Cycling Power Service (CPS)

***Bluetooth*® Test Suite**

- **Revision:** CPS.TS.p9
- **Revision Date:** 2025-02-18
- **Prepared By:** BTI
- **Published during TCRL:** TCRL.2025-1

Contents

1 Scope

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

2 References, definitions, and abbreviations

2.1 References

This document incorporates provisions from other publications by dated or undated reference. These references are cited at the appropriate places in the text, and the publications are listed hereinafter. Additional definitions and abbreviations can be found in [1], [2], and [3].

[1] Test Strategy and Terminology Overview

[2] Bluetooth Core Specification, Version 4.0 or later

[3] Cycling Power Service Specification, Version 1.0 or later

[4] ICS Proforma for Cycling Power Service

[5] GATT Test Suite, GATT.TS

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

[7] Cycling Power Service Implementation eXtra Information for Test, CPS.IXIT

[8] Core Specification Supplement (CSS), Version 6 or later

[9] Cycling Power Service Specification, Version 1.1.1

2.2 Definitions

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

2.3 Acronyms and abbreviations

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

3 Test Suite Structure (TSS)

3.1 Overview

The Cycling Power Service requires the presence of GAP, SM, and GATT. This is illustrated in Figure 3.1.

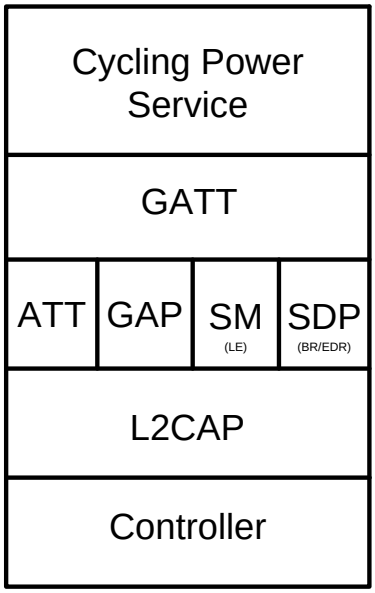

Figure 3.1: Cycling Power Service test model

3.2 Test Strategy

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

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

Additionally, the Cycling Power Measurement Broadcast feature, when supported by the IUT, requires an additional test setup as specified by the preamble defined in Section 4.2.4 so the Lower Tester can be used as a Broadcast Receiver.

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

3.3 Test groups

The following test groups have been defined:

- Generic GATT Integrated Tests
- Characteristic Read
- Configure Indication and Notification
- Configure Broadcast
- Characteristic Notification
- Service Procedures
- Characteristic Broadcast

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 Identifier <spec abbreviation>**
CPS	Cycling Power Service
Identifier Abbreviation	**Role Identifier <IUT role>**
SEN	Sensor Role
Identifier Abbreviation	**Reference Identifier <GGIT test group>**
SGGIT	Server Generic GATT Integrated Tests
Identifier Abbreviation	**Reference Identifier <GGIT class>**
CHA	Characteristic
ISFC	Indication Supported Features Characteristic
SDP	Validate SDP Record
SER	Service
Identifier Abbreviation	**Feature Identifier <feat>**
CB	Characteristic Broadcast
CN	Characteristic Notification
COB	Configure Broadcast
CON	Configure Indication or Notification
CR	Characteristic Read
SPE	Service Procedure – Error Handling
SPM	Service Procedure – Mask Cycling Power Measurement Characteristic Content
SPO	Service Procedure – Start Offset Compensation, Start Enhanced Offset Compensation
SPP	Service Procedures – Handle Server Parameters
SPS	Service Procedures – Set Cumulative Value

Table 4.1: CPS 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 used to test equipment within the tests defined in this document. The preambles here are commonly used to establish initial conditions.

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 Cycling Power Control Point

- Preamble Purpose

  Follow this preamble procedure to enable the IUT for use with the Cycling Power Control Point.

- 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 handle of the Cycling Power Measurement, the Cycling Power Feature, the Sensor Location, the Cycling Power Control Point and Cycling Power Vector characteristics have been previously discovered by the Lower Tester during the test procedure in Section 4.3 or is known to the Lower Tester by other means.
  3. The handle of the Client Characteristic Configuration descriptor of the Cycling Power Measurement characteristic and Cycling Power Control Point characteristic has been previously discovered by the Lower Tester during the test procedure in Section 4.3 or is known to the Lower Tester by other means.
  4. If the IUT requires bonding, then the Lower Tester performs a bonding procedure.
  5. The IUT configures the Cycling Power Control Point characteristic for indications, and if the test case requires notifications of the Cycling Power Measurement characteristic or the Cycling Power Vector characteristic, then the IUT configures these characteristics for notifications. Those configurations may happen in any order.

4.2.4 Cycling Power Measurement Broadcast

- Preamble Purpose

  Follow this preamble procedure to enable the IUT for use with the Cycling Power Measurement Broadcast feature.

- 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 handle of the Cycling Power Measurement characteristic has been previously discovered by the Lower Tester during the test procedure in Section 4.3 or is known to the Lower Tester by other means.
  3. The handles of the Server Characteristic Configuration descriptor of the Cycling Power Measurement characteristic have been previously discovered by Lower Tester during the test procedure in Section 4.3 or is known to the Lower Tester by other means.
  4. If the IUT requires bonding, then the Lower Tester performs a bonding procedure.
  5. The Lower Tester configures the Cycling Power Measurement characteristic for broadcast.

4.3 Generic GATT Integrated Tests

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

TCID	Service/ Characteristic/ Descriptor	Reference	Properties	Value Length (Octets)	Service Type
CPS/SEN/SGGIT/SER/BV-01-C [Service GGIT – Cycling Power]	Cycling Power Service	[3] 2	-	-	Primary or Secondary Service
CPS/SEN/SGGIT/SDP/BV-01-C [SDP Record]	Cycling Power Service	[3] 2, 4	-	-	-
CPS/SEN/SGGIT/CHA/BV-01-C [Characteristic GGIT – Cycling Power Feature]	Cycling Power Feature Characteristic	[3] 3	0x02 (Read)	Skip	-
CPS/SEN/SGGIT/CHA/BV-07-C [Characteristic GGIT – Cycling Power Feature – Indicate]	Cycling Power Feature Characteristic	[9] 3, 3.1.1	0x22 (Read, Indicate	Skip	-
CPS/SEN/SGGIT/CHA/BV-02-C [Characteristic GGIT – Cycling Power Measurement]	Cycling Power Measurement Characteristic	[3] 3	0x10 (Notify)	Skip	-
CPS/SEN/SGGIT/CHA/BV-06-C [Characteristic GGIT – Cycling Power Measurement – Broadcast]	Cycling Power Measurement Characteristic	[3] 3	0x11 (Broadcast, Notify)	Skip	-
CPS/SEN/SGGIT/CHA/BV-03-C [Characteristic GGIT – Sensor Location]	Sensor Location Characteristic	[3] 3	0x02 (Read)	Skip	-
CPS/SEN/SGGIT/CHA/BV-04-C [Characteristic GGIT – Cycling Power Control Point]	Cycling Power Control Point Characteristic	[3] 3	0x28 (Write, Indicate)	Skip	-
CPS/SEN/SGGIT/CHA/BV-05-C [Characteristic GGIT – Cycling Power Vector]	Cycling Power Vector Characteristic	[3] 3	0x10 (Notify)	Skip	-

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 6.3 [9] Server Test Procedures using Table 4.3 below as input:

TCID	Characteristic	Reference	TC Configuration
CPS/SEN/SGGIT/ISFC/BV-01-C [Characteristic GGIT – Cycling Power Feature Indication]	Cycling Power Feature Characteristic	[9] 3.1.1	N/A

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

4.4 Characteristic Read

- Test Purpose

  This test group contains test cases to read and verify that the characteristic values required by the service are compliant. The verification is done one value at a time, as enumerated in the test cases in Table 4.4, using this generic test procedure.

- Reference

  [3] 3.1.1 and 3.3.1

- Initial Condition

  - The handle of each characteristic value referenced in the test cases below has been previously discovered by the Lower Tester during the test procedure in Section 4.3 or is known to the Lower Tester by other means.
  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.
  - If IUT permissions for the characteristic require a specific security mode or security level, establish a connection meeting those requirements.

- Test Case Configuration

Test Case	Value (Requirements)
CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature]	4 octets with RFU bits set to 0. ([3] 3.1.1)
CPS/SEN/CR/BV-02-C [Characteristic Read - Sensor Location]	1 octet with value other than RFU range. ([3] 3.3.1)

Table 4.4: Characteristic Read Value test cases

- Test Procedure

  1. The Lower Tester sends an ATT_Read_Request to the IUT to read the characteristic value.
  2. The IUT sends an ATT_Read_Response to the Lower Tester.
  3. Verify that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The characteristic is successfully read, and the characteristic value meets the requirements of the service.

4.5 Configure Indication and Notification

- Test Purpose

  This test group contains test cases to verify compliant operation in response to enable and disable characteristic indication or notification. The verification is done one value at a time, as enumerated in the test cases in Table 4.5, using this generic test procedure.

- Reference

  [3] 3.2, 3.4, and 3.5

- Initial Condition
  - The handle of each characteristic value referenced in the test cases below has been previously discovered by the Lower Tester during the test procedure in Section 4.3 or is known to the Lower Tester by other means.
  - The handle of the Client Characteristic Configuration descriptor of each characteristic referenced in the test cases below has been previously discovered by the Lower Tester during the test procedure in Section 4.3 or is known to the Lower Tester by other means.
  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.
  - If IUT permissions for the characteristic descriptor require a specific security mode or security level, establish a connection meeting those requirements.
- Test Case Configuration

Test Case	Requirements
CPS/SEN/CON/BV-01-C [Configure Notification - Cycling Power Measurement]	0x0001 ([3] 3.2)
CPS/SEN/CON/BV-02-C [Configure Indication - Cycling Power Control Point]	0x0002 ([3] 3.4)
CPS/SEN/CON/BV-03-C [Configure Notification - Cycling Power Vector]	0x0001 ([3] 3.5)

Table 4.5: Configure Indication and Notification test cases

- Test Procedure
  1. Disable indication or notification by writing value 0x0000 to the Client Characteristic Configuration descriptor of the characteristic.
  2. If the test case is for notification, enable notification by writing value 0x0001 to the Client Characteristic Configuration descriptor of the characteristic. If the test case is for indication, enable indication by writing value 0x0002 to the Client Characteristic Configuration descriptor of the characteristic.
  3. The Lower Tester reads the value of the Client Characteristic Configuration descriptor.
- Expected Outcome

  Pass verdict

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

4.6 Configure Broadcast

- Test Purpose

  This test group contains test cases to verify compliant operation in response to enable and disable characteristic broadcast. The verification is done one value at a time, as enumerated in the test cases in Table 4.6, using this generic test procedure.

- Reference

  [3] 3.2

- Initial Condition
  - The handle of each characteristic value referenced in the test cases below has been previously discovered by the Lower Tester during the test procedure in Section 4.3 or is known to the Lower Tester by other means.
  - The handle of the Server Characteristic Configuration descriptor of each characteristic referenced in the test cases below has been previously discovered by the Lower Tester during the test procedure in Section 4.3 or is known to the Lower Tester by other means.
  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.
  - If IUT permissions for the characteristic descriptor require a specific security mode or security level, establish a connection meeting those requirements.
- Test Case Configuration

Test Case	Requirements
CPS/SEN/COB/BV-01-C [Configure Broadcast - Cycling Power Measurement]	0x0001 ([3] 3.2.2.2)

Table 4.6: Configure Broadcast test cases

- Test Procedure
  1. Disable broadcast by writing value 0x0000 to the Server Characteristic Configuration descriptor of the characteristic.
  2. Enable broadcast by writing value 0x0001 to the Server Characteristic Configuration descriptor of the characteristic.
  3. The Lower Tester reads the value of the Server Characteristic Configuration descriptor.
- Expected Outcome

  Pass verdict

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

4.7 Characteristic Notification

CPS/SEN/CN/BV-01-C [Cycling Power Measurement Notifications]

- Test Purpose

  Verify that the IUT can send notifications of the Cycling Power Measurement characteristic that include the mandatory fields (e.g., the Flags field and the Instantaneous Power field).
- Reference

  [3] 3.2
- Initial Condition
  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - The Cycling Power Measurement characteristic is configured for notification.

