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| **Joint Video Experts Team (JVET)****of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29**27th Meeting, by teleconference, 13–22 July 2022 | Document: JVET-AA\_Notes\_d0 |

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| *Title:* | **Meeting Report of the 27th Meeting of the Joint Video Experts Team (JVET),by teleconference, 13–22 July 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-seventh meeting during 13–22 July 2022 as an online-only meeting. It had previously been planned to be in Cologne, DE, but this plan was changed due to uncertainties 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 eighth 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 0500 hours UTC on Wednesday 13 July 2022. Meeting sessions were held on all days except the weekend days of Saturday and Sunday 16 and 17 July 2022, until the meeting was closed at approximately 00XX hours UTC on Saturday 23 July 2022. Approximately XXX people attended the JVET meeting, and approximately XXX input documents (not counting crosschecks), 13 AHG reports, 2 EE summary reports, and X BoG reports were discussed. The meeting took place in coordination with a meeting of various SC29 Working Groups and Advisory Groups – where WG 5 is representing the Joint Video Coding Team(s) and their activities from the perspective of the SC 29 parent body, under whose auspices this JVET meeting was held. The subject matter of the JVET meeting activities consisted of work on further development and maintenance of the twin-text video coding technology standards *Advanced Video Coding* (AVC), *High Efficiency Video Coding* (HEVC), *Versatile Video Coding* (VVC)*, Coding-independent Code Points (Video)* (CICP), and *Versatile Supplemental Enhancement Information Messages for Coded Video Bitstreams* (VSEI), as well as related technical reports, reference software and conformance testing packages. Further important goals were reviewing the results of the Exploration Experiment (EE) on Neural Network-based Video Coding, of the EE on Enhanced Compression beyond VVC capability, of other technical input on novel aspects of video coding technology, and to plan next steps for investigation of candidate technology towards further standard development.

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

* JVET-Z1003 Coding-independent code points for video signal type identification (Draft 1 of 3rd edition)
* JVET-Z1004 Errata report items for VVC, VSEI, HEVC, AVC, Video CICP, and CP usage TR
* JVET-Z1005 New levels for HEVC (Draft 3), also issued as WG 5 CDAM
* JVET-Z1008 Additional colour type identifiers for AVC and HEVC (Draft 1)
* JVET-Z2002 Algorithm description for Versatile Video Coding and Test Model 17 (VTM 17)
* JVET-Z2005 New level and systems-related supplemental enhancement information for VVC (Draft 2), also issued as WG 5 CDAM
* JVET-Z2006 Additional SEI messages for VSEI (Draft 1)
* JVET-Z2011 VTM and HM common test conditions and evaluation procedures for HDR/WCG video
* JVET-Z2016 Common Test Conditions and evaluation procedures for neural network-based video coding technology
* JVET-Z2023 Exploration Experiment on neural network-based video coding (EE1)
* JVET-Z2024 Exploration Experiment on enhanced compression beyond VVC capability (EE2)
* JVET-Z2025 Algorithm description of Enhanced Compression Model 5 (ECM 5)

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

* JVET-Z1003 Coding-independent code points for video signal type identification (Draft 1 of 3rd edition)
* JVET-Z1004 Errata report items for VVC, VSEI, HEVC, AVC, Video CICP, and CP usage TR
* JVET-Z1005 New levels for HEVC (Draft 3), also issued as WG 5 CDAM
* JVET-Z1008 Additional colour type identifiers for AVC and HEVC (Draft 1)
* JVET-Z2002 Algorithm description for Versatile Video Coding and Test Model 17 (VTM 17)
* JVET-Z2005 New level and systems-related supplemental enhancement information for VVC (Draft 2), also issued as WG 5 CDAM
* JVET-Z2006 Additional SEI messages for VSEI (Draft 1)
* JVET-Z2011 VTM and HM common test conditions and evaluation procedures for HDR/WCG video
* JVET-Z2016 Common Test Conditions and evaluation procedures for neural network-based video coding technology
* JVET-Z2023 Exploration Experiment on neural network-based video coding (EE1)
* JVET-Z2024 Exploration Experiment on enhanced compression beyond VVC capability (EE2)
* JVET-Z2025 Algorithm description of Enhanced Compression Model 5 (ECM 5)

For the organization and planning of its future work, the JVET established 13 “ad hoc groups” (AHGs) to progress the work on particular subject areas. At this meeting, 2 Exploration Experiments (EE) were defined. The next eight JVET meetings were planned for 21 – 28 October 2022 under ITU-T SG16 auspices in Antalya, TR; during 11 – 20 January 2023 under ISO/IEC JTC 1/‌SC 29 auspices, to be conducted as a teleconference meeting; during April 2023 under ISO/IEC JTC 1/‌SC 29 auspices, date and location t.b.d.; during July 2023 under ITU-T SG16 auspices, date and location t.b.d.; during October 2023 under ISO/IEC JTC 1/‌SC 29 auspices, date and location t.b.d.; during January 2024 under ISO/IEC JTC 1/‌SC 29 auspices, date and location t.b.d.; during April 2024 under ITU-T SG16 auspices, date and location t.b.d.; and during July 2024 under ISO/IEC JTC 1/‌SC 29 auspices, date and 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 sites <http://phenix.int-evry.fr/jvet/>, <http://phenix.int-evry.fr/jct/>, and <http://phenix.int-evry.fr/jct3v/> are still accessible, but were converted to read-only.

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

# Administrative topics

## Organization

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

The Joint Video Experts Team (JVET) of ITU-T WP3/16 and ISO/IEC JTC 1/‌SC 29 held its twenty-seventh meeting during 13–22 July 2022 as an online-only meeting, using the Zoom teleconferencing tool. For ISO/IEC purposes, JVET is alternatively designated ISO/IEC JTC 1/‌SC 29/‌WG 5, and this was the eighth meeting as WG 5. The JVET meeting was held under the chairmanship of Dr Jens-Rainer Ohm (RWTH Aachen/Germany).

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

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

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

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

This report contains three important annexes, as follows:

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

## Meeting logistics

Information regarding logistics arrangements for the meeting had been provided via the email reflector jvet@lists.rwth-aachen.de and at <http://wftp3.itu.int/av-arch/jvet-site/2022_07_AA_Virtual/>.

## Primary goals

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

* JVET-Z1003 Coding-independent code points for video signal type identification (Draft 1 of 3rd edition)
* JVET-Z1004 Errata report items for VVC, VSEI, HEVC, AVC, Video CICP, and CP usage TR
* JVET-Z1005 New levels for HEVC (Draft 3), also issued as WG 5 CDAM
* JVET-Z1008 Additional colour type identifiers for AVC and HEVC (Draft 1)
* JVET-Z2002 Algorithm description for Versatile Video Coding and Test Model 17 (VTM 17)
* JVET-Z2005 New level and systems-related supplemental enhancement information for VVC (Draft 2), also issued as WG 5 CDAM
* JVET-Z2006 Additional SEI messages for VSEI (Draft 1)
* JVET-Z2011 VTM and HM common test conditions and evaluation procedures for HDR/WCG video
* JVET-Z2016 Common Test Conditions and evaluation procedures for neural network-based video coding technology
* JVET-Z2023 Exploration Experiment on neural network-based video coding (EE1)
* JVET-Z2024 Exploration Experiment on enhanced compression beyond VVC capability (EE2)
* JVET-Z2025 Algorithm description of Enhanced Compression Model 5 (ECM 5)

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

## Documents and document handling considerations

### General

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

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 on text are marked by the string “Decision (SW):”.
* Decisions that fix a “bug” in one of the test model descriptions such as VTM, HM, etc. (an error, oversight, or messiness) or in the associated software package are marked by the string “Decision (BF):”.
* Decisions that are merely editorial without effect on the technical content of a draft standard are marked by the string "Decision (Ed.):". Such editorial decisions are merely suggestions to the editor, who has the discretion to determine the final action taken if their judgment differs.
* Some decisions are recorded with the word “agreed” rather than “Decision:”, especially for non-normative, editorial and planning matters.

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

### Late and incomplete document considerations

The formal deadline for registering and uploading non-administrative contributions had been announced as Wednesday, 6 July 2022. Any documents uploaded after 1159 hours Paris/Geneva time on Thursday 7 July 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-AA0150 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 has been to require the submitters of late contributions and late revisions to describe the characteristics of the late or revised (or missing) material at the beginning of discussion of the contribution. This has been agreed to be a helpful approach to be followed at the meeting.

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

* JVET-AA0XXX (a proposal on …), uploaded 07-XX,
* … .

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

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

* JVET-AA0XXX (a document on …), uploaded 07-XX,
* … .

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

At some previous meetings, some cross-verification reports had not been uploaded yet by the time when the meeting ended, and neither were they provided within two weeks after the meeting: This case did not happen at this meeting.

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-AA0041, JVET-AA0049, JVET-AA0050, JVET-AA0060, JVET-AA0068, JVET-AA0180.

“Placeholder” contribution documents that were basically empty of content, or lacking any results showing benefit for the proposed technology, and obviously uploaded with an intent to provide a more complete submission as a revision, had been agreed to be considered unacceptable and to be rejected in the document management system until a more complete version was available (which would then be counted as a late contribution if the update was after the document deadline). At the current meeting, this situation did apply with documents JVET-AA0094 and JVET-AA0143, which were both categorized as late in the list above, based on the time of the first reasonable document upload.

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

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

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

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

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

### Outputs of the preceding meeting

All output documents of the previous meeting, particularly the meeting report JVET-Z1000, the Coding-independent code points for video signal type identification (Draft 1 of 3rd edition) JVET-Z1003, the Errata report items for VVC, VSEI, HEVC, AVC, Video CICP, and CP usage TR JVET-Z1004, the New levels for HEVC (Draft 3) JVET-Z1005, the Additional colour type identifiers for AVC and HEVC (Draft 1) JVET-Z1008, the Algorithm description for Versatile Video Coding and Test Model 17 (VTM 17) JVET-Z2002, the New level and systems-related supplemental enhancement information for VVC (Draft 2), JVET-Z2005, the Additional SEI messages for VSEI (Draft 1) JVET-Z2006, the VTM and HM common test conditions and evaluation procedures for HDR/WCG video JVET-Z2011, the Common Test Conditions and evaluation procedures for neural network-based video coding technology JVET-Z2016, the Description of the EE on Neural Network-based Video Coding JVET-Y2023, the Description of the EE on Enhanced Compression beyond VVC capability JVET-Y2024, and the Algorithm description of Enhanced Compression Model 5 (ECM 5) JVET-Z2025, had been completed and were approved. The software implementations of VTM (version 17.0), and ECM (version 5.0) were also approved. Any other SW?

Only minor editorial issues were found in the meeting report JVET-Z1000; 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, since 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.
* Generally do not use video for the teleconferencing calls in order to avoid overloading people’s internet connections; enable only voice and screen sharing.
* Extensive use of screen sharing is encouraged, to enable participants to view the presented material and the meeting notes. At times, multiple sources of screen sharing may be enabled, so it may be necessary for participants to understand that this is happening and to understand how to select which one they want to watch.

## Agenda

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

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

The plans for the times of meeting sessions were established as follows, in UTC (which for this meeting was 2 hours behind the time in Geneva and Paris; 7 hours ahead of the time in Los Angeles, etc.). No session was scheduled to last longer than 2 hrs.

* 0500–0700 1st “morning” session [break after 2 hours]
* 0720–0920 2nd “morning” session
* [“midday” break – nearly 4 hours]
* 1300–1500 1st “afternoon” session [break after 2 hours]
* 1520–1720 2nd “afternoon” 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 UTC session times were used as in the 24th JVET meeting (which had been the seventh 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. It is noted that the SADL package for neural network-based video coding uses the same licensing terms.

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. 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 1182 (as of 11 July 2022). All discussions (including those on AVC, HEVC, VVC, CICP, etc.) shall be conducted on the JVET reflector rather than any of the old reflectors (including JVT, JCT-VC, and JCT-3V) which are retained for archiving purposes.

