

PHILIPS

HearLink

Whitepaper

HearLink 50 with SoundGuide

SoundMap 3 and SoundTie 3 Technologies



AI-Powered, Person-centered Hearing Technology is here

Philips Hearing Solutions presents the latest audiological and connectivity advancements designed to empower people with slight to profound hearing loss.



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Putting listeners at the center of their hearing journey

Philips Hearing Solutions continually introduces advancements to its SoundMap sound processing and SoundTie connectivity protocols to help hearing aid wearers create more connections. Chief among them in the latest release include a new audiological innovation called SoundGuide that incorporates motion data into the hearing aid; Low Energy Audio (LE Audio), the highly anticipated new standard for Bluetooth® connectivity; and an update to the Philips Journal, allowing users to see their progress and how well they are adapting to their instruments via the HearLink 2 app. Intuitive developments like these, along with other new and existing features, create the backbone of what we call “person-centered hearing technology” – putting listeners at the center of their hearing journey.

HearLink 50 highlights

Now more than ever, advanced hearing technology has nearly reached a point where individuals with hearing loss can blend their hearing solutions into their lifestyle almost as seamlessly as wearing glasses. Environment detection, automatic features, artificial intelligence, and personalized app interactions empower hearing aid users to have a healthy outlook between their hearing and their overall lives.

With new SoundGuide, the hearing aid analyzes the wearer’s physical head and body movements. By doing so, it expands access to clear speech in more scenarios than before when motion occurs. Exclusive to HearLink 50, SoundGuide leverages real-time user data from built-in motion sensors. Information from the user’s behaviors and environment is fed into the automated directionality and AI-NR (artificial intelligence noise reduction) systems. Using these multiple inputs, HearLink 50 generates an optimized output based on user activity to account for where they are, and how they move, to deliver more appropriate help for hearing speech in noise.

HearLink 50 with SoundGuide is the ideal hearing solution for persons with slight to profound hearing loss, who strive to be at the center of their hearing health outcomes in any situation. Central to this theme, users can gain insights into their own usage data via Philips Journal, to track their daily hearing habits with more granularity and become more familiar with their new hearing aids, further empowering hearing health goals with technology.

Audiological and connectivity advancements for HearLink 50 do not stop there. Improvements to sound quality include stronger AI-NR noise control to efficiently remove more background noise. New miniFit Detect receivers support a wider frequency bandwidth, from <100 to 10,000 Hz, to give a fuller listening experience for entertainment and music; on top of that, they identify left or right side to make receiver replacements easier. LE Audio offers unique advantages such as two-way streaming for hands-free calls with

select Android™ devices and compatibility with Auracast™ broadcast audio when it becomes available, for streaming in public places like airports, gyms, and restaurants. Plus, a redesigned rechargeable miniRITE style and charger offer users a full day's power in an hour. Collectively, these person-centered hearing technologies strengthen the user experience for better hearing in more listening environments to ultimately create more connections. In the pages that follow, you will learn how and why this is so.

Evolution of HearLink and SoundMap

HearLink 50 with SoundMap 3 is designed to deliver our best, continuous speech-in-noise performance. Always aiming to help hearing aid users connect to others, HearLink 50 expands the number of scenarios where users can expect this promise to be met. The primary goal of the evolution of SoundMap technology in Philips HearLink is to increase connections by improving access to speech in noisy environments. Since the launch of SoundMap in 2019, major introductions have included (i) extending the number of frequency bands from 16 to 24, since more frequency bands allow speech harmonics more isolation and separation from noise; (ii) AI-NR, which coordinates noise reduction across frequency bands to efficiently clean speech signals in noise, and (iii) SoundProtect to reduce wind, handling, and transient noise in the presence of speech more effectively. SoundMap 3 heralds our next major advancement, with the introduction of SoundGuide for more intuitive delivery of sound with movement.

Listening and movement

Sensorineural hearing loss disrupts psychoacoustic listening abilities to varying degrees in adults, making communication problematic. Reduced frequency selectivity contributes to difficulty in understanding speech in noise, and reduced cochlear compression leads to loudness recruitment (Moore, 2002). Fortunately, modern hearing aids can help. Besides compensating for the loss of volume at certain frequencies, they include detectors to identify meaningful signal characteristics (e.g., intensity, modulation, time, signal level, SNR) from the microphone and activate automated features such as directionality and noise reduction to provide help in challenging listening environments.

