Title:	JCT-VC AHG report: Support for range extensions (AHG 7)
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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 10th and 11th 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, using J0191 and J0357 as the starting basis.

- 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).

- Consider needs for lossless coding and screen content coding support in the range extensions.

- Discuss and propose test conditions and test material for the development of the range extensions, using J0581 as the starting basis.

- Study techniques for colour conversion and resampling and their relationship to non-4:2:0 chroma coding, including consideration of techniques in J0127.

Matters arising

A number of test sequences were made available according to the BoG recommendations of the previous meeting [1] 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/

Unfortunately, no additional "native" 4:2:2 sequences were available, and as such, some 4:4:4 sequences were converted to 4:2:2.

A branch of HM-8.0 was made for the release of a combined software model for testing of merits between the J0191 and J0357 approaches. Performance was evaluated against JM 18.4 anchors (See Tables 1 and 2), and further testing by proponents has provided results of various choices.

An issue with RDOQ process under 4:2:2 conditions has been discovered shortly before the meeting causing a strong bias towards chroma.

Table 1: Performance of HM-8.0-ahg7-dev vs JM18.4 with 4:4:4 input

	Main			HE10		
	Y	Cb	Cr	Y	Cb	Cr
All Intra	-14.7%	-15.3%	-17.0%	-17.1%	-17.8%	-22.5%
Random Access	-29.8%	-43.4%	-40.5%	-33.0%	-47.3%	-47.9%
Low Delay B	-35.5%	-42.9%	-50.9%	-38.5%	-46.0%	-56.1%
Low Delay P	-35.5%	-42.9%	-50.9%	-38.5%	-46.0%	-56.1%

Table 2: Performance of HM-8.0-ahg7-dev vs JM18.4 with 4:2:2 input

	Main			HE10		
	Y	Cb	Cr	Y	Cb	Cr
All Intra	-14.0%	-25.2%	-28.7%	-16.0%	-27.8%	-32.4%
Random Access	-37.2%	-41.8%	-43.6%	-39.4%	-46.2%	-48.8%
Low Delay B	-42.6%	-39.9%	-41.0%	-44.8%	-44.4%	-46.8%
Low Delay P	-38.6%	-39.4%	-44.7%	-40.9%	-43.3%	-50.0%

Contributions

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

- Non-4:2:0 coding by extension of current design [2, 3, 4, 5], cross-check [6].
- New non-4:2:0 tools (not in current draft) [7, 8, 9, 10, 11, 12], cross-checks [13, 14, 15, 16].
- Lossless coding modes [17], cross-check [18].
- Deriving one sampling format from another [19, 20], cross-check [21].
- Test sequences [22, 23, 24].

Recommendations

It is recommended to:

- Present the above documents,
- Select a set of features to act as a baseline model for incorporation into HM-9 for further work.

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