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| **ITU – Telecommunications Standardization Sector**  STUDY GROUP 21 Question 6  **Video Coding Experts Group (VCEG)**  76th Meeting: 27 March – 4 April 2025, Teleconference | Document VCEG-BX11-v1 |

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| Question: | 6/21 (VCEG) | | |
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| Title: | **Description and correction of errors in H.BWC test model since January meeting** | | |
| Purpose: | Proposal | | |

**Abstract**

This contribution reports errors and proposes corrections to the current version of the H.BWC test model *software* and/or draft *spec*ification text, found after the January VCEG meeting in Geneva. These errors, corrections of which cause only very small changes in coding performance, include:

* fix of trellis coded quantization (TCQ) code for zeroed coefficients in some cases (*software*),
* harmonization of trigonometric transform scaling across code base for better maintainability,
* fix of syntax/equations on transform type and linear predictive coding order signaling (*spec*),
* correction of handling of boundary cases in delta-coding of block matching predictor (both).

It is proposed to adopt these corrections into the next software resp. draft specification text version.

1. **Description of Errors and Corrections**

In the following, a detailed description of each of the above 4 errors and proposed fixes is provided. All errors are located in software and/or specification text provided by HHI in response to the 2024 Call for Proposals on biomedical waveform coding, and none of the fixes affect the codec runtime.

## Trellis coded quantization (TCQ) #define HHI\_BUGFIX\_TCQ

In the current version of the H.BWC reference software [1], zero-quantized transform coefficients (i.e., coefficients with level == 0) are reconstructed by incorporating the parity bit (state&1) of the continuously updated TCQ state. This is wrong, and it is proposed to reconstruct zero-quantized transform coefficients simply by setting the reconstructed coefficient value to 0. No change to *spec*.

## Transform scaling harmonization #define SCALING\_TRAFO

Different parts of the current version of the H.BWC reference software [1] apply different ways of scaling (i. e., different value ranges) of transform coefficients–in some parts, the coefficient scaling includes term 2/sqrt(*N*), with *N* being the block size, while in other parts, the coefficients are scaled to a value range of 32 bit (to maximize precision), regardless of *N*. To ease maintenance and further standard development, it is proposed to include factor 2/sqrt(*N*) in all transform related code paths.

Effect on coding efficiency, when measured in PRD based BD-rate [2]: ±0.01%, depending on set.

## Fixes related to specification text specificationtextonly

In 7.3.3.3.5 of the draft specification text, the linear predictive filter (LPF) order is wrongly derived via a binary left-shift,1« (lpf\_num\_weights\_idx+1), instead of a multiplication, 2·(lpf...), and in 7.3.3.3.1, a transform\_skip\_flag is utilized, instead of a transform\_**present**\_flag as is intended and applied in the H.BWC software as well as other text places (e.g., block\_delta\_zlsb\_**present**\_flag).

## Fix to block matching prediction #define HHI\_BUGFIX\_BM

The block matching (BM) predictor in H.BWC applies temporal delta-coding of its parameter, with value-range checking related adjustment upon changing block sizes. This adjustment was found to be incomplete in that it is only currently applied when the current block’s size is greater than the previous block’s size. Therefore, it is proposed to apply an analogous adjustment in the opposite case, by extending 7.3.3.3.3 of [3] as follows and correcting the software accordingly: before text

if( bmOffsetPred < ( 1 << Log2BlockSize ) )

add

if( log2BMBlockSizePred > Log2BlockSize && bmOffsetMinusBlockSizePred > ( Log2BlockSize << 6 ) )  
 bmOffsetPred = bmOffsetPred >> ( log2BMBlockSizePred – Log2BlockSize )

Effect on coding efficiency, when measured in PRD based BD-rate [2]: –0.01% on ECG, 0% else.

Detailed BD-rate results and patches for corrections to the software can be provided upon request.

1. **References**

[1] VCEG, “Reference software for biomedical waveform data compression,” tag BWC-1.0. 🌍: <https://vcgit.hhi.fraunhofer.de/vceg-sw/bwc/-/tags>, presets *combined...cfg* in directory*bwc/cfg*

[2] J. Pfaff, C. Fersch, and Rapporteur Q6/21, “Common test conditions and evaluation procedures for H.BWC technical experiments,” *ITU-T document SG21-TD68/WP3*, Geneva, Jan. 2025. 🌍: <https://www.itu.int/wftp3/av-arch/video-site/2501_Gen/T25-SG21-TD-WP3-068-BWC-CTC.docx>.

[3] J. Pfaff and C. Fersch, “H.BWC draft specification text,” *ITU-T document SG21-C0019*, 2024.

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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