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| **Joint Video Experts Team (JVET)**  **of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29**  25th Meeting, by teleconference, 12–21 January 2022 | Document: JVET-X\_Notes\_d0 |

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| *Title:* | **Meeting Report of the 25h Meeting of the Joint Video Experts Team (JVET), by teleconference, 12–21 Jamuary 2022** | | |
| *Status:* | Report document from the chair of JVET | | |
| *Purpose:* | Report | | |
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| *Source:* | Chair of JVET | | |

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# Summary

The Joint Video Experts Team (JVET) of ITU-T WP3/16 and ISO/IEC JTC 1/‌SC 29 held its twenty-fifth meeting during 12–21 January 2022 as an online-only meeting. It had previously been planned to be in Geneva, CH, but this plan was changed due to the difficulties resulting from the COVID-19 pandemic. For ISO/IEC purposes, JVET is alternatively designated ISO/IEC JTC 1/‌SC 29/‌WG 5, and this was the sixth 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 2.14 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 1300 hours UTC on Wednesday 12 January 2022. Meeting sessions were held on all days except the weekend days of Saturday and Sunday 15 and 16 January 2022, until the meeting was closed at approximately XXXX hours UTC on XXday 2X January 2022. Approximately XXX people attended the JVET meeting, and approximately XXX input documents (not counting crosschecks), 13 AHG reports, 2 EE summary reports, X BoG reports, and X report on experts viewing conducted during the meeting were discussed. The meeting took place in a coordinated fashion with a teleconference meeting of SG16 – one of the two parent bodies of the JVET, under whose auspices this JVET meeting was held. Various other SC29 Working Groups – where WG 5 is representing the Joint Video Coding Team(s) and their activities from the perspective of the SC 29 parent body – were also meeting in parallel, and some coordination was conducted with those as well. 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 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 was performed in the interim period since the twenty-fourth JVET meeting in producing the following documents:

* JVET-X1000 Meeting report
* JVET-X1004 Errata report items for VVC, VSEI, HEVC, AVC, Video CICP, and CP usage TR
* JVET-X1005 New level for HEVC (Draft 1)
* JVET-X2002 Algorithm description for Versatile Video Coding and Test Model 15 (VTM 15)
* JVET-X2005 VVC operation range extensions (Draft 5)
* JVET-X2006 Additional SEI messages for VSEI (Draft 5)
* JVET-X2008 Conformance testing for versatile video coding (Draft 7)
* JVET-X2016 Common Test Conditions and evaluation procedures for neural network-based video coding technology
* JVET-X2017 Common Test Conditions and evaluation procedures for enhanced compression tool testing
* JVET-X2022 Core Experiment on film grain synthesis
* JVET-X2023 Exploration Experiment on neural network-based video coding (EE1)
* JVET-X2024 Exploration Experiment on enhanced compression beyond VVC capability (EE2)
* JVET-X2025 Algorithm description of Enhanced Compression Model 3 (ECM 3)
* JVET-X2026 Conformance testing for VVC operation range extensions (Draft 2)

As a main result, the JVET produced XX output documents from the current meeting (update):

* JVET-X1004 Errata report items for VVC, VSEI, HEVC, AVC, Video CICP, and CP usage TR
* JVET-X1005 New level for HEVC (Draft 1)
* JVET-X2002 Algorithm description for Versatile Video Coding and Test Model 15 (VTM 15)
* JVET-X2005 VVC operation range extensions (Draft 5)
* JVET-X2006 Additional SEI messages for VSEI (Draft 5)
* JVET-X2008 Conformance testing for versatile video coding (Draft 7)
* JVET-X2016 Common Test Conditions and evaluation procedures for neural network-based video coding technology
* JVET-X2017 Common Test Conditions and evaluation procedures for enhanced compression tool testing
* JVET-X2022 Core Experiment on film grain synthesis
* JVET-X2023 Exploration Experiment on neural network-based video coding (EE1)
* JVET-X2024 Exploration Experiment on enhanced compression beyond VVC capability (EE2)
* JVET-X2025 Algorithm description of Enhanced Compression Model 3 (ECM 3)
* JVET-X2026 Conformance testing for VVC operation range extensions (Draft 2)

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, X Exploration Experiments (EE) were defined. The next eight JVET meetings were planned for Fri. 22 – Fri. 29 April 2022 under ISO/IEC JTC 1/‌SC 29 auspices in Alpbach, AT, to be conducted as a hybrid meeting; during Fri. 15 – Fri. 22 July 2022 under ISO/IEC JTC 1/‌SC 29 auspices in Cologne, DE; during October 2022 under ITU-T SG16 auspices, location t.b.d.; during January 2023 under ISO/IEC JTC 1/‌SC 29 auspices, location t.b.d.; during April 2023 under ISO/IEC JTC 1/‌SC 29 auspices, location t.b.d.; during July 2023 under ITU-T SG16 auspices in Geneva, CH; during October 2023 under ISO/IEC JTC 1/‌SC 29 auspices, location t.b.d.; and during January 2024 under ISO/IEC JTC 1/‌SC 29 auspices, location t.b.d.

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/> is still accessible, but was 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 the 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 twenty-fifth meeting during 12–21 January 2022 as an online-only meeting, using Zoom teleconferencing tools. For ISO/IEC purposes, JVET is alternatively designated ISO/IEC JTC 1/‌SC 29/‌WG 5, and this was the sixth 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. 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 minor 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/2022_01_Y_Virtual/>.

## Primary goals

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

* JVET-X1000 Meeting report
* JVET-X1004 Errata report items for VVC, VSEI, HEVC, AVC, Video CICP, and CP usage TR
* JVET-X1005 New level for HEVC (Draft 1)
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* JVET-X2005 VVC operation range extensions (Draft 5)
* JVET-X2006 Additional SEI messages for VSEI (Draft 5)
* JVET-X2008 Conformance testing for versatile video coding (Draft 7)
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* JVET-X2022 Core Experiment on film grain synthesis
* JVET-X2023 Exploration Experiment on neural network-based video coding (EE1)
* JVET-X2024 Exploration Experiment on enhanced compression beyond VVC capability (EE2)
* JVET-X2025 Algorithm description of Enhanced Compression Model 3 (ECM 3)
* JVET-X2026 Conformance testing for VVC operation range extensions (Draft 2)

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/> is still accessible, but was converted to read-only.

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 (other than as contribution registration and upload times) follow the UTC timezone.

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 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 and editorial 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 Wednesday, 5 January 2022. Any documents uploaded after 1159 hours Paris/Geneva time on Thursday 6 January 2022 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-Y0163 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, 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 was 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 was 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-Y0XXX (a proposal on …), uploaded 01-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 document not proposing normative technical content, but with some need for consideration, were registered and/or uploaded late:

* JVET-Y0XXX (a document on …), uploaded 01-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 cross-verification reports had not been uploaded yet by the time when the meeting ended, neither were they provided within 2 weeks after the meeting: JVET-Y01XXX, …. Therefore, they were markesd as withdrawn by action of the chair.

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-Y0064, ….

“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 typically be counted as a late contribution). At the current meeting, this situation did not apply.

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.). These 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 were 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-X1000, the Errata report items for VVC, VSEI, HEVC, AVC, Video CICP, and CP usage TR JVET-X1004, the New level for HEVC (draft 1) JVET-X1005, the Algorithm description for Versatile Video Coding and Test Model 15 (VTM 15) JVET-X2002, the Operation range extensions for VVC (Draft 5) JVET-X2005, the Additional SEI messages for VSEI (Draft 5) JVET-X2006, the Conformance testing for Versatile Video Coding (draft 7) JVET-X2008, the Common Test Conditions and evaluation procedures for neural network-based video coding technology JVET-X2016, the Common Test Conditions and evaluation procedures for enhanced compression tool testing JVET-X2017, the Description of the EE on Neural Network-based Video Coding JVET-X2023, the Description of the EE on Enhanced Compression beyond VVC capability JVET-X2024, the Algorithm description of Enhanced Compression Model 3 (ECM 3) JVET-W2026, and the Conformance testing for VVC operation range extensions (Draft 2) JVET-X2026, had been completed and were approved. The software implementations of HM (version 16.XX), VTM (version 15.0), ECM (version 3.0), and HDRTools (version 0.23) were also approved.

Only minor editorial issues were found in the meeting report JVET-X1000 – no need to produce an update was identified (see section 2.12 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 the 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.
* 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.
* Use your full name and company/organization and country affiliation in your joining information, as the participation list of Zoom would also be used to compile attendance records.
* Turn on the chat window and watch for chair communication and side commentary there as well as by audio.
* Avoid overloading people’s internet connections by not using video for the teleconferencing calls – only voice and screen sharing. Extensive use of screen sharing is encouraged.

## 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
* Opening remarks and review of meeting logistics and communication practices
* Code of conduct policy reminder
* IPR policy reminder and declarations
* Contribution document allocation
* Review of results of the previous meeting
* 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 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
* Coordination of visual quality testing
* Coordination activities with other organizations
* 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, meeting planning, other planning issues

Other business as appropriate for considerationThe plans for the times of meeting sessions were established as follows, in UTC (1 hour behind the time in Geneva, Paris; 8 hours ahead of the time in Los Angeles, etc.). No session should last longer than 2 hrs.

* 1300–1500 1st “afternoon” session [break after 2 hours]
* 1520–1720 2nd “afternoon” session
* [“evening” break – nearly 4 hours]
* 2100–2300 1st “night” session [break after 2 hours]
* 2320–0120+1 2nd “night” session

It was also pointed out that the session times had been changed from meeting to meeting, such that different time zones of the world might be treated approximately equally fairly either in one meeting or another. For the current meeting, the same session times were used as in the 22nd JVET meeting (which had been the fifth meeting conducted as an online meeting)

* 1. ***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/PUB100397.html>.

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

These include points relating to:

* Respecting others
* Behaving ethically
* Escalating and resolving disputes
* Working for the net benefit of the international community
* Upholding consensus and governance
* Agreeing to a clear purpose and scope
* Participating actively and managing effective representation

## 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 is used in the process of designing the VTM software, and for evaluating proposals for technology to be potentially included in the design. 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.

Software packages that had been developed in prior work of the JCT-VC 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 1353 (as of 9 January 2022). All future discussions (including those on HEVC, VVC, CICP, etc.) shall be conducted on the JVET reflector rather than the JCT-VC reflector, while the old reflectors (including JVT, JCT-VC, and JCT-3V) 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).

## 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
* **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
* **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
* **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
* **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 constitutes our draft standard design – 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
* **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
* **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
* **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
* **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).
* **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.
* **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
* **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).
* **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.

## Opening remarks

Remarks during the opening session of the meeting Wednesday 12 January at 1300 UTC were as follows.

