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| **Joint Collaborative Team on Video Coding (JCT-VC)**  **of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29/WG 11**  11th Meeting: Shanghai, CN, 10–19 Oct. 2012 | Document: JCTVC-K0359 |

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| *Title:* | **BoG report on contouring artefact** | | |
| *Status:* | Input Document to JCT-VC | | |
| *Purpose:* | BoG report | | |
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# Abstract

This report provides BoG mandate, a summary of discussions, visual test results and recommendations.

# Mandate

The mandates of this BoG are:

* Verify the Contouring problem through visual testing
  + Use JCTVC-K0139 as a reference
* How to perform visual test & test conditions?
  + Side by side
  + Single frame vs. video
  + What Sequence/frame – how many?
* Recommendation
  + Verification of the problem?
  + What to do next?

# Summary of Discussions

The BoG reviewed contribution JCTVC-K0139 and observed the HM8.0 encoded sequences and visual artifact was observed and verified in Class E sequences for random access (RA) as well as low delay (LD).

The JCTVC-K0139 was cross-checked by 3 other companies (JCTVC-K0178, JCTVC-K0215 and JCTVC-K0310). The objective results under common conditions were confirmed to have insignificant change when JCTVC-K0139 was applied.

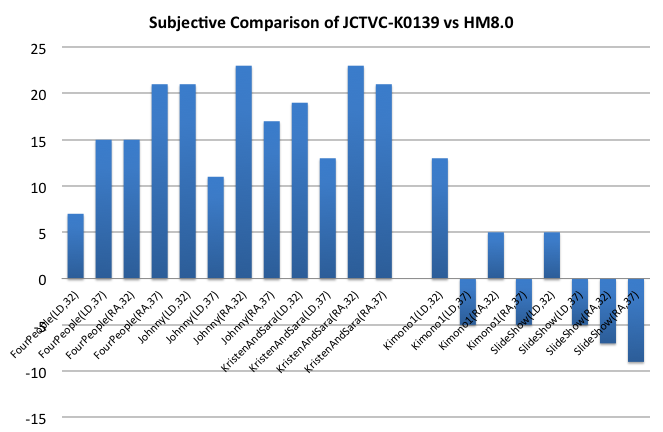
The BoG decided that the next action is to subjectively test the solution offered by JCTVC-K0139. The following conditions were decided for the test:

* 3 sequences (Johnny, KristenAndSara, FourPeople) in which HM-8.0 has contouring artefacts:
* 2 control sequences (SlideShow, Kimono1) where HM8.0 does not have contouring artifact and applying JCTVC-K0139 resulted in the largest BD-rate loss.
* ABAB blind
* Main LD / RA
* QP 32 / 37
* Binary decision: not allowed to say that A & B are the same.
  + Choose the one where the contouring is reduced and no new undesirable artifact is introduced.
* 35 subjects (7 sessions of 5 subjects, 20mins per session).
* Sum of all the scores were plotted for each test point (20 test points in total).
  + +1 if JCTVC-K0139 is chosen, -1 otherwise

# Subjective test results

The following graph shows the scores of the subjective viewing as defined above.

* 1. On average 75% of viewers prefer JCTVC-K0139 when HM8.0 has contouring artifacts.
  2. On sequences without contouring artifacts (control sequences), viewers were undecided (~50:50), on average.



(Sequences where HM8.0 has visible contouring)

(Control sequences)

-1.0

17.2

The raw data for the subjective test are attached to this contribution.

# Draft text presented during the BoG

8.4.4.2.3 Filtering process of neighbouring samples

Inputs to this process are:

– neighbouring samples p[ x ][ y ], with x, y = −1..2\*nT−1,

– a variable nT specifying the transform block size.

Output of this process are:

– filtered samples pF[ x ][ y ],. with x, y = −1..2\*nT−1.

The variable intThreshold is set to 8.

The variable interpolateFlag is derived as follows.

