

Advanced Media Framework – HEVC Video Encoder

Programming Guide

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1 Introduction

1.1 Scope

This document provides a complete description of the AMD Advanced Media Framework (AMF) Video Encoder Component. This component exposes the AMD Video Compression Engine, which provides hardware accelerated HEVC video encoding functionality.

Figure 1 provides a system overview of the AMF Video Encoder Component.

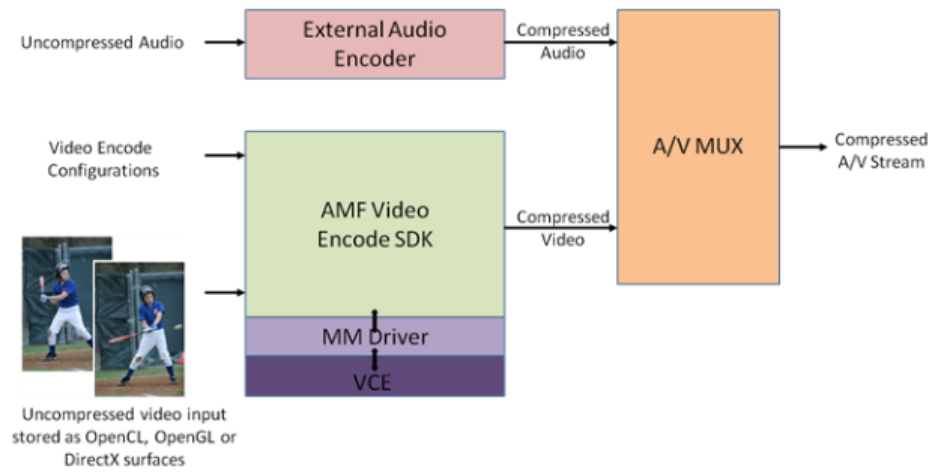


Figure 1 — System overview of the AMF Video Encode SDK

The AMF Video Encoder Component compresses RAW uncompressed video to an HEVC elementary bitstream.

The component does not provide a mechanism to handle audio compression, or stream multiplexing.

The component provides four different sets of pre-defined usages, which provide a convenient way for developers to configure the encoder to match the intended application use case. Advanced developers can also adjust encoding parameters to tailor the behavior to their specific application requirements.

HEVC encoding is currently supported on Windows only.

1.2 Pre-defined Encoder Usages

The following table provides a brief overview of the encoding usage modes that have been defined:

Usage Mode	Intended use-cases	Comments
Transcoding	Transcoding, video editing	Favor compression efficiency and throughput over latency.
Ultra-low latency	Video game streaming	Optimize for extremely low latency use cases (e.g. cap the number of bits per frame), to enable high-interactivity applications.
Low Latency	Video collaboration, remote desktop	Optimize for low latency scenarios, but allow occasional bitrate overshoots to preserve quality.
Webcam	Video conferencing	Optimize for a low-latency video conferencing scenario.
HQ	High quality mode	Optimize for best subjective video quality with possible loss of performance.
HQLL	High quality low latency mode	Optimize for good quality with low latency.

Table 1. Encoding usage modes

2 AMF Video Encoder UVD/VCN-HEVC Component

The AMF Video Encoder HEVC component provides hardware accelerated HEVC encoding using AMD's IP.

To instantiate the AMF Video Encoder component, call the `AMFFactory::CreateComponent` method passing `AMFVideoEncoderHW_HEVC` component IDs defined in the `/include/components/VideoEncoderHEVC.h` header.

2.1 Input Submission and Output Retrieval

The AMF Video Encoder component accepts `AMFSurface` objects as input and produces `AMFBuffer` objects for output.

2.2 Encode Parameters

Annex A provides the detailed description of encoding parameters (i.e., encoder properties) exposed by the Video Encoder HEVC component for the following four usages:

- Transcoding mode,
- Ultra-low latency mode,
- Low Latency mode,
- Webcam mode,
- HQ mode, and
- HQLL mode.

All properties are accessed using the `AMFPropertyStorage` interface of the Encoder object.

2.2.1 Static Properties

Static properties (e.g., profile, tier, level, usage) must be defined before the `Init()` function is called, and will apply until the end of the encoding session.

2.2.2 Dynamic Properties

All dynamic properties have default values. Several properties can be changed subsequently and these changes will be flushed to encoder only before the next `Submit()` call.

2.2.3 Frame Per-Submission Properties

Per submission properties are applied on a per frame basis. They can be set optionally to force a certain behavior (e.g., force frame type to IDR) by updating the properties of the `AMFSurface` object that is passed through the `AMFComponent::Submit()` call.

2.2.4 ROI Feature

Region of importance (ROI) feature provides a way to specify the relative importance of the macroblocks in the video frame. Encoder will further adjust the bits allocation among code blocks based on the importance, on top of the base rate control decisions. More important blocks will be encoded with relatively better quality.

The ROI map can be attached to the input frame on a per frame basis. Currently, the ROI map can only use system memory. The ROI map includes the importance values of each 64x64 CTB, ranging from 0 to 10, stored in 32bit unsigned format. Refer to SimpleROI sample application for further implementation details.

2.2.5 Encoder Statistics Feedback

If an application sets the `AMF_VIDEO_ENCODER_HEVC_STATISTICS_FEEDBACK` flag on for an input picture, the encoder will feedback to the application statistics for this specific picture. After the encoding ends, the application can retrieve by name the specific statistic(s) it is interested in. The supported encoder statistics are listed in Table A-3. This feature is supported by Radeon RX 5000 Series or newer GPUs as well as Ryzen 2000 U/H series or newer APUs.

2.2.6 Picture Transfer Mode

If an application enables `AMF_VIDEO_ENCODER_HEVC_PICTURE_TRANSFER_MODE` for a specific input picture, it can dump out the reconstructed picture after encoding and/or it can inject a picture to be used as the reference picture during the encoding. It is worth noting that reference picture injection is a feature that is intended for advanced algorithm testing and exploration. It needs to be used with care since the internal DPB in the current encoding session will be overridden by the injected reference picture(s). The reader can refer to SimpleFrameInjection sample application for further implementation details. This feature is supported by Radeon RX 5000 Series or newer GPUs as well as Ryzen 2000 U/H series or newer APUs.

2.2.7 SVC Properties

Scalable Video Coding (SVC) is enabled by setting `AMF_VIDEO_ENCODER_HEVC_NUM_TEMPORAL_LAYERS` to a value that is greater than 1. `AMF_VIDEO_ENCODER_HEVC_NUM_TEMPORAL_LAYERS` is a dynamic property and can be changed at any time during an encoding session. To ensure proper support, `AMF_VIDEO_ENCODER_HEVC_MAX_NUM_TEMPORAL_LAYERS` needs to be set before initializing the encoder to a value that is not smaller than the number of temporal layers. As an example, the maximum number of temporal layers shall be set to 4 if the number of temporal layers will be changed from 3 to 4 in an encoding session. The maximum number of temporal layers supported by the encoder can be queried from the encoder capabilities before initializing the encoder.

To define SVC parameters per layer, the following format must be used:

```
TL<Temporal_Layer_Number>.QL<Quality_Layer_Number>.<Parameter_name>
```

As an example with two temporal layers, to configure “Target bitrate” for the base/first temporal layer and first quality layer, the following parameter should be used:

```
TL0.QL0.HevcTargetBitrate
```

To configure “Target bitrate” for the second temporal layer and first quality layer, the following parameter should be used:

```
TL1.QL0.HevcTargetBitrate
```

When setting per layer parameters, the equivalent non-SVC layer parameters should not be set for the encoder otherwise the per layer configuration will be overwritten.

