Comfort Audio
HEAR THE FUTURE

SECURESTREAM TECHNOLOGY

Wireless Transmission of Sound Without Disturbance or Dropouts

By Carljohan Lagervall, August Pansell, Anna K Lejon, March 2012

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Abstract:
Over recent decades, hearing aids have become more technologically advanced, and today most incorporate noise reduction. However, it remains difficult to improve the signal-to-noise ratio with more than 3-6 dB (SNR) with a hearing aid alone.

To achieve the maximum benefit of hearing aids in all situations, a system with wireless digital transmission can be used to improve the SNR with up to 24 dB.

Why Wireless Transmission of Sound?

Understanding speech whilst wearing a hearing aid in a noisy environment is extremely difficult. 38% of the hearing aid users are dissatisfied with the performance of their hearing aid in noisy environments, and 44% of hearing aid users are dissatisfied with their hearing aids in larger groups. (Kochkin 2010)

One explanation for this level of dissatisfaction is that it is difficult to evaluate an individual's hearing ability within a noisy environment. Speech understanding in noise can be tested, and the resulting measurements make it possible to determine realistic expectations and potential improvements of hearing aids and avoid dissatisfaction at the end of rehabilitation.

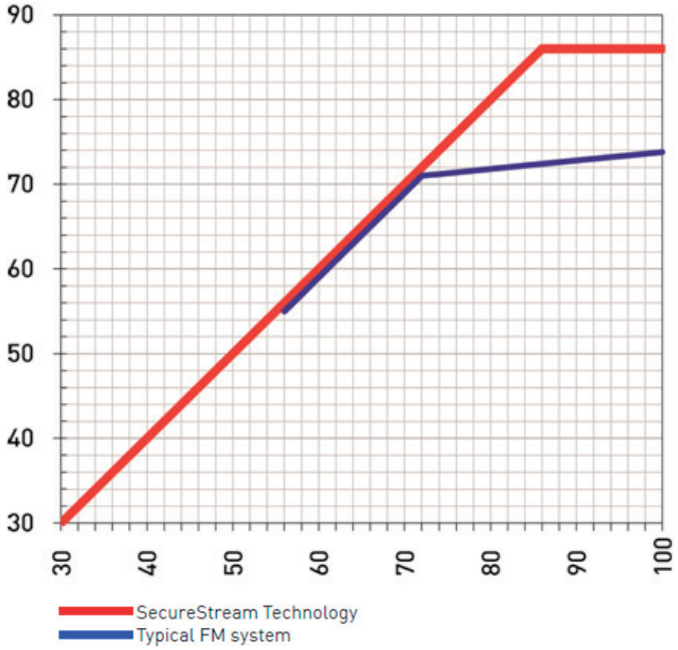
Over recent decades, hearing aids have become more technologically advanced, and today most incorporate noise reduction. However, it remains difficult to improve the signal-to-noise ratio with more than 3-6 dB (SNR) with a hearing aid alone. (Pumford et al 2000) In noisy environments, and when a speaker is at a distance from the listener, wireless sound transmission is unmatched in improving the listening experience. Sanford and Kierkhaefer have shown that wireless sound transmission systems have the potential to improve the SNR by as much as 15-18 dB.

Traditional hearing aids have a relatively small receptive area owing to the microphone size and location. Hearing aid users cannot continually locate the optimum position to receive a desired signal. (Ross 2004) The distance between listener and speaker can increase unpredictably, simultaneously decreasing the SNR and introducing significant ambient noise into the conversation. When the speaker's voice is transmitted directly to the hearing aid, the distance between speaker and listener is effectively reduced and the SNR significantly increased (Arlinger 1999).

Analogue versus digital transmission of sound

For good speech perception, the sound also has to be transmitted with as little interference as possible. In other words, there should be no radio interference, and the sound transmission should be stable. The user should experience a constant sound, without interruptions or delays. The disadvantages of analogue transmitting techniques, audible transmission noise and low dynamic range, are caused by frequency and amplitude signal compression. The dynamic range of a system should match the dynamic range of the signal to be transmitted. Where speech is to be transmitted, the dynamic range should range from 20 – 30 dB to 75 – 80 dB to cater for amplitude levels. The frequency dynamic

range should be about 250-7000 Hz. If there is a low dynamic range in the transmission chain, loud speech will be distorted, quiet voices will be masked by background noise and drop-outs occur. In these instances speech perception will be unintelligible for those with hearing difficulties, and a user can then miss important parts of speech or other sounds necessary for understanding.

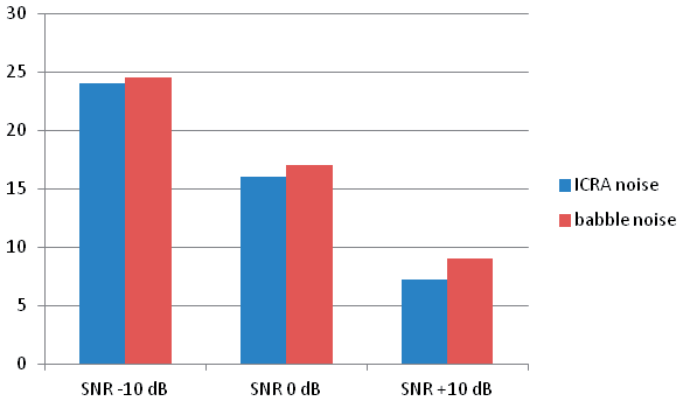


The graph indicates how weak and loud the transmitted signals can be. If there is insufficient dynamic range in any part of the transmission chain, the loud parts of speech are distorted while the weak sounds of speech will be masked by background noise. This means that speech perception is impaired.

Digital transmission of sound, known as Secure Stream Technology (SST) in the Comfort Digisystem of Comfort Audio, transmits speech to a hearing aid listener, without transmission noise and with minimal distortion. SST technology provides crystal clear, eavesdrop-secure sound transmission, in less than half a millisecond, and with low energy consumption.

What is the benefit of digital transmission?

An objective study to investigate the benefits of digital transmitted sound has been conducted by Sergei Smirnov PhD, at the Department of Electrical and Information Technology, Lund University, Sweden. The result showed that depending on the level of input, the SNR could be improved with up to 24.75 dB, the benefit for the user was depending on the original SNR. The improvement could be shown both by using babble noise and ICRA noise in the test.



Using Comfort Digisystem in a situation with a SNR of -10 dB, the SNR was improved by up to 24 dB; the improvement in a situation where speech and noise level were equal, SNR 0, the improvement was up to 17 dB, and in +10 dB SNR, the improvement was up to 8 dB.

Conclusion

To achieve the maximum benefit of hearing aids in all situations, a system with wireless digital transmission can be used to improve the SNR with up to 24 dB. This kind of system makes it possible to follow a conversation even in the most demanding sound environments.

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