Automatic Clinical Report

Braintrain.ir

Quantitative EEG Analyses

PATIENT INFORMATION

Name:
EEG ID: **EC_**
Age: **17.10**
Gender: **Male**
Handedness:
Eyes: **Closed**

RECORDING

Date: **10/29/2024**
Ref. By:
Test Site:
Analysis Length: **01:17**
Ave. SH Reliability: **0.98**
Ave. TRT Reliability: **0.95**

MEDICATION:

HISTORY BY REFERRING CLINICIAN:

QEEG Impression

SUMMARY: **The qEEG analyses were abnormal and showed dysregulation in bilateral frontal lobes - especially in the right frontal lobe, bilateral parietal lobes - especially in the left parietal lobe, and bilateral occipital lobes - especially in the right occipital lobe. LORETA showed dysregulation in the left supramarginal gyrus, right occipital lobe, and right posterior cingulate gyrus. The frontal lobes are involved in executive functioning, abstract thinking, expressive language, sequential planning, mood control, and social skills. The parietal lobes are involved in visual-spatial information processing, short-term memory, executive attention, receptive language on the left, and empathy control and awareness of emotional expression in others on the right (e.g., prosody). The occipital lobes are involved in the visual processing of color, form, movement, visual perception, and spatial processing. The posterior cingulate gyrus is involved in spatial memory, autobiographical memory, salience and attention control by regulation of limbic emotional and memory input to the hippocampus and neocortex. To the extent there is deviation from normal electrical patterns in these structures, then sub-optimal functioning is expected.**

Detailed Narrative

LINKED EARS: **The Linked Ears power spectral analyses were deviant from normal with excessive power in bilateral frontal regions - especially in the right frontal region from 11 - 12 Hz. Excessive power was present in bilateral parietal regions - especially in the midline parietal region from 11 - 13 Hz and 22 - 23 Hz. Excessive power was also present in bilateral occipital regions - especially in the right occipital region at 11 Hz and 21 - 23 Hz.**

SURFACE LAPLACIAN: **The Laplacian power spectral analyses were deviant from normal with excessive power in the left frontal region at 11 Hz. Excessive power was present in bilateral parietal regions - especially in the left parietal region from 11 - 13 Hz and 22 Hz. Excessive power was also present in bilateral occipital regions - especially in the right occipital region from 11 - 12 Hz and 21 - 22 Hz.**

NEUROIMAGING: **LORETA 3-dimensional source analyses were consistent with the surface EEG and showed elevated current sources in the left supramarginal gyrus with a maximum at 11 Hz (Brodmann Area 7). Elevated LORETA current source was present in the left supramarginal gyrus with a maximum at 12 Hz (Brodmann Area 7). Elevated LORETA current source was present in the right occipital lobe with a maximum at 21 Hz (Brodmann Area 17). Elevated LORETA current source was present in the right occipital lobe with a maximum at 22 Hz (Brodmann Area 17). Elevated LORETA current source also was present in the right posterior cingulate gyrus with a maximum at 23 Hz (Brodmann Area 31).**

CONNECTIVITY ANALYSES: **EEG amplitude asymmetry, coherence and phase were deviant from normal, especially in frontal, temporal, parietal and occipital relations. Elevated coherence was present in frontal, temporal and occipital regions which indicates reduced functional differentiation. Reduced coherence was present in frontal, temporal, parietal and occipital regions which indicates reduced functional connectivity. Both conditions are often related to reduced speed and efficiency of information processing.**

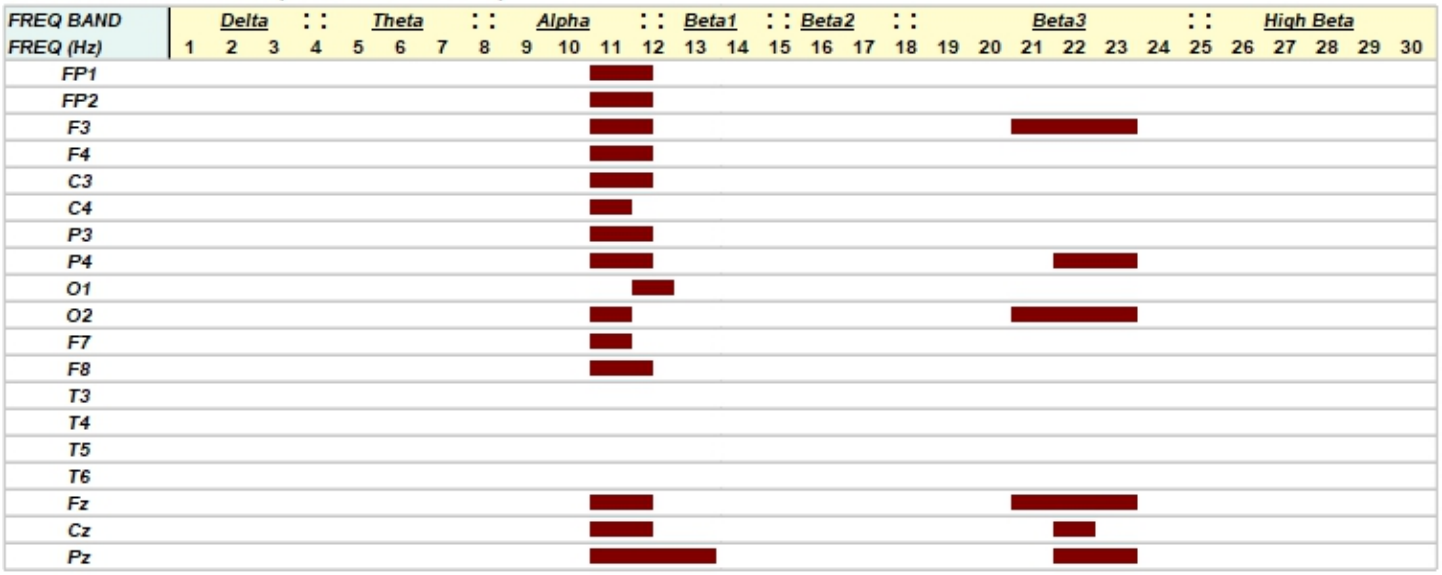
DISCRIMINANT ANALYSES: **The mild head injury discriminant function detected a pattern in the EEG that is commonly present in individuals with a history of mild traumatic brain injury.**
The learning disability discriminant function detected a pattern in the EEG that is commonly present in individuals with a history of general academic problems. The brain performance index (BPI) predicted an above average capacity to efficiently allocate neural resources with a balanced prediction for performance I.Q. and verbal I.Q. The BPI was not designed to replace neuropsychological testing but rather is a measure of the general health of the brain and the degree to which neural resources are efficiently allocated.

CONCUSSION INDEX: **The Concussion Index was good.**

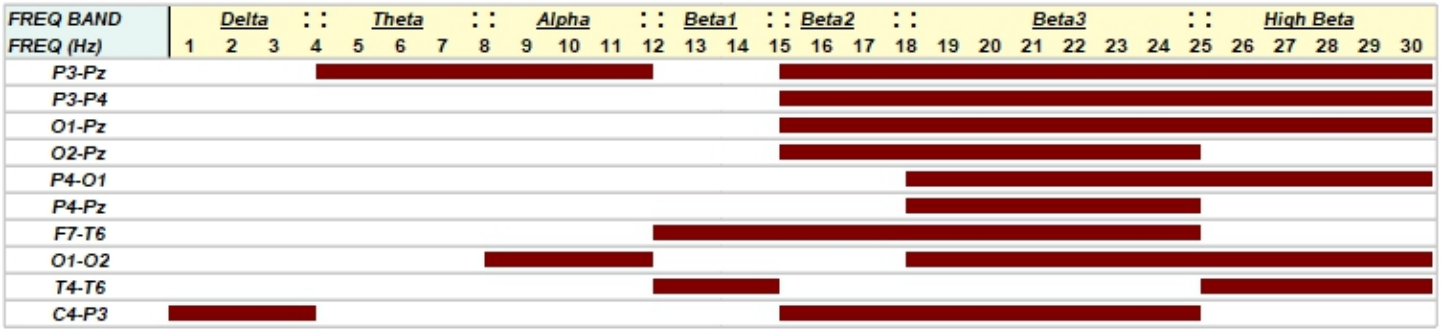
BRAIN FUNCTION INDEX: **The Brain Function Index was moderate at 3.82.**

General Neurofeedback Recommendations

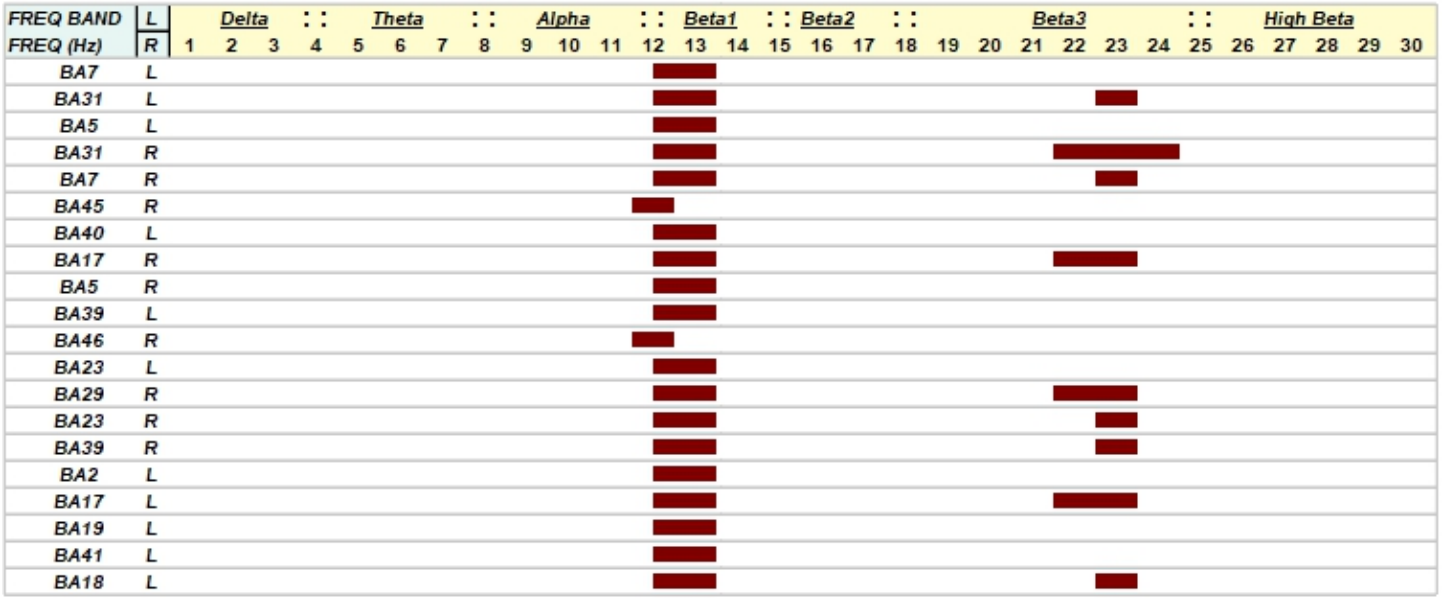
Surface Neurofeedback: (move towards Z = 0)



Coherence Neurofeedback: (move towards Z = 0)



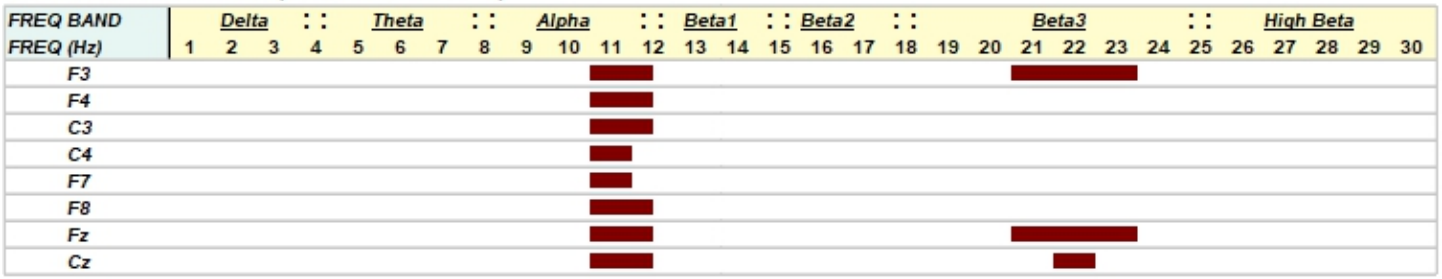
Loreta Neurofeedback: (move towards Z = 0)



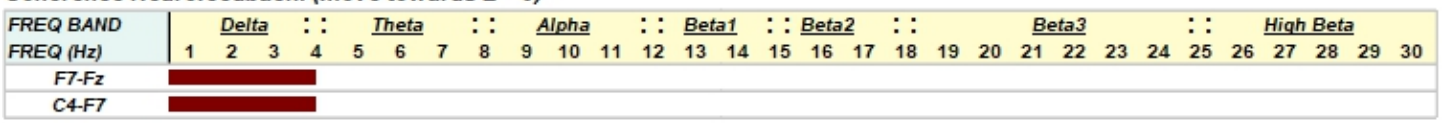
The implications for neurotherapy are offered based upon the clinical evaluation of the patient as well as the reference data base results. These suggestions for neurotherapy should be evaluated with caution and should only be considered as possible strategies that the clinician may have considered in his/her evaluation. If the patient is depressed, then the clinician should consider treating this condition first through alpha frequency enhancement or some other biofeedback protocol that may reduce depression. If depression or poor mood and/or motivation is not a problem then the clinician may consider using one or more strategies with the priority of treatment in the order presented above.

Addiction/Reward Network Recommendations

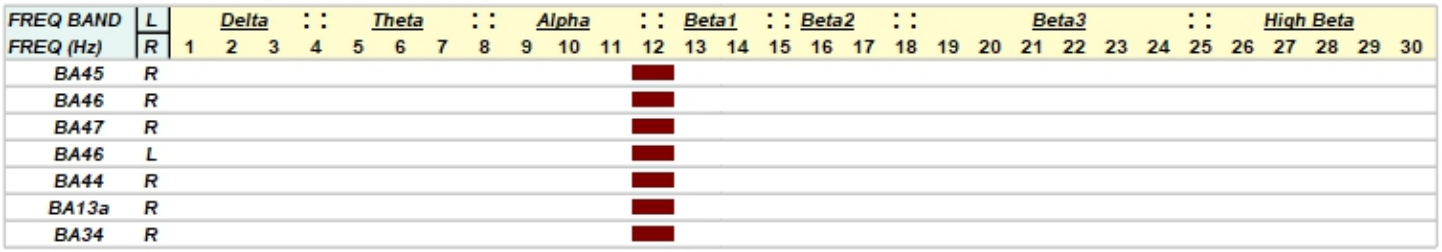
Surface Neurofeedback: (move towards Z = 0)



Coherence Neurofeedback: (move towards Z = 0)



Loreta Neurofeedback: (move towards Z = 0)

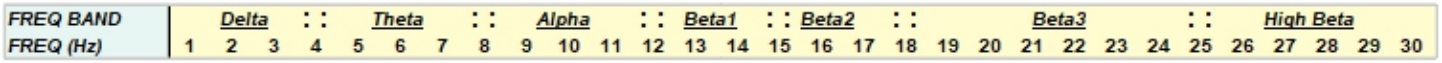


Anxiety Network Recommendations

Surface Neurofeedback: (move towards Z = 0)

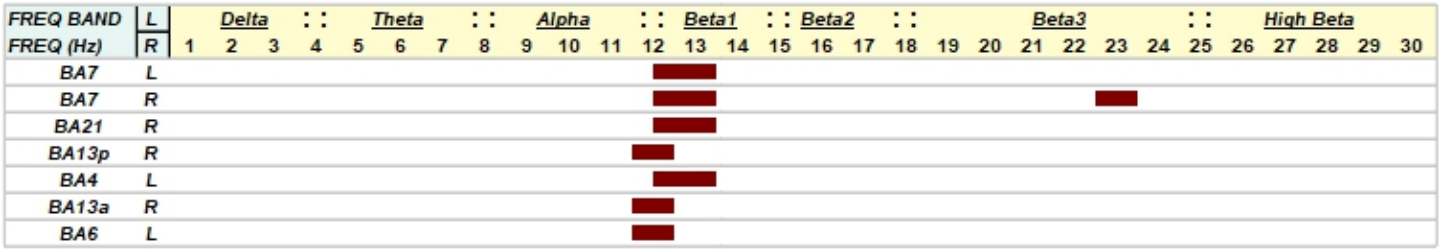


Coherence Neurofeedback: (move towards Z = 0)



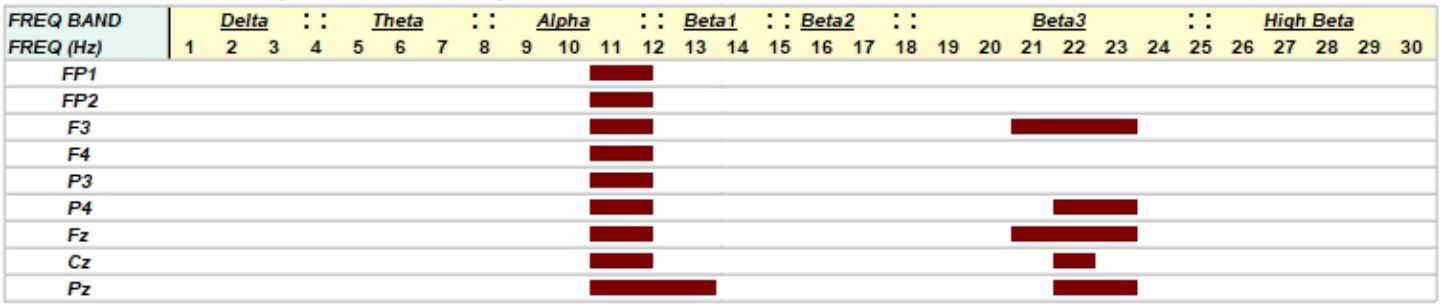
None reached Z score threshold.

