



Image sourced from the Audioscan YouTube channel

Real-Ear Measurements

Ensuring precision in
hearing aid fittings

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Webinar FAQs

Real Ear Measurements:
Ensuring precision in
hearing aid fitting

How to Ask a Question

Click Q & A, type your question, click Send.

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Risks and Benefits

- The applicability and accuracy of the course content may vary by the clinical, geographical, and cultural context, you should evaluate the course accordingly.
- As healthcare is rapidly evolving, new findings may change the validity of the information presented in this course. Providers should always consult the latest research and guidelines from professional associations.
- The interventions discussed in this course may be limited in generalizability, requiring practitioners to consider specific, individual and population factors.
- The course may not cover all possible risk factors, diagnostic methods, or treatment options, and complex cases may require additional considerations.
- Healthcare providers should apply cultural competence and sensitivity to ensure effective and respectful care based on their patients' diverse needs.
- Providers should always evaluate the limitations of diagnostic and screen tools, considering their potential for false results as well as any ethical implications.
- It is the responsibility of course participants to critically evaluate the evidence from multiple sources to guide professional practice.

Learning Outcomes

1

Explain the benefits of utilizing real-ear measurements in their practice

2

Describe how to prepare for real-ear measurements

3

Describe the basic real-ear measurement process



Best Practice



Contributes to higher overall satisfaction with hearing aids and their hearing care professional, as well as an improved patient experience¹

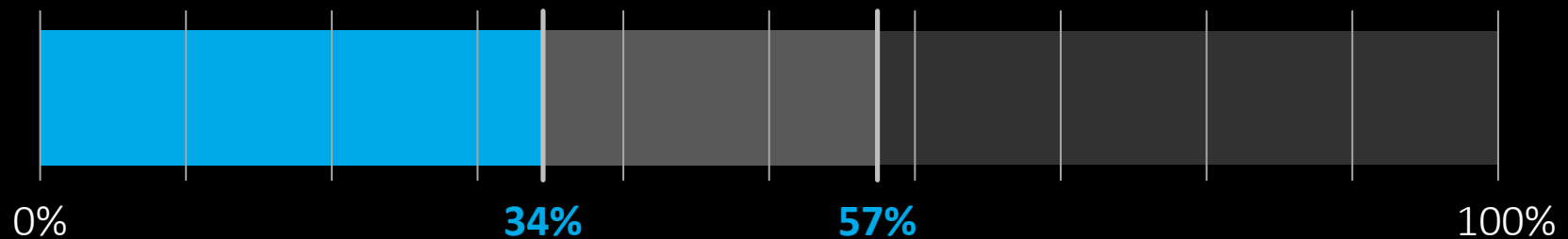


Includes individual ear information for a **more precise, personalized hearing aid fitting**



The best way to verify the performance of a hearing aid according to best practices^{2,3}

Usage of Real-Ear Verification



57% of survey respondents report owning real-ear verification equipment
but only 34% report using it routinely⁵

Reasons may include lack of time, space constraints, or practice setting constraints

Goals of REM



Image sourced from the
Audioscan YouTube channel

Goals of REM



Verify
Audibility



Verify
Output



Ensure Patient
Benefit

Bottom Line



Soft sounds must be
made audible



Speech should remain
at a comfortable level



Loud sounds cannot become
uncomfortably loud



Prescriptive Fitting Formulas

Prescriptive Fitting Procedures and Fitting Formulas

The compression architecture

Generic fitting formulas

not manufacturer specific

NAL-1

NAL-3

NAL-2

NAL-R

DSL

Proprietary fitting formulas

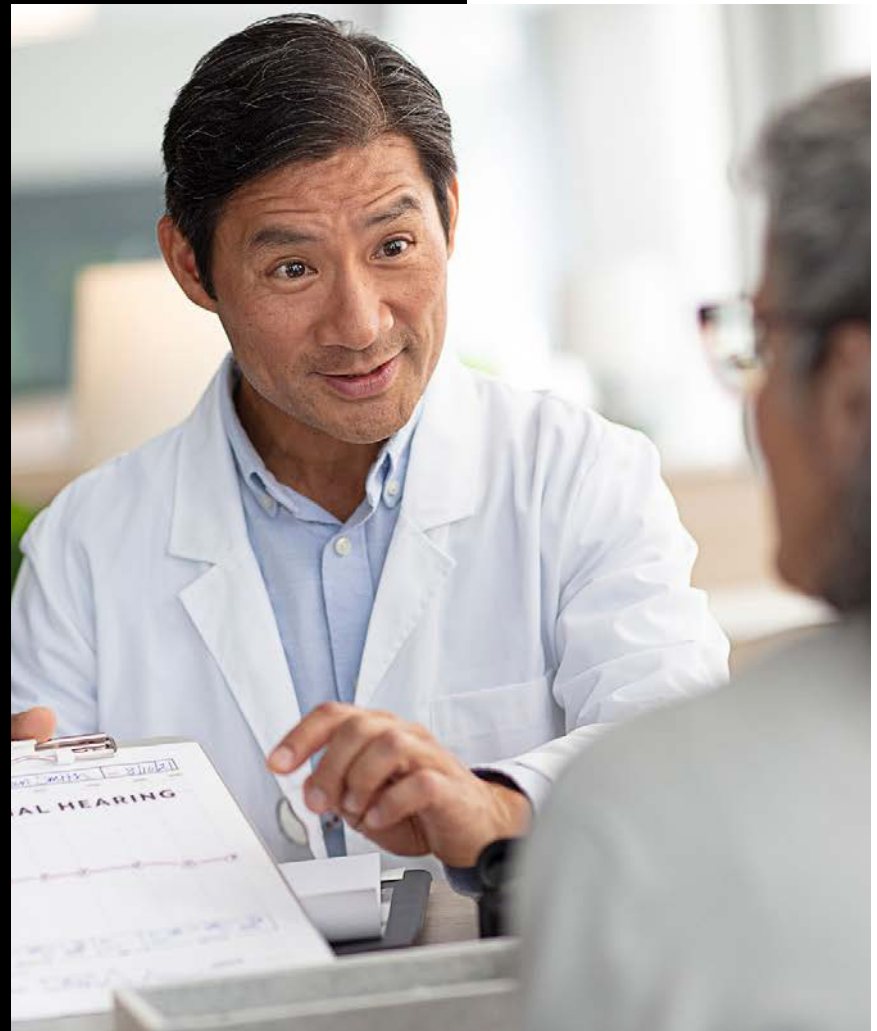
manufacturer specific



NAL-R

Linear formula

Utilizes a loudness
equalization rationale



NAL-NL1

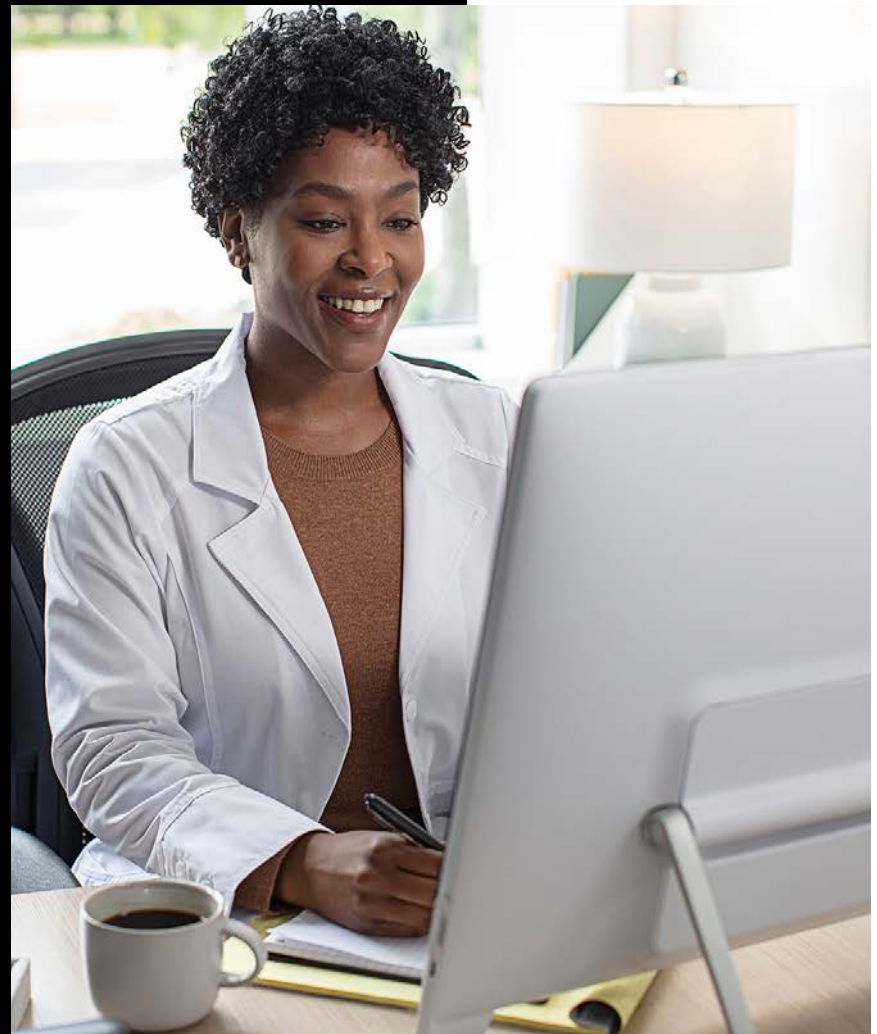
Development based on NAL-R

WDRC

Based upon predictive model for
speech intelligibility

Derived ANSI SII

Utilizes a loudness
normalization rationale



NAL-NL2

Developed based on empirical data collected over a decade regarding NAL-NL1

Primary goal remained the same

- Loudness normalization

- Predictive model of speech intelligibility



NAL-NL3

Built on millions of real-world hearing aid fittings

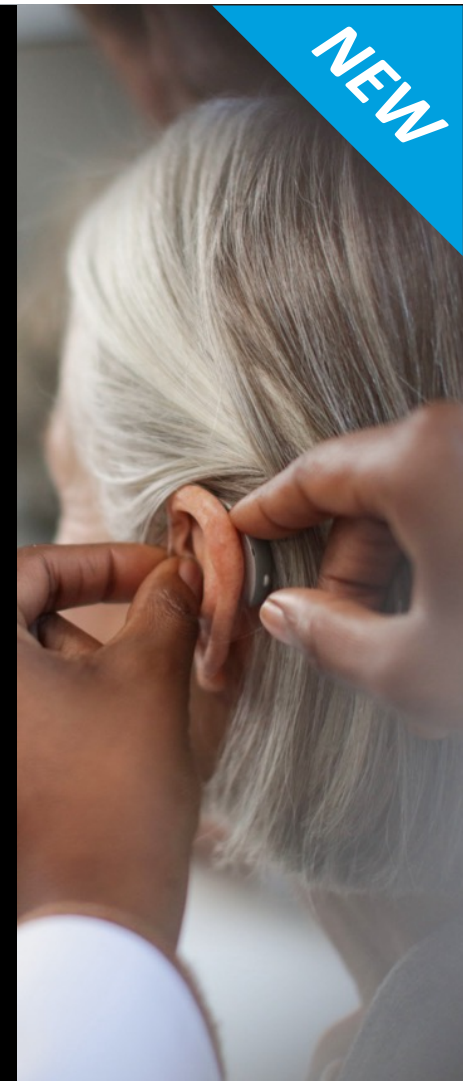
Machine learning and neural networks:

Analyzes millions of historical fittings to identify optimal amplification patterns

Ecological Momentary Assessment (EMA):

Incorporates 10,000+ real-world feedback points from users

Accounts for real-life listening environments for personalized adjustments



DSL v5.0

Desired sensation level

Developed for pediatric fittings

Compression characteristics

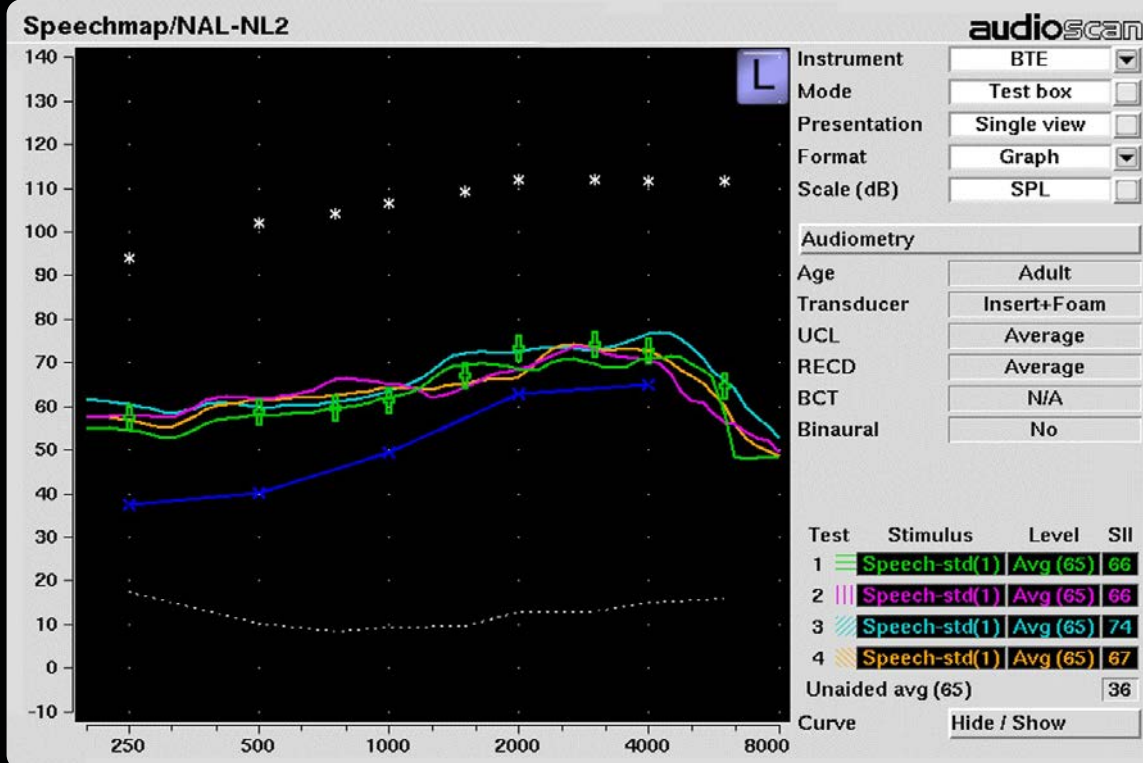
Dependent on the severity of loss

Resembles a loudness
equalization rationale





Fitting Formulas Same for All Manufacturers?



Manufacturer-specific
approaches to signal
processing impact
hearing aid responses

Universal fitting formulas
**do not produce
equivalent results**

A woman with dark curly hair, wearing a white lab coat over a light blue button-down shirt, is seated at a desk. She is looking down and writing in a notebook with a pen. On the desk, there is a laptop, a glass of water, and a black pen holder. In the background, there is a white shelf with some items and a potted plant.

REM Terminology

An underwater scene with a blue gradient background. At the bottom, there are dark blue and black silhouettes of coral reefs. Numerous small white bubbles are scattered throughout the water. The text is centered in the upper half of the image.

REUR REOG
REAR REOR RECD
SII REIG REAG

Response

An *absolute* measure of SPL

$$\text{Input} + \text{Gain} = \text{Response/Output}$$

Gain

A response that is expressed *relative* to a specified input or reference response

$$\text{Output} - \text{Input} = \text{Gain}$$

REAR

Real-Ear Aided *Response*

(ANSI S3.46-1997)

The SPL, as a function of frequency, at a specified measurement point in the ear canal for a specified sound field, with the hearing aid in place and turned on

REAG

Real-Ear Aided *Gain*

(ANSI S3.46-1997)

Difference in decibels, as a function of frequency, between the SPL at a specified measurement point in the ear canal and the SPL at the field reference point, for a specified sound field, with the hearing aid in place and turned on

$$\text{REAR} - \text{INPUT} = \text{REAG}$$



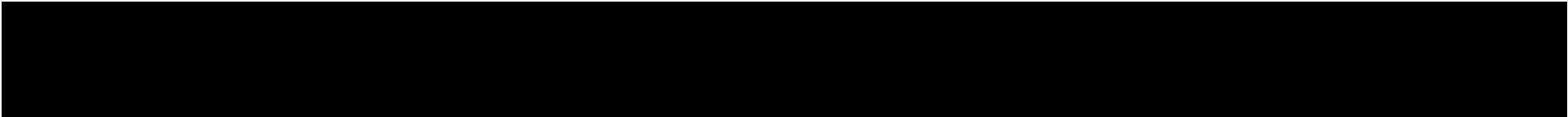
SII

Speech Intelligibility Index

(ANSI, S3.5, 1997, p. 1)

The SII score is a way of quantifying the likely intelligibility of speech based on the proportion of speech cues that are audible to the listener

It is a measure ranging between 0.0 and 1.0 “that is highly correlated with the intelligibility of speech.”



Audioscan Verifit

Speechmap™





Image sourced from the Audioscan YouTube channel

Set-up Steps

- ① Calibration
- ② Enter audiogram
- ③ Select fitting formula
- ④ Select device type/coupling
- ⑤ Select stimulus
- ⑥ Patient placement
- ⑦ On-ear probe tube placement
- ⑧ Hearing aid set-up
- ⑨ Patient preparation

SETUP

Calibration

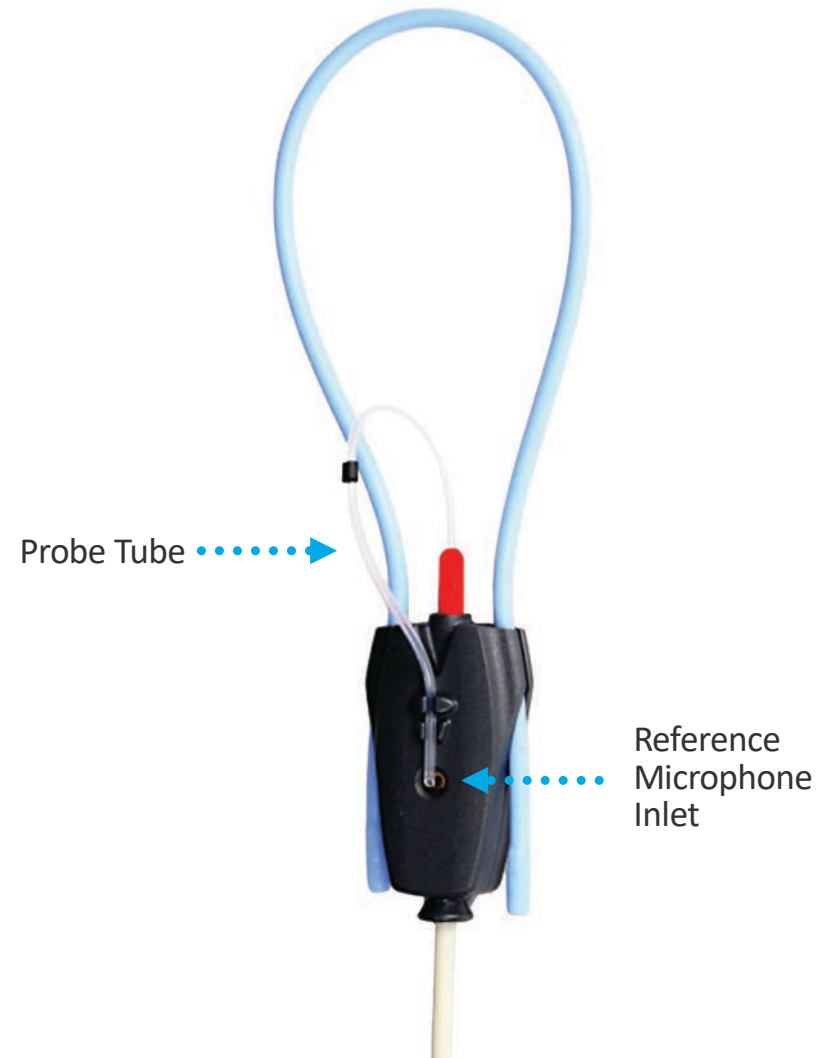
Compares frequency response of probe tube to flat frequency response of the external reference mic, and compensates for this difference in all subsequent measurements



STEP 1

Calibration

Fold the probe tube over and place the probe tube opening on top of the reference microphone



