

**Joint Video Experts Team (JVET)  
of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC  
29/WG 11**

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MPEG: m66910

33rd Meeting, by teleconference, 17-26 January 2024

**Title:** BoG report on ECM expert viewing preparations

**Status:** Input document to JVET

**Purpose:** Proposal

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**Source:** M. Wien

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Agenda

Develop a tentative plan for testing ECM performance by expert viewing tests at the 34th JVET meeting in April 2024

Selection of test sequences / categories / resolution(s)

Selection of configuration(s) to be tested

Consideration of potential subsets of ECM tools to be tested.

Proposal of a time line for AhG work between this and the next meeting.

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## MEETING NOTES

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[JVET-AG0333](#) BoG report on ECM expert viewing preparations [M. Wien]

The BoG on ECM expert viewing preparations met during 0600–0700 on Thursday 25 January 2024 (chaired by M. Wien)

A brief review of JVET-AB0041 “AHG4, 7, 12: Report on AHG meetings on ECM performance evaluation preparation” for checking the preparations for ECM viewing which have taken place before the Mainz meeting in October 2022 (reported in JVET-AB2029) was conducted.

Discussion on the possible size of the test:

- About 30s of test time per PVS (processed video sequence)
- Separate sessions for different resolutions
- Recommended duration of one test session: 15min (20min max)
- In the JVET-AB2029 tests
  - 7 UHD sequences: all RA
  - 6 HD sequences: 3 RA, 3 LD

It was suggested to follow the basic layout of the test reported in JVET-AB2029. The size of the test could be extended a bit, but keeping it at about this size might be good. Rough calculation: 8 sequences  $\times$  4 rate points  $\times$  3 variants = 96 PVS under test, i.e. 48 of testing time with the DCR protocol. It was noted that using ACR-HR (Absolute Category Rating with Hidden Reference) can be done with about half of the testing time.

Approach: Start with a set of about 10 candidate sequences per resolution, narrow this down to the set to be used in the AhG phase.

It was suggested to focus on non-CTC sequences in the viewing tests. An overlap of the test sequences of the new test and the JVET-AB2029 test was considered useful to study the progression between the two tests. It was noted that testing non-CTC sequences would be more interesting than CTC sequences which already have been assessed in various previous tests during the development.

It was noted that the configuration files provided with the JVET CTC, which have been used in the visual tests, are significantly tuned towards optimization of PSNR. This also holds for the encoder decision making in the reference software packages.

It was noted that consideration of different testing methods might be helpful for different question: e.g., the comparison of VTM vs. ECM could be performed with an DCR test while ECM tool group tests could be done using A-B comparisons.

It was noted that using non-CTC sequences which appear to be challenging for the ECM would be interesting. It might be good to have a mix of sequences, i.e. to include ‘corner case’ sequences w.r.t. RD performance evaluated using PSNR.

Options for testing are:

- DCR, providing good differentiability of difference coding schemes, and comparability with the previous ECM test
- ACR-HR, being much faster than DCR, potentially at slightly less differentiability
- A-B comparisons, useful if smaller difference between versions are expected.

It was suggested to use ECM 11 for preparations as it is available for directly starting preparations for the tests. Using the CTC RA configuration and CTC LDB configuration is recommended to maintain comparability with the previous test.

Time line (meeting start on April 17<sup>th</sup>)

- April 18: Tests to be conducted in Rennes before the start of the MPEG week, latest on Sat
- April 14: Final bitstreams available
- April 01: Crosscheck of bitstreams complete

Volunteers for encoding and other preparation efforts were identified as follows (further updating needed, see AHG4 mandates):

- E. Alshina (Huawei) (to be confirmed)
- K. Andersson (Ericsson)
- O. Chubach (MediaTek)
- E. François (InterDigital)
- X. Li (Google)
- X. Li (Alibaba)
- V. Seregin (Qualcomm)
- F. Wang (OPPO)
- Y. Wang (Bytedance)
- A. Wieckowski (HHI)

## **BoG Recommendations**

- Set up AhG calls for determining the rate points. 3 AhG meetings are suggested. Meeting slots accommodating the volunteers for encoding are suggested
  - Feb. 13: Determination of settings and sequence candidate list, determination of ECM group test layout
  - Meeting in week of Mar 18: review of results, determination of selection process to be viewed
  - Meeting in week of Apr 8: set of tentative candidate sequences
- Use of ECM-11
- Use CTC configurations

The BoG report was presented Fri. 26 Jan. at 0725.

The recommendations of the BoG were confirmed by JVET.

It was commented that the planned viewing test is highly important to understand the potential of additional coding tools for future standardization. Therefore, additional volunteers contributing to the preparation are sought.

## AHG8: Optimization of encoders and receiving systems for machine analysis of coded video content (7+1)

Contributions in this area were discussed at 2240–2300 and 2320-0135+1 on Tuesday 23 Jan. 2024, at 2230-2310 on Wednesday 24 Jan. 2024, and at 0540-0600 on Thursday 25 Jan. 2024 (chaired by JRO).

[JVET-AG0333](#) BoG report on ECM expert viewing preparations [M. Wien]

See section 4.9.

## Liaison communications (1)

[m66811](#) [ISO/IEC JTC 1/SC 29/WG 1] Liaison statement from SC 29/WG 1 to WG 5 on JPEG AI [SC 29/WG 1 N 100689]

[SG16-TD329/GEN](#) [ISO/IEC JTC1/SC29/WG1] LS on JPEG AI

JPEG liaison statement [m66811](#) and [SG16-TD329/GEN](#) were essentially the same liaison statement sent to both WG 5 (JVET) and VCEG. This liaison statement provided an update on the JPEG AI project.

JPEG AI verification model (VM 4) targets a standard reconstruction task and has two basic configurations, the first with a minimal set of networks for encoding/decoding images (“tools-off”) and the second to enable additional networks and tools to achieve further compression performance improvements (“tools-on”). Moreover, the VM has two operating points with different complexity targets: the base and the high operating points, with approximately 20kMAC/px and 200kMAC/px, targeting resource-constrained and high-end devices, respectively. The JPEG AI VM4 evaluation reportedly shows 16.2% and 28.2% compression efficiency gains over the VVC Intra anchor, for base and high operating, points respectively, for the tools-on configuration, based on some fidelity metrics used by the JPEG WG.

