Heart Rate Service (HRS)

Bluetooth® Test Suite

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- **Group Prepared By**: Medical Devices Working Group
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1 Scope

This Bluetooth document contains the Test Suite Structure (TSS) and Test Cases (TC) to test the Bluetooth Heart Rate Service Specification.

The objective of this test suite is to provide a basis for interoperability for Bluetooth devices giving a high probability of air interface interoperability between different manufacturers' Bluetooth devices.
## 2 References, Definitions, and Abbreviations

### 2.1 References

This *Bluetooth* document incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter.

[1] Test Strategy and Terminology Overview

[2] Bluetooth Core Specification, v4.0 or later

[3] Heart Rate Service Specification v1.0

[4] ICS Proforma for Heart Rate Service, HRS.ICS

[5] GATT Test Suite, GATT.TS

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

### 2.2 Definitions

For the purpose of this Bluetooth document, the definitions in [1] and [2] apply.

### 2.3 Abbreviations

For the purpose of this Bluetooth document, the abbreviations in [1] and [2] apply.
3 Test Suite Structure (TSS)

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

![Heart Rate Service Test Model](image)

3.2 Test Strategy
The test objectives are to verify functionality of the Heart Rate Service within a Bluetooth Host and enable interoperability between Bluetooth Hosts on different devices. The testing approach is to cover mandatory and optional requirements in the service specification and to match these to the support of the IUT as described in the ICS Proforma [4].

The test equipment shall provide an implementation of the Radio Controller and the parts of the Host needed to perform the test cases defined in the Heart Rate Service Test Suite. 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, an MMI, or another interface supported by the IUT.

The Heart Rate 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 Cases.

The test suite structure is a tree with the first level representing the protocol groups as listed in Section 3.3.
3.3 Test Groups

The following test groups have been defined:

3.3.1 Service Definition
Verify the service definition.

3.3.2 Characteristic Declaration
Verify the presence and contents of characteristic declarations.

3.3.3 Characteristic Descriptors
Verify the presence and contents of characteristic descriptors.

3.3.4 Characteristic Read
Verify characteristics which support reading can be read. Verify the format and value of characteristic values.

3.3.5 Characteristic Write
Verify characteristics which support writing can be written.

3.3.6 Configure Notification
Verify characteristics can be configured for notification.

3.3.7 Characteristic Notification
Verify characteristics which support notification can be notified.
4 Test Cases (TC)

4.1 Introduction

4.1.1 TC Identification Conventions

Test cases shall be assigned unique identifiers per the conventions in [2]. The convention used here is <spec abbreviation>/<IUT role>/<class>/<feat>/<func>/<subfunc>/<cap>/<xx><nn>-<yy>. Bolded ID parts shall appear in the order prescribed. Non-bolded ID parts (if applicable) shall appear between the bolded parts. The order of the non-bolded parts may vary from test suite to test suite, but shall be consistent within each individual test suite.

<table>
<thead>
<tr>
<th>Identifier Abbreviation</th>
<th>Spec Identifier &lt;spec abbreviation&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRS</td>
<td>Heart Rate Service</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Identifier Abbreviation</th>
<th>Role Identifier &lt;IUT role&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEN</td>
<td>Sensor role</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Identifier Abbreviation</th>
<th>Feature Identifier &lt;feat&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>CN</td>
<td>Characteristic Notification</td>
</tr>
<tr>
<td>CON</td>
<td>Configure Notification</td>
</tr>
<tr>
<td>CR</td>
<td>Characteristic Read</td>
</tr>
<tr>
<td>CW</td>
<td>Characteristic Write</td>
</tr>
<tr>
<td>DEC</td>
<td>Characteristic Declaration</td>
</tr>
<tr>
<td>DES</td>
<td>Characteristic Descriptors</td>
</tr>
<tr>
<td>SD</td>
<td>Service Definition</td>
</tr>
</tbody>
</table>

*Table 4.1: Heart Rate Service TC Class Naming Convention*

4.1.2 Conformance

When conformance is claimed, all capabilities indicated as mandatory for this Specification shall be supported in the specified manner (process-mandatory). This also applies for all optional and conditional capabilities for which support is indicated. All mandatory capabilities, and optional and conditional capabilities for which support is indicated are subject to verification as part of the Bluetooth Qualification Program.

