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Oticon CROS

A revolutionary sound experience

Rob Dowling, AuD
Education & Training Specialist, Blue Ridge Region

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Learning Objectives

After this course, participants will be able to:

. . . describe the acoustic limitations of individuals with single-sided deafness

. . . describe how an unprecedented signal processing technology can provide better conditions for speech understanding and localization

. . . identify the full portfolio of devices available to support Oticon CROS

. . . list the steps to setup and program Oticon CROS

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The Oticon CROS family

Outstanding sound quality for those with single-sided deafness

SSD can result in poor speech understanding especially in noise and reduced localization ability

Users need innovative technology that is reliable and compatible

The technology needs to give access to speech on the poor side and allow for streaming at the same time

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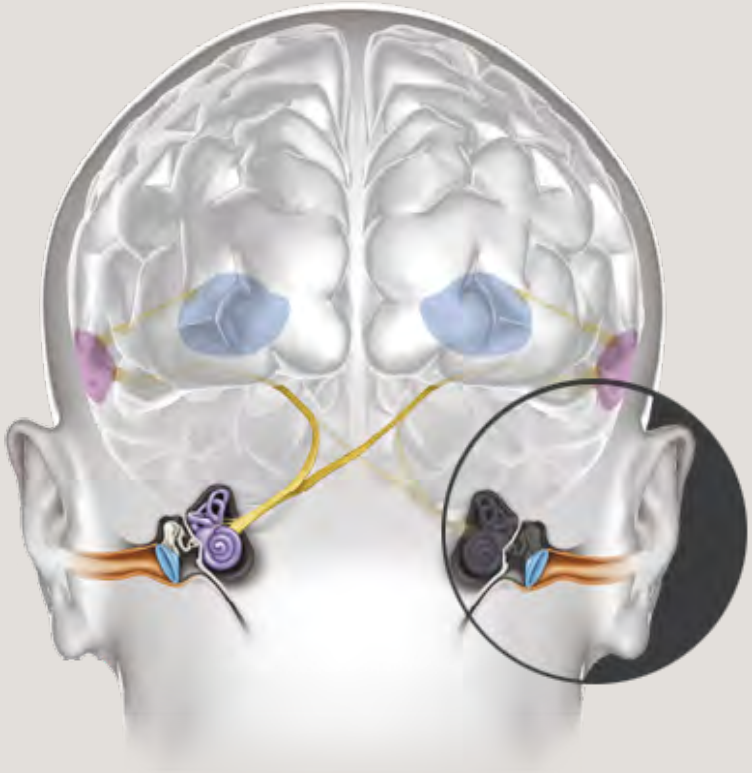
Background on SSD



How many of you…

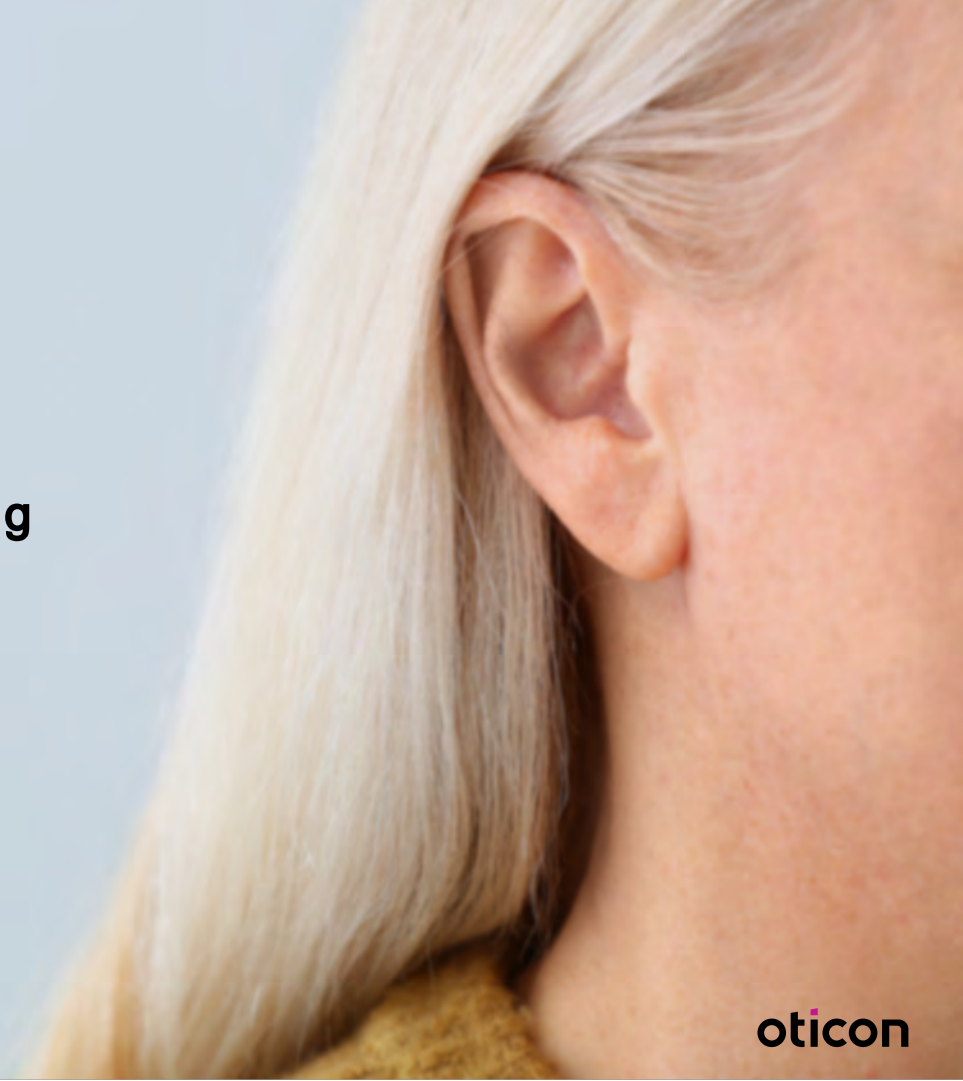
…have seen a client with single-sided deafness?

…in your mind, what constitutes single-sided deafness?

Single-sided deafness

Unaidable hearing in one ear and **normal hearing** or an **aidable hearing loss in the other ear**

Taylor 2010



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Every year . . .

60,000
USA

= 1%

of the population

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Who is affected?

SSD can occur in all population groups

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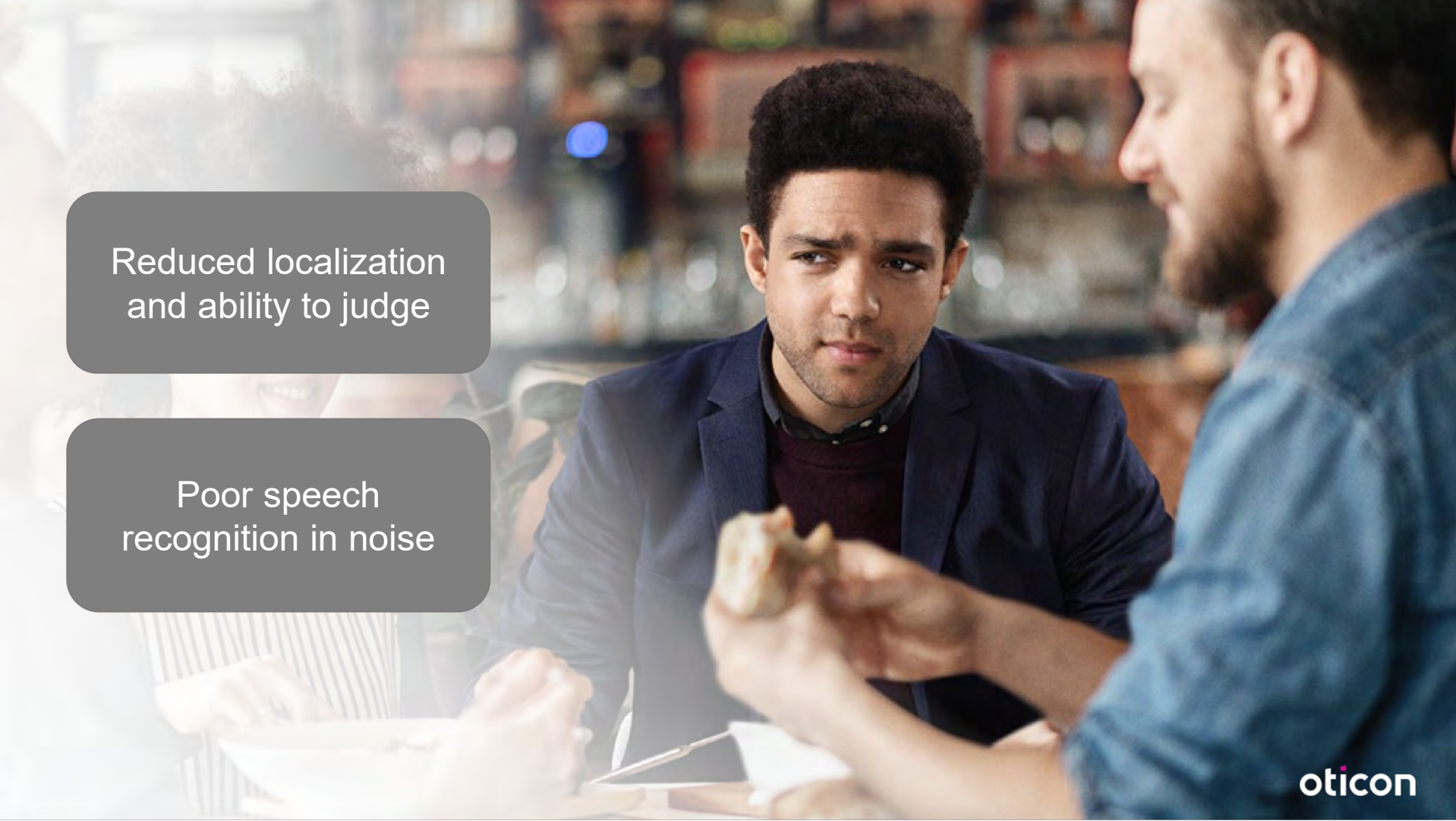
Reduced localization and ability to judge
Poor speech recognition in noise

The importance of binaural hearing

2 ears are necessary in order to obtain the benefits of…

Binaural loudness summation

Binaural redundancy

Binaural squelch

Head shadow effect

Dillon 2012

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Treatment options for SSD

Benefits and Considerations

	CROS 	BAHS 
Pros	• Non-surgical • Can accommodate for hearing loss on better ear	• Wears one device, nothing in better ear
Cons	• The better ear may be partially occluded • User must wear two devices • Does not restore binaural hearing	• Minimally invasive surgery • Does not restore binaural hearing

