Device Time Service (DTS)

***Bluetooth*® Test Suite**

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1 Scope

This Bluetooth document contains the Test Suite Structure (TSS) and Test Cases (TC) to test the implementation of the Bluetooth Device Time Service 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, 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 hereinafter.

[1] Bluetooth Core Specification v4.2 or later

[2] Bluetooth Test Strategy and Terminology Overview

[3] Device Time Service (DTS) v1.0

[4] ICS Proforma for Device Time Service, DTS.ICS

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

[6] GATT Test Suite, GATT.TS

[7] Device Time Service Implementation eXtra Information for Test, IXIT

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 from [1] and [2] apply.

3 Test Suite Structure (TSS)

3.1 Overview

DTS requires ATT, GAP, SM (when used over LE transport), SDP (when used over BR/EDR transport), and GATT. This is illustrated in Figure 1.

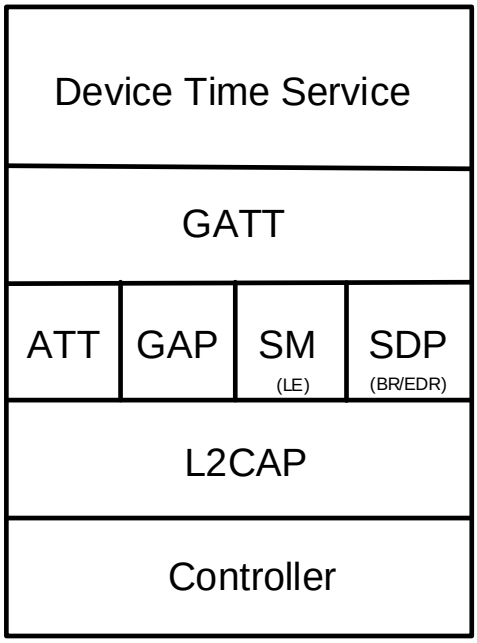

Figure 1: Device Time Service Test Model

3.2 Test strategy

The test objectives are to verify the functionality of the DTS 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. Any defined test herein is applicable to the IUT, if the ICS logical expression defined in the Test Case Mapping Table (TCMT) is valid.

The test equipment provides an implementation of the Radio Controller and the parts of the Host needed to perform the Test Cases defined in the test suite. 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.

Some Test Cases require a second test system (Lower Tester 2), which emulates a 2nd device the IUT is connected to. Lower Tester 2 may update characteristic values within the IUT. The IUT will then need to inform the test equipment (Lower Tester 1) about these updates.

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

  This group, using the Server Generic GATT Integrated Tests, verifies the presence and contents of the Device Time service, characteristics, and descriptors, and verifies:

  a) That characteristics that support reading can be read and the format and value of the characteristic is verified

  b) IUT operation for handling of general Control Point error situations

- Configure Indication and Notification

  This group verifies that characteristics can be configured for indication and notification.

- Characteristic Indication

  This group verifies that characteristics that support indication can be indicated upon a change of specific characteristic field values.

- Device Time Control Point (DTCP)

  This group verifies valid IUT behavior of the implemented DTCP procedures and error handling, and general Server error situations (e.g., E2E-CRC error).

- Time Change Logging Events

  This group verifies the IUT reporting of the implemented time change events and logs.

- Record Access Control Point (RACP) Procedures

  This group verifies valid IUT behavior of the implemented RACP procedures and 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 [2]. 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 [6] 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>**
DTS	Device Time 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
SDP	Validate SDP Record
SER	Service
Identifier Abbreviation	**Feature Identifier <feat>**
CI	Characteristic Indication
CON	Configure Indication or Notification
CP	Control Point
RAA	RACP – Abort procedure
RAC	RACP – Combined Report procedure
RAE	RACP – Error Handling
RAN	RACP – Report Number of Stored Records procedure
RAR	RACP – Report Stored Records procedure
SPE	Service Procedure – Error handling
SPT	Service Procedure – Device Time Control Point
TCL	Time Change Log Data – Event Log Types

Table 4.1: DTS TC feature naming convention

4.1.2 Conformance

When conformance is claimed for a particular specification, all capabilities are to be supported in the specified manner (process-mandatory). 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 that is 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 exist, 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 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 generated by Launch Studio, 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 errata request such that the issue may be addressed.

4.1.3 Pass/Fail verdict conventions

Each Test Case has an Expected Outcome section. The IUT is granted the Pass Verdict when all the detailed pass criteria conditions within the Expected Outcome section are met.

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

4.2 Setup preambles

4.2.1 ATT Bearer on LE transport

- Preamble Procedure

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

4.2.2 ATT Bearer on BR/EDR transport

- Preamble Procedure

  1. Establish a BR/EDR transport connection between the IUT and the Lower Tester.
  2. Establish an L2CAP channel (PSM 0x001F) between the IUT and the Lower Tester over that BR/EDR transport.

4.2.3 Device Time Control Points Configuration

- Preamble Purpose

  This preamble procedure enables the IUT for use with required <Control Point Characteristic> and <Corresponding Mandatory Characteristic>, as described in Table 4.2.

- Preamble Procedure

  1. Ensure that an ATT Bearer connection is established between the Lower Tester and the IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.
  2. The Lower Tester is acting as a Client.
  3. If the IUT supports bonding, then the Lower Tester performs a bonding procedure.
  4. The handles of the <Control Point Characteristic>, the <Corresponding Mandatory Characteristic>, and the Client Characteristic Configuration Descriptors (CCCDs) have been previously discovered by the Lower Tester during the test procedure in Section 4.3 or are known to the Lower Tester by other means.
  5. The <Control Point Characteristic> is configured for indication, and <Corresponding Mandatory Characteristic> is configured as defined in Table 4.2.

Control Point Characteristic	Corresponding Mandatory Characteristic	Corresponding Mandatory Characteristic configured for
Device Time Control Point (DTCP)	N/A	N/A
Record Access Control Point (RACP)	Time Change Log Data	Notification

Table 4.2: Configuration Preamble for DTCP and RACP

4.2.4 Preamble for updating selected Device Time Feature, Parameters, and Device Time characteristic field or flag

- Preamble Purpose

  This preamble enables the IUT to update the selected <Characteristics field or flag> value described in Table 4.3.

- Preamble Procedure

  1. Establish an ATT Bearer connection between the Lower Tester and the IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.
  2. If the IUT supports bonding, then the Lower Tester performs a bonding procedure.
  3. The handles of the <DTS Characteristic>, the DTCP characteristic, and descriptors have been previously discovered by the Lower Tester or are known to the Lower Tester by other means.
  4. The <DTS Characteristic> and the DTCP characteristic are configured for indication.
  5. The Upper Tester induces the IUT to update the selected <Characteristics field or flag> via the <Required action for the update>, as defined in Table 4.3, either via an initiation by an authorized Lower Tester, via an interaction with the IUT's User Interface (UI), or via other means.

DTS Characteristic	Characteristic field or flag	Required action for the update
Device Time Parameters (DT Parameters) characteristic	Non_Logged_Time_Adjustment_Limit field	Via a Propose Non-Logged Time Adjustment Limit procedure
	Displayed_Formats field	Via the IUT's UI
Device Time characteristic (DT characteristic)	Time_Zone field	Via a Propose Time Update procedure with a Time Update operand containing a new Time_Zone_Update field value and the other Time Update operand fields set as required Or Via the IUT's UI

DTS Characteristic	Characteristic field or flag	Required action for the update
	DST_Offset field	Via a Propose Time Update procedure with a Time Update operand containing a new DST_Offset_Update field value and the other Time Update operand fields set as required Or Via the IUT's UI
	User_Time field	Via the IUT's UI
	DT_Status field: Time Fault flag	By removing the IUT's battery
	DT_Status field: UTC Aligned flag	Via a Force Time Update procedure with a Time Update operand with the Time_Source_Update field value set to "Manual" or "Unknown" and the other Time Update operand fields set as required
	DT_Status field: Propose Time Update Request flag	Via a Force Time Update procedure with a Time Update Operand with the Time Source set to "Manual" or "Unknown" and the other Time Update Operand fields set as required
	DT_Status field: Non-Logged Time Change Active flag	Forcing a log entry: Perform a Propose Non-Logged Time Adjustment Limit procedure or a User Time change
	DT_Status field: Log Consolidation Active flag	Forcing a log entry: Perform a Propose Non-Logged Time Adjustment Limit procedure or a User Time change
Device Time Feature (DT Feature) characteristic	DT_Features field	Via the IUT's UI

Table 4.3: Preamble for updating selected DT Parameters and DT characteristic fields and flags

4.3 Generic GATT Integrated Tests

Execute the Generic GATT Integrated Tests defined in Section 6.3 [6] Server Test Procedures using Table 4.4 below as input:

- Additional Pass Verdict
  - All RFU bits are set to 0

TCID	Service / Characteristic	Reference	Properties	Value Length (Octets)	Service Type
DTS/SR/SGGIT/SER/BV-01-C [Service GGIT – Device Time]	Device Time Service	[3] 2	-	-	Primary Service

TCID	Service / Characteristic	Reference	Properties	Value Length (Octets)	Service Type
DTS/SR/SGGIT/CHA/BV-02-C [Characteristic GGIT – Device Time Feature]	Device Time Feature characteristic	[3] 3.1	0x02 (Read) or 0x22 (Read, Indicate)	4	-
DTS/SR/SGGIT/CHA/BV-03-C [Characteristic GGIT – Device Time Parameters]	Device Time Parameters characteristic	[3] 3.2	0x02 (Read) or 0x22 (Read, Indicate)	2 - 12	-
DTS/SR/SGGIT/CHA/BV-04-C [Characteristic GGIT – Device Time]	Device Time characteristic	[3] 3.3	0x22 (Read, Indicate)	8 - 20	-
DTS/SR/SGGIT/CHA/BV-05-C [Characteristic GGIT – Time Change Log Data]	Time Change Log Data characteristic	[3] 3.4	0x10 (Notify)	Skip	-
DTS/SR/SGGIT/CHA/BV-06-C [Characteristic GGIT – Device Time Control Point]	Device Time Control Point (DTCP) characteristic	[3] 3.7	0x28 (Write, Indicate)	Skip	-
DTS/SR/SGGIT/CHA/BV-07-C [Characteristic GGIT – Record Access Control Point]	Record Access Control Point (RACP) characteristic	[3] 3.8	0x28 (Write, Indicate)	Skip	-
DTS/SR/SGGIT/SDP/BV-08-C [SDP Record – Device Time Service]	Device Time Service	[3] 5	-	-	-

Table 4.4: Input for the GGIT Server Test Procedure

4.3.1 Generic GATT Control Point Tests (SGGIT)

Execute the Generic GATT Control Point Tests defined in Section 6.3 Server test procedures (SGGIT) of [6] using Table 4.5 below as input.

