IEC 62481-6-2

Edition 1.0 2017-07

INTERNATIONAL STANDARD

Digital living network alliance (DLNA) home networked device interoperability guidelines –
Part 6-2: Remote user interface – RVU

IEC 62481-6-2:2017-07(en)

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 33.160; 35.100.05; 35.110

ISBN 978-2-8322-4558-3

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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International Standard IEC 62481-6-2 has been prepared under technical area 8: Multimedia home systems and applications for end-user network IEC technical committee 100: Audio, video and multimedia systems and equipment.

The text of this International Standard is based on the following documents:

CDV	Report on voting
100/2742/CDV	100/2888/RVC

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of IEC 62481 series, published under the general title *Digital Living Network Alliance (DLNA) home networked device interoperability guidelines,* can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

INTRODUCTION

Consumers are acquiring, viewing, and managing an increasing number of digital media (photos, music, and video) on devices in the consumer electronics (CE), mobile, and personal computer (PC) domains. As such, they want to conveniently enjoy the content, regardless of the source, across different devices and locations in the home. The digital home vision integrates the Internet, mobile, and broadcast networks through a seamless, interoperable network, which will provide a unique opportunity for manufacturers and consumers alike. In order to deliver on this vision, a common set of industry design guidelines is needed that allows vendors to participate in a growing marketplace, leading to more innovation, simplicity, and value for consumers. This document serves that purpose and provides vendors with the information needed to build interoperable networked platforms and devices for the digital home.

DIGITAL LIVING NETWORK ALLIANCE (DLNA) HOME NETWORKED DEVICE INTEROPERABILITY GUIDELINES –

Part 6-2: Remote User Interface – RVU

1 Scope

This part of IEC 62481-6 specifies guidelines for RVU which is a remote user interface (RUI) protocol that allows clients to present a full-featured user interface by implementing minimal functionality, leaving most of the processing to the server. The RVU RUI delivers bitmapped and/or vector graphic user interface data for a robust, consistent UI experience throughout the home via thin clients.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62481-1-1:2017, *Digital living network alliance (DLNA) home networked device interoperability guidelines - Part 1-1: Architecture and protocols*

IEC 62481-6-1:2017, *Digital living network alliance (DLNA) home networked device interoperability guidelines - Part 6-1: HTML 5 RUI*

ISO/IEC 29341-4-10, *Information technology – UPnP Device Architecture – Part 4-10: Audio Video Device Control Protocol – Level 2 – Audio Video Transport Service*

ISO/IEC 29341-4-11, *Information technology – UPnP Device Architecture – Part 4-11: Audio Video Device Control Protocol – Level 2 – Connection Manager Service*

ISO/IEC 29341-12-1, *Information Technology – UPnP Device Architecture – Part 12-1: Remote User Interface Device Control Protocol - Remote User Interface Client Device*

ISO/IEC 29341-12-2, *Information Technology – UPnP Device Architecture – Part 12-2: Remote User Interface Device Control Protocol – Remote User Interface Server Device*

ISO/IEC 29341-12-10:2015, *Information Technology - UPnP Device Architecture – Part 12-10: Remote User Interface Device Control Protocol – Remote User Interface Client Service Description*

ISO/IEC 29341-12-11:2015, *Information Technology – UPnP Device Architecture – Part 12-11: Remote User Interface Device Control Protocol – Remote User Interface Server Service Description*

RVU Protocol Specification: V1.0 2014, RVU Alliance
http://www.rvualliance.org

3 Terms, definitions and conventions

For the purposes of this document, the terms and definitions given in IEC 62481-1-1:2017 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1 Terms and definitions

3.1.1
AVT
AVTransport Service
UPnP service that provides network-based control for common transport operations such as play, stop, pause, next, previous, and seek

Note 1 to entry: The AVTransport Service specification is a standard UPnP DCP.

3.1.2
CDS
ContentDirectory Service
UPnP service that provides network-based discovery of content

Note 1 to entry: The ContentDirectory Service specification is a standard UPnP Device Control Protocol.

3.1.3
DMR
Digital Media Renderer
DLNA Device Class having home network environmental characteristics, with the role of rendering content it receives after being setup by another network entity

3.1.4
DMS
Digital Media Server
DLNA Device Class having home network environmental characteristics, with the role of exposing and distributing content throughout the home

3.1.5
MSCP
MediaServer Control Point
UPnP AV control point that issues actions to a DMS

3.1.6
XDMR
eXtended DMR
device class defined to combine the functionality of a Digital Media Renderer (DMR) and a Media Server Control Point (MSCP)

Note 1 to entry: This device class is equivalent to combining previous device classes known as a DMR and a DMP.

