Industrial Measurement Device Service (IMDS)

***Bluetooth*® Test Suite**

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Contents

1 Scope

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

2 References, definitions, and abbreviations

2.1 References

This document incorporates provisions from other publications by dated or undated reference. These references are cited at the appropriate places in the text, and the publications are listed hereinafter. Additional definitions and abbreviations can be found in [1] and [3].

[1] Bluetooth Core Specification, Version 5.4 or later

[2] Test Strategy and Terminology Overview

[3] Industrial Measurement Device Service Specification, Version 1.0

[4] ICS Proforma for IMDS

[5] IXIT Proforma for IMDS

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

[7] GATT Test Suite, GATT.TS

[8] Permitted Characteristics (https://www.bluetooth.com/specifications/assigned-numbers)

[9] GATT Specification Supplement (https://www.bluetooth.com/specifications/assigned-numbers)

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 Industrial Measurement Device Service is made up of one or more IMD Measurement Characteristic instances.

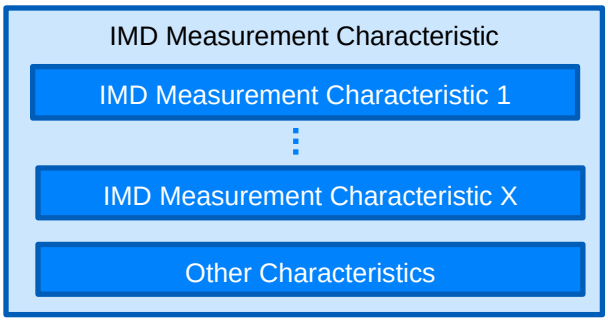

Figure 3.1 IMD Measurement Characteristics

Each IMD Measurement Characteristic may have different descriptors exposed.

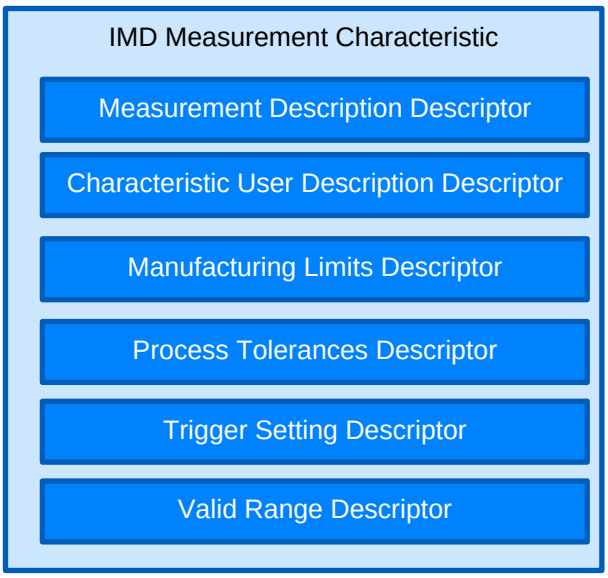

Figure 3.2 IMD Measurement Characteristic Descriptors

3.2 Test Strategy

The test objectives are to verify the functionality of the Industrial Measurement Device Service specification and enable interoperability between devices operating in the IMD Server and Collector roles. 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. Test cases are also provided to ensure forward compatibility by the checking of RFU values.

Test cases will be implemented using a test setup consisting of a Lower Tester, an IUT, and an Upper Tester. Conformance tests using GATT and the Generic GATT Integrated Tests (GGIT) framework will test the behavior of the defined characteristics.

There are several test cases that require a Lower Tester 2 to test indications when another client makes changes, and for validating that Authorization works only for the client that performed the authorization.

The IUT may expose multiple instances of the IMD Measurement characteristic. Tests that acting upon the IMD Measurement will need to repeat the steps for each and a successful pass verdict requires each instance to pass.

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:

- Generic GATT Integrated Tests
- IMD Measurement reading and writing of characteristics and descriptors
- IMD Measurement change notifications
- IMD Measurement change indications
- IMD Control
- Record Access Control Point

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>**
IMDS	Industrial Measurement Device Service
Identifier Abbreviation	**Role Identifier <IUT role>**
SR	Server
Identifier Abbreviation	**Reference Identifier <GGIT test group>**
SGGIT	Server Generic GATT Integrated Tests
Identifier Abbreviation	**Reference Identifier <GGIT class>**
CHA	Characteristic
DES	Descriptor
SER	Service
Identifier Abbreviation	**Features and Behaviors Identifier <feat>**
CI	Characteristic Indication
CIW	Characteristic Indication – By Write
CN	Characteristic Notification
CR	Characteristic Read
CT	Custom Trigger
DC	Device Control
DEC	Characteristic Declaration
DES	Descriptors
PT	Process Tolerances
RACP	Record Access Control Point
SPE	Service Procedure – Error Handling
TD	Trigger by Delta
TT	Trigger by Time
UD	User Description

Table 4.1: IMDS TC feature naming conventions

4.1.2 Conformance

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

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

Such tests may verify:

- That claimed capabilities may be used in any order and any number of repetitions not excluded by the specification
- That capabilities enabled by the implementations are sustained over durations expected by the use case
- That the implementation gracefully handles any quantity of data expected by the use case
- That in cases where more than one valid interpretation of the specification exists, the implementation complies with at least one interpretation and gracefully handles other interpretations
- That the implementation is immune to attempted security exploits

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

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

4.1.3 Pass/Fail verdict conventions

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

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

4.2 Setup preambles

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

4.2.1 ATT Bearer on LE transport

- Preamble Procedure

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

4.2.2 ATT Bearer on BR/EDR transport

- Preamble Procedure

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

4.2.3 RACP preamble

- Preamble Procedure

  1. A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1, if using ATT over an LE transport, or Section 4.2.2 if using ATT over a BR/EDR transport.
  2. The Lower Tester has discovered and cached the IMDS service and characteristic handles (e.g., by running the test procedure in Section 4.3).
  3. The Lower Tester configures the IMD Historical Data characteristics for notifications.
  4. The Lower Tester configures the Record Access Control Point for indications.

4.2.4 Generate Historical Records preamble

- Parameters

  <Record Type>, <# of Records>

- Reference

  [3] 3.7.2, 3.8.2.1

- Preamble Procedure

  The Lower Tester executes Step 1 or 2 until <# of Records> are generated.

  1. If <Record Type> is IMD Service Cycle Data Record:
     a. The Lower Tester executes the GATT Write Characteristic Value sub-procedure for the Service Cycle Data characteristic with a valid Next Service Data.
  2. If <Record Type> is Work Cycle Data Record:
     a. The Lower Tester executes the GATT Write Characteristic Value sub-procedure for the IMD Control characteristic with an Op Code of Request to Start Measurement with valid parameters.

4.3 Generic GATT Integrated Tests

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

TCID	Service/ Characteristic/ Descriptor	Reference	Properties	Value Length (Octets)	Type
IMDS/SR/SGGIT/SER/BV-01-C [Service GGIT – Industrial Measurement Device]	Industrial Measurement Device Service	[3] 2	-	-	-
IMDS/SR/SGGIT/CHA/BV-01-C [Characteristic GGIT – IMD Status]	IMD Status	[3] 3.2	0x10 (Notify)	Skip	-
IMDS/SR/SGGIT/CHA/BV-02-C [Characteristic GGIT – IMD Descriptor Value Changed]	IMD Descriptor Value Changed	[3] 3.4	0x20 (Indicate)	Skip	-
IMDS/SR/SGGIT/CHA/BV-03-C [Characteristic GGIT – First Use Date]	First Use Date	[3] 3.5	0x02 (Read)	2	-
IMDS/SR/SGGIT/CHA/BV-04-C [Characteristic GGIT – First Use Date – Read, Write]	First Use Date	[3] 3.5	0x0A (Read, Write)	2, Skip-Write	-
IMDS/SR/SGGIT/CHA/BV-05-C [Characteristic GGIT – Life Cycle Data]	Life Cycle Data	[3] 3.6	0x02 (Read)	2-35	-
IMDS/SR/SGGIT/CHA/BV-06-C [Characteristic GGIT – Life Cycle Data, Read, Write]	Life Cycle Data	[3] 3.6	0x0A (Read, Write)	2-35, Skip-Write	-
IMDS/SR/SGGIT/CHA/BV-07-C [Characteristic GGIT – Work Cycle Data]	Work Cycle Data	[3] 3.7	0x02 (Read)	13	-
IMDS/SR/SGGIT/CHA/BV-08-C [Characteristic GGIT – Work Cycle Data, Read, Write]	Work Cycle Data	[3] 3.7	0x0A (Read, Write)	13, Skip-Write	-
IMDS/SR/SGGIT/CHA/BV-09-C [Characteristic GGIT – Work Cycle Data, Read, Notify]	Work Cycle Data	[3] 3.7	0x12 (Read, Notify)	13	-
IMDS/SR/SGGIT/CHA/BV-10-C [Characteristic GGIT – Work Cycle Data, Read, Write, Notify]	Work Cycle Data	[3] 3.7	0x1A (Read, Write, Notify)	13, Skip-Write	-

TCID	Service/ Characteristic/ Descriptor	Reference	Properties	Value Length (Octets)	Type
IMDS/SR/SGGIT/CHA/BV-11-C [Characteristic GGIT – Service Cycle Data, Read, Write]	Service Cycle Data	[3] 3.8	0x0A (Read, Write)	2-17, Skip-Write	-
IMDS/SR/SGGIT/CHA/BV-12-C [Characteristic GGIT – IMD Control]	IMD Control	[3] 3.9	0x08 (Write)	Skip	-
IMDS/SR/SGGIT/CHA/BV-13-C [Characteristic GGIT – IMD Historical Data]	IMD Historical Data	[3] 3.10	0x10 (Notify)	Skip	-
IMDS/SR/SGGIT/CHA/BV-14-C [Characteristic GGIT – Record Access Control Point]	Record Access Control Point	[3] 3.11	0x28 (Write, Indicate)	Skip	-
IMDS/SR/SGGIT/SDP/BV-01-C [SDP Record]	SDP Record	[3] 4	-	-	-

Table 4.2: Input for the GGIT Server test procedure

4.4 IMD Measurement tests

IMDS/SR/DEC/BV-01-C [Characteristic Declaration – IMD Measurement]

- 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.

