

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.

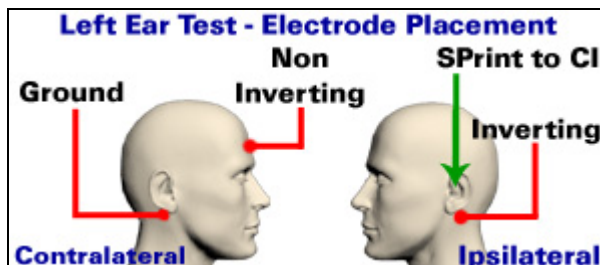
What is eABR?

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.

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:

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



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 NRT 3.0 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 NRT 3.0 computer by connecting the PCI to the computer and the Sprint unit to the PCI.
- Set up the electrode montage as previously specified.
- Start NRT and Login. Once on the main screen, press F8 to bring up the parameters screen select EABR mode and click on the button labeled "More"
- Change the RF blanking to 10000. (this step may not be necessary in later versions of NRT, consult your software documentation for details)

Nucleus Cochlear Implant eABR using SmartEP and NRT 3.0

- Enter the EABR parameters; see the suggested values in the next section
- 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 NRT Stimulation set; may need to repeat to achieve number of sweeps.

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 eABR acquisition on the NRT:

Mode:	Bipolar.
Level:	Start as T, go up in 5 CL steps.
Pulse Width:	50.
Pulse Rate:	33 or slower, do not run at multiples of 60.
Repetitions:	1000. May need to perform more than one set to achieve desired number of sweeps

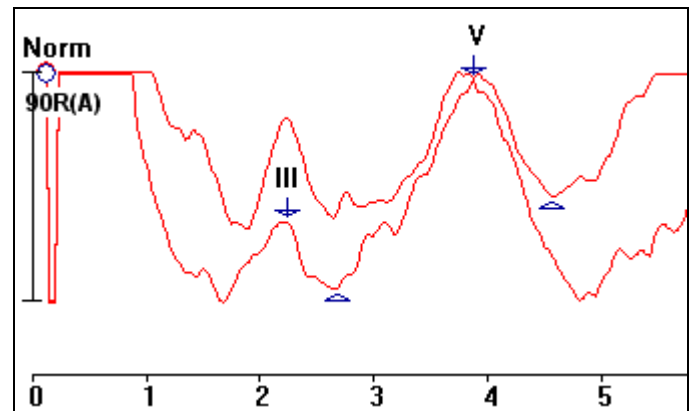
The following table shows the recommended settings for SmartEP in eABR mode:

Filters:	10 – 3000 Hz.
Notch Filter:	OFF. ON if there is excessive electrical line noise present.
Amplification:	100x.
Analysis Time	5 milliseconds.
Window:	

Sweeps:	2000 (1000 for large responses)
Electrode	Ipsilateral Array
Montage:	

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. (Data provided by Cochlear Corp.)

	I	II	III	IV	V
ABR	1.72	2.89	3.84	4.47	5.63
EABR	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.