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**ISO/IEC JTC 1/SC 29/WG 11**

**CODING OF MOVING PICTURES AND AUDIO**

**ISO/IEC JTC 1/SC 29/WG 11 N16603**

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|  |  |
| --- | --- |
| **Source:** | **Leonardo Chiariglione**  |
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| **Purpose:** | **Work plan management** |

**MPEG work plan**

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# Video coding

## Video Coding Independent Code Points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| ? | 1 | E1 | ? | Currently expressed within ISO/IEC 23001-8, there is a growing set of coding-independent code points for indicating properties of video content such as colour type identifiers, aspect ratio, and frame packing types. The current approach of specifying these within a single specification that includes other types of code points, such as those for audio layouts, has become difficult to maintain, so there is a plan to move the video code points to a separate Specification text. |

### Additional code points for colour description

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| ? | 2 | ? | ? | This part of ISO/IEC 23001 specifies defines various code-points and fields which document aspects that are bit-rate and compression independent, of a video stream. They describe the characteristics of the signal before the signal is actually compressed by any encoder that is suitable for compressing such an input signal, or after decompressing the signal. |

## Internet Video Coding

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 33 | E1 |  | Internet Video Coding (IVC) aims to develop a Type 1 video coding standard with a performance as good as possible under the given constraints. |

## HEVC

### Additional colour representation code point

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 2 | A1 |  | Specification of additional Video Usability Information (VUI) code points for video colour interpretation, in particular the ICtCp colour space.  |

### Progressive High 10 Profile

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 10 | A4 | 16032 | This amendment of ISO/IEC 14496-10 will introduce an additional profile for applications that use 10 bit 4:2:0 progressive-scan video content (Progressive High 10). It will also specify additional VUI code points for video colour interpretation and an SEI message for transfer characteristics. |

### Picture Repetition Indication in HEVC

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 2 | A? |  | HEVC contains a method of representing picture repetition periods for display of video content with a fixed display frame rate. This potential amendment could add longer repetition periods in addition to those that can already be expressed in HEVC syntax. |

### Main 10 Still Picture Profile

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 2 | A2 | 16496  | Specification of a profile for the coding of still pictures with 4:2:0 format and bit depths of 8-10 bits per sample. |

### Content Colour Volume SEI Message

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 2 | A3 |  16687 |  Specifies SEI messages, including:* Content colour volume characteristics
* Motion-constrained tile sets extraction information
* Omnidirectional 360° projection indication
* Region nesting of other SEI messages
 |

### Conversion and coding practices for HDR/WCG video

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 14 | T1 |  16504 | This technical report will describe methods that can be applied to use HEVC Main 10 profile for providing good quality of high dynamic range and wide colour gamut video content. This includes encoder optimization, bitstream signaling, as well as pre and post processing that should be applied in this context. |

### Signalling, backward compatibility and display adaptation for HDR/WCG video

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 15 | T1 |  16504 | This technical report complements and extends work in another report, ISO/IEC 23008-14 “Conversion and Coding Practices for HDR/WCG Y′CbCr 4:2:0 Video with PQ Transfer Characteristics”. Specifically, this report expands on the application of ICtCp, HLG, and SEI messages in the coding of HDR/WCG video |

## *Network distributed video coding*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| C | ? | ? |  | We envisage a system for video encoding and decoding where processing is distributed across three or more processing units, wherein the processing units are interconnected through links with individual bandwidth constraints, and each unit has an individual processing capability. One of the units is the “original” encoder and one of the processing units is the “final” decoder. |

## *New Video Coding*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| ? | ? | ? |  | Investigation on the benefit of video coding technology which could improve the compression performance or give new functionality, as compared to HEVC. Further, test cases and evaluation methodologies for assessment of such benefits are investigated. |

## *Immersive video*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| ? | ? | ? |  | Immersive video adds over classical video an immersive experience to the user, surrounding him/her with a large field of view video (up to 360 degrees) through Virtual Reality goggles or large 3D video walls. The user is presented different viewpoints to his/her surroundings, corresponding to rotational head movements only (so-called Three Degrees of Freedom, 3DoF), possibly augmented with a virtual or physical translational body/head movement in a limited volume around a central position (referred to as 3DoF+). |

