

Advanced Media Framework – AV1 Video Encoder

Programming Guide

Disclaimer

The information contained herein is for informational purposes only, and is subject to change without notice. While every precaution has been taken in the preparation of this document, it may contain technical inaccuracies, omissions and typographical errors, and AMD is under no obligation to update or otherwise correct this information.

Advanced Micro Devices, Inc. makes no representations or warranties with respect to the accuracy or completeness of the contents of this document, and assumes no liability of any kind, including the implied warranties of noninfringement, merchantability or fitness for particular purposes, with respect to the operation or use of AMD hardware, software or other products described herein. No license, including implied or arising by estoppel, to any intellectual property rights is granted by this document. Terms and limitations applicable to the purchase or use of AMD's products are as set forth in a signed agreement between the parties or in AMD's Standard Terms and Conditions of Sale.

AMD, the AMD Arrow logo, ATI Radeon™, CrossFireX™, LiquidVR™, TrueAudio™ and combinations thereof are trademarks of Advanced Micro Devices, Inc. Other product names used in this publication are for identification purposes only and may be trademarks of their respective companies.

Windows™, Visual Studio and DirectX are trademark of Microsoft Corp.

Copyright Notice

© 2022 Advanced Micro Devices, Inc. All rights reserved

Notice Regarding Standards. AMD does not provide a license or sublicense to any Intellectual Property Rights relating to any standards, including but not limited to any audio and/or video codec technologies such as MPEG-2, MPEG-4; AVC/H.264; HEVC/H.265; AV1; AAC decode/FFMPEG; AAC encode/FFMPEG; VC-1; and MP3 (collectively, the "Media Technologies"). For clarity, you will pay any royalties due for such third party technologies, which may include the Media Technologies that are owed as a result of AMD providing the Software to you.

MIT license

Copyright (c) 2022 Advanced Micro Devices, Inc. All rights reserved.

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

Contents

- [Advanced Media Framework – AV1 Video Encoder - Programming Guide](#)
 - [Disclaimer](#)
 - [Copyright Notice](#)
 - [MIT license](#)
 - [Contents](#)
 - [1 Introduction](#)
 - [1.1 Scope](#)
 - [1.2 Pre-defined Encoder Usages](#)
 - [2 AMF Video Encoder VCN-AV1 Component](#)
 - [2.1 Input Submission and Output Retrieval](#)
 - [2.2 Encode Parameters](#)
 - [2.2.1 Static Properties](#)
 - [2.2.2 Dynamic Properties](#)
 - [2.2.3 Frame Per-Submission Properties](#)
 - [2.2.4 ROI Feature](#)
 - [2.2.5 Encoder Statistics Feedback](#)
 - [2.2.6 SVC Properties](#)
 - [2.2.7 LTR Properties](#)
 - [2.2.8 SmartAccess Video](#)
 - [3 Sample Applications](#)
 - [3.1 List of Parameters](#)
 - [3.2 Command line example](#)
 - [3.2.1 Transcoding application \(TranscodeHW.exe\)](#)
 - [3.2.2 D3D application \(VCEEncoderD3D.exe\)](#)
 - [4 Annex A: Encoding & frame parameters description](#)
 - [Table A-1. Encoder parameters](#)
 - [Table A-2. Input frame and encoded data parameters](#)
 - [Table A-3. Encoder capabilities exposed in AMFCaps interface](#)
 - [Table A-4. Encoder statistics feedback](#)
 - [Table A-5. Encoder PSNR/SSIM feedback](#)

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 AV1 video encoding functionality.

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

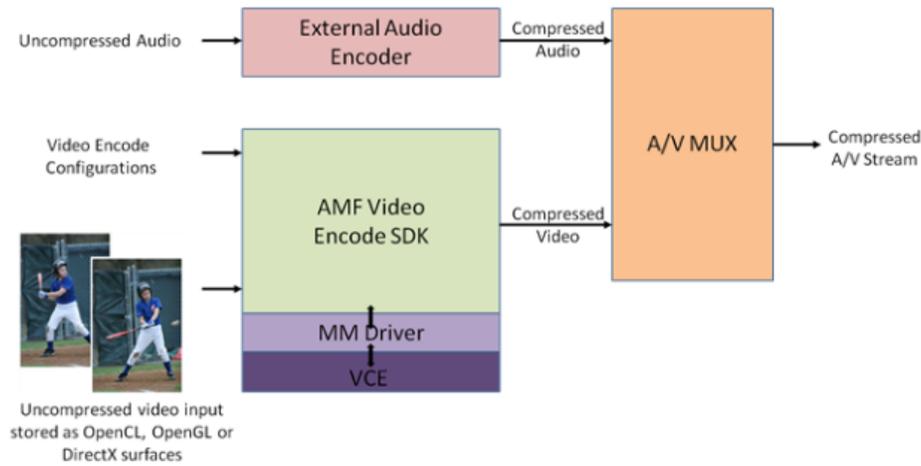


Figure 1 — System overview of the AMF Video Encode SDK

The AMF Video Encoder Component compresses RAW uncompressed video to an AV1 elementary bitstream.

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

The component provides six 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.

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 VCN-AV1 Component

The AMF Video Encoder AV1 component provides hardware accelerated AV1 encoding using AMD's IP.

To instantiate the AMF Video Encoder component, call the `AMFFactory::CreateComponent` method passing `AMFVideoEncoderHW_AV1` component IDs defined in the `public/include/components/VideoEncoderAV1.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 AV1 component.

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 SB, ranging from 0 (least important) to 10 (most important), 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_AV1_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.

2.2.6 SVC Properties

Scalable Video Coding (SVC) is enabled by setting `AMF_VIDEO_ENCODER_AV1_NUM_TEMPORAL_LAYERS` to a value that is greater than 1. `AMF_VIDEO_ENCODER_AV1_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_AV1_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.AMF_VIDEO_ENCODER_AV1_TARGET_BITRATE
```

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

TL1.QL0.AMF_VIDEO_ENCODER_AV1_TARGET_BITRATE

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.

The framerate for each layer should follow a fixed relationship as the table below:

Layer=2, framerate0:framerate1=1:1, here framerate0 means the framerate of layer0 and framerate1 means the framerate of layer1.

Layer=3, framerate0:framerate1:framerate2=1:1:2

Layer=4, framerate0:framerate1:framerate2:framerate3=1:1:2:4

2.2.7 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 AV1, maximum of 8 reference frames are supported according to the spec. These 8 reference frames are shared by SVC and LTR. To use LTR, you need to set these properties as Static Properties:

AMF_VIDEO_ENCODER_AV1_MAX_LTR_FRAMES, Max number of LTR frames. The maximum value can be queried from AMF_VIDEO_ENCODER_AV1_CAP_MAX_NUM_LTR_FRAMES. AMF_VIDEO_ENCODER_AV1_LTR_MODE default = AMF_VIDEO_ENCODER_AV1_LTR_MODE_RESET_UNUSED; remove/keep unused LTRs (not specified in property AMF_VIDEO_ENCODER_AV1_FORCE_LTR_REFERENCE_BITFIELD)

The LTR_MODE has two options:

```
enum AMF_VIDEO_ENCODER_AV1_LTR_MODE_ENUM
{
    AMF_VIDEO_ENCODER_AV1_LTR_MODE_RESET_UNUSED    = 0,
    AMF_VIDEO_ENCODER_AV1_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_AV1_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_AV1_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_AV1_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_AV1_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 existing in LTR slot will generate an Intra only frame.

