

Evaluation of the First Generation of Auracast-Compatible Transmitters, Hearing Aids and Earbuds

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Abstract Text For the past decade, the hearing aid (HA) industry has been working with the Bluetooth Special Interest Group (SIG) to develop a new low-energy, low-latency audio standard with broadcast capabilities. Finalized in 2022 as Bluetooth LE Audio with Auracast, this new standard promises universal audio streaming compatibility across all future HAs and smart earbuds, capable of replacing legacy proprietary streaming protocols. However, while LE Audio itself is a standard created by the Bluetooth SIG, the details of the Auracast broadcasting component of LE Audio are covered primarily by a set of recommendations and a certification process at present—standards analogous to those for telecoil magnetic induction loop systems and receivers are still in development.

In this study, we have conducted a quantitative evaluation of a selection of Auracast compatible HAs and earbuds currently available. In the first experiment, we measured the audio streaming latencies achieved by different combinations of Auracast transmitters and receivers (both HAs and earbuds). In the second experiment, we used a KEMAR manikin to measure the sound pressure levels (SPLs) produced by different combinations of transmitters and earbuds for long-term average spectrum (LTAS) speech-shaped noise, while adjusting the volume settings of the audio source, the transmitter, and/or the earbuds.

The results of the first experiment reveal that the audio streaming latency is highly variable across different combinations of transmitters and receiver devices, with the earbuds generally having much longer latencies than the HAs. Additionally, the measured latencies were all greater than the target latency range of 25–40 milliseconds set by the Bluetooth SIG, with some latencies exceeding 80 milliseconds. The results of the second experiment similarly exhibit high variability in measured dB SPL for different combinations of transmitters and earbuds, with the SPL change produced by a volume setting change also being highly variable across the device combinations and dependent on

which volume setting (audio source, transmitter or earbud) was adjusted.

This study indicates that the first generation of Auracast-compatible audio transmitters, HAs and earbuds available commercially differ greatly in their implementations of the Auracast component of Bluetooth LE Audio, leading to substantial variability in audio streaming latencies and SPLs across different combinations of transmitters and devices. This suggests that manufacturers should work more closely with the Bluetooth SIG and other relevant standards organizations in the development and implementation of an industry-wide Auracast standard.