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| **Joint Video Experts Team (JVET)****of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29**20th Meeting, by teleconference, 7 – 16 October 2020 | Document: JVET-T\_Notes\_d0 |

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| *Title:* | **Meeting Report of the 20th Meeting of the Joint Video Experts Team (JVET),by teleconference, 7 – 16 October 2020** |
| *Status:* | Report document from the chairs of JVET |
| *Purpose:* | Report |
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| *Source:* | Chairs 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 twentieth meeting during 7 – 16 October 2020 as an online-only meeting. It had previously been planned to be in Rennes, FR, but this plan was changed due to the difficulties resulting from the COVID-19 pandemic. The JVET meeting was held under the chairmanship of Dr Gary Sullivan (Microsoft/USA) and 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 2.13 of this document. 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 a new standard. The name Versatile Video Coding (VVC) was chosen in April 2018 as the informal nickname for the new standard.

The JVET meeting began at approximately 0500 hours UTC on Wednesday 7 October 2020. Meeting sessions were held on all days except the weekend days of Saturday and Sunday 10 and 11 October 2020, until the meeting was closed at approximately XXXX hours UTC on Friday 16 October 2020. Approximately XXX people attended the JVET meeting, and approximately XXX input documents (not counting crosschecks), and 18 AHG reports were discussed. The latter included reports of 5 AHGs which had originally been established by the Joint Collaborative Team on Video Coding (JCT-VC), after the parent bodies had negotiated to continue those work items within JVET as a single joint team. The meeting took place in a collocated fashion with a meeting of various SG16 Working Groups – where WG 5 is representing the Joint Video Coding Team(s) and their activities from the SC 29 parent body. The subject matter of the JVET meeting activities consisted of work on further development and maintenance of the twin-text video coding technology standards *Advanced Video Coding* (AVC), *High Efficiency Video Coding* (HEVC), *Versatile Video Coding* (VVC)*, Coding-independent Code Points (Video)* (CICP), and *Versatile Supplemental Enhancement Information Messages for Coded Video Bitstreams* (VSEI), as well as related technical reports, software and conformance packages. As a primary goal, the JVET meeting reviewed the work that was performed in the interim period since the nineteenth JVET meeting in producing a tenth draft of the VVC standard (which was approved by the parent bodies as version 1 of the VVC standard), and the tenth version of the associated VVC test model (VTM). Further important goals were reviewing technical input on novel aspects of video coding technology, and plan next steps for investigation of candidate technology towards further standard development.

The JVET produced X output documents from the meeting (Update):

* JVET-S2001 Versatile Video Coding specification text (Draft 10)
* JVET-S2002 Algorithm description for Versatile Video Coding and Test Model 10 (VTM 10)
* JVET-S2004 Algorithm descriptions of projection format conversion and video quality metrics in 360Lib (Version 11)
* JVET-S2005 Methodology and reporting template for coding tool testing
* JVET-S2007 Supplemental enhancement information messages for coded video bitstreams (Draft 5)
* JVET-S2008 Conformance testing for versatile video coding (Draft 4)
* JVET-S2009 VVC verification test plan (Draft 3)
* JVET-S2011 JVET common test conditions and evaluation procedures for HDR/WCG video
* JVET-S2016 Summary information on BD-rate experiment evaluation practices.

For the organization and planning of its future work, the JVET established X “ad hoc groups” (AHGs) to progress the work on particular subject areas. At this meeting, no Core Experiments (CE) were defined. The next four JVET meetings were planned for 8–15 January 2021 under SC29 auspices in Capetown, ZA, during 21–28 April 2021 under ITU-T SG16 auspices in Geneva, CH, during 9–16 July 2021 under SC29 auspices in Prague, CZ, and during … .

The document distribution site <http://phenix.int-evry.fr/jvet/> was used for distribution of all documents.

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 the ISO/IEC JTC 1/SC 29/WG 5. The parent bodies of the JVET are ITU-T WP3/16 and ISO/IEC JTC 1/SC 29.

The Joint Video Experts Team (JVET) of ITU-T WP3/16 and ISO/IEC JTC 1/ SC 29 held its twentieth meeting 7 – 16 October 2020 as an online-only meeting, using Zoom teleconferencing tools. The JVET meeting was held under the chairmanship of Dr Gary Sullivan (Microsoft/USA) and Dr Jens-Rainer Ohm (RWTH Aachen/Germany).

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

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

## 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/2020_10_T_Virtual/>.

## Primary goals

As a primary goal, the JVET meeting reviewed the work that was performed in the interim period since the nineteenth JVET meeting in producing a tenth draft of the VVC standard (which was approved by the parent bodies as version 1 of the VVC standard), and the tenth version of the associated VVC test model (VTM). Further important goals were reviewing technical input on novel aspects of video coding technology, and plan next steps for investigation of candidate technology towards further standard development.

## Documents and document handling considerations

### General

The documents of the JVET meeting are listed in Annex A of this report. The documents can be found at <http://phenix.int-evry.fr/jvet/>.

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 local time at the meeting facility.

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 the VTM software but have no normative effect are marked by the string “Decision (SW):”.
* Decisions that fix a “bug” in the VTM description (an error, oversight, or messiness) or in the software are marked by the string “Decision (BF):”.
* Decisions that are merely editorial without effect on the technical content of the 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.

This meeting report is based primarily on notes taken by the JVET chairs. 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.

### Late and incomplete document considerations

The formal deadline for registering and uploading non-administrative contributions had been announced as Wednesday, 30 September 2020. Any documents uploaded after 1159 hours Paris/Geneva time on Thursday 1 October 2020 were considered “officially late”, giving 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-T0093 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. Also, all cross-check reports were uploaded late.

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

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

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

* JVET-T0XXX (a proposal on …), uploaded XX-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. For example, some of them were proposing combinations or simplifications of other proposals.

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

* JVET-T0XXX (a document on …), uploaded XX-XX.
* …

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

The following (X) contribution registrations were later cancelled, withdrawn, never provided, were cross-checks of a withdrawn contribution, or were registered in error: JVET-T0083, ...

“Placeholder” contribution documents that were basically empty of content, or lacking any results showing benefit for the proposed technology, and obviously uploaded with an intent to provide a more complete submission as a revision, had been agreed to be considered unacceptable and to be rejected in the document management system until a more complete version was available (which would then typically be counted as a late contribution). At the current meeting, this situation applied to the initial uploads of documents JVET-T0XXX, … .

Contributions that had significant problems with uploaded versions included the following:

* JVET-T0XXX (…)
* …

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 was some expression of annoyance and remarks on the difficulty of dealing with late contributions and late revisions.

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

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

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

### Outputs of the preceding meeting

All output documents of the previous meeting, particularly the meeting report JVET-S2000, the Versatile Video Coding specification text (Draft 10) JVET-S2001, the Algorithm description for Versatile Video Coding and Test Model 10 (VTM 10) JVET-S2002, the Algorithm descriptions of projection format conversion and video quality metrics in 360Lib (Version 11) JVET-S2004, the Methodology and reporting template for coding tool testing JVET-S2005, the Supplemental enhancement information messages for coded video bitstreams (Draft 5) JVET-S2007, the Conformance testing for VVC (Draft 4) JVET-S2008, the VVC verification test plan (Draft 3) JVET-S2009, the JVET common test conditions and nd evaluation procedures for HDR/WCG video JVET-S2011, the Working practices using objective metrics for evaluation of video coding efficiency experiments (Draft 3) JVET-S2016, and the Technologies under consideration for VSEI JVET-S2017 had been completed and were approved. The software implementations of VTM (versions 10.0 and 10.1) and 360lib (version 11.0) was also approved. Furthermore, the former JCT-VC output documents from the 40th JCT-VC meeting, particularly the meeting report JCTVC-AN1000, the High Efficiency Video Coding (HEVC) Test Model 16 (HM 16) Encoder Description Update 14 JCTVC-AN1002, the Errata report items for HEVC, AVC, Video CICP, and CP usage TR JCTVC-AN1004, the Annotated regions and shutter interval information SEI messages for AVC (Draft 1) JCTVC-AN1006, and the Usage of video signal type code points (Draft 1 for version 3) JCTVC-AN1008, were approved.

The group was initially asked to review the meeting report(s) of the previous meeting for finalization. The meeting report was later approved with a minor modification of including a missing output document in a list.