2.2.8 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 AV1 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 |
| PREVIEWMODE | bool |

Table 2. Additional miscellaneous parameters of TranscodeHW application

Name: `CODEC`

Values: `AV1` or `av1`

Default Values: `AV1`

Description: Specify codec type.

Name: `OUTPUT`

Values: File name, relative or absolute path

Default Value: `NULL`

Description: Output AV1 file for encoded data.

Name: INPUT

Values: File name, relative or absolute path

Default Value: NULL

Description: Input file with frames.

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

Default Value: DX11

Description: Specify Engine type.

Name: FRAMES

Values: Number of frames to be encoded

Default Values: 100

Description: Number of frames to render.

Name: THREADCOUNT

Values: Number

Default Values: 1

Description: Number of session run ip parallel.

Name: PREVIEWMODE

Values: true, false

Default Values: false

Description: Preview Mode.

Additional parameters of VCEncoderD3D 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 |
| FRAMERATE | int |

Table 3. Miscellaneous parameters of VCEncoderD3D application.

Name: CODEC

Values: AV1 or av1

Default Value: AV1

Description: Specify codec type.

Name: OUTPUT

Values: File name, relative or absolute path

Default Value: NULL

Description: Output AV1 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: DX11

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 render.

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. Valid range is [0.. (number of instances - 1)].

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.mp4 -codec AV1 -width 1280 -height 720 -AV1Usage transcoding -AV1RateControlMethod cbr -AV1TargetBitrate 100000
```

This command transcodes H264 elementary stream to AV1 video in .mp4 container. Encoder is created with "Transcoding" usage.

3.2.2 D3D application (VCEEncoderD3D.exe)

```
VCEEncoderD3D.exe -output VideoSample_1024x768.mp4 -codec AV1 -width 1024 -height 768 -AV1Usage transcoding -AV1RateControlMethod cbr -AV1TargetBitrate 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_AV1_") | Type |
|--|-----------|
| USAGE | amf_int64 |

| Name (Prefix "AMF_VIDEO_ENCODER_AV1_") | Type |
|--|-----------|
| PROFILE | amf_int64 |
| LEVEL | amf_int64 |
| MAX_LTR_FRAMES | amf_int64 |
| TILES_PER_FRAME | amf_int64 |
| LTR_MODE | amf_int64 |
| MAX_NUM_REFRAMES | amf_int64 |
| ENCODING_LATENCY_MODE | amf_int64 |
| FRAMESIZE | AMFSize |
| ALIGNMENT_MODE | amf_int64 |
| PRE_ANALYSIS_ENABLE | amf_bool |
| MAX_NUM_TEMPORAL_LAYERS | amf_int64 |
| ENABLE_SMART_ACCESS_VIDEO | amf_bool |

Table 4. Encoder static parameters

Name: AMF_VIDEO_ENCODER_AV1_USAGE

Values: AMF_VIDEO_ENCODER_AV1_USAGE_ENUM : AMF_VIDEO_ENCODER_AV1_USAGE_TRANSCODING ,
AMF_VIDEO_ENCODER_AV1_USAGE_LOW_LATENCY , AMF_VIDEO_ENCODER_AV1_USAGE_ULTRA_LOW_LATENCY ,
AMF_VIDEO_ENCODER_AV1_USAGE_WEBCAM , AMF_VIDEO_ENCODER_AV1_USAGE_HIGH_QUALITY ,
AMF_VIDEO_ENCODER_AV1_USAGE_LOW_LATENCY_HIGH_QUALITY

Default Value: AMF_VIDEO_ENCODER_AV1_USAGE_TRANSCODING

Description: Selects the AMF usage (see 1.2).

Name: AMF_VIDEO_ENCODER_AV1_PROFILE

Values: AMF_VIDEO_ENCODER_AV1_PROFILE_ENUM : AMF_VIDEO_ENCODER_AV1_PROFILE_MAIN

Default Value: AMF_VIDEO_ENCODER_PROFILE_MAIN

Description: Selects the AV1 profile.

Name: AMF_VIDEO_ENCODER_AV1_LEVEL

Values: AMF_VIDEO_ENCODER_AV1_LEVEL_ENUM : AMF_VIDEO_ENCODER_AV1_LEVEL_2_0 , AMF_VIDEO_ENCODER_AV1_LEVEL_2_1 ,
AMF_VIDEO_ENCODER_AV1_LEVEL_2_2 , AMF_VIDEO_ENCODER_AV1_LEVEL_2_3 , AMF_VIDEO_ENCODER_AV1_LEVEL_3_0 ,
AMF_VIDEO_ENCODER_AV1_LEVEL_3_1 , AMF_VIDEO_ENCODER_AV1_LEVEL_3_2 , AMF_VIDEO_ENCODER_AV1_LEVEL_3_3 ,
AMF_VIDEO_ENCODER_AV1_LEVEL_4_0 , AMF_VIDEO_ENCODER_AV1_LEVEL_4_1 , AMF_VIDEO_ENCODER_AV1_LEVEL_4_2 ,
AMF_VIDEO_ENCODER_AV1_LEVEL_4_3 , AMF_VIDEO_ENCODER_AV1_LEVEL_5_0 , AMF_VIDEO_ENCODER_AV1_LEVEL_5_1 ,
AMF_VIDEO_ENCODER_AV1_LEVEL_5_2 , AMF_VIDEO_ENCODER_AV1_LEVEL_5_3 , AMF_VIDEO_ENCODER_AV1_LEVEL_6_0 ,
AMF_VIDEO_ENCODER_AV1_LEVEL_6_1 , AMF_VIDEO_ENCODER_AV1_LEVEL_6_2 , AMF_VIDEO_ENCODER_AV1_LEVEL_6_3 ,
AMF_VIDEO_ENCODER_AV1_LEVEL_7_0 , AMF_VIDEO_ENCODER_AV1_LEVEL_7_1 , AMF_VIDEO_ENCODER_AV1_LEVEL_7_2 ,
AMF_VIDEO_ENCODER_AV1_LEVEL_7_3

Default Value: `AMF_VIDEO_ENCODER_AV1_LEVEL_6_2`

Description: Selects the AV1 Level.

Name: `AMF_VIDEO_ENCODER_AV1_MAX_LTR_FRAMES`

Values: 0 ... 8

Default Value: 0

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

Remarks:

- When == 0, the encoder can 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 SVC setting and AV1 Level limits, encoding resolution, and DPB size. The DPB size limit impacts the maximum number of LTR allowed.
-

Name: `AMF_VIDEO_ENCODER_AV1_TILES_PER_FRAME`

Values: >=1

Default Value: 1

Description: Sets the number of tiles per frame.