- Reference

  [3] 3.1

- Initial Condition

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

- Test Procedure

  For each IMD Measurement characteristic identified in the ICS [4]:

  1. The Lower Tester discovers all characteristics of the service by executing the test procedure of GATT test case GATT/SR/GAD/BV-04-C in [7].
  2. For a discovered characteristic, verify that the characteristic properties field of the characteristic declaration meets the requirements of the service.

- Expected Outcome

  Pass verdict

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

4.4.1 Characteristic Descriptor Declaration and Read

- Test Purpose

  Verify that the characteristic descriptors meet the requirements of the service. The verification is performed one descriptor at a time, as enumerated in the test cases in Table 4.3.

- Reference

  [3] 3.1

- Initial Condition

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

- Test Case Configuration

Test Case	Value and Format Requirements
IMDS/SR/DES/BV-01-C [IMD Measurement characteristics – Measurement Description descriptor]	Permissions: 0x02 (Read) Format: Defined in [3] 3.1.2.1
IMDS/SR/DES/BV-02-C [IMD Measurement characteristics – Characteristic User Description descriptor]	Permissions: 0x02 (Read) or 0x0A (Read, Write) Format: Defined in [3] 3.1.2.2
IMDS/SR/DES/BV-03-C [IMD Measurement characteristics – Manufacturer Limits descriptor]	Permissions: 0x02 (Read) Format: Defined in [3] 3.1.2.3
IMDS/SR/DES/BV-04-C [IMD Measurement characteristics – Process Tolerances descriptor]	Permissions: 0x02 (Read) or 0x0A (Read, Write) Format: Defined in [3] 3.1.2.4
IMDS/SR/DES/BV-05-C [IMD Measurement characteristics – Trigger Settings descriptor]	Permissions: 0x02 (Read) or 0x0A (Read, Write) Format: Defined in [3] 3.1.2.5
IMDS/SR/DES/BV-06-C [IMD Measurement characteristics – Valid Range descriptor]	Permissions: 0x02 (Read) Format: Defined in [3] 3.1.2.6
IMDS/SR/DES/BV-07-C [IMD Measurement characteristics – Characteristic Extended Properties descriptor]	Permissions: 0x02 (Read) Format: Defined in [3] 3.1.2.7
IMDS/SR/DES/BV-08-C [IMD Measurement characteristics – CCCD]	Permissions: 0x0A (Read, Write)

Table 4.3: IMD Measurement – Descriptors test cases

- Test Procedure

  For each IMD Measurement characteristic identified in the ICS [4]:

  1. The Lower Tester discovers all characteristic descriptors of the characteristic by executing the test procedure of GATT test case GATT/SR/GAD/BV-06-C in [7] using the handle range of the characteristic.
  2. The Lower Tester reads all characteristic descriptors of the characteristic by executing the test procedure of GATT test case GATT/SR/GAR/BV-06-C in [7].
  3. Verify that the permissions and value format of the characteristic descriptor meet the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT returns at least one handle-UUID pair in Step 1.

  The characteristic descriptor is discovered, and its permissions and value format meet the requirements of the service.

IMDS/SR/CR/BV-01-C [IMD Measurement – Valid Read]

- Test Purpose

  Verify that the IMD Measurement characteristic and Measurement Description descriptor values required by the service are compliant and can be read.

- Reference

  [3] 3.1

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1, if using ATT over an LE transport, or Section 4.2.2 if using ATT over a BR/EDR transport.

- The Lower Tester has discovered and cached the IMD service and characteristic handles (e.g., by running the test procedure in Section 4.3).

- Test Procedure

  For each IMD Measurement characteristic identified in the ICS [4]:

  1. The Lower Tester executes the GATT Read Characteristic Value for that IMD Measurement characteristic.
  2. The Lower Tester executes the GATT Read Characteristic Descriptor for the Measurement Description descriptor if present.

- Expected Outcome

  Pass verdict

  The IUT returns a properly formatted IMD Measurement characteristic value in Step 1.

  The IUT returns a properly formatted Measurement Description descriptor value in Step 2.

  If there are multiple IMD Measurement characteristic instances, then the IUT exposes the Measurement Description descriptor that each has a unique combination of the Sampling Function and Description fields.

  The IUT exposes only one instance of a Measurement Description descriptor for the IMD Measurement characteristic.

IMDS/SR/UD/BV-01-C [Writable Characteristic User Description]

- Test Purpose

  Verify that the Characteristic User Description descriptor is writable.

- Reference

  [3] 3.1

- Initial Condition

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

- Test Procedure

  For each IMD Measurement characteristic identified in the ICS [4]:

  1. The Lower Tester executes the GATT Read Characteristic Descriptor for the Characteristic Extended Properties descriptor for that IMD Measurement characteristic.
  2. The Lower Tester executes the GATT Read Characteristic Descriptor for the Characteristic User Description for that IMD Measurement characteristic.
  3. The Lower Tester executes the GATT Write Characteristic Descriptor for the Characteristic User Description for that IMD Measurement characteristic with a different value than in Step 2.
  4. The Lower Tester executes the GATT Read Characteristic Descriptor for the Characteristic User Description for that IMD Measurement characteristic.

- Expected Outcome

  Pass verdict

  The Writable Auxiliaries bit is set in the Characteristic Extended Properties descriptor value in Step 2.

  The Character User Description in Step 3 persisted in the IUT.

IMDS/SR/PT/BV-01-C [Writable Process Tolerances descriptor]

- Test Purpose

  Verify that the Process Tolerances descriptor is writable and that the values persist.

- Reference

  [3] 3.1

- Initial Condition

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

- Test Procedure

  Perform Steps 1–10 for each instance of the IMD Measurement characteristic identified in the ICS [4]:

  1. The Lower Tester executes the GATT Read Characteristic Descriptor for the Manufacturer Limits descriptor for that IMD Measurement characteristic.
  2. The Lower Tester executes the GATT Read Characteristic Descriptor for the Process Tolerances descriptor for that IMD Measurement characteristic.

  Repeat Steps 3–8 twice, once using the relative form and once using the absolute form.

  3. The Lower Tester executes the GATT Write Characteristic Descriptor for the Process Tolerances descriptor for that IMD Measurement characteristic with a different value (that is in the targeted form) for the Low Tolerance Read, Low Tolerance Yellow, High Tolerance Yellow, High Tolerance Read fields than that read in Step 2 and within the limits retrieved in Step 1.
  4. The Lower Tester executes the GATT Read Characteristic Descriptor for the Process Tolerances descriptor for that IMD Measurement characteristic.

  Repeat Steps 5–6 using a random combination of the fields enumerated in Table 4.4 until all fields have been written.

  5. The Lower Tester executes the GATT Write Characteristic Descriptor for the Process Tolerances descriptor for that IMD Measurement characteristic with a different value (that is in the-target form) than that written in Step 3 and within the limits retrieved in Step 1.
  6. The Lower Tester executes the GATT Read Characteristic Descriptor for the Process Tolerances descriptor for that IMD Measurement characteristic.
  7. The Lower Tester executes the GATT Write Characteristic Descriptor for the Process Tolerances descriptor for that IMD Measurement characteristic with a value for one field (that is in a non-targeted form) within the limits retrieved in Step 1.
  8. The Lower Tester receives an error response.
  9. The Lower Tester executes the GATT Write Characteristic Descriptor for the Process Tolerances descriptor for that IMD Measurement characteristic with a value (either in the relative or absolute form) outside the limits retrieved in Step 1.

10. The Lower Tester receives an error response.

Fields
Target Value
Low Tolerance Red
Low Tolerance Yellow
High Tolerance Yellow
High Tolerance Red

Table 4.4: Fields used for setting Process Tolerances

- Expected Outcome

  Pass verdict

  The Process Tolerances descriptor value persisted in the IUT in Steps 3 and 5.

  The IUT rejects invalid values written in Steps 5, 7, and 9 with a Value Not Allowed error response.

4.4.2 IMD Measurement notifications

4.4.2.1 Triggers – By Time Condition

- Test Purpose

  Verify that the Trigger Settings descriptor is writable and notifications are sent when the Time Condition is used.