– If all of the following conditions are true, interpolateFlag is set equal to 1

– nT is equal 32

– Abs(p[ −1 ][ −1 ]+ p[ 2\*nT−1 ][ −1 ]–2\* p[ nT−1 ][ −1 ]) < intThreshold

– Abs(p[ −1 ][ −1 ]+ p[ −1 ][ 2\*nT−1 ]–2\* p[ −1 ][ nT−1 ]) < intThreshold

Otherwise, interpolateFlag is set equal to 0.

The variable filterFlag is derived as follows.

– If one or more of the following conditions are true, filterFlag is set equal to 0

– intraPredMode is equal to Intra\_DC

– nT is equal 4

– interpolateFlag is equal 1

Otherwise, the following applies.

– The variable minDistVerHor is set equal to Min( Abs( intraPredMode − 26 ), Abs( intraPredMode − 10 ) ).

– The variable intraHorVerDistThres[ nT ] is specified in Table 8 3.

– The variable filterFlag is derived as follows.

– If minDistVerHor is larger than intraHorVerDistThresh[ nT ], filterFlag is set equal to 1,

– Otherwise, filterFlag is set equal to 0.

Table 8 3 – Specification of intraHorVerDistThres[ nT ] for various transform block sizes

|  |  |  |  |
| --- | --- | --- | --- |
|  | **nT = 8** | **nT = 16** | **nT = 32** |
| **intraHorVerDistThresh[ nT ]** | 7 | 1 | 0 |

When interpolateFlag is equal to 1, the filtered sample values pF[ x, y ] with x = −1..63 and y = −1..63 are derived as follows.

pF[ −1 ][ 63 ] = p[ −1 ][ 63 ] (8 28)

pF[ 63 ][ −1 ] = p[ 63 ][ −1 ] (8 29)

pF[ −1 ][ y ] = p[ −1 ][ −1 ] + (y+1)\*(p[ −1 ][ 63 ] − p[ −1 ][ −1 ] + 32 ) >> 6 for y = 0..62 (8 30)

pF[ −1 ][ −1] = p[ −1 ][ −1] (8 31)

pF[ x ][ −1 ] = p[ −1 ][ −1 ] + (x+1)\*(p[ 63 ][ −1 ] − p[ −1 ][ −1 ] + 32 ) >> 6 for x = 0..62 (8 32)

When filterFlag is equal to 1, the filtered sample values pF[ x, y ] with x = −1..nT\*2−1 and y = −1..nT\*2−1 are derived as follows.

pF[ −1 ][ nT\*2−1 ] = p[ −1 ][ nT\*2−1 ] (8 28)

pF[ nT\*2−1 ][ −1 ] = p[ nT\*2−1 ][ −1 ] (8 29)

pF[ −1 ][ y ] = ( p[ −1 ][ y+1 ] + 2\*p[ −1 ][ y ] + p[ −1 ][ y−1 ] + 2 ) >> 2 for y = nT\*2−2..0 (8 30)

pF[ −1 ][ −1] = ( p[ −1 ][ 0 ] + 2\*p[ −1 ][ −1] + p[ 0 ][ −1 ] + 2) >> 2 (8 31)

pF[ x ][ −1 ] = ( p[ x−1 ][ −1 ] + 2\*p[ x ][ −1 ] + p[ x+1 ][ −1 ] + 2 ) >> 2 for x = 0..nT\*2−2 (8 32)

# Conclusions and Recommendations

1. The contouring artifact problem was verified.
2. The solution in JCTVC-K0139 to reduce the contouring artifact was confirmed by the visual test conducted by the BoG at the meeting.
   1. On average 75% of viewers prefer JCTVC-K0139 for sequences in which HM8.0 has contouring artifacts.
   2. On sequences without contouring artifacts, viewers were undecided (~50:50).
3. BoG agrees that a fix for this problem is required.
   1. The adoption of JCTVC-K0139 was discussed in the BoG and the following were noted.
      1. Apply the solution to MaxTU size (down to 16x16) instead of just 32x32 blocks that was tested in the subjective test.
      2. It might be desirable to have a high level syntax (SPS) flag to turn this off at the sequence level.
      3. It is preferred to make any changes at this meeting rather than the next meeting.
   2. Based on the findings, the adoption of JCTVC-K0139 should be decided in the plenary.