Glucose Service (GLS)

***Bluetooth*® Test Suite**

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Contents

1 Scope

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

The objective of this test suite is to provide a basis for interoperability tests for Bluetooth devices giving a high probability of air interface interoperability between different manufacturers' Bluetooth devices.

2 References, Definitions, and Abbreviations

2.1 References

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

[1] Bluetooth Test Strategy and Terminology Overview

[2] Bluetooth Core Specification, Version 4.0 or later

[3] Glucose Service Specification V1.0

[4] ICS Proforma for Glucose Service V1.0

[5] GATT Test Suite GATT.TS

2.2 Definitions

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

2.3 Abbreviations

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

3 Test Suite Structure (TSS)

3.1 Overview

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

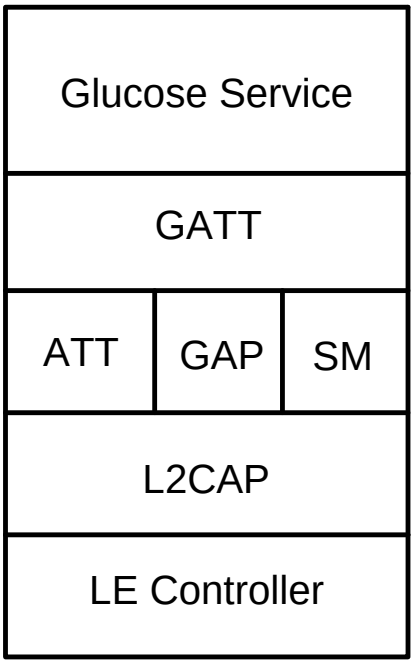


Figure 3.1: Glucose Service Test Model

3.2 Test Strategy

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

The test equipment shall provide an implementation of the Radio Controller and the parts of the Host needed to perform the test cases defined in the Glucose Service Test Suite. For some test cases, it is necessary to stimulate the IUT from an Upper Tester. In practice, this could be implemented as a special test interface, an MMI, or another interface supported by the IUT.

The Glucose 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.

The test suite structure is a tree with the first level representing the protocol groups and described on Section 3.3.

The interface between the IUT and the Upper Tester may be:

- A man-machine interface
- Provided by the IUT manufacturer

3.3 Test Groups

The following test groups have been defined.

- Service Definition
  - Verify the service definition.
- Characteristic Declaration
  - Verify the presence and contents of characteristic declarations.
- Characteristic Descriptors
  - Verify the presence and contents of characteristic descriptors.
- Characteristic Read
  - Verify that characteristics that support reading can be read. Verify the format and value of characteristic values.
- Configure Indication and Notification
  - Verify characteristics can be configured for indication or notification.
- Characteristic Notification
  - Verify that characteristics that support notification can be notified.
- Service Procedures
  - Verify the operation of additional procedures defined in the service specification including aborting procedures, deleting records, reporting records and counting the number of records.

4 Test Cases (TC)

4.1 Introduction

4.1.1 TC Naming Conventions

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

Bolded ID parts shall appear in the order prescribed. Non-bolded ID parts (if applicable) shall appear between the bolded parts. The order of the non-bolded parts may vary from test suite to test suite, but shall be consistent within each individual test suite.

Identifier Abbreviation	**Spec Identifier <spec abbreviation>**
GLS	Glucose Service
Identifier Abbreviation	**Role Identifier <IUT role>**
SEN	Sensor role
Identifier Abbreviation	**Feature Identifier <feat>**
CN	Characteristic Notification
CON	Configure Indication and Notification
CR	Characteristic Read
DEC	Characteristic Declaration
DES	Characteristic Descriptors
SD	Service Definition
SPA	Service Procedure - Abort
SPD	Service Procedure - Delete
SPE	Service Procedure - Error Handling
SPN	Service Procedure - Number
SPR	Service Procedure - Report
SPT	Service Procedure - Time Updates

Table 4.1: GLS TP Class Naming Convention

4.1.2 Conformance

When conformance is claimed, all capabilities indicated as mandatory for this Specification shall be supported in the specified manner (process-mandatory). This also applies for all optional and conditional

capabilities for which support is indicated. All mandatory capabilities, and optional and conditional capabilities for which support is indicated, are subject to verification as part of the Bluetooth Qualification Program.

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

Such tests may verify:

- That claimed capabilities may be used in any order and any number of repetitions that is not excluded by the Specification, OR
- That capabilities enabled by the implementations are sustained over durations expected by the use case, OR
- That the implementation gracefully handles any quantity of data expected by the use case, OR
- That in cases where more than one valid interpretation of the Specification exist, the implementation complies with at least one interpretation and gracefully handles other interpretations OR
- That the implementation is immune to attempted security exploits

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

In any case, where a member finds an issue with the Test Plan Generator, the Test Case as described in the Test Suite, or with the Test System utilized, the Member is required to notify the responsible party via an errata request such that the issue may be addressed.

4.1.3 Pass/Fail Verdict Conventions

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

The convention in this test suite is that, unless there is a specific set of fail conditions outlined in the test case, the IUT fails the test case as soon one of the pass criteria conditions cannot be met and in case this occurs the outcome of the test shall be the Fail Verdict.

4.2 Setup Preambles

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

4.2.1 ATT Bearer on LE Transport

Follow the preamble procedure described in [5] Section 4.2.1.2 with the IUT operating in the Peripheral role.

4.2.2 Record Access Control Point

Follow this preamble procedure to enable the IUT for use with the Record Access Control Point.

1. Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1.
2. The handle of the Glucose Measurement characteristic, Glucose Measurement Context characteristic (if supported) and Record Access Control Point characteristic has been previously discovered by the Lower Tester during the test procedure in Section 4.4 or is known to the Lower Tester by other means.
3. The handle of the Client Characteristic Configuration descriptor of the Glucose Measurement characteristic, Glucose Measurement Context characteristic (if supported) and Record Access Control Point characteristic has been previously discovered by the Lower Tester during the test procedure in Section 4.5 or is known to the Lower Tester by other means.
4. If the Lower Tester and IUT were not previously bonded, perform a bonding procedure. If previously bonded, re-enable encryption.
5. The Glucose Measurement characteristic and Glucose Measurement Context characteristic (if supported) are configured for notifications.
6. The Record Access Control Point characteristic is configured for indications.
7. The Lower Tester has retrieved the most recent stored record using the Report Stored Records Op Code with Operator, 'last record' (0x06) and no Operand.

4.3 Service Definition

Verify the service definition.

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

- Test Purpose

  Verify the IUT has one instantiation of the Glucose Service as either a primary service or a secondary service.

- Reference

  [3] 2

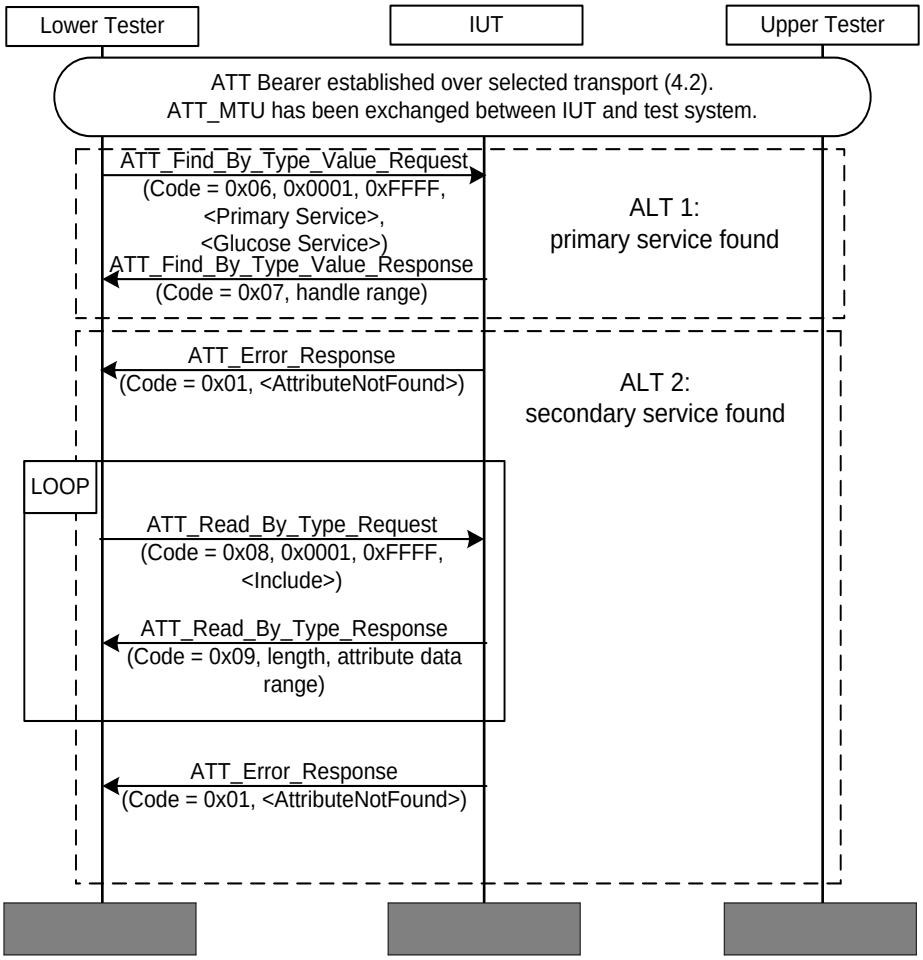
- Initial Condition

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

- Test Procedure

  1. The Lower Tester sends an *ATT_Find_By_Type_Value_Request* (0x0001, 0xFFFF) to the IUT, with type set to «Primary Service» and value set to «Glucose Service». Verify one attribute handle range is returned, containing the starting handle and the ending handle of the service definition.
  2. If no instances of Glucose Service as a primary service are found, the Lower Tester performs the find included services procedure by sending an *ATT_Read_By_Type_ Request* (0x0001,

0xFFFF) to the IUT, with type set to «Include». Verify one attribute handle range is returned, containing the starting handle and the ending handle of the service definition.



