

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

**Coding of moving pictures and audio**

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**Email of convenor: leonardo@chiariglione.org**

**Committee URL: mpeg.chiariglione.org**

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

**CODING OF MOVING PICTURES AND AUDIO**

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**Geneva, CH – Oct 2019**

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| **Source:** | **3DG** |
| **Title:** | **G-PCC Future Enhancements** |

The text for G-PCC (Geometry-based Point Cloud Compression) future enhancements is provided as the attachment.

# Abstract

[Ed. Notes (G-PCC future enhancements)]:

* accepted DoC changes (see w18895 )
* m51064 [G-PCC] Clarification and Modification of CD syntax and semantics
* m50745 [G-PCC] syntax modification for lifting attribute coding
* m51063 [G-PCC] EE13.5 Report on region-wise quantization control
* m50924 [G-PCC] EE13.6 report on geometry quantization
* m50927 [G-PCC][EE13.6 related] slice based geometry quantization
* m51160 [G-PCC] EE13.7 Report on Interchannel Prediction for Near lossless Coding
* m50741 [G-PCC] CE13.15 report on LoD generation for spatial scalability
* m50773 [G-PCC] CE13.20 report on neighbor’s weight modification on lifting and predicting scheme
* m51040 [G-PCC] CE 13.21 Report on RAHT Quantization
* m50008 [GPCC] CE13.22 report on planar coding mode
* m50921 [G-PCC] CE13.22 report on implicit QTBT partition
* m50922 [G-PCC][CE13.22 related] Harmonization of implicit QTBT and planar mode
* m50009 [GPCC] CE13.23 report on duplicated points in IDCM
* m50669 [G-PCC][New proposal]An improved context selection of a flag in attribute residuals coding
* m51025 [G-PCC][New proposal] G-PCC multi-frame sequence coding
* m51027 [G-PCC][New proposal] G-PCC geometry swizzling

[Ed. Notes (G-PCC Improvements)]:

* m49379 G-PCC CE13.10 report on bypass bin coding
* m49043 [G-PCC] CE13.15 report on LoD generation for spatial scalability
  + Could be part of a profile, e.g. introduce a flag
* m49380 G-PCC CE13.18 report on upsampled transform domain prediction in RAHT
  + Introduce APS depth flag to enable/disable DC prediction
* m49624 [G-PCC] CE13.19 Report on Attribute Layer Quantization Control
* m49144 [G-PCC][New proposal] An improved attribute coding method for low complexity application scenario
  + Rename “SearchRange” to “SearchRangeMinusOne” and update SW to not allow a search range of zero
* m49628 [G-PCC] On the unification of single-layer and multi-layer LoD in TMC13
  + subject of adding the additional condition. Edit the spec to make sure it is consistent.
* m49629 [G-PCC] Modification on LoD generation process in TMC13
  + Resolution: keep only ascending order.
* m49630 [G-PCC] On dependency issue of predicting transform in TMC13
  + Resolution: adopt (condition A is forced to be true).

[Ed. Notes (G-PCC CD)]:

* CE3.4 Tool 1 m46148: Adopt, Tool 2 m46149: Adopt, Tool 3 m46150: SW adoption
* CE13.2 Tool 1 m47398, m46491: Adopt syntax C
* CE13.6 Tool 1 m47402, m46107: Adopt
  + Allow to switch the tool on for certain LoDs , e.g. starting from layer X
* CE13.14 Tool 1 m47732, m44900: Adopt
* CE13.15 Tool 1 m47733, m46188: Adopt
  + Remove the binary LoD
* CE13.16 Tool 1 m47399, m46106
  + QP aspect
    - m47401 [G-PCC] Quantization Parameter table in Attribute Coding
    - m47507 [G-PCC] New contribution on quantization parameter definition
* CE13.17 Tool 1 m47403, m46108:
* m47405 [G-PCC] Bug report on binary tree based LoD and RAHT in TMC13

[Ed. Notes (WD G-PCC v5)]:

* occupancy contextualisation using adjacent child neighbours (m46482, CE3.4 Tool 1 from m44752 and CE3.4 Tool 2 from m44753)
* Tile/Slice HLS support (m45867, CE13.2 Tool 1 m42463: HLS aspect)
* known attribute support for the frame index for the combine frame coding (m46101, CE13.5 Tool 1 m44813: the attribute based approach)
* the simplified attributes prediction strategy for Lifting (m46189, CE13.6 Tool 1 m44899)
* fixed point RAHT (m46209, CE13.14 Tool 1 m44486)
* fixed point Trisoup (m46036, CE13.14 Tool 3 m44706)
* LOD generation using binary tree for Lifting (m45966, CE13.15 Tool 1 m44940)
* Morton code derivation clarification (m46245)
* modification on the update LUT in OBUF (m46402)
* general HLS cleanup (m46530)

[Ed. Notes (WD G-PCC v4)]:

* Optimized Lifting scheme with bottom-up LoD approach and approximation nearest neighbour search (m43781 CE13.1 tool 1)
* Adaptive predictor selection for Lifting scheme (m43665, m44804 CE13.6 tool 1)
* Introduce the entropy coding method used in the Dirac|VC-2 (m43649, m44882 CE13.10 tool 1)
* Intra prediction for the context in the geometry entropy coding (m43600, m44883 CE13.11 tool 1)
* Banalization scheme for attribute transform coefficients (m43780, m44896 CE13.12)
* Trisoup decoding simplification (m44706)
* Optimal Banalization with Update on the Fly (OBUF) for the geometry entropy coding (m44750)
* Banalization with adaptive look up table (A-LUT) for the geometry entropy coding (m43592)
* Contextualization to encode the 3 neighbour information (m44811)

[Ed. Notes (WD G-PCC v3)]:

* Change spec name from WDC13 to G-PCC (N17694)
* Introduce self-contained high level syntax structure (m43953)
* Trisoup syntax update (m43786)
* Optional restriction for neighbour-dependent entropy coding from CE3.4 (m43662)
* adaptive distance-based prediction scheme from CE 13.3 lossless and near-Lossless compression (m43587)
* Introduce look-ahead cube procedure and specify the volume where the search should be done. (m43591)
* having only binary coding from CE13.4 on banalisation of occupancy entropy coding (m43645)
* Encoding of attribute ranges in the header (m43387)

[Ed. Notes (WDC13v2)]:

* Used HEVC-DIS as a template
* Merged WD1of TMC3 and WD1 of TMC1 and accepted changes according to convergence between TMC1 and TMC3 (m42634)
* Added text from HEVC for general sections such as mathematical operations (track changes on)
* Added new abbreviations and definitions (track changes on)
* Few clean up (track changes on)
* Added highlights identifying TMC1 or 3 where relevant.
* Removal of CABAC section occasionally copied from the reference spec.
* mergeDuplicatedPoints signalling to the header (m42690)
* an empty placeholder profiles/levels section into the WD output documents (m42439)
* Syntax tables and semantics from the previous WDC1 and WDC3 are merged.
* bitstream syntax and semantics for RAHT (CE0.1, m42634/m42708)
* CE3.2 Part 2: inferred direct coding mode adopted (m42608)
* CE3.4 occupancy coding using neighbours adopted (m42609)