Health Thermometer Profile (HTP)

***Bluetooth*® Test Suite**

- **Revision:** HTP.TS.p5
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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 Health Thermometer Profile Specification with the objective to provide a high probability of air interface interoperability between the tested implementation and other manufacturers' Bluetooth devices.

2 References, definitions, and abbreviations

2.1 References

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

[1] Test Strategy and Terminology Overview

[2] Bluetooth Core Specification, Version 4.0 or later

[3] Health Thermometer Profile Specification, Version 1.0

[4] ICS Proforma for Health Thermometer Profile

[5] GAP Test Suite, GAP.TS

[6] SM Test Suite, SM.TS

[7] GATT Test Suite, GATT.TS

[8] Health Thermometer Service, Version 1.0

[9] Device Information Service, Version 1.1

[10] Health Thermometer Service Test Suite, HTS.TS

2.2 Definitions

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

2.3 Abbreviations

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

3 Test Suite Structure (TSS)

3.1 Overview

The Health Thermometer Profile requires the presence of GAP, SM, and GATT. This is illustrated in Figure 3.1.

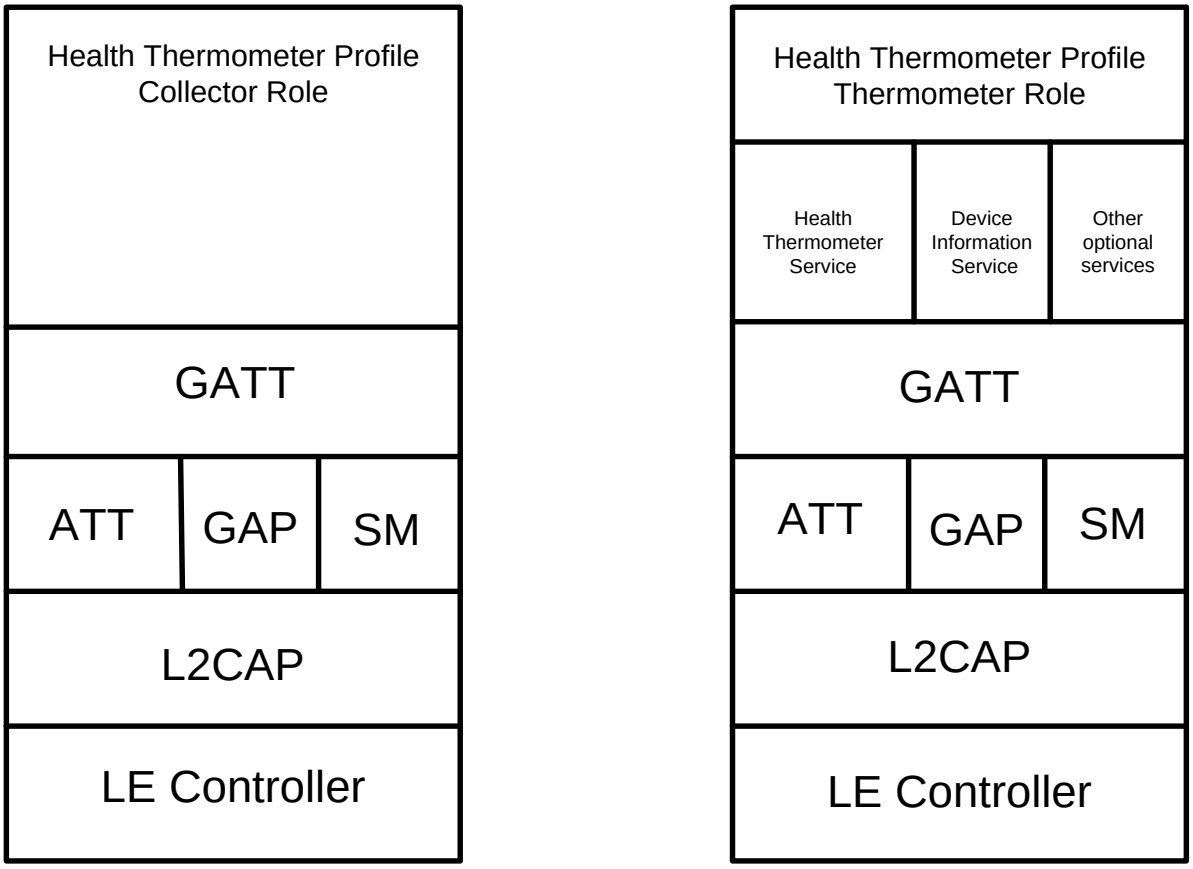

Figure 3.1: Health Thermometer Test Model

3.2 Test Strategy

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

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

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.

3.2.1 Test database requirements

The following requirements apply to the set of databases used by the Lower Tester for testing of GATT Client functionality:

- The Lower Tester includes one instantiation of each of the services used by this profile including all defined characteristics.
- Each service instantiation also contains two «future» characteristics.
  - If possible, with one inserted before the first characteristic defined
  - If possible, with one appended after the last characteristic defined
- Each «future» characteristic has a 16-bit UUID randomly selected from unassigned UUIDs at the time of the test.

3.3 Test groups

The following test groups have been defined:

- Generic GATT Integrated Tests
- Discovery of Services and Characteristics
- Features

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 [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>**
HTP	Health Thermometer Profile
Identifier Abbreviation	**Role Identifier <IUT role>**
COL	Collector Role
SEN	Sensor (Thermometer) Role
Identifier Abbreviation	**Reference Identifier <GGIT test group>**
CGGIT	Client Generic GATT Integrated Tests
SGGIT	Server Generic GATT Integrated Tests
Identifier Abbreviation	**Reference Identifier <GGIT class>**
CHA	Characteristic
DES	Descriptor
SDPNF	SDP Record Not Found
SER	Service
Identifier Abbreviation	**Feature Identifier <feat>**
SPC	Service Procedure – Start Sensor Calibration
SPE	Service Procedure – Error Handling
SPS	Service Procedure – Set Cumulative Value
SPU	Service Procedure – Update Sensor Location
THF	Features
THS	Discovery of Characteristics

Table 4.1: HTP 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, 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.

initial conditions.

4.2.1 Set up LE Transport

Use GATT.TS [7] Preamble [Set up ATT Bearer over LE].

4.2.2 Set up BR/EDR Transport

This procedure is used for negative tests only (see Section 4.3.12).

Use GATT.TS [7] Preamble [Set up ATT Bearer over BR/EDR].

4.2.3 Thermometer: initiate Undirected Connectable mode before Indication

This is a setup procedure for the Thermometer to enter the Undirected Connectable mode and accept connection from a Collector.

- Reference

  [3] 5.1.3

  [2] GAP 9.3.3, 9.3.4

- Initial Condition
  - A preamble procedure defined in Section 4.2.1 is used to set up the LE transport and L2CAP channel. The Thermometer and the Lower Tester (Collector) may have bonded following GAP procedures.
  - The Thermometer is disconnected.
  - ALT A: The Thermometer has been configured to accept commands from the Upper Tester to generate temperature measurements.
  - ALT B: The Thermometer has been configured by the Lower Tester (as Collector) to generate temperature measurements, see HTP/COL/THF/BV-01-C [Temperature Measurement Configuration]. The Thermometer is configured to generate a measurement indication within a time predictable by the Lower Tester.
- Preamble Procedure
  1. The Lower Tester waits for the IUT to send ADV_IND packets (GAP Undirected Connectable Mode).
  2. After receipt of either advertising packet, the Lower Tester sends CONNECT REQ and an empty packet to the Thermometer IUT.
  3. The Thermometer IUT generates ADV_IND packets.

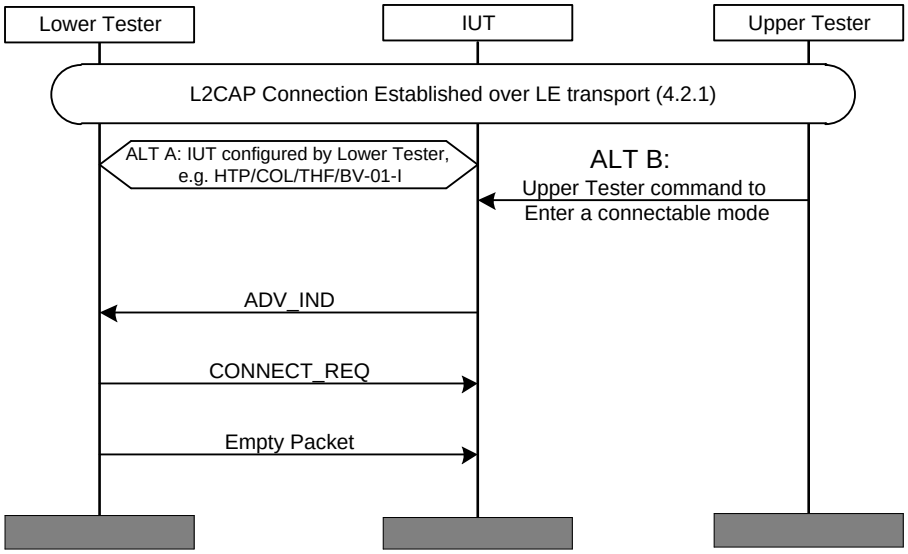

Figure 4.1: Setup preamble: Thermometer: initiate Undirected Connectable mode before Indication

4.2.4 Collector: Initiate Connection when ready for Indications or Notifications

This is a setup procedure for the Collector to initiate connection to a Thermometer.