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 that is not excluded by the Specification, OR
- that capabilities enabled by the implementations are sustained over durations expected by the use case, OR
- that the implementation gracefully handles any quantity of data expected by the use case, OR
- that the implementation gracefully rejects any attempt to exercise capabilities which were declared as not supported. Graceful rejection means that the implementation demonstrates uninterrupted conformance to the specification immediately after rejecting such attempts without any need to be externally reset or adjusted, OR
- 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 OR
- that the implementation is immune to attempted security exploits

A single execution of each of the required tests is required in order to constitute a pass verdict. However, it is noted that in order 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 Generator, 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 errata request such that the issue may be addressed.

4.1.3 Pass/Fail Verdict Conventions

Each test case has an Expected Outcome section, which outlines all the detailed pass criteria conditions that shall be met by the IUT to merit a Pass Verdict.

The convention in this test suite is that, unless there are 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 shall be the Fail Verdict.

4.2 Setup Preambles

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

4.2.1 ATT Bearer on LE Transport

Follow the preamble procedure described in [5] Section 4.2.1.2 with the IUT operating in the Peripheral role.
4.3 Service Definition
Verify the service definition.

4.3.1 HRS/SEN/SD/BV-01-C [Service Definition]

- Test Purpose
  Verify the IUT has an instantiation of the Heart Rate Service as a primary service.

- Reference
  [3] 2

- Initial Condition
  Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1.

- Test Procedure
  1. Discover primary services by service UUID by executing the test procedure of GATT test case GATT/ST/GAD/BV-02-C, Discover Primary Services by Service UUID, in [5] with the service UUID set to «Heart Rate Service».
  2. Verify one attribute handle range is returned, containing the starting handle and the ending handle of the service definition.

- Expected Outcome
  Pass verdict
  One attribute handle range is returned, containing the starting handle and the ending handle of the service definition.

4.4 Characteristic Declaration

- Test Purpose
  This test group contains test cases to verify that the characteristic property field of the characteristic declaration meets the requirements of the service. The verification is performed one property at the time, as enumerated in the test cases in Table 4.2, using this generic test procedure.

- Reference
  [3] 3

- Initial Condition
  The handle range of the service has been previously discovered by the Lower Tester in test case HRS/SEN/SD/BV-01-C [Service Definition].

  Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1.
• Test Procedure

The following test procedure applies to the test cases listed in Table 4.2:

1. Discover all characteristics of the service by executing the test procedure of GATT test case GATT/SR/GAD/BV-04-C, Discover All Characteristics of a Service, in [5].
2. For a discovered characteristic that is listed in Table 4.2, verify the characteristic properties field of the characteristic declaration meets the requirements of the service.

• Expected Outcome

The following pass and fail verdicts apply to the test cases listed in Table 4.2.

Pass verdict

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

<table>
<thead>
<tr>
<th>Test Case</th>
<th>Property Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.4.1 HRS/SEN/DEC/BV-01-C [Characteristic Declaration - Heart Rate Measurement]</td>
<td>[3] Table 3.1</td>
</tr>
<tr>
<td>4.4.2 HRS/SEN/DEC/BV-02-C [Characteristic Declaration – Body Sensor Location]</td>
<td>[3] Table 3.1</td>
</tr>
<tr>
<td>4.4.3 HRS/SEN/DEC/BV-03-C [Characteristic Declaration – Heart Rate Control Point]</td>
<td>[3] Table 3.1</td>
</tr>
</tbody>
</table>

Table 4.2: Characteristic Declaration Test Cases

4.5 Characteristic Descriptors

• Test Purpose

This test group contains test cases to verify that the characteristic descriptors meet the requirements of the service. The verification is done one descriptor at the time, as enumerated in the test cases in Table 4.3, using this generic test procedure.

