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| *Title:* | **SCCE3: Test A.5 - Palette table prediction** | | |
| *Status:* | Input Document to JCT-VC | | |
| *Purpose:* | Proposal | | |
| *Author(s) or Contact(s):* | Yuwen He, Xiaoyu Xiu, Yan Ye, Chia-Ming Tsai 9710 Scranton Rd, #250 San Diego, CA 92121, USA | Tel: Email: | +1-858-210-4819/-4830/-4803 [yuwen.he@interdigital.com](mailto:yuwen.he@interdigital.com) [xiaoyu.xiu@interdigital.com](mailto:xiaoyu.xiu@interdigital.com) [yan.ye@interdigital.com](mailto:yan.ye@interdigital.com) kevin190@gmail.com |
| *Source:* | InterDigital Communications, Inc. | | |

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# Abstract

This proposal reports the simulation results for palette table prediction (SCCE3 Test A.5). The technologies were originally proposed in the response of SCC CfP (JCTVC-Q0037) from InterDigital. There are two technologies in this test. The first technology is palette dictionary merging. The palette dictionary used for palette table prediction is updated based on the palette table of current coding unit and last palette dictionary via merging process. The second technology is palette table sharing. The palette table of current coding unit is derived from palette dictionary without explicit palette table coding. Compared to SCCE3 full frame IntraBC anchors, the proposed technologies achieve average BD rate gain up to -2.0%, -1.3%, -0.8% for lossy AI, RA and LDB coding for Y component excluding categories of animation and camera captured.

# Introduction

Palette dictionary merging and palette table sharing were first proposed in JCTVC-Q0037[2]. In SCCE3 anchor software, the palette table can be predicted from palette dictionary. However, the palette dictionary is replaced by palette table of current coding (CU) unit if current CU is palette coded. Palette dictionary merging is to update the dictionary by merging the last dictionary and the palette table of current CU to keep more coded colors in the dictionary, which can improve future palette table prediction efficiency. The merging process is shown in Figure 1. The maximum palette dictionary size is signaled in the Picture Parameter sets (PPS), and it depends on lossy or lossless coding and different coding configurations (AI, RA, LDB). The palette table sharing is to derive the palette table from the palette dictionary by reusing those colors located at the beginning of dictionary. One additional flag “palette\_sharing\_flag” is added to indicate if palette table is shard or not. If palette\_sharing\_flag is 1, the colors are continuously copied starting from the beginning of palette dictionary until palette table is full or it reaches the end of dictionary. Otherwise the same palette table coding method as SCCE3 anchor software is applied.



Figure 1. Palette dictionary update process with merging

# Simulation results

There are two tests based on SCCE3 anchor software. One is palette dictionary merging, and another is palette dictionary merging plus palette table sharing. The compression performance is measured using BD rate compared with SCCE3 anchors, using the SCCE3 test conditions [1]. Table 1 and Table 2 gives the detailed average BD rate reduction for lossless and lossy coding with palette dictionary merging plus palette table sharing compared with SCCE3 full frame IntraBC anchors, respectively. The full test results are provided with the accompanying spreadsheets for details.

As shown in Table 1, compared with SCCE3 anchors, the lossless coding achieves total bit-rate saving of 4.6%, 1.2% and 1.0% for the category (YUV, text & graphics with motion, 1080p) for AI, RA and LDB, respectively. As shown in Table 2, the lossy coding achieves average {Y, U, V} BD rate gain of {-4.1%, -4.5%, -4.4%}, {-2.3%, -2.6%, -2.6%} and {-1.3%, -1.6%, -1.6%} for the category (YUV, text & graphics with motion, 1080p) for AI, RA and LDB, respectively.

Table 1. Average BD rate reduction for lossless coding compared with SCCE3 full frame IntraBC anchors

