

JVET-Y0223

On luma/chroma BD-rate balance in ECM:
tests combining JVET-Y0102 and JVET-Y0113

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Observations: luma and chroma BDR-rate gains of ECM vs VTM are not well balanced, both for SDR and for HDR content

SDR content
ECM3.1 vs
VTM11.0+V0056

All Intra Main 10			
Over VTM-11.0+V0056			
	Y	U	V
Class A1	-6.98%	-12.44%	-16.63%
Class A2	-6.44%	-13.13%	-11.99%
Class B	-6.05%	-13.75%	-14.21%
Class C	-7.06%	-10.21%	-10.67%
Class E	-7.58%	-11.55%	-12.41%
Overall	-6.75%	-12.28%	-13.16%
Class D	-5.86%	-8.45%	-8.23%
Class F	-10.80%	-15.69%	-15.66%
Class TGM	-15.62%	-18.73%	-18.25%
Random Access Main 10			
Over VTM-11.0+V0056			
	Y	U	V
Class A1	-14.95%	-16.42%	-21.85%
Class A2	-15.84%	-20.38%	-20.42%
Class B	-13.57%	-19.94%	-19.32%
Class C	-15.35%	-17.27%	-16.98%
Class E			
Overall	-14.77%	-18.61%	-19.42%
Class D	-16.10%	-17.65%	-16.99%
Class F	-13.54%	-18.02%	-17.76%
Class TGM	-14.65%	-18.96%	-19.20%
Low delay B Main 10			
Over VTM-11.0+V0056			
	Y	U	V
Class A1			
Class A2			
Class B	-12.28%	-24.89%	-24.11%
Class C	-12.51%	-18.81%	-18.94%
Class E	-12.11%	-17.24%	-19.15%
Overall	-12.31%	-20.95%	-21.14%
Class D	-14.09%	-20.17%	-19.36%
Class F	-12.15%	-18.99%	-18.67%
Class TGM	-14.02%	-21.79%	-22.13%

All Intra								
Over VTM-11.0 MCTF								
			wPSNR			PSNR		
	DE100	PSNR-L100	Y	U	V	Y	U	V
Class H1	-12.31%	-6.65%	-6.19%	-18.42%	-22.07%	-6.08%	-18.18%	-21.57%
Class H2						-6.02%	-11.86%	-16.05%
Overall	-12.31%	-6.65%	-6.19%	-18.42%	-22.07%	-6.06%	-15.88%	-19.57%
Random Access								
Over VTM-11.0 MCTF								
			wPSNR			PSNR		
	DE100	PSNR-L100	Y	U	V	Y	U	V
Class H1	-22.98%	-12.41%	-11.59%	-27.82%	-31.98%	-11.49%	-27.21%	-31.36%
Class H2						-10.79%	-20.84%	-24.42%
Overall	-22.98%	-12.41%	-11.59%	-27.82%	-31.98%	-11.24%	-24.89%	-28.84%

HDR content
ECM3.1 vs
VTM11.0+V0056 (as reported in JVET-Y0117, setting2)

Goal of the study

- Investigate alternate balancing of luma and chroma BDR-rate gains of ECM vs VTM by tuning some encoder cfg parameters
 - JVET-Y0102: adapts chroma QP mapping tables (parameter "QpOutValCb")
 - JVET-Y0113: adapts chroma residual scaling (parameter "LMCSOffset").
- This contribution completes JVET-Y0102 and JVET-Y0113 with additional tests combining both solutions

SDR – tested configurations

- Tested chroma mapping tables

AI	QpOutValC0 (CTCs)	QpOutValC1	QpOutValC2
SameCQPTablesForAllChroma	1	1	1
QpInValCb	17 27 32 44	17 27 32 44	17 27 32 44
QpOutValCb	17 29 34 41	17 30 35 42	17 29 35 42

RA	QpOutValC0 (CTCs)	QpOutValC1	QpOutValC2
SameCQPTablesForAllChroma	1	1	1
QpInValCb	17 22 34 42	17 22 34 42	17 22 34 42
QpOutValCb	17 23 35 39	17 23 36 40	17 23 35 41

LDB	QpOutValC0 (CTCs)	QpOutValC1	QpOutValC2
SameCQPTablesForAllChroma	1	1	1
QpInValCb	17 22 34 42	17 22 34 42	17 22 34 42
QpOutValCb	17 23 35 39	17 24 36 40	17 23 36 40

- Various LMCSOffset values

SDR – results

- Blue font : CTCs setting
- Red font : suggested new setting

Cfg	SDR – AI	Y	U	V
SDR-AI0	QpOutValC0, CRS 2	-6.75%	-12.28%	-13.16%
SDR-AI1	QpOutValC0, CRS -7	-7.19%	-6.62%	-7.47%
SDR-AI2	QpOutValC1, CRS 2	-8.05%	-2.23%	-3.41%
SDR-AI3	QpOutValC2, CRS 2	-7.29%	-7.93%	-8.71%
SDR-AI4	QpOutValC2, CRS 1	-7.33%	-7.36%	-8.19%

