Scan Parameters Profile

*Bluetooth® Test Specification*

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- **Group Prepared by**: BTI
- **Feedback Email**: bti-main@bluetooth.org
- **Abstract**

This document defines test structures and procedures for conformance test of products implementing the Scan Parameters Profile Specification.
### Revision History

<table>
<thead>
<tr>
<th>Revision History</th>
<th>Date</th>
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### Contributors

<table>
<thead>
<tr>
<th>Name</th>
<th>Company</th>
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</thead>
<tbody>
<tr>
<td>Chris Church</td>
<td>CSR</td>
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</tbody>
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Contents

1 Scope .......................................................................................................................... 6

2 References, Definitions, and Abbreviations ................................................................. 7
  2.1 References ............................................................................................................... 7
  2.2 Definitions ............................................................................................................ 7
  2.3 Abbreviations ....................................................................................................... 7

3 Test Suite Structure (TSS) .......................................................................................... 8
  3.1 Overview ............................................................................................................... 8
  3.2 Test Strategy .......................................................................................................... 8
    3.2.1 Scan Parameters Profile Scan Client Testing Configuration ............................ 9
  3.3 Test Groups .......................................................................................................... 9
    3.3.1 Discovery of Services ...................................................................................... 9
    3.3.2 Discovery of Characteristics and Characteristic Descriptors ......................... 10
    3.3.3 Write Features ............................................................................................... 10
    3.3.4 Configuration Features .................................................................................. 10
    3.3.5 Notification Features ..................................................................................... 10

4 Test Cases ................................................................................................................... 11
  4.1 Introduction ......................................................................................................... 11
    4.1.1 Test Case Naming Conventions ..................................................................... 11
    4.1.2 Conformance ................................................................................................. 11
    4.1.3 Pass/Fail Verdict Conventions ..................................................................... 12
  4.2 Setup Preambles .................................................................................................. 12
    4.2.1 ATT Bearer on LE Transport ........................................................................ 12
  4.3 Discovery of Services .......................................................................................... 12
    4.3.1 SCPP/CL/SPDS/BV-01-I [Discover Scan Parameters Service] ..................... 12
  4.4 Discovery of Characteristics and Characteristic Descriptors ................................. 14
    4.4.1 SCPP/CL/SPDC/BV-01-I [Discover Scan Interval Window Characteristic] .... 14
    4.4.2 SCPP/CL/SPDC/BV-02-I [Discover Scan Refresh Characteristic] ............... 15
    4.4.3 SCPP/CL/SPDC/BV-03-I [Discover Scan Refresh Client Characteristic Configuration Descriptor] ......................................................... 17
  4.5 Write Features ...................................................................................................... 18
    4.5.1 SCPP/CL/SWCF/BV-01-I [Write Scan Interval Window Characteristic Value] .... 18
  4.6 Configuration Features ....................................................................................... 19
    4.6.1 SCPP/CL/SPCF/BV-01-I [Scan Refresh Client Characteristic Configuration - Enable Notifications (Write with 0x0001)] ......................................................... 19
4.7 Notification Features ........................................................................................................................................... 21

4.7.1 SCPP/CL/SPNF/BV-01-I [Scan Refresh Characteristic - Scan Behavior update Upon Receiving Notifications] ........................................................................................................... 21

5 Test Case Mapping .................................................................................................................................................. 23
1 Scope

This Bluetooth document contains the Test Suite Structure (TSS) and Test Cases (TC) to test the Bluetooth Scan Parameters Profile Specification.

The objective of this test specification is to provide a basis for interoperability tests for Bluetooth devices giving a high probability of air interface interoperability between different manufacturers' Bluetooth devices.
2 References, Definitions, and Abbreviations

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

[1] Bluetooth Test Strategy and Terminology Overview
[2] Bluetooth Core Specification, Version 4.0 or later
[3] Scan Parameters Service Specification v1.0
[4] GATT Test Specification, GATT.TS.4.0.1
[6] Scan Parameters Profile Specification v1.0
[7] ICS Proforma Scan Parameters Profile, SCPP.ICS

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

2.3 Abbreviations
For the purpose of this Bluetooth document, the definitions from [1] and [2] apply.
3 Test Suite Structure (TSS)

3.1 Overview

The Scan Parameters Profile is a client of GAP, SM and GATT. This is illustrated in Figure 3.1.

