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| **ITU – Telecommunications Standardization Sector**STUDY GROUP 21 Question 6**Video Coding Experts Group (VCEG)**77th Meeting: 26 June – 4 July 2025, Daejeon, KR | Document VCEG-BY02-v2 |

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| Question: | 6/21 (VCEG)  |
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| Title: | **Status of core experiment CE-2.1 on deblocking in H.BWC (continuation of BX13)** |
| Purpose: | Core experiment report |

**Abstract**

In document VCEG-BX13, a deblocking approach resulting in up to 3.16% of BD-rate loss was presented. Since then, the BD-rate loss could be reduced to at most 2.71%, and further changes to the algorithm optimizing the choice and nature of the deblocking parameter are being integrated. A minor, perceptually motivated modification to the block-wise DC predictor is also implemented. However, with the establishment of new CEs at the last meeting, the H.BWC software is likely to change significantly in the near future, thereby making current optimization and evaluation of the above deblocking algorithm difficult and, potentially, improvable. It is, therefore, kindly requested to allow this CE to continue until at least the next VCEG meeting before taking any further decision.

1. **Description of Changes**

Prior documents regarding this core experiment (CE) are VCEG-BX13 [1] and VCEG-BX24 [2]. Since the April 2025 VCEG meeting, the following changes to the deblocking CE were integrated:

* modification of MSE-vs-perceptual optimization tradeoff with --*PerceptMode*=1in encoder,
* modification of mean value (DC) block predictor for reduced likelihood of blocking artifacts.

The second aspect concerns the design of the DC block predictor which, in the current version of H.BWC, provides a constant-value predictor signal for a given waveform block *b* with the constant being determined as the mean value of the last 4 reconstructed samples within the given channel. The following illustrates the calculation of the DC predictor signal on increasing waveform values:

 ... (start of *b*)
 o
 o **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ DC prediction signal for *b***
 o
o

As can be observed, in the absence of a residual signal for *b*, blocking artifacts at the left-side block boundary of *b* are quite likely to occur. It is proposed to, instead, calculate the constant for the DC predictor by linear extrapolation of the last 4 reconstructed samples, a functionality which already exists in H.BWC for other purposes (namely, prediction signal generation for other predictor type):

 **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ DC prediction signal for *b***
 o
 o
 o
o

Note that, in terms of objective BD-rate performance, this change to the DC predictor calculation does not result in significant changes (–0.01% BD-rate on INCART ECG dataset, ≈0.0% on others).

1. **Performance Results**

By implementing the abovenoted changes, the PRD based BD-rates reportedly improve as follows:

* **ECG**: from BD-rate 3.16%, decoding time ratio 95.8% to BD-rate **1.93**%, dec time ratio 99%
* **EMG**: from BD-rate1.12%, decoding time ratio100.1% to BD-rate <**1**%, dec time ratio 99%

Informal visual inspection of the decoded, deblocked waveforms indicates that the deblocking can reduce blocking artifacts roughly as well as previously described and depicted in VCEG-BX13[1].

The 2.71% BD-rate reported in the abstract is the average result for the “deblocking critical” subset initially evaluated, comprising the MIT (ECG), INCART (ECG), and CHBMIT (EEG) sets. More detailed results, as resulting from the source code committed to the CE repository, are listed below:

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| with --PerceptOpt= 1 | **Lossy Compression** |
|  | **Over BWC-2.1** |
|  | BD-PSNR1 | BD-PSNR2 | EncT | DecT |
| MIT (ECG) | 1.94% | 1.93% | 110% | 100% |
| INCART (ECG) | 4.56% | 4.52% | 104% | 101% |
| CHBMIT (EEG) | 1.66% | 1.66% | 101% |  99% |
| NMR55 (EEG) | 0.92% | 0.91% | 101% |  98% |
| NMR57 (EEG) | 1.58% | 1.57% | 100% |  99% |
| Ozdemir (EMG) | 0.79% | 0.85% | 100% | 102% |
| **Overall** | 1.91% | 1.91% | 103% | 100% |

When disabling the deblocking and only evaluating the change to the DC predictor, the results are:

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| --- | --- |
| with --PerceptOpt= 0 | **Lossy Compression** |
|  | **Over BWC-2.1** |
|  | BD-PSNR1 | BD-PSNR2 | EncT | DecT |
| MIT (ECG) | 0.00% | 0.00% | 100% |  99% |
| INCART (ECG) | –0.01% | –0.01% | 100% |  99% |
| CHBMIT (EEG) | 0.00% | 0.00% | 100% | 100% |
| NMR55 (EEG) | 0.00% | 0.00% | 100% | 100% |
| NMR57 (EEG) | 0.00% | 0.00% | 100% |  99% |
| Ozdemir (EMG) | 0.01% | 0.01% | 100% |  99% |
| **Overall** | 0.00% | 0.00% | 100% |  99% |

1. **References**

[1] C. Helmrich *et al.*, “Core experiment CE 1-2 on improved deblocking in biomedical waveform coding,” *ITU-T document VCEG-BX13*, Apr. 2025. 🌍 <https://www.itu.int/wftp3/av-arch/video-site/2503_Tel/VCEG-BX13-v2-Deblock.docx>.

[2] J. Pfaff, C. Fersch, “CE description for H.BWC,” *ITU-T document VCEG-BX24*, Apr. 2025. 🌍 <https://www.itu.int/wftp3/av-arch/video-site/2503_Tel/VCEG-BX24-v1-CEdescription.docx>.

1. **Patent Rights Declaration**

**Fraunhofer 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 (per box 2 of the ITU-T/ITU-R/ISO/IEC patent statement and licensing declaration form).**

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