In particular, directional microphones emphasize signals from one direction and reduce signals from other directions in settings with speech and noise (Bentler et al., 2005). Also known as beamformers, they increase the signal-to-noise ratio (SNR) to improve speech intelligibility when listeners face the sound source, and noise is in the null of the microphone (Picou & Ricketts, 2019). Listening in this orientation is generally possible for stationary positions like sitting and standing, however it becomes impractical in more dynamic real-world situations when movement is involved. While listeners often naturally turn their head to look at a speaker (Lu & Brimijoin, 2022),

they cannot be expected to completely face a conversation partner when walking on a busy street or hearing someone approaching from behind. In these conditions, automated beamformers may attenuate important sounds to the sides and behind the listener's head and potentially reduce speech understanding in noise (Hládek et al., 2019). Therefore, information about the listener's physical movements can add an important dimension for hearing speech clearly – a high priority for anyone with hearing loss. Since typical adaptive beamformers will activate in challenging settings despite the listener's movements, input about motion can help the hearing system better manage the help needed in noise. For example, research from Archer-Boyd et al. (2018) concluded that a wider directional response may give listeners the greatest chance to optimize their hearing in dynamic conditions with speech, noise, and movement.

Whether the user is stationary or moving, the hearing aids' microphone system is the starting point to assign help for listener needs in noise. Following an overview of the Philips Dynamic Directionality system, learn how SoundMap 3 incorporates motion input in HearLink 50 to provide a better sound experience.

Dynamic Directionality overview

Based on acoustic information alone, the Dynamic Directionality system in HearLink 50 freely adapts between an omnidirectional state in speech-in-quiet and an adaptive, monaural beamformer in speech-in-noise to achieve an SNR improvement that is more favorable than other directional options when noises occur from unpredictable locations. The feature includes two selectable settings: Pinna Mode (Figure 1a) and Maximum Effect (Figure 1b).

Pinna Mode

The microphone patterns are fixed based on what you select under Pinna Mode



Omni Directional

Provides the standard omnidirectional response sensitive to sounds from all directions with slightly more emphasis towards the front



Pinna

Mimics the natural attributes of the pinna that provides more focus on the front for an optimized signal-to-noise ratio

Figure 1a: Pinna Mode in HearLink 50

Pinna Mode can be set to Omni Directional for maximum sensitivity to sound from all directions, or it can be set to Pinna to mimic the attributes of the external ear for slight directional emphasis in the high frequencies. The Pinna setting uses fixed directionality in the high frequencies to achieve a microphone behavior similar to the external ear to restore lost pinna cues. This makes the instrument more sensitive to higher frequencies from the front to aid in speech intelligibility and localization for microphones placed above the pinna (Xu & Han, 2014). The better match to the ears' natural response for behind-the-ear hearing aids can improve SNR benefit, compared to the omni mode.

In environments with diffuse noise such as crowds or cocktail parties, Dynamic Directionality applies traditional front-facing polar patterns (e.g., cardioid) to focus on sound from the front and reduce sound from the back. Maximum Effect refers to the automated beamformer response, personalized to a layer of strength for more-or-less help with more distracting noise. In static conditions, the beamformer collects input from the front and rear microphones to locate noise and generate nulls in the necessary direction to attenuate it. The microphones continuously adjust the null direction to select the polar response with the best SNR. As a result, fluid-like changes in null steering quickly react to moving or changing noise sources, to better suppress noise and preserve the signal of interest from the front. Working in 24 frequency bands, the system applies diverse polar patterns in various frequency regions to cancel multiple noise sources, so long as the signals differ in location and in spectral content. Up to three control options (low, medium, high) are available to personalize the amount of help the user needs in noise.

Maximum Effect

Adjusts the microphone pattern in response to diffuse and/or distinct noise in 24 frequency bands.

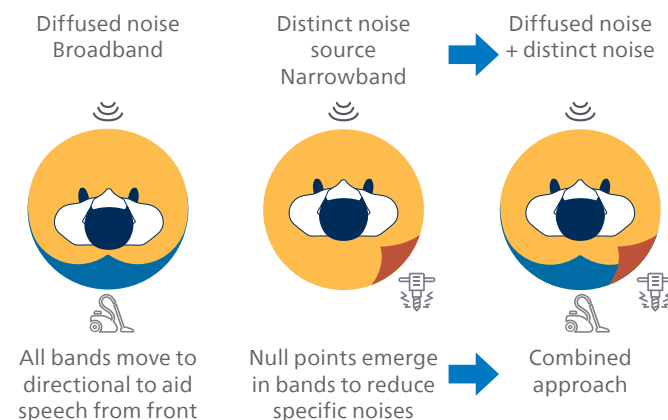


Figure 1b: Maximum Effect in HearLink 50

SoundGuide overview

Up to this point, SoundMap technologies could only detect acoustic input from the hearing aid microphones for managing speech in background noise – now they can detect motion input as well.

