Heart Rate Profile (HRP)

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 Heart Rate 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]   Heart Rate Profile Specification, Version 1.0 or later

[4]   ICS Proforma for Heart Rate Profile, HRP.ICS

[5]   GAP Test Suite, GAP.TS

[6]   SM Test Suite, SM.TS

[7]   GATT Test Suite, GATT.TS

[8]   Heart Rate Service, Version 1.0 or later

[9]   Device Information Service, Version 1.0 or later

[10]   Heart Rate Service Test Suite, HRS.TS

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

[12]   Heart Rate Profile Implementation eXtra Information for Test, IXIT

2.2   Definitions

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

2.3   Acronyms and abbreviations

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

3 Test Suite Structure (TSS)

3.1 Overview

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

```
┌─────────────────────────┐   ┌─────────────────────────────────────┐
│ Heart Rate Profile      │   │ Heart Rate Profile                  │
│ Collector Role          │   │ Heart Rate Sensor Role              │
│                         │   ├──────────┬──────────┬───────────────┤
│                         │   │ Heart    │ Device   │ Other         │
│                         │   │ Rate     │ Info     │ optional      │
│                         │   │ Service  │ Service  │ services      │
├─────────────────────────┤   ├──────────┴──────────┴───────────────┤
│ GATT                    │   │ GATT                                │
├───────┬───────┬─────────┤   ├──────────┬──────────┬───────────────┤
│ ATT   │ GAP   │ SM      │   │ ATT      │ GAP      │ SM            │
├───────┴───────┴─────────┤   ├──────────┴──────────┴───────────────┤
│ L2CAP                   │   │ L2CAP                               │
├─────────────────────────┤   ├─────────────────────────────────────┤
│ LE Controller           │   │ LE Controller                       │
└─────────────────────────┘   └─────────────────────────────────────┘
```
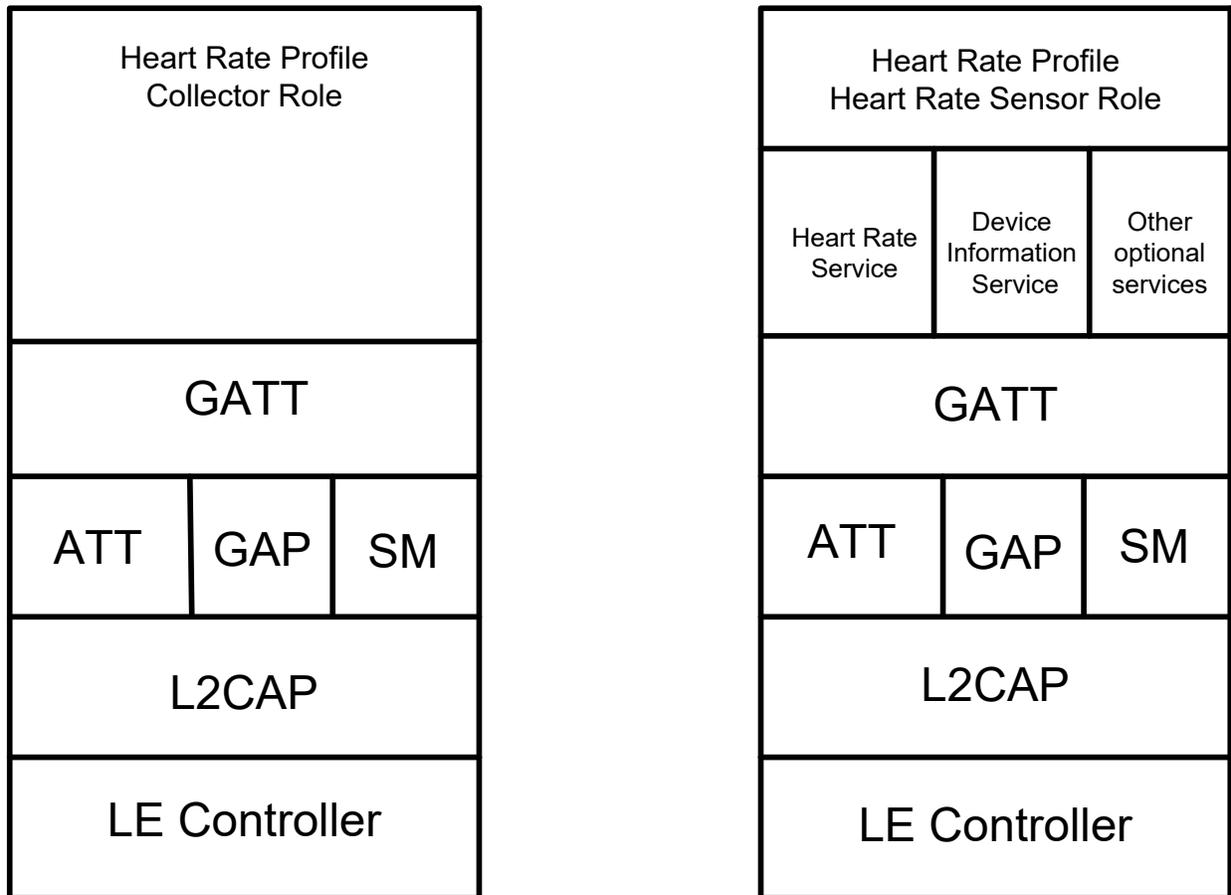
Figure 3.1: Heart Rate Test Model

3.2 Test Strategy

The test objectives are to verify the functionality of the Heart Rate 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 [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>
HRP	Heart Rate Profile
Identifier Abbreviation	**Role Identifier <IUT role>**
COL	Collector Role
SEN	Sensor 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
SDPNF	SDP Record Not Found
SER	Service
Identifier Abbreviation	**Feature Identifier <feat>**
HRD	Discovery of Characteristics
HRF	Features

Table 4.1: HRP 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.

