

The background is a solid green color with a repeating pattern of white line-art icons. These icons include various nautical and marine elements such as anchors, lifebuoys, seashells, jellyfish, fish, and a sun. There are also some geometric shapes like triangles and circles scattered throughout.

**MEDIATEK**

**JVET-Q0196**

# **MTS redundancy removal**

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# Overall Summary

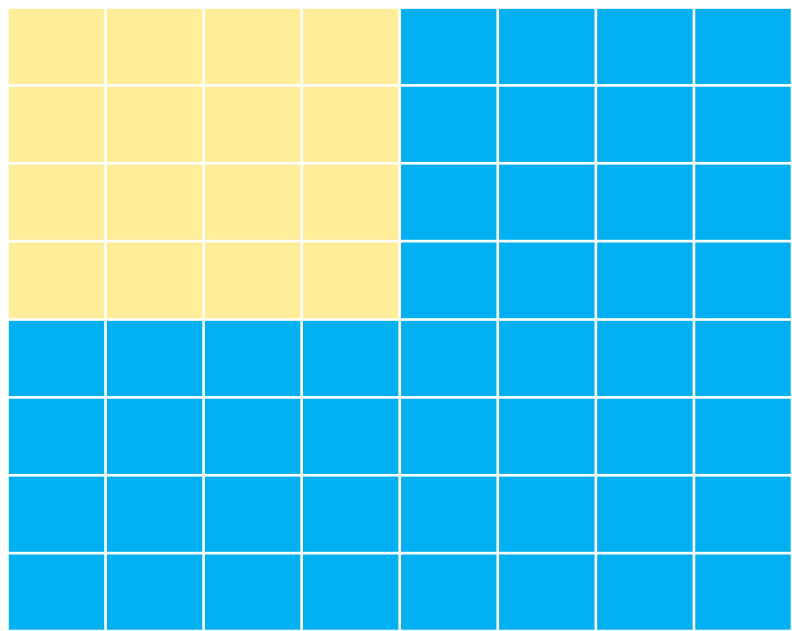
- A coefficient group (CG) significant flag checking is proposed to totally avoid the redundant multiple transform selection (MTS) index signalling

#	Config.	VTM-7.0		
		Y	U	V
Proposed method	AI	0.00%	0.00%	-0.01%
	RA	0.00%	-0.01%	0.02%
	LB	0.00%	-0.10%	-0.03%

# Introduction to MTS Signalling (1/2)

- In VVC, MTS is only applied to luma TBs
- When MTS is applied, transform coefficients outside the top left 16x16 region are zeroed out

Take 32 x 32 luma TB as an example  
Blue region: MTS zero-out region



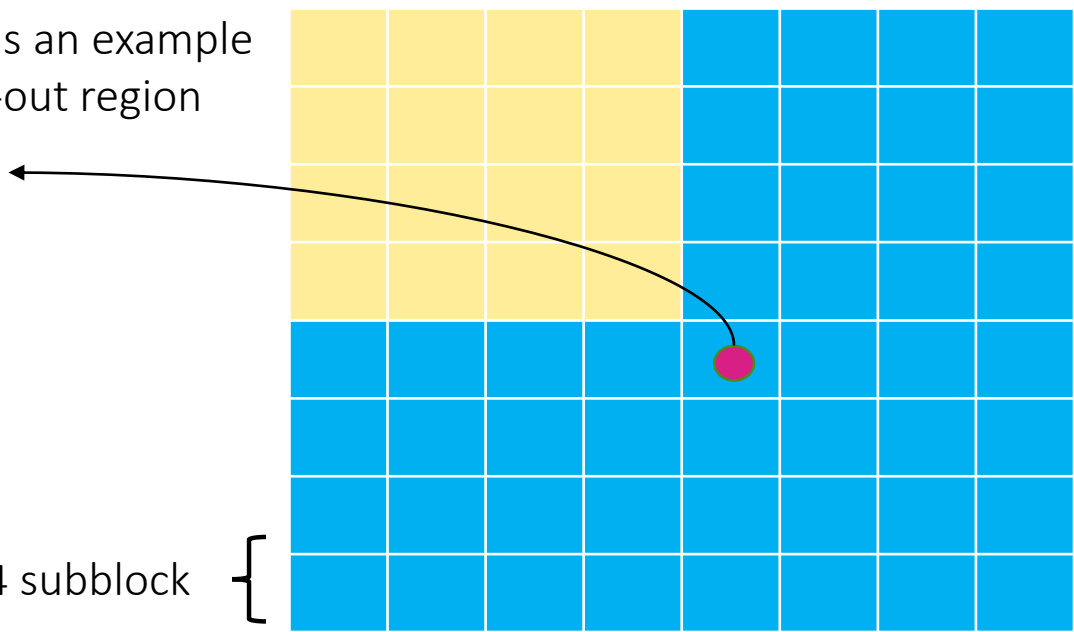
# Introduction to MTS Signalling (2/2)

- An MTS index is signalled at the end of CU
- When parsing each TB, if any transform coefficient is located in MTS zero-out region, this means MTS is not selected for this CU at encoder
  - In VVC, this case is checked by “the last significant coefficient”
  - If the last significant coefficient position is in MTS zero-out region, the MTS index is inferred to 0

