

**MEDIATEK**

# CE2-related: Temporal BV merge mode on CE2 Test-1 and Test-7

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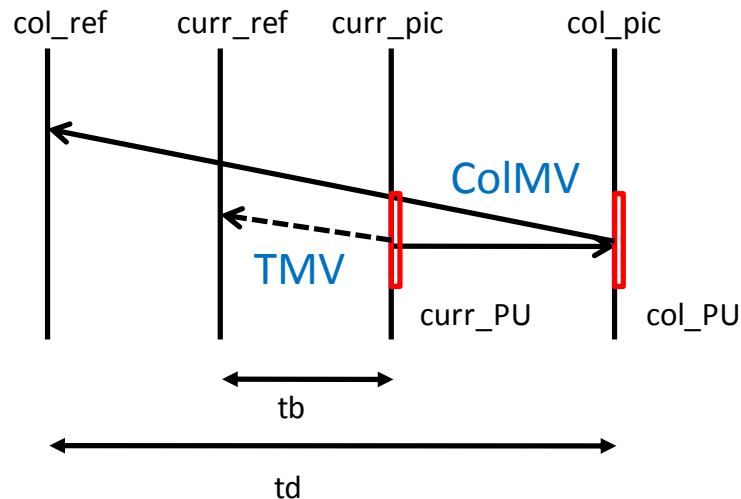
# Overview Summary

- Proposed to include the BVs in temporal merge mode derivation on top of CE2 Test-1 and Test-7
  - In CE2 Test-1 and Test-7, the reconstructed current picture is mark as long-term reference picture
  - The BV (the MV that points to the reconstructed picture of the co-located picture) is not valid in temporal merge mode derivation

Text & graphics with motion Lossy BD-rate	RA-RGB	RA-YUV	RA-RGB	RA-YUV
CE2 Test 1 + Proposed vs CE2 Test 1	-0.6%	-0.6%	-0.7%	-0.7%
CE2 Test 7 + Proposed vs CE2 Test 7	-0.6%	-0.6%	-0.6%	-0.7%

# Temporal Merge Candidate Derivation in HEVC

- In HEVC temporal merge mode derivation, a scaled motion vector is derived from co-located PU
  - $TMV = ColMV \times (tb/td)$
  - $ref\_idx = 0$
- If the  $col\_ref$  is long-term reference picture and the  $curr\_ref$  is short-term reference picture, the temporal merge candidate is not available



# Intra Block Copy and Inter Signalling Unification in CE2 Test-1 and Test-7

- The IntraBC mode is signalled reusing inter signalling by adding the reconstructed current picture as the last reference picture in LIST\_0
  - The reconstructed current picture is marked as long-term picture
  - If co-located PU is IntraBC coded block, col\_ref is long-term reference picture
- The BV (the MV that points to the reconstructed picture of the co-located picture) of the co-located IntraBC coded PU cannot be used to derive the temporal merge candidate
  - The curr\_ref is short-term reference picture in RA and LB in current CTC
  - The curr\_ref is short-term reference picture and col\_ref is long-term reference picture

# Proposed Method for Temporal BV Merge Mode

- The the BVs are proposed to be utilized in temporal merge candidate derivation
  - If the MV of the co-located block is BV (points to the reconstructed picture of the co-located picture), the BV is used as the temporal merge candidate
  - The ref\_idx points to the current reconstructed picture

# Modification in Spec

- Only change one item with adding two comparators

## 8.5.3.2.9 Derivation process for collocated motion vectors

The variables mvLXCol and availableFlagLXCol are derived as follows:

...

and mvLXCol and availableFlagLXCol are derived as follows:

-If curr\_pic\_as\_ref\_enabled\_flag is 1 and colPocDiff is equal to 0, mvLXCol is set equal to mvCol and refIdxLX is set equal to the the current picture.

-**Otherwise** if LongTermRefPic( currPic, currPb, refIdxLX, LX ) is not equal to LongTermRefPic( ColPic, colPb, refIdxCol, listCol ), both components of mvLXCol are set equal to 0 and availableFlagLXCol is set equal to 0.

