

ALANGO

Technologies and solutions

ALANGO COMPANY NEWS

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ListenThrough™ Environmental audio awareness technology

for Bluetooth® headphones
and earbuds

Auditory alertness while consuming audio

Slip on a pair of headphones or earbuds and you'll shut yourself off from critical sounds. Alango ListenThrough™ technology—a “smart algorithm” for headphones/earphones—allows enjoyment of the music while staying alert to important environmental sounds.

Audio transparency is not as simple as it sounds

Imagine this: between your eyes and a neighbor there is a sheet of glass. You can see the neighbor through the window because the glass is transparent. That's because light passes through the glass without substantial scattering of light rays. With our sense of sight, the light creates a clear picture in our head.

What about our sense of hearing? Put on your headphones, stream audio, such as music, and activate the transparency mode. Now walk outside your house and listen to the neighbor speak. Has your audio been rendered transparent, allowing you to hear just the neighbor? Or do you hear a mixture of the audio and the neighbor?

As light passes through a material without appreciable scattering of light, so shall important ambient sounds be passed through audio to the human auditory system—without noticeable reduction of the ambient sounds, and while eliminating unnecessary background noise.

While the analogy to optical transparency is imperfect (“audio transparency” is not a lucid term), there is a product feature of earbuds that enables the user to hear notable environmental sounds with suppressed background noise while listening to flawless audio, and it is based on sound technology.



A window to the world

ListenThrough is an audio technology developed for headphone OEMs, allowing their products to complement audio playback with environmental alertness—preserving important ambient sounds (e.g., car sirens, alarms, etc.) while eliminating the background noise. This is a software solution that extends existing audio processing.

When we talk about going outside to listen to the neighbor, while listening to music with headphones, there are specific considerations and challenges. But let's look at a more intense use case. For instance, a person pushing their stroller in a busy city while absorbed in loud music. The music is played via earphones, rendering the person detached from the sounds of the city. Some of these sounds may be important to hear for their safety.

ListenThrough technology can be used in devices such as earbuds or earphones. These are mostly Bluetooth® enabled, typically with one or more external microphones. A single microphone delivers ambience to the headphones but is deficient compared to a two-mic solution. With two microphones, each earpiece should be equipped with its own microphone. The signals of each one must be coordinated for a binaural experience. For example, the signal amplitude level of the car honking on the person's left side should be higher for the left channel than the right channel, in order to facilitate sound localization by the user. Level and time differences between each ear are how the human auditory system perceives the direction and distance of a sound. ListenThrough performs binaural coordination so the user can localize the direction of sounds. This coordination is vital—perhaps even lifesaving—since it might be a siren or another important sound event. Thus, identifying the location of the sound enhances alertness and safety.

How ListenThrough works

To some extent, transparent audio can be understood as simply a mixer which adds ambient sounds to the audio stream, thus removing walls between ears and surroundings. But that interpretation is not entirely correct. People who listen to music do not want to hear the droning of traffic, or ambient restaurant noise. ListenThrough technology must eliminate this meaningless and distracting noise; this is the principal task. Also, it must remove slow, distant transient noises such as far-off vehicles. However, before extracting ambience, local feedback must be removed.

For implementations where microphones are located close to the speakers, ListenThrough has incorporated an acoustic feedback removal block—this removes the feedback from the speakers acquired by the microphones. Simple subtraction will not work; depending on the environment (user's ears, head, hat, walls, etc.), this block must adapt in its performance. Therefore, ListenThrough has an adaptive acoustic feedback suppression block, which ensures feedback-free sound delivery to the end-user. This block is controlled by its set of parameters and can be adjusted easily to the configuration required.

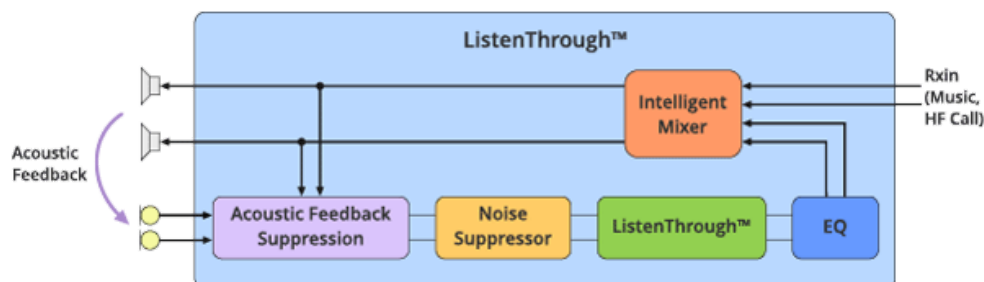
ListenThrough's noise reduction (NR) block monitors ambient sounds and determines noise level in the available frequency range. Preserved sounds are those exceeding the background noise level, by some predefined value, in certain parts of the frequency spectrum. ListenThrough NR is equipped with both stationary and transient noise suppressors, which make detection of sounds smooth and reliable. NR is controlled by its set of parameters and can be adjusted easily to the actual configuration.

Finally, an intelligent mixer (IM) block combines the music and noise-free ambient sounds. The mixer does this 'in-band,' meaning the frequency response curve is adjusted for important sounds to be clearly heard while the main audio stream is preserved.

In summary, ListenThrough comprises three basic blocks: Feedback Suppression, NR and IM. They work in low latency and tight coupling to achieve maximum user perception.

With a two-microphone solution, every mic-speaker path has these three blocks for sustaining the natural audio-listening experience. ListenThrough can be added with Automatic Gain Control, Dynamic Range Compression, Music Equalization and other blocks which will enhance the user's listening satisfaction.

The figure below depicts ListenThrough basic configuration with another block which might be essential for some configurations: Equalizer (EQ). This block should adjust the microphones frequency response when needed.



There are places where we wish to block ambient sounds from spoiling the audio experience, such as inside our home. Other locations require alertness. Regardless of what the headphone feature is called, it must be based on sound technology that provides more than just a window to ambient sounds.

Hear the important sounds, stay alert and aware while preserving the music experience. And, as always, we look forward to HEARING from you.

**This newsletter was inspired by the song "[Window to the World](#)".*