Body Composition Service (BCS)

Bluetooth® Test Suite

- **Revision**: BCS.TS.1.0.1 edition 2
- **Revision Date**: 2019-11-12
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1 Scope

This Bluetooth document contains the Test Suite Structure (TSS) and Test Cases (TC) to test the Bluetooth Body Composition 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. Additional definitions and abbreviations can be found in [1] and [2].

[1] Bluetooth Test Strategy and Terminology Overview
[2] Bluetooth Core Specification, Version 4.0 or later
[3] Body Composition Service Specification v1.0
[5] GATT Test Suite, GATT.TS
3  Test Suite Structure (TSS)

3.1  Overview

The Body Composition Service requires the presence of GAP, SM (LE), SDP (BR/EDR), and GATT. This is illustrated in Figure 3.1.

![Body Composition Service Test Model]

Figure 3.1: Body Composition Service Test Model

3.2  Test Strategy

The test objectives are to verify functionality of the Body Composition 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.

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 Body Composition 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 Upper Tester, or another interface supported by the IUT.

The 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.
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 Configure Indication

Verify characteristics can be configured for indication.

3.3.6 Characteristic Indication

Verify characteristics which support indication can be indicated.
4 Test Cases (TC)

4.1 Introduction

4.1.1 Test Case Identification Conventions

Test cases shall be 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>`.

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>BCS</td>
<td>Body Composition 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>SR</td>
<td>Server Role</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Identifier Abbreviation</th>
<th>Class Identifier &lt;class&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>CI</td>
<td>Characteristic Indication</td>
</tr>
<tr>
<td>CON</td>
<td>Configure Indications</td>
</tr>
<tr>
<td>CR</td>
<td>Characteristic Read</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: Body Composition 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 in cases where more than one valid interpretation of the Specification exist, 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 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 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.

4.2.2 ATT Bearer on BR/EDR Transport

Follow the preamble procedure described in [5] Section 4.2.1.1.

4.3 Service Definition

Verify the service definition.

4.3.1 BCS/SR/SD/BV-01-C [Service Definition over LE]

• Test Purpose

  Verify the IUT has an instantiation of the Body Composition Service as either a primary service or a secondary service. This test case only applies when using the LE transport.

• Reference

  [3] 2
• Initial Condition

Initial conditions are as specified in the GATT test cases referenced below.

• Test Procedure

1. The Lower Tester attempts to discover the service as a primary service by executing the test procedure included in GATT test case GATT/SR/GAD/BV-02-C [Discover Primary Services by Service UUID - from server] in [5] with value set to. «Body Composition Service», Starting Handle set to 0x0001 and Ending Handle set to 0xFFFF, until all Primary Services with a matching service UUID (if any) are found.

2. The Lower Tester attempts to discover the service as a secondary service by executing the test procedure included in GATT test case GATT/SR/GAD/BV-03-C [Find Included Services - from server] in [5] with Starting Handle set to 0x0001 and Ending Handle set to 0xFFFF, until all Include declarations containing the service UUID «Body Composition Service» in the response (if any) are found.

3. Verify that the Body Composition Service has been discovered in at least one of the above steps.

• Expected Outcome

Pass verdict

An attribute handle range is returned for the Body Composition Service either as a primary service or a secondary service, containing the starting handle and the ending handle of the instantiation of the Body Composition Service definition.

4.3.2 BCS/SR/SD/BV-02-C [SDP Record]

• Test Purpose

Verify the SDP Record for the Body Composition Service. This test case only applies when using the BR/EDR transport.

• Reference

[3] 2, 4

• Initial Condition

An ACL connection over BR/EDR is established between the Lower Tester and IUT.

• Test Procedure

1. The Lower Tester establishes an SDP connection to the IUT.

2. The Lower Tester sends SDP requests to retrieve all attributes of the SDP record for the Body Composition Service.

• Expected Outcome

Pass verdict

The SDP record for the service is found.
All attributes which are mandatory for the service are present in the SDP record.

The values of all attributes in the SDP record meet the requirements of the service.

The GATT Start Handle and GATT End Handle parameters in the SDP record match the start handle and end handle of the service.

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 a time, as enumerated in the test cases in Table 4.2 below, using this generic test procedure.

