Current Time Service (CTS)

Bluetooth® Test Suite

- **Revision**: CTS.TS.1.1.2 edition 2
- **Revision Date**: 2019-12-03
- **Group Prepared By**: BTI
- **Feedback Email**: bti-main@bluetooth.org
This document, regardless of its title or content, is not a Bluetooth Specification subject to the licenses granted by the Bluetooth SIG Inc. (“Bluetooth SIG”) and its members under the Bluetooth Patent/Copyright License Agreement and Bluetooth Trademark License Agreement.

THIS DOCUMENT IS PROVIDED “AS IS” AND BLUETOOTH SIG, ITS MEMBERS, AND THEIR AFFILIATES MAKE NO REPRESENTATIONS OR WARRANTIES AND DISCLAIM ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY, TITLE, NON-INFRINGEMENT, FITNESS FOR ANY PARTICULAR PURPOSE, THAT THE CONTENT OF THIS DOCUMENT IS FREE OF ERRORS.

TO THE EXTENT NOT PROHIBITED BY LAW, BLUETOOTH SIG, ITS MEMBERS, AND THEIR AFFILIATES DISCLAIM ALL LIABILITY ARISING OUT OF OR RELATING TO USE OF THIS DOCUMENT AND ANY INFORMATION CONTAINED IN THIS DOCUMENT, INCLUDING LOST REVENUE, PROFITS, DATA OR PROGRAMS, OR BUSINESS INTERRUPTION, OR FOR SPECIAL, INDIRECT, CONSEQUENTIAL, INCIDENTAL OR PUNITIVE DAMAGES, HOWEVER CAUSED AND REGARDLESS OF THE THEORY OF LIABILITY, AND EVEN IF BLUETOOTH SIG, ITS MEMBERS, OR THEIR AFFILIATES HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

This document is proprietary to Bluetooth SIG. This document may contain or cover subject matter that is intellectual property of Bluetooth SIG and its members. The furnishing of this document does not grant any license to any intellectual property of Bluetooth SIG or its members.

This document is subject to change without notice.

Copyright © 2011–2019 by Bluetooth SIG, Inc. The Bluetooth word mark and logos are owned by Bluetooth SIG, Inc. Other third-party brands and names are the property of their respective owners.
## Contents

1 Scope........................................................................................................................................................................... 5

2 References, Definitions, and Abbreviations ......................................................................................................................... 6
  2.1 References ......................................................................................................................................................................... 6
  2.2 Definitions .......................................................................................................................................................................... 6
  2.3 Abbreviations ...................................................................................................................................................................... 6

3 Test Suite Structure (TSS) ....................................................................................................................................................... 7
  3.1 Overview ............................................................................................................................................................................ 7
  3.2 Test Strategy ...................................................................................................................................................................... 7
  3.3 Test Groups ......................................................................................................................................................................... 8
    3.3.1 Service Definition.......................................................................................................................................................... 8
    3.3.2 Characteristic Declaration ......................................................................................................................................... 8
    3.3.3 Characteristic Descriptor ......................................................................................................................................... 8
    3.3.4 Characteristic Read ...................................................................................................................................................... 8
    3.3.5 Characteristic Descriptor Configuration ..................................................................................................................... 8
    3.3.6 Characteristic Notification ......................................................................................................................................... 8
    3.3.7 Service Procedures ..................................................................................................................................................... 8

