Dolby

Latency Indication Protocol Specification

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Notices

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Contents

1

Introduction

This document specifies the latency indication protocol used to exchange information about audio and video latency between devices connected via High-Definition Multimedia Interface (HDMI).

1.1 Terminology conventions

When referring to devices, such as source device, TV, or audio system, this documentation follows terminology conventions used in the HDMI 1.4 specification.

Audio system
A device other than a TV that is capable of rendering audio, for example, an audio/video receiver (AVR) or a sound bar.

Source device
A device that is transmitting audio/video content via HDMI, for example, a set-top box, a game console, or a digital media adapter (DMA).

TV
A device with an HDMI input that is capable of displaying the input HDMI signal.

Hub (device)
When speaking about an HDMI consisting of three devices, a device that is in the middle of the chain. For example, in the following device chain: source device → TV→ audio system, the TV is the hub.

1.2 Standards and Dolby documents

Standards and Dolby documents provide additional information to assist you in designing your product.

Standards

- CTA-861-G (2016), *A DTV Profile for Uncompressed High Speed Digital Interfaces*, available from http://www.cta.tech.
- HDMI 2.1, *High-Definition Multimedia Interface Version 2.1*, available from http://www.hdmi.org.
- IEC 61937-1:2007+AMD1:2011 CSV, *Digital Audio—Interface for Nonlinear PCM Encoded Audio Bitstreams Applying IEC 60958—Part 1: General*, available from http://www.iec.ch.
- IEC 61937-2:2007+AMD1:2011+AMD2:2018 CSV, *Digital Audio Interface for Nonlinear PCM Encoded Audio Bitstreams Applying IEC 60958—Part 2: Burst Info*, available from http://www.iec.ch.
- VESA E-EDID standard, *VESA Enhanced Extended Display Identification Data Standard*, available from http://www.vesa.org.

1.3 Version history

A publication history of this specification.

Version	Date published	Changes
0.1	1 April 2019	First published draft
0.9	9 August 2019	Major updates to the protocol messages and functionality

2

Latency indication protocol overview

The latency indication protocol is an extension of the Consumer Electronics Control (CEC) protocol designed for improved audio/video (A/V) synchronization when the audio and video content is decoded and rendered on different devices interconnected via HDMI.

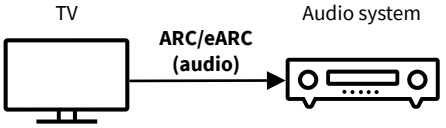
A source device that has received information about downstream device latencies can optimally compensate the difference and ensure a proper A/V synchronization at the rendering points.

2.1 Latency indication protocol scenarios

The latency indication protocol is designed for specific device setups.

The latency indication protocol supports the following scenarios:

[1] TV audio output via ARC or eARC



Use case

The TV outputs audio via Audio Return Channel (ARC) or enhanced Audio Return Channel (eARC):

- The TV is the source device.
- The audio is rendered on the audio system.

Expectation

Upon request, the audio system reports its audio latency to the TV.

The TV is expected to:

- Delay its video if the audio latency is larger than the video latency.
- Delay its audio if the video latency is larger than the audio latency.

[2] Source device connected directly to a TV

Use case

A source device directly connected to a TV.

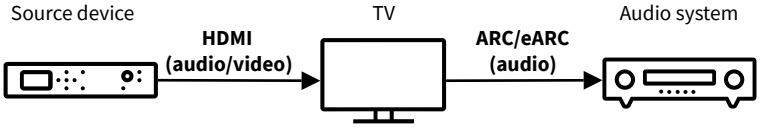
Expectation

Upon request, the TV reports its audio and video latency to the source device.

The source device is expected to:

- Delay its video if the audio latency is larger than the video latency.
- Delay its audio if the video latency is larger than the audio latency.

[3] TV as the hub



Use case

The TV acts as the hub:

- The source device, such as a set-top-box, an optical disk player, a video recorder, a DMA, or a game console, connected directly to the TV.
- The audio is rendered either on the TV or on the audio system via ARC or eARC.

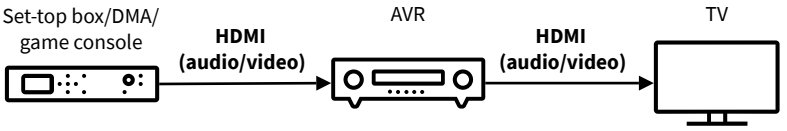
Expectation

When active, the audio system reports its audio latency to the TV. The TV reports to the source device its video latency and its audio pass-through/transcoding latency plus the audio latency of the audio system.

The source device is expected to:

- Delay its video if the audio latency is larger than the video latency.
- Delay its audio if the video latency is larger than the audio latency.

[4] Audio system as the hub



Use case

An audio system acts as the hub:

- The source device, such as a set-top box, an optical disk player, a video recorder, a DMA or a game console, connected directly to the audio system.
- The audio is rendered on the audio system or on the TV.

Expectation

The TV reports to the audio system its video latency and its audio latency if requested by the audio system.

The audio system reports to the source device the following values:

- When the audio is rendered on the audio system, its audio latency and its video pass-through latency plus the video latency of the TV.
- When the audio is rendered on the TV, the pass-through/transcoding audio latency and video latency of the audio system plus the audio and video latency of the TV.

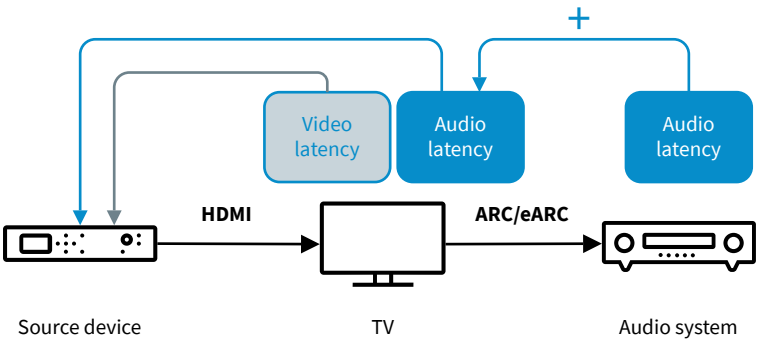
The source device is expected to:

- Delay its video if the audio latency is larger than the video latency.
- Delay its audio if the video latency is larger than the audio latency.

2.2 Cumulative downstream latency

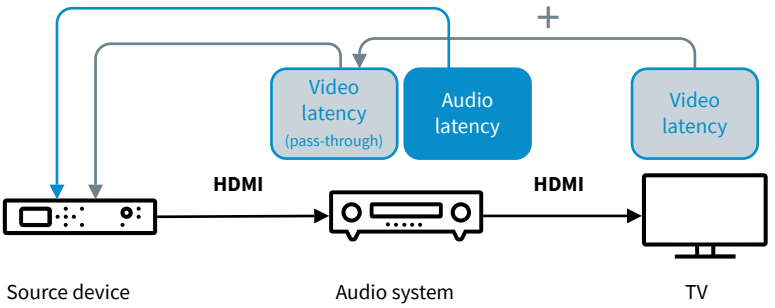
A source device that supports latency indication protocol expects to receive the total latency from its HDMI output to the rendering end point.

TV as the hub



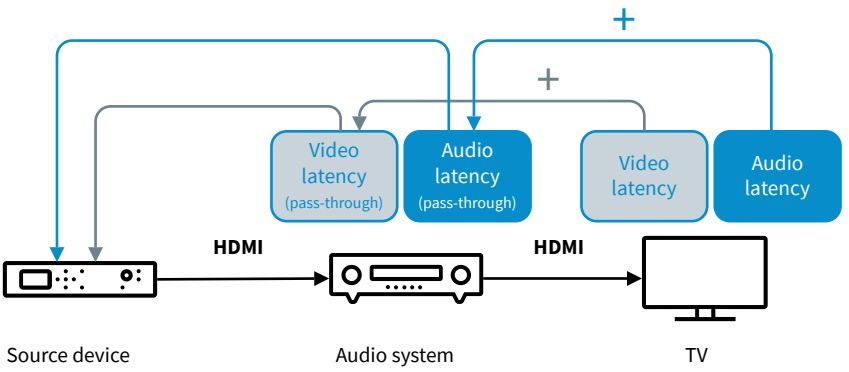
The TV reports to its source its own video latency and the total audio latency by adding up its own audio pass-through/transcoding latency and the audio latency reported by the ARC or eARC connected audio system.

Audio system as the hub (audio rendered on the audio system)



The audio system reports to its sources its own audio latency and the total video latency by adding up its own video latency and the video latency reported by the TV.

Audio system as the hub (audio rendered on the TV)



The audio system reports to the source the following information:

- Its own pass-through/transcoding audio latency plus the audio latency of the TV
- Its pass-through/transcoding video latency plus the video latency of the TV.

3

Device addressing and communication

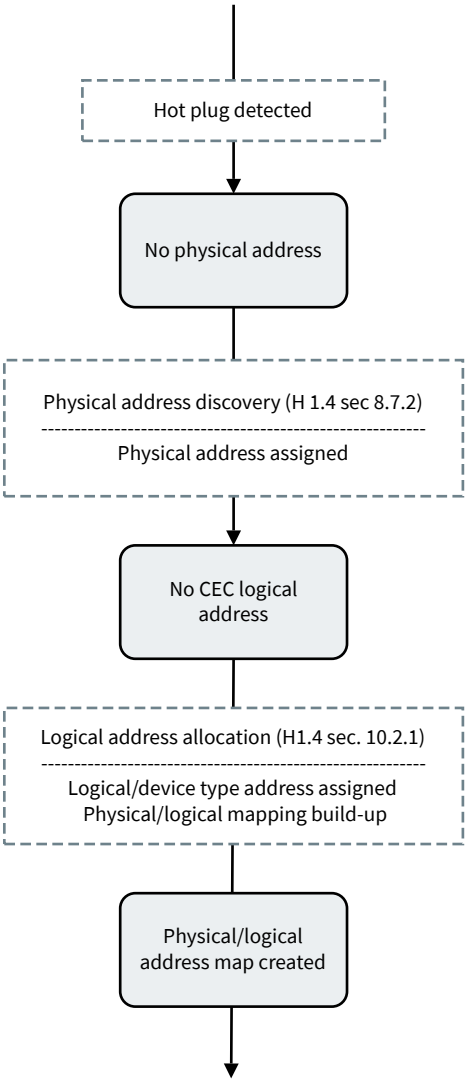
The latency indication protocol uses the CEC communication channel and its open vendor-specific commands as defined in the HDMI v1.4b and later versions of the specification.

3.1 Device addressing

Devices in a CEC network are identified by a combination of physical addresses and logical addresses. The addressing of CEC devices is specified in the HDMI v1.4 specification.

A device that supports the latency indication protocol must follow the CEC addressing mechanism specified in the CEC 10 "Device connectivity and addressing" section of the HDMI v1.4 specification.

