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| --- | --- | --- | --- |
| *Title:* | **Crosscheck of CE2 Test 6.1** | | |
| *Status:* | Input Document to JCT-VC | | |
| *Purpose:* | Report | | |
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# Abstract

This document reports a crosscheck summary for the methods and results in CE2 Test 6.1 (JCTVC-T0040). The source code provided by the proponents was verified to be consistent with the description in CE2 document. The rate-distortion performance was evaluated for CE2 test conditions JCTVC-S1102 and matches the one provided in JCTVC-T0040.

# Introduction

JCTVC-T0040 [1] describes a technique where the block vector predictor candidate list construction is changed. The two spatial candidates in SCM-3.0 are replaced using 5 spatial merge candidates in HEVC. The other parts of the BVP in SCM-3.0 remain the same. An encoder optimization is also proposed to use full RDO check for the non-constant BV predictors.

# Simulation results

The performance of the CE2 [2] test 6.1 is cross-checked according to CE2 test conditions [3] and is summarized below. The detailed results can be found in the attached excel datasheets.

Table 1. Average BD rate reduction for Test 6.1 Test 1 444 lossless coding

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **All Intra** | | | |
|  | Bit-rate change (Total) | Bit-rate change (Average) | Bit-rate change (Min) | Bit-rate change (Max) |
|  |
| RGB, text & graphics with motion, 1080p & 720p | -0.9% | -1.1% | -3.4% | -0.1% |
| RGB, mixed content, 1440p & 1080p | -1.5% | -1.3% | -2.4% | -0.3% |
| RGB, Animation, 720p | 0.0% | 0.0% | 0.0% | 0.0% |
| RGB, camera captured, 1080p | 0.0% | 0.0% | 0.0% | 0.0% |
| YUV, text & graphics with motion, 1080p & 720p | -0.4% | -0.5% | -0.9% | 0.0% |
| YUV, mixed content, 1440p & 1080p | -1.2% | -1.1% | -2.2% | -0.1% |
| YUV, Animation, 720p | 0.0% | 0.0% | 0.0% | 0.0% |
| YUV, camera captured, 1080p | 0.0% | 0.0% | 0.0% | 0.0% |
| Enc Time[%] | 123% | | | |
| Dec Time[%] | 101% | | | |
|  |  |  |  |  |
|  | **Random Access** | | | |
|  | Bit-rate change (Total) | Bit-rate change (Average) | Bit-rate change (Min) | Bit-rate change (Max) |
|  |
| RGB, text & graphics with motion, 1080p & 720p | -0.7% | -0.8% | -2.0% | -0.1% |
| RGB, mixed content, 1440p & 1080p | -0.2% | -0.3% | -0.5% | 0.0% |
| RGB, Animation, 720p | 0.0% | 0.0% | 0.0% | 0.0% |
| RGB, camera captured, 1080p | 0.0% | 0.0% | 0.0% | 0.0% |
| YUV, text & graphics with motion, 1080p & 720p | -0.5% | -0.6% | -1.8% | -0.1% |
| YUV, mixed content, 1440p & 1080p | -0.2% | -0.2% | -0.4% | 0.0% |
| YUV, Animation, 720p | 0.0% | 0.0% | 0.0% | 0.0% |
| YUV, camera captured, 1080p | 0.0% | 0.0% | 0.0% | 0.0% |
| Enc Time[%] | 102% | | | |
| Dec Time[%] | 98% | | | |
|  |  |  |  |  |
|  |  |  |  |  |
|  | **Low Delay B** | | | |
|  | Bit-rate change (Total) | Bit-rate change (Average) | Bit-rate change (Min) | Bit-rate change (Max) |
|  |
| RGB, text & graphics with motion, 1080p & 720p | -0.6% | -0.8% | -2.6% | -0.1% |
| RGB, mixed content, 1440p & 1080p | -0.1% | -0.1% | -0.2% | 0.0% |
| RGB, Animation, 720p | 0.0% | 0.0% | 0.0% | 0.0% |
| RGB, camera captured, 1080p | 0.0% | 0.0% | 0.0% | 0.0% |
| YUV, text & graphics with motion, 1080p & 720p | -0.5% | -0.7% | -2.4% | 0.0% |
| YUV, mixed content, 1440p & 1080p | -0.1% | -0.1% | -0.2% | 0.0% |
| YUV, Animation, 720p | 0.0% | 0.0% | 0.0% | 0.0% |
| YUV, camera captured, 1080p | 0.0% | 0.0% | 0.0% | 0.0% |
| Enc Time[%] | 101% | | | |
| Dec Time[%] | 102% | | | |