• Reference

[3]

• Initial Condition

The handle range of the service has been previously discovered by the Lower Tester in test case BCS/SR/SD/BV-01-C [Service Definition over LE] or BCS/SR/SD/BV-02-C [SDP Record].

Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1 if using an LE transport or Section 4.2.2 if using a BR/EDR transport.

• Test 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 - from server] in [4].

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.

Characteristic Declaration Test Cases

<table>
<thead>
<tr>
<th>Test Case</th>
<th>Characteristic Properties Value (Requirements)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.4.1 BCS/SR/DEC/BV-01-C [Characteristic Declaration – Body Composition Feature]</td>
<td>0x02 ([3] Table 3.1)</td>
</tr>
</tbody>
</table>
### 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

**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 Lower Tester by other means.

Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1 if using an LE transport or Section 4.2.2 if using a BR/EDR transport.

**Test Procedure**

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

1. 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 - from server] in [4] using the handle range of the characteristic. The IUT returns at least one handle-UUID pair.

2. 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 - from server server] in [4].

3. 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.
### Characteristic Descriptor Test Cases

<table>
<thead>
<tr>
<th>Test Case</th>
<th>Value (Requirements)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.5.1 BCS/SR/DES/BV-01-C [Body Composition Measurement - Client Characteristic Configuration Descriptor]</td>
<td>0x0000 or 0x0002 ([3] 3)</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] 3.1.1, 3.3.1

- **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 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 using an LE transport or Section 4.2.2 if using a BR/EDR transport.

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

- **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 - from Server] in [4].

   2. Verify the characteristic value meets the requirements of the service.

- **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.
### Characteristic Read Value Test Cases

<table>
<thead>
<tr>
<th>Test Case</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.6.1 BCS/SR/CR/BV-01-C [Characteristic Read – Body Composition Feature]</td>
<td>2 octets with RFU bits set to 0. ([3] 3.1.1)</td>
</tr>
</tbody>
</table>

*Table 4.4: Characteristic Read Value Test Cases*

### 4.7 Configure Indication

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

- **Reference**

  [3] 3.2

- **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 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 using an LE transport or Section 4.2.2 if using a BR/EDR transport.

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

- **Test Procedure**

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

  1. Disable indication 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 [4].

  2. Enable indication by writing value 0x0002 to the client characteristic configuration descriptor of the characteristic.

  3. The Lower Tester reads the value of the client characteristic configuration descriptor.

- **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 Indication Test Cases

<table>
<thead>
<tr>
<th>Test Case</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.7.1</td>
<td>0x0002 ([3] 3.2)</td>
</tr>
</tbody>
</table>

Table 4.5: Configure Indication Test Cases

4.8 Characteristic Indication

This test group contains test cases to verify compliant operation when the IUT sends indications of characteristic values.

4.8.1 BCS/SR/CI/BV-01-C [Body Composition Measurement Indications]

• Test Purpose

Verify the IUT can send an indication of the Body Composition Measurement characteristic that includes the mandatory fields (i.e., the Flags field and the Body Fat Percentage field).

• Reference

[3] 3.2

• Initial Condition

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

The Body Composition Measurement characteristic is configured for indication.

The Lower Tester has read and cached the value of the Body Composition Feature characteristic.

If desired, establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1 if using an LE transport or Section 4.2.2 if using a BR/EDR transport.

If IUT permissions for the Body Composition 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 an indication of the Body Composition Measurement characteristic along with the Flags field and the Body Fat Percentage field (i.e. the IUT advertises). The IUT and Lower Tester connect.

2. If the devices were not bonded, the Lower Tester configures the Body Composition Measurement characteristic for indication.
3. The Lower Tester receives one ATT_Handle_Value_Indication from the IUT containing the Body Composition Measurement characteristic handle and value along with the Flags field and the Body Fat Percentage field.

4. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.

5. Verify the characteristic value meets the requirements of the service.

6. The Lower Tester configures the Body Composition Measurement characteristic to disable indications.

7. Perform an action on the IUT that will generate a new Body Composition Measurement.

8. Verify the Lower Tester does not receive an ATT_Handle_Value_Indication from the IUT containing the Body Composition Measurement characteristic.

• Expected Outcome

Pass verdict

The IUT sends one indication of the Body Composition Measurement characteristic and it includes at least the Flags field and the Body Fat Percentage field.