![Scan Parameters Profile Test Model](image)

Figure 3.1: Scan Parameters Profile Test Model

3.2 Test Strategy

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

The basis for the test approach is the general concepts and conformance testing principles defined in ISO/IEC 9646-1 and ISO/IEC 9646-2; both are part of the OSI Conformance Testing Methodology and Framework (CTMF).

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

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

The test suite structure is a tree with the first level representing the protocol groups and is listed in section 3.3.

### 3.2.1 Scan Parameters Profile Scan Client Testing Configuration

The following configuration is recommended for testing Scan Parameters Profile Scan Client IUT:

![scan parameters profile scan client testing configuration](image)

**Figure 3.2: Scan Parameters Profile Scan Client Testing Configuration**

The sample database of Characteristics used by the Lower Tester is specified in each test case. All Scan Parameters Profile Scan Client test cases, which use a configuration as shown in Figure 3.2, contain test procedure descriptions and expected results. These in turn use example message syntax between the Upper Tester and the IUT. Those example messages are generic; there is no normative specification for these messages. The normative specifications are the functional descriptions for the test procedures and the expected results.

In Test Cases where more than one alternative method of performing the Test Case exists, a Scan Client IUT shall perform the Test Case once for each supported alternative method.

### 3.3 Test Groups

The following test groups have been defined.

#### 3.3.1 Discovery of Services

This group tests IUT discovery of the Scan parameters Service.
3.3.2 Discovery of Characteristics and Characteristic Descriptors
This group tests IUT discovery of Scan Parameters Service Characteristics and Characteristic Descriptors.

3.3.3 Write Features
This group tests IUT implementation of the Scan Parameters Profile Write Features.

3.3.4 Configuration Features
This group tests IUT implementation of the Scan Parameters Profile Configuration Features.

3.3.5 Notification Features
This group tests IUT implementation of the Scan Parameters Profile Notification Features.
4 Test Cases

4.1 Introduction

4.1.1 Test Case Naming Conventions
Test cases shall be assigned unique identifiers per the conventions in [1][1]. The convention used here is <spec abbreviation>/<IUT role>/<class>/<xx>-<nn>-<y>.

Test group abbreviations for class, feature, function, sub-function or capability (as applicable to this test specification) are defined in Table 4.1.

<table>
<thead>
<tr>
<th>Identifier</th>
<th>Class Identifier &lt;class&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCPP</td>
<td>Scan Parameters Profile</td>
</tr>
<tr>
<td>CL</td>
<td>Scan Parameters Profile Client Role</td>
</tr>
<tr>
<td>SPDS</td>
<td>Scan Parameters Profile Discovery of Services</td>
</tr>
<tr>
<td>SPDC</td>
<td>Scan Parameters Profile Discovery of Characteristics and Characteristic Descriptors</td>
</tr>
<tr>
<td>SPWF</td>
<td>Scan Parameters Profile Write Features</td>
</tr>
<tr>
<td>SPCF</td>
<td>Scan Parameters Profile Configuration Features</td>
</tr>
<tr>
<td>SPNF</td>
<td>Scan Parameters Profile Notification Features</td>
</tr>
</tbody>
</table>

*Table 4.1: Scan Parameters Profile Test Case Naming Convention*

4.1.2 Conformance
When conformance is claimed, all capabilities indicated as mandatory for this Specification shall be supported in the specified manner (process-mandatory). This also applies for all optional and conditional capabilities for which support is indicated. All mandatory capabilities, and optional and conditional capabilities for which support is indicated, are subject to verification as part of the Bluetooth certification program.

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

Such tests may verify:

• That claimed capabilities may be used in any order and any number of repetitions that is not excluded by the Specification, OR

• That capabilities enabled by the implementations are sustained over durations expected by the use case, OR

• That the implementation gracefully handles any quantity of data expected by the use case, OR
• That in cases where more than one valid interpretation of the Specification exist, the implementation complies with at least one interpretation and gracefully handles other interpretations OR

• That the implementation is immune to attempted security exploits.

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

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

4.1.3 Pass/Fail Verdict Conventions

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

The convention in this test specification 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 and in case this occurs the outcome of the test shall be the Fail Verdict.

