CFM
Olympic Brainz Monitor

A CEREBRAL FUNCTION MONITOR

PATTERN RECOGNITION: QUICK REFERENCE GUIDE

Overview of the Olympic Brainz Monitor

This quick guide is for reference purposes only. Interpretation of the patterns must be performed by a qualified clinician.

The Olympic Brainz Monitor is a cerebral function monitor (CFM) utilizing EEG signals from either 2 or 4 active electrodes placed on the infant's head and one ground electrode placed on the infant's torso. The EEG signal(s) are filtered, rectified, compressed and displayed using an internal algorithm focusing on changes in peak to peak EEG amplitude. This process builds the amplitude-integrated electroencephalogram or aEEG trace. The resultant aEEG trace reveals where the infant's brain is spending the majority of its time in terms of microvoltage and creates repeatable and recognizable patterns. The patterns are then assessed and categorized based on the upper and lower margin microvoltage, presence or absence of sleep wake cycling, bandwidth variability, lower margin variability, and the presence or absence of seizure activity.

It is recommended that clinicians always view the raw EEG to validate what is seen within the aEEG pattern.

General Trace Interpretation Definitions

aEEG traces are categorized according to background brain activity patterns and seizure activity patterns. The following basic definitions will assist with trace pattern identification:

Upper and Lower Margin – Top and bottom borders of the central band of the trace, measured in microvoltage (μV)

Sleep/Wake Cycling (SWC) – Present or Absent

- Smooth sinusoidal variations, mostly in the lower margin
- Broader trace bandwidth representing discontinuous background activity during quiet sleep
- Narrow bandwidth corresponding to more continuous activity during wakefulness and active sleep
- Cycle duration > 20 minutes
- Total SWC ~60-90 minutes

Bandwidth Variability – Limited, Increased, or Greatly Reduced

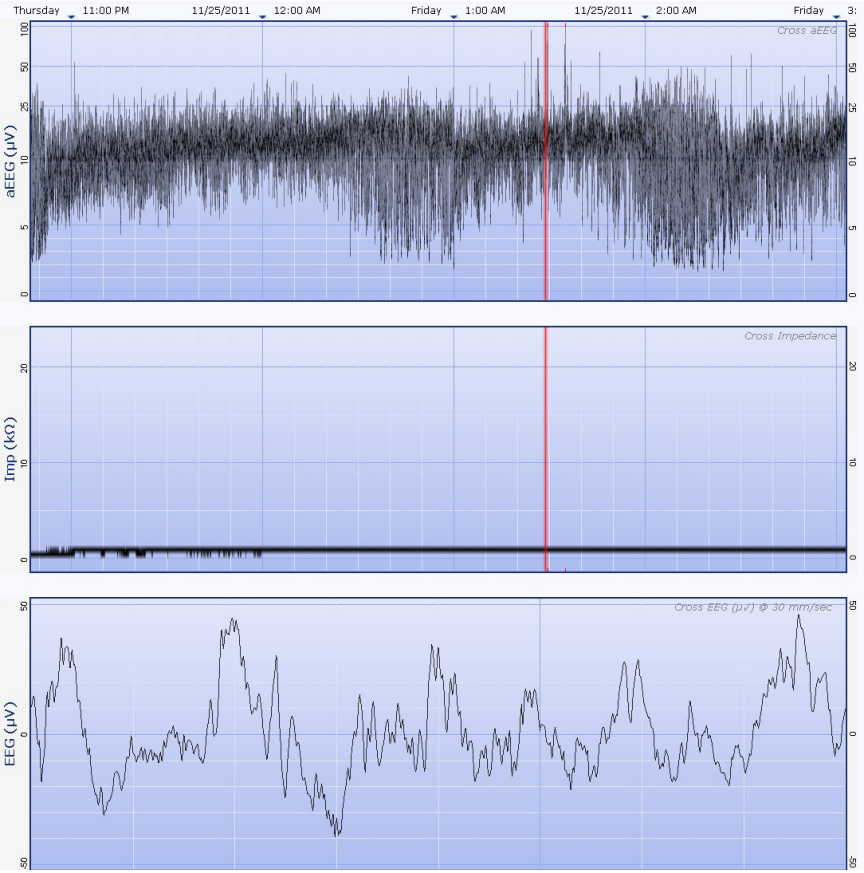
- Limited bandwidth variability may be indicative of organized/continuous brain activity at higher voltages or severe brain injury at lower voltages
- Increased bandwidth variability may be indicative of discontinuous brain activity
- Greatly reduced bandwidth variability may be indicative of poor background activity, especially when both the upper and lower margin are < 5 μV

