Ranging Service (RAS)

***Bluetooth*® Test Suite**

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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 Ranging Service with the objective to provide a high probability of air interface interoperability between the tested implementation and other manufacturers' Bluetooth devices.

2 References, definitions, and abbreviations

2.1 References

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

[1] Bluetooth Core Specification, Version 6.0 or later

[2] Test Strategy and Terminology Overview

[3] Ranging Service Specification, Version 1.0

[4] ICS Proforma for Ranging Service

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

[6] GATT Test Suite, GATT.TS

[7] Document Naming and Marking Document

[8] Channel Sounding Input Test Data for Filtering: https://files.bluetooth.com/download/channel-sounding-input-test-data-for-filtering/

[9] Filtered Ranging Data Round 1 and 2: https://files.bluetooth.com/download/filtered-ranging-data-round-1-and-2/

[10] Filtered Ranging Data Round 3 and 4: https://files.bluetooth.com/download/filtered-ranging-data-round-3-and-4/

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 Ranging Service [3] requires the presence of GAP, SM, L2CAP, and GATT. This is illustrated in Figure 3.1.

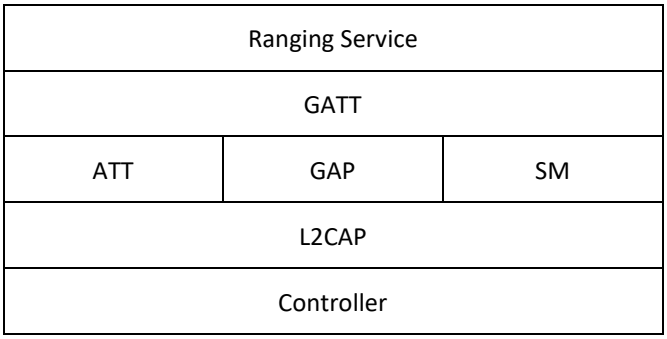

Figure 3.1: Ranging Service test model

3.2 Test Strategy

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

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

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

3.3 Test groups

The following test groups have been defined:

- Generic GATT Integrated Tests
- RAS characteristic operations
- Real-time Ranging Data
- RAS Control Point
- Service procedure error handling

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 [6] 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>**
RAS	Ranging Service
Identifier Abbreviation	**Role Identifier <IUT role>**
SR	Server
Identifier Abbreviation	**Role Identifier <GGIT test group>**
SGGIT	Server Generic GATT Integrated Tests
Identifier Abbreviation	**Reference Identifier <GGIT class>**
CHA	Characteristic
SER	Service
Identifier Abbreviation	**Features and Behaviors Identifier <feat>**
RCO	RAS Characteristic Operations
RCP	RAS Control Point
RRD	Real-time Ranging Data
SPE	Service Procedure Error Handling

Table 4.1: RAS 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, then 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 ATT Bearer on LE transport

1. Establish an LE transport connection between the IUT and the Lower Tester.
2. Establish an L2CAP channel 0x0004 between the IUT and the Lower Tester over that LE transport.

4.3 Generic GATT Integration Tests

Execute the Generic GATT Integrated Tests defined in Section 6.3, Server test procedures (SGGIT), in [6] using Table 4.2 below as input:

TCID	Service / Characteristic / Descriptor	Reference	Properties	Value Length (Octets)	Service Type
RAS/SR/SGGIT/SER/BV-01-C [Service GGIT – Ranging Service]	Ranging Service	[3] 2.6	-	-	Primary Service, Unique
RAS/SR/SGGIT/CHA/BV-01-C [Characteristic GGIT – RAS Features]	RAS Features characteristic	[3] 3, 3.1	0x02 (Read)	Skip	-
RAS/SR/SGGIT/CHA/BV-02-C [Characteristic GGIT – Real-time Ranging Data]	Real-time Ranging Data characteristic	[3] 3, 3.2.3	0x30 (Notify, Indicate)	Skip	-
RAS/SR/SGGIT/CHA/BV-03-C [Characteristic GGIT – On-demand Ranging Data]	On-demand Ranging Data characteristic	[3] 3, 3.2.4	0x30 (Notify, Indicate)	Skip	-
RAS/SR/SGGIT/CHA/BV-04-C [Characteristic GGIT – RAS Control Point]	RAS Control Point characteristic	[3] 3, 3.3	0x24 (Write Without Response, Indicate)	Skip	-
RAS/SR/SGGIT/CHA/BV-05-C [Characteristic GGIT – Ranging Data Ready – Indicate]	Ranging Data Ready characteristic	[3] 3, 3.4	0x20 (Indicate)	Skip	-
RAS/SR/SGGIT/CHA/BV-06-C [Characteristic GGIT – Ranging Data Ready – Indicate, Notify]	Ranging Data Ready characteristic	[3] 3, 3.4	0x30 (Indicate, Notify)	Skip	-
RAS/SR/SGGIT/CHA/BV-07-C [Characteristic GGIT – Ranging Data Ready – Indicate, Read]	Ranging Data Ready characteristic	[3] 3, 3.4	0x22 (Indicate, Read)	Skip	-
RAS/SR/SGGIT/CHA/BV-08-C [Characteristic GGIT – Ranging Data Ready – Indicate, Notify, Read]	Ranging Data Ready characteristic	[3] 3, 3.4	0x32 (Indicate, Notify, Read)	Skip	-
RAS/SR/SGGIT/CHA/BV-09-C [Characteristic GGIT – Ranging Data Overwritten – Indicate]	Ranging Data Overwritten characteristic	[3] 3, 3.5	0x20 (Indicate)	Skip	-

TCID	Service / Characteristic / Descriptor	Reference	Properties	Value Length (Octets)	Service Type
RAS/SR/SGGIT/CHA/BV-10-C [Characteristic GGIT – Ranging Data Overwritten – Indicate, Notify]	Ranging Data Overwritten characteristic	[3] 3, 3.5	0x30 (Indicate, Notify)	Skip	-
RAS/SR/SGGIT/CHA/BV-11-C [Characteristic GGIT – Ranging Data Overwritten – Indicate, Read]	Ranging Data Overwritten characteristic	[3] 3, 3.5	0x22 (Indicate, Read)	Skip	-
RAS/SR/SGGIT/CHA/BV-12-C [Characteristic GGIT – Ranging Data Overwritten – Indicate, Notify, Read]	Ranging Data Overwritten characteristic	[3] 3, 3.5	0x32 (Indicate, Notify, Read)	Skip	-

Table 4.2 Input for the GGIT Server test procedure

4.4 RAS characteristic operations

RAS/SR/RCO/BV-01-C [Characteristic Read – RAS Features]

- Test Purpose

  Verify that the IUT responds to a RAS Features characteristic read.

- Reference

  [3] 3.1

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1.
  - The Lower Tester has discovered and cached the RAS service and characteristic handles (e.g., by running the test procedures in Section 4.3).

- Test Procedure

  1. The Lower Tester executes the GATT Read Characteristic Value sub-procedure for the RAS Features characteristic.

- Expected Outcome

  Pass verdict

  The RAS Features characteristic is read and the characteristic value and format match the IUT's capabilities listed in the ICS [4].

  All RFU bits are set to zero.

4.4.1 Ranging Data Overwritten

- Test Purpose

  Verify that the IUT sends a Ranging Data Overwritten characteristic indication or notification when unread Ranging Data is overwritten by new Ranging Data and that the IUT can respond to a Ranging Data Overwritten read request.

- Reference

  [3] 3.5

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1.
  - The Lower Tester has discovered and cached the RAS service and characteristic handles (e.g., by running the test procedures in Section 4.3).
  - The Ranging Data Overwritten characteristic is configured for notifications or indications depending on the property in Table 4.3.
  - The Ranging Data Ready characteristic is configured for indications.
  - The RAS Control Point characteristic is configured for indications.
  - The On-demand Ranging Data characteristic is configured for notifications or indications.
  - No Ranging Data has been previously sent on the connection.

