

Tire Pressure Monitoring System Profile (TPMSP)

Bluetooth® Test Suite

- **Revision:** TPMSP.TS.p0
- **Revision Date:** 2026-08-11
- **Prepared By:** Automotive Working Group
- **Published during TCRL:** TCRL.pkg104-addition



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1 Scope

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

2 References, definitions, and abbreviations

2.1 References

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

- [1] Bluetooth Core Specification, Version 4.0 or later
- [2] Test Strategy and Terminology Overview
- [3] Tire Pressure Monitoring System Profile Specification
- [4] Tire Pressure Monitoring System Service Specification
- [5] ICS Proforma for Tire Pressure Monitoring System Profile
- [6] Characteristic and Descriptor descriptions are accessible via the [Bluetooth SIG Assigned Numbers](#)
- [7] GATT Test Suite, GATT.TS
- [8] Device Information Service Specification
- [9] Battery Service Specification
- [10] GAP Test Suite, GAP.TS

2.2 Definitions

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

2.3 Acronyms and abbreviations

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

3 Test Suite Structure (TSS)

3.1 Overview

The Tire Pressure Monitoring System Profile requires the presence of GAP, SM, and GATT. The two roles defined by the profile are illustrated in the following figure.

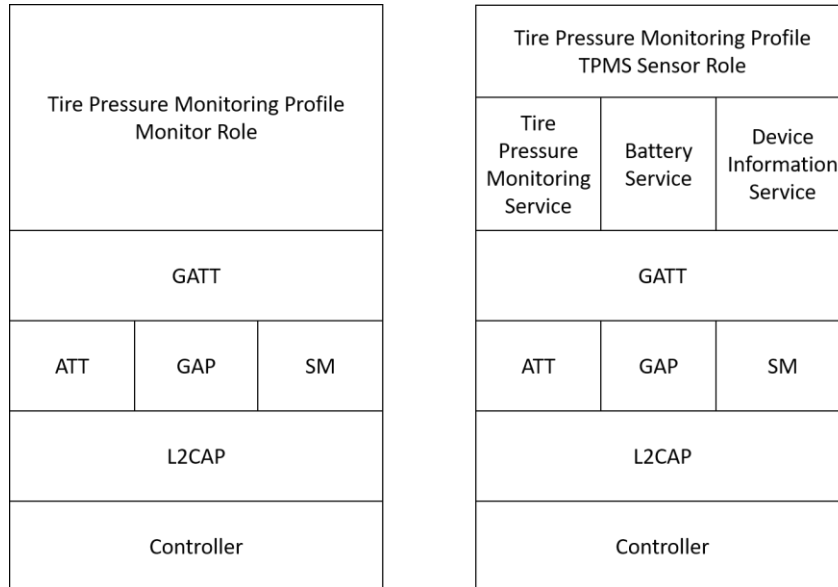


Figure 3.1: Tire Pressure Monitoring System Profile Test Model

3.2 Test strategy

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

The test equipment provides an implementation of the Radio Controller and the parts of the Host needed to perform the test cases defined in this Test Suite. For some test cases, it is necessary to stimulate the IUT from an Upper Tester. In practice, this could be implemented as a special test interface, a Man-Machine Interface (MMI), or another interface supported by the IUT. For example, for a TPMS Sensor, it may be necessary to cause a change in the detected tire pressure or tire temperature to trigger a required event during testing.

When the Lower Tester is acting as a TPMS Sensor, its TPM Service includes additional characteristics not defined by the TPMS Service. This tests against compatibility of Monitor IUTs with future TPMS Service characteristics. Monitor IUTs ignore these additional characteristics.

The TPMS Sensor uses legacy advertising PDUs using the LE 1M PHY at all times.

This Test Suite contains Valid Behavior (BV) tests complemented with Invalid Behavior (BI) tests where required. The test coverage mirrored in the Test Suite Structure is the result of a process that started with catalogued specification requirements that were logically grouped and assessed for testability enabling coverage in defined test purposes. Certain test cases may require a second Lower Tester. For example, one Lower Tester may represent a Primary Monitor while a second Lower Tester acts as a Secondary Monitor. Either two Lower Testers or one item of test equipment that has the capability to simulate two Lower Testers with different Bluetooth addresses may be employed.

3.3 Test groups

The following test groups have been defined:

- Generic GATT Integrated Tests
- Characteristic Writes
- Configure Notifications and Indications
- Tire Pressure Monitoring Features
- Error Handling
- TPMS Service Data

4 Test cases (TC)

4.1 Introduction

4.1.1 Test case identification conventions

Test cases are assigned unique identifiers per the conventions in [2]. The convention used here is:

<spec abbreviation>/<IUT role>/<class>/<feat>/<func>/<subfunc>/<cap>/<xx>-<nn>-<y>.

Additionally, testing of this specification includes tests from the GATT Test Suite [7] referred to as Generic GATT Integrated Tests (GGIT); when used, the test cases in GGIT are referred to through a TCID string using the following convention:

<spec abbreviation>/<IUT role>/<GGIT test group>/< GGIT class >/<xx>-<nn>-<y>.

Identifier Abbreviation	Spec Identifier <spec abbreviation>
TPMSP	Tire Pressure Monitoring System Profile
Identifier Abbreviation	Role Identifier <IUT role>
MON	Monitor
SEN	TPMS Sensor
Identifier Abbreviation	Reference Identifier <GGIT test group>
CGGIT	Client Generic GATT Integrated Tests
Identifier Abbreviation	Reference Identifier <GGIT class>
CHA	Characteristic
SER	Service
Identifier Abbreviation	Feature Identifier <feat>
ADV	Sensor Advertising
CGGIT	Client Generic GATT Integrated Tests
CON	Configure Notification and Indication
CWM	Characteristic Writes by Monitor
ERH	Error Handling
SSM	TPMS Sensor State Machine
TPMF	Tire Pressure Monitoring Features

Table 4.1: TPMSP TC feature naming conventions

4.1.2 Conformance

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

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

Such tests may verify:

- That claimed capabilities may be used in any order and any number of repetitions not excluded by the specification

- That capabilities enabled by the implementations are sustained over durations expected by the use case
- That the implementation gracefully handles any quantity of data expected by the use case
- That in cases where more than one valid interpretation of the specification exists, the implementation complies with at least one interpretation and gracefully handles other interpretations
- That the implementation is immune to attempted security exploits

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

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

4.1.3 Pass/Fail verdict conventions

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

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

4.2 Setup preambles

The procedures defined in this section are used to achieve specific conditions on the IUT and the test equipment within the tests defined in this document. The preambles here are commonly used to establish initial conditions.

4.2.1 Encrypted connection on LE Transport

- Preamble Purpose
Establish an encrypted LE transport connection.
- Preamble Procedure
 1. The Sensor may need to be in either the Early Driving or Service state.
 2. The Central initiates a Pairing Request command.
 3. The Peripheral responds with a Pairing Response command.
 4. The two devices perform phase 2 of the LE pairing and establish an encrypted link with the key generated in Step 3, using a minimum of LE Security Mode 1 Level 2, with LE Security Mode 1 Level 4 preferred, and a key size of 128 bit minimum.

4.2.2 Read a TPMS Sensor characteristic

- Preamble Purpose
The Monitor reads a TPMS Sensor characteristic.
- Preamble Procedure
 1. The Sensor may need to be in one of the specific TPMS Sensor states, such as Service state or Early Driving state. The Sensor is placed in a connectable state.



