Generic Health Sensor Service (GHSS)

***Bluetooth*® Test Suite**

- **Revision:** GHSS.TS.p2
- **Revision Date:** 2025-07-08
- **Prepared By:** Medical Devices Working Group
- **Published during TCRL:** TCRL.pkg100

Contents

1 Scope

This Bluetooth document contains the Test Suite Structure (TSS) and test cases to test the implementation of Bluetooth Generic Health Sensor Service (GHSS) 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] Bluetooth Core Specification, Version 4.2 or later

[2] Test Strategy and Terminology Overview

[3] Generic Health Sensor Service Specification, Version 1.0

[4] ICS Proforma for Generic Health Sensor Service, Version 1.0

[5] IXIT Proforma for Generic Health Sensor Service

[6] GATT Test Suite, GATT.TS

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

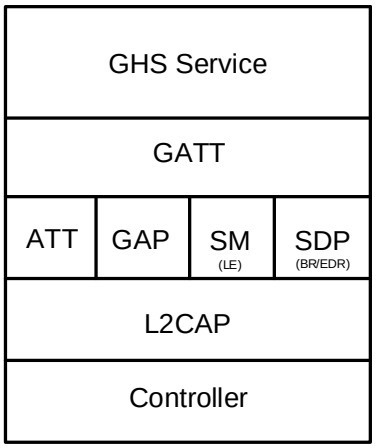

Figure 3.1: Generic Health Sensor Service test model

3.2 Test Strategy

The test objectives are to verify the functionality of the GHSS 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.

The Test Suite relies on IXIT values that are described in the respective test cases that make use of the IXIT value.

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.

Certain tests in this Test Suite require two independent Lower Testers to be run concurrently against the IUT.

3.3 Test groups

The following test groups have been defined:

- Generic GATT Integrated Tests
- Characteristic Read
- Configure Indication and Notification
- Segmentation of Health Observations
- GHS Control Point procedures and error handling
- Characteristic Indication or Notification
- Record Access Control Point (RACP) procedures and error handling
- Observation Schedule descriptor write and error handling
- Observation Schedule Changed 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 [2]. The convention used here is:
<spec abbreviation>/<IUT role>/<class>/**<feat>**/<func>/<subfunc>**/**<cap>**/<xx>-<nn>-<y>**.

Additionally, testing of this specification includes tests from the GATT Test Suite [6] 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>**
GHSS	Generic Health Sensor 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
CP	Control Point
ISFC	Indication Supported Features Characteristic
SDP	Validate SDP Record
SER	Service
Identifier Abbreviation	**Features and Behaviors Identifier <feat>**
CDRW	Characteristic Descriptor Read and Write (Configure Indication and Notification)
CR	Characteristic Read
DW	Descriptor Write and Error Handling
GCP	GHS Control Point
GCPE	GHS Control Point Error Handling
RAA	RACP Abort Operation procedure
RAC	RACP Combined Report procedure
RAD	RACP Delete Stored Records procedure
RAE	RACP Error Handling
RAN	RACP Report Number of Stored Records procedure
SCI	Service Characteristic Indications
SCIN	Service Characteristic Indications or Notifications
SCN	Service Characteristic Notifications
SEG	Segmentation of Health Observations

Table 4.1: GHSS 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 an L2CAP channel (PSM 0x001F) between the IUT and the Lower Tester over that BR/EDR transport.

4.2.3 Control Points Configuration

- Preamble Purpose

  This preamble procedure enables the IUT for use with the GHS Control Point and RACP.

- Preamble Procedure

1. Establish an ATT Bearer connection between the Lower Tester and the IUT as described in Section 4.2.1, if using an LE transport, or in Section 4.2.2 if using a BR/EDR transport.
2. The Lower Tester is acting as a Client.
3. If the IUT requires bonding, then the Lower Tester performs a bonding procedure. If previously bonded, then re-enable encryption.
4. The handles of the <Control Point Characteristic>, the <Corresponding Characteristic>, and the Client Characteristic Configuration descriptor (CCCD), have been previously discovered by the Lower Tester during the test procedure in Section 4.3 or are known to the Lower Tester by other means.
5. The <Control Point Characteristic> is configured for indication and <Corresponding Characteristic> is configured as defined in Table 4.2.

Control Point Characteristic	Corresponding Characteristic	Corresponding Characteristic configured for
GHS Control Point	Live Health Observations	Notification or Indication or both
RACP	Stored Health Observations	Notification or Indication or both

Table 4.2: Configuration Preamble for GHS Control Point and RACP

4.3 Generic GATT Integrated Tests

Execute the Generic GATT Integrated Tests defined in [6] in Section 6.3, Server test procedures (SGGIT), using Table 4.3 below as input:

TCID	Service / Characteristic / Descriptor	Reference	Properties	Value Length (Octets)	Type
GHSS/SR/SGGIT/SER/BV-01-C [Service GGIT – Generic Health Sensor]	Generic Health Sensor Service	[3] 2.6	-	-	Primary Service
GHSS/SR/SGGIT/CHA/BV-02-C [Characteristic GGIT – Health Sensor Features]	Health Sensor Features characteristic	[3] 3.1	0x02 (Read)	Skip	-
GHSS/SR/SGGIT/CHA/BV-03-C [Characteristic GGIT – Health Sensor Features with indicate]	Health Sensor Features characteristic	[3] 3.1	0x22 (Read, Indicate)	Skip	-
GHSS/SR/SGGIT/CHA/BV-04-C [Characteristic GGIT – Live Health Observations with indicate]	Live Health Observations characteristic	[3] 3.2	0x20 (Indicate)	Skip	-
GHSS/SR/SGGIT/CHA/BV-05-C [Characteristic GGIT – Live Health Observations with notify]	Live Health Observations characteristic	[3] 3.2	0x10 (Notify)	Skip	-
GHSS/SR/SGGIT/CHA/BV-06-C [Characteristic GGIT – Live Health Observations with indicate and notify]	Live Health Observations characteristic	[3] 3.2	0x30 (Indicate, Notify)	Skip	-
GHSS/SR/SGGIT/CHA/BV-07-C [Characteristic GGIT – Stored Health Observations with indicate and notify]	Stored Health Observations characteristic	[3] 3.3	0x30 (Indicate, Notify)	Skip	-
GHSS/SR/SGGIT/CHA/BV-08-C [Characteristic GGIT – RACP]	RACP characteristic	[3] 3.4	0x28 (Write, Indicate)	Skip	-
GHSS/SR/SGGIT/CHA/BV-09-C [Characteristic GGIT – GHS Control Point]	GHS Control Point characteristic	[3] 3.5	0x28 (Write, Indicate)	Skip	-
GHSS/SR/SGGIT/CHA/BV-10-C [Characteristic GGIT – Observation Schedule Changed]	Observation Schedule Changed characteristic	[3] 3.6	0x20 (Indicate)	Skip	-

TCID	Service / Characteristic / Descriptor	Reference	Properties	Value Length (Octets)	Type
GHSS/SR/SGGIT/DES/BV-11-C [Descriptor GGIT – Observation Schedule]	Observation Schedule descriptor	[3] 3.7, 3.7.1	0x02 (Read)	12	-
GHSS/SR/SGGIT/DES/BV-12-C [Descriptor GGIT – Observation Schedule with write]	Observation Schedule descriptor	[3] 3.7, 3.7.1	0x0A (Read, Write)	12	-
GHSS/SR/SGGIT/DES/BV-13-C [Descriptor GGIT – Valid Range and Accuracy]	Valid Range and Accuracy descriptor	[3] 3.7, 3.7.2	0x02 (Read)	14–18	-
GHSS/SR/SGGIT/SDP/BV-14-C [SDP Record – Generic Health Sensor]	Generic Health Sensor Service	[3] 4	-	-	-
GHSS/SR/SGGIT/CHA/BV-15-C [Characteristic GGIT – Stored Health Observations with indicate]	Stored Health Observations characteristic	[3] 3.3	0x20 (Indicate)	Skip	-
GHSS/SR/SGGIT/CHA/BV-16-C [Characteristic GGIT – Stored Health Observations with notify]	Stored Health Observations characteristic	[3] 3.3	0x10 (Notify)	Skip	-

Table 4.3: 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 [6] in Section 6.3, Server test procedures (SGGIT), using Table 4.4 below as input:

TCID	Characteristic	Reference
GHSS/SR/SGGIT/ISFC/BV-15-C [Characteristic GGIT – Health Sensor Features indication]	Health Sensor Features	[3] 3.1.2

Table 4.4: GGIT Indication Supported Features Characteristic tests

4.3.2 Generic GATT Control Point tests

Execute the Generic GATT Control Point tests defined in [6] in Section 6.3, Server test procedures (SGGIT), using Table 4.5 below as input:

TCID	Characteristic	Reference	Parameter(s)	Pass Verdict
GHSS/SR/SGGIT/CP/BI-01-C [RACP – Client Characteristic Configuration Descriptor Improperly Configured]	RACP Characteristic	[3] 3.4.4	Opcode = 0x07 (Combined Report) Operator = A supported Operator and, if applicable, Operand	Client Characteristic Configuration Descriptor Improperly Configured
GHSS/SR/SGGIT/CP/BI-02-C [GHS Control Point – Client Characteristic Configuration Descriptor Improperly Configured]	GHS Control Point characteristic	[3] 3.5.2	Opcode = 0x01 (Start sending live observations)	Client Characteristic Configuration Descriptor Improperly Configured

Table 4.5: Input for the GGIT Control Point tests

4.4 Characteristic Read

- Test Purpose

  Read and verify that the characteristic values required by the service are successfully read.

- Reference

  [3] 3.1

- Initial Condition

  - The handle of the Health Sensor Features characteristic value 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.
  - An ATT Bearer connection has been established between the Lower Tester and the 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 Case Configuration

Test Case	Reference	Value (Requirements)
GHSS/SR/CR/BV-01-C [Characteristic Read of Health Sensor Features Flags]	[3] 3.1.1.1	If the Supported Device Specializations field is not present Bit 0 of Flags field = 0, Else Bit 0 of Flags field = 1
GHSS/SR/CR/BV-02-C [Characteristic Read of Health Sensor Features Supported Observation Types]	[3] 3.1.1.2	Number of supported observation types and their codes
GHSS/SR/CR/BV-03-C [Characteristic Read of Health Sensor Features Supported Device Specializations]	[3] 3.1.1.3	Number of supported device specializations, their codes and version numbers

Table 4.6: Characteristic Read Value test cases

- Test Procedure

  1. The Lower Tester sends an ATT_READ_REQ PDU to the IUT to read the characteristic value.
  2. The IUT sends an ATT_READ_RSP PDU to the Lower Tester.

- Expected Outcome

  Pass verdict

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

GHSS/SR/CR/BV-04-C [Read Long Characteristic Value from Server]

- Test Purpose

  Verify that the IUT supports the reading of a value of the Health Sensor Features characteristic when the length of the value to be read requires the GATT Read Long Characteristic Values sub-procedure.

- Reference

  [3] 3.1.2

- Initial Condition
  - An ATT Bearer connection has been established between the Lower Tester and the 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 handle of the Health Sensor Features characteristic value 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 Lower Tester does not permit an ATT_MTU size larger than the default ATT_MTU size for LE to be negotiated.
  - The TSPX_read_long_features_characteristic_value is known from the IXIT [5].
- Test Procedure
  1. The Lower Tester reads the value of the Health Sensor Features characteristic by executing the Read Long Characteristic Values sub-procedure.
- Expected Outcome

  Pass verdict

  The IUT sends the expected value of the Health Sensor Features characteristic described in the IXIT [5].

4.5 Configure indication and notification

- Test Purpose

  Verify compliant operation in response to enable and disable characteristic indication or notification and reading of the CCCD value.
- Reference

  [3] 3
- Initial Condition
  - An ATT Bearer connection has been established between the Lower Tester and the 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 handle of each characteristic value referenced in the test cases in Table 4.7 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 CCCD of each characteristic referenced in the test cases in Table 4.7 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.
- Test Case Configuration

Test Case	Value (Requirements)
GHSS/SR/CDRW/BV-01-C [Configure Health Sensor Features characteristic for indication]	0x0002 (Section 3.1 in [3])
GHSS/SR/CDRW/BV-02-C [Configure Live Health Observations characteristic for notification]	0x0001 (Section 3.2 in [3])
GHSS/SR/CDRW/BV-03-C [Configure Live Health Observations characteristic for indication]	0x0002 (Section 3.2 in [3])

Test Case	Value (Requirements)
GHSS/SR/CDRW/BV-04-C [Configure Stored Health Observations characteristic for notification]	0x0001 (Section 3.3 in [3])
GHSS/SR/CDRW/BV-05-C [Configure RACP characteristic for indication]	0x0002 (Section 3.4 in [3])
GHSS/SR/CDRW/BV-06-C [Configure GHS Control Point characteristic for indication]	0x0002 (Section 3.5 in [3])
GHSS/SR/CDRW/BV-07-C [Configure Observation Schedule Changed characteristic for indication]	0x0002 (Section 3.6 in [3])
GHSS/SR/CDRW/BV-08-C [Configure Stored Health Observations characteristic for indication]	0x0002 (Section 3.3 in [3])

Table 4.7: Configure indication and notification test cases

- Test Procedure

  1. Disable indication or notification on the IUT by writing value 0x0000 to the CCCD of the characteristic with the Lower Tester.
  2. The Lower Tester reads the value of the CCCD.
  3. Enable notification or indication on the IUT by writing the <Value (Requirements)>, described in Table 4.7, to the CCCD of the characteristic with the Lower Tester.
  4. The Lower Tester reads the value of the CCCD.

- Expected Outcome

  Pass verdict

  The characteristic descriptor is successfully written.

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

4.6 Segmentation of Health Observation

- Test Purpose

  This test group contains one or more test cases to verify compliant operation by characteristics that send indications or notification, to report generated observations with optional fields present and with a size below and above the (ATT_MTU – 4) as supported by the IUT, which may require segmentation of the Health Observations Body into multiple indications or notifications.

- Reference

  [3] 3.2.2.1, 3.3.2

- Initial Condition

  - The preamble described in Section 4.2.3 has been performed to enable the IUT for use with the <Control Point Characteristic> set to GHS Control Point or RACP characteristics.
  - The Lower Tester knows the observation types supported by the IUT (e.g., by executing test case GHSS/SR/CR/BV-02-C [Characteristic Read of Health Sensor Features Supported Observation Types]).
  - The IUT has been configured to send generated health observations (live or temporarily stored observations or stored observations) to the Lower Tester (e.g., by executing test case GHSS/SR/GCP/BV-01-C [Start sending live observations]).

- Test Case Configuration

Test Case	Reference
GHSS/SR/SEG/BV-01-C [Segmentation of Live Health Observations Notifications]	[3] 3.2.1, 3.2.2
GHSS/SR/SEG/BV-02-C [Segmentation of Live Health Observations Indications]	[3] 3.2.1, 3.2.2
GHSS/SR/SEG/BV-03-C [Segmentation of Stored Health Observations Notifications]	[3] 3.2.2.1, 3.3
GHSS/SR/SEG/BV-04-C [Segmentation of Stored Health Observations Indications]	[3] 3.2.2.1, 3.3

Table 4.8: Segmented Indication and Notification test cases

- Test Procedure

  1. The Upper Tester orders the IUT to configure the service with live or temporarily stored observations or stored observations of varying size and when supported by the IUT with the size of at least one observation greater than (ATT_MTU – 4) and at least one observation not greater than (ATT_MTU – 4).
  2. The Upper Tester orders the IUT to generate one or more indications or notifications with the maximum set of fields.
  3. The IUT sends one or more indications or notifications of the characteristic being tested to the Lower Tester.

- Expected Outcome

  Pass verdict

  The IUT sends one or more indications or notifications of the characteristic being tested.

  The time between two consecutive indications or notifications of segments that are part of one health observation is less than 30 seconds.

  The Segmentation_Header field includes the First Segment bit, Last Segment bit, and Rolling Segment Counter bits with appropriate values. The mandatory fields of the Health Observation Body are included in the indication or notification.

  The optional fields included in any segment of the indication or notification have the associated bit of the Health Observation Body Flags field set to 1; other bits are set to 0.

4.7 GHS Control Point

Verify the IUT's ability to perform compliant operation and interpret values of the GHS Control Point characteristic or its error handling.

GHSS/SR/GCP/BV-01-C [Start sending live observations]

- Test Purpose

  Verify that the IUT does not send live observations prior to a Start sending live observations command and that it can execute the Start sending live observations command.