Remark: quality layers are not supported. “QL0” must be used for quality layers.

This feature is supported by Radeon RX 5000 Series or newer GPUs as well as Ryzen 2000 U/H series or newer APUs.

2.2.8 LTR Properties

LTR (Long Term Reference) is to manually select a reference frame which can be far away to encode current frame. Normally, the encoder selects last frame as reference or a frame at lower layer in the SVC case.

In HEVC, maximum of 16 reference frames are supported according to the spec. These 16 reference frames are shared by SVC and LTR.

To use LTR, you need to set these properties as Static Properties:

```
AMF_VIDEO_ENCODER_HEVC_MAX_LTR_FRAMES , Max number of LTR frames.
```

```
AMF_VIDEO_ENCODER_HEVC_LTR_MODE default = AMF_VIDEO_ENCODER_HEVC_LTR_MODE_RESET_UNUSED ; remove/keep unused LTRs (not specified in property AMF_VIDEO_ENCODER_HEVC_FORCE_LTR_REFERENCE_BITFIELD )
```

The `LTR_MODE` has two options:

```
enum AMF_VIDEO_ENCODER_HEVC_LTR_MODE_ENUM
{
    AMF_VIDEO_ENCODER_HEVC_LTR_MODE_RESET_UNUSED    = 0,
    AMF_VIDEO_ENCODER_HEVC_LTR_MODE_KEEP_UNUSED
};
```

Reset_unused: encoder will discard all other LTR frames stored once a LTR frame is used as reference.

Keep_unused: encoder will not change other LTR frames stored once any LTR frame is used as reference. When we enable auto LTR mode in PA, this mode will be automatically selected internally and `AMF_VIDEO_ENCODER_HEVC_MAX_LTR_FRAMES` will be set to 4 no matter what users set. For details of “auto LTR mode”, please refer to `AMF_Video_PreAnalysis_API` document.

There are two Frame Per-Submission Properties need be set to use LTR:

`AMF_VIDEO_ENCODER_HEVC_MARK_CURRENT_WITH_LTR_INDEX` , Mark current frame with LTR index. `-1` means don't save current frame into LTR slots. `0~N` means save current frame into a LTR slot with index of `0~N` . Here N should be `<=`

`AMF_VIDEO_ENCODER_HEVC_MAX_LTR_FRAMES-1` .

When we use SVC encoding, only next base frame can be stored as LTR frame (i.e. only temporal layer number = `0` frames are allowed to be saved into LTR slot.)

`AMF_VIDEO_ENCODER_HEVC_FORCE_LTR_REFERENCE_BITFIELD` , force LTR bit-field. This is a bit-field mask that indicate which LTR slot can be used as reference for current frame. `0b1` means only slot 0 can be used as reference. `0b10` means only slot 1 can be used as reference. `0b100` means only slot 2 can be used as reference...

`0b0` means no LTR frame will be used as reference for current frame hence current frame will select short term reference frame (usually last frame) as reference.

When there are multiple bits are enabled, for example: `0b1111` (=decimal 15), that means LTR slots 0,1,2 and 3 are all allowed to be selected as reference. In this case, the closest LTR frame to current frame will be selected.

When we encode a key frame or switch frame, all save LTR slots will be cleared.

Referring to a LTR frame not exiting in LTR slot will generate an Intra only frame.

2.2.9 SmartAccess Video

On supported APU + GPU systems, there is an opportunity to use SmartAccess Video. SmartAccess Video - an optimization logic which enables the parallelization of encode and decode streams across multiple Video Codec Engine (VCN) hardware instances – empowers apps to process streams faster through seamless job distribution across available hardware. With a simple enablement of the encoder and decoder control flags, the SmartAccess Video logic will optimally use hardware resources to benefit media apps. Follow the `SMART_ACCESS_VIDEO` tag in the documentation to search for the property flags to set. On systems without SmartAccess Video support, the `SMART_ACCESS_VIDEO` properties have no effect.

3 Sample Applications

The AMF Encoder Sample application show how to setup and use the AMF Video Encoder HEVC Component to encode video frames that are loaded from disk or rendered by the DirectX 3D engine.

3.1 List of Parameters

Sample applications support almost all visible encoder parameters (except PictureStructure, EndOfSequence, EndOfStream) and few additional parameters.

Additional parameters of `TranscodeHW` application:

Name	Type
CODEC	string
OUTPUT	string
INPUT	string
WIDTH	int
HEIGHT	int
ADAPTERID	int
ENGINE	string
FRAMES	int
THREADCOUNT	int

Name	Type
PREVIEWMODE	bool

Table 2. Additional miscellaneous parameters of TranscodeHW application

Name: CODEC

Values: AVC or H264 , HEVC or H265 , AV1

Default Value: AVC

Description: Specify codec type.

Name: OUTPUT

Values: File name, relative or absolute path

Default Value NULL

Description: Output HEVC file for encoded data.

Name: INPUT

Values: File name, relative or absolute path

Default Value: NULL

Description: Input file with frames (AVC or HEVC).

Name: WIDTH

Values: Frame width

Default Value: 0

Description: Frame width.

Name: HEIGHT

Values: Frame height

Default Value: 0

Description: Frame height.

Name: AdapterID

Values: Number

Default Value: 0

Description: Index of GPU adapter.

Name: ENGINE

Values: DX9 , DX11 , Vulkan

Default Value: DX11

Description: Specify Engine type.

Name: FRAMES

Values: Number of frames to be encoded

Default Value: 100

Description: Number of frames to render.

Name: THREADCOUNT

Values: Number

Default Value: 1

Description: Number of session run ip parallel.

Name: PREVIEWMODE

Values: true , false

Default Value: false

Description: Preview Mode .

Additional parameters of VCEEncoderD3D application:

Name	Category
CODEC	string
OUTPUT	string
RENDER	string
WIDTH	int
HEIGHT	int
FRAMES	int
ADAPTERID	int
WINDOWMODE	bool
FULLSCREEN	bool
QueryInstanceCount	bool
UseInstance	int

Name	Category
FRAMERATE	int

Table 3. Miscellaneous parameters of VCEEncoderD3D application

Name: CODEC

Values: AVC or H264 , HEVC or H265 , AV1

Default Value: AVC

Description: Codec name.

Name: OUTPUT

Values: File name, relative or absolute path

Default Value: NULL

Description: Output HEVC file for encoded data.

Name: RENDER

Values: DX9 , DX9Ex , DX11 , OpenGL , OpenCL , Host , OpenCLDX9 , OpenCLDX11 , OpenGLDX9 , OpenGLDX11 , OpenCLOpenGLDX9 , OpenCLOpenGLDX11 , HostDX9 , HostDX11 , DX11DX9 , Vulkan

Default Value: DX9

Description: Specifies render type.

Name: WIDTH

Values: Frame width

Default Value: 1280

Description: Frame width.

Name: HEIGHT

Values: Frame height

Default Value: 720

Description: Frame height.

Name: FRAMES

Values: Number of frames to be encoded

Default Value: 100

Description: Number of frames to be encoded.

Name: ADAPTERID

Values: Number

Default Value: 0

Description: Index of GPU adapter.

Name: WINDOWMODE

Values: true , false

Default Value: false

Description: Shows rendering window for D3D sample application.