- Reference

  [3] 5.2.2

  [2] GAP 9.3.3, 9.3.4

- Initial Condition
  - A preamble procedure defined in Section 4.2.1 is used to set up the LE transport and L2CAP channel. The Collector and the Lower Tester (Thermometer) may have bonded following GAP procedures.
  - The Collector is disconnected.
  - The Collector has been configured to accept commands from the Upper Tester to request and receive temperature measurements.
- Preamble Procedure

1. The Upper Tester commands the Collector IUT to initiate a connection.
2. The Lower Tester sends ADV_IND packets (GAP Undirected Connectable Mode) to the Collector IUT:
3. The Lower Tester waits for responses from the Collector IUT.
4. The Collector IUT sends a CONNECT_REQ and an empty packet to the Lower Tester.

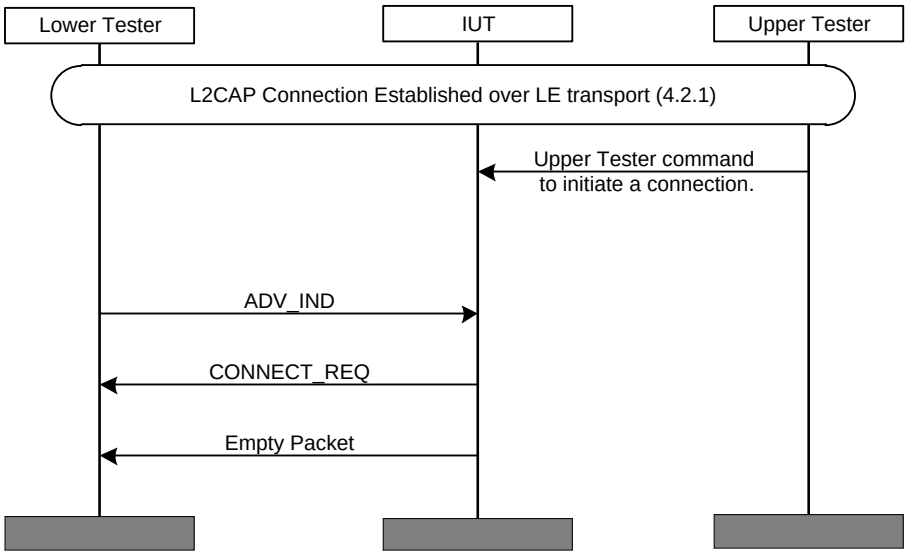

Figure 4.2: Setup preamble: Collector: Initiate Connection when ready for Indications or Notifications

4.3 Generic GATT Integrated Tests

Execute the Generic GATT Integrated Tests defined in Section 6.3, Server test procedures (SGGIT), and Section 6.4, Client test procedures (CGGIT), in [7] using Table 4.2 below as input:

TCID	Service / Characteristic / Descriptor	Reference	Properties	Value Length (Octets)	Service Type
HTP/COL/CGGIT/SER/BV-01-C [Service GGIT – Health Thermometer]	Health Thermometer Service	[3] 4.2.1	-	-	Primary Service
HTP/COL/CGGIT/SER/BV-02-C [Service GGIT – Device Information]	Device Information Service	[3] 4.2.2	-	-	Primary Service
HTP/COL/CGGIT/CHA/BV-01-C [Characteristic GGIT – Temperature Measurement]	Temperature Measurement Characteristic	[3] 4.3.1.1	0x20 (Indicate)	Skip	-
HTP/COL/CGGIT/CHA/BV-02-C [Characteristic GGIT – Temperature Type]	Temperature Type Characteristic	[3] 4.3.1.2	0x02 (Read)	1	-
HTP/COL/CGGIT/CHA/BV-03-C [Characteristic GGIT – Immediate Temperature]	Immediate Temperature Characteristic	[3] 4.3.1.3	0x10 (Notify)	Skip	-
HTP/COL/CGGIT/CHA/BV-04-C [Characteristic GGIT – Measurement Interval]	Measurement Interval Characteristic	[3] 4.3.1.4	0x2A (Read, Indicate, Write)	2	-
HTP/COL/CGGIT/DES/BV-01-C [Descriptor GGIT – Valid Range]	Valid Range Descriptor	[3] 4.3.1.4	0x02 (Read)	4	-
HTP/SEN/SGGIT/SDPNF/BV-01-C [Not discoverable over BR/EDR – Health Thermometer]	Health Thermometer Service	[3] 2.5	-	-	-

Table 4.2: Input for the GGIT Server and Client test procedures

4.4 Discover Characteristics

The procedures defined in this test group verify Thermometer IUT discovery of the characteristics defined in the Device Information Service [9] by a Thermometer IUT, by a Collector IUT.

HTP/COL/THS/BV-13-C [Discover Device Information Service Characteristics]

- Test Purpose

  Verify that the Collector IUT can discover all characteristics of a Device Information Service supported by the IUT.

- Reference

  [3] 4.3.2

- Initial Condition

  - Via IXIT the IUT manufacturer specifies all characteristics of the Device Information Service supported by the IUT.
  - Establish an ATT Bearer connection between the Lower Tester and IUT and run the setup procedure for the Collector to initiate connection to a Thermometer using preamble 0.
  - For alternative 1A below, the IUT has executed the procedure included in HTP/COL/CGGIT/SER/BV-02-C [Service GGIT – Device Information] and has saved the handle range for the instantiation of the Device Information Service contained in the Lower Tester.

- Test Procedure

  The Upper Tester issues a command to the IUT to discover all characteristics of the Device Information Service supported by the IUT. There are two alternatives:

  Alternative 1A (the IUT executes the Discover All Characteristics of a Service sub-procedure):

  1A. Using the handle range returned after executing the procedure in test HTP/COL/CGGIT/SER/BV-02-C [Service GGIT – Device Information], the IUT executes the Discover All Characteristic of a Service sub-procedure.

  Alternative 1B (the IUT executes the Discover All Characteristics by UUID sub-procedure):

  1B The IUT executes the Discover All Characteristics by UUID sub-procedure using each of the UUID for the characteristics of the Device Information Service supported by the IUT.

- Expected Outcome

  Pass verdict

  For each characteristic supported by the IUT contained in the Lower Tester's instantiation of the Device Information Service, the IUT reports attribute handle/UUID pair(s) for all characteristics specified in the IXIT to the Upper Tester.

HTP/COL/THS/BV-14-C [Read Device Information Service Characteristics]

- Test Purpose

  Verify that the Collector IUT can read all characteristics of a Device Information Service supported by the IUT.

- Reference

  [3] 4.3.2

- Initial Condition
  - Via IXIT the IUT manufacturer specifies all characteristics of the Device Information Service supported by the IUT.
  - Establish an ATT Bearer connection between the Lower Tester and IUT and run the setup procedure for the Collector to initiate connection to a Thermometer using preamble 0.
  - The Lower Tester includes one instantiation of the Device Information Service [9] including all defined characteristics.
  - The IUT has previously executed the procedure included in HTP/COL/THS/BV-13-C [Discover Device Information Service Characteristics], so it has the handle/value pairs for all characteristics of the Device Information Services supported by the IUT.

- Test Procedure

  The Upper Tester issues a command to the IUT to read all characteristics of the Device Information Service supported by the IUT.

  For each characteristic of the Device Information Service supported by the IUT, the IUT executes the GATT Read Characteristic Value sub-procedure.

- Expected Outcome

  Pass verdict

  For each characteristic contained in the Lower Tester's instantiation of the Device Information Service supported by the IUT, the IUT reports the attribute UUID and the characteristic value for all characteristics specified in the IXIT to the Upper Tester.

4.5 Health Thermometer Features

The procedures defined in this test group verify Thermometer IUT implementation of the Features defined in the Health Thermometer Profile Specification [3] by a Thermometer IUT, and usage of the same features by a Collector IUT.

HTP/SEN/THF/BV-01-C [Health Thermometer Service UUID in AD]

- Test Purpose

  Verify that the Health Thermometer Service UUID is included in AD (Advertising Data) from the Thermometer IUT when in GAP Discoverable Mode.

- Reference

  [3] 3.1.1

- Initial Condition
  - The IUT is powered on in GAP Discoverable Mode.
  - The IUT is induced to generate Advertising Packets using preamble 4.2.3.

- Test Procedure

  The Lower Tester listens for Advertising Packets from the IUT.

- Expected Outcome

  Pass verdict

  At least one received Advertising Packet contains the defined Service UUID for «Health Thermometer Service».

HTP/SEN/THF/BV-02-C [Local Name included in AD or Scan Response]

- Test Purpose

  Verify that the Local Name is included in AD (Advertising Data) or Scan Response data from the Thermometer IUT.

