

# **JCTVC-C405: Summary of HEVC working draft 1 and HEVC test model (HM)**

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# HEVC Test Model – High Efficiency and Low Complexity

Table 1: Structure of tools tools forming the HM.

High Efficiency	Low Complexity
Coding Unit 8x8 up to 64x64 in tree structure	
Prediction Units	
Transform unit tree (3 level max)	Transform unit tree (2 level max)
Transform block size of 4x4 to 32x32 samples	
Angular Intra Prediction (Max. 34 directions)	
DCT-based interpolation filter 12 tap	Directional interpolation filter 6 tap
Advanced motion vector prediction	
CABAC entropy coding	LCEC Phase 2
Internal bit-depth increase (4 bits)	X
X	Transform precision extension (4 bits)
Deblocking filter	
Adaptive loop filter	X

# HM high level summary by category

- Coding Structure
  - CTB/CU Quadtree
  - PU
  - RQT
- Intra Prediction
  - Angular Intra Prediction
- Inter Prediction
  - Interpolation Filter
    - DCT-IF 12-tap for High Efficiency and
    - DIF for Low Complexity
  - Advanced motion vector prediction
  - CU Merging + CU Skip / Direct
- Transforms
  - 4x4 to 32x32 transforms
- Entropy Coding
  - CABAC for High Efficiency
  - LCEC Phase 2 for Low Complexity
- Loop Filter
  - Deblocking Filter
  - Adaptive Loop Filter
- Others
  - Higher Level Syntax

# Coding Structure

- Tools adopted in HM
  - CTB / CU Quadtree
  - CU Splitting into PUs
  - RQT (JCTVC-C311, JCTVC-C319)
    - HE: 3-level QT
    - LC: LCEC phase 2 + 2-level QT is equivalent to LCEC phase 2 with RQT off
      - Includes Qualcomm CBP flag
    - Encoder Setting fast intra encode per JCTVC-C311
      - HHI\_RQT\_INTRA\_SPEEDUP = 1
      - HHI\_RQT\_INTRA\_SPEEDUP\_MOD=0
      - (Slower search for Intra modes to remain in software)
    - Same maximum QT depth for luma and chroma
- TMuC features for further investigation (Not in the HM)
  - Asymmetric Motion Partitions
  - Geometric Partitioning

# Intra Prediction

- Tools adopted in HM
  - Simplified Unified Intra Prediction (JCTVC-C042)
  - Encoder modification for intra prediction search (JCTVC-C207)
- TMuC features for further investigation (Not in the HM)
  - AIS – turn off, DEFAULT\_IS 0
  - CIP
  - Planar Prediction
  - Edge base prediction

# Inter Prediction

- Tools adopted in HM
  - Interpolation filters
    - HE: DCT-IF 12-tap
    - LC: DIF
  - Bi-direction rounding control
    - Rounding offset for bi-predictive rounding signalled. (0 or 1)
      - Enable this when IBDI is off and Disable when IBDI is on.
    - Encoder only modifications for software speedup. (JCTVC-C253)
  - CU Merging + CU Skip / Direct
  - Advanced motion vector prediction / Motion Vector Competition
  - Bi-directional prediction for Temporal Level 0 (JCTVC-C278, JCTVC-C285)
- TMuC features for further investigation (Not in the HM)
  - Interleaved MV Prediction (IMVP)
  - Adaptive Motion Resolution
  - Motion Vector Prediction Scaling
  - PU Merging + modified CU Skip / Direct
  - Partition Based Illumination Compensation.

# Transforms

- Tools adopted in HM
  - Transform block sizes of 4x4 up to 32x32 samples
- TMuC features for further investigation (Not in the HM)
  - MDDT
  - ROT
  - Transform block size 64x64 samples

# Entropy Coding

- Tools adopted in HM
  - CABAC for High Efficiency
  - LCEC Phase 2 for Low Complexity
  - Coefficient Sign PCP (JCTVC-B088 Section 3.2)
  - Coeff Level BinIdx 0 PCP (JCTVC-B088 Section 3.3)
  - Coded Block Flag signaling in VLC (JCTVC-C262)
  - Coded Block Flag redundancy removal (JCTVC-C277)
  - HHI Transform coefficient coding
- TMuC features for further investigation (Not in the HM)
  - PIPE / V2V

# Loop Filter

- Tools adopted in HM
  - Deblocking filter
  - Adaptive loop filter (ALF)
  - Signaling ALF quadtree in slice header
- TMuC features for further investigation (Not in the HM)
  - 3 Input ALF

# Others

- Tools adopted in HM
  - Higher Level Syntax (as decided in Geneva)
  - Bit depth support beyond 8 bits per sample decoding (4 bits)
  - Transform Precision Extension with 4 bit added precision for 8-bit decoding
  - RDOQ (encoder only)