Time Profile (TIP)

*Bluetooth® Test Suite*

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- **Revision Date**: 2020-01-10
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1 Scope

This Bluetooth document contains the Test Suite Structure (TSS) and Test Cases (TC) to test the Time Profile 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
[3] ICS Proforma for Time Profile, TIP.ICS
[5] GAP Test Suite, GAP.TS
[6] SM Test Suite, SM.TS
[7] GATT Test Suite, GATT. TS
[8] Current Time Service Specification v1.0
[9] Reference Time Update Service Specification v1.0
[10] Next DST Change Service Specification v1.0

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 Time Profile is a client of the Generic Attribute Profile (GATT). This is illustrated in Figure 3.1.

<table>
<thead>
<tr>
<th>Time Profile Time</th>
<th>←→</th>
<th>Time Profile Time Server Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client Role</td>
<td></td>
<td>Current Time service</td>
</tr>
<tr>
<td>GATT</td>
<td></td>
<td>Next DST Change service</td>
</tr>
<tr>
<td>ATT</td>
<td>←→</td>
<td>Reference Time service</td>
</tr>
<tr>
<td>GAP</td>
<td></td>
<td>Other optional service</td>
</tr>
<tr>
<td>L2CAP</td>
<td>←→</td>
<td>Controller</td>
</tr>
<tr>
<td>Controller</td>
<td>←→</td>
<td></td>
</tr>
</tbody>
</table>

Figure 3.1: Time Profile Test Model

3.2 Test Strategy

The test objectives are to verify functionality of the Time Profile 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.

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

The test suite structure is a tree with the first level representing the protocol groups as listed in Section 3.3.
### 3.2.1 Time Server Testing Configuration

The following configuration is recommended for testing Time Server IUT:

![Time Server Test Configuration Diagram](image)

*Figure 3.2: Time Server Test Configuration*

### 3.2.2 Time Client Testing Configuration

The following configuration is recommended for testing Time Client IUT:

![Time Profile Client Test Configuration Diagram](image)

*Figure 3.3: Time Profile Client Test Configuration*

The sample database of Characteristics used by the Lower Tester is specified in each test case.

All Time client test cases, which use a configuration as show in *Figure 3.3*, contain test procedure descriptions and expected results. These in turn use example message syntax between the Upper Tester and the IUT. Those example messages are generic; there is no normative specification for these messages. The normative specifications are the functional descriptions for the test procedures and the expected results.
3.3 Test Groups
The following test groups have been defined.

3.3.1 Discover Services and Characteristics and Descriptors
This group tests IUT discovery of the Current Time Service and Characteristics and Descriptors, the Next DST Change Service and Characteristics and the Reference Time Update Service and Characteristics.

3.3.2 Configuration Features
This group tests IUT implementation of the Time Profile Read features.

3.3.3 Read Features
This group tests IUT implementation of the Time Profile Read Features.

3.3.4 Write Features
This group tests IUT implementation of the Time Profile Write Features.

3.3.5 Notify Features
This group tests IUT implementation of the Time Profile Notify Features.
4 Test Cases (TC)

4.1 Introduction

4.1.1 Test Case Identification Conventions

Test cases shall be assigned unique identifiers per the conventions in [1]. The convention used here is `<spec abbreviation>/<IUT role>/<class>/<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>TIP</td>
<td>Time Profile</td>
</tr>
<tr>
<td>Identifier Abbreviation</td>
<td>Role Identifier &lt;IUT role&gt;</td>
</tr>
<tr>
<td>CL</td>
<td>Time Profile Time Client Role</td>
</tr>
<tr>
<td>SR</td>
<td>Time Profile Time Server Role</td>
</tr>
<tr>
<td>Identifier Abbreviation</td>
<td>Feature Identifier &lt;feat&gt;</td>
</tr>
<tr>
<td>TPCF</td>
<td>Time Profile Configure Features</td>
</tr>
<tr>
<td>TPCN</td>
<td>Time Profile Connection Features</td>
</tr>
<tr>
<td>TPD</td>
<td>Time Profile Discovery of Services and Characteristics and Descriptors</td>
</tr>
<tr>
<td>TPNF</td>
<td>Time Profile Notify Features</td>
</tr>
<tr>
<td>TPRF</td>
<td>Time Profile Read Features</td>
</tr>
<tr>
<td>TPWF</td>
<td>Time Profile Write Features</td>
</tr>
</tbody>
</table>

