Cycling Speed and Cadence Profile (CSCP)

***Bluetooth*® Test Suite**

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Contents

1 Scope

This Bluetooth document contains the Test Suite Structure (TSS) and test cases to test the implementation of the Bluetooth Cycling Speed and Cadence Profile Specification with the objective to provide a high probability of air interface interoperability between the tested implementation and other manufacturers' Bluetooth devices.

2 References, definitions, and abbreviations

2.1 References

This document incorporates provisions from other publications by dated or undated reference. These references are cited at the appropriate places in the text, and the publications are listed hereinafter. Additional definitions and abbreviations can be found in [1] and [2].

[1] Test Strategy and Terminology Overview

[2] Bluetooth Core Specification, Version 4.0 or later

[3] Cycling Speed and Cadence Profile Specification, Version 1.0 or later

[4] ICS Proforma for Cycling Speed and Cadence Profile, CSCP.ICS

[5] GATT Test Suite, GATT.TS

[6] Cycling Speed and Cadence Service Specification, Version 1.0 or later

[7] Cycling Speed and Cadence Service Test Suite, CSCS.TS

[8] Device Information Service Specification, Version 1.1 or later

[9] Cycling Speed and Cadence Profile Implementation eXtra Information for Test, CSCP.IXIT

[10] Appropriate Language Mapping Tables document

[11] Cycling Speed and Cadence Profile Specification, Version 1.0.1

2.2 Definitions

In this Bluetooth document, the definitions from [1] and [2] apply.

Certain terms that were identified as inappropriate have been replaced. For a list of the original terms and their replacement terms, see the Appropriate Language Mapping Tables document [10].

2.3 Acronyms and abbreviations

In this Bluetooth document, the definitions, acronyms, and abbreviations from [1] and [2] apply.

3 Test Suite Structure (TSS)

3.1 Overview

The Cycling Speed and Cadence Profile requires the presence of GAP, SM, and GATT. This is illustrated in Figure 3.1.

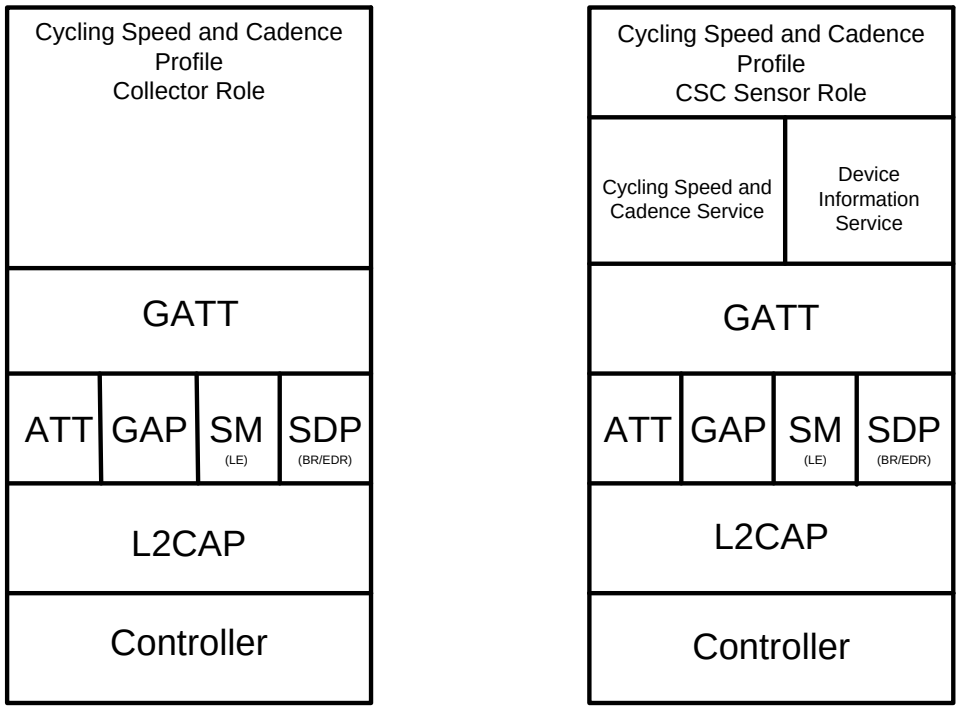

Figure 3.1: Cycling Speed and Cadence Test Model

3.2 Test Strategy

The test objectives are to verify functionality of the Cycling Speed and Cadence Profile within a Bluetooth Host and enable interoperability between Bluetooth Hosts on different devices. The testing approach covers mandatory and optional requirements in the specification and matches these to the support of the IUT as described in the ICS. Any defined test herein is applicable to the IUT if the ICS logical expression defined in the Test Case Mapping Table (TCMT) evaluates to true.

The test equipment provides an implementation of the Radio Controller and the parts of the Host needed to perform the test cases defined in this Test Suite. A Lower Tester acts as the IUT's peer device and interacts with the IUT over-the-air interface. The configuration, including the IUT, needs to implement similar capabilities to communicate with the test equipment. For some test cases, it is necessary to stimulate the IUT from an Upper Tester. In practice, this could be implemented as a special test interface, a Man Machine Interface (MMI), or another interface supported by the IUT.

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

3.2.1 Test database requirements

The following requirements apply to the set of databases used by the Lower Tester for testing of GATT Client functionality:

- The Lower Tester includes one instantiation of each of the services used by this profile including all defined characteristics.
- Each service instantiation also contains two «future» characteristics.
  - If possible, with one inserted before the first characteristic defined
  - If possible, with one appended after the last characteristic defined
- Each «future» characteristic has a 16-bit UUID randomly selected from unassigned UUIDs at the time of the test.

3.3 Test groups

The following test groups have been defined:

- Generic GATT Integrated Tests
- Discovery of Services and Characteristics
- Features
- Service Procedures

4 Test cases (TC)

4.1 Introduction

4.1.1 Test case identification conventions

Test cases are assigned unique identifiers per the conventions in [1]. The convention used here is:
<spec abbreviation>/<IUT role>/<class>/**<feat>**/<func>/<subfunc>**/**<cap>**/<xx>-<nn>-<y>**.

Additionally, testing of this specification includes tests from the GATT Test Suite [5] referred to as Generic GATT Integrated Tests (GGIT); when used, the test cases in GGIT 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 Abbreviation <spec abbreviation>**
CSCP	Cycling Speed and Cadence Profile
Identifier Abbreviation	**Role identifier <IUT role>**
COL	Collector Role
SEN	CSC Sensor Role
Identifier Abbreviation	**Reference Identifier <GGIT test group>**
CGGIT	Client Generic GATT Integrated Tests
SGGIT	Server Generic GATT Integrated Tests
Identifier Abbreviation	**Reference Identifier <GGIT class>**
CHA	Characteristic
ISFC	Indication Supported Features Characteristic
SDPNF	SDP Record Not Found
SER	Service
Identifier Abbreviation	**Class identifier <class>**
CSCD	Discovery of Services and Characteristics
CSCF	Features
SPE	Service Procedure – Error Handling
SPL	Service Procedure – Request Supported Sensor Locations
SPS	Service Procedure – Set Cumulative Value
SPU	Service Procedure – Update Sensor Location

Table 4.1: CSCP TC feature naming conventions

4.1.2 Conformance

When conformance is claimed for a particular specification, all capabilities are to be supported in the specified manner. The mandated tests from this Test Suite depend on the capabilities to which conformance is claimed.

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

Such tests may verify:

- That claimed capabilities may be used in any order and any number of repetitions not excluded by the specification
- That capabilities enabled by the implementations are sustained over durations expected by the use case
- That the implementation gracefully handles any quantity of data expected by the use case
- That in cases where more than one valid interpretation of the specification exists, the implementation complies with at least one interpretation and gracefully handles other interpretations
- That the implementation is immune to attempted security exploits

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

In any case, where a member finds an issue with the test plan generated by the Bluetooth SIG qualification tool, with the test case as described in the Test Suite, or with the test system utilized, the member is required to notify the responsible party via an erratum request such that the issue may be addressed.

4.1.3 Pass/Fail verdict conventions

Each test case has an Expected Outcome section. The IUT is granted the Pass verdict when all the detailed pass criteria conditions within the Expected Outcome section are met.

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

4.2 Setup preambles

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

4.2.1 ATT Bearer on LE Transport

- 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 several L2CAP channels (PSM 0x001F) between the IUT and the Lower Tester over that BR/EDR transport.

4.2.3 Collector: Configure CSC Sensor for use with SC Control Point

- Preamble Purpose

  This preamble procedure specifies how the Collector IUT configures the CSC Sensor for use with SC Control Point and is valid for LE and BR/EDR transports.

- Preamble Procedure

  1. Establish an ATT Bearer connection between the Lower Tester and 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 handles of the CSC Measurement characteristic, CSC Feature, Sensor Location and SC Control Point characteristic have been previously discovered by the Lower Tester during the test procedures in Section 4.3 or are known to the Lower Tester by other means.
  3. The handles of the Client Characteristic Configuration descriptor of the CSC Measurement characteristic, SC Control Point characteristic 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.
  4. The Lower Tester may perform a bonding procedure. If previously bonded, enable encryption if not already enabled.
  5. The IUT configures the SC Control Point characteristic for indications, and if the test case requires notifications of the CSC Measurement characteristic, the IUT configures the CSC Measurement characteristic for notifications. These configurations may occur in any order.

4.2.4 LE Collector: Scan to detect Sensor Advertisements

- Preamble Purpose

  This LE preamble procedure specifies how the Collector IUT scans for CSC Sensor advertisements for the case when a Sensor has new data available.

- Reference

  [3] 5.2

  [2] GAP 9.3.3, 9.3.4

- Preamble Procedure

  1. Configure the Collector IUT to accept commands from the Upper Tester to receive CSC measurements.
  2. The Upper Tester commands the Collector IUT to initiate a connection and the IUT starts scanning.
  3. The CSC Sensor (Lower Tester) advertises to the Collector IUT either using:

     - ALT 1: GAP Directed Connectable Mode (send ADV_DIRECT_IND packets)

     or

     - ALT 2: GAP Undirected Connectable Mode (send ADV_IND packets)

  4. The Lower Tester waits for responses from the Collector IUT.
  5. The Collector IUT sends a CONNECT_REQ and an optionally empty PDU to the Lower Tester.