Lower Margin Variability – Present or Absent

- Wavy lower margin = variability present
- Straight/flat lower margin = variability absent
- Lower margin variability may be the determining factor between a discontinuous and burst suppression trace

aEEG Trace Pattern Examples

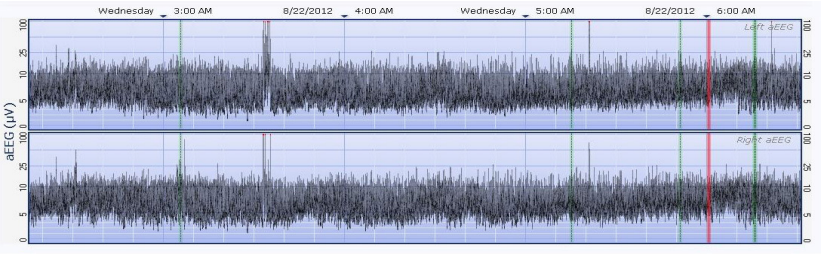
Continuous Normal Voltage (CNV)

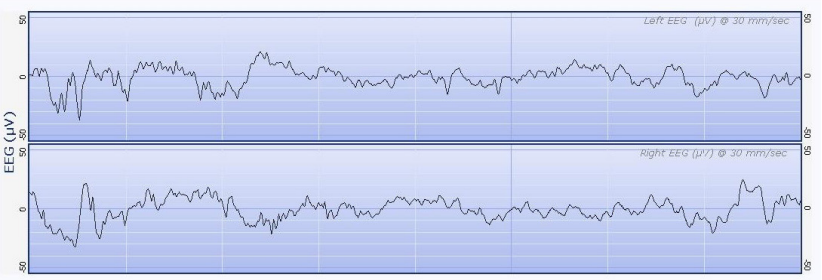


The CNV trace is a narrow, wavy trace meeting the defined µV criteria.

- Lower margin > 5 µV (generally between 7-10 µV)
- Upper margin > 10 µV (generally between 10-25 µV)
- SWC present
- Bandwidth variability is limited – generally between 5-15 µV
- Lower margin variability is present – the lower margin is wavy

Discontinuous Normal Voltage (DNV)

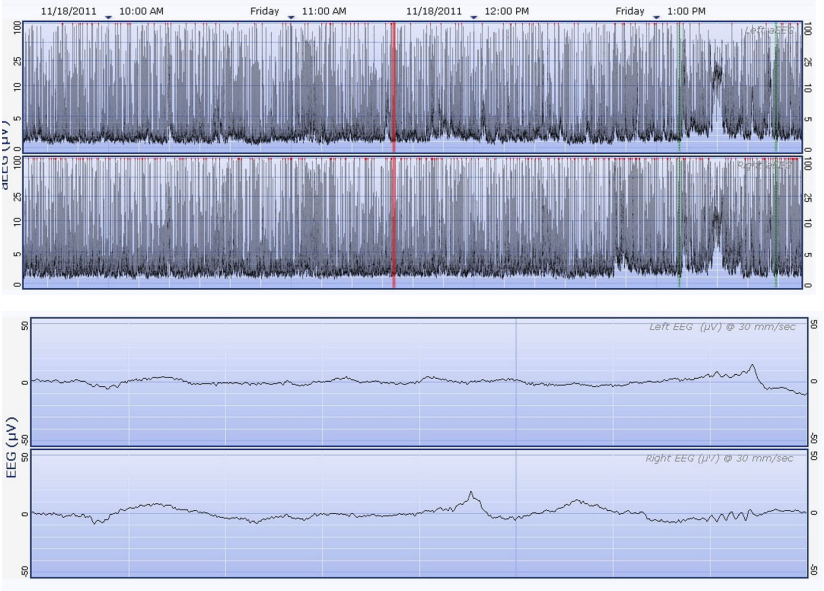




The DNV trace is a wide banded pattern that appears universally gray. The widened trace indicates increased variability in background brain activity due to intermittent levels of lower activity.

