

Conversations Shine with CROS Lumity.

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Learning Outcomes

- After this course, participants will be able to list new Lumity products designed to address single-sided hearing loss.
- After this course, participants will be able to list the benefits of SmartSpeech Technology.
- After this course, participants will be able to list resources available to them and their patients.

What is UHL and what are the challenges?



What is
Unilateral Hearing
Loss (UHL)?

...any degree of permanent hearing
loss in one ear with normal hearing
in the opposite ear.²

Prevalence and causes of UHL.

1 in 1000

identified at birth³

3 in 100

for school age children⁴

7.2%

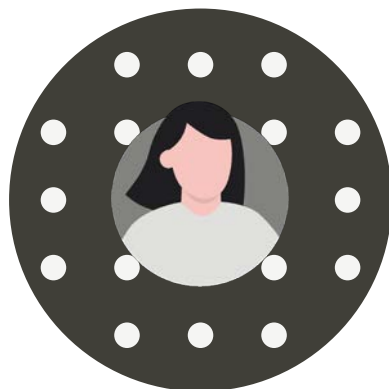
of American adults⁵

- Congenital cytomegalovirus
- Cochlear malformations
- Bacterial meningitis
- Enlarged vestibular aqueduct
- Chiari malformation
- Premature birth
- Genetic causes
- Postnatal infections
- Sudden idiopathic hearing loss
- Head trauma
- Meniere's Disease
- Acoustic Neuroma
- Unknown causes

Challenges for people with unaidable hearing loss on one side

Normal hearing in both ears

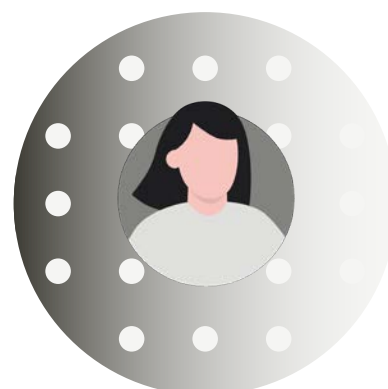
Localize sounds accurately



No head shadow

Unilateral Hearing Loss

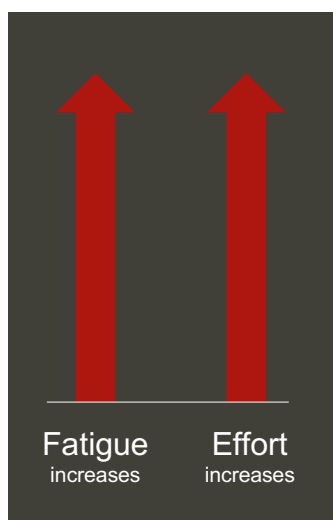
Localize target sounds mainly in the field of the better ear



Head shadow

Challenges for people with unaidable hearing loss on one side

Perceived effort and fatigue studies show:



Children with unilateral hearing loss (UHL) who have the largest asymmetry between their ears report the **most overall fatigue.**



Adults with SSD are **5 times more likely** to report severe fatigue than adults with no hearing loss.



Listening effort and hearing fatigue are now known to affect people with UHL as much and **sometimes more than those with a mild-moderate hearing loss in both ears.**

Phonak Well-Hearing is Well-Being™



Social-emotional well-being:

Hearing well fosters easier engagement, stronger connections and a more positive outlook.



Cognitive well-being:

Hearing well supports cognitive fitness.¹⁵



Physical well-being:

Hearing well enables people to live a more active and healthy lifestyle.



How does untreated UHL affect patients?

Audiological (e.g. Lieu, 2010; McKay, 2010, Snapp, 2017, Snapp 2019)

- Localization
- Awareness on deaf side
- Hearing in noise/ at a distance
- Increased listening effort?
- Difficulties hearing in noise & tinnitus presence more likely with UHL than bilateral HL (Pierzycki et. al., 2020)

Social-Emotional (e.g. Lucas et. al. 2017, Leterme et. al, 2015, Wie et. al., 2010, Snapp, 2019, Pierzycki et. al., 2020)

- Reduced social/psychological well-being
- Reduced quality of life
- Affects communication & social interaction
- Increased loneliness. Some outcomes worse than for bilateral HL

Educational (e.g. Bess et.al.,1988; Oyler et.al.,1986; Lieu et al. 2013)

- More likely to repeat a year of school
- More likely to need support services at school
- Speech and language delays

How unaidable hearing loss affects hearing well and well-being



When using a CROS system compared to unaided | 1. Stewart, E. & Woodward, J. (2021). Out of the (Head) Shadow: A Systematic Review of CROS/BiCROS Literature. The Hearing Review, 28(8), 22-25. <https://www.hearingreview.com/inside-hearing/research/head> | 2. Picou, E. M., Davis, H., Lewis, D., & Tharpe, A. M. (2020). Contralateral Routing of Signal Systems Can Improve Speech Recognition and Comprehension in Dynamic Classrooms. J Speech Lang Hear Res, 63(7), 2468-2482. https://doi.org/10.1044/2020_JSLHR-19-00411

How CROS systems help overcome hearing and well-being challenges



1. Picou, E. M., Davis, H., Lewis, D., & Tharpe, A. M. (2020). Contralateral Routing of Signal Systems Can Improve Speech Recognition and Comprehension in Dynamic Classrooms. J Speech Lang Hear Res, 63(7), 2468-2482. https://doi.org/10.1044/2020_JSLHR-19-00411