Loreta Neurofeedback: (move towards Z = 0)

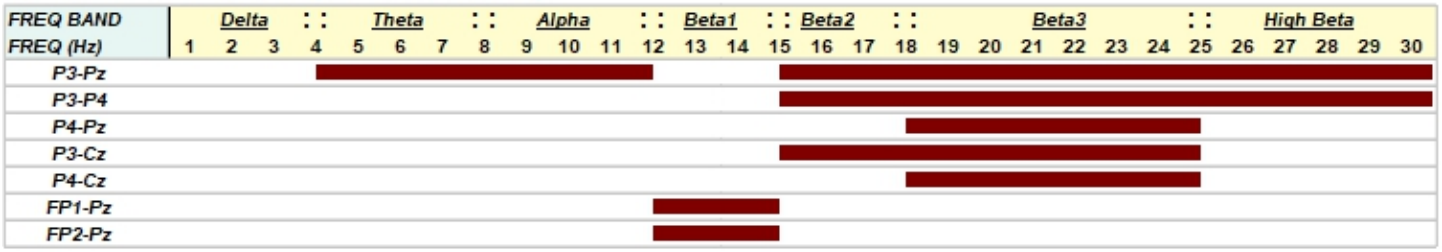


Attention Network Recommendations

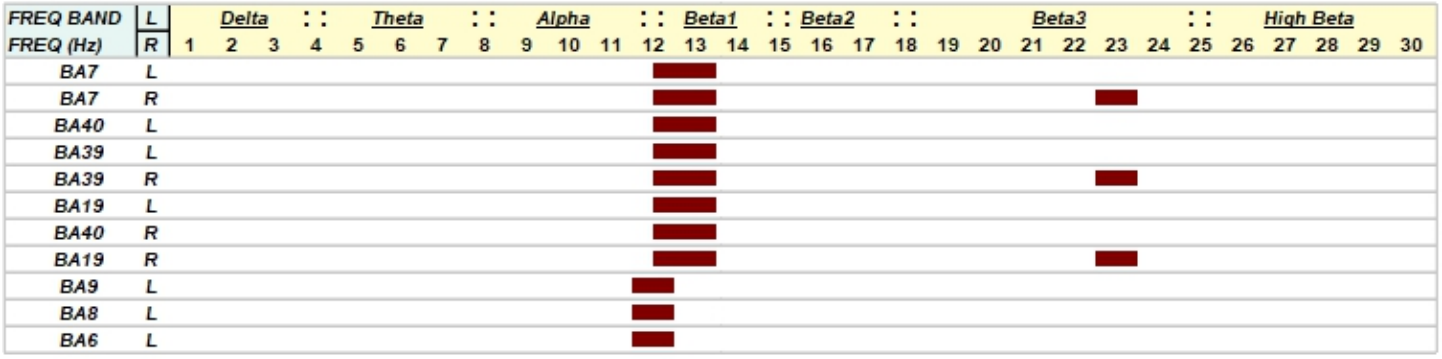
Surface Neurofeedback: (move towards Z = 0)



Coherence Neurofeedback: (move towards Z = 0)

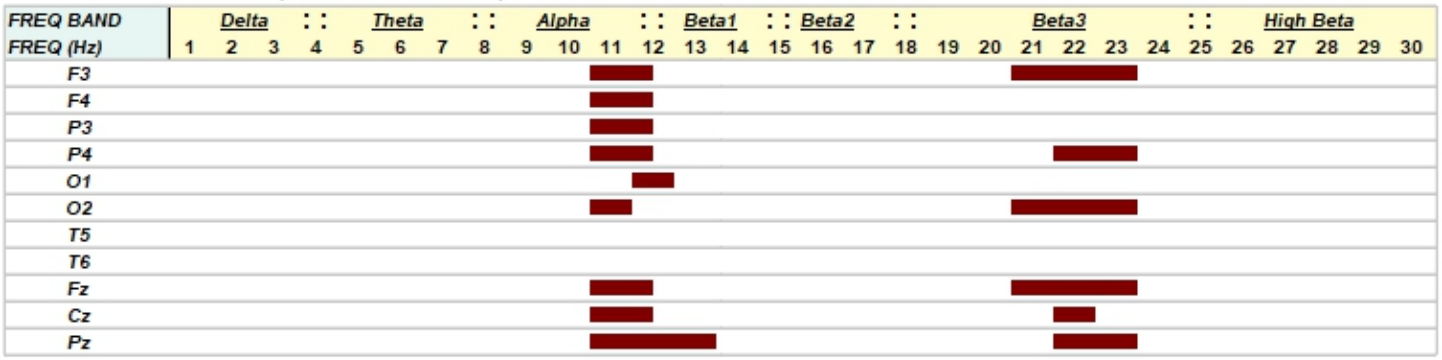


Loreta Neurofeedback: (move towards Z = 0)

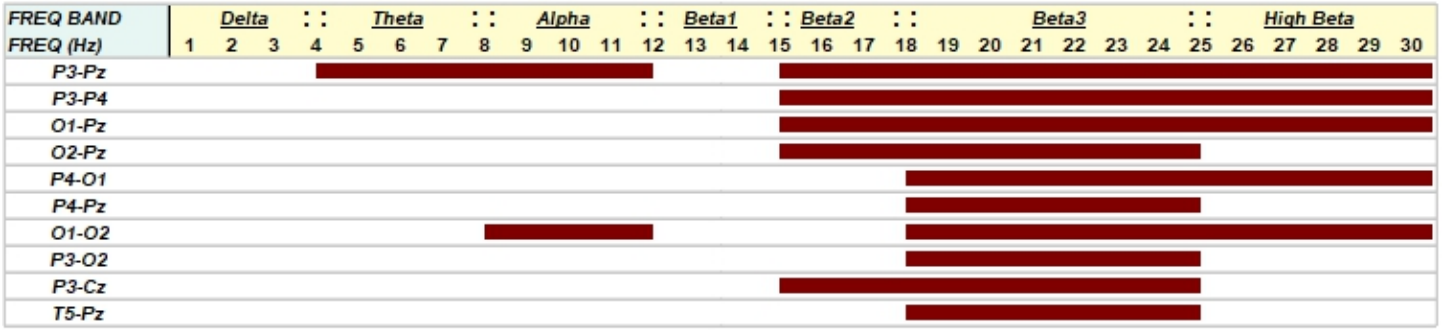


Default Mode Network Recommendations

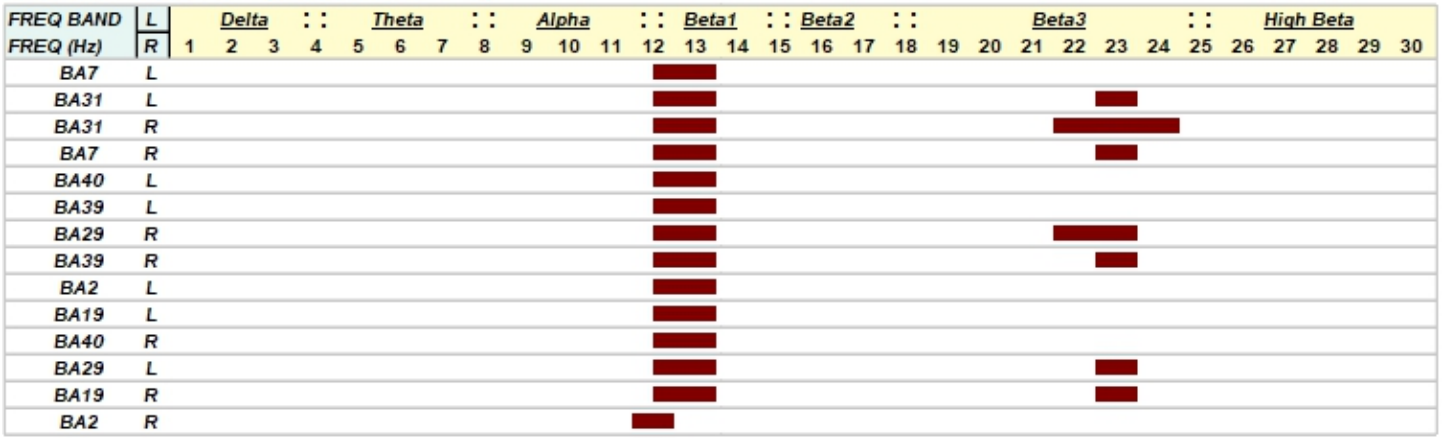
Surface Neurofeedback: (move towards Z = 0)



Coherence Neurofeedback: (move towards Z = 0)

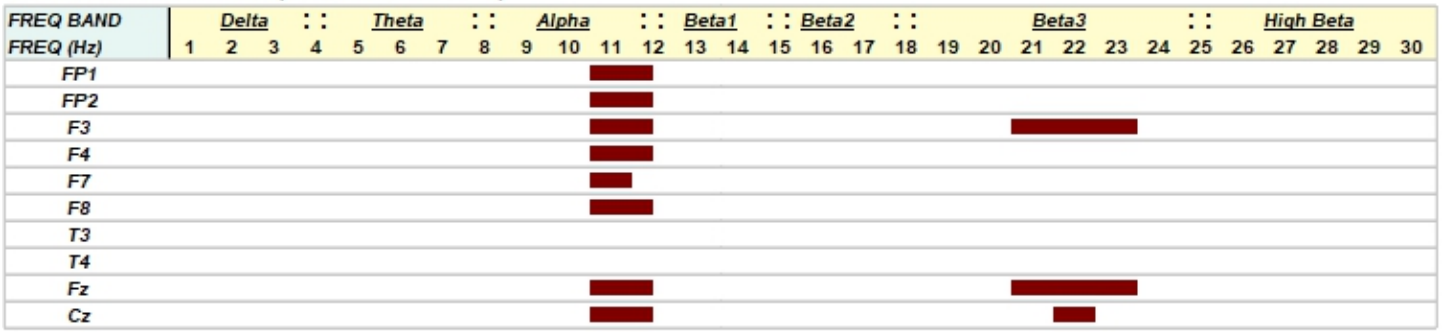


Loreta Neurofeedback: (move towards Z = 0)

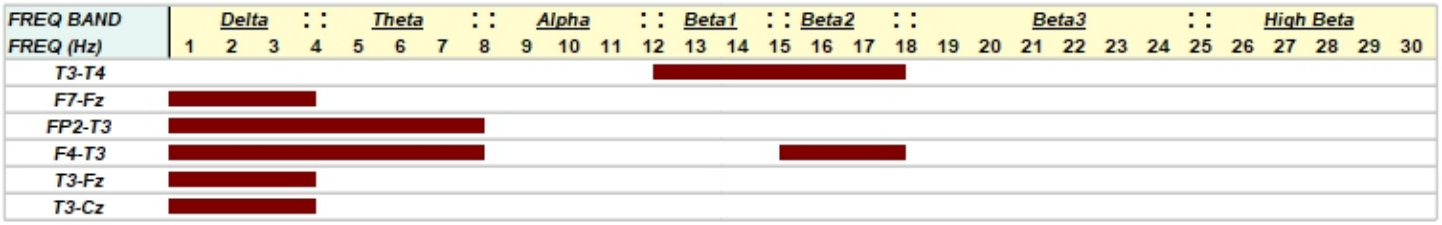


Mood Network Recommendations

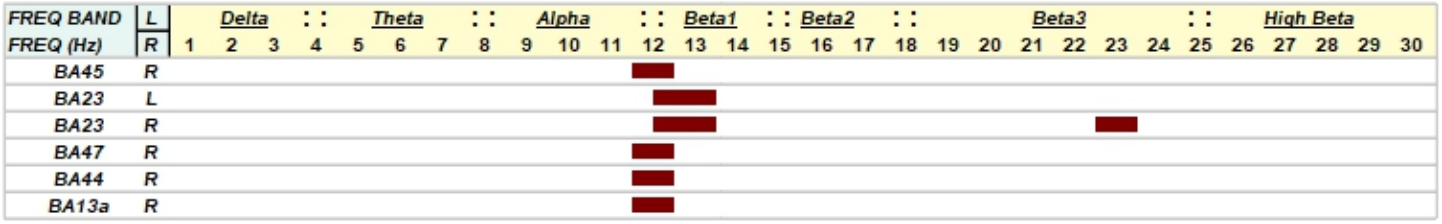
Surface Neurofeedback: (move towards Z = 0)



Coherence Neurofeedback: (move towards Z = 0)

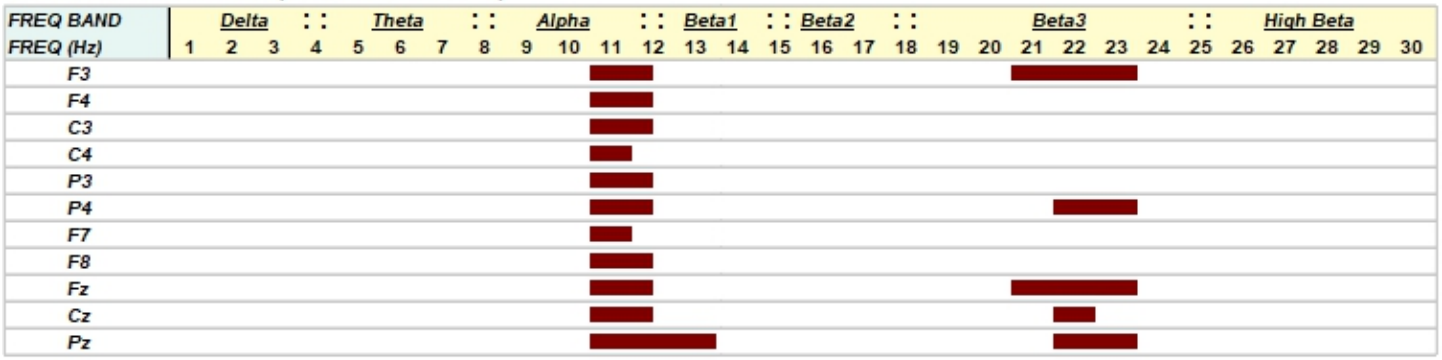


Loreta Neurofeedback: (move towards Z = 0)

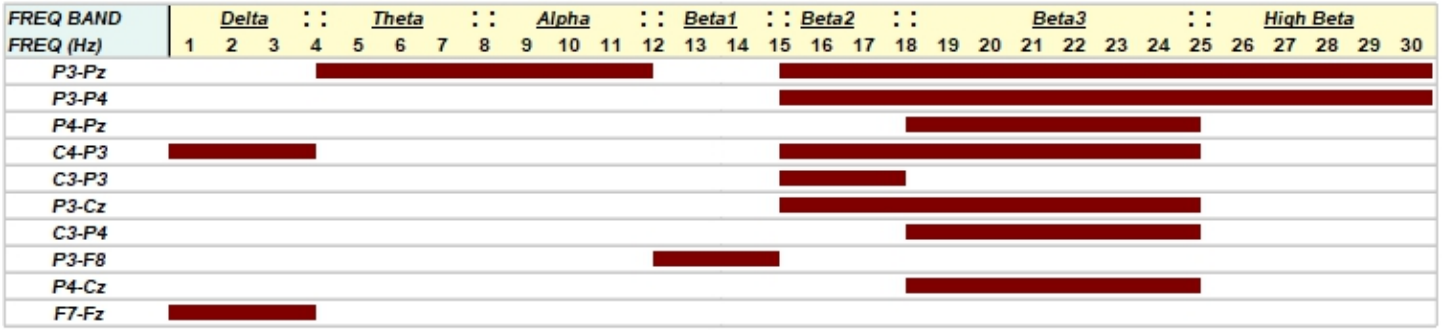


Executive Function Network Recommendations

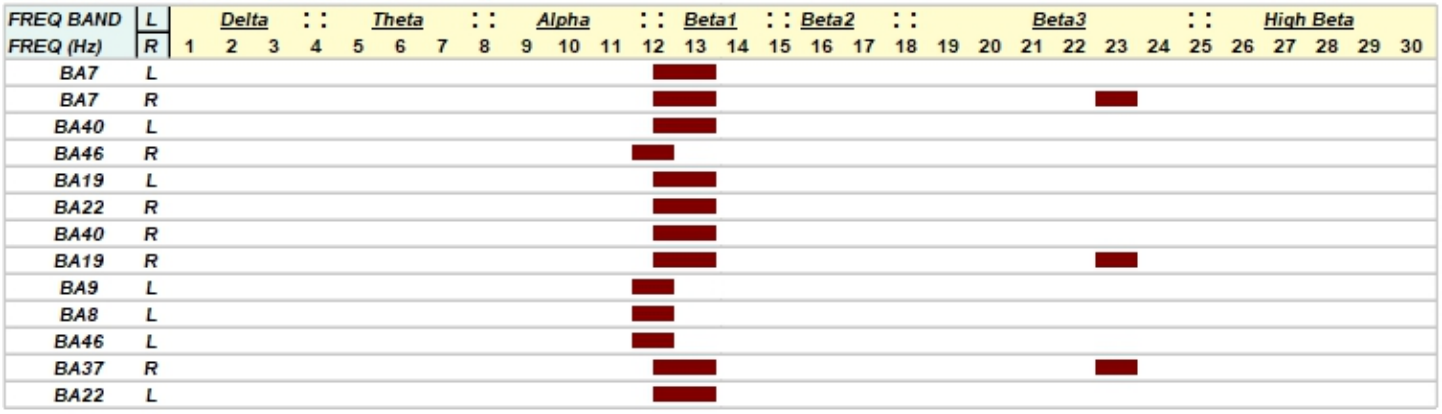
Surface Neurofeedback: (move towards Z = 0)



Coherence Neurofeedback: (move towards Z = 0)



Loreta Neurofeedback: (move towards Z = 0)



Memory Network Recommendations

Surface Neurofeedback: (move towards Z = 0)

FREQ BAND	Delta			Theta				Alpha				Beta1			Beta2				Beta3							High Beta					
FREQ (Hz)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30

None reached Z score threshold.

