



**MEDIATEK**

**JVET-Q0180**

# **AHG9: On inter-layer referencing of scaling list and LMCS**

**Authors: Chen-Yen Lai, Olena Chubach, Ching-Yeh Chen, Lulin Chen, Tzu-Der Chuang, Yu-Wen Huang, Shaw-Min Lei**

**Presenter: Chen-Yen Lai**

# Overall Summary

- The current design of Scaling List (SL)/LMCS APS cannot reference APS from a different layer.
  - Inefficient to signal the same SL/LMCS APSs in two CLVSs
- Propose inter-layer referencing between a direct reference layer and the current layer for SL and LMCS APSs

# Allowed Reference Layer

- Reference the design of available reference pictures in reference picture list (RPL)
  - Only APSs from **a direct reference layer** can be referenced.
  - The referenced APSs shall be **the APSs available in a picture unit (PU) which is in the same AU with the current picture**, and with `nuh_layer_id` less than the `nuh_layer_id` of the current picture.

# Method 1: Signal On/Off Control and Reference Layer in SPS

- In SPS,

	Descriptor
seq_parameter_set_rbsp( ) {	
...	
sps_lmcs_enabled_flag	u(1)
if (sps_lmcs_enabled_flag) {	
→ sps_lmcs_inter_layer_ref_enabled_flag	u(1)
if (sps_lmcs_inter_layer_ref_enabled_flag)	
sps_lmcs_inter_layer_idx → Indicate the LMCS reference layer index in the list of direct reference layers	ue(v)
}	
...	
sps_scaling_list_enabled_flag	u(1)
if (sps_scaling_list_enabled_flag) {	
→ sps_scaling_list_inter_layer_ref_enabled_flag	u(1)
if (sps_scaling_list_inter_layer_ref_enabled_flag)	
sps_scaling_list_inter_layer_idx → Indicate the SL reference layer index in the list of direct reference layers	ue(v)
}	

# Method 1: Signal On/Off Control and Reference Layer in SPS

- For `pic_lmcs_aps_id`,
  - If `sps_lmcs_inter_ref_enabled_flag` is equal to 1, `pic_lmcs_aps_id` specifies the APS ID of the Imcs APS in a layer with index equal to `sps_lmcs_inter_layer_idx` of the list of direct reference layers.
- For `pic_scaling_list_aps_id`,
  - If `sps_scaling_list_inter_ref_enabled_flag` is equal to 1, `pic_scaling_list_aps_id` specifies the APS ID of the scaling list APS in a layer with index equal to `sps_scaling_list_inter_layer_idx` of the list of direct reference layers.

# Method 2: Allow Disabling Inter-Layer Referencing in PH When Enabled in SPS

- In SPS, same as Method1

	Descriptor
seq_parameter_set_rbsp( ) {	
...	
sps_lmcs_enabled_flag	u(1)
if (sps_lmcs_enabled_flag) {	
→ sps_lmcs_inter_layer_ref_enabled_flag	u(1)
if (sps_lmcs_inter_layer_ref_enabled_flag)	
→ sps_lmcs_inter_layer_idx	ue(v)
}	
...	
sps_scaling_list_enabled_flag	u(1)
if (sps_scaling_list_enabled_flag) {	
→ sps_scaling_list_inter_layer_ref_enabled_flag	u(1)
if (sps_scaling_list_inter_layer_ref_enabled_flag)	
→ sps_scaling_list_inter_layer_idx	ue(v)
}	

# Method 2: Allow Disabling Inter-Layer Referencing in PH When Enabled in SPS

- In PH,

if( sps_lmcs_enabled_flag ) {	
<b>pic_lmcs_enabled_flag</b>	u(1)
if( pic_lmcs_enabled_flag ) {	
if( sps_lmcs_inter_layer_ref_enabled_flag )	
<b>ph_lmcs_inter_layer_ref_enabled_flag</b>	u(1)
<b>pic_lmcs_aps_id</b>	u(2)
if( ChromaArrayType != 0 )	
<b>pic_chroma_residual_scale_flag</b>	u(1)
}	
}	
if( sps_scaling_list_enabled_flag ) {	
<b>pic_scaling_list_present_flag</b>	u(1)
if( pic_scaling_list_present_flag )	
if( sps_scaling_list_inter_layer_ref_enabled_flag )	
<b>ph_scaling_list_inter_layer_ref_enabled_flag</b>	u(1)
<b>pic_scaling_list_aps_id</b>	u(3)
}	

## Method 2: Allow Disabling Inter-Layer Referencing in PH When Enabled in SPS

- For `pic_lmcs_aps_id`,
  - If `ph_lmcs_inter_ref_enabled_flag` is equal to 1, `pic_lmcs_aps_id` specifies the APS ID of the Imcs APS in a layer with index equal to `sps_lmcs_inter_layer_idx` of the list of direct reference layers.
- For `pic_scaling_list_aps_id`,
  - If `ph_scaling_list_inter_ref_enabled_flag` is equal to 1, `pic_scaling_list_aps_id` specifies the APS ID of the scaling list APS in a layer with index equal to `sps_scaling_list_inter_layer_idx` of the list of direct reference layers.



# Comparison

Design for both SL and LMCS

Method	Allowed inter-layer referencing for SL/LMCS APSs	Signalled the on-off of inter-layer referencing in SPS	Signalled the on-off of inter-layer referencing in PH	Signalled the reference layer index
VVC Draft 7	X	-	-	-
Method 1	V	V	X	SPS
Method 2	V	V	V	SPS

# Conclusion

- It is suggested to allow inter-layer referencing for SL/LMCS APS
- Two proposed methods:
  - Method 1: Signal on/off control and reference layer for inter-layer referencing of SL/LMCS in SPS
  - Method 2: Based on Method 1, allow disabling inter-layer referencing in PH when enabled in SPS