* Timing and organization of online meetings, calendar posting of session plans
* Standards, TRs, supplements and technical papers approval and publication status
  + Working practices using objective metrics report
    - HSTP-VID-WPOM V1: approved 2020-07-03, published 2020-11
    - ISO/IEC TR 23002-8 (Ed. 1) published 2021-05-20
  + AVC
    - H.264 V14 Consented at 22nd meeting on 2021-04-30 (with annotated regions, shutter interval, and miscellaneous corrections), approved 2021-08-22, published 2020-10-13 (during the current meeting)
    - ISO/IEC 14496-10:2020 (Ed. 9) FDIS ballot closed 2020-11-27, published 2020-12-15 – corresponding aspects for additional SEI messages are partly in the in-progress DIS (see below)
  + HEVC
    - H.265 V7 approved 2019-11-29, published 2020-01-10
    - ISO/IEC 23008-2:2020 (Ed. 4) FDIS closed 2020-07-16, published 2020-08-27
    - H.265 V8 Consented at the 22nd meeting (Shutter interval information SEI message and miscellaneous corrections), was published 2020-10-13 (during the current meeting)
    - ISO/IEC 23008-2:2020 FDAM 1 ballot closed 2021-06-03 (Shutter interval information SEI message) published 2021-07-12
  + Usage of code points report
    - H.Sup19 V3 approved 2021-04-30, published 2021-06-04
    - ISO/IEC TR 23091-4 (Ed. 3) published 2021-05-23
  + VVC
    - H.266 V1 approved 2020-08-29, published 2020-11-10
    - ISO/IEC 23090-3:2021 (Ed. 1) published 2021-02-16
  + VSEI
    - H.274 V1 approved 2020-08-29, published 2020-11-10
    - ISO/IEC 23002-7:2021 (Ed. 1) published 2021-01-28
  + CICP V2 (includes errata items)
    - ISO/IEC 23091-2 had been forwarded from DIS directly for publication in 2021-04

Post-meeting note: This was published after the meeting on 2021-10-18

* + - 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
  + 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
  + The following freely available standards are published here in ISO/IEC:  
    <https://standards.iso.org/ittf/PubliclyAvailableStandards/index.html>
    - ISO/IEC 14496-10:2020 (Ed. 9)
    - ISO/IEC 23002-7:2021 (Ed. 1) VSEI
    - ISO/IEC 23008-2:2020 (Ed. 4) HEVC
    - ISO/IEC 23090-3:2021 (Ed. 1) VVC
    - ISO/IEC 23091-2:2019 (Ed. 1) Video CICP
    - CICP 2nd ed.?
    - HEVC Amd.1?
* Draft standards progression status
  + VVC conformance – FDIS from previous meeting under ballot, to be submitted for ITU-T consent from current meeting
  + VCC conformance for operation range extensions – CDAM from previous meeting, ballot closed XX-XX, progression to DAM, no action yet in ITU-T
    - [m58554](https://dms.mpeg.expert/doc_end_user/current_document.php?id=81284&id_meeting=189) Summary of voting on ISO/IEC 23090-15 CDAM1
  + VVC reference SW – under DIS 23090-16 ballot closed 2021-09-30, FDIS and ITU-T consent submission from current meeting – shall also include reference software for version 2 of VVCand VSEI
    - [m57767](https://dms.mpeg.expert/doc_end_user/documents/136_OnLine/wg11/m57767-v1-m57767.zip) Summary of voting on ISO/IEC DIS 23090-16
    - [n20909](https://dms.mpeg.expert/doc_end_user/current_document.php?id=81004&id_meeting=188) Draft disposition of comments received on ISO/IEC DIS 23090-16 (WG 5 N87)
  + AVC additional SEI messages – integrated into DIS of new edition at 23rd meeting, ballot closed 2021-12-27, FDIS from current meeting
    - [m58533](https://dms.mpeg.expert/doc_end_user/current_document.php?id=81263&id_meeting=189) Summary of voting on ISO/IEC DIS 14496-10
  + VSEI extensions – integrated into DIS of new edition (version 2) at 23rd meeting, ballot closed 2021-12-27, FDIS and ITU-T consent submission from current meeting
    - [m58534](https://dms.mpeg.expert/doc_end_user/current_document.php?id=81264&id_meeting=189) Summary of voting on ISO/IEC DIS 23002-7
  + VVC operation range extensions – integrated into DIS of new edition (version 2) at 23rd meeting, ballot closed 2021-12-27, FDIS and ITU-T consent submission from current meeting
    - [m58535](https://dms.mpeg.expert/doc_end_user/current_document.php?id=81265&id_meeting=189) Summary of voting on ISO/IEC DIS 23090-3
  + New level (from JVET-X1005) for CDAM (or CD targeting new edition on HEVC incorporating Amd.1 and corrigenda items in October, and consent in ITU-T by the same time; note that shutter interval is already in latest ITU-T edition)
  + The request for free availability in ISO/IEC has to be made for each edition, amendment and corrigendum, and these will also need a request form to be filled out and be approved in the Recommendations. A freely available URL on ITU part should be provided for the following parts:
    - ISO/IEC 14496-10:202X – AVC new edition
    - ISO/IEC 23002-7:202X – VSEI new edition
    - ISO/IEC 23090-3:202X – VVC new edition
    - ISO/IEC 23090-15:202X – VVC conformance
    - ISO/IEC 23090-16:202X – VVC reference software
    - ISO/IEC 23008-2:2020/Amd 1 – HEVC done 23rd meeting
    - ISO/IEC DIS 23091-2, 2nd edition – CICP done 23rd meeting
* The meeting logistics, agenda, working practices, policies, and document allocation were reviewed.
  + The meeting was conducted using Zoom.
  + 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-X1000 were reviewed. The following small copy-paste issues in the meeting report were noted and were not considered sufficient to warrant issuing a revision:
  + In sections 2.1 and 2.3, some numbering errors occurred: VTM should be 15 instead 14, ECM should be 3 instead 2, JVET-X2007 should be JVET-X2008. In the document site and output document list, everything is correct.
  + …
* There was somewhat less of a problem of late non-cross-check documents and no “placeholders” (see section 2.4.2).
* There were quite a few documents where authors’ given names were not abbreviated, and company affiliation was missing in the authors’ list. Reminder to stick to our conventions.
* The primary goals of the meeting were
  + FDIS on v1 of VVC conformance and software
  + Errata
  + Conformance and software for version2 of VVC & VSEI
  + Extensions of VVC (High bit rate / high bit depth)
  + Additional SEI messages for VSEI
  + Exploration Experiments
    - Neural network-based video coding
    - Enhanced compression beyond VVC
* Funding of verification testing activities: recommendation of thanks, recommendation calling for funding wrt upcoming tests.
* Liaison communication
* Number of documents slightly higher than last meeting (90->110)
* Scheduling was discussed, and it was agreed to avoid conducting “track” sessions in parallel (some BoG parallelism might occur)
* Principles of standards development were discussed.
* Meeting plans need to be discussed, in particular regarding the possibility of a hybrid meeting in April 2022

## Scheduling of discussions

The plans for the times of meeting sessions were established as follows, in UTC (1 hour behind the time in Geneva, Paris; 8 hours ahead of the time in Los Angeles, etc.). No session should last longer than 2 hrs.

* 1300–1500 1st “afternoon” session [break after 2 hours]
* 1520–1720 2nd “afternoon” session
* [“evening” break – nearly 4 hours]
* 2100–2300 1st “night” session [break after 2 hours]
* 2320–0120+1 2nd “night” session

Sessions were announced via the calendar in the JVET document site at least 22 hrs. in advance. Particular scheduling notes are shown below, although not necessarily 100% accurate or complete:

* Wed. 12 Jan., 1st day
  + Session 1:
    - 1300–XXXX Opening remarks, review of practices, agenda, IPR reminder
    - XXXX–1500 Reports of AHGs 1–X
  + Session 2:
    - 1520–XXXX Reports of AHGs X–13
    - XXXX–XXXX Review of EE1
  + Session 3:
    - 2100–2300 Review of EE1 and EE2
  + Session 4:
    - 2320–0120+1 Further review of EE2
* Thu. 13 Jan., 2nd day
  + Session 5:
    - 1300–XXXX Review of …
* Fri. 14 Jan., 3rd day
  + Session 9:
    - 1300–XXXX Review of …
* Mon. 17 Jan., 4th day
  + 0500–0730 MPEG information sharing session
  + 1215–1345 SG16/WP3 plenary (no JVET meeting in parallel)
  + Session 13:
    - 1400–1500 Review of …
    - …
* Tue. 18 Jan., 5th day
  + XXXX–XXXX ITU-T workshop on “AI and multimedia”
  + …
* Wed. 19 Jan., 6th day
  + 0500–0600 MPEG information sharing session
  + 1400–1530 VCEG
  + …
* Thu. 20 Jan., 7th day
  + …
* Fri. 21 Jan., 8th day
  + Plenary:
    - 1300–1500 Remaining business, Approval of output docs, AHGs, recommendations
  + 2100–2300 MPEG information sharing session
  + XXXX+1–XXXX+1 WG 5 Closing plenary: Approval 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 may not be completely accurate):

* AHG reports (13) (section 3)
* Project development (section 4)
  + Deployment and advertisement of standards (3)
  + Text development and errata reporting (2)
  + Test conditions (3)
  + Verification testing (1)
  + Test Material (3)
  + Quality assessment (2)
  + Conformance test development (1)
  + Software development (1)
  + Implementation studies (3)
  + AHG7: Low latency and constrained complexity (7)
  + Encoding algorithm optimization (10)
  + Profile/tier/level specification (5)
  + Proposed modification of system interface (0)
* Low-level tool technology proposals (section 5) with subtopics (number counts excluding BoG and summary reports)
  + AHG8: High bit depth and high bit rate coding (1) (section 5.1)
  + AHG11 and EE1: Neural network-based video coding (22) (section 5.2)
  + AHG12 and EE2: Enhanced compression beyond VVC capability (54) (section 5.3)
* High-level syntax (HLS) proposals (section 6) with subtopics
  + AHG9: SEI message studies and proposals (9) (section 6.1)
  + Film grain synthesis (3) (section 6.2)
  + Non-SEI HLS aspects (0) (section 6.3)
* Joint meetings, plenary discussions, BoG and viewing reports (0), 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 (13)

These reports were discussed Wednesday 12 Jan. 2022 during 13XX–XXXX and 1520–XXXX UTC (chaired by JRO).