- Lower margin < 5 µV
- Upper margin > 10 µV
- SWC absent
- Bandwidth variability is increased – generally > 25 µV
- Lower margin variability is present – the lower margin is wavy

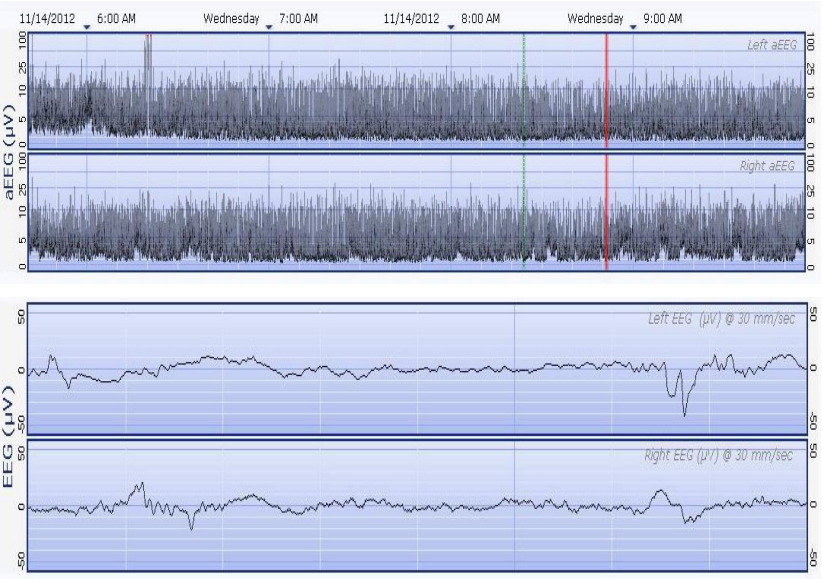
Burst Suppression (BS)



The BS pattern is indicative of the brain going through bursts of brain activity followed by periods of suppression which can be referred to as the interburst interval (IBI – the time between bursts of activity).

- Lower margin < 5 µV
- Upper margin > 10 µV
- SWC absent
- Bandwidth variability is increased – generally > 25 µV
- Lower margin variability is absent – the lower margin is flat
- As the interburst interval (IBI) increases, the trace takes the shape of a fine tooth comb
- A dark band appears on the lower portion of the trace between 0 µV and 3-4 µV

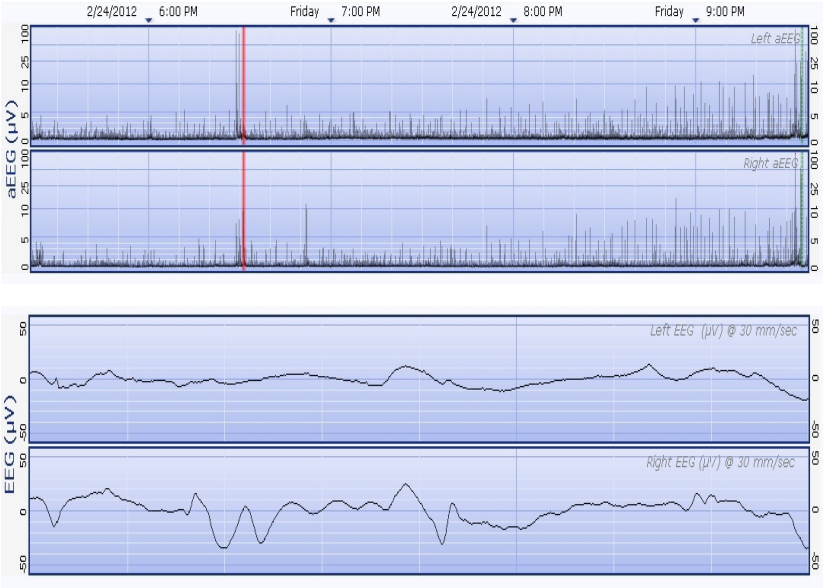
Continuous Low Voltage (CLV)



The CLV pattern is indicative of the brain spending the majority of its activity in the very low voltage range.

- Lower margin < 5 µV
- Upper margin < 10 µV
- SWC absent
- Bandwidth variability is limited – generally between 4-8 µV
- Lower margin variability is absent – the lower margin is flat

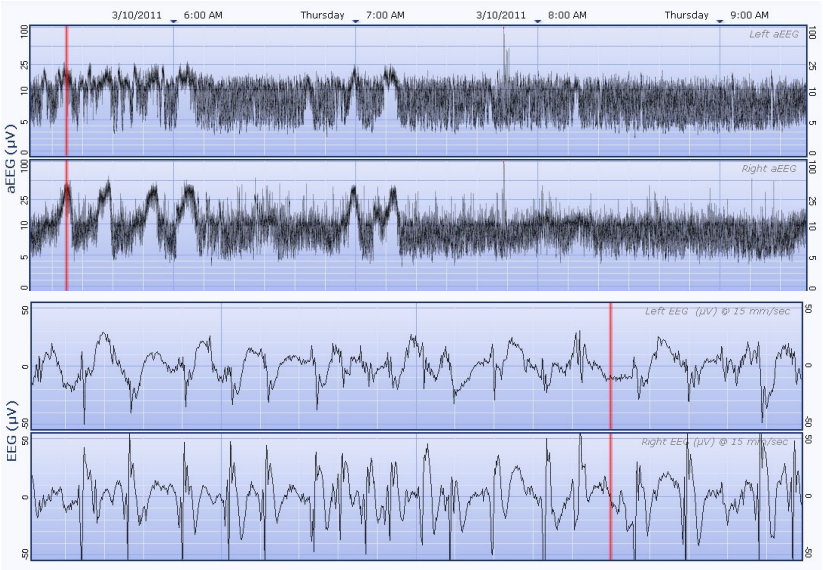
Inactive, Flat Trace (FT)