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 HRP/SEN/SGGIT/SDPNF/BV-01-C [Not discoverable over BR/EDR – Heart Rate]).

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

4.2.3 Heart Rate Sensor: Initiate Undirected Connectable mode before Notification

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

- Reference

    [3] Section 5.1

    [2] GAP 9.3.3, 9.3.4

- Initial Condition

    - A preamble procedure defined in Section 4.2.1 is used to setup the LE transport and L2CAP channel. The Heart Rate Sensor and the lower tester (Collector) may have bonded following GAP procedures.

- The Heart Rate Sensor is disconnected.

- The Heart Rate Sensor has been configured to accept commands from the upper tester to generate heart rate measurements.

- 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 Heart Rate Sensor IUT.
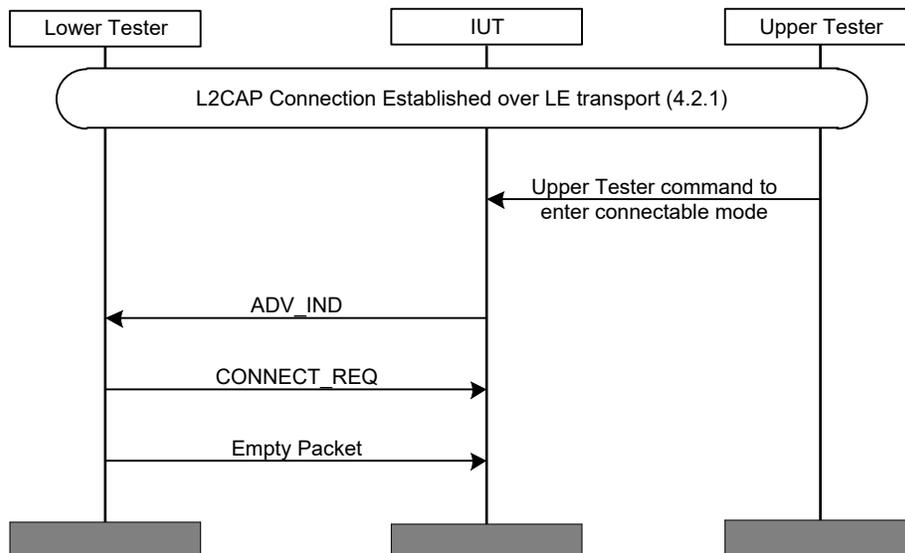
Figure 4.1: Heart Rate Sensor: Initiate Undirected Connectable mode before Notification setup procedure

4.2.4   Collector: Initiate Connection when ready to receive Notifications

This is a setup procedure for the Collector to initiate connection to a Heart Rate Sensor.

- Reference

   [3] Section 5.2

   [2] GAP 9.3.3, 9.3.4

- Initial Condition

   - A preamble procedure defined in Section 4.2.1 is used to setup the LE transport and L2CAP channel. The Collector and the Lower Tester (Heart Rate Sensor) 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 heart rate measurements.

- Preamble Procedure

   The Upper Tester commands the Collector IUT to initiate a connection.

   The Lower Tester sends ADV_IND packets (GAP Undirected Connectable Mode) to the Collector IUT.

   The Lower Tester waits for responses from the Collector IUT.

The Collector IUT sends a CONNECT_REQ and an empty packet to the Lower Tester.
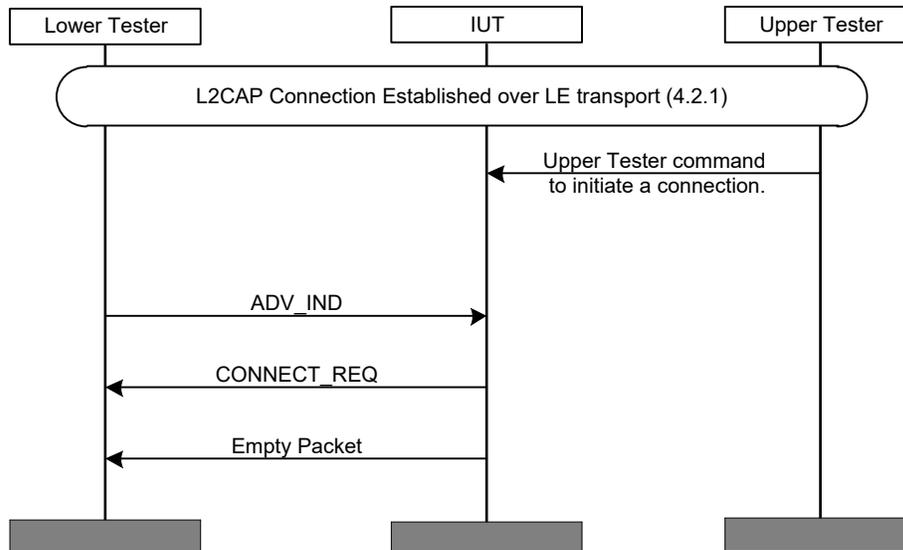
Figure 4.2: Collector: Initiate Connection when ready to receive Notifications setup procedure