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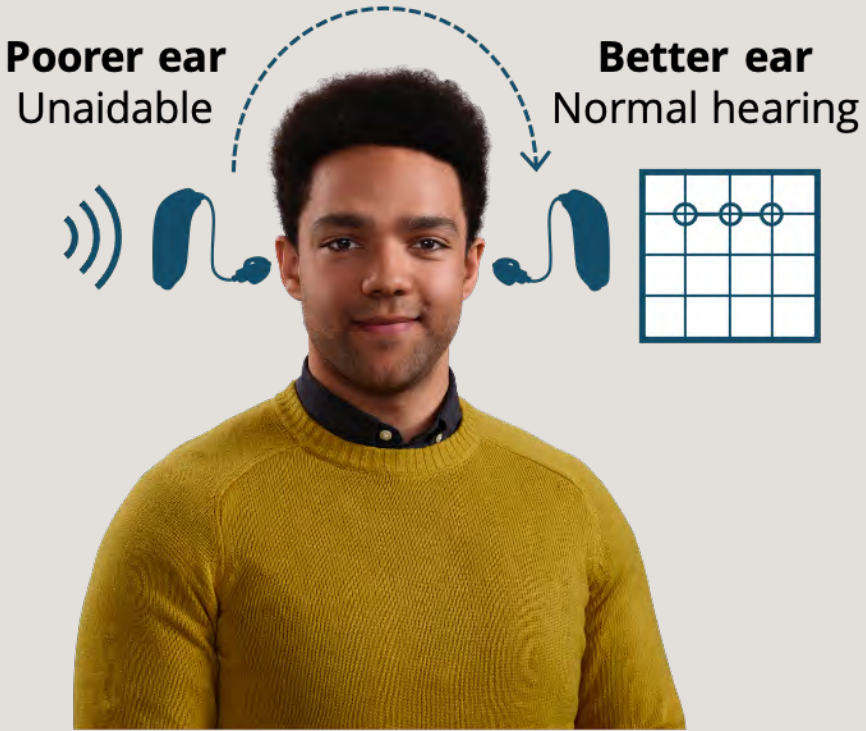
Oticon CROS solution



CROS stands for
“Contralateral routing of signal”

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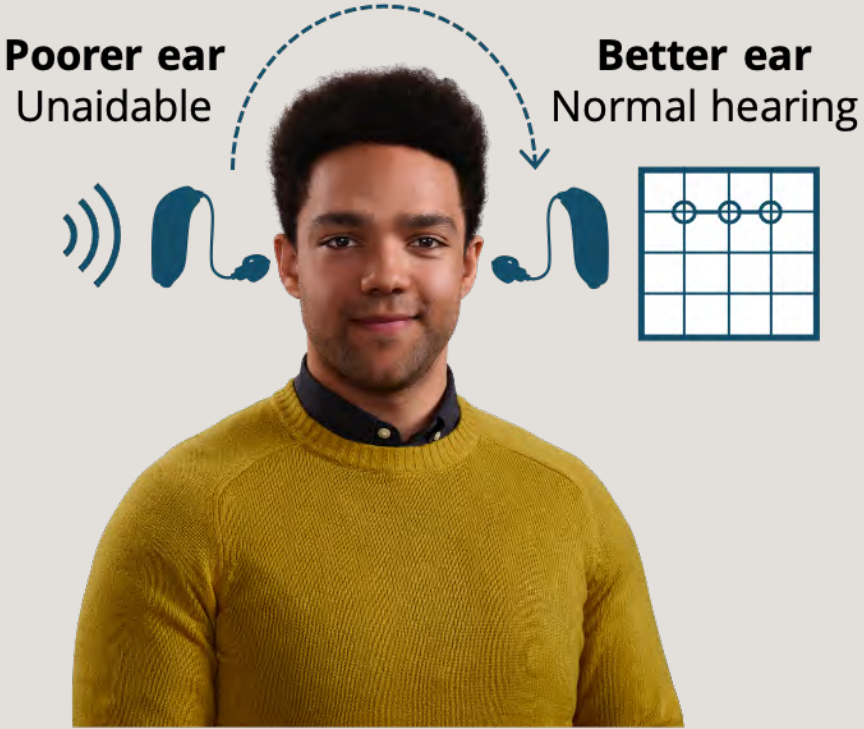
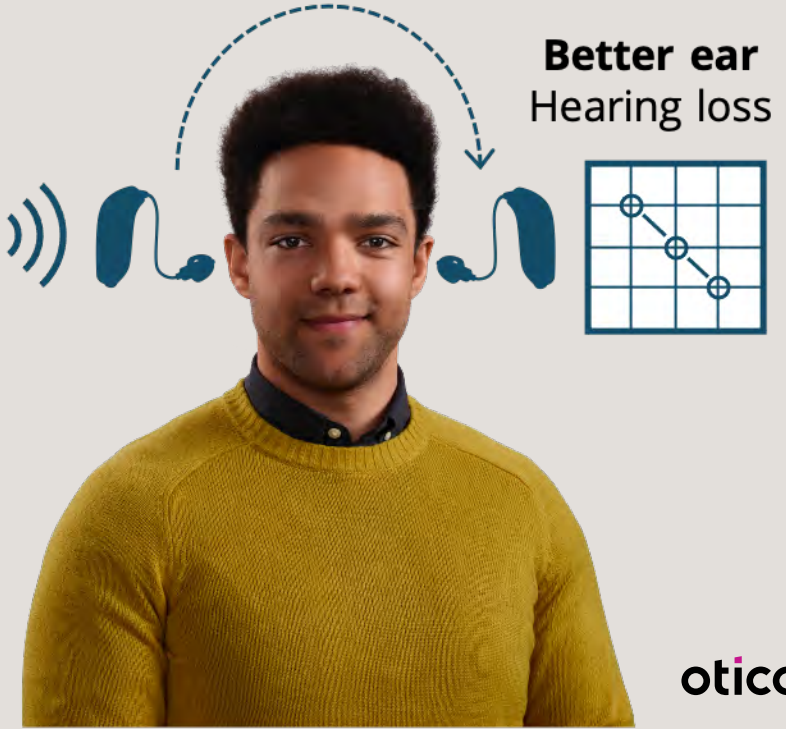
Oticon CROS solution

CROS solution



BiCROS solution



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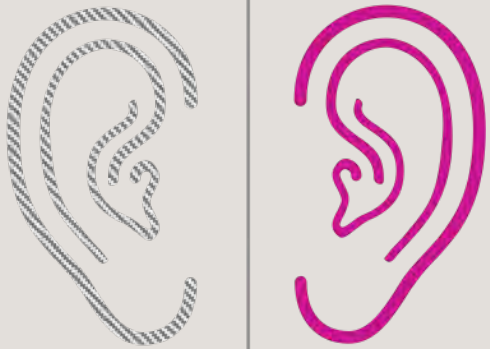
Candidacy

Candidacy

…can the user benefit from conventional amplification?



…is one ear normal or not?

Are children candidates?

CROS/BiCROS fittings

Candidacy is based on:

- Age
- Ability to monitor & adjust the listening environment

Intended use:

- Not intended for children below 5 years of age
- Caution is advised for children from 5 to 8 years of age

Bagatto et al., 2019

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The Oticon CROS family

The expanded Oticon CROS family

Oticon
CROS PX
miniRITE R

Oticon
CROS
miniRITE T

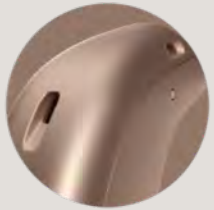
miniRITE T transmitter

miniRITE R transmitter

Colors

A variety of color choices

CO90
Chroma Beige



CO94
Terracotta

CO93
Chestnut Brown

CO63
Diamond Black

CO92
Steel Grey

CO91
Silver Grey

CO44
Silver

CO79
Hear Pink

*Hear Pink is only available for Oticon CROS PX miniRITE R

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Oticon CROS PX miniRITE R

The rechargeable addition to the Oticon CROS family

POLARIS™

A full day of power*

Exceptional sound quality

Unparalleled compatibility

*Lithium-ion performance varies depending on hearing loss, lifestyle and streaming behavior

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Firmware version requirements

More- 1.1.0 or later

Opn S, Opn Play, Xceed, Xceed Play- 8.0 or later

Ruby- 1.0 or later

Unparalleled compatibility

**Except Oticon Opn S 3 and Oticon Opn Play 2*

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A choice of elegant power supplies

The Oticon charger family

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A choice of elegant power supplies

The Oticon charger family

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Super fast charging time

Charging times for a completely drained battery

3 hours	1 hour	0.5 hour
Fully charged	**50%** charged	**25%** charged

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Charging times with SmartCharger

Charging of the power bank and miniRITE R transmitter

3 hours	1 hour	0.5 hour
Fully charged	**50%** charged	**25%** charged

4 hours	Up to 8 hours
Fully charged power bank battery	**Fully charged** power bank and hearing aids

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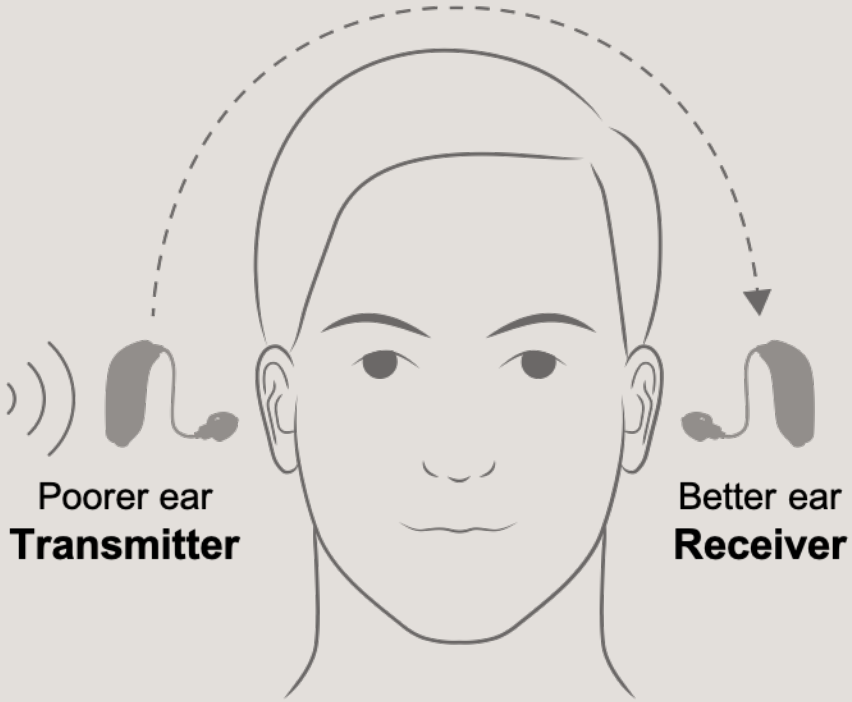
Which one should I recommend?

How does the Oticon CROS solution work?

