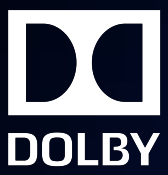

Dolby Vision Profiles and Levels Version 1.3.2

Specification

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Notices

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For information, contact:

Dolby Laboratories, Inc.
1275 Market Street
San Francisco, CA 94103-1410 USA
Telephone 415-558-0200
Fax 415-645-4000
http://www.dolby.com

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Contents

1

Introduction to Dolby Vision bitstream profiles and levels

This documentation defines Dolby Vision bitstream profiles and levels. Dolby Vision profiles and levels are designed to facilitate implementation of a Dolby Vision product, such as an encoder or decoder, based on consideration of various requirements from typical multimedia applications.

The Dolby Vision profiles provide a rich feature set to support various ecosystems, such as over-the-top streaming and Blu-ray Discs. Dolby Vision deliverables based on these profiles support many different device implementation types, such as graphics processing unit (GPU) accelerated software implementations, full-fledged hardware implementations, and hardware/software combinations. It is not practical to implement an application capable of supporting the complete Dolby Vision feature set. A limited number of subsets of the Dolby Vision features are stipulated by means of bitstream profiles and levels. Refer to the appropriate Dolby Vision kit for more information about which profiles and levels are important to support in your product.

A Dolby Vision profile is composed of:

- A video codec profile (such as HEVC main10).
- A representative Dolby Vision bitstream profile string
- Dolby Vision composer metadata and Dolby Vision content metadata carried and encoded in a specified fashion appropriate for the codec. Dolby Vision metadata may be carried as a private network abstraction layer (NAL) unit, a standardized and/or private SEI message, or other carriage methods appropriate for elementary streams of a particular video codec.

Certain Dolby Vision profiles support a cross-compatible base layer based on video elementary stream metadata, such as video usability information (VUI). Such bitstreams:

- Can be played by a decoder system that is unaware of Dolby Vision using only the base layer
- Result in a standards-based base-layer video signal, such as HDR10, Hybrid Log-Gamma (HLG), or BT.709 standard dynamic range (SDR), using video elementary stream metadata (for example, HEVC VUI and/or standardized and/or private supplemental enhancement information (SEI) message, or other carriage methods appropriate for elementary streams of a particular video codec)
- Imply additional (potentially duplicate) stream signaling for a base layer and an enhancement layer

Note: This document does not define standards-based dynamic HDR bitstreams such as those specified by ATSC, or as may be specified in the future by DVB, ISDB-T, ETSI, or other standards.

- New in this version
- Standards and Dolby documentation
- Contacting Dolby

1.1 New in this version

Changes have been made to the latest version of this documentation.

For v1.3.2, the changes include:

- Structural adjustment, to more easily distinguish content critical for playback devices from that for professional tools and content creation
- Expand variants of HLG supported to include HLG (*ARIB STD-B67*) with base-layer HEVC electro-optical transfer function (EOTF) VUI = 18
- Other clarifications and rearranging to improve the usability of this documentation.

1.2 Standards and Dolby documentation

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

These are the standards relevant to this documentation:

- RFC 6381, *The 'Codecs' and 'Profiles' Parameters for "Bucket" Media Types*, August 2011, available from http://tools.ietf.org/html.
- CTA-861-G, *A DTV Profile for Uncompressed High Speed Digital Interfaces*, available from http://www.cta.tech.
- SMPTE RP-431-2:2011, *D-Cinema Quality—Reference Projector and Environment*, available from http://www.smpte.org.
- SMPTE ST 2084:2014, *High Dynamic Range Electro-Optical Transfer Function of Mastering Reference Displays*, available from http://www.smpte.org.
- SMPTE ST 2086:2014, *Mastering Display Color Volume Metadata Supporting High Luminance and Wide Color Gamut Images*, available from http://www.smpte.org.
- ITU-R BT.709, *Parameter Values for the HDTV Standards for Production and International Program Exchange*, available from http://www.itu.int
- ITU-R Recommendation BT.2020, *Parameter Values for Ultra-High Definition Television Systems for Production and International Program Exchange*, available from http://www.itu.int.
- ITU-R Recommendation BT.2100, *Image Parameter Values for High Dynamic Range Television for Use in Production and International Program Exchange*, available from http://www.itu.int.
- Report ITU-R BT.2390, *High Dynamic Range Television for Production and International Program Exchange*, available from http://www.itu.int.
- ETSI GS CCM 001 v1.1.1 (2017-02), *Compound Content Management Specification*, available from http://www.etsi.org/standards.
- ITU-T H.265, *Infrastructure of Audiovisual Services—Coding of Moving Video*, available from http://www.itu.int
- ISO/IEC 14496-12:2015, *Information Technology—Coding of Audio-Visual Objects, Part 12: ISO Base Media File Format*, available from http://www.iso.org. This documentation is Part 12 of the MPEG-4 specification and describes storage of content in a media file.
- ETSI TS 101 154, *Digital Video Broadcasting (DVB); Specification for the Use of Video and Audio Coding in Broadcasting Applications Based on the MPEG-2 Transport Stream*, available from http://www.etsi.org.
- ARIB STD-B67, July 3, 2015, *Essential Parameter Values for the Extended Image Dynamic Range Television (EIDRTV) System for Program Production*, available from http://www.arib.or.jp.
- ITU-T, Series H, Supplement 18, Oct 2017, *Signaling, Backward Compatibility and Display Adaptation for HDR/WCG Video Coding*, available from http://www.itu.int.
- *4cc codes* as registered at http://mp4ra.org/#/codecs.
- *Dolby Vision Streams Within the ISO Base Media File Format.*
- *Dolby Vision Streams Within the MPEG-2 Transport Stream Format.*
- *Dolby Vision Streams Within the MPEG-DASH Format.*