- Test Case Configuration

Test Case	Property
RAS/SR/RCO/BV-02-C [Ranging Data Overwritten, Indication]	Indication
RAS/SR/RCO/BV-03-C [Ranging Data Overwritten, Notification]	Notification
RAS/SR/RCO/BV-04-C [Ranging Data Overwritten, Read]	Indication and Read

Table 4.3: Ranging Data Overwritten test cases

- Test Procedure

1. If the Read property is present in Table 4.3, the Lower Tester executes the GATT Read Characteristic Value sub-procedure for the Ranging Data Overwritten characteristic.
2. Perform an action that will induce the IUT to receive CS Subevent Data (e.g., by the Lower Tester or IUT configuring and initiating a CS procedure).
3. When the Ranging Data is ready, the IUT sends an indication of the Ranging Data Ready characteristic to the Lower Tester.
4. Continue generating Ranging Data on the IUT until the IUT has run out of memory and is forced to delete older Ranging Data.
5. The IUT sends a notification or indication of the Ranging Data Overwritten characteristic to the Lower Tester.
6. If the Read property is present in Table 4.3, the Lower Tester executes the GATT Read Characteristic Value sub-procedure for the Ranging Data Overwritten characteristic.

- Expected Outcome

Pass verdict

The IUT sends a notification or indication of the Ranging Data Overwritten characteristic with the Ranging Counter set to the Ranging Counter of the procedure being overwritten.

If the Read property is present in Table 4.3:

- In Step 1, the Ranging Data Overwritten characteristic is read and the Ranging Counter value is 0.
- In Step 6, the Ranging Data Overwritten characteristic is read and the Ranging Counter value matches the Ranging Counter value of the notification or indication sent in Step 5.

4.4.2 Ranging Data Ready and On-demand Ranging Data notifications and indications

- Test Purpose

Verify that the IUT sends a Ranging Data Ready characteristic indication or notification when Ranging Data is ready to be sent, that the IUT can respond to a Ranging Data Ready read request, and that when the On-demand Ranging Data characteristic is configured for notifications and indications, the IUT only sends notifications.

- Reference

[3] 3.2.3.1, 3.4

- Initial Condition

- A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1.

- The Lower Tester has discovered and cached the RAS service and characteristic handles (e.g., by running the test procedures in Section 4.3).
- The Ranging Data Ready characteristic is configured based on Table 4.4.
- The RAS Control Point characteristic is configured for indications.
- The On-demand Ranging Data characteristic is configured for notifications and indications.
- No Ranging Data has been previously sent on the connection.

- Test Case Configuration

Test Case	Property
RAS/SR/RCO/BV-05-C [Ranging Data Ready, Indication]	Indication
RAS/SR/RCO/BV-06-C [Ranging Data Ready, Notification]	Notification
RAS/SR/RCO/BV-07-C [Ranging Data Ready, Read]	Indication and Read

Table 4.4: Ranging Data Ready and On-demand Ranging Data notifications and indications test cases

- Test Procedure

1. If the Read property is present in Table 4.4, the Lower Tester executes the GATT Read Characteristic Value sub-procedure for the Ranging Data Ready characteristic.
2. Perform an action that will induce the IUT to receive CS Subevent Data (e.g., by the Lower Tester or IUT configuring and initiating a CS procedure).
3. When the Ranging Data is ready, the IUT sends a notification or indication of the Ranging Data Ready characteristic to the Lower Tester.
4. If the Read property is present in Table 4.4, the Lower Tester executes the GATT Read Characteristic Value sub-procedure for the Ranging Data Ready characteristic.
5. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x00 (Get Ranging Data) and Parameter #1 set to the Ranging Counter value in Step 3.
6. The IUT sends one or more On-demand Ranging Data notifications to the Lower Tester.
7. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x00 (Complete Ranging Data Response) and Parameter #1 set to the Ranging Counter value in Step 3 to the Lower Tester.
8. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x01 (ACK Ranging Data) and Parameter #1 set to the Ranging Counter value in Step 3.
9. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x02 (Response Code) and Parameter #1 set to 0x01 (Success) to the Lower Tester.

- Expected Outcome

Pass verdict

The IUT sends a notification or indication of the Ranging Data Ready characteristic with a valid Ranging Counter.

In Step 6, the IUT only sends notifications of the On-demand Ranging Data characteristic.

If the Read property is present in Table 4.4:

- In Step 1, the Ranging Data Ready characteristic is read and the Ranging Counter is 0.
- In Step 4, the Ranging Data Ready characteristic is read and the Ranging Counter value matches the Ranging Counter value of the notification or indication sent in Step 3.

4.4.3 Notifications and indications, Ranging Data Overwritten and Ranging Data Ready

- Test Purpose

  Verify that the IUT, which is configured for both notifications and indications of the Ranging Data Overwritten or the Ranging Data Ready characteristic, only sends indications.

- Reference

  [3] 3.4.2, 3.5.2

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1.
  - The Lower Tester has discovered and cached the RAS service and characteristic handles (e.g., by running the test procedures in Section 4.3).
  - The Ranging Data Overwritten characteristic is configured based on Table 4.5.
  - The Ranging Data Ready characteristic is configured based on Table 4.5.
  - The RAS Control Point characteristic is configured for indications.
  - The On-demand Ranging Data characteristic is configured for notifications or indications.

- Test Case Configuration

Test Case	Ranging Data Overwritten	Ranging Data Ready
RAS/SR/RCO/BV-08-C [Notifications and indications, Ranging Data Overwritten]	Notifications and Indications	Indications
RAS/SR/RCO/BV-09-C [Notifications and indications, Ranging Data Ready]	Indications	Notifications and Indications

Table 4.5: Notifications and indications, Ranging Data Overwritten and Ranging Data Ready test cases

- Test Procedure

  1. Perform an action that will induce the IUT to receive CS Subevent Data (e.g., by the Lower Tester or IUT configuring and initiating a CS procedure).
  2. When the Ranging Data is ready, the IUT sends an indication of the Ranging Data Ready characteristic to the Lower Tester.
  3. Continue generating Ranging Data on the IUT until the IUT has run out of memory and is forced to delete older Ranging Data.
  4. The IUT sends an indication of the Ranging Data Overwritten characteristic to the Lower Tester.

- Expected Outcome

  Pass verdict

  The IUT only sends an indication of the Ranging Data Overwritten or Ranging Data Ready characteristic to the Lower Tester when configured for both notifications and indications.

4.5 Real-time Ranging Data

RAS/SR/RRD/BV-01-C [Real-time Ranging Data]

- Test Purpose

  Verify that the IUT sends notifications or indications of the Real-time Ranging Data characteristic when Ranging Data is available.

- Reference

  [3] 3.2.3

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1.
  - The Lower Tester has discovered and cached the RAS service and characteristic handles (e.g., by running the test procedures in Section 4.3).
  - The Ranging Data Ready characteristic is configured for indications.
  - No Ranging Data has been previously sent on the connection.

- Test Procedure

  Execute Steps 1–4 for each round in Table 4.6:

  1. The Lower Tester writes the value from Table 4.6 to the Real-time Ranging Data characteristic's Client Characteristic Configuration descriptor to enable notifications or indications.
  2. Perform an action that will induce the IUT to receive enough CS Subevent Data (e.g., by the Lower Tester or IUT configuring and initiating a CS procedure) such that the Rolling Segment Counter rolls over when incremented at 63.
  3. The IUT sends one or more Real-time Ranging Data notifications or indications to the Lower Tester.
  4. The Lower Tester writes 0x0000 to the Real-time Ranging Data characteristic's Client Characteristic Configuration descriptor to disable notifications and indications.

Round	Real-time Ranging Data Characteristic CCCD Write Value
1	0x0001 (Notification)
2	0x0002 (Indication)

Table 4.6: Real-time Ranging Data rounds

- Expected Outcome

  Pass verdict

  When notifications or indications are configured and enabled, the IUT sends Real-time Ranging Data notifications or indications with valid Ranging Data. The Ranging Data is sent chronologically with the oldest being sent first, and no parameters are filtered from the Ranging Data if the IUT supports Filter Ranging Data.

  When notifications or indications are disabled, the IUT ceases sending Real-time Ranging Data notifications or indications.

  The IUT never sends an indication of the Ranging Data Ready characteristic.

In Step 3:

- The first notification or indication sent has the First Segment bit in the Segmentation Header field set to 1 and the Last Segment bit set to 0. Segment Index is set to 0.
- For each notification or indication after the first but not the final, the First Segment bit and Last Segment bit are set to 0 and the Segment Index is increased by 1 from the previous value unless the previous value is 63, which means that the Segment Index goes to 0 when incremented.
- The final notification or indication sent has the First Segment bit set to 0 and the Last Segment bit set to 1.