- Expected Outcome

  Pass verdict

  One attribute handle range is returned (either as a primary service or a secondary service), containing the starting handle and the ending handle of a Glucose Service definition. The Attribute Type in that service declaration is either «primary service» or «secondary service».

4.4 Characteristic Definition

- Test Purpose

  This test group is for generic use and contains one or more test cases to verify that the characteristic property field of the characteristic declaration meets the requirements of the service. The verification is performed one property at a time, as enumerated in the test cases in Table 4.1 below, using this generic test procedure.

- Reference

  [3] 3

- Initial Condition

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

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

- Test Procedure

  The following test procedure applies to the test cases listed in the table below:

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

- Expected Outcome

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

  Pass verdict

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

  Characteristic Declaration Test Cases

Test Case	Characteristic Properties Value (Requirements)
4.4.1 GLS/SEN/DEC/BV-01-C [Characteristic Declaration - Glucose Measurement]	0x10 ([3] Table 3.1)
4.4.2 GLS/SEN/DEC/BV-02-C [Characteristic Declaration - Glucose Measurement Context]	0x10 ([3] Table 3.1)
4.4.3 GLS/SEN/DEC/BV-03-C [Characteristic Declaration - Glucose Feature]	0x02 ([3] Table 3.1)
4.4.4 GLS/SEN/DEC/BV-04-C [Characteristic Declaration – Record Access Control Point]	0x28 ([3] Table 3.1)

Table 4.2: Characteristic Declaration Test Cases

4.5 Characteristic Descriptors

- Test Purpose

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

- Reference

  [3] 3.1.2, 3.2.2, 3.4.6

- Initial Condition

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

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

- Test Procedure

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

  For each characteristic referenced in a test case below:

  1. Discover all characteristic descriptors of the characteristic by executing the test procedure of GATT test case GATT/SR/GAD/BV-06-C in [5] using the handle range of the characteristic. The IUT returns one or more handle-UUID pairs.
  2. If the UUID in a handle-UUID pair is for a characteristic descriptor referenced in a test case below, read the characteristic descriptor by executing the test procedure of GATT test case GATT/SR/GAR/BV-06-C in [5].
  3. Verify the value of the characteristic descriptor meets the requirements of the service.

- Expected Outcome

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

  Pass verdict

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

Characteristic Descriptor Test Cases

Test Case	Value (Requirements)
4.5.1 GLS/SEN/DES/BV-01-C [Glucose Measurement - Client Characteristic Configuration Descriptor] 0x0000 or 0x0001 ([3] 3.1.2.1)	0x0000 or 0x0001 ([3] 3.1.2.1)
4.5.2 GLS/SEN/DES/BV-02-C [Glucose Measurement Context - Client Characteristic Configuration Descriptor] 0x0000 or 0x0001 ([3] 3.2.2.1)	0x0000 or 0x0001 ([3] 3.2.2.1)
4.5.3 GLS/SEN/DES/BV-03-C [Record Access Control Point - Client Characteristic Configuration Descriptor] 0x0000 or 0x0002 ([3] 3.4.6.1)	0x0000 or 0x0002 ([3] 3.4.6.1)

Table 4.3: Characteristic Descriptor Test Cases

4.6 Characteristic Read

- Test Purpose

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

- Reference

  [3] 3.3

- Initial Condition

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

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

- Test Procedure

  The following test procedure applies to the test cases listed in the table below for each characteristic referenced in a test case below:

  1. Read the characteristic value by executing the test procedure of GATT test case GATT/SR/GAR/BV-01-C in [5].
  2. Verify the characteristic value meets the requirements of the service.

- Expected Outcome

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

  Pass verdict

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

  Characteristic Read Value Test Cases

Test Case	Value (Requirements)
4.6.1 GLS/SEN/CR/BV-01-C [Characteristic Read – Glucose Feature]	2 octets with RFU bits set to 0. ([3] 3.3.1)

Table 4.4: Characteristic Read Value Test Cases

4.6.2 GLS/SEN/CR/BV-02-C [Characteristic Read – Glucose Feature - Multiple Bonds]

- Test Purpose

  Verify the IUT claims proper support for multiple bonds in the Glucose Feature characteristic.

- Reference

  [3] 3.3.1

- Initial Condition

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

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

- Test Procedure

  1. Read the value of the Glucose Feature characteristic by executing the test procedure of GATT test case GATT/SR/GAR/BV-01-C in [5].
  2. Verify the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The characteristic is successfully read and bit 10 of the Glucose Feature characteristic is set to 1.

4.7 Configure Indication and Notification

- Test Purpose

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

- Reference

  [3] 3.1.2, 3.2.2

- Initial Condition

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

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

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

- Test Procedure

  The following test procedure applies to the test cases listed in the table below:

  1. Disable indication or notification by writing value 0x0000 to the client characteristic configuration descriptor of the characteristic using the test procedure of GATT test case GATT/SR/GAW/BV-08-C in [5].
  2. If the test case is for notification, enable notification by writing value 0x0001 to the client characteristic configuration descriptor of the characteristic.
  3. Otherwise, if the test case is for indication, enable indication by writing value 0x0002 to the client characteristic configuration descriptor of the characteristic.
  4. 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.

Configure Indication and Notification Test Cases

Test Case	Value (Requirements)
4.7.1 GLS/SEN/CON/BV-01-C [Configure Notification – Glucose Measurement]	0x0001 ([3] 3.1.2.1)
4.7.2 GLS/SEN/CON/BV-02-C [Configure Notification – Glucose Measurement Context]	0x0001 ([3] 3.2.2.1)
4.7.3 GLS/SEN/CON/BV-03-C [Configure Indication – Record Access Control Point]	0x0002 ([3] 3.4.6.1)

Table 4.5: Configure Indication and Notification Test Cases

4.8 Characteristic Notification

4.8.1 GLS/SEN/CN/BV-01-C [Glucose Measurement Notifications]

- Test Purpose

  Verify the IUT can send notifications of the Glucose Measurement characteristic.

- Reference

  [3] 3.1.1

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

  1. Perform an action on the IUT to create a record containing a Glucose Measurement characteristic.
  2. A connection is established between the Lower Tester and IUT.
  3. Lower Tester uses the RACP (e.g., using any supported and applicable procedure, such as in Section 4.9.7) to cause the record to be notified.
  4. Verify the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one or more notifications of the Glucose Measurement characteristic.

  The length of the characteristic corresponds to the bits in Flags field (Length between 10 and 17 octets).

Flags field is present.

Sequence Number field is present.

The Base Time field is present.

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

If either the Glucose Concentration field or the Type-Sample Location field is present, verify that both are present.

4.8.2 GLS/SEN/CN/BV-02-C [Glucose Measurement Notifications – Time Offset]

- Test Purpose

  Verify the IUT can send notifications of the Glucose Measurement characteristic that include Time Offset values.

- Reference

  [3] 3.1.1.4

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

  1. Perform an action on the IUT to create a record containing a Glucose Measurement characteristic that will induce it to send notifications of the Glucose Measurement characteristic that includes a Time Offset value.
  2. A connection is established between the Lower Tester and IUT.
  3. The Lower Tester uses the RACP (e.g., using any supported and applicable procedure, such as in Section 4.9.7) to cause the record to be notified.
  4. Verify the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one or more notifications of the Glucose Measurement characteristic that include Time Offset values.

  The length of the characteristic corresponds to the bits in Flags field.

  Bit 0 of the Flags field is set.

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

4.8.3 GLS/SEN/CN/BV-03-C [Glucose Measurement Notifications – Glucose Concentration and Type-Sample Location – kg/L]

- Test Purpose

  Verify the IUT can send notifications of the Glucose Measurement characteristic that include a Glucose Concentration value in units of kg/L and a Type-Sample Location value.

- Reference

  [3] 3.1.1.5

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

  1. Perform an action on the IUT to create a record containing a Glucose Measurement characteristic that includes Glucose Concentration and Type-Sample Location values. The units of Glucose concentration is set to kg/L (bit 2 = 0). The value of the Glucose concentration is between 1 and 99 mg/dL with a resolution of 1.
  2. A connection is established between the Lower Tester and IUT.
  3. The Lower Tester uses the RACP (e.g., using any supported and applicable procedure, such as in Section 4.9.7) to cause the record to be notified.
  4. Verify the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one or more notifications of the Glucose Measurement characteristic that include a Glucose Concentration value in kg/L and a Type-Sample Location value.

  Both Glucose Concentration and Type-Sample Location fields are present.

  Verify that the Type nibble is the Least Significant Nibble and the Sample Location nibble is the Most Significant Nibble.

  Bit 1 of the Flags field is set.

  The length of the characteristic corresponds to the bits in Flags field.

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

  Bit 2 is 0 meaning Glucose concentration is in units of kg/L.

  The value of the mantissa of the Glucose Concentration SFLOAT is consistent with the value sent by the IUT.

  The exponent of the SFLOAT is -5 (since the bluetooth.org base unit is kg/L).

4.8.4 GLS/SEN/CN/BV-04-C [Glucose Measurement Notifications – Glucose Concentration and Type-Sample Location – mol/L]

- Test Purpose

  Verify the IUT can send notifications of the Glucose Measurement characteristic that include a Glucose Concentration value in units of mol/L and a Type-Sample Location value.

- Reference

  [3] 3.1.1.5

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

  1. Perform an action on the IUT to create a record containing a Glucose Measurement characteristic that includes Glucose Concentration and Type-Sample Location values. The units of Glucose concentration is set to mol/L (bit 2 = 1). The value of the Glucose concentration is between 1.0 mmol/L and 99.9 mmol/L with a resolution of 0.1 mmol/L.
  2. A connection is established between the Lower Tester and IUT.
  3. The Lower Tester uses the RACP (e.g., using any supported and applicable procedure, such as in Section 4.9.7) to cause the record to be notified.
  4. Verify the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one or more notifications of the Glucose Measurement characteristic that include a Glucose Concentration value in mol/L and a Type-Sample Location value.

  Both Glucose Concentration and Type-Sample Location fields are present.

  Verify that the Type nibble is the Least Significant Nibble and the Sample Location nibble is the Most Significant Nibble.