Name: FULLSCREEN

Values: true , false

Default Value: false

Description: Enables full screen.

Name: QueryInstanceCount

Values: true , false

Default Value: false

Description: If the flag is set, the number of independent VCE instances will be queried and printed.

Name: UseInstance

Values: 0 ... number of instances - 1

Default Value: Depends on usage

Description: If there are more than one VCE Instances, you can force which instance to use.

Name: FRAMERATE

Values: Render frame rate

Default Value: 0

Description: Render frame rate.

3.2 Command line example

3.2.1 Transcoding application (TranscodeHW.exe)

```
TranscodeHW.exe -input input.h264 -output out.h265 -codec HEVC -width 1280 -height 720 -HevcUsage transcoding -  
HevcRateControlMethod cbr -HevcTargetBitrate 100000
```

This command transcodes H264 elementary stream to H.265 video. Encoder is created with “Transcoding” usage.

3.2.2 D3D application (VCEEncoderD3D.exe)

```
VCEEncoderD3D.exe -output VideoSample_1024x768.h265 -codec HEVC -width 1024 -height 768 -HevcUsage transcoding -  
HevcRateControlMethod cbr -HevcTargetBitrate 500000 -frames 400
```

This command encodes 400 frames through D3D renderer and creates an output file with the encoded data. Encoder is created with “Transcoding” usage. Initial configuration sets bitrate to a value of 500 kbits/sec.

4 Annex A: Encoding & frame parameters description

Table A-1. Encoder parameters

Name (Prefix “AMF_VIDEO_ENCODER_HEVC_”)	Type
USAGE	amf_int64
INSTANCE_INDEX	amf_int64
PROFILE	amf_int64
TIER	amf_int64
PROFILE_LEVEL	amf_int64
MAX_LTR_FRAMES	amf_int64
LTR_MODE	amf_int64
MAX_NUM_REFRAMES	amf_int64
LOWLATENCY_MODE	amf_bool
PRE_ANALYSIS_ENABLE	amf_bool
MAX_NUM_TEMPORAL_LAYERS	amf_int64

Table 4. Encoder static parameters

Name: AMF_VIDEO_ENCODER_HEVC_USAGE

Values: AMF_VIDEO_ENCODER_HEVC_USAGE_ENUM : AMF_VIDEO_ENCODER_HEVC_USAGE_TRANSCODING ,
AMF_VIDEO_ENCODER_HEVC_USAGE_TRANSCODING , AMF_VIDEO_ENCODER_HEVC_USAGE_ULTRA_LOW_LATENCY ,
AMF_VIDEO_ENCODER_HEVC_USAGE_LOW_LATENCY , AMF_VIDEO_ENCODER_HEVC_USAGE_WEBCAM ,
AMF_VIDEO_ENCODER_HEVC_USAGE_HIGH_QUALITY , AMF_VIDEO_ENCODER_HEVC_USAGE_LOW_LATENCY_HIGH_QUALITY

Default Value: N/A

Description: Selects the AMF usage (see Section 1.2).

Name: AMF_VIDEO_ENCODER_HEVC_INSTANCE_INDEX

Values: 0 , 1

Default Value: 0

Description: Selects the encoder engine used for encoding.

Name: AMF_VIDEO_ENCODER_HEVC_PROFILE

Values: AMF_VIDEO_ENCODER_HEVC_PROFILE_ENUM : AMF_VIDEO_ENCODER_HEVC_PROFILE_MAIN ,
AMF_VIDEO_ENCODER_HEVC_PROFILE_MAIN_10

Default Value: AMF_VIDEO_ENCODER_HEVC_PROFILE_MAIN

Description: Selects the HEVC profile.

Name: AMF_VIDEO_ENCODER_HEVC_TIER

Values: AMF_VIDEO_ENCODER_HEVC_TIER_ENUM : AMF_VIDEO_ENCODER_HEVC_TIER_MAIN , AMF_VIDEO_ENCODER_HEVC_TIER_HIGH

Default Value: AMF_VIDEO_ENCODER_HEVC_TIER_MAIN

Description: Selects the HEVC tier.

Name: AMF_VIDEO_ENCODER_HEVC_PROFILE_LEVEL

Values: AMF_VIDEO_ENCODER_LEVEL_ENUM : AMF_LEVEL_1 , AMF_LEVEL_2 , AMF_LEVEL_2_1 , AMF_LEVEL_3 , AMF_LEVEL_3_1 ,
AMF_LEVEL_4 , AMF_LEVEL_4_1 , AMF_LEVEL_5 , AMF_LEVEL_5_1 , AMF_LEVEL_5_2 , AMF_LEVEL_6 , AMF_LEVEL_6_1 , AMF_LEVEL_6_2

Default Value: AMF_LEVEL_6_2

Description: Selects the HEVC Profile Level.

Name: AMF_VIDEO_ENCODER_HEVC_MAX_LTR_FRAMES

Values: 0 ... 16

Default Value: 0

Description: The number of long-term references controlled by the user. Remarks:

- When == 0 , the encoder may or may not use LTRs during encoding.
 - When > 0 , the user has control over all LTR.
 - With user control of LTR, Intra-refresh features are not supported.
 - The actual maximum number of LTRs allowed depends on H.265 (HEVC) Annex A Table Level limits, which defines dependencies between the H.265 Level number, encoding resolution, and DPB size. The DPB size limit impacts the maximum number of LTR allowed.
-

Name: AMF_VIDEO_ENCODER_HEVC_LTR_MODE

Values: AMF_VIDEO_ENCODER_HEVC_LTR_MODE_ENUM : AMF_VIDEO_ENCODER_HEVC_LTR_MODE_RESET_UNUSED ,
AMF_VIDEO_ENCODER_HEVC_LTR_MODE_KEEP_UNUSED

Default Value: AMF_VIDEO_ENCODER_HEVC_LTR_MODE_RESET_UNUSED

Description: Remove/keep unused LTRs not specified inside the LTR reference bitfield.

Name: `AMF_VIDEO_ENCODER_HEVC_MAX_NUM_REFRAMES`

Values: `0` ... `16`

Default Value: `1`

Description: Maximum number of reference frames.

Name: `AMF_VIDEO_ENCODER_HEVC_LOWLATENCY_MODE`

Values: `true` (on), `false` (off)

Default Value associated with usages:

- Transcoding: `false`
- Ultra low latency: `true`
- Low latency: `false`
- Webcam: `false`
- HQ: `false`
- HQLL: `true`

Description: Enables low latency mode in the encoder

Name: `AMF_VIDEO_ENCODER_HEVC_PRE_ANALYSIS_ENABLE`

Values: `true` , `false`

Default Value: `false`

Description: Enables the pre-analysis module. Some features require this to be enabled. Refer to AMF Video PreAnalysis API reference for more details.

Name: `AMF_VIDEO_ENCODER_HEVC_MAX_NUM_TEMPORAL_LAYERS`

Values: `1` ... Maximum number of temporal layers supported

Default Value: `1`

Description: Sets the maximum number of temporal layers. It shall not be exceeded by the number of temporal layers. The maximum number of temporal layers supported is determined by the corresponding encoder capability.

Name: `AMF_VIDEO_ENCODER_HEVC_ENABLE_SMART_ACCESS_VIDEO`

Values: `true` , `false`

Default Value: `false`

Description: When set to `true` , enables the SmartAccess Video feature, which optimally allocates the encoding task on supported APU/GPU pairings.

