

AC440 Speech Audiometry¹

Most people acquire hearing aids because they or their relatives experience that they have trouble hearing speech. Speech audiometry has the advantage of employing speech signals and is used to quantify the client's ability to understand everyday communication. It examines the processing ability and can be useful to investigate whether the processing is affected by disorders of the middle ear, cochlear, auditory nerve, brain stem pathway, or auditory centres of the cortex. Speech audiometry can be performed using a number of tests. To mention a few the SRT (Speech Recognition Threshold) refers to the level at which the client can repeat 50% of the presented words correctly. It serves as a check of the pure tone audiogram, gives an index of hearing sensitivity for speech and helps determining the starting point for other suprathreshold measures such as WR (Word Recognition). WR is sometimes also referred to as SDS (Speech Discrimination Scores) and represents the number of words correctly repeated expressed in percent.

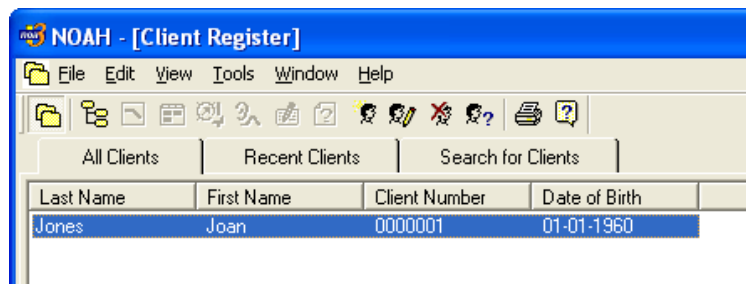
Note: there is a predictable relationship between the patients pure tone threshold and speech threshold. Speech audiometry may therefore be useful as a cross-check of the pure tone audiogram.

Needed Items:

- The Affinity/Equinox
- The AC440 software
- A audiometric headset, insert phones, or Free Field speakers
- A microphone, CD player, or Wavefiles

Starting the System:

- 1) Open **Noah** and double click on any client:



- 2) Open **Module Selection** 

- 3) Select the **Measurement** tab 

- 4) Select the **Affinity/Equinox Suite** icon

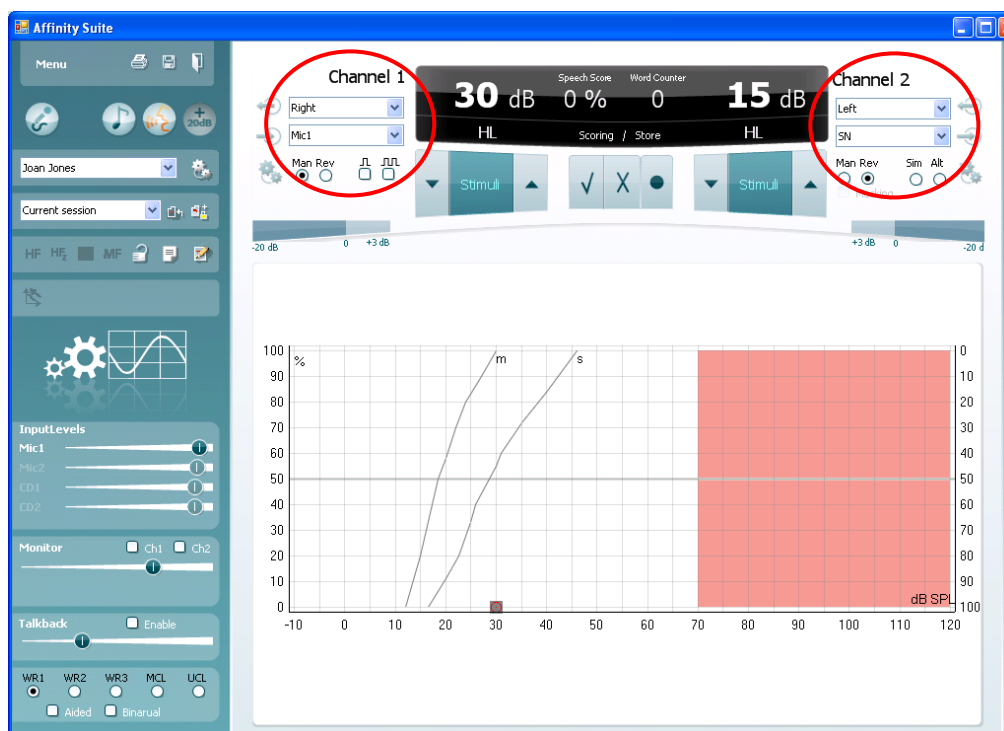



¹ This document will provide a short introduction to the audiometry process using the AC440. The methods described here primarily based on the textbooks by Stach (1998) and Katz (2002) and describes one way of performing the individual tests. Other standards may, however, dictate other procedures.

Performing Speech Audiometry:

The clinician may want to do the tone audiogram prior to performing the speech test as the tone audiogram provides valuable predictive information useful in the speech testing (see *AC440 Air and Bone Conduction Audiometry*). Furthermore, the PTA level (pure tone average) gives the clinician a basis for calculating the starting point for speech testing. How the PTA is to be calculated can be defined in the AC440 Setup.

Note: The screen shot below shows graph mode. However the procedure using table mode is the same.



1) Go to the **Speech Screen** by clicking the tone button  if this is not already set up to be the default start screen in the AC440 Setup.

2) Select desired test in the **List of defined protocols** 

Both user defined and standard test protocols can be found in this dropdown. If a customized test setup is not created, the AC440 will automatically pick a standard test.

3) If not already done perform otoscopy to make sure that no anatomical changes should be taken into account and that cerumen is not obstructing the ear canal.

4) Select the input and output for **Channel 1** using the dropdowns. Choose between *Right*, *Left*, *FF1*, *FF2*, *Insert Right*, or *Insert Left* in the output selection. Below in the input dropdown the clinician may decide whether the speech test is to be performed using a microphone (*Mic1* and *Mic2*), CD (*CD1* and *CD2*) or Wave files.

In the **Channel 2** input and output dropdowns the clinician can decide whether or not masking is to be employed. Using the output dropdown the clinician can choose from *Right*, *Left*, *Insert Mask FF1*, *FF2*, *Insert Right*, *Insert Left* and *Off*. In the input dropdown the clinician has a selection of microphone (*Mic1* and *Mic2*), CD (*CD1* and *CD2*), *WN* (White Noise) and *SN* (Speech Noise).

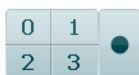
5) Before mounting the headphones (if using headphones) explain to the patient that they will now hear some words/numbers/sentences through the ear phones/free field speakers. Tell them that they are to repeat what they hear even though it may be very soft. Clients may also be encouraged to guess

if they are unsure about the word/number/sentence. If performing the speech test in noise do not forget to instruct the client not to focus on the noise but on the speech.


- 6) Start presenting the *words*, *numbers* or *sentences*. Depending on the setup for speech testing the speech test can be scored using the following buttons:

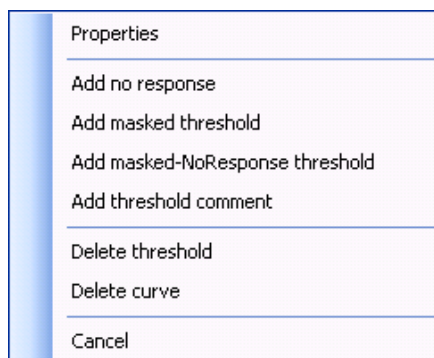


Correct, Incorrect, Store





Number of correct Phonemes, Store

- 7) If mistakes are made during the test, please press  **Edit Mode**. A right click on the threshold will prompt the menu shown on the screen shot above. Besides deleting single thresholds or whole curves the Edit Mode also provides the option to **Add No Response**, **Add Masked Threshold**, **Add Masked No Response Threshold**, and **Add Threshold Comment**. Comment writing may be useful if the client seems insecure or reacts in a way that the clinician finds noteworthy.