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	Reference	Properties	Value Length (Octets)	Service Type
HRP/COL/CGGIT/SER/BV-01-C [Service GGIT – Heart Rate]	Heart Rate Service	[3] 4.2.1	-	-	Primary Service
HRP/COL/CGGIT/SER/BV-02-C [Service GGIT – Device Information]	Device Information Service	[3] 4.2.2	-	-	Primary Service
HRP/COL/CGGIT/CHA/BV-01-C [Characteristic GGIT – Heart Rate Measurement]	Heart Rate Measurement Characteristic	[3] 4.3.1.1	0x10 (Notify)	Skip	-
HRP/COL/CGGIT/CHA/BV-02-C [Characteristic GGIT – Body Sensor Location]	Body Sensor Location Characteristic	[3] 4.3.1.2	0x02 (Read)	1	-
HRP/COL/CGGIT/CHA/BV-03-C [Characteristic GGIT – Heart Rate Control Point]	Heart Rate Control Point Characteristic	[3] 4.3.1.3	0x08 (Write)	Skip	-
HRP/SEN/SGGIT/SDPNF/BV-01-C [Not discoverable over BR/EDR – Heart Rate]	Heart Rate 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 Heart Rate Sensor IUT discovery of the characteristics defined in the Device Information Service [9] by a Heart Rate Sensor IUT, by a Collector IUT.

HRP/COL/HRD/BV-09-C [Discover Device Information Service Characteristics]

- Test Purpose

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

- Reference

  [3] 4.3.2

- Initial Condition

  - Using the TSPX_iut_supported_dis_characteristics_uuid_list IXIT [12] entry 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 preamble procedure for the Collector to initiate connection to a Heart Rate Sensor included in the Section 4.2.4.

  - The IUT has executed the test procedure of HRP/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

  1. The Upper Tester issues a command to the IUT to discover all characteristics of the User Data Service supported by the IUT.
  2. The IUT executes either alternative 2A or 2B:

     Alternative 2A (Discover All Characteristics of a Service sub-procedure):

     2A: Discover All Characteristics of a Service with the specified handle range, with the Lower Tester instantiating the database specified in the Initial Condition.

     Alternative 2B (Discover Characteristic by UUID sub-procedure):

     2B: Discover Characteristic by UUID using each of the UUIDs for the UDS Characteristics of the User Data Service supported by the IUT, with the Lower Tester instantiating the database specified in the Initial Condition.

- 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/value pair(s) for all characteristics specified in the TSPX_iut_supported_dis_characteristics_uuid_list IXIT [12] entry to the Upper Tester.

HRP/COL/HRD/BV-10-C [Read Device Information Service Characteristics]

- Test Purpose

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

- Reference

  [3] 3.2, 4.3.2

- Initial Condition

  - Using the TSPX_iut_supported_dis_characteristics_uuid_list IXIT [12] entry 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 preamble procedure for the Collector to initiate connection to a Heart Rate Sensor included in the Section 4.2.4.

  - 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 HRP/COL/HRD/BV-09-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

  This test is run twice and a disconnection may occur between the two tests. In the first pass, the string includes only character values in the ASCII printable range. In the second pass, the string includes character values outside the ASCII printable range.

  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 procedure included in GATT.TS [7], GATT/CL/GAR/BV-01-C [Read Characteristic Value – by client].

- 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 TSPX_iut_supported_dis_characteristics_uuid_list IXIT [12] entry to the upper tester, including any printable or non-printable ASCII values.

4.5   Heart Rate Features

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

HRP/SEN/HRF/BV-01-C [Heart Rate Service UUID in AD]

- Test Purpose

  Verify that the Heart Rate Service UUID is included in AD (Advertising Data) from the Heart Rate Sensor IUT.

- Reference

  [3] Section 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

  <u>Pass verdict</u>

  At least one received Advertising Packet contains the defined Service UUID for «Heart Rate Service».

HRP/SEN/HRF/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 Heart Rate Sensor IUT.

