

INTERNATIONAL STANDARD



**Digital living network ALLIANCE (DLNA) home networked device interoperability
guidelines –
Part 10: Low-power mode**

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Part 10: Low-power mode**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

Part 10: Low-power mode

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International Standard IEC 62481-10 has been prepared under technical area 8: Multimedia home systems and applications for end-user network, of 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
100/2750/CDV	100/2892/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

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- withdrawn,
- replaced by a revised edition, or
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INTRODUCTION

Consumers are acquiring, viewing, and managing an increasing amount 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.

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

Part 10: Low-power mode

1 Scope

This part of IEC 62481 specifies guidelines for low-power mode management.

Power saving is modular within a physical device. In the context of DLNA networked devices, each physical network interface can have various power modes, some of which can allow Layer 2 or Layer 3 connectivity to still be present, even when many of the other components of the device are powered down. Other physical components, such as screens, hard drives, and similar resources, can also support different power modes.

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*

ISO/IEC 29341-31-1, *Information technology – UPnP Device Architecture – Part 31-1: Energy management device control protocol – Energy management service*

3 Terms, definitions and conventions

For the purposes of this document, the terms, definitions and abbreviated terms 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

Network Interface Mode

operation mode of a network interface, the set of modes includes: "up" for IP traffic, "down" but wakeable either internally or externally, or unwakeable

Note 1 to entry: See ISO/IEC 29341-31-1

3.1.2

Network Interface Information

information related to a physical device and its network interface(s)

3.1.3

EMS

EnergyManagement Service

UPnP service that provides information relating to network interfaces and capabilities for resource subscription

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

3.2 Conventions

In IEC 62481-1-1:2017 and 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 meanings.

4 Networking architecture and guideline conventions

4.1 DLNA home networking architecture

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

4.2 Document conventions

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

4.3 Guideline structure and layout

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

5 DLNA Device Model

5.1 General

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

5.2 Device Functions

Power saving is modular within a physical device. In the context of DLNA networked devices, each physical network interface can have various power modes, some of which can allow Layer 2 or Layer 3 connectivity to still be present, even when many of the other components of the device are powered down. Other physical components, such as screens, hard drives, and similar resources, can also support different power modes.

- UPnP EnergyManagement Service: a UPnP EnergyManagement Service makes available information about the description and Network Interface Mode of a physical device's network interface(s). It can also allow other devices to indicate when they are interested in ensuring the availability of the functionality in a DLNA Device Class, and to reserve use of the needed resources at that time.
- UPnP EnergyManagement Control Point: a UPnP EnergyManagement Control Point issues action requests to a UPnP EnergyManagement Service to get information about the description and Network Interface Mode of a physical device's Network Interfaces. It can also issue action requests to indicate when it is interested in ensuring the availability of functionality in a DLNA Device Class, and to reserve use of the needed resources at that time.

- WakeOnPattern Signaler: a Wake-on Pattern Signaler transmits a bit pattern intended to cause a Network Interface on another device to change its Network Interface Mode to "IP-up" (active).

5.3 Device Capabilities

For the low-power mode interoperability guidelines and system usages, the following Device Capabilities are defined.

- A Low-Power Controller (+LPC+) with the role of providing a control point for issuing action requests to a Low-Power Endpoint or a Low-Power Proxy.
- A Low-Power Endpoint (+LPE+) with the role of responding to actions requests to provide information on Network Interface Mode and access to services based on subscriptions.
- A Low-Power Proxy (+LPPRX+) with the role of tracking the availability of network interfaces and providing the information to the Low-Power Controller on behalf of other DLNA Low-Power Endpoints.

5.4 System usage

The low-power mode feature does not impact existing DLNA system usages pertaining to content sharing, but provides mechanisms and protocols between networked devices so that awareness of the availability of DLNA functionality, even in the presence of power saving modes of operation, can exist in the DLNA network.

The introduction of networked devices in low power modes can introduce some latency and longer response time in DLNA operation. This specification does not provide guidelines nor recommendations on the user interface but it is expected that a Low-Power Controller could give some feedback to the end-user to provide a good quality of experience.

5.5 System usage for Low-Power Controller and Low-Power Endpoint

The following steps illustrate the device interaction model between a device with Low-Power Endpoint Device Capability and one with Low-Power Controller Device Capability. The ordering of steps is provided for the purpose of this example and is not intended to place restrictions or limitations on actual implementations. The steps can be considered optional and can be performed in any order. The steps are numbered for reference in Figure 1.