Name (Prefix "AMF_VIDEO_ENCODER_HEVC_")	Type
FRAMESIZE	AMFSize
ASPECT_RATIO	AMFRatio

Table 5. Encoder resolution parameters

Name: AMF_VIDEO_ENCODER_HEVC_FRAMESIZE

Values: Width: 192 – 4096 Height: 128 – 2176

Default Value: Width: 0 Height: 0

Description: Frame width/Height in pixels, maximum value is hardware-specific, should be queried through AMFCaps

Name: AMF_VIDEO_ENCODER_HEVC_ASPECT_RATIO

Values: (1,1) ... (INT_MAX, INT_MAX)

Default Value: (1,1)

Description: Pixel aspect ratio

Name (Prefix "AMF_VIDEO_ENCODER_HEVC_")	Type
TARGET_BITRATE	amf_int64
PEAK_BITRATE	amf_int64
RATE_CONTROL_METHOD	amf_int64
QVBR_QUALITY_LEVEL	amf_int64
RATE_CONTROL_SKIP_FRAME_ENABLE	amf_bool
MIN_QP_I	amf_int64
MAX_QP_I	amf_int64
MIN_QP_P	amf_int64
MAX_QP_P	amf_int64
QP_I	amf_int64
QP_P	amf_int64
FRAMERATE	AMFRate
VBV_BUFFER_SIZE	amf_int64
INITIAL_VBV_BUFFER_FULLNESS	amf_int64
ENFORCE_HRD	amf_bool
PREENCODE_ENABLE	amf_bool
ENABLE_VBAQ	amf_bool
FILLER_DATA_ENABLE	amf_bool

Name (Prefix “AMF_VIDEO_ENCODER_HEVC_”)	Type
HIGH_MOTION_QUALITY_BOOST_ENABLE	amf_bool

Table 6. Encoder rate-control parameters

Name: AMF_VIDEO_ENCODER_HEVC_TARGET_BITRATE

Values: >0

Default Value: 20 mbps

Description: Sets the target bitrate, bit/s based on use case.

Name: AMF_VIDEO_ENCODER_HEVC_PEAK_BITRATE

Values: >= TargetBitrate

Default Value:

- Transcoding: 30 mbps
- Ultra low latency: 20 mbps
- Low latency: 20 mbps
- Webcam: 20 mbps
- HQ: 80 mbps
- HQLL: 30 mbps

Description: Sets the peak bitrate.

Name: AMF_VIDEO_ENCODER_HEVC_RATE_CONTROL_METHOD

Values: AMF_VIDEO_ENCODER_HEVC_RATE_CONTROL_METHOD_ENUM : AMF_VIDEO_ENCODER_HEVC_RATE_CONTROL_METHOD_UNKNOWN , AMF_VIDEO_ENCODER_HEVC_RATE_CONTROL_METHOD_CONSTANT_QP , AMF_VIDEO_ENCODER_HEVC_RATE_CONTROL_METHOD_LATENCY_CONSTRAINED_VBR , AMF_VIDEO_ENCODER_HEVC_RATE_CONTROL_METHOD_PEAK_CONSTRAINED_VBR , AMF_VIDEO_ENCODER_HEVC_RATE_CONTROL_METHOD_CBR , AMF_VIDEO_ENCODER_HEVC_RATE_CONTROL_METHOD_QUALITY_VBR , AMF_VIDEO_ENCODER_HEVC_RATE_CONTROL_METHOD_HIGH_QUALITY_VBR , AMF_VIDEO_ENCODER_HEVC_RATE_CONTROL_METHOD_HIGH_QUALITY_CBR

Default Value associated with usages:

- Transcoding: AMF_VIDEO_ENCODER_HEVC_RATE_CONTROL_METHOD_PEAK_CONSTRAINED_VBR
- Ultra low latency: AMF_VIDEO_ENCODER_HEVC_RATE_CONTROL_METHOD_LATENCY_CONSTRAINED_VBR
- Low latency: AMF_VIDEO_ENCODER_HEVC_RATE_CONTROL_METHOD_PEAK_CONSTRAINED_VBR
- Webcam: AMF_VIDEO_ENCODER_HEVC_RATE_CONTROL_METHOD_PEAK_CONSTRAINED_VBR
- HQ: AMF_VIDEO_ENCODER_HEVC_RATE_CONTROL_METHOD_PEAK_CONSTRAINED_VBR
- HQLL: AMF_VIDEO_ENCODER_HEVC_RATE_CONTROL_METHOD_PEAK_CONSTRAINED_VBR

Description: Selects the rate control method:

- CQP – Constrained QP,
- VBR_LAT - Latency Constrained VBR

- VBR - Peak Constrained VBR,
- CBR - Constant Bitrate
- QVBR – Quality VBR
- HQVBR – High Quality VBR
- HQCBR – High Quality CBR

Remarks:

- When SVC encoding is enabled, some rate-control parameters can be configured differently for a particular SVC-layer. An SVC-layer is denoted by an index pair [SVC-Temporal Layer index][SVC-Quality Layer index] . E.g. The bitrate may be configured differently for SVC-layers [0][0] and [1][0] .
- We restrict all SVC layers to have the same Rate Control method.
- QVBR, HQVBR and HQCBR are only supported if PreAnalysis is enabled.
- QVBR, HQVBR and HQCBR target improving subjective quality with the possible loss of objective quality (PSNR or VMAF).

Name: AMF_VIDEO_ENCODER_HEVC_QVBR_QUALITY_LEVEL

Values: 1 – 51

Default Value: 23

Description: Sets the quality level for QVBR rate control method. Remarks: Only available for QVBR rate control method.

Name: AMF_VIDEO_ENCODER_HEVC_RATE_CONTROL_SKIP_FRAME_ENABLE

Values: true , false

Default Value associated with usages:

- Transcoding: false
- Ultra low latency: true
- Low latency: true
- Webcam: true
- HQ: false
- HQLL: false

Description: Enables skip frame for rate control

Name: AMF_VIDEO_ENCODER_HEVC_MIN_QP_I

Values: 0 – 51

Default Value: 0

Description: Sets the minimum QP for I frame

Name: AMF_VIDEO_ENCODER_HEVC_MAX_QP_I

Values: 0 – 51

Default Value: 51

Description: Sets the maximum QP for I frame

Name: AMF_VIDEO_ENCODER_HEVC_MIN_QP_P

Values: 0 – 51

Default Value: 0

Description: Sets the minimum QP for P frame.

Name: AMF_VIDEO_ENCODER_HEVC_MAX_QP_P

Values: 0 – 51

Default Value: 51

Description: Sets the maximum QP for P frame.

Name: AMF_VIDEO_ENCODER_HEVC_QP_I

Values: 0 – 51

Default Value: 26

Description: Sets the constant QP for I-pictures. Remarks: Only available for CQP rate control method.

Name: AMF_VIDEO_ENCODER_HEVC_QP_P

Values: 0 – 51

Default Value: 26

Description: Sets the constant QP for P-pictures. Remarks: Only available for CQP rate control method.

Name: AMF_VIDEO_ENCODER_HEVC_FRAMERATE

Values: 1*FrameRateDen ... 60* FrameRateDen

Default Value: 30 fps

Description: Frame rate numerator/denominator.

Name: AMF_VIDEO_ENCODER_HEVC_VBV_BUFFER_SIZE

Values: >0

Default Value associated with usages:

- Transcoding: 20 mbits
- Ultra low latency: 735 kbits
- Low latency: 4 mbits
- Webcam: 2 mbits

- HQ: 40 mbits
- HQLL: 10 mbits

Description: Sets the VBV buffer size in bits based on use case.