4.2 Setup Preambles

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

4.2.1 ATT Bearer on LE Transport

Follow the preamble procedure described in [4] section 4.2.1.2.

4.3 Discovery of Services

The procedures defined in this Test Group verify IUT discovery of the Service defined in the Scan Parameters Profile [6] by a Scan Client IUT.

4.3.1 SCPP/CL/SPDS/BV-01-I [Discover Scan Parameters Service]

• Test Purpose

  Verify the Scan Parameters Service can be discovered by a Scan Client IUT.

• Reference

  [6] 4.2.1

• Initial Condition
Establish an ATT Bearer connection between the Lower Tester and the IUT as defined in section 4.2.1. The Scan Client (IUT) and the Scan Server (Lower Tester) may have bonded following GAP procedures.

The Lower Tester has a single instance of the Scan Parameters Service [3].

- Test Procedure

The Upper Tester issues a command to the IUT to discover primary services. There are two alternatives:

1. Execute the procedure included in GATT.TS [4] Discover All Primary Services, GATT/CL/GAD/BV-01-C once, with the database specified in [3].

2. Execute the procedure included in GATT.TS [4] Discover Primary Services by Service UUID, GATT/CL/GAD/BV-02-C once, with the service UUID set to «Scan Parameters Service», with the database specified in [3].
• Expected Outcome

   **Pass verdict**

   One and only one attribute handle range with the service UUID set to «Scan Parameters Service» is returned, containing the starting handle and the ending handle of the service definition.

### 4.4 Discovery of Characteristics and Characteristic Descriptors

The procedures defined in this Test Group verify discovery of the Characteristics and Characteristic Descriptors defined in the Scan Parameters Service Specification [3] by a Scan Client IUT.

#### 4.4.1 SCPP/CL/SPDC/BV-01-I [Discover Scan Interval Window Characteristic]

• **Test Purpose**

   Verify the Scan Interval Window characteristic can be discovered by a Scan Client IUT.

• **Reference**

   [6] 4.3.1.1

• **Initial Condition**

   Establish an ATT Bearer connection between the Lower Tester and the IUT as defined in section 4.2.1. The Scan Client (IUT) and the Scan Server (Lower Tester) may have bonded following GAP procedures.

   The Lower Tester has a single instance of the Scan Parameters Service [3]. That instance contains one and only instance of the Scan Interval Window characteristic.

   The IUT has executed SCPP/CL/SPDS/BV-01-I [Discover Scan Parameters Service] and has saved the handle range for the instance of the Scan Parameters Service.

• **Test Procedure**

   The Upper Tester issues a command to the IUT to discover characteristics. There are two alternatives:

2. Execute the procedure included in GATT.TS [4] Discover Characteristics by UUID, GATT/CL/GAD/BV-05-C once, with the characteristic UUID set to «Scan Interval Window» with the database specified in [3].

- Expected Outcome

Pass verdict

The IUT sends a correctly formatted ATT_Read_By_Type_Request to the Lower Tester. The IUT receives the ATT_Read_By_Type_Response from the Lower Tester. One and only one attribute handle-value pair is returned, and matches the Scan Interval Window characteristic attribute handle-value pair implemented in the Lower Tester.

4.4.2 SCPP/CL/SPDC/BV-02-I [Discover Scan Refresh Characteristic]

- Test Purpose
Verify the Scan Refresh characteristic can be discovered by a Scan Client IUT.

- **Reference**
  
  [6] 4.3.1.2

- **Initial Condition**

  Establish an ATT Bearer connection between the Lower Tester and the IUT as defined in section 4.2.1. The Scan Client (IUT) and the Scan Server (Lower Tester) may have bonded following GAP procedures.

  The Lower Tester has a single instance of the Scan Parameters Service [3]. That instance contains one and only instance of the Scan Refresh characteristic.

  The IUT has executed SCPP/CL/SPDS/BV-01-I [Discover Scan Parameters Service] and has saved the handle range for the instance of the Scan Parameters Service.

- **Test Procedure**

  The Upper Tester issues a command to the IUT to discover characteristics. There are two alternatives:


  2. Execute the procedure included in GATT.TS [4] Discover Characteristics by UUID, GATT/CL/GAD/BV-05-C once, with the characteristic UUID set to «Scan Refresh» with the database specified in [3].
• Expected Outcome

Pass verdict

The IUT sends a correctly formatted ATT_Read_By_Type_Request to the Lower Tester.