- Reference

  [3] 3.1.2

- Initial Condition

  - The IUT is powered on.
  - The IUT is induced to generate Advertising Packets using preamble 4.2.3.

- Test Procedure

  The Lower Tester listens for Advertising Packets from the IUT. When the Lower Tester receives an Advertising Packet from IUT, it sends a Scan Request to the IUT. Then the Lower Tester listens for a Scan Response from the IUT.

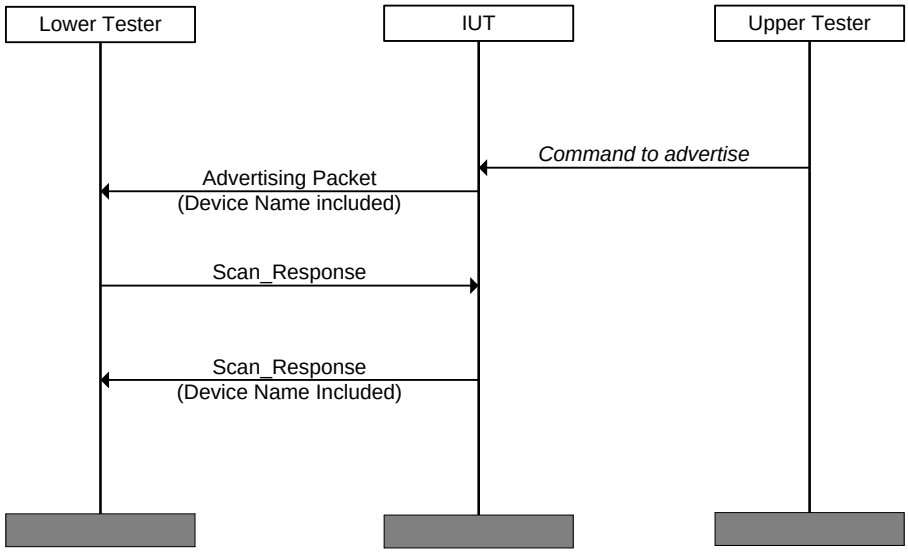

Figure 4.3: HTP/SEN/THF/BV-02-C [Local Name included in AD or Scan Response]

- Expected Outcome

  Pass verdict

  The IUT sends an Advertising packet and a Scan Response packet.

  The IUT includes the Local Name in either the Advertising packet or Scan Response packet.

HTP/COL/THF/BV-01-C [Temperature Measurement Configuration]

- Test Purpose

  Verify that the Collector IUT can configure a Thermometer (Lower Tester) to Indicate Temperature measurements.

- Reference

  [3] 4.4

- Initial Condition

  - A preamble procedure defined in Section 4.2.4 is used to set up the LE transport and L2CAP channel and initiate connection to a Thermometer.
  - The IUT has executed the procedure included in HTP/COL/CGGIT/CHA/BV-01-C [Characteristic GGIT – Temperature Measurement], which returns the handle of a Client Configuration Descriptor for a Temperature Measurement characteristic contained in the Lower Tester.

- Test Procedure

  The Upper Tester sends a command to the IUT to configure to receive temperature measurements.

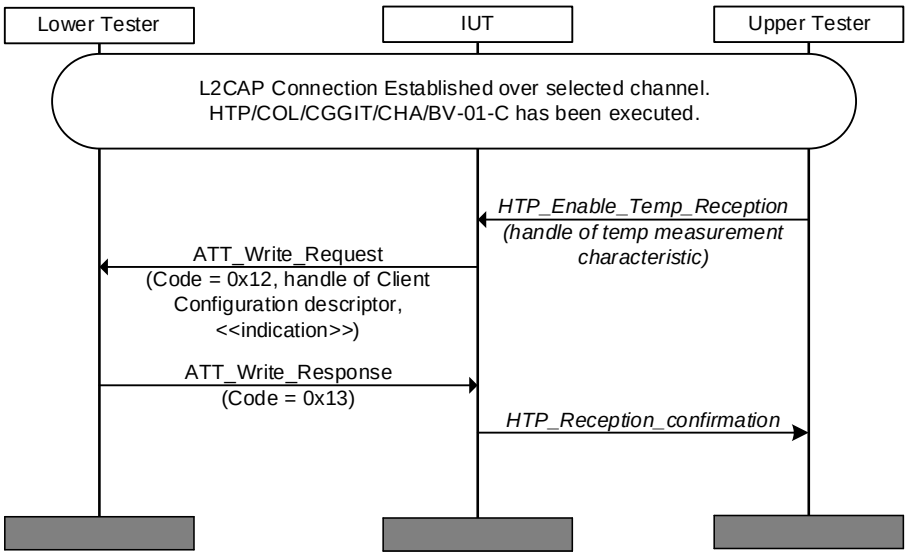

Figure 4.4: HTP/COL/THF/BV-01-C [Temperature Measurement Configuration]

- Expected Outcome

  Pass verdict

  IUT sends a correctly formatted ATT_Write_Request (0x12) to the Lower Tester, with the handle set to that of the Client Configuration Descriptor for a Temperature Measurement characteristic, and the value set to «indication».

HTP/COL/THF/BV-02-C [Temperature Measurement Configuration]

- Test Purpose

  Verify that the Collector IUT can receive indication of the Temperature Measurement Characteristic value from a Thermometer for various field configurations.

- Reference

  [3] 4.4

- Initial Condition

  - A preamble procedure defined in Section 4.2.4 is used to set up the LE transport and L2CAP channel and initiate connection to a Thermometer.
  - The IUT is configured to expect Temperature Measurement Indication, after executing the procedure included in HTP/COL/THF/BV-01-C [Temperature Measurement Configuration].
  - The IUT knows the handle of the Temperature Measurement characteristic.

- Test Procedure

  The Lower Tester sends an ATT_Handle_Value_Indication containing a Temperature Measurement characteristic value to the IUT.

  This test is run for each value of each bit shown in the following table:

Flag Field	Value	Pass Criteria (Reported in Temperature Measurement characteristic)
bit 0	0	Temperature is In units of Celsius
	1	Temperature is in units of Fahrenheit
bit 1	0	Time Stamp field is not present
	1	Time Stamp field is present
bit 2	0	Temperature Type field not present
	1	Temperature Type field present

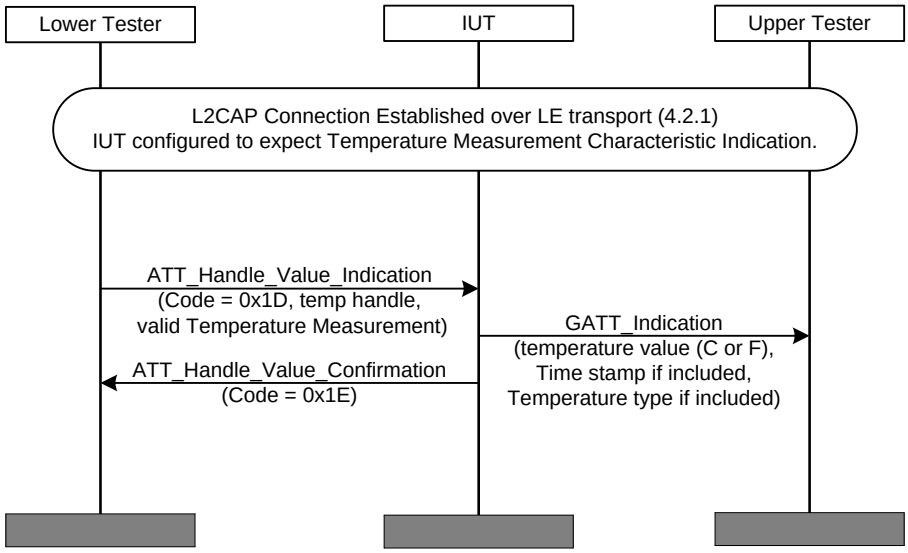

Figure 4.5: HTP/COL/THF/BV-02-C [Temperature Measurement Configuration]

- Expected Outcome

  Pass verdict

  IUT sends a correctly formatted ATT_Handle_Value_Confirmation (0x1E) to the Lower Tester.

IUT reports the received Temperature measurement values in expected combinations to the Upper Tester using the pass criteria in the table above. The reported temperature value matches the one sent by the Lower Tester.

HTP/COL/THF/BI-01-C [Receive Temperature Measurement Indications with reserved flags]

- Test Purpose

  Verify that the Collector IUT can receive indication of the Temperature Measurement Characteristic value from a Thermometer in the presence of reserved flags.

- Reference

  [3] 4.4

- Initial Condition

  - A preamble procedure defined in Section 4.2.4 is used to set up the transport and L2CAP channel and initiate connection to a Thermometer.
  - The IUT is configured to expect Temperature Measurement Indication, after executing the procedure included in HTP/COL/THF/BV-01-C [Temperature Measurement Configuration].
  - The IUT knows the handle of the Temperature Measurement characteristic.