TCID	Control Point Characteristic	Reference	TC Configuration	Parameter(s)	Pass Verdict
DTS/SR/SGGIT/CP/BI-01-C [DTCP - Client Characteristic Configuration Descriptor Improperly Configured]	DTCP Characteristic	[3] 3.5.3	N/A	Opcode = 0x02 (Propose Time Update)	Client Characteristic Configuration Descriptor Improperly Configured (0xFD)

Table 4.5: Input table for GGIT Control Point tests

4.4 Configure Indication and Notification

- Test Purpose

  This test group verifies compliant operation in response to enabling and disabling characteristic indication or notification, and reading of the Client Characteristic Configuration Descriptor value. The

verification is done one value at a time, as enumerated in the test cases in Table 4.6, using this generic test procedure.

- Reference

  [3] 3

- Initial Condition

  - Establish an ATT Bearer connection between the Lower Tester and the IUT as described in Section 4.2.1 or Section 4.2.2.
  - The handle range of each characteristic and handle of the Client Characteristic Configuration Descriptor 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.

- Test Case Configuration

TCID	Value (Requirement)
DTS/SR/CON/BV-01-C [Configure Indication - Device Time Parameters]	0x0002 ([3] 3.2.1)
DTS/SR/CON/BV-02-C [Configure Indication - Device Time]	0x0002 ([3] 3.3.1)
DTS/SR/CON/BV-03-C [Configure Notification - Time Change Log Data]	0x0001 ([3] 3.4.1)
DTS/SR/CON/BV-04-C [Configure Indication - Device Time Control Point]	0x0002 ([3] 3.5.5.1)
DTS/SR/CON/BV-05-C [Configure Indication - Record Access Control Point]	0x0002 ([3] 3.5.5.2)
DTS/SR/CON/BV-06-C [Configure Indication - Device Time Feature]	0x0002 ([3] 3.1.1)

Table 4.6: Configure Indication and Notification test cases

- Test Procedure

  1. Disable indication or notification by writing value 0x0000 to the Client Characteristic Configuration Descriptor of the characteristic using the test procedure of GATT/SR/GAW/BV-08-C in [6].
  2. Perform either alternative 2A or 2B depending on whether the test case is for notification or indication.
     Alternative 2A (Notification):
     2A.1. Enable notification by writing value 0x0001 to the Client Characteristic Configuration Descriptor of the characteristic.
     Alternative 2B (Indication):
     2B.1. Enable indication by writing value 0x0002 to the Client Characteristic Configuration Descriptor of the characteristic.
  3. If either DTS/SR/CON/BV-01-C [Configure Indication - Device Time Parameters] or DTS/SR/CON/BV-02-C [Configure Indication - Device Time] is executed, after configuring the Client Characteristic Configuration Descriptor for indication, this will result in the immediate indication of the characteristic with at least the mandatory fields. For each indication of the characteristic, the IUT receives an ATT_Handle_Value_Confirmation from the Lower Tester.
  4. The Lower Tester reads the value of the client characteristic configuration descriptor.

- Expected Outcome

  Pass verdict

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

For test cases DTS/SR/CON/BV-01-C [Configure Indication - Device Time Parameters] and DTS/SR/CON/BV-02-C [Configure Indication - Device Time], the characteristic is successfully indicated and the characteristic value meets the requirements of the service.

4.5 Characteristic Indication

This test group verifies the ability of the IUT to send indications upon a change of the DT Parameters or DT characteristic.

4.5.1 DT Feature, DT Parameters, and DT characteristic indication

- Test Purpose

  For each test case in Table 4.7, verify that the IUT can send, upon a change to the <Characteristic field or flag>, an indication of the <Characteristic> with the updated <Characteristic field or flag> as described in Table 4.7.

- Reference

  [3] 3

- Initial Condition

  - Establish an ATT Bearer connection between the Lower Tester and the IUT as described in Section 4.2.1 or Section 4.2.2.
  - The Lower Tester has performed a bonding procedure and is bonded with the IUT.
  - The Lower Tester has performed the applicable test procedures in Section 4.3 and has:
    - Acquired the handles and value of the DT Feature, DT Parameters, and DT characteristics and <Characteristic field or flag> described in Table 4.7.
    - Configured for indication the CCCD for the DT Feature, DT Parameters, and DT characteristics.
  - The Lower Tester and the IUT disconnect.

- Test Case Configuration

TCID	Reference	Characteristic	Characteristic field or flag
DTS/SR/CI/BV-01-C [DT Parameters characteristic indication – Non Logged Time Adjustment Limit change]	[3] 3.2.1.5	DT Parameters	Non_Logged_Time_Adjustment_Limit field (see IXIT [7])
DTS/SR/CI/BV-02-C [DT Parameters characteristic indication - Displayed Formats change]	[3] 3.2.1.6	DT Parameters	Displayed_Formats field
DTS/SR/CI/BV-03-C [DT characteristic indication – Time Zone change]	[3] 3.3.1.3	Device Time	Time_Zone field

TCID	Reference	Characteristic	Characteristic field or flag
DTS/SR/CI/BV-04-C [DT characteristic indication – DST Offset change]	[3] 3.3.1.4	Device Time	DST_Offset field
DTS/SR/CI/BV-05-C [DT characteristic indication - DT Status field with Propose Time Update Request bit set]	[3] 3.3.1.5, 3.3.1.5.4	Device Time	DT_Status field with Propose Time Update Request flag
DTS/SR/CI/BV-06-C [DT characteristic indication – User Time change]	[3] 3.3.1.6	Device Time	User_Time field
DTS/SR/CI/BV-07-C [DT characteristic indication - DT Status field with Non-Logged Time Change Active bit set]	[3] 3.3.1.5, 3.3.1.5.6	Device Time	DT_Status field with Non-Logged Time Change Active flag
DTS/SR/CI/BV-08-C [DT characteristic indication - DT Status field with Log Consolidation Active bit set]	[3] 3.3.1.5, 3.3.1.5.7	Device Time	DT_Status field with Log Consolidation Active flag
DTS/SR/CI/BV-09-C [DT Feature characteristic indication]	[3] 3.1.1	DT Feature	DT_Features field

Table 4.7: Test cases for indications of the DT Parameters and DT characteristics fields

- Test Procedure

  For each test case in Table 4.7, perform the following steps:

  1. Using the preamble described in Section 4.2.4, the Upper Tester induces the IUT to change the <Characteristic field or flag> described in Table 4.7 to a new value.
  2. Establish a connection between the Lower Tester and the IUT as described in Section 4.2.1 or Section 4.2.2.
  3. The IUT sends an ATT_Handle_Value_Indication containing the <Characteristic> handle and value to the Lower Tester.
  4. The IUT receives an ATT_Handle_Value_Confirmation from the Lower Tester.

- Expected Outcome

  Pass verdict

  The IUT sends an indication of the <Characteristic>, including the updated <Characteristic field or flag>.

DTS/SR/CI/BV-10-C [DT characteristic indication due to a Base Time update performed by another Client]

- Test Purpose

  Verify that the IUT can indicate to a Lower Tester 1, to which it was previously bonded, and that another Lower Tester 2 updated the IUT's Base Time.

- Reference

  [3] 3.3.1

- Initial Condition

  - Establish an ATT Bearer connection between Lower Tester 1 and the IUT as described in Section 4.2.1 or Section 4.2.2.
  - Lower Tester 1 bonds with the IUT.
  - Lower Tester 1 performs the applicable test procedures in Section 4.3 and configures the CCCD for the DT characteristic of the IUT for indication.
  - Lower Tester 1 and the IUT disconnect.
  - The IUT's UTC Aligned flag is set to 0 using the preamble described in Section 4.2.4.
  - Establish an ATT Bearer connection between a new Lower Tester 2 and the IUT as described in Section 4.2.1 or Section 4.2.2.
  - Lower Tester 2 performs the applicable test procedures in Section 4.3 and configures the CCCD for the DT characteristic of the IUT for indication.
  - Lower Tester 2 updates the IUT's Base Time by performing either the DTS/SR/SPT/BV-01-C [Propose Time Update] or DTS/SR/SPT/BV-02-C [Propose Time Update with Base Time Second-Fractions] procedure.
  - Lower Tester 2 and the IUT disconnect.

- Test Procedure

  1. Establish an ATT Bearer connection between Lower Tester 1 and the IUT as described in Section 4.2.1 or Section 4.2.2.
  2. The IUT sends an ATT_Handle_Value_Indication containing the DT characteristic handle and value to Lower Tester 1.
  3. The IUT receives an ATT_Handle_Value_Confirmation from Lower Tester 1.

- Expected Outcome

  Pass verdict

  The IUT sends an indication to Lower Tester 1, containing the DT characteristic handle and an updated value.

4.6 Device Time Control Point Procedures

This test group contains test cases to verify the IUT's ability to perform compliant operation and interpret values of the Device Time Control Point (DTCP) characteristic or the handling of errors specific to the procedure or control point.

4.6.1 Propose Time Update

- Test Purpose

  Verify that the IUT allows a Lower Tester to execute the Propose Time Update procedure.

- Reference

  [3] 3.7.2.2

- Initial Condition

  - Using the preamble described in Section 4.2.4, the IUT's:
    - UTC Aligned flag is set to 0
    - Propose Time Update Request flag is set to 1
    - Non-Logged Time Change Active flag is set to 0
    - Log Consolidation Active flag is set to 0
  - Perform the preamble described in Section 4.2.3 to enable the IUT for use with the required <Control Point Characteristic> set to DTCP characteristic.
  - The Lower Tester is authorized to execute the Propose Time Update procedure.
  - The Lower Tester acquires the IUT's DT Features by reading the DT Feature characteristic.
  - The Lower Tester acquires the IUT's DT Status flags field and the Next_Sequence_Number field by reading the DT characteristic.

- Test Case Configuration

TCID	Time Update operand
DTS/SR/SPT/BV-01-C [Propose Time Update]	Exclude Base_Time_Second_Fractions_Update field
DTS/SR/SPT/BV-02-C [Propose Time Update with Base Time Second-Fractions]	With a valid Base_Time_Second_Fractions_Update field value.

Table 4.8: DTCP Propose Time Update test cases

- Test Procedure

  For each test case in Table 4.8, perform the following steps:

  1. The Lower Tester writes the Propose Time Update Opcode (0x02) to the DTCP characteristic with a Time Update operand with valid mandatory fields proposed by a time source (i.e., GPS source) which is UTC aligned, Base_Time_Second_Fractions_Update field set as described in Table 4.8, and epoch year set as required.
  2. The IUT sends an ATT_Handle_Value_Indication of the DTCP characteristic with the DTCP Response Opcode (0x09) and an operand representing the Request Opcode (0x02) followed by the Response Value for Success (0x01).

3. The IUT receives an ATT_Handle_Value_Confirmation from the Lower Tester.
4. The Lower Tester acquires the IUT's time and status by reading the DT characteristic.

- Expected Outcome

  Pass verdict

  In step 2, the IUT responds with an ATT_Handle_Value_Indication with the expected content.