2. The Monitor establishes an encrypted connection as described in Section 4.2.1.
3. If the characteristic to be read is the TPMS Signing Key, then the Monitor must be the Primary Monitor. A Monitor can become a Primary Monitor by bonding with the TPMS Sensor. On some TPMS Sensors, this may require breaking a bond with a prior Primary Monitor.
4. The Monitor discovers the desired TPMS Sensor characteristic using either the GATT Discover All characteristics of a Service sub-procedure, or the Discover Characteristics by UUID sub-procedure.
5. The Monitor executes the GATT Read Characteristic Value sub-procedure to read the characteristic.
6. Depending on the requirements of the specific test, the Monitor may need to no longer be the Primary Monitor at the start of the test procedure. This may be performed by using the Bond Management Service (BMS) if supported, by a factory reset procedure, or by implementation-specific means.

4.3 Generic GATT Integration Tests

Execute the Generic GATT Integrated Tests defined in Section 6.4, Client test procedures (CGGIT), in [7] using Table 4.2 below as input:

TCID	Service / Characteristic	Reference	Properties	Value Length (Octets)	Service Type
TPMSP/MON/CGGIT/SER/BV-01-C [Service GGIT – Tire Pressure Monitoring]	Tire Pressure Monitoring System Service	[3] 3	-	-	Primary Service
TPMSP/MON/CGGIT/CHA/BV-01-C [Characteristic GGIT – Tire Pressure]	Tire Pressure Characteristic	[3] 4.2	0x12 (Read, Notify)	3	-
TPMSP/MON/CGGIT/CHA/BV-02-C [Characteristic GGIT – Tire Temperature]	Tire Temperature Characteristic	[3] 4.2	0x12 (Read, Notify)	2	-
TPMSP/MON/CGGIT/CHA/BV-03-C [Characteristic GGIT – Tire Acceleration]	Tire Acceleration Characteristic	[3] 4.2	0x02 (Read)	2	-
TPMSP/MON/CGGIT/CHA/BV-04-C [Characteristic GGIT – TPMS Properties]	TPMS Properties Characteristic	[3] 4.2	0x02 (Read)	Skip	-
TPMSP/MON/CGGIT/CHA/BV-05-C [Characteristic GGIT – TPMS Duty Cycle]	TPMS Duty Cycle Characteristic	[3] 4.2	0x0A (Read, Write)	13, Skip-Write	-
TPMSP/MON/CGGIT/CHA/BV-06-C [Characteristic GGIT – TPMS Position]	TPMS Position Characteristic	[3] 4.2	0x0A (Read, Write)	1, Skip-Write	-
TPMSP/MON/CGGIT/CHA/BV-14-C [Characteristic GGIT – TPMS Signing Key]	TPMS Signing Key Characteristic	[3] 4.2	0x22 (Read, Indicate)	Skip	-
TPMSP/MON/CGGIT/SER/BV-02-C [Service GGIT – Device Information Service]	Device Information Service	[3] 4.2	-	-	Not Defined
TPMSP/MON/CGGIT/CHA/BV-07-C [Characteristic GGIT – Manufacturer Name String characteristic]	Manufacturer Name String characteristic	[3] 4.2	0x02 (Read)	Variable	-
TPMSP/MON/CGGIT/CHA/BV-08-C [Characteristic GGIT – Model Number String characteristic]	Model Number String characteristic	[3] 4.2	0x02 (Read)	Variable	-
TPMSP/MON/CGGIT/CHA/BV-09-C [Characteristic GGIT – Serial Number String characteristic]	Serial Number String characteristic	[3] 4.2	0x02 (Read)	Variable	-
TPMSP/MON/CGGIT/CHA/BV-10-C [Characteristic GGIT – Software Revision String characteristic]	Software Revision String characteristic	[3] 4.2	0x02 (Read)	Variable	-
TPMSP/MON/CGGIT/SER/BV-03-C [Service GGIT – Battery Service]	Battery Service	[3] 4.2	-	-	Not Defined



TCID	Service / Characteristic	Reference	Properties	Value Length (Octets)	Service Type
TPMSP/MON/CGGIT/CHA/BV-11-C [Characteristic GGIT – Battery Level]	Battery Level	[3] 4.2	0x02 (Read)	1	-
TPMSP/MON/CGGIT/SER/BV-04-C [Service GGIT – Bond Management Service]	Bond Management Service	[3] 4.2	-	-	Not Defined
TPMSP/MON/CGGIT/CHA/BV-15-C [Characteristic GGIT – Bond Management Control Point characteristic]	Bond Management Control Point characteristic	[3] 4.2	0x02 (Read)	Skip	-
TPMSP/MON/CGGIT/CHA/BV-16-C [Characteristic GGIT – Bond Management Feature characteristic]	Bond Management Feature characteristic	[3] 4.2	0x02 (Read)	1-3	-

Table 4.2 Input for the GGIT Client test procedure

Execute the Generic GATT Integrated Tests defined in Section 6.3, Server Test Procedures, in [7] using Table 4.3 below as input:

TCID	Service / Characteristic	Reference	Properties	Value Length (Octets)	Service Type
TPMSP/SEN/SGGIT/SER/BV-01-C [Service GGIT – Tire Pressure Monitoring]	Tire Pressure Monitoring Service	[4] 2.6	Unique	-	Primary Service

Table 4.3: Input for the GGIT Server test procedure

4.4 Characteristic Writes

This test group contains test cases to verify that a Monitor or Sensor IUT correctly handles characteristic writes.

4.4.1 TPMS Characteristic Writes by Primary Monitor

- Test Purpose
Verify that a Primary Monitor IUT can write to writeable TPMS characteristics of a TPMS Sensor.
- Reference
[\[3\]](#) 4.3.3, 4.3.4
- Initial Condition
 - The Lower Tester acts as a TPMS Sensor.
 - The IUT has bonded with the Lower Tester and is a Primary Monitor.
 - The handle of the characteristic specified in [Table 4.4](#) is discovered by the IUT.
 - An encrypted ATT Bearer connection is established between the IUT and Lower Tester as described in [Section 4.2.1](#).
- Test Case Configuration

Test Case	Characteristic
TPMSP/MON/CWM/BV-03-C [Characteristic Write – TPMS Duty Cycle]	TPMS Duty Cycle
TPMSP/MON/CWM/BV-04-C [Characteristic Write – TPMS Position]	TPMS Position

Table 4.4: Characteristic Writes by Primary Monitor test cases

- Test Procedure
 1. The IUT executes the GATT Read Characteristic Value sub-procedure with the characteristic specified in [Table 4.4](#), using the handle for the specified characteristic.
 2. The IUT writes the previously read value to the characteristic specified in [Table 4.4](#) by performing the GATT Write Characteristic Value sub-procedure, using the handle for the specified characteristic.
- Expected Outcome
Pass verdict
The characteristic value is successfully written.

