

# **TOSHIBA**

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## **JCTVC-F319**

# **Adaptive scaling with offset for reference pictures memory compression**

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# Adaptive scaling with offset

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- **Process by 4x4 block**
- **Loss less compression on 8-bit depth level**
  - Worst PNSR between reference picture and decompressed image

$$PSNR_{worst} = 10 \log_{10} \left( \frac{1020^2}{2^2} \right) = 54.15 dB$$

- **Complexity is negligible**
- **Fixed length format**
- **Definition of compression distortion control**

# Format

- D. Hoang (Zenverge) suggested a format (128-bit)

u(8)	/* P0_flag */
if (P0_flag != 0) {	
for (i=1; i<16; i++) u(8)	/* pixel value P[i] */
} else {	
u(1)	/* S: [0..1] */
u(10-S)	/* M >> S */
u(S)	/* offset */
u(4)	/* M_index */
for (i=0; i<15; i++) u(7)	/* residual excluding M */
}	

E432 and E133 are merged

# Definition of compression distortion control

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- (1) Find min4x4 and max4x4 in 4x4 block
- (2) Decide the scaling value S from difference between max4x4 and min4x4.  
for (S=0, Range=max4x4 –min4x4, MaxRange = (BitDepth<11) ? 128 : 64;  
Range>(MaxRange<<S)-1 && S<BitDepth-8;  
S++, Range=max4x4-(min4x4&(~0<<S)));
- (3) Control bit depth of pixels according to S.  
if (S==BitDepth-8) {  
Offset = 1<<(S-1);  
recPicL[0] = (recPicL[0]<Offset)? 1<<S : (recPicL[0]+Offset) & (~0<<S);  
for (i=1; i<16; i++) recPicL[i] = (recPicL[i]+Offset)>(1<<BitDepth)-1)?  
(1<<BitDepth)-1 : (recPicL[i]+Offset) & (~0<<S);  
} else if (S!=0) {  
for (i=0, sum=0; i<16; i++) sum += (recPicL[i] & ((1<<S)-1));  
for (i=0, Offset=((sum+8)>>4); i<16; i++)  
recPicL[i] = Clip3(0, (1<<BitDepth)-1, (recPicL[i] & (~0<<S)) +Offset);  
}

# Experimental results (Summary)

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	Adaptive scaling with offset	Fixed rounding	IBDI off
Random access	0.09	0.94	2.14
Low delay	0.76	3.05	2.81
Low delay P	0.62	2.73	2.47

Adaptive(0.49)<Fixed(2.24)< Internal 8-bit(2.47)

“with Offset” improves 0.22 on average.

# Complexity

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- **Encoding and decoding time**
  - Increase rate (%) of average encoding and decoding times

	Adaptive scaling with offset	Fixed rounding	IBDI off
Enc Time[%]	100%	101%	99%
Dec Time[%]	105%	108%	94%

**Not significantly increase**

# Conclusion

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- **Adaptive scaling with offset for reference picture compression**
- **Cross-checked by JCTVC-F620 (Zhenvege)**
- **Ready a draft for WD**
- **We recommend that a new CE for reference picture memory compression should be created.**

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