The IUT receives the ATT_Read_By_Type_Response from the Lower Tester.

One and only one attribute handle-value pair is returned, and matches the Scan Refresh characteristic attribute handle-value pair implemented in the Lower Tester.

### 4.4.3 SCPP/CL/SPDC/BV-03-I [Discover Scan Refresh Client Characteristic Configuration Descriptor]

• Test Purpose

Verify the Client Characteristic Configuration Descriptor for the Scan Refresh characteristic can be discovered by a Scan Client IUT.

• Reference

[6] 4.3.1.2

• Initial Condition

Establish an ATT Bearer connection between the Lower Tester and the IUT as defined in section 4.2.1. The Scan Client (IUT) and the Scan Server (Lower Tester) may have bonded following GAP procedures.

The Lower Tester has a single instance of the Scan Parameters Service [3]. That instance contains one and only instance of the Scan Refresh characteristic.

The IUT has executed SCPP/CL/SPDC/BV-02-I [Discover Scan Refresh Characteristic] and has saved the handle range for the instance of the Scan Refresh characteristic.

• Test Procedure
The Upper Tester issues a command to the IUT to discover characteristic descriptors.

Execute the procedure included in GATT.TS [4] Discover All Characteristic Descriptors, GATT/CL/GAD/BV-06-C once, with the handle range specified in initial conditions.

• **Expected Outcome**

  **Pass verdict**

  The IUT sends a correctly formatted ATT_Find_Information_Request to the Lower Tester.

  One and only one attribute handle/UUID pair is returned with UUID = «Client Characteristic Configuration» and a matching attribute handle for the Scan Refresh characteristic Client Characteristic Configuration characteristic descriptor implemented in the Lower Tester.

### 4.5 Write Features

The procedures defined in this Test Group verify implementation of the Scan Parameter Profile Write Features by a Scan Client IUT.

#### 4.5.1 SCPP/CL/SWCF/BV-01-I [Write Scan Interval Window Characteristic Value]

• **Test Purpose**

  Verify the Client Scan Interval Window characteristic can be written by a Scan Client IUT with the value for LE_Scan_Interval and LE_Scan_Window.

• **Reference**

  [6] 4.4

• **Initial Condition**
Establish an ATT Bearer connection between the Lower Tester and the IUT as defined in section 4.2.1. The Scan Client (IUT) and the Scan Server (Lower Tester) may have bonded following GAP procedures.

The Lower Tester has a single instance of the Scan Parameters Service [3]. That instance contains one and only instance of the Scan Interval Window characteristic.

The IUT has executed SCPP/CL/SPDC/BV-01-I [Discover Scan Interval Window Characteristic] and has saved the handle range for the instance of the Scan Interval Window characteristic.

**Test Procedure**

The Upper Tester issues a command to write to the value of the Scan Interval Window characteristic with the value for LE_Scan_Interval and LE_Scan_Window.

![Diagram](https://via.placeholder.com/150)

- **Expected Outcome**

  **Pass verdict**

  The IUT sends a correctly formatted ATT_Write_Command to the Lower Tester, specifying the handle of the Scan Interval Window Characteristic to be written and the value for LE_Scan_Interval and LE_Scan_Window that is to be written.

**4.6 Configuration Features**

The procedures defined in this Test Group verify implementation of the Scan Parameter Profile Configuration Features by a Scan Client IUT.

**4.6.1 SCPP/CL/SPCF/BV-01-I [Scan Refresh Client Characteristic Configuration - Enable Notifications (Write with 0x0001)]**

- **Test Purpose**
Verify the Client Characteristic Configuration Descriptor for the Scan Refresh characteristic can be configured for notification by a Scan Client IUT.

- **Reference**
  
  [6] 4.3.1.2

- **Initial Condition**

  Establish an ATT Bearer connection between the Lower Tester and the IUT as defined in section 4.2.1. The Scan Client (IUT) and the Scan Server (Lower Tester) may have bonded following GAP procedures.

  The Lower Tester has a single instance of the Scan Parameters Service [3]. That instance contains one and only instance of the Scan Refresh characteristic, and one and only one instance of the Client Characteristic Configuration Descriptor for the Scan Refresh characteristic.