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 11 (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 on the WG11 host’s website. Access to the teleconference sessions of the main JVET meeting was controlled with a password that is distributed to the registered participants; this should help overloading the teleconferencing tool.

The following rules were initially set up for the Zoom teleconference meeting:

o 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.

o Stay muted unless you have something to say. (people were muted by default when they join and would 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).

o Identify who you are and your affiliation when you begin speaking.

o Use your full name and company/organization affiliation in your joining information. We will use the participation list for attendance records.

o Turn on the chat window and watch for chair communication and side commentary there as well as by audio.

o Avoid overloading people’s internet connections, we do not plan to use video for the teleconferencing calls – only voice and screen sharing. Extensive use of screen sharing is encouraged.

## Agenda

The agenda for the meeting was as follows:

* Opening remarks and review of meeting logistics and communication practices
* IPR policy reminder and declarations
* Contribution document allocation
* Review of results of the previous meeting
* Reports of *ad hoc* group (AHG) activities
* Consideration of contributions on high-level syntax
* Consideration of contributions and communications on project guidance
* Consideration of video coding technology contributions
* Consideration of information contributions
* Coordination of visual quality testing
* Coordination activities with other working groups
* Approval of output documents and associated editing periods
* Future planning: Determination of next steps, discussion of working methods, communication practices, establishment of coordinated experiments (if any), establishment of AHGs, meeting planning, other planning issues
* Other business as appropriate for consideration

The plans for the times of meeting sessions were established as follows, in UTC (2 hours behind the time in Geneva, 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
* [“overday” break – nearly 10 hours]
* 1900-2100 1st “evening” session [break after 2 hours]
* 2120-2320 2nd “evening” session

## IPR policy reminder

[+ISO Code of Conduct]

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)
* <http://www.itscj.ipsj.or.jp/sc29/29w7proc.htm> (JTC 1/‌SC 29 Procedures)

It is noted that the ITU TSB director’s AHG on IPR had issued a clarification of the IPR reporting process for ITU-T standards, as follows, per SG 16 TD 327 (GEN/16):

“TSB has reported to the TSB Director’s IPR Ad Hoc Group that they are receiving Patent Statement and Licensing Declaration forms regarding technology submitted in Contributions that may not yet be incorporated in a draft new or revised Recommendation. The IPR Ad Hoc Group observes that, while disclosure of patent information is strongly encouraged as early as possible, the premature submission of Patent Statement and Licensing Declaration forms is not an appropriate tool for such purpose.

In cases where a contributor wishes to disclose patents related to technology in Contributions, this can be done in the Contributions themselves, or informed verbally or otherwise in written form to the technical group (e.g. a Rapporteur’s group), disclosure which should then be duly noted in the meeting report for future reference and record keeping.

It should be noted that the TSB may not be able to meaningfully classify Patent Statement and Licensing Declaration forms for technology in Contributions, since sometimes there are no means to identify the exact work item to which the disclosure applies, or there is no way to ascertain whether the proposal in a Contribution would be adopted into a draft Recommendation.

Therefore, patent holders should submit the Patent Statement and Licensing Declaration form at the time the patent holder believes that the patent is essential to the implementation of a draft or approved Recommendation.”

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 software implementation package uses 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.

## Communication practices

The documents for the meeting can be found at <http://phenix.int-evry.fr/jvet/>.

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 was 1251.

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)
* **ARSS**: Adaptive reference sample smoothing
* **ATMVP** or “subblock-based temporal merging candidates”: Alternative temporal motion vector prediction
* **AU**: Access unit
* **AUD**: Access unit delimiter.
* **AVC**: Advanced video coding – the video coding standard formally published as ITU-T Recommendation H.264 and ISO/IEC 14496-10.
* **BA**: Block adaptive.
* **BC**: See CPR or IBC.
* **BCW**: Biprediction with CU based weighting
* **BD**: Bjøntegaard-delta – a method for measuring percentage bit rate savings at equal PSNR or decibels of PSNR benefit at equal bit rate (e.g., as described in document VCEG-M33 of April 2001).
* **BDOF**: Bi-directional optical flow (formerly known as **BIO**).
* **BDPCM**: Block-wise DPCM.
* **BL**: Base layer.
* **BMS**: Benchmark set (no longer used), a former preliminary compilation of coding tools on top of VTM, which provide somewhat better compression performance, but are not deemed mature for standardzation.
* **BoG**: Break-out group.
* **BR**: Bit rate.
* **BT**: Binary tree.
* **BV**: Block vector (used for intra BC prediction).
* **CABAC**: Context-adaptive binary arithmetic coding.
* **CBF**: Coded block flag(s).
* **CC**: May refer to context-coded, common (test) conditions, or cross-component.
* **CCALF**: Cross-component ALF.
* **CCLM**: Cross-component linear model.
* **CCP**: Cross-component prediction.
* **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.
* **DCT**: Discrete cosine transform (sometimes used loosely to refer to other transforms with conceptually similar characteristics).
* **DCTIF**: DCT-derived interpolation filter.
* **DF**: Deblocking filter.
* **DMVR**: Decoder-side 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).
* **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
* **HDR**: High dynamic range.
* **HEVC**: High Efficiency Video Coding – the video coding standard developed and extended by the JCT-VC, formalized by ITU-T as Rec. ITU-T H.265 and by ISO/IEC as ISO/IEC 23008-2.
* **HLS**: High-level syntax.
* **HM**: HEVC Test Model – a video coding design containing selected coding tools that constitutes our draft standard design – now also used especially in reference to the (non-normative) encoder algorithms (see WD and TM).
* **HMVP**: History based motion vector prediction.
* **HRD**: Hypothetical reference decoder.
* **HyGT**: Hyper-cube Givens transform (a type of NSST).
* **IBC** (also **Intra BC**): Intra block copy, also known as CPR – a technique by which sample values are predicted from other samples in the same picture by means of a displacement vector called a block vector, in a manner conceptually similar to motion-compensated prediction.
* **IBDI**: Internal bit-depth increase – a technique by which lower bit-depth (8 bits per sample) source video is encoded using higher bit-depth signal processing, ordinarily including higher bit-depth reference picture storage (ordinarily 12 bits per sample).
* **IBF**: Intra boundary filtering.
* **ILP**: Inter-layer prediction (in scalable coding).
* **ILRP**: Inter-layer reference picture.
* **IPCM**: Intra pulse-code modulation (similar in spirit to IPCM in AVC and HEVC).
* **IRAP**: Intra random access picture.
* **ISP**: Intra subblock partitioning
* **JCCR**: Joint coding of chroma residuals
* **JEM**: Joint exploration model – the software codebase for future video coding exploration.
* **JM**: Joint model – the primary software codebase that has been developed for the AVC standard.
* **JSVM**: Joint scalable video model – another software codebase that has been developed for the AVC standard, which includes support for scalable video coding extensions.
* **KLT**: Karhunen-Loève transform.
* **LB** or **LDB**: Low-delay B – the variant of the LD conditions that uses B pictures.
* **LD**: Low delay – one of two sets of coding conditions designed to enable interactive real-time communication, with less emphasis on ease of random access (contrast with RA). Typically refers to LB, although also applies to LP.
* **LFNST**: Low-frequency non-separable transform
* **LIC**: Local illumination compensation.
* **LM**: Linear model.
* **LMCS**: Luma mapping with chroma scaling (formerly sometimes called “in-loop reshaping”)
* **LP** or **LDP**: Low-delay P – the variant of the LD conditions that uses P frames.
* **LUT**: Look-up table.
* **LTRP**: Long-term reference picture.
* **MC**: Motion compensation.
* **MCP**: Motion compensated prediction.
* **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 (WG 11, the parent body working group in ISO/IEC JTC 1/‌SC 29, one of the two parent bodies of the JVET).
* **MPM**: Most probable mode (in intra prediction).
* **MRL**: Multiple reference line intra prediction.
* **MV**: Motion vector.
* **MVD**: Motion vector difference.
* **NAL**: Network abstraction layer.
* **NSQT**: Non-square quadtree.
* **NSST**: Non-separable secondary transform.
* **NUH**: NAL unit header.
* **NUT**: NAL unit type (as in AVC and HEVC).
* **OBMC**: Overlapped block motion compensation (e.g., as in H.263 Annex F).
* **OETF**: Opto-electronic transfer function – a function that converts to input light (e.g., light input to a camera) to a representation value.
* **OLS**: Output layer set.
* **OOTF**: Optical-to-optical transfer function – a function that converts input light (e.g. l,ight input to a camera) to output light (e.g., light emitted by a display).
* **operation point**: A temporal subset of an OLS.
* **PDPC**: Position-dependent (intra) prediction combination.
* **PERP**: Padded equirectangular projection (a 360° projection format).
* **PH**: Picture header.
* **PHEC**: Padded hybrid equiangular cubemap (a 360° projection format).
* **PMMVD**: Pattern-matched motion vector derivation.
* **POC**: Picture order count.
* **PoR**: Plan of record.
* **PROF**: Prediction refinement with optical flow
* **PPS**: Picture parameter set (as in AVC and HEVC).
* **PTL**: Profile/tier/level combination.
* **QM**: Quantization matrix (as in AVC and HEVC).
* **QP**: Quantization parameter (as in AVC and HEVC, sometimes confused with quantization step size).
* **QT**: Quadtree.
* **RA**: Random access – a set of coding conditions designed to enable relatively-frequent random access points in the coded video data, with less emphasis on minimization of delay (contrast with LD).
* **RADL**: Random-access decodable leading (type of picture).
* **RASL**: Random-access skipped leading (type of picture).
* **R-D**: Rate-distortion.
* **RDO**: Rate-distortion optimization.
* **RDOQ**: Rate-distortion optimized quantization.
* **RDPCM**: Residual DPCM
* **ROT**: Rotation operation for low-frequency transform coefficients.
* **RPL**: Reference picture list.
* **RPLM**: Reference picture list modification.
* **RPR**: Reference picture resampling (e.g., as in H.263 Annex P), a special case of which is also known as ARC or DRC.
* **RPS**: Reference picture set.
* **RQT**: Residual quadtree.
* **RRU**: Reduced-resolution update (e.g. as in H.263 Annex Q).
* **RVM**: Rate variation measure.
* **SAO**: Sample-adaptive offset.
* **SBT**: Subblock transform.
* **SbTMVP**: Subblock based temporal motion vector prediction.
* **SCIPU**: Smallest chroma intra prediction unit.
* **SD**: Slice data; alternatively, standard-definition.
* **SDH**: Sign data hiding.
* **SDT**: Signal-dependent transform.
* **SE**: Syntax element.
* **SEI**: Supplemental enhancement information (as in AVC and HEVC).
* **SH**: Slice header.
* **SHM**: Scalable HM.
* **SHVC**: Scalable high efficiency video coding.
* **SIF**: Switchable (motion) interpolation filter.
* **SIMD**: Single instruction, multiple data.
* **SMVD**: Symmetric MVD.
* **SPS**: Sequence parameter set (as in AVC and HEVC).
* **STMVP**: Spatial-temporal motion vector prediction.
* **STRP**: Short-term reference picture.
* **STSA**: Step-wise temporal sublayer access.
* **TBA/TBD/TBP**: To be announced/determined/presented.
* **TGM**: Text and graphics with motion – a category of content that primarily contains rendered text and graphics with motion, mixed with a relatively small amount of camera-captured content.
* **TMVP**: Temporal motion vector prediction.
* **TS**: Transform skip.
* **TSRC**: Transform skip residual coding.
* **TT**: Ternary tree.
* **UCBDS**: Unrestricted center-biased diamond search.
* **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.
* **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 7 October at 0500 UTC (chaired by GJS and JRO) were as follows.