Name: AMF_VIDEO_ENCODER_HEVC_INITIAL_VBV_BUFFER_FULLNESS

Values: 0 - 64

Default Value: 64

Description: Sets the initial VBV buffer fullness.

Name: AMF_VIDEO_ENCODER_HEVC_ENFORCE_HRD

Values: true , false

Default Value associated with usages:

- Transcoding: false
- Ultra low latency: true
- Low latency: false
- Webcam: false
- HQ: false
- HQLL: false

Description: Disables/enables constraints on QP variation within a picture to meet HRD requirement(s).

Name: AMF_VIDEO_ENCODER_HEVC_PREENCODE_ENABLE

Values: true , false

Default Value associated with usages:

- Transcoding: false
- Ultra low latency: false
- Low latency: false
- Webcam: false
- HQ: true
- HQLL: false

Description: Pre-analysis assisted rate control

Name: AMF_VIDEO_ENCODER_HEVC_ENABLE_VBAQ

Values: true , false

Default Value associated with usages:

- Transcoding: false
- Ultra low latency: false
- Low latency: false

- Webcam: false
- HQ: true
- HQLL: true

Description: By default, disable VBAQ.Note: Cannot use when RATE_CONTROL_METHOD is CQP.

Name: AMF_VIDEO_ENCODER_HEVC_FILLER_DATA_ENABLE

Values: true , false

Default Value: false

Description: Enable filler data for CBR usage.

Name: AMF_VIDEO_ENCODER_HEVC_HIGH_MOTION_QUALITY_BOOST_ENABLE

Values: true , false

Default Value associated with usages:

- Transcoding: false
- Ultra low latency: false
- Low latency: false
- Webcam: false
- HQ: true
- HQLL: true

Description: Enable high motion quality boost mode to pre-analyze the motion of the video and use this information to improve encoding.

Name (Prefix “AMF_VIDEO_ENCODER_HEVC_”)	Type
MAX_AU_SIZE	amf_int64
HEADER_INSERTION_MODE	amf_int64
GOP_SIZE	amf_int64
NUM_GOPS_PER_IDR	amf_int64
DE_BLOCKING_FILTER_DISABLE	amf_bool
SLICES_PER_FRAME	amf_int64
INTRA_REFRESH_NUM_CTBS_PER_SLOT	amf_int64

Table 7. Encoder picture-control parameters

Name: AMF_VIDEO_ENCODER_HEVC_MAX_AU_SIZE

Values: 0 – 100 000 000 bits

Default Value: 0

Description: Maximum AU size in bits.

Name: AMF_VIDEO_ENCODER_HEVC_HEADER_INSERTION_MODE

Values: AMF_VIDEO_ENCODER_HEVC_HEADER_INSERTION_MODE_ENUM : AMF_VIDEO_ENCODER_HEVC_HEADER_INSERTION_MODE_NONE
AMF_VIDEO_ENCODER_HEVC_HEADER_INSERTION_MODE_GOP_ALIGNED , AMF_VIDEO_ENCODER_HEVC_HEADER_INSERTION_MODE_IDR_ALIGNED

Default Value: AMF_VIDEO_ENCODER_HEVC_HEADER_INSERTION_MODE_NONE

Description: Sets the headers insertion mode.

Name: AMF_VIDEO_ENCODER_HEVC_GOP_SIZE

Values: 0 ... 1000

Default Value associated with usages:

- Transcoding: 30
- Ultra low latency: 300
- Low latency: 300
- Webcam: 30
- HQ: 30
- HQLL: 30

Description: The period to insert IDR/CRA in fixed size mode. 0 means only insert the first IDR/CRA (infinite GOP size).

Name: AMF_VIDEO_ENCODER_HEVC_NUM_GOPS_PER_IDR

Values: 1 – 65535

Default Value: 1

Description: Determines the frequency to insert IDR as start of a GOP. 0 means no IDR will be inserted except for the first picture in the sequence.

Name: AMF_VIDEO_ENCODER_HEVC_DE_BLOCKING_FILTER_DISABLE

Values: true , false

Default Value: false

Description: Disable/enable the de-blocking filter.

Name: AMF_VIDEO_ENCODER_HEVC_SLICES_PER_FRAME

Values: 1 - #CTBs per frame

Default Value: 1

Description: Sets the number of slices per frame.

Name: AMF_VIDEO_ENCODER_HEVC_INTRA_REFRESH_NUM_CTBS_PER_SLOT

Values: 0 - #CTBs per frame

Default Value: 0

Description: Sets the number of intra-refresh 64x64 coding-tree-blocks per slot.

Name (Prefix "AMF_VIDEO_ENCODER_HEVC_")	Type
QUALITY_PRESET	amf_int64
PICTURE_TRANSFER_MODE	amf_int64
QUERY_TIMEOUT	amf_int64

Table 8. Encoder miscellaneous parameters

Name: AMF_VIDEO_ENCODER_HEVC_QUALITY_PRESET

Values: AMF_VIDEO_ENCODER_HEVC_QUALITY_PRESET_ENUM : AMF_VIDEO_ENCODER_HEVC_QUALITY_PRESET_BALANCED , AMF_VIDEO_ENCODER_HEVC_QUALITY_PRESET_QUALITY , AMF_VIDEO_ENCODER_HEVC_QUALITY_PRESET_SPEED

Default Value associated with usages:

- Transcoding: AMF_VIDEO_ENCODER_HEVC_QUALITY_PRESET_BALANCED
- Ultra low latency: AMF_VIDEO_ENCODER_HEVC_QUALITY_PRESET_SPEED
- Low latency: AMF_VIDEO_ENCODER_HEVC_QUALITY_PRESET_SPEED
- Webcam: AMF_VIDEO_ENCODER_HEVC_QUALITY_PRESET_QUALITY
- HQ: AMF_VIDEO_ENCODER_HEVC_QUALITY_PRESET_QUALITY
- HQLL: AMF_VIDEO_ENCODER_HEVC_QUALITY_PRESET_QUALITY

Description: Selects the quality preset.

Name: AMF_VIDEO_ENCODER_HEVC_PICTURE_TRANSFER_MODE

Values: AMF_VIDEO_ENCODER_HEVC_PICTURE_TRANSFER_MODE_ENUM : AMF_VIDEO_ENCODER_HEVC_PICTURE_TRANSFER_MODE_ON , AMF_VIDEO_ENCODER_HEVC_PICTURE_TRANSFER_MODE_OFF

Default Value: AMF_VIDEO_ENCODER_HEVC_PICTURE_TRANSFER_MODE_OFF

Description: The application can turn on this flag for a specific input picture to allow dumping the reconstructed picture and/or injecting a reference picture.

Name: AMF_VIDEO_ENCODER_HEVC_QUERY_TIMEOUT

Values: Timeout for QueryOutput call in ms

Default Value associated with usages:

- Transcoding: 0 (no wait)
- Ultra low latency: 0 (no wait)
- Low latency: 0 (no wait)
- Webcam: 0 (no wait)
- HQ: 50
- HQLL: 50

Description: Timeout for QueryOutput call in ms.

Name (Prefix "AMF_VIDEO_ENCODER_HEVC_")	Type
MOTION_HALF_PIXEL	amf_bool
MOTION_QUARTERPIXEL	amf_bool

Table 9. Encoder motion estimation parameters

Name: AMF_VIDEO_ENCODER_HEVC_MOTION_HALF_PIXEL

Values: true , false

Default Value: true

Description: Turns on/off half-pixel motion estimation.

