|  |  |
| --- | --- |
| **Joint Video Experts Team (JVET)**  **of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29**  31st Meeting, Geneva, CH, 11–19 July 2023 | Document: JVET-AE\_notes\_d0 |

|  |  |  |  |
| --- | --- | --- | --- |
| *Title:* | **Meeting Report of the 31st Meeting of the Joint Video Experts Team (JVET), Geneva, CH, 11–19 July 2023** | | |
| *Status:* | Report document from the chair of JVET | | |
| *Purpose:* | Report | | |
| *Author(s) or Contact(s):* | **Jens-Rainer Ohm** Institute of Communication Engineering RWTH Aachen Melatener Straße 23 D-52074 Aachen | Tel: Email: | +49 241 80 27671 [ohm@ient.rwth-aachen.de](mailto:ohm@ient.rwth-aachen.de) |
| *Source:* | Chair of JVET | | |

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# Summary

The Joint Video Experts Team (JVET) of ITU-T WP3/16 and ISO/IEC JTC 1/‌SC 29 held its thirty-first meeting during 11–19 July 2023 at the ITU premises in Geneva, Switzerland. The meeting was held as a face-to-face meeting, but remote participation was provided on best-effort basis for experts who were unable to travel.

For ISO/IEC purposes, JVET is alternatively designated ISO/IEC JTC 1/‌SC 29/‌WG 5, and this was the twelfth meeting as WG 5. The JVET meeting was held under the chairmanship of Dr Jens-Rainer Ohm (RWTH Aachen/Germany). For rapid access to particular topics in this report, a subject categorization is found (with hyperlinks) in section 2.16 of this document. It is further noted that work items which had originally been conducted by the Joint Collaborative Team on Video Coding (JCT-VC) were continued in JVET as a single joint team, and explorations towards possible future need of standardization in the area of video coding are also conducted by JVET, as negotiated by the parent bodies.

The JVET meeting began at approximately 0900 CEST (UTC+2) on Tuesday 11 July 2023. Meeting sessions were held on all days, including the weekend days of Saturday and Sunday 15 and 16 July 2023, until the meeting was closed at approximately XXXX hours CEST on Wednesday 19 July 2023. Approximately XXX people attended the JVET meeting (XXX in person and XXX remotely), and approximately XXX input documents (not counting crosschecks, reports, and summary documents), 14 AHG reports, 2 EE summary reports, X BoG reports, and X incoming liaison documents were discussed. The meeting took place in a collocated fashion with a meeting of SG16 – one of the two parent bodies of the JVET, under whose auspices this JVET meeting was held. Various SC29 Working Groups and Advisory Groups were also meeting with partial temporal overlap – where WG 5 is representing the Joint Video Coding Team(s) and their activities from the perspective of the SC 29 parent body. The subject matter of the JVET meeting activities consisted of work on further development and maintenance of the twin-text video coding technology standards *Advanced Video Coding* (AVC), *High Efficiency Video Coding* (HEVC), *Versatile Video Coding* (VVC)*, Coding-independent Code Points (Video)* (CICP), and *Versatile Supplemental Enhancement Information Messages for Coded Video Bitstreams* (VSEI), as well as related technical reports, reference software and conformance testing packages. Further important goals were reviewing the results of the Exploration Experiment (EE) on Neural Network-based Video Coding, of the EE on Enhanced Compression beyond VVC capability, of other technical input on novel aspects of video coding technology, and to plan next steps for investigation of candidate technology towards further standard development.

As a primary goal, the JVET meeting reviewed the work that had been performed in the interim period since the thirtieth JVET meeting in producing the following documents:

* [JVET-AD1003](https://jvet-experts.org/doc_end_user/current_document.php?id=12566) Coding-independent code points for video signal type identification (Draft 2 of 3rd edition), also issued as WG 5 preliminary FDIS N 206
* [JVET-AD1004](https://jvet-experts.org/doc_end_user/current_document.php?id=12567) Errata report items for VVC, VSEI, HEVC, AVC, and Video CICP
* [JVET-AD1008](https://jvet-experts.org/doc_end_user/current_document.php?id=12568) Additional colour type identifiers for AVC and HEVC (Draft 4), also issued as WG 5 preliminary WD N 200
* [JVET-AD1012](https://jvet-experts.org/doc_end_user/current_document.php?id=12569) Overview of IT systems used in JVET
* [JVET-AD2002](https://jvet-experts.org/doc_end_user/current_document.php?id=12572) Algorithm description for Versatile Video Coding and Test Model 20 (VTM 20)
* [JVET-AD2005](https://jvet-experts.org/doc_end_user/current_document.php?id=12574) New level and systems-related supplemental enhancement information for VVC (Draft 5)
* [JVET-AD2006](https://jvet-experts.org/doc_end_user/current_document.php?id=12574) Additional SEI messages for VSEI (Draft 4)
* [JVET-AD2007](https://jvet-experts.org/doc_end_user/current_document.php?id=12575) Guidelines for NNVC software development
* [JVET-AD2016](https://jvet-experts.org/doc_end_user/current_document.php?id=12576) Common test conditions and evaluation procedures for neural network-based video coding technology
* [JVET-AD2017](https://jvet-experts.org/doc_end_user/current_document.php?id=12576) Common test conditions and evaluation procedures for enhanced compression tool testing
* [JVET-AD2019](https://jvet-experts.org/doc_end_user/current_document.php?id=12563) Description of algorithms and software in neural network-based video coding (NNVC) version 3
* [JVET-AD2021](https://jvet-experts.org/doc_end_user/current_document.php?id=12578) Verification test plan for VVC multilayer coding
* [JVET-AD2022](https://jvet-experts.org/doc_end_user/current_document.php?id=12579) Draft plan for subjective quality testing of FGC SEI message
* [JVET-AD2023](https://jvet-experts.org/doc_end_user/current_document.php?id=12560) Exploration experiment on neural network-based video coding (EE1)
* [JVET-AD2024](https://jvet-experts.org/doc_end_user/current_document.php?id=12562) Exploration experiment on enhanced compression beyond VVC capability (EE2)
* [JVET-AD2025](https://jvet-experts.org/doc_end_user/current_document.php?id=12580) Algorithm description of Enhanced Compression Model 9 (ECM 9)
* [JVET-AD2027](https://jvet-experts.org/doc_end_user/current_document.php?id=12582) SEI processing order SEI message in VVC (Draft 4), also issued as WG 5 preliminary WD N 203
* [JVET-AD2028](https://jvet-experts.org/doc_end_user/current_document.php?id=12583) Additional conformance bitstreams for VVC multilayer configurations
* [JVET-AD2030](https://jvet-experts.org/doc_end_user/current_document.php?id=12564) Optimization of encoders and receiving systems for machine analysis of coded video content (draft 2), also issued as WG 5 preliminary WD N 199
* [JVET-AD2031](https://jvet-experts.org/doc_end_user/current_document.php?id=12584) Common test conditions for optimization of encoders and receiving systems for machine analysis of coded video content

As main results, the JVET produced XX output documents from the current meeting (to be updated):

* [JVET-AD1003](https://jvet-experts.org/doc_end_user/current_document.php?id=12566) Coding-independent code points for video signal type identification (Draft 2 of 3rd edition), also issued as WG 5 preliminary FDIS N 206
* [JVET-AD1004](https://jvet-experts.org/doc_end_user/current_document.php?id=12567) Errata report items for VVC, VSEI, HEVC, AVC, and Video CICP
* [JVET-AD1008](https://jvet-experts.org/doc_end_user/current_document.php?id=12568) Additional colour type identifiers for AVC and HEVC (Draft 4), also issued as WG 5 preliminary WD N 200
* [JVET-AD1012](https://jvet-experts.org/doc_end_user/current_document.php?id=12569) Overview of IT systems used in JVET
* [JVET-AD2002](https://jvet-experts.org/doc_end_user/current_document.php?id=12572) Algorithm description for Versatile Video Coding and Test Model 20 (VTM 20)
* [JVET-AC2003](https://jvet-experts.org/doc_end_user/current_document.php?id=12573) Guidelines for VTM-based software development
* [JVET-AD2005](https://jvet-experts.org/doc_end_user/current_document.php?id=12574) New level and systems-related supplemental enhancement information for VVC (Draft 5)
* [JVET-AD2006](https://jvet-experts.org/doc_end_user/current_document.php?id=12574) Additional SEI messages for VSEI (Draft 4)
* [JVET-AD2007](https://jvet-experts.org/doc_end_user/current_document.php?id=12575) Guidelines for NNVC software development
* [JVET-AD2016](https://jvet-experts.org/doc_end_user/current_document.php?id=12576) Common test conditions and evaluation procedures for neural network-based video coding technology
* [JVET-AD2017](https://jvet-experts.org/doc_end_user/current_document.php?id=12576) Common test conditions and evaluation procedures for enhanced compression tool testing
* [JVET-AD2019](https://jvet-experts.org/doc_end_user/current_document.php?id=12563) Description of algorithms and software in neural network-based video coding (NNVC) version 3
* [JVET-AD2021](https://jvet-experts.org/doc_end_user/current_document.php?id=12578) Verification test plan for VVC multilayer coding
* [JVET-AD2022](https://jvet-experts.org/doc_end_user/current_document.php?id=12579) Draft plan for subjective quality testing of FGC SEI message
* [JVET-AD2023](https://jvet-experts.org/doc_end_user/current_document.php?id=12560) Exploration experiment on neural network-based video coding (EE1)
* [JVET-AD2024](https://jvet-experts.org/doc_end_user/current_document.php?id=12562) Exploration experiment on enhanced compression beyond VVC capability (EE2)
* [JVET-AD2025](https://jvet-experts.org/doc_end_user/current_document.php?id=12580) Algorithm description of Enhanced Compression Model 9 (ECM 9)
* [JVET-AD2027](https://jvet-experts.org/doc_end_user/current_document.php?id=12582) SEI processing order SEI message in VVC (Draft 4), also issued as WG 5 preliminary WD N 203
* [JVET-AD2028](https://jvet-experts.org/doc_end_user/current_document.php?id=12583) Additional conformance bitstreams for VVC multilayer configurations
* [JVET-AD2030](https://jvet-experts.org/doc_end_user/current_document.php?id=12564) Optimization of encoders and receiving systems for machine analysis of coded video content (draft 2), also issued as WG 5 preliminary WD N 199
* [JVET-AD2031](https://jvet-experts.org/doc_end_user/current_document.php?id=12584) Common test conditions for optimization of encoders and receiving systems for machine analysis of coded video content

The following documents were produced as WG 5 documents only:

* WG 5 N 197 Draft disposition of comments received on ISO/IEC 23002-7:2022 DAM 1
* WG 5 N 198 Preliminary text of ISO/IEC FDIS 23002-7:202x Versatile supplemental enhancement information messages for coded video bitstreams (3rd edition)
* WG 5 N 201 Draft disposition of comments received on ISO/IEC 23090-3:2022 DAM 1
* WG 5 N 202 Preliminary text of ISO/IEC FDIS 23090-3:202x Versatile video coding (3rd edition)
* WG 5 N 205 Draft disposition of comments received on ISO/IEC DIS 23091-3:202X (Video CICP 3rd edition)

For the organization and planning of its future work, the JVET established XX “ad hoc groups” (AHGs) to progress the work on particular subject areas. At this meeting, 2 Exploration Experiments (EE) were defined. The next eight JVET meetings were planned for 13 – 20 October 2023 under ISO/IEC JTC 1/‌SC 29 auspices in Hannover, DE; during 17 – 26 January 2024 under ISO/IEC JTC 1/‌SC 29 auspices, to be conducted as teleconference meeting; during April 2024 under ITU-T SG16 auspices, date and location t.b.d.; during 12 – 19 July 2024 under ISO/IEC JTC 1/‌SC 29 auspices in Sapporo, JP; during October 2024 under ISO/IEC JTC 1/‌SC 29 auspices, date and location t.b.d.; during January 2025 under ITU-T SG16 auspices, date and location t.b.d.; during April 2025 under ISO/IEC JTC 1/‌SC 29 auspices, date and location t.b.d.; and during 26 June – 4 July 2025 under ISO/IEC JTC 1/‌SC 29 auspices in Daejeon, KR.

The document distribution site <https://jvet-experts.org/> was used for distribution of all documents. It was noted that the previous sites <http://phenix.int-evry.fr/jvet/>, <http://phenix.int-evry.fr/jct/>, and <http://phenix.int-evry.fr/jct3v/> are still accessible, but were converted to read-only.

The reflector to be used for discussions by the JVET and all its AHGs is the JVET reflector:  
[jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de) hosted at RWTH Aachen University. For subscription to this list, see <https://lists.rwth-aachen.de/postorius/lists/jvet.lists.rwth-aachen.de/>.

# Administrative topics

## Organization

The ITU-T/ISO/IEC Joint Video Experts Team (JVET) is a group of video coding experts from the ITU-T Study Group 16 Visual Coding Experts Group (VCEG) and ISO/IEC JTC 1/‌SC 29/‌WG 5. The parent bodies of the JVET are ITU-T WP3/16 and ISO/IEC JTC 1/‌SC 29.

The Joint Video Experts Team (JVET) of ITU-T WP3/16 and ISO/IEC JTC 1/‌SC 29 held its thirty-first meeting during 11–19 July 2023 at the ITU premises in Geneva, Switzerland. The meeting was held as a face-to-face meeting, but remote participation was provided on best-effort basis for experts who were unable to travel. For ISO/IEC purposes, JVET is alternatively designated ISO/IEC JTC 1/‌SC 29/‌WG 5, and this was the twelfth meeting as WG 5. The JVET meeting was held under the chairmanship of Dr Jens-Rainer Ohm (RWTH Aachen/Germany).

It is further noted that the unabbreviated name of JVET was formerly known as “Joint Video *Exploration* Team”, but the parent bodies modified it when entering the phase of formal development of the *Versatile Video Coding* (VVC) and *Versatile Supplemental Enhancement Information Messages for Coded Video Bitstreams* (VSEI) standards, as well as associated conformance test sets, reference software, verification testing, and non-normative guidance information. Furthermore, starting from the twentieth meeting, work items which had originally been conducted by the Joint Collaborative Team on Video Coding (JCT-VC) were continued to be conducted in JVET as a single joint team, as negotiated by the parent bodies. This particularly consists of work on:

* *High Efficiency Video Coding* (HEVC) and its extensions, the development of associated conformance test sets, reference software, verification testing, and non-normative guidance information,
* Specification of *Coding-independent Code Points (Video)* (CICP), and associated technical report(s),
* Maintenance and enhancement work on the *Advanced Video Coding* (AVC) standard, associated conformance test sets and reference software.

Furthermore, explorations towards possible future need of standardization in the area of video coding are also conducted by JVET. Currently, the following topics are under investigation:

* Exploration on Neural Network-based Video Coding
* Exploration on Enhanced Compression beyond VVC capability

This report contains three important annexes, as follows:

* Annex A contains a list of the documents of the JVET meeting
* Annex B contains a list of the meeting participants, as recorded by the teleconferencing tool used for the meeting
* Annex C contains the meeting recommendations of ISO/IEC JTC 1/‌SC 29/‌WG 5 for purposes of results reporting to ISO/IEC.

## Meeting logistics

Information regarding logistics arrangements for the meeting had been provided via the email reflector [jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de) and at <http://wftp3.itu.int/av-arch/jvet-site/2023_07_AE_Geneva/>.

## Primary goals

As a primary goal, the JVET meeting reviewed the work that was performed in the interim period since the twenty-ninth JVET meeting in producing the following documents:

* [JVET-AD1003](https://jvet-experts.org/doc_end_user/current_document.php?id=12566) Coding-independent code points for video signal type identification (Draft 2 of 3rd edition), also issued as WG 5 preliminary FDIS N 206
* [JVET-AD1004](https://jvet-experts.org/doc_end_user/current_document.php?id=12567) Errata report items for VVC, VSEI, HEVC, AVC, and Video CICP
* [JVET-AD1008](https://jvet-experts.org/doc_end_user/current_document.php?id=12568) Additional colour type identifiers for AVC and HEVC (Draft 4), also issued as WG 5 preliminary WD N 200
* [JVET-AD1012](https://jvet-experts.org/doc_end_user/current_document.php?id=12569) Overview of IT systems used in JVET
* [JVET-AD2002](https://jvet-experts.org/doc_end_user/current_document.php?id=12572) Algorithm description for Versatile Video Coding and Test Model 20 (VTM 20)
* [JVET-AC2003](https://jvet-experts.org/doc_end_user/current_document.php?id=12573) Guidelines for VTM-based software development
* [JVET-AD2005](https://jvet-experts.org/doc_end_user/current_document.php?id=12574) New level and systems-related supplemental enhancement information for VVC (Draft 5)
* [JVET-AD2006](https://jvet-experts.org/doc_end_user/current_document.php?id=12574) Additional SEI messages for VSEI (Draft 4)
* [JVET-AD2007](https://jvet-experts.org/doc_end_user/current_document.php?id=12575) Guidelines for NNVC software development
* [JVET-AD2016](https://jvet-experts.org/doc_end_user/current_document.php?id=12576) Common test conditions and evaluation procedures for neural network-based video coding technology
* [JVET-AD2017](https://jvet-experts.org/doc_end_user/current_document.php?id=12576) Common test conditions and evaluation procedures for enhanced compression tool testing
* [JVET-AD2019](https://jvet-experts.org/doc_end_user/current_document.php?id=12563) Description of algorithms and software in neural network-based video coding (NNVC) version 3
* [JVET-AD2021](https://jvet-experts.org/doc_end_user/current_document.php?id=12578) Verification test plan for VVC multilayer coding
* [JVET-AD2022](https://jvet-experts.org/doc_end_user/current_document.php?id=12579) Draft plan for subjective quality testing of FGC SEI message
* [JVET-AD2023](https://jvet-experts.org/doc_end_user/current_document.php?id=12560) Exploration experiment on neural network-based video coding (EE1)
* [JVET-AD2024](https://jvet-experts.org/doc_end_user/current_document.php?id=12562) Exploration experiment on enhanced compression beyond VVC capability (EE2)
* [JVET-AD2025](https://jvet-experts.org/doc_end_user/current_document.php?id=12580) Algorithm description of Enhanced Compression Model 9 (ECM 9)
* [JVET-AD2027](https://jvet-experts.org/doc_end_user/current_document.php?id=12582) SEI processing order SEI message in VVC (Draft 4), also issued as WG 5 preliminary WD N 203
* [JVET-AD2028](https://jvet-experts.org/doc_end_user/current_document.php?id=12583) Additional conformance bitstreams for VVC multilayer configurations
* [JVET-AD2030](https://jvet-experts.org/doc_end_user/current_document.php?id=12564) Optimization of encoders and receiving systems for machine analysis of coded video content (draft 2), also issued as WG 5 preliminary WD N 199
* [JVET-AD2031](https://jvet-experts.org/doc_end_user/current_document.php?id=12584) Common test conditions for optimization of encoders and receiving systems for machine analysis of coded video content

Further important goals were reviewing the results of the EE on Neural Network-based Video Coding, of the EE on Enhanced Compression beyond VVC capability, of other technical input on novel aspects of video coding technology, and planning next steps for investigation of candidate technology towards further standard development.

## Documents and document handling considerations

### General

The document distribution site <https://jvet-experts.org/> was used for distribution of all documents. It was noted that the previous site <http://phenix.int-evry.fr/jvet/> was still accessible, but had been converted to read-only.

Document registration timestamps, initial upload timestamps, and final upload timestamps are listed in Annex A of this report.

The document registration and upload times and dates listed in Annex A and in headings for documents in this report are in Paris/Geneva time. Dates mentioned for purposes of describing events at the meeting follow the TRT timezone (local time in Antalya), except as otherwise noted.

Highlighting of recorded decisions in this report is practised as follows:

* Decisions made by the group that might affect the normative content of a future standard are identified in this report by prefixing the description of the decision with the string “Decision:”.
* Decisions that affect one of the various software packages but have no normative effect on text are marked by the string “Decision (SW):”.
* Decisions that fix a “bug” in one of the test model descriptions such as VTM, HM, etc. (an error, oversight, or messiness) or in the associated software package are marked by the string “Decision (BF):”.
* Decisions that are merely editorial without effect on the technical content of a draft standard are marked by the string "Decision (Ed.):". Such editorial decisions are merely suggestions to the editor, who has the discretion to determine the final action taken if their judgment differs.
* Some decisions are recorded with the word “agreed” rather than “Decision:”, especially for non-normative, editorial and planning matters.

This meeting report is based primarily on notes taken by the JVET chair. The preliminary notes were also circulated publicly by ftp and http during the meeting on a daily basis. It should be understood by the reader that 1) some notes may appear in abbreviated form, 2) summaries of the content of contributions are often based on abstracts provided by contributing proponents without an intent to imply endorsement of the views expressed therein, and 3) the depth of discussion of the content of the various contributions in this report is not uniform. Generally, the report is written to include as much information about the contributions and discussions as is feasible (in the interest of aiding study), although this approach may not result in the most polished output report. Expressions such as “X.XX%” indicate that the desired results were not available at the time the information was recorded.

### Late and incomplete document considerations

The formal deadline for registering and uploading non-administrative contributions had been announced as Tuesday, 4 July 2023. Any documents uploaded after 1159 hours Paris/Geneva time on Wednesday 5 July 2023 were considered “officially late”, with a grace period of 12 hours (to accommodate those living in different time zones of the world). The deadline does not apply to AHG reports and other such reports which can only be produced after the availability of other input documents.