The Oticon CROS solution

TwinLink
NFMI + 2.4 GHz



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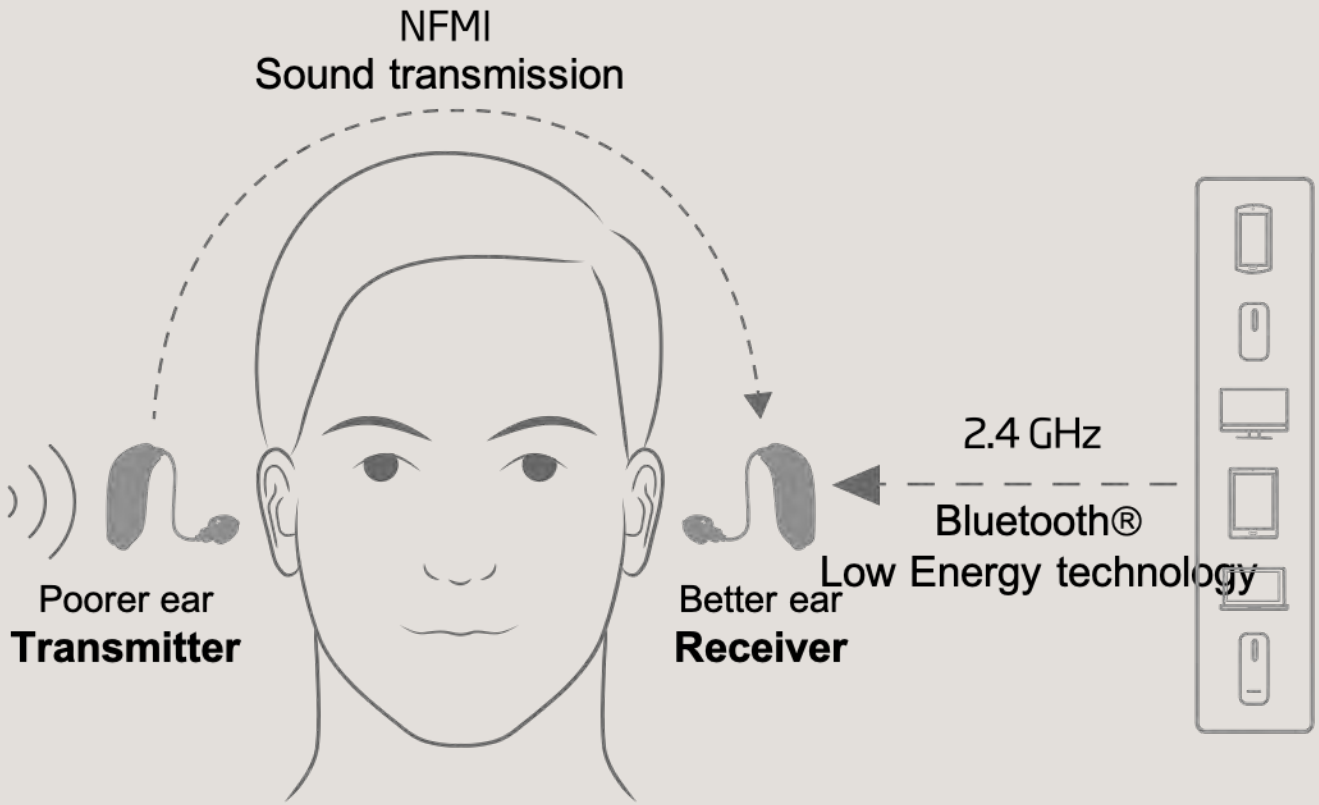
The Oticon CROS solution



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TwinLinko dual streaming with Oticon CROS & CROS PX

Receiver can simultaneously receive 2.4 GHz and NFMI streamed signals

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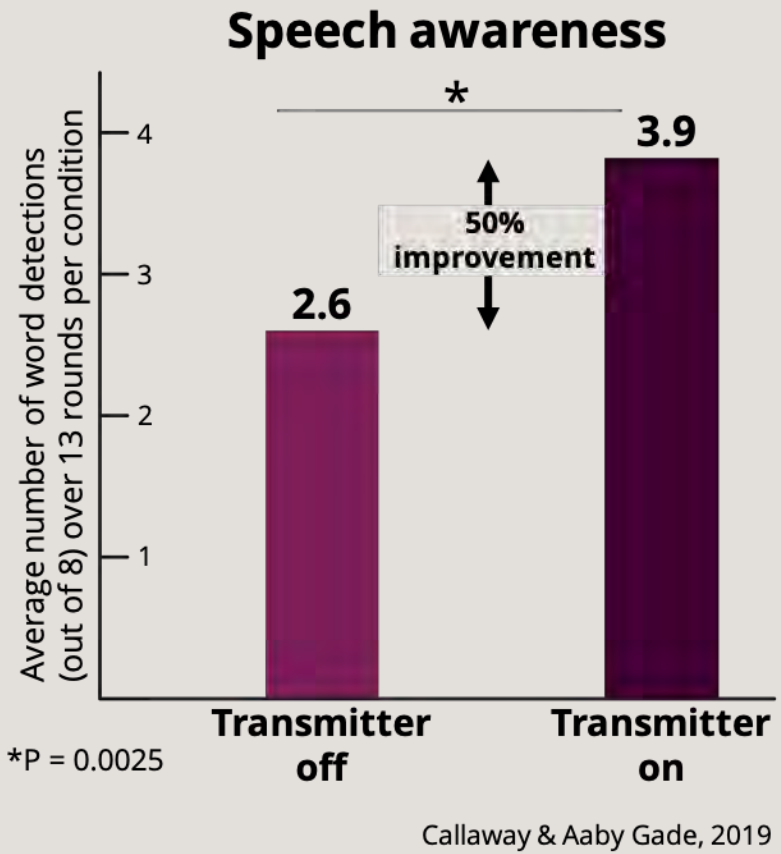
TwinLink dual streaming benefits



*P = 0.0025

Callaway & Aaby Gade, 2019

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WHITEPAPER
2019

Oticon CROS

SUMMARY

Oticon now introduces Oticon CROS, the first ever wireless CROS/BiCROS solution using an open sound paradigm and with dual-streaming capability using TwinLink™.

Oticon CROS is a unique solution for persons with single-sided deafness and it now makes the advanced signal processing of the OpenSound Navigator™ feature available to even more people with hearing loss.

A 2019 internal study shows the benefit of having dual-streaming capability within a CROS solution. While streaming sound using 2.4 GHz Bluetooth Low Energy technology, the CROS transmission was switched on and off in order to determine whether or not transmission of sound from the test subject's poorer ear side affected a person's awareness of speech in the environment. Results showed a 50% improvement in speech awareness from 33% to 49% awareness when transmission was active during streaming from an external source.

This tells us that CROS/BiCROS users can benefit greatly from having access to speech information in their environment, also when streaming.

Susanna Løve Callaway, Au.D.
Director of Clinical Audiology,
Oticon A/S, Denmark

Pernille Aaby Gade
Clinical Research
Audiology Assistant
Oticon A/S, Denmark

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PEOPLE FIRST

The Oticon CROS solution

An overview

Transmitter **Receiver**

Oticon CROS/CROS PX transmitter

Speaker unit has no acoustic purpose (retention only)

Signal is cleaned-up before being sent to the receiver

10 kHz broad bandwidth is transmitted to the receiver

Volume control adjusts the level of the transmission

No **Bluetooth®** Low Energy technology in the transmitter

The Oticon CROS solution

The receiving device

Transmitter **Receiver**

Oticon CROS/CROS PX receiver hearing aid

Receiver functions as **a normal Polaris/Velox S** hearing aid

Receives NFMI signal from CROS/CROS PX transmitter

Can be controlled via the **Oticon ON app, ConnectClip or Remote Control**

Volume Control adjusts the overall volume (combined input)

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Signal processing - Oticon CROS miniRITE T

Optimized-for-CROS OpenSound Navigatoro

- Settings are **optimized for users with SSD**
- **Transition** is set to Low
- **5 dB noise reduction** in ALL environments

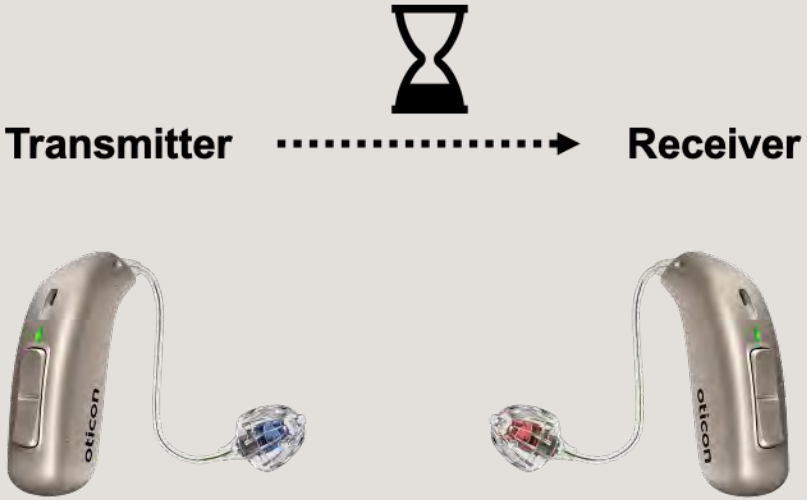
Signal processing - Oticon CROS PX miniRITE R

Optimized-for-CROS MoreSound Intelligenceo

- Settings are **optimized for users with SSD**
- **Environment configuration** is set to Complex (for influencing the **Spatial Balancer** activation)
- **6 dB noise suppression** in ALL environments
- **Virtual Outer Ear** is set to Balanced
- **Sound Enhancer** is set to Balanced

Signal processing – High pass filter

Oticon CROS/CROS PX



High pass filter with 1500 Hz cut-off:

- Sounds above 1500 Hz are transmitted via NFMI
- Sounds below 1500 Hz pass the head naturally

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Using the combined Oticon CROS/BiCROS solution

Transmitter **Receiver**

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Changing the volume in a CROS solution

Volume control of transmitted sound
Short press

Volume control of transmitted sound
Short press

Transmitter
Oticon CROS/
Oticon CROS PX

Receiver

oticon

Changing the volume in a BiCROS fitting

Receiver with double push button (recommended)

Volume control of transmitted sound
Short press

Volume control of transmitted sound
Short press

Transmitter
Oticon CROS/
Oticon CROS PX

Receiver

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Muting the transmitted signal

Mute/un-mute
Press min. 4 sec

(Short press to unmute)

Transmitter **Receiver**

Oticon CROS PX cannot be muted

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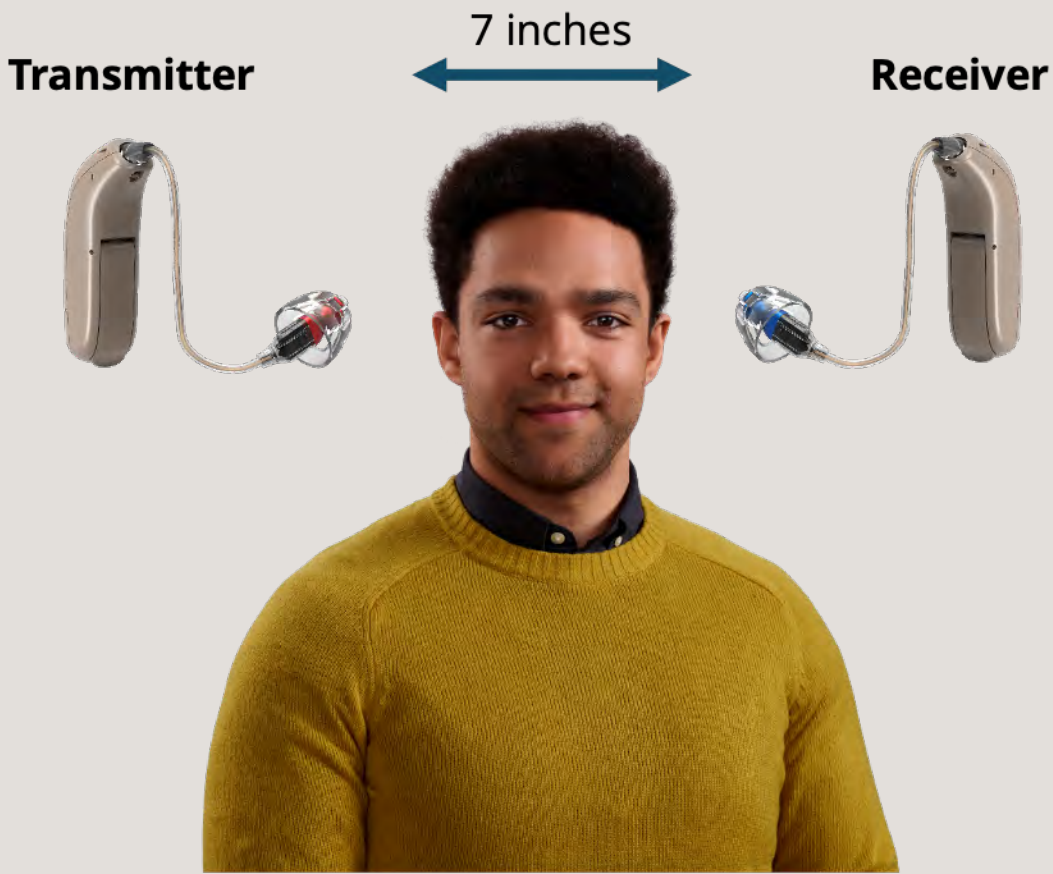
Volume control with a miniRITE receiver

miniRITE receiver

miniRITE
no volume control

Wearing Oticon CROS



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Fitting an Oticon CROS/BiCROS solution in Oticon Genie 2

