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**Information technology — High  
efficiency coding and media delivery  
in heterogeneous environments —**

**Part 3:  
3D audio**

**AMENDMENT 1: MPEG-H, 3D audio  
profile and levels**

*Technologies de l'information — Codage à haute efficacité et livraison  
des médias dans des environnements hétérogènes —*

*Partie 3: Audio 3D*

*AMENDEMENT 1: Niveaux et profil audio 3D MPEG-H*

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# Information technology — High efficiency coding and media delivery in heterogeneous environments —

## Part 3: 3D audio

### AMENDMENT 1: MPEG-H, 3D audio profile and levels

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Add the following section after Clause 18.

#### **19 MPEG-H 3D Audio Profile Definition**

##### **19.1 Profile: Main Profile**

The Main Profile for MPEG-H 3D Audio contains all normative bitstream elements and normative decoder tools defined in MPEG-H 3D Audio specification.

That means that the following tools will be included Main Profile decoders:

- MPEG-H 3D Audio Core Decoder
- HOA Rendering
- SAOC 3D Renderer
- Static object metadata (MAE) and rendering
- Dynamic object metadata (OAM) and rendering
- Generic Loudspeaker Rendering/Format Conversion
- Immersive Loudspeaker Rendering/Format Conversion
- Binaural Rendering Time Domain and/or Frequency Domain
- H2B Binaural Rendering
- Loudness Metadata
- DRC processing

The following table specifies the levels of the *Main Profile*.

| MpegH3daProfileLevelIndication                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Applicable Notes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Max. number of core channels | Max. sampling rate of core | Max number of loudspeaker output channels | Max. PCU in wMOPSA | Max. RCU |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|----------------------------|-------------------------------------------|--------------------|----------|
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 8                            | 48000                      | 8                                         | 138                |          |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 16                           | 48000                      | 16                                        | 265                |          |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1) 2) 3)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 32                           | 48000                      | 24                                        | 448                |          |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1) 2) 3)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 64                           | 48000                      | 24                                        | 830                |          |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1) 2) 3)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 128                          | 96000                      | 64                                        | 3223               |          |
| General restrictions for all levels:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                              |                            |                                           |                    |          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <div><div>— HOA: The number of active predictions must not be larger than <math>\text{ceil}\left(\frac{(N+1)^2}{4}\right)</math> (NumActivePred in Table 127 Syntax of HOAPredictionInfo(DirSigChannelIds, NumOfDirSigs)). N is the HOA order. For the definition of global HOA parameters refer to 12.4.1.1.</div><div>— The HOA order must not be larger than 3 for Level 1, 4 for Level 2, 5 for Level 3, 6 for Level 4 and 7 for Level 5 (see HoaOrder in Table 119 Syntax of HOAConfig()).</div><div>— The number of input objects (for SAOC encoding) must not be larger than 2 times the maximum number of core coder channels</div><div>— The number of predominant sounds of HOA must not be larger than 8 for Level 1, 10 for Level 2, 12 for Level 3, 14 for Level 4, and 16 for Level 5.</div></div> |                              |                            |                                           |                    |          |
| Restrictions for specific levels:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                              |                            |                                           |                    |          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <div>1) SAOC: The maximum number of SAOC downmix channels is 32.</div> <div>SAOC objects must be grouped, i.e. a set of SAOC objects is mixed into a group of maximum of 8 downmix channels and not to any other downmix channel. IOCs must not be transmitted between SAOC objects different groups.</div> <div>2) The maximum number of channels in each group with SignalGroupTypeChannels is 24, multiple such groups can exist</div> <div>3) For DRC-1 and DRC-3 the maximum number of channel groups for each is 16.</div>                                                                                                                                                                                                                                                                                 |                              |                            |                                           |                    |          |
| Note:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                              |                            |                                           |                    |          |
| <div>Also, it is assumed that the both Binaural Renderers (TD and FD) are implemented. The total complexity may increase if only a single Binaural Renderer is available.</div> <div>The numbers for binaural processing are calculated on the basis of BRIR filters of 1 second length measured in a BS.1116 compliant room.</div> <div>a The maximum PCU numbers are based on theoretical calculations and estimations of the number of operations. They represent worst case total complexity numbers. All PCU figures are provided as informative data.</div> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                              |                            |                                           |                    |          |

### 19.1.1 Examples for Level 1 of Main Profile

Example 1:

8 input channels as a 7.1 mix are carried as channels and coded at a low bitrate. In the decoder a downmix is performed to 5.1 channels. Finally, a multi-band dynamic range compression is applied to the 6 loudspeaker output signals.

| Decoder building block | Core Coder channels         | Rendering    | Domain switch | DRC              | Post-processing | Total PCU in wMOPS |
|------------------------|-----------------------------|--------------|---------------|------------------|-----------------|--------------------|
| Description            | 8 (incl all tools) = 4 CPEs | 8 ch -> 6 ch | 6 ch FD-> TD  | multi-band DRC 2 | -none-          |                    |
| PCU                    | 46                          | 5            | 9             | 2.2              |                 | 62                 |

Example 2:

A 2<sup>nd</sup> order HOA signal is carried in 8 core coder channels and is decoded to produce 9 HOA components.