  Bit 1 of the Flags field is set.

  The length of the characteristic corresponds to the bits in Flags field.

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

  Bit 2 is 1 meaning Glucose concentration is in units of mol/L.

  The value of the mantissa of the Glucose Concentration SFLOAT(-4) is consistent with the value sent by the IUT.

  The exponent of the SFLOAT is consistent with the value sent by the IUT (since the bluetooth.org base unit is mol/L and the resolution is 0.1 mmol/L).

4.8.5 GLS/SEN/CN/BV-05-C [Glucose Measurement Notifications – Sensor Status Annunciation]

- Test Purpose

  Verify the IUT can send notifications of the Glucose Measurement characteristic that Sensor Status Annunciation value.

- Reference

  [3] 3.1.1.6

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

  1. Perform an action on the IUT to create a record containing a Glucose Measurement characteristic that includes a Sensor Status Annunciation value.
  2. A connection is established between the Lower Tester and IUT.
  3. The Lower Tester uses the RACP (e.g., using any supported and applicable procedure, such as in Section 4.9.7) to cause the record to be notified.
  4. Verify the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one or more notifications of the Glucose Measurement characteristic that include Sensor Status Annunciation values.

  Bit 3 of the Flags field is set.

  The length of the characteristic corresponds to the bits in Flags field.

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

  None of the bits that are set to 1 contradict the features declared in the Glucose Feature characteristic.

4.8.6 GLS/SEN/CN/BV-06-C [Glucose Measurement Context Notifications]

- Test Purpose

  Verify the IUT can send notifications of the Glucose Measurement Context characteristic.

- Reference

  [3] 3.2.1

- Initial Condition

  Perform the preamble described in Section 4.2.2.

If a connection exists, it shall be disconnected.

- Test Procedure

  1. Perform an action on the IUT to create a record containing a Glucose Measurement Context characteristic.
  2. A connection is established between the Lower Tester and IUT.
  3. The Lower Tester uses the RACP (e.g., using any supported and applicable procedure, such as in Section 4.9.7) to cause the record to be notified.
  4. Verify the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one or more notifications of the Glucose Measurement Context characteristic.

  The length of the characteristic corresponds to the bits in Flags field (Length between 4 and 17 octets).

  Flags field is present.

  Sequence Number field is present.

  At least one optional field is present.

  The notifications for the Glucose Measurement Context characteristic follow the corresponding Glucose Measurement characteristic.

  The Context Information Follows Flag in the Flags field of the Glucose Measurement characteristic is set to 1 and the values of the Sequence Number fields for the two characteristics is the same.

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

  If either the Carbohydrate ID field or the Carbohydrate field is present, verify that both are present.

  If either the Exercise Duration field or the Exercise Intensity field is present, verify that both are present.

  If either the Medication ID field or the Medication field is present, verify that both are present.

4.8.7 GLS/SEN/CN/BV-07-C [Glucose Measurement Context Notifications - Carbohydrate ID and Carbohydrate]

- Test Purpose

  Verify the IUT can send notifications of the Glucose Measurement Context characteristic that include Carbohydrate ID and Carbohydrate values.

- Reference

  [3] 3.2.1.4

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

  1. Perform an action on the IUT to create a record containing a Glucose Measurement Context characteristic that includes Carbohydrate ID and Carbohydrate values. The value of the Carbohydrate field is between 1 and 99 grams with a resolution of 1.
  2. A connection is established between the Lower Tester and IUT.
  3. The Lower Tester uses the RACP (e.g., using any supported and applicable procedure, such as in Section 4.9.7) to cause the record to be notified.
  4. Verify the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one or more notifications of the Glucose Measurement Context characteristic that include Carbohydrate ID and Carbohydrate values.

  Both the Carbohydrate ID value and the Carbohydrate fields are present.

  Bit 0 of the Flags field is set.

  The length of the characteristic corresponds to the bits in Flags field.

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

  The value of the mantissa of the Carbohydrate SFLOAT is consistent with the value sent by the IUT.

  The exponent of the SFLOAT is -3 (since the bluetooth.org base unit is kg).

4.8.8 GLS/SEN/CN/BV-08-C [Glucose Measurement Context Notifications - Meal]

- Test Purpose

  Verify the IUT can send notifications of the Glucose Measurement Context characteristic that include Meal values.

- Reference

  [3] 3.2.1.5

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

  1. Perform an action on the IUT to create a record containing a Glucose Measurement Context characteristic that includes a Meal value.

2. A connection is established between the Lower Tester and IUT.
3. The Lower Tester uses the RACP (e.g., using any supported and applicable procedure, such as in Section 4.9.7) to cause the record to be notified.
4. Verify the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one or more notifications of the Glucose Measurement Context characteristic that include Meal values.

  Bit 1 of the Flags field is set.

  The length of the characteristic corresponds to the bits in Flags field.

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

4.8.9 GLS/SEN/CN/BV-09-C [Glucose Measurement Context Notifications – Tester-Health]

- Test Purpose

  Verify the IUT can send notifications of the Glucose Measurement Context characteristic that include Tester-Health values.

- Reference

  [3] 3.2.1.6

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

1. Perform an action on the IUT to create a record containing a Glucose Measurement Context characteristic that includes a Tester-Health value.
2. A connection is established between the Lower Tester and IUT.
3. The Lower Tester uses the RACP (e.g., using any supported and applicable procedure, such as in Section 4.9.7) to cause the record to be notified.
4. Verify the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one or more notifications of the Glucose Measurement Context characteristic that include Tester-Health values.

  Bit 2 of the Flags field is set.

  The length of the characteristic corresponds to the bits in Flags field.

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

Verify that the Tester nibble is the Least Significant Nibble and the Health nibble is the Most Significant Nibble.

4.8.10 GLS/SEN/CN/BV-10-C [Glucose Measurement Context Notifications – Exercise Duration and Exercise Intensity]

- Test Purpose

  Verify the IUT can send notifications of the Glucose Measurement Context characteristic that include Exercise Duration and Exercise Intensity values.

- Reference

  [3] 3.2.1.7

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

  1. Perform an action on the IUT to create a record containing a Glucose Measurement Context characteristic that includes Exercise Duration and Exercise Intensity values.
  2. A connection is established between the Lower Tester and IUT.
  3. The Lower Tester uses the RACP (e.g., using any supported and applicable procedure, such as in Section 4.9.7) to cause the record to be notified.
  4. Verify the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one or more notifications of the Glucose Measurement Context characteristic that include Exercise Duration and Exercise Intensity values.

  Both the Exercise Duration and Exercise Intensity fields are present.

  Bit 3 of the Flags field is set.

  The length of the characteristic corresponds to the bits in Flags field.

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

4.8.11 GLS/SEN/CN/BV-11-C [Glucose Measurement Context Notifications – Medication ID and Medication - kilograms]

- Test Purpose

  Verify the IUT can send notifications of the Glucose Measurement Context characteristic that include a Medication ID and a Medication value in kilograms.

- Reference

  [3] 3.2.1.8

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

  1. Perform an action on the IUT to create a record containing a Glucose Measurement Context characteristic that includes Medication ID and Medication values. The units of Medication are set to kilograms (bit 5 = 0). The value of the Medication concentration is between 1 and 99 milligrams with a resolution of 1.
  2. A connection is established between the Lower Tester and IUT.
  3. The Lower Tester uses the RACP (e.g., using any supported and applicable procedure, such as in Section 4.9.7) to cause the record to be notified.
  4. Verify the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one or more notifications of the Glucose Measurement Context characteristic that include a Medication ID and a Medication value in kilograms.

  Both Medication ID and Medication fields are present.

  Bit 4 of the Flags field is set.

  The length of the characteristic corresponds to the bits in Flags field.

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

  Bit 5 = 0 indicates that Medication is in units of kilograms.

  The value of the mantissa of the Medication SFLOAT is consistent with the value sent by the IUT.

  The exponent of the SFLOAT is -6 (since the bluetooth.org base unit is kg).

4.8.12 GLS/SEN/CN/BV-12-C [Glucose Measurement Context Notifications – Medication ID and Medication - liters]

- Test Purpose

  Verify the IUT can send notifications of the Glucose Measurement Context characteristic that include a Medication ID and a Medication value in liters.

- Reference

  [3] 3.2.1.8

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

  1. Perform an action on the IUT to create a record containing a Glucose Measurement Context characteristic that includes Medication ID and Medication values. The units of Medication are set to liters (bit 5 = 1). The value of the Medication concentration is between 1 and 99 milliliters.
  2. A connection is established between the Lower Tester and IUT.
  3. The Lower Tester uses the RACP (e.g., using any supported and applicable procedure, such as in Section 4.9.7) to cause the record to be notified.
  4. Verify the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one or more notifications of the Glucose Measurement Context characteristic that include a Medication ID and a Medication value in liters.

  Both Medication ID and Medication fields are present.

  Bit 4 of the Flags field is set.

  The length of the characteristic corresponds to the bits in Flags field.

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

  Bit 5 = 1 indicates that Medication is in units of liters.

  The value of the Medication amount is between 1 and 99 mL.

  The mantissa of the SFLOAT is consistent with the value sent by the IUT.

  The exponent of the SFLOAT is consistent with the value sent by the IUT, i.e., an exponent of -3 if resolution is in mL or -6 if in uL (since the Bluetooth.org base unit is L).

4.8.13 GLS/SEN/CN/BV-13-C [Glucose Measurement Context Notifications – Medication ID and Medication - HbA1c]

- Test Purpose

  Verify the IUT can send notifications of the Glucose Measurement Context characteristic that include HbA1c values.

- Reference

  [3] 3.2.1.9

- Initial Condition

  Perform the preamble described in Section 4.2.2.

If a connection exists, it shall be disconnected.

- Test Procedure

  1. Perform an action on the IUT to create a record containing a Glucose Measurement Context characteristic that includes an HbA1c value. The value of the HbA1c field is between 1 and 99 percent with a resolution of 1.
  2. A connection is established between the Lower Tester and IUT.
  3. The Lower Tester uses the RACP (e.g., using any supported and applicable procedure, such as in Section 4.9.7) to cause the record to be notified.
  4. Verify the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one or more notifications of the Glucose Measurement Context characteristic that include HbA1c values.