Speech Recognition Threshold (SRT)

The SRT examines at which level 50% of the speech material (usually numbers or spondaic words) is repeated correctly. The SRT can be used as a cross check of the air conduction audiometry and it is generally accepted that if the PTA and the SRT is within ± 6 dB of each other the accordance is good, if it is ± 7 to 12 dB it is adequate, and if it ± 13 or more it is poor.

- 1) Perform air and bone conduction audiometry as described in *AC440 Air and Bone Conduction Audiometry* in order to obtain the PTA.
- 2) Open the Speech Screen  and ensure that the SRT test is active. This is shown by the SRT label being orange 
- 3) Start with the better hearing ear according to the bone conduction audiogram and set the intensity to 15 dB above PTA.
- 4) Begin presenting the speech material and reduce the intensity in 5 dB steps for every correctly repeated word (1 or 2 dB procedures may also be used if preferred by the clinician). Use the Store button to store and the SRT.



- 5) Upon changing *Transducer*, *Masking*, and/or *Aided* and re-testing an additional SRT entry will appear in the SRT table. This allows for multiple SRT measurements to be shown in the SRT table. When more than 4 tests are made scrollbars will appear.

	Transducer	Test Type	Intensity	Masking	Aided	
SRT	Right	HL	30	15		▲
	Right	HL	10	15	x	☰
	Left	HL	10	15	x	
	Left	HL	30	15		▼


If the SRT is not in accordance with the air conduction thresholds, the air conduction audiogram should be checked and the procedure repeated.

(Nielsen & Carver 1997; Katz 2002)

Word Recognition (WR)

The Word Recognition score determines the client's discrimination ability expressed in %. It provides information about what phonemes the client has difficulty hearing at a particular intensity level. This is helpful for counselling and rehabilitation purposes. The diagnostic value has shown to be fairly low but it is generally accepted that the word and sentence recognition are least affected by conductive and most affected by neural loss.

There are numerous ways of performing the WR. The procedure described below is merely a suggestion.

- 1) Perform *air and bone conduction audiometry* as described in *AC440 Air and Bone Conduction Audiometry* in order to obtain the PTA.
- 2) Open the Speech Screen  and ensure that the preferred WR test is active. This is shown by the corresponding WR label being orange **WR1**.
- 3) Start in the better hearing ear according to the bone conduction audiogram and set the intensity to approximately 40 dB above PTA (minimum 55 dB). In cases where recruitment is present start lower at about 20 dB above PTA and ask the client if the level is comfortable after 2-3 words.
- 4) Begin presenting the speech material. Use the scoring buttons to score and store the results. The current percentage will appear in the upper black bar.



	Transducer	WR	Intensity	Masking	Score	Aided
WR1	Right	WR1	55		85	
	Right	WR1	55		95	x
WR2	Binaural	WR2	55		100	x
	Left	WR3	50	15	90	x
WR3	Binaural	WR3	50	15	75	x

- 5) Upon changing *Transducer*, *Masking*, and/or *Aided* re-testing an additional WR entry will appear in the WR table. This allows for multiple SRT measurements to be shown in the SRT table. When more than 4 tests are made scrollbars will appear.

(Nielsen & Carver 1997; Katz 2002)

References:

Katz J. (2002) *Handbook of Clinical Audiology*, Fifth Edition. Lippincott Williams & Wilkins

Nielsen H. & Carver K. R. (1997) *Håndbog i Audiologiske Tests*. Phonak Danmark

Stach, B. A. (1998) *Clinical Audiology an Introduction*. Singular Publishing Group San Diego, Thomson Learning