• Reference

[3] 3.1.2.1

• Initial Condition

The handle range of each characteristic referenced in the test cases below has been previously discovered by the Lower Tester during the test procedure in Section 4.4 or is known to the Tester by other means.

Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1.
• **Test Procedure**

The following test procedure applies to the test cases listed in Table 4.3:

1. For each characteristic referenced in a test case in Table 4.3:
2. Discover all characteristic descriptors of the characteristic by executing the test procedure of GATT test case GATT/SR/GAD/BV-06-C, Discover All Characteristic Descriptors, in [5] using the handle range of the characteristic. The IUT returns at least one handle-UUID pair.
3. If the UUID in a handle-UUID pair is for a characteristic descriptor referenced in a test case below, read the characteristic descriptor by executing the test procedure of GATT test case GATT/SR/GAR/BV-06-C, Read Characteristic Descriptors, in [5].
4. Verify the value of the characteristic descriptor meets the requirements of the service.

• **Expected Outcome**

The following pass and fail verdicts apply to the test cases listed in Table 4.3:

**Pass verdict**

The characteristic descriptor is discovered, the characteristic descriptor is read, and the value of the characteristic descriptor meets the requirements of the service.

<table>
<thead>
<tr>
<th>Test Case</th>
<th>Value Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.5.1 HRS/SEN/DES/BV-01-C [Heart Rate Measurement - Client Characteristic Configuration Descriptor]</td>
<td>[3] 3.1.2.1</td>
</tr>
</tbody>
</table>

*Table 4.3: Characteristic Descriptor Test Cases*

### 4.6 Characteristic Read

• **Test Purpose**

This test group contains test cases to read and verify that the characteristic values required by the service are compliant. The verification is done one value at a time, as enumerated in the test cases in Table 4.4, using this generic test procedure.

• **Reference**

[3] 3.2.1

• **Initial Condition**

The handle of each characteristic value referenced in the test cases below has been previously discovered by the Lower Tester during the test procedure in Section 4.4 or is known to the Lower Tester by other means.

If the IUT requires a bonding procedure then perform a bonding procedure.

Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1.
If IUT permissions for the characteristic require a specific security mode or security level, establish a connection meeting those requirements.

- **Test Procedure**

  The following test procedure applies to the test cases listed in **Table 4.4**:

  1. Read the characteristic value by executing the test procedure of GATT test case GATT/SR/GAR/BV-01-C, Read Characteristic Value, in [5].
  2. Verify the characteristic value meets the requirements of the service.
  3. Repeat steps 1-2 for each instance of the characteristic.

- **Expected Outcome**

  The following pass and fail verdicts apply to the test cases listed in **Table 4.4**:

  **Pass verdict**

  The characteristic is successfully read and the characteristic value meets the requirements of the service.

<table>
<thead>
<tr>
<th>Test Case</th>
<th>Value Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.6.1 HRS/SEN/CR/BV-01-C [Characteristic Read - Body Sensor Location]</td>
<td>[3] 3.2.1</td>
</tr>
</tbody>
</table>

*Table 4.4: Characteristic Read Value Test Cases*

### 4.7 Characteristic Write

This test group contains test cases to write and verify that the characteristic values required by the service are compliant.

#### 4.7.1 HRS/SEN/CW/BV-01-C [Characteristic Write – Heart Rate Control Point – Reset Energy Expended]

- **Test Purpose**

  Verify that the IUT responds appropriately when a Client writes the Heart Rate Control Point for Reset Energy Expended.

- **Reference**

  [3] 3.3.1

- **Initial Condition**

  If the IUT requires a bonding procedure then perform a bonding procedure.

  The Heart Rate Measurement characteristic is configured for notification.

  If desired, establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1.
If IUT permissions for the Heart Rate Measurement characteristic require a specific security mode or security level, establish a connection meeting those requirements.

