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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**  23rd Meeting: San Diego, USA, 19–26 February 2016 | Document: JCTVC-W0112 / m37857 |

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| *Title:* | **HDR CE2: crosscheck of** **CE2.a-2, CE2.c, CE2.d and CE2.e-3 (JCTVC-W0084)** | | |
| *Status:* | Input Document to JCT-VC | | |
| *Purpose:* | Information | | |
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| *Source:* | Technicolor | | |

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# Abstract

This document reports the cross-checking of core experiment HDR CE2.a-2, CE2.c, CE2.d and CE2.e-3, described in document JCTVC-W0084. It is reported that objective results are perfectly matching. It is also reported that the overall visual quality compared to the anchors is improved. Some comments on the differences of bitrate repartition compared to the anchors are also made.

# Introduction

The proposal JCTVC-W0084 provides the results of a combination of HDR CE2 subtests: CE2.a-2 on luma forward reshaping improvement, CE2.c on chromaQPOffset, CE2.d on DeltaQP adjustment for luma, and CE2.e-3 on automatic selection of ETM parameters.

The aim of this document is to report the objective cross-check and subjective assessment of JCTVC-W0084 results, compared to the HDR CE1 - v3.2 anchors. In addition, some observations about the differences in bitrate distribution between the anchors and the proposal are made.

# Compression performance

## Objective results

No compilation issue has been identified for the distributed modified HDRTools and HM software. Simulations have been achieved on linux platform. Table 1 lists the cross-checking simulation results of CE2.a-2, CE2.c, CE2.d and CE2.e-3. They match the results provided by proponents.

Table 1. CE2.1.2a results compared to CE1 - V3.2 anchor.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | X | Y | Z | XYZ | tOSNR-XYZ | DE100 | MD100 | PSNRL100 |
| FireEaterClip4000r1 | 1.9% | 7.1% | -6.8% | 1.0% | 0.0% | -6.3% | -17.7% | 3.4% |
| Market3Clip4000r2 | 3.4% | 3.6% | 1.6% | 2.8% | -1.0% | 12.8% | -80.3% | -10.8% |
| SunRise | 4.7% | 6.6% | 3.1% | 4.7% | 4.9% | 34.4% | -40.4% | 0.4% |
| BikeSparklers cut 1 | -5.5% | -6.3% | -2.9% | -4.7% | -9.6% | -7.9% | -27.2% | -0.6% |
| BikeSparklers cut 2 | -3.1% | -3.7% | -1.4% | -2.6% | -7.4% | -2.9% | -45.3% | 0.0% |
| GarageExit | 7.0% | 6.4% | 11.1% | 8.3% | 5.6% | 11.7% | 0.3% | 3.3% |
| ShowGirl2Teaser | 10.7% | 12.8% | 11.9% | 11.7% | 16.1% | -4.9% | -2.8% | -0.3% |
| StEM\_MagicHour cut 1 | -2.9% | 0.0% | 1.0% | -0.1% | -1.2% | -10.2% | 0.6% | -0.9% |
| StEM\_MagicHour cut 2 | -0.9% | 0.8% | 2.3% | 1.2% | 0.7% | -7.6% | -5.0% | 0.2% |
| StEM\_MagicHour cut 3 | -0.5% | 1.1% | 3.6% | 2.1% | 1.9% | -5.5% | 23.2% | 0.0% |
| StEM\_WarmNight cut 1 | 8.7% | 10.5% | 1.4% | 6.3% | 4.1% | -11.9% | 1.3% | -4.2% |
| StEM\_WarmNight cut 2 | 2.1% | 4.4% | -4.6% | -0.2% | 2.9% | -12.8% | -29.3% | -2.0% |
| BalloonFestival | 14.9% | 19.4% | 9.1% | 13.7% | 9.2% | 19.0% | -21.9% | -5.1% |
| EBU\_04\_Hurdles | 2.9% | -1.4% | 1.4% | 0.9% | -2.6% | 28.5% | 64.9% | -11.0% |
| EBU\_06\_Start | 13.6% | 10.1% | 6.9% | 9.9% | 6.2% | 50.3% | -17.0% | -5.7% |
| **Overall** | 3.8% | 4.8% | 2.5% | 3.7% | 2.0% | 5.8% | -13.1% | -2.2% |

## Subjective results

According to HDR CE2 plan, subjective viewing was conducted, on SIM2 display. The evaluation was performed in priority in video mode, then in still picture mode to assess more specific details.

Compared to the CE1 - V3.2 anchors, the visual quality is better on the following sequences:

* BalloonFestival : Sharper on mountain, better on rope
* BikeSparklers (cut1, cut2) : Sharper everywhere (roof, ground)
* Hurdles : Racetrack sharper
* Starting : sharper on Grass, red line, roof, cameras, rope and pylon
* Market : wall and tower

Compared to the CE1 - V3.2 anchors, the visual quality is slightly better on the following sequences (mostly when viewing in still picture mode, the difference being rather difficult to catch in video mode):

* Showgirl (face)
* Stem\_MagicHour (cut1, cut2,cut3) : Slightly sharper
* Stem\_WramNight (cut1, cut2) : Slightly sharper
* garageExit : faces and ropes

Finally, an equivalent quality with the anchors is observed on:

* FireEater
* SunRise

In conclusion the visual quality is globally better than HDR CE1 - v3.2 anchors.

## Temporal bit cost evolution compared to the anchors

An analysis of the bitrate repartition has also been made to check the differences compared to the anchors. The figures below depict some examples of the bit cost difference, per frame, with the anchor, on different sequences and for rate R2. As in other CEs, it is observed that the solution generates different bitrate distribution than the anchors.

In particular it seems that more bits are spent on intra pictures with the proposal. One possible explanation is that the proposed reshaping by itself results in distributing more bits in intra pictures, because of a larger use of codewords range, which is then compensated by a lower cost spent for inter pictures. The improvement of the intra frames quality generally leads to a quality improvement on the entire sequence, especially for sequences with low amplitude global motion. The bitrate repartition actually strongly depends on the automatic reshaping function and on the way the codewords are redistributed by the reshaping.

Figure 1. Bit cost difference with anchors, per frame.

# References

# Taoran Lu, Fangjun Pu, Peng Yin, Tao , “HDR CE2: CE2.a-2, CE2.c, CE2.d and CE2.e-3 “document ISO/IEC JTC 1/SC 29/WG 11 , 23rd Meeting: San Diego, USA, 19–26 February 2016

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