Alert Notification Service (ANS)

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 Alert Notification Service Specification.
## Revision History

<table>
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<tr>
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<th>Date</th>
<th>Comments</th>
</tr>
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<tr>
<td>D09R00</td>
<td>2011-06-05</td>
<td>Initial draft (based on Link Loss service TS)</td>
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<tr>
<td>D09R01</td>
<td>2011-08-04</td>
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<td>TSE 4884: Change wording in section 4.9, initial condition.</td>
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<td>2013-04-23</td>
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<td></td>
<td>• Update to TCMT mapping, TP/SP/BV-06-C removed from “Enable categories and Notify immediately commands behavior for New Alert” to replace duplicate mapping for “New Alert Behavior, Multiple events”.</td>
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<td></td>
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• Minor edits in Characteristic Configuration Descriptors Write section, Characteristic Notify section.  
• Test Purpose of TP/SP/BV-05-C and TP/SP/BV-11-C updated to add "descriptor". |
| 1.0.4r02         | 2014-06-1 | Added Pass/Fail Verdict Conventions according to applicable test specification template.                                                  |
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1 Scope

This Bluetooth document contains the Test Suite Structure (TSS) and Test Cases (TC) to test the Bluetooth Alert Notification Service 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

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 Alert Notification Service requires GAP, SM (LE), SDP (BR/EDR) and GATT. This is illustrated in Figure 3.1.

<table>
<thead>
<tr>
<th>Alert Notification Service</th>
<th>GAP</th>
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<tr>
<td>GATT</td>
<td>SM</td>
</tr>
<tr>
<td>ATT</td>
<td></td>
</tr>
<tr>
<td>L2CAP</td>
<td></td>
</tr>
<tr>
<td>LE Controller</td>
<td></td>
</tr>
</tbody>
</table>

*Figure 3.1: Alert Notification Service Test Model*

3.2 Test Strategy

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

The 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 Alert Notification Service 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 Alert Notification 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 as listed in section 3.3.

### 3.3 Test Groups

The following test groups have been defined.

#### 3.3.1 Service Definition

Verify the service definition.

#### 3.3.2 Characteristic Declaration

Verify the presence and contents of characteristic declarations.

#### 3.3.3 Characteristic Descriptors

Verify the presence of characteristic descriptors.

#### 3.3.4 Characteristic Configuration Descriptors Write

Verify characteristic descriptors which support writing can be written.

#### 3.3.5 Characteristic Read

Verify characteristics which support reading can be read. Verify the format and value of characteristic values.

#### 3.3.6 Characteristic Write

Verify characteristics which support writing can be written.

#### 3.3.7 Characteristic Notify

Verify characteristics which support notifying can be notified. Verify the format and value of characteristic values.

#### 3.3.8 Service Procedures

Verify the operation of additional procedures defined in the service specification.

#### 3.3.9 Error Handling

Verify proper handling of invalid commands.
4 Test Cases

4.1 Introduction

4.1.1 Test Case Identification Conventions

Test cases shall be assigned unique identifiers per the conventions in [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>
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<tbody>
<tr>
<td>ANS</td>
<td>Alert Notification Service</td>
</tr>
<tr>
<td>SR</td>
<td>Server Role</td>
</tr>
<tr>
<td>SD</td>
<td>Service Definition</td>
</tr>
<tr>
<td>DEC</td>
<td>Characteristic Declaration</td>
</tr>
<tr>
<td>DES</td>
<td>Characteristic Descriptors</td>
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<tr>
<td>DESW</td>
<td>Characteristic Configuration Descriptor Write</td>
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<tr>
<td>CR</td>
<td>Characteristic Read</td>
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<tr>
<td>CW</td>
<td>Characteristic Write</td>
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<td>CN</td>
<td>Characteristic Notify</td>
</tr>
<tr>
<td>SP</td>
<td>Service Procedures</td>
</tr>
<tr>
<td>EH</td>
<td>Error Handling</td>
</tr>
</tbody>
</table>

Table 4.1: Alert Notification Service TC Class Naming Convention

4.1.2 Conformance

When conformance is claimed, all capabilities indicated as mandatory for this Specification shall be supported in the specified manner (process-mandatory). This also applies for all optional and conditional capabilities for which support is indicated. All mandatory capabilities, and optional and conditional capabilities for which support is indicated, are subject to verification as part of the Bluetooth 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 are 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 [5] section 4.2.1.2.

4.3 Service Definition

Verify the service definition.

4.3.1 ANS/SR/SD/BV-01-C [Service Definition]

• Test Purpose

  Verify that the IUT has one instantiation of the Alert Notification Service as a primary service.