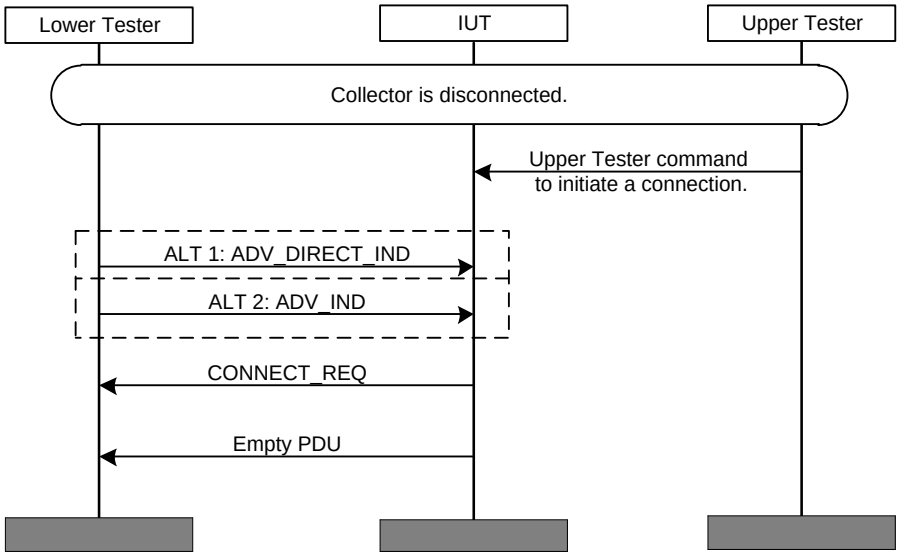

Figure 4.1: LE Collector: Scan to detect Sensor Advertisements

4.2.5 BR/EDR Collector

4.2.5.1 Unbonded Devices

- Preamble Purpose

  This BR/EDR preamble procedure specifies how the Collector IUT scans for the CSC Sensor for the case when a CSC Sensor has new records available.

- Reference

  [3] 5.3

  [2] GAP 4.1, 4.2

- Preamble Procedure

  1. Configure the Collector IUT to accept commands to receive CSC measurements.
  2. Put the CSC Sensor in General Discoverable mode.
  3. The Upper Tester commands the Collector IUT to initiate a connection and the IUT starts scanning.
  4. The CSC Sensor (Lower Tester) exposes the SDP record for the Cycling Speed and Cadence Service.
  5. The Collector IUT validates the SDP record and establishes a connection to the CSC Sensor.
  6. The Collector uses the GAP General Discovery procedure to discover a CSC Sensor to establish a connection to a CSC Sensor.

4.2.5.2 Bonded Devices

- Preamble Purpose

  In case of BR/EDR, either a CSC Sensor or Collector could initiate connection when they are bonded. The device initiating the connection becomes a Central and is referred to herein as a paging device and the device accepting the connection becomes a Peripheral and is referred to herein as a page scanning device.

This BR/EDR preamble procedure specifies how a paging device connects to a page scanning device.

- Reference

  [3] 5.3

  [2] GAP 4.1, 4.2

- Preamble Procedure

  1. Configure the Collector to accept commands to receive CSC measurements.
  2. Put the page scanning device in connectable mode to accept a connection from the paging device.
  3. The connection is initiated by paging device.
  4. The Peripheral exposes the SDP record for the Cycling Speed and Cadence Service.
  5. The Central validates the SDP record and establishes a connection to the Peripheral.
  6. The Central uses the GAP Link Establishment Procedure to connect to any bonded device.

4.3 Generic GATT Integrated Tests

Execute the Generic GATT Integrated Tests defined in Section 6.3, Server test procedures (SGGIT), and Section 6.4, Client test procedures (CGGIT), in [5] using Table 4.2 as input:

TCID	Service / Characteristic / Descriptor	Reference	Properties	Value Length (Octets)	Service Type
CSCP/COL/CGGIT/SER/BV-01-C [Service GGIT - Cycling Speed and Cadence Service]	Cycling Speed and Cadence Service	[3] 4.2.1	-	-	Primary Service
CSCP/COL/CGGIT/SER/BV-02-C [Service GGIT - Device Information Service]	Device Information Service	[3] 4.2.2	-	-	Primary Service
CSCP/COL/CGGIT/CHA/BV-01-C [Characteristic GGIT - CSC Measurement]	CSC Measurement Characteristic	[3] 4.3.1.1	0x10 (Notify)	Skip	-
CSCP/COL/CGGIT/CHA/BV-02-C [Characteristic GGIT - CSC Feature]	CSC Feature Characteristic	[3] 4.3.1.2	0x22 (Read, Indicate)	2	-
CSCP/COL/CGGIT/CHA/BV-03-C [Characteristic GGIT - Sensor Location]	Sensor Location Characteristic	[3] 4.3.1.3	0x02 (Read)	1	-
CSCP/COL/CGGIT/CHA/BV-04-C [Characteristic GGIT – SC Control Point]	SC Control Point Characteristic	[3] 4.3.1.4	0x28 (Write, Indicate)	Skip	-
CSCP/SEN/SGGIT/SDPNF/BV-01-C [Not discoverable over BR/EDR - Cycling Speed and Cadence Service]	Cycling Speed and Cadence Service	[3] 2.5	-	-	-

Table 4.2: Input for the GGIT Server test procedure

4.3.1 Generic GATT Indication Supported Features characteristic

Execute the Generic GATT Indication Supported Features Characteristic Tests defined in Section 6.4, Client Test Procedures (CGITT), in [5] using Table 4.3 below as input:

TCID	Characteristic	Reference	TC Configuration
CSCP/COL/CGGIT/ISFC/BV-01-C [Characteristic GGIT – CSC Feature indication]	CSC Feature	[11] 4.5	N/A

Table 4.3: Input for the GGIT Indication Supported Features Characteristic tests

4.4 Discover Services and Characteristics

The procedures defined in this test group verify the IUT's ability to discover the services and characteristics exposed by a CSC Sensor (Lower Tester).

CSCP/COL/CSCD/BV-11-C [Discover Device Information Service Characteristics]

- Test Purpose

  Verify that a Collector IUT can discover all characteristics of a Device Information Service supported by the IUT.

- Reference

  [3] 4.3.2

- Initial Condition

  - Via IXIT [9] the IUT manufacturer specifies all characteristics of the Device Information Service supported by the IUT.
  - Run the preamble procedure to enable the Collector to initiate connection to a CSC Sensor included in Section 4.2.4 if using an LE transport or Section 4.2.5 if using a BR/EDR transport.
  - The IUT has executed CSCP/COL/CGGIT/SER/BV-02-C [Service GGIT - Device Information Service] procedure and has saved the handle range for an instantiation of the Device Information contained in the Lower Tester. The Device Information Service contains one or more characteristics.

- Test Procedure

  1. The Upper Tester issues a command to the IUT to discover all characteristics of the Device Information Service supported by the IUT.
  2. The IUT executes either alternative 2A or 2B.

     Alternative 2A (Discover All Characteristics of a Service sub-procedure):

     2A: Discover All Characteristics of a Service using the specified handle range, with the Lower Tester instantiating the database specified in Section 3.2.1.

     Alternative 2B (Discover Characteristics by UUID sub-procedure):

     2B: Discover Characteristics by UUID using each of the UUIDs for the characteristics of the Device Information Service supported by the IUT, with the Lower Tester instantiating the database specified in Section 3.2.1.

- Expected Outcome

  Pass verdict

  For each characteristic supported by the IUT contained in the Lower Tester's instantiation of the Device Information Service, the IUT reports an attribute handle/value pair for each characteristic specified in the IXIT [9] to the Upper Tester.

CSCP/COL/CSCD/BV-12-C [Read Device Information Service Characteristics]

- Test Purpose

  Verify that a Collector IUT can read all characteristics of a Device Information Service supported by the IUT.

- Reference

  [3] 3.2, 4.3.2

- Initial Condition

  - Via IXIT [9] the IUT manufacturer specifies all characteristics of the Device Information Service supported by the IUT.
  - Run the preamble procedure to enable the Collector to initiate connection to a CSC Sensor included in Section 4.2.4 if using an LE transport or Section 4.2.5 if using a BR/EDR transport.
  - The Lower Tester includes one instantiation of the Device Information Service [8] including all defined characteristics.
  - The IUT has previously executed the procedure included in CSCP/COL/CSCD/BV-11-C [Discover Device Information Service Characteristics], so it has the handle/value pairs for all characteristics of the Device Information Service supported by the IUT.

- Test Procedure

  The following test steps are run twice and a disconnection may occur between the two rounds. In the first pass, the string includes only character values in the ASCII printable range (i.e., 0x20 – 0x7E). In the second pass, the string includes character values outside the ASCII printable range.

  1. The Upper Tester issues a command to the IUT to read all characteristics of the Device Information Service supported by the IUT.
  2. For each characteristic of the Device Information Service supported by the IUT, the IUT sends an ATT_Read_Request to the Lower Tester containing the handle specified by the Upper Tester.
  3. The IUT receives an ATT_Read_Response and reports the value to the Upper Tester.

- Expected Outcome

  Pass verdict

  For each characteristic contained in the Lower Tester's instantiation of the Device Information Service supported by the IUT, the IUT reports the characteristic value for all characteristics specified in the IXIT [9] to the Upper Tester, including any printable or non-printable ASCII values.

4.5 Cycling Speed and Cadence Features

The procedures defined in this test group verify Cycling Speed and Cadence Sensor IUT implementation of the Features defined in the Cycling Speed and Cadence Profile Specification [3] by a CSC Sensor IUT, and usage of the same features by a Collector IUT.

CSCP/SEN/CSCF/BV-01-C [Cycling Speed and Cadence Service UUID in AD]

- Test Purpose

  Verify that the Cycling Speed and Cadence Service UUID is included in AD (Advertising Data) from the CSC Sensor IUT when using the LE Transport.

- Reference

  [3] 3.1.1

- Initial Condition

  - The IUT is powered on in GAP Discoverable Mode.
  - The IUT is induced to generate Advertising Packets using the preamble described in Section 4.2.3.

- Test Procedure

  The Lower Tester listens for Advertising Packets from the IUT.

- Expected Outcome

  Pass verdict

  At least one received Advertising Packet contains the defined Service UUID for «Cycling Speed and Cadence Service».

CSCP/SEN/CSCF/BV-02-C [Local Name included in AD or Scan Response]

- Test Purpose

  Verify that the Local Name is included in AD (Advertising Data) or Scan Response data from the CSC Sensor IUT when using the LE Transport.

- Reference

  [3] 3.1.1.2

- Initial Condition

  - The IUT is powered on.
  - The IUT is induced to generate Advertising Packets using the preamble described in Section 4.2.3.

- Test Procedure

  1. The Lower Tester listens for Advertising Packets from the IUT.
  2. When the Lower Tester receives an Advertising Packet from IUT, it sends a Scan Request to the IUT.
  3. The Lower Tester listens for a Scan Response from the IUT.

