

ReSound GN

ReSound Advanced Technology Series:

Noise Tracker II and Wind Guard

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Today's Agenda

- Introduction
- Noise Tracker II
- Wind Guard
- Fitting software and app adjustments
- Summary
- Q&A

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Learning Objectives

By the end of this course, you will be able to:

1. Describe the technology in Noise Tracker II digital noise reduction.
2. Describe the technology in Wind Guard wind noise reduction.
3. Adjust both noise reduction features using updated fitting software.

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Introduction

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Hear More Than You Ever Thought Possible

Our commitment since 2009, Surround Sound by Resound harnesses advanced technologies to emulate the human ear, taking advantage of the brain's natural ability to recognize and localize sounds while maintaining an open sound picture

Surround Sound by ReSound delivers:

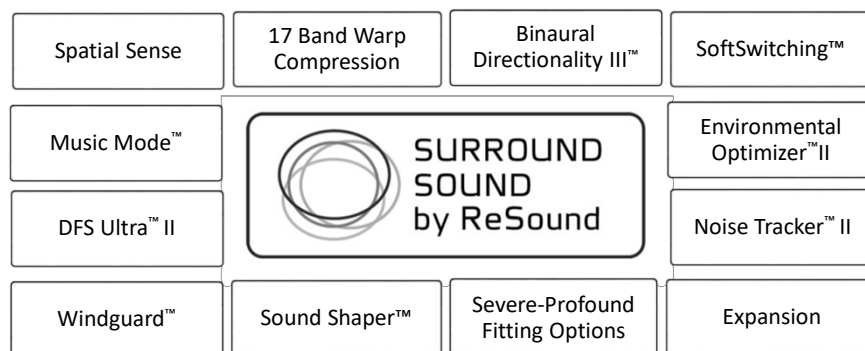
- Clear, rich, vibrant sound
- Exceptional speech understanding
- Best sense of where sounds are coming from



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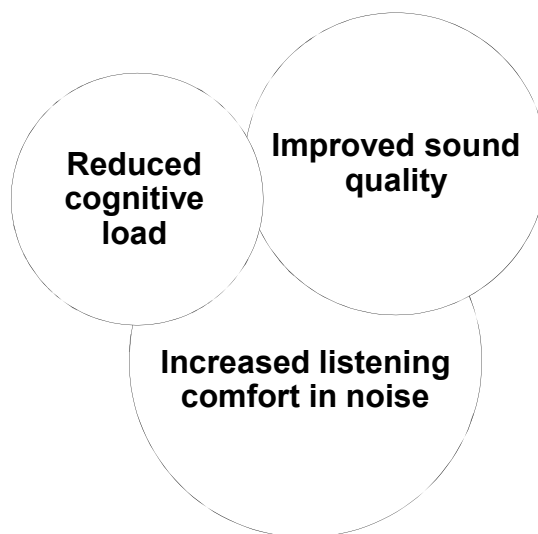
Surround Sound by ReSound



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Why noise reduction?



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Why noise reduction?

Hearing in noise is considered a top priority by experienced hearing aid users

Desired features in a hearing aid are to hear well in noise and for the hearing aid to adjust automatically

Top priority features (most mentioned)
Automatic adjustment to sound situations
Hear in noisy Environments
Easy to operate
Good noise cancellation
Clarity of speech

Source: DesignIt study, internal, 2017

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Noise Tracker II

Digital noise reduction

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Modulation based DNR

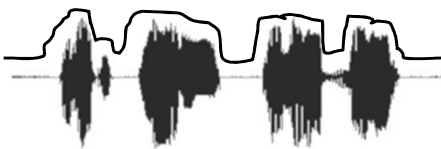
Uses modulation characteristics to classify speech and noise

If the channel input is classified primarily as:

- Noise- Gain is reduced
- Speech- Gain remains unaltered

Speech

Modulation frequency: < 10 Hz
Modulation depth: 30-50 dB



Noise

Modulation frequency: > 30 Hz
Modulation depth: 5 dB (steady state), 20 dB (babble)



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Modulation based DNR

Works best with more difference between incoming sounds

- Single talker vs. steady state noise
- Spectral separation- speech signal vs. narrowband noise