• Reference

  [3] 2
• Initial Condition

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

• Test Procedure

Discover all primary services by executing the test procedure of GATT test case GATT/SR/GAD/BV-01-C, Discover All Primary Services, in [5] or primary services by service UUID by executing the test procedure of GATT test case GATT/SR/GAD/BV-02-C, Discover Primary Services by Service UUID in [5] with the service UUID set to «Alert Notification Service».

Verify one attribute handle range with the service UUID set to «Alert Notification Service» is returned, containing the starting handle and the ending handle of the service definition.

• Expected Outcome

Pass verdict

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

4.4 Characteristic Declaration

• Test Purpose

Verify the presence of and contents of the characteristic declaration specified by the service.

• Reference

[3] 3.1, 3.2, 3.3, 3.4

• Initial Condition

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

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

• Test Procedure

The following test procedure applies to the test cases listed in Table 4.2.

1. Discover all characteristics of the service by executing the test procedure of GATT test case GATT/SR/GAD/BV-04-C, Discover All Characteristics of a Service, in [5].

2. For a discovered characteristic that is listed in Table 4.2, verify the characteristic properties field of the characteristic declaration meets the requirements of the service.
• **Expected Outcome**

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

**Pass verdict**

The characteristic is discovered and the characteristic properties field of the characteristic properties of the declaration ([2] section 3.3.1.1) meets the requirements of the service as shown in Table 4.2.

Only one instance of the characteristic is found.

### Characteristic Declaration Test Cases

<table>
<thead>
<tr>
<th>Test Case</th>
<th>Requirements</th>
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<tr>
<td>4.4.1 ANS/SR/DEC/BV-01-C [Characteristic Declaration – Supported New Alert Category]</td>
<td>0x02 ([3] 3.1)</td>
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<td>4.4.2 ANS/SR/DEC/BV-02-C [Characteristic Declaration – Alert Notification Control Point]</td>
<td>0x08 ([3] 3.5)</td>
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<tr>
<td>4.4.3 ANS/SR/DEC/BV-03-C [Characteristic Declaration – New Alert]</td>
<td>0x10 ([3] 3.2)</td>
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<tr>
<td>4.4.4 ANS/SR/DEC/BV-04-C [Characteristic Declaration – Unread Alert Status]</td>
<td>0x10 ([3] 3.4)</td>
</tr>
<tr>
<td>4.4.5 ANS/SR/DEC/BV-05-C [Characteristic Declaration – Supported Unread Alert Category]</td>
<td>0x02 ([3] 3.3)</td>
</tr>
</tbody>
</table>

*Table 4.2: Characteristic Declaration Test Cases*

### 4.5 Characteristic Descriptors

• **Test Purpose**

Verify the presence of characteristic descriptors specified by the service.

• **Reference**

[3] 3.2.2, 3.4.2

• **Initial Condition**

If the IUT requires a bonding procedure then perform a bonding procedure.

The handle range of each characteristic referenced in the test cases below has been previously discovered by the Lower Tester during the test procedure in section 4.4 or is known to the Lower Tester by other means.
Establish an ATT Bearer connection between the Lower Tester and IUT as described in section 4.2.1.

- Test Procedure

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


2. If the UUID in a handle-UUID pair is for a Client Configuration characteristic, read the Client Configuration characteristic by executing the test procedure of GATT test case GATT/SR/GAR/BV-06-C, Read Characteristic Descriptors – from Server, in [5].

- Expected Outcome

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

Pass verdict

The Client Characteristic Configuration descriptor is discovered, the Client Characteristic Configuration descriptor is read, and the value of the Client Characteristic Configuration descriptor meets the requirements of the service as shown in [5].

**Characteristic Descriptors Test Cases**

<table>
<thead>
<tr>
<th>Test Case</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>4.5.1</em> ANS/SR/DES/BV-01-C [Client Configuration Descriptor – New Alert]</td>
<td>[3] 3.2 Value is 0x0000 or 0x0001</td>
</tr>
<tr>
<td><em>4.5.2</em> ANS/SR/DES/BV-02-C [Client Configuration Descriptor – Unread Alert Status]</td>
<td>[3] 3.4 Value is 0x0000 or 0x0001</td>
</tr>
</tbody>
</table>

*Table 4.3: Characteristic Descriptors Test Cases*

### 4.6 Characteristic Configuration Descriptors Write

- Test Purpose

Verify client characteristic configuration descriptors which support writing can be written. Verify the presence of characteristic descriptors specified by the service.

- Reference

[3] 3.2, 3.4

- Initial Condition
The handle range of each characteristic referenced in the test cases below has been previously discovered by the Lower Tester during the test procedure in section 4.5 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.

