

Lossy vs lossless, PCM vs container, FLAC vs ALAC, the 4 GB ceiling, and which format to pick.

Lossy vs lossless

Lossy (MP3, AAC): deletes detail to shrink the file. Output is NOT the original. Like a JPEG.

Lossless (FLAC, ALAC): compresses reversibly. Output = original, sample for sample. Like a ZIP.

Two layers: the audio and the box

PCM = the raw audio (the numbers). WAV / AIFF / BWF store it raw; FLAC / ALAC pack it smaller, reversibly.

Quality lives in the PCM, not the container. All five decode to the same samples.

Format comparison

Format	Compression	Decoded	Best fit
WAV	None (raw PCM)	= original	Universal exchange, editing
AIFF	None (raw PCM)	= original	Apple / pro editing (big-endian)
BWF	None (raw PCM)	= original	Film & broadcast masters (+bext)
FLAC	Lossless ~50-70%	= original	Web, archives, broad support
ALAC	Lossless ~50-70%	= original	Apple ecosystem

Watch out: the 4 GB WAV ceiling

Classic WAV / AIFF / BWF use a 32-bit size field -> max ~4 GB. A long 5.1 record overruns it.

Fix: RF64 (EBU Tech 3306) -> 64-bit sizes, ceiling ~16 exabytes.

Rule of thumb

- Master / edit / exchange** -> WAV (or BWF for film & broadcast)
- Lossless storage or delivery** -> FLAC for widest support
- Apple-only audience** -> ALAC, native playback
- Most viewers, smallest files** -> lossy AAC — not lossless