Table 2. Average BD rate reduction for Test 6.1 Test 1 444 lossy coding

|  |  |  |  |
| --- | --- | --- | --- |
|  | **All Intra** | | |
|  | G/Y | B/U | R/V |
| RGB, text & graphics with motion, 1080p & 720p | -1.3% | -1.3% | -1.3% |
| RGB, mixed content, 1440p & 1080p | -1.2% | -1.4% | -1.4% |
| RGB, Animation, 720p | -0.1% | -0.1% | -0.1% |
| RGB, camera captured, 1080p | 0.0% | 0.0% | 0.0% |
| YUV, text & graphics with motion, 1080p & 720p | -1.4% | -1.4% | -1.3% |
| YUV, mixed content, 1440p & 1080p | -1.1% | -1.0% | -1.1% |
| YUV, Animation, 720p | -0.2% | -0.3% | -0.3% |
| YUV, camera captured, 1080p | 0.0% | 0.0% | 0.0% |
| Enc Time[%] | 131% | | |
| Dec Time[%] | 100% | | |
|  |  |  |  |
|  | **Random Access** | | |
|  | G/Y | B/U | R/V |
| RGB, text & graphics with motion, 1080p & 720p | -1.3% | -1.3% | -1.3% |
| RGB, mixed content, 1440p & 1080p | -0.8% | -1.0% | -1.0% |
| RGB, Animation, 720p | 0.0% | 0.1% | 0.0% |
| RGB, camera captured, 1080p | 0.0% | 0.0% | 0.0% |
| YUV, text & graphics with motion, 1080p & 720p | -1.5% | -1.5% | -1.5% |
| YUV, mixed content, 1440p & 1080p | -1.0% | -0.9% | -1.0% |
| YUV, Animation, 720p | -0.1% | -0.2% | 0.1% |
| YUV, camera captured, 1080p | 0.0% | 0.0% | -0.1% |
| Enc Time[%] | 102% | | |
| Dec Time[%] | 97% | | |
|  |  |  |  |
|  | **Low delay B** | | |
|  | G/Y | B/U | R/V |
| RGB, text & graphics with motion, 1080p & 720p | -1.1% | -1.0% | -1.1% |
| RGB, mixed content, 1440p & 1080p | -0.6% | -0.5% | -0.7% |
| RGB, Animation, 720p | 0.0% | -0.1% | -0.1% |
| RGB, camera captured, 1080p | 0.1% | 0.0% | 0.0% |
| YUV, text & graphics with motion, 1080p & 720p | -1.2% | -1.2% | -1.3% |
| YUV, mixed content, 1440p & 1080p | -1.0% | -0.9% | -0.8% |
| YUV, Animation, 720p | 0.0% | 0.3% | 0.1% |
| YUV, camera captured, 1080p | 0.0% | 0.0% | -0.1% |
| Enc Time[%] | 101% | | |
| Dec Time[%] | 99% | | |

Table 3. Average BD rate reduction for Test 6.1 Test 1 420 lossless coding

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **All Intra** | | | |
|  | Bit-rate change (Total) | Bit-rate change (Average) | Bit-rate change (Min) | Bit-rate change (Max) |
|  |
| Text & graphics with motion, 720p | -0.9% | -0.9% | -1.0% | -0.8% |
| Mixed content, 480p | -0.1% | -0.1% | -0.1% | -0.1% |
| Animation, 768p | 0.0% | 0.0% | 0.0% | 0.0% |
| Average of all sequences | -0.3% | -0.5% | -1.0% | 0.0% |
| Enc Time[%] | 110% | | | |
| Dec Time[%] | 98% | | | |
|  |  |  |  |  |
|  | **Random Access** | | | |
|  | Bit-rate change (Total) | Bit-rate change (Average) | Bit-rate change (Min) | Bit-rate change (Max) |
|  |
| Text & graphics with motion, 720p | -0.3% | -0.4% | -0.7% | -0.2% |
| Mixed content, 480p | 0.0% | 0.0% | 0.0% | 0.0% |
| Animation, 768p | 0.0% | 0.0% | 0.0% | 0.0% |
| Average of all sequences | 0.0% | -0.2% | -0.7% | 0.0% |
| Enc Time[%] | 99% | | | |
| Dec Time[%] | 98% | | | |
|  |  |  |  |  |
|  | **Low Delay B** | | | |
|  | Bit-rate change (Total) | Bit-rate change (Average) | Bit-rate change (Min) | Bit-rate change (Max) |
|  |
| Text & graphics with motion, 720p | 0.0% | 0.0% | 0.0% | 0.0% |
| Mixed content, 480p | 0.0% | 0.0% | 0.0% | 0.0% |
| Animation, 768p | 0.0% | 0.0% | 0.0% | 0.0% |
| Average of all sequences | 0.0% | 0.0% | 0.0% | 0.0% |
| Enc Time[%] | 98% | | | |
| Dec Time[%] | 97% | | | |