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

## Terminology

* **ACT**: Adaptive colour transform
* **AFF**: Adaptive frame-field
* **AI**: All-intra
* **AIF**: Adaptive interpolation filtering
* **ALF**: Adaptive loop filter
* **AMP**: Asymmetric motion partitioning – a motion prediction partitioning for which the sub-regions of a region are not equal in size (in HEVC, being N/2x2N and 3N/2x2N or 2NxN/2 and 2Nx3N/2 with 2N equal to 16 or 32 for the luma component)
* **AMVP**: Adaptive motion vector prediction
* **AMT or MTS**: Adaptive multi-core transform, or multiple transform selection
* **AMVR**: (Locally) adaptive motion vector resolution
* **APS**: Adaptation parameter set
* **ARC**: Adaptive resolution conversion (synonymous with DRC, and a form of RPR)
* **ARMC**: Adaptive re-ordering of merge candidates
* **ARSS**: Adaptive reference sample smoothing
* **ATM**: AVC-based multiview and 3D test model
* **ATMVP** or “subblock-based temporal merging candidates”: Alternative temporal motion vector prediction
* **AU**: Access unit
* **AUD**: Access unit delimiter
* **AVC**: Advanced video coding – the video coding standard formally published as ITU-T Recommendation H.264 and ISO/IEC 14496-10
* **BA**: Block adaptive
* **BC**: See CPR or IBC
* **BCW**: Biprediction with CU based weighting
* **BD**: Bjøntegaard-delta – a method for measuring percentage bit rate savings at equal PSNR or decibels of PSNR benefit at equal bit rate (e.g., as described in document VCEG-M33 of April 2001)
* **BDOF**: Bi-directional optical flow (formerly known as **BIO**)
* **BDPCM**: Block-wise DPCM
* **BL**: Base layer
* **BMS**: Benchmark set (no longer used), a former preliminary compilation of coding tools on top of VTM, which provide somewhat better compression performance, but are not deemed mature for standardzation
* **BoG**: Break-out group
* **BR**: Bit rate
* **BT**: Binary tree
* **BV**: Block vector (used for intra BC prediction)
* **CABAC**: Context-adaptive binary arithmetic coding
* **CBF**: Coded block flag(s)
* **CC**: May refer to context-coded, common (test) conditions, or cross-component
* **CCALF**: Cross-component ALF
* **CCLM**: Cross-component linear model
* **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 conforms to the HEVC standard design (possibly with under-development extensions) – now also used especially in reference to the (non-normative) encoder algorithms (see WD and TM)
* **HMVP**: History based motion vector prediction
* **HRD**: Hypothetical reference decoder
* **HTM**: HEVC-based multiview and 3D test model (developed by JCT-3V)
* **HyGT**: Hyper-cube Givens transform (a type of NSST)
* **IBC** (also **Intra BC**): Intra block copy, also known as CPR – a technique by which sample values are predicted from other samples in the same picture by means of a displacement vector called a block vector, in a manner conceptually similar to motion-compensated prediction
* **IBDI**: Internal bit-depth increase – a technique by which lower bit-depth (8 bits per sample) source video is encoded using higher bit-depth signal processing, ordinarily including higher bit-depth reference picture storage (ordinarily 12 bits per sample)
* **IBF**: Intra boundary filtering
* **ILP**: Inter-layer prediction (in scalable coding)
* **ILRP**: Inter-layer reference picture
* **IPCM**: Intra pulse-code modulation (similar in spirit to IPCM in AVC and HEVC)
* **IRAP**: Intra random access picture
* **ISP**: Intra subblock partitioning
* **JCCR**: Joint coding of chroma residuals
* **JCT-3V**: Joint collaborative team on 3D video (for AVC and HEVC)
* **JCT-VC**: Joint collaborative team on video coding (for HEVC)
* **JEM**: Joint exploration model – a software codebase previously used for video coding exploration
* **JM**: Joint model – the primary software codebase that has been developed for the AVC standard
* **JSVM**: Joint scalable video model – another software codebase that has been developed for the AVC standard, which includes support for scalable video coding extensions
* **JVET**: Joint video experts team (initially for VVC, later expanded)
* **JVT**: Joint video team (for AVC)
* **KLT**: Karhunen-Loève transform
* **LB** or **LDB**: Low-delay B – the variant of the LD conditions that uses B pictures
* **LD**: Low delay – one of two sets of coding conditions designed to enable interactive real-time communication, with less emphasis on ease of random access (contrast with RA). Typically refers to LB, although also applies to LP
* **LFNST**: Low-frequency non-separable transform
* **LIC**: Local illumination compensation
* **LM**: Linear model
* **LMCS**: Luma mapping with chroma scaling (formerly sometimes called “in-loop reshaping”)
* **LP** or **LDP**: Low-delay P – the variant of the LD conditions that uses P frames
* **LUT**: Look-up table
* **LTRP**: Long-term reference picture
* **MANE**: Media-aware network element
* **MC**: Motion compensation
* **MCP**: Motion compensated prediction
* **MCTF**: Motion compensated temporal pre-filtering
* **MDNSST**: Mode dependent non-separable secondary transform
* **MIP**: Matrix-based intra prediction
* **MMLM**: Multi-model (cross component) linear mode
* **MMVD**: Merge with MVD
* **MPEG**: Moving picture experts group (an alliance of working groups and advisory groups in ISO/IEC JTC 1/‌SC 29, one of the two parent bodies of the JVET)
* **MPM**: Most probable mode (in intra prediction)
* **MRL**: Multiple reference line intra prediction
* **MV**: Motion vector
* **MVD**: Motion vector difference
* **NAL**: Network abstraction layer
* **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.
* **SADL**: Small adhoc deep learning library
* **SAO**: Sample-adaptive offset.
* **SBT**: Subblock transform.
* **SbTMVP**: Subblock based temporal motion vector prediction.
* **SCIPU**: Smallest chroma intra prediction unit.
* **SD**: Slice data; alternatively, standard-definition.
* **SDH**: Sign data hiding.
* **SDT**: Signal-dependent transform.
* **SE**: Syntax element.
* **SEI**: Supplemental enhancement information (as in AVC and HEVC).
* **SH**: Slice header.
* **SHM**: Scalable HM.
* **SHVC**: Scalable high efficiency video coding.
* **SIF**: Switchable (motion) interpolation filter.
* **SIMD**: Single instruction, multiple data.
* **SMVD**: Symmetric MVD.
* **SPS**: Sequence parameter set (as in AVC and HEVC).
* **STMVP**: Spatial-temporal motion vector prediction.
* **STRP**: Short-term reference picture.
* **STSA**: Step-wise temporal sublayer access.
* **TBA/TBD/TBP**: To be announced/determined/presented.
* **TGM**: Text and graphics with motion – a category of content that primarily contains rendered text and graphics with motion, mixed with a relatively small amount of camera-captured content.
* **TIMD**: Template-based intra mode derivation
* **TM**: Template matching.
* **TMVP**: Temporal motion vector prediction.
* **TS**: Transform skip.
* **TSRC**: Transform skip residual coding.
* **TT**: Ternary tree.
* **UCBDS**: Unrestricted center-biased diamond search.
* **UGC**: User-generated content.
* **UWP**: Unequal weight prediction.
* **VCEG**: Visual coding experts group (ITU-T Q.6/16, the relevant rapporteur group in ITU-T WP3/16, which is one of the two parent bodies of the JVET).
* **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 20 April at 0500 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
	+ 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
		- ISO/IEC 14496-10:2020 (Ed. 9) FDIS ballot closed 2020-11-27, published 2020-12-15
		- ISO/IEC 14496-10:202X (Ed. 10), had been forwarded from DIS directly for publication 2022-01-21 (with annotated regions, shutter interval, and miscellaneous corrections) with editing period, pending submission to ITTF
		- Conformance testing
			* H.264.1 V6 Approved 2016-02-13, published 2016-06-17
			* Various amendments of ISO/IEC 14496-4:2004, including:
				+ ISO/IEC 14496-4:2004/AMD 6:2005 Advanced Video Coding conformance
				+ ISO/IEC 14496-4:2004/AMD 9:2006 AVC fidelity range extensions conformance
				+ ISO/IEC 14496-4:2004/AMD 30:2009 Conformance testing for new profiles for professional applications
				+ ISO/IEC 14496-4:2004/AMD 31:2009 Conformance testing for SVC profiles
				+ ISO/IEC 14496-4:2004/AMD 38:2010 Conformance testing for Multiview Video Coding
				+ ISO/IEC 14496-4:2004/AMD 41:2014 Conformance testing of MVC plus depth extension of AVC
				+ ISO/IEC 14496-4:2004/AMD 42:2014 Conformance testing of Multi-Resolution Frame Compatible Stereo Coding extension of AVC
				+ ISO/IEC 14496-4:2004/AMD 43:20153D-AVC conformance testing
				+ ISO/IEC 14496-4:2004/AMD 45:2016 Conformance Testing for the Multi-resolution Frame Compatible Stereo Coding with Depth Maps Extension of AVC
		- Reference software
			* H.264.2 V7 Approved 2016-02-13, published 2016-05-30
			* Various amendments of ISO/IEC 14496-5:2001, including:
				+ ISO/IEC 14496-5:2001/AMD 6:2005 Advanced Video Coding (AVC) and High Efficiency Advanced Audio Coding (HE AAC) reference software
				+ ISO/IEC 14496-5:2001/AMD 8:2006 AVC fidelity range extensions reference software
				+ ISO/IEC 14496-5:2001/AMD 15:2010 Reference software for Multiview Video Coding
				+ ISO/IEC 14496-5:2001/AMD 18:2008 Reference software for new profiles for professional applications
				+ ISO/IEC 14496-5:2001/AMD 19:2009 Reference software for Scalable Video Coding
				+ ISO/IEC 14496-5:2001/AMD 33:2015 Reference software for MVC plus depth extension of AVC
				+ ISO/IEC 14496-5:2001/AMD 34:2014 Reference software of the multi-resolution frame compatible stereo coding of AVC
				+ ISO/IEC 14496-5:2001/AMD 35:2015 3D-AVC Reference software
				+ ISO/IEC 14496-5:2001/AMD 39:2016 Reference software for the Multi-resolution Frame Compatible Stereo Coding with Depth Maps of AVC
				+ ISO/IEC 14496-5:2001/AMD 42:2017 Reference software for the alternative depth information SEI message extension of AVC
	+ HEVC
		- 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), published 2020-10-13
		- ISO/IEC 23008-2:2020 FDAM 1 ballot closed 2021-06-03 (shutter interval information SEI message) published 2021-07-12
		- ISO/IEC 23008-2:2020 CDAM 2 High-range levels output of 25th meeting of January 2022, CDAM ballot closed 2022-04-15, ballot results in [m59308](https://dms.mpeg.expert/doc_end_user/documents/138_OnLine/wg11/m59308-v1-m59308.zip)
		- Conformance testing
			* H.265.1 V3 approved 2018-10-14, published 2019-01-15
			* ISO/IEC 23008-8:2018 (Ed. 2) Conformance specification for HEVC, published 2018-08
			* ISO/IEC 23008-8:2018/AMD 1:2019 Conformance testing for HEVC screen content coding (SCC) extensions and non-intra high throughput profiles, published 2019-10
		- Reference software
			* H.265.2 V4 approved 2016-12-22, published 2017-04-10
			* ISO/IEC 23008-5:2017 (Ed. 2) Reference software for high efficiency video coding, published 2017-02
			* ISO/IEC 23008-5:2017/AMD 1:2017 Reference software for screen content coding extensions, published 2017-10
	+ VVC
		- H.266 V1 approved 2020-08-29, published 2020-11-10
		- ISO/IEC 23090-3:2021 (Ed. 1) published 2021-02-16
		- H.266 V2 with operation range extensions, Consented 2022-01-28, Last Call began 2022-04-01, to close 2022-04-28
		- ISO/IEC 23090-3:202x (Ed. 2) with operation range extensions, FDIS approval at WG level 2022-01-21
		- Conformance testing
			* H.266.1 V1 Consented 2022-01-28, Last Call began 2022-04-01, to close 2022-04-28
			* ISO/IEC 23090-15 V1 FDIS approval at WG level 2022-10-15
			* ISO/IEC 23090-15 DAM 1 operation range extensions – DAM from previous meeting, DAM ballot pending, no action at his meeting
		- Reference software
			* H.266.2 V1 Consented 2022-01-28, Last Call began 2022-04-01, to close 2022-04-28
			* ISO/IEC 23090-16 V1 FDIS approval at WG level 2022-01-21, FDIS ballot pending
	+ VSEI
		- H.274 V1 approved 2020-08-29, published 2020-11-10
		- ISO/IEC 23002-7:2021 (Ed. 1) published 2021-01-28
		- H.274 V2 Consented 2022-01-28, Last Call began 2022-04-01, to close 2022-04-28
		- ISO/IEC 23002-7:202x (Ed. 2) FDIS approval at WG level 2022-01-21, FDIS ballot pending
	+ CICP V2 (includes errata items)
		- ISO/IEC 23091-2 V2 had been forwarded from DIS directly for publication in 2021-04 and published 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
	+ Usage of video signal type code points
		- H.Sup19 V3 approved 2021-04-30, published 2021-06-04
		- ISO/IEC TR 23091-4 (Ed. 3) published 2021-05-23
	+ Working practices using objective metrics for evaluation of video coding efficiency experiments
		- HSTP-VID-WPOM V1: approved 2020-07-03, published 2020-11
		- ISO/IEC TR 23002-8 (Ed. 1) published 2021-05-20
	+ Film grain synthesis technologies for video applications
		- ISO/IEC TR 23002-9 WD 1 issued 2022-01, uploaded 2022-04-20
	+ 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) AVC
		- ISO/IEC 23002-7:2021 (Ed. 1) VSEI
		- ISO/IEC 23008-2:2020 (Ed. 4) HEVC
		- ISO/IEC 23090-3:2021 (Ed. 1) VVC
	+ The following standards that have been intended by JVET to be publicly available were not available at <https://standards.iso.org/ittf/PubliclyAvailableStandards/index.html> as of 2022-04-17. (Please see below for record of previously issued requests.)
		- ISO/IEC 23091-2:2021 (Ed. 2) Video CICP (was requested in April 2021, and the 2019 previous edition was also not made available there)
		- ISO/IEC 23008-2:2020 (Ed. 4) Amd.1:2021: Shutter interval information SEI message (has not been requested but separate publication may not be necessary if it is promptly included in a next edition)
		- ISO/IEC 14496-10:202X – AVC 10th edition – final text issued and public availability requested at the 25th meeting (January 2022)
		- ISO/IEC 23002-7:202X – VSEI 2nd edition – FDIS issued and public availability requested at the 25th meeting (January 2022)
		- ISO/IEC 23090-3:202X – VVC 2nd edition – FDIS issued and public availability requested at the 25th meeting (January 2022)
		- ISO/IEC 23090-15:202X – VVC conformance – FDIS issued and public availability requested at the 24th meeting (October 2021)
		- ISO/IEC 23090-16:202X – VVC reference software – FDIS issued and public availability requested at the 25th meeting (January 2022)
* Draft standards progression status
	+ New levels (from JVET-Z1005) – ISO/IEC 23008-2 DIS of new edition of HEVC was issued from 26th meeting, incorporating Amd.1 and corrigenda items (expecting FDIS in January 2023, ITU-T consent in October); note that Amd.1 = shutter interval is already included in latest ITU-T edition of H.265
	+ New level and systems-related supplemental enhancement information (from JVET-Z2005) –VVC CDAM was issued from 26th meeting, DAM (JVET draft 3) to be issued
	+ Additional SEI messages (from JVET-Z2006) –VSEI CDAM (JVET draft 2) to be issued from current meeting (request made by 26th meeting)
	+ Film grain synthesis technology for video applications (from JVET-Y2020) – JVET draft 2 to be issued at the current meeting, also ISO/IEC 23002-9 DTR (request made by 25th meeting)
	+ VVC Conformance testing for operation range extensions – (from JVET-Y2026) – plan for ISO/IEC 23090-16 FDAM and ITU consent in October – new JVET draft at current meeting? New edition ISO/IEC in October?
	+ Video CICP new edition (from JVET-Z1003) – JVET draft 2 to be issued at the current meeting, also ISO/IEC 23091-2 CD (request made by 26th meeting)
	+ The request for free availability in ISO/IEC has to be made for each edition, amendment and corrigendum, and the request needs to be approved in the Recommendations. A request form also needs to be filled out (but the form does not need to be issued as a WG 5 document). A freely available URL for the ITU publication should be provided for the following parts:
		- For the ongoing work items, when they become finalized
		- ISO/IEC 23008-2:2020/Amd.1:2021 – HEVC FDAM issued 20th meeting (October 2020), public availability not yet requested but may not be necessary if it becomes included in next edition
* The meeting logistics, agenda, working practices, policies, and document allocation considerations 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-Z1000 were reviewed. The following small issues in the meeting report were noted and were not considered sufficient to warrant issuing a revision:
	+ In 1 (summary), the information that JVET-Z1005 would have been issued as WG 5 CDAM is wrong. The CDAM had already been issued from JVETR-Y1005 of the 25th meeting.
	+ In 2.13, the session 0720-0920 should have been designated as 2nd “morning” session instead of “afternoon” session.
* There was somewhat less of a problem of late non-cross-check documents; two “placeholders” were rejected in their initial versions, and updates were not made before the deadline (see section 2.4.2).
* There were again a few documents registered where authors’ given names were not abbreviated, and/or company affiliation was missing in the authors’ list. Participants were reminded to stick to JVET’s conventions.
* Experts are asked to inform the chair when the title of a document is changed, or if authors are added. Otherwise, that might not be correct in the meeting notes.
* The primary goals of the meeting were
	+ Errata
	+ Checking the status on conformance testing for version 2 of VVC (under DAM ballot)
	+ New levels for HEVC (DIS under ballot)
	+ New level and systems-related SEI for VVC (DAM)
	+ Additional SEI in VSEI (CDAM)
	+ Preparation of TR for film grain (draft 2)
	+ New edition video CICP (CD)
	+ Additional color type identifiers for AVC and HEVC (Draft 2)?
	+ Exploration Experiments
		- Neural network-based video coding
		- Enhanced compression beyond VVC
* Liaison communication: tbd.
* The number of documents was lower than for the previous meeting (135->115)
* Scheduling was discussed, and it was agreed to avoid conducting “track” sessions in parallel (some BoG parallelism could occur)
* Principles of standards development were discussed.
* Meeting plans needed to be discussed, in particular regarding the plan of a hybrid/physical meeting in October 2022

