

  The IUT stops sending notifications of the ESS Characteristic after the Lower Tester configures the characteristic to disable notifications.

4.10 ESS Characteristic Notifications – ES Trigger Settings Writable

- Test Purpose

  Verify that the IUT can send notifications of supported ESS Characteristics when specified trigger conditions are met. The verification is done one value at a time, as enumerated in the test cases in Table 4.8, Table 4.9, and Table 4.10, using this generic test procedure.

  The TCMT logic defines the applicable test cases depending on the number of supported ES Trigger Setting descriptors:

  - If at least one (i.e., one, two or three) writable ES Trigger Setting descriptor is supported (ESS 6/5 AND ESS 6/2 [4]), this requires Test Cases in Table 4.8.
  - If at least two (i.e., two or three) writable ES Trigger Setting descriptors is supported (ESS 6/5 AND ESS 6/3 [4]), this additionally requires Test Cases in Table 4.9.
  - If three writable ES Trigger Setting descriptors is supported (ESS 6/5 AND ESS 6/4 [4]), this additionally requires Test Cases in Table 4.10.

  Where requirements for the values have been specified for the ES Trigger Setting descriptors in the tables below, they have been defined such that notifications of the ESS Characteristic should not be sent until some further action is taken to satisfy the trigger conditions. Since the IUT is typically a device that measures environmental parameters, this may require the ability to control the environmental conditions to trigger the sending of notifications. This may be achieved by using an environmental chamber or by other means.

  For the purposes of this test case, the ES Trigger Setting descriptors are referred to as “ES Trigger Setting Descriptor1”, “ES Trigger Setting Descriptor2” and “ES Trigger Setting Descriptor3”. If the IUT supports only one ES Trigger Setting descriptor, it is designated as “ES Trigger Setting Descriptor1”. If the IUT supports only two ES Trigger Setting descriptors, they are designated as “ES Trigger Setting Descriptor1” and “ES Trigger Setting Descriptor2”.

- Reference

  [3] 3.1.2.2

- Initial Condition

  - The characteristics and characteristic descriptors referenced in this test case have been previously discovered.
  - The ESS Characteristic is configured for notification.
  - The IUT and the Lower Tester are bonded.
  - The IUT has been allowed sufficient time to settle so that values reported in the ESS Characteristic(s) are expected to be close to actual values.

- Test Case Configuration

  Test cases for use with one, two or three ES Trigger Setting descriptors:

  Values of Trigger Setting descriptors 2 and 3 (if present) are set to 0x00 (inactive).

  Value of ES Configuration Descriptor (if present) is set to 0x00.

Test Case	ES Trigger Setting Descriptor1 Condition, Operand	Value (Requirements)
ESS/SEN/CN/BV-02-C [ESS Characteristic Notifications – ES Trigger Settings Writable- 1]	0x01, n	Sends every n seconds
ESS/SEN/CN/BV-03-C [ESS Characteristic Notifications – ES Trigger Settings Writable - 2]	0x00, N/A	Does not send (Inactive)
ESS/SEN/CN/BV-04-C [ESS Characteristic Notifications – ES Trigger Settings Writable - 3]	0x03	Sends whenever value changes relative to previous value
ESS/SEN/CN/BV-05-C [ESS Characteristic Notifications – ES Trigger Settings Writable - 4]	0x04, value1 value1 is slightly less than current value	Sends while less than the value (see Note 1)
ESS/SEN/CN/BV-06-C [ESS Characteristic Notifications – ES Trigger Settings Writable - 5]	0x05, value1 value1 is slightly less than current value	Sends while less than or equal to the specified value (see Note 1)
ESS/SEN/CN/BV-07-C [ESS Characteristic Notifications – ES Trigger Settings Writable - 6]	0x06, value1 value1 is slightly greater than current value	Sends while greater than the specified value (see Note 1)
ESS/SEN/CN/BV-08-C [ESS Characteristic Notifications – ES Trigger Settings Writable - 7]	0x07, value1 value1 is slightly greater than current value	Sends while greater than or equal to the specified value (see Note 1)
ESS/SEN/CN/BV-09-C [ESS Characteristic Notifications – ES Trigger Settings Writable - 8]	0x08, value1 value1 is not equal to current value	Sends while equal to the specified value
ESS/SEN/CN/BV-10-C [ESS Characteristic Notifications – ES Trigger Settings Writable - 9]	0x09, value1 value1 is equal to current value	Sends while not equal to the specified value

Table 4.8: Test cases for One to Three Trigger Setting descriptors

Note 1: In the TCMT, these test cases are excluded for any ESS Characteristic whose value is an enumeration such as Barometric Pressure Trend or any ESS Characteristic with a format containing multiple fields such as Magnetic Flux Density - 2D or Magnetic Flux Density - 3D.