4 Test Cases (TC) ........................................................................................................................................................................ 9
  4.1 Introduction ....................................................................................................................................................................... 9
    4.1.1 Test Case Naming Conventions .................................................................................................................................. 9
    4.1.2 Conformance ................................................................................................................................................................. 9
    4.1.3 Pass/Fail Verdict Conventions ................................................................................................................................... 10
  4.2 Setup Preambles ............................................................................................................................................................... 10
    4.2.1 ATT Bearer on LE Transport ...................................................................................................................................... 10
    4.2.2 ATT Bearer on BR/EDR Transport ................................................................................................................................ 10
  4.3 Service Definition ............................................................................................................................................................ 10
    4.3.1 CTS/SR/CSD/BV-01-C [Service Definition over LE] ................................................................................................. 10
    4.3.2 CTS/SR/CSD/BV-02-C [SDP Record] .......................................................................................................................... 11
  4.4 Characteristic Declarations ............................................................................................................................................... 12
    4.4.1 CTS/SR/CDC/BV-01-C [Characteristic Declaration – Current Time] .......................................................................... 13
    4.4.2 CTS/SR/CDC/BV-02-C [Characteristic Declaration – Local Time Information] ......................................................... 13
    4.4.3 CTS/SR/CDC/BV-03-C [Characteristic Declaration – Reference Time Information] ............................................. 13
  4.5 Characteristic Descriptor .................................................................................................................................................... 13
    4.5.1 CTS/SR/CDS/BV-01-C [Current Time - Client Characteristic Configuration Descriptor] ................................................ 13
  4.6 Characteristic Read ............................................................................................................................................................ 14
    4.6.1 CTS/SR/CCR/BV-01-C [Current Time Characteristic - Read] ...................................................................................... 14
    4.6.2 CTS/SR/CCR/BV-02-C [Local Time Information Characteristic - Read] ....................................................................... 15
    4.6.3 CTS/SR/CCR/BV-03-C [Reference Time Information Characteristic - Read] ............................................................... 17
  4.7 Configure Notification ......................................................................................................................................................... 18
    4.7.1 CTS/SR/CCC/BV-01-C [Configure Notification-Current Time] .................................................................................. 18
  4.8 Characteristic Write ............................................................................................................................................................ 19
    4.8.1 CTS/SR/CCW/BV-01-C [Current Time Characteristic - Write] ..................................................................................... 19
    4.8.2 CTS/SR/CCW/BV-01-C [Current Time Characteristic – Illegal Write] ...................................................................... 20
    4.8.3 CTS/SR/CCW/BV-02-C [Local Time Information Characteristic – Write] ................................................................. 21
    4.8.4 CTS/SR/CCW/BV-02-C [Local Time Information Characteristic – Illegal Write] ...................................................... 22
  4.9 Service Procedures............................................................................................................................................................. 23
    4.9.1 CTS/SR/CSP/BV-01-C [Current Time Characteristic- Notify disabled] ................................................................. 23
4.9.3 Current Time Characteristic – Notify .......................................................... 25
4.9.3.1 CTS/SR/CSP/BV-03-C [Current Time Characteristic-Notify, Time Zone Change] .................. 26
4.9.3.2 CTS/SR/CSP/BV-04-C [Current Time Characteristic-Notify, DST Change] .............................. 27
4.9.3.3 CTS/SR/CSP/BV-05-C [Current Time Characteristic-Notify by “Get Reference Update” command, with the Reference Time Update service] ........................................................................ 27

5 Test Case Mapping ......................................................................................... 29
6 Revision History and Contributors ............................................................... 31
1 Scope

This Bluetooth document contains the Test Suite Structure (TSS) and Test Cases (TC) to test the Bluetooth Current Time Service Specification.

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

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

[1] Bluetooth Test Strategy and Terminology Overview
[2] Bluetooth Core Specification Version 4.0 or later
[5] GATT Test Suite

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

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

3.1 Overview
The Current Time Service requires the presence of GAP, L2CAP, SM (for LE), SDP (for BR/EDR), and GATT. This is illustrated in Figure 3.1.

![Current Time Service Model](image)

Figure 3.1: Current Time Service Model

3.2 Test Strategy
The test objectives are to verify functionality of the Current Time Service and enable interoperability between different devices. The testing approach is to cover mandatory and optional requirements in the Profile specification and to match these to the support of the IUT as described in the ICS Proforma.

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

The conformance test equipment shall provide an implementation of the Radio Controller and the parts of the Host needed to perform the test cases defined in the Current Time Service 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.

The Current Time Service 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 cases.
The test suite structure is a tree with the first level representing the protocol groups:

- Service Definition
- Characteristic Declaration
- Characteristic Descriptor
- Characteristic Read
- Configuration Notify
- Service Procedures

The interface between the IUT and the Upper Tester may be:

- A man-machine interface
- Provided by the IUT manufacturer

### 3.3 Test Groups

The following test groups have been defined.

#### 3.3.1 Service Definition
Verify the service definition.

#### 3.3.2 Characteristic Declaration
Verify the presence and contents of characteristic declarations.

#### 3.3.3 Characteristic Descriptor
Verify the presence and contents of characteristic descriptors.

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

#### 3.3.5 Characteristic Descriptor Configuration
Verify Client Configuration characteristic which support reading/writing can be read/written. Verify the value of written a Client Configuration characteristic.

#### 3.3.6 Characteristic Notification
Verify characteristics which support notification can be notified.

#### 3.3.7 Service Procedures
Verify the operation of additional procedures defined in the service specification.
4 Test Cases (TC)

4.1 Introduction

4.1.1 Test Case Naming Conventions

Test cases shall be 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>`.

Bolded ID parts shall appear in the order prescribed. Non-bolded ID parts (if applicable) shall appear between the bolded parts. The order of the non-bolded parts may vary from test suite to test suite, but shall be consistent within each individual test suite.