- Reference

  [3] 3.5.1

- Initial Condition
  - The preamble described in Section 4.2.3 has been performed to enable the IUT for use with the <Control Point Characteristic> set to GHS Control Point characteristic.
  - The IUT has live observations or temporarily stored observations to report, but it has not been configured to send the observations.
- Test Procedure
  1. The Lower Tester does not receive any observations for a time longer than the TSPX_time_required_for_generating_observations [5].
  2. The Lower Tester writes the Start sending live observations (0x01) command to the GHS Control Point characteristic.
  3. The IUT sends an ATT_HANDLE_VALUE_IND PDU of the GHS Control Point characteristic with code Success (0x80) to the Lower Tester.
  4. The Lower Tester sends an ATT_HANDLE_VALUE_CFM PDU to the IUT.
  5. The IUT sends one or more ATT_HANDLE_VALUE_IND PDU(s) or ATT_HANDLE_VALUE_NTF PDU(s) containing the Live Health Observations characteristic handle and value to the Lower Tester.
  6. For each received indication, the Lower Tester sends an ATT_HANDLE_VALUE_CFM PDU to the IUT.
- Expected Outcome

  Pass verdict

  In Step 1, the IUT does not send any indication or notification to the Lower Tester.

  In Step 3, the IUT sends an ATT_HANDLE_VALUE_IND PDU of the GHS Control Point characteristic with code Success (0x80).

  In or after Step 4, the IUT sends one or more indications or notifications of the Live Health Observations characteristic.

GHSS/SR/GCP/BV-02-C [Stop sending live observations]

- Test Purpose

  Verify that the IUT can execute the Stop sending live observations command.
- Reference

  [3] 3.5.1
- Initial Condition
  - The preamble described in Section 4.2.3 has been performed to enable the IUT for use with the <Control Point Characteristic> set to GHS Control Point characteristic.
  - The IUT has been configured to send Live Health Observations characteristic values to the Lower Tester (e.g., by executing test case GHSS/SR/GCP/BV-01-C [Start sending live observations]).
- Test Procedure
  1. The Lower Tester writes the Stop sending live observations (0x02) command to the GHS Control Point characteristic.
  2. The IUT sends an ATT_HANDLE_VALUE_IND PDU of the GHS Control Point characteristic with code Success (0x80) to the Lower Tester.
  3. The Lower Tester sends an ATT_HANDLE_VALUE_CFM PDU to the IUT.

4. Perform an action on the IUT that induces it to generate one or more live observations.
5. The live observations generated in Step 4 are not transmitted to the Lower Tester for a time longer than the TSPX_time_required_for_generating_observations [5].

- Expected Outcome

  Pass verdict

  In Step 2, the IUT sends an ATT_HANDLE_VALUE_IND PDU of the GHS Control Point characteristic with code Success (0x80).

  In Step 5, the IUT does not send an indication or notification to the Lower Tester containing any live observations generated in Step 4.

GHSS/SR/GCPE/BI-01-C [Live Health Observations characteristic not enabled for indication or notification]

- Test Purpose

  Verify that the IUT responds appropriately when a Lower Tester attempts to execute the Start sending live observations command with the Live Health Observations characteristic not configured for indication or notification.

- Reference

  [3] 3.5.2

- Initial Condition

  - The preamble described in Section 4.2.3 has been performed to enable the IUT for use with the <Control Point Characteristic> set to GHS Control Point characteristics.
  - The TSPX_time_required_for_generating_observations is known from the IXIT [5].

- Test Procedure

1. The Lower Tester resets the CCCD of the Live Health Observations characteristic to 0.
2. The Lower Tester writes the Start sending live observations (0x01) command to the GHS Control Point characteristic.
3. The IUT sends an ATT_HANDLE_VALUE_IND PDU of the GHS Control Point characteristic with code Success (0x80) to the Lower Tester.
4. The Lower Tester sends an ATT_HANDLE_VALUE_CFM PDU to the IUT.
5. Perform an action on the IUT that induces it to generate one or more observations.
6. The observations generated in Step 5 are not transmitted to the Lower Tester for a time longer than the TSPX_time_required_for_generating_observations [5].

- Expected Outcome

  Pass verdict

  In Step 3, the IUT sends an ATT_HANDLE_VALUE_IND PDU of the GHS Control Point characteristic with code Success (0x80).

  In Step 6, the IUT does not send any indication or notification, containing observations, to the Lower Tester.

GHSS/SR/GCPE/BI-02-C [Command not supported]

- Test Purpose

  Verify that the IUT responds with a Command not supported error response when the Lower Tester writes a value to the GHS Control Point that does not match a supported command.

- Reference

  [3] 3.5.2

- Initial Condition

  - The preamble described in Section 4.2.3 has been performed to enable the IUT for use with the <Control Point Characteristic> set to GHS Control Point characteristics.

- Test Procedure

  1. The Lower Tester sends an ATT_WRITE_REQ PDU, to the GHS Control Point, with a value that does not match a supported command.
  2. The IUT sends an ATT_ERROR_RSP PDU with the code Command not supported (0x81) to the Lower Tester.

- Expected Outcome

  Pass verdict

  The IUT sends an ATT_ERROR_RSP PDU with the code Command not supported (0x81).

4.8 Characteristic indication or notification

4.8.1 Indication or notification of live or temporarily stored observations

- Test Purpose

  Verify compliant operation when the IUT sends live or temporarily stored observations using indications or notifications of the Live Health Observations characteristic.

- Reference

  [3] 3.2

- Initial Condition

  - An ATT Bearer connection has been established between the Lower Tester and the 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 the IUT requires bonding, then the Lower Tester has performed a bonding procedure.
  - The handle range of the Live Health Observations characteristic has been previously discovered by the Lower Tester during the test procedures in Section 4.3 or is known to the Lower Tester by other means.
  - The Live Health Observations characteristic has been configured for indication or notification.
  - The IUT has been configured to send Live Health Observations characteristic values to the Lower Tester (e.g., by executing test case GHSS/SR/GCP/BV-01-C [Start sending live observations]).
  - The Lower Tester knows the IUT's supported Observation Types and Supported Device Specializations (e.g., by executing test cases GHSS/SR/CR/BV-02-C [Characteristic Read of Health Sensor Features Supported Observation Types] and GHSS/SR/CR/BV-03-C [Characteristic Read of Health Sensor Features Supported Device Specializations]).

- Test Case Configuration

Test Case	Reference
GHSS/SR/SCI/BV-01-C [Indications of live or temporarily stored observations with Numeric observation]	[3] 3.2.1.15.1
GHSS/SR/SCN/BV-01-C [Notifications of live or temporarily stored observations with Numeric observation]	[3] 3.2.1.15.1
GHSS/SR/SCI/BV-02-C [Indications of live or temporarily stored observations with Simple discrete observation]	[3] 3.2.1.15.2
GHSS/SR/SCN/BV-02-C [Notifications of live or temporarily stored observations with Simple discrete observation]	[3] 3.2.1.15.2
GHSS/SR/SCI/BV-03-C [Indications of live or temporarily stored observations with String observation]	[3] 3.2.1.15.3
GHSS/SR/SCN/BV-03-C [Notifications of live or temporarily stored observations with String observation]	[3] 3.2.1.15.3
GHSS/SR/SCI/BV-04-C [Indications of live or temporarily stored observations with Sample array observation]	[3] 3.2.1.15.4
GHSS/SR/SCN/BV-04-C [Notifications of live or temporarily stored observations with Sample array observation]	[3] 3.2.1.15.4
GHSS/SR/SCI/BV-05-C [Indications of live or temporarily stored observations with Compound observation]	[3] 3.2.1.15.7
GHSS/SR/SCN/BV-05-C [Notifications of live or temporarily stored observations with Compound observation]	[3] 3.2.1.15.7
GHSS/SR/SCI/BV-06-C [Indications of live or temporarily stored observations with Compound Discrete Event observation]	[3] 3.2.1.15.5
GHSS/SR/SCN/BV-06-C [Notifications of live or temporarily stored observations with Compound Discrete Event observation]	[3] 3.2.1.15.5
GHSS/SR/SCI/BV-07-C [Indications of live or temporarily stored observations with Compound State/Event observation (bit string)]	[3] 3.2.1.15.6
GHSS/SR/SCN/BV-07-C [Notifications of live or temporarily stored observations with Compound State/Event observation (bit string)]	[3] 3.2.1.15.6
GHSS/SR/SCI/BV-08-C [Indications of live or temporarily stored observations with TLV-encoded observation]	[3] 3.2.1.15.8
GHSS/SR/SCN/BV-08-C [Notifications of live or temporarily stored observations with TLV-encoded observation]	[3] 3.2.1.15.8
GHSS/SR/SCI/BV-09-C [Indications of live or temporarily stored observations with Observation bundle]	[3] 3.2.1.15.9
GHSS/SR/SCN/BV-09-C [Notifications of live or temporarily stored observations with Observation bundle]	[3] 3.2.1.15.9

Table 4.9: Indication or notification of live or temporarily stored observations test cases

- Test Procedure

1. Perform an action on the IUT that induces it to generate one or more live observations or temporarily stored observations.
2. The IUT sends one or more ATT_HANDLE_VALUE_IND PDU(s) or ATT_HANDLE_VALUE_NTF PDU(s) containing the characteristic handle and value to the Lower Tester.
3. For each received indication, the Lower Tester sends an ATT_HANDLE_VALUE_CFM PDU to the IUT.

