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# **JVET-E0129: Subjective Quality Assessment for HM and JEM Video Codec Efficiency**

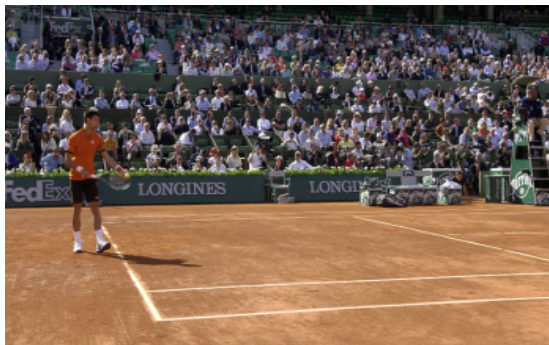
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## Subjective video quality comparison between HM16 and JEM 3.0 video codecs

- ▶ Confirm the objective quality advantage (25%-30%) shown by the JEM codec with respect to HM
- ▶ Weakness of objective quality metrics
- ▶ Does the JEM codec enhance the subjective video quality compared to HM ?



## Six video sequences in 4K resolution



Djoko 10p50 15s (4EVER)



Metro 10p60 10s (MPEG)



FoodMarket2 10p60 5s (MPEG)



Tango 10p60 5s (MPEG)



ToddlerFountain 10p60 5s (MPEG)



Voiles 10p50 15s (4EVER)

## HM16.7 and JEM3.0 video codecs

- ▶ JVET common test conditions
- ▶ Random Access coding configuration
- ▶ Constant QP

## Six 4K and six HD video sequences

- ▶ 4K sequences downsampled to HD with the SHM filter

## 8 bitrates in the operating range of broadcast scenario

- ▶ HD resolution: **0.5 - 1 - 1.5 - 2 - 3 - 4 - 6 - 8** Mbps
- ▶ 4K resolution: **2 - 4 - 6 - 10 - 12 - 16 - 20 - 24** Mbps
- ▶ 4 bitrates selected for each sequence and resolution

**In total 6 (sequences) x 2 (codecs) x 4 (bitrates) 48 HD and 48 4K bitstreams used in the experiment**



## Considered objective metrics

- ▶  $WPSNR = (6 \times YPSNR + UPSNR + VPSNR) / 8$
- ▶ Bjontegaard-Rate (BD-Rate)



## Subjective assessment methodology

- ▶ Degradation Category Rating (DCR) method according to ITU-T Recommendation P.910 (A+B+vote)
- ▶ Quality scores with rating scale from 1 (lowest quality) to 10 (highest quality)
- ▶ Psychovisual room complying with the ITU-R BT.500-13 Recommendation
- ▶ 65" LED-Backlit Ultra High Definition Professional Display (x651UHD) – NEC DisplayPort



## Subjective assessment methodology

- ▶ Seventeen observers, 10 men and 7 women aged from 18 to 44 years old
- ▶ Two sessions of 22 minutes corresponding to HD and 4K video sequences
- ▶ Training session

## Scores analysis

- ▶ Compute the Mean Opinion Score (MOS)

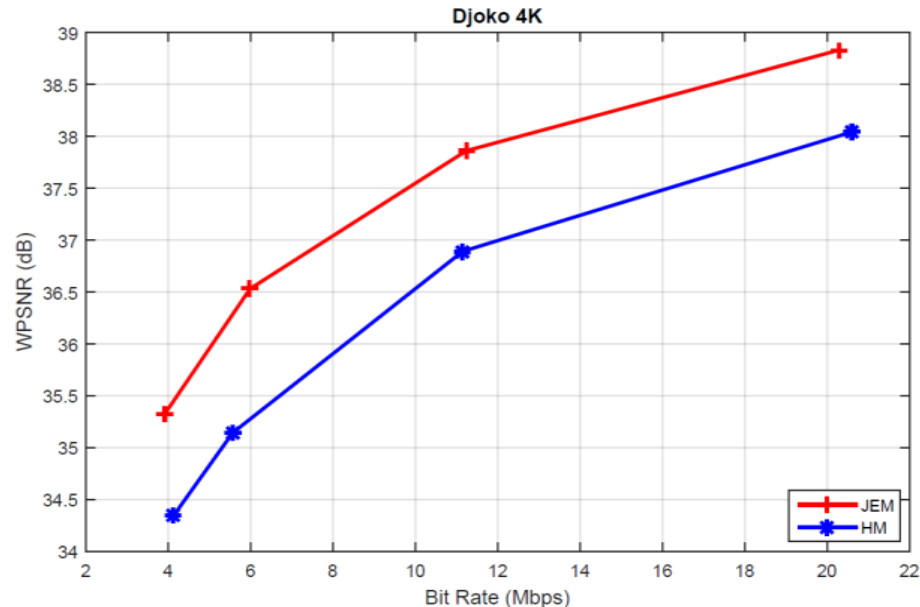
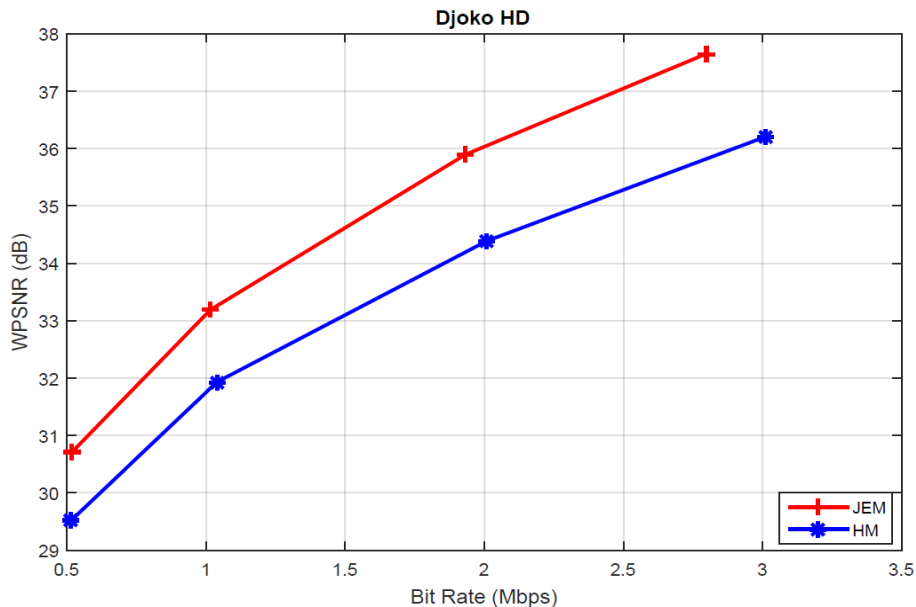
$$MOS_{jk} = \frac{1}{N} \sum_{i=1}^N S_{ijk}$$