All contribution documents with registration numbers higher than JVET-AE0183 were registered after the “officially late” deadline (and therefore were also uploaded late). However, some documents in the “late” range might include break-out activity reports that were generated during the meetings, or documents which were requested to be produced for the purpose of improving specification text, and are therefore better considered as report documents rather than as late contributions.

In many cases, contributions were also revised after the initial version was uploaded. The contribution document archive website retains publicly accessible prior versions in such cases. The timing of late document availability for contributions is generally noted in the section discussing each contribution in this report.

One suggestion to assist with the issue of late submissions has been to require the submitters of late contributions and late revisions to describe the characteristics of the late or revised (or missing) material at the beginning of discussion of the contribution. This has been agreed to be a helpful approach to be followed at the meeting.

The following technical design proposal contributions were registered and/or uploaded late:

* JVET-AE0XXX (a proposal on …), uploaded 07-XX,
* …

It may be observed that some of the above-listed contributions were submissions made in response to issues that arose in discussions during the meeting or from the study of other contributions, and thus could not have been submitted by the ordinary deadline.

The following other documents not proposing normative technical content, but with some need for consideration, were registered and/or uploaded late:

* JVET-AE0XXX (a document discussing …), uploaded 07-XX,
* …

All cross-verification reports at this meeting were registered late, and/or uploaded late. In the interest of brevity, these are not specifically identified here. Initial upload times for each document are recorded in Annex A of this report.

The following contribution registrations were noted that were later cancelled, withdrawn, never provided, were cross-checks of a withdrawn contribution, or were registered in error: JVET-AE0045, … .

The cross-verification reports JVET-AE0XXX and … had still been missing by the end of the meeting on Wednesday 19 July, but became available one or two days later. The following cross-verification reports were still missing three weeks after the end of the meeting: JVET-AE0XXX. These were thus marked as withdrawn by the JVET chair (this case did not happen at the current meeting, sentence kept for future use).

“Placeholder” contribution documents that were basically empty of content, or lacking any results showing benefit for the proposed technology, and obviously uploaded with an intent to provide a more complete submission as a revision, had been agreed to be considered unacceptable and to be rejected in the document management system until a more complete version was available (which would then be counted as a late contribution if the update was after the document deadline). At the current meeting, this situation did apply with documents JVET-AE0XXX and … , which were categorized as late in the list above, based on the time of the first reasonable document upload.

Contributions that had significant problems with uploaded versions were not observed.

As a general policy, missing documents were not to be presented, and late documents (and substantial revisions) could only be presented when there was a consensus to consider them and there was sufficient time available for their review. Again, an exception is applied for AHG reports, CE and HLS topic summaries, and other such reports which can only be produced after the availability of other input documents. There were no objections raised by the group regarding presentation of late contributions, although there may have been some expression of annoyance and remarks on the difficulty of dealing with late contributions and late revisions.

It was remarked that documents that are substantially revised after the initial upload can also be a problem, as this becomes confusing, interferes with study, and puts an extra burden on synchronization of the discussion. This can especially be a problem in cases where the initial upload is clearly incomplete, and in cases where it is difficult to figure out what parts were changed in a revision. For document contributions, revision marking is very helpful to indicate what has been changed. Also, the “comments” field on the web site can be used to indicate what is different in a revision, although participants tend to seldom notice what is recorded there.

A few contributions may have had some problems relating to IPR declarations in the initial uploaded versions (missing declarations, declarations saying they were from the wrong companies, etc.). Any such issues were corrected by later uploaded versions in a reasonably timely fashion in all cases (to the extent of the awareness of the responsible coordinators).

Some other errors may have also noticed in other initial document uploads (wrong document numbers or meeting dates or meeting locations in headers, etc.) which were generally sorted out in a reasonably timely fashion. The document web site contains an archive of each upload.

### Outputs of the preceding meeting

All output documents of the previous meeting, particularly the meeting report JVET-AD1000, the Coding-independent code points for video signal type identification (Draft 2 of 3rd edition) JVET-AD1003, the Errata report items for VVC, VSEI, HEVC, AVC, and Video CICP JVET-AD1004, the Additional colour type identifiers for AVC, HEVC and Video CICP (Draft 4) JVET-AD1008, the Overview of IT systems used in JVET [JVET-AD1012](https://jvet-experts.org/doc_end_user/current_document.php?id=12569), the Algorithm description for Versatile Video Coding and Test Model 20 (VTM 20) JVET-AD2002, the New level and systems-related supplemental enhancement information for VVC (Draft 5) JVET-AD2005, the Additional SEI messages for VSEI (Draft 4) JVET-AD2006, the Guidelines for NNVC software development JVET-AD2007. the Common test conditions and evaluation procedures for neural network-based video coding technology JVET-AD2016, the Common test conditions and evaluation procedures for enhanced compression tool testing JVET-AD2017, the Description of algorithms and software in neural network-based video coding (NNVC) version 3 JVET-AD2019, the Verification test plan for VVC multilayer coding JVET-AD2021, the Draft plan for subjective quality testing of FGC SEI message JVET-AD2022, the Description of the EE on Neural Network-based Video Coding JVET-AD2023, the Description of the EE on Enhanced Compression beyond VVC capability JVET-AD2024, the Algorithm description of Enhanced Compression Model 9 (ECM 9) JVET-AD2025, the SEI processing order SEI message in VVC (Draft 4) JVET-AD2027, the Additional conformance bitstreams for VVC multilayer configurations JVET-AD2028, the Optimization of encoders and receiving systems for machine analysis of coded video content (Draft 2) [JVET-AD2030](https://jvet-experts.org/doc_end_user/current_document.php?id=12564), and the Common test conditions for optimization of encoders and receiving systems for machine analysis of coded video content [JVET-AD2031](https://jvet-experts.org/doc_end_user/current_document.php?id=12584), had been completed and were approved. The software implementations of HM?? (no new version had been planned on top of 18.0), VTM (version 21.0 had been planned), ECM (versions 9.0 and 9.1), and NNVC (versions 5.0 and 5.1) were also approved.

Only minor editorial issues were found in the meeting report JVET-AD1000; no need to produce an update was identified (see section 2.14 for details).

The available output documents of the previous meeting and the software had been made available in a reasonably timely fashion.

## Attendance

The list of participants in the JVET meeting can be found in Annex B of this report.

The meeting was open to those qualified to participate either in ITU-T WP3/16 or ISO/IEC JTC 1/‌SC 29/‌WG 5 (including experts who had been personally invited as permitted by ITU-T or ISO/IEC policies).

Participants had been reminded of the need to be properly qualified to attend. Those seeking further information regarding qualifications to attend future meetings may contact the responsible coordinators.

It was further announced that it is necessary to register for the meeting through the ISO Meetings website for ISO/IEC experts or through the Q6/16 rapporteur for ITU-T experts. The password for meeting access had been sent to registered participants via these channels. Links to the Zoom sessions (without the necessary password) were available in the posted meeting logistics information and the calendar of meeting sessions in the JVET web site.

The following rules were established for those participating remotely via Zoom teleconference meeting:

* Use the “hand-raising” function to enter yourself in the queue to speak (unless otherwise instructed by the session chair). If you are dialed in by phone, request your queue position verbally. The online queue will be interleaved with the room queue, though it may not always be guaranteed that the sequence perfectly follows the sequence by which hand raising occurred.
* Stay muted unless you have something to say. People are muted by default when they join and need to unmute themselves to speak. The chair may mute anyone who is disrupting the proceedings (e.g. by forgetting they have a live microphone while chatting with their family or by causing bad noise or echo).
* Identify who you are and your affiliation when you begin speaking. The same applies for speakers in the room to let online participants know who is speaking.
* Use your full name and company/organization and country affiliation in your joining information, since the participation list of Zoom would also be used to compile the online part of attendance records.
* Turn on the chat window and watch for chair communication and side commentary there as well as by audio.
* Generally do not use video for the teleconferencing calls in order to avoid overloading people’s internet connections; enable only voice and screen sharing.
* Extensive use of screen sharing is encouraged, to enable participants to view the presented material and the meeting notes. At times, multiple sources of screen sharing may be enabled, so it may be necessary for participants to understand that this is happening and to understand how to select which one they want to watch.

## Agenda

The agenda for the meeting, for the further development and maintenance of the twin-text video coding technology standards *Advanced Video Coding* (AVC), *High Efficiency Video Coding* (HEVC), *Versatile Video Coding* (VVC)*, Coding-independent Code Points (Video)* (CICP), and *Versatile Supplemental Enhancement Information Messages for Coded Video Bitstreams* (VSEI), as well as related technical reports, software and conformance packages, was as follows:

* Opening remarks and review of meeting logistics and communication practices
* Roll call of participants
* Adoption of the agenda
* Code of conduct policy reminder
* IPR policy reminder and declarations
* Contribution document allocation
* Review of results of the previous meeting
* Review of target dates
* Reports of ad hoc group (AHG) activities
* Report of exploration experiments on neural-network-based video coding
* Report of exploration experiments on enhanced compression beyond VVC capability
* Consideration of contributions on high-level syntax
* Consideration of contributions and communications on project guidance
* Consideration of video coding technology contributions
* Consideration of contributions on conformance and reference software development
* Consideration of contributions on coding-independent code points for video signal type identification
* Consideration of contributions on film grain synthesis technology
* Consideration of contributions on optimization of encoders and receiving systems for machine analysis of coded video content
* Consideration of contributions on errata relating to standards in the domain of JVET
* Consideration of contributions on technical reports relating to standards and exploration study activities in the domain of JVET
* Consideration of contributions providing non-normative guidance relating to standards and exploration study activities in the domain of JVET
* Consideration of information contributions
* Consideration of future work items
* Coordination of visual quality testing
* Liaisons, coordination activities with other organizations
* Review of project editor and liaison assignments
* Approval of output documents and associated editing periods
* Future planning: Determination of next steps, discussion of working methods, communication practices, establishment of coordinated experiments (if any), establishment of AHGs, future meeting planning, other planning issues
* Other business as appropriate for consideration
* Closing

The agenda was approved as suggested.

The times of meeting sessions followed the needs of the face-to-face meeting, with highest priority given to the aim of achieving the goals of the meeting. Typical meeting hours were expected to be 0900-1900 CEST with coffee breaks and lunch breaks as appropriate, however some early morning or late-night sessions were anticipated to be necessary. Sessions were announced in the online JVET calendar in advance as far as possible, but it was anticipated that some activities (such as breakout sessions) could be held at short notice.

## ISO and IEC Code of Conduct reminders

Participants were reminded of the ISO and IEC Codes of Conduct, found at

<https://www.iso.org/publication/PUB100011.html>.

<https://www.iecapc.jp/F/IEC_Code_of_Conduct.pdf>

These include points relating to:

* Complying with legal and statutory obligations
* Performing and acting in good faith, consistent with the purpose, policies and principles of the organization
* Behaving ethically
* Promoting and enabling all voices to be heard
* Engaging constructively in ISO and IEC activities
* Declaring actual and potential conflicts of interest and managing them appropriately
* Protecting confidential information
* Protecting ISO and IEC assets
* Avoiding and preventing any form of bribery or corruption
* Escalating and resolving disputes and upholding agreed resolutions

## IPR policy reminder

Participants were reminded of the IPR policy established by the parent organizations of the JVET and were referred to the parent body websites for further information. The IPR policy was summarized for the participants.

The ITU-T/ITU-R/ISO/IEC common patent policy shall apply. Participants were particularly reminded that contributions proposing normative technical content shall contain a non-binding informal notice of whether the submitter may have patent rights that would be necessary for implementation of the resulting standard. The notice shall indicate the category of anticipated licensing terms according to the ITU-T/ITU-R/ISO/IEC patent statement and licensing declaration form.

This obligation is supplemental to, and does not replace, any existing obligations of parties to submit formal IPR declarations to ITU-T/ITU-R/ISO/IEC.

Participants were also reminded of the need to formally report patent rights to the top-level parent bodies (using the common reporting form found on the database listed below) and to make verbal and/or document IPR reports within the JVET necessary in the event that they are aware of unreported patents that are essential to implementation of a standard or of a draft standard under development.

Some relevant links for organizational and IPR policy information are provided below:

* <http://www.itu.int/ITU-T/ipr/index.html> (common patent policy for ITU-T, ITU-R, ISO, and IEC, and guidelines and forms for formal reporting to the parent bodies)
* <http://ftp3.itu.int/av-arch/jvet-site> (JVET contribution templates)
* <http://www.itu.int/ITU-T/dbase/patent/index.html> (ITU-T IPR database)

The responsible coordinators invited participants to make any necessary verbal reports of previously-unreported IPR in technology that might be considered as prospective candidate for inclusion in future standards, and opened the floor for such reports: No such verbal reports were made.

## Software copyright disclaimer header reminder

It was noted that the VTM and ECM software implementation packages use the same software copyright license header as the HEVC reference software, where the latter had been agreed at the 5th meeting of the JCT-VC and approved by both parent bodies at their collocated meetings at that time. This license header language is based on the BSD license with a preceding sentence declaring that other contributor or third party rights, including patent rights, are not granted by the license, as recorded in [N 10791](http://phenix.it-sudparis.eu/mpeg/doc_end_user/current_document.php?id=27881&id_meeting=16) of the 89th meeting of ISO/IEC JTC 1/‌SC 29/‌WG 11. Both ITU and ISO/IEC will be identified in the <OWNER> and <ORGANIZATION> tags in the header. This software header is also used in the process of designing the VTM and ECM software, and for evaluating proposals for technology to be potentially included in these designs. This software or parts thereof might be published by ITU-T and ISO/IEC as an example implementation of a future video coding standard and for use as the basis of products to promote adoption of such technology.

Different copyright statements shall not be committed to the committee software repository (in the absence of subsequent review and approval of any such actions). As noted previously, it must be further understood that any initially-adopted such copyright header statement language could further change in response to new information and guidance on the subject in the future.

These considerations apply to the 360Lib video conversion software and HDRTools as well. The SADL and NNVC packages for neural network-based video coding use the same licensing terms.

Software packages that had been developed in prior work of the JVT, the JCT-VC and the JCT-3V have similar considerations and are maintained according to the past practice in that work.

## Communication practices

The documents for the meeting can be found at <https://jvet-experts.org/>. It was noted that the previous site <http://phenix.int-evry.fr/jvet/> is still accessible, but was converted to read-only. It was reminded to send a notice to the chairs in cases of changes to document titles, authors, etc.

JVET email lists are managed through the site <https://lists.rwth-aachen.de/postorius/lists/jvet.lists.rwth-aachen.de/>, and to send email to the reflector, the email address is [jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de). Only members of the reflector can send email to the list. However, membership of the reflector is not limited to qualified JVET participants.

It was emphasized that reflector subscriptions and email sent to the reflector must use real names when subscribing and sending messages and subscribers must respond to inquiries regarding the nature of their interest in the work. The current number of subscribers on the JVET email list was 1199 (as of 19 April 2023). All discussions (including those on AVC, HEVC, VVC, CICP, etc.) shall be conducted on the JVET reflector rather than any of the old reflectors (including JVT, JCT-VC, and JCT-3V) which are retained for archiving purposes.

For distribution of test sequences, a password-protected ftp site had been set up at RWTH Aachen University, with a mirror site at FhG-HHI. Accredited members of JVET may contact the responsible JVET coordinators to obtain the password information (but the site is not open for use by others).

It is further emphasized that the document JVET-AD1012 gives valuable hints about communication practices as well as other IT resources used in JVET, such as software, conformance, and test materials.