For the base operating point, on CPU platforms, the JPEG AI encoder execution was reported to be 70 times faster compared to the VVC intra reference implementation while the JPEG AI decoder execution time is twice as long. For the base operating point, on GPU platforms, the JPEG AI encoder execution was reported to be 1000 times faster compared to the VVC intra reference implementation, and the JPEG AI decoder execution was reported as 10 times faster.

At the 101st meeting, the JPEG AI timeline was reviewed. For version 1 of the JPEG AI standard, the CD was released during the October 2023 meeting, DIS was planned for April 2024 and IS publication in October 2024. JPEG also planned that JPEG AI version 2 will address requirements not yet fulfilled in version 1 (especially machine consumption tasks) and also significant improvements on requirements already

addressed in version 1, e.g. compression efficiency. JPEG was planning to issue a JPEG AI version 2 final Call for Proposals in January 2025 and have presentation and evaluation of JPEG AI version 2 proposals in July 2025.

At the October 2023 meeting, more than 40 contributions related to JPEG AI were received. The results of the fifth round of Core Experiment were discussed and analyzed resulting in the adoption of several improvements, which will be integrated into a common platform for further study in the scope of the Integration Core Experiment (CE). The following list highlights the main adoptions for this CE:

- Feature clipping model to achieve a significant reduction of artefacts.
- New hyper-scale decoder quantization procedure.
- Harmonization between the ANS-based coding engine and skip mode.
- Optimization of the probability distribution tables used for entropy decoding.
- New encoder and decoder for increased chroma quality.
- Color space adaptive synthesis transform.
- Reduction on the number of models to cover the entire quality range.
- Base operating point synthesis transform simplification.
- Several hyper-decoder simplifications.
- New 4-stage simplified context model.
- Multi-branch decoding, where multiple synthesis transforms can independently operate.
- A new HDR and synthetic test dataset.
- A new training dataset with natural and synthetic images.
- Harmonization and simplification of enhancement filters and tools.

Moreover, two demos were remotely shown where preliminary JPEG AI decoder implementations were run on two smartphone devices, a Huawei Mate50 Pro (wg1m101084) and an iPhone 14 Pro (wg1m101102). In the Huawei smartphone, a 1K image can be decoded in approximately 28ms while in iPhone it currently takes 13ms. Some of the implementation difficulties and issues were described and discussed, which can lead to further optimizations of the JPEG AI VM.

In the October JPEG meeting, multiple core experiments were established to further continue this work:

- CE6.1 - Integration CE
- CE6.2 - Encoder design for multi-branch JPEG AI decoding
- CE6.3 - Model integerization
- CE6.4 - JPEG AI high-level syntax and HDR metadata
- CE6.5 - Training dataset and procedure
- CE6.6 - EFE enhancement
- CE6.7 - Device interoperability
- CE6.8 - Synthesis transform simplification
- CE6.9 - Improved variable bit-rate training strategy

- CE6.10 - Feature clipping
- CE6.11 - Tiling and spatial random access

The JPEG group was seeking further information exchange between the two groups working on learning-based image coding and neural network-based coding tools.

A reply was drafted as WG 5 N 269. It provided an update on the exploration of neural network-based video coding (NNVC), neural network-based post-filtering, and the Enhanced Compression Model (ECM) exploration experiments.

On the exploration of neural network-based video coding (NNVC), it reported that we have updated our common software codebase to version 7.1 (NNVC-7.1), saying that the new version of NNVC supports five tools: NN-based intra mode, NN-based super-resolution, NN-based post-filter, low operation point NN-based in-loop filter, and high operation point NN-based in-loop filter. Test results for some possible tool combinations with NNVC-7.1 were noted to be found in [JVET-AG0014](#).

The reply said the primary focus in the NNVC development is its use for video coding with inter-picture prediction for random access and low-delay configurations. However, of particular interest for JPEG would be results in the all-intra test configuration. Relative to VVC, the measured improvement of NNVC-6.0 was reported by JVET as follows:

- LOP (Low Operation Point) BD-rate: 8.1%, Enc. Time  $\times 1.8$ , Dec.Time  $\times 56$ , kMAC/pixel 25;
- HOP (High Operation Point) BD-rate: 12.6%, Enc. Time  $\times 3.4$ , Dec.Time  $\times 1150$ , kMAC/pixel 480;

PSNR-Y was reported to have been used as the metric for these results, with encoding and decoding run time being measured on a CPU.

JPEG was informed of the document describing algorithms and software modules contained in the NNVC common software codebase that was issued as [JVET-AG2019](#) / WG 5 N 265 (with an editing period).

The outgoing reply informed JPEG of the [JVET-AG0023](#) summary of our Exploration Experiment 1 evaluating performance and complexity aspects of NNVC technologies. One of the recent developments was the improvement of the high operation point in-loop filter by establishing a better balance between luma and chroma performance. The training strategy and bit allocation during inference were changed, but the unified filter architecture remains the same. A significant speedup of encoder-side overfitting for content-adaptive NN-based filtering has been achieved; the overfitting time was reduced from approximately one day to one hour. The complexity of NN-based super-resolution has been reduced from 400 kMAC/pixel to 20 kMAC/pixel, preserving approximately the same compression performance. Decoding run time for NN-based inter predictive technology has been reduced by a factor of four. A strong dependency was found between NN-based inter coding technology performance and the quality, diversity and quantity of training data. To address this issue and ensure further progress of NNVC study, it was noted that JVET has issued a Call for Training Materials as [JVET-AG2036](#) / WG 5 N 266 (with an editing period).

