

## Which compression technology should be used?

Different technologies are widely used to compress and transports broadcast video:

- Uncompressed over fiber
- JPEG-2K or AVC-I Intra-frame technologies requiring high bit-rate
- MPEG-4 or MPEG-2 long GOP technologies requiring low bit-rate

Remark: AVC-I stands for MPEG-4 Intra frames-only technology (MPEG-4/H.264 High 4:2:2 Intra Profile)

The best technology quality-wise is the uncompressed technology because no degradation is introduced. But it usually needs fiber for transport. The following chart gives the different bit-rates depending on the video format.

576i25	480i30	720p50	720p60	1080i25	1080i30	1080p50	1080p60
0,207 Gbps	0,207 Gbps	0,922 Gbps	1,106 Gbps	1,037 Gbps	1,244 Gbps	2,074 Gbps	2,488 Gbps

Legend:

- The first number is the number of lines per image (576i25 means 576 lines)
- The letter 'i' or 'p' is for interlaced (2 fields per image) or progressive (1 frame per image)
- The 2<sup>nd</sup> number is the number of images per second
- 576i25 and 480i30 are Standard Definitions (SD), others are High Definition (HD)

The following table gives the additional use cases for 3D (left and right full frames):

3D 1080i25	3D 1080i30	3D 1080p50	3D 1080p60
2,074 Gbps	2,488 Gbps	4,147 Gbps	4,977 Gbps

Other technologies are used at different bit-rate operating points depending on video resolutions. The following table gives customary used bit-rate ranges depending on the CODEC choice for the five standard video resolutions:

- SD: 576i25 & 480i30 (0,2 Gbps uncompressed)
- HD: 720p50, 720p60, 1080i25 & 1080i30 (0.9 to 1.2 Gbps uncompressed)
- HD 1080p: 1080p50 & 1080p60 (2 to 2.5 Gbps uncompressed)
- 3D HD: two 1080i25 or 1080i30 video (2 to 2.5 Gbps uncompressed)
- 3D 1080p: two 1080p50 or 1080p60 video (4 to 5 Gbps uncompressed)

Bit-rate (Mbps)	SD	HD	HD 1080p	3D HD	3D 1080p
<b>Lossless JPEG-2000</b>	110	600	1200	1200	2400
<b>JPEG-2000</b>	20-80	100-400	200-800	200-800	400-1600
<b>AVC-I</b>	15-40	55-150	120-300	120-300	240-600
<b>MPEG-2 long GOP</b>	6-20	25-100	NA	NA	NA
<b>MPEG-4 long GOP</b>	4-15	10-60	20-80	20-120	40-160

Note: blue colors means that bit-rates are compatible with Satellite or Contribution over fiber link (part of the range for Satellite). Red colors means that bit-rates are only compatible with Contribution over fiber link.

JPEG-2K and AVC-I are intra frame technologies. This means that each image of a video sequence is independently encoded:

- These technologies are editable.
- AVC-I technology is the newest with a better efficiency.
- These 2 technologies encode natively 10-bit video without truncation.
- 1080p videos have twice the pixels than 1080i video. As no optimization is possible with inter-frames coding, bit-rates are also doubled leading to very high bit-rates.

MPEG-2 long GOP and MPEG-4 long GOP are inter-frames technologies using motion compensation to reduce the bit-rate. This explains why 1080p videos don't need to double the bit-rate but only a moderate increase of about 30%.

- MPEG-2 long GOP has been editable for some time now, but it still not yet widely the case for MPEG-4 long GOP.
- MPEG-4 long GOP can be configured to process natively 10-bit or be limited to 8-bit as is the case with MPEG-2
- MPEG-4 technology is the newest with a better efficiency (roughly 50% bit-rate reduction at the same video quality compared to MPEG-2 with the highest-end).
- MPEG-4 can encode every format up to 3D 1080p with a bit-rate lower than 155 Mbps (STM1).