• Test Procedure

The following test procedure applies to the test cases listed in Table 4.4.

1. Disable notification by writing value 0x0000 to the client characteristic configuration descriptor of the characteristic using the test procedure of GATT test case GATT/SR/GAW/BV-08-C, Write Characteristic Descriptors – from Server, in [5].

2. Enable notification by writing value 0x0001 to the client characteristic configuration descriptor of the characteristic.

• Expected Outcome

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

Pass verdict

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

### Characteristic Configuration Descriptors Write Test Cases

<table>
<thead>
<tr>
<th>Test Case</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4.6.1</strong> ANS/SR/DESW/BV-01-C [Client Configuration Descriptor – New Alert]</td>
<td>[3] 3.2</td>
</tr>
<tr>
<td><strong>4.6.2</strong> ANS/SR/DESW/BV-02-C [Client Configuration Descriptor – Unread Alert Status]</td>
<td>[3] 3.4</td>
</tr>
</tbody>
</table>

*Table 4.4: Characteristic Configuration Descriptors Write Test Cases*

### 4.7 Characteristic Read

• Test Purpose

Read and verify characteristic value that an IUT supports alert categories.

• Reference

[3] 3.1

• Initial Condition
The handle of the characteristic value referenced in the test case below has been previously discovered by the Lower Tester during the test procedure in section 4.4 or is known to the Lower Tester by other means.

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 IUT permissions for the characteristic require a specific security mode or security level, establish a connection meeting those requirements.

• Test Procedure

The following test procedure applies to the test cases listed in Table 4.5.

1. Read the characteristic value by executing the test procedure of GATT test case GATT/SR/GAR/BV-01-C, Read Characteristic Value - from Server, in [5].

2. Verify the characteristic value meets the requirements of the service.

• Expected Outcome

The following pass and fail verdicts apply to the test cases listed in Table 4.5:

Pass verdict

The characteristic is successfully read and the characteristic value meets the requirements of the service as shown in Table 4.5.

### Characteristic Read Test Cases

<table>
<thead>
<tr>
<th>Test Case</th>
<th>Value (Requirements)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4.7.1 ANS/SR/CR/BV-01-C [Characteristic Read – Supported New Alert Category]</strong></td>
<td>At least 2 octets, at least 1 that is not 0 ([3] 3.1)</td>
</tr>
<tr>
<td><strong>4.7.2 ANS/SR/CR/BV-02-C [Characteristic Read – Supported Unread Alert Category]</strong></td>
<td>At least 2 octets ([3] 3.3)</td>
</tr>
</tbody>
</table>

*Table 4.5: Characteristic Read Test Cases*

### 4.8 Characteristic Write

This test group contains test cases to verify that the characteristics that support write can be written.

#### 4.8.1 ANS/SR/CW/BV-01-C [Characteristic Write – Alert Notification Control Point]

• Test Purpose

Write characteristic value with a command that is supported by the IUT.
• Reference

[3] 3.5

• Initial Condition

The handle of the Alert Notification Control Point characteristic value referenced in the test case below has been previously discovered by the Lower Tester during the test procedure in section 4.4 or is known to the Lower Tester by other means.

The supported alert category referenced in the test case below has been previously confirmed by the Lower Tester during the test procedure in section 4.7.

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 IUT permissions for the characteristic require a specific security mode or security level, establish a connection meeting those requirements.

• Test Procedure

1. Select a value that is valid for the Alert Notification Control Point characteristic. Write the characteristic value by executing the test procedure of GATT test case GATT/SR/GAW/BV-03-C, Write Characteristic Value - to Server, in [5].

2. Verify the characteristic value is successfully written.

• Expected Outcome

Pass verdict
The characteristic value is successfully written.

4.9 Characteristic Notify

• Test Purpose

Notify characteristic value according to the Alert Notification Control Point characteristics write.

• Reference

[3] 3.2, 3.4

• Initial Condition

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

The supported alert category referenced in the test case below shall be enabled by executing the applicable write client characteristic configuration descriptors test procedure in section 4.6 and the applicable write Alert Notification Control Point characteristic test procedure in section 4.8.1.

If IUT permissions for the characteristic require a specific security mode or security level, establish a connection meeting those requirements.

- **Test Procedure**

  The following test procedure applies to the test cases listed in Table 4.6:

  1. The Upper Tester triggers an event that causes the IUT to notify the New Alert characteristic (for 4.9.1) or the Unread Alert Status characteristic (for 4.9.2).

- **Expected Outcome**

  The following pass and fail verdicts apply to the test cases listed in Table 4.6:

  **Pass verdict**

  The characteristic values are successfully notified and the values are valid for requirement of service as shown in Table 4.6.