Coherence Neurofeedback: (move towards Z = 0)

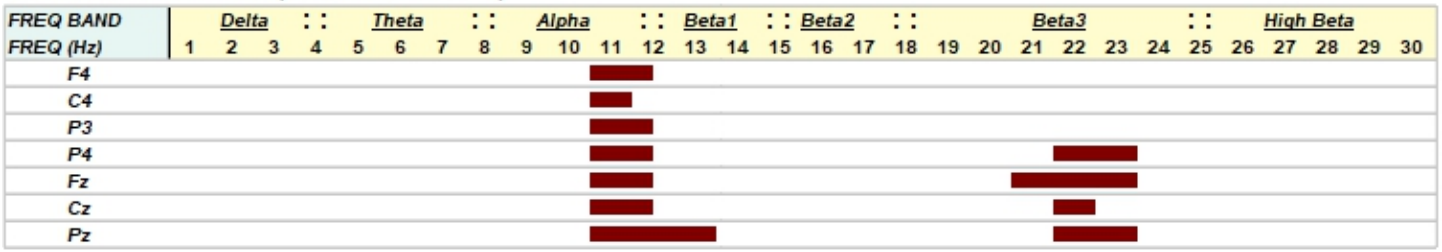
FREQ BAND	Delta			Theta				Alpha				Beta1			Beta2				Beta3							High Beta					
FREQ (Hz)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
T4-T6												■	■	■											■	■	■	■	■	■
T3-T4												■	■	■	■	■	■	■													
T3-T6								■	■	■	■	■	■	■	■	■	■	■													

Loreta Neurofeedback: (move towards Z = 0)

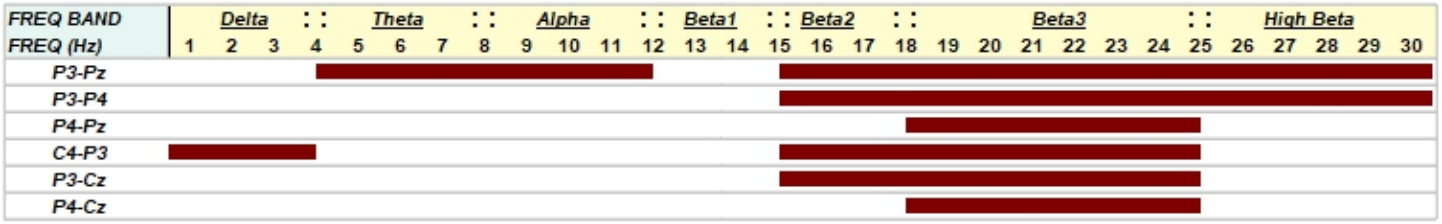
FREQ BAND	L	Delta			Theta				Alpha				Beta1			Beta2				Beta3							High Beta					
FREQ (Hz)	R	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
BA36	R												■																		
BA34	R												■																		
BA28	R												■																		

Pain Network Recommendations

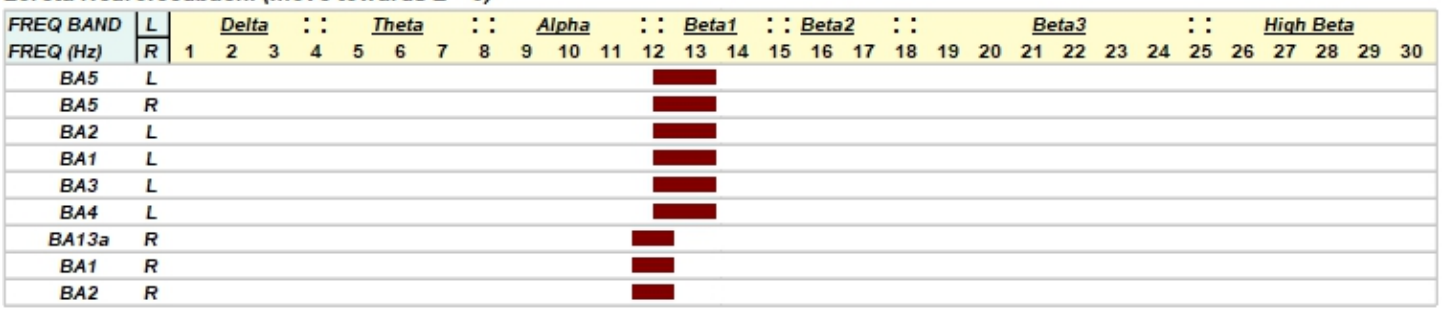
Surface Neurofeedback: (move towards Z = 0)



Coherence Neurofeedback: (move towards Z = 0)

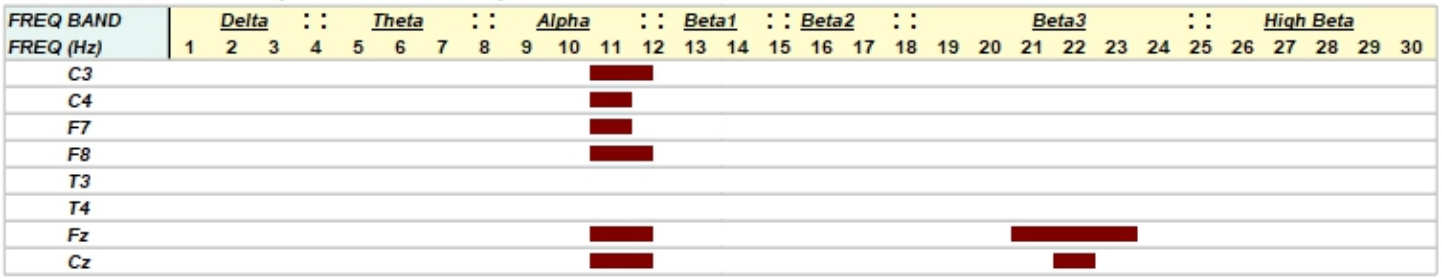


Loreta Neurofeedback: (move towards Z = 0)

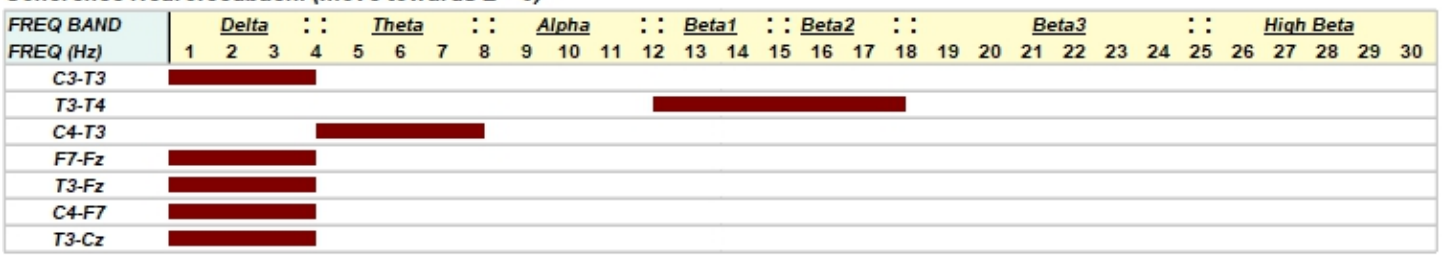


Mirror Neuron Network Recommendations

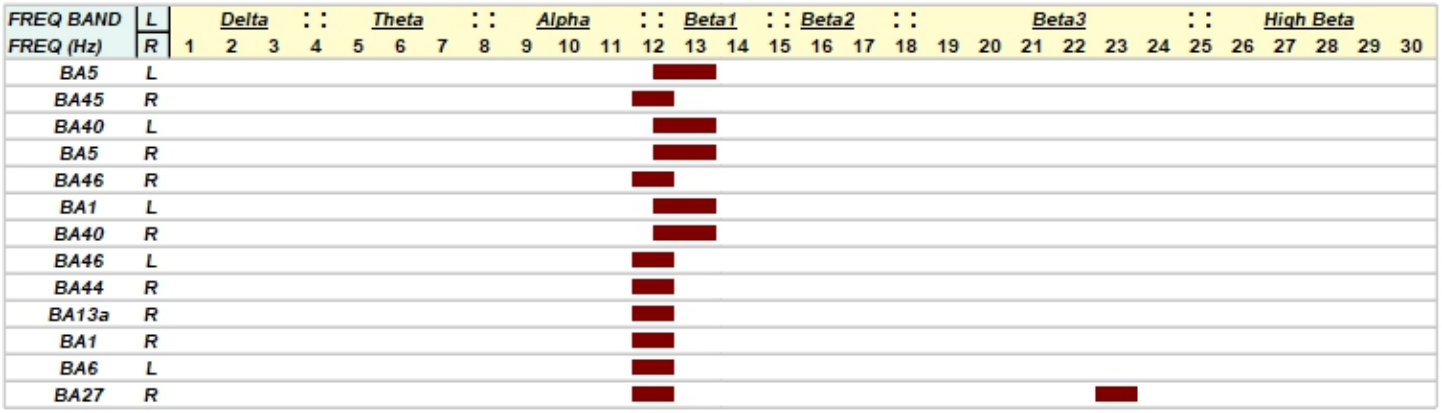
Surface Neurofeedback: (move towards Z = 0)



Coherence Neurofeedback: (move towards Z = 0)

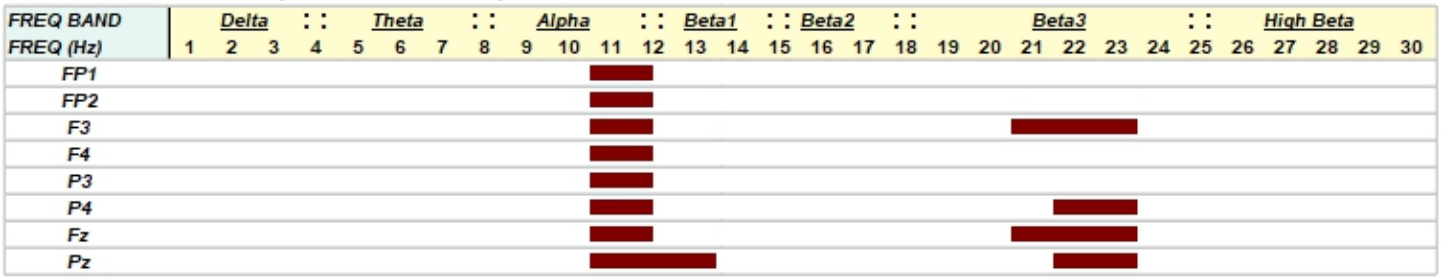


Loreta Neurofeedback: (move towards Z = 0)

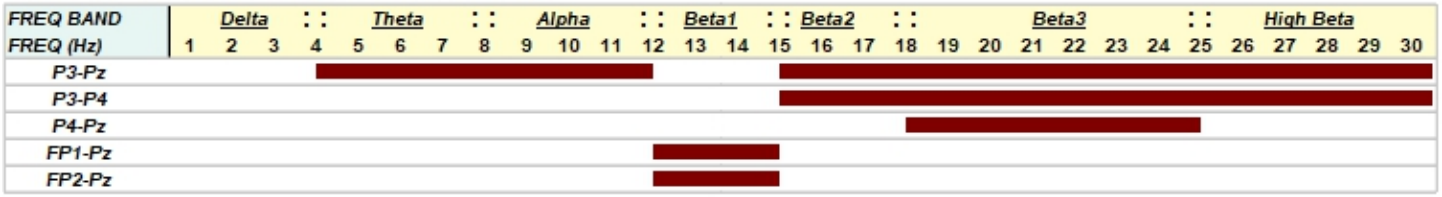


Salience Network Recommendations

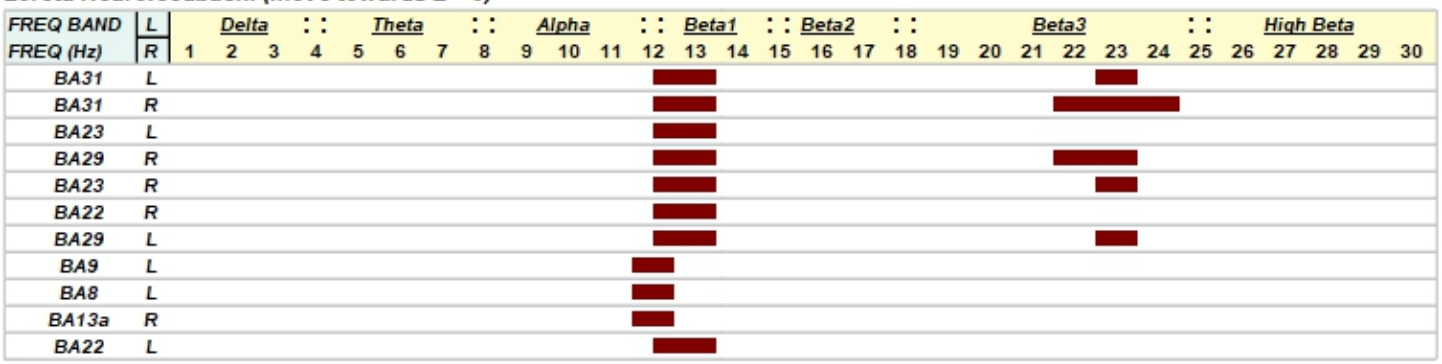
Surface Neurofeedback: (move towards Z = 0)



Coherence Neurofeedback: (move towards Z = 0)

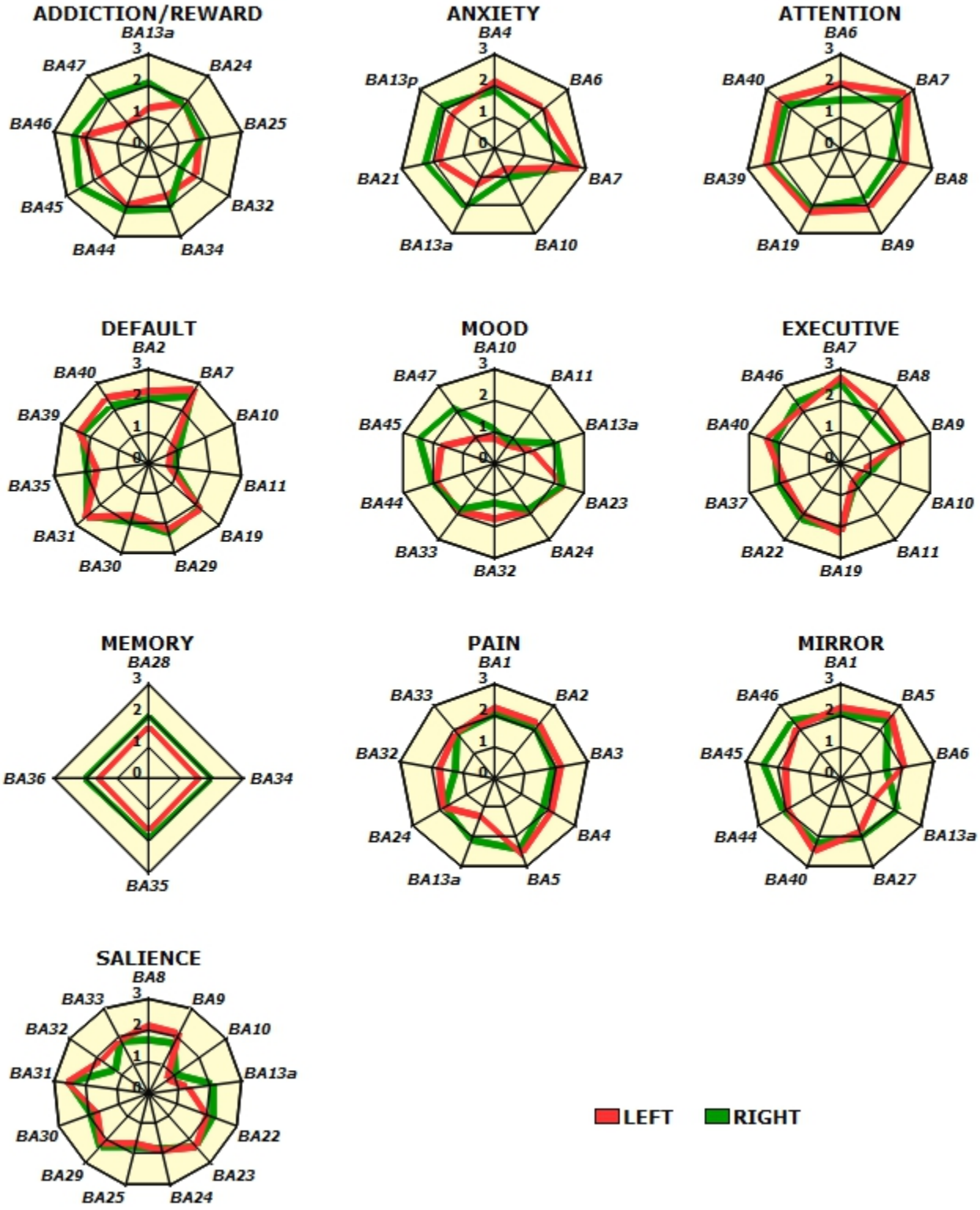


Loreta Neurofeedback: (move towards Z = 0)

