Phonak Insight.

Enhancing outdoor communication: WindBlock 2.0 delivers up to 50 dB of wind noise reduction

Phonak EON introduces WindBlock 2.0, going beyond suppression to actively preserve speech signals in wind, automatically and across all performance levels. Achieving up to an impressive 30 dB of SNR improvement and up to 50 dB of wind noise reduction compared to WindBlock off, EON delivers improved signal transparency – because conversation shouldn't stop for the wind.

Lindeman, A. & Brunner, J., August 2026

Introduction

Spending time outdoors is a fundamental part of daily life – a walk with a friend, a round of golf, or cycling through the city. These are some of the moments hearing aids are meant to make accessible, yet wind consistently gets in the way.

A younger, more diverse population is entering the market (Jilla & Jorgensen, 2025), bringing with them higher expectations of what their devices should deliver. Comfort matters, but so does the ability to communicate clearly while moving through the world. Wind noise does not simply reduce audio quality; it degrades speech intelligibility, increases listening effort, and can limit participation in the outdoor activities that many users value most (Latzel & Appleton, 2013a; Sarampalis et al., 2009).

Every hearing aid relies on one or more microphones, which are designed to detect the air pressure fluctuations created by sound waves. That same sensitivity to air pressure changes makes these microphones vulnerable to wind. When wind strikes obstacles, such as the ear or a hearing aid, the turbulence it creates generates pressure fluctuations at the microphone inlet, causing the diaphragm to vibrate. The result is a phantom signal, something that registers as sound but has no acoustic origin whatsoever (Cook et al., 2021). The human ear has some natural protection from this problem. The tragus and the geometry of the ear canal actively attenuate wind-induced pressure fluctuations before they reach the eardrum, a natural defense that exposed microphones simply do not have.

Wind noise occupies a strange category: it isn't really a sound, and it isn't really noise in any traditional sense. It is an artefact of the technology itself. Detecting and resolving wind noise can be particularly challenging because wind is unpredictable: it fluctuates with gusts, changes direction, and varies with user activity, producing a time-varying, broadband interference (Chung et al., 2009; Cook et al., 2021). It can also arise from the hearing aid's own movement as much as from external conditions, so even a light breeze or a brisk walk is enough to trigger it (Latzel & Appleton, 2013a; Phonak, 2012). This makes it a more complex target than steady-state noise sources such as traffic or crowd noise. The spectral overlap between wind noise and speech compounds the problem further. Wind noise is broadband, meaning its energy spreads across a wide range of frequencies, but it is most intense at the low end of the spectrum, precisely where vowels and other important speech cues are concentrated (Chung et al., 2009; Cook et al., 2021). Aggressive attenuation in these regions risks removing or distorting speech content alongside the noise, reducing naturalness and in some cases, intelligibility (Sarampalis et al., 2009).

For a growing population of active users, this is not an occasional inconvenience. Addressing it effectively (i.e., not just reducing annoyance, but maintaining speech understanding in windy conditions) is therefore central to successful hearing aid adoption and rehabilitation (Latzel & Appleton, 2013a; Latzel & Appleton, 2013b).

WindBlock

It's not only hearing aid microphones that are susceptible to wind noise. Outdoor news reporters, sports commentators, and content creators all face the same problem, which is why microphones used in the field are routinely fitted with a windscreen. These fluffy shields deflect and disrupt airflow while allowing sound to pass through (Phonak, 2012). Hearing aids, for obvious reasons, cannot accommodate a fluffy cover; instead, wind noise must be managed internally. This occurs in two sequential stages: detection and suppression. In the detection stage, a wind noise detector monitors microphone input continuously, focusing on low frequencies where wind noise energy is most concentrated, and analyses the correlation between the two microphone signals. Unlike genuine environmental sounds, wind turbulence produces random pressure fluctuations at each microphone, so there's little correlation between what each one captures moment to moment. When the hearing aid identifies uncorrelated low-frequency signals across both microphones, it recognizes this as wind noise and triggers suppression (Phonak, 2012).