* Timing and organization of online meetings, calendar
* VVC/VSEI approval and publication status:
"H.266" | ISO/IEC 23090-3 for VVC and H.274 | ISO/IEC 23002-7
	+ …
* AVC, HEVC and CICP status
* The meeting logistics, agenda, working practices, policies, and document allocation were reviewed.
	+ The meeting is 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 were reviewed.
* There was somewhat less of a problem of late non-cross-check documents and no “placeholders” – (see section 2.4.2).
* The primary goals of the meeting were …
* Less documents than recently, not necessary to conduct sessions in parallel
* Verification test planning
* VVC conformance and reference software
* Scheduling was discussed
* Principles of standards development were discussed.
	+ It was noted that now is the time for the filing of formal IPR declarations for those who have patent rights that would be necessary for implementation of VVC or the associated SEI standard.

## Scheduling of discussions

The plans for the times of meeting sessions were established as follows, in UTC (2 hours behind the time in Geneva, 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 “afternoon” session
* [“overday” break – nearly 10 hours]
* 1900-2100 1st “evening” session [break after 2 hours]
* 2120-2320 2nd “evening” session

All 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. 7 October, 1st day
	+ 0500–0530 Opening remarks, review of practices, agenda, IPR reminder
	+ 0530–XXXX Reports of AHGs XX
	+ …
* …

## 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 JVET + 5 JCT-VC) (section 3)
* Project development (section 4)
	+ General (0)
	+ Text development and errata reporting (4)
	+ Test conditions (1)
	+ Verification test (5)
	+ Coding studies and tools on specific use cases (0)
	+ Test Material (2)
	+ Conformance development (0)
	+ Software development (3)
	+ Implementation studies (3)
	+ Complexity analysis (2)
	+ Encoder optimization (2)
	+ Profile/tier/level specification (1)
* Low-level tool technology proposals (13) (section 5) with subtopics
	+ AHG12: High bit depth coding (9) (section 5.1)
	+ AHG10: Neural-network-based technology (11) (section 5.2)
	+ Other (0) (section 5.3)
* High-level syntax (HLS) proposals (section 6) with subtopics
	+ AHG8: Layered coding and resolution adaptation (2) (section 6.1)
	+ AHG9: SEI message studies and proposals (15) (section 6.2)
	+ Other (1) (section 6.3)
* Withdrawn (1) (section 7)
* Joint meetings, plenary discussions, BoG reports, Summary of actions (section 8)
* Project planning (section 9)
* Establishment of AHGs (section 10)
* Output documents (section 11)
* Future meeting plans and concluding remarks (section 12)

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

# AHG reports (13+5)

These reports were discussed Wednesday 7 October 2020 during 0500-0700 and … UTC (chaired by GJS & JRO), except as otherwise noted.

[JVET-T0001](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10474) JVET AHG report: Project management (AHG1) [J.-R. Ohm, G. J. Sullivan]

[JVET-T0002](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10475) JVET AHG report: Draft text and test model algorithm description editing (AHG2) [B. Bross, J. Chen, J. Boyce, S. Kim, S. Liu, Y.-K. Wang, Y. Ye]

[JVET-T0003](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10476) JVET AHG report: Test model software development (AHG3) [F. Bossen, X. Li, K. Sühring]

[JVET-T0004](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10477) JVET AHG report: Test material and visual assessment (AHG4) [V. Baroncini, T. Suzuki, M. Wien, A. Norkin, A. Segall, Y. Ye]

[JVET-T0005](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10478) JVET AHG report: Conformance testing (AHG5) [J. Boyce, W. Wan, E. Alshina, F. Bossen, I. Moccagatta, K. Kawamura, K. Sühring, X. Xu]

[JVET-T0006](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10479) JVET AHG report: 360° video coding, software and test conditions (AHG6) [J. Boyce, Y. He, K. Choi, J.-L. Lin, Y. Ye]

[JVET-T0007](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10480) JVET AHG report: Coding of HDR/WCG material (AHG7) [A. Segall, E. François, W. Husak, S. Iwamura, D. Rusanovskyy]

[JVET-T0008](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10481) JVET AHG report: Layered coding and resolution adaptivity (AHG8) [S. Wenger, A. Segall, M. M. Hannuksela, Hendry, S. McCarthy, Y.-C. Sun, P. Topiwala, Y.-K. Wang]

[JVET-T0009](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10482) JVET AHG report: SEI message studies (AHG9) [S. McCarthy, J. Boyce, P. de Lagrange, A. Luthra, A. Tourapis, Y.-K. Wang, S. Wenger]

[JVET-T0010](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10483) JVET AHG report: Encoding algorithm optimization (AHG10) [A. Duenas, A. Tourapis, S. Ikonin, A. Norkin, R. Sjöberg, J. Le Tanou, J.-M. Thiesse]

