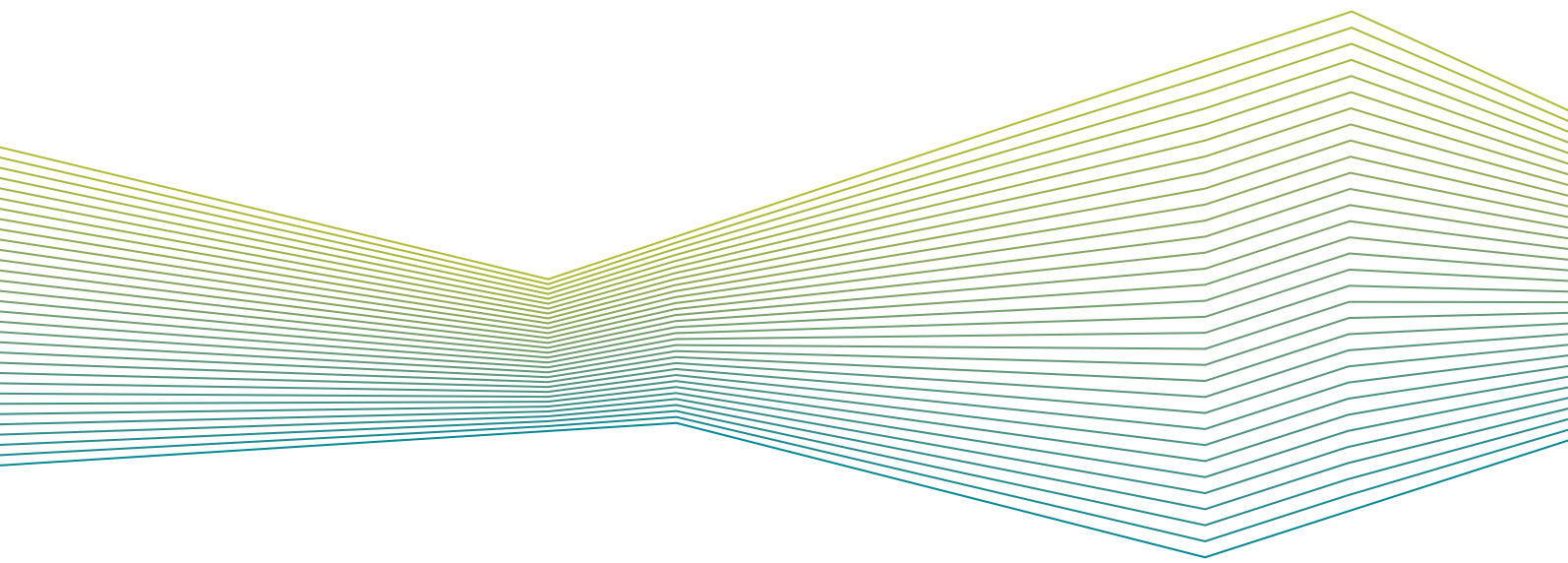




Dolby Vision streams within the HTTP Live Streaming format v1.1

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Contents

1.1 Copyright 3

1.2 Trademarks 4

1 Introduction to Dolby Vision streams within the HTTP Live Streaming format 5

1.1 Dolby Vision encoding 5

1.2 HTTP Live Streaming 6

1.3 Dolby Vision stream multiplexing in HTTP Live Streaming 6

1.4 Standards and Dolby documents 6

1.5 Contacting Dolby 7

2 Dolby Vision profiles and levels 8

2.1 Dolby Vision profiles 8

2.2 Dolby Vision levels 9

3 Signaling Dolby Vision in an HTTP Live Streaming playlist file 10

3.1 HTTP Live Streaming playlist files 10

3.2 HTTP Live Streaming playlist files with Dolby Vision 10

3.3 HTTP Live Streaming playlist examples 12

3.3.1 Dual-layer AVC 8-bit backward-compatible Dolby Vision stream 12

3.3.2 Dual-layer HEVC 10-bit backward-compatible Dolby Vision stream 13

3.3.3 Single-layer HEVC 10-bit non-backward-compatible Dolby Vision stream 13

Glossary 15

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1 Introduction to Dolby Vision streams within the HTTP Live Streaming format

This document specifies the required data formatting and signaling between a server and its clients to enable Dolby Vision to be transported within MPEG-2 transport streams under HTTP Live Streaming (HLS) protocol.

