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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-W0032 |

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| *Title:* | **Encoder optimization for HDR/WCG coding** | | |
| *Status:* | Input Document to JCT-VC | | |
| *Purpose:* | Proposal | | |
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# Abstract

This proposal reports the testing results for two encoder optimization methods for HDR/WCG coding: deblocking filter parameter selection, and chroma quantization parameter offset adjustment based on CE1 anchor version 3.0. These two encoder optimization methods were proposed in last meeting. Viewing results on SIM2 show that, compared to CE1 anchors, quality improvements can be observed: more details and less blocky artifacts, and the quality improvements are more visible at low bitrate.

# Introduction

Three encoder optimization methods were proposed in m37223 [1]. They were requested to be tested based on the new CE1 anchor [2]. We integrated the two methods: deblocking filter parameter selection and chroma quantization parameter (QP) offset adjustment based on CE1 anchor V3.0 released on Nov. 21, 2015.

The deblocking filter parameter selection is to select the optimal deblocking parameters to minimize the distortion between deblocked picture and original picture.

The chroma QP offset adjustment is to adjust the chroma QP offset calculated with sequence level luma QP by considering the temporal level: allocating more bits to pictures at lower temporal level than to those at higher temporal level. The chroma QP adjustment in anchor V3.0 is computed as follows:

QPc\_offset = S2\*(S1\*QP + O)

where QP is sequence level luma QP, and QPc\_offset is chroma QP offset. S2/S1 and O are the scaling factor and offset applied in CE1 anchor.

We add an additional QPc\_adj to CE1 anchor V3.0 based on TL\_Idx, the temporal level index:

QPc\_offset = S2\*(S1\*QP + O) + QPc\_adj(TL\_Idx)

The chroma QP QPc is calculated as:

QPc = QP + Clip(-12, 0, QPc\_offset)

The chroma QP offset adjustment QPc\_adj(TL\_Idx) for Cb and Cr components used in the simulation is shown in Figure 1.



Figure 1. The chroma QP offset adjustment used in the simulation

# Simulation results

Two tests were performed:

Test1: deblocking filter parameter selection + chroma QP offset adjustment;

Test2: deblocking filter parameter selection only.

Table 1 and Table 2 list the results of Test1 and Test2 compared to CE1 anchor V3.0, respectively. Subjective viewing was conducted by the proponents on SIM2 display. Compared to the CE1 anchor V3.0, quality improvement in terms of more details and less blocky artifacts was observed especially for the following sequences for Test1: SunRise, WarmNight, BalloonFestival, BikeSparklers, ShowGirl in continuous playback, and Market in toggle mode. The improvement is more visible at lowest bitrate.

The quality improvement was observed especially for the following sequences for Test2 at lowest bitrate: WarmNight, BikeSparklers, ShowGirl.

Table 1. Test1 compared to CE1 anchor V3.0

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | X | Y | Z | XYZ | tOSNR-XYZ | DE100 | PSNRL100 |
| class A | FireEaterClip4000r1 | 1.1% | -0.8% | 9.3% | 2.6% | 5.3% | 6.0% | -0.3% |
|  | Market3Clip4000r2 | -1.0% | -1.2% | 2.7% | 0.3% | 0.9% | 11.6% | -1.5% |
|  | SunRise | -1.1% | -1.1% | 2.5% | 0.3% | 1.6% | 7.4% | -0.9% |
| class B | BikeSparklers cut 1 | -3.0% | -3.5% | 6.6% | 0.0% | 0.3% | 8.4% | -3.3% |
|  | BikeSparklers cut 2 | -2.7% | -3.6% | 8.3% | 0.2% | 0.9% | 11.0% | -3.3% |
|  | GarageExit | -1.7% | -2.5% | 7.0% | 1.2% | 2.3% | 12.8% | -2.3% |
| class C | ShowGirl2Teaser | -0.9% | -1.3% | 4.7% | 0.8% | 3.1% | 9.3% | -1.1% |
| class D | StEM\_MagicHour cut 1 | -0.8% | -1.2% | 4.9% | 1.8% | 2.1% | 5.1% | -1.1% |
|  | StEM\_MagicHour cut 2 | -1.3% | -2.1% | 5.4% | 1.6% | 2.4% | 10.0% | -1.8% |
|  | StEM\_MagicHour cut 3 | -0.7% | -1.8% | 6.2% | 2.4% | 3.0% | 9.5% | -1.6% |
|  | StEM\_WarmNight cut 1 | -0.6% | -1.1% | 4.1% | 1.2% | 1.7% | 6.1% | -1.0% |
|  | StEM\_WarmNight cut 2 | -0.6% | -1.1% | 5.0% | 1.7% | 2.1% | 3.7% | -1.1% |
| class G | BalloonFestival | -1.0% | -2.1% | 6.0% | 1.6% | 3.2% | 11.7% | -2.1% |
| class H | EBU\_04\_Start | -1.7% | -2.5% | 4.3% | 0.6% | 1.7% | 17.5% | -2.3% |
|  | EBU\_06\_Hurdles | -2.4% | -3.2% | 4.4% | 0.0% | 0.6% | 11.7% | -3.1% |
|  | **Overall** | -1.2% | -1.9% | 5.4% | 1.1% | 2.1% | 9.5% | -1.8% |