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

The IUT stops sending indications of the Body Composition Measurement characteristic after the Lower Tester configures the characteristic to disable indications.

The RFU bits of the Flags field are set to zero.

4.8.2 BCS/SR/CI/BV-02-C [Body Composition Measurement Indications – Time Stamp]

• Test Purpose

Verify the IUT can send an indication of the Body Composition Measurement characteristic that includes the Time Stamp field.

• Reference

[3] 3.2.1.3

• Initial Condition

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

The Body Composition Measurement characteristic is configured for indication.

The Lower Tester has read and cached the value of the Body Composition Feature characteristic.

If desired, establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1 if using an LE transport or Section 4.2.2 if using a BR/EDR transport.

If IUT permissions for the Body Composition 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 an indication of the Body Composition Measurement characteristic along with the Time Stamp field (i.e. the IUT advertises). The IUT and Lower Tester connect.

2. If the devices were not bonded, the Lower Tester configures the Body Composition Measurement characteristic for indication.

3. The Lower Tester receives one ATT_Handle_Value_Indication from the IUT containing the Body Composition Measurement characteristic handle and value along with the Time Stamp field.

4. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.

5. Verify the characteristic value meets the requirements of the service.

Expected Outcome

Pass verdict

The IUT sends one indication of the Body Composition Measurement characteristic and it includes the Time Stamp field with the appropriate flag set in the Flags field.

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

The value of the Time Stamp Supported bit of the cached Body Composition Feature characteristic is set to 1.

The RFU bits of the Flags field are set to zero.

4.8.3 BCS/SEN/CI/BV-03-C [Body Composition Measurement Indications – User ID]

Test Purpose

Verify the IUT can send an indication of the Body Composition Measurement characteristic that includes the User ID field.

Reference

[3] 3.2.1.4

Initial Condition

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

The Body Composition Measurement characteristic is configured for indication.

The Lower Tester has read and cached the value of the Body Composition Feature characteristic.

If desired, establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1 if using an LE transport or Section 4.2.2 if using a BR/EDR transport.

The IUT has previously been configured for at least two users and Lower Tester has been assigned only one User ID at initial connection with the IUT.
If IUT permissions for the Body Composition 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 an indication of the Body Composition Measurement characteristic along with the User ID field (i.e. the IUT advertises). The IUT and Lower Tester connect.
2. If the devices were not bonded, the Lower Tester configures the Body Composition Measurement characteristic for indication.
3. The Lower Tester receives one ATT_Handle_Value_Indication from the IUT containing the Body Composition Measurement characteristic handle and value along with the User ID field and appropriate User ID value.
4. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.
5. Verify the characteristic value meets the requirements of the service.
6. Perform an action on the IUT that will induce it to send an indication of the Body Composition Measurement characteristic that is not designated for the user assigned to the Lower Tester (i.e. the IUT advertises).

• Expected Outcome

Pass verdict

The IUT sends one indication of the Body Composition Measurement characteristic and it includes the User ID field with the appropriate flag set in the Flags field.

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

The value of the User ID field is consistent with the value assigned to the Lower Tester at initial configuration.

The Lower Tester does not receive the second measurement for the user to which it is not associated.

The value of the Multiple Users Supported bit of the cached Body Composition Feature characteristic is set to 1.

The RFU bits of the Flags field are set to zero.

4.8.4 BCS/SR/CI/BV-04-C [Body Composition Measurement Indications – Basal Metabolism]

• Test Purpose

Verify the IUT can send an indication of the Body Composition Measurement characteristic that includes the Basal Metabolism fields.

• Reference

[3] 3.2.1.5
• Initial Condition

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

The Body Composition Measurement characteristic is configured for indication.

The Lower Tester has read and cached the value of the Body Composition Feature characteristic.

If desired, establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1 if using an LE transport or Section 4.2.2 if using a BR/EDR transport.

If IUT permissions for the Body Composition 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 an indication of the Body Composition Measurement characteristic along with the Basal Metabolism field (i.e. the IUT advertises). The IUT and Lower Tester connect.

2. If the devices were not bonded, the Lower Tester configures the Body Composition Measurement characteristic for indication.

3. The Lower Tester receives one ATT_Handle_Value_Indication from the IUT containing the Body Composition Measurement characteristic handle and value along with the Basal Metabolism field.

4. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.