### Video Tool Library

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| C | 4 | 1 |  | This amendment specifies functional units and functional network description for an RVC implementation of HEVC Main 10 Profile, as well as new functional units for an alternative parser implementation supporting parallel processing. The latter can also be used in the context of HEVC Main Profile. |

### *Free Viewpoint Television*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| ? | ? | ? |  | After developing various aspects of 3D video standardization since 2001 (MVC: efficient coding of multiple camera views; 3DV: viewing and display adaptation of multiview displays), MPEG is currently investigating new coding techniques for emerging super multiview 3D displays that anticipate the next generation of auto-stereoscopic display, providing ultra-realistic 3D visualization and navigation at acceptable cost. The main issue is synthesis from a lower number of input camera views (for cost reasons) and real time rendering of a large number of multi-view images on super multiview 3D displays. |

### *Light Field Coding*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| ? | ? | ? |  | Light field cameras, introduced in 2010, have been introduced as a new technology that has the potential to dramatically increase the sense of immersion that can be achieved by images and video captured by cameras, and arrays of cameras focused on a particular scene. The technology and associated applications have been deployed with interest steadily increasing across all of the constituents in the content capture, production, and distribution ecosystem, display manufacturers, and service providers. A key issue with the technology is the incredibly large amount of data necessary to achieve the desired sense of immersion, without unwelcome impacts on the user (i.e. motion sickness, viewer fatigue, and eye strain).In this exploration we study existing devices, applications, and use cases for light fields and light field applications with the goal to develop new technologies that can be used to compress light field data. |

# Audio coding

## Audio Coding Independent Code Point

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| ? | 3 | E1 | ? | Definition of various code-points and fields which document aspects that are bit-rate and compression independent, of an audio stream. They describe the characteristics of the signal before the signal is actually compressed by any encoder that is suitable for compressing such an input signal, or after decompressing the signal. |

## Advanced Audio Coding

### Levels and Downmixing Method for 22.2 Channel Programs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 3 | A6 | 15827 | To signal and carry Dynamic Range Control data in MPEG-4 Audio elementary streams. This enables the Dynamic Range Control to be used with e.g. the AAC family of codecs. |

## Dynamic Range Control

### Support for MPEG-D DRC

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| D | 4 | 3 | 15256 | Support for DRC gain generation at the decoder. It offers flexible DRC gain sequence mapping for multi-band DRC and DRC target characteristics provided by the encoder. Metadata based equalization can be applied and support for loudness equalization is built in. |

### Parametric DRC, Gain Mapping and Equalization Tools

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| D | 4 | 1 | 15841 | Support for DRC gain generation at the decoder. It offers flexible DRC gain sequence mapping for multi-band DRC and DRC target characteristics provided by the encoder. Metadata based equalization can be applied and support for loudness equalization is built in. |

## MPEG-H 3D Audio

### 3D Audio Profiles

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 3 | A1 | 14757 | Specifies profiles and levels for MPEG-H 3D Audio. Currently there is one profile defined: Main Profile, which includes all tools with levels defined to give a range of decoder complexities. |

### Carriage of systems metadata in MPEG-H 3D Audio

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 3 | A4 |   | Provides a means for Systems metadata to reach a Systems decoder in case there is no transmission protocol for carriage of Systems data. This could, for example, permit MPEG-H MMT to use this channel to communicate information to a MMT decoder engine in a TV for the purposes of displaying enhanced information.  |

## *Immersive Audio*

### *Audio Coding for AR/VR*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| ? | ? | ? |  | Will explore how MPEG Audio technology, including MPEG-H 3D Audio, can be extended to support AR and VR use cases. When concrete use cases and requirements are established, new work will begin. |

### *Audio Wave Field Coding*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| ? | ? | ? |  | Will explore audio wave field capture, coding and presentation use cases and requirements. |

# 3D Graphics

## Animation Framework eXtension

### Metadata for Realistic Material Representation

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 16 |  |  | Realistic material representations to specify makeup information on a human face. Combined with the spectrum light source and the spectrum textures of objects specified in the MPEG-4 Part 11, this information enables to reproduce a realistic avatar appearance |