<table>
<thead>
<tr>
<th>Identifier Abbreviation</th>
<th>Spec Identifier &lt;spec abbreviation&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTS</td>
<td>Current Time Service</td>
</tr>
<tr>
<td>Identifier Abbreviation</td>
<td>Role Identifier &lt;IUT role&gt;</td>
</tr>
<tr>
<td>SR</td>
<td>Server role</td>
</tr>
<tr>
<td>Identifier Abbreviation</td>
<td>Feature Identifier &lt;feat&gt;</td>
</tr>
<tr>
<td>CCC</td>
<td>Current Time Service Client Configuration Characteristics Configuration</td>
</tr>
<tr>
<td>CCN</td>
<td>Current Time Service Characteristics Notification</td>
</tr>
<tr>
<td>CCR</td>
<td>Current Time Service Characteristics Read</td>
</tr>
<tr>
<td>CCW</td>
<td>Current Time Service Characteristic Write</td>
</tr>
<tr>
<td>CDC</td>
<td>Current Time Service Characteristic Declaration</td>
</tr>
<tr>
<td>CDS</td>
<td>Current Time Service Characteristic Descriptors</td>
</tr>
<tr>
<td>CSD</td>
<td>Current Time Service Definition</td>
</tr>
<tr>
<td>CSP</td>
<td>Current Time Service Procedures</td>
</tr>
</tbody>
</table>

Table 4.1: Current Time Service TC Feature Naming Convention

4.1.2 Conformance

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

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

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

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

- That the implementation gracefully handles any quantity of data expected by the use case, OR

- That in cases where more than one valid interpretation of the Specification exist, the implementation complies with at least one interpretation and gracefully handles other interpretations, OR

- That the implementation is immune to attempted security exploits.

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

In any case, where a member finds an issue with the Test Plan Generator, the Test Case as described in the Test 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, which outlines all the detailed pass criteria conditions that shall be met by the IUT to merit a Pass Verdict.

The convention in this test 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 one of the pass criteria conditions cannot be met. If this occurs the outcome of the test shall be the Fail Verdict.

**4.2 Setup Preambles**

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

**4.2.1 ATT Bearer on LE Transport**

Follow the preamble procedure described in [5] Section 4.2.1.2.

**4.2.2 ATT Bearer on BR/EDR Transport**

Follow the preamble procedure described in [5] Section 4.2.1.1.

**4.3 Service Definition**

Verify the service definition.

**4.3.1 CTS/SR/CSD/BV-01-C [Service Definition over LE]**

- Test Purpose
  
  Verify the IUT has one instantiation of the Current Time Service as a primary service.

- Reference

  [4] 2
• Initial Condition
   Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1.

• Test Procedure
   Discover all primary services by executing the test procedure of GATT test case GATT/SR/GAD/BV-01-C in [5] or primary services by service UUID by executing the test procedure of GATT test case GATT/SR/GAD/BV-02-C in [5] with the service UUID set to «Current Time Service».

• Expected Outcome
   Pass verdict
   One attribute handle range with the service UUID set to «Current Time Service» is returned, containing the starting handle and the ending handle of the Current Time service definition.

4.3.2 CTS/SR/CSD/BV-02-C [SDP Record]

• Test Purpose
   Verify the SDP Record for the Current Time Service. This test case only applies when using the BR/EDR transport.

• Reference
   [7] 4

• Initial Condition
   An ACL connection over BR/EDR is established between the Lower Tester and IUT.

• Test Procedure
   1. The Lower Tester establishes an SDP connection to the IUT.
   2. The Lower Tester sends SDP requests to retrieve all attributes of the SDP record for the Current Time Service.

• Expected Outcome
   Pass verdict
   The SDP record for the service is found.
   All attributes which are mandatory for the service are present in the SDP record.
   The values of all attributes in the SDP record meet the requirements of the service.
   The GATT Start Handle and GATT End Handle parameters in the SDP record match the start handle and end handle of the service.
4.4 Characteristic Declarations

- **Test Purpose**
  
  Verify the presence of and contents of characteristic declarations specified by the service.

- **Reference**
  
  [4] 3.1, 3.2, 3.3  
  
  [7] 3.1, 3.2, 3.3

- **Initial Condition**

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

  The handle range of instance of the Current Time service has been previously discovered by the Lower Tester either in test case CTS/SR/CSD/BV-01-C [Service Definition over LE] or CTS/SR/CSD/BV-02-C [SDP Record].

- **Test Procedure**

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

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

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

![Diagram](image)

*Figure 4.1: Characteristic Declarations*
Expected Outcome

Pass verdict

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

Only one instance of the characteristic is found.

<table>
<thead>
<tr>
<th>Test Case</th>
<th>Characteristic Properties Value (Requirements)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.4.1 CTS/SR/CDC/BV-01-C [Characteristic Declaration – Current Time]</td>
<td>0x12 or 0x1a ([4] 3.1)</td>
</tr>
<tr>
<td>4.4.2 CTS/SR/CDC/BV-02-C [Characteristic Declaration – Local Time Information]</td>
<td>0x02 or 0x0a ([4] 3.2)</td>
</tr>
<tr>
<td>4.4.3 CTS/SR/CDC/BV-03-C [Characteristic Declaration – Reference Time Information]</td>
<td>0x02 ([4] 3.3)</td>
</tr>
</tbody>
</table>

Table 4.2: Characteristic Declaration Test Cases

4.5 Characteristic Descriptor

4.5.1 CTS/SR/CDS/BV-01-C [Current Time - Client Characteristic Configuration Descriptor]

- Test Purpose

  Verify the presence of and contents of Client Configuration characteristic descriptors specified by the service.