3.2 Conventions

In this document, a number of terms, conditions, mechanisms, sequences, parameters, events, states, or similar terms are printed with the first letter of each word in uppercase and the rest lowercase (e.g., Move). Any lowercase uses of these words have the normal technical English meaning.

4 Networking architecture, device models and guideline conventions

4.1 DLNA home networking architecture

This document extends the DLNA home networking architecture that is defined in Clause 4 of IEC 62481-1-1:2017.

4.2 Document conventions and conventions

See Clause 6 of IEC 62481-1-1:2017 for a full description of the DLNA document conventions.

4.3 Guideline structure and layout

See 7.1 of IEC 62481-1-1:2017 for guideline and attribute table layout descriptions.

5 RVU Device Model and Device Function

5.1 Device Model

Refer to Clause 5 of IEC 62481-1-1:2017 for detailed descriptions of existing DLNA Device Model. This document extends the existing DLNA devices and system usages.

5.2 Device Capabilities and roles

For the RVU guidelines, the following Device Function is defined.

An RVU Pull Controller (+RVUPL+), an RVU Source capability (+RVUSRC+), an RVU Sink capability (+RVUSINK+), and an RVU Controller (+RVUCTRL+) have the same roles as DLNA RUI-H capabilities. The system usages for RVU RUI capabilities are the same as DLNA RUI-H capabilities as specified in Clause 5.3 of IEC 62481-6-1:2017, but with DLNA RUI-H capabilities replaced by RVU RUI capabilities:

- an RVU Pull Controller (+RVUPL+) with the role of finding and loading remote UI content exposed by a +RVUSRC+ capability and rendering and interacting with the UI content;
- an RVU Source capability (+RVUSRC+) with the role of exposing and sourcing UI content;
- an RVU Sink capability (+RVUSINK+) with the role of exposing remote UI functionality and rendering UI content it receives from a +RVUSRC+ capability;
- an RVU Controller (+RVUCTRL+) with the role of finding +RVUSRC+ and +RVUSINK+ capabilities, finding matching UIs, and setting up the connection between the +RVUSINK+ and +RVUSRC+.

6 RVU guidelines

6.1 RVU Remote User Interfaces

6.1.1

DLNA devices adhere to the conditionally mandatory requirements in this section only when applying +RVUPL+, +RVUSRC+, +RVUSINK+, and +RVUCTRL+ device capabilities.

6.1.2

[GUIDELINE] An RVU Source capability (+RVUSRC+) shall implement a UPnP RemoteUIServerDevice and a UPnP RemoteUIServer with XML device description as defined in ISO/IEC 29341-12-2 and an XML service description as defined in ISO/IEC 29341-12-11:2015.

[ATTRIBUTES]

M	A	+RVUSRC+	n/a	n/a	ISO/IEC 29341-12-2 ISO/IEC 29341-12-11:2015	2KOQH	

6.1.3

[GUIDELINE] An RVU Pull Controller capability (+RVUPL+) shall implement a UPnP RemoteUIServerDevice control point that calls the required actions of the UPnP RemoteUIServer.

[ATTRIBUTES]

M	A	+RVUPL+	n/a	n/a	ISO/IEC 29341-12-11:2015	ANCNN	

6.1.4

[GUIDELINE] An RVU Sink capability (+RVUSINK+) shall implement a UPnP RemoteUIClientDevice and a UPnP RemoteUI Client with XML device description as defined in ISO/IEC 29341-12-1 and an XML service description as defined in ISO/IEC 29341-12-10:2015.

[ATTRIBUTES]

M	A	+RVUSINK+	n/a	n/a	ISO/IEC 29341-12-1 ISO/IEC 29341-12-10:2015	H3Q8Q	

6.1.5

[GUIDELINE] An RVU Controller capability (+RVUCTRL+) shall implement a UPnP RemoteUIServer control point that calls the required actions of the UPnP RemoteUIServer.

[ATTRIBUTES]

M	A	+RVUCTRL+	n/a	n/a	ISO/IEC 29341-12-11:2015	AVHLG	

6.1.6

[GUIDELINE] An RVU Controller capability (+RVUCTRL+) shall implement a UPnP RemoteUIClient control point that calls the required actions of the UPnP RemoteUIClient.