## *Point Cloud Coding*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| ? | ? | ? |   | This standard addresses compression of 3D point clouds. Point clouds can have attributes such as colors, material properties and/or other attributes. Point Clouds are typically captured using multiple cameras and depth sensors in various setups, however the acquisition is outside of the scope of this standard.Point clouds typically have thousands up to billions of points to represent realistically reconstructed scenes. The standard targets lossy compression useful for real-time communications, lossless for GIS, CAD and cultural heritage applications.The standard targets both efficient geometry and attributes compression, scalable/progressive coding, and coding of sequences of point clouds captured over time. In addition, the compressed data format should support random access to subsets of the point cloud. |

## Reconfigurable Media Coding

### FU and FN extensions for Parser Instantiation

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| C | 4 | A3 | 15768 | This amendment provides description on two management functional units (FUs) for RMC which are necessary to instantiate a parser FU from a given bitstream syntax description (BSD). Two FU networks based on this process are provided as examples. The FU and FN description provided by this amendment is technically compliant with the parser instantiation process described in ISO/IEC 23001-4:2014/E/A/T1 and reference software provided in ISO/IEC 23002-5:2014/E/A/T3. |

### FU and FN extensions for SHVC and Main10 Profiles of SHVC

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| C | 4 |  |   | This amendment will provide additional functional unit (FU) and functional network (FN) descriptions for RMC which are necessary to implement Scalable and Main10 profiles of HEVC.  |

### Tools for Reconfigurable Media Coding Implementations

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| C | 6 | E1 |   | This technical report will provide development and testing tools as well as additional guidelines for implementation of RMC.  |

# Font Coding

## Font Collection Items

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 22 | A1 |  | The advances in developing the Unicode Standard and the addition of new characters that represent most of the world's languages and writing systems resulted in a significant increase of the Unicode character repertoire to more than 100,000 characters. However, due to the finite size of many bitfields, the existing ISO/IEC 14496-22:2009 specification only provides the capabilities for a single font to support up to 64K glyphs. The Composite Font Standard is intended to resolve the existing limitation by providing a solution that would allow linking of existing OFF fonts (and, possibly, fonts in other formats) into a single Composite Font to be used as a virtual font by any compliant implementation. |

## Updated text layout features and implementations

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 22 | A2 | 15930 | This amendement introduces changes in complex layout support and the additional support for new layout features necessitate corresponding updates to the functionality of the existing layout features and definition of new ones. |

# Digital Items

## Media Value Chain Ontology

### MVCO Extensions on Time Segments and Multi-Track Audio

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 21 | 19 |  |  | This amendment constitutes an extension to MVCO and in particular to its functionality related to description of composite IP entities in the audio domain, whereby the components of a given IP entity can be located in time and, for the case of multi-track audio, associated with specific tracks. |

# Media context and control

## Media Context and Control – Control Information

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| V | 2 |  E4 |   | Capabilities and preferences for new sensors and actuators such as 3D printer, E-nose, Camera array, and Radar. |

## Media Context and Control – Sensory Information

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| V | 3 |  E4 |   | New sensory effects added related to color models of 3D printing. |

## Media Context and Control – Virtual World Object Characteristics

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| V | 4 |  E4 |   | By adding new actuators and sensors, the characteristics of the virtual world objects should be realigned with other parts. |

## Media Context and Control – Data Formats for Interaction Devices

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| V | 5 |  E4 |  | New actuators and sensors such as 3D printer, E-nose, Camera array, and Radar are added. |

## Media Context and Control – Common Types and Tools

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| V | 6 |  E4 |   | By adding new actuators and sensors, new classification schemes and tools are added. |

# *Genomic Information Representation*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| ? | ? | ? |  | Today, DNA sequencing machines generate large amount of data and metadata that in the currently used formats can easily require amounts of storage in the order of a Tera byte. Typically, several data sets can be generated for a single person for health care purposes. MPEG is developing a standard for the compression, transport and storage of genomic sequencing data and associated metadata. The standard also addresses the capability of accessing these data sets efficiently, including selective fast browsing, searching and access capabilities directly in compressed form. The standard will facilitate the usage and manipulation of sequencing data sets for genomic analysis application by defining standard APIs and ensuring interoperability of transport and storage formats at all levels of the various processing pipelines.  |