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

- Test Procedure

  1. Perform an action on the IUT that will induce it, once connected, to send notifications of the Cycling Power Measurement characteristic along with the Flags field and the Instantaneous Power field.
  2. A connection is established between the Lower Tester and IUT meeting the security requirements of the IUT, if not already done so prior to Step 1.
  3. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  4. The Lower Tester receives one or more *ATT_Handle_Value_Notification* from the IUT containing the Cycling Power Measurement characteristic handle and value along with the Flags field and the Instantaneous Power field.
  5. Verify that the characteristic value meets the requirements of the service.
  6. Repeat Steps 4–5 until the Lower Tester receives one or more additional notifications.
  7. The Lower Tester configures the Cycling Power Measurement characteristic to disable notifications.
  8. Repeat Steps 1–2 with notifications disabled.
  9. Verify that the Lower Tester does not receive an *ATT_Handle_Value_Notification* from the IUT containing the Cycling Power Measurement characteristic.

- Expected Outcome

  Pass verdict

  The IUT sends two or more notifications of the Cycling Power Measurement characteristic along with the Flags field and the Instantaneous Power field.

  The Cycling Power Measurement characteristics contain at least the Flags field and the Instantaneous Power field.

  The value of each field of the characteristic meets the requirements of the service.

  The IUT stops sending notifications of the Cycling Power Measurement characteristic after the Lower Tester configures the characteristic to disable notifications.

  In all cases, ensure that the RFU bits of the Flags field are set to zero.

CPS/SEN/CN/BV-02-C [Cycling Power Measurement Notifications – Pedal Power Balance]

- Test Purpose

  Verify that the IUT can send notifications of the Cycling Power Measurement characteristic that include Pedal Power Balance value.

- Reference

  [3] 3.2.1.3

- Initial Condition

  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - The Cycling Power Measurement characteristic is configured for notification.

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

- Test Procedure

  1. Perform an action on the IUT that will induce it, once connected, to send notifications of the Cycling Power Measurement characteristic along with Pedal Power Balance field.
  2. A connection is established between the Lower Tester and IUT meeting the security requirements of the IUT, if not already done so prior to Step 1.
  3. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  4. The Lower Tester receives one or more *ATT_Handle_Value_Notification* from the IUT containing the Cycling Power Measurement characteristic handle and value along with the Pedal Power Balance field.
  5. Verify that the characteristic value meets the requirements of the service.
  6. Repeat Steps 4–5 until the Lower Tester receives one or more additional notifications.
  7. The Lower Tester configures the Cycling Power Measurement characteristic to disable notifications.

- Expected Outcome

  Pass verdict

  The IUT sends two or more notifications of the Cycling Power Measurement characteristic and, at least, one includes the Pedal Power Balance value with the appropriate flag set in the Flags field.

  The value of each field of the characteristic meets the requirements of the service.

  The value of the Pedal Power Balance Supported bit of the Cycling Power Feature characteristic is set to 1.

  In all cases, ensure that the RFU bits of the Flags field are set to zero.

CPS/SEN/CN/BV-03-C [Cycling Power Measurement Notifications – Accumulated Torque]

- Test Purpose

  Verify that the IUT can send notifications of the Cycling Power Measurement characteristic that include Accumulated Torque value.

- Reference

  [3] 3.2.1.4

- Initial Condition

  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - The Cycling Power Measurement characteristic is configured for notification.
  - 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.
  - If IUT permissions for the Cycling Power Measurement characteristic require a specific security mode or security level, establish a connection meeting those requirements.

- Test Procedure

  1. Perform an action on the IUT that will induce it, once connected, to send notifications of the Cycling Power Measurement characteristic along with Accumulated Torque field.
  2. A connection is established between the Lower Tester and IUT meeting the security requirements of the IUT, if not already done so prior to Step 1.
  3. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  4. The Lower Tester receives one or more *ATT_Handle_Value_Notification* from the IUT containing the Cycling Power Measurement characteristic handle and value along with the Accumulated Torque field.
  5. Verify that the characteristic value meets the requirements of the service.
  6. Repeat Steps 4–5 until the Lower Tester receives one or more additional notifications.
  7. The Lower Tester configures the Cycling Power Measurement characteristic to disable notifications.

- Expected Outcome

  Pass verdict

  The IUT sends two or more notifications of the Cycling Power Measurement characteristic and at least, one includes the Accumulated Torque value with the appropriate flag set in the Flags field.

  The value of each field of the characteristic meets the requirements of the service.

  The value of the Accumulated Torque Supported bit of the Cycling Power Feature characteristic is set to 1.

  In all cases, ensure that the RFU bits of the Flags field are set to zero.

CPS/SEN/CN/BV-04-C [Cycling Power Measurement Notifications - Wheel Revolution Data]

- Test Purpose

  Verify that the IUT can send notifications of the Cycling Power Measurement characteristic that include Cumulative Wheel Revolutions and Last Wheel Event Time values.

- Reference

  [3] 3.2.1.5

- Initial Condition

  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - The Cycling Power Measurement characteristic is configured for notification.
  - 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.
  - If IUT permissions for the Cycling Power Measurement characteristic require a specific security mode or security level, establish a connection meeting those requirements.

- Test Procedure

  1. Perform an action on the IUT that will induce it, once connected, to send notifications of the Cycling Power Measurement characteristic along with Cumulative Wheel Revolutions and Last Wheel Event Time fields.
  2. A connection is established between the Lower Tester and IUT meeting the security requirements of the IUT, if not already done so prior to Step 1.
  3. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  4. The Lower Tester receives one or more *ATT_Handle_Value_Notification* from the IUT containing the Cycling Power Measurement characteristic handle and value.
  5. Verify that the characteristic value meets the requirements of the service.
  6. Repeat Steps 4–5 until the Lower Tester receives one or more additional notifications.
  7. The Lower Tester configures the Cycling Power Measurement characteristic to disable notifications.

- Expected Outcome

  Pass verdict

  The IUT sends two or more notifications of the Cycling Power Measurement characteristic and at least, one includes the Cumulative Wheel Revolutions and the Last Wheel Event Time values with the appropriate flag set in the Flags field.

  The value of each field of the characteristic meets the requirements of the service.

  The value of the Wheel Revolution Data Supported bit of the Cycling Power Feature characteristic is set to 1.

  In all cases, ensure that the RFU bits of the Flags field are set to zero.

CPS/SEN/CN/BV-05-C [Cycling Power Measurement Notifications – Forward Wheel Revolution Data]

- Test Purpose

  Verify that the IUT can send notifications of the Cycling Power Measurement characteristic that include Cumulative Wheel Revolutions and Last Wheel Event Time values when the wheel is rotated in the forward direction.

- Reference

  [3] 3.2.1.5

- Initial Condition

  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - The Cycling Power Measurement characteristic is configured for notification.
  - 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.
  - If IUT permissions for the Cycling Power Measurement characteristic require a specific security mode or security level, establish a connection meeting those requirements.

- Test Procedure

  1. Perform an action on the IUT that will induce it, once connected, to send notifications of the Cycling Power Measurement characteristic along with Cumulative Wheel Revolutions and Last Wheel Event Time values when the wheel is rotated in the forward direction.
  2. A connection is established between the Lower Tester and IUT meeting the security requirements of the IUT, if not already done so prior to Step 1.
  3. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  4. The Lower Tester receives one or more *ATT_Handle_Value_Notifications* from the IUT containing the Cycling Power Measurement characteristic handle and value along with Cumulative Wheel Revolutions and Last Wheel Event Time values.
  5. Verify that the characteristics value meet the requirements of the service.
  6. Repeat Steps 4–5 until the Lower Tester receives one or more additional notifications.
  7. The Lower Tester configures the Cycling Power Measurement characteristic to disable notifications.

- Expected Outcome

  Pass verdict

  The IUT sends two or more notifications of the Cycling Power Measurement characteristic and at least, one includes the Cumulative Wheel Revolutions and Last Wheel Event Time values with the appropriate flag set in the Flags field.

  The value of the characteristic meets the requirements of the service.

  The value of the Wheel Revolution Data Supported bit of the Cycling Power Feature characteristic is set to 1.

  In all cases, ensure that the RFU bits of the Flags field are set to zero.

CPS/SEN/CN/BV-06-C [Cycling Power Measurement Notifications – Reverse Wheel Revolution Data]

- Test Purpose

  Verify that when an IUT supports the ability for the Cumulative Wheel Revolutions that can count in reverse (i.e., when the wheel is rotated in the reverse direction), it does not decrement below zero.

- Reference

  [3] 3.2.1.5

- Initial Condition

  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - The Cycling Power Measurement characteristic is configured for notification.
  - 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.
  - If IUT permissions for the Cycling Power Measurement characteristic require a specific security mode or security level, establish a connection meeting those requirements.

- Test Procedure

  1. Perform an action to set the value of the Cumulative Wheel Revolutions to a value near zero (e.g., set to of 0x00000005 using the procedure in CPS/SEN/SPS/BV-02-C [Set Cumulative Value - Set to non-zero]).
  2. Perform an action on the IUT that will induce it, once connected, to send notifications of the Cycling Power Measurement characteristic along with Cumulative Wheel Revolutions and Last Wheel Event Time values when the wheel is rotated in the reverse direction.
  3. A connection is established between the Lower Tester and IUT meeting the security requirements of the IUT, if not already done so prior to Step 1.
  4. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  5. Perform an action on the IUT that will induce it to count down a number of times greater than the value set in Step 1.
  6. The Lower Tester receives one or more *ATT_Handle_Value_Notifications* from the IUT containing the Cycling Power Measurement characteristic handle and value along with Cumulative Wheel Revolutions and Last Wheel Event Time values.
  7. Verify that the characteristics value meet the requirements of the service.
  8. Repeat Steps 6–7 until the Lower Tester receives one or more additional notifications.
  9. The Lower Tester configures the Cycling Power Measurement characteristic to disable notifications.

- Expected Outcome

  Pass verdict

  The IUT sends two or more notifications of the Cycling Power Measurement characteristic and at least, one includes the Cumulative Wheel Revolutions and Last Wheel Event Time values with the appropriate flag set in the Flags field.

  The value of the characteristic meets the requirements of the service.

  The value of the Wheel Revolution Data Supported bit of the Cycling Power Feature characteristic is set to 1.

  The value of the Cumulative Wheel Revolutions field reverses and ends at a count of 0x00000000 and does not roll over.

  In all cases, ensure that the RFU bits of the Flags field are set to zero.

CPS/SEN/CN/BV-07-C [Cycling Power Measurement Notifications – Crank Revolution Data]

- Test Purpose

  Verify that the IUT can send notifications of the Cycling Power Measurement characteristic that include Cumulative Crank Revolutions and Last Crank Event Time values.

- Reference

  [3] 3.2.1.6

- Initial Condition

  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - The Cycling Power Measurement characteristic is configured for notification.

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

- Test Procedure

  1. Perform an action on the IUT that will induce it, once connected, to send notifications of the Cycling Power Measurement characteristic along with Cumulative Crank Revolutions and Last Crank Event Time values.
  2. A connection is established between the Lower Tester and IUT meeting the security requirements of the IUT, if not already done so prior to Step 1.
  3. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  4. The Lower Tester receives one or more *ATT_Handle_Value_Notifications* from the IUT containing the Cycling Power Measurement characteristic handle and value along with Cumulative Crank Revolutions and Last Crank Event Time values.
  5. Verify that the characteristic value meets the requirements of the service.
  6. Repeat Steps 4–5 until the Lower Tester receives one or more additional notifications.
  7. The Lower Tester configures the Cycling Power Measurement characteristic to disable notifications.