RAS/SR/RRD/BV-02-C [Real-time Ranging Data with Ranging Data Filter]

- Test Purpose

  Verify that the IUT sends Ranging Data that applies to the current filter settings via Real-time Ranging Data notifications or indications to the Lower Tester.

- Reference

  [3] 3.2.3, 3.3.2.4

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1.
  - The Lower Tester has discovered and cached the RAS service and characteristic handles (e.g., by running the test procedures in Section 4.3).
  - The RAS Control Point characteristic is configured for indications.

- Test Procedure

  Execute Steps 1–10 for each round in Table 4.7:

  1. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x04 (Set Filter) and Parameter #1 set to the value in Table 4.7.
  2. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x02 (Response Code) and Parameter #1 set to 0x01 (Success) or Parameter #1 set to 0x04 (Success/Persisted) to the Lower Tester.
  3. The Lower Tester writes the value from Table 4.7 to the Real-time Ranging Data characteristic's Client Characteristic Configuration descriptor to enable notifications or indications.
  4. The Upper Tester sends the IUT the Channel Sounding Input Test Data for Filtering [8].
  5. The IUT sends one or more Real-time Ranging Data notifications or indications to the Lower Tester.
  6. The Lower Tester disconnects and reconnects with the IUT.
  7. The Lower Tester writes the value from Table 4.7 to the Real-time Ranging Data characteristic's Client Characteristic Configuration descriptor to enable notifications or indications.
  8. The Upper Tester sends the IUT the Channel Sounding Input Test Data for Filtering [8].
  9. The IUT sends one or more Real-time Ranging Data notifications or indications to the Lower Tester.
  10. The Lower Tester disconnects and reconnects with the IUT. The Lower Tester reconfigures the RAS Control Point characteristic for indications.

Round	CCCD Write Value	Parameter #1
1	0x0001 (Notification)	0x28 (Mode 0; Filter: Packet Quality and Packet Antenna)
		0x31 (Mode 1; Filter: Packet Quality, Packet NADM, Packet Antenna, Packet PCT1 and PCT2)
		0x4E (Mode 2; Filter: Tone Quality Indicator, Antenna Path 1, Antenna Path 3, and Antenna Path 4)
		0x15A3 (Mode 3; Filter: Packet Quality, Packet NADM, Packet RSSI, Packet Antenna, Antenna Permutation Index, Tone Quality Indicator, Antenna Path 2-4)
2	0x0002 (Indication)	0x28 (Mode 0; Filter: Packet Quality and Packet Antenna)
		0x31 (Mode 1; Filter: Packet Quality, Packet NADM, Packet Antenna, Packet PCT1 and PCT2)
		0x4E (Mode 2; Filter: Tone Quality Indicator, Antenna Path 1, Antenna Path 3, and Antenna Path 4)
		0x15A3 (Mode 3; Filter: Packet Quality, Packet NADM, Packet RSSI, Packet Antenna, Antenna Permutation Index, Tone Quality Indicator, Antenna Path 2-4)
3	0x0001 (Notification)	0x20 (Mode 0; Filter: All but Measured Freq Offset)
		0x21 (Mode 1; Filter: All but ToD ToA)
		0x0A (Mode 2; Filter: All but Tone_PCT)
		0x423 (Mode 3; Filter: All but ToD ToA and Tone_PCT)
4	0x0002 (Indication)	0x20 (Mode 0; Filter: All but Measured Freq Offset)
		0x21 (Mode 1; Filter: All but ToD ToA)
		0x0A (Mode 2; Filter: All but Tone_PCT)
		0x423 (Mode 3; Filter: All but ToD ToA and Tone_PCT)

Table 4.7: Real-time Ranging Data with Ranging Data Filter rounds

- Expected Outcome

  Pass verdict

  In Step 5, the IUT sends Real-time Ranging Data characteristic notifications or indications with Ranging Data that matches the Filtered Ranging Data Round 1 and 2 [9] for Rounds 1 and 2 in Table 4.7 and the Filtered Ranging Data Round 3 and 4 [10] for Rounds 3 and 4 in Table 4.7.

  In Step 9:

  - If the IUT does not permanently store the filter settings by replying with 0x01 (Success) in Step 2, then the IUT sends Real-time Ranging Data characteristic notifications or indications with all parameters for that mode present in the Ranging Data Body indicating that the IUT is not filtering out any parameters.
  - If the IUT permanently stores the filter settings by replying with 0x04 (Success/Persisted) in Step 2, then the IUT sends Real-time Ranging Data characteristic notifications or indications with Ranging Data that matches the Filtered Ranging Data Round 1 and 2 [9] for Rounds 1 and 2 in Table 4.7 and the Filtered Ranging Data Round 3 and 4 [10] for Rounds 3 and 4 in Table 4.7.

- Notes

  The Channel Sounding Input Test Data [8] contains invalid Channel Sounding Procedure Data as it includes data for all Modes in one Procedure so that Ranging Data Filtering can be tested more efficiently.

RAS/SR/RRD/BV-03-C [Real-time Ranging Data notifications and indications]

- Test Purpose

  Verify that the IUT only sends Real-time Ranging Data notifications when configured for both notifications and indications.

- Reference

  [3] 3.2.3.1

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1.
  - The Lower Tester has discovered and cached the RAS service and characteristic handles (e.g., by running the test procedures in Section 4.3).

- Test Procedure

  1. The Lower Tester writes 0x0003 to the Real-time Ranging Data characteristic's Client Characteristic Configuration descriptor to enable notifications and indications.
  2. Perform an action that will induce the IUT to receive CS Subevent Data (e.g., by the Lower Tester or IUT configuring and initiating a CS procedure).
  3. The IUT sends one or more Real-time Ranging Data notifications to the Lower Tester.

- Expected Outcome

  Pass verdict

  The IUT sends only notifications of the Real-time Ranging Data characteristic to the Lower Tester when configured for both notifications and indications.

RAS/SR/RRD/BV-04-C [Real-time Ranging Data overwritten]

- Test Purpose

  Verify that when Ranging Data is overwritten when sending Real-time Ranging Data notifications or indications, the IUT does not send a Ranging Data Overwritten notification or indication and begins sending notifications or indications of the new Ranging Data.

- Reference

  [3] 3.2.3.1

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1.
  - The Lower Tester has discovered and cached the RAS service and characteristic handles (e.g., by running the test procedures in Section 4.3).
  - The Ranging Data Overwritten characteristic is configured for notifications or indications.

- Test Procedure

  1. The Lower Tester enables Real-time Ranging Data notifications or indications.
  2. Perform an action that will induce the IUT to receive a large amount of CS Subevent Data (e.g., by the Lower Tester or IUT configuring and initiating a CS procedure).
  3. The IUT sends one or more Real-time Ranging Data notifications or indications to the Lower Tester.

4. As the IUT begins sending Real-time Ranging Data notifications or indications, perform an action that will induce the IUT to receive new CS Subevent Data (e.g., by the Lower Tester or IUT configuring and initiating a CS procedure).
5. The IUT stops sending Real-time Ranging Data notifications or indications containing the Ranging Data from Step 2 and starts sending Real-time Ranging Data notifications or indications to the Lower Tester containing the new Ranging Data from Step 4.

- Expected Outcome

  Pass verdict

  When the Ranging Data is overwritten in Step 4, the IUT stops sending the old Ranging Data and begins sending the new Ranging Data.

  The IUT does not notify or indicate the Ranging Data Overwritten characteristic after the Ranging Data is overwritten in Step 4.

RAS/SR/RRD/BV-05-C [Real-Time Ranging Data disconnection]

- Test Purpose

  Verify that the IUT does not resume sending Real-time Ranging Data notifications or indications after a disconnection occurs.

- Reference

  [3] 2.7

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1.
  - The Lower Tester has discovered and cached the RAS service and characteristic handles (e.g., by running the test procedures in Section 4.3).

- Test Procedure

  1. The Lower Tester enables Real-time Ranging Data notifications or indications.
  2. Perform an action that will induce the IUT to receive CS Subevent Data (e.g., by the Lower Tester or IUT configuring and initiating a CS procedure).
  3. The IUT sends one or more Real-time Ranging Data notifications or indications to the Lower Tester.
  4. As the IUT begins sending Real-time Ranging Data notifications or indications, the Lower Tester disconnects and reconnects with the IUT. The Lower Tester reconfigures the Real-time Ranging Data characteristic for notifications or indications.
  5. The IUT does not continue sending Real-time Ranging Data notifications or indications containing the previous Ranging Data.