Cfg	SDR – RA	Y	U	V
SDR-RA0	QpOutValC0, CRS 6	-14.77%	-18.61%	-19.42%
SDR-RA1	QpOutValC0, CRS -7	-15.01%	-15.39%	-16.28%
SDR-RA2	QpOutValC1, CRS 6	-15.64%	-11.50%	-12.80%
SDR-RA3	QpOutValC2, CRS 6	-15.18%	-17.08%	-18.05%
SDR-RA4	QpOutValC2, CRS -4			

Cfg	SDR – LDB	Y	U	V
SDR-LDB0	QpOutValC0, CRS 1	-12.31%	-20.95%	-21.14%
SDR-LDB1	QpOutValC0, CRS -7	-12.54%	-15.40%	-15.92%
SDR-LDB2	QpOutValC1, CRS 1	-13.00%	-6.33%	-6.16%
SDR-LDB3	QpOutValC2, CRS 1	-12.88%	-9.79%	-9.81%
SDR-LDB4	QpOutValC2, CRS 6			

SDR – with suggested settings

Current CTCs

	All Intra Main 10		
	Over VTM-11.0+V0056		
	Y	U	V
Class A1	-6.98%	-12.44%	-16.63%
Class A2	-6.44%	-13.13%	-11.99%
Class B	-6.05%	-13.75%	-14.21%
Class C	-7.06%	-10.21%	-10.67%
Class E	-7.58%	-11.55%	-12.41%
Overall	-6.75%	-12.28%	-13.16%
Class D	-5.86%	-8.45%	-8.23%
Class F	-10.80%	-15.69%	-15.66%
Class TGM	-15.62%	-18.73%	-18.25%
	Random Access Main 10		
	Over VTM-11.0+V0056		
	Y	U	V
Class A1	-14.95%	-16.42%	-21.85%
Class A2	-15.84%	-20.38%	-20.42%
Class B	-13.57%	-19.94%	-19.32%
Class C	-15.35%	-17.27%	-16.98%
Class E			
Overall	-14.77%	-18.61%	-19.42%
Class D	-16.10%	-17.65%	-16.99%
Class F	-13.54%	-18.02%	-17.76%
Class TGM	-14.65%	-18.96%	-19.20%
	Low delay B Main 10		
	Over VTM-11.0+V0056		
	Y	U	V
Class A1			
Class A2			
Class B	-12.28%	-24.89%	-24.11%
Class C	-12.51%	-18.81%	-18.94%
Class E	-12.11%	-17.24%	-19.15%
Overall	-12.31%	-20.95%	-21.14%
Class D	-14.09%	-20.17%	-19.36%
Class F	-12.15%	-18.99%	-18.67%
Class TGM	-14.02%	-21.79%	-22.13%

With suggested CTC changes

	All Intra Main 10		
	Over VTM-11.0+V0056		
	Y	U	V
Class A1	-7.69%	-7.24%	-12.67%
Class A2	-7.46%	-8.79%	-8.11%
Class B	-6.46%	-8.85%	-8.36%
Class C	-7.56%	-5.16%	-5.29%
Class E	-8.01%	-6.49%	-7.37%
Overall	-7.33%	-7.36%	-8.19%
Class D	-6.35%	-3.09%	-2.52%
Class F	-11.30%	-12.06%	-12.05%
Class TGM	#VALEUR!	#VALEUR!	#VALEUR!
	Random Access Main 10		
	Over VTM-11.0+V0056		
	Y	U	V
Class A1	-16.05%	-13.78%	-20.74%
Class A2	-16.28%	-19.47%	-19.42%
Class B	-13.73%	-18.53%	-17.70%
Class C	-15.51%	-15.95%	-15.43%
Class E			
Overall	-15.18%	-17.08%	-18.05%
Class D	-16.24%	-16.63%	-15.78%
Class F	-13.87%	-16.59%	-16.11%
Class TGM	-15.38%	-17.83%	-18.18%
	Low delay B Main 10		
	Over VTM-11.0+V0056		
	Y	U	V
Class A1			
Class A2			
Class B	-12.84%	-13.60%	-11.86%
Class C	-13.24%	-7.13%	-7.08%
Class E	-12.45%	-6.96%	-10.05%
Overall	-12.88%	-9.79%	-9.81%
Class D	-14.58%	-8.31%	-7.89%
Class F	-13.18%	-11.16%	-10.26%
Class TGM	#VALEUR!	#VALEUR!	#VALEUR!