- Test Procedure

  The Lower Tester sends an ATT_Handle_Value_Indication containing a Temperature Measurement characteristic value to the IUT. There are many combinations of reserved flag settings. For this test use Flags = 0xFF (all 1s). Also include valid uses of the other flags: temperature in Fahrenheit, time stamp and Temperature Type. Any valid values for time stamp and for temperature type may be sent by the Lower Tester.

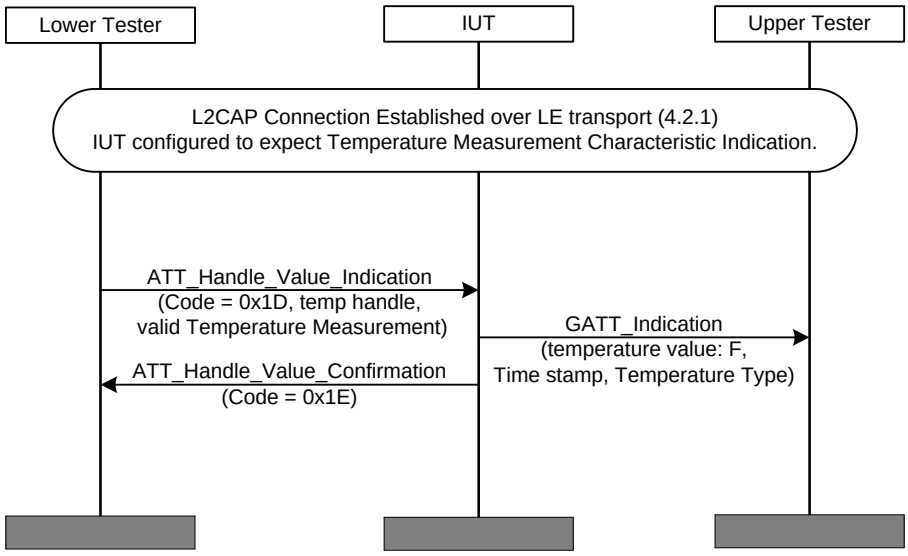

Figure 4.6: HTP/COL/THF/BV-02-C [Temperature Measurement Configuration]

- Expected Outcome

  Pass verdict

  IUT sends a correctly formatted ATT_Handle_Value_Confirmation (0x1E) to the Lower Tester.

IUT reports the received Temperature measurement to the Upper Tester, e.g., GATT_Indication(Fahrenheit temperature value, time stamp, Temperature Type).

The reported temperature value matches the one sent by the Lower Tester.

HTP/COL/THF/BI-02-C [Receive Temperature Measurement Indications with reserved temperature type]

- Test Purpose

  Verify that the Collector IUT can receive indication of the Temperature Measurement Characteristic value from a Thermometer including a reserved temperature type.

- Reference

  [3] 4.4

- Initial Condition

  - A preamble procedure defined in Section 4.2.4 is used to set up the transport and L2CAP channel and initiate connection to a Thermometer.
  - The IUT is configured to expect Temperature Measurement Indication, after executing the procedure included in HTP/COL/THF/BV-01-C [Temperature Measurement Configuration].
  - The IUT knows the handle of the Temperature Measurement characteristic.

- Test Procedure

  The Lower Tester sends an ATT_Handle_Value_Indication containing a Temperature Measurement characteristic value to the IUT. That value contains: flags = 0x06, valid Celsius temperature, valid time stamp, reserved temperature type (e.g., 0xFF).

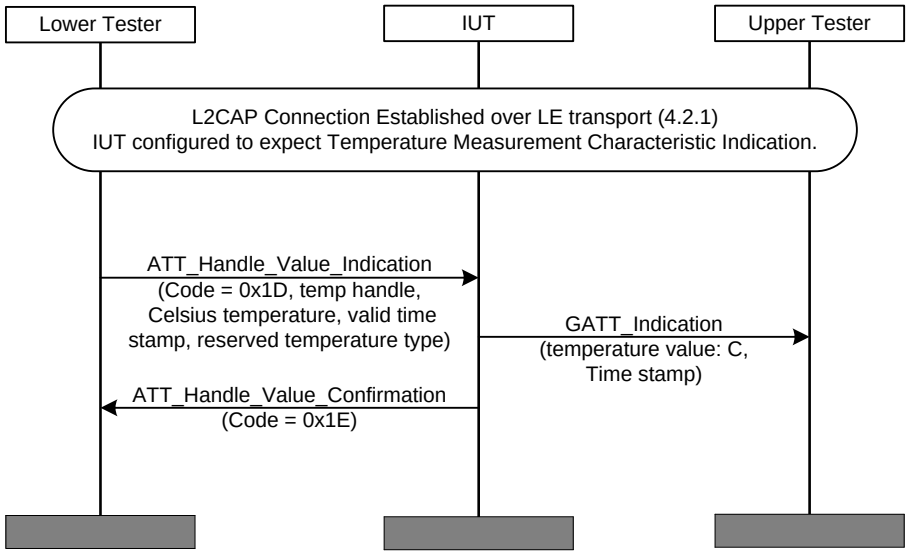

Figure 4.7: HTP/COL/THF/BV-02-C [Temperature Measurement Configuration]

- Expected Outcome

  Pass verdict

  IUT sends a correctly formatted ATT_Handle_Value_Confirmation (0x1E) to the Lower Tester.

IUT reports the received Temperature measurement to the Upper Tester, e.g., GATT_Indication(Celsius temperature value, time stamp, <no temperature type>).

The reported temperature value matches the one sent by the Lower Tester.

HTP/COL/THF/BI-03-C [Receive Temperature Measurement Indications with additional octets not represented in the flags field]

- Test Purpose

  Verify that the Collector IUT can receive indication of the Temperature Measurement Characteristic value from a Thermometer including additional octets not represented in the flags field.

- Reference

  [3] 4.4

- Initial Condition

  - A preamble procedure defined in Section 4.2.4 is used to set up the transport and L2CAP channel and initiate connection to a Thermometer.
  - The IUT is configured to expect Temperature Measurement Indication, after executing the procedure included in HTP/COL/THF/BV-01-C [Temperature Measurement Configuration].
  - The IUT knows the handle of the Temperature Measurement characteristic.

- Test Procedure

  The Lower Tester sends an ATT_Handle_Value_Indication containing a Temperature Measurement characteristic value to the IUT. That value contains: flags = 0x06, valid Celsius temperature, valid time stamp, valid temperature type, and at least two additional octets not represented in the flags field. The total number of octets does not exceed the maximum MTU size.

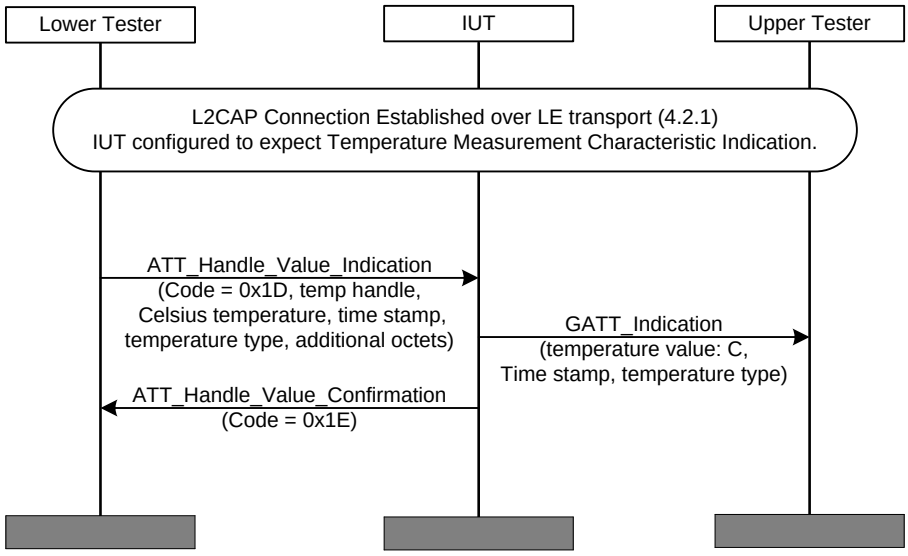

Figure 4.8: HTP/COL/THF/BI-03-C [Receive Temperature Measurement Indications with additional octets not represented in the flags field]

- Expected Outcome

  Pass verdict

  IUT sends a correctly formatted ATT_Handle_Value_Confirmation (0x1E) to the Lower Tester.

IUT reports the received Temperature measurement to the Upper Tester, e.g., GATT_Indication(Celsius temperature value, time stamp, temperature type, <no additional octets>).

The reported temperature value matches the one sent by the Lower Tester.

HTP/COL/THF/BV-03-C [Receive multiple Temperature Measurement Indications]

- Test Purpose

  Verify that the Collector IUT can receive a series of Temperature Measurement indications.

