Location and Navigation Service (LNS)

***Bluetooth*® Test Suite**

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Contents

1 Scope

This Bluetooth document contains the Test Suite Structure (TSS) and test cases to test the implementation of the Bluetooth Location and Navigation Service Specification with the objective to provide a high probability of air interface interoperability between the tested implementation and other manufacturers' Bluetooth devices.

2 References, definitions, and abbreviations

2.1 References

This document incorporates provisions from other publications by dated or undated reference. These references are cited at the appropriate places in the text, and the publications are listed hereinafter. Additional definitions and abbreviations can be found in [1] and [2].

[1] Test Strategy and Terminology Overview

[2] Bluetooth Core Specification, Version 4.0 or later

[3] Location and Navigation Service Specification, Version 1.0 or later

[4] Location and Navigation Service ICS, LNS.ICS

[5] GATT Test Suite, GATT.TS

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

[7] Location and Navigation Service Specification, Version 1.0.1

2.2 Definitions

In this Bluetooth document, the definitions from [1] and [2] apply.

2.3 Acronyms and abbreviations

In this Bluetooth document, the definitions, acronyms, and abbreviations from [1] and [2] apply.

3 Test Suite Structure (TSS)

3.1 Overview

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

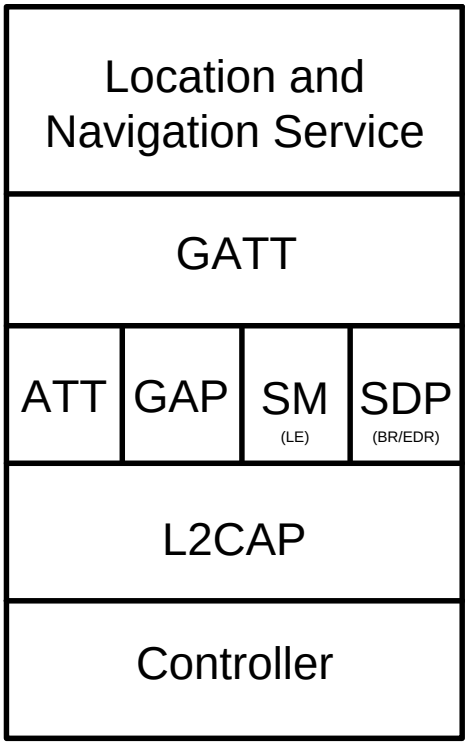

Figure 3.1: Location and Navigation Service test model

3.2 Test Strategy

The test objectives are to verify the functionality of the Location and Navigation Service within a Bluetooth Host and enable interoperability between Bluetooth Hosts on different devices. The testing approach covers mandatory and optional requirements in the specification and matches these to the support of the IUT as described in the ICS. Any defined test herein is applicable to the IUT if the ICS logical expression defined in the Test Case Mapping Table (TCMT) evaluates to true.

The test equipment provides an implementation of the Radio Controller and the parts of the Host needed to perform the test cases defined in this Test Suite. A Lower Tester acts as the IUT's peer device and interacts with the IUT over-the-air interface. The configuration, including the IUT, needs to implement similar capabilities to communicate with the test equipment. For some test cases, it is necessary to stimulate the IUT from an Upper Tester. In practice, this could be implemented as a special test interface, a Man Machine Interface (MMI), or another interface supported by the IUT.

This Test Suite contains Valid Behavior (BV) tests complemented with Invalid Behavior (BI) tests where required. The test coverage mirrored in the Test Suite Structure is the result of a process that started with catalogued specification requirements that were logically grouped and assessed for testability enabling coverage in defined test purposes.

3.3 Test groups

The following test groups have been defined:

- Generic GATT Integrated Tests
- Characteristic Read
- Characteristic Write
- Configure Notification
- Configure Indication
- Characteristic Notification
- Characteristic Indication

4 Test cases (TC)

4.1 Introduction

4.1.1 Test case identification conventions

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

Additionally, testing of this specification includes tests from the GATT Test Suite [5] referred to as Generic GATT Integrated Tests (GGIT); when used, the GGIT tests are referred to through a TCID string using the following convention:
<spec abbreviation>/<IUT role>/<GGIT test group>/< GGIT class >/<xx>-<nn>-<y>.

Identifier Abbreviation	**Spec Identifier <spec abbreviation>**
LNS	Location and Navigation Service
Identifier Abbreviation	**Role Identifier <IUT role>**
SEN	Sensor Role
Identifier Abbreviation	**Reference Identifier <GGIT test group>**
SGGIT	Server Generic GATT Integrated Tests
Identifier Abbreviation	**Reference Identifier <GGIT class>**
CHA	Characteristic
ISFC	Indication Supported Features Characteristic
SDP	Validate SDP Record
SER	Service
Identifier Abbreviation	**Feature Identifier <feat>**
CN	Characteristic Notification
CON	Configure Indication or Notification
CR	Characteristic Read
CW	Characteristic Write
SPA	Service Procedure – Set Elevation (Altitude)
SPE	Service Procedure – Error handling
SPF	Service Procedure – Set Fix Rate
SPM	Service Procedure – Mask Location and Speed Characteristic Content
SPN	Service Procedures – Navigation
SPS	Service Procedures – Set Cumulative Value

Table 4.1: LNS TC feature naming conventions

4.1.2 Conformance

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

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

Such tests may verify:

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

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

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

4.1.3 Pass/Fail verdict conventions

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

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

4.2 Setup preambles

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

4.2.1 ATT Bearer on LE Transport

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

4.2.2 ATT Bearer on BR/EDR Transport

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

4.2.3 LN Control Point

- Preamble Purpose

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

- Preamble Procedure

  1. Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.
  2. The handle of the LN Feature, the Location and Speed, the Position Quality, the LN Control Point and the Navigation characteristics has been previously discovered by the Lower Tester during the test procedure in Section 4.3 or is known to the Lower Tester by other means.
  3. The handle of the Client Characteristic Configuration descriptor of the Location and Speed, Navigation and the LN Control Point characteristics has been previously discovered by the Lower Tester during the test procedure in Section 4.3 or is known to the Lower Tester by other means.
  4. If the IUT requires bonding, then the Lower Tester performs a bonding procedure.
  5. The IUT configures the LN Control Point characteristic for indications, and if the test case requires notifications of the Location and Speed characteristic or the Navigation characteristic, then the IUT configures these characteristics for notifications. Those configurations may happen in any order.

4.3 Generic GATT Integrated Tests

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

TCID	Service / Characteristic / Descriptor	Reference	Properties	Value Length (Octets)	Service Type
LNS/SEN/SGGIT/SER/BV-01-C [Service GGIT – Location and Navigation Service]	Location and Navigation Service	[3] 2	-	-	Primary or Secondary Service
LNS/SEN/SGGIT/SDP/BV-01-C [Validate SDP Record – Location and Navigation Service]	Location and Navigation Service	[3] 4	-	-	-
LNS/SEN/SGGIT/CHA/BV-01-C [Characteristic GGIT– LN Feature]	LN Feature Characteristic	[3] 3.1	0x02 (Read)	Skip	-
LNS/SEN/SGGIT/CHA/BV-02-C [Characteristic GGIT– Location and Speed]	Location and Speed Characteristic	[3] 3.2	0x10 (Notify)	Skip	-
LNS/SEN/SGGIT/CHA/BV-03-C [Characteristic GGIT– Position Quality]	Position Quality Characteristic	[3] 3.3	0x02 (Read)	Skip	-
LNS/SEN/SGGIT/CHA/BV-04-C [Characteristic GGIT– Navigation]	Navigation Characteristic	[3] 3.5	0x10 (Notify)	Skip	-
LNS/SEN/SGGIT/CHA/BV-05-C [Characteristic GGIT – LN Control Point]	LN Control Point Characteristic	[3] 3.4	0x28 (Indicate, Write)	Skip	-
LNS/SEN/SGGIT/CHA/BV-06-C [Characteristic GGIT – LN Feature]	LN Feature Characteristic	[7] 3, 3.1.1	0x22 (Read, Indicate)	Skip	-

Table 4.2: Input for the GGIT Server test procedure

4.3.1 Generic GATT Indication Supported Features Characteristic

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

TCID	Characteristic	Reference	TC Configuration
LNS/SEN/SGGIT/ISFC/BV-01-C [Characteristic GGIT – LN Feature Indication]	LN Feature Characteristic	[7] 3.1.1	N/A

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

4.4 Characteristic Read

- Test Purpose

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

- Reference

  [3] 3.1.1 and 3.3.1

- 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 4.3 or is known to the Lower Tester by other means.
  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.
  - If IUT permissions for the characteristic require a specific security mode or security level, establish a connection meeting those requirements.