- Expected Outcome

  Pass verdict

  After disconnection and reconnection occurs during the Real-time Ranging Data process, the IUT does not continue sending Real-time Ranging Data notifications or indications containing the previous Ranging Data.

4.6 RAS Control Point

RAS/SR/RCP/BV-01-C [Get Ranging Data]

- Test Purpose

  Verify that the IUT sends one complete Ranging Data via On-demand Ranging Data characteristic notifications or indications to the Lower Tester and processes the ACK Ranging Data when received after the transfer is complete.

- Reference

  [3] 3.3.1, 3.3.2.1

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1.
  - The Lower Tester has discovered and cached the RAS service and characteristic handles (e.g., by running the test procedures in Section 4.3).
  - The Ranging Data Ready characteristic is configured for indications.
  - The RAS Control Point characteristic is configured for indications.
  - No Ranging Data has been previously sent on the connection.

- Test Procedure

  Execute Steps 1–8 for each round in Table 4.8:

  1. The Lower Tester writes the value from Table 4.8 to the On-demand Ranging Data characteristic's Client Characteristic Configuration descriptor to enable notifications or indications.
  2. Perform an action that will induce the IUT to receive enough CS Subevent Data (e.g., by the Lower Tester or IUT configuring and initiating a CS procedure) such that the Rolling Segment Counter rolls over when incremented at 63.
  3. When the Ranging Data is ready, the IUT sends an indication of the Ranging Data Ready characteristic to the Lower Tester.
  4. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x00 (Get Ranging Data) and Parameter #1 set to the Ranging Counter value in Step 3.
  5. The IUT sends one or more On-demand Ranging Data notifications or indications to the Lower Tester.
  6. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x00 (Complete Ranging Data Response) and Parameter #1 set to the Ranging Counter value in Step 3 to the Lower Tester.
  7. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x01 (ACK Ranging Data) and Parameter #1 set to the Ranging Counter value in Step 3.
  8. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x02 (Response Code) and Parameter #1 set to 0x01 (Success) to the Lower Tester.

Round	On-demand Ranging Data CCCD Write Value
1	0x0001 (Notification)
2	0x0002 (Indication)

Table 4.8: Get Ranging Data rounds

- Expected Outcome

  Pass verdict

  The IUT sends a Ranging Data Ready indication when the Ranging Data is ready to be sent, On-demand Ranging Data notifications or indications when Ranging Data is being sent, a RAS Control Point indication with the Complete Ranging Data Response Op Code when Ranging Data has finished sending, and a RAS Control Point indication with the Success response code value after receiving the ACK Ranging Data.

  The Ranging Data is sent chronologically with the oldest being sent first, and no parameters are filtered from the Ranging Data if the IUT supports Filter Ranging Data.

  In Step 5:

  - The first notification or indication sent has the First Segment bit in the Segmentation Header set to 1 and the Last Segment bit set to 0. Segment Index is set to 0.
  - For each notification or indication after the first but not the final, the First Segment bit and Last Segment bit are set to 0 and the Segment Index is increased by 1 from the previous value unless the previous value is 63, which means that the Segment Index goes to 0 when incremented.
  - The final notification or indication sent has the First Segment bit set to 0 and the Last Segment bit set to 1.

RAS/SR/RCP/BV-02-C [Retrieve Lost Ranging Data Segments]

- Test Purpose

  Verify that the IUT retransmits segments of Ranging Data sent via On-demand Ranging Data characteristic notifications or indications to the Lower Tester.

- Reference

  [3] 3.3.1, 3.3.2.3

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1.
  - The Lower Tester has discovered and cached the RAS service and characteristic handles (e.g., by running the test procedures in Section 4.3).
  - The Ranging Data Ready characteristic is configured for indications.
  - The RAS Control Point characteristic is configured for indications.

- Test Procedure

  Execute Steps 1–17 for each round in Table 4.9:

  1. The Lower Tester writes the value from Table 4.9 to the On-demand Ranging Data characteristic's Client Characteristic Configuration descriptor to enable notifications or indications.
  2. Perform an action that will induce the IUT to receive CS Subevent Data (e.g., by the Lower Tester or IUT configuring and initiating a CS procedure).
  3. When the Ranging Data is ready, the IUT sends an indication of the Ranging Data Ready characteristic to the Lower Tester.
  4. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x00 (Get Ranging Data) and Parameter #1 set to the Ranging Counter value in Step 3.

5. The IUT sends multiple On-demand Ranging Data notifications or indications.
6. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x00 (Complete Ranging Data Response) and Parameter #1 set to the Ranging Counter value in Step 3 to the Lower Tester.
7. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x02 (Retrieve Lost Ranging Data Segments), Parameter #1 set to the Ranging Counter value in Step 3, and Parameter #2 and Parameter #3 set to a Segment Index value for one notification or indication sent in Step 5.
8. The IUT sends an On-demand Ranging Data notification or indication with Segment Index set to the value from Step 7.
9. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x01 (Complete Lost Ranging Data Segment Response), Parameter #1 set to the Ranging Counter value in Step 3, and Parameter #2 and Parameter #3 set to the values in Step 7 to the Lower Tester.
10. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x02 (Retrieve Lost Ranging Data Segments), Parameter #1 set to the Ranging Counter value in Step 3, Parameter #2 set to a Segment Index value for one notification or indication sent in Step 5, and Parameter #3 set to a valid higher Segment Index value than Parameter #2 that was sent in Step 5.
11. The IUT sends multiple On-demand Ranging Data notifications or indications with Segment Index set to the Parameter #2 and Parameter #3 range requested in Step 10.
12. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x01 (Complete Lost Ranging Data Segment Response), Parameter #1 set to the Ranging Counter value in Step 3, and Parameter #2 and Parameter #3 set to the values in Step 10 to the Lower Tester.
13. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x02 (Retrieve Lost Ranging Data Segments), Parameter #1 set to the Ranging Counter value in Step 3, Parameter #2 set to a Segment Index value for one notification or indication sent in Step 5, and Parameter #3 set to 0xFF.
14. The IUT sends multiple On-demand Ranging Data notifications or indications with Segment Index set from Parameter #2 requested in Step 13 to the last Segment Index value sent in Step 5.
15. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x01 (Complete Lost Ranging Data Segment Response), Parameter #1 set to the Ranging Counter value in Step 3, Parameter #2 set to the value in Step 13, and Parameter #3 set to the last Segment Index value sent in Step 5 to the Lower Tester.
16. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x01 (ACK Ranging Data) and Parameter #1 set to the Ranging Counter value in Step 3.
17. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x02 (Response Code) and Parameter #1 set to 0x01 (Success) to the Lower Tester.

Round	On-demand Ranging Data CCCD Write Value
1	0x0001 (Notification)
2	0x0002 (Indication)

Table 4.9: Retrieve Lost Ranging Data Segments rounds

- Expected Outcome

  Pass verdict

  The IUT resends single or multiple On-demand Ranging Data notifications or indications with the requested Segment Index when requested by the Lower Tester.

  The IUT sends RAS Control Point indications with the Complete Lost Ranging Data Segment Response Op Code when the requested Ranging Data segment(s) have been resent.

RAS/SR/RCP/BV-03-C [Abort Operation]

- Test Purpose

  Verify that the IUT stops a RAS Control Point process in progress when the Abort Operation is requested by the Lower Tester.

- Reference

  [3] 3.3.1, 3.3.2.5

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1.
  - The Lower Tester has discovered and cached the RAS service and characteristic handles (e.g., by running the test procedures in Section 4.3).
  - The Ranging Data Ready characteristic is configured for indications.
  - The RAS Control Point characteristic is configured for indications.
  - The On-demand Ranging Data characteristic is configured for notifications or indications.