Remarks:

- The frame automatically gets split into tiles evenly based on the the tile size limitations in the AV1 spec.
 - `MAX_TILE_WIDTH` = 4096, which means there will be an automatic vertical split of the frame if the width is above 4096 pixels; otherwise there will not be any vertical split.
 - `MAX_TILE_AREA` = 4096 * 2304, which means if tile width is 4096 pixels, the maximum tile height is 2304 pixels, there will be an automatic horizontal split of the frame if frame height is bigger than 2304 pixels; Maximum tile height can be calculated based on tile width, $MAX_TILE_AREA / \{tile\ width\}$.
 - Split will be done automatically in order to satisfy AV1 spec, regardless if `AMF_VIDEO_ENCODER_AV1_TILES_PER_FRAME` is set or not.
 - A frame can be horizontally split into more tile rows by setting `AMF_VIDEO_ENCODER_AV1_TILES_PER_FRAME`.
 - `MAX_TILE_WIDTH` and `MAX_TILE_AREA` constrain the minimum number of tiles.
 - A frame can be split into more tile rows by setting `AMF_VIDEO_ENCODER_AV1_TILES_PER_FRAME`, remember $\{number\ of\ tiles\} = \{number\ of\ tile\ columns\} * \{number\ of\ tile\ rows\}$.
 - If the user set value cannot be satisfied, it will be adjusted internally to a number close to the user set value instead.
 - Additionally, for multiple-tile cases, the output would still be frame by frame if `AMF_VIDEO_ENCODER_AV1_OUTPUT_MODE` property is set `AMF_VIDEO_ENCODER_AV1_OUTPUT_MODE_FRAME`, but there will be multiple tiles within each frame.
-

Name: `AMF_VIDEO_ENCODER_AV1_LTR_MODE`

Values: `AMF_VIDEO_ENCODER_AV1_LTR_MODE_ENUM` : `AMF_VIDEO_ENCODER_AV1_LTR_MODE_RESET_UNUSED`,
`AMF_VIDEO_ENCODER_AV1_LTR_MODE_KEEP_UNUSED`

Default Value: `AMF_VIDEO_ENCODER_AV1_LTR_MODE_RESET_UNUSED`

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

Name: AMF_VIDEO_ENCODER_AV1_MAX_NUM_REFRAMES

Values: 0 ... 8

Default Value: 1

Description: Maximum number of reference frames.

Name: AMF_VIDEO_ENCODER_AV1_ENCODING_LATENCY_MODE

Values: AMF_VIDEO_ENCODER_AV1_ENCODING_LATENCY_MODE_ENUM : AMF_VIDEO_ENCODER_AV1_ENCODING_LATENCY_MODE_NONE , AMF_VIDEO_ENCODER_AV1_ENCODING_LATENCY_MODE_POWER_SAVING_REAL_TIME , AMF_VIDEO_ENCODER_AV1_ENCODING_LATENCY_MODE_REAL_TIME , AMF_VIDEO_ENCODER_AV1_ENCODING_LATENCY_MODE_LOWEST_LATENCY

Default Value associated with usages:

- Transcoding: AMF_VIDEO_ENCODER_AV1_ENCODING_LATENCY_MODE_NONE
- Ultra low latency: AMF_VIDEO_ENCODER_AV1_ENCODING_LATENCY_MODE_LOWEST_LATENCY
- Low latency: AMF_VIDEO_ENCODER_AV1_ENCODING_LATENCY_MODE_NONE
- Webcam: AMF_VIDEO_ENCODER_AV1_ENCODING_LATENCY_MODE_NONE
- HQ: AMF_VIDEO_ENCODER_AV1_ENCODING_LATENCY_MODE_NONE
- HQLL: AMF_VIDEO_ENCODER_AV1_ENCODING_LATENCY_MODE_LOWEST_LATENCY

Description: Choose different mode to balance encoder latency with power consumption.

Name: AMF_VIDEO_ENCODER_AV1_FRAMESIZE

Values: Width: 256 – 8192 Height: 128 – 4352

Default Value: 0,0

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

Name: AMF_VIDEO_ENCODER_AV1_ALIGNMENT_MODE

Values: AMF_VIDEO_ENCODER_AV1_ALIGNMENT_MODE_ENUM : AMF_VIDEO_ENCODER_AV1_ALIGNMENT_MODE_64X16_ONLY , AMF_VIDEO_ENCODER_AV1_ALIGNMENT_MODE_64X16_1080P_CODED_1082 , AMF_VIDEO_ENCODER_AV1_ALIGNMENT_MODE_NO_RESTRICTIONS

Default Value: AMF_VIDEO_ENCODER_AV1_ALIGNMENT_MODE_64X16_ONLY

Description: AV1 alignment Mode.

Name: AMF_VIDEO_ENCODER_AV1_PRE_ANALYSIS_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: Some encoder properties require this property to be set. Enables the pre-analysis module. Refer to *AMF Video PreAnalysis API* reference for more details on the pre-analysis module and its settings under different usages.

Name: `AMF_VIDEO_ENCODER_AV1_MAX_NUM_TEMPORAL_LAYERS`

Values: Maximum number of temporal layers supported \leq `4`

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_AV1_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_AV1_") | Type |
|--|-----------|
| TARGET_BITRATE | amf_int64 |
| PEAK_BITRATE | amf_int64 |
| RATE_CONTROL_METHOD | amf_int64 |
| QVBR_QUALITY_LEVEL | amf_int64 |
| RATE_CONTROL_SKIP_FRAME | amf_bool |
| MIN_Q_INDEX_INTRA | amf_int64 |
| MAX_Q_INDEX_INTRA | amf_int64 |
| MIN_Q_INDEX_INTER | amf_int64 |
| MAX_Q_INDEX_INTER | amf_int64 |
| Q_INDEX_INTRA | amf_int64 |
| Q_INDEX_INTER | amf_int64 |
| FRAMERATE | AMFRate |
| VBV_BUFFER_SIZE | amf_int64 |
| INITIAL_VBV_BUFFER_FULLNESS | amf_int64 |
| ENFORCE_HRD | amf_bool |
| RATE_CONTROL_PREENCODE | amf_bool |
| AQ_MODE | amd_int64 |

| Name (Prefix "AMF_VIDEO_ENCODER_AV1_") | Type |
|--|----------|
| FILLER_DATA | amf_bool |
| HIGH_MOTION_QUALITY_BOOST | amf_bool |

Table 5. Encoder rate-control parameters

Name: AMF_VIDEO_ENCODER_AV1_TARGET_BITRATE

Values: >0

Default Value: 20 mbps

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

Name: AMF_VIDEO_ENCODER_AV1_PEAK_BITRATE

Values: >= TargetBitrate

Default Value associated with usages:

- 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, use for HRD model.

Name: AMF_VIDEO_ENCODER_AV1_RATE_CONTROL_METHOD

Values: AMF_VIDEO_ENCODER_AV1_RATE_CONTROL_METHOD_ENUM : AMF_VIDEO_ENCODER_AV1_RATE_CONTROL_METHOD_UNKNOWN , AMF_VIDEO_ENCODER_AV1_RATE_CONTROL_METHOD_CONSTANT_QP , AMF_VIDEO_ENCODER_AV1_RATE_CONTROL_METHOD_LATENCY_CONSTRAINED_VBR , AMF_VIDEO_ENCODER_AV1_RATE_CONTROL_METHOD_PEAK_CONSTRAINED_VBR , AMF_VIDEO_ENCODER_AV1_RATE_CONTROL_METHOD_CBR , AMF_VIDEO_ENCODER_AV1_RATE_CONTROL_METHOD_QUALITY_VBR , AMF_VIDEO_ENCODER_AV1_RATE_CONTROL_METHOD_HIGH_QUALITY_VBR , AMF_VIDEO_ENCODER_AV1_RATE_CONTROL_METHOD_HIGH_QUALITY_CBR

Default Value associated with usages:

- Transcoding: AMF_VIDEO_ENCODER_AV1_RATE_CONTROL_METHOD_PEAK_CONSTRAINED_VBR
- Ultra low latency: AMF_VIDEO_ENCODER_AV1_RATE_CONTROL_METHOD_LATENCY_CONSTRAINED_VBR
- Low latency: AMF_VIDEO_ENCODER_AV1_RATE_CONTROL_METHOD_PEAK_CONSTRAINED_VBR
- Webcam: AMF_VIDEO_ENCODER_AV1_RATE_CONTROL_METHOD_PEAK_CONSTRAINED_VBR
- HQ: AMF_VIDEO_ENCODER_AV1_RATE_CONTROL_METHOD_PEAK_CONSTRAINED_VBR
- HQLL: AMF_VIDEO_ENCODER_AV1_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 SSIM or VMAF).