- [Dolby Vision encoding](#)
- [HTTP Live Streaming](#)
- [Dolby Vision stream multiplexing in HTTP Live Streaming](#)
- [Standards and Dolby documents](#)
- [Contacting Dolby](#)

1.1 Dolby Vision encoding

Dolby Vision video content can be encoded in one single layer or two separate layers along with Dolby Vision metadata. Both schemes allow the format to deliver more dynamic range and a wider color gamut, while providing backward compatibility with standard dynamic range (SDR) playback devices in some of the dual-layer cases.

When encoded using the dual-layer scheme, the Dolby Vision stream consists of a base layer, an enhancement layer, and a reference picture unit.

- The base layer may or may not be SDR compliant (that is, compliant with ITU-R Recommendation BT.709 [Rec. 709] standards). When compliant with Rec. 709 standards, the base layer offers backward compatibility, allowing playback of Dolby Vision streams from SDR-compliant devices that do not support Dolby Vision.
- The enhancement layer carries the color and brightness differences between the graded source (that is, source that is graded to Dolby Vision standards) and base layer version of the source.
- The reference picture unit is a special Network Abstraction Layer (NAL) unit that contains the Dolby Vision metadata. It is also a complete Dolby Vision metadata access unit for the current picture.

For a dual-layer Dolby Vision stream, these layers are encoded in either one or two video elementary streams. The video elementary stream codec is either Advanced Video Coding (AVC) or High-Efficiency Video Coding (HEVC), as defined in ISO/IEC 14496-10, ISO/IEC 14496-15, and ISO/IEC 23008-2.

When encoded using the single-layer scheme, the Dolby Vision stream consists of the base layer and reference picture unit only (without the enhancement layer) and is encoded in one 10-bit HEVC elementary stream. Because the base layer in this case is not SDR compliant, the single-layer scheme does not offer backward compatibility.

For detailed information, refer to the *Dolby Vision VES multiplexing specification*.

1.2 HTTP Live Streaming

HTTP Live Streaming is a protocol developed by Apple for transferring streams of media data. HTTP Live Streaming supports both live broadcasts and prerecorded content (video on demand).

HTTP Live Streaming uses segmented MPEG-2 transport streams for streaming the video-only content of a multimedia presentation, and uses segmented audio elementary streams for streaming audio-only content. These segmented streams are created from unbounded MPEG-2 transport streams or audio-only elementary streams by using a segmentation tool.

Information about the contained multimedia presentation is signalled with the MPEG-2 transport stream metadata and HTTP Live Streaming playlist file.

1.3 Dolby Vision stream multiplexing in HTTP Live Streaming

A Dolby Vision stream is transported in a single program transport stream (SPTS) under HTTP Live Streaming protocol.

For transmission using HTTP Live Streaming, the base-layer, enhancement-layer if available, and reference-picture-unit substreams are combined into a single Dolby Vision stream. This Dolby Vision stream is used as input for encoding a regular AVC or HEVC elementary stream. The resulting elementary stream can be multiplexed into a single program transport stream.

There are two types of Dolby Vision stream configuration: a dual-layer Dolby Vision stream and a single-layer Dolby Vision stream. A dual-layer Dolby Vision stream is composed of both the base-layer and enhancement-layer substreams (and a reference-picture-unit substream). A single-layer Dolby Vision stream is composed of the base-layer and reference-picture-unit substreams only, without the enhancement layer.

In either stream configuration, the base-layer substream is compliant with ISO/IEC 14496-10, ISO/IEC 14496-15, and ISO/IEC 23008-2 and decodable by an AVC or HEVC-compliant decoder. Depending on whether or not the output of the decoder is an SDR signal, a Dolby Vision stream can be defined as an SDR or non-SDR-compliant stream, respectively.

For detailed information about the multiplexing process, refer to the *Dolby Vision VES multiplexing specification*.

1.4 Standards and Dolby documents

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

Standards

- *HTTP Live Streaming—draft-pantos-http-live-streaming-19*, available from <https://datatracker.ietf.org>. (Search for "pantos".)
- ISO/IEC 13818-1:201X/PDAM 3, *Information technology—Generic coding of moving pictures and associated audio information: Systems amendment 3*, available from <http://www.iso.org>.
- ISO/IEC 14496-10:2014, *Information technology—Coding of audio-visual objects, part 10: Advanced video coding*, available from <http://www.iso.org>.