## Scheduling of discussions

The plans for the times of meeting sessions were established as follows, in UTC (which for this meeting was 2 hours behind the time in Geneva and Paris; 7 hours ahead of the time in Los Angeles, etc.). No session should last longer than 2 hrs.

* 0500–0700 1st “morning” session [break after 2 hours]
* 0720–0920 2nd “morning” session
* [“midday” break – nearly 4 hours]
* 1300–1500 1st “afternoon” session [break after 2 hours]
* 1520–1720 2nd “afternoon” 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. 13 July, 1st day
	+ Session 1:
		- 0500–0550 Opening remarks, review of practices, agenda, IPR reminder (section 2)
		- 0550–0700 Reports of AHGs 1–X (section 3)
	+ Session 2:
		- 0720–XXXX Reports of AHGs X–13 (section 3)
		- XXXX–0920 Review of EE1 summary (section 5.2.1)
	+ Session 3:
		- 1300–1500 Review of EE2 summary (section 5.3.1)
	+ Session 4:
		- 1520–1720 Review of EE2 related (section 5.3.3) & “non-EE2” (section 5.3.4)
* Thu. 14 July, 2nd day
	+ Session 5:
		- 0500–0700 Review of EE1 and related (section 5.2)
		- …
* Fri. 15 July, 3rd day
	+ Session X:
		- 0500–0700 Review of … (section XX)
		- …
* Mon. 18 July, 4th day
	+ 0500–0700 MPEG information sharing session
		- …
* Tue. 19 July, 5th day
	+ Session X:
		- 0500–0700 Review of … (section XX)
	+ …
* Wed. 20 July, 6th day
	+ 0500–0600 MPEG information sharing session
	+ …
* Thu. 21 July, 7th day
	+ Session X:
		- 0500–0700 Review of … (section XX)
		- …
* Fri. 22 July, 8th day
	+ Plenary:
		- 0500–XXXX AHG, output document timelines, review/approvals of DoCRs & requests
		- XXXX–XXXX Output document reviews and approvals (section 10), draft recommendations, meeting planning, AoB
	+ 2100–2300 MPEG information sharing session
	+ XXXX–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 (1)
	+ Text development and errata reporting (1)
	+ Test conditions (2)
	+ Verification testing (0)
	+ Test Material (1)
	+ Quality assessment (0)
	+ Conformance test development (1)
	+ Software development (2)
	+ Implementation studies and complexity analysis (1)
	+ AHG7: Low latency and constrained complexity (3)
	+ Encoding algorithm optimization (1)
	+ Profile/tier/level specification (0)
	+ 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 (24) (section 5.2)
	+ AHG12 and EE2: Enhanced compression beyond VVC capability (60) (section 5.3)
* High-level syntax (HLS) proposals (section 6) with subtopics
	+ AHG9: SEI message studies and proposals (5) (section 6.1)
	+ Neural-network post filter (8) (section 6.2)
	+ Film grain synthesis (2) (section 6.3)
	+ Non-SEI HLS aspects (1) (section 6.4)
* Joint meetings, plenary discussions, BoG and viewing reports (0), summary of actions (section 0)
* 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 13 July 2022 in session 1 during 05XX–0700 and in session 2 0720–0XXX UTC (chaired by JRO).

[JVET-AA0001](https://jvet-experts.org/doc_end_user/current_document.php?id=11827) JVET AHG report: Project management (AHG1) [J.-R. Ohm, G. J. Sullivan (AHG chairs)]

[JVET-AA0002](https://jvet-experts.org/doc_end_user/current_document.php?id=11828) JVET AHG report: Draft text and test model algorithm description editing (AHG2) [B. Bross, 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 (AHG chairs)]

[JVET-AA0003](https://jvet-experts.org/doc_end_user/current_document.php?id=11829) JVET AHG report: Test model software development (AHG3) [F. Bossen, X. Li, K. Sühring, Y. He, K. Sharman, V. Seregin, A. Tourapis (AHG chairs)]

[JVET-AA0004](https://jvet-experts.org/doc_end_user/current_document.php?id=11830) JVET AHG report: Test material and visual assessment (AHG4) [V. Baroncini, T. Suzuki, M. Wien, S. Liu, G. Martin-Cocher, A. Segall, P. Topiwala, S. Wenger, J. Xu, Y. Ye (AHG chairs)]

[JVET-AA0005](https://jvet-experts.org/doc_end_user/current_document.php?id=11831) JVET AHG report: Conformance testing (AHG5) [D. Rusanovskyy, I. Moccagatta, F. Bossen, K. Kawamura, T. Hashimoto, H.-J. Jhu, K. Sühring, Y. Yu (AHG chairs)]

[JVET-AA0006](https://jvet-experts.org/doc_end_user/current_document.php?id=11716) JVET AHG report: ECM software development (AHG6) [V. Seregin, J. Chen, F. Le Léannec, K. Zhang (AHG chairs)]

[JVET-AA0007](https://jvet-experts.org/doc_end_user/current_document.php?id=11832) JVET AHG report: Low latency and constrained complexity (AHG7) [A. Duenas, T. Poirier, S. Liu, L. Wang, J. Xu (AHG chairs)]

[JVET-AA0008](https://jvet-experts.org/doc_end_user/current_document.php?id=11833) JVET AHG report: High bit depth, high bit rate, and high frame rate coding (AHG8) [A. Browne, T. Ikai, D. Rusanovskyy, X. Xiu, Y. Yu (AHG chairs)]

[JVET-AA0009](https://jvet-experts.org/doc_end_user/current_document.php?id=11834) JVET AHG report: SEI message studies (AHG9) [S. McCarthy, Y.-K. Wang, T. Chujoh, S. Deshpande, C. Fogg, P. de Lagrange, G. J. Sullivan, A. Tourapis, S. Wenger (AHG chairs)]

[JVET-AA0010](https://jvet-experts.org/doc_end_user/current_document.php?id=11835) JVET AHG report: Encoding algorithm optimization (AHG10) [P. de Lagrange, A. Duenas, R. Sjöberg, A. Tourapis (AHG chairs)]

[JVET-AA0011](https://jvet-experts.org/doc_end_user/current_document.php?id=11836) JVET AHG report: Neural network-based video coding (AHG11) [E. Alshina, S. Liu, A. Segall, F. Galpin, J. Pfaff, S. S. Wang, Z. Wang, M. Wien, P. Wu, J. Xu (AHG chairs)]

[JVET-AA0012](https://jvet-experts.org/doc_end_user/current_document.php?id=11837) JVET AHG report: Enhanced compression beyond VVC capability (AHG12) [M. Karczewicz, Y. Ye, L. Zhang, B. Bross, X. Li, K. Naser, H. Yang (AHG chairs)]

[JVET-AA0013](https://jvet-experts.org/doc_end_user/current_document.php?id=11838) JVET AHG report: Film grain technologies (AHG13) [W. Husak, M. Radosavljević, W. Wan, D. Grois, Y. He, P. de Lagrange, A. Segall, A. Tourapis (AHG chairs)]

# Project development (13)

## Deployment and advertisement of standards (1)

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

[JVET-AA0020](https://jvet-experts.org/doc_end_user/current_document.php?id=11726) Deployment status of the HEVC standard [G. J. Sullivan (Microsoft)]

## Text development and errata reporting (1)

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

[JVET-AA0048](https://jvet-experts.org/doc_end_user/current_document.php?id=11723) Some VVC text changes [Y.-K. Wang (Bytedance), G. J. Sullivan (Microsoft)]

## Test conditions (2)

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

[JVET-AA0046](https://jvet-experts.org/doc_end_user/current_document.php?id=11721) [AhG4] Report on AhG4 meeting on development of a gaming-type CTC class [M. Wien (AHG chair)]

[JVET-AA0130](https://jvet-experts.org/doc_end_user/current_document.php?id=11806) AHG8: Draft VTM and HM common test conditions for high bit depth and high bit rate video coding [A. Browne, T. Ikai, D. Rusanovskyy, X. Xiu, Y. Yu (AHG chairs)]

## Verification testing (0)

Section kept as a template for future use.