5. Verify the characteristic value meets the requirements of the service.

• Expected Outcome

Pass verdict

The IUT sends an indication of the Body Composition Measurement characteristic that includes the Basal Metabolism field with the appropriate flag set in the Flags field. This field may be in the first indication or in a continuation packet in a second indication.

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

The value of the Basal Metabolism Supported bit of the cached Body Composition Feature characteristic is set to 1.

The RFU bits of the Flags field are set to zero.

4.8.5 BCS/SR/CI/BV-05-C [Body Composition Measurement Indications – Muscle Percentage]

• Test Purpose

Verify the IUT can send an indication of the Body Composition Measurement characteristic that includes the Muscle Percentage field.

• Reference

[3] 3.2.1.6
• Initial Condition

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

The Body Composition Measurement characteristic is configured for indication.

The Lower Tester has read and cached the value of the Body Composition Feature characteristic.

If desired, establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1 if using an LE transport or Section 4.2.2 if using a BR/EDR transport.

If IUT permissions for the Body Composition 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 an indication of the Body Composition Measurement characteristic along with the Muscle Percentage field (i.e. the IUT advertises). The IUT and Lower Tester connect.

2. If the devices were not bonded, the Lower Tester configures the Body Composition Measurement characteristic for indication.

3. The Lower Tester receives one ATT_Handle_Value_Indication from the IUT containing the Body Composition Measurement characteristic handle and value along with the Muscle Percentage field.

4. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.

5. Verify the characteristic value meets the requirements of the service.

• Expected Outcome

Pass verdict

The IUT sends an indication of the Body Composition Measurement characteristic that includes the Muscle Percentage field with the appropriate flag set in the Flags field. This field may be in the first indication or in a continuation packet in a second indication.

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

The value of the Muscle Percentage Supported bit of the cached Body Composition Feature characteristic is set to 1.

The RFU bits of the Flags field are set to zero.

4.8.6 BCS/SR/CI/BV-06-C [Body Composition Measurement Indications – Muscle Mass]

• Test Purpose

Verify the IUT can send an indication of the Body Composition Measurement characteristic that includes the Muscle Mass field.

• Reference

[3] 3.2.1.7
• Initial Condition

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

The Body Composition Measurement characteristic is configured for indication.

The Lower Tester has read and cached the value of the Body Composition Feature characteristic.

If desired, establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1 if using an LE transport or Section 4.2.2 if using a BR/EDR transport.

If IUT permissions for the Body Composition 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 an indication of the Body Composition Measurement characteristic along with the Muscle Mass field (i.e. the IUT advertises). The IUT and Lower Tester connect.

2. If the devices were not bonded, the Lower Tester configures the Body Composition Measurement characteristic for indication.

3. The Lower Tester receives one ATT_Handle_Value_Indication from the IUT containing the Body Composition Measurement characteristic handle and value along with the Muscle Mass field.

4. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.

5. Verify the characteristic value meets the requirements of the service.

• Expected Outcome

Pass verdict

The IUT sends an indication of the Body Composition Measurement characteristic that includes the Muscle Mass field with the appropriate flag set in the Flags field. This field may be in the first indication or in a continuation packet in a second indication.

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

The value of the Muscle Mass Supported bit of the cached Body Composition Feature characteristic is set to 1.

The RFU bits of the Flags field are set to zero.

4.8.7 BCS/SR/CI/BV-07-C [Body Composition Measurement Indications – Fat Free Mass]

• Test Purpose

Verify the IUT can send an indication of the Body Composition Measurement characteristic that includes the Fat Free Mass field.

• Reference

[3] 3.2.1.8
• Initial Condition

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

The Body Composition Measurement characteristic is configured for indication.

The Lower Tester has read and cached the value of the Body Composition Feature characteristic.

If desired, establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1 if using an LE transport or Section 4.2.2 if using a BR/EDR transport.

If IUT permissions for the Body Composition 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 an indication of the Body Composition Measurement characteristic along with the Fat Free Mass field (i.e. the IUT advertises). The IUT and Lower Tester connect.

2. If the devices were not bonded, the Lower Tester configures the Body Composition Measurement characteristic for indication.

3. The Lower Tester receives one ATT_Handle_Value_Indication from the IUT containing the Body Composition Measurement characteristic handle and value along with the Fat Free Mass field.

4. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.

