

What is ABR?

Auditory Brainstem Responses are potential differences generated when a person's ear is stimulated with any kind of sound. The potential difference originates in the VIII cranial nerve and the auditory brainstem system. These potential differences can be evoked using controlled stimulation, allowing acquisition of these differences by averaging the acquired signal over a specified period of time. The ABR response is commonly found between one and fifteen milliseconds from the time of stimulation.

The recordings acquired will contain certain peaks and valleys. A standard ABR recording will contain seven peaks, some more identifiable than others, peak five being the most prominent. The amplitudes, latencies and relationship of those peaks and valleys can be used to diagnose certain pathological conditions. ABR responses are most commonly acquired using surface electrodes.

Why acquire ABRs?

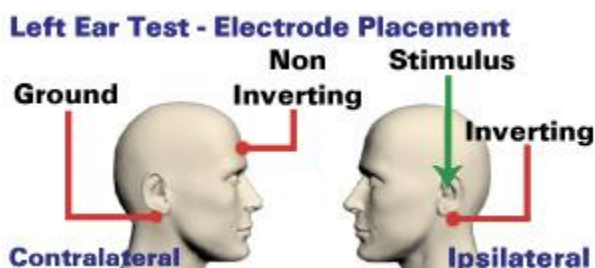
Auditory brainstem responses may be used to diagnose certain auditory conditions. This type of testing can provide the physician with very useful information about hearing loss in a patient. This technique is especially helpful to test infants and newborns that cannot yet respond to behavioral testing (many states now require hearing screening of newborns). It may also be helpful to test adult patients with a certain degree of mental impairment, such as the autistic and developmentally delayed.

ABR testing can help determine the amount and type of hearing loss at specific frequencies, (i.e. hearing threshold), depending on the cause of hearing impairment. ABR testing can also provide information about existing acoustic neuromas that may be causing a degree of hearing loss and the presence of nervous system abnormalities, particularly referring to the VIII nerve and auditory brainstem.

Patient Preparation

The patient must be placed in a comfortable and quiet environment, preferably a sound booth where the patient lies down on a comfortable bed. The patient must be instructed to relax during testing. It is recommended that the patient avoid stimulants, such as caffeine, before testing. Electrodes may be placed in the following configuration:

- Inverting (-) : Ipsilateral (Testing) Mastoid
- Non-Inverting (+) : High Forehead
- Ground: Contralateral Mastoid



When testing both ears, in a dual channel system, place the corresponding inverting electrodes on the mastoids, place the ground electrode on the lower forehead and place the two non-inverting leads, using a Y-adaptor, above the ground electrode. Consult the SmartEP and Smart Screener manuals for additional electrode placement details.

Electrode Usage

Surface electrodes are sufficient for acquiring ABR recordings. Clean and prepare electrode pacing sites in order to reduce the impedance and acquire a clearer recording.

Setting up SmartEP

Acquiring ABRs is SmartEP's main function. The system may be setup with a few clicks of the mouse. Complete the following steps in the order outlined, use the test settings that best fit

Acquiring ABR with SmartEP

your requirements or use the recommended settings shown on the next section:

- Under **Stimulus > Modality** in the main menu, make sure *Auditory > ABR* is selected.
- Set the stimulus, Click on **Stim** from the control panel and set the stimulus type, duration, frequency, window, masking and transducer, as necessary.
- Click on the **EEG and Amplifier** button on the control panel and set the filters, notch filter, artifact rejection ratio and region and desired amplification for each channel.
- On the control panel, set rate, polarity, intensity and the number of sweeps.
- Press the **Acquire** button to start. Repeat acquisition 2 to 4 times.

SmartEP allows automation of the acquisition process; consult your user's manual to learn how to create your own testing protocol or how to save your settings for future use.

Make sure to carefully select your filter settings in the EEG and Amplifier dialog box. An unfiltered recording can always be filtered digitally to obtain a smoother waveform; however, hardware filtering cannot be undone.

Recommended Test Settings

This table shows the recommended settings for ABR acquisition:

Stimulus:	0.1 msec Click or Tone Bursts
Rate:	19.3/sec or 21.1/sec. Slower rates are used to enhance wave I.
Polarity:	Rarefaction provides clearest wave I. Use condensation if response is not optimal. Use alternating if there is excessive stimulus artifact.
Transducers:	Insert Earphones
Intensity:	80 to 95 dB HL for Neurodiagnosis. 90 dB HL down to 0 dB HL for Threshold search.
Filters:	30 – 3000 Hz (100 –3000 Hz for Adult ABR and 30-1500 Hz for an infant ABR).
Notch Filter:	OFF. ON if there is excessive electrical line noise present.

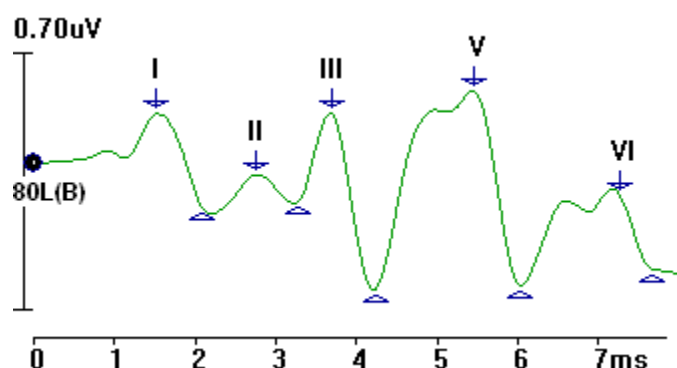
Amplification:	100x
Analysis Time	12.8 msec
Window:	
Sweeps:	1024 or 2048
Electrode Montage:	Ipsilateral or Contralateral Array

Marking Peaks

To accurately diagnose a condition, you must first place the applicable labels on the recently acquired recording. Peaks I to VII may be marked when recognizable follow these steps for each of the labels:

- Right click at the point of the recording where the label is to be placed.
- Select the peak to be marked (I – VII).
- Once placed, drag the top marker of the labels to the top of the peak.
- Drag the bottom marker to the valley following the peak.

The graph shows suggested label placing for an acquired signal.



Analysis

Select Print Pages or Print Page from the SmartEP main Menu to print a report of the currently displayed signals. See the SmartEP manual for other report generation options.

Since label placement is subjective, all results must be evaluated by an audiologist or medical professional trained in ABR techniques.