

REDEFINING MOBILITY



JCTVC-Q0148: Quantization Rounding for RDPCM

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Outline

■ Existing Problem

- Dead-zone plus uniform threshold quantization (DZ-UTQ) for RDPCM blocks
- DZ-UTQ designed for transform coefficients
- RDPCM is second order prediction error
 - Different statistics
 - Error propagation

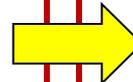
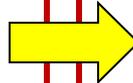
■ Proposed Solution

- Simple rounding based quantization for RDPCM blocks

Quantization Rounding for RDPCM

Anchor6.0

- Intra frame RDPCM
 - Related with intra prediction mode (implicit)
 - **Dead-zone based quantization (no RDOQ)**
- Inter frame RDPCM
 - Three candidates, RDPCM_Off, Vert, and Hori (explicit)
 - **Dead-zone based quantization to select the best candidate (SAD)**
 - If RDPCM_Off is selected, RDOQ is used to refine



Proposed

- Intra frame RDPCM
 - Related with intra prediction mode (implicit)
 - **Rounding based quantization (no RDOQ)**
- Inter frame RDPCM
 - Three candidates, RDPCM_Off, Vert, and Hori (explicit)
 - **Rounding based quantization (SAD)**
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Quantization Rounding for RDPCM

Software Change : two lines only

```
#if QC_SCC_ENC_RDPCM_QUANT
    iAdd = 256 << (iQBits - 9); // Rounding
    if (!bRDPCM)
        iAdd = (pcCU->getSlice()->getSliceType() == I_SLICE ? 171 : 85) << (iQBits - 9);
#else
    iAdd = (pcCU->getSlice()->getSliceType() == I_SLICE ? 171 : 85) << (iQBits - 9);
#endif
```

Results (Ahg8 CTC, Crosscheck by JCTVC-Q0181)

	All Intra Main-tier			All Intra High-tier			All Intra Super-High-tier		
	Y	U	V	Y	U	V	Y	U	V
Class F	-0.2%	0.2%	0.1%	-0.2%	0.3%	0.3%	-0.1%	0.1%	0.1%
Class B	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB 4:4:4 SC	-0.4%	0.1%	0.0%	-0.3%	0.1%	0.0%	-0.4%	-0.1%	-0.1%
RGB 4:4:4 Animation	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YCbCr 4:4:4 SC	-0.4%	0.3%	0.3%	-0.3%	0.3%	0.3%	-0.4%	0.0%	0.0%
YCbCr 4:4:4 Animation	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RangeExt	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB 4:4:4 SC (Optional)	-0.6%	-0.5%	-0.6%	-0.3%	-0.2%	-0.2%	-0.6%	-0.6%	-0.6%
YCbCr 4:4:4 SC (Optional)	-0.3%	0.0%	0.0%	-0.5%	0.1%	0.0%	-0.7%	-0.2%	-0.3%
Enc Time[%]	103%			103%			102%		
Dec Time[%]	102%			102%			101%		
	Random Access Main-tier			Random Access High-tier					
	Y	U	V	Y	U	V			
Class F	-0.3%	-0.1%	0.0%	-0.3%	-0.2%	-0.1%			
Class B	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
RGB 4:4:4 SC	-0.9%	-0.4%	-0.4%	-1.0%	-0.5%	-0.5%			
RGB 4:4:4 Animation	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%			
YCbCr 4:4:4 SC	-0.8%	0.2%	0.1%	-1.0%	-0.1%	-0.2%			
YCbCr 4:4:4 Animation	0.1%	0.0%	0.0%	0.0%	0.1%	0.0%			
RangeExt	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%			
RGB 4:4:4 SC (Optional)	-0.8%	-0.7%	-0.7%	-0.7%	-0.6%	-0.6%			
YCbCr 4:4:4 SC (Optional)	-0.4%	0.0%	-0.1%	-1.2%	-0.6%	-0.6%			
Enc Time[%]	99%			100%					
Dec Time[%]	101%			101%					
	Low delay B Main-tier			Low delay B High-tier					
	Y	U	V	Y	U	V			
Class F	-0.5%	-0.1%	-0.1%	-0.6%	-0.3%	-0.2%			
Class B	0.0%	-0.1%	0.0%	0.0%	-0.1%	-0.1%			
RGB 4:4:4 SC	-1.1%	-0.7%	-0.7%	-1.3%	-1.0%	-0.9%			
RGB 4:4:4 Animation	-0.1%	0.1%	0.0%	-0.1%	0.0%	0.0%			
YCbCr 4:4:4 SC	-1.2%	-0.3%	-0.1%	-1.3%	-0.3%	-0.4%			
YCbCr 4:4:4 Animation	0.1%	0.0%	0.1%	0.1%	0.1%	0.2%			
RangeExt	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
RGB 4:4:4 SC (Optional)	-1.9%	-1.9%	-2.2%	-3.6%	-3.6%	-4.2%			
YCbCr 4:4:4 SC (Optional)	-1.6%	-1.6%	-1.3%	-2.0%	-1.7%	-1.5%			
Enc Time[%]	99%			100%					
Dec Time[%]	100%			101%					

Conclusion

- Proposed uniform quantization rounding for RDPCM
 - Encoder only
 - Simple two line change
 - 0.2%, 0.4%, 0.8% BD-rate savings on average for AI, RA and LB main tiers

- Recommend for adoption