Table 4.1: Time Profile TC Class Naming Convention

4.1.2 Conformance

When conformance is claimed, all capabilities indicated as mandatory for this Specification shall be supported in the specified manner (process-mandatory). This also applies for all optional and conditional capabilities for which support is indicated. All mandatory capabilities, and optional and conditional capabilities for which support is indicated are subject to verification as part of the Bluetooth 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 are 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 the implementation gracefully rejects any attempt to exercise capabilities which were declared as not supported. Graceful rejection means that the implementation demonstrates uninterrupted conformance to the specification immediately after rejecting such attempts without any need to be externally reset or adjusted, OR
- that in cases where more than one valid interpretation of the Specification exists, the implementation complies with at least one interpretation and gracefully handles other interpretations, 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 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 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 [7] Section 4.2.1.2.
4.3 Discover Services and Characteristics and Descriptors

The procedures defined in this test group verify IUT discovery of the Services defined in the Current Time Service Specification [8] and to those defined in the Next DST Change Service [10] and Reference Time Update Service [9] by a Time Server IUT, by a Time Client IUT.

4.3.1 TIP/CL/TPD/BV-01-I [Discover Current Time Service]

- Test Purpose
  Verify that the Current Time Service can be detected by the Time Client IUT.

- Reference
  [4] 4.1

- Initial Condition
  Establish an ATT Bearer connection between the Lower Tester and IUT as defined in Section 4.2.1. The Lower Tester includes at least one instantiation of the Current Time Service [8].

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

  1. Execute the procedure included in GATT.TS [7] Discover All Primary Services, GATT/CL/GAD/BV-01-C once, with the database specified in [8].
2. Execute the procedure included in GATT.TS [7] Discover Primary Services by Service UUID, GATT/CL/GAD/BV-02-C once with the service UUID set to «Current Time Service», with the database specified in [8].

```
• Expected Outcome

Pass verdict

At least one attribute handle range is returned, containing the starting handle and the ending handle of each instantiation of a Current Time Service definition.
```

### 4.3.2 TIP/CL/TPD/BV-02-I [Discover Next DST Change Service]

#### Test Purpose

Verify that the Next DST Change Service can be detected by the Time Client IUT.

#### Reference

[4] 4.1

#### Initial Condition

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

The Lower Tester includes at least one instantiation of the Next DST Change Service [10].

#### Test Procedure

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

1. Execute the procedure included in GATT.TS [7] Discover All Primary Services, GATT/CL/GAD/BV-01-C once, with the database specified in [10].
2. Execute the procedure included in GATT.TS [7] Discover Primary Services by Service UUID, GATT/CL/GAD/BV-02-C once with the service UUID set to «Next DST Change Service», with the database specified in [10].
• Expected Outcome
Pass verdict

At least one attribute handle range is returned, containing the starting handle and the ending handle of each instantiation of a Next DST Change Service definition.

4.3.3  TIP/CL/TPD/BV-03-I [Discover Reference Time Update Service]

• Test Purpose
Verify that the Reference Time Update Service can be detected by the Time Client IUT.

• Reference
[4] 4.1

• Initial Condition
Establish an ATT Bearer connection between the Lower Tester and IUT as defined in Section 4.2.1.
The Lower Tester includes at least one instantiation of the Reference Time Update Service [9].

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

1. Execute the procedure included in GATT.TS [7] Discover All Primary Services, GATT/CL/GAD/BV-01-C once, with the database specified in [9].
2. Execute the procedure included in GATT.TS [7] Discover Primary Services by Service UUID, GATT/CL/GAD/BV-02-C once with the service UUID set to «Reference Time Update Service», with the database specified in [9].

• Expected Outcome
Pass verdict

At least one attribute handle range is returned, containing the starting handle and the ending handle of each instantiation of a Reference Time Update Service definition.

4.3.4  TIP/CL/TPD/BV-04-I [Discover Current Time Characteristic]

• Test Purpose
Verify that the Current Time Characteristic can be detected by the Time Client IUT.

• Reference
[4] 4.2

• Initial Condition
Establish an ATT Bearer connection between the Lower Tester and IUT as defined in Section 4.2.1.
The Lower Tester includes at least one instantiation of the Current Time Service [8].
The IUT has executed TIP/CL/TPD/BV-01-I [Discover Current Time Service], and has saved the handle range for an instantiation of the Current Time Service. That instantiation contains an instantiation of the Current Time characteristic.

