

# AHG18: Performance of CE7-1.2d\* and CE7-2.2a\* on lossless coding

Yung-Hsuan Chao, Aican Nalci, Hongtao Wang,  
Muhammed Coban, Marta Karczewicz (Qualcomm)



# Introduction

- CE7-1.2d\*: a new Rice-Golomb coding for TS residual is applied after context bin limit is reached
- CE7-2.2a\*: a new binarization for TS residual coding is proposed to replace gtX coding
- The two methods are tested for lossless coding
  - Lossless coding base - JVET-P0082 method 1:
    - Enable both transform (TR) residual coding and transform skip (TS) residual coding for lossless coding
    - Enable BDPCM in lossless coding for both TR and TS

# Results - CE7-1.2d\*

- Anchor: JVET-P0082 method1 (TR, TS, BDPCM for lossless coding)

	All Intra			Random Access			Low delay B		
	ratio		bit-rate savings	ratio		bit-rate savings	ratio		bit-rate savings
	AHG18 LL	Proposal		AHG18 LL	Proposal		AHG18 LL	Proposal	
Class A1	2.2	2.3	-0.17%	2.3	2.3	-0.06%			
Class A2	1.8	1.8	-0.58%	1.9	1.9	-0.16%			
Class B	2.1	2.1	-0.24%	2.3	2.3	-0.04%	2.3	2.3	-0.03%
Class C	2.1	2.1	-0.37%	2.6	2.6	-0.04%	2.6	2.6	-0.02%
Class D	2.0	2.0	-0.57%	2.8	2.8	-0.10%	2.8	2.8	-0.05%
Class E	3.0	3.0	-1.05%				3.4	3.4	-0.02%
Class F	5.7	5.8	-0.74%	41.3	41.5	-0.36%	64.4	64.6	-0.21%
TGM	12.7	12.9	-1.16%	115.7	116.7	-0.88%	146.4	148.1	-1.04%
<b>Overall (A1, A2, B, C, E)</b>	<b>2.2</b>	<b>2.2</b>	<b>-0.45%</b>	<b>2.3</b>	<b>2.3</b>	<b>-0.07%</b>	<b>2.7</b>	<b>2.7</b>	<b>-0.02%</b>
<b>Overall</b>	<b>4.1</b>	<b>4.2</b>	<b>-0.60%</b>	<b>25.8</b>	<b>26.0</b>	<b>-0.23%</b>	<b>36.9</b>	<b>37.2</b>	<b>-0.23%</b>
Enc Time[%]	95%			99%			99%		
Dec Time[%]	104%			101%			101%		

# Results - CE7-2.2a\*



- Anchor: JVET-P0082 method1 (TR, TS, BDPCM for lossless coding)

	All Intra			Random Access			Low delay B		
	ratio		bit-rate savings	ratio		bit-rate savings	ratio		bit-rate savings
	AHG18 LL	Proposal		AHG18 LL	Proposal		AHG18 LL	Proposal	
Class A1	2.2	2.3	-0.13%	2.3	2.3	0.01%			
Class A2	1.8	1.8	-0.57%	1.9	1.9	-0.10%			
Class B	2.1	2.1	-0.29%	2.3	2.3	-0.04%	2.3	2.3	-0.03%
Class C	2.1	2.1	-0.29%	2.6	2.6	0.00%	2.6	2.6	0.02%
Class D	2.0	2.0	-0.45%	2.8	2.8	-0.04%	2.8	2.8	0.01%
Class E	3.0	3.0	-0.89%				3.4	3.4	0.00%
Class F	5.7	5.8	-1.25%	41.3	42.0	-0.74%	64.4	65.0	-0.42%
TGM	12.7	13.5	-5.46%	115.7	120.7	-3.58%	146.4	153.2	-3.53%
<b>Overall (A1, A2, B, C, E)</b>	<b>2.2</b>	<b>2.2</b>	<b>-0.41%</b>	<b>2.3</b>	<b>2.3</b>	<b>-0.03%</b>	<b>2.7</b>	<b>2.7</b>	<b>-0.01%</b>
<b>Overall</b>	<b>4.1</b>	<b>4.3</b>	<b>-1.20%</b>	<b>25.8</b>	<b>26.7</b>	<b>-0.66%</b>	<b>36.9</b>	<b>38.2</b>	<b>-0.66%</b>
Enc Time[%]	97%			101%			102%		
Dec Time[%]	106%			101%			100%		

We thank LGE for crosschecking



# Thank you!

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# Results - CE7-1.2d\*

- Anchor: JVET-P0082 method1 (TR, TS, BDPCM for lossless coding)
  - DepQuant = 0