- Test Procedure
  1. Perform an action on the IUT that will induce it to send notifications of the Heart Rate Measurement characteristic along with Energy Expended values as in HRS/SEN/CN/BV-02-C [Heart Rate Measurement Notifications – Energy Expended].
  2. After receiving a characteristic with the Energy Expended field present, note the value of this field.
  3. Write the Heart Rate Control Point characteristic value of 0x01 (Reset Energy Expended) by using the Characteristic Value Write test procedure in [5].
  4. After receiving another characteristic with the Energy Expended field present, confirm that the value in this field has been reset.

- Expected Outcome
  Pass verdict

  The Energy Expended field in the Heart Rate Measurement characteristic is successfully reset.

4.7.2 HRS/SEN/CW/BI-01-C [Characteristic Write — Heart Rate Control Point – Unsupported Control Point]

- Test Purpose
  Verify that the IUT responds appropriately when a Client writes an unsupported value into the Heart Rate Control Point.

- Reference
  [3] 3.3.1

- Initial Condition
  If the IUT requires a bonding procedure then perform a bonding procedure.
  
  If desired, establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1.
  
  If IUT permissions for the Heart Rate Measurement characteristic require a specific security mode or security level, establish a connection meeting those requirements.

- Test Procedure
  1. Write to the Heart Rate Control Point characteristic a value from the Reserved for Future Use range by using the Characteristic Value Write test procedure in [5].
  2. Verify the proper response of the IUT.

- Expected Outcome
  Pass verdict

  The IUT responds with Control Point Not Supported (0x80).
4.8 Configure Notification

• Test Purpose

This test group contains test cases to verify compliant operation in response to enable and disable characteristic notification. The verification is done one value at the time, as enumerated in the test cases in Table 4.5, using this generic test procedure.

• Reference

[3] 3.1.2

• Initial Condition

The handle of each characteristic value referenced in the test cases below has been previously discovered by the Lower Tester during the test procedure in Section 4.4 or is known to the Lower Tester by other means.

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

If the IUT requires a bonding procedure then perform a bonding procedure.

Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1.

If IUT permissions for the characteristic descriptor require a specific security mode or security level, establish a connection meeting those requirements.

• Test Procedure

The following test procedure applies to the test cases listed in Table 4.5:

1. Disable notification by writing value 0x0000 to the client characteristic configuration descriptor of the characteristic using the test procedure of GATT test case GATT/SR/GAW/BV-08-C, Write Characteristic Descriptors – from Server, in [5].

2. Enable notification by writing value 0x0001 to the client characteristic configuration descriptor of the characteristic.

• Expected Outcome

The following pass and fail verdicts apply to the test cases listed in Table 4.5:

Pass verdict

The characteristic descriptor is successfully written and the value returned when read is consistent with the value written.
Configure Notification Test Cases

<table>
<thead>
<tr>
<th>Test Case</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.8.1 HRS/SEN/CON/BV-01-C</td>
<td>[3] 3.1.2.1</td>
</tr>
<tr>
<td>[Configure Notification -</td>
<td></td>
</tr>
<tr>
<td>Heart Rate Measurement]</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.5: Configure Notification Test Cases

4.9 Characteristic Notification

4.9.1 HRS/SEN/CN/BV-01-C [Heart Rate Measurement Notifications]

- Test Purpose
  Verify the IUT can send notifications of the Heart Rate Measurement characteristic.

- Reference
  [3] 3.1

- Initial Condition
  If the IUT requires a bonding procedure then perform a bonding procedure.

  The Heart Rate Measurement characteristic is configured for notification.

  If desired, establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1.

  If IUT permissions for the Heart Rate Measurement characteristic require a specific security mode or security level, establish a connection meeting those requirements.

- Test Procedure
  1. Perform an action on the IUT that will induce it to send notifications of the Heart Rate Measurement characteristic.
  2. A connection is established between the Lower Tester and IUT meeting the security requirements of the IUT, if not already done so prior to step 1.
  3. The Lower Tester receives an ATT_Handle_Value_Notification from the IUT containing the Heart Rate Measurement characteristic handle and value.
  4. Verify the characteristic value meets the requirements of the service.
  5. Repeat steps 3-4 for each received notification until the IUT stops sending notifications.
  6. The Lower Tester configures the Heart Rate Measurement characteristic to disable notifications.
  7. Repeat steps 1-2 with notifications disabled.
  8. Verify the Lower Tester does not receive an ATT_Handle_Value_Notification from the IUT containing the Heart Rate Measurement characteristic.