## Terminology

* **ACT**: Adaptive colour transform
* **AFF**: Adaptive frame-field
* **AI**: All-intra
* **AIF**: Adaptive interpolation filtering
* **ALF**: Adaptive loop filter
* **AMP**: Asymmetric motion partitioning – a motion prediction partitioning for which the sub-regions of a region are not equal in size (in HEVC, being N/2x2N and 3N/2x2N or 2NxN/2 and 2Nx3N/2 with 2N equal to 16 or 32 for the luma component)
* **AMVP**: Adaptive motion vector prediction
* **AMT or MTS**: Adaptive multi-core transform, or multiple transform selection
* **AMVR**: (Locally) adaptive motion vector resolution
* **APS**: Adaptation parameter set
* **ARC**: Adaptive resolution conversion (synonymous with DRC, and a form of RPR)
* **ARMC**: Adaptive re-ordering of merge candidates
* **ARSS**: Adaptive reference sample smoothing
* **ATM**: AVC-based multiview and 3D test model
* **ATMVP** or “subblock-based temporal merging candidates”: Alternative temporal motion vector prediction
* **AU**: Access unit
* **AUD**: Access unit delimiter
* **AVC**: Advanced video coding – the video coding standard formally published as ITU-T Recommendation H.264 and ISO/IEC 14496-10
* **BA**: Block adaptive
* **BC**: See CPR or IBC
* **BCW**: Biprediction with CU based weighting
* **BD**: Bjøntegaard-delta – a method for measuring percentage bit rate savings at equal PSNR or decibels of PSNR benefit at equal bit rate (e.g., as described in document VCEG-M33 of April 2001)
* **BDOF**: Bi-directional optical flow (formerly known as **BIO**)
* **BDPCM**: Block-wise DPCM
* **BL**: Base layer
* **BMS**: Benchmark set (no longer used), a former preliminary compilation of coding tools on top of VTM, which provide somewhat better compression performance, but are not deemed mature for standardzation
* **BoG**: Break-out group
* **BR**: Bit rate
* **BT**: Binary tree
* **BV**: Block vector (used for intra BC prediction)
* **CABAC**: Context-adaptive binary arithmetic coding
* **CBF**: Coded block flag(s)
* **CC**: May refer to context-coded, common (test) conditions, or cross-component
* **CCALF**: Cross-component ALF
* **CCLM**: Cross-component linear model
* **CCCM**: Cross-component convolutional model
* **CCP**: Cross-component prediction
* **CCSAO**:Cross-component SAO
* **CE**: Core Experiment – a coordinated experiment conducted toward assessment of coding technology
* **CG**: Coefficient group
* **CGS**: Colour gamut scalability (historically, coarse-grained scalability)
* **CIIP**: Combined inter/intra prediction
* **CIPF**: CABAC initialization from the previous frame
* **CL-RAS**: Cross-layer random-access skip
* **CPB**: Coded picture buffer
* **CPMV**: Control-point motion vector
* **CPMVP**: Control-point motion vector prediction (used in affine motion model)
* **CPR**: Current-picture referencing, also known as IBC – a technique by which sample values are predicted from other samples in the same picture by means of a displacement vector called a block vector, in a manner conceptually similar to motion-compensated prediction
* **CST**: Chroma separate tree
* **CTC**: Common test conditions
* **CVS**: Coded video sequence
* **DCI**: Decoder capability information
* **DCT**: Discrete cosine transform (sometimes used loosely to refer to other transforms with conceptually similar characteristics)
* **DCTIF**: DCT-derived interpolation filter
* **DF**: Deblocking filter
* **DIMD**: Decoder intra mode derivation
* **DMVR**: Decoder motion vector refinement
* **DoCR**: Disposition of comments report
* **DPB**: Decoded picture buffer
* **DPCM**: Differential pulse-code modulation
* **DPS**: Decoding parameter sets
* **DRC**: Dynamic resolution conversion (synonymous with ARC, and a form of RPR)
* **DT**: Decoding time
* **DQ**: Dependent quantization
* **ECS**: Entropy coding synchronization (typically synonymous with WPP)
* **EMT**: Explicit multiple-core transform
* **EOTF**: Electro-optical transfer function – a function that converts a representation value to a quantity of output light (e.g., light emitted by a display
* **EPB**: Emulation prevention byte (as in the emulation\_prevention\_byte syntax element)
* **ECM**: Enhanced compression model – a software codebase for future video coding exploration
* **ECV**: Extended Colour Volume (up to WCG)
* **EL**: Enhancement layer
* **EOS**: End of (coded video) sequence
* **ET**: Encoding time
* **FRUC**: Frame rate up conversion (pattern matched motion vector derivation)
* **GCI**: General constraints information
* **GDR**: Gradual decoding refresh
* **GLM**: Gradient linear model
* **GOP**: Group of pictures (somewhat ambiguous)
* **GPM**: Geometry partitioning mode
* **GRA**: Gradual random access
* **HBD**: High bit depth
* **HDR**: High dynamic range
* **HEVC**: High Efficiency Video Coding – the video coding standard developed and extended by the JCT-VC, formalized by ITU-T as Rec. ITU-T H.265 and by ISO/IEC as ISO/IEC 23008-2
* **HLS**: High-level syntax
* **HM**: HEVC Test Model – a video coding design containing selected coding tools that conforms to the HEVC standard design (possibly with under-development extensions) – now also used especially in reference to the (non-normative) encoder algorithms (see WD and TM)
* **HMVP**: History based motion vector prediction
* **HRD**: Hypothetical reference decoder
* **HTM**: HEVC-based multiview and 3D test model (developed by JCT-3V)
* **HyGT**: Hyper-cube Givens transform (a type of NSST)
* **IBC** (also **Intra BC**): Intra block copy, also known as CPR – a technique by which sample values are predicted from other samples in the same picture by means of a displacement vector called a block vector, in a manner conceptually similar to motion-compensated prediction
* **IBDI**: Internal bit-depth increase – a technique by which lower bit-depth (8 bits per sample) source video is encoded using higher bit-depth signal processing, ordinarily including higher bit-depth reference picture storage (ordinarily 12 bits per sample)
* **IBF**: Intra boundary filtering
* **ILP**: Inter-layer prediction (in scalable coding)
* **ILRP**: Inter-layer reference picture
* **IPCM**: Intra pulse-code modulation (similar in spirit to IPCM in AVC and HEVC)
* **IRAP**: Intra random access picture
* **ISP**: Intra subblock partitioning
* **JCCR**: Joint coding of chroma residuals
* **JCT-3V**: Joint collaborative team on 3D video (for AVC and HEVC)
* **JCT-VC**: Joint collaborative team on video coding (for HEVC)
* **JEM**: Joint exploration model – a software codebase previously used for video coding exploration
* **JM**: Joint model – the primary software codebase that has been developed for the AVC standard
* **JSVM**: Joint scalable video model – another software codebase that has been developed for the AVC standard, which includes support for scalable video coding extensions
* **JVET**: Joint video experts team (initially for VVC, later expanded)
* **JVT**: Joint video team (for AVC)
* **KLT**: Karhunen-Loève transform
* **LB** or **LDB**: Low-delay B – the variant of the LD conditions that uses B pictures
* **LD**: Low delay – one of two sets of coding conditions designed to enable interactive real-time communication, with less emphasis on ease of random access (contrast with RA). Typically refers to LB, although also applies to LP
* **LFNST**: Low-frequency non-separable transform
* **LIC**: Local illumination compensation
* **LM**: Linear model
* **LMCS**: Luma mapping with chroma scaling (formerly sometimes called “in-loop reshaping”)
* **LP** or **LDP**: Low-delay P – the variant of the LD conditions that uses P frames
* **LUT**: Look-up table
* **LTRP**: Long-term reference picture
* **MANE**: Media-aware network element
* **MC**: Motion compensation
* **MCP**: Motion compensated prediction
* **MCTF**: Motion compensated temporal pre-filtering
* **MDNSST**: Mode dependent non-separable secondary transform
* **MIP**: Matrix-based intra prediction
* **MMLM**: Multi-model (cross component) linear mode
* **MMVD**: Merge with MVD
* **MPEG**: Moving picture experts group (an alliance of working groups and advisory groups in ISO/IEC JTC 1/‌SC 29, one of the two parent bodies of the JVET)
* **MPM**: Most probable mode (in intra prediction)
* **MRL**: Multiple reference line intra prediction
* **MV**: Motion vector
* **MVD**: Motion vector difference
* **NAL**: Network abstraction layer
* **NNVC**: Neural network-based video coding (experimental software package)
* **NSQT**: Non-square quadtree
* **NSST**: Non-separable secondary transform
* **NUH**: NAL unit header
* **NUT**: NAL unit type (as in AVC and HEVC)
* **OBMC**: Overlapped block motion compensation (e.g., as in H.263 Annex F)
* **OETF**: Opto-electronic transfer function – a function that converts to input light (e.g., light input to a camera) to a representation value
* **OLS**: Output layer set.
* **OOTF**: Optical-to-optical transfer function – a function that converts input light (e.g. l,ight input to a camera) to output light (e.g., light emitted by a display).
* **ONNX**: Open Neural Network Exchange – a format used to convert code from common neural network software packages into SADL code.
* **operation point**: A temporal subset of an OLS.
* **PDPC**: Position-dependent (intra) prediction combination.
* **PERP**: Padded equirectangular projection (a 360° projection format).
* **PH**: Picture header.
* **PHEC**: Padded hybrid equiangular cubemap (a 360° projection format).
* **PMMVD**: Pattern-matched motion vector derivation.
* **POC**: Picture order count.
* **PoR**: Plan of record.
* **PROF**: Prediction refinement with optical flow
* **PPS**: Picture parameter set (as in AVC and HEVC).
* **PTL**: Profile/tier/level combination.
* **QM**: Quantization matrix (as in AVC and HEVC).
* **QP**: Quantization parameter (as in AVC and HEVC, sometimes confused with quantization step size).
* **QT**: Quadtree.
* **RA**: Random access – a set of coding conditions designed to enable relatively-frequent random access points in the coded video data, with less emphasis on minimization of delay (contrast with LD).
* **RADL**: Random-access decodable leading (type of picture).
* **RASL**: Random-access skipped leading (type of picture).
* **R-D**: Rate-distortion.
* **RDO**: Rate-distortion optimization.
* **RDOQ**: Rate-distortion optimized quantization.
* **RDPCM**: Residual DPCM
* **ROT**: Rotation operation for low-frequency transform coefficients.
* **RPL**: Reference picture list.
* **RPLM**: Reference picture list modification.
* **RPR**: Reference picture resampling (e.g., as in H.263 Annex P), a special case of which is also known as ARC or DRC.
* **RPS**: Reference picture set.
* **RQT**: Residual quadtree.
* **RRU**: Reduced-resolution update (e.g. as in H.263 Annex Q).
* **RVM**: Rate variation measure.
* **SADL**: Small adhoc deep learning library
* **SAO**: Sample-adaptive offset.
* **SBT**: Subblock transform.
* **SbTMVP**: Subblock based temporal motion vector prediction.
* **SCIPU**: Smallest chroma intra prediction unit.
* **SD**: Slice data; alternatively, standard-definition.
* **SDH**: Sign data hiding.
* **SDT**: Signal-dependent transform.
* **SE**: Syntax element.
* **SEI**: Supplemental enhancement information (as in AVC and HEVC).
* **SH**: Slice header.
* **SHM**: Scalable HM.
* **SHVC**: Scalable high efficiency video coding.
* **SIF**: Switchable (motion) interpolation filter.
* **SIMD**: Single instruction, multiple data.
* **SMVD**: Symmetric MVD.
* **SPS**: Sequence parameter set (as in AVC and HEVC).
* **STMVP**: Spatial-temporal motion vector prediction.
* **STRP**: Short-term reference picture.
* **STSA**: Step-wise temporal sublayer access.
* **TBA/TBD/TBP**: To be announced/determined/presented.
* **TGM**: Text and graphics with motion – a category of content that primarily contains rendered text and graphics with motion, mixed with a relatively small amount of camera-captured content.
* **TIMD**: Template-based intra mode derivation
* **TM**: Template matching.
* **TMVP**: Temporal motion vector prediction.
* **TS**: Transform skip.
* **TSRC**: Transform skip residual coding.
* **TT**: Ternary tree.
* **UCBDS**: Unrestricted center-biased diamond search.
* **UGC**: User-generated content.
* **UWP**: Unequal weight prediction.
* **VCEG**: Visual coding experts group (ITU-T Q.6/16, the relevant rapporteur group in ITU-T WP3/16, which is one of the two parent bodies of the JVET).
* **VCM**: Video coding for machines.
* **VPS**: Video parameter set – a parameter set that describes the overall characteristics of a coded video sequence – conceptually sitting above the SPS in the syntax hierarchy.
* **VQA**: Visual quality assessment.
* **VT**: Verification testing.
* **VTM**: VVC Test Model.
* **VUI**: Video usability information.
* **VVC**: Versatile Video Coding, the standardization project developed by JVET.
* **WAIP**: Wide-angle intra prediction
* **WCG**: Wide colour gamut.
* **WG**: Working group, a group of technical experts (usually used to refer to WG 11, a.k.a. MPEG).
* **WPP**: Wavefront parallel processing (usually synonymous with ECS).
* Block and unit names in HEVC:
  + **CTB**: Coding tree block (luma or chroma) – unless the format is monochrome, there are three CTBs per CTU.
  + **CTU**: Coding tree unit (containing both luma and chroma, synonymous with LCU), with a size of 16x16, 32x32, or 64x64 for the luma component.
  + **CB**: Coding block (luma or chroma), a luma or chroma block in a CU.
  + **CU**: Coding unit (containing both luma and chroma), the level at which the prediction mode, such as intra versus inter, is determined in HEVC, with a size of 2Nx2N for 2N equal to 8, 16, 32, or 64 for luma.
  + **PB**: Prediction block (luma or chroma), a luma or chroma block of a PU, the level at which the prediction information is conveyed or the level at which the prediction process is performed in HEVC.
  + **PU**: Prediction unit (containing both luma and chroma), the level of the prediction control syntax within a CU, with eight shape possibilities in HEVC:
    - **2Nx2N**: Having the full width and height of the CU.
    - **2NxN (or Nx2N)**: Having two areas that each have the full width and half the height of the CU (or having two areas that each have half the width and the full height of the CU).
    - **NxN**: Having four areas that each have half the width and half the height of the CU, with N equal to 4, 8, 16, or 32 for intra-predicted luma and N equal to 8, 16, or 32 for inter-predicted luma – a case only used when 2N×2N is the minimum CU size.
    - **N/2x2N** paired with **3N/2x2N** or **2NxN/2** paired with **2Nx3N/2**: Having two areas that are different in size – cases referred to as AMP, with 2N equal to 16 or 32 for the luma component.
  + **TB**: Transform block (luma or chroma), a luma or chroma block of a TU, with a size of 4x4, 8x8, 16x16, or 32x32.
  + **TU**: Transform unit (containing both luma and chroma), the level of the residual transform (or transform skip or palette coding) segmentation within a CU (which, when using inter prediction in HEVC, may sometimes span across multiple PU regions).
* Block and unit names in VVC:
  + **CTB**: Coding tree block (luma or chroma) – there are three CTBs per CTU in a P or B slice or in an I slice that uses a single tree, and one CTB per luma CTU and two CTBs per chroma CTU in an I slice that uses separate trees.
  + **CTU**: Coding tree unit (synonymous with LCU, containing both luma and chroma in a P or B slice or in an I slice that uses a single tree, containing only luma or only chroma in an I slice that uses separate trees), with a size of 16x16, 32x32, 64x64, or 128x128 for the luma component.
  + **CB**: Coding block, a luma or chroma block in a CU.
  + **CU**: Coding unit (containing both luma and chroma in P/B slice, containing only luma or chroma in I slice), a leaf node of a QTBT. It’s the level at which the prediction process and residual transform are performed in JEM. A CU can be square or rectangle shape.
  + **PB**: Prediction block, a luma or chroma block of a PU.
  + **PU**: Prediction unit, has the same size as a CU in the VVC context.
  + **TB**: Transform block, a luma or chroma block of a TU.
  + **TU**: Transform unit, has the same size as a CU in the VVC context.

## Standards, TRs, supplements and technical papers approval and publication status

* AVC
  + ITU-T H.264 V14 was Consented at 22nd meeting on 2021-04-30 (with annotated regions, shutter interval, and miscellaneous corrections), approved 2021-08-22, published 2021-10-13
  + ISO/IEC 14496-10:2020 (Ed. 9) FDIS ballot closed 2020-11-27, published 2020-12-15
  + ISO/IEC 14496-10:2022 (Ed. 10), had been forwarded from DIS directly for publication 2022-01-21 (with annotated regions, shutter interval, and miscellaneous corrections) with an editing period, submitted to ITTF in 2022-05 after consultation with ISO staff on format of graphics files, upgraded to “DIS approved for registration” in ISO Project system 2022-07-04, published 2022-11-07
  + Preliminary draft text for YCgCo-Re and YCgCo-Ro issued at 26th meeting, second draft including SMPTE ST 2128 issued at 28th meeting, third draft issued at 29th meeting (not yet formally requested as a project)
  + Conformance testing
    - ITU-T H.264.1 V6 Approved 2016-02-13, published 2016-06-17
    - Various amendments of ISO/IEC 14496-4:2004, including:
      * ISO/IEC 14496-4:2004/AMD 6:2005 Advanced Video Coding conformance
      * ISO/IEC 14496-4:2004/AMD 9:2006 AVC fidelity range extensions conformance
      * ISO/IEC 14496-4:2004/AMD 30:2009 Conformance testing for new profiles for professional applications
      * ISO/IEC 14496-4:2004/AMD 31:2009 Conformance testing for SVC profiles
      * ISO/IEC 14496-4:2004/AMD 38:2010 Conformance testing for Multiview Video Coding
      * ISO/IEC 14496-4:2004/AMD 41:2014 Conformance testing of MVC plus depth extension of AVC
      * ISO/IEC 14496-4:2004/AMD 42:2014 Conformance testing of Multi-Resolution Frame Compatible Stereo Coding extension of AVC
      * ISO/IEC 14496-4:2004/AMD 43:2015 3D-AVC conformance testing
      * ISO/IEC 14496-4:2004/AMD 45:2016 Conformance Testing for the Multi-resolution Frame Compatible Stereo Coding with Depth Maps Extension of AVC
  + Reference software
    - ITU-T H.264.2 V7 Approved 2016-02-13, published 2016-05-30
    - Various amendments of ISO/IEC 14496-5:2001, including:
      * ISO/IEC 14496-5:2001/AMD 6:2005 Advanced Video Coding (AVC) and High Efficiency Advanced Audio Coding (HE AAC) reference software
      * ISO/IEC 14496-5:2001/AMD 8:2006 AVC fidelity range extensions reference software
      * ISO/IEC 14496-5:2001/AMD 15:2010 Reference software for Multiview Video Coding
      * ISO/IEC 14496-5:2001/AMD 18:2008 Reference software for new profiles for professional applications
      * ISO/IEC 14496-5:2001/AMD 19:2009 Reference software for Scalable Video Coding
      * ISO/IEC 14496-5:2001/AMD 33:2015 Reference software for MVC plus depth extension of AVC
      * ISO/IEC 14496-5:2001/AMD 34:2014 Reference software of the multi-resolution frame compatible stereo coding of AVC
      * ISO/IEC 14496-5:2001/AMD 35:2015 3D-AVC Reference software
      * ISO/IEC 14496-5:2001/AMD 39:2016 Reference software for the Multi-resolution Frame Compatible Stereo Coding with Depth Maps of AVC
      * ISO/IEC 14496-5:2001/AMD 42:2017 Reference software for the alternative depth information SEI message extension of AVC
* HEVC
  + ITU-T H.265 V7 approved 2019-11-29, published 2020-01-10
  + ISO/IEC 23008-2:2020 (Ed. 4) FDIS ballot closed 2020-07-16, published 2020-08-27
  + ITU-T H.265 V8 Consented at the 22nd meeting (shutter interval information SEI message and miscellaneous corrections), published 2020-10-13
  + ISO/IEC 23008-2:2020/AMD 1:2021 (shutter interval information SEI message) published 2021-07-12
  + ISO/IEC 23008-2:202x (Ed. 5) began as CDAM 2 High-range levels output of 25th meeting of January 2022, CDAM ballot closed 2022-04-15, conversion to 5th edition with miscellaneous corrections planned at 26th meeting of April 2022, text submitted for DIS ballot 2022-07-10, DIS ballot closed 2023-01-10
  + Preliminary draft text for YCgCo-Re and YCgCo-Ro issued at 26th meeting, second draft including SMPTE ST 2128 issued at 28th meeting (not yet formally requested as a project)
  + Conformance testing
    - ITU-T H.265.1 V3 approved 2018-10-14, published 2019-01-15
    - ISO/IEC 23008-8:2018 (Ed. 2) Conformance specification for HEVC, published 2018-08-06
    - ISO/IEC 23008-8:2018/AMD 1:2019 Conformance testing for HEVC screen content coding (SCC) extensions and non-intra high throughput profiles, published 2019-10-15
  + Reference software
    - ITU-T H.265.2 V4 approved 2016-12-22, published 2017-04-10
    - ISO/IEC 23008-5:2017 (Ed. 2) Reference software for high efficiency video coding, published 2017-03-01
    - ISO/IEC 23008-5:2017/AMD 1:2017 Reference software for screen content coding extensions, published 2017-11-09
* VVC
  + ITU-T H.266 V1 approved 2020-08-29, published 2020-11-10
  + ISO/IEC 23090-3:2021 (Ed. 1) published 2021-02-16
  + ITU-T H.266 V2 with operation range extensions, Consented 2022-01-28, Last Call began 2022-04-01, Approved 2022-04-29, pre-published 2022-06-06, published 2022-07-12
  + ISO/IEC 23090-3:2022 (Ed. 2) with operation range extensions, approval at WG level to proceed to FDIS 2022-01-21, published 2022-09-25
  + ISO/IEC 23090-3:202x (Ed. 2) / Amd.1 New level and systems-related supplemental enhancement information, CDAM 1 issued from 26th meeting, ballot closed 2022-07-14, DAM 1 issued from 27th meeting, ballot closed 2023-01-03 (ready for action at this meeting)
  + Conformance testing
    - ITU-T H.266.1 V1 Consented 2022-01-28, Last Call began 2022-04-01, Approved 2022-04-29, pre-published 2022-05-17, published 2022-07-12
    - ISO/IEC 23090-15:2022 V1 approval at WG level to proceed to FDIS 2022-10-15, upgraded to “DIS approved for registration” in ISO Projects system 2021-10-24, upgraded to “FDIS registered for formal approval” 2022-07-11, FDIS ballot closed 2022-11-04, published 2022-11-24
    - ISO/IEC 23090-15:202x Amd.1 Operation range extensions – DAM 1 issued from 25th meeting 2022-01-21, upgraded to “CD approved for registration as DIS” status in ISO Projects system 2022-05-31, upgraded to “DIS registered” 2022-06-22, DAM ballot closed 2022-11-15, consolidated into FDIS issued as an output of the 29th meeting in January 2023 (remaining under preparation at the time of this meeting)
  + Reference software
    - ITU-T H.266.2 V1 Consented 2022-01-28, Last Call began 2022-04-01, Approved 2022-04-29, pre-published 2022-05-17, published 2022-07-12
    - ISO/IEC 23090-16:2022 V1 approval at WG level to proceed to FDIS 2022-01-21, upgraded to “DIS approved for registration” status in ISO Projects system 2022-04-21, upgraded to “FDIS registered for formal approval” 2022-04-22, FDIS ballot initiated 2022-07-24, FDIS ballot closed 2022-09-19, published 2022-10-23
* VSEI
  + ITU-T H.274 V1 approved 2020-08-29, published 2020-11-10
  + ISO/IEC 23002-7:2021 (Ed. 1) published 2021-01-28
  + ITU-T H.274 V2 Consented 2022-01-28, Last Call began 2022-04-01, Approved 2022-05-22 (after 1 Last Call comment and Additional Review), pre-published 2022-06-17, published 2022-07-25
  + ISO/IEC 23002-7:2022 (Ed. 2) approval at WG level to proceed to FDIS 2022-01-21, upgraded to “DIS approved for registration” status in ISO Projects system 2022-05-05 and “FDIS registered for formal approval” 2022-05-08, FDIS ballot closed 2022-09-27, published 2022-10-30
  + ISO/IEC 23002-7:202x (2nd Ed.) Amd.1 Request for new edition and CD for additional SEI messages issued at 27th meeting, ballot closed 2022-10-10, DAM registered 2022-11-13, DAM ballot closed 2022-04-06: comments in [m62571](https://dms.mpeg.expert/doc_end_user/current_document.php?id=86620&id_meeting=194) from Finland, Japan, US, ISO CS (minor)
* CICP
  + ISO/IEC 23091-2:2021 (Ed. 2) had been forwarded from DIS directly for publication in 2021-04 and published 2021-10-18
  + ITU-T H.273 V2 (with 4:2:0 sampling alignment and corrections for range of values for sample aspect ratio, ICTCP equations for HLG, and transfer characteristics function for sYCC of IEC 61966-2-1) Consented on 2021-04-30, Last Call closed during the 23rd meeting with approval on 2021-07-14, published 2021-09-24
  + ISO/IEC 23091-2:202x (Ed. 3) Request for new edition and CD for new edition (including YCgCo-Re and YCoCg-Ro) issued at 27th meeting, ballot closed 2022-10-10, DIS registered 2022-11-13, pending DIS ballot (no action at this meeting)
  + Preliminary draft text for including SMPTE ST 2128 issued at 28th meeting (not yet formally requested as a project)
* Conversion and coding practices for HDR/WCG Y′CbCr 4:2:0 video with PQ transfer characteristics
  + H.Sup15 V1, approved 2017-01-27, published 2017-04-12
  + ISO/IEC TR 23008-14:2018 published 2018-08
* Signalling, backward compatibility and display adaptation for HDR/WCG video coding
  + H.Sup18 V1, approved 2017-10-27, published 2018-01-18
  + ISO/IEC TR 23008-15:2018 published 2018-08
* Usage of video signal type code points
  + H.Sup19 V3 approved 2021-04-30, published 2021-06-04
  + ISO/IEC TR 23091-4 (Ed. 3) published 2021-05-23
* Working practices using objective metrics for evaluation of video coding efficiency experiments
  + HSTP-VID-WPOM V1: approved 2020-07-03, published 2020-11
  + ISO/IEC TR 23002-8 (Ed. 1) published 2021-05-20
* Film grain synthesis technologies for video applications
  + ISO/IEC TR 23002-9 Request for subdivision and WD 1 issued at 25th meeting 2022-01-21, WD 2 issued at 27th meeting, WD 3 issued at 28th meeting, CDTR issued at 29th meeting (consultation period not yet started at the time of this meeting)
* The following freely available standards are published here in ISO/IEC:  
  <https://standards.iso.org/ittf/PubliclyAvailableStandards/index.html> as of 2023-05-26.
  + Various amendments of ISO/IEC 14496-4:2004 Conformance for AVC
  + Various amendments of ISO/IEC 14496-5:2001 Reference software for AVC
  + ISO/IEC 14496-10:2022 (Ed. 10) AVC
  + ISO/IEC 23002-7:2022 (Ed. 2) – VSEI
  + ISO/IEC 23008-2:2020 (Ed. 4) HEVC
  + ISO/IEC 23090-3:2022 (Ed. 2) VVC
  + ISO/IEC 23090-15:2022 (Ed. 1) Conformance for VVC
  + ISO/IEC 23090-16:2022 (Ed. 1) Reference software for VVC
  + ISO/IEC 23091-2:2021 (Ed. 2) Video CICP (was requested in April 2021, and the 2019 previous edition was also not available there)
* The following standards that have been intended by JVET to be publicly available were not available at <https://standards.iso.org/ittf/PubliclyAvailableStandards/index.html> as of 2023-05-26. (These should be checked for previously issued requests for free availability.)
  + ISO/IEC 23008-2:2020 (Ed. 4) Amd.1:2021: Shutter interval information SEI message, published 2021-07-12 (has not been requested)
  + ISO/IEC 23008-5:2017 (Ed. 2) Reference software for high efficiency video coding, published 2017-03-01
  + ISO/IEC 23008-5:2017/AMD 1:2017 Reference software for screen content coding extensions, published 2017-11-09
  + ISO/IEC 23008-8:2018 (Ed. 2) Conformance specification for HEVC, published 2018-08, published 2018-08-06
  + ISO/IEC 23008-8:2018/AMD 1:2019 Conformance testing for HEVC screen content coding (SCC) extensions and non-intra high throughput profiles, published 2019-10-15
* It appears necessary to check if all older software and conformance packages are publicly available – it might be that it was never requested, e.g. for those that were produced by JCT-3V. This topic was left TBD until the next meeting – perhaps it would be best to compile a list of all relevant software and conformance parts of AVC, HEVC, MPEG-2 aka H.262, CICP, and request these in bulk.