- Test Case Configuration

Test Case	Value (Requirements)
LNS/SEN/CR/BV-01-C [LN Feature]	4 octets with RFU bits set to 0 ([3] Section 3.1)
LNS/SEN/CR/BV-02-C [Position Quality – no optional fields present]	2 octets with RFU bits set to 0 ([3] Section 3.3)
LNS/SEN/CR/BV-03-C [Position Quality – Number of Satellites in Solution]	Flags field with RFU bits set to 0, Number of Beacons in Solution Present bit set to 1 and other bits of the Flags field may be set to either 0 or 1. In addition to the Flags field, the Number of Beacons in Solution field is present and other optional fields may also be present as defined in [3], Section 3.3.
LNS/SEN/CR/BV-04-C [Position Quality – Number of Satellites in View]	Flags field with RFU bits set to 0, Number of Beacons in View Present bit set to 1 and other bits of the Flags field may be set to either 0 or 1. In addition to the Flags field, the Number of Beacons in View field is present and other optional fields may also be present as defined in [3], Section 3.3.
LNS/SEN/CR/BV-05-C [Position Quality – Time to First Fix]	Flags field with RFU bits set to 0, Time to First Fix Present bit set to 1 and other bits of the Flags field may be set to either 0 or 1. In addition to the Flags field, the Time to First Fix field is present and other optional fields may also be present as defined in [3], Section 3.3.
LNS/SEN/CR/BV-06-C [Position Quality – EHPE]	Flags field with RFU bits set to 0, EHPE Present bit set to 1 and other bits of the Flags field may be set to either 0 or 1. In addition to the Flags field, the EHPE field is present and other optional fields may also be present as defined in [3], Section 3.3.

Test Case	Value (Requirements)
LNS/SEN/CR/BV-07-C [Position Quality – EVPE]	Flags field with RFU bits set to 0, EVPE Present bit set to 1 and other bits of the Flags field may be set to either 0 or 1. In addition to the Flags field, the EVPE field is present and other optional fields may also be present as defined in [3], Section 3.3.
LNS/SEN/CR/BV-08-C [Position Quality – HDOP]	Flags field with RFU bits set to 0, HDOP Present bit set to 1 and other bits of the Flags field may be set to either 0 or 1. In addition to the Flags field, the HDOP field is present and other optional fields may also be present as defined in [3], Section 3.3.
LNS/SEN/CR/BV-09-C [Position Quality – VDOP]	Flags field with RFU bits set to 0, VDOP Present bit set to 1 and other bits of the Flags field may be set to either 0 or 1. In addition to the Flags field, the VDOP field is present and other optional fields may also be present as defined in [3], Section 3.3.

Table 4.4: Characteristic Read Value test cases

- Test Procedure

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

- Expected Outcome

  Pass verdict

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

4.5 Configure Indication and Notification

- Test Purpose

  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, using this generic test procedure.

- Reference

  [3] 3.2, 3.4, and 3.5

- 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 4.3 or is known to the Lower Tester by other means.
  - The handle of the client characteristic configuration descriptor of each characteristic referenced in the test cases below has been previously discovered by the Lower Tester during the test procedure in Section 4.3 or is known to the Lower Tester by other means.
  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.
  - If IUT permissions for the characteristic require a specific security mode or security level, establish a connection meeting those requirements.

- Test Case Configuration

Test Case	Value (Requirements)
LNS/SEN/CON/BV-01-C [Configure Notification – Location and Speed]	0x0001 ([3] 3.2)
LNS/SEN/CON/BV-02-C [Configure Indication – LN Control Point]	0x0001 ([3] 3.4)
LNS/SEN/CON/BV-03-C [Configure Notification – Navigation]	0x0001 ([3] 3.5)

Table 4.5: Configure Indication and Notification test cases

- Test Procedure

1. Disable indication or notification by writing value 0x0000 to the client characteristic configuration descriptor of the characteristic.
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. The Lower Tester reads the value of the client characteristic configuration descriptor.

- Expected Outcome

  Pass verdict

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

4.6 Characteristic Notification

LNS/SEN/CN/BV-01-C [Location and Speed Notifications]

- Test Purpose

  Verify that the IUT can send notifications of the Location and Speed characteristic that include the mandatory fields (i.e., the Flags field).

- Reference

  [3] 3.2

- Initial Condition

  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - The Location and Speed characteristic is configured for notification.
  - Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.
  - If IUT permissions for the Location and Speed characteristic require a specific security mode or security level, establish a connection meeting those requirements.

- Test Procedure

1. Perform an action on the IUT that will induce it, once connected, to send notifications of the Location and Speed characteristic along with the Flags field.
2. The Lower Tester reads the LN Feature characteristic (e.g., by executing test case LNS/SEN/CR/BV-01-C [LN Feature] or by other means).

3. The Lower Tester receives one or more ATT_Handle_Value_Notification from the IUT containing the Location and Speed characteristic handle and value along with the Flags field.
4. Verify that the characteristic value meets the requirements of the service.
5. Repeat steps 4–5 until the Lower Tester receives one or more additional notifications.
6. The Lower Tester configures the Location and Navigation characteristic to disable notifications.
7. Repeat steps 1–2 with notifications disabled.
8. Verify that the IUT does not send an ATT_Handle_Value_Notification to the Lower Tester containing the Location and Speed characteristic.

- Expected Outcome

  Pass verdict

  The IUT sends two or more notifications of the Location and Speed characteristic along with the Flags field.

  The Location and Speed characteristics contain at least the Flags field.

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

  The IUT stops sending notifications of the Location and Speed characteristic after the Lower Tester configures the characteristic to disable notifications.

  In all cases, ensure that the RFU bits of the Flags field are set to zero.

LNS/SEN/CN/BV-02-C [Location and Speed Notifications – Instantaneous Speed]

- Test Purpose

  Verify that the IUT can send notifications of the Location and Speed characteristic that include Instantaneous Speed value.

- Reference

  [3] 3.2.1.2

- Initial Condition

  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - The Location and Speed characteristic is configured for notification.
  - Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.
  - If IUT permissions for the Location and Speed characteristic require a specific security mode or security level, establish a connection meeting those requirements.

- Test Procedure

1. Perform an action on the IUT that will induce it, once connected, to send notifications of the Location and Speed characteristic along with Instantaneous Speed field.
2. The Lower Tester reads the LN Feature characteristic (e.g., by executing test case LNS/SEN/CR/BV-01-C [LN Feature] or by other means).
3. The Lower Tester receives one or more ATT_Handle_Value_Notification from the IUT containing the Location and Speed characteristic handle and value along with the Instantaneous Speed field.
4. Verify that the characteristic value meets the requirements of the service.
5. Repeat steps 3–4 until the Lower Tester receives one or more additional notifications.
6. The Lower Tester configures the Location and Speed characteristic to disable notifications.

- Expected Outcome

  Pass verdict

  The IUT sends two or more notifications of the Location and Speed characteristic and at least one includes the Instantaneous Speed value with the appropriate flag set in the Flags field.

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

  The value of the Instantaneous Speed Supported bit of the LN Feature characteristic is set to 1.

  In all cases, ensure that the RFU bits of the Flags field are set to zero.

LNS/SEN/CN/BV-03-C [Location and Speed Notifications – Total Distance]

- Test Purpose

  Verify that the IUT can send notifications of the Location and Speed characteristic that include Total Distance value.

- Reference

  [3] 3.2.1.3

- Initial Condition

  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - The Location and Speed characteristic is configured for notification.
  - Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.
  - If IUT permissions for the Location and Speed characteristic require a specific security mode or security level, establish a connection meeting those requirements.

- Test Procedure

  1. Perform an action on the IUT that will induce it, once connected, to send notifications of the Location and Speed characteristic along with Total Distance field.
  2. The Lower Tester reads the LN Feature characteristic (e.g., by executing test case LNS/SEN/CR/BV-01-C [LN Feature] or by other means).
  3. The Lower Tester receives one or more ATT_Handle_Value_Notification from the IUT containing the Location and Speed characteristic handle and value along with the Total Distance field.
  4. Verify that the characteristic value meets the requirements of the service.
  5. Repeat steps 3–4 until the Lower Tester receives one or more additional notifications.
  6. The Lower Tester configures the Location and Speed characteristic to disable notifications.

- Expected Outcome

  Pass verdict

  The IUT sends two or more notifications of the Location and Speed characteristic and at least one includes the Total Distance value with the appropriate flag set in the Flags field.

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

  The value of the Total Distance Supported bit of the LN Feature characteristic is set to 1.

  In all cases, ensure that the RFU bits of the Flags field are set to zero.

LNS/SEN/CN/BV-04-C [Location and Speed Notifications – Location]

- Test Purpose

  Verify that the IUT can send notifications of the Location and Speed characteristic that include Latitude and Longitude values.

- Reference

  [3] 3.2.1.4

- Initial Condition

  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - The Location and Speed characteristic is configured for notification.
  - Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.
  - If IUT permissions for the Location and Speed characteristic require a specific security mode or security level, establish a connection meeting those requirements.

- Test Procedure

  1. Perform an action on the IUT that will induce it, once connected, to send notifications of the Location and Speed characteristic along with Latitude and Longitude fields.
  2. The Lower Tester reads the LN Feature characteristic (e.g., by executing test case LNS/SEN/CR/BV-01-C [LN Feature] or by other means).
  3. The Lower Tester receives one or more ATT_Handle_Value_Notification from the IUT containing the Location and Speed characteristic handle and value.
  4. Verify that the characteristic value meets the requirements of the service.
  5. Repeat steps 3–4 until the Lower Tester receives one or more additional notifications.
  6. The Lower Tester configures the Location and Speed characteristic to disable notifications.