Name: AMF_VIDEO_ENCODER_AV1_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_AV1_RATE_CONTROL_SKIP_FRAME

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_AV1_MIN_Q_INDEX_INTRA

Values: 1 – 255

Default Value: 1

Description: Sets the minimum QIndex for Intra frame.

Name: AMF_VIDEO_ENCODER_AV1_MAX_Q_INDEX_INTRA

Values: 1 – 255

Default Value: 255

Description: Sets the maximum QIndex for Intra frame.

Name: AMF_VIDEO_ENCODER_AV1_MIN_Q_INDEX_INTER

Values: 1 – 255

Default Value: 1

Description: Sets the minimum QIndex for Inter frame.

Name: AMF_VIDEO_ENCODER_AV1_MAX_Q_INDEX_INTER

Values: 1 – 255

Default Value: 255

Description: Sets the maximum QIndex for Inter frame.

Name: AMF_VIDEO_ENCODER_AV1_Q_INDEX_INTRA

Values: 1 – 255

Default Value: 26

Description: Sets the constant QIndex for Intra frames.

Remarks: Only available for CQP rate control method.

Name: AMF_VIDEO_ENCODER_AV1_Q_INDEX_INTER

Values: 1 – 255

Default Value: 26

Description: Sets the constant QIndex for Inter frames.

Remarks: Only available for CQP rate control method.

Name: AMF_VIDEO_ENCODER_AV1_FRAMERATE

Values: 1*FrameRateDen ... 120* FrameRateDen

Default Value: 30 fps

Description: Frame rate numerator/denominator. Input is : AMFRate for example, the code below will set the frame rate to $30000 / 1001 = 29.97$ FPS: `pEncoder->SetProperty(AMF_VIDEO_ENCODER_AV1_FRAMERATE, ::AMFConstructRate(30000, 1001));`

Name: AMF_VIDEO_ENCODER_AV1_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, use for HRD model.

Name: AMF_VIDEO_ENCODER_AV1_INITIAL_VBV_BUFFER_FULLNESS

Values: 0 – 64, 0 = 0%, 64 = 100%

Default Value: 64

Description: Sets the initial VBV buffer fullness, use for HRD model.

Name: AMF_VIDEO_ENCODER_AV1_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 rate control to meet HRD model requirement(s) with peak_bitrate, VBV buffer size and VBV buffer fullness settings.

Name: AMF_VIDEO_ENCODER_AV1_RATE_CONTROL_PREENCODE

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_AV1_AQ_MODE

Values: AMF_VIDEO_ENCODER_AV1_AQ_MODE_ENUM : AMF_VIDEO_ENCODER_AV1_AQ_MODE_NONE , AMF_VIDEO_ENCODER_AV1_AQ_MODE_CAQ

Default Value associated with usages:

- Transcoding: AMF_VIDEO_ENCODER_AV1_AQ_MODE_NONE
- Ultra low latency: AMF_VIDEO_ENCODER_AV1_AQ_MODE_NONE
- Low latency: AMF_VIDEO_ENCODER_AV1_AQ_MODE_NONE
- Webcam: AMF_VIDEO_ENCODER_AV1_AQ_MODE_NONE
- HQ: AMF_VIDEO_ENCODER_AV1_AQ_MODE_CAQ
- HQLL: AMF_VIDEO_ENCODER_AV1_AQ_MODE_CAQ

Description: Similar to VBAQ in HEVC and AVC, By default, disable Adaptive Quality Mode. This feature cannot be used together with the CQP rate control method.

Name: AMF_VIDEO_ENCODER_AV1_FILLER_DATA

Values: true , false

Default Value: false

Description: Enable filler data for CBR usage.

Name: AMF_VIDEO_ENCODER_AV1_HIGH_MOTION_QUALITY_BOOST

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_AV1_") | Type |
|--|-----------|
| MAX_COMPRESSED_FRAME_SIZE | amf_int64 |
| HEADER_INSERTION_MODE | amf_int64 |
| SWITCH_FRAME_INSERTION_MODE | amf_int64 |
| SWITCH_FRAME_INTERVAL | amd_int64 |
| GOP_SIZE | amd_int64 |
| CDEF_MODE | amd_int64 |
| INTRA_REFRESH_MODE | amf_int64 |
| INTRAREFRESH_STRIPES | amf_int64 |

Table 6. Encoder picture-control parameters

Name: `AMF_VIDEO_ENCODER_AV1_MAX_COMPRESSED_FRAME_SIZE`

Values: `0` – no limit

Default Value: `0`

Description: Maximum compressed frame size in bits that rate control algorithm will try to limit. May still larger than this number in some cases.

Name: `AMF_VIDEO_ENCODER_AV1_HEADER_INSERTION_MODE`

Values: `AMF_VIDEO_ENCODER_AV1_HEADER_INSERTION_MODE_ENUM` : `AMF_VIDEO_ENCODER_AV1_HEADER_INSERTION_MODE_NONE` ,
`AMF_VIDEO_ENCODER_AV1_HEADER_INSERTION_MODE_GOP_ALIGNED` , `AMF_VIDEO_ENCODER_AV1_HEADER_INSERTION_MODE_KEY_FRAME_ALIGNED`

Default Value: `AMF_VIDEO_ENCODER_AV1_HEADER_INSERTION_MODE_NONE`

Description: Sets the headers insertion mode.

Name: `AMF_VIDEO_ENCODER_AV1_SWITCH_FRAME_INSERTION_MODE`

Values: `AMF_VIDEO_ENCODER_AV1_SWITCH_FRAME_INSERTION_MODE_ENUM` `AMF_VIDEO_ENCODER_AV1_SWITCH_FRAME_INSERTION_MODE_NONE` ,
`AMF_VIDEO_ENCODER_AV1_SWITCH_FRAME_INSERTION_MODE_FIXED_INTERVAL`

Default Value: depends on `USAGE`

Description: Switch frame insertion mode.

Name: `AMF_VIDEO_ENCODER_AV1_SWITCH_FRAME_INTERVAL`

Values: `>0`

Default Value: depends on `USAGE`

Description: The interval between two inserted switch frames. Valid only when

`AMF_VIDEO_ENCODER_AV1_SWITCH_FRAME_INSERTION_MODE` is `AMF_VIDEO_ENCODER_AV1_SWITCH_FRAME_INSERTION_MODE_FIXED_INTERVAL` .

Name: `AMF_VIDEO_ENCODER_AV1_GOP_SIZE`

Values: `>0`

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 key frame in fixed size mode. 0 means only insert the first frame (infinite GOP size).

