

Cycling Power Service (CPS)

Bluetooth® Test Specification



- **Issued** 2016-12-13
- **Document Number** CPS.TS.1.1.2
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- **Abstract**

This document defines test structures and procedures for conformance test of products implementing the Cycling Power Service Specification.

Revision History

Revision History	Date	Comments
D0.9.4	2013-02-10	Version approved for prototyping.
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.
1.0.1	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.
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
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.
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.
1.1.2	2016-12-13	Approved by BTI. Prepared for TCRL 2016-2 publication.

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1 Scope

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

The objective of this test specification is to provide a basis for interoperability tests for Bluetooth devices giving a high probability of air interface interoperability between different manufacturers' Bluetooth devices.

2 References, Definitions, and Abbreviations

2.1 References

This Bluetooth document incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For the purpose of this Bluetooth document, the definitions, and abbreviations in [1], [2], and [3] apply.

- [1] Test Strategy and Terminology Overview
- [2] Bluetooth Core Specification v4.0 or later
- [3] Cycling Power Service Specification v1.0 or later
- [4] Cycling Power Service ICS, CPS.ICS
- [5] GATT Test Specification, GATT.TS
- [6] Characteristic and Descriptor descriptions are accessible via the [Bluetooth SIG Assigned Numbers](#).
- [7] Cycling Power Service Implementation Extra Information for Test, IXIT
- [8] Core Specification Supplement (CSS) v6

2.2 Definitions

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

2.3 Abbreviations

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

3 Test Suite Structure (TSS)

3.1 Overview

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

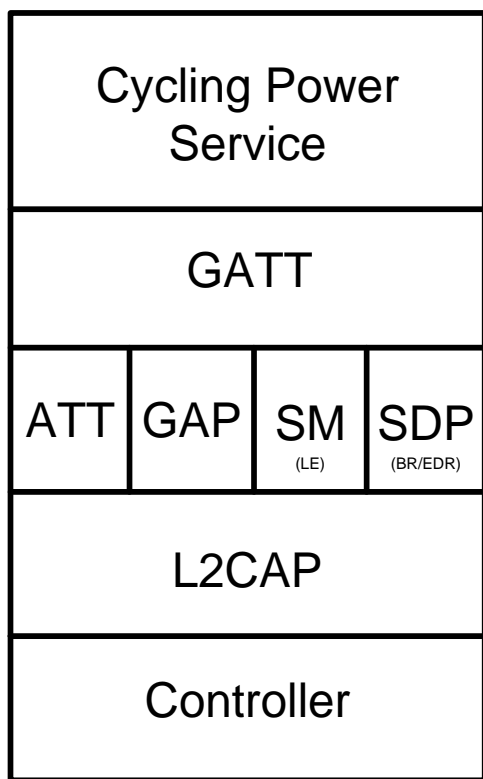


Figure 3.1: Cycling Power Service Test Model

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 is to cover mandatory and optional requirements in the service specification and to match these to the support of the IUT as described in the ICS Proforma.

The test equipment shall provide an implementation of the Radio Controller and the parts of the Host needed to perform the test cases defined in the Cycling Power Service Test Specification. For some test cases, it is necessary to stimulate the IUT from an Upper Tester. In practice, this could be implemented as a special test interface, an MMI, or another interface supported by the IUT.

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.

The Cycling Power 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:

- Service Definition
 - Verify the service definition.
- Characteristic Declaration
 - Verify the presence and contents of characteristic declarations.
- Characteristic Descriptors
 - Verify the presence and contents of characteristic descriptors.
- Characteristic Read
 - Verify characteristics that support reading can be read. Verify the format and value of characteristic values.
- Configure Indication and Notification
 - Verify characteristics can be configured for notification or for indication depending on the characteristic requirements.
- Configure Broadcast
 - Verify characteristics can be configured for broadcast.
- Characteristic Notification
 - Verify characteristics which support notification can be notified.
- Service Procedures
 - Verify procedures as specified by the service such as set cumulative value, handle server parameters, start offset compensation, mask cycling power measurement characteristic content, start enhanced offset compensation, and general error handling.
- Characteristic Broadcast
 - Verify characteristics which support broadcast can be broadcasted by the IUT.