[JVET-T0011](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10484) JVET AHG report: Neural-network-based video coding (AHG11) [A. Alshina, S. Liu, J. Pfaff, M. Wien, P. Wu, Y. Ye]

[JVET-T0012](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10485) JVET AHG report: High bit depth, high bit rate, and high frame rate coding (AHG12) [A. Browne, T. Ikai, X. Xiu]

[JVET-T0013](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10486) JVET AHG report: Tool reporting procedure and testing (AHG13) [W.-J. Chien, J. Boyce, Y.-W. Chen, R. Chernyak, K. Choi, R. Hashimoto, Y.-W. Huang, H. Jang, R.-L. Liao, S. Liu]

[JVET-T0021](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10487) JCT-VC AHG report: Project management (AHG1) [G. J. Sullivan, J.-R. Ohm]

[JVET-T0022](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10488) JCT-VC AHG report: Test model editing and errata reporting (AHG2) [B. Bross, C. Rosewarne, J.-R. Ohm, K. Sharman, G. J. Sullivan, A. Tourapis, Y.-K. Wang]

[JVET-T0023](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10489) JCT-VC AHG report: Software development and software technical evaluation (AHG3) [K. Sühring, B. Li, K. Sharman, V. Seregin, G. Tech, A. Tourapis]

[JVET-T0024](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10490) JCT-VC AHG report: Supplemental enhancement information (AHG4) [J. Boyce, C. Fogg, S. McCarthy, G. J. Sullivan]

[JVET-T0025](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10491) JCT-VC AHG report: Test sequence material (AHG5) [T. Suzuki, V. Baroncini, E. François, P. Topiwala, S. Wenger]Formularende

# Project development (XX)

## General (0)

## Text development and errata reporting (4)

[JVET-T0048](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10427) On the syntax design for extending SEI messages and VUI for HEVC, VVC and VSEI [Y.-K. Wang (Bytedance), G. J. Sullivan (Microsoft)]

[JVET-T0054](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10433) Some errata items for HEVC and AVC [Y.-K. Wang, L. Zhang (Bytedance), A. M. Tourapis (Apple)]

[JVET-T0055](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10434) Some errata items for VVC [Y.-K. Wang, Z. Deng (Bytedance)]

[JVET-T0075](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10454) AHG9: Errata and editorial clarifications for AVC and HEVC film grain characteristics SEI message semantics [S. McCarthy, P. Yin, W. Husak, T. Lu, F. Pu, T. Chen (Dolby)]

## Test conditions (1)

[JVET-T0063](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10442) Suggestion to upgrading random access configuration in CTC with GOP 32 configuration [Kenneth Andersson, Jack Enhorn, Rickard Sjöberg, Jacob Ström, Lukasz Litwic, Per Wennersten (Ericsson)]

## Verification test (5)

[JVET-T0043](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10422) Status Report on SDR HD Low Delay Verification Test Preparation [M. Wien, V. Baroncini]

[JVET-T0044](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10423) Status Report on 360 Video Verification Test Preparation [M. Wien, V. Baroncini]

[JVET-T0045](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10424) AHG4: Agenda and report of the AHG meeting on the SDR HD Verification Tests on 2020-09-03 [M. Wien, V. Baroncini]

[JVET-T0046](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10425) AHG4: Agenda and report of the AHG meeting on the 360 Video Verification Tests on 2020-09-04 [M. Wien, V. Baroncini, Y. Ye]

[JVET-T0097](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10494) Report on VVC compression performance verification testing in the SDR UHD Random Access Category [M. Wien (RWTH), V. Baroncini (VABTECH)] [miss]

## Coding studies and tools on specific use cases (0)

## Test material (2)

[JVET-T0060](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10439) AHG4: new video conference sequences for HD verification testing [S. Xu, R.-L. Liao, J. Chen, Y. Ye (Alibaba)]

[JVET-T0082](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10461) New HLG sequences for high bit-depth video coding [K. Kondo, M. Ikeda, A. Browne (Sony)]

## Conformance development (0)

## Software development (3)

[JVET-T0064](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10443) Addition of ALF filter strength control to VTM [Kenneth Andersson, Jacob Ström (Ericsson)]

[JVET-T0078](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10457) GDR Software [S. Hong, L. Wang, K. Panusopone (Nokia)]

[JVET-T0081](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10460) AHG3: On StreamMergeApp design [E. Thomas (TNO)]

## Implementation studies (3)

[JVET-T0061](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10440) Multi-threaded VTM decoder description and performance analysis [S. Gudumasu, T. Poirier, F. Urban, F. Hiron, R. Jullian, P. de Lagrange (interdigital)]

[JVET-T0095](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10492) Performance of a VVC software decoder [B. Zhu, S. Liu, X. Xu, X. Zhang, C. Gu, L. Wang, W. Feng (Tencent)] [late]

[JVET-T0099](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10496) Open optimized VVC encoder (VVenC) and decoder (VVdeC) implementations [A. Wieckowski, J. Brandenburg, C. Bartnik, V. George, J. Güther, G. Hege, C. Helmrich, A. Henkel, T. Hinz, C. Lehmann, C. Stoffers, I. Zupancic, B. Bross, H. Schwarz, D. Marpe (HHI)] [late]

## Complexity analysis (2)

[JVET-T0067](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10446) Bit Stream Feature Analyzer (BSFA) for Coding Tool Statistics based on VTM-10.0 [M. Kränzler, C. Herglotz, A. Kaup]

[JVET-T0068](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10447) Decoding Time and Energy Assessment of VTM-10.0 and VVdeC [M. Kränzler, C. Herglotz, A. Kaup]

## Encoder optimization (2)

[JVET-T0062](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10441) AHG10: Extension of rate control to support random access configuration with GOP size of 32 [F. Liu, Z. Liu, Y. Li, Z. Chen (Wuhan Univ.)]

[JVET-T0074](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10453) AHG10: LMCS encoder algorithm for YUV4:4:4 content [F. Pu, T. Lu, P. Yin, S. McCarthy, W. Husak, T. Chen (Dolby)]

[JVET-T0098](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10495) Crosscheck of JVET-T0074:AHG10: LMCS encoder algorithm for YUV4:4:4 content [J. Chen (Alibaba)] [late] [miss]

## Profile/tier/level specification (1)

[JVET-T0065](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10444) Conformance points for multilayer 8K [F. Bossen (Sharp)]

# Low-level tool technology proposals (19)

## AHG12: High bit depth coding for VVC (9)

[JVET-T0047](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10426) AHG12: Preliminary common test conditions for high bitdepth video coding [T. Ikai, A. Browne, X. Xiu (AHG coordinators)]

[JVET-T0072](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10451) AHG12: Rice parameter selection for high bit depths [A. Browne, S. Keating, K. Sharman (Sony)]

[JVET-T0084](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10463) AHG12: Transform coefficients range extension for high bit-depth coding [T. Zhou, T. Chujoh, E. Sasaki, T. Ikai (Sharp)]

[JVET-T0085](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10464) AHG12: Rice parameter derivation for high bit-depth coding [T. Hashimoto, T. Ikai (Sharp)]

[JVET-T0086](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10465) AHG12: SIMD implementation of BDOF for high bit-depth coding [T. Chujoh, E. Sasaki, T. Ikai (Sharp)]

[JVET-T0087](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10466) AHG12: VVC coding tool evaluation for high bit-depth coding [T. Ikai, T. Zhou, T. Hashimoto (Sharp)]

[JVET-T0089](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10468) AHG12: Slice based Rice parameter selection for transform skip residual coding [H.-J. Jhu, X. Xiu, Y.-W. Chen, T.-C. Ma, C.-W. Kuo, X. Wang (Kwai Inc.)]