Figure 1: CEC addressing flow



This process allows the devices to create a mapping between the physical addresses and logical addresses of devices that make up an HDMI cluster.

Devices supporting the latency indication protocol should keep track of the map between physical and logical address as all communication uses point-to-point addressing based on the logical addresses.

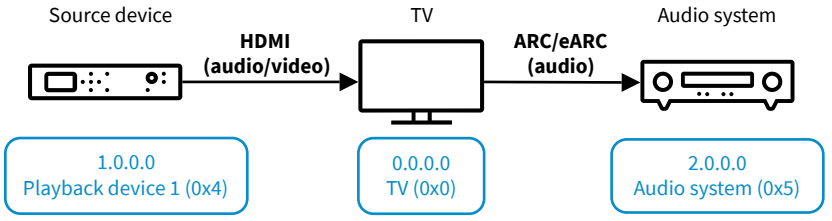
3.2 Latency indication protocol constraints

In addition to implementing CEC addressing, the following conditions must be met for a latency indication protocol implementation to work correctly.

- The latency indication protocol assumes that there is *one* and only *one* TV in the HDMI CEC chain and at most *one* audio system connected directly to the TV.

- The TV is assigned the physical address 0.0.0.0 and responds to the logical address “TV” (`0x0`).
- The TV assigns the physical address X.0.0.0 (X ≠ 0) to the audio system.
- An audio receiver such as an AVR or a sound bar responds to the logical address “audio system” (`0x5`).
- A source device is connected directly to the TV or the audio receiver with the logical address "audio system" (`0x5`)
- Both TV and audio system must support the System Audio Control feature as described in section CEC 13.15 of the HDMI 1.4b specification.

Figure 2: Example device addressing in an HDMI chain



3.3 Cluster updates

Devices supporting the latency indication protocol should monitor certain CEC messages that indicate changes in an HDMI cluster for the protocol to work correctly.

Devices should monitor `<Report Physical Address>` messages to maintain a valid map of physical and logical addresses of devices in the cluster.

Source device → audio system → TV

In a cluster with an audio system as the hub, the behavior of the audio system depends on the `System Audio Mode` status:

- If `Off`, that is either the audio system is in stand-by mode or audio is played back by a TV, the audio system should report to the source the audio latency of the TV plus its own audio pass-through latency.
- If `On`, that is the audio system is powered on and plays audio over its speakers, the audio system should report to the source its own audio latency.

(Source →) TV → audio system

The TV should monitor the CEC line for a `<Set System Audio Mode>` broadcast message:

- After receiving a broadcast message `<Set System Audio Mode> ["On"]`, the TV should report its own transcoding/pass-through latency combined with the audio system latency when queried.
- After receiving a broadcast message `<Set System Audio Mode> ["Off"]`, the TV should report its own audio rendering latency when queried.

4

Functionality description

The functionality of latency indication protocol includes querying for the support of the protocol, sending information about the audio and video latency values of sink devices, and providing dynamic updates to the source device on changes in the cluster or processing mode of a sink device.

- Protocol initialization
- Latency requests and reports
- UUID updates
- Protocol not supported on one of devices
- Error handling

4.1 Protocol initialization

A device that has been plugged in sends the <Request LIP Support> message to the downstream device to find out whether the device supports the latency indication protocol.

The latency indication protocol initialization must be preceded by the physical address discovery (HDMI 1.4b section 8.7.2) and the logical address allocation (HDMI 1.4b section 10.2.1). As a result, a physical-logical address map of devices in the cluster is created. An HDMI source device or ARC/eARC transmitter uses this map to address its immediate downstream device.

The source device initiates the latency indication protocol discovery by sending out the <Request LIP Support> message with the logical address of its immediate downstream device.

When receiving the <Request LIP Support> request from one of its sources, a device that supports the latency indication protocol:

- Adds this source to the list of sources that support the latency indication protocol.
- Responds with the <Report LIP Support> message that unambiguously identifies the device or device chain with a unique identifier (UUID) and audio/video rendering modes.

  Note: In the case of a source device → audio system → TV chain where the TV does not support the latency indication protocol, the audio system responds with a <Feature Abort> message even though the audio system itself supports the protocol.

  In this case, it is preferred that the source device does not use the partial latency information to apply compensation.

- Replies to upcoming latency indication protocol requests from this source device.

Related information

Message flow for protocol initialization on page 23

4.2 Latency requests and reports

After the source device establishes support of the latency indication protocol in the HDMI chain, the source device initiates the request to obtain the latency values of the downstream devices.

To optimize the CEC bandwidth usage, latency related commands are defined to request and report latency values for both audio and video, audio only, and video only. The specification defines the following message pairs:

Request	Report
<Request Audio-and-Video Latency>	<Report Audio-and-Video Latency>
<Request Audio Latency>	<Report Audio Latency>
<Request Video Latency>	<Report Video Latency>

For a detailed description of the messages, see *Message description*.

On receiving the latency values, the source device is expected to apply compensation of the delay based on the received values until an event occurs that may require updating of the values.

On receiving 255 for either the audio or video latency, the source device should not apply compensation based on the latency indication protocol.

The source device should request new latency values when it is about to start transmitting in another audio or video format, either due to the incoming content change or change to the source device settings.

A request for new latency values may also be triggered in the following scenarios:

- An update in the device chain, for example, when the speaker output switches from a TV to an ARC or eARC receiver or the other way round.

- An update of the audio or video rendering mode on a downstream device.

Related information

Message flow for latency information exchange (source/audio system/TV) on page 23
Message flow for latency information exchange (source/TV/audio system) on page 24
Message flow for user setting change (source/audio system/TV) on page 24
Message flow for video content change (source/audio system/TV) on page 25
Message description on page 19

4.3 UUID updates

To minimize the CEC traffic, the protocol enables identification of devices with a 32-bit unique identifier (UUID). The UUID provides a key for optional caching of the latency information related to a given chain of devices and audio/video rendering modes.

The UUID consists of the following fields:

- 4-bit audio rendering mode that reflects the audio processing settings of the active audio sink
- 4-bit audio mode that reflects the audio processing settings of the hub device
- 4-bit video rendering mode that reflects the video processing settings of the active video sink
- 4-bit video mode that reflects the video processing settings of the hub device
- 16-bit hash value that uniquely identifies a device or a device chain

  For a single device in the chain, the value is obtained from the 16 least significant bits of a hash, for example, MD5, of the device Enhanced Extended Display Identification Data (E-EDID) and firmware version.

  With three devices in a chain, the hub device should hash its 16-bit hash with the 16-bit hash received from the downstream device so that the composite UUID uniquely identifies a chain of devices.

Device setup	Hash value of the chain
Source device → TV → audio system	hash(TV hash, audio system hash)
Source device → audio system → TV	hash(audio system hash, TV hash)

The UUID may be used by the source device for caching latency values for various combinations of rendering modes and device chains.

The `<Update UUID>` message is sent in the following scenarios:

- The TV sends this message when a user activates or deactivates an ARC or eARC link.
- An active sink device sends this message when a user changes audio or video processing mode.
- An active hub device sends this message when a user changes audio or video processing mode.
- An active hub device sends this message when a hot-plug event is detected on its output port and a new sink device is added to the cluster. After exchanging the `<Request LIP Support>`/`<Report LIP Support>` messages with the sink device, the hub sends an `<Update UUID>` message to the source device.

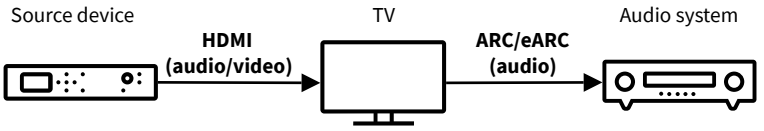
Related information

Message flow for changes in audio or video rendering settings (source/TV/audio system) on page 26
Message flow for changes in the device chain (source/TV/audio system) on page 27

4.3.1 Dynamic downstream updates in an HDMI chain

The latency indication protocol allows for dynamic latency updates during playback when a new device is switched on and added to the chain or when it is switched off and is no longer part of the chain.

TV as the hub scenario



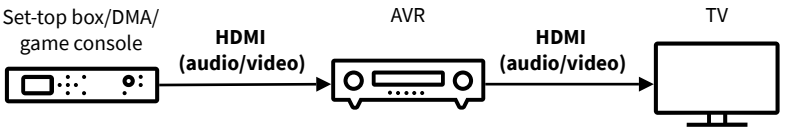
When the audio system is activated, the TV should mute its internal speakers and send an `<Update UUID>` message to the active source with the following data:

- A UUID resulting from the hashing of the TV UUID and the audio system UUID
- The audio rendering mode of the ARC or eARC connected audio system
- The video rendering mode and the audio processing mode of the TV

When the TV switches from ARC or eARC playback to TV speaker playback or when the downstream audio system gets switched off, the TV should send to the active source an `<Update UUID>` message with the following data:

- The UUID of the TV
- The audio rendering mode of the TV
- The video rendering mode of the TV

Audio system as the hub scenario



When the audio system has been switched on, the source device is expected to query the latency indication protocol support of the downstream audio system and get the latency information of the entire chain directly from the audio system.

When the audio system has been switched off, the source device continues sending requests to the audio system and the audio system forwards the messages to the TV. The audio system responds with the latency values of the TV plus its own pass-through latency.

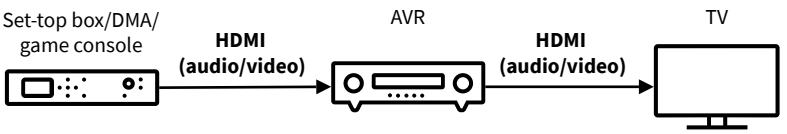
Related information

Message flow for changes in the device chain (source/TV/audio system) on page 27

4.4 Protocol not supported on one of devices

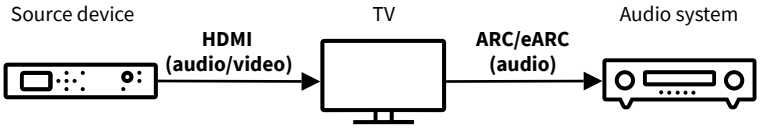
If one of the downstream devices does not support the latency indication protocol, it may not be possible to use the protocol to compensate audio or video delay.

Audio system as the hub



If either the audio system or the TV do not support the latency indication protocol, it is assumed that the protocol is not supported.

TV as the hub



If the TV does not support the latency indication protocol, it is assumed that the protocol is not supported.

If the audio system does not support the latency indication protocol, the TV should use the value of the decoding latency specified in the relevant IEC 61937 standard or codec vendor's documentation and add this value to its own processing latency.

4.5 Error handling

A device that supports the latency indication protocol must be able to handle communication errors (due to such factors as CEC bus congestion or incorrect protocol implementation) and situations when a device in an HDMI chain does not support the protocol.