4 Test Cases

4.1 Introduction

4.1.1 Test Case Identification Conventions

Test cases shall be assigned unique identifiers per the conventions in [1]. The convention used here is <spec abbreviation>/<IUT role>/<class>/<xx>-<nn>-<y>.

Test group abbreviations for class, feature, function, sub-function or capability (as applicable to this test specification) are defined in Table 4.1.

Identifier	Class identifier <class>
CPS	Cycling Power Service
SEN	Sensor Role
SD	Service Definition
DEC	Characteristic Declaration
DES	Characteristic Descriptors
CR	Characteristic Read
CON	Configure Indication or Notification
COB	Configure Broadcast
CN	Characteristic Notification
SPS	Service Procedures – Set Cumulative Value
SPP	Service Procedures – Handle Server Parameters
SPO	Service Procedure – Start Offset Compensation Service Procedure – Start Enhanced Offset Compensation
SPM	Service Procedure – Mask Cycling Power Measurement Characteristic Content
SPE	Service Procedure – Error Handling
CB	Characteristic Broadcast

Table 4.1: TP Class Naming Convention

4.1.2 Conformance

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

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

Such tests may verify:

- that claimed capabilities may be used in any order and any number of repetitions that is not excluded by the Specification, OR
- that capability enabled by the implementations are sustained over durations expected by the use case, OR
- that the implementation gracefully handles any quantity of data expected by the use case, OR
- that the implementation gracefully rejects any attempt to exercise capabilities which were declared as not supported. Graceful rejection means that the implementation demonstrates uninterrupted conformance to the specification immediately after rejecting such attempts without any need to be externally reset or adjusted, OR
- that in cases where more than one valid interpretation of the Specification exist, the implementation complies with at least one interpretation and gracefully handles other interpretations, OR
- that the implementation is immune to attempted security exploits.

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

In any case, where a member finds an issue with the Test Plan Generator, the Test Case as described in the Test Specification, or with the Test System utilized, the Member is required to notify the responsible party via an errata request such that the issue may be addressed.

4.1.3 Pass/Fail Verdict Conventions

Each test case has an Expected Outcome section, which outlines all the detailed pass criteria conditions that shall be met by the IUT to merit a Pass Verdict.

The convention in this test specification is that, unless there is a specific set of fail conditions outlined in the test case, then the IUT fails the test case as soon one of the pass criteria conditions cannot be met and in case this occurs the outcome of the test shall be the Fail Verdict.

4.2 Setup Preambles

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

4.2.1 ATT Bearer on LE Transport

Follow the preamble procedure described in [5] Section 4.2.1.2 with the IUT operating in the Peripheral role.

4.2.2 ATT Bearer on BR/EDR Transport

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

4.2.3 Cycling Power Control Point

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

Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1 if using an LE transport or 4.2.2 if using a BR/EDR transport.

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 4.4 or is known to the Lower Tester by other means.

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 4.5 or is known to the Lower Tester by other means.

If the IUT requires bonding, then the Lower Tester performs a bonding procedure.

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

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

Establish an ATT Bearer connection between the Lower Tester and IUT as described in Section 4.2.1 if using an LE transport or 4.2.2 if using a BR/EDR transport.

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

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 4.5 or is known to the Lower Tester by other means.

If the IUT requires bonding, then the Lower Tester performs a bonding procedure.

The Lower Tester configures the Cycling Power Measurement characteristic for broadcast.

4.3 Service Definition

Verify the service definition.

4.3.1 CPS/SEN/SD/BV-01-C [Service Definition over LE]

- Test Purpose

Verify the IUT has an instantiation of the Cycling Power Service as either a primary service or a secondary service. This test case only applies when using the LE transport.

- Reference

[3] 2

- Initial Condition

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

- Test Procedure

The Lower Tester sends an *ATT_Find_By_Type_Value_Request* (0x0001, 0xFFFF) to the IUT, with type set to «Primary Service» and Value set to «Cycling Power Service». Verify one attribute handle range is returned, containing the starting handle and the ending handle of the service definition.