## Test material (1)

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

[JVET-AA0123](https://jvet-experts.org/doc_end_user/current_document.php?id=11799) [AHG-7] Update on gaming sequences from InterDigital [T. Poirier, S. Puri, G. Martin-Cocher, E. Faivre d'Arcier (InterDigital)]

## Quality assessment (0)

Section kept as a template for future use.

## Conformance test development (1)

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

[JVET-AA0109](https://jvet-experts.org/doc_end_user/current_document.php?id=11785) Editors' update on conformance testing for VVC operation range extensions [D. Rusanovskyy (Qualcomm), T. Ikai (Sharp), H.-J. Jhu (Kwai), I. Moccagatta (Intel), Y. Yu (OPPO)]

## Software development (2)

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

[JVET-AA0086](https://jvet-experts.org/doc_end_user/current_document.php?id=11762) AHG11: Small Ad-hoc Deep-Learning Library (SADL) update [F. Galpin, T. Dumas, P. Bordes, E. François (InterDigital)]

[JVET-AA0132](https://jvet-experts.org/doc_end_user/current_document.php?id=11808) AHG6: ECM software configuration parameters for template matching tools [C.-C. Chen, H. Huang, V. Seregin, M. Karczewicz (Qualcomm)]

## Implementation studies and complexity analysis (1)

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

[JVET-AA0154](https://jvet-experts.org/doc_end_user/current_document.php?id=11842) 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, B. Bross, H. Schwarz, D. Marpe, T. Schierl (HHI)] [miss] [late]

## AHG7: Low latency and constrained complexity (3)

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

[JVET-AA0046](https://jvet-experts.org/doc_end_user/current_document.php?id=11721) [AhG4] Report on AhG4 meeting on development of a gaming-type CTC class [M. Wien (AHG chair)]

[JVET-AA0117](https://jvet-experts.org/doc_end_user/current_document.php?id=11793) AHG-7: refining low delay configuration for cloud gaming [S. Puri, T. Poirier, P. Le Guyadec, A. Robert, G. Martin-Cocher, E. François (InterDigital)]

[JVET-AA0123](https://jvet-experts.org/doc_end_user/current_document.php?id=11799) [AHG-7] Update on gaming sequences from InterDigital [T. Poirier, S. Puri, G. Martin-Cocher, E. Faivre d'Arcier (InterDigital)]

## AHG10: Encoding algorithm optimization (1)

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

[JVET-AA0129](https://jvet-experts.org/doc_end_user/current_document.php?id=11805) Non-EE2/AHG10: Improved inter hash RDO considering OBMC off in ECM5.0 [X. Xiu, C.-W. Kuo, H.-J. Jhu, W. Chen, N. Yan, X. Wang (Kwai)]

## Profile/tier/level specification (0)

Section kept as a template for future use.

## Proposed modification of system interface (0)

Section kept as a template for future use.

# 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 XX July 2022 (chaired by JRO).

[JVET-AA0130](https://jvet-experts.org/doc_end_user/current_document.php?id=11806) AHG8: Draft VTM and HM common test conditions for high bit depth and high bit rate video coding [A. Browne, T. Ikai, D. Rusanovskyy, X. Xiu, Y. Yu (AHG chairs)]

## AHG11: Neural network-based video coding (24)

### Summary and BoG reports

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

[JVET-AA0047](https://jvet-experts.org/doc_end_user/current_document.php?id=11722) [AHG 11] Brief information about JPEG AI CfP status [E. Alshina, J. Ascenso, T. Ebrahimi, F. Pereira, T. Richter]

### EE1 contributions: Neural network-based video coding (9)

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

[JVET-AA0059](https://jvet-experts.org/doc_end_user/current_document.php?id=11735) EE1-3.1: Supplementary experiments based on JVET-Z0077 [Q. Qin, C. Jung (Xidian Univ.), D. Zou, M. Li (OPPO)]

[JVET-AA0066](https://jvet-experts.org/doc_end_user/current_document.php?id=11742) EE1-1.7: Content-adaptive post-filter based on SADL inference [R. Yang, M. Santamaria, F. Cricri, H. Zhang, J. Lainema, R. G. Youvalari, M. M. Hannuksela (Nokia)]

[JVET-AA0071](https://jvet-experts.org/doc_end_user/current_document.php?id=11747) EE1-2.1: A CNN-based Super Resolution Method Combined with GOP Level Adaptive Resolution [S. Peng, C. Fang, D. Jiang, J. Lin, X. Zhang (Dahua), J. Nam, S. Yoo, J. Lim, S. Kim (LGE)]

[JVET-AA0081](https://jvet-experts.org/doc_end_user/current_document.php?id=11757) EE1-1.2: NN intra model without attention, partitioning and boundary strength [J. Ström, D. Liu, M. Damghanian, K. Andersson, Y. Li, P. Wennersten, R. Yu (Ericsson)]

[JVET-AA0172](https://jvet-experts.org/doc_end_user/current_document.php?id=11860) Cross-check of JVET-AA0081 (EE1-1.2: NN intra model without attention, partitioning and boundary strength) [M. Santamaria, F. Cricri (Nokia)] [late]

[JVET-AA0085](https://jvet-experts.org/doc_end_user/current_document.php?id=11761) EE1-1.1: The Performance of Single-Model Filter Trained on the VTM and ECM Reconstruction [R. Chang, L. Wang, X. Xu, S. Liu (Tencent)]

[JVET-AA0179](https://jvet-experts.org/doc_end_user/current_document.php?id=11867) Crosscheck of JVET-AA0085 (EE1-1.1: The Performance of Single-Model Filter Trained on the VTM and ECM Reconstruction) [C. Zhou (vivo)] late] [miss]

[JVET-AA0087](https://jvet-experts.org/doc_end_user/current_document.php?id=11763) EE1-1.4: Neural network based in-loop filter with 2 models [L. Wang, S. Lin, X. Xu, S. Liu (Tencent), F. Galpin (InterDigital)]

[JVET-AA0088](https://jvet-experts.org/doc_end_user/current_document.php?id=11764) EE1-1.5: Neural network based in-loop filter with a single model [L. Wang, S. Lin, X. Xu, S. Liu (Tencent), F. Galpin (InterDigital)]

[JVET-AA0178](https://jvet-experts.org/doc_end_user/current_document.php?id=11866) Crosscheck of JVET-AA0088 (EE1-1.5: Neural network based in-loop filter with a single model) [H. Wang (Qualcomm)] [late] [miss]

[JVET-AA0174](https://jvet-experts.org/doc_end_user/current_document.php?id=11862) [EE1] Crosscheck of training stage for EE1-1.5 and EE1-1.6 tests [J. Sauer, B. Wang, E. Alshina (Huawei)] [late] [miss]

[JVET-AA0111](https://jvet-experts.org/doc_end_user/current_document.php?id=11787) EE1-1.6: Deep In-Loop Filter With Fixed Point Implementation [Y. Li, K. Zhang, J. Li, L. Zhang (Bytedance), H. Wang, M. Coban, A.M. Kotra, M. Karczewicz (Qualcomm), F. Galpin (InterDigital), K. Andersson, J. Ström, D. Liu, R. Sjöberg (Ericsson)]

[JVET-AA0181](https://jvet-experts.org/doc_end_user/current_document.php?id=11869) Cross-check of JVET-AA0111 (EE1-1.6: Deep In-Loop Filter With Fixed Point Implementation) [K. Lin, C. Jia, S. Wang (??)] late] [miss]

[JVET-AA0122](https://jvet-experts.org/doc_end_user/current_document.php?id=11798) EE1-1.3: On BaseQP adjustment in CNNLF [Z. Xie, Y. Yu, H. Yu, D. Wang (OPPO)]

### EE1 related contributions: Neural network-based video coding (8)

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

[JVET-AA0074](https://jvet-experts.org/doc_end_user/current_document.php?id=11750) [EE1-related] Lighter WCDANN: CNN Based In-Loop Filters [H. Zhang, C. Jung (Xidian Univ.), D. Zou, M. Li (OPPO)]

[JVET-AA0089](https://jvet-experts.org/doc_end_user/current_document.php?id=11765) EE1-related: More refinements on EE1-1.4 and EE1-1.5 [L. Wang, S. Lin, X. Xu, S. Liu (Tencent), Z. Xie, Y. Yu, H. Yu, D. Wang (OPPO)]

[JVET-AA0090](https://jvet-experts.org/doc_end_user/current_document.php?id=11766) EE1-related: One luma model with IPB and skip for filtering intra and inter luma slices [D. Liu, J. Ström, M. Damghanian, P. Wennersten, Y. Li (Ericsson)]

[JVET-AA0094](https://jvet-experts.org/doc_end_user/current_document.php?id=11770) EE1-related: Deep In-Loop Filter in EE1-1.6 with Adaptive Input Samples [C. Zhou, Z. Lv, J. Zhang (vivo), W. Chen, J. Guo, B. Ai (BJTU)] [placehold] [late]

[JVET-AA0112](https://jvet-experts.org/doc_end_user/current_document.php?id=11788) EE1-1.6-related: Deep In-Loop Filter with Additional Input Information [Y. Li, K. Zhang, L. Zhang (Bytedance)]

[JVET-AA0113](https://jvet-experts.org/doc_end_user/current_document.php?id=11789) EE1-1.6-related: RDO Considering Deep In-Loop Filter with SADL [J. Li, Y. Li, K. Zhang, L. Zhang (Bytedance)]

[JVET-AA0115](https://jvet-experts.org/doc_end_user/current_document.php?id=11791) EE1-1.6-related: ALF with Samples before Deep In-Loop Filter [J. Li, K. Zhang, Y. Li, L. Zhang (Bytedance)]

[JVET-AA0131](https://jvet-experts.org/doc_end_user/current_document.php?id=11807) EE1-related: CNN based in-loop filtering with large activation layer [H. Wang, S. Eadie, M. Coban, M. Karczewicz (Qualcomm)]

### Other NN technology related contributions (7)

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

[JVET-AA0063](https://jvet-experts.org/doc_end_user/current_document.php?id=11739) AHG11: A hybrid codec using E2E image coding combined with VVC video coding [Y. He, B. Wang, E. Alshina, J. Sauer (Huawei)]

[JVET-AA0065](https://jvet-experts.org/doc_end_user/current_document.php?id=11741) AHG11: CNN Filter for Super-Resolution with RPR functionality in VVC [S. Huang, C. Jung, Y. Liu, M. Li]

[JVET-AA0076](https://jvet-experts.org/doc_end_user/current_document.php?id=11752) AHG11: RPR-Based Super-Resolution Guided by Partition Information [Q. Han, C. Jung (Xidian Univ.), Y. Liu, M. Li (OPPO)]

[JVET-AA0080](https://jvet-experts.org/doc_end_user/current_document.php?id=11756) AHG11: Complexity reduction on neural-network loop filter [J. N. Shingala, S. Kadaramandalgi, A. Shyam (Ittiam), T. Shao, A. Arora, P. Yin, F. Pu, T. Lu, S. McCarthy (Dolby)]

[JVET-AA0082](https://jvet-experts.org/doc_end_user/current_document.php?id=11758) AHG11: Deep Reference Frame Generation for Inter Prediction Enhancement [Z. Liu, X. Xu, S. Liu (Tencent), J. Jia, Z. Chen (Wuhan Univ.)]