- ▶ Compute confidence interval at 95%

$$C_{jk} = 1.95 \frac{\delta_{jk}}{\sqrt{N}} \quad \delta_{jk} = \sqrt{\sum_{i=1}^N \frac{(S_{ijk} - MOS_{jk})^2}{N}}$$

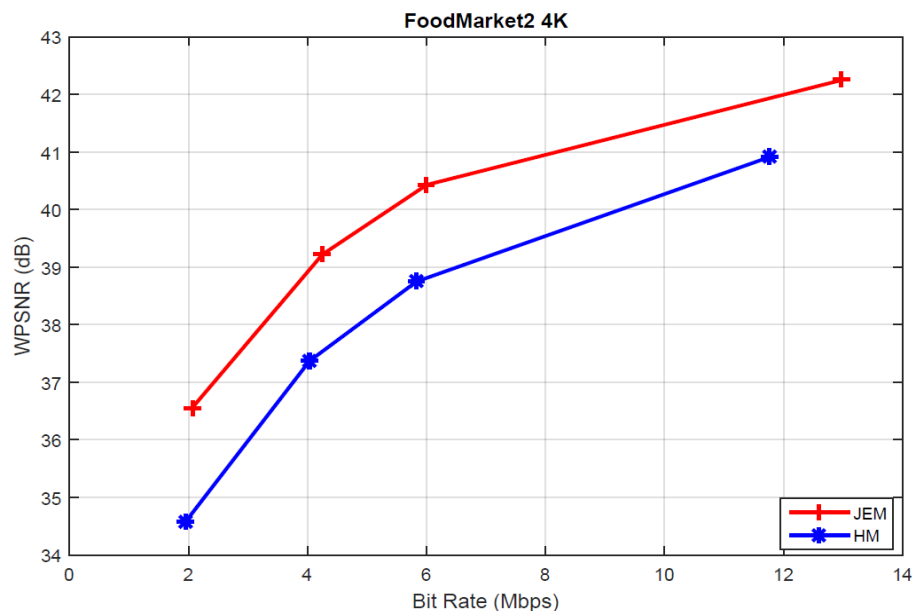
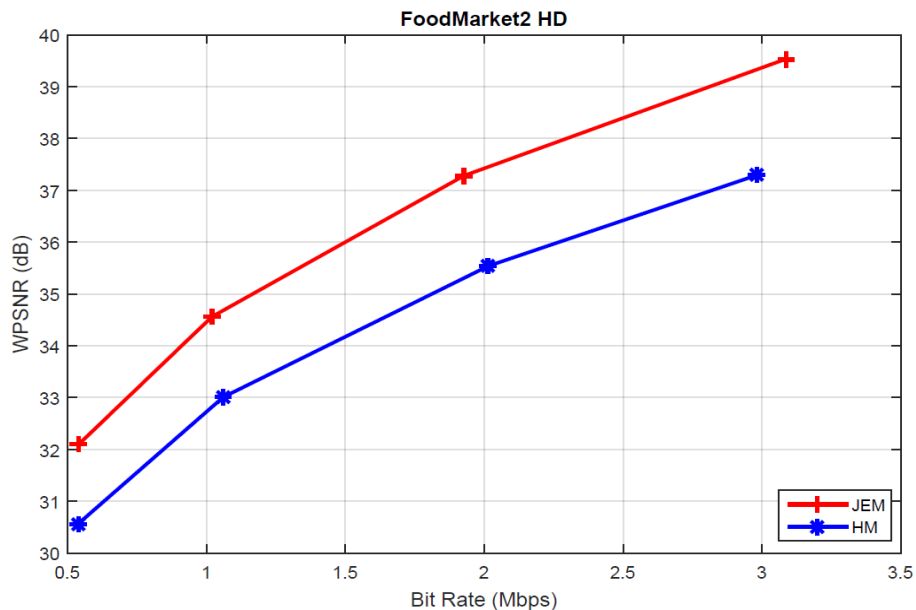
- ▶ Remove parasite data (two participants from the 4K session)