## Draft standards progression status

* AVC and HEVC colour type indicators for YCgCo-Re, YCgCo-Ro, and SMPTE ST 2128 (IPT-PQ-C2) are drafted and pending formal action.
* HEVC new levels (from JVET-Z1005) – ISO/IEC 23008-2 DIS of new edition of HEVC was issued from the April 2022 26th meeting, incorporating Amd.1 and corrigenda items (ballot closed 2023-01-10, ballot comments in the Summary of Voting document [m61834](https://dms.mpeg.expert/doc_end_user/current_document.php?id=85619&id_meeting=193)); note that Amd.1 = shutter interval SEI is already included in latest ITU-T edition of H.265. It is noted that there are potential additional items (corrigenda+tickets, YCgCo-Re and YCgCo-Ro draft, SMPTE ST 2128, multiview profiles draft) where only corrigenda items were included in the FDIS text based on ballot comments, ballot had not been started yet. ITU-T consent for a new edition is planned for July 2023. It was noted that the referencing of VSEI is also somewhat different in the ITU-T and ISO/IEC versions of HEVC and/or AVC, which might be aligned at the next convenient time (basically editorial – e.g., the ITU version of AVC specifies the annotated regions SEI message without referencing VSEI, whereas the ISO/IEC version references VSEI for the syntax and semantics of that SEI message). However, there is currently no other need for HEVC to reference the VSEI standard. An FDIS for HEVC was issued as an output of the 29th meeting in January 2023 (and it does not reference VSEI).
* VVC new level and systems-related supplemental enhancement information (from JVET-AA2005) – VVC DAM was issued from 27th meeting, ballot closed 2023-01-03, ballot comments in the Summary of Voting document [m61833](https://dms.mpeg.expert/doc_end_user/current_document.php?id=85618&id_meeting=193). This was converted into a preliminary FDIS of VVC 3rd edition ([WG 5 N 183](https://dms.mpeg.expert/doc_end_user/current_document.php?id=86365&id_meeting=193)) at the 29th meeting of January 2023, anticipating that some alignment will be necessary with the ongoing VSEI amendment. ITU-T consent is planned for July 2023 when a new edition of VSEI is also planned to be consented, to keep VVC and VSEI aligned.
* VVC Conformance testing for operation range extensions – (from JVET-Y2026) – the DAM ballot closed 2022-11-15 (ballot comments in the Summary of Voting document [m61832](https://dms.mpeg.expert/doc_end_user/current_document.php?id=85617&id_meeting=193)), and this was consolidated into an FDIS at the 29th meeting, but the ballot had not been started yet. ITU-T consent was planned for July 2023.
* VSEI additional SEI messages (from JVET-AB2006) – VSEI DAM (JVET draft 3) was issued from the 28th meeting and a DAM ballot was issued, Summary of Voting document is available as [m62571](https://dms.mpeg.expert/doc_end_user/current_document.php?id=86620&id_meeting=194). It was planned to be consolidated into FDIS of new edition in April (if possible) or July, with ITU-T consent in July 2023. There were numerous input contributions in particular on NNPF, so the FDIS was expected to be deferred to July 2023.
* Film grain synthesis technology for video applications – JVET draft 4 was issued at the 29th meeting (JVET-AC2020), and the ISO/IEC 23002-9 CDTR was issued (a request to start work on the TR had been made at the 25th meeting), but the CDTR consultation period had not been started yet. The publication limit date was reportedly 2023-08-09, so action to extend that date may be needed.
* Video CICP new edition with for YCgCo-Re and YCgCo-Ro (from JVET-Z1003), an ISO/IEC 23091-2 DIS was issued from the 28th meeting and the Summary of Voting document was available as [m62572](https://dms.mpeg.expert/doc_end_user/current_document.php?id=86621&id_meeting=194). ITU-T consent is planned for July 2023.
* Video CICP colour type indicator for SMPTE ST 2128 is drafted and pending formal action. It was reported that it is expected to become finalized in the SMPTE meeting in March. It was further reported that some clarification on its conversion equations is necessary.
* A request for free availability in ISO/IEC has to be made for each edition, amendment and corrigendum, and the request needs to be approved in the WG 5 Recommendations. A request form also needs to be filled out (but the form does not need to be issued as a WG 5 document). A freely available URL for the ITU publication should be provided for the following parts:
  + For the ongoing work items, when they become finalized
  + ISO/IEC 23008-2:2020/Amd.1:2021 – HEVC FDAM issued 20th meeting (October 2020), public availability not yet requested but may not be necessary as it becomes included in next edition

## Opening remarks

Remarks during the opening session of the meeting Tuesday 11 July at 0900 CEST were as follows.

* Timing and organization of the meeting and online access, calendar posting of session plans
  + The initial number of documents was lower than for the previous meeting (200->150) – parallel sessions might nevertheless be necessary, considering the preparation of various deliverables.
  + Scheduling of NNVC discussions – any JPEG-AI sessions in parallel during the first JVET week and over the weekend (JPEG meeting starts only next week and finishes after JVET)?
* Plans for subsequent F2F meeting in October (Hannover), April (??), and July 2024 (Sapporo)
* The meeting logistics, agenda, working practices, policies, and document allocation considerations were reviewed.
  + Remote access to the meeting was provided using Zoom. This required discipline in the meeting room (no microphone to be switched on, podium and room microphones to be under central control).
  + Having text and software available is crucial (and not just arriving at the end of the meeting).
  + There were no objections voiced in the opening plenary to the consideration of late contributions.
* The results of the previous meeting and the meeting report JVET-AD1000 were reviewed. The following small issues in the meeting report were noted and were not considered sufficient to warrant issuing a revision. These are obviously left over from a previous report, and the correct information can be found in other places of the report:
  + The title of the document designates the meeting as teleconference meeting, whereas it had been held in face-to-face mode in Antalya, TR.
  + In the summary (section 1), the meeting of April 2025 was expressed to be held under ITU-T SG16 auspices, whereas regulary it should be expected to be held under ISO/IEC SC 29 auspices.
  + In the summary (section 1), JVET-AC2003 is wrongly listed as output from the meeting. The corresponding line should have been removed, and the total number of outputs was 20 instead of 21.
  + In 2.4.3 outputs of preceding meeting, document JVET-AD2027 (SEI processing order SEI message) was designated to be draft 2, whereas actually it had already been the third draft. Further below, a reference to section 2.12 about minor errors in the previous meeting report should have been referencing section 2.14 (opening remarks).
  + In section 8.2 (experiment planning), documents JVET-AC2023 and JVET-AC2024 are referred to instead of JVET-AD2023 and JVET-AD2024, respectively.
* There was somewhat less of a problem of late non-cross-check documents.
* There were only few documents registered where authors’ given names were not abbreviated, and/or company affiliation was missing in the authors’ list. Participants were reminded to stick to JVET’s conventions.
* Experts are asked to inform the chair when the title of a document is changed, or if authors are added. Otherwise, that might not be correct in the meeting notes.
* The primary goals of the meeting were:
  + 2nd edition of VVC confomance (H.266.1) is originally planned tom be delivered for ITU consent at this meeting, but the corresponding JVET document JVET-AC2025 and WG 5 FDIS 23090-15 N 185 have not been produced yet
  + Any action on a new version of VVC software as standards part?
  + VVC and VSEI third editions FDIS, and consent on next ITU editions
    - VVC DAM ballot response in [m61833](https://dms.mpeg.expert/doc_end_user/current_document.php?id=85618&id_meeting=193), draft DoCR (from last meeting) in [MDS22705](https://dms.mpeg.expert/doc_end_user/current_document.php?id=87851&id_meeting=194), and preliminary FDIS text in [MDS22706](https://dms.mpeg.expert/doc_end_user/current_document.php?id=87852&id_meeting=194).
    - VSEI DAM ballot response in [m62571](https://dms.mpeg.expert/doc_end_user/current_document.php?id=86620&id_meeting=194), draft DoCR (from last meeting) in [MDS22702](https://dms.mpeg.expert/doc_end_user/current_document.php?id=87848&id_meeting=194), and preliminary FDIS text in [MDS22703](https://dms.mpeg.expert/doc_end_user/current_document.php?id=87849&id_meeting=194).
  + New edition video CICP FDIS (DIS ballot response in [m62572](https://dms.mpeg.expert/doc_end_user/current_document.php?id=86621&id_meeting=194) draft DoCR in [MDS22710](https://dms.mpeg.expert/doc_end_user/current_document.php?id=87856&id_meeting=194), and preliminary FDIS text in [MDS22711](https://dms.mpeg.expert/doc_end_user/current_document.php?id=87857&id_meeting=194)), and consent for next ITU next edition) – inclusion of ST 2128 descriptor needs clarification of the status, this may impose delay
  + TR on film grain synthesis technology for video applications – CD TR 23002-9 ballot response in [m63723](https://dms.mpeg.expert/doc_end_user/current_document.php?id=88067&id_meeting=195), plan to issue TR in ISO, and submit for ITU consent
  + Optimization of encoders and receiving systems for machine analysis of coded video content – new WD of TR to be issued
  + Preparation of verification tests film grain and multilayer – expert viewing?
  + Any action items on reference software JM/HM/VTM? Status of MV-HEVC software and test conditions (refer to resolution of last meeting for the latter)?
  + Plan for new edition of AVC (both ISO and ITU)
    - Additional colour type identifiers for AVC and HEVC (Draft 3 in JVET-AD1008 was issued at the last meeting) – clarify for status of SMPTE ST 2128 (same as for CICP
    - Errata items from JVET-AD1004
    - Anything else? SEI messages?
    - Could be premature for ITU consent, but ISO CD an request could be issued
  + Plan for new edition of HEVC (only ITU version; FDIS of ISO version was issued recently)
    - Additional colour type identifiers for AVC and HEVC (Draft 3 in JVET-AD1008 was issued at the last meeting) – clarify for status of SMPTE ST 2128 (same as for CICP
    - Errata items from JVET-AD1004
    - Anything else? SEI messages? 10-bit Multiview profile (depends on SW and CT status)?
  + Exploration Experiments
    - Neural network-based video coding
    - Enhanced compression beyond VVC
* Liaison communication:
  + Any incoming liaison statements? Any outgoing? JPEG?
* Joint meetings were expected with …
* Principles of standards development were discussed.

## Scheduling of discussions

The times of meeting sessions followed the needs of the face-to-face meeting, with highest priority given to the aim of achieving the goals of the meeting. Typical meeting hours were in the range of 0900-1900 CEST with coffee breaks and lunch breaks as appropriate, however some early morning or late-night sessions were anticipated to be necessary. Sessions were announced in the JVET calendar and the ITU posting system in advance as far as possible, although it was acknowledged that some activities (such as breakout sessions) might be held at short notice.

Particular scheduling notes are shown below, although not necessarily 100% accurate or complete. Times are recorded in the local timezone of the meeting venue, except as otherwise noted:

* Tue. 11 July, 1st day
  + Morning session:
    - 0930–XXXX Opening remarks, review of practices, agenda, IPR policy reminder
    - XXXX–XXXX Reports of AHGs
  + Afternoon session:
    - XXXX–XXXX EEX summary report
    - …
* Wed. 12 July, 2nd day
  + Morning session:
    - 0900–XXXX Review of …
    - …
  + Afternoon session:
    - 1400–XXXX Review of …
    - …
* Mon. 17 July, 7th day
  + 0900–1130 MPEG information sharing session (out of JVET)
  + …
* Wed. 19 July, 9th day
  + 0900–1030 MPEG information sharing session (out of JVET)
  + XXXX–XXXX and XXXX–XXXX Plenary:
    - BoG reports
    - Review and approval of output docs
    - Establishment of AHGs
    - Approval of meeting recommendations
    - Future planning, a.o.b.
* Fri. 28 April
  + 1400–1600 MPEG information sharing session (out of JVET)
  + 1645–1655 WG 5 presentation of meeting recommendations

## Contribution topic overview

The approximate subject categories and quantity of contributions per category for the meeting were summarized as follows (note that the noted document counts do not include crosschecks and summary reports, and may not be completely accurate; documents which are allocated to multiple sections are only counted in one of them):

* AHG reports (14) (section 3)
* Project development (section 4)
  + AHG1: Deployment and advertisement of standards (1)
  + AHG2: Text development and errata reporting (1)
  + AHG3: Test conditions (0)
  + AHG3: Software development (1)
  + AHG4: Subjective quality testing and verification testing (3)
  + AHG4: Test Material (1)
  + AHG4: Quality assessment methodology (1)
  + AHG5: Conformance test development (1)
  + AHG7: ECM tool assessment (2)
  + AHG8: Optimization of encoders and receiving systems for machine analysis of coded video content (5)
  + AHG10: Encoding algorithm optimization (5)
  + AHG13: Film grain synthesis (0)
  + Implementation studies (1)
  + Profile/tier/level specification (0)
  + General aspects of standards development and applications of standards (0)
* Low-level tool technology proposals (section 5) with subtopics (number counts excluding BoG and summary reports)
  + AHG11/AHG14 and EE1: Neural network-based video coding (14) (section 5.1)
  + AHG6/AHG12 and EE2: Enhanced compression beyond VVC capability (74) (section 5.2)
* AHG9: High-level syntax (HLS) proposals (section 6) with subtopics
  + SEI messages on neural-network post filter (27) (section 6.1)
  + SEI messages on topics other than NNPF (12) (section 6.2)
  + Non-SEI HLS aspects (0) (section 6.3)
* Joint meetings, plenary discussions, BoG reports (X), liaison (X), summary of actions (section 7)
* Project planning (section 8)
* Establishment of AHGs (section 9)
* Output documents (section 10)
* Future meeting plans and concluding remarks (section 11)

The document counts above do not include cross-checks and summary reports.

# AHG reports (14)

These reports were discussed during XXXX–XXXX on Tuesday 11 July 2023 (chaired by JRO).

[JVET-AE0001](https://jvet-experts.org/doc_end_user/current_document.php?id=13073) JVET AHG report: Project Management (AHG1) [J.-R. Ohm (chair), G. J. Sullivan (vice-chair)]

[JVET-AE0002](https://jvet-experts.org/doc_end_user/current_document.php?id=13074) JVET AHG report: Draft text and test model algorithm description editing (AHG2) [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)]

[JVET-AE0003](https://jvet-experts.org/doc_end_user/current_document.php?id=13075) JVET AHG report: Test model software development (AHG3) [F. Bossen, X. Li, K. Sühring (co-chairs), E. François, Y. He, K. Sharman, V. Seregin, A. Tourapis (vice-chairs)]

[JVET-AE0004](https://jvet-experts.org/doc_end_user/current_document.php?id=13076) JVET AHG report: Test material and visual assessment (AHG4) [V. Baroncini, T. Suzuki, M. Wien (co-chairs), S. Iwamura, S. Liu, S. Puri, A. Segall, P. Topiwala, S. Wenger, J. Xu, Y. Ye (vice-chairs)]

[JVET-AE0005](https://jvet-experts.org/doc_end_user/current_document.php?id=13077) JVET AHG report: Conformance testing (AHG5) [D. Rusanovskyy, I. Moccagatta (co-chairs), F. Bossen, K. Kawamura, T. Ikai, S. Iwamura, H.-J. Jhu, K. Sühring, Y. Yu (vice-chairs)]

[JVET-AE0006](https://jvet-experts.org/doc_end_user/current_document.php?id=12989) JVET AHG report: ECM software development (AHG6) [V. Seregin (chair), J. Chen, F. Le Léannec, K. Zhang (vice-chairs)]

[JVET-AE0007](https://jvet-experts.org/doc_end_user/current_document.php?id=13078) JVET AHG report: ECM tool assessment (AHG7) [X. Li (chair), L.-F. Chen, Z. Deng, J. Gan, E. François, H.-J. Jhu, X. Li, H. Wang (vice-chairs)]

[JVET-AE0008](https://jvet-experts.org/doc_end_user/current_document.php?id=13080) JVET AHG report: Optimization of encoders and receiving systems for machine analysis of coded video content (AHG8) [C. Hollmann, S. Liu, S. Wang, M. Zhou (AHG chairs)]

[JVET-AE0009](https://jvet-experts.org/doc_end_user/current_document.php?id=13082) JVET AHG report: SEI message studies (AHG9) [S. McCarthy, Y.-K. Wang (co-chairs), T. Chujoh, S. Deshpande, C. Fogg, Hendry, P. de Lagrange, G. J. Sullivan, A. Tourapis, S. Wenger (vice-chairs)]

[JVET-AE0010](https://jvet-experts.org/doc_end_user/current_document.php?id=13085) JVET AHG report: Encoding algorithm optimization (AHG10) [P. de Lagrange, A. Duenas, R. Sjöberg, A. Tourapis (AHG chairs)]

[JVET-AE0011](https://jvet-experts.org/doc_end_user/current_document.php?id=13086) JVET AHG report: Neural network-based video coding (AHG11) [E. Alshina, S. Liu, A. Segall (co chairs), F. Galpin, J. Li, R.-L. Liao, D. Rusanovskyy, T. Shao, M. Wien, P. Wu (vice-chairs)]

[JVET-AE0012](https://jvet-experts.org/doc_end_user/current_document.php?id=13087) JVET AHG report: Enhanced compression beyond VVC capability (AHG12) [M. Karczewicz, Y. Ye, L. Zhang (co-chairs), B. Bross, R. Chernyak, X. Li, K. Naser, H. Yang (vice-chairs)]

[JVET-AE0013](https://jvet-experts.org/doc_end_user/current_document.php?id=13089) JVET AHG report: Film grain technologies (AHG13) [W. Husak, M. Radosavljević (co-chairs), A. Duenas, D. Grois, Y. He, P. de Lagrange, X. Meng, A. Segall, A. Tourapis, W. Zhang (vice-chairs)]

[JVET-AE0014](https://jvet-experts.org/doc_end_user/current_document.php?id=13090) JVET AHG report: NNVC software development (AHG14) [S. Eadie, F. Galpin, Y. Li, J. Shingala, L. Wang, Z. Xie (AHG chairs)]

# Project development (19)

## AHG1: Deployment and advertisement of standards (1)

Contributions in this area were discussed at XXXX–XXXX on XXday XX July 2023 (chaired by XX).

[JVET-AE0154](https://jvet-experts.org/doc_end_user/current_document.php?id=13117) MC-IF VVC technical guidelines [L. Litwic (Ericsson), S. McCarthy (Dolby), S. Wenger (Tencent), J. Ridge (Nokia), B. Bross (Fraunhofer HHI), D. Rusanovskyy (Qualcomm), Alan Stein (InterDigital)]

## AHG2: Text development and errata reporting (1)

Contributions in this area were discussed at XXXX–XXXX on XXday XX July 2023 (chaired by XX).

[JVET-AE0155](https://jvet-experts.org/doc_end_user/current_document.php?id=13118) Editor commentary on the post-filter hint SEI message semantics [G. J. Sullivan, Y.-K. Wang (Editors)]

## AHG3: Test conditions (0)

This section is kept as a template for future use.

## AHG3: Software development (1)

Contributions in this area were discussed at XXXX–XXXX on XXday XX July 2023 (chaired by XX).