If no instances of Cycling Power Service as a primary service are found, the Lower Tester sends an *ATT_Find_By_Type_Value_Request* (0x0001, 0xFFFF) to the IUT, with type set to «Secondary Service» and Value set to the UUID for «Cycling Power Service». Verify one attribute handle range is returned, containing the starting handle and the ending handle of the service definition.

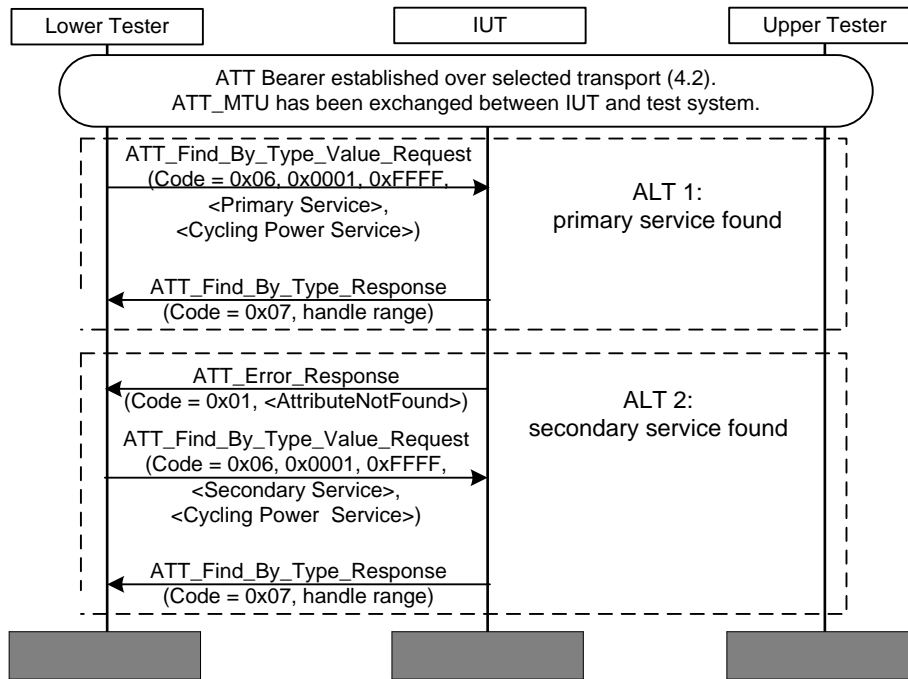


Figure 4.1: Service Definition over LE

- Expected Outcome

Pass verdict

One attribute handle range is returned (either as a primary service or a secondary service), containing the starting handle and the ending handle of the service definition. The Attribute Type in that service declaration is either «Primary Service» or «Secondary Service».

4.3.2 CPS/SEN/SD/BV-02-C [SDP Record]

- Test Purpose

Verify the SDP Record for the Cycling Power Service. This test case only applies when using the BR/EDR transport.

- Reference

[3] 2, 4

- Initial Condition

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

- Test Procedure

The Lower Tester establishes an SDP connection to the IUT.

The Lower Tester sends SDP requests to retrieve all attributes of the SDP record for the Cycling Power.

- Expected Outcome

Pass verdict

The SDP record for the service is found.

All attributes, which are mandatory for the service, are present in the SDP record.

The values of all attributes in the SDP record meet the requirements of the service.

The GATT Start Handle and GATT End Handle parameters in the SDP record match the start handle and end handle of the service.

4.4 Characteristic Declaration

This test group contains test cases to verify that the characteristic property field of the characteristic declaration meets the requirements of the service. The verification is performed one property at a time, as enumerated in the test cases in [Table 4.2](#), using this generic test procedure.

- Reference

[\[3\]](#) 3

- Initial Condition

The handle range of the service has been previously discovered by the Lower Tester in test case [CPS/SEN/SD/BV-01-C \[Service Definition over LE\]](#) if using an LE transport or [CPS/SEN/SD/BV-02-C \[SDP Record\]](#) if using a BR/EDR transport.

