Digital Audio Basics — Cheat Sheet

Sample rate, bit depth, the Nyquist rule, and raw PCM bitrates at a glance.

The two dials

Sample rate	How often you measure the wave. 48 kHz = 48,000 measurements/second. Standard for video.
Bit depth	How precisely each measurement is stored. 16-bit = 65,536 levels; 24-bit = 16.7 million.

Rules of thumb

- Nyquist: sample at least 2x the highest frequency you want to keep. 2 x 20 kHz = 40 kHz minimum.
- Dynamic range (dB) ~ 6.02 x bit depth + 1.76. 16-bit ~ 96 dB; 24-bit ~ 144 dB.
- Raw bitrate = sample rate x bit depth x channels.
- Higher numbers are not automatically better. Past 48 kHz / 16-bit you capture all the ear can hear.
- Use 32-bit float when recording or editing (headroom), not for final delivery.

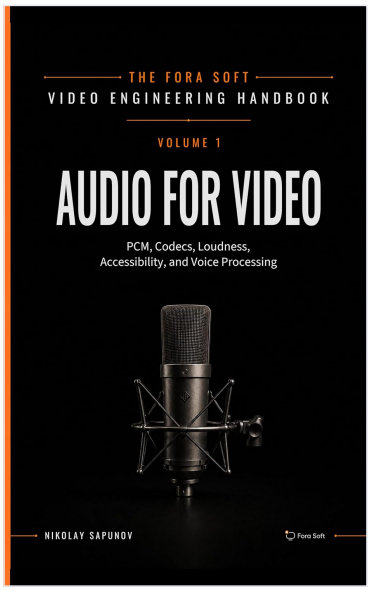
Raw PCM bitrate by use case

Use case	Sample rate	Bit depth	Channels	Raw bitrate
Telephone (G.711)	8 kHz	8-bit	mono	**64 kbps**
Conferencing (wideband)	16 kHz	16-bit	mono	**256 kbps**
Video production	48 kHz	24-bit	stereo	**2,304 kbps**
CD music	44.1 kHz	16-bit	stereo	**1,411 kbps**
Hi-res master	96 kHz	24-bit	stereo	**4,608 kbps**

Worked example — CD-quality stereo

44,100 samples/s x 16 bits x 2 channels = 1,411,200 bits/s
= 1,411 kbps ~ 10 MB per minute of uncompressed audio.
Codecs (AAC, Opus, MP3) shrink this PCM stream; the samples are what they compress.

Companion to: 'What Is Digital Audio: From Sound Wave to Bits'
www.forasoft.com/learn/audio-for-video/articles-audio/what-is-digital-audio



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This sheet covers sample rate, bit depth, the Nyquist rule and raw PCM bitrates. Volume 4 starts from exactly these basics and goes deep: sampling, bit depth and dynamic range, channels and layouts, loudness and LUFS, and codecs from Opus to AAC.

WHAT YOU WILL FIND INSIDE

- Sampling and bit depth
- Channels and layouts
- Dynamic range and loudness (LUFS)
- Opus, AAC and speech codecs

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