[JVET-Y0001](https://jvet-experts.org/doc_end_user/current_document.php?id=11358) JVET AHG report: Project management (AHG1) [J.-R. Ohm, G. J. Sullivan]

[JVET-Y0002](https://jvet-experts.org/doc_end_user/current_document.php?id=11359) JVET AHG report: Draft text and test model algorithm description editing (AHG2) [B. Bross, J. Chen, C. Rosewarne, F. Bossen, J. Boyce, A. Browne, S. Kim, S. Liu, J.-R. Ohm, G. J. Sullivan, A. Tourapis, Y.-K. Wang, Y. Ye]

[JVET-Y0003](https://jvet-experts.org/doc_end_user/current_document.php?id=11360) JVET AHG report: Test model software development (AHG3) [F. Bossen, X. Li, K. Sühring, Y. He, K. Sharman, V. Seregin, A. Tourapis]

[JVET-Y0004](https://jvet-experts.org/doc_end_user/current_document.php?id=11361) JVET AHG report: Test material and visual assessment (AHG4) [V. Baroncini, T. Suzuki, M. Wien, E. François, S. Liu, A. Norkin, A. Segall, P. Topiwala, S. Wenger, Y. Ye]

[JVET-Y0005](https://jvet-experts.org/doc_end_user/current_document.php?id=11362) JVET AHG report: Conformance testing (AHG5) [D. Rusanovskyy, I. Moccagatta, F. Bossen, K. Kawamura, T. Hashimoto, H.-J. Jhu, K. Sühring, Y. Yu]

[JVET-Y0006](https://jvet-experts.org/doc_end_user/current_document.php?id=11363) JVET AHG report: ECM software development (AHG6) [V. Seregin, J. Chen, F. Le Léannec, K. Zhang]

[JVET-Y0007](https://jvet-experts.org/doc_end_user/current_document.php?id=11364) JVET AHG report: Low latency and constrained complexity (AHG7) [T. Poirier, S. Liu, L. Wang, J. Xu]

[JVET-Y0008](https://jvet-experts.org/doc_end_user/current_document.php?id=11365) JVET AHG report: High bit depth, high bit rate, and high frame rate coding (AHG8) [A. Browne, T. Ikai, D. Rusanovskyy, M. Sarwer, X. Xiu, Y. Yu]

[JVET-Y0009](https://jvet-experts.org/doc_end_user/current_document.php?id=11366) JVET AHG report: SEI message studies (AHG9) [J. Boyce, S. McCarthy, C. Fogg, P. de Lagrange, J. Samuelsson, G. J. Sullivan, A. Tourapis, Y.-K. Wang, S. Wenger]

[JVET-Y0010](https://jvet-experts.org/doc_end_user/current_document.php?id=11367) JVET AHG report: Encoding algorithm optimization (AHG10) [P. de Lagrange, R. Sjöberg, A. Tourapis]

[JVET-Y0011](https://jvet-experts.org/doc_end_user/current_document.php?id=11368) JVET AHG report: Neural network-based video coding (AHG11) [E. Alshina, S. Liu, A. Segall, J. Chen, F. Galpin, J. Pfaff, S. S. Wang, Z. Wang, M. Wien, P. Wu, J. Xu]

[JVET-Y0012](https://jvet-experts.org/doc_end_user/current_document.php?id=11369) JVET AHG report: Enhanced compression beyond VVC capability (AHG12) [M. Karczewicz, Y. Ye, L. Zhang, B. Bross, X. Li, K. Naser, H. Yang]

[JVET-Y0013](https://jvet-experts.org/doc_end_user/current_document.php?id=11370) JVET AHG report: Film grain technologies (AHG13) [W. Husak, M. Radosavljević, W. Wan, D. Grois, A. Tourapis]

# Project development (22)

## Deployment and advertisement of standards (3)

Contributions in this area were discussed in session X at XXXX–XXXX UTC on XXday X Jan. 2022 (chaired by XXX).

Formularende[JVET-Y0020](https://jvet-experts.org/doc_end_user/current_document.php?id=11243) Deployment status of the HEVC standard [G. J. Sullivan]

[JVET-Y0021](https://jvet-experts.org/doc_end_user/current_document.php?id=11244) Deployment status of the VVC standard [G. J. Sullivan]

[JVET-Y0122](https://jvet-experts.org/doc_end_user/current_document.php?id=11316) Ali266 @ Youku: Trial deployment of VVC for video streaming [Y. Jia, Y. Zhang, F. Hu, M. Li, W. Jiang (Youku), Z. Huang, J. Liu, J. Chen, Y. Ye (Alibaba)]

## Text development and errata reporting (2)

Contributions in this area were discussed in session X at XXXX–XXXX UTC on XXday X Jan. 2022 (chaired by XXX).

[JVET-Y0049](https://jvet-experts.org/doc_end_user/current_document.php?id=11241) AHG2/AHG8: On the range extensions GCI flags [Y.-K. Wang (Bytedance)]

[JVET-Y0050](https://jvet-experts.org/doc_end_user/current_document.php?id=11242) AHG2/AHG9: On the alpha channel information SEI message [Y.-K. Wang (Bytedance)]

## Test conditions (3)

Contributions in this area were discussed in session X at XXXX–XXXX UTC on XXday X Jan. 2022 (chaired by XXX).

[JVET-Y0108](https://jvet-experts.org/doc_end_user/current_document.php?id=11302) AHG3/AHG12: Modification of JVET CTC for environmental considerations [F. Galpin, M. Radosavljević, E. François (InterDigital)]

[JVET-Y0112](https://jvet-experts.org/doc_end_user/current_document.php?id=11306) [AHG3] Merged VTM and HM CTC for SD 4:2:0 10-bit video [K. Sühring, F. Bossen, X. Li, V. Seregin, K. Sharman]

[JVET-Y0117](https://jvet-experts.org/doc_end_user/current_document.php?id=11311) AHG12: ECM coding performance for HDR/WCG content and suggested common test conditions [T. Lu, F. Pu, P. Yin, S. McCarthy, W. Husak, T. Chen (Dolby), N. Hu, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-Y0167](https://jvet-experts.org/doc_end_user/current_document.php?id=11374) Cross-check report of JVET-Y0117 on suggested ECM common test conditions for HDR/WCG content [E. François (InterDigital)] [late]

## Verification testing (1)

Contributions in this area were discussed in session X at XXXX–XXXX UTC on XXday X Jan. 2022 (chaired by XXX).

[JVET-Y0047](https://jvet-experts.org/doc_end_user/current_document.php?id=11239) AHG4: First report of spatial scalability verification tests [P. de Lagrange, F. Urban, E. François (InterDigital), W. Hamidouche (INSA)]

## Test material (3)

Contributions in this area were discussed in session X at XXXX–XXXX UTC on XXday X Jan. 2022 (chaired by XXX).

[JVET-Y0042](https://jvet-experts.org/doc_end_user/current_document.php?id=11234) AHG7: Modification of and new classes of sequences [G. Martin-Cocher (InterDigital)]

[JVET-Y0071](https://jvet-experts.org/doc_end_user/current_document.php?id=11265) New Test Content for Video Conferencing Applications [Z. Sinno, G. Desgouttes, A. M. Tourapis, D. Singer (Apple)] [late] [miss]

[JVET-Y0123](https://jvet-experts.org/doc_end_user/current_document.php?id=11317) On Test Sequences [J. Xu, L. Zhang (ByteDance), M. Martin-Cocher (InterDigital)]

## Quality assessment (2)

Contributions in this area were discussed in session X at XXXX–XXXX UTC on XXday X Jan. 2022 (chaired by XXX).

[JVET-Y0045](https://jvet-experts.org/doc_end_user/current_document.php?id=11237) AHG11/EE1 viewing preparation report [[E. Alshina](mailto:elena.alshina@huawei.com), M. Wien, A. Segall]

[JVET-Y0083](https://jvet-experts.org/doc_end_user/current_document.php?id=11277) AHG4/AHG10: Report of Teleconference on Viewing Session Preparation for Deblocking [M. Wien, H. Zhang, X. Li]

## Conformance test development (1)

Contributions in this area were discussed in session X at XXXX–XXXX UTC on XXday X Jan. 2022 (chaired by XXX).

[JVET-Y0127](https://jvet-experts.org/doc_end_user/current_document.php?id=11321) AHG5: Editors update on conformance testing for VVC operation range extensions [D. Rusanovskyy, T. Hashimoto, H.-J. Jhu, I. Moccagatta, M. G. Sarwer, Y. Yu]

## Software development (1)

Contributions in this area were discussed in session X at XXXX–XXXX UTC on XXday X Jan. 2022 (chaired by XXX).

[JVET-Y0110](https://jvet-experts.org/doc_end_user/current_document.php?id=11304) AHG11: Small Ad-hoc Deep-Learning Library (SADL) update [F. Galpin, F. Mom, T. Dumas, P. Bordes, P. Nikitin, E. François (InterDigital)]

## Implementation studies (3)

Contributions in this area were discussed in session X at XXXX–XXXX UTC on XXday X Jan. 2022 (chaired by XXX).

[JVET-Y0054](https://jvet-experts.org/doc_end_user/current_document.php?id=11248) Update on a VVC software decoder, BVC, for heterogeneous CPU plus GPU systems [L. Li, H. Yin, L. Zhang, Y. Zhang (Bytedance)]

[JVET-Y0066](https://jvet-experts.org/doc_end_user/current_document.php?id=11260) Update on Ali266, the optimized VVC encoder implementation by Alibaba [X. Dong, S. Fang, Z. Huang, J. Liu, S. Xu, R. Yang, L. Yu, J. Chen, R.-L. Liao, Y. Ye (Alibaba)]

[JVET-Y0136](https://jvet-experts.org/doc_end_user/current_document.php?id=11330) Update on open, optimized VVC implementations VVenC and VVdeC [A. Wieckowski, J. Brandenburg, C. Bartnik, V. George, J. Güther, G. Hege, C. Helmrich, A. Henkel, T. Hinz, C. Lehmann, C. Stoffers, I. Zupancic, B. Bross, H. Schwarz, D. Marpe, T. Schierl (HHI)] [late] [miss]

## AHG7: Low latency and constrained complexity (7)

Contributions in this area were discussed in session X at XXXX–XXXX UTC on XXday X Jan. 2022 (chaired by XXX).

[JVET-Y0041](https://jvet-experts.org/doc_end_user/current_document.php?id=11233) AHG7: Proposed new class of gaming sequences with depth and optical flow information [G. Martin-Cocher, M. Badawi, T. Poirier, S. Puri, K. Naser (InterDigital)]

[JVET-Y0042](https://jvet-experts.org/doc_end_user/current_document.php?id=11234) AHG7: Modification of and new classes of sequences [G. Martin-Cocher (InterDigital)]

[JVET-Y0043](https://jvet-experts.org/doc_end_user/current_document.php?id=11235) AHG7: LLCC Scenarios and baseline configurations [G. Martin-Cocher, S. Puri, T. Poirier, K. Naser (InterDigital), J. Xu (Bytedance), D. Nicholson (Ektacom), M. Sychev (Huawei), L. Wang (Nokia), S. Liu, W. Yang (Tencent), J. M. Tiesse (VITEC), M. Karczewicz (Qualcomm)]

[JVET-Y0060](https://jvet-experts.org/doc_end_user/current_document.php?id=11254) AHG7: refined LLCC configurations [G. Martin-Cocher, K. Nasser, T. Poirier, S. Puri (InterDigital)]

[JVET-Y0101](https://jvet-experts.org/doc_end_user/current_document.php?id=11295) AHG7/AHG10: Depth motion based fast Multi-Type Tree Splitting [S. Puri, K. Naser, T. Poirier, G. Martin-Cocher (InterDigital)]

[JVET-Y0162](https://jvet-experts.org/doc_end_user/current_document.php?id=11356) AHG7: Gradual Decoding Refresh for ECM [S. Hong, L. Wang, K. Panusopone (Nokia), T. Poirier, G. Martin-Cocher (InterDigital)] [late] [miss]

[JVET-Y0163](https://jvet-experts.org/doc_end_user/current_document.php?id=11357) AHG7: New Gradual Decoding Refresh for ECM [L. Wang, S. Hong, K. Panusopone, M. M. Hannuksela, J. Lainema (Nokia)] [late] [miss]

## AHG10: Encoding algorithm optimization (10)

Contributions in this area were discussed in session X at XXXX–XXXX UTC on XXday X Jan. 2022 (chaired by XXX).