[JVET-AE0181](https://jvet-experts.org/doc_end_user/current_document.php?id=13144) Scaling window support for VTM [S. Iwamura, S. Nemoto, A. Ichigaya (NHK)]

## AHG4: Subjective quality testing and verification testing (3)

Contributions in this area were discussed at XXXX–XXXX on XXday XX July 2023 (chaired by XX).

[JVET-AE0041](https://jvet-experts.org/doc_end_user/current_document.php?id=12988) AHG4: Report on AhG meeting on verification testing for VVC multilayer coding [M. Wien (AhG4 co-chair)]

[JVET-AE0219](https://jvet-experts.org/doc_end_user/current_document.php?id=13182) AHG4: Results of visual checking of SVVC VT streams with and without DMVR fix [M. Wien (AhG4 co-chair)] [miss]

[JVET-AE0227](https://jvet-experts.org/doc_end_user/current_document.php?id=13190) AHG4: experiments in preparation of scalable quality ladder visual testing [P. de Lagrange, F. Urban (InterDigital)] [late] [miss]

## AHG4: Test material (1)

Contributions in this area were discussed at XXXX–XXXX on XXday XX July 2023 (chaired by XX).

[JVET-AE0179](https://jvet-experts.org/doc_end_user/current_document.php?id=13142) AHG4: Renewed license statement for Ghost Town Fly and Undo Dancer 3D video test sequences [M. M. Hannuksela, N. Salonen (Nokia)] [late]

## AHG4: Quality assessment methodology (1)

Contributions in this area were discussed at XXXX–XXXX on XXday XX July 2023 (chaired by XX).

[JVET-AE0092](https://jvet-experts.org/doc_end_user/current_document.php?id=13040) [AHG4] Occupancy-only PSNR calculations for V3C V-PCC coding evaluation [S. Schwarz, M. M. Hannuksela (Nokia)]

## AHG5: Conformance test development (1)

Contributions in this area were discussed at XXXX–XXXX on XXday XX July 2023 (chaired by XX).

[JVET-AE0111](https://jvet-experts.org/doc_end_user/current_document.php?id=13059) Additional conformance tests of spatial scalability for multilayer coding [C. Salmon-Legagneur, P. de Lagrange, F. Urban (InterDigital)]

## AHG7: ECM tool assessment (2)

Contributions in this area were discussed at XXXX–XXXX on XXday XX July 2023 (chaired by XX).

[JVET-AE0174](https://jvet-experts.org/doc_end_user/current_document.php?id=13137) AHG7: On TM control for non-inter tools [Z. Deng, K. Zhang, L. Zhang (Bytedance)]

[JVET-AE0212](https://jvet-experts.org/doc_end_user/current_document.php?id=13175) Cross-check of JVET-AE0174 On TM control for non-inter tools [X. Li (Google)] [late] [miss]

[JVET-AE0195](https://jvet-experts.org/doc_end_user/current_document.php?id=13158) AhG7: ECM stages complexity assessment [F. Galpin, F. Le Léannec, C. Salmon-Legagneur, E. François (InterDigital)] [late]

## AHG8: Optimization of encoders and receiving systems for machine analysis of coded video content (5)

Contributions in this area were discussed at XXXX–XXXX on XXday XX July 2023 (chaired by XX).

[JVET-AE0081](https://jvet-experts.org/doc_end_user/current_document.php?id=13029) [AHG8] De-noising filter as pre-processing for machine task C. Kim, D. Gwak, J. Lim (LGE)

[JVET-AE0221](https://jvet-experts.org/doc_end_user/current_document.php?id=13184) Crosscheck of JVET-AE0081 ([AHG8] De-noising filter as pre-processing for machine task) [C. Hollmann (Ericsson)] [late] [miss]

[JVET-AE0096](https://jvet-experts.org/doc_end_user/current_document.php?id=13044) [AHG8] Study on using different VTM versions [C. Hollmann, J. Ström (Ericsson)]

[JVET-AE0099](https://jvet-experts.org/doc_end_user/current_document.php?id=13047) [AHG8] NNPF and post-filter hint SEI messages for the technical report [C. Hollmann, M. Pettersson, R. Sjöberg, M. Damghanian (Ericsson)]

[JVET-AE0107](https://jvet-experts.org/doc_end_user/current_document.php?id=13055) AHG8: Improvements of the BD-rate model using monotonic curve-fitting method [H. Wang, X. Pan, Z. Liu, X. Xu, S. Liu (Tencent)]

[JVET-AE0143](https://jvet-experts.org/doc_end_user/current_document.php?id=13106) AHG8: A spatial resampling algorithm and an exemplar software implementation [S. Wang, B. Li, J. Chen, Y. Ye (Alibaba), S. Wang (CityU)]

Contributions related to SEI messages:

[JVET-AE0053](https://jvet-experts.org/doc_end_user/current_document.php?id=13001) AHG8/AHG9: Neural-network post-filter regions SEI message [T. Chujoh, Y. Yasugi, T. Ikai (Sharp)]

[JVET-AE0064](https://jvet-experts.org/doc_end_user/current_document.php?id=13012) AHG8/AHG9: Signalling encoder preprocessing and human / machine viewing indications [C. Kim, D. Gwak, Hendry, J. Lim, S. Kim (LGE), M. M. Hannuksela, F. Cricri, H. Zhang (Nokia)]

[JVET-AE0079](https://jvet-experts.org/doc_end_user/current_document.php?id=13027) AHG8/AHG9: Source picture timing information SEI message [S. McCarthy, G. J. Sullivan, P. Yin (Dolby)]

[JVET-AE0090](https://jvet-experts.org/doc_end_user/current_document.php?id=13038) AHG8/AHG9: On machine vision indication [J. Gao, H.-B. Teo, C.-S. Lim, K. Abe (Panasonic)]

[JVET-AE0095](https://jvet-experts.org/doc_end_user/current_document.php?id=13043) AHG8/AHG9: proposed changes to the candidate new object mask information SEI message [P. de Lagrange, E. François, D. Doyen (InterDigital), J. Chen, S. Wang, Y. Ye (Alibaba)] [late]

## AHG10: Encoding algorithm optimization (5)

Contributions in this area were discussed at XXXX–XXXX on XXday XX July 2023 (chaired by XX).

[JVET-AE0057](https://jvet-experts.org/doc_end_user/current_document.php?id=13005) MTT split modes early termination [W. Ahmad, P. Wennersten, K. Andersson (Ericsson)]

[JVET-AE0215](https://jvet-experts.org/doc_end_user/current_document.php?id=13178) crosscheck of JVET-AE0057 MTT split modes early termination [K. Naser (InterDigital)] [late] [miss]

[JVET-AE0104](https://jvet-experts.org/doc_end_user/current_document.php?id=13052) AHG10: GOP-based RPR encoder control using parallel resolution encoding [D. Arai, S. Nemoto, S. Iwamura, A. Ichigaya (NHK)]

[JVET-AE0114](https://jvet-experts.org/doc_end_user/current_document.php?id=13062) AHG10: Low-Delay configuration improvements [J. Enhorn, P. Wennersten (Ericsson)]

[JVET-AE0122](https://jvet-experts.org/doc_end_user/current_document.php?id=13070) AHG10: GOP-based RPR and scalable coding [K. Andersson (Ericsson)]

[JVET-AE0123](https://jvet-experts.org/doc_end_user/current_document.php?id=13071) AHG10: Lagrange multiplier optimization for chroma ALF and CCALF [S.-W. Xie, Y. Gao, M.-H. Jia, Y.-L. Hu, C. Huang, P. Wu (ZTE)]

## AHG13: Film grain synthesis (0)

This section is kept as a template for future use.

## Implementation studies (1)

Contributions in this area were discussed at XXXX–XXXX on XXday XX July 2023 (chaired by XX).

[JVET-AE0172](https://jvet-experts.org/doc_end_user/current_document.php?id=13135) Update on multilayer coding support for VVenC [S. Iwamura, S. Nemoto, A. Ichigaya (NHK)]

## Profile/tier/level specification (0)

This section is kept as a template for future use.

## Proposed modification of system interface (0)

This section is kept as a template for future use.

## General aspects of standards development and applications of standards (0)

This section is kept as a template for future use.

# Low-level tool technology proposals

## AHG11/AHG14: Neural network-based video coding (14)

### Summary, BoG reports, and information documents

Contributions in this area were discussed at XXXX–XXXX on XXday XX July 2023 (chaired by XX).

[JVET-AE0023](https://jvet-experts.org/doc_end_user/current_document.php?id=13091) EE1: Summary report of exploration experiment on neural network-based video coding [E. Alshina, F. Galpin, Y. Li, D. Rusanovskyy, M. Santamaria, J. Ström, L. Wang, Z. Xie (EE coordinators)]

[JVET-AE0042](https://jvet-experts.org/doc_end_user/current_document.php?id=12990) AhG14 & AHG11: Report on AhG teleconference on high operation point (HOP) unified filter training [E. Alshina (AhG11 co-chair)]

### EE1 contributions: Neural network-based video coding (7)

Contributions in this area were discussed at XXXX–XXXX on XXday XX July 2023 (chaired by XX).

[JVET-AE0067](https://jvet-experts.org/doc_end_user/current_document.php?id=13015) EE1-4.1: Neural-network loop filters with further complexity reduction [J. N. Shingala, A. Shyam, A. Suneja, S. Badya (Ittiam), T. Shao, A. Arora, P. Yin, F. Pu, T. Lu, Sean McCarthy (Dolby)]

[JVET-AE0183](https://jvet-experts.org/doc_end_user/current_document.php?id=13146) Crosscheck of JVET-AE0067 (EE1-4.1: Neural-network loop filters with further complexity reduction) [J. Ström (Ericsson)] [late] [miss]

[JVET-AE0112](https://jvet-experts.org/doc_end_user/current_document.php?id=13060) EE1-5.1: Deep Reference Frame Generation for Inter Prediction Enhancement [W. Bao, W. Meng, J. Jia, Y. Zhang, H. Wang, Z. Chen (Wuhan Univ.), Z. Liu, X. Xu, S. Liu (Tencent)]

[JVET-AE0229](https://jvet-experts.org/doc_end_user/current_document.php?id=13192) Crosscheck of JVET-AE0112(EE1-5.1: Deep Reference Frame Generation for Inter Prediction Enhancement) [Z. Xie (OPPO)] [late]

[JVET-AE0144](https://jvet-experts.org/doc_end_user/current_document.php?id=13107) EE1-6.1: neural network-based intra prediction with reduced complexity [T. Dumas, F. Galpin, P. Bordes (Interdigital)]

[JVET-AE0160](https://jvet-experts.org/doc_end_user/current_document.php?id=13123) EE1-1.5: Optimization for complexity-performance trade-off of HOP network [R. Chang, L. Wang, X. Xu, S. Liu (Tencent)]

[JVET-AE0164](https://jvet-experts.org/doc_end_user/current_document.php?id=13127) EE1-1.2 Complexity-performance tradeoff of decomposition [D. Rusanovskyy, Y. Li, M. Karczewicz (Qualcomm)]

[JVET-AE0165](https://jvet-experts.org/doc_end_user/current_document.php?id=13128) EE1-4.4: Low complexity NN filter with design elements of Unified Filter Architecture and EE1-1.2 and EE1-1.3 [Y. Li, D. Rusanovskyy, M. Karczewicz (Qualcomm)]

[JVET-AE0191](https://jvet-experts.org/doc_end_user/current_document.php?id=13154) AhG11 - EE1-0 High Operation Point model [F. Galpin (InterDigital), S. Eadie, D. Rusanovskyy (Qualcomm), Y. Li, J. Li (ByteDance), L. Wang, R. Chang (Tencent), Z. Xie (Oppo), E. Alshina (Huawei)] [late]

### EE1 related contributions: Neural network-based video coding (3)

Contributions in this area were discussed at XXXX–XXXX on XXday XX July 2023 (chaired by XX).

[JVET-AE0072](https://jvet-experts.org/doc_end_user/current_document.php?id=13020) [AHG11] On residual adjustments for NNLF [Z. Dai, Y. Yu, H. Yu, D. Wang (OPPO)]

[JVET-AE0232](https://jvet-experts.org/doc_end_user/current_document.php?id=13195) Crosscheck of JVET-AE0072 ([AHG11] On residual adjustments for NNLF) T. Shao (Dolby)

[JVET-AE0093](https://jvet-experts.org/doc_end_user/current_document.php?id=13041) AHG11: Content-adaptive neural network loop-filter [R. Yang, M. Santamaria, F. Cricri, H. Zhang, J. Lainema, R. G. Youvalari, M. M. Hannuksela (Nokia)]

[JVET-AE0171](https://jvet-experts.org/doc_end_user/current_document.php?id=13134) AHG11: Neural network-based in-loop filter with layer normalization [Y. Li, K. Zhang, L. Zhang (Bytedance)]

### Improvements of NNVC software beyond EE1 (4)

Contributions in this area were discussed at XXXX–XXXX on XXday XX July 2023 (chaired by XX).

[JVET-AE0119](https://jvet-experts.org/doc_end_user/current_document.php?id=13067) AHG14: The extension of SADL library [W. Bao, H. Wang, Z. Chen (Wuhan Univ.)]

[JVET-AE0161](https://jvet-experts.org/doc_end_user/current_document.php?id=13124) AHG11: Input and output rotation of model for NNVC in-loop filter [R. Chang, L. Wang, X. Xu, S. Liu (Tencent)]

[JVET-AE0162](https://jvet-experts.org/doc_end_user/current_document.php?id=13125) AHG11/AHG14: Fix MS-SSIM calculation for SR [R. Chang, L. Wang, X. Xu, S. Liu (Tencent)]

[JVET-AE0230](https://jvet-experts.org/doc_end_user/current_document.php?id=13193) Crosscheck of JVET-AE0162(AHG11/AHG14: Fix MS-SSIM calculation for SR) [Z. Xie (OPPO)] [late] [miss]

[JVET-AE0194](https://jvet-experts.org/doc_end_user/current_document.php?id=13157) AhG14: SADL update [F. Galpin, T. Dumas, P. Bordes, E. François (InterDigital)] [late]

### Other aspects of neural network-based video coding (0)

Section kept as a template for future use.

## AHG6/AHG12: Enhanced compression beyond VVC capability (74)

### Summary and BoG reports

Contributions in this area were discussed at XXXX–XXXX on XXday XX July 2023 (chaired by XX).

[JVET-AE0024](https://jvet-experts.org/doc_end_user/current_document.php?id=13092) EE2: Summary report of exploration experiment on enhanced compression beyond VVC capability [V. Seregin, J. Chen, R. Chernyak, K. Naser, J. Ström, F. Wang, M. Winken, X. Xiu, K. Zhang (EE coordinators)]

### EE2 contributions: Enhanced compression beyond VVC capability (24)

There was no presentation or discussion about specific proposals in this category.

For actions decided to be taken, see section 5.2.1, unless otherwise noted.

[JVET-AE0043](https://jvet-experts.org/doc_end_user/current_document.php?id=12991) EE2-2.7: Cross-component merge mode with temporal candidates [H.-Y. Tseng, C.-M. Tsai, C.-Y. Chuang, C.-W. Hsu, C.-Y. Chen, T.-D. Chuang, O. Chubach, Y.-W. Chen, Y.-W. Huang, S.-M. Lei (MediaTek)]

[JVET-AE0220](https://jvet-experts.org/doc_end_user/current_document.php?id=13183) Crosscheck of JVET-AE0043 (EE2-2.7: Cross-component merge mode with temporal candidates) [P. Bordes (InterDigital)] [late] [miss]

[JVET-AE0046](https://jvet-experts.org/doc_end_user/current_document.php?id=12994) EE2-3.2: Bi-predictive GPM [R. Yu, P. Wennersten, J. Enhorn, K. Andersson (Ericsson)]

[JVET-AE0199](https://jvet-experts.org/doc_end_user/current_document.php?id=13162) Crosscheck of JVET-AE0046 (EE2-3.2: Bi-predictive GPM) [Y. Ahn (LGE)] [late] [miss]

[JVET-AE0059](https://jvet-experts.org/doc_end_user/current_document.php?id=13007) EE2-3.1: Cross-component residual model (CCRM) for inter prediction [P. Astola, J. Lainema (Nokia)]

[JVET-AE0065](https://jvet-experts.org/doc_end_user/current_document.php?id=13013) EE2-3.5: Iterative BDOF pass in multi-pass DMVR [M. Salehifar, Y. He, K. Zhang, H. Liu, L. Zhang (Bytedance), J. Chen, R.-L. Liao, X. Li, Y. Ye (Alibaba)]

[JVET-AE0200](https://jvet-experts.org/doc_end_user/current_document.php?id=13163) Crosscheck of JVET-AE0065 (EE2-3.5: Iterative BDOF pass in multi-pass DMVR) [Z. Lv (vivo)] [late] [miss]

[JVET-AE0076](https://jvet-experts.org/doc_end_user/current_document.php?id=13024) EE2-2.8: An extrapolation filter-based intra prediction mode [L. Xu, Y. Yu, H. Yu, D. Wang (OPPO)]

[JVET-AE0217](https://jvet-experts.org/doc_end_user/current_document.php?id=13180) Crosscheck of JVET-AE0076 (EE2-2.8: An extrapolation filter-based intra prediction mode) [H.-J. Jhu (Kwai)] [late] [miss]

[JVET-AE0077](https://jvet-experts.org/doc_end_user/current_document.php?id=13025) EE2-2.9: Extended search areas for IntraTMP mode [Y. Yu, L. Zhang, F. Wang, J. Gan, H. Yu, L. Xu, Z. Xie, D. Wang (OPPO), Y. Ma, H. Zhang, J. Huo, F. Yang, X. Gao (Xidian University), X. Xiu, N. Yan, C. Ma, H. Jhu, C. Kuo, W. Chen (Kwai)]

[JVET-AE0210](https://jvet-experts.org/doc_end_user/current_document.php?id=13173) crosscheck of JVET-AE0077 EE2-2.9: Extended search areas for IntraTMP mode [K. Naser (InterDigital)] [late] [miss]

[JVET-AE0216](https://jvet-experts.org/doc_end_user/current_document.php?id=13179) Crosscheck of JVET-AE0077 (EE2-2.9: Extended search areas for IntraTMP mode) [P.-H Lin (Qualcomm)] [late] [miss]

[JVET-AE0078](https://jvet-experts.org/doc_end_user/current_document.php?id=13026) EE2-2.10: IBC-LIC extension [Z. Xie, Y. Yu, H. Yu, D. Wang (OPPO)]

[JVET-AE0157](https://jvet-experts.org/doc_end_user/current_document.php?id=13120) Crosscheck of JVET-AE0078(EE2-2.10: IBC-LIC extension) [W. Yin (Bytedance)] [late] [miss]

[JVET-AE0084](https://jvet-experts.org/doc_end_user/current_document.php?id=13032) EE2-2.11: Harmonization of IBC HMVP and IBC-LIC [N. Zhang, K. Zhang, L. Zhang (Bytedance), Z. Xie, Y. Yu, H. Yu, D. Wang (OPPO)]

[JVET-AE0222](https://jvet-experts.org/doc_end_user/current_document.php?id=13185) Crosscheck of JVET-AE0084 (EE2-2.11: Harmonization of IBC HMVP and IBC-LIC) [C. Ma (Kwai)] [late]

[JVET-AE0086](https://jvet-experts.org/doc_end_user/current_document.php?id=13034) EE2-4.2: Large NSPT [M. Koo, J. Zhao, J. Lim, S. Kim (LGE)]

[JVET-AE0118](https://jvet-experts.org/doc_end_user/current_document.php?id=13066) Crosscheck of JVET-AE0086 (EE2-4.2: Large NSPT) [P. Garus (Qualcomm)] [late] [miss]

[JVET-AE0087](https://jvet-experts.org/doc_end_user/current_document.php?id=13035) EE2-3.3: High-Accuracy template matching [Y. Wang, K. Zhang, L. Zhang (Bytedance)]

[JVET-AE0091](https://jvet-experts.org/doc_end_user/current_document.php?id=13039) EE2-3.8: Combination of Test 3.3e and Test 3.5 [M. Salehifar, Y. Wang, Y. He, K. Zhang, H. Liu, L. Zhang (Bytedance), J. Chen, R.-L. Liao, X. Li, Y. Ye (Alibaba)]

[JVET-AE0223](https://jvet-experts.org/doc_end_user/current_document.php?id=13186) Crosscheck of JVET-AE0091 (EE2-3.8: Combination of Test 3.3e and Test 3.5) [C. Ma (Kwai)] [late] [miss]

[JVET-AE0094](https://jvet-experts.org/doc_end_user/current_document.php?id=13042) EE2-2.6: IBC with non-adjacent spatial candidates [C. Ma, X. Xiu, W. Chen, H.-H. Jhu, C.-W. Kuo, N. Yan, X. Wang (Kwai), Y. Wang, K. Zhang, L. Zhang (Bytedance)]

[JVET-AE0100](https://jvet-experts.org/doc_end_user/current_document.php?id=13048) EE2-2.1: Block vector guided CCCM [R. G. Youvalari, D. Bugdayci Sansli, P. Astola, J. Lainema (Nokia)]

[JVET-AE0226](https://jvet-experts.org/doc_end_user/current_document.php?id=13189) Crosscheck of JVET-AE0100 (EE2-2.1: Block vector guided CCCM) [M. Abdoli (IRT b-com)] [late] [miss]