A look back at Phonak CROS systems



2011
CROS



2015
CROS II



2016
CROS B

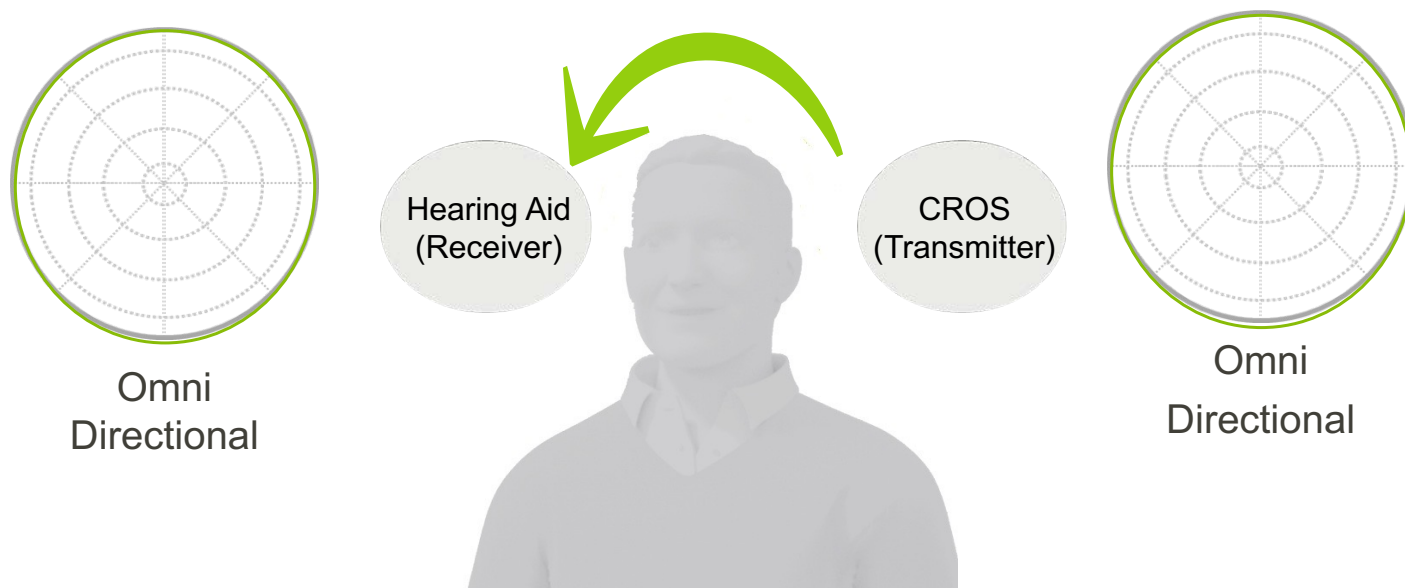


2018
CROS B-R

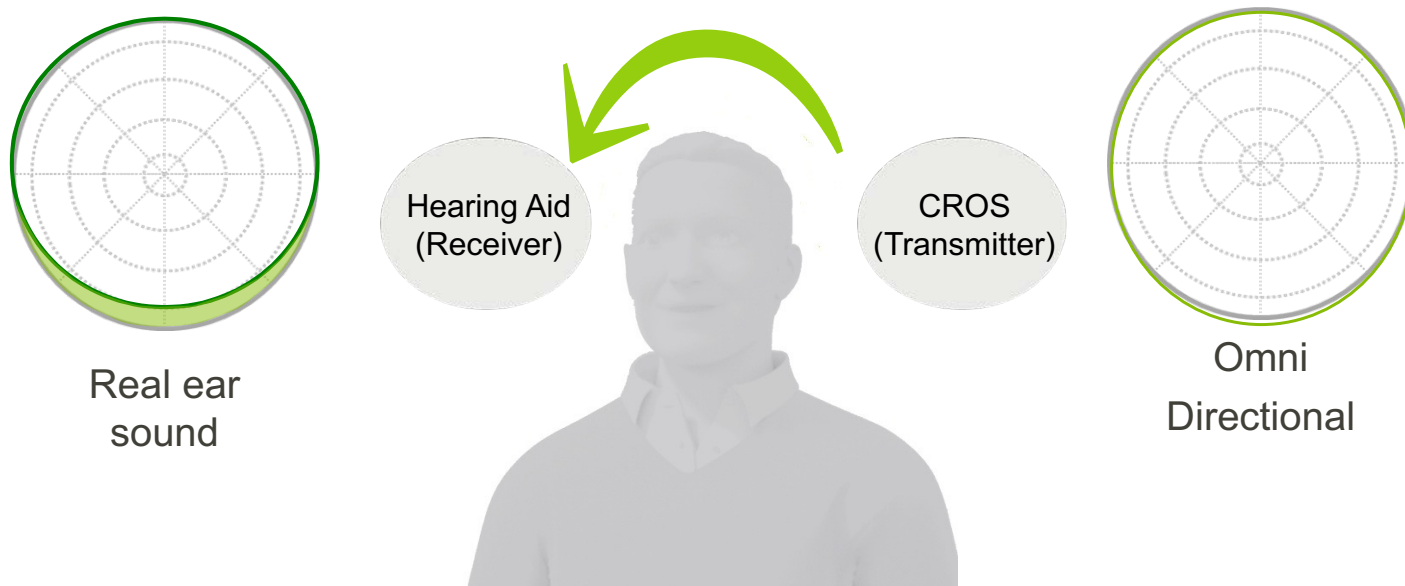


2021
CROS P

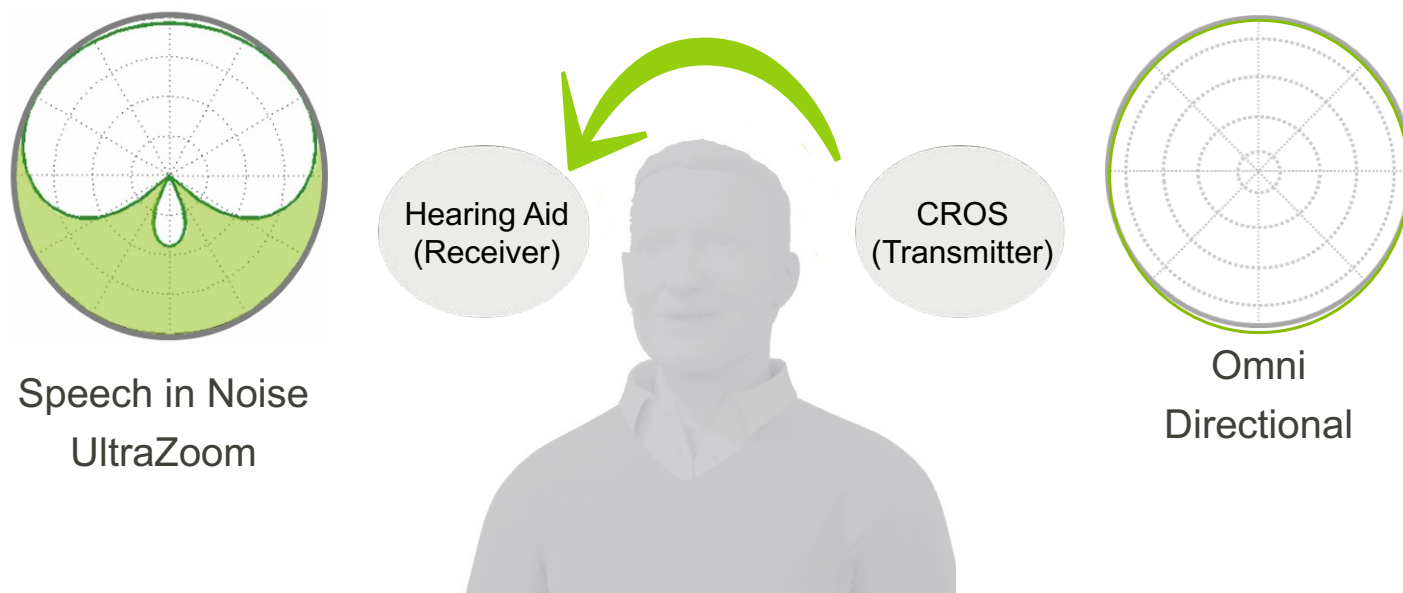
Evolution of CROS



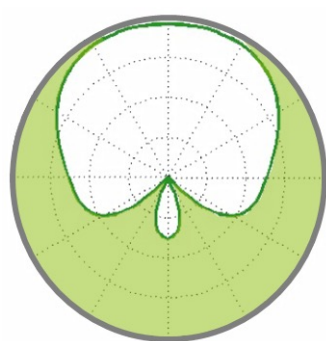
Evolution of CROS



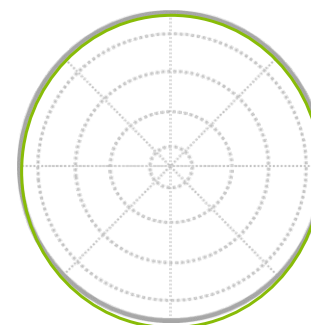
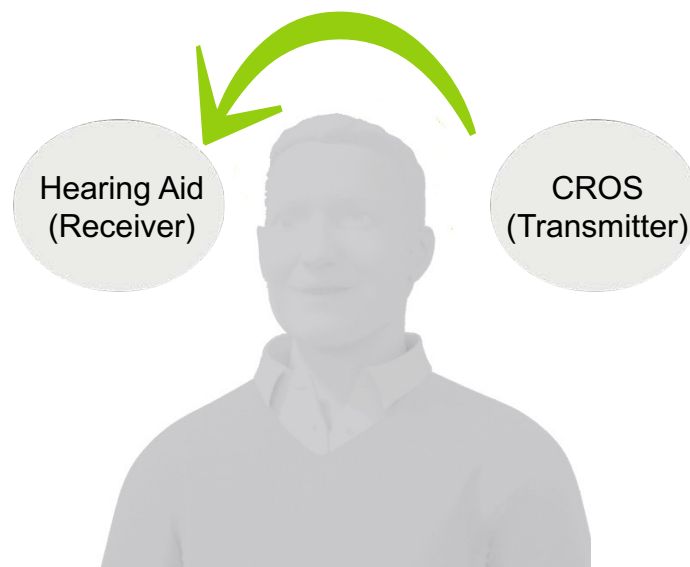
Evolution of CROS