A source device or a device acting as the hub must implement the CEC reliable communication mechanism as described in the HDMI 1.4b specification section CEC 7. The latency indication protocol does not implement a retransmission mechanism on the protocol level.

<Feature Abort>

After sending a latency indication protocol request, the device must wait for the corresponding answer or a `<Feature Abort>` message.

The `<Feature Abort>` message is specified in the HDMI 1.4b specification.

If the `<Feature Abort>` message is received as a response to `<Request LIP Support>`, the source should not send any further latency indication protocol requests to this device.

Timeouts

To avoid deadlocks, this specification defines the following timeouts:

- **Required**: 1 second timeout on the hub device.

  If the timer expires, the hub device is expected to behave as if the downstream device does not support the latency indication protocol:

  - Audio system as the hub: replies to the source device with a `<Feature Abort>` message and the source device does not apply compensation based on the latency indication protocol.
  - TV as the hub: replies with its own video latency and its own audio latency plus the latency from the relevant IEC 61937 standard for a particular audio format.
  - If the hub receives a late response, we recommend that the hub device retransmits its response to the source device; the source device should ignore the response and send the request again.
- **Recommended**: 2 second timeout on the source device.

  If the timer expires, the source device does not apply compensation based on the latency indication protocol.

  If the source device receives a late response, we recommend that the device ignores the response and sends the request again.

5

Latency indication protocol messages

The latency indication protocol consists of a set of messages for exchanging information about audio and video latency for different audio and video formats, device rendering modes, and device setups.

The latency indication protocol messages are optimized for minimum size and structured so as to avoid redundancy.

5.1 Message structure

A latency indication protocol message extends the <Vendor Command With ID> message defined in the HDMI specification.

A latency indication protocol message is structured as follows:

[Initiator,Target] [Vendor Command With ID] [Dolby vendor ID] [Latency indication protocol opcode][Parameters]

[Initiator,Target]
The logical address of the device that is sending the message and the logical address of the target device.

[Vendor Command With ID]
0xA0, as defined in the HDMI specification.

[Dolby vendor ID]
0x00D046, as defined in http://standards-oui.ieee.org/oui.txt.

[Latency indication protocol opcode]
Latency indication protocol message identifier (opcode), as defined in *Message description*.

[Parameters]
Parameters used by the latency indication protocol message, as defined in *Parameter description*.

5.2 Message description

The description for each latency indication protocol message includes the message opcode value, its function, and, if applicable, its parameters and an expected response.

Opcode	Value	Parameters	Description	Response
<Request LIP Support>	0x10		Queries the downstream device if it supports the latency indication protocol.	<Report LIP Support>
<Report LIP Support>	0x11	[Version] [UUID]	Confirms that the latency indication protocol is supported. Reports a unique identifier that enables association of the reported latency values to the current device chain and rendering modes.	
<Request Audio-and-Video Latency>	0x12	[Video Format] [HDR Format] [Audio Format] ([Audio Format Extension])	Requests the audio and video latency for a given video and audio format.	<Report Audio-and-Video Latency>
<Report Audio-and-Video Latency>	0x13	[Video Latency] [Audio Latency]	Reports its audio and video latency for the specified audio and video format in the specified processing mode. The reported latency takes into account any further downstream latency values.	
<Request Audio Latency>	0x14	[Audio Format] ([Audio Format Extension])	Requests the audio latency value of a downstream device. For example, the TV requests the audio latency value of the audio system connected via ARC or eARC.	<Report Audio Latency>

Opcode	Value	Parameters	Description	Response
<Report Audio Latency>	0x15	[Audio Latency]	Reports audio latency. For example, the audio system playing from its ARC or eARC input reports its audio latency for the requested audio format and for its current processing mode.	
<Request Video Latency>	0x16	[Video Format] [HDR Format]	Requests video latency of a downstream device. For example, the audio system requests the video latency value of the downstream TV.	<Report Video Latency>
<Report Video Latency>	0x17	[Video Latency]	Reports video latency. For example, the TV reports its video latency for the requested video format and its current processing mode.	
<Update UUID>	0x18	[UUID]	Update the UUID sent by a sink device to an upstream device. Sending this message reflects a change in the downstream playback chain or processing mode. For example, switching from the TV speaker rendering to ARC rendering.	

5.3 Parameter description

The description for each parameter includes its supported values, its length, and its purpose.

Name	Range description		Length	Purpose
[Version]	“Protocol version”	0	1 byte	Specifies the latest version of the latency indication protocol supported by a sink device.
	Reserved	1..255		
[UUID]	0x00000000 ≤ N ≤ 0xFFFFFFFF		4 bytes	Uniquely identifies a downstream device or cluster of devices. Bits 0..3: user-specified audio rendering mode of the active audio sink. Bit 4..7: user-specified audio processing mode of the hub device, for example, pass-through, transcoding etc. Bits 8..11: user-specified video rendering mode of the active video sink. Bit 12..15: user-specified video processing mode of the hub device, for example, scaling up, scaling down etc. Bits 16..31: a 16-bit hash value.
[Audio Format]	“LPCM”	0	1 byte	Specifies the format of the audio stream that will be sent over HDMI, ARC, or eARC. For pulse code modulation (PCM) audio, the value is 0. For compressed audio, the value corresponds to bits [0..4] of audio codec-specific PC field defined in IEC 61937-2.
	“Compressed audio”	1..31		
	Reserved	32..255		

Name	Range description		Length	Purpose
[Audio Format Extension]	“Compressed audio extension”	0..255	1 byte	An optional parameter for compressed audio format whose latency depends on additional information, for example, frame duration. For PCM, this field must be ignored. For compressed audio, corresponds to bits [5..12] of the audio codec-specific PC field defined in IEC 61937-2.
[Audio Latency]	[0, 254]: latency in 2 ms steps between [0, 508] ms 255: format not supported		1 byte	Reports the audio latency for the requested audio format and format extension.
[Video Format]	As per CTA-861-G table 3.		1 byte	Gets the latency information for a specific video format; frame size and frame rate as per the video information code (VIC) written by the source on the video InfoFrame.
[HDR Format]	“HDR_Static_SDR”	0	1 byte	When querying the video latency, specifies the dynamic range of video as output by the source in video InfoFrames. Values 0..63 are reserved for HDR static formats as defined in CTA-861-G section 7.5.13. Values 64..127 are reserved for HDR dynamic formats as defined in CTA-861-G section 7.5.14. Values 128..192 are reserved for Dolby Vision formats as defined in Dolby Vision Vendor-Specific Video Data Block (VSVDB) v2. Values 193..255 are reserved for future use.
	“HDR_Static_HDR”	1		
	“HDR_Static_SMPTE_ST_2084”	2		
	“HDR_Static_HLG”	3		
	Reserved	4..63		
	“HDR_Dynamic_SMPTE_ST_2094_10”	64		
	“HDR_Dynamic_ETSI_TS_103_433”	65		
	“HDR_Dynamic_ITU_T_H265”	66		
	“HDR_Dynamic_SMPTE_ST_2094_40”	67		
	Reserved	68..127		
	“Dolby_Vision_Sink_Led	128		
	“Dolby_Vision_Source_Led	129		
	Reserved	130..255		
[Video Latency]	[0, 254]: latency in 2 ms steps between [0, 508] ms 255: format not supported		1 byte	Reports the video latency for the requested video format and HDR format.

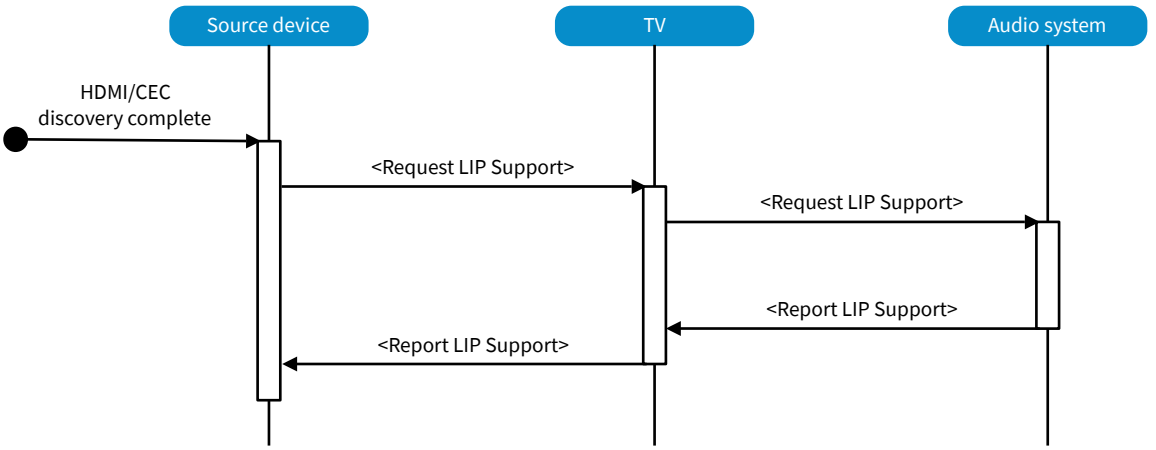
6

Message flow diagrams

The message flow diagrams show example sequences of latency indication protocol messages exchanged between devices in an HDMI chain.

6.1 Message flow for protocol initialization

When the CEC address discovery is complete, the source device sends a <Request LIP Support> message to check the latency indication protocol support of the downstream device.



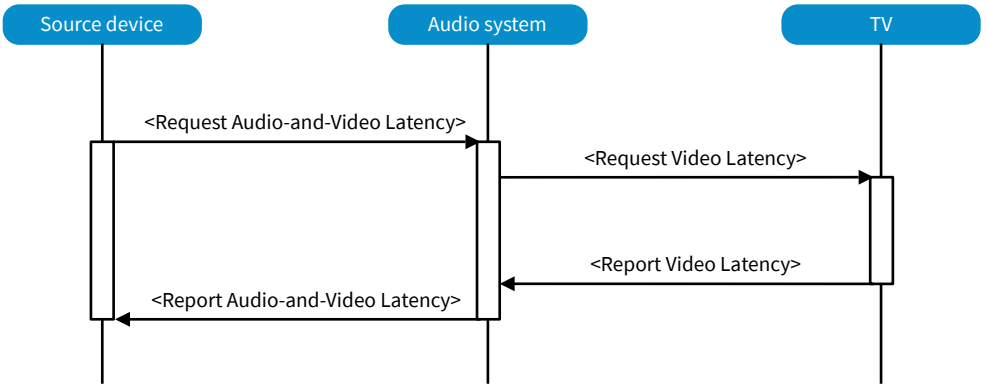
If the chain consists of three devices, the intermediate device first queries its downstream device to check the protocol support on the last device in the chain before sending a <Report LIP Support> message to the source.