4.4.2 Bond Management Control Point Characteristic Write by Primary Monitor

- Test Purpose
Verify that a TPMS Sensor IUT allows only the Primary Monitor to access the Bond Management Control Point characteristic.
- Reference
[\[3\]](#) 3.5

- Initial Condition
 - Lower Tester 1 acts as the Primary Monitor. Lower Tester 1 has bonded with the IUT.
 - Lower Tester 2 acts as a Secondary Monitor. Lower Tester 2 has paired with the IUT.
 - An encrypted ATT Bearer connection is established between the IUT and Lower Tester 2 as described in Section 4.2.1.
 - The handle of the Bond Management Control Point characteristic is discovered by Lower Tester 2.
- Test Case Configuration

Test Case	Op-Codes	Description
TPMSP/SEN/CWM/BV-05-C [Bond Management Control Point Characteristic Write Delete Bond of Requesting Device]	0x01 or 0x03	Delete bond of requesting device (BR/EDR and LE) or Delete bond of requesting device (LE Transport Only)
TPMSP/SEN/CWM/BV-06-C [Bond Management Control Point Characteristic Write Delete All Bonds]	0x04 or 0x06	Delete all bonds on server (BR/EDR and LE) or Delete all bonds on server (LE transport only)

Table 4.5: Bond Management Control Point Characteristic Write test cases

- Test Procedure
 - Lower Tester 2 attempts to execute one of the BMS op-codes defined in Table 4.5 by writing to the Bond Management Control Point characteristic using the discovered handle.
 - The IUT rejects the Write Request by returning an error response with the error code set to "Write Request Rejected" (0xFC).
 - Lower Tester 2 disconnects from the IUT.
 - The Upper Tester commands the IUT to enter a Connectable state.
 - An encrypted ATT Bearer connection is established between the IUT and Lower Tester 1 as described in Section 4.2.1.
 - The handle of the Bond Management Control Point characteristic is discovered by Lower Tester 1.
 - Lower Tester 1 successfully executes one of the BMS op-codes defined in Table 4.5 by writing to the Bond Management Control Point characteristic using the discovered handle.

- Expected Outcome

Pass verdict

In Step 2, the IUT rejects the Write Request by returning error code "Write Request Rejected" (0xFC).

In Step 7, the IUT allows Lower Tester 1 to successfully execute one of the BMS op-codes defined in Table 4.5 by writing to the Bond Management Control Point characteristic.

TPMSP/MON/CWM/BV-05-C [Primary Monitor Removes Bonding using BMS]

- Test Purpose

Verify that a Primary Monitor IUT can remove its own bond using the Bond Management Service.
- Reference

[3] 4.2



- Initial Condition
 - The Lower Tester acts as the TPMS Sensor and supports BMS.
 - The IUT and Lower Tester have previously bonded, establishing the IUT as the Lower Tester's Primary Monitor.
 - An encrypted ATT Bearer connection is established between the IUT and the Lower Tester as described in Section 4.2.1.
 - The handle of the Lower Tester's BMS is discovered by the IUT.
- Test Procedure
 1. The Upper Tester commands the IUT to remove its bond from the Lower Tester using BMS.
 2. The IUT sends a BMS command that deletes its bond to the Lower Tester using the Bond Management Control Point characteristic.
 3. The IUT successfully removes its bond with the Lower Tester and reports success to the Upper Tester.
- Expected Outcome

Pass verdict

The IUT successfully removes its bond with the Lower Tester using BMS.

4.5 Configure Notifications and Indications

- Test Purpose

Verify that the Monitor IUT enables characteristic notifications or indications upon establishing an encrypted connection with the TPMS Sensor.
- Reference

[3] 4.3.1
- Initial Condition
 - The Lower Tester acts as a TPMS Sensor.
 - The Lower Tester removes any previous pairing with the IUT.
 - The handle of the Characteristic specified in Table 4.6 is discovered by the IUT.
- Test Case Configuration

Test Case	Characteristic	Value
TPMSP/MON/CON/BV-01-C [Configure Notification – Tire Pressure]	Tire Pressure	0x0001
TPMSP/MON/CON/BV-02-C [Configure Notification – Tire Temperature]	Tire Temperature	0x0001
TPMSP/MON/CON/BV-03-C [Configure Indication – TPMS Signing Key]	TPMS Signing Key	0x0002

Table 4.6: Configure Notification test cases

- Test Procedure
 1. The Upper Tester commands the IUT to bond and to enable notification or indications by writing the Value specified in [Table 4.6](#) to the relevant client characteristic configuration descriptor of the Lower Tester.
 2. The Lower Tester generates a notification or indication for the Characteristic specified in [Table 4.6](#).

- Expected Outcome

Pass verdict

The IUT successfully writes to the characteristic descriptor.

The IUT reports the notification or indication to the Upper Tester.

TPMSP/MON/CON/BV-04-C [TPMS Signing Key Update Indication]

- Test Purpose

Verify that a Primary Monitor IUT correctly handles the update of the TPMS Signing Key.
- Reference

[\[3\]](#) 4.2.7, 4.3, 5.1.5
- Initial Condition
 - The Lower Tester acts as a TPMS Sensor.
 - The Lower Tester and IUT have previously bonded, making the IUT the Lower Tester's Primary Monitor.
 - The IUT has configured the TPMS Signing Key characteristic for indications on the Lower Tester by writing to the Client Characteristic Configuration Descriptor.
 - The IUT has read and cached the Lower Tester's TPMS Signing Key and TPMS Properties.
 - The Lower Tester is in Monitoring Mode.
- Test Procedure
 1. The Lower Tester advertises data signed with the TPMS Signing Key previously cached by the IUT.
 2. The IUT authenticates the Lower Tester's data against the TPMS Signing Key and provides it to the Upper Tester.
 3. The Lower Tester enters the Connectable Mode and begins sending connectable advertisements.
 4. The IUT establishes an encrypted connection with the Lower Tester.
 5. The Lower Tester generates an indication to the IUT, signaling that the TPMS Signing Key has changed.
 6. The IUT disconnects from the Lower Tester.
 7. The Lower Tester advertises, using the updated TPMS Signing Key.
 8. The IUT authenticates the Lower Tester's data against the updated TPMS Signing Key and provides it to the Upper Tester.
- Expected Outcome

Pass verdict

In Step 2, the IUT authenticates the Lower Tester's advertised data against the cached TPMS Signing Key.

In Step 4, the IUT establishes an encrypted connection.

In Step 8, the IUT authenticates the Lower Tester's advertised data against the revised TPMS Signing Key.

4.6 Tire Pressure Monitoring Features

TPMSP/SEN/TPMF/BV-01-C [Tire Pressure Monitoring Service UUID in AD]

- Test Purpose

Verify that a TPMS Sensor IUT includes the Tire Pressure Monitoring Service UUID in Advertising Data (AD).
- Reference

[3] 3.3
- Initial Condition
 - The Lower Tester and IUT have previously bonded and the Lower Tester is the Primary Monitor.
 - The Lower Tester has read the TPMS Signing Key and TPMS Properties characteristics and can thus authenticate the advertised data.
 - The IUT is in GAP Discoverable Mode.
- Test Procedure
 1. The Upper Tester orders the IUT to generate advertising packets.
 2. The Lower Tester listens for advertising packets from the IUT.
- Expected Outcome

Pass verdict

At least one received advertising packet contains the defined Service UUID for «Tire Pressure Monitoring Service».

The 32-bit SEQ and 32-bit MAC are appended at the end of the data.

The advertising packet is authenticated against the TPMS Signing Key characteristic.