[JVET-AE0102](https://jvet-experts.org/doc_end_user/current_document.php?id=13050) EE2-4.3: Context modeling for transform coefficients for LFNST/NSPT [P. Nikitin, M. Coban, C. S. Coban, B. Ray, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-AE0225](https://jvet-experts.org/doc_end_user/current_document.php?id=13188) Crosscheck of JVET-AE0102 (EE2-4.3: Context modelling for transform coefficients for LFNST/NSPT) [M. Abdoli (IRT b-com)] [late]

[JVET-AE0116](https://jvet-experts.org/doc_end_user/current_document.php?id=13064) EE2-4.4: InterMTS for IBC and IntraTMP [P. Garus, M. Coban, B. Ray, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-AE0211](https://jvet-experts.org/doc_end_user/current_document.php?id=13174) crosscheck of JVET-AE0116 EE2-4.4: InterMTS for IBC and IntraTMP [K. Naser (InterDigital)] [late] [miss]

[JVET-AE0125](https://jvet-experts.org/doc_end_user/current_document.php?id=13079) EE2-4.1: Shifting quantization center [M. Balcilar, K. Naser, F. Galpin, F. Le Léannec (InterDigital)]

[JVET-AE0149](https://jvet-experts.org/doc_end_user/current_document.php?id=13112) Crosscheck of JVET-AE0125 (EE2-4.1 Shifting Quantizer Center) [M. Coban (Qualcomm)] [late] [miss]

[JVET-AE0132](https://jvet-experts.org/doc_end_user/current_document.php?id=13095) EE2-1.1: Partitioning prediction [G. Laroche, P. Onno (Canon)]

[JVET-AE0139](https://jvet-experts.org/doc_end_user/current_document.php?id=13102) EE2-5.2: Improved fixed filters for ALF [M. Karczewicz, N. Hu, H. Wang, V. Seregin (Qualcomm)]

[JVET-AE0193](https://jvet-experts.org/doc_end_user/current_document.php?id=13156) Crosscheck of JVET-AE0139 (EE2-5.2: Improved fixed filters for ALF) [C.-W. Kuo (Kwai)] [late] [miss]

[JVET-AE0150](https://jvet-experts.org/doc_end_user/current_document.php?id=13113) EE2-3.7 RPR with new filters for scale factor 1.25x and 1.33x [J. Samuelsson-Allendes, S. Deshpande (Sharp)]

[JVET-AE0204](https://jvet-experts.org/doc_end_user/current_document.php?id=13167) Crosscheck of JVET-AE0150 (EE2-3.7 RPR with new filters for scale factor 1.25x and 1.33x) [Z. Zhang (Qualcomm)] [late] [miss]

[JVET-AE0151](https://jvet-experts.org/doc_end_user/current_document.php?id=13114) EE2-5.1: CCSAO with extended edge classifiers and history offsets [C.-W. Kuo, X. Xiu, W. Chen, H.-J. Jhu, N. Yan, C. Ma, X. Wang (Kwai)]

[JVET-AE0209](https://jvet-experts.org/doc_end_user/current_document.php?id=13172) Crosscheck of JVET-AE0151 (EE2-5.1: CCSAO with extended edge classifiers and history offsets) [N. Hu (Qualcomm)] [late] [miss]

[JVET-AE0152](https://jvet-experts.org/doc_end_user/current_document.php?id=13115) EE2-5.3: Combination of Test 5.1b and Test 5.2c [C.-W. Kuo, X. Xiu, W. Chen, H.-J. Jhu, N. Yan, C. Ma, X. Wang (Kwai), M. Karczewicz, N. Hu, H. Wang, V. Seregin (Qualcomm)]

[JVET-AE0159](https://jvet-experts.org/doc_end_user/current_document.php?id=13122) EE2-2.5: Filtered Intra Block Copy (FIBC) [H.-J. Jhu, X. Xiu, C.-W. Kuo, W. Chen, N. Yan, C. Ma, X. Wang (Kwai), B. Ray, M. Coban, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-AE0228](https://jvet-experts.org/doc_end_user/current_document.php?id=13191) Crosscheck of JVET-AE0159 (EE2-2.5: Filtered Intra Block Copy (FIBC) [L. Zhang, Y. Yu (OPPO)] [late] [miss]

[JVET-AE0169](https://jvet-experts.org/doc_end_user/current_document.php?id=13132) EE2-2.2/EE2-2.3/EE2-2.4: Bi-predictive IBC GPM, bi-predictive IBC, and IBC MBVD list derivation for camera captured and screen contents [Y. Kidani, H. Kato, K. Kawamura (KDDI), C. Ma, X. Xiu, W. Chen, H.-J. Jhu, C.-W. Kuo, N. Yan, X. Wang (Kwai), G. Verba, Z. Zhang, P. Nikitin, H. Huang, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-AE0197](https://jvet-experts.org/doc_end_user/current_document.php?id=13160) Crosscheck of JVET-AE0169 (EE2-2.2c: Bi-predictive IBC-GPM and EE2-2.3c: Combination of 2.3b and 2.2c)) [W. Yin (Bytedance)] [late] [miss]

[JVET-AE0205](https://jvet-experts.org/doc_end_user/current_document.php?id=13168) Crosscheck of JVET-AE0169 (Test EE2-2.3c and EE2-2.4c) [R. Yu (Ericsson)] [late] [miss]

[JVET-AE0196](https://jvet-experts.org/doc_end_user/current_document.php?id=13159) EE2-3.4: OBMC with HPel flag and BCW weights [A. Robert, F. Le Léannec, F. Galpin, T. Poirier, Y. Chen (InterDigital)] [late]

### EE2 related contributions (2)

Contributions in this area were discussed at XXXX–XXXX on XXday XX July 2023 (chaired by XX).

[JVET-AE0176](https://jvet-experts.org/doc_end_user/current_document.php?id=13139) EE2-related: Enhancements on CCRM [Z. Deng, K. Zhang, L. Zhang (Bytedance)]

[JVET-AE0186](https://jvet-experts.org/doc_end_user/current_document.php?id=13149) Non-EE2-2.1: Block Vector Guided Chroma Direct Mode [K. Naser, F. Le Léannec, P. Bordes, Y. Chen, G. Rath (InterDigital)] [late]

### ECM modifications and software improvements beyond EE2 (45)

Contributions in this area were discussed at XXXX–XXXX on XXday XX July 2023 (chaired by XX).

[JVET-AE0044](https://jvet-experts.org/doc_end_user/current_document.php?id=12992) AHG12: Dynamic Scaling of Bilateral Filter (BIF) [V. Shchukin, P. Wennersten, J. Ström (Ericsson)]

[JVET-AE0190](https://jvet-experts.org/doc_end_user/current_document.php?id=13153) Crosscheck of JVET-AE0044 (AHG12: Dynamic Scaling of Bilateral Filter) [W. Yin (Bytedance)] [late] [miss]

[JVET-AE0047](https://jvet-experts.org/doc_end_user/current_document.php?id=12995) AHG12: On GPM-MMVD [R. Yu (Ericsson)]

[JVET-AE0218](https://jvet-experts.org/doc_end_user/current_document.php?id=13181) Crosscheck of JVET-AE0047 (AHG12: On GPM-MMVD) [Z. Deng (Bytedance)] [late] [miss]

[JVET-AE0055](https://jvet-experts.org/doc_end_user/current_document.php?id=13003) AHG12: Sign prediction parameter configuration for low-delay conditions [Y. Yasugi, T. Ikai (Sharp)]

[JVET-AE0056](https://jvet-experts.org/doc_end_user/current_document.php?id=13004) Non-EE2: Changes on TIMD and SGPM for reducing ECM decoder complexity [Z. Fan, Y. Yasugi, T. Ikai (Sharp)]

[JVET-AE0201](https://jvet-experts.org/doc_end_user/current_document.php?id=13164) Crosscheck of JVET-AE0056 (Non-EE2: Changes on TIMD and SGPM for reducing ECM decoder complexity) [F. Wang (OPPO)] [late] [miss]

[JVET-AE0058](https://jvet-experts.org/doc_end_user/current_document.php?id=13006) AHG12: Spatial CABAC tuning [J. Lainema, A. Aminlou, P. Astola, R. G. Youvalari, D. Bugdayci Sansli (Nokia)]

[JVET-AE0071](https://jvet-experts.org/doc_end_user/current_document.php?id=13019) AHG12: DIMD Merge [S. Blasi, I. Zupancic, J. Lainema (Nokia)]

[JVET-AE0073](https://jvet-experts.org/doc_end_user/current_document.php?id=13021) Non-EE2: IBC-LIC Model Merge mode [L. Zhang, Y. Yu, H. Yu, D. Wang (OPPO)]

[JVET-AE0074](https://jvet-experts.org/doc_end_user/current_document.php?id=13022) Non-EE2: Improvement on cross-component prediction merge mode [H. Huang, Y. Yu, H. Yu, D. Wang (OPPO)]

[JVET-AE0075](https://jvet-experts.org/doc_end_user/current_document.php?id=13023) Non-EE2: On IntraTMP block vector [Y. Yu, L. Zhang, L. Xu, H. Yu, J. Gan, F. Wang, Z. Xie, D. Wang (OPPO)]

[JVET-AE0202](https://jvet-experts.org/doc_end_user/current_document.php?id=13165) Crosscheck of JVET-AE0075 (Non-EE2: On IntraTMP block vector) [W. Lim, S.-C. Lim (ETRI)] [late] [miss]

[JVET-AE0082](https://jvet-experts.org/doc_end_user/current_document.php?id=13030) AHG12: Non-square quadtree partitioning [Y. Ahn, J. Nam, N. Park, J. Lim, S. Kim (LGE)]

[JVET-AE0206](https://jvet-experts.org/doc_end_user/current_document.php?id=13169) Crosscheck of JVET-AE0082 (AHG12: Non-square quadtree partitioning) [R. Yu (Ericsson)] [late] [miss]

[JVET-AE0085](https://jvet-experts.org/doc_end_user/current_document.php?id=13033) Non-EE2: Direct block vector (DBV) mode extension [M. Hong, J. Choi, N. Park, J. Lim, S. Kim (LGE)]

[JVET-AE0097](https://jvet-experts.org/doc_end_user/current_document.php?id=13045) AHG12: On the cross-component merge mode [H. Huang, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-AE0188](https://jvet-experts.org/doc_end_user/current_document.php?id=13151) Crosscheck of JVET-AE0097 (AHG12: On the cross-component merge mode) [K. Zhang (Bytedance)] [late] [miss]

[JVET-AE0098](https://jvet-experts.org/doc_end_user/current_document.php?id=13046) AHG12: On the chroma DBV mode [H. Huang, H. Wang, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-AE0203](https://jvet-experts.org/doc_end_user/current_document.php?id=13166) Crosscheck of JVET-AE0098 (AHG12: On the chroma DBV mode) [L. Xu, Y. Yu (OPPO)] [late] [miss]

[JVET-AE0103](https://jvet-experts.org/doc_end_user/current_document.php?id=13051) Weighted Edge Enhancement Filtering for Picture Upscaling and RPR [T. Claßen, M. Wien (RWTH Aachen University)]

[JVET-AE0105](https://jvet-experts.org/doc_end_user/current_document.php?id=13053) Non-EE2: Local illumination compensation with multiple templates [Y. Wang, K. Zhang, Y. He, H. Liu, L. Zhang (Bytedance)]

[JVET-AE0224](https://jvet-experts.org/doc_end_user/current_document.php?id=13187) Crosscheck of JVET-AE0105 (Non-EE2: Local illumination compensation with multiple templates) [C. Ma (Kwai)] [late] [miss]

[JVET-AE0108](https://jvet-experts.org/doc_end_user/current_document.php?id=13056) AHG12: DMVR with robust MV derivation [K. Andersson, R. Yu (Ericsson)]

[JVET-AE0109](https://jvet-experts.org/doc_end_user/current_document.php?id=13057) Non-EE2: LIC flag derivation of merge candidates with template costs [N. Zhang, K. Zhang, H. Liu, Y. Wang, L. Zhang (Bytedance)]

[JVET-AE0110](https://jvet-experts.org/doc_end_user/current_document.php?id=13058) Non-EE2: An improved method for IntraTMP fusion [S. Peng, D. Jiang, J. Lin, C. Zheng, K. Fu, P. Zhang (Dahua)]

[JVET-AE0115](https://jvet-experts.org/doc_end_user/current_document.php?id=13063) Non-EE2: Unified intra CC-models parameters precision P. Bordes, K. Naser, F. Galpin, F. Le Léannec (InterDigital)]

[JVET-AE0117](https://jvet-experts.org/doc_end_user/current_document.php?id=13065) Non-EE2: Enhanced subblock-based motion compensation [L. Zhao, K. Zhang, L. Zhang (Bytedance)]

[JVET-AE0120](https://jvet-experts.org/doc_end_user/current_document.php?id=13068) Non-EE2: Intra Angular Prediction Extension [J. Fu, J. Zhang, C. Jia, S. Ma (PKU)] [late]

[JVET-AE0121](https://jvet-experts.org/doc_end_user/current_document.php?id=13069) Non-EE2: Luma Residual Taps in Chroma-ALF and CCALF [W. Yin, K. Zhang, Z. Deng, L. Zhang (Bytedance)]

[JVET-AE0231](https://jvet-experts.org/doc_end_user/current_document.php?id=13194) Crosscheck of JVET-AE0121 (Non-EE2: Luma Residual Taps in Chroma-ALF and CCALF) [Z. Xie (OPPO)] [late] [miss]

[JVET-AE0124](https://jvet-experts.org/doc_end_user/current_document.php?id=13072) Non-EE2: Fixes related to Intra TMP [J.-L Lin, P.-H Lin, Y.-J Chang, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-AE0129](https://jvet-experts.org/doc_end_user/current_document.php?id=13088) AHG12 Template-based CIIP weight derivation [M.-H. Jia, Y.-L. Hu, S.-W. Xie, Y. Gao, C. Huang (ZTE)]

[JVET-AE0130](https://jvet-experts.org/doc_end_user/current_document.php?id=13093) Non-EE2: DIMD with filtered template [C. Zhou, Z. Lv (vivo)]

[JVET-AE0131](https://jvet-experts.org/doc_end_user/current_document.php?id=13094) Non-EE2: Variance based classification for in-loop filtering [W. Yin, K. Zhang, L. Zhang (Bytedance)]

[JVET-AE0207](https://jvet-experts.org/doc_end_user/current_document.php?id=13170) Crosscheck of JVET-AE0131 (Non-EE2: Variance based Classification for In-loop Filtering) [V. Shchukin (Ericsson)] [late] [miss]

[JVET-AE0136](https://jvet-experts.org/doc_end_user/current_document.php?id=13099) Non-EE2: Fix on TM-based reordering for affine MMVD mode [D. Kim, W. Lim, J. Kim, S.-C. Lim, J. S. Choi (ETRI)]

[JVET-AE0213](https://jvet-experts.org/doc_end_user/current_document.php?id=13176) Crosscheck of JVET-AE0136 (Non-EE2: Fix on TM-based reordering for affine MMVD mode) [M. Salehifar (Bytedance)] [late] [miss]

[JVET-AE0137](https://jvet-experts.org/doc_end_user/current_document.php?id=13100) Non-EE2: On TIMD fusion [P. Andrivon, M. Blestel (Ofinno)]

[JVET-AE0138](https://jvet-experts.org/doc_end_user/current_document.php?id=13101) Non-EE2: Reference sample interpolation for intra prediction [G. Rath, F. Le Leannec, F. Urban, F. Racape, T. Dumas (InterDigital)]

[JVET-AE0208](https://jvet-experts.org/doc_end_user/current_document.php?id=13171) Crosscheck of JVET-AE0138 (Non-EE2: Reference sample interpolation for intra prediction) [P. Nikitin (Qualcomm)] [late] [miss]

[JVET-AE0140](https://jvet-experts.org/doc_end_user/current_document.php?id=13103) Non-EE2: LIC extensions [A. Filippov, V. Rufitskiy, K. Suverov (Ofinno)] [late] [miss]

[JVET-AE0145](https://jvet-experts.org/doc_end_user/current_document.php?id=13108) AHG 12: Flexible GDR [L. Wang, S. Hong, K. Panusopone (Nokia)]

[JVET-AE0146](https://jvet-experts.org/doc_end_user/current_document.php?id=13109) AHG 12: Fixes H-CCP Table for CUs in Refreshed Areas of GDR/Recovering Pictures [S. Hong, L. Wang, K. Panusopone (Nokia)]

[JVET-AE0147](https://jvet-experts.org/doc_end_user/current_document.php?id=13110) AHG12: Updating context model parameters for ECM [R.-L. Liao, Y. Ye, J. Chen, X. Li (Alibaba)]

[JVET-AE0148](https://jvet-experts.org/doc_end_user/current_document.php?id=13111) Non-EE2: Affine subblock BDOF refinement [Z. Zhang, H. Huang, J.-L Lin, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-AE0153](https://jvet-experts.org/doc_end_user/current_document.php?id=13116) Non-EE2: Enabling template-based inter tools for scaled reference pictures in the RPR [X. Xiu, H.-J. Jhu, C.-W. Kuo, C. Ma, N. Yan, W. Chen, X. Wang (Kwai)]

[JVET-AE0158](https://jvet-experts.org/doc_end_user/current_document.php?id=13121) AHG12: LUT-based angle calculation for DIMD [A. Aminlou, J. Lainema (Nokia)]

[JVET-AE0166](https://jvet-experts.org/doc_end_user/current_document.php?id=13129) AHG12: IntraTMP and IBC search area harmonization [D. Ruiz Coll, B. Chen, P. Andrivon, M. Blestel (Ofinno)]

[JVET-AE0167](https://jvet-experts.org/doc_end_user/current_document.php?id=13130) AHG12: DBV improvement [L. Xu, Y. Yu, H. Yu, D. Wang (OPPO)]

[JVET-AE0168](https://jvet-experts.org/doc_end_user/current_document.php?id=13131) Non-EE2: Sample-based BDOF for Chroma [C.-C. Chen, H. Huang, Z. Zhang, C. S. Coban, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-AE0170](https://jvet-experts.org/doc_end_user/current_document.php?id=13133) Non-EE2: Enhancements on CCP merge [K. Zhang, Z. Deng, L. Zhang (Bytedance)]

[JVET-AE0177](https://jvet-experts.org/doc_end_user/current_document.php?id=13140) Non-EE2: Local illumination compensation with slope adjustment [Y. Wang, K. Zhang, Y. He, H. Liu, L. Zhang (Bytedance)]

[JVET-AE0178](https://jvet-experts.org/doc_end_user/current_document.php?id=13141) Non-EE2: Cross-component prediction merge mode for chroma inter coding [M.-S. Chiang, H.-Y. Tseng, C.-M. Tsai, C.-Y. Chuang, C.-W. Hsu, C.-Y. Chen, T.-D. Chuang, O. Chubach, Y.-W. Chen, Y.-W. Huang, S.-M. Lei (MediaTek)]

[JVET-AE0184](https://jvet-experts.org/doc_end_user/current_document.php?id=13147) AHG12: TIMD with IntraTMP and IBC candidates [K. Naser, F. Le Léannec, P. Bordes, F. Galpin, A. Robert (InterDigital)] [late]

[JVET-AE0185](https://jvet-experts.org/doc_end_user/current_document.php?id=13148) AHG12: IntraTMP with neighboring candidates [K. Naser, F. Le Léannec, A. Robert, F. Galpin (InterDigital)] [late]

[JVET-AE0198](https://jvet-experts.org/doc_end_user/current_document.php?id=13161) AHG12: Extended Search Region for IntraTMP [K. Naser, P. Bordes, F. Le Léannec, F. Galpin (InterDigital)] [late]

[JVET-AE0214](https://jvet-experts.org/doc_end_user/current_document.php?id=13177) AHG12: on Intra CIIP [K. Naser, P. Bordes, F. Galpin, K. Reuzé (InterDigital)] [late] [miss]

### CTC for EE2/ECM (3)

Contributions in this area were discussed at XXXX–XXXX on XXday XX July 2023 (chaired by XX).

[JVET-AE0133](https://jvet-experts.org/doc_end_user/current_document.php?id=13096) AhG12: On EE2 Common test conditions change based on EE2 Test 1.1 [G. Laroche, P. Onno (Canon)]

v1 of document does not come with any results – placeholder status?

[JVET-AE0163](https://jvet-experts.org/doc_end_user/current_document.php?id=13126) AHG12: modified CTC proposal for low-delay configuration [S. Puri, C. Bonnineau, F. Le Léannec, T. Poirier, E. François (InterDigital)]

[JVET-AE0180](https://jvet-experts.org/doc_end_user/current_document.php?id=13143) On ECM SW memory consumption [R. Chernyak, S. Liu (Tencent), Y. Yasugi, T. Ikai (Sharp)]

[JVET-AE0192](https://jvet-experts.org/doc_end_user/current_document.php?id=13155) Crosscheck JVET-AE0180 (On ECM SW memory consumption) [C.-W. Kuo, X. Xiu (Kwai)] [late] [miss]

# High-level syntax (HLS) and related proposals (39)

## AHG9: SEI messages on neural-network post filter (27)

Contributions in this area were discussed at XXXX–XXXX on XXday XX July 2023 (chaired by XX).