- Expected Outcome

  Pass verdict

  The IUT sends two or more notifications of the Cycling Power Measurement characteristic and at least, one includes the Cumulative Crank Revolutions and Last Crank Event Time values with the appropriate flag set in the Flags field.

  The value of the characteristic meets the requirements of the service.

  The value of the Crank Revolution Data Supported bit of the Cycling Power Feature characteristic is set to 1.

  In all cases, ensure that the RFU bits of the Flags field are set to zero.

CPS/SEN/CN/BV-08-C [Cycling Power Measurement Notifications – Extreme Magnitude]

- Test Purpose

  Verify that the IUT can send notifications of the Cycling Power Measurement characteristic that include Maximum Magnitude and Minimum Magnitude values.

- Reference

  [3] 3.2.1.7

- Initial Condition

  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - The Cycling Power Measurement characteristic is configured for notification.
  - 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.
  - If IUT permissions for the Cycling Power Measurement characteristic require a specific security mode or security level, establish a connection meeting those requirements.

- Test Procedure

  1. Perform an action on the IUT that will induce it, once connected, to send notifications of the Cycling Power Measurement characteristic along with Maximum Magnitude and Minimum Magnitude fields.
  2. A connection is established between the Lower Tester and IUT meeting the security requirements of the IUT, if not already done so prior to Step 1.
  3. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  4. The Lower Tester receives one or more *ATT_Handle_Value_Notifications* from the IUT containing the Cycling Power Measurement characteristic handle and value along with the Maximum Magnitude and Minimum Magnitude values.
  5. Verify that the characteristic value meets the requirements of the service.
  6. Repeat Steps 4–5 until the Lower Tester receives one or more additional notifications.
  7. The Lower Tester configures the Cycling Power Measurement characteristic to disable notifications.

- Expected Outcome

  Pass verdict

  The IUT sends two or more notifications of the Cycling Power Measurement characteristic and at least, one includes the Maximum Magnitude and Minimum Magnitude values with the appropriate flag set in the Flags field.

  The value of each field of the characteristic meets the requirements of the service.

  The value of the Extreme Magnitudes Supported bit of the Cycling Power Feature characteristic is set to 1.

  In all cases, ensure that the RFU bits of the Flags field are set to zero.

CPS/SEN/CN/BV-09-C [Cycling Power Measurement Notifications – Extreme Angles]

- Test Purpose

  Verify that the IUT can send notifications of the Cycling Power Measurement characteristic that include Maximum Angle and Minimum Angle values.

- Reference

  [3] 3.2.1.8

- Initial Condition

  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - The Cycling Power Measurement characteristic is configured for notification.
  - 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.
  - If IUT permissions for the Cycling Power Measurement characteristic require a specific security mode or security level, establish a connection meeting those requirements.

- Test Procedure

  1. Perform an action on the IUT that will induce it, once connected, to send notifications of the Cycling Power Measurement characteristic along with Maximum Angle and Minimum Angle fields.
  2. A connection is established between the Lower Tester and IUT meeting the security requirements of the IUT, if not already done so prior to Step 1.
  3. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  4. The Lower Tester receives one or more *ATT_Handle_Value_Notifications* from the IUT containing the Cycling Power Measurement characteristic handle and value along with Maximum Angle and Minimum Angle values.
  5. Verify that the characteristic value meets the requirements of the service.
  6. Repeat Steps 4–5 until the Lower Tester receives one or more additional notifications.
  7. The Lower Tester configures the Cycling Power Measurement characteristic to disable notifications.

- Expected Outcome

  Pass verdict

  The IUT sends two or more notifications of the Cycling Power Measurement characteristic and at least, one includes the Maximum Angle and Minimum Angle values with the appropriate flag set in the Flags field.

  The value of each field of the characteristic meets the requirements of the service.

  The value of the Extreme Angles Supported bit of the Cycling Power Feature characteristic is set to 1.

  In all cases, ensure that the RFU bits of the Flags field are set to zero.

CPS/SEN/CN/BV-10-C [Cycling Power Measurement Notifications – Top Dead Spot]

- Test Purpose

  Verify that the IUT can send notifications of the Cycling Power Measurement characteristic that include Top Dead Spot value.

- Reference

  [3] 3.2.1.9

- Initial Condition

  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - The Cycling Power Measurement characteristic is configured for notification.
  - 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.
  - If IUT permissions for the Cycling Power Measurement characteristic require a specific security mode or security level, establish a connection meeting those requirements.

- Test Procedure

  1. Perform an action on the IUT that will induce it, once connected, to send notifications of the Cycling Power Measurement characteristic along with Top Dead Spot field.
  2. A connection is established between the Lower Tester and IUT meeting the security requirements of the IUT, if not already done so prior to Step 1.

3. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
4. The Lower Tester receives one or more *ATT_Handle_Value_Notification* from the IUT containing the Cycling Power Measurement characteristic handle and value along with the Top Dead Spot field.
5. Verify that the characteristic value meets the requirements of the service.
6. Repeat Steps 4–5 until the Lower Tester receives one or more additional notifications.
7. The Lower Tester configures the Cycling Power Measurement characteristic to disable notifications.

- Expected Outcome

  Pass verdict

  The IUT sends two or more notifications of the Cycling Power Measurement characteristic and at least, one includes the Top Dead Spot value with the appropriate flag set in the Flags field.

  The value of each field of the characteristic meets the requirements of the service.

  The value of the Top Dead Spot Supported bit of the Cycling Power Feature characteristic is set to 1.

  In all cases, ensure that the RFU bits of the Flags field are set to zero.

CPS/SEN/CN/BV-11-C [Cycling Power Measurement Notifications – Bottom Dead Spot]

- Test Purpose

  Verify that the IUT can send notifications of the Cycling Power Measurement characteristic that include Bottom Dead Spot value.

- Reference

  [3] 3.2.1.10

- Initial Condition

  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - The Cycling Power Measurement characteristic is configured for notification.
  - 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.
  - If IUT permissions for the Cycling Power Measurement characteristic require a specific security mode or security level, establish a connection meeting those requirements.

- Test Procedure

1. Perform an action on the IUT that will induce it, once connected, to send notifications of the Cycling Power Measurement characteristic along with Bottom Dead Spot field.
2. A connection is established between the Lower Tester and IUT meeting the security requirements of the IUT, if not already done so prior to Step 1.
3. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
4. The Lower Tester receives one or more ATT_Handle_Value_Notification from the IUT containing the Cycling Power Measurement characteristic handle and value along with the Bottom Dead Spot field.
5. Verify that the characteristic value meets the requirements of the service.

6. Repeat Steps 4–5 until the Lower Tester receives one or more additional notifications.
7. The Lower Tester configures the Cycling Power Measurement characteristic to disable notifications.

- Expected Outcome

  Pass verdict

  The IUT sends two or more notifications of the Cycling Power Measurement characteristic and at least, one includes the Bottom Dead Spot value with the appropriate flag set in the Flags field.

  The value of each field of the characteristic meets the requirements of the service.

  The value of the Bottom Dead Spot Supported bit of the Cycling Power Feature characteristic is set to 1.

  In all cases, ensure that the RFU bits of the Flags field are set to zero.

CPS/SEN/CN/BV-12-C [Cycling Power Measurement Notifications – Accumulated Energy]

- Test Purpose

  Verify that the IUT can send notifications of the Cycling Power Measurement characteristic that include Accumulated Energy value.

- Reference

  [3] 3.2.1.11

- Initial Condition

  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - The Cycling Power Measurement characteristic is configured for notification.
  - 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.
  - If IUT permissions for the Cycling Power Measurement characteristic require a specific security mode or security level, establish a connection meeting those requirements.

- Test Procedure

  1. Perform an action on the IUT that will induce it, once connected, to send notifications of the Cycling Power Measurement characteristic along with Accumulated Energy field.
  2. A connection is established between the Lower Tester and IUT meeting the security requirements of the IUT, if not already done so prior to Step 1.
  3. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  4. The Lower Tester receives one or more *ATT_Handle_Value_Notification* from the IUT containing the Cycling Power Measurement characteristic handle and value along with the Accumulated Energy field.
  5. Verify that the characteristic value meets the requirements of the service.
  6. Repeat Steps 4–5 until the Lower Tester receives one or more additional notifications.
  7. The Lower Tester configures the Cycling Power Measurement characteristic to disable notifications.

- Expected Outcome

  Pass verdict

  The IUT sends two or more notifications of the Cycling Power Measurement characteristic and at least, one includes the Accumulated Energy value with the appropriate flag set in the Flags field.

  The value of each field of the characteristic meets the requirements of the service.

  The value of the Accumulated Energy Supported bit of the Cycling Power Feature characteristic is set to 1.

  In all cases, ensure that the RFU bits of the Flags field are set to zero.

CPS/SEN/CN/BV-13-C [Cycling Power Measurement Notifications – Offset Compensation Indicator]

- Test Purpose

  Verify that the IUT can send notifications of the Cycling Power Measurement characteristic with the Offset Compensation Indicator bit of the Flags field set to a valid value.

- Reference

  [3] 3.5.1.1

- Initial Condition

  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - The Cycling Power Measurement characteristic is configured for notification.
  - 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.
  - If IUT permissions for the Cycling Power Measurement characteristic require a specific security mode or security level, establish a connection meeting those requirements.

- Test Procedure

  1. Perform an action on the IUT that will induce it, once connected, to send notifications of the Cycling Power Measurement characteristic with the Offset Compensation Indicator bit of the Flags field set to a valid value (e.g., via the test case CPS/SEN/CON/BV-01-C [Configure Notification - Cycling Power Measurement]).
  2. A connection is established between the Lower Tester and IUT meeting the security requirements of the IUT, if not already done so prior to Step 1.
  3. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  4. The Lower Tester receives one or more *ATT_Handle_Value_Notification* from the IUT containing the Cycling Power Measurement characteristic handle and value along with the Offset Compensation Indicator bit of the Flags field set to a valid value.
  5. Verify that the characteristic value meets the requirements of the service.
  6. Repeat Steps 4–5 until the Lower Tester receives one or more additional notifications.
  7. The Lower Tester configures the Cycling Power Measurement characteristic to disable notifications.

- Expected Outcome

  Pass verdict

  The IUT sends two or more notifications of the Cycling Power Measurement characteristic with the appropriate flags set in the Flags field.

  The value of each field of the characteristic meets the requirements of the service.

  In all cases, ensure that the RFU bits of the Flags field are set to zero.

CPS/SEN/CN/BV-14-C [Cycling Power Vector Notifications – Instantaneous Force Magnitude Array]

- Test Purpose

  Verify that the IUT can send notifications of the Cycling Power Vector characteristic that include the mandatory field (e.g., the Flags field) and the Instantaneous Force Magnitude Array field.

- Reference

  [3] 3.5

- Initial Condition

  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - The Cycling Power Vector characteristic is configured for notification.
  - 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.
  - If IUT permissions for the Cycling Power Vector characteristic require a specific security mode or security level, establish a connection meeting those requirements.
  - If the IUT uses the GAP Connection Parameter Update procedure to request faster connection parameters in order to send the notifications of the Cycling Power Vector characteristic, the Lower Tester accepts any valid parameters and then, the Lower Tester also updates the connection parameters as requested.

- Test Procedure

  1. Perform an action on the IUT that will induce it, once connected, to send notifications of the Cycling Power Vector characteristic along with the Flags field and the Instantaneous Force Magnitude Array field (e.g., via the test case CPS/SEN/CON/BV-03-C [Configure Notification - Cycling Power Vector]).
  2. A connection is established between the Lower Tester and IUT meeting the security requirements of the IUT, if not already done so prior to Step 1.
  3. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  4. The Lower Tester receives one or more *ATT_Handle_Value_Notification* from the IUT containing the Cycling Power Vector characteristic handle and value along with the Flags field and the Instantaneous Force Magnitude Array field.
  5. Verify that the characteristic value meets the requirements of the service.
  6. Repeat Steps 4–5 until the Lower Tester receives one or more additional notifications.
  7. The Lower Tester configures the Cycling Power Vector characteristic to disable notifications.
  8. Repeat Steps 1–2 with notifications disabled.
  9. Verify that the Lower Tester does not receive an *ATT_Handle_Value_Notification* from the IUT containing the Cycling Power Vector characteristic.