**Test Procedure**

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


   ![Diagram 1](Diagram1.png)

   **ATT Bearer established over selected transport.**
   **TIP/CL/TPD/BV-01-C has been executed.**

   
   **ATT_Read_By_Type_Request**
   (Code = 0x08, 1st Handle, end Handle, Type=, <Characteristic>)

   **ATT_Read_By_Type_Resp.**
   (Code = 0x09, Length, Sets of handle-value pairs)

   **DiscServiceChar**
   (service handle range)

   **DiscAllServices**
   (handle/characteristic list)

2. Execute the procedure included in GATT.TS [7] Discover Characteristics by UUID, GATT/CL/GAD/BV-05-C once, with the characteristic UUID set to «Current Time», with the database specified in initial conditions.

   ![Diagram 2](Diagram2.png)

   **ATT Bearer established over selected transport.**
   **TIP/CL/TPD/BV-01-C has been executed.**

   
   **ATT_Read_By_Type_Request**
   (Code = 0x08, 1st Handle, end Handle, Type=, <Characteristic>)

   **ATT_Read_By_Type_Resp.**
   (Code = 0x09, Length, Sets of handle-value pairs)

   **DiscServiceCharUUID**
   (service handle range, UUID)

   **DiscCharacteristics**
   (handle/UUID list)

**Expected Outcome**

**Pass verdict**

One attribute handle is returned for a Current Time Characteristic implemented in the Lower Tester.
4.3.5 TIP/CL/TPD/BV-05-I [Discover Current Time – Client Characteristic Configuration Descriptor]

- **Test Purpose**
  Verify that the Time Client IUT can discover the Client Characteristic Configuration descriptor of the Current Time characteristic.

- **Reference**
  [4] 4.2

- **Initial Condition**
  Establish an ATT Bearer connection between the Lower Tester and IUT as defined in Section 4.2.1.
  The Lower Tester includes at least one instantiation of the Current Time Service [8].
  The IUT has executed TIP/CL/TPD/BV-01-I [Discover Current Time Service], and has saved the handle range for an instantiation of the Current Time Service.

- **Test Procedure**
  The Upper Tester issues a command to the IUT to Discover All Characteristic Descriptors using the handle range returned after running TIP/CL/TPD/BV-01-I [Discover Current Time Service] above.
  The IUT executes one pass of the procedure included in GATT.TS [7] Discover All Characteristic Descriptors, GATT/CL/GAD/BV-06-C using the specified handle range.

  ![Diagram](attachment:image.png)

- **Expected Outcome**
  **Pass verdict**
  At least one attribute handle/UUID pair is returned with UUID = «Client Characteristic Descriptor».
4.3.6 TIP/CL/TPD/BV-06-I [Discover Local Time Information Characteristic]

- Test Purpose
  Verify that the Local Time Information Characteristic can be detected by the Time Client IUT.

- Reference
  [4] 4.2

- Initial Condition
  Establish an ATT Bearer connection between the Lower Tester and IUT as defined in Section 4.2.1.
  The Lower Tester includes at least one instantiation of the Current Time Service [8].
  The IUT has executed TIP/CL/TPD/BV-01-I [Discover Current Time Service], and has saved the handle range for an instantiation of the Current Time Service. That instantiation contains an instantiation of the Local Time Information characteristic.

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

  2. Execute the procedure included in GATT.TS [7] Discover Characteristics by UUID, GATT/CL/GAD/BV-05-C once, with the characteristic UUID set to «Local Time Information», with the database specified in initial conditions.

- Expected Outcome
  Pass verdict
  One attribute handle is returned for a Local Time Information Characteristic implemented in the Lower Tester.

4.3.7 TIP/CL/TPD/BV-07-I [Discover Reference Time Information Characteristic]

- Test Purpose
  Verify that the Reference Time Information Characteristic can be detected by the Time Client IUT.