The reply informed JPEG that the study of NN-based algorithms for video coding will be continued in Exploration Experiment 1. The description for tests included into the next round of EE 1 has been issued as

JVET-AG2023 / WG 5 N 264 (with an editing period). Exploration Experiment 1 will include the following categories of explorations: high and low operation point in-loop filters, super-resolution, and NN-based inter coding. New tests in EE1 will include the study a very-low-complexity operation point NN-based in-loop filter with around 5 kMAC/pixel computational complexity.

Regarding for neural-network post-filtering (NNPF), the reply informed JPEG of the new SEI messages developed for version 3 of VSEI and VVC, with publication process details as follows:

- For VSEI, version 3 of Rec. ITU-T H.274 was approved in ITU-T on 29 September 2023 and pre-published on 11 October 2023, and is currently pending final publication in ITU-T. The corresponding edition 3 of ISO/IEC 23002-7 was issued from the July 2023 JVET meeting and was currently in preparation for FDIS ballot.
- For VVC, version 3 of Rec. ITU-T H.266 was approved in ITU-T on 29 September 2023 and pre-published on 29 November 2023, and is currently pending final publication in ITU-T. The corresponding edition 3 of ISO/IEC 23090-3 was issued from the July 2023 JVET meeting and was currently in preparation for FDIS ballot.

Another major focus of JVET was indicated to be the exploration of potential tools extensions using more conventional video coding technologies for coding efficiency improvements. This work also primarily focuses on inter-picture predictive video coding with random access and low-delay configurations. Candidate technologies have been adopted into the Enhanced Compression Model (ECM), with an algorithm description documented in [JVET-AG2025](#) / WG 5 N 268 (with an editing period) and coordinated software implementation for testing. The performance of ECM-11.0 is summarized in [JVET-AG0006](#). Of particular interest to JPEG is the all-intra configuration. Relative to a corresponding VVC anchor, ECM-11.0 was reported to demonstrate 12.8% BD-rate gain (based on PSNR-Y) in the all-intra configuration with  $\times 8.1$  encoding and  $\times 4.1$  decoding run time ratios.

JVET indicated that we look forward to further communicating with JPEG on items of mutual interest.

The liaison response was reviewed in JVET on Thursday 25 Jan. at 0725-0905. The draft reply was also presented in the MPEG AG 3 Communication meeting Thursday 25 Jan. at 1300-1500.

## Project planning

### Software timeline

ECM 12.0 software (including all adoptions) was planned to be available 3 weeks after the meeting.

The NNVC 8.0 codebase software was planned to be available 2 weeks after the meeting.

Bug fixes on top of VTM23.0 software will be released as appropriate.

Updates on top of HM17.0 software were not planned, but might be released after merging pending requests, as appropriate.

As a general rule in software development, a person who is executing a merge shall not be from the same company as the person who submitted that merge request.

## Core experiment and exploration experiment planning

An EE on neural network-based video coding was established, as recorded in output document JVET-AG2023.

An EE on enhanced compression technology beyond VVC capability using techniques other than neural-network technology was also established, as recorded in output document JVET-AG2024.

Initial versions of these documents were presented and approved.

## Drafting of specification text, encoder algorithm descriptions, and software

The following agreement has been established: the editorial team has the discretion to not integrate recorded adoptions for which the available text is grossly inadequate (and cannot be fixed with a reasonable degree of effort), if such a situation hypothetically arises. In such an event, the text would record the intent expressed by the committee without including a full integration of the available inadequate text.

## Plans for improved efficiency and contribution consideration

The group considered it important to have the full design of proposals documented to enable proper study.

Adoptions need to be based on properly drafted working draft text (on normative elements) and HM/VTM encoder algorithm descriptions – relative to the existing drafts. Proposal contributions should also provide a software implementation (or at least such software should be made available for study and testing by other participants at the meeting, and software must be made available to cross-checkers in EEs).

Suggestions for future meetings included the following generally-supported principles:

- Normative contributions (relating to changes in bitstream/decoder) shall include draft specification text
- Proposals shall contain all details relevant for understanding and be self-contained. In cases where the document is a follow-up of a previous contribution, the overall concept and the novelties should be highlighted at minimum
- Coding tool and encoder optimization proposals shall contain Excel sheets that allow assessment on a per-sequence basis
- Algorithm description text is strongly encouraged for non-normative contributions that are intended to be included in model description documents (VTM, ECM, etc.), and that is required for inclusion in TR drafts.
- Early upload deadline to enable substantial study prior to the meeting

- Using a clock timer to ensure efficient proposal presentations (5 min) and discussions (not exercised currently)

As general guidance, it was suggested to avoid usage of company names in document titles, software modules etc., and not to describe a technology by using a company name.

## General issues for experiments

It was emphasized that those rules which had been set up or refined during the 12th JVET meeting should be observed. In particular, for some CEs of some previous meetings, results were available late, and some changes in the experimental setup had not been sufficiently discussed on the JVET reflector.

Group coordinated experiments have been planned as follows:

- “Core experiments” (CEs) are the coordinated experiments on coding tools which are deemed to be interesting but require more investigation and could potentially become part of a draft standard by the next meeting or in the near future.
- “Exploration experiments” (EEs) are also coordinated experiments. These are conducted on technology which is not foreseen to become part of a draft standard in the near future. The investigating methodology for assessment of such technology can also be an important part of an EE. (Further general rules for EEs, as far as deviating from the CE rules below, should be discussed in a future meeting. For the current meeting, procedures as described in the EE description document are deemed to be sufficient.)
- A CE is a test of a specific fully described technology in a specific agreed way. It is not a forum for thinking of new ideas (like an AHG). The CE coordinators are responsible for making sure that the CE description is complete and correct and has adequate detail. Reflector discussions about CE description clarity and other aspects of CE plans are encouraged.
- A description of each experiment is to be approved at the meeting at which the experiment plan is established. This should include the issues that were raised by other experts when the tool was presented, e.g., interference with other tools, contribution of different elements that are part of a package, etc. The experiment description document should provide the names of individual people, not just company names.
- Software for tools investigated in a CE will be provided in one or more separate branches of the software repository. Each CE will have a “fork” of the software, and within the CE there may be multiple branches established by the CE coordinator. The software coordinator will help coordinate the creation of these forks and branches and their naming. All JVET members will have read access to the CE software branches (using shared read-only credentials as described below).
- During the experiment, revisions of the experiment plans can be made, but not substantial changes to the proposed technology. Withdrawing parts of experiments that were intended to show the individual benefits of a tool or parts of a tool is strongly discouraged. Combination tests may not be considered in such cases. Any changes made to individual tools in a combination shall be documented.
- The CE description must match the CE testing that is done. The CE description needs to be revised if there has been some change of plans.
- The CE summary report must describe any changes that were made in the process of finalizing the CE.