Name: AMF_VIDEO_ENCODER_AV1_CDEF_MODE

Values: AMF_VIDEO_ENCODER_AV1_CDEF_MODE_ENUM : AMF_VIDEO_ENCODER_AV1_CDEF_DISABLE , AMF_VIDEO_ENCODER_AV1_CDEF_ENABLE_DEFAULT

Default Value: AMF_VIDEO_ENCODER_AV1_CDEF_ENABLE_DEFAULT

Description: Disable/enable the CDEF filter.

Name: AMF_VIDEO_ENCODER_AV1_INTRA_REFRESH_MODE

Values: AMF_VIDEO_ENCODER_AV1_INTRA_REFRESH_MODE_ENUM : AMF_VIDEO_ENCODER_AV1_INTRA_REFRESH_MODE__DISABLED , AMF_VIDEO_ENCODER_AV1_INTRA_REFRESH_MODE__GOP_ALIGNED , AMF_VIDEO_ENCODER_AV1_INTRA_REFRESH_MODE__CONTINUOUS

Default Value: AMF_VIDEO_ENCODER_AV1_INTRA_REFRESH_MODE__DISABLED

Description: The mode of intra refresh.

Name: AMF_VIDEO_ENCODER_AV1_INTRAREFRESH_STRIPES

Values: >=1 , how many stripes in a frame for intra refresh

Default Value: N/A

Description: Valid only when intra refresh is enabled.

| Name (Prefix "AMF_VIDEO_ENCODER_AV1_") | Type |
|--|--------------|
| QUALITY_PRESET | amf_int64 |
| QUERY_TIMEOUT | amf_int64 |
| INPUT_QUEUE_SIZE | amf_int64 |
| EXTRA_DATA | AMFBufferPtr |
| OUTPUT_MODE | amf_int64 |

Table 7. Encoder miscellaneous parameters

Name: AMF_VIDEO_ENCODER_AV1_QUALITY_PRESET

Values: AMF_VIDEO_ENCODER_AV1_QUALITY_PRESET_ENUM : AMF_VIDEO_ENCODER_AV1_QUALITY_PRESET_HIGH_QUALITY , AMF_VIDEO_ENCODER_AV1_QUALITY_PRESET_QUALITY , AMF_VIDEO_ENCODER_AV1_QUALITY_PRESET_BALANCED , AMF_VIDEO_ENCODER_AV1_QUALITY_PRESET_SPEED

Default Value associated with usages:

- Transcoding: AMF_VIDEO_ENCODER_AV1_QUALITY_PRESET_BALANCED
- Ultra low latency: AMF_VIDEO_ENCODER_AV1_QUALITY_PRESET_SPEED
- Low latency: AMF_VIDEO_ENCODER_AV1_QUALITY_PRESET_SPEED
- Webcam: AMF_VIDEO_ENCODER_AV1_QUALITY_PRESET_QUALITY
- HQ: AMF_VIDEO_ENCODER_AV1_QUALITY_PRESET_QUALITY
- HQLL: AMF_VIDEO_ENCODER_AV1_QUALITY_PRESET_QUALITY

Description: Selects the quality preset in HW to balance between encoding speed and video quality.

Name: AMF_VIDEO_ENCODER_AV1_QUERY_TIMEOUT

Values: 0 ... 50

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. Setting this to a nonzero value will reduce polling load when QueryOutput is called; it will be blocked until the frame is ready or until the timeout is reached.

Name: AMF_VIDEO_ENCODER_AV1_INPUT_QUEUE_SIZE

Values: 1 ... 32

Default Value: 16

Description: Set encoder input queue size. For high-resolution sequence, recommend to set a smaller value to save storage. For low-resolution sequence, recommend to set a larger value to improve encoding speed.

Name: AMF_VIDEO_ENCODER_AV1_EXTRA_DATA

Values: AMFBufferPtr

Default Value: NULL

Description: Buffer to retrieve coded sequence header.

Name: AMF_VIDEO_ENCODER_AV1_OUTPUT_MODE

Values: AMF_VIDEO_ENCODER_AV1_OUTPUT_MODE_ENUM : AMF_VIDEO_ENCODER_AV1_OUTPUT_MODE_FRAME , AMF_VIDEO_ENCODER_AV1_OUTPUT_MODE_TILE

Default Value: AMF_VIDEO_ENCODER_AV1_OUTPUT_MODE_FRAME

Description: Defines encoder output mode.

| Name (Prefix "AMF_VIDEO_ENCODER_AV1_") | Type |
|--|----------|
| SCREEN_CONTENT_TOOLS | amf_bool |
| PALETTE_MODE | amf_bool |
| FORCE_INTEGER_MV | amf_bool |
| ORDER_HINT | amf_bool |

| Name (Prefix "AMF_VIDEO_ENCODER_AV1_") | Type |
|--|-----------|
| FRAME_ID | amf_bool |
| TILE_GROUP_OBU | amf_bool |
| ERROR_RESILIENT_MODE | amf_bool |
| COLOR_BIT_DEPTH | amf_int64 |
| CDF_UPDATE | amf_bool |
| CDF_FRAME_END_UPDATE_MODE | amd_int64 |

Table 8. Encoder configuration

Name: AMF_VIDEO_ENCODER_AV1_SCREEN_CONTENT_TOOLS

Values: true, false

Default Value: true

Description: If true, allow enabling screen content tools by AMF_VIDEO_ENCODER_AV1_PALETTE_MODE_ENABLE and AMF_VIDEO_ENCODER_AV1_FORCE_INTEGER_MV; if false, all screen content tools are disabled.

Name: AMF_VIDEO_ENCODER_AV1_PALETTE_MODE

Values: true, false

Default Value: true

Description: If true, enable palette mode; if false, disable palette mode. Valid only when AMF_VIDEO_ENCODER_AV1_SCREEN_CONTENT_TOOLS is true.

Name: AMF_VIDEO_ENCODER_AV1_FORCE_INTEGER_MV

Values: true, false

Default Value: false

Description: If true, enable force integer MV; if false, disable force integer MV. Valid only when AMF_VIDEO_ENCODER_AV1_SCREEN_CONTENT_TOOLS is true.

Name: AMF_VIDEO_ENCODER_AV1_ORDER_HINT

Values: true, false

Default Value: false

Description: Code order hint; if false, don't code order hint.

Name: AMF_VIDEO_ENCODER_AV1_FRAME_ID

Values: true, false

Default Value: depends on `USAGE`

Description: If `true`, code frame id; if `false`, don't code frame id.

Name: `AMF_VIDEO_ENCODER_AV1_TILE_GROUP_OBU`

Values: `true`, `false`

Default Value: depends on `USAGE`

Description: If `true`, code `FrameHeaderObu + TileGroupObu` and each `TileGroupObu` contains one tile; if `false`, code `FrameObu`.

Name: `AMF_VIDEO_ENCODER_AV1_ERROR_RESILIENT_MODE`

Values: `true`, `false`

Default Value: depends on `USAGE`

Description: If `true`, enable error resilient mode; if `false`, disable error resilient mode.

Name: `AMF_VIDEO_ENCODER_AV1_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_AV1_CDF_UPDATE`

Values: `true`, `false`

Default Value: `true`

Description: If `false`, disable CDF update. If `true`, enable CDF update.