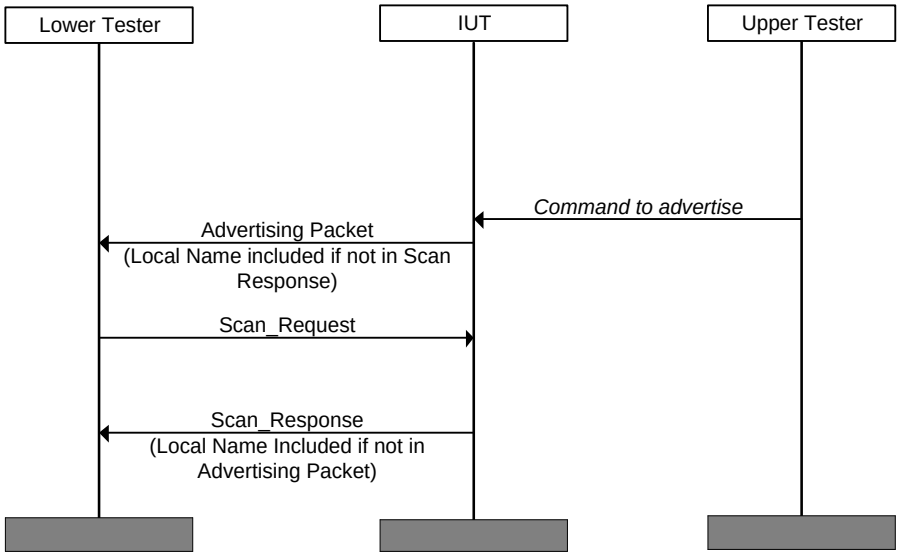

Figure 4.2: CSCP/SEN/CSCF/BV-02-C [Local Name included in AD or Scan Response]

- Expected Outcome

  Pass verdict

  The IUT sends an Advertising packet and a Scan Response packet.

  The IUT includes the Local Name in either the Advertising packet or Scan Response packet, but not both.

CSCP/SEN/CSCF/BV-03-C [Appearance included in AD or Scan Response]

- Test Purpose

  Verify that the Appearance characteristic value is included in AD (Advertising Data) or Scan Response data from the CSC Sensor IUT when using the LE Transport.

- Reference

  [3] 3.1.1.4

- Initial Condition

  - The IUT is powered on.
  - The IUT is induced to generate Advertising Packets using the preamble described in Section 4.2.3.

- Test Procedure

  1. The Lower Tester listens for Advertising Packets from the IUT.
  2. When the Lower Tester receives an Advertising Packet from IUT, it sends a Scan Request to the IUT.
  3. The Lower Tester listens for a Scan Response from the IUT.

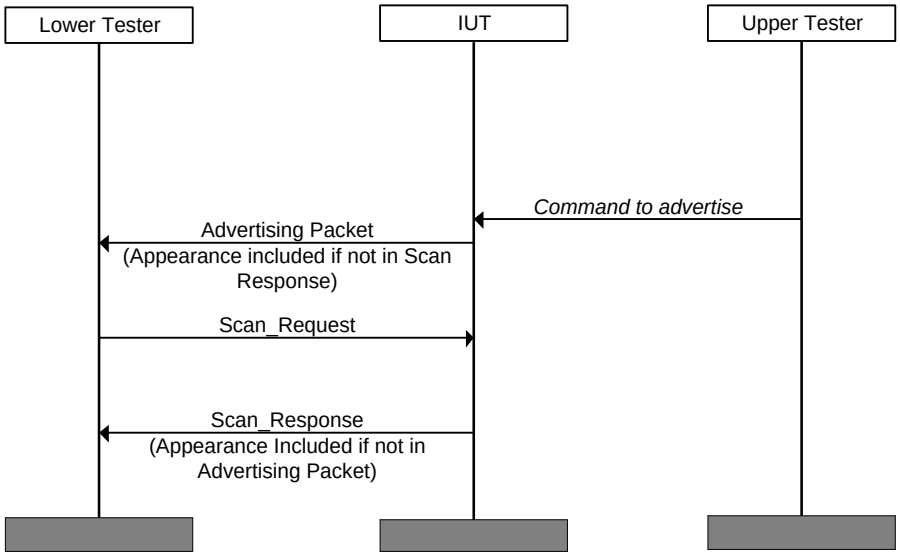

Figure 4.3: CSCP/SEN/CSCF/BV-03-C [Appearance included in AD or Scan Response]

- Expected Outcome

  Pass verdict

  The IUT sends an Advertising packet and a Scan Response packet.

  The IUT includes the Appearance characteristic value in either the Advertising packet or Scan Response packet, but not both.

CSCP/COL/CSCF/BV-04-C [Configure CSC Measurement for Notification]

- Test Purpose

  Verify that the Collector IUT can configure a CSC Sensor (Lower Tester) to notify CSC Measurement characteristics.

- Reference

  [3] 4.4

- Initial Condition

  - A preamble procedure defined in Section 4.2.4 if using an LE transport or Section 4.2.5 if using a BR/EDR transport is used to setup the transport and L2CAP channel and initiate connection to a CSC Sensor.
  - The IUT has discovered the Client Configuration Descriptor for a CSC Measurement characteristic contained in the Lower Tester.

- Test Procedure

  1. The Upper Tester sends a command to the IUT to configure the CSC Sensor to receive CSC Measurement characteristics.

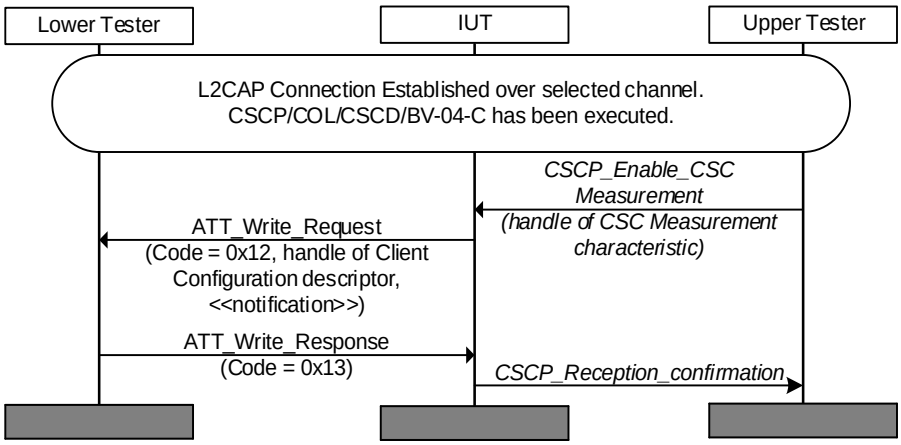

Figure 4.4: CSCP/COL/CSCF/BV-04-C [Configure CSC Measurement for Notification]

- Expected Outcome

  Pass verdict

  IUT sends a correctly formatted ATT_Write_Request (0x12) to the Lower Tester, with the handle set to that of the Client Configuration Descriptor for a CSC Measurement characteristic, and the value set to «notification».

CSCP/COL/CSCF/BV-05-C [Receive CSC Measurement Notifications]

- Test Purpose

  Verify that the Collector IUT can receive notifications of the CSC Measurement Characteristic, including all variants.

- Reference

  [3] 4.4

- Initial Condition

  - A preamble procedure defined in Section 4.2.4 if using an LE transport or Section 4.2.5 if using a BR/EDR transport is used to setup the transport and L2CAP channel and initiate connection to a CSC Sensor.
  - The IUT has executed the procedure included in CSCP/COL/CSCF/BV-04-C [Configure CSC Measurement for Notification], which configures it to expect CSC Measurement Notifications.
  - The IUT knows the handle of the CSC Measurement characteristic.

- Test Procedure

  1. The Lower Tester sends an ATT_Handle_Value_Notification containing a CSC Measurement characteristic value to the IUT.
  2. The Lower Tester sends one CSC Measurement characteristic notification for each Test Pattern shown in the following table. For each Test Pattern, the value of the Flags field is shown along with the corresponding pass criteria.

Test Pattern	Flags Field Value	Pass Criteria
1	000000001	Only optional fields present are Cumulative Wheel Revolutions and Last Wheel Event Time.
2	000000010	Only optional fields present are Cumulative Crank Revolutions and Last Crank Event Time.
3	000000011	All optional fields are present: Cumulative Wheel Revolutions, Last Wheel Event Time, Cumulative Crank Revolutions and Last Crank Event Time.

Table 4.4: CSCP/COL/CSCF/BV-05-C [Receive CSC Measurement Notifications] Test Patterns

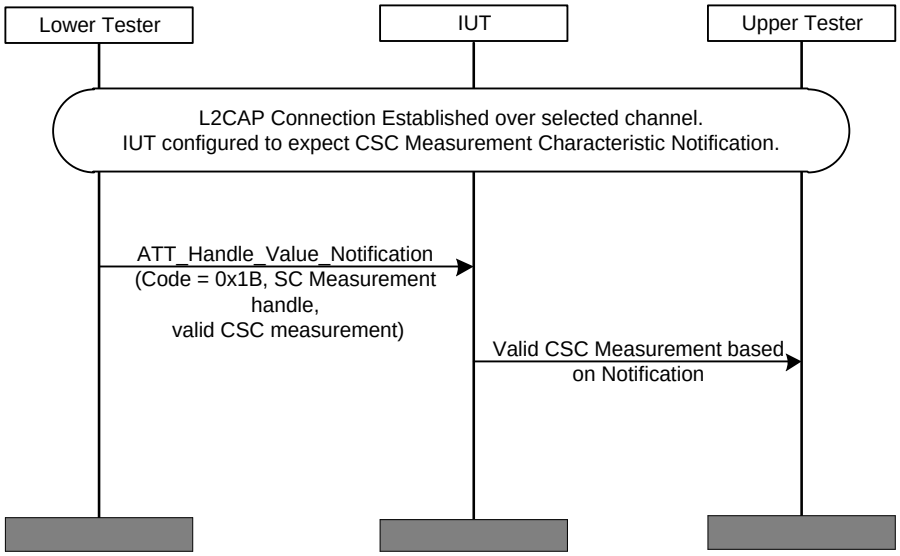

Figure 4.5: CSCP/COL/CSCF/BV-05-C [Receive CSC Measurement Notifications]

- Expected Outcome

  Pass verdict

  IUT is able to correctly parse the received CSC Measurement values according to the pass criteria in the table above. The reported CSC Measurement field values match the ones sent by the Lower Tester.