## WPSNR for Djoko HD and 4K

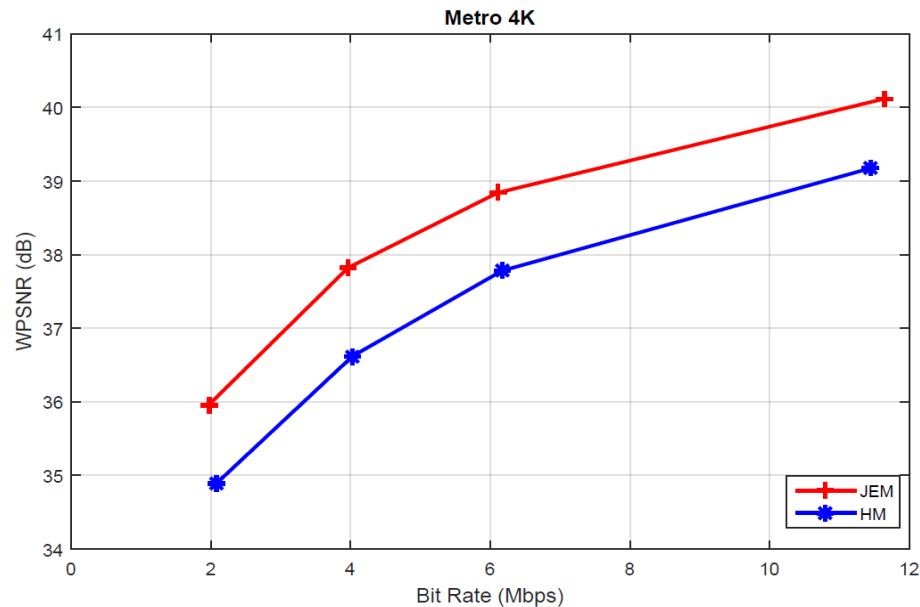
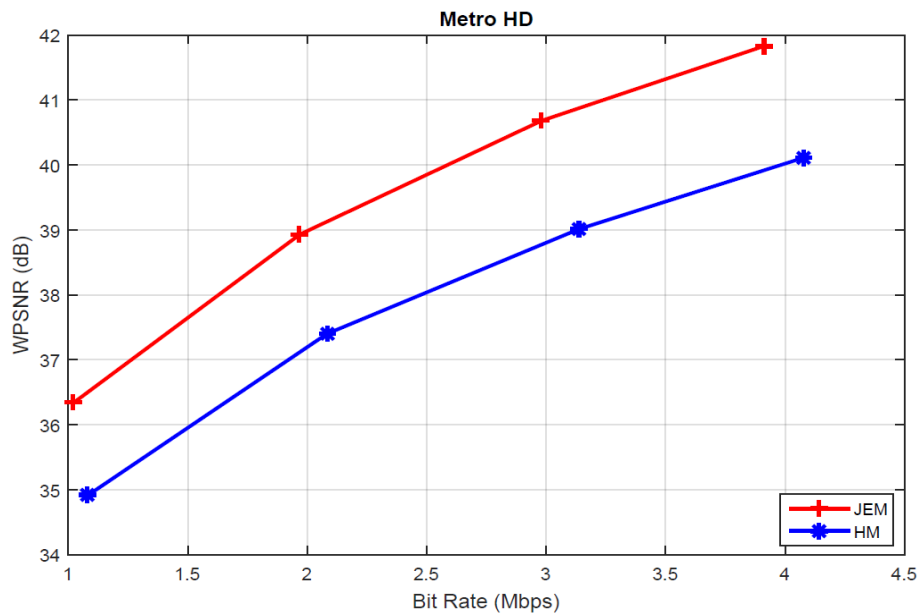




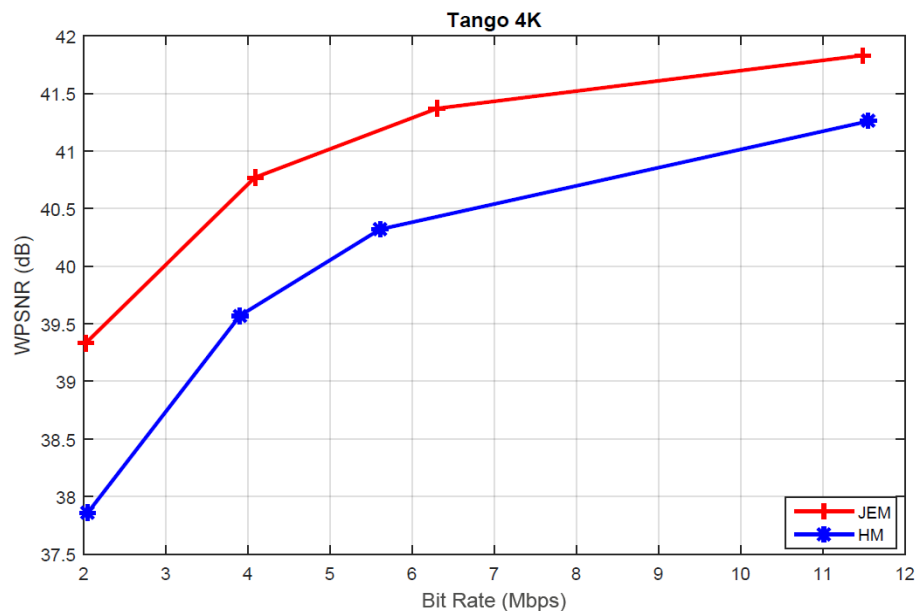
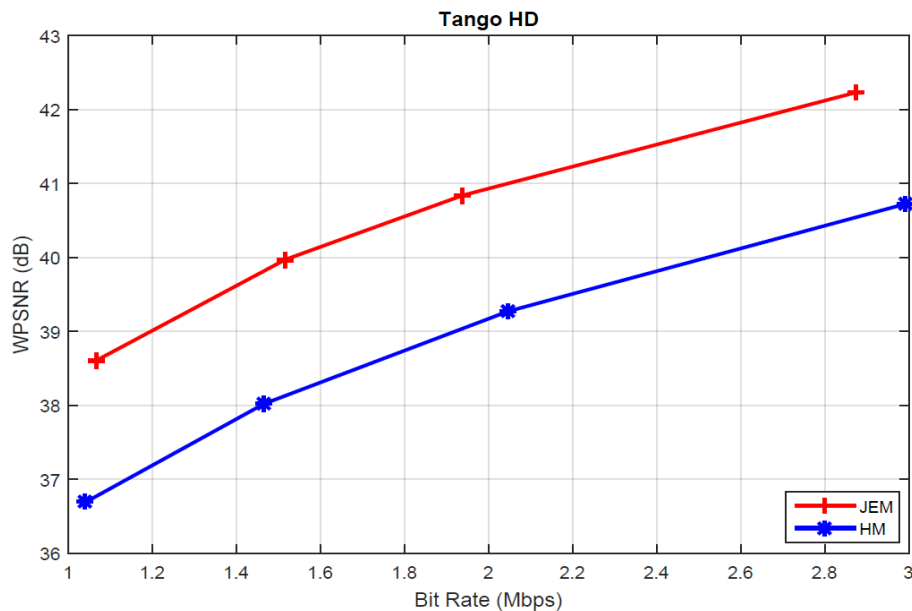
## WPSNR for FoodMarket2 HD and 4K