Preparing for the fitting

Oticon CROS PX miniRITE R

Ensure the receiver hearing aid and Oticon CROS PX are fully charged

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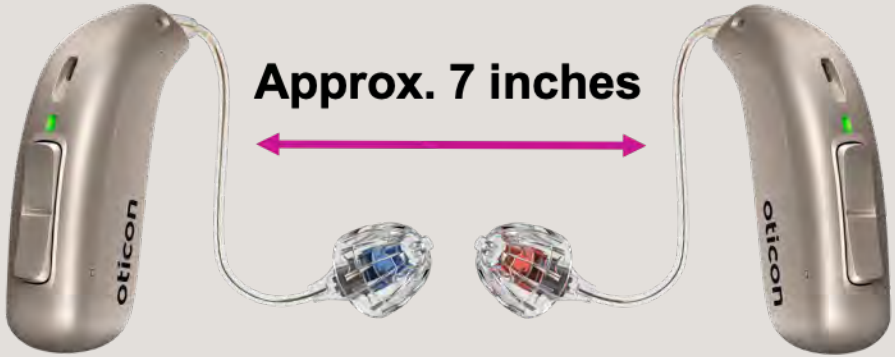
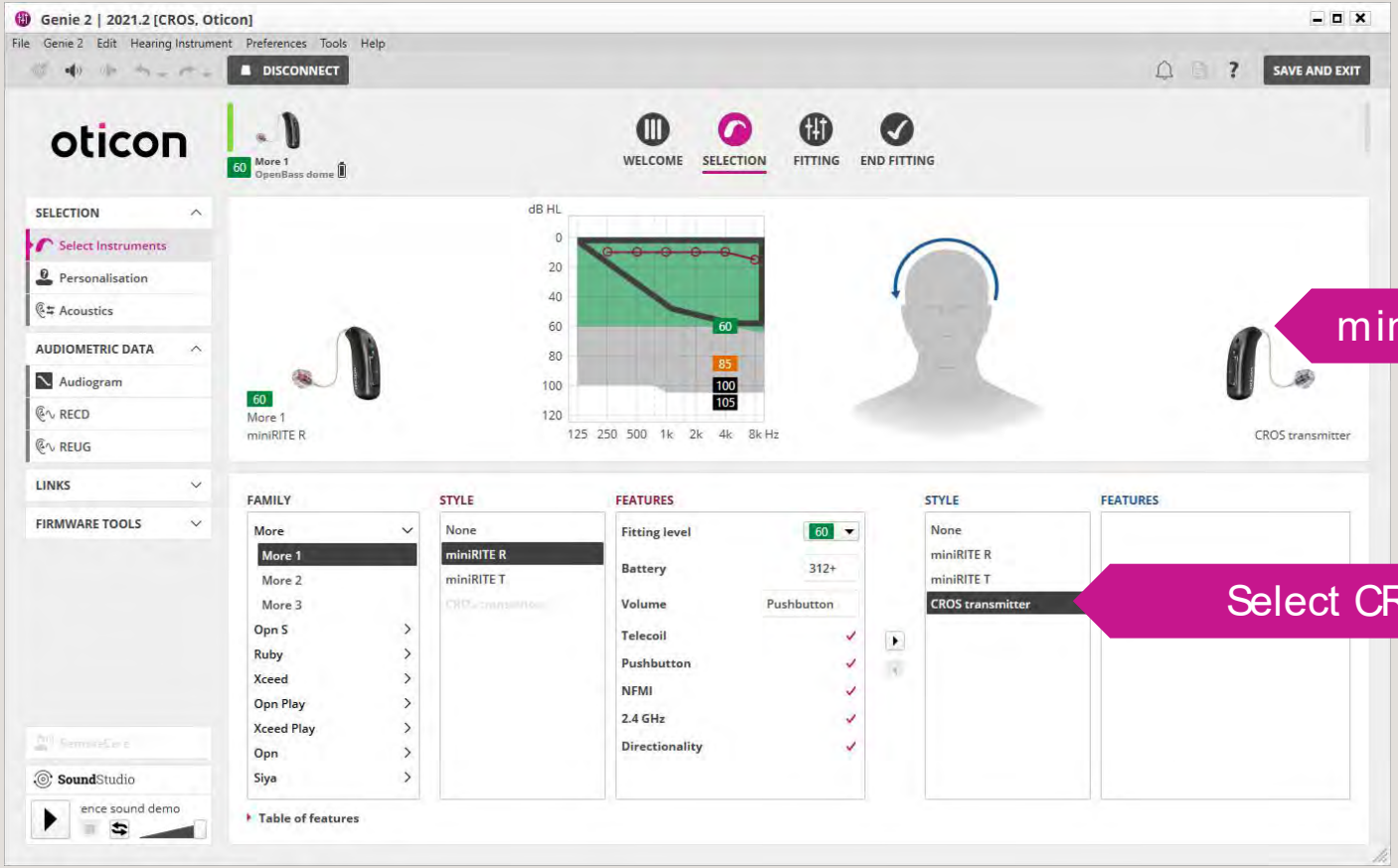
Pairing transmitter and receiver for the first time



Close proximity pairing

Selection: Select instruments



miniRITE R is displayed

Select CROS transmitter

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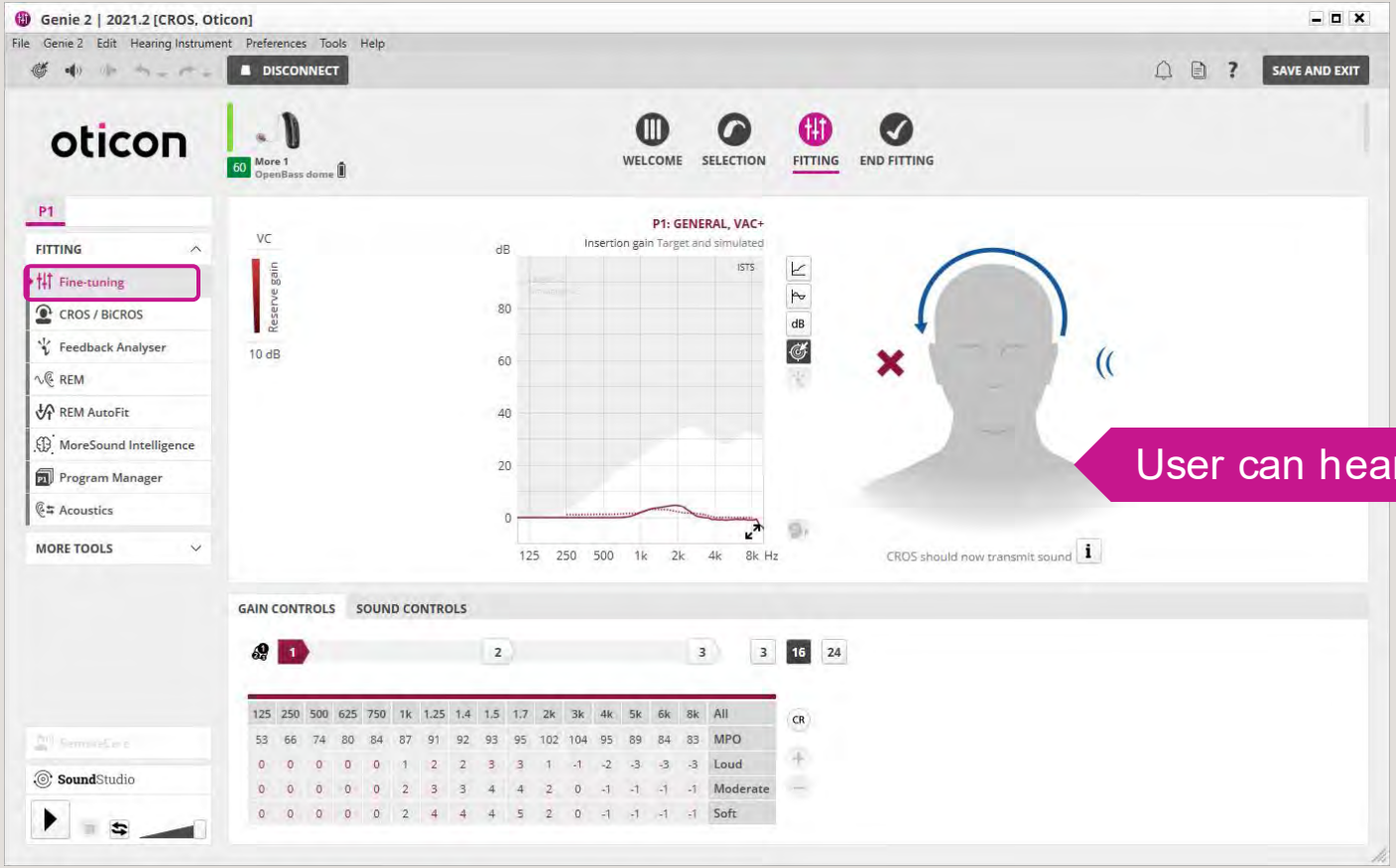
Fitting: testing signal