- Reference
  [4] 4.2

- Initial Condition
  Establish an ATT Bearer connection between the Lower Tester and IUT as defined in Section 4.2.1.
  The Lower Tester includes at least one instantiation of the Current Time Service [8].
  The IUT has executed TIP/CL/TPD/BV-01-I [Discover Current Time Service], and has saved the handle range for an instantiation of the Current Time Service. That instantiation contains an instantiation of the Reference Time Information characteristic.
• Test Procedure
The Upper Tester issues a command to the IUT to discover characteristics. There are two alternatives:


• Expected Outcome
Pass verdict

One attribute handle is returned for a Reference Time Information Characteristic implemented in the Lower Tester.

4.3.8 TIP/CL/TPD/BV-08-I [Discover Time with DST Characteristic]

• Test Purpose
Verify that the Time with DST Characteristic can be detected by the Time Client IUT.

• Reference
[4] 4.2

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

The Lower Tester includes at least one instantiation of the Next DST Change Service [10].

The IUT has executed TIP/CL/TPD/BV-02-I [Discover Next DST Change Service], and has saved the handle range for an instantiation of the Next DST Change Service. That instantiation contains an instantiation of the Time with DST characteristic.

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

2. Execute the procedure included in GATT.TS [7] Discover Characteristics by UUID, GATT/CL/GAD/BV-05-C once, with the characteristic UUID set to «Time with DST», with the database specified in initial conditions.

• Expected Outcome
Pass verdict

One attribute handle is returned for a Time with DST Characteristic implemented in the Lower Tester.
4.3.9  TIP/CL/TPD/BV-09-I [Discover Time Update Control Point Characteristic]

• Test Purpose
  Verify that the Time Update Control Point Characteristic can be detected by the Time Client IUT.

• Reference
  [4] 4.2

• Initial Condition
  Establish an ATT Bearer connection between the Lower Tester and IUT as defined in Section 4.2.1.
  The Lower Tester includes at least one instantiation of the Reference Time Update Service [9].
  The IUT has executed TIP/CL/TPD/BV-03-I [Discover Reference Time Update Service], and has saved the handle range for an instantiation of the Reference Time Update Service. That instantiation contains an instantiation of the Time Update Control Point characteristic.

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

  2. Execute the procedure included in GATT.TS [7] Discover Characteristics by UUID, GATT/CL/GAD/BV-05-C once, with the characteristic UUID set to «Time Update Control Point», with the database specified in initial conditions.

• Expected Outcome
  Pass verdict
  One attribute handle is returned for a Time Update Control Point Characteristic implemented in the Lower Tester.

4.3.10  TIP/CL/TPD/BV-10-I [Discover Time Update State Characteristic]

• Test Purpose
  Verify that the Time Update State Characteristic can be detected by the Time Client IUT.

• Reference
  [4] 4.2

• Initial Condition
  Establish an ATT Bearer connection between the Lower Tester and IUT as defined in Section 4.2.1.
  The Lower Tester includes at least one instantiation of the Reference Time Update Service [9].
  The IUT has executed TIP/CL/TPD/BV-03-I [Discover Reference Time Update Service], and has saved the handle range for an instantiation of the Reference Time Update Service. That instantiation contains an instantiation of the Time Update State characteristic.
• Test Procedure
  The Upper Tester issues a command to the IUT to discover characteristics. There are two alternatives:

  2. Execute the procedure included in GATT.TS [7] Discover Characteristics by UUID, GATT/CL/GAD/BV-05-C once, with the characteristic UUID set to «Time Update State», with the database specified in initial conditions.

• Expected Outcome
  
  Pass verdict

  One attribute handle is returned for a Time Update State Characteristic implemented in the Lower Tester.

4.4 Configuration Feature

The procedures defined in this test group verify Time Server IUT implementation of the Features defined in the Time Profile Specification [4] by a Time Server IUT, and usage of the same features by a Time Client IUT.

4.4.1 TIP/CL/TPCF/BV-01-I [Current Time Characteristic Configuration, write with 0x0001]

• Test Purpose
  Verify that the Time Client IUT can configure the Client Characteristic Configuration of Current Time in a Time Server.

• Reference
  [4] 4.4

• Initial Condition

  A preamble procedure defined in Section 4.2.1 is used to set up the transport and L2CAP channel.

  The Lower Tester includes one instantiation of the Current Time Service [8].

  The IUT has executed TIP/CL/TPD/BV-05-I [Discover Current Time – Client Characteristic Configuration Descriptor], and has saved the handle of a Client Characteristic Configuration for Current Time.
• **Test Procedure**

The Upper Tester issues a command to the IUT to configure to receive Current Time.