- By the next meeting it is expected that at least one independent cross-checker will report a detailed analysis of each proposed feature that has been tested and confirm that the implementation is correct. Commentary on the potential benefits and disadvantages of the proposed technology in cross-checking reports is highly encouraged. Having multiple cross-checking reports is also highly encouraged (especially if the cross-checking involves more than confirmation of correct test results). The reports of cross-checking activities may (and generally should) be integrated into the CE report rather than submitted as separate documents.
- It is mandatory to report encoder optimizations made for the benefit of a tool, and if an equivalent optimization could be applied on the anchor, a comparison against the improved anchor shall be provided.
- A new proposal can be included in a CE based on group decision, regardless if an independent party has already performed a cross-check in the meeting when it was first proposed.

It is possible to define sub-experiments within particular CEs, for example designated as CEX.a, CEX.b, etc., where X is the basic CE number.

As a general rule, it was agreed that each CE should be run under the same testing conditions using one software codebase, which should be based on the group test model software codebase. An experiment is not to be established as a CE unless there is access given to the participants in (any part of) the CE to the software used to perform the experiments.

The general agreed common conditions for single-layer coding efficiency experiments for SDR video are described in the prior output document JVET-T2010.

Experiment descriptions should be written in a way such that it is understood as a JVET output document (written from an objective “third party perspective”, not a proponent perspective – e.g. not referring to methods as “improved”, “optimized”, “enhanced”, etc.). The experiment descriptions should generally not express opinions or suggest conclusions – rather, they should just describe what technology will be tested, how it will be tested, who will participate, etc. Responsibilities for contributions to CE work should identify individuals in addition to company names.

CE descriptions contain a basic description of the technology under test, but should not contain excessively verbose descriptions of a technology (at least not unless the technology is not adequately documented elsewhere). Instead, the CE descriptions should refer to the relevant proposal contributions for any necessary further detail. However, the complete detail of what technology will be tested must be available – either in the CE description itself or in documents that are referenced in the CE description that are also available in the JVET document archive.

Any technology must have at least one cross-check partner to establish a CE – a single proponent is not enough. It is highly desirable have more than just one proponent and one cross-checker.

The CE development workflow is described at:

[https://vcgit.hhi.fraunhofer.de/jvet/VVCSoftware\\_VTM/wikis/Core-experiment-development-workflow](https://vcgit.hhi.fraunhofer.de/jvet/VVCSoftware_VTM/wikis/Core-experiment-development-workflow)

CE read access is available using shared accounts: One account exists for MPEG members, which uses the usual MPEG account data. A second account exists for VCEG members with account information available in the TIES informal ftp area (IFA) system at:

[https://www.itu.int/ifa/t/2017/sg16/exchange/wp3/q06/vceg\\_account.txt](https://www.itu.int/ifa/t/2017/sg16/exchange/wp3/q06/vceg_account.txt)

Some agreements relating to CE activities were established as follows:

- Only qualified JVET members can participate in a CE.
- Participation in a CE is possible without a commitment of submitting an input document to the next meeting. Participation was requested by contacting the CE coordinator.
- All software, results, and documents produced in the CE should be announced and made available to JVET in a timely manner.
- A JVET CE reflector will be established and announced on the main JVET reflector. Discussion of logistics arrangements, exchange of data, minor refinement of the test plans, and preparation of documents shall be conducted on the JVET CE reflector, with subject lines prefixed by “[CEx: ]”, where “x” is the number of the CE. All substantial communications about a CE other than such details shall take place on main JVET reflector. In the case that large amounts of data are to be distributed, it is recommended to send a link to the data rather than the data itself, or upload the data as an input contribution to the next meeting.

General timeline for CEs

T1= 3 weeks after the JVET meeting: To revise the CE description and refine questions to be answered. Questions should be discussed and agreed on JVET reflector. Any changes of planned tests after this time need to be announced and discussed on the JVET reflector. Initially assigned description numbers shall not be changed later. If a test is skipped, it is to be marked as “withdrawn”.

T2 = Test model software release + 2 weeks: Integration of all tools into a separate CE branch of the VTM is completed and announced to JVET reflector.

- Initial study by cross-checkers can begin.
- Proponents may continue to modify the software in this branch until T3.
- 3rd parties are encouraged to study and make contributions to the next meeting with proposed changes

T3: 3 weeks before the next JVET meeting or T2 + 1 week, whichever is later: Any changes to the CE test branches of the software must be frozen, so the cross-checkers can know exactly what they are cross-checking. A software version tag should be created at this time. The name of the cross-checkers and list of specific tests for each tool under study in the CE plan description shall be documented in an updated CE description by this time.

T4: Regular document deadline minus 1 week: CE contribution documents including specification text and complete test results shall be uploaded to the JVET document repository (particularly for proposals targeting to be promoted to the draft standard at the next meeting).

The CE summary reports shall be available by the regular contribution deadline. This shall include documentation about crosscheck of software, matching of CE description and confirmation of the appropriateness of the text change, as well as sufficient crosscheck results to create evidence about correctness (crosscheckers must send this information to the CE coordinator at least 3 days ahead of the document deadline). Furthermore, any deviations from the timelines above shall be documented. The numbers used in the summary report shall not be changed relative to the description document.