User can hear transmitted sound

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Fitting: CROS / BiCROS

Select the mode for each program

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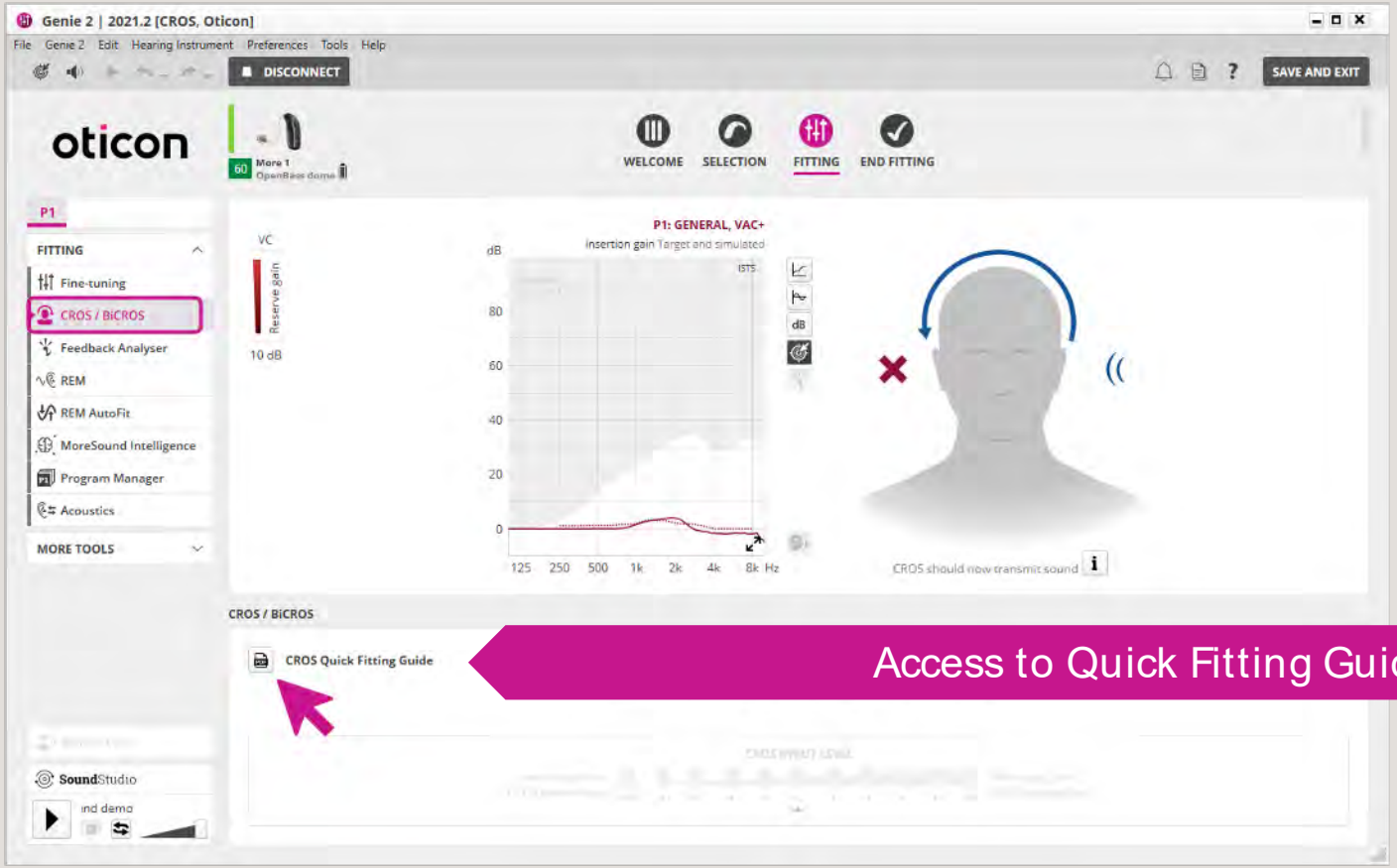
Fitting: CROS / BiCROS



Access to Quick Fitting Guide

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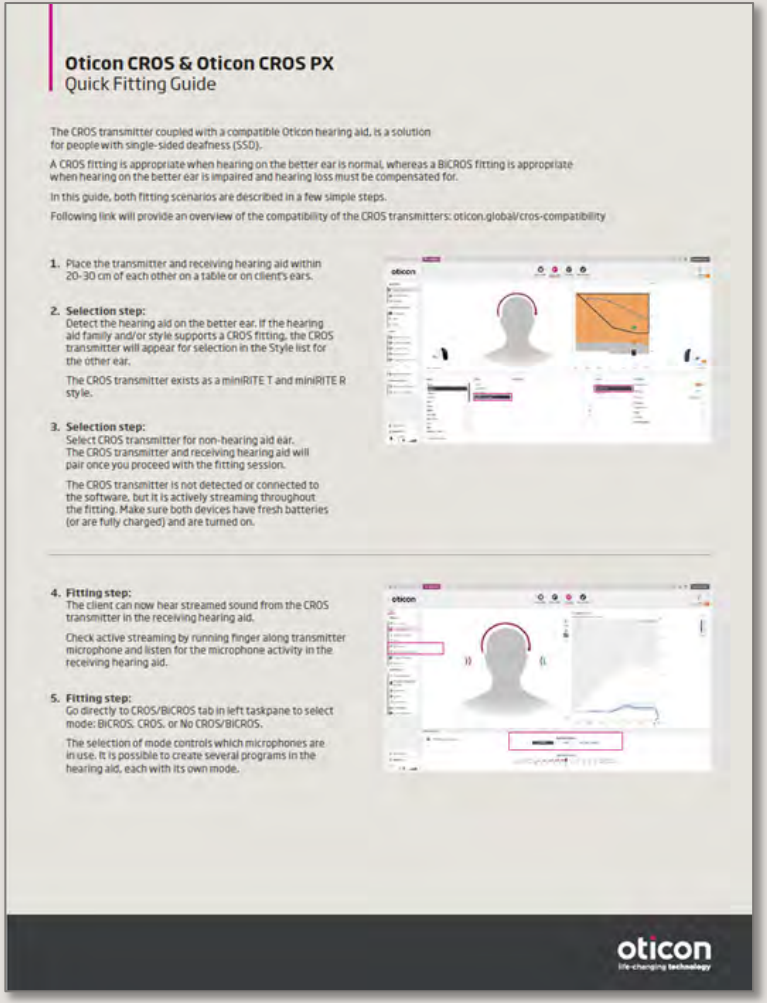

Oticon CROS & Oticon CROS PX
Quick Fitting Guide

The CROS transmitter coupled with a compatible Oticon hearing aid, is a solution for people with single-sided deafness (SSD).

A CROS fitting is appropriate when hearing on the better ear is normal, whereas a BiCROS fitting is appropriate when hearing on the better ear is impaired and hearing loss must be compensated for.

In this guide, both fitting scenarios are described in a few simple steps.

Following link will provide an overview of the compatibility of the CROS transmitters: oticon.global/cros-compatibility

1. Place the transmitter and receiving hearing aid within 20-30 cm of each other on a table or on client's ears.

2. **Selection step:**
   Detect the hearing aid on the better ear. If the hearing aid family and/or style supports a CROS fitting, the CROS transmitter will appear for selection in the Style list for the other ear.

   The CROS transmitter exists as a miniRITE T and miniRITE R style.

3. **Selection step:**
   Select CROS transmitter for non-hearing aid ear. The CROS transmitter and receiving hearing aid will pair once you proceed with the fitting session.

   The CROS transmitter is not detected or connected to the software, but it is actively streaming throughout the fitting. Make sure both devices have fresh batteries (or are fully charged) and are turned on.

4. **Fitting step:**
   The client can now hear streamed sound from the CROS transmitter in the receiving hearing aid.

   Check active streaming by running finger along transmitter microphone and listen for the microphone activity in the receiving hearing aid.

5. **Fitting step:**
   Go directly to CROS/BiCROS tab in left taskpane to select mode: BiCROS, CROS, or No CROS/BiCROS.

   The selection of mode controls which microphones are in use. It is possible to create several programs in the hearing aid, each with its own mode.

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A step-by-step guide for fitting Oticon CROS and BiCROS solutions in Oticon Genie 2

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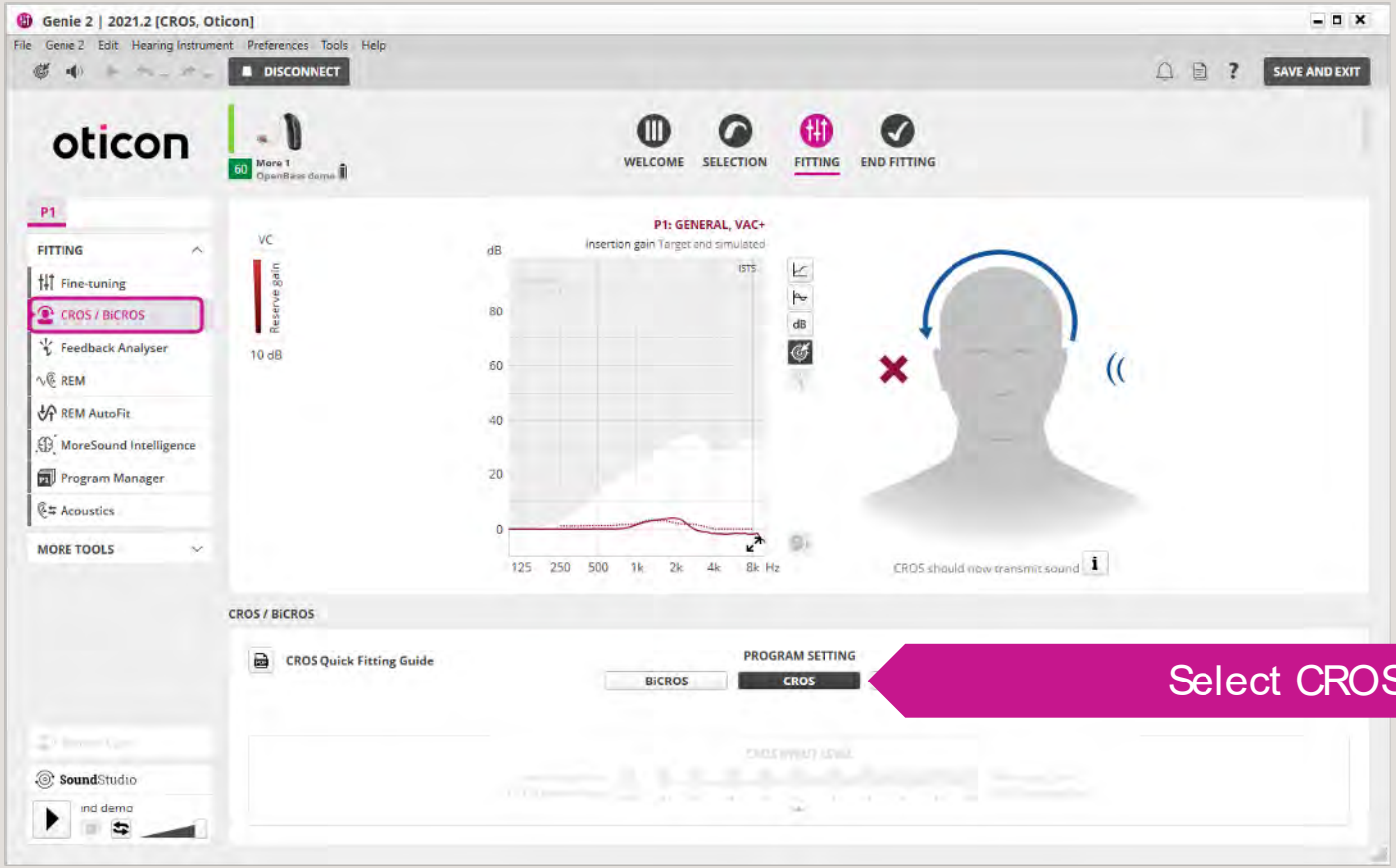
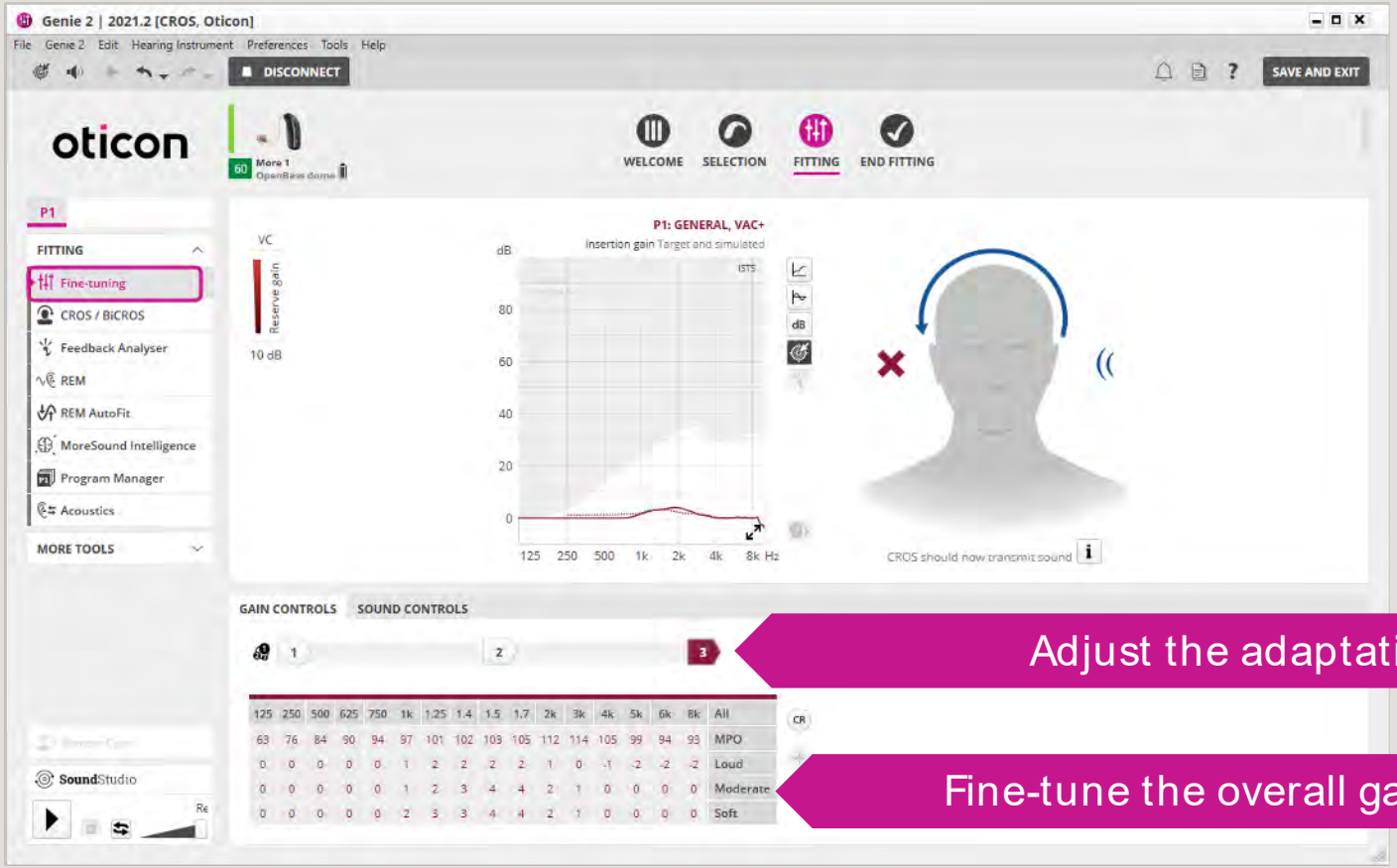
Fitting: CROS / BiCROS – a CROS fitting



