Alert Notification Service (ANS)

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 Alert Notification 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.

[1] Test Strategy and Terminology Overview

[2] Bluetooth Core Specification, Version 4.0 or later

[3] Alert Notification Service Specification, Version 1.0

[4] ICS Proforma for Alert Notification Service, ANS.ICS

[5] GATT Test Suite, GATT.TS

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

Alert Notification Service	GAP
GATT	SM
ATT	
L2CAP	
LE Controller	

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 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 Configuration Descriptors Write

- Characteristic Read

- Characteristic Write

- Characteristic Notify

- Service Procedures

- Error Handling

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>
ANS	Alert Notification Service
Identifier Abbreviation	**Role Identifier <IUT role>**
SR	Server Role
Identifier Abbreviation	**Reference Identifier <GGIT test group>**
SGGIT	Server Generic GATT Integrated Tests
Identifier Abbreviation	**Reference Identifier <GGIT class>**
CHA	Characteristic
SER	Service
Identifier Abbreviation	**Feature Identifier <feat>**
CN	Characteristic Notify
CR	Characteristic Read
CW	Characteristic Write
DES	Characteristic Descriptors
DESW	Characteristic Configuration Descriptor Write
EH	Error Handling
SP	Service Procedures

Table 4.1: ANS TC class 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 Launch Studio, 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 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   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 below as input:

TCID	Service / Characteristic / Descriptor	Reference	Properties	Value Length (Octets)	Service Type
ANS/SR/SGGIT/SER/BV-01-C [Service GGIT – Alert Notification Service]	Alert Notification Service	[3] 2	-	-	Primary Service
ANS/SR/SGGIT/CHA/BV-01-C [Characteristic GGIT – Supported New Alert Category]	Supported New Alert Category Characteristic	[3] 3.1	0x02 (Read)	Skip	-
ANS/SR/SGGIT/CHA/BV-02-C [Characteristic GGIT – Alert Notification Control Point]	Alert Notification Control Point Characteristic	[3] 3.5	0x08 (Write)	Skip	-
ANS/SR/SGGIT/CHA/BV-03-C [Characteristic GGIT – New Alert]	New Alert Characteristic	[3] 3.2	0x10 (Notify)	Skip	-
ANS/SR/SGGIT/CHA/BV-04-C [Characteristic GGIT – Unread Alert Status]	Unread Alert Status Characteristic	[3] 3.4	0x10 (Notify)	Skip	-
ANS/SR/SGGIT/CHA/BV-05-C [Characteristic GGIT – Supported Unread Alert Category]	Supported Unread Alert Category Characteristic	[3] 3.3	0x02 (Read)	Skip	-

Table 4.2: Input for the GGIT Server test procedure

4.4 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 4.3 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 Case Configuration

Test Case	Requirements
ANS/SR/DES/BV-01-C [Client Configuration Descriptor – New Alert]	[3] 3.2 Value is 0x0000 or 0x0001
ANS/SR/DES/BV-02-C [Client Configuration Descriptor – Unread Alert Status]	[3] 3.4 Value is 0x0000 or 0x0001

Table 4.3: Characteristic Descriptors test cases

- Test Procedure

  1. The Lower Tester executes the Discover All Characteristic Descriptors sub-procedure using the handle range of the characteristic. The IUT returns one handle-UUID pairs.

  2. The Lower Tester executes the Read Characteristic Descriptors sub-procedure using the handle range of the descriptor from step 1.

- Expected Outcome

  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].

4.5 Characteristic Configuration Descriptors Write

- Test Purpose

  Verify that 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 4.3 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.

- Test Case Condition

Test Case	Requirements
ANS/SR/DESW/BV-01-C [Client Configuration Descriptor – New Alert]	[3] 3.2
ANS/SR/DESW/BV-02-C [Client Configuration Descriptor – Unread Alert Status]	[3] 3.4

Table 4.4: Characteristic Configuration Descriptors Write test cases

- Test Procedure

    1. The Lower Tester sends an ATT_Write_Request to disable notification by writing value 0x0000 to the client characteristic configuration descriptor of the characteristic.

    2. The Lower Tester sends an ATT_Write_Request to enable notification by writing value 0x0001 to the client characteristic configuration descriptor of the characteristic.

    3. 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 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 4.3 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 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)
ANS/SR/CR/BV-01-C [Characteristic Read – Supported New Alert Category]	At least 2 octets, at least 1 that is not 0 ([3] 3.1)
ANS/SR/CR/BV-02-C [Characteristic Read – Supported Unread Alert Category]	At least 2 octets ([3] 3.3)

Table 4.5: Characteristic Read 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 as shown in Table 4.5.

