
JVET-L0027

**CE7 Summary Report on
Quantization and
Coefficient Coding**

Tools under Test

sub CE	test	tester	document	short description	cross checker
7.1	7.1.1	C. Auyeung	JVET-L0397	complexity reduction of context model selection	Y. Piao
	7.1.2	M. Coban	JVET-L0384	entropy coding for dependent quantization (sig-based)	H. Schwarz
	7.1.3	H. Schwarz	JVET-L0274	reduction of number of context-coded bins (two versions)	C. Auyeung
	7.1.4			withdrawn	
7.2	7.2.1	Y. Zhao	JVET-L0360	adaptive residual scaling (two versions)	Y. Kidani
	7.2.2	Y. Zhao	JVET-L0360	adaptive residual scaling for large blocks only	Y. Kidani
	7.2.3	Y. Zhao	JVET-L0360	non-normative delta QP selection (based on measures for ARS, two versions)	Y. Kidani
	7.2.4			withdrawn	
	7.2.5			withdrawn	
	7.2.6	C. Helmrich	JVET-L0210	VTM-2.1 non-normative QP adaptation (two versions)	Y. Kidani
7.3	7.3.1	Y. Kidani	JVET-L0379	block size dependent coefficient scanning	J.-A. Choi
	7.3.2	Y. Kidani	JVET-L0379	block size dependent coefficient scanning with NSST	Y. Zhao
	7.3.3	Y. Kidani	JVET-L0379	block size dependent coefficient scanning for low QPs	Y. Zhao

Sub-CEs

Sub-CE 7.1

- Complexity reduction of transform coefficient coding
- Modified state machine for dependent quantization
- Reduction of maximum number of context-coded bins / simplifications

Sub-CE 7.2

- Improvement of perceptual quality by block-based variation of quantization step size
- Adaptive residual scaling (normative change, based on neighbourhood)
- Non-normative QP adaptations

Sub-CE 7.3

- Block-size dependent coefficient scanning

Sub-CE 7.1: Transform Coefficient Coding

Test 7.1.1: (Huawei) Complexity reduction of context model selection

- For subblocks other than DC subblock: Removal of position dependency

Test 7.1.2: (Qualcomm) Entropy coding for dependent quantization

- Sig-based state machine for dependent quantization (instead of parity based)
- Bit plane coding of transform coefficients (similar to JEM coefficient coding), with up to 16 sig_flag's, 10 gt1_flag's, 2 gt2_flag's + Rice-Golomb bypass

Test 7.1.3: (HHI / Qualcomm) Reduction of number of context-coded bins

- Version A: Up to 34 bins (sig/par/gt1) in first pass + 2 bins (gt2) in second pass
Some absolute levels can be completely bypass coded (modified Rice code)
- Version B: Includes additional change in binarization (first gt1_flag, then par_flag)
Up to 28 bins (sig/par/gt1) in first pass + 4 bins (gt2) in second pass
- *Update after CE: Special restriction for chroma 2x2 subblocks (6 + 2 bins)
CABAC initialization table for version B*

Sub-CE 7.1: Average Results

CE 7.1		high complexity (CTC)					low complexity (DQ off, RDOQ off, SDH on)				
		Y	U	V	encT	decT	Y	U	V	encT	decT
AI	7.1.1	0.05%	0.00%	0.05%	101%	99%	0.01%	0.01%	0.01%	102%	100%
	7.1.2	0.20%	0.40%	0.44%	114%	104%	0.02%	0.08%	0.07%	106%	101%
	7.1.3a	0.03%	0.13%	0.15%	110%	100%	0.02%	0.05%	0.05%	101%	100%
	7.1.3b	-0.18%	-0.06%	0.00%	109%	101%	0.04%	0.08%	0.11%	101%	101%
RA	7.1.1	0.04%	0.00%	0.04%	100%	99%	0.01%	0.03%	-0.05%	100%	99%
	7.1.2	0.19%	0.31%	0.33%	106%	101%	0.04%	0.05%	-0.10%	101%	99%
	7.1.3a	0.03%	0.10%	0.16%	105%	100%	0.02%	0.09%	-0.03%	100%	100%
	7.1.3b	-0.07%	-0.02%	0.09%	104%	100%	0.08%	0.08%	-0.06%	100%	101%
LB	7.1.1	0.01%	0.10%	-0.22%	100%	99%	-0.01%	0.10%	0.20%	100%	99%
	7.1.2	-0.04%	0.41%	0.10%	105%	100%	-0.01%	-0.13%	0.08%	101%	100%
	7.1.3a	0.06%	0.14%	-0.16%	105%	105%	0.01%	0.08%	-0.24%	101%	103%
	7.1.3b	-0.15%	-0.27%	-0.36%	104%	104%	0.00%	-0.03%	0.12%	100%	103%

Note: Document JVET-L0274 includes results for an update of tests 7.1.3a/b
(additional restriction for chroma 2x2 subblocks, update CABAC initialization table for 7.1.3b)

Sub-CE 7.2: Block-adaptive Quantization / Residual Scaling

Test 7.2.1 / 7.2.2: (Huawei) Adaptive residual scaling (ARS)

