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| **Joint Collaborative Team on 3D Video Coding Extension Development**  **of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29/WG 11**  3rd Meeting: Geneva, CH, 17–23 Jan. 2013 | Document: JCT3V-D1104 |

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| *Title:* | **Description of Core Experiment 4 (CE4) on Illumination Compensation** | | |
| *Status:* | Output Document | | |
| *Purpose:* | Core Experiment Description | | |
| *Author(s) or Contact(s):* | Tomohiro Ikai  1-9-2 Nakase, Mihama-ku, Chiba-shi, Chiba 261-8520 JAPAN | Tel:  Email: | +81-43-299-8526  ikai.tomohiro@sharp.co.jp |
|  | Hongbin Liu | Tel:  Email: | hongbin.liu@lge.com |
| *Source:* | CE coordinators | | |

# Introduction

This Core Experiment relates to illumination compensation. During the 3rd JCT-3V meeting, several proposals, JCT3V-D0061, JCT3V-D0096 and JCT3V-D0114, proposes to simplify illumination compensation on prediction process and parameter derivation process. Some of them also reportedly shows that coding efficient improvement is also achieved with more robust or more accurate parameter derivation or more robust prediction model. Other proposal, JCT3V-D0106 proposes to simplify IC related bi-prediction process by unifying the clipping operation in uni-prediction case and bi-prediction case. In the meeting, combination test with JCT3V-D0106 and other proposal was also suggested.

# Participants List

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| No. | Name | Company | Email | Remarks |
| 1 | Honbin Liu  Jiwook Jung | LG | hongbin.liu@lge.com  jiwook.jung@lge.com | P / C |
| 2 | Min Woo Park Jin Young Lee | Samsung | [m.w.park@samsung.com](mailto:m.w.park@samsung.com) [jinyoung79.lee@samsung.com](mailto:jinyoung79.lee@samsung.com) | P / C |
| 3 | Tomohiro Ikai | Sharp | ikai.tomohiro@sharp.co.jp | P / C |
| 4 | Yi-Wen Chen  Jian-Liang Lin  Yu-Lin Chang  Yu-Wen Huang | MediaTek | [yiwen.chen@mediatek.com](mailto:yiwen.chen@mediatek.com)  [jl.lin@mediatek.com](mailto:jl.lin@mediatek.com)  yulin.chang@mediatek.com  [yuwen.huang@mediatek.com](mailto:yuwen.huang@mediatek.com) | P / C |
| 5 | Xiaozhenzheng | Hisilicon | [zhengxiaozhen@huawei.com](mailto:zhengxiaozhen@huawei.com) | C |
| 6 | Jewon Kang | Qualcomm | jewonk@qti.qualcomm.com |  |
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# Cross-checking

The package released for cross-checking shall include both software and test results. Software only without test results should not be considered as ready for cross-check release.

In Test 1, complexity assessment data shall be provided by the proponent, and cross-checker is obliged to check the data.

The following table provides the cross-checker assignment for test tools.

**Test 1: Compensation and parameter derivation method (CTC)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| No | Test | Anchor | Proponent | Cross-checker |
| 1.1 | D0061 | HTM70 | Sharp | Samsung |
| 1.2 | D0114 | HTM70 | Samsung | LG |
| 1.3 | D0096 | HTM70 | LG | Sharp |

**Test 2: Bi-prediction operation (IBP)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Test | Test | Anchor | Tester 1 | Tester 2 |
| 2.0 | D0106 | HTM70 | MediaTek | Hisilicon |
| 2.1 | D0106+D0061 | HTM70 | Sharp | MediaTek |
| 2.2 | D0106+D0114 | HTM70 | Samsung | MediaTek |
| 2.3 | D0106+D0096 | HTM70 | LG | MediaTek |

# Experiment description

### Test 1.1 Liner model with regression improvement (JCT3V-D0061, Sharp)

Test 1.1 consists of the following aspect:

* Linear model
* Replace variable shift with fixed shift in IC prediction process
* One specific example of fixed offset is described as below.
* (predSamplesLX[ x ][ y ] \* icWeightLX ) >> FIXED\_SHIFT  ) + icOffsetLX
* Add parameter cost by adding value to both denominator and numerator in IC parameter derivation process

IC using the current linear model with fixed shift is tested. Parameter is derived with adding cost in both denominator and numerator to improve coding efficiency.

Note: L0 only restriction proposed by JVT3V-D0061 is excluded in this test because this restriction is different from other proposals (thus with it, the result is not comparable).

### Test 1.2 Liner model without square component operation (JCT3V-D0114, Samsung)

Test 1.2 consists of the following aspect:

* Linear model
* Replace variable shift with fixed shift in IC prediction process: one
* One specific example of fixed offset is described as below.
* (predSamplesLX[ x ][ y ] \* icWeightLX ) >> FIXED\_SHIFT  ) + icOffsetLX
* Remove quadratic variables derivation (Σx\*x and Σx\*y) in IC parameter derivation process

IC using the linear model with fixed shift is tested. Parameter is derived by removing multiplicative terms from the scale factor derivation.