- Test Procedure

  1. Perform an action that will induce the IUT to receive CS Subevent Data (e.g., by the Lower Tester or IUT configuring and initiating a CS procedure) with enough subevents such that the transmission cannot complete before an Abort Operation procedure is attempted.
  2. When the Ranging Data is ready, the IUT sends an indication of the Ranging Data Ready characteristic to the Lower Tester.
  3. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x00 (Get Ranging Data) and Parameter #1 set to the Ranging Counter value in Step 2.
  4. The IUT starts to send On-demand Ranging Data notifications or indications.
  5. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic and Op Code set to 0x03 (Abort Operation).
  6. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x02 (Response Code) and Parameter #1 set to 0x01 (Success) to the Lower Tester.

- Expected Outcome

  Pass verdict

  The IUT stops sending On-demand Ranging Data notifications or indications and does not send the RAS Control Point indication with the Complete Ranging Data Response Op Code after sending the RAS Control Point indication with the Success response code value to the Lower Tester indicating that the Abort Operation process has completed.

RAS/SR/RCP/BV-04-C [Get Ranging Data with Ranging Data Filtering]

- Test Purpose

  Verify that the IUT sends Ranging Data that applies to the current filter settings via On-demand Ranging Data characteristic notifications or indications to the Lower Tester.

- Reference

  [3] 3.3.2.4

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1.
  - The Lower Tester has discovered and cached the RAS service and characteristic handles (e.g., by running the test procedures in Section 4.3).
  - The Ranging Data Ready characteristic is configured for indications.
  - The RAS Control Point characteristic is configured for indications.

- Test Procedure

  Execute Steps 1–19 for each round in Table 4.10:

  1. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x04 (Set Filter) and Parameter #1 set to the value in Table 4.10.
  2. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x02 (Response Code) and Parameter #1 set to 0x01 (Success) or Parameter #1 set to 0x04 (Success/Persisted) to the Lower Tester.
  3. The Lower Tester writes the value from Table 4.10 to the On-demand Ranging Data characteristic's Client Characteristic Configuration descriptor to enable notifications or indications.
  4. The Upper Tester sends the IUT the Channel Sounding Input Test Data for Filtering [8].
  5. When the Ranging Data is ready, the IUT sends an indication of the Ranging Data Ready characteristic to the Lower Tester.
  6. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x00 (Get Ranging Data) and Parameter #1 set to the Ranging Counter value in Step 5.
  7. The IUT sends one or more On-demand Ranging Data notifications or indications to the Lower Tester.
  8. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x00 (Complete Ranging Data Response) and Parameter #1 set to the Ranging Counter value in Step 5 to the Lower Tester.
  9. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x01 (ACK Ranging Data) and Parameter #1 set to the Ranging Counter value in Step 5.
  10. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x02 (Response Code) and Parameter #1 set to 0x01 (Success) to the Lower Tester.
  11. The Lower Tester disconnects and reconnects with the IUT. The Lower Tester reconfigures the Ranging Data Ready characteristic for indications, the RAS Control Point characteristic for indications, and the On-demand Ranging Data characteristic for the property in Table 4.10.
  12. The Upper Tester sends the IUT the Channel Sounding Input Test Data for Filtering [8].
  13. When the Ranging Data is ready, the IUT sends an indication of the Ranging Data Ready characteristic to the Lower Tester.

14. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x00 (Get Ranging Data) and Parameter #1 set to the Ranging Counter value in Step 13.
15. The IUT sends one or more On-demand Ranging Data notifications or indications to the Lower Tester.
16. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x00 (Complete Ranging Data Response) and Parameter #1 set to the Ranging Counter value in Step 13 to the Lower Tester.
17. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x01 (ACK Ranging Data) and Parameter #1 set to the Ranging Counter value in Step 13.
18. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x02 (Response Code) and Parameter #1 set to 0x01 (Success) to the Lower Tester.
19. The Lower Tester disconnects and reconnects with the IUT. The Lower Tester reconfigures the Ranging Data Ready characteristic for indications and the RAS Control Point characteristic for indications.

Round	CCCD Write Value	Parameter #1
1	0x0001 (Notification)	0x28 (Mode 0; Filter: Packet Quality and Packet Antenna)
		0x31 (Mode 1; Filter: Packet Quality, Packet NADM, Packet Antenna, Packet PCT1 and PCT2)
		0x4E (Mode 2; Filter: Tone Quality Indicator, Antenna Path 1, Antenna Path 3, and Antenna Path 4)
		0x15A3 (Mode 3; Filter: Packet Quality, Packet NADM, Packet RSSI, Packet Antenna, Antenna Permutation Index, Tone Quality Indicator, Antenna Path 2-4)
2	0x0002 (Indication)	0x28 (Mode 0; Filter: Packet Quality and Packet Antenna)
		0x31 (Mode 1; Filter: Packet Quality, Packet NADM, Packet Antenna, Packet PCT1 and PCT2)
		0x4E (Mode 2; Filter: Tone Quality Indicator, Antenna Path 1, Antenna Path 3, and Antenna Path 4)
		0x15A3 (Mode 3; Filter: Packet Quality, Packet NADM, Packet RSSI, Packet Antenna, Antenna Permutation Index, Tone Quality Indicator, Antenna Path 2-4)
3	0x0001 (Notification)	0x20 (Mode 0; Filter: All but Measured Freq Offset)
		0x21 (Mode 1; Filter: All but ToD ToA)
		0x0A (Mode 2; Filter: All but Tone_PCT)
		0x423 (Mode 3; Filter: All but ToD ToA and Tone_PCT)
4	0x0002 (Indication)	0x20 (Mode 0; Filter: All but Measured Freq Offset)
		0x21 (Mode 1; Filter: All but ToD ToA)
		0x0A (Mode 2; Filter: All but Tone_PCT)
		0x423 (Mode 3; Filter: All but ToD ToA and Tone_PCT)

Table 4.10: Get Ranging Data with Ranging Data Filtering rounds

- Expected Outcome

  Pass verdict

  In Step 7, the IUT sends On-demand Ranging Data characteristic notifications or indications with Ranging Data that matches the Filtered Ranging Data Round 1 and 2 [9] for Rounds 1 and 2 in Table 4.10 and the Filtered Ranging Data Round 3 and 4 [10] for Rounds 3 and 4 in Table 4.10.

  In Step 15:

  - If the IUT does not permanently store the filter settings by replying with 0x01 (Success) in Step 2, then the IUT sends On-demand Ranging Data characteristic notifications or indications with all parameters for that mode present in the Ranging Data Body indicating that the IUT is not filtering out any parameters.
  - If the IUT permanently stores the filter settings by replying with 0x04 (Success/Persisted) in Step 2, then the IUT sends On-demand Ranging Data characteristic notifications or indications with Ranging Data that matches the Filtered Ranging Data Round 1 and 2 [9] for Rounds 1 and 2 in Table 4.10 and the Filtered Ranging Data Round 3 and 4 [10] for Rounds 3 and 4 in Table 4.10.

- Notes

  The Channel Sounding Input Test Data [8] contains invalid Channel Sounding Procedure Data as it includes data for all Modes in one Procedure so that Ranging Data Filtering can be tested more efficiently.

RAS/SR/RCP/BV-05-C [RAS Control Point process disconnection]

- Test Purpose

  Verify that the IUT does not resume a RAS Control Point process if a disconnection occurs during the process.

- Reference

  [3] 3.3.4

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1.
  - The Lower Tester has discovered and cached the RAS service and characteristic handles (e.g., by running the test procedures in Section 4.3).
  - The Ranging Data Ready characteristic is configured for indications.
  - The RAS Control Point characteristic is configured for indications.
  - The On-demand Ranging Data characteristic is configured for notifications or indications.

- Test Procedure

  1. Perform an action that will induce the IUT to receive CS Subevent Data (e.g., by the Lower Tester or IUT configuring and initiating a CS procedure).
  2. When the Ranging Data is ready, the IUT sends an indication of the Ranging Data Ready characteristic to the Lower Tester.
  3. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x00 (Get Ranging Data) and Parameter #1 set to the Ranging Counter value in Step 2.

4. The IUT sends one or more On-demand Ranging Data notifications or indications to the Lower Tester.
5. As the IUT sends On-demand Ranging Data notifications or indications, the Lower Tester disconnects and reconnects with the IUT. The Lower Tester reconfigures the Ranging Data Ready characteristic for indications, the RAS Control Point characteristic for indications, and the On-demand Ranging Data characteristic for notifications or indications.
6. The IUT does not continue sending On-demand Ranging Data notifications or indications.

