AC440 Air and Bone Conduction Audiometry[1]

In air conduction audiometry a test signal is presented to the test subject by earphones and the test subject responds to the signal by pressing a client response button. The audiometric threshold is defined as the lowest intensity at which the client is able to detect the test signal 50% of the time.
The purpose of air-conduction audiometry is to establish the hearing sensitivity at various frequencies. The test provides information about the conductive and sensory systems of hearing but cannot distinguish between abnormality in the conductive mechanism and sensorineural mechanism.

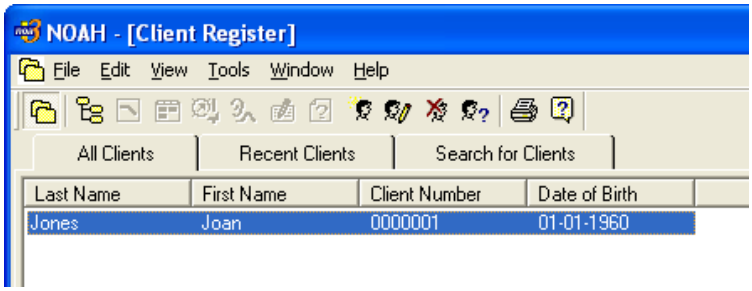
In bone-conduction audiometry, the test signal is presented by a bone vibrator placed on the mastoid of the test subject. It is recommended to start hearing threshold level determinations with air-conduction measurements followed by bone-conduction measurements.
The bone vibrator uses the skull to transfer the vibrations to the cochlear and bypasses the outer and middle ear. Bone conduction thresholds thereby provide a measure of the cochlear and retrocochlear function regardless of the outer and middle ear function. The difference which is detected between the bone and air conduction is called the air-bone gap.

Needed Items:

- The Affinity/Equinox
- The AC440 software
- An audiometric headset (TDH39) or Insert phones
- A bone conductor
- A response button

Starting the System:

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



2) Open **Module Selection** 

3) Select the **Measurement** tab 

Affinity Interacoustics Equinox Interacoustics

[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.

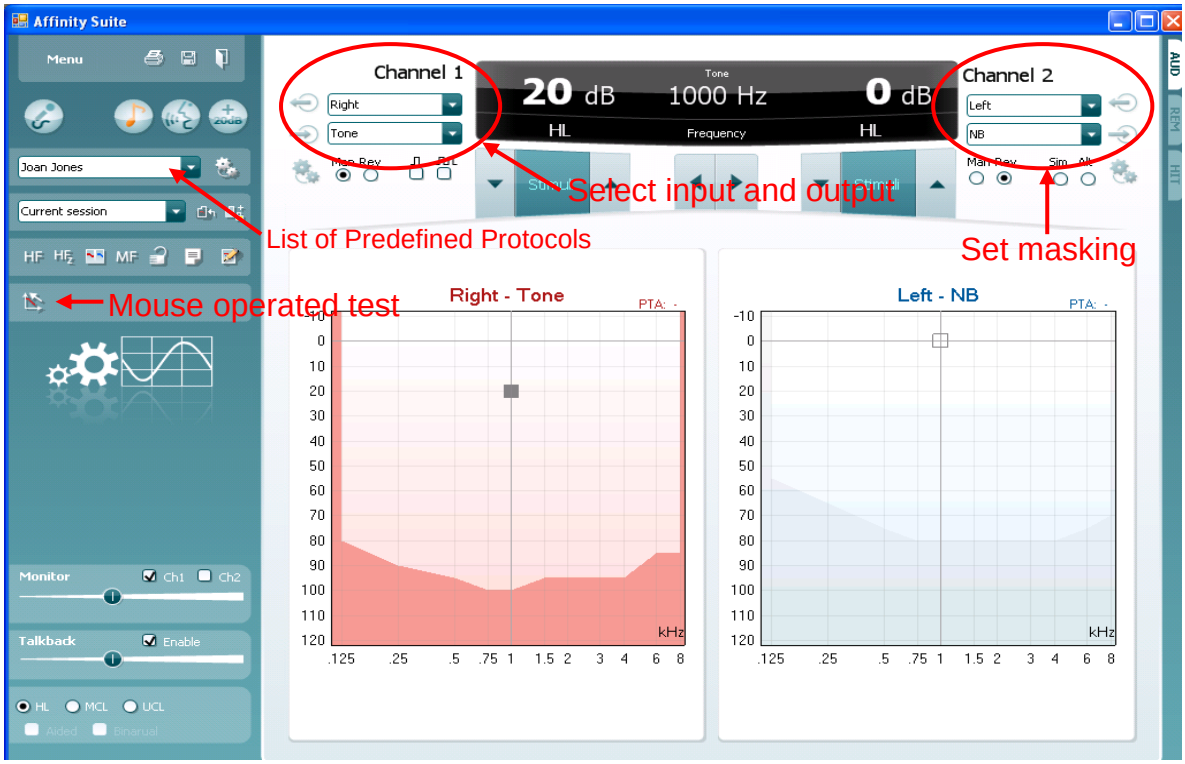
4) Select the **Affinity/Equinox Suite** Icon

Performing Air Conduction Audiometry

1) Open the **Tone 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) Perform otoscopy to make sure that no anatomical changes should be taken into account and that cerumen is not obstructing the ear canal. The clinician may want to ask if the client is experiencing tinnitus. If yes, it may be considered to do the test using warble tones or narrow band noise instead of pure tones with can be hard to distinguish from the tinnitus at some frequencies.