- Reference

  [3] 4.4

- Initial Condition

  - A preamble procedure defined in Section 4.2.4 is used to set up the transport and L2CAP channel and initiate connection to a Thermometer.
  - The IUT is configured to expect Temperature Measurement Indication, after executing the procedure included in HTP/COL/THF/BV-01-C [Temperature Measurement Configuration].
  - The IUT knows the handle of the Temperature Measurement characteristic.
  - The IUT manufacturer has reported the maximum number of temperature measurements that the IUT can receive and store via IXIT.

- Test Procedure

  The Lower Tester sends multiple ATT_Handle_Value_Indications to the IUT; each contains a Temperature Measurement characteristic value in Celsius with a time stamp and a Temperature Type. The number of Temperature measurements sent does not exceed the value supported by the IUT reported in the IXIT.

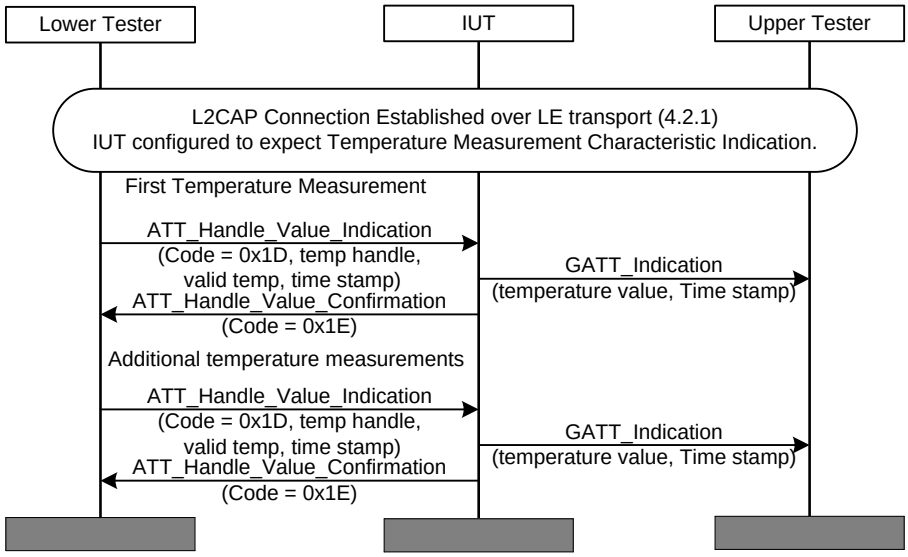

Figure 4.9: HTP/COL/THF/BV-03-C [Receive multiple Temperature Measurement Indications]

- Expected Outcome

  Pass verdict

  For each ATT_Handle_Value_Indication sent to the IUT:

  - The IUT sends a correctly formatted ATT_Handle_Value_Confirmation (0x1E) to the Lower Tester.
  - The IUT reports all of the received Celsius Temperature values to the Upper Tester, e.g., GATT_Indication (temperature value, time stamp, Temperature Type) as specified in the flags field. The reported temperature measurements match those sent by the Lower Tester.

HTP/COL/THF/BV-04-C [Configure Intermediate Temperature for Notification]

- Test Purpose

  Verify that the Collector IUT can configure a Thermometer (Lower Tester) to Notify Intermediate Temperature characteristics.

- Reference

  [3] 4.5

- Initial Condition

  - A preamble procedure defined in Section 4.2.4 is used to set up the transport and L2CAP channel and initiate connection to a Thermometer.
  - The IUT has executed the procedure included in HTP/COL/CGGIT/CHA/BV-03-C [Characteristic GGIT – Immediate Temperature], which returns the handle of a Client Configuration Descriptor for an Intermediate Temperature characteristic contained in the Lower Tester.

- Test Procedure

  The Upper Tester issues a command to the IUT to configure to receive intermediate temperature characteristics. There are two alternatives:

  Alternative 1A (configure to receive intermediate temperature characteristics):

  1A. The Upper Tester sends a command to the IUT to configure to receive intermediate temperature characteristics.

  Alternative 1B (configure to receive both intermediate temperature characteristics AND temperature measurement characteristics):

  1B. The Upper Tester sends a command to the IUT to configure to receive both intermediate temperature characteristics AND temperature measurement characteristics.

  Note: if the IUT had already executed the procedure included in HTP/COL/THF/BV-01-C [Temperature Measurement Configuration] to enable indications, it may then enable both Temperature Measurement indications AND Intermediate Temperature notifications.

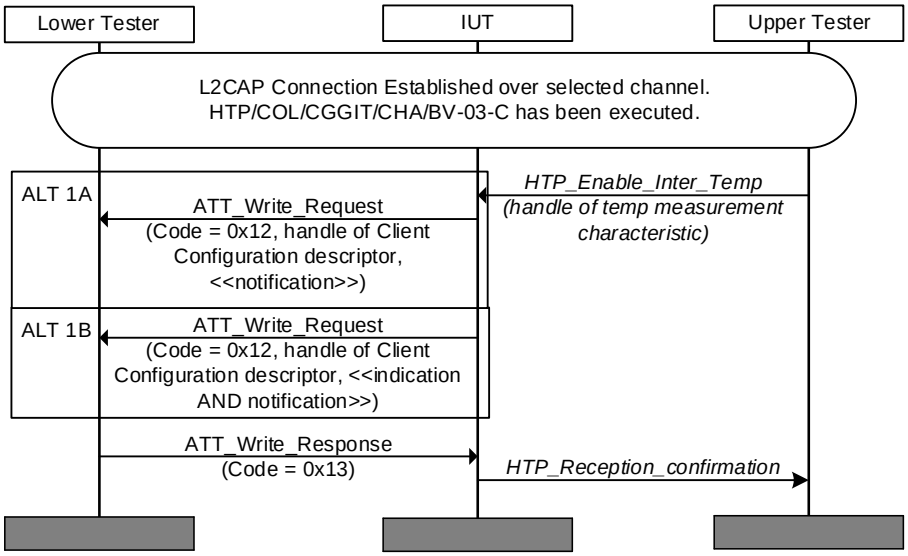

Figure 4.10: HTP/COL/THF/BV-04-C [Configure Intermediate Temperature for Notification]

- Expected Outcome

  Pass verdict

  IUT sends a correctly formatted ATT_Write_Request (0x12) to the Lower Tester, with the handle set to that of the Client Configuration Descriptor for an Intermediate Temperature characteristic, and the value set to «notification» for Alternative 1A or «indication AND notification» for Alternative 1B.

HTP/COL/THF/BV-05-C [Receive Intermediate Temperature Notifications]

- Test Purpose

  Verify that the Collector IUT can receive notifications of the Intermediate Temperature characteristic for various field configurations.

- Reference

  [3] 4.5

- Initial Condition

  - A preamble procedure defined in Section 4.2.4 is used to set up the transport and L2CAP channel and initiate connection to a Thermometer.
  - The IUT has executed the procedure included in HTP/COL/THF/BV-04-C [Configure Intermediate Temperature for Notification], which configures it to expect Intermediate Temperature Notification.
  - The IUT has executed the procedure included in HTP/COL/CGGIT/CHA/BV-03-C [Characteristic GGIT – Immediate Temperature], which returns the handle of a Client Configuration Descriptor for an Intermediate Temperature characteristic contained in the Lower Tester.
  - The IUT knows the handle of the Intermediate Temperature characteristic.

- Test Procedure

  The Lower Tester sends an ATT_Handle_Value_Notification containing an Intermediate Temperature characteristic value in Celsius to the IUT.

This test is run for each value of each bit shown in the following table:

Flag Field	Value	Pass Criteria (Reported in Intermediate Temperature Measurement characteristic)
bit 0	0	Temperature is in units of Celsius
	1	Temperature is in units of Fahrenheit
bit 1	0	Time Stamp field is not present
	1	Time Stamp field is present
bit 2	0	Temperature Type field not present
	1	Temperature Type field present

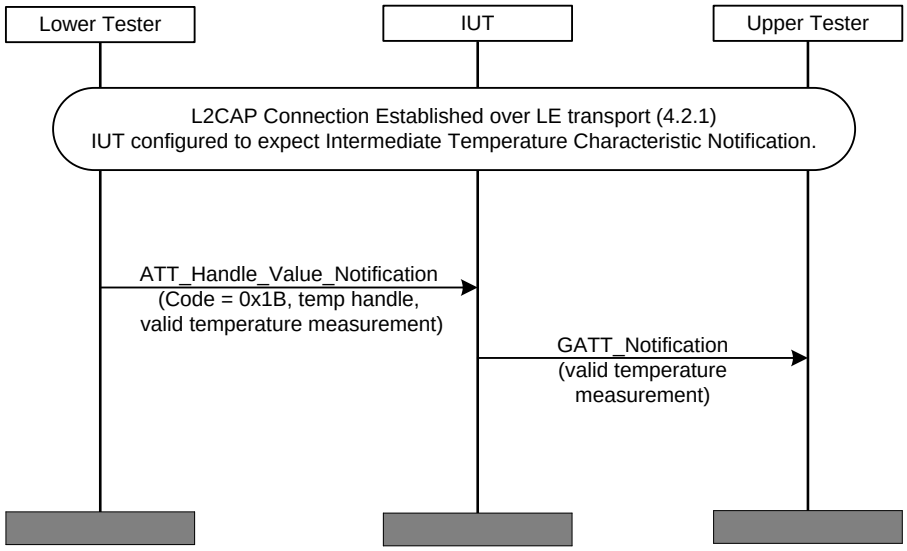

Figure 4.11: HTP/COL/THF/BV-05-C [Receive Intermediate Temperature Notifications]

- Expected Outcome

  Pass verdict

  IUT reports the received Intermediate Temperature values in expected combinations to the Upper Tester using the pass criteria in the table above. The reported field values match the ones sent by the Lower Tester.