![Diagram showing ATT_Write_Request and ATT_Write_Response]  

- **Expected Outcome**

  **Pass verdict**

  The IUT sends a correctly formatted ATT_Write_Request to the Lower Tester, containing the handle specified by the Upper Tester, and the value set to <0x0001, Notification>.

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

### 4.5 Read Feature

The procedures defined in this test group verify Time Server IUT implementation of the Features defined in the Time Profile Specification [4] by a Time Server IUT, and usage of the same features by a Time Client IUT.

#### 4.5.1 TIP/CL/TPRF/BV-01-I [Current Time Characteristic]

• **Test Purpose**

  Verify that the Time Client IUT can read the Current Time in a Time Server.

• **Reference**

  [4] 4.3

• **Initial Condition**

  A preamble procedure defined in Section 4.2.1 is used to set up the transport and L2CAP channel.

The Lower Tester includes one instantiation of the Current Time Service [8].

The IUT has executed TIP/CL/TPD/BV-04-I [Discover Current Time Characteristic], and has saved the handle range for an instantiation of the Current Time Service. That instantiation contains an instantiation of the Current Time characteristic.
• **Test Procedure**

The Upper Tester issues a command to the IUT to read the Current Time characteristic by executing GATT.TS [7] Read Characteristic Value, GATT/CL/GAR/CL/BV-01-C.

![Diagram of the test procedure](image)

- **Expected Outcome**

  **Pass verdict**

  The IUT sends a correctly formatted ATT_Read_Request to the Lower Tester, containing the handle specified by the Upper Tester.

  The IUT receives a correctly formatted ATT_Read_Response from the Lower Tester and sends the ReadRes containing the correct Current Time value.

  The received Current Time value matches the one sent by the Lower Tester.

**4.5.2 TIP/CL/TPRF/BV-02-I [Local Time Information Characteristic, read]**

- **Test Purpose**

  Verify that the Time Client IUT can read the Local Time Information value in a Time Server.

- **Reference**

  [4] 4.6

- **Initial Condition**

  A preamble procedure defined in Section 4.2.1 is used to set up the transport and L2CAP channel.

  The Lower Tester includes one instantiation of the Current Time Service [8].

  The IUT has executed TIP/CL/TPD/BV-06-I [Discover Local Time Information Characteristic], and has saved the handle range for an instantiation of the Current Time Service. That instantiation contains an instantiation of the Local Time Information characteristic.
• Test Procedure

The Upper Tester issues a command to the IUT to read the Local Time Information characteristic by executing GATT.TS [7] Read Characteristic Value, GATT/CL/GAR/CL/BV-01-C.

• Expected Outcome

Pass verdict

The IUT sends a correctly formatted ATT_Read_Request to the Lower Tester, containing the handle specified by the Upper Tester.

The IUT receives a correctly formatted ATT_Read_Response from the Lower Tester and sends the ReadRes containing the correct Local Time Information value to the Upper Tester.

The received Local Time Information value matches the one sent by the Lower Tester.

4.5.3 TIP/CL/TPRF/BV-03-I [Reference Time Information Characteristic, read]

• Test Purpose

Verify that the Time Client IUT can read the Reference Time Information value in a Time Server.

• Reference

[4] 4.9

• Initial Condition

A preamble procedure defined in Section 4.2.1 is used to set up the transport and L2CAP channel.

The Lower Tester includes one instantiation of the Current Time Service [8].

The IUT has executed TIP/CL/TPD/BV-07-I [Discover Reference Time Information Characteristic], and has saved the handle range for an instantiation of the Current Time Service. That instantiation contains an instantiation of the Reference Time Information characteristic.

• Test Procedure

The Upper Tester issues a command to the IUT to read the Reference Time Information characteristic by executing GATT.TS [7] Read Characteristic Value, GATT/CL/GAR/CL/BV-01-C.

• Expected Outcome

Pass verdict

The IUT sends a correctly formatted ATT_Read_Request to the Lower Tester, containing the handle specified by the Upper Tester.

The IUT receives a correctly formatted ATT_Read_Response from the Lower Tester and sends the ReadRes containing the correct Reference Time Information value to the Upper Tester.

