

Volume Control Profile (VCP)

Bluetooth® Implementation Conformance Statement (ICS) Proforma

- **Revision:** VCP.ICS.p1 edition 2
- **Revision Date:** 2023-03-15
- **Prepared By:** Generic Audio Working Group
- **Published during TCRL:** TCRL.2022-1



This document, regardless of its title or content, is not a Bluetooth Specification as defined in the Bluetooth Patent/Copyright License Agreement (“PCLA”) and Bluetooth Trademark License Agreement. Use of this document by members of Bluetooth SIG is governed by the membership and other related agreements between Bluetooth SIG Inc. (“Bluetooth SIG”) and its members, including the PCLA and other agreements posted on Bluetooth SIG’s website located at www.bluetooth.com.

THIS DOCUMENT IS PROVIDED “AS IS” AND BLUETOOTH SIG, ITS MEMBERS, AND THEIR AFFILIATES MAKE NO REPRESENTATIONS OR WARRANTIES AND DISCLAIM ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY, TITLE, NON-INFRINGEMENT, FITNESS FOR ANY PARTICULAR PURPOSE, THAT THE CONTENT OF THIS DOCUMENT IS FREE OF ERRORS.

TO THE EXTENT NOT PROHIBITED BY LAW, BLUETOOTH SIG, ITS MEMBERS, AND THEIR AFFILIATES DISCLAIM ALL LIABILITY ARISING OUT OF OR RELATING TO USE OF THIS DOCUMENT AND ANY INFORMATION CONTAINED IN THIS DOCUMENT, INCLUDING LOST REVENUE, PROFITS, DATA OR PROGRAMS, OR BUSINESS INTERRUPTION, OR FOR SPECIAL, INDIRECT, CONSEQUENTIAL, INCIDENTAL OR PUNITIVE DAMAGES, HOWEVER CAUSED AND REGARDLESS OF THE THEORY OF LIABILITY, AND EVEN IF BLUETOOTH SIG, ITS MEMBERS, OR THEIR AFFILIATES HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

This document is proprietary to Bluetooth SIG. This document may contain or cover subject matter that is intellectual property of Bluetooth SIG and its members. The furnishing of this document does not grant any license to any intellectual property of Bluetooth SIG or its members.

This document is subject to change without notice.

Copyright © 2019–2023 by Bluetooth SIG, Inc. The Bluetooth word mark and logos are owned by Bluetooth SIG, Inc. Other third-party brands and names are the property of their respective owners.



Contents

1	Identification of the implementation.....	4
1.1	Implementation Under Test (IUT) identification	4
1.2	Roles	5
1.3	Transports.....	5
1.4	Volume Renderer Role	5
1.4.1	Services – Volume Renderer Role.....	5
1.4.2	GAP Requirements	6
1.4.3	SM Requirements	6
1.5	Volume Controller Role.....	7
1.5.1	Services Support – Volume Controller Role.....	7
1.5.2	GATT Requirements	10
1.5.3	GAP Requirements	10
1.5.4	SM Requirements	11
2	References	12
3	Revision history and acknowledgments	13

1 Identification of the implementation

1.1 Implementation Under Test (IUT) identification

Identification of the Implementation Under Test (IUT) is to be filled in to provide as much detail as possible regarding version numbers and configuration options.

An ICS contact person to respond to queries regarding information supplied in this ICS proforma is named in the Declaration of Compliance: Summary of Selected Specifications in Implementation.

1.2 Roles

Table 1: Role Requirements

Item	Role	Reference	Status
1	Volume Renderer	[1] 3.0	C.1
2	Volume Controller	[1] 4.0	C.1

C.1: Mandatory to support at least one.

1.3 Transports

Table 2: Transport Requirements

Item	Transport	Reference	Status
1	Profile supported over BR/EDR	[1] 2.4	C.1
2	Profile supported over LE	[1] 2.4	C.1

C.1: Mandatory to support at least one.