STEP 1

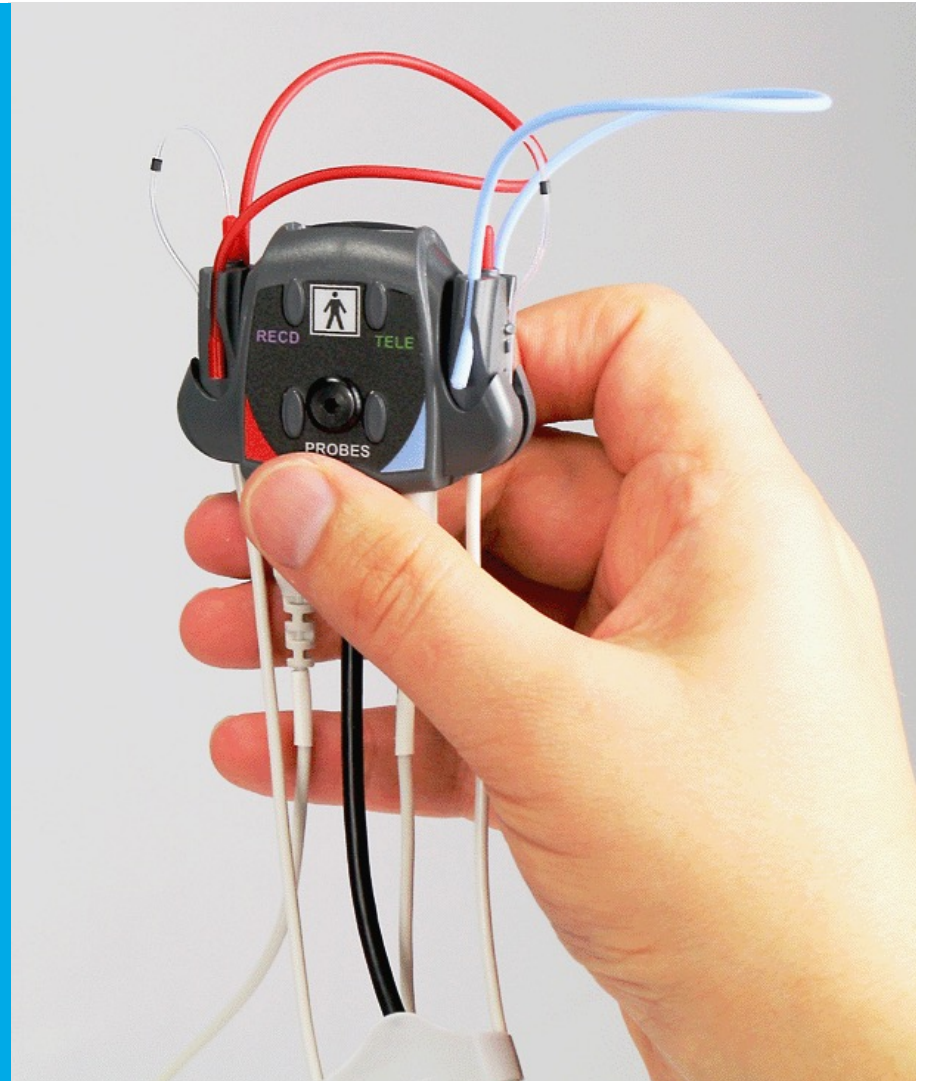
Calibration

To Calibrate

Hold the probe dock 6-36 inches from the speaker

Select 'Calibrate'

Image taken from the Verifit® VF-2 User's Guide 2025.1



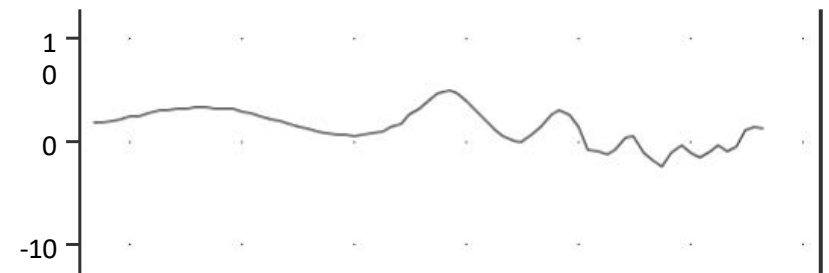
STEP 1

Calibration

To Calibrate

View calibration curve

Repeat for other probe dock

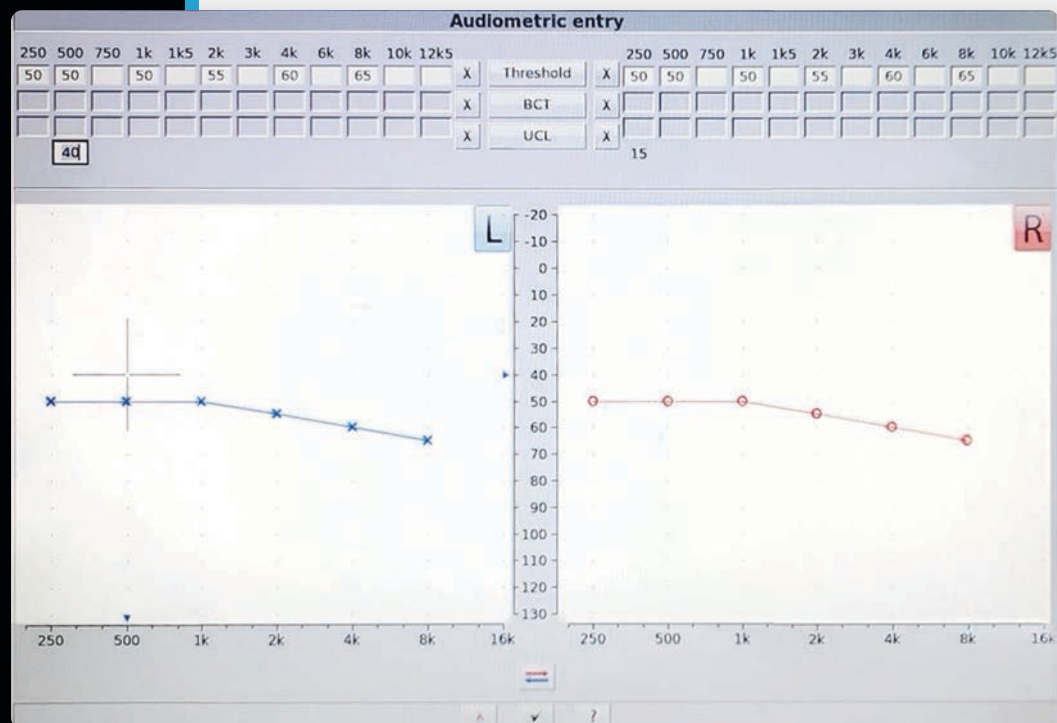


STEP 2

Enter Audiogram

Required to generate targets

Manual entry or transfer from database



STEP 3

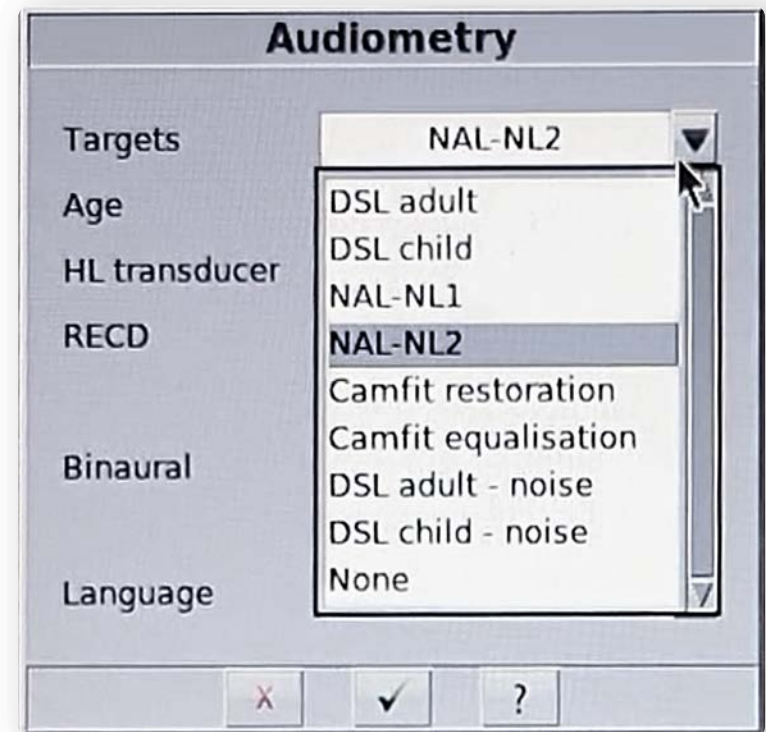
Select Fitting Formula

Determines fitting targets based on fitting formula philosophy

Match fitting formula selected in the fitting software

Approximate fitting formula based on manufacturer proprietary formula*

*Contact manufacturer for guidance



STEP 4

Select Device Type and Coupling/Vent

Ensures appropriate target generation

Determines need for sound field equalization



Sound Field Equalization

Concurrent

For occluded fittings

Reference microphone is on during measurements

If the patient moves during the measurement, the system will adjust the signal level as needed

May result in an underestimation of hearing aid gain if used with open fit

Stored

For open fittings

Reference microphone is off during measurements

Patient must remain still during the measurement, or equalization should be repeated if patient moves

Will prevent underestimation of hearing aid gain due to leakage

STEP 5

Select Stimulus

ISTS

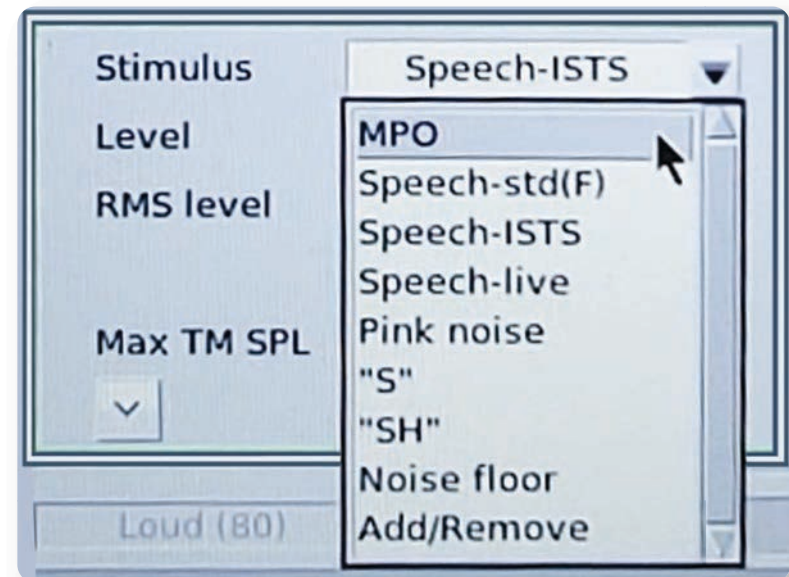
Female talker

Segments of 6 languages sliced together to match the average speech spectrum

Speech-std

Carrot passage

Filtered to provide the long-term average speech spectrum (LTASS)



