

# **JVET-Q0142**

## **Clipping of minimum QP prime value**

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## ■ Problem statement

- Adaptive color transform (ACT) was adopted to VVC7.
- When ACT is applied,  $Q_p'$  is compensated to adjust dynamic range of residuals after the ACT.
- Consequently,  $Q_p'$  can be unintended value ( $< 0$ ).

## ■ Proposal

- The minimum value of  $Q_p'$  is clipped after the compensation by ACT with following value:
  - 0 for non-TS block,
  - 4 for TS block.

## ■ Related proposal

- Q0098, Q0166, Q0241, Q0425, and Q0511 propose the same solution regarding the min. value.
  - Clip with 0 for non-TS block (same as our proposal).
  - Clip with  $Q_p\text{PrimeTsMin}$  for non-TS block.

## ■ The minimum value of $Q_p'$ is clipped after the compensation by ACT.

- If  $\text{transform\_skip\_flag}[xTbY][yTbY][cIdx]$  is equal to 0, the following applies:

$$qP = qP - (\text{cu\_act\_enabled\_flag}[xTbY][yTbY] ? 5 : 0) \quad (1133)$$

$$qP = \text{Max}(0, qP) \quad (\text{xxxx})$$

- Otherwise ( $\text{transform\_skip\_flag}[xTbY][yTbY][cIdx]$  is equal to 1), the following applies:

$$qP = \text{Max}(Q_{p\text{PrimeTsMin}}, qP) - (\text{cu\_act\_enabled\_flag}[xTbY][yTbY] ? 5 : 0) \quad (1136)$$

$$qP = \text{Max}(4, qP) \quad (\text{xxxx})$$

## ■ The clipping value for non-TS block is same as Q0098, Q0166, Q0241, Q0425, and Q0511.

## ■ For TS block, we propose clipping with not $Q_{p\text{PrimeTsMin}}$ but 4.

- For TS block, we propose clipping with not QpPrimeTsMin but 4 ( $\leq$  QpPrimeTsMin).
- QpPrimeTsMin means Qp' reaches “quantization step  $\approx 1$  (nearly lossless)” in TS block **not applied ACT**.
- In ACT block, dynamic range of residuals are reduced, that's why Qp' is compensated with minus offset values (-5 or -3 in VVC D7).

$$\begin{bmatrix} C'_0 \\ C'_1 \\ C'_2 \end{bmatrix} = \begin{bmatrix} 2 & 1 & 1 \\ 2 & -1 & -1 \\ 0 & -2 & 2 \end{bmatrix} \begin{bmatrix} C_0 \\ C_1 \\ C_2 \end{bmatrix} / 4$$

Forward ACT

- Therefore, it is reasonable that Qp' can be less than QpPrimeTsMin in ACT block.
  - Practically, clipping with QpPrimeTsMin also seems be OK because quantization step is very small.

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## ■ Proposal or related proposal is recommended to adopt to VVC D8 and VTM-8.