  **Characteristic Notify Test Cases**

<table>
<thead>
<tr>
<th>Test Case</th>
<th>Value (Requirements)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4.9.1</strong> ANS/SR/CN/BV-01-C [Characteristic Notify – New Alert]</td>
<td>At least 2 octets ([3] 3.2)</td>
</tr>
<tr>
<td><strong>4.9.2</strong> ANS/SR/CN/BV-02-C [Characteristic Notify – Unread Alert Status]</td>
<td>2 octets ([3] 3.4)</td>
</tr>
</tbody>
</table>

*Table 4.6: Characteristic Notify Test Cases*

**4.10 Service Procedures**

This test group contains test cases to verify the operation of additional procedures defined in the service specification.

**4.10.1** ANS/SR/SP/BV-01-C [Service Behavior – Alert Notification Control Point for New Alert, CCCD=ON, Category=OFF]

- **Test Purpose**
Verify the IUT behaves correctly when the Lower Tester writes the commands related with the New Alert. In this situation, the Client Characteristic Configuration for the New Alert is set to “Notify”, but no categories are enabled in the IUT.

- Reference
  [3] 4.1.1

- Initial Condition

The handle of the Alert Notification Control Point characteristic value referenced in the test case below has been previously discovered by the Lower Tester during the test procedure in section 4.4 or is known to the Lower Tester by other means.

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.

All categories are disabled to notify in the IUT.

Categories that are supported by the IUT are known after executing ANS/SR/CR/BV-01-C [Characteristic Read – Supported New Alert Category] (if a bit is set in the Supported New Alert Category characteristic, that category is supported).

- Test Procedure

1. The Lower Tester configures the Client Characteristic Configuration descriptor for the New Alert in the IUT to “Notify”.
2. The Lower Tester writes the “Notify New Alert immediately” command to the Alert Notification Control Point characteristic in the IUT.

- Expected Outcome

Pass verdict
The IUT doesn’t send any notifications of the New Alert.

4.10.2 ANS/SR/SP/BV-02-C [Service Behavior – Alert Notification Control Point for New Alert, CCCD=ON, Category=ON]

- Test Purpose

Verify the IUT behaves correctly when the Lower Tester writes the commands related with the Unread Alert Status.

- Reference
  [3] 4.1.1

- Initial Condition
The handle of the Alert Notification Control Point characteristic value referenced in the test case below has been previously discovered by the Lower Tester during the test procedure in section 4.4 or is known to the Lower Tester by other means.

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.

All categories are disabled to notify in the IUT.

Categories that are supported by the IUT are known after executing ANS/SR/CR/BV-01-C [Characteristic Read – Supported New Alert Category] (if a bit is set in the Supported New Alert Category characteristic, that category is supported).

- **Test Procedure**
  1. The Lower Tester configures the Client Characteristic Configuration descriptor for the New Alert Status in the IUT to "Notify".
  2. The Lower Tester writes the "Enable New Alert Notification" command with the supported category ID of the IUT to the Alert Notification Control Point characteristic in the IUT.
  3. The Lower Tester writes the "Notify New Alert immediately" command to the Alert Notification Control Point characteristic with category ID that is set by procedure 2 in the IUT.

- **Expected Outcome**
  
  **Pass verdict**

  The New Alert filled by the category ID that is specified by procedure 2 is notified and the values that the Lower Tester receives matches to requirements for this characteristic.

4.10.3 ANS/SR/SP/BV-03-C [Service Behavior – Alert Notification Control Point for New Alert, CCCD=ON, Category=ON<Non-support>]

- **Test Purpose**

  Verify that the IUT behaves correctly when the Lower Tester writes the commands related with the New Alert. In this situation, the IUT receives a command of notify immediately, but the category is either not supported if only one category is supported, or not enabled if multiple categories are supported.

- **Reference**

  [3] 4.1.1

- **Initial Condition**
The handle of the Alert Notification Control Point characteristic value referenced in the test case below has been previously discovered by the Lower Tester during the test procedure in section 4.4 or is known to the Lower Tester by other means.

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.

All categories are disabled to notify in the IUT.

Categories that are supported by the IUT are known after executing ANS/SR/CR/BV-01-C [Characteristic Read – Supported New Alert Category] (if a bit is set in the Supported New Alert Category characteristic, that category is supported).

• Test Procedure

1. The Lower Tester configures the Client Characteristic Configuration descriptor for the New Alert in the IUT to "Notify".

2. The Lower Tester writes the "Enable New Alert Notification" command with the supported category ID of the IUT to the Alert Notification Control Point characteristic in the IUT.