Related information

Protocol initialization on page 14

6.2 Message flow for latency information exchange (source/audio system/TV)

After receiving the information that the latency indication protocol is supported, the source device requests information about relevant latencies.

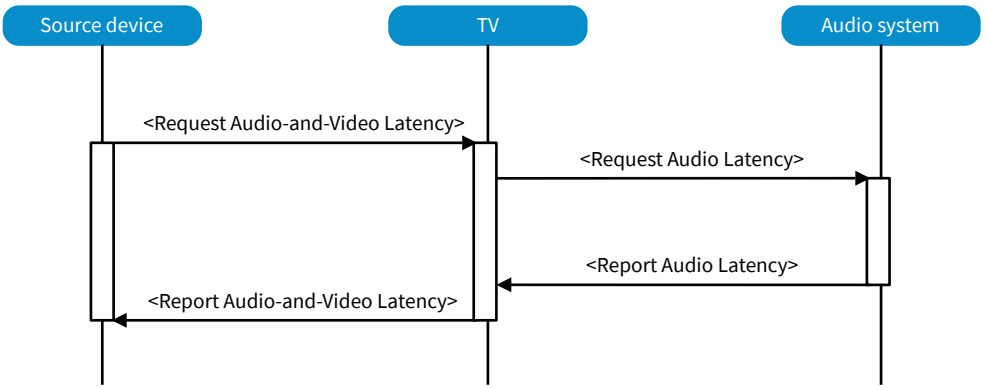


Related information

Latency requests and reports on page 14

6.3 Message flow for latency information exchange (source/TV/audio system)

After receiving the information that the latency indication protocol is supported, the source device requests information about relevant latencies.

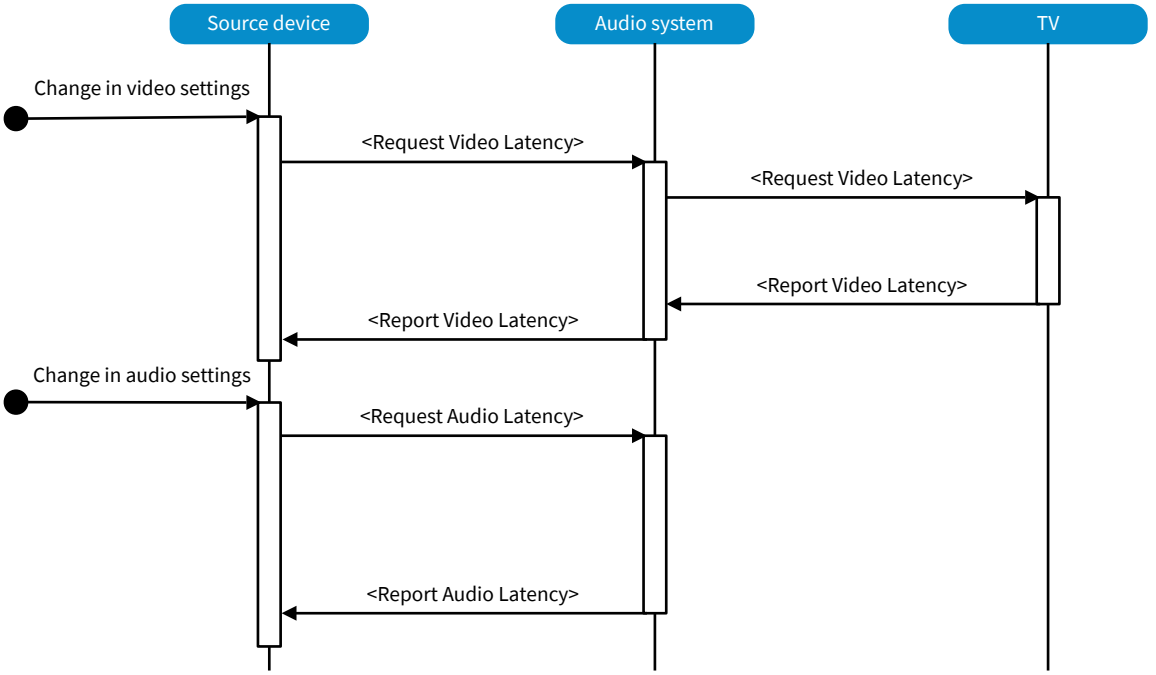


Related information

Latency requests and reports on page 14

6.4 Message flow for user setting change (source/audio system/TV)

When a user setting change occurs on the source device, the source device triggers a request for updated audio and video latencies from its downstream devices.

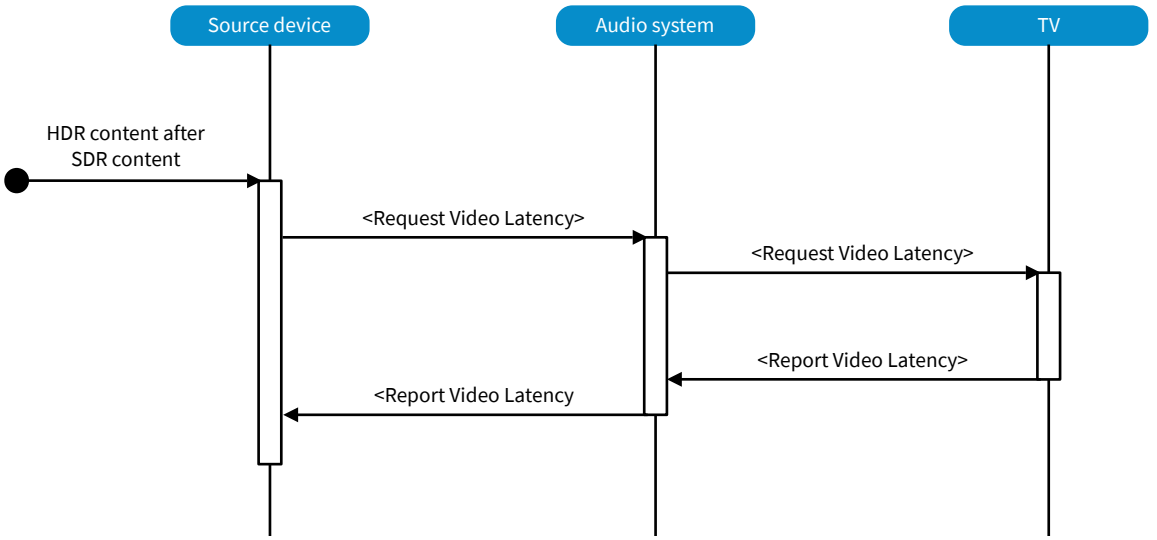


Related information

Latency requests and reports on page 14

6.5 Message flow for video content change (source/audio system/TV)

When the source device has information that the incoming video content is about to change, the source device triggers a request for updated latencies from its downstream devices.



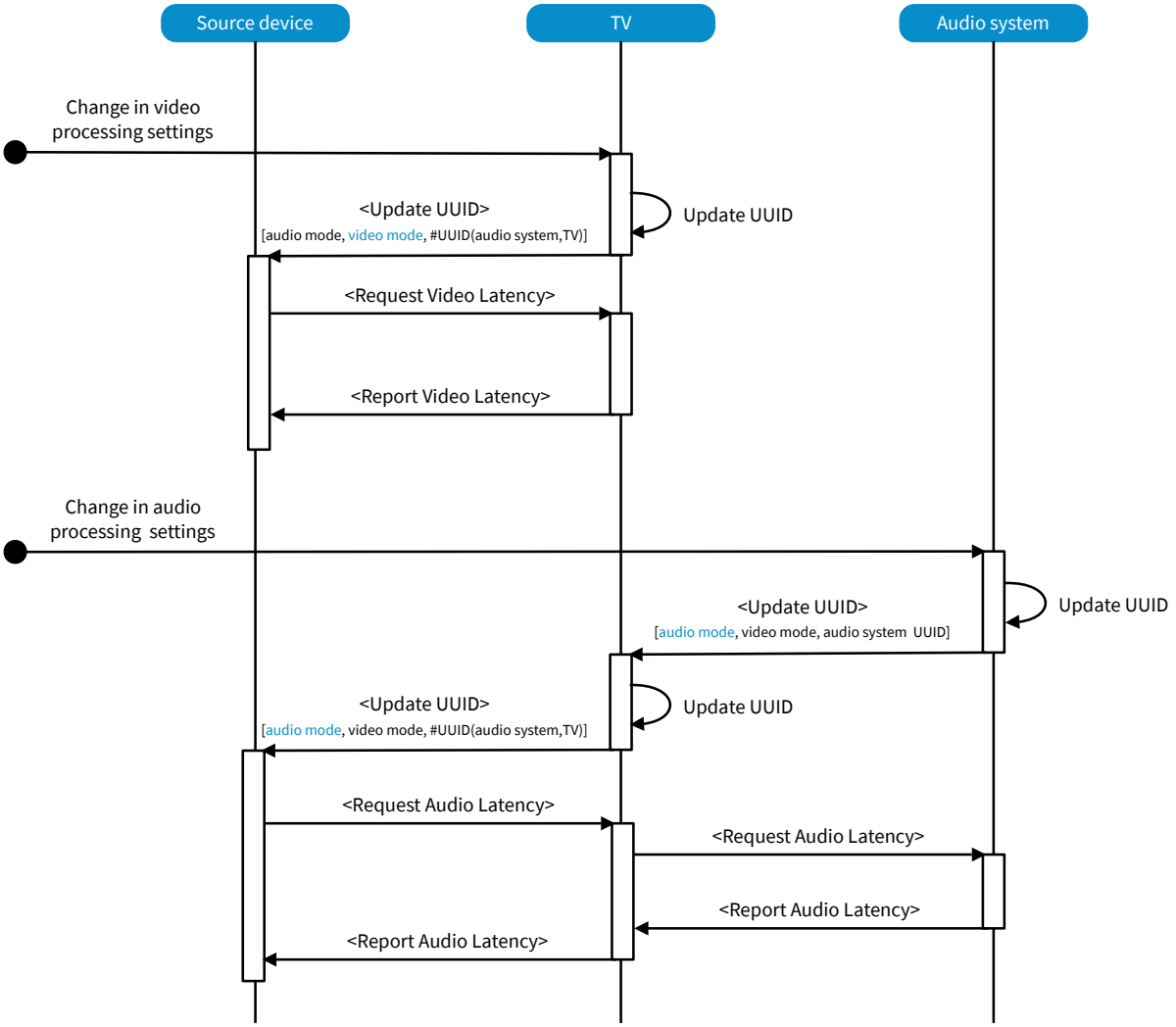
Assuming that the source device stores cached audio latency values, it sends a request only for updated video latency.

Related information

Latency requests and reports on page 14

6.6 Message flow for changes in audio or video rendering settings (source/TV/audio system)

When a user-triggered setting change occurs on one of the sink devices, the device whose settings have changed sends an <Update UUID> message with a new UUID value for the current audio or video rendering mode.