Additional test cases for use with two or three ES Trigger Setting descriptors:

Value of Trigger Setting descriptors 3 (if present) is set to 0x00 (inactive).

Test Case	ES Trigger Setting Descriptor1 Condition, Operand	ES Configuration Descriptor	ES Trigger Setting Descriptor2 Condition, Operand	Value (Requirements)
ESS/SEN/CN/BV-11-C [ESS Characteristic Notifications – ES Trigger Settings Writable - 10]	0x04, value1 value1 is slightly less than current value	0x01 (OR)	0x06, value2 value 2 is slightly greater than current value	Sends while less than value1 OR while greater than value2 (i.e., sends while outside a specified range): x < value1 OR x > value2

Test Case	ES Trigger Setting Descriptor1 Condition, Operand	ES Configuration Descriptor	ES Trigger Setting Descriptor2 Condition, Operand	Value (Requirements)
ESS/SEN/CN/BV-12-C [ESS Characteristic Notifications – ES Trigger Settings Writable - 11]	0x02, n	0x00 (AND)	0x06, value2 value2 is slightly greater than current value	Sends with an interval of at least n seconds duration but only while the current value is greater than value2
ESS/SEN/CN/BV-13-C [ESS Characteristic Notifications – ES Trigger Settings Writable - 12]	0x04, value1	0x00 (AND)	0x06, value2 value2 is slightly greater than current value	Sends while less than value1 AND greater than value2 (i.e., sends while within a specified range): value2 < x < value1

Table 4.9: Test cases for Two or Three Trigger Setting descriptors

Additional test cases for use with three ES Trigger Setting descriptors:

Test Case	ES Trigger Setting Descriptor1 Condition, Operand	ES Configuration Descriptor	ES Trigger Setting Descriptor2 Condition, Operand	ES Trigger Setting Descriptor3 Condition, Operand	Value (Requirements)
ESS/SEN/CN/BV-14-C [ESS Characteristic Notifications – ES Trigger Settings Writable - 13]	0x04, value1	0x00 (AND)	0x06, value2 value2 is slightly greater than current value	0x01, n	Sends every n seconds but only while the current value is less than value1 AND greater value2: value2 < x < value1 AND every n seconds (i.e., sends when within a specified range, every n seconds)

Table 4.10: Test cases for Three Trigger Setting descriptors

- Test Procedure

  The following test procedure applies to the test cases listed in Table 4.8, Table 4.9 and Table 4.10 for each ESS Characteristic that supports notifications, and where the ES Trigger Setting descriptor(s) are writable by the Client:

  1. If a Valid Range descriptor is present for the ESS Characteristic under test, the Lower Tester reads the value.
  2. The Lower Tester writes a value to the ES Configuration descriptor, if present, and the ES Trigger Setting Descriptor(s) of the ESS Characteristic, ensuring that the value(s) written meet the requirements of the test case as specified in the tables below and are within the range specified in the Valid Range descriptor (if the Valid Range descriptor is present and is applicable to the trigger condition).
  3. To avoid the transmission of unintended notifications, the Lower Tester disables notifications via the Client Characteristic Configuration descriptor before executing a new Test Case and re-enables notifications only after the writing of values to the relevant ES Trigger Setting descriptor(s) and any associated ES Configuration descriptor is complete.

4. Perform an action that will cause the trigger condition to be met. This may be achieved by changing the environmental conditions to meet the specified trigger conditions.
5. Verify that a connection is established and the IUT sends one or more notifications of the triggered ESS Characteristic meeting the requirements of the test case as stated in the tables, and that the characteristic value meets the requirements of the service.
6. Perform an action that will cause the trigger condition to cease to be met. This may be achieved by changing the environmental conditions so that they no longer satisfy the specified trigger conditions.
7. Verify that the IUT ceases sending notifications of the ESS Characteristic.
8. Repeat steps 1–6 until every applicable test case has been performed with at least one representative ESS Characteristic.