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.

- Test Procedure

The following test procedure applies to the test cases listed in [Table 4.2](#):

Discover all characteristics of the service by executing the test procedure of GATT test case [GATT/SR/GAD/BV-04-C](#) and [GATT/SR/GAD/BV-05-C](#) in [\[5\]](#).

For a discovered characteristic that is listed in [Table 4.2](#), verify the characteristic properties field of the characteristic declaration meets the requirements of the service.

- Expected Outcome

The following pass and fail verdicts apply to the test cases listed in [Table 4.2](#).

Pass verdict

The characteristic is discovered and the characteristic properties field of the characteristic declaration meets the requirements of the service.

Test Case	Characteristic Properties Value (Requirements)
4.4.1 CPS/SEN/DEC/BV-01-C [Characteristic Declaration - Cycling Power Feature]	0x02 ([3] Table 3.1)
4.4.2 CPS/SEN/DEC/BV-02-C [Characteristic Declaration - Cycling Power Measurement]	0x10 ([3] Table 3.1)
4.4.3 CPS/SEN/DEC/BV-03-C [Characteristic Declaration - Cycling Power Measurement (With Broadcast Property Supported)]	0x11 ([3] Table 3.1)
4.4.4 CPS/SEN/DEC/BV-04-C [Characteristic Declaration - Sensor Location]	0x02 ([3] Table 3.1)
4.4.5 CPS/SEN/DEC/BV-05-C [Characteristic Declaration - Cycling Power Control Point]	0x28 ([3] Table 3.1)
4.4.6 CPS/SEN/DEC/BV-06-C [Characteristic Declaration - Cycling Power Vector]	0x10 ([3] Table 3.1)

Table 4.2: Characteristic Declaration Test Cases

4.5 Characteristic Descriptors

This test group contains test cases to verify that the characteristic descriptors meet the requirements of the service. The verification is done one descriptor at a time, as enumerated in the test cases in [Table 4.3](#), using this generic test procedure.

- Reference

[3] 3

- Initial Condition

The handle range of each characteristic referenced in the test cases below has been previously discovered by the Lower Tester during the test procedure in [Section 4.4](#) or is known to the Lower Tester by other means.

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.

- Test Procedure

The following test procedure applies to the test cases listed in [Table 4.3](#):

- Discover all characteristic descriptors of the characteristic by executing the test procedure of GATT test case GATT/SR/GAD/BV-06-C in [\[5\]](#) using the handle range of the characteristic. The IUT returns, at least, one handle-UUID pair.
- If the UUID in a handle-UUID pair is for a characteristic descriptor referenced in a test case below, read the characteristic descriptor by executing the test procedure of GATT test case GATT/SR/GAR/BV-06-C in [\[5\]](#).

- Verify the value of the characteristic descriptor meets the requirements of the service.
- Expected Outcome

The following pass and fail verdicts apply to the test cases listed in [Table 4.3](#):

Pass verdict

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

Test Case	Value (Requirements)
4.5.1 CPS/SEN/DES/BV-01-C [Cycling Power Measurement - Client Characteristic Configuration Descriptor]	0x0000 or 0x0001 ([3] 3)
4.5.2 CPS/SEN/DES/BV-02-C [Cycling Power Measurement - Server Characteristic Configuration Descriptor]	0x0000 or 0x0001 ([3] 3)
4.5.3 CPS/SEN/DES/BV-03-C [Cycling Power Control Point - Client Characteristic Configuration Descriptor]	0x0000 or 0x0002 ([3] 3)
4.5.4 CPS/SEN/DES/BV-04-C [Cycling Power Vector - Client Characteristic Configuration Descriptor]	0x0000 or 0x0001 ([3] 3)

Table 4.3: Characteristic Descriptor Test Cases

4.6 Characteristic Read

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 4.4](#) 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 Procedure

The following test procedure applies to the test cases listed in [Table 4.4](#):

Read the characteristic value by executing the test procedure of GATT test case GATT/SR/GAR/BV-01-C in [\[5\]](#).

Verify the characteristic value meets the requirements of the service.

