

Proposed addition of new higher levels for MPEG-4 AVC/ITU-T H.264 (JVT-Y035)

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UHDTV: Ultra High Definition Television

- Higher resolution video system beyond HDTV
 - Two video formats: defined as LSDI (Large Screen Digital Imagery) formats in Rec. ITU-R BT.1769
 - 3840 x 2160 / up to 60p
 - 7680 x 4320 / up to 60p



Sensation of Reality

- An experiment using a large display showed that perception of reality increases with the broadening of viewing angle.
- Psychological evaluations and body-sway measurements led to set the viewing angle more than 100 arc-degrees.
- People with visual acuity of 1.0 can perceive 60 pixels per one arc-degree viewing angle.



60 pixels x 100 arc-degree = 6,000 pixels

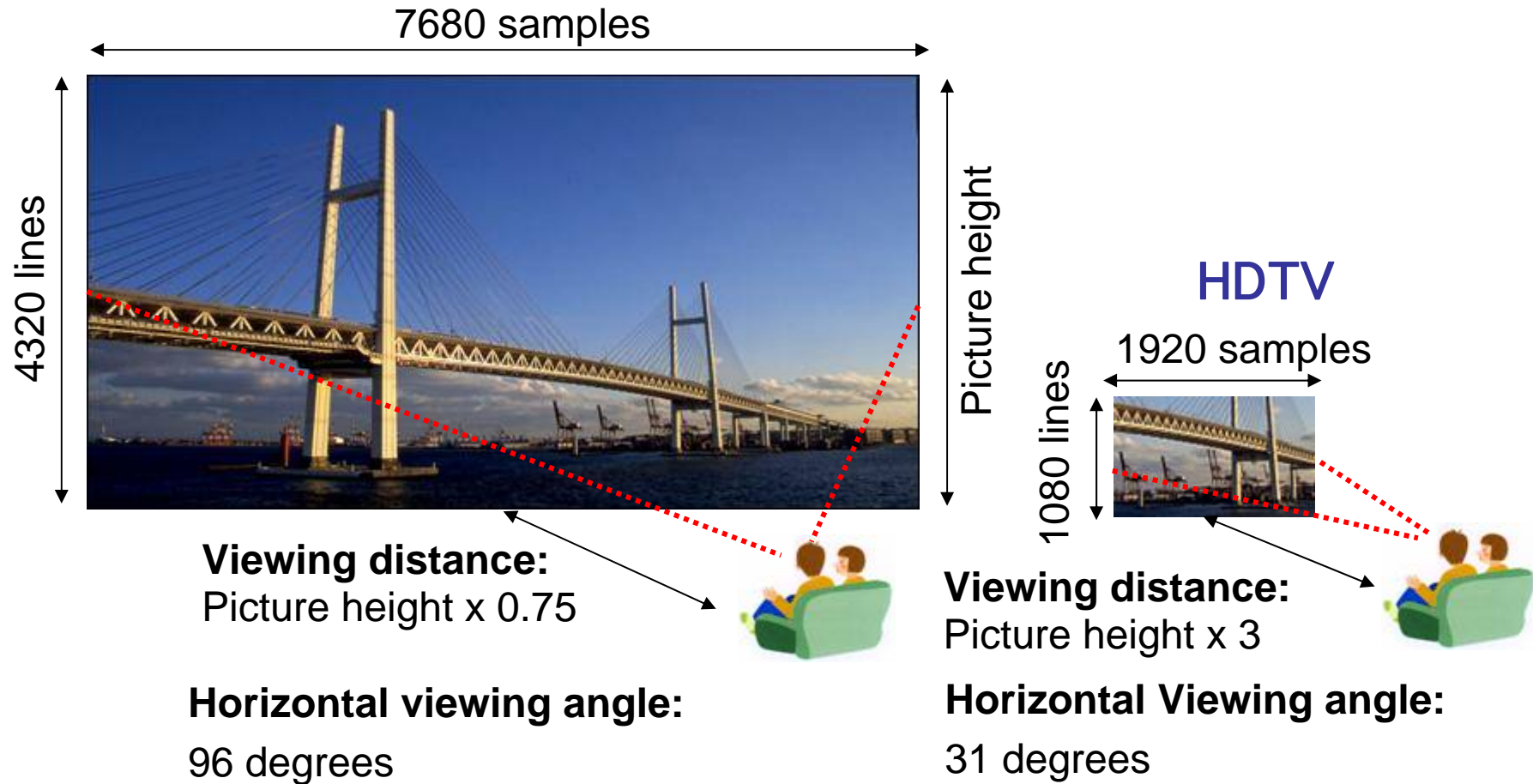
Need more than 6,000 pixels in horizontal direction