- Reference

  [3] Section 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 Connection Request to the IUT. Then the Lower Tester listens for a Scan Response from the IUT.
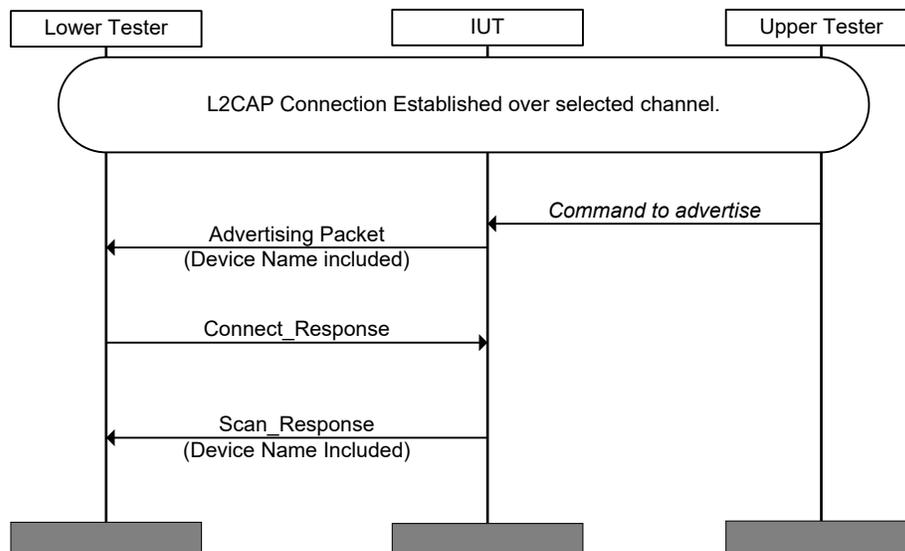

Figure 4.3: HRP/SEN/HRF/BV-02-C [Local Name included in AD or Scan Response]

- Expected Outcome

<u>Pass verdict</u>

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.

HRP/COL/HRF/BV-03-C [Configure Heart Rate Measurement for Notification]

- Test Purpose

Verify that the Collector IUT can configure a Heart Rate Sensor (Lower Tester) to Notify Heart Rate Measurement characteristics.

- Reference

[3] Section 4.4

- Initial Condition

  - A preamble procedure defined in paragraph 4.2.4 is used to setup the LE transport and L2CAP channel and initiate connection to a Heart Rate Sensor.

  - The IUT has executed the test procedure of HRP/COL/CGGIT/CHA/BV-01-C [Characteristic GGIT – Heart Rate Measurement], which returns the handle of a Client Configuration Descriptor for a Heart Rate Measurement characteristic contained in the Lower Tester.

- Test Procedure

The Upper Tester sends a command to the IUT to configure to receive Heart Rate Measurement characteristics.
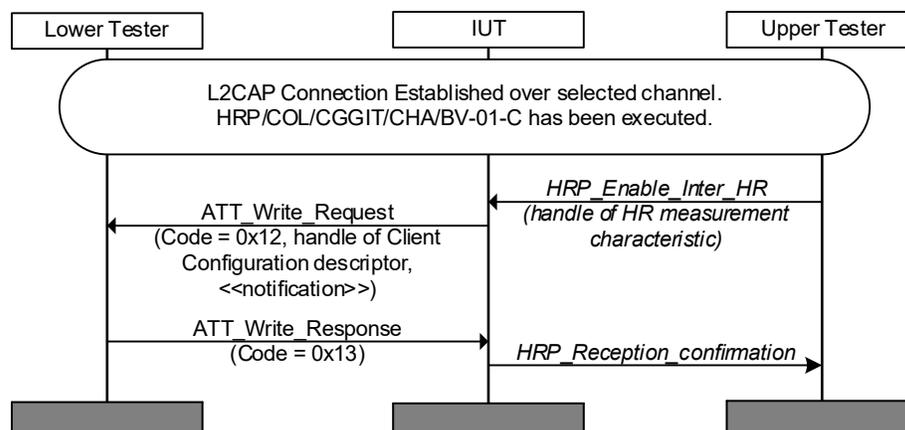

Figure 4.4: HRP/COL/HRF/BV-03-C [Configure Heart Rate Measurement for Notification]

- Expected Outcome

<u>Pass verdict</u>

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 Heart Rate Measurement characteristic, and the value set to «notification».

HRP/COL/HRF/BV-04-C [Receive Heart Rate Measurement Notifications]

- Test Purpose

  Verify that the Collector IUT can receive notifications of the Heart Rate Measurement Characteristic, including all variants.

- Reference

  [3] Section 4.4

- Initial Condition

  - A preamble procedure defined in paragraph 4.2.4 is used to setup the transport and L2CAP channel and initiate connection to a Heart Rate Sensor.

  - The IUT has executed the procedure included in HRP/COL/HRF/BV-03-C [Configure Heart Rate Measurement for Notification], which configures it to expect Heart Rate Measurement Notifications.

  - The IUT knows the handle of the Heart Rate Measurement characteristic.

- Test Procedure

  The Lower Tester sends an *ATT_Handle_Value_Notification* containing a Heart Rate 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 Heart Rate Measurement characteristic)
bit 0	0	Heart Rate Value Format is set to UINT8
	1	Heart Rate Value Format is set to UINT16
bit 1	0	This bit only has meaning if the skin contact feature is supported (i.e. bit 2 = 1): The sensor is not in contact with the body.
	1	This bit only has meaning if the skin contact feature is supported (i.e. bit 2 = 1): The sensor is in contact with the body.
bit 2	0	Skin contact feature is not supported.
	1	Skin contact feature is supported.
bit 3	0	Energy Expended field is not present
	1	Energy Expended field is present
bit 4	0	RR-Interval values are not present
	1	One or more RR-Interval values are present