[JVET-T0091](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10470) AHG12: Fix on encoder overflow issue of the LMCS at high bit-depth coding [X. Xiu, H.-J. Jhu, Y.-W. Chen, T.-C. Ma, X. Wang (Kwai)]

[JVET-T0093](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10472) AHG12: On signalling for high-bit depth [Y. Kidani, K. Kawamura, K. Unno (KDDI)]

## AHG11: Neural-network-based technology (11)

[JVET-T0041](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10420) Methodology and reporting template for neural network coding tool testing [S. Liu, A. Segall, E. Alshina, J. Boyce, M. Wien, D. Grois]

[JVET-T0042](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10421) Report of AHG11 Meeting on Neural Network-based Video Coding on 2020-07-30 [S. Liu, E. Alshina, J. Pfaff, M. Wien, P. Wu, Y. Ye]

[JVET-T0057](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10436) AHG11: A case study to reduce computation of a neural network based in-loop filter by pruning [C. Auyeung, W. Wang, W. Jiang, X. Li, S. Liu (Tencent)]

[JVET-T0058](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10437) AHG11: Information on inter-prediction coding tool with deep neural network [B. Choi, Z. Li, W. Wang, W. Jiang, X. Xu, S. Liu (Tencent)]

[JVET-T0069](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10448) AHG11: SSIM based CNN model for in-loop filtering [T. Ouyang, F. Liu, H. Zhu, Z. Chen (Wuhan Unvi.), X. Xu, S. Liu (Tencent)]

[JVET-T0073](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10452) AHG11: Neural Network-based intra prediction with transform selection in VVC [T. Dumas, F. Galpin, P. Bordes, F. Leleannec (Interdigital)]

[JVET-T0079](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10458) AHG11: Neural Network-based In-Loop Filter [H. Wang, M. Karczewicz, J. Chen, A.M. Kotra (Qualcomm)]

[JVET-T0088](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10467) AHG11: Convolutional neural networks-based in-loop filter [Y. Li, L. Zhang, K. Zhang, Y. He, J. Xu (Bytedance)]

[JVET-T0092](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10471) AHG9/AHG11: Neural network based super resolution SEI [T. Chujoh, E. Sasaki, T. Ikai (Sharp)]

[JVET-T0094](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10473) AHG11: In-loop filtering based on neural network [T.-C. Ma, W. Chen, X. Xiu, Y.-W. Chen, H.-J. Jhu, C.-W. Kuo, X. Wang (Kwai)] [late]

[JVET-T0096](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10493) AHG11: Deep neural network for super-resolution [J. Y. Lee (Sejong University), W. Lim, G. Bang (ETRI)] [late]

## Other (0)

# High-level syntax (HLS) proposals (17)

## AHG8: Layered coding and resolution adaptivity (2)

[JVET-T0070](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10449) AHG9/AHG8: Scalability dimension SEI message [Y.-K. Wang, L. Zhang, K. Zhang, Z. Deng (Bytedance)]

[JVET-T0080](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10459) AHG9: Multilayered OLS decoded picture assembling SEI message [E. Thomas (TNO)]

## AHG9: SEI message studies and proposals (15)

[JVET-T0048](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10427) On the syntax design for extending SEI messages and VUI for HEVC, VVC and VSEI [Y.-K. Wang (Bytedance), G. J. Sullivan (Microsoft)]

[JVET-T0049](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10428) Composite Picture Information SEI Message [Hendry, H. Jang, S. Kim, J. Lim (LGE)]

[JVET-T0050](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10429) AHG9: HEVC Annotated Regions SEI message software update for HM [P. Guruva reddiar, J. Boyce (Intel)]

[JVET-T0051](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10430) AHG9: Object tracking information file format for use with Annotated Regions SEI messages [P. Guruva reddiar, J. Boyce (Intel)]

[JVET-T0052](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10431) AHG9: AVC Annotated Regions SEI message software for JM [P. Guruva reddiar, J. Boyce (Intel)]

[JVET-T0053](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10432) AHG9: VVC and VSEI Annotated Regions SEI message [J. Boyce, P. Guruva reddiar (Intel)]

[JVET-T0056](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10435) AHG9: SEI manifest and SEI prefix indication SEI messages [Y.-K. Wang (Bytedance), T. Stockhammer (Qualcomm), A. M. Tourapis, D. Singer (Apple)]

[JVET-T0059](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10438) AHG9: object representation SEI message [J. Chen, Y. Ye, J. Hu, K. Li, L. Hu, Y. Long (Alibaba)]

[JVET-T0066](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10445) AHG9: IRAP only HRD SEI message [R. Skupin, Y. Sanchez, K. Suehring, T. Schierl (Fraunhofer HHI), Y.-K. Wang, L. Zhang (Bytedance), S. Deshpande (Sharp)]

[JVET-T0070](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10449) AHG9/AHG8: Scalability dimension SEI message [Y.-K. Wang, L. Zhang, K. Zhang, Z. Deng (Bytedance)]

[JVET-T0071](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10450) AHG9: SEI messages for support of cross RAP referencing based video coding [Y.-K. Wang (Bytedance)]

[JVET-T0076](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10455) AHG9: ALF control SEI message [H.-B. Teo, H.-W. Sun, C.-S. Lim (Panasonic)]

[JVET-T0080](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10459) AHG9: Multilayered OLS decoded picture assembling SEI message [E. Thomas (TNO)]

[JVET-T0090](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10469) AHG9: Digital signature SEI message [J. Xu, Y.-K. Wang, L. Zhang, K. Zhang (Bytedance)]

[JVET-T0092](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10471) AHG9/AHG11: Neural network based super resolution SEI [T. Chujoh, E. Sasaki, T. Ikai (Sharp)]

## Other (1)

[JVET-T0077](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=10456) CICP- Use cases for signalling of still image graphics (chyrons) in video [Yasser Syed, Walt Husak, Chris Seeger]

# Withdrawn (X)

Section kept for future use.

JVET-T0083 Withdrawn

# Plenary meetings, joint meetings, BoG reports, and summary of actions taken

## Joint meeting with MPEG Systems Monday 29 June 1430-1500

## Joint meeting with JCT-VC, VCEG (Q6/16) and MPEG Requirements Tuesday 30 June 1300-1500

## Closing plenary meeting Wednesday XX June xxxx-xxxx

## BoGs (X)

No formal break-out groups were established at this meeting that produced reports, although some offline studies were reported.

## List of actions taken affecting the draft text of VVC, the VTM, and 360Lib

[Remove this section]

The following is a summary, in the form of a brief list, of the actions taken at the meeting that affect the text of the VVC draft text, VTM or 360Lib description. Both technical and editorial issues are included. This list is provided only as a summary – details of specific actions are noted elsewhere in this report and the list provided here may not be complete and correct. The listing of a document number only indicates that the document is related, not that it was adopted in whole or in part. The description given in the “Tool” column is a best effort for the sake of understanding but may not precisely reflect the functionality of the tool. It is also noted that in cases where several contributions proposed the same method, usually only one of the is listed as adoption below; refer to the meeting notes about the adoption to see which other contributions are related.

[Add actions of Friday 24 April.]

[This is just a reflection of what has already been recorded.]

# Project planning

## Core experiment planning

No CEs were planned at this meeting.

## 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 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

The document upload deadline for the next meeting was planned to be XXday XX Apr 2020.

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 during the opening plenary on January 9 that those rules which had been set up or refined during the 12th meeting should be observed. In particular, for some CEs, results were available late, and some changes in the experimental setup (particularly in CE4) were not 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 the draft standard by the next meeting.
* 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; the method for members to obtain the credentials is TBA on the reflector).
* During the experiment, revisions of the experiment plans can be made, but not substantial changes to the proposed technology.
* The CE description must match the CE testing that is done. The CE description needs to be revised if there has been some change of plans.
* The CE summary report must describe any changes that were made in the process of finalizing the CE.
* By the next meeting it is expected that at least one independent cross-checker will report a detailed analysis of each proposed feature that has been tested and confirm that the implementation is correct. Commentary on the potential benefits and disadvantages of the proposed technology in cross-checking reports is highly encouraged. Having multiple cross-checking reports is also highly encouraged (especially if the cross-checking involves more than confirmation of correct test results). The reports of cross-checking activities may (and generally should) be integrated into the CE report rather than submitted as separate documents.

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

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

The general agreed common conditions for single-layer coding efficiency experiments are described in the output document JVET-N1010.

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

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

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

[Add info on software access.]

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 marked as “withdrawn”.

T2 = Test model software release + 2 weeks or X XX, whichever is earlier: 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 – 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 deadline. This shall include documentation about crosscheck of software, matching of CE description and confirmation of the appropriateness of the text change, as well as sufficient crosscheck results to create evidence about correctness (crosscheckers must send this information to the CE coordinator at least 3 days ahead of the document deadline). Furthermore, any deviations from the timelines above shall be documented. The numbers used in the summary report shall not be changed relative to the description document.