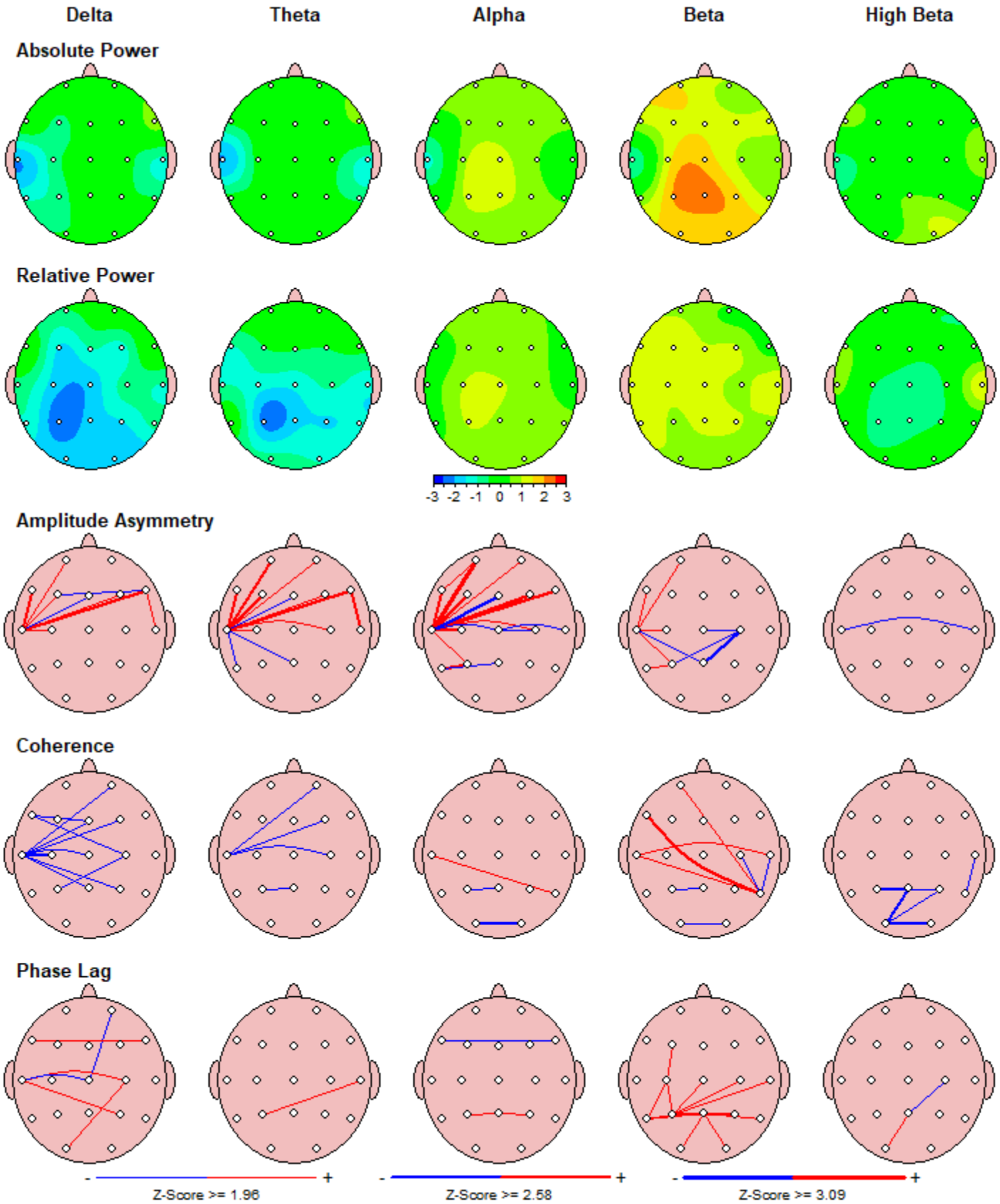


Significant Functioning Network Z-Scores

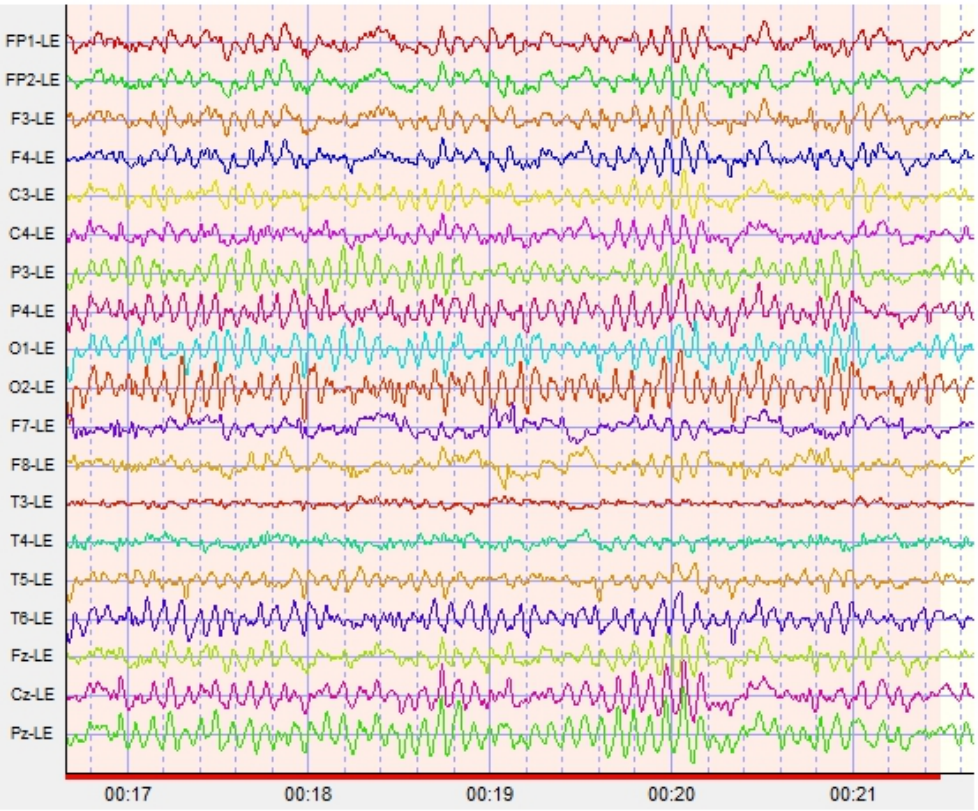
(Circles = zSCOREs, Radial Lines = Brodmann Areas)

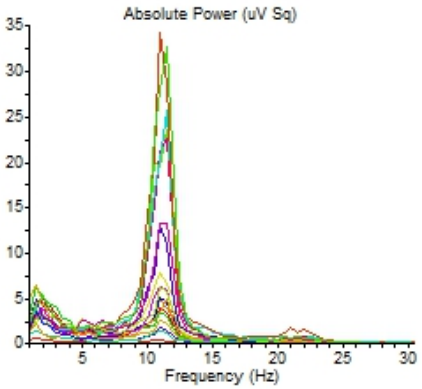


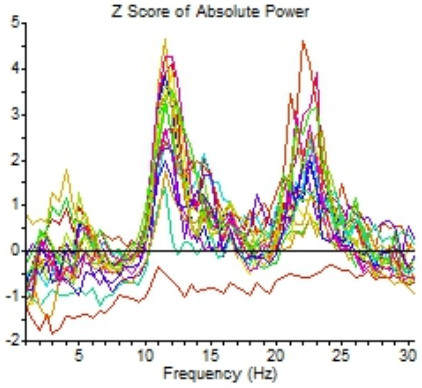
QEEG Overview Maps



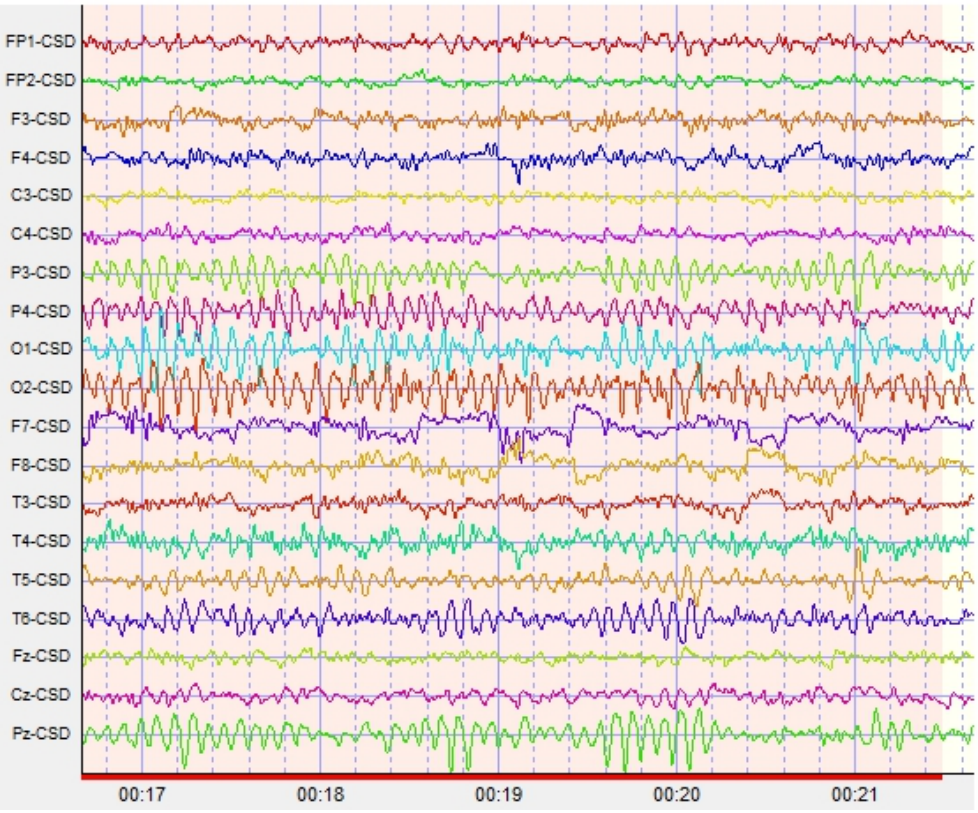
Example of Linked Ears EEG and Absolute Power - Eyes Closed Condition

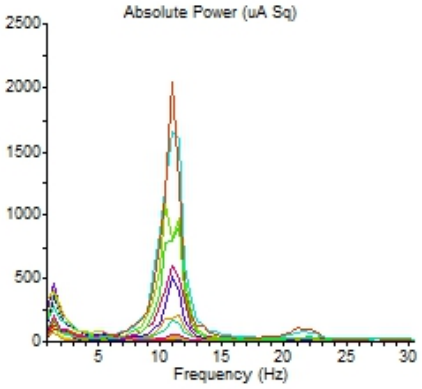


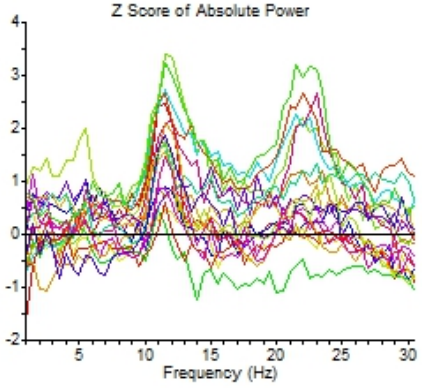




Example of Laplacian EEG and Absolute Power - Eyes Closed Condition

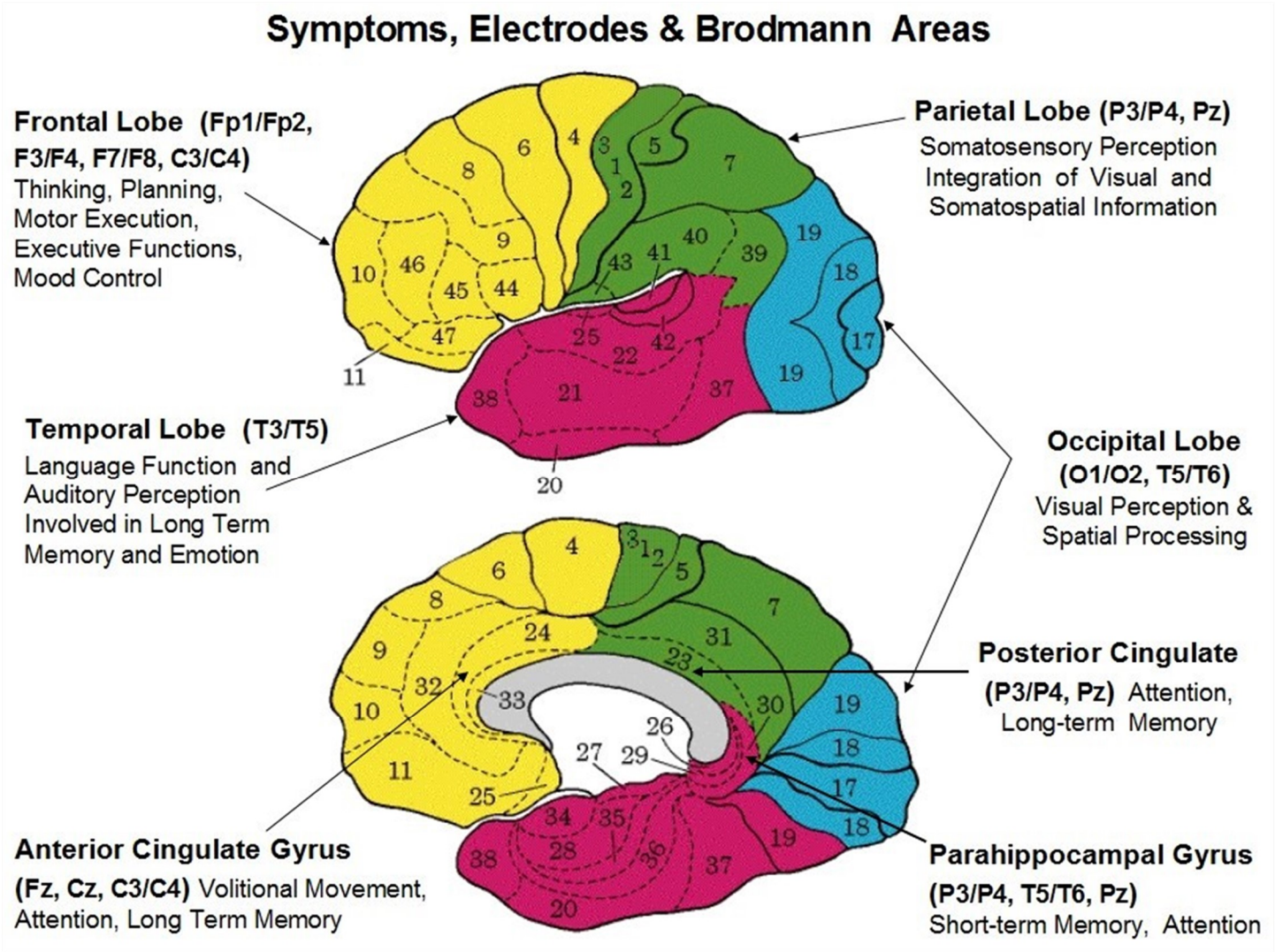






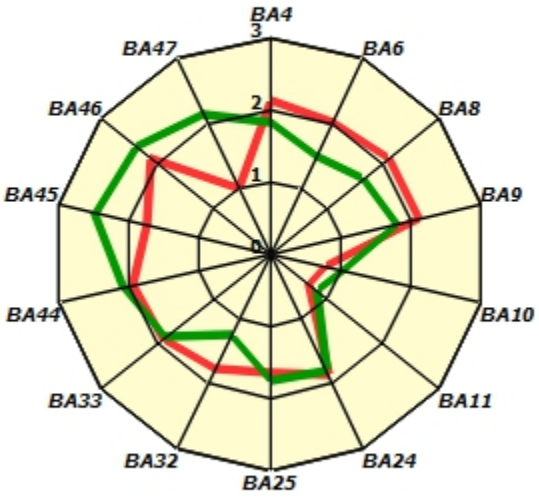
Electrical NeuroImaging

Linking a patient's symptoms and complaints to functional systems in the brain is important in evaluating the health and efficiency of cognitive and perceptual functions. The electrical rhythms in the EEG arise from many sources but approximately 50% of the power arises directly beneath each recording electrode. Electrical NeuroImaging uses a mathematical method called an "Inverse Solution" to accurately estimate the sources of the scalp EEG (Pascual-Marqui et al, 1994; Pascual-Marqui, 1999). Below is a Brodmann map of anatomical brain regions that lie near to each 10/20 scalp electrode with associated functions as evidenced by fMRI, EEG/MEG and PET NeuroImaging methods.

