

AppNote

Hearing aid performance in a real ear differs from performance measured in a hearing aid test box because the sound reaching the hearing aid microphone is different (microphone location effects), and because the real-ear presents a different acoustic load to the hearing aid (acoustic impedance) than does the 2cc coupler.

The RECD is defined as the difference, in dB as a function of frequency, between the SPL produced by an insert transducer at the eardrum and in a 2cc coupler.

Adult ear canal volumes are typically in the range of .65 to 1.75 cc. Children's ear canal volumes are smaller. Generally, the hearing instrument will produce higher output in the ear of the listener than in the 2cc coupler, because of the smaller real-ear volume. This is an important consideration when fitting amplification, especially for children.

The RECD measurement can be performed at the time of the hearing assessment. The values can be printed and re-entered when the client is seen on subsequent visits. The Audioscan NOAH module can be used to facilitate this process.

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Performing Real-Ear-to-Coupler Difference (RECD) Measurements Using the Audioscan® RM500

with software version 2.6 or higher¹

Because ears are different from 2cc couplers, a procedure has been implemented on the Audioscan RM500 that quickly measures the individual's unique ear-to-coupler transform values. The real-ear-to-coupler difference (RECD) values for each individual are derived by comparing the real-ear levels, measured by a probe microphone for a given test signal, to the levels measured in a 2cc coupler for the same test signal across frequencies.

SEVERAL CONSIDERATIONS SHOULD BE NOTED PRIOR TO MEASURING THE RECD:

- An Audioscan RE770 RECD transducer or insert earphone coupled to a 1/4" to RCA adapter is required to perform the RECD measurement.
- On instruments not having an auxiliary loudspeaker jack, it will be necessary to unplug the loudspeaker and plug the RECD transducer into the speaker jack. REMEMBER to plug the speaker back in after the RECD measurement has been completed.
- The RECD is always measured using the BTE (HA-2) type coupler. The RM500 will make any necessary mathematical corrections to ITE (HA-1) values. The RM500 will also correct RECD measurements for deep insertion when CIC is selected as the hearing aid type in DSL.
- The coupler portion of the RECD measurement can be conducted prior to the client's arrival and need only be done once per power up.
- If the transducer used for audiometric assessment purposes is an insert earphone coupled to the client's custom earmold, then the RECD should be measured using the same earmold.

ACCESSING THE RECD MEASUREMENT PROCEDURE

To measure the RECD on the Audioscan RM500 real-ear system:

1. Calibrate both the hearing aid test (HAT) box and real-ear measurement (REM) sections of the RM500 (see RM500 User's Guide for details).
2. Ensure the RM500 is in REM mode. (If necessary, to select REM mode, press any key in the REM area of the keyboard.)
3. Press the <ADVANCED FEATURES> key.
4. Highlight TESTS and SPEECHMAP/DSL. Press <CONTINUE>.
5. Press the <AGRAM> key to display the ASSESSMENT DATA ENTRY POSTER.
6. Using the cursor arrows on the keyboard, scroll through the window at each item to select specific client information (AGE, TRANSDUCER, UCL, RECD and REDD). Set the RECD window to MEASURE. Press <CONTINUE>.
7. Enter the client's threshold information by following the onscreen instructions. Press <CONTINUE>.
8. The RM500 will automatically advance to the RECD measurement procedure. Onscreen instructions are provided to facilitate the measurement.

The RECD measurement procedure enables:

- precise definition of the individual's auditory area for the purposes of selecting and fitting amplification;
- specification of hearing instrument gain and SSPL90 (OSPL) in 2cc coupler terms for hearing instrument selection purposes;
- the capability to perform all hearing instrument response shaping in the controlled conditions of the hearing instrument test box;
- the ability to measure the acoustic properties of a child's ear and earmold coupling; and
- a substantial reduction in the amount of time and degree of cooperation required in the fitting process.

Complete details of how the RECD measurement is used in the Audioscan RM500 Speechmap/DSL fitting system are provided in Cole & Sinclair (1998).

The measured RECD values, as a function of frequency, should generally be greater than or equal to 0 dB. A negative RECD value might indicate an inadequate seal of the foam coupling (or earmold) in the ear, larger than average ear, perforated eardrum or myringotomy tube in place.

Reference:

Cole WA, Sinclair ST (1998). The Audioscan RM500 Speechmap/DSL Fitting System. Trends in Amplification, 3(4): 125-139.

COUPLER MEASURE

1. Plug the RE770 transducer into the auxiliary speaker jack (located at the right rear of the HAT box lid.)
2. Screw the BTE coupler onto the coupler microphone and plug into the microphone jack inside the HAT box.
3. Couple the RE770 transducer to the BTE coupler tubing. Lie coupler on RM500 keyboard or place inside HAT box.
4. Press <CONTINUE> to introduce signal.
5. Press <CONTINUE> again to store the coupler response.



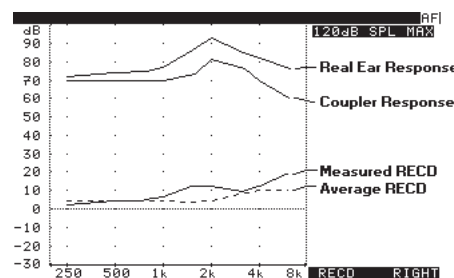
REAL-EAR MEASURE

1. Leave the RE770 transducer plugged into the auxiliary speaker jack.
2. Unplug the coupler microphone and plug the probe module into the microphone jack inside the HAT box.
3. Prepare client for real-ear measurements. Ensure probe tube is within 5 mm of eardrum (see RM500 User's Guide for details).
4. Couple the RE770 transducer to the standard foam ear tip (or earmold tubing)
5. Insert the foam ear tip (or custom earmold) into the ear. Wait for the coupling to seal at the ear before proceeding.
6. Press <CONTINUE> to introduce signal.



REAL-EAR-TO-COUPLER DIFFERENCE (RECD) SCREEN

Four curves will be displayed on the RM500 screen. The two curves on the upper portion of the screen are the result of the current real-ear measurement and the stored coupler measurement. The two curves on the lower portion of the screen are the current measured RECD values and the age-appropriate average RECD values (for comparison purposes). If the measured RECD curve is below -10 or unstable in the low frequencies, check the seal of the foam ear tip. If the measured RECD is below 0 in the 4 – 6 kHz region, check for proper placement of the probe tube (i.e., within 5 mm of eardrum) and blockage of the probe tube by the foam tip.



7. Press <CONTINUE> a second time to store the real ear curve (and RECD measurement).

THE UNAIDED SPLOGRAM SCREEN

Following completion of the RECD measurement procedure, the RM500 automatically proceeds to the Speechmap/DSL unaided SPLogram screen. The measured RECD values can now be obtained in numerical form at the top of the SPLogram printout by pressing <PRINT SCREEN>. If desired, these RECD values can be re-entered into the RM500 at a later date by scrolling to ENTER in the RECD window of the ASSESSMENT DATA ENTRY POSTER.