  Bit 6 of the Flags field is set.

  The length of the characteristic corresponds to the bits in Flags field.

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

  The value of the mantissa of the HbA1c SFLOAT is consistent with the value sent by the IUT.

  The exponent of the SFLOAT is 0 (since the bluetooth.org base unit is percentage).

4.9 Service Procedures – Report Stored Records

This test group contains test cases to verify compliant operation when the Lower Tester uses Record Access Control Point (RACP) Report Stored Records procedure.

4.9.1 GLS/SEN/SPR/BV-01-C [Report Stored Records - All records]

- Test Purpose

  Verify the IUT can perform the Report Stored Records procedure with an Operator of ‘all records’.

- Reference

  [3] 3.4.3.4

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

  1. Perform an action on the IUT that will induce it to generate 3 records that may or may not contain Glucose Measurement Context characteristics. If the Glucose Measurement Context characteristic is supported, it is only present in the second record.

2. A connection is established between the Lower Tester and IUT.
3. Lower Tester writes the Report stored records Op Code (0x01) to the RACP using an Operator of ‘all records’ (0x01) and no Operand.
4. The IUT sends three notifications of the Glucose Measurement characteristic and one notification of the Glucose Measurement Context characteristic (if supported).
5. The Lower Tester receives three *ATT_Handle_Value_Notification* from the IUT containing the Glucose Measurement characteristic handle and value and one *ATT_Handle_Value_Notification* of the Glucose Measurement Context characteristic handle and value (if supported).
6. The IUT sends an indication of the Record Access Control Point characteristic with the Response Code Op Code (0x06) an Operator of Null (0x00) and an Operand representing Request Op Code (0x01) followed by the Response Code for ‘success’ (0x01).
7. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Record Access Control Point characteristic handle and value.
8. The Lower Tester sends an *ATT_Handle_Value_Confirmation* to the IUT.
9. Verify the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends three notifications of the Glucose Measurement characteristic and (if supported) one notification of the Glucose Measurement Context characteristic after the second Glucose Measurement characteristic.

  The IUT sends one indication of the Record Access Control Point characteristic with the Response Code Op Code containing a valid Operator and Operand.

  If the Glucose Measurement Context characteristic was included, the Context Information Follows Flag in the Flags field of the Glucose Measurement characteristic shall be set to 1 and the values of the Sequence Number fields for the two characteristics is the same.

  The oldest record is transmitted before newer records.

  The value of the Sequence Number increments by 1 for each successive Glucose Measurement characteristic.

  The Time offset field is included in first transmitted record and at least anytime when it changes.

4.9.2 GLS/SEN/SPR/BV-02-C [Report Stored Records - Less than or equal to Sequence Number]

- Test Purpose

  Verify the IUT can perform the Report Stored Records procedure with an Operator of ‘less than or equal to’ and using the Sequence Number Filter Type in the Operand.

- Reference

  [3] 3.4.3.4

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

  1. Perform an action on the IUT that will induce it to generate 3 records that may or may not contain Glucose Measurement Context characteristics. If the Glucose Measurement Context characteristic is supported, it is only present in the second record.
  2. A connection is established between the Lower Tester and IUT.
  3. Lower Tester writes the Report stored records Op Code (0x01) to the RACP using an Operator of 'less than or equal to' (0x02) and an Operand representing the Sequence Number Filter Type (0x01) and the maximum value for the filter representing the sequence number of the second record.
  4. The IUT sends two notifications of the Glucose Measurement characteristic and one notification of the Glucose Measurement Context characteristic (if supported) representing the oldest two records.
  5. The Lower Tester receives two *ATT_Handle_Value_Notification* from the IUT containing the Glucose Measurement characteristic handle and value and one *ATT_Handle_Value_Notification* of the Glucose Measurement Context characteristic handle and value (if supported).
  6. The IUT sends an indication of the Record Access Control Point characteristic with the Response Code Op Code (0x06) an Operator of Null (0x00) and an Operand representing Request Op Code (0x01) followed by the Response Code for 'success' (0x01).
  7. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Record Access Control Point characteristic handle and value.
  8. The Lower Tester sends an *ATT_Handle_Value_Confirmation* to the IUT.
  9. Verify the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends two notifications of the Glucose Measurement characteristic and (if supported) one notification of the Glucose Measurement Context characteristic after the second Glucose Measurement characteristic that represent the oldest two records.

  The IUT sends one indication of the Record Access Control Point characteristic with the Response Code Op Code containing a valid Operator and Operand.

  If the Glucose Measurement Context characteristic was included, the Context Information Follows Flag in the Flags field of the Glucose Measurement characteristic shall be set to 1 and the values of the Sequence Number fields for the two characteristics is the same.

4.9.3 GLS/SEN/SPR/BV-03-C [Report Stored Records - Greater than or equal to Sequence Number]

- Test Purpose

  Verify the IUT can perform the Report Stored Records procedure with an Operator of ‘greater than or equal to’ and using the Sequence Number Filter Type in the Operand.

- Reference

  [3] 3.4.3.4, 3.4.1

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

  1. Perform an action on the IUT that will induce it to generate 3 records that may or may not contain Glucose Measurement Context characteristics. If the Glucose Measurement Context characteristic is supported, it is only present in the second record.
  2. A connection is established between the Lower Tester and IUT.
  3. Lower Tester writes the Report stored records Op Code (0x01) to the RACP using an Operator of ‘greater than or equal to’ (0x03) and an Operand representing the Sequence Number Filter Type (0x01) and the maximum value for the filter representing the sequence number of the second record.
  4. The IUT sends two notifications of the Glucose Measurement characteristic and one notification of the Glucose Measurement Context characteristic (if supported) representing the two most recent records.
  5. The Lower Tester receives two *ATT_Handle_Value_Notification* from the IUT containing the Glucose Measurement characteristic handle and value and one *ATT_Handle_Value_Notification* of the Glucose Measurement Context characteristic handle and value (if supported).
  6. The IUT sends an indication of the Record Access Control Point characteristic with the Response Code Op Code (0x06) an Operator of Null (0x00) and an Operand representing Request Op Code (0x01) followed by the Response Code for ‘success’ (0x01).
  7. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Record Access Control Point characteristic handle and value.
  8. The Lower Tester sends an *ATT_Handle_Value_Confirmation* to the IUT.
  9. Perform step 3 again using a Sequence Number greater than the most recent record.
  10. The IUT sends an indication of the Record Access Control Point characteristic with the Response Code Op Code (0x06) an Operator of Null (0x00) and an Operand representing Request Op Code (0x01) followed by the Response Code for ‘no records found’ (0x06)
  11. Verify the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends two notifications of the Glucose Measurement characteristic and (if supported) one notification of the Glucose Measurement Context characteristic after the first Glucose Measurement characteristic representing the two most recent records.

  For the ‘success’ case, the IUT sends one indication of the Record Access Control Point characteristic with the Response Code Op Code containing a valid Operator and Operand.

  For the ‘no records found’ case, the IUT sends one indication of the Record Access Control Point characteristic with the Response Code Op Code containing a valid Operator and Operand.

  If the Glucose Measurement Context characteristic was included, the Context Information Follows Flag in the Flags field of the Glucose Measurement characteristic shall be set to 1 and the values of the Sequence Number fields for the two characteristics is the same.

4.9.4 GLS/SEN/SPR/BV-04-C [Report Stored Records - Greater than or equal to User Facing Time]

- Test Purpose

  Verify the IUT can perform the Report Stored Records procedure with an Operator of ‘greater than or equal to’ and using the User Facing Time Filter Type in the Operand.

- Reference

  [3] 3.4.3.4

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

  1. Perform an action on the IUT that will induce it to generate 3 records that may or may not contain Glucose Measurement Context characteristics. If the Glucose Measurement Context characteristic is supported, it is only present in the second record.
  2. A connection is established between the Lower Tester and IUT.
  3. Lower Tester writes the Report stored records Op Code (0x01) to the RACP using an Operator of ‘greater than or equal to’ (0x03) and a Operand containing the User Facing Time Filter Type (0x02) followed by the value of the user facing time for the second record.
  4. The IUT sends two notifications of the Glucose Measurement characteristic and one notification of the Glucose Measurement Context characteristic (if supported) representing the two most recent records.
  5. The Lower Tester receives two *ATT_Handle_Value_Notification* from the IUT containing the Glucose Measurement characteristic handle and value and one *ATT_Handle_Value_Notification* of the Glucose Measurement Context characteristic handle and value (if supported).

6. The IUT sends an indication of the Record Access Control Point characteristic with the Response Code Op Code (0x06) an Operator of Null (0x00) and an Operand representing Request Op Code (0x01) followed by the Response Code for 'success' (0x01).
7. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Record Access Control Point characteristic handle and value.
8. The Lower Tester sends an *ATT_Handle_Value_Confirmation* to the IUT.
9. Verify the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends two notifications of the Glucose Measurement characteristic and (if supported) one notification of the Glucose Measurement Context characteristic after the first Glucose Measurement characteristic representing the two most recent records.

  The IUT sends one indication of the Record Access Control Point characteristic with the Response Code Op Code containing a valid Operator and Operand.

  If the Glucose Measurement Context characteristic was included, the Context Information Follows Flag in the Flags field of the Glucose Measurement characteristic shall be set to 1 and the values of the Sequence Number fields for the two characteristics is the same.

4.9.5 GLS/SEN/SPR/BV-05-C [Report Stored Records - Within range of Sequence Number value pair]

- Test Purpose

  Verify the IUT can perform the Report Stored Records procedure with an Operator of 'within range of' and using the Sequence Number Filter Type in the Operand.

- Reference

  [3] 3.4.3.4

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

1. Perform an action on the IUT that will induce it to generate 4 records that may or may not contain Glucose Measurement Context characteristics. If the Glucose Measurement Context characteristic is supported, it is only present in the second record.
2. A connection is established between the Lower Tester and IUT.
3. Lower Tester writes the Report stored records Op Code (0x01) to the RACP using an Operator of 'within range of' (0x04) and a Operand containing the Sequence Number Filter Type (0x01) followed by a pair of sequence number values representing the value of the second record and the value of the third record.