HTP/COL/THF/BI-04-C [Receive Intermediate Temperature Notifications with reserved flags]

- Test Purpose

  Verify that the Collector IUT can receive notifications of the Intermediate Temperature characteristic from a Thermometer including reserved flags.

- Reference

  [3] 4.5

- Initial Condition

  - A preamble procedure defined in Section 4.2.4 is used to set up the transport and L2CAP channel and initiate connection to a Thermometer.

- The IUT has executed the procedure included in HTP/COL/THF/BV-04-C [Configure Intermediate Temperature for Notification], which configures it to expect Intermediate Temperature Notification.
- The IUT knows the handle of the Intermediate Temperature characteristic.

- Test Procedure

  The Lower Tester sends an ATT_Handle_Value_Notification containing an Intermediate Temperature characteristic value to the IUT. There are many combinations of reserved flag settings. For this test use Flags = 0xFF (all 1s). Also include valid uses of the other flags: temperature in Fahrenheit, time stamp and Temperature Type. Any valid values for time stamp and for temperature type may be sent by the Lower Tester.

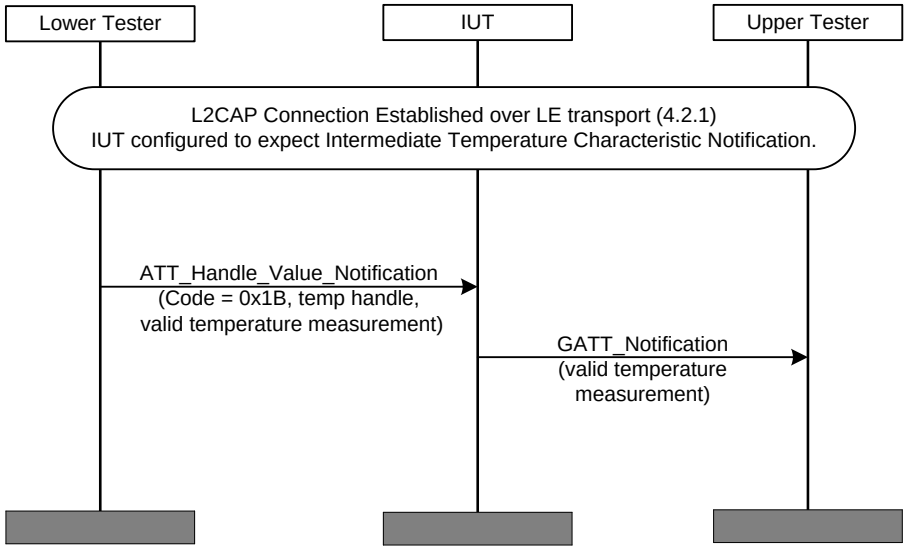

Figure 4.12: HTP/COL/THF/BI-04-C [Receive Intermediate Temperature Notifications with reserved flags]

- Expected Outcome

  Pass verdict

  IUT reports the received Fahrenheit Temperature value to the Upper Tester, e.g., GATT_Notification (intermediate temperature). The reported intermediate temperature value matches the one sent by the Lower Tester.

HTP/COL/THF/BI-05-C [Receive Intermediate Temperature Notifications with reserved temperature type]

- Test Purpose

  Verify that the Collector IUT can receive notifications of the Intermediate Temperature Characteristic from a Thermometer including a reserved temperature type.

- Reference

  [3] 4.5

- Initial Condition
  - A preamble procedure defined in Section 4.2.4 is used to set up the transport and L2CAP channel and initiate connection to a Thermometer.

- The IUT has executed the procedure included in HTP/COL/THF/BV-04-C [Configure Intermediate Temperature for Notification], which configures it to expect Intermediate Temperature Notification.
- The IUT knows the handle of the Intermediate Temperature characteristic.

- Test Procedure

  The Lower Tester sends an ATT_Handle_Value_Notification containing an Intermediate Temperature characteristic value to the IUT. That value contains: flags = 0x06, valid Celsius temperature, valid time stamp, reserved temperature type (e.g., 0xFF).

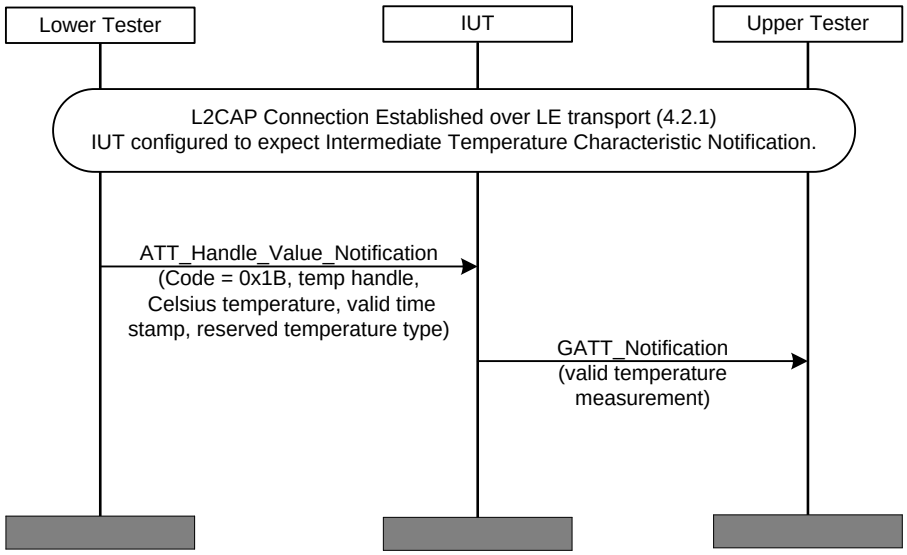

Figure 4.13: HTP/COL/THF/BI-05-C [Receive Intermediate Temperature Notifications with reserved temperature type]

- Expected Outcome

  Pass verdict

  IUT reports the received Celsius Temperature value to the Upper Tester, e.g., GATT_Notification (intermediate temperature, valid time stamp, <no temperature type>). The reported intermediate temperature value matches the one sent by the Lower Tester.

HTP/COL/THF/BI-06-C [Receive Intermediate Temperature Notifications with additional octets not represented in the flags field]

- Test Purpose

  Verify that the Collector IUT can receive notifications of the Intermediate Temperature Characteristic from a Thermometer including additional octets not represented in the flags field.

- Reference

  [3] 4.5

- Initial Condition

  - A preamble procedure defined in Section 4.2.4 is used to set up the transport and L2CAP channel and initiate connection to a Thermometer.

- The IUT has executed the procedure included in HTP/COL/THF/BV-04-C [Configure Intermediate Temperature for Notification], which configures it to expect Intermediate Temperature Notification.
- The IUT knows the handle of the Intermediate Temperature characteristic.

- Test Procedure

  The Lower Tester sends an ATT_Handle_Value_Notification containing an Intermediate Temperature characteristic value to the IUT. That value contains: flags = 0x06, valid Celsius temperature, valid time stamp, valid temperature type, and at least two additional octets not represented in the flags field. The total number of octets does not exceed the maximum MTU size.

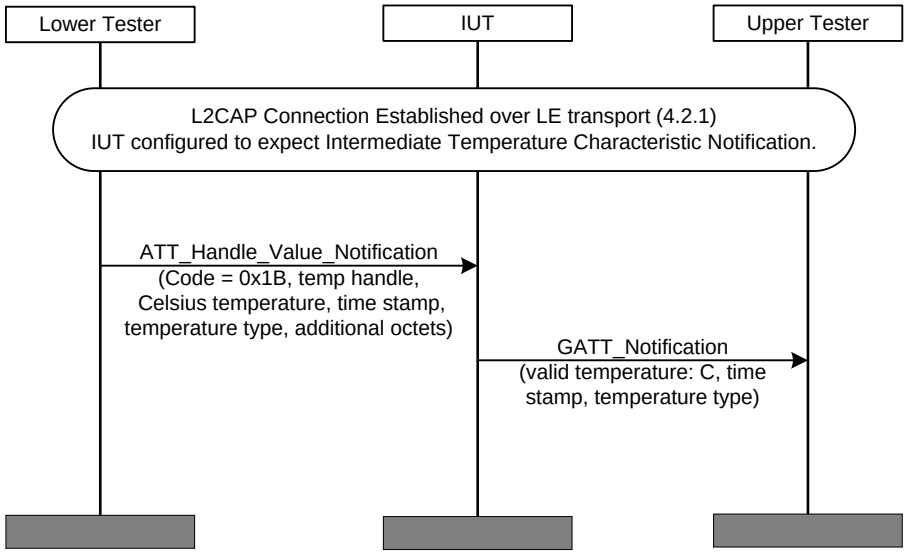

Figure 4.14: HTP/COL/THF/BI-06-C [Receive Intermediate Temperature Notifications with additional octets not represented in the flags field]

- Expected Outcome

  Pass verdict

  IUT reports the received Temperature value to the Upper Tester, e.g., GATT_Notification (intermediate temperature, valid time stamp, temperature type, <no additional octets>). The reported intermediate temperature value matches the one sent by the Lower Tester.