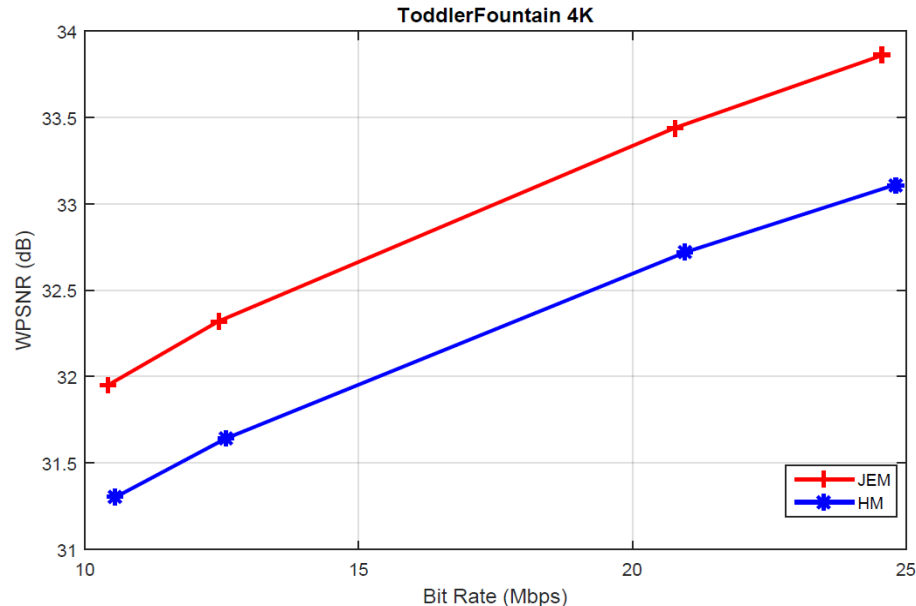
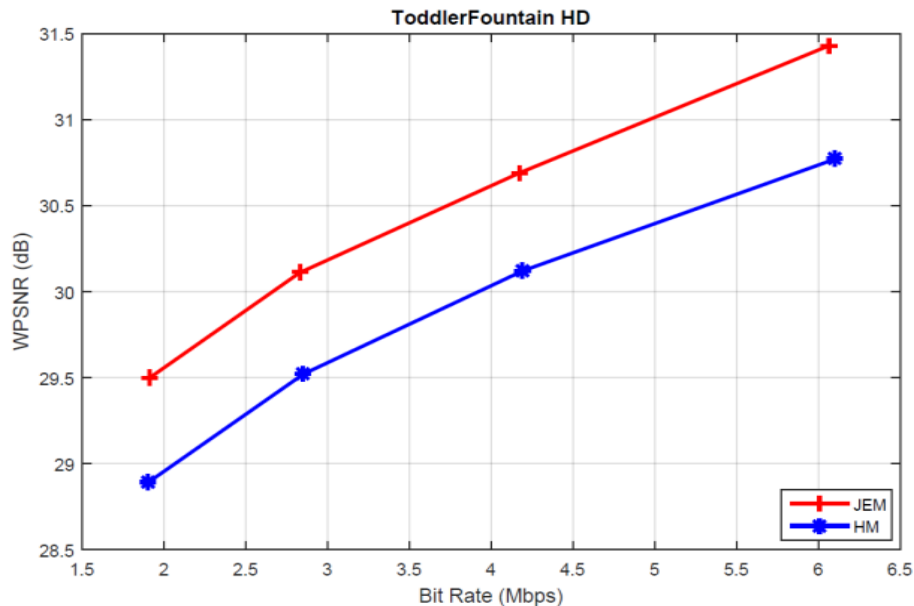
## WPSNR for Metro HD and 4K



## WPSNR for Tango HD and 4K

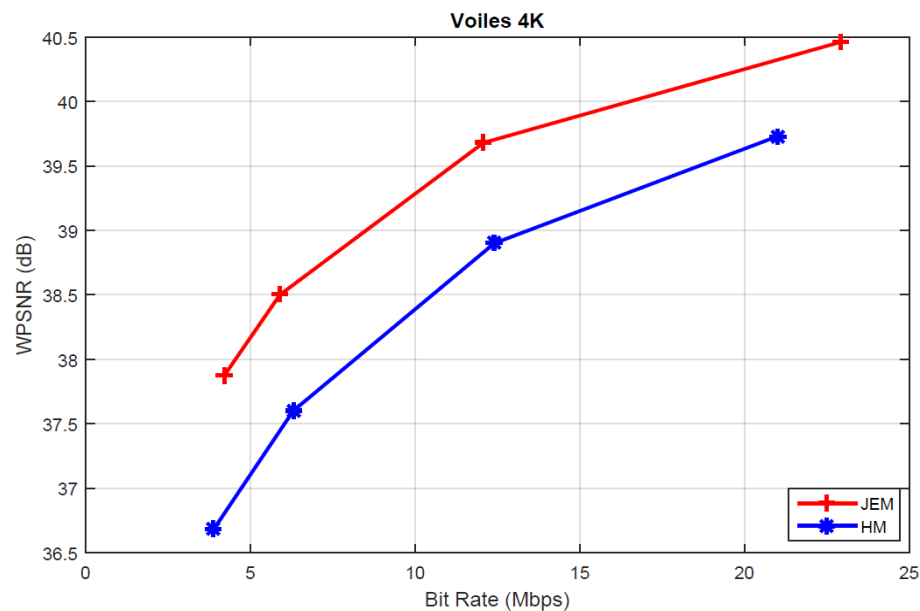
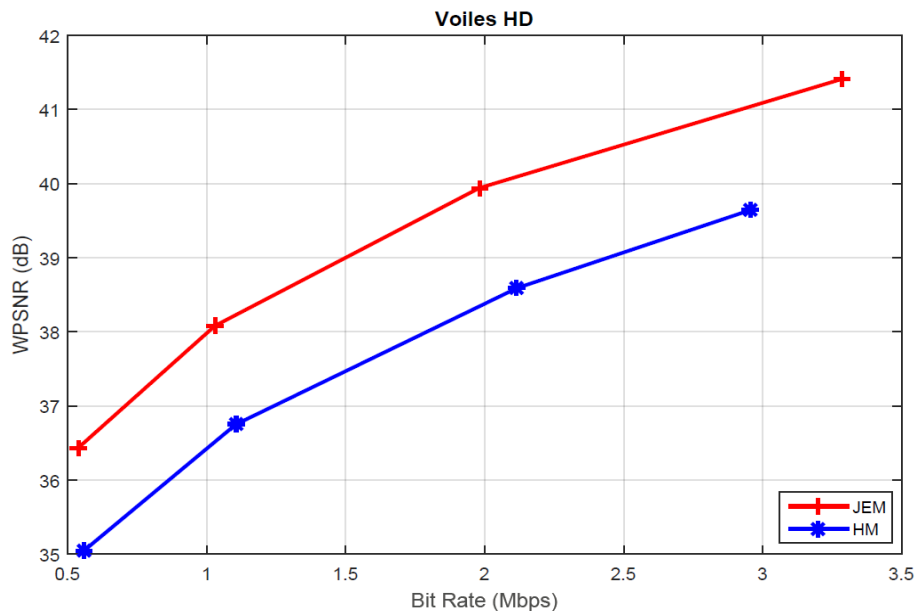