CE reports may contain additional information about tests of straightforward combinations of the identified technologies. Such supplemental testing needs to be clearly identified in the report if it was not part of the CE plan.

New branches may be created which combine two or more tools included in the CE document or the VTM (as applicable).

It is not necessary to formally name cross-checkers in the initial version of the CE description document. To adopt a proposed feature at the next meeting, JVET would like to see comprehensive cross-checking done, with analysis of whether the description matches the software, and a recommendation of the value of the tool and given tradeoffs.

The establishment of a CE does not indicate that a proposed technology is mature for adoption or that the testing conducted in the CE is fully adequate for assessing the merits of the technology, and a favourable outcome of CE does not indicate a need for adoption of the technology into a standard or test model.

Availability of specification text is important to have a detailed understanding of the technology and also to judge what its impact on the complexity of the specification will be. There must also be sufficient time to study this in detail. CE contributions without sufficiently mature draft specification text in the CE input document should not be considered for adoption.

Lists of participants in CE documents should be pruned to include only the active participants. Read access to software will be available to all members.

## Establishment of ad hoc groups

The ad hoc groups established to progress work on particular subject areas until the next meeting are described in the table below. The discussion list for all of these ad hoc groups was agreed to be the main JVET reflector ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de)).

Review of AHG plans was conducted during the plenary on Friday 26 Jan. 2024 at 0510-0625.

| Title and Email Reflector                                                                                    | Chairs                                            | Mtg |
|--------------------------------------------------------------------------------------------------------------|---------------------------------------------------|-----|
| <b>Project Management (AHG1)</b><br><a href="mailto:jvet@lists.rwth-aachen.de">jvet@lists.rwth-aachen.de</a> | J.-R. Ohm (chair), G. J. Sullivan<br>(vice-chair) | N   |

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| <ul style="list-style-type: none"> <li>• Coordinate overall JVET interim efforts.</li> <li>• Supervise AHG and experiment studies.</li> <li>• Report on project status to JVET reflector.</li> <li>• Provide a report to the next meeting on project coordination status.</li> <li>• Supervise processing and delivery of output documents</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                          |          |
| <p><b>Draft text and test model algorithm description editing (AHG2)</b></p> <p>(<a href="mailto:jvet@lists.rwth-aachen.de">jvet@lists.rwth-aachen.de</a>)</p> <ul style="list-style-type: none"> <li>• Produce and finalize draft text outputs of the meeting (J JVET-AG2027 and JVET-AG2034).</li> <li>• Collect reports of errata for the VVC, VSEI, HEVC, AVC, CICC, and the published related technical reports and produce the JVET-AG1004 errata output collection.</li> <li>• Coordinate with the test model software development AhG to address issues relating to mismatches between software and text.</li> <li>• Collect and consider errata reports on the texts.</li> </ul>                                                                                                                                                    | <p>B. Bross, C. Rosewarne (co-chairs), F. Bossen, A. Browne, S. Kim, S. Liu, J.-R. Ohm, G. J. Sullivan, A. Tourapis, Y.-K. Wang, Y. Ye (vice-chairs)</p> | <p>N</p> |
| <p><b>Test model software development (AHG3)</b></p> <p>(<a href="mailto:jvet@lists.rwth-aachen.de">jvet@lists.rwth-aachen.de</a>)</p> <ul style="list-style-type: none"> <li>• Coordinate development of test models (VTM, HM, SCM, SHM, HTM, MFC, MFCD, JM, JSVM, JMVM, 3DV-ATM, 360Lib, and HDRTools) software and associated configuration files.</li> <li>• Produce documentation of software usage for distribution with the software.</li> <li>• Enable software support for recently standardized additional SEI messages, and SEI messages in TuC (the latter in a separate branch of VTM).</li> <li>• Discuss and make recommendations on the software development process.</li> <li>• Perform comparative tests of test model behaviour using common test conditions, including HDR, high bit depth and high bit rate.</li> </ul> | <p>F. Bossen, X. Li, K. Sühling (co-chairs), E. François, Y. He, K. Sharman, V. Seregin, A. Tourapis (vice-chairs)</p>                                   | <p>N</p> |

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| <ul style="list-style-type: none"> <li>• Suggest configuration files for additional testing of tools.</li> <li>• Investigate how to minimize the number of separate codebases maintained for group reference software.</li> <li>• Coordinate with AHG on Draft text and test model algorithm description editing (AHG2) to identify any mismatches between software and text, and make further updates and cleanups to the software as appropriate.</li> <li>• Prepare drafts of merged and updated CTC documents for HM and VTM, as applicable.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                         |                                                   |
| <p><b>Test material and visual assessment (AHG4)</b></p> <p>(<a href="mailto:jvet@lists.rwth-aachen.de">jvet@lists.rwth-aachen.de</a>)</p> <ul style="list-style-type: none"> <li>• Consider plans for additional verification testing of VVC capability, particularly target conducting a first test for VVC multi-layer features by the next meeting, and update the test plan according to subsequent tests.</li> <li>• Coordinate with AHG13 on assessing new test material and investigating metrics that could be used to assess quality of synthesized film grain; improve and update the draft test plan for subjective quality testing of the FGC SEI message.</li> <li>• Maintain the video sequence test material database for testing the VVC and HEVC standards and potential future extensions, as well as exploration activities.</li> <li>• Study coding performance and characteristics of available and proposed video test material.</li> <li>• Identify and recommend appropriate test material for testing the VVC standard and potential future extensions, as well as exploration activities.</li> <li>• Identify and characterize missing types of video material, solicit contributions, collect, and make available a variety of video sequence test material, in coordination with other AHGs, as appropriate.</li> <li>• Maintain and update the directory structure for the test sequence repository, as necessary.</li> </ul> | <p>V. Baroncini, T. Suzuki, M. Wien (co-chairs), W. Husak, S. Iwamura, P. de Lagrange, S. Liu, X. Meng, S. Puri, A. Segall, S. Wenger (vice-chairs)</p> | <p>Y (tel., 2 weeks notice), first on Feb. 13</p> |