Table 4.3: HRP/COL/HRF/BV-04-C [Receive Heart Rate Measurement Notifications]
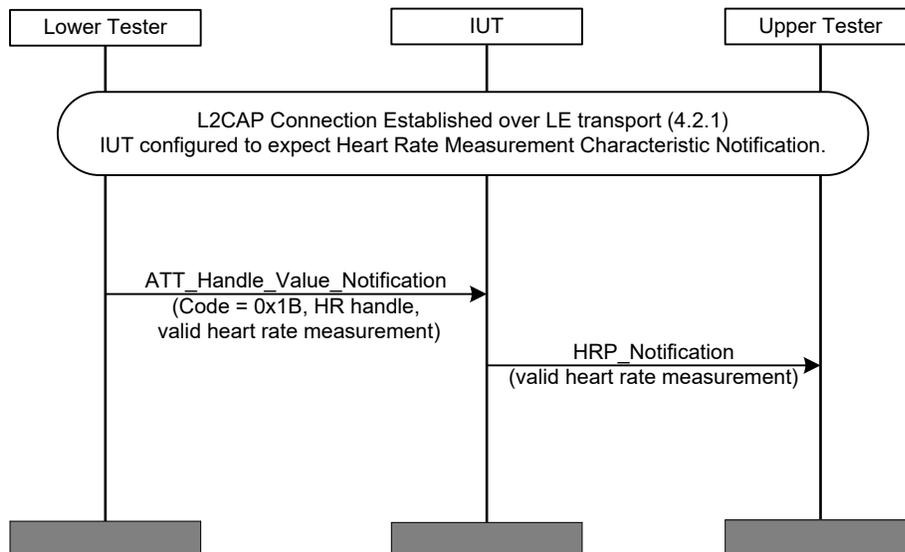
Figure 4.5: HRP/COL/HRF/BV-04-C [Receive Heart Rate Measurement Notifications]

- Expected Outcome

  Pass verdict

  IUT sends notifications of Heart Rate values in expected combinations to the Upper Tester according to the pass criteria in the table above. The reported Heart Rate Measurement field values match the ones sent by the Lower Tester.

HRP/COL/HRF/BI-01-C [Receive Heart Rate Measurement Notifications with reserved flags]

- Test Purpose

  Verify that the Collector IUT can receive notifications of the Heart Rate Measurement Characteristic from a Heart Rate Sensor including reserved flags.

- Reference

  [3] Section 4.4

- Initial Condition

  - A preamble procedure defined in Section 4.2.4 is used to setup the transport and L2CAP channel and initiate connection to a Heart Rate Sensor.

  - The IUT has executed the procedure included in HRP/COL/HRF/BV-03-C [Configure Heart Rate Measurement for Notification], which configures it to expect Heart Rate Measurement Notifications.

  - The IUT knows the handle of the Heart Rate Measurement characteristic.

- Test Procedure

  The Lower Tester sends an *ATT_Handle_Value_Notification* containing a Heart Rate Measurement characteristic value to the IUT. There are many combinations of reserved flag settings. For this test use Flags = 0xE0. This includes reserved bits 7, 6, and 5 = 111 and valid uses of the other flags: Heart Rate Value Format bit = 0, Sensor Contact Status bits = 00, Energy Expended Status bit = 0, RR-Interval bit = 0.
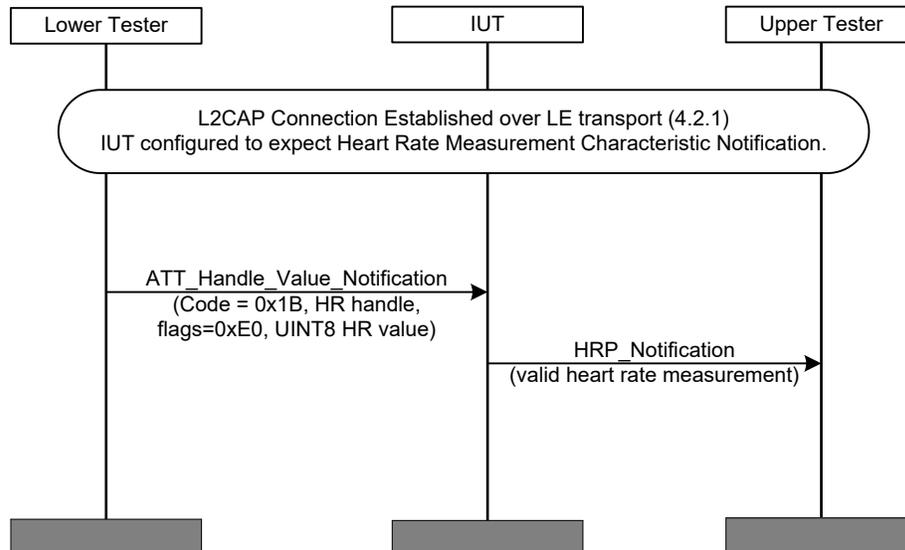
Figure 4.6: HRP/COL/HRF/BI-01-C [Receive Heart Rate Measurement Notifications with reserved flags]

- Expected Outcome

  Pass verdict

  IUT reports the received Heart Rate Measurement value to the Upper Tester, e.g., *HRP_Notification* (Heart Rate Measurement). The reported Heart Rate Measurement value matches the one sent by the lower tester, including the reserved bits of the Flags field.