5. Verify the characteristic value meets the requirements of the service.

• Expected Outcome

Pass verdict

The IUT sends an indication of the Body Composition Measurement characteristic that includes the Fat Free Mass field with the appropriate flag set in the Flags field. This field may be in the first indication or in a continuation packet in a second indication.

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

The value of the Fat Free Mass Supported bit of the cached Body Composition Feature characteristic is set to 1.

The RFU bits of the Flags field are set to zero.

4.8.8 BCS/SR/CI/BV-08-C [Body Composition Measurement Indications – Soft Lean Mass]

• Test Purpose

Verify the IUT can send an indication of the Body Composition Measurement characteristic that includes the Soft Lean Mass field.

• Reference

[3] 3.2.1.9
• **Initial Condition**

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

The Body Composition Measurement characteristic is configured for indication.

The Lower Tester has read and cached the value of the Body Composition Feature characteristic.

If desired, establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1 if using an LE transport or Section 4.2.2 if using a BR/EDR transport.

If IUT permissions for the Body Composition 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 an indication of the Body Composition Measurement characteristic along with the Soft Lean Mass field (i.e. the IUT advertises). The IUT and Lower Tester connect.

2. If the devices were not bonded, the Lower Tester configures the Body Composition Measurement characteristic for indication.

3. The Lower Tester receives one ATT_Handle_Value_Indication from the IUT containing the Body Composition Measurement characteristic handle and value along with the Soft Lean Mass field.

4. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.

5. Verify the characteristic value meets the requirements of the service.

• **Expected Outcome**

  **Pass verdict**

The IUT sends an indication of the Body Composition Measurement characteristic that includes the Soft Lean Mass field with the appropriate flag set in the Flags field. This field may be in the first indication or in a continuation packet in a second indication.

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

The value of the Soft Lean Mass Supported bit of the cached Body Composition Feature characteristic is set to 1.

The RFU bits of the Flags field are set to zero.

4.8.9  BCS/SR/CI/BV-09-C [Body Composition Measurement Indications – Body Water Mass]

• **Test Purpose**

Verify the IUT can send an indication of the Body Composition Measurement characteristic that includes the Body Water Mass field.

• **Reference**

[3] 3.2.1.10
• Initial Condition

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

The Body Composition Measurement characteristic is configured for indication.

The Lower Tester has read and cached the value of the Body Composition Feature characteristic.

If desired, establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1 if using an LE transport or Section 4.2.2 if using a BR/EDR transport.

If IUT permissions for the Body Composition 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 an indication of the Body Composition Measurement characteristic along with the Body Water Mass field (i.e. the IUT advertises). The IUT and Lower Tester connect.

2. If the devices were not bonded, the Lower Tester configures the Body Composition Measurement characteristic for indication.

3. The Lower Tester receives one ATT_Handle_Value_Indication from the IUT containing the Body Composition Measurement characteristic handle and value along with the Body Water Mass field.

4. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.

5. Verify the characteristic value meets the requirements of the service.

• Expected Outcome

Pass verdict

The IUT sends an indication of the Body Composition Measurement characteristic that includes the Body Water Mass field with the appropriate flag set in the Flags field. This field may be in the first indication or in a continuation packet in a second indication.

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

The value of the Body Water Mass Supported bit of the cached Body Composition Feature characteristic is set to 1.

The RFU bits of the Flags field are set to zero.

4.8.10 BCS/SR/CI/BV-10-C [Body Composition Measurement Indications – Impedance]

• Test Purpose

Verify the IUT can send an indication of the Body Composition Measurement characteristic that includes the Impedance field.

• Reference

[3] 3.2.1.11
• Initial Condition

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

The Body Composition Measurement characteristic is configured for indication.

The Lower Tester has read and cached the value of the Body Composition Feature characteristic.

If desired, establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1 if using an LE transport or Section 4.2.2 if using a BR/EDR transport.

If IUT permissions for the Body Composition 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 an indication of the Body Composition Measurement characteristic along with the Impedance field (i.e. the IUT advertises). The IUT and Lower Tester connect.

2. If the devices were not bonded, the Lower Tester configures the Body Composition Measurement characteristic for indication.

3. The Lower Tester receives one ATT_Handle_Value_Indication from the IUT containing the Body Composition Measurement characteristic handle and value along with the Impedance field.

4. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.

5. Verify the characteristic value meets the requirements of the service.

• Expected Outcome

Pass verdict

The IUT sends an indication of the Body Composition Measurement characteristic that includes the Impedance field with the appropriate flag set in the Flags field. This field may be in the first indication or in a continuation packet in a second indication.

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

The value of the Impedance Supported bit of the cached Body Composition Feature characteristic is set to 1.

The RFU bits of the Flags field are set to zero.

4.8.11 BCS/SR/CI/BV-11-C [Body Composition Measurement Indications – Weight]

• Test Purpose

Verify the IUT can send an indication of the Body Composition Measurement characteristic that includes the Weight field.

• Reference

[3] 3.2.1.12
• Initial Condition

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

The Body Composition Measurement characteristic is configured for indication.

The Lower Tester has read and cached the value of the Body Composition Feature characteristic.

If desired, establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1 if using an LE transport or Section 4.2.2 if using a BR/EDR transport.

If IUT permissions for the Body Composition 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 an indication of the Body Composition Measurement characteristic along with the Weight field (i.e. the IUT advertises). The IUT and Lower Tester connect.

2. If the devices were not bonded, the Lower Tester configures the Body Composition Measurement characteristic for indication.

3. The Lower Tester receives one ATT_Handle_Value_Indication from the IUT containing the Body Composition Measurement characteristic handle and value along with the Weight field.

4. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.

5. Verify the characteristic value meets the requirements of the service.

• Expected Outcome

Pass verdict

The IUT sends an indication of the Body Composition Measurement characteristic that includes the Weight field with the appropriate flag set in the Flags field. This field may be in the first indication or in a continuation packet in a second indication.

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

The value of the Weight Supported bit of the cached Body Composition Feature characteristic is set to 1.

The RFU bits of the Flags field are set to zero.

4.8.12 BCS/SR/CI/BV-12-C [Body Composition Measurement Indications – Height]

• Test Purpose

Verify the IUT can send an indication of the Body Composition Measurement characteristic that includes the Height field.

• Reference

[3] 3.2.1.13
• **Initial Condition**

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

The Body Composition Measurement characteristic is configured for indication.

The Lower Tester has read and cached the value of the Body Composition Feature characteristic.

If desired, establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1 if using an LE transport or Section 4.2.2 if using a BR/EDR transport.

If IUT permissions for the Body Composition 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 an indication of the Body Composition Measurement characteristic along with the Height field (i.e. the IUT advertises). The IUT and Lower Tester connect.
2. If the devices were not bonded, the Lower Tester configures the Body Composition Measurement characteristic for indication.
3. The Lower Tester receives one ATT_Handle_Value_Indication from the IUT containing the Body Composition Measurement characteristic handle and value along with the Height field.
4. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.
5. Verify the characteristic value meets the requirements of the service.

• **Expected Outcome**

**Pass verdict**

The IUT sends an indication of the Body Composition Measurement characteristic that includes the Height field with the appropriate flag set in the Flags field. This field may be in the first indication or in a continuation packet in a second indication.

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

The value of the Height Supported bit of the cached Body Composition Feature characteristic is set to 1.

The RFU bits of the Flags field are set to zero.

4.8.13 **BCS/SR/CI/BV-13-C [Stored Body Composition Measurements – Single User]**

• **Test Purpose**

Verify the single-user IUT can send multiple indications of stored Body Composition Measurement characteristics that include the Time Stamp field.

• **Reference**

[3] 3.2.1.3
• **Initial Condition**

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

The Body Composition Measurement characteristic is configured for indication.

The Lower Tester has read and cached the value of the Body Composition Feature characteristic.

If desired, establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1 if using an LE transport or Section 4.2.2 if using a BR/EDR transport.

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

If a connection exists, it should be disconnected.

• **Test Procedure**

1. Perform an action on the IUT that will induce it to store several (e.g. 5 or more) Body Composition Measurements.

2. Perform an action on the IUT that will induce it to send stored measurements (i.e. the IUT advertises). The IUT and Lower Tester connect.

3. If the devices were not bonded, the Lower Tester configures the Body Composition Measurement characteristic for indication.

4. The Lower Tester receives one ATT_Handle_Value_Indication from the IUT containing the Body Composition Measurement characteristic handle and value along with the Time Stamp field.

5. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.

6. Repeat steps 4-5 until all stored measurements are received (the IUT may terminate the connection upon completion).

7. Verify the characteristic value in each indication contains the time stamp field.

8. Verify the indications are received in order according to the time stamp with the oldest measurement received first.

• **Expected Outcome**

**Pass verdict**

The IUT sends several indications of the Body Composition Measurement characteristic

Each characteristic includes the Time Stamp field with the appropriate flag set in the Flags field. If continuation packets are received, these do not include the Time Stamp field.

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

The value of the Time Stamp Supported bit of the cached Body Composition Feature characteristic is set to 1.

The RFU bits of the Flags field are set to zero.
The indications are received with the oldest data being sent first followed by the next oldest data (in FIFO order) until all stored data has been transferred.

4.8.14 BCS/SR/CI/BV-14-C [Stored Body Composition Measurements – Multiple Users]

- Test Purpose
  Verify the multi-user IUT can send multiple indications of stored Body Composition Measurement characteristics that include the Time Stamp field and User ID field to the designated Lower Tester.

- Reference
  [3] 3.2.1.3, 3.2.1.4

- Initial Condition
  If the IUT requires a bonding procedure then perform a bonding procedure.
  The Body Composition Measurement characteristic is configured for indication.
  The Lower Tester has read and cached the value of the Body Composition Feature characteristic.
  If desired, establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1 if using an LE transport or Section 4.2.2 if using a BR/EDR transport.
  The IUT has previously been configured for at least two users and Lower Tester has been assigned only one User ID at initial connection with the IUT.
  If IUT permissions for the Body Composition Measurement characteristic require a specific security mode or security level, establish a connection meeting those requirements.
  If a connection exists, it should be disconnected.

- Test Procedure
  1. Perform an action on the IUT that will induce it to store several (e.g. 5 or more) Body Composition Measurements for the user assigned to the Lower Tester and also several (e.g. 5 or more) Body Composition Measurements for one or more users not assigned to the Lower Tester.
  2. Perform an action on the IUT that will induce it to send stored measurements (i.e. the IUT advertises). The IUT and Lower Tester connect.
  3. If the devices were not bonded, the Lower Tester configures the Body Composition Measurement characteristic for indication.
  4. The Lower Tester receives one ATT_Handle_Value_Indication from the IUT containing the Body Composition Measurement characteristic handle and value along with the Time Stamp field and appropriate User ID value.
  5. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.
  6. Repeat steps 4-5 until all stored measurements are received (the IUT may terminate the connection upon completion).
  7. Verify the characteristic value in each indication contains the time stamp field.
8. Verify the indications are received in order according to the time stamp with the oldest measurement received first.

• Expected Outcome

  Pass verdict

The IUT sends several indications of the Body Composition Measurement characteristic

Each characteristic includes the Time Stamp field and User ID field with the appropriate flag set in the Flags field. If continuation packets are received, these do not include the Time Stamp field or User ID field.

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

The value of the Time Stamp Supported bit of the cached Body Composition Feature characteristic is set to 1.

The value of the Multiple Users Supported bit of the cached Body Composition Feature characteristic is set to 1.

The value of the User ID field is consistent with the value assigned to the Lower Tester at initial configuration.

The Lower Tester does not receive any measurements for users to which it is not associated.

The RFU bits of the Flags field are set to zero.

The indications are received with the oldest data being sent first followed by the next oldest data (in FIFO order) until all stored data has been transferred.

4.8.15 BCS/SR/CI/BV-15-C [Body Composition Measurement Indications – Continuation Packet]

• Test Purpose

  Verify the IUT using LE and a default ATT_MTU can send an indication of the Body Composition Measurement characteristic that includes the mandatory fields (i.e. the Flags field and the Body Fat Percentage field), additional fields, followed by a second indication (continuation packet).

• Reference

  [3] 3.2.1

• Initial Condition

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

  The Body Composition Measurement characteristic is configured for indication.

  The Lower Tester has read and cached the value of the Body Composition Feature characteristic.