- Expected Outcome

  Pass verdict

  The IUT sends one or more indications or notifications of the Live Health Observations characteristic with the live observation or temporarily stored observation.

  The time stamps in the reported observations (when present) are ordered from old to new.

  The temporarily stored observations include a time stamp.

GHSS/SR/SCI/BV-10-C [Health Sensor Features characteristic indication to connected client]

- Test Purpose

  Verify that the IUT can send an indication of the Health Sensor Features characteristic, to a connected client, after the IUT's supported features are changed.

- Reference

  [3] 3.1.2

- Initial Condition

  - An ATT Bearer connection has been established between the Lower Tester and the 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 the IUT requires bonding, then the Lower Tester has performed a bonding procedure.
  - The handle range of the Health Sensor Features characteristic has been previously discovered by the Lower Tester during the test procedures in Section 4.3 or is known to the Lower Tester by other means.
  - The Health Sensor Features characteristic has been configured for indication.

- Test Procedure

  1. The Upper Tester induces the IUT to change the Health Sensor Features characteristic to a new value.
  2. The IUT sends an ATT_HANDLE_VALUE_IND PDU containing the Health Sensor Features characteristic handle and value to the Lower Tester.
  3. The Lower Tester sends an ATT_HANDLE_VALUE_CFM PDU to the IUT.

- Expected Outcome

  Pass verdict

  The IUT sends an indication of the Health Sensor Features characteristic value consistent with the value described in Step 1.

GHSS/SR/SCIN/BV-01-C [Reporting of live or temporarily stored observations when both indication and notification are enabled]

- Test Purpose

  Verify that the IUT sends only indications or notifications, but not both, of the Live Health Observations characteristic.

- Reference

  [3] 2.7, 3.2.2

- Initial Condition
  - An ATT Bearer connection has been established between the Lower Tester and the 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 the IUT requires bonding, then the Lower Tester has performed a bonding procedure.
  - The handle range of the Live Health Observations characteristic has been previously discovered by the Lower Tester during the test procedures in Section 4.3 or is known to the Lower Tester by other means.
  - The Live Health Observations characteristic has been configured for indication and notification.
  - The IUT has been configured to send Live Health Observations characteristic values to the Lower Tester.
- Test Procedure
  1. Perform an action on the IUT that induces it to generate one or more live observations or temporarily stored observations.
  2. The IUT sends one or more ATT_HANDLE_VALUE_IND PDU(s) or ATT_HANDLE_VALUE_NTF PDU(s) containing the Live Health Observations characteristic handle and value to the Lower Tester.
  3. For each received indication, the Lower Tester sends an ATT_HANDLE_VALUE_CFM PDU to the IUT.
- Expected Outcome

  Pass verdict

  The IUT sends one or more indications or notifications of the Live Health Observations characteristic, but not both, with the generated observations.

4.9 Record Access Control Point procedures

Verify that the IUT can be configured, conducts compliant operation, provides correctly formatted values of the Stored Health Observations characteristic, and correctly interprets values of the RACP characteristic and error handling.

Tables 3.31 and 3.32 in [3] define the Opcodes, Operators, and Operand values used in the Record Access Control Point procedure test cases in this section.

This test group uses the Operators and Operands values listed in Table 4.10.

Operator	Operand
All records (0x01)	N/A
First record (0x05)	N/A
Last record (0x06)	N/A
Less than or equal to (0x02)	Record Number (0x01) <Max filter value>
	Time (0x02) <Max filter value>
Greater than or equal to (0x03)	Record Number (0x01) <Min filter value>
	Time (0x02) <Min filter value>
Within range of (inclusive) (0x04)	Record Number (0x01) <Min filter value>, <Max filter value>
	Time (0x02) <Min filter value>, <Max filter value>

Table 4.10: RACP Operators and Operands

GHSS/SR/RAC/BV-01-C [Combined Report procedure]

- Test Purpose

  Verify that the IUT can perform the Combined Report procedure with the combination of Operators and, if applicable, Operand listed in Table 4.10.

- Reference

  [3] 3.4.3.1

- Initial Condition

  - The Lower Tester does not permit an ATT_MTU size larger than the default ATT_MTU size for LE to be negotiated.
  - The preamble described in Section 4.2.3 has been performed to enable the IUT for use with the RACP characteristic.
  - An action on the IUT has been performed that induces it to generate at least three records with stored observations or, if supported, a stored observation bundle.
  - The Lower Tester knows the last record number or time stamp of the stored records.

- Test Procedure

  1. For each <Operator> in Table 4.10, perform the following steps:
     a. The Lower Tester writes the Combined Report opcode (0x07) to the RACP characteristic using the listed <Operator>, and if applicable, <Operand> and corresponding filter parameter(s).
        i. IF the <Operator> is NOT supported, then the IUT sends an ATT_HANDLE_VALUE_IND PDU of the RACP characteristic with the Response Code opcode (0x06), an operator of Null (0x00), and an operand representing the Request opcode (0x07) followed by the Response Code Value for Operator Not Supported (0x04).
        ii. ELSE IF the <Operand> is NOT supported, then the IUT sends an ATT_HANDLE_VALUE_IND PDU of the RACP characteristic with the Response Code opcode (0x06), an operator of Null (0x00), and an operand representing the Request opcode (0x07) followed by the Response Code Value for Operand Not Supported (0x09).
        iii. ELSE IF for the <Operand> NO corresponding record exists for the filter value or range, then the IUT sends an ATT_HANDLE_VALUE_IND PDU of the RACP characteristic with the Response Code opcode (0x06), an operator of Null (0x00), and an operand representing the Request opcode (0x07) followed by the Response Code Value for No records found (0x06).
        iv. ELSE, the IUT sends one or more ATT_HANDLE_VALUE_IND PDU(s) or ATT_HANDLE_VALUE_NTF PDU(s) of the Stored Health Observations characteristic. Each notification contains a Segmentation_Header field and a partial or a whole Stored_Health_Observations_Segment field as described in Section 3.3.1 of [3].
           a) The IUT sends an ATT_HANDLE_VALUE_IND PDU of the RACP characteristic with the Combined Report Response opcode (0x08), an operator of Null (0x00), and an operand representing the number of records sent.
        v. The IUT receives an ATT_HANDLE_VALUE_CFM PDU from the Lower Tester.

2. Verify that the control point behavior meets the requirements of the service.

- Expected Outcome

  Pass verdict

  For each <Operator>, based on the Stored Health Observations characteristic size and the default ATT_MTU size, the IUT sends:

  - One or more indications or notifications of the Stored Health Observations characteristic; each indication or notification contains a Segmentation_Header field with the appropriate values and the Stored_Health_Observations_Segment field,
  - The time stamps in the reported observations are ordered from old to new, and
  - An indication with the Combined Report Response opcode (0x08) containing a valid operator and operand. The value of the operand represents the correct number of records sent.

  OR

  - The appropriate error message.

GHSS/SR/RAC/BV-02-C [Combined Report procedure with both indication and notification enabled]

- Test Purpose

  Verify that the IUT can perform the Combined Report procedure and sends only indications or notifications, but not both, of the Stored Health Observations characteristic.

