Car Connectivity Consortium

MirrorLink®

UPnP Server Device Test Specification

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TERMS AND ABBREVIATIONS

UPnP	Universal Plug and Play

1 ABOUT

This document specifies all MirrorLink protocol conformance test cases for the UPnP Server Device [2].

The specification lists a series of requirements, either explicitly or within the text, which are mandatory elements for a compliant solutions. Recommendations are given, to ensure optimal usage and to provide suitable performance. All recommendations are optional.

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are following the notation as described in RFC 2119 [1].

1. MUST: This word, or the terms "REQUIRED" or "SHALL", mean that the definition is an absolute requirement of the specification.
2. MUST NOT: This phrase, or the phrase "SHALL NOT", mean that the definition is an absolute prohibition of the specification.
3. SHOULD: This word, or the adjective "RECOMMENDED", mean that there may exist valid reasons in particular circumstances to ignore a particular item, but the full implications must be understood and carefully weighed before choosing a different course.
4. SHOULD NOT: This phrase, or the phrase "NOT RECOMMENDED" mean that there may exist valid reasons in particular circumstances when the particular behavior is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behavior described with this label.
5. MAY: This word, or the adjective "OPTIONAL", means that an item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because the vendor feels that it enhances the product while another vendor may omit the same item. An implementation which does not include a particular option MUST be prepared to interoperate with another implementation which does include the option, though perhaps with reduced functionality. In the same vein an implementation which does include a particular option MUST be prepared to interoperate with another implementation which does not include the option (except, of course, for the feature the option provides.)

2 DEFINITIONS

2.1 Execution of Test Cases

Every test case is uniquely identified by an identifier.

- A MirrorLink server MUST pass all test cases, starting with SR.
- A MirrorLink client MUST pass all test cases, starting with CL

Every test case description includes an entry, whether the test cases is considered mandatory or not.

- Test cases marked as MANDATORY, MUST be executed.
- Test cases marked as CONDITIONAL, MUST be executed if the given condition is met.
- Test cases marked as CONDITIONAL, MUST NOT be executed if the given condition is not met.
- Test cases marked as NONE, MUST NOT be executed.

2.2 Server Definitions

2.2.1 UPnP Server Connect

This definition contains all necessary steps to make an UPnP "connection" to the UPnP Server.

Step	Name	Description	Expected Result
1	UPnP Connect	Preparing the UPnP connection by making an initialization, registering the client and waiting for the device to announce itself.	
2	UPnP MSearch	Send MSearch request	• Device announces itself
3	UPnP Device Description	Test the service description for parsable XML formating and availability of service types and their control and event URLs.	• Valid device description (according to specification) • Support for TmApplicationServer:1 service • Support for TmClientProfile:1 service • Contains X_Signature element

2.2.2 UPnP Server Disconnect

This definition contains all necessary steps to "disconnect" from the UPnP Server.

Step	Name	Description	Expected Result
1	UPnP Disconnect	No action needed	

2.3 Client Definitions

2.3.1 UPnP Control Point Connect

This definition contains all necessary steps to make an UPnP "Connection" to the UPnP Control Point.

Step	Name	Description	Expected Result
1	UPnP Connect	Preparing the UPnP connection by making the physical connection. Note: Send UPnP Bye-Bye message, prior UPnP connect, if UPnP Server is still operational.	
2	UPnP Detection	SSDP:alive advertisements	• Control Point checks for Device XML • Control Point MAY use M-Search instead
3	UPnP Device Description	Provide Server Device XML	• Retrieve Service XML
4	UPnP Service Description	Provide Server Service XML	

2.3.2 UPnP Control Point Disconnect

This definition contains all necessary steps to "disconnect" from the UPnP Control Point.

Step	Name	Description	Expected Result
1	UPnP Control Point Disconnect	SSDP:byebye	

3 SERVER FEATURE TEST CASES

3.1 Device Template

3.1.1 SR/UPNP/DEVICE/SSDPalive

Requirement: MANDATORY

Condition: None

Test if the UPnP server starts advertising itself using SSDP:alive UDP broadcasts.