Changing video settings on a TV triggers an update of the video mode value in the UUID.

Changing audio settings on an audio system triggers an update of the audio mode in the UUID.

On receiving an <Update UUID> message, the source device is expected to behave as follows:

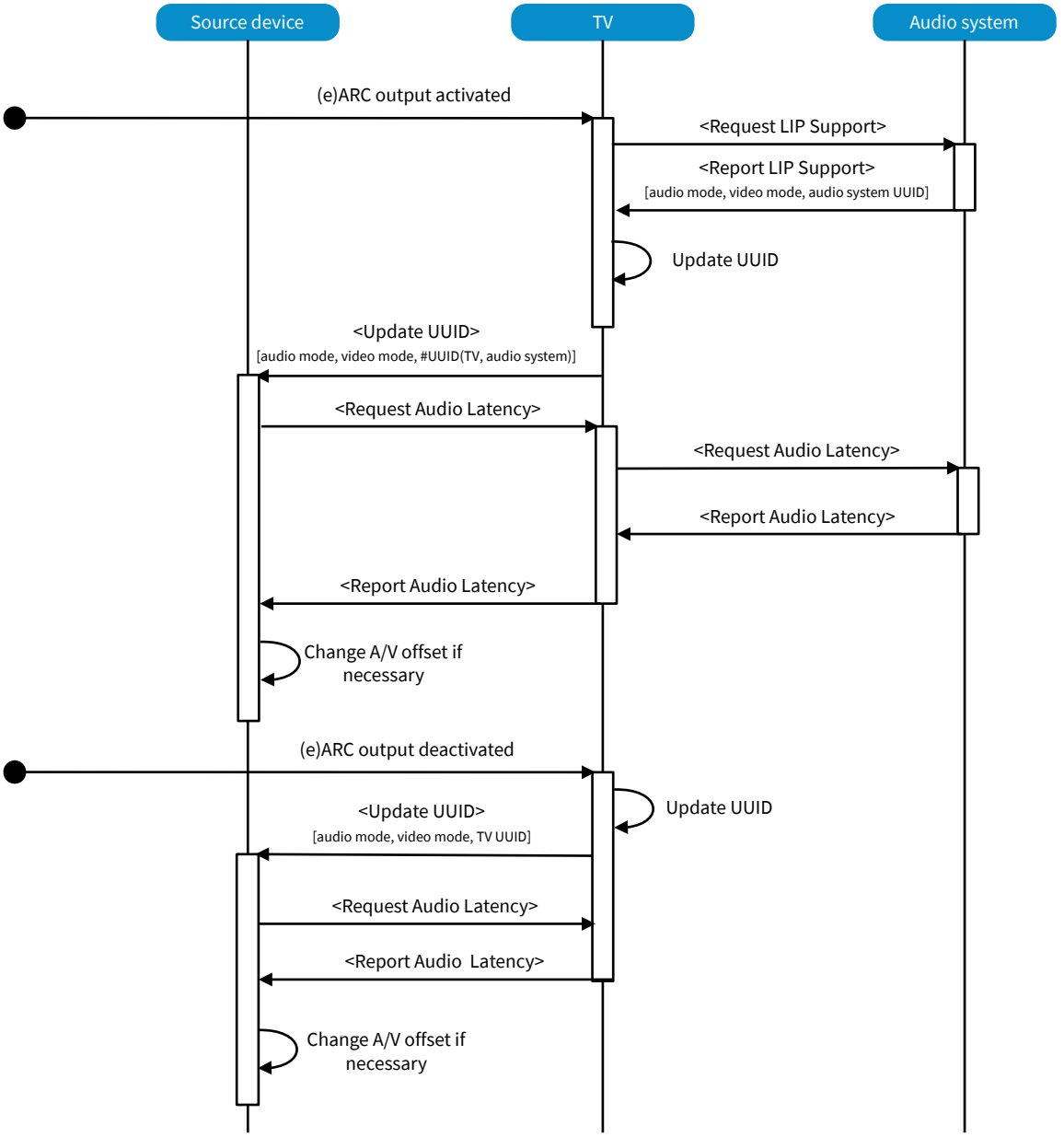
- If the source device does not implement caching or does not store the values corresponding to the updated UUID, it sends a request for new audio, video, or audio and video latency values and waits to receive the latency values for the entire chain.
- If the source device stores cached values corresponding to the updated UUID, it may use those values to compensate the delay.

Related information

UUID updates on page 15

6.7 Message flow for changes in the device chain (source/TV/audio system)

When an ARC or eARC receiver connected to a TV is activated, the TV needs to establish if the downstream device supports the latency indication protocol and sends the <Update UUID> message to inform the source device about the change in the device chain.



On receiving an <Update UUID> message, the source device is expected to behave as follows:

- If the source device does not implement caching or does not store the values corresponding to the updated UUID, it sends a request for new audio and video latency values and waits to receive the latency values for the entire chain.
- If the source device stores cached values corresponding to the updated UUID, it may use those values to compensate the delay.

Related information

UUID updates on page 15

Dynamic downstream updates in an HDMI chain on page 16

7

Device state diagrams

The state diagrams show the incoming and outgoing latency indication protocol commands and device states based on the type of device (a TV, an audio system, a source device) and its function (for example, TV as a video and audio sink or TV as a video sink only).