Evolution of CROS

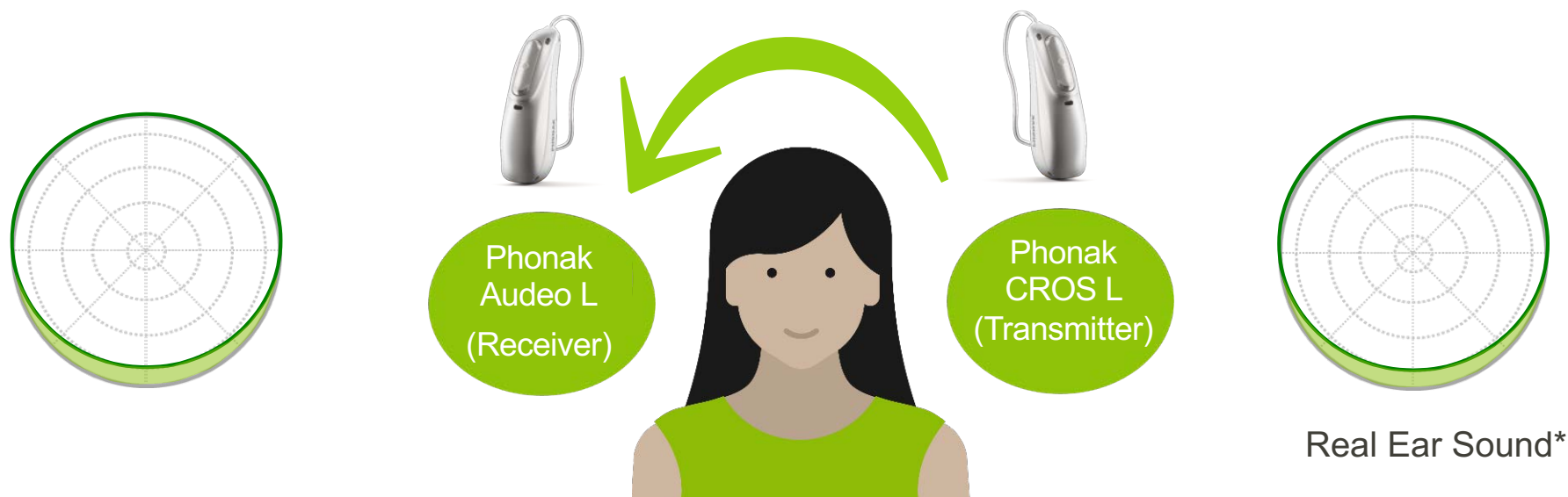


Speech in Loud
Noise
Adaptive
Stereozoom



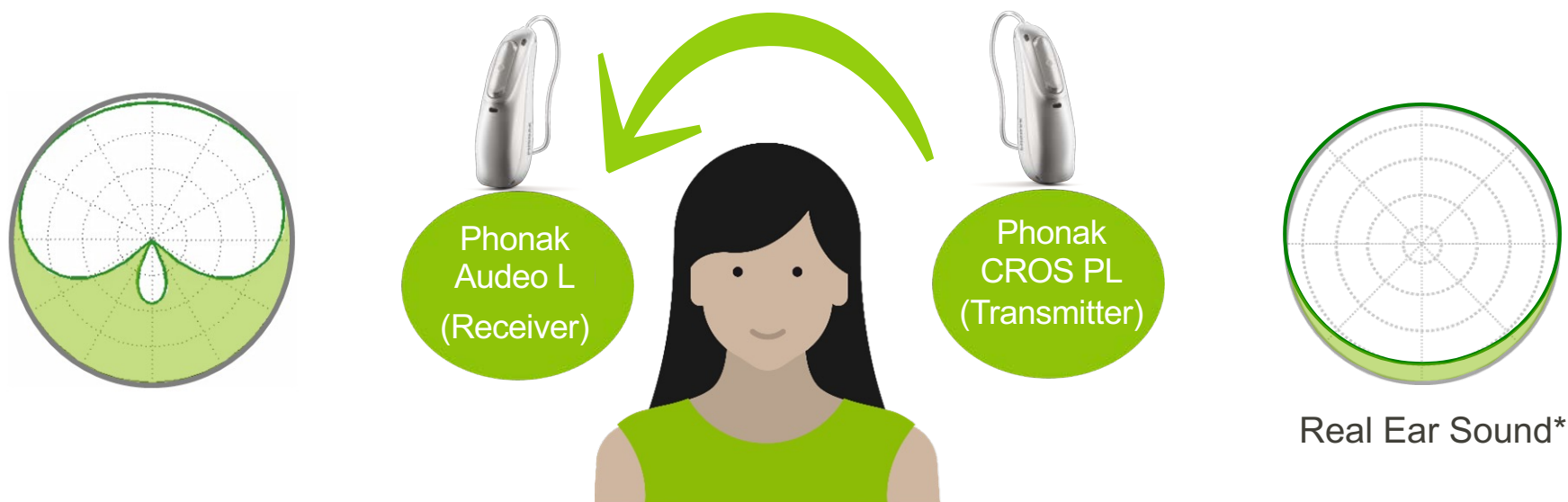
Omni
Directional

CROS Lumity in Calm



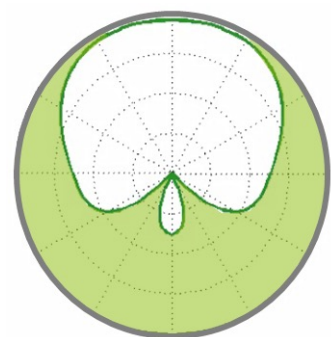
* Audeo L 50, 70 and 90 only. Audeo L30 utilizes an omnidirectional mic pattern

CROS Lumity in Speech in Noise

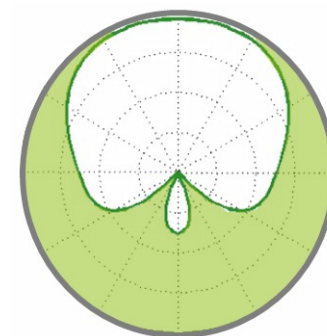
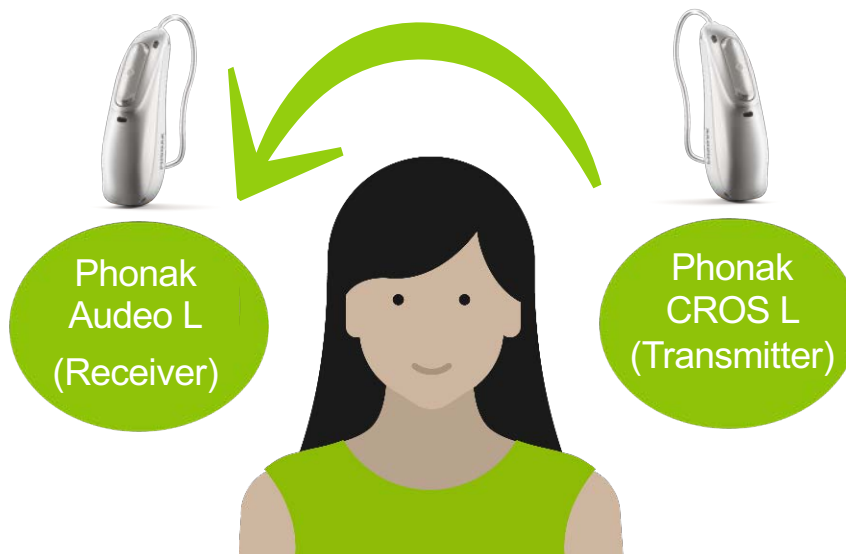


* Audeo L 50, 70 and 90 only. Audeo L30 utilizes an omnidirectional mic pattern

CROS Lumity in Speech in Loud Noise



Speech in Loud Noise
Adaptive StereoZoom



Speech in Loud Noise
Adaptive StereoZoom

Audeo L 90 – Speech in Loud Noise part of AutoSense OS automatic program

Audeo L 70 – Speech in Loud Noise is a manual choice program



Lumity and SmartSpeech
Technology●

Phonak SmartSpeech™ Technology

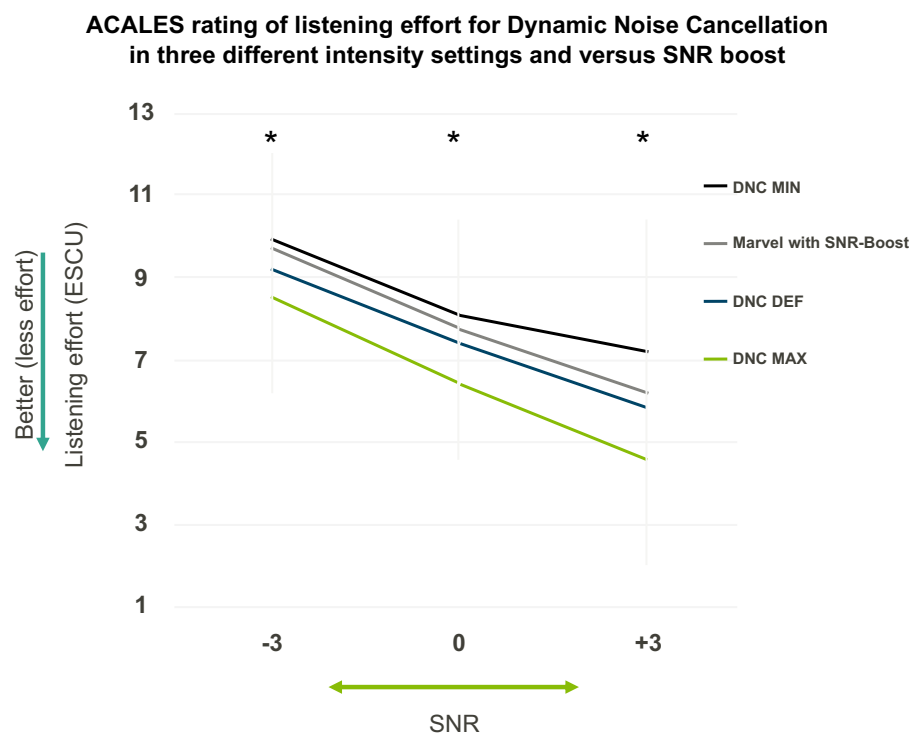


Dynamic Noise Cancellation

- Spatial noise canceller that works in combination with a directional beamformer to improve the SNR in noise up to 4 dB.
 - Reduces noise from the back and sides
 - Reduces listening effort
 - Personalized in the myPhonak app
-
- Available in 90 AND 70 levels of technology



Dynamic Noise Cancellation-Reduces listening effort



Appleton, J. (2020) AutoSense OS 4.0 - significantly less listening effort and preferred for speech intelligibility. Phonak Field Study News retrieved from www.phonakpro.com/evidence, accessed August 10, 2022.

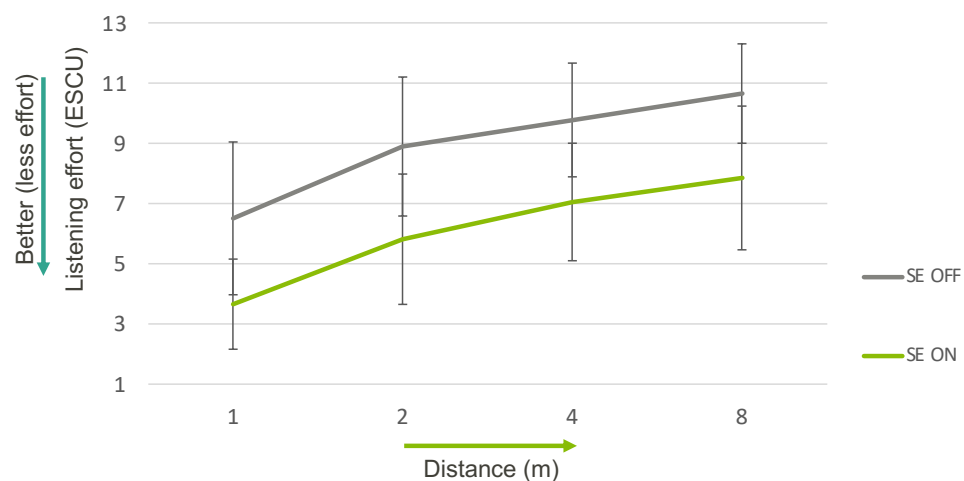
Speech Enhancer

- Adaptive feature that is designed to enhance the peaks of speech in quiet situations
 - More gain for speech in quiet while maintaining listening comfort and natural sound quality.
 - Less listening effort
-
- Available in 90 level technology



Speech Enhancer—Reduced listening effort

ACALES rating of listening effort for Speech Enhancer ON v. OFF



ESCU (y-axis) = Effort Scaling Categorical Unit
1 = no effort, 13 = extreme amount of effort.



