

HVAC Integration NLC Profile (HVINLCP)

Bluetooth® Test Suite

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1 Scope

This Bluetooth document contains the Test Suite Structure (TSS) and test cases to test the implementation of the Bluetooth HVAC Integration NLC Profile 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 [5].

- [1] Bluetooth Core Specification, Version 4.2 or later
- [2] Mesh Protocol Specification, Version 1.1 or later
- [3] Mesh Model Specification, Version 1.1 or later
- [4] Test Strategy and Terminology Overview
- [5] HVAC Integration NLC Profile Specification, Version 1.0 or later
- [6] ICS Proforma for HVAC Integration NLC Profile
- [7] Mesh Model Specification Test Suite, Annex: Generic Mesh Integrated Tests

2.2 Definitions

In this Bluetooth document, the definitions from all references apply.

2.3 Acronyms and abbreviations

In this Bluetooth document, the acronyms and abbreviations from all references apply.

3 Test Suite Structure (TSS)

3.1 Overview

Bluetooth NLC profile specifications are high layer profiles on top of the Mesh Protocol and Mesh Model layers, and they mandate several features that are optional in these specifications, and additionally define performance requirements for a mesh device.

This document defines tests for HVINLCP that verify basic end-to-end functionality focusing on the extra requirements that are not or cannot be properly tested in Mesh Protocol and Mesh Model qualification testing. To execute any test case in this Test Suite, the IUT is expected to contain a fully functional Mesh Protocol stack with all the features and models mandated by HVINLCP.

3.2 Test Strategy

The test objectives are to verify the functionality of HVINLCP on mesh 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 HVINLCP and all underlying mesh specifications. A Lower Tester acts as the IUT's peer device and interacts with the IUT's 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:

- GMIT
- Profile-specific

4 Test cases (TC)

4.1 Introduction

4.1.1 Test case identification conventions

Test cases are assigned unique identifiers per the conventions in [4]. The convention used here is: **<spec abbreviation>/<IUT role>/<class>/<feat>/<func>/<subfunc>/<cap>/<xx>-<nn>-<y>**.

| Identifier Abbreviation | Spec Identifier <spec abbreviation> |
|-------------------------|--|
| HVINLCP | HVAC Integration NLC Profile |
| Identifier Abbreviation | Role Identifier <IUT role> |
| HVI | HVAC Integration |
| Identifier Abbreviation | Group Identifier <class> |
| GMIT | Generic Mesh Integrated Tests |
| SPEC | Profile-specific |
| Identifier Abbreviation | Features and Behaviors Identifier <feat> |
| FEAT | Features and models |
| PBGT | Provisioning over PB-GATT |
| PERF | Performance |
| PROP | Device properties |

Table 4.1: HVINLCP TC feature naming conventions

4.1.2 Conformance

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

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

Such tests may verify:

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

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

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

4.1.3 Pass/Fail verdict conventions

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

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

4.2 Generic Mesh Integrated Tests (GMIT)

Execute the GMIT test procedures, defined in [7], using the input table defined below:

| HVINLCP/HVI/GMIT/PBGT/BV-01-C [Provisioning over PB-GATT] | |
|---|------------------------------------|
| Reference | [5] 3.1 |
| _SCAN_NAME_ | Yes |
| HVINLCP/HVI/GMIT/FEAT/BV-01-C [Features and models] | |
| Reference | [5] 3.2, 3.3 |
| _CRPL_ | 255 |
| _MESH_PROFILE_UUID_ | «HVAC Integration NLC Profile 1.0» |
| HVINLCP/HVI/GMIT/PERF/BV-01-C [Device performance] | |
| Reference | [5] 3.4 |
| _NET_KEYS_ | 2 |
| _APP_KEYS_ | 3 |
| _SUB_LIST_ | 32 |
| _PROXY_FILTER_SIZE | 8 |
| _NET_CACHE_SIZE_ | 64 |

Table 4.2 GMIT input table

4.3 Profile-specific

This section defines profile-specific test cases.

HVINLCP/HVI/SPEC/PROP/BV-01-C [Receive Sensor Status]

- Test Purpose

Verify that the IUT can receive Sensor Status messages with the required device properties.
- Reference

[5] 3.5
- Initial Condition
 - The IUT has been provisioned by the Lower Tester.

- Test Procedure

Repeat Steps 1–2 for each round in [Table 4.3](#).

| Round | Device Properties |
|-------|---|
| 1 | Motion Sensed, Time Since Motion Sensed |
| 2 | People Count |
| 3 | Presence Detected, Time Since Motion Sensed |

Table 4.3 Rounds for checking device properties in Sensor Status

1. The Lower Tester sends a Sensor Status message to the IUT with a Sensor Property ID field for each of the device properties of this round.
2. The IUT reports to the Upper Tester that it has received the correct properties.

- Expected Outcome

Pass verdict

The IUT receives all required device properties.

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 HVINLCP ICS [6].

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

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

Test Case(s): The applicable test case identifiers are required for Bluetooth Qualification if the corresponding y/x references defined in the Item column are supported. Further details about the function of the TCMT are elaborated in [4].

For the purpose and structure of the ICS/IXIT, refer to [4].

| Item | Feature | Test Case(s) |
|-------------|---|--|
| HVINLCP 2/2 | Mandatory profile requirements for HVAC Integration NLC Profile | HVINLCP/HVI/GMIT/PBGT/BV-01-C HVINLCP/HVI/GMIT/FEAT/BV-01-C HVINLCP/HVI/GMIT/PERF/BV-01-C HVINLCP/HVI/SPEC/PROP/BV-01-C |

Table 5.1 Test case mapping

6 Revision history and acknowledgments

Revision History

| Publication Number | Revision Number | Date | Comments |
|--------------------|-----------------|------------|---|
| 0 | p0 | 2025-07-08 | Approved by BTI on 2025-05-29. HVINLCP v1.0 adopted by the BoD on 2025-06-30. Prepared for initial publication. |

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