4. The IUT sends two notifications of the Glucose Measurement characteristic and one notification of the Glucose Measurement Context characteristic (if supported) representing the second and third records.
5. The Lower Tester receives two *ATT_Handle_Value_Notification* from the IUT containing the Glucose Measurement characteristic handle and value and one *ATT_Handle_Value_Notification* of the Glucose Measurement Context characteristic handle and value (if supported).
6. The IUT sends an indication of the Record Access Control Point characteristic with the Response Code Op Code (0x06) an Operator of Null (0x00) and an Operand representing Request Op Code (0x01) followed by the Response Code for 'success' (0x01).
7. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Record Access Control Point characteristic handle and value.
8. The Lower Tester sends an *ATT_Handle_Value_Confirmation* to the IUT.
9. Verify the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends two notifications of the Glucose Measurement characteristic and (if supported) one notification of the Glucose Measurement Context characteristic after the first Glucose Measurement characteristic representing the second and third records.

  The IUT sends one indication of the Record Access Control Point characteristic with the Response Code Op Code containing a valid Operator and Operand.

  If the Glucose Measurement Context characteristic was included, the Context Information Follows Flag in the Flags field of the Glucose Measurement characteristic shall be set to 1 and the values of the Sequence Number fields for the two characteristics is the same.

4.9.6 GLS/SEN/SPR/BV-06-C [Report Stored Records – First record]

- Test Purpose

  Verify the IUT can perform the Report Stored Records procedure with an Operator of 'first record'.

- Reference

  [3] 3.4.3.4

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

1. Perform an action on the IUT that will induce it to generate 3 records that may or may not contain Glucose Measurement Context characteristics. If the Glucose Measurement Context characteristic is supported, it is only present in the second record.
2. A connection is established between the Lower Tester and IUT.

3. Lower Tester writes the Report stored records Op Code (0x01) to the RACP using an Operator of ‘first record’ (0x05) and no Operand.
4. The IUT sends one notification of the Glucose Measurement characteristic.
5. The Lower Tester receives one *ATT_Handle_Value_Notification* from the IUT containing the Glucose Measurement characteristic handle and value.
6. The IUT sends an indication of the Record Access Control Point characteristic with the Response Code Op Code (0x06) an Operator of Null (0x00) and an Operand representing Request Op Code (0x01) followed by the Response Code for ‘success’ (0x01).
7. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Record Access Control Point characteristic handle and value.
8. The Lower Tester sends an *ATT_Handle_Value_Confirmation* to the IUT.
9. Verify the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one notification of the Glucose Measurement characteristic representing the oldest record.

  The IUT sends one indication of the Record Access Control Point characteristic with the Response Code Op Code containing a valid Operator and Operand.

  If the Glucose Measurement Context characteristic was included, the Context Information Follows Flag in the Flags field of the Glucose Measurement characteristic shall be set to 1 and the values of the Sequence Number fields for the two characteristics is the same.

4.9.7 GLS/SEN/SPR/BV-07-C [Report Stored Records – Last record]

- Test Purpose

  Verify the IUT can perform the Report Stored Records procedure with an Operator of ‘last record’.

- Reference

  [3] 3.4.3.4

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

1. Perform an action on the IUT that will induce it to generate 3 records that may or may not contain Glucose Measurement Context characteristics. If the Glucose Measurement Context characteristic is supported, it is only present in the second record.
2. A connection is established between the Lower Tester and IUT.
3. Lower Tester writes the Report stored records Op Code (0x01) to the RACP using an Operator of ‘last record’ (0x06) and no Operand.

4. The IUT sends one notification of the Glucose Measurement characteristic representing the most recent record.
5. The Lower Tester receives one *ATT_Handle_Value_Notification* from the IUT containing the Glucose Measurement characteristic handle and value.
6. The IUT sends an indication of the Record Access Control Point characteristic with the Response Code Op Code (0x06) an Operator of Null (0x00) and an Operand representing Request Op Code (0x01) followed by the Response Code for ‘success’ (0x01).
7. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Record Access Control Point characteristic handle and value.
8. The Lower Tester sends an *ATT_Handle_Value_Confirmation* to the IUT.
9. Verify the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one notification of the Glucose Measurement characteristic representing the most recent record.

  The IUT sends one indication of the Record Access Control Point characteristic with the Response Code Op Code containing a valid Operator and Operand.

  If the Glucose Measurement Context characteristic was included, the Context Information Follows Flag in the Flags field of the Glucose Measurement characteristic shall be set to 1 and the values of the Sequence Number fields for the two characteristics is the same.

4.10 Service Procedures – Delete Stored Records

This test group contains test cases to verify compliant operation when the Lower Tester uses Record Access Control Point (RACP) Delete Stored Records procedure.

4.10.1 GLS/SEN/SPD/BV-01-C [Delete Stored Records - All records]

- Test Purpose

  Verify the IUT can perform the Delete Stored Records procedure with an Operator of ‘all records’. Also verify that the sequence number value is not reset following this procedure.

- Reference

  [3] 3.4.3.3

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

  1. Perform an action on the IUT that will induce it to generate 3 records that may or may not contain Glucose Measurement Context characteristics. If the Glucose Measurement Context characteristic is supported, it is only present in the second record.

2. A connection is established between the Lower Tester and IUT.
3. Lower Tester writes the Delete stored records Op Code (0x02) to the RACP using an Operator of ‘all records’ (0x01) and no Operand.
4. The IUT sends the Delete stored records Op Code (0x02) to the RACP using an Operator of ‘all records’ (0x01) and no Operand.
5. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Record Access Control Point characteristic handle and value.
6. The Lower Tester sends an *ATT_Handle_Value_Confirmation* to the IUT.
7. Verify that all records have been deleted from the IUT.
8. Connection established between Tester and IUT is disconnected.
9. Perform an action on the IUT that will induce it to generate 1 more record that may or may not contain Glucose Measurement Context characteristic.
10. A connection is established between the Lower Tester and IUT.
11. The Lower Tester writes the Report stored records Op Code (0x01) to the RACP using an Operator of ‘all records’ (0x01) and no Operand.
12. The IUT sends one notification of the Glucose Measurement characteristic and one notification of the Glucose Measurement Context characteristic (if supported).
13. The IUT sends an indication of the Record Access Control Point characteristic with the Response Code Op Code (0x06) an Operator of Null (0x00) and an Operand representing Request Op Code (0x01) followed by the Response Code for ‘success’ (0x01).
14. Verify the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one indication of the Record Access Control Point characteristic with the Response Code Op Code containing a valid Operator and Operand for each operation.

  Verify that the sequence number was not altered by the Delete Stored Records operation.

  All records had been deleted from the IUT.

4.10.2 GLS/SEN/SPD/BV-02-C [Delete Stored Records - Within range of Sequence Number value pair]

- Test Purpose

  Verify the IUT can perform the Delete Stored Records procedure with an Operator of ‘within range of’.

- Reference

  [3] 3.4.3.3

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

  1. Perform an action on the IUT that will induce it to generate 4 records that may or may not contain Glucose Measurement Context characteristics. If the Glucose Measurement Context characteristic is supported, it is only present in the second record.
  2. A connection is established between the Lower Tester and IUT.
  3. Lower Tester writes the Delete stored records Op Code (0x02) to the RACP using an Operator of 'within range of' (0x04) and a Operand containing the Sequence Number Filter Type (0x01) followed by a pair of sequence number values representing the value of the second record and the value of the third record.
  4. The IUT sends the Delete stored records Op Code (0x02) to the RACP using an Operator of 'within range of' (0x04) and a Operand containing the Sequence Number Filter Type (0x01) followed by a pair of sequence number values representing the value of the second record and the value of the third record.
  5. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Record Access Control Point characteristic handle and value.
  6. The Lower Tester sends an *ATT_Handle_Value_Confirmation* to the IUT.
  7. Verify that the second and third records have been deleted from the IUT.
  8. Verify the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one indication of the Record Access Control Point characteristic with the Response Code Op Code containing a valid Operator and Operand.

  The second and third records have been deleted from the IUT.

4.11 Service Procedures – Abort Operation

This test group contains test cases to verify compliant operation when the Lower Tester uses Record Access Control Point (RACP) Abort Operation procedure.

4.11.1 GLS/SEN/SPA/BV-01-C [Abort Operation – Report Stored Records]

- Test Purpose

  Verify the IUT can perform an Abort of the Report Stored Records procedure.

- Reference

  [3] 3.4.3.5

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

  1. Perform an action on the IUT that will induce it to generate enough records such that the transmission is not able to complete before the abort is attempted. In most cases ~200 records is sufficient since this will take over 5 seconds to transfer. The records may or may not contain Glucose Measurement Context characteristics.
  2. A connection is established between the Lower Tester and IUT.
  3. Lower Tester writes the Report stored records Op Code (0x01) to the RACP using an Operator of 'all records' (0x01) and no Operand.
  4. The IUT starts to send notifications of the Glucose Measurement characteristic and the Glucose Measurement Context characteristic (if supported).
  5. The Lower Tester receives one or more *ATT_Handle_Value_Notification* from the IUT containing the Glucose Measurement characteristic handle and value and one or more notifications of the Glucose Measurement Context characteristic handle and value (if supported).
  6. The Lower Tester writes the Abort Operation Op Code (0x03) to the RACP with an Operator of Null and no Operand.
  7. The IUT sends an indication of the Record Access Control Point characteristic with the Response Code Op Code (0x06) an Operator of Null (0x00) and an Operand representing Request Op Code (0x03) followed by the Response Code for 'success' (0x01).
  8. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Record Access Control Point characteristic handle and value.
  9. The Lower Tester sends an *ATT_Handle_Value_Confirmation* to the IUT.
  10. Verify the notifications stop.
  11. Verify the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends some, but not all notifications of the Glucose Measurement characteristic and (if supported) notifications of the Glucose Measurement Context characteristic.