- *Dolby Vision Streams Within the HTTP Live Streaming Format.*

1.3 Contacting Dolby

Support services are available to address any questions and to provide advice about integrating Dolby technology into your product.

For product design or testing, contact Dolby at systemsupport@dolby.com. By utilizing Dolby expertise, especially during the design process, many problems that might require design revisions before a product is approved can be prevented.

Dolby is also available to review product plans, including preliminary design information, markings, displays, and control and menu layouts, with the goal of preventing problems early in the product development cycle.

If you have comments or feedback about this documentation, send us an email at documentation@dolby.com.

2

Dolby Vision profiles and levels

Dolby Vision profiles and levels are defined by Dolby to specify possible feature configurations for a Dolby Vision stream.

2.1 Dolby Vision bitstream profiles

A Dolby Vision profile is a subset of Dolby Vision feature configurations predefined by Dolby.

Note: Read the *Notes to profiles* section before employing the Dolby Vision bitstream profiles.

Table 1: Dolby Vision bitstream profiles

Dolby Vision bitstream profile ID	Representative Dolby Vision bitstream profile string	BL/EL codec	BL:EL	BL signal cross-compatibility ID (CCID for pro-tools and content creation)
4	`dvhe.04`	10-bit HEVC	1:¼	2
5	`dvhe.05`	10-bit HEVC	N/A	0
7	`dvhe.07`	10-bit HEVC	1:¼ for UHD; 1:1 for FHD	6
8	`dvhe.08`	10-bit HEVC	N/A	1, 2, or 4
9	`dvav.09`	8-bit AVC	N/A	2

The columns in this table include:

- **Representative Dolby Vision bitstream profile string**: Contains information about the associated profile. For single-layer profiles, this represents the codec of the base layer. For dual-layer profiles, this represents the codec of the enhancement layer (irrespective of whether the profile has cross-compatibility). The Dolby Vision bitstream profile string does not represent a description of a standards-based codec. These codec profile strings represent unspecified Network Abstraction Layer (NAL) units type as allowed with AVC by ISO/IEC 14496-15:2017, Fourth Edition, 2017-02-01; Amendment 1, 2018-02, section 5.2, 6.2, and Annex F, and with HEVC by ISO/IEC 23008-2:2017, section 7.4.2.2. They have been registered with the MP4 registration authority. For details, see *Dolby Vision profile string* and *Dolby Vision Streams Within the ISO Base Media File Format*.

  Alphabetic versions of profile strings that historically were used for asset management and file names can be found in *Annex III*.
- **BL/EL codec**:
  - 8-bit AVC: H.264 high profile
  - 10-bit HEVC: H.265 main10 profile
- **BL:EL**: Indicates the resolution ratio of base layer to enhancement layer. When N/A, this profile has no enhancement layer. 10 - 99 are reserved.
- **Dolby Vision bitstream profile ID**: A decimal representation of a Dolby Vision profile.
- **BL signal cross-compatibility ID (CCID)**: For content creation and pro-tools, an identification number that can be used as a shorthand for a particular form of a base-layer substream that can be decoded to a signal compliant with a particular set of standards, if any. Cross-compatibility ID may be used to identify assets to encoders during content creation. These IDs, however, are not carried in a bitstream and are not available to a decoder. Dolby Vision encoders must use only the baseline profile composer for incompatible profiles. The behavior of a decoder is not dependent on these Dolby Vision defined cross-compatibility IDs. The base layer signal cross-compatibility ID mapping to standards is listed as follows:
  - 0

    None
  - 1

CTA HDR10, as specified by EBU TR 038: HDR10, specifies the use of the perceptual quantization EOTF (SMPTE ST 2084) with 10-bit quantization, an ITU-R BT.2020 color space, Mastering Display Color Volume as specified in SMPTE ST 2086, and optional static metadata parameters maximum frame-average light level/maximum content light level (MaxFALL/MaxCLL). It uses a limited-range video signal. It is referred to as PQ10 when the static metadata are not used, as might be the case for a live application. Additionally, for Dolby Vision systems, P3 color gamut information is sent using the BT. 2020 container. Also, it uses YCbCr 4:2:0 sampling.