3. The Lower Tester writes the "Notify New Alert immediately" command to the Alert Notification Control Point characteristic with a category ID NOT enabled in procedure 2 for an IUT supporting multiple categories. If the IUT supports only one category, the Lower Tester will write the command to a category not supported by the IUT.

• Expected Outcome

Pass verdict

The IUT does not send any notifications of the New Alert for the category NOT enabled or supported in procedure 3.

4.10.4 ANS/SR/SP/BV-04-C [Service Behavior – Alert Notification Control Point for New Alert, CCCD=ON, Category=ON command with 0xff]

• Test Purpose

Verify that the IUT behaves correctly when the Lower Tester writes the commands related with the New Alert. In this situation, the IUT receives the notify immediately command for all categories. But, some categories may not enable to notify.

• Reference

[3] 4.1.1

• Initial Condition
The handle of the Alert Notification Control Point characteristic value referenced in the test case below has been previously discovered by the Lower Tester during the test procedure in section 4.4 or is known to the Lower Tester by other means.

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.

All categories are disabled to notify in the IUT.

Categories that are supported by the IUT are known after executing ANS/SR/CR/BV-01-C [Characteristic Read – Supported New Alert Category] (if a bit is set in the Supported New Alert Category characteristic, that category is supported).

- Test Procedure

  1. The Lower Tester configures the Client Characteristic Configuration descriptor for the New Alert in the IUT to "Notify".

  2. The Lower Tester writes the "Enable New Alert Notification" with the supported category ID of the IUT to the Alert Notification Control Point characteristic in the IUT.

  3. The Lower Tester writes the "Notify New Alert immediately" command to the Alert Notification Control Point characteristic with '0xff' for category ID in the IUT again.

- Expected Outcome

  Pass verdict

  Only notification of New Alert filled by the category ID that is specified by procedure 2 is sent and the values that the Lower Tester receives matches to requirements for this characteristic.

4.10.5 ANS/SR/SP/BV-05-C [Service Behavior – Alert Notification Control Point for New Alert, CCCD=OFF, Category=ON]

- Test Purpose

  Verify the IUT behaves correctly when the Lower Tester writes the commands related with the New Alert. In this situation, the Client Characteristic Configuration descriptor is NOT set to “Notify”.

- Reference

  [3] 4.1.1

- Initial Condition

  The handle of the Alert Notification Control Point characteristic value referenced in the test case below has been previously discovered by the Lower Tester during the test procedure in section 4.4 or is known to the Lower Tester by other means.
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.

All categories are disabled to notify in the IUT.

Categories that are supported by the IUT are known after executing ANS/SR/CR/BV-01-C [Characteristic Read – Supported New Alert Category] (if a bit is set in the Supported New Alert Category characteristic, that category is supported).

- Test Procedure
  1. The Lower Tester configures the Client Characteristic Configuration descriptor for the New Alert in the IUT to "Notify".
  2. The Lower Tester writes the "Enable New Alert Notification" command with the supported category ID of the IUT to the Alert Notification Control Point characteristic in the IUT.
  3. The Lower Tester configures the Client Characteristic Configuration descriptor for the New Alert in the IUT with 0x0000. (No notifications)
  4. The Lower Tester writes the "Notify New Alert immediately" command with the category ID field set to 0xff to the Alert Notification Control Point characteristic in the IUT again.

- Expected Outcome
  
  Pass verdict
  The IUT doesn’t send any notifications of the New Alert.

4.10.6 ANS/SR/SP/BV-06-C [Service Behavior – Alert Notification Control Point for New Alert, CCCD=ON, Category=ON <All>]

- Test Purpose
  Verify the IUT behaves correctly when the Lower Tester writes the commands related with the New Alert. In this situation, the IUT needs to notify multiple categories.

- Reference
  [3] 4.1.1

- Initial Condition

  The handle of the Alert Notification Control Point characteristic value referenced in the test case below has been previously discovered by the Lower Tester during the test procedure in section 4.4 or is known to the Lower Tester by other means.

  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.

All categories are disabled to notify in the IUT.

Categories that are supported by the IUT are known after executing ANS/SR/CR/BV-01-C [Characteristic Read – Supported New Alert Category] (if a bit is set in the Supported New Alert Category characteristic, that category is supported).

• Test Procedure

1. The Lower Tester configures the Client Characteristic Configuration descriptor for the New Alert in the IUT to "Notify".

2. The Lower Tester writes the "Enable New Alert Notification" command with the supported category ID of the IUT to the Alert Notification Control Point characteristic in the IUT.

3. The Lower Tester writes the "Enable New Alert Notification" command filled by '0xff' to target category field of the IUT to the Alert Notification Control Point characteristic in the IUT.