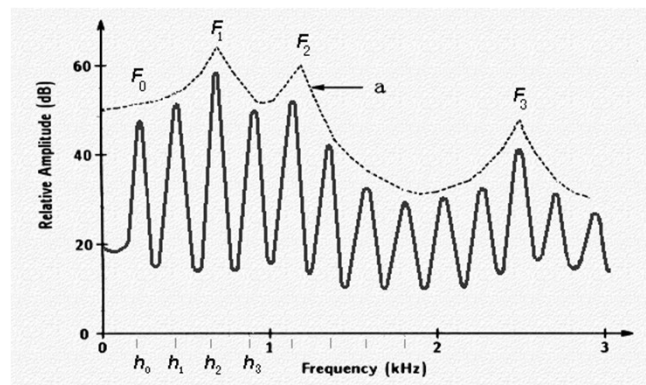
Challenges

- Systems using modulation based DNR differ widely on a number of settings
- As noise becomes more speech-like, modulation DNR may mis-identify speech and noise more often

Comodulation

Identifies speech based on presence of harmonics, while identifying noise as non-harmonic

In this case, music would also be considered "speech," and no gain reduction applied



Noise Tracker II

ReSound uses a different noise reduction method called *spectral subtraction*

Spectral subtraction estimates a noise-free signal

For a sample of speech + noise, the gaps between speech are used as models for noise spectrum

Noise can then be subtracted from the overall signal



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Spectral subtraction

Challenges

- Assumes that speech and noise are stationary
- Some forms of spectral subtraction, such as Wiener filtering, originates from a mathematical algorithm that does not take human auditory perception into account

How does Noise Tracker II overcome these challenges?

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Identifying speech

Algorithm analyzes signal at 1-millisecond intervals

Identifies speech using a probability-based method based on acoustic characteristics associated with speech

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Probability of speech

Based on the PS - different Noise Tracker profiles are applied:

**When the speech probability is 0%
(no chance of speech)**

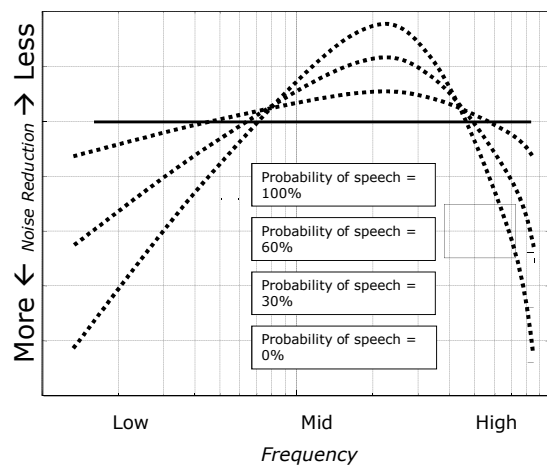
Flat noise reduction profile will be applied

Same amount of noise reduction will be applied over the whole frequency range

**When the speech probability is >0%
(greater chance of speech)**

Provides more gain reduction in the low- and high frequencies

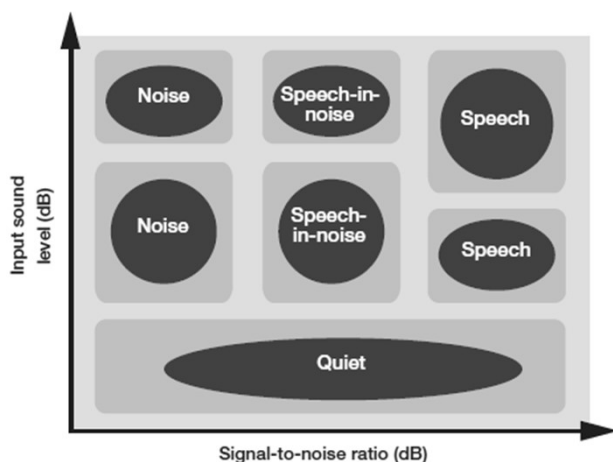
Provides less gain reduction in the frequency area containing speech



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Analyzing the sound environment



Amount of gain reduction is based on:

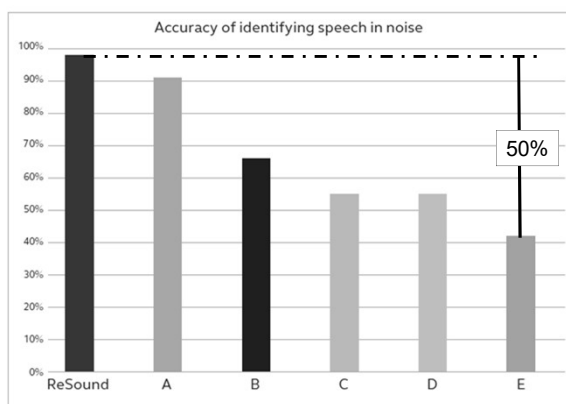
- Probability of speech
- Estimated SNR of the input signal
- Environmental classification