HTP/COL/THF/BV-07-C [Receive multiple Intermediate Temperature Notifications]

- Test Purpose

  Verify that the Collector IUT can receive notifications of the Intermediate Temperature Notifications followed by a Temperature Measurement indication.

- Reference

  [3] 4.4, 4.5

- Initial Condition

  - A preamble procedure defined in Section 4.2.4 is used to set up the transport and L2CAP channel and initiate connection to a Thermometer.
  - The Lower Tester is configured to enable Temperature Measurement Indication, by executing the procedure included in HTP/COL/THF/BV-01-C [Temperature Measurement Configuration].

- The Lower Tester is configured to enable Intermediate Temperature Notification, by executing the procedure included in HTP/COL/THF/BV-04-C [Configure Intermediate Temperature for Notification].
- The IUT knows the handle of the Temperature Measurement characteristic.
- The IUT knows the handle of the Intermediate Temperature characteristic.

- Test Procedure

  The Lower Tester sends two or more ATT_Handle_Value_Notifications to the IUT; each contains the Intermediate Temperature characteristic value in Celsius.

  The Lower Tester sends an ATT_Handle_Value_Indication to the IUT; containing a Temperature Measurement characteristic value in Celsius with a time stamp and a Temperature Type.

- Expected Outcome

  Pass verdict

  For each ATT_Handle_Value_Notification sent to the IUT:

  - The IUT reports the received Celsius Temperature value to the Upper Tester. The reported temperature value matches that sent by the Lower Tester.

  For the ATT_Handle_Value_Indication sent to the IUT:

  - The IUT sends a correctly formatted ATT_Handle_Value_Confirmation (0x1E) to the Lower Tester.
  - The IUT reports the received Celsius Temperature values to the Upper Tester, e.g., GATT_Indication (temperature value, time stamp, Temperature Type) as specified in the flags field. The reported temperature value matches that sent by the Lower Tester.

HTP/COL/THF/BV-08-C [Configure Measurement Interval for Indication]

- Test Purpose

  Verify that the Collector IUT can configure a Thermometer (Lower Tester) to Indicate Measurement Interval characteristics.

- Reference

  [3] 4.6

- Initial Condition

  - A preamble procedure defined in Section 4.2.4 is used to set up the transport and L2CAP channel and initiate connection to a Thermometer.
  - The IUT has executed the procedure included in HTP/COL/CGGIT/CHA/BV-04-C [Characteristic GGIT – Measurement Interval], which returns the handle of a Client Configuration Descriptor for a Measurement Interval characteristic contained in the Lower Tester.

- Test Procedure

  The Upper Tester sends a command to the IUT to configure to receive measurement interval indications.

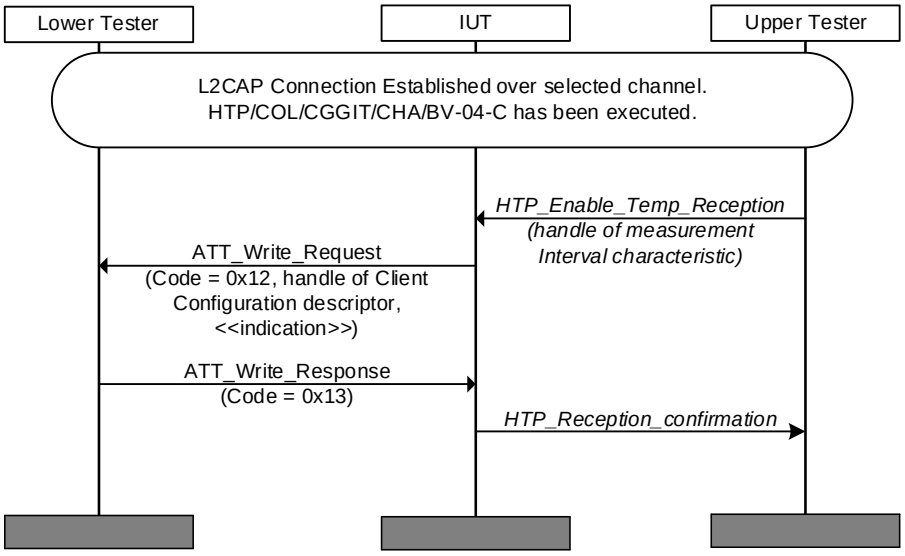

Figure 4.15: HTP/COL/THF/BV-08-C [Configure Measurement Interval for Indication]

- Expected Outcome

  Pass verdict

  IUT sends a correctly formatted ATT_Write_Request (0x12) to the Lower Tester, with the handle set to that of the Client Configuration Descriptor for a Measurement Interval characteristic, and the value set to «indication».

HTP/COL/THF/BV-09-C [Receive Measurement Interval Indications]

- Test Purpose

  Verify that the Collector IUT can receive Measurement Interval characteristic value indications from a Thermometer.

- Reference

  [3] 4.6

- Initial Condition

  - A preamble procedure defined in Section 4.2.4 is used to set up the transport and L2CAP channel and initiate connection to a Thermometer.
  - The IUT is configured to expect Measurement Interval Indication.
  - The IUT knows the handle of the Measurement Interval characteristic.

- Test Procedure

  The Lower Tester sends an ATT_Handle_Value_Indication containing a Measurement Interval characteristic value to the IUT.

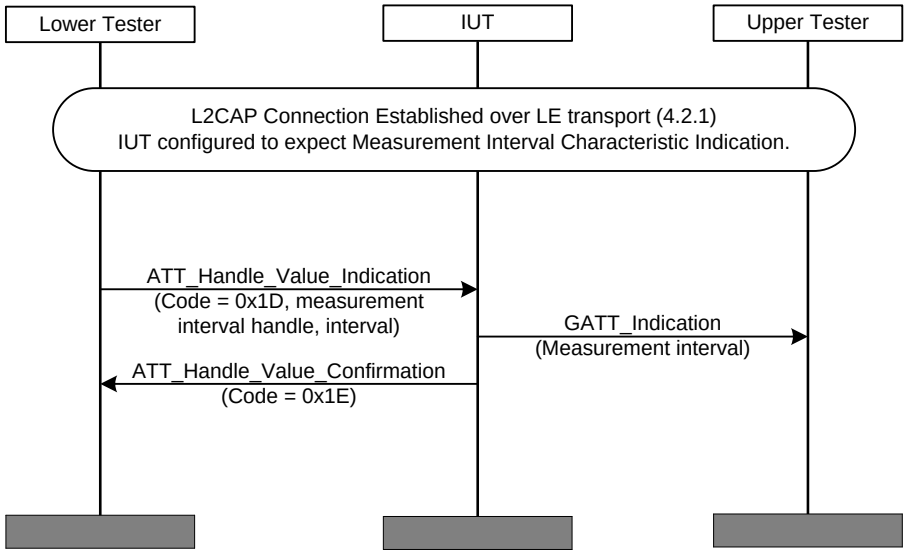

Figure 4.16: HTP/COL/THF/BV-09-C [Receive Measurement Interval Indications]

- Expected Outcome

  Pass verdict

  IUT sends a correctly formatted ATT_Handle_Value_Confirmation (0x1E) to the Lower Tester. The reported measurement interval value matches the one sent by the Lower Tester.

HTP/COL/THF/BI-07-C [Read Temperature Type characteristic with reserved value]

- Test Purpose

  Verify that the Collector IUT can read the Temperature Type characteristic from a Thermometer and discard reserved values.

- Reference

  [3] 4.7

- Initial Condition

  - A preamble procedure defined in Section 4.2.4 is used to set up the transport and L2CAP channel and initiate connection to a Thermometer.
  - The Upper Tester knows the handle of a Temperature Type characteristic contained in the Lower Tester.

- Test Procedure

  Send a command from the Upper Tester to request IUT to read a Temperature Type Characteristic from the Lower Tester e.g., GATT_ReadRequest (handle, value).

  After receipt of the expected result by the Lower Tester, send an ATT_Read_Response (0x0B) from the Lower Tester to the IUT containing a reserved value.