Table 4. Average BD rate reduction for Test 6.1 Test 1 420 lossy coding

|  |  |  |  |
| --- | --- | --- | --- |
|  | **All Intra** | | |
|  | G/Y | B/U | R/V |
| Text & graphics with motion, 720p | -2.3% | -2.5% | -2.3% |
| Mixed content, 480p | -0.4% | -0.4% | -0.4% |
| Animation, 768p | -0.2% | -0.3% | -0.2% |
| Average of all sequences | -1.3% | -1.4% | -1.3% |
| Enc Time[%] | 111% | | |
| Dec Time[%] | 96% | | |
|  |  |  |  |
|  | **Random Access** | | |
|  | G/Y | B/U | R/V |
| Text & graphics with motion, 720p | -1.4% | -1.5% | -1.4% |
| Mixed content, 480p | -0.2% | 0.0% | -0.3% |
| Animation, 768p | -0.1% | -0.4% | 0.0% |
| Average of all sequences | -0.8% | -0.8% | -0.8% |
| Enc Time[%] | 100% | | |
| Dec Time[%] | 97% | | |
|  |  |  |  |
|  | **Low delay B** | | |
|  | G/Y | B/U | R/V |
| Text & graphics with motion, 720p | -0.7% | -1.5% | -1.9% |
| Mixed content, 480p | 0.2% | 0.3% | 0.6% |
| Animation, 768p | -0.1% | 0.0% | -0.3% |
| Average of all sequences | -0.3% | -0.7% | -0.9% |
| Enc Time[%] | 99% | | |
| Dec Time[%] | 92% | | |

