

JVET-P0488

Non-CE7 : On updating a variable for context model selection

Sunmi Yoo, Jungah Choi, Seung Hwan Kim, Jaehyun Lim

LG Electronics Inc.

Summary

- We introduce two alternative methods to fix the inconsistency for AbsLevelPass1
 - Method 1 : To change spec text to align with software
 - Method 2 : To remove updates process of AbsLevelPass1
- Performance impact by method 2 (Based on VTM-6.0)

Standard QPs (22, 27, 32, 37)															
	All Intra					Random access					Low Delay B				
	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT
Overall	0.00%	0.00%	0.01%	98%	101%	0.00%	0.06%	-0.01%	97%	99%	0.01%	0.13%	0.17%	99%	100%
Class D	0.01%	0.06%	-0.14%	96%	92%	0.01%	-0.09%	-0.10%	94%	91%	0.03%	0.30%	0.29%	98%	98%
Class F	-0.01%	0.03%	0.00%	98%	100%	0.01%	-0.06%	-0.02%	96%	98%	0.02%	0.25%	0.36%	99%	99%

Low QPs (2, 7, 12, 17)															
	All Intra					Random access					Low Delay B				
	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT
Overall	0.00%	0.01%	0.01%	101%	101%	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!	0.00%	0.00%	-0.01%	101%	103%
Class D	0.01%	0.00%	0.04%	100%	103%	0.02%	-0.07%	0.03%	100%	102%	-0.01%	-0.01%	-0.08%	101%	103%
Class F	0.04%	-0.01%	-0.02%	101%	102%	-0.13%	-0.18%	-0.12%	101%	103%	0.00%	-0.02%	-0.13%	101%	106%

- Thank InterDigital (JVET-P0907) for crosschecking ☺

Proposed method #1

- To change spec text and software to be aligned for AbsLevelPass1
 - AbsLevelPass1 is updated after restoring the levels for each position, for deriving the ctxIdc for sig_coeff_flag, par_flag, and abs_gtx_flag
 - In spec, AbsLevelPass1 is updated after dec_abs_level
 - To parse dec_abs_level → no syntax elements for context coding in TB
 - AbsLevelPass1 update process should be after parsing abs_level for the next CG

Proposed spec change for method #1

7.4.9.11 Residual coding semantics⁴

(...)⁴

abs_remainder[n] is the remaining absolute value of a transform coefficient level that is coded with Golomb-Rice code at the scanning position n. When **abs_remainder**[n] is not present, it is inferred to be equal to 0.⁴

It is a requirement of bitstream conformance that the value of **abs_remainder**[n] shall be constrained such that the corresponding value of **TransCoeffLevel**[x0][y0][cIdx][xC][yC] is in the range of **CoeffMin** to **CoeffMax**, inclusive.⁴

The value of **AbsLevelPass1**[xC][yC] is derived as follows:⁴

$$\text{AbsLevelPass1}[xC][yC] = \text{Min}(4 + (\text{AbsLevel}[xC][yC] \& 1), \text{AbsLevel}[xC][yC]) \text{ --- (7-176)}^4$$

dec_abs_level[n] is an intermediate value that is coded with Golomb-Rice code at the scanning position n. Given **ZeroPos**[n] that is derived in clause 9.3.3.2 during the parsing of **dec_abs_level**[n], the absolute value of a transform coefficient level at location (xC, yC) **AbsLevel**[xC][yC] is derived using as follows:⁴

- If **dec_abs_level**[n] is equal to **ZeroPos**[n], **AbsLevel**[xC][yC] is set equal to 0.⁴
- Otherwise, if **dec_abs_level**[n] is less than **ZeroPos**[n], **AbsLevel**[xC][yC] is set equal to **dec_abs_level**[n] + 1;⁴
- Otherwise (**dec_abs_level**[n] is greater than **ZeroPos**[n]), **AbsLevel**[xC][yC] is set equal to **dec_abs_level**[n].⁴

The value of **AbsLevelPass1**[xC][yC] is derived as follows:⁴

$$\text{AbsLevelPass1}[xC][yC] = \text{Min}(4 + (\text{AbsLevel}[xC][yC] \& 1), \text{AbsLevel}[xC][yC]) \text{ --- (7-176)}^4$$

It is a requirement of bitstream conformance that the value of **dec_abs_level**[n] shall be constrained such that the corresponding value of **TransCoeffLevel**[x0][y0][cIdx][xC][yC] is in the range of **CoeffMin** to **CoeffMax**, inclusive.⁴

