A guide to the Audible Contrast Threshold (ACT™) test

Interacoustics

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What is the ACT test?

The ACT diagnostic test is an above-threshold, non-language specific test that quantifies a person's real-world ability to hear in noise. The test applies the shape and levels of the audiogram to ensure the correct stimulus intensity is applied.

When we get an audiogram, it allows us to objectively map out a person's hearing thresholds. ACT then applies this person's audiogram to deliver an above-threshold stimulus (a siren-like sound) to objectively map their hearing-in-noise ability.

In other words, where the audiogram measures the quantity of hearing, ACT measures the quality of hearing. This way, we have a robust assessment that reflects a person's real-world hearing abilities.

Once you have obtained the ACT value, you can use it to counsel your client on their speech-in-noise ability. It also provides you with advice on how best to support your client to hear better in noisy environments.

ACT is performed unaided. However, due to the test being conducted at above-threshold intensity, you can get a clearer understanding of how well your client will perform with hearing aids when in noisy situations. There is also the possibility to prescribe help in noise in selected hearing aids.

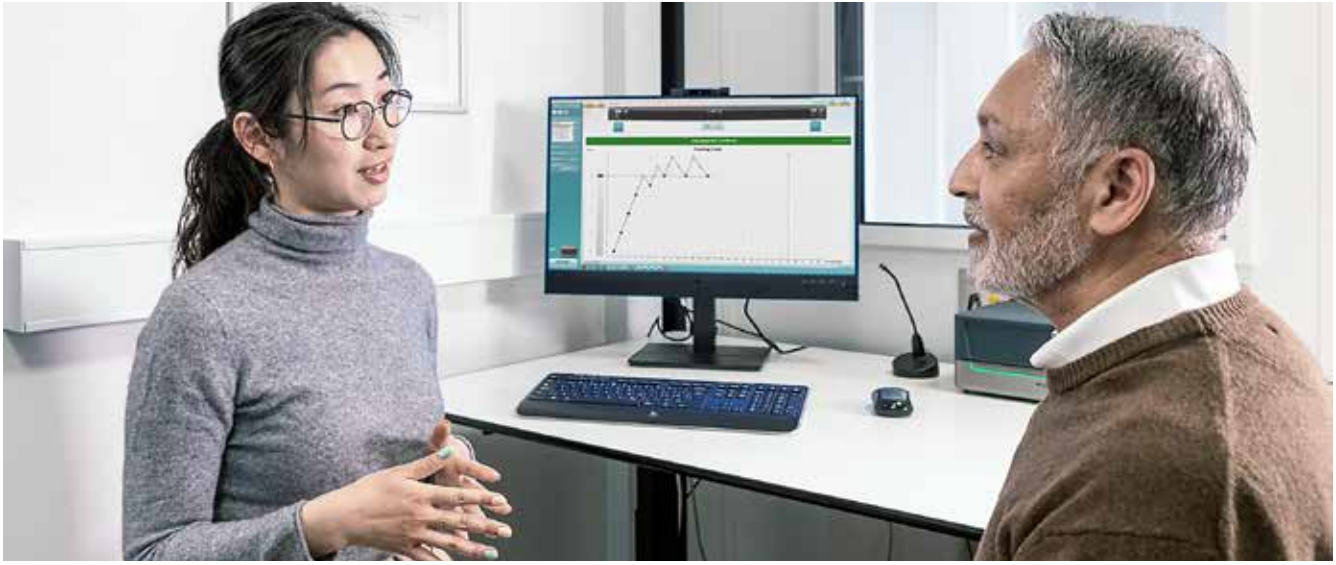
The ACT value is denoted as dB **nCL** which stands for '**n**ormalized **C**ontrast **L**evel.' This is a novel scale developed by the research team at the Interacoustics Research Unit (IRU). In brief, the background definition of nCL stands for:

- n (normalized): the scale is normalized based on normative data acquired from young, normally hearing people
- C (contrast): clients are detecting a contrast in the modulation of a signal
- L (level): this is a dB measure and is denoted as such

Pre-test counseling guidance

You can perform ACT on any adult client that you deem suitable to perform pure tone audiometry. It may be useful to counsel the client on the reason for performing ACT. Here, you will find an example script.

"We will perform a test called ACT. The result from this test will clarify your abilities to hear in background noise. This can be challenging, particularly if you have a hearing loss. So, performing this test will help me to know to what degree this is also a challenge for you."