- Reference

  [4] 3.1, 3.2, 3.3

  [7] 3.1, 3.2, 3.3

- Initial Condition

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

  The handle range of instance of the Current Time characteristic has been previously discovered by the Lower Tester during the test procedure in section 4.4 or is known to the Lower Tester by other means.

- Test Procedure

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

![Diagram](current_time_service/cts/sr/cds/bv-01-c.png)

**Figure 4.2: CTS/SR/CDS/BV-01-C [Current Time - Client Characteristic Configuration Descriptor]**

- Expected Outcome
  - **Pass verdict**

The Client Characteristic Configuration is discovered, the Client Characteristic Configuration descriptor is read, and the value of the Client Configuration descriptor meets the requirements of the service (value is 0x0001 or 0x0000).

### 4.6 Characteristic Read

#### 4.6.1 CTS/SR/CCR/BV-01-C [Current Time Characteristic - Read]

- **Test Purpose**

  Read the Current Time characteristic on the IUT and verify that read value is matched to the IUT’s capability/availability.

- **Reference**

  - [4] 3.1.1
  - [7] 3.1.1

- **Initial Condition**

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

  The handle of the Current Time characteristic value has been previously discovered by the Lower Tester during the test procedure in Section 4.4 or is known to the Lower Tester by other means. If the IUT requires a bonding procedure then perform a bonding procedure.
• **Test Procedure**

Read the characteristic value by executing the test procedure of GATT test case GATT/SR/GAR/BV-01-C in [5], Read Characteristic Value. The Upper Tester reads the date and time from the IUT.

![Diagram](image)

**Figure 4.3: CTS/SR/CCR/BV-01-C [Current Time Characteristic - Read]**

• **Expected Outcome**

**Pass verdict**

- The characteristic is successfully read and the value of characteristic matches the capability/availability of the IUT.
- If the IUT is capable of showing 1/256 seconds, the value is shown correct 1/256 seconds, otherwise set to ‘0’.
- If the IUT is capable of showing Day of Week, the value is shown correct Day of Week, otherwise set to ‘0’.
- If the IUT is capable of showing Year, the value is shown correct Year, otherwise set to ‘0’.
- If the IUT is capable of showing Month, the value is shown correct Month, otherwise set to ‘0’.
- If the IUT is capable of showing Day, the value is shown correct Day, otherwise set to ‘0’.
- The valid time and date values read from the IUT matches the time and date in the IUT as read by the Upper Tester. The time and date values are considered to match if the difference in time is less than or equal to what can be explained by distance in time between the Upper Tester reading the time from the IUT and the Lower Tester reading the time from the IUT.

4.6.2 **CTS/SR/CCR/BV-02-C [Local Time Information Characteristic - Read]**

• **Test Purpose**

Read and verify the Local Time Information characteristic value that is set meets the requirements of the service.
• Reference

[4] 3.2

[7] 3.2.1

• Initial Condition

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

The handle of the Local Time Information characteristic value has been previously discovered by the Lower Tester during the test procedure in Section 4.4 or is known to the Lower Tester by other means.

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

• Test Procedure

1. The Lower Tester requests the Local Time Information characteristic value from the IUT by executing \textit{ATT\_Read\_Request\_command}.

2. The IUT requests the Local Time Information from the Upper Tester immediately.

3. The Upper Tester responds with the Local Time Information to the IUT according to the latest Local Time Information.

4. The IUT responds with the Local Time Information characteristic value to the Lower Tester by executing \textit{ATT\_Read\_Response\_command}.

\begin{center}
\begin{tikzpicture}
  \node (lower) at (0,0) {Lower Tester};
  \node (iut) at (4,0) {IUT (CTS)};
  \node (upper) at (8,0) {Upper Tester};
  \node (connection) at (4,-2) {L2CAP Connection established over selected transport CTS/SR/CDC/BV-02-C has been executed};
  \draw[->] (lower) -- (iut) node[midway,above] {\textit{ATT\_Read\_Request} \ (Code = 0x0A, handle)};
  \draw[->] (iut) -- (upper) node[midway,above] {LocalTime InformationReq} node[midway,below] {LocalTime InformationRes \ (latest value)};
  \draw[->] (upper) -- (lower) node[midway,below] {\textit{ATT\_Read\_Response} \ (Code = 0x0B, value)};
\end{tikzpicture}
\end{center}

\textit{Figure 4.4: CTS/SR/CCR/BV-02-C [Local Time Information Characteristic - Read]}
• Expected Outcome
  Pass verdict

  The characteristic is successfully read and the characteristic value meets the requirements of the service (two octets, first octet is greater than or equal to -48 and less than or equal to +56, second octet is 0, 2, 4 or 8).