Up to 10 dB of gain reduction is possible

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ReSound LiNX 3D is up to 50% better at identifying speech in various environments



Source: Groth (2015)

ReSound LiNX 3D and premium hearing aids from 5 other manufacturers were exposed to a conversation between a male and a female speaker in different kinds of noisy environments (party, train station, grocery store, hand mixer etc.)

The hearing aids were connected to their respective fitting software and the data logging was read from the hearing aids

All manufacturers have classification environments that include speech-in-noise

ReSound LiNX 3D showed the greatest accuracy at 98%. The least accurate hearing aid classified only 42% of hours as speech-in-noise.

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Noise Tracker II

Noise Tracker II adds up to undistorted noise output at a lower gain than desired speech

Speech in crowd noise at 0 dB SNR

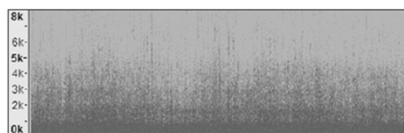


Figure 4. Spectrogram of the background noise only.

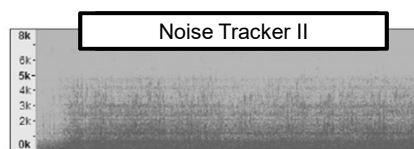


Figure 5. Spectrogram showing the difference between NoiseTracker II off and on. The reduction corresponds well to the background noise spectrogram in Figure 4.

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Wind Guard

Wind noise reduction

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The problem with wind

Turbulence: The flow of air around an object

Wind rushes over the microphones, where the turbulence is then amplified

This results in...

- Saturation and distortion
- Uncomfortable for the listener
- Can interfere with speech audibility



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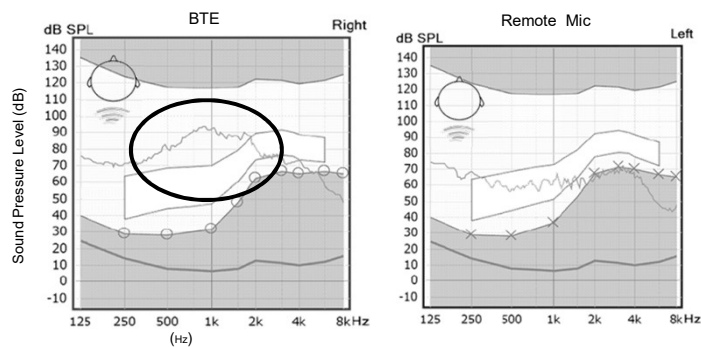
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Acoustic solutions

Windscreens to reduce turbulence at the microphones

Strategic microphone placement

Wind noise measured from the rear



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Algorithmic Solution

An ideal wind noise algorithm is designed to:

- Reduce gain when wind noise is detected
- Minimizes gain reduction for speech or other environmental sounds

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Identifying wind

Wind has very specific characteristics

- Low-frequency spectrum
- Wind creates *uncorrelated* input into each microphone, unlike speech or background noise
- Directional microphones will amplify both inputs, creating more noise than omnidirectional



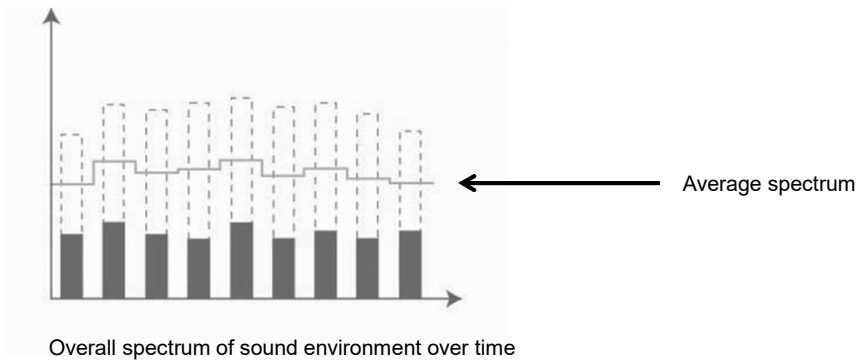
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Identifying wind