# Media Description

## MPEG-7 Visual

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 7 | 3 | E2 |  | New edition of MPEG-7 Visual, integrating the main text with amendments 1-4, and corrigenda issued so far. |

## Compact Descriptors for Visual Search

## *Compact Descriptors for Video Analysis*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 7 | ? | ? |  | To extend image description to video for such applications as video retriev­al, computer vision, automotive, security and where many video streams need to be evaluated. While traditional implementations com­press many video streams and analyze the decoded video at a central site, this activity will enable the “Analyze-Then-Compress” (ATC) paradigm where descriptors are extracted at the source, compressed and evaluated at a central site. |

# Systems support

# IPMP

## Support for multi-keyed samples

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| B | 7 | A? |  | There are cases where it may be desirable or needed to have multiple keys, with their associated IVs, for a single sample. For example, when a scalable or tiled media bitstream was represented by multiple tracks in a file, each of the tracks protected with its own keys, multiple keys per sample description is required to re-package the bitstream as a single track in the file. The support for multiple keys per sample is introduced using the following tools:1. extension of the seig sample group

extension of the sample auxiliary info data for CENC |

### Support for sample variants for multiple encryption schemes

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| B | 12 | A? |  | This standard supports use case where ISOBMFF files/segments carry sample data with more than one encryption schemes. In the use case, CENC ‘cbcs’ and ‘cens’ encryption schemes are used. These two schemes use subsample pattern based encryption of the video streams. In this use case every sample in the main track there is an associated sample variant data (only encrypted blocks) in the sample variant track. The sample variant may have the same KID as the main track samples. It may have different KID than the main track. The encryption schemes are different between samples from the main track and samples from the sample variant tracks.  |

## Green Metadata

### HEVC SEI message for Green Metadata

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| B | 11 | A2 |  | This amendment enriches the standardized AVC metrics to improve complexity prediction model, specifies the HEVC metrics and extends AVC and HEVC metrics granularity to slice/tile/multi-layers. |

## Media orchestration

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| ? | ? |   |   | The proliferation of capture and display devices combined with ever-increasing bandwidth, including mobile bandwidth, necessitates better and standardized mechanisms for coordinating such devices, media streams and available resources, like media processing and transmission. With so many capture and display devices, and with applications and services moving towards a more immersive experience, we need the tools to be able to manage multiple, heterogeneous devices over multiple, heterogeneous networks, to create a single experience. We call this process Media Orchestration: orchestrating devices, media streams and resources to create such an experience. |

# Transport

## MPEG-2 Transport Stream

### Carriage of MPEG-H 3D audio over MPEG-2 Systems

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 2 | 1 | A5 |  | This amendment defines stream type, descriptors and buffer model to carry MPEG-H 3D audio bitstream in MPEG-2 TS. Two stream types will be assigned to distinguish main stream from auxiliary stream. Descriptors will provide information on user selectable and/or modifiable audio objects and information on which object contains either supplementary or main audio. T-STD extension will allow splitting an encoded audio scene into several elementary streams. One single audio decoder decodes all elementary streams to one audio presentation. Each of those elementary streams carries one or more encoded channel signals. |

### Carriage of Quality Metadata in MPEG-2 Systems

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 2 | 1 | A6 |  | This amendment specifies the carriage of Quality Metadata (ISO/IEC 23001-10) in MPEG-2 systems. Quality metadata enhances adaptive streaming in clients during the presentation of media. The carriage is specified for transport streams only and includes the signalling of static metadata as well as dynamic metadata.  |

### Virtual segments in MPEG-2 Systems

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 2 | 1 | A7 |  | This amendment provides several enhancements to the current ISO/IEC 13818-1 (specifically to Annex U, TEMI), in order to allow easy distributed generation of time-aligned segments for multiple adaptive streaming systems, such as MPEG DASH and aid in IPTV services. We also provide tools for verifying stream integrity and authenticity in real time. We would like to ask for a 2-month PDAM ballot due to the industry and SDO need in features introduced in this amendment. |