Required equipment

To perform an ACT test, you will need:

- Affinity Compact or Callisto
- Patient response button
- Connected PC and keyboard
- Headphones or insert earphones
- Licensed AC440 audiometry module including an ACT license

Points to note

It is recommended that you listen to the acoustic stimuli over monitor headphones during the test. This will help you to present the target stimuli in an unpredictable manner.

To perform ACT, you must complete an audiogram for air conduction at the following frequencies:

- 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz
- Inter-octave frequencies will be considered in ACT testing if they have been completed.

Should the following notification appear: 'Insufficient data to complete the test', please ensure all mandatory thresholds have been stored for both ears. A 'no response' will be factored into the ACT test, but a 'Could not test' or 'Did not test' will be excluded and you will not be able to complete the ACT test.

ACT test procedure

1. Launch your Affinity Suite into AUD mode.

2. Ensure there is an audiogram inserted into the current session.

3. Click on 'Menu'.

4. Click on 'Test.'

5. Select ACT.

6. The instructions will pop up in a separate window (Figure 1).

7. Read the instructions to the client.

8. Use the 'sound examples' to demonstrate and explain the test procedure. You can play these sound examples as many times as is necessary to familiarize the client.

9. Once you are confident that the client has understood the test, click 'Proceed to test'.

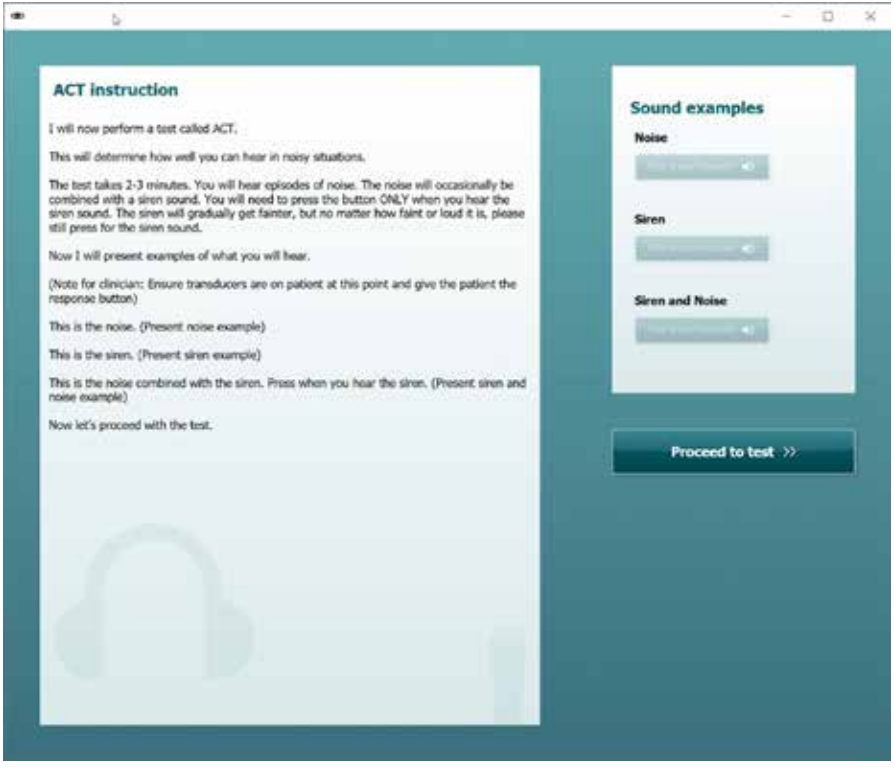


Figure 1: *ACT instructions.*

If you wish to read instructions again at any point, click on 'i' in the left-hand menu (Figure 2).

Figure 2: *Access to instruction screen.*

10. Press START.

a. A sequence of noise episodes will start.

b. You perform the test in the same way as pure tone audiometry using the Hughson-Westlake adaptive method (2 down, 1 up) with a 3 out of 5 criterion, as described in the flowchart in Appendix 1.

c. Present the stimulus by clicking once on your chosen presentation key. If you press 'spacebar' to present a stimulus, press this once. DO NOT press and hold.

d. A black dot appears automatically when the client correctly hears the target stimulus (Figure 3).

e. A white dot appears automatically when the client has not heard the stimulus or has not responded in the viable time frame (Figure 3).