- Expected Outcome

  Pass verdict

  While the trigger conditions are satisfied, the IUT sends notifications of each applicable ESS Characteristic in accordance with the pass criteria for each test case.

  The value of each field of the ESS Characteristic meets the requirements of the service.

  The IUT stops sending notifications of the ESS Characteristic when the requirements of the trigger condition cease to be satisfied.

ESS/SEN/CN/BV-15-C [ESS Characteristic Notifications – ES Trigger Settings Writable – Multiple Clients]

- Test Purpose

  Verify that the IUT can properly send notifications of an ESS Characteristic independently to two Clients that have independently configured ES Trigger Setting descriptors.

- Reference

  [3] 3.1

- Initial Condition

  - A representative ESS Characteristic is chosen for use in this test case. The client characteristic configuration descriptor of the ESS Characteristic to be used is configured for notification.
  - The current value of the ESS Characteristic on the IUT is less than the Upper Value and greater than the Lower Value as identified in the IXIT [7]. Since the IUT is typically a device that measures environmental parameters, this may require the ability to control the environmental conditions. This may be achieved by using an environmental chamber or by other means.

- Test Procedure

  1. A connection is established between Lower Tester 1 and the IUT meeting the security requirements of the IUT, and a bonding procedure is performed. An ATT Bearer connection is established between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.
  2. Lower Tester 1 configures an ES Trigger Setting descriptor to send notifications of the ESS Characteristic when the value is greater than the Upper Value.
  3. Lower Tester 1 disconnects from IUT.
  4. A connection is established between Lower Tester 2 and the IUT meeting the security requirements of the IUT, and a bonding procedure is performed. An ATT Bearer connection is

established between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.

5. Lower Tester 2 configures an ES Trigger Setting descriptor to send notifications of the ESS Characteristic when the value is less than the Lower Value.
6. Lower Tester 2 disconnects from IUT.
7. Perform an action on the IUT that will induce the Lower Tester 1 trigger condition to be met (i.e., the value of the ESS Characteristic becomes greater than the Upper Value).
8. Verify that a connection is established with Lower Tester 1 and a notification is sent out to Lower Tester 1.
9. Verify that the characteristic value meets the requirements of the service.
10. Lower Tester 1 disconnects from IUT.
11. Perform an action on the IUT that will induce the Lower Tester 2 trigger condition to be met (i.e., the value of the ESS Characteristic becomes lower than the Lower Value).
12. Verify that a connection is established with Lower Tester 2 and a notification is sent out to Lower Tester 2.
13. Verify that the characteristic value meets the requirements of the service.
14. Lower Tester 2 disconnects from IUT.

- Expected Outcome

  Pass verdict

  The IUT sends one notification of the ESS Characteristic value to the Lower Tester 1 once the trigger condition is met.

  The IUT sends one notification of the ESS Characteristic value to the Lower Tester 2 once the trigger condition is met.

  The value of the ESS Characteristic notified to Lower Tester 1 is consistent with the ES Trigger Setting for Lower Tester 1 and meets the requirements of the service.

  The notification intended for Lower Tester 1 is not sent to Lower Tester 2.

  The value of the ESS Characteristic notified to Lower Tester 2 is consistent with the ES Trigger Setting for Lower Tester 2 and meets the requirements of the service.

  The notification intended for Lower Tester 2 is not sent to Lower Tester 1.

4.11 Characteristic Indication

4.11.1 Descriptor Value Changed Indication – Change at Server

- Test Purpose

  Verify that the IUT can send indications of the Descriptor Value Changed characteristic when descriptor values are changed at the Server. The verification is done one value at a time, as enumerated in the test cases in Table 4.11, using this generic test procedure.

- Reference

  See Table 4.11.

- Initial Condition

  - Characteristics and characteristic descriptors have been previously discovered.
  - The Descriptor Value Changed characteristic is configured for indication.
  - Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.