[JVET-Y0048](https://jvet-experts.org/doc_end_user/current_document.php?id=11240) AHG10: study of layer bitrate allocation for spatial scalability in VTM [P. de Lagrange, F. Urban, G. Marquant (InterDigital)]

[JVET-Y0077](https://jvet-experts.org/doc_end_user/current_document.php?id=11271) AHG10: Block importance mapping [P. Wennersten, J. Enhorn, C. Hollmann, J. Ström (Ericsson)]

[JVET-Y0083](https://jvet-experts.org/doc_end_user/current_document.php?id=11277) AHG4/AHG10: Report of Teleconference on Viewing Session Preparation for Deblocking [M. Wien, H. Zhang, X. Li]

[JVET-Y0085](https://jvet-experts.org/doc_end_user/current_document.php?id=11279) AHG10: Report of Deblocking filter setting for VTM [H. Zhang, J. Jung, X. Li, S. Liu (Tencent)]

[JVET-Y0101](https://jvet-experts.org/doc_end_user/current_document.php?id=11295) AHG7/AHG10: Depth motion based fast Multi-Type Tree Splitting [S. Puri, K. Naser, T. Poirier, G. Martin-Cocher (InterDigital)]

[JVET-Y0105](https://jvet-experts.org/doc_end_user/current_document.php?id=11299) AHG10: An improved VVC rate control scheme [G. Ren, J. Jia, J. Wang, Z. Chen (Wuhan Univ.), Z. Liu (Tencent)]

[JVET-Y0118](https://jvet-experts.org/doc_end_user/current_document.php?id=11312) AHG10: On Temporal-Layer-Based ChromaQP Coding [K. Sato, Y. Yu, H. Yu, Z. Xie, L. Xu, F. Wang, H. Huang, J. Gan, D. Wang (OPPO)]

[JVET-Y0126](https://jvet-experts.org/doc_end_user/current_document.php?id=11320) AHG10: VTM encoder configurations for tests targeting improved coding performance [D. Rusanovskyy, M. Karczewicz (Qualcomm), K. Andersson, R. Sjöberg, L. Litwic (Ericsson), P. Nikitin, G. Martin-Cocher (InterDigital), A. Wieckowski, J. Brandenburg, B. Bross (HHI)]

[JVET-Y0152](https://jvet-experts.org/doc_end_user/current_document.php?id=11346) AHG10: Fast skip of TT split partitioning on top of ECM reference software [L.-F. Chen, X. Li, S. Liu (Tencent)]

[JVET-Y0155](https://jvet-experts.org/doc_end_user/current_document.php?id=11349) AHG10: Fixes and clean up for temporal prefilter [F. Bossen (Sharp)] [late] [miss]

## Profile/tier/level specification (5)

Contributions in this area were discussed in session X at XXXX–XXXX UTC on XXday X Jan. 2022 (chaired by XXX).

[JVET-Y0056](https://jvet-experts.org/doc_end_user/current_document.php?id=11250) AHG2: High tier for lower levels [S. Keating, A. Browne, K. Sharman (Sony)]

[JVET-Y0057](https://jvet-experts.org/doc_end_user/current_document.php?id=11251) AHG2: MinCr for still picture profiles [S. Keating, A. Browne, K. Sharman (Sony)]

[JVET-Y0063](https://jvet-experts.org/doc_end_user/current_document.php?id=11257) AHG2: On Main 10 4:4:4 Still Picture profile for VVC v1 and v2 [M. Pettersson, R. Sjöberg, M. Damghanian (Ericsson)]

[JVET-Y0072](https://jvet-experts.org/doc_end_user/current_document.php?id=11266) New Levels for HEVC and VVC [A. M. Tourapis, D. Singer, K. Kolarov (Apple)] [late] [miss]

[JVET-Y0099](https://jvet-experts.org/doc_end_user/current_document.php?id=11293) VVC level 4.2 [G. Martin-Cocher (InterDigital)]

## Proposed modification of system interface (0)

Contributions in this area were discussed in session X at XXXX–XXXX UTC on XXday X Jan. 2022 (chaired by XXX).

See the notes on this topic from the joint meeting in section 7.4.

# Low-level tool technology proposals

## AHG8: High bit rate and high bit depth coding for VVC (1)

Contributions in this area were discussed in session X at XXXX–XXXX UTC on XXday X Jan. 2022 (chaired by XXX).

[JVET-Y0049](https://jvet-experts.org/doc_end_user/current_document.php?id=11241) AHG2/AHG8: On the range extensions GCI flags [Y.-K. Wang (Bytedance)]

## AHG11: Neural network-based video coding (22)

### BoG reports

[JVET-Y0045](https://jvet-experts.org/doc_end_user/current_document.php?id=11237) AHG11/EE1 viewing preparation report [[E. Alshina](mailto:elena.alshina@huawei.com), M. Wien, A. Segall]

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

Contributions in this area were discussed in session X at XXXX–XXXX UTC on XXday X Jan. 2022 (chaired by XXX).

[JVET-Y0061](https://jvet-experts.org/doc_end_user/current_document.php?id=11255) EE1-2.1: Super Resolution with existing VVC functionality [E. Alshina, J. Sauer (Huawei]

[JVET-Y0069](https://jvet-experts.org/doc_end_user/current_document.php?id=11263) EE1-2.3: CNN-based Super Resolution for Video Coding Using Decoded Information [C. Lin, Y. Li, K. Zhang, L. Zhang (Bytedance)]

[JVET-Y0169](https://jvet-experts.org/doc_end_user/current_document.php?id=11376) Crosscheck of JVET-Y0069 (EE1-2.3: CNN-based Super Resolution for Video Coding Using Decoded Information) [J. Sauer (Huawei)] [late]

[JVET-Y0070](https://jvet-experts.org/doc_end_user/current_document.php?id=11264) EE1-2.4: CNN-based Super Resolution for Video Coding Using Separate Networks for Chroma Components [C. Lin, Y. Li, K. Zhang, L. Zhang (Bytedance)]

[JVET-Y0078](https://jvet-experts.org/doc_end_user/current_document.php?id=11272) EE1-1.1: neural network based in-loop filter with constrained storage and low complexity [L. Wang, X. Xu, S. Liu (Tencent)]

[JVET-Y0082](https://jvet-experts.org/doc_end_user/current_document.php?id=11276) EE1-3.1: intra prediction using neural networks [T. Dumas, F. Galpin, P. Bordes, E. François (InterDigital)]

[JVET-Y0084](https://jvet-experts.org/doc_end_user/current_document.php?id=11278) EE1-1.3: A Deep In-Loop Filter [X. Zhang, D. Jiang, J. Lin, C. Fang, S. Peng (Dahua)]

[JVET-Y0143](https://jvet-experts.org/doc_end_user/current_document.php?id=11337) EE1-1.2: Test on Deep In-Loop Filter with Adaptive Parameter Selection and Residual Scaling [Y. Li, K. Zhang, L. Zhang (Bytedance), H. Wang, K. Reuzé, A.M. Kotra, M. Karczewicz (Qualcomm)]

[JVET-Y0166](https://jvet-experts.org/doc_end_user/current_document.php?id=11373) Crosscheck of EE1-1.2.1 from JVET-Y0143 (EE1-1.2: Test on Deep In-Loop Filter with Adaptive Parameter Selection and Residual Scaling) [J. Ström (Ericsson)] [late]

### EE1 related contributions: Neural network-based video coding (5)

Contributions in this area were discussed in session X at XXXX–XXXX UTC on XXday X Jan. 2022 (chaired by XXX).

[JVET-Y0068](https://jvet-experts.org/doc_end_user/current_document.php?id=11262) EE1-2.1-related: RPR encoder with multiple scale factors [J. Nam, S. Yoo, J. Lim, S. Kim (LGE)]

[JVET-Y0079](https://jvet-experts.org/doc_end_user/current_document.php?id=11273) EE1-1.1-related: the result of neural network based in-loop filter on ECM [L. Wang, X. Xu, S. Liu (Tencent)]

[JVET-Y0080](https://jvet-experts.org/doc_end_user/current_document.php?id=11274) EE1-1.1-related: alternative filter designs [L. Wang, X. Xu, S. Liu (Tencent)]

[JVET-Y0087](https://jvet-experts.org/doc_end_user/current_document.php?id=11281) AHG11: An Improved CNN-based Super Resolution Method [S. Peng, D. Jiang, J. Lin, C. Fang, X. Zhang (Dahua)]

[JVET-Y0098](https://jvet-experts.org/doc_end_user/current_document.php?id=11292) EE1-related: Combination of VVC deblocking and NN loop filtering [K. Andersson, J. Ström, D. Liu, R. Sjöberg (Ericsson)]

### Other NN technology related conributions (10)

Contributions in this area were discussed in session X at XXXX–XXXX UTC on XXday X Jan. 2022 (chaired by XXX).

[JVET-Y0046](https://jvet-experts.org/doc_end_user/current_document.php?id=11238) AHG11: ALF improvement for NNVC [W. Zou, Y. Zhou (Xidian Univ.), C. Huang, Y. X. Bai (ZTE)]

[JVET-Y0051](https://jvet-experts.org/doc_end_user/current_document.php?id=11245) AHG11: Deep omnidirectional video compression in YUV domain [Q. Qin, C. Jung (Xidian University), D. Zou, M. Li (OPPO)]

[JVET-Y0052](https://jvet-experts.org/doc_end_user/current_document.php?id=11246) AHG11: CNN post-processing filter based on depthwise separable convolution and attention mechanism [H. Zhang, C. Jung (Xidian University), D. Zou, M. Li (OPPO)]

[JVET-Y0059](https://jvet-experts.org/doc_end_user/current_document.php?id=11253) AHG11: Content-adaptive post-processing filter [M. Santamaria, J. Lainema, F. Cricri, R. G. Youvalari, H. Zhang, G. Rangu, H. R. Tavakoli, H. Afrabandpey, M. M. Hannuksela (Nokia)]

[JVET-Y0081](https://jvet-experts.org/doc_end_user/current_document.php?id=11275) AHG11: Transformer based in-loop filtering [T. Ouyang, H. Wang, H. Zhu, Z. Chen (Wuhan University)] [late] [miss]

[JVET-Y0086](https://jvet-experts.org/doc_end_user/current_document.php?id=11280) AHG11: A Unet-Based Deep In-Loop Filter [X. Zhang, D. Jiang, J. Lin, C. Fang, S. Peng (Dahua)]

[JVET-Y0090](https://jvet-experts.org/doc_end_user/current_document.php?id=11284) AHG11: Neural Network Based Motion Compensation Enhancement for Video Coding [C. Ma, R.-L. Liao, Y. Ye (Alibaba)]

[JVET-Y0096](https://jvet-experts.org/doc_end_user/current_document.php?id=11290) AHG11: NN-based Reference Frame Interpolation for VVC Hierarchical Coding Structure [Z. Liu, X. Xu, S. Liu (Tencent), Y. Guo, Z. Chen (Wuhan Univ.)]