- 1) [unspecified] Device with +LPE+ starts execution and collects information regarding networking interfaces.
- 2) Device with +LPC+ requests network interface information from +LPE+, which provides that information in a response. For example, the information can include a specified bit pattern or information on doze schedule.
- 3) When a device with +LPE+ changes its Network Interface Mode, the device sends an Event message. For example, if the Network Interface Mode is changed to "IP-down-with-WakeOn" or "IP-down-with-WakeOnAuto" ("wakeable"), the +LPE+ events this Network Interface Mode to +LPC+.
- 4) [unspecified] Device with +LPC+ displays list of DLNA devices to user, including those that are currently dozing or otherwise currently unavailable. Currently unavailable devices include devices that sent an Event noting its interface would be changing its Network Interface Mode or that had provided interface information indicating its physical interface could be awakened by a specified bit pattern. The user selects a device and the +LPC+ acts to awaken a potentially wakeable device and/or the user is informed to wait because it can take time for the device to wake up.
- 5) Device with +LPC+ sends a message with the specified bit pattern, in an attempt to awaken the interface. Upon receiving the specified bit pattern, a device with +LPE+ changes the Network Interface Mode to "IP-up" ("active") and can provide DLNA service with the network interface.
- 6) Alternatively, network interfaces can be in periodic doze mode or other physical resources can be in a low-power mode of operation. In order for devices that provide services to

manage their resources, clients are encouraged to make requests for services using Service Subscription actions of the UPnP EnergyManagement Service.

- 7) [unspecified] UPnP EnergyManagement Service interacts with underlying OS to control availability of physical resources.