- Expected Outcome

  Pass verdict

  The IUT sends two or more notifications of the Location and Speed characteristic and at least one includes the Latitude and the Longitude values with the appropriate flag set in the Flags field.

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

  The value of the Location Supported bit of the LN Feature characteristic is set to 1.

  In all cases, ensure that the RFU bits of the Flags field are set to zero.

LNS/SEN/CN/BV-05-C [Location and Speed Notifications – Elevation]

- Test Purpose

  Verify that the IUT can send notifications of the Location and Speed characteristic that include Elevation value.

- Reference

  [3] 3.2.1.5

- Initial Condition

  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - The Location and Speed characteristic is configured for notification.

- Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.
- If IUT permissions for the Location and Speed characteristic require a specific security mode or security level, establish a connection meeting those requirements.

- Test Procedure

  1. Perform an action on the IUT that will induce it, once connected, to send notifications of the Location and Speed characteristic along with Elevation value.
  2. The Lower Tester reads the LN Feature characteristic (e.g., by executing test case LNS/SEN/CR/BV-01-C [LN Feature] or by other means).
  3. The Lower Tester receives one or more ATT_Handle_Value_Notifications from the IUT containing the Location and Speed characteristic handle and value along with Elevation value.
  4. Verify that the characteristics value meets the requirements of the service.
  5. Repeat steps 3–4 until the Lower Tester receives one or more additional notifications.
  6. The Lower Tester configures Location and Speed characteristic to disable notifications.

- Expected Outcome

  Pass verdict

  The IUT sends two or more notifications of the Location and Speed characteristic and at least one includes the Elevation value with the appropriate flag set in the Flags field.

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

  The value of the Elevation Supported bit of the LN Feature characteristic is set to 1.

  In all cases, ensure that the RFU bits of the Flags field are set to zero.

LNS/SEN/CN/BV-06-C [Location and Speed Notifications – Heading]

- Test Purpose

  Verify that the IUT can send notifications of the Location and Speed characteristic that include Heading value.

- Reference

  [3] 3.2.1.6

- Initial Condition

  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - The Location and Speed characteristic is configured for notification.
  - Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.
  - If IUT permissions for the Location and Speed characteristic require a specific security mode or security level, establish a connection meeting those requirements.

- Test Procedure

  1. Perform an action on the IUT that will induce it, once connected, to send notifications of the Location and Speed characteristic along with Heading value.
  2. The Lower Tester reads the LN Feature characteristic (e.g., by executing test case LNS/SEN/CR/BV-01-C [LN Feature] or by other means).

3. The Lower Tester receives one or more ATT_Handle_Value_Notifications from the IUT containing the Location and Speed characteristic handle and value along with Heading value.
4. Verify that the characteristics value meets the requirements of the service.
5. Repeat steps 3–4 until the Lower Tester receives one or more additional notifications.
6. The Lower Tester configures the Location and Speed characteristic to disable notifications.

- Expected Outcome

  Pass verdict

  The IUT sends two or more notifications of the Location and Speed characteristic and at least one includes the Heading value with the appropriate flag set in the Flags field.

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

  The value of the Heading Supported bit of the LN Feature characteristic is set to 1.

  In all cases, ensure that the RFU bits of the Flags field are set to zero.

LNS/SEN/CN/BV-07-C [Location and Speed Notifications – Rolling Time]

- Test Purpose

  Verify that the IUT can send notifications of the Location and Speed characteristic that include Rolling Time value.

- Reference

  [3] 3.2.1.7

- Initial Condition

  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - The Location and Speed characteristic is configured for notification.
  - Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.
  - If IUT permissions for the Location and Speed characteristic require a specific security mode or security level, establish a connection meeting those requirements.

- Test Procedure

1. Perform an action on the IUT that will induce it, once connected, to send notifications of the Location and Speed characteristic along with Rolling Time value.
2. The Lower Tester reads the LN Feature characteristic (e.g., by executing test case LNS/SEN/CR/BV-01-C [LN Feature] or by other means).
3. The Lower Tester receives one or more ATT_Handle_Value_Notifications from the IUT containing the Location and Speed characteristic handle and value along with Rolling Time value.
4. Verify that the characteristic value meets the requirements of the service.
5. Repeat steps 3–4 until the Lower Tester receives one or more additional notifications.
6. The Lower Tester configures the Location and Speed characteristic to disable notifications.

- Expected Outcome

  Pass verdict

  The IUT sends two or more notifications of the Location and Speed characteristic and at least one includes the Rolling Time value with the appropriate flag set in the Flags field.

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

The value of the Rolling Time Supported bit of the LN Feature characteristic is set to 1.

In all cases, ensure that the RFU bits of the Flags field are set to zero.

LNS/SEN/CN/BV-08-C [Location and Speed Notifications – UTC Time]

- Test Purpose

  Verify that the IUT can send notifications of the Location and Speed characteristic that include UTC Time value.

- Reference

  [3] 3.2.1.8

- Initial Condition

  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - The Location and Speed characteristic is configured for notification.
  - Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.
  - If IUT permissions for the Location and Speed characteristic require a specific security mode or security level, establish a connection meeting those requirements.

- Test Procedure

  1. Perform an action on the IUT that will induce it, once connected, to send notifications of the Location and Speed characteristic along with UTC Time field.
  2. The Lower Tester reads the LN Feature characteristic (e.g., by executing test case LNS/SEN/CR/BV-01-C [LN Feature] or by other means).
  3. The Lower Tester receives one or more ATT_Handle_Value_Notification from the IUT containing the Location and Speed characteristic handle and value along with the UTC Time field.
  4. Verify that the characteristic value meets the requirements of the service.
  5. Repeat steps 3–4 until the Lower Tester receives one or more additional notifications.
  6. The Lower Tester configures the Location and Speed characteristic to disable notifications.

- Expected Outcome

  Pass verdict

  The IUT sends two or more notifications of the Location and Speed characteristic and at least one includes the UTC Time value with the appropriate flag set in the Flags field.

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

  The value of the UTC Time Supported bit of the LN Feature characteristic is set to 1.

  In all cases, ensure that the RFU bits of the Flags field are set to zero.

LNS/SEN/CN/BV-09-C [Navigation Notifications – Remaining Distance]

- Test Purpose

  Verify that the IUT can send notifications of the Navigation characteristic that include Remaining Distance value.

- Reference

  [3] 3.5.1.4

- Initial Condition
  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - The Navigation characteristic is configured for notification.
  - Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.
  - If IUT permissions for the Navigation characteristic require a specific security mode or security level, establish a connection meeting those requirements.
- Test Procedure
  1. Perform an action on the IUT that will induce it, once connected, to send notifications of the Navigation characteristic along with Remaining Distance value (e.g., via the Navigation Control procedure test case LNS/SEN/SPN/BV-04-C [Navigation Control – Start]).
  2. The Lower Tester reads the LN Feature characteristic (e.g., by executing test case LNS/SEN/CR/BV-01-C [LN Feature] or by other means).
  3. The Lower Tester receives one or more ATT_Handle_Value_Notification from the IUT containing the Navigation characteristic handle and value along with the Remaining Distance value.
  4. Verify that the characteristic value meets the requirements of the service.
  5. Repeat steps 3–4 until the Lower Tester receives one or more additional notifications.
  6. The Lower Tester configures the Navigation characteristic to disable notifications (e.g., via the Navigation Control procedure test case LNS/SEN/SPN/BV-05-C [Navigation Control – Stop]).
- Expected Outcome

  Pass verdict

  The IUT sends two or more notifications of the Navigation characteristic and at least one includes the Remaining Distance value with the appropriate flag set in the Flags field.

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

  The value of the Remaining Distance Supported bit of the LN Feature characteristic is set to 1.

  In all cases, ensure that the RFU bits of the Flags field are set to zero.

LNS/SEN/CN/BV-10-C [Navigation Notifications – Remaining Vertical Distance]

- Test Purpose

  Verify that the IUT can send notifications of the Navigation characteristic that include Remaining Vertical Distance value.

- Reference

  [3] 3.5.1.5

- Initial Condition
  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - The Navigation characteristic is configured for notification.
  - Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.
  - If IUT permissions for the Navigation characteristic require a specific security mode or security level, establish a connection meeting those requirements.

- Test Procedure

  1. Perform an action on the IUT that will induce it, once connected, to send notifications of the Navigation characteristic along with Remaining Vertical Distance value (e.g., via the Navigation Control procedure test case LNS/SEN/SPN/BV-04-C [Navigation Control – Start]).
  2. The Lower Tester reads the LN Feature characteristic (e.g., by executing test case LNS/SEN/CR/BV-01-C [LN Feature] or by other means).
  3. The Lower Tester receives one or more ATT_Handle_Value_Notification from the IUT containing the Navigation characteristic handle and value along with the Remaining Vertical Distance value.
  4. Verify that the characteristic value meets the requirements of the service.
  5. Repeat steps 3–4 until the Lower Tester receives one or more additional notifications.
  6. The Lower Tester configures the Navigation characteristic to disable notifications (e.g., via the Navigation Control procedure test case LNS/SEN/SPN/BV-05-C [Navigation Control – Stop]).

