**** **ISO/IEC JTC 1/SC 29/WG 03 N1026**

**ISO/IEC JTC 1/SC 29/WG 03**

**MPEG Systems   
Convenorship: KATS (Korea, Republic of)**

**Document type:** Output Document

**Title: Preliminary draft of ISO/IEC 23000-19 AMD New structural CMAF brand profile and new media profiles**

**Status:** Approved

**Date of document:** 2023-10-20

**Source:** ISO/IEC JTC 1/SC 29/WG 03

**Expected action:** ACT

**Action due date:**

**No. of pages:** 13 (with cover page)

**Email of Convenor:** young.L@samsung.com

**Committee URL:** <https://isotc.iso.org/livelink/livelink/open/jtc1sc29wg3>

**INTERNATIONAL ORGANIZATION FOR STANDARDIZATION**

**ORGANISATION INTERNATIONALE DE NORMALISATION**

**ISO/IEC JTC 1/SC 29/WG 03 MPEG SYSTEMS**

**ISO/IEC JTC 1/SC 29/WG 03 N1026**

**Hannover, Germany – October 2023**

|  |  |
| --- | --- |
| **Title** | **Preliminary draft of ISO/IEC 23000-19 AMD New structural CMAF brand profile and new media profiles** |
| **Source** | **WG 03, MPEG Systems** |
| **Status** | **Approved** |
| **Serial Number** | **23179** |

**ISO 23000-19:2022(X)**

ISO/IEC JTC1 /SC 29 /WG 03 /N0XXX

Secretariat: XXXX

Information technology — Multimedia application format (MPEG-A) — Part 19: Common media application format (CMAF) for segmented media, AMENDMENT 2: New structural CMAF brand profile and new media profiles

WD stage

**Warning for WDs and CDs**

This document is not an ISO International Standard. It is distributed for review and comment. It is subject to change without notice and may not be referred to as an International Standard.

Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

© ISO 2020

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office

Case postale 56 • CH-1211 Geneva 20

Tel.  + 41 22 749 01 11

Fax  + 41 22 749 09 47

E-mail  copyright@iso.org

Web  www.iso.org

Published in Switzerland.

# Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. [www.iso.org/directives](http://www.iso.org/directives)

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received. [www.iso.org/patents](http://www.iso.org/patents)

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](http://www.iso.org/iso/home/standards_development/resources-for-technical-work/foreword.htm)

The committee responsible for this document is ISO/IEC JTC1 SC29.

# Introduction to Amendment 2

This amendment adds support for

* A new structural media profile.

Information technology — Multimedia application format (MPEG-A) — Part 19: Common media application format (CMAF) for segmented media, AMENDMENT 2: New Structural Profile and Other Technologies

# Change 1: Acronyms

# 1 Abbreviated terms

[…]

|  |  |
| --- | --- |
| MIME | multipurpose internet mail extensions |
| MPD | media presentation description |
| MPEG | moving picture experts group |
| MSE | media source extension |
| MV | Multi-view |
| NAL | network adaptation layer |
| NTSC | National Television System Committee |
| OETF | opto-electronic-transfer-funktion |

[…]

# Change 2: New Structural Profile

## Update 7.1 Overview

The CMAF track format is derived from the ISO base media file format in this clause and structural brands are specified. At this point, the 'cmfc', the 'cmf1' and the 'cmf2' CMAF structural brands are defined. The 'cmf2' brands further restricts the 'cmfc' brand. The ‘cmf1' brand extends and restricts ‘cmfc’.

Several CMAF media objects are derived from the CMAF track format.

