Body Composition Service (BCS)

***Bluetooth*® Test Suite**

- **Revision:** BCS.TS.p3
- **Revision Date:** 2024-07-01
- **Prepared By:** BTI
- **Published during TCRL:** TCRL.2024-1

Contents

1 Scope

This Bluetooth document contains the Test Suite Structure (TSS) and test cases to test the implementation of the Bluetooth Body Composition Service 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] Body Composition Service Specification, Version 1.0

[4] ICS Proforma for Body Composition Service, BCS.ICS

[5] GATT Test Suite, GATT.TS

[6] Body Composition Service Specification, Version 1.0.1

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

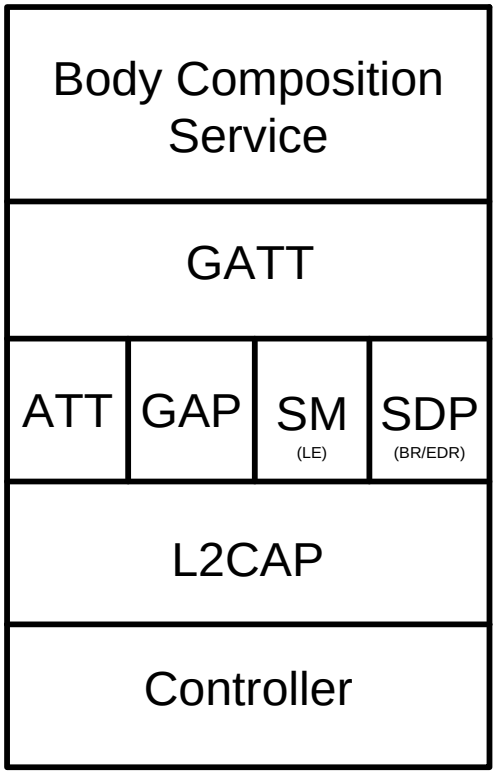

Figure 3.1: Body Composition Service test model

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 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.

3.3 Test groups

The following test groups have been defined:

- Generic GATT Integrated Tests
- Characteristic Read
- Configuration Indication
- Characteristic Indication

4 Test cases (TC)

4.1 Introduction

4.1.1 Test case identification conventions

Test cases are assigned unique identifiers per the conventions in [1]. The convention used here is:
<spec abbreviation>/<IUT role>/<class>/**<feat>**/<func>/<subfunc>/<cap>/**<xx>-<nn>-<y>**.

Additionally, testing of this specification includes tests from the GATT Test Suite [5] 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>**
BCS	Body Composition Service
Identifier Abbreviation	**Role Identifier <IUT role>**
SR	Server Role
Identifier Abbreviation	**Reference Identifier <GGIT test group>**
SGGIT	Server Generic GATT Integrated Tests
Identifier Abbreviation	**Reference Identifier <GGIT class>**
CHA	Characteristic
ISFC	Indication Supported Features Characteristic
SDP	Validate SDP Record
SER	Service
Identifier Abbreviation	**Class Identifier <class>**
CI	Characteristic Indication
CR	Characteristic Read

Table 4.1: BCS TC feature naming conventions

4.1.2 Conformance

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

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

Such tests may verify:

- That claimed capabilities may be used in any order and any number of repetitions not excluded by the specification
- That capabilities enabled by the implementations are sustained over durations expected by the use case
- That the implementation gracefully handles any quantity of data expected by the use case

- That in cases where more than one valid interpretation of the specification exists, the implementation complies with at least one interpretation and gracefully handles other interpretations
- That the implementation is immune to attempted security exploits

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

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

4.1.3 Pass/Fail verdict conventions

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

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

4.2 Setup preambles

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

4.2.1 ATT Bearer on LE Transport

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

4.2.2 ATT Bearer on BR/EDR Transport

- Preamble Procedure
  1. Establish a BR/EDR transport connection between the IUT and the Lower Tester.
  2. Establish several L2CAP channels (PSM 0x001F) between the IUT and the Lower Tester over that BR/EDR transport.