We strongly recommend that bitstreams with a cross-compatibility ID of `1` include ST 2086 metadata in an MPEG SEI message to facilitate broader applications of the bitstreams (for example, transmission over ATSC 3.0).

ITU-R BT.2100 provides an additional specification of the EOTF, color subsampling, and signal range.

- 2

  SDR: BT.1886, ITU-R BT.709, YCbCr 4:2:0

  .
- 3

  Reserved.
- 4

  - For certain broadcast and mobile systems, an EOTF VUI value of 18 may provide base-layer compatibility that works best with certain classes of devices. This uses a BT.2100 gamut in ITU-R BT.2020, NCL Y'CbCr 4:2:0, and assumes non-SDR backward-compatible HLG signaling, as defined in H.265, ITU-R BT.2100-2, ATSC3, and ARIB STD-B67. Default assumptions: peak luminance of 1,000 cd/m^2, and gamma as specified in BT.2100-2. The recommended chroma sample location type VUI is `2` (top-left).
  - For other broadcasts systems, an EOTF VUI value of 14, as per ETSI TS 101 154, v2.5.1 (2019-01) (and optionally 1, 6, or 15) may provide the best base-layer SDR backward-compatible HLG signaling when used with the `alternative_transfer_characteristic` SEI message, at every random access point, with the `preferred_transfer_function` set to `18`, as per ETSI TS 101 154, v2.5.1 (2019-01). Note that BT Report 2390 defines a bridge point for translation of PQ and HLG at a luminance of 1,000 cd/m^2. The recommended chroma sample location type VUI is `0` (center-left).

  ITU-R BT.2100 provides an additional specification of the EOTF, color subsampling, and signal range.
- 5

  Reserved.
- 6

  Ultra HD Blu-ray Disc HDR (per Blu-ray Disc Association standard).
- 7:

  Reserved.

Each base layer signal cross-compatibility ID is related to a VUI value. The mapping is listed in the following table.

BL signal cross-compatibility ID	Type of cross-compatibility	VUI
0	None	• Base layer: `1,2,2,2,0`
1	HDR10	• Base layer: `0,9,16,9,0`

BL signal cross-compatibility ID	Type of cross-compatibility	VUI
2	SDR	• Base layer: `0,1,1,1,0` • Enhancement layer of profile 4: `1,2,2,2,0`
4	HLG	• ARIB base layer: 0,9,18,9,2. • DVB base layer: 0,9,14,9,0.
6	Blu-ray	• Base layer: `0,9,16,9,2` • Enhancement layer: `0,9,16,9,2`

For both base layer and enhancement layer, the comma-separated five-part VUI value represents range, color primaries, EOTF, matrix, and chroma sample location type, respectively.

For VUI value definition, see ITU-T H.265. Dolby Vision uses some unspecified VUI values to signal some Dolby Vision specific characteristics. Take profile 5 as an example: the VUI value of `1,2,2,2,0`, as defined in ITU-T H.265, represents full-range, unspecified, unspecified, unspecified, and center-left siting. This specification further defines the unspecified VUI values of profile 5; for more information, see the *Notes to profiles* section.

Note: For certain profiles, VUI parameters are required, as bitstreams employing these profiles have a non-SDR base layer. For other Dolby Vision profiles, VUI parameters are optional. For detailed information, see the *Notes to profiles* section.

Dolby Vision bitstreams for all profiles other than profile 7 may use center-left or top-left luma-chroma siting. A chroma sample location type VUI is mandatory unless center-left siting is used. If a chroma sample location type VUI is present, it must be accurate. As of the effective date of this specification, top-left chroma siting is not tested during Dolby Vision SoC or device certification.

Note: H.265 (2018-02) requires top-left chroma siting (VUI = `2`), if the decoded video is intended for interpretation according to ITU-R BT.2020-2 or Rec. ITU-R BT.2100-1. Previously, H.265 (2016-12) described the default chroma siting as center left (VUI = `0`).