SoundMap 3 with new SoundGuide increases the amount of information the hearing system can use, by sensing the user's sound environment jointly with their physical movements (Figure 2).

An embedded accelerometer detects head movement by measuring changes in velocity over time. It also measures whether the speed of the movement is brief or constant.

As a result, SoundGuide allows HearLink 50 to prioritize the amount of help needed for speech-in-noise as listeners naturally move throughout their day.

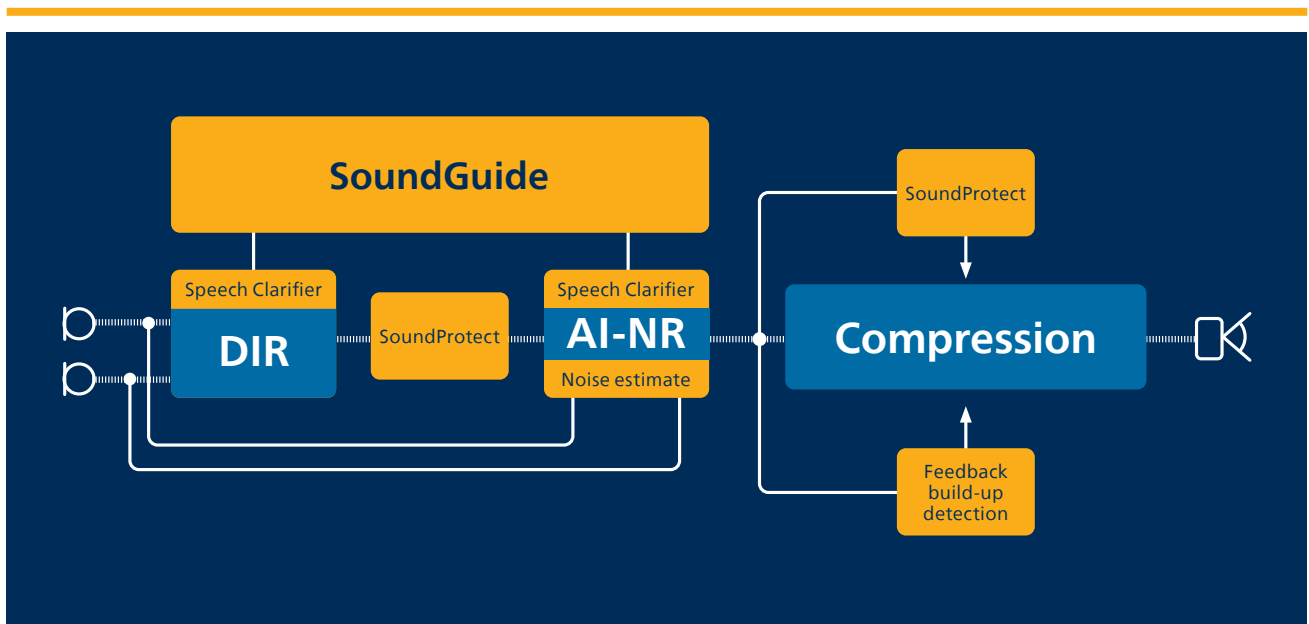
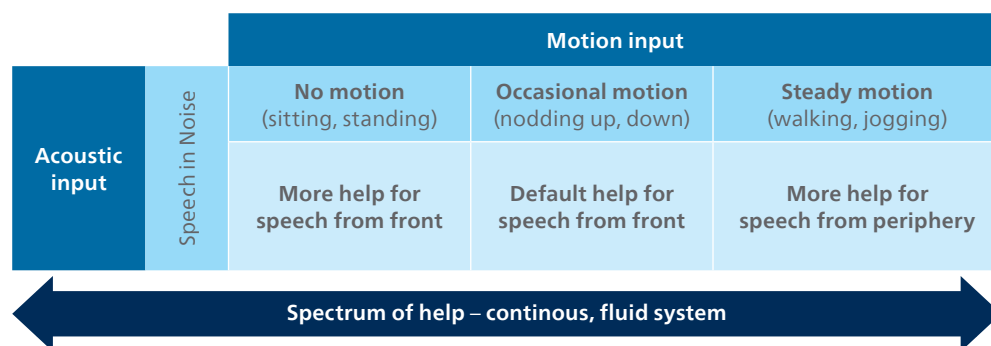