[ATTRIBUTES]

M	A	+RVUCTRL+	n/a	n/a	ISO/IEC 29341-12-10:2015	5DVST	

6.2 RVU 2-box connection establishment

6.2.1

[GUIDELINE] A +RVUPL+ shall invoke the UPnP RemoteUIServer:GetCompatibleUIs service action on a +RVUSRC+ capability in accordance with 3.2.2-1 and 3.2.3.1 of RVU Protocol Specification: V1.0 2014 and in accordance with 3.1.3 of ISO/IEC 29341-12-11:2015.

[ATTRIBUTES]

M	A	+RVUPL+	n/a	n/a	RVU Protocol Specification: V1.0 2014 ISO/IEC 29341-12-11:2015	YWDRC	

6.2.2

[GUIDELINE] A +RVUSRC+ shall respond to a +RVUPL+ connection initiation in accordance with sections 3.2.2-2, 3.2.2-3, and 3.2.3.2 of RVU Protocol Specification: V1.0 2014 and 3.1.2 of ISO/IEC 29341-12-11:2015.

[ATTRIBUTES]

M	A	+RVUSRC+	n/a	n/a	RVU Protocol Specification: V1.0 2014 ISO/IEC 29341-12-11:2015	ABM62	

6.3 RVU 3-box connection establishment

6.3.1

[GUIDELINE] A +RVUCTRL+ shall invoke the UPnP RemoteUIServer:GetCompatibleUIs service action on a +RVUSRC+ capability in accordance with 3.2.2-1 and 3.2.3.1 of RVU Protocol Specification: V1.0 2014 and in accordance with 3.1.3 of ISO/IEC 29341-12-11:2015.

[ATTRIBUTES]

M	A	+RVUCTRL+	n/a	n/a	RVU Protocol Specification: V1.0 2014 ISO/IEC 29341-12-11:2015	ATKEJ	

6.3.2

[GUIDELINE] A +RVUSRC+ shall respond to a +RVUCTRL+ connection initiation in accordance with 3.2.2-2, -3, and 3.2.3.2 of RVU Protocol Specification: V1.0 2014 and 3.1.2 of ISO/IEC 29341-12-11:2015.

[ATTRIBUTES]

M	A	+RVUSRC+	n/a	n/a	RVU Protocol Specification: V1.0 2014 ISO/IEC 29341-12-11:2015	5IO37	

6.3.3

[GUIDELINE] A +RVUCTRL+ shall invoke RemoteUIClient:GetDeviceProfile to retrieve remote UI capabilities implemented by a +RVUSINK+.

[ATTRIBUTES]

M	A	+RVUCTRL+	n/a	n/a	ISO/IEC 29341-12-10:2015	7MA6V	

[**COMMENT**] The primary information returned by this action is the list of remoting protocols supported by the client.

6.3.4

[GUIDELINE] In response to RemoteUIClient:GetDeviceProfile, a +RVUSINK+ shall include a protocol element with "RVU-RUI" as the value of the shortName attribute within its DeviceProfile state variable.

[ATTRIBUTES]

M	A	+RVUSINK+	n/a	n/a	ISO/IEC 29341-12-10:2015	O8BR8	

6.3.5

[GUIDELINE] A +RVUCTRL+ shall invoke the RemoteUIClient:Connect action on the +RVUSINK+ as described in 2.4.1 and 3.2.1 of ISO/IEC 29341-12-10:2015.

[ATTRIBUTES]

M	A	+RVUCTRL+	n/a	n/a	ISO/IEC 29341-12-10:2015	6WKL7	

[**COMMENT**] A +RVUCTRL+ calls the RemoteUIClient:Connect action as described in the basic scenario of 3.2.1 of ISO/IEC 29341-12-10:2015. In the case of RVU capabilities, the Connect action will succeed if shortName within the DeviceProfile value returned by a +RVUSINK+ and if shortName within the CompatibleUIs value returned by a +RVUSRC+ matches with value RVU-RUI.

6.4 RVU RUI session establishment

6.4.1

[GUIDELINE] To establish an RVU RUI 2-box system usage session, a +RVUPL+ shall initiate an RVU RUI command-channel to the port listed in the +RVUSRC+ response to RemoteUIServer:GetCompatibleUIs as required in 4.2-1 to 4.2-20 of RVU Protocol Specification: V1.0 2014.

[ATTRIBUTES]

M	A	+RVUPL+	n/a	n/a	RVU Protocol Specification: V1.0 2014	LYL2Y	

[COMMENT] A session always begins with command channel initiation by a +RVUPL+, however, as noted in the referenced paragraphs of RVU Protocol Specification: V1.0 2014, subsequent channel initiation from a +RVUSRC+ is allowed.