[JVET-Y0110](https://jvet-experts.org/doc_end_user/current_document.php?id=11304) AHG11: Small Ad-hoc Deep-Learning Library (SADL) update [F. Galpin, F. Mom, T. Dumas, P. Bordes, P. Nikitin, E. François (InterDigital)]

[JVET-Y0111](https://jvet-experts.org/doc_end_user/current_document.php?id=11305) AHG11: Hybrid Conventional/Deep-learning-based image coding [F. Galpin, T. Dumas, P. Bordes, F. Racapé, E. François (InterDigital), Y. Li, Kai Zhang, Li Zhang (Bytedance), H. Wang, K. Reuzé, A.M. Kotra, M. Karczewicz (Qualcomm)]

### NN related HLS signalling (4)

Contributions in this area were discussed in session X at XXXX–XXXX UTC on XXday X Jan. 2022 (chaired by XXX).

[JVET-Y0073](https://jvet-experts.org/doc_end_user/current_document.php?id=11267) AHG9: Colour component description for post-filter purpose SEI message [T. Chujoh, Y. Yasugi, K. Takada, T. Ikai (Sharp)]

[JVET-Y0074](https://jvet-experts.org/doc_end_user/current_document.php?id=11268) AHG9: Data conversion description for NNR post-filter SEI message [Y. Yasugi, T. Chujoh, K. Takada, T. Ikai (Sharp)]

[JVET-Y0075](https://jvet-experts.org/doc_end_user/current_document.php?id=11269) AHG9: Complexity description for NNR post-filter SEI message [K. Takada, Y. Yasugi, T. Chujoh, T. Ikai (Sharp)]

[JVET-Y0115](https://jvet-experts.org/doc_end_user/current_document.php?id=11309) AHG9: On post-filter SEI [M. M. Hannuksela, M. Santamaria, F. Cricri, E. B. Aksu, H. R. Tavakoli (Nokia)]

## AHG12: Enhanced compression beyond VVC capability (55)

### EE2 contributions: Enhanced compression beyond VVC capability (18)

Contributions in this area were discussed in session X at XXXX–XXXX UTC on XXday X Jan. 2022 (chaired by XXX).

[JVET-Y0058](https://jvet-experts.org/doc_end_user/current_document.php?id=11252) EE2-3.13: Modifications of IBC Merge/AMVP List Construction [N. Zhang, K. Zhang, L. Zhang, J. Xu (Bytedance)]

[JVET-Y0065](https://jvet-experts.org/doc_end_user/current_document.php?id=11259) EE2-3.1: GPM with inter and intra prediction (JVET-X0166) [Y. Kidani, H. Kato, K. Kawamura (KDDI), H. Jang, S. Kim, J. Lim (LGE), Z. Deng, K. Zhang, L. Zhang (Bytedance)]

[JVET-Y0067](https://jvet-experts.org/doc_end_user/current_document.php?id=11261) EE2-3.9 and EE2-3.10: TM based reordering for MMVD and affine MMVD and MVD sign prediction [M. Salehifar, Y. He, K. Zhang, N. Zhang, L. Zhang (Bytedance), Y. Zhang, B. Ray, H. Huang, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-Y0093](https://jvet-experts.org/doc_end_user/current_document.php?id=11287) EE2-3.3: On TMVP improvement [R.-L. Liao, J. Chen, Y. Ye, X. Li (Alibaba)]

[JVET-Y0094](https://jvet-experts.org/doc_end_user/current_document.php?id=11288) EE2-4.1: Test Results on Sign Prediction Improvement J. Chen, Y. Yan, R.-L. Liao, X. Li (Alibaba)]

[JVET-Y0100](https://jvet-experts.org/doc_end_user/current_document.php?id=11294) EE2-3.2: Pairwise merge candidate [G. Laroche, P. Onno, R. Bellessort (Canon)]

[JVET-Y0106](https://jvet-experts.org/doc_end_user/current_document.php?id=11300) EE2-5.1: Edge-based classifier for Cross-component Sample Adaptive Offset (CCSAO) [A. M. Kotra, N. Hu, V. Seregin, M. Karczewicz (Qualcomm), C.-W. Kuo, X. Xiu, Y.-W. Chen, H.-J. Jhu, W. Chen, N. Yan, X. Wang (Kwai)]

[JVET-Y0116](https://jvet-experts.org/doc_end_user/current_document.php?id=11310) EE2-2.1: Extended MRL candidate list [K. Cao, Y.-J. Chang, B. Ray, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-Y0171](https://jvet-experts.org/doc_end_user/current_document.php?id=11378) Cross-check of JVET-Y0116 (Test 2.1a): EE2-2.1: Extended MRL candidate list [K. Sato (OPPO)] [late] [miss]

[JVET-Y0132](https://jvet-experts.org/doc_end_user/current_document.php?id=11326) EE2-3.7: On the increased number of TM merge candidates [Y.-J. Chang, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-Y0134](https://jvet-experts.org/doc_end_user/current_document.php?id=11328) EE2-3.4, EE2-3.5, EE2-3.6: Experimental results of the MV candidates reordering in candidate types based on template matching costs [Y.-J. Chang, H. Huang, V. Seregin, C.-C. Chen, M. Karczewicz (Qualcomm), R.-L. Liao, J. Chen, Y. Ye, X. Li (Alibaba), L. Zhao, K. Zhang, N. Zhang, L. Zhang (Bytedance), G. Laroche, P. Onno, R. Bellessort (Canon)]

[JVET-Y0137](https://jvet-experts.org/doc_end_user/current_document.php?id=11331) EE2-4.2: Enhanced sign prediction [X. Xiu, Y.-W. Chen, N. Yan, C.-W. Kuo, H.-J. Jhu, W. Chen, X. Wang (Kwai)]

[JVET-Y0138](https://jvet-experts.org/doc_end_user/current_document.php?id=11332) EE2-4.3: Combined Test Results of EE2-4.1 and EE2-4.2 on Sign Prediction [J. Chen, Y. Ye, R.-L. Liao, X. Li (Alibaba), X. Xiu, Y.-W. Chen, N. Yan, C.-W. Kuo, H.-J. Jhu, W. Chen, X. Wang (Kwai)]

[JVET-Y0142](https://jvet-experts.org/doc_end_user/current_document.php?id=11336) EE2-4.4: adaptive intra MTS [B. Ray, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-Y0145](https://jvet-experts.org/doc_end_user/current_document.php?id=11339) EE2-3.12a: History-parameter-based affine model inheritance [K. Zhang, L. Zhang, Z. Deng, N. Zhang, Y. Wang (Bytedance)]

[JVET-Y0146](https://jvet-experts.org/doc_end_user/current_document.php?id=11340) EE2-3.12b/c: A joint test of EE-2.3.11 and EE-2.3.12a [K. Zhang, L. Zhang, Z. Deng, N. Zhang, Y. Wang (Bytedance), W. Chen, X. Xiu, Y.-W. Chen, H.-J. Jhu, C.-W. Kuo, X. Wang (Kwai)]

[JVET-Y0147](https://jvet-experts.org/doc_end_user/current_document.php?id=11341) EE2-5.2: Adaptive Filter Shape Selection for ALF [W. Yin, K. Zhang, L. Zhang (Bytedance), N. Hu, V. Seregin, M. Karczewicz (Qualcomm), M. G. Sarwer, R.-L. Liao, J. Chen, Y. Yan, X. Li (Alibaba)]

[JVET-Y0150](https://jvet-experts.org/doc_end_user/current_document.php?id=11344) EE2-1: Tests on unsymmetric partitioning methods [K. Zhang, L. Zhang, Z. Deng, N. Zhang, Y. Wang (Bytedance), F. Urban, K. Naser, F. Galpin (InterDigital)]

[JVET-Y0153](https://jvet-experts.org/doc_end_user/current_document.php?id=11347) EE2-3.11: Non-adjacent spatial neighbors for affine merge mode [W. Chen, X. Xiu, Y.-W. Chen, H.-J. Jhu, C.-W. Kuo, X. Wang (Kwai)]

### EE2 related contributions (13)

Contributions in this area were discussed in session X at XXXX–XXXX UTC on XXday X Jan. 2022 (chaired by XXX).

[JVET-Y0088](https://jvet-experts.org/doc_end_user/current_document.php?id=11282) EE2-related: IBC with Template Matching [A. Robert, K. Naser, T. Poirier, Y. Chen, F. Galpin (InterDigital)]

[JVET-Y0119](https://jvet-experts.org/doc_end_user/current_document.php?id=11313) EE2-related: On Extended MRL Intra Prediction [K. Sato, Y. Yu, H. Yu, Z. Xie, L. Xu, F. Wang, H. Huang, J. Gan, D. Wang (OPPO)]

[JVET-Y0120](https://jvet-experts.org/doc_end_user/current_document.php?id=11314) EE2-related: Non-adjacent temporal MVP [F. Wang, Z. Xie, Y. Yu, H. Yu, L. Xu, K. Sato, J. Gan, D. Wang (OPPO)]

[JVET-Y0121](https://jvet-experts.org/doc_end_user/current_document.php?id=11315) EE2-4.2-related: On adaptive sign prediction position selection [L. Xu, Y. Yu, H. Yu, Z. Xie, F. Wang, D. Wang (OPPO)]

[JVET-Y0130](https://jvet-experts.org/doc_end_user/current_document.php?id=11324) EE2-related: Unification of availability check for intra mode coding [S. Yoo, H. Jang, J. Nam, J. Choi, J. Lim, S. Kim (LGE)]

[JVET-Y0131](https://jvet-experts.org/doc_end_user/current_document.php?id=11325) EE2-related: Clean-up on DIMD [S. Yoo, H. Jang, J. Nam, J. Choi, J. Lim, S. Kim (LGE)]

[JVET-Y0133](https://jvet-experts.org/doc_end_user/current_document.php?id=11327) EE2-related: BVP candidate adjustment based on IBC reference region implemented on top of test EE2-3.13 [D. Ruiz Coll, A. Filippov, V. Rufitskiy, T. M. Bae (Ofinno)] [late] [miss]

[JVET-Y0140](https://jvet-experts.org/doc_end_user/current_document.php?id=11334) EE2-related: On the LCU boundary processing by intra-prediction tools [A. Filippov, V. Rufitskiy, D. Ruiz Coll (Ofinno)] [late] [miss]

[JVET-Y0141](https://jvet-experts.org/doc_end_user/current_document.php?id=11335) EE2-4.3 related: More combined test results for sign prediction [J. Chen, Y. Ye, R.-L. Liao, X. Li (Alibaba), X. Xiu, Y.-W. Chen, N. Yan, C.-W. Kuo, H.-J. Jhu, W. Chen, X. Wang (Kwai)]

[JVET-Y0149](https://jvet-experts.org/doc_end_user/current_document.php?id=11343) EE2-related: Modifications of the extended MRL candidate list [A. Filippov, V. Rufitskiy, E. Dinan (Ofinno)] [late] [miss]

[JVET-Y0159](https://jvet-experts.org/doc_end_user/current_document.php?id=11353) EE2-related: inter MTS refinement on adaptive intra MTS (EE2-4.4) [T. Hashimoto, T. Ikai (Sharp)]

[JVET-Y0160](https://jvet-experts.org/doc_end_user/current_document.php?id=11354) EE2-3.13-related: Enlarged HMVP table for IBC [N. Zhang, K. Zhang, L. Zhang (Bytedance)]

[JVET-Y0161](https://jvet-experts.org/doc_end_user/current_document.php?id=11355) EE2-3.12-related: Extensions of history-parameter-based affine model inheritance [K. Zhang, L. Zhang, Z. Deng, N. Zhang, Y. Wang (Bytedance)]

### ECM modifications beyond EE2 (24)

Contributions in this area were discussed in session X at XXXX–XXXX UTC on XXday X Jan. 2022 (chaired by XXX).