HRP/COL/HRF/BI-02-C [Receive Heart Rate Measurement Notifications with additional octets not represented in the flags field]

- Test Purpose

  Verify that the Collector IUT can receive notifications of the Heart Rate Measurement Characteristic from a Heart Rate Sensor including additional octets not represented in the flags field.

- Reference

  [3] Section 4.4

- Initial Condition

  - A preamble procedure defined in Section 4.2.4 is used to setup the transport and L2CAP channel and initiate connection to a Heart Rate Sensor.

  - The IUT has executed the procedure included in HRP/COL/HRF/BV-03-C [Configure Heart Rate Measurement for Notification], which configures it to expect Heart Rate Measurement Notifications.

  - The IUT knows the handle of the Heart Rate Measurement characteristic.

- Test Procedure

  The Lower Tester sends an *ATT_Handle_Value_Notification* containing a Heart Rate Measurement characteristic value to the IUT. That value contains: flags = 0x00, valid UINT8 Heart Rate, no Sensor Contact Status, no Energy Expended field, no RR-Interval octets, and at least two additional octets not represented in the flags field. The total number of octets does not exceed the maximum MTU size.
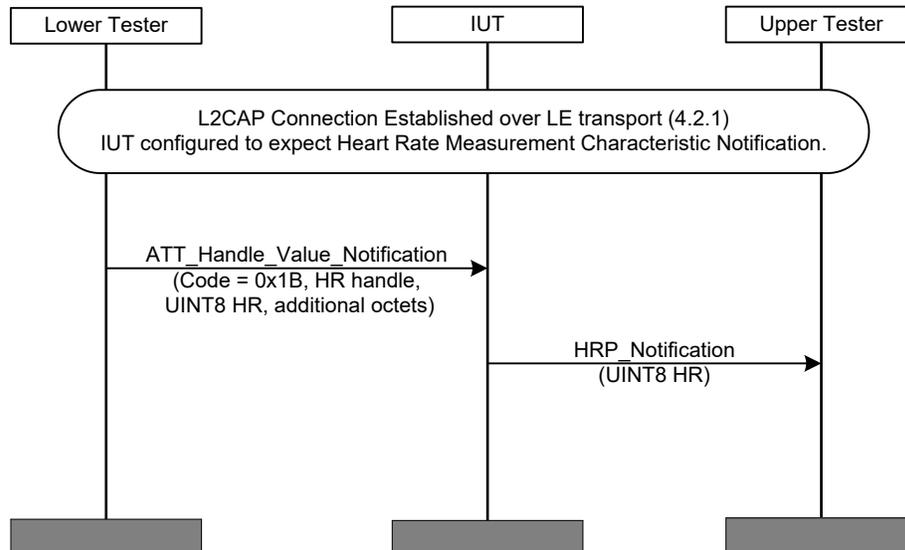
Figure 4.7: HRP/COL/HRF/BI-01-C [Receive Heart Rate Measurement Notifications with reserved flags]

- Expected Outcome

  Pass verdict

  IUT reports the received Heart Rate value to the Upper Tester, e.g., *HRP_Notification* (Heart Rate Measurement, <no additional octets>). The reported Heart Rate Measurement value matches the one sent by the Lower Tester.

HRP/COL/HRF/BV-05-C [Receive multiple Heart Rate Measurement Notifications]

- Test Purpose

  Verify that the collector IUT can receive multiple Heart Rate Measurement notifications.

- Reference

  [3] Section 4.4, 4.5

- Initial Condition

  - A preamble procedure defined in Section 4.2.4 is used to setup the transport and L2CAP channel and initiate connection to a Heart Rate Sensor.

  - The Lower Tester is configured to enable Heart Rate Measurement Notification, by executing the procedure contained in HRP/COL/HRF/BV-03-C [Configure Heart Rate Measurement for Notification].

  - The IUT knows the handle of the Heart Rate Measurement characteristic.

- Test Procedure

  The Lower Tester sends two or more *ATT_Handle_Value_Notifications* to the IUT; each contains the Heart Rate Measurement characteristic value.

- Expected Outcome

Pass verdict

For each ATT_Handle_Value_Notification sent to the IUT:

- The IUT reports the received Heart Rate value to the Upper Tester.

- The reported Heart Rate values match that sent by the Lower Tester.

HRP/COL/HRF/BI-03-C [Read Body Sensor Location characteristic with reserved value]

- Test Purpose

Verify that the Collector IUT can read the Body Sensor Location characteristic from a Heart Rate Sensor, and discard reserved values.

- Reference

[3] Section 4.5

- Initial Condition

- A preamble procedure defined in Section 4.2.4 is used to setup the transport and L2CAP channel and initiate connection to a Heart Rate Sensor.

- The Upper Tester knows the handle of a Body Sensor Location characteristic contained in the Lower Tester.

- Test Procedure

Send a command from Upper Tester to request IUT to read a Body Sensor Location Characteristic from the Lower Tester e.g., HRP_*ReadRequest (handle, value)*.