HDR – tested configurations

- Chroma Qp Offset + 1
- Tested chroma mapping tables
 - Class H1 (HDR-PQ)

Parameter	QpOutValC0 (CTCs)	QpOutValC2
SameCQPTablesForAllChroma	0	0
QpInValCb	13 20 36 38 43 54	13 20 36 38 43 54
QpOutValCb	13 21 29 29 32 37	13 21 30 30 33 38
QpInValCr	13 20 37 41 44 54	13 20 37 41 44 54
QpOutValCr	13 21 27 29 32 37	13 21 28 30 33 38
QpInValCbCr	12 21 41 43 54	12 21 41 43 54
QpOutValCbCr	12 22 30 32 37	12 22 31 33 38

- Class H2 (HDR-HLG)

Parameter	QpOutValC0 (CTCs)	QpOutValC1	QpOutValC2
SameCQPTablesForAllChroma	1	1	1
QpInValCb	9 23 33 42	9 23 33 42	9 23 33 42
QpOutValCb	9 24 33 37	9 24 34 38	9 24 35 39

- Various LMCSOffset values

HDR – results

- Blue font : CTCs setting
- Red font : suggested new setting

Cfg	Class H1 – AI	DE100	psnrL	wY	wU	wV	Y	U	V
H1-AI0	QpOutValC0, CRS1	-12.31%	-6.65%	-6.19%	-18.43%	-22.07%	-6.08%	-18.18%	-21.57%
H1-AI1	QpOutValC0, CRS1, qpOffCh1	6.09%	-8.82%	-8.54%	19.13%	12.42%	-8.43%	19.53%	14.21%
H1-AI2	QpOutValC0, CRS-7	-7.91%	-7.04%	-6.64%	-9.47%	-13.21%	-6.54%	-8.28%	-11.23%
H1-AI3	QpOutValC2, CRS0	-5.87%	-7.61%	-7.22%	-8.68%	-7.40%	-7.10%	-8.26%	-6.42%

Cfg	Class H1 – RA	DE100	psnrL	wY	wU	wV	Y	U	V
H1-RA0	QpOutValC0, CRS1	-22.98%	-12.41%	-11.59%	-27.82%	-31.98%	-11.49%	-27.21%	-31.36%
H1-RA1	QpOutValC0, CRS1, qpOffCh1	-8.26%	-13.67%	-13.02%	0.36%	-5.45%	-12.91%	0.78%	-4.40%
H1-RA2	QpOutValC0, CRS-7	-19.96%	-12.58%	-11.81%	-21.68%	-25.70%	-11.72%	-20.38%	-24.22%
H1-RA3	QpOutValC2, CRS-7	-15.42%	-13.25%	-12.52%	-17.36%	-13.16%	-12.41%	-16.06%	-11.36%

Cfg	Class H2 – AI	Y	U	V
H2-AI0	QpOutValC0, CRS0	-6.02%	-11.86%	-16.05%
H2-AI1	QpOutValC0, CRS0, qpOffCh1	-7.47%	7.78%	3.62%
H2-AI2	QpOutValC0, CRS-7	-6.21%	-8.46%	-12.76%
H2-AI3	QpOutValC2, CRS3	-6.66%	-3.44%	-7.28%
H2-AI4	QpOutValC2, CR6	-6.57%	-4.42%	-8.20%

Cfg	Class H2 – RA	Y	U	V
H2-RA0	QpOutValC0, CRS0	-10.79%	-20.84%	-24.42%
H2-RA1	QpOutValC0, CRS0, qpOffCh1	-11.66%	-1.72%	-4.47%
H2-RA2	QpOutValC0, CRS-7	-10.91%	-17.31%	-20.95%
H2-RA3	QpOutValC1, CRS-7	-11.35%	-9.56%	-13.52%

HDR – with suggested settings

	All Intra							
	Over VTM-11.0 MCTF							
	wPSNR					PSNR		
	DE100	PSNR-L100	Y	U	V	Y	U	V
Class H1	-12.31%	-6.65%	-6.19%	-18.42%	-22.07%	-6.08%	-18.18%	-21.57%
Class H2						-6.02%	-11.86%	-16.05%
Overall	-12.31%	-6.65%	-6.19%	-18.42%	-22.07%	-6.06%	-15.88%	-19.57%
	Random Access							
	Over VTM-11.0 MCTF							
	wPSNR					PSNR		
	DE100	PSNR-L100	Y	U	V	Y	U	V
Class H1	-22.98%	-12.41%	-11.59%	-27.82%	-31.98%	-11.49%	-27.21%	-31.36%
Class H2						-10.79%	-20.84%	-24.42%
Overall	-22.98%	-12.41%	-11.59%	-27.82%	-31.98%	-11.24%	-24.89%	-28.84%

Current CTCs

	All Intra							
	Over VTM-11.0 MCTF							
	wPSNR					PSNR		
	DE100	PSNR-L100	Y	U	V	Y	U	V
Class H1	-5.87%	-7.61%	-7.22%	-8.68%	-7.40%	-7.10%	-8.26%	-6.42%
Class H2						-6.66%	-3.44%	-7.28%
Overall	-5.87%	-7.61%	-7.22%	-8.68%	-7.40%	-6.94%	-6.51%	-6.73%
	Random Access							
	Over VTM-11.0 MCTF							
	wPSNR					PSNR		
	DE100	PSNR-L100	Y	U	V	Y	U	V
Class H1	-15.42%	-13.25%	-12.52%	-17.36%	-13.16%	-12.41%	-16.06%	-11.36%
Class H2						-11.35%	-9.56%	-13.52%
Overall	-15.42%	-13.25%	-12.52%	-17.36%	-13.16%	-12.03%	-13.70%	-12.14%

With suggested
CTC changes

Thanks Dolby for cross-check (JVET-Y0227)