The received Reference Time Information value matches the one sent by the Lower Tester.
4.5.4  TIP/CL/TPRF/BV-04-I [Time with DST Characteristic, read]

- **Test Purpose**
  Verify that the Time Client IUT can read the Time with DST value in a Time Server.

- **Reference**
  [4] 4.6

- **Initial Condition**
  A preamble procedure defined in Section 4.2.1 is used to set up the transport and L2CAP channel.

  The Lower Tester includes one instantiation of the Next DST Change Service [10].

  The IUT has executed TIP/CL/TPD/BV-08-I [Discover Time with DST Characteristic], and has saved the handle range for an instantiation of the Current Time Service. That instantiation contains an instantiation of the Time with DST characteristic.

- **Test Procedure**
  The Upper Tester issues a command to the IUT to read the Time with DST characteristic by executing GATT.TS [7] Read Characteristic Value, GATT/CL/GAR/CL/BV-01-C.

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

  The IUT sends a correctly formatted ATT_Read_Request to the Lower Tester, containing the handle specified by the Upper Tester.

  The IUT receives a correctly formatted ATT_Read_Response from the Lower Tester and sends the ReadRes containing the correct Time with DST value to the Upper Tester.

  The received Time with DST value matches the one sent by the Lower Tester.

4.5.5  TIP/CL/TPRF/BV-05-I [Time Update State Characteristic, read]

- **Test Purpose**
  Verify that the Time Client IUT can read the Time Update State in a Time Server.

- **Reference**
  [4] 4.9

- **Initial Condition**
  A preamble procedure defined in Section 4.2.1 is used to set up the transport and L2CAP channel.

  The Lower Tester includes one instantiation of the Reference Time Update Service [9].

  The IUT has executed TIP/CL/TPD/BV-03-I [Discover Reference Time Update Service], and has saved the handle range for an instantiation of the Reference Time Update Service. That instantiation contains an instantiation of the Time Update State characteristic.
• Test Procedure
The Upper Tester issues a command to the IUT to read the Time Update State characteristic by executing GATT.TS [7] Read Characteristic Value, GATT/CL/GAR/CL/BV-01-C.

• Expected Outcome
Pass verdict
The IUT sends a correctly formatted ATT_Read_Request to the Lower Tester, containing the handle specified by the Upper Tester.

The IUT receives a correctly formatted ATT_Read_Response from the Lower Tester and sends the ReadRes containing the correct Time Update State value to the Upper Tester.

The received Time Update State value matches the one sent by the Lower Tester.

4.6 Write Feature
The procedures defined in this test group verify Time Server IUT implementation of the Features defined in the Time Profile Specification [4] by a Time Server IUT, and usage of the same features by a Time Client IUT.

4.6.1 TIP/CL/TPWF/BV-01-I [Time Update Control Point Characteristic, write with 0x01]
• Test Purpose
Verify that the Time Client IUT can write the Time Update Control Point characteristic in a Time Server.

• Reference
[4] 4.9

• Initial Condition
A preamble procedure defined in Section 4.2.1 is used to set up the transport and L2CAP channel.

The Lower Tester includes one instantiation of the Reference Time Update Service [9].

The IUT has executed TIP/CL/TPD/BV-09-I [Discover Time Update Control Point Characteristic], and has saved the handle of a Time Update Control Point characteristic.
• Test Procedure

The Upper Tester issues a command to the IUT to write:

```
L2CAP Connection established over selected transport. TIP/CL/TPD/BV-09-C has been executed.
```

```
ATT_Write_Command
(Code = 0x52, Handle of Time Update Control Point, Get Reference Update)
```

```
WriteRequest
(handle, value)
```

```
Upper Tester  IUT  Lower Tester
```

• Expected Outcome

Pass verdict

The IUT sends a correctly formatted ATT_Write_Command Lower Tester, containing the handle specified by the Upper Tester, and the value set to <0x01, Get Reference Update>.

The Lower Tester confirms the written Time Update Control Point characteristic matches the one sent by the IUT.

4.6.2 TIP/CL/TPWF/BV-02-I [Time Update Control Point Characteristic, write with 0x02]

• Test Purpose

Verify that the Time Client IUT can write the Time Update Control Point characteristic in a Time Server.

• Reference

[4] 4.9

• Initial Condition

A preamble procedure defined in Section 4.2.1 is used to set up the transport and L2CAP channel.

The Lower Tester includes one instantiation of the Reference Time Update Service [9].

