

## Why acquire eABR?

When fitting a patient with a new Cochlear Implant, it is necessary to obtain an objective measure of the auditory capabilities provided by the implant. An eABR measurement will provide information about adjustments to the implant, needed to bring the patient's hearing to the expected level (e.g. balancing the cochlear implant electrodes). Fitting optimization using this method is especially helpful when audiometric testing is not a viable option, such as in the case of individuals with pre-lingual deafness and/or newly implanted patients.

## What is eABR?

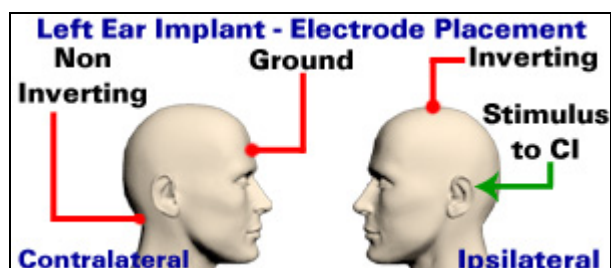
Electrical Auditory Brainstem Responses are potential differences generated when a patient's auditory brainstem is stimulated with an electrical pulse, while bypassing the tympanic membrane and outer ear. In cases where the patient has a cochlear implant, the electrical stimulation is provided directly to the implant. The potential difference originated is produced by the VIII cranial nerve and the auditory brainstem system. These potential differences can be evaluated using controlled stimulation, allowing acquisition of these differences by averaging the acquired signal over a specified period of time.

The recordings acquired will contain certain peaks and valleys. A standard eABR recording will contain three peaks, some more identifiable than others, peak V being the most prominent. The amplitudes, latencies and relationship of those peaks and valleys can be used to diagnose certain pathological conditions.

## Patient Preparation

The patient must be placed in a quiet environment, 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:

- Inverting (-) : Vertex (Cz)
- Non-Inverting (+) : Back of the Neck
- Ground: Center Forehead



When testing both ears, in a dual channel system, keep electrode placement as indicated and switch only the stimulus to the opposite side. It is recommended to switch the electrode leads at the transmitter side to the opposite channel in order to maintain referential integrity with the recording names automatically created by the system; alternatively, use Y-Adapters on both the inverting and non-inverting electrodes. Consult appropriate literature or the Cochlear Implant manufacturer documentation or your institutions regulations for further electrode placement recommendations.

## Electrode Usage

Surface electrodes are sufficient for acquiring eABR 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 setting that best fit your requirements or use the recommended settings shown on the next section:

- Connect the trigger output of the Cochlear Implant computer to the trigger input of the Universal Smart Box.

# Cochlear Implant eABR using SmartEP

- Set up the electrode montage as previously specified, or as specified by the cochlear implant manufacturer.
- Set up the cochlear implant computer stimulation options as required.
- In the SmartEP main menu, under **Stimulus > Modality**, make sure *Auditory eABR* and the appropriate option is selected; such as ECoch, ABR, MLR or LLR.
- 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 the number of sweeps to be acquired.
- When acquiring a left ear recording, set **Ear** to Left and **Mode** to Contra, and plug the electrodes to the right channel of the amplifier. Invert both settings when testing the right ear.
- Press the **Acquire** button to start. The SmartEP system will wait for the triggers to start acquisition.

Make sure to carefully select your filter settings in the EEG and Amplifier dialog box since hardware filtering cannot be undone. Note that the USB Box can be triggered using 5 Volts TTL signals with a pulse width from 100 usec. to 2 msec.

## Recommended Test Settings

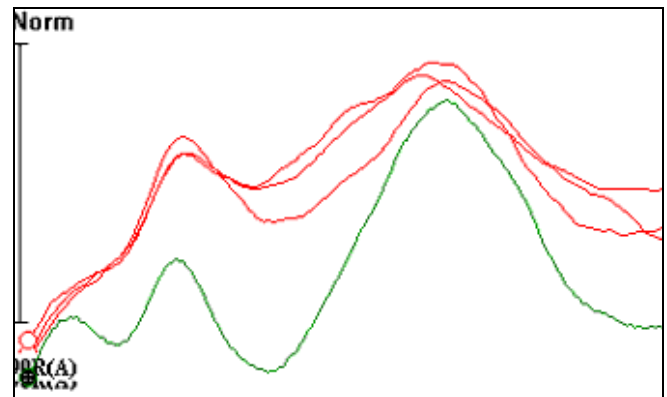
This table shows the recommended settings for eABR acquisition (ABR Mode). Some of the recommended settings may vary according to the specifications of the Implant manufacturer, please consult the appropriate literature.

<b>Stimulus:</b>	As specified by the CI computer
<b>Rate:</b>	As specified by the CI computer
<b>Polarity:</b>	As specified by the CI computer
<b>Transducers:</b>	Cochlear Implant computer
<b>Intensity:</b>	As specified by the CI computer
<b>Filters:</b>	30 – 3000 Hz (100 –3000 Hz for Adult ABR and 30-1500 Hz for an infant ABR).
<b>Notch Filter:</b>	OFF. ON if there is excessive electrical line noise present.

<b>Amplification:</b>	100x
<b>Analysis Time</b>	12.8 msec
<b>Window:</b>	
<b>Sweeps:</b>	2048 (1024 for large responses)
<b>Electrode Montage:</b>	Vertex Positive Array

## Analysis

The following shows a section of a Cochlear Implant eABR recording set acquired using the described techniques.



To accurately assess the patient, you should first place the applicable labels on the acquired recording. Peaks I to VII may be marked when recognizable, for eABR usually peaks I, III and V are used. Follow these steps for each label:

- 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.

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

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.