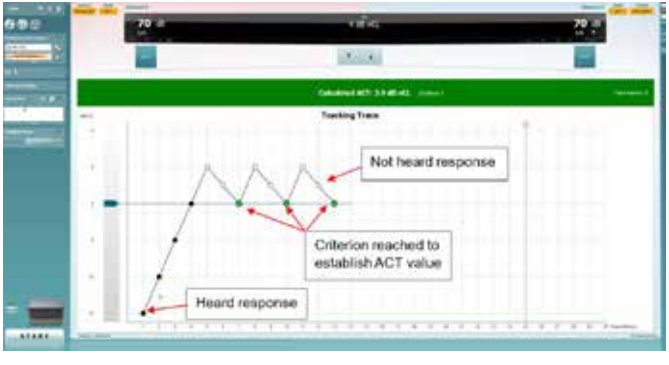
OPTIONAL: If you are not confident that your client knows when to respond after presenting the sound examples within the instruction box, try starting the test and perform 3 presentations at 16 dB nCL. Then continue as in step 10.

11. Once the required number of thresholds has been reached to produce an ACT value, the test will automatically stop. The calculated ACT value is then stored in the middle of the green band across the screen.

Points to consider:

- You can stop the test at any point by pressing the 'STOP' button.

- If the test exceeds 25 presentations (indicated as a line on the trace), there is a higher risk of client fatigue. Please refer to scenario 3 below for guidance on how to address this.



Figures 3 and 4: *Example traces.*

Guidance on what to do in case of inconsistent responses during the test

Every client is different and may not follow normative patterns when conducting ACT. The following pages show some examples on what you can do based on irregular responses.

Scenario 1: Client keeps pressing response button despite no stimulus

The client has many false positives (responds at the right time but has not heard the signal) or presses the button too often. To solve this, increase the nCL to 4 dB nCL above the expected threshold (or even higher) to remind the client what to listen for and return to the previous level (Figure 5).

Figure 5: *Scenario 1.*

Scenario 2: Client is losing concentration

The client is close to obtaining a threshold, but loses concentration and fails to respond at levels previously detected.
To solve this, increase the nCL to a clearly detectable level (e.g. 16 dB nCL) to remind the client what to listen for (Figure 6).

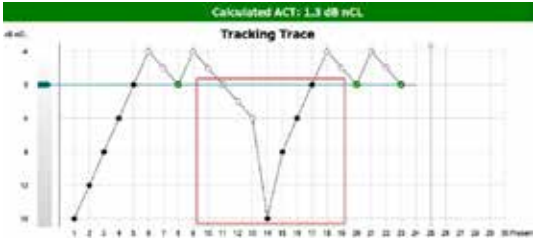


Figure 6: *Scenario 2.*

Scenario 3: The run exceeds 25 presentations

The run reaches 25 presentations and there is no threshold in sight (Figure 7). There is a higher risk of client fatigue at this point. To solve this, give the client a break, and re-iterate the instructions if needed. You can also perform ACT in a separate appointment, as long as the client's audiogram is present.

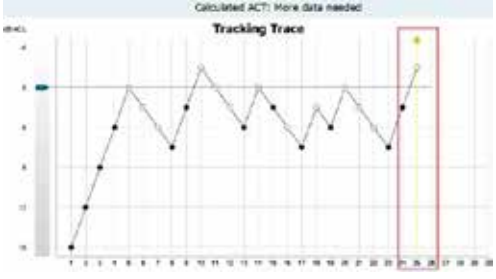


Figure 7: *Scenario 3.*

Scenario 4: Client responds unexpectedly

An otherwise reliable client responds against your expectation. To solve this, present the stimulus again at the same dB nCL to make sure the first response was not a coincidence (Figure 8).

Figure 8: *Scenario 4.*

Post-test counseling guidance

To access the post-test counseling guidance, click the 'Guidance' drop box in the middle of the screen (Figure 9). This will reveal the ACT severity categories with accompanying fitting advice (Figure 10).

Figure 9: *Guidance drop box.*

Figure 10: *Fitting guidance based on ACT value.*

Now that you have obtained your ACT value, you can use this in many ways, such as:

- Recommend assistive listening devices
- Set the adaptive features in all hearing aids
- Focus on rehabilitation and communication strategies
- Use selected hearing aids to automatically prescribe adaptive features
- Counsel clients on the prediction of how well they will cope in noisy situations

Automatic hearing aid adaptive feature adjustments using the ACT value

The most effective way to use the ACT value is within the hearing aid fitting software itself. This will automatically optimize the adaptive features of a hearing aid such as noise reduction and directionality. This option is available in selected hearing aid brands only.