1.4 Volume Renderer Role

Table 3: Volume Renderer, X.Y Versions

Prerequisite: VCP 1/1 "Volume Renderer"

Item	Version	Reference	Status
1	Volume Control Profile 1.0	[1]	M

Table 4: Volume Renderer, X.Y.Z Versions

Table number reserved but not yet in use

1.4.1 Services – Volume Renderer Role

Table 5: Service Requirements

Prerequisite: VCP 1/1 "Volume Renderer"

Item	Capability	Reference	Status	Inter-Layer Dependency
1	Volume Control Service	[1] 3.0	M	[6] VCS
2	Volume Offset Control Service	[1] 3.0	O	[4] VOCS
3	Audio Input Control Service	[1] 3.0	O	[5] AICS
4	Extended Advertising	[1] 6.1.1.1	M	[8] LL 9/41

1.4.2 GAP Requirements

Table 6: GAP Requirements – Volume Renderer Role

Prerequisite: VCP 1/1 “Volume Renderer”

Item	Capability	Reference	Status	Inter-Layer Dependency
1	LE security mode 1	[1] 5.1	C.1	[3] GAP 25/1
2	Unauthenticated Pairing (LE security mode 1 level 2) with LE Secure Connections Pairing only	[1] 5.1	C.1	[3] GAP 25/11
3	Authenticated Pairing (LE security mode 1 level 3) with LE Secure Connections Pairing only	[1] 5.1	C.3	[3] GAP 25/12
4	Derivation of LE LTK from BR/EDR Link Key	[1] 5.1	C.4	[3] GAP 43/2b
5	Security mode 4, level 2	[1] 5.2	C.2	[3] GAP 2/7c
6	128-bit encryption key size capable (BR/EDR)	[1] 5.2	C.2	[3] GAP 2/13
7	Derivation of BR/EDR Link Key from LE LTK	[1] 5.2	C.5	[3] GAP 43/2a
8	Minimum 128 Bit entropy key (LE)	[1] 5.1	C.1	[3] GAP 25/13

C.1: Mandatory IF VCP 2/2 “Profile supported over LE”, otherwise not defined.

C.2: Mandatory IF VCP 2/1 “Profile supported over BR/EDR”, otherwise not defined.

C.3: Optional IF VCP 2/2 “Profile supported over LE”, otherwise not defined.

C.4: Mandatory IF VCP 7/2 “Cross Transport Key Derivation Supported (Peripheral)” AND VCP 2/2 “Profile supported over LE”, otherwise not defined.

C.5: Mandatory IF VCP 7/2 “Cross Transport Key Derivation Supported (Peripheral)” AND VCP 2/1 “Profile supported over BR/EDR”, otherwise not defined.

1.4.3 SM Requirements

Table 7: SM Requirements – Volume Renderer Role

Prerequisite: VCP 1/1 “Volume Renderer”

Item	Capability	Reference	Status	Inter-Layer Dependency
1	LE Secure Connections	[1] 5.1	C.1	[7] SM 2/5
2	Cross Transport Key Derivation Supported (Peripheral)	[1] 5.1	C.1	[7] SM 8b/1
3	OOB supported	[1] 5.1	C.1	[7] SM 2/4

C.1: Mandatory to support at least one.

1.5 Volume Controller Role

Table 8: Volume Controller, X.Y Versions

Prerequisite: VCP 1/2 “Volume Controller”

Item	Version	Reference	Status
1	Volume Control Profile 1.0	[1]	M

Table 9: Volume Controller, X.Y.Z Versions

Table number reserved but not yet in use

1.5.1 Services Support – Volume Controller Role

Table 10: Volume Control Service Support

Prerequisite: VCP 1/2 “Volume Controller”

Item	Capability	Reference	Status
1	Volume Control Service	[1] 4.0	M
2	Volume Offset Control Service	[1] 4.0	O
3	Audio Input Control Service	[1] 4.0	O

Table 11: Volume Control Service Characteristic Support Requirements

Prerequisite: VCP 10/1 “Volume Control Service”

Item	Capability	Reference	Status
1	Volume State	[1] 4.3.1	M
2	Volume Control Point	[1] 4.3.1	M
3	Volume Flags	[1] 4.3.1	O

Table 12: Volume Control Service Procedure Support Requirements

Prerequisite: VCP 10/1 “Volume Control Service”

Item	Capability	Reference	Status
1	Configure Volume State Notifications	[1] 4.4.1, 4.4.1.1	M
2	Read Volume State	[1] 4.4.1, 4.4.1.2	M
3	Configure Volume Flags Notifications	[1] 4.4.1, 4.4.1.3	O
4	Read Volume Flags	[1] 4.4.1, 4.4.1.4	O
5	Set Initial Volume	[1] 4.4.1, 4.4.1.5	C.1
6	Set Absolute Volume	[1] 4.4.1, 4.4.1.6.5	C.2
7	Relative Volume Down	[1] 4.4.1, 4.4.1.6.1	C.3
8	Relative Volume Up	[1] 4.4.1, 4.4.1.6.2	C.3
9	Unmute/ Relative Volume Down	[1] 4.4.1, 4.4.1.6.3	C.4