-Otherwise, the variable availableFlagLXCol is set equal to 1, refPicListCol[ refIdxCol ] is set to be the picture with reference index refIdxCol in the reference picture list listCol of the slice containing prediction block currPb in the collocated picture specified by ColPic, and the following applies

# Encoder Modification

- In the proposed method, it might generate the temporal merge candidates that List\_0 MV is a BV, and List\_1 MV is a normal MV
  - {List\_0\_BV, List\_1\_MV}
  - This kind of merge candidates is disabled in CE2 Test-1 and Test-7 encoder searching
- In this contribution, the encoder modified to be able to search this kind of merge candidates

# Lossy Coding Result on Top of CE2 Test 1 and Test-7

- Anchor: SCM-3.0
  - Test: CE2 Test-1 or Test-7 + encoder modification + proposed method
- Thanks ITRI for cross-checking**

On top of CE2 Test-1	Random Access			Low delay B		
	G/Y	B/U	R/V	G/Y	B/U	R/V
RGB, text & graphics with motion, 1080p & 720p	-2.8%	-4.6%	-4.5%	-3.0%	-4.4%	-4.4%
RGB, mixed content, 1440p & 1080p	-0.9%	-2.4%	-2.6%	-1.3%	-2.8%	-3.0%
RGB, Animation, 720p	0.0%	0.0%	-0.1%	-0.1%	-0.2%	-0.2%
RGB, camera captured, 1080p	-0.2%	-0.1%	-0.2%	0.0%	0.0%	0.0%
YUV, text & graphics with motion, 1080p & 720p	-2.9%	-4.6%	-4.9%	-3.1%	-4.5%	-4.4%
YUV, mixed content, 1440p & 1080p	-1.2%	-3.0%	-3.1%	-1.7%	-4.2%	-4.4%
YUV, Animation, 720p	-0.1%	-0.4%	0.0%	0.0%	0.0%	-0.1%
YUV, camera captured, 1080p	-0.2%	-0.1%	-0.2%	0.0%	0.1%	0.1%

On top of CE2 Test-7	Random Access			Low delay B		
	G/Y	B/U	R/V	G/Y	B/U	R/V
RGB, text & graphics with motion, 1080p & 720p	-3.1%	-5.0%	-4.9%	-3.0%	-4.5%	-4.5%
RGB, mixed content, 1440p & 1080p	-1.2%	-2.6%	-2.7%	-1.6%	-2.9%	-3.2%
RGB, Animation, 720p	0.0%	0.0%	-0.1%	0.0%	-0.1%	-0.1%
RGB, camera captured, 1080p	-0.2%	-0.1%	-0.1%	0.0%	0.0%	0.0%
YUV, text & graphics with motion, 1080p & 720p	-3.4%	-5.1%	-5.3%	-3.2%	-4.7%	-5.0%
YUV, mixed content, 1440p & 1080p	-1.6%	-3.4%	-3.6%	-1.9%	-4.0%	-4.5%
YUV, Animation, 720p	-0.2%	-0.6%	-0.3%	0.1%	-0.4%	-0.5%
YUV, camera captured, 1080p	-0.2%	-0.1%	-0.4%	0.0%	0.1%	0.0%



# Lossy Coding Result on Top of CE2 Test 1 and Test-7

- Anchor: CE2 Test-1 or Test-7
- Test: CE2 Test-1 or Test-7 + encoder modification + proposed method

On top of CE2 Test-1	Random Access			Low delay B		
	G/Y	B/U	R/V	G/Y	B/U	R/V
RGB, text & graphics with motion, 1080p & 720p	-0.6%	-0.6%	-0.6%	-0.7%	-0.6%	-0.7%
RGB, mixed content, 1440p & 1080p	-0.2%	-0.2%	-0.2%	-0.4%	-0.3%	-0.5%
RGB, Animation, 720p	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%
RGB, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%
YUV, text & graphics with motion, 1080p & 720p	-0.6%	-0.6%	-0.6%	-0.7%	-0.6%	-0.4%
YUV, mixed content, 1440p & 1080p	-0.2%	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%
YUV, Animation, 720p	0.0%	0.0%	0.0%	0.0%	-0.2%	-0.3%
YUV, camera captured, 1080p	0.0%	0.0%	-0.1%	0.0%	0.1%	-0.1%

On top of CE2 Test-7	Random Access			Low delay B		
	G/Y	B/U	R/V	G/Y	B/U	R/V
RGB, text & graphics with motion, 1080p & 720p	-0.6%	-0.6%	-0.6%	-0.6%	-0.5%	-0.6%
RGB, mixed content, 1440p & 1080p	-0.2%	-0.2%	-0.2%	-0.3%	-0.2%	-0.3%
RGB, Animation, 720p	0.0%	0.0%	0.1%	0.0%	-0.1%	0.0%
RGB, camera captured, 1080p	0.0%	0.0%	0.1%	-0.1%	-0.1%	0.0%
YUV, text & graphics with motion, 1080p & 720p	-0.6%	-0.6%	-0.7%	-0.7%	-0.7%	-0.7%
YUV, mixed content, 1440p & 1080p	-0.2%	-0.1%	-0.2%	-0.3%	0.0%	-0.2%
YUV, Animation, 720p	0.0%	-0.1%	0.0%	0.1%	-0.2%	-0.4%
YUV, camera captured, 1080p	0.0%	-0.1%	0.0%	0.0%	0.0%	0.0%