- Expected Outcome

  Pass verdict

  The IUT sends two or more notifications of the Navigation characteristic and at least one includes the Remaining Vertical Distance value with the appropriate flag set in the Flags field.

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

  The value of the Remaining Vertical Distance Supported bit of the LN Feature characteristic is set to 1.

  In all cases, ensure that the RFU bits of the Flags field are set to zero.

LNS/SEN/CN/BV-11-C [Navigation Notifications – Estimated Time of Arrival]

- Test Purpose

  Verify that the IUT can send notifications of the Navigation characteristic that include Estimated Time of Arrival value.

- Reference

  [3] 3.5.1.6

- Initial Condition

  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - The Navigation characteristic is configured for notification.
  - Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport or Section 4.2.2, if using a BR/EDR transport.
  - If IUT permissions for the Navigation characteristic require a specific security mode or security level, establish a connection meeting those requirements.

- Test Procedure

  1. Perform an action on the IUT that will induce it, once connected, to send notifications of the Navigation characteristic along with Estimated Time of Arrival value (e.g., via the Navigation Control procedure test case LNS/SEN/SPN/BV-04-C [Navigation Control – Start]).
  2. The Lower Tester reads the LN Feature characteristic (e.g., by executing test case LNS/SEN/CR/BV-01-C [LN Feature] or by other means).
  3. The Lower Tester receives one or more ATT_Handle_Value_Notification from the IUT containing the Navigation characteristic handle and value along with the Estimated Time of Arrival value.

4. Verify that the characteristic value meets the requirements of the service.
5. Repeat steps 3–4 until the Lower Tester receives one or more additional notifications.
6. The Lower Tester configures the Navigation characteristic to disable notifications (e.g., via the Navigation Control procedure test case LNS/SEN/SPN/BV-05-C [Navigation Control – Stop]).

- Expected Outcome

  Pass verdict

  The IUT sends two or more notifications of the Navigation characteristic and at least one includes the Estimated Time of Arrival value with the appropriate flag set in the Flags field.

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

  The value of the Estimated Time of Arrival Supported bit of the LN Feature characteristic is set to 1.

  In all cases, ensure that the RFU bits of the Flags field are set to zero.

4.7 Service Procedures – Set Cumulative Value

Verify compliant operation when the Lower Tester uses LN Control Point Set Cumulative Value procedure.

LNS/SEN/SPS/BV-01-C [Set Cumulative Value – Set to zero]

- Test Purpose

  Verify that the IUT can perform the Set Cumulative Value procedure to set a zero value to the Total Distance.

- Reference

  [3] 3.4.2.1

- Initial Condition

  - Perform the preamble described in Section 4.2.3.
  - The value of Total Distance in the IUT is set to a known non-zero value.

- Test Procedure

1. A connection is established between the Lower Tester and IUT.
2. The Lower Tester reads the LN Feature characteristic (e.g., by executing test case LNS/SEN/CR/BV-01-C [LN Feature] or by other means).
3. The IUT sends one or more notifications of the Location and Speed characteristic.
4. The Lower Tester writes the Set Cumulative Value Op Code (0x01) to the LN Control Point with a Parameter Value of 0x000000.
5. The IUT sends an indication of the LN Control Point characteristic with the Response Code Op Code (0x20), a Parameter Value representing Request Op Code (0x01) followed by the Response Value for ‘success’ (0x01) without Response Parameter.
6. The Lower Tester receives an ATT_Handle_Value_Indication from the IUT containing the LN Control Point characteristic handle and value.
7. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.
8. Verify that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one or more notifications of the Location and Speed characteristic with the Total Distance field set to a non-zero value.

  The IUT sends one indication of the LN Control Point characteristic with the Response Code Op Code containing a valid Parameter Value.

  After setting the value to zero, the IUT sends the next notification of the Location and Speed characteristic with the Total Distance field set to 0 (or slightly higher in case of movement).

  The value of the Total Distance Supported bit of the LN Feature characteristic is set to 1.

LNS/SEN/SPS/BV-02-C [Set Cumulative Value – Set to non-zero]

- Test Purpose

  Verify that the IUT can perform the Set Cumulative Value procedure to set a non-zero value to Total Distance.

- Reference

  [3] 3.4.2.1

- Initial Condition

  - Perform the preamble described in Section 4.2.3.
  - The value of Total Distance in the IUT is set to a known non-zero value.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester reads the LN Feature characteristic (e.g., by executing test case LNS/SEN/CR/BV-01-C [LN Feature] or by other means).
  3. The IUT sends one or more notifications of the Location and Speed characteristic.
  4. The Lower Tester writes the Set Cumulative Value Op Code (0x01) to the LN Control Point with a Parameter Value other than 0x000000 and different from the initial value.
  5. The IUT sends an indication of the LN Control Point characteristic with the Response Code Op Code (0x20), a Parameter Value representing Request Op Code (0x01) followed by the Response Value for ‘success’ (0x01) without Response Parameter.
  6. The Lower Tester receives an ATT_Handle_Value_Indication from the IUT containing the LN Control Point characteristic handle and value.
  7. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.
  8. Verify that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one or more notifications of the Location and Speed characteristic with the Total Distance field set to a non-zero value.

  The IUT sends one indication of the LN Control Point characteristic with the Response Code Op Code containing a valid Parameter Value.

After setting the value to a non-zero value, the IUT sends the next notification of the Location and Speed characteristic with the Total Distance field set to the specified value (or slightly higher in case of movement).

The value of the Total Distance Supported bit of the LN Feature characteristic is set to 1.

4.8 Service Procedure – Mask Location and Speed Characteristic Content

LNS/SEN/SPM/BV-01-C [Mask Location and Speed Characteristic Content]

- Test Purpose

  Verify that the IUT can perform the Mask Location and Speed Characteristic Content procedure.

- Reference

  [3] 3.4.2.2

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester reads the LN Feature characteristic (e.g., by executing test case LNS/SEN/CR/BV-01-C [LN Feature] or by other means).
  3. The Lower Tester configures the IUT for sending notification of the Location and Speed characteristic (e.g., by executing test case LNS/SEN/CN/BV-01-C [Location and Speed Notifications]).
  4. The Lower Tester receives one or more ATT_Handle_Value_Notifications of the Location and Speed characteristic with at least one optional field present.
  5. The Lower Tester writes the Mask Location and Speed Characteristic Content Op Code (0x02) to the LN Control Point with a Parameter Value set to 0x007F (UINT16) to turn off all the optional fields.
  6. The IUT sends an indication of the LN Control Point characteristic with the Response Code Op Code (0x20), the Parameter Value representing Request Op Code (0x02) and the Response Value for ‘success’ (0x01) without Response Parameter.
  7. The Lower Tester receives an ATT_Handle_Value_Indication from the IUT containing the LN Control Point characteristic handle and value.
  8. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.
  9. The Lower Tester receives one or more ATT_Handle_Value_Notifications of the Location and Speed characteristic with optional fields not present.
  10. Verify that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  For steps 1–4:

  - The IUT sends one or more notifications of the Location and Speed characteristic with at least one optional field present.
  - The value of the Location and Speed Characteristic Content Masking Supported bit of the LN Feature characteristic is set to 1.

For steps 5–10:

- The IUT sends one indication of the LN Control Point characteristic with the Response Code Op Code containing a valid Parameter Value.
- The IUT sends one or more notifications of the Location and Speed characteristic without any optional field present.

LNS/SEN/SPM/BV-02-C [Mask Location and Speed Characteristic Content – Most Recent Mask Value is not Cached]

- Test Purpose

  Verify that the IUT does not cache the most recent configuration.

- Reference

  [3] 3.4.2.2

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester reads the LN Feature characteristic (e.g., by executing test case LNS/SEN/CR/BV-01-C [LN Feature] or by other means).
  3. The Lower Tester configures the IUT for sending notification of the Location and Speed characteristic (e.g., by executing test case LNS/SEN/CN/BV-01-C [Location and Speed Notifications]).
  4. The Lower Tester receives one or more ATT_Handle_Value_Notifications of the Location and Speed characteristic with at least one optional field present.
  5. The Lower Tester writes the Mask Location and Speed Characteristic Content Op Code (0x02) to the LN Control Point with a Parameter Value set to 0x007F (UINT16) to turn off all the optional fields.
  6. The IUT sends an indication of the LN Control Point characteristic with the Response Code Op Code (0x20), the Parameter Value representing Request Op Code (0x02) and the Response Value for ‘success’ (0x01) without Response Parameter.
  7. The Lower Tester receives an ATT_Handle_Value_Indication from the IUT containing the LN Control Point characteristic handle and value.
  8. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.
  9. The Lower Tester continues to receive one or more ATT_Handle_Value_Notifications of the Location and Speed characteristic with optional fields not present.
  10. Verify that the optional characteristic fields are masked.
  11. The Lower Tester terminates the link.
  12. A connection is established between the Lower Tester and IUT.
  13. The Lower Tester reads the LN Feature characteristic (e.g., by executing test case LNS/SEN/CR/BV-01-C [LN Feature] or by other means).
  14. If not bonded, the Lower Tester again enables the notification of the Location and Speed characteristic (e.g., by executing test case LNS/SEN/CN/BV-01-C [Location and Speed Notifications]).
  15. The Lower Tester receives one or more notifications of the Location and Speed characteristic with at least one optional field present.
  16. Verify that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  For steps 1–4:

  - The IUT sends one or more notifications of the Location and Speed characteristic with at least one optional field present.

