Electrodes checking and benchmark

Here below we perform the evaluation of the quality of the different electrodes from OPENBCI

* Passive flat OPENBCI
* Passive spike
* Active with cover
* Active without cover

EVALUATION

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ELECTRODE | MEAN | STD | RMS | PeaktoPeak | SNR | PSD comments |
| Passive flat  FP1 | -0.019767142869325304 | 19.441890129953585 | 19.441900178869446 | 163.35933839670867 | 5.269960579519166 | ok |
| Passive spike  FP2 | 0.011119395900497892 | 16.92560446915362 | 16.925608121636227 | 149.47619372305923 | 4.305468700433664 | ok |
| Active cover | 1.9503003998366368 | 41.05378283425904 | 41.10008219763198 | 183.25825342366613 | 9.834275567629435 | ok |
| Active without cover | 0.3070676231741368 | 41.26533979035388 | 41.26648226513334 | 182.16647383336698 | 10.7277988060442 |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

***UPDATE SNR is not a good metric, because we can not separate the noise from the good dataas it is real signal***

1. **Active without cover** (SNR ≈ 10.7 dB)
2. **Active with cover** (SNR ≈ 9.8 dB)
3. **Passive flat (FP1)** (SNR ≈ 5.3 dB)
4. **Passive spike (FP2)** (SNR ≈ 4.3 dB)

5 neoxa

* 5 reference kits
* 25 electrodes
* 5 boards cyton

SPECS

The ThinkPulse™ EEG sensor, developed by Conscious Labs, is an active dry electrode designed for long-term electroencephalographic (EEG) recording through hair, without the use of conductive gels.

The sensor consists of three primary components:

* **Dry Polymer Comb Disk:**  
  A scalp-contacting disk made from conductive polymer. Its comb-like design allows it to bypass hair and establish direct skin contact.
* **Embedded Active Circuit:**  
  Includes an impedance-matching **amplifier circuit** that amplifies the EEG signal at the source. This minimizes signal loss due to impedance mismatches with the acquisition system.
* **Shielded Cable with 2.54 mm Dupont Connector:**  
  Reduces electromagnetic noise and ensures clean signal transmission.

### **Electrical Characteristics**

* **Input Impedance:** 10 MΩ
* **Power Supply:**
  + V+ (Red): +2.5 V
  + V– (Black): –2.5 V
* **Output (White):** Vout – EEG analog signal output

The embedded circuit includes a body-safe resistor, a decoupling resistor, and a stabilizing capacitor for power regulation and safety. It is compatible with standard analog front ends for EEG acquisition.

TRIAL 29 APRIL

Test open eyes and eyes closed, the following electrodes are tested:

Af7 1

Fp1 2

Fp2 4

Af8 3

The reference and the ground are positioned on the front

SIGNAL TO NOISE RATIO

<https://psychology.stackexchange.com/questions/8930/how-is-the-signal-to-noise-ratio-of-an-event-related-potential-measured#:~:text=So%20SNR%20%3D%20signal%2Fnoise.,ERPamplitude%20%2F%20NOISEamplitude>).

<https://neuroimage.usc.edu/forums/t/compute-snr-in-eeg/19800>