Name: `AMF_VIDEO_ENCODER_AV1_CDF_FRAME_END_UPDATE_MODE`

Values: `AMF_VIDEO_ENCODER_AV1_CDF_FRAME_END_UPDATE_MODE_ENUM`: `AMF_VIDEO_ENCODER_AV1_CDF_FRAME_END_UPDATE_MODE_DISABLE`, `AMF_VIDEO_ENCODER_AV1_CDF_FRAME_END_UPDATE_MODE_ENABLE_DEFAULT`

Default Value: `AMF_VIDEO_ENCODER_AV1_CDF_FRAME_END_UPDATE_MODE_DISABLE`

Description: CDF frame end update mode.

| Name (Prefix "AMF_VIDEO_ENCODER_AV1_") | Type |
|--|------------------------|
| <code>INPUT_COLOR_PROFILE</code> | <code>amf_int64</code> |
| <code>INPUT_TRANSFER_CHARACTERISTIC</code> | <code>amf_int64</code> |
| <code>INPUT_COLOR_PRIMARIES</code> | <code>amf_int64</code> |
| <code>OUTPUT_COLOR_PROFILE</code> | <code>amf_int64</code> |

| Name (Prefix "AMF_VIDEO_ENCODER_AV1_") | Type |
|--|--------------|
| OUTPUT_TRANSFER_CHARACTERISTIC | amf_int64 |
| OUTPUT_COLOR_PRIMARIES | amf_int64 |
| INPUT_HDR_METADATA | AMFBufferPtr |

Table 9. Encoder color conversion parameters

Name: AMF_VIDEO_ENCODER_AV1_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 , AMF_VIDEO_CONVERTER_COLOR_PROFILE_COUNT

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_AV1_INPUT_TRANSFER_CHARACTERISTIC

Values: AMF_COLOR_TRANSFER_CHARACTERISTIC_ENUM : AMF_COLOR_TRANSFER_CHARACTERISTIC_UNDEFINED , AMF_COLOR_TRANSFER_CHARACTERISTIC_BT709 , AMF_COLOR_TRANSFER_CHARACTERISTIC_UNSPECIFIED , 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_AV1_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 , AMF_COLOR_PRIMARIES_CCCS

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_AV1_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 ,
AMF_VIDEO_CONVERTER_COLOR_PROFILE_COUNT

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_AV1_OUTPUT_TRANSFER_CHARACTERISTIC

Values: AMF_COLOR_TRANSFER_CHARACTERISTIC_ENUM : AMF_COLOR_TRANSFER_CHARACTERISTIC_UNDEFINED ,
AMF_COLOR_TRANSFER_CHARACTERISTIC_BT709 , AMF_COLOR_TRANSFER_CHARACTERISTIC_UNSPECIFIED ,
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_AV1_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 , AMF_COLOR_PRIMARIES_CCCS

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: AMF_VIDEO_ENCODER_AV1_INPUT_HDR_METADATA

Values: AMFBuffer

Default Value: NULL

Description: Buffer to retrieve coded sequence header.

| Name (Prefix "AMF_VIDEO_ENCODER_AV1_") | Type |
|--|-----------|
| NUM_TEMPORAL_LAYERS | amf_int64 |

Table 10. Encoder SVC parameters

Name: AMF_VIDEO_ENCODER_AV1_NUM_TEMPORAL_LAYERS

Values: 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_AV1_") | Type |
|--|------|
| TL<TL_Num>.QL0.<Parameter_name> | |

Table 11. Encoder SVC per-layer parameters

Name: TL<TL_Num>.QL0.<Parameter_name>

Values: Parameter-specific values

Default Value: N/A

Description: Configures rate-control parameter per SVC layer.

- TL_Num — temporal layer number
- QL0 - quality layer 0
- Parameter_name — rate-control parameter name (see below with AMF_VIDEO_ENCODER_AV1_ prefix)

Rate-control parameters supported:

- TARGET_BITRATE
- PEAK_BITRATE
- VBV_BUFFER_SIZE
- FRAMERATE
- Max_Q_INDEX_INTRA
- Max_Q_INDEX_INTER
- Min_Q_INDEX_INTRA
- Min_Q_INDEX_INTER
- Q_INDEX_INTRA
- Q_INDEX_INTER
- FILLER_DATA

- RATE_CONTROL_SKIP_FRAME
- ENFORCE_HRD
- MAX_COMPRESSED_FRAME_SIZE

Table A-2. Input frame and encoded data parameters

| Name (Prefix "AMF_VIDEO_ENCODER_AV1_") | Type |
|--|--------------------|
| FORCE_INSERT_SEQUENCE_HEADER | amf_bool |
| FORCE_FRAME_TYPE | amf_int64 |
| 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 |
| SSIM_FEEDBACK | amf_bool |
| BLOCK_Q_INDEX_FEEDBACK | amf_bool |

Table 12. Frame per-submission parameters

Name: AMF_VIDEO_ENCODER_AV1_FORCE_INSERT_SEQUENCE_HEADER

Values: true, false

Default Value: false

Description: If true, force insert sequence header with current frame.

Name: AMF_VIDEO_ENCODER_AV1_FORCE_FRAME_TYPE

Values: AMF_VIDEO_ENCODER_AV1_FORCE_FRAME_TYPE_ENUM : AMF_VIDEO_ENCODER_AV1_FORCE_FRAME_TYPE_NONE, AMF_VIDEO_ENCODER_AV1_FORCE_FRAME_TYPE_KEY, AMF_VIDEO_ENCODER_AV1_FORCE_FRAME_TYPE_INTRA_ONLY, AMF_VIDEO_ENCODER_AV1_FORCE_FRAME_TYPE_SWITCH, AMF_VIDEO_ENCODER_AV1_FORCE_FRAME_TYPE_SHOW_EXISTING

Default Value: AMF_VIDEO_ENCODER_AV1_FORCE_FRAME_TYPE_NONE

Description: Forces the frame type.

Name: AMF_VIDEO_ENCODER_AV1_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_AV1_FORCE_LTR_REFERENCE_BITFIELD`

Values: Bitfield `MaxOfLTRFrames` (max possible 8 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_AV1_ROI_DATA`

Values: Video surface in `AMF_SURFACE_GRAY32` format

Default Value: `N/A`

Description: Importance value for each 64x64 block ranges from `0` (least important) to `10` (most important), stored in 32bit unsigned format.

Name: `AMF_VIDEO_ENCODER_AV1_STATISTICS_FEEDBACK`

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

Default Value: `false`

Description: Signal encoder to collect and feedback encoder statistics.

Name: `AMF_VIDEO_ENCODER_AV1_PSNR_FEEDBACK`

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

Default Value: `false`

Description: Signal encoder to calculate PSNR score.

Name: `AMF_VIDEO_ENCODER_AV1_SSIM_FEEDBACK`

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

Default Value: `false`

Description: Signal encoder to calculate SSIM score.

Name: AMF_VIDEO_ENCODER_AV1_BLOCK_Q_INDEX_FEEDBACK

Values: true (on), false (off)

Default Value: false

Description: Signal encoder to collect and feedback block level QIndex values.

| Name (Prefix "AMF_VIDEO_ENCODER_AV1_") | Type |
|--|------------|
| OUTPUT_FRAME_TYPE | amf_int64 |
| OUTPUT_MARKED_LTR_INDEX | amf_int64 |
| OUTPUT_REFERENCED_LTR_INDEX_BITFIELD | amf_int64 |
| OUTPUT_BUFFER_TYPE | amf_int64 |
| RECONSTRUCTED_PICTURE | AMFSurface |

Table 13. Encoded data parameters

Name: AMF_VIDEO_ENCODER_AV1_OUTPUT_FRAME_TYPE

Values: AMF_VIDEO_ENCODER_AV1_OUTPUT_FRAME_TYPE_ENUM : AMF_VIDEO_ENCODER_AV1_OUTPUT_FRAME_TYPE_KEY , AMF_VIDEO_ENCODER_AV1_OUTPUT_FRAME_TYPE_INTRA_ONLY , AMF_VIDEO_ENCODER_AV1_OUTPUT_FRAME_TYPE_INTER , AMF_VIDEO_ENCODER_AV1_OUTPUT_FRAME_TYPE_SWITCH , AMF_VIDEO_ENCODER_AV1_OUTPUT_FRAME_TYPE_SHOW_EXISTING

Default Value: N/A

Description: Type of encoded frame.