### Signaling of carriage of HDR/WCG video in MPEG-2 Systems

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 2 | 1 | A8 |  | All Main 10 Profile based receivers will be able to decode the video but may not be able to do appropriate processing required to make video presentable on a non-HDR or non-WCG display. Therefore in many applications (such as broadcast) that use the MPEG-2 TS it will be beneficial to signal presence of WCG and HDR video content as well as additional information at a program level. This enables HDR and WCG capable receivers process the information in video ES and render the decoded content correctly. Receivers that do not have the capability to process WCG and HDR can either ignore the content or do their best effort to render the content on non-WCG and non-HDR display devices. This amendment suggests some minimal MPEG-2 TS ‘signaling’ to indicate presence of WCG and HDR video in the HEVC elementary stream. |

### Ultra-Low-Latency mode and higher resolution support for transport of JPEG 2000 video

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 2 | 1 | A9 |  |

|  |
| --- |
| Addresses the following issues.1. Enable JPEG 2000 Ultra-Low Latency (ULL) encoding and transport of professional video, audio and data over Internet Protocol networks
2. Enable transport of 4K or higher resolution JPEG 2000 video
3. Correcting defects from ISO/IEC 13818-1:2007/Amd.5:2012.
 |

 |

## ISO Base Media File Format

### DRC file format extensions

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 12 | A1 | 15637 | This Amendment adds support for DRC configuration extensions in MPEG-D DRC. It increases the available range of downmix coefficients. The loudness metadata is enhanced to support the EQ extension of MPEG-D DRC. |

### Support for Image File Format

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 12 | A2 | 16164 | 1. Addition of general tools currently defined in Image File Format (23008-12)
2. Support for Dependent Random Access Point (DRAP) sample grouping
3. Support of an optional MIME type box for media.
 |

### Partial File Storage

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 12 | ? | ? | The partial file format is intended to serve as a storage and exchange format for other file formats delivered over lossy channels. The format provides the following set of tools:1. Reception data, which provides means to store the received data and document transmission information such as lost byte ranges or whether the corrupted/lost bytes are present in the file.
2. Repair information, such as location of the source file, possible byte offsets in that source, byte stream position at which a parser can try processing a corrupted file; depending on the communication channel, this information may be setup by the receiver or through out-of-band means.
3. File format specific information, which depend on the type of file stored as a partial file; this specification only defines additionnal tools for files based on ISO/IEC 14496-12.
 |

### Support for CTA 708 captioning in SEI message

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 30 | 1 | 16283 | This amendment describes how CTA-708 timed text in SEI messages in a video stream is carried in files based on the ISO base media file format. |

### Carriage of ROI coordinates

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| B | 10 | A1 |   | Definition of a storage format for spatial coordinates, a new type of timed metadata metrics that relate to the position of media track with respect to another media track in the ISO Base Media File Format. |

## Carriage of NAL unit structured video in ISO BMFF

### Enhanced carriage of HEVC

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 15 | E4 |  | This amendment specifies the storage of video bitstreams consisting of multiple views and the associated depth, encoded based on Annex I of ISO/IEC 14496-10. The design is based on the MVC file format, which is specified in Clause 7 of ISO/IEC 14496-15, in a backwards-compatible manner. In the design, storage of the texture and depth of a particular view in either separate tracks or the same track is supported. The design also includes the signalling of various indications, such as the presence of texture and/or depth for each view, as well as whether the texture or depth component or both of a view is required for the presentation of another view. The amendment also adds the signaling (using HEVC video descriptor) to indicate use of HEVC low-delay coding mode in each access unit where the STD buffer management is performed using the HEVC HRD parameters. |

### Layered coding of images

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 15 | ? | ? | This amendment enables the Still Image file format to be used for the carriage of images and image sequences coded using Advanced Video Coding (ISO/IEC 14496-10), JPEG (ISO/IEC 10918-1), and layered coding (including layered High Efficiency Video Coding ISO/IEC 23008-2). |