Phonak's wind noise canceller, WindBlock, applies up to 23 dB of attenuation to signals below 1 kHz (Phonak, 2012). Studies have shown a preference for WindBlock in windy environments over not using it (Latzel & Appleton, 2013b). However, a key consideration of this approach is that attenuation is applied broadly - the hearing aid cannot distinguish between wind noise and genuine sound in the same frequency region, meaning real sounds, including speech, are reduced alongside the wind noise (Phonak, 2012). Despite this, WindBlock represented a meaningful step forward, reducing the perceived annoyance of wind and improving user experience in windy conditions.

It's known that suppressing wind noise improves comfort, but comfort alone does not translate into better communication. The broader goal must be to preserve speech understanding in windy environments, not simply to make them more tolerable by attenuating both speech and wind noise.

WindBlock 2.0.

Building upon the success of WindBlock, WindBlock 2.0 delivers improved target sound fidelity while continuing to effectively attenuate low-frequency wind noise. The new wind noise cancellation algorithm is guided by two key observations: wind noise is uncorrelated across microphones, and in most cases, the rear microphone experiences less wind than the front microphone.

At its core, WindBlock 2.0 emphasizes the rear microphone signal where wind is typically less prevalent. The approach starts with the rear microphone signal and applies a dynamic gain derived from the cross-correlation between the front and rear microphones. The portion of the signal correlated with the front microphone (e.g., speech) is preserved, while the uncorrelated wind noise is suppressed, resulting in a signal where the intended speech remains largely unchanged and the wind noise is attenuated.

There are of course some situations where the rear microphone is more affected by wind noise compared to the front. In those cases, a fallback mode is triggered, where instead of the rear microphone signal, the front microphone signal is emphasized.

To measure the effectiveness of WindBlock 2.0, technical measurements of wind noise level and SNR were conducted using recordings obtained from the microphones of Phonak Audéo EON RIC hearing instruments on a KEMAR mannequin (GRAS Sound & Vibration, Denmark) in a wind tunnel located at Sonova headquarters in Stäfa, Switzerland.

Methodology

The phase-inversion method described by Hagerman and Olofsson (2004) was used for the measurements. It requires separate signal (S) and noise (N) audio signals such that they can be inverted and combined to play three blocks as follows: A = S+N, B = S-N, and C = -S-N to the devices under test. The recorded output of the hearing aids can then be separated into reconstructed signal (S') and noise (N') which allow calculating the signal-to-noise ratio (SNR').

As described above, a very important property of wind noise is that the signals at the front and rear microphones are uncorrelated. Therefore, wind noise detection and cancellation would not work on wind noise played from a speaker because the wind noise would be treated like a normal, wanted signal.

The performance of the wind noise canceller was therefore measured as follows:

1. Record wind noise directly from each of the microphones of a pair of modified hearing aids on KEMAR for use as noise (N).
2. Measure head-related transfer functions (HRTFs) from a speaker at different angles to the same hearing aid microphone satellites on KEMAR.
3. Convolute a speech signal with the HRTFs from the wanted angle to obtain the hearing aid microphone signals as if the speech was played from that angle. Those signals are then used as signal (S).
4. Play combinations of S and N to the hearing aid inputs and record their outputs.
5. Reconstruct S' and N' from the recordings.

Additionally, for measuring the attenuation of pure wind noise without speech, the full output signals of the hearing aids were analyzed without first separating them into signal and noise components.

Measurement Setup

A modified pair of Phonak Audéo EON RIC R hearing instruments on KEMAR was used to record wind noise in a wind tunnel with wind speeds of 4 m/s and 7 m/s. The same pair of modified hearing aids was also used to measure HRTFs on KEMAR.

The stimuli defined in the next paragraph were played to a pair of differently modified hearing aids by directly connecting sound card outputs instead of microphones to the electronics of the hearing aids and also connecting sound card inputs in place of the receivers to record the hearing aid output.

Presented stimulus

The hearing aid microphone recordings of wind noise from the front were combined with a male-spoken speech signal from 60° relative to the air inlet. The signals were scaled such that the wind noise level in the hearing aids was as originally recorded and the speech signal was at 70 dB SPL.

For each of blocks A, B, and C, a 10-second stimulus, comprised of the signal and noise, was presented. To allow the hearing aids' adaptive processing to stabilize, the first 5 seconds of each stimulus were repeated before the full 10-second playback, resulting in 15 seconds of playback per block. The initial 5-second adaptation period was discarded from the final recordings.