- Expected Outcome

The following pass and fail verdicts apply to the test cases listed in [Table 4.4](#):

Pass verdict

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

Test Case	Value (Requirements)
4.6.1 CPS/SEN/CR/BV-01-C [Characteristic Read – Cycling Power Feature]	4 octets with RFU bits set to 0. ([3] 3.1.1)
4.6.2 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

4.7 Configure Indication and Notification

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 4.4](#) 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 4.5](#) 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 Procedure

The following test procedure applies to the test cases listed in [Table 4.5](#):

Disable indication or notification by writing value 0x0000 to the Client Characteristic Configuration descriptor of the characteristic using the test procedure of GATT test case GATT/SR/GAW/BV-08-C in [\[5\]](#).

If the test case is for notification, enable notification by writing value 0x0001 to the Client Characteristic Configuration descriptor of the characteristic.

Otherwise, if the test case is for indication, enable indication by writing value 0x0002 to the Client Characteristic Configuration descriptor of the characteristic.

The Lower Tester reads the value of the Client Characteristic Configuration descriptor.

- Expected Outcome

The following pass and fail verdicts apply to the test cases listed in [Table 4.5](#):

Pass verdict

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

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

Table 4.5: Configure Indication and Notification Test Cases

4.8 Configure Broadcast

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 4.4](#) 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 4.5](#) 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 Procedure

The following test procedure applies to the test cases listed in Table 4.6:

Disable broadcast by writing value 0x0000 to the Server Characteristic Configuration descriptor of the characteristic using the test procedure of GATT test case GATT/SR/GAW/BV-08-C in [5].

Enable broadcast by writing value 0x0001 to the Server Characteristic Configuration descriptor of the characteristic.

The Lower Tester reads the value of the Server Characteristic Configuration descriptor.

- Expected Outcome

The following pass and fail verdicts apply to the test cases listed in Table 4.6:

Pass verdict

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

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

Table 4.6: Configure Broadcast Test Cases

4.9 Characteristic Notification

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

- Test Purpose

Verify 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.

If desired, 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 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 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.

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

- Test Purpose

Verify 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.

If desired, 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 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.

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

- Test Purpose

Verify 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.

If desired, 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 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.

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

- Test Purpose

Verify 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.

If desired, 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 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.

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

- Test Purpose

Verify 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.

If desired, 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 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.

4.9.6 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.

If desired, 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 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.

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

- Test Purpose

Verify 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.

If desired, 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 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.

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

- Test Purpose

Verify 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.

If desired, 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 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.

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

- Test Purpose

Verify 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.

If desired, 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 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.

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

- Test Purpose

Verify 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.

If desired, 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 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.

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

- Test Purpose

Verify 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.

If desired, 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 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.

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

- Test Purpose

Verify 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.

If desired, 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 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.

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

- Test Purpose

Verify 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.

If desired, 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 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.

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

- Test Purpose

Verify 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.

If desired, 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 shall accept any valid parameters and then, the Lower Tester shall also update 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 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 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.

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

- Test Purpose

Verify 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.

If desired, 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 shall accept any valid parameters and then, the Lower Tester shall also update 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 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 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.

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

- Test Purpose

Verify 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.

If desired, 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 shall accept any valid parameters and then, the Lower Tester shall also update 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 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.

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

- Test Purpose

Verify 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.

If desired, 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 shall accept any valid parameters and then, the Lower Tester shall also update 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 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.

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

- Test Purpose

- Verify 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.

- If desired, 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 shall accept any valid parameters and then, the Lower Tester shall also update 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 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.

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

- Test Purpose

Verify 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.

If desired, 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.

4.10 Service Procedures – Set Cumulative Value

This test group contains test cases to verify compliant operation when the Lower Tester uses Cycling Power Control Point Set Cumulative Value procedure.

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

- Test Purpose

Verify 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 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.

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

- Test Purpose

Verify 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 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.

4.11 Service Procedure – Handle Server Parameters

This test group contains test cases to verify compliant operation when the Lower Tester uses Cycling Power Control Point procedures to handle internal Server parameters (e.g. Set or Request).