- Expected Outcome

  Pass verdict

  The IUT sends two or more notifications of the Cycling Power Vector characteristic along with the Flags field and the Instantaneous Force Magnitude Array field, including one or more Instantaneous Magnitude values.

  The value of each field of the characteristic meets the requirements of the service.

  The IUT stops sending notifications of the Cycling Power Vector characteristic after the Lower Tester configures the characteristic to disable notifications.

  In all cases, ensure that the RFU bits of the Flags field are set to zero.

CPS/SEN/CN/BV-15-C [Cycling Power Vector Notifications – Instantaneous Torque Magnitude Array]

- Test Purpose

  Verify that the IUT can send notifications of the Cycling Power Vector characteristic that include the mandatory field (e.g., the Flags field) and the Instantaneous Torque Magnitude Array field.

- Reference

  [3] 3.5.1.4

- Initial Condition

  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - The Cycling Power Vector characteristic is configured for notification.
  - 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.
  - If IUT permissions for the Cycling Power Vector characteristic require a specific security mode or security level, establish a connection meeting those requirements.
  - If the IUT uses the GAP Connection Parameter Update procedure to request faster connection parameters in order to send the notifications of the Cycling Power Vector characteristic, the Lower Tester accepts any valid parameters and then, the Lower Tester also updates the connection parameters as requested.

- Test Procedure

  1. Perform an action on the IUT that will induce it, once connected, to send notifications of the Cycling Power Vector characteristic along with the Flags field and the Instantaneous Torque Magnitude Array field (e.g., via the test case CPS/SEN/CON/BV-03-C [Configure Notification - Cycling Power Vector]).
  2. A connection is established between the Lower Tester and IUT meeting the security requirements of the IUT, if not already done so prior to Step 1.
  3. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  4. The Lower Tester receives one or more *ATT_Handle_Value_Notification* from the IUT containing the Cycling Power Vector characteristic handle and value along with the Flags field and the Instantaneous Torque Magnitude Array field.
  5. Verify that the characteristic value meets the requirements of the service.
  6. Repeat Steps 4–5 until the Lower Tester receives one or more additional notifications.
  7. The Lower Tester configures the Cycling Power Vector characteristic to disable notifications.

8. Repeat Steps 1–2 with notifications disabled.
9. Verify that the Lower Tester does not receive an *ATT_Handle_Value_Notification* from the IUT containing the Cycling Power Vector characteristic.

- Expected Outcome

  Pass verdict

  The IUT sends two or more notifications of the Cycling Power Vector characteristic along with the Flags field and the Instantaneous Torque Magnitude Array field, including one or more Instantaneous Magnitude values.

  The value of each field of the characteristic meets the requirements of the service.

  The IUT stops sending notifications of the Cycling Power Vector characteristic after the Lower Tester configures the characteristic to disable notifications.

  In all cases, ensure that the RFU bits of the Flags field are set to zero.

CPS/SEN/CN/BV-16-C [Cycling Power Vector Notifications – Crank Revolution Data]

- Test Purpose

  Verify that the IUT can send notifications of the Cycling Power Vector characteristic that include Cumulative Crank Revolutions and Last Crank Event Time values.

- Reference

  [3] 3.5.1.2

- Initial Condition

  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - The Cycling Power Vector characteristic is configured for notification.
  - 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.
  - If IUT permissions for the Cycling Power Vector characteristic require a specific security mode or security level, establish a connection meeting those requirements.
  - If the IUT uses the GAP Connection Parameter Update procedure to request faster connection parameters in order to send the notifications of the Cycling Power Vector characteristic, the Lower Tester accepts any valid parameters and then, the Lower Tester also updates the connection parameters as requested.

- Test Procedure

  1. Perform an action on the IUT that will induce it, once connected, to send notifications of the Cycling Power Vector characteristic along with Cumulative Crank Revolutions and Last Crank Event Time values (e.g., via the test case CPS/SEN/CON/BV-03-C [Configure Notification - Cycling Power Vector]).
  2. A connection is established between the Lower Tester and IUT meeting the security requirements of the IUT, if not already done so prior to Step 1.
  3. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  4. The Lower Tester receives one or more *ATT_Handle_Value_Notification* from the IUT containing the Cycling Power Vector characteristic handle and value along with the Cumulative Crank Revolutions and Last Crank Event Time values.

5. Verify that the characteristic value meets the requirements of the service.
6. Repeat Steps 4–5 until the Lower Tester receives one or more additional notifications.
7. The Lower Tester configures the Cycling Power Vector characteristic to disable notifications.

- Expected Outcome

  Pass verdict

  The IUT sends two or more notifications of the Cycling Power Vector characteristic and at least, one includes the Cumulative Crank Revolutions and Last Crank Event Time values with the appropriate flag set in the Flags field.

  The value of each field of the characteristic meets the requirements of the service.

  The value of the Crank Revolution Data Supported bit of the Cycling Power Feature characteristic is set to 1.

  In all cases, ensure that the RFU bits of the Flags field are set to zero.

CPS/SEN/CN/BV-17-C [Cycling Power Vector Notifications – First Crank Measurement Angle]

- Test Purpose

  Verify that the IUT can send notifications of the Cycling Power Vector characteristic that include First Crank Measurement Angle value.

- Reference

  [3] 3.5.1.3

- Initial Condition

  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - The Cycling Power Vector characteristic is configured for notification.
  - 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.
  - If IUT permissions for the Cycling Power Vector characteristic require a specific security mode or security level, establish a connection meeting those requirements.
  - If the IUT uses the GAP Connection Parameter Update procedure to request faster connection parameters in order to send the notifications of the Cycling Power Vector characteristic, the Lower Tester accepts any valid parameters and then, the Lower Tester also updates the connection parameters as requested.

- Test Procedure

  1. Perform an action on the IUT that will induce it, once connected, to send notifications of the Cycling Power Vector characteristic along with First Crank Measurement Angle value (e.g., via the test case CPS/SEN/CON/BV-03-C [Configure Notification - Cycling Power Vector]).
  2. A connection is established between the Lower Tester and IUT meeting the security requirements of the IUT, if not already done so prior to Step 1.
  3. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  4. The Lower Tester receives one or more *ATT_Handle_Value_Notification* from the IUT containing the Cycling Power Vector characteristic handle and value along with the First Crank Measurement Angle value.

5. Verify that the characteristic value meets the requirements of the service.
6. Repeat Steps 4–5 until the Lower Tester receives one or more additional notifications.
7. The Lower Tester configures the Cycling Power Vector characteristic to disable notifications.

- Expected Outcome

  Pass verdict

  The IUT sends two or more notifications of the Cycling Power Vector characteristic and at least, one includes the First Crank Measurement Angle value with the appropriate flag set in the Flags field.

  The value of each field of the characteristic meets the requirements of the service.

  In all cases, ensure that the RFU bits of the Flags field are set to zero.

CPS/SEN/CN/BV-18-C [Cycling Power Vector Notifications – Instantaneous Measurement Direction]

- Test Purpose

  Verify that the IUT can send notifications of the Cycling Power Vector characteristic with the Instantaneous Measurement Direction bits of the Flags field set to a valid value.

- Reference

  [3] 3.5.1.1

- Initial Condition

  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - The Cycling Power Vector characteristic is configured for notification.
  - 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.
  - If IUT permissions for the Cycling Power Vector characteristic require a specific security mode or security level, establish a connection meeting those requirements.
  - If the IUT uses the GAP Connection Parameter Update procedure to request faster connection parameters in order to send the notifications of the Cycling Power Vector characteristic, the Lower Tester accepts any valid parameters and then, the Lower Tester also updates the connection parameters as requested.

- Test Procedure

  1. Perform an action on the IUT that will induce it, once connected, to send notifications of the Cycling Power Vector characteristic with the Instantaneous Measurement Direction bits of the Flags field set to a valid value (e.g., via the test case CPS/SEN/CON/BV-03-C [Configure Notification - Cycling Power Vector]).
  2. A connection is established between the Lower Tester and IUT meeting the security requirements of the IUT, if not already done so prior to Step 1.
  3. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  4. The Lower Tester receives one or more *ATT_Handle_Value_Notification* from the IUT containing the Cycling Power Vector characteristic handle and value along with the Instantaneous Measurement Direction bits of the Flags field set to a valid value.
  5. Verify that the characteristic value meets the requirements of the service.
  6. Repeat Steps 4–5 until the Lower Tester receives one or more additional notifications.
  7. The Lower Tester configures the Cycling Power Vector characteristic to disable notifications.

- Expected Outcome

  Pass verdict

  The IUT sends two or more notifications of the Cycling Power Vector characteristic with the appropriate flags set in the Flags field.

  The value of each field of the characteristic meets the requirements of the service.

  In all cases, ensure that the RFU bits of the Flags field are set to zero.

CPS/SEN/CN/BI-01-C [Cycling Power Vector Notifications – Inappropriate Connection Parameters]

- Test Purpose

  Verify that the IUT responds appropriately when the Lower Tester attempts to enable the notification of the Cycling Power Vector characteristic and does not accept the *L2CAP Connection Parameter Update Request* from the IUT (e.g., the IUT do not change the connection parameters as requested).

- Reference

  [3] 3.5

- Initial Condition

  - If the IUT requires a bonding procedure, then perform a bonding procedure.
  - Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1, if using an LE transport, or Section 4.2.2 if using a BR/EDR transport.
  - If IUT permissions for the Cycling Power Vector characteristic require a specific security mode or security level, establish a connection meeting those requirements.

- Test Procedure

  1. Perform an action on the IUT that will induce it, once connected, to send notifications of the Cycling Power Vector characteristic.
  2. A connection is established between the Lower Tester and IUT meeting the security requirements of the IUT, if not already done so prior to Step 1.
  3. The Lower Tester reads the slowest connection interval for Cycling Power Vector characteristic notifications supported by the IUT in the IXIT [7] and uses this value to set the connection parameters (e.g., using the GAP Connection Parameter Update procedure defined in [2] Volume 3 Part C Section 9.3.9) to a larger value.
  4. The Lower Tester writes (e.g., using ATT Write Request) 0x0001 to the Client Characteristic Configuration Descriptor of the Cycling Power Vector characteristic to enable the notification of the Cycling Power Vector characteristic.
  5. The IUT requires the Lower Tester to update the connection parameters prior to start the sending of the Cycling Power Vector notifications (e.g., using the L2CAP Connection Parameter Update Request).
  6. The Lower Tester rejects the request from the IUT and does not change the connection parameters as requested.
  7. Verify that the Lower Tester receives an ATT Error Response with an Error Code set to 0x80 (Inappropriate Connection Parameters).
  8. Verify that the Lower Tester does not receive any notification of the Cycling Power Vector characteristic.

- Expected Outcome

  Pass verdict

  When the Lower tester writes to the Client Characteristic Configuration descriptor of the Cycling Power Vector characteristic to enable the notifications, the IUT sends an L2CAP Connection Parameter Update Request to the Lower Tester. After a period of time defined by the IUT, the IUT sends an ATT Error Response with an Application Error Code set to 0x80 *(Inappropriate Connection Parameters).*

  The IUT do not send any notification of the Cycling Power Vector characteristic.

4.8 Service Procedures – Set Cumulative Value

Verify compliant operation when the Lower Tester uses Cycling Power Control Point Set Cumulative Value procedure.