4. The Lower Tester writes the "Notify New Alert immediately" command with the category ID field set to 0xff to the Alert Notification Control Point characteristic in the IUT again.

• Expected Outcome

Pass verdict

Notifications for all categories that are supported by the IUT are sent by the IUT and these values that the Lower Tester receives matches to requirements for this characteristic.

4.10.7 ANS/SR/SP/BV-07-C [Service Behavior – Alert Notification Control Point for Unread Alert Status, CCCD=ON, Category=OFF]

• Test Purpose

Verify the IUT behaves correctly when the Lower Tester writes the commands related with the Unread Alert Status. In this situation, the Client Characteristic Configuration for the Unread Alert Status is set to "Notify", but no categories are enabled in the IUT.

• Reference

[3] 4.1.1

• Initial Condition

The handle of the Alert Notification Control Point characteristic value referenced in the test case below has been previously discovered by the Lower Tester during the test procedure in section 4.4 or is known to the Lower Tester by other means.

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.

All categories are disabled to notify in the IUT.

Categories that are supported by the IUT are known after executing ANS/SR/CR/BV-02-C [Characteristics Read – Supported Unread Alert Category] (if a bit is set in the Supported New Alert Category characteristic, that category is supported).

- Test Procedure

1. The Lower Tester configures the Client Characteristic Configuration descriptor for the Unread Alert Status in the IUT to "Notify".
2. The Lower Tester writes the "Notify Unread Alert Status immediately" command to the Alert Notification Control Point characteristic in the IUT.

- Expected Outcome

Pass verdict

The IUT doesn’t send any notifications of the Unread Alert Status.

4.10.8 ANS/SR/SP/BV-08-C [Service Behavior – Alert Notification Control Point for Unread Alert Status, CCCD=ON, Category=ON]

- Test Purpose

Verify the IUT behaves correctly when the Lower Tester writes the commands related with the Unread Alert Status.

- Reference

[3] 4.1.1

- Initial Condition

The handle of the Alert Notification Control Point characteristic value referenced in the test case below has been previously discovered by the Lower Tester during the test procedure in section 4.4 or is known to the Lower Tester by other means.

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.

All categories are disabled to notify in the IUT.

Categories that are supported by the IUT are known after executing ANS/SR/CR/BV-02-C [Characteristics Read – Supported Unread Alert Category] (if a bit is set in the Supported New Alert Category characteristic, that category is supported).

- Test Procedure
1. The Lower Tester configures the Client Characteristic Configuration descriptor for the Unread Alert Status in the IUT to "Notify".

2. The Lower Tester writes the "Enable Unread Alert Status Notification" command with the supported category ID of the IUT to the Alert Notification Control Point characteristic in the IUT.

3. The Lower Tester writes the "Notify Unread Alert Status immediately" command to the Alert Notification Control Point characteristic with category ID that is set by procedure 2 in the IUT.

• Expected Outcome

Pass verdict
The Unread Alert Status filled by the category ID that is specified by procedure 2 is notified and the values that the Lower Tester receives matches to requirements for this characteristic.

4.10.9 ANS/SR/SP/BV-09-C [Service Behavior – Alert Notification Control Point for Unread Alert Status, CCCD=ON, Category=ON<Non-support>]

• Test Purpose
Verify the IUT behaves correctly when the Lower Tester writes the commands related with the Unread Alert Status. In this situation the IUT receives a command of notify immediately, but the category is either not supported if only one category is supported, or not enabled if multiple categories are supported.

• Reference
[3] 4.1.1

• Initial Condition
The handle of the Alert Notification Control Point characteristic value referenced in the test case below has been previously discovered by the Lower Tester during the test procedure in section 4.4 or is known to the Lower Tester by other means.

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.

All categories are disabled to notify in the IUT.

Categories that are supported by the IUT are known after executing ANS/SR/CR/BV-02-C [Characteristic Read – Supported Unread Alert Category] (if a bit is set in the Supported New Alert Category characteristic, that category is supported).

• Test Procedure
1. The Lower Tester configures the Client Characteristic Configuration descriptor for the Unread Alert Status in the IUT to "Notify".

2. The Lower Tester writes the "Enable Unread Alert Status Notification" command with the supported category ID of the IUT to the Alert Notification Control Point characteristic in the IUT.

3. The Lower Tester writes the "Notify Unread Alert Status immediately" command to the Alert Notification Control Point characteristic with a category ID NOT enabled in procedure 2 for an IUT supporting multiple categories. If the IUT supports only one category, the Lower Tester will write the command to a category not supported by the IUT.

• Expected Outcome

   **Pass verdict**
   The IUT does not send any notifications of the Unread Alert Status for the category NOT enabled or supported in procedure 3.