4.6.1 TPMS Sensor advertises in accordance with the expected TPMS Duty Cycle

- Test Purpose

Verify that a TPMS Sensor IUT starts and stops advertising in accordance with the expected duty cycle.
- Reference

[3] 3.4.1
- Initial Condition
 - The Lower Tester and IUT have previously bonded and the Lower Tester is the Primary Monitor.
 - The IUT is in Monitoring Mode.
 - The Lower Tester has read the TPMS Signing Key and TPMS Properties characteristics and can thus authenticate the advertised data.

- The Advertising State Duration field of the TPMS Duty Cycle characteristic is set to 100 (1 second).
- The Field Name in TPMS Duty Cycle specified in [Table 4.7](#) is set to 2 minutes.
- Test Case Configuration

Test Case	Field Name	Active State
TPMSP/SEN/TPMF/BV-04-C [Standby State Duration in Parked State]	Standby State Duration in Parked State	Parked state
TPMSP/SEN/TPMF/BV-15-C [Standby State Duration in Early Driving State]	Standby State Duration in Early Driving State	Early Driving state
TPMSP/SEN/TPMF/BV-16-C [Standby State Duration in Driving State]	Standby State Duration in Driving State	Driving state
TPMSP/SEN/TPMF/BV-17-C [Standby State Duration in Early Parked State]	Standby State Duration in Early Parked State	Early Parked state

Table 4.7: TPMS Sensor Advertising Duty Cycle test cases

- Test Procedure
 1. The Upper Tester commands the IUT to enter a connectable state.
 2. The Lower Tester establishes an encrypted connection with the IUT as described in Section [4.2.1](#).
 3. The Lower Tester writes the Field Name characteristic field specified in [Table 4.7](#) to 20 (20 seconds) and the Advertising State Duration field to 200 (2 seconds).
 4. The Lower Tester disconnects from the IUT.
 5. The Upper Tester commands the IUT to enter the Active State Specified in [Table 4.7](#).
 6. The Lower Tester waits for the IUT to send the first advertising packet and marks the time.
 7. The Lower Tester waits for the IUT to stop sending any advertising packets, marks the time and determines the IUT's Advertising State Duration.
 8. The Lower Tester waits for the IUT to once again begin advertising, marks the time and determines the IUT's Standby State Duration.

- Expected Outcome

Pass verdict

The IUT sends advertising packets.

The Advertising State Duration is measured to be in the range of 1.6 to 2.4 seconds.

The Standby State Duration is measured to be in the range of 16 to 24 seconds.

The 32-bit SEQ and 32-bit MAC are appended at the end of the advertising data.

The 32-bit SEQ increases each time the data changes or the TPMS Sensor enters the Advertising State (new burst of advertising events is started).

The advertising packet is authenticated against the TPMS Signing Key characteristic.

TPMSP/SEN/TPMF/BV-05-C [TPMS Sensor Adds a Secondary Monitor]

- Test Purpose

Verify that a TPMS Sensor IUT designates a Monitor as a Secondary Monitor if it has previously bonded with another Monitor designated as a Primary Monitor.

- Reference

[3] 6.2.2

- Initial Condition

- The Lower Tester acts as a Secondary Monitor.
- The IUT has previously bonded with a Monitor other than the Lower Tester.
- The IUT and Lower Tester have not previously bonded.
- No connection is established between the IUT and the Lower Tester.

- Test Procedure

1. The Upper Tester commands the IUT to enter a connectable state.
2. The IUT and Lower Tester establish an encrypted connection as described in Section 4.2.1. The IUT designates the Lower Tester as a Secondary Monitor and the devices do not bond.
3. The Lower Tester attempts to read the TPMS Signing Key characteristic.
4. The IUT sends the error code “Insufficient Authorization” (0x08) message to the Lower Tester in response.

- Expected Outcome

Pass verdict

The IUT connects to the Lower Tester and designates it as a Secondary Monitor.

The devices do not bond. Bonding information is not exchanged or stored.

The IUT sends the error code “Insufficient Authorization” (0x08) message to the Lower Tester.

TPMSP/MON/TPMF/BV-07-C [Secondary Monitor Pairs to TPMS Sensor]

- Test Purpose

Verify that a Secondary Monitor IUT pairs with TPMS Sensor without bonding.

- Reference

[3] 6.2.2

- Initial Condition

- The Lower Tester acts as a TPMS Sensor.
- The IUT is not paired to the Lower Tester and the devices are not bonded.
- No connection is established between the IUT and the Lower Tester.

- Test Procedure

1. The Lower Tester enters a connectable state.
2. The Upper Tester commands the IUT to establish an encrypted connection as described in Section 4.2.1.
3. The Upper Tester commands the IUT to pair with the Lower Tester.
4. The Bonding Flags field is set “No Bonding” in the Pairing Request message. The devices pair but do not bond.

- Expected Outcome

Pass verdict

The IUT pairs with the Lower Tester. The Bonding Flags field is set "No Bonding" in the Pairing Request message.

The devices do not bond. Bonding information is not exchanged or stored.

TPMSP/SEN/TPMF/BV-10-C [TPMS Sensor Rejects Second Primary Monitor]

- Test Purpose

Verify that a TPMS Sensor IUT, which has performed authenticated pairing with one Primary Monitor, can reject a new Pairing Request from a second Monitor if IO Capabilities indicate that an unauthenticated pairing procedure will be used.

- Reference

[3] 2.3, 6.2.1

- Initial Condition

- Lower Tester 1 acts as the Primary Monitor. Lower Tester 1 has paired and bonded with the IUT using an authenticated pairing method.
- Lower Tester 2 has not bonded to the IUT.

- Test Procedure

1. The Upper Tester orders the IUT to enter Service state, or equivalent connectable state if Service state is not supported.
2. The IUT begins advertising connectable advertising, including undirected, connectable advertising.
3. Lower Tester 2 sends a connection request to the IUT.
4. Lower Tester 2 sends a Pairing Request to the IUT, setting its IO Capabilities to a value that would result in using an unauthenticated pairing method (e.g., NoInputNoOutput).
5. The IUT rejects the pairing request from Lower Tester 2 with a Pairing Failed message.

- Expected Outcome

Pass verdict

The IUT connects to Lower Tester 2.

The IUT rejects the Pairing Request from Lower Tester 2.

TPMSP/SEN/TPMF/BV-11-C [TPMS Sensor Link Loss Reconnection Procedure]

- Test Purpose

Verify that a TPMS Sensor IUT can attempt to reconnect to a Monitor after a connection is terminated due to link loss.

- Reference

[3] 5.3.1

- Initial Condition

- The Lower Tester acts as a Primary Monitor.



- The IUT and the Lower Tester have previously bonded.
- An encrypted ATT Bearer connection is established between the IUT and Lower Tester as described in Section 4.2.1.
- Test Procedure
 1. The Lower Tester performs an action that causes the link to be lost.
 2. The IUT enters a GAP Connectable Mode and attempts to reconnect to the Lower Tester.
 3. The Lower Tester reconnects to the IUT.
- Expected Outcome

Pass verdict

The IUT reconnects to the Lower Tester after the link loss.
- Notes

Recommended, though not mandated, parameters are as follows:

 1. The advertising interval is 1.28 sec.
 2. Reconnection attempts should be limited to no longer than 60 seconds.

TPMSP/MON/TPMF/BV-01-C [Primary Monitor Connects to Unbonded TPMS Sensor]

- Test Purpose

Verify that a Monitor IUT can connect to an unbonded TPMS Sensor as a Primary Monitor when the TPMS Sensor has not previously designated another Monitor as a Primary Monitor.
- Reference

[3] 3.2.6, 4.4.3
- Initial Condition
 - The Lower Tester acts as a TPMS Sensor.
 - The IUT has not previously bonded with the Lower Tester.
 - The IUT is in a mode in which it is seeking connection to a TPMS Sensor to which it has not previously connected.
 - The Lower Tester is in a bondable state and seeking to bond with a new Primary Monitor.
- Test Procedure
 1. The Lower Tester begins advertising connectable advertising.
 2. The Lower Tester receives a connect request from the IUT in response.
 3. The IUT bonds with the Lower Tester, making it the Primary Monitor.
- Expected Outcome

Pass verdict

The IUT successfully connects to the Lower Tester.