  For steps 5–10:

  - The IUT sends one indication of the LN Control Point characteristic with the Response Code Op Code containing a valid Parameter Value.
  - The value of the Location and Speed Characteristic Content Masking Supported bit of the LN Feature characteristic is set to 1.
  - The content of the Location and Speed characteristic does not include the fields that were turned off.

  For steps 11–16:

  - The IUT sends one indication of the LN Control Point characteristic with the Response Code Op Code containing a valid Parameter Value.
  - The value of the Location and Speed Characteristic Content Masking Supported bit of the LN Feature characteristic is set to 1.
  - The content of the Location and Speed characteristic includes the fields that were seen in step 4.
  - The IUT sends one or more notifications of the Location and Speed characteristic with at least one optional field present.

4.9 Service Procedure – Navigation

LNS/SEN/SPN/BV-01-C [Request Number of Routes]

- Test Purpose

  Verify that the IUT can perform the Request Number of Routes procedure.

- Reference

  [3] 3.4.2.4

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester discovers the Navigation characteristic using the test procedure LNS/SEN/SGGIT/CHA/BV-04-C [Characteristic GGIT– Navigation] or by any other means.
  3. The Lower Tester writes the Request Number of Routes Op Code (0x04) to the LN Control Point without any Parameter Value.
  4. The IUT sends an indication of the LN Control Point characteristic with the Response Code Op Code (0x20), the Parameter Value representing Request Op Code (0x04) and the Response Value for ‘success’ (0x01) followed by the number of available routes (UINT16).
  5. The Lower Tester receives an ATT_Handle_Value_Indication from the IUT containing the LN Control Point characteristic handle and value.

6. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.
7. Verify that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one indication of the LN Control Point characteristic with the Response Code Op Code containing a valid Parameter Value.

LNS/SEN/SPN/BV-02-C [Request Name of Route]

- Test Purpose

  Verify that the IUT can perform the Request Name of Route procedure.

- Reference

  [3] 3.4.2.5

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester discovers the Navigation characteristic using the test procedure LNS/SEN/SGGIT/CHA/BV-04-C [Characteristic GGIT– Navigation] or by any other means.
  3. The Lower Tester writes the Request Name of Route Op Code (0x05) to the LN Control Point with a Parameter Value set to valid route number (UINT16). Valid route number is a number from 0 to number of routes – 1. Number of routes can be obtained by executing the procedure included in LNS/SEN/SPN/BV-01-C [Request Number of Routes], or by other means.
  4. The IUT sends an indication of the LN Control Point characteristic with the Response Code Op Code (0x20), the Parameter Value representing Request Op Code (0x05) and the Response Value for ‘success’ (0x01) followed by the name of route (UTF-8 string).
  5. The Lower Tester receives an ATT_Handle_Value_Indication from the IUT containing the LN Control Point characteristic handle and value.
  6. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.
  7. Verify that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one indication of the LN Control Point characteristic with the Response Code Op Code containing a valid Parameter Value.

LNS/SEN/SPN/BV-03-C [Select Route]

- Test Purpose

  Verify that the IUT can perform the Select Route procedure.

- Reference

  [3] 3.4.2.6

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester discovers the Navigation characteristic using the test procedure LNS/SEN/SGGIT/CHA/BV-04-C [Characteristic GGIT– Navigation] or by any other means.
  3. The Lower Tester writes the Select Route Op Code (0x06) to the LN Control Point with a Parameter Value set to valid route number (UINT16). Valid route number is a number from 0 to number of routes – 1. Number of routes can be obtained by executing the procedure included in LNS/SEN/SPN/BV-01-C [Request Number of Routes], or by other means.
  4. The IUT sends an indication of the LN Control Point characteristic with the Response Code Op Code (0x20), the Parameter Value representing Request Op Code (0x06) and the Response Value for ‘success’ (0x01) without Response Parameter.
  5. The Lower Tester receives an ATT_Handle_Value_Indication from the IUT containing the LN Control Point characteristic handle and value.
  6. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.
  7. Verify that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one indication of the LN Control Point characteristic with the Response Code Op Code containing a valid Parameter Value.

LNS/SEN/SPN/BV-04-C [Navigation Control – Start]

- Test Purpose

  Verify that the IUT can perform the Navigation Control procedure.

- Reference

  [3] 3.4.2.3

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester selects the route for navigation (e.g., by executing test case LNS/SEN/SPN/BV-03-C [Select Route] or by other means).
  3. The Lower Tester writes the Navigation Control Characteristic Content Op Code (0x03) to the LN Control Point with a Parameter Value set to 0x01 (UINT8) (start the navigation) to start the sending of the Navigation notifications.
  4. The IUT sends an indication of the LN Control Point characteristic with the Response Code Op Code (0x20), the Parameter Value representing Request Op Code (0x03) and the Response Value for ‘success’ (0x01) without Response Parameter.
  5. The Lower Tester receives an ATT_Handle_Value_Indication from the IUT containing the LN Control Point characteristic handle and value.
  6. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.
  7. Verify that the characteristic value meets the requirements of the service.
  8. The Lower Tester receives one or more ATT_Handle_Value_Notification from the IUT containing the Navigation characteristic handle and value along with the Flags field, the Bearing field and the Heading field.

- Expected Outcome

  Pass verdict

  The IUT sends one indication of the LN Control Point characteristic with the Response Code Op Code containing a valid Parameter Value when the Lower Tester requests to start the sending of the Navigation characteristic.

  The IUT sends one or more notifications of the Navigation characteristic along with the Flags field, the Bearing field, and the Heading field.

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

LNS/SEN/SPN/BV-05-C [Navigation Control – Stop]

- Test Purpose

  Verify that the IUT can perform the Navigation Control procedure.

- Reference

  [3] 3.4.2.3

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. Perform an action on the IUT that will induce it, once connected, to send notifications of the Navigation characteristic along with the Flags field, the Bearing field and the Heading field (e.g., via the Navigation Control procedure test case LNS/SEN/SPN/BV-04-C [Navigation Control – Start]).
  2. A connection is established between the Lower Tester and IUT meeting the security requirements of the IUT, if not already done so prior to step 1.
  3. The Lower Tester receives one or more ATT_Handle_Value_Notification from the IUT containing the Navigation characteristic handle and value along with the Flags field, the Bearing field and the Heading field.
  4. Verify that the characteristic value meets the requirements of the service.
  5. The Lower Tester writes the Navigation Control Characteristic Content Op Code (0x03) to the LN Control Point with a Parameter Value set to 0x00 (UINT8) (stop the navigation) to stop the sending of the Navigation notifications.
  6. The IUT sends an indication of the LN Control Point characteristic with the Response Code Op Code (0x20), the Parameter Value representing Request Op Code (0x03) and the Response Value for ‘success’ (0x01) without Response Parameter.
  7. The Lower Tester receives an ATT_Handle_Value_Indication from the IUT containing the LN Control Point characteristic handle and value.
  8. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.
  9. Verify that the characteristic value meets the requirements of the service.
  10. Verify that the IUT does not send an ATT_Handle_Value_Notification to the Lower Tester containing the Navigation characteristic.

- Expected Outcome

  Pass verdict

  The IUT sends one indication of the LN Control Point characteristic with the Response Code Op Code containing a valid Parameter Value when the Lower Tester requests to start the sending of the Navigation characteristic.

The IUT sends one or more notifications of the Navigation characteristic along with the Flags field, the Bearing field, and the Heading field.

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

The IUT sends one indication of the LN Control Point characteristic with the Response Code Op Code containing a valid Parameter Value when the Lower Tester requests to stop the sending of the Navigation characteristic.

IUT stops sending notifications of the Navigation characteristic.

LNS/SEN/SPN/BV-06-C [Navigation Control – Pause and Continue]

- Test Purpose

  Verify that the IUT can perform the Navigation Control procedure.

