

## **EE2-3.3 related: Fix on LFNST/NSPT index signalling (JVET-AG0237)**

**Moonmo Koo, Jie Zhao, Jaehyun Lim, and Seung Hwan Kim**

LG Electronics Inc.



# Proposed fix

- EE2-3.3 (Utilizing LFNST/NSPT for inter coding)
  - LFNST/NSPT for inter coding is applied to the Luma component and also signalled, only when the Luma component satisfies “**DC condition**”
    - **DC condition**: last non-zero coefficient should not be at DC position.
- Procedure to decide overall DC condition in EE2-3.3 SW
  - **DC\_cond = Y\_DC\_cond || Cb\_DC\_cond || Cr\_DC\_cond**
  - Cb\_DC\_cond (Cr\_DC\_cond) is always TRUE
  - Therefore, DC\_cond becomes TRUE although Y\_DC\_cond is FALSE.
    - **Unnecessary index signalling occurs even for FALSE Y\_DC\_cond.**
- A simple and straightforward fix is proposed:
  - **DC\_cond = Y\_DC\_cond**, by making Cb/Cr\_DC\_cond to be FALSE for inter coding
  - More aligned with the fact that inter LFNST/NSPT is not applied to Chroma

# Experimental results

- Slight BD-rate changes for RA and LD, relative to EE2-3.3
  - For LD, LFNST/NSPT is enabled for both test and anchor.

	Random access Main10				
	Over EE2-3.3 CTC				
	Y	U	V	EncT	DecT
Class A1	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
Class A2	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
Class B	0.02%	-0.27%	0.03%	100%	100%
Class C	-0.01%	-0.23%	0.02%	98%	99%
Class E					
<b>Overall</b>	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
Class D	0.01%	-0.36%	-0.22%	98%	99%
Class F	-0.02%	-0.08%	-0.05%	99%	99%

	Low delay B Main10				
	Over EE2-3.3 w/ LFNST enabled CTC				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	#VALUE!	#VALUE!	#VALUE!	#DIV/0!	#DIV/0!
Class C	0.01%	-0.50%	-0.40%	100%	100%
Class E	-0.03%	-0.28%	0.03%	100%	100%
<b>Overall</b>	#VALUE!	#VALUE!	#VALUE!	#DIV/0!	#DIV/0!
Class D	-0.14%	-0.32%	-1.62%	99%	100%
Class F	#VALUE!	#VALUE!	#VALUE!	#DIV/0!	#DIV/0!

# Conclusion

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- The problem on how to decide DC condition for inter LFNST/NSPT in EE2-3.3 is pointed out
  - Luma DC condition becomes meaningless due to the always-TRUE Chroma DC condition.
  - Unnecessary LFNST/NSPT index signalling even for FALSE Luma DC condition
- A simple and straightforward fix was proposed.
  - Effectively not checking Chroma DC conditions for inter LFNST/NSPT
- It is recommended to adopt the proposed method in next ECM.

Thanks to OPPO and InterDigital for crosschecking!

# Appendix

- SW changes by the proposed fix (CABACWriter.ccp)

```
if (... && tu.blocks[compID].height >= 4 && tu.blocks[compID].width >= 4)
{
    const int lfnstLastScanPosTh = isLuma( compID ) ?
        ( CU::isIntra(*(tu.cu)) ? LFNST_LAST_SIG_LUMA : LFNST_LAST_SIG_LUMA_INTER )
        : LFNST_LAST_SIG_CHROMA;
    cuCtx->lfnstLastScanPos |= ( CU::isIntra( *( tu.cu ) ) || isLuma( compID ) ) ?
        ( cctx.scanPosLast() >= lfnstLastScanPosTh ) : false;
}
```

- One encoder fix is accompanied (in InterSearch.cpp), because
  - DC condition is not relevant to Chroma anymore.

```
//else if (cu.lfnstIdx && !cuCtx.lfnstLastScanPos)
else if( cu.lfnstIdx && ( isLuma( compID ) && !cuCtx.lfnstLastScanPos ) )
{
    currCompCost = MAX_DOUBLE;
}
```