

JCTVC-U0105
NON-CE1: SIMPLIFICATION
ON DERIVING
NUMPALETTEINDICES FOR
PALETTE MODE

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Introduction

- Palette index signaling in HEVC SCC draft 3
 - Palette indices, *palette_index_idc*, are grouped together and put in front of other context syntax elements
 - The number of palette indices, *NumPaletteIndices*, needs to be signaled
- *NumPaletteIndices* is derived based on syntax element, *num_palette_indices_idc*
 - The derivation process uses a complicated segment-based mapping function

```
if( num_palette_indices_idc >= ( MaxPaletteIndex - 1 ) * 32 )
```

```
    NumPaletteIndices = num_palette_indices_idc + 1
```

```
else if( num_palette_indices_idc % 32 == 31 )
```

```
    NumPaletteIndices = MaxPaletteIndex - ( num_palette_indices_idc + 1 ) / 32 (7 79)
```

```
else
```

```
    NumPaletteIndices = ( num_palette_indices_idc / 32 ) * 31 + ( num_palette_indices_idc % 32 ) +  
    MaxPaletteIndex
```

Proposal

- **Simplify** the derivation of NumPaletteIndices from num_palette_indices_idc

num_palette_indices_idc is an indication of the number of palette indices signalled for the current block.

When num_palette_indices_idc is not present, it is inferred to be equal to 0.

The variable NumPaletteIndices specifies the number of palette indices signalled for the current block and is derived as follows: $\text{MaxPaletteIndex} + \text{num_palette_indices_idc}$.

```
if(num_palette_indices_idc >= (MaxPaletteIndex - 1) * 32)
  NumPaletteIndices = num_palette_indices_idc + 1
else if(num_palette_indices_idc % 32 == 31)
  NumPaletteIndices = MaxPaletteIndex - (num_palette_indices_idc + 1) / 32 (7-79)
else
  NumPaletteIndices = (num_palette_indices_idc / 32) * 31 + (num_palette_indices_idc % 32) +
  MaxPaletteIndex
```

- **One necessary constraint:** disallowing unused major colors to be signaled in the palette table

Simulation results

- Lossy 444 results using **full frame IBC search**
- No BD-rate performance loss

	All Intra			Random Access			Low delay B		
	G/Y	B/U	R/V	G/Y	B/U	R/V	G/Y	B/U	R/V
RGB, text & graphics with motion, 1080p & 720p	-0.1%	-0.1%	-0.1%	0.0%	-0.1%	0.0%	-0.1%	0.0%	0.0%
RGB, mixed content, 1440p & 1080p	0.0%	-0.1%	-0.1%	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%
RGB, Animation, 720p	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	-0.1%	0.0%	0.0%
RGB, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, text & graphics with motion, 1080p & 720p	-0.1%	-0.1%	0.0%	-0.1%	0.0%	-0.1%	0.0%	0.0%	0.3%
YUV, mixed content, 1440p & 1080p	0.0%	-0.1%	0.0%	0.0%	0.0%	-0.2%	-0.1%	0.4%	0.0%
YUV, Animation, 720p	0.0%	0.0%	0.0%	-0.1%	0.0%	0.1%	0.0%	0.1%	-0.1%
YUV, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	0.0%	0.0%	0.0%
Enc Time[%]	107%			104%			104%		
Dec Time[%]	108%			103%			105%		

Simulation results

- Lossy 444 results using **local IBC search**
- No BD-rate performance loss

	All Intra			Random Access			Low delay B		
	G/Y	B/U	R/V	G/Y	B/U	R/V	G/Y	B/U	R/V
RGB, text & graphics with motion, 1080p & 720p	0.0%	-0.1%	-0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
RGB, mixed content, 1440p & 1080p	0.0%	0.0%	-0.1%	-0.1%	-0.1%	0.0%	0.1%	0.0%	0.0%
RGB, Animation, 720p	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	0.1%	-0.1%	0.0%
RGB, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, text & graphics with motion, 1080p & 720p	-0.1%	0.0%	-0.1%	0.0%	0.0%	0.0%	0.1%	0.2%	0.1%
YUV, mixed content, 1440p & 1080p	0.0%	0.0%	0.0%	0.0%	0.1%	-0.1%	0.0%	-0.3%	0.0%
YUV, Animation, 720p	0.0%	0.0%	0.0%	0.0%	0.2%	-0.1%	0.0%	-0.2%	0.0%
YUV, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	0.0%	0.1%
Enc Time[%]	105%			103%			104%		
Dec Time[%]	107%			104%			106%		

Simulation results

- Lossy 420 coding
- No BD-rate performance loss

	All Intra			Random Access			Low delay B		
	G/Y	B/U	R/V	G/Y	B/U	R/V	G/Y	B/U	R/V
YUV, text & graphics with motion, 1080p & 720p	0.0%	0.0%	0.0%	-0.1%	0.0%	-0.1%	0.0%	-0.1%	0.1%
YUV, mixed content, 1440p & 1080p	0.0%	0.0%	0.0%	0.1%	0.0%	-0.1%	-0.1%	-0.2%	0.4%
YUV, Animation, 720p & 768p	0.0%	-0.1%	0.0%	0.0%	0.2%	0.0%	0.0%	0.2%	-0.1%
Enc Time[%]	100%			97%			96%		
Dec Time[%]	92%			92%			93%		

Simulation results

- Lossless 444 results
- No Bit-rate performance loss

All Intra				Random Access				Low Delay B			
Bit-rate change (Total)	Bit-rate change (Average)	Bit-rate change (Min)	Bit-rate change (Max)	Bit-rate change (Total)	Bit-rate change (Average)	Bit-rate change (Min)	Bit-rate change (Max)	Bit-rate change (Total)	Bit-rate change (Average)	Bit-rate change (Min)	Bit-rate change (Max)
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
98%				96%				95%			
96%				93%				93%			

Simulation results

- Lossless 420 results
- No Bit-rate performance loss

All Intra				Random Access				Low Delay B			
Bit-rate change (Total)	Bit-rate change (Average)	Bit-rate change (Min)	Bit-rate change (Max)	Bit-rate change (Total)	Bit-rate change (Average)	Bit-rate change (Min)	Bit-rate change (Max)	Bit-rate change (Total)	Bit-rate change (Average)	Bit-rate change (Min)	Bit-rate change (Max)
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
93%				93%				94%			
91%				95%				94%			

Thanks to ITRI for the cross-check!

Closing remarks

- Simplified derivation of *NumPaletteIndices*
- Bit-stream conformance constraint to disallow unused major colors to be signaled in palette table
- No performance impact
 - 0.1% gain in some cases
- Suggest to adopt into SCC