CPS/SEN/SPS/BV-01-C [Set Cumulative Value - Set to zero]

- Test Purpose

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

- Reference

  [3] 3.4.2.1

- Initial Condition

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

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  3. The IUT sends one or more notifications of the Cycling Power Measurement characteristic.
  4. The Lower Tester writes the Set Cumulative Value Op Code (0x01) to the Cycling Power Control Point with a Parameter Value of 0x00000000.
  5. The IUT sends an indication of the Cycling Power Control Point characteristic with the Response Code Op Code (0x20), a Parameter Value representing Request Op Code (0x01) followed by the Response Value for ‘success’ (0x01) without Response Parameter.
  6. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Cycling Power Control Point characteristic handle and value.
  7. The Lower Tester sends an *ATT_Handle_Value_Confirmation* to the IUT.
  8. Verify that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one or more notifications of the Cycling Power Measurement characteristic with the Cumulative Wheel Revolutions field set to a non-zero value.

  The IUT sends one indication of the Cycling Power Control Point characteristic with the Response Code Op Code containing a valid Parameter Value.

After setting the value to zero, the IUT sends the next notification of the Cycling Power Measurement characteristic with the Cumulative Wheel Revolutions field set to 0 (or slightly higher in case of movement).

The value of the Wheel Revolution Data Supported bit of the Cycling Power Feature characteristic is set to 1.

CPS/SEN/SPS/BV-02-C [Set Cumulative Value - Set to non-zero]

- Test Purpose

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

- Reference

  [3] 3.4.2.1

- Initial Condition

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

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  3. The IUT sends one or more notifications of the Cycling Power Measurement characteristic.
  4. The Lower Tester writes the Set Cumulative Value Op Code (0x01) to the Cycling Power Control Point with a Parameter Value other than 0x00000000 and different from the initial value.
  5. The IUT sends an indication of the Cycling Power Control Point characteristic with the Response Code Op Code (0x20), a Parameter Value representing Request Op Code (0x01) followed by the Response Value for ‘success’ (0x01) without Response Parameter.
  6. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Cycling Power Control Point characteristic handle and value.
  7. The Lower Tester sends an *ATT_Handle_Value_Confirmation* to the IUT.
  8. Verify that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one or more notifications of the Cycling Power Measurement characteristic with the Cumulative Wheel Revolutions field set to a non-zero value.

  The IUT sends one indication of the Cycling Power Control Point characteristic with the Response Code Op Code containing a valid Parameter Value.

  After setting the value to a non-zero value, the IUT sends the next notification of the Cycling Power Measurement characteristic with the Cumulative Wheel Revolutions field set to the specified value (or slightly higher in case of movement).

  The value of the Wheel Revolution Data Supported bit of the Cycling Power Feature characteristic is set to 1.

4.9 Service Procedure – Handle Server Parameters

Verify compliant operation when the Lower Tester uses Cycling Power Control Point procedures to handle internal Server parameters (e.g., Set or Request).

CPS/SEN/SPP/BV-01-C [Update Sensor Location]

- Test Purpose

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

- Reference

  [3] 3.4.2.2

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  3. The Lower Tester reads the Sensor Location characteristic to determine the present value.
  4. For each supported Sensor Location value (known by executing CPS/SEN/SPP/BV-02-C [Request Supported Sensor Locations] or by other means), perform the following:
  5. The Lower Tester writes the Update Sensor Location Op Code (0x02) to the Cycling Power Control Point with a Parameter Value set to another supported sensor location.
  6. The IUT sends an indication of the Cycling Power Control Point characteristic with the Response Code Op Code (0x20), a Parameter Value representing Request Op Code (0x02) followed by the Response Value for ‘success’ (0x01) without Response Parameter.
  7. The Lower Tester receives an ATT_Handle_Value_Indication from the IUT containing the Cycling Power Control Point characteristic handle and value.
  8. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.
  9. Verify that the characteristic value meets the requirements of the service.
  10. The Lower Tester reads the Sensor Location characteristic and verifies that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  For each supported Sensor Location value, verify the following:

  - The IUT sends one indication of the Cycling Power Control Point characteristic with the Response Code Op Code containing a valid Parameter Value.
  - The Sensor Location value is set to the value written as a Parameter to the Cycling Power Control Point.

  The value of the Multiple Sensor Locations Supported bit of the Cycling Power Feature characteristic is set to 1.

CPS/SEN/SPP/BV-02-C [Request Supported Sensor Locations]

- Test Purpose

  Verify that the IUT can perform the Request Supported Sensor Location procedure.

- Reference

  [3] 3.4.2.3

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  3. The Lower Tester writes the Request Supported Sensor Locations Op Code (0x03) to the Cycling Power Control Point without any Parameter Value.
  4. The IUT sends an indication of the Cycling Power Control Point characteristic with the Response Code Op Code (0x20), the Parameter Value representing Request Op Code (0x03), the Response Value for ‘success’ (0x01) followed by the list of the supported sensor locations.
  5. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Cycling Power Control Point characteristic handle and value.
  6. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.
  7. Verify that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one indication of the Cycling Power Control Point characteristic with the Response Code Op Code containing a valid Parameter Value.

  The value of the Multiple Sensor Locations Supported bit of the Cycling Power Feature characteristic is set to 1.

CPS/SEN/SPP/BV-03-C [Set Crank Length]

- Test Purpose

  Verify that the IUT can perform the Set Crank Length procedure.

- Reference

  [3] 3.4.2.4

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  3. The Lower Tester requests the crank length actually configured in the IUT to determine the present value (e.g., using the Request Crank Length procedure).

4. The Lower Tester writes the Set Crank Length Op Code (0x04) to the Cycling Power Control Point with a Parameter Value set to another valid crank length value (UINT16) in millimeters with a resolution of 1/2 millimeter.
5. The IUT sends an indication of the Cycling Power Control Point characteristic with the Response Code Op Code (0x20), a Parameter Value representing Request Op Code (0x04) followed by the Response Value for 'success' (0x01) without Response Parameter.
6. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Cycling Power Control Point characteristic handle and value.
7. The Lower Tester sends an *ATT_Handle_Value_Confirmation* to the IUT.
8. Verify that the characteristic value meets the requirements of the service.
9. The Lower Tester requests the crank length to determine the present value (e.g., using the Request Crank Length procedure).

- Expected Outcome

  Pass verdict

  The IUT sends one indication of the Cycling Power Control Point characteristic with the Response Code Op Code containing a valid Parameter Value.

  The requested crank length value is set to the value written as a Parameter to the Cycling Power Control Point.

  The value of the Crank Length Adjustment Supported bit of the Cycling Power Feature characteristic is set to 1.

CPS/SEN/SPP/BV-04-C [Request Crank Length]

- Test Purpose

  Verify that the IUT can perform the Request Crank Length procedure.

- Reference

  [3] 3.4.2.5

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

1. A connection is established between the Lower Tester and IUT.
2. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
3. The Lower Tester writes the Request Crank Length Op Code (0x05) to the Cycling Power Control Point without any Parameter Value.
4. The IUT sends an indication of the Cycling Power Control Point characteristic with the Response Code Op Code (0x20), the Parameter Value representing Request Op Code (0x05), the Response Value for 'success' (0x01) followed by the value of the crank length (UINT16) in millimeters with a resolution of 1/2 millimeter.
5. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Cycling Power Control Point characteristic handle and value.
6. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.
7. Verify that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one indication of the Cycling Power Control Point characteristic with the Response Code Op Code containing a valid Parameter Value.

  The value of the Crank Length Adjustment Supported bit of the Cycling Power Feature characteristic is set to 1.

CPS/SEN/SPP/BV-05-C [Set Chain Length]

- Test Purpose

  Verify that the IUT can perform the Set Chain Length procedure.

- Reference

  [3] 3.4.2.6

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  3. The Lower Tester requests the chain length actually configured in the IUT to determine the present value (e.g., using the Request Chain Length procedure).
  4. The Lower Tester writes the Set Chain Length Op Code (0x06) to the Cycling Power Control Point with a Parameter Value set to another valid chain length value (UINT16) in millimeters with a resolution of 1 millimeter.
  5. The IUT sends an indication of the Cycling Power Control Point characteristic with the Response Code Op Code (0x20), a Parameter Value representing Request Op Code (0x06) followed by the Response Value for ‘success’ (0x01) without Response Parameter.
  6. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Cycling Power Control Point characteristic handle and value.
  7. The Lower Tester sends an *ATT_Handle_Value_Confirmation* to the IUT.
  8. Verify that the characteristic value meets the requirements of the service.
  9. The Lower Tester requests the chain length to determine the present value (e.g., using the Request Chain Length procedure).

- Expected Outcome

  Pass verdict

  The IUT sends one indication of the Cycling Power Control Point characteristic with the Response Code Op Code containing a valid Parameter Value.

  The requested chain length value is set to the value written as a Parameter to the Cycling Power Control Point.

  The value of the Chain Length Adjustment Supported bit of the Cycling Power Feature characteristic is set to 1.

CPS/SEN/SPP/BV-06-C [Request Chain Length]

- Test Purpose

  Verify that the IUT can perform the Request Chain Length procedure.

- Reference

  [3] 3.4.2.7

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  3. The Lower Tester writes the Request Chain Length Op Code (0x07) to the Cycling Power Control Point without any Parameter Value.
  4. The IUT sends an indication of the Cycling Power Control Point characteristic with the Response Code Op Code (0x20), the Parameter Value representing Request Op Code (0x07), the Response Value for ‘success’ (0x01) followed by the value of the chain length (UINT16) in millimeters with a resolution of 1 millimeter.
  5. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Cycling Power Control Point characteristic handle and value.
  6. The Lower Tester sends an *ATT_Handle_Value_Confirmation* to the IUT.
  7. Verify that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one indication of the Cycling Power Control Point characteristic with the Response Code Op Code containing a valid Parameter Value.

  The value of the Chain Length Adjustment Supported bit of the Cycling Power Feature characteristic is set to 1.

CPS/SEN/SPP/BV-07-C [Set Chain Weight]

- Test Purpose

  Verify that the IUT can perform the Set Chain Weight procedure.

- Reference

  [3] 3.4.2.8

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  3. The Lower Tester requests the chain weight actually configured in the IUT to determine the present value (e.g., using the Request Chain Weight procedure).

4. The Lower Tester writes the Set Chain Weight Op Code (0x08) to the Cycling Power Control Point with a Parameter Value set to another valid chain weight value (UINT16) in grams with a resolution of 1 gram.
5. The IUT sends an indication of the Cycling Power Control Point characteristic with the Response Code Op Code (0x20), a Parameter Value representing Request Op Code (0x08) followed by the Response Value for 'success' (0x01) without Response Parameter.
6. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Cycling Power Control Point characteristic handle and value.
7. The Lower Tester sends an *ATT_Handle_Value_Confirmation* to the IUT.
8. Verify that the characteristic value meets the requirements of the service.
9. The Lower Tester requests the chain weight to determine the present value (e.g., using the Request Chain Weight procedure).

- Expected Outcome

  Pass verdict

  The IUT sends one indication of the Cycling Power Control Point characteristic with the Response Code Op Code containing a valid Parameter Value.

  The requested chain weight value is set to the value written as a Parameter to the Cycling Power Control Point.

  The value of the Chain Weight Adjustment Supported bit of the Cycling Power Feature characteristic is set to 1.

CPS/SEN/SPP/BV-08-C [Request Chain Weight]

- Test Purpose

  Verify that the IUT can perform the Request Chain Weight procedure.

- Reference

  [3] 3.4.2.9

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

1. A connection is established between the Lower Tester and IUT.
2. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
3. The Lower Tester writes the Request Chain weight Op Code (0x09) to the Cycling Power Control Point without any Parameter Value.
4. The IUT sends an indication of the Cycling Power Control Point characteristic with the Response Code Op Code (0x20), the Parameter Value representing Request Op Code (0x09), the Response Value for 'success' (0x01) followed by the value of the chain weight (UINT16) in grams with a resolution of 1 gram.
5. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Cycling Power Control Point characteristic handle and value.
6. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.
7. Verify that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one indication of the Cycling Power Control Point characteristic with the Response Code Op Code containing a valid Parameter Value.

  The value of the Chain Weight Adjustment Supported bit of the Cycling Power Feature characteristic is set to 1.