4.3 Generic GATT Integrated Tests

Execute the Generic GATT Integrated Tests defined in Section 6.3, Server test procedures (SGGIT), in [5] using Table 4.2 as input:

TCID	Service / Characteristic / Descriptor	Reference	Properties	Value Length (Octets)	Service Type
BCS/SR/SGGIT/SER/BV-01-C [Service GGIT – Body Composition Service]	Body Composition Service	[3] 2	-	-	Primary or Secondary Service
BCS/SR/SGGIT/SDP/BV-01-C [Validate SDP Record – Body Composition Service]	Body Composition Service	[3] 4	-	-	-
BCS/SR/SGGIT/CHA/BV-01-C [Characteristic GGIT – Body Composition Feature]	Body Composition Feature Characteristic	[3] 3.1	0x02 (Read)	Skip	-
BCS/SR/SGGIT/CHA/BV-02-C [Characteristic GGIT - Body Composition Measurement]	Body Composition Measurement Characteristic	[3] 3.2	0x20 (Indicate)	Skip	-
BCS/SR/SGGIT/CHA/BV-03-C [Characteristic GGIT – Body Composition Feature – Indicate]	Body Composition Feature Characteristic	[6] 3, 3.1.1	0x22 (Read, Indicate)	Skip	-

Table 4.2: Input for the GGIT Server test procedure

4.3.1 Generic GATT Indication Supported Features Characteristic

Execute the Generic GATT Indication Supported Features Characteristic Tests defined in Section 6.3, Server test procedures (SGGIT), in [5] using Table 4.3 below as input:

TCID	Characteristic	Reference	TC Configuration
BCS/SR/SGGIT/ISFC/BV-01-C [Characteristic GGIT – Body Composition Feature Indication]	Body Composition Feature Characteristic	[6] 3.1.1	N/A

Table 4.3: Input for the GGIT Indication Supported Features Characteristic tests

4.4 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 4.3 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.

- Characteristic Read Value Test Cases

Test Case	Requirements
BCS/SR/CR/BV-01-C [Characteristic Read – Body Composition Feature]	2 octets with RFU bits set to 0. ([3] 3.1.1)

Table 4.4: Characteristic Read Value test cases

- Test Procedure

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

  1. The Lower Tester sends an ATT_Read_Request to the IUT to read the characteristic value.
  2. The IUT sends an ATT_Read_Response to the Lower Tester.
  3. Verify that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

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

4.5 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 4.3 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 4.3 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.
- Configure Indication Test Cases

Test Case	Requirements
BCS/SR/CON/BV-01-C [Configure Indication – Body Composition Measurement]	0x0002 ([3] 3.2)

Table 4.5: Configure Indication test cases

- 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.
  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

  Pass verdict

  The characteristic descriptor is successfully written and the value returned when read is consistent with the value written.

4.6 Characteristic Indication

This test group contains test cases to verify compliant operation when the IUT indicates characteristic values.

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

- Test Purpose

  Verify that the IUT can indicate 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.
  - 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 to induce it to indicate 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 that 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 to generate a new Body Composition Measurement.
  8. Verify that 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.

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

- Test Purpose

  Verify that the IUT can indicate 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.
  - 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 to induce it to indicate 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 that 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.

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

- Test Purpose

  Verify that the IUT can indicate 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.

- 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 to induce it to indicate 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 that the characteristic value meets the requirements of the service.
  6. Perform an action on the IUT to induce it to indicate 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.

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

- Test Purpose

  Verify that the IUT can indicate 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.
  - 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 to induce it to indicate 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 that 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.

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

- Test Purpose

  Verify that the IUT can indicate 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.

- 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 to induce it to indicate 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 that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT indicates 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.

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

- Test Purpose

  Verify that the IUT can indicate 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.
  - 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 to induce it to indicate 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 that 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.