Overall spectrum of incoming sound environment is monitored

- Wind Guard monitors spectrum up to 3000 Hz
- Spectrum is updated every 250 milliseconds



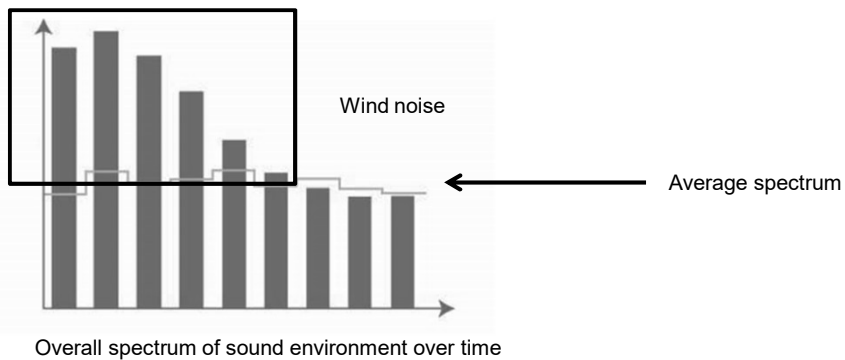
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Identifying wind

Algorithm can detect a burst of greater SPL compared to overall environment

- The input from both microphones is compared to detect any uncorrelated input (wind)
- A comparison of wind noise versus average environmental spectrum is calculated



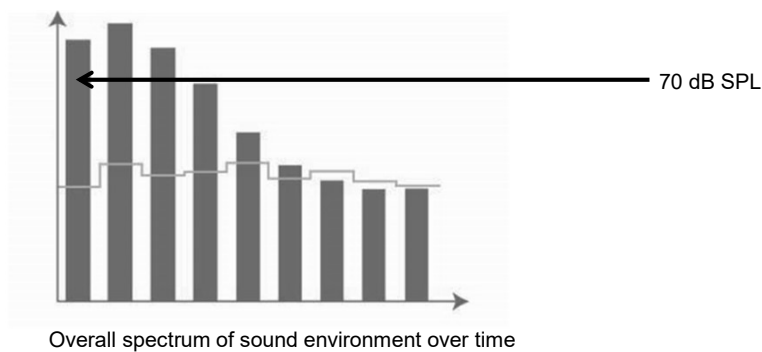
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Wind Guard

Wind Guard will activate when:

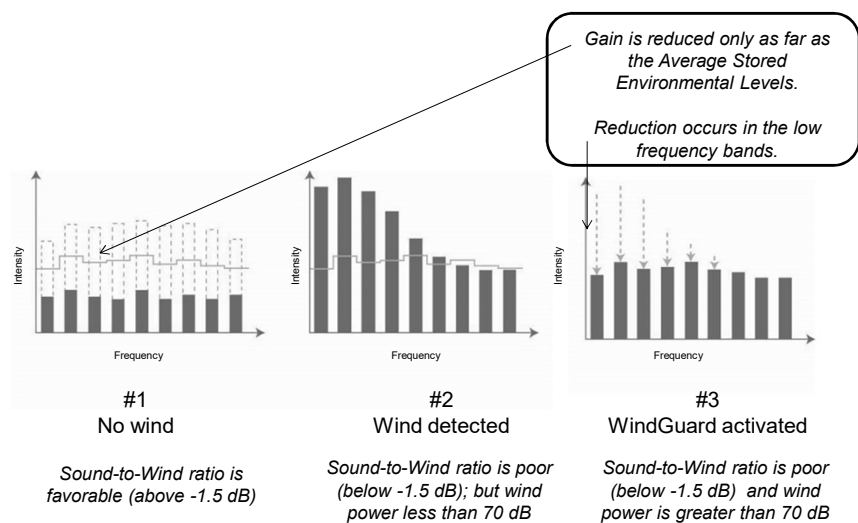
- Wind noise is 70 dB SPL or greater
- Wind noise is at least 1.5 dB louder than overall environment



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Wind Guard



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Wind Guard

Gain reduction = average environmental level – wind noise level + **offset**

Offset = Level selected in fitting software

- Mild = 6 dB
- Moderate = 3 dB
- Strong = 0 dB

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Fitting software and app adjustments