Name: AMF_VIDEO_ENCODER_AV1_OUTPUT_MARKED_LTR_INDEX

Values: -1 ... MaxOfLTRFrames -1

Default Value: N/A

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_AV1_OUTPUT_REFERENCED_LTR_INDEX_BITFIELD

Values: Bitfield MaxOfLTRFrames (max possible 8 bits)

Default Value: N/A

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_AV1_OUTPUT_BUFFER_TYPE

Values: AMF_VIDEO_ENCODER_AV1_OUTPUT_BUFFER_TYPE_ENUM :

AMF_VIDEO_ENCODER_AV1_OUTPUT_BUFFER_TYPE_FRAME , AMF_VIDEO_ENCODER_AV1_OUTPUT_BUFFER_TYPE_TILE ,
AMF_VIDEO_ENCODER_AV1_OUTPUT_BUFFER_TYPE_TILE_LAST

Default Value: N\A

Description: Encoder output buffer type.

Name: AMF_VIDEO_ENCODER_AV1_RECONSTRUCTED_PICTURE

Values: AMFSurface

Default Value: N\A

Description: Returns reconstructed picture as an AMFSurface attached to the output buffer as property

AMF_VIDEO_ENCODER_RECONSTRUCTED_PICTURE of AMFInterface type.

Table A-3. Encoder capabilities exposed in AMFCaps interface

| Name (prefix with AMF_VIDEO_ENCODER_AV1_CAP_) | Type |
|---|-----------|
| NUM_OF_HW_INSTANCES | amf_int64 |
| MAX_THROUGHPUT | amf_int64 |
| REQUESTED_THROUGHPUT | amf_int64 |
| COLOR_CONVERSION | amf_int64 |
| PRE_ANALYSIS | amf_bool |
| MAX_BITRATE | amf_int64 |
| MAX_PROFILE | amf_int64 |
| MAX_LEVEL | amf_int64 |
| MAX_NUM_TEMPORAL_LAYERS | amf_int64 |
| MAX_NUM_LTR_FRAMES | amf_int64 |
| SUPPORT_TILE_OUTPUT | amf_bool |
| WIDTH_ALIGNMENT_FACTOR | amf_int64 |
| HEIGHT_ALIGNMENT_FACTOR | amf_int64 |

Table 14. Encoder capabilities exposed in AMFCaps interface

Name: AMF_VIDEO_ENCODER_AV1_CAP_NUM_OF_HW_INSTANCES

Values: 0 ... number of instances - 1

Description: Number of HW encoder instances.

Name: AMF_VIDEO_ENCODER_AV1_CAP_MAX_THROUGHPUT

Values: Integers, >=0

Description: MAX throughput for AV1 encoder in MB (16 x 16 pixels).

Name: AMF_VIDEO_ENCODER_AV1_CAP_REQUESTED_THROUGHPUT

Values: 0 ... number of instances - 1

Description: Currently total requested throughput for AV1 encode in MB (16 x 16 pixels).

Name: AMF_VIDEO_ENCODER_AV1_CAP_COLOR_CONVERSION

Values: AMF_ACCELERATION_TYPE

Description: Type of supported color conversion.

Name: AMF_VIDEO_ENCODER_AV1_CAP_PRE_ANALYSIS

Values: true , false

Description: Pre analysis module is available.

Name: AMF_VIDEO_ENCODER_AV1_CAP_MAX_BITRATE

Values: Integers, >=0 **Description:** Maximum bit rate in bits.

Name: AMF_VIDEO_ENCODER_AV1_CAP_MAX_PROFILE

Values: AMF_VIDEO_ENCODER_AV1_PROFILE_ENUM : AMF_VIDEO_ENCODER_AV1_PROFILE_MAIN

Description: Maximum value of code profile.

Name: AMF_VIDEO_ENCODER_AV1_CAP_MAX_LEVEL

Values: AMF_VIDEO_ENCODER_AV1_LEVEL_ENUM : AMF_VIDEO_ENCODER_AV1_LEVEL_2_0 , AMF_VIDEO_ENCODER_AV1_LEVEL_2_1 , AMF_VIDEO_ENCODER_AV1_LEVEL_2_2 , AMF_VIDEO_ENCODER_AV1_LEVEL_2_3 , AMF_VIDEO_ENCODER_AV1_LEVEL_3_0 , AMF_VIDEO_ENCODER_AV1_LEVEL_3_1 , AMF_VIDEO_ENCODER_AV1_LEVEL_3_2 , AMF_VIDEO_ENCODER_AV1_LEVEL_3_3 , AMF_VIDEO_ENCODER_AV1_LEVEL_4_0 , AMF_VIDEO_ENCODER_AV1_LEVEL_4_1 , AMF_VIDEO_ENCODER_AV1_LEVEL_4_2 , AMF_VIDEO_ENCODER_AV1_LEVEL_4_3 , AMF_VIDEO_ENCODER_AV1_LEVEL_5_0 , AMF_VIDEO_ENCODER_AV1_LEVEL_5_1 , AMF_VIDEO_ENCODER_AV1_LEVEL_5_2 , AMF_VIDEO_ENCODER_AV1_LEVEL_5_3 , AMF_VIDEO_ENCODER_AV1_LEVEL_6_0 , AMF_VIDEO_ENCODER_AV1_LEVEL_6_1 , AMF_VIDEO_ENCODER_AV1_LEVEL_6_2 , AMF_VIDEO_ENCODER_AV1_LEVEL_6_3 , AMF_VIDEO_ENCODER_AV1_LEVEL_7_0 , AMF_VIDEO_ENCODER_AV1_LEVEL_7_1 , AMF_VIDEO_ENCODER_AV1_LEVEL_7_2 , AMF_VIDEO_ENCODER_AV1_LEVEL_7_3

Description: Maximum value of codec level.

Name: AMF_VIDEO_ENCODER_AV1_CAP_MAX_NUM_TEMPORAL_LAYERS

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

Description: The cap of maximum number of temporal layers.

Name: AMF_VIDEO_ENCODER_AV1_CAP_MAX_NUM_LTR_FRAMES

Values: Integers, >=0

Description: The cap of maximum number of LTR frames. This value is calculated based on current value of AMF_VIDEO_ENCODER_AV1_MAX_NUM_TEMPORAL_LAYERS .

Name: AMF_VIDEO_ENCODER_AV1_CAP_SUPPORT_TILE_OUTPUT

Values: true , false

Description: If tile output is supported.

