

REDEFINING MOBILITY



# **Non-RCE3: Explicit signaling of intra RDPCM**

## **JCTVC-D0178**

**Jewon Kang, Rajan Joshi, Joel Sole, and Marta Karczewicz**

# Introduction

- In the current HEVC RExt design RDPCM for Intra and Inter modes is treated differently
  - Intra RDPCM: The RDPCM mode is chosen **implicitly**
    - RDPCM used only for horizontal and vertical intra prediction modes
    - On the other hand, in inter-RDPCM, the DPCM mode is explicitly signaled.
  - Inter (and intra block copy): The RDPCM mode is coded **explicitly**
    - DPCM\_OFF, DPCM\_HOR, DPCM\_VER
- Proposal
  - Signal RDPCM mode explicitly for intra
  - Unify the treatment of intra, inter and intra block copy

# Description of the method

- Same RDPCM modes as in inter RDPCM
  - DPCM\_OFF, DPCM\_HOR, DPCM\_VERT
- Same method of signaling as in inter RDPCM
  - One flag to signal whether RDPCM is ON/OFF
  - If RDPCM is ON, another flag to signal direction (HOR/VER)
- Same encoder search as in inter RDPCM
  - SAD based decision

# Results (Lossy - Intra)

	All Intra HE Main-tier			All Intra HE High-tier			All Intra HE Super-High-tier		
	Y	U	V	Y	U	V	Y	U	V
Class F	-0.6%	-0.4%	-0.5%	-0.6%	-0.4%	-0.5%	-0.5%	-0.3%	-0.4%
Class B	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
SC RGB 444	-1.0%	-1.0%	-1.0%	-1.1%	-1.1%	-1.1%	-1.1%	-1.1%	-1.1%
Animation RGB 444	-0.1%	0.0%	0.0%	-0.1%	0.0%	0.0%	-0.2%	0.0%	0.0%
SC YUV 444	-0.9%	-0.7%	-0.8%	-1.0%	-0.8%	-0.8%	-1.0%	-0.8%	-0.8%
Animation YUV 444	-0.1%	0.0%	0.0%	-0.1%	0.0%	0.0%	-0.1%	-0.1%	-0.1%
RangeExt	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
SC(444) GBR Optional	-1.3%	-1.2%	-1.2%	-1.6%	-1.6%	-1.4%	-1.9%	-1.7%	-1.7%
SC(444) YUV Optional	-1.2%	-1.0%	-0.8%	-1.3%	-1.3%	-1.1%	-1.6%	-1.6%	-1.7%
Enc Time[%]	104%			106%			106%		
Dec Time[%]	103%			102%			102%		

# Results (Lossy – RA and LB)

	Random Access HE Main-tier			Random Access HE High-tier		
	Y	U	V	Y	U	V
Class F	-0.5%	-0.4%	-0.4%	-0.4%	-0.3%	-0.3%
Class B	0.0%	0.1%	0.0%	0.0%	0.0%	0.1%
SC RGB 444	-0.6%	-0.7%	-0.8%	-0.8%	-0.9%	-0.9%
Animation RGB 444	0.0%	0.0%	0.0%	-0.1%	0.0%	0.0%
SC YUV 444	-0.5%	-0.6%	-0.6%	-0.6%	-0.7%	-0.7%
Animation YUV 444	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%
RangeExt	0.0%	0.0%	0.1%	0.0%	0.1%	0.0%
SC(444) GBR Optional	-1.0%	-1.0%	-1.0%	-1.3%	-1.1%	-1.2%
SC(444) YUV Optional	-1.1%	-1.0%	-1.2%	-1.2%	-1.2%	-1.3%
Enc Time[%]	101%			100%		
Dec Time[%]	103%			103%		
	Low delay B HE Main-tier			Low delay B HE High-tier		
	Y	U	V	Y	U	V
Class F	-0.1%	-0.4%	-0.3%	-0.1%	-0.1%	-0.1%
Class B	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
SC RGB 444	-0.4%	-0.3%	-0.4%	-0.6%	-0.5%	-0.7%
Animation RGB 444	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
SC YUV 444	-0.2%	-0.3%	-0.2%	-0.2%	-0.2%	-0.3%
Animation YUV 444	0.0%	0.1%	0.1%	0.0%	0.1%	0.0%
RangeExt	0.0%	0.0%	-0.1%	0.0%	0.0%	0.0%
SC(444) GBR Optional	-1.8%	-2.0%	-1.7%	-1.7%	-1.8%	-1.6%
SC(444) YUV Optional	-1.9%	-1.5%	-1.9%	-1.4%	-1.3%	-1.6%
Enc Time[%]	105%			105%		
Dec Time[%]	103%			102%		