1. Appleton, J. (2020) AutoSense OS 4.0 - significantly less listening effort and preferred for speech intelligibility. Phonak Field Study News retrieved from www.phonakpro.com/evidence, accessed August 10, 2022.
2. Pichora-Fuller, M.L. & Singh, G. (2006). Effects of age on auditory and cognitive processing: implications for hearing aid fitting and audiologic rehabilitation. *Trends in Amplification*, 10(1), 29-59. <https://doi.org/10.1177/108471380601000103>

Phonak SmartSpeech™ Technology





StereoZoom 2.0:
Smoother, smarter,
stronger●

StereoZoom 2.0: Smoother, smarter and stronger

Smoother activation

Smarter noise level dependent activation

Stronger real time adjustment to personal preference



Hear more conversation from the front

3.0dB better SNR for speech from front in challenging environments*

2.5dB better SNR at maximum strength compared to default strength**

Independent study indicated that our sense of hearing contributes to sense of environmental awareness¹

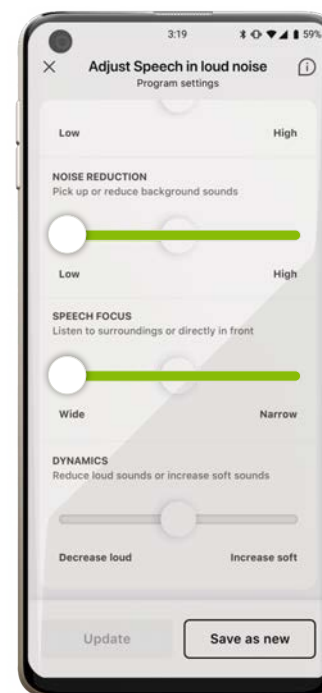


* Compared to Real Ear Sound with power dome

** with power dome

1. Brungart, D.S., Cohen, J., Cord, M., Zion, D., & Kalluri, S. (2014). Assessment of auditory spatial awareness in complex listening environments. The Journal of the Acoustical Society of America, 136(4), 1808. <https://doi.org/10.1121/1.4893932>.

StereoZoom 2.0: Smoother, smarter and stronger



StereoZoom 2.0

- For focus on speech coming from the front
 - 2.5 dB better SNR than StereoZoom 1.0
 - 16% better speech understanding (compared to fixed directional)
 - Decreased listening effort
-
- In Lumity:
 - 90-Automatic
 - 70-Manual
 - Can control directionality via Speech Focus slider in myPhonak app





SpeechSensor:
hear more from
side and back●

Speech Sensor: Detect the direction of speech

Constant monitoring of sound environment

360 degree picture of the sound environment

Accurate detection of speech signal in a challenging environment



Hear more conversations from the side and behind

3.4dB better SNR with fixed directional
when speech is from the side

2.5dB better SNR with Real Ear Sound
when speech is from behind

More access to sound not only provides
clarity but reduces listening effort^{1,2,3}



¹ Hornsby, B.W.Y. (2013). The effects of hearing aid use on listening effort and mental fatigue associated with sustained speech processing demands. *Ear and Hearing*, 34(5), 523–534. <https://doi.org/10.1097/AUD.0b013e31828003d8>

² Picou, E.M., Ricketts, T.A., & Hornsby, B.W.Y. (2013). How hearing aids, background noise, and visual cues influence objective listening effort. *Ear and Hearing*, 34(5), e52–e64. <https://doi.org/10.1097/AUD.0b013e31827f0431>

³ Pichora-Fuller, M.K., & Singh, G. (2006). Effects of Age on Auditory and Cognitive Processing: Implications for Hearing Aid Fitting and Audiologic Rehabilitation. *Trends in Amplification*, 10(1), 29–59. <https://doi.org/10.1177/108471380601000103>

SpeechSensor

- Spatial speech detection algorithm, accurately detects the direction of the primary speech signal in noise.
 - Improved SNR when speech is coming from the sides or back
 - Reduced listening effort when speech is not in the front as compared to SZ2.0.
-
- Available in 90 level technology





CROS Lumity ●

Introducing the Phonak CROS L system



Experience speech understanding with our innovative technology



Easy to use



New ways to personalize the hearing experience



Connect people to the world around them



CROS system under the Lumity hood

- AutoSense OS 5.0
- StereoZoom 2.0
- Speech Enhancer*
- Dynamic Noise Cancellation*
- RogerDirect™
- APD 2.0*

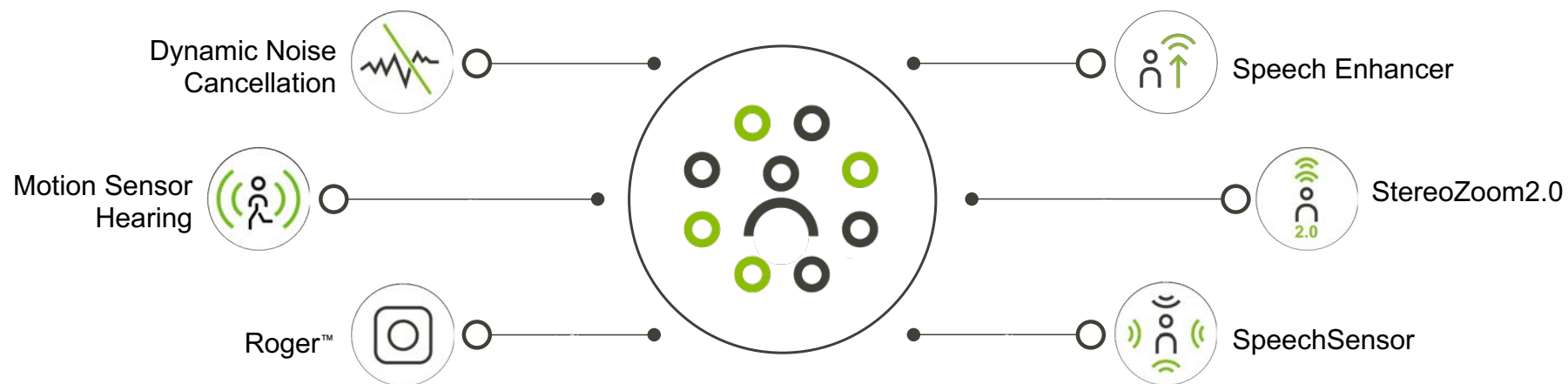


- Robust and reliable housing
- myPhonak and myPhonak Junior app compatible
- Lumity rechargeable compatible**
- Health data tracking and Remote Support
- Stylish color range
- Universal Bluetooth® connectivity
- Hands-free calls

