

Oticon ♦ Epoq

child
friendly
hearing
care

Matching Epoq W & XW to DSL v5.0, Paediatric Targets

A paediatric fitting guide with **Affinity**^{2.0}

oticon
PAEDIATRICS

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Introduction

The process of fitting hearing instruments to infants and young children is challenging and differs from the approach typically taken with adults. Children's ears have their own unique acoustic characteristics such as smaller ear canals and softer structures, which need to be taken into account (Bagatto *et al.*, 2005). In particular, acoustic data based on predicted values is not as precise for estimating true hearing thresholds because of high age-related variance. Another consideration is the auditory needs of this particular population.

Access to speech

Children need access to as much speech information as possible in order to acquire good speech and language skills. The Desired Sensation Level (DSL v5.0) Method, developed by Dr. Richard Seewald and colleagues at the University of Western Ontario, was designed to Maximise speech audibility and is widely employed when fitting amplification to children. The use of this type of prescriptive strategy in conjunction with an appropriate verification protocol helps ensure children are able to take advantage of their residual auditory capabilities.

The main goal when fitting paediatric hearing instruments is to achieve a good match between the auditory characteristics of infants and young children and the amplification characteristics of the hearing instruments. Hearing care professionals should try to maximise the use of the child's residual hearing ability in order to maximise the potential for optimal speech and language development.



Age-Related Considerations

Adult amplification protocols are not appropriate for children for several reasons. Correction factors applied to audiometric data obtained from adults are not necessarily appropriate for infants and young children. There are significant differences between adults and children with regards to ear canal acoustics and middle ear characteristics. Infants and young children are often uncooperative when attempting to obtain lengthy in-situ real-ear measurements (REM) and use of age appropriate predictions are sometimes necessary (Bagatto *et al.*, 2005).

When in-situ REM cannot be obtained, it becomes important to verify hearing instrument settings in the test box. When hearing instruments are tested in a test box, a 2cc coupler is used. However, the 2cc coupler was not designed to approximate the human ear canal (child or adult). The human ear

canal is smaller and the middle ear system demonstrates different impedance than the 2cc coupler. Furthermore, a child's ear canal characteristics change significantly from infancy into childhood.

Therefore, in order to use test box measures to predict the real-ear output of a hearing instrument in a child's ear, it becomes important to understand the relationship between that child's ear and the 2cc coupler. Once this relationship is established, measurements made in the coupler can reliably be used to predict hearing instrument output in the ear canal.

Real-ear-to-coupler difference

To overcome these problems, Dr. Richard Seewald *et al.*, developed the DSL v5.0 Method. This includes not only prescriptive targets for gain and maximum output, which are calculated based on the audibility of speech, but also a fitting protocol

in which electroacoustic verification is optimised (Moodie *et al.*, 1994; Seewald *et al.*, 1999). The approach uses SPL at the eardrum to compute the prescriptive targets to account for the age-related issues. The real-ear-to-coupler difference (RECD) is applied as the acoustic transform to convert hearing thresholds obtained with insert earphones in the dB HL scale to dB SPL at the eardrum. In general, the measurement yields higher RECD values for young children compared to adults resulting in higher dB SPL threshold values for children and adults who may have the same dB HL audiogram (Bagatto *et al.*, 2005).

The DSL v5.0 Method provides the option of using RECD values in order to simulate REM in a test box. By using the child's own RECD or an age appropriate average RECD, a more precise and Individualised fitting can be obtained.



Fitting Steps Overview

The general procedure described can also be employed for other test boxes than the Affinity^{2.0} from Interacoustics, i.e. Verifit from Audioscan, MADSEN Aurical, etc.

1

Preparing the Affinity^{2.0}

Entering Audiometric Data

Setting Up a Protocol

Setting the REM Test Settings

2

Measuring the RECD

Measuring the Coupler and Ear Response

Reading and Saving the RECD Values

3

Preparing Epoq

Connecting the Hearing Instrument

Programming the Hearing Instrument

4

Fitting and Verification

Retrieve the RECD

REM in Coupler Mode on Affinity^{2.0}

Verify Performance for Soft Input Levels

Verify Performance for Mid Input Levels

Verify Performance for Loud Input Levels

Fitting to DSL v5.0 Targets

General Fitting Guidelines

Preparing the **Affinity**^{2.0}

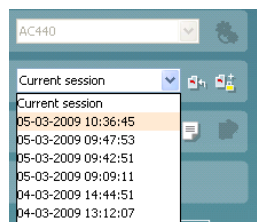


Entering Audiometric Data

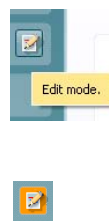


- ▶ Audiometric data is entered or retrieved using the **AUD** screen in which the Affinity^{2.0} opens
- ▶ There are three ways of obtaining the audiogram:
 - A)** Retrieve an existing audiogram via Noah in the **Session list** where they can be selected by date
 - B)** Enter the values manually by choosing **Edit mode** followed by mouse clicking to the audiometric points
 - C)** If the clinic has a license to the AC440 audiometry module, the audiogram can be measured directly in the audiogram screen

A)



B)

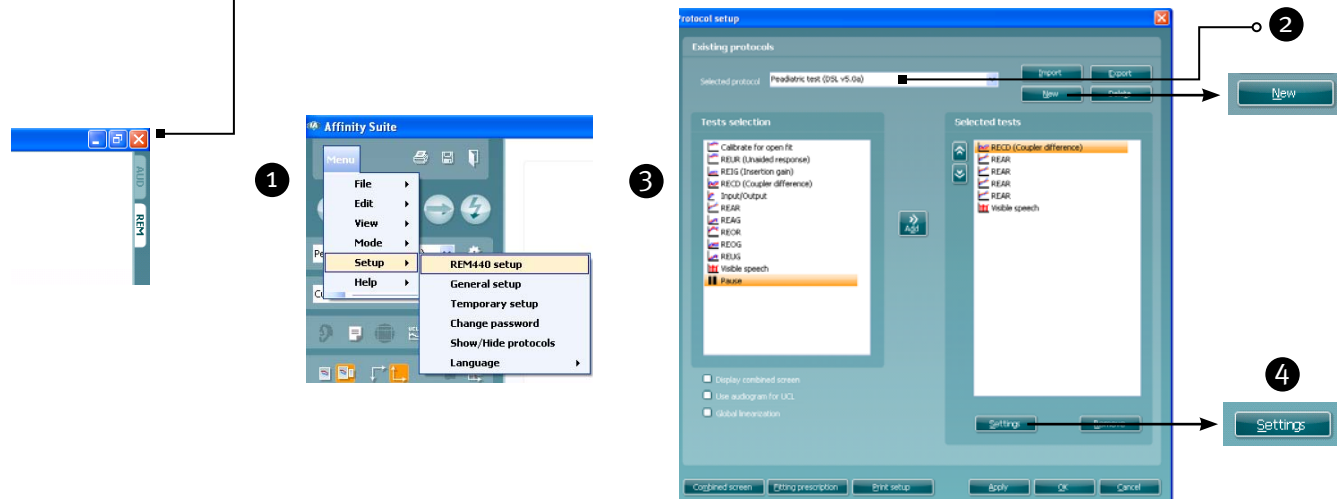


Setting up a Protocol*

Click on the **REM** tab to enter the REM Module

Choose:

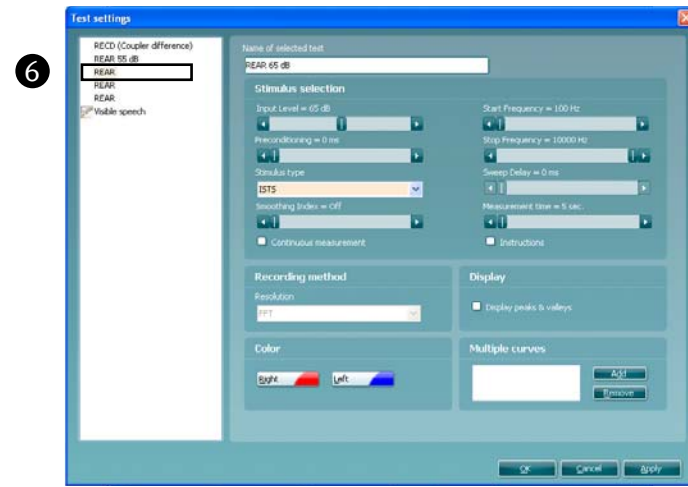
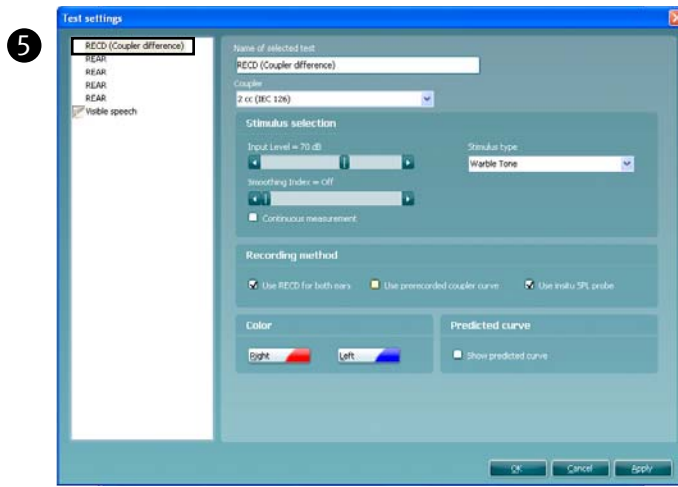
- 1 – **Menu** on the screen → **Setup** → **REM440 setup** to setup the paediatric test in the Protocol Setup
- 2 – **New** in the pop-up → **No** when asked if you wish to create a copy of the current selected protocol → **Name** the test under **Selected protocol** (e.g. Paediatric test (DSL v5.a))
- 3 – **RECD** and four **REAR** tests in the **Test selection**, i.e. for measurement at three input levels as well as the MPO
- 4 – **Settings**



* Setting up a protocol with preferred REM test settings only needs to be done the first time using the Affinity^{2.0}. Afterwards the protocol will be selectable from the Affinity^{2.0} front screen and the clinician can go directly to the RECD measurement.

Setting the REM Test Settings

- 5 Setup Test Settings for RECD
 - **Stimulus selection**, e.g. Random Noise
 - **Recording method**, e.g. Use in-situ SPL probe and Use RECD for both ears
 - **Predicted curve** if preferred, e.g. Show predicted curve
- 6 Setup Test Settings for REAR(s)
 - **Stimulus selection**, e.g. Input level and Stimulus type. Use different input levels (such as 55 dB, 65 dB, and 75 dB) and a speech stimulus for all measures (such as ISTS, International Speech Test Signal). Each REAR can be renamed, e.g. REAR 55 dB, MPO, if preferred
- 7 Save Protocol and Test Settings
 - Click **OK** to **Test settings**
 - Click **OK** to **Protocol setup**



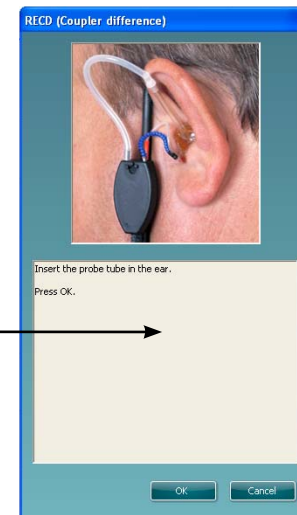
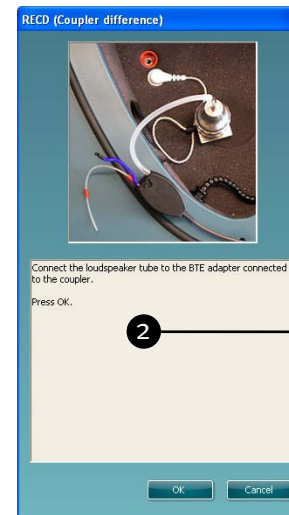
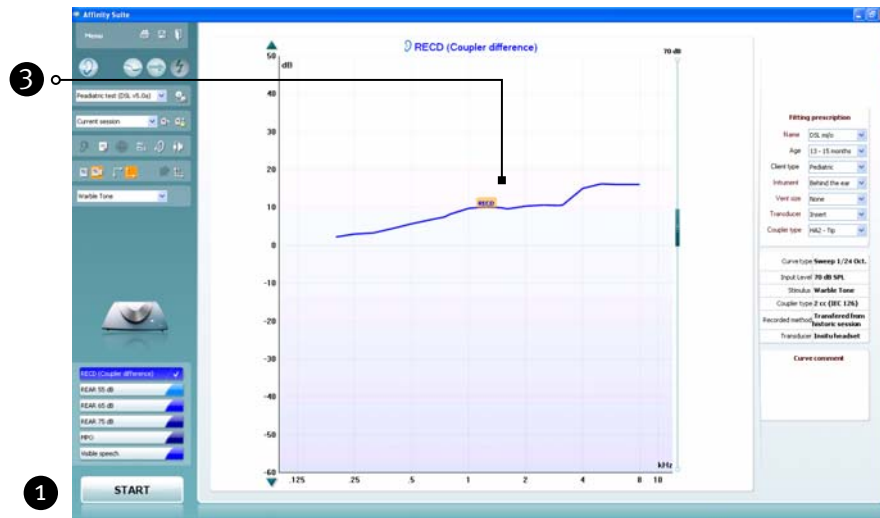
7

Measuring the RECD



Measuring the Coupler and Ear Response

- 1 ▶ Press **START**
- 2 ▶ Follow the instructions offered by the Affinity^{2.0} and press **OK**
- 3 ▶ View the RECD on screen



Preparing Epoq

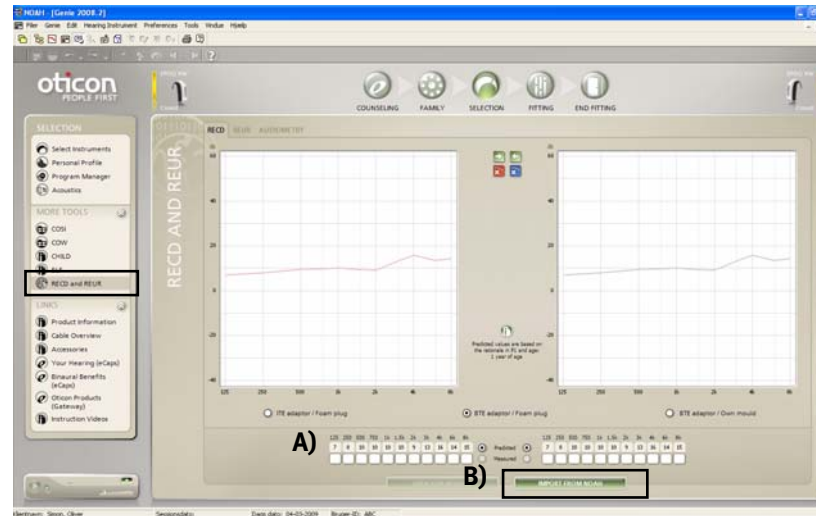


Connecting the Hearing Instrument

- ▶ See the Epoq Quick Fitting Guide for further assistance on preprogramming the hearing instrument
- ▶ Connect the hearing instruments through Noah to Genie 2009.1

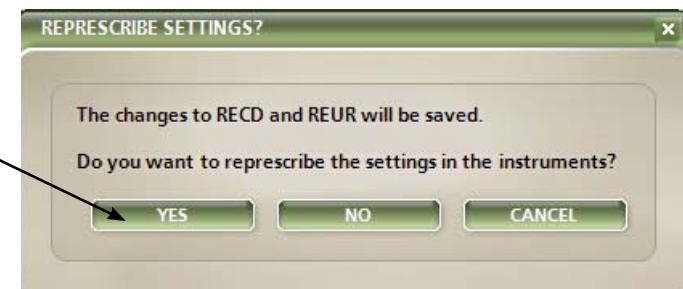
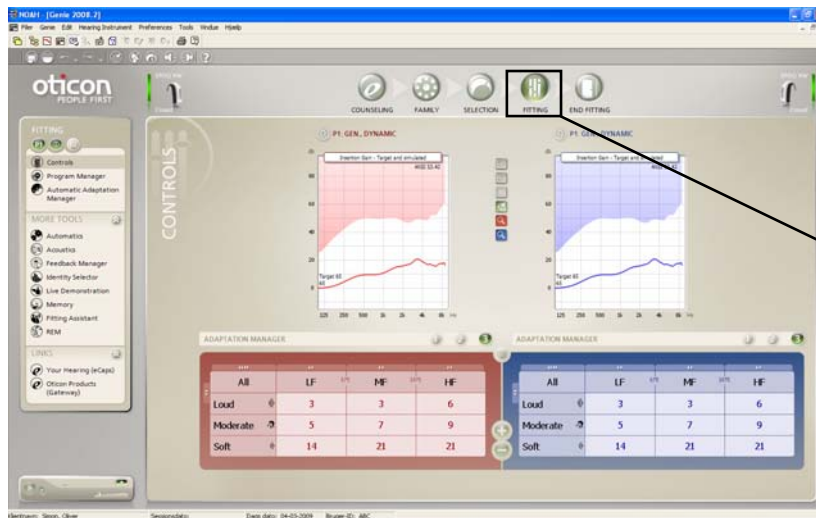
There are two ways of entering the measured RECD:

- A)** Enter the measured RECD values manually in the Selection step
- B)** If using Noah click **Import from Noah** and the RECD will be uploaded to Genie automatically



Programming the Hearing Instrument

- ▶ Go to the Fitting step and click **YES** when asked if you want to represcribe settings
- ▶ Place the one hearing instrument, still connected to Genie, in the designated spot inside the test box, with the hearing instrument microphone positioned close to the text box reference microphone
- ▶ Close the lid and continue to Fitting and Verification



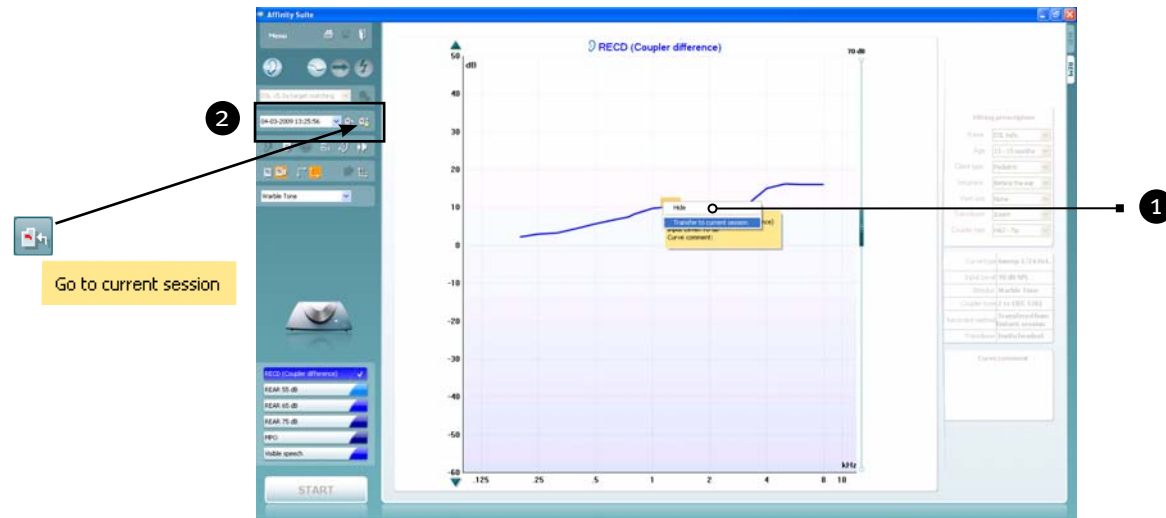
Previous fine tuning will be lost

Fitting and Verification



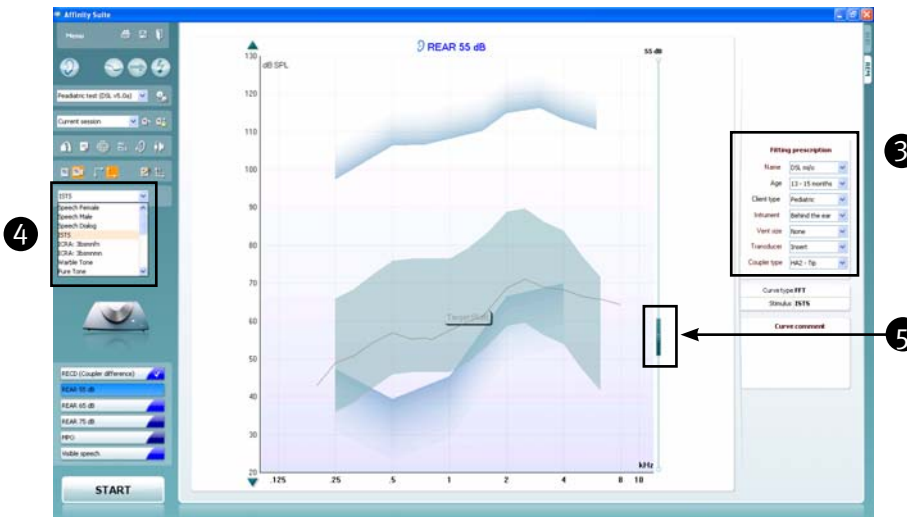
Retrieve the RECD

- If the RECD was saved retrieve it using the **Session list** dropdown
- ① ‣ Right click on the RECD mark and select **Transfer to current session**
- ② ‣ Return to the current session by clicking **Go to current session**



REM in Coupler Mode on Affinity^{2.0}

- 3 > Select DSL v5.0 mi/o (i.e. v5.0a), the correct age, and hearing instrument characteristics in the **Fitting prescription** dropdowns
- 4 > Select a speech input such as **ISTS** if not predefined in the protocol setup
- 5 > Select input level using the **Input level slider** if not predefined in the protocol setup



Verify Performance for Soft Input Levels

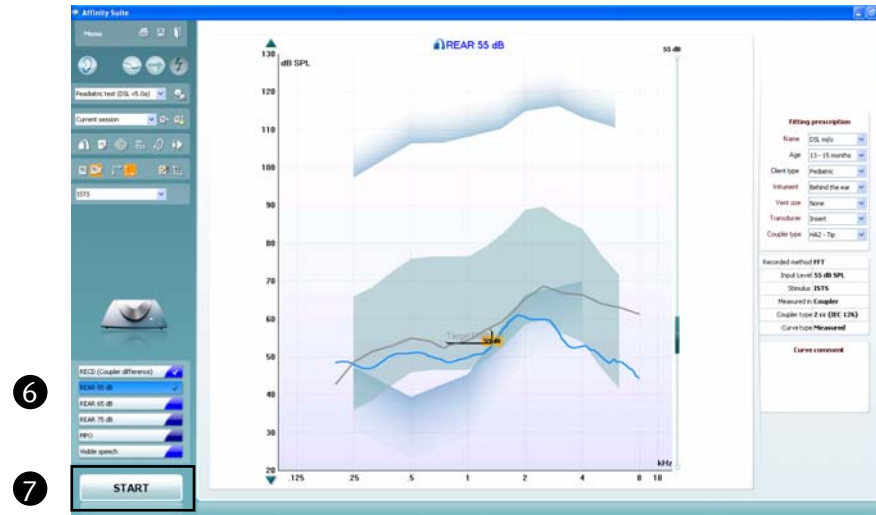
Soft speech inputs are measured to confirm that even soft sounds are audible

- 6 > Highlight the first **REAR** in the custom made or standard protocol (in this case REAR 55 dB) to measure a real-ear-aided response
- 7 > Press **START**

Results

Across frequency the output is around 10 - 15 dB lower than prescribed by the DSL v5.0 prescriptive formula

Above 1000 Hz a part of the speech signal is below the hearing threshold



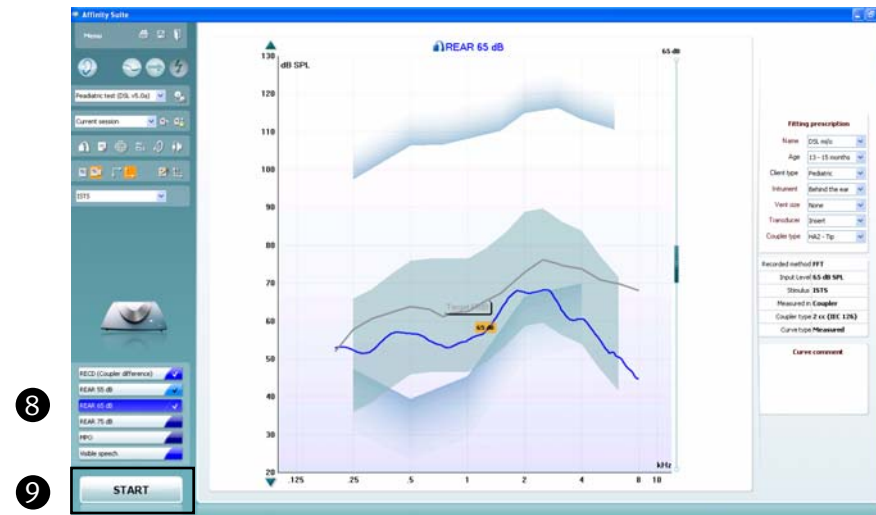
Verify Performance for Mid Input Levels

Average speech inputs are measured to ensure that normal speech is audible and comfortable

- 8 > Click on the second **REAR 65 dB**
- 9 > Press **START**

Results:

Again the output is much lower than prescribed by the DSL mi/o v5.0 Above 2000 Hz a part of the speech signal is below the hearing threshold



Verify Performance for Loud Input Levels

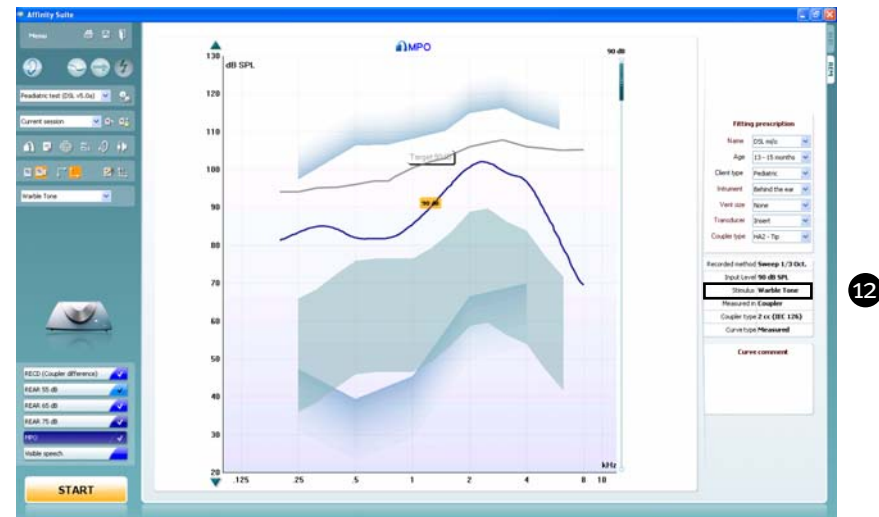
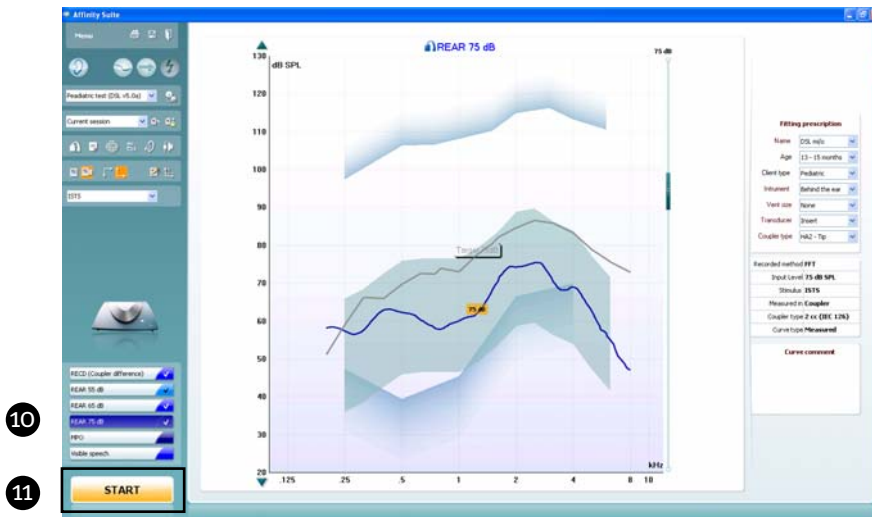
Loud speech inputs are measured to confirm that these remain comfortable

- 10 > Click on the third **REAR 75 dB**
- 11 > Press **START**
 - > Also ensure that MPO targets are not exceeded to ensure comfort at all times
- 12 **Note:** MPO should be evaluated with a pure tone or warble tone sweep

Results:

The 75 dB speech signal is significantly below target at all frequencies

The MPO stays below the 90 dB target ensuring that no sounds are uncomfortable

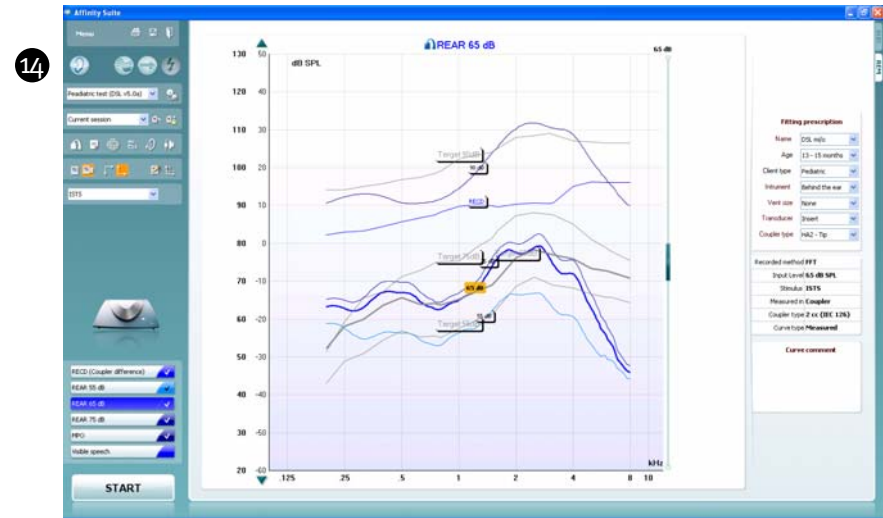
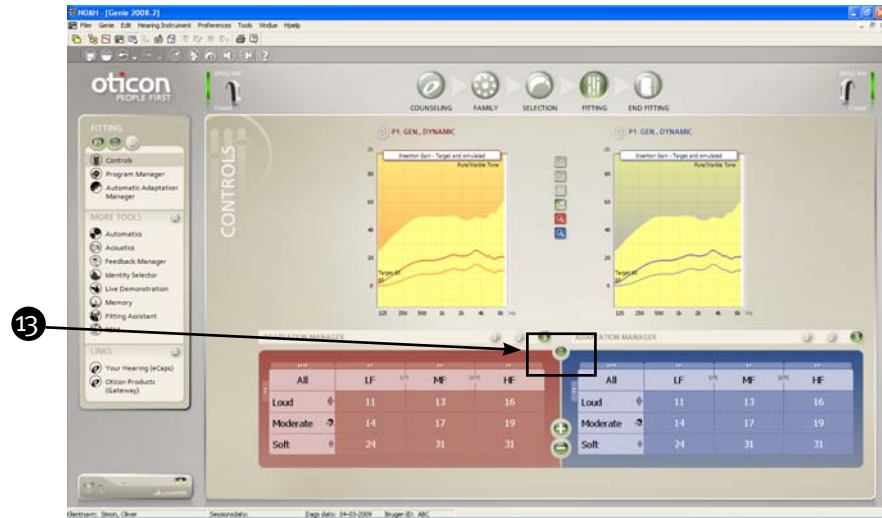


Fitting to DSL v5.0 Targets

- 13 ▶ Link the hearing instruments in Genie to adjust the gain settings simultaneously if necessary
- ▶ Adjust the gain according to the output measurements, i.e. increasing by 10 dB across frequency bands and input levels
- ▶ Run the REAR for one or more input levels as well as the MPO again

14 Results:

For loud inputs the response still falls considerably below targets. For soft and average speech levels the response falls below target values from 2000 Hz and up. The MPO is above targets in the 2 to 4 kHz range and needs to be adjusted

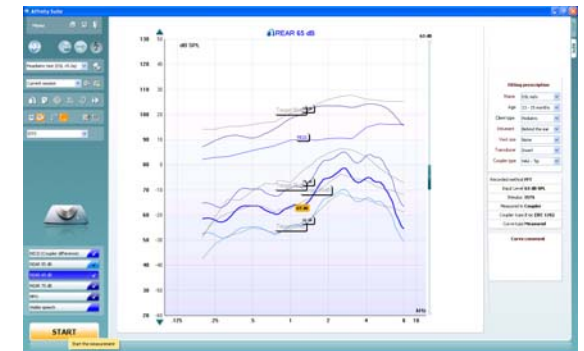
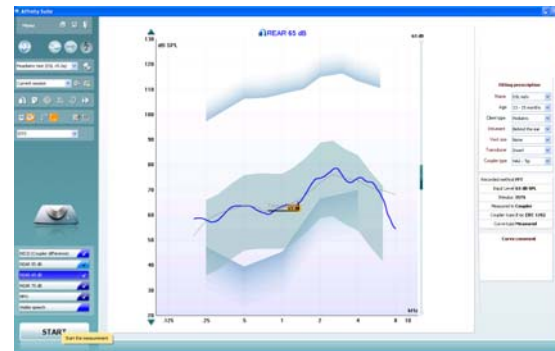
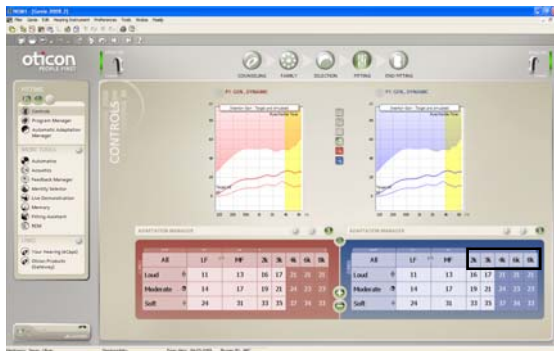


Fitting to DSL v5.0 Targets (continued)

- ▶ The procedure outlined above is carried out until the match to target is transparent
- 15 ▶ To fully benefit from the extended bandwidth in Epoq, click on the HF-control to access the individual controls for frequencies between 2 and 8 kHz. Increase the gain for 6 and 8 kHz as appropriate (high frequency gain may need to be increased as much as 25 dB depending on the degree of hearing loss)
- ▶ Once you have adjusted the gain for mid sounds and the MPO targets, it is important to verify performance for soft and loud sounds
- ▶ Once the appropriate adjustments have been made, be sure to save the parameters in both the hearing instrument and NOAH, via Genie under the End Fitting step

Alternative approach:

While running the REM, adjust the gain for one or more bands in Genie as needed, until the hearing instrument output matches the DSL targets for the chosen stimulus





General Fitting Guidelines

- For soft speech sounds
 - Check that most of the information is above the child's hearing thresholds, so all of the soft speech sounds will be audible. If most of this information needs to be adjusted, consider modifying the compression ratios for one or more channels by increasing the soft sound levels
- For loud speech sounds
 - Check that the curve is not at or above the MPO targets. If this is the case, make the appropriate adjustments via the software
 - Check whether the dynamic range for speech stimulus is too compressed. Consider adjusting the compression ratios, either by increasing the gain for loud sounds or decreasing it for soft sounds
- For the MPO
 - Check that the curve is at or below the MPO targets (some of them may be above). If this is the case, adjust the MPO levels or the hearing instrument via the software
- Extended Bandwidth in Epoq
 - Epoq W and XW have an extended bandwidth up to 10 kHz
 - The 8 kHz DSL v5.0 target prescription is applied at the high frequencies between 8 kHz and 10 kHz

References

Bagatto, M., Moodie, S., Scollie, S., Seewald, R.C., et al (2005). Clinical protocols for hearing instrument fitting in the Desired Sensation Level method.
Trends in Amplification 9(4):199-226

Moodie, K.S., Seewald, R.C., Sinclair, S.T. (1994).
Procedure for predicting real-ear hearing instrument performance in young children.
American Journal of Audiology 3:23-31

Seewald, R.C. (1995). The Desired Sensation Level method for hearing instrument fitting in infants and children.
Phonak Focus 20. Stäfa, Switzerland: Phonak AG:4-18

Seewald, R.C., Moodie, K.S., Sinclair, S.T., Scollie, S.D. (1999). Predictive validity of a procedure for paediatric hearing instrument fitting.
American Journal of Audiology 8(2):143-152



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It takes a truly dedicated approach to help children with hearing problems achieve their full potential. That's why we deliver the solutions and services professionals and caregivers need to provide children the opportunities they deserve. This is what *child-friendly hearing care* is all about.