	All Intra			Random Access			Low delay B		
	ratio		bit-rate savings	ratio		bit-rate savings	ratio		bit-rate savings
	AHG18 LL	Proposal		AHG18 LL	Proposal		AHG18 LL	Proposal	
Class A1	2.3	2.3	-0.15%	2.4	2.3	-0.02%			
Class A2	1.8	1.8	-0.58%	1.9	1.9	-0.15%			
Class B	2.1	2.1	-0.22%	2.3			0.0	0.0	0.00%
Class C	2.1	2.1	-0.33%	2.6	2.6	-0.02%	2.6	2.6	-0.01%
Class D	2.0	2.0	-0.53%	2.8	2.8	-0.07%	2.8	2.8	-0.03%
Class E	3.0	3.0	-0.99%				3.4	3.4	0.00%
Class F	5.8	5.8	-0.69%	41.5	41.7	-0.34%	84.2	84.8	-0.42%
TGM	12.8	12.9	-1.10%	116.4	117.4	-0.84%	123.4		
<b>Overall (A1, A2, B, C, E)</b>	<b>2.2</b>	<b>2.2</b>	<b>-0.42%</b>						
<b>Overall</b>	<b>4.2</b>	<b>4.2</b>	<b>-0.56%</b>						
Enc Time[%]	95%			#NUM!			#NUM!		
Dec Time[%]	102%			#NUM!			#NUM!		

# Results - CE7-2.2a\*

- Anchor: JVET-P0082 method1 (TR, TS, BDPCM for lossless coding)
  - DepQuant = 0

	All Intra			Random Access			Low delay B		
	ratio		bit-rate savings	ratio		bit-rate savings	ratio		bit-rate savings
	AHG18 LL	Proposal		AHG18 LL	Proposal		AHG18 LL	Proposal	
Class A1	2.3	2.3	-0.13%	2.4	2.3	0.00%			
Class A2	1.8	1.8	-0.57%	1.9	1.9	-0.10%			
Class B	2.1	2.1	-0.29%	2.3	2.3	-0.04%	0.0	0.0	0.00%
Class C	2.1	2.1	-0.28%	2.6	2.6	0.00%	2.6	2.6	0.01%
Class D	2.0	2.0	-0.47%	2.8	2.8	-0.04%	2.8	2.8	-0.01%
Class E	3.0	3.0	-0.85%				3.4	3.4	0.00%
Class F	5.8	5.8	-1.28%	41.5	42.2	-0.77%	84.2	85.4	-0.74%
TGM	12.8	13.5	-5.39%	116.4	121.3	-3.48%			
<b>Overall (A1, A2, B, C, E)</b>	<b>2.2</b>	<b>2.2</b>	<b>-0.40%</b>	<b>1.8</b>	<b>2.3</b>	<b>-0.04%</b>	<b>1.7</b>	<b>1.7</b>	<b>0.00%</b>
<b>Overall</b>	<b>4.2</b>	<b>4.3</b>	<b>-1.19%</b>	<b>25.7</b>	<b>26.8</b>	<b>-0.66%</b>	<b>27.3</b>		
Enc Time[%]	96%			#NUM!			#NUM!		
Dec Time[%]	99%			#NUM!			#NUM!		



# Results - CE7-1.2d\*

- Anchor: AHG18 lossless code
  - DepQuant = 1

	All Intra			Random Access			Low delay B		
	ratio		bit-rate savings	ratio		bit-rate savings	ratio		bit-rate savings
	AHG18 LL	Proposal		AHG18 LL	Proposal		AHG18 LL	Proposal	
Class A1	2.2	2.3	-1.03%	2.3	2.3	-0.42%			
Class A2	1.7	1.8	-1.74%	1.9	1.9	-0.42%			
Class B	2.1	2.1	-1.57%	2.3	2.3	-0.29%	2.3	2.3	-0.32%
Class C	2.1	2.1	-1.81%	2.6	2.6	-0.38%	2.6	2.6	-0.40%
Class D	1.9	2.0	-3.21%	2.8	2.8	-0.62%	2.7	2.8	-0.53%
Class E	2.9	3.0	-2.89%				3.3	3.4	-1.01%
Class F	5.5	5.8	-4.51%	39.4	41.5	-3.10%	60.7	64.6	-3.36%
TGM	12.3	12.9	-4.66%	112.6	116.7	-3.52%	142.4	148.1	-3.61%
Overall (A1, A2, B, C, E)	2.2	2.2	-1.78%	2.3	2.3	-0.37%	2.6	2.7	-0.52%
Overall	4.0	4.2	-2.72%	25.1	26.0	-1.28%	35.6	37.2	-1.51%
Enc Time[%]	108%			109%			113%		
Dec Time[%]	94%			100%			101%		