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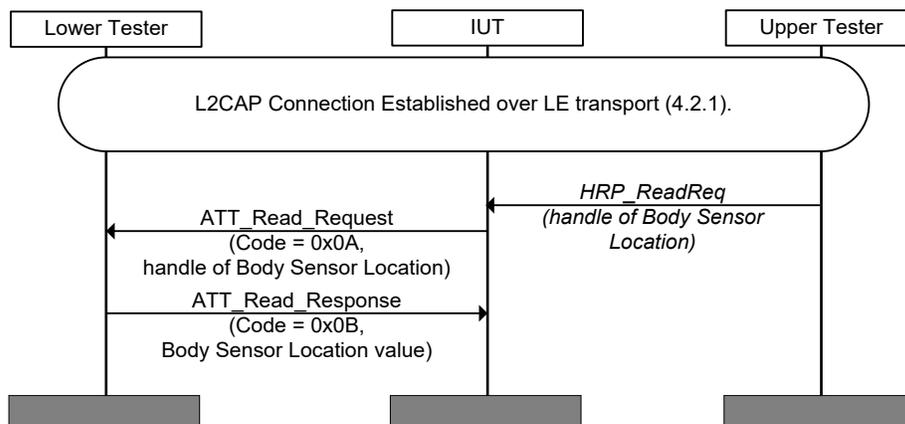

Figure 4.8: HRP/COL/HRF/BI-03-C [Read Body Sensor Location characteristic with reserved value]

- 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.

HRP/COL/HRF/BV-07-C [Write Heart Rate Control Point characteristic – reset energy expended]

- Test Purpose

Verify that the Collector IUT can write the Heart Rate Control Point characteristic value to a Heart Rate Sensor to reset the energy expended.

- Reference

[3] Section 4.6

- Initial Condition

  - A preamble procedure defined in Section 4.2.4 is used to setup the transport and L2CAP channel and initiate connection to a Heart Rate Sensor.

  - The Upper Tester has the handle of a writeable Heart Rate Control Point characteristic contained in the Lower Tester.

- Test Procedure

Send a command from Upper Tester to request IUT to reset the energy expended: write a valid Heart Rate Control Point Characteristic value 0x01 to handle in the Lower Tester e.g., HRP_*WriteRequest (handle, value)*.

After receipt of the *ATT_Write_Request* by the Lower Tester, send an *ATT_Write_Response* from the Lower Tester to the IUT.

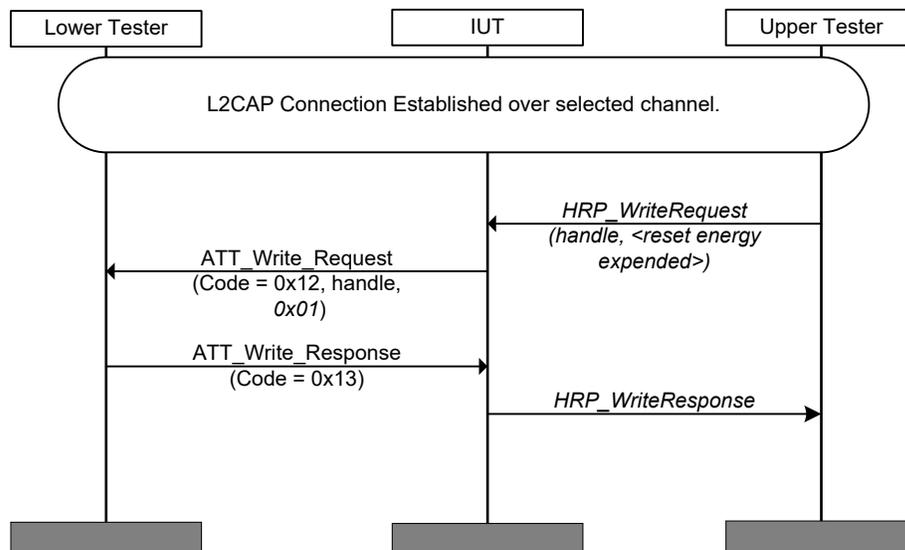*Figure 4.9: HRP/COL/HRF/BV-07-C [Write Heart Rate Control Point characteristic – reset energy expended]*

- Expected Outcome

<u>Pass verdict</u>

The IUT sends a correctly formatted *ATT_Write_Request* (0x12) to the Lower Tester, containing the handle specified by the Upper Tester, and with the value 0x01 specified by the Upper Tester.

The IUT receives the response from the Lower Tester and sends the *HRP_WriteResponse* to the Upper Tester.

HRP/COL/HRF/BV-08-C [Verify Bond Status on Reconnection]

- Test Purpose

  Verify that the Collector IUT starts encryption with a bonded Heart Rate Sensor on reconnection.

- Reference

  [3] Section 5.2.2

- Initial Condition

  - The IUT and the Lower Tester are bonded.

  - The IUT has configured the Lower Tester to enable notifications on the Heart Rate Measurement characteristic of the Lower Tester's Heart Rate Service.

  - No connection is established between the IUT and Lower Tester.

- Test Procedure

  The Lower Tester begins advertising using GAP undirected connectable mode.

  The IUT establishes a connection to the Lower Tester.

  The Lower Tester does not send any notifications to IUT.

  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 Heart Rate Profile (HRP) [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 the purpose and structure of the ICS/IXIT, refer to [1].