4.10.10  **ANS/SR/SP/BV-10-C [Service Behavior – Alert Notification Control Point for Unread Alert Status, CCCD=ON, Category=ON command with 0xff]**

• Test Purpose

   Verify the IUT behaves correctly when the Lower Tester writes the commands related with the Unread Alert Status. In this situation, the IUT receives the notify immediately command for all categories. But some categories may not enable to notify.

• Reference

   [3] 4.1.1

• Initial Condition

   The handle of the Alert Notification Control Point characteristic value referenced in the test case below has been previously discovered by the Lower Tester during the test procedure in section 4.4 or is known to the Lower Tester by other means.

   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.

   All categories are disabled to notify in the IUT.

   Categories that are supported by the IUT are known after **ANS/SR/CR/BV-02-C [Characteristic Read – Supported Unread Alert Category]** (if a bit is set in the Supported New Alert Category characteristic, that category is supported).

• Test Procedure
1. The Lower Tester configures the Client Characteristic Configuration descriptor for the Unread Alert Status in the IUT to "Notify".

2. The Lower Tester writes the "Enable Unread Alert Status Notification" command with the supported category ID of the IUT to the Alert Notification Control Point characteristic in the IUT.

3. The Lower Tester writes the "Alert Unread Category Status immediately" command to the Alert Notification Control Point characteristic with '0xff' for category ID in the IUT again.

   • Expected Outcome

   **Pass verdict**

   Only notification of Unread Alert Status filled by the category ID that is specified by procedure 3 is sent and the values that the Lower Tester receives matches to requirements for this characteristic.

4.10.11 **ANS/SR/SP/BV-11-C [Service Behavior – Alert Notification Control Point for Unread Alert Status, CCCD=OFF, Category=ON]**

   • Test Purpose

   Verify the IUT behaves correctly when the Lower Tester writes the commands related with the Unread Alert Status. In this situation, the Client Characteristic Configuration descriptor is NOT set to "Notify".

   • Reference

   [3] 4.1.1

   • Initial Condition

   The handle of the Alert Notification Control Point characteristic value referenced in the test case below has been previously discovered by the Lower Tester during the test procedure in section 4.4 or is known to the Lower Tester by other means.

   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.

   All categories are disabled to notify in the IUT.

   Categories that are supported by the IUT are known after **ANS/SR/CR/BV-02-C [Characteristic Read – Supported Unread Alert Category]** (if a bit is set in the Supported New Alert Category characteristic, that category is supported).

   • Test Procedure
1. The Lower Tester configures the Client Characteristic Configuration descriptor for the Unread Alert Status in the IUT to "Notify".

2. The Lower Tester writes the "Enable Unread Alert Status Notification" command with the supported category ID of the IUT to the Alert Notification Control Point characteristic in the IUT.

3. The Lower Tester configures the Client Characteristic Configuration descriptor for the Unread Alert Status in the IUT with 0x0000. (No notifications)

4. The Lower Tester writes the "Notify Unread Alert Status immediately" command with the category ID field set to 0xff to the Alert Notification Control Point characteristic in the IUT.

• Expected Outcome

Pass verdict
The IUT doesn't send any notifications of the Unread Alert Status.

4.10.12 ANS/SR/SP/BV-12-C [Service Behavior – Alert Notification Control Point for Unread Alert Status, CCCD=ON, Category=ON <All>]

• Test Purpose

Verify the IUT behaves correctly when the Lower Tester writes the commands related with the Unread Alert Status. In this situation, the IUT needs to notify multiple categories.

• Reference

[3] 4.1.1

• Initial Condition

The handle of the Alert Notification Control Point characteristic value referenced in the test case below has been previously discovered by the Lower Tester during the test procedure in section 4.4 or is known to the Lower Tester by other means.

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.

All categories are disabled to notify in the IUT.

Categories that are supported by the IUT are known after ANS/SR/CR/BV-02-C [Characteristic Read – Supported Unread Alert Category] (if a bit is set in the Supported New Alert Category characteristic, that category is supported).

• Test Procedure
1. The Lower Tester configures the Client Characteristic Configuration descriptor for the Unread Alert Status in the IUT to "Notify".

2. The Lower Tester writes the "Enable Unread Alert Status Notification" command filled by '0xff' to target category field of the IUT to the Alert Notification Control Point characteristic in the IUT.

3. The Lower Tester writes the "Notify Unread Alert Status immediately" command with the category ID field set to 0xff to the Alert Notification Control Point characteristic in the IUT.

   • Expected Outcome
     
     Pass verdict
     
     Notifications for all categories that are supported by the IUT are sent by the IUT and these values that the Lower Tester receives matches to requirements for this characteristic.