Figure 2: SoundMap 3 technologies + SoundGuide

Here’s how it works. When noise levels reach a minimum of ~47-60 dB SPL across settings and the accelerometer detects movement, SoundGuide activates. The feature informs the highly adaptable Dynamic Directionality and AI-NR systems to offer a spectrum of help to target speech, aligned to how the user moves (Table 1):

- **Steady motion:** When constant motion is detected (e.g., walking, running), the maximum amount of help for detecting speech from all directions occurs. The automated beamformer widens its directional response, transitioning to its maximum omnidirectional response, to allow greater access to speech in various locations around the user’s head – not just to the front. At the same time, the amount of AI-NR applied decreases across frequencies to preserve potentially relevant sounds in the environment during movement.
- **Occasional head motion:** When brief, natural head movements are detected (e.g., standing or seated with head nodding and turns), the default beamformer and AI-NR settings engage to provide the recommended help for speech-in-noise as prescribed in the fitting software.
- **No head motion:** When the listener is still (e.g., seated, stationary), the beamformer applies greater directionality to improve access to speech from the front in the look-direction. AI-NR increases across frequencies to attenuate diffuse noise from various locations.



In these ways, SoundGuide instructs Dynamic Directionality and AI-NR to offer help for speech-in-noise that is suitable for the listening situation and behavior. When listeners are sitting still and conversing in a difficult environment, SoundGuide will provide more help to detect speech from the front. Conversely, when listeners move their head or body during a conversation, or walk across a noisy room, SoundGuide will adapt to the body movement, to provide more help to detect speech from peripheral directions. The automated systems continue receiving input from Speech Clarifier, which helps speech stand out in noise, and SoundProtect, which removes irritating sounds. The synergy of all SoundMap 3 technologies working together optimizes speech-in-noise performance to let listeners hear better when still or on the move, whether they are engaged in conversation in a crowded place or walking and talking on a busy street.

Improved AI-NR in HearLink 50

Driving our AI-powered technology is AI-NR, the primary noise reduction system in SoundMap 3. Now in HearLink 50, the AI training process has been enhanced with higher resolution. This improvement allows AI-NR to attenuate more noise, particularly in the low and mid frequencies, without distortion. In addition, a greater difference in attenuation can exist between adjacent frequency bands while keeping speech clear. As a result, the Noise Reduction Mode in Philips HearSuite is improved. It can offer stronger noise reduction for diffuse noises (e.g., traffic, crowd noise) while supporting ideal sound quality. The new "Very high" setting can reduce more noise, up to 12 dB in very noisy listening environments (Figure 3).

Noise Reduction Mode



Figure 3: Noise Reduction Mode in Philips HearSuite: new Very high setting

AI-NR is unique in that it coordinates its response with acoustic input from Dynamic Directionality. Now with access to motion input from SoundGuide, AI-NR can better manage noise across 24 bands. AI-NR adapts to SoundGuide activity to ensure the listener receives the proper amount of help for their listening behaviors. Noise management will vary based on many factors, including the acoustic input, the motion input, the Maximum Effect setting, the Noise Reduction Mode setting, and the SoundMap Noise Control Transition setting – which determines at which environmental noise level and SNR the directionality and noise reduction will be applied. The level can be adjusted to specify how assertive the automatic systems shall be according to the amount of help the listener needs or prefers in background noise (Figure 4).

SoundMap Noise Control Transition



Figure 4: SoundMap Noise Control Transition in Philips HearSuite

SoundTie 3 with MFi, ASHA and LE Audio

Alongside the powerful SoundMap 3 technology, SoundTie 3 technology lets HearLink 50 conveniently interact with smartphones and wireless accessories, helping users connect to calls, TV, movies, and music seamlessly. HearLink 50 are Made for iPhone (MFi) hearing aids, which allows users to directly stream audio and talk hands-free on an iPhone, iPad, or Mac. Additionally, HearLink 50 are compatible with Android's Audio Streaming for Hearing Aids (ASHA) protocol, which permits users to directly stream audio from Android phones and tablets to their hearing aids.