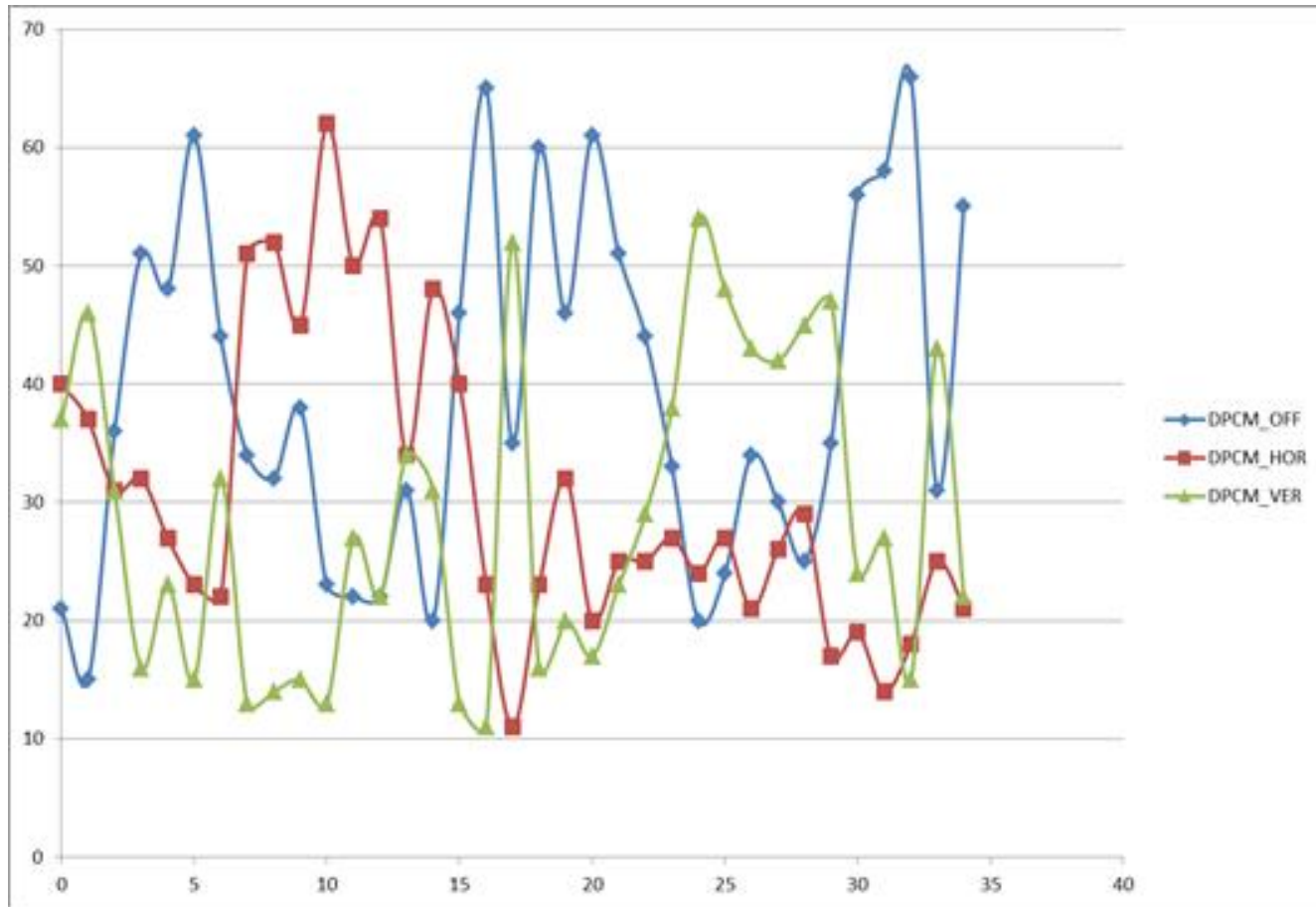
# Results (Lossless - Intra)

	AI Main					
	compression ratio (Total)		Bit-rate saving (Total)	Bit-rate saving (Average)	Bit-rate saving (Min)	Bit-rate saving (Max)
	Ref.	Tested				
Class F	4.57	4.60	0.6%	0.7%	-0.4%	2.1%
Class B	2.24	2.28	1.4%	1.4%	1.4%	1.5%
SC RGB 444	7.88	7.97	1.1%	1.3%	0.4%	2.3%
Animation RGB 444	2.48	2.52	1.6%	1.6%	0.7%	2.6%
SC YUV 444	11.09	11.16	0.6%	0.8%	0.2%	1.8%
Animation YUV 444	3.00	3.02	0.6%	0.6%	0.4%	1.0%
RangeExt	1.92	1.94	1.1%	1.0%	0.6%	1.7%
SC GBR 444 Optional	20.30	20.55	1.2%	1.5%	0.5%	2.6%
SC YUV 444 Optional	31.85	31.93	0.3%	0.4%	-0.6%	1.2%
Enc Time[%]			104%			
Dec Time[%]			103%			