Table 2. Test2 compared to CE1 anchor V3.0

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | X | Y | Z | XYZ | tOSNR-XYZ | DE100 | PSNRL100 |
| class A | FireEaterClip4000r1 | -0.1% | -0.2% | -0.5% | -0.2% | -0.2% | 0.0% | -0.2% |
|  | Market3Clip4000r2 | -0.4% | -0.4% | -0.5% | -0.4% | -0.6% | 0.1% | -0.6% |
|  | SunRise | -0.7% | -0.7% | -0.3% | -0.5% | -0.4% | 1.6% | -0.6% |
| class B | BikeSparklers cut 1 | -0.7% | -0.7% | -0.7% | -0.7% | -0.5% | -0.5% | -0.4% |
|  | BikeSparklers cut 2 | -0.6% | -0.7% | -1.1% | -0.8% | -0.6% | -0.4% | -0.4% |
|  | GarageExit | -0.3% | -0.2% | -0.5% | -0.3% | -0.2% | -0.2% | -0.1% |
| class C | ShowGirl2Teaser | -0.3% | -0.2% | -0.9% | -0.5% | 0.0% | -0.1% | -0.2% |
| class D | StEM\_MagicHour cut 1 | -0.3% | -0.2% | 0.0% | -0.2% | -0.1% | 0.1% | -0.1% |
|  | StEM\_MagicHour cut 2 | -0.9% | -0.8% | -0.5% | -0.7% | -0.6% | -0.5% | -0.6% |
|  | StEM\_MagicHour cut 3 | -0.6% | -0.6% | 0.3% | -0.1% | 0.1% | 0.0% | -0.3% |
|  | StEM\_WarmNight cut 1 | -0.4% | -0.4% | -0.2% | -0.3% | -0.3% | 0.0% | -0.2% |
|  | StEM\_WarmNight cut 2 | 0.0% | -0.1% | 0.3% | 0.1% | 0.1% | 0.4% | 0.0% |
| class G | BalloonFestival | -0.3% | -0.4% | -0.3% | -0.3% | -0.3% | -0.3% | -0.2% |
| class H | EBU\_04\_Start | -0.6% | -0.4% | -0.5% | -0.5% | -0.3% | -0.5% | -0.2% |
|  | EBU\_06\_Hurdles | -0.5% | -0.4% | -0.3% | -0.4% | -0.4% | -0.2% | -0.4% |
|  | **Overall** | -0.5% | -0.4% | -0.4% | -0.4% | -0.3% | 0.0% | -0.3% |

All results will be prepared for viewing during the interim meeting.

# Patent rights declaration(s)

**InterDigital Communications, Inc. may have IPR relating to the technology described in this contribution and, conditioned on reciprocity, is prepared to grant licenses under reasonable and non-discriminatory terms as necessary for implementation of the resulting ITU-T Recommendation | ISO/IEC International Standard (per box 2 of the ITU-T/ITU-R/ISO/IEC patent statement and licensing declaration form).**

# References

1. Y. He, Y. Ye, L. Kerofsky, A. Vosoughi, “Encoder optimization for HDR/WCG coding”, m37223, Geneva, CH, Oct. 2015
2. J. Strom, J. Sole, Y. He, “HDR CE1: Optimization without HEVC Specification Change”, m37501, Geneva, CH, Oct. 2015.