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| <ul style="list-style-type: none"> <li>• Collect information about test sequences that have been made available by other organizations.</li> <li>• Prepare and conduct expert viewing for purposes of subjective quality evaluation.</li> <li>• Coordinate with AG 5 in studying and developing further methods of subjective quality evaluation, e.g. based on crowd sourcing.</li> <li>• Coordinate with AHG15 on investigating sequences with gaming content, and make such sequences available for study.</li> <li>• Define testing conditions and prepare bitstreams for subjective evaluation of ECM by expert viewing at the next meeting in coordination with AG 5, AHG6, and AHG12.</li> <li>• Prepare availability of viewing equipment and facilities arrangements for future meetings.</li> </ul>                                                    |                                                                                                                                                  |          |
| <p><b>Conformance testing (AHG5)</b></p> <p><a href="mailto:jvet@lists.rwth-aachen.de">jvet@lists.rwth-aachen.de</a></p> <ul style="list-style-type: none"> <li>• Study the draft of additional conformance bitstreams for VVC multilayer configurations JVET-AE2028, and investigate the need for future improvements of conformance testing specifications.</li> <li>• Study the conformance needs for HEVC multi-view profiles, and develop a set of conformance bitstreams as appropriate.</li> <li>• Study the requirements of VVC, HEVC, and AVC conformance testing to ensure interoperability.</li> <li>• Maintain and update the conformance bitstream database, and contribute to report problems, and suggest actions to resolve these.</li> <li>• Study additional testing methodologies to fulfil the needs for VVC conformance testing.</li> </ul> | <p>I. Moccagatta (chair), F. Bossen, K. Kawamura, P. de Lagrange, T. Ikai, S. Iwamura, H.-J. Jhu, S. Paluri, K. Sühring, Y. Yu (vice-chairs)</p> | <p>N</p> |
| <p><b>ECM software development (AHG6)</b></p> <p><a href="mailto:jvet@lists.rwth-aachen.de">jvet@lists.rwth-aachen.de</a></p> <ul style="list-style-type: none"> <li>• Coordinate development of the ECM software and associated configuration files.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <p>V. Seregin (chair), J. Chen, R. Chernyak, F. Le Léannec, K. Zhang (vice-chairs)</p>                                                           | <p>N</p> |

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| <ul style="list-style-type: none"> <li>• Produce documentation of software usage for distribution with the software.</li> <li>• Prepare and deliver ECM-12.0 software version (and potential updates) and the reference configuration encodings according to the ECM common test conditions.</li> <li>• Investigate encoder speedup and other software optimization such as reduction of memory consumption.</li> <li>• Coordinate with ECM algorithm description editors to identify any mismatches between software and text, make further updates and cleanups to the software as appropriate.</li> <li>• Define testing conditions and prepare bitstreams for subjective evaluation of ECM by expert viewing at the next meeting in coordination with AG 5, AHG4, and AHG12.</li> </ul>                                                                                                                                       |                                                                                                         |          |
| <p><b>ECM tool assessment (AHG7)</b></p> <p><a href="mailto:jvet@lists.rwth-aachen.de">jvet@lists.rwth-aachen.de</a></p> <ul style="list-style-type: none"> <li>• Investigate methodology of tool assessment.</li> <li>• Coordinate with AHG6 on resolving tool-off test related software issues (missing tool controls and software bugs).</li> <li>• Prepare configuration files and generate bitstreams and results of tool-on/tool-off testing.</li> <li>• Prepare reporting of tool assessment results.</li> <li>• Collect simulation results on non-CTC sequences (e.g., those used in previous verification tests), and identify a set of non-CTC sequences that would be appropriate for additional testing.</li> <li>• Investigate the possibility of conducting subjective tests on subsets of tools in coordination with AHG4 and AG 5.</li> <li>• Develop methodology of more reliable runtime measurement</li> </ul> | <p>X. Li (chair), L.-F. Chen, Z. Deng, J. Gan, E. François, H.-J. Jhu, X. Li, H. Wang (vice-chairs)</p> | <p>N</p> |
| <p><b>Optimization of encoders and receiving systems for machine analysis of coded video content (AHG8)</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <p>C. Hollmann, S. Liu, S. Wang, M. Zhou (AHG chairs)</p>                                               | <p>N</p> |

([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))

- Solicit and study non-normative encoder and receiving systems technologies that enhance performance of machine analysis tasks on coded video content.
- Identify and collect test materials that are suitable to be used by JVET for machine analysis tasks.
- Generate anchors according to the common test conditions JVET-AF2031.
- Discuss improvements on the evaluation framework, including evaluation procedures and methodologies.
- Coordinate software development, and continue to migrate the software basis used in AHG8 to newest VTM version.
- Coordinate experiments on optimization of encoders and receiving systems for machine analysis of coded video content.
- Maintain the software implementation example algorithms in the repository, including sufficient documentation in terms of operation and performance.
- Evaluate proposed technologies and their suitability for machine analysis applications.
- Propose improvements to the working draft JVET-AG2030 on optimization of encoders and receiving systems for machine analysis of coded video content.
- Study the potential of using SEI messages for the purpose of machine analysis in coordination with AHG9.
- Investigate the impact of using different machine task models in the evaluation of the compression performance of tools optimized for machine analysis tasks.
- Coordinate with WG 4 VCM AHG on aspects such as unified common test conditions, evaluation metrics, test and training materials, usage of SEI messages, and on studying characteristics and requirements of machine analysis tasks, etc.