[JVET-AA0084](https://jvet-experts.org/doc_end_user/current_document.php?id=11760) AHG11: Neural Network based Super Resolution for Video Coding Using Multiple Side Information [R. Chang, L. Wang, X. Xu, S. Liu (Tencent)]

[JVET-AA0086](https://jvet-experts.org/doc_end_user/current_document.php?id=11762) AHG11: Small Ad-hoc Deep-Learning Library (SADL) update [F. Galpin, T. Dumas, P. Bordes, E. François (InterDigital)]

## AHG12: Enhanced compression beyond VVC capability (60)

### Summary and BoG reports

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

### EE2 contributions: Enhanced compression beyond VVC capability (22)

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

[JVET-AA0042](https://jvet-experts.org/doc_end_user/current_document.php?id=11717) EE2-2.8, 2.9, 2.10: Longer luma and chroma filters for RPR [K. Andersson, R. Yu (Ericsson)]

[JVET-AA0057](https://jvet-experts.org/doc_end_user/current_document.php?id=11733) EE2-1.1a: Convolutional cross-component intra prediction model [P. Astola, J. Lainema, R. G. Youvalari, A. Aminlou, K. Panusopone (Nokia)]

[JVET-AA0156](https://jvet-experts.org/doc_end_user/current_document.php?id=11844) Crosscheck of JVET-AA0057 (EE2-1.1a: Convolutional cross-component intra prediction model) [Y.-J. Chang (Qualcomm)] [late]

[JVET-AA0058](https://jvet-experts.org/doc_end_user/current_document.php?id=11734) EE2-2.7: GPM adaptive blending (JVET-Z0059, JVET-Z0137) [Y. Kidani, H. Katou, K. Unno, K. Kawamura (KDDI), N. Yan, X. Xiu, W. Chen, H.-J. Jhu, C.-W. Kuo, X. Wang (Kwai)]

[JVET-AA0159](https://jvet-experts.org/doc_end_user/current_document.php?id=11847) Crosscheck of JVET-AA0058 (EE2-2.7: GPM adaptive blending (JVET-Z0059, JVET-Z0137) [Z. Deng (Bytedance)] [late] [miss]

[JVET-AA0061](https://jvet-experts.org/doc_end_user/current_document.php?id=11737) EE2-3.1: IBC Merge Mode with Block Vector Differences [N. Zhang, J. Xu, K. Zhang, M. Salehifar, L. Zhang (Bytedance)]

[JVET-AA0062](https://jvet-experts.org/doc_end_user/current_document.php?id=11738) EE2-3.3: Combination of EE2-3.1 and EE2-3.2 [N. Zhang, Z. Deng, K. Zhang, J. Xu, M. Salehifar, L. Zhang (Bytedance)]

[JVET-AA0070](https://jvet-experts.org/doc_end_user/current_document.php?id=11746) EE2-3.2: Reconstruction-Reordered IBC for screen content coding [Z. Deng, K. Zhang, L. Zhang (Bytedance)]

[JVET-AA0072](https://jvet-experts.org/doc_end_user/current_document.php?id=11748) EE2-2.4: ARMC with refined motion [Y. Wang, K. Zhang, N. Zhang, Z. Deng, L. Zhang (Bytedance)]

[JVET-AA0078](https://jvet-experts.org/doc_end_user/current_document.php?id=11754) EE2-1.6: Weighted chroma prediction [J.-Y. Huo, Z.-Y. Zhang, H.-Q. Du, Y.-Z. Ma, F.-Z. Yang (Xidian Univ.), J. Ren, M. Li (OPPO)]

[JVET-AA0164](https://jvet-experts.org/doc_end_user/current_document.php?id=11852) Crosscheck of JVET-AA0078 (EE2-1.6: Weighted chroma prediction) [X. Li (Alibaba)] [late] [miss]

[JVET-AA0092](https://jvet-experts.org/doc_end_user/current_document.php?id=11768) EE2-2.5: ARMC improvements [G. Laroche, P. Onno (Canon)]

[JVET-AA0158](https://jvet-experts.org/doc_end_user/current_document.php?id=11846) Crosscheck of JVET-AA0092 (EE2-2.5: ARMC improvements) [Y. Wang (Bytedance)] [late]

[JVET-AA0093](https://jvet-experts.org/doc_end_user/current_document.php?id=11769) EE2-2.6: Combination test of Test 2.4 (on ARMC with refined motion) and Test 2.5 (on ARMC improvements) [G. Laroche, P. Onno (Canon), Y. Wang, K. Zhang, N. Zhang, Z. Deng, L. Zhang (Bytedance)]

[JVET-AA0095](https://jvet-experts.org/doc_end_user/current_document.php?id=11771) EE2-5: Adaptive filter shape switch and using samples before deblocking filter for adaptive loop filter [N. Hu, V. Seregin, M. Karczewicz (Qualcomm), W. Yin, K. Zhang, L. Zhang (Bytedance)]

[JVET-AA0168](https://jvet-experts.org/doc_end_user/current_document.php?id=11856) Crosscheck of JVET-AA0095 (EE2-5.2: Using sample before deblocking filter for adaptive loop filter) [W. Yin (Bytedance)] [late]

[JVET-AA0096](https://jvet-experts.org/doc_end_user/current_document.php?id=11772) EE2-2.2: Motion compensated picture boundary padding [F. Le Léannec, P. Andrivon, M. Radosavljević (Xiaomi), Z. Zhang, H. Huang, C-C. Chen, Y-J. Chang, Y. Zhang, V. Seregin, M. Coban, M. Karczewicz (Qualcomm)]

[JVET-AA0106](https://jvet-experts.org/doc_end_user/current_document.php?id=11782) EE2-1.7: IBC Adaptation for Camera-Captured Content [J. Xu, Y. Wang (Bytedance)]

[JVET-AA0107](https://jvet-experts.org/doc_end_user/current_document.php?id=11783) EE2-2.1: Regression based affine candidate derivation [Y. Zhang, H. Huang, V. Seregin, M. Coban, M. Karczewicz (Qualcomm)]

[JVET-AA0116](https://jvet-experts.org/doc_end_user/current_document.php?id=11792) EE2-2.3: MMVD and Affine MMVD Extension [M. Salehifar, Y. He, K. Zhang, N. Zhang, L. Zhang (Bytedance)]

[JVET-AA0118](https://jvet-experts.org/doc_end_user/current_document.php?id=11794) EE2-1.4: Spatial GPM [F. Wang, Y. Yu, H. Yu, D. Wang (OPPO)]

[JVET-AA0151](https://jvet-experts.org/doc_end_user/current_document.php?id=11839) Crosscheck of JVET-AA0118 (EE2-1.4: Spatial GPM) [K. Naser (InterDigital)] [miss] [late]

[JVET-AA0125](https://jvet-experts.org/doc_end_user/current_document.php?id=11801) EE2-1.1b and 1.2: Filter-based linear model and gradient linear model [C.-W. Kuo, H.-J. Jhu, X. Xiu, N. Yan, W. Chen, X. Wang (Kwai)]

[JVET-AA0162](https://jvet-experts.org/doc_end_user/current_document.php?id=11850) Crosscheck of JVET-AA0125 (EE2-1.1b and 1.2: Filter-based linear model and gradient linear model) [X. Li (Alibaba)] [late] [miss]

[JVET-AA0126](https://jvet-experts.org/doc_end_user/current_document.php?id=11802) EE2-1.1c, 1.3a and 1.3b: Combined tests of EE2-1.1a, 1.1b and 1.2 [P. Astola, J. Lainema, R. G. Youvalari, A. Aminlou, K. Panusopone (Nokia), C.-W. Kuo, H.-J. Jhu, X. Xiu, N. Yan, W. Chen, X. Wang (Kwai)]

[JVET-AA0160](https://jvet-experts.org/doc_end_user/current_document.php?id=11848) Crosscheck of JVET-AA0126 (EE2-1.3a: Combined tests of EE2-1.1a and 1.2) [Z. Deng (Bytedance)] [late] [miss]

[JVET-AA0133](https://jvet-experts.org/doc_end_user/current_document.php?id=11809) EE2-4.1: Inter MTS optimization [B. Ray, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-AA0182](https://jvet-experts.org/doc_end_user/current_document.php?id=11870) Crosscheck of JVET-AA0133 (EE2-4.1: Inter MTS optimization) [Z. Fan, Y. Yasugi, T. Ikai (Sharp)] late] [miss]

[JVET-AA0135](https://jvet-experts.org/doc_end_user/current_document.php?id=11811) EE2-1.5: Chroma intra modes derived from collocated luma blocks and neighbouring chroma blocks [Y.-J. Chang, K. Cao, B. Ray, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-AA0152](https://jvet-experts.org/doc_end_user/current_document.php?id=11840) Crosscheck of JVET-AA0135 (EE2-1.5: Chroma intra modes derived from collocated luma blocks and neighbouring chroma blocks) [K. Naser (InterDigital)] [miss] [late]

[JVET-AA0153](https://jvet-experts.org/doc_end_user/current_document.php?id=11841) EE2-1.6b: Convolutional cross-component intra prediction model + weighted chroma prediction [P. Astola, J. Lainema (Nokia)] [late]

[JVET-AA0157](https://jvet-experts.org/doc_end_user/current_document.php?id=11845) Crosscheck of JVET-AA0153 (EE2-1.6b: Convolutional cross-component intra prediction model + weighted chroma prediction) [Y.-J. Chang (Qualcomm)] [late]

[JVET-AA0176](https://jvet-experts.org/doc_end_user/current_document.php?id=11864) EE2 2.1d: Combination test of EE2 2.1b and 2.5 [Y. Zhang, H. Huang, V. Seregin, M. Coban, M. Karczewicz (Qualcomm), G. Laroche, P. Onno (Canon)] [late] [miss]

### EE2 related contributions (10)

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

[JVET-AA0045](https://jvet-experts.org/doc_end_user/current_document.php?id=11720) [EE2-1.4 related] Reduced Complexity Spatial GPM [K. Naser, Y. Chen, A. Robert, K. Reuzé (InterDigital)]

[JVET-AA0103](https://jvet-experts.org/doc_end_user/current_document.php?id=11779) EE2-related: CCLM with non-linear term [X. Li, Y. Ye, R.-L. Liao, J. Chen (Alibaba)]

[JVET-AA0114](https://jvet-experts.org/doc_end_user/current_document.php?id=11790) [EE2-related] Division-free operation and mean-compensation for convolutional cross-component model (CCCM) [A. Aminlou, J. Lainema, P. Astola (Nokia)]

[JVET-AA0175](https://jvet-experts.org/doc_end_user/current_document.php?id=11863) Crosscheck of JVET-AA0114 ([EE2-related] Division-free operation and mean-compensation for convolutional cross-component model (CCCM)) [Y.-J. Chang (Qualcomm)] [late] [miss]

[JVET-AA0119](https://jvet-experts.org/doc_end_user/current_document.php?id=11795) EE2-1.4a-related: Modifications of Spatial GPM [F. Wang, Y. Yu, H. Yu, D. Wang (OPPO)]

[JVET-AA0127](https://jvet-experts.org/doc_end_user/current_document.php?id=11803) EE2-1 related: Encoder optimization of EE2-1.2 and 1.3 [C.-W. Kuo, H.-J. Jhu, X. Xiu, N. Yan, W. Chen, X. Wang (Kwai)]

[JVET-AA0161](https://jvet-experts.org/doc_end_user/current_document.php?id=11849) Crosscheck of JVET-AA0127 (EE2-1 related: Encoder optimization of EE2-1.2 and 1.3) [Z. Deng (Bytedance)] [late] [miss]

[JVET-AA0163](https://jvet-experts.org/doc_end_user/current_document.php?id=11851) Crosscheck of JVET-AA0127 (EE2-1 related: Encoder optimization of EE2-1.2 and 1.3) [X. Li (Alibaba)] [late] [miss]

[JVET-AA0128](https://jvet-experts.org/doc_end_user/current_document.php?id=11804) EE2-related: On regression based affine candidate derivation [W. Chen, X. Xiu, C.-W. Kuo, H.-J. Jhu, N. Yan, X. Wang (Kwai)]

[JVET-AA0138](https://jvet-experts.org/doc_end_user/current_document.php?id=11814) EE2-related: On Gradient Linear Model (GLM) [X. Li, Y. Ye, R.-L. Liao, J. Chen (Alibaba)]

[JVET-AA0173](https://jvet-experts.org/doc_end_user/current_document.php?id=11861) Crosscheck of JVET-AA0138 (EE2-related: On Gradient Linear Model (GLM)) [C.-W. Kuo (Kwai)] [late] [miss]

[JVET-AA0140](https://jvet-experts.org/doc_end_user/current_document.php?id=11816) EE2-related: Self-Aware Filter Estimation for CCLM [K. Zhang, Z. Deng, L. Zhang (Bytedance)]

[JVET-AA0147](https://jvet-experts.org/doc_end_user/current_document.php?id=11823) EE2-Related: Extended Offline-Filtering Taps for ALF [W. Yin, K. Zhang, Z. Deng, L. Zhang (Bytedance)]

[JVET-AA0149](https://jvet-experts.org/doc_end_user/current_document.php?id=11825) EE2-1.4 related: Improvements on Spatial GPM [A. Natesan, J. N. Shingala, J. R. Arumugam, V. Valvaiker (Ittiam), T. Lu, P. Yin, F. Pu, T. Shao, A. Arora, S. McCarthy (Dolby)]

### ECM modifications beyond EE2 (28)

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

[JVET-AA0043](https://jvet-experts.org/doc_end_user/current_document.php?id=11718) IntraTMP Adaptation for Camera Captured Contents [K. Naser, T. Poirier, F. Galpin, A. Robert (InterDigital)]

[JVET-AA0044](https://jvet-experts.org/doc_end_user/current_document.php?id=11719) IntraTMP for chroma Components [K. Naser, T. Dumas, T. Poirier, F. Galpin (InterDigital)]

[JVET-AA0171](https://jvet-experts.org/doc_end_user/current_document.php?id=11859) Crosscheck of JVET-AA0044 (IntraTMP for chroma Components) [W. Lim, S.-C Lim (ETRI)] [late] [miss]

[JVET-AA0053](https://jvet-experts.org/doc_end_user/current_document.php?id=11729) AHG12: Using block vector derived from IntraTMP for IBC [W. Lim, D. Kim, S.-C. Lim, J. S. Choi (ETRI)]