## WPSNR for ToddlerFountain HD and 4K





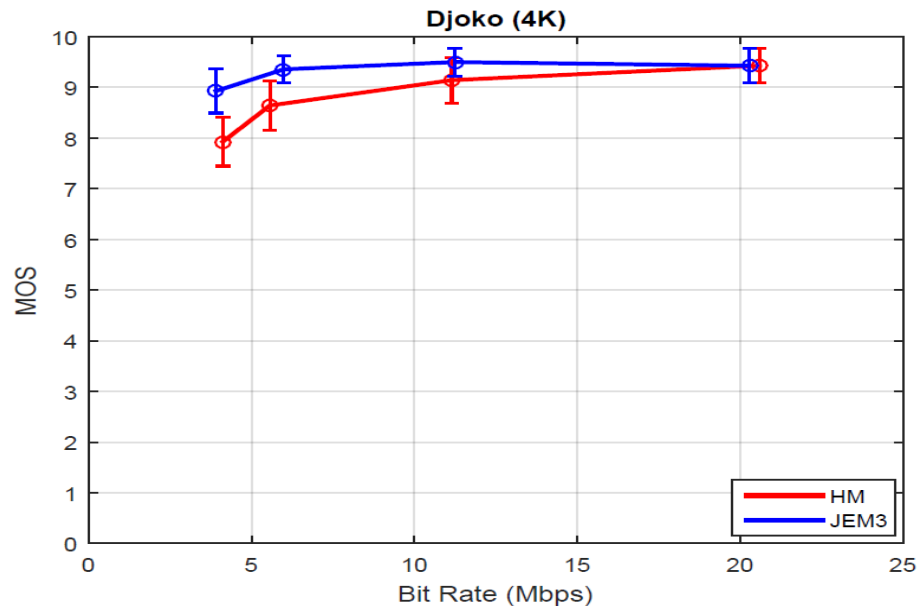
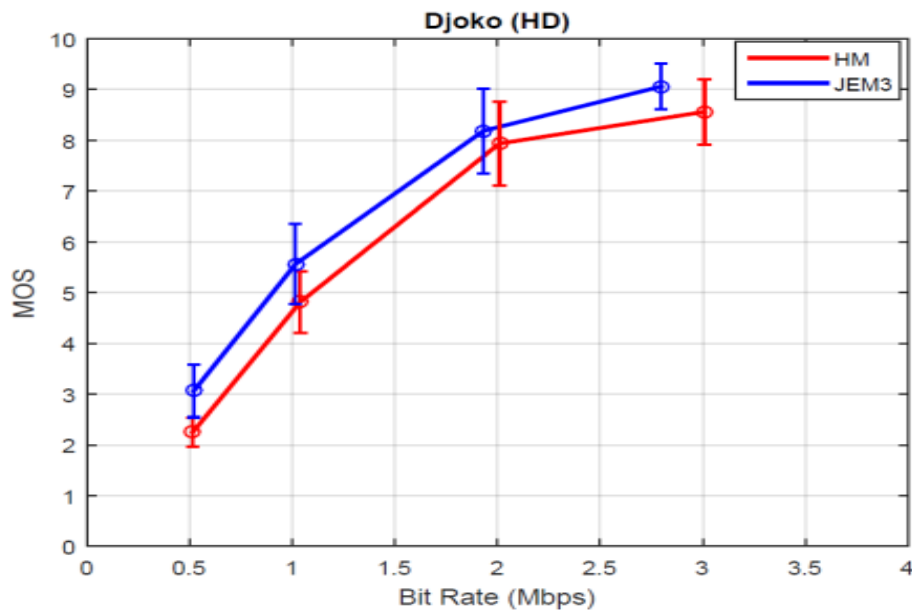
## WPSNR for Voiles HD and 4K