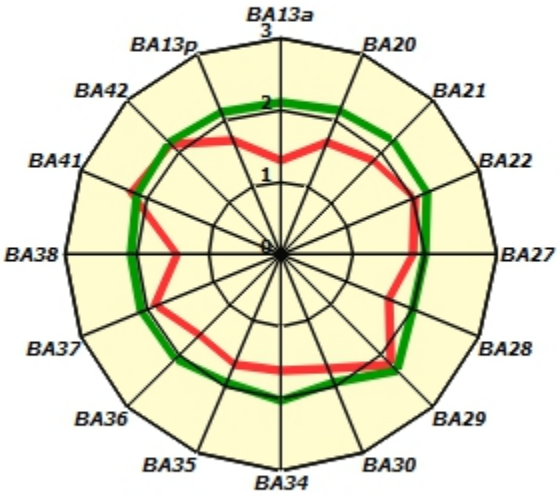


Significant Brain Lobe Z-Scores

FRONTAL BRODMANN AREAS

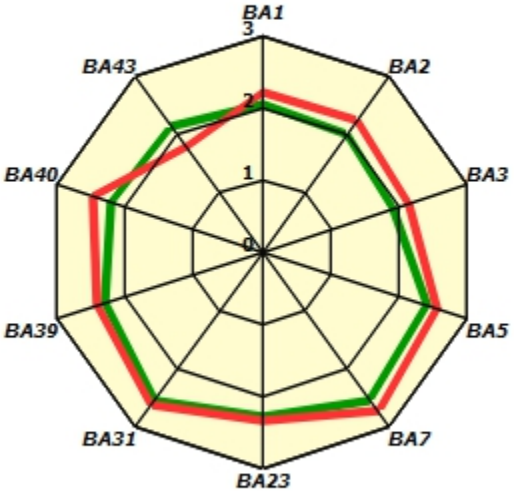


TEMPORAL BRODMANN AREAS

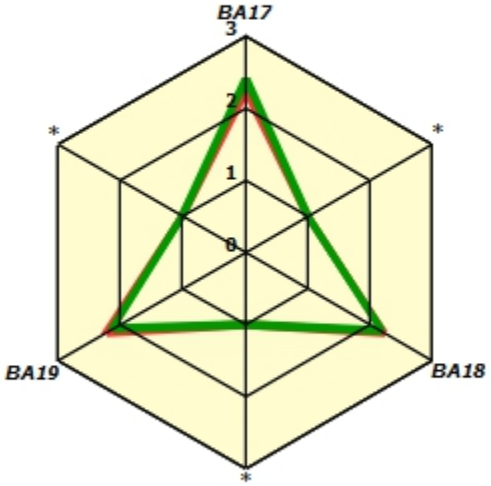


LEFT RIGHT

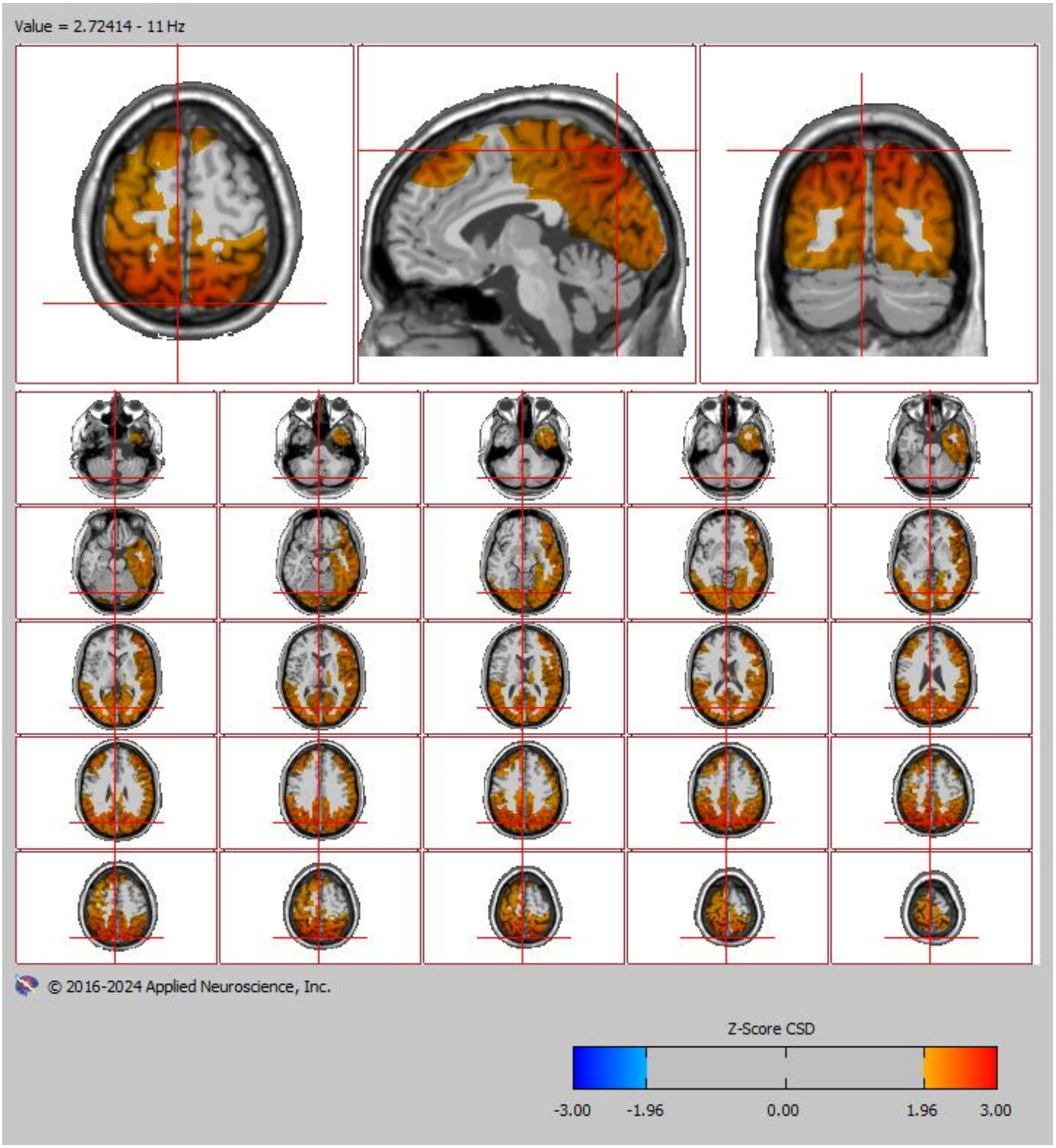
PARIETAL BRODMANN AREAS



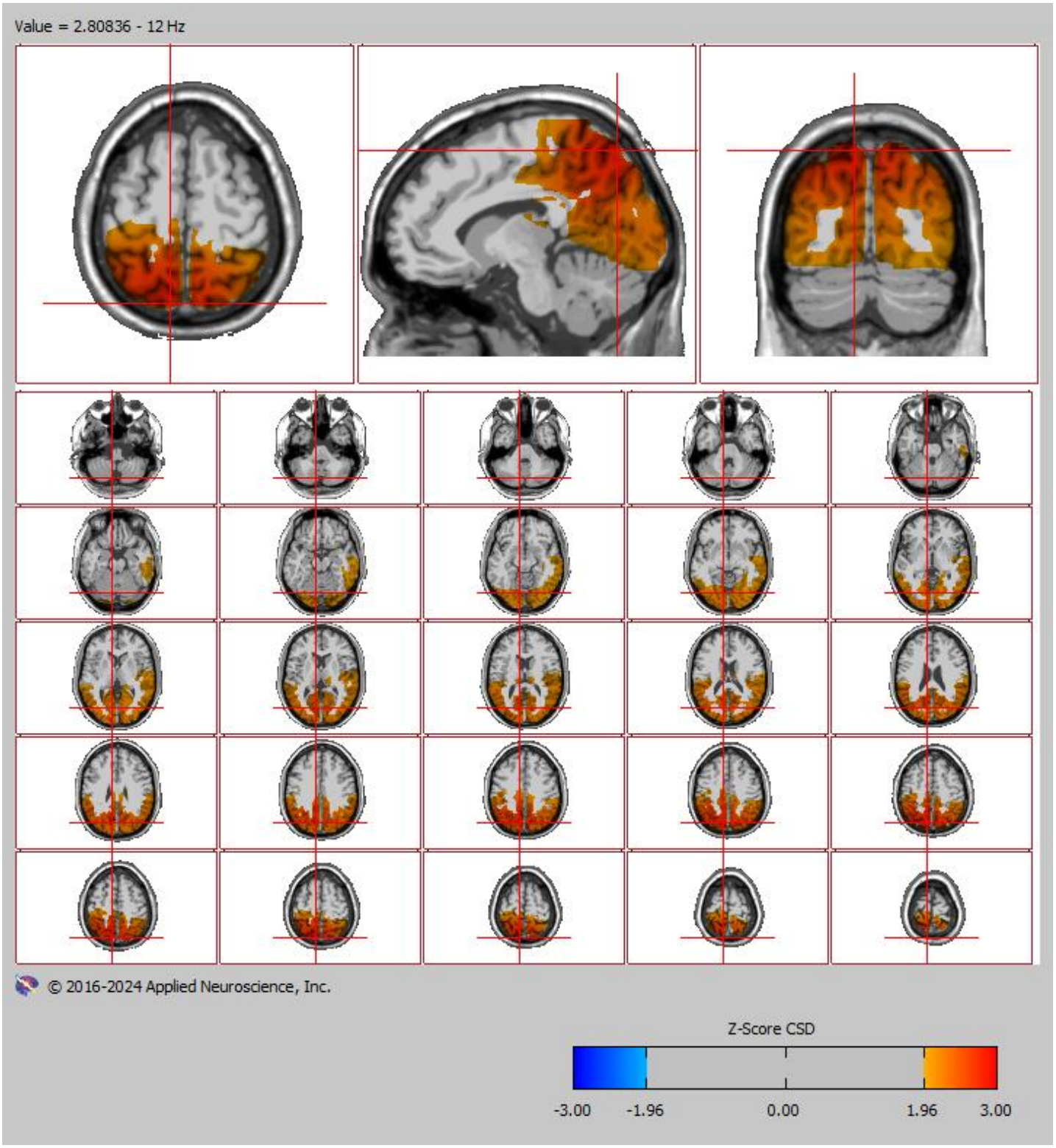
OCCIPITAL BRODMANN AREAS



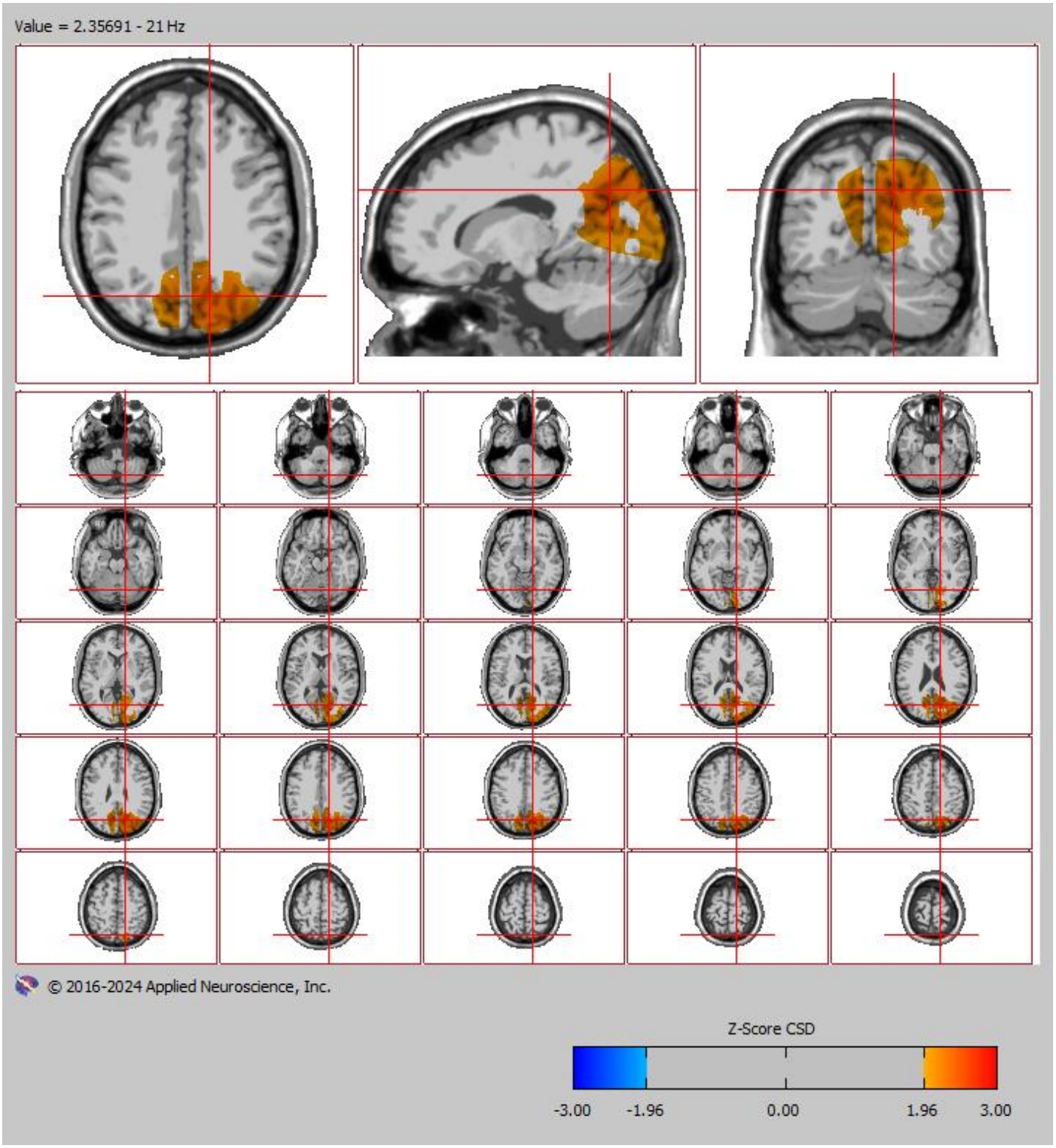
Significant LORETA NeuroImaging - 11 Hz - Brodmann Area 7



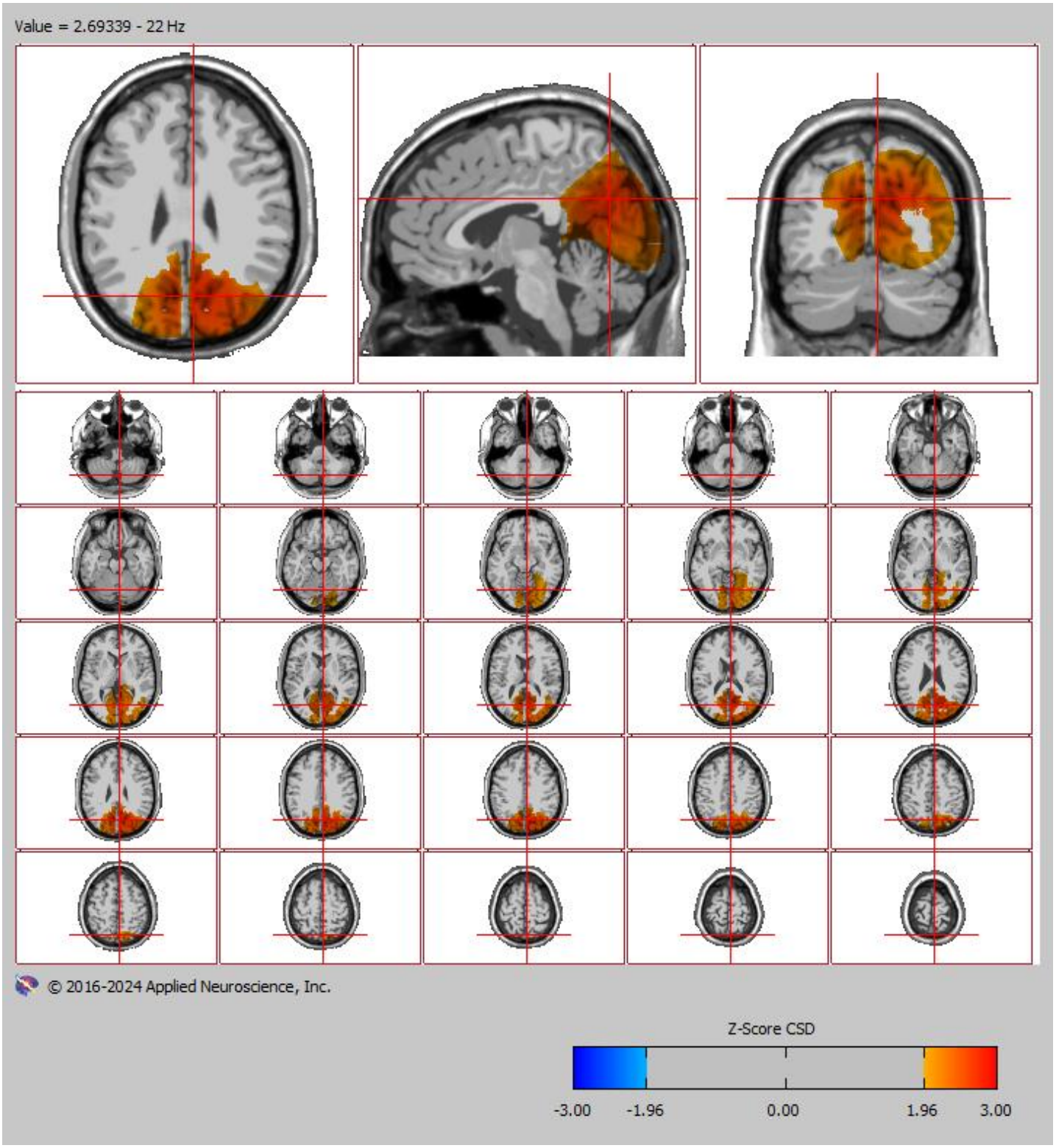
Significant LORETA NeuroImaging - 12 Hz - Brodmann Area 7



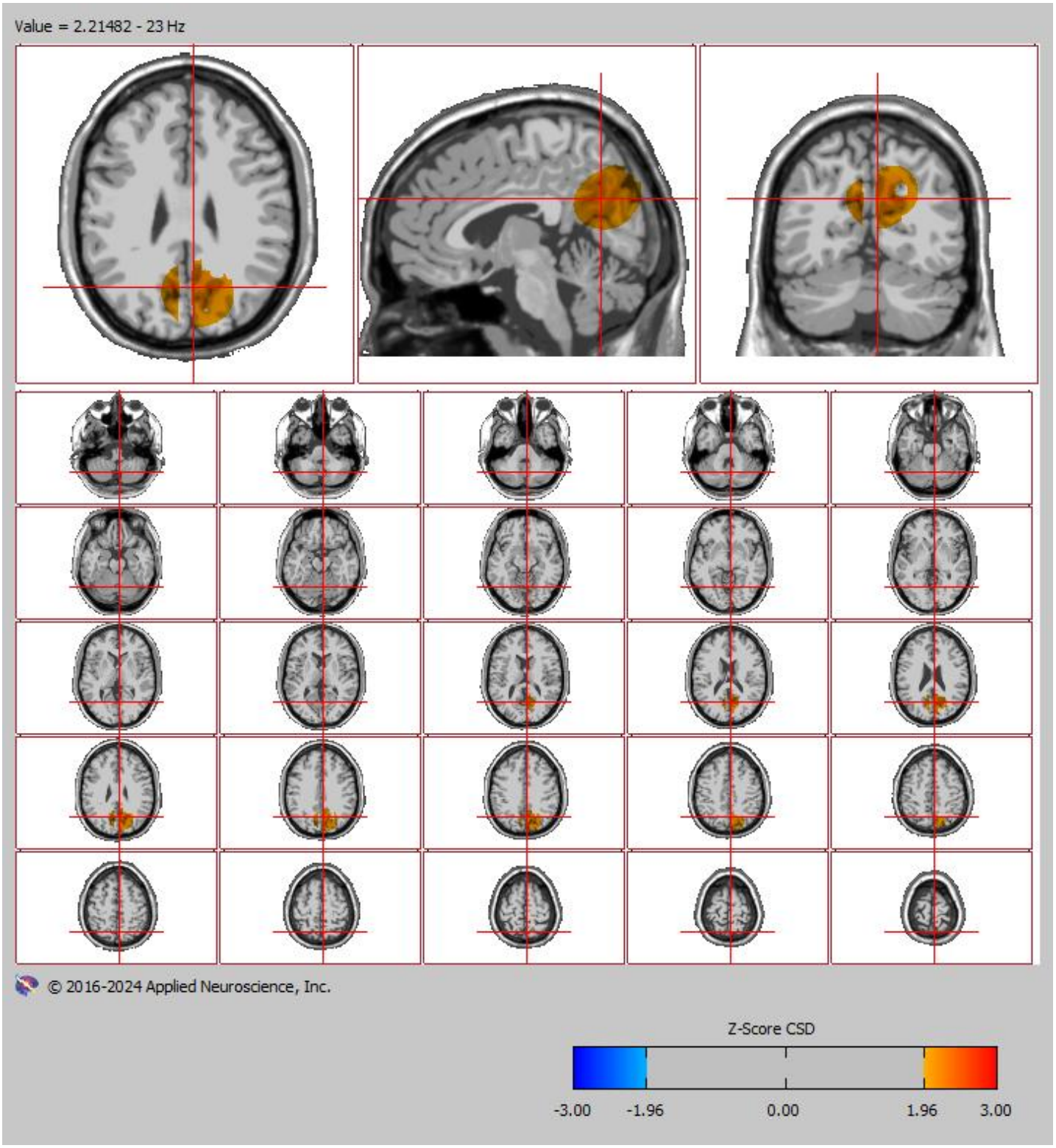
Significant LORETA NeuroImaging - 21 Hz - Brodmann Area 17



