

Title: JCT-VC AHG report: Support for range extensions (AHG 7)

Status: Input Document to JCT-VC

Purpose: Ad-hoc group report

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Source: AHG 7

Abstract

This report summarizes the activities of Ad Hoc Group 7 on support for range extensions between the 11th and 12th JCT-VC meetings.

Mandates

The ad hoc group was mandated to:

- Study aspects of the technical design and develop software relating to the support of non-4:2:0 chroma formats and bit depths beyond 8 bits.
- Assist and advise in the work of removing any implicit assumptions of 8-bit depth and 4:2:0 formatting from the current draft and software (where feasible).
- Discuss and propose test conditions and test material for the development of the range extensions.
- Analyze and consider the implications of the use of square versus non-square transforms for 4:2:2 coding.
- Study techniques for colour conversion and resampling and their relationship to non-4:2:0 chroma coding.

Matters arising

A number of test sequences were made available according to the BoG recommendations of the previous meeting [?] and uploaded along with documentation of the conversion process to the uni-hannover ftp site:

<ftp://hevc@ftp.tnt.uni-hannover.de/testsequences/FrExt-candidate-sequences/>

We would like to thank the EBU for their kind contribution of a number of 4:2:2 and 4:4:4 test sequences.

The software development has been performed by creating an HM-range-extensions branch based upon the previous HM-8.0-ahg7-dev branch. To simplify development, the HM releases have been merged into the new branch as appropriate to keep the two systems from diverging.

The software revision r3055 (known as HM-9.0.1-rext-1.0) incorporates the recommendations from the previous meeting. Performance was evaluated against JM 18.4 anchors (See Tables ?? and ??) based upon the preferred configuration decided at the previous meeting [?].

A working draft text [?] has been produced and reintegrated into K1003_v13. One part is still pending integration. There are a number of parsing issues that the editors have identified which should be

addressed at this meeting. Some of these may be addressed in either version 1 or version 2.

Table 1: Performance of HM-9.0.1-rext-1.0 vs JM18.4 with 4:4:4 input

	Main-tier			High-tier		
	Y	Cb	Cr	Y	Cb	Cr
All Intra	-23.3 %	-20.4%	-25.2%	-23.5%	-22.8%	-28.1%
Random Access	-46.1 %	-51.6%	-51.5%	-44.3%	-49.0%	-56.5%
Low Delay B	-48.0 %	-56.9%	-61.2%	-44.4%	-50.3%	-56.1%

Table 2: Performance of HM-9.0.1-rext-1.0 vs JM18.4 with 4:2:2 input

	Main-tier			High-tier		
	Y	Cb	Cr	Y	Cb	Cr
All Intra	-21.0%	-15.7%	-17.2%	-17.8%	-14.9%	-18.7%
Random Access	-34.9%	-31.5%	-30.2%	-31.9%	-33.5%	-35.8%
Low Delay B	-38.9%	-30.9%	-32.2%	-31.6%	-30.1%	-34.8%

Contributions

A number of documents have been contributed, relating to a number of areas:

- Transform sizes. CE1 has a number of results addressing the question of non-square chroma transforms and how this impacts 4:2:2 and 4:4:4 conditions.
 - L0146[?], L0148[?], L0182[?], L0333[?] (cross-checks L0147[?], L0159[?], L0320[?], L0331[?], L0350[?], L0406[?])
 - L0149[?], L0150[?], L0151[?], L0351[?] (cross-check L0407[?], L0409[?] L0417[?])
 - The authors of L0332[?] provide an informative contribution examining the transform dynamic range and will update to include information for the non-square transform.
- Prediction. Modifications are proposed to the intra prediction process in L0112[?], L0128[?], L0129[?], L0176[?], L0370[?], L0240[?] (cross-checks, L0391[?], L0374[?], L0275[?], L0399[?]).
- Colour transforms. An adaptive in-loop colour-space transformation is proposed in L0371[?] (cross-checks L0124[?])
- Mixed chroma formats. Methods for handling of non-native chroma sampling formats in L0162[?], L0175[?], by changing the sampling format and conveying reconstruction filter information. An informative contribution, L0250[?], provides a use case for coding simultaneous mixed coding of two formats.
- In-loop filtering of chroma L0127[?] (cross-check L0373[?]).
- Possible issues with performance at higher bit-depths are presented in L0189[?] (informative).
- Transform design L0332
- Interlace 378
- Lossless coding 114 117 118 161

Recommendations

It is recommended to:

- Present the above documents,
- Resolve outstanding issues with the draft text