- Expected Outcome

  Pass verdict

  After disconnection and reconnection occurs during the middle of the RAS Control Point process, the IUT does not continue sending On-demand Ranging Data notifications or indications.

4.7 Service procedure error handling

4.7.1 Op Code Not Supported

- Test Purpose

  Verify that the IUT responds to a RAS Control Point write with an unsupported Op Code with the “Op Code Not Supported” response code.

- Reference

  [3] 3.3.3

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1.
  - The Lower Tester has discovered and cached the RAS service and characteristic handles (e.g., by running the test procedures in Section 4.3).
  - The RAS Control Point characteristic is configured for indications.

- Test Case Configuration

Test Case	Op Code
RAS/SR/SPE/BI-01-C [Op Code Not Supported, Retrieve Lost Ranging Data Segments]	0x02 (Retrieve Lost Ranging Data Segments)
RAS/SR/SPE/BI-02-C [Op Code Not Supported, Abort Operation]	0x03 (Abort Operation)
RAS/SR/SPE/BI-03-C [Op Code Not Supported, Set Filter]	0x04 (Set Filter)
RAS/SR/SPE/BI-04-C [Op Code Not Supported, RFU]	Any RFU value

Table 4.11: Op Code Not Supported test cases

- Test Procedure

1. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to the value in Table 4.11 and any required Parameters set to valid values.
2. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x02 (Response Code) and Parameter #1 set to 0x02 (Op Code Not Supported) to the Lower Tester.

- Expected Outcome

  Pass verdict

  The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x02 (Response Code) and Parameter #1 set to 0x02 (Op Code Not Supported) to the Lower Tester.

RAS/SR/SPE/BI-05-C [Invalid Parameter, Abort Operation]

- Test Purpose

  Verify that the IUT responds to an Abort Operation RAS Control Point write with a Parameter with the Invalid Parameter response code.

- Reference

  [3] 3.3.3

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1.
  - The Lower Tester has discovered and cached the RAS service and characteristic handles (e.g., by running the test procedures in Section 4.3).
  - The Ranging Data Ready characteristic is configured for indications.
  - The RAS Control Point characteristic is configured for indications.
  - The On-demand Ranging Data characteristic is configured for notifications or indications.

- Test Procedure

  1. Perform an action that will induce the IUT to receive CS Subevent Data (e.g., by the Lower Tester or IUT configuring and initiating a CS procedure).
  2. When the Ranging Data is ready, the IUT sends an indication of the Ranging Data Ready characteristic to the Lower Tester.
  3. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x00 (Get Ranging Data) and Parameter #1 set to the Ranging Counter value in Step 2.
  4. The IUT sends one or more On-demand Ranging Data notifications or indications to the Lower Tester.
  5. As the IUT sends On-demand Ranging Data notifications or indications, the Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x03 (Abort Operation) and Parameter set to any uint8 value.
  6. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x02 (Response Code) and Parameter #1 set to 0x03 (Invalid Parameter) to the Lower Tester.
  7. The IUT continues sending On-demand Ranging Data notifications or indications relating to the request in Step 3.
  8. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x00 (Complete Ranging Data Response) and Parameter #1 set to the Ranging Counter value in Step 2 to the Lower Tester.

- Expected Outcome

  Pass verdict

  In Step 6, the IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x02 (Response Code) and Parameter #1 set to 0x03 (Invalid Parameter) to the Lower Tester.

  The IUT completes the original Get Ranging Data request.

RAS/SR/SPE/BI-06-C [Get Ranging Data and ACK Ranging Data errors]

- Test Purpose

  Verify that the IUT responds with the No Records Found response code when the IUT does not find Ranging Data records that the Lower Tester requests via the Get Ranging Data and ACK Ranging Data process, the IUT responds with Server Busy when receiving a RAS Control Point write request from the Lower Tester while a RAS Control Point request is already running, and the IUT responds with Invalid Parameter when Get Ranging Data and ACK Ranging Data are written with the wrong number of Parameters or a Parameter with the wrong length.

- Reference

  [3] 3.3.2.1, 3.3.2.2, 3.3.3

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1.
  - The Lower Tester has discovered and cached the RAS service and characteristic handles (e.g., by running the test procedures in Section 4.3).
  - The Ranging Data Ready characteristic is configured for indications.
  - The RAS Control Point characteristic is configured for indications.
  - The On-demand Ranging Data characteristic is configured for notifications or indications.

- Test Procedure

  1. Perform an action that will induce the IUT to receive CS Subevent Data (e.g., by the Lower Tester or IUT configuring and initiating a CS procedure).
  2. When the Ranging Data is ready, the IUT sends an indication of the Ranging Data Ready characteristic to the Lower Tester.

  Execute Steps 3–4 for each round in Table 4.12:

  3. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x00 (Get Ranging Data) and Parameters set to the values in Table 4.12.
  4. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x02 (Response Code) and Parameter #1 set to the Response Code Value in Table 4.12 to the Lower Tester.
  5. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x00 (Get Ranging Data) and Parameter #1 set to the Ranging Counter value in Step 2.
  6. The IUT sends one or more On-demand Ranging Data notifications or indications to the Lower Tester.
  7. As the IUT sends On-demand Ranging Data notifications or indications, the Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point

characteristic, Op Code set to 0x00 (Get Ranging Data) and Parameter #1 set to the Ranging Counter value in Step 2.

8. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x02 (Response Code) and Parameter #1 set to 0x07 (Server Busy) to the Lower Tester.
9. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x00 (Complete Ranging Data Response) and Parameter #1 set to the Ranging Counter value in Step 2 to the Lower Tester.

Execute Steps 10–11 for each round in Table 4.12:

10. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x01 (ACK Ranging Data) and Parameters set to the values in Table 4.12.
11. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x02 (Response Code) and Parameter #1 set to Response Code Value in Table 4.12 to the Lower Tester.
12. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x01 (ACK Ranging Data) and Parameter #1 set to the Ranging Counter value in Step 2.
13. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x02 (Response Code) and Parameter #1 set to 0x01 (Success) to the Lower Tester.

Round	Parameters	Response Code Value
1	Parameter #1: Unused Ranging Counter value	0x08 (No Records Found)
2	Parameter #1: Ranging Counter value in Step 2 Parameter #2: Any uint8 value	0x03 (Invalid Parameter)
3	Parameter #1: Any uint8 value	0x03 (Invalid Parameter)

Table 4.12: Get Ranging Data and ACK Ranging Data errors rounds

- Expected Outcome

  Pass verdict

  For each round: In Steps 4 and 11, the IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x02 (Response Code) and Parameter #1 set to the Response Code Value in Table 4.12 to the Lower Tester.

  After Step 7, the IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x02 (Response Code) and Parameter #1 set to 0x07 (Server Busy) to the Lower Tester and continues sending On-demand Ranging Data notifications or indications to the Lower Tester.

RAS/SR/SPE/BI-07-C [Server Busy]

- Test Purpose

  Verify that the IUT responds to an Op Code procedure request while an Op Code procedure is already occurring with the Server Busy response code value.

- Reference

  [3] 3.3.3

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1.

- The Lower Tester has discovered and cached the RAS service and characteristic handles (e.g., by running the test procedures in Section 4.3).
- The Ranging Data Ready characteristic is configured for indications.
- The RAS Control Point characteristic is configured for indications.
- The On-demand Ranging Data characteristic is configured for notifications or indications.

- Test Procedure

  1. Perform an action that will induce the IUT to receive CS Subevent Data (e.g., by the Lower Tester or IUT configuring and initiating a CS procedure).
  2. When the Ranging Data is ready, the IUT sends an indication of the Ranging Data Ready characteristic to the Lower Tester.
  3. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x00 (Get Ranging Data) and Parameter #1 set to the Ranging Counter value in Step 2.
  4. The IUT sends one or more On-demand Ranging Data notifications or indications to the Lower Tester.
  5. As the IUT sends On-demand Ranging Data notifications or indications, the Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x01 (ACK Ranging Data) and Parameter #1 set to the Ranging Counter value in Step 2.
  6. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x02 (Response Code) and Parameter #1 set to 0x07 (Server Busy) to the Lower Tester.
  7. The IUT continues sending On-demand Ranging Data notifications or indications relating to the request in Step 3.
  8. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x00 (Complete Ranging Data Response) and Parameter #1 set to the Ranging Counter value in Step 2 to the Lower Tester.