- DepQuant = 0

	All Intra			Random Access			Low delay B		
	ratio		bit-rate savings	ratio		bit-rate savings	ratio		bit-rate savings
	AHG18 LL	Proposal		AHG18 LL	Proposal		AHG18 LL	Proposal	
Class A1	2.2	2.3	-1.11%	2.3	2.3	-0.52%			
Class A2	1.7	1.8	-1.75%	1.9	1.9	-0.48%			
Class B	2.1	2.1	-1.72%	2.3	2.3	-25.56%	2.3	0.0	-500.00%
Class C	2.1	2.1	-1.99%	2.6	2.6	-0.78%	2.6	2.6	-0.83%
Class D	1.9	2.0	-3.39%	2.8	2.8	-1.07%	2.7	2.8	-0.98%
Class E	2.9	3.0	-3.15%				3.3	3.4	-1.44%
Class F	5.5	5.8	-4.78%	39.4	41.7	-3.52%	60.7	84.8	-37.87%
TGM	12.3	12.9	-5.02%	112.6	117.4	-4.03%	142.4	157.9	-37.75%
Overall (A1, A2, B, C, E)	2.2	2.2	-1.92%	2.3	2.2	-7.23%	2.6	1.7	-42.30%
Overall	4.0	4.2	-2.91%	25.1	26.1	-5.29%	35.6	31.7	-30.77%
Enc Time[%]	107%			#NUM!			#NUM!		
Dec Time[%]	93%			#NUM!			#NUM!		

# Results - CE7-2.2a\*

- Anchor: AHG18 lossless code
  - DepQuant = 1

	All Intra			Random Access			Low delay B		
	ratio		bit-rate savings	ratio		bit-rate savings	ratio		bit-rate savings
	AHG18 LL	Proposal		AHG18 LL	Proposal		AHG18 LL	Proposal	
Class A1	2.2	2.3	-1.00%	2.3	2.3	-0.36%			
Class A2	1.7	1.8	-1.73%	1.9	1.9	-0.37%			
Class B	2.1	2.1	-1.62%	2.3	2.3	-0.29%	2.3	2.3	-0.31%
Class C	2.1	2.1	-1.73%	2.6	2.6	-0.34%	2.6	2.6	-0.36%
Class D	1.9	2.0	-3.10%	2.8	2.8	-0.56%	2.7	2.8	-0.47%
Class E	2.9	3.0	-2.73%				3.3	3.4	-0.99%
Class F	5.5	5.8	-5.01%	39.4	42.0	-3.46%	60.7	65.0	-3.55%
TGM	12.3	13.5	-8.80%	112.6	120.7	-6.14%	142.4	130.6	-40.41%
<b>Overall (A1, A2, B, C, E)</b>	<b>2.2</b>	<b>2.2</b>	<b>-1.75%</b>	<b>2.3</b>	<b>2.3</b>	<b>-0.33%</b>	<b>2.6</b>	<b>2.7</b>	<b>-0.50%</b>
<b>Overall</b>	<b>4.0</b>	<b>4.3</b>	<b>-3.30%</b>	<b>25.1</b>	<b>26.7</b>	<b>-1.69%</b>	<b>35.6</b>	<b>28.9</b>	<b>-5.97%</b>
Enc Time[%]	110%			111%			#NUM!		
Dec Time[%]	96%			100%			#NUM!		

- DepQuant = 0

	All Intra			Random Access			Low delay B		
	ratio		bit-rate savings	ratio		bit-rate savings	ratio		bit-rate savings
	AHG18 LL	Proposal		AHG18 LL	Proposal		AHG18 LL	Proposal	
Class A1	2.2	2.3	-1.10%	2.3	2.3	-0.49%			
Class A2	1.7	1.8	-1.74%	1.9	1.9	-0.43%			
Class B	2.1	2.1	-1.78%	2.3	2.3	-0.57%	2.3	0.0	-500.00%
Class C	2.1	2.1	-1.95%	2.6	2.6	-0.76%	2.6	2.6	-0.81%
Class D	1.9	2.0	-3.33%	2.8	2.8	-1.04%	2.7	2.8	-0.96%
Class E	2.9	3.0	-3.01%				3.3	3.4	-1.44%
Class F	5.5	5.8	-5.36%	39.4	42.2	-3.92%	60.7	85.4	-38.16%
TGM	12.3	13.5	-9.14%	112.6	121.3	-6.58%	142.4	135.1	-109.10%
<b>Overall (A1, A2, B, C, E)</b>	<b>2.2</b>	<b>2.2</b>	<b>-1.90%</b>	<b>2.3</b>	<b>2.3</b>	<b>-0.58%</b>	<b>2.6</b>	<b>1.7</b>	<b>-42.29%</b>
<b>Overall</b>	<b>4.0</b>	<b>4.3</b>	<b>-3.52%</b>	<b>25.1</b>	<b>26.8</b>	<b>-2.03%</b>	<b>35.6</b>	<b>23.2</b>	<b>-35.17%</b>
Enc Time[%]	107%			108%			#NUM!		
Dec Time[%]	90%			97%			#NUM!		