



# Sample Adaptive Offset for Chroma

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# Overall Summary

- Apply the same SAO for luma on chroma as well
- Three components are independent.
- Results:
  - Encoding and decoding times were similar to those of the anchor.
  - Luma BD-rate degradations were less than 0.1% in average.
  - Chroma BD-rates showed significant gains as follows:

	HE-AI	HE-RA	HE-LD	LC-AI	LC-RA	LC-LD
Cb	-2.0%	-3.3%	-4.6%	-1.8%	-2.7%	-6.3%
Cr	-2.9%	-3.9%	-5.9%	-2.4%	-2.8%	-7.6%

# Simulation Result

- Anchor: JCTVC-E700
- Software platform:  
HM-3.0
- Cross-check report:  
JCTVC-F364
  - Thank In Suk Chong  
(Qualcomm)

	All intra HE			All intra LC		
	Y	U	V	Y	U	V
Class A	0.1	-3.2	-5.0	0.1	-2.2	-3.2
Class B	0.2	-1.7	-3.2	0.1	-1.5	-2.2
Class C	0.2	-1.8	-2.5	0.2	-1.9	-2.8
Class D	0.1	-0.8	-1.2	0.1	-1.3	-1.9
Class E	0.2	-3.0	-2.1	0.1	-2.5	-2.3
<b>Overall</b>	<b>0.2</b>	<b>-2.0</b>	<b>-2.9</b>	<b>0.1</b>	<b>-1.8</b>	<b>-2.4</b>
Enc Time[%]	102%			99%		
Dec Time[%]	98%			96%		

	Random access HE			Random access LC		
	Y	U	V	Y	U	V
Class A	0.0	-5.6	-6.3	0.0	-4.8	-4.8
Class B	0.0	-3.2	-3.7	0.1	-3.1	-2.5
Class C	0.1	-2.6	-3.3	0.1	-2.1	-3.2
Class D	0.1	-1.8	-2.3	0.1	-0.8	-1.0
Class E						
<b>Overall</b>	<b>0.0</b>	<b>-3.3</b>	<b>-3.9</b>	<b>0.1</b>	<b>-2.7</b>	<b>-2.8</b>
Enc Time[%]	98%			102%		
Dec Time[%]	98%			101%		

	Low delay (B) HE			Low delay (B) LC		
	Y	U	V	Y	U	V
Class A						
Class B	-0.1	-5.1	-6.3	0.0	-6.5	-7.4
Class C	0.0	-4.8	-6.4	0.1	-5.6	-7.7
Class D	0.0	-2.9	-3.5	0.1	-3.4	-4.4
Class E	0.1	-5.7	-7.8	0.3	-11.0	-11.7
<b>Overall</b>	<b>0.0</b>	<b>-4.6</b>	<b>-5.9</b>	<b>0.1</b>	<b>-6.3</b>	<b>-7.6</b>
Enc Time[%]	101%			100%		
Dec Time[%]	100%			102%		

# Conclusions

- SAO is also effective on chroma
- Results:
  - Encoding and decoding times were similar to those of the anchor.
  - Luma BD-rate degradations were less than 0.1% in average.
  - Chroma BD-rates showed significant gains as follows:

	HE-AI	HE-RA	HE-LD	LC-AI	LC-RA	LC-LD
Cb	-2.0%	-3.3%	-4.6%	-1.8%	-2.7%	-6.3%
Cr	-2.9%	-3.9%	-5.9%	-2.4%	-2.8%	-7.6%

# Proposed Method

- If the SAO for luma is turned on for current picture, the same SAO algorithm can be applied on Cb and Cr.
- Use one flag for each component to indicate the on/off control of SAO.
- Each component is independent and has its own partitions and offsets.
- The chroma syntax structure is the same as the luma syntax structure in HM-3.0

```

sao_param( ) {
  sao_flag
  if( sao_flag ) {
    SAO is turned on for luma
  }
  sao_flag_cb
  if( sao_flag_cb ) {
    SAO is turned on for Cb
  }
  sao_flag_cr
  if( sao_flag_cr ) {
    SAO is turned on for Cr
  }
}

```