[JVET-AA0155](https://jvet-experts.org/doc_end_user/current_document.php?id=11843) Cross-check of JVET-A0053 "AHG12: Using block vector derived from IntraTMP for IBC" [F. Le Léannec (Xiaomi)] [miss] [late]

[JVET-AA0064](https://jvet-experts.org/doc_end_user/current_document.php?id=11740) AHG12: A study on non-separable primary transform [J. Choi, M. Koo, J. Lim, J. Zhao, S. Kim (LGE)]

[JVET-AA0069](https://jvet-experts.org/doc_end_user/current_document.php?id=11745) Non-EE2: AmvpMerge for low delay [H. Jang, J. Nam, N. Park, J. Lim, S. Kim (LGE)]

[JVET-AA0073](https://jvet-experts.org/doc_end_user/current_document.php?id=11749) Non-EE2: Modification of LFNST for MIP coded block [J.-Y. Huo, W.-H. Qiao, X. Hao, Y.-Z. Ma, F.-Z. Yang (Xidian Univ.), J. Ren, M. Li (OPPO)]

[JVET-AA0075](https://jvet-experts.org/doc_end_user/current_document.php?id=11751) Non-EE2: Template matching based BCW index derivation for merge mode [R.-L. Liao, J. Chen, Y. Ye, X. Li (Alibaba)]

[JVET-AA0077](https://jvet-experts.org/doc_end_user/current_document.php?id=11753) AHG12: On BVD coding for IBC [A. Filippov, V. Rufitskiy (Ofinno)] [miss] [late]

[JVET-AA0097](https://jvet-experts.org/doc_end_user/current_document.php?id=11773) ECM fix for block-level out-of-bound checking [F. Le Léannec, P. Andrivon, M. Radosavljević (Xiaomi)]

[JVET-AA0167](https://jvet-experts.org/doc_end_user/current_document.php?id=11855) Crosscheck of JVET-AA0097: ECM fix for block-level out-of-bound checking [X. Xiu (Kwai)] [late] [miss]

[JVET-AA0098](https://jvet-experts.org/doc_end_user/current_document.php?id=11774) AHG12: Encoder configuration proposal to reduce worst case encoding time [F. Le Léannec, P. Andrivon, M. Radosavljević (Xiaomi)]

[JVET-AA0170](https://jvet-experts.org/doc_end_user/current_document.php?id=11858) Crosscheck of JVET-AA0098 (AHG 12: encoder configuration proposal to reduce worst case encoding time) [W. Lim, S.-C Lim (ETRI)] [late] [miss]

[JVET-AA0104](https://jvet-experts.org/doc_end_user/current_document.php?id=11780) Non-EE2: On planar horizontal mode and planar vertical mode [X. Li, R.-L. Liao, J. Chen, Y. Ye (Alibaba)]

[JVET-AA0184](https://jvet-experts.org/doc_end_user/current_document.php?id=11872) Crosscheck of JVET-AA0104 Non-EE2: On planar horizontal mode and planar vertical mode [W. Jia (Bytedance)] late] [miss]

[JVET-AA0108](https://jvet-experts.org/doc_end_user/current_document.php?id=11784) AHG12: IBC AMVP candidates clustering [D. Ruiz Coll, V. Warudkar (Ofinno)] [miss] [late]

[JVET-AA0120](https://jvet-experts.org/doc_end_user/current_document.php?id=11796) Non-EE2: Template-based multiple reference line intra prediction [L. Xu, Y. Yu, H. Yu, D. Wang (OPPO)]

[JVET-AA0166](https://jvet-experts.org/doc_end_user/current_document.php?id=11854) Crosscheck of JVET-AA0120 (Non-EE2: Template-based multiple reference line intra prediction) [X. Li (Alibaba)] [late] [miss]

[JVET-AA0121](https://jvet-experts.org/doc_end_user/current_document.php?id=11797) Non-EE2: Template-based MIP [Z. Xie, Y. Yu, H. Yu, D. Wang, Y. Liu, M. Li (OPPO), J. Huo, W. Qiao, X. Hao, Y. Ma, F. Yang (Xidian University)]

[JVET-AA0165](https://jvet-experts.org/doc_end_user/current_document.php?id=11853) Crosscheck of JVET-AA0121 (Non-EE2: Template-based MIP) [X. Li (Alibaba)] [late] [miss]

[JVET-AA0124](https://jvet-experts.org/doc_end_user/current_document.php?id=11800) Non-EE2: Enable amvpMerge mode on scaled reference pictures when DMVD is disabled [Z. Zhang, H. Huang, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-AA0129](https://jvet-experts.org/doc_end_user/current_document.php?id=11805) Non-EE2/AHG10: Improved inter hash RDO considering OBMC off in ECM5.0 [X. Xiu, C.-W. Kuo, H.-J. Jhu, W. Chen, N. Yan, X. Wang (Kwai)]

[JVET-AA0169](https://jvet-experts.org/doc_end_user/current_document.php?id=11857) Cross-check of JVET-AA0129 [F. Le Léannec (Xiaomi)] [late] [miss]

[JVET-AA0132](https://jvet-experts.org/doc_end_user/current_document.php?id=11808) AHG6: ECM software configuration parameters for template matching tools [C.-C. Chen, H. Huang, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-AA0134](https://jvet-experts.org/doc_end_user/current_document.php?id=11810) Non-EE2: POC based BCW weights derivation [Z. Zhang, H. Huang, C.-C. Chen, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-AA0136](https://jvet-experts.org/doc_end_user/current_document.php?id=11812) Non-EE2: On CCCM improvement [Y.-J. Chang, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-AA0183](https://jvet-experts.org/doc_end_user/current_document.php?id=11871) Crosscheck of JVET-AA0136 (Non-EE2: On CCCM improvement) [J. Lainema (Nokia)] late] [miss]

[JVET-AA0137](https://jvet-experts.org/doc_end_user/current_document.php?id=11813) Non-EE2: Intra Prediction Fusion [K. Cao, V. Seregin, M. Karczewicz (Qualcomm)]

[JVET-AA0139](https://jvet-experts.org/doc_end_user/current_document.php?id=11815) Non-EE2: Longer deblocking filter for luma [K. Andersson, J. Enhorn (Ericsson)]

[JVET-AA0177](https://jvet-experts.org/doc_end_user/current_document.php?id=11865) Crosscheck of JVET-AA0139 (Non-EE2: Longer deblocking filter for luma) [N. Hu (Qualcomm)] [late] [miss]

[JVET-AA0141](https://jvet-experts.org/doc_end_user/current_document.php?id=11817) Non-EE2: Enhanced temporal motion information derivation [L. Zhao, K. Zhang, L. Zhang (Bytedance)]

[JVET-AA0142](https://jvet-experts.org/doc_end_user/current_document.php?id=11818) AHG12/Non-EE2: Picture-Level Geometry Transform [W. Jia, K. Zhang, Y. Wang, T. Fu, Y. Li, L. Zhang (Bytedance)]

[JVET-AA0143](https://jvet-experts.org/doc_end_user/current_document.php?id=11819) Non-EE2: Simplification methods for OBMC [K. Kim, D. Kim, J.-H. Son, J.-S. Kwak (WILUS)] [placehold] [late]

[JVET-AA0144](https://jvet-experts.org/doc_end_user/current_document.php?id=11820) Non-EE2: DMVR for affine merge coded blocks [J. Chen, R.-L. Liao, X. Li, Y. Ye (Alibaba)]

[JVET-AA0146](https://jvet-experts.org/doc_end_user/current_document.php?id=11822) AHG12/Non-EE2: Fixes on ECM for 360-degree video coding [Y. Wang, K. Zhang, Z. Deng, L. Zhang (Bytedance)]

[JVET-AA0148](https://jvet-experts.org/doc_end_user/current_document.php?id=11824) Non-EE2: On MHP (Multi-Hypothesis Prediction) [K. Sato, Y. Yu, H. Yu, D. Wang (OPPO)]

[JVET-AA0150](https://jvet-experts.org/doc_end_user/current_document.php?id=11826) AHG12: On CIPF (CABAC Initialization from the Previous Frame) [K. Sato, Y. Yu, H. Yu, D. Wang (OPPO)]

# High-level syntax (HLS) and related proposals (16)

## AHG9: SEI message studies and proposals (5)

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

[JVET-AA0079](https://jvet-experts.org/doc_end_user/current_document.php?id=11755) AHG9: Decoded picture hash SEI message extension [P. Bordes, F. Galpin, P. DeLagrange, E. François (InterDigital)]

[JVET-AA0091](https://jvet-experts.org/doc_end_user/current_document.php?id=11767) AHG9: Resolution Change Information SEI message [V. Drugeon, K. Abe, T. Toma (Panasonic)]

[JVET-AA0102](https://jvet-experts.org/doc_end_user/current_document.php?id=11778) AHG9: SEI processing order SEI message [P. Yin, S. McCarthy, W. Husak, K. Konstantinos, T. Lu, F. Pu, A. Arora, T. Shao (Dolby)]

[JVET-AA0105](https://jvet-experts.org/doc_end_user/current_document.php?id=11781) AHG9: Metadata for display on transparent screens based on ACI SEI messages [E. Thomas, P. Andrivon, F. Le Léannec, M. Radosavljević, M.-L. Champel (Xiaomi)]

[JVET-AA0110](https://jvet-experts.org/doc_end_user/current_document.php?id=11786) AHG9: SEI message with sample phase indication for consistent rendering [J. Samuelsson-Allendes, S. Deshpande (Sharp)]

## Neural-network post filter (8)

[JVET-AA0054](https://jvet-experts.org/doc_end_user/current_document.php?id=11730) AHG9: On Neural-network Post-filter Characteristics SEI Message [S. Deshpande (Sharp)]

[JVET-AA0055](https://jvet-experts.org/doc_end_user/current_document.php?id=11731) AHG9: Comments on Neural-network Post-filter Characteristics SEI Message [S. Deshpande, A. Sidiya (Sharp)]

[JVET-AA0056](https://jvet-experts.org/doc_end_user/current_document.php?id=11732) AHG9: On syntax gating in the neural-network post-filter characteristics SEI message [M. M. Hannuksela, F. Cricri, M. Santamaria (Nokia), T. Chujoh, Y. Yasugi, T. Ikai (Sharp), S. McCarthy, A. Arora, T. Shao, P. Yin, T. Lu, F. Pu, W. Husak (Dolby)]

[JVET-AA0067](https://jvet-experts.org/doc_end_user/current_document.php?id=11743) AHG9: Some specification improvements for neural-network post-filter characteristics SEI message [T. Chujoh, Y. Yasugi, T. Ikai (Sharp), M. Hannuksela, F. Cricri (Nokia), S. McCarthy, A. Arora, T. Shao, P. Yin, T. Lu, F. Pu, W. Husak (Dolby)]

[JVET-AA0083](https://jvet-experts.org/doc_end_user/current_document.php?id=11759) AHG9: NNR post-filter SEI message extension for flexible decoding capabilities [F. Galpin, T. Dumas, P. Bordes, E. François (InterDigital)]

[JVET-AA0100](https://jvet-experts.org/doc_end_user/current_document.php?id=11776) AHG9: On auxiliary input and separate colour description in the neural-network post-filter characteristics SEI message [T. Shao, A. Arora, P. Yin, S. McCarthy, T. Lu, F. Pu, W. Husak (Dolby), Miska M. Hannuksela, Francesco Cricri, Maria Santamaria Gomez (Nokia)]

[JVET-AA0101](https://jvet-experts.org/doc_end_user/current_document.php?id=11777) AHG9: On processing order in the neural-network post-filter activation SEI message [T. Shao, A. Arora, P. Yin, S. McCarthy, T. Lu, F. Pu, W. Husak (Dolby)]

[JVET-AA0145](https://jvet-experts.org/doc_end_user/current_document.php?id=11821) AHG9: On decoupling neural-network post-filter activation SEI message [H.-B. Teo, J. Gao, C.-S. Lim, K. Abe, V. Drugeon (Panasonic)]

## Film grain synthesis (2)

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

[JVET-AA0051](https://jvet-experts.org/doc_end_user/current_document.php?id=11727) AHG13: Film grain synthesis technology for video applications (Draft 2) [D. Grois (Comcast), Y. He (Qualcomm), W. Husak (Dolby), P. de Lagrange (InterDigital), M. Radosavljević (Xiaomi), A. Tourapis (Apple), W. Wan (Broadcom)]

[JVET-AA0052](https://jvet-experts.org/doc_end_user/current_document.php?id=11728) AHG13: On VSEI film grain profiles [Y. He, M. Coban, M. Karczewicz (Qualcomm), M. Radosavljević (Xiaomi)]

## Non-SEI HLS aspects (1)

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

[JVET-AA0099](https://jvet-experts.org/doc_end_user/current_document.php?id=11775) AHG9: On subpictures order [Hendry, S. Kim, S. Lee (LGE)]

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

## JVET plenaries (update)

No intermediate plenaries were held, as document review and decisions were made in single-track mode at this meeting.