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

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

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

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

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

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

## Software development and anchor generation (update)

Proponents of adopted aspects were asked to inform the AHG3 chairs to clarify whether software action is needed.

The planned timeline for software releases was established as follows:

* VTM8.0 will be released by 2020-02-17 including all adoptions necessary for CTC. VTM8.1 with non-CTC adoptions will be released 2020-03-16. Further versions of VTM may be released for additional bug fixing, as appropriate.
* Preparation of the VTM software will include immediate removal of macros that were added in the previous meeting cycle. The software coordinator has the discretion to retain some such macros.
* 360lib software is to be revised for the modified generalized cubemap, which was requested by 2019-02-28
* No change of HDRTools software was noted in response to meeting.

# 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).

+Meeting plans for ad hocs

|  |  |  |
| --- | --- | --- |
| **Title and Email Reflector** | **Chairs** | **Mtg** |
| **Project Management (AHG1)**(jvet@lists.rwth-aachen.de)* Coordinate overall JVET interim efforts.
* Supervise AHG studies.
* Report on project status to JVET reflector.
* Provide a report to the next meeting on project coordination status.
 | J.-R. Ohm, G. J. Sullivan (co-chairs) | N |
| **Draft text and test model algorithm description editing (AHG2)**(jvet@lists.rwth-aachen.de)* Produce and finalize JVET-S2001 VVC text specification draft 10 and JVET-S2007 VSEI text specification draft 5.
* Produce and finalize JVET-S2002 VVC Test Model 10 (VTM 10) Algorithm and Encoder Description.
* Gather and address comments for finalization of these documents.
* Coordinate with test model software development AhG to address issues relating to mismatches between software and text.
* Collect and consider errata reports on the texts
 | B. Bross, J. Chen (co-chairs), J. Boyce, S. Kim, S. Liu, Y.-K. Wang, Y. Ye (vice-chairs) | N |
| **Test model software development (AHG3)**(jvet@lists.rwth-aachen.de)* Coordinate development of test model (VTM) software and associated configuration files.
* Produce documentation of software usage for distribution with the software.
* Discuss and make recommendations on the software development process.
* Propose improvements to the guideline document for developments of the test model software.
* Perform tests of VTM behaviour relative to HEVC and the previous VTM using the VTM common test conditions.
* 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.
* Coordinate with AHG6 for integration with 360lib software.
 | F. Bossen, X. Li, K. Sühring (co-chairs) | N |
| **Test material and visual assessment (AHG4)**(jvet@lists.rwth-aachen.de)* Produce the draft verification test plan JVET-S2009 and develop proposed improvements for verification testing of VVC capability.
* Maintain the video sequence test material database for testing the VVC standard and potential future extensions.
* Identify and recommend appropriate test materials for testing the VVC standard and potential future extensions.
* Identify missing types of video material, solicit contributions, collect, and make available a variety of video sequence test material.
* Evaluate new test sequences.
* Maintain and update the directory structure for the test sequence repository as necessary.
* Prepare availability of viewing equipment and facilities arrangements for the next meeting, and prepare testing upon consultation with CE coordinators.
 | V. Baroncini, T. Suzuki, M. Wien (co-chairs), A. Norkin, A. Segall, Y. Ye (vice-chairs) | Tel.2 weeks notice |
| **Conformance testing (AHG5)**(jvet@lists.rwth-aachen.de)* Produce the JVET-S2008 draft conformance testing specification and develop proposed improvements.
* Study the requirements of VVC conformance testing to ensure interoperability.
* Maintain and update the conformance bitstream database
* Study additional testing methodologies to fulfil the needs for VVC conformance testing.
 | J. Boyce and W. Wan (co-chairs), E. Alshina, F. Bossen, I. Moccagatta, K. Kawamura, K. Sühring, X. Xu (vice-chairs) | N |
| **360° video coding, software and test conditions (AHG6)**(jvet@lists.rwth-aachen.de)* Study the effect on compression and subjective quality of different projections formats, resolutions, and packing layouts.
* Solicit additional test sequences, and evaluate suitability of test sequences on head-mounted displays and normal 2D displays.
* Study the effect of viewport resolution, field of view, and viewport speed/direction on visual comfort.
* Prepare and deliver the 360Lib-11 software version and common test condition configuration files according to JVET-L1012.
* Generate CTC anchors and PERP results for the VTM according to JVET-L1012 within two weeks of availability of SDR CTC anchors.
* Coordinate with AHG4 in preparation for verification testing for 360° video content.
* Produce documentation of software usage for distribution with the software.
 | J. Boyce and Y. He (co-chairs), K. Choi, J.-L. Lin, Y. Ye (vice-chairs) | N |
| **Coding of HDR/WCG material (AHG7)**(jvet@lists.rwth-aachen.de)* Study and evaluate available HDR/WCG test content.
* Study objective metrics for quality assessment of HDR/WCG material, including investigation of the correlation between subjective and objective results.
* Compare the performance of the VTM and HM for HDR/WCG content.
* Generate CTC anchors for the VTM according to JVET-S2011 within two weeks of availability of SDR CTC anchors.
* Study the luma/chroma bit allocation in the HDR CTC, especially for HLG content.
* Coordinate implementation of HDR anchor aspects in the test model software with AHG3.
* Coordinate with AHG4 in preparation for verification testing for HDR video content.
* Study additional aspects of coding HDR/WCG content.
 | A. Segall (chair), E. François, W. Husak, S. Iwamura, D. Rusanovskyy (vice-chairs) | N |
| **Layered coding and resolution adaptivity (AHG8)**(jvet@lists.rwth-aachen.de)* Study approaches for support of layered scalable coding and adaptive-resolution coding, including spatial, temporal, quality, view, subpicture, and region-of-interest aspects; and analyse their coding efficiency and complexity characteristics.
* Consider 360° viewport-dependent streaming and real-time communication applications of layered coding and resolution adaptivity.
* Coordinate with AHG2 and AHG3 for text drafting and software development for the layered coding and resolution adaptivity aspects of the VVC design.
* Study and develop improvements of the JVET-Q2015 functionality testing condition description.
* Propose common test conditions for layered coding and resolution adaptivity.
 | S. Wenger and A. Segall (co-chairs), M. M. Hannuksela, Hendry, S. McCarthy, Y.-C. Sun, P. Topiwala, Y.-K. Wang (vice-chairs) | N |
| **SEI message studies (AHG9)**(jvet@lists.rwth-aachen.de)* Study the SEI messages in VVC and VSEI.
* Collect software and SEI showcase information for SEI messages, including encoder and decoder implementations and bitstreams for demonstration and testing.
* Identify potential needs for additional SEI messages, particularly including those in the TuC JVET-S2xxx.
* Study SEI messages defined in HEVC and AVC for potential use in the VVC context.
 | S. McCarthy (chair), J. Boyce, P. de Lagrange, A. Luthra, A. Tourapis, Y.-K. Wang, S. Wenger (vice-chairs) | N |
| **Encoding algorithm optimization (AHG10)**(jvet@lists.rwth-aachen.de)* Study the impact of using techniques such as GOP structures and perceptually optimized adaptive quantization for encoder optimization.
* Study encoding techniques of optimization for objective quality metrics and their relationship to subjective quality.
* Study the impact of adaptive quantization.
* 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.
 | A. Duenas, A. Tourapis (co-chairs), S. Ikonin, A. Norkin, R. Sjöberg, J. Le Tanou, J.-M. Thiesse (vice-chairs) | N |
| **Neural-network-based video coding (AHG11)**(jvet@lists.rwth-aachen.de)* Study potential extensions of VVC with NN-based coding tools for video coding, such as intra or inter prediction modes, partitioning, transforms, and in-loop or post filtering.
* Study NN-based encoding optimization for VVC.
* Study the impact of training on the performance of candidate technology.
* Analyse complexity characteristics and perform complexity analysis of candidate technology.
* Identify video test materials, training set materials, and testing methods for assessment of the effectiveness and complexity of considered tools.
* Develop reporting templates for test results and analysis of candidate technology.
* Coordinate with relevant activities of the parent bodies.
 | E. Alshina, S. Liu, J. Pfaff, M. Wien, P. Wu, Y. Ye (co-chairs) | Tel.2 weeks notice |
| **High bit depth, high bit rate, and high frame rate coding (AHG12)**(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.
* Identify potential needs for future extension of VVC to support such application usage.
* Define testing conditions and test sequences for high bit depth, high bit rate, and high frame rate coding in coordination with AHG 4.
 | A. Browne, T. Ikai, X. Xiu (co-chairs) | N |
| **Tool reporting procedure and testing (AHG13)**(jvet@lists.rwth-aachen.de)* Prepare output document JVET-S2005, which describes the methodology of tool-off testing and a list of tools to be tested by identified testers, including non-CTC configurations as appropriate.
* Produce, study and develop improvements of the JVET-R2013 testing condition description for non-4:2:0 colour format coding.
* Provide configurations files, bitstreams, and results of tool-on/tool-off testing.
* Develop and collect test results for additional testing of VVC capabilities.
* Maintain VTM software aspects for memory bandwidth analysis in coordination with AHG3.
* Use the tool usage counts and memory bandwidth usage to study the decoder complexity of features in on/off testing.
* Prepare a report with results of the tests.
 | W.-J. Chien, J. Boyce (co-chairs), Y.-W. Chen, R. Chernyak, K. Choi, R. Hashimoto, Y.**-**W. Huang, H. Jang, R.-L. Liao, S. Liu (vice-chairs) | N |