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **All Intra** | | | |
|  | Bit-rate saving (Total) | Bit-rate saving (Average) | Bit-rate saving (Min) | Bit-rate saving (Max) |
|  |
| RGB, text & graphics with motion, 1080p | 3.1% | 3.1% | 1.4% | 6.0% |
| RGB, text & graphics with motion,720p | 2.8% | 2.6% | 0.0% | 6.5% |
| RGB, mixed content, 1440p | 0.3% | 0.3% | 0.2% | 0.4% |
| RGB, mixed content, 1080p | 0.2% | 0.2% | 0.2% | 0.2% |
| RGB, Animation, 720p | 0.0% | 0.0% | 0.0% | 0.0% |
| RGB, camera captured, 1080p | 0.0% | 0.0% | 0.0% | 0.0% |
| YUV, text & graphics with motion, 1080p | 4.6% | 4.7% | 1.6% | 7.5% |
| YUV, text & graphics with motion,720p | 3.2% | 3.0% | 0.0% | 7.3% |
| YUV, mixed content, 1440p | 0.1% | 0.1% | 0.0% | 0.3% |
| YUV, mixed content, 1080p | 0.1% | 0.1% | 0.1% | 0.1% |
| YUV, Animation, 720p | 0.0% | 0.0% | 0.0% | 0.0% |
| YUV, camera captured, 1080p | 0.0% | 0.0% | 0.0% | 0.0% |
| Enc Time[%] | 105% | | | |
| Dec Time[%] | 102% | | | |
|  |  |  |  |  |
|  | **Random Access** | | | |
|  | Bit-rate saving (Total) | Bit-rate saving (Average) | Bit-rate saving (Min) | Bit-rate saving (Max) |
|  |
| RGB, text & graphics with motion, 1080p | 1.0% | 1.8% | 0.7% | 3.8% |
| RGB, text & graphics with motion,720p | 0.4% | 1.2% | 0.0% | 2.6% |
| RGB, mixed content, 1440p | 0.0% | 0.0% | 0.0% | 0.1% |
| RGB, mixed content, 1080p | 0.0% | 0.0% | 0.0% | 0.0% |
| RGB, Animation, 720p | 0.0% | 0.0% | 0.0% | 0.0% |
| RGB, camera captured, 1080p | 0.0% | 0.0% | 0.0% | 0.0% |
| YUV, text & graphics with motion, 1080p | 1.2% | 2.6% | 0.9% | 4.7% |
| YUV, text & graphics with motion,720p | 0.4% | 1.6% | 0.0% | 3.7% |
| YUV, mixed content, 1440p | 0.0% | 0.0% | 0.0% | 0.0% |
| YUV, mixed content, 1080p | 0.0% | 0.0% | 0.0% | 0.0% |
| YUV, Animation, 720p | 0.0% | 0.0% | 0.0% | 0.0% |
| YUV, camera captured, 1080p | 0.0% | 0.0% | 0.0% | 0.0% |
| Enc Time[%] | 110% | | | |
| Dec Time[%] | 98% | | | |
|  |  |  |  |  |
|  |  |  |  |  |
|  | **Low Delay B** | | | |
|  | Bit-rate saving (Total) | Bit-rate saving (Average) | Bit-rate saving (Min) | Bit-rate saving (Max) |
|  |
| RGB, text & graphics with motion, 1080p | 0.9% | 1.2% | 0.5% | 2.2% |
| RGB, text & graphics with motion,720p | 0.3% | 0.8% | 0.0% | 1.8% |
| RGB, mixed content, 1440p | 0.0% | 0.0% | 0.0% | 0.0% |
| RGB, mixed content, 1080p | 0.0% | 0.0% | 0.0% | 0.0% |
| RGB, Animation, 720p | 0.0% | 0.0% | 0.0% | 0.0% |
| RGB, camera captured, 1080p | 0.0% | 0.0% | 0.0% | 0.0% |
| YUV, text & graphics with motion, 1080p | 1.0% | 1.7% | 0.8% | 2.6% |
| YUV, text & graphics with motion,720p | 0.3% | 1.0% | 0.0% | 2.1% |
| YUV, mixed content, 1440p | 0.0% | 0.0% | 0.0% | 0.0% |
| YUV, mixed content, 1080p | 0.0% | 0.0% | 0.0% | 0.0% |
| YUV, Animation, 720p | 0.0% | 0.0% | 0.0% | 0.0% |
| YUV, camera captured, 1080p | 0.0% | 0.0% | 0.0% | 0.0% |
| Enc Time[%] | 109% | | | |
| Dec Time[%] | 99% | | | |