CSCP/COL/CSCF/BV-06-C [Receive CSC Measurement Notifications – Last Wheel Event Time Roll Over]

- Test Purpose

  Verify that the Collector IUT can receive notifications of the CSC Measurement Characteristic and properly calculate speed when the value of the Last Wheel Event Time field rolls over.

- Reference

  [3] 4.4

- Initial Condition
  - A preamble procedure defined in Section 4.2.4 if using an LE transport or Section 4.2.5 if using a BR/EDR transport is used to setup the transport and L2CAP channel and initiate connection to a CSC Sensor.
  - The IUT has executed the procedure included in CSCP/COL/CSCF/BV-04-C [Configure CSC Measurement for Notification], which configures it to expect CSC Measurement Notifications.
  - The IUT knows the handle of the CSC Measurement characteristic.
- Test Procedure
  1. Configure the IUT for Instantaneous Speed calculation with a wheel circumference of 210 centimeters. An IUT may be configured to an alternative value for calculation. Any alternative value is noted and included in testing evidence to support the calculated value of Instantaneous Speed.
  2. Perform an action on the Lower Tester that will induce it to set the Cumulative Wheel Revolutions values and the Last Wheel Event Time values in the table below such as to induce a Last Wheel Event Time rollover event.

	Cumulative Wheel Revolution	Last Wheel Event Time	Expected Instantaneous Speed at IUT [km/h]
1	1000	64000	N/A
2	1008	65024	60.48
3	1016	512	60.48
4	1024	1536	60.48
5	1032	2560	60.48

Table 4.5: CSCP/COL/CSCF/BV-06-C [Receive CSC Measurement Notifications – Last Wheel Event Time Roll Over]

  3. The Lower Tester sends five ATT_Handle_Value_Notifications containing a CSC Measurement characteristic value to the IUT (corresponding to the sequence of rows in the table above) that simulate a regular and consistent wheel rotation as on a bike including a Last Wheel Event Time field roll over event.
  4. Verify that the IUT responds correctly when the Last Wheel Event Time value rolls over.
- Expected Outcome

  Pass verdict

  IUT receives notifications of CSC Measurement values from the Lower Tester that include Wheel Revolution Data.

  IUT correctly calculates consistent instantaneous speed values before and after the roll over event.

CSCP/COL/CSCF/BV-07-C [Receive CSC Measurement Notifications – Cumulative Crank Revolutions Roll Over]

- Test Purpose

  Verify that the Collector IUT can receive notifications of the CSC Measurement Characteristic and properly calculate cadence when the value of the Cumulative Crank Revolutions field rolls over.

- Reference

  [3] 4.4

- Initial Condition

  - A preamble procedure defined in Section 4.2.4 if using an LE transport or Section 4.2.5 if using a BR/EDR transport is used to setup the transport and L2CAP channel and initiate connection to a CSC Sensor.
  - The IUT has executed the procedure included in CSCP/COL/CSCF/BV-04-C [Configure CSC Measurement for Notification], which configures it to expect CSC Measurement Notifications.
  - The IUT knows the handle of the CSC Measurement characteristic.

- Test Procedure

  1. Perform an action on the Lower Tester that will induce it to set the Cumulative Crank Revolutions values and the Last Crank Event Time values in the table below such as to induce a Cumulative Crank Revolutions rollover event.

	Cumulative Crank Revolutions	Last Crank Event Time	Expected Instantaneous Cadence [rpm]
1	65534	9300	N/A
2	65535	10324	60
3	0	11348	60
4	1	12372	60
5	2	13396	60

Table 4.6: CSCP/COL/CSCF/BV-07-C [Receive CSC Measurement Notifications – Cumulative Crank Revolutions Roll Over]

  2. The Lower Tester sends five ATT_Handle_Value_Notifications containing a CSC Measurement characteristic value to the IUT (corresponding to the sequence of rows in the table above) that simulate a regular and consistent crank rotation as on a bike including a Cumulative Crank Revolutions field roll over event.
  3. Verify that the IUT responds correctly when the Cumulative Crank Revolutions value rolls over.

- Expected Outcome

  Pass verdict

  IUT receives notifications of CSC Measurement values from the Lower Tester that include Crank Revolution Data.

  IUT correctly calculates consistent instantaneous cadence values before and after the roll over event.

CSCP/COL/CSCF/BV-08-C [Receive CSC Measurement Notifications – Last Crank Event Time Roll Over]

- Test Purpose

  Verify that the Collector IUT can receive notifications of the CSC Measurement Characteristic and properly calculate cadence when the value of the Last Crank Event Time field rolls over.

- Reference

  [3] 4.4

- Initial Condition

  - A preamble procedure defined in Section 4.2.4 if using an LE transport or Section 4.2.5 if using a BR/EDR transport is used to setup the transport and L2CAP channel and initiate connection to a CSC Sensor.
  - The IUT has executed the procedure included in CSCP/COL/CSCF/BV-04-C [Configure CSC Measurement for Notification], which configures it to expect CSC Measurement Notifications.
  - The IUT knows the handle of the CSC Measurement characteristic.

- Test Procedure

  1. Perform an action on the Lower Tester that will induce it to set the Cumulative Crank Revolutions values and the Last Crank Event Time values in the table below such as to induce a Last Crank Event Time rollover event.

	Cumulative Crank Revolutions	Last Crank Event Time	Expected Instantaneous Cadence [rpm]
1	1000	64000	N/A
2	1001	65024	60
3	1002	512	60
4	1003	1536	60
5	1004	2560	60

Table 4.7: CSCP/COL/CSCF/BV-08-C [Receive CSC Measurement Notifications – Last Crank Event Time Roll Over]

  2. The Lower Tester sends five ATT_Handle_Value_Notifications containing a CSC Measurement characteristic value to the IUT (corresponding to the sequence of rows in the table above) that simulate a regular and consistent crank rotation as on a bike including a Last Crank Event Time field roll over event.
  3. Verify that the IUT responds correctly when the Last Crank Event Time value rolls over.

- Expected Outcome

  Pass verdict

  IUT receives notifications of CSC Measurement values from the Lower Tester that include Crank Revolution Data.

  IUT correctly calculates consistent instantaneous cadence values before and after the roll over event.

CSCP/COL/CSCF/BV-09-C [Receive CSC Measurement Notifications – Wheel Revolution Data During Link Loss]

- Test Purpose

  Verify that the Collector IUT can receive notifications of the CSC Measurement Characteristic that contain Wheel Revolution Data and that it properly recovers following a link loss.

- Reference

  [3] 4.4

- Initial Condition

  - A preamble procedure defined in Section 4.2.4 if using an LE transport or Section 4.2.5 if using a BR/EDR transport is used to setup the transport and L2CAP channel and initiate connection to a CSC Sensor.
  - The IUT has executed the procedure included in CSCP/COL/CSCF/BV-04-C [Configure CSC Measurement for Notification], which configures it to expect CSC Measurement Notifications.
  - The IUT knows the handle of the CSC Measurement characteristic.

- Test Procedure

  1. Configure the IUT for Instantaneous Speed calculation with a wheel circumference of 210 centimeters. An IUT may be configured to an alternative value for calculation. Any alternative value is noted and included in testing evidence to support the calculated value of Instantaneous Speed.
  2. Perform an action on the Lower Tester that will induce it to set the Cumulative Wheel Revolutions values and the Last Wheel Event Time values in the following table.

	Cumulative wheel Revolutions	Last Wheel Event Time [1/1024s]	Expected Instantaneous Speed at IUT [km/h]
1	1000	1200	N/A
2	1008	2224	60.48
	Link Loss and Reconnection (simulated for 10 seconds)		
3	1088	12464	60.48
4	1096	13488	60.48
5	1104	14512	60.48

Table 4.8: CSCP/COL/CSCF/BV-09-C [Receive CSC Measurement Notifications – Wheel Revolution Data during Link Loss]

  3. The Lower Tester sends two ATT_Handle_Value_Notifications containing a CSC Measurement characteristic value to the IUT (corresponding to the sequence of rows 1 and 2 in the table above) that simulate a regular and consistent wheel rotation as on a bike for several seconds.
  4. Perform an action on the Lower Tester that will cause the link to be lost for several seconds while continuing to simulate wheel rotation for several seconds at the IUT.
  5. Perform an action on the Lower Tester that allows the link to be restored.
  6. The Lower Tester sends the three remaining ATT_Handle_Value_Notifications containing a SC Measurement characteristic value to the IUT (corresponding to the sequence of rows 3, 4 and 5 in the table above) that simulate a regular and consistent wheel rotation as on a bike for several seconds.
  7. Verify that the IUT responds correctly during the link loss and after the link is restored.

- Expected Outcome

  Pass verdict

  IUT receives notifications of CSC Measurement values from the Lower Tester that include Wheel Revolution Data.

  IUT correctly calculates consistent instantaneous speed values despite the link loss.

CSCP/COL/CSCF/BV-10-C [Receive CSC Measurement Notifications – Crank Revolution Data During Link Loss]

- Test Purpose

  Verify that the Collector IUT can receive notifications of the CSC Measurement Characteristic that contain Crank Revolution Data and that it properly recovers following a link loss.

- Reference

  [3] 4.4

- Initial Condition

  - A preamble procedure defined in Section 4.2.4 if using an LE transport or Section 4.2.5 if using a BR/EDR transport is used to setup the transport and L2CAP channel and initiate connection to a CSC Sensor.
  - The IUT has executed the procedure included in CSCP/COL/CSCF/BV-04-C [Configure CSC Measurement for Notification], which configures it to expect CSC Measurement Notifications.
  - The IUT knows the handle of the CSC Measurement characteristic.

- Test Procedure

  1. Perform an action on the Lower Tester that will induce it to set the Cumulative Crank Revolutions values and the Last Crank Event Time values in the following table.

	Cumulative Crank Revolutions	Last Crank Event Time	Expected Instantaneous Cadence [rpm]
1	1000	10000	N/A
2	1001	11024	60
	Link Loss and Reconnection (simulated for 10 seconds)		
3	1011	21264	60
4	1012	22288	60
5	1013	23312	60

Table 4.9: CSCP/COL/CSCF/BV-10-C [Receive CSC Measurement Notifications – Crank Revolution Data during Link Loss]

  2. The Lower Tester sends two ATT_Handle_Value_Notifications containing a SC Measurement characteristic value to the IUT (corresponding to the sequence of rows 1 and 2 in the table above) that simulate a regular and consistent crank rotation as on a bike for several seconds.
  3. Perform an action on the Lower Tester that will cause the link to be lost for several seconds while continuing to simulate crank rotation for several seconds at the IUT.
  4. Perform an action on the Lower Tester that allows the link to be restored.