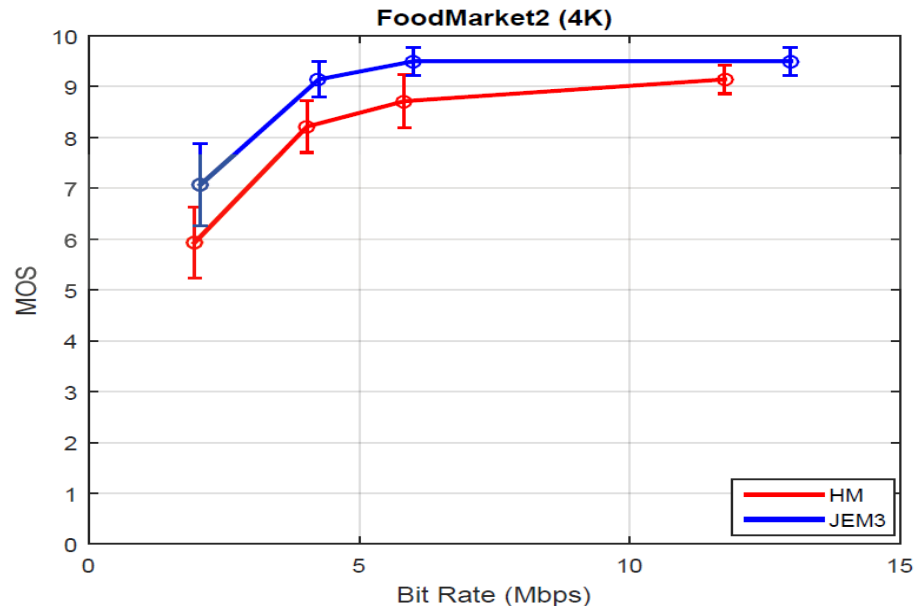
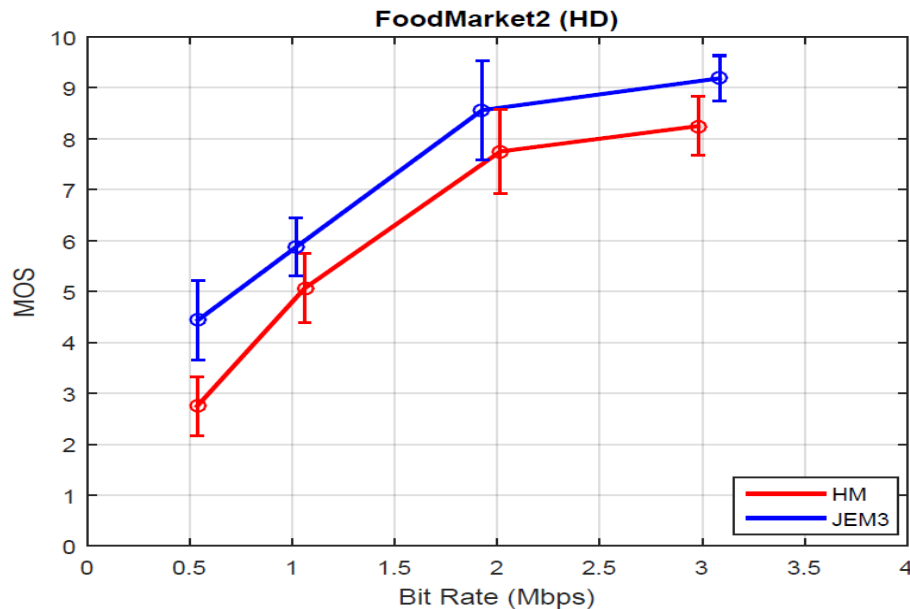
## BD-Rate performance

Video sequences	Djoko	FoodMarket2	Metro	Tango	ToddlerFountain	Voiles	Average
BD-Rate (HD)	-30.94%	-35.52%	-35.59%	-38.28%	-31.34%	-42.34%	-35.66%
BD-Rate (4K)	-37.17%	-36.31%	-37.21%	-42.18%	-28.45%	-40.83%	-37.02%

## MOS performance for Djoko HD and 4K

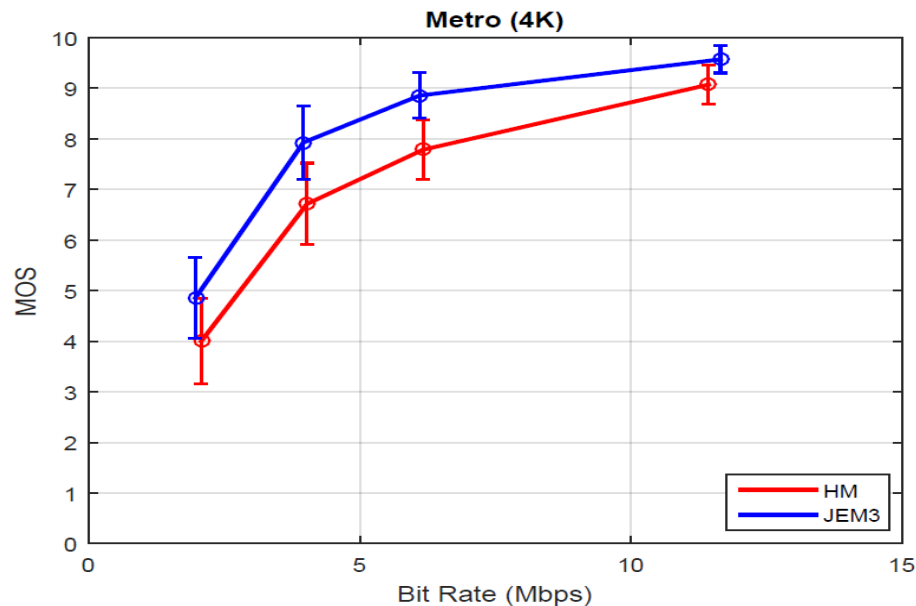
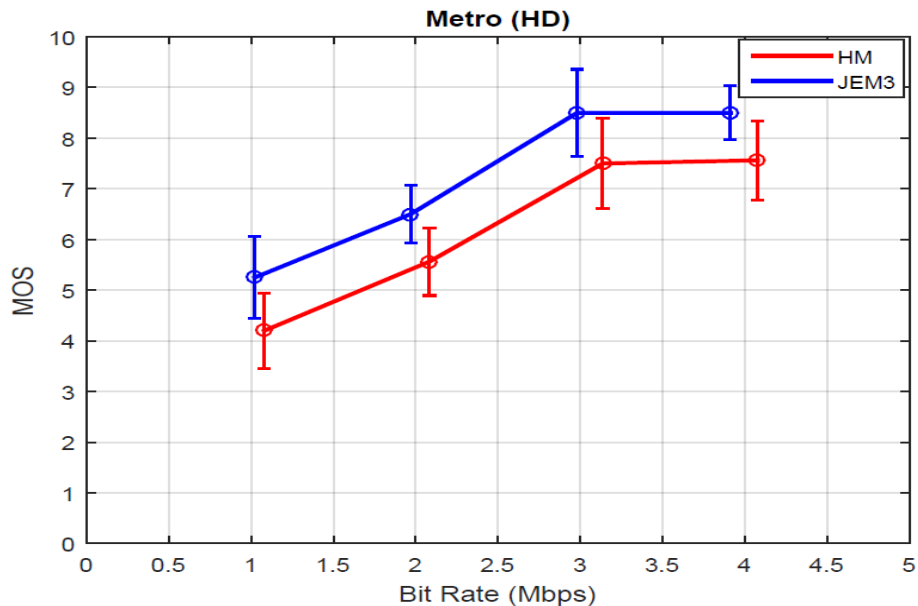