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

- Test Purpose

  Verify that the IUT can indicate 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.
  - 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 to induce it to indicate 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 that 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.

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

- Test Purpose

  Verify that the IUT can indicate 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.
  - 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 to induce it to indicate 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 that 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.

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

- Test Purpose

  Verify that the IUT can indicate 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.
  - 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 to induce it to indicate 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 that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT indicates 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.

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

- Test Purpose

  Verify that the IUT can indicate 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.
  - 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 to induce it to indicate 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 that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT indicates 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.

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

- Test Purpose

  Verify that the IUT can indicate 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.
  - 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 to induce it to indicate 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 that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT indicates 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.

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

- Test Purpose

  Verify that the IUT can indicate 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.
  - 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 to induce it to indicate 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 that 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.

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

- Test Purpose

  Verify that 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.
  - 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 to induce it to store several (e.g., 5 or more) Body Composition Measurements.
  2. Perform an action on the IUT to 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 that the characteristic value in each indication contains the time stamp field.
  8. Verify that the indications are received 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.

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

- Test Purpose

  Verify that the multi-user IUT can send multiple indications of stored Body Composition Measurement characteristics including 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.
  - 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 to 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 to 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 that the characteristic value in each indication contains the time stamp field.
  8. Verify that the indications are received 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.

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

- Test Purpose

  Verify that the IUT using LE and a default ATT_MTU can indicate 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.
  - 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 to induce it to indicate 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 that 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 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 Body Composition Service (BCS) [4].

Feature: A brief, informal description of the feature being tested.

Test Case(s): The applicable test case identifiers are required for Bluetooth Qualification if the corresponding y/x references defined in the Item column are supported. Further details about the function of the TCMT are elaborated in [1].

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

Item	Feature	Test Case(s)
BCS 2/1 OR BCS 2/2	Discover Body Composition Service	BCS/SR/SGGIT/SER/BV-01-C
BCS 2/1	Body Composition Service – SDP Record	BCS/SR/SGGIT/SDP/BV-01-C
BCS 4/1	Body Composition Feature Characteristic Read	BCS/SR/CR/BV-01-C
BCS 4/1 AND NOT BCS 4a/2	Body Composition Feature Characteristic	BCS/SR/SGGIT/CHA/BV-01-C
BCS 4a/2	Body Composition Feature Indication	BCS/SR/SGGIT/CHA/BV-03-C BCS/SR/SGGIT/ISFC/BV-01-C
BCS 4/2	Body Composition Measurement Characteristic	BCS/SR/SGGIT/CHA/BV-02-C BCS/SR/CON/BV-01-C BCS/SR/CI/BV-01-C
BCS 4/3	Time Stamp field of the Body Composition Measurement Characteristic	BCS/SR/CI/BV-02-C
BCS 3/1 AND NOT BCS 3/2	Stored Body Composition Measurement Characteristics – Single User	BCS/SR/CI/BV-13-C
BCS 4/4	User ID field of the Body Composition Measurement Characteristic	BCS/SR/CI/BV-03-C
BCS 3/1 AND BCS 3/2	Stored Body Composition Measurement Characteristics – Multiple Users	BCS/SR/CI/BV-14-C
BCS 4/5	Basal Metabolism field of the Body Composition Measurement Characteristic	BCS/SR/CI/BV-04-C
BCS 4/6	Muscle Percentage field of the Body Composition Measurement Characteristic	BCS/SR/CI/BV-05-C