Select CROS mode

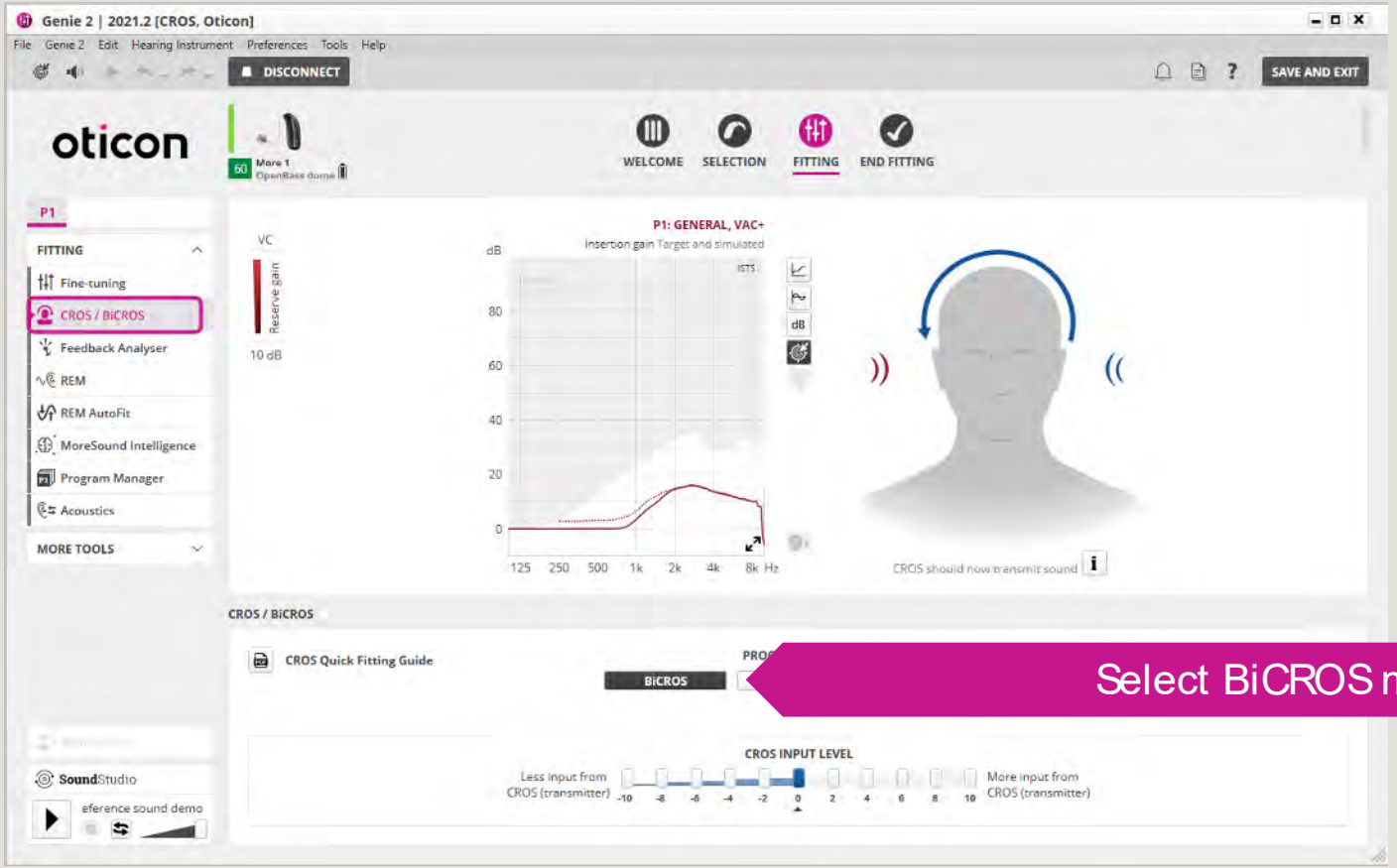
Fitting: CROS / BiCROS – a CROS fitting



Adjust the adaptation step

Fine-tune the overall gain as required

Fitting: CROS / BiCROS – a BiCROS fitting



Select BiCROS mode

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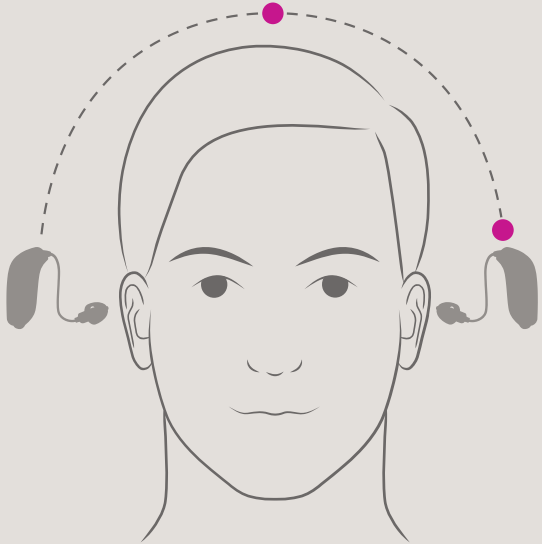
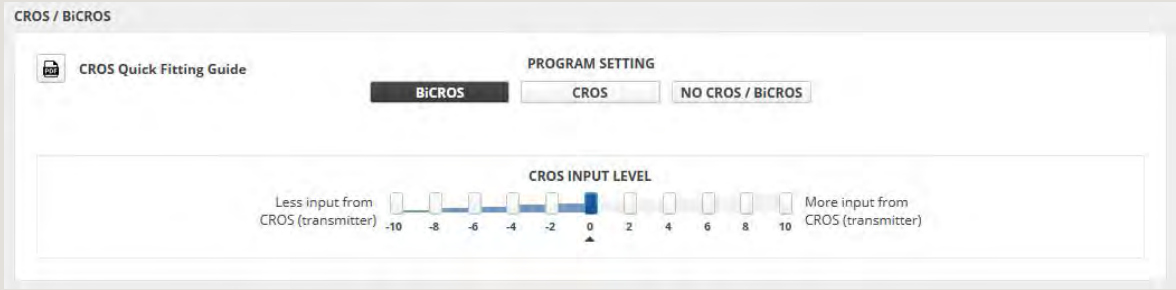
Balancing the transmitter and receiver

The transferred sound should not be louder than the sound naturally entering the better ear





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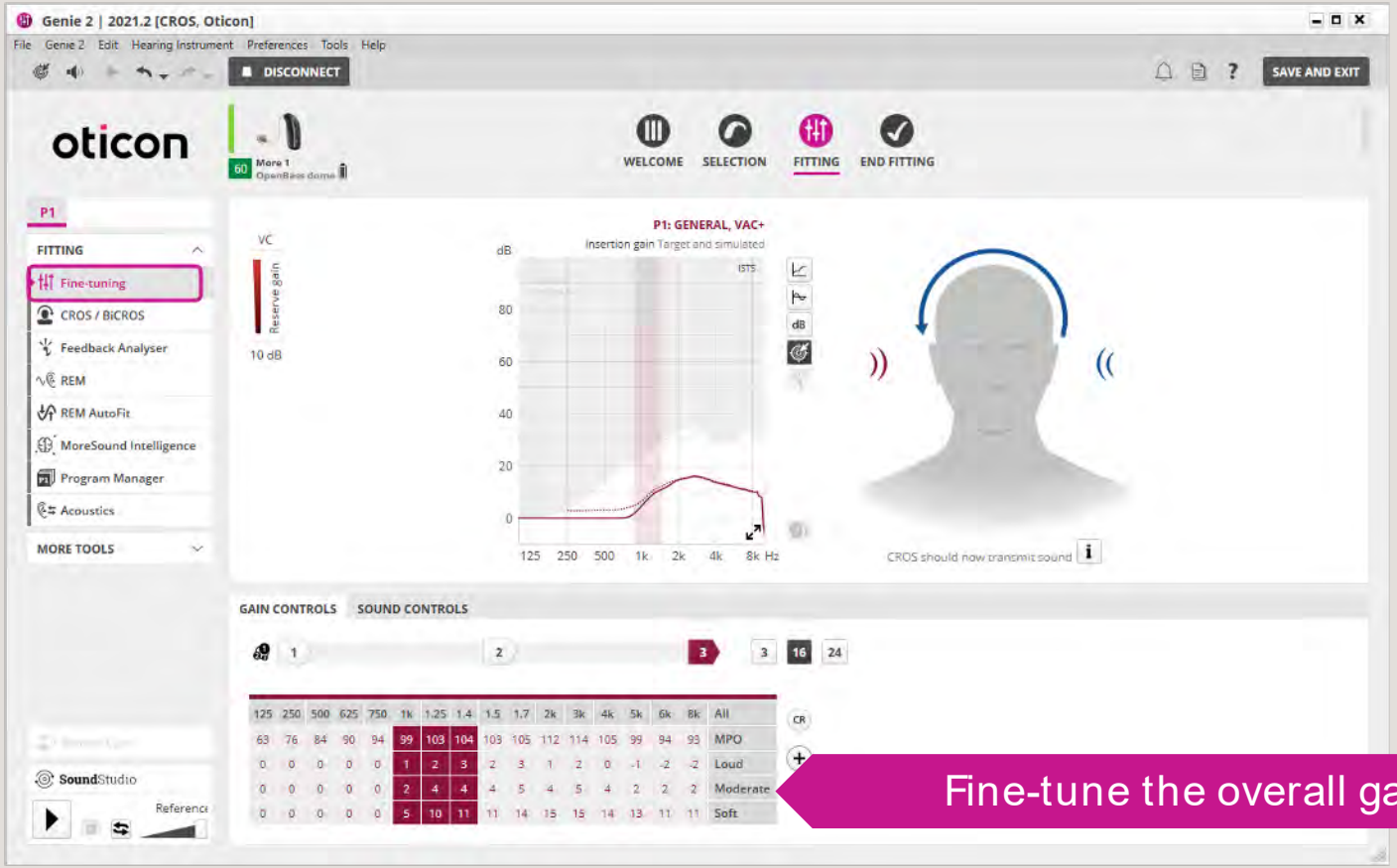
Fitting: CROS / BiCROS – a BiCROS fitting