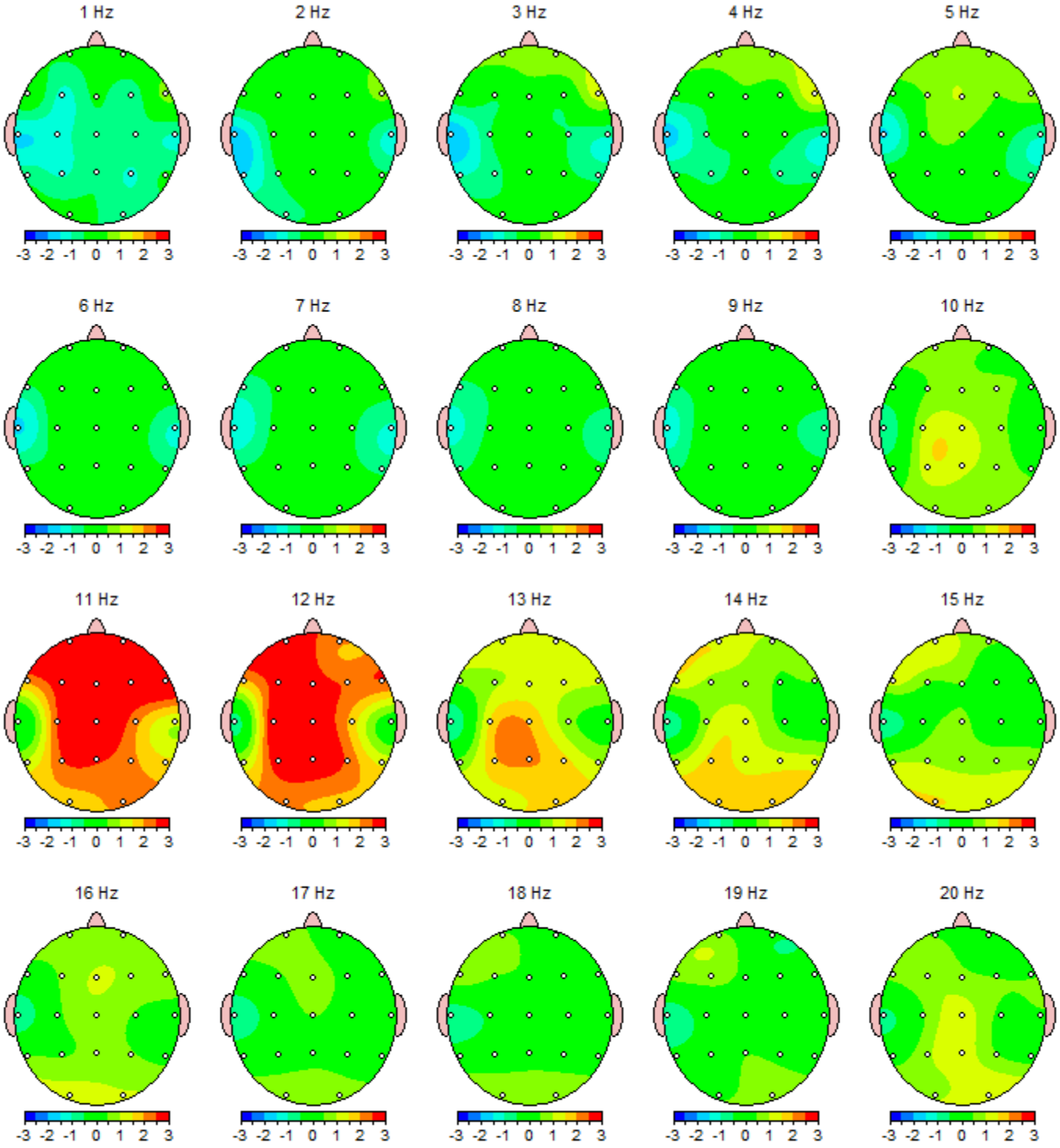
Significant LORETA NeuroImaging - 22 Hz - Brodmann Area 17



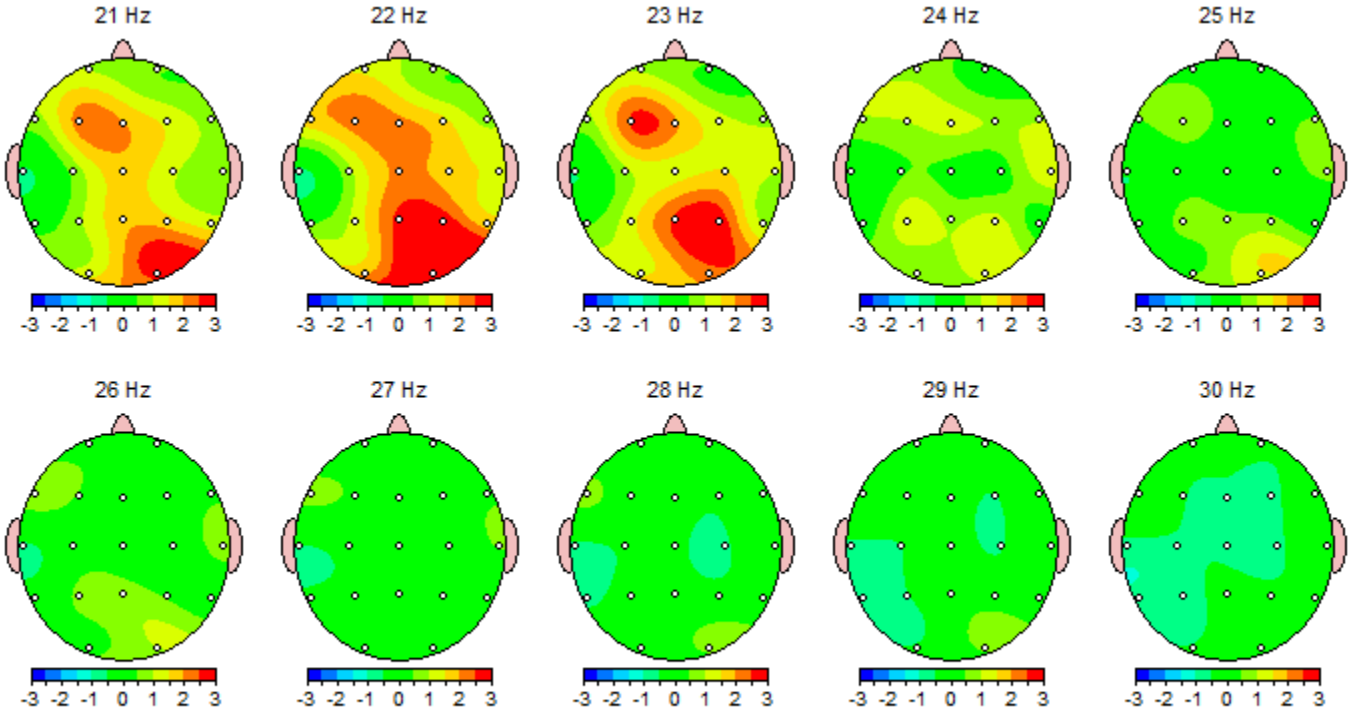
Significant LORETA NeuroImaging - 23 Hz - Brodmann Area 31



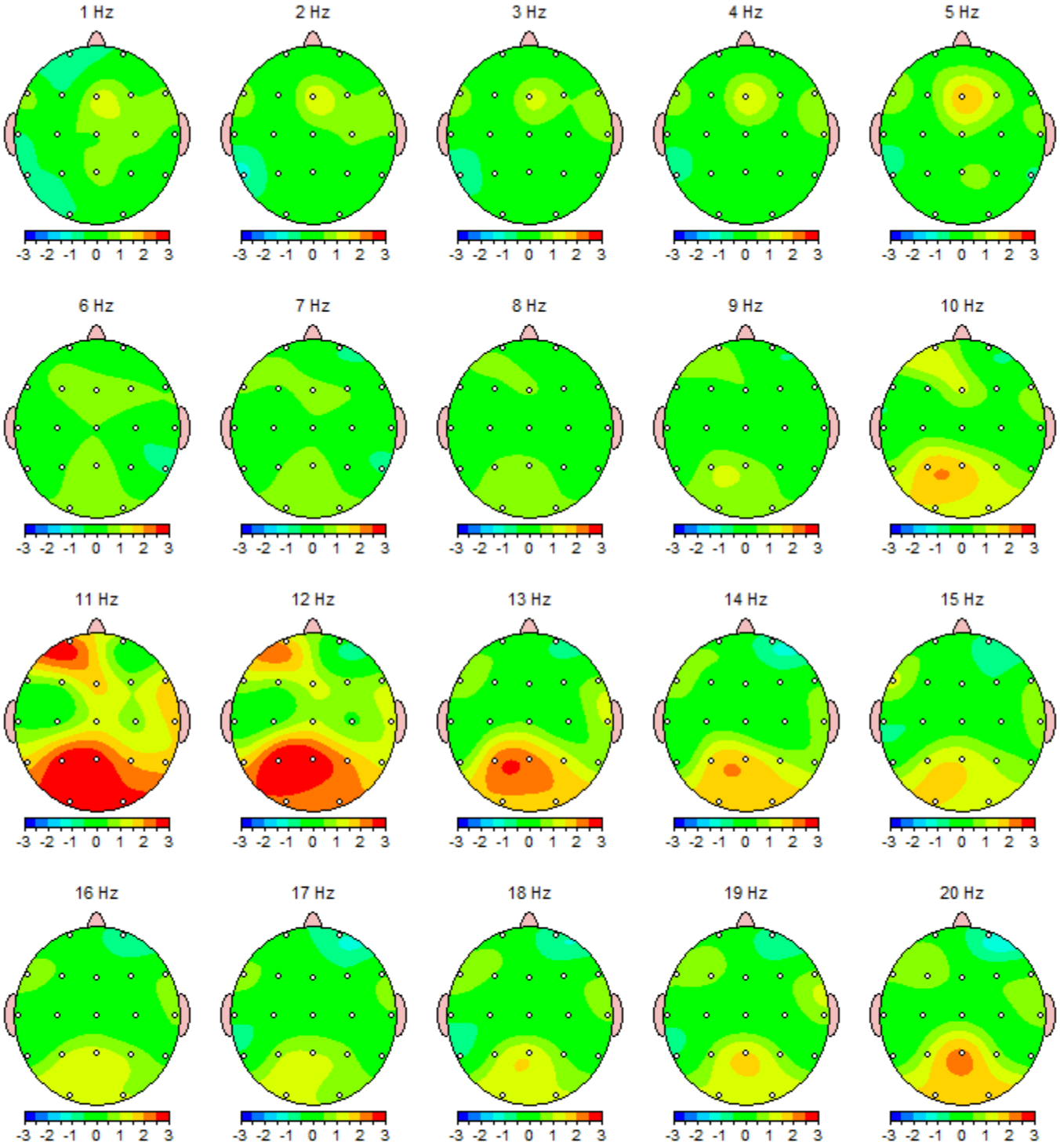
Linked-Ears Absolute Power (1-30 Hz) QEEG Maps



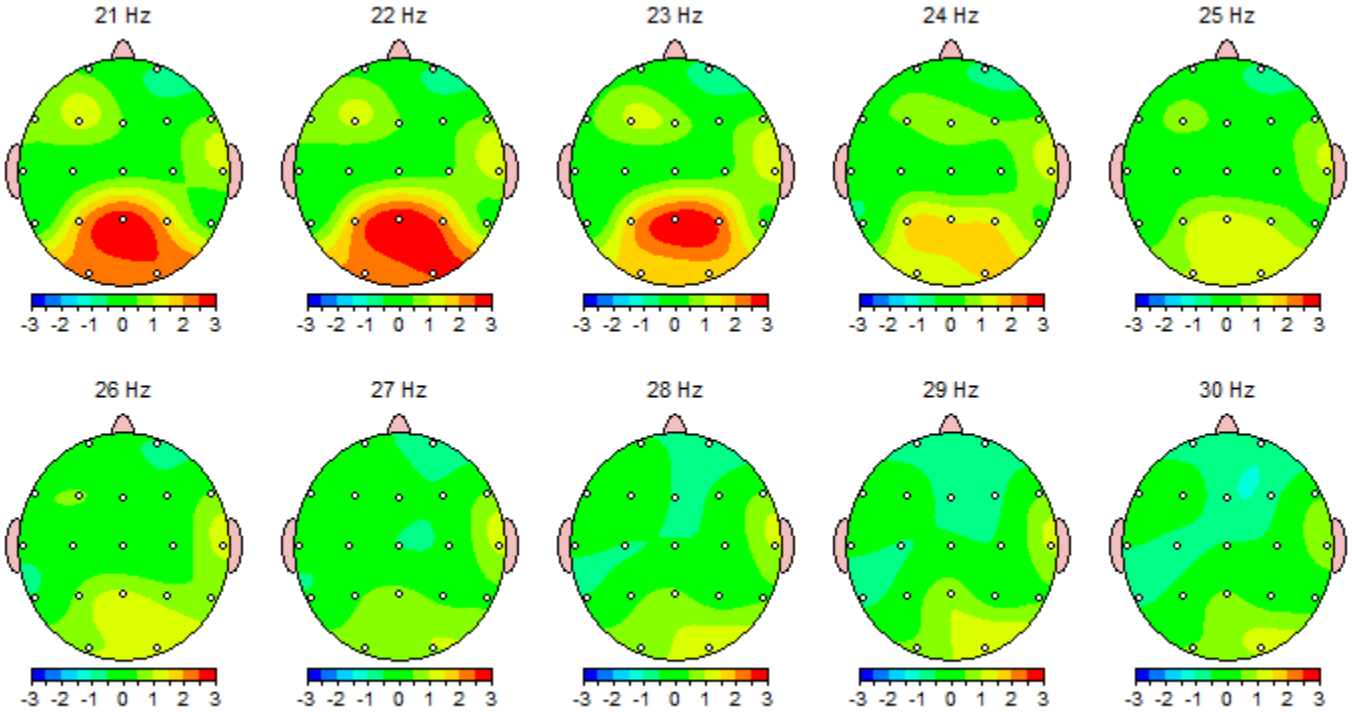
Linked-Ears Absolute Power (1-30 Hz) QEEG Maps



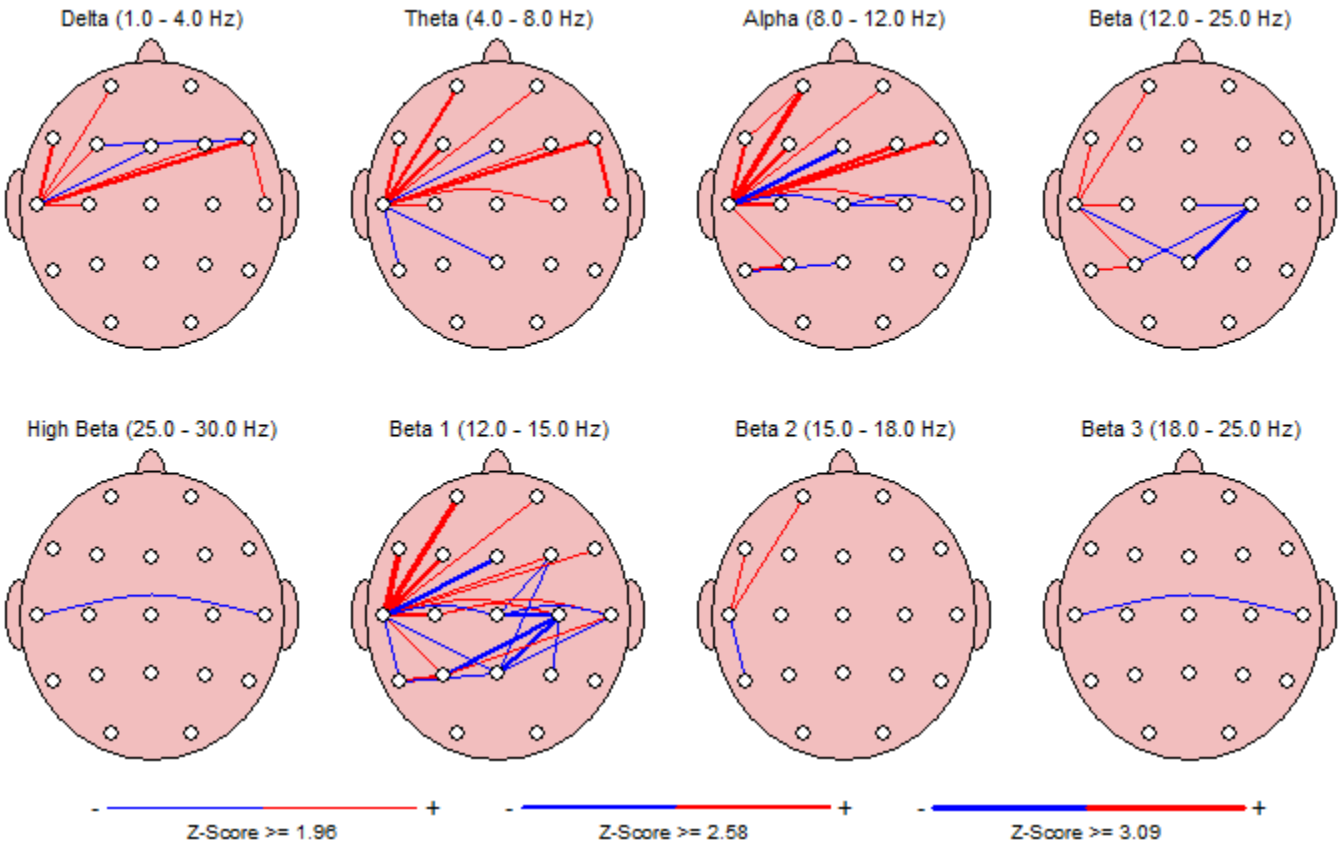
Laplacian Absolute Power (1-30 Hz) QEEG Maps