Item	Capability	Reference	Status
10	Unmute/ Relative Volume Up	[1] 4.4.1, 4.4.1.6.4	C.4
11	Mute	[1] 4.4.1, 4.4.1.6.6	O
12	Unmute	[1] 4.4.1, 4.4.1.6.7	O

- C.1: Optional IF VCP 12/4 “Read Volume Flags” OR VCP 12/6 “Set Absolute Volume”, otherwise Excluded.
- C.2: Mandatory IF NOT VCP 12/7 “Relative Volume Down” AND NOT VCP 12/8 “Relative Volume Up” AND NOT VCP 12/9 “Unmute/ Relative Volume Down” AND NOT VCP 12/10 “Unmute/ Relative Volume Up”, otherwise Optional.
- C.3: Mandatory to support none or all.
- C.4: Mandatory to support none or all.

Table 13: Volume Offset Control Service Characteristic Support Requirements

Prerequisite: VCP 10/2 “Volume Offset Control Service”

Item	Capability	Reference	Status
1	Volume Offset State	[1] 4.3.2	C.1
2	Audio Location	[1] 4.3.2	O
3	Volume Offset Control Point	[1] 4.3.2	O
4	Audio Output Description	[1] 4.3.2	O

- C.1: Mandatory IF VCP 14/1 “Configure Offset State Notifications” OR VCP 14/2 “Read Volume Offset State” OR VCP 14/3 “Configure Audio Location Notifications” OR VCP 14/4 “Read Audio Location” OR VCP 14/5 “Set Audio Location” OR VCP 14/6 “Set Volume Offset” OR VCP 14/7 “Configure Audio Output Description Notifications” OR VCP 14/8 “Read Audio Output Description” OR VCP 14/9 “Set Audio Output Description”, otherwise Optional.

Table 14: Volume Offset Control Service Procedure Support Requirements

Prerequisite: VCP 10/2 “Volume Offset Control Service”

Item	Capability	Reference	Status
1	Configure Offset State Notifications	[1] 4.4.2.1	C.1, C.2
2	Read Volume Offset State	[1] 4.4.2.2	C.1, C.2
3	Configure Audio Location Notifications	[1] 4.4.2.3	O
4	Read Audio Location	[1] 4.4.2.4	O
5	Set Audio Location	[1] 4.4.2.5	O
6	Set Volume Offset	[1] 4.4.2.6.1	O
7	Configure Audio Output Description Notifications	[1] 4.4.2.7	O
8	Read Audio Output Description	[1] 4.4.2.8	O
9	Set Audio Output Description	[1] 4.4.2.9	O

- C.1: Mandatory IF VCP 14/3 “Configure Audio Location Notifications” OR VCP 14/4 “Read Audio Location” OR VCP 14/5 “Set Audio Location” OR VCP 14/6 “Set Volume Offset” OR VCP 14/7 “Configure Audio Output Description Notifications” OR VCP 14/8 “Read Audio Output Description” OR VCP 14/9 “Set Audio Output Description”, otherwise Optional.
- C.2: Mandatory to support none or all.

Table 15: Audio Input Control Service Characteristic Support Requirements*Prerequisite: VCP 10/3 "Audio Input Control Service"*

Item	Capability	Reference	Status
1	Audio Input State	[1] 4.3.3	C.1
2	Gain Setting Properties	[1] 4.3.3	C.1
3	Audio Input Type	[1] 4.3.3	O
4	Audio Input Status	[1] 4.3.3	O
5	Audio Input Control Point	[1] 4.3.3	O
6	Audio Input Description	[1] 4.3.3	O

C.1: Mandatory IF VCP 16/1 "Configure Audio Input State Notifications" OR VCP 16/2 "Read Audio Input State" OR VCP 16/3 "Read Gain Setting Properties" OR VCP 16/4 "Read Audio Input Type" OR VCP 16/5 "Configure Audio Input Status Notifications" OR VCP 16/6 "Read Audio Input Status" OR VCP 16/7 "Set Gain Setting" OR VCP 16/8 "Mute" OR VCP 16/9 "Unmute" OR VCP 16/10 "Set Manual Gain Mode" OR VCP 16/11 "Set Automatic Gain Mode" OR VCP 16/12 "Configure Audio Input Description Notifications" OR VCP 16/13 "Read Audio Input Description" OR VCP 16/14 "Set Audio Input Description", otherwise Optional.