The IUT bonds with the Lower Tester.

TPMSP/SEN/TPMF/BV-18-C [TPMS Sensor Bonds to New Primary Monitor]

- Test Purpose

Verify that a TPMS Sensor can bond to a new Primary Monitor when the IUT has not previously designated another Monitor as a Primary Monitor.
- Reference

[3] 3.2.6
- Initial Condition
 - The Lower Tester acts as a Primary Monitor.
 - The IUT has not previously bonded with the Lower Tester.
 - The IUT does not have a designated Primary Monitor.
- Test Procedure
 1. The Upper Tester commands the IUT to enter a connectable state in which it is able to bond to new Primary Monitors.
 2. The IUT begins advertising connectable advertising.
 3. The Lower Tester establishes an encrypted connection with the IUT as described in Section 4.2.1.
 4. The IUT bonds with the Lower Tester, making the Lower Tester the Primary Monitor.
 5. After connection, the Lower Tester reads the TPMS Signing Key on the IUT.

- Expected Outcome

Pass verdict

The IUT successfully connects to the Lower Tester.

The IUT bonds with the Lower Tester.

The IUT allows the Lower Tester to read the TPMS Signing Key, confirming the Lower Tester is now a Primary Monitor.

TPMSP/MON/TPMF/BV-02-C [Monitor Connects to Bonded TPMS Sensor]

- Test Purpose

Verify that a Monitor IUT can establish an encrypted connection to a bonded TPMS Sensor as a Primary Monitor when the TPMS Sensor has previously designated the IUT as a Primary Monitor.
- Reference

[3] 5.2
- Initial Condition
 - The Lower Tester acts as a TPMS Sensor.
 - The IUT has previously bonded with the Lower Tester.
 - The IUT is in a mode in which it is seeking connection to a TPMS Sensor.
- Test Procedure
 1. The Lower Tester is in a connectable state and begins advertising using connectable advertising.

2. The Lower Tester receives a connect request from the IUT in response.
3. The IUT and Lower Tester establish an encrypted connection.

- Expected Outcome

Pass verdict

The IUT successfully establishes an encrypted connection to the Lower Tester.

TPMSP/MON/TPMF/BV-04-C [Monitor Receives TPMS Service Data from Multiple TPMS Sensors]

- Test Purpose

Verify that a Primary Monitor IUT can receive advertisements from two TPMS Sensors.

- Reference

[3] 2.3, 4.4.2

- Initial Condition

- Lower Testers 1 and Lower Tester 2 act as TPMS Sensors. The Tire Acceleration characteristic is present in both Lower Testers.
- The IUT has read and stored the TPMS Signing Key and TPMS Properties characteristics of Lower Tester 1 and Lower Tester 2.
- The IUT has read and stored the TPMS Properties characteristic of Lower Tester 1 and Lower Tester 2 and confirmed that both report radial acceleration (Tire Acceleration Type = 0b1).
- The Lower Testers are in the Driving or Service state (or any state, including manufacturer specific, that allow the Lower Testers to advertise.)

- Test Procedure

1. Lower Tester 1 begins advertising. It transmits Options 1, 2, 3, and 4 (Temperature Accuracy, TPMS Position, Angle Data, and only the instantaneous Acceleration for Option 4), Pressure of 260 kPa, Pressure Accuracy of 10, Temperature of 55 C, Temperature Accuracy of 5 C, Angle of 5, Angular Frequency of 10, Time Offset of 20, Indicators = 0x01 (Rotating/Stationary = Rotating, Pressure Change = Not Detected, Battery Low = Not Low, Bondable = non-bondable mode, Authenticated Pairing Only = unauthenticated pairing is supported), TPMS Position = 0x01, and instantaneous Acceleration of 45.00 G (0x2D0).
2. The IUT receives, authenticates, and provides the advertised data to the Upper Tester.
3. Lower Tester 2 begins advertising. It transmits Options 1, 2, and 4 (Temperature Accuracy, TPMS Position and Acceleration Data with two samples), Pressure of 210 kPa, Pressure Accuracy of 15, Temperature of 56 C, Temperature Accuracy of 6 C, Indicators = 0x07 (Rotating/Stationary = Rotating, Pressure Change = Detected, Battery Low = Low), and TPMS Position = 0x02. Acceleration is 45.00 G (0x2D0), the most recent Acceleration sample is 44.75 G (value corresponds to 0xFC), and the older sample is 45.25 G (value corresponds to 0x04).
4. The IUT receives, authenticates, and provides the advertised data to the Upper Tester.

- Expected Outcome

Pass verdict

The IUT reports the data as described in Steps 1 and 3 from both Lower Testers to the Upper Tester. It authenticates the data against the previously read TPMS Signing Key and Sequence Number.



TPMSP/MON/TPMF/BV-09-C [Ignore Unallocated Optional LTV]

- Test Purpose

Verify that a Monitor IUT skips an unknown optional LTV advertised by a TPMS Sensor.
- Reference

[3] 4.4.2
- Initial Condition
 - The Lower Tester acts as a TPMS Sensor.
 - The IUT and the Lower Tester have previously bonded, and thus the IUT is the Primary Monitor.
 - The Lower Tester is in Monitoring Mode and includes in its Service Data advertising data an Option field with an unallocated Option Type Code (e.g., 0x05), Option Length 2 and 2 random octets as Option Data, followed by an Option field with Option Type Code 0x02 (Position), Option Length 1, and a valid TPMS Position.
- Test Procedure
 1. The Lower Tester begins advertising the Service Data, including the unallocated LTV.
 2. The IUT receives the Service Data from the Lower Tester and reports it to the Upper Tester.
- Expected Outcome

Pass verdict

The Service Data reported by the IUT does not include the unallocated Option advertised by the Lower Tester.

The Service Data reported by the IUT includes the Option for Position.

4.7 Error Handling**TPMSP/MON/ERH/BI-01-C [Primary Monitor Only Accepts Valid Sensor Data]**

- Test Purpose

Verify that a Primary Monitor IUT only accepts authenticated data from a TPMS Sensor.
- Reference

[3] 4.3
- Initial Condition
 - The Lower Tester acts as a TPMS Sensor.
 - The IUT has previously read and stored the TPMS Signing Key and TPMS Properties characteristics of the Lower Tester and can thus authenticate the data.
 - The Advertising State Duration field of the IUT's TPMS Duty Cycle characteristic is set to 100 (1 second). The Standby State Duration in Driving State field of the TPMS Duty Cycle characteristic is set to 9 (9 seconds).
 - The IUT has read the Lower Tester's TPMS Monitoring Mode Duty Cycle characteristic and is thus aware of the fast update rate and can scan accordingly.
 - The IUT and Lower Tester are in Monitoring Mode.