The IUT has executed TIP/CL/TPD/BV-09-I [Discover Time Update Control Point Characteristic], and has saved the handle of a Time Update Control Point characteristic.
• **Test Procedure**

The Upper Tester issues a command to the IUT to write:

![Diagram showing communication between Lower Tester, IUT, and Upper Tester]

- **Expected Outcome**

  **Pass verdict**

  The IUT sends a correctly formatted ATT_Write_Command Lower Tester, containing the handle specified by the Upper Tester, and the value set to <0x02, Cancel Reference Update>.

  The Lower Tester confirms the written Time Update Control Point characteristic matches the one sent by the IUT.

4.7 **Notify Feature**

The procedures defined in this test group verify Time Server IUT implementation of the Features defined in the Time Profile Specification [4] by a Time Server IUT, and usage of the same features by a Time Client IUT.

4.7.1 **TIP/CL/TPNF/BV-01-I [Notify Current Time Characteristic, Notify]**

• **Test Purpose**

  Verify that the Time Client IUT can receive notification of the Current Time characteristic in a Time Server.

• **Reference**

  [4] 4.4

• **Initial Condition**

  A preamble procedure defined in Section 4.2.1 is used to set up the transport and L2CAP channel.

  The Lower Tester includes one instantiation of the Current Time Service [8].
The IUT has executed TIP/CL/TPD/BV-04-I [Discover Current Time Characteristic], and has saved the handle of a Current Time characteristic.

The IUT has executed TIP/CL/TPCF/BV-01-I [Current Time Characteristic Configuration, write with 0x0001] to expect Current Time Notification.

- **Test Procedure**

The Lower Tester sends an ATT_Handle_Value_Notification containing a Current Time characteristic value to the IUT.

- **Expected Outcome**

  Pass verdict

The IUT indicated the received Current Time value to the Upper Tester, e.g., Notification (Current Time value). The reported Current Time value matches the one sent by the Lower Tester.

### 4.8 Connection Features

The procedures defined in this test group verify Time Server IUT implementation of the Features defined in the Time Profile Specification [4] by a Time Server IUT, and usage of the same features by a Time Client IUT.

#### 4.8.1 Verify Bond Status on Reconnection

- **Test Purpose**

  Verify that the Central starts encryption with a previously bonded Peripheral on reconnection, and success.

- **Test Case IDs**

  TIP/CL/TPCN/BV-01-I
  TIP/SR/TPCN/BV-01-I

- **Reference**

  [4] 5.2.3
• Initial Condition

The IUT and the Lower Tester are bonded.

No connection is established between the IUT and Lower Tester.

• Test Procedure

1. The Lower Tester begins advertising using GAP undirected connectable mode.
2. The IUT establishes a connection to the Lower Tester.
3. The IUT starts encryption when the connection is established.

• Expected Outcome

Pass verdict

The IUT starts encryption when the connection is established.