5. The Lower Tester sends the three remaining ATT_Handle_Value_Notifications containing a CSC Measurement characteristic value to the IUT (corresponding to the sequence of rows 3, 4 and 5 in the table above) that simulate a regular and consistent crank rotation as on a bike for several seconds.
6. Verify that the IUT responds correctly during the link loss and after the link is restored.

- Expected Outcome

  Pass verdict

  IUT receives notifications of CSC Measurement values from the Lower Tester that include Crank Revolution Data.

  IUT correctly calculates consistent instantaneous cadence values despite the link loss.

CSCP/COL/CSCF/BI-01-C [Receive CSC Measurement Notifications with reserved flags]

- Test Purpose

  Verify that the Collector IUT can receive notifications of the CSC Measurement Characteristic from a CSC Sensor including reserved flags.

- Reference

  [3] 4.4

- Initial Condition

  - A preamble procedure defined in Section 4.2.4 if using an LE transport or Section 4.2.5 if using a BR/EDR transport is used to setup the transport and L2CAP channel and initiate connection to a CSC Sensor.
  - The IUT has executed the procedure included in CSCP/COL/CSCF/BV-04-C [Configure CSC Measurement for Notification], which configures it to expect CSC Measurement Notifications.
  - The IUT knows the handle of the CSC Measurement characteristic.

- Test Procedure

  The Lower Tester sends an ATT_Handle_Value_Notification containing a CSC Measurement characteristic value to the IUT. There are many combinations of reserved flag settings. For this test use Flags = 0xFF. This includes reserved bits 7, 6, 5, 4, 3 and 2 = 111111 and valid uses of the defined flags: Crank Revolution Data Present bit = 1, Wheel Revolution Data Present bit = 1.

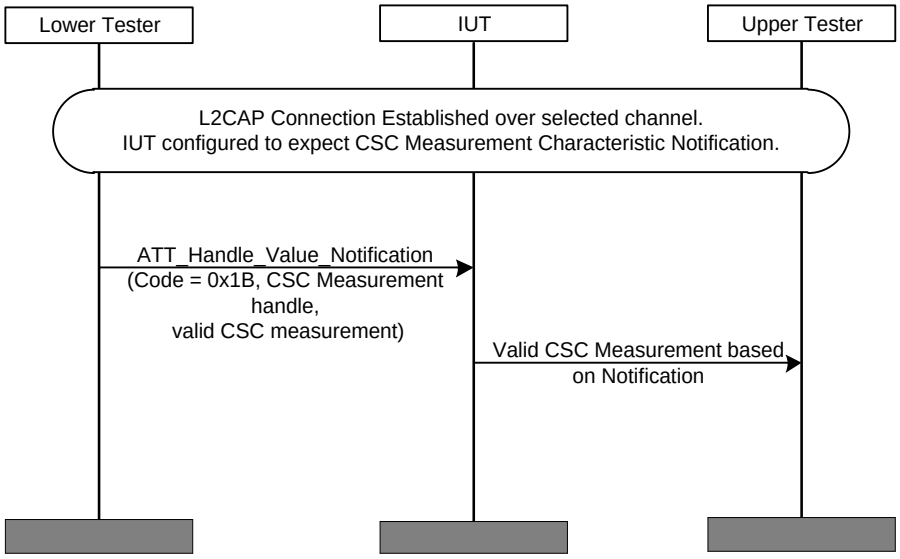

Figure 4.6: CSCP/COL/CSCF/BI-01-C [Receive CSC Measurement Notifications with reserved flags]

- Expected Outcome

  Pass verdict

  IUT reports the received CSC Measurement value to the Upper Tester. The reported CSC Measurement value matches the one sent by the Lower Tester, including the reserved bits of the Flags field.

CSCP/COL/CSCF/BI-02-C [Receive CSC Measurement Notifications with additional octets not represented in the flags field]

- Test Purpose

  Verify that the Collector IUT can receive notifications of the CSC Measurement Characteristic from a CSC Sensor including additional octets not represented in the flags field.

- Reference

  [3] 4.4

- Initial Condition

  - A preamble procedure defined in Section 4.2.4 if using an LE transport or Section 4.2.5 if using a BR/EDR transport is used to setup the transport and L2CAP channel and initiate connection to a CSC Sensor.
  - The IUT has executed the procedure included in CSCP/COL/CSCF/BV-04-C [Configure CSC Measurement for Notification], which configures it to expect CSC Measurement Notifications.
  - The IUT knows the handle of the CSC Measurement characteristic.

- Test Procedure

  The Lower Tester sends an ATT_Handle_Value_Notification containing a CSC Measurement characteristic value to the IUT. That value contains: Flags = 0x01, Cumulative Wheel Revolutions and Last Wheel Event Time. Cumulative Crank Revolutions and Last Crank Event Time are not present,

and at least two additional octets not represented in the flags field. The total number of octets does not exceed the maximum MTU size.

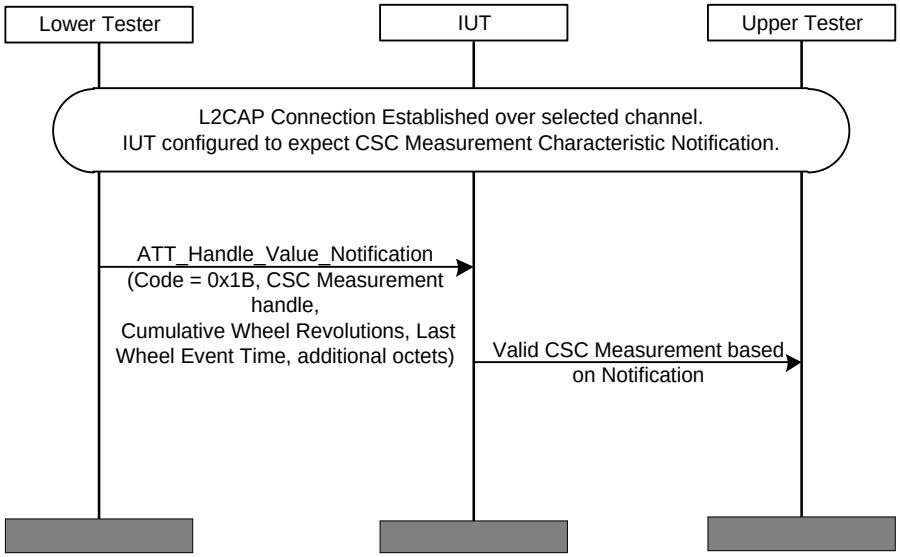

Figure 4.7: CSCP/COL/CSCF/BI-02-C [Receive CSC Measurement Notifications with additional octets not represented in the flags field]

- Expected Outcome

  Pass verdict

  IUT reports the received CSC Measurement value to the Upper Tester with no additional octets. The reported CSC Measurement value matches the one sent by the Lower Tester.

  Fail verdict

  The additional octets are reported to the Upper Tester.

CSCP/COL/CSCF/BV-11-C [Receive multiple CSC Measurement Notifications]

- Test Purpose

  Verify that the collector IUT can receive multiple CSC Measurement notifications.

- Reference

  [3] 4.4, 4.5

- Initial Condition

  - A preamble procedure defined in Section 4.2.4 if using an LE transport or Section 4.2.5 if using a BR/EDR transport is used to setup the transport and L2CAP channel and initiate connection to a CSC Sensor.
  - The IUT has executed the procedure included in CSCP/COL/CSCF/BV-04-C [Configure CSC Measurement for Notification], which configures it to expect CSC Measurement Notifications.
  - The IUT knows the handle of the CSC Measurement characteristic.

- Test Procedure

  The Lower Tester sends two or more ATT_Handle_Value_Notifications to the IUT; each contains the CSC Measurement characteristic value.

- Expected Outcome

  Pass verdict

  For each ATT_Handle_Value_Notification sent to the IUT:

  - The IUT reports the received CSC Measurement value to the Upper Tester.
  - The reported CSC Measurement values match that sent by the Lower Tester.

CSCP/COL/CSCF/BI-03-C [Read CSC Feature characteristic with reserved value]

- Test Purpose

  Verify that the Collector IUT can read the CSC Feature characteristic from a CSC Sensor, and ignore reserved bits.

- Reference

  [3] 4.5

- Initial Condition

  - A preamble procedure defined in Section 4.2.4 if using an LE transport or Section 4.2.5 if using a BR/EDR transport is used to setup the transport and L2CAP channel and initiate connection to a CSC Sensor.
  - The Upper Tester knows the handle of a CSC Feature characteristic contained in the Lower Tester.

- Test Procedure

  1. Send a command from Upper Tester to request the IUT to read a CSC Feature Characteristic from the Lower Tester e.g., CSCP_ReadRequest (handle, value).
  2. The Lower Tester sends an ATT_Read_Response (0x0B) to the IUT containing values with some reserved bits set to 1.

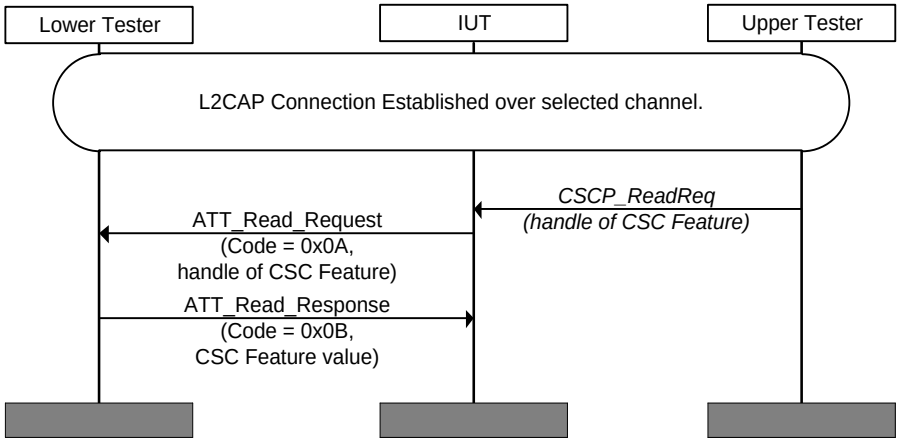

Figure 4.8: CSCP/COL/CSCF/BI-03-C [Read CSC Feature characteristic with reserved value]

- Expected Outcome

  Pass verdict

  The IUT sends a correctly formatted ATT_Read_Request (0x0A) to the Lower Tester, containing the handle specified by the Upper Tester.

  The IUT receives the response from the Lower Tester, ignores the reserved bits and continues to operate as if the reserved bits were not set.