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ReSound Smart Fit



Enhance your clients
fittings experience

Designed together with
audiologists

More time for support
and guidance

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Joan Smith
First Time User
Data Logging

Instruments
Noahlink ☒ Connect
Right Not Connected Left Not Connected
LT961-DRW LP Receiver LT961-DRW LP Receiver
Mute ☐ Mute ☐

Media Player
Select Sound
00:00.0/00:00.0

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Patient Instruments Fitting Summary
Gain Adjustments Advanced Features Environmental Optimizer II Device Controls

Noise Tracker II
Per Environment...
Quiet
Speech (soft)
Speech (loud)
Speech in noise (mod.)
Speech in noise (loud)
Noise (mod.)
Noise (loud)
Off Mild Moderate Considerable Strong

Frequency (Hz) 125 250 500 1K 2K 4K 8K

Gain Level (%) 100%

Autoscope Adaptive Directionality ☒
Autoscope ☒
Syllabic Fast Moderate Slow
Off Mild Moderate Strong Music
On Off
Auto DFS
Noise Tracker II ☒
Wind Guard ☐
Exp ☐

Calibrate DFS Pair Accessories

Joan Smith
First Time User
Data Logging

Instruments
Noahlink ☒ Connect
Right Not Connected Left Not Connected
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Patient Instruments Fitting Summary
Gain Adjustments Advanced Features Environmental Optimizer II Device Controls

Frequency (Hz) 125 250 500 1K 2K 4K 8K

Gain Level (%) 100%

Autoscope Adaptive Directionality ☒
Autoscope ☒
Syllabic Fast Moderate Slow
Off Mild Moderate Strong Music
On Off
Auto DFS
Noise Tracker II ☒
Wind Guard ☐
Exp ☐

Calibrate DFS Pair Accessories

Mild	-3 dB
Moderate	-6 dB
Considerable	-8 dB
Strong	-10 dB

Joan Smith
First Time User
Data Logging

Instruments
 (i) Noahlink ☒ Connect
 ● Right Not Connected ● Left Not Connected
 LT961-DRW LP Receiver LT961-DRW LP Receiver
 Mute ☐ Mute ☐

Media Player
 Select Sound
 00:00.0/00:00.0
 ReSound GN

File Edit View Instrument Fitting Help
 Patient Instruments **Fitting** Summary
 Gain Adjustments Advanced Features Environmental Optimizer II Device Controls

