



**MEDIATEK**

**JVET-N0113**

# **AHG16: Subblock-based chroma residual scaling**

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# Overall Summary

- Proposed two methods to reduce the delay of chroma sample reconstruction
  - Method 1: derive chroma residue inverse scale value at subblock level
  - Method 2: derive chroma residue inverse scale value using top-left at most 256-luma-sample in a luma TB
- **The worst case delay is reduced from 64x64 to 16x16 luma prediction samples**

	RA			LB		
	Y	U	V	Y	U	V
Method 1	0.00	0.03	0.04	0.01	0.25	0.11
Method 2	0.01	-0.02	-0.01	-0.01	0.08	-0.19

# Introduction

- In VTM-4.0, there exists data dependency between luma prediction samples and chroma residuals reconstruction when enabling reshaper

$$\text{Decoder side: } C_{Res} = C_{ResScale} * C_{ScaleInv}$$

- The inverse scale is derived using the prediction samples of the **entire** collocated luma TB
- In the worst case, the delay is the processing time of generating 64x64 luma prediction samples

# Method 1 – Subblock-based chroma residual scaling

- Divide each chroma TB into multiple 8x8 subblocks
  - For each subblock, derive its own inverse scale value from the prediction samples of its collocated luma TB
  - Each chroma subblock uses its own inverse scale values for chroma residual scaling
- The delay of the chroma sample reconstruction is reduced to 16x16 luma prediction samples

## Method 2 – Simplified subblock-based chroma residual scaling

- Use the top-left subblock's collocated luma prediction samples to derive the inverse scale value
    - When the size of the first chroma subblock is less than 64 samples, use the top-left 256 luma samples in the collocated luma TB
  - Apply the derived chroma scale value to all chroma subblocks
- The delays of the chroma reconstruction is reduced to 16x16 luma prediction samples
- Only one chroma inverse scale value is derived

# Results - Method 1

	Random access Main10				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1	0.00%	-0.04%	0.00%	101%	102%
Class A2	-0.02%	0.00%	-0.04%	100%	99%
Class B	0.00%	0.00%	0.08%	100%	101%
Class C	0.00%	0.15%	0.07%	100%	100%
Class E					
<b>Overall</b>	<b>0.00%</b>	<b>0.03%</b>	<b>0.04%</b>	<b>100%</b>	<b>101%</b>
Class D	0.01%	0.06%	0.02%	101%	100%
Class F	0.01%	0.02%	-0.05%	100%	99%

	Low delay B Main10				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	0.00%	0.18%	0.18%	100%	102%
Class C	0.00%	0.24%	0.22%	101%	101%
Class E	0.02%	0.36%	-0.17%	100%	96%
<b>Overall</b>	<b>0.01%</b>	<b>0.25%</b>	<b>0.11%</b>	<b>100%</b>	<b>100%</b>
Class D	-0.03%	-0.15%	-0.46%	101%	102%
Class F	-0.09%	-0.16%	0.02%	100%	101%

# Results - Method 2

	Random access Main10				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1	0.00%	0.09%	0.04%	100%	102%
Class A2	-0.01%	-0.07%	0.00%	100%	101%
Class B	0.01%	-0.04%	0.02%	100%	101%
Class C	0.02%	-0.02%	-0.10%	100%	100%
Class E					
<b>Overall</b>	<b>0.01%</b>	<b>-0.02%</b>	<b>-0.01%</b>	<b>100%</b>	<b>101%</b>
Class D	0.00%	0.07%	0.09%	102%	101%
Class F	-0.01%	0.02%	-0.02%	101%	100%

	Low delay B Main10				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	0.00%	-0.15%	-0.24%	100%	104%
Class C	-0.03%	0.18%	0.13%	100%	101%
Class E	0.00%	0.33%	-0.52%	101%	96%
<b>Overall</b>	<b>-0.01%</b>	<b>0.08%</b>	<b>-0.19%</b>	<b>100%</b>	<b>101%</b>
Class D	-0.02%	0.23%	-0.30%	101%	102%
Class F	0.00%	0.15%	0.16%	100%	101%

# Conclusion

- Propose to apply chroma residual scaling at subblock level
- Method 1: derive the inverse scale value at subblock level
- Method 2: derive the inverse value for the first subblock and apply this inverse scale value to the chroma residuals of the entire chroma TB
- The worst case delay of chroma sample reconstruction is reduced to 16x16 luma prediction samples
- Thank ETRI for crosschecking!

	RA			LB		
	Y	U	V	Y	U	V
Method 1	0.00	0.03	0.04	0.01	0.25	0.11
Method 2	0.01	-0.02	-0.01	-0.01	0.08	-0.19



The background is a solid light blue color with a repeating pattern of white line-art icons. These icons include various nautical items like anchors, lifebuoys, seashells, and fish, as well as outdoor and travel-related items like a compass, a map, a tent, a backpack, and a camera. The icons are scattered across the entire page.

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**Thank you!**