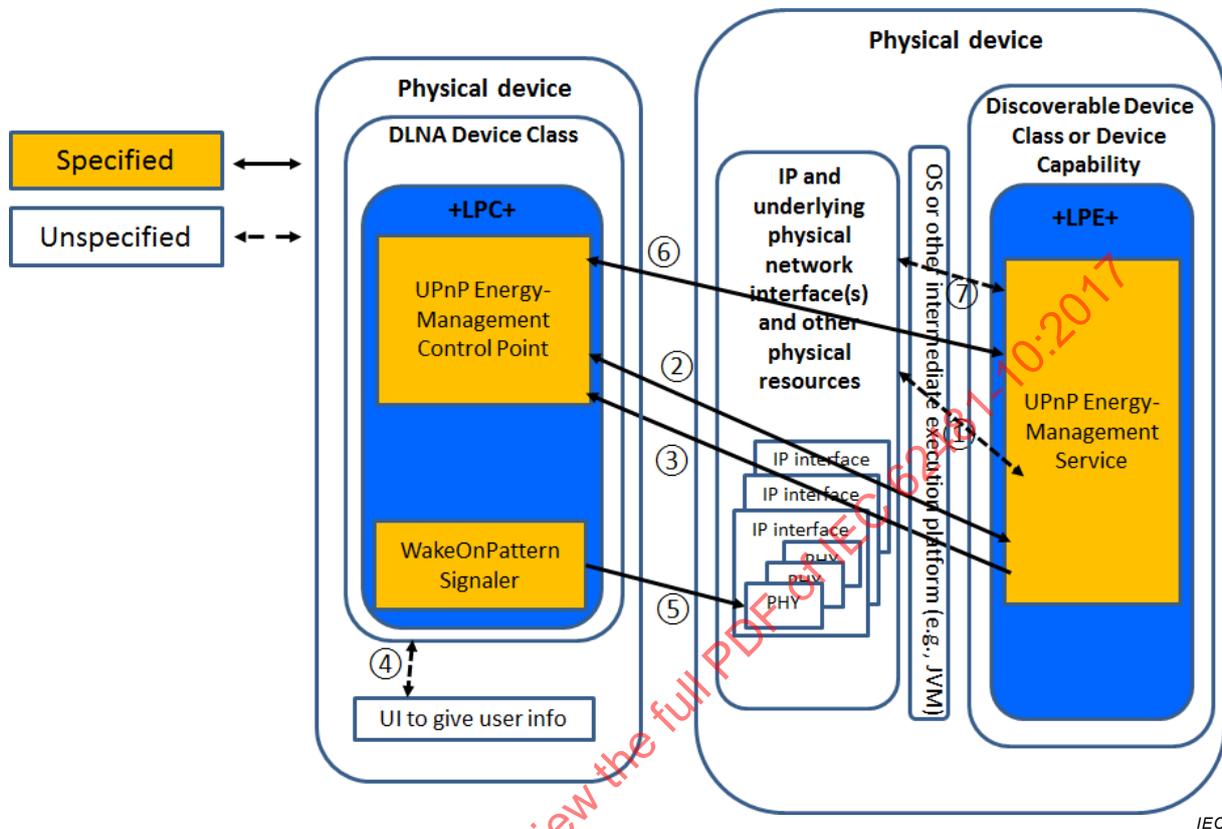
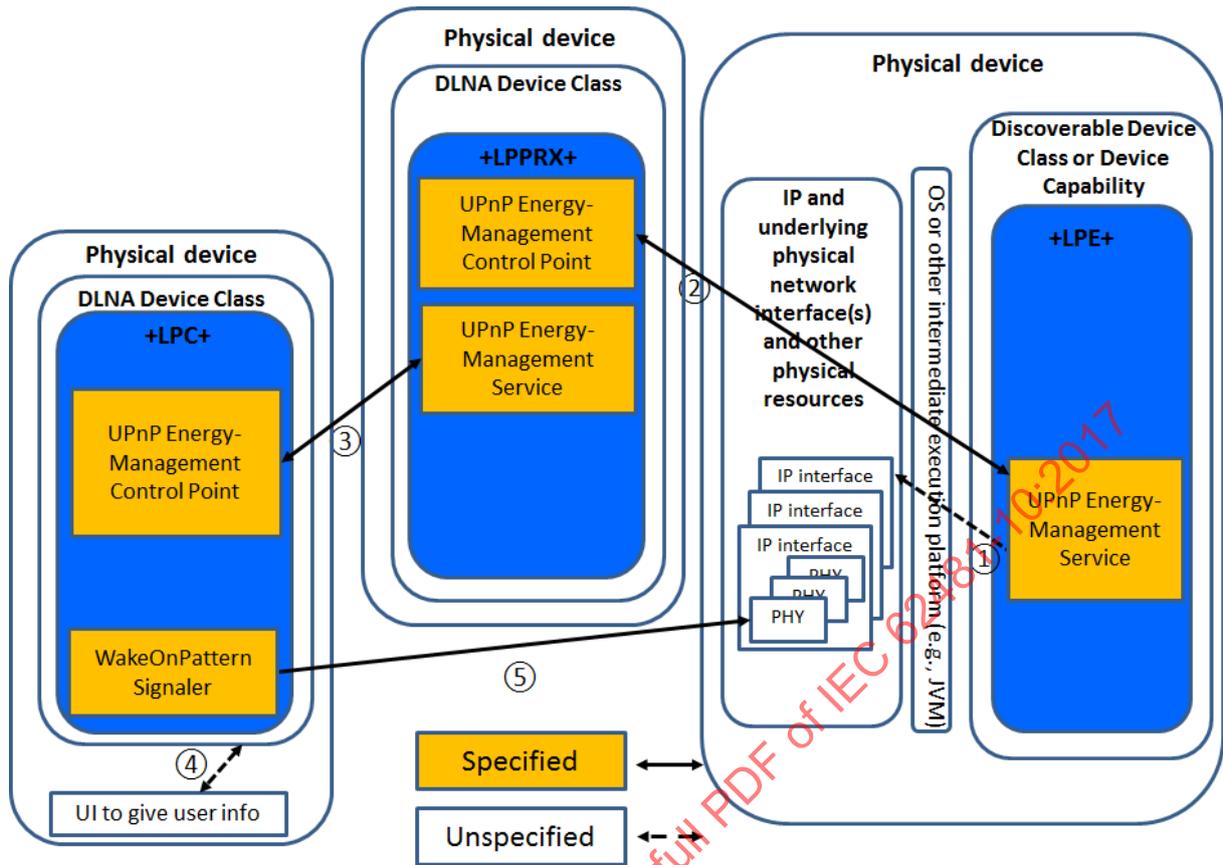


Figure 1 – System usage for Low-Power Controller and Low-Power Endpoint

5.6 System usage for Low-Power Proxy

The following steps illustrate the device interaction model between a device with Low-Power Proxy Device Capability and devices with Low-Power Endpoint and Low-Power Controller Device Capabilities. Since the Low-Power Proxy does not interact with Service Subscription actions of UPnP EnergyManagement, no steps are shown in reference to those functions. The ordering of steps is provided for the purpose of this example and is not intended to place restrictions or limitations on actual implementations. The steps can be considered optional and can be performed in any order. The steps are numbered for reference in Figure 2.