- ISO/IEC 14496-12:2012, *Information technology—Coding of audio-visual objects, part 12: ISO base media file format*, available from <http://www.iso.org>. This document is Part 12 of the MPEG-4 specification and describes storage of content in a media file.
- ISO/IEC 14496-15:2014, *Information technology—Coding of audio-visual objects, part 15: Carriage of network abstraction layer (NAL) unit structured video in ISO base media file format*, available from <http://www.iso.org>.
- ISO/IEC 23008-2:2013, *Information technology—High efficiency coding and media delivery in heterogeneous environments, part 2: High efficiency video coding*, available from <http://www.iso.org>.
- RFC 6381, *The 'codecs' and 'profiles' parameters for "bucket" media types*, August 2011, available from <http://tools.ietf.org/html>.

Dolby documents

- *Dolby Vision Video Elementary Stream multiplexing specification* (dovi_proenc_ves_muxing_spec.pdf), located in the documentation package of the kit.
- *Dolby Vision bitstreams within the MPEG-2 transport stream format*, located in the documentation package of the kit.

1.5 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 document, send us an email at documentation@dolby.com.

2 Dolby Vision profiles and levels

The Dolby Vision format provides many features, not all of which apply to every application. Subsets of Dolby Vision features are stipulated in profiles and levels. Develop your application to support one or more of these profiles and levels as needed.

- [Dolby Vision profiles](#)
- [Dolby Vision levels](#)

2.1 Dolby Vision profiles

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

This table only lists profiles that are supported in online streaming formats. There are more profiles applicable to other use cases. For details, refer to *Dolby Vision profiles and levels*.

Table 1: Dolby Vision profiles

Profile ID	Profile name	BL codec	EL codec	BL:EL	BL backward compatibility	BL/EL layer full alignment	BL codec profile	EL codec profile
0	dvav.per	AVC	AVC	1:¼	SDR	Yes	H.264 High	H.264 High
4	dvhe.dtr	HEVC10	HEVC10	1:¼	SDR	No	H.265 main10	H.265 main10
5	dvhe.stn	HEVC10	N/A	N/A	None	N/A	H.265 main10	N/A

In this table,

- **Profile name** is a string composed by following a common naming convention. This string contains all information about the associated profile. For details, see the *Dolby Vision profile string* section.
- **BL:EL** indicates the resolution ratio of base layer to enhancement layer.
- **BL/EL full alignment** indicates whether the enhancement-layer group of picture (GOP) and sub-GOP structures are fully aligned with the base layer. When fully aligned in decoding order, the base-layer and enhancement-layer instantaneous decoder refresh (IDR) frames are aligned, and the base-layer and enhancement-layer access units that belong to the same picture have identical picture order count (POC). In this situation, skipping and seeking operations can be performed anywhere in a stream and are not limited to IDR frames. We recommend encoders that produce dual-layer Dolby Vision streams generate base layer and enhancement layer with full GOP/sub-GOP structure alignment for all the profiles listed in the table.
- **Base-layer backward compatibility** indicates whether the base-layer substream can be decoded to an SDR-compliant signal. Dolby Vision encoders must only use the baseline profile composer for non-backward compatible profiles (with a backward compatibility value of None).

2.2 Dolby Vision levels

A Dolby Vision level specifies the maximum frame rate, bit rate, and resolution supported by a product within a given profile.

Typically, there is a limit on the maximum number of pixels a product can process per second within a given profile; the levels defined here generally correspond to the product processing capability.

Table 2: Dolby Vision levels

Level ID	Level name	Example maximum resolution × frame rate (fps)	Maximum bit rates (base layer and enhancement layer combined)	
			Main tier (Mbps)	High tier (Mbps)
1	hd24	1280 × 720 × 24	20	50
2	hd30	1280 × 720 × 30	20	50
3	fhd24	1920 × 1080 × 24	20	70
4	fhd30	1920 × 1080 × 30	20	70
5	fhd60	1920 × 1080 × 60	20	70
6	uhd24	3840 × 2160 × 24	25	130
7	uhd30	3840 × 2160 × 30	25	130
8	uhd48	3840 × 2160 × 48	40	130
9	uhd60	3840 × 2160 × 60	40	130

The columns in this table include:

- **Level name:** These are strings composed by following a common naming convention. These strings contain all information about the associated level. For details, see *Dolby Vision level string*.
- **Example max resolution × frame rate (fps):** This column lists imposed limits on arithmetic combinations of resolution and frame rate (resolution multiplied by frame rate). The maximum pixels per second is a constant for a given level. The resolution is inversely proportional to the frame rate, meaning that the resolution can be reduced for obtaining higher frame rate, and vice versa.