7.1 Device states: source device

Figure 3: Source device initialization

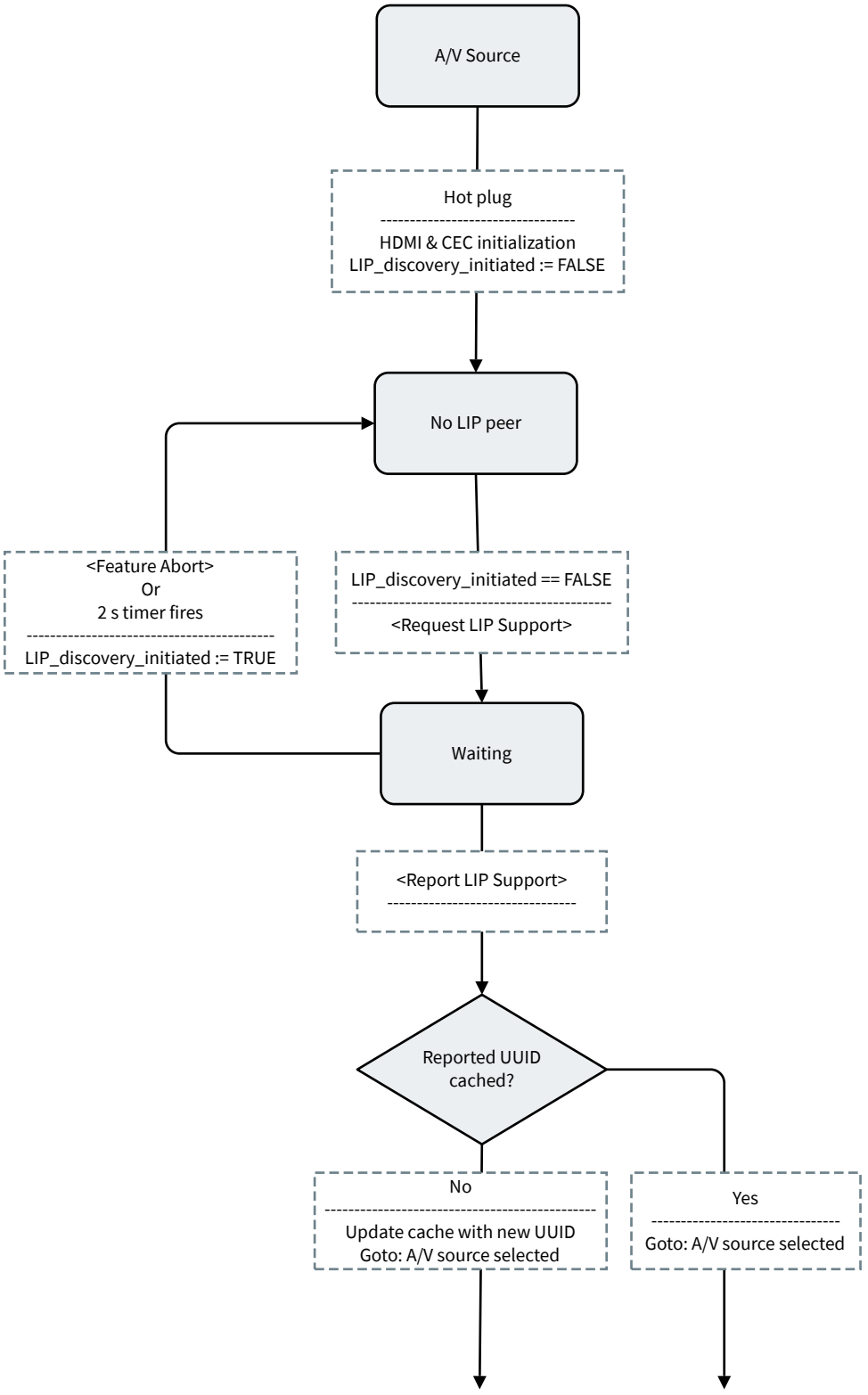
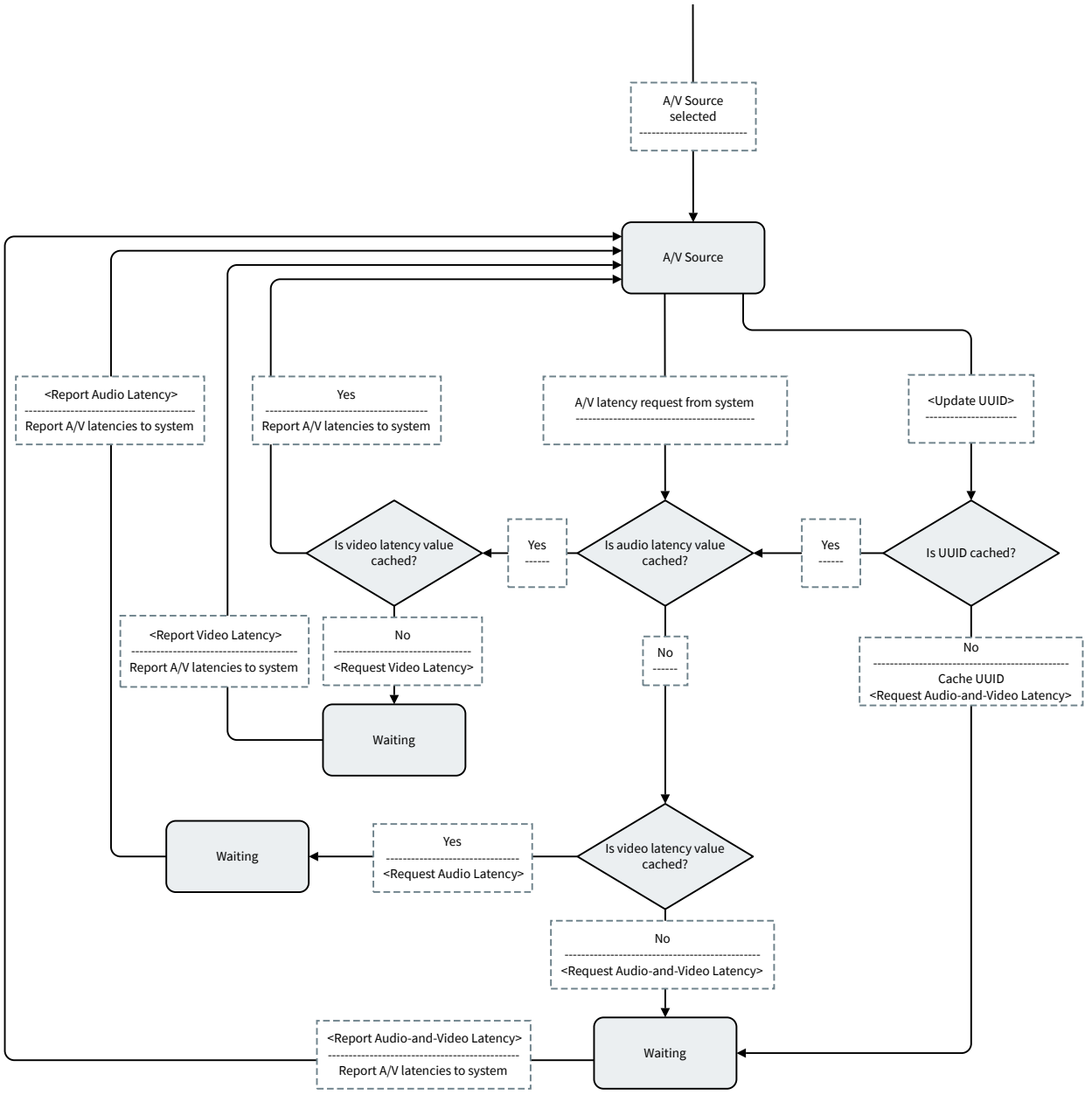
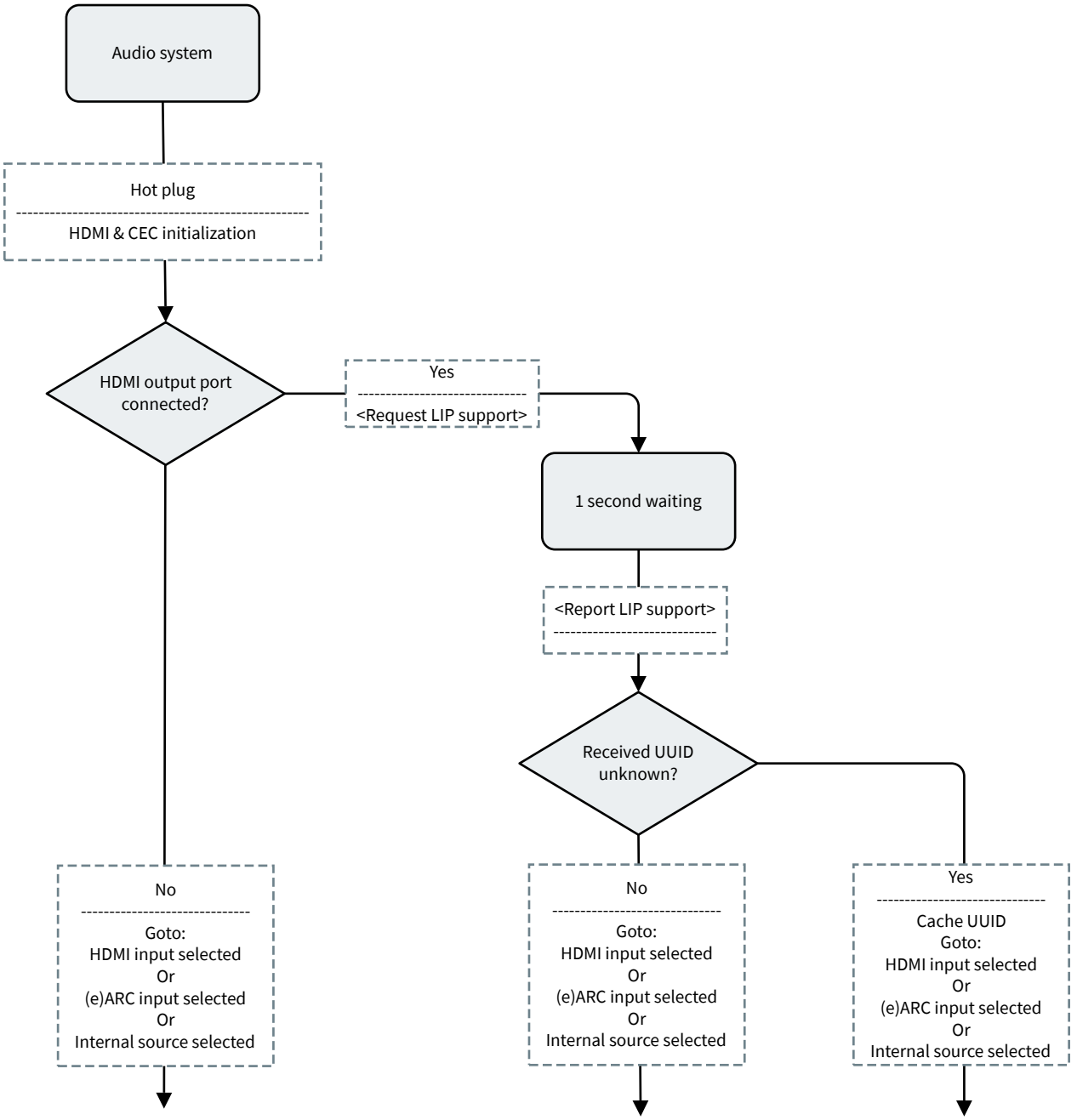