[JVET-Y0055](https://jvet-experts.org/doc_end_user/current_document.php?id=11249) AHG12: Slope adjustment for CCLM [J. Lainema, A. Aminlou, P. Astola, R. G. Youvalari (Nokia)]

[JVET-Y0062](https://jvet-experts.org/doc_end_user/current_document.php?id=11256) Non-EE2: Cross-component palette coding [B. Vishwanath, K. Zhang, L. Zhang (Bytedance)]

[JVET-Y0076](https://jvet-experts.org/doc_end_user/current_document.php?id=11270) Non-EE2: Template Matching-based OBMC Design [Z. Lv, C. Zhou, J. Zhang (vivo)]

[JVET-Y0164](https://jvet-experts.org/doc_end_user/current_document.php?id=11371) Crosscheck of JVET-Y0076 (Non-EE2: Template Matching-based OBMC Design) [Y.-J. Chang (Qualcomm)] [late] [miss]

[JVET-Y0089](https://jvet-experts.org/doc_end_user/current_document.php?id=11283) Non-EE2: DMVR with BCW enabled [P. Bordes, A. Robert, Y. Chen, F. Galpin (InterDigital)]

[JVET-Y0091](https://jvet-experts.org/doc_end_user/current_document.php?id=11285) Non-EE2: MVP refinement for regular AMVP mode [C. Zhou, Z. Lv, J. Zhang (vivo)]

[JVET-Y0092](https://jvet-experts.org/doc_end_user/current_document.php?id=11286) Non-EE2: On chroma intra prediction mode [X. Li, R.-L. Liao, J. Chen, Y. Ye (Alibaba)]

[JVET-Y0095](https://jvet-experts.org/doc_end_user/current_document.php?id=11289) Non-EE2: RPR with luma-only re-scaling [P. Bordes, F. Galpin, E. François (InterDigital)]

[JVET-Y0168](https://jvet-experts.org/doc_end_user/current_document.php?id=11375) Cross-check of JVET-Y0095 "Non-EE2: RPR with luma-only re-scaling" [F. Le Léannec (Xiaomi)] [late] [miss]

[JVET-Y0097](https://jvet-experts.org/doc_end_user/current_document.php?id=11291) AhG12: Removed DIMD from MPM list of TIMD [K. Naser, T. Dumas, Y. Chen, F. Galpin (InterDigital)]

[JVET-Y0102](https://jvet-experts.org/doc_end_user/current_document.php?id=11296) On the balance of ECM coding gains between luma and chroma [F. Le Léannec, P. Andrivon, E. Thomas (Xiaomi)]

[JVET-Y0109](https://jvet-experts.org/doc_end_user/current_document.php?id=11303) AHG12: Neural Network-based intra prediction [T. Dumas, F. Galpin, P. Bordes, F. Mom, E. François (InterDigital)]

[JVET-Y0113](https://jvet-experts.org/doc_end_user/current_document.php?id=11307) Adjusting luma/chroma BD-rate balance in ECM [Y. Chen, E. François, P. Nikitin (InterDigital)]

[JVET-Y0114](https://jvet-experts.org/doc_end_user/current_document.php?id=11308) Non-EE2: Dependent quantization with 4 states for chroma components [Y. Chen, E. François, F. Galpin, P. de Lagrange (InterDigital)]

[JVET-Y0170](https://jvet-experts.org/doc_end_user/current_document.php?id=11377) Crosscheck of JVET-Y0114 (Non-EE2: Dependent quantization with 4 states for chroma components) [T. Lu (Dolby)] [late] [miss]

[JVET-Y0124](https://jvet-experts.org/doc_end_user/current_document.php?id=11318) Non-EE2: Intra Block Copy with An Extended Reference Area [J. Xu (ByteDance)]

[JVET-Y0125](https://jvet-experts.org/doc_end_user/current_document.php?id=11319) AHG12: Enhanced bi-directional motion compensation [Y.-W. Chen, C.-W. Kuo, N. Yan, W. Chen, X. Xiu, X. Wang (Kwai Inc.)]

[JVET-Y0128](https://jvet-experts.org/doc_end_user/current_document.php?id=11322) Non-EE2: fixing issues for RPR enabling and non-CTC configuration in ECM [Z. Zhang, H. Huang, C.-C. Chen, V. Seregin, M. Karczewicz (Qualcomm), P. Bordes (InterDigital)]

[JVET-Y0129](https://jvet-experts.org/doc_end_user/current_document.php?id=11323) Non-EE2: MVD and merge index signaling of AMVP-merge mode [Z. Zhang, H. Huang, C.-C. Chen, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-Y0135](https://jvet-experts.org/doc_end_user/current_document.php?id=11329) Non-EE2: Template matching based reordering for GPM split modes [C.-C. Chen, H. Huang, Y. Zhang, Z. Zhang, Y.-J. Chang, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-Y0139](https://jvet-experts.org/doc_end_user/current_document.php?id=11333) Non-EE2: On the extended number of active reference pictures and reference picture reordering [H. Huang, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-Y0144](https://jvet-experts.org/doc_end_user/current_document.php?id=11338) Non-EE2: DIMD Flag Signalling Clean-up [J. Zhao, S. Kim (LGE)]

[JVET-Y0148](https://jvet-experts.org/doc_end_user/current_document.php?id=11342) Non-EE2: Spatial-Temporal Adaptive Loop Filter [W. Yin, K. Zhang, Y. Li, H. Liu, L. Zhang (Bytedance)]

[JVET-Y0151](https://jvet-experts.org/doc_end_user/current_document.php?id=11345) Non-EE2: Adaptive re-ordering of merge candidates with refined motion [Y. Wang, K. Zhang, N. Zhang, Z. Deng, L. Zhang (Bytedance)]

[JVET-Y0154](https://jvet-experts.org/doc_end_user/current_document.php?id=11348) AHG12: Bilinear Interpolation Filtering for ARMC [W. Chen, X. Xiu, H. Gao, Y.-W. Chen, X. Wang (Kwai)]

[JVET-Y0157](https://jvet-experts.org/doc_end_user/current_document.php?id=11351) AHG12: Improved probability estimation for CABAC [X. Xiu, Y.-W. Chen, W. Chen, H. Gao, H.-J. Jhu, C.-W. Kuo, X. Wang (Kwai)]

[JVET-Y0172](https://jvet-experts.org/doc_end_user/current_document.php?id=11379) Non-EE2: Long tap interpolation filtering on chroma components [X. Xie, K. Zhang, L. Zhang, J. Li, M. Wang, S. Wang (Bytedance)] [late]

# High-level syntax (HLS) proposals (12)

## AHG9: SEI message studies and proposals (9)

Contributions in this area were discussed in session X at XXXX–XXXX UTC on XXday X Jan. 2022 (chaired by XXX).

[JVET-Y0044](https://jvet-experts.org/doc_end_user/current_document.php?id=11236) AHG9: Signalling of Green metadata and Video Decoding Interface SEI messages in VVC specification [E. François (InterDigital), Y. He (Qualcomm), C. Herglotz (FAU), Y. Lim (Samsung)]

[JVET-Y0050](https://jvet-experts.org/doc_end_user/current_document.php?id=11242) AHG2/AHG9: On the alpha channel information SEI message [Y.-K. Wang (Bytedance)]

[JVET-Y0053](https://jvet-experts.org/doc_end_user/current_document.php?id=11247) AHG9/AHG13: Film grain blending process for film grain characteristics SEI message [Y. He, M. Coban, M. Karczewicz (Qualcomm)]

[JVET-Y0073](https://jvet-experts.org/doc_end_user/current_document.php?id=11267) AHG9: Colour component description for post-filter purpose SEI message [T. Chujoh, Y. Yasugi, K. Takada, T. Ikai (Sharp)]

[JVET-Y0074](https://jvet-experts.org/doc_end_user/current_document.php?id=11268) AHG9: Data conversion description for NNR post-filter SEI message [Y. Yasugi, T. Chujoh, K. Takada, T. Ikai (Sharp)]

[JVET-Y0075](https://jvet-experts.org/doc_end_user/current_document.php?id=11269) AHG9: Complexity description for NNR post-filter SEI message [K. Takada, Y. Yasugi, T. Chujoh, T. Ikai (Sharp)]

[JVET-Y0103](https://jvet-experts.org/doc_end_user/current_document.php?id=11297) AHG9: Down-sample phase indication (SEI message) [P. Bordes, P. de Lagrange, E. François (InterDigital)]

[JVET-Y0104](https://jvet-experts.org/doc_end_user/current_document.php?id=11298) AHG9: Transparency information SEI for transparent screens [E. Thomas, P. Andrivon, F. Le Léannec, M.-L. Champel (Xiaomi)]

[JVET-Y0107](https://jvet-experts.org/doc_end_user/current_document.php?id=11301) AHG9: Text improvement for the film grain SEI [E. Thomas (Xiaomi)]

[JVET-Y0115](https://jvet-experts.org/doc_end_user/current_document.php?id=11309) AHG9: On post-filter SEI [M. M. Hannuksela, M. Santamaria, F. Cricri, E. B. Aksu, H. R. Tavakoli (Nokia)]

[JVET-Y0156](https://jvet-experts.org/doc_end_user/current_document.php?id=11350) AHG9: SEI message with sample phase indication for consistent rendering [F. Bossen, A. Segall (Sharp)]

## Film Grain Synthesis (3)

Contributions in this area were discussed in session X at XXXX–XXXX UTC on XXday X Jan. 2022 (chaired by XXX).

[JVET-Y0053](https://jvet-experts.org/doc_end_user/current_document.php?id=11247) AHG9/AHG13: Film grain blending process for film grain characteristics SEI message [Y. He, M. Coban, M. Karczewicz (Qualcomm)]

[JVET-Y0165](https://jvet-experts.org/doc_end_user/current_document.php?id=11372) Crosscheck of JVET-Y0053 (AHG9/AHG13: Film grain blending process for film grain characteristics SEI message) [M. Radosavljević (InterDigital)] [late] [miss]

[JVET-Y0107](https://jvet-experts.org/doc_end_user/current_document.php?id=11301) AHG9: Text improvement for the film grain SEI [E. Thomas (Xiaomi)]

[JVET-Y0158](https://jvet-experts.org/doc_end_user/current_document.php?id=11352) AHG13: Draft Film Grain Technical Report Text [W. Husak, A. Tourapis, W. Wan, M. Radosavljević, D. Grois] [late] [miss]

## Non-SEI HLS aspects (0)

Contributions in this area were discussed in session X at XXXX–XXXX UTC on XXday X Jan. 2022 (chaired by XXX).