- Reference

  [3] 3.1.2.5.1

- Initial Condition

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

- Test Case Configuration

Test Case	IMD Status Supported
IMDS/SR/TT/BV-01-C [Triggers – By Time Condition]	No
IMDS/SR/TT/BV-02-C [Triggers – By Time Condition, IMD Status]	Yes

Table 4.5: Triggers – By Time Condition test cases

- Test Procedure

  For each IMD Measurement characteristic identified in the ICS [4]:

  1. The Lower Tester configures the IMD Measurement characteristic for notification.
  2. The Lower Tester executes the GATT Write Characteristic Descriptor for the Trigger Settings descriptor for that IMD Measurement characteristic with the Time Condition field set to a value between TSPX_Minimum_Trigger_Time and TSPX_Maximum_Trigger_Time.
  3. The Lower Tester listens for four intervals of the value written in Step 2.

  Steps 4–6 happen while listening.

  4. The IUT sends notifications for the IMD Measurement characteristic to the Lower Tester on the interval written in Step 2.
  5. If the IMD Status characteristic is supported:
     a. The Upper Tester causes a change of the IMD Measurement that results in an IMD Status change.
  6. If the IMD Status characteristic is supported:
     a. The IUT sends notifications for the IMD Status characteristic to the Lower Tester on the next interval.
     b. The IUT doesn't send a notification for the IMD Status characteristic on the interval after Step 6a.
  7. The Lower Tester executes the GATT Write Characteristic Descriptor for the Trigger Settings descriptor for that IMD Measurement characteristic with the Time Condition field set to zero.
  8. The Lower Tester listens for one second longer than the value written in Step 2.

- Expected Outcome

  Pass verdict

  The IUT exposed only one Trigger Setting descriptor for an IMD Measurement characteristic.

  The IUT sends the IMD Measurement notification on the time interval used in Step 2 for the duration in Step 3.

  If the IMD Status characteristic is supported, then the IUT sends an IMD Status notification on the time interval used in Step 2 for the duration in Step 6a and doesn't send a notification in Step 6b.

  The IUT doesn't send notifications for the duration of Step 6.

4.4.2.2 Triggers – By Delta Condition

- Test Purpose

  Verify that the Trigger Setting descriptor is writable and that notifications are sent when the Delta Condition is used.

- Reference

  [3] 3.1.2.5.1

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1, if using ATT over an LE transport, or Section 4.2.2 if using ATT over a BR/EDR transport.

- The Lower Tester has discovered and cached the IMD service and characteristic handles (e.g., by running the test procedure in Section 4.3).
- The Lower Tester has configured the IMD Status characteristic if supported by the IUT.

- Test Case Configuration

Test Case	IMD Status Supported
IMDS/SR/TD/BV-01-C [Triggers – By Delta Condition]	No
IMDS/SR/TD/BV-02-C [Triggers – By Delta Condition, IMD Status]	Yes

Table 4.6: Triggers – By Delta Condition test cases

- Test Procedure

  For each IMD Measurement characteristic identified in the ICS [4]:

  1. The Lower Tester configures the IMD Measurement characteristic for notification.
  2. The Lower Tester executes the GATT Read Characteristic Value for that IMD Measurement characteristic.
  3. The Lower Tester executes the GATT Write Characteristic Descriptor for the Trigger Settings descriptor for that IMD Measurement characteristic with the Delta Condition field set to TSPX_DELTA_CONDITION IXIT value.
  4. The Lower Tester starts listening for 60 seconds.
  5. The Upper Tester causes the measurement value to change that is less than the TSPX_DELTA_CONDITION IXIT value on the IUT.
  6. The Lower Tester starts listening for 60 seconds
  7. The Upper Tester causes the measurement value to exceed the TSPX_DELTA_CONDITION IXIT value on the IUT.
  8. The IUT sends notifications for the IMD Measurement characteristic to the Lower Tester.
  9. If IMD Status is supported, then the IUT sends a notification for the IMD Status characteristic to the Lower Tester.
  10. The Lower Tester executes the GATT Write Characteristic Descriptor for the Trigger Settings descriptor for that IMD Measurement characteristic with the Delta Condition field set to zero.
  11. The Lower Tester listens for 60 seconds

- Expected Outcome

  Pass verdict

  The IUT exposes only one Trigger Settings descriptor for the IMD Measurement characteristic.

  The IUT sends the notification where the value changed between Step 2 and Step 7.

  The IUT sends a notification after Step 8 if the IMD Status characteristic is supported.

  The IUT doesn't send notifications after Step 5 and Step 9.

IMDS/SR/CT/BV-01-C [Triggers – Custom Condition]

- Test Purpose

  Verify that the IMD Measurement characteristic sends a notification when a Custom Condition is used.

- Reference

  [3] 3.1.2.5

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

  For each IMD Measurement characteristic identified in the ICS [4]:

  1. The Lower Tester configures the IMD Measurement characteristic for notification.
  2. The Upper Tester orders the IUT to generate a measurement that triggers the Custom Condition.
  3. The Lower Tester listens for TSPX_Minimum_Trigger_Time.
  4. The IUT sends notifications for the IMD Measurement characteristic to the Lower Tester.
- Expected Outcome

  Pass verdict

  The IUT doesn't expose a Trigger Settings descriptor for the IMD Measurement characteristic.

  The IUT sends the notification in Step 4.

4.4.3 IMD Status - Notifications

- Test Purpose

  Verify that the IUT can send notifications of the IMD Status characteristic when its underlying status changes.
- Reference

  [3] 3.2
- Initial Condition
  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1, if using ATT over an LE transport, or Section 4.2.2 if using ATT over a BR/EDR transport.
  - The Lower Tester has discovered and cached the IMD service and characteristic handles (e.g., by running the test procedure in Section 4.3).
  - The Lower Tester has read the Measurement Description descriptor if supported by the IUT.
  - The IMD Status characteristic is configured for notifications.
- Test Case Configuration

Test Case	Property Changed
IMDS/SR/CN/BV-01-C [IMD Status changed, Manufacturer Limits]	Manufacturer Limits

Table 4.7: IMD Status - Notification test cases

- Test Procedure

  The following test procedure applies to the test cases listed in Table 4.9 for each IMD Measurement characteristic identified by the TSPX_IMD_Measurement IXIT entry for the characteristics where its property can be updated.

  1. Perform an action on the IUT that updates the measured value tested by the test case.
  2. The Lower Tester receives a GATT Characteristic Value Notification from the IUT.

- Expected Outcome

  Pass verdict

  The IUT sends a notification of the IMD Status characteristic with the Status field value correct for the test case and the UUID field set to the TSPX_IMD_Measurement IXIT entry.

  If the Measurement Description descriptor is supported by that IMD Measurement characteristic as indicated by the ICS, then:

  - The notification Description field should match the Description field of the Measurement Description descriptor, if present; otherwise, its value should be 0x0000.
  - The notification Sampling Function field should match the Sampling Function field of the Measurement Description descriptor, if present; otherwise, its value should be 0x1.

IMDS/SR/CN/BV-02-C [IMD Status changed, Process Tolerances]

- Test Purpose

  Verify that the IUT's IMD Status notifications correspond to the Process Tolerations descriptor values.

- Reference

  [3] 3.1.4.2, 3.2

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1, if using ATT over an LE transport, or Section 4.2.2 if using ATT over a BR/EDR transport.
  - The Lower Tester has discovered and cached the IMD service and characteristic handles (e.g., by running the test procedure in Section 4.3).
  - The Lower Tester has read the Measurement Description descriptor, if supported by the IUT.
  - The IMD Status characteristic is configured for notifications.

- Test Procedure

  The following test procedure applies for the IMD Measurement characteristic identified by the TSPX_IMD_Measurement IXIT entry for the characteristics where its property can be updated.

  For rounds 1–8 in Table 4.8, execute Steps 1–3

  1. The Lower Tester executes the GATT Read Characteristic Descriptor for the Process Tolerances descriptor for the IMD Measurement characteristic.
  2. The Upper Tester updates the measured value tested on the IUT that will exceed the tolerance for this round.
  3. The Lower Tester receives a GATT Characteristic Value Notification from the IUT.

Round	Tolerance
1	User-defined low Red Process Tolerance
2	User-defined low Yellow Process Tolerance
3	User-defined high Red Process Tolerance
4	User-defined high Yellow Process Tolerance
5	Manufacturer-defined low Red Process Tolerance
6	Manufacturer-defined low Yellow Process Tolerance
7	Manufacturer-defined high Red Process Tolerance
8	Manufacturer-defined high Yellow Process Tolerance

Table 4.8: IMD Status changed, Process Tolerances rounds

- Expected Outcome

  Pass verdict

  In Step 3, the IUT sends a notification of the IMD Status characteristic with the Status field value correct for the test case and the UUID field set to the TSPX_IMD_Measurement IXIT entry, and the status field bits are set to what is appropriate for that round.

  If the Measurement Description descriptor is supported by that IMD Measurement characteristic as indicated by the ICS, then:

  - The notification Description field should match the Description field of the Measurement Description descriptor, if present; otherwise, its value should be 0x0000.
  - The notification Sampling Function field should match the Sampling Function field of the Measurement Description descriptor, if present; otherwise, its value should be 0x1.

4.4.4 Descriptor Value Changed indication – Change at Server

- Test Purpose

  Verify that the IUT can send indications of the IMDS Descriptor Value Changed characteristic when descriptor values are changed at the Server.

- Reference

  [3] 3.3

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1, if using ATT over an LE transport, or Section 4.2.2 if using ATT over a BR/EDR transport.
  - The Lower Tester has discovered and cached the IMDS service and characteristic handles (e.g., by running the test procedure in Section 4.3).
  - The IMDS Descriptor Value Changed characteristic is configured for indication.
  - The IUT and the Lower Tester are bonded.