3 Signaling Dolby Vision in an HTTP Live Streaming playlist file

Information about the Dolby Vision streams encapsulated in an HTTP Live Streaming stream can be signaled within a playlist file.

- [HTTP Live Streaming playlist files](#)
- [HTTP Live Streaming playlist files with Dolby Vision](#)
- [HTTP Live Streaming playlist examples](#)

3.1 HTTP Live Streaming playlist files

An HLS playlist file provides information for a playback device about the available content for a multimedia presentation.

Specifically, HLS playlist files provide information about:

- The media segments that comprise the multimedia presentation
- Available content variants in the content selection process (for example, different languages)
- Available content renditions (for example, content rendered for different bandwidths)

HLS playlist files are regular M3U playlists, extended by the addition of information specific to HTTP Live Streaming. This extended information is contained in lines that start with an #EXT prefix inside the playlist. A playlist contains URIs that point to media files or to other playlists.

The HLS protocol defines a specific type of playlist, known as a variant playlist, to allow a client device to select from different versions of the same piece of content. For example, these versions can be encoded at different bit rates to enable the client to switch to a lower data rate when the available delivery bandwidth is reduced, or to switch to a higher data rate to improve audio and video quality. A variant playlist may also point to alternative content for a presentation, such as an alternative language version of the content.

3.2 HTTP Live Streaming playlist files with Dolby Vision

In HTTP Live Streaming, the main way of signaling the type of video to be streamed is by using the EXT-X-STREAM-INF or EXT-X-I-FRAME-STREAM-INF tag and its associated CODECS attribute as defined in RFC 6381.

The CODEC attribute of the EXT-X-STREAM-INF parameter (or EXT-X-I-FRAME-STREAM-INF) must include a dot-separated, three-part value to signal the codec, profile, and level information of the referenced Dolby Vision stream.

For a non-backward-compatible Dolby Vision stream, the video codec value is composed in this format:

```
[Dolby_Vision_fourCC].[Dovi_Profile_ID].[Dovi_Level_ID]
```

In this string,

- The [Dolby_Vision_fourCC] is a four-character value as listed in the *Sample description entry code* table. This value indicates the codec type.
- The [Dovi_Profile_ID] is a two-digit value representing the Dolby Vision profile ID as listed in the *Dolby Vision profiles* section. This value can be obtained from the DOVI_video_stream_descriptor, as described in the *Dolby Vision bitstreams within the MPEG-2 transport stream format* specification.
- The [Dovi_Level_ID] is a two-digit value representing the Dolby Vision level ID as listed in the *Dolby Vision levels* section. This value can be obtained from the DOVI_video_stream_descriptor, as described in the *Dolby Vision bitstreams within the MPEG-2 transport stream format* specification.

For a non-backward-compatible Dolby Vision stream, only Dolby Vision fourCC code is referenced in the playlist; for a backward-compatible Dolby Vision stream, the correlated SDR fourCC code and Dolby Vision fourCC code must be used in pairs as shown in this table.

Table 3: Sample description entry code

Codec	Codec variant	SDR fourCC code	Dolby Vision fourCC code
AVC	Parameter sets (PPS or SPS) are stored either in the sample entries or as part of the samples, or in both.	avc3	dvav
	Parameter sets (PPS or SPS) are stored either in the sample entries of the video stream or in the parameter set stream, but never in both.	avc1	dva1
HEVC	Parameter sets (VPS, PPS, or SPS) are stored either in the sample entries or as part of the samples, or in both.	hev1	dvhe
	Parameter sets (VPS, PPS, or SPS) are stored in the sample entries only.	hvc1	dvh1


For example:

```
#EXT-X-STREAM-INF:BANDWIDTH=2560000,CODECS="dvhe.05.07,ec-3",AUDIO="ddp" low/
video.m3u8
```

In this example, the highlighted string indicates that the video element is signaled as a single-layer, non-backward-compatible Dolby Vision stream encoded as 10-bit HEVC video with a maximum resolution of 3840 × 2160 at 30 fps. This corresponds to Dolby Vision profile ID 5 and level ID 7.

For a backward-compatible Dolby Vision stream, the CODECS attribute must include the codec values for both the base layer and enhancement layer as a comma-separated list.

```
[BL_compatible_codec],[Dolby_Vision_fourCC].[Dovi_Profile_ID].[Dovi_Level_ID]
```

 **Note:** The base-layer and enhancement-layer codec strings must be separated by a comma.

In the string, the [BL_compatible_codec] takes a standard SDR codec value format that begins with the SDR fourCC code and may optionally be followed by profile and level information; for details, refer to RFC 6381. The [Dolby_Vision_fourCC] takes a value of the Dolby Vision fourCC code, which indicates the codec type of the Dolby Vision enhancement layer, as listed in the *Sample description entry code* table.