- Expected Outcome
  Pass verdict

  The IUT sends one or more notifications of the Heart Rate Measurement characteristic with the appropriate flag set in the Flags field.
The value of the characteristic meets the requirements of the service.

The IUT stops sending notifications of the Heart Rate Measurement characteristic after the Lower Tester configures the characteristic to disable notifications.

4.9.2  HRS/SEN/CN/BV-02-C [Heart Rate Measurement Notifications – Energy Expended]

- Test Purpose
  Verify the IUT can send notifications of the Heart Rate Measurement characteristic that include Energy Expended values.

- Reference
  [3] 3.1

- Initial Condition
  If the IUT requires a bonding procedure then perform a bonding procedure.

  The Heart Rate Measurement characteristic is configured for notification.

  If desired, establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1.

  If IUT permissions for the Heart Rate Measurement characteristic require a specific security mode or security level, establish a connection meeting those requirements.

- Test Procedure
  1. Perform an action on the IUT that will induce it to send notifications of the Heart Rate Measurement characteristic along with Energy Expended values.
  2. A connection is established between the Lower Tester and IUT meeting the security requirements of the IUT, if not already done so prior to step 1.
  3. The Lower Tester receives an ATT_Handle_Value_Notification from the IUT containing the Heart Rate Measurement characteristic handle and value.
  4. Verify the characteristic value meets the requirements of the service.

- Expected Outcome
  Pass verdict

  The IUT sends one or more notifications of the Heart Rate Measurement characteristic that include the Energy Expended value with the appropriate flag set in the Flags field.

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

4.9.3  HRS/SEN/CN/BV-03-C [Heart Rate Measurement Notifications – RR-Interval]

- Test Purpose
  Verify the IUT can send notifications of the Heart Rate Measurement characteristic that include RR-Interval values.

- Reference
  [3] 3.1
• Initial Condition

If the IUT requires a bonding procedure then perform a bonding procedure.

The Heart Rate Measurement characteristic is configured for notification.

If desired, establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1.

If IUT permissions for the Heart Rate Measurement characteristic require a specific security mode or security level, establish a connection meeting those requirements.

• Test Procedure

1. Perform an action on the IUT that will induce it to send notifications of the Heart Rate Measurement characteristic along with RR-Interval values.
2. A connection is established between the Lower Tester and IUT meeting the security requirements of the IUT, if not already done so prior to step 1.
3. The Lower Tester receives an ATT_Handle_Value_Notification from the IUT containing the Heart Rate Measurement characteristic handle and value.
4. Verify the characteristic value meets the requirements of the service.

• Expected Outcome

Pass verdict

The IUT sends one or more notifications of the Heart Rate Measurement characteristic that include one or more the RR-Interval values with the appropriate flag set in the Flags field.

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

When more than one RR-Interval value is present in the characteristic, the values are arranged form oldest to newest as defined in the characteristic definition.

4.9.4 HRS/SEN/CN/BV-04-C [Heart Rate Measurement Notifications – 16-bit HR Value]

• Test Purpose

Verify the IUT can send notifications of the Heart Rate Measurement characteristic that are 16 bits in length.

• Reference

[3] 3.1

• Initial Condition

If the IUT requires a bonding procedure then perform a bonding procedure.

The Heart Rate Measurement characteristic is configured for notification.

If desired, establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1.

If IUT permissions for the Heart Rate Measurement characteristic require a specific security mode or security level, establish a connection meeting those requirements.
• Test Procedure
  1. Perform an action on the IUT that will induce it to send notifications of the Heart Rate Measurement characteristic along with 16-bit Heart Rate Measurement values.
  2. A connection is established between the Lower Tester and IUT meeting the security requirements of the IUT, if not already done so prior to step 1.
  3. The Lower Tester receives an ATT_Handle_Value_Notification from the IUT containing the Heart Rate Measurement characteristic handle and value.
  4. Verify the characteristic value meets the requirements of the service.

