SO MANY BITS, IT HERTZ: DIGITAL RECORDING S & SOUND QUALITY

Andrew Justice
University of North Texas
Blue - Original

Red - Compressed
1983

<table>
<thead>
<tr>
<th>Uncompressed (raw)</th>
<th>Lossless Compression</th>
<th>Lossy Compression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waveform Audio File Format (WAV)</td>
<td>Apple Lossless Audio Codec (ALAC / MP4)</td>
<td>Advanced Audio Coding (AAC)</td>
</tr>
<tr>
<td>Audio Interchange File Format (AIFF)</td>
<td>Free Lossless Audio Codec (FLAC)</td>
<td>MPEG-2 Audio Layer III (MP3)</td>
</tr>
<tr>
<td>Resource Interchange File Format (RIFF): bitstream method for storing data in chunks</td>
<td>Shorten (SHN)</td>
<td>Ogg Vorbis</td>
</tr>
<tr>
<td></td>
<td>Windows Media Lossless (WMA Lossless)</td>
<td>Windows Media Audio (WMA)</td>
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</tbody>
</table>

**Key:** bitrate.
COMPARISON: POP

Michael Jackson: "Wanna Be Startin' Somethin" (1982 / 2001 remaster)

1. WAV (uncompressed)
2. FLAC (lossless)
3. MP3 @ 320 kbps
4. MP3 @ 192 kbps
5. MP3 @ 64 kbps
6. WAV
COMPARISON: CLASSICAL

Sibelius: Symphony No. 1, III. Scherzo (Minnesota Orchestra / Vänskä, 2013)

WAV

MP3 @ 192kbps

MP3 @ 64kbps
COMPARISON: JAZZ

John Coltrane: “Moment’s Notice” (1957 / 1997 remaster)

- WAV
- MP3 @ 192kbps
- MP3 @ 64kbps
STREAMING SERVICES

**YouTube**
AAC (lossy)
Bitrate: 64-128 mono, 128-384 stereo, 196-512 Dolby 5.1
“High quality uploads for creators with enterprise quality internet connections”
Extremely dependent upon the uploader

**Spotify**
Ogg Vorbis (lossy)
~96: Normal quality on mobile
~160: Standard quality on desktop & web player, high quality on mobile
~320 (Premium): High quality on desktop, extreme quality on mobile

**Pandora**
AAC+ (lossy)
Web: 64 free & 192 for subscribers
In-home devices: 128
Mobile devices “receive a variety of different rates depending on the capability of the device & network but never more than 64”

**Naxos Music Library**
AAC (lossy)
Dependent on Internet connection
Broadband: 128 (CD)
DSL: 64 (near CD)
Dial-up: 20 (FM)
2.2 **Sampling Rate:** The sampling rate fixes the maximum limit on frequency response. When producing digital copies of analogue material IASA recommends a minimum sampling rate of 48 kHz for any material. However, higher sampling rates are readily available and may be advantageous for many content types. Although the higher sampling rates encode audio outside of the human hearing range, the net effect of higher sampling rate and conversion technology improves the audio quality within the ideal range of human hearing. The unintended and undesirable artefacts in a recording are also part of the sound document, whether they were inherent in the manufacture of the recording or have been subsequently added to the original signal by wear, mishandling or poor storage. Both must be preserved with utmost accuracy. For certain signals and some types of noise, sampling rates in excess of 48 kHz may be advantageous. IASA recommends 96 kHz as a higher sampling rate, though this is intended only as a guide, not an upper limit; however, for most general audio materials the sampling rates described should be adequate. For audio digital-original items, the sampling rate of the storage technology should equal that of the original item.
THANK YOU!
andrew.justice@unt.edu