Hands-free calls are now possible with HearLink 50 and select Android devices, due to advancements in Bluetooth. SoundTie 3 includes LE Audio, the latest Bluetooth low energy technology, which expands connectivity and direct streaming options between HearLink 50 and smart devices like phones, tablets, and PCs. SoundTie 3 continues to support the complementary Philips HearLink 2 app, letting users manage their hearing aids from their smartphone, while gaining personal insights from the Philips Journal to further guide them on their hearing journey. The following provides more details on each.

Bluetooth LE Audio

Bluetooth has come in many different versions over the last two decades, from Bluetooth Classic to Bluetooth Low Energy. While the classic version can offer consistent audio streaming, it comes at the cost of high battery drain. On the other hand, Bluetooth Low Energy can prioritize battery efficiency, but it is most ideal for connections that need only a brief amount of time to transmit a small amount of data. Now, LE Audio provides the double advantage of reliable audio streaming while conserving power for wireless devices. In addition, LE Audio minimizes latency and increases bandwidth for transmissions to ensure high sound quality. This is due to its new Low Complexity Communication (LC3) codec for better streaming compared to the classic version. On top of that, it allows multiple connections to devices, bidirectional streaming, binaural pairing, and compatibility with the forthcoming Auracast™ broadcast audio standard so that many people can listen to the same audio feed.

Thanks to support for LE Audio technology in hearing aids, HearLink 50 can connect to wireless devices that also have LE Audio. That means HearLink 50 now supports high quality hands-free communication and direct streaming with select Android phones with OS 14. HearLink 50 will also be able to connect to Windows 11 PCs with LE Audio, letting listeners directly pair, take calls, listen to music, and stream audio seamlessly from their computer or laptop. Note that iPhone, iPad and Mac continue to use a proprietary Bluetooth protocol (MFi) that allows hearing aid compatibility – meaning LE Audio is currently not supported in their products.

For added wireless convenience, users can take advantage of the new tap control feature to manage their calls with iPhones, iPads and other LE Audio compatible devices. A simple double-tap on their hearing aid or their ear accepts or ends the conversation, keeping their hands free for other tasks. HearLink 50 is also ready for the future technology Auracast broadcast audio. Auracast broadcast audio is anticipated to be the leading assistive listening solution that can help listeners hear broadcasts in complex environments like airports, theaters, and arenas with greater ease.

Philips Journal

The Philips HearLink 2 app is much more than a remote control or interface for remote fitting. The Philips Journal is an in-app feature that lets users set a goal for wearing their hearing aid each day. The goal can be set from as low as 2 hours to as high as 16 hours per day. Philips Journal will then measure progress toward that goal, which will help facilitate their adaptation process by giving them insights about their own hearing aid use (Figure 5). If they have reached their daily goal, they will see a green checkmark and a message indicating the goal was met.

Now, Philips Journal has been updated to offer more support. Short, easy to read notifications can be set to 1) alert users when their daily wearing goal is achieved; 2) show them daily and weekly wearing time progress summaries; and 3) remind them to connect their hearing aids to the app to log wearing time data. With this update, Philips Journal aims to help listeners feel empowered and engaged during their hearing aid journey, by allowing them to set personal goals, monitor their daily wear time, and receive encouragement from notifications. They can adjust their daily goal and view progress by day, week, month, and year to help them understand how well they are adapting to their hearing aids. The data they receive about their listening activity coaches them to become self-reliant to reach their personal goals (Figure 6).



Figure 5: Philips Journal Wearing time screen



Figure 6: Philips Journal Goal reached notification

AI-powered, person-centered hearing

Continuing our promise of creating connections, HearLink 50 features powerful audiological and connectivity advancements, personalizing sound so that speech is always clear. People with slight to profound hearing loss can take advantage of benefits like these:

- SoundMap 3 including the new SoundGuide feature with motion detection and updated AI sound technology for exceptional access to clean, clear speech.
- SoundTie 3 incorporating Philips Journal for more insights via the HearLink 2 app and LE Audio for high sound quality while streaming, more connectivity options, and hands-free calls on select Android devices*, in addition to iPhone, iPad and Mac.
- Exclusive new miniRITE style offering faster charging, updated receivers, and stylish design.

With improved sound quality, connectivity, and style, HearLink 50 is AI-powered, person-centered hearing technology that puts listeners at the center of their hearing. HearLink 50 helps users create more connections to others, to the world around them, and most importantly, to themselves. Four performance levels are available, including HearLink 9050, 7050, 5050, and 3050.

* A smartphone that supports LE Audio is required.

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