Item	Feature	Test Case(s)
BCS 4/7	Muscle Mass field of the Body Composition Measurement Characteristic	BCS/SR/CI/BV-06-C
BCS 4/8	Fat Free Mass field of the Body Composition Measurement Characteristic	BCS/SR/CI/BV-07-C
BCS 4/9	Soft Lean Mass field of the Body Composition Measurement Characteristic	BCS/SR/CI/BV-08-C
BCS 4/10	Body Water Mass field of the Body Composition Measurement Characteristic	BCS/SR/CI/BV-09-C
BCS 4/11	Impedance field of the Body Composition Measurement Characteristic	BCS/SR/CI/BV-10-C
BCS 4/12	Weight field of the Body Composition Measurement Characteristic	BCS/SR/CI/BV-11-C
BCS 4/13	Height field of the Body Composition Measurement Characteristic	BCS/SR/CI/BV-12-C
BCS 3/3 AND BCS 2/2	Multiple Packet Measurement Supported	BCS/SR/CI/BV-15-C

Table 5.1: Test case mapping

6 Revision history and acknowledgments

Revision History

Publication Number	Revision Number	Date	Comments
p0	1.0.0	2014-10-21	Publication
	1.0.1r00	2016-05-20	Converted to new Test Case ID conventions as defined in TSTO v4.1.
	1.0.1r01	2016-06-18	Converted to current test specification template
p1	1.0.1	2016-07-13	Prepared for TCRL 2016-1 publication.
	1.0.1 edition2r00	2018-11-29	Editorial changes only. Template updated. Revision History and Contributors to the end of the document.
	1.0.1 edition 2	2018-11-12	Updated copyright page and confidentiality markings to support new Documentation Marking Requirements, performed minor formatting updates, and accepted all tracked changes to prepare for edition 2 publication.
	1.0.1 edition 3r00	2020-05-07	TSE 14785 (rating 1): Updated TCID from BCS/SEN/CI/BV-03-C to BCS/SR/CI/BV-03-C to align with TCMT and TCRL.
	1.0.1 edition 3	2020-06-01	Performed minor formatting and template updates and accepted all tracked changes. Approved by BTI on 2020-06-01. Prepared for edition 3 publication.
	p2r00–r06	2022-03-21 – 2022-05-09	TSE 17223 (rating 2): Converted the following test cases to GGIT: BCS/SR/SD/BV-01-C – -02-C, BCS/SR/DEC/BV-01-C – -02-C, and BCS/SR/DES/BV-01-C. The new GGIT converted TCIDs are BCS/SR/SGGIT/SER/BV-01-C, BCS/SR/SGGIT/SDP/BV-01-, and BCS/SR/SGGIT/CHA/BV-01-C – -02-C. Updated the TCMT accordingly. Updated section references in the initial condition sections for BCS/SR/CR/BV-01-C and BCS/SR/CON/BV-01-C. TSE 18439 (rating 1): Removed direct references to GATT test cases from the test procedures for BCS/SR/CR/BV-01-C and BCS/SR/CON/BV-01-C. Removed direct references to GATT TS sections from the ATT Bearer preambles. TSE 18707 (rating 1): Editorials to align the document with the latest TS template in anticipation of a .Z release. Made editorials to align the document with the latest TS template. Aligned copyright page with v2 of the DNMD. Made consistency check update.
2	p2	2022-06-28	Approved by BTI on 2022-05-31. Prepared for TCRL 2022-1 publication.

Publication Number	Revision Number	Date	Comments
	p3r00–r01	2023-08-23 – 2023-10-05	TSE 16705 (rating 4): Per E16256, added the new test group ISFC and a reference for BCS, Version 1.0.1. Updated the TCID conventions table. Added new test cases BCS/SR/SGGIT/CHA/BV-03-C and BCS/SR/SGGIT/ISFC/BV-01-C and updated the TCMT accordingly. Updated the TCMT entry for BCS/SR/SGGIT/CHA/BV-01-C. Editorials to align the document with the latest TS template.
3	p3	2024-07-01	Approved by BTI on 2024-04-21. Prepared for TCRL 2024-1 publication.

Acknowledgments

Name	Company
Dejan Berec	Bluetooth SIG, Inc.
Jawid Mirani	Bluetooth SIG, Inc.
Laurence Richardson	Cambridge Silicon Radio
Robert D. Hughes	Intel