Name: AMF_VIDEO_ENCODER_HEVC_MOTION_QUARTERPIXEL

Values: true , false

Default Value: true

Description: Turns on/off quarter-pixel motion estimation.

Name (Prefix "AMF_VIDEO_ENCODER_HEVC_")	Type
COLOR_BIT_DEPTH	amf_int64
INPUT_COLOR_PROFILE	amf_int64
INPUT_TRANSFER_CHARACTERISTIC	amf_int64
INPUT_COLOR_PRIMARIES	amf_int64
OUTPUT_COLOR_PROFILE	amf_int64
OUTPUT_TRANSFER_CHARACTERISTIC	amf_int64
OUTPUT_COLOR_PRIMARIES	amf_int64

Table 10. Encoder color conversion parameters

Name: AMF_VIDEO_ENCODER_HEVC_COLOR_BIT_DEPTH

Values: AMF_COLOR_BIT_DEPTH_ENUM : AMF_COLOR_BIT_DEPTH_UNDEFINED , AMF_COLOR_BIT_DEPTH_8 , AMF_COLOR_BIT_DEPTH_10

Default Value: AMF_COLOR_BIT_DEPTH_8

Description: Sets the number of bits in each pixel's color component in the encoder's compressed output bitstream.

Name: AMF_VIDEO_ENCODER_HEVC_INPUT_COLOR_PROFILE

Values: AMF_VIDEO_CONVERTER_COLOR_PROFILE_ENUM : AMF_VIDEO_CONVERTER_COLOR_PROFILE_UNKNOWN , AMF_VIDEO_CONVERTER_COLOR_PROFILE_601 , AMF_VIDEO_CONVERTER_COLOR_PROFILE_709 , AMF_VIDEO_CONVERTER_COLOR_PROFILE_2020 , AMF_VIDEO_CONVERTER_COLOR_PROFILE_JPEG , AMF_VIDEO_CONVERTER_COLOR_PROFILE_FULL_601 , AMF_VIDEO_CONVERTER_COLOR_PROFILE_FULL_709 , AMF_VIDEO_CONVERTER_COLOR_PROFILE_FULL_2020

Default Value: AMF_VIDEO_CONVERTER_COLOR_PROFILE_UNKNOWN

Description: Color profile of the input surface. SDR - Setting this parameter (COLOR_PROFILE) can fully describe a surface for SDR use case. HDR – For HDR use case the TRANSFER_CHARACTERISTIC , COLOR_PRIMARIES , and NOMINAL_RANGE parameters describe the surface.

Name: AMF_VIDEO_ENCODER_HEVC_INPUT_TRANSFER_CHARACTERISTIC

Values: AMF_COLOR_TRANSFER_CHARACTERISTIC_ENUM : AMF_COLOR_TRANSFER_CHARACTERISTIC_UNDEFINED , AMF_COLOR_TRANSFER_CHARACTERISTIC_BT709 , AMF_COLOR_TRANSFER_CHARACTERISTIC_RESERVED , AMF_COLOR_TRANSFER_CHARACTERISTIC_GAMMA22 , AMF_COLOR_TRANSFER_CHARACTERISTIC_GAMMA28 , AMF_COLOR_TRANSFER_CHARACTERISTIC_SMPTE170M , AMF_COLOR_TRANSFER_CHARACTERISTIC_SMPTE240M , AMF_COLOR_TRANSFER_CHARACTERISTIC_LINEAR , AMF_COLOR_TRANSFER_CHARACTERISTIC_LOG , AMF_COLOR_TRANSFER_CHARACTERISTIC_LOG_SQRT , AMF_COLOR_TRANSFER_CHARACTERISTIC_IEC61966_2_4 , AMF_COLOR_TRANSFER_CHARACTERISTIC_BT1361_ECG , AMF_COLOR_TRANSFER_CHARACTERISTIC_IEC61966_2_1 , AMF_COLOR_TRANSFER_CHARACTERISTIC_BT2020_10 , AMF_COLOR_TRANSFER_CHARACTERISTIC_BT2020_12 , AMF_COLOR_TRANSFER_CHARACTERISTIC_SMPTE2084 , AMF_COLOR_TRANSFER_CHARACTERISTIC_SMPTE428 , AMF_COLOR_TRANSFER_CHARACTERISTIC_ARIB_STD_B67

Default Value: AMF_COLOR_TRANSFER_CHARACTERISTIC_UNDEFINED

Description: Characteristic transfer function of the input surface used to perform the mapping between linear light components (tristimulus values) and a nonlinear RGB signal.Used (alongside COLOR_PRIMARIES and NOMINAL_RANGE parameters) to describe surface in HDR use case.

Name: AMF_VIDEO_ENCODER_HEVC_INPUT_COLOR_PRIMARIES

Values: AMF_COLOR_PRIMARIES_ENUM : AMF_COLOR_PRIMARIES_UNDEFINED , AMF_COLOR_PRIMARIES_BT709 , AMF_COLOR_PRIMARIES_UNSPECIFIED , AMF_COLOR_PRIMARIES_RESERVED , AMF_COLOR_PRIMARIES_BT470M , AMF_COLOR_PRIMARIES_BT470BG , AMF_COLOR_PRIMARIES_SMPTE170M , AMF_COLOR_PRIMARIES_SMPTE240M , AMF_COLOR_PRIMARIES_FILM , AMF_COLOR_PRIMARIES_BT2020 , AMF_COLOR_PRIMARIES_SMPTE428 , AMF_COLOR_PRIMARIES_SMPTE431 , AMF_COLOR_PRIMARIES_SMPTE432 , AMF_COLOR_PRIMARIES_JEDEC_P22

Default Value: AMF_COLOR_PRIMARIES_UNDEFINED

Description: Color space primaries for the input surface which are the maximum red, green, and blue value permitted within the color space. Used (alongside TRANSFER_CHARACTERISTIC and NOMINAL_RANGE parameters) to describe surface in HDR use case.

Name: AMF_VIDEO_ENCODER_HEVC_OUTPUT_COLOR_PROFILE

Values: AMF_VIDEO_CONVERTER_COLOR_PROFILE_ENUM : AMF_VIDEO_CONVERTER_COLOR_PROFILE_UNKNOWN , AMF_VIDEO_CONVERTER_COLOR_PROFILE_601 , AMF_VIDEO_CONVERTER_COLOR_PROFILE_709 , AMF_VIDEO_CONVERTER_COLOR_PROFILE_2020 , AMF_VIDEO_CONVERTER_COLOR_PROFILE_JPEG , AMF_VIDEO_CONVERTER_COLOR_PROFILE_FULL_601 , AMF_VIDEO_CONVERTER_COLOR_PROFILE_FULL_709 , AMF_VIDEO_CONVERTER_COLOR_PROFILE_FULL_2020

Default Value: AMF_VIDEO_CONVERTER_COLOR_PROFILE_UNKNOWN

Description: Color profile of the compressed output stream. SDR - Setting this parameter (COLOR_PROFILE) can fully describe a surface for SDR use case. HDR – For HDR use case the TRANSFER_CHARACTERISTIC , COLOR_PRIMARIES , and NOMINAL_RANGE

parameters describe the surface. Determines the optional VUI parameter `matrix_coefficients`.