4) Select the input and output for **Channel 1** using the dropdowns in the upper part of the screen. Choose between *Right, Left, FF1, FF2, Insert Right,* or *Insert Left* in the output selection. The tone audiometry is, however, often performed using head phones/insert phones. In the input dropdown below the clinician may determine the signal to be employed for the tone audiometry selecting from *Tone, Warble Tone,* or *NB* (Narrow Band noise).

5) Using the **Channel 2** input and output dropdowns the clinician can decide whether or not masking is to be employed. This decision is, however, usually made after performing an unmasked audiogram based on differences in thresholds. Channel 2 may therefore be set to *Off* in the output dropdown.

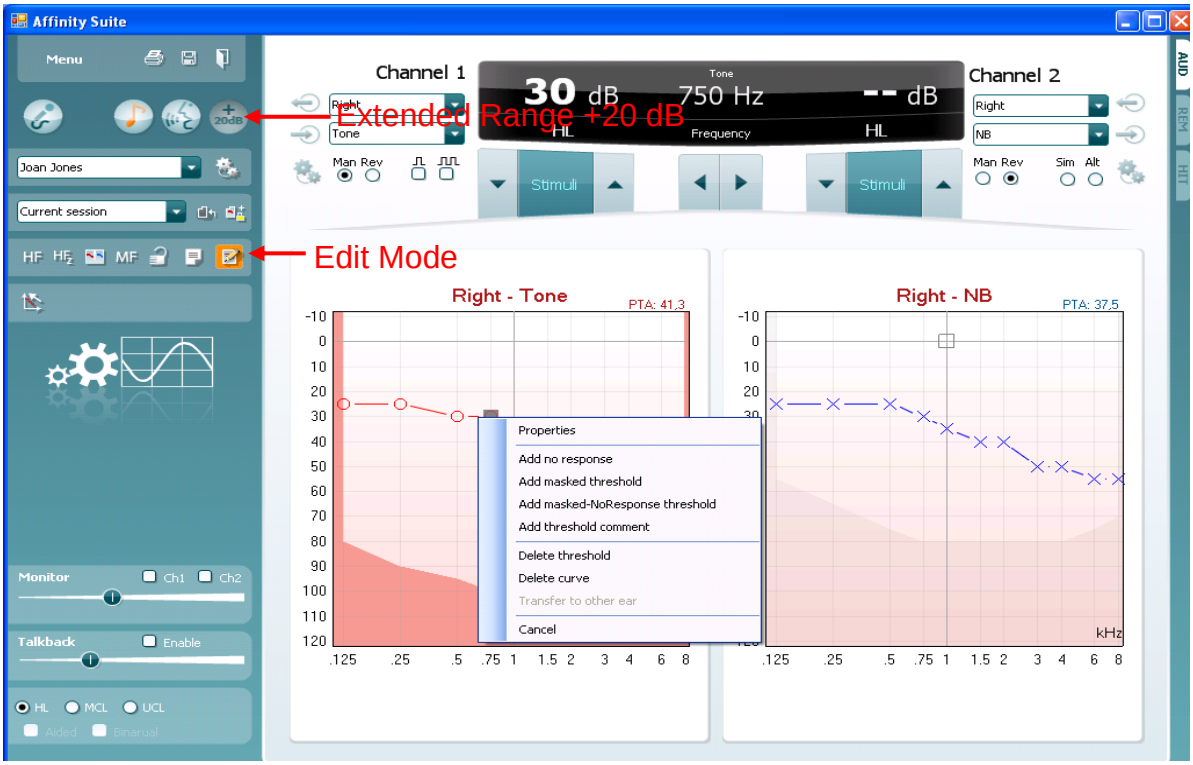
6) Before placing the headphones on the client and handing them the response button the clinician may want to clarify the audiometry procedure. Explain to the client that they will now hear a number of different tones through the headphones and that they are supposed to react by pressing the response button whenever the tone is audible. Make clear that they should also respond even though the tone is very weak.

7) If one ear is assumed to be worse hearing compared to the other, start the audiometry on the better ear. If the hearing level is assumed to be equal on both ears, start on the right. Change stimulus level and frequency with the PC keyboard arrow keys (up / down and left / right) or the buttons in the front screen. Masking levels controlled by PgUp / PgDn. Store the threshold by pressing “s” on the PC keyboard or by left clicking mouse in stimulus field. Store “Not heard” by “n” or by right clicking in stimuli field.