*Former JCT-VC AHGs (change reflector, and merge some)*

|  |  |  |
| --- | --- | --- |
| **Title and Email Reflector** | **Chairs** | **Mtg** |
| **JCT-VC project management (AHG1) merge**(jct-vc@lists.rwth-aachen.de)* Coordinate overall JCT-VC interim efforts.
* Report on project status to JCT-VC reflector.
* Provide a report to next meeting on project coordination status.
 | G. J. Sullivan, J.-R. Ohm (co‑chairs) | N |
| **Test model editing and errata reporting (AHG2)**(jct-vc@lists.rwth-aachen.de)* Propose improvements to the JCTVC-AL1002 HEVC Test Model 16 (HM 16) Update 13 of Encoder Description
* Collect reports of errata for the HEVC, AVC, CICP, the codepoint usage TR specification and the published HDR-related technical reports.
* Gather and address comments for refinement of these documents.
* Coordinate with AHG3 on software development and software technical evaluation to address issues relating to mismatches between software and text.
 | B. Bross, C. Rosewarne (co‑chairs), J.‑R. Ohm, K. Sharman, G. J. Sullivan, A. Tourapis, Y.‑K. Wang (vice‑chairs) | N |
| **Software development and software technical evaluation (AHG3)**(jct-vc@lists.rwth-aachen.de)* Coordinate development of the HM, SCM, SHM, HTM, MFC, MFCD, JM, JSVM, JMVM, 3DV-ATM, and HDRTools software and their distribution.
* Enable software support for recently standardized additional SEI messages.
* Produce documentation of software usage for distribution with the software.
* Prepare and deliver results, reporting templates, and anchor test results according to JCT-VC common 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 AHG2 on HEVC and AVC test model editing and errata reporting to identify any mismatches between software and text.
 | K. Sühring (chair),B. Li, K. Sharman, V. Seregin, G. Tech, A. Tourapis (vice‑chairs) | N |
| **Supplemental enhancement information (AHG4) merge**(jct-vc@lists.rwth-aachen.de)* Study the status of text and potential needs for SEI messages for AVC and HEVC.
* Consider proposals for additional SEI message data and associated syntax and semantics specification.
* Develop usage scenario descriptions and showcase demonstrations.
* Coordinate with AHG3 for software support of SEI messages.
 | J. Boyce (chair), C. Fogg, S. McCarthy, G. J. Sullivan, Y.-K. Wang (vice‑chairs) | N |
| **Test sequence material (AHG5) merge**(jct-vc@lists.rwth-aachen.de)* Maintain the video sequence test material database for development of HEVC and its RExt, SHVC and SCC extensions.
* Identify, collect, and make available a variety of video sequence test material, especially focusing on new needs for HDR/WCG test material and corresponding SDR test material.
* Collect information about test sequences that have been made available by other organizations.
* Study coding performance and characteristics in relation to video test materials.
* Identify and recommend appropriate test materials and corresponding test conditions for use in development of HEVC and its extensions.
* Coordinate with the activities in AHG3 and AHG6 regarding HDR/WCG testing.
 | T. Suzuki, V. Baroncini (co‑chairs), E. François, P. Topiwala, S. Wenger (vice‑chairs) | N |

# 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 MPEG output document, a separate version under the MPEG document header should be generated. This version should be sent to GJS and JRO for upload.

[JVET-S2000](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=9674) Meeting Report of the 19th JVET Meeting [G. J. Sullivan, J.-R. Ohm] (2020-10-xx, near next meeting)

Initial versions of the meeting notes (d0 … d8) were made available on a daily basis during the meeting.

[JVET-S2001](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=9675) Versatile Video Coding (Draft 10) [B. Bross, J. Chen, S. Liu, Y.-K. Wang] [WG 11 N 19470 (2020-07-29)

(A technically complete draft available by closure of the meeting as -vA, aside from editorial aspects and double-checking of CABAC initialization values.)

DoCR N 19478.

[JVET-S2002](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=9676) Algorithm description for Versatile Video Coding and Test Model 10 (VTM 10) [J. Chen, Y. Ye, S. Kim] [WG 11 N 19471] (2020-10-05, near next meeting)

Software release of the 10.0 version was expected by 2020-07-31, and contributors need to submit their software revisions at least a week in advance of that date (certainly sooner than that is preferred).

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] (2019-04-01)

[JVET-S2004](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=9677) Algorithm descriptions of projection format conversion and video quality metrics in 360Lib (Version 11) [Y. Ye, J. Boyce] (2020-10-xx, near next meeting)

It was also noted that a viewport extraction configuration file PCMP was missing from the software package, and other software improvements had been made.

[JVET-S2005](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=9678) Methodology and reporting template for coding tool testing [W.-J. Chien and J. Boyce] (2020-08-15)

Remains valid – not updated: [JVET-M1006](http://phenix.int-evry.fr/jvet/doc_end_user/current_document.php?id=5758) Methodology and reporting template for neural network coding tool testing [Y. Li, S. Liu, K. Kawamura] (2019-02-01)

This prior output was produced to capture aspects specific to enable study of neural network techniques.

[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] [WG 11 N 19472] (2020-07-29)

(Technically complete draft available by closure of the meeting as -v3, aside from editorial aspects.)

DoCR WG 11 N 19479.

[JVET-S2008](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=9680) Conformance testing for versatile video coding (Draft 4) [J. Boyce, E. Alshina, F. Bossen, K. Kawamura, I. Moccagatta, W. Wan] [WG 11 N 19474] (2020-10-05, near next meeting)

Bitstreams were requested to be provided by two weeks after the release of the VTM 10.0 software.

Test bitstream providers were to provide bitstream descriptions in the document at the Nextcloud link given above.

[JVET-S2009](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=9681) VVC verification test plan (Draft 3) [M. Wien, V. Baroncini, A. Segall, Y. Ye] [WG 11 N 19475] (2020-07-31)

A preliminary draft was reviewed.

An initial draft is to be available by 2020-07-10.

The verification test coordinators are delegated the selection of GOP size (not changing the IRAP spacing), as determined by expert viewing.

Volunteering test sites will be mandated to successfully conduct a calibration experiment.

Given sufficient resources, we would like to have more than one lab perform each test.

Raw data from each test lab will be provided to the test coordinators.

If more labs volunteer than would be needed, the quality for workmanship in conducting the calibration experiment would be used to select sufficient testing resources.

The test coordinators were asked to produce a budget estimate for the test expenses.

Following the test, a summary report of the financial arrangements will be provided.

The test coordinators will seek volunteers to generate the necessary encodings.

See notes in section 4.4.

Remains valid – not updated: [JVET-N1010](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=6643) JVET common test conditions and software reference configurations for SDR video [F. Bossen, J. Boyce, X. Li, V. Seregin, K. Sühring] (2019-04-12)

[JVET-S2011](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=8862) JVET common test conditions and evaluation procedures for HDR/WCG video [A. Segall, E. François, W. Husak, S. Iwamura, D. Rusanovskyy] (2020-07-24)

Waiting on provision of “DayStreet” and “PeopleInShoppingCenter” test sequences.