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

- Test Purpose

Verify 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 the characteristic value meets the requirements of the service.
10. The Lower Tester reads the Sensor Location characteristic and verifies 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.

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

- Test Purpose

- Verify 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 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.

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

- Test Purpose

Verify 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 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.

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

- Test Purpose

Verify 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 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.

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

- Test Purpose
Verify 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 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.

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

- Test Purpose

Verify 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 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.

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

- Test Purpose

Verify 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 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.

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

- Test Purpose

Verify 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 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.

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

- Test Purpose

Verify 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 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.

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

- Test Purpose

Verify 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 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.

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

- Test Purpose

Verify 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 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.

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

- Test Purpose

Verify 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/DEC/BV-06-C \[Characteristic Declaration - Cycling Power Vector\]](#) 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 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.

4.12 Service Procedure – Start Offset Compensation

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

- Test Purpose

Verify 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 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.

4.13 Service Procedure – Mask Cycling Power Measurement Characteristic Content

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

- Test Purpose

Verify 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 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.

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

- Test Purpose

Verify 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 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 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.

4.14 Service Procedure – Start Enhanced Offset Compensation

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

- Test Purpose

Verify 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 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.

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

- Test Purpose

Verify 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 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.

4.15 Service Procedure – General Error Handling

This test group contains test cases to verify compliant operation when the Lower Tester uses Cycling Power Control Point procedure and error results.

4.15.1 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 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 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.

4.15.2 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 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.

4.15.3 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 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).

4.15.4 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 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.

4.15.5 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.

4.16 Characteristic Broadcast

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

- Test Purpose

Verify 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 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 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 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 and

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

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

- Test Purpose

Verify 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 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 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 capabilities in the ICS. Profiles, protocols, and services may define multiple roles, and it is possible that a product may implement more than one role. The product shall be tested in all roles for which support is declared in the ICS document. For products which support more than one role, a separate TCMT shall be filled out for each role, and separate tests shall be conducted for each role.

The columns for the TCMT are defined as follows:

Item: contains a y/x reference, where y corresponds to the table number and x corresponds to the feature number as defined in the ICS Proforma for Cycling Power Service [4]. If the item is defined with Protocol, Profile or Service abbreviation before y/x, the table and feature number referenced are defined in the abbreviated ICS proforma document.

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

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

Test Case Applicable: may be used to note if a test is required based on the supported features.

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

Item	Feature	Test case(s)	Test Case Applicable
CPS 1/2 AND CPS 3/1	Cycling Power Service – Service Definition over LE	CPS/SEN/SD/BV-01-C	
CPS 1/1 AND CPS 3/1 AND CPS 3/38	Cycling Power Service – SDP Record	CPS/SEN/SD/BV-02-C	
CPS 3/2	Cycling Power Feature Characteristic	CPS/SEN/DEC/BV-01-C CPS/SEN/CR/BV-01-C	
CPS 3/3	Cycling Power Measurement Characteristic	CPS/SEN/DEC/BV-02-C CPS/SEN/DES/BV-01-C CPS/SEN/CON/BV-01-C CPS/SEN/CN/BV-01-C	
CPS 2/21	Cycling Power Measurement Broadcast Feature Supported	CPS/SEN/DEC/BV-03-C CPS/SEN/DES/BV-02-C CPS/SEN/COB/BV-01-C CPS/SEN/CB/BV-01-C CPS/SEN/CB/BV-02-C	

Item	Feature	Test case(s)	Test Case Applicable
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	
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/DEC/BV-04-C CPS/SEN/CR/BV-02-C	
CPS 3/17	Cycling Power Control Point Characteristic	CPS/SEN/DEC/BV-05-C CPS/SEN/DES/BV-03-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	

Item	Feature	Test case(s)	Test Case Applicable
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	
CPS 3/34	Cycling Power Vector Characteristic	CPS/SEN/DEC/BV-06-C CPS/SEN/DES/BV-04-C CPS/SEN/CON/BV-03-C 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	

Item	Feature	Test case(s)	Test Case Applicable
CPS 2/18 AND CPS 3/37	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