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| *Title:* | **HEVC Screen Content Coding Core Experiment 5 (SCCE5): Inter-component prediction and adaptive color transforms** | | |
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# Abstract

This document is a description of the HEVC Screen Content Coding Core Experiment 5 on inter-component prediction and adaptive color transforms.

# Introduction

This document defines the HEVC Screen Content Coding Core Experiment 5 (SCCE5) on inter-component prediction and adaptive color transforms, to be performed for the upcoming 18th JCT-VC meeting.

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# Tools to be tested

## Inter-component prediction

### JCTVC-Q0034 (Huawei)

It is proposed to introduce the modified LMChroma model to further exploit the cross-color component correlation. A new chroma mode is added in current HEVC RExt draft to signal the LMChroma. Available luma and chroma component samples are utilized to derive the linear prediction.

### JCTVC-Q0036 (Mitsubishi)

It is proposed to introduce a chroma prediction mode using the correlation between two components. The proposed prediction mode is available for PUs applying intra prediction or intra block copy for luma component. A PU-level flag is signaled to indicate whether to use the proposed chroma prediction or not. If the flag is enabled, inter-component prediction (ICP) using scaling and offset parameter is conducted at corresponding PU. The parameters are derived by the same formula as “LM chroma” mode. Moreover, a reference color component selection flag for each PU is introduced for the R (Cr) component.

The prediction sample generation process is conducted for each TU and PU for the intra prediction CU and intra block copy CU, respectively. It is noted that the derivation process of the scaling and the offset parameter is performed for each CU not PU for intra block copy CU.

On combination of ICP and cross-component prediction (CCP) in RExt, the proposed scheme applies the restriction that CCP is always disabled at the block applying ICP. In this subtest, the proposed scheme will be evaluated by the following tests.

**- Test 1 (common test)**

This test evaluates the coding performance of the proposed scheme under SCCE5 test conditions described in Section 5.

**- Test 2 (additional test)**

For the sake of appropriate evaluation of Y BD-rate for YCbCr sequences, this test uses the modified chroma value for the proposed scheme. Such modification has the effect that inter-component prediction works as the tool of bitrate reduction instead of that of chroma PSNR improvement [8].

In this test, the coding experiment conducts only for YCbCr sequences for lossy configurations. The test conditions of this test also conform to the common test conditions in Section 5.

### JCTVC-Q0033 (MediaTek)

It is observed that alpha being equal to 4 or 8 takes quite a large proportion in RGB sequences. Because the current coding method does not match with such a distribution very well, it is proposed to code the alpha parameter adaptively. In the method, a flag scale\_parameter\_coding\_mode in PPS extension (since the inter-component residual prediction enabling flag is carried in PPS) is signalled to indicate whether the following new signalling scheme is applied.

In the new signalling, the alpha parameter is represented by log2\_res\_scale\_pred\_4minus and log2\_res\_scale\_neg as depicted in Table 2. The binarization for the two syntax elements and the corresponding alphas are demonstrated in Table. 3. Five context models are used by the five bins separately for log2\_res\_scale\_pred\_4minus. And log2\_res\_scale\_neg is coded in the by-pass mode simply. In summary, alpha parameter equals to 1<<(4–log2\_res\_scale\_4minus) when scale\_parameter\_coding\_mode equal to 1 and log2\_res\_scale\_4minus is equal to neither 0 nor 5. If log2\_res\_scale\_4minus equals to 5, alpha parameter equals to – (1<< log2\_res\_scale\_neg). If log2\_res\_scale\_4minus equals to 0, alpha parameter equals to 0. In this proposal, the flag scale\_parameter\_coding\_mode is set to be 1 for RGB sequences, and set to be 0 for YUV sequences.