4.6.3  CTS/SR/CCR/BV-03-C [Reference Time Information Characteristic - Read]

• Test Purpose
  Read and verify the Reference Time Information characteristic value that is set meets the requirements of the service.

• Reference
  [4] 3.3
  [7] 3.3

• Initial Condition
  Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1.

  The handle range of Reference Time Information characteristic value has been previously discovered by the Lower Tester during the test procedure in section 4.4 or is known to the Lower Tester by other means.

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

• Test Procedure
  1. The Lower Tester requests the Reference Time Information characteristic value from the IUT by executing ATT_Read_Request_command.
  2. The IUT requests the Reference Time Information from the Upper Tester immediately.
  3. The Upper Tester responds with the Reference Time Information to the IUT according to the latest Reference Time Information.
  4. The IUT responds with the Reference Time Information characteristic value to the Lower Tester by executing ATT_Read_Response_command.
**Expected Outcome**

**Pass verdict**

The characteristic is successfully read and the characteristic value meets the requirements of the service (four octets, first octet is greater or equal to 0 and less than 7).

### 4.7 Configure Notification

#### 4.7.1 CTS/SR/CCC/BV-01-C [Configure Notification-Current Time]

**Test Purpose**

Verify compliant operation in response to enable and disable Current Time characteristic notification.

**Reference**

[4] 3.1.1  
[7] 3.1.2

**Initial Condition**

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

The handle of the Current Time characteristic value has been previously discovered by the Lower Tester during the test procedure in Section 4.4 or is known to the Lower Tester by other means.

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

If IUT permissions for the characteristic require a specific security mode or security level, establish a connection meeting those requirements.
The handle of the client characteristic configuration descriptor has been previously discovered by the Lower Tester during the test procedure in Section 4.5 or is known to the Lower Tester by other means.

- **Test Procedure**
  1. Disable notification by writing value 0x0000 to the client characteristic configuration descriptor of the characteristic using the test procedure of GATT test case GATT/SR/GAW/BV-08-C in [5].
  2. If the test case is for notification, enable notification by writing value 0x0001 to the client characteristic configuration descriptor of the characteristic.

![Diagram](image)

*Figure 4.6: CTS/SR/CCC/BV-01-C [Configure Notification - Current Time]*

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

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

### 4.8 Characteristic Write

#### 4.8.1 CTS/SR/CCW/BV-01-C [Current Time Characteristic - Write]

- **Test Purpose**

  Write the Current Time characteristic on the IUT and verify that the value is accepted by the IUT or that the IUT sends an error response.

- **Reference**

  [7] 3.1.3

- **Initial Condition**

  Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1.
The handle of the Current Time characteristic value has been previously discovered by the Lower Tester during the test procedure in Section 4.4 or is known to the Lower Tester by other means. If the IUT requires a bonding procedure then perform a bonding procedure.

- **Test Procedure**

  Write the characteristic value by executing the test procedure of GATT test case GATT/SR/GAW/BV-03-C in [5], Write Characteristic Value.

  The IUT sends the received value to the Upper Tester.

*Figure 4.7: CTS/SR/CCW/BV-01-C [Current Time Characteristic - Write]*

- **Expected Outcome**

  *Pass verdict*

  - The Upper Tester verifies the value written by the Lower Tester was received correctly by the IUT.

  - The IUT responds with an `ATT_Write_Response` or an `ATT_Error_Response` with the handle of the Current Time characteristic and the error code 0x80.

4.8.2  **CTS/SR/CCW/BI-01-C [Current Time Characteristic – Illegal Write]**

- **Test Purpose**

  Write the Current Time characteristic on the IUT with an illegal value and verify that the IUT sends an error response.

- **Reference**

  [7] 3.1.3

- **Initial Condition**

  Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1.
The handle of the Current Time characteristic value has been previously discovered by the Lower Tester during the test procedure in Section 4.4 or is known to the Lower Tester by other means. If the IUT requires a bonding procedure then perform a bonding procedure.

• Test Procedure

Write the characteristic value by executing the test procedure of GATT test case GATT/SR/GAW/BV-03-C in [5], Write Characteristic Value, using a tester generated DateTime value with an illegal field value.

![Diagram of ATT Error Response and Connection Establishments](https://via.placeholder.com/150)

**Figure 4.8: CTS/SR/CCW/BI-01-C [Current Time Characteristic – Illegal Write]**

• Expected Outcome

Pass verdict

- The IUT responds with an **ATT_Error_Response** with the handle of the Current Time characteristic and the error code 0x80.

4.8.3 CTS/SR/CCW/BV-02-C [Local Time Information Characteristic – Write]

• Test Purpose

Write the Local Time Information characteristic on the IUT and verify that the value is accepted by the IUT or that the IUT sends an error response.