  The DT characteristic is successfully read, and the values reflect the Time Update operand, and:

  - The UTC Aligned flag in DT_Status field is set to 1.
  - If the IUT supports the RTC Drift Tracking feature, the Accumulated_RTC_Drift field is cleared.
  - If the IUT supports the Time Change Logging feature and the IUT is implementing either consolidated logging or non-logged time adjustments:
    - The Log Consolidation Active flag is set to 1.
    - The Non-Logged Time Change Active flag is set to 1.
  - If the IUT supports the Time Change Logging feature and the IUT is implementing neither consolidated logging nor non-logged time adjustments:
    - The Log Consolidation Active flag is set to 0.
    - The Non-Logged Time Change Active flag is set to 0.
    - The Next_Sequence_Number field value is incremented indicating a time change event has occurred.

  If the IUT supports the E2E-CRC feature, the checksum sent in the ATT_Handle_Value_Indication and ATT_Read_Response must be present.

DTS/SR/SPT/BV-03-C [Propose Time Update with concurrent connections]

- Test Purpose

  Verify that the IUT, while concurrently connected to Lower Tester 1 and Lower Tester 2, after allowing Lower Tester 2 to execute the Propose Time Update procedure, sends an indication of the DT characteristic to Lower Tester 1.

- Reference

  [3] 3.7.2.2

- Initial Condition

  - Using the preamble described in Section 4.2.4, the IUT's:
    - UTC Aligned flag is set to 0.
    - Propose Time Update Request flag is set to 1.
    - Non-Logged Time Change Active flag is set to 0.
    - Log Consolidation Active flag is set to 0.
  - Establish an ATT Bearer connection between Lower Tester 1 and the IUT as described in Section 4.2.1 or Section 4.2.2.
  - Lower Tester 1 bonds with the IUT.

- Lower Tester 1 performs the applicable test procedures in Section 4.3 and configures the CCCD for the DT characteristic of the IUT for indication.
- Establish an ATT Bearer connection between Lower Tester 2 and the IUT as described in Section 4.2.1 or Section 4.2.2.
- Perform the preamble described in Section 4.2.3 to enable the IUT for use with the required <Control Point Characteristic> set to DTCP characteristic.
- Lower Tester 2 acquires the IUT's DT Features by reading the DT Feature characteristic.
- Lower Tester 2 is authorized to execute the Propose Time Update procedure.

- Test Procedure

  1. Lower Tester 2 writes the Propose Time Update Opcode (0x02) to the DTCP characteristic with a Time Update operand with valid mandatory fields proposed by a time source (e.g., GPS source) which is UTC aligned, Base_Time_Second_Fractions_Update field and epoch year set as required.
  2. The IUT sends an ATT_Handle_Value_Indication of the DTCP characteristic with the DTCP Response Opcode (0x09) and an operand representing the Request Opcode (0x02) followed by the Response Value for Success (0x01).
  3. The IUT receives an ATT_Handle_Value_Confirmation from Lower Tester 2.
  4. The IUT sends an ATT_Handle_Value_Indication containing the DT characteristic handle and value to Lower Tester 1.
  5. The IUT receives an ATT_Handle_Value_Confirmation from Lower Tester 1.

- Expected Outcome

  Pass verdict

  In step 2, the IUT responds to Lower Tester 2 with an ATT_Handle_Value_Indication with the expected content.

  In step 4, the IUT sends an indication to Lower Tester 1 containing the DT characteristic with the updated fields.

  If the IUT supports the E2E-CRC feature, the checksum sent in the ATT_Handle_Value_Indication and ATT_Read_Response must be present.

4.6.2 Force Time Update

- Test Purpose

  Verify that the IUT allows an authorized Lower Tester to execute the Force Time Update procedure.

- Reference

  [3] 3.7.2.3

- Initial Condition

  - Using the preamble described in Section 4.2.4, the IUT's:
    - Non-Logged Time Change Active flag is set to 0.
    - Log Consolidation Active flag is set to 0.
  - Perform the preamble described in Section 4.2.3 to enable the IUT for use with the required <Control Point Characteristic> set to DTCP characteristic.
  - The Lower Tester is authorized to execute the Force Time Update procedure.

- The Lower Tester acquires the IUT's DT Features by reading the DT Feature characteristic.
- The Lower Tester acquires the IUT's DT Status flags field and the Next_Sequence_Number field by reading the DT characteristic.

- Test Case Configuration

TCID	Time Update operand
DTS/SR/SPT/BV-04-C [Force Time Update]	Exclude Base_Time_Second_Fractions_Update field.
DTS/SR/SPT/BV-05-C [Force Time Update with Base Time Second-Fractions]	With a valid Base_Time_Second_Fractions_Update field value.

Table 4.9: DTCP Force Time Update test cases

- Test Procedure

  For the selected test case in Table 4.9, perform the following steps:

  1. The Lower Tester writes the Force Time Update Opcode (0x03) to the DTCP characteristic with a Time Update operand with valid mandatory fields, Base_Time_Second_Fractions_Update field set as described in Table 4.9, and epoch year set as required.
  2. The IUT sends an ATT_Handle_Value_Indication of the DTCP characteristic with the DTCP Response Opcode (0x09) and an operand representing the Request Opcode (0x03) followed by the Response Value for Success (0x01).
  3. The IUT receives an ATT_Handle_Value_Confirmation from the Lower Tester.
  4. The Lower Tester acquires the IUT's time and status by reading the DT characteristic.

- Expected Outcome

  Pass verdict

  In step 2, the IUT responds with an ATT_Handle_Value_Indication with the expected content.

  The DT characteristic is successfully read, and the values reflect the Time Update operand, and:

  - If the IUT supports the RTC Drift Tracking feature, the Accumulated_RTC_Drift field is cleared.
  - If the IUT supports the Time Change Logging feature and the IUT is implementing either consolidated logging or non-logged time adjustments:
    - The Log Consolidation Active flag is set to 1.
    - The Non-Logged Time Change Active flag is set to 1.
  - If the IUT supports the Time Change Logging feature and the IUT is implementing neither consolidated logging nor non-logged time adjustments:
    - The Log Consolidation Active flag is set to 0.
    - The Non-Logged Time Change Active flag is set to 0.
    - The Next_Sequence_Number field value is incremented indicating that a time change event has occurred.

  If the IUT supports the E2E-CRC feature, the checksum sent in the ATT_Handle_Value_Indication and ATT_Read_Response must be present.

4.6.3 Propose Non-Logged Time Adjustment Limit

- Test Purpose

  Verify that the IUT allows an authorized Lower Tester to execute the Propose Non-Logged Time Adjustment Limit procedure.

- Reference

  [3] 3.7.2.4

- Initial Condition

  - Perform the preamble described in Section 4.2.3 to enable the IUT for use with the required <Control Point Characteristic> set to DTCP characteristic.
  - The Lower Tester is authorized to execute the Propose Non-Logged Time Adjustment Limit procedure.
  - The IXIT [7] describes the Non-Logged Time Adjustment Limit value implemented by the IUT, the supported range, and if a Non-Logged Time Adjustment Limit value of zero is within the range.
  - The Lower Tester acquires the IUT's Non_Logged_Time_Adjustment_Limit field value by reading the DT Parameters characteristic.

- Test Case Configuration

TCID	Operand Non_Logged_Time_Adjustment_Limit_New field value
DTS/SR/SPT/BV-06-C [Propose non-Logged Time Adjustment Limit with the Operand value set to a non-zero value]	A non-zero value in the range (as described in the IXIT [7]) that is different from the value read from the DT Parameters characteristic
DTS/SR/SPT/BV-07-C [Propose non-Logged Time Adjustment Limit with the Operand value set to zero]	0x0000 (if zero is within the range as described in the IXIT [7])

Table 4.10: DTCP Propose Non-Logged Time Adjustment Limit test cases

- Test Procedure

  For each test case in Table 4.10, based on the Non-Logged Time Adjustment Limit value read from the DT Parameters characteristic, perform the following steps:

  1. The Lower Tester writes the Propose Non-Logged Time Adjustment Limit Opcode (0x04) to the DTCP characteristic with operand Non_Logged_Time_Adjustment_Limit_New field value set as described in Table 4.10.
  2. The IUT sends an ATT_Handle_Value_Indication of the DTCP characteristic with the DTCP Response Opcode (0x09) and an operand representing the Request Opcode (0x04) followed by the Response Value for Success (0x01).
  3. The IUT receives an ATT_Handle_Value_Confirmation from the Lower Tester.
  4. The Lower Tester acquires the IUT's Non_Logged_Time_Adjustment_Limit value by reading the DT Parameters characteristic.

- Expected Outcome

  Pass verdict

  The IUT sends an ATT_Handle_Value_Indication of the DTCP characteristic with the Response Value for Success (0x01).

After the Propose Non-Logged Time Adjustment Limit procedure is completed, the IUT does not send an indication of the DT Parameters characteristic.

The DT Parameters characteristic is successfully read, and the Non-Logged Time Adjustment Limit value is verified as equivalent to the value used in step 1.

DTS/SR/SPT/BV-08-C [Retrieve Active Time Adjustments]

- Test Purpose

  Verify that the IUT allows a Lower Tester to execute the Retrieve Active Time Adjustments procedure.

- Reference

  [3] 3.7.2.5

- Initial Condition

  - Perform the preamble described in Section 4.2.3 to enable the IUT for use with the required <Control Point Characteristic> set to DTCP characteristic.

- Test Procedure

  1. The Lower Tester acquires the IUT's Non-Logged Time Change Active flag and Log Consolidation Active flag in the DT_Status field by reading the DT characteristic.
  2. The Lower Tester writes the Retrieve Active Time Adjustments Opcode (0x05) to the DTCP characteristic with no operand.
  3. The IUT sends an ATT_Handle_Value_Indication of the DTCP characteristic with the Report Active Time Adjustments Opcode (0x07) and an operand comprising the Base_Time, Active_Time_Adjustments, and, if supported, Base_Time_Second_Fractions fields.
  4. The IUT receives an ATT_Handle_Value_Confirmation from the Lower Tester.
  5. The Lower Tester acquires the IUT's time and status by reading the DT characteristic.

- Expected Outcome

  Pass verdict

  In step 1, the DT characteristic is successfully read and:

  If the Non-Logged Time Change Active flag OR the Log Consolidation Active flag is set to 1:

  The IUT is implementing Base Time adjustments, and in step 3, the IUT responds with an ATT_Handle_Value_Indication of the DTCP characteristic with valid values for the Base_Time, Active_Time_Adjustments, and, if supported, Base_Time_Second_Fractions fields;

  Else:

  The IUT is not implementing Base Time adjustments, and in step 3, the IUT responds with an ATT_Handle_Value_Indication of the DTCP characteristic with the Base_Time, Active_Time_Adjustments, and, if supported, Base_Time_Second_Fractions fields set to a value of zero.

4.6.4 Device Time Control Point – Error Handling

This test group contains test cases to verify compliant operation of the IUT when a Device Time Control Point (DTCP) is written with an invalid operand or a time update is rejected or other errors specific to the procedure or control point.

4.6.4.1 DTCP Response Values to Propose Time Updates

- Test Purpose

  For each test case in Table 4.11, verify that the IUT responds with the appropriate DTCP Response Value.