### Handling of Unspecified NAL Unit Types and other improvements

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 15 | ? | 16548 | Describes the required management mechanism for the nal\_unit\_type fields that are defined in ISO/IEC 14496-10 (AVC), clause 7.4.1 and ISO/IEC 23008-2 (HEVC), clause 7.4.2.2 for use 'as determined by the application'. Some values are defined in this standard and some (marked as 'user definable' in Tables 13, 14, 15, and 16) are available for use under other conditions. |

### Additional Brands

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 15 | A2 | ? | This amendment defines two brands, 'hvti' and 'lhte'  |

## MMT

### Use of MMT Data in MPEG-H 3D Audio

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 1 | A1 | 15670 | Defines normative behavior of using the system data carried over MPEG-H 3D Audio |

### MMT Enhancements for Mobile Environments

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 1 | A2 | 15995 | Adds capabilities to support the use cases identified and documented as part of TRUFFLE such as: session setup and control, QoS and consumption reporting, multi-path delivery, and other technologies. |

### MMT Implementation Guidelines

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **Amd** | **Req** | **Short description** |
| H | ? | E1 | 16357 |  The MMT Implementation Guidelines describe the usage of MMT for multipath delivery, layer aware FEC and so on. |

### Image file format

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **Amd** | **Req** | **Short description** |
| H | 12 | A1 |  | Supporting multi-layered image and AVC, JPEG in the image file format. This amendment also register MIME type. |

## DASH

### Authentication, Access Control and Multiple MPDs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| DA | 1 | 3 |  | The following rationale for this amendment is:* Authentication and authorization of a client are key enablers of establishing trust in a client (e.g., a player). This is needed to ensure only clients that obey a specific set of requirements (e.g. ones imposed by advertisers or MVPDs) have access to content.
* MPD linking allows pointing to media components in other MPDs to provide a relation, such that seamless transition between such MPDs is possible. A specific example is mosaic channels in combination with Spatial Relation Description as defined in the ISO/IEC 23009-1:2014 E/A/T.2.
* The callback event is considered relevant for different use cases, including consumption and ad tracking.
* Period continuity enables to break content into multiple Periods, but provides a seamless playout across Period boundaries. This is relevant for use cases such as providing robust live services and ad insertion.
 |

### Segment Independent SAP Signalling, MPD chaining and other extensions

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| DA | 1 | A4 | 15809 | Specifies carriage of MPEG-DASH media presentations over full-duplex HTTP-based protocols, particularly HTTP/2 and WebSockets, taking advantage of the features these protocols support over HTTP/1.1 to improve delivery performance, while still maintaining backwards compatibility. |

### MPEG-DASH Implementation Guidelines

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| DA | 3 | E2 |  | Contains a set of guidelines for design and deployment of streaming media delivery systems using ISO/IEC 23009 (MPEG-DASH) standard.  This includes guidelines for content generation, guidelines for client implementation, and examples of deployment scenarios.   |

### Server and Network Assisted DASH

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| DA | 5 | E1 | 15225 | In order to enhance the delivery of DASH content, Server and network assisted DASH (SAND) introduces messages that are exchanged between infrastructure components and DASH clients over underlying network protocols (e.g., HTTP 1.1, 2.0 or Websockets). The infrastructure components may comprise, but are not limited to, servers, proxies, caches, CDNs and analytics servers. |

### DASH with Server Push and WebSockets

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| DA | 6 | E1 | 15992 | Specification of carriage of MPEG-DASH media presentations over full-duplex HTTP-based protocols, particularly HTTP/2 and WebSockets. This carriage takes advantage of the features these protocols support over HTTP/1.1 to improve delivery performance, while still maintaining backwards compatibility. |

# Application Formats

## Multisensorial Effects Application Format

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| A | 17 | E1 |  | To address applications such as 4D Media – a new type of media service provided by a combination of the traditional media and its sensory effects – by grouping together a set of MPEG technologies. In 4D Media, traditional media data could be represented by conventional audio or video data and accompanying sensory effect metadata represented by using the MPEG-V standard. 4D Media can provide with sensory effects, giving real-sense experience and immersion.  |