4.7 Characteristic Write

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

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 4.3 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 4.6.

  - 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. The Lower Tester sends an ATT_Write_Request to the IUT to write the Alert Notification Control Point characteristic value.
  2. The IUT sends an ATT_Write_Response to the Lower Tester.

3. The Lower Tester sends an ATT_Read_Request to the IUT to read the Alert Notification Control Point characteristic value written in step 1.
4. The IUT sends an ATT_Read_Response to the Lower Tester.
5. Verify that the characteristic value is successfully written.

- Expected Outcome

  Pass verdict

  The characteristic value is successfully written.

4.8 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 4.3 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.

  - The supported alert category referenced in the test case below is enabled by executing the applicable write client characteristic configuration descriptors test procedure in Section 4.5 and the applicable write Alert Notification Control Point characteristic test procedure in ANS/SR/CW/BV-01-C [Characteristic Write – Alert Notification Control Point]0.

  - 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)
ANS/SR/CN/BV-01-C [Characteristic Notify – New Alert]	At least 2 octets ([3] 3.2)
ANS/SR/CN/BV-02-C [Characteristic Notify – Unread Alert Status]	2 octets ([3] 3.4)

Table 4.6: Characteristic Notify test cases

- Test Procedure

  1. The Upper Tester triggers an event that causes the IUT to notify the New Alert characteristic (for ANS/SR/CN/BV-01-C [Characteristic Notify – New Alert]) or the Unread Alert Status characteristic (for ANS/SR/CN/BV-02-C [Characteristic Notify – Unread Alert Status]).

- Expected Outcome

  Pass verdict

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

4.9 Service Procedures

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

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

- Test Purpose

  Verify that 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 4.3 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.

  - 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.

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

- Test Purpose

  Verify that 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 4.3 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.

  - 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.

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 4.3 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.

    - 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.

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 4.3 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.

- 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.

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

- Test Purpose

    Verify that 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 4.3 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.

    - 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.

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

- 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 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 4.3 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.

  - 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.

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

- Test Purpose

  Verify that 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 4.3 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.

  - 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 "Notify Unread Alert Status immediately" command to the Alert Notification Control Point characteristic in the IUT.

- Expected Outcome

  <u>Pass verdict</u>

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

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

- Test Purpose

  Verify that 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 4.3 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.

- 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 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.

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 that 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 4.3 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.

  - 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.

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 that 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 4.3 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.

    - 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.

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

- Test Purpose

Verify that 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 4.3 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.

    - 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.

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

- Test Purpose

  Verify that 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 4.3 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.

  - 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.

4.10 Error Handling

This test group contains test cases to verify error handling.

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 4.3 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 4.6.

  - 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. The Lower Tester writes the invalid command to the Alert Notification Control Point by executing the GATT Write Characteristic Value sub-procedure.

- Expected Outcome

  <u>Pass verdict</u>

  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 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 Alert Notification Service (ANS) [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)
ANS 2/1	Alert Notification Service	ANS/SR/SGGIT/SER/BV-01-C
ANS 2/2	Supported New Alert Category Characteristic	ANS/SR/SGGIT/CHA/BV-01-C
ANS 2/3	Supported New Alert Category, Read	ANS/SR/CR/BV-01-C
ANS 2/4	Supported Unread Alert Category Characteristic	ANS/SR/SGGIT/CHA/BV-05-C
ANS 2/6	Supported Unread Alert Category, Read	ANS/SR/CR/BV-02-C
ANS 2/7	New Alert Characteristic	ANS/SR/SGGIT/CHA/BV-03-C
ANS 2/8	Client Characteristic Configuration descriptor for New Alert	ANS/SR/DES/BV-01-C ANS/SR/DESW/BV-01-C
ANS 2/9	New Alert Characteristic, Notify	ANS/SR/CN/BV-01-C
ANS 2/10	Unread Alert Status Characteristic	ANS/SR/SGGIT/CHA/BV-04-C
ANS 2/11	Client Characteristic Configuration descriptor for Unread Alert Status	ANS/SR/DES/BV-02-C ANS/SR/DESW/BV-02-C
ANS 2/12	Unread Alert Status Characteristic, Notify	ANS/SR/CN/BV-02-C
ANS 2/13	Alert Notification Control Point Characteristic	ANS/SR/SGGIT/CHA/BV-02-C
ANS 2/14	Alert Notification Control Point Characteristic, Write	ANS/SR/CW/BV-01-C
ANS 2/15	Enable categories and Notify immediately commands behavior for New Alert	ANS/SR/SP/BV-01-C ANS/SR/SP/BV-02-C ANS/SR/SP/BV-03-C ANS/SR/SP/BV-04-C ANS/SR/SP/BV-05-C
ANS 2/16	Enable categories and Notify immediately commands behavior for Unread Alert Status	ANS/SR/SP/BV-07-C ANS/SR/SP/BV-08-C ANS/SR/SP/BV-09-C ANS/SR/SP/BV-10-C ANS/SR/SP/BV-11-C
ANS 2/17	New Alert behavior, Multiple events	ANS/SR/SP/BV-06-C
ANS 2/18	Unread Alert Status, Multiple events	ANS/SR/SP/BV-12-C