- Test Procedure

Round	Tire Pressure	Tire Temperature	SEQ	MAC	Reported Pressure	Reported Temperature
1	220 kPa	55 C	increments	valid	220 kPa	55 C
2	30 kPa	150 C	increments	invalid	220 kPa	55 C
3	221 kPa	56 C	increments	valid	221 kPa	56 C
4	20 kPa	145 C	low	valid	221 kPa	56 C
5	222 kPa	57 C	increments	valid	222 kPa	57 C

Table 4.8: Monitor only accepts valid sensor data test values

- For each round specified in Table 4.8, perform Steps 2–3.
- The Lower Tester advertises the Tire Pressure and Tire Temperature as specified in Table 4.8. SEQ increments as expected if “increments” is given under SEQ, and uses some lower value than expected if “low” is specified. The MAC column indicates if the MAC field is valid or invalid. It advertises this data through at least two Advertising State Durations.
- The IUT reports the Report Pressure and Report Temperature as specified in Table 4.8.

- Expected Outcome

Pass verdict

The IUT reports the tire pressures and tire temperatures as specified in Table 4.8, ignoring any invalid advertisements sent.

4.8 TPMS Service Data

This test group contains test cases to verify that a server includes mandatory values in the service data in its advertising packets. Additionally, these test cases verify that corresponding Flag bits are set for supported features and the advertising packets contain octets for values of supported features.

4.8.1 Service Data in Monitoring Mode

- Test Purpose

Verify that the Sensor IUT includes correctly formatted signed Service Data in its Advertising Data (AD).

- Reference

[3] 3.3

- Initial Condition

- The IUT is in Monitoring Mode.
- The Lower Tester acts as a Primary Monitor.
- The Lower Tester and IUT have previously bonded and the Lower Tester is the Primary Monitor.
- The Lower Tester has read the IUT's TPMS Signing Key and TPMS Properties characteristics and can thus authenticate the advertised data.

- Test Case Configuration

Test Case	MAC Method	Option Type (data)
TPMSP/SEN/ADV/BV-01-C [Mandatory Service Data in Monitoring Mode with HMAC]	HMAC	N/A
TPMSP/SEN/ADV/BV-08-C [Mandatory Service Data in Monitoring Mode with CMAC]	CMAC	N/A
TPMSP/SEN/ADV/BV-09-C [Temperature Accuracy in Service Data in Monitoring Mode]	HMAC or CMAC	Temperature Accuracy
TPMSP/SEN/ADV/BV-10-C [Acceleration Data in Service Data in Monitoring Mode]	HMAC or CMAC	Acceleration Data (Acceleration data with no acceleration samples sequence)
TPMSP/SEN/ADV/BV-11-C [Position in Service Data in Monitoring Mode]	HMAC or CMAC	Position
TPMSP/SEN/ADV/BV-12-C [Angle Data in Service Data in Monitoring Mode]	HMAC or CMAC	Angle Data

Table 4.9: TPMS Service Data Advertising Format test cases

- Test Procedure

Data	Present	Size (octets)	Option Type Code
AD Type Service Data	Always	1	N/A
TPMS Service UUID	Always	2	N/A
Pressure	Always	2	N/A
Pressure Accuracy	Always	1	N/A
Temperature	Always	1	N/A
Indicators	Always	1	N/A
Temperature Accuracy	Optionally	2	0x01
Position	Optionally	2	0x02
Angle Data	Optionally	7	0x03
Acceleration Data	Optionally	Variable, minimum of 3	0x04
Sequence Number (SEQ)	Always	4	N/A
Message Authentication Code (MAC)	Always	4	N/A

Table 4.10: TPMS Service Data Advertising Format

1. The Upper Tester commands the IUT to enter Advertising State. The IUT uses the MAC method indicated in [Table 4.9](#) and includes in its advertising data the Optional Fields, and when indicated in parenthesis the option-specific data, indicated in [Table 4.9](#).
2. The Lower Tester listens for advertising packets from the IUT.

- Expected Outcome

Pass verdict

The IUT sends one or more advertising packets.

The IUT includes the «Service Data» AD Type in the AD Type field of the advertising packet.

The Service Data includes the always-present fields from [Table 4.10](#), and the fields have the sizes specified in [Table 4.10](#).

If optional data is included as per the Option Type column in [Table 4.9](#), then a corresponding Option field is present in the advertising data. The Option field has the Options Type Code indicated in [Table 4.10](#) and the Option Length, where applicable, corresponds to the Size field in [Table 4.10](#).

The 32-bit SEQ and 32-bit MAC are appended at the end of the data.

The IUT uses the MAC Method indicated in [Table 4.9](#).

The SEQ value increases each time the data in the advertising data changes.

The advertising packet is authenticated against the TPMS Signing Key characteristic, which does not change at any time.

4.8.2 Authenticating Service Data

- Test Purpose

Verify that the Monitor IUT correctly authenticates Service Data using the chosen MAC method.

- Reference

[\[3\]](#) 4.4.1

- Initial Condition

- The Lower Tester acts as a TPMS Sensor and is in Monitoring Mode.
- The Lower Tester and IUT have previously bonded and the IUT is the Primary Monitor.
- The IUT has read the Lower Tester's TPMS Signing Key and TPMS Properties characteristics and can thus authenticate the advertised data.
- The Lower Tester advertises valid data for all mandatory and optional service data fields, as specified in [Table 4.10](#), and calculates the MAC field according to the MAC Method defined in [Table 4.11](#).

- Test Case Configuration

Test Case	MAC Method
TPMSP/MON/ADV/BV-01-C [Service Data Authenticated Using HMAC]	HMAC
TPMSP/MON/ADV/BV-02-C [Service Data Authenticated Using CMAC]	CMAC

Table 4.11: Authenticating Service Data Test Cases

- Test Procedure

1. The Upper Tester commands the IUT to receive advertising packets from the Lower Tester.

- Expected Outcome

Pass verdict

The IUT successfully authenticates the service data using the MAC Method specified in [Table 4.11](#).

4.8.3 Indicators in Monitoring Mode

- Test Purpose

Verify that the Sensor IUT sets the corresponding bits in the Indicators field in its Service Data when it is triggered to send advertising by a certain event.

- Reference

[\[3\]](#) 3.3

- Initial Condition

- The IUT is in the Initial Mode specified in [Table 4.12](#).
- The Lower Tester acts as a Primary Monitor.
- The Lower Tester and IUT have previously bonded.
- The Lower Tester has read the IUT's Signing Key and TPMS Properties characteristics and can thus authenticate the advertised data.