Adjustment to the current HDTV system

Horizontal: 4 times of 1,920 = 7,680 pixels

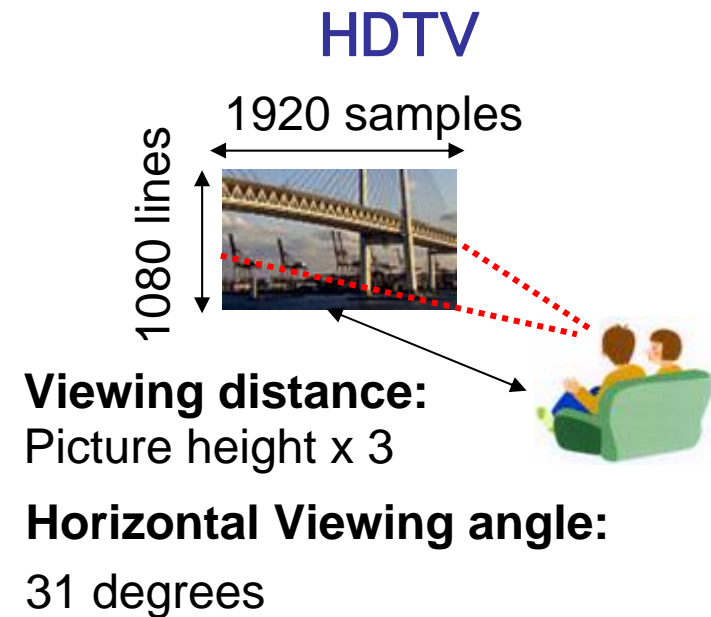
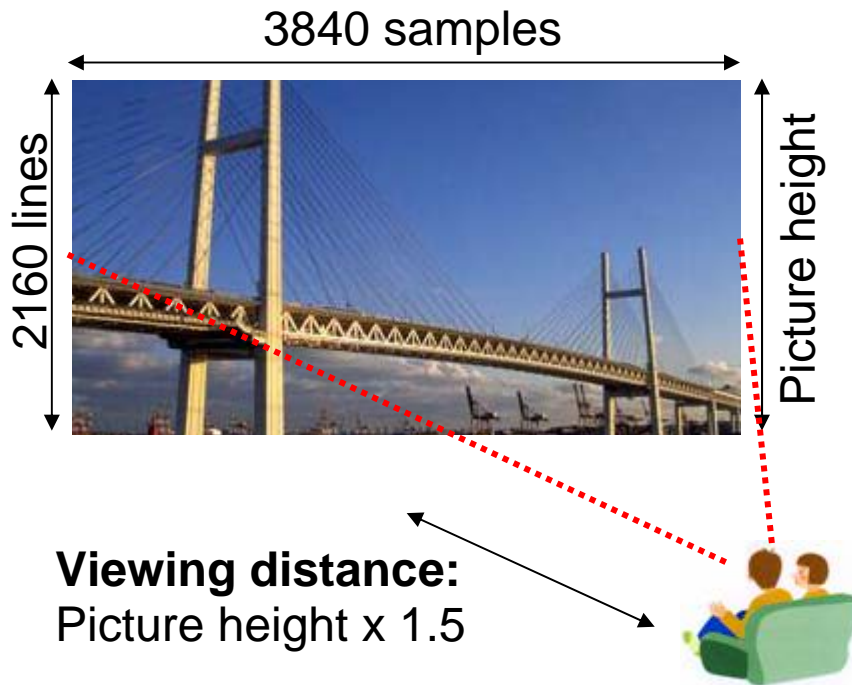
Vertical: 4 times of 1,080 = 4,320 lines

7680 x 4320 system



These values are calculated, assuming the distance at which scanning lines just cannot be perceived by people with visual acuity of 1.0.