- Reference

  [3] 3.7.2.1, 3.7.2.2

- Initial Condition
  - Using the preamble described in Section 4.2.4, the IUT's:
    - UTC Aligned flag is set to 0.
    - Propose Time Update Request flag is set to 1.
  - Perform the preamble described in Section 4.2.3 to enable the IUT for use with the required <Control Point Characteristic> set to DTCP characteristic.
  - The Lower Tester acquires the IUT's supported features by reading the DT Feature characteristic, and the DT Status flags field by reading the DT characteristic.
  - The Lower Tester is authorized to execute the Propose Time Update procedure.

- Test Case Configuration

TCID	Time Update operand field values are as specified	DTCP Response Value
DTS/SR/SPE/BI-01-C [Propose Time Update rejected – Operand out of range case 1]	Base_Time_Update field value is out of range (the valid range is described in the IXIT [7]). UTC Aligned bit in Time_Update_Flags is set to 1. Time source is Global Positioning System (GPS).	Procedure Rejected (0x05), and with the Rejection Flags Bit 2 is set to 1, or Bit 9 is set to 1, or both Bit 2 and Bit 9 are set to 1
DTS/SR/SPE/BI-02-C [Propose Time Update rejected – Operand out of range case 2]	Time_Zone_Update field is set to a value outside the range (i.e., outside of the range -48 to +56, but not equal -128) or the DST_Offset_Update field is set to an RFU value. UTC Aligned flag in Time_Update_Flags is set to 1. Time source is Global Positioning System (GPS).	Procedure Rejected (0x05), and with the Rejection Flags Bit 2 is set to 1, or Bit 10 is set to 1, or both Bit 2 and Bit 10 are set to 1
DTS/SR/SPE/BI-03-C [Propose Time Update – Invalid Operand case 1]	Exclude Base_Time_Second_Fractions_Update field. UTC Aligned flag is set to 1. Time source is Global Positioning System (GPS).	Invalid Operand (0x03)

TCID	Time Update operand field values are as specified	DTCP Response Value
DTS/SR/SPE/BI-04-C [Propose Time Update – Invalid Operand case 2]	Include Base_Time_Second_Fractions_Update field value. UTC Aligned flag is set to 1. Time source is Global Positioning System (GPS).	Invalid Operand (0x03)

Table 4.11: Propose Time Update - Procedure rejected test cases

- Test Procedure

  For each test case in Table 4.11, perform the following steps once:

  1. The Lower Tester writes the Propose Time Update Opcode (0x02) to the DTCP characteristic with a Time Update operand, which maintains the same field values of the IUT except for the fields as described in Table 4.11.
  2. The IUT sends an ATT_Handle_Value_Indication of the DTCP characteristic with the DTCP Response Opcode (0x09) and an operand representing the Request Opcode (0x02) followed by the DTCP Response Value as described in Table 4.11.
  3. The IUT receives an ATT_Handle_Value_Confirmation from the Lower Tester.

- Expected Outcome

  Pass verdict

  For each test case, the IUT responds with an ATT_Handle_Value_Indication of the DTCP characteristic with DTCP Response Value as described in Table 4.11.

- Notes

  The bits not specified in the table are not relevant in the test cases and may either be set or zero.

4.6.4.2 Epoch Year 2000 flag not aligned with supported epoch

- Test Purpose

  Verify that the IUT does not allow a Time Update procedure with a Time Update operand with the Epoch Year 2000 flag of the Time_Update_Flags field set to a value not aligned with the IUT's Epoch Year.

- Reference

  [3] 3.7.2.2, 3.7.2.3

- Initial Condition

  - Perform the preamble described in Section 4.2.3 to enable the IUT for use with the required <Control Point Characteristic> set to DTCP characteristic.
  - The Lower Tester is authorized to execute the Time Update procedure.
  - The Lower Tester acquires the IUT's supported Epoch Year (a single Epoch Year) by reading the DT Feature characteristic.
  - The Lower Tester acquires the IUT's DT Status flags field by reading the DT characteristic, and the Propose Time Update Request flag is set to 1.

- Test Case Configuration

TCID	Time Update Opcode
DTS/SR/SPE/BI-05-C [Propose Time Update rejected - Epoch Year 2000 flag not aligned with supported epoch]	Proposed Time Update Opcode (0x02)
DTS/SR/SPE/BI-06-C [Force Time Update rejected - Epoch Year 2000 flag not aligned with supported epoch]	Force Time Update Opcode (0x03)

Table 4.12: Epoch Year 2000 flag not aligned with supported epoch

- Test Procedure

  For each test case in Table 4.12, perform the following steps:

  1. The Lower Tester writes the <Time Update Opcode>, as described in Table 4.12, to the DTCP characteristic with a Time Update operand with valid mandatory fields except for the Epoch Year 2000 flag of the Time_Update_Flags field, which is set to a value not aligned with the IUT's supported Epoch Year.
  2. The IUT sends an ATT_Handle_Value_Indication of the DTCP characteristic with the DTCP Response Opcode (0x09) and an operand representing the Request Opcode (<Time Update Opcode>) followed by the DTCP Response Value for Procedure Rejected (0x05), and with bit 6 of the Rejection Flags, Epoch Year flag is not aligned with Server supported features, set to 1.
  3. The IUT receives an ATT_Handle_Value_Confirmation from the Lower Tester.

- Expected Outcome

  Pass verdict

  The IUT sends an ATT_Handle_Value_Indication of the DTCP characteristic with Procedure Rejected (0x05), and with bit 6 of Rejection Flags set to 1.

DTS/SR/SPE/BI-07-C [Propose Non-Logged Time Adjustment Limit rejected - Proposed value is out of range]

- Test Purpose

  Verify that the IUT does not allow a Propose Non-Logged Time Adjustment Limit procedure with an operand Non-Logged Time Adjustment Limit value that is out of range.

- Reference

  [3] 3.2.1.5, 3.7.2.4

- Initial Condition

  - Perform the preamble described in Section 4.2.3 to enable the IUT for use with the required <Control Point Characteristic> set to DTCP characteristic.
  - The Lower Tester is authorized to execute the Propose Non-Logged Time Adjustment Limit procedure, and the range of allowed Non-Logged Time Adjustment Limit value is described in the IXIT [7].

- Test Procedure

  1. The Lower Tester writes the Propose Non-Logged Time Adjustment Limit Opcode (0x04) to the DTCP characteristic with an operand Non_Logged_Time_Adjustment_Limit_New field value that is out of the range described in the IXIT [7].

2. The IUT sends an ATT_Handle_Value_Indication of the DTCP characteristic with the DTCP Response Opcode (0x09) and an operand representing the Request Opcode (0x04) followed by the DTCP Response Value for Procedure Rejected (0x05) with bit 2 of Rejection Flags, Operand is out of range, set to 1.
3. The IUT receives an ATT_Handle_Value_Confirmation from the Lower Tester.

- Expected Outcome

  Pass verdict

  The IUT sends an ATT_Handle_Value_Indication of the DTCP characteristic with Procedure Rejected (0x05), and with bit 2 of Rejection Flags set to 1.

DTS/SR/SPE/BI-08-C [Procedure not Authorized]

- Test Purpose

  For at least one of the test patterns in Table 4.13, verify that the IUT does not allow the selected control point procedure when the Lower Tester is not authorized.

- Reference

  [3] 3.1.1.2.8

- Initial Condition

  - Perform the preamble described in Section 4.2.3 to enable the IUT for use with the required <Control Point Characteristic> set to DTCP characteristic.
  - The Lower Tester is not authorized to execute at least one of the DTCP procedures listed in Table 4.13.

- Test Procedure

  For each test pattern in Table 4.13, perform the following steps:

  1. The Lower Tester writes the <Opcode> to the DTCP characteristic with the <Operand>, with valid fields, described in Table 4.13.
  2. The IUT sends:
     an ATT_Handle_Value_Indication of the DTCP characteristic with the DTCP Response Opcode (0x09) and an operand representing the Request Opcode <Opcode> followed by the DTCP Response Value for Procedure Rejected (0x05) with bit 1 of Rejection Flags, Requested procedure is not authorized, set to 1.

     Or

     an ATT_Handle_Value_Indication of the DTCP characteristic with the DTCP Response Opcode (0x09) and an operand representing the Request Opcode <Opcode> followed by another DTCP Response Value.
  3. The IUT receives an ATT_Handle_Value_Confirmation from the Lower Tester.

- Expected Outcome

  Pass verdict

  The IUT sends at least one ATT_Handle_Value_Indication of the DTCP characteristic with Procedure Rejected (0x05), and with bit 1 of Rejection Flags set to 1.

Test Pattern	Reference	Opcode	Operand
1	[3] 3.7.2.2	Propose Time Update Opcode (0x02)	Time Update Operand
2	[3] 3.7.2.3	Force Time Update Opcode (0x03)	Time Update Operand
3	[3] 3.7.2.4	Propose Non-Logged Time Adjustment Limit Opcode (0x04)	Non_Logged_Time_Adjustment_Limit_New field value

Table 4.13: Test Cases for Procedure Rejected with Rejection Code Not authorized

DTS/SR/SPE/BI-09-C [DTCP - Op Code not supported]

- Test Purpose

  Verify that the IUT responds appropriately when a Lower Tester writes an Opcode to the DTCP with a value from the RFU range.

- Reference

  [3] 3.5.3

- Initial Condition

  - Perform the preamble described in Section 4.2.3 to enable the IUT for use with the required <Control Point Characteristic> set to DTCP characteristic.

- Test Procedure

  1. The Lower Tester writes an Opcode with a value from the RFU range to the DTCP characteristic.
  2. The IUT sends an ATT_Handle_Value_Indication of the DTCP characteristic with the DTCP Response Opcode (0x09) and an operand representing the Request Opcode followed by the DTCP Response Value for Opcode not supported (0x02).
  3. The IUT receives an ATT_Handle_Value_Confirmation from the Lower Tester.

- Expected Outcome

  Pass verdict

  The IUT sends an ATT_Handle_Value_Indication of the DTCP characteristic with Response Value for Opcode not supported (0x02).

DTS/SR/SPE/BI-10-C [DTCP - Invalid CRC]

- Test Purpose

  Verify that the IUT does not allow a write of the DTCP characteristic if the required E2E-CRC is invalid.

- Reference

  [3] 3.5.4, 3.7.2.2

- Initial Condition
  - Perform the preamble described in Section 4.2.3 to enable the IUT for use with the required <Control Point Characteristic> set to DTCP characteristic.
- Test Procedure
  1. The Lower Tester writes the Propose Time Update Opcode (0x02) to the DTCP characteristic with a Time Update operand, and with an invalid E2E_CRC field value attached.
  2. The IUT sends an ATT_Error_Response with the Error Code Invalid CRC (0x80).
  3. The Lower Tester receives an ATT_Error_Response with the Error Code Invalid CRC (0x80).
- Expected Outcome

  Pass verdict

  The IUT sends an ATT_Error_Response with the Error Code Invalid CRC (0x80).