Fine-tune the overall gain as required

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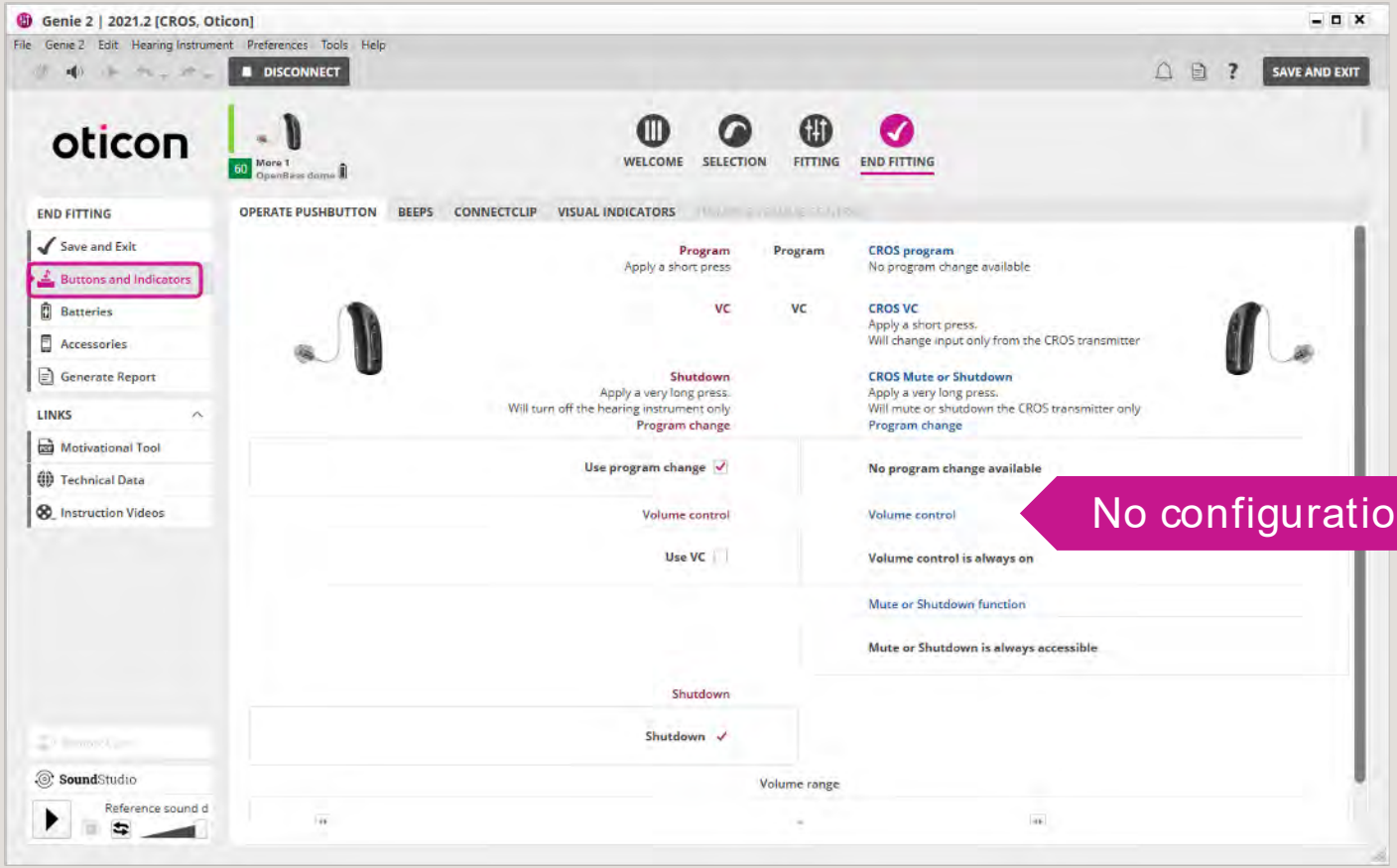
End Fitting: buttons and indicators



No configuration for CROS buttons

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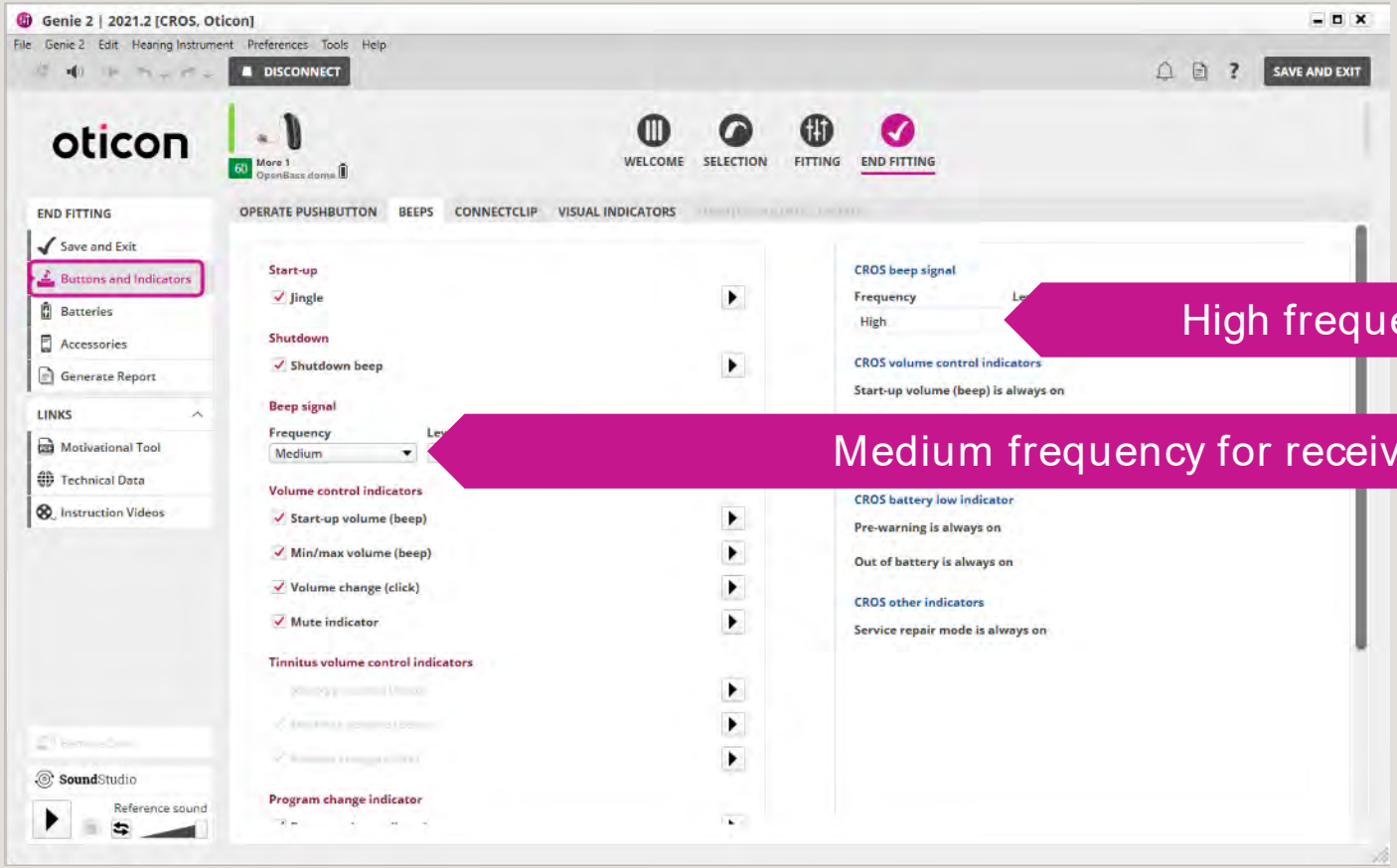
End Fitting: buttons and indicators



High frequency for CROS

Medium frequency for receiver

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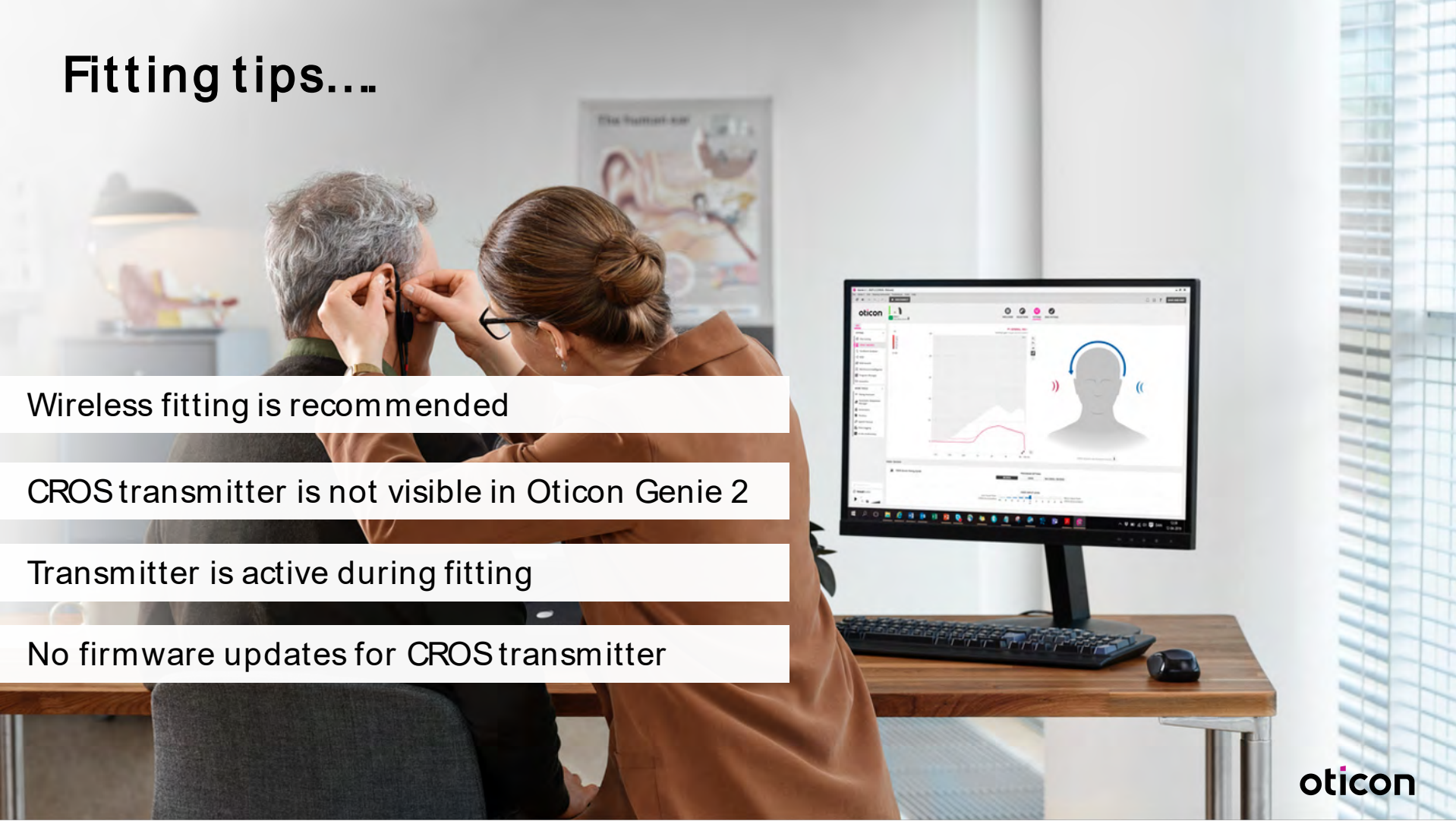
Fitting tips….



