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| *Title:* | **CE6.a: Cross-check results of intra chroma prediction** | | |
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# Abstract

This contribution reports cross-check results for the proposals on intra chroma coding defined in CE6.a.

# Introduction

In the 7th JCT-VC meeting, it was decided that four tools for intra chroma prediction should be tested to evaluate the performance [1]. The selected tools are listed as follows.

* Cross-channel intra chroma residual prediction (JCTVC-G173)
* Luma-based chroma prediction - Model correction (JCTVC-G244)
* Chroma intra prediction based on residual luma samples (JCTVC-G346)
* New modes for chroma intra prediction (JCTVC-G358)

In this contribution, six combinations are tested and their results are provided. The tested combinations are listed as follows.

* G244
* G358
* G173 + G244
* G173 + G358
* G244 + G358
* G173 + G244 + G358

Summary results of all combination are also provided in section 3.

It is noted YUV BD-bitrate assessment is added to the summary table because the gain is come from Cb/Cr improvement. A detail of YUV BD-bitrate is described in JCTVC-F386 [2].

# Cross-check results

The software version was HM5.0. The reference was generated by using the common test conditions [3]. The provided source code was compiled on 64-bit Windows XP environment, and the experiments were performed on the same PCs.

G244 and G358 are based on LM mode which is turned off in the LC setting. Therefore, the test results of LC are not reported.

Table 1 Summary of BD-bitrate by G244 for all intra condition

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **All Intra HE** | | | |
|  | Y | U | V | YUV |
| Class A (8bit) | -0.1% | -3.3% | -2.0% | -0.5% |
| Class B | -0.1% | -1.7% | -0.7% | -0.2% |
| Class C | -0.1% | -1.4% | -1.4% | -0.3% |
| Class D | -0.1% | -1.1% | -1.2% | -0.3% |
| Class E | 0.0% | -1.9% | -1.7% | -0.3% |
| **Overall** | -0.1% | -1.7% | -1.3% | -0.3% |
|  | -0.1% | -1.7% | -1.3% | -0.3% |
| Class F | -0.2% | -1.0% | -1.0% | -0.3% |
| Enc Time[%] | 101% | | | |
| Dec Time[%] | 99% | | | |

Table 2 Summary of BD-bitrate by G358 for all intra condition

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **All Intra HE** | | | |
|  | Y | U | V | YUV |
| Class A (8bit) | -0.1% | -2.0% | -1.6% | -0.4% |
| Class B | -0.1% | -2.6% | -2.1% | -0.5% |
| Class C | -0.2% | -2.3% | -2.9% | -0.6% |
| Class D | -0.1% | -2.1% | -2.3% | -0.5% |
| Class E | 0.0% | -1.7% | -1.8% | -0.3% |
| **Overall** | -0.1% | -2.2% | -2.2% | -0.5% |
|  | -0.1% | -2.2% | -2.2% | -0.5% |
| Class F | -0.4% | -2.5% | -3.0% | -0.8% |
| Enc Time[%] | 107% | | | |
| Dec Time[%] | 102% | | | |

Table 3 Summary of BD-bitrate by G173+G244 for all intra condition

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **All Intra HE** | | | |
|  | Y | U | V | YUV |
| Class A (8bit) | -0.4% | -3.1% | -4.9% | -1.0% |
| Class B | -0.1% | -1.5% | -3.0% | -0.4% |
| Class C | -0.5% | -2.6% | -4.2% | -1.1% |
| Class D | -0.5% | -2.3% | -4.1% | -1.0% |
| Class E | -0.2% | -2.2% | -3.8% | -0.7% |
| **Overall** | -0.4% | -2.2% | -3.8% | -0.8% |
|  | -0.4% | -2.2% | -3.8% | -0.8% |
| Class F | -0.6% | -2.3% | -2.7% | -0.9% |
| Enc Time[%] | 101% | | | |
| Dec Time[%] | 100% | | | |

Table 4 Summary of BD-bitrate by G173+G358 for all intra condition

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **All Intra HE** | | | |
|  | Y | U | V | YUV |
| Class A (8bit) | -0.4% | -2.1% | -5.3% | -1.0% |
| Class B | -0.2% | -2.7% | -4.8% | -0.7% |
| Class C | -0.6% | -3.4% | -5.7% | -1.3% |
| Class D | -0.5% | -3.3% | -5.2% | -1.2% |
| Class E | -0.3% | -1.9% | -4.3% | -0.8% |
| **Overall** | -0.4% | -2.8% | -5.1% | -1.0% |
|  | -0.4% | -2.8% | -5.0% | -1.0% |
| Class F | -0.8% | -3.6% | -4.7% | -1.4% |
| Enc Time[%] | 107% | | | |
| Dec Time[%] | 101% | | | |