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| <p><b>SEI message studies (AHG9)</b></p> <p>(<a href="mailto:jvet@lists.rwth-aachen.de">jvet@lists.rwth-aachen.de</a>)</p> <ul style="list-style-type: none"> <li>• Study the SEI messages in VSEI, VVC, HEVC and AVC.</li> <li>• Discuss JVET-AG2027, JVET-AG2032, and JVET-AG2034, and propose improvements as appropriate.</li> <li>• Collect software and showcase information for SEI messages, including encoder and decoder implementations and bitstreams for demonstration and testing.</li> <li>• Coordinate with WG 4 and AG 5 to evaluate visual quality in the context of MPI, and prepare for conducting subjective viewing during the next meeting.</li> <li>• Identify potential needs for additional SEI messages, including the study of SEI messages defined in HEVC and AVC for potential use in the VVC context.</li> <li>• Study the alignments of the same SEI messages in different standards.</li> <li>• Coordinate with AHG8 and WG 4 to study mechanisms for signalling metadata in the context of machine analysis of coded video content.</li> <li>• Coordinate with AHG3 for software support of SEI messages.</li> </ul> | <p>S. McCarthy, Y.-K. Wang (co-chairs), T. Chujoh, S. Deshpande, C. Fogg, M. M. Hannuksela, Hendry, P. de Lagrange, G. J. Sullivan, A. Tourapis, S. Wenger (vice-chairs)</p> | <p>Y (tel., 2 weeks notice)</p> |
| <p><b>Encoding algorithm optimization (AHG10)</b></p> <p>(<a href="mailto:jvet@lists.rwth-aachen.de">jvet@lists.rwth-aachen.de</a>)</p> <ul style="list-style-type: none"> <li>• Study the impact of using techniques such as tool adaptation and configuration, and perceptually optimized adaptive quantization for encoder optimization.</li> <li>• Study the impact of non-normative techniques of preprocessing for the benefit of encoder optimization.</li> <li>• Study encoding techniques of optimization for objective quality metrics and their relationship to subjective quality.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p>P. de Lagrange, A. Duenas, R. Sjöberg, A. Tourapis (AHG chairs)</p>                                                                                                       | <p>N</p>                        |

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| <ul style="list-style-type: none"> <li>• Study optimized encoding for reference picture resampling and scalability modes in VTM, and coordinate with AHG4 on improving encoders and test settings for multi-layer verification testing.</li> <li>• Study optimized encoding and suitable test settings for noisy materials, such as sequences containing film grain.</li> <li>• Study optimized encoding and tool combinations for low latency and low complexity.</li> <li>• Consider neural network-based encoding optimization technologies for video coding standards.</li> <li>• Investigate other methods of improving objective and/or subjective quality, including adaptive coding structures and multi-pass encoding.</li> <li>• Study methods of rate control and rate-distortion optimization and their impact on performance, subjective and objective quality.</li> <li>• Study the potential of defining default or alternate software configuration settings and test conditions optimized for either subjective quality, or higher objective quality, and coordinate such efforts with AHG3 and AHG6.</li> <li>• Study the effect of varying configuration parameters depending on temporal layer, such as those related to deblocking, partitioning, chroma QP.</li> </ul> |                                                                                                                                                      |                                                   |
| <p><b>Neural network-based video coding (AHG11)</b></p> <p><a href="mailto:jvet@lists.rwth-aachen.de">jvet@lists.rwth-aachen.de</a></p> <ul style="list-style-type: none"> <li>• Evaluate and quantify the performance improvement potential of NN-based video coding technologies compared to existing video coding standards such as VVC, including both individual coding tools, architectures and content adaptation with NN parameters overfitting.</li> <li>• Discuss potential refinements of the test conditions for NN-based video coding in JVET-AF2016. Generate and distribute anchor encoding, and develop supporting software as needed.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <p>E. Alshina, F. Galpin, S. Liu, A. Segall (co-chairs), J. Li, R.-L. Liao, D. Rusanovskyy, M. Santamaria, T. Shao, M. Wien, P. Wu (vice chairs)</p> | <p>Y (tel., 2 weeks notice), first on Feb. 13</p> |

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| <ul style="list-style-type: none"> <li>• Study the impact of training (including the impact of loss functions) on the performance of candidate technologies and identify suitable material for testing and training.</li> <li>• Analyse complexity characteristics for technologies under study, including transformers, perform complexity analysis, and develop complexity reductions of candidate technology.</li> <li>• Finalize and discuss the EE on neural network-based video coding.</li> <li>• Promote the call for training materials, distribute it, and actively communicate with content owners.</li> <li>• Coordinate with other groups, including SC 29/AG 5 on the evaluation and assessment of visual quality, and AHG12 on the interaction with ECM coding tools. If possible, prepare encodings with combinations of tools included in the NNVC software for visual quality assessment at the next meeting.</li> <li>• Coordinate with AHG14 on items related to NNVC software development.</li> </ul> |                                                                                                                |          |
| <p><b>Enhanced compression beyond VVC capability (AHG12)</b></p> <p><a href="mailto:jvet@lists.rwth-aachen.de">jvet@lists.rwth-aachen.de</a></p> <ul style="list-style-type: none"> <li>• Solicit and study non-neural-network video coding tools with enhanced compression capabilities beyond VVC.</li> <li>• Discuss and propose refinements to the ECM12 algorithm description JVET-AG2025.</li> <li>• Coordinate with AHG7 to study the performance and complexity tradeoff of these video coding tools.</li> <li>• Coordinate with AHG6 on ECM software development.</li> <li>• Support AHG6 in generating anchors according to the test conditions in JVET-AF2017.</li> <li>• Analyse the results of exploration experiments described in JVET-AG2024 in coordination with the EE coordinators.</li> </ul>                                                                                                                                                                                                          | <p>M. Karczewicz, Y. Ye, L. Zhang (co-chairs), B. Bross, R. Chernyak, X. Li, K. Naser, Y. Yu (vice-chairs)</p> | <p>N</p> |