Step	Name	Description	Expected Result
1	UPnP Connect	All necessary steps completed for the physical connectivity. This test requires an IP connection.	
2	UPnP Advertisement	No action required	• Device announces itself in time
3	UPnP Disconnect	Releasing the UPnP connection to the MirrorLink server.	

Table 1: UPnP Connect – Test Steps

3.1.2 SR/UPNP/DEVICE/MSearch

Requirement: MANDATORY

Condition: None

Test if the UPnP server responds to MSearch broadcasts.

Step	Name	Description	Expected Result
1	UPnP Connect	All necessary steps completed for the physical connectivity. This test requires an IP connection.	
2	UPnP MSearch	Send MSearch request	• Device announces itself
3	UPnP Disconnect	Releasing the UPnP connection to the MirrorLink server.	

Table 2: UPnP MSearch – Test Steps

3.1.3 SR/UPNP/DEVICE/DeviceDescription

Requirement: MANDATORY

Condition: None

Test the device description for parsable XML format and availability of service types and their control and event URLs.

Step	Name	Description	Expected Result
1	UPnP Connect	Preparing the UPnP connection by making an initialization, registering the client and waiting for the device to announce itself.	

Step	Name	Description	Expected Result
2	UPnP MSearch	Send MSearch request	• Device announces itself
3	UPnP Device Description	Test the service description for parsable XML formating and availability of service types and their control and event URLs.	• XML prolog available. • Valid device description (according to specification) • Support for TmApplicationServer:1 service • Support for TmClientProfile:1 service • Support for TmNotificationServer:1 service • Contains all mandatory elements • Contains X_Signature element
4	UPnP Service Description	Read available service descriptions	• XML prolog available. • Valid service description (according to specification) • Contains all service actions and variables
5	UPnP Disconnect	Releasing the UPnP connection to the MirrorLink server.	

1 Table 3: UPnP Device Description – Test Steps

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3.2 Extensions

3.2.1 SR/UPNP/EXT/BdAddr

Requirement: CONDITIONAL

Condition: If BT address is provided

Test the device description for parsable XML format and availability of service types and their control and event URLs.

Step	Name	Description	Expected Result
1	UPnP Server Connect	See Definitions	
2	Device Description BdAddr	Read BT Mac Adress from the Server device	• MAC address is equal to bdAddr in UPnP Server Device Description
3	UPnP Server Disconnect	See Definitions	

Table 4: UPnP Device Description – Test Steps

3.2.2 SR/UPNP/EXT/DeviceKeys

Requirement: CONDITIONAL

Condition: If Device Keys are supported

Test the device description for parsable XML format and availability of service types and their control and event URLs.

Step	Name	Description	Expected Result
1	UPnP Server Connect	See Definitions	
2	UPnP Device Keys	Test the X_deviceKeys subtree of the UPnP Server device description for all mandatory nodes.	• All mandatory nodes are present • Provided Device Key is existing on MirrorLink Server
3	UPnP Server Disconnect	See Definitions	

Table 5: UPnP Device Description – Test Steps

3.3 XML Signature

3.3.1 SR/UPNP/DEVICE/SIGN/ValidXmlSignature

Requirement: MANDATORY

Condition: None

Test the device XML for a valid Signature.

Step	Name	Description	Expected Result
1	UPnP Server Connect	See Definitions	

Step	Name	Description	Expected Result
2	Signature Validation	Validate the XML Signature of the Device XML	• Signature is using `enveloped-signature` transformation • Use of `xml-c14n`, `xml-exc-c14n` or `xml-c14n11` canonicalization only • No `XPath` or `XSLT` XML transformations • Use of `sha1` digest method • Use of `rsa-sha1` signature algorithm • `Reference URI` is empty • No `xml:id` attribute • Signed from the private key distributed bound to the UPnP Server via DAP • `Digest Value` matches calculated value and is calculated over the `root` element. • `Signature Value` matches calculated value
3	UPnP Server Disconnect	See Definitions	

3.4 PICS Validation

The PICS validation test cases will independently detect the existence of MirrorLink features in the DUT. All features, which are detectable, could in practice be used from a connected MirrorLink device, and are therefore subject to validation in the certification program through other test cases. Hence the objective of the PICS validation test cEases is not to assess whether the feature is implemented correctly, but to collect supported features from the DUT and to check this against the entries made in the PICS document.

