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| **Joint Collaborative Team on Video Coding (JCT-VC)**  **of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29/WG 11**  24th Meeting: Geneva, CH, 26 May – 1 June 2016 | Document: JCTVC-X0035 |

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| *Title:* | **SHM encoder improvements for HDR verification testing** | | |
| *Status:* | Input Document from JCT-VC | | |
| *Purpose:* | Information | | |
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# Introduction

This document describes and includes SHM software changes to help choose HDR/WCG coding candidates for the dual-layer solution of similar quality to the single-layer solution. The modifications developed in the context of CE1 for HM and used for the generation of the so-called anchors 3.2 have been integrated for the enhancement layer on top of SHM-11.0.

# Description

In the context of the MPEG AhG on HDR/WCG and the subsequent work in JCT-VC, the capabilities of coding HDR/WCG content of HM have significantly improved. JCT-VC CE1 [1] produced several anchors, anchor 3.2 being the latest version. The addition of JCT-VC CE1 tools in SHM helped in comparison of the enhancement layer with the single-layer and in selection of candidates for testing against the single layer. Without these tools enabled, the variation in the quality compared to the single layer is much more within a picture. The patch for HM16.7 to generate anchor 3.2 can be found in [2] and has the following changes:

1. Average-luma controlled adaptive QP
2. Chroma QP offset
3. Setting correct VUI/SEI parameters for HDR10

These changes have been included for the enhancement layer on top of SHM-11.0. The base layer is not modified. Software was released to the JCT-VC reflector on April 25th including changes 1 and 2 above. The software also including change 3 was released on May 4th, which only introduces few additional bits (signalling of some VUI parameters and mastering display colour volume information SEI).

Included in this proposal are the configuration files. Instructions are in Annex A.

# Results

The proposed software changes have been tested and verified. Included in the proposal are the results obtained using the anchor 3.2 pre- and post-processing with the CTC described in [3] for the enhancement layer and the SDR for the base layer. Some of the SDR sequences are obtained by manual grading, while some of the other sequences have been obtained by automated grading process. SDR sequences are available as described in the MPEG HDR CfE document [4] or the JCTVC ftp in the directory /testsequences/candidates/hdr. The base layer is coded in the BT.2020 container.

Table 1: BD-rate (Test BL+EL vs Ref BL+EL)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test vs SHVC** | tPSNR X | tPSNR Y | tPSNR Z | tPSNR XYZ | tOSNR-XYZ | DE100 | MD100 | PSNRL100 | Y psnr | U psnr | V psnr | YUV psnr |
| Class A | 6.6% | 8.2% | 5.4% | 6.6% | 5.3% | -3.7% | -32.8% | 1.6% | 20.2% | 6.0% | -10.7% | 20.2% |
| Class G | -2.5% | 4.8% | -10.5% | -4.7% | -9.4% | -20.9% | -22.9% | -0.3% | 6.1% | -19.0% | -31.5% | 2.9% |
| EBU | -0.1% | 13.4% | -10.8% | -1.2% | -1.7% | -25.8% | 21.3% | 11.4% | 13.3% | -35.5% | -46.0% | 9.4% |
| Class A | 8.3% | 9.0% | 6.1% | 7.9% | 7.3% | 1.9% | -27.5% | 3.0% | 21.4% | 10.8% | 0.6% | 21.2% |
| Class C | 10.1% | 12.8% | 3.9% | 9.0% | 4.0% | -8.0% | 51.3% | 0.7% | 14.7% | -1.6% | -3.3% | 11.5% |
| Class D | 5.4% | 5.6% | 3.8% | 4.6% | 4.4% | -1.5% | 4.0% | -0.4% | 5.9% | 33.5% | 8.1% | 7.9% |
| Class G | -0.3% | 5.5% | -9.4% | -3.0% | -10.0% | -23.6% | -15.8% | -2.5% | 6.9% | -21.7% | -32.1% | 3.8% |
| **Average** | **3.9%** | **8.5%** | **-1.7%** | **2.7%** | **0.0%** | **-11.7%** | **-3.2%** | **1.9%** | **12.6%** | **-3.9%** | **-16.4%** | **11.0%** |

Table 2: BD-rate (Test EL vs EL)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test vs SHVC** | tPSNR X | tPSNR Y | tPSNR Z | tPSNR XYZ | tOSNR-XYZ | DE100 | MD100 | PSNRL100 | Y psnr | U psnr | V psnr | YUV psnr |
| Class A | 6.9% | 9.6% | 3.6% | 6.4% | 3.8% | -11.1% | -45.7% | 2.5% | 18.2% | -10.6% | -27.7% | 17.4% |
| Class G | 33.8% | 48.8% | 16.7% | 28.9% | 19.9% | -3.1% | -5.0% | 39.8% | 51.4% | -6.2% | -26.4% | 44.9% |
| EBU | 148.9% | 172.7% | 119.0% | 142.9% | 139.5% | 84.2% | 210.0% | 167.7% | 171.1% | 42.5% | 26.3% | 162.9% |
| Class A | 16.3% | 17.3% | 13.7% | 15.8% | 14.2% | 4.5% | -44.3% | 10.3% | 27.2% | 7.3% | -3.7% | 26.8% |
| Class C | -11.4% | -9.0% | -16.8% | -12.3% | -17.0% | -28.3% | 22.2% | -20.9% | -7.2% | -22.1% | -24.0% | -9.7% |
| Class D | -63.2% | -63.3% | -63.0% | -62.9% | -63.3% | -66.4% | -61.2% | -66.1% | -63.2% | -51.5% | -63.5% | -62.1% |
| Class G | 7.9% | 16.2% | -5.4% | 4.0% | -5.9% | -24.9% | -11.9% | 5.1% | 18.3% | -25.1% | -38.1% | 14.2% |
| **Average** | **19.9%** | **27.5%** | **9.7%** | **17.5%** | **13.0%** | **-6.5%** | **9.2%** | **19.8%** | **30.8%** | **-9.4%** | **-22.5%** | **27.8%** |

# References

1. J. Strom, J. Sole, Y. He, “Report of HDR Core Experiment 1”, JCTVC-W0021, San Diego, USA, Feb. 2016
2. http://wg11.sc29.org/content/Explorations/HDR/CEs\_Software\_113/CE1/, package updatedCTCsPackage\_20160127.zip
3. E. Francois, J. Sole, P. Yin, J. Ström, “Updated Common Test Conditions for HDR/WCG Video Coding Experiments”, JCTVC-W1020, San Diego, USA, Feb. 2016
4. A. Luthra, E. Francois, W. Husak, “Call for Evidence (CfE) for HDR and WCG Video Coding”, m15083, Geneva, CH, Feb. 2015.

### Annex A

To run the encoder:

TAppEncoderStatic -c encoder\_SRA\_m10\_vui.cfg -c layers\_vui\_sei.cfg -c SeqCommon.cfg

Sequence-specific encoder line parameters:

-i0 SDRYUVFILENAME -i1 HDRYUVFILENAME -f FRAMENUM -ip0 SEQIP -ip1 SEQIP -q0 BLQP -q1 ELQP -fr0 SEQFR -fr1 SEQFR -b str.bin

Additional encoder line parameters

CbQpScale1=cbqpsc

CrQpScale1=crqpsc

ChromaQpScale1=-0.46

ChromaQpOffset1=9.26

LumaDeltaQP1=1

Where, for P3 gamut set cbqpsc = 1.04 and crqpsc = 1.39, and for 709 gamut, set cbqpsc = 1.14 and crqpsc = 1.79

To run the decoder, use:

TAppDecoderStatic -b str.bin -o1 ELDECYUV