STEP 6

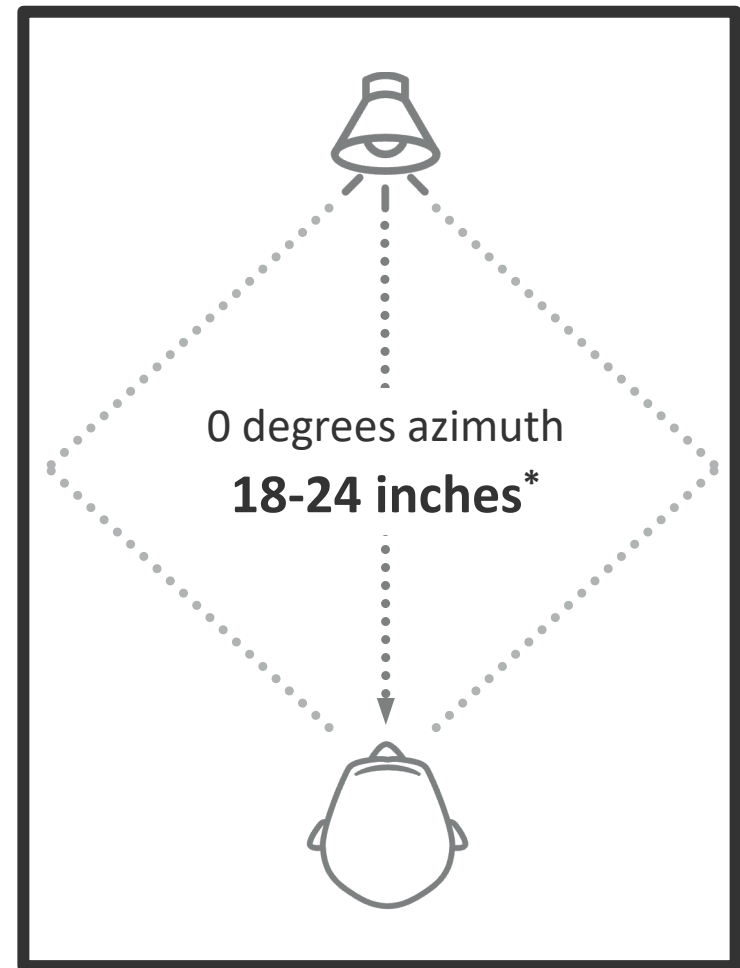
Patient Placement

To Position

Choose a quiet location

Position patient 18-24 inches
in front of the speaker

*Follow instructions from real-ear system manufacturer



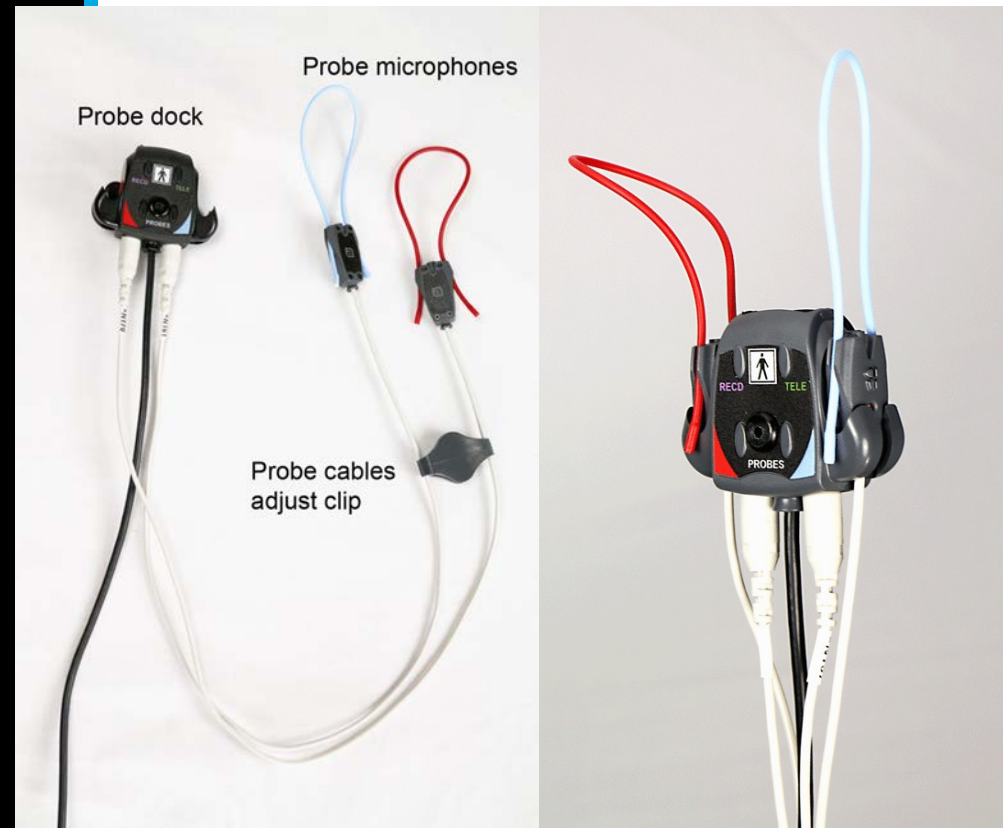
STEP 7

On-Ear Probe Tube Placement

To Position

Clip probe dock to patient's shirt

Hang ear loops over pinna and adjust to fit near the head and away from acoustic influence of pinna or hearing aid



STEP 7

On-Ear Probe Tube Placement

To Position

Positioning the probe tube

Goal: within 2-5mm of eardrum

Adult males: ~30mm

Adult females: ~28mm

Children: ~20-25mm



Image taken from the VeriFit® VF-2 User's Guide 2025.1



CAUTION: Do not poke the eardrum with the probe tube

STEP 7

On-Ear Probe Tube Placement

To Position

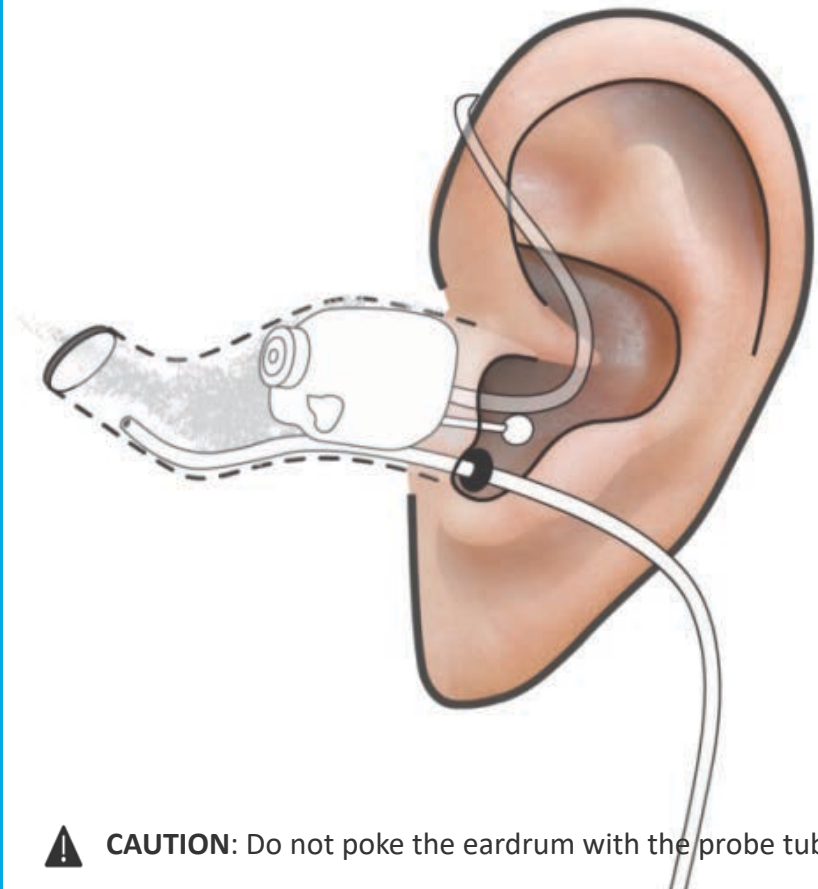
Positioning the probe tube

Goal: within 2-5mm of eardrum

Adult males: ~30mm

Adult females: ~28mm

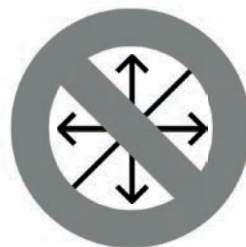
Children: ~20-25mm



CAUTION: Do not poke the eardrum with the probe tube

STEP 8

Hearing Aid Setup



DIRECTIONALITY



NOISE REDUCTION



FEEDBACK CANCELLER

STEP 9

Patient Preparation

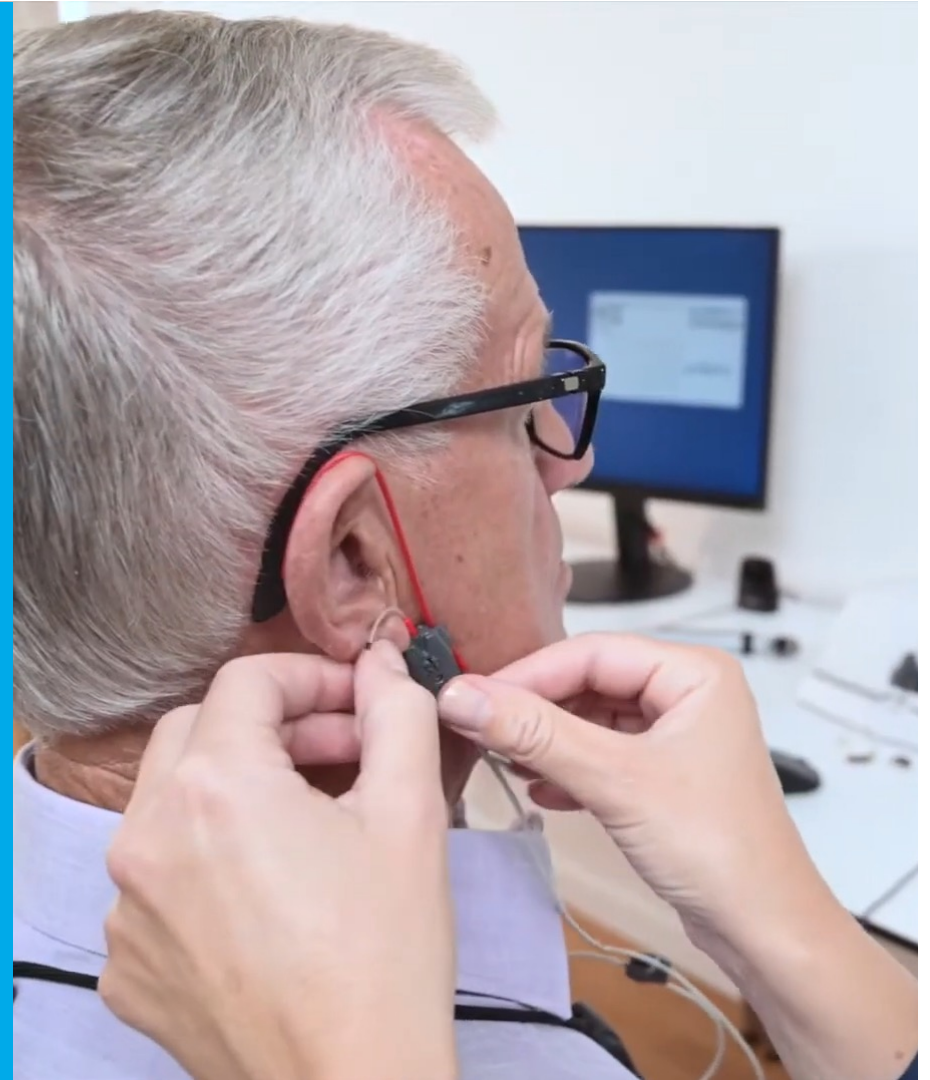
Remain quiet and still

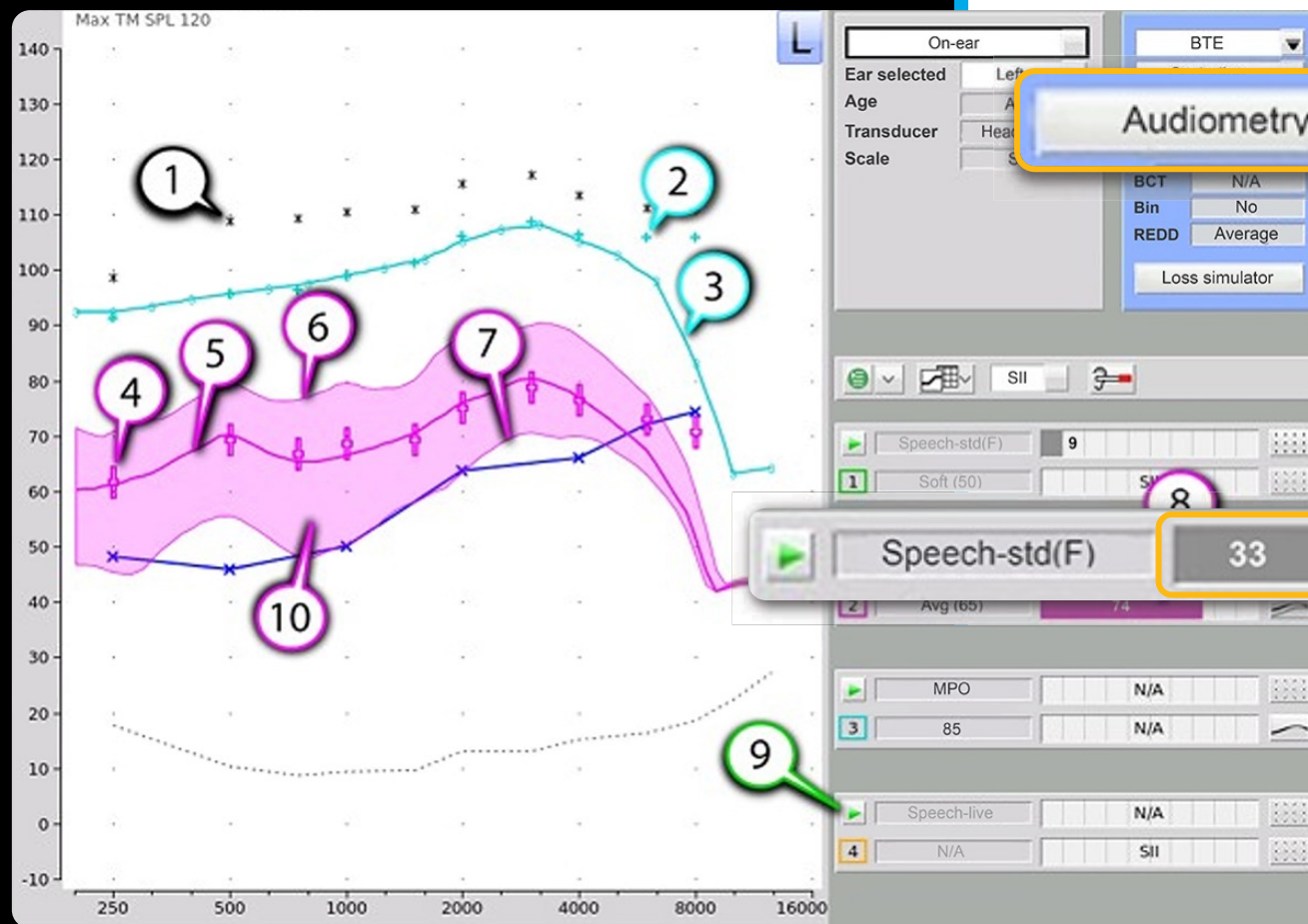
Will be listening to speech at different volume levels

Do not need to repeat back or even understand stimulus

If signal gets uncomfortably loud, raise hand

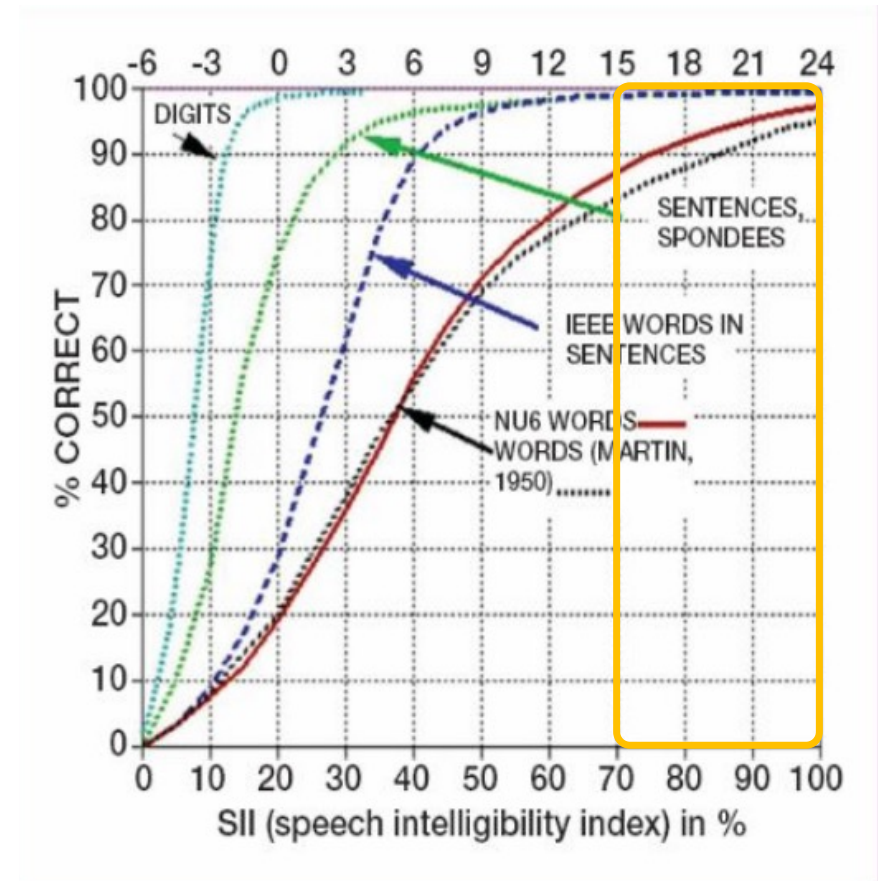
Image sourced from the Audioscan YouTube channel

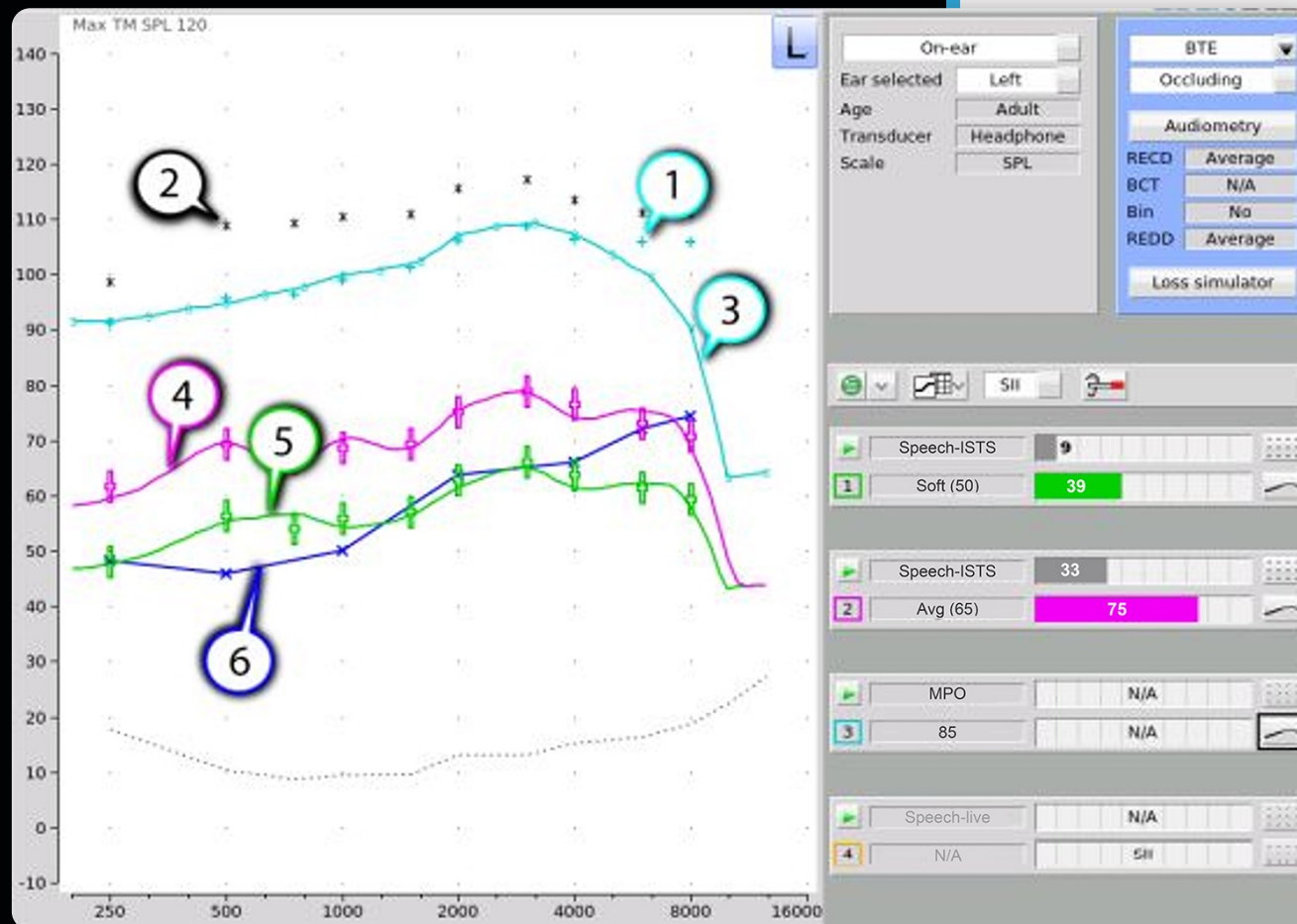




- ① Estimated UCL
- ② 90 dB target (for tones)
- ③ MPO Result
- ④ Targets
- ⑤ 65 dB Response curve
- ⑥ Speech Peak
- ⑦ Speech Valley
- ⑧ SII
- ⑨ Start Test
- ⑩ Amplified speech region

SII (%)	% Cor.	% Cor.	% Cor.
	Digits	IEEE Sentences	NU6 Words
0	0	0	0
5	30	4	4
10	80	9	8
15	96	13	11
20	98	19	19
25	99	43	27
30	100	60	36
35	100	74	45
40	100	89	56
45	100	94	63
50	100	96	70
55	100	98	76
60	100	99	81
70	100	99	87
80	100	100	93
90	100	100	96





- ① 90 dB target (for tones)
- ② Estimated UCL
- ③ MPO result
- ④ 65 dB response curve
- ⑤ 50 dB response curve
- ⑥ Audiogram (SPL)

Speechmap/NAL-NL2

VeriFit 2

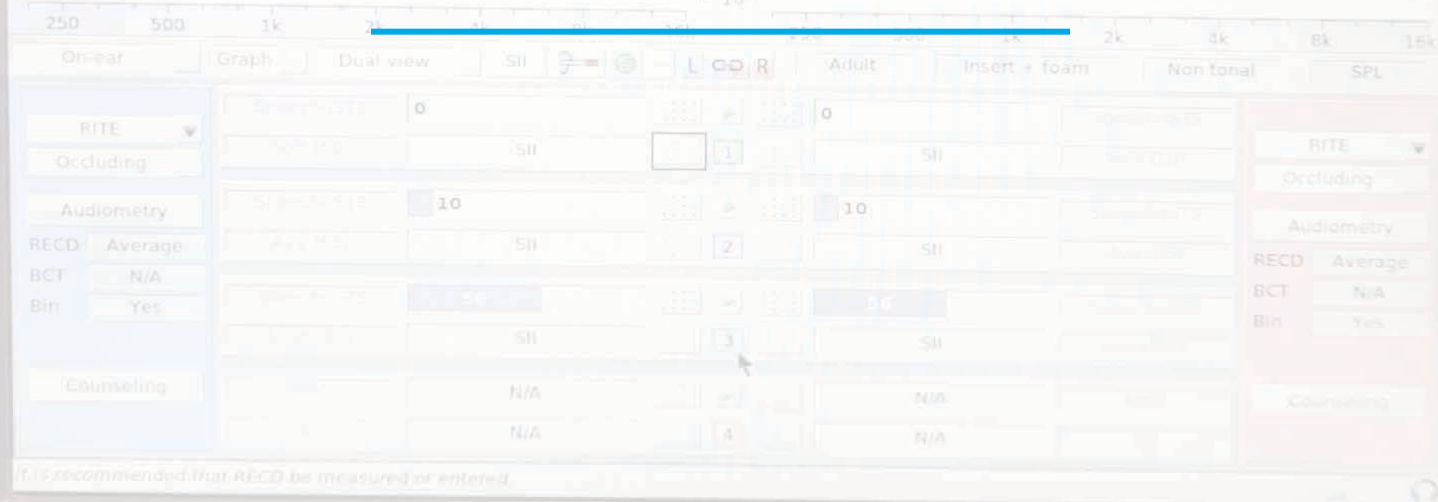
Max IM SPL 125

L

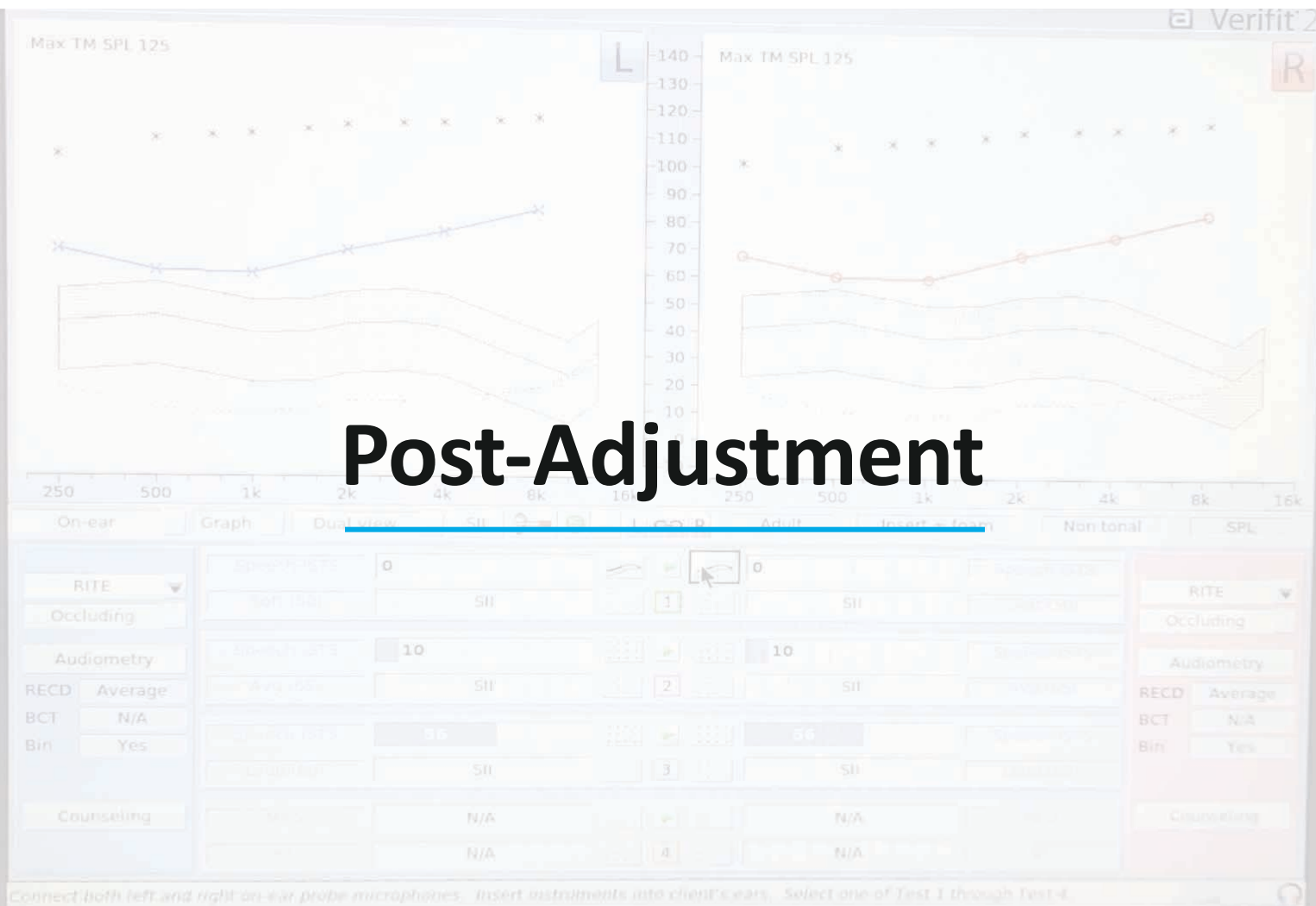
Max IM SPL 125

R

Pre-Adjustment



Post-Adjustment



Using SII for Counseling

	50 dB SPL		65 dB SPL		80 dB SPL	
	Left	Right	Left	Right	Left	Right
Unaided SII	0 %	0 %	10 %	10 %	56 %	56 %

Using SII for Counseling

	50 dB SPL		65 dB SPL		80 dB SPL	
	Left	Right	Left	Right	Left	Right
Unaided SII	0 %	0 %	10 %	10 %	56 %	56 %
Aided SII (pre)	6 %	11 %	32 %	34 %	63 %	64 %

Using SII for Counseling

	50 dB SPL		65 dB SPL		80 dB SPL	
	Left	Right	Left	Right	Left	Right
Unaided SII	0 %	0 %	10 %	10 %	56 %	56 %
Aided SII (pre)	6 %	11 %	32 %	34 %	63 %	64 %
Aided SII (post)	31 %	35 %	54 %	57 %	69 %	70 %

REM Target Match

A streamlined process for automatically matching real ear targets to provide an accurate and efficient fitting experience



REM Target Match

Omega AI 24 Right **Binaural** Left Omega AI 24

Experience Level 3

Fitting Formula e-STAT 2.0

Acoustic Options Medium Vent

Verifit Target

Stimulus

- Current gain adjustments will be lost by running REM Target Match.
- Select the Real Ear system you wish to use and ensure it is powered on.
- Select target and stimulus to be used during REM Target Match.
- Click Launch to begin.

The Real Ear system has been successfully launched. Click Next to proceed.

Verifit2 (1406)

Setup

REM Target Match

Fully integrated workflow via the REM Target Match Tool

Allows for **live display** of **simultaneous binaural real ear measurements** relative to target

Automatic target matching for both the e-STAT proprietary and standard prescriptive formulas

Allows for manual fine tuning to further personalize a fitting as needed

REM Target Match

REM Target Match is an automatic real ear measurement (REM) tool that allows the hearing professional to quickly and automatically fit hearing aids using the unique acoustics of the patient's ears

Steps for REM Target Match

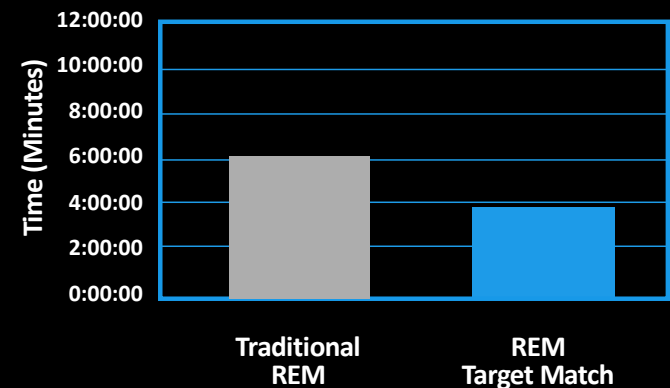
1. Setup
2. Calibration*
3. Unaided**
4. Aided

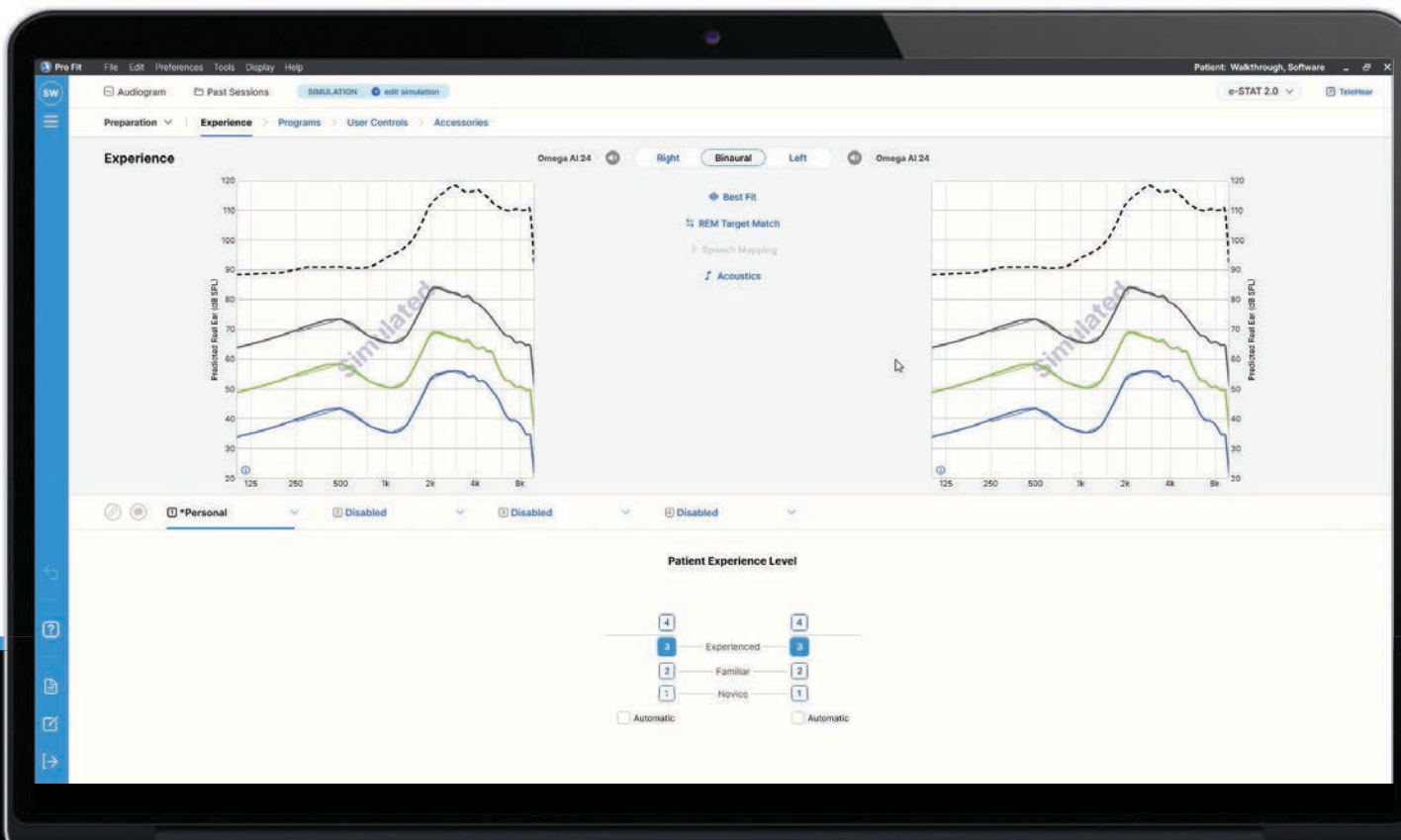
*Calibration completed through Verifit console; **Verifit does not support unaided measurements

Compatible Devices Include:

Verifit 1 and 2
MedRx Avant REM Speech+
Interacoustics Affinity Suite
Inventis Trumpet
Otometrics Aurical FreeFit

Average Time for REM – Verifit 2 (BTE)





REM Target Match Tips & Tricks



Verifit | Good to Know



If calibration has been completed daily or weekly, the calibration prompt will be skipped, you will be prompted to start aided measurements



If the Binaural Sound Field Assist is skipped using the Verifit 2, measurements will be run monaurally until all measurements are complete



Verifit 1 will only run monaural measurements (i.e. one ear at a time)
The measurements will automatically switch between ears until all measurements are complete

Verifit 2 will run simultaneous binaural measurements



NAL-NL2 requires bone conduction entry at 500 Hz and 2000 Hz

REM Target Match

1

Experience Manager

REM Target Match Tool will
always target match to
experience level 3

REM Target Match

Viewing Measurement Curves

2

Once you exit REM Target Match, there isn't a way to access the REM measurement curves again

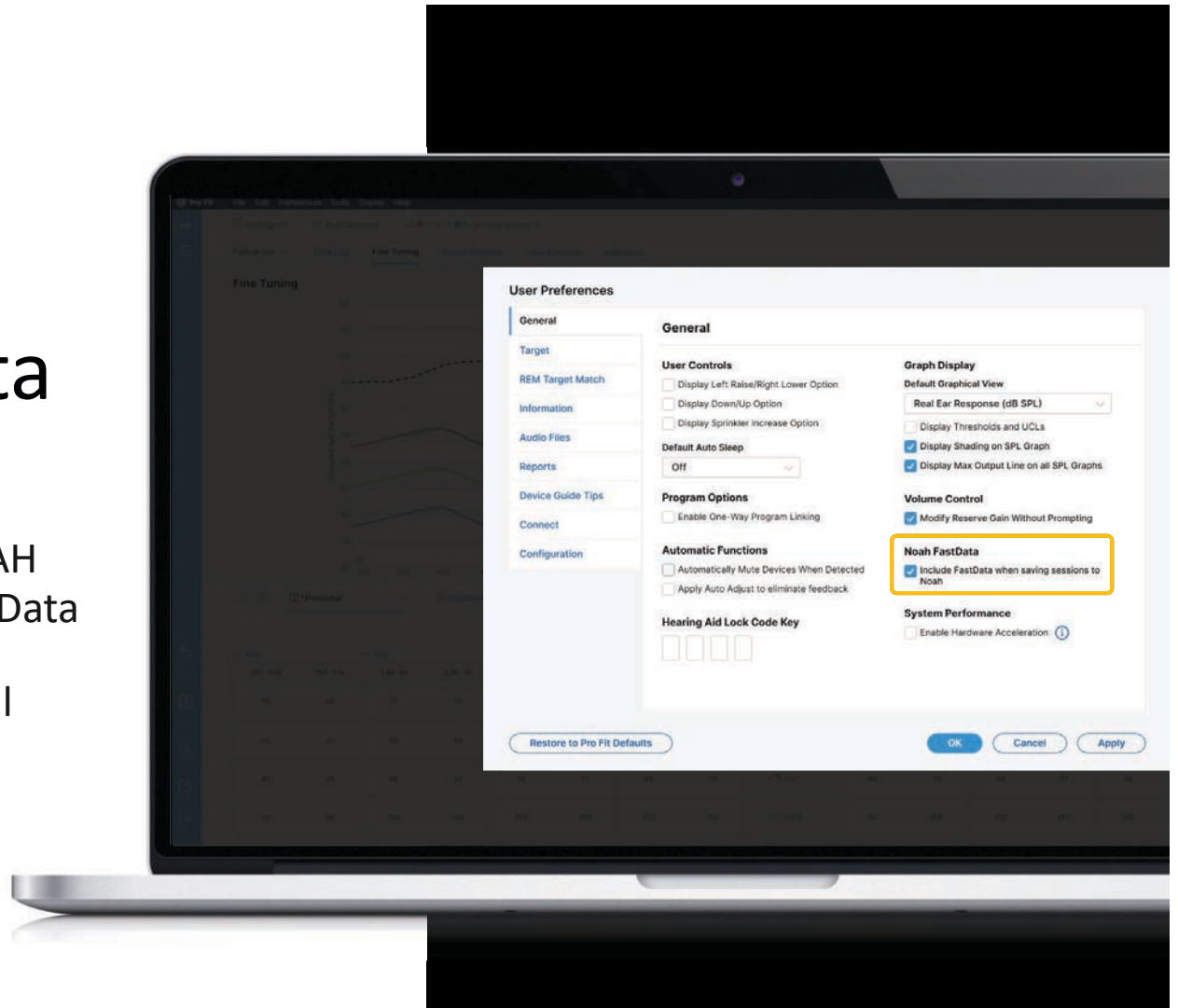
Printing the fitting report graph before closing is recommended

NOAH Fast Data

Measurements are visible
in fitting report

Data is not saved in the NOAH
file unless using NOAH Fast Data

Select Preferences > General



REM Target Match

3

Selecting Max Sound Level

Select the loudness level at which
the system will automatically
stop measuring

May be useful to align the
max sound level with UCL
measurements

REM Target Match

4

Selecting Input Levels

Soft, average and loud targets are
matched

65 dB SPL is the default view

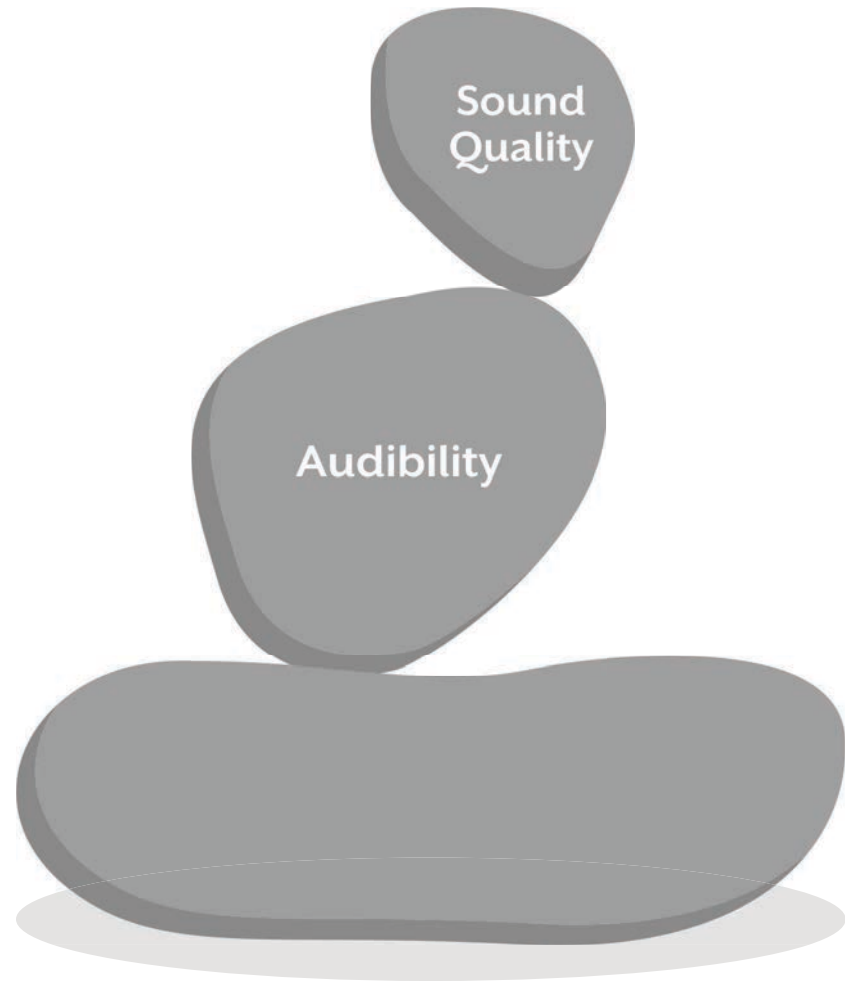
Check the boxes to also view soft
and loud curves
(e.g. 50 dB and/or 80 dB)

Now What?

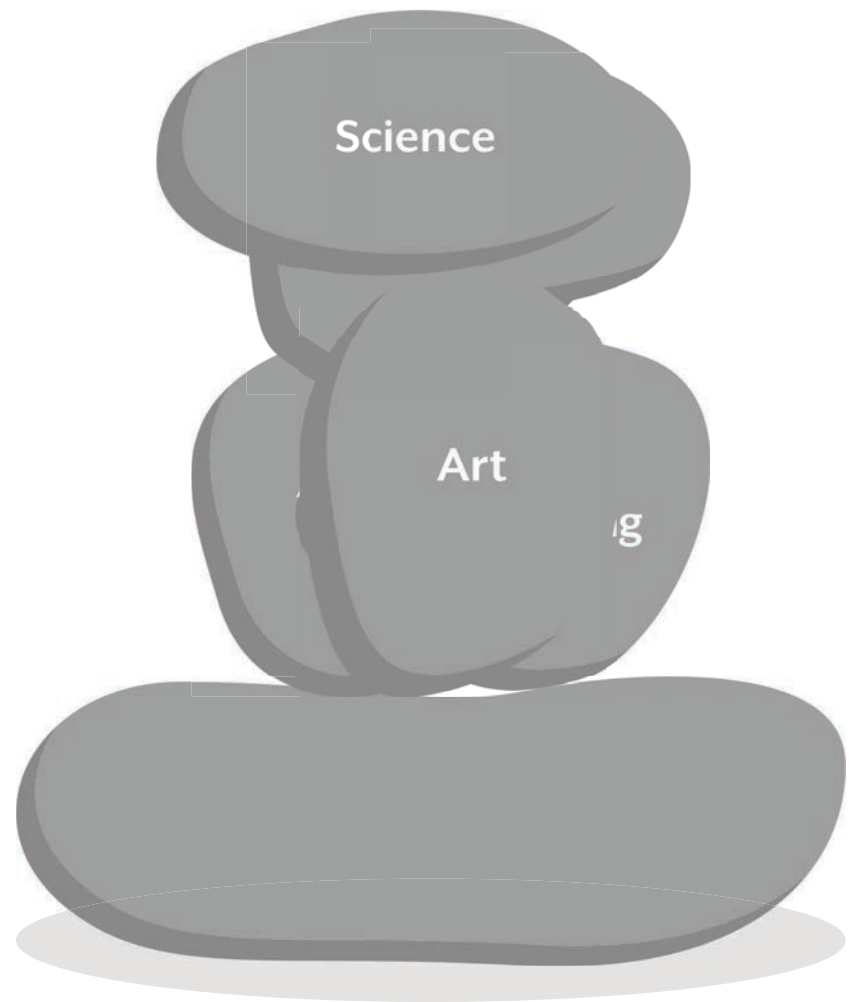
Audibility and comfort verified

Our Role

Ensure patients are satisfied
with their hearing aids



Real-World Balancing Act



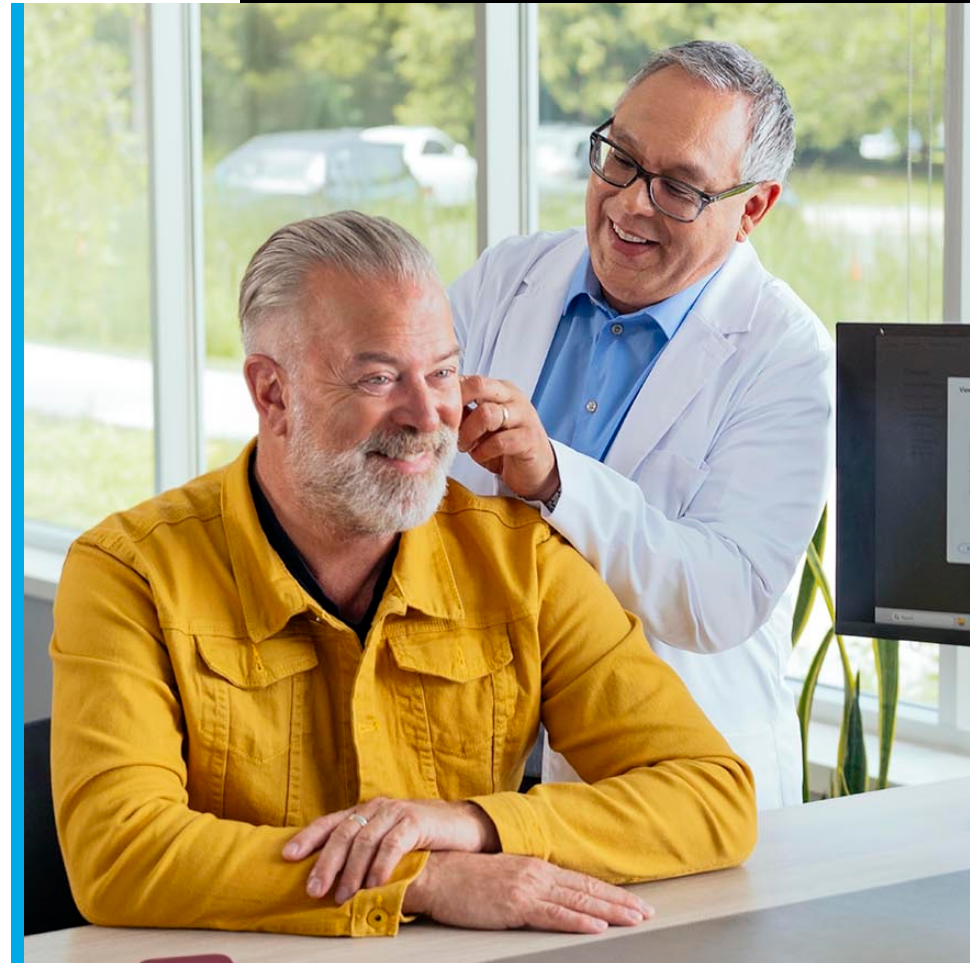
Greater perceptual
benefit with REM

Reduced listening effort

Improved speech understanding

Reduced patient visits

Kochkin S. (2011) MarkeTrak VIII: Reducing patient visits through verification and validation. *Hearing Review*, 18(6),10-12.





Learn More

American Academy
of Audiology

<https://www.audiology.org>

American Speech and
Hearing Association

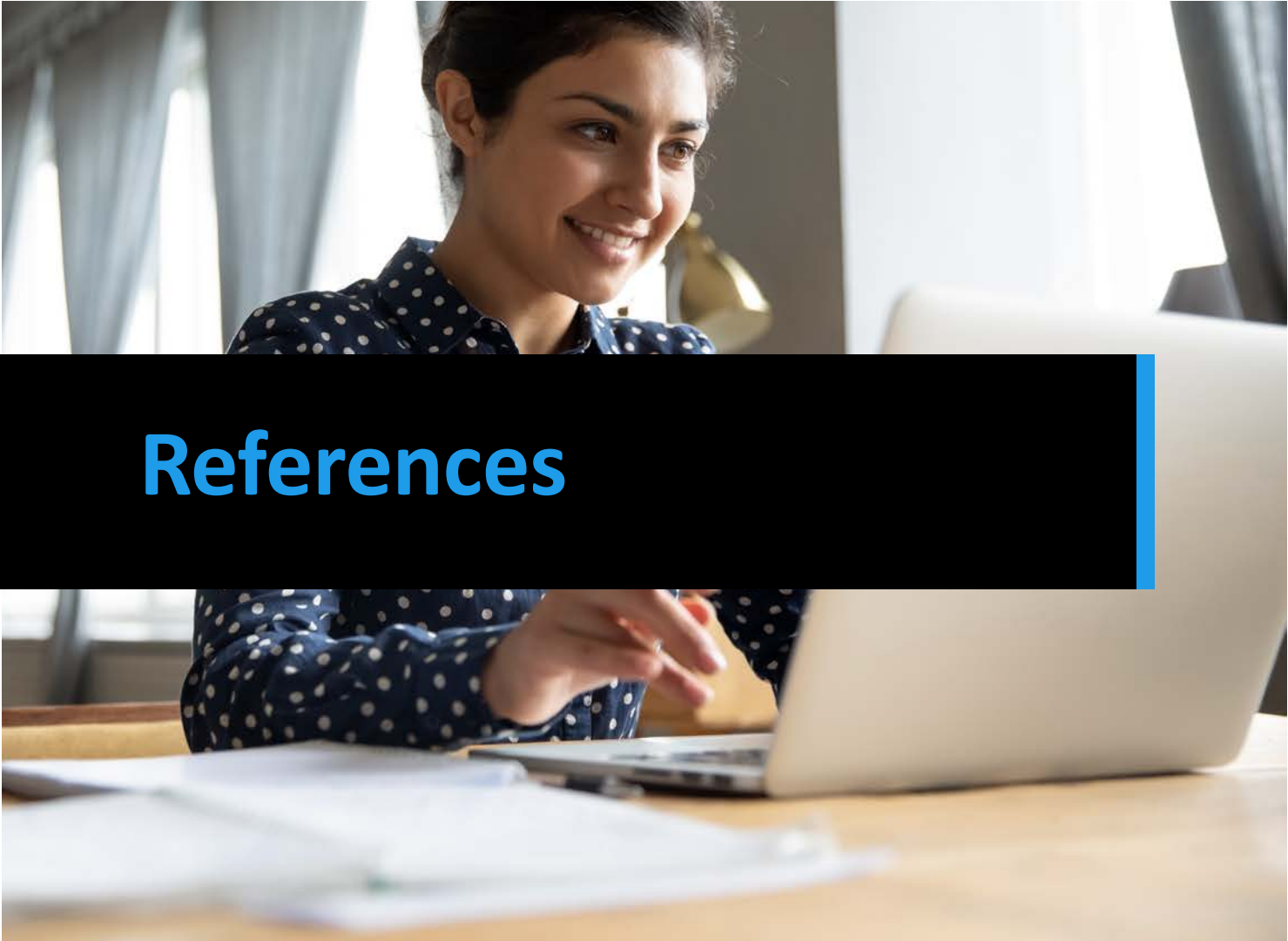
<https://www.asha.org>

Verifit® VF-2 User's
Guide 2025.1



PDF

**Visit audiologyonline.com and [StarkeyPro.com](https://starkeypro.com)
to register for more training classes**

A woman with dark hair tied back, wearing a dark blue polka-dot shirt, is sitting at a wooden desk. She is smiling and looking towards the right side of the frame. In front of her is a silver laptop. To her left, there are some papers and a pen on the desk. The background shows a window with light blue curtains and a brass lamp. A black horizontal bar with a blue vertical line on the right side is overlaid on the image, containing the word "References" in blue text.

References

References

1. Amlani AM, Pumford J, Gessling E. Improving patient perception of clinical services through real-ear measurements. *Hearing Review*. 2016;23(12):12-21.
2. American Academy of Audiology. Guidelines for the Audiological Management of Adult Hearing Impairment. *Audiology Today*. 2006;18(5):32-37.
3. American Speech-Language-Hearing Association. Guidelines for Hearing Aid Fitting for Adults. 2015. Available at: http://www.asha.org/PRPSpecificTopic.aspx?folderid=8589935381§ion=Key_Issues
4. Audioscan. (2025). *Verifit® user's guide (2025.1)* [Manual]. [Verifit® VF-2 User's Guide 2025.1](#)
5. Jorgensen, L. E. (2016). Verification and validation of hearing aids: Opportunity not an obstacle. *Journal of Otology*, 11(2), 57–62. <https://doi.org/10.1016/j.joto.2016.05.001>
6. Killion, Mead, Mueller, H. Gustav (2010). Twenty year later: A NEW Count-The-Dots method. *The Hearing Journal*, 63(1):10-15.
7. Kirkwood, D. H. (2006). Dispensers fitted more hearing aids in 2005 at higher prices. *The Hearing Journal*, 59(4), 40. Retrieved from <https://journals.lww.com/thehearingjournal/toc/2006/04000>