• Expected Outcome
  Pass verdict

  The IUT sends one or more notifications of the Heart Rate Measurement characteristic that include one or more 16-bit Heart Rate Measurement Values with the appropriate flag set in the Flags field.

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

4.9.5  HRS/SEN/CN/BV-05-C [Heart Rate Measurement Notifications – Sensor Contact]

• Test Purpose
  Verify the IUT can send notifications of the Heart Rate Measurement characteristic along with Sensor Contact feature information.

• Reference
  [3] 3.1

• Initial Condition
  If the IUT requires a bonding procedure then perform a bonding procedure.

  The Heart Rate Measurement characteristic is configured for notification.

  If desired, establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1.

  If IUT permissions for the Heart Rate Measurement characteristic require a specific security mode or security level, establish a connection meeting those requirements.

• Test Procedure
  1. Perform an action on the IUT that will induce it to send notifications of the Heart Rate Measurement characteristic along with Sensor Contact information in the Flags field.
  2. A connection is established between the Lower Tester and IUT meeting the security requirements of the IUT, if not already done so prior to step 1.
  3. The Lower Tester receives an ATT_Handle_Value_Notification from the IUT containing the Heart Rate Measurement characteristic handle and value.
  4. Perform an action on the IUT that will induce a change to the Sensor Contact bit (e.g. contact with sensor, no contact with sensor).
  5. Verify the characteristic value meets the requirements of the service.
• Expected Outcome
  Pass verdict

  The IUT sends notifications of the Heart Rate Measurement characteristic that include Sensor Contact information in the Flags field.

  Sensor Contact Support bit (bit 2 of the Flags field) is 1.

  As contact is detected and not detected, the Sensor Contact bit in the Flags field toggles appropriately: when no contact is detected, bit 1 of the flags field is 0 and when contact is detected, bit 1 of the flags field is 1.

  The value of the characteristic meets the requirements of the service.
5 Test Case Mapping

The Test Case Mapping Table (TCMT) maps test cases to specific capabilities in the ICS. Profiles, protocols and services may define multiple roles, and it is possible that a product may implement more than one role. The product shall be tested in all roles for which support is declared in the ICS document.

The columns for the TCMT are defined as follows:

**Item:** contains an y/x reference, where y corresponds to the table number and x corresponds to the feature number as defined in the ICS Proforma for Heart Rate Service (HRS) [4]. If the item is defined with Protocol, Profile or Service abbreviation before y/x, the table and feature number referenced are defined in the abbreviated ICS proforma document.

**Feature:** recommended to be the primary feature defined in the ICS being tested or may be the test case name.

**Test Case(s):** the applicable test case identifiers required for Bluetooth Qualification if the corresponding y/x references defined in the Item column are supported.

For purpose and structure of the ICS/IXIT proforma and instructions for completing the ICS/IXIT proforma refer to the Bluetooth ICS and IXIT proforma document.

<table>
<thead>
<tr>
<th>Item</th>
<th>Feature</th>
<th>Test case(s)</th>
</tr>
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<tbody>
<tr>
<td>HRS 2/1</td>
<td>Heart Rate Service</td>
<td>HRS/SEN/SD/BV-01-C</td>
</tr>
<tr>
<td>HRS 2/2</td>
<td>Heart Rate Measurement Characteristic</td>
<td>HRS/SEN/DEC/BV-01-C HRS/SEN/CON/BV-01-C HRS/SEN/DES/BV-01-C HRS/SEN/CN/BV-01-C</td>
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<tr>
<td>HRS 2/3</td>
<td>Support for Heart Rate Measurement Values in UINT16 format</td>
<td>HRS/SEN/CN/BV-04-C</td>
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<tr>
<td>HRS 2/4</td>
<td>Sensor Contact feature</td>
<td>HRS/SEN/CN/BV-05-C</td>
</tr>
<tr>
<td>HRS 2/5</td>
<td>Energy Expended feature</td>
<td>HRS/SEN/CN/BV-02-C</td>
</tr>
<tr>
<td>HRS 2/6</td>
<td>RR-Interval feature</td>
<td>HRS/SEN/CN/BV-03-C</td>
</tr>
<tr>
<td>HRS 2/7</td>
<td>Body Sensor Location Characteristic</td>
<td>HRS/SEN/DEC/BV-02-C HRS/SEN/CR/BV-01-C</td>
</tr>
<tr>
<td>HRS 2/8</td>
<td>Heart Rate Control Point Characteristic</td>
<td>HRS/SEN/DEC/BV-03-C HRS/SEN/CW/BV-01-C</td>
</tr>
<tr>
<td>HRS 2/9</td>
<td>Heart Rate Control Point Characteristic – Reset Energy Expended</td>
<td>HRS/SEN/CW/BV-01-C</td>
</tr>
</tbody>
</table>