**Table 2. Alpha parameter syntax in method 2**

|  |  |
| --- | --- |
| cross\_comp\_pred ( x0, y0, c ) { | Descriptor |
| if(scale\_parameter\_coding\_mode = = 0) { |  |
| **log2\_res\_scale\_abs\_plus1[ c ]** | ae(v) |
| **if( log2\_res\_scale\_abs\_plus1[ c ] != 0 )** |  |
| **res\_scale\_sign\_flag[****c ]** | ae(v) |
| } |  |
| else { |  |
| **log2\_res\_scale\_pred\_4minus[ c ]** | ae(v) |
| if(log2\_res\_scale\_4minus [ c ] == 5) |  |
| **log2\_res\_scale\_neg [ c ]** | ae(v) |
| } |  |
| } |  |

**Table 3. Binarization and corresponding alphas in method 2**

|  |  |  |
| --- | --- | --- |
| Alpha | log2\_res\_scale\_pred\_4minus[ c ] | log2\_res\_scale\_neg [ c ] |
| 0 | 0(0) | Na |
| 8 | 1(10) | Na |
| 4 | 2(110) | Na |
| 2 | 3(1110) | Na |
| 1 | 4(11110) | Na |
| -1 | 5(11111) | 0(00) |
| -2 | 5(11111) | 1(01) |
| -4 | 5(11111) | 2(10) |
| -8 | 5(11111) | 3(11) |

## Adaptive color transform

### JCTVC-Q0031 (Qualcomm)

The CU-level adaptive color-space transform to YCoCg color space is investigated in this test. A flag is signalled for each CU to indicate the usage of color-space transform. The method is applicable to both lossy and lossless coding. For lossless coding, the YCoCg-R transform is employed while for lossy coding, the modified YCoCg transform is used. Different QPs are applied to the CUs coded with and without color-space transform. In this test, the forward transform with different normalization factors will be tested to achieve the best trade-off of coding performance.

### JCTVC-Q0035 + JCTVC-Q0213 (Microsoft)

Adaptive color space coding will be investigated in the test. Adaptive color space is designed to improve the coding efficiency of RGB (GBR) video. Besides GBR, coding in YCoCg, RGB, and BGR spaces are enabled for intra predicted CU for lossy coding. For lossless coding, only reordering (e.g. RGB, BGR) is allowed. When different color space is used, different QP setting for different color component will also be tested in this test. A CU level flag is signaled to indicate the usage of color space. When YCoCg color space is used, different QPs will be used for normalization.

### JCTVC-Q0037 (InterDigital)

In this study of the SCCE, the adaptive color space conversion algorithm in the residue domain will be tested for RGB coding. Specifically, it is proposed to convert residuals from RGB to YCgCo color space before transform and quantization at the encoder. At the decoder side, after inverse quantization and inverse transform, the reconstructed residuals are converted from YCgCo back to RGB. Two different color space conversion methods are applied to lossless and lossy coding respectively. Also, the performance with normalized forward color transform will be studied in this test.

# Cross-checks

|  |  |
| --- | --- |
| **Subtest** | **Cross-checker(s)** |
| 3.1.1 (Huawei) | MedaTek |
| 3.1.2 (Mitsubishi) | Qualcomm |
| 3.1.3 (MediaTek) | KDDI |
| 3.2.1 (Qualcomm) | Mitsubishi, InterDigital |
| 3.2.2 (Microsoft) | Huawei |
| 3.2.3 (InterDigital) | Huawei |

# Test conditions

All the methods that are studied in this SCCE shall be tested against the following two anchors:

* SCM-1.0 basis using intraBC with full frame search
* SCM-1.0 basis using intraBC with 2-CTU search

# Timeline

T0 (April 18, 2014): Finalization of SCCE document

T1 (April 25, 2014): Release of SCM-1.0

T2 (May 16, 2014): Release of software and simulation results for cross-check, T2 = T1 + 3 weeks

T3 (May 30, 2014): Release of cross-check results, T3 = T2 + 2 weeks

T4 (June 20, 2014): Document upload deadline

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