- If IUT permissions for the Descriptor Value Changed characteristic require a specific security mode or security level, establish a connection meeting those requirements.
- The IUT and the Lower Tester are bonded.

- Test Case Configuration

Test Case	Value (Requirements)
ESS/SEN/CI/BV-01-C [Descriptor Value Changed – ES Measurement]	0x02 (Source of Change: At Server, Change to ES Measurement Descriptor) [3] 3.1.2.1
ESS/SEN/CI/BV-02-C [Descriptor Value Changed – ES Trigger Setting]	0x04 (Source of Change: At Server, Change to one or more ES Trigger Setting Descriptors) [3] 3.1.2.2
ESS/SEN/CI/BV-03-C [Descriptor Value Changed – ES Configuration]	0x08 (Source of Change: At Server, Change to ES Configuration Descriptor) [3] 3.1.2.3
ESS/SEN/CI/BV-04-C [Descriptor Value Changed – Characteristic User Description]	0x10 (Source of Change: At Server, Change to Characteristic User Description Descriptor) [3] 3.1.2.4

Table 4.11: Descriptor Value Changed at Server test cases

- Test Procedure

  For each ESS Characteristic identified in the ICS [4] for which one or more of the associated characteristic descriptors can be updated by the Server (i.e., where the value of the characteristic descriptor can be changed without being written by a Client):

  1. The Lower Tester reads and caches all descriptor values listed in the table below for all ESS Characteristics.
  2. The Lower Tester disconnects from the IUT.
  3. Perform an action on the IUT that will update the value of each descriptor in the table below for one of the supported ESS Characteristics one at a time.
  4. The Lower Tester connects to the IUT.
  5. The Lower Tester receives one or more ATT_Handle_Value_Indications from the IUT containing the Descriptor Value Changed characteristic handle and value.
  6. Verify that the characteristic value meets the requirements of the service. Specifically, the bits corresponding to the changed descriptors are set in the Flags field and the value of the Characteristic UUID field corresponds to the UUID of the ESS Characteristic used in the test.
  7. Repeat steps 1–6 for each ESS Characteristic identified in the ICS [4] for which one or more of the associated characteristic descriptors can be updated by the Server.

- Expected Outcome

  Pass verdict

  The IUT sends one or more indications of the Descriptor Value Changed characteristic corresponding to the changed descriptors.

  The value of the Flags field corresponds to the changed descriptors and meets the requirements of the service. The ‘Source of Change’ bit is set to 0 in all cases, identifying the Server as the source.

  The value of the Characteristic UUID field corresponds to the affected ESS Characteristic.

ESS/SEN/CI/BV-05-C [Descriptor Value Changed Indication – Change to User Description at Other Client]

- Test Purpose

  Verify that the IUT can send indications of the Descriptor Value Changed characteristic to a Client when the Characteristic User Description descriptor is writable and changed by another Client.

- Reference

  [3] 3.1.2.4

- Initial Condition

  - Characteristics and characteristic descriptors have been previously discovered.
  - The Descriptor Value Changed characteristic is configured for indication.
  - Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.
  - If IUT permissions for the Descriptor Value Changed characteristic require a specific security mode or security level, establish a connection meeting those requirements.
  - The IUT and Lower Tester 1 are bonded.
  - The IUT is also bonded with Lower Tester 2.

- Test Procedure

  1. Lower Tester 1 writes a new value to Characteristic User Description descriptor.
  2. Lower Tester 1 disconnects from IUT.
  3. Establish a connection between Lower Tester 2 and IUT meeting the security requirements of the IUT.
  4. Lower Tester 2 receives one ATT_Handle_Value_Indication from the IUT containing the Descriptor Value Changed characteristic handle and value.
  5. Verify that the characteristic value meets the requirements of the service. Specifically, the bits corresponding to the changed descriptor is set in the Flags field and the value of the Characteristic UUID field corresponds to the UUID of the ESS Characteristic used in the test.

- Expected Outcome

  Pass verdict

  The IUT does not send an indication of the Descriptor Value Changed characteristic to Lower Tester 1.

  The IUT sends one indication of the Descriptor Value Changed characteristic corresponding to the changed descriptor to Lower Tester 2.

