



## Theater or Concert Hall Sound Mixing for People with Hearing Loss

A sound mix tailored specifically for people with hearing loss can easily be implemented on many modern mixing consoles, especially those in large venues like theaters and concert halls. Such a mix would be close to a standard sound mix for, say, a Broadway show or an orchestral concert with a few simple, but important changes.

Here are a few of the considerations that should go into the creation of a sound mix for a wireless assistive listening system in a theater or concert hall:

1. **An assistive listening sound mix (AL mix) should avail itself of the full frequency response of the sound system.** Even though modern-day hearing aids provide nowhere close to the full frequency response of modern audio equipment, I believe the sound going into the assistive listening system should be as accurate as possible. Therefore, the sound mix that is distributed to peoples' assistive listening devices—including hearing aids via neckloops or phased array room loop systems—should comprise the same frequency response as the standard house mix and not be cut off at some arbitrary low frequency below that.
2. Those of us with hearing loss are extremely sensitive to any kind of distortion due to issues like hyperacusis and recruitment. We need both a loud *and* a clean signal which, unfortunately, is often not the case. A good rule of thumb is that if the AL mix sounds distorted to the house engineer, it will sound far more distorted for someone with hearing loss and will possibly be unlistenable.
3. **An AL mix should be compressed and limited in its dynamic range, and likely somewhat more so than a standard house mix.** People with hearing loss have a restricted dynamic range and cannot hear soft sounds without amplification. What is less well known is that people with hearing loss can also be overwhelmed when the sound is too loud. Therefore, the sound we receive should have no sudden peaks and no passages that are very soft. To achieve this properly, thresholds, attack and release times for compressors need to be set carefully to minimize pumping effects, which I have heard quite often over assistive listening systems and which can easily be avoided by the use of modern hardware and plug-ins. There should be a set of compressor presets for typical situations, e.g., orchestra concert, play, musical, jazz or rock concert which are simply switched on as needed. Also, since sound levels are invariably quite high for people with hearing loss, it is important that a brick wall limiter be placed just before the final output to the wireless system to prevent sudden, dangerous transient peaks.

4. **An AL mix should be available in mono as well as stereo.** For example, I have only one working ear after my sudden sensorineural hearing loss and can't wear headphones because of recruitment and hyperacusis in my bad ear.
5. **An AL mix should probably feature somewhat more prominent voices in vocal music mixes** say for operas and musicals and **should be a bit brighter than a typical house mix, especially on the vocals.** Please note that a small emphasis is all that is necessary. If the vocals are severely over-emphasized and the instruments too soft which I have experienced at a major Broadway musical in New York City you lose all the pleasure of the music, and it is very unpleasant. Likewise, too much brightness creates a harsh, displeasing sound even for people with a serious high frequency loss. Probably only a bit of vocal rebalancing (3-6 dB louder vocals vs. the standard house mix) and high frequency emphasis again, only a few dB is desirable.

**Richard Einhorn** is a composer, music producer, and hearing loss consultant. A summa cum laude graduate of Columbia University, Richard's oratorio with silent film, *Voices of Light*, has been called a "great masterpiece of modern music" and been performed by the National Symphony, Baltimore Symphony, and at such venues as Disney Hall, Avery Fisher Hall, the National Cathedral of Washington, and the Sydney Opera House. Richard's production of Yo-Yo Ma's Bach Cello Suites was awarded a Grammy for Best Instrumental Performance. Richard's advocacy for better hearing technology has been featured numerous times in *The New York Times*, *Washington Post*, and on NPR.

After losing much of his hearing to a virus in June 2010, Richard has become a nationally known advocate for better hearing assistance. He has consulted on the design of hearing apps for smartphones, product development for hearing products, written articles on hearing loops and improved hearing technology for audiology and medical magazines, and given numerous public presentations in the United States and England on hearing loss. Elected to the Board of the Hearing Loss Association of America, (HLAA) Richard delivered the Keynote Address at HLAA's annual convention in June 2014. In the spring of 2015, he presented his views on hearing loss technology to the Institute of Medicine in Washington, DC, and also to the President's Council of Advisors on Science and Technology.

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