• Reference

[7] 3.2.2

• Initial Condition

Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1.
The handle of the Local Time Information characteristic value has been previously discovered by the Lower Tester during the test procedure in Section 4.4 or is known to the Lower Tester by other means. If the IUT requires a bonding procedure then perform a bonding procedure.

- **Test Procedure**

Write the characteristic value by executing the test procedure of GATT test case GATT/SR/GAW/BV-03-C in [5], Write Characteristic Value.

The IUT sends the received value to the Upper Tester.

![Diagram](image)

*Figure 4.9: CTS/SR/CCW/BV-02-C [Local Time Information Characteristic – Write]*

- **Expected Outcome**

  **Pass verdict**

  - The Upper Tester verifies the value written by the Lower Tester was received correctly by the IUT.
  - The IUT responds with an `ATT_Write_Response` or an `ATT_Error_Response` with the handle of the Current Time characteristic and the error code 0x80.

**4.8.4 CTS/SR/CCW/BI-02-C [Local Time Information Characteristic – Illegal Write]**

- **Test Purpose**

Write the Local Time Information characteristic on the IUT with an illegal value and verify that the IUT sends an error response.

- **Reference**

  [7] 3.2.2

- **Initial Condition**

  Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1.
The handle of the Local Time Information characteristic value has been previously discovered by the Lower Tester during the test procedure in Section 4.4 or is known to the Lower Tester by other means. If the IUT requires a bonding procedure then perform a bonding procedure.

- **Test Procedure**

Write the characteristic value by executing the test procedure of GATT test case GATT/SR/GAW/BV-03-C in [5], Write Characteristic Value, using a tester generated characteristic value with an illegal field value for either the Time Zone field or the DST Offset field.

![Diagram](image_url)

*Figure 4.10: CTS/SR/CCW/BI-02-C [Local Time Information Characteristic – Illegal Write]*

- **Expected Outcome**

  **Pass verdict**

  - The IUT responds with an *ATT_Error_Response* with the handle of the Current Time characteristic and the error code 0x80.

4.9 **Service Procedures**

4.9.1 **CTS/SR/CSP/BV-01-C [Current Time Characteristic- Notify disabled]**

- **Test Purpose**

  Verify that the IUT doesn't issue notification of the Current Time characteristic when the value of Client Characteristic Configuration descriptor is 0x0000.

- **Reference**

  [4] 3.1.1
  [7] 3.1.2
• Initial Condition

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

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

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

To disable notification of the Current Time characteristics, configure the Client Configuration characteristic of the Current Time by executing the test procedure of CTS/SR/CCC/BV-01-C [Configure Notification-Current Time] in section 4.7.1.

• Test Procedure

1. Upper Tester drives the event of a time adjustment caused by External Reference Time Update OR Change of Time Zone OR Change of DST OR Manual Time Update to the IUT.

![Diagram: L2CAP Connection established over selected transport. CTS/SR/CDC/BV-01-C has been executed. CTS/SR/CCC/BV-01-C has been executed. OccurTimeAdjustment (value of CT Time).]

Figure 4.11: CTS/SR/CSP/BV-01-C [Current Time Characteristic- Notify disabled]

• Expected Outcome

Pass verdict

The IUT doesn’t send ATT_Handle_Value_Notification to the Lower Tester.

4.9.2 CTS/SR/CSP/BV-02-C [Current Time Characteristic-Notify, Manual Change]

• Test Purpose

Verify the IUT can perform notification of the Current Time characteristic.

• Reference

[4] 3.1.1.1

[7] 3.1.2.1
• Initial Condition

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

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

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

To enable notification of the Current Time characteristics, configure the Client Configuration characteristic of the Current Time by executing the test procedure of CTS/SR/CCC/BV-01-C [Configure Notification-Current Time] in Section in section 4.7.1.

• Test Procedure

1. Trigger the Manual Time Update event from the Upper Tester.

   ![Diagram of ATT_Bearer_connection](image)

   **Figure 4.12:** CTS/SR/CSP/BV-02-C [Current Time Characteristic-Notify, Manual Change]

   • Expected Outcome

     **Pass verdict**

     The IUT sends a correctly formatted Notification of the Current Time Characteristic.

   4.9.3 Current Time Characteristic – Notify

   • Test Purpose

     Verify a notification of the Current Time characteristic.

   • Reference

     [4] 3.1.1.1, 3.1.1.2, 3.1.1.3, 3.1.1.4
3.1.2.1, 3.1.2.2, 3.1.2.3, 3.1.2.4

• Initial Condition

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

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

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

To enable notification of the Current Time characteristics, configure the Client Configuration characteristic of the Current Time by executing the test procedure of CTS/SR/CCC/BV-01-C [Configure Notification-Current Time] in section 4.7.1.

• Test Procedure

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

1. Trigger the event that can cause the local time in the server device to change with the time update cause as listed in Table 4.3.