Table 5. Average BD rate reduction for Test 6.1 Test 2 444 lossless coding

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **All Intra** | | | |
|  | Bit-rate change (Total) | Bit-rate change (Average) | Bit-rate change (Min) | Bit-rate change (Max) |
|  |
| RGB, text & graphics with motion, 1080p & 720p | -0.6% | -0.8% | -3.0% | 0.0% |
| RGB, mixed content, 1440p & 1080p | -1.3% | -1.2% | -2.1% | -0.2% |
| RGB, Animation, 720p | 0.0% | 0.0% | 0.0% | 0.0% |
| RGB, camera captured, 1080p | 0.0% | 0.0% | 0.0% | 0.0% |
| YUV, text & graphics with motion, 1080p & 720p | -0.2% | -0.2% | -0.4% | 0.0% |
| YUV, mixed content, 1440p & 1080p | -1.0% | -0.9% | -1.9% | -0.1% |
| YUV, Animation, 720p | 0.0% | 0.0% | 0.0% | 0.0% |
| YUV, camera captured, 1080p | 0.0% | 0.0% | 0.0% | 0.0% |
| Enc Time[%] | 120% | | | |
| Dec Time[%] | 99% | | | |
|  |  |  |  |  |
|  | **Random Access** | | | |
|  | Bit-rate change (Total) | Bit-rate change (Average) | Bit-rate change (Min) | Bit-rate change (Max) |
|  |
| RGB, text & graphics with motion, 1080p & 720p | -0.5% | -0.6% | -1.5% | -0.1% |
| RGB, mixed content, 1440p & 1080p | -0.2% | -0.2% | -0.5% | 0.0% |
| RGB, Animation, 720p | 0.0% | 0.0% | 0.0% | 0.0% |
| RGB, camera captured, 1080p | 0.0% | 0.0% | 0.0% | 0.0% |
| YUV, text & graphics with motion, 1080p & 720p | -0.3% | -0.4% | -1.3% | 0.0% |
| YUV, mixed content, 1440p & 1080p | -0.2% | -0.2% | -0.4% | 0.0% |
| YUV, Animation, 720p | 0.0% | 0.0% | 0.0% | 0.0% |
| YUV, camera captured, 1080p | 0.0% | 0.0% | 0.0% | 0.0% |
| Enc Time[%] | 102% | | | |
| Dec Time[%] | 99% | | | |
|  |  |  |  |  |
|  |  |  |  |  |
|  | **Low Delay B** | | | |
|  | Bit-rate change (Total) | Bit-rate change (Average) | Bit-rate change (Min) | Bit-rate change (Max) |
|  |
| RGB, text & graphics with motion, 1080p & 720p | -0.5% | -0.6% | -2.1% | 0.0% |
| RGB, mixed content, 1440p & 1080p | -0.1% | -0.1% | -0.2% | 0.0% |
| RGB, Animation, 720p | 0.0% | 0.0% | 0.0% | 0.0% |
| RGB, camera captured, 1080p | 0.0% | 0.0% | 0.0% | 0.0% |
| YUV, text & graphics with motion, 1080p & 720p | -0.3% | -0.5% | -1.9% | 0.0% |
| YUV, mixed content, 1440p & 1080p | -0.1% | -0.1% | -0.1% | 0.0% |
| YUV, Animation, 720p | 0.0% | 0.0% | 0.0% | 0.0% |
| YUV, camera captured, 1080p | 0.0% | 0.0% | 0.0% | 0.0% |
| Enc Time[%] | 101% | | | |
| Dec Time[%] | 98% | | | |

Table 6. Average BD rate reduction for Test 6.1 Test 2 444 lossy coding

|  |  |  |  |
| --- | --- | --- | --- |
|  | **All Intra** | | |
|  | G/Y | B/U | R/V |
| RGB, text & graphics with motion, 1080p & 720p | -0.5% | -0.5% | -0.5% |
| RGB, mixed content, 1440p & 1080p | -0.8% | -0.9% | -1.0% |
| RGB, Animation, 720p | -0.1% | -0.1% | -0.1% |
| RGB, camera captured, 1080p | 0.0% | 0.0% | 0.0% |
| YUV, text & graphics with motion, 1080p & 720p | -0.5% | -0.5% | -0.5% |
| YUV, mixed content, 1440p & 1080p | -0.6% | -0.5% | -0.6% |
| YUV, Animation, 720p | -0.2% | -0.2% | -0.2% |
| YUV, camera captured, 1080p | 0.0% | 0.0% | 0.0% |
| Enc Time[%] | 126% | | |
| Dec Time[%] | 100% | | |
|  |  |  |  |
|  | **Random Access** | | |
|  | G/Y | B/U | R/V |
| RGB, text & graphics with motion, 1080p & 720p | -0.8% | -0.8% | -0.8% |
| RGB, mixed content, 1440p & 1080p | -0.4% | -0.7% | -0.7% |
| RGB, Animation, 720p | 0.0% | 0.0% | 0.0% |
| RGB, camera captured, 1080p | 0.0% | 0.0% | 0.0% |
| YUV, text & graphics with motion, 1080p & 720p | -0.9% | -1.0% | -1.1% |
| YUV, mixed content, 1440p & 1080p | -0.6% | -0.6% | -0.6% |
| YUV, Animation, 720p | -0.2% | -0.3% | 0.0% |
| YUV, camera captured, 1080p | 0.0% | -0.1% | -0.1% |
| Enc Time[%] | 103% | | |
| Dec Time[%] | 98% | | |
|  |  |  |  |
|  | **Low delay B** | | |
|  | G/Y | B/U | R/V |
| RGB, text & graphics with motion, 1080p & 720p | -0.9% | -0.8% | -0.8% |
| RGB, mixed content, 1440p & 1080p | -0.4% | -0.4% | -0.5% |
| RGB, Animation, 720p | -0.1% | 0.0% | -0.1% |
| RGB, camera captured, 1080p | 0.0% | 0.0% | 0.0% |
| YUV, text & graphics with motion, 1080p & 720p | -0.9% | -0.8% | -0.9% |
| YUV, mixed content, 1440p & 1080p | -0.7% | -0.7% | -1.0% |
| YUV, Animation, 720p | 0.0% | 0.1% | 0.3% |
| YUV, camera captured, 1080p | -0.1% | 0.0% | 0.1% |
| Enc Time[%] | 101% | | |
| Dec Time[%] | 97% | | |

