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| *Title:* | **CE on Entropy Coding for High Bit Depth and High Bit Rate Coding** | | |
| *Status:* | Output document of JVET | | |
| *Purpose:* | Core Experiment description | | |
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| *Source:* | CE coordinators | | |

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# Abstract

The goal of this Core Experiment (CE) is to conduct a study of Rice parameter derivation proposals submitted to the T meeting of JVET.

Participants in this activity are Kwai, Qualcomm, Sharp and Sony.

The software basis for this CE is VTM-11.0 or later. For the test sequences, configurations and test conditions, the High Bit-depth CTC described in JVET-T2018 is used, unless otherwise specified in the CE description.

# Participants

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# Test conditions and evaluation criteria

The proposals will be tested under the High Bit-Depth CTC specified in [1] in both lossy and lossless configurations. In addition to the sequences included in the CTC, the sequences FireEater2Clip4000r1\_1920x1080p\_25\_12b\_pq\_709\_ct2020\_444 and FireEater2Clip4000r1\_1920x1080p\_25\_12b\_pq\_709\_ct2020\_422 are included in the test sequences as they they have both light and dark areas and thus will have a large variation in coefficient values. This will allow the assessment of adaption techniques. An updated spreadsheet containing the additional sequences will be made available at the same time as the final CE text.

Planned tests in the CE shall be implemented on, and compared with, VTM-11.0 with the modification described in [XXX] to enable high bit depth processing.For 16 bit testing, extended precision processing will be enabled, and all results will be compared with an anchor with the same setting. For 12 bit testing, extended precision will be disabled and the results will be compared with an anchor with extended precision disabled.

Transform skip setings will follow CTC settings.

Proposals will be compared with respect to bit rate, objective quality and complexity.

Comments: Update the document as per examples from CEs on transforms and entropy coding, e.g. throughput issue should be considered, bin to bit ratio.

Comments: If proposal changes processing performance at 8/10 bit depth coding, additional results for regular VVC v1 CTC to be provided.

Comments: It is recommended to test different components of the proposals separately, namely separately for RRC and TSRC.

# Proposals descriptions

## Rice parameter selection for high bit depths (JVET-T0072)

The proposal JVET-T0072 introduces a modification to the VVC Rice parameter derivation method for both regular residual coding (RRC) and transform skip residual coding (TSRC). The modification extends the existing VVC Rice parameter deriviation method by adding an adaption technique based on selecting one of a series of counters. These counters are used to predict the magnitude of coefficients and are updated when coefficients are coded. The predicted magnitude is then used in an adaptation of the existing VVC technique.

## Rice parameter derivation for high bit depths (JVET-T0085)

The proposal of JVET-T0085 introduces a modification to the VVC Rice parameters derivation method for regular residual coding (RRC). It is proposed to use a formula instead of conventional look-up table. Specifically, the rice parameter value is predicted using linear prediction with log2 operation. The linear prediction parameter depend on syntax (i.e. abs\_reminder or dec\_abs\_level).

## Slice based Rice parameter selection for transform skip residual coding (JVET-T0089)

The proposal of JVET-T0089 introduces a modification to the VVC Rice parameters derivation method for transform skip residual coding (TSRC). It is proposed to explicitly signal the Rice parameter for each slice to indicate the Rice parameter for the binary codewords of abs\_remainder.

## On the Rice parameter derivation for high bit-depth coding (JVET-T0105)

The proposal of JVET-T0105 introduces a modification to the VVC Rice parameters derivation method for regular residual coding (RRC). It is proposed for high bitdepth coding to derive rice parameters based on a adjusted value of the *locSumAbs*. Amount of adjustment can be determined either globally, or being locally adaptive.

# Planned tests

## Tests on proposed regular residual coding.

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| **Test** | **Proponent(s)** | **Cross-checker(s)** |
| *CEx-1.1* | Qualcomm | Sony |
| *CEx-1.2* | Qualcomm | Sony |
| *CEx-1.3* | Sharp | Kwai |
| *CEx-1.4* | Sony | Qualcomm |
| *CEx-1.5* | Sony | Qualcomm |

## Tests on proposed transform skip residual coding.

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| **Test** | **Proponent(s)** | **Cross-checker(s)** |
| CEx-2.1 | Kwai | Sharp |
| CEx-2.2 | Sony | Kwai |
| CEx-2.3 | Sony | Kwai |

# Tests description:

## CEX-1.1: Method of JVET-T0105 without adaptive adjustment.

Method proposed in JVET-T0105 with globally derived adjusment for rice parameter derivation.

## CEX-1.2: Method of JVET-T0105 with content adaptive adjustment.

Method proposed in JVET-T0105 with locally adaptive adjusment for rice parameter derivation.

## CEX-1.3: Method of JVET-T0085.

Method proposed in JVET-T0085, it is proposed to use a formula instead of conventional look-up table.

## CEX-1.4: Method of JVET-T0072 with standard TSRC

The RRC component of the method proposed in JVET-T0072 with rice parameter adaption based on previously coded coefficients. For this experiment the TSRC component of the modification described in JVET-T0072 is disabled and standard VVC TSRC is used.

## CEX-1.5: Method of JVET-T0072 with simplification and standard TSRC

The RRC component of the simplification proposed in JVET-T0072 of the technique described in CEX-1.4. For this experiment the TSRC component of the modification described in JVET-T0072 is disabled and standard VVC TSRC is used.

## CEX-2.1: Method of JVET-T0089

Method proposed in JVET-T0089, it is proposed to explicitly signal the Rice parameter for each slice to indicate the Rice parameter for the binary codewords of abs\_remainder.

## CEX-2.2: Method of JVET-T0072 with standard RRC

The TSRC component of the method proposed in JVET-T0072 with rice parameter adaption based on previously coded coefficients. For this experiment the RRC component of the modification described in JVET-T0072 is disabled and standard VVC RRC is used.

## CEX-2.3: Method of JVET-T0072 with simplification and standard RRC

The TSRC component of the simplification proposed in JVET-T0072 of the technique described in CEX-2.2. For this experiment the RRC component of the modification described in JVET-T0072 is disabled and standard VVC RRC is used.

# Time-line and Responsibilities

T1: 2020-October-30: Final CE description uploaded

T2: VTM11.0 + N weeks: Cross-checking begins, proponents provide software

T3: 2020-XXXX-XX: Final version of CE software is provided; final cross-check begins.

T4: 2020-December-30: CE contribution documents including specification text and complete test results are uploaded to the JVET document repository.

# References

[1] A. Browne, T. Ikai, D.  Rusanovskyy, X. Xiu, “Common test conditions for high bit depth and high bit rate video coding”, JVET-T2018, JVET, 20th Meeting: by teleconference, 7-16 Oct. 2020