# Lossy Coding Result on Top of CE2 Test 1 and Test-7

- Anchor: CE2 Test-1 or Test-7 + encoder modification
- Test: CE2 Test-1 or Test-7 + encoder modification + proposed method

On top of CE2 Test-1	Random Access			Low delay B		
	G/Y	B/U	R/V	G/Y	B/U	R/V
RGB, text & graphics with motion, 1080p & 720p	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.5%
RGB, mixed content, 1440p & 1080p	0.0%	0.0%	-0.1%	-0.1%	0.0%	-0.1%
RGB, Animation, 720p	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%
RGB, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, text & graphics with motion, 1080p & 720p	-0.4%	-0.4%	-0.5%	-0.5%	-0.5%	-0.4%
YUV, mixed content, 1440p & 1080p	-0.1%	-0.1%	-0.1%	-0.2%	-0.2%	-0.1%
YUV, Animation, 720p	0.0%	-0.1%	0.0%	-0.1%	0.0%	0.1%
YUV, camera captured, 1080p	0.0%	-0.1%	-0.1%	0.0%	0.1%	0.1%

On top of CE2 Test-7	Random Access			Low delay B		
	G/Y	B/U	R/V	G/Y	B/U	R/V
RGB, text & graphics with motion, 1080p & 720p	-0.4%	-0.3%	-0.4%	-0.4%	-0.4%	-0.5%
RGB, mixed content, 1440p & 1080p	-0.1%	-0.1%	-0.1%	-0.2%	-0.1%	-0.2%
RGB, Animation, 720p	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%
RGB, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, text & graphics with motion, 1080p & 720p	-0.4%	-0.4%	-0.4%	-0.5%	-0.5%	-0.6%
YUV, mixed content, 1440p & 1080p	-0.1%	0.0%	0.0%	-0.2%	-0.1%	0.0%
YUV, Animation, 720p	0.0%	0.0%	0.0%	0.0%	-0.2%	-0.1%
YUV, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%

# Lossy Coding Result of Encoder Modification

- Anchor: CE2 Test-1 or Test-7
- Test: CE2 Test-1 or Test-7 + encoder modification

On top of CE2 Test-1	Random Access			Low delay B		
	G/Y	B/U	R/V	G/Y	B/U	R/V
RGB, text & graphics with motion, 1080p & 720p	-0.2%	-0.2%	-0.2%	-0.3%	-0.2%	-0.2%
RGB, mixed content, 1440p & 1080p	-0.1%	-0.1%	-0.1%	-0.2%	-0.3%	-0.3%
RGB, Animation, 720p	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%
RGB, camera captured, 1080p	0.0%	0.0%	0.0%	-0.1%	0.0%	0.0%
YUV, text & graphics with motion, 1080p & 720p	-0.1%	-0.2%	-0.2%	-0.2%	-0.1%	0.1%
YUV, mixed content, 1440p & 1080p	-0.2%	-0.2%	-0.2%	-0.1%	-0.1%	-0.2%
YUV, Animation, 720p	0.0%	0.0%	0.0%	0.1%	-0.1%	-0.3%
YUV, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	-0.2%

On top of CE2 Test-7	Random Access			Low delay B		
	G/Y	B/U	R/V	G/Y	B/U	R/V
RGB, text & graphics with motion, 1080p & 720p	-0.2%	-0.2%	-0.2%	-0.2%	-0.1%	-0.1%
RGB, mixed content, 1440p & 1080p	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%
RGB, Animation, 720p	0.0%	0.1%	0.0%	0.0%	-0.1%	0.0%
RGB, camera captured, 1080p	-0.1%	-0.1%	0.0%	-0.1%	0.0%	-0.1%
YUV, text & graphics with motion, 1080p & 720p	-0.2%	-0.2%	-0.2%	-0.2%	-0.1%	-0.1%
YUV, mixed content, 1440p & 1080p	-0.2%	-0.1%	-0.3%	-0.1%	0.0%	-0.3%
YUV, Animation, 720p	0.0%	-0.1%	0.0%	0.1%	0.1%	-0.3%
YUV, camera captured, 1080p	0.0%	-0.1%	0.0%	0.0%	0.1%	0.1%

# Conclusion

- Proposed to include the BVs in temporal merge mode derivation on top of CE2 Test-1 and Test-7
  - If the MV of the co-located block is BV, the BV is used as the temporal merge candidate
  - The ref\_idx points to the current reconstructed picture

Text & graphics with motion Lossy BD-rate	RA-RGB	RA-YUV	RA-RGB	RA-YUV
CE2 Test 1 + Proposed vs CE2 Test 1	-0.6%	-0.6%	-0.7%	-0.7%
CE2 Test 7 + Proposed vs CE2 Test 7	-0.6%	-0.6%	-0.6%	-0.7%