## Omnidirectional Media Application Format

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| A | 19 | E1 |   | To define storage, distribution and playback of omnidirectional video contents. Some metadata useful for conversion from projected 2D image to sphere 3D image are contained in the OMAF stream. If the OMAF stream is fed into an OMAF parser, the 3D model and projection metadata will be parsed and shared to 3D projector. The 3D projector will map the projected 2D image onto the surface of a specific 3D model, using the shared projection metadata. Note that the illustrated solution can be enabled by adding minimum metadata on top of legacy file format, such as ISO BMFF, without changes in CODEC or System level. |

## Common Media Application Format

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| A | 20 | E1 |   |  The Common Media Application Format defines the media format only. MPEG technologies such as DASH and MMT may be used for the delivery of the Common Media Application Format Segment. Multiple delivery protocols may specify how the same Common Media Application Format Segments are delivered. The description and delivery of presentations are both considered to be in layers above the layer that defines the media format and the encoding and decoding of Media Segments, and therefore they are out of the proposed scope. |

## Visual Identity Privacy Management Application Format

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| A | ? | ? |   | Provides a framework for managing privacy of users on the pictures or videos when pictures or videos are being shared among users in response to concerns on user privacy arising from sharing pictures in social media services. People can be on a picture taken by someone else, either intentionally or by mistake, and such picture can be posted on a social media service without any permission of the person captured on the picture and possibly without the person even being aware to be on the picture. Social media service operators try to provide some ways to manage such cases but it seems quite limited. Same happens for various video capturing devices such as CCTVs.  |

# Media Systems

## MPEG-V Architecture

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| V | 1 | E4 |  |  The use cases for newly added actuators and sensors, such as 3D printer, E-nose, Camera array, and Radar, should be added. |

## MPEG-M Architecture

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| M | 1 | E3 |  | To extend the MPEG-M Architecture to include the specification of a High Level Application API |

## Mixed and Augmented Reality Reference Model

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| J | 1 | E1 |  | The reference model (RM) is intended for use by current and future developers of mixed and augmented reality (MAR) applications, components, systems, services, or specifications to describe, compare, contrast, and communicate their architectural design and implementation (referred to in the abbreviated form as MAR-RM herein). The MAR-RM is designed to apply to MAR systems independent of specific algorithms, implementation methods, computational platforms, display systems, and sensors or devices used.This International Standard does not specify how a particular MAR application, component, system, service, or specification shall be designed, developed, or implemented. It also does not specify the bindings of those designs and concepts to programming languages, or the encoding of MAR information through any coding technique or interchange format. This specification contains a list of representative system classes and use cases with respect to its reference model. |

## *Immersive Media Architectures*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 23090 | 1 | E1 | ? | The report will form the basis of the Project on Coded Representation of Immersive Media and investigate aspects of Immersive Media, which includes Virtual Reality, that are relevant to understand the needs for standardisation by WG11 |

## *Internet of Media Things and Wearables*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| ? | ? | ? |  | Data formats and communication protocols for Media Things (MThings), defined as Things with at least one of audio/visual sensing or actuating capabilities. MThings can be part of complex distributed systems implying interaction between MThings and between humans and MThings. This activity is part of an increasing interest from the industry in Internet of Things (IoT), where a Thing is any thing that can communicate with other Things; additionally it may sense and/or act on any physical or virtual object sensed by and/or acted on by Things.  |

## *Big Media Data*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| ? | ? | ? |  | With the huge amount of media content produced, transmitted and consumed in today’s word, media constitutes an important part of the Big Data paradigm.The main objectives of the Big Media project is (1) review the state of the art in MPEG standards related to the Big Data paradigm (2) explore of new areas for standardization in the intersection between multimedia content and Big Data.To achieve these objectives, the project is starting by collecting and analysing use cases. The next step will be (1) to elaborate a conceptual model for media related functionalities in Big Data that is aligned with ISO/IEC JTC 1 WG 9 Big Data Reference Architecture under development (2) Identify gaps that can be filled by future MPEG standardization. |

## *Network Distributed Video Coding*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| **C** | **?** | **?** | **?** | We envisage a system for video encoding and decoding where processing is distributed across three or more processing units, wherein the processing units are interconnected through links with individual bandwidth constraints, and each unit has an individual processing capability. One of the units is the “original” encoder and one of the processing units is the “final” decoder. |