  The value of the Flags field corresponds to the changed descriptors and meets the requirements of the service. i.e., 0x11 (Source of Change: Client, Change to Characteristic User Description Descriptor).

  The value of the Characteristic UUID field corresponds to the UUID of the affected ESS Characteristic.

4.12 Service Procedure – General Error Handling

Verify compliant operation when the Lower Tester generates invalid behavior.

ESS/SEN/SPE/BI-01-C [Write Request Rejected – ES Configuration RFU Value]

- Test Purpose

  Verify that the IUT responds appropriately when the ES Configuration descriptor is writable and a Client attempts to write a value that is RFU.

- Reference

  [3] 3.1.2.3.1

- Initial Condition

  - The handle range of the service has been previously discovered by the Lower Tester in test case ESS/SEN/SGGIT/SER/BV-01-C [Service GGIT – Environmental Sensing Service] if using an LE transport or ESS/SEN/SGGIT/SDP/BV-01-C [Validate SDP Record – Environmental Sensing Service] if using a BR/EDR transport.
  - Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.
  - The ES Configuration descriptor is writable.

- Test Procedure

  The following test procedure is required to be run on only one of the supported ESS Characteristics identified in the ICS [4], and for which the ES Configuration descriptor is present and writable:

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester writes a value to the ES Configuration descriptor that is within its RFU range.
  3. Verify that the IUT response meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT rejects the Write Request by sending an Error Response with an Attribute Protocol Application Error code set to Write Request Rejected (0x80).

ESS/SEN/SPE/BI-02-C [Condition Not Supported –ES Trigger Setting RFU Value]

- Test Purpose

  Verify that the IUT responds appropriately when the ES Trigger Setting descriptor is writable and a Client attempts to write a Condition value that is RFU or trigger condition that is otherwise not supported by the IUT.

- Reference

  [3] 3.1.2.3.1

- Initial Condition

  - The handle range of the service has been previously discovered by the Lower Tester in test case ESS/SEN/SGGIT/SER/BV-01-C [Service GGIT – Environmental Sensing Service] if using an LE transport or ESS/SEN/SGGIT/SDP/BV-01-C [Validate SDP Record – Environmental Sensing Service] if using a BR/EDR transport.

- Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.
- The ES Trigger Setting descriptor is writable.

- Test Procedure

  The following test procedure is required to be run on only one of the supported ESS Characteristics identified in the ICS [4], and where the ES Trigger Setting descriptor is present and writable:

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester writes a value to the Condition field of one of the ES Trigger Setting descriptors that is within its RFU range.
  3. Verify that the IUT response meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT rejects the Write Request by sending an Error Response with an Attribute Protocol Application Error code set to Condition Not Supported (0x81).

  The value of the ES Trigger Setting descriptor is not changed.

ESS/SEN/SPE/BI-03-C [Out of Range –ES Trigger Setting Operand]

- Test Purpose

  Verify that the IUT responds appropriately when the ES Trigger Setting descriptor is writable and a Client attempts to write an Operand that is outside of the operating range of the Server defined by its Valid Range descriptor.

- Reference

  [3] 3.1.2.3.1, 3.1.2.5

- Initial Condition

  - The handle range of the service has been previously discovered by the Lower Tester in test case ESS/SEN/SGGIT/SER/BV-01-C [Service GGIT – Environmental Sensing Service] if using an LE transport or ESS/SEN/SGGIT/SDP/BV-01-C [Validate SDP Record – Environmental Sensing Service] if using a BR/EDR transport.
  - Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.
  - The ES Trigger Setting descriptor is writable.
  - The Valid Range Descriptor is present.

- Test Procedure

  The following test procedure is required to be run on only one of the supported ESS Characteristics identified in the ICS [4], and where the ES Trigger Setting and Valid Range descriptors are present and where the ES Trigger Setting descriptor is writable:

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester reads the value of the Valid Range descriptor associated with an ESS Characteristic.

3. The Lower Tester writes a value to the Operand field of one of the associated ES Trigger Setting descriptors that is far outside of its valid operating range.
4. Verify that the IUT response meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT rejects the Write Request by sending an Error Response with an Attribute Protocol Application Error code set to Out of Range (0xFF).