CSCP/COL/CSCF/BI-04-C [Read Sensor Location characteristic with reserved value]

- Test Purpose

  Verify that the Collector IUT can read the Sensor Location characteristic from a CSC Sensor, and discard a reserved value or change it to 'Other'.

- Reference

  [3] 4.6

- Initial Condition

  - A preamble procedure defined in Section 4.2.4 if using an LE transport or Section 4.2.5 if using a BR/EDR transport is used to setup the transport and L2CAP channel and initiate connection to a CSC Sensor.
  - The Upper Tester knows the handle of a Sensor Location characteristic contained in the Lower Tester.

- Test Procedure

  1. Send a command from Upper Tester to request IUT to read a Sensor Location characteristic from the Lower Tester e.g., CSCP_ReadRequest (handle, value).
  2. The Lower Tester sends an ATT_Read_Response (0x0B) to the IUT containing a reserved value.

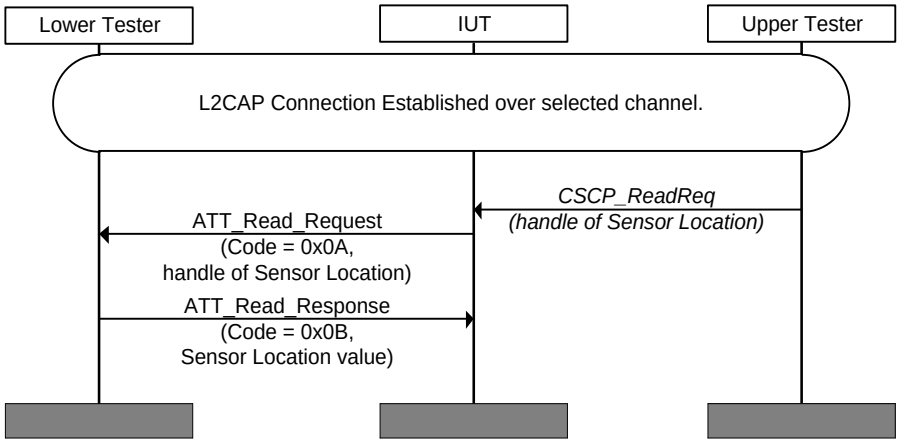

Figure 4.9: CSCP/COL/CSCF/BI-04-C [Read Sensor Location characteristic with reserved value]

- Expected Outcome

  Pass verdict

  The IUT sends a correctly formatted ATT_Read_Request (0x0A) to the Lower Tester, containing the handle specified by the Upper Tester.

The IUT receives the response from the Lower Tester and discards it or changes it to “Other”.

CSCP/COL/CSCF/BV-14-C [Lost Bond Procedure when using LE transport]

- Test Purpose

  Verify that the Collector IUT starts encryption with a bonded CSC Sensor on reconnection and rediscovers and reconfigures the CSC Sensor if bond is lost.

- Reference

  [3] 5.2.2

- Initial Condition

  - The IUT and the Lower Tester have previously bonded.
  - The IUT has configured the Lower Tester to enable notifications on the CSC Measurement characteristic of the Lower Tester's Cycling Speed and Cadence Service.
  - The Lower Tester has the «Service Changed» characteristic in its database.
  - No connection is established between the IUT and Lower Tester.
  - The bond is deleted at the 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 Lower Tester does not send any notifications to IUT.
  4. Verify that the IUT starts encryption when the connection is established and rediscovers and reconfigures the CSC Sensor upon detection of the lost bond.

- Expected Outcome

  Pass verdict

  The IUT starts encryption when the connection is established.

  The IUT rediscovers the CSC Service.

  The IUT reconfigures the Client Characteristic Configuration descriptors of the CSC Measurement characteristic and the SC Control Point characteristic (if supported).

CSCP/COL/CSCF/BV-15-C [Lost Bond Procedure when using BR/EDR transport]

- Test Purpose

  Verify that the Collector IUT reconfigures the CSC Sensor if the bond is lost.

  In case of BR/EDR, either the Lower Tester or Collector IUT could initiate connection when they are bonded. The device initiating the connection becomes a Central and is referred to herein as a paging device and the device accepting the connection becomes a Peripheral and is referred to herein as a page scanning device. Verify that the Central starts encryption with a bonded Peripheral on reconnection.

- Reference

  [3] 5.3.1.2

- Initial Condition
  - The IUT and the Lower Tester have previously bonded.
  - The IUT has configured the Lower Tester to enable notifications on the CSC Measurement characteristic of the Lower Tester's Cycling Speed and Cadence Service.
  - The Lower Tester has the «Service Changed» characteristic.
  - No connection is established between the IUT and Lower Tester.
  - The bond is deleted at the Lower Tester.
- Test Procedure
  1. The page scanning device is in connectable mode.
  2. The paging device establishes a connection to the page scanning device.
  3. The Lower Tester does not send any notifications to the IUT.
  4. The Central starts encryption when the connection is established.
  5. Verify that the IUT rediscovers and reconfigures the CSC Sensor upon detection of the lost bond.
- Expected Outcome

  Pass verdict

  The Central starts encryption when the connection is established.

  The IUT rediscovers the CSC Service.

  The IUT reconfigures the Client Characteristic Configuration descriptors of the CSC Measurement characteristic and the SC Control Point characteristic (if supported).

CSCP/COL/CSCF/BV-16-C [Receive CSC Measurement Notifications – Reverse Wheel Revolution]

- Test Purpose

  Verify that the Collector IUT is tolerant of CSC Sensors which have the capability to decrement the Cumulative Wheel Revolutions field (e.g., when the wheel rotates in reverse).
- Reference

  [3] 4.4
- Initial Condition
  - A preamble procedure defined in Section 4.2.4 if using an LE transport or Section 4.2.5 if using a BR/EDR transport is used to setup the transport and L2CAP channel and initiate connection to a CSC Sensor.
  - The IUT has executed the procedure included in CSCP/COL/CSCF/BV-04-C [Configure CSC Measurement for Notification], which configures it to expect CSC Measurement Notifications.
  - The IUT knows the handle of the CSC Measurement characteristic.
- Test Procedure
  1. Configure the IUT for Instantaneous Speed calculation with a wheel circumference of 210 centimeters. An IUT may be configured to an alternative value for calculation. Any alternative value is noted and included in testing evidence to support the calculated value of Instantaneous Speed.

2. Perform an action on the Lower Tester that will induce it to set the Cumulative Wheel Revolutions values and the Last Wheel Event Time values in the following table.

	Cumulative Wheel Revolution	Last Wheel Event Time	Expected Instantaneous Speed at IUT [km/h]
1	1010	512	N/A
2	1012	1536	15.12
3	1008	2560	N/A
4	1006	3584	N/A
5	1007	4608	7.56
6	1009	5632	15.12
7	1011	6656	15.12

Table 4.10: CSCP/COL/CSCF/BV-16-C [Receive CSC Measurement Notifications –Reverse Wheel Revolution]

3. The Lower Tester sends six ATT_Handle_Value_Notifications containing a CSC Measurement characteristic value to the IUT (corresponding to the sequence of rows in the table above) that simulate an initial consistent forward rotation, followed by consistent reverse wheel rotation followed by consistent forward wheel rotation as on a bike.
4. Verify that the IUT responds correctly when the Cumulative Wheel Revolutions value initially increases.
5. Verify that the IUT responds correctly when the Cumulative Wheel Revolutions value increases once again.

- Expected Outcome

  Pass verdict

  IUT receives notifications of CSC Measurement values from the Lower Tester that include Wheel Revolution Data.

  IUT correctly calculates consistent instantaneous speed values when the wheel rotates forward both before and after the Cumulative Wheel Revolutions value decreases.

- Notes

  The behavior of the IUT while the wheel rotates in reverse corresponding to rows 3 and 4 is left to the implementation (e.g., the implementation may or may not calculate and display reverse speed during that time).

CSCP/COL/CSCF/BV-17-C [Read CSC Feature Characteristic with Bonding Enabled]

- Test Purpose

  Verify that, after the initial connection and bonding, the Collector IUT can read the CSC Feature characteristic.

- Reference

  [11] 4.5

- Initial Condition
  - 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.
  - The IUT is bonded with the Lower Tester.
  - The Upper Tester knows the handle of the CSC Feature characteristic contained in the Lower Tester.
- Test Procedure
  1. The Upper Tester commands the IUT to read the CSC Feature characteristic from the Lower Tester.
  2. The IUT sends an ATT_Read_Request to the Lower Tester containing the handle specified by the Upper Tester.
  3. The Lower Tester receives the ATT_Read_Request and then sends an ATT_Read_Response to the IUT containing the value of the characteristic.
  4. The IUT receives the ATT_Read_Response and reports the value to the Upper Tester.
- Expected Outcome

  Pass verdict

  The IUT reads the CSC Feature characteristic and reports its value to the Upper Tester.

  Reserved for future use bit values are ignored.

CSCP/COL/CSCF/BV-18-C [Enable CSC Feature Characteristic for Indication or Read Feature Characteristic Upon Reconnection]

- Test Purpose

  Verify that the Collector IUT can either enable the CSC Feature characteristic for indication or read the CSC Feature characteristic upon reconnection.
- Reference

  [11] 4.4.1
- Initial Condition
  - The handles of the CSC Feature characteristic and Client Characteristic Configuration descriptor have been previously discovered by the Upper Tester during the test procedures in Section 4.3.1 or are known to the Upper Tester by other means.
  - 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.
  - The IUT is not paired and bonded with the Lower Tester.
- Test Procedure
  1. The Upper Tester orders the IUT to initiate pairing and bonding.
  2. The Upper Tester commands the IUT to perform either alternative 2A or 2B:

     Alternative 2A (Configure the CSC Feature characteristic for indication):

     2A.1. The IUT configures the CSC Feature characteristic for indication.

Or,

Alternative 2B (Read the CSC Feature characteristic upon reconnection):

2B.1. The Upper Tester commands the IUT to disconnect, and the IUT terminates the connection with the Lower Tester.

2B.2. The Upper Tester commands the IUT to reconnect to the Lower Tester.

2B.3. The IUT reads the CSC Feature characteristic from the Lower Tester and reports the value to the Upper Tester.

- Expected Outcome

  Pass verdict

  In step 1, the IUT successfully completes pairing and bonding.

  In step 2A.1, the IUT enables the CSC Feature characteristic for indication.

  In step 2B.3, the IUT reads the CSC Feature characteristic and reports its value to the Upper Tester.

  Reserved for future use bit values are ignored.

4.6 Service Procedures – Set Cumulative Value

This test group contains test cases to verify compliant operation when the SC Control Point Set Cumulative Value procedure is used.

