

## Why acquire eABR?

After 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.

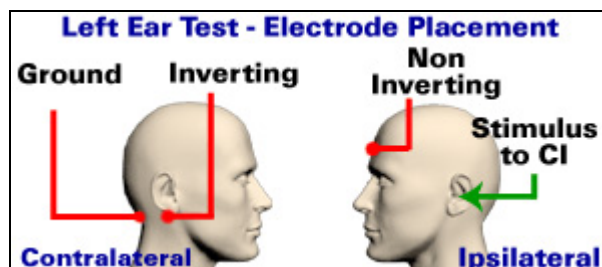
## What is eABR?

eABRs 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 by 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.

## Patient Preparation

The patient should lie 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. The following electrode montage is recommended by Advanced Bionics, (makers of Clarion®):

- Inverting (-) : Contralateral Mastoid
- Non-Inverting (+) : Forehead
- Ground: Back of the Head



When testing both ears, using a dual channel system, move the electrode leads at the transmitter side to achieve the mirrored setup.

## 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 as you would for acquisition of a normal ABR.

## Setting up SmartEP

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 Clarion SCLIN computer to the trigger input of the Universal Smart Box using the provided BNC cable. Make sure the USB box is properly connected and powered.
- Set up the Clarion computer by connecting the CPI to the computer and the Speech Processor unit to the CPI.
- Set up the electrode montage as previously specified.
- Start SCLIN. Once on the main screen, go to Utilities > Options > Objective Measures.
- Enter the eABR parameters; see the suggested values for SCLIN in the next section

# eABR - Cochlear Implant using SmartEP and NRT 3.0

- In the SmartEP main menu, under **Stimulus > Modality**, make sure *Auditory eABR* and the appropriate option is selected; in this case, ABR.
- Using the Page Parameters Menu (PP Button) change the plot begin and end times to 0 and 5 ms respectively.
- 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.
- Press the **Acquire** button to start. The SmartEP system will wait for the triggers to start acquisition.
- Start the SCLIN Stimulation set.

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. 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 on the SCLIN as provided by Advanced Bionics:

<b>Polarity:</b>	Normal.
<b>Coupling:</b>	Medial.
<b>Pulse Width:</b>	75 usec.
<b>Pulse Rate:</b>	21.1 per second.
<b>Sweeps:</b>	1000 – Clinic use. 500 – OR use.

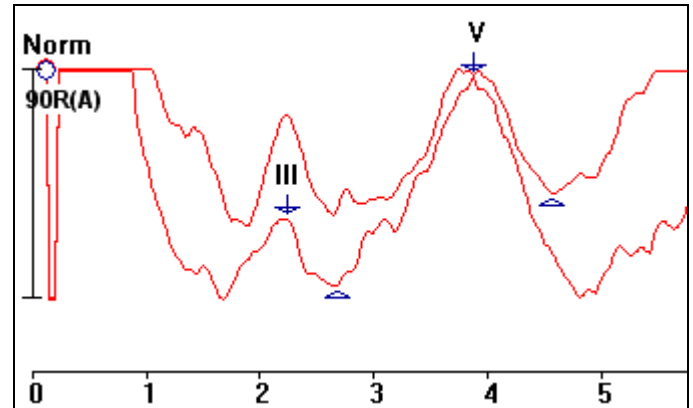
The following table shows the recommended settings for SmartEP in eABR mode:

<b>Filters:</b>	100 – 3000 Hz.
<b>Notch Filter:</b>	OFF. ON if there is excessive electrical line noise present.
<b>Amplification:</b>	100x.
<b>Analysis Time</b>	5 milliseconds.
<b>Window:</b>	

<b>Sweeps:</b>	1000 – Clinic use 500 – OR use Increase in noisy conditions.
<b>Electrode Montage:</b>	Contralateral 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. To place, right-click at the point of the recording where the label is to be placed and select the peak to be marked (I – VII). Once placed, reposition the markers as needed.

Since label placement is subjective, all results must be evaluated by an audiologist or other medical professional trained in Cochlear Implant eABR techniques. The saturation seen at the beginning of the response is expected stimulation artifact. The following table shows normal latency values for ABR and eABR recordings.

	I	II	III	IV	V
<b>ABR</b>	1.72	2.89	3.84	4.47	5.63
<b>EABR</b>	0.83	1.20	2.10	3.29	4.09

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.