5 Test case mapping

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

The columns for the TCMT are defined as follows:

Item: Contains a logical expression based on specific entries from the associated ICS document. Contains a logical expression (using the operators AND, OR, NOT as needed) based on specific entries from the applicable ICS document(s). The entries are in the form of y/x references, where y corresponds to the table number and x corresponds to the feature number as defined in the ICS document for the Environmental Sensing Service (ESS) [4].

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

Test Case(s): The applicable test case identifiers, required for Bluetooth Qualification, if the corresponding y/x references defined in the Item column are supported. Further details about the function of the TCMT are elaborated in [1].

For the purpose and structure of the ICS/IXIT, refer to [1].

Item	Feature	Test Case(s)
ESS 2/1	ESS Service – SDP Record	ESS/SEN/SGGIT/SDP/BV-01-C
ESS 2/1 OR ESS 2/2	Discover ESS Service and ESS Characteristic(s)	ESS/SEN/SGGIT/SER/BV-01-C ESS/SEN/DEC/BV-02-C ESS/SEN/CR/BV-01-C
ESS 8/1	Descriptor Value Changed Characteristic	ESS/SEN/SGGIT/CHA/BV-01-C ESS/SEN/CON/BV-02-C
ESS 7/1	Descriptor Value Changed Indication – ES Measurement	ESS/SEN/CI/BV-01-C
ESS 7/2	Descriptor Value Changed Indication – ES Trigger Setting	ESS/SEN/CI/BV-02-C
ESS 7/3	Descriptor Value Changed Indication – ES Configuration	ESS/SEN/CI/BV-03-C
ESS 7/4	Descriptor Value Changed Indication – Characteristic User Description changed at Server	ESS/SEN/CI/BV-04-C
ESS 6/8	Characteristic User Description Descriptor	ESS/SEN/DES/BV-05-C
ESS 9/6 AND ESS 6/8	Read Long Characteristic User Description Descriptor	ESS/SEN/DES/BV-09-C
ESS 6/9	Writable Characteristic User Description Descriptor	ESS/SEN/DES/BV-06-C ESS/SEN/CI/BV-05-C ESS/SEN/DW/BV-03-C
ESS 9/7 AND ESS 6/9	Write Long Characteristic User Description Descriptor	ESS/SEN/DW/BV-04-C
ESS 6/11	Valid Range Descriptor	ESS/SEN/DES/BV-07-C
ESS 6/1	ES Measurement Descriptor	ESS/SEN/DES/BV-02-C
ESS 6/2	ES Trigger Setting Descriptor	ESS/SEN/CON/BV-01-C ESS/SEN/DES/BV-01-C ESS/SEN/DES/BV-03-C

Item	Feature	Test Case(s)
ESS 6/5 AND ESS 6/2	Writable ES Trigger Setting Descriptor (at least one trigger setting descriptor)	ESS/SEN/DW/BV-01-C ESS/SEN/CN/BV-03-C ESS/SEN/CN/BV-04-C ESS/SEN/CN/BV-09-C ESS/SEN/CN/BV-10-C ESS/SEN/CN/BV-02-C ESS/SEN/SPE/BI-02-C ESS/SEN/SPE/BI-03-C
ESS 6/5 AND ESS 6/3	Writable ES Trigger Setting Descriptor (two or three trigger setting descriptors)	ESS/SEN/CN/BV-11-C ESS/SEN/CN/BV-12-C ESS/SEN/CN/BV-13-C
ESS 6/5 AND ESS 6/4	Writable ES Trigger Setting Descriptor (three trigger setting descriptors	ESS/SEN/CN/BV-14-C
ESS 6/5 AND NOT (ESS 4/17 OR ESS 4/19 OR ESS 4/20)	Writable ES Trigger Setting Descriptor AND the ESS Characteristic format is not an enumeration or multiple field type	ESS/SEN/CN/BV-05-C ESS/SEN/CN/BV-06-C ESS/SEN/CN/BV-07-C ESS/SEN/CN/BV-08-C
ESS 9/2 AND NOT ESS 6/5	ESS Characteristic Notifications with ES Trigger Settings Not Writable	ESS/SEN/CN/BV-01-C
ESS 8/2 AND ESS 6/5	ESS Characteristic Notifications with ES Trigger Settings Writable and Multiple Clients	ESS/SEN/CN/BV-15-C
ESS 6/6	ES Configuration Descriptor	ESS/SEN/DES/BV-04-C
ESS 6/7	Writable ES Configuration Descriptor	ESS/SEN/DW/BV-02-C ESS/SEN/SPE/BI-01-C