4.7 Time Change Event Log Types

This test group contains test cases to verify that the IUT can create time change event log types based on time change events or changes to the DT Parameters characteristic.

DTS/SR/TCL/BV-01-C [Time Fault event]

- Test Purpose

  Verify that the IUT can create a Time_Fault event and responds with the correct formatting of the event log type.
- Reference

  [3] 3.4.1.1.2
- Initial Condition
  - The Lower Tester does not permit an ATT_MTU size larger than the default ATT_MTU size for LE to be negotiated.
  - Perform the preamble described in Section 4.2.3 to enable the IUT for use with the required <Control Point Characteristic> set to DTCP and RACP characteristics.
  - The Lower Tester acquires the IUT's DT Features by reading the DT Feature characteristic.
  - The Lower Tester acquires the Next_Sequence_Number field value by reading the DT characteristic.
  - The Lower Tester is authorized to execute the Propose Time Update procedure.
- Test Procedure
  1. Perform the required actions on the IUT, as described in Section 4.2.4, to generate a Time Fault.
     i) If the IUT disconnects, to induce the Time Fault, perform the preamble described in Section 4.2.3 to enable the IUT for use with the required <Control Point Characteristic> set to DTCP characteristic and RACP characteristic.
  2. Perform a time update procedure on the IUT by executing DTS/SR/SPT/BV-01-C [Propose Time Update] or DTS/SR/SPT/BV-02-C [Propose Time Update with Base Time Second-Fractions].
  3. The Lower Tester writes the Combined Report Opcode (0x07) to the RACP using an operator of Greater than or equal to and using the Sequence Number, Filter Type in the operand followed by

a minimum value for the filter representing the Next_Sequence_Number field value determined in the initial condition.

4. The IUT sends one or more ATT_Handle_Value_Notification of the Time Change Log Data characteristic. Each notification contains a Segmentation_Header field and a partial or a whole Time_Change_Log_Data_Record field as described in Section 3.4.1.2 of [3].
5. Once all the records have been notified, the IUT sends an ATT_Handle_Value_Indication of the RACP characteristic with the Combined Report Response Opcode (0x08), an operator of Null (0x00), and an operand representing the number of records that were sent.
6. The IUT receives an ATT_Handle_Value_Confirmation from the Lower Tester.

- Expected Outcome

  Pass verdict

  In step 2, the IUT successfully executes the time update procedure.

  In step 4, the IUT sends:

  - One or more notifications of the Time Change Log Data characteristic. Each notification contains a Segmentation_Header field with the appropriate values and a Time_Change_Log_Data_Record field.
    - The Time_Change_Log_Data_Record fields include a Time_Fault event and the Time_Update event created in step 2.
    - The value of each field of the Time_Fault event meets the requirements of the service.

  In step 5, the IUT sends one indication of the RACP characteristic with the Combined Report Response Opcode (0x08) and an operand representing the number of records that were sent.

DTS/SR/TCL/BV-02-C [Time Update event]

- Test Purpose

  Verify that the IUT can create a Time_Update event and responds with the correct formatting of the event log type.

- Reference

  [3] 3.4.1.1.1

- Initial Condition

  - The IUT is not in a Time Fault condition.
  - The Lower Tester does not permit an ATT_MTU size larger than the default ATT_MTU size for LE to be negotiated.
  - Perform the preamble described in Section 4.2.3 to enable the IUT for use with the required <Control Point Characteristic> set to DTCP and RACP characteristics.
  - The Lower Tester acquires the IUT's DT Features by reading the DT Feature characteristic.
  - The Lower Tester acquires the Next_Sequence_Number field value by reading the DT characteristic.
  - If in step 2B.1 the Propose Non-Logged Time Adjustment Limit procedure is used, the Lower Tester is authorized to execute the procedure.
  - The Lower Tester is authorized to execute the Propose Time Update procedure.

- Test Procedure

  1. Perform a time update procedure on the IUT by executing DTS/SR/SPT/BV-01-C [Propose Time Update] or DTS/SR/SPT/BV-02-C [Propose Time Update with Base Time Second-Fractions].
  2. Perform either alternative 2A or 2B to induce the creation of a log entry for another supported event log type.
     Alternative 2A (User_Time_Change event):
     2A.1. The Upper Tester induces the IUT to update the User_Time field via an interaction with the IUT's UI.
     Alternative 2B (DT_Parameters_Changed event):
     2B.1. Perform a Propose Non-Logged Time Adjustment Limit procedure on the IUT by executing DTS/SR/SPT/BV-06-C [Propose non-Logged Time Adjustment Limit with the Operand value set to a non-zero value] or DTS/SR/SPT/BV-07-C [Propose non-Logged Time Adjustment Limit with the Operand value set to zero], or the Upper Tester induces the IUT to update the Displayed_Formats field via an interaction with the IUT's UI.
  3. The Lower Tester writes the Combined Report Opcode (0x07) to the RACP using an operator of Greater than or equal to and using the Sequence Number, Filter Type in the operand followed by a minimum value for the filter representing the Next_Sequence_Number field value determined in the initial condition.
  4. The IUT sends one or more ATT_Handle_Value_Notification of the Time Change Log Data characteristic. Each notification contains a Segmentation_Header field and a partial or a whole Time_Change_Log_Data_Record field as described in Section 3.4.1.2 of [3].
  5. Once all the records have been notified, the IUT sends an ATT_Handle_Value_Indication of the RACP characteristic with the Combined Report Response Opcode (0x08), an operator of Null (0x00), and an operand representing the number of records that were sent.
  6. The IUT receives an ATT_Handle_Value_Confirmation from the Lower Tester.

- Expected Outcome

  Pass verdict

  In step 2, the IUT successfully executes a User_Time field update or an update to the described field of the DT Parameters characteristic.

  In step 4, the IUT sends:

  - One or more notifications of the Time Change Log Data characteristic. Each notification contains a Segmentation_Header field with the appropriate values and a Time_Change_Log_Data_Record field.
    - The Time_Change_Log_Data_Record fields include the Time_Update event created in step 1 followed by the User_Time_Change or DT_Parameters_Changed event created in step 2.
    - The value of each field of the Time_Update event meets the requirements of the service.

  In step 5, the IUT sends one indication of the RACP characteristic with the Combined Report Response Opcode (0x08) and an operand representing the number of records that were sent.

4.7.1 User Time Change or DT Parameters Changed event

- Test Purpose

  For each test case in Table 4.14, verify that the IUT can create the required event log type and responds with the correct formatting of the event logs.

- Reference

  [3] 3.4.1.1.3, 3.4.1.1.5

- Initial Condition

  - The Lower Tester does not permit an ATT_MTU size larger than the default ATT_MTU size for LE to be negotiated.
  - Perform the preamble described in Section 4.2.3 to enable the IUT for use with the required <Control Point Characteristic> set to DTCP and RACP characteristics.
  - The Lower Tester acquires the IUT's DT Features by reading the DT Feature characteristic.
  - The Lower Tester acquires the Next_Sequence_Number field value by reading the DT characteristic.
  - If in step 1 the Propose Non-Logged Time Adjustment Limit procedure is used, the Lower Tester is authorized to execute the procedure.

- Test Case Configuration

TCID	Event Log Type	Octets per log entry
DTS/SR/TCL/BV-03-C [User Time Change event]	User_Time_Change	16–26 octets depending on the IUT supported features
DTS/SR/TCL/BV-04-C [DT Parameters Changed event]	DT_Parameters_Changed	14–24 octets depending on the IUT supported features

Table 4.14: User Time Change and DT Parameters Changed event log type entries

- Test Procedure

  For each test case in Table 4.14, repeat the following steps:

  1. Perform the required actions between the Lower Tester and the IUT to generate the <Event Log Type> described in Table 4.14.
  2. The Lower Tester writes the Combined Report Opcode (0x07) to the RACP using an operator of Greater than or equal to and using the Sequence Number, Filter Type in the operand followed by a minimum value for the filter representing the Next_Sequence_Number field value determined in the initial condition.
  3. The IUT sends one or more ATT_Handle_Value_Notification of the Time Change Log Data characteristic. Each notification contains a Segmentation_Header field and a partial or a whole Time_Change_Log_Data_Record field as described in Section 3.4.1.2 of [3].
  4. Once all the records have been notified, the IUT sends an ATT_Handle_Value_Indication of the RACP characteristic with the Combined Report Response Opcode (0x08), an operator of Null (0x00), and an operand representing the number of records that were sent.
  5. The IUT receives an ATT_Handle_Value_Confirmation from the Lower Tester.

- Expected Outcome

  Pass verdict

  The IUT sends one or more notifications of the Time Change Log Data characteristic. Each notification contains a Segmentation_Header field with the appropriate values and a Time_Change_Log_Data_Record field.

  - The Time_Change_Log_Data_Record field contains the expected event log type fields according to the IUT's supported features as defined in [3].
  - The value of each field of the expected event log type meets the requirements of the service.
  - The different Event Log Types are not combined.

  The IUT sends one indication of the RACP characteristic with the Combined Report Response Opcode (0x08) and an operand representing the number of records that were sent.

4.7.2 Logging of Base Time changes

- Test Purpose

  For each test case in Table 4.15, verify that the IUT logs the time changes according to the Non-Logged Time Adjustment Limit described.

- Reference

  [3] 3.2.1.5, 3.4.1

- Initial Condition

  - The IUT is not in a Time Fault condition.
  - Using the preamble described in Section 4.2.4, the IUT's:
    - UTC Aligned flag is set to 0.
    - Propose Time Update Request flag is set to 1.
    - Non-Logged Time Change Active flag is set to 0.
    - Log Consolidation Active flag is set to 0.
  - Perform the preamble described in Section 4.2.3 to enable the IUT for use with the required <Control Point Characteristic> set to DTCP and RACP characteristics.
  - The Lower Tester does not permit an ATT_MTU size larger than the default ATT_MTU size for LE to be negotiated.
  - The Lower Tester acquires the IUT's DT Features by reading the DT Feature characteristic.
  - The Lower Tester acquires the IUT's Non-Logged Time Adjustment Limit field value as described in Table 4.15.
  - If in step 3B.1 the Propose Non-Logged Time Adjustment Limit procedure is used, the Lower Tester is authorized to execute the procedure.