[JVET-AE018](https://www.jvet-experts.org/doc_end_user/current_document.php?id=13150)7 AHG9: A summary of SEI proposals on NNPF [Y.-K. Wang (Bytedance)] [late]

[JVET-AE0048](https://jvet-experts.org/doc_end_user/current_document.php?id=12996) AHG9: Miscellaneous VSEI changes on neural-network post-filter SEI messages [M. M. Hannuksela, F. Cricri, M. Santamaria (Nokia)]

[JVET-AE0049](https://jvet-experts.org/doc_end_user/current_document.php?id=12997) AHG9: Miscellaneous VVC changes on neural-network post-filter SEI messages [M. M. Hannuksela, F. Cricri, M. Santamaria (Nokia)]

[JVET-AE0050](https://jvet-experts.org/doc_end_user/current_document.php?id=12998) AHG9: On NNPF input picture selection [M. M. Hannuksela, F. Cricri (Nokia)]

[JVET-AE0051](https://jvet-experts.org/doc_end_user/current_document.php?id=12999) AHG9: On persistent NNPF activation [M. M. Hannuksela, F. Cricri (Nokia)]

[JVET-AE0052](https://jvet-experts.org/doc_end_user/current_document.php?id=13000) AHG9: NNPF cascades and alternatives [M. M. Hannuksela, F. Cricri (Nokia)] [late]

[JVET-AE0053](https://jvet-experts.org/doc_end_user/current_document.php?id=13001) AHG8/AHG9: Neural-network post-filter regions SEI message [T. Chujoh, Y. Yasugi, T. Ikai (Sharp)]

[JVET-AE0060](https://jvet-experts.org/doc_end_user/current_document.php?id=13008) [AHG9] Comments on NNPFC [S. Deshpande (Sharp)]

[JVET-AE0061](https://jvet-experts.org/doc_end_user/current_document.php?id=13009) [AHG9] On NNPFC Application Purpose [S. Deshpande (Sharp)]

[JVET-AE0062](https://jvet-experts.org/doc_end_user/current_document.php?id=13010) [AHG9] On NNPF for Deinterlacing [A. Sidiya, S. Deshpande (Sharp)]

[JVET-AE0063](https://jvet-experts.org/doc_end_user/current_document.php?id=13011) [AHG9] On operations for multiple NNPFs [L. Chen, O. Chubach, Y.-W. Huang, S. Lei (MediaTek)]

[JVET-AE0068](https://jvet-experts.org/doc_end_user/current_document.php?id=13016) AHG9: On extensibility of purpose syntax element in NNPFC SEI message [Hendry, J. Nam, S. Kim, J. Lim (LGE)]

[JVET-AE0069](https://jvet-experts.org/doc_end_user/current_document.php?id=13017) AHG9: On the signalling of output pictures in NNPFA SEI message [Hendry, J. Nam, S. Kim, J. Lim (LGE)]

[JVET-AE0070](https://jvet-experts.org/doc_end_user/current_document.php?id=13018) AHG9: On input pictures that are not present in the bitstream for NNPF SEI messages [Hendry, J. Nam, S. Kim, J. Lim (LGE)]

[JVET-AE0101](https://jvet-experts.org/doc_end_user/current_document.php?id=13049) [AHG2][AHG9] Neural network post filter and phase indication SEI messages for AVC and HEVC [T. Ikai, T. Chujoh (Sharp), Y.-K. Wang, J. Xu, W. Jia (Bytedance)]

[JVET-AE0106](https://jvet-experts.org/doc_end_user/current_document.php?id=13054) AHG9: On missing value ranges for some syntax elements in the NNPFC SEI message [C. Lin, Y.-K. Wang, J. Xu, W. Jia, J. Li, Y. Li, K. Zhang, L. Zhang (Bytedance)] [late]

[JVET-AE0113](https://jvet-experts.org/doc_end_user/current_document.php?id=13061) AHG9: Extendibility and code word length of nnpfc\_purpose [R. Sjöberg, M. Pettersson (Ericsson)]

[JVET-AE0126](https://jvet-experts.org/doc_end_user/current_document.php?id=13081) AHG9: NNPF cleanup and editorial changes for VSEI [Y.-K. Wang, W. Jia, J. Xu, C. Lin (Bytedance)]

[JVET-AE0127](https://jvet-experts.org/doc_end_user/current_document.php?id=13083) AHG9: NNPF editorial changes for VVC [Y.-K. Wang, W. Jia, J. Xu (Bytedance)]

[JVET-AE0128](https://jvet-experts.org/doc_end_user/current_document.php?id=13084) AHG9: On NNPFC extensibility and base filter signalling [Y.-K. Wang (Bytedance)]

[JVET-AE0134](https://jvet-experts.org/doc_end_user/current_document.php?id=13097) AHG9: Align the design of NNPF with multiple input pictures to NNPF including picture rate upsampling [J. Xu, Y.-K. Wang (Bytedance)]

[JVET-AE0135](https://jvet-experts.org/doc_end_user/current_document.php?id=13098) AHG9: On NNPF picture rate upsampling constraints [J. Xu, Y.-K. Wang (Bytedance)]

[JVET-AE0141](https://jvet-experts.org/doc_end_user/current_document.php?id=13104) AHG9: Fix a bug in NNPFC SEI message for colourization [J. Xu, Y.-K. Wang (Bytedance)]

[JVET-AE0142](https://jvet-experts.org/doc_end_user/current_document.php?id=13105) AHG9: On derivation of NNPF input pictures and the value of nnpfc\_purpose [W. Jia, Y.-K. Wang, J. Xu, L. Zhang (Bytedance)]

[JVET-AE0173](https://jvet-experts.org/doc_end_user/current_document.php?id=13136) [AHG9] Clarification and improvements of signaling of NNPF update [Y. Lim (Samsung)]

[JVET-AE0175](https://jvet-experts.org/doc_end_user/current_document.php?id=13138) [AHG9] Editorial improvements of nnpfc\_mode\_idc [Y. Lim (Samsung)]

[JVET-AE0189](https://jvet-experts.org/doc_end_user/current_document.php?id=13152) AHG9: On the design of nnpfa\_target\_base\_flag in NNPFA SEI message [Hendry (LGE)] [late]

## AHG9: SEI messages on topics other than NNPF (12)

Contributions in this area were discussed at XXXX–XXXX on XXday XX July 2023 (chaired by XX).

[JVET-AE0054](https://jvet-experts.org/doc_end_user/current_document.php?id=13002) AHG2/AHG9: Editorial improvements of annotated regions SEI message [T. Chujoh, T. Aono, T. Ikai (Sharp)]

[JVET-AE0064](https://jvet-experts.org/doc_end_user/current_document.php?id=13012) AHG8/AHG9: Signalling encoder preprocessing and human / machine viewing indications [C. Kim, D. Gwak, Hendry, J. Lim, S. Kim (LGE), M. M. Hannuksela, F. Cricri, H. Zhang (Nokia)]

[JVET-AE0066](https://jvet-experts.org/doc_end_user/current_document.php?id=13014) AHG9: Multiplane Image Information SEI [T. Lu, P. Yin, G. Su, D. Lee, T. Huang, S. McCarthy, W. Husak, G. J. Sullivan (Dolby)]

[JVET-AE0079](https://jvet-experts.org/doc_end_user/current_document.php?id=13027) AHG8/AHG9: Source picture timing information SEI message [S. McCarthy, G. J. Sullivan, P. Yin (Dolby)]

[JVET-AE0080](https://jvet-experts.org/doc_end_user/current_document.php?id=13028) AHG9: Generative Face Video SEI message [S. McCarthy, P. Yin, G.-M. Su, A. K. Choudhury, W. Husak (Dolby)]

[JVET-AE0083](https://jvet-experts.org/doc_end_user/current_document.php?id=13031) AHG9: Common SEI Message of Generative Face Video [B. Chen, J. Chen, Y. Ye (Alibaba), S. Wang (CityU)]

[JVET-AE0088](https://jvet-experts.org/doc_end_user/current_document.php?id=13036) AHG9: A study on Generative Face Video SEI Message [H.-B. Teo, J.-Y Thong, K. Jayashree, C.-S. Lim, K. Abe (Panasonic)]

[JVET-AE0089](https://jvet-experts.org/doc_end_user/current_document.php?id=13037) AHG9: Alternative Output Timing Hint SEI [H.-B. Teo, J. Gao, C.-S. Lim, K. Abe (Panasonic)]

[JVET-AE0090](https://jvet-experts.org/doc_end_user/current_document.php?id=13038) AHG8/AHG9: On machine vision indication [J. Gao, H.-B. Teo, C.-S. Lim, K. Abe (Panasonic)]

[JVET-AE0095](https://jvet-experts.org/doc_end_user/current_document.php?id=13043) AHG8/AHG9: proposed changes to the candidate new object mask information SEI message [P. de Lagrange, E. François, D. Doyen (InterDigital), J. Chen, S. Wang, Y. Ye (Alibaba)] [late]

[JVET-AE0156](https://jvet-experts.org/doc_end_user/current_document.php?id=13119) AHG9: Message wrapping and importance indication for the SEI processing order SEI message [G. J. Sullivan, S. McCarthy, P. Yin (Dolby Labs)]

[JVET-AE0182](https://jvet-experts.org/doc_end_user/current_document.php?id=13145) AHG9: SEI message extension of VVC for object-wave compression and computer-generated hologram use [K. Nonaka, R. Koiso, H. Kojima, K. Kawamura, H. Kato (KDDI)]

## Non-SEI HLS aspects (0)

Section kept as a template for future use.

# Plenary meetings, joint meetings, BoG reports, and liaison communications

## JVET plenaries

No intermediate plenaries were held, as document review and decisions were made in single-track mode at this meeting (with some BoG activity as noted). Further detail on scheduling is recorded in section 2.15.

Communication and coordination items were discussed on XXday July XX at XXXX.

* Initial joint meetings planned were as follows:
  + …
* Session planning (participants were encouraged to see the posted online calendar)
* Output document / deliverables planning
* Liaison …

General plenary wrap-up discussions are recorded under sections 8, 9, and 10.

## Information sharing meetings

Information sharing sessions with other WGs and AGs of the MPEG community were held on Monday 17 July 0900–1130, Wednesday 19 July 0900–1030, and Friday 21 July 1400–1600. The status and plans for the work in the MPEG WGs and AGs was reviewed at these information sharing sessions.

## Joint meetings with MPEG … on …

This joint session was held on XXday XX July at XXXX-XXXX.

…

## BoGs (3)

The following break-out groups were established at this meeting to conduct discussion and develop recommendations on particular subjects.

## Liaison communications (1)

…

A reply was drafted by JVET as …. The draft reply was presented in the AG 3 meeting Thursday XX:XX (XXXX) and was reviewed in JVET on XXday XX July XXXX (, kept for future use).

# Project planning

## Software timeline (update)

ECM 10 software (including all adoptions) was planned to be available 3 weeks after the meeting.

The NNVC 6.0 codebase software (integrating “low” operation point loop filter) was planned to be available 2 weeks after the meeting. An update 5.1 (also including verified “high” operation point) was planned to be available after training verification.

VTM21.0 software was planned to be available on 2023-05-30. (Note that further updates may be released later)

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

## Core experiment and exploration experiment planning

An EE on neural network-based video coding was established, as recorded in output document JVET-AE2023.

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-AE2024.

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:

* No review of normative contributions without draft specification text
* VTM algorithm description text is strongly encouraged for non-normative contributions
* Early upload deadline to enable substantial study prior to the meeting
* Using a clock timer to ensure efficient proposal presentations (5 min) and discussions

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.
* 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>

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>

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 is 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 XXday XX July 2023 at XXXX.

|  |  |  |
| --- | --- | --- |
| **Title and Email Reflector** | **Chairs** | **Mtg** |
| **Project Management (AHG1)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Coordinate overall JVET interim efforts. * Supervise AHG and experiment studies. * Report on project status to JVET reflector. * Provide a report to the next meeting on project coordination status. * Supervise processing and delivery of output documents | J.-R. Ohm (chair), G. J. Sullivan (vice‑chair) | N |
| **Draft text and test model algorithm description editing (AHG2)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Produce and finalize draft text outputs of the meeting (JVET-AD1003, JVET-AD1008, JVET-AD2002, JVET-AD2005, JVET-AD2006, and JVET-AD2027. * Collect reports of errata for the VVC, VSEI, HEVC, AVC, CICP, and the published related technical reports and produce the JVET-AD1004 errata output collection. * Coordinate with the test model software development AhG to address issues relating to mismatches between software and text. * Collect and consider errata reports on the texts. | 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) | N |
| **Test model software development (AHG3)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * 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. * Produce documentation of software usage for distribution with the software. * Enable software support for recently standardized additional SEI messages. * Discuss and make recommendations on the software development process. * Perform comparative tests of test model behaviour using common test conditions, including HDR, high bit depth and high bit rate. * Suggest configuration files for additional testing of tools. * Investigate how to minimize the number of separate codebases maintained for group reference software. * 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. * Prepare drafts of merged and updated CTC documents for HM and VTM, as applicable. | F. Bossen, X. Li, K. Sühring (co-chairs), E. François, Y. He, K. Sharman, V. Seregin, A. Tourapis (vice‑chairs) | N |
| **Test material and visual assessment (AHG4)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * 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. * Maintain the video sequence test material database for testing the VVC and HEVC standards and potential future extensions, as well as exploration activities. * Study coding performance and characteristics of available and proposed video test material. * Identify and recommend appropriate test material for testing the VVC standard and potential future extensions, as well as exploration activities. * 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. * Maintain and update the directory structure for the test sequence repository, as necessary. * Collect information about test sequences that have been made available by other organizations. * Prepare and conduct expert viewing for purposes of subjective quality evaluation. * Coordinate with AG 5 in studying and developing further methods of subjective quality evaluation, e.g. based on crowd sourcing. * Prepare availability of viewing equipment and facilities arrangements for future meetings. | V. Baroncini, T. Suzuki, M. Wien (co-chairs), S. Iwamura, S. Liu, S. Puri, A. Segall, P. Topiwala, S. Wenger, J. Xu, Y. Ye (vice-chairs) | Y (tel., 2 weeks notice) |
| **Conformance testing (AHG5)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Produce and finalize the draft of additional conformance bitstreams for VVC multilayer configurations JVET-AD2028, and investigate the need for future improvements of conformance testing specifications. * Study the requirements of VVC, HEVC, and AVC conformance testing to ensure interoperability. * Maintain and update the conformance bitstream database, and contribute to report problems, and suggest actions to resolve these. * Study additional testing methodologies to fulfil the needs for VVC conformance testing. | D. Rusanovskyy, I. Moccagatta (co-chairs), F. Bossen, K. Kawamura, T. Ikai, S. Iwamura, H.-J. Jhu, K. Sühring, Y. Yu (vice‑chairs) | N |
| **ECM software development (AHG6)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Coordinate development of the ECM software and associated configuration files. * Produce documentation of software usage for distribution with the software. * Prepare and deliver ECM-9.0 software version and the reference configuration encodings according to the ECM common test conditions. * Investigate encoder speedup and other encoder software optimization. * Coordinate with ECM algorithm description editors to identify any mismatches between software and text, make further updates and cleanups to the software as appropriate. | V. Seregin (chair), J. Chen, F. Le Léannec, K. Zhang (vice-chairs) | Y (tel., 2 weeks notice) |
| **ECM tool assessment (AHG7)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Investigate methodology of tool assessment. * Coordinate with AHG6 on resolving tool-off test related software issues (missing tool controls and software bugs). * Prepare configuration files and generate bitstreams and results of tool-on/tool-off testing. * Prepare reporting of tool assessment results. * Collect simulation results on non-CTC sequences, and report any issues identified with non-CTC sequences * Develop methodology of more reliable runtime measurement | X. Li (chair), L.-F. Chen, Z. Deng, J. Gan, E. François, H.-J. Jhu, X. Li, H. Wang (vice‑chairs) | Y (tel., 2 weeks notice) |
| **Optimization of encoders and receiving systems for machine analysis of coded video content (AHG8)**  ([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-AD2031. * Discuss improvements on the evaluation framework, including evaluation procedures and methodologies. * Coordinate software development, and investigate the possibility of migrating the software basis 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 draft technical report JVET-AD2030 on optimization of encoders and receiving systems for machine analysis of coded video content. * Coordinate with WG 4 VCM AHG on common interests and activities such as common test conditions, test and training materials, and on studying characteristics and requirements of targeted machine analysis tasks, etc. | C. Hollmann, S. Liu, S. Wang, M. Zhou (AHG chairs) | Y (tel., 2 weeks notice) |
| **SEI message studies (AHG9)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Study the SEI messages in VSEI, VVC, HEVC and AVC. * Collect software and showcase information for SEI messages, including encoder and decoder implementations and bitstreams for demonstration and testing. * 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. * Study the alignments of the same SEI messages in different standards * Coordinate with AHG8 and WG 4 to study mechanisms for signalling metadata in the context of machine analysis of coded video content. * Coordinate with AHG3 for software support of SEI messages. | S. McCarthy, Y.-K. Wang (co-chairs), T. Chujoh, S. Deshpande, C. Fogg, Hendry, P. de Lagrange, G. J. Sullivan, A. Tourapis, S. Wenger (vice-chairs) | N |
| **Encoding algorithm optimization (AHG10)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Study the impact of using techniques such as tool adaptation and configuration, and perceptually optimized adaptive quantization for encoder optimization. * Study the impact of non-normative techniques of preprocessing for the benefit of encoder optimization. * Study encoding techniques of optimization for objective quality metrics and their relationship to subjective quality. * Study optimized encoding for reference picture resampling and scalability modes in VTM. * Study optimized encoding and tool combinations for low latency and low complexity. * Consider neural network-based encoding optimization technologies for video coding standards. * Investigate other methods of improving objective and/or subjective quality, including adaptive coding structures and multi-pass encoding. * Study methods of rate control and rate-distortion optimization and their impact on performance, subjective and objective quality. * 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. * Study the effect of varying configuration parameters depending on temporal layer, such as those related to deblocking, partitioning, chroma QP. | P. de Lagrange, A. Duenas, R. Sjöberg, A. Tourapis (AHG chairs) | N |
| **Neural network-based video coding (AHG11)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * 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 and novel architectures. * Discuss potential refinements of the test conditions for NN-based video coding in JVET-AD2016. Generate and distribute anchor encoding, and develop supporting software as needed. * 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. * Analyse complexity characteristics, perform complexity analysis, and develop complexity reductions of candidate technology. * Finalize and discuss the EE on neural network-based video coding. * Coordinate with other relevant groups, including SC29/AG5 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. * Coordinate with AHG14 on items related to NNVC software development. | E. Alshina, S. Liu, A. Segall (co‑chairs), F. Galpin, J. Li, R.-L. Liao, D. Rusanovskyy, T. Shao, M. Wien, P. Wu (vice‑chairs) | Y (tel., 2 weeks notice) |
| **Enhanced compression beyond VVC capability (AHG12)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Solicit and study non-neural-network video coding tools with enhanced compression capabilities beyond VVC. * Discuss and propose refinements to the ECM9 algorithm description JVET-AD2025. * Coordinate with AHG7 to study the performance and complexity tradeoff of these video coding tools. * Coordinate with AHG6 on ECM software development. * Support AHG6 in generating anchors according to the test conditions in JVET-AD2017. * Analyse the results of exploration experiments described in JVET-AD2024 in coordination with the EE coordinators. * Coordinate with AHG11 to study the interaction with neural network-based coding tools. | M. Karczewicz, Y. Ye, L. Zhang (co-chairs), B. Bross, R. Chernyak, X. Li, K. Naser, H. Yang (vice-chairs) | Y (tel., 2 weeks notice) |
| **Film grain technologies (AHG13)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Study the benefits and characteristics of film grain technologies, including autoregressive and frequency-filtering technologies. * Study alternative film grain models and their associated documentation. * In consultation with AHG4, study and define content characteristics and test conditions that are desirable for the study and testing of film grain technologies. * 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. * Study preprocessing and encoder technologies for determining values for FGC (Film Grain Characteristics) SEI message syntax elements. * Identify potential need for additional film grain technology and signalling, if needed. * Coordinate development of film grain technology software and configuration files. * Coordinate with AG 5 on finalizing the draft plan for subjective quality testing of the FGC SEI message JVET-AD2022, and conduct preparations for such testing. * Coordinate with AHG3 for software support of the FGC SEI message. | W. Husak, M. Radosavljević (co-chairs), A. Duenas, D. Grois, Y. He, P. de Lagrange, X. Meng, A. Segall, A. Tourapis, W. Zhang (vice-chairs) | Y (tel., 2 weeks notice) |
| **NNVC software development (AHG14)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Coordinate development of the NNVC software and associated configuration files. * Prepare and deliver NNVC-5.0 software version and the reference configuration encodings according to the NNVC common test conditions as described in JVET-AD2016. * Investigate combinations of tools included in the NNVC software, prepare and release anchor data for all configurations of the software, including anchor for High Operation Point configuration. * Study and maintain the SADL (Small Adhoc Deep-Learning Library). Identify gaps in functionality and develop improvements as needed. * Coordinate with NNVC algorithm and software description (JVET-AD2019) editors to identify any mismatches between software and description document, suggest further updates to the description document as appropriate. * Develop the software basis for High Operation Point in NNVC-5.1 as described in JVET-AD0380. * Coordinate with AHG11 on items related to NNVC activities. | S. Eadie, F. Galpin, Y. Li, J. Shingala, L. Wang, Z. Xie (AHG chairs) | Y (tel., 2 weeks notice) |

It was confirmed that the rules which can be found in document ISO/IEC JTC 1/‌SC 29/‌AG 2 [N 046](https://www.mpegstandards.org/wp-content/uploads/2022/01/ISO-IECJTC1-SC29-AG2_N0046_AhG.pdf) “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 XXX) 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 JVET ad hoc groups was also issued as a WG 5 output document WG 5 N 212, as noted in section 9.