CPS/SEN/SPP/BV-09-C [Set Span Length]

- Test Purpose

  Verify that the IUT can perform the Set Span Length procedure.

- Reference

  [3] 3.4.2.10

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  3. The Lower Tester requests the span length actually configured in the IUT to determine the present value (e.g., using the Request Span Length procedure).
  4. The Lower Tester writes the Set Span Length Op Code (0x0A) to the Cycling Power Control Point with a Parameter Value set to another valid span length value (UINT16) in millimeters with a resolution of 1 millimeter.
  5. The IUT sends an indication of the Cycling Power Control Point characteristic with the Response Code Op Code (0x20), a Parameter Value representing Request Op Code (0x0A) followed by the Response Value for ‘success’ (0x01) without Response Parameter.
  6. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Cycling Power Control Point characteristic handle and value.
  7. The Lower Tester sends an *ATT_Handle_Value_Confirmation* to the IUT.
  8. Verify that the characteristic value meets the requirements of the service.
  9. The Lower Tester requests the span length to determine the present value (e.g., using the Request Span Length procedure).

- Expected Outcome

  Pass verdict

  The IUT sends one indication of the Cycling Power Control Point characteristic with the Response Code Op Code containing a valid Parameter Value.

  The requested span length value is set to the value written as a Parameter to the Cycling Power Control Point.

  The value of the Span Length Adjustment Supported bit of the Cycling Power Feature characteristic is set to 1.

CPS/SEN/SPP/BV-10-C [Request Span Length]

- Test Purpose

  Verify that the IUT can perform the Request Span Length procedure.

- Reference

  [3] 3.4.2.11

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  3. The Lower Tester writes the Request Span Length Op Code (0x0B) to the Cycling Power Control Point without any Parameter Value.
  4. The IUT sends an indication of the Cycling Power Control Point characteristic with the Response Code Op Code (0x20), the Parameter Value representing Request Op Code (0x0B), the Response Value for ‘success’ (0x01) followed by the value of the span length (UINT16) in millimeters with a resolution of 1 millimeter.
  5. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Cycling Power Control Point characteristic handle and value.
  6. The Lower Tester sends an ATT_Handle_Value_Confirmation to the IUT.
  7. Verify that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one indication of the Cycling Power Control Point characteristic with the Response Code Op Code containing a valid Parameter Value.

  The value of the Span Length Adjustment Supported bit of the Cycling Power Feature characteristic is set to 1.

CPS/SEN/SPP/BV-11-C [Request Factory Calibration Date]

- Test Purpose

  Verify that the IUT can perform the Request Factory Calibration Date procedure.

- Reference

  [3] 3.4.2.1515

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  3. The Lower Tester writes the Request Span Length Op Code (0x0F) to the Cycling Power Control Point without any Parameter Value.

4. The IUT sends an indication of the Cycling Power Control Point characteristic with the Response Code Op Code (0x20), the Parameter Value representing Request Op Code (0x0F) and the Response Value for 'success' (0x01) followed by the factory calibration date (see Date Time characteristic format in [6]).
5. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Cycling Power Control Point characteristic handle and value.
6. The Lower Tester sends an *ATT_Handle_Value_Confirmation* to the IUT.
7. Verify that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one indication of the Cycling Power Control Point characteristic with the Response Code Op Code containing a valid Parameter Value.

  The value of the Factory Calibration Date Supported bit of the Cycling Power Feature characteristic is set to 1.

CPS/SEN/SPP/BV-12-C [Request Sampling Rate]

- Test Purpose

  Verify that the IUT can perform the Request Sampling Rate procedure.

- Reference

  [3] 3.4.2.14

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

1. A connection is established between the Lower Tester and IUT.
2. The Lower Tester discovers the Cycling Power Vector characteristic using the test procedure CPS/SEN/SGGIT/CHA/BV-05-C [Characteristic GGIT – Cycling Power Vector] or by any other mean.
3. The Lower Tester writes the Request Sampling Rate Op Code (0x0E) to the Cycling Power Control Point without any Parameter Value.
4. The IUT sends an indication of the Cycling Power Control Point characteristic with the Response Code Op Code (0x20), the Parameter Value representing Request Op Code (0x0E) and the Response Value for 'success' (0x01) followed by the value of the sampling rate (UINT8) in Hertz with a resolution of 1 Hertz.
5. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Cycling Power Control Point characteristic handle and value.
6. The Lower Tester sends an *ATT_Handle_Value_Confirmation* to the IUT.
7. Verify that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one indication of the Cycling Power Control Point characteristic with the Response Code Op Code containing a valid Parameter Value.

  The Cycling Power Vector characteristic is discovered.

4.10 Service Procedure – Start Offset Compensation

CPS/SEN/SPO/BV-01-C [Start Offset Compensation]

- Test Purpose

  Verify that the IUT can perform the Start Offset Compensation procedure.

- Reference

  [3] 3.4.2.12

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  3. The Lower Tester writes the Start Offset Compensation Op Code (0x0C) to the Cycling Power Control Point without any Parameter Value.
  4. The IUT sends an indication of the Cycling Power Control Point characteristic with the Response Code Op Code (0x20), the Parameter Value representing Request Op Code (0x0C) and the Response Value for 'success' (0x01) followed by the Response Parameter representing the value of the offset before the offset is compensated (SINT16) in either Newtons with a resolution of 1 Newton or Newton meters with a resolution of 1/32 Newton meter depending on the Sensor Measurement Context bit of the Cycling Power Feature characteristic.
  5. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Cycling Power Control Point characteristic handle and value.
  6. The Lower Tester sends an *ATT_Handle_Value_Confirmation* to the IUT.
  7. Verify that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one indication of the Cycling Power Control Point characteristic with the Response Code Op Code containing a valid Parameter Value.

  The value of the Offset Compensation Supported bit of the Cycling Power Feature characteristic is set to 1.

4.11 Service Procedure – Mask Cycling Power Measurement Characteristic Content

CPS/SEN/SPM/BV-01-C [Mask Cycling Power Measurement Characteristic Content]

- Test Purpose

  Verify that the IUT can perform the Mask Cycling Power Measurement Characteristic Content procedure.

- Reference

  [3] 3.4.2.13

- Initial Condition
  - Perform the preamble described in Section 4.2.3.
- Test Procedure
  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  3. The Lower Tester configures the IUT for sending notification of the Cycling Power Measurement characteristic (e.g., by executing test case CPS/SEN/CN/BV-01-C [Cycling Power Measurement Notifications]).
  4. The Lower Tester receives one or more *ATT_Handle_Value_Notifications* of the Cycling Power Measurement characteristic with at least one optional field present.
  5. The Lower Tester writes the Mask Cycling Power Measurement Characteristic Content Op Code (0x0D) to the Cycling Power Control Point with a Parameter Value set to 0x01FF (UINT16) to turn off all the optional fields.
  6. The IUT sends an indication of the Cycling Power Control Point characteristic with the Response Code Op Code (0x20), the Parameter Value representing Request Op Code (0x0D) and the Response Value for ‘success’ (0x01) without Response Parameter.
  7. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Cycling Power Control Point characteristic handle and value.
  8. The Lower Tester sends an *ATT_Handle_Value_Confirmation* to the IUT.
  9. The Lower Tester receives one or more *ATT_Handle_Value_Notifications* of the Cycling Power Measurement characteristic with optional fields not present.
  10. Verify that the characteristic value meets the requirements of the service.
- Expected Outcome

  Pass verdict

  For Steps 1–4:

  The IUT sends one or more notification of the Cycling Power Measurement characteristic with at least one optional field present.

  The value of the Cycling Power Measurement Characteristic Content Masking Supported bit of the Cycling Power Feature characteristic is set to 1.

  For Steps 5–10:

  The IUT sends one indication of the Cycling Power Control Point characteristic with the Response Code Op Code containing a valid Parameter Value.

  The IUT sends one or more notifications of the Cycling Power Measurement characteristic without any optional field present.

CPS/SEN/SPM/BV-02-C [Mask Cycling Power Measurement Characteristic Content – Most Recent Mask Value is not Cached]

- Test Purpose

  Verify that the IUT does not cache the most recent configuration.
- Reference

  [3] 3.4.2.13

- Initial Condition
  - Perform the preamble described in Section 4.2.3.
- Test Procedure
  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  3. The Lower Tester configures the IUT for sending notification of the Cycling Power Measurement characteristic (e.g., by executing test case CPS/SEN/CN/BV-01-C).
  4. The Lower Tester receives one or more *ATT_Handle_Value_Notifications* of the Cycling Power Measurement characteristic with at least one optional field present.
  5. The Lower Tester writes the Mask Cycling Power Measurement Characteristic Content Op Code (0x0D) to the Cycling Power Control Point with a Parameter Value set to 0x01FF (UINT16) to turn off all the optional fields.
  6. The IUT sends an indication of the Cycling Power Control Point characteristic with the Response Code Op Code (0x20), the Parameter Value representing Request Op Code (0x0D) and the Response Value for ‘success’ (0x01) without Response Parameter.
  7. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Cycling Power Control Point characteristic handle and value.
  8. The Lower Tester sends an *ATT_Handle_Value_Confirmation* to the IUT.
  9. The Lower Tester continues to receive one or more *ATT_Handle_Value_Notifications* of the Cycling Power Measurement characteristic with optional fields not present.
  10. Verify that the optional characteristic fields are masked.
  11. The Lower Tester terminates the link.
  12. A connection is established between the Lower Tester and IUT.
  13. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  14. If not bonded, the Lower Tester again enables the notification of the Cycling Power Measurement characteristic (e.g., by executing test case CPS/SEN/CN/BV-01-C).
  15. The Lower Tester receives one or more notifications of the Cycling Power Measurement characteristic with at least one optional field present.
  16. Verify that the characteristic value meets the requirements of the service.
- Expected Outcome

  Pass verdict

  For Steps 1–4:

  The IUT sends one or more notifications of the Cycling Power Measurement characteristic with at least one optional field present.

  For Steps 5–10:

  The IUT sends one indication of the Cycling Power Control Point characteristic with the Response Code Op Code containing a valid Parameter Value.

  The value of the Cycling Power Measurement Characteristic Content Masking Supported bit of the Cycling Power Feature characteristic is set to 1.

  The content of the Cycling Power Measurement characteristic does not include the fields that were turned off.

For Steps 11–16:

The IUT sends one indication of the Cycling Power Control Point characteristic with the Response Code Op Code containing a valid Parameter Value.

The value of the Cycling Power Measurement Characteristic Content Masking Supported bit of the Cycling Power Feature characteristic is set to 1.

The content of the Cycling Power Measurement characteristic includes the fields that were seen in Step 4.

The IUT sends one or more notifications of the Cycling Power Measurement characteristic with at least one optional field present.

4.12 Service Procedure – Start Enhanced Offset Compensation

CPS/SEN/SPO/BV-02-C [Start Enhanced Offset Compensation]

- Test Purpose

  Verify that the IUT can perform the Start Enhanced Offset Compensation procedure.

- Reference

  [3] 3.4.2.16

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  3. The Lower Tester writes the Start Enhanced Offset Compensation Op Code (0x10) to the Cycling Power Control Point without any Parameter Value.
  4. The IUT sends an indication of the Cycling Power Control Point characteristic with the Response Code Op Code (0x20), the Parameter Value representing Request Op Code (0x10) and the Response Value for ‘success’ (0x01) followed by the Response Parameter representing the value of the offset before the offset is compensated (SINT16) in either Newton with a resolution of 1 Newton or Newton meters with a resolution of 1/32 Newton meter depending on the Sensor Measurement Context bit of the Cycling Power Feature characteristic followed by a UINT16 value representing the manufacturer Company ID as given in the SIG assigned numbers, a UINT8 representing the number of octets of manufacturer specific data (e.g., Analog to Digital Conversion data), and the corresponding manufacturer specific data in the Response Parameter.
  5. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Cycling Power Control Point characteristic handle and value.
  6. The Lower Tester sends an *ATT_Handle_Value_Confirmation* to the IUT.
  7. Verify that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one indication of the Cycling Power Control Point characteristic with the Response Code Op Code containing a valid Parameter Value.