- Reference

  [3] 3.4.2.3

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester selects the route for navigation (e.g., by executing test case LNS/SEN/SPN/BV-03-C [Select Route] or by other means).
  3. The Lower Tester writes the Navigation Control Characteristic Content Op Code (0x03) to the LN Control Point with a Parameter Value set to 0x01 (UINT8) to “start the navigation” and to start the sending of the Navigation notifications.
  4. The IUT sends an indication of the LN Control Point characteristic with the Response Code Op Code (0x20), the Parameter Value representing Request Op Code (0x03) and the Response Value for ‘success’ (0x01) without Response Parameter.
  5. The Lower Tester receives an ATT_Handle_Value_Indication from the IUT containing the LN Control Point characteristic handle and value.
  6. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.
  7. Verify that the characteristic value meets the requirements of the service.
  8. The Lower Tester receives one or more ATT_Handle_Value_Notification from the IUT containing the Navigation characteristic handle and value along with the Flags field, the Bearing field and the Heading field.
  9. The Lower Tester writes the Navigation Control Characteristic Content Op Code (0x03) to the LN Control Point with a Parameter Value set to 0x02 (UINT8) to “pause the navigation” and to stop the sending of the Navigation notifications.
  10. The IUT sends an indication of the LN Control Point characteristic with the Response Code Op Code (0x20), the Parameter Value representing Request Op Code (0x03) and the Response Value for ‘success’ (0x01) without Response Parameter.
  11. The Lower Tester receives an ATT_Handle_Value_Indication from the IUT containing the LN Control Point characteristic handle and value.
  12. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.
  13. Verify that the characteristic value meets the requirements of the service.
  14. Verify that the IUT does not send an ATT_Handle_Value_Notification to the Lower Tester containing the Navigation characteristic.

15. The Lower Tester writes the Navigation Control Characteristic Content Op Code (0x03) to the LN Control Point with a Parameter Value set to 0x03 (UINT8) to “continue the navigation” and to start the sending of the Navigation notifications.
16. The IUT sends an indication of the LN Control Point characteristic with the Response Code Op Code (0x20), the Parameter Value representing Request Op Code (0x03) and the Response Value for ‘success’ (0x01) without Response Parameter.
17. The Lower Tester receives an ATT_Handle_Value_Indication from the IUT containing the LN Control Point characteristic handle and value.
18. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.
19. Verify that the characteristic value meets the requirements of the service.
20. The Lower Tester receives one or more ATT_Handle_Value_Notification from the IUT containing the Navigation characteristic handle and value along with the Flags field, the Bearing field and the Heading field.
21. The Lower Tester writes the Navigation Control Characteristic Content Op Code (0x03) to the LN Control Point with a Parameter Value set to 0x00 (UINT8) to “stop the navigation” and to stop the sending of the Navigation notifications.
22. The IUT sends an indication of the LN Control Point characteristic with the Response Code Op Code (0x20), the Parameter Value representing Request Op Code (0x03) and the Response Value for ‘success’ (0x01) without Response Parameter.
23. The Lower Tester receives an ATT_Handle_Value_Indication from the IUT containing the LN Control Point characteristic handle and value.
24. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.
25. Verify that the characteristic value meets the requirements of the service.
26. Verify that the IUT does not send an ATT_Handle_Value_Notification to the Lower Tester containing the Navigation characteristic.

- Expected Outcome

  Pass verdict

  The IUT sends one indication of the LN Control Point characteristic with the Response Code Op Code containing a valid Parameter Value when the Lower Tester requests to start the sending of the Navigation characteristic (using start navigation or continue navigation).

  The IUT sends one or more notifications of the Navigation characteristic along with the Flags field, the Bearing field, and the Heading field.

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

  The IUT sends one indication of the LN Control Point characteristic with the Response Code Op Code containing a valid Parameter Value when the Lower Tester requests to stop the sending of the Navigation characteristic (using stop navigation or pause navigation).

  IUT stops sending notifications of the Navigation characteristic.

LNS/SEN/SPN/BV-07-C [Navigation Control – Skip Waypoint]

- Test Purpose

  Verify that the IUT can perform the Navigation Control procedure.

- Reference

  [3] 3.4.2.3

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester selects the route for navigation (e.g., by executing test case LNS/SEN/SPN/BV-03-C [Select Route] or by other means).
  3. The Lower Tester writes the Navigation Control Characteristic Content Op Code (0x03) to the LN Control Point with a Parameter Value set to 0x01 (UINT8) to “start the navigation” and to start the sending of the Navigation notifications.
  4. The IUT sends an indication of the LN Control Point characteristic with the Response Code Op Code (0x20), the Parameter Value representing Request Op Code (0x03) and the Response Value for ‘success’ (0x01) without Response Parameter.
  5. The Lower Tester receives an ATT_Handle_Value_Indication from the IUT containing the LN Control Point characteristic handle and value.
  6. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.
  7. Verify that the characteristic value meets the requirements of the service.
  8. The Lower Tester receives one or more ATT_Handle_Value_Notification from the IUT containing the Navigation characteristic handle and value along with the Flags field, the Bearing field and the Heading field.
  9. The Lower Tester writes the Navigation Control Characteristic Content Op Code (0x03) to the LN Control Point with a Parameter Value set to 0x04 (UINT8) to “skip waypoint”.
  10. The IUT sends an indication of the LN Control Point characteristic with the Response Code Op Code (0x20), the Parameter Value representing Request Op Code (0x03) and the Response Value for ‘success’ (0x01) without Response Parameter.
  11. The Lower Tester receives an ATT_Handle_Value_Indication from the IUT containing the LN Control Point characteristic handle and value.
  12. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.
  13. Verify that the characteristic value meets the requirements of the service.
  14. The Lower Tester receives one or more ATT_Handle_Value_Notification from the IUT containing the Navigation characteristic handle and value along with the Flags field, the Bearing field and the Heading field.
  15. The Lower Tester writes the Navigation Control Characteristic Content Op Code (0x03) to the LN Control Point with a Parameter Value set to 0x00 (UINT8) to “stop the navigation” and to stop the sending of the Navigation notifications.
  16. The IUT sends an indication of the LN Control Point characteristic with the Response Code Op Code (0x20), the Parameter Value representing Request Op Code (0x03) and the Response Value for ‘success’ (0x01) without Response Parameter.
  17. The Lower Tester receives an ATT_Handle_Value_Indication from the IUT containing the LN Control Point characteristic handle and value.
  18. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.
  19. Verify that the characteristic value meets the requirements of the service.
  20. Verify that the IUT does not send an ATT_Handle_Value_Notification to the Lower Tester containing the Navigation characteristic.

- Expected Outcome

  Pass verdict

  The IUT sends one indication of the LN Control Point characteristic with the Response Code Op Code containing a valid Parameter Value when the Lower Tester requests to start the sending of the Navigation characteristic.

  The IUT sends one or more notifications of the Navigation characteristic along with the Flags field, the Bearing field, and the Heading field.

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

The IUT sends one indication of the LN Control Point characteristic with the Response Code Op Code containing a valid Parameter Value when the Lower Tester requests to skip waypoint.

After skipping the waypoint, the IUT sends one or more notifications of the Navigation characteristic along with the Flags field, the Bearing field and the Heading field.

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

The IUT sends one indication of the LN Control Point characteristic with the Response Code Op Code containing a valid Parameter Value when the Lower Tester requests to stop the sending of the Navigation characteristic.

LNS/SEN/SPN/BV-08-C [Navigation Control – Select Nearest Waypoint on a Route]

- Test Purpose

  Verify that the IUT can perform the Navigation Control procedure.

- Reference

  [3] 3.4.2.3

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester reads the LN Feature characteristic (e.g., by executing test case LNS/SEN/CR/BV-01-C [LN Feature] or by other means).
  3. The Lower Tester selects the route for navigation (e.g., by executing test case LNS/SEN/SPN/BV-03-C [Select Route] or by other means).
  4. The Lower Tester writes the Navigation Control Characteristic Content Op Code (0x03) to the LN Control Point with a Parameter Value set to 0x05 (UINT8) to “select nearest waypoint on a route” and to start the sending of the Navigation notifications.
  5. The IUT sends an indication of the LN Control Point characteristic with the Response Code Op Code (0x20), the Parameter Value representing Request Op Code (0x03) and the Response Value for ‘success’ (0x01) without Response Parameter.
  6. The Lower Tester receives an ATT_Handle_Value_Indication from the IUT containing the LN Control Point characteristic handle and value.
  7. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.
  8. Verify that the characteristic value meets the requirements of the service.
  9. The Lower Tester receives one or more ATT_Handle_Value_Notification from the IUT containing the Navigation characteristic handle and value along with the Flags field, the Bearing field and the Heading field.
  10. The Lower Tester writes the Navigation Control Characteristic Content Op Code (0x03) to the LN Control Point with a Parameter Value set to 0x00 (UINT8) to “stop the navigation” and to stop the sending of the Navigation notifications.
  11. The IUT sends an indication of the LN Control Point characteristic with the Response Code Op Code (0x20), the Parameter Value representing Request Op Code (0x03) and the Response Value for ‘success’ (0x01) without Response Parameter.
  12. The Lower Tester receives an ATT_Handle_Value_Indication from the IUT containing the LN Control Point characteristic handle and value.
  13. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.

14. Verify that the characteristic value meets the requirements of the service.
15. Verify that the IUT does not send an ATT_Handle_Value_Notification to the Lower Tester containing the Navigation characteristic.

- Expected Outcome

  Pass verdict

  The IUT sends one indication of the LN Control Point characteristic with the Response Code Op Code containing a valid Parameter Value when the Lower Tester requests to select nearest waypoint on a route and to start the sending of the Navigation characteristic.

  The IUT sends one or more notifications of the Navigation characteristic along with the Flags field, the Bearing field, and the Heading field.

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

  The IUT sends one indication of the LN Control Point characteristic with the Response Code Op Code containing a valid Parameter Value when the Lower Tester requests to skip waypoint.