Encryption is successfully done.
## 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 Time Profile (TIP) [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>TIP 8/1</td>
<td>Use Current Time Service</td>
<td>TIP/CL/TPD/BV-01-I</td>
</tr>
<tr>
<td>TIP 8/2</td>
<td>Use Next DST Change Service</td>
<td>TIP/CL/TPD/BV-02-I</td>
</tr>
<tr>
<td>TIP 8/3</td>
<td>Use Reference Time Update Service</td>
<td>TIP/CL/TPD/BV-03-I</td>
</tr>
<tr>
<td>TIP 8/4</td>
<td>Discover Current Time Characteristic for Current Time Service</td>
<td>TIP/CL/TPD/BV-04-I</td>
</tr>
<tr>
<td>TIP 8/5</td>
<td>Discover Client Characteristic Configuration Descriptor for Current Time</td>
<td>TIP/CL/TPD/BV-05-I</td>
</tr>
<tr>
<td>TIP 8/6</td>
<td>Discover Local Time Information Characteristic for Current Time Service</td>
<td>TIP/CL/TPD/BV-06-I</td>
</tr>
<tr>
<td>TIP 8/7</td>
<td>Discover Reference Time Information Characteristic for Current Time Service</td>
<td>TIP/CL/TPD/BV-07-I</td>
</tr>
<tr>
<td>TIP 8/8</td>
<td>Discover Time with DST Characteristic for Next DST Change Service</td>
<td>TIP/CL/TPD/BV-08-I</td>
</tr>
<tr>
<td>TIP 8/9</td>
<td>Discover Time Update Control Point Characteristic for Current Time Service</td>
<td>TIP/CL/TPD/BV-09-I</td>
</tr>
<tr>
<td>TIP 8/10</td>
<td>Discover Time Update State Characteristic for Current Time Service</td>
<td>TIP/CL/TPD/BV-10-I</td>
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<tr>
<td>TIP 9/1</td>
<td>Read Current Time</td>
<td>TIP/CL/TPRF/BV-01-I</td>
</tr>
<tr>
<td>Item</td>
<td>Feature</td>
<td>Test case(s)</td>
</tr>
<tr>
<td>-----------------------------</td>
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<tr>
<td>TIP 9/2 AND TIP 9/3</td>
<td>Configure Client Characteristic Configuration for Current Time</td>
<td>TIP/CL/TPCF/BV-01-I</td>
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<tr>
<td>TIP 9/4</td>
<td>Read Local Time Information</td>
<td>TIP/CL/TPRF/BV-02-I</td>
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<tr>
<td>TIP 9/5</td>
<td>Read Reference Time Information</td>
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</tr>
<tr>
<td>TIP 9/6</td>
<td>Read Time with DST</td>
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</tr>
<tr>
<td>TIP 9/7</td>
<td>Read Time Update State</td>
<td>TIP/CL/TPRF/BV-05-I</td>
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<tr>
<td>TIP 9/8</td>
<td>Write without Response, Time Update Control Point</td>
<td>TIP/CL/TPWF/BV-01-I</td>
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<tr>
<td>TIP 9/3</td>
<td>Receive Notification of Current Time</td>
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<tr>
<td>TIP 9/9 AND TIP 11/2</td>
<td>Verify Bond Status on Reconnection for Time Server (Client IUT)</td>
<td>TIP/CL/TPCN/BV-01-I</td>
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<tr>
<td>TIP 4/1</td>
<td>Verify Bond Status on Reconnection for Time Server (Server IUT)</td>
<td>TIP/SR/TPCN/BV-01-I</td>
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</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>2011-09-15</td>
<td>Adopted by the Bluetooth SIG Board of Directors</td>
</tr>
<tr>
<td>1.0.1r0</td>
<td>2012-05-21</td>
<td>TSE 4629: Delete TC TP/TPCF/TPC/BV-02-C; update TCMT for TP/TPCF/TPC/BV-01-C</td>
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<tr>
<td>1.0.1</td>
<td>2012-07-24</td>
<td>Prepare for publication.</td>
</tr>
<tr>
<td>1.0.2r1</td>
<td>2012-09-06</td>
<td>TSE 4931: All test cases changed from –C to –I. TSE 4937: Editorial error in section 4.5.5. TP/TPD/TPC/BV-11-I changed to TP/TPD/TPC/BV-03-I.</td>
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<tr>
<td>1.0.2</td>
<td>2012-10-30</td>
<td>Prepare for Publication</td>
</tr>
<tr>
<td>1.0.3r00</td>
<td>2016-05-21</td>
<td>Converted to new Test Case ID conventions as defined in TSTO v4.1.</td>
</tr>
<tr>
<td>1.0.3r01</td>
<td>2016-06-09</td>
<td>Test Spec Template Conversion</td>
</tr>
<tr>
<td>1.0.3r02</td>
<td>2016-06-09</td>
<td>Reviewed by Magnus Sommansson</td>
</tr>
<tr>
<td>1.0.3r03</td>
<td>2016-06-13</td>
<td>Split Verify Bond Status test case by role into two test cases (TIP/CL/TPCN/BV-01-I and TIP/SR/TPCN/BV-01-I) following conversion to new test case ID conventions</td>
</tr>
<tr>
<td>1.0.3</td>
<td>2016-07-14</td>
<td>Prepared for TCRL 2016-1 publication.</td>
</tr>
<tr>
<td>1.0.3 edition 2r00</td>
<td>2018-11-29</td>
<td>Editorial changes only. Template updated. Revision History and contributors moved to the end of the document.</td>
</tr>
<tr>
<td>1.0.3 edition 2</td>
<td>2020-01-10</td>
<td>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.</td>
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## Contributors

<table>
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<tr>
<th>Name</th>
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</table>