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Automatic Real-Ear Measurements (AutoREM): A Smarter Approach to Hearing Care

PRODUCT INSIGHTS

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Trumpet is Inventis' advanced and intuitive Real Ear Measurement system, designed to deliver fast and precise in-situ verification of hearing aids. Featuring lightweight probes, available in both wired and optional wireless versions, Trumpet integrates a built-in amplified speaker for seamless signal reproduction during REM and audiometric exams.

Thanks to its compatibility with major hearing aid fitting software platforms including Starkey Inspire, Oticon Genie 2, ReSound Smart Fit, and more, Trumpet supports AutoREM, the fully automated real ear measurement procedure that elevates the fitting process to a new level of speed, standardization, and accuracy.

Connected via USB and controlled through the user-friendly Maestro interface, Trumpet ensures a smooth and efficient workflow.

INTRODUCTION

Clinicians fitting hearing aids on a daily basis are constantly seeking ways to improve both the accuracy and efficiency of the fitting process.

As experienced professionals know, manually adjusting a hearing aid's gain settings to optimize audibility can be time-consuming. The complexity and duration of this task often depend on several factors, such as the degree, type, and configuration of hearing loss, as well as the style and manufacturer of the hearing aid in use.

In this context, Automatic Real Ear Measurement (AutoREM) emerges as a valuable clinical tool. By streamlining the fitting workflow, AutoREM helps achieve more accurate and consistent fittings, in less time.

APPLYING AUTOREM IN EVERYDAY AUDIOLOGY PRACTICE

AutoREM operates by creating a communication link between the probe microphone system and the hearing aid manufacturer's fitting software, using a protocol known as inter-module communication (IMC).

Once this connection is established, the fitting software triggers a series of aided response measurements using the REM speaker hardware, such as the Inventis Trumpet. These measurements are performed at various input levels and are compared to the prescriptive target outputs across different frequencies.

The software then calculates the error—the difference between the measured output in the patient's ear canal and the target output—and automatically adjusts the hearing aid's gain settings to better match the prescribed real-ear targets.

This process eliminates the need for manual adjustments, allowing clinicians to save time while maintaining a high standard of fitting accuracy.

BARRIERS TO MAKING AUTOREM ROUTINE

Despite the clear clinical advantages of AutoREM, its adoption in daily practice remains relatively limited.

One of the primary barriers appears to be habitual workflow resistance. As in many professional fields, clinicians may be reluctant to embrace new technologies—especially those that introduce unfamiliar procedures. This hesitation often stems from a natural resistance to change and a degree of uncertainty about the benefits of automation.

Nevertheless, for many types and configurations of hearing loss, AutoREM provides a faster and more streamlined method to ensure hearing aids are matched to prescriptive real-ear targets, enhancing both audibility and patient outcomes.

It is important to note, however, that AutoREM may not deliver equal effectiveness across all hearing loss profiles. This variability in clinical results may discourage some clinicians from fully integrating AutoREM into their routine fitting protocols.

Finally, compatibility remains a limiting factor. Not all hearing aid manufacturers provide seamless integration with every REM system, which can further impact widespread adoption.

HEARING LOSS CONFIGURATIONS BEST SUITED FOR AUTOREM

AutoREM proves particularly effective in cases of moderate hearing loss, especially when the audiogram includes a low- or mid-frequency component, or presents a relatively flat configuration—including gently rising or sloping patterns.

Clinical experience has shown AutoREM to be especially valuable in managing both downward-sloping and upward-sloping audiograms. In these scenarios, the automated adjustment of gain settings helps clinicians achieve precise and efficient fittings, aligned with prescriptive targets.

Below are four illustrative examples, two for each configuration, demonstrating how AutoREM contributed to accurate, time-saving fittings in real-world cases.

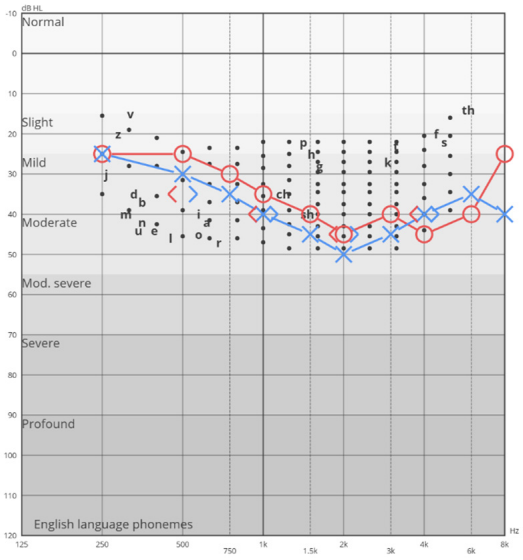

Figure 1 AutoREM performs exceptionally well in cases of mild sloping to moderate sensorineural hearing loss (SNHL).

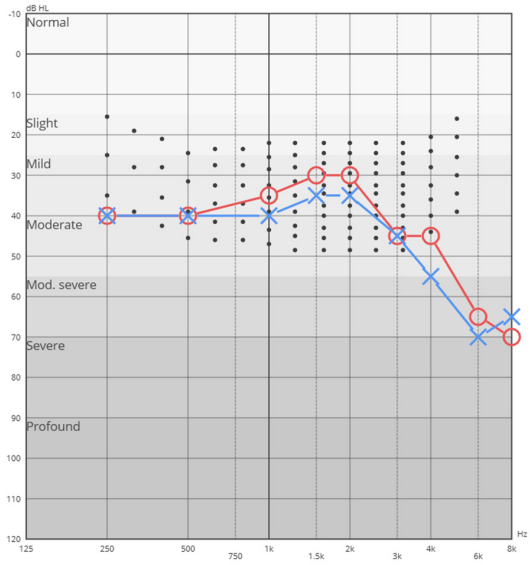

Figure 2 AutoREM is also effective for moderate to moderately severe hearing loss configurations.

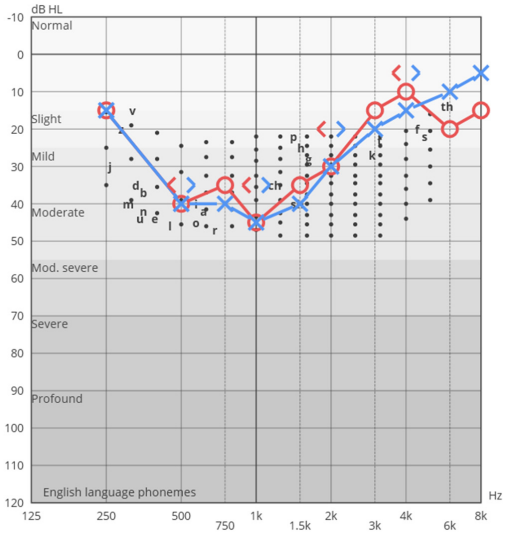

Figure 3 AutoREM is equally effective in reverse configurations, such as mild to moderate rising hearing loss approaching normal or slight thresholds.

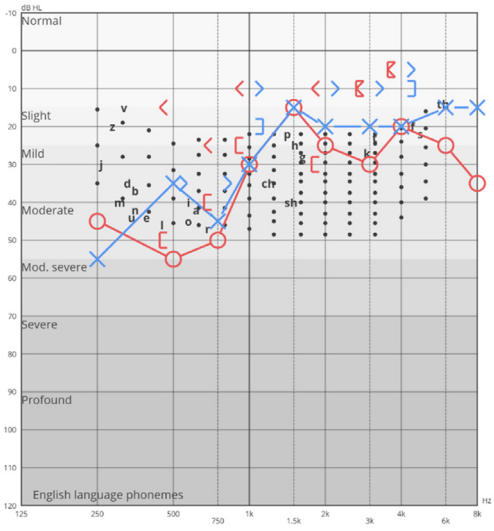

Figure 4 AutoREM can also be successfully applied in cases of moderate rising to mild hearing loss.

AUDIOGRAM CONFIGURATIONS LESS SUITABLE FOR AUTOREM

While AutoREM is a valuable tool in many fitting scenarios, its effectiveness tends to decrease as the hearing loss deviates from the moderate range, whether toward slight/mild or severe/profound levels.

In particular, AutoREM is not recommended for cases of slight or mild hearing loss, or for low-gain hearing aid fittings. In these situations, prescriptive targets may be unreliable, as a patient's average speech levels can already exceed the target output before any amplification is applied.

Below are some examples of challenging hearing loss configurations where the use of AutoREM may be less suitable, and where manual fine-tuning may offer better results.

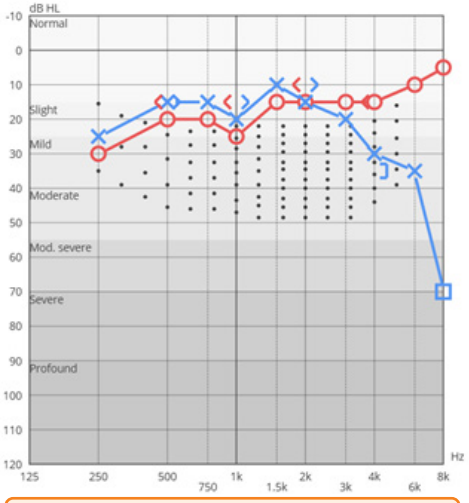

Figure 5 Asymmetrical mild high-frequency sensorineural hearing loss (SNHL): not ideal for AutoREM.

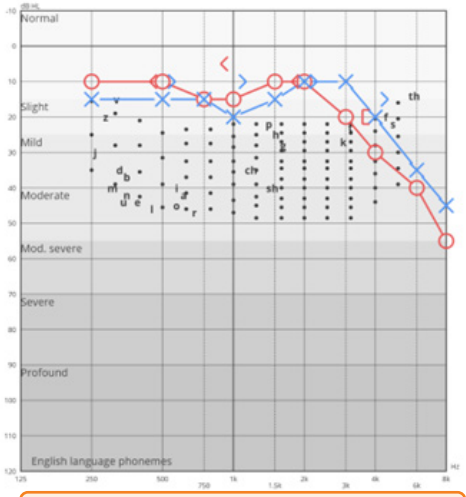

Figure 6 Mild high-frequency hearing loss: AutoREM may be unsuitable.

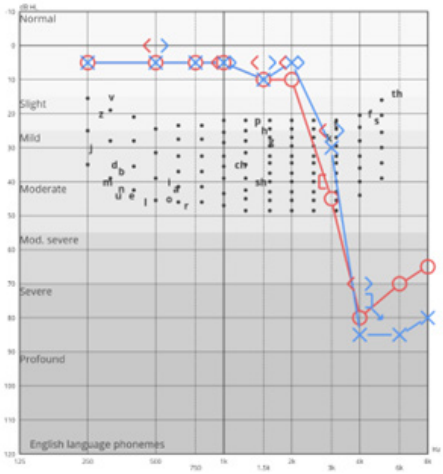

Figure 7 Steeply or precipitously sloping high-frequency hearing loss: AutoREM may not be appropriate due to a high risk of feedback. The system does not account for this and will raise gain to target regardless, potentially causing feedback issues.

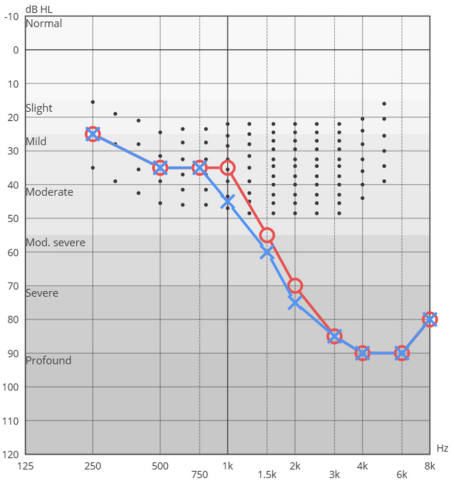

Figure 8 Another challenging hearing loss configuration where AutoREM may not be appropriate.

COMPARING AUTOREM AND MANUAL APPROACHES: KEY DIFFERENCES AND CONSIDERATIONS

While AutoREM provides a fast and efficient method for matching hearing aids to prescriptive targets, it does present certain limitations that clinicians should be aware of.

One common limitation is that many AutoREM implementations—though not all—do not display Speech Intelligibility Index (SII) values, either aided or unaided. These values are extremely useful for estimating the perceived benefit a patient receives from amplification. In cases where aided SII is an important clinical consideration, additional manual measurements may be necessary following the AutoREM procedure.

To explore this topic in more detail, see the webinar "Measuring and Assessing Aided Audibility Using the SII" available here.

Another point to consider is that some AutoREM systems lack functionality for Maximum Power Output (MPO) adjustments or verification at multiple input levels. These critical steps in the fitting process may also require manual completion to ensure optimal outcomes.

For this reason, AutoREM is best viewed as an excellent starting point. It allows clinicians to get very close to target quickly and consistently, after which minor manual adjustments can be applied to fine-tune the fitting, ensuring that loudness perception is both comfortable and appropriate for each individual patient.

BEYOND ACCURACY AND SPEED: ADDITIONAL BENEFITS OF AUTOREM

In addition to improving fitting accuracy and workflow efficiency, AutoREM offers several benefits that are particularly valuable for less experienced clinicians or those still building confidence with manual real-ear measurements.

For example, most AutoREM systems automatically mute the hearing aids during level calibration when an open acoustic setting is detected. This feature prevents sound leakage from the ear canal into the reference microphone, a frequent cause of inaccurate measurements that may go unnoticed by less experienced users.

Moreover, some systems incorporate automated warning prompts when the deviation from target values is unusually large. These alerts can help clinicians quickly detect fitting anomalies, such as a dislodged probe tube, before proceeding with further adjustments.

Finally, for clinicians who may not yet feel at ease making manual gain corrections, AutoREM provides a safe and reliable method for applying these adjustments automatically, enhancing patient comfort and supporting more consistent fitting outcomes.

SUMMARY

AutoREM represents a game-changing advancement in hearing aid fitting—enabling clinicians to improve outcomes with greater accuracy, objectivity, and efficiency, while also saving valuable clinical time.

For experienced clinicians, AutoREM offers a fast, reliable, and convenient method for reaching prescriptive targets. It provides an excellent foundation, after which manual fine-tuning can be applied based on clinical expertise and individual patient needs.

For those newer to the field, the structured and guided workflow of AutoREM reduces the barriers to performing

real-ear measurements. Features such as automatic hearing aid muting during calibration help avoid common errors and support growing confidence in the fitting process.

It is important to recognize, however, that AutoREM is not a replacement for clinical judgment. It is not suitable for every patient or audiogram configuration, and it does not eliminate the need for professional interpretation. Rather, AutoREM should be viewed as a powerful and neutral tool—one that complements and reinforces the clinician's expertise.

Clinicians who implement AutoREM into their workflow often find that it enhances fitting consistency and improves patient outcomes. For those who haven't yet explored its potential, now is the ideal time to start.

TWO COMPLETE AUTOREM EXAMPLES

The following are two clinical cases in which AutoREM proved particularly beneficial. Both fittings were conducted using the Inventis Trumpet REM system, with AutoREM executed through the Starkey ProFit fitting software.

FIRST EXAMPLE

In the first case, the manufacturer's default best-fit settings initially resulted in over-amplification, with output levels significantly exceeding the prescriptive targets. By applying AutoREM, the system was able to automatically reduce the gain, bringing the hearing aid output in line with the target curve and substantially improving patient comfort.

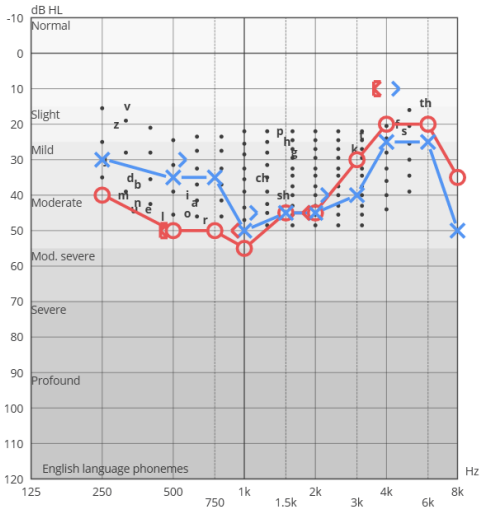

Figure 9 Pure-tone audiogram (PTA) of the patient in Example 1, used as the basis for the initial hearing aid fitting.

Step 1: Probe Tube Calibration performed prior to AutoREM measurements. (Figure 10)

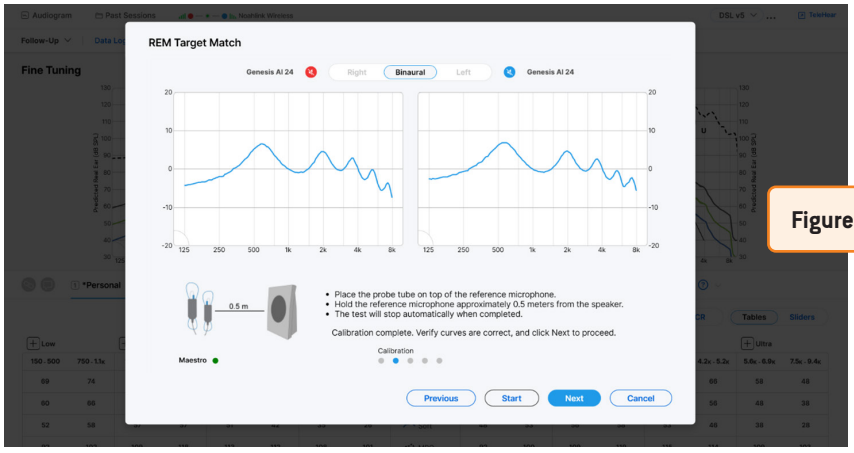

Figure 10

Step 2: Measurement of the ear canal resonance of the open ear. (Figure 11)

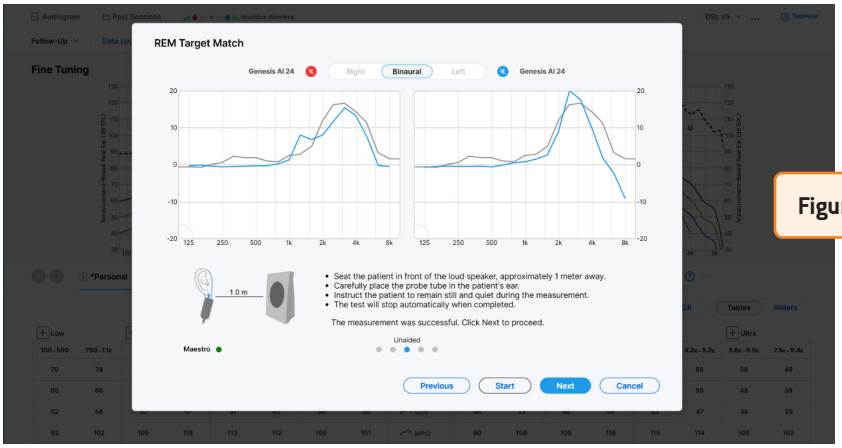

Figure 11

Step 3: Solid thin lines below show the target curves (Figure 12)

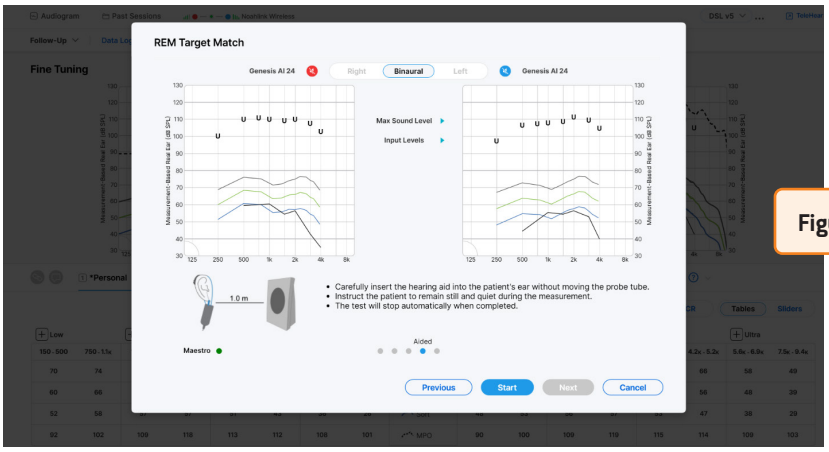

Figure 12

Step 4: Dotted lines below show the measured responses, before adjustments (Figure 13)

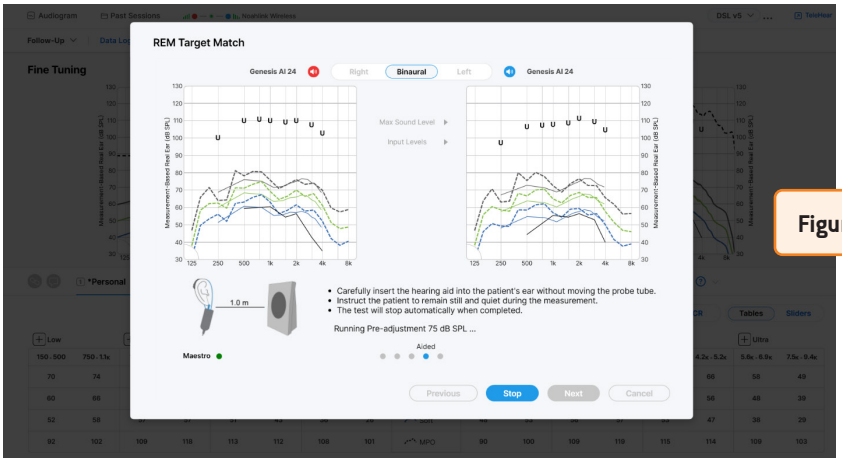

Figure 13

Step 5: The solid bold lines show the response post-adjustments (Figure 14)

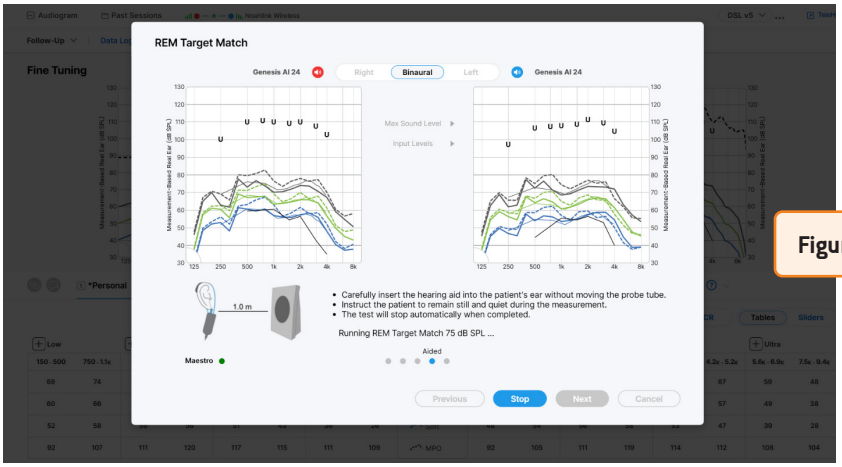

Figure 14

Final Step – Manual Verification of AutoREM Accuracy (Figure 15)

To confirm the effectiveness of the AutoREM procedure, a manual real-ear measurement was performed following the automatic fitting. The results demonstrated an excellent match-to-target, with both aided and unaided Speech Intelligibility Index (SII) values available for reference.

In the accompanying graph, the dotted line represents the prescriptive target, while the solid line displays the measured aided response after the AutoREM adjustments were applied, clearly illustrating the alignment achieved through the process.

Figure 15

SECOND EXAMPLE

In this second case, the initial best-fit provided by the manufacturer's fitting software resulted in significant under-amplification. The output was well below target across key frequencies.

AutoREM effectively addressed this by automatically increasing the hearing aid gain, bringing the measured response much closer to the prescriptive targets and improving audibility for the patient.

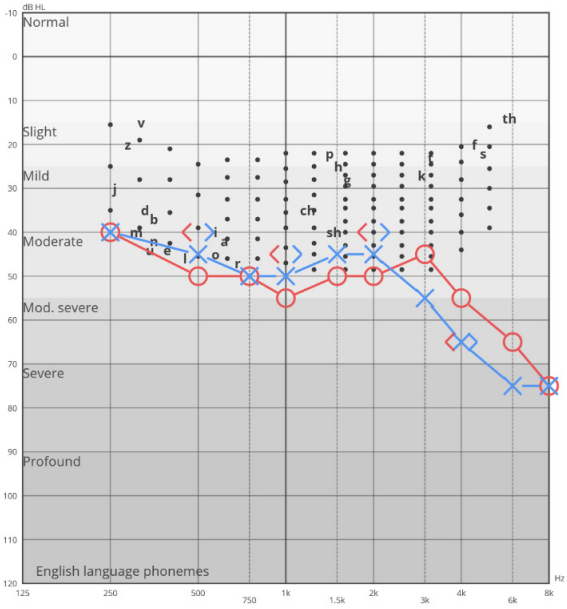

Figure 16 Pure-tone audiogram (PTA) of the patient in Example 2, used as the basis for the initial hearing aid fitting.

In this example, the graph illustrates the complete AutoREM correction process. The thin solid lines represent the prescriptive targets, while the dotted lines show the initial measured response before any adjustments were made.

Following the AutoREM procedure, the bold solid lines display the corrected aided response, now closely matching the prescribed targets (Figure 17).

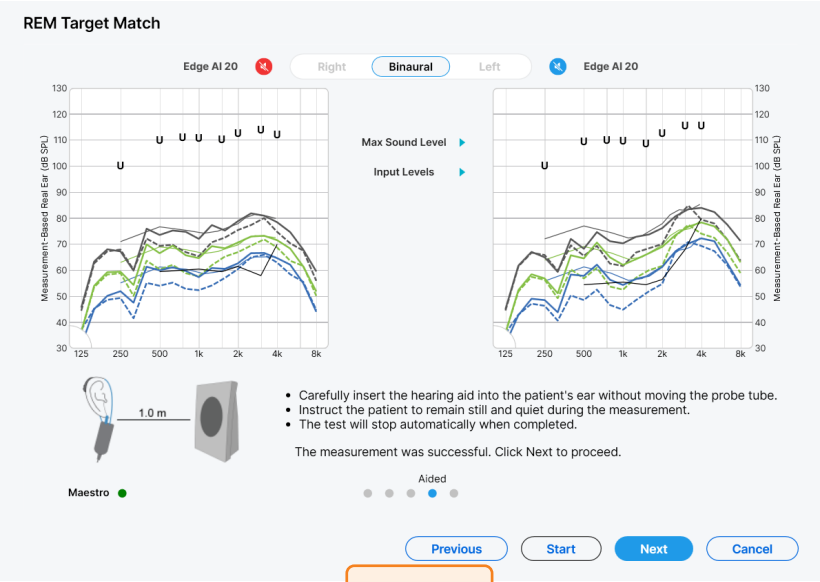

Figure 17

To validate the effectiveness of the AutoREM correction, a manual real-ear measurement was conducted following the automated fitting. The results revealed a close match to the prescriptive target, confirming the accuracy and reliability of the AutoREM process.

In the corresponding graph (Figure 18), the dotted line indicates the prescriptive target, the solid line represents the measured aided response, and the turquoise curve below illustrates the unaided response, included for reference.

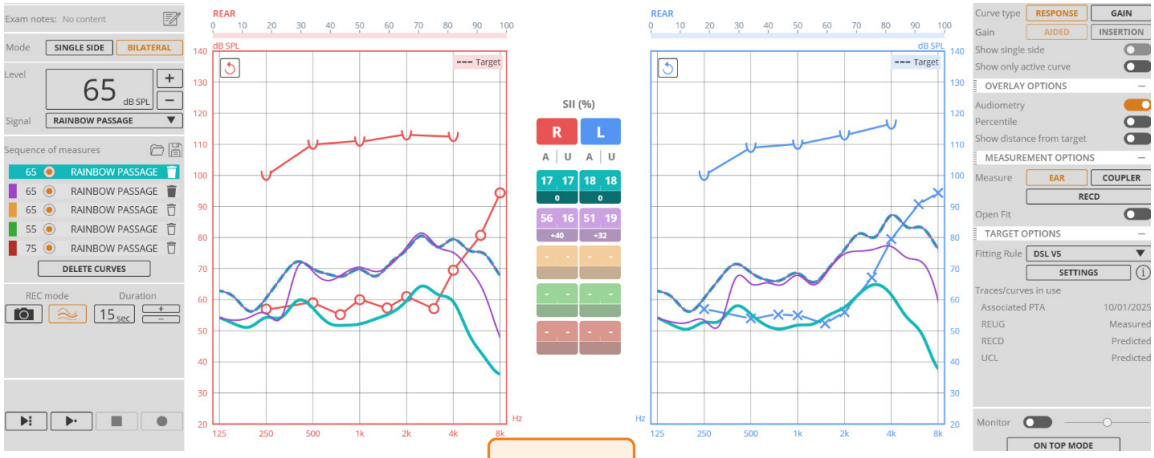

Figure 18

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