- Reference

  [3] 2.7, 3.3.2, 3.4.3.1

- Initial Condition

  - The Lower Tester does not permit an ATT_MTU size larger than the default ATT_MTU size for LE to be negotiated.
  - The preamble described in Section 4.2.3 has been performed to enable the IUT for use with the RACP characteristic with both indications and notifications of the Stored Health Observations characteristic enabled.
  - An action on the IUT has been performed that induces it to generate one record with stored observations or, if supported, a stored observation bundle.

- Test Procedure

  1. The Lower Tester writes the Combined Report opcode (0x07) to the RACP characteristic using an operator of All records.
  2. The IUT sends one or more ATT_HANDLE_VALUE_IND PDU(s) or ATT_HANDLE_VALUE_NTF PDU(s) of the Stored Health Observations characteristic. Each indication or notification contains a Segmentation_Header field and a partial or a whole Stored_Health_Observations_Segment field as described in Section 3.3.1 of [3].
  3. For each received indication, the Lower Tester sends an ATT_HANDLE_VALUE_CFM PDU to the IUT.
  4. The IUT sends an ATT_HANDLE_VALUE_IND PDU of the RACP characteristic with the Combined Report Response opcode (0x08), an operator of Null (0x00), and an operand representing the number of records sent.

5. The Lower Tester sends an ATT_HANDLE_VALUE_CFM PDU to the IUT.
6. Verify that the control point behavior meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends:

  - One or more indications or notifications of the Stored Health Observations characteristic, but not both; each indication or notification contains a Segmentation_Header field with the appropriate values and the Stored_Health_Observations_Segment field, and
  - An indication with the Combined Report Response opcode (0x08) and the number of records sent.

GHSS/SR/RAN/BV-01-C [Report Number of Stored Records procedure]

- Test Purpose

  Verify that the IUT can perform the Report Number of Stored Records procedure with the combination of Operators and, if applicable, Operand listed in Table 4.10.

- Reference

  [3] 3.4.3.2

- Initial Condition

  - The Lower Tester does not permit an ATT_MTU size larger than the default ATT_MTU size for LE to be negotiated.
  - The preamble described in Section 4.2.3 has been performed to enable the IUT for use with the RACP characteristic.
  - An action on the IUT has been performed that induces it to generate at least three records with stored observations or, if supported, a stored observation bundle.
  - The Lower Tester knows the last record number or time stamp of the stored records.

- Test Procedure

  1. For each <Operator> in Table 4.10, perform the following steps:
     a. The Lower Tester writes the Report Number of Stored Records opcode (0x04) to the RACP characteristic using the listed <Operator> and, if applicable, <Operand> and corresponding filter parameter(s).
        i. IF the <Operator> is NOT supported, then the IUT sends an ATT_HANDLE_VALUE_IND PDU of the RACP characteristic with the Response Code opcode (0x06), an operator of Null (0x00), and an operand representing the Request opcode (0x04) followed by the Response Code Value for Operator Not Supported (0x04).
        ii. ELSE IF the <Operand> is NOT supported, then the IUT sends an ATT_HANDLE_VALUE_IND PDU of the RACP characteristic with the Response Code opcode (0x06), an operator of Null (0x00), and an operand representing the Request opcode (0x04) followed by the Response Code Value for Operand Not Supported (0x09).
        iii. ELSE IF for the <Operand> NO corresponding record exists for the filter value or range, then the IUT sends an ATT_HANDLE_VALUE_IND PDU of the RACP

characteristic with the Number of Stored Records Response opcode (0x05), an operator of Null (0x00), and an operand set to 0x0000.

iv. ELSE, the IUT sends an ATT_HANDLE_VALUE_IND PDU of the RACP characteristic with the Number of Stored Records Response opcode (0x05), an operator of Null (0x00), and an operand representing the number of records found.

v. The IUT receives an ATT_HANDLE_VALUE_CFM PDU from the Lower Tester.

2. Verify that the control point behavior meets the requirements of the service.

- Expected Outcome

  Pass verdict

  For each <Operator>, the IUT sends:

  - One indication of the RACP characteristic with the Number of Stored Records Response opcode containing a valid operator and operand. The value of the operand represents the correct number of available records.

  OR

  - The appropriate error message.

GHSS/SR/RAD/BV-01-C [Delete Stored Records procedure]

- Test Purpose

  Verify that the IUT can perform the Delete Stored Records procedure with the combination of Operators and, if applicable, Operand listed in Table 4.10.

- Reference

  [3] 3.4.3.3

- Initial Condition

  - The preamble described in Section 4.2.3 has been performed to enable the IUT for use with the RACP characteristic.

- Test Procedure

  1. Perform an action on the IUT that induces it to generate at least three records with stored observations or, if supported, a stored observation bundle.
  2. The Lower Tester knows the last record number or time stamp of the stored records.
  3. For each <Operator> in Table 4.10, perform the following steps:

     a. The Lower Tester writes the Delete Stored Records opcode (0x02) to the RACP characteristic using the listed <Operator> and, if applicable, <Operand> and corresponding filter parameter(s).

        i. IF the <Operator> is NOT supported, then the IUT sends an ATT_HANDLE_VALUE_IND PDU of the RACP characteristic with the Response Code opcode (0x06), an operator of Null (0x00), and an operand representing the Request opcode (0x02) followed by the Response Code Value for Operator Not Supported (0x04).

        ii. ELSE IF the <Operand> is NOT supported, then the IUT sends an ATT_HANDLE_VALUE_IND PDU of the RACP characteristic with the Response Code opcode (0x06), an operator of Null (0x00), and an operand representing the

Request opcode (0x02) followed by the Response Code Value for Operand Not Supported (0x09).

iii. ELSE IF for the <Operand> NO corresponding record exists for the filter value or range, then the IUT sends an ATT_HANDLE_VALUE_IND PDU of the RACP characteristic with the Response Code opcode (0x06), an operator of Null (0x00), and an operand representing the Request opcode (0x02), followed by the Response Code Value for No records found (0x06).

iv. ELSE, the IUT sends an ATT_HANDLE_VALUE_IND PDU of the RACP characteristic with the Response Code opcode (0x06), an operator of Null (0x00), and an operand representing the Request opcode (0x02), followed by the Response Code Value for Success (0x01).

v. The IUT receives an ATT_HANDLE_VALUE_CFM PDU from the Lower Tester.

4. The Lower Tester verifies that the required records have been deleted by performing the Combined Report (0x07) with operator All records.
5. Verify that the control point behavior meets the requirements of the service.

- Expected Outcome

  Pass verdict

  For each <Operator>, the IUT sends:

  - One indication of the RACP characteristic containing a valid operator and operand for each operation (Combination supported) and the required records are deleted.

  OR

  - The appropriate error message.

GHSS/SR/RAA/BV-01-C [Abort Operation procedure]

- Test Purpose

  Verify that the IUT can perform the Abort Operation procedure.

- Reference

  [3] 3.4.3.4

- Initial Condition

  - The preamble described in Section 4.2.3 has been performed to enable the IUT for use with the RACP characteristic.

- Test Procedure

  1. Perform an action on the IUT that induces it to generate enough records such that the transmission does not complete before an abort procedure is attempted.
  2. The Lower Tester writes the Combined Report opcode (0x07) to the RACP characteristic using an operator of All records.
  3. The IUT starts to send ATT_HANDLE_VALUE_IND PDU(s) or ATT_HANDLE_VALUE_NTF PDU(s) of the Stored Health Observations characteristic.
  4. The Lower Tester writes the Abort Operation opcode (0x03) to the RACP characteristic with an operator of Null (0x00) and no operand.

5. The IUT sends an ATT_HANDLE_VALUE_IND PDU of the RACP characteristic with the Response Code opcode (0x06), an operator of Null (0x00), and an operand representing the Request opcode (0x03) followed by the Response Code Value for Success (0x01).
6. The IUT receives an ATT_HANDLE_VALUE_CFM PDU from the Lower Tester.
7. Verify that the indications or notifications stop.

- Expected Outcome

  Pass verdict

  The IUT sends some but not all indications or notifications of the Stored Health Observations characteristic.

  The IUT sends one indication of the RACP characteristic with the Response Code Value for Success (0x01).

4.9.1 RACP Procedures – Error Handling

Verify compliant operation of the IUT when the Record Access Control Point procedures is written with values outside defined ranges, or considered invalid or unexpected.