For the recordings of pure wind noise the speech component was omitted.

Hearing aid fittings

The hearing aids were fitted with a flat 10 dB insertion gain at all frequencies and levels. The measurement setup has no direct sound and no insertion loss, equivalent to an ideal fully occluded coupling. All hearing aid features were disabled except for WindBlock or WindBlock 2.0 which were set to default strength of 16 for measurements with speech in wind, max strength of 20 for measurements with pure wind noise, or 0 strength (off) to measure the reference with all stimuli.

Results

Prior to evaluating WindBlock 2.0's effect on wind noise and SNR, the accuracy of the measurement recordings was first verified. The measurement error relative to the total output signal as estimated by the Hagerman/Olofsson method was below -22 dBA for all recordings with speech shown below.

Wind noise attenuation

The measured attenuation of wind noise while a speech signal was present was between 33 and 38 dBA with WindBlock 2.0. WindBlock achieved between 9 and 17 dBA, depending on the wind speed (Figure 1).

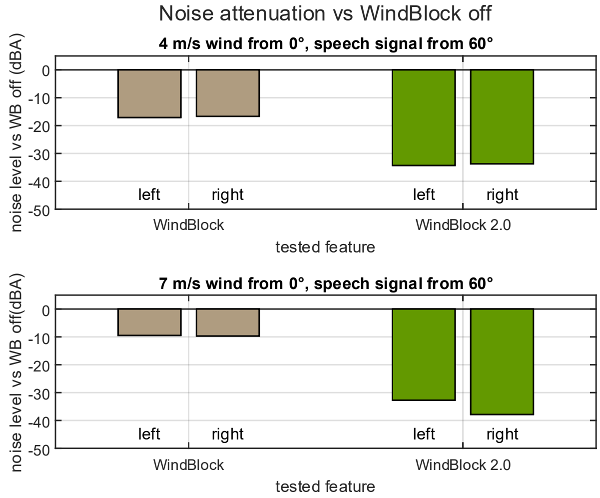

Figure 1. Wind noise attenuation of the WindBlock features measured with the Hagerman/Olofsson method in an electric setup

Higher values for wind noise attenuation between 35 and 50 dBA were measured with WindBlock 2.0 at maximum strength in pure wind noise without speech signals or other sounds (Figure 2).

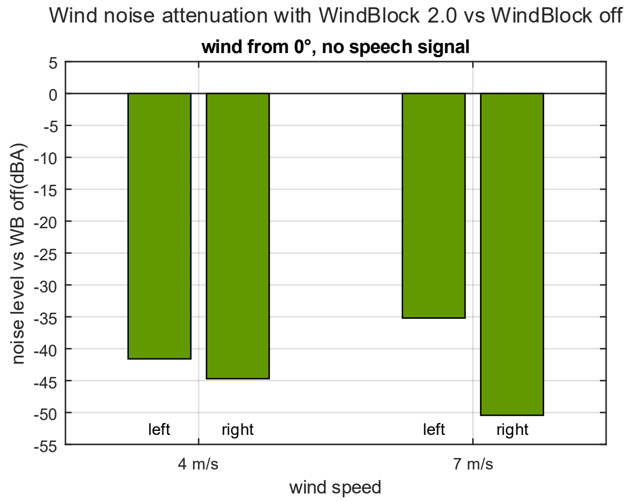

Figure 2. Wind noise attenuation without additional acoustic signals and with WindBlock 2.0 at maximum strength

SNR benefit

The measured SNR benefit of WindBlock 2.0 is between 19 and 30 dBA whereas the SNR benefit of WindBlock varies between -1 and 13 dBA.