- Test Case Configuration

TCID	Non-Logged Time Adjustment Limit	Base Time adjustment value
DTS/SR/TCL/BV-05-C [Logging of Base Time changes above the Non-Logged Time Adjustment Limit]	Value read from the DT Parameters characteristic, and the IXIT [7] describes the supported range	Exceeds the Non_Logged_Time_Adjustment_Limit value
DTS/SR/TCL/BV-06-C [Logging of trivial Base Time changes]	Set to a value of 0x0000	The Base Time value read in step 1

Table 4.15: Logging of Base Time changes based on Non-Logged Time Adjustment Limit value

- Test Procedure

  For each test case in Table 4.15, perform the following steps:

  1. The Lower Tester acquires the IUT's time and status by reading the DT characteristic.
  2. Perform a time update procedure on the IUT, by executing DTS/SR/SPT/BV-01-C [Propose Time Update] or DTS/SR/SPT/BV-02-C [Propose Time Update with Base Time Second-Fractions], using valid time update operand fields and with the Base Time adjustment value set as described in Table 4.15.
  3. Perform either alternative 3A or 3B to induce the creation of a log entry for another supported event log type.
     Alternative 3A (User_Time_Change event):
     3A.1. The Upper Tester induces the IUT to update the User_Time field via an interaction with the IUT's UI.
     Alternative 3B (DT_Parameters_Changed event):
     3B.1. Perform a Propose Non-Logged Time Adjustment Limit procedure on the IUT, by executing DTS/SR/SPT/BV-06-C [Propose non-Logged Time Adjustment Limit with the Operand value set to a non-zero value] or DTS/SR/SPT/BV-07-C [Propose non-Logged Time Adjustment Limit with the Operand value set to zero], or the Upper Tester induces the IUT to update the Displayed_Formats field via an interaction with the IUT's UI.
  4. The Lower Tester writes the Combined Report Opcode (0x07) to the RACP using an operator of Greater than or equal to and using the Sequence Number, Filter Type in the operand followed by a minimum value for the filter representing the Next_Sequence_Number field value determined in step 1.
  5. The IUT sends one or more ATT_Handle_Value_Notification of the Time Change Log Data characteristic. Each notification contains a Segmentation_Header field and a partial or a whole Time_Change_Log_Data_Record field as described in Section 3.4.1.2 of [3].
  6. Once all the records have been notified, the IUT sends an ATT_Handle_Value_Indication of the RACP characteristic with the Combined Report Response Opcode (0x08), an operator of Null (0x00), and an operand representing the number of records that were sent.
  7. The IUT receives an ATT_Handle_Value_Confirmation from the Lower Tester.
  8. The Lower Tester acquires the IUT's time and status by reading the DT characteristic.

- Expected Outcome

  Pass verdict

  In step 2, the IUT successfully executes the time update procedure.

In step 5, the IUT sends:

- One or more notifications of the Time Change Log Data characteristic. Each notification contains a Segmentation Header field with the appropriate values and a Time_Change_Log_Data_Record field.
  - The Time_Change_Log_Data_Record fields include the Time_Update event created in step 2 followed by the User_Time_Change or DT_Parameters_Changed event created in step 3.
  - The value of each field of the Time_Update event meets the requirements of the service.

In step 6, the IUT sends one indication of the RACP characteristic with the Combined Report Response Opcode and an operand representing the number of records that were sent.

In step 8, the DT characteristic is successfully read, and the Log Consolidation Active flag in the DT Status field is set 0.

DTS/SR/TCL/BV-07-C [Accumulation of non-logged time adjustments exceeds the Non-Logged Time Adjustment Limit]

- Test Purpose

  Verify that the IUT logs a time change from a Base Time update that causes the accumulation of non-logged time adjustments to exceed the Non-Logged Time Adjustment Limit.

- Reference

  [3] 3.4.1.1.1.2

- Initial Condition
  - The IUT is not in a Time Fault condition.
  - Using the preamble described in Section 4.2.4, the IUT's:
    - UTC Aligned flag is set to 0.
    - Propose Time Update Request flag is set to 1.
    - Non-Logged Time Change Active flag is set to 0.
    - Log Consolidation Active flag is set to 0.
  - Perform the preamble described in Section 4.2.3 to enable the IUT for use with the required <Control Point Characteristic> set to DTCP and RACP characteristic.
  - The Lower Tester does not permit an ATT_MTU size larger than the default ATT_MTU size for LE to be negotiated.
  - The IXIT [7] describes the Non-Logged Time Adjustment Limit value implemented by the IUT, a non-zero value, and the supported range.
  - The Lower Tester acquires the IUT's Non_Logged_Time_Adjustment_Limit field value by reading the DT Parameters characteristic.

- Test Procedure

  1. The Lower Tester acquires the IUT's time and status by reading the DT characteristic.
  2. Perform a series of time updates by executing the DTS/SR/SPT/BV-01-C [Propose Time Update] or DTS/SR/SPT/BV-02-C [Propose Time Update with Base Time Second-Fractions] procedure, with Base Time adjustment values that are less than the Non_Logged_Time_Adjustment_Limit

field value. The series of time updates cause the accumulation of non-logged time adjustments to exceed the Non-Logged Time Adjustment Limit value.

3. The Lower Tester writes the Combined Report Opcode (0x07) to the RACP using an operator of Greater than or equal to and using the Sequence Number, Filter Type in the operand followed by a minimum value for the filter representing the Next_Sequence_Number field value determined in step 1.
4. The IUT sends one or more ATT_Handle_Value_Notification of the Time Change Log Data characteristic. Each notification contains a Segmentation_Header field and a partial or a whole Time_Change_Log_Data_Record field as described in Section 3.4.1.2 of [3].
5. The IUT sends an ATT_Handle_Value_Indication of the RACP characteristic with the Combined Report Response Opcode (0x08), an operator of Null (0x00), and an operand representing the number of records that were sent.
6. The IUT receives an ATT_Handle_Value_Confirmation from the Lower Tester.

- Expected Outcome

  Pass verdict

  In step 2, the IUT successfully executes the series of time update procedures.

  In step 4, the IUT sends:

  - One or more notifications of the Time Change Log Data characteristic. Each notification contains a Segmentation_Header field with the appropriate values and a Time_Change_Log_Data_Record field.
    - The Time_Change_Log_Data_Record fields include the Time_Update event, created in step 2, with the expected fields in which:
      - The Non_Logged_Time_Adjustment_Counter field represents the number of non-logged adjustments to the Base Time.
      - The Active_Time_Adjustments field comprises the Accumulated_Non_Logged_Base_Time_Seconds, and, if supported, the Accumulated_Non_Logged_Base_Time_Second_Fractions, which report the accumulated Base Time adjustments.

  In step 5, the IUT sends one indication of the RACP characteristic with the Combined Report Response Opcode and an operand representing the number of records that were sent.

4.8 Record Access Control Point procedures

This test group contains test cases to verify that the IUT can be configured, conducts compliant operation, provides correctly formatted values of the Time Change Log Data characteristic, and correctly interprets values of the Record Access Control Point characteristic.

Table 3.24 in [3] defines the Opcodes, operators, and operand values used in the Record Access Control Point procedure test cases in this section.

This test group uses the operators and operands listed in Table 4.16.

Operator	Operand
	Sequence Number (0x01)
All records (0x01)	N/A
First record (0x05)	N/A
Last record (0x06)	N/A

Operator	Operand
	Sequence Number (0x01)
Greater than or equal to (0x03)	<Min filter value>
Less than or equal to (0x02)	<Max filter value>
Within range of (inclusive) (0x04)	<Min filter value>, <Max filter value>

Table 4.16: RACP – Operators and Operands

DTS/SR/RAC/BV-01-C [Combined Report procedure]

- Test Purpose

  Verify that the IUT can perform the Combined Report procedure with the combination of operators and, if applicable, the Operand Sequence Number listed in Table 4.16.

- Reference

  [3] 3.8.3.2

- Initial Condition

  - The Lower Tester does not permit an ATT_MTU size larger than the default ATT_MTU size for LE to be negotiated.
  - Perform the preamble described in Section 4.2.3 to enable the IUT for use with the required <Control Point Characteristic> set to RACP characteristic.
  - Perform an action on the IUT that induces it to generate at least 3 records comprising time changes.
  - The Lower Tester acquires the last Sequence Number by reading the Next_Sequence_Number field value in the DT characteristic.

- Test Procedure

  1. For each <Operator> in Table 4.16, perform the following steps:

     a. The Lower Tester writes the Combined Report Opcode (0x07) to the RACP characteristic using the listed <Operator> and, if applicable, Operand Sequence Number and corresponding filter parameter(s).

        i. IF the <Operator> is NOT supported, the IUT sends an ATT_Handle_Value_Indication of the RACP characteristic with the Response Code Opcode (0x06), an operator of Null (0x00), and an operand representing the Request Opcode (0x07) followed by the Response Code Value for Operator not supported (0x04).

        ii. ELSE IF for the Operand Sequence Number NO corresponding record exists for the filter value or range:

            a. The IUT sends an ATT_Handle_Value_Indication of the RACP characteristic with the Combined Report Response Opcode (0x08), an operator of Null (0x00), and an operand representing that no records were found (0x0000).

        iii. ELSE, the IUT sends one or more ATT_Handle_Value_Notification of the Time Change Log Data characteristic. Each notification contains a

Segmentation_Header field and a partial or a whole Time_Change_Log_Data_Record field as described in Section 3.4.1.2 of [3].

a. The IUT sends an ATT_Handle_Value_Indication of the RACP characteristic with the Combined Report Response Opcode (0x08), an operator of Null (0x00) and an operand representing the number of records that were sent.

iv. The IUT receives an ATT_Handle_Value_Confirmation from the Lower Tester.

2. Verify that the control point behavior meets the requirements of the service.

- Expected Outcome

  Pass verdict

  For each <Operator> based on the Time Change Log Data characteristic size and the default ATT_MTU size, the IUT sends:

  - One or more notifications of the Time Change Log Data characteristic; each notification contains a Segmentation_Header field with the appropriate values and the Time_Change_Log_Data_Record field

    and

  - An indication with the Combined Report Response Opcode (0x08) and the number of records that were sent

  OR

  - The appropriate error message

DTS/SR/RAR/BV-01-C [Report Stored Records procedure]

- Test Purpose

  Verify that the IUT can perform the Report Stored Records procedure with the combination of Operators and, if applicable, Operand Sequence Number listed in Table 4.16.

- Reference

  [3] 3.8.3.3

- Initial Condition

  - The Lower Tester does not permit an ATT_MTU size larger than the default ATT_MTU size for LE to be negotiated.
  - Perform the preamble described in Section 4.2.3 to enable the IUT for use with the required <Control Point Characteristic> set to RACP characteristic.
  - Perform an action on the IUT that induces it to generate at least 3 records comprising time changes.
  - The Lower Tester acquires the last Sequence Number by reading the Next_Sequence_Number field value in the DT characteristic.

- Test Procedure

  1. For each <Operator> in Table 4.16, perform the following steps:

     a. The Lower Tester writes the Report Stored Records Opcode (0x01) to the RACP characteristic using the listed <Operator>, and, if applicable, Operand Sequence Number and corresponding filter parameter(s).

        i. IF the <Operator> is NOT supported, the IUT sends an ATT_Handle_Value_Indication of the RACP characteristic with the Response Code Opcode (0x06), an operator of Null (0x00), and an operand representing the Request Opcode (0x01) followed by the Response Code Value for Operator not supported (0x04).

        ii. ELSE IF for the Operand Sequence Number NO corresponding record exists for the filter value range, the IUT sends an ATT_Handle_Value_Indication of the RACP characteristic with the Response Code Opcode (0x06), an operator of Null (0x00), and an operand representing the Request Opcode (0x01) followed by the Response Code Value for No records found (0x06).

        iii. ELSE, the IUT sends one or more ATT_Handle_Value_Notification of the Time Change Log Data characteristic. Each notification contains a Segmentation_Header field and a partial or a whole Time_Change_Log_Data_Record field as described in Section 3.4.1.2 of [3].

           a. The IUT sends an ATT_Handle_Value_Indication of the RACP characteristic with the Response Code Opcode (0x06), an operator of Null (0x00), and an operand representing the Request Opcode (0x01) followed by the Response Code Value for Success (0x01).

        iv. The IUT receives an ATT_Handle_Value_Confirmation from the Lower Tester.

