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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-BX09-v1 |

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| Question: | 6/21 (VCEG) |
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| Title: | **Report on reference software development and anchor results for H.BWC** |
| Purpose: | Report |

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**Abstract**

This document summarizes reference software development for biomedical waveform coding (H.BWC) between the 75th and 76th VCEG meetings and presents anchor results for version 1.0 of the reference software.

1. **Introduction**

The reference software is a common framework which enables testing of new coding technologies in a unified environment and provides an exemplary implementation conforming to the draft specification of biomedical waveform coding (H.BWC).

This document reports on the progress of reference software development and provides anchor results for BWC-1.0.

1. **Software Development**

Development of the reference software was continued on the GitLab server located at:
<https://vcgit.hhi.fraunhofer.de/vceg-sw/bwc>

The registration and development workflow are documented at:
<https://vcgit.hhi.fraunhofer.de/vceg-sw/bwc/-/wikis/BWC-Software-Development-Workflow>

The latest software model version before the start of the meeting was BWC-1.0:

<https://vcgit.hhi.fraunhofer.de/vceg-sw/bwc/-/tree/BWC-1.0?ref_type=tags>

The repositories for the core experiments can be found at:
<https://vcgit.hhi.fraunhofer.de/vceg-bwc-ce/2501_gen-ce-1-1/bwc>
<https://vcgit.hhi.fraunhofer.de/vceg-bwc-ce/2501_gen-ce-1-2/bwc>
<https://vcgit.hhi.fraunhofer.de/vceg-bwc-ce/2501_gen-ce-1-3/bwc>
<https://vcgit.hhi.fraunhofer.de/vceg-bwc-ce/2501_gen-ce-1-4/bwc>

The CE repositories are only accessible by the CE participants and the CE coordinators. Access can be granted by the CE coordinators.

# Software Development Progress

The progress in software development before the start of this meeting can be summarized as follows:

* Aligned the software with the draft specification [1]
* Enabled independent channel coding and provided encoder configuration files, respectively
* Issued the first version of the BWC reference software (BWC-1.0)
* Created software repositories for the core experiments defined in [2] based on BWC-1.0
* Generated anchor coding results for further testing

# Anchor Results

Anchor results have been generated according to the common test conditions (CTC) described in [3] based on BWC-1.0. For each test set, there are two configurations. The first configuration realizes a joint coding of the channels while the second configuration realizes an independent coding of the channels.

The results are attached to this document as csv and pdf (plots) files. There is a csv file for each test set containing the test/sequence name and working point, the number of bits per samples (BPS), PSNR1 and PSNR2 as defined in the CTC. These results shall be used to compute a Bjøntegaard Delta (BD) rate for a technology under test. A corresponding Python script for BD-rate calculation) is attached to the CTC document [3]. For each input sequence and PSNR measure (PSNR1 and PSNR2), there is a pdf-file showing plots for independent channel coding with respect to joint channel coding, since there are no prior anchors available yet.

Further plots are provided for each input sequence showing results for BWC-1.0 with respect to xHE-AAC audio encoder measuring the PRD (percentage root-mean-squared difference) over the number of bits per sample. These results are informative.

# References

1. J. Pfaff, C. Fersch ,“H.BWC Draft Specification Text,” Jan. 2025.
<https://www.itu.int/wftp3/av-arch/video-site/2501_Gen/>
2. J. Pfaff, C. Fersch ,“Core experiments for H.BWC,” ITU-T SG21  (Study Period 2025)  Temporary Document  71-WP3, Jan. 2025. <https://www.itu.int/md/T25-SG21-250113-TD-WP3-0071/en>
3. J. Pfaff, C. Fersch ,“Common test conditions and evaluation procedures for H.BWC technical experiments,” ITU-T SG21  (Study Period 2025)  Temporary Document  68-WP3, Jan. 2025. <https://www.itu.int/md/T25-SG21-250113-TD-WP3-0068/en>