SCE1: Summary report of SHVC Core Experiment on support for arbitrary scalability ratio

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SCE1 scope

- Support of arbitrary spatial scalability ratio
  - Not only ratios 1.5x and 2x

- Evaluates different luma/chroma 16-phase upsampling filters

- Reference: 16-phase filters agreed in JCTVC-N0375

List of proposals

Proposal	Initial proposal	Proposal documents	Cross-checking documents
1.1	JCTVC-N0219	JCTVC-O0076 (Samsung, Qualcomm)	JCTVC-O0124 (Canon)
1.2	JCTVC-N0273	JCTVC-O0052 (Arris)	JCTVC-O0281 (Samsung)

Luma filters			
phase	Reference (N0375)	Proposal 1.1	Proposal 1.2
0/16	0,0, 0,64, 0, 0,0, 0	0,0, 0,64, 0, 0,0, 0	0,0, 0,64, 0, 0,0, 0
1/16	0,1, -3,63, 4, -2,1, 0	0,1, -3,63, 4, -2,1, 0	0,1, -3,63, 4, -2,1, 0
2/16	-1,2, -5,62, 8, -3,1, 0	-1,2, -5,62, 8, -3,1, 0	-1,3, -7,63, 8, -3,1, 0
3/16	-1,3, -8,60,13, -4,1, 0	-1,3, -8,60,13, -4,1, 0	-1,3, -8,60,13, -4,1, 0
4/16	-1,4,-10,58,17, -5,1, 0	-1,4,-10,58,17, -5,1, 0	-1,4,-10,58,17, -5,1, 0
5/16	-1,4,-11,52,26, -8,3,-1	-1,4,-11,52,26, -8,3,-1	-1,4,-11,54,23, -7,3,-1
6/16	-1,3, -9,47,31,-10,4,-1	-1,4,-11,50,28, -8,2, 0	-1,3, -9,47,31,-10,4,-1
7/16	-1,4,-11,45,34,-10,4,-1	-1,4,-11,45,34,-10,4,-1	-1,4,-11,45,34,-10,4,-1
8/16	-1,4,-11,40,40,-11,4,-1	-1,4,-11,40,40,-11,4,-1	-1,4,-11,40,40,-11,4,-1

Chroma filters			
phase	Reference (N0375)	Proposal 1.1	Proposal 1.2
0/16	0, 64, 0, 0	0, 64, 0, 0	0, 64, 0, 0
1/16	-2, 62, 4, 0	-2, 62, 4, 0	0, 58, 8, -2
2/16	-2, 58, 10, -2	-2, 58, 10, -2	-2, 58, 10, -2
3/16	-4, 56, 14, -2	-4, 56, 14, -2	-2, 53, 17, -4
4/16	-4, 54, 16, -2	-4, 54, 16, -2	-4, 54, 16, -2
5/16	-6, 52, 20, -2	-6, 52, 20, -2	-4, 48, 24, -4
6/16	-6, 46, 28, -4	-6, 46, 28, -4	-4, 44, 28, -4
7/16	-4, 42, 30, -4	-4, 42, 30, -4	-6, 44, 30, -4
8/16	-4, 36, 36, -4	-4, 36, 36, -4	-4, 36, 36, -4

Test conditions

- 3 ratios considered:
  - ▫ 1.5x / 2x   - already used in CTCs
  - ▫ ~1.75x   - adjusted to ensure picture size multiple of 8
                  - enables to test all of the 16 phases.

- 2 downsamplers
  - ▫ SHVC downsampler   - based on M23485 and M24499
                              - for 1.5x and 2x, identical to CTCs
  - ▫ JSVM downsampler   - with luma-chroma alignment phase = 0
                              - for 1.5x and 2x, new base layers

- 4 tests

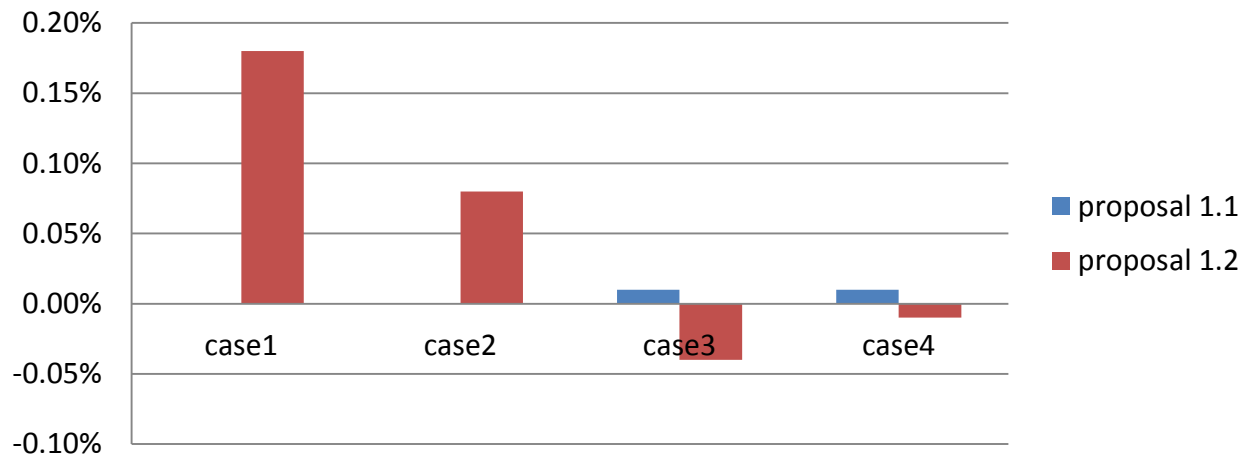| Downsampler	SHVC dwnsamp	JSVM downsampler
Ratios		
1.5x and 2x	Case 1 (CTCs)	Case 2 (CTCs with new BL)
~1.75x	Case 3	Case 4