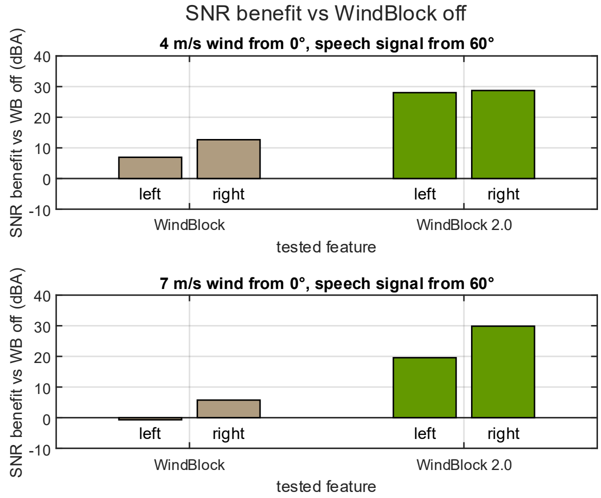

Figure 3. SNR benefit of the WindBlock features measured with the Hagerman/Olofsson method in an electric setup

Spectrograms

Spectrograms of the hearing aid recordings with speech in 4 m/s wind were produced to give a visual representation of WindBlock performance and support analysis of the data presented in this section.

A spectrogram shows how energy is distributed across frequency regions over time. Frequency is shown on the vertical axis and time on the horizontal axis, with color indicating power spectral density at each point: brighter colors (yellow, white) represent more energy, while darker colors (red, black) represent less. This makes it possible to see not only how much energy is present in a recording, but where in the frequency range it sits and how it changes from moment to moment (see Figures Figure 4-Figure 7).

Wind noise is characterized by very high, continuous energy concentrated in the low frequencies, typically below about 1 kHz. In a spectrogram, this appears as a bright band spanning the entire time axis in the lower part of the frequency range. Speech, by contrast, appears as scattered, time-varying bursts of moderate energy across a wider frequency range, corresponding to the rapid alternation of vowels, consonants, and pauses that make up connected speech. This is visible as brighter streaks that come and go over time rather than a constant band.

Figure 4 shows the unprocessed spectrogram with WindBlock off and without wind. It serves as a reference and to more clearly see the effect of wind noise on the total signal.

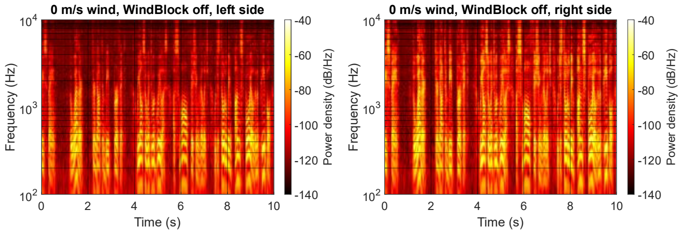

Figure 4. Spectrograms of male speech signal without wind without WindBlock

Figure 5 shows the unprocessed spectrogram, with WindBlock off, in 4 m/s wind. Wind noise is visible as a bright, continuous band below about 1 kHz that persists across the full duration of the recording. This low-frequency energy masks part of the speech signal, as any speech energy in this same frequency region is overwhelmed by the much stronger wind noise.

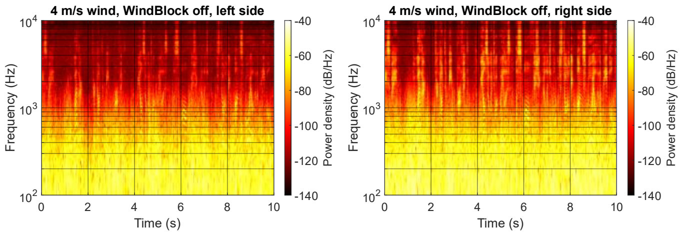

Figure 5. Spectrograms of male speech signal in 4 m/s wind without WindBlock

Figure 6 shows the spectrograms with WindBlock applied, in 4 m/s wind. The low-frequency band up to 1 kHz is visibly darker than in Figure 5, indicating that WindBlock attenuates wind noise in this region. As a side effect, speech energy in the same low-frequency region is also attenuated along with the wind, so this part of the spectrogram remains relatively dim overall, with little distinguishable speech energy visible below 1 kHz.

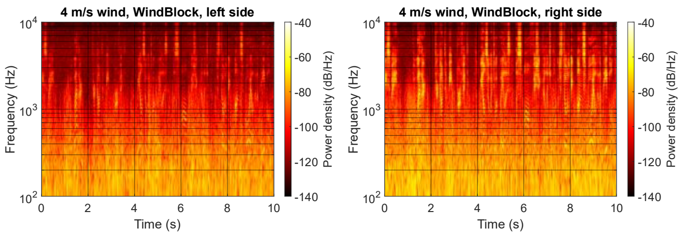

Figure 6. Spectrograms of male speech signal in 4 m/s wind with WindBlock

Figure 7 shows the spectrograms with WindBlock 2.0 applied, in 4 m/s wind. WindBlock 2.0 attenuates the wind noise even further while retaining more of the speech signal. The low-frequency speech components are now clearly visible as distinct bursts of energy below 1 kHz, rather than being suppressed along with the wind.