For example:

```
#EXT-X-STREAM-INF:BANDWIDTH=2560000,CODECS="hvc1.1.0.L120.00,dvh1.04.09,ec-3",
AUDIO="ddp" low/video.m3u8
```

In this example, the highlighted string indicates that the video element is a dual-layer Dolby Vision stream encoded as 10-bit HEVC video in each layer with a max resolution of 3840 × 2160 at 60 fps, where the base layer is a backward-compatible, SDR Rec.709-compliant signal.

For another example:

```
#EXT-X-STREAM-INF:BANDWIDTH=2560000,CODECS="avc1.4D4028,dva1.00.04,ec-3", AUDIO="ddp"
low/video.m3u8
```

In this example, the highlighted string indicates that the video element is a dual-layer Dolby Vision stream encoded as 8-bit AVC video in each layer, where the base layer is a backward-compatible, SDR Rec.709-compliant signal.

Related information

[Dolby Vision profiles](#) on page 8

[Dolby Vision levels](#) on page 9

3.3 HTTP Live Streaming playlist examples

Examples of HTTP Live Streaming playlist files that contain Dolby Vision video elements, as well as Dolby Digital Plus audio media elements, are provided in this section.

In addition to the Dolby Vision programs (single or dual layer), Dolby recommends including a separate program for delivering a pure SDR version of the same content as the Dolby Vision version. This alternate rendition ensures that the multimedia presentation can be decoded and played back by a device that does not support Dolby Vision.

3.3.1 Dual-layer AVC 8-bit backward-compatible Dolby Vision stream

This example shows a master playlist listing three Dolby Vision programs and one audio-only program. The bit rate is the only major parameter that differs across the Dolby Vision programs. Each Dolby Vision program is packetized in a single .ts file and contains a combination Dolby Vision stream that consists of both the base-layer and enhancement-layer substreams. The essence of each Dolby Vision program is a dual-layer signal encoded as 8-bit AVC video with a resolution of 1920 × 1080 at 30 fps in each layer, where the base layer is a backward-compatible, SDR Rec.709-compliant signal.

```
#EXTM3U
#EXT-X-MEDIA:TYPE=AUDIO,GROUP-ID="aac",NAME="aac",
DEFAULT=YES,AUTOSELECT=YES,LANGUAGE="en",URI="main/english-aac.m3u8"
#EXT-X-MEDIA:TYPE=AUDIO,GROUP-ID="ddp",NAME="ddp",
DEFAULT=YES,AUTOSELECT=YES,LANGUAGE="en",URI="main/english-ddp.m3u8"
#EXT-X-STREAM-INF:BANDWIDTH=2560000,CODECS="avc1.4D4028,dva1.00.04,ec-3",AUDIO="ddp"
low/video.m3u8
#EXT-X-STREAM-INF:BANDWIDTH=7680000,CODECS="avc1.4D4028,dva1.00.04,ec-3",AUDIO="ddp"
mid/video.m3u8
#EXT-X-STREAM-INF:BANDWIDTH=14156144,CODECS="avc1.4D4028,dva1.00.04,ec-3",AUDIO="ddp"
```

```
hi/video.m3u8
#EXT-X-STREAM-INF:BANDWIDTH=65000,CODECS="mp4a.40.5",AUDIO="aac" main/english-aac.m3u8
```

In this playlist example, the SDR fourCC code for the base layer is `avc1`, which determines the Dolby Vision fourCC code must be set to `dva1`. In case the SDR fourCC code for the base layer is `avc3`, the Dolby Vision fourCC code must be set to `dvav`, as indicated in the *HTTP Live Streaming playlist files with Dolby Vision* section; consequently the video codec string in the CODECS value would be `avc3.4D4028,dvav.00.04`.

