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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-BY03-v1 |

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| Question: | 6/21 (VCEG) | | |
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| Title: | **Report of CE-3** | | |
| Purpose: | Proposal | | |

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# Abstract

This document reports on the simulation results of Core Experiments 3 (CE3), which investigate the CABAC modifications proposed in VCEG-BX15.

# Software and configurations

CE3 is divided into two sub-categories, namely CE3.1 and CE3.2. In CE3.1, the modified level coding proposed in VCEG-BX15 is evaluated under the BWC Common Test Conditions (CTC). In CE3.2, the same modifications are assessed under the CTC, but using a fixed block size equal to 2¹¹. Note that the CTC specifies an independent channel coding configuration, which is referred to as ICC in this document.

The software used for the experiments is BWC-2.1, with the proposed modifications implemented on top of this baseline. For the BD-rate calculation, the anchor is the unmodified BWC-2.1 software using the encoder configuration specified for each sub-category, while the test candidate is the modified BWC-2.1 software using the same encoder configurations.

# Experimental results

Note that although the tables denote “Over BWC-2.0”, the anchor results were generated using BWC-2.1, and not BWC-2.0.

## CE3.1

In this sub-category, the impact of the modified level coding is evaluated under the current CTC.

CTC (Non-ICC Configuration)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Lossy Compression** | | | |
|  | **Over BWC-2.0** | | | |
|  | BD-PSNR1 | BD-PSNR2 | EncT | DecT |
| MIT (ECG) | -0.58% | -0.57% | 103% | 99% |
| INCART (ECG) | 0.25% | 0.22% | 103% | 103% |
| CHBMIT (EEG) | -1.46% | -1.45% | 103% | 103% |
| NMR55 (EEG) | -1.37% | -1.17% | 103% | 101% |
| NMR57 (EEG) | -0.55% | -0.52% | 102% | 101% |
| Ozdemir (EMG) | -2.47% | -2.43% | 109% | 109% |
| **Overall** | -1.03% | -0.99% | 104% | 103% |
|  |  |  |  |  |
|  |  | | | |
|  | **Lossless Compression** | | |  |
|  | **Over BWC-2.0** | | |  |
|  | BR-R | EncT | DecT |  |
| MIT (ECG) | 0.00% | 101% | 100% |  |
| INCART (ECG) | 0.00% | 101% | 100% |  |
| CHBMIT (EEG) | -0.03% | 102% | 100% |  |
| NMR55 (EEG) | -0.01% | 101% | 100% |  |
| NMR57 (EEG) | -0.01% | 100% | 100% |  |
| Ozdemir (EMG) | -0.01% | 100% | 100% |  |
| **Overall** | -0.01% | 101% | 100% |  |

CTC – Independent Channel Coding (ICC)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Lossy Compression** | | | |
|  | **Over BWC-2.0** | | | |
|  | BD-PSNR1 | BD-PSNR2 | EncT | DecT |
| MIT (ECG) | -0.80% | -0.80% | 102% | 99% |
| INCART (ECG) | -0.45% | -0.43% | 103% | 109% |
| CHBMIT (EEG) | -1.17% | -1.18% | 102% | 110% |
| NMR55 (EEG) | -0.86% | -0.60% | 103% | 101% |
| NMR57 (EEG) | -0.86% | -0.78% | 103% | 104% |
| Ozdemir (EMG) | -2.04% | -2.01% | 103% | 114% |
| **Overall** | -1.03% | -0.97% | 102% | 106% |
|  |  | | | |
|  | **Lossless Compression** | | |  |
|  | **Over BWC-2.0** | | |  |
|  | BR-R | EncT | DecT |  |
| MIT (ECG) | 0.00% | 100% | 99% |  |
| INCART (ECG) | 0.00% | 100% | 99% |  |
| CHBMIT (EEG) | -0.01% | 101% | 100% |  |
| NMR55 (EEG) | 0.01% | 101% | 100% |  |
| NMR57 (EEG) | 0.00% | 100% | 100% |  |
| Ozdemir (EMG) | 0.00% | 101% | 100% |  |
| **Overall** | 0.00% | 101% | 100% |  |

## CE3.2

In this sub-category, the impact of the modified level coding is evaluated using a fixed block size equal to 2¹¹.

CTC – Block Size 2¹¹, Non-ICC Configuration

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Lossy Compression** | | | |
|  | **Over BWC-2.0** | | | |
|  | BD-PSNR1 | BD-PSNR2 | EncT | DecT |
| MIT (ECG) | -0.28% | -0.28% | 109% | 98% |
| INCART (ECG) | 0.00% | 0.00% | 105% | 103% |
| CHBMIT (EEG) | -3.47% | -3.48% | 104% | 103% |
| NMR55 (EEG) | -2.68% | -2.39% | 105% | 100% |
| NMR57 (EEG) | -2.70% | -2.65% | 102% | 100% |
| Ozdemir (EMG) | -2.04% | -1.94% | 109% | 105% |
| **Overall** | -1.86% | -1.79% | 106% | 101% |
|  |  |  |  |  |
|  |  | | | |
|  | **Lossless Compression** | | |  |
|  | **Over BWC-2.0** | | |  |
|  | BR-R | EncT | DecT |  |
| MIT (ECG) | 0.00% | 100% | 101% |  |
| INCART (ECG) | 0.00% | 104% | 100% |  |
| CHBMIT (EEG) | -0.02% | 103% | 100% |  |
| NMR55 (EEG) | -0.02% | 101% | 101% |  |
| NMR57 (EEG) | -0.01% | 100% | 100% |  |
| Ozdemir (EMG) | -0.02% | 102% | 102% |  |
| **Overall** | -0.01% | 102% | 101% |  |

CTC – Block Size 2¹¹, ICC Configuration

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Lossy Compression** | | | |
|  | **Over BWC-2.0** | | | |
|  | BD-PSNR1 | BD-PSNR2 | EncT | DecT |
| MIT (ECG) | -0.65% | -0.66% | 105% | 97% |
| INCART (ECG) | -0.12% | -0.13% | 105% | 115% |
| CHBMIT (EEG) | -3.28% | -3.46% | 104% | 116% |
| NMR55 (EEG) | -2.01% | -2.06% | 104% | 100% |
| NMR57 (EEG) | -2.45% | -2.27% | 104% | 109% |
| Ozdemir (EMG) | -2.04% | -1.94% | 104% | 106% |
| **Overall** | -1.76% | -1.75% | 104% | 107% |
|  |  |  |  |  |
|  |  | | | |
|  | **Lossless Compression** | | |  |
|  | **Over BWC-2.0** | | |  |
|  | BR-R | EncT | DecT |  |
| MIT (ECG) | 0.00% | 102% | 101% |  |
| INCART (ECG) | 0.00% | 102% | 100% |  |
| CHBMIT (EEG) | -0.06% | 102% | 102% |  |
| NMR55 (EEG) | 0.00% | 102% | 100% |  |
| NMR57 (EEG) | -0.02% | 100% | 101% |  |
| Ozdemir (EMG) | -0.01% | 102% | 101% |  |
| **Overall** | -0.02% | 102% | 101% |  |

# Observation and Summary

The experimental results show that the modifications to the level coding proposed in VCEG-BX15 provide coding efficiency improvements for the standard CTC configurations, as well as for a CTC configuration using a fixed block size equal to 2¹¹. Since the primary focus of the proposed changes is on larger block sizes and configurations with fewer prediction coding tools, the higher coding efficiency improvement observed in CE3.2 is consistent with expectations. Based on these findings, the proposed modifications should be incorporated into the next version of the BWC software.

# Patent rights declaration(s)

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

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