Table 5 Summary of BD-bitrate by G173+G358 for all intra condition

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **All Intra HE** | | | |
|  | Y | U | V | YUV |
| Class A (8bit) | -0.1% | -4.5% | -3.8% | -0.8% |
| Class B | -0.1% | -3.7% | -3.0% | -0.7% |
| Class C | -0.2% | -3.4% | -3.8% | -0.8% |
| Class D | -0.1% | -2.9% | -3.2% | -0.6% |
| Class E | 0.0% | -3.4% | -3.0% | -0.6% |
| **Overall** | -0.1% | -3.5% | -3.3% | -0.7% |
|  | -0.1% | -3.4% | -3.3% | -0.7% |
| Class F | -0.4% | -2.9% | -3.4% | -0.9% |
| Enc Time[%] | 105% | | | |
| Dec Time[%] | 100% | | | |

Table 6 Summary of BD-bitrate by G173+G244+G358 for all intra condition

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **All Intra HE** | | | |
|  | Y | U | V | YUV |
| Class A (8bit) | -0.5% | -4.5% | -6.6% | -1.3% |
| Class B | -0.2% | -3.7% | -5.4% | -0.9% |
| Class C | -0.6% | -4.4% | -6.2% | -1.5% |
| Class D | -0.6% | -4.0% | -5.8% | -1.3% |
| Class E | -0.2% | -3.6% | -5.1% | -1.0% |
| **Overall** | -0.4% | -4.0% | -5.8% | -1.2% |
|  | -0.4% | -3.9% | -5.7% | -1.2% |
| Class F | -0.8% | -4.0% | -5.1% | -1.5% |
| Enc Time[%] | 106% | | | |
| Dec Time[%] | 101% | | | |

# Summary results

Summary results of "all intra HE" condition are shown in Table 7 and Figure 1.

Table 7 Summary of BD-bitrate for all intra condition in CE6.a

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| HM5.0 CE6a AI-HE | Y | U | V | YUV | Enc | Dec |
| G173 | -0.3% | -0.6% | -3.1% | -0.6% | 101.0% | 100.7% |
| G244 | -0.1% | -1.7% | -1.3% | -0.3% | 100.5% | 99.3% |
| G346 | -0.1% | -2.6% | -2.5% | -0.5% | 101.3% | 100.9% |
| G358 | -0.1% | -2.2% | -2.2% | -0.5% | 106.9% | 101.7% |
|  |  |  |  |  |  |  |
| G173G244 | -0.4% | -2.2% | -3.8% | -0.8% | 101.4% | 99.8% |
| G173G346 | -0.4% | -3.2% | -5.2% | -1.0% | 101.6% | 101.2% |
| G173G358 | -0.4% | -2.8% | -5.1% | -1.0% | 106.9% | 101.0% |
| G244G346 | -0.1% | -3.6% | -3.2% | -0.7% | 102.2% | 101.3% |
| G244G358 | -0.1% | -3.5% | -3.3% | -0.7% | 104.9% | 100.2% |
| G346G358 | -0.2% | -4.0% | -4.0% | -0.8% | 107.9% | 102.0% |
|  |  |  |  |  |  |  |
| G173G244G346 | -0.4% | -4.1% | -5.6% | -1.1% | 102.3% | 103.6% |
| G173G244G358 | -0.4% | -4.0% | -5.8% | -1.2% | 105.5% | 100.5% |
| G173G346G358 | -0.4% | -4.5% | -6.5% | -1.3% | 107.3% | 101.6% |
| G244G346G358 | -0.2% | -4.8% | -4.7% | -1.0% | 107.5% | 101.3% |
|  |  |  |  |  |  |  |
| G173G244G346G358 | -0.4% | -5.3% | -7.0% | -1.4% | 107.8% | 101.8% |



Figure 1 CE6.a results in Enc Time v.s. YUV BD-bitrate

# Conclusions

Test results of combinations of intra chroma proposals listed in CE6.a “Intra chroma prediction” are reported in this contribution. Coding efficiency results completely matched with the results of the proponents. No mismatch between the decoded picture and the locally decoded picture is observed. The encoding / decoding runtime also matched closely to those reported by the proponent.

# References

1. A. Tabatabai, E. Francois and K. Chono, "CE6: Intra Coding Improvements," Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, Document: JCTVC-G1206, 7th Meeting: Geneva, CH, 21-30 November, 2011
2. T. K. Tan, F. Bossen, " Chroma RD cost computation in HM3.0," Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6th Meeting: Torino, 14-22 July, 2011.
3. F. Bossen, “Common test conditions and software reference configurations”, Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, Document: JCTVC-G1200, 7th Meeting: Geneva, CH, 21-30 Nov, 2011.

# Patent rights declaration(s)

**KDDI Corporation may have current or pending patent rights 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).**