# Reference implementation

## Video

## Audio

### Reference Software for MPEG Surround Extensions for 3D Audio

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| D | 1 | 4 |  |  |

### Reference Software for DRC

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| D | 4 | 1 |  | To provide a reference implementation of MPEG-D Part 4, Dynamic Range Control. |

### Reference Software for 3D Audio

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 6 | E1 |  | To provide a reference implementation of 3D Audio (23008-3) |

## Digital Items

### Reference Software and Implementation Guidelines of User Description

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 21 | 22 | 1 | 15921 | Reference implementation of the User Description standard |

## Media context and control

### Reference Software for MPEG-V

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| V | 5 |  |  | To provide a reference implementation of XML and binary version of MPEG-V types |

## Media Description

## Systems support

## Transport

### Reference Software for File Format

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 32 | E1 |  | To specify conformance bitstreams for |

### Reference Software for MMT

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 4 | E1 |  | To provide a reference implementation of MMT version 1 (23008-1) |

### Reference Software for MMT with Network Capabilities

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 4 | A1 | 15966 | To provide a reference implementation of MMT with Network Capabilities |

## Application Formats

### Reference Software for ARAF

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| A | 14 | 1 |  | To provide a reference implementation of the ARAF PROTOs. |

# Conformance

## Video

## Conformance for HEVC

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 8 | A1 | 14983 | To provide a conformance test set for the SCC profile of HEVC |

## Audio

### Conformance for New levels for AAC profiles and uniDRC support

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 26 | ? | 14447 | To specify where and in which format the MPEG-D DRC metadata is carried in AAC. It also contains the specification of the SAOC DE profile and level indication. |

### Conformance for DRC

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **Amd** | **Req** | **Short description** |
| D | 4 | 1 | 16294 |  |

### Conformance for 3D Audio

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 10 | E1 |  | To specify conformance bitstreams for 3D Audio (23008-3) |

## 3D Graphics

## Digital Items

## Media context and control

### Conformance for MPEG-V

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| V | 4 | E4 |  | To provides the conformance of the XML and binary version of MPEG-V types. |

## Media description

## System support

## Transport

### Conformance for File Format

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 32 | E1 |  | To specify conformance bitstreams for file format |

## Conformance for MMT

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 4 | E1 |  | To specify conformance bitstreams for MMT version 1 (23008-1) |

## Application Formats

### Conformance for ARAF

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| A | 14 | 1 |  | To provide examples validating the ARAF PROTOS. The examples are encapsulated in MPEG-4 files which can be played by an ARAF player. |

# Maintenance

## Systems coding standards

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **Cor** | **Req** | **Short description** |
|  |  |  |  | Collection of defect reports and development of corrigenda in the systems coding area |

## Video coding standards

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **Cor** | **Req** | **Short description** |
|  |  |  |  | Collection of defect reports and development of corrigenda in the video coding area |

## Audio coding standards

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **Cor** | **Req** | **Short description** |
|  |  |  |  | Collection of defect reports and development of corrigenda in the audio coding area |

## 3DG coding standards

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **Cor** | **Req** | **Short description** |
| 4 | 16 |  |  | Collection of defect reports and development of corrigenda in the 3DG coding area |

## Systems description coding standards

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **Cor** | **Req** | **Short description** |
| 7 | 1 |  |  | Collection of defect reports and development of corrigenda in the systems description coding area |

## Visual description coding standards

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **Cor** | **Req** | **Short description** |
| 7 | 3 |  |  | Collection of defect reports and development of corrigenda in the visual description coding area |

## Audio description coding standards

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **Cor** | **Req** | **Short description** |
| 7 | 4 |  |  | Collection of defect reports and development of corrigenda in the audio description coding area |

## MPEG-21 standards

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **Cor** | **Req** | **Short description** |
| 21 |  |  |  | Collection of defect reports and development of corrigenda for MPEG-21 standards |

## MPEG-A standards

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **Cor** | **Req** | **Short description** |
| A |  |  |  | Collection of defect reports and development of corrigenda for multimedia application standards |