*Table 5.1: Test Case Mapping*
# 6 Revision History and Contributors

## Revision History

<table>
<thead>
<tr>
<th>Revision History</th>
<th>Date</th>
<th>Comments</th>
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</thead>
<tbody>
<tr>
<td>D09R01</td>
<td>2011-02-07</td>
<td>Initial draft for review.</td>
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<tr>
<td>D09R02</td>
<td>2011-04-09</td>
<td>Updated for Cambridge IOP. Updated 4.5 and 4.7. Added additional test cases.</td>
</tr>
<tr>
<td>D09R03</td>
<td>2011-04-09</td>
<td>Updated during IOP. Accepted all changes. Added back TP/DES/BV-01-C</td>
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<tr>
<td>D09R04</td>
<td>2011-05-17</td>
<td>Incorporated latest relevant change form HTS.TS.</td>
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<tr>
<td>D09R05</td>
<td>2011-05-17</td>
<td>Accepted all changes. Prepared for BTI review.</td>
</tr>
<tr>
<td>D1.0.0r1</td>
<td>2011-06-01</td>
<td>Updated to draft 1.0. Changed names of Control Point and Sensor Location characteristics to be more specific to Heart Rate. Incorporated feedback from BTI.</td>
</tr>
<tr>
<td>D1.0.0r2</td>
<td>2011-06-24</td>
<td>Added pass criteria to TP/CN/BV-03-C. Changed name of HR Sensor Location to be more generic.</td>
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<tr>
<td>D1.0.0r3</td>
<td>2011-06-27</td>
<td>Accepted all changes. Submitted to BTI for approval.</td>
</tr>
<tr>
<td>1.0.0</td>
<td>2011-07-12</td>
<td>Adopted by Bluetooth SIG Board of Directors</td>
</tr>
<tr>
<td>1.0.1r00</td>
<td>2016-05-20</td>
<td>Converted to new Test Case ID conventions as defined in TSTO v4.1.</td>
</tr>
<tr>
<td>1.0.1r01</td>
<td>2016-06-01</td>
<td>Review by Miles Smith</td>
</tr>
<tr>
<td>1.0.1r02</td>
<td>2016-06-02</td>
<td>Review by Alicia Courtney</td>
</tr>
<tr>
<td>1.0.1</td>
<td>2016-07-14</td>
<td>Prepared for TCRL 2016-1 publication.</td>
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<tr>
<td>1.0.2r00</td>
<td>2016-08-18</td>
<td>TSE 7044: Bit 1 of the flags field changed from “0” to “1” for test case HRS/SEN/CN/BV-05-C.</td>
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<tr>
<td>1.0.2</td>
<td>2016-12-13</td>
<td>Approved by BTI. Prepared for TCRL 2016-2 publication.</td>
</tr>
<tr>
<td>1.0.2 edition 2r00</td>
<td>2018-11-29</td>
<td>Editorial changes only. Template updated. Revision History and contributors moved to the end of the document.</td>
</tr>
<tr>
<td>1.0.2 edition 2</td>
<td>2019-12-13</td>
<td>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.</td>
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</table>
## Contributors

<table>
<thead>
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<td>Guillaume Schatz</td>
<td>Polar</td>
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</tbody>
</table>