Figure 4: Source device as an A/V source



7.2 Device states: audio system

Figure 5: Audio system: initialization



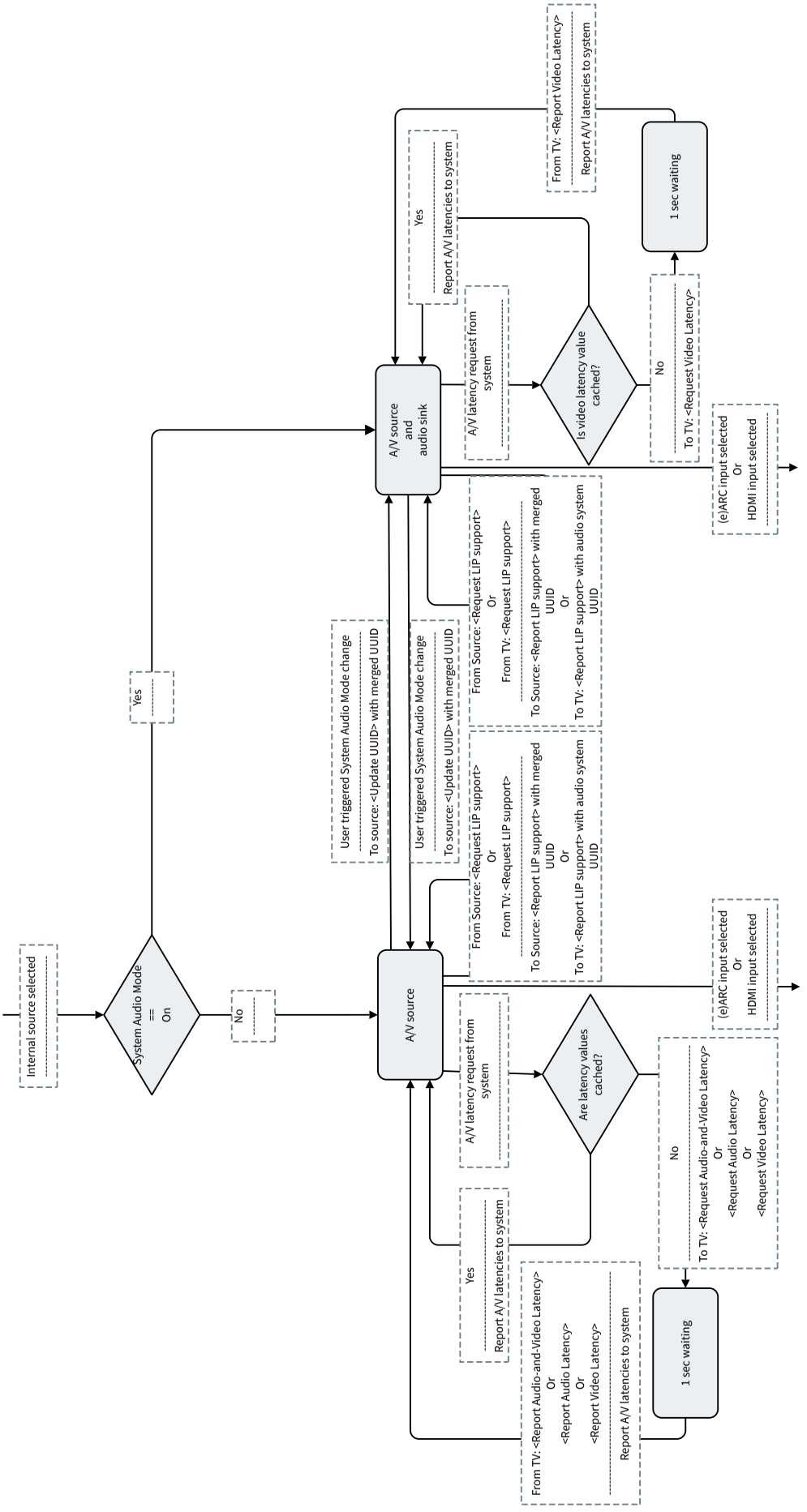


Figure 6: Audio system as the source device

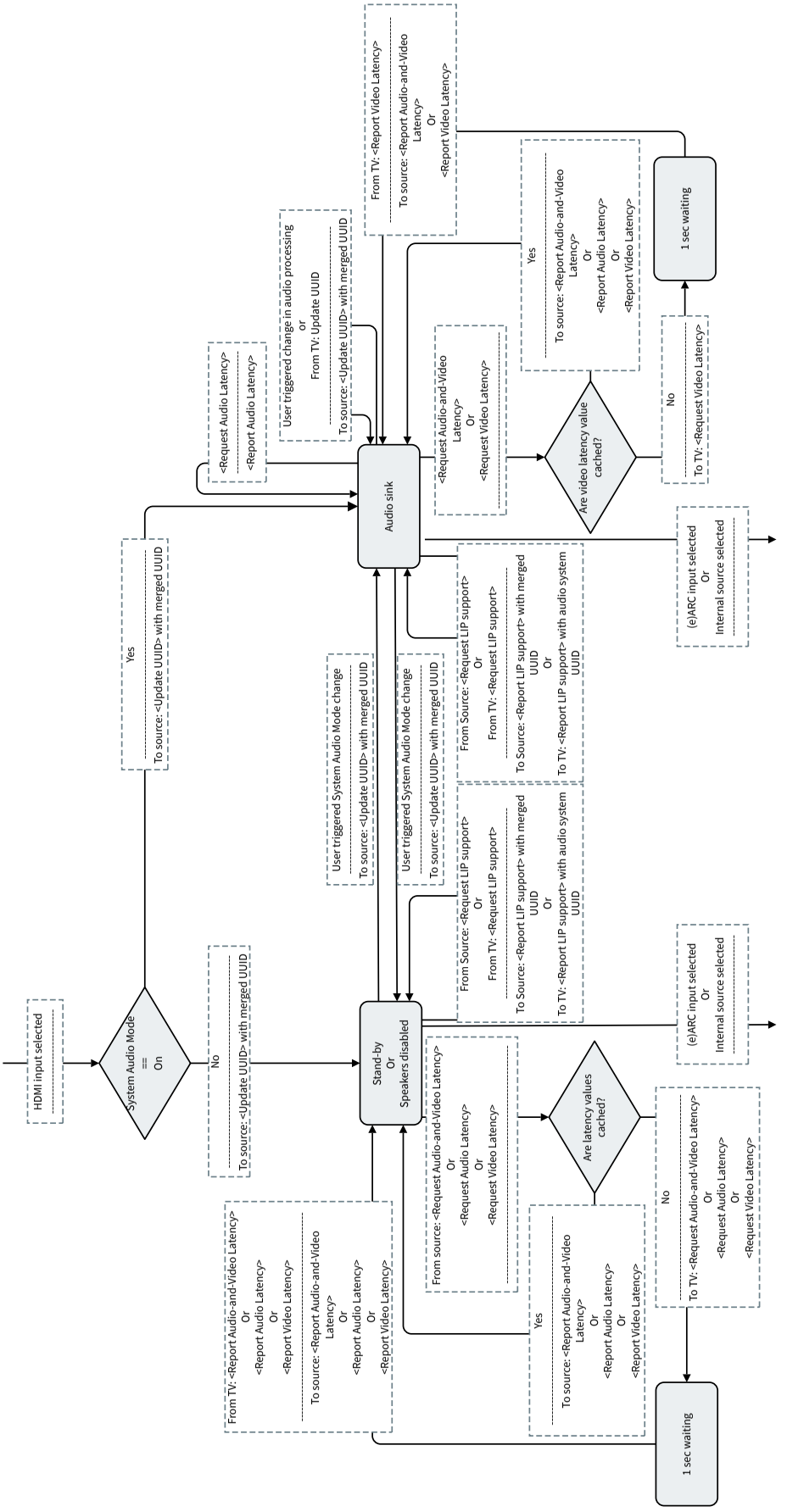
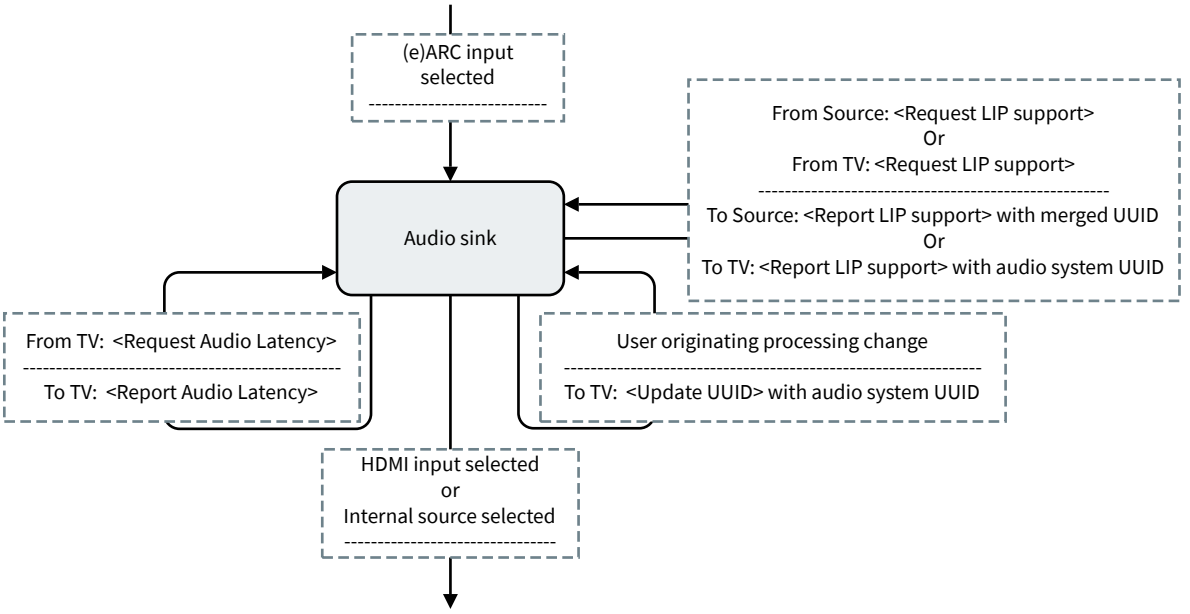