- Expected Outcome

  Pass verdict

  In Step 6, the IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x02 (Response Code) and Parameter #1 set to 0x07 (Server Busy) to the Lower Tester.

  The IUT completes the original Get Ranging Data request.

4.7.2 Invalid Parameter – Set Filter

- Test Purpose

  Verify that the IUT responds with the Invalid Parameter response code when the Set Filter Op Code is written to the RAS Control Point after notifications or indications of the Real-time Ranging Data characteristic or On-demand Ranging Data characteristic are enabled.

- Reference

  [3] 3.3.2.4, 3.3.2.5

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1.
  - The Lower Tester has discovered and cached the RAS service and characteristic handles (e.g., by running the test procedures in Section 4.3).

- The Ranging Data Ready characteristic is configured for indications.
- The RAS Control Point characteristic is configured for indications.
- The characteristic in Table 4.13 is configured for notifications or indications.

- Test Case Configuration

Test Case	Characteristic
RAS/SR/SPE/BI-08-C [Invalid Parameter – Set Filter, On-demand Ranging Data]	On-demand Ranging Data
RAS/SR/SPE/BI-09-C [Invalid Parameter – Set Filter, Real-time Ranging Data]	Real-time Ranging Data

Table 4.13: Invalid Parameter – Set Filter test cases

- Test Procedure

1. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x04 (Set Filter) and Parameters set to valid values.
2. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x02 (Response Code) and Parameter #1 set to 0x03 (Invalid Parameter) to the Lower Tester.
3. The Lower Tester writes 0x0000 to the Client Characteristic Configuration descriptor of the characteristic in Table 4.13 to disable notifications or indications.

Execute Steps 4–5 for each round in Table 4.14:

4. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x04 (Set Filter) and Parameters set to the values in Table 4.14.
5. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x02 (Response Code) and Parameter #1 set to 0x03 (Invalid Parameter) to the Lower Tester.
6. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x04 (Set Filter) and Parameter #1 set to 0xFFFC (Mode 0 with all 1s in the Filter bit mask).
7. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x02 (Response Code) and Parameter #1 set to 0x01 (Success) or Parameter #1 set to 0x04 (Success/Persisted) to the Lower Tester.

Round	Parameters
1	Parameter #1: Any valid value with Mode 2 Parameter #2: Any uint8 value
2	Parameter #1: Any uint8 value

Table 4.14: Invalid Parameter – Set Filter rounds

- Expected Outcome

Pass verdict

In Step 2 and for each round in Step 5, the IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x02 (Response Code) and Parameter #1 set to 0x03 (Invalid Parameter) to the Lower Tester.

In Step 7, the IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x02 (Response Code) and Parameter #1 set to 0x01 (Success) or Parameter #1 set to 0x04 (Success/Persisted) to the Lower Tester.

RAS/SR/SPE/BI-10-C [Retrieve Lost Ranging Data Segments request errors]

- Test Purpose

  Verify that the IUT responds with the Server Busy response code, the No Records Found response code, and the Invalid Parameter response code when a Retrieve Lost Ranging Data Segments process is requested with various errors, and the IUT ignores additional Retrieve Lost Ranging Data Segments requests while a retransmission is in progress.

- Reference

  [3] 3.3.2.3, 3.3.3

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1.
  - The Lower Tester has discovered and cached the RAS service and characteristic handles (e.g., by running the test procedures in Section 4.3).
  - The Ranging Data Ready characteristic is configured for indications.
  - The RAS Control Point characteristic is configured for indications.

- Test Procedure

  1. Perform an action that will induce the IUT to receive CS Subevent Data (e.g., by the Lower Tester or IUT configuring and initiating a CS procedure).
  2. When the Ranging Data is ready, the IUT sends an indication of the Ranging Data Ready characteristic to the Lower Tester.
  3. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x02 (Retrieve Lost Ranging Data Segments), Parameter #1 set to the Ranging Counter value in Step 2, and Parameter #2 and Parameter #3 set to a valid Segment Index value.
  4. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x02 (Response Code) and Parameter #1 set to 0x03 (Invalid Parameter) to the Lower Tester.
  5. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x00 (Get Ranging Data) and Parameter #1 set to the Ranging Counter value in Step 2.
  6. The IUT sends one or more On-demand Ranging Data notifications or indications to the Lower Tester.
  7. As the IUT sends On-demand Ranging Data notifications or indications, the Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x02 (Retrieve Lost Ranging Data Segments) and valid Parameter values.
  8. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x02 (Response Code) and Parameter #1 set to 0x07 (Server Busy) to the Lower Tester.
  9. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x00 (Complete Ranging Data Response) and Parameter #1 set to the Ranging Counter value in Step 2 to the Lower Tester.

  Execute Steps 10–11 for each round in Table 4.15:

  10. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x02 (Retrieve Lost Ranging Data Segments), and Parameters set to the values in Table 4.15.

11. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x02 (Response Code) and Parameter #1 set to the Response Code Value in Table 4.15 to the Lower Tester.
12. The Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x02 (Retrieve Lost Ranging Data Segments), Parameter #1 set to the Ranging Counter value in Step 2, Parameter #2 set to a Segment Index value for one notification or indication sent in Step 6, and Parameter #3 set to a valid higher Segment Index value than Parameter #2 that was sent in Step 6.
13. As the IUT sends On-demand Ranging Data notifications or indications, the Lower Tester executes the GATT Write Without Response sub-procedure with the RAS Control Point characteristic, Op Code set to 0x02 (Retrieve Lost Ranging Data Segments) and valid Parameter values.
14. The IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x01 (Complete Lost Ranging Data Segment Response), Parameter #1 set to the Ranging Counter value in Step 2, and Parameter #2 and Parameter #3 set to the values in Step 12 to the Lower Tester.

Round	Parameters	Response Code Value
1	Parameter #1: Unused Ranging Counter value Parameters #2 and #3: Valid Segment Index value sent in Step 6	0x08 (No Records Found)
2	Parameter #1: Ranging Counter value in Step 2 Parameter #2: Valid Segment Index value sent in Step 6 Parameter #3: Segment Index value not sent in Step 6	0x08 (No Records Found)
3	Parameter #1: Ranging Counter value in Step 2 Parameters #2 and #3: Valid Segment Index value sent in Step 6 Parameter #4: Any uint8 value	0x03 (Invalid Parameter)

Table 4.15: Retrieve Lost Ranging Data Segments request errors rounds

- Expected Outcome

  Pass verdict

  In Step 4, the IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x02 (Response Code) and Parameter #1 set to 0x03 (Invalid Parameter) to the Lower Tester.

  In Step 8, the IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x02 (Response Code) and Parameter #1 set to 0x07 (Server Busy) to the Lower Tester.

  For each round: In Step 11, the IUT sends an indication of the RAS Control Point characteristic with Op Code set to 0x02 (Response Code) and Parameter #1 set to the Response Code Value in Table 4.15 to the Lower Tester.

  In Step 13, the IUT ignores the additional Retrieve Lost Ranging Data Segments procedure request while a re-transmission is already in progress and sends a RAS Control Point indication when the Retrieve Lost Ranging Data Segments request in Step 12 is completed.

RAS/SR/SPE/BI-11-C [Client enables both Real-time Ranging Data and On-demand Ranging Data notifications or indications]

- Test Purpose

  Verify that the IUT responds with the Client Characteristic Configuration Descriptor Improperly Configured error when both Real-time Ranging Data and On-demand Ranging Data notifications or indications are enabled.

- Reference

  [3] 2.7

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1.
  - The Lower Tester has discovered and cached the RAS service and characteristic handles (e.g., by running the test procedures in Section 4.3).