*Lumity L-PR only

**Compatible with Audéo L-R, Audéo L-RT, Naída L-PR and Sky L-PR

Experience speech understanding with Phonak SmartSpeech™ Technology



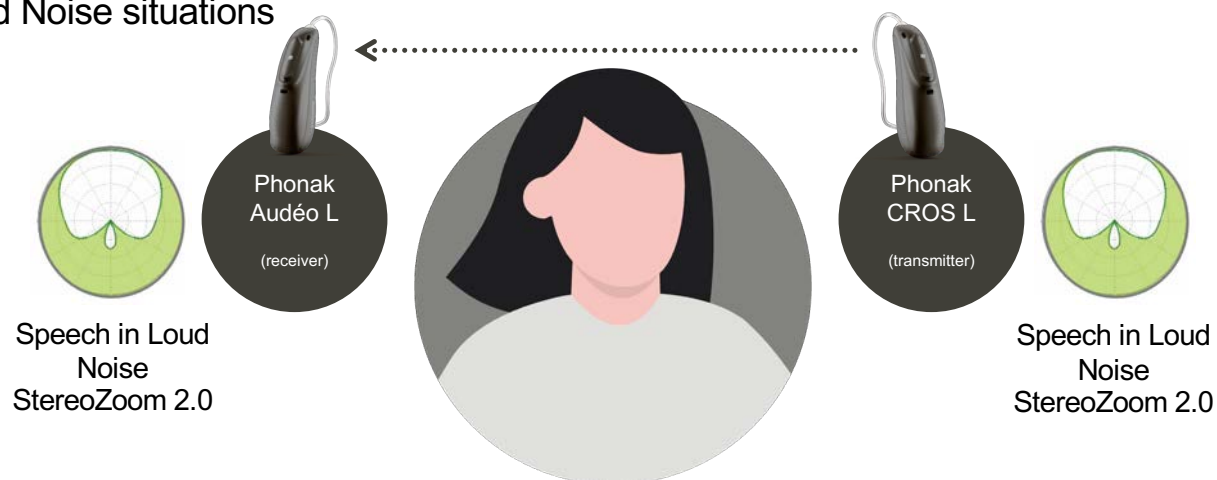


Technology levels

	90 Premium				
	ActiveVent™ Performance +*				
	Dynamic Noise Cancellation				
	Speech Enhancer				
	StereoZoom 2.0				
	Comfort in Echo				
	Speech in Car				
	Speech in Loud Noise				
	Comfort in Echo (manual)				
	Speech in Loud Noise (manual)				
	Speech in 360° (manual)				
	EchoBlock				
	WindBlock				
	SoundRelax				
	DuoPhone				
	Real Ear Sound				
	SoundRecover2				
	WhistleBlock				
	Tinnitus Balance				
	20 Channels				
		70 Advanced			
		ActiveVent Performance +*			
		Dynamic Noise Cancellation			
		StereoZoom 2.0			
		Motion Sensor Hearing			
		UltraZoom			
		Roger Technology			
		Music			
		Comfort in Noise			
		Speech in Noise			
		Calm Situation			
		Streaming Speech			
		Streaming Music			
		Speech in Loud Noise (manual)			
		Speech in 360° (manual)			
		WindBlock			
		SoundRelax			
		DuoPhone			
		Real Ear Sound			
		SoundRecover2			
		WhistleBlock			
		Tinnitus Balance			
		20 Channels			
			50 Standard		
			ActiveVent Performance +*		
			Motion Sensor Hearing		
			UltraZoom		
			Roger Technology		
			Comfort in Noise		
			Speech in Noise		
			Calm Situation		
			Streaming Speech		
			Streaming Music		
			WindBlock		
			DuoPhone		
			Real Ear Sound		
			SoundRecover2		
			WhistleBlock		
			Tinnitus Balance		
			16 Channels		
				30 Essential	
				ActiveVent Performance +*	
				UltraZoom	
				Roger Technology	
				Speech in Noise	
				Calm Situation	
				Streaming Speech	
				Streaming Music	
				WindBlock	
				SoundRecover2	
				WhistleBlock	
				Tinnitus Balance	
				12 Channels	

CROS L with SmartSpeech Technology includes StereoZoom 2.0 for improved speech understanding in diffuse noise*

Audéo L and CROS L:
Speech in Loud Noise situations



Audéo L 90 – Speech in Loud Noise part of AutoSense OS automatic program
Audéo L 70 – Speech in Loud Noise is a manual choice program

*BiCROS (unaidable hearing loss in one ear and aidable hearing loss in the other ear) fittings only

1. Appleton, J. (2020). AutoSense OS 4.0 - significantly less listening effort and preferred for speech intelligibility. Phonak Field Study News www.phonak.com/evidence 2. www.phonak.com/evidence
3. Thibodeau L.M. (2020). Benefits in Speech Recognition in Noise with Remote Wireless Microphones in Group Settings. Journal of the American Academy of Audiology, 31(6), 404–411.
4. Latzel, M., Lesimple, C., & Woodward, J. (2023). Speech Enhancer significantly reduces listening effort and increases intelligibility for speech from a distance. Phonak Field Study News. retrieved from www.phonak.com/evidence.
5. Pending study SRF-461



The SmartSpeech Technology advantage

- Phonak has the only CROS system that utilizes StereoZoom 2.0
- With StereoZoom 2.0 more than **10dB** has been measured in the results for 50% SRT in diffuse noise compared to unaided* with Phonak CROS Lumity

*BiCROS (unaidable hearing loss in one ear and aidable hearing loss in the other ear) fittings only

Folkeard, P Saleh,H.K, Kuehnel, V, Voss,S.C, Qian,J, & Scollie S.(2023, April 19-22). Assessing speech intelligibility in noise , subjective listening effort and subjective quality in hearing in BiCROS hearing aid fittings [poster presentation]. American Academy of Audiology

Phonak SmartSpeech™ Technology improvements: CROS Lumity compared to CROS Paradise



Increasing the gain on the Lumity hearing aid side compensates for the reduction in gain of resonant frequencies*

=



StereoZoom 2.0 provides additional measurable improvement in SNR for CROS Lumity compared to CROS Paradise.

StereoZoom 2.0 provides additional measurable improvement in SNR for CROS Lumity compared to CROS Paradise.

The BiCROS subjective patient experience

Individuals with unaidable hearing loss on one side demonstrate **higher subjective quality of hearing** scores when fitted with BiCROS hearing systems compared to being unaided.



Folkeard P., Saleh H., Kuehnel V., Voss S., Qian J., Scollie S. (April 2023). The BiCROS experience: A patient-oriented approach to investigate subjective outcomes using questionnaires, and a patient perspective of BiCROS preference. Poster displayed at AAA publication pending.



New ways to
personalize your
hearing experience

CROS Lumity compatibility

CROS L



Audéo L-R/RT



Naída L- PR



Sky L-PR



CROS L-R colors

New* fresh colors



Precious
Pink



Caribbean
Pirate



Electric
Green

Standard colors



Sand
Beige



Sandalwood



Chestnut



Champagne



Silver
Gray



Graphite
Gray



Black



Beige

*Compared to CROS Paradise

CROS Lumity charging solution



Charger Ease

Coupling options

Solution 1



CROS Tube



Domes

Solution 2



CROS Tube



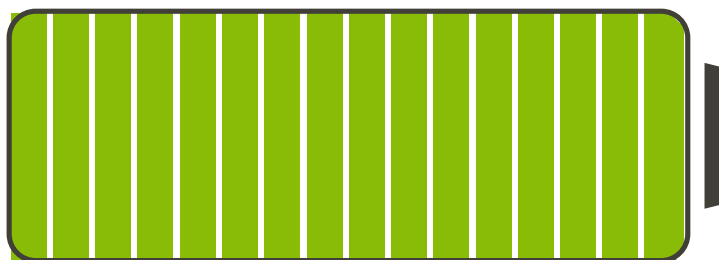
SlimTip

Solution 3



CROS Tip

Average CROS battery life



12.5 hours*

*Battery life of a CROS L system, not that of a CROS L devices.



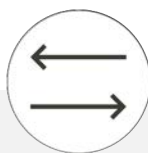


CROS L in Target 9.0 ●

Connection to Phonak Target



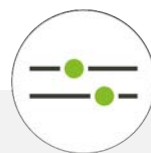
Connect to
**Phonak
Target** using
**Noahlink
Wireless**



