H.265 / HEVC Cheat Sheet

Profile, level, x265 recipes, patent calendar for 2026

Companion to article 3.5 of Block 3 (Codec Evolution). Print on A4 or US Letter.

Identity - three names, one standard

ITU-T H.265	Published by ITU-T VCEG; first edition Apr/Jun 2013; 8th edition 2024
ISO/IEC 23008-2	MPEG-H Part 2, published by ISO/IEC JTC 1/SC 29/WG 11
HEVC	High Efficiency Video Coding - the marketing-friendly name
Authors	JCT-VC: G. Sullivan (Microsoft), J.-R. Ohm (RWTH), T. Wiegand (HHI)

Profile @ Tier @ Level - what to ship where

Profile @ Tier @ Level	Resolution / fps	Max bitrate	Where it ships
Main @ Main @ 3.1	1280 x 720 @ 33	10 Mbps	Mobile, low-latency streaming
Main @ Main @ 4.1	2048 x 1080 @ 60	20 Mbps	1080p60 SDR streaming
Main 10 @ Main @ 4.1	2048 x 1080 @ 60	20 Mbps	1080p60 HDR streaming
Main 10 @ Main @ 5.0	4096 x 2160 @ 30	25 Mbps	4K30 streaming
Main 10 @ Main @ 5.1	4096 x 2160 @ 60	40 Mbps	DEFAULT: 4K HDR + UHD Blu-ray
Main 10 @ High @ 5.1	4096 x 2160 @ 60	160 Mbps	UHD broadcast, ATSC 3.0
Main 4:2:2 10 @ High @ 5.1	4096 x 2160 @ 60	160 Mbps	Broadcast contribution, XAVC-HS
Main 4:4:4 16 Intra @ High	up to 4K @ 60	n/a (intra)	Studio mastering, lossless
SCC @ Main @ 5.1	4K30/60	40 Mbps	Cloud gaming, remote desktop
Main 10 @ High @ 6.2	8192 x 4320 @ 120	800 Mbps	8K broadcast, future use

FFmpeg + x265 recipes you will actually use

1080p60 SDR VOD, Main 10, CRF 22:

```
ffmpeg -i in.mov -c:v libx265 -preset slow -crf 22 -profile:v main10 \
  -pix_fmt yuv420p10le -x265-params level=4.1 -tag:v hvc1 out.mp4
```

4K HDR10 master, Main 10, High tier, Level 5.1:

```
ffmpeg -i in.mxf -c:v libx265 -preset slower -profile:v main10 \
  -pix_fmt yuv420p10le -x265-params 'level=5.1:tier=high:colorprim=bt2020 \
  :transfer=smpte2084:colormatrix=bt2020nc' -tag:v hvc1 out.mp4
```

Live ingest, 1080p30, Main tier Level 4.0, fixed 2 s keyframes:

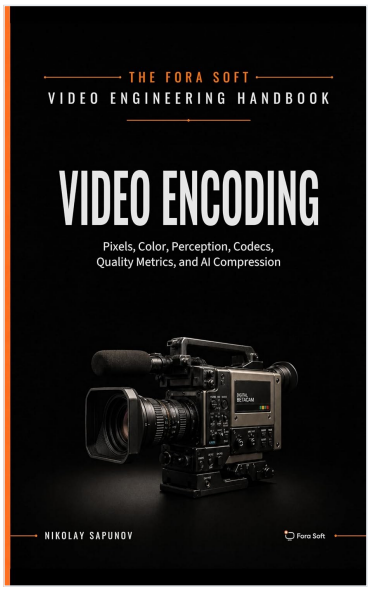
```
ffmpeg -re -i in -c:v libx265 -preset veryfast -profile:v main \
  -x265-params 'level=4.0:keyint=60:min-keyint=60' -b:v 5500k \
  -maxrate 5500k -bufsize 11000k -tag:v hvc1 -f flv rtmp://ingest/key
```

Patent pool calendar (2026)

- Two active pools in 2026: Access Advance (HEVC Advance + VCL Advance / ex-Via LA) and Velos Media.
- Approx. 15-25% of essential HEVC patents are held outside any pool (GreyB 2024 estimate).
- Access Advance device royalty rose 25% on 1 Jan 2026 for new licensees.
- Deadline to lock pre-increase rates: 30 June 2026 (extended Jan 2026 from earlier deadline).
- Velos Media: flat $0.20/device, no content royalty.
- Multi-Codec Bridging Agreement (MCBA) discount when combining HEVC + VVC.
- AAC audio + Dolby Vision / Atmos are separate licence chains - clear them in the same model.

Why HEVC is ~50% smaller than H.264

- Coding Tree Units: blocks up to 64x64 (H.264 fixed 16x16), quadtree down to 8x8.
- 35 intra-prediction modes (H.264 has 9): tighter directional match, smaller residual.
- Better motion: 8-tap luma interpolation, AMVP, merge mode for free copy from neighbours.
- Two in-loop filters: deblocking then Sample Adaptive Offset (SAO) - kills smooth banding.
- Parallelism baked in: Tiles, WPP, Dependent Slices - 4K60 decodes on commodity cores.



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This sheet covers HEVC profiles and levels, working x265 recipes and the 2026 patent-pool picture. Volume 1 explains the codec behind those settings: coding tree units, intra and inter prediction, in-loop filters and SAO, rate control in x265, and how HEVC compares with H.264 and AV1 at matched quality.

WHAT YOU WILL FIND INSIDE

- Coding tree units, prediction modes and SAO
- x265 presets and rate control
- Profiles, tiers and levels for HDR and 4K
- HEVC against H.264 and AV1 at matched VMAF

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Shipping HEVC for Apple and 4K HDR and worried about licensing?

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