4.10 Service Procedures – Set Fix Rate

Verify compliant operation when the Lower Tester uses LN Control Point Set Fix Rate procedure.

LNS/SEN/SPF/BV-01-C [Set Fix Rate]

- Test Purpose

  Verify that the IUT can perform the Set Fix Rate procedure.

- Reference

  [3] 3.4.2.7

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester reads the LN Feature characteristic (e.g., by executing test case LNS/SEN/CR/BV-01-C [LN Feature] or by other means).
  3. The Lower Tester writes the Set Fix Rate Op Code (0x07) to the LN Control Point with a Parameter Value set to valid fix rate value in seconds (UINT8). The parameter value of 0x00 represents the fastest possible fix rate, which can be faster than once a second.
  4. The IUT sends an indication of the LN Control Point characteristic with the Response Code Op Code (0x20), a Parameter Value representing Request Op Code (0x07) followed by the Response Value for ‘success’ (0x01) without Response Parameter.
  5. The Lower Tester receives an ATT_Handle_Value_Indication from the IUT containing the LN Control Point characteristic handle and value.
  6. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.

- Expected Outcome

  Pass verdict

  The IUT sends one indication of the LN Control Point characteristic with the Response Code Op Code containing a valid Parameter Value.

  The value of the Fix Rate Setting Supported bit of the LN Feature characteristic is set to 1.

4.11 Service Procedures – Set Elevation

Verify compliant operation when the Lower Tester uses LN Control Point Set Elevation procedure.

LNS/SEN/SPA/BV-01-C [Set Elevation]

- Test Purpose

  Verify that the IUT can perform the Set Elevation procedure.

- Reference

  [3] 3.4.2.8

- Initial Condition

  - Perform the preamble described in Section 4.2.3.
  - The value of Elevation in the IUT is set to a known value.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester reads the LN Feature characteristic (e.g., by executing test case LNS/SEN/CR/BV-01-C [LN Feature] or by other means).
  3. The IUT sends one or more notifications of the Location and Speed characteristic.
  4. The Lower Tester writes the Set Elevation Op Code (0x08) to the LN Control Point with a Parameter Value different from the initial value.
  5. The IUT sends an indication of the LN Control Point characteristic with the Response Code Op Code (0x20), a Parameter Value representing Request Op Code (0x08) followed by the Response Value for ‘success’ (0x01) without Response Parameter.
  6. The Lower Tester receives an ATT_Handle_Value_Indication from the IUT containing the LN Control Point characteristic handle and value.
  7. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.
  8. The IUT sends one or more notifications of the Location and Speed characteristic.
  9. Verify that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one or more notifications of the Location and Speed characteristic with the Elevation field set to a known value.

  The IUT sends one indication of the LN Control Point characteristic with the Response Code Op Code containing a valid Parameter Value.

  After setting the value to a different value from the initial value, the IUT sends the next notification of the Location and Speed characteristic with the Elevation field set to this value.

  The value of the Elevation Supported bit and the value of the Elevation Setting Supported bit of the LN Feature characteristic are set to 1.

4.12 Service Procedure – General Error Handling

Verify compliant operation when the Lower Tester uses LN Control Point procedure and an error results.

LNS/SEN/SPE/BI-01-C [Op Code Not Supported]

- Test Purpose

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

- Reference

  [3] 3.4.3

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester writes an Op Code Value of 0x00 to the LN Control Point without Parameter Value.
  3. Verify that the IUT response meets the requirements of the service.
  4. The Lower Tester writes an Op Code value from the Reserved for Future Use range other than 0x00 to the LN Control Point without Parameter Value.
  5. Verify that the IUT response meets the requirements of the service.

- Expected Outcome

  Pass verdict

  For both cases, the IUT sends a Write Response followed by an indication of the LN Control Point characteristic with the Response Code Op Code (0x20), a Parameter Value representing Request Op Code (i.e., 0x00 for step 2 and the RFU value written for step 4) followed by the Response Value for ‘Op Code not supported’ (0x02) and without Response Parameter.

LNS/SEN/SPE/BI-02-C [Invalid Parameter]

- Test Purpose

  Verify that the IUT responds appropriately when a Client writes a supported Op Code followed by an invalid Parameter Value to the LN Control Point.

- Reference

  [3] 3.4.3

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester writes the Set Cumulative Value Op Code (0x01) to the LN Control Point with a Parameter Value set to any UINT16 value.
  3. Verify that the IUT response meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends a Write Response followed by an indication of the LN Control Point characteristic with the Response Code Op Code (0x20), a Parameter Value representing Request Op Code (0x01) followed by the Response Value for 'Invalid Parameter' (0x03) and without Response Parameter.

LNS/SEN/SPE/BI-03-C [Client Characteristic Configuration Descriptor Improperly Configured]

- Test Purpose

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

- Reference

  [3] 3.4.3

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester resets to 0 the Client Characteristic Configuration descriptor of the LN Control Point characteristic.
  3. The Lower Tester writes a valid Op Code to the LN Control Point.
  4. Verify that the IUT response meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT rejects the Write Request by sending an Error Response with an Attribute Protocol Error Code set to Client Characteristic Configuration Descriptor Improperly Configured (0xFD).

LNS/SEN/SPE/BI-04-C [Procedure Already In Progress]

- Test Purpose

  Verify that the IUT responds appropriately when a Client attempts to perform a LN Control Point procedure when a procedure is already in progress.

- Reference

  [3] 3.4.3

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester sets to 0x0002 the Client Characteristic Configuration descriptor of the LN Control Point characteristic.
  3. The Lower Tester writes a valid Op Code supported by the IUT to the LN Control Point without Parameter Value.

4. The Lower Tester receives one Indication of the SC Control Point to acknowledge the first request. The Lower Tester does not send any Confirmation to acknowledge this Indication.
5. The Lower Tester sends five consecutive write requests all with valid Op codes to the LN Control Point without Parameter value. There are two alternatives (a or b):
    a. The Lower Tester receives an Error Response with an Attribute Protocol Application Error Code set to Procedure Already in Progress (0xFE).
    b. The Lower Tester receives five indications of the CP Control Point to acknowledge each request sent by the Lower Tester in step 5.
6. Verify that the IUT response(s) meet the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT acknowledges the first write request with appropriate Response Value.

  The IUT successfully performs one of the following alternatives (a or b):

    a. Rejects a Write Request in step 5 by sending an Error Response with an Attribute Protocol Application Error Code set to Procedure Already in Progress (0xFE).
    b. Acknowledges all five write requests with appropriate Response Values.

LNS/SEN/SPE/BI-05-C [LN Control Point Procedure Timeout]

- Test Purpose

  Verify that the IUT stops sending indications related to the operation after an ATT Transaction Timeout.

- Reference

  [3] 3.4.4

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

1. A connection is established between the Lower Tester and IUT.
2. The Lower Tester sends write request for any of the supported Op Codes supported by the IUT to the LN Control Point using an appropriate Parameter for the Op Code.
3. The IUT sends an indication of the LN Control Point characteristic with the Response Code Op Code (0x20), a Parameter Value representing the Request Op Code followed by the Response Value for ‘success’ (0x01) with an appropriate Response Parameter.
4. The Lower Tester receives an ATT_Handle_Value_Indication from the IUT containing the LN Control Point characteristic handle and value.
5. The Lower Tester receives the indication but does not send a Handle Value Confirmation for an ATT Transaction Timeout plus several seconds.
6. After the ATT Transaction Timeout, the IUT does not send any further notifications and considers the procedure to have failed.

- Expected Outcome

  Pass verdict

  The IUT stops sending any further notifications after the ATT Transaction Timeout.

  The IUT returns to a stable state and may disconnect based on implementation.

5 Test case mapping

The Test Case Mapping Table (TCMT) maps test cases to specific requirements in the ICS. The IUT is tested in all roles for which support is declared in the ICS document.

The columns for the TCMT are defined as follows:

Item: Contains a logical expression based on specific entries from the associated ICS document. Contains a logical expression (using the operators AND, OR, NOT as needed) based on specific entries from the applicable ICS document(s). The entries are in the form of y/x references, where y corresponds to the table number and x corresponds to the feature number as defined in the ICS document for Location and Navigation Service (LNS) [4].

