

High Fidelity

High Fidelity (also called Hi-Fi or HiFi) is the concept where recorded music is reproduced with a high degree of realism. This distinguishes high fidelity equipment and sound from other, usually cheaper and less capable, equipment that cannot reproduce sound as accurately.

The main distinguishing features of equipment for high fidelity sound reproduction are that it has an accurate frequency response, low noise and low distortion. The frequency response should cover the human hearing range, which is 20Hz to 20kHz; with as few variations as possible such that the relative level of recorded frequencies are not changed in any way on reproduction. Similarly, noise and distortion must be at very low levels. In this way a high fidelity reproduction will accurately reproduce the tone of the recorded instrument or sound with as little variation as possible. All electrical processes add noise and distortion, and electro-mechanical transducers (loudspeakers, microphones, phono-cartridges and so on) are far from perfect. In high fidelity equipment great care is taken to minimise these imperfections to produce a more faithful listening experience. There are no official set standards, but *typically* for high fidelity electronics, distortion must be about 0.01% or less, and noise should be 80dB or more *below* the signal level. Transducers (speakers, phono cartridges and so on) cannot achieve these distortion results and the best high-fidelity transducers typically produce about 1% distortion. Frequency response for electronics is typically flat between 20Hz-20KHz, plus or minus 1dB. Again, transducers (particularly speakers) cannot achieve such accuracy and while some achieve a 20Hz-20kHz response at plus or minus 3dB, most high fidelity speakers manage this deviation across approximately 50Hz to 15kHz – and this is adequate for acceptable performance except on some specific music. Unfortunately, there is no standardization or regulation over the term high fidelity and marketers or manufacturers use the term at will, regardless of the specifications of the equipment it is applied to.

Most high fidelity equipment is modular, meaning that the amplifiers, speakers and sources (cd players, record players, computer audio players and so on) are separate and may be from several manufacturers. This allows the consumer to create a playback system that best suits their needs.

The first person to record sound was Édouard-Léon Scott de Martinville in France in 1857 with a device called the phonautograph. However, the phonautograph could only be used to study the sound waves, as it was not possible to play back a recording. The sound was recorded on paper coated in carbon or candle-soot, and the paper was wrapped around a rotating cylinder.

Thomas Alva Edison created the cylinder audio recording in 1878 that could be replayed. Emil Berliner created a similar device that used a disk as the medium in 1887. By the early 20th century audio recordings could be manufactured and sold. This created a market for recorded sound and music, and both cylinder records and disk records were in fierce competition.

Edison believed in the superiority of his cylinder recordings over disk recordings, and set about proving this through a series of “*tone-tests*”. These were events where a recording of a performer, typically a singer, was replayed on a stage in a hall, with the singer also on stage to take over when the recording stopped. The audience was often fooled into not

knowing if the cylinder player or the performer was making the sound, and Edison salesmen used this to demonstrate the quality of the reproduction. This is the birth of the idea that the *fidelity* of the reproduction was of great value. Of course it seems laughable to us now that such poor quality reproduction could pass as real, but performers often modified their performance so that they sounded like the phonograph. The results of the tone tests are probably more a testament to the performers being able to sound like the poor recordings and the psychology of demonstrations. The Edison “tone-tests” marked the beginning of the subjective evaluation of sound reproduction. Such subjective evaluation has continued to today where it is routine for Hi-Fi magazines to subjectively listen to, and report on, the “sound” and quality of reproduction of pieces of equipment. More objective listening tests are also undertaken “double-blind”, where the listeners do not know the identity of the equipment being listened to, and neither does the tester, to remove potential biases from the results.

Electrical recording in the mid 1920’s brought about advances in sound quality, and most notably the removal of the horn resonances from purely acoustic recording. From the late 1920s to the early 1930s, films technology developed and “talking” pictures were introduced. It was quickly discovered that the quality of the audio was a great attraction to the audience. Film production started to push for higher quality audio, and optical film soundtracks were inherently superior to the 78rpm records of the day. High fidelity FM radio broadcasting was introduced in 1936, putting further demands on the requirement for high fidelity recordings.

Stereo audio was developed by Alan Blumlein in 1940, as well as the microphone techniques to record it and the disk cutting technique to store it and play it back. After WWII, the victorious allies appropriated German high-quality tape recorder technology and this led to Ampex Corporation in America developing high fidelity tape recorders in the early 1950s. Soon after, Les Paul developed “overdubbing” techniques to make multi-part recordings in his home studio with his wife Mary Ford. The LP (long playing) record was also introduced in the early 1950s. This played longer than the older 78rms disks and offered much better quality because the polyvinylchloride plastic used in them had a lower surface noise and allowed a greater frequency response and better resistance to wear. The development of transistors made high fidelity equipment more robust and affordable through the 1960s, 70s and 80s. LP records remained the main means of high fidelity music playback until the late 1980s.

Digital audio was developed through the 1970s, and the first CD was released late in 1982 (an ABBA record), and the first commercially available CD players were introduced in 1983. Digital audio offers many advantages over analogue storage and playback; perfect copies can be made, there is much less noise and distortion, the playback medium does not wear with use and so on. CDs were very popular with the consumer for these reasons and in 1986 CDs outsold records for the first time.

The use of digital audio techniques in the production and playback of music has made high fidelity more affordable than ever before. Music is now distributed via digital audio files online, outselling CDs in 2010, and many listeners have relatively high quality playback devices in their pockets, either as a dedicated music player or built into their mobile phones, although MP3 coding can seriously reduce the fidelity if done poorly.

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Further reading:

White, G. D., & Louie, G. J., (2004) *The Audio Dictionary*, University of Washington Press.