

# JCTVC-J0221

## Clean-up of semantics and decoding process on weighted prediction

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# Summary

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- **Weighted prediction of current WD7**
  - Some equations are described in semantics part
  - Range limits of signaling values of weighting factor and additive offset are explicitly undefined
- **Proposal**
  - These equations are moved to the decoding process on weighted prediction
  - Range limits are defined
    - Signaling value of weighting factor has a range of -128 to 127, inclusive (signed 8bit).
    - Signaling value of additive offset for Chroma has a range of -512 to 511, inclusive (signed 10bit) and the reconstructed value is clipped in the range of -128 to 127.
- **Results**
  - The coding results are almost unchanged

# Weighted prediction (WP)

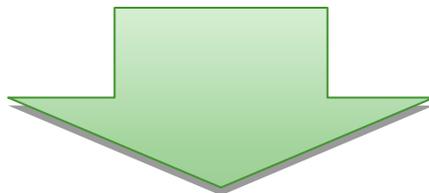
- Point 1: Clean-up of semantics on WP

## 7.4.3.7 Weighted prediction parameter semantics

...

**delta\_luma\_weight\_l0[ i ]** is the difference of the weighting factor applied to the luma prediction value for list 0 prediction using RefPicList0[ i ]. **The variable LumaWeightL0[ i ] is specified by  $(1 \ll \text{luma\_log2\_weight\_denom}) + \text{delta\_luma\_weight\_l0}[ i ]$ .** When luma\_weight\_l0\_flag is equal to 1, the value of LumaWeightL0[ i ] shall be in the range of  $-128$  to  $127$ , inclusive. When luma\_weight\_l0\_flag is equal to 0, LumaWeightL0[ i ] is inferred to be equal to  $2^{\text{luma\_log2\_weight\_denom}}$  for RefPicList0[ i ].

...



- These decoding processes are moved to the decoding process part in 8.3.6.
- This modification does not change anymore.

# Weighted prediction (WP)

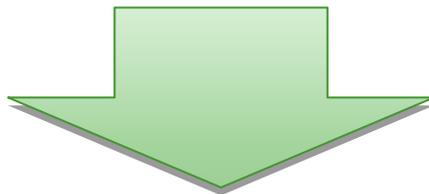
- **Point 2:** Range limit of signaling value of **weighting factor** is undefined explicitly

## 7.4.3.7 Weighted prediction parameter semantics

...

**delta\_luma\_weight\_l0[ i ]** is the difference of the weighting factor applied to the luma prediction value for list 0 prediction using RefPicList0[ i ]. The variable LumaWeightL0[ i ] is specified by  $(1 \ll \text{luma\_log2\_weight\_denom}) + \text{delta\_luma\_weight\_l0}[ i ]$ . When luma\_weight\_l0\_flag is equal to 1, **the value of LumaWeightL0[ i ] shall be in the range of -128 to 127, inclusive**. When luma\_weight\_l0\_flag is equal to 0, LumaWeightL0[ i ] is inferred to be equal to  $2^{\text{luma\_log2\_weight\_denom}}$  for RefPicList0[ i ].

...



- Signaling value of weighting factor has a range of -128 to 127, inclusive (signed 8bit).

# Weighted prediction (WP)

- **Point 2:** Range limit of signaling value of additive offset for chroma is undefined explicitly

## 7.4.3.7 Weighted prediction parameter semantics

...

**delta\_chroma\_offset\_l0[ i ][ j ]** is the difference of the additive offset applied to the chroma prediction values for list 0 prediction using RefPicList0[ i ] with j equal to 0 for Cb and j equal to 1 for Cr.

The variable ChromaOffsetL0[ i ][ j ] is specified as follows:

... Equation (7-65)

**The variable ChromaOffsetL0[ i ][ j ] shall be in the range of -127 to 128, inclusive.** When chroma\_weight\_l0\_flag is equal to 0, ChromaOffsetL0[ i ][ j ] is inferred to be equal to 0 for RefPicList0[ i ].

...



- Signaling value of additive offset for Chroma has a range of -512 to 511, inclusive and the reconstructed value is clipped in the range of -128 to 127.