If the chroma sample location type VUI is used, both fields must be set to the same value, consistent with HEVC requirements for progressive video.

Note: As of the effective date of this specification, all commercially produced profile 4 and profile 5 Dolby Vision bitstreams have used center-left siting during chroma downsampling, and are distributed without the VUI value for chroma sample location type. Those bitstreams are compliant with this specification.

Related information

Notes to profiles on page 10
Annex III: Dolby Vision profiles with alphabetic string names on page 21

2.1.1 Notes to profiles

Take these notes into consideration when using the Dolby Vision bitstream profiles.

- For profile 4:
  - Profile 4 is not supported for new applications by service providers.
  - Base layer/enhancement instantaneous decoding refresh (IDR) alignment is required.
  - The optional EL VUI uses MPEG H.265-compliant values of `2,2,2,1,0`, where 2 means unspecified. These values are different from those used by profile 7.

- A profile 4 bitstream with a MEL is a constrained version of the original profile 4 bitstream. It produces a high dynamic range Dolby Vision video signal on both older and new Dolby Vision certified devices. An original profile 4 bitstream with a full enhancement layer distributed after 31 December, 2017, may not produce the high dynamic range Dolby Vision video signal on all Dolby Vision devices.
- A new Dolby Vision certified device is able to decode a profile 4 MEL bitstream without instantiating a secondary HEVC decoder for the enhancement layer.
- A new Dolby Vision device that chooses not to instantiate a second HEVC decoder and supports profile 4 must distinguish the original profile 4 bitstream from the profile 4 MEL bitstream. When receiving an original profile 4 bitstream, such a device:
  - Exits the Dolby Vision video pipeline
  - Uses its normal video pipeline for video processing, and displays a standard dynamic range video signal only
  - Does not display the Dolby Vision logo

  For more information, see *Annex II: Differentiating MEL and non-MEL bitstreams*.

- For profile 5:
  - The base layer uses the optional VUI values of `2,2,2,1,0`. These values are compliant with the VUI definition in ITU-T H.265, where the first three 2s represent unspecified.
  - Within the Dolby Vision context, a profile 5 bitstream must use perceptual quantization with reshaping for EOTF; uses Dolby Vision proprietary IPT color space for color primaries and color matrix; uses full range for range; and uses center-left siting for chroma sample location.

    Dolby Vision proprietary IPT color space is similar to BT.2100 ICtCp, where I is similar to I, P similar to Cp, and T similar to Ct.
- For profile 7:
  - Base-layer/enhancement-layer full alignment is required, as documented in the *Blu-ray Disc Association Specifications*.
  - The currently used EL VUI values are compliant with the *Blu-ray Disc Association's UltraHD Blu-ray Specification*.
  - The specification of top-left chroma siting for the base layer and enhancement layer is compliant with the *Blu-ray Disc Association's UltraHD Blu-ray Specification*.
  - The MEL can be used for profile 7 to minimize the processing requirements for the enhancement layer and therefore ensure broader use among UltraHD Blu-ray SoCs. For the information, see *Annex II: Differentiating MEL and non-MEL bitstreams*.
- For profiles 8.4 (profile ID: 8; cross-compatibility ID: 4), only test streams are available. We are still in the process of finalizing encoding tools.
- The Reserved profile is reserved for other video ecosystems and video codecs.
- For profiles 7, 8.1, and 8.4, VUI parameters are required, as bitstreams employing these profiles have a non-SDR base layer. For other Dolby Vision profiles, VUI parameters are optional.
- For information about profile 0, 1, 2, 3, and 6, see *Annex I: Profiles not supported for new applications*.

Related information

Annex I: Profiles not supported for new applications on page 20
Annex II: Differentiating MEL and non-MEL bitstreams on page 20
Dolby Vision bitstream profiles on page 8

2.1.2 Dolby Vision profile strings

To signal the profile information of a Dolby Vision bitstream, a Dolby Vision bitstream profile string is used. This profile string follows a predefined naming convention.

A Dolby Vision bitstream profile string is composed in this pattern:

```
[Codec_type].[bitstream_profile_ID]
```

Table 2: Dolby Vision profile string

Attribute	Value	Description
Codec_type	dvhe, hev1	• dvh* represents the HEVC-based Dolby Vision codecs. • he** and hv** represent HEVC codecs.
	dvh1, hvc1	
	dvav, avc3	• dva* represents the AVC-based Dolby Vision codecs. • avc* represents AVC codecs.
	dva1, avc1	
bitstream_profile_ID	04, 05, 07, 08, 09	A representation of the bitstream profile ID.