Gain Level (%) 100%

Frequency (Hz) 125 250 500 1K 2K 4K 8K

Directionality Omni

Syllabic Fast Moderate Slow

Time Constants Off Mild Moderate Strong Music

DFS Ultra II

Auto DFS

Noise Tracker II

Wind Guard

Expansion

Sound Shaper

Calibrate DFS Pair Accessories Save

9:41 AM 100%

Outdoor

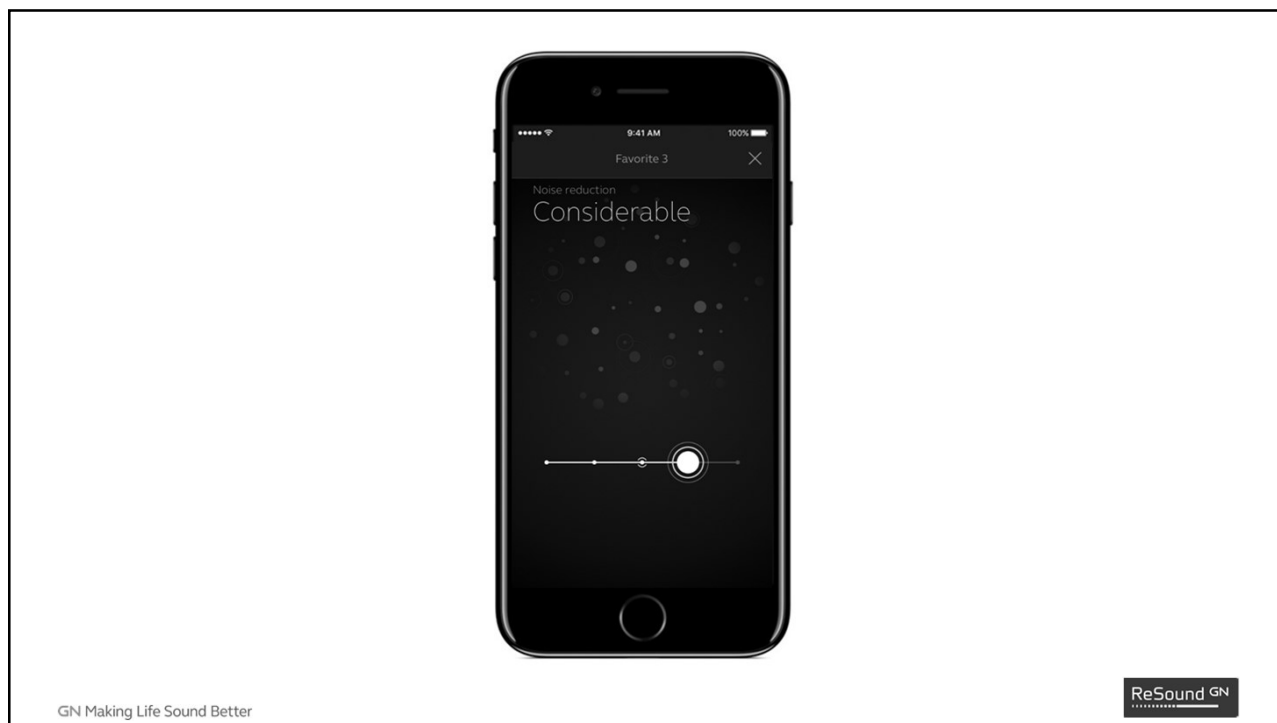
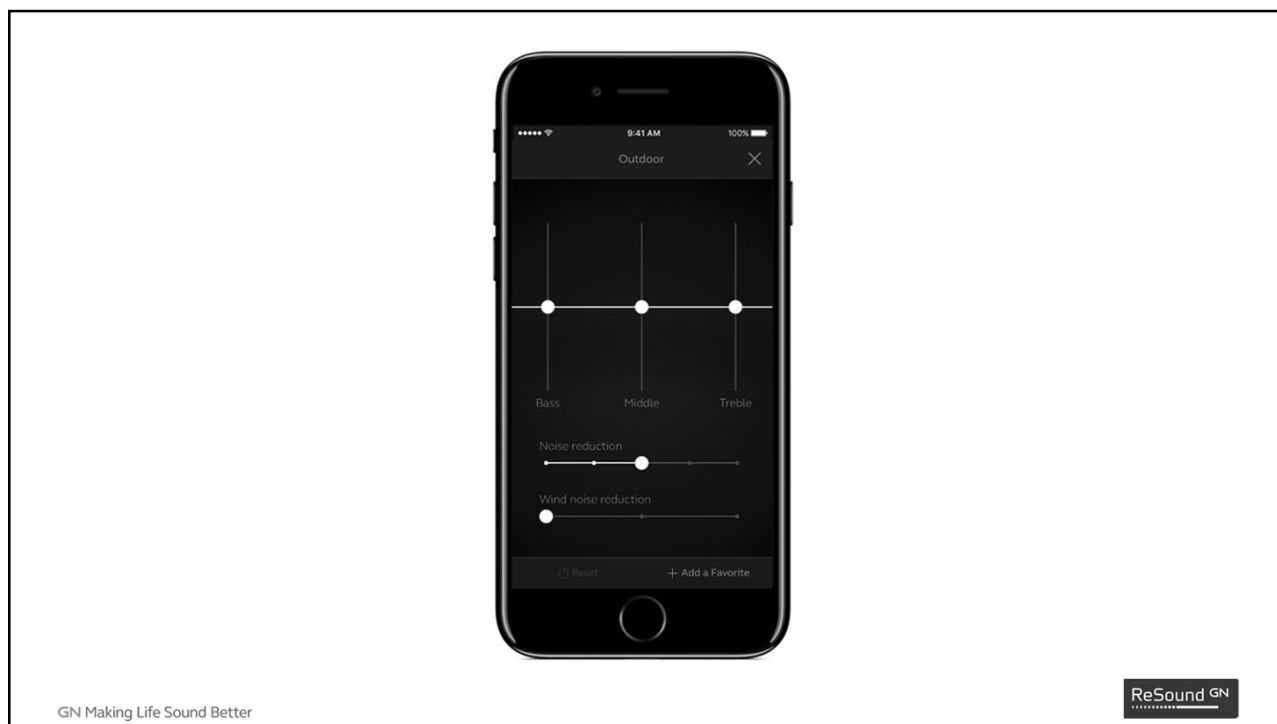
Noise filter Speech clarity