GHSS/SR/RAE/BI-01-C [Server Busy]

- Test Purpose

  Verify that the IUT responds appropriately when a Lower Tester attempts to perform an RACP procedure while the IUT is reporting live or temporarily stored observations.

- Reference

  [3] 3.4.4

- Initial Condition

  - The preamble described in Section 4.2.3 has been performed to enable the IUT for use with the GHS Control Point and RACP characteristics.
  - The handle range of the Live Health Observations characteristic has been previously discovered by the Lower Tester during the test procedures in Section 4.3 or is known to the Lower Tester by other means.
  - The Live Health Observations characteristic has been configured for indication or notification.
  - The IUT has been configured to send Live Health Observations characteristic values to the Lower Tester (e.g., by executing test case GHSS/SR/GCP/BV-01-C [Start sending live observations]).
  - An action on the IUT has been performed that induces it to generate at least three records with stored observations or, if supported, a stored observation bundle.

- Test Procedure

  1. Perform either alternative 1A or 1B depending on whether the IUT reports live observations or temporarily stored observations:

     Alternative 1A (The IUT reports live observations):

     1A.1. Perform an action on the IUT that induces it to generate enough live observations such that the transmission does not complete before an RACP procedure is attempted.

Alternative 1B (The IUT reports temporarily stored observations):

1B.1. The Lower Tester and the IUT disconnect.

1B.2. Perform an action on the IUT that induces it to generate enough temporarily stored observations such that the transmission does not complete before an RACP procedure is attempted.

1B.3. Establish an ATT Bearer connection between the Lower Tester and the IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.

2. The IUT starts sending ATT_HANDLE_VALUE_IND PDU(s) or ATT_HANDLE_VALUE_NTF PDU(s) containing the characteristic handle and values to the Lower Tester.
3. For each received indication, the Lower Tester sends an ATT_HANDLE_VALUE_CFM PDU to the IUT.
4. Before all the observations are reported, the Lower Tester writes the Combined Report opcode (0x07) to the RACP characteristic with an operator of All records (0x01) and no operand.
5. The IUT sends an ATT_HANDLE_VALUE_IND PDU of the RACP characteristic with the Response Code opcode (0x06), an operator of Null (0x00), and an operand representing the Request opcode (0x07) followed by the Response Code Value for Server Busy (0x0A) to the Lower Tester.
6. The IUT receives an ATT_HANDLE_VALUE_CFM PDU from the Lower Tester.

- Expected Outcome

  Pass verdict

  The IUT sends one or more indications or notifications of the Live Health Observations characteristic.

  The IUT rejects the write request to start the RACP procedure and sends an indication of the RACP characteristic with Response Code Value for Server Busy (0x0A).

GHSS/SR/RAE/BI-02-C [Procedure Already in Progress]

- Test Purpose

  Verify that the IUT responds appropriately when a Lower Tester attempts to perform an RACP procedure before another RACP procedure is completed.

- Reference

  [3] 3.4.4

- Initial Condition

  - The preamble described in Section 4.2.3 has been performed to enable the IUT for use with the RACP characteristic.
  - An action on the IUT has been performed that induces it to generate several records.

- Test Procedure

  1. The Lower Tester writes the Combined Report opcode (0x07) to the RACP characteristic using a combination of a supported operator and, if applicable, operand.
  2. Before all records are indicated or notified by the IUT and the procedure is completed, the Lower Tester performs the same procedure again by writing the Combined Report opcode (0x07) to the RACP characteristic using a combination of a supported operator and, if applicable, operand.
  3. The IUT sends an ATT_ERROR_RSP PDU with error code Procedure Already in Progress (0xFE) to the Lower Tester.

- Expected Outcome

  Pass verdict

  The IUT rejects the Write Request to start the second procedure and responds with an ATT_ERROR_RSP PDU with error code set to Procedure Already in Progress (0xFE).

4.9.1.1 RACP Opcode, Operator, and Operand error response

- Test Purpose

  Verify that the IUT responds with the <Request Op Code, Response Code Value> when a Lower Tester writes the <Op Code, Operator, and Operand> described in Table 4.11 to the RACP characteristic.

- Reference

  [3] 3.4.4

- Initial Condition

  - The preamble described in Section 4.2.3 has been performed to enable the IUT for use with the RACP characteristic.

- Test Case Configuration

Test Case	Op Code, Operator, and Operand	Request Op Code, Response Code Value
GHSS/SR/RAE/BI-03-C [RACP Op Code Not Supported]	Op Code = RFU value Operator = 0x01 (All records) Operand = n/a	Request Op Code = RFU value Response Code Value = 0x02 (Op Code Not Supported)
GHSS/SR/RAE/BI-04-C [RACP Operand Not Supported]	Op Code = 0x07 (Combined Report) Operator = 0x03 (Greater than or equal to) Operand Filter Type = RFU value followed by an appropriate Filter Parameters (minimum filter value)	Request Op Code = 0x07 (Combined Report) Response Code Value = 0x09 (Operand Not Supported)
GHSS/SR/RAE/BI-05-C [RACP Invalid Operator]	Op Code = 0x07 (Combined Report) Operator = 0x00 (Null) Operand = 0x01 (Record Number)	Request Op Code = 0x07 (Combined Report) Response Code Value = 0x03 (Invalid Operator)
GHSS/SR/RAE/BI-06-C [RACP Operator Not Supported]	Op Code = 0x07 (Combined Report) Operator = RFU value Operand Filter Type = Record Number	Request Op Code = 0x07 (Combined Report) Response Code Value = 0x04 (Operator Not Supported)

Table 4.11: RACP Opcode, Operator, and Operand error response test cases

- Test Procedure

  1. The Lower Tester writes the <Op Code, Operator, and Operand>, as described in Table 4.11, to the RACP characteristic.
  2. The IUT sends an ATT_HANDLE_VALUE_IND PDU of the RACP characteristic with the Response Code opcode (0x06), an operator of Null (0x00), and the operand with the <Request Op Code, Response Code Value> described in Table 4.11.
  3. The IUT receives an ATT_HANDLE_VALUE_CFM PDU from the Lower Tester.

- Expected Outcome

  Pass verdict

  The IUT sends an indication of the RACP characteristic with <Request Op Code, Response Code Value> as described in Table 4.11.

4.10 Observation Schedule descriptor write

GHSS/SR/DW/BV-01-C [Observation Schedule descriptor write]

- Test Purpose

  Verify that the IUT supports the writing of a value to the Observation Schedule descriptor.

- Reference

  [3] 3.7.1.2

- Initial Condition

  - An ATT Bearer connection has been established between the Lower Tester and the 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 the IUT requires bonding, then the Lower Tester has performed a bonding procedure.
  - The handle of each supported Observation Schedule descriptor has been previously discovered by the Lower Tester during the test procedures in Section 4.3 or is known to the Lower Tester by other means.
  - For each Observation Schedule descriptor, the Lower Tester knows the Observation Type, Measurement Period, and Update Interval values (e.g., by executing the test procedures in Section 4.3).
  - The TSPX_measurement_period_change_value and TSPX_update_interval_change_value schedule, for the Observation Type, are defined in the IXIT [5].

- Test Procedure

  For each Observation Schedule descriptor, perform the following steps:

  1. The Lower Tester sends an ATT_WRITE_REQ PDU, to set the schedule for a specified Observation Type to the values known from the initial condition incremented by the value defined in the IXIT [5], to the IUT.
  2. The IUT sends an ATT_WRITE_RSP PDU to the Lower Tester.
  3. The Lower Tester sends an ATT_READ_REQ PDU to read the Observation Schedule descriptor.
  4. The IUT sends an ATT_READ_RSP PDU to the Lower Tester.

- Expected Outcome

  Pass verdict

  Each Observation Schedule descriptor is successfully written, and the value returned when read is consistent with the value written.

4.10.1 Out of Range error response

- Test Purpose

  Verify that the IUT responds appropriately when the Lower Tester attempts to write, to the Observation Schedule descriptor, the <Value> described in Table 4.12.