- Test Procedure

  1. The Lower Tester writes 0x0001 or 0x0002 to the Real-time Ranging Data characteristic's Client Characteristic Configuration descriptor to enable notifications or indications.
  2. The Lower Tester writes 0x0001 or 0x0002 to the On-demand Ranging Data characteristic's Client Characteristic Configuration descriptor to enable notifications or indications.
  3. The IUT sends an ATT Error Response with Error Code set to 0xFD (Client Characteristic Configuration Descriptor Improperly Configured).
  4. The Lower Tester reads the value of the Real-time Ranging Data and On-demand Ranging Data Client Characteristic Configuration descriptors.
  5. The Lower Tester writes 0x0000 to the Real-time Ranging Data characteristic's Client Characteristic Configuration descriptor to disable notifications or indications.
  6. The Lower Tester writes 0x0001 or 0x0002 to the On-demand Ranging Data characteristic's Client Characteristic Configuration descriptor to enable notifications or indications.
  7. The Lower Tester writes 0x0001 or 0x0002 to the Real-time Ranging Data characteristic's Client Characteristic Configuration descriptor to enable notifications or indications.
  8. The IUT sends an ATT Error Response with Error Code set to 0xFD (Client Characteristic Configuration Descriptor Improperly Configured).
  9. The Lower Tester reads the value of the Real-time Ranging Data and On-demand Ranging Data Client Characteristic Configuration descriptors.

- Expected Outcome

  Pass verdict

  In Steps 3 and 8, the IUT rejects the second CCCD write and responds with the 0xFD error code.

  In Step 4, the Real-time Ranging Data CCCD is set to 0x0001 or 0x0002 and On-demand Ranging Data CCCD is set to 0x0000.

  In Step 9, Real-time Ranging Data CCCD is set to 0x0000 and On-demand Ranging Data CCCD is set to 0x0001 or 0x0002.

4.7.3 Enable unsupported notifications

- Test Purpose

  Verify that the IUT rejects the write and sends the Write Request Rejected error code when notifications are enabled but not supported for a characteristic.

- Reference

  [3] 2.7

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1.
  - The Lower Tester has discovered and cached the RAS service and characteristic handles (e.g., by running the test procedures in Section 4.3).

- Test Case Configuration

Test Case	Characteristic
RAS/SR/SPE/BI-12-C [Enable unsupported notifications, Ranging Data Ready]	Ranging Data Ready
RAS/SR/SPE/BI-13-C [Enable unsupported notifications, Ranging Data Overwritten]	Ranging Data Overwritten

Table 4.16: Enable unsupported notifications test cases

- Test Procedure

  1. The Lower Tester writes 0x0001 to the Client Characteristic Configuration descriptor of the characteristic in Table 4.16 to enable notifications.
  2. The IUT sends an ATT Error Response with Error Code set to 0xFC (Write Request Rejected).

- Expected Outcome

  Pass verdict

  The IUT rejects the CCCD write and responds with the 0xFC error code.

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 Ranging Service [3].

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

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

Test Case(s): The applicable test case identifiers are required for Bluetooth Qualification if the corresponding y/x references defined in the Item column are supported. Further details about the function of the TCMT are elaborated in [2].

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

Item	Feature	Test Case(s)
RAS 1/2	Ranging Service	RAS/SR/SGGIT/SER/BV-01-C RAS/SR/SPE/BI-04-C
RAS 2/1	RAS Features characteristic	RAS/SR/SGGIT/CHA/BV-01-C RAS/SR/RCO/BV-01-C
RAS 2/2	Real-time Ranging Data characteristic	RAS/SR/SGGIT/CHA/BV-02-C RAS/SR/RRD/BV-01-C RAS/SR/RRD/BV-03-C RAS/SR/RRD/BV-04-C RAS/SR/RRD/BV-05-C
RAS 2/3	On-demand Ranging Data characteristic	RAS/SR/SGGIT/CHA/BV-03-C
RAS 2/4	RAS Control Point characteristic	RAS/SR/SGGIT/CHA/BV-04-C
RAS 2/5 AND NOT RAS 2/6 AND NOT RAS 2/7	Ranging Data Ready characteristic - Indicate	RAS/SR/SGGIT/CHA/BV-05-C
RAS 2/5 AND RAS 2/6 AND NOT RAS 2/7	Ranging Data Ready characteristic - Indicate and Notify	RAS/SR/SGGIT/CHA/BV-06-C
RAS 2/5 AND NOT RAS 2/6 AND RAS 2/7	Ranging Data Ready characteristic - Indicate and Read	RAS/SR/SGGIT/CHA/BV-07-C
RAS 2/5 AND RAS 2/6 AND RAS 2/7	Ranging Data Ready characteristic - Indicate, Notify, and Read	RAS/SR/SGGIT/CHA/BV-08-C
RAS 2/5	Ranging Data Ready, Indication	RAS/SR/RCO/BV-05-C
RAS 2/6	Ranging Data Ready, Notification	RAS/SR/RCO/BV-06-C
RAS 2/7	Ranging Data Ready, Read	RAS/SR/RCO/BV-07-C

Item	Feature	Test Case(s)
RAS 2/5 AND RAS 2/6	Ranging Data Ready notifications and indications	RAS/SR/RCO/BV-09-C
RAS 2/8 AND NOT RAS 2/9 AND NOT RAS 2/10	Ranging Data Overwritten characteristic – Indicate	RAS/SR/SGGIT/CHA/BV-09-C
RAS 2/8 AND RAS 2/9 AND NOT RAS 2/10	Ranging Data Overwritten characteristic – Indicate and Notify	RAS/SR/SGGIT/CHA/BV-10-C
RAS 2/8 AND NOT RAS 2/9 AND RAS 2/10	Ranging Data Overwritten characteristic – Indicate and Read	RAS/SR/SGGIT/CHA/BV-11-C
RAS 2/8 AND RAS 2/9 AND RAS 2/10	Ranging Data Overwritten characteristic – Indicate, Notify, and Read	RAS/SR/SGGIT/CHA/BV-12-C
RAS 2/8	Ranging Data Overwritten, Indication	RAS/SR/RCO/BV-02-C
RAS 2/9	Ranging Data Overwritten, Notification	RAS/SR/RCO/BV-03-C
RAS 2/10	Ranging Data Overwritten, Read	RAS/SR/RCO/BV-04-C
RAS 2/8 AND RAS 2/9	Ranging Data Overwritten notifications and indications	RAS/SR/RCO/BV-08-C
RAS 2/2 AND RAS 3/5	Real-time Ranging Data with Ranging Data Filter	RAS/SR/RRD/BV-02-C RAS/SR/SPE/BI-09-C
RAS 3/1	Get Ranging Data	RAS/SR/RCP/BV-01-C RAS/SR/RCP/BV-05-C
RAS 3/3	Retrieve Lost Ranging Data Segments	RAS/SR/RCP/BV-02-C RAS/SR/SPE/BI-10-C
RAS 3/4	RAS Control Point Abort Operation	RAS/SR/RCP/BV-03-C RAS/SR/SPE/BI-05-C
RAS 2/3 AND RAS 3/5	Get Ranging Data with Ranging Data Filtering	RAS/SR/RCP/BV-04-C RAS/SR/SPE/BI-08-C
NOT RAS 3/3	Op Code Not Supported, Retrieve Lost Ranging Data Segments	RAS/SR/SPE/BI-01-C
NOT RAS 3/4	Op Code Not Supported, Abort Operation	RAS/SR/SPE/BI-02-C
NOT RAS 3/5	Op Code Not Supported, Filter	RAS/SR/SPE/BI-03-C
RAS 3/1 OR RAS 3/2	Get Ranging Data and ACK Ranging Data - No Records Found and Server Busy	RAS/SR/SPE/BI-06-C RAS/SR/SPE/BI-07-C
RAS 2/2 AND RAS 2/3	Client enables both Real-time Ranging Data and On-demand Ranging Data notifications or indications	RAS/SR/SPE/BI-11-C
NOT RAS 2/6	Enable unsupported notifications, Ranging Data Ready	RAS/SR/SPE/BI-12-C
NOT RAS 2/9	Enable unsupported notifications, Ranging Data Overwritten	RAS/SR/SPE/BI-13-C

Table 5.1: Test case mapping

6 Revision history and acknowledgments

Revision History

Publication Number	Revision Number	Date	Comments
0	p0	2024-11-19	Approved by BTI on 2024-10-29. RAS v1.0 adopted by the BoD on 2024-11-12. Prepared for initial publication.
	p1r00	2025-05-07	TSE 27420 (rating 1): Added a note to RAS/SR/RRD/BV-02-C and RAS/SR/RCP/BV-04-C regarding sample data for Filtering.
1	p1	2025-07-08	Approved by BTI on 2025-06-15. Prepared for TCRL pkg100 publication.

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Name	Company
Dejan Berec	Bluetooth SIG, Inc.
Tiberiu Marinescu	Bluetooth SIG, Inc.