A feature, which is detected, but marked as "`not implemented`" in the PICS document will fail the test case. A feature, which is not detected, but marked as "`implemented`" in the PICS document, will fail the test case.

3.4.1 SR/UPNP/DEVICE/PICS/DeviceXml

Requirement: MANDATORY

Condition: None

This test case validates the PICS entries with respect to the Device XML settings.

Step	Name	Description	Expected Result
1	UPnP Server Connect	See Definitions	
2	Check PICS feature	FEAT_SERVER_UPnP_ServerDevice	• Device XML available
3	Check PICS feature	FEAT_SERVER_UPNP_Server_BT	• Device XML includes a `X_connectivity@bluetooth` element

Step	Name	Description	Expected Result
4	Check PICS feature	FEAT_SERVER_UPNP_Server_Device_Keys	• Device XML includes a `X_connectivity@deviceKeys` element
5	DAP launch	CTS launches DAP endpoint and requests DAP attestation of the `TerminalMode:UPnP-Server` component.	• DAP attestation response received for "`TerminalMode:UPnP-Server`"
6	Check PICS feature	FEAT_SERVER_UPNP_Server_XML_Signing	• Device XML includes a `X_Signature` element
7	Check PICS Identification	ML Version	• Device XML includes `X_mirrorLink` element • Subelements `majorVersion` and `minorVersion` matche the identified ML version

Table 6: MirrorLink Server Device XML settings PICS Checkup

3.4.2 SR/UPNP/DEVICE/PICS/ServiceXml

Requirement: MANDATORY

Condition: None

This test case validates the PICS entries with respect to the Service XML settings.

Step	Name	Description	Expected Result
1	UPnP Server Connect	See Definitions	
2	Check PICS feature	FEAT_SERVER_UPnP_ApplicationServerService	• Service XML includes Application Server Service
3	Check PICS feature	FEAT_SERVER_UPnP_ClientProfileService	• Service XML includes Client Profile Service
4	Check PICS feature	FEAT_SERVER_UPNP_Notification	• Service XML includes Notification Server Service

Table 7: MirrorLink Server Service XML settings PICS Checkup

4 CLIENT FEATURE TEST CASES

4.1 Device Template

4.1.1 CL/UPNP/DEVICE/DetectUpnpServer

Requirement: MANDATORY

Condition: None

Test if the client can detect the UPnP Server.

Step	Name	Description	Expected Result
1	UPnP Connect	Preparing the UPnP connection by making the physical connection. Note: Send UPnP Bye-Bye message, prior UPnP connect, if UPnP Server is still operational.	
2	UPnP Detection	SSDP:alive advertisements	• SSDP:discover or waiting for SSDP:alive • Control Point accesses Device XML

4.1.2 CL/UPNP/DEVICE/LookUpDeviceXML

Requirement: MANDATORY

Condition: None

Tests if the client accesses the UPnP server's device XML.

Step	Name	Description	Expected Result
1	UPnP Connect	Preparing the UPnP connection by making the physical connection. Note: Send UPnP Bye-Bye message, prior UPnP connect, if UPnP Server is still operational.	
2	UPnP Detection	SSDP:alive advertisements	• SSDP:discover or waiting for SSDP:alive • Control Point accesses Device XML
3	UPnP Device XML	Provide Server Device XML	• Control Point access Service XML

4.1.3 CL/UPNP/DEVICE/LookUpServiceXML

Requirement: MANDATORY

Condition: None

Tests if the client accesses the UPnP server's service XMLs

Step	Name	Description	Expected Result
1	UPnP Control Point	Preparing the UPnP connection by making the physical connection.	