- Reference

  [3] 3.7.1.2

- Initial Condition

  - An ATT Bearer connection has been established between the Lower Tester and the 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 the IUT requires bonding, then the Lower Tester has performed a bonding procedure.
  - The handle of each supported Observation Schedule descriptor has been previously discovered by the Lower Tester during the test procedures in Section 4.3 or is known to the Lower Tester by other means.
  - For each Observation Schedule descriptor, the Lower Tester knows the Observation Type, Measurement Period, and Update Interval values (e.g., by executing the test procedures in Section 4.3).
  - The TSPX_unsupported_measurement_period and TSPX_unsupported_update_interval schedule, for the Observation Type, are defined in IXIT [5].

- Test Case Configuration

Test Case	Value
GHSS/SR/DW/BI-01-C [Out of Range error response 1]	A schedule that is not supported [5].
GHSS/SR/DW/BI-02-C [Out of Range error response 2]	An Observation Type value that is different from the value acquired in the initial condition.

Table 4.12: Observation Schedule descriptor error handling test cases

- Test Procedure

  For each Observation Schedule descriptor, perform the following steps:

  1. The Lower Tester sends an ATT_WRITE_REQ PDU with the <Value> described in Table 4.12 to the IUT.
  2. The IUT sends an Attribute Protocol Application Error Code set to Out of Range (0xFF) to the Lower Tester.

- Expected Outcome

  Pass verdict

  The IUT rejects each Write Request by sending an Attribute Protocol Application Error Code set to Out of Range (0xFF).

4.11 Observation Schedule Changed characteristic indication

GHSS/SR/SCI/BV-11-C [Observation Schedule Changed indication]

- Test Purpose

  Verify that the IUT can send indications of the Observation Schedule Changed characteristic when descriptor values are changed at the Server.

- Reference

  [3] 3.6.2

- Initial Condition

  - An ATT Bearer connection has been established between the Lower Tester and the 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 the IUT requires bonding, then the Lower Tester has performed a bonding procedure.
  - The handle ranges of the Observation Schedule Changed characteristic and Observation Schedule descriptor have been previously discovered by the Lower Tester during the test procedures in Section 4.3 or are known to the Lower Tester by other means.
  - The Observation Schedule Changed characteristic has been configured for indication.

- Test Procedure

  1. The Lower Tester reads and caches all descriptor values for the Observation Schedule descriptor.
  2. Perform an action on the IUT that updates the value of the Observation Schedule descriptor.
  3. The IUT sends one or more ATT_HANDLE_VALUE_IND PDU(s) containing the Observation Schedule Changed characteristic handle and value to the Lower Tester.
  4. The Lower Tester sends an ATT_HANDLE_VALUE_CFM PDU to the IUT.

- Expected Outcome

  Pass verdict

  The IUT sends one or more indications of the Observation Schedule Changed characteristic corresponding to the changed descriptor.

GHSS/SR/SCI/BV-12-C [Observation Schedule Changed indication due to change to the Observation Schedule descriptor by another Client]

- Test Purpose

  Verify that the IUT can send indications of the Observation Schedule Changed characteristic to a Lower Tester when the Observation Schedule descriptor is changed by a different Lower Tester.

- Reference

  [3] 3.6.2

- Initial Condition

  - An ATT Bearer connection has been established between Lower Tester 1 and the 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 handle ranges of the Observation Schedule Changed characteristic and Observation Schedule descriptor have been previously discovered by Lower Tester 1 and Lower Tester 2 during the test procedures in Section 4.3 or are known to the Lower Testers by other means.
- The Observation Schedule Changed characteristic has been configured for indication by Lower Tester 2, and Lower Tester 2 is connected to the IUT.
- The TSPX_measurement_period_change_value and TSPX_update_interval_change_value schedule, for the Observation Type, are known from the IXIT [5].

- Test Procedure

  1. Lower Tester 1 writes a new value, to set the schedule for a specified Observation Type with the value described in [5], to the Observation Schedule descriptor.
  2. The IUT sends an ATT_HANDLE_VALUE_IND PDU containing the Observation Schedule Changed characteristic handle and value to Lower Tester 2.
  3. Lower Tester 2 sends an ATT_HANDLE_VALUE_CFM PDU to the IUT.

- Expected Outcome

  Pass verdict

  The IUT sends one indication of the Observation Schedule Changed characteristic corresponding to the changed Observation Schedule descriptor to Lower Tester 2.

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 GHSS [4].

If a test case is mandatory within the respective layer, then the y/x reference is omitted.

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 [2].

For the purpose and structure of the ICS/IXIT, refer to [2].

Item	Feature	Test Case(s)
GHSS 2/1 OR GHSS 2/2	Generic Health Sensor Service	GHSS/SR/SGGIT/SER/BV-01-C
GHSS 4/1 AND NOT GHSS 4/3	Health Sensor Features characteristic (without indicate)	GHSS/SR/SGGIT/CHA/BV-02-C
GHSS 4/1 OR GHSS 4/3	Read Health Sensor Features characteristic	GHSS/SR/CR/BV-01-C GHSS/SR/CR/BV-02-C
GHSS 4/2	Health Sensor Features Supported Device Specializations	GHSS/SR/CR/BV-03-C
GHSS 4/1 AND GHSS 8/3	Read Long Characteristic Value from Server	GHSS/SR/CR/BV-04-C
GHSS 4/1 AND GHSS 4/3	Health Sensor Features characteristic with indicate	GHSS/SR/SGGIT/CHA/BV-03-C GHSS/SR/CDRW/BV-01-C
GHSS 4/3 AND GHSS 9/2	Characteristic GGIT – Health Sensor Features indication	GHSS/SR/SGGIT/ISFC/BV-15-C
GHSS 4/3 OR GHSS 3/5	Health Sensor Features characteristic indication to connected client	GHSS/SR/SCI/BV-10-C
GHSS 4/8 AND NOT GHSS 4/9	Live Health Observations characteristic with indicate	GHSS/SR/SGGIT/CHA/BV-04-C GHSS/SR/CDRW/BV-03-C
GHSS 4/8 AND (GHSS 5/2 OR GHSS 5/3 OR GHSS 5/4 OR GHSS 5/5 OR GHSS 5/6 OR GHSS 5/7 OR GHSS 5/8 OR GHSS 5/9 OR GHSS 5/10)	Segmentation of Live Health Observations Indications	GHSS/SR/SEG/BV-02-C
GHSS 4/9 AND NOT GHSS 4/8	Live Health Observations characteristic with notify	GHSS/SR/SGGIT/CHA/BV-05-C GHSS/SR/CDRW/BV-02-C

Item	Feature	Test Case(s)
GHSS 4/9 AND (GHSS 5/2 OR GHSS 5/3 OR GHSS 5/4 OR GHSS 5/5 OR GHSS 5/6 OR GHSS 5/7 OR GHSS 5/8 OR GHSS 5/9 OR GHSS 5/10)	Segmentation of Live Health Observations Notifications	GHSS/SR/SEG/BV-01-C
GHSS 4/16	Live Health Observations characteristic with indicate and notify	GHSS/SR/SGGIT/CHA/BV-06-C GHSS/SR/SCIN/BV-01-C
GHSS 4/18 AND NOT GHSS 4/19	Stored Health Observations with indicate	GHSS/SR/SGGIT/CHA/BV-15-C GHSS/SR/CDRW/BV-08-C
GHSS 4/19 AND NOT GHSS 4/18	Stored Health Observations with notify	GHSS/SR/SGGIT/CHA/BV-16-C GHSS/SR/CDRW/BV-04-C
GHSS 4/17	Stored Health Observations characteristic with indicate and notify	GHSS/SR/SGGIT/CHA/BV-07-C GHSS/SR/RAC/BV-02-C
GHSS 4/11 AND GHSS 4/18 AND (GHSS 5/2 OR GHSS 5/3 OR GHSS 5/4 OR GHSS 5/5 OR GHSS 5/6 OR GHSS 5/7 OR GHSS 5/8 OR GHSS 5/9 OR GHSS 5/10)	Segmentation of Stored Health Observations Indications	GHSS/SR/SEG/BV-04-C
GHSS 4/11 AND GHSS 4/19 AND (GHSS 5/2 OR GHSS 5/3 OR GHSS 5/4 OR GHSS 5/5 OR GHSS 5/6 OR GHSS 5/7 OR GHSS 5/8 OR GHSS 5/9 OR GHSS 5/10)	Segmentation of Stored Health Observations Notifications	GHSS/SR/SEG/BV-03-C
GHSS 4/11	RACP characteristic	GHSS/SR/SGGIT/CHA/BV-08-C GHSS/SR/SGGIT/CP/BI-01-C GHSS/SR/CDRW/BV-05-C GHSS/SR/RAC/BV-01-C GHSS/SR/RAN/BV-01-C GHSS/SR/RAE/BI-02-C GHSS/SR/RAE/BI-03-C GHSS/SR/RAE/BI-04-C GHSS/SR/RAE/BI-05-C GHSS/SR/RAE/BI-06-C
GHSS 4/12	GHS Control Point	GHSS/SR/SGGIT/CHA/BV-09-C GHSS/SR/CDRW/BV-06-C GHSS/SR/GCP/BV-01-C GHSS/SR/GCP/BV-02-C GHSS/SR/GCPE/BI-01-C GHSS/SR/SGGIT/CP/BI-02-C GHSS/SR/GCPE/BI-02-C
GHSS 4/13	Characteristic GGIT – Observation Schedule Changed	GHSS/SR/SGGIT/CHA/BV-10-C GHSS/SR/CDRW/BV-07-C
GHSS 4/4	Descriptor GGIT – Observation schedule	GHSS/SR/SGGIT/DES/BV-11-C