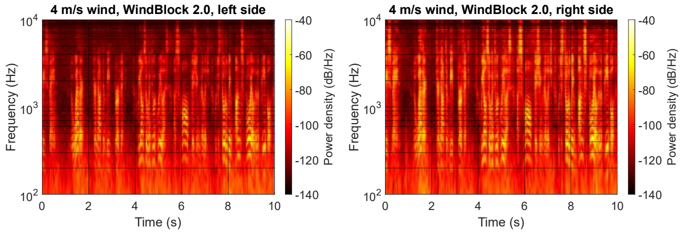

Figure 7. Spectrograms of male speech signal in 4 m/s wind with WindBlock 2.0

This indicates better speech clarity and more natural sound compared to WindBlock. Those sound attributes are also related to listeners perceiving lower listening effort in wind using WindBlock 2.0 vs WindBlock (Vaisberg et al., 2026).

Conclusion

Effective wind noise management requires more than comfort; it requires a solution that actively preserves speech understanding in the conditions where it is most challenged. WindBlock 2.0 addresses this directly, moving beyond broadband attenuation towards selective separation of wind from speech.

The technical measurements outlined demonstrate WindBlock 2.0 delivering up to 50 dB of wind noise reduction in the absence of speech, up to 38 dB of wind noise reduction in the presence of speech, and an SNR improvement of up to 30 dB. As a result, greater signal transparency has been achieved, as well as a more comfortable, natural, and clear listening experience (Vaisberg, Brunner & Sanchez, 2026).

WindBlock 2.0 marks a significant step forward in Phonak wind management, operating automatically and across all performance levels; because conversation shouldn't stop for the wind.

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Authors and Experts

Alice Lindeman, Audiology Manager at Phonak HQ

Alice joined Sonova HQ as Audiology Manager in 2026, coming from Sonova Wholesale New Zealand, where she led the Unitron brand. She holds a Master of Audiology degree and brings experience across clinical audiology, sales, and as an independent practice owner. This background shapes her perspective on customer needs and informs her contributions to product development and consumer research.

Jan Brunner, Hearing Performance Engineer

Jan Brunner is a Hearing Performance Engineer with focus on beamforming and other sound processing topics. He has a PhD in Nanosciences from the University of Basel, has worked in the field of applied optics and taught physics to students of applied sciences. He has been employed by Sonova since 2019.

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One-page summary

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Phonak EON introduces WindBlock 2.0, going beyond suppression to actively preserve speech signals in wind, automatically and across all performance levels. Achieving up to an impressive 30 dB of SNR improvement and up to 50 dB of wind noise reduction compared to WindBlock off, EON delivers improved signal transparency – because conversation shouldn't stop for the wind.

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Key highlights

- WindBlock 2.0 emphasizes the rear microphone signal where wind is less present and attenuates the front microphone signal which is more susceptible to wind.
- To measure the effectiveness of WindBlock 2.0, technical measurements of wind noise level and SNR were conducted, using recordings obtained from the microphones of Phonak Audéo EON RIC hearing instruments on a KEMAR mannequin (GRAS Sound & Vibration, Denmark) in a wind tunnel.
- WindBlock 2.0 provides up to 50 dB of wind noise reduction and up to 30 dB of SNR improvement, delivering greater signal transparency.

Considerations for practice

- The profile of hearing aid users is evolving, drawing a younger, more diverse population who place greater emphasis on hearing well in dynamic, mobile environments. For this growing population, the ability to follow conversation outdoors in wind is not a secondary consideration - it is essential to staying connected
- WindBlock 2.0 builds on the comfort of the original WindBlock; users can expect enhanced speech clarity, a more natural sound, and lower listening effort in wind (Vaisberg et al., 2026).
- WindBlock 2.0 is available at all EON performance levels, hearing care professionals can therefore be confident recommending EON devices for both indoor and outdoor hearing across a range of listening needs.

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