## 7.2 CMAF brands

[…]

Table 1 — CMAF brands

|  |  |  |
| --- | --- | --- |
| **Brand** | **Location** | **Conformance requirements** |
| cmfc | FileTypeBox and SegmentTypeBox | 7.6 |
| cmf1 | FileTypeBox and SegmentTypeBox | 7.8 |
| cmf2 | FileTypeBox and SegmentTypeBox | 7.7 |
| cmfs | SegmentTypeBox | 7.3.3.1 |
| cmfl | SegmentTypeBox | 7.3.3.2 |
| cmff | SegmentTypeBox | 7.3.2.3 |
| cmfr | SegmentTypeBox | 7.3.2.4 |

## Add a new Clause

## 7.8 The structural CMAF Brand 'cmf1'

### 7.8.1 General

A CMAF track conforming to the CMAF structural brand 'cmf1' shall conform to constraints of the CMAF structural brand 'cmfc' and all remaining constraints and exceptions in subclause 7.8.

These constraints introduced to signal that the CMAF tracks and CMAF switching set track headers are conforming as if all CMAF Tracks of the presentation also conforming to this brand would be included in a single ISO BMFF file.

### 7.8.2 Track Header Box ('tkhd')

CMAF TrackHeaderBoxes shall conform to subclause 7.5.4 with the following additional constraints.

— If all CMAF Tracks of the CMAF Presentation are combined into a single ISO BMFF container, then the track header shall be valid. This for example included that

— The track\_ID is set to a unique identifier over within this CMAF presentation;

— All tracks within one CMAF Switching Set have alternate\_group shall be set to the same value. Each CMAF Switching Set in the CMAF Presentation shall have a unique value for the alternate\_group.

— For a video track, every decoder output signal shall have decoded and cropped image size in video spatial samples measured on a uniformly sampled square grid identical to the value of width and height defined in the Track Header.

**Update to B.1 HEVC video CMAF tracks**

This annex defines HEVC video tracks and specific CMAF media profiles with HEVC elementary stream constraint sets. Applications that do not conform to the HEVC video track or any of these CMAF media profiles can either specify their own HEVC video track definition or CMAF media profile or both. Applications can also signal brand conformance to just a CMAF structural brand defined in this document (e.g. 'cmfc' ,'cmf1' or 'cmf2').

# Change 3: MV-HEVC

1. X  
   (normative)  
     
   MV-HEVC media profile and track format
   1. General

The specification for Dependent CMAF tracks (Annex H.1) applies also for MV-HEVC media profile.

* 1. MV-HEVC CMAF tracks

MV-HEVC CMAF tracks shall conform to Clauses  7, 8, 9, and 12, and shall additionally conform to the constraints specified in this Annex.

Each MV-HEVC CMAF track that does not contain VCL NAL units with nuh\_layer\_id and TemporalID both equal to 0 is a dependent CMAF track and the constraints specified for dependent CMAF tracks in Clause H.1 shall apply. It is expected that the manifest provides signalling to express the dependency of a dependent CMAF track on another CMAF track, for example, using the @dependencyID in a DASH MPD.

* 1. CMAF switching set constraints for MV-HEVC CMAF tracks and media profiles
     1. General

Subclause 9.2.3 applies, and additionally the following constraints apply:

— Each CMAF track with sample entry 'hev1' shall conform to the HEVC media profile and track format as specified in Annex B.

— Each CMAF track containing a MV-HEVC bitstream or part thereof shall contain exactly one ISO BMFF track.

— When multiple CMAF tracks are present for carrying a MV-HEVC bitstream, the corresponding ISO BMFF tracks shall use distinct track IDs.

— CMAF switching sets containing a media profile listed in Clause H.6 with sample entry 'hev2' and 'lhe1' shall conform to single initialization CMAF switching set constraints.

Each coded video sequence in a MV-HEVC bitstream shall contain the necessary sequence parameter set and picture parameter set NAL units to signal decoding parameters changes allowed between CMAF tracks in the same switching set.

* + 1. Sample Description Box ('stsd')

Specification of Annex H.3.2 applies.

* + 1. Track Header Box ('tkhd')

Specification of Annex H.3.3 applies.

* + 1. Access units

Specification of Annex H.3.4 applies.