### Test 1.3 Offset model IC (JCT3V-D0096, LG)

Test 1.3 consists of the following aspect:

* Offset model
* Remove multiplication operation in IC prediction process
* One specific example of offset model is described as below.
* predSamplesLX[ x ][ y ] + icOffsetLX
* Remove quadratic variables derivation (Σx\*x and Σx\*y) in IC parameter derivation process

IC using the offset model, which doesn’t require any multiplication in the parameter estimation and prediction process, is tested.

Test 2 Bi-prediction operation (JCT3V-D0106, MediaTek)Test 2 consists of the following aspect:

* Align the operations between the uni-prediction and bi-prediction when IC is enabled.
* One specific example to align the operations between uni-prediction and bi-prediction are described as below.
  + 1. ~~predVal0 = !puIcFlagL0 ? predSamplesL0[ x ][ y ] :   
       ( ( predSamplesL0[ x ][ y ] \* icWeightL0 ) >> icShiftL0  ) + ( icOffsetL0 << shift1 ) ) (‑188)~~
    2. clipPredVal= Clip3( 0, ( 1 << bitDepth ) − 1, ( predSamplesL0[ x ][ y ] + offset1 ) >> shift1 ) (‑)
    3. predVal0 = !puIcFlagL0 ? clipPredVal :   
       ( Clip3( 0, ( 1 << bitDepth ) − 1, ( clipPredVal \* icWeightL0 ) >> icShiftL0 ) + icOffsetL0 ) (‑)
    4. ~~predVal1 = !puIcFlagL1 ? predSamplesL1[ x ][ y ] :   
       ( ( predSamplesL1[ x ][ y ] \* icWeightL1 ) >> icShiftL1 ) + ( icOffsetL1 << shift1 ) ) (‑189)~~
    5. clipPredVal = Clip3( 0, ( 1 << bitDepth ) − 1, ( predSamplesL1[ x ][ y ] + offset1 ) >> shift1 ) (‑)
    6. predVal1 = !puIcFlagL1 ? clipPredVal :   
       ( Clip3( 0, ( 1 << bitDepth ) − 1, ( clipPredVal \* icWeightL1 ) >> icShiftL1 ) + icOffsetL1 ) (‑)

# Test Sequences / Test Points / SW Configuration

Simulation results will be generated for sequences and coding conditions specified in the document JCT3V-D1100. 3D-HTM 7.0 will be used for evaluation.

The results of CTC condition shall be tested in test 1.

The results of IBP condition shall be tested in test 2.

# Definition of Performance Measurement Criteria

## Coding Performance Measurements

Measure impact on bitrate/PSNR using provided data (4 points, BD-Rate)

## Complexity Considerations

To provide an indicative assessment of complexity, the following numbers should be provided:

* Encoding time (compared to the default configuration)
* Decoding time (compared to the default configuration)

Test 1 proponents provide the complexity assessment of the following aspect

* Number of operations\*1

\*1: Number of operations in the case of 8x8 block (smallest luma block) and bitDepth equal to 8, shall be reported with the provided common spreadsheet where step by step operation is also provided for cross-checking

# Time-line

2013-May-03: CE-3 description finalized and uploaded.

2013-May-10: Release of the Excel template for Complexity evaluation to participants

2013-May-31: Release of reference software HTM7.0

2013-June-06: Distribute Test2.0 software to all participants

2013-June-13: Cross-verification of Test1 begins, proponents provide software, draft of contribution text and results to participants

2013-June-20: Proponents of Test1 provide complexity analysis results to participants

2013-June-27: Cross-verification of Test2 begins, proponents provide software, draft of contribution text and results to participants

2013-July-11: Cross-verifiers report results to CE participants

2013-July-13: Contribution documents uploaded, the document number and title are reported to coordinators.

2013-July-20: Summary report uploaded

# Related contributions

[JCT3V-D0061](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=745) 3D-CE5.h related: Illumination compensation regression improvement and simplification [T. Ikai (Sharp)]

[JCT3V-D0114](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=799) 3D-CE5.h related: Simplification of illumination compensation [M. W. Park, J. Y. Lee, H.-C. Wey, J. Yoon, B. Choi, Y. Cho, C. Kim (Samsung)]

[JCT3V-D0096](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=781) CE5.h The results on simplified illumination compensation [J. W. Jung, H. Liu, J. Jia, S. Yea (LG)]

[JCT3V-D0106](http://phenix.it-sudparis.eu/jct3v/doc_end_user/current_document.php?id=791) 3D-CE5.h related: On complexity reduction of bi-prediction for illumination compensation [Y.-W. Chen, T.-D. Chuang, J.-L. Lin, Y.-W. Huang, S. Lei (MediaTek)]