The H2B binaural processing is applied to render the signal for a headphone output. Single band dynamic range compression is applied to the output.

| Decoder building block | Core Coder channels                   | Rendering                                           | Domain switch                                | DRC             | Post-processing                            | Total PCU in wMOPS |
|------------------------|---------------------------------------|-----------------------------------------------------|----------------------------------------------|-----------------|--------------------------------------------|--------------------|
| Description            | 8 (including all tools) = 4SCE + 2CPE | 4 Amb + 4 PS (HOA rendering matrix 9x8 not applied) | 8 ch FD-> TD (if SBR, otherwise not applied) | DRC 2 full band | H2B-Binaural Rendering of 9 HOA components |                    |
| PCU                    | 12.6+21.6 = 34.2                      | 15                                                  | 12/0                                         | 0.5             | 21                                         | 82/70              |

### 19.1.2 Examples for Level 2 of Main Profile

Example 1:

A 4<sup>th</sup> Order Higher Order Ambisonics (HOA) signal is coded at about 500 kbit/s, so no SBR is applied. The output domain of the core decoder is time domain so no domain switch is necessary. The HOA spatial decoder reproduces a 4<sup>th</sup> order HOA signal which is rendered to a 11.1 loudspeaker setup.

| Decoder building block | Core Coder channels                    | Rendering                                              | Domain switch | DRC             | Post-processing | Total PCU in wMOPS |
|------------------------|----------------------------------------|--------------------------------------------------------|---------------|-----------------|-----------------|--------------------|
| Description            | 8 (including all tools) = 2CPE + 4 SCE | 4 Amb + 4 PS (HOA Decoding + Rendering to 11 Speakers) | -             | DRC 2 full band |                 |                    |
| PCU                    | 8+19.4=27.4                            | 24 + 13 = 37                                           | 0             | 0.5             | 0               | 65                 |

## Example 2:

A 4<sup>th</sup> Order Higher Order Ambisonics (HOA) signal is coded at about 250 kbit/s, so SBR is applied. The output domain of the core decoder is frequency domain and a domain switch is necessary. The HOA spatial decoder reproduces a 4<sup>th</sup> order HOA signal which is rendered to a 11.1 loudspeaker setup. Additionally 2 dialogue objects accompany the HOA scene.

| Decoder building block | Core Coder channels                               | Rendering                                                          | Domain switch  | DRC             | Post-processing | Total PCU in wMOPS |
|------------------------|---------------------------------------------------|--------------------------------------------------------------------|----------------|-----------------|-----------------|--------------------|
| Description            | 8 (HOA) = 2CPE + 4SCE plus<br>2 (Objects) = 2 SCE | 4 Amb + 4 PS (HOA Decoding + Rendering to 11 Speakers) + 2 Objects | 10 ch FD to TD | DRC 2 full band |                 |                    |
| PCU                    | 12.6 + 21.6 + 6.3 = 40.5                          | 24 + 13 + 2 = 39                                                   | 15             | 0.5             | 0               | 95                 |

## 19.1.3 Examples for Level 3 of Main Profile

## Example 1:

A 4<sup>th</sup> Order Higher Order Ambisonics (HOA) signal is coded at about 250 kbit/s, so SBR is applied. The output domain of the core decoder is frequency domain and a domain switch on the core coder transport channels is necessary. The HOA spatial decoder reproduces a 4<sup>th</sup> order HOA signal which is rendered to a 22.2 loudspeaker setup.

| Decoder building block | Core Coder channels        | Rendering                                              | Domain switch | DRC             | Post-processing | Total PCU in wMOPS |
|------------------------|----------------------------|--------------------------------------------------------|---------------|-----------------|-----------------|--------------------|
| Description            | 8 (HOA) = 2CPE + 4SCE plus | 4 Amb + 4 PS (HOA Decoding + Rendering to 22 Speakers) | 8 ch FD to TD | DRC 2 full band |                 |                    |
| PCU                    | 12.6 + 21.6 = 34.2         | 24 + 26 = 50                                           | 12            | 1               | 0               | 97                 |