* 1. Sample and CMAF fragment constraints
     1. Storage of MV-HEVC elementary streams
        1. Conformance

MV-HEVC video tracks shall comply with ISO/IEC 14496-15:2017, Clause 9, with the following constraints:

— Each track shall carry only one layer or only a subset of one layer.

— Aggregators (as defined in ISO/IEC 14496-15:2017, Annex A) shall not be included in any track.

— The external base layer sample group shall not be included in any track.

The base layer (coded according to HEVC specification) shall be stored as described in subclause B.3.1.

* + - 1. Visual sample entry

Specification of Annex H.4.1.2 applies.

* + - 1. HEVCDecoderConfigurationRecord and LHEVCDecoderConfigurationRecord

Specification of Annex H.4.1.3 applies.

* + 1. Constraints on MV-HEVC elementary streams
       1. General

The following constraints apply to all CMAF MV-HEVC elementary streams. See Clause H.6 for media profile constraints on tier, profile, level and frame rates.

* + - 1. General constraints

The bitstream shall conform to Multiview Main 10 profile and main tier.

* + - 1. Picture rate related constraints

— All other views shall have the same picture rate as the base layer.

— The vps\_vui\_present\_flag in each VPS shall be set equal to 1, pic\_rate\_present\_vps\_flag shall be set equal to 1, and pic\_rate\_present\_flag[ i ][ j ] shall be set equal to 1.

— The vui\_parameters\_present\_flag in each SPS shall be set equal to 1, vui\_timing\_info\_present\_flag in each SPS shall be set equal to 1, and vui\_hrd\_parameters\_present\_flag in each SPS shall be set equal to 1.

* + - 1. Picture type

All pictures shall be encoded as coded frames, and shall not be encoded as coded fields.

* + - 1. Video parameter sets (VPS)
         1. VPS fields

Each MV-HEVC video sample in the CMAF track shall reference the VPS in the CMAF header sample entry according to ISO/IEC 14496-15. VPS shall not change within CMAF tracks or between CMAF tracks in a switching set. A CMAF MV-HEVC track shall conform to the multi-layer extensions and to the Multiview high efficiency video coding specified in ISO/IEC 23008-2 with the following additional constraints:

— The following fields shall have values set as follows for each profile\_tier\_level() structure in VPS:

— general\_progressive\_source\_flag shall be set to 1.

— general\_frame\_only\_constraint\_flag shall be set to 1.

— general\_interlaced\_source\_flag shall be set to 0.

— general\_non\_packed\_constraint\_flag shall be set to 1.

— vps\_extension\_flag shall be set to 1.

— vps\_vui\_present\_flag shall be set to 1.

— The condition of the following fields for each profile\_tier\_level() structure in VPS shall not change throughout an MV-HEVC elementary stream:

— general\_profile\_space

— general\_profile\_idc

— general\_tier\_flag

— general\_level\_idc

— The value of vps\_max\_layers\_minus1 of each VPS shall be set equal to 1.

* + - * 1. VPS visual usability information (VPS VUI) fields

VPS VUI parameters that occur within a CMAF MV-HEVC track shall conform to the multi-layer extensions and the Multiview high efficiency video coding specified in ISO/IEC 23008-2 with the following additional constraints:

— pic\_rate\_present\_vps\_flag shall be set equal to 1.

— pic\_rate\_present\_flag[ i ][ j ] shall be set equal to 1.

The values of the following fields in each video\_signal\_info() in VPS VUI shall not change throughout a CMAF track and switching set:

— vps\_video\_format

— video\_full\_range\_vps\_flag

— colour\_primaries\_vps

— transfer\_characteristics\_vps

— matrix\_coeffs\_vps

* + - 1. Sequence parameter sets (SPS)
         1. SPS fields

Sequence parameter set NAL units that occur within a CMAF MV-HEVC track shall conform to the multi-layer extensions and to the Multiview high efficiency video coding specified in ISO/IEC 23008-2 with the following additional constraints:

— The following fields shall have pre-determined values as follows:

— general\_progressive\_source\_flag shall be set to 1.