  The IUT sends one indication of the Record Access Control Point characteristic with the Response Code Op Code containing a valid Operator and Operand for Abort Operation.

  If the Glucose Measurement Context characteristic was included, the Context Information Follows Flag in the Flags field of the Glucose Measurement characteristic shall be set to 1 and the values of the Sequence Number fields for the two characteristics is the same.

4.12 Service Procedures – Report Number of Stored Records

This test group contains test cases to verify compliant operation when the Lower Tester uses Record Access Control Point (RACP) Report Number of Stored Records procedure.

4.12.1 GLS/SEN/SPN/BV-01-C [Report Number of Stored Records - All records]

- Test Purpose

  Verify the IUT can perform the Report Number of Stored Records procedure with an Operator of ‘all records’.

- Reference

  [3] 3.4.3.2

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

  1. Perform an action on the IUT that will induce it to generate 3 records that may or may not contain Glucose Measurement Context characteristics. If the Glucose Measurement Context characteristic is supported, it is only present in the second record.
  2. A connection is established between the Lower Tester and IUT.
  3. The Lower Tester writes the Report number of stored records Op Code (0x04) to the RACP using an Operator of ‘all records’ (0x01) and no Operand.
  4. The IUT sends an indication of the Record Access Control Point characteristic with the Number of stored records response Op Code (0x05) an Operator of Null (0x00) and an Operand representing that three records were found (0x0003).
  5. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Record Access Control Point characteristic handle and value.
  6. The Lower Tester sends an *ATT_Handle_Value_Confirmation* to the IUT.
  7. Verify the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one indication of the Record Access Control Point characteristic with the Number of Stored Records Response Op Code containing a valid Operator and Operand.

  The Operand contains a value of 3 records found.

  The value of the Operand represents the correct number of all records in the IUT.

4.12.2 GLS/SEN/SPN/BV-02-C [Report Number of Stored Records - Greater than or equal to Sequence Number]

- Test Purpose

  Verify the IUT can perform the Report Number of Stored Records procedure with an Operator of 'greater than or equal to' and using the Sequence Number Filter Type in the Operand.

- Reference

  [3] 3.4.3.2

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

  1. Perform an action on the IUT that will induce it to generate 3 records that may or may not contain Glucose Measurement Context characteristics. If the Glucose Measurement Context characteristic is supported, it is only present in the second record.
  2. A connection is established between the Lower Tester and IUT.
  3. The Lower Tester writes the Report number of stored records Op Code (0x04) to the RACP using an Operator of 'greater than or equal to' (0x03) and a Operand containing the Sequence Number Filter Type (0x01) followed by the value of the sequence number for second record.
  4. The IUT sends an indication of the Record Access Control Point characteristic with the Number of stored records response Op Code (0x05) an Operator of Null (0x00) and an Operand representing that two records were found (0x0002).
  5. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Record Access Control Point characteristic handle and value.
  6. The Lower Tester sends an *ATT_Handle_Value_Confirmation* to the IUT.
  7. Verify the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one indication of the Record Access Control Point characteristic with the Number of Stored Records Response Op Code containing a valid Operator and Operand.

  The value of the Operand represents that two records were found.

4.12.3 GLS/SEN/SPN/BV-03-C [Report Number of Stored Records – No records found]

- Test Purpose

  Verify the IUT responds properly if the Report Number of Stored Records procedure is performed with an Operator of 'all records' and the IUT does not contain any records.

- Reference

  [3] 3.4.3.2

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

  1. If the IUT supports the Delete Stored Records Op Code feature, as indicated in the ICS proforma for Glucose Service document [4], the Lower Tester performs the Delete Stored Records procedure with an Operator of ‘all records’. Otherwise, perform an action on the IUT that will induce it to remove all the stored records.
  2. Verify that all records have been deleted from the IUT.
  3. A connection is established between the Lower Tester and IUT.
  4. The Lower Tester writes the Report number of stored records Op Code (0x04) to the RACP using an Operator of ‘all records’ (0x01) and no Operand.
  5. The IUT sends an indication of the Record Access Control Point characteristic with the Number of stored records response Op Code (0x05) an Operator of Null (0x00) and an Operand representing that no records were found (0x0000).
  6. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Record Access Control Point characteristic handle and value.
  7. The Lower Tester sends an *ATT_Handle_Value_Confirmation* to the IUT.
  8. Verify the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one indication of the Record Access Control Point characteristic with the Number of Stored Records Response Op Code containing a valid Operator and Operand.

  The Number of Records value in the Operand is 0x0000.

4.13 Service Procedures – Time Update

This test group contains test cases to verify compliant operation when time is updated at the IUT in different ways and the Lower Tester uses the Record Access Control Point (RACP) procedure to retrieve the data.

4.13.1 GLS/SEN/SPT/BV-01-C [Service Procedure - Time Update]

- Test Purpose

  Verify when time is updated at the IUT it correctly updates the Time Offset field in the Glucose Measurement characteristic.

- Reference

  [3] 3.1.1.4, 3.5

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

  1. Perform an action on the IUT that will induce it to generate 3 records that may or may not contain Glucose Measurement Context characteristics. If the Glucose Measurement Context characteristic is supported, it is only present in the second record.
  2. Perform an action that updates the user facing time on the IUT by +1 hour.
  3. Within 2 minutes of completing step 2, perform an action on the IUT that will induce it to generate 3 records that may or may not contain Glucose Measurement Context characteristics. If the Glucose Measurement Context characteristic is supported, it is only present in the second record.
  4. Perform an action that updates the user facing time on the IUT by -2 hours.
  5. Within 2 minutes of completing step 4, perform an action on the IUT that will induce it to generate 3 records that may or may not contain Glucose Measurement Context characteristics. If the Glucose Measurement Context characteristic is supported, it is only present in the second record.
  6. A connection is established between the Lower Tester and IUT.
  7. The Lower Tester writes the Report stored records Op Code (0x01) to the RACP using an Operator of ‘all records’ (0x01) and no Operand.
  8. The IUT sends 9 notifications of the Glucose Measurement characteristic and 3 notifications of the Glucose Measurement Context characteristic (if supported).
  9. The Lower Tester receives 9 *ATT_Handle_Value_Notification* from the IUT containing the Glucose Measurement characteristic handle and value and 3 *ATT_Handle_Value_Notification* of the Glucose Measurement Context characteristic handle and value (if supported).
  10. The IUT sends an indication of the Record Access Control Point characteristic with the Response Code Op Code (0x06) an Operator of Null (0x00) and an Operand representing Request Op Code (0x01) followed by the Response Code for ‘success’ (0x01).
  11. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Record Access Control Point characteristic handle and value.
  12. The Lower Tester sends an *ATT_Handle_Value_Confirmation* to the IUT.
  13. Verify the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The Time Offset field is included in the 1st Glucose Measurement characteristic.

  If a time update has never been done, the value of the Time Offset field is 0x0000. Otherwise all pass criteria is relative to the received value.

The Time Offset field is included in the 4th Glucose Measurement characteristic.

The value of the Time Offset field has a value that is at least 1 hour greater than the previous received value with a tolerance of 3 minutes for the user to generate the additional records needed and to account for timeoffset resolution.

The Time Offset field is included in the 7th Glucose Measurement characteristic.

The value of the Time Offset field has a value that is approximately 2 hours less than the previous received value. The value shall have a tolerance of 3 minutes to account for the user generating the additional records needed and still accounting for the timeoffset resolution.

The Time offset field is included in first transmitted record and at least anytime when it changes and may be included otherwise.

4.14 Service Procedures – General Error Handling

This test group contains test cases to verify compliant operation when the Lower Tester uses the Record Access Control Point (RACP) procedure and an error results.

4.14.1 GLS/SEN/SPE/BI-01-C [Unsupported Op Code]

- Test Purpose

  Verify that the IUT responds appropriately when a Client writes an unsupported Op Code to the RACP.

- Reference

  [3] 3.4.4

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

  1. Perform an action on the IUT that will induce it to generate 3 records that may or may not contain Glucose Measurement Context characteristics.
  2. A connection is established between the Lower Tester and IUT.
  3. The Lower Tester writes an Op Code value of 0x00 to the RACP using an Operator of ‘all records’ (0x01) and no Operand.
  4. Verify the IUT response meets the requirements of the service.
  5. The Lower Tester writes an Op Code value from the Reserved for Future Use range other than 0x00 to the RACP using an Operator of ‘all records’ (0x01) and no Operand.
  6. Verify the IUT response meets the requirements of the service.

- Expected Outcome

  Pass verdict

  For both cases, the IUT sends an indication of the Record Access Control Point characteristic with the Response Code Op Code (0x06) an Operator of Null (0x00) and an Operand representing Request Op Code (i.e., the RFU value written) followed by the Response Code Value for ‘Op Code not supported’ (0x02).

4.14.2 GLS/SEN/SPE/BI-02-C [Invalid Operator]

- Test Purpose

  Verify that the IUT responds appropriately when a Client writes an unsupported Op Code to the RACP.

- Reference

  [3] 3.4.4

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

  1. Perform an action on the IUT that will induce it to generate 3 records that may or may not contain Glucose Measurement Context characteristics.
  2. A connection is established between the Lower Tester and IUT.
  3. The Lower Tester writes the Report Stored Records Op Code (0x01) to the RACP using an Operator of Null (0x00) and no Operand.
  4. Verify the IUT response meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends an indication of the Record Access Control Point characteristic with the Response Code Op Code (0x06) an Operator of Null (0x00) and an Operand representing Request Op Code (0x01) followed by the Response Code Value for ‘Invalid Operator’ (0x03).

4.14.3 GLS/SEN/SPE/BI-03-C [Unsupported Operator]

- Test Purpose

  Verify that the IUT responds appropriately when a Client writes an Op Code to the RACP with an unsupported Operator.