# Experimental results on Point 2

## Black-fade sequences

	Random Access Main			Random Access HE10		
	Y	U	V	Y	U	V
Class A	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Class B	0.1%	0.1%	0.2%	0.3%	-0.9%	0.0%
Class C	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%
Class D	-0.1%	0.1%	-0.3%	-0.1%	-0.4%	-0.4%
Class E						
<b>Overall</b>	0.0%	0.0%	0.0%	0.1%	-0.4%	-0.1%
Enc Time[%]	99%			100%		
Dec Time[%]	99%			99%		

	Low delay B Main			Low delay B HE10		
	Y	U	V	Y	U	V
Class A						
Class B	0.0%	-0.3%	-0.2%	0.0%	0.1%	-0.1%
Class C	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%
Class D	0.0%	-0.1%	0.0%	0.0%	0.0%	0.0%
Class E	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<b>Overall</b>	0.0%	-0.1%	0.0%	0.0%	0.1%	0.0%
Enc Time[%]	100%			99%		
Dec Time[%]	99%			100%		

	Low delay P Main			Low delay P HE10		
	Y	U	V	Y	U	V
Class A						
Class B	0.0%	0.0%	0.0%	0.0%	0.1%	-0.1%
Class C	0.0%	0.1%	-0.1%	0.0%	0.0%	0.0%
Class D	0.0%	0.1%	0.1%	0.0%	0.1%	-0.2%
Class E	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<b>Overall</b>	0.0%	0.0%	0.0%	0.0%	0.1%	-0.1%
Enc Time[%]	100%			100%		
Dec Time[%]	98%			100%		

## White-fade sequences

	Random Access Main			Random Access HE10		
	Y	U	V	Y	U	V
Class A	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Class B	0.2%	0.2%	0.3%	0.3%	-1.0%	0.0%
Class C	0.0%	0.0%	0.1%	0.0%	-0.1%	-0.1%
Class D	-0.1%	0.0%	-0.3%	0.0%	0.0%	-0.2%
Class E						
<b>Overall</b>	0.0%	0.0%	0.0%	0.1%	-0.3%	-0.1%
Enc Time[%]	100%			100%		
Dec Time[%]	97%			99%		

	Low delay B Main			Low delay B HE10		
	Y	U	V	Y	U	V
Class A						
Class B	0.0%	0.0%	-0.1%	0.0%	-0.1%	0.0%
Class C	0.0%	-0.1%	0.1%	0.0%	0.0%	0.0%
Class D	0.0%	0.1%	0.0%	0.0%	0.1%	0.1%
Class E	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<b>Overall</b>	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Enc Time[%]	99%			100%		
Dec Time[%]	98%			100%		

	Low delay P Main			Low delay P HE10		
	Y	U	V	Y	U	V
Class A						
Class B	0.0%	0.1%	-0.1%	-0.1%	-0.2%	-0.1%
Class C	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%
Class D	0.0%	0.0%	0.0%	0.0%	-0.4%	0.0%
Class E	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<b>Overall</b>	0.0%	0.0%	0.0%	0.0%	-0.2%	0.0%
Enc Time[%]	100%			100%		
Dec Time[%]	98%			100%		

The coding results are almost unchanged.

# Additional results for delta\_chroma\_offset

- We tested several signaling ranges from 8 to 12bit.

	Random Access Main			Random Access HE10		
	Y	U	V	Y	U	V
<b>Signaling range 8bit</b>	0.0%	0.0%	0.0%	2.0%	0.4%	0.6%
<b>Signaling range 9bit</b>	0.0%	0.0%	0.0%	0.3%	-0.2%	0.1%
<b>Signaling range 10bit</b>	0.0%	0.0%	0.0%	0.1%	-0.3%	-0.1%
<b>Signaling range 11bit</b>	0.0%	0.0%	0.0%	0.1%	-0.3%	-0.1%
<b>Signaling range 12bit</b>	0.0%	0.0%	0.0%	0.1%	-0.3%	-0.1%
	Low delay B Main			Low delay B HE10		
	Y	U	V	Y	U	V
<b>Signaling range 8bit</b>	0.0%	0.0%	0.0%	0.2%	0.7%	0.6%
<b>Signaling range 9bit</b>	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%
<b>Signaling range 10bit</b>	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<b>Signaling range 11bit</b>	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<b>Signaling range 12bit</b>	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Low delay P Main			Low delay P HE10		
	Y	U	V	Y	U	V
<b>Signaling range 8bit</b>	0.0%	0.0%	0.0%	0.5%	0.6%	1.0%
<b>Signaling range 9bit</b>	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<b>Signaling range 10bit</b>	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<b>Signaling range 11bit</b>	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<b>Signaling range 12bit</b>	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

- It is suggested that the range limit of delta\_chroma\_offset is signed 10bit.

# Conclusion

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- **Proposal**

- Clean-up text on weighted prediction is provided
  - The decoding process part on weighted prediction semantics is moved to the new decoding process.
  - Range limits of signaling WP parameters are defined
    - Signaling value of weighting factor has a range of -128 to 127, inclusive.
    - Signaling value of additive offset has a range of -512 to 511, inclusive and the reconstructed value is clipped in the range of -128 to 127.

- **Suggestion;**

- This clean-up is applied to the next version of HEVC WD and software.

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