The FT pattern could be indicative of the brain spending nearly all of its time with extremely low or no µV activity.

- Lower margin < 5 µV
- Upper margin < 5 µV
- SWC absent
- Bandwidth variability is greatly reduced – generally between 1-2 µV
- Lower margin variability is absent – the lower margin is flat

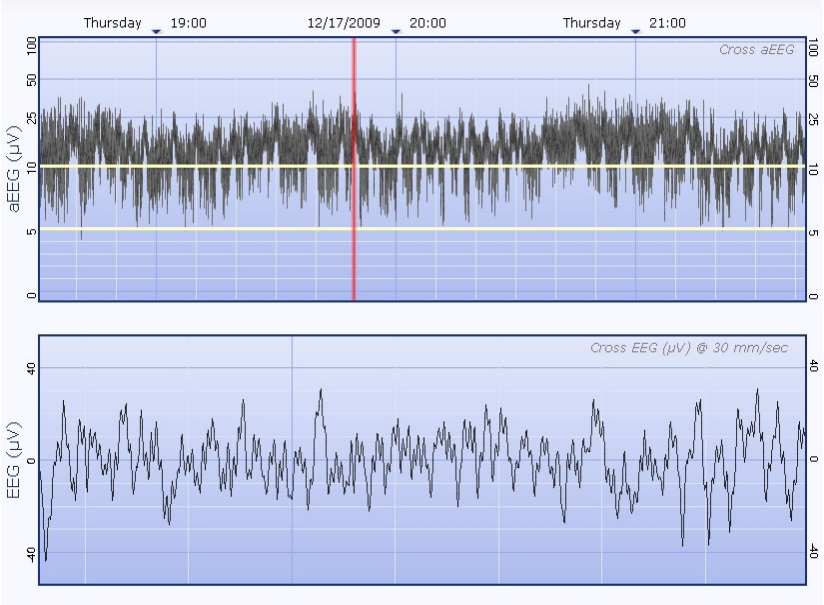
Seizures (Sz)



Categorized by a sudden rise in the lower margin sometimes accompanied by a rise in the upper margin

- Often appear as rhythmic discharges on the raw EEG

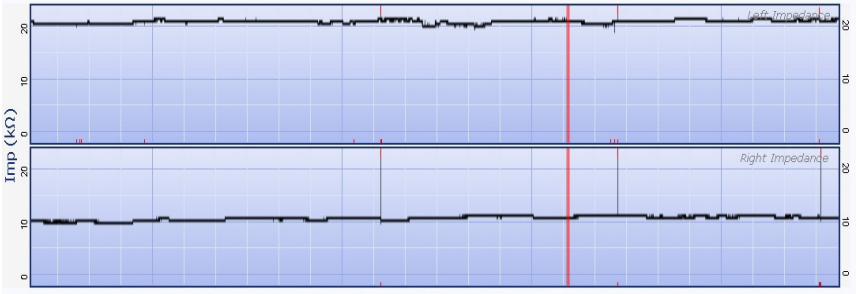
Status Epilepticus



- Continuous unremitting seizures > 30 minutes in duration
- Recurrent seizures, without regaining consciousness between seizures for > 30 minutes
- Often appears as a saw tooth pattern on aEEG