- Wireless fitting is recommended
- CROS transmitter is not visible in Oticon Genie 2
- Transmitter is active during fitting
- No firmware updates for CROS transmitter

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Oticon CROS/BiCROS verification

Objective verification

Verification with REMs are considered Best Practice

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Real-ear verification

Delivering a fitting that sounds transparent to the user

Best practice

Allows for objective verification of functionality

Safeguards audibility

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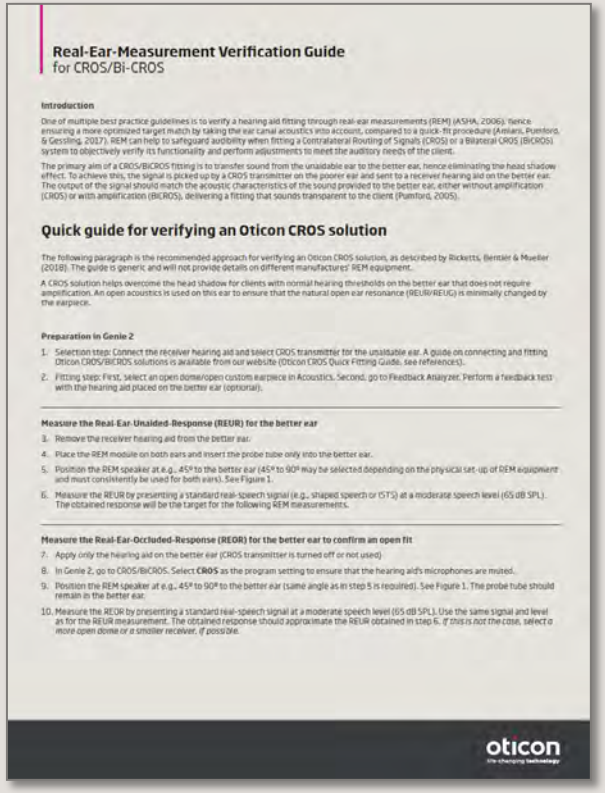
Real Ear Measurement Verification Guide



Real-Ear-Measurement Verification Guide
for CROS/Bi-CROS

Introduction

One of multiple best practice guidelines is to verify a hearing aid fitting through real-ear measurements (REM) (ASHA, 2006), hence ensuring a more optimized target match by taking the ear canal acoustics into account, compared to a quick-fit procedure (Amlani, Pumford, & Gessling, 2017). REM can help to safeguard audibility when fitting a Contralateral Routing of Signals (CROS) or a Bilateral CROS (BiCROS) system to objectively verify its functionality and perform adjustments to meet the auditory needs of the client.

The primary aim of a CROS/BiCROS fitting is to transfer sound from the unaidable ear to the better ear, hence eliminating the head shadow effect. To achieve this, the signal is picked up by a CROS transmitter on the poorer ear and sent to a receiver hearing aid on the better ear. The output of the signal should match the acoustic characteristics of the sound provided to the better ear, either without amplification (CROS) or with amplification (BiCROS), delivering a fitting that sounds transparent to the client (Pumford, 2005).

Quick guide for verifying an Oticon CROS solution

The following paragraph is the recommended approach for verifying an Oticon CROS solution, as described by Ricketts, Bentler & Mueller (2018). The guide is generic and will not provide details on different manufactures' REM equipment.

A CROS solution helps overcome the head shadow for clients with normal hearing thresholds on the better ear that does not require amplification. An open acoustics is used on this ear to ensure that the natural open ear resonance (REUR/REUG) is minimally changed by the earpiece.

Preparation in Genie 2

1. Selection step: Connect the receiver hearing aid and select CROS transmitter for the unaidable ear. A guide on connecting and fitting Oticon CROS/BiCROS solutions is available from our website (Oticon CROS Quick Fitting Guide, see references).
2. Fitting step: First, select an open dome/open custom earpiece in Acoustics. Second, go to Feedback Analyzer. Perform a feedback test with the hearing aid placed on the better ear (optional).

Measure the Real-Ear-Unaided-Response (REUR) for the better ear

3. Remove the receiver hearing aid from the better ear.
4. Place the REM module on both ears and insert the probe tube only into the better ear.
5. Position the REM speaker at e.g., 45° to the better ear (45° to 90° may be selected depending on the physical set-up of REM equipment and must consistently be used for both ears). See Figure 1.
6. Measure the REUR by presenting a standard real-speech signal (e.g., shaped speech or ISTS) at a moderate speech level (65 dB SPL). The obtained response will be the target for the following REM measurements.

Measure the Real-Ear-Occluded-Response (REOR) for the better ear to confirm an open fit

7. Apply only the hearing aid on the better ear (CROS transmitter is turned off or not used)
8. In Genie 2, go to CROS/BiCROS. Select **CROS** as the program setting to ensure that the hearing aid's microphones are muted.
9. Position the REM speaker at e.g., 45° to 90° to the better ear (same angle as in step 5 is required). See Figure 1. The probe tube should remain in the better ear.
10. Measure the REOR by presenting a standard real-speech signal at a moderate speech level (65 dB SPL). Use the same signal and level as for the REUR measurement. The obtained response should approximate the REUR obtained in step 6. *If this is not the case, select a more open dome or a smaller receiver, if possible.*

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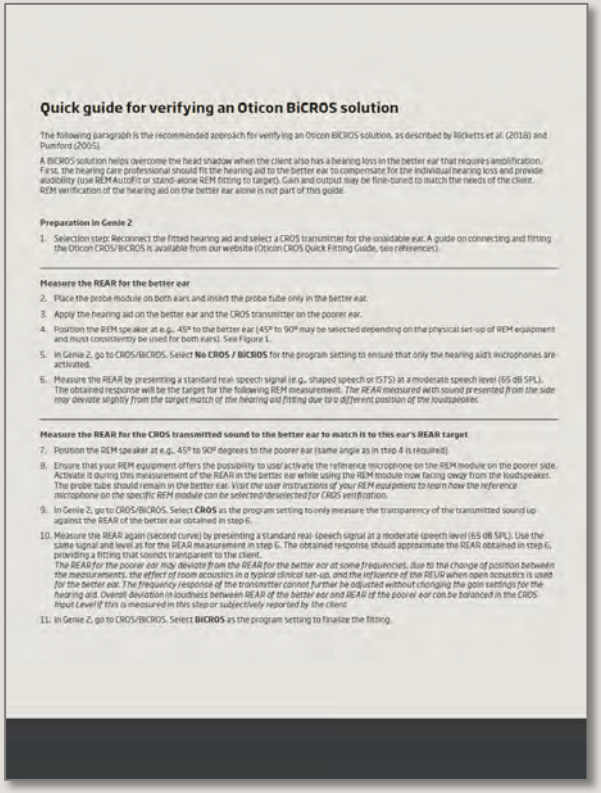

Quick guide for verifying an Oticon BiCROS solution

The following paragraph is the recommended approach for verifying an Oticon BiCROS solution, as described by Ricketts et al. (2018) and Pumford (2005).

A BiCROS solution helps overcome the head shadow when the client also has a hearing loss in the better ear that requires amplification. First, the hearing care professional should fit the hearing aid to the better ear to compensate for the individual hearing loss and provide audibility (use REM AutoFit or stand-alone REM fitting to target). Gain and output may be fine-tuned to match the needs of the client. REM verification of the hearing aid on the better ear alone is not part of this guide.

Preparation in Genie 2

1. Selection step: Reconnect the fitted hearing aid and select a CROS transmitter for the unaidable ear. A guide on connecting and fitting the Oticon CROS/BiCROS is available from our website (Oticon CROS Quick Fitting Guide, see references).

Measure the REAR for the better ear

2. Place the probe module on both ears and insert the probe tube only in the better ear.
3. Apply the hearing aid on the better ear and the CROS transmitter on the poorer ear.
4. Position the REM speaker at e.g., 45° to the better ear (45° to 90° may be selected depending on the physical set-up of REM equipment and must consistently be used for both ears). See Figure 1.
5. In Genie 2, go to CROS/BiCROS. Select **No CROS / BiCROS** for the program setting to ensure that only the hearing aid's microphones are activated.
6. Measure the REAR by presenting a standard real-speech signal (e.g., shaped speech or ISTS) at a moderate speech level (65 dB SPL). The obtained response will be the target for the following REM measurement. *The REAR measured with sound presented from the side may deviate slightly from the target match of the hearing aid fitting due to a different position of the loudspeaker.*

Measure the REAR for the CROS transmitted sound to the better ear to match it to this ear's REAR target

7. Position the REM speaker at e.g., 45° to 90° degrees to the poorer ear (same angle as in step 4 is required)
8. Ensure that your REM equipment offers the possibility to use/activate the reference microphone on the REM module on the poorer side. Activate it during this measurement of the REAR in the better ear while using the REM module now facing away from the loudspeaker. The probe tube should remain in the better ear. *Visit the user instructions of your REM equipment to learn how the reference microphone on the specific REM module can be selected/deselected for CROS verification.*
9. In Genie 2, go to CROS/BiCROS. Select **CROS** as the program setting to only measure the transparency of the transmitted sound up against the REAR of the better ear obtained in step 6.
10. Measure the REAR again (second curve) by presenting a standard real-speech signal at a moderate speech level (65 dB SPL). Use the same signal and level as for the REAR measurement in step 6. The obtained response should approximate the REAR obtained in step 6, providing a fitting that sounds transparent to the client.
The REAR for the poorer ear may deviate from the REAR for the better ear at some frequencies, due to the change of position between the measurements, the effect of room acoustics in a typical clinical set-up, and the influence of the REUR when open acoustics is used for the better ear. The frequency response of the transmitter cannot further be adjusted without changing the gain settings for the hearing aid. Overall deviation in loudness between REAR of the better ear and REAR of the poorer ear can be balanced in the CROS Input Level if this is measured in this step or subjectively reported by the client.
11. In Genie 2, go to CROS/BiCROS. Select **BiCROS** as the program setting to finalize the fitting.

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Subjective verification and counseling

Remote fitting options for Oticon CROS/BiCROS

Oticon CROS family benefits

Exceptional sound quality your patients can count on

More choice, more compatibility

Access to speech while streaming with TwinLink


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Oticon CROS

A revolutionary sound experience

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