Dolby Vision profile strings that begin with d use Dolby Vision codecs as defined here. Compatible bitstreams employ a standard 4cc codec string that starts with an h or a. As defined in *Dolby Vision Streams Within the ISO Base Media File Format*, Dolby Vision specific configuration boxes may be used with standard codecs strings for certain profiles. he and av represent standard codecs as defined at https://mp4ra.github.io/atoms.html, and consistent with ISO/IEC 14496-12:2012. Codecs other than HEVC or AVC may be supported in the future, for which additional Dolby Vision bitstream profile IDs will be added.

Refer to the bitstream profile name column in the *Dolby Vision bitstream profiles* table for examples.

For transmission of Dolby Vision streams within the MPEG-DASH or HLS format, see these specifications: *Dolby Vision Streams Within the MPEG-DASH Format* and *Dolby Vision Streams Within the HTTP Live Streaming Format*.

For certain asset management and production applications, alphabetic versions of Dolby Vision profile strings are used. For more information, see *Annex III*.

Related information

Annex III: Dolby Vision profiles with alphabetic string names on page 21

2.2 Dolby Vision levels

A Dolby Vision level specifies the maximum pixel rate, maximum decoded bitstream video width, and maximum bit rate supported by a product within a given bitstream profile.

Typically, there is a limit on the maximum number of pixels a product can process per second within a given bitstream profile; the levels defined here generally correspond to the product processing capability. Although not listed, noninteger frame rates are supported.

Table 3: Dolby Vision levels

Level ID	Maximum pixel rate (pps)	Maximum decoded bitstream video width (pixels)	Example decoded bitstream resolution @ frame rate (fps)	Maximum bit rates	
				Main tier (Mbps)	High tier (Mbps)
01	22,118,400	1280	1280 × 720 @ 24	20	50
02	27,648,000	1280	1280 × 720 @ 30	20	50
03	49,766,400	1920	1920 × 1080 @ 24	20	70

Table 3: Dolby Vision levels (continued)

Level ID	Maximum pixel rate (pps)	Maximum decoded bitstream video width (pixels)	Example decoded bitstream resolution @ frame rate (fps)	Maximum bit rates	
				Main tier (Mbps)	High tier (Mbps)
04	62,208,000	2560	1920 × 1080 @ 30	20	70
05	124,416,000	3840	1920 × 1080 @ 60	20	70
06	199,065,600	3840	3840 × 2160 @ 24	25	130
07	248,832,000	3840	3840 × 2160 @ 30 Also supports: 1920 × 1080 @ 120 [a]	25	130
08	398,131,200	3840	3840 × 2160 @ 48	40	130
09	497,664,000	3840	3840 × 2160 @ 60	40	130
10	995,328,000	3840	3840 × 2160 @ 120	60	240
11	995,328,000	7680	7680 × 4320 @ 30	60	240
12	1,990,656,000	7680	7680 × 4320 @ 60	120	480
13	3,981,312,000	7680	7680 × 4320 @ 120	240	800

[a] This frame rate can be used for Dolby Vision bitstreams packetized in a single program compliant to MPEG-2 transport streams.

The columns in this table include:

- **Maximum pixel rate (PPS)**: This column lists imposed limits on arithmetic combinations of decoded bitstream resolution and frame rate (decoded bitstream resolution multiplied by frame rate: horizontal pixels × vertical pixels × frame rate). The maximum pixels per second is a constant for a given level. The decoded bitstream resolution is inversely proportional to the frame rate, meaning that the decoded bitstream resolution can be reduced for obtaining higher frame rate, and vice versa. Note that the decoded bitstream resolution here is for baseband video, irrespective of the particular video compression codec that is used.
- **Maximum decoded bitstream video width (pixels)**: This column indicates the maximum decoded bitstream video width. This parameter is unique to a Dolby Vision level; it is not a parameter typically specified for codec levels, such as HEVC or AVC. This parameter is specified for a Dolby Vision level due to constraints that exist in certain Dolby Vision IP cores.
- **Example decoded bitstream resolution @ frame rate (fps)**: Baseband picture horizontal and vertical pixels followed by frame rate.
- **Maximum bit rates**: This column indicates the maximum combined bit rate of the base and enhancement layers, when applicable.
- **High tier**: Note that for Dolby Vision bitstream profile 7, Blu-ray Disc Association specifications allow a maximum high tier bit rate of 100 Mbps for each level. Similarly, there may be other Dolby Vision enabled systems that limit or require different maximum bit rates. Additionally, high tier may be required for some applications that use temporal subscale layers.

2.2.1 Dolby Vision level ID

To signal the level information of a Dolby Vision bitstream, the Dolby Vision level ID is used.

Refer to the level ID column in *Dolby Vision levels* for details.