## MOS performance for FoodMarket2 HD and 4K

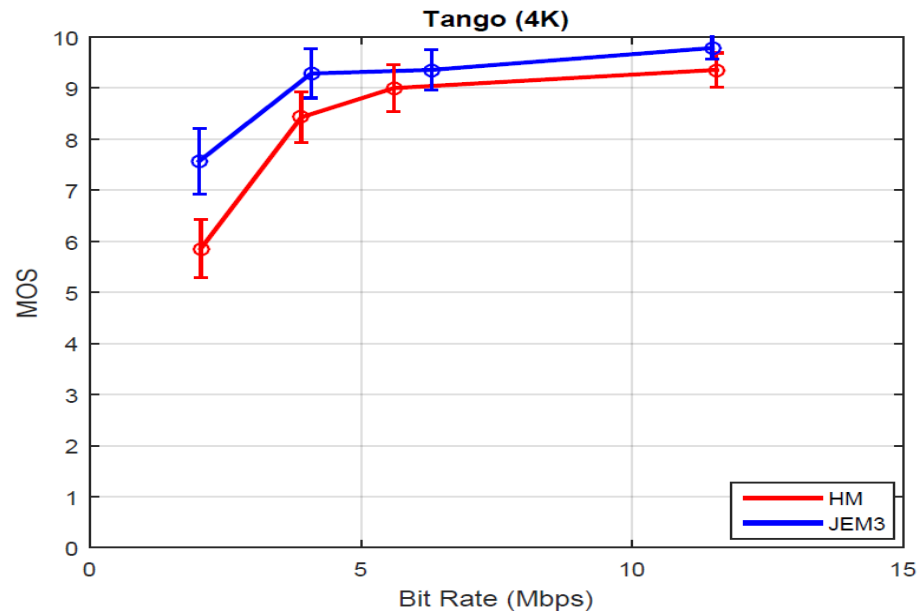
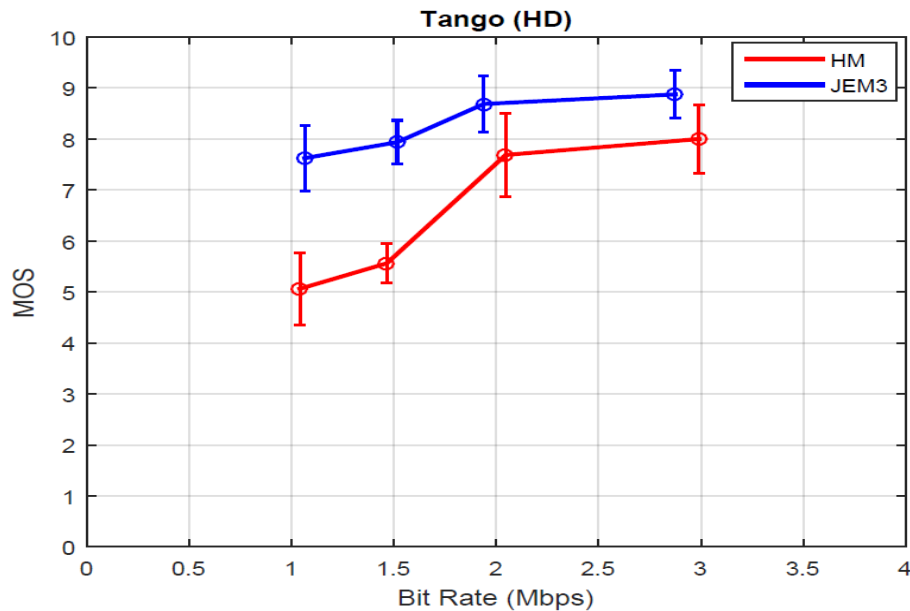