- 7.2.1a: Block-adaptive residual scaling (all block sizes)
- 7.2.1b: Same as 7.2.1a, but without Lagrange multiplier changes
- 7.2.2: Same as 7.2.1a, but QP derivation only for blocks ≥ 256 samples

Test 7.2.3: (Huawei) Non-normative Delta QP (based on measures for ARS)

- 7.2.3a: Delta QP signaling at CTU level
- 7.2.3b: Delta QP signaling at split depth 2 (or less)

Test 7.2.6: (HHI) Non-normative QP adaptation of VTM-2.1 / BMS-2.1

- Delta QPs are derived based on block-based activity measures
- Delta QPs are transmitted at CTU level (uses smaller CTUs for smaller resolutions)
- Version b: $Cb/CrOffset = 1$ in VTM reference

CE 7.2		MS-SSIM					PSNR				
		Y	U	V	encT	decT	Y	U	V	encT	decT
AI	7.2.1a	-5.24%	0.23%	0.12%	103%	103%	2.54%	0.55%	0.47%	103%	103%
	7.2.1b	-3.74%	0.17%	0.14%	102%	104%	2.02%	0.43%	0.41%	102%	104%
	7.2.2	-4.14%	-0.04%	-0.12%	102%	103%	2.65%	0.11%	0.09%	102%	103%
	7.2.3a	-2.90%	-1.22%	-1.25%	101%	100%	0.98%	-1.26%	-1.25%	101%	100%
	7.2.3b	-4.66%	-1.97%	-2.09%	100%	103%	3.01%	-1.94%	-1.98%	100%	103%
	7.2.6a	-5.54%	-4.43%	-6.69%	114%	104%	3.37%	-4.70%	-5.56%	114%	104%
	7.2.6b	-4.13%	-15.74%	-17.81%	114%	104%	4.98%	-15.86%	-16.68%	114%	104%
RA	7.2.1a	-5.81%	1.37%	0.97%	103%	102%	2.72%	2.38%	2.12%	103%	102%
	7.2.1b	-3.56%	-0.30%	-0.34%	100%	102%	2.17%	-0.07%	-0.10%	100%	102%
	7.2.2	-4.77%	1.23%	0.97%	103%	102%	2.85%	2.23%	1.96%	103%	102%
	7.2.3a	-2.91%	-0.21%	0.14%	104%	100%	1.01%	0.51%	0.97%	104%	100%
	7.2.3b	-4.70%	0.54%	0.81%	105%	101%	3.20%	1.99%	2.49%	105%	101%
	7.2.6a	-8.23%	12.76%	8.58%	101%	99%	3.94%	12.62%	10.71%	101%	99%
	7.2.6b	-6.96%	-2.10%	-5.85%	102%	98%	5.34%	-2.22%	-3.57%	102%	98%
LB	7.2.1a	-5.99%	4.87%	3.90%	99%	102%	3.48%	6.13%	5.22%	99%	102%
	7.2.1b	-3.13%	-1.78%	-2.42%	95%	102%	2.72%	-1.94%	-2.47%	95%	102%
	7.2.2	-4.68%	4.43%	3.37%	98%	100%	3.71%	5.47%	4.49%	98%	100%
	7.2.3a	-2.41%	1.34%	0.99%	101%	99%	1.59%	2.27%	1.95%	101%	99%
	7.2.3b	-4.25%	4.17%	3.90%	101%	101%	4.29%	6.12%	5.69%	101%	101%
	7.2.6a	-4.50%	14.48%	10.19%	112%	104%	7.29%	13.25%	10.59%	112%	104%
	7.2.6b	-3.70%	-5.21%	-9.00%	113%	100%	8.28%	-6.33%	-8.54%	113%	100%

Sub-CE 7.3: Mode dependent coefficient scanning

Test 7.3.1 – 7.3.3: (KDDI) Block size dependent coefficient scanning

- Similar to HM/JEM: Scan order depends on intra prediction mode (hor, ver, diag)
- Difference to HM/JEM: Multiple scans are only supported for selected block sizes (diagonal scan is used for other block sizes)
- Test 7.3.1: As proposed
- Test 7.3.2: NSST is additionally enabled in tested version and reference
- Test 7.3.3: Same as 7.3.1, but for QP range 12, 17, 22, 27

Sub-CE 7.3: Average Results

CE 7.3		Y	U	V	encT	decT
AI	7.3.1	-0.08%	-0.09%	-0.07%	101%	101%
	7.3.2	0.01%	-0.03%	-0.03%	101%	100%
	7.3.3	-0.04%	-0.07%	-0.08%	101%	101%
RA	7.3.1	-0.03%	-0.07%	0.00%	101%	100%
	7.3.2	0.01%	-0.01%	-0.02%	100%	100%
	7.3.3	-0.01%	-0.06%	-0.03%	101%	101%
LB	7.3.1	-0.06%	0.08%	-0.10%	100%	101%
	7.3.2	-0.02%	0.18%	0.08%	100%	100%
	7.3.3	-0.03%	0.13%	0.06%	100%	100%