2.3 Dolby Vision codec string

In different use cases, the profile strings and level IDs are presented in different formats for signaling Dolby Vision specific information.

For example, the Dolby Vision codec string is composed in this pattern:

```
[Dolby_Vision_Profile_String].[Dolby_Vision_Level_ID]
```

For detailed information, refer to the *Dolby Vision profile strings* and *Dolby Vision level ID* sections.

Codec string examples:

- `dvav.09.04`

  This string represents a single-layer SDR backward-compatible Dolby Vision stream encoded as 8-bit AVC video with a pixel rate that does not exceed 62,208,000 pixels/sec (for example, 1920 × 1080 at 30 fps).
- `dvhe.05.07`

  This string represents a single-layer incompatible Dolby Vision stream encoded as 10-bit HEVC video with a pixel rate that does not exceed 248,832,000 pixels/sec (for example, 3840 × 2160 at 30 fps).
- `dvhe.07.06`

  This string represents a dual-layer Blu-ray HDR10 compatible Dolby Vision stream encoded as 10-bit HEVC video with a pixel rate that does not exceed 299,065,600 pixels/sec (for example, 3840 × 2160 at 24 fps).

For detailed information about how to signal Dolby Vision specific information, refer to *Dolby Vision Streams Within the ISO Based Media File Format*, *Dolby Vision Streams Within the MPEG-2 Transport Stream Format*, *Dolby Vision Streams Within the HTTP Live Streaming Format*, and *Dolby Vision Streams Within the MPEG-DASH Format*.

3

Dolby Vision playback device capabilities

Dolby Vision profiles and levels specify typical Dolby Vision stream configurations. A playback device capable of decoding these streams can also advertise its capabilities by using the same Dolby Vision profiles and levels strings.

This table lists example devices and their capabilities specified by Dolby Vision profiles and levels strings.

Example device	Device capabilities
Field-programmable gate array (FPGA)–based TV	• `dvhe.04.06` • `dvhe.05.07`
First-generation chipset-based TV	• `dvhe.04.07` • `dvhe.05.07`
First-generation chipset-based ultra-high definition (UHD) Blu-ray player	• `dvhe.07.06` • `dvhe.07.07`
Chipset-based UHD over-the-top (OTT) digital media adapter	• `dvhe.05.09` • `dvhe.08.09`
Chipset-based full high definition (FHD) set-top box (STB)	• `dvhe.05.07` • `dvhe.08.05`
Chipset-based HD STB	• `dvhe.09.04`
Media PCs	• `dvhe.05.09` • `dvhe.08.09`

Every Dolby Vision playback device must pass Dolby Vision system development kit certification. During the certification procedure, the chipset implementing the Dolby Vision decoder will be tested against the advertised device capabilities, and Dolby will approve the device capabilities.

4

Constraints

Certain constraints are imposed by Dolby Vision profiles and levels.

4.1 Constraints on codec level

A Dolby Vision profile can support different level settings. Within a given profile, the maximum level a base layer or enhancement layer can take is restricted by the profile.

The maximum Dolby Vision levels, base-layer codec levels, and enhancement-layer codec levels to which a valid Dolby Vision stream can be set are listed for each Dolby Vision profile.

Table 4: Constraints on codec level

Profile ID	Profile Name	BL/EL codec	BL:EL	Dolby Vision level (maximum)	BL/EL codec profile	BL codec level (maximum)	EL codec level (maximum)
4	`dvhe.04`	10-bit HEVC	1:¼	`09`	H.265 main10	5.1	4.1
5	`dvhe.05`	10-bit HEVC	NA	`13`	H.265 main10	6.2	NA
7	`dvhe.07`	10-bit HEVC	1:1	`05`	H.265 main10	High Tier 5.1	High Tier 5.1
			1:¼	`09`	H.265 main10	High Tier 5.1	High Tier 5.1
8	`dvhe.08`	10-bit HEVC	NA	`13`	H.265 main10	6.2	NA
9	`dvav.09`	8-bit AVC	NA	`05`	H.264 high	4.2	NA

Note: Profiles 0–3 and 6 are not supported for new applications.

In certain cases, the Dolby Vision specification imposes tighter constraints on the maximum tier bit rate and the maximum decoded picture buffer size, as compared to the HEVC Main10 Level 5.1 specification. See sections *Dolby Vision levels* and *Limitation on decoder buffer size*.

4.2 Limitation on decoder buffer size

The Dolby Vision levels put limitations on the size of the decoded picture buffer.

In all cases, the maximum number of reference frames is the same for the base layer and enhancement layer.

The number of reference frames in the individual layer's decoded picture buffer, whether base-layer or enhancement-layer, must not exceed six for all levels listed in the *Dolby Vision levels*.