Table 5.1: Test case mapping

6 Revision history and acknowledgments

Revision History

Publication Number	Revision Number	Date	Comments
	D0.9.0	2013-10-14	Initial draft for review based on CPS.TS
	D0.9.1	2013-10-30	Incorporated test cases from Casio. Incorporated feedback from Nordic and Polar. Significant updating and restructuring.
	D0.9.2	2013-11-15	Significant changes. Incorporated feedback from Tatsuo, Guillaume and Anand.
	D0.9.3	2013-11-15	Incorporated feedback from Tatsuo and Anand. Prepared for initial review by BTI. Incorporated feedback from PTS team. Deleted DR test tests.
	D0.9.4	2013-11-21	Incorporated feedback from BTI.
	D0.9.5	2013-11-22	TCMT section updated.
	D0.9.6	2014-08-01	Incorporated several changes to clarify test cases as a result of feedback from formal IOP. Also added references to the proposed ICS Supplement in Section 5 and in the relevant test cases throughout the document. A full review and update of the TCMT was done. Addressed working group review comments from Guillaume Schatz. Added test cases for read long and write long for Characteristic User Description descriptor. Addressed WG review comments from Robert Hughes. Revised the Service Definition over LE test case in Section 4.3.1.
	D1.0.0r01	2014-09-16	Incorporated feedback from BTI. Removed references to ESS Supplement. Updated TCMT to align with recent changes to ESS.ICS. Prepared for BTI review.
	1.0.0r02	2014-10-14	Incorporated further feedback from BTI. Completed TE and Legal review.
	1.0.0r03	2014-10-23	Incorporated further feedback from Magnus (BTI).
0	1.0.0	2014-11-25	Prepare for Publication
	1.0.1r00	2016-05-24	Converted to new Test Case ID conventions as defined in TSTO v4.1.
1	1.0.1	2016-07-14	Prepared for TCRL 2016-1 publication.
	1.0.2r00	2017-10-06	TSE 9921 (rating 1): Update test suite template and conventions.
2	1.0.2	2018-06-27	Approved by BTI. Prepared for TCRL 2018-1 publication.
	p3r00–r04	2022-03-18 – 2022-04-29	TSE 17260 (rating 2): Converted the following test cases to GGIT: ESS/SEN/SD/BV-01-C – -02-C, ESS/SEN/DEC/BV-01-C, and ESS/SEN/DES/BV-08-C. The new GGIT converted TCIDs are: ESS/SEN/SGGIT/SER/BV-01-C, ESS/SEN/SGGIT/SDP/BV-01-C, and ESS/SEN/SGGIT/CHA/BV-01-C. Updated the TCMT accordingly. Updated the Test Groups section and the test case identification conventions. Updated section

Publication Number	Revision Number	Date	Comments
			cross-references in the initial condition for ESS/SEN/DEC/BV-02-C, ESS/SEN/DES/BV-01-C – -07-C and -09-C, ESS/SEN/CR/BV-01-C, ESS/SEN/DW/BV-04-C, and ESS/SEN/SPE/BI-01-C – -03-C. TSE 18433 (rating 1): Removed direct references to GATT test cases from the test procedure for ESS/SEN/DEC/BV-02-C, ESS/SEN/DES/BV-01-C – -07-C and -09-C, ESS/SEN/CR/BV-01-C, ESS/SEN/DW/BV-01-C – -04-C, ESS/SEN/CON/BV-01-C and -02-C, and ESS/SEN/CN/BV-01-C. Removed direct references to GATT TS sections from the ATT Bearer preambles and replaced with preamble procedure text. TSE 18717 (rating 1): Editorials to align the document with the latest TS template in anticipation of a .Z release. Editorials, including assigning publication number 2 to previous v1.0.2, consistency checker fixes, and aligning the copyright page with v2 of the DNMD.
3	p3	2022-06-28	Approved by BTI on 2022-05-31. Prepared for TCRL 2022-1 publication.

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