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| **Joint Collaborative Team on Video Coding (JCT-VC)**  **of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11**  9th Meeting: Geneva, Switzerland, 27 April – 07 May, 2012 | Document: JCTVC-I0120  M24359 |

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| *Title:* | **AHG7: Cross-verification of Broadcom proposal JCTVC-I0216 on “Reducing HEVC worst-case memory bandwidth by restricting bi-directional 4x8 and 8x4 prediction units”** | | |
| *Status:* | Input Document to JCT-VC | | |
| *Purpose:* | Information | | |
| *Author(s) or Contact(s):* | Minhua Zhou Texas Instruments Inc., USA | Tel: Email:  : | +1-214-480-3816 [zhou@ti.com](mailto:zhou@ti.com) |
| *Source:* | Texas Instruments Inc; | | |

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# Abstract

This contribution reports cross-check results for Broadcom’s proposal JCTVC-I0216 on “Reducing HEVC worst-case memory bandwidth by restricting bi-directional 4x8 and 8x4 prediction units”. In the proposal, it is advocated to permanently disable 4x4 inter PUs, and restrict 4x8 and 8x4 PUs to uni-prediction for HD and larger-sized pictures to address the worst case motion compensation memory bandwidth issue. The other normative changes include not transmitting PU-level merge flag and inter prediction direction flag for 8x4 and 4x8 PUs. The BD-rate results match the ones reported by proponents. The source code was checked and confirmed to be consistent with the proposal description.

# Test Settings and Conditions

The simulations of this document have used HM6.0 software, the simulation platform is LSF equipped with Intel(R) Xeon(R) CPU X5570 64 bits Linux machines of different frequencies, the common test conditions and reference configurations specified in [1] are followed.

# Experimental results

The experimental results are summarized in Table 1. There is on average 0.2% to 0.5% loss caused by restricting uni-prediction for 4x8 and 8x4 PUs. The results match the ones reported by proponents. Please be advised that runtime here may not be accurate.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Random Access Main** | | | **Random Access HE10** | | |
|  | Y | U | V | Y | U | V |
| Class A | 0.3% | 0.3% | 0.4% | 0.2% | 0.3% | 0.2% |
| Class B | 0.3% | 0.3% | 0.3% | 0.2% | 0.1% | 0.2% |
| Class C | 0.5% | 0.8% | 0.6% | 0.4% | 0.5% | 0.4% |
| Class D | 0.7% | 0.7% | 0.9% | 0.6% | 0.7% | 0.6% |
| Class E |  |  |  |  |  |  |
| **Overall** | 0.4% | 0.5% | 0.6% | 0.3% | 0.4% | 0.4% |
|  | 0.4% | 0.5% | 0.5% | 0.3% | 0.4% | 0.4% |
| Class F | 0.2% | 0.4% | 0.3% | 0.2% | 0.3% | 0.4% |
| Enc Time[%] | 93% | | | 90% | | |
| Dec Time[%] | 99% | | | 95% | | |
|  |  |  |  |  |  |  |
|  | **Low delay B Main** | | | **Low delay B HE10** | | |
|  | Y | U | V | Y | U | V |
| Class A |  |  |  |  |  |  |
| Class B | 0.3% | 0.0% | 0.2% | 0.3% | 0.1% | 0.3% |
| Class C | 0.7% | 0.9% | 0.8% | 0.6% | 0.7% | 0.8% |
| Class D | 0.8% | 0.7% | 0.7% | 0.7% | 0.9% | 0.5% |
| Class E | 0.5% | 0.5% | 0.5% | 0.1% | 0.4% | 0.4% |
| **Overall** | 0.6% | 0.5% | 0.5% | 0.4% | 0.5% | 0.5% |
|  | 0.6% | 0.5% | 0.6% | 0.4% | 0.5% | 0.5% |
| Class F | 0.5% | 0.3% | 1.0% | 0.5% | -0.2% | 0.6% |
| Enc Time[%] | 91% | | | 91% | | |
| Dec Time[%] | 99% | | | 96% | | |
|  |  |  |  |  |  |  |
|  | **Low delay P Main** | | | **Low delay P HE10** | | |
|  | Y | U | V | Y | U | V |
| Class A |  |  |  |  |  |  |
| Class B | 0.4% | -0.2% | -0.2% | 0.3% | 0.2% | -0.2% |
| Class C | 0.6% | 0.2% | 0.4% | 0.4% | 0.4% | 0.3% |
| Class D | 0.6% | 0.2% | -0.5% | 0.5% | 0.6% | -0.1% |
| Class E | 0.4% | 0.7% | 0.7% | 0.3% | 0.9% | -0.1% |
| **Overall** | 0.5% | 0.2% | 0.1% | 0.4% | 0.5% | 0.0% |
|  | 0.5% | 0.2% | 0.1% | 0.4% | 0.5% | 0.0% |
| Class F | 0.4% | 0.5% | 0.5% | 0.2% | 1.5% | 0.8% |
| Enc Time[%] | 102% | | | 101% | | |
| Dec Time[%] | 100% | | | 100% | | |

Table 1. Experimental results of restricting uni-prediction for 8x4 and 4x8 PUs

# Comments

The proposed restriction effectively cuts the worst case motion compensation memory bandwidth by approximately 30% on the cost of 0.2% to 0.5% coding loss. It is recommended to consider the proposed restriction together with other restrictions in the same category, and apply the restrictions across levels, not just impose them on high levels.

# References

[1] F. Bossen, “Common test conditions and software reference configurations,” JCT-VC Document, JCTVC-G1100, San Jose, CA, USA, February 2012.

[2] [B. Bross](mailto:benjamin.bross@hhi.fraunhofer.de), [W.-J. Han](mailto:wjhan.han@samsung.com), [J.-R. Ohm](mailto:ohm@ient.rwth-aachen.de), [G. J. Sullivan](mailto:garysull@microsoft.com), [T. Wiegand](mailto:thomas.wiegand@hhi.fraunhofer.de) “High Efficiency Video Coding (HEVC) Test Model 6 (HM 6) Encoder Description,” JCT-VC Document, JCTVC-G1003, San Jose, CA, USA, February 2012.

[3] T. Hellman, W. Wan, “Reducing HEVC worst-case memory bandwidth by restricting bi-directional 4x8 and 8x4 prediction units,” JCT-VC Document, JCTVC-I0216, 9th Meeting: Geneva, Switzerland, 27 April – 07 May, 2012