5

Translating Dolby Vision bitstream profiles to ETSI Compound Content Management profiles

For use cases in broadcast, use the mapping relationship described in this section to translate Dolby Vision bitstream profiles to ETSI Compound Content Management (CCM) profiles. One potentially relevant use case involves professional distribution of a bitstream prior to an ATSC or DVB broadcast.

This table shows the mapping of Dolby Vision bitstream profiles to ETSI CCM profiles. For more information, see ETSI GS CCM 001 v1.1.1 (2017-02), *Compound Content Management Specification, Annex A*.

Table 5: Mapping of Dolby Vision bitstream profiles to ETSI CCM profiles

Dolby Vision bitstream profile ID	Bitstream profile name	ETSI generic stream CCM 001 profile name	Comments
4	dvhe.04	Profile 1	
5	dvhe.05	Profile 2	
7	dvhe.07	Profile 1	
8	dvhe.08	Profile 1	
9	dvav.09	Profile 1	

Note: Profiles 0–3 and 6 are not supported for new applications.

Note: An ETSI generic stream CCM 001 Profile 1 decoder can decode all ETSI profiles.

6

Annex

6.1 Annex I: Profiles not supported for new applications

These profiles are not supported for new applications.

Table 6: Dolby Vision bitstream profiles

Dolby Vision bitstream profile ID	BL signal cross-compatibility ID	Bitstream profile name	BL/EL codec	BL:EL
0	2	`dvav.per`	Advanced Video Coding (AVC)	1:¼
1	0	`dvav.pen`	AVC	1:1
2	2	`dvhe.der`	8-bit HEVC	1:¼
3	0	`dvhe.den`	8-bit HEVC	1:1
6	1	`dvhe.dth`	10-bit HEVC	1:¼
8	3	`dvhe.08`	10-bit HEVC	N/A
8	5	`dvhe.08`	10-bit HEVC	N/A

For profiles 0 and 1, base layer/enhancement layer group-of-pictures alignment is required. For all other dual-layer profiles (profiles 2, 3, 4, and 6), instantaneous-decoder-refresh alignment is required.

For profiles 1, 3, and 6, VUI parameters are required, as bitstreams employing these profiles have a non-SDR base layer. For other Dolby Vision profiles that have an SDR base layer, VUI parameters are optional.

Related information

Notes to profiles on page 10

6.2 Annex II: Differentiating MEL and non-MEL bitstreams

Pictures contained in a Dolby Vision bitstream can be encoded as either MEL or non-MEL, not both. Use the approach described in this section to differentiate the MEL and non-minimum enhancement layer bitstreams.

The MEL consists of Dolby Vision composer and content metadata of a mid-gray flat-field video sequence, carried in a Network Abstraction Layer (NAL) unit.

If a Dolby Vision playback device supports Dolby Vision profile 4 and chooses not to instantiate a second HEVC decoder, then it must check for these values in the reference processing unit of a Dolby Vision bitstream. If the values are not exactly as shown for all three channels, the device must flag the bitstream as a Dolby Vision original profile 4 bitstream; otherwise, flag the bitstream as profile 4 minimum enhancement layer.

If a Dolby Vision playback device supports Dolby Vision profile 7, it can check for these values in the reference processing unit of a Dolby Vision bitstream. If the values are not exactly as shown for all three channels, the device can flag the bitstream as a Dolby Vision profile 7 full enhancement layer bitstream; otherwise, flag the bitstream as profile 7 MEL.

```
rdnp->nlq_offset = 0;
rdnp->vdr_in_max_int = 1;
rdnp->uv.vdr_in_max = 0;
rdnp->up.nlq_linear_dz.linear_deadzone_slope_int = 0;
rdnp->up.nlq_linear_dz.us.linear_deadzone_slope  = 0;
rdnp->up.nlq_linear_dz.linear_deadzone_threshold_int = 0;
rdnp->up.nlq_linear_dz.ut.linear_deadzone_threshold  = 0;
```

Related information

Notes to profiles on page 10

6.3 Annex III: Dolby Vision profiles with alphabetic string names

For certain asset management and production applications, Dolby Vision profiles with alphabetic profile names are used.

Note: It is the responsibility of the user of this type of naming to translate to numeric profile names (as defined in *Dolby Vision bitstream profiles*) before interaction with external systems.