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| <ul style="list-style-type: none"> <li>• Coordinate with AHG11 to study the interaction with neural network-based coding tools.</li> <li>• Define testing conditions and prepare bitstreams for subjective evaluation of ECM by expert viewing at the next meeting in coordination with AG 5, AHG4, and AHG6.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                     |                                 |
| <p><b>Film grain technologies (AHG13)</b></p> <p><a href="mailto:jvet@lists.rwth-aachen.de">jvet@lists.rwth-aachen.de</a></p> <ul style="list-style-type: none"> <li>• Study the benefits and characteristics of film grain technologies, including autoregressive and frequency-filtering technologies.</li> <li>• Study alternative film grain models and their associated documentation.</li> <li>• Study the technical report JVET-AG2020, and suggest improvements for possible future versions.</li> <li>• In consultation with AHG4, study and define content characteristics and test conditions that are desirable for the study and testing of film grain technologies, and perform an assessment of newly available test materials in that regard.</li> <li>• Investigate metrics for measuring film grain fidelity in itself, or as present in a video.</li> <li>• Discuss the potential need for film grain conformance guidelines.</li> <li>• Given the study of desirable content characteristics, solicit or create new test material for further determining the operational characteristics of, testing, and developing any related technologies.</li> <li>• Study preprocessing and encoder technologies for determining values for FGC (Film Grain Characteristics) SEI message syntax elements.</li> <li>• Identify potential need for additional film grain technology and signalling, if needed.</li> <li>• Coordinate development of film grain technology software and configuration files.</li> <li>• Coordinate with AG 5 on improving the draft plan for subjective quality testing of the FGC SEI message JVET-AG2022, and conduct preparations for such testing.</li> </ul> | <p>W. Husak, P. de Lagrange (co-chairs), A. Duenas, D. Grois, Y. He, X. Meng, M. Radosavljević, A. Segall, G. Teniou, A. Tourapis (vice-chairs)</p> | <p>Y (tel., 2 weeks notice)</p> |

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| <ul style="list-style-type: none"> <li>• Coordinate with AHG3 for software support of the FGC SEI message.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                     |                                                   |
| <p><b>NNVC software development (AHG14)</b></p> <p>(<a href="mailto:jvet@lists.rwth-aachen.de">jvet@lists.rwth-aachen.de</a>)</p> <ul style="list-style-type: none"> <li>• Coordinate development of the NNVC software and associated configuration files.</li> <li>• Prepare and deliver NNVC-8.0 software version (and potential updates), and provide reference configuration encodings according to the NNVC common test conditions as described in JVET-AF2016.</li> <li>• Investigate combinations of tools included in the NNVC software, prepare and release anchor data for all configurations of the software, including anchors for High and Low Operation Point (HOP/LOP) configurations.</li> <li>• Study and maintain the SADL (Small Adhoc Deep-Learning Library). Identify gaps in functionality and develop improvements as needed.</li> <li>• Coordinate with NNVC algorithm and software description (JVET-AG2019) editors to identify any mismatches between software and description document, suggest further updates to the description document as appropriate.</li> <li>• Coordinate with AHG11 on items related to NNVC activities.</li> </ul> | <p>F. Galpin (chair), Y. Li, Y. Li, J. Shingala, L. Wang, Z. Xie (vice chairs)</p>  | <p>Y (tel., 2 weeks notice), first on Nov. 16</p> |
| <p><b>Gaming content compression (AHG15)</b></p> <p>(<a href="mailto:jvet@lists.rwth-aachen.de">jvet@lists.rwth-aachen.de</a>)</p> <ul style="list-style-type: none"> <li>• Identify gaming content application scenarios and their requirements for codec operation.</li> <li>• Identify and characterize required types of content; solicit contributions, collect, and make a variety of gaming content available, in coordination with AHG4 and AG 5.</li> <li>• Propose test conditions appropriate for gaming applications.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <p>S. Puri, J. Sauer (co-chairs), R. Chernyak, A. Duenas, L. Wang (vice chairs)</p> | <p>Y (tel., 2 weeks notice)</p>                   |

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| <ul style="list-style-type: none"> <li>• Evaluate JVET test models (such as ECM, VTM, NNVC, etc.) under the proposed test conditions.</li> <li>• Investigate possibilities to enhance compression capability for gaming content.</li> <li>• Solicit contributions from industry on typical bitrate/quality/resolution used for gaming content compression.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                             |                                 |
| <p><b>Generative face video compression (AHG16)</b></p> <p>(<a href="mailto:jvet@lists.rwth-aachen.de">jvet@lists.rwth-aachen.de</a>)</p> <ul style="list-style-type: none"> <li>• Produce the output document JVET-AG2035, and provide an associated GFVC performance reporting template.</li> <li>• Maintain GFVC software tools, associated configuration files, and software usage documentation.</li> <li>• Identify additional test content suitable for use in GFVC performance evaluation.</li> <li>• Investigate GFVC performance under test conditions beyond those defined in JVET-AG2035, including performance on additional test content and wider bitrate ranges.</li> <li>• Coordinate with AHG9 on further development of the GFVC SEI message in JVET-AG2032.</li> </ul> | <p>Y. Ye (chair), H.-B. Teo, Z. Lyu, S. McCarthy, S. Wang (vice chairs)</p> | <p>Y (tel., 2 weeks notice)</p> |

It was confirmed that the rules which can be found in document ISO/IEC JTC 1/SC 29/AG 2 [N 046](#) “Ad hoc group rules for MPEG AGs and WGs” (available at <https://www.mpegstandards.org/adhoc/>), are consistent with the operation mode of JVET AHGs. It is pointed out that JVET does not maintain separate AHG reflectors, such that any JVET member is implicitly a member of any AHG. This shall be mentioned in the related WG Recommendations. The list above was also issued as a separate WG 5 document (ISO/IEC JTC 1/SC 29/WG 5 N 270) in order to make it easy to reference.

## Output documents

The following documents were agreed to be produced or endorsed as outputs of the meeting. Names recorded below indicate the editors responsible for the document production. Where applicable, dates of planned finalization and corresponding parent-body document numbers are also noted.

It was reminded that in cases where the JVET document is also made available as a WG 5 output document, a separate version under the WG 5 document header should be generated. This version should

be sent to GJS and JRO for upload.

The list of JNET ad hoc groups was also issued as a WG 5 output document WG 5 N 270, as noted in section 9.

#### CITATION

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M. Wien, "BoG report on ECM expert viewing preparations", JNET-AG0333, 33rd Meeting: by teleconference, CH, January 2024.