- Test Case Configuration

Test Case	Descriptor
IMDS/SR/CI/BV-01-C [Descriptor Value Changed, Measurement Description]	Measurement Description
IMDS/SR/CI/BV-02-C [Descriptor Value Changed, Characteristic User Description]	Characteristic User Description

Test Case	Descriptor
IMDS/SR/CI/BV-03-C [Descriptor Value Changed, Manufacturer Limits]	Manufacturer Limits
IMDS/SR/CI/BV-04-C [Descriptor Value Changed, Process Tolerances]	Process Tolerances
IMDS/SR/CI/BV-05-C [Descriptor Value Changed, Trigger Settings]	Trigger Settings
IMDS/SR/CI/BV-06-C [Descriptor Value Changed, Valid Range]	Valid Range

Table 4.9: Descriptor Value Changed at Server test cases

- Test Procedure

  The following test procedure applies to the test cases listed in Table 4.9 for each IMD Measurement characteristic identified in the ICS [4] for which one or more of the associated characteristic descriptors can be updated by the Server.

  1. The Lower Tester reads and caches all descriptor values listed in Table 4.9 for all IMD Measurement characteristics.
  2. The Lower Tester disconnects from the IUT.
  3. Perform an action on the IUT that updates the value of the descriptor as specified in Table 4.9.
  4. The Lower Tester connects to the IUT.
  5. The Lower Tester receives a GATT Characteristic Value Indication from the IUT.
  6. Perform an action on the IUT that updates the value of the descriptor tested by the test case.
  7. The Lower Tester receives a GATT Characteristic Value Indication from the IUT.
  8. The Lower Tester disconnects from the IUT.
  9. Perform an action on the IUT that will update the value of multiple descriptors.
  10. The Lower Tester connects to the IUT.
  11. The Lower Tester receives a GATT Characteristic Value Indication from the IUT.

- Expected Outcome

  Pass verdict

  The IUT sends an indication of the IMDS Descriptor Value Changed characteristic with the Descriptor Handle field set to the correct GATT handle in Steps 5 and 7.

  The IUT sends an indication of the IMDS Descriptor Value Changed characteristic with the Descriptor Handle field set to zero in Step 11.

4.4.5 Descriptor Value Changed indication – By Write

- Test Purpose

  Verify that the IUT can send indications of the IMDS Descriptor Value Changed characteristic to a client when the descriptor is writable and changed by another client.

- Reference

  [3] 3.3

- Initial Condition

  - A bearer connection between Lower Tester 1 and the IUT is established as described in Section 4.2.1, if using ATT over an LE transport, or Section 4.2.2 if using ATT over a BR/EDR transport.
  - Lower Tester 1 has discovered and cached the IMD service and characteristic handles (e.g., by running the test procedure in Section 4.3).
  - The IMDS Descriptor Value Changed characteristic is configured for indication.

- If IUT permissions for the IMDS Descriptor Value Changed characteristic require a specific security mode or security level, establish a connection meeting those requirements.
- The IUT is bonded with Lower Tester 2.

- Test Case Configuration

Test Case	Descriptor
IMDS/SR/CIW/BV-01-C [IMDS Descriptor Value Changed, Characteristic User Description, By Write]	Characteristic User Description
IMDS/SR/CIW/BV-02-C [IMDS Descriptor Value Changed, Process Tolerances, By Write]	Process Tolerances
IMDS/SR/CIW/BV-03-C [IMDS Descriptor Value Changed, Trigger Settings, By Write]	Trigger Settings

Table 4.10: Descriptor Value Changed indication – by Write test cases

- Test Procedure

  The following test procedure applies to the test cases listed in Table 4.10 for each IMD Measurement characteristic identified in the ICS [4] for which one or more of the associated characteristic descriptors can be updated by the Server.

  1. Lower Tester 1 writes a new value to the descriptor specified in Table 4.10.
  2. Lower Tester 1 disconnects from the IUT.
  3. Establish a connection between Lower Tester 2 and the IUT meeting the security requirements of the IUT.
  4. Lower Tester 2 receives one GATT Characteristic Value Indication from the IUT containing the IMDS Descriptor Value Changed characteristic handle and value.
  5. Lower Tester 2 executes the GATT Read Characteristic Descriptor for the descriptor written in Step 1.

- Expected Outcome

  Pass verdict

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

  The value persisted in the IUT in Step 1 and is read in Step 5.

IMDS/SR/CW/BV-01-C [Writable First Use Date]

- Test Purpose

  Verify that the First Use Date is writable and that it persisted.

- Reference

  [3] 3.4.2

- Initial Condition

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

- Test Procedure

  1. The Lower Tester executes the GATT Read Characteristic Descriptor for the First Use Date characteristic.
  2. The Lower Tester executes the GATT Write Characteristic Descriptor for the First Use Date characteristic with a different value than in Step 1.
  3. The Upper Tester power cycles the IUT.
  4. The Lower Tester re-establishes a bearer connection to the IUT.
  5. The Lower Tester executes the GATT Read Characteristic Descriptor for the First Use Date characteristic.

- Expected Outcome

  Pass verdict

  The First Use Date in Step 2 persisted in the IUT.

4.4.6 Work Cycle Start/Stop

- Test Purpose

  Verify that the First Use Date characteristic is set properly when the first Work Cycle is started and that the Work Cycle Data and Life Cycle Data characteristic values are updated.

- Reference

  [3] 3.4.2

- Initial Condition

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

- Test Case Configuration

Test Case	Start/Stop Action
IMDS/SR/CR/BV-02-C [Work Cycle Start]	The Upper Tester orders the IUT to start or stop a Work Cycle.
IMDS/SR/CW/BV-04-C [Work Cycle Start/Stop - Writable]	The Lower Tester writes the value of 0x00 or 0x01 to the Work Cycle Data characteristic.

Table 4.11: Work Cycle Start/Stop test cases

- Test Procedure

  1. The Lower Tester executes the GATT Read Characteristic procedure for the Life Cycle Data and Work Cycle Data characteristics.
  2. Perform the Start action specified in Table 4.11.
  3. The Lower Tester executes the GATT Read Characteristic procedure for the Life Cycle Data and Work Cycle Data characteristics.
  4. Perform the Stop action specified in Table 4.11.
  5. The Lower Tester executes the GATT Read Characteristic procedure for the Life Cycle Data and Work Cycle Data characteristics.

- Expected Outcome

  Pass verdict

  The IUT returns a value of zero in Step 1 and the current date in Step 3.

  In Step 3, the IUT returns a value of 0x01 in the Status field of the Work Cycle Data characteristic, and 0x02 in Step 5.

  The values for the Work Cycle Index field and Start Time field of the Work Cycle Data characteristic are incremented between Steps 1 and 3.

  If the Work Cycle Counter field is exposed, then the value for the Work Cycle Counter field of the Life Cycle Data characteristic is incremented between Steps 1 and 5.

4.4.7 Work Cycle Start/Stop with notifications

- Test Purpose

  Verify that the First Use Date characteristic is set properly when the first Work Cycle is started and that the Work Cycle Data and Life Cycle Data characteristic values are updated and notifications are supported.

- Reference

  [3] 3.4.2

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1, if using ATT over an LE transport, or Section 4.2.2 if using ATT over a BR/EDR transport.
  - The Lower Tester has discovered and cached the IMD service and characteristic handles (e.g., by running the test procedure in Section 4.3).
  - The IUT has the First Use Date characteristic set to zero.
  - The Work Cycle Data characteristic is configured for notifications.

- Test Case Configuration

Test Case	Start/Stop Action
IMDS/SR/CR/BV-03-C [Work Cycle Start/Stop – Notifications]	The Upper Tester orders the IUT to start or stop a Work Cycle.
IMDS/SR/CW/BV-05-C [Work Cycle Start/Stop – Writable, Notifications]	The Lower Tester writes the value of 0x00 or 0x01 to the Work Cycle Data characteristic.

Table 4.12: Work Cycle Start/Stop with notifications test cases

- Test Procedure

  1. The Lower Tester executes the GATT Read Characteristic procedure for the Life Cycle Data and Work Cycle Data characteristics.
  2. Perform the Start action specified in Table 4.12.
  3. The Lower Tester receives a notification of the Work Cycle Data characteristic.
  4. The Lower Tester executes the GATT Read Characteristic procedure for the Life Cycle Data characteristic.
  5. Perform the Stop action specified in Table 4.12.
  6. The Lower Tester receives a notification of the Work Cycle Data characteristic.

7. The Lower Tester executes the GATT Read Characteristic procedure for the Life Cycle Data characteristic.

- Expected Outcome

  Pass verdict

  The IUT returns a value of zero in Step 1 and the current date in Step 4.

  In Step 3, the IUT sends a notification with the value of 0x01 in the Status field of the Work Cycle Data characteristic, and 0x02 in Step 6.

  The values for the Work Cycle Index field and Start Time field of the Work Cycle Data characteristic are incremented between Steps 1 and 3.

  If the Work Cycle Counter field is exposed, then the value for the Work Cycle Counter field of the Life Cycle Data characteristic is incremented between Steps 1 and 5.

IMDS/SR/CW/BV-02-C [Writable Life Cycle Data]

- Test Purpose

  Verify that the Life Cycle Data characteristic is writable and returns an error for the fields that are not supported.