[JVET-AE1000](https://jvet-experts.org/doc_end_user/current_document.php?id=12968) Meeting Report of the 31st JVET Meeting [J.-R. Ohm] [WG 5 N XXX] (2023-08-XX)

Initial versions of the meeting notes (d0 … d9) were made available on a daily basis during the meeting.

Remains valid – not updated: [JVET-AC1001](https://jvet-experts.org/doc_end_user/current_document.php?id=12566) Guidelines for HM-based software development [K. Sühring, F. Bossen, X. Li (software coordinators)]

Remains valid – not updated: [JVET-Y1002](https://jvet-experts.org/doc_end_user/current_document.php?id=11463) High Efficiency Video Coding (HEVC) Test Model 16 (HM 16) Encoder Description Update 16 [C. Rosewarne (primary editor), K. Sharman, R. Sjöberg, G. J. Sullivan (co-editors)] [WG 5 [N 103](https://dms.mpeg.expert/doc_end_user/current_document.php?id=82085&id_meeting=189)]

[JVET-AD1003](https://jvet-experts.org/doc_end_user/current_document.php?id=12970) Coding-independent code points for video signal type identification (Draft 2 of 3rd edition) [WG 5 preliminary FDIS N 206] [G. J. Sullivan, A. Tourapis] (2023-06-30)

Text for IPT-C2 from JVET-AC1008 is carried over, with swapping of the number assignment of IPT-C2 and YCgCo-Rx as suggested in the related ballot comment. A Draft DoCR N 205 was reviewed Thursday 27 April 1510. It was reported that SMPTE ST 2128 might be published before the July meeting, when it is planned to issue the FDIS.

[JVET-AD1004](https://jvet-experts.org/doc_end_user/current_document.php?id=12971) Errata report items for VVC, VSEI, HEVC, AVC, and Video CICP [Y.-K. Wang, B. Bross, I. Moccagatta, C. Rosewarne, G. J. Sullivan] (2023-06-30, near next meeting)

New aspects included the issues pointed out in JVET-AD0078 (for AVC) Editors were asked to check if any items for VVC, VSEI, HEVC and Video CICP could be removed that have already been resolved in new editions. A new edition of H.264 might be produced at next meeting for ITU-T consent, and a new edition of ISO/IEC 14496-10 might also be requested and started with the DIS stage. If additional SEI messages would be carried over from initial development for other standards, it might be better to start with a CD consultation stage.

Remains valid – not updated: [JVET-Z1005](https://jvet-experts.org/doc_end_user/current_document.php?id=11707) New levels for HEVC (Draft 3) [T. Suzuki, A. Tourapis, Y.-K. Wang]

The content of this document will be included in a new edition of HEVC. For additional corrigenda items included, see documents JVET-AB1004, as well as notes under JVET-AC0311 and JVET-AC0346. A DoCR on ISO/IEC DIS23008-2 was submitted as WG 5 N178 (reviewed during session 24), and the FDIS was submitted as WG 5 N 179.

(JVET-Z1005 can be removed after publication of the new edition of ISO/IEC 23008-2.)

No output: JVET-Axx1006

Remains valid – not updated: [JCTVC-V1007](http://phenix.it-sudparis.eu/jct/doc_end_user/current_document.php?id=10312) SHVC Test Model 11 (SHM 11) Introduction and Encoder Description [G. Barroux, J. Boyce, J. Chen, M. M. Hannuksela, Y. Ye] [WG 11 N 15778]

[JVET-AD1008](https://jvet-experts.org/doc_end_user/current_document.php?id=12972) Additional colour type identifiers for AVC and HEVC (Draft 4) [G. J. Sullivan, W. Husak, A. Tourapis] [WG 5 Preliminary WD N 200] (2023-06-30)

Remove items related to CICP, and swap number assignment IPT-C2 and YCgCo-Rx.

Remains valid – not updated: [JCTVC-AC1009](https://jvet-experts.org/doc_end_user/current_document.php?id=12569) Common test conditions for SHVC [K. Sühring]

This requires an update, as the previous version referred to an outdated location of test sequences.

Remains valid – not updated [JCTVC-O1010](http://phenix.it-sudparis.eu/jct/doc_end_user/current_document.php?id=8511) Guidelines for Conformance Testing Bitstream Preparation [T. Suzuki, W. Wan]

Remains valid – not updated: [JVET-AA1011](https://jvet-experts.org/doc_end_user/current_document.php?id=11944) HEVC multiview profiles supporting extended bit depth (draft 1) [A. Tourapis, W. Husak] [WG 5 preliminary WD N 143]

Proponents of the new profiles reported that they were currently developing software and conformance bitstreams.

JVET-[AD1012](https://jvet-experts.org/doc_end_user/current_document.php?id=12973) Overview of IT systems used in JVET [J.-R. Ohm, I. Moccagatta, K. Sühring, M. Wien] (2023-05-19)

Adding an annex from JVET-AD0004.

Remains valid – not updated: [JCT3V-G1003](http://phenix.int-evry.fr/jct3v/doc_end_user/current_document.php?id=1884) 3D-AVC Test Model 9 [ D. Rusanovskyy, F. C. Chen, L. Zhang, T. Suzuki ] [WG 11 N 14239]

Remains valid – not updated: [JCT3V-K1003](http://phenix.int-evry.fr/jct3v/doc_end_user/current_document.php?id=2499) Test Model 11 of 3D-HEVC and MV-HEVC [Y. Chen, G. Tech, K. Wegner, S. Yea] [WG 11 N 15141]

Reserved number – [JVET-Ax1013](https://jvet-experts.org/doc_end_user/current_document.php?id=12570) Common test conditions of 3DV experiments [K. Sühring]

The prior planned output JVET-AC1013 was withdrawn.

Remains valid – not updated [JCTVC-V1014](http://phenix.it-sudparis.eu/jct/doc_end_user/current_document.php?id=10316) Screen Content Coding Test Model 7 Encoder Description (SCM 7) [R. Joshi, J. Xu, R. Cohen, S. Liu, Y. Ye] [WG 11 N 16049]

Remains valid – not updated: [JVET-AC1015](https://jvet-experts.org/doc_end_user/current_document.php?id=12571) Common test conditions for SCM-based screen content coding [K. Sühring]

This requires an update, as the previous version referred to an outdated location of test sequences.

No output: JVET-Axx1016 through JVET-Axx1099

Remains valid – not updated [JVET-AA1100](https://jvet-experts.org/doc_end_user/current_document.php?id=11944) Common Test Conditions for HM Video Coding Experiments [K. Sühring, K. Sharman]

This specifies only the CTC for non-4:2:0 colour formats. The corresponding document for VVC is JVET-T2013, with no unification yet.

**No output: JVET-Axx2001**

[JVET-AD2002](https://jvet-experts.org/doc_end_user/current_document.php?id=12974) Algorithm description for Versatile Video Coding and Test Model 20 (VTM 20) [A. Browne, Y. Ye, S. Kim] [WG 5 N 204] (2023-07-07, near next meeting)

Updates from JVET-AD0169 (description of RPR downsampling), and JVET-AD0045.

It is noted that the list above may not be complete; if some adoption is missing that is recorded somewhere else in the meeting notes it shall also be considered included.

Remains valid – not updated: [JVET-AC2003](https://jvet-experts.org/doc_end_user/current_document.php?id=12573) Guidelines for VTM-based software development [F. Bossen, X. Li, K. Sühring]

Remains valid – not updated: [JVET-T2004](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10542) Algorithm descriptions of projection format conversion and video quality metrics in 360Lib (Version 12) [Y. Ye, J. Boyce]

[JVET-AD2005](https://jvet-experts.org/doc_end_user/current_document.php?id=12975) New level and systems-related supplemental enhancement information for VVC (Draft 5) [E. François, B. Bross, M. M. Hannuksela, A. Tourapis, Y.-K. Wang] (2023-06-30)

New version, changes to NNPFA according to JVET-AD0362, and editorial change from JVET-AD0077, and potentially additional tickets at editors’ discretion.

The content of this delta (amendment style) document was included in a new edition of VVC. A draft DoCR on ISO/IEC 23090-3/DAM1 was issued as WG 5 N 201 (reviewed Thursday 27 April 1530), and the preliminary FDIS text was issued as WG 5 N 202.

[JVET-AD2006](https://jvet-experts.org/doc_end_user/current_document.php?id=12976) Additional SEI messages for VSEI (Draft 4) [S. McCarthy, T. Chujoh, M. M. Hannuksela, G. J. Sullivan, Y.-K. Wang] (2023-06-30)

The content of this delta (amendment style) document was included in a new edition of VSEI. A draft DoCR on ISO/IEC 23007-7/DAM1 was issued as WG 5 N 197 (reviewed Thursday 27 April 1535), and the preliminary FDIS text was issued as WG 5 N 198.

See notes under JVET-AD0362 for elements included.

[JVET-AD2007](https://jvet-experts.org/doc_end_user/current_document.php?id=12977) Guidelines for NNVC software development [F. Galpin, S. Eadie, L. Wang, Z. Xie, Y. Li] (2023-05-26)

Developed from JVET-AD0111

Remains valid – not updated: [JVET-X2008](https://jvet-experts.org/doc_end_user/current_document.php?id=11228) Conformance testing for versatile video coding (Draft 7) [J. Boyce, F. Bossen, K. Kawamura, I. Moccagatta, W. Wan]

Remains valid – not updated: [JVET-Y2009](https://jvet-experts.org/doc_end_user/current_document.php?id=11470) Reference software for versatile video coding (Draft 3) [F. Bossen, K. Sühring, X. Li]

Remains valid – not updated [JVET-AB2010](https://jvet-experts.org/doc_end_user/current_document.php?id=12216) VTM and HM common test conditions and software reference configurations for SDR 4:2:0 10 bit video [F. Bossen, X. Li, V. Seregin, K. Sharman, K. Sühring]

Remains valid – not updated: [JVET-AC2011](https://jvet-experts.org/doc_end_user/current_document.php?id=12575) VTM and HM common test conditions and evaluation procedures for HDR/WCG video [A. Segall, E. François, W. Husak, S. Iwamura, D. Rusanovskyy]

Remains valid – not updated: [JVET-U2012](https://jvet-experts.org/doc_end_user/current_document.php?id=10681) JVET common test conditions and evaluation procedures for 360° video [Y. He, J. Boyce, K. Choi, J.-L. Lin]

Remains valid – not updated: [JVET-T2013](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10546) VTM common test conditions and software reference configurations for non-4:2:0 colour formats [Y.-H. Chao, Y.-C. Sun, J. Xu, X. Xu]

Remains valid – not updated: [JVET-Q2014](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=9683) JVET common test conditions and software reference configurations for lossless, near lossless, and mixed lossy/lossless coding [T.-C. Ma, A. Nalci, T. Nguyen]

Remains valid – not updated: [JVET-Q2015](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=9684) JVET functionality confirmation test conditions for reference picture resampling [J. Luo, V. Seregin]

[JVET-AD2016](https://jvet-experts.org/doc_end_user/current_document.php?id=12978) Common test conditions and evaluation procedures for neural network-based video coding technology [E. Alshina, R.-L. Liao, S. Liu, A. Segall] (2023-05-12)

This included the new definition of low-complexity operation point as anchor.

[JVET-AD2017](https://jvet-experts.org/doc_end_user/current_document.php?id=12979) Common test conditions and evaluation procedures for enhanced compression tool testing [M. Karczewicz and Y. Ye] (2023-05-13)

This included editorial improvements as suggested in JVET-AD0242, and an increase of runtime reporting precision as suggested in JVET-AD0401.

Remains valid – not updated: [JVET-AA2018](https://jvet-experts.org/doc_end_user/current_document.php?id=11949) Common test conditions for high bit depth and high bit rate video coding [A. Browne, T. Ikai, D. Rusanovskyy, X. Xiu, Y. Yu]

[JVET-AD2019](https://jvet-experts.org/doc_end_user/current_document.php?id=12980) Description of algorithms and software in neural network-based video coding (NNVC) version 3 [F. Galpin, Y. Li, D. Rusanovskyy, J. Ström, L. Wang] [WG 5 N 208] (2023-06-16)

New elements from notes elsewhere in this report:

* …

It is noted that the list above may not be complete; if some adoption is missing that is recorded somewhere else in the meeting notes it shall also be considered included.

Remains valid – not updated: [JVET-AC2020](https://jvet-experts.org/doc_end_user/current_document.php?id=12577) Film grain synthesis technology for video applications (Draft 4) [D. Grois, Y. He, W. Husak, P. de Lagrange, A. Norkin, M. Radosavljević, A. Tourapis, W. Wan] [WG 5 CDTR N 176] (2023-03-31)

[JVET-AD2021](https://jvet-experts.org/doc_end_user/current_document.php?id=12981) Verification test plan for VVC multilayer coding [S. Iwamura, P. de Lagrange, M. Wien] (2023-05-26)

See notes under section 4.5 for updates. See notes under JVET-AD0102 and JVET-AD0399.

[JVET-AD2022](https://jvet-experts.org/doc_end_user/current_document.php?id=12982) Draft plan for subjective quality testing of FGC SEI message [P. de Lagrange, W. Husak, M. Radosavljević, M. Wien] (2023-06-16)

See notes under sections 4.4 and 4.5 for updates. Update for phase 1 based on conclusions from expert viewing (AD0382). More test material needed. Update for phase 2 concepts based on considerations discussed under JVET-AD0268 and JVET-AD0369. For judging preservation of artistic intent, this might need involving (non-technical) expert viewers. To be discussed in interim AHG meeting.

[JVET-AD2023](https://jvet-experts.org/doc_end_user/current_document.php?id=12967) Exploration experiment on neural network-based video coding (EE1) [E. Alshina, F. Galpin, Y. Li, D. Rusanovskyy, M. Santamaria, J. Ström, L. Wang, Z. Xie] [WG 5 N 207] (2023-05-12)

An initial draft of this document was reviewed and approved at 0920-0945 on Friday 28 April.

Categories are:

* …

[JVET-AD2024](https://jvet-experts.org/doc_end_user/current_document.php?id=12966) Exploration experiment on enhanced compression beyond VVC capability (EE2) [V. Seregin, J. Chen, R. Chernyak, K. Naser, J. Ström, F. Wang, M. Winken, X. Xiu, K. Zhang] [WG 5 N 209] (2023-05-26)

An initial draft of this document was reviewed and approved at 0945-1000 on Friday 28 April.

Categories are partitioning, intra prediction, inter prediction, transforms, and in-loop filters.

[JVET-AD2025](https://jvet-experts.org/doc_end_user/current_document.php?id=12983) Algorithm description of Enhanced Compression Model 9 (ECM 9) [M. Coban, R.-L. Liao, K. Naser, J. Ström, L. Zhang] [WG 5 N 210] (2023-06-30)

New elements from notes elsewhere in this report:

* …

It is noted that the list above may not be complete; if some adoption is missing that is recorded somewhere else in the meeting notes it shall also be considered included.

Remains valid – not updated: [JVET-AC2026](https://jvet-experts.org/doc_end_user/current_document.php?id=12581) Conformance testing for VVC operation range extensions (Draft 4) [D. Rusanovskyy, T. Hashimoto, H.-J. Jhu, I. Moccagatta, Y. Yu] (2023-04-14)

[JVET-AD2027](https://jvet-experts.org/doc_end_user/current_document.php?id=12984) SEI processing order SEI message in VVC (draft 4) [S. McCarthy, M. M. Hannuksela, Y.-K. Wang] [WG 5 preliminary WD 3 N 203] (2023-05-19)

Updated from JVET-AD0386 and JVET-AD0362.

[JVET-AD2028](https://jvet-experts.org/doc_end_user/current_document.php?id=12985) Additional conformance bitstreams for VVC multilayer configurations [S. Iwamura, I. Moccagatta] (2023-05-26)

Include new streams from JVET-AD0101.

Remains valid – not updated: [JVET-AB2029](https://jvet-experts.org/doc_end_user/current_document.php?id=12225) Visual quality comparison of ECM/VTM encoding [V. Baroncini, J.-R. Ohm, M. Wien] [AG 5 N75]

[JVET-AD2030](https://jvet-experts.org/doc_end_user/current_document.php?id=12986) Optimization of encoders and receiving systems for machine analysis of coded video content (draft 2) [J. Chen, C. Hollmann, S. Liu] [WG 5 N 199)] (2023-06-09)

From JVET-AD0042, plus annex about example algorithms from JVET-AD0047 and JVET-AD0135.

[JVET-AD2031](https://jvet-experts.org/doc_end_user/current_document.php?id=12987) Common test conditions for optimization of encoders and receiving systems for machine analysis of coded video content [S. Liu, C. Hollmann] (2023-05-12)

This includes a new Excel template from JVET-AD0043, potentially new anchor settings from JVET-AD0122, and the new sequences from JVET-AD0181.

# Future meeting plans, expressions of thanks, and closing of the meeting

Future meeting plans were established according to the following guidelines (assuming face-to-face meetings):

* Meeting under ITU-T SG16 auspices when it meets (ordinarily starting meetings on the Wednesday of the first week and closing it on the Wednesday of the second week of the SG16 meeting – a total of 8 meeting days), and
* Otherwise meeting under ISO/IEC JTC 1/‌SC 29 auspices when its MPEG WGs meet (ordinarily starting meetings on the Friday prior to the main week of such meetings and closing it on the same day as other MPEG WGs – a total of 8 meeting days).

In cases where an exceptionally high workload is expected for a meeting, an earlier starting date may be defined. In cases of online meetings, no sessions should be held on weekend days, such that meetings would typically start two days earlier.

Some specific future meeting plans (to be confirmed) were established as follows:

* During Fri. 13 – Fri. 20 October 2023, 32nd meeting under ISO/IEC JTC 1/‌SC 29 auspices in Hannover, DE,
* During Wed. 17 – Fri. 19 and Mon. 22 – Fri. 26 January 2024, 33rd meeting under ISO/IEC JTC 1/‌SC 29 auspices, to be held as teleconference meeting,
* During April 2024, 34th meeting under ITU-T SG16 auspices, date and location t.b.d.,
* During Fri. 12 – Fri. 19 July 2024, 35th meeting under ISO/IEC JTC 1/‌SC 29 auspices in Sapporo, JP,
* During October 2024, 36th meeting under ISO/IEC JTC 1/‌SC 29 auspices, date and location t.b.d.,
* During January 2025, 37th meeting under ITU-T SG16 auspices, date and location t.b.d.,
* During April 2025, 38th meeting under ISO/IEC JTC 1/‌SC 29 auspices, date and location t.b.d.,
* During Thu. 26 June – Fri. 4 July 2025, 39th meeting under ISO/IEC JTC 1/‌SC 29 auspices in Daejeon, KR.

The agreed document deadline for the 32nd JVET meeting was planned to be Friday 6 October 2023.

It was suggested that it would be interesting to perform subjective quality investigation with the elements adopted to NNVC software in a future meeting (provided that close enough rate/quality matching with VTM anchor is achieved).

Marius Preda was thanked for his support in maintaining the document site jvet-experts.org, as well as the document sites of JCT-VC and JCT-3V. Institut Mines-Télécom is thanked for hosting the sites.

(update) Ali Begen was thanked for the dedication put into organizing, and for the hospitality experienced during the 31st JVET meeting. Mustafa Bay, Alev Yavuz, Basak Erel and Merve Dağlı of Dekon Congress & Tourism, and the staff of Mirage Park Resort Hotel were thanked for the excellent support during the meeting, including the capability for remote access. Further thanks were expressed to the sponsors Adobe, Ateme, Comcast, Dolby, Ericsson, Nokia, özyegin University, ofinno, Perculus, Pico TV, Pixery, Turkish Airlines, Unified Streaming, and V-Nova.

The 31st JVET meeting was closed at approximately XXXX hours CEST (UTC+2) on Wednesday 19 July 2023.

# Annex A to JVET report: List of documents

(Dates and times in the table below are in Paris/Geneva time.)

# Annex B1 to JVET report: List of meeting participants attending in person

The participants who were personally present at the meeting site of the thirty-first meeting of the JVET, according to an attendance sheet circulated during the JVET meeting sessions (approximately XXX people in total), were as follows:

1. …

# Annex B2 to JVET report: List of meeting participants attending remotely

The remote participants of the thirtieth meeting of the JVET, according to the participation records from the Zoom teleconferencing tool used for the meeting sessions (approximately XXX people in total, not including those who had attended the meeting in person at least part-time (see annex B1), and not including those who attended only the joint sessions with other groups), were as follows:

# Annex C to JVET report:

# Recommendations of the 12th meeting of ISO/IEC JTC 1/SC 29/WG 5 MPEG Joint Video Coding Team(s) with ITU-T SG 16

**ISO/IEC JTC 1/SC 29/WG 5 N XXX**