Impedance

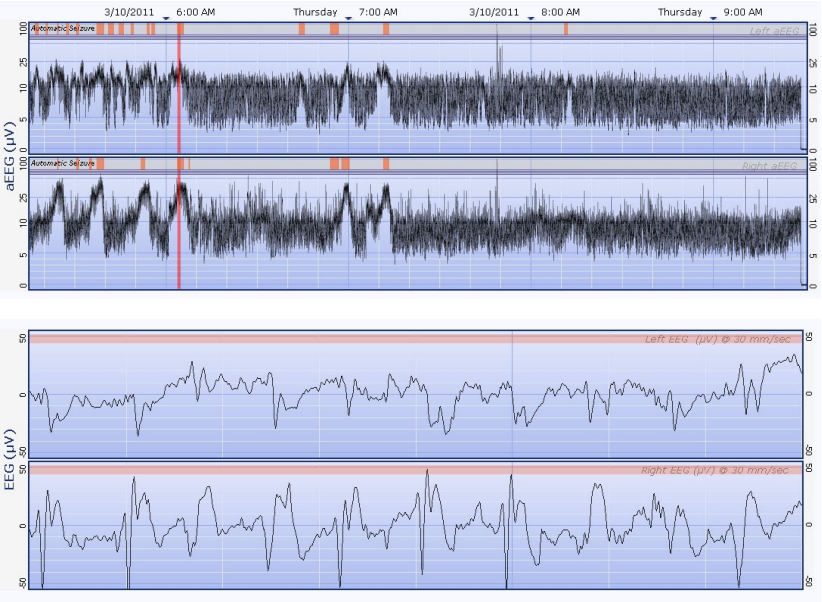
Impedance is a measure of electrode connectivity. Maintaining a lower impedance (as close to zero as possible) provides the best quality of EEG and aEEG. High impedance conditions may be caused by poor electrode contact, electrical/mechanical noise, or other factors, which in turn can alter the appearance of the aEEG Trace. The screen capture below shows a recording with very high impedance on the left side and moderately high impedance on the right side.



The default setting of the Olympic Brainz Monitor CFM high impedance notification is set to > 20kΩ, however this setting can be altered to accommodate clinicians preferences.

Automatic Detectors

The Olympic Brainz Monitor CFM provides the option of a separate software-based clinical seizure detector. The seizure detection option (OBM00092) provides clinicians with automatic detection of suspected seizure activity (the light orange highlighted area above the aEEG trace) to draw attention to specific areas of the study for review. The Olympic Brainz Monitor does not provide any diagnostic capability.



Cerebral Function Monitoring - Troubleshooting

Common factors that impact the aEEG trace

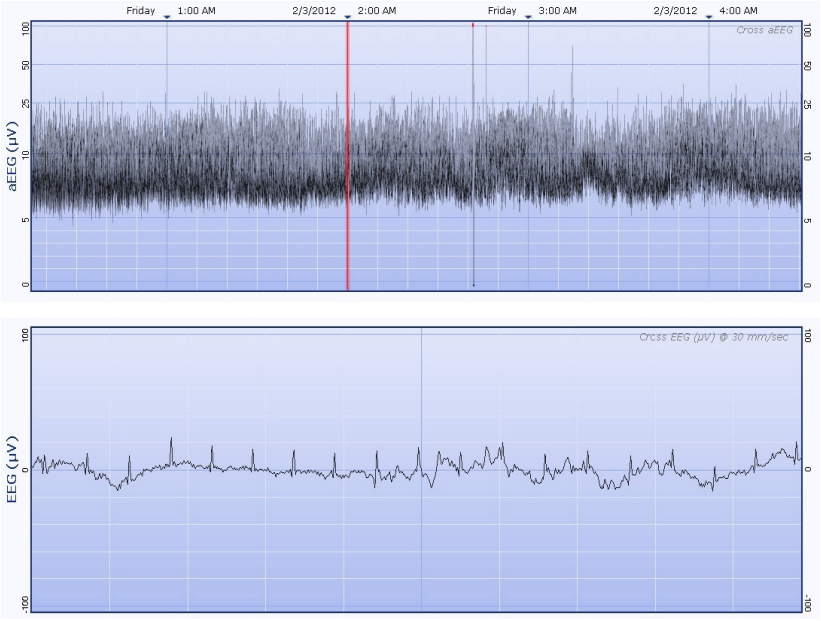
- Background pattern appears erratic or extremely elevated – Possible causes:
  - ECG artifact (lower margin appears elevated)
  - Handling/patting
  - Muscle activity/infant movement
  - High-frequency ventilation
  - Status epilepticus
  - Gasp artifact

- Background pattern appears unusually dampened or depressed – amoung possible causes:
  - Severe scalp edema
  - Electrodes placed significantly too close together
  - Significant sedation

Tips to insure quality aEEG trace(s)

- Carefully prepare skin and place electrodes according to 10/20 positioning and always check impedance levels
- Properly place and label markers for any care/procedures, concerning movements and specific medications
- Review the raw EEG display to evaluate for artifact that may falsely elevate the aEEG baseline and help in positively identifying seizure activity

Example of ECG Artifact



ECG and other causes of artifact may elevate the lower margin beyond the level of the actual brain activity. In the example above, the aEEG is elevated due to the peak to peak voltage of the electricity/contractility of the heart (ECG artifact).

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