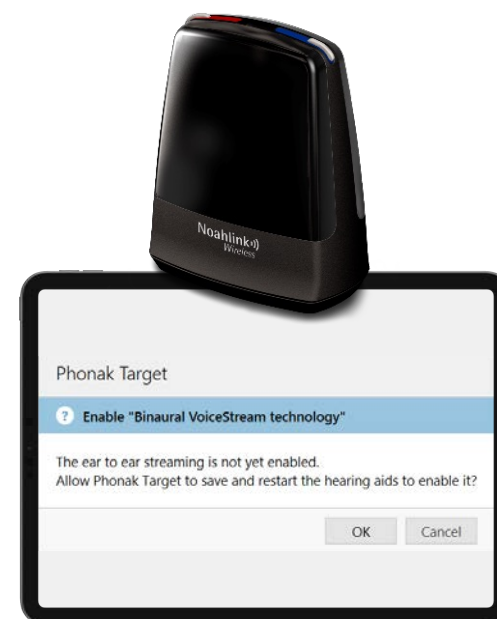
Enable
BVST



CROS
transmitter is
active during
the fitting
process



Fine tuning
is done in
real time

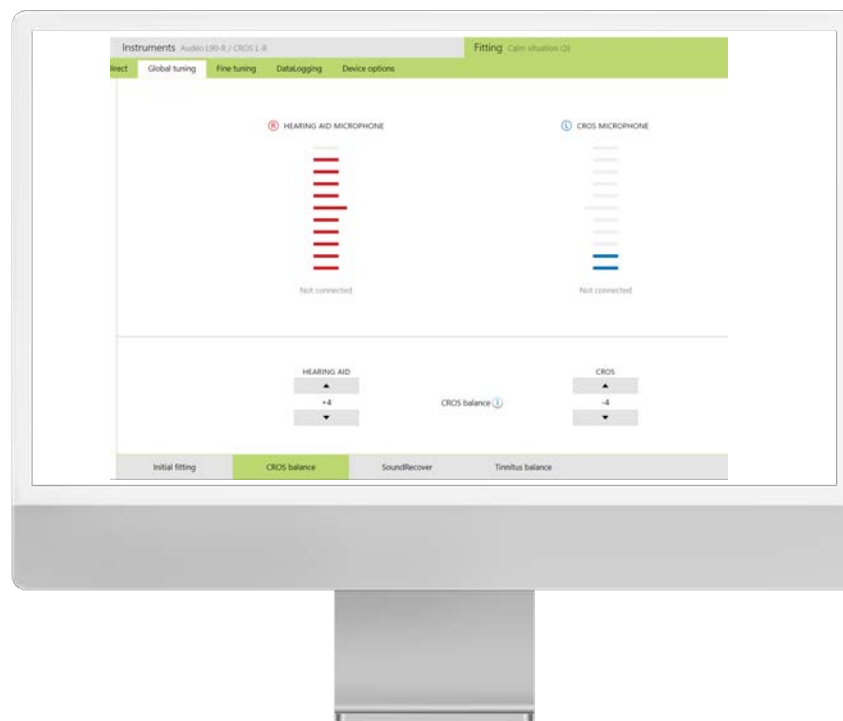


CROS balance in Phonak Target

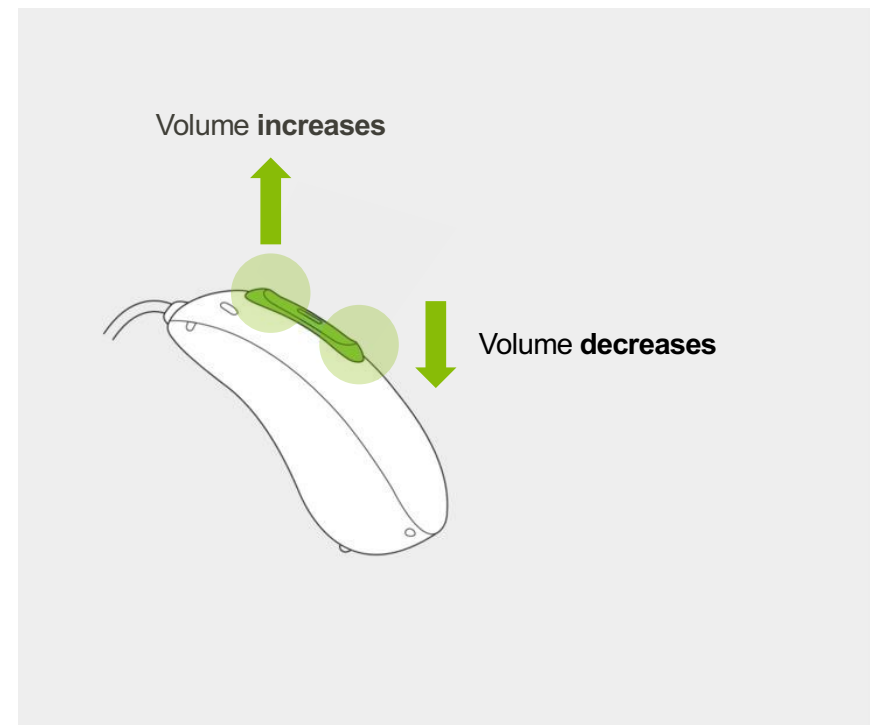
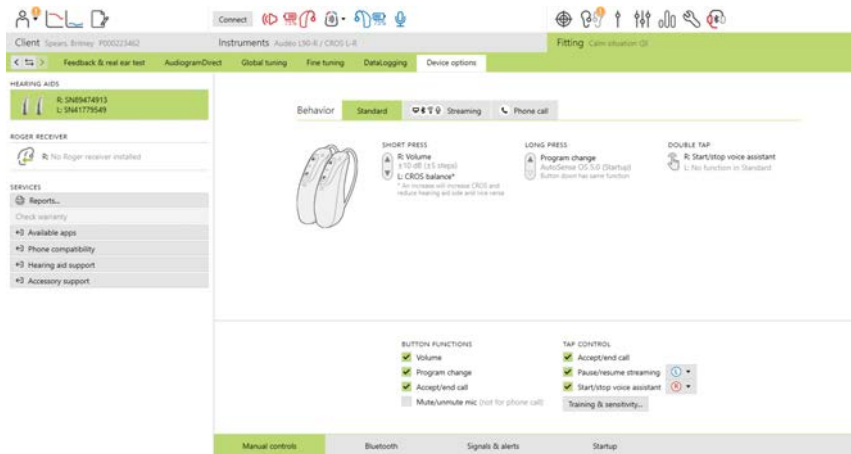
- **Balance** the loudness levels
- **Accessible** in Global Tuning
- **Default** starting point is 0, +/- 5 steps

CROS balance on the push button is unique

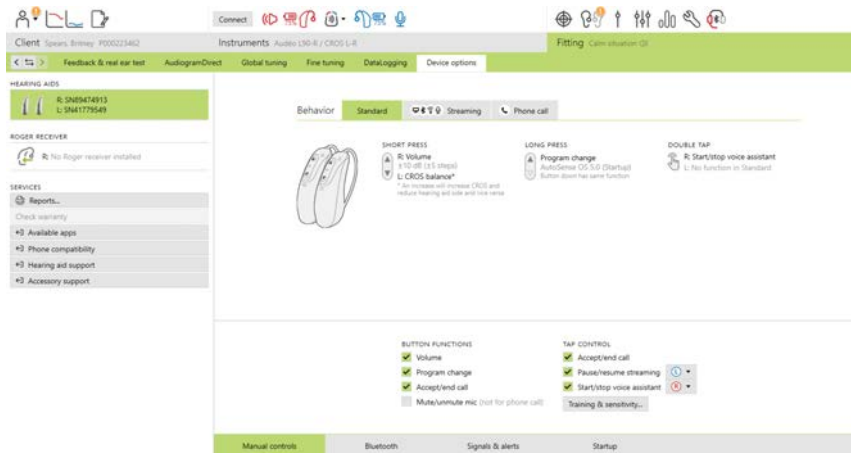
- **Short press up**
→ increase CROS signal and decrease hearing aid input
- **Short press down**
→ decrease CROS signal and increase hearing aid input



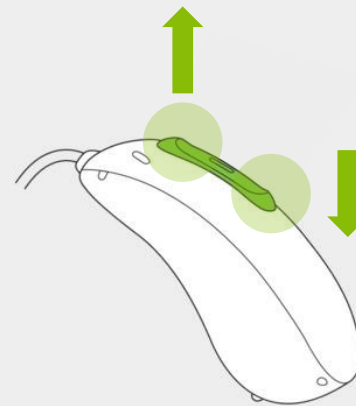
Multifunction button: Audéo L - Volume



Multifunction button: Audéo L – CROS Balance

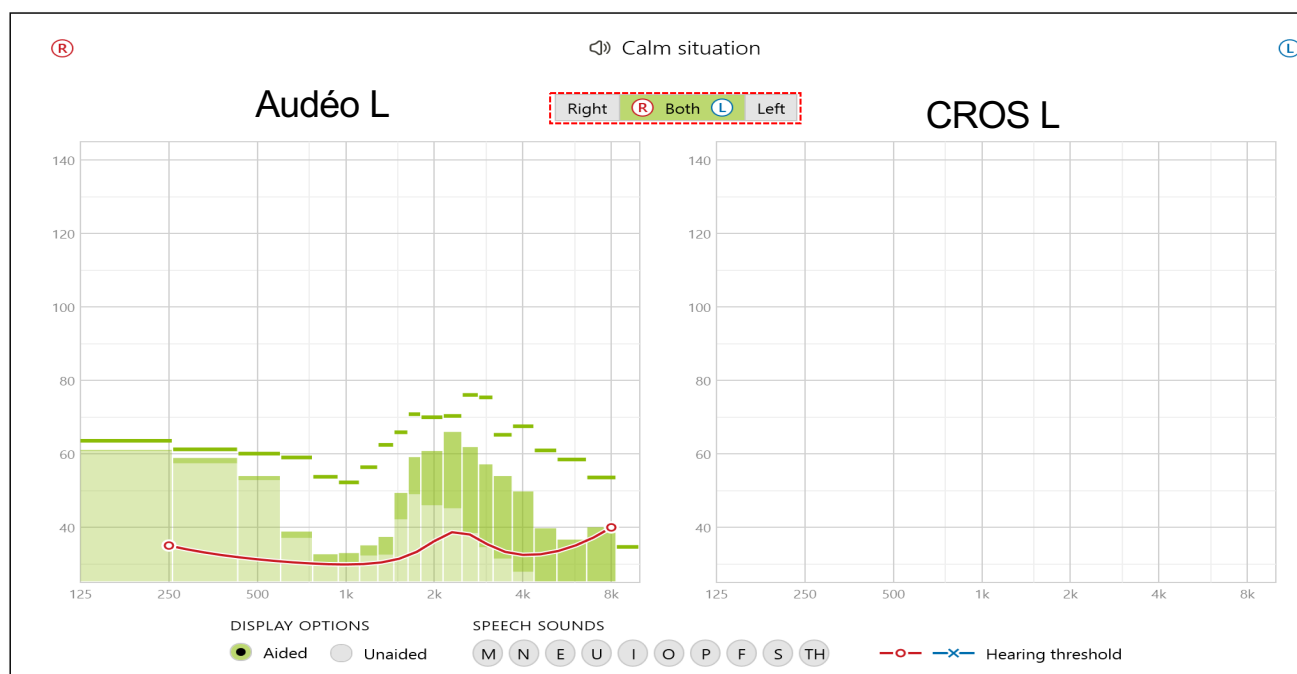


CROS signal **increases** and
hearing aid input **decreases**



CROS signal **decreases** and
hearing aid input **increases**

Client view with real time display





PHONAK
life is on

Connect to the
world around
you with CROS

The Phonak CROS system connects to the world around you



Staying connected



*Roger requires activation of Roger receivers in the hearing aids

The CROS L system is compatible with all Roger™ microphones



Roger
On™



Roger
Table Mic II



Roger
Select™



Roger
Clip-On Mic

Fitting configurations using Roger

Unilateral
hearing loss

Aidable UHL

Benefit from



Unaidable UHL

Benefit from

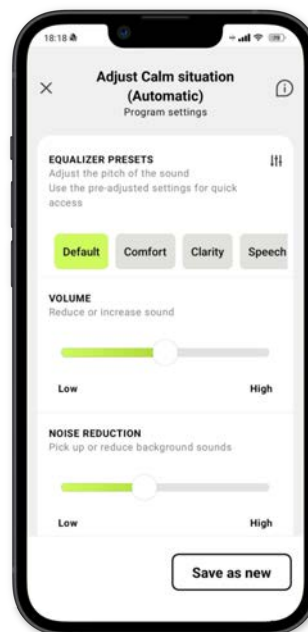


CROS system

Ear-level receiver

myPhonak and myPhonak Junior apps for an optimized listening experience

- Access Remote Support appointments
- Adjust volume of CROS system
- View battery life status
- Option to stay connected to the app