4.11 Error Handling

This test group contains test cases to verify error handling.

4.11.1 ANS/SR/EH/BV-01-C [Error Handling - Alert Notification Control Point, write]

   • Test Purpose
     
     Verify that the IUT does Error handling correctly.

   • Reference
     
     [3] 3.5.2

   • Initial Condition

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

     The supported alert category referenced in the test case below has been previously confirmed by the Lower Tester during the test procedure in section 4.7.

     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 IUT permissions for the characteristic require a specific security mode or security level, establish a connection meeting those requirements.

   • Test Procedure
The Lower Tester writes the invalid command to the Alert Notification Control Point by executing the test procedure of GATT test case GATT/SR/GAW/BV-03-C, Write Characteristic Value - to Server, in [5].

- Expected Outcome

**Pass verdict**

The error code is correctly returned via the ATT Error Response.
# 5 Test Case Mapping

The Test Case Mapping Table (TCMT) maps test cases to specific capabilities in the ICS.

The columns for the TCMT are defined as follows:

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

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

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

- **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.

<table>
<thead>
<tr>
<th>Item</th>
<th>Feature</th>
<th>Test Case(s)</th>
<th>Test Case Applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANS 2/1</td>
<td>Alert Notification Service</td>
<td>ANS/SR/SD/BV-01-C</td>
<td></td>
</tr>
<tr>
<td>ANS 2/2</td>
<td>Supported New Alert Category Characteristic</td>
<td>ANS/SR/DEC/BV-01-C</td>
<td></td>
</tr>
<tr>
<td>ANS 2/3</td>
<td>Supported New Alert Category, Read</td>
<td>ANS/SR/CR/BV-01-C</td>
<td></td>
</tr>
<tr>
<td>ANS 2/4</td>
<td>Supported Unread Alert Category Characteristic</td>
<td>ANS/SR/DEC/BV-05-C</td>
<td></td>
</tr>
<tr>
<td>ANS 2/6</td>
<td>Supported Unread Alert Category, Read</td>
<td>ANS/SR/CR/BV-02-C</td>
<td></td>
</tr>
<tr>
<td>ANS 2/7</td>
<td>New Alert Characteristic</td>
<td>ANS/SR/DEC/BV-03-C</td>
<td></td>
</tr>
<tr>
<td>ANS 2/9</td>
<td>New Alert Characteristic, Notify</td>
<td>ANS/SR/CN/BV-01-C</td>
<td></td>
</tr>
<tr>
<td>ANS 2/10</td>
<td>Unread Alert Status Characteristic</td>
<td>ANS/SR/DEC/BV-04-C</td>
<td></td>
</tr>
<tr>
<td>ANS 2/11</td>
<td>Client Characteristic Configuration descriptor for Unread Alert Status</td>
<td>ANS/SR/DES/BV-02-C, ANS/SR/DESW/BV-02-C</td>
<td></td>
</tr>
<tr>
<td>ANS 2/12</td>
<td>Unread Alert Status Characteristic, Notify</td>
<td>ANS/SR/CN/BV-02-C</td>
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<tr>
<td>Item</td>
<td>Feature</td>
<td>Test Case(s)</td>
<td>Test Case Applicable</td>
</tr>
<tr>
<td>--------</td>
<td>-------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>ANS 2/13</td>
<td>Alert Notification Control Point Characteristic</td>
<td>ANS/SR/DEC/BV-02-C</td>
<td></td>
</tr>
<tr>
<td>ANS 2/14</td>
<td>Alert Notification Control Point Characteristic, Write</td>
<td>ANS/SR/CW/BV-01-C</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ANS/SR/SP/BV-05-C</td>
<td></td>
</tr>
<tr>
<td>ANS 2/16</td>
<td>Enable categories and Notify immediately commands behavior for Unread Alert Status</td>
<td>ANS/SR/SP/BV-07-C, ANS/SR/SP/BV-08-C, ANS/SR/SP/BV-09-C, ANS/SR/SP/BV-10-C,</td>
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<tr>
<td></td>
<td></td>
<td>ANS/SR/SP/BV-11-C</td>
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<tr>
<td>ANS 2/17</td>
<td>New Alert behavior, Multiple events</td>
<td>ANS/SR/SP/BV-06-C</td>
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<tr>
<td>ANS 2/18</td>
<td>Unread Alert Status, Multiple events</td>
<td>ANS/SR/SP/BV-12-C</td>
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</tr>
<tr>
<td>ANS 2/19</td>
<td>Alert Notification Control Point characteristic, error handling</td>
<td>ANS/SR/EH/BV-01-C</td>
<td></td>
</tr>
</tbody>
</table>

**Table 5.1: Test Case Mapping**