  2. Verify that the control point behavior meets the requirements of the service.

- Expected Outcome

  Pass verdict

  For each <Operator> based on the Time Change Log Data characteristic size and the default ATT_MTU size, the IUT sends:

  - One or more notifications of the Time Change Log Data characteristic; each notification contains a Segmentation_Header field with the appropriate values and the Time_Change_Log_Data_Record field

    and

  - An indication with the Response Code Value for Success (0x01)

  OR

  - The appropriate error message

DTS/SR/RAN/BV-01-C [Report Number of Stored Records procedure]

- Test Purpose

  Verify that the IUT can perform the Report Number of Stored Records procedure with the combination of Operators listed in Table 4.16.

- Reference

  [3] 3.8.3.4

- Initial Condition

  - Perform the preamble described in Section 4.2.3 to enable the IUT for use with the required <Control Point Characteristic> set to RACP characteristic.
  - Perform an action on the IUT that induces it to generate at least 5 records comprising time changes.
  - The Lower Tester acquires the last Sequence Number by reading the Next_Sequence_Number field value in the DT characteristic.

- Test Procedure

  1. For each <Operator> in Table 4.16, perform the following steps:
     a. The Lower Tester writes the Report Number of Stored Records Opcode (0x04) to the RACP characteristic using the listed <Operator> and, if applicable, Operand Sequence Number and corresponding filter parameter(s).
        i. IF the <Operator> is NOT supported, the IUT sends an ATT_Handle_Value_Indication of the RACP characteristic with the Response Code Opcode (0x06), an operator of Null (0x00), and an operand representing the Request Opcode (0x04) followed by the Response Code Value for Operator not supported (0x04).
        ii. ELSE, the IUT sends an ATT_Handle_Value_Indication of the RACP characteristic with the Number of Stored Records Response Opcode (0x05), an operator of Null (0x00), and an operand representing the number of records that were found.
        iii. The IUT receives an ATT_Handle_Value_Confirmation from the Lower Tester.
  2. Verify that the control point behavior meets the requirements of the service.

- Expected Outcome

  Pass verdict

  For each <Operator> the IUT sends:

  - One indication of the RACP characteristic with the Number of Stored Records Response with an operand representing the number of records that were found

  OR

  - One indication of the RACP characteristic with the Response Value for Operator not supported (0x04)

DTS/SR/RAA/BV-01-C [Abort Operation procedure]

- Test Purpose

  Verify that the IUT can perform the Abort Operation procedure.

- Reference

  [3] 3.8.3.5

- Initial Condition
  - Perform the preamble described in Section 4.2.3 to enable the IUT for use with the required <Control Point Characteristic> set to RACP characteristic.
- Test Procedure
  1. Perform an action on the IUT that induces it to generate enough records such that the transmission does not complete before an abort procedure is attempted.
  2. The Lower Tester writes the Combined Report Opcode (0x07) to the RACP characteristic using an operator of All records.
  3. The IUT starts to send ATT_Handle_Value_Notifications of the Time Change Log Data characteristic.
  4. The Lower Tester writes the Abort Operation Opcode (0x03) to the RACP characteristic with an operator of Null (0x00) and no operand.
  5. The IUT sends an ATT_Handle_Value_Indication of the RACP characteristic with the Response Code Opcode (0x06), an operator of Null (0x00), and an operand representing the Request Opcode (0x03) followed by the Response Code Value for Success (0x01).
  6. The IUT receives an ATT_Handle_Value_Confirmation from the Lower Tester.
  7. Verify that the notifications stop.
- Expected Outcome

  Pass verdict

  The IUT sends some but not all notifications of the Time Change Log Data characteristic.

  The IUT sends one indication of the RACP characteristic with the Response Code Value for Success (0x01).

4.8.1 Record Access Control Point Procedures – Error Handling

This test group contains test cases to verify compliant operation of the IUT when the Record Access Control Point Procedures is written with values outside defined ranges, or considered invalid or unexpected.

4.8.1.1 RACP Opcode, Operator not supported and Invalid Operand test cases

- Test Purpose

  For each test case in Table 4.17, verify that the IUT responds with the <Request Opcode, Response Code Value> when a Lower Tester writes the <Opcode, Operator, and Operand>, described in Table 4.17, to the RACP characteristic.
- Reference

  [3] 3.5.3, 3.8.3.2, 3.8.3.6
- Initial Condition
  - Perform the preamble described in Section 4.2.3 to enable the IUT for use with the RACP characteristic.

- Test Case Configuration

Test Case ID	Opcode, Operator, and Operand	Request Opcode, Response Code Value
DTS/SR/RAE/BI-01-C [RACP – Op Code not Supported]	Opcode = RFU value Operator = 0x01 (All records) Operand = N/A	Request Opcode = RFU value Response Code Value = 0x02 (Opcode Not Supported)
DTS/SR/RAE/BI-02-C [RACP – Operand not Supported]	Opcode = 0x07 (Combined Report) Operator = 0x03 (Greater than or equal to) Operand Filter Type = RFU value followed by an appropriate Filter Parameters (minimum filter value)	Request Opcode = 0x07 (Combined Report) Response Code Value = 0x09 (Operand not supported)
DTS/SR/RAE/BI-03-C [RACP – Invalid Operator]	Opcode = 0x07 (Combined Report) Operator = 0x00 (Null) Operand = 0x01 (Sequence Number)	Request Opcode = 0x07 (Combined Report) Response Code Value = 0x03 (Invalid Operator)

Table 4.17: RACP Opcode, Operator, and Operand error handling test cases

- Test Procedure

  For each test case in Table 4.17, perform the following steps:

  1. The Lower Tester writes the <Opcode, Operator, and Operand>, as described in Table 4.17, to the RACP characteristic.
  2. The IUT sends an ATT_Handle_Value_Indication of the RACP characteristic with the Response Code Opcode (0x06), an operator of Null (0x00), and the operand with the <Request Opcode, Response Code Value> described in Table 4.17.
  3. The IUT receives an ATT_Handle_Value_Confirmation from the Lower Tester.

- Expected Outcome

  Pass verdict

  For each test case, the IUT sends an indication of the RACP characteristic with <Request Opcode, Response Code Value> as described in Table 4.17.

5 Test Case Mapping

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

The columns for the TCMT are defined as follows:

Item: Contains 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 DTS [4].

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

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.

For the purpose and structure of the ICS/IXIT and instructions for completing the ICS/IXIT, refer to the Bluetooth ICS and IXIT Proforma documents.

Item	Feature	Test Case(s)
DTS 3/1	Device Time Service and mandatory characteristics	DTS/SR/SGGIT/SER/BV-01-C DTS/SR/SGGIT/CHA/BV-02-C DTS/SR/SGGIT/CHA/BV-03-C DTS/SR/SGGIT/CHA/BV-04-C DTS/SR/SGGIT/CHA/BV-06-C DTS/SR/SGGIT/CP/BI-01-C DTS/SR/CON/BV-02-C DTS/SR/CON/BV-04-C DTS/SR/SPE/BI-09-C
DTS 1/1	Service Supported over BR/EDR	DTS/SR/SGGIT/SDP/BV-08-C
DTS 2/21	Configure Indication – Device Time (DT) Feature	DTS/SR/CON/BV-06-C
DTS 2/21 AND (DTS 7/1 OR DTS 7/2)	DT Feature characteristic indication after reconnection	DTS/SR/CI/BV-09-C
DTS 2/14	Configure Indication - Device Time Parameters	DTS/SR/CON/BV-01-C
DTS 2/14 AND (DTS 7/1 OR DTS 7/2)	DT Parameters characteristic indication after reconnection	DTS/SR/CI/BV-01-C DTS/SR/CI/BV-02-C
DTS 3/4 AND (DTS 7/1 OR DTS 7/2)	Device Time characteristic indication after reconnection	DTS/SR/CI/BV-03-C DTS/SR/CI/BV-04-C DTS/SR/CI/BV-05-C DTS/SR/CI/BV-07-C DTS/SR/CI/BV-08-C
DTS 2/18 AND (DTS 7/1 OR DTS 7/2)	DT characteristic indication due to a Base Time update performed by another Client	DTS/SR/CI/BV-10-C
DTS 2/7 AND (DTS 7/1 OR DTS 7/2)	DT characteristic indication due to a User Time field change	DTS/SR/CI/BV-06-C

Item	Feature	Test Case(s)
DTS 2/2	Time Change Log Data and Record Access Control Point	DTS/SR/SGGIT/CHA/BV-05-C DTS/SR/SGGIT/CHA/BV-07-C DTS/SR/RAE/BI-01-C DTS/SR/CON/BV-03-C DTS/SR/CON/BV-05-C
DTS 4/1 AND (DTS 2/10 OR DTS 2/11) AND (NOT DTS 2/3) AND DTS 2/18	Propose Time Update	DTS/SR/SPT/BV-01-C
DTS 4/1 AND (DTS 2/10 OR DTS 2/11) AND DTS 2/3 AND DTS 2/18	Propose Time Update with Base Time Second-Fractions	DTS/SR/SPT/BV-02-C
DTS 4/1 AND (DTS 2/10 OR DTS 2/11) AND DTS 2/15 AND DTS 2/18 AND (DTS 7/1 OR DTS 7/2)	Propose Time Update with concurrent connections	DTS/SR/SPT/BV-03-C
DTS 4/2 AND (DTS 2/10 OR DTS 2/11) AND NOT DTS 2/3	Force Time Update	DTS/SR/SPT/BV-04-C
DTS 4/2 AND (DTS 2/10 OR DTS 2/11) AND DTS 2/3	Force Time Update with Base Time Second-Fractions value	DTS/SR/SPT/BV-05-C
DTS 4/3	Propose Non-Logged Time Adjustment Limit	DTS/SR/SPT/BV-06-C
DTS 4/3 AND DTS 2/22	Propose Non-Logged Time Adjustment Limit rejected - Proposed value is out of range	DTS/SR/SPE/BI-07-C
DTS 4/3 AND DTS 2/16	Propose Non-Logged Time Adjustment Limit with the Operand value set to zero	DTS/SR/SPT/BV-07-C
DTS 4/4	Retrieve Active Time Adjustments	DTS/SR/SPT/BV-08-C
DTS 4/1 AND DTS 2/19	Propose Time Update rejected – Operand out of range case 1	DTS/SR/SPE/BI-01-C
DTS 4/1	Propose Time Update rejected – Operand out of range case 2	DTS/SR/SPE/BI-02-C
DTS 4/1 AND DTS 2/3	Propose Time Update – Invalid Operand case 1	DTS/SR/SPE/BI-03-C
DTS 4/1 AND NOT DTS 2/3	Propose Time Update – Invalid Operand case 2	DTS/SR/SPE/BI-04-C
DTS 4/1 AND ((DTS 2/10 AND NOT DTS 2/11) OR (DTS 2/11 AND NOT DTS 2/10))	Propose Time Update rejected – Epoch Year 2000 flag not aligned with supported epoch	DTS/SR/SPE/BI-05-C
DTS 4/2 AND ((DTS 2/10 AND NOT DTS 2/11) OR (DTS 2/11 AND NOT DTS 2/10))	Force Time Update rejected – Epoch Year 2000 flag not aligned with supported epoch	DTS/SR/SPE/BI-06-C
DTS 2/8 AND DTS 4/1	Procedure not Authorized	DTS/SR/SPE/BI-08-C