Name: `AMF_VIDEO_ENCODER_HEVC_OUTPUT_TRANSFER_CHARACTERISTIC`

Values: `AMF_COLOR_TRANSFER_CHARACTERISTIC_ENUM`: `AMF_COLOR_TRANSFER_CHARACTERISTIC_UNDEFINED`, `AMF_COLOR_TRANSFER_CHARACTERISTIC_BT709`, `AMF_COLOR_TRANSFER_CHARACTERISTIC_RESERVED`, `AMF_COLOR_TRANSFER_CHARACTERISTIC_GAMMA22`, `AMF_COLOR_TRANSFER_CHARACTERISTIC_GAMMA28`, `AMF_COLOR_TRANSFER_CHARACTERISTIC_SMPTE170M`, `AMF_COLOR_TRANSFER_CHARACTERISTIC_SMPTE240M`, `AMF_COLOR_TRANSFER_CHARACTERISTIC_LINEAR`, `AMF_COLOR_TRANSFER_CHARACTERISTIC_LOG`, `AMF_COLOR_TRANSFER_CHARACTERISTIC_LOG_SQRT`, `AMF_COLOR_TRANSFER_CHARACTERISTIC_IEC61966_2_4`, `AMF_COLOR_TRANSFER_CHARACTERISTIC_BT1361_ECG`, `AMF_COLOR_TRANSFER_CHARACTERISTIC_IEC61966_2_1`, `AMF_COLOR_TRANSFER_CHARACTERISTIC_BT2020_10`, `AMF_COLOR_TRANSFER_CHARACTERISTIC_BT2020_12`, `AMF_COLOR_TRANSFER_CHARACTERISTIC_SMPTE2084`, `AMF_COLOR_TRANSFER_CHARACTERISTIC_SMPTE428`, `AMF_COLOR_TRANSFER_CHARACTERISTIC_ARIB_STD_B67`

Default Value: `AMF_COLOR_TRANSFER_CHARACTERISTIC_UNDEFINED`

Description: Characteristic transfer function of the compressed output stream used to perform the mapping between linear light components (tristimulus values) and a nonlinear RGB signal. Used (alongside `COLOR_PRIMARIES` and `NOMINAL_RANGE` parameters) to describe surface in HDR use case.

Name: `AMF_VIDEO_ENCODER_HEVC_OUTPUT_COLOR_PRIMARIES`

Values: `AMF_COLOR_PRIMARIES_ENUM`: `AMF_COLOR_PRIMARIES_UNDEFINED`, `AMF_COLOR_PRIMARIES_BT709`, `AMF_COLOR_PRIMARIES_UNSPECIFIED`, `AMF_COLOR_PRIMARIES_RESERVED`, `AMF_COLOR_PRIMARIES_BT470M`, `AMF_COLOR_PRIMARIES_BT470BG`, `AMF_COLOR_PRIMARIES_SMPTE170M`, `AMF_COLOR_PRIMARIES_SMPTE240M`, `AMF_COLOR_PRIMARIES_FILM`, `AMF_COLOR_PRIMARIES_BT2020`, `AMF_COLOR_PRIMARIES_SMPTE428`, `AMF_COLOR_PRIMARIES_SMPTE431`, `AMF_COLOR_PRIMARIES_SMPTE432`, `AMF_COLOR_PRIMARIES_JEDEC_P22`

Default Value: `AMF_COLOR_PRIMARIES_UNDEFINED`

Description: Color space primaries for the compressed output surface which are the maximum red, green, and blue value permitted within the color space. Used (alongside `TRANSFER_CHARACTERISTIC` and `NOMINAL_RANGE` parameters) to describe surface in HDR use case.

Name (Prefix "AMF_VIDEO_ENCODER_HEVC_")	Type
<code>NUM_TEMPORAL_LAYERS</code>	<code>amf_int64</code>

Table 11. Encoder SVC parameters

Name: `AMF_VIDEO_ENCODER_HEVC_NUM_TEMPORAL_LAYERS`

Values: `1` ... Maximum number of temporal layers supported

Default Value: `1`

Description: Sets the number of temporal layers. SVC with temporal scalability is enabled when the number of layers is greater than `1`. The maximum number of temporal layers supported is determined by the corresponding encoder capability. Remarks: Actual modification of the number of temporal layers will be delayed until the start of the next temporal GOP. Intra-refresh feature is not supported with SVC.

Name (Prefix "AMF_VIDEO_ENCODER_HEVC_")	Type
TL<TL_Num>.QL<QL_Num>.<Parameter_name>	

Table 12. Encoder SVC per-layer parameters

Name: TL<TL_Num>.QL<QL_Num>.<Parameter_name>

Values: Parameter-specific values

Default Value: N/A

Description: Configures rate-control parameter per SVC layer.

- TL_Num — temporal layer number
- QL_Num — quality layer number
- Parameter_name — rate-control parameter name (see below) Rate-control parameters supported:
- HevcTargetBitrate
- HevcPeakBitrate
- HevcVBVBufferSize
- HevcFrameRate
- HevcMinQP_I
- HevcMinQP_P
- HevcMinQP_I
- HevcMinQP_P
- HevcQP_I
- HevcQP_P
- HevcFillerDataEnable
- HevcRateControlSkipFrameEnable
- HevcEnforceHRD
- HevcMaxAUSize(Refer to rate-control parameters section of this table for details)

Remarks: Quality layers are not supported. "QL0" must be used for quality layers.

Table A-2. Input frame and encoded data parameters

Name (prefix "AMF_VIDEO_ENCODER_HEVC_")	Type
INSERT_HEADER	amf_bool
INSERT_AUD	amf_bool
FORCE_PICTURE_TYPE	amf_int64
END_OF_SEQUENCE	amf_bool
MARK_CURRENT_WITH_LTR_INDEX	amf_int64
FORCE_LTR_REFERENCE_BITFIELD	amf_int64
ROI_DATA	AMF_SURFACE_GRAY32
STATISTICS_FEEDBACK	amf_bool
PSNR_FEEDBACK	amf_bool

Name (prefix "AMF_VIDEO_ENCODER_HEVC_")	Type
SSIM_FEEDBACK	amf_bool
BLOCK_QP_FEEDBACK	amf_bool
REFERENCE_PICTURE	AMFInterfacePtr

Table 13. Frame per-submission parameters

Name: AMF_VIDEO_ENCODER_HEVC_INSERT_HEADER

Values: true , false

Default Value: false

Description: Inserts SPS, PPS and VPS.

Name: AMF_VIDEO_ENCODER_HEVC_INSERT_AUD

Values: true , false

Default Value: false

Description: Inserts AUD.

Name: AMF_VIDEO_ENCODER_HEVC_FORCE_PICTURE_TYPE

Values: AMF_VIDEO_ENCODER_HEVC_PICTURE_TYPE_ENUM : AMF_VIDEO_ENCODER_HEVC_PICTURE_TYPE_NONE , AMF_VIDEO_ENCODER_HEVC_PICTURE_TYPE_IDR , AMF_VIDEO_ENCODER_HEVC_PICTURE_TYPE_I , AMF_VIDEO_ENCODER_HEVC_PICTURE_TYPE_P

Default Value: AMF_VIDEO_ENCODER_HEVC_PICTURE_TYPE_NONE

Description: Forces the picture type.

Name: AMF_VIDEO_ENCODER_HEVC_END_OF_SEQUENCE

Values: true , false

Default Value: false

Description: End of sequence.