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

## JVET plenaries

Some of the discussions and actions at plenary sessions are noted in this section.

XXday X January XXXX–XXXX:

* Joint meetings:
  + …
* BoG reports
  + …
* Planning of outputs
  + …
* Scheduling, remaining doc reviews
* Whether to hold a hybrid meeting in April 2022
* Review docs from section 4.x

Fri. 21 Jan. 1300-XXXX:

* See notes under sections 8,9,10, and 11.

## Information sharing meetings

In addition to the joint meetings listed below, information sharing sessions with other WGs of the MPEG community were held on Monday 17 Jan. 0500–XXXX, Wednesday 19 Jan. 0500–0600, and Friday 21 Jan. 2100–2300. The status of the work in the MPEG WGs was reviewed at these information sharing sessions.

## Joint meeting with … XXXX–XXXX on XXday X January

The following topics were discussed in this joint session. See also the notes recorded on these topics in other sections of this document.

## BoGs (3)

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

## Liaison communications

The JVET did not directly receive or send any liaison statements at its current meeting. JPEG?

# Project planning

## Software timeline

ECM3 software (including all adoptions) was planned to be available 2 weeks after the meeting.

VTM15 software was planned to be available on 2021-11-15.

## Core experiment and exploration experiment planning

An EE on neural network-based video coding was established, as recorded in output document JVET-X2023.

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-X2024.

Initial versions of these documents were presented and approved in the session 23 on Thursday 14 October.

## 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 near future. 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 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”, 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 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, we would like see comprehensive cross-checking done, with analysis that the description matches the software, and recommendation of value of the tool 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.

Availability of spec text is important to have a detailed understanding of the technology and also to judge what its impact on the complexity of the spec will be. There must also be sufficient time to study it in detail. CE contributions without sufficiently mature draft spec 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 closing plenary on Friday 21 January 2022.

|  |  |  |
| --- | --- | --- |
| **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-X2005 and JVET-X2006). * Collect reports of errata for the VVC, VSEI, HEVC, AVC, CICP, the codepoint usage TR specification and the published HDR-related technical reports and produce the JVET-X1004 errata output collection. * Produce and finalize JVET-X2002 VVC Test Model 15 (VTM 15) Algorithm and Encoder Descriptions. * 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, J. Chen, C. Rosewarne (co-chairs), F. Bossen, J. Boyce, 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. * Propose improvements to the guideline document for developments of the test model software. * Perform comparative tests of test model behaviour using common test conditions. * 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 CTC documents for HM and VTM, as applicable. | F. Bossen, X. Li, K. Sühring (co-chairs), 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 establishing a test plan for VVC scalability features by the next meeting. * 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 in relation to video test materials, including new test materials. * Identify and recommend appropriate test materials for testing the VVC standard and potential future extensions, as well as exploration activities. * Identify missing types of video material, solicit contributions, collect, and make available a variety of video sequence test material. * 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 remote expert viewing for purposes of subjective quality evaluation. * Prepare availability of viewing equipment and facilities arrangements for future meetings. | V. Baroncini, T. Suzuki, M. Wien (co-chairs), E. François, S. Liu, A. Norkin, A. Segall, P. Topiwala, S. Wenger, Y. Ye (vice-chairs) | N |
| **Conformance testing (AHG5)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Study the JVET-X2026 draft conformance testing for operation rage extensions and investigate the need for improvements. * Study the JVET-X2008 draft conformance testing specification and investigate the need for extensions. * Study the requirements of VVC, HEVC, and AVC conformance testing to ensure interoperability. * Maintain and update the conformance bitstream database. * Study additional testing methodologies to fulfil the needs for VVC conformance testing. | D. Rusanovskyy, I. Moccagatta (co-chairs), F. Bossen, K. Kawamura, T. Hashimoto, 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-3.0 software version and the reference configuration encodings according to JVET-X2017 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) | N |
| **Low latency and constrained complexity (AHG7)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Identify key application scenarios (e.g. cloud gaming) and their requirements for low latency and constrained complexity, taking into account aspects of real-time encoding and decoding. * Evaluate and propose new CTC for low latency and constrained complexity application scenarios. * Conduct tests with ECM and VTM to determine the impact of discussed configurations on coding efficiency and run time. * Review current test sequences and if necessary collect new test materials that are suitable for the intended application domains, and establish an applicable dataset in coordination with AHG4. * Coordinate with AHG3 and AHG12 to discuss and recommend configuration(s) applicable to ECM and VTM, taking into account complementarity with existing CTCs. | T. Poirier, S. Liu (co-chairs), L. Wang, J. Xu (vice-chairs) | N |
| **High bit depth, high bit rate, and high frame rate coding (AHG8)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Study the benefits and characteristics of VVC coding tools for high bit depth, high bit rate, and high frame rate coding. * Study lossless coding characteristics of VVC. * Identify technologies for future extension of VVC to support such application usage. * Study the JVET-U2018 testing conditions for high bit depth, high bit rate, and high frame rate coding, and suggest improvements as applicable. * Contribute to the development of software and conformance testing for operation range extensions in coordination with AHG3 and AHG5. * Study the draft text JVET-X2005 and suggest improvements in coordination with AHG 2. * Identify suitable test material for testing of high bit depth, high bit rate, and high frame rate coding in coordination with AHG4. * Study VVC entropy decoding throughput and latency in the cases of high bit depth, high bit rate, and high frame rate coding. | A. Browne, T. Ikai (co-chairs), D. Rusanovskyy, M. Sarwer, X. Xiu, Y. Yu (vice-chairs) | N |
| **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. * Study the draft text JVET-X2006 and suggest improvements in coordination with AHG 2. * Study signalling of essential resampling phase indication and prepare draft text for such signalling. * 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. * Investigate the possible need of mandatory post processing in the context of SEI messages * Study SEI messages defined in HEVC and AVC for potential use in the VVC context. * Coordinate with AHG3 for software support of SEI messages. | J. Boyce, S. McCarthy (co-chairs), C. Fogg, P. de Lagrange, J. Samuelsson, G. J. Sullivan, A. Tourapis, Y.-K. Wang, 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 pre processing 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. * 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 software configuration settings optimized for subjective quality, and coordinate such efforts with AHG3. | P. de Lagrange, R. Sjöberg, A. Tourapis (co-chairs) | N |
| **Neural network-based video coding (AHG11)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Evaluate and quantify 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. * Finalize, conduct and discuss the EE on neural network-based video coding. * Refine the test conditions for NN-based video coding. Generate and distribute anchor encoding, and develop supporting software as needed. * Investigate technical aspects specific to NN-based video coding, such as encoding and decoding complexity of neural networks, design network representation, operation, tensor, on-the-fly network adaption (e.g. updating during encoding) etc; * Study the impact of training (including the impact of loss function) on the performance of candidate technology, and identify suitable materials for training. * Analyse complexity characteristics, perform complexity analysis, and develop complexity reductions of candidate technology. * Refine testing methods for assessment of the effectiveness and complexity of considered technology. * Study the impact of parameter quantization and fixed-point computations in NN-based video coding. * Study and collect information related to near-term and longer-term architectures for neural network-based video coding. * Study and maintain the SADL (Small Adhoc Deep Learning Library). Identify gaps in library support and develop improvements as needed. * Review the outcome of the expert viewing conducted at the meeting, refine the methodology, and prepare viewing for the next meeting. * Coordinate with AHG12 to study the interaction with ECM coding tools. * Contribute to a workshop on NN based technologies with WG 1 and WG 4. * Coordinate with other relevant groups, including SC29/AG5 on visual quality assessment. | E. Alshina, S. Liu, A. Segall (co‑chairs), J. Chen, F. Galpin, J. Pfaff, S. S. Wang, Z. Wang, M. Wien, P. Wu, J. Xu (vice‑chairs) | Y (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 ECM3 algorithm description JVET-X2025. * Study the performance and complexity tradeoff of these video coding tools. * Coordinate with AHG6 on ECM software development. * Refine test conditions in JVET-X2017, generate anchors, identify new test sequences to be added, especially high resolution ones in 8K, in coordination with AHG4. * Analyse the results of exploration experiments described in JVET-X2024 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, X. Li, K. Naser, H. Yang (vice chairs) | N |
| **Film grain technologies (AHG13)**  ([jvet@lists.rwth-aachen.de](mailto:jvet@lists.rwth-aachen.de))   * Study the existing FGC SEI messages in VSEI, HEVC, and AVC. * Study the benefits and characteristics of film grain technologies, including autoregressive and frequency-filtering technologies. * Study encoder technologies for determining values for FGC SEI message syntax elements. * Prepare draft text for a technical report on the use of the FGC SEI message providing examples of different technologies including examples of encoder-side and post-decode processing while considering existing implementations. * Identify potential need for additional film grain technology SEI messages. * Coordinate development of film grain technology software and configuration files. * Study and evaluate available test content (both SDR and HDR) for use in film grain technology development in coordination with AHG4. * Coordinate with AHG3 for software support of the FGC SEI message. | W. Husak, M. Radosavljević, W. Wan (co-chairs), D. Grois, A. Tourapis (vice-chairs) | N |

It was confirmed that the rules which can be found in document ISO/IEC JTC 1/‌SC 29/‌AG 2 N018 “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 however pointed out that JVET does not allow 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 91](https://dms.mpeg.expert/doc_end_user/current_document.php?id=81008&id_meeting=188)) 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 91](https://dms.mpeg.expert/doc_end_user/current_document.php?id=81008&id_meeting=188), as noted in section 9.

[JVET-X1000](https://jvet-experts.org/doc_end_user/current_document.php?id=11222) Meeting Report of the 24th JVET Meeting [J.-R. Ohm] [WG 5 N 82] (2021-11-12)

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

Remains valid – not updated: [JCTVC-H1001](http://phenix.it-sudparis.eu/jct/doc_end_user/current_document.php?id=5095) HEVC software guidelines [K. Sühring, D. Flynn, F. Bossen (software coordinators)]

Remains valid – not updated: [JVET-V1002](https://jvet-experts.org/doc_end_user/current_document.php?id=10846) High Efficiency Video Coding (HEVC) Test Model 16 (HM 16) Encoder Description Update 15 [C. Rosewarne (primary editor), K. Sharman, R. Sjöberg, G. J. Sullivan (co-editors)]

Remains valid – not updated: [JVET-T1003](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10535) Revised coding-independent code points for video signal type identification (Draft 2) [G. J. Sullivan, T. Suzuki, A. Tourapis]

[JVET-X1004](https://jvet-experts.org/doc_end_user/current_document.php?id=11223) Errata report items for VVC, VSEI, HEVC, AVC, Video CICP, and CP usage TR [B. Bross, C. Rosewarne, G. J. Sullivan, Y. Syed, Y.-K. Wang] (2021-12-31, near next meeting)

[JVET-X1005](https://jvet-experts.org/doc_end_user/current_document.php?id=11224) New level for HEVC (Draft 1) [T. Suzuki] (2021-10-29)

This was reviewed in session 23 Thursday 14 Oct.