CSCP/COL/SPS/BV-01-C [Set Cumulative Value – Set to zero]

- Test Purpose

  Verify that the Collector IUT can perform the Set Cumulative Value procedure to set a zero value.

- Reference

  [3] 4.7.2.1

- Initial Condition

  - Perform the preamble described in Section 4.2.3.
  - The value of Cumulative Wheel Revolutions in the Lower Tester is set to a known non-zero value.

- Test Procedure

  1. A connection is established between the IUT and Lower Tester using the Preamble defined in Section 4.2.4 if using an LE transport or Section 4.2.5 if using a BR/EDR transport.
  2. The Lower Tester sends one or more notifications of the CSC Measurement characteristic with the Cumulative Wheel Revolutions field set to a non-zero value.
  3. IUT writes the Set Cumulative Value Op Code (0x01) to the SC Control Point with a Parameter Value of 0x00000000.
  4. The Lower Tester sends an indication of the SC Control Point characteristic with the Response Code Op Code (0x10) and a Parameter representing Request Op Code (0x01) followed by the Response Code for ‘success’ (0x01).

5. The Lower Tester sends a notification of the CSC Measurement characteristic with the Cumulative Wheel Revolutions field set to 0 (or close to 0).
6. Verify that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT receives one or more notifications of the CSC Measurement characteristic with the Total Distance field set to a non-zero value.

  After setting the value to zero, the IUT receives the next notification of the CSC Measurement characteristic containing the Cumulative Wheel Revolutions with the value of the Cumulative Wheel Revolutions field set to 0.

CSCP/COL/SPS/BV-02-C [Set Cumulative Value – Set to non-zero]

- Test Purpose

  Verify that the Collector IUT can perform the Set Cumulative Value procedure to set a non-zero value.

- Reference

  [3] 4.7.2.1

- Initial Condition

  - Perform the preamble described in Section 4.2.3.
  - The value of Cumulative Wheel Revolutions in the Lower Tester is set to a known value.

- Test Procedure

  1. A connection is established between the IUT and Lower Tester using the Preamble defined in Section 4.2.4 if using an LE transport or Section 4.2.5 if using a BR/EDR transport.
  2. The Lower Tester sends one or more notifications of the CSC Measurement characteristic with the Total Distance field set to any value.
  3. The IUT writes the Set Cumulative Value Op Code (0x01) to the SC Control Point with a Parameter Value that is a different than the initial value (e.g. 0x0000FFFF).
  4. The Lower Tester sends an indication of the SC Control Point characteristic with the Response Code Op Code (0x10) and a Parameter representing Request Op Code (0x01) followed by the Response Code for 'success' (0x01).
  5. The Lower Tester sends a notification of the CSC Measurement characteristic with the Cumulative Wheel Revolutions field set to the specified value (or close to the specified value).
  6. Verify that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT receives one or more notifications of the CSC Measurement characteristic with the Cumulative Wheel Revolutions field set to the specified non-zero value.

  After setting the value, the IUT receives the next notification of the CSC Measurement characteristic containing the Cumulative Wheel Revolutions field with the value of the Cumulative Wheel Revolutions field set to the specified value (or slightly higher in case of movement).

4.7 Service Procedures – Request Supported Sensor Locations

This test group contains test cases to verify compliant operation when the SC Control Point Start Sensor Calibration procedure is used.

CSCP/COL/SPL/BV-01-C [Request Supported Sensor Locations]

- Test Purpose

  Verify that the Collector IUT can perform the Request Supported Sensor Locations procedure.

- Reference

  [3] 4.7.2.4

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the IUT and Lower Tester using the Preamble defined in Section 4.2.4 if using an LE transport or Section 4.2.5 if using a BR/EDR transport.
  2. IUT writes the Request Supported Sensor Location Op Code (0x04) to the SC Control Point with no Parameter.
  3. The Lower Tester sends an indication of the SC Control Point characteristic with the Response Code Op Code (0x10) and a Parameter representing Request Op Code (0x04) followed by the Response Code for ‘success’ (0x01) and a list of supported sensor locations.
  4. Verify that the supported sensor locations values meet the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT receives a list of supported and valid sensor locations.

4.8 Service Procedures – Update Sensor Location

This test group contains test cases to verify compliant operation when the SC Control Point Update Sensor Location procedure is used.

CSCP/COL/SPU/BV-01-C [Update Sensor Location]

- Test Purpose

  Verify that the Collector IUT can perform the Update Sensor Location procedure.

- Reference

  [3] 4.7.2.2

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the IUT and Lower Tester using the Preamble defined in Section 4.2.4 if using an LE transport or Section 4.2.5 if using a BR/EDR transport.

2. IUT writes the Update Sensor Location Op Code (0x03) to the SC Control Point with the Parameter of this Control Point set to a location supported by the CSC Sensor.
3. The Lower Tester sends an indication of the SC Point characteristic with the Response Code Op Code (0x10) and a Parameter representing Request Op Code (0x03) followed by the Response Code for 'success' (0x01).
4. Verify that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The Sensor Location value is updated with the correct value.

  The IUT receives the Request Op Code ‘success’.

4.9 Service Procedures – General Error Handling

This test group contains test cases to verify compliant operation when an error is caused by the Server side.

CSCP/COL/SPE/BI-01-C [Unsupported Op Code]

- Test Purpose

  Verify that the Collector IUT behaves appropriately when it receives an ‘Op Code not supported’ SC Control Point Response Code.

- Reference

  [3] 3.7.3

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the IUT and Lower Tester using the Preamble defined in Section 4.2.4 if using an LE transport or Section 4.2.5 if using a BR/EDR transport.
  2. IUT writes any Op Code to the SC Control Point using an appropriate Parameter for the Op Code.
  3. The Lower Tester sends an indication of the SC Control Point characteristic with the Response Code Op Code (0x10) and a Parameter representing Request Op Code followed by the Response Code Value for 'Op Code not supported' (0x02) (i.e. the Lower Tester simulates an unsupported Op Code).
  4. Verify that the IUT considers the procedure to have failed.

- Expected Outcome

  Pass verdict

  The IUT returns to stable state and can process commands normally.

- Notes

  The test purpose is to verify the IUT’s capability to handle an Op Code not supported response by the Sensor. This Sensor response may be provoked by the IUT writing an Op Code that is not supported by the responding compliant Sensor, or where the Sensor response to the IUT may be yielded by a test system that emulates that it does not support an Op Code.

CSCP/COL/SPE/BI-02-C [Invalid Parameter]

- Test Purpose

  Verify that the Collector IUT behaves appropriately when it receives an ‘Invalid Parameter’ SC Control Point Response Code.

- Reference

  [3] 3.7.3

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the IUT and Lower Tester using the Preamble defined in Section 4.2.4 if using an LE transport or Section 4.2.5 if using a BR/EDR transport.
  2. IUT writes the Update Sensor Location Op Code to the SC Control Point using any Sensor Location value.
  3. The Lower Tester sends an indication of the SC Control Point characteristic with the Response Code Op Code (0x10) and a Parameter representing Request Op Code (0x03) followed by the Response Code Value for 'Invalid Parameter' (0x03) (i.e. the Lower Tester simulates an unsupported value).

- Expected Outcome

  Pass verdict

  The IUT returns to stable state and can process commands normally.

CSCP/COL/SPE/BI-03-C [Operation Failed]

- Test Purpose

  Verify that the Collector IUT behaves appropriately when it receives an ‘Operation Failed’ SC Control Point Response Code.

- Reference

  [3] 3.7.3

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the IUT and Lower Tester using the Preamble defined in Section 4.2.4 if using an LE transport or Section 4.2.5 if using a BR/EDR transport.
  2. IUT writes any Op Code to the SC Control Point using an appropriate Parameter for the Op Code.
  3. The Lower Tester sends an indication of the SC Control Point characteristic with the Response Code Op Code (0x10) and a Parameter representing Request Op Code followed by the Response Code Value for 'Operation Failed' (0x04) (i.e. the Lower Tester simulates a failed operation).

- Expected Outcome

  Pass verdict

  The IUT returns to stable state and can process commands normally.

CSCP/COL/SPE/BI-04-C [SC Control Point Procedure Timeout]

- Test Purpose

  Verify that if the Collector IUT does not receive a response to an SC Control Point Op Code, it will time out after the Attribute Transaction Timeout.

- Reference

  [3] 4.7.4

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the IUT and Lower Tester using the Preamble defined in Section 4.2.4 if using an LE transport or Section 4.2.5 if using a BR/EDR transport.
  2. The IUT writes any of the defined Op Codes (Set Cumulative Value or Start Calibration or Update Sensor Location or Request Supported Sensor Locations) to the SC Control Point using an appropriate Parameter for the Op Code.
  3. The Lower Tester does not send an indication of the SC Control Point characteristic for at least longer than the Attribute Protocol Timeout.
  4. After the specified timeout the IUT sends a notification of Attribute Transaction Timeout to the Upper Tester and the IUT considers the procedure to have failed.

- Expected Outcome

  Pass verdict

  The IUT returns to stable state and can process commands normally.

5 Test case mapping

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

The columns for the TCMT are defined as follows:

Item: Contains a logical expression based on specific entries from the associated ICS document. Contains a logical expression (using the operators AND, OR, NOT as needed) based on specific entries from the applicable ICS document(s). The entries are in the form of y/x references, where y corresponds to the table number and x corresponds to the feature number as defined in the ICS document for Cycling Speed and Cadence Profile (CSCP) [4].

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

Test Case(s): The applicable test case identifiers are required for Bluetooth Qualification if the corresponding y/x references defined in the Item column are supported. Further details about the function of the TCMT are elaborated in [1].

For the purpose and structure of the ICS/IXIT, refer to [1].