- Reference

  [3] 3.4.4

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

  1. Perform an action on the IUT that will induce it to generate 3 records that may or may not contain Glucose Measurement Context characteristics.
  2. A connection is established between the Lower Tester and IUT.
  3. The Lower Tester writes the Report Stored Records Op Code (0x01) to the RACP using an Operator from the Reserved for Future Use range and no Operand.
  4. Verify the IUT response meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends an indication of the Record Access Control Point characteristic with the Response Code Op Code (0x06) an Operator of Null (0x00) and an Operand representing Request Op Code (0x01) followed by the Response Code Value for ‘Operator not supported’ (0x04).

4.14.4 GLS/SEN/SPE/BI-04-C [Invalid Operand – Type 1]

- Test Purpose

  Verify that the IUT responds appropriately when a Client writes an Op Code to the RACP with an Operand where none was expected.

- Reference

  [3] 3.4.4

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

  1. Perform an action on the IUT that will induce it to generate 3 records that may or may not contain Glucose Measurement Context characteristics.
  2. A connection is established between the Lower Tester and IUT.
  3. The Lower Tester writes the Report stored records Op Code (0x01) to the RACP using an Operator of ‘all records’ (0x01) and an Operand containing the Sequence Number Filter Type and Sequence Number value of 0x0001.
  4. Verify the IUT response meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends an indication of the Record Access Control Point characteristic with the Response Code Op Code (0x06) an Operator of Null (0x00) and an Operand representing Request Op Code (0x01) followed by the Response Code Value for ‘Invalid Operand’ (0x05).

4.14.5 GLS/SEN/SPE/BI-05-C [Invalid Operand – Type 2]

- Test Purpose

  Verify that the IUT responds appropriately when a Client writes an Op Code to the RACP with an Operand that is invalid.

- Reference

  [3] 3.4.4

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

  1. Perform an action on the IUT that will induce it to generate 3 records that may or may not contain Glucose Measurement Context characteristics.
  2. A connection is established between the Lower Tester and IUT.
  3. The Lower Tester writes the Report stored records Op Code (0x01) to the RACP using an Operator of ‘within range of’ (0x04) and a Operand containing the Sequence Number Filter Type (0x01) followed by a pair of sequence number values 0xFFFF representing the ‘minimum’ value and 0x0000 representing the ‘maximum’ value.
  4. Verify the IUT response meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends an indication of the Record Access Control Point characteristic with the Response Code Op Code (0x06) an Operator of Null (0x00) and an Operand representing Request Op Code (0x01) followed by the Response Code Value for ‘Invalid Operand’ (0x05).

4.14.6 GLS/SEN/SPE/BI-06-C [Unsupported Operand]

- Test Purpose

  Verify that the IUT responds appropriately when a Client writes an Op Code to the RACP with an unsupported Operand.

- Reference

  [3] 3.4.4

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

  1. Perform an action on the IUT that will induce it to generate 3 records that may or may not contain Glucose Measurement Context characteristics.
  2. A connection is established between the Lower Tester and IUT.
  3. The Lower Tester writes the Report stored records Op Code (0x01) to the RACP using an Operator of ‘greater than or equal to’ (0x03) and an Operand containing a Filter Type from the Reserved for Future Use range followed by a value of 0x000F.
  4. Verify the IUT response meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends an indication of the Record Access Control Point characteristic with the Response Code Op Code (0x06) an Operator of Null (0x00) and an Operand representing Request Op Code (0x01) followed by the Response Code Value for ‘Operand not supported’ (0x09).

4.14.7 GLS/SEN/SPE/BI-07-C [Procedure Already In Progress]

- Test Purpose

  Verify that the IUT responds appropriately when a Client attempts to perform a procedure before another procedure is completed.

- Reference

  [3] 1.7, 3.4.4

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

  1. Perform an action on the IUT that will induce it to generate several (~100) records that may or may not contain Glucose Measurement Context characteristics.
  2. A connection is established between the Lower Tester and IUT.
  3. The Lower Tester writes the Report Stored Records Op Code (0x01) to the RACP using an Operator of ‘all records’ (0x01) and no Operand.
  4. Before the procedure is completed, the Lower Tester performs the same procedure again.
  5. Verify the IUT response meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT rejects the Write Request to start the second procedure and responds with an Attribute Protocol Application Error Code set to Procedure Already in Progress.

4.14.8 GLS/SEN/SPE/BI-08-C [Client Characteristic Configuration Descriptor Improperly Configured]

- Test Purpose

  Verify that the IUT responds appropriately when a Client attempts to perform an RACP procedure with a Client Characteristic Configuration descriptor that is improperly configured.

- Reference

  [3] 1.7, 3.4.4

- Initial Condition

  Perform the preamble described in Section 4.2.2.

  If a connection exists, it shall be disconnected.

- Test Procedure

  1. Perform an action on the IUT that will induce it to generate 3 records that may or may not contain Glucose Measurement Context characteristics.
  2. A connection is established between the Lower Tester and IUT.
  3. The Lower Tester resets to 0 one or more of the Client Characteristic Configuration descriptors from the Glucose Measurement characteristic, Glucose Measurement Context characteristic or Record Access Control Point characteristic.
  4. The Lower Tester writes the Report Stored Records Op Code (0x01) to the RACP using an Operator of ‘all records’ (0x01) and no Operand.
  5. Verify the IUT response meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT rejects the Write Request to start the second procedure and responds with an Attribute Protocol Application Error Code set to Client Characteristic Configuration Descriptor Improperly Configured.

4.14.9 GLS/SEN/SPE/BI-09-C [RACP Write without Authentication]

- Test Purpose

  Verify the IUT does not allow a write of the Record Access Control Point characteristic if it is not authenticated to the Client.

- Reference

  [3] Table 3.1

- Initial Condition

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

  Follow the procedure required to setup the IUT to use the Record Access Control Point, as described in Section 4.2.2, however Step 4 of the procedure should NOT be performed (i.e., do not enable encryption). The Lower Tester initiates a disconnect.

- Test Procedure

  1. The Lower Tester initiates a connection to the IUT without encryption.
  2. The Lower Tester writes the Report Stored Records Op Code (0x01) to the RACP using an Operator of ‘all records’ (0x01) and no Operand.
  3. Verify the IUT response meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT fails the characteristic write request with an ATT Error Response with the error code set to either 'Insufficient Authentication’ or ‘Insufficient Encryption’ as defined in [2].

5 Test Case Mapping

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

The columns for the TCMT are defined as follows:

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

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

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

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

Item	Feature	Test Case(s)
GLS 2/1	Glucose Service	GLS/SEN/SD/BV-01-C
GLS 2/2	Glucose Measurement Characteristic	GLS/SEN/DEC/BV-01-C GLS/SEN/DES/BV-01-C GLS/SEN/CON/BV-01-C GLS/SEN/CN/BV-01-C
GLS 2/3	Time Offset field of Glucose Measurement Characteristic	GLS/SEN/CN/BV-02-C
GLS 2/3 AND GLS 2/3a	Time Offset field of Glucose Measurement Characteristic: Sensor capable of user-facing date and time adjustment	GLS/SEN/SPT/BV-01-C
GLS 2/4	Glucose Concentration field of Glucose Measurement Characteristic – kg/L units	GLS/SEN/CN/BV-03-C
GLS 2/4a	Glucose Concentration field of Glucose Measurement Characteristic – mol/L units	GLS/SEN/CN/BV-04-C
GLS 2/7	Sensor Status Annunciation field of Glucose Measurement Characteristic	GLS/SEN/CN/BV-05-C

Item	Feature	Test Case(s)
GLS 2/8	Glucose Measurement Context Characteristic	GLS/SEN/DEC/BV-02-C GLS/SEN/DES/BV-02-C GLS/SEN/CON/BV-02-C GLS/SEN/CN/BV-06-C
GLS 2/10 OR GLS 2/11	Carbohydrate field of Glucose Measurement Context Characteristic	GLS/SEN/CN/BV-07-C
GLS 2/12	Meal field of Glucose Measurement Context Characteristic	GLS/SEN/CN/BV-08-C
GLS 2/13 OR GLS 2/14	Health nibble of the Tester-Health field of Glucose Measurement Context Characteristic	GLS/SEN/CN/BV-09-C
GLS 2/15 OR GLS 2/16	Exercise Intensity and Duration fields of Glucose Measurement Context Characteristic	GLS/SEN/CN/BV-10-C
GLS 2/17 OR GLS 2/18	Medication field of Glucose Measurement Context Characteristic	GLS/SEN/CN/BV-11-C GLS/SEN/CN/BV-12-C
GLS 2/19	HbA1c field of Glucose Measurement Context Characteristic	GLS/SEN/CN/BV-13-C
GLS 2/20	Glucose Feature Characteristic	GLS/SEN/DEC/BV-03-C GLS/SEN/CR/BV-01-C
GLS 2/21	Record Access Control Point (RACP) Characteristic	GLS/SEN/DEC/BV-04-C GLS/SEN/DES/BV-03-C GLS/SEN/CON/BV-03-C GLS/SEN/SPE/BI-01-C
GLS 2/22	Report Stored Records Op Code	GLS/SEN/SPE/BI-02-C GLS/SEN/SPE/BI-03-C
GLS 2/24	Abort Operation Op Code	GLS/SEN/SPA/BV-01-C
GLS 2/28	Support for Multiple Bonds	GLS/SEN/CR/BV-02-C
GLS 3/1	Report Stored Records Op Code of RACP Characteristic – All Records Operator	GLS/SEN/SPR/BV-01-C GLS/SEN/SPE/BI-04-C GLS/SEN/SPE/BI-07-C GLS/SEN/SPE/BI-08-C GLS/SEN/SPE/BI-09-C