Item	Feature	Test Case(s)
HRP 3/2	Include Heart Rate Service UUID in AD in GAP Discoverable Mode	HRP/SEN/HRF/BV-01-C
HRP 3/3	Include Local Name in AD or Scan Response	HRP/SEN/HRF/BV-02-C
HRP 1/1 AND GATT 1a/4	Heart Rate Sensor support for BR/EDR/LE (dual mode)	HRP/SEN/SGGIT/SDPNF/BV-01-C
HRP 8/1	Discover Heart Rate Service	HRP/COL/CGGIT/SER/BV-01-C
HRP 8/2	Discover Heart Rate Measurement characteristic	HRP/COL/CGGIT/CHA/BV-01-C
HRP 8/4	Discover Body Sensor Location characteristic	HRP/COL/CGGIT/CHA/BV-02-C
HRP 8/5	Discover Heart Rate Control Point characteristic	HRP/COL/CGGIT/CHA/BV-03-C
HRP 9/1	Configure Heart Rate Measurement characteristic for Notifications	HRP/COL/HRF/BV-03-C
HRP 9/2	Receive Heart Rate Measurement characteristic Notifications	HRP/COL/HRF/BV-04-C HRP/COL/HRF/BI-01-C HRP/COL/HRF/BI-02-C HRP/COL/HRF/BV-05-C
HRP 9/3	Read Body Sensor Location characteristic	HRP/COL/HRF/BI-03-C
HRP 9/4	Write Heart Rate Control Point characteristic – Reset energy expended	HRP/COL/HRF/BV-07-C
HRP 9/5	Verify Bond Status on Reconnection	HRP/COL/HRF/BV-08-C
HRP 10/1	Discover Device Information Service	HRP/COL/CGGIT/SER/BV-02-C
HRP 10/2	Manufacturer String characteristic	HRP/COL/HRD/BV-09-C HRP/COL/HRD/BV-10-C

Table 5.1: Test case mapping

6 Revision history and acknowledgments

Revision History

Publication Number	Revision Number	Date	Comments
0	1.0.0	2011-07-12	Adopted by Bluetooth SIG Board of Directors
	1.0.1r1	2013-05-05	TSE 5153: Change all the GATT Client Discovery test case references from -I to –C: TP/HRD/CO/BV-01-I, TP/HRD/CO/BV-02-I, TP/HRD/CO/BV-04-I, TP/HRD/CO/BV-05-I, TP/HRD/CO/BV-07-I, TP/HRD/CO/BV-08-I, TP/HRD/CO/BV-09-I
1	1.0.1	2013-07-02	Prepare for Publication
	1.0.2r01	2013-09-13	TSE 5296: Updated first sentence of test procedure of TP/HRD/CO/BV-10-I to add, "and a disconnection may occur between the two tests" for clarification.
2	1.0.2	2013-12-03	Prepare for Publication
	1.0.3r00	2016-05-21	Converted to new Test Case ID conventions as defined in TSTO v4.1.
3	1.0.3	2016-07-14	Prepared for TCRL 2016-1 publication.
	1.0.4r00	2017-08-23	TSE 9597 (rating 2): For TCMT test case HRP/SEN/HRD/BV-03-I, changed HRP 5/4 to HRP 1/1 AND GATT 1a/4. Updated template. Corrected TC Identification Conventions section.
4	1.0.4	2018-11-21	Approved by BTI. Prepared for TCRL 2018-2 publication.
	p5r00–r01	2023-04-20 – 2023-05-01	TSE 22822 (rating 2): Added new test database requirements section. Added GGIT to the test groups listed. Updated the TCID convention table. Converted the following test cases to GGIT: HRP/COL/HRD/BV-01-I, -02-I, -04-I, -05-I, -07-I, and -08-I; HRP/SEN/HRD/BV-03-I; and HRP/COL/HRF/BV-06-I. The 6 new GGIT converted TCIDs are HRP/COL/CGGIT/SER/BV-01-C and -02-C, HRP/COL/CGGIT/CHA/BV-01-C – -03-C, HRP/SEN/SGGIT/SDPNF/BV-01-C. Updated the TCMT accordingly. Updated the initial condition and test procedure for HRP/COL/HRD/BV-09-I and HRP/COL/HRF/BV-03-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. Changed section titles for single test cases to Heading 8 or 9 per the TS template. Replaced the Bluetooth logo in the footer and updated the copyright page to align with v2 of the DNMD. Added a Publication Number column to the Revision History. Revised the document numbering convention, setting the last release publication of 1.0.4 as p4.

Publication Number	Revision Number	Date	Comments
5	p5	2023-06-29	Approved by BTI on 2023-05-28. Prepared for TCRL 2023-1 publication.
	p6r00	2023-10-30	TSE 23274 (rating 1): Converted -I tests to -C tests as appropriate; updated the TCMT and TCRL accordingly.
6	p6	2024-07-01	Approved by BTI on 2024-04-21. Prepared for TCRL 2024-1 publication.
	p7r00	2025-12-16	TSE 28315 (rating 2): Updated the initial condition and pass verdict for HRP/COL/HRD/BV-09-C and -10-C. Updated the references.
7	p7	2026-02-17	Approved by BTI on 2026-01-21. Prepared for TCRL pkg102 publication.