Remains valid – not updated [JVET-T1006](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10538) Annotated regions and shutter interval information SEI messages for AVC (Draft 2) [J. Boyce, S. McCarthy, Y.-K. Wang]

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]

Remains valid – not updated: [JCTVC-X1009](http://phenix.it-sudparis.eu/jct/doc_end_user/current_document.php?id=10572) Common Test Conditions for SHVC [V. Seregin, Y. He]

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]

No output: JVET-T1011 through JVET-T1013

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 for HM – not updated: [JCTVC-Z1015](http://phenix.it-sudparis.eu/jct/doc_end_user/current_document.php?id=10689) Common Test Conditions for Screen Content Coding [H. Yu, R. Cohen, K. Rapaka, J. Xu]

No output: JVET-X1016 through JVET-X1019

Remains valid for HM – not updated: [JCTVC-Z1020](http://phenix.it-sudparis.eu/jct/doc_end_user/current_document.php?id=10692) Common Test Conditions for HDR/WCG Video Coding Experiments [E. François, J. Sole, J. Ström, P. Yin]

Remains valid for HM – not updated: [JVET-U1100](https://jvet-experts.org/doc_end_user/current_document.php?id=10675) Common Test Conditions for HM Video Coding Experiments [K. Sühring, K. Sharman] (2021-02-01)

Remains valid – not updated: [JVET-T2001](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10540) Versatile Video Coding Draft 10 [B. Bross, J. Chen, S. Liu, Y.-K. Wang]

[JVET-X2002](https://jvet-experts.org/doc_end_user/current_document.php?id=11225) Algorithm description for Versatile Video Coding and Test Model 15 (VTM 15) [A. Browne, J. Chen, Y. Ye, S. Kim] [WG 5 N 92] (2021-12-31, near next meeting)

New descriptiom elements: WPP for version 2, FGS as in software, and multiple APS for subpictures

Remains valid – not updated: [JVET-N1003](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=6638) Guidelines for VVC reference software development [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-X2005](https://jvet-experts.org/doc_end_user/current_document.php?id=11226) VVC operation range extensions (Draft 5) [F. Bossen, B. Bross, T. Ikai, D. Rusanovskyy, G. J. Sullivan, Y.-K. Wang] (2021-11-12)

To be integrated into v2 of VVC by next meeting

[JVET-X2006](https://jvet-experts.org/doc_end_user/current_document.php?id=11227) Additional SEI messages for VSEI (Draft 5) [J. Boyce, G. J. Sullivan, Y.-K. Wang] (2021-11-12)

To be integrated into v2 of VSEI by next meeting

Remains valid – not updated: [JVET-S2007](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=9679) Versatile supplemental enhancement information messages for coded video bitstreams Draft 5 [J. Boyce, V. Drugeon, G. J. Sullivan, Y.-K. Wang]

[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] (2021-11-30)

The basis is document JVET-X0161 which had been reviewed and approved during the meeting.

Was issued as ISO/IEC FDIS 23090-15 as [WG 5 N 84](https://dms.mpeg.expert/doc_end_user/current_document.php?id=81001&id_meeting=188) (and bitstreams attached or sent to the secretary)

A DoCR ([WG 5 N 83](https://dms.mpeg.expert/doc_end_user/current_document.php?id=81000&id_meeting=188)) of the NB comments received in [m57766](https://dms.mpeg.expert/doc_end_user/current_document.php?id=80226&id_meeting=188) from the ISO/IEC JTC 1/SC 29 DIS ballot was reviewed Thursday 14 October in session 23.

Remains valid – not updated: [JVET-U2009](https://jvet-experts.org/doc_end_user/current_document.php?id=10680) Reference software for versatile video coding (Draft 2) [F. Bossen, K. Sühring, X. Li] (2021-03-31)

A draft DoCR ([WG 5 N 87](https://dms.mpeg.expert/doc_end_user/current_document.php?id=81004&id_meeting=188)) of the NB comments received in [m57767](https://dms.mpeg.expert/doc_end_user/current_document.php?id=80227&id_meeting=188) from the ISO/IEC JTC 1/SC 29 DIS ballot was reviewed Friday 15 October during the closing plenary session.

It was planned to integrate software related to v2 of VVC and VSEI by the next meeting and submit it to ITU-T for consent and as an ISO/IEC FDIS.

Remains valid – not updated: [JVET-T2010](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10545) VTM common test conditions and software reference configurations for SDR video [F. Bossen, J. Boyce, X. Li, V. Seregin, K. Sühring]

Remains valid – not updated: [JVET-V2011](https://jvet-experts.org/doc_end_user/current_document.php?id=10851) VTM 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] (2021-03-31)

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-X2016](https://jvet-experts.org/doc_end_user/current_document.php?id=11229) Common Test Conditions and evaluation procedures for neural network-based video coding technology [E. Alshina, R.-L. Liao, S. Liu, A. Segall] (2021-10-29)

This includes updates to the template and clarifications/editorial refinements.

[JVET-X2017](https://jvet-experts.org/doc_end_user/current_document.php?id=11230) Common Test Conditions and evaluation procedures for enhanced compression tool testing [M. Karczewicz and Y. Ye] (2021-10-29)

This is to include clarifications and editorial refinements.

Remains valid – not updated: [JVET-U2018](https://jvet-experts.org/doc_end_user/current_document.php?id=10683) Common test conditions for high bit depth and high bit rate video coding [A. Browne, T. Ikai, D. Rusanovskyy, M. Sarwer, X. Xiu]

No output: JVET-X2019, JVET-X2020, JVET-X2021, JVET-X2022

Numbers retained for future purposes of planning possible additional verification testing and CE.

[JVET-X2023](https://jvet-experts.org/doc_end_user/current_document.php?id=11221) Exploration Experiment on Neural Network-based Video Coding (EE1) [E. Alshina, S. Liu, W. Chen, F. Galpin, Y. Li, Z. Ma, H. Wang] [WG 5 N 88] (2021-10-29)

An initial draft of this document was reviewed and approved during session 23 on Thursday 14 Oct.

Three categories of experiments were planned: Enhancement filters (loop and post), super resolution, and intra prediction. Except for 1.1. and 1.3, proposals from last meeting, more extensive cross-check to be conducted. Tests on top of ECM are also included.

[JVET-X2024](https://jvet-experts.org/doc_end_user/current_document.php?id=11220) Exploration Experiment on Enhanced Compression beyond VVC capability (EE2) [ V. Seregin, J. Chen, L. Li, K. Naser, J. Ström, M. Winken, X. Xiu, K. Zhang] [WG 5 N 89] (2021-11-05)

An initial draft was reviewed and approved during session 23 on Thursday 14 Oct. It was suggested to add a rule that encoder modifications that could also be applied to the anchors should also be implemented in a modified version of the anchor, and results reported.

[JVET-X2025](https://jvet-experts.org/doc_end_user/current_document.php?id=11231) Algorithm description of Enhanced Compression Model 3 (ECM 3) [M. Coban, F. Le Léannec, M. Sarwer, J. Ström] [WG 5 N 90] (2021-11-30)

New elements:

* Adopt 3.3a from JVET-X0083 and 3.4a from JVET-X0049
* Adopt EE combination 4.1/4.3a/4.4 (called 4.8.c in EE report JVET-X0024)
* Adopt JVET-X0056 test 1
* Adopt JVET-X0141
* Adopt JVET-X0090 solution 3
* Adopt JVET-X0124.
* Adopt JVET-X0148 (only the TIMD pipeline modification)
* Adopt JVET-X0149.
* (SW/CTC): Adopt JVET-X0144 trade-off 2
* (SW/BF): Adopt JVET-X0121
* (SW/BF): Adopt JVET-X0122, and perform merge request #16
* (SW/BF): Adopt JVET-X0156

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.

[JVET-X2026](https://jvet-experts.org/doc_end_user/current_document.php?id=11232) Conformance testing for VVC operation range extensions (draft 2) [D. Rusanovskyy, T. Hashimoto, H.-J. Jhu, I. Moccagatta, M. G. Sarwer, Y. Yu] (2021-11-12)

The basis is document JVET-X0185 which had been reviewed and approved during the meeting.

This was agreed to be issued as ISO/IEC 23090-15 CDAM 1 as [WG 5 N 86](https://dms.mpeg.expert/doc_end_user/current_document.php?id=81003&id_meeting=188) (with an editing period as noted).

A request for a new amendment ([WG 5 N 85](https://dms.mpeg.expert/doc_end_user/current_document.php?id=81002&id_meeting=188)) was reviewed Thursday 14 October in session 23.

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

Future meeting plans were established according to the following guidelines:

* Meeting under ITU-T SG 16 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 SG 16 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 case of online meetings, no sessions should be held on weekend days. This may imply an earlier starting date as well.

A poll using the Zoom tool was conducted on possible physical participation in a hybrid meeting in April 2022. 152 (80% of people present at the time) people voted, with roughly 21% saying yes, 47% saying no, and 32% saying they didn’t know yet.

Contribution to a workshop (likely around the end of November) to be held with JPEG was solicited, with possible presentations on NN-based video coding. Two such contributions were suggested:

* Methodologies for evaluation and complexity assessment
* Overview of technologies considered in exploration (possibly two, on hybrid and end-to-end)

A. Segall and E. Alshina indicated their willingness to contribute, and it was agreed to include this in an AHG11 mandate.

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

* Fri. 22 – Fri. 29 April 2022, 26th meeting under ISO/IEC JTC 1/‌SC 29 auspices, possibly as a hybrid meeting in Alpbach, AT
* Fri. 15 – Fri. 22 July 2022, 27th meeting under ISO/IEC JTC 1/‌SC 29 auspices in Cologne, DE.
* During October 2022, 28th meeting under ITU-T SG16 auspices, location t.b.d.
* During January 2023, 29th meeting under ISO/IEC JTC 1/‌SC 29 auspices, location t.b.d.
* During April 2023, 30th meeting under ISO/IEC JTC 1/‌SC 29 auspices, location t.b.d.
* During July 2023, 31st meeting under ITU-T SG16 auspices in Geneva, CH.
* During October 2023, 32nd meeting under ISO/IEC JTC 1/‌SC 29 auspices, location t.b.d.
* During January 2024, 33rd meeting under ISO/IEC JTC 1/‌SC 29 auspices, location t.b.d.

The agreed document deadline for the 26th JVET meeting was planned to be XXday X April 2022.

XXX was thanked for providing financial support for the VVC verification tests.

Mathias Wien was thanked for planning, organizing and conducting the remote expert viewing related to the exploration experiment on neural network-based video compression.

The 25th JVET meeting was closed at approximately XXXX hours UTC on Saturday 22 January 2022.

# Annex A to JVET report: List of documents

# Annex B to JVET report: List of meeting participants

The participants of the twenty-fifth meeting of the JVET, according to the participation records from the Zoom teleconferencing tool used for the meting sessions (approximately XXX people in total, not including those who attended only the joint sessions with other groups), were as follows:



# Annex C to JVET report: Recommendations of the 6th 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 XX**](https://sd.iso.org/documents/ui/#!/browse/iso/iso-iec-jtc-1/iso-iec-jtc-1-sc-29/iso-iec-jtc-1-sc-29-wg-5/library/4/Recommendations%20of%20the%204th%20WG%205%20meeting)