Item	Feature	Test Case(s)
GLS 3/2	Report Stored Records Op Code of RACP Characteristic - Less than or equal to Sequence Number	GLS/SEN/SPR/BV-02-C
GLS 3/5	Report Stored Records Op Code of RACP Characteristic - Greater than or equal to Operator	GLS/SEN/SPE/BI-06-C
GLS 3/6	Report Stored Records Op Code of RACP Characteristic - Greater than or equal to Operator – Sequence Number Operand	GLS/SEN/SPR/BV-03-C
GLS 3/7	Report Stored Records Op Code of RACP Characteristic - Greater than or equal to User Facing Time	GLS/SEN/SPR/BV-04-C
GLS 3/8	Report Stored Records Op Code of RACP Characteristic – Within Range of Sequence Number value pair	GLS/SEN/SPR/BV-05-C GLS/SEN/SPE/BI-05-C
GLS 3/11	Report Stored Records Op Code of RACP Characteristic – First Record Operator	GLS/SEN/SPR/BV-06-C
GLS 3/12	Report Stored Records Op Code of RACP Characteristic – Last Record Operator	GLS/SEN/SPR/BV-07-C
GLS 4/1	Delete Stored Records Filter Parameters – All Records Operator	GLS/SEN/SPD/BV-01-C
GLS 4/8	Delete Stored Records Filter Parameters - Within range of (inclusive) Operator	GLS/SEN/SPD/BV-02-C
GLS 6/1	Report Number of Stored Records Filter Parameters – All Records	GLS/SEN/SPN/BV-01-C

Item	Feature	Test Case(s)
GLS 4/1 AND GLS 6/1	Report Number of Stored Records Filter Parameters – All Records – No records found	GLS/SEN/SPN/BV-03-C
GLS 6/6	Report Number of Stored Records Filter Parameters – Greater than or equal to Operator – Sequence Number Operand	GLS/SEN/SPN/BV-02-C

Table 5.1: Test Case Mapping

6 RACP Test Matrix

The following tables summarize the features of RACP and the combinations with other features that are tested and not tested. For the tables, below, the following key applies:

- YES = A test for this combination exists.
- NO = A test for this combination does not exist.
- N/A = Not a valid combination.

	RACP Request Op Codes			
RACP Operands	Report stored records	Delete stored records	Abort operation	Report number of stored records
All records	YES	YES	YES	YES
Less than or equal to	YES	NO	N/A	NO
Greater than or equal to	YES	NO	N/A	YES
Within range of (inclusive)	YES	YES	N/A	NO
First record	YES	NO	N/A	NO
Last record	YES	NO	N/A	NO
Sequence Number Filter Type	YES	YES	N/A	YES
User Facing Time Filter Type	YES	NO	N/A	NO

	RACP Request Op Codes			
RACP Response Codes	Report stored records	Delete stored records	Abort operation	Report number of stored records
Success	YES	YES	YES	YES
Op Code not supported	N/A	N/A	N/A	N/A
Invalid Operator	YES (add later)	NO	N/A	NO
Operator not supported	YES (add later)	NO	N/A	NO
Invalid Operand	YES (add later)	NO	N/A	NO
No records found	YES	NO	N/A	N/A
Abort unsuccessful	N/A	N/A	NO	N/A
Procedure not completed	N/A	N/A	N/A	N/A
Operand not supported	YES (add later)	N/A	N/A	NO

	Filter Type	
RACP Operands	Sequence Number Filter Type	User Facing Time Filter Type
All records	N/A	N/A
Less than or equal to	YES	NO
Greater than or equal to	YES	YES
Within range of (inclusive)	YES	NO
First record	N/A	N/A
Last record	N/A	N/A

7 Revision History and Contributors

Revision History

Revision History	Date	Comments
D0.9.0	2011-11-14	Initial draft for review. Incorporated review feedback.
D0.9.1	2011-11-14	Accepted all changes. Submitted to BTI for review. Incorporated feedback from Laurence, Ray, and Badri.
D0.9.2	2011-11-22	Accepted all changes. Resubmitted to BTI. Incorporated feedback from BTI. Added error test cases. Incorporated MED WG feedback.
D0.9.3	2011-11-23	Accepted all changes. Candidate for IOP. Incorporated feedback from Laurence. Update Write test.
D0.9.4	2011-11-28	Accepted all changes. Second candidate for IOP. Fixed errors and incorporated feedback.
D0.9.5	2011-11-29	Accepted all changes. Third candidate for IOP. Incorporated feedback from reviewers. Added test case to 4.12.3. Added fixes from IOP. Version used at IOP.
D1.0.0	2012-02-23	Rolled revision to Draft 1.0. Incorporated updates to align with GLS D10r01, D10r02 and D10r03. Submitting for BTI review.
D1.0.1	2012-03-21	Incorporated changes from previous review. Resubmitted for BTI approval.
D1.0.2	2012-03-23	BTI approved. Accepted all changes, updated revision.
1.0.0	2012-04-03	Adopted by the Bluetooth SIG Board of Directors
1.0.1r0	2012-05-18	TSE 4782: TP/SPN/BV-03-C (GLS/SR/SPN/BV-03-C after ID conversion): Test Procedure and TCMT update.
1.0.1	2012-07-24	Prepare for publication.
1.0.2r01	2013-08-16	TCRL 2013-2 TSE 5152: Update to step 2 in Test Procedure for TP/SD/BV-01-C (GLS/SR/SD/BV-01-C after ID conversion). TSE 5196: Updated step 3 in the Test Procedure for TP/SPN/BV-03-C (GLS/SR/SPN/BV-03-C after ID conversion).
1.0.2r02	2013-10-06	Review by Miles
1.0.2r03	2013-10-22	Review by Alicia
1.0.2	2013-12-03	Prepare for Publication

Revision History	Date	Comments
1.0.3r00	2014-04-11	TSE 5541: Added “If a connection exists, it shall be disconnected” to the Initial Condition of TP/CN/BV-01-C through TP/CN/BV-13-C (GLS/SR/CN/BV-01-C through GLS/SR/CN/BV-13-C after ID conversion). Updated the Test Procedure for TP/SPD/BV-01-C (GLS/SR/SPD/BV-01-C after ID conversion). TSE 5583: Updated Request Op Code from (0x014) to (0x01) in Step 10 for TP/SPT/BV-01-C (GLS/SR/SPT/BV-01-C after ID conversion). TSE 5521: Updated TCMT mapping for TP/SPT/BV-01-C (GLS/SR/SPT/BV-01-C after ID conversion) to “GLS 2/3 AND GLS 2/3a”
1.0.3r01	2014-06-01	Added Pass/Fail Verdict Conventions according to applicable test specification template.
1.0.4r00	2015-05-10	TSE 5827: Revised parameters in step 1 of TP/CN/BV-04-C (GLS/SR/CN/BV-04-C after ID conversion) TSE 6012: Added alternative outcome in Pass verdict of TP/SPE/BI-09-C (GLS/SR/SPE/BI-09-C after ID conversion) TSE 6030: Updated TCMT mapping for TP/CN/BV-03-C and 04-C (GLS/SR/CN/BV-03-C and GLS/SR/CN/BV-04-C after ID conversion) TSE 6087: Revised test procedure in TP/SPN/BV-03-C (GLS/SR/SPN/BV-03-C after ID conversion) TSE 6202: Revised test procedure in TP/CN/BV-01-C through TP/CN/BV-13-C (GLS/SR/CN/BV-01-C through GLS/SR/CN/BV-13-C after ID conversion) to clarify that alternative methods of notifying the record may be used
1.0.4r01	2015-05-19	Review by Alicia Courtney Converted to current template and document standards
1.0.4r02	2015-05-27	Updated TP/CN/BV-04-C (GLS/SR/CN/BV-04-C after ID conversion) according to revisions to TSE 5827 adding corresponding corrections to pass verdict. Review by Magnus Sommansson
1.0.4	2015-07-14	Prepared for TCRL 2015-1 publication

Revision History	Date	Comments
1.0.5r00	2015-10-01	TSE 6607: Removed incorrect text from the pass verdict in TP/SPE/BI-09-C (GLS/SR/SPE/BI-09-C after ID conversion) in Section 4.14.9. TSE 6415: Revised TP/SPT/BV-01-C (GLS/SR/SPT/BV-01-C after ID conversion) in Section 4.13.1 to specify tolerances for the generation of records during user test cases. TSE 6592: Revised TP/SPE/BI-09-C (GLS/SR/SPE/BI-09-C after ID conversion) in Section 4.14.9 to allow additional connection. TSE 6383: Added Medication amount value range and SFLOAT exponent clarifications for TP/CN/BV-12-C (GLS/SR/CN/BV-12-C after ID conversion) in Section 4.8.12.
1.0.5r01	2015-10-21	Reviewed by Alicia Courtney
1.0.5	2015-12-22	Prepared for TCRL 2015-2 publication.
1.0.6r00	2016-03-01	TSE 6837: Updated step 1 of Test Procedure for test case GLS/SR/SPN/BV-03-C.
1.0.6r01	2016-04-13	Converted to new Test Case ID conventions as defined in TSTO v4.1.
1.0.6r02	2016-04-22	Reviewed by Alicia Courtney. Editorial changes made.
1.0.6	2016-07-13	Prepared for TCRL 2016-1 publication.
1.0.7r00	2017-04-18	TSE 8769: Global edit. Updated all test case names; Changed IUT role from “SR” to “SEN,” e,g, “GLS/SR/SD/BV-01-C” > “GLS/SEN/SD/BV-01-C”
1.0.7r01	2017-05-16	Corrected a global replace all error in integrating TSE 8769. Changed “GATT/SEN” back to “GATT/SR” for GATT test cases. Global change.
1.0.7r02	2017-05-24	Corrected test procedure step numbering in sections 4.9.5 – 4.14.9
1.0.7	2017-06-26	Approved by BTI. Prepared for TCRL 2017-1 publication.
1.0.8r00	2019-04-15	TSE 11100 (rating 2): Modified RACP Preamble in Section 4.2.2 to add a step so that the Lower Tester can find out the sequence number of the most recent record generated by the IUT. Updated the wording in step 4 of the test procedure for test case GLS/SEN/SPR/BV-05-C. Addressed miscellaneous editorial issues to update the document to the latest template conventions.
1.0.8	2019-07-29	Approved by BTI. Prepared for TCRL 2019-1 publication.
1.0.9r00–r01	2019-09-16 – 2019-10-23	TSE 12573 (rating 2): Updated pass verdict of test case GLS/SEN/CN/BV-04-C to clarify resolution for mol/L.

Revision History	Date	Comments
1.0.9	2020-01-07	Approved by BTI on 2019-11-03. Prepared for TCRL 2019-2 publication.

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