2. If the cause for the update event is a Reference Time Update, the Lower Tester executes the test procedure of RTUS/SR/CW/BV-01-C with the Command ID set to “Get Reference Update” in [6] within 15 minutes from procedure 1.

• Expected Outcome

Pass verdict

Notification with the correct format is emitted with the value requirements in Table 4.3.

<table>
<thead>
<tr>
<th>Test Case</th>
<th>Notification Event Cause</th>
<th>Value (Requirements)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.9.3.1</td>
<td>Change of the Time Zone</td>
<td>Adjust reason “Change of Time Zone” bit is set, if the time zone was changed manually the “Manual Time Update” bit will also be set.</td>
</tr>
</tbody>
</table>
### 4.9.3.2 CTS/SR/CSP/BV-04-C [Current Time Characteristic-Notify, DST Change]

<table>
<thead>
<tr>
<th>Test Case</th>
<th>Notification Event Cause</th>
<th>Value (Requirements)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.9.3.2</td>
<td>Change of the DST Offset</td>
<td>Adjust reason “Change of DST Offset” bit is set, if the time zone was changed manually the “Manual Time Update” bit will also be set.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test Case</th>
<th>Notification Event Cause</th>
<th>Value (Requirements)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.9.3.3</td>
<td>Reference Time Change</td>
<td>Adjust reason “External Reference Time Update” bit is set.</td>
</tr>
</tbody>
</table>

Table 4.3: Current Time Characteristic - Notify Test Cases

### 4.9.4 CTS/SR/CSP/BV-06-C [Current Time Characteristic-With and Without Notification by Reference Time Change]

- **Test Purpose**
  
  Verify a notification of the Current Time characteristic when the External Reference Time Update has occurred.

- **Reference**
  
  [4] 3.1.1
  
  [7] 3.1.2

- **Initial Condition**

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

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

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

  To enable notification of the Current Time characteristics, configure the Client Configuration characteristic of the Current Time by executing the test procedure of CTS/SR/CCC/BV-01-C [Configure Notification-Current Time] in section 4.7.1.

  Drive/Feed the External Reference Time Update event again from the Upper Tester and make IUT notify the Current Time Characteristic to the Lower Tester.
• Test Procedure

1. Drive/Feed the External Reference Time Update event again from the Upper Tester within 15 minutes from the last notification of Current Time characteristic. The Adjusting Time is less than a one minute difference from the original time.

2. Drive/Feed the External Reference Time Update event again from the Upper Tester within 15 minutes from last Notification of Current Time characteristic. The Adjusting Time is more than a one minute difference from the original time.

3. Drive/Feed the External Reference Time Update event from the Upper Tester more than 15 minutes from the last notification of Current Time characteristic.

• Expected Outcome

Pass verdict

No Notification is emitted in procedure step 1, but Notification with the correct format is emitted in procedure steps 2 and 3.
5 Test Case Mapping

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

**Item:** contains an y/x reference, where y corresponds to the table number and x corresponds to the feature number as defined in the ICS Proforma for the Current Time Service (CTS) [3]. If the item is defined with Protocol, Profile or Service abbreviation before y/x, the table and feature number referenced are defined in the abbreviated ICS proforma document.

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

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

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

<table>
<thead>
<tr>
<th>Item</th>
<th>Feature</th>
<th>Test Case(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTS 1/2 AND CTS 3/1</td>
<td>Current Time Service over LE</td>
<td>CTS/SR/CSD/BV-01-C</td>
</tr>
<tr>
<td>CTS 1/1 AND CTS 3/1</td>
<td>Current Time Service SDP Record</td>
<td>CTS/SR/CSD/BV-02-C</td>
</tr>
<tr>
<td>CTS 3/2</td>
<td>Current Time Characteristic Declaration</td>
<td>CTS/SR/CDC/BV-01-C</td>
</tr>
<tr>
<td>CTS 3/3</td>
<td>Client Characteristic Configuration Descriptor for Current Time Declaration</td>
<td>CTS/SR/CDS/BV-01-C</td>
</tr>
<tr>
<td>CTS 3/4</td>
<td>Read Current Time</td>
<td>CTS/SR/CCR/BV-01-C</td>
</tr>
<tr>
<td>CTS 3/5</td>
<td>Local Time Information Characteristic Declaration</td>
<td>CTS/SR/CDC/BV-02-C</td>
</tr>
<tr>
<td>CTS 3/6</td>
<td>Read Time Information</td>
<td>CTS/SR/CCR/BV-02-C</td>
</tr>
<tr>
<td>CTS 3/7</td>
<td>Reference Time Information Characteristic Declaration</td>
<td>CTS/SR/CDC/BV-03-C</td>
</tr>
<tr>
<td>CTS 3/8</td>
<td>Read Reference Time Information Characteristic</td>
<td>CTS/SR/CCR/BV-03-C</td>
</tr>
<tr>
<td>CTS 3/9</td>
<td>Current Time Characteristic, Configure to set Notification – enable/disable</td>
<td>CTS/SR/CCC/BV-01-C</td>
</tr>
<tr>
<td>CTS 3/10</td>
<td>Current Time Characteristic, Notify disabled</td>
<td>CTS/SR/CSP/BV-01-C</td>
</tr>
<tr>
<td>Item</td>
<td>Feature</td>
<td>Test Case(s)</td>
</tr>
<tr>
<td>--------</td>
<td>-------------------------------------------------------------------------</td>
<td>---------------------------------------</td>
</tr>
<tr>
<td>CTS 3/11</td>
<td>Current Time Characteristic, Notify by Manual Change</td>
<td>CTS/SR/CSP/BV-02-C</td>
</tr>
<tr>
<td>CTS 3/12</td>
<td>Current Time Characteristic, Notify by Time Zone Change</td>
<td>CTS/SR/CSP/BV-03-C</td>
</tr>
<tr>
<td>CTS 3/13</td>
<td>Current Time Characteristic, Notify by DST Change</td>
<td>CTS/SR/CSP/BV-04-C</td>
</tr>
<tr>
<td>CTS 3/16</td>
<td>Current Time Characteristic Write</td>
<td>CTS/SR/CCW/BV-01-C, CTS/SR/CCW/BI-01-C</td>
</tr>
<tr>
<td>CTS 3/17</td>
<td>Local Time Information Characteristic Write</td>
<td>CTS/SR/CCW/BV-02-C, CTS/SR/CCW/BI-02-C</td>
</tr>
</tbody>
</table>