The clinician may also choose **Mouse operated test mode** (see illustration above) and do the audiometry using only the mouse. Left click to stimulate and right click to store the threshold.

8) Begin the testing at 1000 Hz at an intensity which the client is believed to be able to hear. A normal start level would be approximately 40 dB for a person assumed to have normal hearing and 30 dB above presumed threshold if hearing loss is present. However, the start intensity should never exceed 70-80 dB.

9) Present the stimulus for approximately 2 seconds and wait for the client to respond. The Stimuli area will light up while presenting, visually letting the clinician no when sound is coming out of the headphones. If no reaction is obtained increase the intensity 10 dB at the time until a reaction is achieved. If having to do with a more severe hearing loss the clinician may want to press the **Extended Range +20 dB** button.



10) The clinician may now begin the threshold search using the *“10 down, 5 up”* method. Decrease the intensity 10 dB at the time. When the client stops responding increase the intensity 5 dB. The threshold

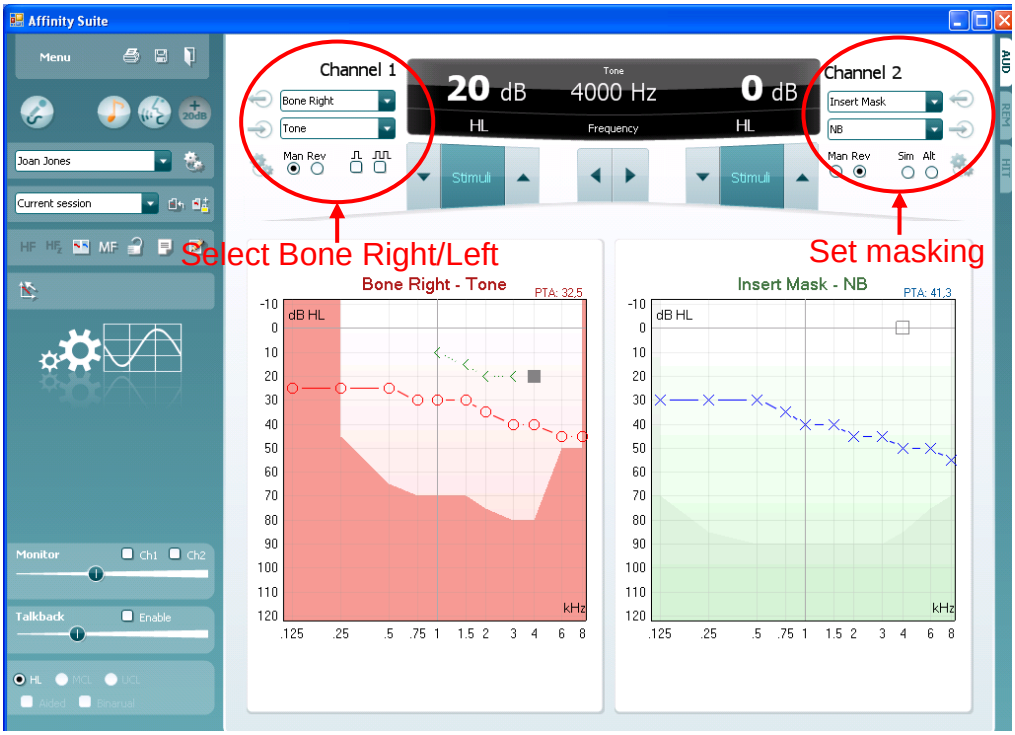
is set at the intensity where the client is able to perceive the tone 50% of the time (typically 2 out of 3 times).

11) Find the threshold for the test frequencies using the preferred jump strategy both of which can be set in the AC440 Setup. If having made a mistake during the test the clinician may at any time during the test click  **Edit Mode** (see illustration above)**.** 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.

Note: If the difference between the two ears exceeds 40 dB (50 dB if using insert phones) there will be a risk of cross hearing (e.g. the good ear is responding at the tone presented to the worse ear). In this case the clinician may consider retesting the worse ear while masking the better. Masking can be activated using the Channel 2 input and output dropdowns in the upper part of the screen. The output dropdown allows the clinician to choose from *Right, Left, Insert Mask FF1, FF2, Insert Right, Insert Left* and *Off* and in the input dropdown the clinician can choose from *Tone, NB* (Narrow Band noise), and *WN* (White Noise) and *SN* (Speech Noise).

Performing Bone Conduction Audiometry

1) After having established the air conduction thresholds as described above place the bone conductor on the mastoid or the forehead and choose *Bone Right* or *Bone Left* corresponding to the cochlear tested in the **Channel 1** output dropdown and decide the signal in the input dropdown. In the **Channel 2** input and output dropdowns the clinician can decide whether or not masking is to be employed.



2) Bone conduction audiometry is performed using the same procedure as described for air conduction audiometry above.

3) Save and exit by clicking “Save and Exit” icon. 

Note: Without masking the clinician cannot know which cochlear perceives the bone conducted test stimulus. If the air conduction audiometry reveals asymmetry the clinician should therefore consider masking.

References:

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

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