  The IUT has executed **SCPP/CL/SPDC/BV-02-I [Discover Scan Refresh Characteristic]** and has saved the handle for the instance of the Client Characteristic Configuration Descriptor for the Scan Refresh characteristic.

- **Test Procedure**

  The Upper Tester commands the IUT to enable notifications for the Scan Refresh characteristic.

  The IUT sends an ATT_Write_Request with the value 0x0001 to the Lower Tester with the handle specified in initial conditions.

  - **Expected Outcome**

    *Pass verdict*
The IUT sends a correctly formatted ATT_Write_Request to the Lower Tester using the handle specified by the upper tester and the value 0x0001.

The IUT receives a correctly formatted ATT_Write_Response from the Lower Tester and sends the WriteResponse to the Upper Tester.

### 4.7 Notification Features

The procedures defined in this Test Group verify implementation of the Scan Parameter Profile Notification Features by a Scan Client IUT.

#### 4.7.1 SCPP/CL/SPNF/BV-01-I [Scan Refresh Characteristic - Scan Behavior update Upon Receiving Notifications]

- **Test Purpose**

  Verify that, when the Client Characteristic Configuration characteristic descriptor is configured for notification, a Scan Client IUT can successfully receive notifications for the Scan Refresh characteristic, and perform a write to the Scan Interval Window characteristic upon receiving that notification.

- **Reference**

  [6] 4.5

- **Initial Condition**

  Establish an ATT Bearer connection between the Lower Tester and the IUT as defined in section 4.2.1.

  The Lower Tester and the IUT have bonded following GAP procedures.

  The Lower Tester has a single instance of the Scan Parameters Service [3].

  The IUT has executed SCPP/CL/SPDC/BV-01-I [Discover Scan Interval Window Characteristic] and has saved the handle for the instance of the Scan Interval Window characteristic.

  The IUT has executed SCPP/CL/SPCF/BV-01-I [Scan Refresh Client Characteristic Configuration - Enable Notifications (Write with 0x0001)] and has configured the Client Characteristic Configuration Descriptor for the Scan Refresh characteristic for notifications.

- **Test Procedure**

  The Lower Tester sends an ATT_Handle_Value_Notification containing the Scan Refresh characteristic value to the IUT.
• **Expected Outcome**

**Pass verdict**

The IUT sends a correctly formatted ATT_Write_Command to the Lower Tester, specifying the handle of the Scan Interval Window characteristic and the value for LE_Scan_Interval and LE_Scan_Window that is to be written.
5 Test Case Mapping

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

The columns for the TCMT are defined as follows:

**Item:** contains an y/x reference, where y corresponds to the table number and x corresponds to the feature number as defined in the ICS Proforma for the Scan Parameters Profile (SCPP) [7]. If the item is defined with Protocol, Profile or Service abbreviation before y/x, the table and feature number referenced are defined in the abbreviated ICS proforma document.

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

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

**Test Case Applicable:** may be used to note if a test is required based on the supported features.

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

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<th>Item</th>
<th>Feature</th>
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<th>Test Case Applicable</th>
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<td>SCPP 7/1</td>
<td>Discover Scan Parameters Service</td>
<td>SCPP/CL/SPDS/BV-01-I</td>
<td></td>
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<tr>
<td>SCPP 7/2</td>
<td>Discover Scan Interval Window Characteristic for Scan Parameters Service</td>
<td>SCPP/CL/SPDC/BV-01-I</td>
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<td>SCPP/CL/SPDC/BV-02-I</td>
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</tr>
<tr>
<td>SCPP 7/4</td>
<td>Discover Client Characteristic Configuration Descriptor for Scan Refresh Characteristic</td>
<td>SCPP/CL/SPDC/BV-03-I</td>
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<td>SCPP 8/1</td>
<td>Write Scan Interval Window Characteristic</td>
<td>SCPP/CL/SPWF/BV-01-I</td>
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<td>SCPP 8/2</td>
<td>Configure Client Characteristic Configuration for Scan Refresh Characteristic</td>
<td>SCPP/CL/SPCF/BV-01-I</td>
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<td>SCPP 8/3</td>
<td>Scan Refresh Notification Behavior</td>
<td>SCPP/CL/SPNF/BV-01-I</td>
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*Table 5.1: Test Case Mapping*