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# Abstract

In this document, we provide

* the scope of the exploratory experiment on low latency coding for mapping and automotive applications in G-PCC,
* the definition of low latency
* a description of the current exploratory model as proposed in m52515 [3],
* the evaluation process of proposed technologies in the exploratory experiment.

# Scope of the exploratory experiment on low latency for G-PCC

## Mandates

The mandates of this exploratory experiment are

* the refinement of the requirements associated with and the definition of a foreseen “low-latency” feature to become part of the Test Model
* the exploration of new tools for low latency for geometry coding and/or attribute coding.
* the assessment of the performance of the new tools against test model 13 (TMC13v9, see [1]), that has no low latency tools for now.
* the assessment of the performance of the new tools against an exploratory model TMC13v9+EMLLv0, that has low latency capability for geometry coding only, and is dedicated to the exploration work of this exploratory experiment.
* the integration of new low latency tools to the Exploratory Model after adoption by the GPCC group

As implicitly stated by the mandates, no tool that does not provide low latency, for either geometry coding or attribute coding, will be considered in the scope of this exploratory experiment. Proponents of low-latency unrelated tools are strongly encouraged to propose these tools directly for evaluation in the Test Model 13.

## EE 13.8 Coordinator

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# Definition of low latency

## Current understanding of low latency

This is the current understanding and definition of low latency to help discriminating low latency tools from non low-latency tools.

This definition applies to either geometry coding or geometry + attribute coding.

On the encoder side, low latency is defined as a limited end-to-end size of buffer of points from, on one end, receiving a point at the encoder input to, on the other end, outputting in a bitstream coded data sufficient to represent the 3D position and/or attributes of said point.

On the decoder side, low latency is defined as a limited end-to-end size of buffer of points from, on one end, receiving from the bitstream data sufficient to represent a coded point to, on the other end, outputting the decoded 3D position and/or attributes of said coded point.

By construction, low latency on the encoder side implies low latency on the decoder side with a decoding buffer size at most the size of the encoding buffer.

## Refinement of low latency definition

Several GPPC participants have raised their strong interest in a low-latency feature for the future GPPC standard. These participants are encouraged to help refining the definition and requirements associated with the low-latency feature, by providing in particular

* their definition of low latency for encoding or decoding or both
* their interest in low latency for encoding or decoding or both
* their interest in low latency for geometry coding only or for a combined geometry + attribute coding
* their interest in low latency for cat3-fused or for cat3-frame or both
* their interest in compatibility with other features like scalability, etc.
* quantification of associated requirements like, for examples, maximum size of point buffers, maximum delay between acquisition and encoding, maximum delay between decoding start and decoded point output, etc.

# The current Low Latency Exploratory Model

## Where to find the low latency model

The low latency exploratory model TMC13v9+EMLLv0 will be located in a Git repository at the following address:

<http://mpegx.int-evry.fr/software/MPEG/PCC/CE/mpeg-pcc-tmc13> mpeg129/ee13.8/anchor

It will be accessible under the same conditions and login as for test model TMC13v9. The repository will contain

* the source code,
* light documentation on how to run the low latency Exploratory Model, and
* test results of the low latency EM.

## List of integrated tools

The exploratory model TMC13v9+EMLLv0 is based on the test model TMC13v9 with the addition of the following tools to support low latency:

* predictive geometry coding (m52515),

The usage of the predictive geometry coding will be allowed by a dedicated flag, that can be enabled in the encoder command line, in order to replace the geometry coding method (octree) of the current TM.

On the encoder side, the exploratory model TMC13v9+EMLLv0 will use a buffer of points of size 512 points to demonstrate low latency on geometry coding. The size of this buffer will be tuneable by an entry parameter in the encoder command line.

Low-latency attribute coding will not be supported by the exploratory model.

# Methodology of evaluation using the exploratory model

## Anchors

Two anchors will be used to evaluate proposed low-latency tools using the exploratory model:

1. test model TMC13v9 under the CTC [2]
2. exploratory model TMC13v9+EMLLv0 using the low latency geometry option with a buffer size of 512 points

Tests will be performed using

* fused content from CTC category 3 (mapping)
* dynamic content from CTC category 3 (automotive)

## Basis for adoption in the exploratory model

In order for a low-latency tool to be adopted in the EM at the next MPEG meeting, a proponent should

* register an input contribution that describes the low latency tool,
* present the input contribution to the PCC group during the MPEG meeting,
* ensure that the results have been cross-checked, and
* take the responsibility of the integration of the C++ code integration in the EM in case of adoption.

The adoption is decided during the MPEG meeting based on the discussion in the PCC group after the presentation. Typical outcomes of the discussion are direct adoption, a request for further study or rejection. New low latency tools are directly integrated in the EM with a mandate to be studied in the EE. Adoption into the EM does not imply automatic adoption into a future edition of the standard.

# Timeline

* **2020-01-31**: Expected date for TMC13v9 release;
* **2020-02-07 [TMC13v9 + 1 week]**: Expected date for exploratory model TMC13v9 + EMLLv0 release including performance results and documentation;
* **2020-04-15**: MPEG document upload deadline.

# References

1. “*G-PCC Test Model v9*”, ISO/IEC JTC1/SC29/WG11 Doc. N19083, Brussels, Belgium, January 2020
2. “*Common Test Conditions for PCC*” ISO/IEC JTC1/SC29/WG11 N19084, Brussels, Belgium, January 2020
3. “*G-PCC CE13.22 report on predictive geometry coding*”, m52515, Apple