Item	Feature	Test Case(s)
DTS 2/2 AND (DTS 2/1 OR DTS 2/3 OR DTS 2/10 OR DTS 2/11) AND DTS 4/1 AND DTS 2/17	Time Fault event log type	DTS/SR/TCL/BV-01-C
DTS 2/2 AND (DTS 2/1 OR DTS 2/3 OR DTS 2/6 OR DTS 2/7 OR DTS 2/10 OR DTS 2/11 OR DTS 2/12) AND DTS 2/18 AND DTS 4/1	Time Update event log type	DTS/SR/TCL/BV-02-C DTS/SR/TCL/BV-05-C
DTS 2/2 AND DTS 2/7	User Time Change event log type	DTS/SR/TCL/BV-03-C
DTS 2/2 AND (DTS 2/6 OR DTS 2/12)	DT Parameters Changed event log type	DTS/SR/TCL/BV-04-C
DTS 2/2 AND (DTS 2/1 OR DTS 2/3 OR DTS 2/6 OR DTS 2/7 OR DTS 2/10 OR DTS 2/11) AND DTS 2/12 AND DTS 2/16 AND DTS 2/18 AND DTS 4/1	Logging of trivial Base Time changes	DTS/SR/TCL/BV-06-C
DTS 2/2 AND (DTS 2/1 OR DTS 2/3 OR DTS 2/6 OR DTS 2/7 OR DTS 2/10 OR DTS 2/11) AND DTS 2/18 AND DTS 4/1	Accumulation of non-logged time adjustments exceeds the Non-Logged Time Adjustment Limit	DTS/SR/TCL/BV-07-C
DTS 5/1	Combined Report	DTS/SR/RAC/BV-01-C DTS/SR/RAE/BI-02-C DTS/SR/RAE/BI-03-C
DTS 5/2	Report Stored Records	DTS/SR/RAR/BV-01-C
DTS 5/3	Report Number of Stored Records	DTS/SR/RAN/BV-01-C
DTS 5/4	Abort Operation	DTS/SR/RAA/BV-01-C
DTS 4/1 AND DTS 2/1 AND (DTS 2/10 OR DTS 2/11)	DTCP – Invalid CRC	DTS/SR/SPE/BI-10-C

Table 5.1: Test case mapping

6 Device Time Control Point Test Matrix

The following table summarizes the combination of some of the Device Time Control Point Opcodes and the DTCP Response Values that are tested and not tested. For the table, below, the following key applies:

YES = A test for this combination exists.

NO = A test for this combination does not exist.

N/A = Not a valid combination.

Device Time CP Response Value	**Device Time CP Opcode**				
	Propose Time Update	Force Time Update	Propose Non-Logged Time Adjustment Limit	Retrieve Active Time Adjustments	Other
Success	YES	YES	YES	N/A	N/A
Opcode not supported	N/A	N/A	N/A	N/A	YES
Invalid Operand	YES	NO	NO	N/A	N/A
Operation failed	NO	NO	NO	NO	N/A
Procedure Rejected	YES	YES	YES	NO	N/A
Device Busy	NO	NO	NO	NO	N/A

Table 6.1: DTCP Response Code test coverage

7 Record Access Control Point Test Matrix

The following tables summarize the features of RACP and the combinations with other features that are tested and not tested. For the tables below, the following key applies:

YES = A test for this combination exists.

NO = A test for this combination does not exist.

N/A = Not a valid combination.

RACP Operators	**RACP Request Opcodes**			
	Combined Report	Report Stored Records	Report Number of Stored Records	Abort Operation
All records	YES	YES	YES	N/A
First record	YES	YES	YES	N/A
Last record	YES	YES	YES	N/A
Greater than or equal to	YES	YES	YES	N/A
Less than or equal to	YES	YES	YES	N/A
Within range of (inclusive)	YES	YES	YES	N/A
Null	N/A	N/A	N/A	YES

Table 7.1: RACP Operator test coverage

RACP Response Code Values	**RACP Request Opcodes**				
	Combined Report	Report Stored Records	Report Number of Stored Records	Abort Operation	Other
Success	N/A	YES	N/A	YES	N/A
Opcode not supported	N/A	N/A	N/A	N/A	YES
Invalid Operator	YES	NO	N/A	NO	N/A
Operator not supported	YES	YES	YES	NO	N/A
Invalid Operand	YES	NO	N/A	NO	N/A
No records found	N/A	YES	N/A	N/A	N/A
Abort unsuccessful	N/A	N/A	N/A	NO	N/A
Procedure not completed	NO	NO	NO	NO	N/A
Operand not supported	YES	NO	NO	N/A	N/A
Procedure not applicable	NO	NO	NO	N/A	N/A

RACP Response Code Values	**RACP Request Opcodes**				
	Combined Report	Report Stored Records	Report Number of Stored Records	Abort Operation	Other
Procedure already in progress	NO	NO	NO	NO	N/A

Table 7.2: RACP Response Code test coverage

RACP Operators	**Filter Type**
	Sequence Number
All records	N/A
First record	N/A
Last record	N/A
Greater than or equal to	YES
Less than or equal to	YES
Within range of (inclusive)	YES
Null	N/A

Table 7.3: RACP Filter Type test coverage

8 Revision history and contributors

Revision History

Publication Number	Revision Number	Date	Comments
	D0.9.0r00–r16	2019-01-15 – 2020-01-02	Updated TS based on DTS D09r02. Updated TS based on DTS D09r03. Updated TCMT based on DTS.ICS 0.9.0r01. Aligned TS with proposed TS template. Updated the GGIT test numbering, aligned TS with approved TS template. Updated test case IDs, DTCP test procedures. Per Formal IOP and F2F feedback: • Updated DTS indications TCs, removed redundant indication test cases covered by the updated DTS TCs indications. • Added new TC DTS/SR/SPT/BV-03-C. • Removed DTS/SR/SPT/BV-09-C as test case is now incorporated by updated DTS/SR/SPT/BV-08-C. • Updated Section 4.6, Time Change Logging Events, TCs. Updated TS based on DTS D09r04. Updated Table 4.3 in Section 4.2.4 by removing the links to test cases and referencing the required test procedures. Updated TCMT. The Last Logged Sequence Number field in DT characteristic was renamed “Next Sequence Number” field. Accordingly, updated all references to Last Logged Sequence Number field in DTS.TS. Updated DTS/SR/TCL/BV-01-C by removing the reference to Time Update event log from the Pass Verdict as it is not the purpose of the test to verify its presence. DTS/SR/SPE/BI-03-C updated step 2 and Pass verdict to refer to bit 2 as updated DTS spec set bit 7 to RFU. Updated pass verdicts for: • DTS/SR/TCL/BV-01-C [Time Fault event log] • DTS/SR/TCL/BV-02-C [Time Update event log] • DTS/SR/TCL/BV-03-C [User Time Change or DT Parameter Changed event logs] Removed DTS/SR/TCL/BV-06-C [Consolidated Base Time Adjustments] and updated TCMT. Updated DTS/SR/SPE/BI-01-C and added DTS/SR/SPE/BI-08-C and updated TCMT. Updated DTS/SR/SPE/BI-01-C by removing test patterns 3, 4, 5 and 8. Added DTS/SR/SPE/BI-09-C and updated TCMT. Removed DTS/SR/SPE/BI-09-C.

Publication Number	Revision Number	Date	Comments
			Added DTS/SR/TCL/BV-TBA-C by splitting DTS/SR/TCL/BV-03-C in two test cases. Updated the test patterns in DTS/SR/SPE/BI-01-C into two distinct test cases: DTS/SR/SPE/BI-01-C and DTS/SR/SPE/BI-TBA2-C and updated TCMT. Updated DTS/SR/SPE/BI-07-C. Updated the initial condition for time update procedures. Updated DTS/SR/SPE/BI-04-C and DTS/SR/SPE/BI-05-C. Removed DTS/SR/SPE/BI-06-C. Added DTS/SR/SPE/BI-TBA5-C. Removed DTS/SR/GEH/BI-02-C. Updated TS based on DTS D09r05. Removed the DTCP and RACP error handling test cases by convert TCs to use the GGIT control point tests. Renumbered the TCs in Section 4.5. Updated TCID to Header 8 and TOC 8 style into the table of content. Due to the updated GGIT tests (TSE 13087) added: • DTS/SR/CON/BV-01-C [Configure Indication - Device Time Parameters] • DTS/SR/CON/BV-02-C [Configure Indication - Device Time] • DTS/SR/CON/BV-03-C [Configure Notification - Time Change Log Data] • DTS/SR/CON/BV-04-C [Configure Indication - Device Time Control Point] • DTS/SR/CON/BV-05-C [Configure Indication - Record Access Control Point] Updated TS to DTS d09r05_20181218. Updated TCID headings in tables to Header 9,TCID-Table.
	p0r00–r10	2020-03-22 – 2020-11-23	Updated TS to DTS_d1.0r00. Updated TS to DTS_d1.0r01. Updated (Issue ID 14852): GGIT/ICP test cases to standalone test cases, and DTS/SR/SGGIT/CP/BI-02-C to standalone TC DTS/SR/SPE/BI-10-C. Updated (Issue ID 14852): DTS/SR/RAE/BI-01-C – 03-C into a test group table format and TCMT. Updated TS to DTS_d1.0r03. Updated TS to DTS_d1.0r05 and DTS.ICS.d1.0r03. Added: SDP GGIT test case DTS/SR/SGGIT/SDP/BV-08-C [SDP Record – Device Time Service], DTS/SR/CON/BV-06-C [Configure Indication - Device Time Feature], and

Publication Number	Revision Number	Date	Comments
			DTS/SR/CI/BV-09-C [DT Feature characteristic indication]. Updated document numbering. Updated Table 4.3. Updated Table 4.4 (Issue ID 16034).
	p0	2020-12-02	Approved by BTI on 2020-12-02. DTS v1.0 adopted by the BoD on 2020-12-15. Prepared for publication.

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