Name: AMF_VIDEO_ENCODER_AV1_CAP_WIDTH_ALIGNMENT_FACTOR

Values: Integers, >=0

Description: This is used for querying the av1 picture width alignment factor

Name: AMF_VIDEO_ENCODER_AV1_CAP_HEIGHT_ALIGNMENT_FACTOR

Values: Integers, >=0

Description: This is used for querying the av1 picture height alignment factor

Table A-4. Encoder statistics feedback

| Statistic Name (prefix "AMF_VIDEO_ENCODER_AV1") | Type |
|---|-----------|
| STATISTIC_FRAME_Q_INDEX | amf_int64 |
| STATISTIC_AVERAGE_Q_INDEX | amf_int64 |
| STATISTIC_MAX_Q_INDEX | amf_int64 |
| STATISTIC_MIN_Q_INDEX | amf_int64 |
| STATISTIC_PIX_NUM_INTRA | amf_int64 |
| STATISTIC_PIX_NUM_INTER | amf_int64 |
| STATISTIC_PIX_NUM_SKIP | amf_int64 |
| STATISTIC_BITCOUNT_RESIDUAL | amf_int64 |
| STATISTIC_BITCOUNT_MOTION | amf_int64 |
| STATISTIC_BITCOUNT_INTER | amf_int64 |
| STATISTIC_BITCOUNT_INTRA | amf_int64 |
| STATISTIC_BITCOUNT_ALL_MINUS_HEADER | amf_int64 |
| STATISTIC_MV_X | amf_int64 |
| STATISTIC_MV_Y | amf_int64 |
| STATISTIC_RD_COST_FINAL | amf_int64 |

| Statistic Name (prefix "AMF_VIDEO_ENCODER_AV1") | Type |
|---|-----------|
| STATISTIC_RD_COST_INTRA | amf_int64 |
| STATISTIC_RD_COST_INTER | amf_int64 |
| STATISTIC_SAD_FINAL | amf_int64 |
| STATISTIC_SAD_INTRA | amf_int64 |
| STATISTIC_SAD_INTER | amf_int64 |
| STATISTIC_SSE | amf_int64 |
| STATISTIC_VARIANCE | amf_int64 |

Table 15. Encoder statistics feedback

Name: AMF_VIDEO_ENCODER_AV1_STATISTIC_FRAME_Q_INDEX

Description: Rate control base frame/initial QIndex.

Name: AMF_VIDEO_ENCODER_AV1_STATISTIC_AVERAGE_Q_INDEX

Description: Average QIndex of all encoded SBs in a picture. Value may be different from the one reported by bitstream analyzer when there are skipped SBs.

Name: AMF_VIDEO_ENCODER_AV1_STATISTIC_MAX_Q_INDEX

Description: Max QIndex among all encoded SBs in a picture. Value may be different from the one reported by bitstream analyzer when there are skipped SBs.

Name: AMF_VIDEO_ENCODER_AV1_STATISTIC_MIN_Q_INDEX

Description: Min QIndex among all encoded SBs in a picture. Value may be different from the one reported by bitstream analyzer when there are skipped SBs.

Name: AMF_VIDEO_ENCODER_AV1_STATISTIC_PIX_NUM_INTRA

Description: Number of the intra encoded pixels.

Name: AMF_VIDEO_ENCODER_AV1_STATISTIC_PIX_NUM_INTER

Description: Number of the inter encoded pixels.

Name: AMF_VIDEO_ENCODER_AV1_STATISTIC_PIX_NUM_SKIP

Description: Number of the skip mode pixels.

Name: AMF_VIDEO_ENCODER_AV1_STATISTIC_BITCOUNT_RESIDUAL

Description: The bit count that corresponds to residual data.

Name: AMF_VIDEO_ENCODER_AV1_STATISTIC_BITCOUNT_MOTION

Description: The bit count that corresponds to motion vectors.

Name: AMF_VIDEO_ENCODER_AV1_STATISTIC_BITCOUNT_INTER

Description: The bit count that are assigned to inter SBs.

Name: AMF_VIDEO_ENCODER_AV1_STATISTIC_BITCOUNT_INTRA

Description: The bit count that are assigned to intra SBs.

Name: AMF_VIDEO_ENCODER_AV1_STATISTIC_BITCOUNT_ALL_MINUS_HEADER

Description: The bit count of the bitstream excluding header.

Name: AMF_VIDEO_ENCODER_AV1_STATISTIC_MV_X

Description: Accumulated absolute values of horizontal MV's.

Name: AMF_VIDEO_ENCODER_AV1_STATISTIC_MV_Y

Description: Accumulated absolute values of vertical MV's.

Name: AMF_VIDEO_ENCODER_AV1_STATISTIC_RD_COST_FINAL

Description: Frame level final RD cost for full encoding.

Name: AMF_VIDEO_ENCODER_AV1_STATISTIC_RD_COST_INTRA

Description: Frame level intra RD cost for full encoding.

Name: AMF_VIDEO_ENCODER_AV1_STATISTIC_RD_COST_INTER

Description: Frame level inter RD cost for full encoding.

Name: AMF_VIDEO_ENCODER_AV1_STATISTIC_SATD_FINAL

Description: Frame level final SAD for full encoding.

Name: AMF_VIDEO_ENCODER_AV1_STATISTIC_SATD_INTRA

Description: Frame level intra SAD for full encoding.

Name: AMF_VIDEO_ENCODER_AV1_STATISTIC_SATD_INTER

Description: Frame level inter SAD for full encoding.

Name: AMF_VIDEO_ENCODER_AV1_STATISTIC_SSE

Description: Frame level SSE (only calculated for AV1).

Name: AMF_VIDEO_ENCODER_AV1_STATISTIC_VARIANCE

Description: Frame level variance for full encoding.

| Statistic Name | Type |
|-------------------|------------|
| BLOCK_Q_INDEX_MAP | AMFSurface |

Table 16. Encoder block level feedback

Name: AMF_VIDEO_ENCODER_AV1_BLOCK_Q_INDEX_MAP

Description: AMFSurface of format AMF_SURFACE_GRAY32 containing block level QIndex values.

Table A-5. Encoder PSNR/SSIM feedback

| Statistic Name (prefix "AMF_VIDEO_ENCODER_AV1") | Type |
|---|------------|
| STATISTIC_PSNR_Y | amf_double |
| STATISTIC_PSNR_U | amf_double |
| STATISTIC_PSNR_V | amf_double |
| STATISTIC_PSNR_ALL | amf_double |
| STATISTIC_SSIM_Y | amf_double |
| STATISTIC_SSIM_U | amf_double |
| STATISTIC_SSIM_V | amf_double |
| STATISTIC_SSIM_ALL | amf_double |

Table 17. Encoder statistics feedback

Name: AMF_VIDEO_ENCODER_AV1_STATISTIC_PSNR_Y

Description: PSNR Y.

Name: AMF_VIDEO_ENCODER_AV1_STATISTIC_PSNR_U

Description: PSNR U.

Name: AMF_VIDEO_ENCODER_AV1_STATISTIC_PSNR_V

Description: PSNR V.

Name: AMF_VIDEO_ENCODER_AV1_STATISTIC_PSNR_ALL

Description: PSNR YUV.

Name: AMF_VIDEO_ENCODER_AV1_STATISTIC_SSIM_Y

Description: SSIM Y.

Name: AMF_VIDEO_ENCODER_AV1_STATISTIC_SSIM_U

Description: SSIM U.

Name: AMF_VIDEO_ENCODER_AV1_STATISTIC_SSIM_V

Description: SSIM V.

Name: AMF_VIDEO_ENCODER_AV1_STATISTIC_SSIM_ALL

Description: SSIM YUV.