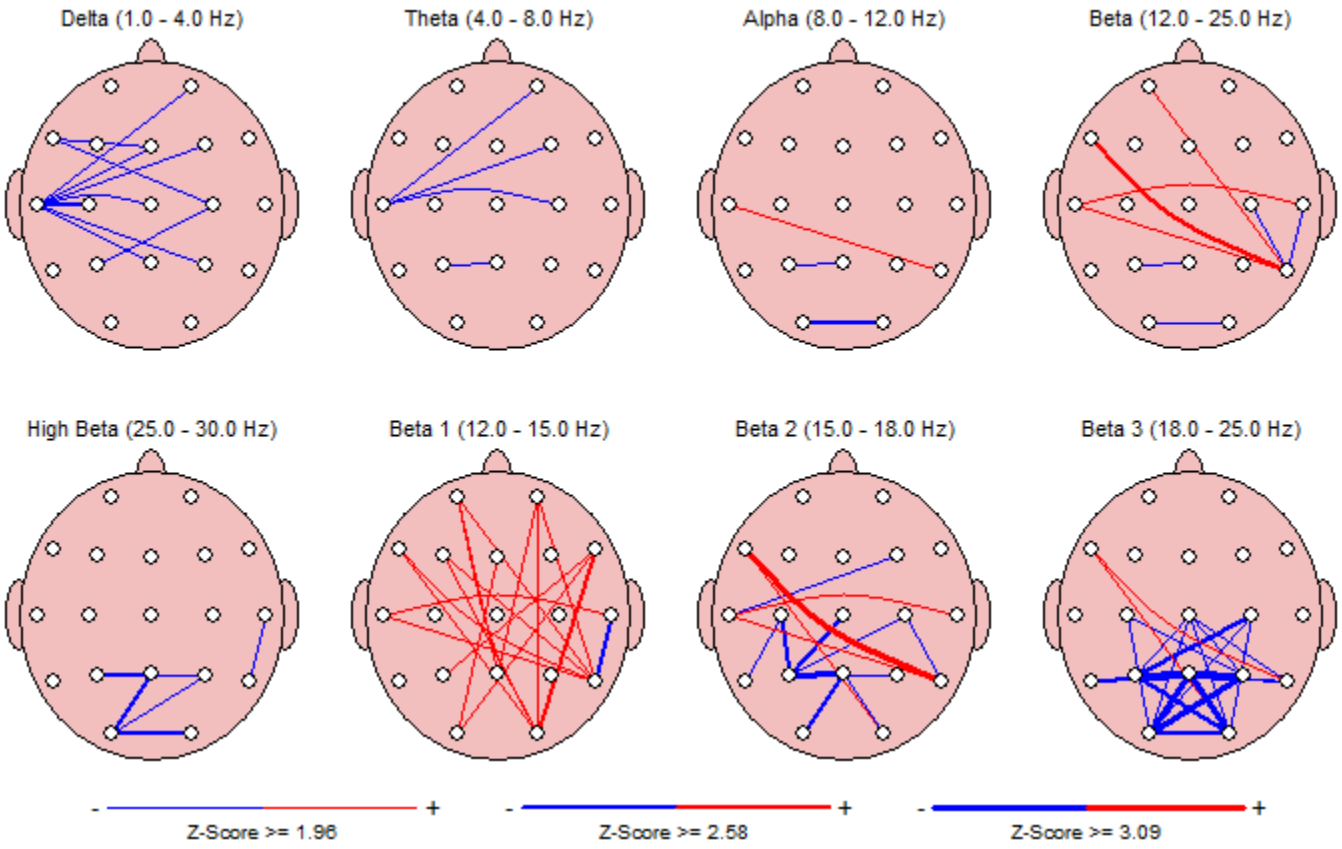
Laplacian Absolute Power (1-30 Hz) QEEG Maps



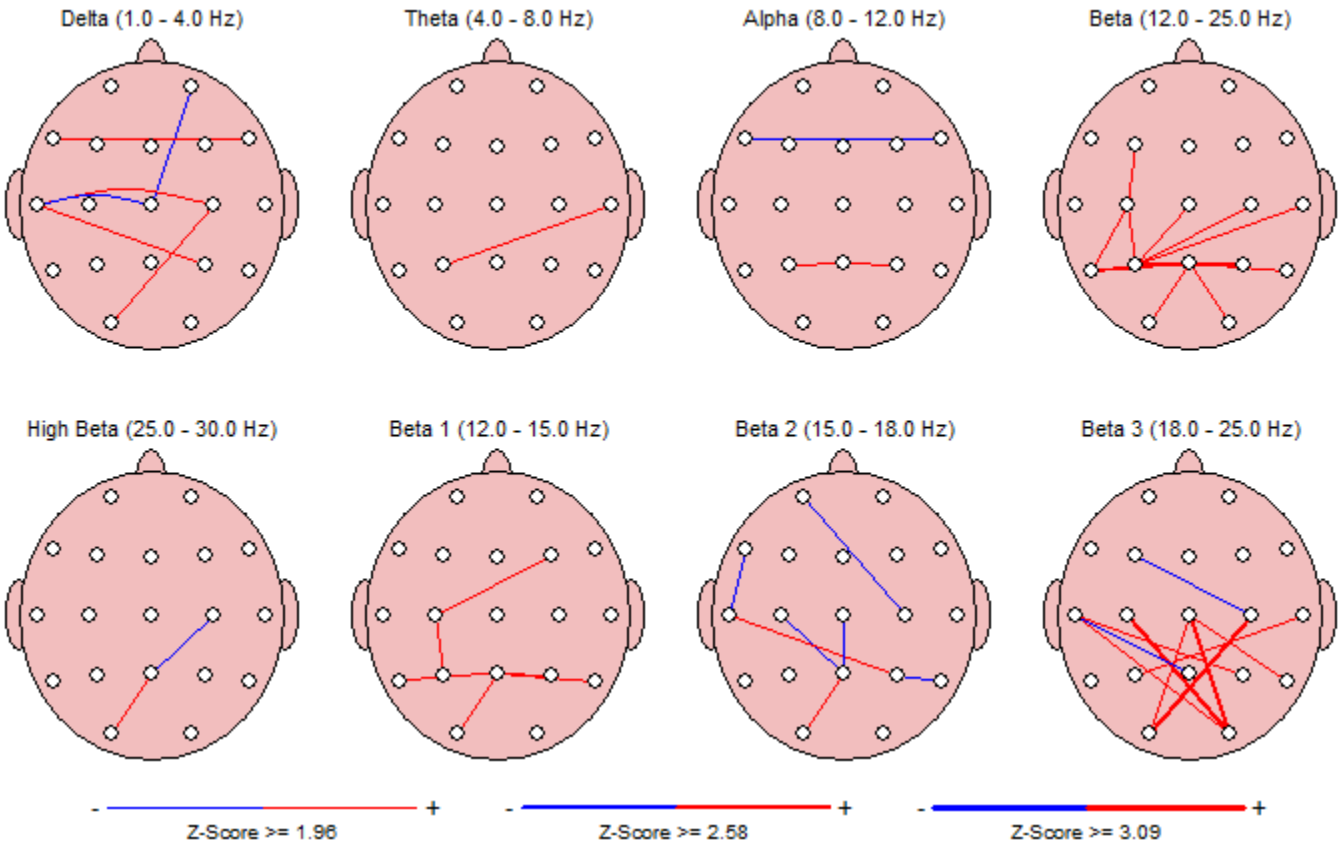
Significant Z-Scores Amplitude Asymmetry Connection Maps



Significant Z-Scores Coherence Connection Maps



Significant Z-Scores Phase Lag Connection Maps

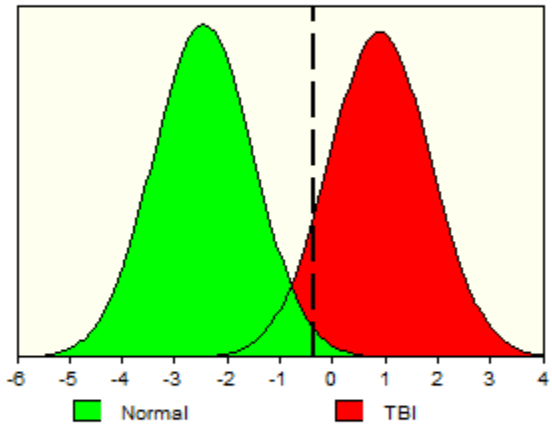


Traumatic Brain Injury Discriminant Analysis

TBI DISCRIMINANT SCORE = -0.41

TBI PROBABILITY INDEX = 80.0%

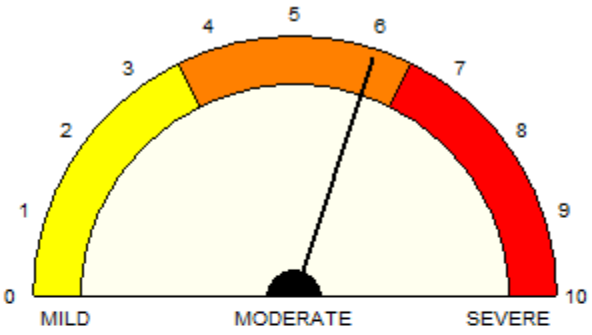
The TBI Probability Index is the subject's probability of membership in the mild traumatic brain injury population. (see Thatcher et al, EEG and Clin. Neurophysiol., 73: 93-106, 1989.)



			RAW	Z
FP1-F3	COH	Theta	87.83	1.21
T3-T5	COH	Beta	50.31	0.13
C3-P3	COH	Beta	70.26	0.10
FP2-F4	PHA	Beta	-0.23	-0.86
F3-F4	PHA	Beta	0.51	-0.33
F4-T6	AMP	Alpha	-70.09	-0.21
F8-T6	AMP	Alpha	-110.29	-0.04
F4-T6	AMP	Beta	-43.04	-0.75
F8-T6	AMP	Beta	-64.99	-0.15
F3-O1	AMP	Alpha	-124.64	-0.43
F4-O2	AMP	Alpha	-134.76	-0.58
F7-O1	AMP	Alpha	164.96	0.59
F4-O2	AMP	Beta	-109.73	-1.17
P3	RP	Alpha	68.14	1.31
P4	RP	Alpha	63.72	0.97
O1	RP	Alpha	64.87	0.50
O2	RP	Alpha	66.19	0.57
T4	RP	Alpha	27.84	-0.53
T5	RP	Alpha	45.17	-0.07
T6	RP	Alpha	57.94	0.58

TBI SEVERITY INDEX = 6.00

This severity score places the patient in the MODERATE range of severity.



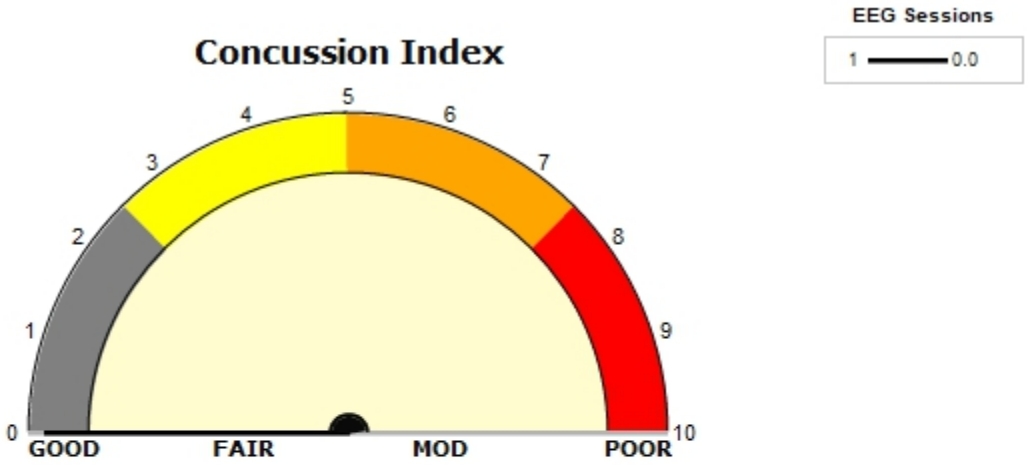
			RAW	Z
FP1-C3	COH	Delta	66.38	1.62
FP1-FP2	COH	Theta	89.17	0.81
O1-F7	COH	Alpha	30.17	-0.00
O2-T6	COH	Alpha	91.71	1.14
P3-O1	COH	Beta	84.87	1.61
FP1-T3	PHA	Theta	0.70	-1.34
T3-T4	PHA	Theta	4.12	-1.16
O1-F7	PHA	Alpha	32.39	0.17
F7-F8	PHA	Alpha	-0.50	-1.06
T5-T6	PHA	Beta	0.90	-0.98
C3-F7	AMP	Delta	-3.86	-2.24
FP2-F4	AMP	Delta	42.17	2.01
C4-F8	AMP	Delta	-59.89	-4.10
O1-O2	AMP	Theta	-12.12	-0.34
P3-F7	AMP	Alpha	165.27	0.97
FP2-P4	AMP	Alpha	-129.33	-0.39

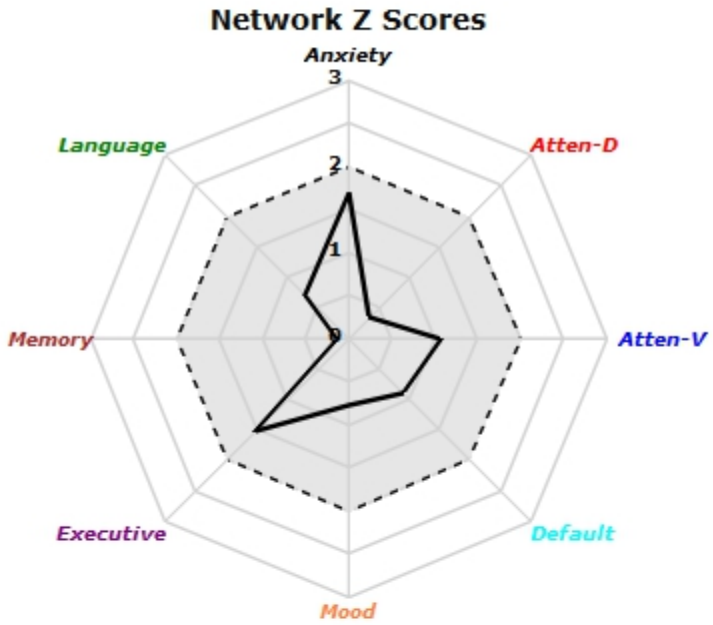
The TBI Severity Index is an estimate of the neurological severity of injury. (see Thatcher et al, J. Neuropsychiatry and Clinical Neuroscience, 13(1): 77-87, 2001.)

***Statement of Indications of Use:**

The Discriminant Analysis and Severity Index are to be used by experienced and qualified professionals for the post-hoc statistical evaluation of the human electroencephalogram (EEG). The Discriminant Analysis and Severity Index are to be viewed as an adjunct to the evaluation of the patient, and they do not serve as a primary basis for a diagnosis. Warning: Inclusion criteria of a history of traumatic brain injury and greater than 13 years of age must be adhered to.

LORETA Networks Injury Index





*Statement of Indications of Use:

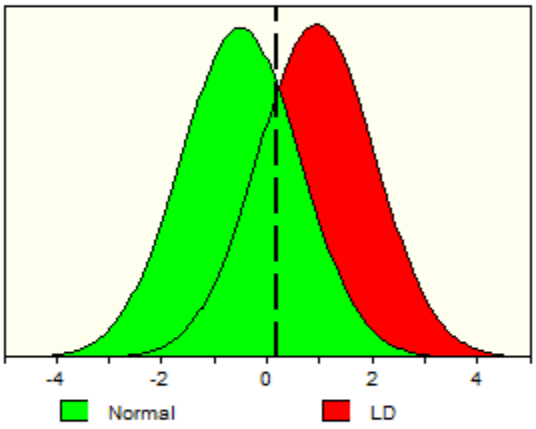
The Concussion Index is to be used by experienced and qualified professionals for the post-hoc statistical evaluation of the human electroencephalogram (EEG). The Concussion Index is to be viewed as an adjunct to the evaluation of the patient, and does not serve as a primary basis for a diagnosis.

Learning Disability Discriminant Analysis

LD DISCRIMINANT SCORE = 0.15

LD PROBABILITY INDEX = 70.0%

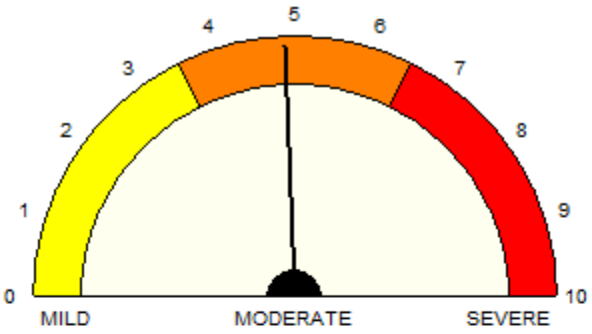
The Learning Disability Probability Index is the subject's probability of membership in the Learning Disability (LD) population.



			RAW	Z
F8	RATIO	T/B	1.07	-0.49
P3	AP	Theta	10.07	-0.23
Cz-C4	AMP	Theta	53.66	-0.88
F7-T6	AMP	Alpha	-144.71	-0.65
T5-O2	COH	Theta	33.56	0.46
F3-Fz	COH	Alpha	87.60	-0.16
FP1-T5	PHA	Beta	-30.86	0.91
T4-T6	PHA	Delta	6.51	0.59
F8-T3	PHA	Delta	-29.80	1.42
T4-Pz	PHA	Theta	18.30	1.35
FP1-Pz	PHA	Delta	14.34	0.29
F8-Pz	PHA	Beta	42.17	1.61
C3-O2	PHA	Alpha	70.40	0.68
FP1-F4	PHA	Alpha	1.97	-0.42

LD SEVERITY INDEX = 4.87

This severity score places the patient in the MODERATE range of severity.



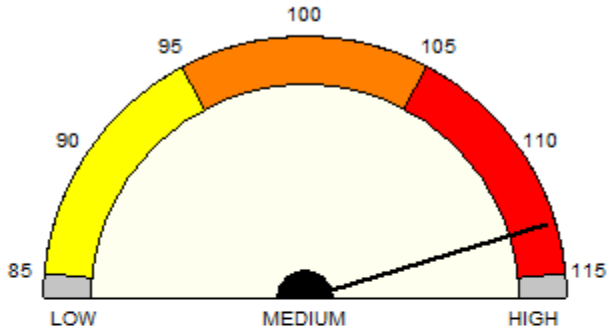
The LD Severity Index is an estimate of the neurological severity of Learning Disability.

***Statement of Indications of Use:**

The Discriminant Analysis and Severity Index are to be used by experienced and qualified professionals for the post-hoc statistical evaluation of the human electroencephalogram (EEG). The Discriminant Analysis and Severity Index are to be viewed as an adjunct to the evaluation of the patient, and they do not serve as a primary basis for a diagnosis. Warning: Inclusion criteria of a history of academic problems, no history of traumatic brain injury, and age between 5 and 18 years must be adhered to.