Table 7: Dolby Vision bitstream profiles

Dolby Vision bitstream profile ID	Alphabetic bitstream profile string
4	`dvhe.dtr`
5	`dvhe.stn`
7	`dvhe.dtb`
8	`dvhe.st`
9	`dvav.se`
Reserved	Reserved

The alphabetic profile strings are constructed in this pattern:

```
dv[BL_codec_type].[number_of_layers][bit_depth][cross-compatibility]
```

Table 8: Alphabetic Dolby Vision profile string

Attribute	Value	Description
`dv`		`dv` represents Dolby Vision.
`BL_codec_type`	`av`, `he`	• `av` indicates AVC. • `he` indicates HEVC.
`number_of_layers`	`s`, `d`	• `s` indicates that the Dolby Vision stream contains a single layer. • `d` indicates a dual-layer Dolby Vision stream with one type of alignment.

Table 8: Alphabetic Dolby Vision profile string (continued)

Attribute	Value	Description
`bit_depth`	`e`, `t`	• `e` indicates a bit depth of 8. • `t` indicates a bit depth of 10.
`cross-compatibility`	`n`, `h`, `r`, `b`	Cross-compatibility includes either base layer cross-compatibility or Dolby Vision enhancement layer decoder cross-compatibility, represented by letters. Newer profiles, such as profile 8 and 9, rely on the VUI of the base layer rather than a cross-compatibility attribute that is part of the Dolby Vision profile string; as such, they do not use a third character in the Dolby Vision profile string. The definitions for BL signal cross-compatibility IDs describe relevant standards. For more information, see *Dolby Vision bitstream profiles*: • `n` indicates that the Dolby Vision stream is not compatible with other standards for dynamic range, but uses the Dolby Vision IPTPQc2/IPT color space. BL signal cross-compatibility ID = `0`. • `h` indicates that the Dolby Vision stream is compatible with CTA HDR10. • `r` indicates that the Dolby Vision stream is backward compatible and can be decoded to an SDR signal. • `b` indicates that the Dolby Vision stream is Blu-ray Disc backward compatible (Ultra HD Blu-ray Disc high dynamic range).

Related information

Dolby Vision bitstream profiles on page 8

Glossary

AVC
Advanced Video Coding. See H.264.

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.

EOTF
Electro-optical transfer function. A generic way of describing a specific function used to convert digital data into light (usually dictated by a particular standard specification). For example, the specification ITU-R BT.1886 describes an EOTF that allows a flat-panel display to simulate the characteristics of a cathode ray tube (CRT) display.

FHD
Full high definition. Video with a display resolution of 1920×1080 pixels and an aspect ratio of 16:9. Also referred to as 1080p.

HDR
High dynamic range.

HDR10
An open-source video format that is characterized by certain properties, such as bit depth, color primaries, metadata, and other factors.

HEVC
High-Efficiency Video Coding. See H.265.

HLG
Hybrid Log-Gamma. High-dynamic range standard format developed jointly by the British Broadcasting Corporation (BBC) and Nippon Hoso Kyokai (Japan Broadcasting Corporation), and defined in ARIB STD-B67 and ETSI/DVB TS 101-154.

HLS
HTTP Live Streaming. An adaptive streaming protocol developed by Apple for delivery of media content in various software environments.

IDR
Instantaneous decoding refresh. A coded video sequence always begins with an instantaneous decoding refresh frame, which also contains an intra picture. The IDR contains metadata indicating that no subsequent frames in that sequence can reference any frame prior to the IDR frame.

MEL
Minimal enhancement layer.

MPEG
Moving Picture Experts Group. An ISO/IEC working group that develops video and audio coding standards.

MPEG-DASH
MPEG Dynamic Adaptive Streaming over HTTP. An adaptive bit-rate streaming protocol that enables high-quality streaming of media content over the Internet delivered from HTTP.

MPEG-DASH
MPEG Dynamic Adaptive Streaming over HTTP. An adaptive bit-rate streaming protocol that enables high-quality streaming of media content over the Internet delivered from HTTP.

NAL
Network Abstraction Layer.

OTT
Over-the-top. The delivery of audio, video, and other media over the Internet without the involvement of a multichannel video programming distributor (MVPD) or a pay TV operator in the control or distribution of the content.

perceptual quantization
An electro-optical transfer function (EOTF) curve that models the contrast perception of the human eye, allowing for the most efficient encoding of luminance at a given bit depth. This is critical for high-dynamic range images.

SDR
Standard dynamic range. A Rec. 709 signal with peak luminance of 100 cd/m^2.

SEI
Supplemental enhancement information. Data unit that carries supplemental video information about decoding or display, introduced in H.264.

STB
Set-top box.

UHD
Ultra-high definition. Ultra-high-definition television or video, with a display resolution of 3840×2160 pixels in the 16:9 aspect ratio. Also referred to as 2160p.

VUI
Video usability information. A syntax structure that collects information that prepares the decoded video for output and display.