	RA Main					
	compression ratio (Total)		Bit-rate saving (Total)	Bit-rate saving (Average)	Bit-rate saving (Min)	Bit-rate saving (Max)
	Ref.	Tested				
Class F	8.66	8.69	0.3%	0.2%	-0.3%	0.6%
Class B	2.60	2.61	0.2%	0.3%	0.1%	0.4%
SC RGB 444	53.71	53.86	0.3%	0.6%	-0.6%	1.8%
Animation RGB 444	3.58	3.59	0.1%	0.1%	0.0%	0.3%
SC YUV 444	73.79	73.97	0.2%	0.6%	0.0%	0.9%
Animation YUV 444	3.8	3.84	0.0%	0.0%	-0.1%	0.2%
RangeExt	2.1	2.1	0.3%	0.2%	0.0%	0.5%
SC GBR 444 Optional	42.0	42.1	0.4%	1.5%	0.3%	2.8%
SC YUV 444 Optional	101.1	100.9	-0.2%	0.4%	-0.4%	1.4%
Enc Time[%]	99%					
Dec Time[%]	100%					
	LB Main					
	compression ratio (Total)		Bit-rate saving (Total)	Bit-rate saving (Average)	Bit-rate saving (Min)	Bit-rate saving (Max)
	Ref.	Tested				
Class F	8.9	8.9	0.3%	0.2%	-0.2%	0.3%
Class B	2.6	2.6	0.2%	0.2%	0.1%	0.3%
SC RGB 444	62.2	62.3	0.1%	0.6%	0.0%	1.6%
Animation RGB 444	3.6	3.6	0.0%	0.0%	-0.1%	0.1%
SC YUV 444	85.1	85.1	0.0%	0.2%	-0.5%	0.7%
Animation YUV 444	4	3.9	-0.1%	0.0%	-0.2%	0.0%
RangeExt	2.1	2.1	0.2%	0.2%	0.0%	0.5%
SC GBR 444 Optional	45	45.2	0.3%	2.2%	0.2%	3.5%
SC YUV 444 Optional	117.1	116.6	-0.4%	-1.0%	-4.0%	1.4%
Enc Time[%]	98%					
Dec Time[%]	96%					

Lossless  
results  
(RA and LB)

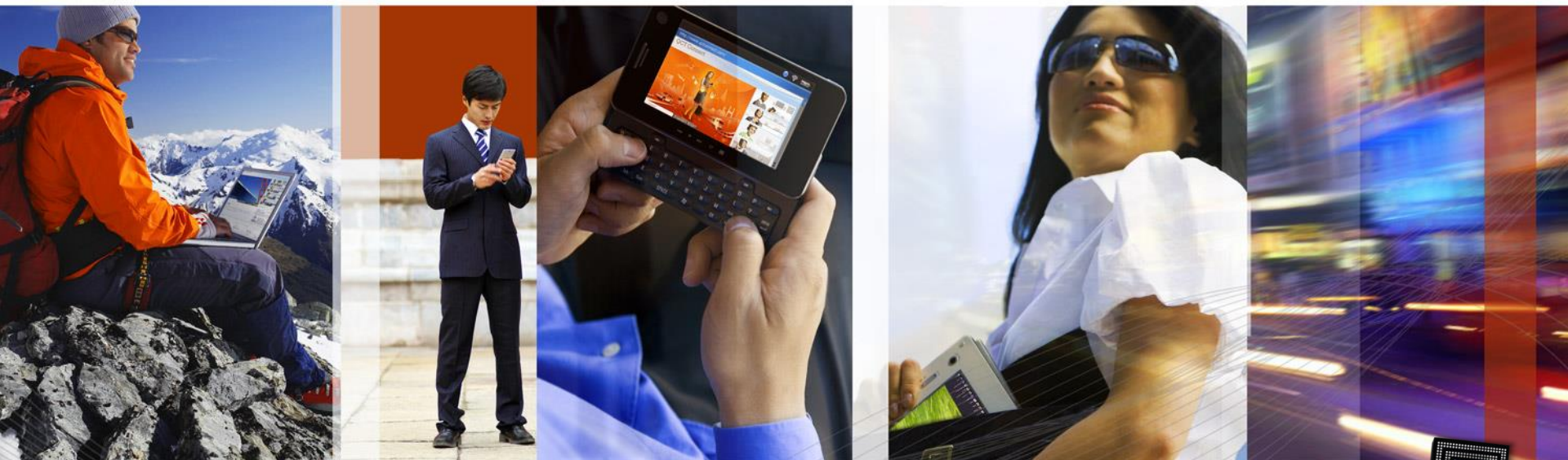
# Selected RDPCM mode for different intra prediction directions





# Conclusions

- Explicit signaling of intra RDPCM mode
- Unification of RDPCM mode signaling for intra, inter and intra block copy
- Consistent gains screen content and class F sequences



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