Item	Feature	Test Case(s)
ANS 2/19	Alert Notification Control Point characteristic, error handling	ANS/SR/EH/BV-01-C

Table 5.1: Test case mapping

6 Revision history and acknowledgments

Revision History

Publication Number	Revision Number	Date	Comments
0	1.0.0	2011-09-15	Adopted by the Bluetooth SIG Board of Directors
	1.0.1r0	2011-12-12	TSE 4558: Rewritten TP/SP/BV-01-C, TP/SP/BV02-C, TP/SP/BV/03-C, TP/SP/BV/04-C, 6 new test cases
	1.0.1r1	2011-12-13	Added changes to TCMT for new test cases.
1	1.01.	2012-03-30	Prepare for publication.
	1.0.2r1	2012-09-19	TSE 4884: Change wording in Section 4.9, initial condition. TSE 4932: Wording change from "Unread Alert" to "New Alert" in test case TP/SP/BV-04-C. TSE 4913: Wording change from "Unread Alert" to "New Alert" in test case TP/SP/BV-02-C. TSE 4908: Changes to TP/SP/BV-03-C and TP/SP/BV-09-C.
2	1.0.2	2012-10-30	Prepare for Publication
	1.0.3r1	2013-04-23	TSE 5121: 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". Update to TCMT mapping, TP/SP/BV-12-C removed from "Enable categories and Notify immediately commands behavior for Unread Alert Status" to replace duplicate mapping for "Unread Alert Status, Multiple events"
3	1.0.3	2013-07-09	Prepare for Publication
	1.0.4r00	2014-04-10	TSE 5600: Corrected instances of the "Tester" to specify upper or lower where necessary. Revised Characteristic Notify section initial condition (TP/CN/BV-01-C and TP/CN/BV-02-C). Correction to TP/SP/BV-05-C and TP/SP/BV-11-C test purpose and Test Procedure.
	1.0.4r01	2014-04-15	BTI Review by Miles 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.
4	1.0.4	2014-07-07	TCRL 2014-1 Publication
	1.0.5r00	2016-05-20	Converted to new Test Case ID conventions as defined in TSTO v4.1.
	1.0.5r01	2016-06-04	Converted to current test specification template
5	1.0.5	2016-07-13	Prepared for TCRL 2016-1 publication.

Publication Number	Revision Number	Date	Comments
	1.0.5 edition 2r00	2018-11-29	Editorial changes only. Template updated. Revision History and Contributors moved to the end of the document.
	1.0.5 edition 2	2019-11-11	Updated copyright page and confidentiality markings to support new Documentation Marking Requirements, performed minor formatting updates, and accepted all tracked changes to prepare for edition 2 publication.
	p6r00–r02	2023-04-10 – 2023-05-01	TSE 22467 (rating 2): Converted the following test cases to GGIT: ANS/SR/SD/BV-01-C and ANS/SR/DEC/BV-01-C – -05-C. The new GGIT converted TCIDs are: ANS/SR/SGGIT/SER/BV-01-C and ANS/SR/SGGIT/CHA/BV-01-C – -05-C. Updated the TCMT accordingly. Made updates to the initial condition, test procedure, and/or expected outcome for ANS/SR/DES/BV-01-C and -02-C, ANS/SR/DESW/BV-01-C and -02-C, ANS/SR/CR/BV-01-C and -02-C, ANS/SR/CW/BV-01-C, ANS/SR/CN/BV-01-C and -02-C, and ANS/SR/EH/BV-01-C. Corrected the placement of Test Case Configuration tables to align with the latest TS template. Added a Publication Number column to the Revision History. Revised the document numbering convention, setting the last release publication of 1.0.5 as p5. Changed section titles for single test cases to Heading 8 per TS template. Performed other editorials to align the document with the latest TS template and updated the scope, references, Test Strategy, test case identification conventions, conformance, Pass/Fail verdict conventions, setup preambles, and TCMT introductory text. Replaced the Bluetooth logo in the footer and updated the copyright page to align with v2 of the DNMD.
6	p6	2023-06-29	Approved by BTI on 2023-05-28. Prepared for TCRL 2023-1 publication.