Proposed method #2

- To remove updates process of AbsLevelPass1
 - Currently, AbsLevelPass1 is updated after restoring complete level value
 - If the absolute level is larger than 4 and it is an odd number, AbsLevelPass1 is updated to 5
 - If this update process is removed, AbsLevelPass1 is 4 at most

dec_abs_level[n] is an intermediate value that is coded with Golomb-Rice code at the scanning position **n**. Given **ZeroPos[n]** that is derived in clause 9.3.3.2 during the parsing of **dec_abs_level[n]**, the absolute value of a transform coefficient level at location (**xC**, **yC**) **AbsLevel[xC][yC]** is derived using as follows:↵

- If **dec_abs_level[n]** is equal to **ZeroPos[n]**, **AbsLevel[xC][yC]** is set equal to 0.↵
- Otherwise, if **dec_abs_level[n]** is less than **ZeroPos[n]**, **AbsLevel[xC][yC]** is set equal to **dec_abs_level[n] + 1**;↵
- Otherwise (**dec_abs_level[n]** is greater than **ZeroPos[n]**), **AbsLevel[xC][yC]** is set equal to **dec_abs_level[n]**.↵

~~The value of **AbsLevelPass1[xC][yC]** is derived as follows:↵~~

$$\text{AbsLevelPass1[xC][yC]} = \text{Min}(4 + (\text{AbsLevel[xC][yC]} \& 1), \text{AbsLevel[xC][yC]}) \text{ ——— (7-176)} \text{↵}$$

It is a requirement of bitstream conformance that the value of **dec_abs_level[n]** shall be constrained such that the corresponding value of **TransCoeffLevel[x0][y0][cIdx][xC][yC]** is in the range of **CoeffMin** to **CoeffMax**, inclusive.↵

Experimental results

- Coding performance with standard QP (based on VTM-6.0)

	All Intra					Random access					Low Delay B				
	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT
Class A1	0.01%	-0.05%	-0.04%	99%	101%	-0.02%	-0.03%	-0.04%	98%	100%					
Class A2	0.01%	0.01%	-0.04%	100%	100%	0.01%	0.04%	0.08%	99%	99%					
Class B	0.01%	0.01%	-0.05%	99%	102%	0.00%	0.07%	-0.02%	97%	100%	0.02%	0.12%	-0.08%	99%	99%
Class C	0.00%	0.01%	0.08%	97%	99%	-0.01%	0.14%	-0.05%	95%	97%	-0.04%	0.08%	0.05%	98%	100%
Class E	-0.01%	0.01%	0.08%	97%	102%						0.05%	0.20%	0.74%	98%	100%
Overall	0.00%	0.00%	0.01%	98%	101%	0.00%	0.06%	-0.01%	97%	99%	0.01%	0.13%	0.17%	99%	100%
Class D	0.01%	0.06%	-0.14%	96%	92%	0.01%	-0.09%	-0.10%	94%	91%	0.03%	0.30%	0.29%	98%	98%
Class F	-0.01%	0.03%	0.00%	98%	100%	0.01%	-0.06%	-0.02%	96%	98%	0.02%	0.25%	0.36%	99%	99%

- Coding performance with low QPs (based on VTM-6.0)

	All Intra					Random access					Low Delay B				
	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT
Class A1	0.00%	0.01%	0.01%	101%	101%	#VALU E!	#VALU E!	#VALU E!	#NUM!	#NUM!					
Class A2	0.00%	0.00%	0.00%	101%	100%	#VALU E!	#VALU E!	#VALU E!	#NUM!	#NUM!					
Class B	0.00%	0.01%	0.01%	101%	101%	0.00%	-0.01%	-0.01%	102%	102%	0.00%	0.00%	0.00%	101%	103%
Class C	0.02%	0.04%	0.02%	101%	102%	0.01%	0.00%	-0.03%	101%	102%	-0.01%	0.03%	0.00%	101%	103%
Class E	0.01%	0.00%	0.03%	100%	100%						0.00%	-0.04%	-0.02%	101%	103%
Overall	0.00%	0.01%	0.01%	101%	101%	#VALU E!	#VALU E!	#VALU E!	#NUM!	#NUM!	0.00%	0.00%	-0.01%	101%	103%
Class D	0.01%	0.00%	0.04%	100%	103%	0.02%	-0.07%	0.03%	100%	102%	-0.01%	-0.01%	-0.08%	101%	103%
Class F	0.04%	-0.01%	-0.02%	101%	102%	-0.13%	-0.18%	-0.12%	101%	103%	0.00%	-0.02%	-0.13%	101%	106%

Conclusion

- Two alternative ways for the issue on AbsLevelPass1 are provided
 - Method 1 : To change spec text to align with software
 - Method 2 : To remove updates process of AbsLevelPass1
- It is proposed to use Method 2 for the next VVC as there is no significant impact on coding performance as well as the spec text can be simpler.

Thank you