Figure 7: Audio system as the hub

Figure 8: Audio system as an ARC/eARC receiver



7.3 Device states: TV

Figure 9: TV initialization

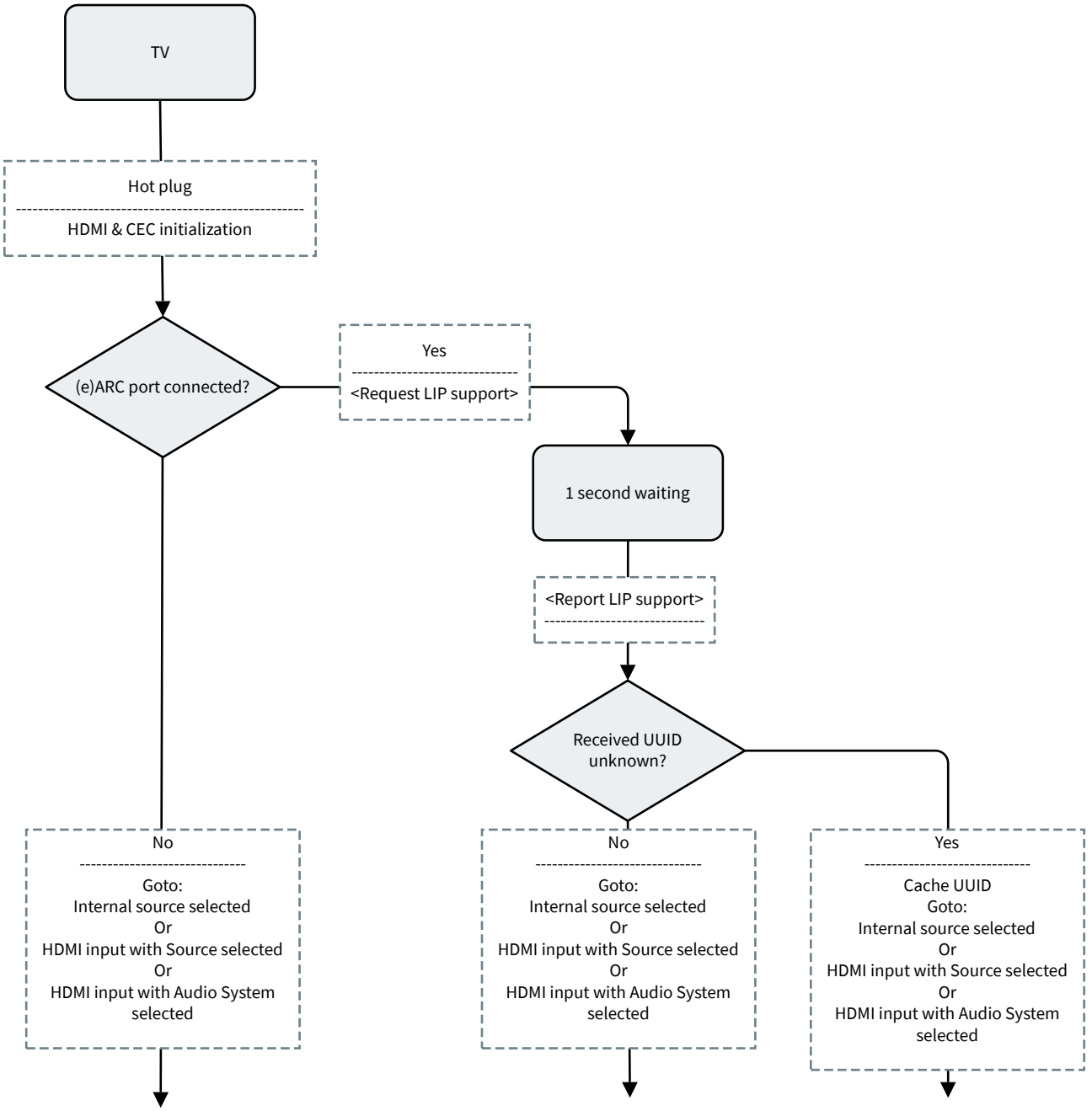


Figure 10: TV as the source

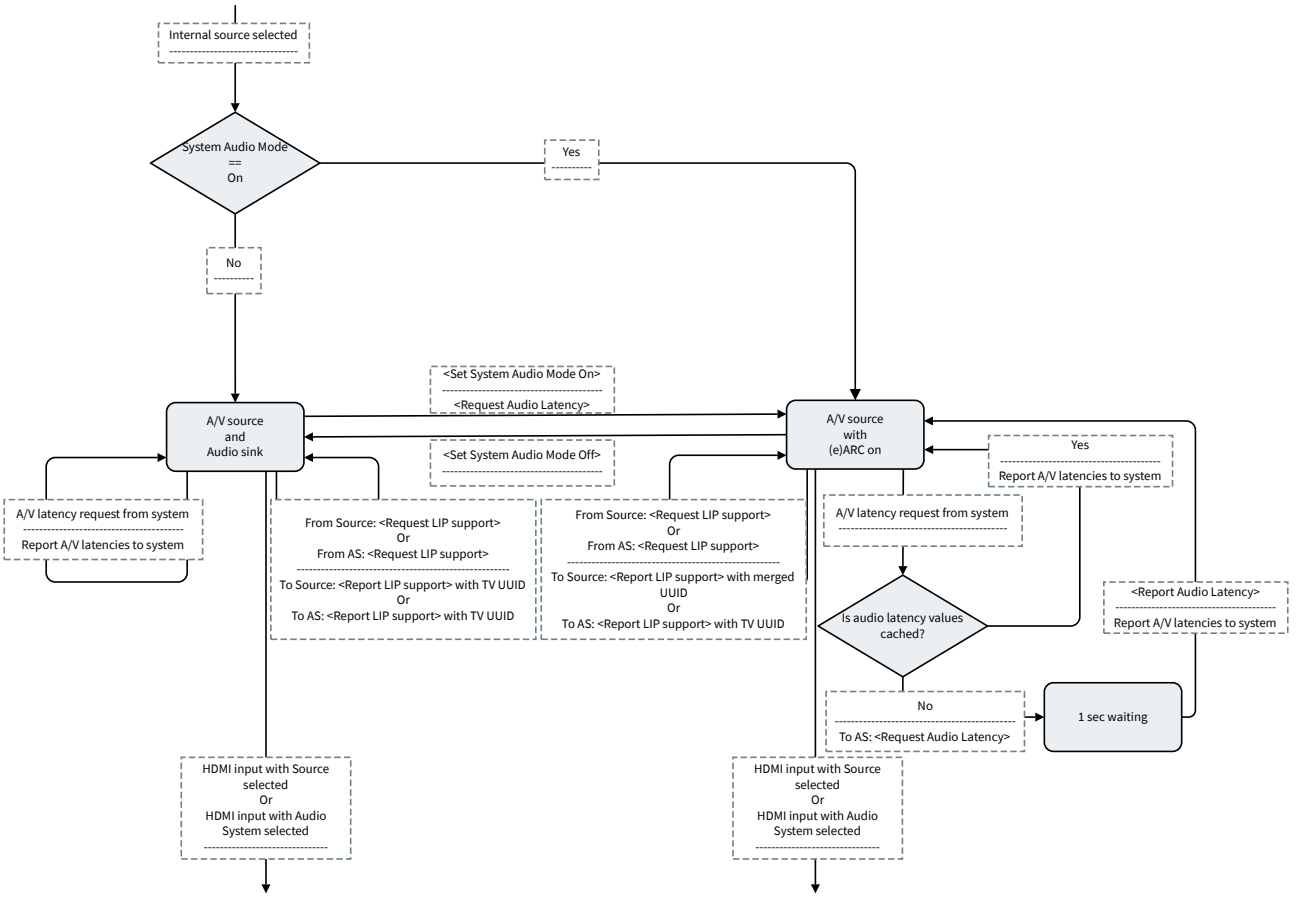


Figure 11: TV with a source device on input

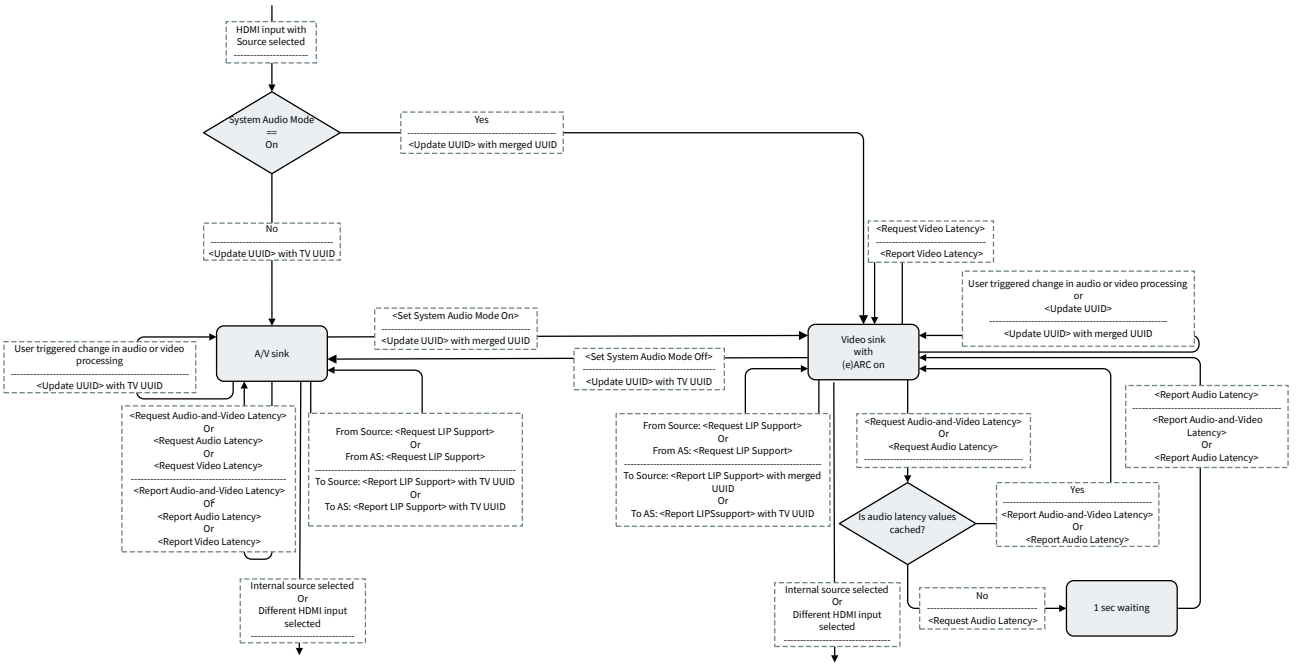
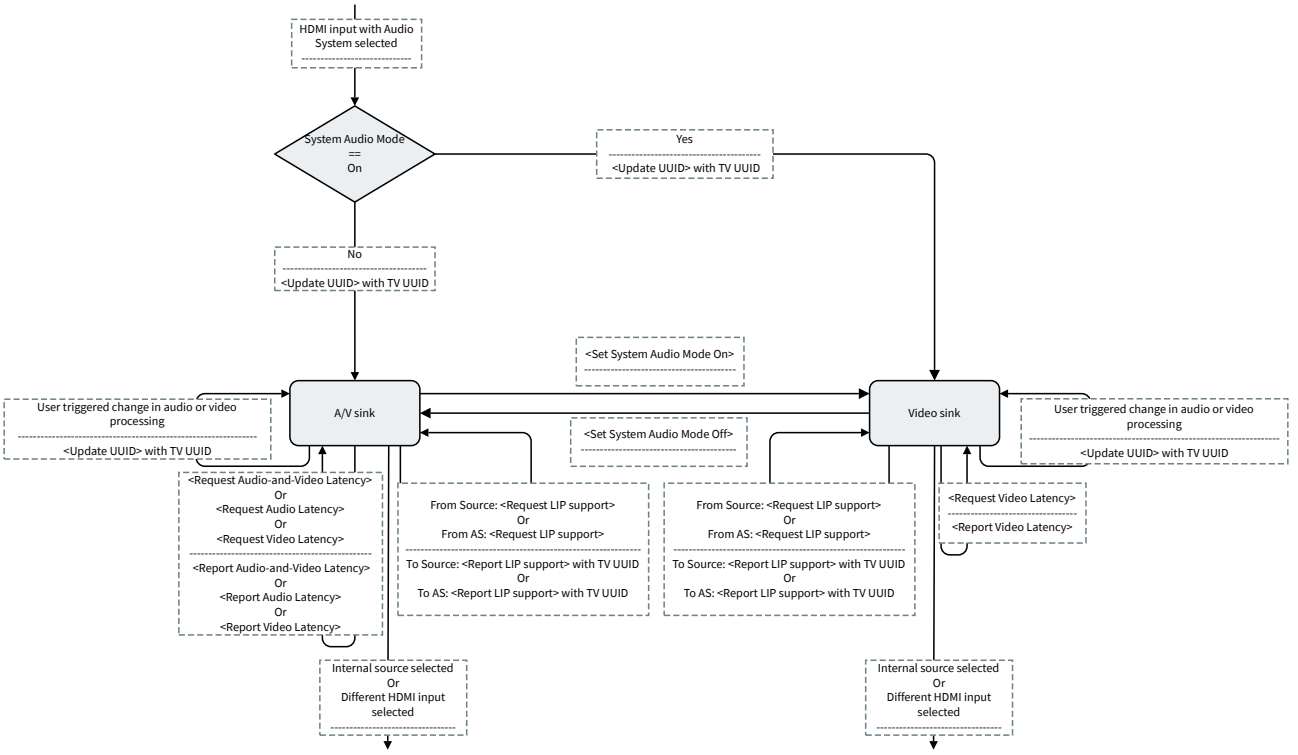


Figure 12: TV with an audio system on input



Glossary

A/V
Audio/video.

ARC
Audio Return Channel. A feature of HDMI that enables audio to be sent through the HDMI cable from the sink to the source.

AVR
Audio/video receiver. An audio amplifier and audio/video (A/V) device for a home theater. It contains inputs for all of the audio and video sources and outputs to one or more sets of speakers and one or more monitors or TVs.

Capabilities Data Structure
A data structure used to signal capabilities of an eARC receiver to an eARC transmitter.

CEC
Consumer Electronics Control. An HDMI protocol that supports the use of a single remote control to command multiple devices that are connected through HDMI.

DMA
Digital media adapter. A consumer electronics device that can stream digital media files from a PC or a network media server to a playback device.

Dolby MAT
Dolby Metadata-enhanced Audio Transmission. An audio coding technology used to transmit Dolby TrueHD bitstreams or object- or channel-based PCM audio with associated metadata via a High-Definition Multimedia Interface (HDMI), and provide a delivery path for object audio metadata (OAMD) used for Dolby Atmos rendering and playback.

eARC
Enhanced Audio Return Channel. An enhanced version of the HDMI Audio Return Channel (ARC) feature that includes support for higher data rates of uncompressed and compressed audio, support for Dolby Metadata-enhanced Audio Transmission (MAT), and operation without reliance on Consumer Electronics Control (CEC).

E-EDID
Enhanced Extended Display Identification Data. A Video Electronics Standards Association (VESA) standard that allows additional data to be stored in Extended Display Identification Data (EDID) extensions.

HDMI
High-Definition Multimedia Interface. A high-speed, high-capacity format for transferring digital information and the specific hardware interface for the format.

HDR
High-dynamic-range imaging. A technique used in imaging and photography to reproduce a greater dynamic range of luminosity than what is possible with standard digital imaging or photographic techniques. The aim is to present a similar range of luminance to that experienced through the human eye.

latency indication protocol
: A protocol that enables signaling of audio/video latency across the HDMI transmission chain and allows for source-based compensation of the reported A/V synchronization error.

PCM
: Pulse code modulation. A digital representation of an analog signal where the amplitude of the signal is sampled at uniform intervals.

VSVDB
: Vendor-Specific Video Data Block. An extension of the Enhanced Extended Display Identification Data (E-EDID) data structure, which indicates the video capabilities of a connected HDMI device.

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