Table 16: Audio Input Control Service Procedure Support Requirements*Prerequisite: VCP 10/3 "Audio Input Control Service"*

Item	Capability	Reference	Status
1	Configure Audio Input State Notifications	[1] 4.4.3.1	C.1, C.2
2	Read Audio Input State	[1] 4.4.3.2	C.1, C.2
3	Read Gain Setting Properties	[1] 4.4.3.3	O
4	Read Audio Input Type	[1] 4.4.3.4	O
5	Configure Audio Input Status Notifications	[1] 4.4.3.5	O
6	Read Audio Input Status	[1] 4.4.3.6	O
7	Set Gain Setting	[1] 4.4.3.7.1	O
8	Mute	[1] 4.4.3.7.3	O
9	Unmute	[1] 4.4.3.7.2	O
10	Set Manual Gain Mode	[1] 4.4.3.7.4	O
11	Set Automatic Gain Mode	[1] 4.4.3.7.5	O
12	Configure Audio Input Description Notifications	[1] 4.4.3.8	O
13	Read Audio Input Description	[1] 4.4.3.9	O
14	Set Audio Input Description	[1] 4.4.3.10	O

C.1: Mandatory IF VCP 16/3 "Read Gain Setting Properties" OR VCP 16/4 "Read Audio Input Type" OR VCP 16/5 "Configure Audio Input Status Notifications" OR VCP 16/6 "Read Audio Input Status" OR VCP 16/7 "Set Gain Setting" OR VCP 16/8 "Mute" OR VCP 16/9 "Unmute" OR VCP 16/10 "Set Manual Gain Mode" OR VCP 16/11 "Set Automatic Gain Mode" OR VCP 16/12 "Configure Audio Input Description Notifications" OR VCP 16/13 "Read Audio Input Description" OR VCP 16/14 "Set Audio Input Description", otherwise Optional.

C.2: Mandatory to support none or all.

1.5.2 GATT Requirements

Table 17: Volume Controller GATT Requirements

Prerequisite: VCP 1/2 "Volume Controller"

Item	Capability	Reference	Status	Inter-Layer Dependency
1	Discover All Primary Services	[1] 4.1	C.1	[2] GATT 3/2
2	Discover Primary Services by Service UUID	[1] 4.1	C.1	[2] GATT 3/3
3	Find Included Services	[1] 4.1	O	[2] GATT 3/4
4	Discover All Characteristics of a Service	[1] 4.1	C.2	[2] GATT 3/5
5	Discover Characteristics by UUID	[1] 4.1	C.2	[2] GATT 3/6
6	Discover All Characteristic Descriptors	[1] 4.1	M	[2] GATT 3/7
7	Read Characteristic Value	[1] 4.1	M	[2] GATT 3/8
8	Write Characteristic Value	[1] 4.1	M	[2] GATT 3/14
9	Notifications	[1] 4.1	M	[2] GATT 3/17
10	Read Characteristic Descriptors	[1] 4.1	M	[2] GATT 3/19
11	Write Characteristic Descriptors	[1] 4.1	M	[2] GATT 3/21

C.1: Mandatory to support at least one.

C.2: Mandatory to support at least one.

1.5.3 GAP Requirements

Table 18: GAP Requirements – Volume Controller Role

Prerequisite: VCP 1/2 "Volume Controller"

Item	Capability	Reference	Status	Inter-Layer Dependency
1	Central	[1] 4.1	C.2	[3] GAP 5/4 or GAP 38/4
2	LE security mode 1	[1] 5.1	C.2	[3] GAP 35/1
3	Bondable mode (LE)	[1] 6.2	C.2	[3] GAP 34/2
4	Bonding procedure	[1] 6.2	C.3	[3] GAP 34/3
5	Initiation of dedicated bonding	[1] 6.3	C.1	[3] GAP 3/6
6	Unauthenticated Pairing (LE security mode 1 level 2) with LE Secure Connections Pairing only	[1] 5.1	C.2	[3] GAP 35/11
7	Authenticated Pairing (LE security mode 1 level 3) with LE Secure Connections Pairing only	[1] 5.1	C.3	[3] GAP 35/12
8	Derivation of LE LTK from BR/EDR Link Key	[1] 5.1	C.5	[3] GAP 41/2b
9	Security mode 4, level 2	[1] 5.2	C.4	[3] GAP 2/7c

