

# **JCTVC-704:Last position coding for CABAC**

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# Introduction

- In HM4.0, up to 20 bins (16 in CABAC and 4 in bypass mode) could be used when coding last significant coefficient position in CABAC.

**Binarization for TU 32x32 in HM4.0, where X means 1 or 0**

Magnitude of last position component	Truncated unary (context model)	Fixed binary (bypass)
0	1	-
1	01	-
2	001	-
3	0001	-
4	00001	-
5	000001	-
6	0000001	-
7	00000001	-
8	000000001	-
9	0000000001	-
10	00000000001	-
11	000000000001	-
12	0000000000001	-
13	00000000000001	-
14	000000000000001	-
15	0000000000000001	-
16-31	0000000000000000	XXXX

# Proposed method

- Progressive codeword structure

Magnitude of last position component	Truncated unary (context model)	Fixed binary (bypass)
0	1	-
1	01	-
2	001	-
3	000(1)	-
4-5	00001	X
6-7	00000(1)	X
8-11	0000001	XX
12-15	0000000(1)	XX
16-23	000000001	XXX
24-31	000000000	XXX

(1) only exists when the TU size is greater than the largest last position that the code can represent

- Context modeling- 2 less contexts compared to HM4.0

Bin index	0	1	2	3	4	5	6	7	8
<b>TU 4x4</b>	0	1	2						
<b>TU 8x8</b>	3	4	5	5	6				
<b>TU 16x16</b>	7	8	9	9	10	10	11		
<b>TU 32x32</b>	12	13	14	14	15	15	16	16	17

# Maximum number of bins

Maximum number of bins (with context modeling)

	<b>HM4.0</b>	<b>Proposed solution</b>
<b>TU 4x4</b>	3	3
<b>TU 8x8</b>	4	5
<b>TU 16x16</b>	8	7
<b>TU 32x32</b>	16	9
<b>Total</b>	<b>31</b>	<b>24</b>

Maximum number of bins (with context modeling and bypass mode)

	<b>HM4.0</b>	<b>Proposed solution</b>
<b>TU 4x4</b>	3	3
<b>TU 8x8</b>	6	6
<b>TU 16x16</b>	11	9
<b>TU 32x32</b>	20	12

# Simulation results

BD-rate	All Intra HE			Random access HE			Low delay B HE		
	Y	U	V	Y	U	V	Y	U	V
Class A	-0.03%	0.01%	0.02%	0.03%	0.05%	-0.07%			
Class B	-0.05%	-0.03%	-0.02%	-0.05%	0.04%	-0.21%	-0.04%	-0.16%	-0.35%
Class C	-0.02%	-0.01%	-0.02%	-0.01%	-0.08%	-0.03%	0.02%	-0.10%	-0.24%
Class D	-0.03%	-0.01%	-0.06%	0.00%	0.01%	-0.12%	0.06%	0.57%	-0.08%
Class E	-0.08%	-0.04%	-0.01%				-0.21%	-0.65%	0.66%
All	-0.04%	-0.02%	-0.02%	-0.01%	0.01%	-0.11%	-0.03%	-0.05%	-0.06%
Enc T[%]	99%			100%			99%		
Dec T[%]	100%			100%			99%		

# Conclusions

- The proposal reduces 2 contexts and up to 8 bins on last significant position coding with a slight coding gain.
- Recommend the adoption of the proposed changes