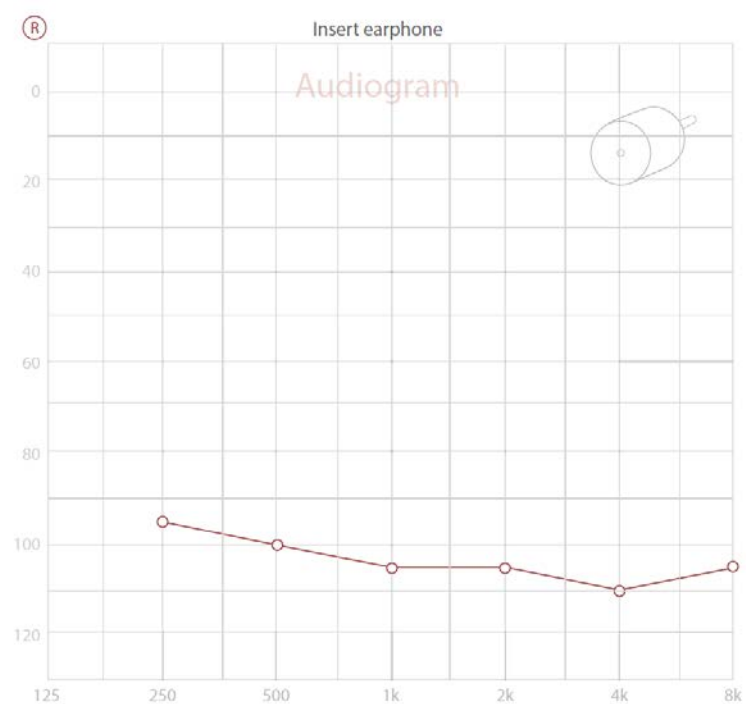
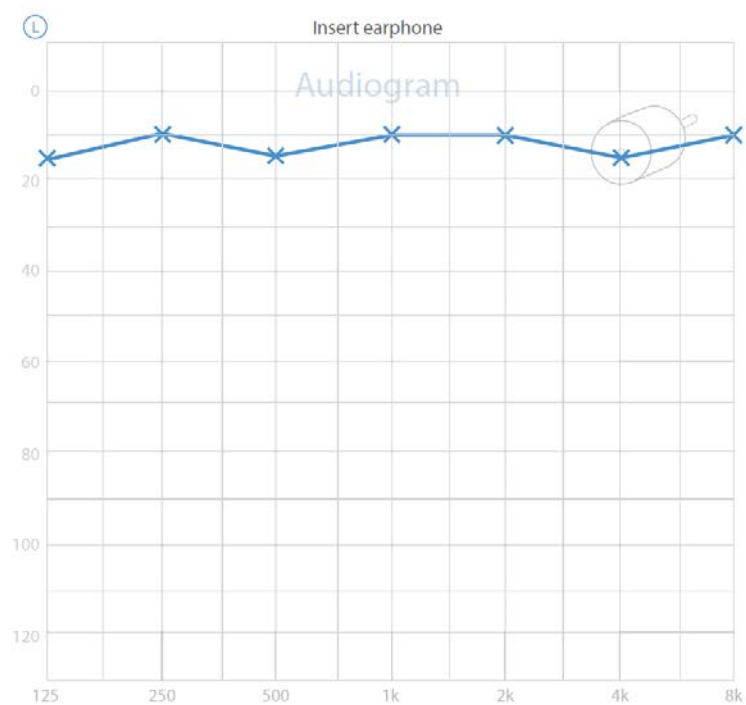


* Requires compatible Lumity hearing aid

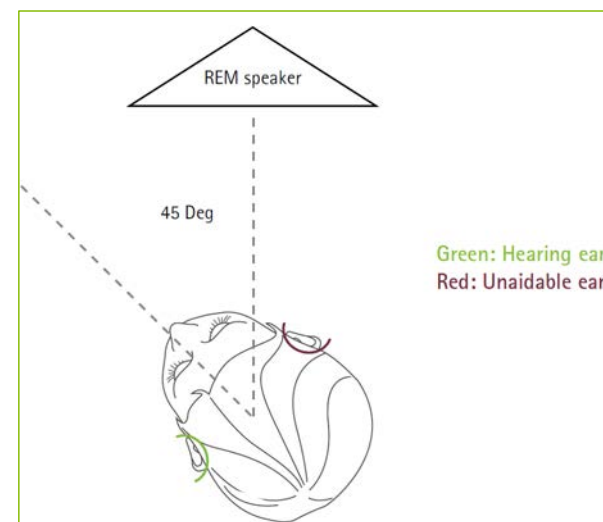
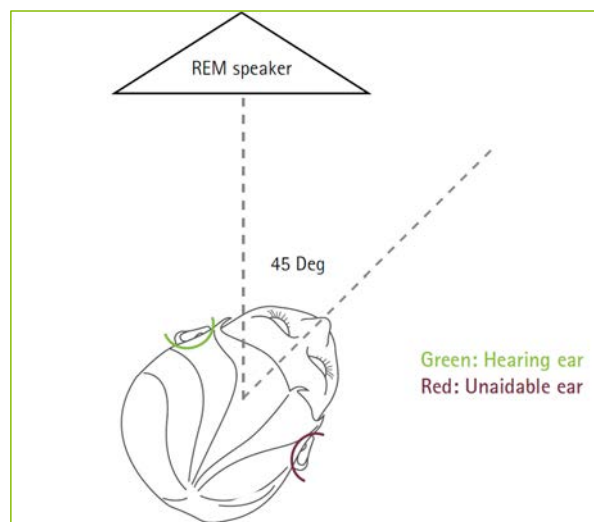
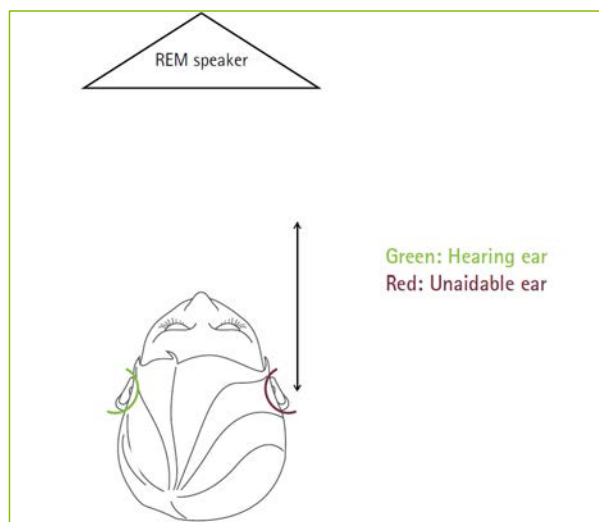


Verifying CROS.