Downsamplers validity check

- SHM3.0.1 vs HM11.0

	×2 SHVC	×2 JSVM	~1,75 SHVC	~1,75 JSVM	×1,5 SHVC	×1,5 JSVM
AI	12.8%	14.1%	14.0%	15.5%	10.5%	13.3%
RA	19.0%	19.4%	19.5%	20.3%	16.2%	17.3%
LD-B	28.3%	28.0%	28.5%	28.7%	24.8%	24.9%
LD-P	26.5%	26.1%	26.6%	26.6%	22.8%	22.8%

- coherent results between the two downsamplers
- "arbitrary ratio" downsamplers work adequately

Test results vs N0375 filters (1 digit)

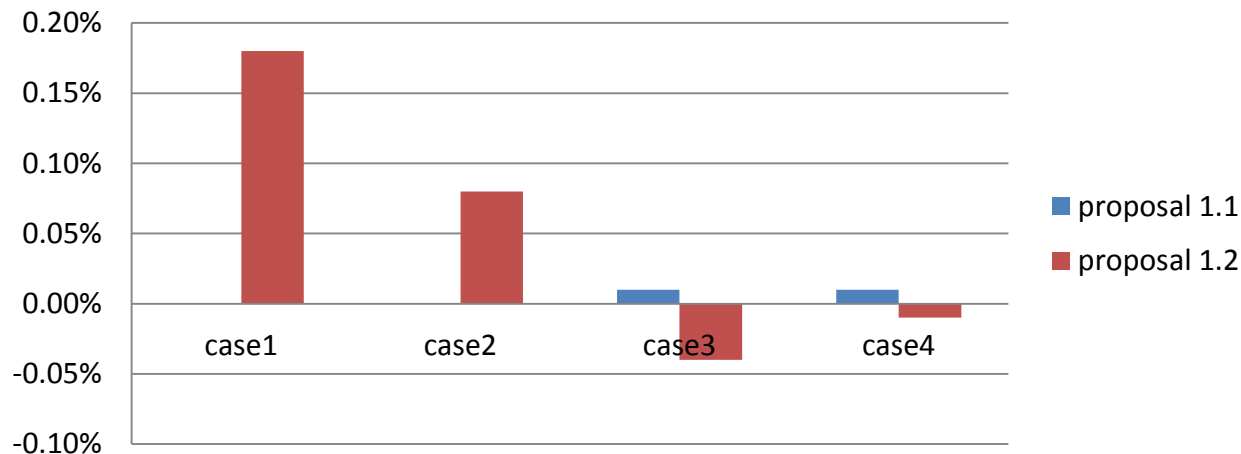|		Proposal 1.1 - O0076					Proposal 1.2 - O0052				
		Y	**U**	**V**	mem	mult	**Y**	**U**	**V**	mem	mult
Case1 CTCs 1.5x/2x	avg	**0.0%**	**0.0%**	**0.0%**	100%	100%	**0.2%**	**0.1%**	**0.0%**	100%	100%
Case2 JSVM 1.5x/2x	avg	**0.0%**	**0.0%**	**0.0%**	100%	100%	**0.1%**	**0.0%**	**0.0%**	100%	100%
Case3 SHVC ~1.75x	avg	**0.0%**	**0.0%**	**0.0%**	100%	100%	**0.0%**	**-0.2%**	**-0.2%**	100%	100%
Case4 SHVC ~1.75x	avg	**0.0%**	**0.0%**	**0.0%**	100%	100%	**0.0%**	**-0.2%**	**-0.1%**	100%	100%

average BDR$_Y$ variations

Both performance and memory usage are demonstrated

Test results vs N0375 filters (2 digits)

		Proposal 1.1 - O0076					Proposal 1.2 - O0052				
		Y	**U**	**V**	mem	mult	**Y**	**U**	**V**	mem	mult
Case1 CTCs 1.5x/2x	avg	0.00%	0.00%	0.00%	100%	100%	0.18%	0.06%	0.03%	100%	100%
Case2 JSVM 1.5x/2x	avg	0.00%	0.00%	0.00%	100%	100%	0.08%	-0.03%	-0.05%	100%	100%
Case3 SHVC ~1.75x	avg	0.01%	-0.02%	0.01%	100%	100%	-0.04%	-0.19%	-0.19%	100%	100%
Case4 SHVC ~1.75x	avg	0.01%	-0.03%	-0.01%	100%	100%	-0.01%	-0.15%	-0.15%	100%	100%

average BDR_Y variations

Both performance and memory usage are demonstrated