Item	Feature	Test Case(s)
CSCP 8/1	Discover Cycling Speed and Cadence Service	CSCP/COL/CGGIT/SER/BV-01-C
CSCP 9/1	Discover Device Information Service	CSCP/COL/CGGIT/SER/BV-02-C
(CSCP 2/2 AND NOT CSCP 2/1) AND CSCP 3/1 AND GATT 1a/4 AND GAP 0/3	Discover Cycling Speed and Cadence Service – Not Discoverable over BR/EDR	CSCP/SEN/SGGIT/SDPNF/BV-01-C
CSCP 8/2	Discover CSC Measurement characteristic	CSCP/COL/CGGIT/CHA/BV-01-C
CSCP 8/4	Discover CSC Feature characteristic	CSCP/COL/CGGIT/CHA/BV-02-C
CSCP 11a/1	Characteristic GGIT – CSC Feature indication	CSCP/COL/CGGIT/ISFC/BV-01-C
CSCP 11a/2 AND (CSCP 13/3 OR CSCP 13/4)	Read CSC Feature characteristic – Bonding enabled	CSCP/COL/CSCF/BV-17-C
(CSCP 11a/1 OR CSCP 11a/2) AND (CSCP 13/3 OR CSCP 13/4)	Enable CSC Feature characteristic for indication or read characteristic upon reconnection	CSCP/COL/CSCF/BV-18-C
CSCP 8/5	Discover Sensor Location characteristic	CSCP/COL/CGGIT/CHA/BV-03-C
CSCP 8/6	Discover SC Control Point characteristic	CSCP/COL/CGGIT/CHA/BV-04-C
CSCP 9/2 OR CSCP 9/4	Discover Manufacturer Name String Characteristic Discover Model Number String Characteristic	CSCP/COL/CSCD/BV-11-C

Item	Feature	Test Case(s)
CSCP 9/3 OR CSCP 9/5	Read Manufacturer Name String Characteristic Read Model Number String Characteristic	CSCP/COL/CSCD/BV-12-C
CSCP 2/2 AND CSCP 3/2	Cycling Speed and Cadence Service UUID in AD in GAP Discoverable Mode	CSCP/SEN/CSCF/BV-01-C
CSCP 2/2 AND CSCP 3/3	Local Name in AD or Scan Response	CSCP/SEN/CSCF/BV-02-C
CSCP 2/2 AND CSCP 3/4	Appearance in AD or Scan Response	CSCP/SEN/CSCF/BV-03-C
CSCP 11/1	Configure CSC Measurement characteristic for notifications	CSCP/COL/CSCF/BV-04-C
CSCP 11/2	Receive CSC Measurement characteristic notifications	CSCP/COL/CSCF/BV-05-C CSCP/COL/CSCF/BI-01-C CSCP/COL/CSCF/BI-02-C CSCP/COL/CSCF/BV-11-C
CSCP 10/5	Calculates Instantaneous Speed	CSCP/COL/CSCF/BV-06-C CSCP/COL/CSCF/BV-16-C
CSCP 10/5 AND CSCP 13/3	Calculates Instantaneous Speed	CSCP/COL/CSCF/BV-09-C
CSCP 10/6	Calculates Instantaneous Cadence	CSCP/COL/CSCF/BV-07-C CSCP/COL/CSCF/BV-08-C
CSCP 10/6 AND CSCP 13/3	Calculates Instantaneous Cadence	CSCP/COL/CSCF/BV-10-C
CSCP 11/3	Read CSC Feature characteristic	CSCP/COL/CSCF/BI-03-C
CSCP 11/4	Read Sensor Location characteristic	CSCP/COL/CSCF/BI-04-C
CSCP 2/2 AND CSCP 11/12	Verify Bond Status on Reconnection - LE	CSCP/COL/CSCF/BV-14-C
CSCP 2/1 AND CSCP 11/12	Verify Bond Status on Reconnection – BR/EDR	CSCP/COL/CSCF/BV-15-C
CSCP 10/1	Set Cumulative Value – Set to zero	CSCP/COL/SPS/BV-01-C
CSCP 10/2	Set Cumulative Value – Set to non-zero	CSCP/COL/SPS/BV-02-C
CSCP 10/4	Request Supported Sensor Locations	CSCP/COL/SPL/BV-01-C
CSCP 10/3	Update Sensor Location	CSCP/COL/SPU/BV-01-C CSCP/COL/SPE/BI-02-C
CSCP 11/6 AND CSCP 11/7	Write to SC Control Point characteristic and Receive SC Control Point characteristic indications	CSCP/COL/SPE/BI-01-C CSCP/COL/SPE/BI-03-C
CSCP 11/11	SC Control Point Characteristic – Procedure Time Out	CSCP/COL/SPE/BI-04-C

Table 5.1: Test case mapping

6 Revision history and acknowledgments

Revision History

Publication Number	Revision Number	Date	Comments
0	1.0.0	2012-08-21	Adopted by the I SIG Board of Directors
	1.0.1r1	2013-04-23	TSE 4993: Revision of number 5 in the “Collector: Configure CSC Sensor for use with SC Control Point” wording. TSE 5140: Edits to test procedure of CSCP/COL/CSCF/BV-07-I, CSCP/COL/CSCF/BV-08-I, and CSCP/COL/CSCF/BV-10-I (legacy ID: TP/CSCF/CO/BV-07-I, TP/CSCF/CO/BV-08-I, and TP/CSCF/CO/BV-10-I) and, table of cumulative crank revolutions updated. TSE 5157: Change all the GATT Client Discovery test case references from -I to -C: CSCP/COL/CSCD/BV-01-I, CSCP/COL/CSCD/BV-02-I, CSCP/COL/CSCD/BV-05-I, CSCP/COL/CSCD/BV-06-I, CSCP/COL/CSCD/BV-07-I, CSCP/COL/CSCD/BV-08-I, CSCP/COL/CSCD/BV-09-I, CSCP/COL/CSCD/BV-10-I, CSCP/COL/CSCD/BV-11-I, (legacy ID: TP/CSCD/CO/BV-01-I, TP/CSCD/CO/BV-02-I, TP/CSCD/CO/BV-05-I, TP/CSCD/CO/BV-06-I, TP/CSCD/CO/BV-07-I, TP/CSCD/CO/BV-08-I, TP/CSCD/CO/BV-09-I, TP/CSCD/CO/BV-10-I, TP/CSCD/CO/BV-11-I)
1	1.0.1	2013-07-02	Prepare for Publication
	1.0.2r01	2013-09-30	TSE 5296: Updated first sentence of test procedure in CSCP/COL/CSCD/BV-12-I (legacy ID: TP/CSCD/CO/BV-12-I) to add, “and a disconnection may occur between the two tests” for clarification. TSE 5310: Corrected reference in initial condition of CSCP/COL/CSCD/BV-12-I (legacy ID: TP/CSCD/CO/BV-12-I), updated “TP/GLD/CO/BV-11-I” to “CSCP/COL/CSCD/BV-11-I” (legacy ID: “TP/CSCD/CO/BV-11-I”)
2	1.0.2	2013-12-03	Prepare for Publication
	1.0.3r00	2015-05-10	TSE 6200: Updated cumulative crank revolution values in table in CSCP/COL/CSCF/BV-08-I (legacy ID: TP/CSCF/CO/BV-08-I)
3	1.0.3	2015-07-14	Prepared for TCRL 2015-1 publication
	1.0.4r00	2016-05-24	Converted to new Test Case ID conventions as defined in TSTO v4.1.
	1.0.4r01	2016-06-20	Test Spec Template Conversion
4	1.0.4	2016-07-14	Prepared for TCRL 2016-1 publication.

Publication Number	Revision Number	Date	Comments
	1.0.5r00	2016-08-17	TSE 7315: Updated Item in TCMT for test case CSCP/SEN/CSCD/BV-04-I.
5	1.0.5	2016-12-13	Approved by BTI. Prepared for TCRL 2016-2 publication.
	1.0.6r00	2017-05-09	SIG staff review. Template conversion. TSE 8441: Updated TCMT for CSCP/COL/CSCF/BV-09-I and CSCP/COL/CSCF/BV-10-I.
	1.0.6r01	2017-05-16	Rolled back changes that were not actually part of the approved TSEs intended for TCRL 2017-1.
6	1.0.6	2017-06-26	Approved by BTI. Prepared for TCRL 2017-1 publication.
	p7r00–r06	2022-03-15 – 2022-05-19	TSE 17257 (rating 2): Converted the following test cases to GGIT: CSCP/COL/CSCD/BV-01-I – -03-I, -05-I – 10-I; CSCP/COL/CSCF/BV-12-I – 013-I; and CSCP/SEN/CSCD/BV-04-I. The new GGIT converted TCIDs are: CSCP/COL/CGGIT/SER/BV-01-C – 02-C, CSCP/COL/CGGIT/CHA/BV-01-C – 04-C, and CSCP/SEN/SGGIT/SDPNF/BV-01-C. Updated TCMT accordingly. Updated the initial condition for CSCP/COL/CSCD/BV-11-I. Added a Test database requirements section. Updated the Test Groups section and the test case identification conventions. Updated section cross-references in the Collector: Configure CSC Sensor for use with SC Control Point section. TSE 18434 (rating 1): Removed direct references to GATT test cases from the test procedures for CSCP/COL/CSCD/BV-11-I – -12-I. Removed direct references to GATT TS sections from the ATT Bearer preambles and replaced with preamble procedure text. TSE 18713 (rating 1): Editorials to align the document with the latest TS template in anticipation of a future .Z release. Performed template-related formatting fixes. Assigned publication number 6 to previous v1.0.6 and aligned copyright page with v2 of the DNMD. Consistency checker update.
7	p7	2022-06-28	Approved by BTI on 2022-05-31. Prepared for TCRL 2022-1 publication.
	p8r00	2022-08-18	TSE 19017 (rating 2): Corrected value length for GGIT test CSCP/COL/CGGIT/CHA/BV-04-C.
8	p8	2023-02-07	Approved by BTI on 2022-12-28. Prepared for TCRL 2022-2 publication.

Publication Number	Revision Number	Date	Comments
	p9r00–r02	2023-09-05 – 2023-09-06	TSE 17238 (rating 4): Per E17169, added new test group ISFC. Added three new test cases: CSCP/COL/CGGIT/ISFC/BV-01-C and CSCP/COL/CSCF/BV-17-C and -18-C, and updated the TCMT accordingly. Updated the Properties value for CSCP/COL/CGGIT/CHA/BV-02-C. Updated the TCID conventions table and the references list. TSE 18589 (rating 1): Per E15783, made Appropriate Language updates to align with CSCP v1.0.1 adoption. Updated the Bonded Devices preamble purpose and preamble procedure and the test purpose, test procedure, and expected outcome for CSCP/COL/CSCF/BV-15-C. Added the Appropriate Language Mapping Tables document to the references list. TSE 23266 (rating 1): Converted the following TCs to -C tests: CSCP/COL/CSCD/BV-11-I and -12-I, CSCP/COL/CSCF/BI-01-I – -04-I, CSCP/COL/CSCF/BV-04-I – -11-I and -14-I – -16-I, CSCP/COL/SPL/BV-01-I, CSCP/COL/SPS/BV-01-I and -02-I, CSCP/COL/SPU/BV-01-I, and CSCP/SEN/CSCF/BV-01-I – -03-I. Updated the TCMT accordingly. Deleted draft revision history comments prior to p0.
9	p9	2024-07-01	Approved by BTI on 2024-04-21. Prepared for TCRL 2024-1 publication.

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