The typical CROS audiogram

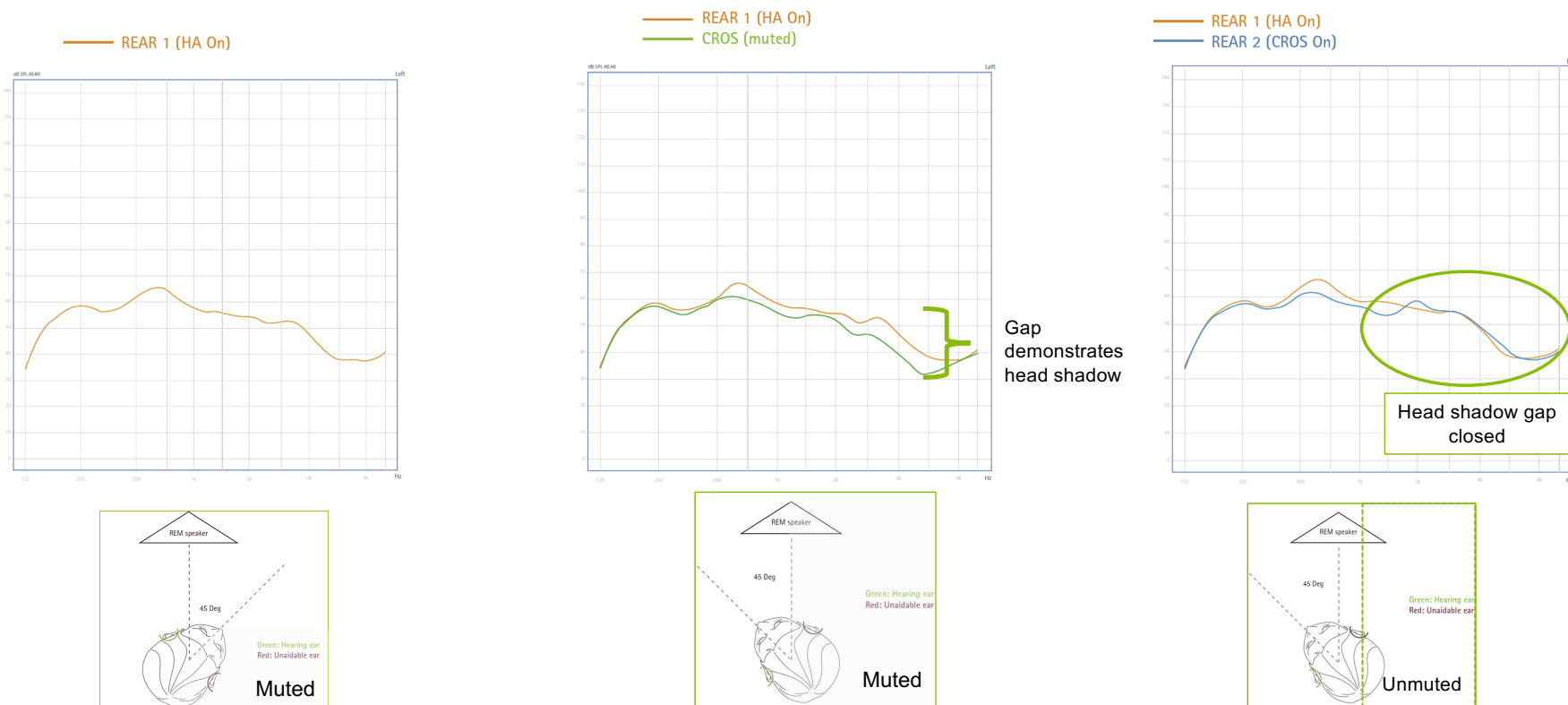


Orientation of the ear relative to the test speaker



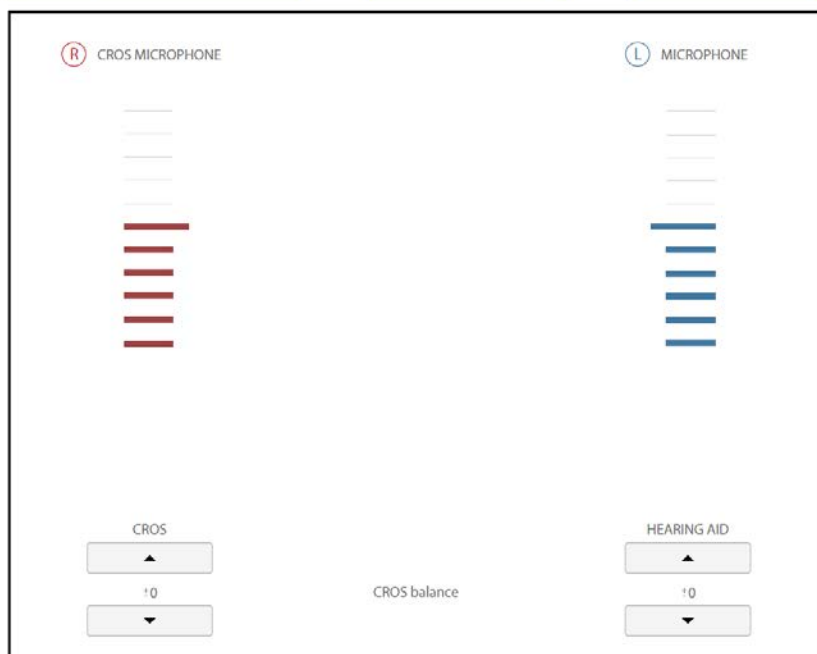
Probe measurement in
"Hearing ear"

Mute and unmute to demonstrate head shadow



Software adjustments

Fitting Calm situation ➡ Global tuning ➡ CROS balance



Fitting Calm situation ➡ Fine tuning ➡ Gain & MPO

MPO	75	90	98	101	102	106	108	105	99	89
ALL	250	500	750	1k	1,5k	2k	3k	4k	6k	8k
G80	1	1	3	8	13	18	22	20	14	5
G65	1	3	8	13	17	24	29	27	22	13
G50	1	2	11	16	21	29	35	33	28	20
CR	1	1	1,3	1	1,4	1,5	1,7	1,8	1,9	2,1

Verification measurements with a CROS L system



A Sonesta brand

CROS L Verification Guide.

Introduction

Most clients present with bilateral, aidable hearing loss. However, some people have hearing loss in only one ear, known as unilateral hearing loss (UHL). People with UHL may experience challenges communicating in noise, at a distance, in quiet and when localizing sounds (Lieu et al., 2013; Snapp et al., 2017; McKay et al., 2008). Contralateral routing of signal (CROS) supports clients with unaidable UHL, where one ear has normal hearing, and the other has an unaidable hearing loss. A CROS transmitter is worn on the unaidable ear to pick up signals and wirelessly transmits them to a hearing aid (HA), which is worn on the ear with normal hearing.

Alongside UHL, where the affected ear is unaidable, some people may also develop hearing loss in the other ear, resulting in an asymmetric hearing loss. Bilateral microphones for Contralateral Routing of Signal (BICROS) is ideal for clients with unaidable UHL who also have a hearing loss in their better hearing ear. A microphone is worn behind both ears. Again, the signal from the unaidable ear is transferred from one ear to the other. However, this signal, as well as sound originating from the aidable side, is then amplified according to the gain requirement for the hearing loss in the better ear.

Benefits of CROS and BICROS

A comprehensive literature review of the benefits and limitations of CROS and BICROS systems completed in March 2021 (Stewart & Woodward, 2021), examined published literature from the last 10 years and found:

1. improved speech intelligibility in noise when speech is presented to the unaidable ear.
2. improved speech intelligibility in diffuse noise.
3. improved subjective quality of hearing, such as ease of communication and sound quality.

The role of verifying CROS fittings using probe microphone measures

While the benefits of binaural amplification for clients with aidable hearing loss in both ears are often immediately evident, they may initially be more subtle for those with unaidable UHL. Mueller & Hawkins (1992) reported that such clients sometimes find it challenging to reliably report whether their CROS system is operational.

Thus, probe microphone measures present an ideal, objective way for verifying that a CROS/BICROS system is functioning well and overcoming the head shadow effect (Pumford, 2005). Further support for utilizing probe microphone measures comes from Markeb's findings for conventional hearing aid fittings, showing those clients receiving best fitting practice experience greater reduction in hearing handicap compared to those that don't (Kochkin, 2011a), and that clients receiving both verification and validation measures required on average 1.2 less visits compared to those that did not (Kochkin, 2011b).

Accordingly, the goal of this paper is to provide an easy, step-by-step guide for performing probe microphone measures to verify CROS/BICROS fittings in clinic.



PHONAK
life is on

Bring the
conversation
back

Phonak CROS L: Let's recap



Experience speech understanding with our innovative technology

- StereoZoom 2.0
- Autosense OS 5.0
- Roger™ microphones for speech understanding in noise and over distance



New ways to personalize your hearing experience

- myPhonak app and myPhonak Junior app
- Compatible with Audéo, Naída and Sky Lumity hearing aids
- CROS Lumity offers a range of stylish colors



Ease of use

- Tap Control
- Hands-free calls
- Rechargeability – Battery hassle-free



Connect to the world around you

- Universal Bluetooth® connectivity to TVs, smartphones, tablets, and more
- Phonak Target 9.0

The benefits of CROS Lumity



1

Improved speech understanding in noisy environments^{*1}

2

Follow^{**} conversations wherever they are coming from^{*1}

3

Proven Lumity performance

4

Universal connectivity to smartphones, TV, Roger and more

5

Easy to use and rechargeable

1. Stewart, E. & Woodward, J. (2021). Out of the (Head) Shadow: A Systematic Review of CROS/BiCROS Literature. *The Hearing Review*, 28(8), 22-25. Retrieved from <https://www.hearingreview.com/inside-hearing/research/head>, accessed October 7, 2021.

^{*} when using a CROS system compared to unaided

^{**} Follow - means awareness of conversation for the wearer to attend to

CROS L-R is powered by a lithium-ion rechargeable battery

Conversations shine for everyone with Lumity

I'm less worn out physically and mentally

I miss fewer words throughout the day

I feel like less of a burden

I'm more aware of my environment

Social situations are less daunting



I can recognize the nature of sounds more quickly

I feel safer overall

I don't have to keep turning!

It's easier to hear in a classroom setting

I can hear speech from my weak side

The world is brighter



Together,
we change lives .