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

* Thu. 28 Apr.
	+ 2100–2300 UTC (session 18): Review of remaining docs and revisits
* Fri. 29 Apr.
	+ 0500–0710 UTC General plenary wrap-up: See notes under sections 8, 9, 10, and 11.
	+ 0005+1–0020(+1) WG 5 Closing plenary: Approval of meeting recommendations

## Information sharing meetings

Information sharing sessions with other WGs and AGs of the MPEG community were held on Monday 18 July 0500–0730, Wednesday 20 July 0500–0600, and Friday 22 July 2100–2300. The status of the work in the MPEG WGs and AGs was reviewed at these information sharing sessions.

## Joint meetings with AG 5 and VCEG 2100–2300 on Wednesday 27 April and 0800–0920 on Thursday 27 April

Two joint meeting sessions with SC 29/AG 5 (Visual Quality Assessment) and VCEG were held during the current meeting.

The following topics were discussed in this joint session.

* Test material (see the notes in section 4.5)
* Quality assessment (see the notes in section 4.6)

## BoGs (0)

Three break-out groups were established at this meeting to conduct discussion and develop recommendations on specific topics. See sections 5.2.1 and 5.3.1 and the notes for JVET-Z0115 in section 6.2 for details.

## Liaison communications

The JVET received a liaison letter from SC 29/WG 1 JPEG ([m59796](https://dms.mpeg.expert/doc_end_user/current_document.php?id=82797&id_meeting=190)) related to its JPEG AI project. The letter was sent to provide information to various MPEG WGs informing them about the scope and CfP for the project, and no specific action was requested in the letter. It was considered not necessary to send a response from JVET.

# Project planning

## Software timeline

ECM5 software (including all adoptions) was planned to be available 3 weeks after the meeting.

VTM17 software was planned to be available on 2022-05-27. (Note that updates 16.1/16.2 are planned to be released shortly after the meeting)

HM16.26 software was planned to be available on 2022-05-13. A new version of HTM was targeted for release before the next meeting.

## Core experiment and exploration experiment planning

An EE on neural network-based video coding was established, as recorded in output document JVET-AA2023.

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-AA2024.

Initial versions of these documents were presented and approved in the first plenary session on Friday 22 July.

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

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

## Plans for improved efficiency and contribution consideration

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

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

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

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

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

## General issues for experiments

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

Group coordinated experiments have been planned as follows:

* “Core experiments” (CEs) are the coordinated experiments on coding tools which are deemed to be interesting but require more investigation and could potentially become part of a draft standard by the next meeting or in the near future.
* “Exploration experiments” (EEs) are also coordinated experiments. These are conducted on technology which is not foreseen to become part of a draft standard in the near future. The investigating methodology for assessment of such technology can also be an important part of an EE. (Further general rules for EEs, as far as deviating from the CE rules below, should be discussed in a future meeting. For the current meeting, procedures as described in the EE description document are deemed to be sufficient.)
* A CE is a test of a specific fully described technology in a specific agreed way. It is not a forum for thinking of new ideas (like an AHG). The CE coordinators are responsible for making sure that the CE description is complete and correct and has adequate detail. Reflector discussions about CE description clarity and other aspects of CE plans are encouraged.
* A description of each experiment is to be approved at the meeting at which the experiment plan is established. This should include the issues that were raised by other experts when the tool was presented, e.g., interference with other tools, contribution of different elements that are part of a package, etc. The experiment description document should provide the names of individual people, not just company names.
* Software for tools investigated in a CE will be provided in one or more separate branches of the software repository. Each CE will have a “fork” of the software, and within the CE there may be multiple branches established by the CE coordinator. The software coordinator will help coordinate the creation of these forks and branches and their naming. All JVET members will have read access to the CE software branches (using shared read-only credentials as described below).
* During the experiment, revisions of the experiment plans can be made, but not substantial changes to the proposed technology.
* The CE description must match the CE testing that is done. The CE description needs to be revised if there has been some change of plans.
* The CE summary report must describe any changes that were made in the process of finalizing the CE.
* By the next meeting it is expected that at least one independent cross-checker will report a detailed analysis of each proposed feature that has been tested and confirm that the implementation is correct. Commentary on the potential benefits and disadvantages of the proposed technology in cross-checking reports is highly encouraged. Having multiple cross-checking reports is also highly encouraged (especially if the cross-checking involves more than confirmation of correct test results). The reports of cross-checking activities may (and generally should) be integrated into the CE report rather than submitted as separate documents.
* It is mandatory to report encoder optimizations made for the benefit of a tool, and if an equivalent optimization could be applied on the anchor, a comparison against the improved anchor shall be provided.

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

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

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

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

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

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

The CE development workflow is described at:

<https://vcgit.hhi.fraunhofer.de/jvet/VVCSoftware_VTM/wikis/Core-experiment-development-workflow>

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

<https://www.itu.int/ifa/t/2017/sg16/exchange/wp3/q06/vceg_account.txt>

Some agreements relating to CE activities were established as follows:

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

General timeline for CEs

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

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

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

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

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

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

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

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

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

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

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

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

# Establishment of ad hoc groups

The ad hoc groups established to progress work on particular subject areas until the next meeting are described in the table below. The discussion list for all of these ad hoc groups was agreed to be the main JVET reflector (jvet@lists.rwth-aachen.de). The previously approved rules for MPEG ad hoc groups established in document [SC29/AG2 N 46](https://www.mpegstandards.org/wp-content/uploads/2022/01/ISO-IECJTC1-SC29-AG2_N0046_AhG.pdf) were agreed to apply to these ad hoc groups.

Review of AHG plans was conducted during the closing plenary on Friday 29 April 2022 at 0500 UTC.

|  |  |  |
| --- | --- | --- |
| **Title and Email Reflector** | **Chairs** | **Mtg** |
| **Project Management (AHG1)**(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)* Produce and finalize draft text outputs of the meeting (JVET-Z1003, JVET-Z1005, JVET-Z1008, JVET-Z2005, and JVET-Z2006).
* 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-Z1004 errata output collection.
* Produce and finalize JVET-Z2002 VVC Test Model 17 (VTM 17) 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, 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)* 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)* 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 of available and proposed video test material.
* Identify and recommend appropriate test material for testing the VVC standard and potential future extensions, as well as exploration activities.
* Identify and characterize missing types of video material, solicit contributions, collect, and make available a variety of video sequence test material.
* 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.
* Coordinate with AG 5 in studying and developing further methods of subjective quality evaluation, e.g. based on crowd sourcing.
* Prepare availability of viewing equipment and facilities arrangements for future meetings.
 | V. Baroncini, T. Suzuki, M. Wien (co-chairs), S. Liu, G. Martin-Cocher, A. Segall, P. Topiwala, S. Wenger, J. Xu, Y. Ye (vice-chairs) | Y (2 weeks notice) |
| **Conformance testing (AHG5)**(jvet@lists.rwth-aachen.de)* Study the JVET-Y2026 draft conformance testing for operation rage extensions and investigate the need for improvements.
* 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)* Coordinate development of the ECM software and associated configuration files.
* Produce documentation of software usage for distribution with the software.
* Prepare and deliver ECM-5.0 software version and the reference configuration encodings according to JVET-Y2017 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)* Identify additional application scenarios and their requirements for low latency and constrained complexity, taking into account aspects of real-time encoding and decoding.
* Discuss requirements of already identified scenario such as cloud gaming, game casting, video conferencing, video surveillance and remote control of systems.
* Evaluate and refine new CTC for low latency and constrained complexity application scenarios, and investigate a set of tools that provide a reasonable tradeoff regarding complexity vs. compression, as well as latency constraints.
* Conduct tests with ECM and VTM to determine the impact of discussed configurations on coding efficiency and run time, and conduct visual tests in coordination with AHG4, including the support for timely availability of test materials and test subjects.
* 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.
 | A. Duenas, 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)* Study the benefits and characteristics of VVC coding tools for high bit depth, high bit rate, and high frame rate coding.
* Study the JVET-U2018 testing conditions for high bit depth, high bit rate, and high frame rate coding, and suggest improvements as applicable, and coordinate with AHG3 towards a combination with JCTVC-AF1100.
* Contribute to the development of software and conformance testing for operation range extensions in coordination with AHG3 and AHG5.
 | A. Browne, T. Ikai (co-chairs), D. Rusanovskyy, X. Xiu, Y. Yu (vice-chairs) | N |
| **SEI message studies (AHG9)**(jvet@lists.rwth-aachen.de)* Study the SEI messages in VSEI, VVC, HEVC and AVC.
* Collect software and showcase information for SEI messages, including encoder and decoder implementations and bitstreams for demonstration and testing.
* Identify potential needs for additional SEI messages.
* 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.
 | S. McCarthy, Y.-K. Wang (co-chairs), T. Chujoh, S. Deshpande, C. Fogg, P. de Lagrange, G. J. Sullivan, A. Tourapis, S. Wenger (vice-chairs) | N |
| **Encoding algorithm optimization (AHG10)**(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 default or alternate software configuration settings and test conditions optimized for either subjective quality, or higher objective quality, and coordinate such efforts with AHG3 and AHG6.
* Study the effect of varying configuration parameters depending on temporal layer, such as those related to deblocking, partitioning, chroma QP.
 | P. de Lagrange, A. Duenas, R. Sjöberg, A. Tourapis (co-chairs) | N |
| **Neural network-based video coding (AHG11)**(jvet@lists.rwth-aachen.de)* Evaluate and quantify the performance improvement potential of NN-based video coding technologies compared to existing video coding standards such as VVC, including both individual coding tools and novel architectures.
* Refine the test conditions for NN-based video coding. Generate and distribute anchor encoding, and develop supporting software as needed.
* Study the impact of training (including the impact of loss function) on the performance of candidate technologies, and identify suitable materials for testing and training.
* Analyse complexity characteristics, perform complexity analysis, and develop complexity reductions of candidate technology.
* Study and maintain the SADL (Small Adhoc Deep-Learning Library). Identify gaps in functionality and develop improvements as needed.
* Finalize and discuss the EE on neural network-based video coding.
* Coordinate with other relevant groups, including SC29/AG5 on the evaluation and assessment of visual quality and AHG12 on the interaction with ECM coding tools. In case of conducting subjective viewing, support shall be given to AHG4 for timely availability of test materials and test subjects.
* Investigate common software for development and verification NN-based video coding technologies.
 | E. Alshina, S. Liu, A. Segall (co‑chairs), F. Galpin, J. Pfaff, S. S. Wang, Z. Wang, M. Wien, P. Wu, J. Xu (vice‑chairs) | N |
| **Enhanced compression beyond VVC capability (AHG12)**(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 ECM5 algorithm description JVET-Z2025.
* Study the performance and complexity tradeoff of these video coding tools.
* Coordinate with AHG6 on ECM software development.
* Support AHG6 in generating anchors according to the test conditions in JVET-Y2017.
* Analyse the results of exploration experiments described in JVET-Z2024 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)* Study the benefits and characteristics of film grain technologies, including autoregressive and frequency-filtering technologies.
* Discuss the JVET-Y2020 draft of the Technical Report on Film grain synthesis technology for video applications, and suggest improvements as necessary.
* Study alternative film grain models and their associated documentation.
* Study preprocessing and encoder technologies for determining values for FGC (Film Grain Characteristics) SEI message syntax elements.
* Identify potential need for additional film grain technology and signalling, if needed.
* Study categorization and/or classification of FGC implementations.
* Study the implication of identifying FGC reference implementations.
* Coordinate development of film grain technology software and configuration files.
* Coordinate with AHG3 for software support of the FGC SEI message.
 | W. Husak, M. Radosavljević, W. Wan (co-chairs), D. Grois, Y. He, P. de Lagrange, A. Segall, A. Tourapis (vice-chairs) | Y (2 weeks notice) |

It was confirmed that the rules which can be found in document ISO/IEC JTC 1/‌SC 29/‌AG 2 [N 046](https://www.mpegstandards.org/wp-content/uploads/2022/01/ISO-IECJTC1-SC29-AG2_N0046_AhG.pdf) “Ad hoc group rules for MPEG AGs and WGs” (available at <https://www.mpegstandards.org/adhoc/>), are consistent with the operation mode of JVET AHGs. It is pointed out that JVET does not maintain separate AHG reflectors, such that any JVET member is implicitly a member of any AHG. This shall be mentioned in the related WG Recommendations. The list above was also issued as a separate WG 5 document (ISO/IEC JTC 1/‌SC 29/‌WG 5 [N 136](https://dms.mpeg.expert/doc_end_user/current_document.php?id=82006&id_meeting=189)) 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 136](https://dms.mpeg.expert/doc_end_user/current_document.php?id=82006&id_meeting=189), as noted in section 9.