6.4.2

[GUIDELINE] To establish an RVU RUI 3-box system usage session, a +RVUSINK+ shall initiate an RVU RUI command-channel as required in 4.2-1 to 4.2-20 of RVU Protocol Specification: V1.0 2014 to the URI obtained from the CurrentConnections value of the RemoteUIClient:Connect() action.

[ATTRIBUTES]

M	A	+RVUSINK+	n/a	n/a	RVU Protocol Specification: V1.0 2014 ISO/IEC 29341-12-10:2015	AM6OI	

[COMMENT] See also 3.2.1 of ISO/IEC 29341-12-10:2015.

6.5 RUI transport

6.5.1

[GUIDELINE] An RVU Pull controller shall implement the RVU RUI graphics, command and data protocol as defined by RVU Protocol Specification: V1.0 2014. Specifically, the RVU Pull Controller shall implement 4.1, 4.2.1, 4.2.2 and the entirety of 4.3 to 4.9 of RVU Protocol Specification: V1.0 2014 that are denoted as M: RVU-C, with the exception of 4.6-3 and 4.8.2.3.1-3.

[ATTRIBUTES]

M	A	+RVUPL+	n/a	n/a	RVU Protocol Specification: V1.0 2014	DQ7SL	

[COMMENT] 4.6-3 of RVU Protocol Specification: V1.0 2014 requires a minimum of 1 MB for the RUI audio buffer and 4.8.2.3.1-3 of RVU Protocol Specification: V1.0 2014 requires a minimum of 64 MB of memory which for these guidelines are not mandatory but are recommended.

4.8.2.6.8 of RVU Protocol Specification: V1.0 2014 defines a RVU RUI command channel Play command for audio user interface applications that does not use UPnP AVTransport and is unrelated to the UPnP AVT:Play command.

6.5.2

[GUIDELINE] An RVU Sink Capability shall implement the RVU RUI graphics, command and data protocol as defined by RVU Protocol Specification: V1.0 2014. Specifically, the RVU Sink shall implement 4.1, 4.2.1, 4.2.2 and the entirety of 4.3 to 4.9 of RVU Protocol Specification: V1.0 2014 that are denoted as M: RVU-C, with the exception of 4.8.2.3.1-3.

[ATTRIBUTES]

M	A	+RVUSINK+	n/a	n/a	RVU Protocol Specification: V1.0 2014	OAPDS	

6.5.3

[GUIDELINE] +RVUPL+ and +RVUSINK+ capabilities shall at a minimum implement RVU RUI audio requirements in 4.8.2.6 of RVU Protocol Specification: V1.0 2014 with two channel PCM at 44,1 KHz and 48 KHz sampling rates in compliance with the DLNA LPCM media format profile.

[ATTRIBUTES]

M	A	+RVUPL+ +RVUSINK+	n/a	n/a	RVU Protocol Specification: V1.0 2014	SYED6	

6.5.4

[GUIDELINE] An RVU Source Capability shall implement 4.1, 4.2.1, 4.2.2 and the entirety of 4.3 to 4.9 of RVU Protocol Specification: V1.0 2014 that are denoted as M: RVU-S.

[ATTRIBUTES]

M	A	+RVUSRC+	n/a	n/a	RVU Protocol Specification: V1.0 2014	GUSWB	

[COMMENT] An RVU Source Capability implements the RVU RUI graphics, command and data protocol as defined by RVU Protocol Specification: V1.0 2014.

6.6 Combining RVU RUI and A/V transport

6.6.1

As described in 5.3 and Tables 1 and 2 of IEC 62481-6-1:2017, combining RUI and A/Transport is enabled through co-location of the +RVUPL+, +RVUSRC+ or +RVUSINK+ capabilities with the appropriate Media Transport Client/Server device functions of existing Device Classes.

6.6.2

[GUIDELINE] A UPnP AV MediaRenderer co-located with a +RVUPL+ or a +RVUSINK+ capability shall implement the UPnP Connection Manager Service action PrepareForConnection in addition to the minimum requirements for DMRs as specified in IEC 62481-1-1:2017, 10.1.2.6.1 (GUN XFCS3).

[ATTRIBUTES]

M	A	DMR	n/a	n/a	ISO/IEC 29341-4-11 IEC 62481-1-1: 2017	6DQTO	

[COMMENT] See comment for requirement 6.6.3.