Related information

[HTTP Live Streaming playlist files with Dolby Vision](#) on page 10

3.3.2 Dual-layer HEVC 10-bit backward-compatible Dolby Vision stream

This example shows a master playlist listing three Dolby Vision programs and one audio-only program. The bit rate is the only major parameter that differs across the Dolby Vision programs. Each Dolby Vision program is packetized in a single `.ts` file and contains a combination Dolby Vision stream that consists of both the base-layer and enhancement-layer substreams. The essence of each Dolby Vision program is a dual-layer signal encoded as 10-bit HEVC video with a resolution of 3840 × 2160 at 30 fps in each layer, where the base layer is a backward-compatible, SDR Rec.709-compliant signal.

```
#EXTM3U
#EXT-X-MEDIA:TYPE=AUDIO,GROUP-ID="aac",NAME="aac",
DEFAULT=YES,AUTOSELECT=YES,LANGUAGE="en",URI="main/english-aac.m3u8"
#EXT-X-MEDIA:TYPE=AUDIO,GROUP-ID="ddp",NAME="ddp",
DEFAULT=YES,AUTOSELECT=YES,LANGUAGE="en",URI="main/english-ddp.m3u8"
#EXT-X-STREAM-INF:BANDWIDTH=2560000,CODECS="hvc1.2.1.L150.B0,dvh1.04.07,ec-3",
AUDIO="ddp" low/video.m3u8
#EXT-X-STREAM-INF:BANDWIDTH=7680000,CODECS="hvc1.2.1.L150.B0,dvh1.04.07,ec-3",
AUDIO="ddp" mid/video.m3u8
#EXT-X-STREAM-INF:BANDWIDTH=14156144,CODECS="hvc1.2.1.L150.B0,dvh1.04.07,ec-3",
AUDIO="ddp" hi/video.m3u8
#EXT-X-STREAM-INF:BANDWIDTH=65000,CODECS="mp4a.40.5",AUDIO="aac" main/english-aac.m3u8
```

In this playlist example, the SDR fourCC code for the base layer is `hvc1`, which determines the Dolby Vision fourCC code must be set to `dvh1`. In case the SDR fourCC code for the base layer is `hev1`, the Dolby Vision fourCC code must be set to `dvhe`, as indicated in the *HTTP Live Streaming playlist files with Dolby Vision* section; consequently the video codec string in the CODECS value would be `hev1.1.0.L120.00,dvhe.04.07`.

Related information

[HTTP Live Streaming playlist files with Dolby Vision](#) on page 10

3.3.3 Single-layer HEVC 10-bit non-backward-compatible Dolby Vision stream

This example shows a master playlist listing three Dolby Vision programs and one audio-only program. The bit rate is the only major parameter that differs across the Dolby Vision programs. Each Dolby Vision program is packetized in a single `.ts` file and contains the Dolby Vision base-layer and reference-picture-unit substreams only. The essence of each Dolby

Vision program is a single-layer signal encoded as 10-bit HEVC video with a resolution of 3840 × 2160 at 30 fps, where the base layer is not backward compatible.

```
#EXTM3U
#EXT-X-MEDIA:TYPE=AUDIO,GROUP-ID="aac",NAME="aac",
DEFAULT=YES,AUTOSELECT=YES,LANGUAGE="en",URI="main/english-aac.m3u8"
#EXT-X-MEDIA:TYPE=AUDIO,GROUP-ID="ddp",NAME="ddp",
DEFAULT=YES,AUTOSELECT=YES,LANGUAGE="en",URI="main/english-ddp.m3u8"

#EXT-X-STREAM-INF:BANDWIDTH=2560000,CODECS="dvhe.05.07,ec-3";AUDIO="ddp" low/
video.m3u8
#EXT-X-STREAM-INF:BANDWIDTH=7680000,CODECS="dvhe.05.07,ec-3";AUDIO="ddp" mid/
video.m3u8
#EXT-X-STREAM-INF:BANDWIDTH=14156144,CODECS="dvhe.05.07,ec-3";AUDIO="ddp" hi/
video.m3u8
#EXT-X-STREAM-INF:BANDWIDTH=65000,CODECS="mp4a.40.5",AUDIO="aac" main/english-aac.m3u8
```

In this playlist example, the base layer is non-backward-compatible, and the Dolby Vision fourCC code is dvhe. In case the Dolby Vision fourCC code is dvh1, the video codec string in the CODECS value must be set to dvh1.05.07.

Related information

[HTTP Live Streaming playlist files with Dolby Vision](#) on page 10

Glossary

AVC

Advanced Video Coding. See [H.264](#).

HEVC

High-Efficiency Video Coding. See [H.265](#).

HLS

HTTP Live Streaming. An adaptive streaming protocol for delivery of media content developed by Apple. The format uses the MPEG-2 transport streams to contain and deliver the content.

SDR

Standard dynamic range. A Rec. 709 signal with peak luminance of 100 cd/m².