Name: AMF_VIDEO_ENCODER_HEVC_MARK_CURRENT_WITH_LTR_INDEX

Values: -1 ... MaxOfLTRFrames - 1

Default Value: N/A

Description: If != -1 , the current picture is coded as a long-term reference with the given index. Remarks:

- When the user controls N LTRs (using the corresponding Create parameter), then the LTR Index the user can assign to a reference picture varies from 0 to N-1 . By default, the encoder will "use up" available LTR Indices (i.e. assign them to

references) even if the user does not request them to be used.

- When LTR is used with SVC encoding, only base temporal layer pictures can be coded as LTR. In this case, the request to mark the current picture as LTR would be delayed to the next base temporal layer picture if the current picture is in an enhancement layer. If the user submits multiple requests to mark current as LTR between base temporal layer pictures, then only the last request is applied.

Name: `AMF_VIDEO_ENCODER_HEVC_FORCE_LTR_REFERENCE_BITFIELD`

Values: Bitfield `MaxOfLTRFrames` (max possible 16 bits)

Default Value: `0`

Description: Force LTR Reference allowed bitfield. If `= 0`, the current picture should predict from the default reference. If `!= 0`, the current picture should predict from one of the LTRs allowed by the bitfield (bit# = LTR Index#). Remarks:

- E.g. if Bit#0 = `1`, then the existing LTR with LTR Index = `0` may be used for reference. The bitfield may allow more than one LTR for reference, in which case the encoder is free to choose which one to use. This bitfield also disallows existing LTRs not enabled by it from current/future reference.
- E.g. if Bit#1 = `0`, and there is an existing reference with LTR Index = `1`, then this LTR Index will not be used for reference until it is replaced with a newer reference with the same LTR Index.

Name: `AMF_VIDEO_ENCODER_HEVC_ROI_DATA`

Values: Video surface in `AMF_SURFACE_GRAY32` format

Default Value: `N/A`

Description: Important value for each 64x64 block ranges from `0` to `10`, stored in 32bit unsigned format.

Name: `AMF_VIDEO_ENCODER_HEVC_STATISTICS_FEEDBACK`

Values: `true (on)`, `false (off)`

Default Value: `false`

Description: Instruct encoder to collect and feedback statistics.

Name: `AMF_VIDEO_ENCODER_HEVC_PSNR_FEEDBACK`

Values: `true (on)`, `false (off)`

Default Value: `false`

Description: Signal encoder to calculate PSNR score.

Name: `AMF_VIDEO_ENCODER_HEVC_SSIM_FEEDBACK`

Values: `true (on)`, `false (off)`

Default Value: `false`

Description: Signal encoder to calculate SSIM score.

Name: AMF_VIDEO_ENCODER_HEVC_BLOCK_QP_FEEDBACK

Values: true (on), false (off)

Default Value: false

Description: Instruct encoder to collect and feedback block level QP values.

Name: AMF_VIDEO_ENCODER_HEVC_REFERENCE_PICTURE

Values: AMFSurface

Default Value: N/A

Description: Injected reference picture. Valid with PICTURE_TRANSFER_MODE turned on.

Name (prefix "AMF_VIDEO_ENCODER_HEVC_")	Type
OUTPUT_DATA_TYPE	amf_int64
OUTPUT_MARKED_LTR_INDEX	amf_int64
OUTPUT_REFERENCED_LTR_INDEX_BITFIELD	amf_int64
OUTPUT_TEMPORAL_LAYER	amf_int64
RECONSTRUCTED_PICTURE	AMFSurface

Table 14. Encoded data parameters

Name: AMF_VIDEO_ENCODER_HEVC_OUTPUT_DATA_TYPE

Values: AMF_VIDEO_ENCODER_HEVC_OUTPUT_DATA_TYPE_ENUM : AMF_VIDEO_ENCODER_HEVC_OUTPUT_DATA_TYPE_I , AMF_VIDEO_ENCODER_HEVC_OUTPUT_DATA_TYPE_P

Default Value: N/A

Description: Type of encoded data.

Name: AMF_VIDEO_ENCODER_HEVC_OUTPUT_MARKED_LTR_INDEX

Values: -1 ... MaxOfLTRFrames -1

Default Value: -1

Description: Marked as LTR Index. If != -1 , then this picture was coded as a long-term reference with this LTR Index.

Name: AMF_VIDEO_ENCODER_HEVC_OUTPUT_REFERENCED_LTR_INDEX_BITFIELD

Values: Bitfield MaxOfLTRFrames (max possible 16 bits)

Default Value: 0

Description: Referenced LTR Index bitfield. If != 0 , this picture was coded to reference long-term references. The enabled bits identify the LTR Indices of the referenced pictures (e.g. if Bit #0 = 1 , then LTR Index 0 was used as a reference when coding this

picture).

Name: AMF_VIDEO_ENCODER_HEVC_OUTPUT_TEMPORAL_LAYER

Values: 0 ... Maximum number of temporal layers supported - 1

Default Value: N/A

Description: Temporal layer of the encoded picture.

Name: AMF_VIDEO_ENCODER_HEVC_RECONSTRUCTED_PICTURE

Values: AMFSurface

Default Value: N/A

Description: Reconstructed picture. Valid with PICTURE_TRANSFER_MODE turned on.

Table A-3. Encoder statistics feedback

Statistic Name	Description
STATISTIC_FRAME_QP	QP of the first encoded CTB in a picture
STATISTIC_AVERAGE_QP	Average QP of all encoded CTBs in a picture
STATISTIC_MAX_QP	Max QP among all encoded CTBs in a picture
STATISTIC_MIN_QP	Min QP among all encoded CTBs in a picture
STATISTIC_PIX_NUM_INTRA	Number of intra-coded pixels
STATISTIC_PIX_NUM_INTER	Number of inter-coded pixels
STATISTIC_PIX_NUM_SKIP	Number of skip-coded pixels
STATISTIC_BITCOUNT_RESIDUAL	Frame level bit count of residual data
STATISTIC_BITCOUNT_MOTION	Frame level bit count of motion vectors
STATISTIC_BITCOUNT_INTER	Frame level bit count of inter CTBs
STATISTIC_BITCOUNT_INTRA	Frame level bit count of intra CTBs
STATISTIC_BITCOUNT_ALL_MINUS_HEADER	Frame level bit count of the bitstream excluding header
STATISTIC_MV_X	Accumulated absolute values of MVX for full encoding
STATISTIC_MV_Y	Accumulated absolute values of MVY for full encoding
STATISTIC_RD_COST_FINAL	Frame level final RD cost
STATISTIC_RD_COST_INTRA	Frame level RD cost for intra mode
STATISTIC_RD_COST_INTER	Frame level RD cost for inter mode
STATISTIC_SATD_FINAL	Frame level final SATD
STATISTIC_SATD_INTRA	Frame level SATD for intra mode

Statistic Name	Description
STATISTIC_SATD_INTER	Frame level SATD for inter mode

Table 15. Encoder statistics feedback

Table A-4. Encoder PSNR/SSIM feedback

Statistic Name	Description
STATISTIC_PSNR_Y	PSNR Y
STATISTIC_PSNR_U	PSNR U
STATISTIC_PSNR_V	PSNR V
STATISTIC_PSNR_ALL	PSNR YUV
STATISTIC_SSIM_Y	SSIM Y
STATISTIC_SSIM_U	SSIM U
STATISTIC_SSIM_V	SSIM V
STATISTIC_SSIM_ALL	SSIM YUV

Table 16. Encoder statistics feedback