— general\_frame\_only\_constraint\_flag shall be set to 1.

— general\_interlaced\_source\_flag shall be set to 0.

— general\_non\_packed\_constraint\_flag shall be set to 1.

— vui\_parameters\_present\_flag shall be set to 1.

— vui\_timing\_info\_present\_flag shall be set to 1, and vui\_hrd\_parameters\_present\_flag in shall be set to 1.

* + - * 1. Visual usability information (VUI) fields

VUI parameters that occur within a CMAF MV-HEVC track shall conform to the multi-layer extensions and to the Multiview high efficiency video coding specified in ISO/IEC 23008-2 with the following additional constraints:

— The following fields shall have pre-determined values as defined:

— video\_full\_range\_flag shall be set to 0.

Specification for:

colour\_description\_present\_flag, overscan\_info\_present\_flag, aspect\_ratio\_idc, low\_delay\_hrd\_flag, colour\_description\_present\_flag, colour\_primaries, transfer\_characteristics, matrix\_coeffs, vui\_time\_scale, vui\_num\_units\_in\_tick as specified in subclause 9.4.2.2.2 apply.

* + - 1. Maximum bitrate

The maximum bitrate of HEVC elementary streams shall be calculated by implementation of the buffer and timing model for multiview extensions of the hypothetical reference decoder defined in ISO/IEC 23008-2.

* + - 1. Frame rate in the elementary stream

Sample durations stored in the ISO Media TrackRunBox shall determine the frame rate of a track.

* 1. Video codec parameters
     1. MV-HEVC signalling of “codecs” parameters

Presentation applications should signal video codec profile and levels of each MV-HEVC track and switching set using parameters conforming to IETF RFC 6381 and ISO/IEC 14496-15:2017, Clause E.4.

* + 1. Cropping

If picture cropping is used, it shall be set by SPS cropping parameters conf\_win\_right\_offset, conf\_win\_top\_offset, conf\_win\_left\_offset and conf\_win\_bottom\_offset. SPS cropping parameters. conf\_win\_top\_offset and conf\_win\_left\_offset shall be set to 0.

* 1. MV-HEVC media profile and track brands

MV-HEVC media profiles and track brands shall conform to Annex B except for Table AX.1.

Table AX.1 — MV-HEVC video media profiles

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Media profile** | **Codec** | **Profile** | **Level** | colour\_primaries **in VUI** | transfer\_characteristics **in VUI a** | matrix\_coefficients **in VUI** | **Max frame height** | **Max frame width** | **Max frame rate** | **CMAF file brand** |
| MVH10 | MV-HEVC | Multiview Main 10 | 5.2 | 1a  9b | 1a  14b | 1a  9c | 2 160 | 3 840 | 120 | 'cvh1' |
| a   This value is equivalent to the definitions in ITU-R BT.709. For details refer to ISO/IEC 23008-2.  b   This value is equivalent to the definitions in ITU-R BT.2020. For details refer to ISO/IEC 23008-2.  c   This value is commonly also known as ITU-R BT.2020 non-constant luminance. For details refer to ISO/IEC 23008-2. | | | | | | | | | | |

# Change 4: LCEVC profile and level indication

**O.6 LCEVC media profile and track brands**

LCEVC media profiles and track brands shall conform to Table O.1.

CMAF file with brand 'clv1' shall contain only LCEVC samples with sample entry 'lvc1'.

clv1.vprf<prof>.vlev<level>

Table O.1 — Video codecs parameters for the LCEVC media profiles

|  |  |  |  |
| --- | --- | --- | --- |
| **codec parameter** | Description | CMAF LCEVC Main Profile | CMAF LCEVC Main 4:4:4 Profile |
| **<prof>** | profile\_idc | 0 | 1 |
| **<level>** | level\_idc | <level>  Examples   * For level 4.1: 41 * For level 5.1: 51 * For level 6.1: 61 | |