Take 32 x 32 luma TB as an example

Blue region: MTS zero-out region

The last significant coefficient



# Redundancy of MTS Signalling

- However, using only the last significant coefficient position fails to prevent redundant MTS index signalling thoroughly
  - When the last significant coefficient position is located in the top left 16x16 region, **some coefficients** still could locate in MTS zero-out region
  - The MTS index is still signalled but always equal to 0
- This contribution proposes to completely clean up the redundant signalling for the MTS index

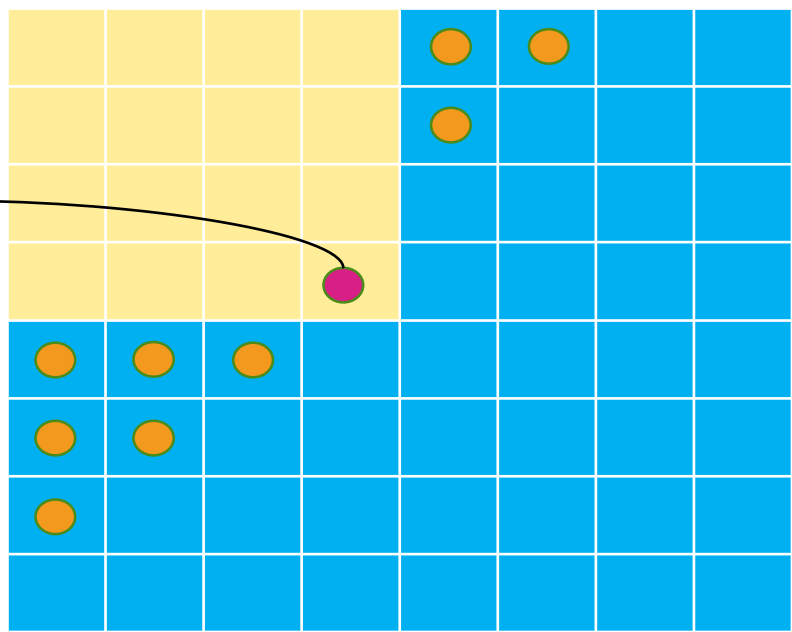
Take 32 x 32 luma TB as an example

Blue region: MTS zero-out region

The last significant coefficient

**Some coefficients  
located in MTS zero-out region**

Each grid means a 4x4 subblock



# Proposed Method

- When parsing each TB, a CG-level checking is applied
  - For those CGs located in MTS zero-out region, if the CG significant flag is true, the MTS index is inferred to 0
- The last significant coefficient position is not used to decide the MTS signalling

# Proposed Text

residual_coding( x0, y0, log2TbWidth, log2TbHeight, cIdx ) {
...
if( ( LastSignificantCoeffX > 15    LastSignificantCoeffY > 15 ) && cIdx == 0 )
MtsZeroOutSigCoeffFlag = 0
QState = 0
for( i = lastSubBlock; i >= 0; i-- ) {
startQStateSb = QState
xS = DiagScanOrder[ log2TbWidth - log2SbW ][ log2TbHeight - log2SbH ]
[ i ][ 0 ]
yS = DiagScanOrder[ log2TbWidth - log2SbW ][ log2TbHeight - log2SbH ]
[ i ][ 1 ]
inferSbDcSigCoeffFlag = 0
if( i < lastSubBlock && i > 0 ) {
<b>coded_sub_block_flag[ xS ][ yS ]</b>
inferSbDcSigCoeffFlag = 1
}
if( ( xS > 3    yS > 3 ) && coded_sub_block_flag[ xS ][ yS ] && cIdx == 0 )
MtsZeroOutSigCoeffFlag = 0
...
}

# Performance of Proposed Method

- The run time is not accurate
- Thank Nokia for cross-checking

All Intra Main10						Random access Main10					
Over VTM-7.0						Over VTM-7.0					
	Y	U	V	EncT	DecT		Y	U	V	EncT	DecT
Class A1	0.00%	-0.03%	0.01%	102%	103%	Class A1	0.01%	-0.07%	0.00%	102%	101%
Class A2	-0.01%	-0.01%	0.00%	102%	102%	Class A2	-0.05%	0.02%	-0.02%	102%	102%
Class B	0.00%	0.01%	-0.03%	101%	102%	Class B	0.02%	0.02%	0.06%	101%	104%
Class C	0.00%	0.00%	0.00%	102%	101%	Class C	0.00%	-0.04%	0.03%	101%	104%
Class E	0.00%	0.00%	-0.03%	101%	105%	Class E					
<b>Overall</b>	0.00%	0.00%	-0.01%	101%	102%	<b>Overall</b>	0.00%	-0.01%	0.02%	101%	103%
Class D	0.00%	0.03%	0.00%	102%	106%	Class D	0.00%	0.01%	-0.03%	101%	103%
Class F	0.00%	0.01%	0.00%	101%	101%	Class F	0.00%	-0.02%	-0.02%	102%	101%



# Conclusion

- Propose to clean up MTS signalling by checking CG significant flags
- Compared to VTM7.0 CTC, the proposed method results in negligible BD-rate changes
- The redundancy of MTS signalling is totally removed