Table 7. Average BD rate reduction for Test 6.1 Test 2 420 lossless coding

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **All Intra** | | | |
|  | Bit-rate change (Total) | Bit-rate change (Average) | Bit-rate change (Min) | Bit-rate change (Max) |
|  |
| Text & graphics with motion, 720p | -0.7% | -0.7% | -0.8% | -0.6% |
| Mixed content, 480p | -0.1% | -0.1% | -0.1% | -0.1% |
| Animation, 768p | 0.0% | 0.0% | 0.0% | 0.0% |
| Average of all sequences | -0.2% | -0.4% | -0.8% | 0.0% |
| Enc Time[%] | 107% | | | |
| Dec Time[%] | 100% | | | |
|  |  |  |  |  |
|  | **Random Access** | | | |
|  | Bit-rate change (Total) | Bit-rate change (Average) | Bit-rate change (Min) | Bit-rate change (Max) |
|  |
| Text & graphics with motion, 720p | -0.2% | -0.2% | -0.2% | -0.2% |
| Mixed content, 480p | 0.0% | 0.0% | 0.0% | 0.0% |
| Animation, 768p | 0.0% | 0.0% | 0.0% | 0.0% |
| Average of all sequences | 0.0% | -0.1% | -0.2% | 0.0% |
| Enc Time[%] | 100% | | | |
| Dec Time[%] | 99% | | | |
|  |  |  |  |  |
|  | **Low Delay B** | | | |
|  | Bit-rate change (Total) | Bit-rate change (Average) | Bit-rate change (Min) | Bit-rate change (Max) |
|  |
| Text & graphics with motion, 720p | -0.1% | -0.2% | -0.3% | 0.0% |
| Mixed content, 480p | 0.0% | 0.0% | 0.0% | 0.0% |
| Animation, 768p | 0.0% | 0.0% | 0.0% | 0.0% |
| Average of all sequences | 0.0% | -0.1% | -0.3% | 0.0% |
| Enc Time[%] | 97% | | | |
| Dec Time[%] | 97% | | | |

Table 8. Average BD rate reduction for Test 6.1 Test 2 420 lossy coding

|  |  |  |  |
| --- | --- | --- | --- |
|  | **All Intra** | | |
|  | G/Y | B/U | R/V |
| Text & graphics with motion, 720p | -1.0% | -1.2% | -0.8% |
| Mixed content, 480p | -0.2% | -0.2% | -0.2% |
| Animation, 768p | -0.1% | -0.2% | -0.2% |
| Average of all sequences | -0.6% | -0.7% | -0.5% |
| Enc Time[%] | 109% | | |
| Dec Time[%] | 95% | | |
|  |  |  |  |
|  | **Random Access** | | |
|  | G/Y | B/U | R/V |
| Text & graphics with motion, 720p | -0.7% | -0.7% | -0.6% |
| Mixed content, 480p | -0.1% | -0.1% | -0.1% |
| Animation, 768p | -0.1% | -0.2% | -0.1% |
| Average of all sequences | -0.4% | -0.4% | -0.4% |
| Enc Time[%] | 100% | | |
| Dec Time[%] | 97% | | |
|  |  |  |  |
|  | **Low delay B** | | |
|  | G/Y | B/U | R/V |
| Text & graphics with motion, 720p | -0.5% | 1.5% | -1.4% |
| Mixed content, 480p | 0.2% | 0.1% | 0.1% |
| Animation, 768p | 0.0% | 0.3% | -0.4% |
| Average of all sequences | -0.2% | 0.8% | -0.8% |
| Enc Time[%] | 98% | | |
| Dec Time[%] | 94% | | |

# References

1. B. Li and J. Xu, “CE2: Result of test 3.1 and 6.1”, JCTVC-T0040, Feb. 2014.
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3. H. Yu, R. Cohen, K. Rapaka, J. Xu, “Common conditions for screen content coding tests” JCTVC-S1015, Oct. 2014.