Item	Capability	Reference	Status	Inter-Layer Dependency
10	128-bit encryption key size capable (BR/EDR)	[1] 5.2	C.4	[3] GAP 2/13
11	Derivation of BR/EDR Link Key from LE LTK	[1] 5.2	C.6	[3] GAP 41/2a
12	Minimum 128 Bit entropy key (LE)	[1] 5.1	C.2	[3] GAP 35/13

- C.1: Optional IF VCP 2/1 “Profile supported over BR/EDR”, otherwise not defined.
- C.2: Mandatory IF VCP 2/2 “Profile supported over LE”, otherwise not defined.
- C.3: Optional IF VCP 2/2 “Profile supported over LE”, otherwise not defined.
- C.4: Mandatory IF VCP 2/1 “Profile supported over BR/EDR”, otherwise not defined.
- C.5: Mandatory IF VCP 19/2 “Cross Transport Key Derivation Supported (Central)” AND VCP 2/2 “Profile supported over LE”, otherwise not defined.
- C.6: Mandatory IF VCP 19/2 “Cross Transport Key Derivation Supported (Central)” AND VCP 2/1 “Profile supported over BR/EDR”, otherwise not defined.

1.5.4 SM Requirements

Table 19: SM Requirements – Volume Controller Role

Prerequisite: VCP 1/2 “Volume Controller”

Item	Capability	Reference	Status	Inter-Layer Dependency
1	LE Secure Connections	[1] 5.1	C.1	[5] SM 2/5
2	Cross Transport Key Derivation Supported (Central)	[1] 5.1	C.1	[5] SM 8a/1
3	OOB supported	[1] 5.1	C.1	[5] SM 2/4

- C.1: Mandatory to support at least one.

2 References

- [1] Volume Control Profile Specification, Version 1.0
- [2] ICS Proforma for Generic Attribute Profile (GATT)
- [3] ICS Proforma for Generic Access Profile (GAP)
- [4] ICS Proforma for Volume Offset Control Service (VOCS)
- [5] ICS Proforma for Audio Input Control Service (AICS)
- [6] ICS Proforma for Volume Control Service (VCS)
- [7] ICS Proforma for Security Manager (SM)
- [8] ICS Proforma for Link Layer (LL)

3 Revision history and acknowledgments

Revision History

Publication Number	Revision Number	Date	Comments
0	p0	2020-12-22	Approved by BTI on 2020-11-29. VCP v1.0 adopted by the BoD on 2020-12-15. Prepared for publication.
	p0ed2 r00–r02	2021-03-23 – 2021-05-23	TSE 15974 (rating 1): Fixed typos in Table 12. Editorials for consistency checker findings.
	p0 edition 2	2021-05-25	Approved by BTI on 2021-05-06. Prepared for edition 2 publication.
	p0ed3 r00–r01	2021-07-26 – 2021-09-24	TSE 16976 (rating 1): Corrected conditional wording for C.1 of Table 12. (NOTE: Other changes tracked in this CR were made in the edition 2 publication.) Consistency checker editorials to align with wording in the latest ICS template.
	p0 edition 3	2021-09-28	Approved by BTI on 2021-09-27. Prepared for edition 3 publication.
	p0ed4r00	2022-01-25	TSE 18189 (rating 1): Updated Link Layer inter-layer dependency item in Table 5 to align with updates made in the LL ICS. Made template-related fixes, including aligning the copyright page with v2 of the DNMD.
	p0 edition 4	2022-01-27	Approved by BTI on 2022-01-27. Prepared for edition 4 publication.
	p1r00	2022-02-24	TSE 18371 (rating 2): Removed “is/not supported” language in the conditionals globally, and updated references for Table 12. Performed template-related formatting fixes. Fixed cross-reference formatting where possible.
1	p1	2022-06-28	Approved by BTI on 2022-06-20. Prepared for TCRL 2022-1 publication.
	p1ed2r00	2023-02-15	TSE 22637 (rating 1): Replaced ILD references to Security Manager 8/1 with SM 8a/1 (for Central role) or SM 8b/1 (for Peripheral role) in Tables 7 and 19. Updated references. Editorials to align the document with the latest ICS template. Deleted draft revision history comments prior to p0.
	p1 edition 2	2023-03-15	Approved by BTI on 2023-03-13. Prepared for edition 2 publication.

Acknowledgments

Name	Company
Gene Chang	Bluetooth SIG, Inc.
Charlie Lenahan	Bluetooth SIG, Inc.
Jawid Mirani	Bluetooth SIG, Inc.