- Reference

  [3] 3.5

- Initial Condition

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

- Test Procedure

  1. The Lower Tester executes the GATT Read Characteristic procedure for the Life Cycle Data characteristic.
  2. The Lower Tester executes the GATT Write Characteristic procedure for the Life Cycle Data characteristic with a different value than that in Step 1 for the fields that indicated support from the Flags field returned in Step 1.
  3. The Lower Tester executes the GATT Read Characteristic procedure for the Life Cycle Data characteristic.

  Repeat Steps 4–5 for each field indicated as not supported from the Flags field returned in Step 1.

  4. The Lower Tester executes the GATT Write Characteristic procedure for the Life Cycle Data characteristic with a value for a field that was indicated as not supported from the Flags field returned in Step 1.
  5. The Lower Tester receives an error response.

- Expected Outcome

  Pass verdict

  The IUT accepted the value written in Step 2 and returned in Step 3.

  The IUT returns a Value Not Allowed error response in Step 5 for each unsupported field.

IMDS/SR/CW/BV-03-C [Writable Service Cycle Data]

- Test Purpose

  Verify that the Service Cycle Data characteristic is writable and returns an error for the fields that are not supported.

- Reference

  [3] 3.7

- Initial Condition

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

- Test Procedure

  1. The Lower Tester executes the GATT Read Characteristic Descriptor for the Service Cycle Data characteristic.
  2. The Lower Tester executes the GATT Write Characteristic Descriptor for the Service Cycle Data characteristic with a different value than that in Step 1 for the fields that indicated support from the Flags field returned in Step 1.
  3. The Lower Tester executes the GATT Read Characteristic Descriptor for the Service Cycle Data characteristic.

  Repeat Steps 4–5 for each field indicated as not supported from the Flags field returned in Step 1.

  4. The Lower Tester executes the GATT Write Characteristic Descriptor for the Service Cycle Data characteristic with a value for a field that was indicated as not supported from the Flags field returned in Step 1.
  5. The Lower Tester receives an error response.

- Expected Outcome

  Pass verdict

  The IUT accepted the value written in Step 2 and returned it in Step 3.

  The IUT returns a Value Not Allowed error response in Step 5 for each unsupported field.

  The Max Use Time, Max Work Cycles Count, Actual Use Time, and Work Cycle Counter are set to zero in Step 3 if they are supported by the IUT.

4.5 IMD Control tests

IMDS/SR/DC/BV-01-C [Request Start Measurement Op Code]

- Test Purpose

  Verify the behavior of the IUT when the client writes the Request to Start Measurement Op Code.

- Reference

  [3] 3.8.2.1

- Initial Condition
  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1, if using ATT over an LE transport, or Section 4.2.2 if using ATT over a BR/EDR transport.
  - The Lower Tester has discovered and cached the IMD service and characteristic handles (e.g., by running the test procedure in Section 4.3).
  - All of the IMD Measurement characteristics are configured for notifications.
- Test Procedure

  The following test procedure applies for each IMD Measurement characteristic identified in the ICS [4].

  1. The Lower Tester executes the GATT Write Characteristic Value sub-procedure with the Op Code set to 0x00 (Start Measurement), the Delay field set to 0, and Sampling Function and Description values that match the targeted IMD Measurement, if present.
  2. The Lower Tester receives a Write Response indicating that the IUT has accepted the Op Code.
  3. The Upper Tester causes the IUT to complete measurement.
  4. The IUT sends a notification on an IMD Measurement characteristic.

  5. The Upper Tester sets the condition so that the IUT is busy and cannot accept the Start Measurement command.
  6. The Lower Tester executes the GATT Write Characteristic Value sub-procedure with the Op Code set to 0x00 (Start Measurement), the Delay field set to 0, and Sampling Function and Description values that match the targeted IMD Measurement, if present.
  7. The Lower Tester receives an ATT error response.

  8. The Upper Tester sets the condition so that the IUT is not busy and can accept the Start Measurement command.
  9. The Lower Tester executes the GATT Write Characteristic Value sub-procedure with the Op Code set to 0x00 (Start Measurement), and the Delay field set to some random uint32 value greater than 10 seconds, and Sampling Function and Description values that match the targeted IMD Measurement, if present.
  10. The Lower Tester receives a Write Response indicating that the IUT has accepted the Op Code.
  11. The Lower Tester executes the GATT Write Characteristic Value sub-procedure with the Op Code set to 0x00 (Start Measurement) and the Delay field set to some random uint32 value between 10 and 60 seconds.
  12. The Lower Tester receives a Write Response indicating that the IUT has accepted the Op Code.
  13. The Upper Tester causes a measurable input to the IUT.
  14. The Lower Tester waits for 1 second more than the value set in Step 11, until the IUT sends a Notification on an IMD Measurement characteristic.

  15. The Lower Tester executes the GATT Write Characteristic Value sub-procedure with the Op Code set to 0x00 (Start Measurement) and an unknown value for the UUID, Sampling Function, or Description field.
  16. The Lower Tester receives an ATT error response.

- Expected Outcome

  Pass verdict

  The IUT accepted the Op Code in Steps 1, 9, and 11.

  The IUT sends a notification from an IMD Measurement in Step 4.

  The IUT sends a notification from an IMD Measurement in Step 14 that is the correct elapsed time from Step 11.

  The IUT sends a Procedure Already In Progress error code in Step 7.

  The IUT sends a Value Not Allowed error code in Step 16.

IMDS/SR/DC/BV-02-C [Request to Abort Current Operation Op Code]

- Test Purpose

  Verify the behavior of the IUT when the client writes the Request to Abort Current Operation Op Code.

- Reference

  [3] 3.8.2.2

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1, if using ATT over an LE transport, or Section 4.2.2 if using ATT over a BR/EDR transport.
  - The Lower Tester has discovered and cached the IMD service and characteristic handles (e.g., by running the test procedure in Section 4.3).
  - All of the IMD Measurement characteristics are configured for notifications.

- Test Procedure

  1. The Lower Tester executes the GATT Write Characteristic Value sub-procedure with the Op Code set to 0x00 (Start Measurement) and the Delay field set to some random uint48 value greater than 10 seconds.
  2. The Lower Tester receives a Write Response indicating that the IUT has accepted the Op Code.
  3. The Lower Tester executes the GATT Write Characteristic Value sub-procedure with the Op Code set to 0x01 (Abort).
  4. The Lower Tester waits 1 second more than the value set in Step 1.

- Expected Outcome

  Pass verdict

  The IUT accepted the Op Code in Step 1.

  The IUT does not send a notification in Step 4.

IMDS/SR/DC/BI-01-C [Cannot abort measurement request]

- Test Purpose

  Verify the behavior of the IUT when the client writes the Request to Abort Current Operation Op Code but the IUT cannot abort the request.

- Reference

  [3] 3.8.2.2

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1, if using ATT over an LE transport, or Section 4.2.2 if using ATT over a BR/EDR transport.
  - The Lower Tester has discovered and cached the IMD service and characteristic handles (e.g., by running the test procedure in Section 4.3).
  - All of the IMD Measurement characteristics are configured for notifications.
  - The IUT is configured so that it cannot process a Request to Abort Current Operation Op Code.

- Test Procedure

  1. The Lower Tester executes the GATT Write Characteristic Value sub-procedure with the Op Code set to 0x00 (Start Measurement).
  2. The Lower Tester receives a Write Response indicating that the IUT has accepted the Op Code.
  3. The Lower Tester executes the GATT Write Characteristic Value sub-procedure with the Op Code set to 0x01 (Abort).
  4. The Lower Tester receives an ATT error response.
  5. The Lower Tester waits until the IUT sends notification of the IMD Measurement characteristic.

- Expected Outcome

  Pass verdict

  The IUT accepted the Op Code in Step 1.

  The IUT sends a Request Not Supported error code in Step 4.

  The IUT sends a notification in Step 5.

IMDS/SR/DC/BI-02-C [IMD Control – Op Code Not Supported]

- Test Purpose

  Verify the behavior of the IUT when the client sends an unknown Op Code.

- Reference

  [3] 3.8.2

- Initial Condition

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

- Test Procedure

  1. The Lower Tester executes the GATT Write Characteristic Value sub-procedure for the IMD Control characteristic with the Calibration Mode field set to an RFU value.
  2. The Lower Tester receives an ATT error response.

- Expected Outcome

  Pass verdict

  The IUT returns an ATT error response with the error code set to Request Not Supported in Step 2.

4.6 Record Access Control Point

		Inner Loop: Operand	
		Sequence Number	Timestamp
Outer Loop: Operator	All Records	No filter parameter	No filter parameter
	Less than or equal to	<Max filter value>	<Max filter value>
	Greater than or equal to	<Min filter value>	<Min filter value>
	Within range of (inclusive)	<Min filter value>, <Max filter value>	<Min filter value>, <Max filter value>
	First Record	No filter parameter	No filter parameter
	Last Record	No filter parameter	No filter parameter

Table 4.13: RACP Operators and Operands

4.6.1 Delete Store Records Op Code

- Test Purpose

  Verify that the IUT can perform the Delete Stored Records procedure with the combination of Operators and Operands listed in Table 4.13.

  If the combination of the Operator and Operand is supported, then the IUT reports a valid response. Where the Operator or Operand or the combination is not supported, the IUT reports a valid error response.