Table 2. Average BD rate reduction for lossy coding compared with SCCE3 full frame IntraBC anchors

|  |  |  |  |
| --- | --- | --- | --- |
|  | **All Intra** | | |
|  | G/Y | B/U | R/V |
| RGB, text & graphics with motion, 1080p | -4.1% | -4.0% | -4.0% |
| RGB, text & graphics with motion,720p | -2.9% | -2.6% | -2.6% |
| RGB, mixed content, 1440p | -0.7% | -0.6% | -0.6% |
| RGB, mixed content, 1080p | -0.7% | -0.7% | -0.6% |
| RGB, Animation, 720p | 0.0% | -0.1% | -0.1% |
| RGB, camera captured, 1080p | 0.0% | 0.0% | 0.0% |
| YUV, text & graphics with motion, 1080p | -4.1% | -4.5% | -4.4% |
| YUV, text & graphics with motion,720p | -1.7% | -2.1% | -2.4% |
| YUV, mixed content, 1440p | -0.8% | -1.2% | -1.3% |
| YUV, mixed content, 1080p | -0.8% | -1.4% | -1.5% |
| YUV, Animation, 720p | 0.0% | 0.0% | -0.1% |
| YUV, camera captured, 1080p | 0.0% | 0.0% | 0.0% |
| Enc Time[%] | 115% | | |
| Dec Time[%] | 109% | | |
|  |  |  |  |
|  | **Random Access** | | |
|  | G/Y | B/U | R/V |
| RGB, text & graphics with motion, 1080p | -2.3% | -2.3% | -2.2% |
| RGB, text & graphics with motion,720p | -2.5% | -2.1% | -2.2% |
| RGB, mixed content, 1440p | -0.5% | -0.2% | -0.2% |
| RGB, mixed content, 1080p | -0.5% | -0.5% | -0.5% |
| RGB, Animation, 720p | 0.0% | -0.1% | 0.0% |
| RGB, camera captured, 1080p | 0.0% | 0.0% | 0.0% |
| YUV, text & graphics with motion, 1080p | -2.3% | -2.6% | -2.6% |
| YUV, text & graphics with motion,720p | -1.5% | -1.8% | -2.2% |
| YUV, mixed content, 1440p | -0.4% | -1.1% | -1.2% |
| YUV, mixed content, 1080p | -0.5% | -1.1% | -1.4% |
| YUV, Animation, 720p | 0.1% | 0.0% | -0.2% |
| YUV, camera captured, 1080p | 0.0% | 0.0% | 0.0% |
| Enc Time[%] | 118% | | |
| Dec Time[%] | 105% | | |
|  |  |  |  |
|  | **Low delay B** | | |
|  | G/Y | B/U | R/V |
| RGB, text & graphics with motion, 1080p | -1.5% | -1.6% | -1.5% |
| RGB, text & graphics with motion,720p | -1.4% | -1.1% | -1.2% |
| RGB, mixed content, 1440p | -0.6% | -0.2% | -0.1% |
| RGB, mixed content, 1080p | -0.3% | -0.3% | -0.5% |
| RGB, Animation, 720p | 0.0% | -0.1% | 0.0% |
| RGB, camera captured, 1080p | 0.0% | 0.0% | 0.0% |
| YUV, text & graphics with motion, 1080p | -1.3% | -1.6% | -1.6% |
| YUV, text & graphics with motion,720p | -0.6% | -0.7% | -1.1% |
| YUV, mixed content, 1440p | -0.3% | -0.6% | -0.9% |
| YUV, mixed content, 1080p | -0.6% | -3.0% | -2.5% |
| YUV, Animation, 720p | 0.0% | 0.1% | -0.1% |
| YUV, camera captured, 1080p | 0.0% | 0.0% | 0.0% |
| Enc Time[%] | 114% | | |
| Dec Time[%] | 109% | | |

# Conclusions

In this proposal, we reported the simulation results SCCE3 test A.5 compared to SCCE3 anchors. The WD text changes for this test are also included.

# Patent rights declaration(s)

**InterDigital Communications, Inc. may have IPR relating to the technology described in this contribution and, conditioned on reciprocity, is prepared to grant licenses under reasonable and non-discriminatory terms as necessary for implementation of the resulting ITU-T Recommendation | ISO/IEC International Standard (per box 2 of the ITU-T/ITU-R/ISO/IEC patent statement and licensing declaration form).**

# References

1. Y.-W. Huang, P. Onno, R. Joshi, R. Cohen, X. Xiu, Z. Ma, “HEVC Screen Content Core Experiment 3 (SCCE3): Palette mode”, JCTVC-Q1123, Apr. 2014.
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