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| **Joint Collaborative Team on Video Coding (JCT-VC)**  **of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11**  7th Meeting: Geneva, CH, 21-30 November, 2011 | Document: JCTVC-G673 |

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| *Title:* | **CE12 Subset 1: Crosscheck for Microsoft’s Deblocking for Larger Blocks in JCTVC-G409** | | |
| *Status:* | Input Document to JCT-VC | | |
| *Purpose:* | Information | | |
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| *Source:* | #MediaTek Inc. | | |

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# Abstract

This contribution is a cross-verification of Microsoft’s deblocking filter proposed in document JCTVC-G409. The cross-verification has been done successfully on Linux computer farm in terms of BD-rates, subjective evaluation and code reviewing. It is reported that the BD-rates match those provided by Microsoft perfectly. The visual quality is reported to be similar to HM4.0.

# Objective Evaluation

The simulation has been done based on the eight configurations of common test condition in JCTVC-F900 [1]. The figures in Table 1 confirm the overall results and running time issues in Microsoft’s proposal [2] in general. The encoding times are got from machines with similar types, and the decoding times are got from the same computer core without writing output files. Note that for the sequence *SlideShow*, the BD-rate at LDHE(P)\_QP32 is slightly different from that provided by Microsoft due to the difference in operating systems, as has been discussed on the general JCTVC reflector. MediaTek further tested this specific QP point on Window 7 and got the same result as Microsoft. For all the other cases, the BD-rates match those provided by Microsoft perfectly.

Table 1. Objective Results by Mediatek

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Intra | | | Intra\_LoCo | | |
| Y BD-rate | U BD-rate | V BD-rate | Y BD-rate | U BD-rate | V BD-rate |
| Class A | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Class B | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Class C | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Class D | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Class E | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Class F | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| All | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| EncTime[%] | 100% | | | 100% | | |
| DecTime[%] | 101% | | | 101% | | |
|  |  |  |  |  |  |  |
|  | RandomAccess | | | RandomAccess\_LoCo | | |
| Y BD-rate | U BD-rate | V BD-rate | Y BD-rate | U BD-rate | V BD-rate |
| Class A | 0.0% | -0.2% | -0.2% | 0.0% | 0.1% | 0.1% |
| Class B | 0.0% | 0.0% | 0.1% | 0.0% | 0.0% | 0.1% |
| Class C | 0.0% | -0.1% | 0.0% | 0.0% | 0.0% | -0.1% |
| Class D | 0.0% | 0.1% | 0.0% | 0.0% | 0.0% | 0.0% |
| Class E |  |  |  |  |  |  |
| Class F | 0.0% | 0.0% | 0.0% | 0.0% | -0.1% | 0.0% |
| All | 0.0% | -0.1% | 0.0% | 0.0% | 0.0% | 0.0% |
| 0.0% | -0.1% | 0.0% | 0.0% | 0.0% | 0.0% |
| EncTime[%] | 100% | | | 100% | | |
| DecTime[%] | 102% | | | 102% | | |
|  |  |  |  |  |  |  |
|  | LowDelay | | | LowDelay\_LoCo | | |
| Y BD-rate | U BD-rate | V BD-rate | Y BD-rate | U BD-rate | V BD-rate |
| Class A |  |  |  |  |  |  |
| Class B | 0.0% | -0.1% | -0.2% | 0.0% | 0.0% | -0.1% |
| Class C | 0.0% | 0.0% | -0.1% | 0.0% | 0.0% | -0.4% |
| Class D | 0.0% | 0.2% | 0.2% | 0.0% | 0.0% | -0.3% |
| Class E | 0.0% | 0.0% | 0.9% | 0.0% | 0.3% | 0.1% |
| Class F | -0.1% | -0.1% | 0.0% | 0.1% | -0.3% | -0.1% |
| All | 0.0% | 0.0% | 0.1% | 0.0% | 0.0% | -0.2% |
| 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | -0.2% |
| EncTime[%] | 100% | | | 100% | | |
| DecTime[%] | 102% | | | 102% | | |
|  |  |  |  |  |  |  |
|  | LowDelay (P) | | | LowDelay\_LoCo (P) | | |
| Y BD-rate | U BD-rate | V BD-rate | Y BD-rate | U BD-rate | V BD-rate |
| Class A |  |  |  |  |  |  |
| Class B | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Class C | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Class D | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Class E | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Class F | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| All | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| EncTime[%] | 100% | | | 100% | | |
| DecTime[%] | 102% | | | 103% | | |

# Subjective Evaluation

For subjective evaluation, visual inspections report better performance than HM4.0 in some smooth regions in terms of blocking artifacts. For other regions, similar performance to HM4.0 is observed.

# Source Code Investigation

In Microsoft’s scheme, chroma filtering and luma weak filtering are the same as in HM4.0. For luma strong filtering, an extra smoothing deblocking mode is defined for large smooth regions with small variation:

1. The line-by-line strong/weak filtering decision remains the same as HM4.0. And the extra smoothing mode will only be used when all the eight pixel lines perpendicular to an 8x8 boundary require strong filtering.
2. Filtering directions and QP values are taken into account during strong filtering. In general, more pixels will be filtered for horizontal filtering and larger QP values.
   1. Vertical Filtering
      1. **QP ≤ 30**: Modify 4 pixels at each side of the boundary. For the upper side, the most distant pixel can be optionally unchanged. The filtering taps are 4, 5, 6, 7, 8, 7, 6 and 5 for p3, p2, p1, p0, q0, q1, q2 and q3, respectively.
      2. **QP > 30**: Modify 4 pixels at the upper side of the boundary and 8 pixels at the lower side of the boundary. For the upper side, the most distant pixel can be optionally unchanged. The filtering taps are 8, 9, 10, 11, 12, 12, 12, 12, 12, 11, 10 and 9 for p3, p2, p1, p0, q0, q1, q2, q3, q4, q5, q6 and q7, respectively.
   2. Horizontal Filtering
      1. **QP ≤ 30**: Modify 4 pixels at each side of the boundary. The filtering taps are always 8.
      2. **QP > 30**: Modify 8 pixels at each side of the boundary. The filtering taps are 12, 13, 14, 15, 16, 16, 16, 16, 16, 16, 16, 16, 16, 15, 14 and 13 for p7, p6, p5, p4, p3, p2, p1, p0, q0, q1, q2, q3, q4, q5, q6 and q7, respectively.

# Conclusion

The software and experimental results of Microsoft’s contribution JCTVC-G409 were cross-verified. The results provided by Microsoft are confirmed.

# References

1. F. Bossen, “Common test conditions and software reference configurations”, JCTVC-F900, JCT-VC meeting, Torino, IT, Jul. 2011.
2. Z. Shi, X. Sun and J. Xu, “CE12, Subset 1: Report of Deblocking for Large Size Blocks,” JCTVC-G409, JCT-VC meeting, Geneva, CH, Nov. 2011.