Manual adjustments to hearing aid adaptive features using the ACT value

If the hearing aid does not have an option to directly input the ACT value, then you can do adjustments based on the ACT value manually. Hearing aids usually prescribe adaptive features such as noise reduction and directionality based on the client's audiogram as well as other data put into to the fitting software such as questionnaires and listening preferences.

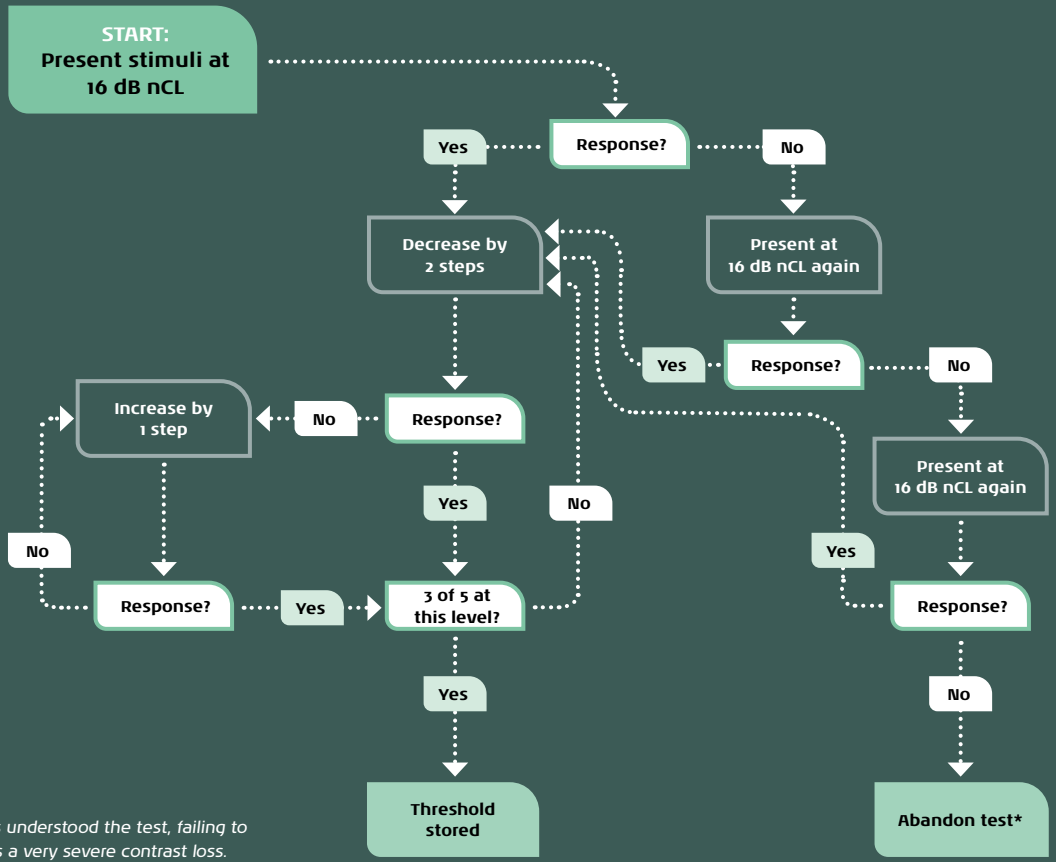
The ACT value allows for a more objective method of predicting the optimal starting point for these features to activate. Before making manual changes to the hearing device, it is important to understand how adaptive settings are programmed in the device you are fitting.

Further counseling advice

Below is an example script you may want to consider when counseling your client on their ACT value. This advice should be termed appropriately to consider both new and existing users of hearing aids.

"*I have now completed the ACT test which tells me about your ability to hear and separate speech from noise in your daily life. Your ACT value today is x, corresponding to within the normal range (or), a mild/moderate/severe contrast loss. A contrast loss means that you need speech and background noise to be separated more to understand what is being said. In other words, you need greater contrast between speech and noise. The higher the value, the more contrast you will need. To help you create this contrast, we need to look at the options available to you to support you in the best way possible. This can be through hearing aid technology level, assistive devices, streaming devices, and communication strategies.*"

APPENDIX 1: ACT test procedure



**Under the assumption that the client has understood the test, failing to respond at 16 dB nCL means the client has a very severe contrast loss.*

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