- Reference

  [3] 3.9.2.3

- Initial Condition

  - Perform the RACP preamble described in Section 4.2.3 to enable the IUT for use with the Record Access Control Point.

- Test Case Configuration

Test Case	Record Type
IMDS/SR/RACP/BV-01-C [Delete Stored Records, Service Cycle Data]	0x00 (Service Cycle Data)
IMDS/SR/RACP/BV-02-C [Delete Stored Records, Work Cycle Data]	0x01 (Work Cycle Data)

Table 4.14: Delete Stored Records Op Code test cases

- Test Procedure

1. The Lower Tester performs the Generate Historical Records preamble described in Section 4.2.4 for the record type specified in Table 4.14 to generate at least five records.
2. For each <Operator> in Table 4.13, perform the following steps (outer loop):
   a. For each <Operand> in Table 4.13, perform the following steps (inner loop):
      i. The Lower Tester writes the Delete Stored Records Op Code (0x02) to the RACP using the record type specified in Table 4.14 and the listed <Operator>, <Operand>, and corresponding filter parameter(s).
      ii. IF the <Operator> is NOT supported, then the IUT sends an ATT_HANDLE_VALUE_IND of the RACP characteristic with the Response Code Op Code (0x06), an Operator of Null (0x00), and an Operand representing the Request Op Code (0x06) followed by the Response Code value for Operator Not Supported (0x04).
         a) The IUT receives an ATT_HANDLE_VALUE_CFM from the Lower Tester.
      iii. ELSE IF the <Operand> is NOT supported, then the IUT sends an ATT_HANDLE_VALUE_IND of the RACP characteristic with the Response Code Op Code (0x06), an Operator of Null (0x00), and an Operand representing the Request Op Code (0x06) followed by the Response Code value for Operand Not Supported (0x09).
         a) The IUT receives an ATT_HANDLE_VALUE_CFM from the Lower Tester.
      iv. ELSE IF the <Operand> is Sequence Number and NO sequence numbers exist in the requested sequence number range OR IF the <Operand> is Timestamp and NO timestamps exist in the requested Timestamp range, then the IUT sends an ATT_HANDLE_VALUE_IND of the RACP characteristic with the Response Code Op Code (0x06), an Operator of Null (0x00), and an Operand representing the Request Op Code (0x06) followed by the Response Code value for No Records Found (0x06).
         a) The IUT receives an ATT_HANDLE_VALUE_CFM from the Lower Tester.
      v. ELSE, the IUT sends an ATT_HANDLE_VALUE_IND of the RACP characteristic with the Response Code Op Code (0x06), an Operator of Null (0x00), and an Operand representing the Request Op Code (0x06) followed by the Response Code for Success (0x01).
         a) The IUT receives an ATT_HANDLE_VALUE_CFM from the Lower Tester.
         b) The Lower Tester verifies that the desired records have been deleted by performing the Report Number of Stored Records Op Code (0x04) with an applicable Operator and Operand.
         c) Perform an action on the IUT that will induce it to generate at least five records of the record type specified in Table 4.14, of which one record should be a supported reference time history event.
         d) Verify that the Lower Tester knows the Sequence Number for the generated records.

- Expected Outcome

  Pass verdict

  For each combination of <Operator> and <Operand>, the IUT sends:

  - One indication of the RACP characteristic with the Response Code Op Code containing a valid Operator and Operand for each operation (Combination supported)

  OR

  - The appropriate error message (Operator Not Supported or No Records Found)

  The Sequence Number is not reset by the Delete Stored Records operation.

4.6.2 Report Number of Stored Records Op Code

- Test Purpose

  Verify that the IUT can perform the Report Number of Stored Records procedure with the combination of Operators and Operands listed in Table 4.13.

  If the combination of the Operator and Operand is supported, then the IUT reports a valid response. Where the Operator or Operand or the combination is not supported, the IUT reports a valid error response.

- Reference

  [3] 3.9.2.2

- Initial Condition

  - Perform the RACP preamble described in Section 4.2.3 to enable the IUT for use with the Record Access Control Point.

- Test Case Configuration

Test Case	Record Type
IMDS/SR/RACP/BV-03-C [Report Number of Stored Records, Service Cycle Data]	0x00 (Service Cycle Data)
IMDS/SR/RACP/BV-04-C [Report Number of Stored Records, Work Cycle Data]	0x01 (Work Cycle Data)

Table 4.15: Report Number of Stored Records Op Code test cases

- Test Procedure

  1. The Lower Tester performs the Generate Historical Records preamble described in Section 4.2.4 for the record type specified in Table 4.15 to generate at least five records.
  2. For each <Operator> in Table 4.13, perform the following steps (outer loop):
     a. For each <Operand> in Table 4.13, perform the following steps (inner loop):
        i. The Lower Tester writes the Report Number of Stored Records Op Code (0x04) to the RACP using the record type specified in Table 4.15 and the listed <Operator>, <Operand>, and corresponding filter parameter(s).
        ii. IF the <Operator> is NOT supported, then the IUT sends an ATT_HANDLE_VALUE_IND of the RACP characteristic with the Response Code Op Code (0x06), an Operator of Null (0x00), and an Operand representing the Report Number of Stored Records Op Code (0x04) followed by the Response Code value for Operator Not Supported (0x04).
        iii. ELSE IF the <Operand> is NOT supported, then the IUT sends an ATT_HANDLE_VALUE_IND of the RACP characteristic with the Response Code Op Code (0x06), an Operator of Null (0x00), and an Operand representing the Report

Number of Stored Records Op Code (0x04) followed by the Response Code value for Operand Not Supported (0x09).

iv. ELSE, the IUT sends an ATT_HANDLE_VALUE_IND of the RACP characteristic with the Number of Stored Records Response Op Code (0x05) an Operator of Null (0x00), and an Operand representing the number of records that were found.

v. The IUT receives an ATT_HANDLE_VALUE_CFM from the Lower Tester.

6. Verify that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  For each combination of <Operator> and <Operand>, the IUT sends:

  - One indication of the Record Access Control Point characteristic with the Number of Stored Records Response Op Code containing a valid Operator and Operand. The value of the Operand represents the correct number of available records (Combination supported).

  OR

  - The appropriate error message (Combination not supported).

4.6.3 Report Number of Stored Records Op Code – With no records

- Test Purpose

  Verify that the IUT responds properly if the Report Number of Stored Records procedure is performed with an Operator of All records when the IUT does not contain any records.

- Reference

  [3] 3.9.2.2

- Initial Condition

  - Perform the RACP preamble described in Section 4.2.3 to enable the IUT for use with the Record Access Control Point.

  - Perform an action on the IUT that will induce it to remove all the stored records (by having the Lower Tester perform a Delete Stored Records procedure) of the record type specified in Table 4.16, or the Lower Tester knows the last sequence number.

- Test Case Configuration

Test Case	Record Type
IMDS/SR/RACP/BV-05-C [Report Number of Stored Records, Service Cycle Data, No records]	0x00 (Service Cycle Data)
IMDS/SR/RACP/BV-06-C [Report Number of Stored Records, Work Cycle Data, No records]	0x01 (Work Cycle Data)

Table 4.16: Report Number of Stored Records Op Code – With no records test cases

- Test Procedure

  1. The Lower Tester writes the Report Number of Stored Records Op Code (0x04) to the RACP with the record type specified in Table 4.16 using a combination of mandatory Operator and Operand, which request a records number that does not exist.
  2. The IUT sends an ATT_HANDLE_VALUE_IND of the RACP characteristic with the Number of Stored Records Response Op Code (0x05), an Operator of Null (0x00), and an Operand representing that no records were found (0x0000 0000).

3. The IUT receives an ATT_HANDLE_VALUE_CFM from the Lower Tester.
4. Verify that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends an indication of the RACP characteristic with the Number of Stored Records Response Op Code (0x05), an Operator of Null (0x00), and an Operand representing that no records were found (0x0000 0000).

4.6.4 Combined Report Op Code

- Test Purpose

  Verify that the IUT can perform the Combined Report procedure with the combination of Operators and Operands listed in Table 4.13.

  If the combination of the Operator and Operand is supported, then the IUT reports a valid response. Where the Operator or Operand or the combination is not supported, the IUT reports a valid error response.

- Reference

  [3] 3.9.2.4

- Initial Condition

  - Perform the RACP preamble described in Section 4.2.3 to enable the IUT for use with the Record Access Control Point.