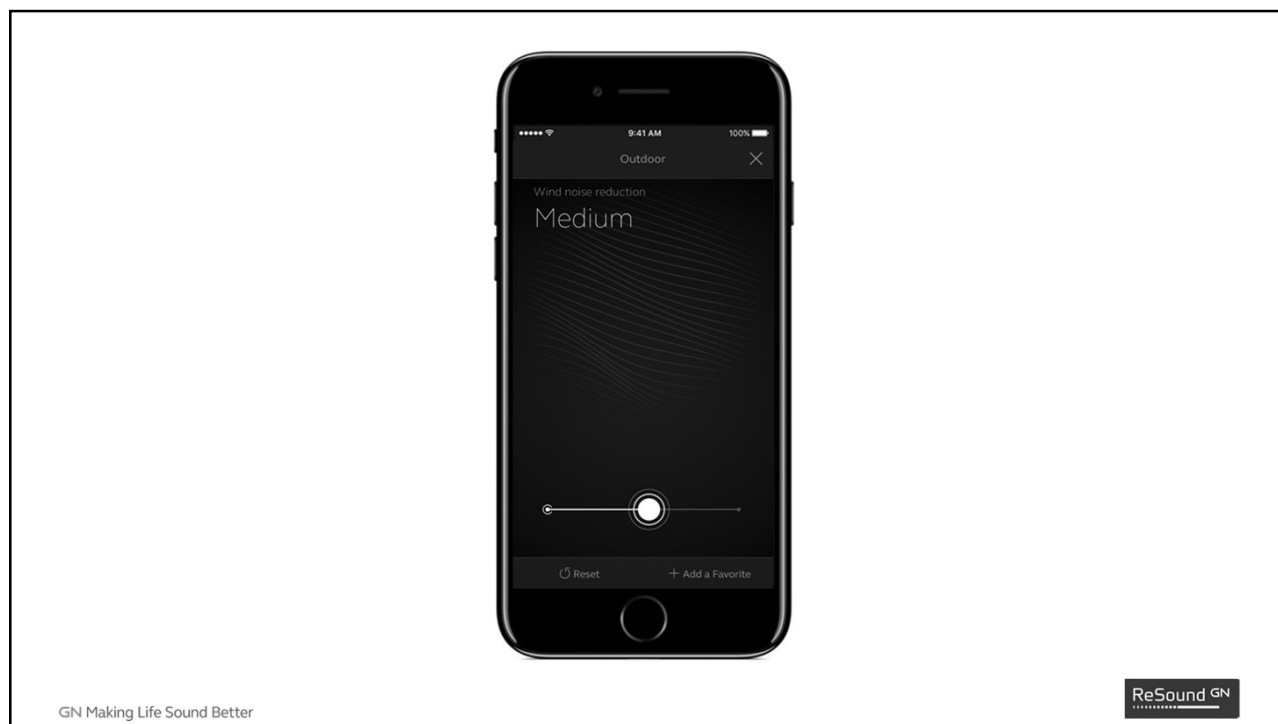
Sound Enhancer

Home Connectivity My ReSound More

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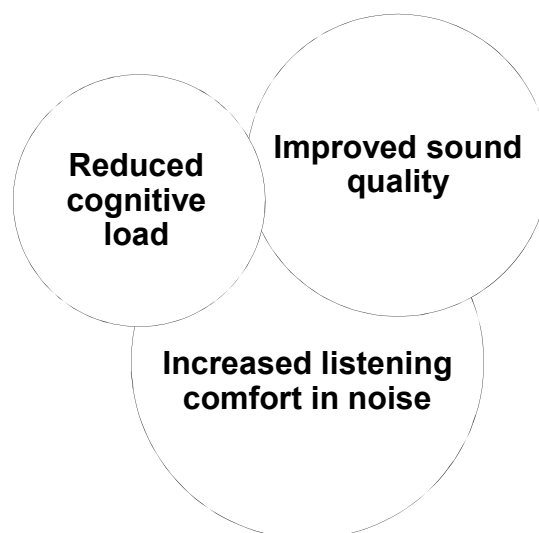


Summary



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Why noise reduction?



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Q&A

Any questions?

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Thank you!

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