Step	Name	Description	Expected Result
		Note: Send UPnP Bye-Bye message, prior UPnP connect, if UPnP Server is still operational.	
2	UPnP Detection	SSDP:alive advertisements	• SSDP:discover or waiting for SSDP:alive • Control Point accesses Device XML
3	UPnP Device XML	Provide Server Device XML	• Control Point access Service XML
4	UPnP Server XMLs	Provide Server Service XMLs	• Control Point access Service XMLs

If this test case is successful, the following test cases MAY be skipped:

- CL/UPNP/DEVICE/DetectUpnpServer
- CL/UPNP/DEVICE/LookUpDeviceXML

4.1.4 CL/UPNP/DEVICE/QueryElementControlUrl

Requirement: MANDATORY

Condition: None

Tests if the client supports query elements in the controlURL entries within the device XML.

Step	Name	Description	Expected Result
1	UPnP Connect	Preparing the UPnP connection by making the physical connection. Note: Send UPnP Bye-Bye message, prior UPnP connect, if UPnP Server is still operational.	
2	UPnP Detection	SSDP:alive advertisements	• SSDP:discover or waiting for SSDP:alive • Control Point accesses Device XML
3	UPnP Device XML	Provide Server Device XML CTS includes query element into `controlURL` elements	• Control Point access Service XML
4	UPnP Action	Test Engineer is asked to start MirrorLink functionality on the DUT (if no SOAP actions is received automatically) Note: CTS may not provide a response to the SOAP action	• Receive UPnP action at `controlURL` (including query element)

4.1.5 CL/UPNP/DEVICE/QueryElementEventUrl

Requirement: CONDITIONAL

Condition: Client supports Evented State Variables

Tests if the client supports query elements in the eventURL entries within the device XML.

Step	Name	Description	Expected Result
1	UPnP Connect	Preparing the UPnP connection by making the physical connection. Note: Send UPnP Bye-Bye message, prior UPnP connect, if UPnP Server is still operational.	
2	UPnP Detection	SSDP:alive advertisements	• SSDP:discover or waiting for SSDP:alive • Control Point accesses Device XML
3	UPnP Device XML	Provide Server Device XML CTS includes query element into `eventURL` elements	• Control Point access Service XML
4	UPnP Event Subscription	Test Engineer is asked to execute known steps to start eventing (if event subscription is not done automatically) Note: CTS may not provide a response to the event subscription	• Receive UPnP event subscription at `eventURL` (including query element)

4.2 XML Signature

4.2.1 CL/UPNP/DEVICE/SIGN/ValidationFailureInvalidDigestValue

Requirement: CONDITIONAL

Condition: Support for XML Signature Verification

Tests if the client rejects an UPnP Server with a device XML file, which is failing verification.

Step	Name	Description	Expected Result
1	UPnP Connect	Preparing the UPnP connection by making the physical connection. Note: Send UPnP Bye-Bye message, prior UPnP connect, if UPnP Server is still operational.	
2	UPnP Detection	SSDP:alive advertisements	• SSDP:discover or waiting for SSDP:alive • Control Point accesses Device XML
3	UPnP Device XML	Provide Server Device XML Device XML: • Digest Value is incorrect. • Signature Value is correct	• Control Point MAY access Service XML
4	DAP launch	DUT launches DAP endpoint and request DAP attestation of at least the TerminalMode:UPnP-Server component.	• DAP attestation request received for `"TerminalMode:UPnP-Server"` (or `"*"`)
5	XML Validation	DUT validates the UPnP Server Device XML	• DUT MAY request UPnP Device XML again

Step	Name	Description	Expected Result
			MirrorLink Session is not trusted • DUT does not establish a MirrorLink session OR • DUT does not list any application as being certified

4.2.2 CL/UPNP/DEVICE/SIGN/ValidationFailureInvalidSignature

Requirement: CONDITIONAL

Condition: Support for XML Signature Verification

Tests if the client rejects an UPnP Server with a device XML file, which is failing verification.