Item	Feature	Test Case(s)
GHSS 4/5	Descriptor GGIT – Observation schedule with write	GHSS/SR/SGGIT/DES/BV-12-C GHSS/SR/DW/BV-01-C GHSS/SR/DW/BI-01-C GHSS/SR/DW/BI-02-C
GHSS 4/6	Descriptor GGIT – Valid Range and Accuracy	GHSS/SR/SGGIT/DES/BV-13-C
GHSS 2/1	SDP Record – Generic Health Sensor Service	GHSS/SR/SGGIT/SDP/BV-14-C
(GHSS 3/2 OR GHSS 3/3) AND GHSS 4/8 AND GHSS 6/1	Indications of live or temporarily stored observations with Numeric observation	GHSS/SR/SCI/BV-01-C
(GHSS 3/2 OR GHSS 3/3) AND GHSS 4/9 AND GHSS 6/1	Notifications of live or temporarily stored observations with Numeric observation	GHSS/SR/SCN/BV-01-C
(GHSS 3/2 OR GHSS 3/3) AND GHSS 4/8 AND GHSS 6/2	Indications of Health Observations with Simple discrete observation	GHSS/SR/SCI/BV-02-C
(GHSS 3/2 OR GHSS 3/3) AND GHSS 4/9 AND GHSS 6/2	Notifications of Health Observations with Simple discrete observation	GHSS/SR/SCN/BV-02-C
(GHSS 3/2 OR GHSS 3/3) AND GHSS 4/8 AND GHSS 6/3	Indications of live or temporarily stored observations with String observation	GHSS/SR/SCI/BV-03-C
(GHSS 3/2 OR GHSS 3/3) AND GHSS 4/9 AND GHSS 6/3	Notifications of live or temporarily stored observations with String observation	GHSS/SR/SCN/BV-03-C
(GHSS 3/2 OR GHSS 3/3) AND GHSS 4/8 AND GHSS 6/4	Indications of live or temporarily stored observations with Sample array observation	GHSS/SR/SCI/BV-04-C
(GHSS 3/2 OR GHSS 3/3) AND GHSS 4/9 AND GHSS 6/4	Notifications of live or temporarily stored observations with Sample array observation	GHSS/SR/SCN/BV-04-C
(GHSS 3/2 OR GHSS 3/3) AND GHSS 4/8 AND GHSS 6/5	Indications of live or temporarily stored observations with Compound observation	GHSS/SR/SCI/BV-05-C
(GHSS 3/2 OR GHSS 3/3) AND GHSS 4/9 AND GHSS 6/5	Notifications of live or temporarily stored observations with Compound observation	GHSS/SR/SCN/BV-05-C
(GHSS 3/2 OR GHSS 3/3) AND GHSS 4/8 AND GHSS 6/6	Indications of live or temporarily stored observations with Compound Discrete Event observation	GHSS/SR/SCI/BV-06-C
(GHSS 3/2 OR GHSS 3/3) AND GHSS 4/9 AND GHSS 6/6	Notifications of live or temporarily stored observations with Compound Discrete Event observation	GHSS/SR/SCN/BV-06-C
(GHSS 3/2 OR GHSS 3/3) AND GHSS 4/8 AND GHSS 6/7	Indications of Health Observations with Compound State/Event observation (bit string)	GHSS/SR/SCI/BV-07-C

Item	Feature	Test Case(s)
(GHSS 3/2 OR GHSS 3/3) AND GHSS 4/9 AND GHSS 6/7	Notifications of live or temporarily stored observations with Compound State/Event observation (bit string)	GHSS/SR/SCN/BV-07-C
(GHSS 3/2 OR GHSS 3/3) AND GHSS 4/8 AND GHSS 6/8	Indications of live or temporarily stored observations with TLV-encoded observation	GHSS/SR/SCI/BV-08-C
GHSS 3/2 AND GHSS 4/9 AND GHSS 6/8	Notifications of live or temporarily stored observations with TLV-encoded observation	GHSS/SR/SCN/BV-08-C
(GHSS 3/2 OR GHSS 3/3) AND GHSS 4/8 AND GHSS 6/9	Indications of live or temporarily stored observations with Observation bundle	GHSS/SR/SCI/BV-09-C
(GHSS 3/2 OR GHSS 3/3) AND GHSS 4/9 AND GHSS 6/9	Notifications of live or temporarily stored observations with Observation bundle	GHSS/SR/SCN/BV-09-C
GHSS 7/3	Delete Stored Records procedure	GHSS/SR/RAD/BV-01-C
GHSS 7/4	Abort Operation procedure	GHSS/SR/RAA/BV-01-C
(GHSS 3/2 OR GHSS 3/3) AND GHSS 3/4 AND (GHSS 4/8 OR GHSS 4/9) AND NOT GHSS 3/7	Server Busy	GHSS/SR/RAE/BI-01-C
GHSS 4/13 AND GHSS 4/14 AND (GHSS 6/1 OR GHSS 6/2 OR GHSS 6/3 OR GHSS 6/4 OR GHSS 6/5 OR GHSS 6/6 OR GHSS 6/7 OR GHSS 6/8 OR GHSS 6/9)	Observation Schedule Changed indication	GHSS/SR/SCI/BV-11-C
GHSS 3/5 AND GHSS 4/5 AND GHSS 4/13 AND (GHSS 6/1 OR GHSS 6/2 OR GHSS 6/3 OR GHSS 6/4 OR GHSS 6/5 OR GHSS 6/6 OR GHSS 6/7 OR GHSS 6/8 OR GHSS 6/9)	Observation Schedule Changed indication due to change to the Observation Schedule descriptor by another Client	GHSS/SR/SCI/BV-12-C

Table 5.1: Test case mapping

6 Revision history and acknowledgments

Revision History

Publication Number	Revision Number	Date	Comments
0	p0	2023-06-13	Approved by BTI on 2023-05-28. GHSS v1.0 adopted by the BoD on 2023-06-13. Prepared for initial publication.
	p1r00–r02	2024-10-04 – 2024-10-10	TSE 24701 (rating 2): Updated TCMT items related to GHSS/SR/SGGIT/CHA/BV-01-C – 03-C for clarity and consistency. TSE 24702 (rating 2): Updated a TCMT item related to GHSS/SR/RAE/BI-01-C for clarity. TSE 25321 (rating 3): Per E25116, updated the pass verdict for GHSS/SR/SEG/BV-01-C – 04-C. TSE 25824 (rating 2): Updated TCMT items related to GHSS/SR/CDRW/BV-02-C, -04-C, and 08-C; GHSS/SR/CR/BV-01-C and -02-C; and GHSS/SR/SGGIT/CHA/BV-05-C, -15-C, and -16-C.
1	p1	2025-02-18	Approved by BTI on 2024-12-23. Prepared for TCRL 2025-1 publication.
	p2r00	2025-01-30	TSE 26959 (rating 2): Updated the TCMT for GHSS/SR/SEG/BV-03-C and -04-C.
2	p2	2025-07-08	Approved by BTI on 2025-06-15. Prepared for TCRL pkg100 publication.

Acknowledgments

Name	Company
Jörg Brakensiek	Bluetooth SIG, Inc.
Ismail Mohamud	Bluetooth SIG, Inc.
Erik Moll	Koninklijke Philips N.V.