  If desired, establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1 if using an LE transport or Section 4.2.2 if using a BR/EDR transport.
If IUT permissions for the Body Composition 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 an indication of the Body Composition Measurement characteristic along with the Flags field and the Body Fat Percentage field and more optional fields than can fit in a default ATT_MTU (i.e. the IUT advertises). The IUT and Lower Tester connect.
  2. If the devices were not bonded, the Lower Tester configures the Body Composition Measurement characteristic for indication.
  3. The Lower Tester receives one ATT_Handle_Value_Indication from the IUT containing the Body Composition Measurement characteristic handle and value along with the Flags field and the Body Fat Percentage field.
  4. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.
  5. Repeat steps 3 and 4 once to get a second indication (the continuation packet).
  6. Verify the characteristic value meets the requirements of the service.

- **Expected Outcome**
  **Pass verdict**

  The IUT sends two indications of the Body Composition Measurement characteristic.

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

  For each indication, the Multiple Packet Measurement bit of the Flags field is set to 1.

  The Flags field and the Body Fat Percentage field are present in both indications.

  If a Time Stamp was present in the first indication, it is not present in the continuation packet.

  If a User ID was present in the first indication, it is not present in the continuation packet.

  The RFU bits of the Flags field are set to zero.
# 5 Test Case Mapping

The Test Case Mapping Table (TCMT) maps test cases to specific capabilities in the ICS.

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 Body Composition Service (BCS) [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.

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<tr>
<th>Item</th>
<th>Feature</th>
<th>Test Case(s)</th>
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<tbody>
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<td>BCS 2/2 AND BCS 0/1</td>
<td>Body Composition Service – Service Definition over LE</td>
<td>BCS/SR/SD/BV-01-C</td>
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<tr>
<td>BCS 2/1 AND BCS 0/1</td>
<td>Body Composition Service – SDP Record</td>
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</tr>
<tr>
<td>BCS 4/1</td>
<td>Body Composition Feature Characteristic</td>
<td>BCS/SR/DEC/BV-01-C, BCS/SR/CR/BV-01-C</td>
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<td>Time Stamp field of the Body Composition Measurement Characteristic</td>
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</tr>
<tr>
<td>BCS 4/4</td>
<td>User ID field of the Body Composition Measurement Characteristic</td>
<td>BCS/SR/CI/BV-03-C</td>
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<tr>
<td>BCS 3/1 AND BCS 3/2</td>
<td>Stored Body Composition Measurement Characteristics – Multiple Users</td>
<td>BCS/SR/CI/BV-14-C</td>
</tr>
<tr>
<td>Item</td>
<td>Feature</td>
<td>Test Case(s)</td>
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<td>--------------</td>
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<td>Muscle Percentage field of the Body Composition Measurement Characteristic</td>
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<td>BCS 4/7</td>
<td>Muscle Mass field of the Body Composition Measurement Characteristic</td>
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<td>BCS 4/8</td>
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<td>BCS 4/9</td>
<td>Soft Lean Mass field of the Body Composition Measurement Characteristic</td>
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<td>BCS 4/10</td>
<td>Body Water Mass field of the Body Composition Measurement Characteristic</td>
<td>BCS/SR/CI/BV-09-C</td>
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<td>BCS 4/11</td>
<td>Impedance field of the Body Composition Measurement Characteristic</td>
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<td>Height field of the Body Composition Measurement Characteristic</td>
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<td>Multiple Packet Measurement Supported</td>
<td>BCS/SR/CI/BV-15-C</td>
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*Table 5.1: Test Case Mapping*
# 6 Revision History and Contributors

## Revision History

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<tr>
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<th>Comments</th>
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<tr>
<td>1.0.0</td>
<td>2014-10-21</td>
<td>Publication</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>
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<tr>
<td>1.0.1r01</td>
<td>2016-06-18</td>
<td>Converted to current test specification template</td>
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<tr>
<td>1.0.1</td>
<td>2016-07-13</td>
<td>Prepared for TCRL 2016-1 publication.</td>
</tr>
<tr>
<td>1.0.1 edition2r00</td>
<td>2018-11-29</td>
<td>Editorial changes only. Template updated. Revision History and Contributors to the end of the document.</td>
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<tr>
<td>1.0.1 edition 2</td>
<td>2018-11-12</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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## Contributors

<table>
<thead>
<tr>
<th>Name</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laurence Richardson</td>
<td>Cambridge Silicon Radio</td>
</tr>
<tr>
<td>Robert D. Hughes</td>
<td>Intel</td>
</tr>
</tbody>
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