Step	Name	Description	Expected Result
1	UPnP Connect	Preparing the UPnP connection by making the physical connection. Note: Send UPnP Bye-Bye message, prior UPnP connect, if UPnP Server is still operational.	
2	UPnP Detection	SSDP:alive advertisements	• SSDP:discover or waiting for SSDP:alive • Control Point accesses Device XML
3	UPnP Device XML	Provide Server Device XML Device XML: • Digest Value is correct. • Signature Value is incorrect	• Control Point MAY access Service XML
4	DAP launch	DUT launches DAP endpoint and request DAP attestation of at least the TerminalMode:UPnP-Server component.	• DAP attestation request received for "`TerminalMode:UPnP-Server`" (or "`*`")
5	XML Validation	DUT validates the UPnP Server Device XML	• DUT MAY request UPnP Device XML again MirrorLink Session is not trusted • DUT does not establish a MirrorLink session OR • DUT does not list any application as being certified

4.2.3 CL/UPNP/DEVICE/SIGN/ValidationFailureNonEmptyReferenceUri

Requirement: CONDITIONAL

Condition: Support for XML Signature Verification

Tests if the client rejects an UPnP Server with a device XML file, which is failing verification.

Step	Name	Description	Expected Result
1	UPnP Connect	Preparing the UPnP connection by making the physical connection. Note: Send UPnP Bye-Bye message, prior UPnP connect, if UPnP Server is still operational.	
2	UPnP Detection	SSDP:alive advertisements	• SSDP:discover or waiting for SSDP:alive • Control Point accesses Device XML
3	UPnP Device XML	Provide Server Device XML Device XML: • Digest Value is correct. • Signature Value is correct • Reference URI is not empty	• Control Point MAY access Service XML
4	DAP launch	DUT launches DAP endpoint and request DAP attestation of at least the TerminalMode:UPnP-Server component.	• DAP attestation request received for "`TerminalMode:UPnP-Server`" (or "`*`")
5	XML Validation	DUT validates the UPnP Server Device XML	• DUT MAY request UPnP Device XML again MirrorLink Session is not trusted • DUT does not establish a MirrorLink session OR • DUT does not list any application as being certified

4.2.4 CL/UPNP/DEVICE/SIGN/ValidationFailureWrongKey

Requirement: CONDITIONAL

Condition: Support for XML Signature Verification

Tests if the client rejects an UPnP Server with a device XML file, which is failing verification.

Step	Name	Description	Expected Result
1	UPnP Connect	Preparing the UPnP connection by making the physical connection. Note: Send UPnP Bye-Bye message, prior UPnP connect, if UPnP Server is still operational.	
2	UPnP Detection	SSDP:alive advertisements	• SSDP:discover or waiting for SSDP:alive • Control Point accesses Device XML

Step	Name	Description	Expected Result
3	UPnP Device XML	Provide Server Device XML Device XML: • Digest Value is correct. • Signature Value is correct • Signed by key provided in `keyInfo` element, but which does not match the key bound to the UPnP Server (DAP)	• Control Point MAY access Service XML
4	DAP launch	DUT launches DAP endpoint and request DAP attestation of at least the TerminalMode:UPnP-Server component.	• DAP attestation request received for "`TerminalMode:UPnP-Server`" (or "`*`")
5	XML Validation	DUT validates the UPnP Server Device XML	• DUT MAY request UPnP Device XML again MirrorLink Session is not trusted • DUT does not establish a MirrorLink session OR • DUT does not list any application as being certified

4.2.5 CL/UPNP/DEVICE/SIGN/ValidationSuccessC14N

Requirement: CONDITIONAL

Condition: Support for XML Signature Verification

Tests if the client accepts an UPnP Server with a device XML file, which is passing verification.