- Test Case Configuration

Test Case	Bit	Initial Mode	Initial Event	Initial Value	Final Event
TPMSP/SEN/ADV/BV-02-C [Service Data Indicators – Rotating/Stationary]	0	Monitoring	Rotating	0b1	Stationary
TPMSP/SEN/ADV/BV-03-C [Service Data Indicators – Pressure Change]	1	Monitoring	Pressure change	0b1	No Pressure Change
TPMSP/SEN/ADV/BV-04-C [Service Data Indicators – Low Battery]	2	Monitoring	Low battery not detected	0b0	Low Battery Detected
TPMSP/SEN/ADV/BV-05-C [Service Data Indicators – Bondable]	3	Connectable	Sensor in bondable mode	0b1	Sensor not in bondable mode
TPMSP/SEN/ADV/BV-06-C [Service Data Indicators – Authenticated Pairing Only]	4	Connectable	Only authenticated pairing procedure is accepted	0b1	N/A
TPMSP/SEN/ADV/BV-17-C [Service Data Indicators – Unauthenticated Pairing Allowed]	4	Connectable	Unauthenticated pairing procedure is allowed	0b0	N/A
TPMSP/SEN/ADV/BV-15-C [Service Data Indicators – Rotation Direction]	5	Monitoring	Rotation direction	0b1	Counter Rotation Direction

Table 4.12: TPMS Sensor Advertising Duty Cycle test cases

- Test Procedure
 1. The Upper Tester commands the IUT to enter Advertising State.
 2. The Upper Tester triggers an action which causes the Initial Event indicated in [Table 4.12](#) to trigger on the IUT.
 3. The IUT sets the Bit identified in [Table 4.12](#) to the given Initial Value.
 4. If a Final Event is specified in [Table 4.12](#), the Upper Tester commands the IUT into that state and the specific Bit toggles.

- Expected Outcome

Pass verdict

The IUT sends an advertising packet.

The IUT includes the «Service Data» AD Type in the AD Type field of the advertising packet.

The Service Data has the appropriate Indicator Bit value as indicated in [Table 4.12](#) for the Initial State, and Final State if applicable. Any RFU bits in the Indicator field are set to 0.

The 32-bit SEQ and 32-bit MAC are appended at the end of the data.

The SEQ value increases each time the data in the advertising data changes.

The advertising packet is authenticated against the TPMS Signing Key characteristic, which does not change at any time.

TPMSP/SEN/ADV/BV-07-C [Sequence Number Reset]

- Test Purpose

Verify that the Sensor IUT changes the value of the signing key to avoid a Sequence Number roll over.
- Reference

[\[3\]](#) 3.3.11
- Initial Condition
 - The IUT is in Monitoring Mode.
 - The Lower Tester acts as a Primary Monitor.
 - The Lower Tester and IUT have previously bonded and the Lower Tester is the Primary Monitor.
 - The Lower Tester has read the IUT's Signing Key characteristic and can thus authenticate the advertised data.
 - The Lower Tester has configured the IUT's Signing Key characteristic for indications.
 - The IUT's Sequence Number is close to the rollover value (0xFFFFFFFF).
- Test Procedure
 1. The Lower Tester commands the IUT to enter a connectable mode and the IUT begins sending connectable advertisements.
 2. The Lower Tester responds by sending a connect request to the IUT.
 3. The IUT and Lower Tester establish an authenticated connection.
 4. The IUT changes the values of the Signing Key characteristic and resets its Sequence Number to 0.

5. The IUT generates an indication to the Lower Tester, signaling that the TPMS Signing Key has changed and provides the updated value.
6. The Lower Tester disconnects from the IUT.
7. The Upper Tester commands the IUT to enter Monitoring Mode. The IUT uses the updated TPMS Signing Key and has reset its SEQ value to 0.
8. The Lower Tester authenticates the IUT's data against the updated TPMS Signing Key.

- Expected Outcome

Pass verdict

In Step 4, the IUT updates the TPMS Signing Key characteristic value.

In Step 4, the IUT resets its Sequence Number to 0.

In Step 7, the IUT is using the updated TPMS Signing Key and has reset its Sequence Counter.

The IUT does not reset the SEQ before informing the Lower Tester of the new Signing Key.

The 32-bit SEQ and 32-bit MAC are appended at the end of the data.

The SEQ value increases each time the data in the advertising data changes.

TPMSP/MON/ADV/BV-03-C [Extension Bit and RFU in Indicators Field]

- Test Purpose

Verify that a Monitor IUT handles the presence of Extension bits and RFU values set to 0b1 in the Indicators field advertised by a TPMS Sensor.

- Reference

[3] 1.1.2, 3.3.6

- Initial Condition

- The Lower Tester acts as a TPMS Sensor.
- The Lower Tester is in Monitoring Mode. The Indicators field in its Service Data advertising data has the structure and values defined in [Table 4.13](#).
- The Lower Tester begins advertising. It transmits Options 1 and 2 (Temperature Accuracy and TPMS Position), with a Temperature Accuracy of 3 C and TPMS Position = 0x09.

- Test Procedure

Bit(s)	Indicator	Bit Value
0	Rotating/Stationary	0b1
1	Pressure Change	0b0
2	Battery Low	0b0
3	Bondable	0b0
4	Authenticated Pairing Only	0b0
5	Rotation Direction	0b0
6	RFU	0b1
7	Extension	0b1
8-14	RFU	0b1111111
15	Extension	0b1

Bit(s)	Indicator	Bit Value
16-22	RFU	0b1111111
23	Extension	0b0

Table 4.13: Bit values with Extension octets added

1. The Lower Tester begins advertising the Service Data, including the RFU bit.
 2. The IUT receives the Service Data from the Lower Tester and reports it to the Upper Tester.
- Expected Outcome

Pass verdict

The Service Data reported by the IUT has the Rotating/Stationary bit of the Indicators field is set to 1 and the Pressure Change, Battery Low, Bondable, and Rotation Direction bits are set to 0.

The IUT reports the Options 1 and 2 data as described in the Initial Condition.

5 Test Case Mapping

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

The columns for the TCMT are defined as follows:

Item: Contains a logical expression based on specific entries from the associated ICS document. Contains a logical expression (using the operators AND, OR, NOT as needed) based on specific entries from the applicable ICS document(s). The entries are in the form of y/x references, where y corresponds to the table number and x corresponds to the feature number as defined in the ICS document for Tire Pressure Monitoring System Profile [5].

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

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. Further details about the function of the TCMT are elaborated in [2].

For the purpose and structure of the ICS/IXIT, refer to [2].

Item	Feature	Test Case(s)
TPMSP 1/1	TPMS Sensor	TPMSP/SEN/SGGIT/SER/BV-01-C
TPMSP 1/2	Monitor	TPMSP/MON/ADV/BV-03-C
TPMSP 17/17	Service Data Authenticated Using HMAC	TPMSP/MON/ADV/BV-01-C
TPMSP 17/18	Service Data Authenticated Using CMAC	TPMSP/MON/ADV/BV-02-C
TPMSP 16/1	Discover TPMS Service over LE	TPMSP/MON/CGGIT/SER/BV-01-C
TPMSP 16/2 AND TPMSP 16/3	Characteristic GGIT – Tire Pressure	TPMSP/MON/CGGIT/CHA/BV-01-C
TPMSP 16/4 AND TPMSP 16/5	Characteristic GGIT – Tire Temperature	TPMSP/MON/CGGIT/CHA/BV-02-C
TPMSP 16/6	Characteristic GGIT – Tire Acceleration	TPMSP/MON/CGGIT/CHA/BV-03-C
TPMSP 16/7	Characteristic GGIT – TPMS Properties	TPMSP/MON/CGGIT/CHA/BV-04-C
TPMSP 16/8	TPMS Monitoring Mode Duty Cycle Characteristic – Monitor Role	TPMSP/MON/CGGIT/CHA/BV-05-C
TPMSP 16/9	Sensor Position Characteristic – Monitor Role	TPMSP/MON/CGGIT/CHA/BV-06-C
TPMSP 16/10	Characteristic GGIT – TPMS Signing Key	TPMSP/MON/CGGIT/CHA/BV-14-C
TPMSP 13/2	Service GGIT – Device Information Service	TPMSP/MON/CGGIT/SER/BV-02-C
TPMSP 16/13	Characteristic GGIT – Manufacturer Name String characteristic	TPMSP/MON/CGGIT/CHA/BV-07-C
TPMSP 16/14	Characteristic GGIT – Model Number String characteristic	TPMSP/MON/CGGIT/CHA/BV-08-C
TPMSP 16/15	Characteristic GGIT – Serial Number String characteristic	TPMSP/MON/CGGIT/CHA/BV-09-C