*Table 5.1: Test Case Mapping*
# 6 Revision History and Contributors

## Revision History

<table>
<thead>
<tr>
<th>Revision History</th>
<th>Date</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0.0</td>
<td>2011-09-13</td>
<td>Adopted by the Bluetooth SIG Board of Directors</td>
</tr>
<tr>
<td>D1.1.0r0</td>
<td>2012-08-14</td>
<td>Updated to CTS version 1.1</td>
</tr>
<tr>
<td>D1.1.0r1</td>
<td>2013-09-11</td>
<td>Added a BI test case for writing of Current Time</td>
</tr>
<tr>
<td>D1.1.0r2</td>
<td>2014-05-19</td>
<td>Update to include writable Local Time Information</td>
</tr>
<tr>
<td>D1.1.0r3</td>
<td>2014-08-10</td>
<td>Responses to first round of BTI &amp; legal review</td>
</tr>
<tr>
<td>D1.1.0r4</td>
<td>2014-08-11</td>
<td>Updated references after discussion on BTI call 8/11</td>
</tr>
<tr>
<td>D1.1.0r5</td>
<td>2014-08-21</td>
<td>PUID responses to second round of BTI comments</td>
</tr>
<tr>
<td>D1.1.0r6</td>
<td>2014-09-08</td>
<td>Submission to BTI as draft 1.0 adoption candidate</td>
</tr>
<tr>
<td>1.1.0</td>
<td>2014-10-14</td>
<td>BoD Approval of CTS 1.1</td>
</tr>
<tr>
<td>1.1.1r0</td>
<td>2015-05-10</td>
<td>TSE 6104: Updated TP/CDC/BV-01-C and 02-C (CTS/SR/CDC/BV-01-C after ID conversion) to add other available values.</td>
</tr>
<tr>
<td>1.1.1</td>
<td>2015-07-14</td>
<td>Prepared for TCRL 2015-1 publication</td>
</tr>
<tr>
<td>1.1.2r00</td>
<td>2016-03-29</td>
<td>Converted to new Test Case ID conventions as defined in TSTO v4.1</td>
</tr>
<tr>
<td>1.1.2r01</td>
<td>2016-04-13</td>
<td>TSE 6994: Updated Test Procedure, MSC, and Pass verdict for test case CTS/SR/CSP/BV-02-C.</td>
</tr>
</tbody>
</table>
| 1.1.2r01-conv    | 2016-04-17 | Re-organized tests for Current Time Characteristic Notify into table form.  
Updated the test case ids in the MSCs. 
Corrected the references from GATT Client tests to GATT Server tests. |
| 1.1.2            | 2016-07-13 | Prepared for TCRL 2016-1 publication.                                    |
| 1.1.2 edition 2r00 | 2018-11-29 | Editorial changes only. Template updated. Revision History and contributors moved to the end of the document. |
| 1.1.2 edition 2  | 2019-12-03 | 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. |
## Contributors

<table>
<thead>
<tr>
<th>Name</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sadao Nagashima</td>
<td>Casio</td>
</tr>
<tr>
<td>Daisuke Matsuoh</td>
<td>Citizen</td>
</tr>
<tr>
<td>Frank Berntsen</td>
<td>Nordic Semiconductor</td>
</tr>
</tbody>
</table>