3840 x 2160 system



These values are calculated, assuming the distance at which scanning lines just cannot be perceived by people with visual acuity of 1.0.

Standardization of UHDTV

- ITU-R Recommendation BT.1769
 - Parameters values for an expanded hierarchy of LSDI (Large Screen Digital Imagery) formats
 - ITU-T Recommendation J.601
 - Transport of LSDI applications for its expanded hierarchy
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Exhibitions of UHDTV

- The 2005 World Exposition, Aichi, Japan
 - UHDTV Theater
- NAB2006
- IBC2006
 - Theater and transmission systems (MPEG-2 based)



Live relay broadcast

- An experimental live relay broadcast of music show from Tokyo to Osaka for public viewing using commercial IP network on December 31, 2006.



Current maximum level of AVC/H.264

- Level 5.1

- Maximum frame size: 4096 x 2304
- Maximum frame rate for 3840 x 2160: 30.3fps



not support UHDTV formats

Proposal

- New levels for beyond HDTV applications
 - **Level 5.2** **3840 x 2160 / 60fps**
 - **Level 6** **7680 x 4320 / 30fps**
 - **Level 6.1** **7680 x 4320 / 60fps**
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Level limits (Table A-1)

Level number	Max macroblock processing rate MaxMBPS (MB/s)	Max frame size MaxFS (MBs)	Max decoded picture buffer size MaxDPB (1024 bytes for 4:2:0)	Max video bit rate MaxBR (1000 bits/s, 1200 bits/s, cpbBrVclFactor bits/s, or cpbBrNalFactor bits/s)	Max CPB size MaxCPB (1000 bits, 1200 bits, cpbBrVclFactor bits, or cpbBrNalFactor bits)	Vertical MV component range MaxVmvR (luma frame samples)	Min compression ratio MinCR	Max number of motion vectors per two consecutive MBs MaxMvsPer2Mb
5	589 824	22 080	41 400.0	135 000	135 000	[-512,+511.75]	2	16
5.1	983 040	36 864	69 120.0	240 000	240 000	[-512,+511.75]	2	16
5.2	1 966 080	36 864	69 120.0	400 000	400 000	[-512,+511.75]	2	16
6	3 932 160	147 456	276 480.0	960 000	960 000	[-512,+511.75]	2	16
6.1	7 864 320	147 456	276 480.0	1 600 000	1 600 000	[-512,+511.75]	2	16

Maximum frame rates (Table A-6)

Level:					5	5.1	5.2	6	6.1
Max frame size (macroblocks):					22 080	36 864	36 864	147 456	147 456
Max macroblocks/second:					589 824	983 040	1 966 080	3 932 160	7 864 320
Max frame size (samples):					5 652 480	9 437 184	9 437 184	37 748 736	37 748 736
Max samples/second:					150 994 944	251 658 240	503 316 480	1 006 632 960	2 013 265 920
Format	Luma Width	Luma Height	MBs Total	Luma Samples					
3616x1536 (2.35:1)	3616	1536	21 696	5 554 176	27.2	45.3	90.6	172.0	172.0
3672x1536 (2.39:1)	3680	1536	22 080	5 652 480	26.7	44.5	89.0	172.0	172.0
3840x2160 (16:9)	3840	2160	32 400	8 294 400	-	30.3	60.7	121.4	172.0
4Kx2K	4096	2048	32 768	8 388 608	-	30.0	60.0	120.0	172.0
4096x2304 (16:9)	4096	2304	36 864	9 437 184	-	26.7	53.3	106.7	172.0
7680x4320 (16:9)	7680	4320	129 600	33 177 600	-	-	-	30.3	60.7
8Kx4K	8192	4096	131 072	33 554 432	-	-	-	30.0	60.0
8192x4608 (16:9)	8192	4608	147 456	37 748 736	-	-	-	26.7	53.3