Item	Feature	Test Case(s)
TPMSP 16/16	Characteristic GGIT – Software Revision String characteristic	TPMSP/MON/CGGIT/CHA/BV-10-C
TPMSP 13/3	Service GGIT – Battery Service	TPMSP/MON/CGGIT/SER/BV-03-C
TPMSP 16/17	Characteristic GGIT – Battery Level	TPMSP/MON/CGGIT/CHA/BV-11-C
TPMSP 13/4	Service GGIT – Bond Management Service	TPMSP/MON/CGGIT/SER/BV-04-C
TPMSP 16/11	Characteristic GGIT – Bond Management Control Point	TPMSP/MON/CGGIT/CHA/BV-15-C TPMSP/MON/CWM/BV-05-C
TPMSP 16/12	Characteristic GGIT – Bond Management Feature	TPMSP/MON/CGGIT/CHA/BV-16-C
TPMSP 6/3	TPMS Sensor Adds a Secondary Monitor or Bonds to a New Primary Monitor	TPMSP/SEN/TPMF/BV-05-C TPMSP/SEN/TPMF/BV-18-C
TPMSP 7/2	Link Loss Reconnection Procedure – TPMS Sensor	TPMSP/SEN/TPMF/BV-11-C
TPMSP 8/1 AND TPMSP 6/4	TPMS Sensor Standby State Duration in Parked state	TPMSP/SEN/TPMF/BV-04-C
TPMSP 8/1 AND TPMSP 6/5	TPMS Sensor Standby State Duration in Early Driving state	TPMSP/SEN/TPMF/BV-15-C
TPMSP 8/1 AND TPMSP 6/6	TPMS Sensor Standby State Duration in Driving state	TPMSP/SEN/TPMF/BV-16-C
TPMSP 8/1 AND TPMSP 6/7	TPMS Sensor Standby State Duration in Early Parked state	TPMSP/SEN/TPMF/BV-17-C
TPMSP 8/2 AND TPMSP 10/4	TPMS Sensor Rejects Second Primary Monitor	TPMSP/SEN/TPMF/BV-10-C
TPMSP 15/1	Primary Monitor	TPMSP/MON/ERH/BI-01-C TPMSP/MON/TPMF/BV-09-C
TPMSP 15/2	Secondary Monitor	TPMSP/MON/TPMF/BV-07-C
TPMSP 15/1 AND TPMSP 17/10	Characteristic Write – TPMS Duty Cycle Characteristic	TPMSP/MON/CWM/BV-03-C
TPMSP 15/1 AND TPMSP 17/12	Characteristic Write – TPMS Position Characteristic	TPMSP/MON/CWM/BV-04-C
TPMSP 5/5 AND TPMSP 7/1	Characteristic Write – Bond Management Control Point Characteristic, Delete Bond Of Requesting Device	TPMSP/SEN/CWM/BV-05-C
TPMSP 5/5 AND TPMSP 7/1 AND (TPMSP 8/11 OR TPMSP 8/12)	Characteristic Write – Bond Management Control Point Characteristic, Delete All Bonds	TPMSP/SEN/CWM/BV-06-C
TPMSP 17/2 AND TPMSP 14/2	Configure Tire Pressure Characteristic for Notifications – Monitor Role	TPMSP/MON/CON/BV-01-C
TPMSP 17/5 AND TPMSP 14/2	Configure Tire Temperature Characteristic for Notification – Monitor Role	TPMSP/MON/CON/BV-02-C

Item	Feature	Test Case(s)
TPMSP 17/14 AND TPMSP 14/2	Configure Tire Temperature Characteristic for Indication – Monitor Role	TPMSP/MON/CON/BV-03-C
TPMSP 14/1 AND TPMSP 17/11 AND TPMSP 17/13 AND TPMSP 17/15	Monitor Receives TPMS Service Data from Multiple TPMS Sensors	TPMSP/MON/TPMF/BV-04-C
TPMSP 18/2	Primary Monitor Connects to Unbonded TPMS Sensor	TPMSP/MON/TPMF/BV-01-C
TPMSP 17/1 AND TPMSP 17/4 AND TPMSP 18/2	Connection Procedure – Bonded TPMS Sensor– Monitor Role	TPMSP/MON/TPMF/BV-02-C
TPMSP 17/13 AND TPMSP 17/14 AND TPMSP 18/2	TPMS Signing Key Update Indication	TPMSP/MON/CON/BV-04-C
TPMSP 5/2	TPMS Service Data in Advertising Data or Tire Pressure Monitoring Service UUID in AD Type in GAP Discoverable Mode	TPMSP/SEN/TPMF/BV-01-C TPMSP/SEN/ADV/BV-02-C TPMSP/SEN/ADV/BV-03-C TPMSP/SEN/ADV/BV-04-C TPMSP/SEN/ADV/BV-05-C TPMSP/SEN/ADV/BV-15-C
TPMSP 5/2 AND TPMSP 10/4	Service Data Indicators – Authenticated Pairing Only	TPMSP/SEN/ADV/BV-06-C
TPMSP 5/2 AND TPMSP 10/3	Service Data Indicators – Unauthenticated Pairing Allowed	TPMSP/SEN/ADV/BV-17-C
TPMSP 5/2 AND TPMSP 8/5	TPMS Service Data in Advertising Data using HMAC	TPMSP/SEN/ADV/BV-01-C
TPMSP 5/2 AND TPMSP 8/6	TPMS Service Data in Advertising Data using CMAC	TPMSP/SEN/ADV/BV-08-C
TPMSP 5/2 AND TPMSP 8/7	TPMS Temperature Accuracy in Service Data in Monitoring Mode	TPMSP/SEN/ADV/BV-09-C
TPMSP 5/2 AND TPMSP 8/8	TPMS Acceleration Data in Service Data in Monitoring Mode	TPMSP/SEN/ADV/BV-10-C
TPMSP 5/2 AND TPMSP 8/9	TPMS Position in Service Data in Monitoring Mode	TPMSP/SEN/ADV/BV-11-C
TPMSP 5/2 AND TPMSP 8/10	TPMS Angle Data in Service Data in Monitoring Mode	TPMSP/SEN/ADV/BV-12-C
TPMSP 6/1 AND TPMSP 7/1	Sequence Number Reset	TPMSP/SEN/ADV/BV-07-C

Table 5.1: Test case mapping

6 Revision history and acknowledgments

Revision History

Publication Number	Revision Number	Date	Comments
0	p0	2026-08-11	Approved by BTI on 2026-06-28. TPMSP v1.0 adopted by the BoD on 2026-08-10. Prepared for initial publication.

Acknowledgments

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