6.6.3

[GUIDELINE] A UPnP AV MediaRenderer co-located with a +RVUPL+ or a +RVUSINK+ capability shall implement the UPnP Connection Manager Service action ConnectionComplete in addition to the minimum requirements for DMRs as specified in IEC 62481-1-1:2017, 10.1.2.6.1 (GUN XFCS3).

[ATTRIBUTES]

M	A	DMR	n/a	n/a	ISO/IEC 29341-4-11 IEC 62481-1-1: 2017	E93X8	

[COMMENT] DMRs co-located with +RVUPL+ and +RVUSINK+ capabilities require implementation of ConnectionManager actions PrepareForConnection and ConnectionComplete to support multiple AV Transport instanceIDs.

6.6.4

[GUIDELINE] A UPnP AV MediaRenderer co-located with a +RVUPL+ or a +RVUSINK+ capability shall implement the UPnP AVTransport:Pause action in addition to the minimum requirements for DMRs as specified in IEC 62481-1-1:2017, 10.1.2.6.1 (GUN XFCS3).

[ATTRIBUTES]

M	A	DMR	n/a	n/a	ISO/IEC 29341-4-10 IEC 62481-1-1: 2017	MJASK	

[COMMENT] This requirement mandates the use of AVT:Pause in addition to the mandatory AVT Play, Seek and Stop actions. DMRs responding to these actions return AVT:LastChange events to maintain the AVTransport state machine control over the TransportState variable. A +PU+ invokes AVT actions with instance IDs and DMRs return LastChange events with transport state values associated with corresponding instance IDs.

6.6.5

[GUIDELINE] A +RVUPL+ or a +RVUSINK+ (RVU client) originated Hello command shall include as an attribute the UUID of the UPnP AV Media Renderer with which the +RVUPL+ or +RVUSINK+ is co-located. See 4.8.2.1.1 of RVU Protocol Specification: V1.0 2014.

[ATTRIBUTES]

M	A	+RVUPL+, +RVUSINK+, DMR	n/a	n/a	RVU Protocol Specification: V1.0 2014	I3QR3	

[COMMENT] This requirement ensures that a server can associate +RVUPL+ and +RVUSINK+ and its remote user interface command channels with the appropriate DMR device, particularly where two DMRs use the same physical device and/or IP address.

6.6.6

[GUIDELINE] A Push Controller co-located with a +RVUSRC+ capability should invoke the UPnP Connection Manager Service action PrepareForConnection to set up a UPnP A/V connection.

[ATTRIBUTES]

S	A	+PU+ +RVUSRC+	n/a	n/a	ISO/IEC 29341-4-11 IEC 62481-1-1: 2017	QUO9K	

[COMMENT] In response to a CM:PrepareForConnection call by a +RVUSRC+ co-located with a Content Source device class a DMR containing a +RVUPL+ or +RVUSINK+ responds with an AVTransportID value. When invoking actions on the AVTransport service, the push controller uses that AVTransportID as an InstanceID value to specify the resources in the DMR that should receive the action. When a Content Source +RVUSRC+ invokes the RUIGetVideoBuffer command it will associate its avtid attribute with the AVTransportID provided by the DMR to the +PU+ in the PrepareForConnection response (see 4.8.2.5.1 of RVU Protocol Specification: V1.0 2014). This ensures that the DMR renders an A/V connection to the appropriate A/V output selected by the user.

6.6.7

[GUIDELINE] A Push Controller co-located with a +RVUSRC+ capability should invoke the UPnP Connection Manager Service action ConnectionComplete to tear down a UPnP A/V connection.

[ATTRIBUTES]

S	A	+PU+ +RVUSRC+	n/a	n/a	ISO/IEC 29341-4-11 IEC 62481-1-1: 2017	REMI3	

6.6.8

[GUIDELINE] In addition to the requirements in IEC 62481-1-1:2017, 10.1.6.16 (GUNs J4K4Z, 4BWN9, 7DW6X, C6RFR, SV393 and 8VLXY), a UPnP AV MediaRenderer co-located with a +RVUPL+ or a +RVUSINK+ capability shall issue AVT:LastChange events with one of these four TransportState variable values: PLAYING, STOPPED, NO_MEDIA_PRESENT, and PAUSED_PLAYBACK.

[ATTRIBUTES]

M	A	DMR	n/a	n/a	ISO/IEC 29341-4-10 RVU Protocol Specification: V1.0 2014 IEC 62481-1-1: 2017	M3Q6M	A