- Test Case Configuration

Test Case	Record Type
IMDS/SR/RACP/BV-07-C [Combined Report, Service Cycle Data]	0x00 (Service Cycle Data)
IMDS/SR/RACP/BV-08-C [Combined Report, Work Cycle Data]	0x01 (Work Cycle Data)

Table 4.17: Combined Report Op Code test cases

- Test Procedure

1. The Lower Tester performs the Generate Historical Records preamble described in Section 4.2.4 for the record type specified in Table 4.17 to generate at least five records.
2. For each <Operator> in Table 4.13, perform the following steps (outer loop):
   a. For each <Operand> in Table 4.13, perform the following steps (inner loop):
      i. The Lower Tester writes the Combined Report Op Code (0x7) to the RACP using the the record type specified in Table 4.17 and the listed <Operator>, <Operand>, and corresponding filter parameter(s).
      ii. IF the <Operator> is NOT supported, then the IUT sends an ATT_HANDLE_VALUE_IND of the RACP characteristic with the Response Code Op Code (0x06), an Operator of Null (0x00), and an Operand representing the Request Op Code of Combined Report (0x07) followed by the Response Code value for Operator not supported (0x04).
      iii. ELSE IF the <Operand> is NOT supported, then the IUT sends an ATT_HANDLE_VALUE_IND of the RACP characteristic with the Response Code Op Code (0x06), an Operator of Null (0x00), and an Operand representing the Request Op Code of Combined Report (0x07) followed by the Response Code value for Operand Not Supported (0x09).

iv. ELSE IF the <Operand> is Sequence Number and NO sequence numbers exist in the requested sequence number range OR IF the <Operand> is Timestamp and NO timestamp exists in the requested Timestamp range, then the IUT sends an ATT_HANDLE_VALUE_IND of the RACP characteristic with the Response Code Op Code (0x06), an Operator of Null (0x00), and an Operand representing the Request Op Code of Combined Report (0x07) followed by the Response Code value for No Records Found (0x06).

v. ELSE, the IUT sends ATT_Handle_Value_Notification(s) of the IMD Historical Data characteristic, representing the required records; number and characteristic values depend on the <Operator>, <Operand>, corresponding filter parameter(s) and the generated list of records.

a) The IUT sends an ATT_HANDLE_VALUE_IND of the RACP characteristic with the Combined Report Response (0x08), an Operator of Null (0x00), and an Operand equal to the number of records sent.

vi. The IUT receives an ATT_HANDLE_VALUE_CFM from the Lower Tester.

- Expected Outcome

  Pass verdict

  For each supported combination of <Operator> and <Operand>, the IUT sends:

  - The required number of notifications of the IMD Historical Data characteristic and an indication containing the RACP characteristic handle and value (Combination supported)

  OR

  - The appropriate error message (Combination not supported)

  The IUT reports records by order of first in, first out, with the oldest Sequence Number reported first.

  The oldest record is transmitted before newer records.

4.6.5 Combined Report Op Code – With no records

- Test Purpose

  Verify that the IUT responds properly if the Combined Report procedure is performed with an Operator of All records when the IUT does not contain any records of a particular type.

- Reference

  [3] 3.9.2.4

- Initial Condition

  - Perform the RACP preamble described in Section 4.2.3 to enable the IUT for use with the Record Access Control Point.

  - Perform an action on the IUT that will induce it to remove all the stored records for a record type (by having the Lower Tester perform a Delete Stored Records procedure) or the Lower Tester knows the last sequence number.

- Test Case Configuration

Test Case	Record Type
IMDS/SR/RACP/BV-09-C [Combined Report, No records, Service Cycle Data]	0x00 (Service Cycle Data)
IMDS/SR/RACP/BV-10-C [Combined Report, No records, Work Cycle Data]	0x01 (Work Cycle Data)

Table 4.18: Combined Report Op Code – With no records test cases

- Test Procedure

  1. The Lower Tester writes the Combined Report Op Code (0x7) to the RACP using a combination of record types as specified in Table 4.18 and supported Operator and Operand, which request records that do not exist.
  2. The IUT sends an ATT_HANDLE_VALUE_IND of the RACP characteristic with the Response Code Op Code (0x06), an Operator of Null (0x00), and an Operand representing the Request Op Code of Combined Report (0x07) followed by the Response Code value for No Records Found (0x06).
  3. The IUT receives an ATT_HANDLE_VALUE_CFM from the Lower Tester.
  4. Verify that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends an indication of the RACP characteristic with the Response Code Op Code (0x06), an Operator of Null (0x00), and an Operand representing the Request Op Code of Combined Report (0x07) followed by the Response Code value for No Records Found (0x06).

IMDS/SR/RACP/BV-11-C [Abort Operation Op Code]

- Test Purpose

  Verify that the IUT can perform an Abort Operation of the Combined Report procedure with a Null Operator and no Operand.

- Reference

  [3] 3.9.2.5

- Initial Condition

  - Perform the RACP preamble described in Section 4.2.3 to enable the IUT for use with the Record Access Control Point.

- Test Procedure

  1. Perform an action on the IUT that will induce it to generate enough records such that the transmission cannot complete before an abort procedure is attempted.
  2. The Lower Tester writes the Combined Report Op Code (0x07) to the RACP using an Operator of All records (0x01) and Record Type set to the TSPX_RECORD_TYPE IXIT entry.
  3. The IUT starts to send ATT_Handle_Value_Notification of the IMD Historical Data characteristic.
  4. The Lower Tester writes the Abort Operation Op Code (0x03) to the RACP with an Operator of Null (0x00) and no Operand.
  5. The IUT sends an ATT_HANDLE_VALUE_IND of the RACP characteristic with the Response Code Op Code (0x06), an Operator of Null (0x00), and an Operand representing the Request Op Code (0x03) followed by the Response Code for Success (0x01).
  6. The IUT receives an ATT_HANDLE_VALUE_CFM from the Lower Tester.
  7. Verify that the notifications stop.
  8. Verify that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends some, but not all, notifications of the IMD Historical Data characteristic.

The IUT sends one indication of the RACP characteristic with the Response Code Op Code containing a Response Code value in the Operand set to Success.

4.7 Record Access Control Point – Error handling

IMDS/SR/ERR/BI-01-C [RACP – CCCD not configured]

- Test Purpose

  Verify that the IUT responds appropriately when a client attempts to perform an IMD RACP procedure with a Client Characteristic Configuration descriptor that is not configured on the IMD Historical Data and RACP characteristics.

- Reference

  [3] 3.10

- Initial Condition

  - Perform the RACP preamble described in Section 4.2.3 to enable the IUT for use with the Record Access Control Point.

- Test Procedure

  1. The Lower Tester has the IMD Historical Data characteristic CCCD configured and the RACP CCCD not configured.
  2. The Lower Tester writes the Report Number of Stored Records Op Code (0x04) to the IMD RACP using an Operator of All records (0x01) and Record Type set to the TSPX_RECORD_TYPE IXIT entry.
  3. The Lower Tester receives an error response.
  4. Repeat Steps 1–3 by switching the CCCD in Step 1.

- Expected Outcome

  Pass verdict

  The IUT responds with an Attribute Protocol Application error code set to Client Characteristic Configuration Descriptor Improperly Configured (0xFD) in Step 3.

IMDS/SR/ERR/BI-02-C [RACP – Operand not supported]

- Test Purpose

  Verify that the IUT responds appropriately when a client writes an Op Code to the IMD RACP with an Operand Filter Type with a value from the RFU range.

- Reference

  [3] 3.10.2.4

- Initial Condition

  - Perform the RACP preamble described in Section 4.2.3 to enable the IUT for use with the Record Access Control Point.

- Test Procedure

  1. The Lower Tester writes the Report Number of Stored Records Op Code (0x04) to the IMD RACP using an Operator of Greater than or equal to (0x03) and an Operand Filter Type with a value from the RFU range followed by an appropriate filter parameters (minimum filter value).

2. The IUT sends an ATT_HANDLE_VALUE_IND of the IMD RACP characteristic with the Response Code Op Code (0x06), an Operator of Null (0x00), and an Operand representing the Report Number of Stored Records Op Code (0x04) followed by the Response Code value for Operand Not Supported (0x09).
3. The IUT receives an ATT_HANDLE_VALUE_CFM from the Lower Tester.
4. Verify that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends an ATT_HANDLE_VALUE_IND of the IMD RACP characteristic with the Response Code Op Code (0x06), an Operator of Null (0x00), and an Operand representing the Request Op Code (0x04) followed by the Response Code value for Operand Not Supported (0x09).

IMDS/SR/ERR/BI-03-C [RACP – Procedure Already in Progress]

- Test Purpose

  Verify that the IUT responds appropriately when a client attempts to perform an IMD RACP procedure before another IMD RACP procedure is completed.

- Reference

  [3] 3.10.2.4

- Initial Condition

  - Perform the RACP preamble described in Section 4.2.3 to enable the IUT for use with the Record Access Control Point.

- Test Procedure

  1. Perform an action on the IUT that will induce it to generate several (~100) records.
  2. The Lower Tester writes the Combined Report Op Code (0x07) to the IMD RACP using an Operator of All records (0x01) and Record Type set to the TSPX_RECORD_TYPE IXIT entry and an Operand Sequence Number (0x01).
  3. Before the procedure is completed, the Lower Tester performs the same procedure again by writing the Combined Report Op Code (0x07) to the IMD RACP using an Operator of All records (0x01) and Operand Sequence Number (0x01).
  4. The IUT sends an ATT error response with error code Procedure Already in Progress (0xFE).
  5. Verify that the IUT response meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT rejects the write request to start the second procedure and responds with an ATT error response with the error code set to Procedure Already in Progress (0xFE).

IMDS/SR/ERR/BI-04-C [RACP – Operator not supported]

- Test Purpose

  Verify that the IUT responds appropriately when a client writes an Op Code to the IMD RACP with an Operator with a value from the RFU range.