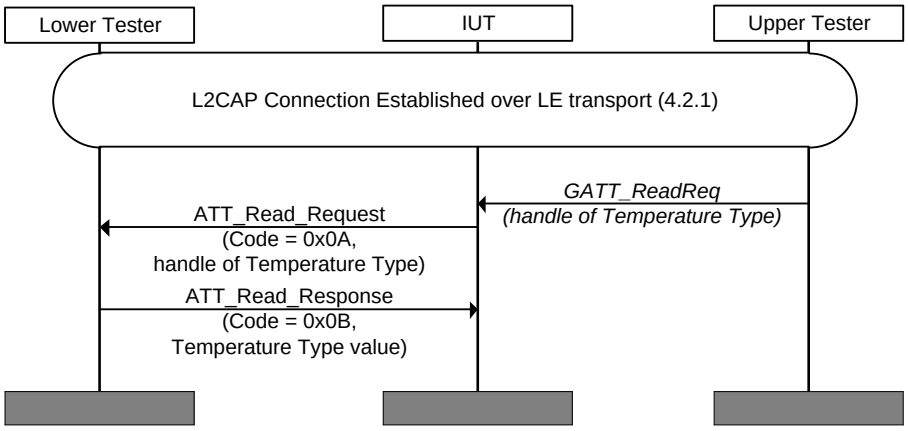

Figure 4.17: HTP/COL/THF/BI-07-C [Read Temperature Type characteristic with reserved value]

- Expected Outcome

  Pass verdict

  The IUT sends a correctly formatted ATT_Read_Request (0x0A) to the Lower Tester, containing the handle specified by the Upper Tester.

  The IUT receives the response from the Lower Tester and discards it. It does not report the received value to the Upper Tester.

HTP/COL/THF/BV-14-C [Verify Bond Status on Reconnection]

- Test Purpose

  Verify that the Collector IUT starts encryption with a previously bonded Thermometer on reconnection.

- Reference

  [3] 5.2.3

- Initial Condition

  - The IUT and the Lower Tester are bonded.
  - The IUT has configured the Lower Tester to enable indications or notifications on one or more of the characteristics of the Lower Tester's Health Thermometer Service.
  - No connection is established between the IUT and Lower Tester.

- Test Procedure

  1. The Lower Tester begins advertising using GAP undirected connectable mode.
  2. The IUT establishes a connection to the Lower Tester.
  3. The Lower Tester does not send any indications or notifications to the IUT.
  4. The IUT starts encryption when the connection is established.

- Expected Outcome

  Pass verdict

  The IUT starts encryption when the connection is established.

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 Health Thermometer Profile (HTP) [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 [1].

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

Item	Feature	Test Case(s)
HTP 3/1 AND GAP 0/3 AND GATT 1a/4	Health Thermometer Service not discovered over BR/EDR	HTP/SEN/SGGIT/SDPNF/BV-01-C
HTP 3/2	Include Health Thermometer Service UUID in AD in GAP Discoverable Mode	HTP/SEN/THF/BV-01-C
HTP 3/3	Include Local Name in AD or Scan Response	HTP/SEN/THF/BV-02-C
HTP 8/1	Discover Health Thermometer Service	HTP/COL/CGGIT/SER/BV-01-C
HTP 8/2	Discover Temperature Measurement characteristic	HTP/COL/CGGIT/CHA/BV-01-C
HTP 8/4	Discover Temperature Type characteristic	HTP/COL/CGGIT/CHA/BV-02-C
HTP 8/5	Discover Intermediate Temperature characteristic	HTP/COL/CGGIT/CHA/BV-03-C
HTP 8/7	Discover Measurement Interval characteristic	HTP/COL/CGGIT/CHA/BV-04-C
HTP 8/9	Discover: Measurement Interval – Valid Range Descriptor	HTP/COL/CGGIT/DES/BV-01-C
HTP 9/1	Configure Temperature Measurement characteristic for Indications	HTP/COL/THF/BV-01-C
HTP 9/2 AND HTP 9/4 AND HTP 9/5	Receive Temperature Measurement characteristic Indications	HTP/COL/THF/BV-02-C HTP/COL/THF/BI-01-C HTP/COL/THF/BI-02-C HTP/COL/THF/BI-03-C
HTP 9/3	Receive multiple Temperature Measurement characteristic Indications	HTP/COL/THF/BV-03-C
HTP 9/6	Configure Intermediate Temperature characteristic for Notifications	HTP/COL/THF/BV-04-C

Item	Feature	Test Case(s)
HTP 9/7 AND HTP 9/4 AND HTP 9/5	Receive Intermediate Temperature characteristic Notifications	HTP/COL/THF/BV-05-C HTP/COL/THF/BI-04-C HTP/COL/THF/BI-05-C HTP/COL/THF/BI-06-C HTP/COL/THF/BV-07-C
HTP 9/8	Configure Measurement Interval characteristic for Indications	HTP/COL/THF/BV-08-C
HTP 9/9	Receive Measurement Interval characteristic Indications	HTP/COL/THF/BV-09-C
HTP 9/13	Read Temperature Type characteristic	HTP/COL/THF/BI-07-C
HTP 9/14	Verify Bond Status on Reconnection	HTP/COL/THF/BV-14-C
HTP 10/1	Discover Device Information Service	HTP/COL/CGGIT/SER/BV-02-C
HTP 10/2 OR HTP 10/3 OR HTP 10/4	Device Information Service Characteristics	HTP/COL/THS/BV-13-C HTP/COL/THS/BV-14-C

Table 5.1: Test case mapping

6 Revision history and acknowledgments

Revision History

Publication Number	Revision Number	Date	Comments
0	1.0.0	2011-05-24	Prepare for publication.
	1.0.1r0	2011-11-03	TSE 4572: TP/THF/TH/BV-02-I: Correct Test procedure and MSC
1	1.0.1	2012-03-30	Prepare for publication.
	1.0.2r1	2012-09-04	TSE 4877: In TCMT changed OR changed to AND for features Receive Temperature Measurement characteristic Indications and Receive Intermediate Temperature characteristic Notifications.
2	1.0.2	2012-10-30	Prepare for Publication
	1.0.3r00	2016-05-24	Converted to new Test Case ID conventions as defined in TSTO v4.1.
	1.0.3r01	2016-06-14	Test Spec Template Conversion
	1.0.3r02	2016-06-22	TSE 7314: Clarified IUT role, test procedure, and pass verdict for HTP/SEN/THS/BV-01-I (previously TP/THS/TH/BV-01-I).
3	1.0.3	2016-07-13	Prepared for TCRL 2016-1 publication.
	1.0.3 edition 2r00	2018-11-29	Editorial changes only. Template updated. Revision History and contributors moved to the end of the document.
	1.0.3 edition 2	2019-12-13	Updated copyright page and confidentiality markings to support new Documentation Marking Requirements, performed minor formatting updates, and accepted all tracked changes to prepare for edition 2 publication.
	1.0.3 edition 3r00	2020-01-16	TSE 12785 (rating 1): Updated pass verdict for test case HTP/COL/THF/BV-10-I so that time and date values are not showing as expected to be returned. TSE 12786 (rating 1): Updated pass verdict for test case HTP/COL/THF/BI-04-I so that it indicates Fahrenheit instead of Celsius.
	1.0.3 edition3r01	2020-05-21	Minor editorials and update of document number to reflect an edition release.
	1.0.3 edition 3	2020-06-01	Performed minor formatting and template updates, rolled back document numbering to reflect an edition release, and accepted all tracked changes. Approved by BTI on 2020-06-01. Prepared for edition 3 publication.
	p4r00–r03	2023-04-26 – 2023-05-23	TSE 22820 (rating 2): Converted the following 15 test cases to GGIT: HTP/SEN/THS/BV-01-I, and HTP/COL/THS/BV-01-I, -02-I, -04-I, -05-I, -07-I – -12-I; HTP/COL/THF/BV-10-I – -13-I. The 8 new GGIT converted TCIDs are HTP/COL/CGGIT/DES/BV-01-C, HTP/SEN/SGGIT/SDPNF/BV-01-C, HTP/COL/CGGIT/SER/BV-01-C and -02-C, and HTP/COL/CGGIT/CHA/BV-01-C – -04-C. Updated the

Publication Number	Revision Number	Date	Comments
			TCMT accordingly. Updated the initial condition and test procedure for HTP/COL/THS/BV-13-I. Updated the test procedure for HTP/COL/THS/BV-14-I. Updated the initial condition and MSC for HTP/COL/THF/BV-01-I and -08-I. Updated the initial condition, test procedure, MSC, and expected outcome for HTP/COL/THF/BV-04-I. Updated the initial condition for HTP/COL/THF/BV-05-I. Performed other editorials to align the document with the latest TS template, including the addition of missing figure captions and updates to the scope, references, Test Strategy, test case identification conventions, conformance, Pass/Fail verdict conventions, and TCMT introductory text. Updated the copyright page to align with v2 of the DNMD. Changed section titles for single test cases to Heading 8 or 9 per the TS template.
4	p4	2023-06-29	Approved by BTI on 2023-05-28. Prepared for TCRL 2023-1 publication.
	p5r00	2023-10-30	TSE 23275 (rating 1): Converted -I tests to -C tests as appropriate; updated the TCMT and TCRL accordingly.
5	p5	2024-07-01	Approved by BTI on 2024-04-21. Prepared for TCRL 2024-1 publication.

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