Step	Name	Description	Expected Result
1	UPnP Connect	Preparing the UPnP connection by making the physical connection. Note: Send UPnP Bye-Bye message, prior UPnP connect, if UPnP Server is still operational.	
2	UPnP Detection	SSDP:alive advertisements	• SSDP:discover or waiting for SSDP:alive • Control Point accesses Device XML
3	UPnP Device XML	Provide Server Device XML Device XML: • Use `xml-c14n` canonicalization	• Control Point MAY access Service XML
4	DAP launch	DUT launches DAP endpoint and request DAP attestation of at least the TerminalMode:UPnP-Server component.	• DAP attestation request received for "`TerminalMode:UPnP-Server`" (or "`*`")

Step	Name	Description	Expected Result
5	XML Validation	DUT validates the UPnP Server Device XML	• DUT MAY request UPnP Device XML again MirrorLink Session is trusted • DUT establishes a MirrorLink session, i.e. application list available AND • DUT lists application as certified (when applicable), i.e. drive certified application can be accessed in drive mode

4.2.6 CL/UPNP/DEVICE/SIGN/ValidationSuccessExcC14N

Requirement: CONDITIONAL

Condition: Support for XML Signature Verification

Tests if the client accepts an UPnP Server with a device XML file, which is passing verification.

Step	Name	Description	Expected Result
1	UPnP Connect	Preparing the UPnP connection by making the physical connection. Note: Send UPnP Bye-Bye message, prior UPnP connect, if UPnP Server is still operational.	
2	UPnP Detection	SSDP:alive advertisements	• SSDP:discover or waiting for SSDP:alive • Control Point accesses Device XML
3	UPnP Device XML	Provide Server Device XML Device XML: • Use `xml-exc-c14n` canonicalization	• Control Point MAY access Service XML
4	DAP launch	DUT launches DAP endpoint and request DAP attestation of at least the TerminalMode:UPnP-Server component.	• DAP attestation request received for `"TerminalMode:UPnP-Server"` (or `"*"`)
5	XML Validation	DUT validates the UPnP Server Device XML	• DUT MAY request UPnP Device XML again MirrorLink Session is trusted • DUT establishes a MirrorLink session, i.e. application list available AND • DUT lists application as certified (when applicable), i.e. drive certified application

Step	Name	Description	Expected Result
			can be accessed in drive mode

4.2.7 CL/UPNP/DEVICE/SIGN/ValidationSuccessC14N11

Requirement: CONDITIONAL

Condition: Support for XML Signature Verification

Tests if the client accepts an UPnP Server with a device XML file, which is passing verification.

Step	Name	Description	Expected Result
1	UPnP Connect	Preparing the UPnP connection by making the physical connection. Note: Send UPnP Bye-Bye message, prior UPnP connect, if UPnP Server is still operational.	
2	UPnP Detection	SSDP:alive advertisements	• SSDP:discover or waiting for SSDP:alive • Control Point accesses Device XML
3	UPnP Device XML	Provide Server Device XML Device XML: • Use `xml-c14n11` canonicalization	• Control Point MAY access Service XML
4	DAP launch	DUT launches DAP endpoint and request DAP attestation of at least the TerminalMode:UPnP-Server component.	• DAP attestation request received for `"TerminalMode:UPnP-Server"` (or `"*"`)
5	XML Validation	DUT validates the UPnP Server Device XML	• DUT MAY request UPnP Device XML again MirrorLink Session is trusted • DUT establishes a MirrorLink session, i.e. application list available AND • DUT lists application as certified (when applicable), i.e. drive certified application can be accessed in drive mode

4.3 UPnP Device Architecture SSDP

4.3.1 CL/UPNP/SSDP/ByeByeMessage

Requirement: MANDATORY

Condition: None

1 Tests if the client honors a disappearing UPnP Server.

Step	Name	Description	Expected Result
1	UPnP Control Point Connect	See definitions	
2	UPnP Action Get Application List	No further action required	• Invoke Get Application List action
3	SSDP:ByeBye	CTS sends a SSDP:byebye message to the DUT	• DUT does not show any application
4	SSDP:Alive	CTS sends a SSDP:alive message to the DU	• DUT reconnects again to the UPnP Control Point • DUT shows a list of available applications

2

3

5 REFERENCES

[1] IETF, RFC 2119, Keys words for use in RFCs to Indicate Requirement Levels, March 1997. http://www.ietf.org/rfc/rfc2119.txt

[2] Car Connectivity Consortium, “MirrorLink – UPnP Server Device”, Version 1.1, CCC-TS-030