Remains valid – not updated: [JVET-L1012](http://phenix.int-evry.fr/jvet/doc_end_user/current_document.php?id=4840) JVET common test conditions and evaluation procedures for 360° video [P. Hanhart, J. Boyce, K. Choi, J.-L. Lin] (2018-10-26)

Remains valid – not updated: [JVET-R2013](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=9682) JVET common test conditions and software reference configurations for non-4:2:0 colour formats [Y.-H. Chao, Y.-C. Sun, J. Xu, X. Xu] (2020-05-15)

Only an update of the configuration files is planned per S0244, which does not affect the document.

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] (2020-03-02)

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] (2020-03-02)

[JVET-S2016](http://phenix.it-sudparis.eu/jvet/doc_end_user/current_document.php?id=9673) Summary information on BD-rate experiment evaluation practices [K. Andersson, F. Bossen, J.-R. Ohm, A. Segall, R. Sjöberg, J. Ström, G. J. Sullivan, A. Tourapis] [WG 11 PDTR N19477 and ITU-T Approval] (2020-07-10)

Request in WG 11 N19476.

Minor refinements of the description.

JVET-S2017 Technologies under consideration for VSEI [J. Boyce, Y.-K. Wang] (2020-07-31)

*Former JCT-VC Outputs & leftover notes from 40th JCT-VC:*

AVC draft annotated regions & shutter interval

Issue output targeted at inclusion in VSEI

Not yet MPEG request for new edition

Issue PDTR Codepoint usage TR v3 23094-4 (check number)

MPEG request

[JCTVC-AN1000](http://phenix.int-evry.fr/jct/doc_end_user/current_document.php?id=11007) Meeting Report of the 40th JCT-VC Meeting [G. J. Sullivan, J.-R. Ohm (chairs)] [2020-xx] (near the next 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)]

[JCTVC-AN1002](http://phenix.int-evry.fr/jct/doc_end_user/current_document.php?id=11000) High Efficiency Video Coding (HEVC) Test Model 16 (HM 16) Encoder Description Update 14 [C. Rosewarne (primary editor), K. Sharman, R. Sjöberg, G. J. Sullivan (co-editors)] (WG 11 N 19473) [2020-10-05] (near next meeting)

Update to describe LDB GOP structure. (New RA GOP structure is already in Update 13.)

[Old notes from prior meeting: This will include a description of the GOP16 structure. The description of the PCC motion search hint functionality of JCTVC-AJ0028 should also be improved. These are to be supported in the HM16.22 software release.]

HM16.22 had still not been released, and the PCC motion search had not yet been included in the work.

Is JCTVC-AJ0028 in the document? Yes, it was described in the document output from the previous meeting.

[In the closing plenary it was mentioned that there is a modified Low-delay B referencing structure used in JVET, described in JVET-P0345. If that fits in the HEVC buffering capacity and we have adequate software/configuration files for it, we would want this in our CTC and test model document. The proponents of that contribution had provided test results in the HEVC context (with about 4.7% gain in luma and somewhat more in chroma). From a look at the contribution, it appeared that the only software impact is on the configuration files. However, it may violate the HEVC buffering capacity. Further study on this was encouraged.]

There is no effect on the CTC document – only in the config files.

The latest tagged version of the HM (16.21) has a capacity-violating RA config (only a 0.2% impact on PSNR) and a not-as-good LDB referencing structure. HM 16.22 will have those features and its release was imminent.

The expected PCC motion search hint changes had not been followed up, and will not be included in HM 16.22.

Remains valid – not updated: JCTVC-AM1003 Draft revised coding-independent code points for video signal type identification [G. Sullivan, T. Suzuki, A. Tourapis] [2020-05-22]

Under ballot, not modified.

MPEG document 19208

+CD for CICP (& request for ISO/IEC)

request 19207.

[JCTVC-AN1004](http://phenix.int-evry.fr/jct/doc_end_user/current_document.php?id=11006) Errata report items for HEVC, AVC, Video CICP, and CP usage TR [G. J. Sullivan, Y. Syed, Y.-K. Wang] [2020-XX] (near next meeting)

Remains valid – not updated: [JCTVC-AL1005](http://phenix.int-evry.fr/jct/doc_end_user/current_document.php?id=10997) Shutter interval information SEI message for HEVC (Draft 2) [S. McCarthy, G. J. Sullivan, Y.-K. Wang] (WG 11 CDAM N 19121 🡪 DAM N 19198) (2020-02-07)

A DAM ballot was issued for WG 11 as WG 11 N 19198 (without changing the text).

In ISO/IEC the amendment will be renamed and renumbered.

JCTVC-AN1006 Annotated regions and shutter interval information SEI messages for AVC (Draft 1) [J. Boyce, S. McCarthy, Y.-K. Wang] (near next meeting)

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 (editors)] (WG 11 [N 15778](http://phenix.it-sudparis.eu/mpeg/doc_end_user/current_document.php?id=53941&id_meeting=165))

JCTVC-AN1008 Usage of video signal type code points (Draft 1 for version 3) [W. Husak, G. J. Sullivan, Y. Syed, A. Tourapis (editors)] 2020-08-07

(only editorial improvements and errata corrections)

PDTR in MPEG N19481

Request in MPEG N19480

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 (editors)]

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 (editors)]

No output: JCTVC-AL1011

No output: JCTVC-AL1012

No output: JCTVC-AL1013

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 (editors)] (WG 11 [N 16049](http://phenix.it-sudparis.eu/mpeg/doc_end_user/current_document.php?id=54889&id_meeting=166))

Remains valid – 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 (editors)] [2017-02-17]

No output: JCTVC-AL1016 through JCTVC-AL1019

Remains valid – not updated: [JCTVC-Z1020](http://phenix.it-sudparis.eu/jct/doc_end_user/current_document.php?id=10692) Common Test Conditions for HDR/WCG Video Coding Experiments [E. François, J. Sole, J. Ström, P. Yin (editors)] [2017-02-17] (1 month)

Remains valid – not updated: – [JCTVC-AF1100](http://phenix.it-sudparis.eu/jct/doc_end_user/current_document.php?id=10693) Common Test Conditions for HM Video Coding Experiments [K. Sharman, K. Sühring (editors)] [2018-09-14]

(Revision only to be issued if needed for coordination; no such need was identified.)

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

Future meeting plans were established according to the following guidelines:

* Meeting under ITU-T SG 16 auspices when it meets (ordinarily starting meetings on the Wednesday of the first week and closing it on the Wednesday of the second week of the SG 16 meeting – a total of 8 meeting days), and
* Otherwise meeting under ISO/IEC JTC 1/SC 29/WG 11 auspices (or its successor) when it meets (ordinarily starting meetings on the Friday prior to such meetings and closing it at lunchtime on the last day of the WG 11 meeting – a total of 7.5 meeting days).

In cases where an exceptionally high workload is expected for a meeting, an earlier starting date may be defined.

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

* Wed. 7 – Fri. 9 and Mon 12 – Friday 16 October 2020, 20th meeting under WG 11 auspices as a teleconference (7.5 meeting days).
* Fri. 8 – Fri. 15 January 2021, 21st meeting under WG 11 auspices in Capetown, ZA.
* Wed. 21 – Wed. 28 April 2021, 22nd meeting under ITU-T auspices in Geneva, CH.
* Fri. 9 – Fri. 16 July 2021, 23rd meeting under WG 11 auspices in Prague, CZ.

The agreed document deadline for the 20th JVET meeting was planned to be Wednesday 30 Sep. 2020.

Vittorio Baroncini, Andrew Segall, Mathias Wien, and Yan Ye were thanked for their efforts in further developing the VVC verification test plan and procedure. GBTech was thanked for kindly providing resources and conducting the dry run for SDR UHD test cases with non-expert viewers. Individuals who participated in the remote experts viewing, and experts who prepared bitstreams were also thanked.

NHK was thanked providing additional 4K HLG test sequences.

Thanks were also expressed to the editors, software coordinators, and all contributors to the development of the VVC and VSEI standards.

The 19h JVET meeting was closed at approximately 2100 hours UTC on Wednesday 1 July 2020.

# Annex A to JVET report:List of documents

# Annex B to JVET report:List of meeting participants

The participants of the nineteenth meeting of the JVET, according to an attendance sheet circulated during the meeting sessions (approximately XXX people in total), were as follows: