

Oticon ♦ Epoq

child
friendly
hearing
care

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

A pediatric fitting guide

oticon
PEDIATRICS

Table of contents

- Introduction 3**
- Age Related Considerations 4**
- Fitting Steps Overview. 5**
- Preparing the Verifit 6**
 - Calibrate the System 7
 - Setting the simulated REM parameters 8
 - Entering Audiometric Data 9
- Measuring the RECD 10**
 - Measuring the Coupler Response. 11
 - Measuring the Real-Ear Response 12
 - Reading the RECD Values 13
- Preparing Epoq. 14**
 - Programming the Hearing Aid 15
- Fitting and Verification 16**
 - Simulated REM in the Verifit 17
 - Verify Performance for All Input Levels 18
 - Fitting to DSL Targets 19
 - General Fitting Guidelines 21
- References 22**





Introduction

The process of fitting hearing aids 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) Method, developed by Dr. Richard Seewald and colleagues at the University of Western Ontario, was designed to maximize 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 pediatric hearing aids is to achieve a good match between the auditory characteristics of infants and young children and the amplification characteristics of the hearing aids. Hearing care professionals should try to maximize the use of the child's residual hearing ability in order to maximize 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 regard 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 aid settings in the test box. When hearing aids 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 aid 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 aid output in the ear canal.

Real-ear-to-coupler difference

To overcome these problems, Dr. Richard Seewald *et al.*, developed the DSL 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 optimized (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 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 individualized fitting can be obtained.



Fitting Steps Overview

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

1

Preparing the Verifit

- Calibrate the System
- Setting the simulated REM parameters
- Entering Audiometric Data

2

Measuring the RECD

- Measuring the Coupler Response
- Measuring the Real-Ear Response
- Reading the RECD Values

3

Preparing Epoq

- Programming the Hearing Aid

4

Fitting and Verification

- Simulated REM in the Verifit
- Verify Performance for All Input Levels
- Fitting to DSL Targets
- General Fitting Guidelines

Preparing the Verifit



Calibrate the System

- › Turn on the Verifit
- › Choose
 - **Tests** on the screen → **Test box measures** → **Calibration** to calibrate the test box reference microphone
 - **Tests** on the keyboard → **On-ear measures** → **Calibration** to calibrate the probe microphones
 - **Tests** on the keyboard → **Test box measures** → **Speechmap**



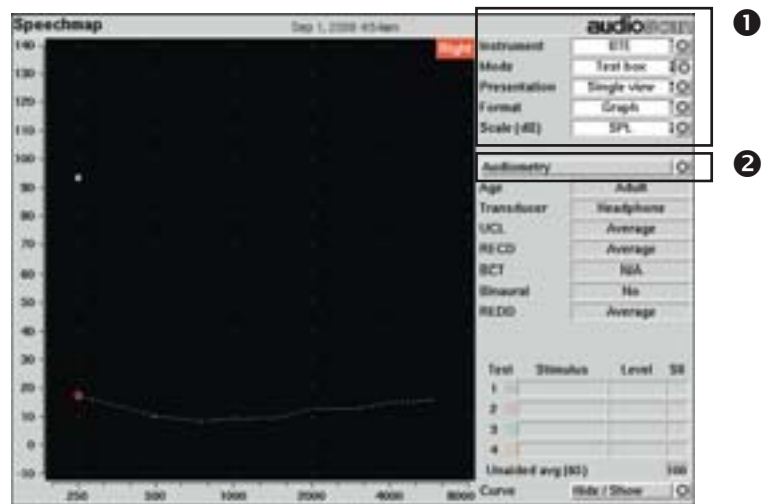
Tests	<input type="checkbox"/>	To perform a test, press Tests.
Setup	<input type="checkbox"/>	To change the setup, press Setup.
Help	<input type="checkbox"/>	To get help anytime, press Help.
Software version 3.0.16 June 12, 2008		

Test selection	
Viewport	<input type="radio"/>
Test box measures	<input type="radio"/>
On-ear measures	<input type="radio"/>
Sensory loss simulator	<input type="radio"/>
Cancel	<input type="checkbox"/>

Setting the simulated REM parameters

- 1 ▶ Select
 - Instrument model, e.g. BTE
 - Mode for verification, i.e. Test box not On-ear
 - Presentation, e.g. Single view
 - Format, e.g. Graph
 - Scale (dB), i.e. SPL not HL

- 2 ▶ Press **Audiometry**



Entering Audiometric Data

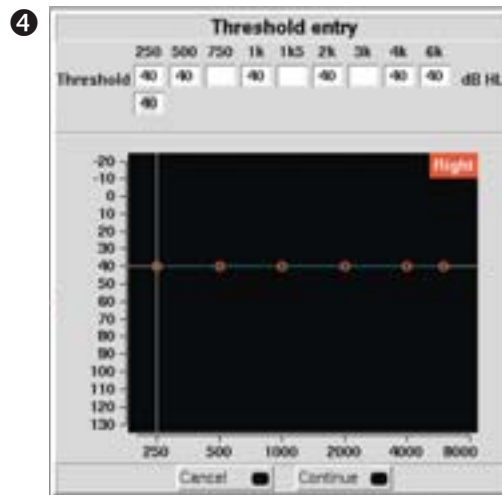
- 3 > Fill in the appropriate information in the pop-up Audiometry screen
 - > The RECD field has three options
 1. Measure, the preferred choice if data can be obtained
 2. Enter, if the values are available from a previous measure
 3. Average, if the individual values are not available
 - > To measure the RECD choose Measure, press **Continue**
- 4 > Enter the hearing thresholds and press **Continue** again

3

Audiometry

Ear	Right
Targets	DSL child
Age	14 months
Transducer	Insert+Foam
Threshold	Entered
Bone conduction	N/A
UCL	Average
RECD	Measure
Binaural	No

Cancel Continue



Measuring the RECD

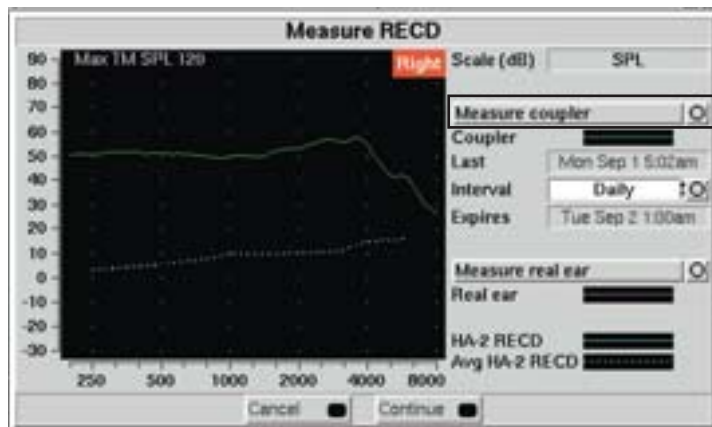


Measuring the Coupler Response

- 1 > Press **Measure coupler**

The Verifit will provide instructions to measure the coupler response of the RECD measurement. After coupling the Verifit RECD measurement transducer to the tip of the BTE coupler, press **Continue**

- > A new screen also called Test setup will then appear, *(not depicted here)*. Wait for the response to settle in the graph before pressing **Continue**
- > The coupler response can be seen in the RECD measurement screen as the **green** curve



The screenshot shows the 'Test setup' screen with the following instructions:

1. Plug the RECD transducer into the appropriately labeled plug on front center of the Verifit.
2. Screw the BTE coupler onto the coupler microphone.
3. Couple the tip of the RECD transducer to the tubing on the BTE coupler.
4. Place the coupler in the Verifit test box.

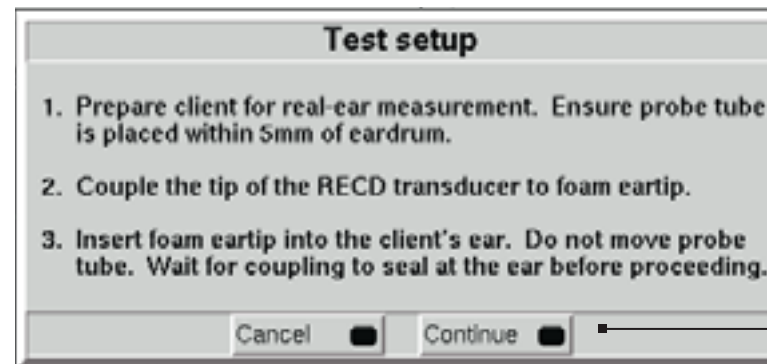
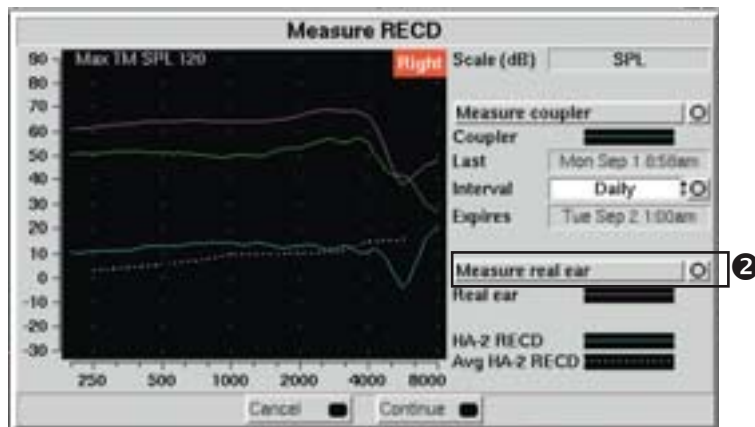
At the bottom are 'Cancel' and 'Continue' buttons.

Measuring the Real-Ear Response

- 2 > Press **Measure real-ear**

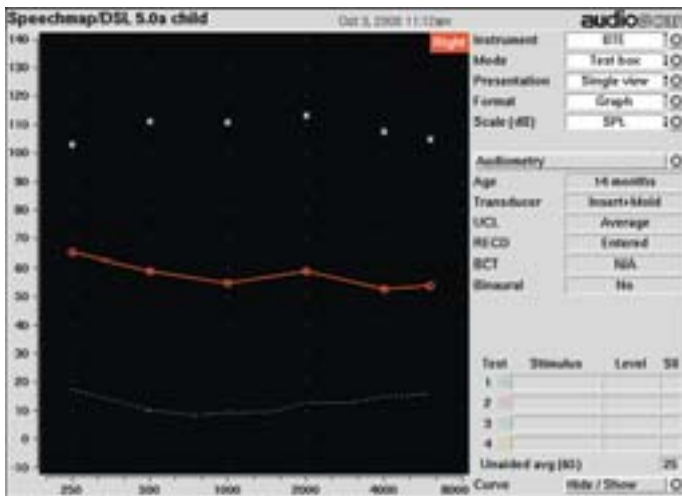
The Verifit will provide instructions to measure the real-ear response of the RECD measurement. After coupling the Verifit RECD measurement transducer to the foam eartip, insert it into the clients ear, press **Continue**

- > A new screen also called Test setup will then appear, *(not depicted here)*. Wait for the response to settle in the graph before pressing **Continue**
- > The real-ear response can be seen in the RECD measurement screen as the **pink** curve
- > The difference between the coupler and the real-ear response, the RECD, is represented in the **blue** curve
- > Press **Continue**



Reading the RECD Values

- ▶ You will now have returned to the Speechmap/DSL 5.0a Child screen, where the patient's corrected hearing thresholds will be displayed in the SPLogram, as well as the MPO targets
- ③ ▶ Select **Table** as the format to read the measured RECD values



Speechmap/DSL 5.0a child - Sep 1, 2008 9:58am

Instrument: E11
 Mode: Test box
 Presentation: Single view
 Format: Table
 Scale (dB): SPL

Age: 14 months
 Transducer: Insert/F-ear
 UCL: Average
 RECD: Measured
 SCL: N/A
 Binaural: No

Test	Stimulus	Level	SR
1			
2			
3			
4			
Unaided avg (dB): 17			

The table view shows the RECD values for each test stimulus across frequencies from 250 to 8000 Hz. The RECD values are approximately 65 dB at 250 Hz, 60 dB at 500 Hz, 55 dB at 1000 Hz, 60 dB at 2000 Hz, 55 dB at 4000 Hz, and 55 dB at 8000 Hz.

Preparing Epoq



Fitting and Verification

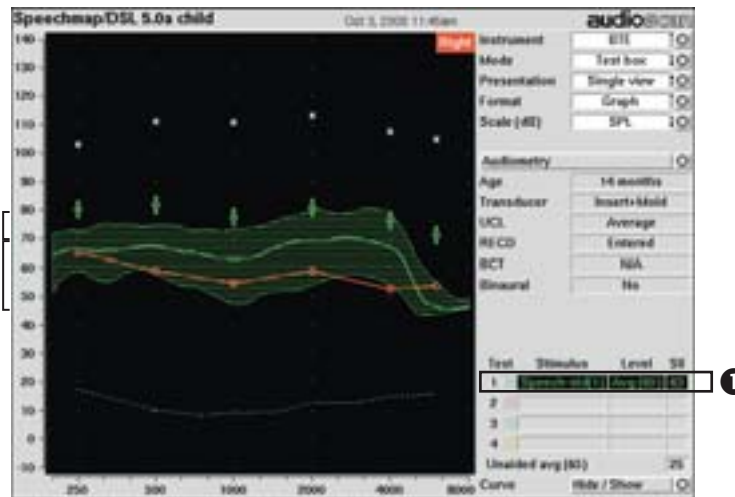


Simulated REM in the Verifit

- 1 ▶ Choose Test # to measure a real-ear-aided response (REAR)
 - ▶ Select
 - Speech-std as test stimulus at average input level, i.e. 65 dB, for the initial fit
 - The speech-std stimulus is shaped appropriately for use with the DSL targets at average, soft, and loud input levels
 - ▶ Press **Continue**

Results from the REAR

- Across the frequency range the output is around 10 dB lower than the DSL targets for a speech signal at 65 dB SPL
- In the frequency range between 500 and 2000 Hz, a large part of the speech signal is below the hearing threshold



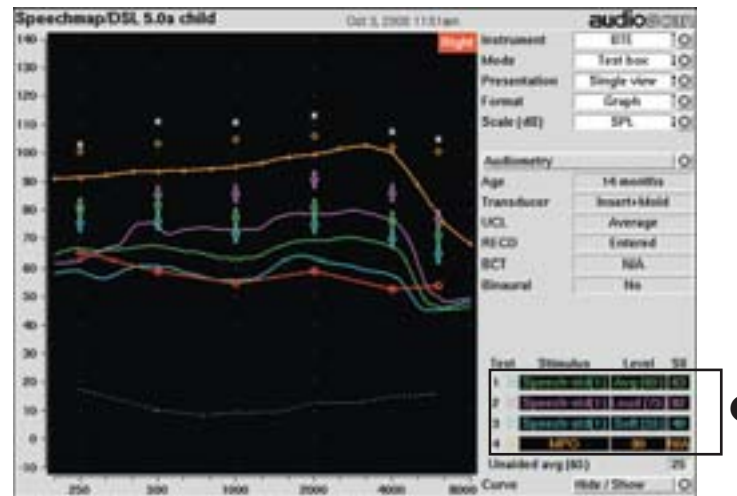
Verify Performance for All Input Levels

- ② › Soft speech inputs, to confirm that even soft sounds are audible
 - › Average speech inputs
 - › Loud speech inputs, to confirm that these remain comfortable
- › MPO targets should not be exceeded to ensure that loud sounds are tolerable at all times

Results

The soft and loud input levels show the same pattern as for the average speech level; the amplification does not meet the DSL targets

The MPO is lower than the targets and does not exploit the full dynamic range of the child

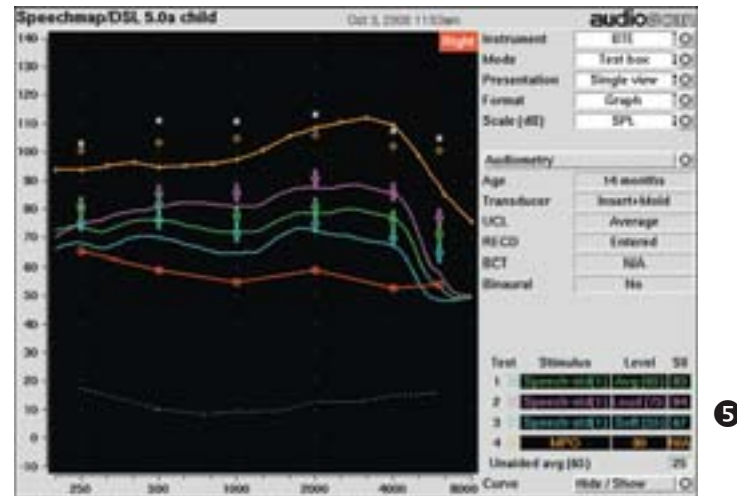


Fitting to DSL Targets

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

Results

The output is a little above targets at 2000 and 4000 Hz for average and loud speech signals as well as for the MPO

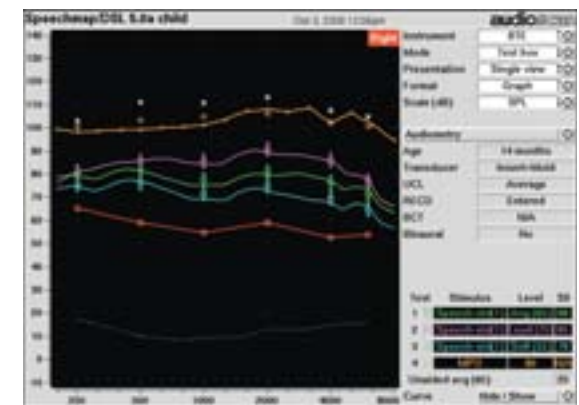
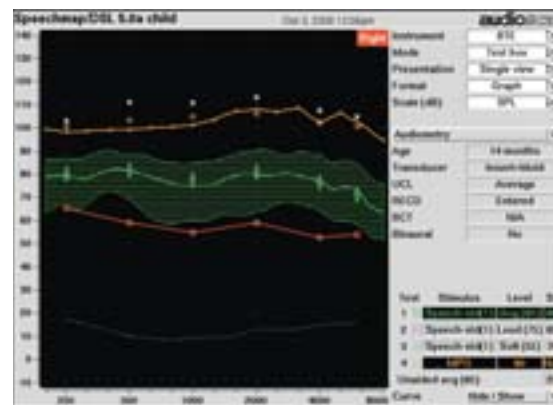


Fitting to DSL Targets (continued)

- › The procedure outlined above is carried out until the match to target is transparent
- ⑥ › 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 aid 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 aid 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 aid via the software
- Extended Bandwidth in Epoq
 - Epoq W and XW have an extended bandwidth up to 10 kHz
 - The 8 kHz DSL 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 aid performance in young children.
American Journal of Audiology 3:23-31

Seewald, R.C. (1995). The Desired Sensation Level method for hearing aid 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 pediatric hearing instrument fitting.
American Journal of Audiology 8(2):143-152



**child
friendly
hearing
care**

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.

www.oticonusa.com
www.oticon.ca

oticon
PEDIATRICS