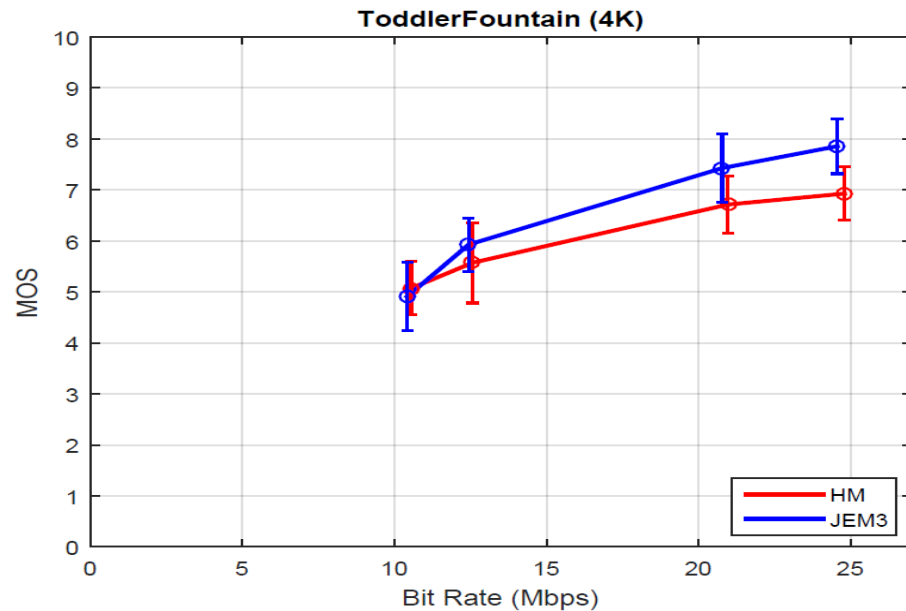
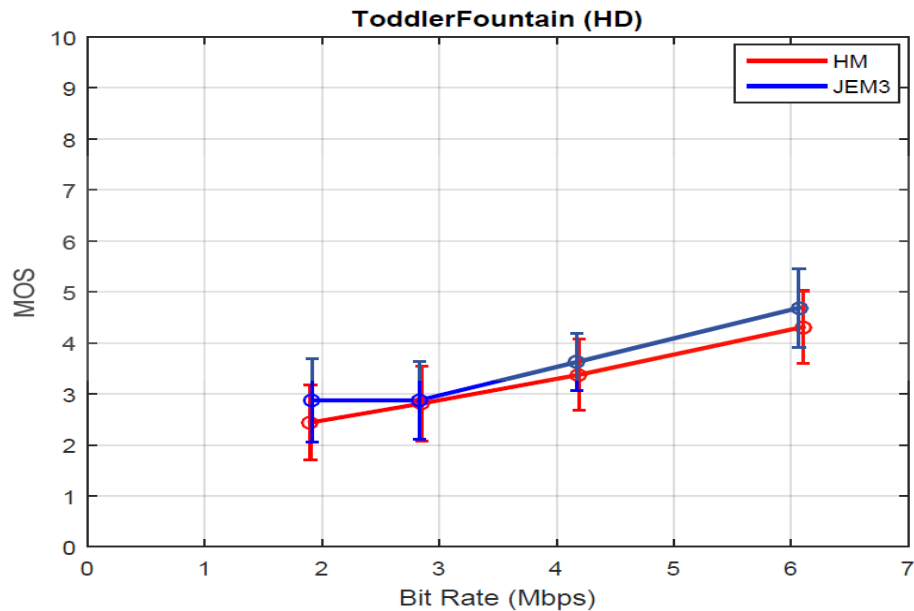
## MOS performance for Metro HD and 4K



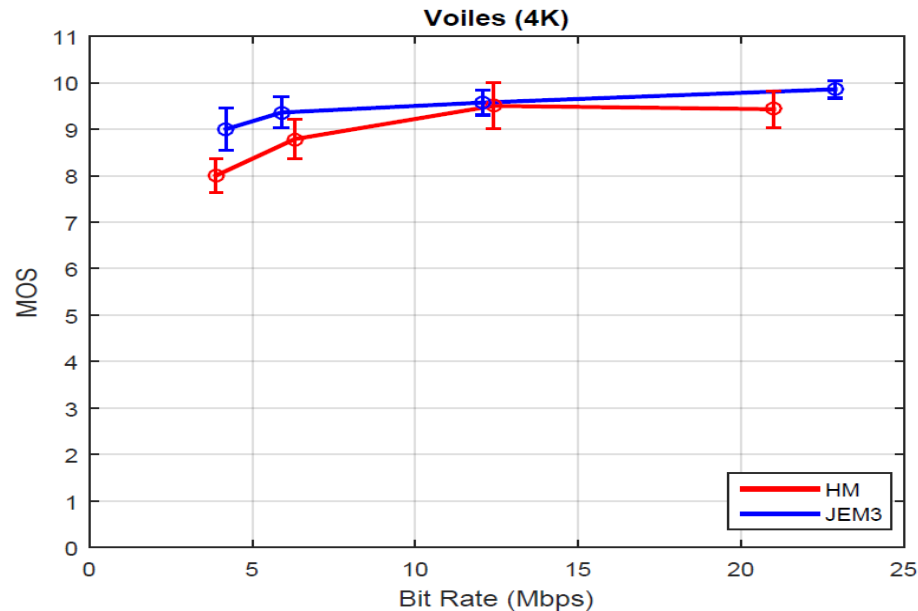
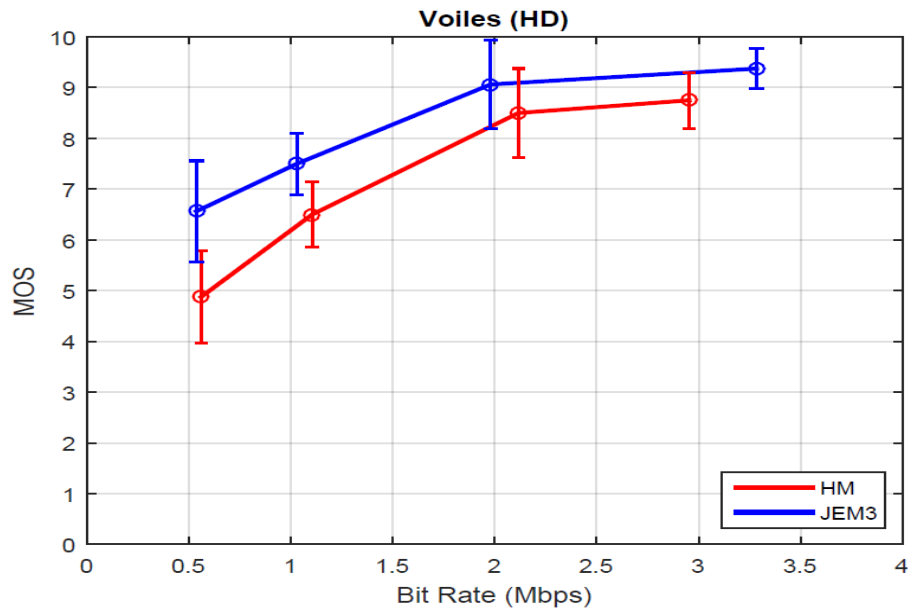
## MOS performance for Tango HD and 4K



## MOS performance for ToddlerFountain HD and 4K



## MOS performance for Voiles HD and 4K





## Four main observations

- ▶ JEM enables a significant subjective quality improvement compared to the HM
- ▶ Both HM and JEM achieve a high video quality at the considered high bitrates
- ▶ For ToddlerFountain video both codecs failed to reach a high video quality at the considered bitrates
- ▶ Subjective tests seem to confirm that the JEM bitrate saving is in the range of 20% to 30% overall

Questions ?