[JVET-Z1000](https://jvet-experts.org/doc_end_user/current_document.php?id=11704) Meeting Report of the 26th JVET Meeting [J.-R. Ohm] [WG 5 N 124] (2022-05-27)

Initial versions of the meeting notes (d0 … d8) 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-Y1002](https://jvet-experts.org/doc_end_user/current_document.php?id=11463) High Efficiency Video Coding (HEVC) Test Model 16 (HM 16) Encoder Description Update 16 [C. Rosewarne (primary editor), K. Sharman, R. Sjöberg, G. J. Sullivan (co-editors)] [WG 5 [N 103](https://dms.mpeg.expert/doc_end_user/current_document.php?id=82085&id_meeting=189)]

[JVET-Z1003](https://jvet-experts.org/doc_end_user/current_document.php?id=11705) Coding-independent code points for video signal type identification (Draft 1 of 3rd edition) [WG 5 WD N 132] [G. J. Sullivan, A. Tourapis] (2022-05-27)

This includes identifiers for YCoCg-R colour representation with equal luma and chroma bit depths.

A request for a new edition (WG 5 N 131) was reviewed Friday 29 April at 0700 UTC

Target dates: CD July 2022, DIS October 2022, FDIS July 2023.

[JVET-Z1004](https://jvet-experts.org/doc_end_user/current_document.php?id=11706) 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] (2022-06-30, near next meeting)

[JVET-Z1005](https://jvet-experts.org/doc_end_user/current_document.php?id=11707) New levels for HEVC (Draft 3) [T. Suzuki, A. Tourapis, Y.-K. Wang] (2022-05-06)

A DoCR for ballot responses on CDAM 2 (WG 5 N 127) was reviewed Friday 29 April at 0635 UTC.

This was integrated into the DIS of HEVC 5th edition (WG 5 N 128), targeting FDIS and ITU-T consent in October, and a recommendation was formulated to integrate the previous Amd.2 into a new edition. A request for the new edition was made in recommendation 3.1.2 of WG 5 (see annex C).

Post-meeting note: In post-meeting consultation with the SC 29 Committee Manager, it was clarified that the approval of the plan to produce a new edition rather than an amendment will cause a delay in the processing of this text for ballot on the ISO/IEC side, such that the timeline envisioned during the meeting is not feasible, thus probably resulting in a delay of one meeting cycle for the ISO/IEC approval process. This does not necessarily affect the ITU-T approval timeline.

Upon consideration of NB comment US-006 on the CDAM 2 ballot, it was decided to increase the maximum frame rate to 960 fps (same value as in the corresponding VVC levels) in the high tier for levels 7.0 and higher.

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]

[JVET](https://jvet-experts.org/doc_end_user/current_document.php?id=11708)-Z1008 Additional colour type identifiers for AVC and HEVC (Draft 1) [G. J. Sullivan, A. Tourapis] (2022-06-03)

This includes identifiers for YCoCg-R colour representation with equal luma and chroma bit depths.

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: [JVET-Y1100](https://jvet-experts.org/doc_end_user/current_document.php?id=11466) Common Test Conditions for HM Video Coding Experiments [K. Sühring, K. Sharman]

This specifies only the range extensions CTC.

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-Z2002](https://jvet-experts.org/doc_end_user/current_document.php?id=11709) Algorithm description for Versatile Video Coding and Test Model 17 (VTM 17) [A. Browne, Y. Ye, S. Kim] [WG 5 N 130] (2022-06-30, near next meeting)

New elements, as recorded elsewhere in the meeting notes:

* JVET-Z0072 Enhanced reference picture structures for ECM and VTM
* JVET-Z0099, Deblocking in RDO and beta offset minus 2 for VTM, enable RDO-DBF for both VTM and ECM in RA, LDB, LDP, for VTM also change beta offset -2, and tc offset 0.
* JVET-Z0111 option B (optional, not CTC), adaptively bypass affine ME in VTM.

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

Remains valid – not updated: [JVET-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-Z2005](https://jvet-experts.org/doc_end_user/current_document.php?id=11710) New level and systems-related supplemental enhancement information for VVC (Draft 2) [B. Bross, E. François, A. Tourapis, Y.-K. Wang] [WG 5 CDAM 1 N 129] (2022-05-13)

The 20xx number for this was changed from that of Draft 1, which was JVET-Y2019.

[JVET-Z2006](https://jvet-experts.org/doc_end_user/current_document.php?id=11711) Additional SEI messages for VSEI (Draft 1) [S. McCarthy, T. Chujoh, M. M. Hannuksela, G. J. Sullivan, Y.-K. Wang] [WG 5 WD N 126] (2022-06-17)

JVET-Z0120 and JVET-Z0244 are included.

The corresponding variables in VVC could be included in a later version of document JVET-Z2005, or as a separate amendment of VVC.

A request for a new edition (WG 5 N 125) was reviewed Friday 29 April at 0850 UTC. Target dates are CDAM in July 2022, DAM in October 2022, FDAM in July 2023.

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]

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

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

This had been issued as ISO/IEC FDIS 23090-16 as WG 5 [N 112](https://dms.mpeg.expert/doc_end_user/current_document.php?id=82000&id_meeting=189), and submitted for ITU-T consent.

Remains valid – not updated: [JVET-Y2010](https://jvet-experts.org/doc_end_user/current_document.php?id=11471) VTM and HM common test conditions and software reference configurations for SDR 4:2:0 10 bit video [F. Bossen, X. Li, V. Seregin, K. Sharman, K. Sühring]

[JVET-Z2011](https://jvet-experts.org/doc_end_user/current_document.php?id=11712) VTM and HM common test conditions and evaluation procedures for HDR/WCG video [A. Segall, E. François, W. Husak, S. Iwamura, D. Rusanovskyy] (2022-05-13)

This includes a merge of HM/VTM CTC of HDR as per JVET-Z0175. No need to review this during the closing plenary was identified.

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-Z2016](https://jvet-experts.org/doc_end_user/current_document.php?id=11713) Common Test Conditions and evaluation procedures for neural network-based video coding technology [E. Alshina, R.-L. Liao, S. Liu, A. Segall] (2022-05-13)

This includes the cross-check of training procedures as suggested in the BoG reported in JVET-Z0234. No need to review this during the closing plenary was identified.

Remains valid – not updated: [JVET-Y2017](https://jvet-experts.org/doc_end_user/current_document.php?id=11473) Common Test Conditions and evaluation procedures for enhanced compression tool testing [M. Karczewicz and Y. Ye]

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

Remains valid – not updated: [JVET-Y2020](https://jvet-experts.org/doc_end_user/current_document.php?id=11475) Film grain synthesis technology for video applications (Draft 1) [D. Grois, Y. He, W. Husak, M. Radosavljević, A. Tourapis, W. Wan] [WG 5 [N 120](https://dms.mpeg.expert/doc_end_user/current_document.php?id=82207&id_meeting=189)]

No outputs: JVET-X2021, JVET-X2022

These numbers are retained for future purposes of planning possible additional VVC verification testing reports and other purposes.

[JVET-Z2023](https://jvet-experts.org/doc_end_user/current_document.php?id=11701) Exploration Experiment on Neural Network-based Video Coding (EE1) [E. Alshina, W. Chen, F. Galpin, Y. Li, Z. Ma, H. Wang, L. Wang] [WG 5 N 133] (2022-05-13)

An initial draft of this document was reviewed and approved at 0735 UTC on Friday 29 April. It was suggested that it would be interest to study the impact of training (e.g. in terms of BPG or VVC be used for coding key pictures) also for the new end-to-end method.

[JVET-Z2024](https://jvet-experts.org/doc_end_user/current_document.php?id=11703) Exploration Experiment on Enhanced Compression beyond VVC capability (EE2) [V. Seregin, J. Chen, G. Li, K. Naser, J. Ström, M. Winken, X. Xiu, K. Zhang] [WG 5 N 134] (2022-05-27)

An initial draft of this document was reviewed and approved on Friday 29 April at 0750 UTC.

Categories are intra prediction, inter prediction, screen content coding, transforms, and in-loop filters.

It was discussed if it would be possible to provide software for proposals included in EE earlier than T3 (based on ECM4 then). It is however argued that this would create additional effort in creating duplicate branches in the repository.

It is further mentioned that there might be problems in imposing such a rule in “ad hoc” fashion at a meeting, as some companies might not have expected it and need time to clear software disclosure before providing it.

It is generally understood that for transparency reasons, contributors of technology are always encouraged to provide software openly. At this stage of exploration, it however appears difficult to make that mandatory, as it might even happen that proposals are withdrawn from EE if no clearance of disclosure is reached within a company.

[JVET-Z2025](https://jvet-experts.org/doc_end_user/current_document.php?id=11714) Algorithm description of Enhanced Compression Model 5 (ECM 5) [M. Coban, F. Le Léannec, K. Naser, J. Ström] [WG 5 N 135] (2022-06-30)

New elements from notes elsewhere in this report:

* From BoG JVET-Z0210: Include the following proposal in the next release of ECM: JVET-Z0131, JVET-Z0127 (option 2)
* Decision: Adopt JVET-Z0050 (Test 1.3b)
* Decision: Adopt JVET-Z0054 (Test 2.1b)
* Decision: Adopt JVET-Z0136 (test EE2 – 2.2a)
* Decision: Adopt JVET-Z0061 (test EE2 – 2.3)
* Decision: Adopt JVET-Z0117, version where no switching between 4-tap and 6-tap filters depending on sequence is applied (no SPS flag, but retain configurability via parameter file or macro
* Decision: Adopt JVET-Z0118 (software, and potentially ECM description, as far as there are deviations from the VVC GDR)
* Decision: Adopt JVET-Z0056 (test EE2 – 2.4)
* Decision: Adopt JVET-Z0139 (version EE2-2.7c)
* Decision: Adopt JVET-Z0139 (version EE2-2.7c)
* Decision: Adopt JVET-Z0153 (3.2), JVET-Z0075 (3.3), JVET-Z0084 (3.4), JVET-Z0160 (3.5b)
* Decision: Adopt JVET-Z0135, Test 4.3b
* Decision: Adopt JVET-Z0085
* Decision: Adopt JVET-Z0102
* Decision: Adopt JVET-Z0105 (not CTC)
* Potential impact of JVET-Z0072 and JVET-Z0099, as applicable (see notes above for VTM JVET-Z2002)

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

Remains valid – not updated: [JVET-Y2026](https://jvet-experts.org/doc_end_user/current_document.php?id=11477) Conformance testing for VVC operation range extensions (Draft 3) [WG 5 DAM [N 110](https://dms.mpeg.expert/doc_end_user/current_document.php?id=81998&id_meeting=189)] [D. Rusanovskyy, T. Hashimoto, H.-J. Jhu, I. Moccagatta, Y. Yu]

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

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

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

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

* Fri. 21 – Fri. 28 October 2022, 28th meeting under ITU-T SG16 auspices in XXXX, XX.
* Wed. 11 – Fri. 13 and Mon. 16 – Fri. 20 January 2023, 29th meeting under ISO/IEC JTC 1/‌SC 29 auspices, to be held as teleconference meeting.
* During Wed. 19 – Fri. 28 April 2023, 30th meeting under ISO/IEC JTC 1/‌SC 29 auspices, date and location t.b.d.
* During July 2023, 31st meeting under ITU-T SG16 auspices, date and location t.b.d.
* During October 2023, 32nd meeting under ISO/IEC JTC 1/‌SC 29 auspices, date and location t.b.d.
* During January 2024, 33rd meeting under ISO/IEC JTC 1/‌SC 29 auspices, date and location t.b.d.
* During April 2024, 34th meeting under ITU-T SG16 auspices, date and location t.b.d.
* During July 2024, 34th meeting under ISO/IEC JTC 1/‌SC 29 auspices, date and location t.b.d.

The agreed document deadline for the 27th JVET meeting was planned to be XXday XX October 2022.

Mathias Wien and Johannes Sauer were thanked for planning, organizing and conducting the remote expert viewings related to the exploration experiment on neural network-based video compression, and to assessment of new test sequences in the category of screen/gaming content.

Alibaba, InterDigital, and Youku were thanked for offering new test materials that can be used for developing and testing video technology standards.

Thanks were expressed to Christian Tulvan for his engagement in maintaining the site jvet-experts.org. Institut Mines-Télécom was thanked for hosting the site.

It was suggested that in a future meeting, perspectives should be discussed for the ongoing exploration, in terms of potentially developing standardization projects and realistic timelines. From the current status of the JVET-internal explorations, there does not seem to be sufficient evidence to embark on standardization soon. Potential requirements need also to be discussed with the parent bodies.

The 27th JVET meeting was closed at approximately 00XX hours UTC on Saturday 23 July 2022.

# Annex A to JVET report:List of documents

# Annex B to JVET report:List of meeting participants

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

1.

# Annex C to JVET report:Recommendations of the 8th meeting ofISO/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 139**

**Recommendations of the 8th WG 5 meeting**