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

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

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

Item	Feature	Test Case(s)
LNS 3/1	Location and Navigation Service	LNS/SEN/SGGIT/SER/BV-01-C
LNS 1/1	Location and Navigation Service – SDP Record	LNS/SEN/SGGIT/SDP/BV-01-C
LNS 3/2	LN Feature Characteristic Read	LNS/SEN/CR/BV-01-C
LNS 3/2 AND NOT LNS 3a/2	LN Feature Characteristic	LNS/SEN/SGGIT/CHA/BV-01-C
LNS 3a/2	LN Feature Indication	LNS/SEN/SGGIT/CHA/BV-06-C LNS/SEN/SGGIT/ISFC/BV-01-C
LNS 3/3	Location and Speed Characteristic	LNS/SEN/SGGIT/CHA/BV-02-C LNS/SEN/CON/BV-01-C LNS/SEN/CN/BV-01-C
LNS 3/4	Instantaneous Speed field of the Location and Speed Characteristic	LNS/SEN/CN/BV-02-C
LNS 3/5	Total Distance field of the Location and Speed Characteristic	LNS/SEN/CN/BV-03-C
LNS 3/6	Location field pair of the Location and Speed Characteristic	LNS/SEN/CN/BV-04-C
LNS 3/7	Elevation field of the Location and Speed Characteristic	LNS/SEN/CN/BV-05-C
LNS 3/8	Heading field of the Location and Speed Characteristic	LNS/SEN/CN/BV-06-C
LNS 3/9	Rolling Time field of the Location and Speed Characteristic	LNS/SEN/CN/BV-07-C
LNS 3/10	UTC Time field of the Location and Speed Characteristic	LNS/SEN/CN/BV-08-C
LNS 3/17	Position Quality Characteristic	LNS/SEN/SGGIT/CHA/BV-03-C LNS/SEN/CR/BV-02-C
LNS 3/18	Number of Satellites in Solution Field of the Position Quality characteristic	LNS/SEN/CR/BV-03-C

Item	Feature	Test Case(s)
LNS 3/19	Number of Satellites in View Field of the Position Quality Characteristic	LNS/SEN/CR/BV-04-C
LNS 3/20	Time to First Fix Field of the Position Quality Characteristic	LNS/SEN/CR/BV-05-C
LNS 3/21	Estimated Horizontal Position Error Field of the Position Quality Characteristic	LNS/SEN/CR/BV-06-C
LNS 3/22	Estimated Vertical Position Error Field of the Position Quality Characteristic	LNS/SEN/CR/BV-07-C
LNS 3/23	Horizontal Dilution Of Precision Field of the Position Quality Characteristic	LNS/SEN/CR/BV-08-C
LNS 3/24	Vertical Dilution Of Precision Field of the Position Quality Characteristic	LNS/SEN/CR/BV-09-C
LNS 3/25	LN Control Point Characteristic	LNS/SEN/SGGIT/CHA/BV-05-C LNS/SEN/CON/BV-02-C LNS/SEN/SPE/BI-01-C LNS/SEN/SPE/BI-02-C LNS/SEN/SPE/BI-03-C LNS/SEN/SPE/BI-04-C LNS/SEN/SPE/BI-05-C
LNS 3/26	Total Distance Supported – Set Cumulative Value Procedure – Set to zero	LNS/SEN/SPS/BV-01-C
LNS 3/27	Total Distance Supported – Set Cumulative Value Procedure – Set to non-zero	LNS/SEN/SPS/BV-02-C
LNS 3/28	Mask Location and Speed Characteristic Content Supported – Mask Location and Speed Characteristic Content	LNS/SEN/SPM/BV-01-C LNS/SEN/SPM/BV-02-C
LNS 3/29	Navigation Supported – Navigation Control	LNS/SEN/SPN/BV-04-C LNS/SEN/SPN/BV-05-C LNS/SEN/SPN/BV-06-C LNS/SEN/SPN/BV-07-C LNS/SEN/SPN/BV-08-C
LNS 3/30	Navigation Supported – Request Number of Routes	LNS/SEN/SPN/BV-01-C
LNS 3/31	Navigation Supported – Request Name of Route	LNS/SEN/SPN/BV-02-C
LNS 3/32	Navigation Supported – Select Route	LNS/SEN/SPN/BV-03-C
LNS 3/33	Setting Fix Rate Supported – Set Fix Rate	LNS/SEN/SPF/BV-01-C
LNS 3/34	Setting Elevation Supported – Set Elevation	LNS/SEN/SPA/BV-01-C
LNS 3/11 AND LNS 3/12 AND LNS 3/13	Navigation Characteristic	LNS/SEN/SGGIT/CHA/BV-04-C LNS/SEN/CON/BV-03-C
LNS 3/14	Remaining Distance field of the Navigation Characteristic	LNS/SEN/CN/BV-09-C
LNS 3/15	Remaining Vertical Distance field of the Navigation Characteristic	LNS/SEN/CN/BV-10-C
LNS 3/16	Estimated Time of Arrival field of the Navigation Characteristic	LNS/SEN/CN/BV-11-C

Table 5.1: Test case mapping

6 Revision history and acknowledgments

Revision History

Publication Number	Revision Number	Date	Comments
0	1.0.0	2013-04-30	Release for publication.
	1.0.1r1	2013-05-16	TSE 5177: Edits to the test procedure and pass verdict of LNS/SEN/SPE/BI-04-C (legacy ID: TP/SPE/BI-04-C).
1	1.0.1	2013-07-02	Prepare for Publication
	1.0.2r1	2013-08-16	TCRL 2013-2 TSE 5190: Updated the value for the LN control point parameter in step 4 of LNS/SEN/SPS/BV-01-C and LNS/SEN/SPS/BV-02-C (legacy ID: TP/SPS/BV-01-C and TP/SPS/BV-02-C).
2	1.0.2	2013-12-03	Prepare for Publication
	1.0.3r00	2014-10-06	TSE 5612: Update of requirements column for Characteristic Read Value Test Cases, LNS/SEN/CR/BV-03-C, LNS/SEN/CR/BV-04-C, LNS/SEN/CR/BV-05-C, LNS/SEN/CR/BV-06-C, LNS/SEN/CR/BV-07-C, LNS/SEN/CR/BV-08-C, LNS/SEN/CR/BV-09-C (legacy ID: TP/CR/BV-03-C, TP/CR/BV-04-C, TP/CR/BV-05-C, TP/CR/BV-06-C, TP/CR/BV-07-C, TP/CR/BV-08-C, and TP/CR/BV-09-C).
3	1.0.3	2014-12-05	Prepare for TCRL 2014-2 publication
	1.0.4r00	2016-05-25	Converted to new Test Case ID conventions as defined in TSTO v4.1.
	1.0.4r01	2016-06-21	Reviewed by Magnus Sommansson and Alicia Courtney
4	1.0.4	2016-07-14	Prepared for TCRL 2016-1 publication.
	1.0.5r00	2017-06-02	TSE 8516: Updated Test Spec Template. Revised the test procedure and the pass verdict of LNS/SEN/SPE/BI-04-C to use the error code (“0xFE”) specified by the Service Spec that is aligned with the CSS. Removed test step that is redundant with the initial conditions for establishing a connection in LNS/SEN/CN/BV-01-C - LNS/SEN/CN/BV-11-C. Modified the feature identifiers in Test Case Identification Conventions section. For LNS/SEN/SPE/BI-02-C, deleted fail verdict. Updated TCMT: Set "and" in all caps for LNS/SEN/DEC/BV-05-C, LNS/SEN/DES/BV-03-C, and LNS/SEN/CON/BV-03-C.
5	1.0.5	2017-06-26	Approved by BTI. Prepared for TCRL 2017-1 publication.

Publication Number	Revision Number	Date	Comments
	p6r00–r03	2022-03-16 – 2022-05-19	TSE 17264 (rating 2): Converted the following test cases to GGIT: LNS/SEN/SD/BV-01-C and -02-C, LNS/SEN/DEC/BV-01-C – -05-C, and LNS/SEN/DES/BV-01-C – -03-C. The new GGIT converted TCIDs are: LNS/SEN/SGGIT/SER/BV-01-C, LNS/SEN/SGGIT/SDP/BV-01-C, and LNS/SEN/SGGIT/CHA/BV-01-C – -05-C. Updated the TCMT accordingly. Updated test groups and test case identification conventions section. Updated the initial condition for LNS/SEN/CR/BV-01-C – -09-C and LNS/SEN/SPN/BV-01-C – -03-C. TSE 18428 (rating 1): Removed direct references to GATT test cases from the test procedures for LNS/SEN/CR/BV-01-C – -09-C and LNS/SEN/CON/BV-01-C – -03-C. Removed direct references to GATT TS sections from the ATT Bearer preambles and replaced with preamble procedure text. TSE 18721 (rating 1): Editorials to align the document with the latest TS template in anticipation of a future .Z release. Editorials, including assigning publication number 5 to previous v1.0.5, removing “if desired” per BTI, and aligning the copyright page with v2 of the DNMD.
6	p6	2022-06-28	Approved by BTI on 2022-05-31. Prepared for TCRL 2022-1 publication.
	p7r00	2022-08-18	TSE 19014 (rating 2): Corrected the value length for GGIT test LNS/SEN/SGGIT/CHA/BV-05-C.
7	p7	2023-02-07	Approved by BTI on 2022-12-28. Prepared for TCRL 2022-2 publication.
	p8r00–r03	2024-08-05 – 2024-08-27	TSE 16707 (rating 4): Per E16267, added new TCs LNS/SEN/SGGIT/CHA/BV-06-C and LNS/SEN/SGGIT/ISFC/BV-01-C and updated the TCMT accordingly. Updated the TCMT entry for LNS/SEN/SGGIT/CHA/BV-01-C. Updated the references list and TCID conventions table.
8	p8	2024-10-08	Approved by BTI on 2024-09-11. LNS v1.0.1 adopted by the BoD on 2024-10-01. Prepared for TCRL 2024-2-addition publication.

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