  The value of the Enhanced Offset Compensation Supported bit of the Cycling Power Feature characteristic is set to 1.

CPS/SEN/SPO/BI-01-C [Start Enhanced Offset Compensation – Incorrect Calibration Position]

- Test Purpose

  Verify that the IUT can perform the respond with the appropriate response if the calibration position is incorrect.

- Reference

  [3] 3.4.2.16

- Initial Condition

  - Perform the preamble described in Section 4.2.3.
  - The IUT is set in an incorrect position for offset compensation (e.g., crankset in the horizontal position).

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester reads the Cycling Power Feature characteristic (e.g., by executing test case CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature] or by other means).
  3. The Lower Tester writes the Start Enhanced Offset Compensation Op Code (0x10) to the Cycling Power Control Point without any Parameter Value.
  4. The IUT sends an indication of the Cycling Power Control Point characteristic with the Response Code Op Code (0x20), the Parameter Value representing Request Op Code (0x10) and the Response Value for ‘operation failed’ (0x04) followed by the Response Parameter for ‘incorrect calibration position’ (0x01).
  5. The Lower Tester receives an *ATT_Handle_Value_Indication* from the IUT containing the Cycling Power Control Point characteristic handle and value.
  6. The Lower Tester sends an *ATT_Handle_Value_Confirmation* to the IUT.
  7. Verify that the characteristic value meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT sends one indication of the Cycling Power Control Point characteristic with the Response Code Op Code containing a valid Parameter Value.

  The value of the Enhanced Offset Compensation Supported bit of the Cycling Power Feature characteristic is set to 1.

4.13 Service Procedure – General Error Handling

Verify compliant operation when the Lower Tester uses Cycling Power Control Point procedure and error results.

CPS/SEN/SPE/BI-01-C [Op Code Not Supported]

- Test Purpose

  Verify that the IUT responds appropriately when a Client writes an unsupported Op Code to the Cycling Power Control Point.

- Reference

  [3] 3.4.3

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester writes an Op Code Value of 0x00 to the Cycling Power Control Point without Parameter Value.
  3. Verify that the IUT response meets the requirements of the service.
  4. The Lower Tester writes an Op Code value from the Reserved for Future Use range other than 0x00 to the Cycling Power Control Point without Parameter Value.
  5. Verify that the IUT response meets the requirements of the service.

- Expected Outcome

  Pass verdict

  For both cases, the IUT sends a Write Response followed by an indication of the Cycling Power Control Point characteristic with the Response Code Op Code (0x20), a Parameter Value representing Request Op Code (i.e., 0x00 for Step 2 and the RFU value written for Step 4) followed by the Response Value for ‘Op Code not supported’ (0x02) and without Response Parameter.

CPS/SEN/SPE/BI-02-C [Invalid Parameter]

- Test Purpose

  Verify that the IUT responds appropriately when a Client writes a supported Op Code followed by an invalid Parameter Value to the Cycling Power Control Point.

- Reference

  [3] 3.4.3

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester reads the Cycling Power Feature characteristic to define the Op Code supported by the IUT.
  3. For each supported Op code, the Lower Tester writes the Op Code followed by a parameter that is invalid (e.g., either the wrong format or a wrong value).

4. Verify that the IUT response meets the requirements of the service.
5. The Lower Tester repeats Steps 3 and 4 for each supported Op Code.

- Expected Outcome

  Pass verdict

  The IUT sends a Write Response followed by an indication of the Cycling Power Control Point characteristic with the Response Code Op Code (0x20), a Parameter Value representing Request Op Code (0x02) followed by the Response Value for 'Invalid Parameter' (0x03) and without Response Parameter.

CPS/SEN/SPE/BI-03-C [Client Characteristic Configuration Descriptor Improperly Configured]

- Test Purpose

  Verify that the IUT responds appropriately when a Client attempts to perform a Cycling Power Control Point procedure with a Client Characteristic Configuration descriptor that is improperly configured.

- Reference

  [3] 3.4.3

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester resets to 0 the Client Characteristic Configuration descriptor of the Cycling Power Control Point characteristic.
  3. The Lower Tester writes a valid Op Code to the Cycling Power Control Point.
  4. Verify that the IUT response meets the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT rejects the Write Request by sending an Error Response with an Attribute Protocol Error Code set to Client Characteristic Configuration Descriptor Improperly Configured (0xFD).

CPS/SEN/SPE/BI-04-C [Procedure Already In Progress]

- Test Purpose

  Verify that the IUT responds appropriately when a Client attempts to perform a Cycling Power Control Point procedure when a procedure is already in progress.

- Reference

  [3] 3.4.3

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester reads the Cycling Power Feature characteristic to define the Op Code supported by the IUT.
  3. The Lower Tester sets to 0x0002 the Client Characteristic Configuration descriptor of the Cycling Power Control Point characteristic.
  4. The Lower Tester writes a valid Op Code to the Cycling Power Control Point with the appropriate Parameter Value.
  5. The Lower Tester receives one Indication of the Cycling Power Control Point to acknowledge the first request. The Lower Tester does not send any Confirmation to acknowledge this Indication.
  6. The Lower Tester sends five consecutive write requests all with valid Op codes to the CP Control Point with the appropriate Parameter value.
  7. There are two alternatives (a or b):

     a) The Lower Tester receives an Error Response with an Attribute Protocol Application Error Code set to Procedure Already in Progress as defined in CSS Part B, Section 1.2 (0xFE) [8].
     b) The Lower Tester receives five indications of the CP Control Point to acknowledge each request sent by the Lower Tester in Step 6.

  8. Verify that the IUT response(s) meet the requirements of the service.

- Expected Outcome

  Pass verdict

  The IUT acknowledges the first write request with appropriate Response Value.

  The IUT successfully performs one of the following alternatives (a or b):

  a) Rejects a Write Request in Step 6 by sending an Error Response with an Attribute Protocol Application Error Code set to Procedure Already in Progress as defined in CSS Part B, Section 1.2 (0xFE) [8].
  b) Acknowledges all five write requests with appropriate Response Values.

CPS/SEN/SPE/BI-05-C [Cycling Power Control Point Procedure Timeout]

- Test Purpose

  Verify that the IUT stops sending indications related to the operation after an ATT Transaction Timeout.

- Reference

  [3] 3.4.4

- Initial Condition

  - Perform the preamble described in Section 4.2.3.

- Test Procedure

  1. A connection is established between the Lower Tester and IUT.
  2. The Lower Tester sends write request for any of the supported Op Codes supported by the IUT to the Cycling Power Control Point using an appropriate Parameter for the Op Code.
  3. The IUT sends an indication of the Cycling Power Control Point characteristic with the Response Code Op Code (0x20), a Parameter Value representing the Request Op Code followed by the Response Value for ‘success’ (0x01) with an appropriate Response Parameter.

4. The Lower Tester receives an ATT_Handle_Value_Indication from the IUT containing the Cycling Power Control Point characteristic handle and value.
5. The Lower Tester receives the indication but does not send a Handle Value Confirmation for an ATT Transaction Timeout plus several seconds.
6. After the ATT Transaction Timeout, the IUT does not send any further notifications and considers the procedure to have failed.

- Expected Outcome

  Pass verdict

  The IUT stops sending any further notifications after the ATT Transaction Timeout.

  The IUT returns to a stable state and may disconnect based on implementation.

4.14 Characteristic Broadcast

CPS/SEN/CB/BV-01-C [Cycling Power Measurement Broadcast]

- Test Purpose

  Verify that the IUT can send the Cycling Power Measurement characteristic that includes the mandatory fields (e.g., the Flags field and the Instantaneous Power field) and depending on the Flags field, some optional fields in a non-connectable undirected advertising event.

- Reference

  [3] 3.2.1.13

- Initial Condition

  - Perform an action on the IUT that will induce it, once connected, to send notifications of the Cycling Power Measurement characteristic along with the Flags field and the Instantaneous Power field and depending on the Flags field, some optional fields.
  - The Lower Tester performs the preamble defined in Section 4.2.4 to enable the Cycling Power Measurement Broadcast feature of the IUT.

- Test Procedure

  1. The Lower Tester enters in a mode that allows receiving undirected non-connectable advertisements.
  2. The Lower Tester receives one or more undirected non-connectable advertisements from the IUT containing the Flag AD Type, the Advertisement Interval AD Type and the Service Data AD Type which includes the UUID of the Cycling Power Service followed by the Cycling Power Measurement characteristic value.
  3. Verify that the characteristic value meets the requirements of the service.
  4. Repeat Steps 2–3 until the Lower Tester receives one or more additional undirected non-connectable advertisements.
  5. The Upper Tester configures the Cycling Power Measurement characteristic to disable notifications.
  6. The Lower Tester receives one or more undirected non-connectable advertisements from the IUT containing the Flag AD Type, the Advertisement Interval AD Type and the Service Data AD Type which includes the UUID of the Cycling Power Service followed by the Cycling Power Measurement characteristic value.
  7. Verify that the characteristic value meets the requirements of the service.

8. Repeat Steps 6–7 with notifications disabled until the Lower Tester receives one or more additional undirected non-connectable advertisements.
9. The Upper Tester disables the broadcast of the Cycling Power Measurement characteristic.
10. Verify that the Lower Tester does not receive an undirected non-connectable advertisement from the IUT containing the Cycling Power Measurement characteristic.

- Expected Outcome

  Pass verdict

  For Steps 1–4:

  The IUT sends two or more undirected non-connectable advertisements including the Cycling Power Measurement characteristic along with the mandatory fields (e.g., the Flags field and the Instantaneous Power field) and depending on the Flags field, optional fields may be present in a non-connectable undirected advertising event.

  For Steps 5–8:

  With notifications disabled, the IUT sends two or more undirected non-connectable advertisements including the Cycling Power Measurement characteristic along with the mandatory fields (e.g., the Flags field and the Instantaneous Power field) and depending on the Flags field, optional fields may be present in a non-connectable undirected advertising event.

  For Steps 9–10:

  With broadcast disabled, the IUT does not send any undirected non-connectable advertisement containing the Cycling Power Measurement characteristic.

  For all steps:

  Ensure each instance of the characteristic, contains a value in the supported fields that meets the requirements of the service.

  Verify that the RFU bits of the Flags field are set to zero.

CPS/SEN/CB/BV-02-C [Cycling Power Measurement Broadcast - Stop Broadcasting when Disconnected]

- Test Purpose

  Verify that the IUT stops broadcasting when the link is terminated.

- Reference

  [3] 3.2.1.13

- Initial Condition

  - Perform an action on the IUT that will induce it, once connected, to send notifications of the Cycling Power Measurement characteristic along with the Flags field and the Instantaneous Power field and depending on the Flags field, some optional fields.
  - The Lower Tester performs the preamble defined in Section 4.2.4 to enable the Cycling Power Measurement Broadcast feature of the IUT.

- Test Procedure

  1. The Lower Tester enters in a mode that allows receiving undirected non-connectable advertisements.
  2. The Lower Tester receives one or more undirected non-connectable advertisements from the IUT containing the Flag AD Type, the Advertisement Interval AD Type and the Service Data AD Type which includes the UUID of the Cycling Power Service followed by the Cycling Power Measurement characteristic value.
  3. Verify that the characteristic value meets the requirements of the service.
  4. Repeat Steps 2–3 until the Lower Tester receives one or more additional undirected non-connectable advertisements.
  5. The Upper Tester terminates the link between the IUT and the Lower Tester.
  6. Verify that the Lower Tester does not receive an undirected non-connectable advertisement from the IUT containing the Cycling Power Measurement characteristic.

- Expected Outcome

  Pass verdict

  The IUT sends two or more undirected non-connectable advertisements including the Cycling Power Measurement characteristic along with the mandatory fields (e.g., the Flags field and the Instantaneous Power field) and depending on the Flags field, some optional fields in a non-connectable undirected advertising event.