- Reference

  [3] 3.10.2.4

- Initial Condition
  - Perform the RACP preamble described in Section 4.2.3 to enable the IUT for use with the Record Access Control Point.
- Test Procedure
  1. The Lower Tester writes the Report Number of Stored Records Op Code (0x04) to the IMD RACP using an Operator with a value from the RFU range and an Operand Sequence Number (0x01).
  2. The IUT sends an ATT_HANDLE_VALUE_IND of the IMD RACP characteristic with the Response Code Op Code (0x06), an Operator of Null (0x00), and an Operand representing the Request Op Code (0x04) followed by the Response Code value for Operator Not Supported (0x04).
  3. The IUT receives an ATT_HANDLE_VALUE_CFM from the Lower Tester.
  4. Verify that the characteristic value meets the requirements of the service.
- Expected Outcome

  Pass verdict

  The IUT sends an ATT_HANDLE_VALUE_IND of the IMD RACP characteristic with the Response Code Op Code (0x06), an Operator of Null (0x00), and an Operand representing the Request Op Code (0x04) followed by the Response Code value for Operator Not Supported (0x04).

IMDS/SR/ERR/BI-05-C [RACP – Invalid Operator]

- Test Purpose

  Verify that the IUT responds appropriately when a client writes an Op Code to the IMD RACP with an invalid Operator.
- Reference

  [3] 3.10.2.4
- Initial Condition
  - Perform the RACP preamble described in Section 4.2.3 to enable the IUT for use with the Record Access Control Point.
- Test Procedure
  1. The Lower Tester writes the Abort Op Code (0x03) to the IMD RACP using an Operator other than Null (0x00).
  2. The IUT sends an ATT_HANDLE_VALUE_IND of the IMD RACP characteristic with the Response Code Op Code (0x06), an Operator of Null (0x00), and an Operand representing the Request Op Code (0x03) followed by the Response Code value for Invalid Operator (0x03).
  3. The IUT receives an ATT_HANDLE_VALUE_CFM from the Lower Tester.
  4. Verify that the characteristic value meets the requirements of the service.
- Expected Outcome

  Pass verdict

  The IUT sends an indication of the IMD RACP characteristic with the Response Code Op Code (0x06), an Operator of Null (0x00), and an Operand representing the Request Op Code (0x03) followed by the Response Code value for Invalid Operator (0x03).

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 Industrial Measurement Device Service [4].

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)
IMDS 2/1 OR IMDS 2/2	Industrial Measurement Device Service	IMDS/SR/SGGIT/SER/BV-01-C
IMDS 2/1	Service Supported over BR/EDR	IMDS/SR/SGGIT/SDP/BV-01-C
IMD Measurement		
IMDS 4/1	IMD Measurement	IMDS/SR/DEC/BV-01-C IMDS/SR/CR/BV-01-C
IMDS 4/2	IMD Measurement, Writable	IMDS/SR/DES/BV-08-C
IMDS 13/1	IMD Measurement, Measurement Description	IMDS/SR/DES/BV-01-C
IMDS 13/2	IMD Measurement, Measurement Description, Autonomous	IMDS/SR/CI/BV-01-C
IMDS 13/3	IMD Measurement, Characteristic User Description descriptor	IMDS/SR/DES/BV-02-C
IMDS 13/4	IMD Measurement – Characteristic User Description – Writable	IMDS/SR/UD/BV-01-C IMDS/SR/CIW/BV-01-C
IMDS 13/5	IMD Measurement – Characteristic User Description – Autonomous	IMDS/SR/CI/BV-02-C
IMDS 13/6	IMD Measurement – Manufacturer Limits descriptor	IMDS/SR/DES/BV-03-C
IMDS 13/7	IMD Measurement – Manufacturer Limits – Autonomous Changes	IMDS/SR/CI/BV-03-C
IMDS 13/8	IMD Measurement– Process Tolerances descriptor	IMDS/SR/DES/BV-04-C
IMDS 13/9	IMD Measurement – Process Tolerances – Writable	IMDS/SR/PT/BV-01-C IMDS/SR/CIW/BV-02-C
IMDS 13/10	IMD Measurement – Process Tolerances – Autonomous Changes	IMDS/SR/CI/BV-04-C
IMDS 13/11	IMD Measurement – Trigger Setting descriptor	IMDS/SR/DES/BV-05-C

Item	Feature	Test Case(s)
IMDS 3/2 AND NOT IMDS 13/11	IMD Measurement – Custom Trigger	IMDS/SR/CT/BV-01-C
IMDS 13/12	IMD Measurement – Trigger Settings – Writable	IMDS/SR/TD/BV-01-C IMDS/SR/TT/BV-01-C IMDS/SR/CIW/BV-03-C
IMDS 13/12 AND IMDS 4/3	IMD Measurement – Trigger Settings – IMD Status Support	IMDS/SR/TD/BV-02-C IMDS/SR/TT/BV-02-C
IMDS 13/13	IMD Measurement – Trigger Settings – Autonomous Changes	IMDS/SR/CI/BV-05-C
IMDS 13/14	IMD Measurement – Valid Range descriptor	IMDS/SR/DES/BV-06-C
IMDS 13/15	IMD Measurement – Valid Range – Autonomous Changes	IMDS/SR/CI/BV-06-C
IMDS 13/16	IMD Measurement – Extended Properties descriptor	IMDS/SR/DES/BV-07-C
Other Stuff		
IMDS 4/3	IMD Status	IMDS/SR/SGGIT/CHA/BV-01-C
IMDS 4/3 AND IMDS 13/6	IMD Status Notifications, Manufacturer Limits	IMDS/SR/CN/BV-01-C
IMDS 4/3 AND IMDS 13/8	IMD Status Notifications, Process Tolerances	IMDS/SR/CN/BV-02-C
IMDS 4/4	Descriptor Value Changed characteristic	IMDS/SR/SGGIT/CHA/BV-02-C
IMDS 4/9 OR IMDS 4/12 AND NOT IMDS 4/10	Work Cycle Start	IMDS/SR/CR/BV-02-C
(IMDS 4/9 OR IMDS 4/12) AND IMDS 4/10	Work Cycle Start/Stop, Writable	IMDS/SR/CW/BV-04-C
IMDS 4/9 OR IMDS 4/12 AND IMDS 4/11	Work Cycle Start/Stop, Notifications	IMDS/SR/CR/BV-03-C
(IMDS 4/9 OR IMDS 4/12) AND IMDS 4/10 AND IMDS 4/11	Work Cycle Start/Stop, Writable, Notifications	IMDS/SR/CW/BV-05-C
IMDS 4/5 AND NOT IMDS 4/6	First Use Date characteristic	IMDS/SR/SGGIT/CHA/BV-03-C
IMDS 4/5 AND IMDS 4/6	First Use Date characteristic, Writable	IMDS/SR/SGGIT/CHA/BV-04-C IMDS/SR/CW/BV-01-C
IMDS 4/7 AND NOT IMDS 4/8	Life Cycle Data characteristic	IMDS/SR/SGGIT/CHA/BV-05-C
IMDS 4/7 AND IMDS 4/8	Life Cycle Data characteristic, Writable	IMDS/SR/SGGIT/CHA/BV-06-C IMDS/SR/CW/BV-02-C
IMDS 4/9 AND NOT (IMDS 4/10 AND IMDS 4/11)	Work Cycle Data characteristic	IMDS/SR/SGGIT/CHA/BV-07-C

Item	Feature	Test Case(s)
IMDS 4/9 AND IMDS 4/10 AND NOT IMDS 4/11	Work Cycle Data characteristic, Writable	IMDS/SR/SGGIT/CHA/BV-08-C
IMDS 4/9 AND NOT IMDS 4/10 AND IMDS 4/11	Work Cycle Data characteristic, Notifiable	IMDS/SR/SGGIT/CHA/BV-09-C
IMDS 4/9 AND IMDS 4/10 AND IMDS 4/11	Work Cycle Data characteristic, Writable, Notifiable	IMDS/SR/SGGIT/CHA/BV-10-C
IMDS 4/12	Service Cycle Data characteristic	IMDS/SR/SGGIT/CHA/BV-11-C IMDS/SR/CW/BV-03-C
IMDS 4/13	IMD Control characteristic	IMDS/SR/SGGIT/CHA/BV-12-C IMDS/SR/DC/BV-01-C IMDS/SR/DC/BV-02-C IMDS/SR/DC/BI-01-C IMDS/SR/DC/BI-02-C
IMDS 4/14	IMD Historical Data characteristic	IMDS/SR/SGGIT/CHA/BV-13-C
IMDS 4/15	Record Access Control Point characteristic	IMDS/SR/SGGIT/CHA/BV-14-C IMDS/SR/RACP/BV-03-C IMDS/SR/RACP/BV-04-C IMDS/SR/RACP/BV-05-C IMDS/SR/RACP/BV-06-C IMDS/SR/RACP/BV-07-C IMDS/SR/RACP/BV-08-C IMDS/SR/RACP/BV-09-C IMDS/SR/RACP/BV-10-C IMDS/SR/RACP/BV-11-C IMDS/SR/ERR/BI-01-C IMDS/SR/ERR/BI-02-C IMDS/SR/ERR/BI-03-C IMDS/SR/ERR/BI-04-C IMDS/SR/ERR/BI-05-C
IMDS 4/15 AND IMDS 15/1	RACP – Delete Stored Records	IMDS/SR/RACP/BV-01-C IMDS/SR/RACP/BV-02-C

Table 5.1: Test case mapping

6 Revision history and acknowledgments

Revision History

Publication Number	Revision Number	Date	Comments
0	p0	2024-10-22	Approved by BTI on 2024-09-30. IMDS v1.0 adopted by the BoD on 2024-10-15. Prepared for initial publication.

Acknowledgments

Name	Company
Charlie Lenahan	Bluetooth SIG, Inc.