- 1) [unspecified] Exactly as step 1 in 5.5.
- 2) A second device with +LPPRX+ uses its CP to request network interface information from the device +LPE+, which provides that information in a response. For example, the information can include a specified bit pattern or information on doze schedule.
- 3) Exactly as step 3 in 5.5.
- 4) A third device with +LPC+ requests Network Interface Information from +LPPRX+, which provides that information in a response. In this case, the +LPPRX+ sends information it has collected from +LPE+, in addition to its own information.
- 5) [unspecified] Exactly as step 4 in 5.5.
- 6) Exactly as step 5 in 5.5.



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Figure 2 – System usage for Low-Power Proxy

6 Low-power mode guidelines

6.1 General

Clause 6 contains guidelines for Device Functions that are elements of DLNA Low-Power Endpoint, Controller and Proxy Device Capabilities.

6.2 Device discovery & control

6.2.1

[GUIDELINE] A Low-Power Proxy shall conform to all guidelines in IEC 62481-1-1:2017 Clause 9 pertaining to UPnP devices, UPnP control points and UPnP endpoints.

[ATTRIBUTES]

M	A	+LPPRX+	n/a	n/a	IEC 62481-1-1:2017	35XZQ
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6.2.2

[GUIDELINE] A Low-Power Endpoint shall conform to all guidelines in Clause 9 of IEC 62481-1-1:2017 pertaining to UPnP devices and UPnP endpoints.

[ATTRIBUTES]

M	A	+LPE+	n/a	n/a	IEC 62481-1-1:2017	FUC35	
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6.2.3

[GUIDELINE] A Low-Power Controller shall conform to all guidelines in Clause 9 of IEC 62481-1-1:2017 pertaining to UPnP control points and UPnP endpoints.

[ATTRIBUTES]

M	A	+LPC+	n/a	n/a	IEC 62481-1-1:2017	PYL8V	
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6.2.4

[GUIDELINE] A Low-Power Endpoint shall use the value of "+LPE+" for the dlna-dev-capability field of the <dlna:X_DLNAIDOC> element.

[ATTRIBUTES]

M	A	+LPE+	n/a	n/a	IEC 62481-1-1:2017	RNG9Y	
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6.2.5

[GUIDELINE] A Low Power Proxy shall use the value of "+LPPRX+" for the dlna-dev-capability field of the <dlna:X_DLNAIDOC> element.

[ATTRIBUTES]

M	A	+LPPRX+	n/a	n/a	IEC 62481-1-1:2017	5IFZH	
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6.3 UPnP EnergyManagement Service and EnergyManagement Control Point

6.3.1

[GUIDELINE] A Low-Power Endpoint shall implement a UPnP EnergyManagement Service.

[ATTRIBUTES]

M	A	+LPE+	n/a	n/a	ISO/IEC 29341-31-1	LO98E	
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6.3.2

[GUIDELINE] A Low-Power Proxy shall implement a UPnP EnergyManagement Service.

[ATTRIBUTES]

M	A	+LPPRX+	n/a	n/a	ISO/IEC 29341-31-1	LB472	
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6.3.3

[GUIDELINE] A Low-Power Controller shall implement a UPnP EnergyManagement Control Point function.

[ATTRIBUTES]

M	A	+LPC+	n/a	n/a	ISO/IEC 29341-31-1	57LXQ	
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6.3.4

[GUIDELINE] A Low-Power Proxy shall implement a UPnP EnergyManagement Control Point function.

[ATTRIBUTES]

M	A	+LPPRX+	n/a	n/a	ISO/IEC 29341-31-1	KI2UR	
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6.3.5

[GUIDELINE] A Low-Power Controller and Low-Power Proxy UPnP EnergyManagement Control Point shall subscribe to UPnP EnergyManagement Service events.

[ATTRIBUTES]

M	A	+LPC+ +LPPRX+	n/a	n/a	IEC 62481-1-1:2017 ISO/IEC 29341-31-1	5Y8IL	
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6.3.6

[GUIDELINE] A Low-Power Proxy UPnP EnergyManagement Service shall place the last EMS.NetworkInterfaceInfo data received by its UPnP EnergyManagement Control Point in its EMS.ProxiedNetworkInterfaceInfo (replacing any previously received information from that same device).

[ATTRIBUTES]

M	A	+LPPRX+	n/a	n/a	ISO/IEC 29341-31-1	MZDZD	
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6.3.7

[GUIDELINE] A Low-Power Proxy UPnP EnergyManagement Control Point that receives a NetworkInterfaceInfo event shall reflect the change indicated by the event in the EMS.ProxiedNetworkInterfaceInfo.

[ATTRIBUTES]

M	A	+LPPRX+	n/a	n/a	ISO/IEC 29341-31-1	ADCXI	
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