  The Cycling Power Measurement characteristics contain at least the Flags field and the Instantaneous Power field.

  The value of each field of the characteristic meets the requirements of the service.

  In all cases, ensure that the RFU bits of the Flags field are set to zero.

  The IUT stop sending broadcast when the link is terminated.

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 Power Service [4].

If a test case is mandatory within the respective layer, then the y/x reference is omitted.

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)
CPS 3/1	Cycling Power Service – Service Definition	CPS/SEN/SGGIT/SER/BV-01-C
CPS 1/1 AND CPS 3/1	Cycling Power Service – SDP Record	CPS/SEN/SGGIT/SDP/BV-01-C
CPS 3/2	Cycling Power Feature Characteristic	CPS/SEN/CR/BV-01-C
CPS 3/2 AND NOT CPS 3b/2	Cycling Power Feature Characteristic	CPS/SEN/SGGIT/CHA/BV-01-C
CPS 3b/2	Cycling Power Feature Indication	CPS/SEN/SGGIT/CHA/BV-07-C CPS/SEN/SGGIT/ISFC/BV-01-C
CPS 3/3	Cycling Power Measurement Characteristic	CPS/SEN/CON/BV-01-C CPS/SEN/CN/BV-01-C
CPS 3/3 AND NOT CPS 2/21	Cycling Power Measurement Characteristic	CPS/SEN/SGGIT/CHA/BV-02-C
CPS 2/21	Cycling Power Measurement Broadcast Feature Supported	CPS/SEN/SGGIT/CHA/BV-06-C CPS/SEN/COB/BV-01-C CPS/SEN/CB/BV-01-C CPS/SEN/CB/BV-02-C
CPS 2/9	Offset Compensation Indicator bit of the Flags field of the Cycling Power Measurement Characteristic	CPS/SEN/CN/BV-13-C
CPS 3/5	Pedal Power Balance field of the Cycling Power Measurement Characteristic	CPS/SEN/CN/BV-02-C
CPS 3/6	Accumulated Torque field of the Cycling Power Measurement Characteristic	CPS/SEN/CN/BV-03-C
CPS 3/7	Forward Wheel Revolution Data field of the Cycling Power Measurement Characteristic	CPS/SEN/CN/BV-04-C CPS/SEN/CN/BV-05-C

Item	Feature	Test Case(s)
CPS 3/14	Reverse Wheel Revolution Data field of the Cycling Power Measurement Characteristic	CPS/SEN/CN/BV-06-C
CPS 3/8	Crank Revolution Data field of the Cycling Power Measurement Characteristic	CPS/SEN/CN/BV-07-C
CPS 3/9	Extreme Magnitude field of the Cycling Power Measurement Characteristic	CPS/SEN/CN/BV-08-C
CPS 3/10	Extreme Angles field of the Cycling Power Measurement Characteristic	CPS/SEN/CN/BV-09-C
CPS 3/11	Top Dead Spot field of the Cycling Power Measurement Characteristic	CPS/SEN/CN/BV-10-C
CPS 3/12	Bottom Dead Spot field of the Cycling Power Measurement Characteristic	CPS/SEN/CN/BV-11-C
CPS 3/13	Accumulated Energy field of the Cycling Power Measurement Characteristic	CPS/SEN/CN/BV-12-C
CPS 3/16	Sensor Location Characteristic	CPS/SEN/SGGIT/CHA/BV-03-C CPS/SEN/CR/BV-02-C
CPS 3/17	Cycling Power Control Point Characteristic	CPS/SEN/SGGIT/CHA/BV-04-C CPS/SEN/CON/BV-02-C CPS/SEN/SPE/BI-01-C CPS/SEN/SPE/BI-02-C CPS/SEN/SPE/BI-03-C CPS/SEN/SPE/BI-04-C CPS/SEN/SPE/BI-05-C
CPS 3/18	Wheel Revolution Data Supported – Set Cumulative Value Procedure – Set to zero	CPS/SEN/SPS/BV-01-C
CPS 3/19	Wheel Revolution Data Supported – Set Cumulative Value Procedure – Set to non-zero	CPS/SEN/SPS/BV-02-C
CPS 3/20 AND CPS 3/21	Multiple Sensor Locations Supported	CPS/SEN/SPP/BV-01-C CPS/SEN/SPP/BV-02-C
CPS 3/22	Set Crank Length Supported	CPS/SEN/SPP/BV-03-C
CPS 3/23	Request Crank Length Supported	CPS/SEN/SPP/BV-04-C
CPS 3/24	Set Chain Length Supported	CPS/SEN/SPP/BV-05-C
CPS 3/25	Request Chain Length Supported	CPS/SEN/SPP/BV-06-C
CPS 3/26	Set Chain Weight Supported	CPS/SEN/SPP/BV-07-C
CPS 3/27	Request Chain Weight Supported	CPS/SEN/SPP/BV-08-C
CPS 3/28	Set Span Length Supported	CPS/SEN/SPP/BV-09-C
CPS 3/29	Request Span Length Supported	CPS/SEN/SPP/BV-10-C
CPS 3/33	Request Factory Calibration Date Supported	CPS/SEN/SPP/BV-11-C
CPS 3/32	Request Sampling Rate Supported	CPS/SEN/SPP/BV-12-C
CPS 3/30	Start Offset Compensation Supported	CPS/SEN/SPO/BV-01-C
CPS 3a/1	Start Enhanced Offset Compensation Supported	CPS/SEN/SPO/BV-02-C CPS/SEN/SPO/BI-01-C
CPS 3/31	Mask Cycling Power Measurement Characteristic Content Supported	CPS/SEN/SPM/BV-01-C CPS/SEN/SPM/BV-02-C

Item	Feature	Test Case(s)
CPS 3/34	Cycling Power Vector Characteristic	CPS/SEN/SGGIT/CHA/BV-05-C CPS/SEN/CON/BV-03-C
CPS 3/34 AND CPS 3/34a	Cycling Power Vector Characteristic Connection Parameter Update	CPS/SEN/CN/BI-01-C
CPS 3/35	Crank Revolution Data Field of the Cycling Power Vector Characteristic	CPS/SEN/CN/BV-16-C
CPS 3/36	Frist Crank Measurement Angle Field of the Cycling Power Vector Characteristic	CPS/SEN/CN/BV-17-C
CPS 2/17 AND CPS 3/37	Instantaneous Magnitude Array Field of Cycling Power Vector Characteristic – Force	CPS/SEN/CN/BV-14-C
CPS 2/18 AND CPS 3/38	Instantaneous Magnitude Array Field of Cycling Power Vector Characteristic - Torque	CPS/SEN/CN/BV-15-C
CPS 2/19	Instantaneous Measurement Direction bits of the Flags field of the Cycling Power Vector Characteristic	CPS/SEN/CN/BV-18-C

Table 5.1: Test case mapping

6 Revision history and acknowledgments

Revision History

Publication Number	Revision Number	Date	Comments
0	1.0.0	2013-04-30	Release for publication.
	1.0.1r1	2013-05-16	TSE 5176: Edits to the test procedure and pass verdict of TP/SPE/BI-04-C.
1	1.0.1	2013-07-02	Prepare for Publication
	1.0.2r1	2013-08-16	TCRL 2013-2 TSE 5184: Updated test procedure for TP/SPE/BI-02-C and TP/SPE/BI-04-C.
2	1.0.2	2013-12-03	Prepare for Publication
	1.1.0r00	2015-11-02	Modified for CPS version 1.1: - Added tests for new feature 'Start Enhanced Offset Compensation' (section 4.14) - Updated Test Case Mapping Table.
	1.1.0r01	2015-11-04	Minor editorial fixes in sections 4.14.1 and 4.14.2
	1.1.0r02	2015-11-11	Added Pass/Fail Verdict Conventions according to applicable test specification template;
	1.1.0r03	2016-01-06	Converted to current document template.
	1.1.0r04	2016-02-15	Minor editorial update, correct TCMT and sync up the document with the changes from last IOP.
	1.1.0r05	2016-04-05	Addressed BTI feedback
	1.1.0r06	2016-04-08	Fixed indent on test case section heading
	1.1.0	2016-04-19	Approved by BTI
	1.1.0	2016-05-03	Specification version 1.1 adopted by the Bluetooth SIG BoD
3	1.1.0	2016-05-09	Prepared for publication
	1.1.1r00	2016-05-23	Converted to new Test Case ID conventions as defined in TSTO v4.1.
4	1.1.1	2016-07-13	Prepared for TCRL 2016-1 publication.
	1.1.2r00	2016-08-17	TSE 7227: Updated Test Procedure (step 7a) and Pass verdict for test case TP/SPE/BI-04-C.
5	1.1.2	2016-12-13	Approved by BTI. Prepared for TCRL 2016-2 publication.
	1.1.2 edition 2r00	2018-11-29	Editorial changes only. Template updated. Revision History and contributors moved to the end of the document.
	1.1.2 edition 2	2019-11-13	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.

Publication Number	Revision Number	Date	Comments
	p6r00–r06	2022-03-22 – 2022-05-18	TSE 17256 (rating 2): Converted the following test cases to GGIT: CPS/SEN/SD/BV-01-C – -02-C, CPS/SEN/DEC/BV-01-C – -06-C, CPS/SEN/DES/BV-01-C – -04-C. The new GGIT converted TCIDs are: CPS/SEN/SGGIT/SER/BV-01-C, CPS/SEN/SGGIT/SDP/BV-01-C, and CPS/SEN/SGGIT/CHA/BV-01-C – -06-C. Updated TCMT accordingly. Updated section cross-references in the Cycling Power Control Point and Cycling Power Measurement Broadcast sections and in the initial condition sections for CPS/SEN/CR/BV-01-C – -02C, CPS/SEN/CON/BV-01-C – -03-C, and CPS/SEN/COB/BV-01-C. Updated a reference in the test procedure for CPS/SEN/SPP/BV-12-C. TSE 18437 (rating 1): Removed direct references to GATT test cases from the test procedures for CPS/SEN/COB/BV-01-C, CPS/SEN/CR/BV-01-C – -02-C, and CPS/SEN/CON/BV-01-C – -03-C. Removed direct references to GATT TS sections from the ATT Bearer preambles and replaced with preamble procedure text. TSE 18712 (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 5 to previous v1.1.2 and aligned copyright page with v2 of the DNMD.
6	p6	2022-06-28	Approved by BTI on 2022-05-31. Prepared for TCRL 2022-1 publication.
	p7r00	2022-08-18	TSE 19018 (rating 2): Corrected value length for GGIT test CPS/SEN/SGGIT/CHA/BV-04-C.
7	p7	2023-02-07	Approved by BTI on 2022-12-28. Prepared for TCRL 2022-2 publication.
	p8r00–r02	2023-09-04 – 2023-09-22	TSE 17237 (rating 4): Per E16586, added the new test group ISFC. Added new test cases CPS/SEN/SGGIT/CHA/BV-07-C and CPS/SEN/SGGIT/ISFC/BV-01-C; updated the TCMT accordingly. Updated the TCMT for CPS/SEN/SGGIT/CHA/BV-01-C. Added a reference for Cycling Power Profile Specification v1.1.1. TSE 23165 (rating 2): Corrected the TCMT entry for CPS/SEN/CN/BV-15-C.
8	p8	2024-07-01	Approved by BTI on 2024-04-21. Prepared for TCRL 2024-1 publication.
	p9r00	2024-10-29	TSE 23395 (rating 3): Updated TCMT for CPS/SEN/CN/BI-01-C.
9	p9	2025-02-18	Approved by BTI on 2024-12-23. Prepared for TCRL 2025-1 publication.

Acknowledgments

Name	Company
Dejan Berec	Bluetooth SIG, Inc.
Jawid Mirani	Bluetooth SIG, Inc.
Bob Hughes	Intel
Leif-Alexandre Aschehoug	Nordic Semiconductor
Guillaume Schatz	Polar