Predicted Neuropsychological Scores

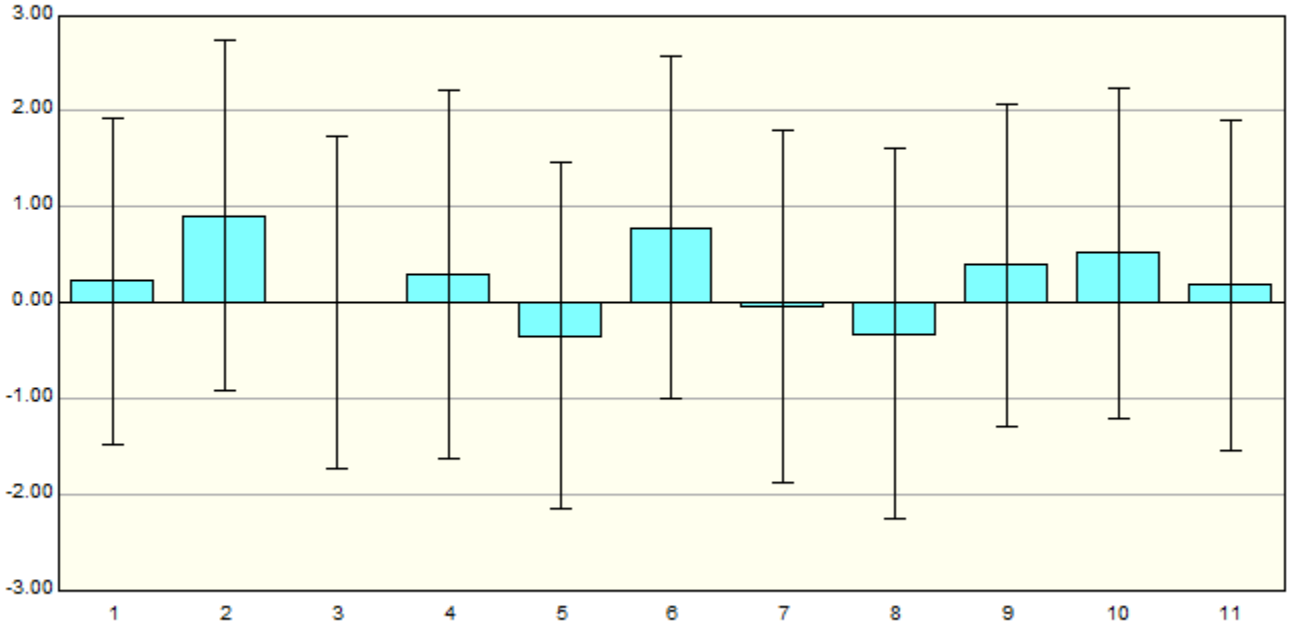
Full Scale IQ



Predicted Cognitive Performance

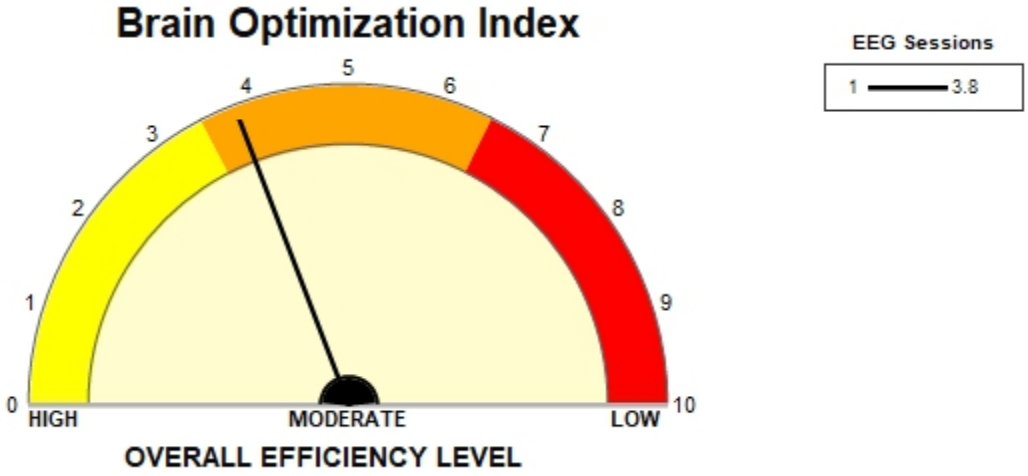
	Neuropsychological Tests	Scaled Score	Min SS	Max SS	Z Score	Min Z	Max Z
1	Information	11.74	6.17	17.32	0.22	-1.48	1.92
2	Mathematics	13.55	7.78	19.31	0.90	-0.93	2.73
3	Vocabulary	11.51	5.56	17.45	-0.00	-1.73	1.73
4	Digit Span	11.03	5.06	17.00	0.30	-1.62	2.23
5	Picture Completion	10.06	4.79	15.33	-0.35	-2.16	1.46
6	Block Design	13.56	7.39	19.72	0.78	-1.01	2.57
7	Coding	10.22	4.37	16.06	-0.05	-1.89	1.79
8	Mazes	10.36	4.13	16.59	-0.33	-2.26	1.61
9	Full IQ	112.95	86.34	139.56	0.39	-1.29	2.07
10	Verbal IQ	114.43	85.39	143.47	0.51	-1.21	2.24
11	Performance IQ	109.37	83.31	135.43	0.18	-1.54	1.90

Predicted Z-Score Achievement and Neuropsychological Measures with 95% Confidence Intervals

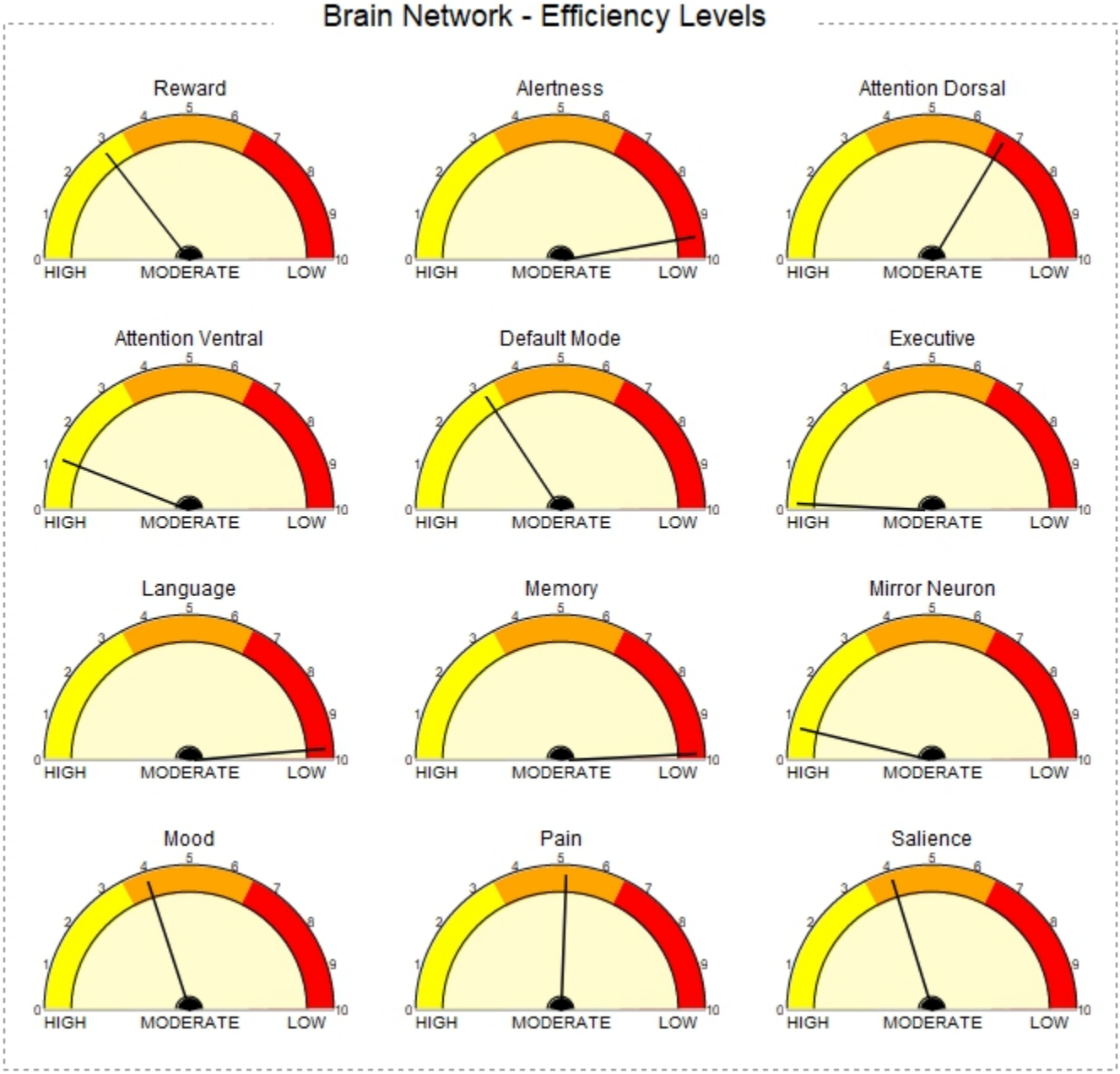


LORETA Networks Function Index

Brain Optimization Index



Brain Network - Efficiency Levels



Quality Control of EEG Collection

Record Length: 03:43

Edit Length: 01:17

Reliability:

	Split Half	Test Retest
Average	0.98	0.95
FP1	0.98	0.91
FP2	0.98	0.97
F3	0.98	0.92
F4	0.98	0.98
C3	0.97	0.93
C4	0.96	0.96
P3	1.00	0.97
P4	0.97	0.94
O1	0.98	1.00
O2	0.97	0.99
F7	1.00	0.85
F8	1.00	0.99
T3	0.98	0.95
T4	0.97	0.96
T5	1.00	0.97
T6	0.95	0.93
Fz	0.99	0.92
Cz	0.99	0.97
Pz	0.99	0.97

Sampling Rate: 250

Collection Hardware: Mitsar EEG-201

Important Disclaimer: **QEEG tests are ancillary tests that are not intended to provide a diagnosis by themselves, but are used to evaluate the nature and severity of deregulation in the brain such as in mild traumatic brain injury (MTBI). The QEEG tests provide a quantitative assessment of areas of brain dysfunction and information on impaired conduction and connectivity between different regional neural networks in the brain. The assessment of impaired connectivity is based on abnormal measurements of Coherence and Phase. The TBI Discriminant and Concussion Index do not provide a diagnosis for MTBI but only information on the presence of a pattern in the EEG that is often found in patients with a history of mild traumatic brain injury. The TBI Discriminant and Concussion Index also provide information about connectivity and excitability of brain regions. The TBI Discriminant and Concussion Index are to be used only on patients with a clinical history and symptoms of a Traumatic Brain Injury and Post Concussion syndrome. The diagnosis of MTBI is a clinical one and is not based on any one test. A diagnosis is performed by the clinician, who integrates the medical history, clinical symptoms, neurocognitive tests with the abovementioned brain function tests as well as other information to render a diagnosis. The information on impaired brain connectivity is derived primarily from abnormal measurements of Coherence and Phase. Assessments of regional abnormality rely also on abnormal amplitude (power) distribution across the spectrum of EEG frequencies as compared to the normative database.**

Artifact Rejection: **NeuroGuide uses the standard deletion of artifact method to only select artifact free EEG data for analyses. The entire EEG record must be viewed by clicking end and page down and page up and home and by arrow keys and by moving the wiper at the bottom of the screen. A careful visual examination of the EEG record is necessary to detect epilepsy and gross pathology as well as to identify artifacts. The goal is to avoid selecting any artifact and instead to only select artifact free segments of EEG. There are three methods of obtaining Artifact Free Selections: 1- Manual Selections are obtained by pressing the left mouse button and dragging to select, press right mouse button and drag to erase; 2- Artifact Free Template Matching; and 3- Z Score Artifact Free Selections. All three methods can be used and manual selection takes priority over all methods of artifact free selection. That is, left and right mouse button dragging will override all other methods. View the Length of EEG Selections in seconds and View the dynamic Reliability Measures of the EEG Selections. For Manual Selections of Artifact Free EEG Depress the left mouse button and drag it over the sections of EEG that do not contain eye movement or muscle or drowsiness or head movement or any other type of artifact. Select at least 60 seconds of artifact free EEG data as shown in the Edit Time counter (upper left of screen). If a mistake is made, then right mouse click and drag over the EEG traces to erase a selection. View the Test Re-Test reliability which must be at least 0.90. Scan the EEG record and select real and valid EEG and avoid selecting artifact. Splice discontinuities are removed by filtering and exercises to prove no distortion due to splicing are available in the Handbook of QEEG and EEG Biofeedback. Pattern recognition routines are used to identify likely eye movement (EOG), drowsiness and muscle (EMG) artifact in the record and thereby mark these suspected segments and disallow them to be included in subsequent analyses. The pattern recognition routines are based on physics and physiology of artifact. For example, all electrical sources decrement with distance and in the case of eye movement detection is by the presence of an electrical field gradient in the delta frequency band from Fp1/2 > F3/4 > C3/4 and/or 120 degrees or higher of inverse phase between F7 and F8. EMG electrical gradients at > 10 Hz from T3/4 > C3/4 and/or Fp1/2 > F3/4 > C3/4 and/or O1/2 > P3/4. Drowsiness occurs when the locus coeruleus reduces inhibition on the hypothalamic sleep centers resulting in 2 - 4 Hz action potential bursting that projects to the ventral posterior thalamic relay nuclei. Drowsiness pattern detection involves elevated**

slow waves in the EEG maximal in Cz and Fz as well as alpha slowing. NeuroGuide does not use any regression methods to allegedly remove artifact such as ICA/PCA or Blind Source or unpublished methods like SARA that distort Phase and Coherence and other aspects of the Power Spectrum. Details and tutorials demonstrating how the ICA and regression methods distort Phase and Coherence are available at:
https://www.appliedneuroscience.com/PDFs/Tutorial_Adulteration_Phase_Relations_when_using_ICA.pdf

Split Half and Test Re-Test Reliability: **Split-Half (SH) reliability is the ratio of variance between the even and odd seconds of the time series of selected digital EEG (variance = sum of the square of the deviation of each time point from the mean of the time points). Examine the average reliability and the reliability of each channel as you increase the length of the sample and manually select different segments. Selection of artifact free EEG should have a reliability > 0.95 and a sample length of edited EEG > 60 seconds. Test Re-Test (TRT) reliability is the ratio of variance between the first half vs. the second half of the selected EEG segments (variance = sum of the square of the deviation of each time point from the mean of the time points). Test Re-Test reliability > 0.90 and a sample length of edited EEG > 60 seconds is commonly published in the scientific literature. Test Re-Test reliability is an excellent statistic to compare Brain state changes such as drowsiness as well as the consistency of a measure independent of changes in brain state.**

NeuroGuide Normative Database Description: **The NeuroGuide normative database in versions 1.0 to 2.4.6 included a total of 678 carefully screened individual subjects ranging in age from 2 months to 82 years. NG 2.6.8 involved the addition of 49 adult subjects ranging in age from 18.3 years to 72.6 years resulting in a normative database of 727 subjects. The inclusion/exclusion criteria, demographics, neuropsychological tests, Gaussian distribution tests and cross- validation tests are described in several peer reviewed publications (Thatcher et al, 1983; 1987; 2003). Two year means were computed using a sliding average with 6 month overlap of subjects. This produced a stable and higher age resolution normative database with a total of 21 different age groups. The 21 age groups and age ranges and number of subjects per age group is shown in the bar graph in Appendix F figure 2 in the NeuroGuide Manual (click Help > NeuroGuide Help).**

The individuals used to create the normative database met specific clinical standards of no history of neurological disorders, no history of behavioral disorders, performed at grade level in school, etc. Most of the subjects in the normative database were given extensive neuropsychological tests. Details of the normative database are published at: Thatcher, R.W., Walker, R.A. and Guidice, S. Human cerebral hemispheres develop at different rates and ages. Science, 236: 1110-1113, 1987 and Thatcher R.W., Biver, C.L., North, D., Curtin, R. and Walker, R.W. Quantitative EEG Normative Databases: Validation and Clinical Correlation. Journal of Neurotherapy, 2003, 7(3-4): 87-121. You can download a description of the normative database by going to
www.appliedneuroscience.com
and clicking on the webpage Articles & Links > Articles > Article #5.

Normative Database for Different Montages: **The raw digital data from the same group of normal subjects is analyzed using different montages such as Average Reference, Laplacian current source density, a common reference based on all 19 channels of the 10/20 system and standard clinical bipolar montages (e.g., longitudinal, circular, transverse). Users can create any montage that they wish and there will be a normative reference database comparison available for both eyes closed and eyes open conditions.**

Age Range of LORETA Normative Databases: **The LORETA current density and source correlation norms use the same subjects as are used for the surface EEG norms and the age range is 2 months to 82 years. The computational details of the LORETA current density norms are published at: Thatcher, R.W., North, D., Biver, C. EEG inverse solutions and parametric vs. non-parametric statistics of Low Resolution Electromagnetic Tomography (LORETA). Clin. EEG and Neuroscience, 36(1): 1-9, 2005 and Thatcher, R.W., North, D., Biver, C. Evaluation and Validity of a LORETA normative EEG database. Clin. EEG and Neuroscience, 2005, 36(2): 116-122. Copies of these publications are available to download from www.appliedneuroscience.com by clicking Articles & Links > Articles > Numbers 11 and 12. The computational details of the LORETA source correlation norms are in the NeuroGuide Manual, click Help > NeuroGuide Help > Appendix-G.**

Implementation of LORETA Measurement in NeuroGuide: **The Key Institute's LORETA equations and the LORETA viewer (Pacual-Marqui et al, 1994; Pascual- Marqui, 1999) can be launched by a single mouse click in the NeuroGuide window. NeuroGuide exports frequency domain and time domain edits of 19 channel x 256 point digital EEG in microvolts (or uv^2) in the Lexicor electrode order as the standard input to the Key Institute T-Matrix. Rows are 256 microvolt time points and the columns are 19 channels at a sample rate of 128 thus producing 0.5 Hz resolution from 1 to 30 Hz. 1 Hz increments in the LORETA viewer are computed as the sum of adjacent 0.5 Hz bins and thus the 'Time Frame' control in the LORETA Viewer is frequency from 1 to 30 Hz. See Pascual-Marqui RD, Michel CM, Lehmann D., 1994. Low resolution electromagnetic tomography: a new method for localizing electrical activity in the brain. International J. of Psychophysiology, 18:49-65. For computational details see: Pascual-Marqui. R.D., 1999. Review of Methods for Solving the EEG Inverse Problem. International J. of Bioelectromagnetism, 1(1): 75-86. Pascual-Margui, R.D., 2004. The Key Institute's free software and documentation was downloaded from www.unizh.ch/keyinst/NewLORETA/Software/Software.htm**

Amplifier Matching Importance: **This stems from the fact that amplifiers have different frequency gain characteristics. The matching of amplifiers to the NeuroGuide database amplifier was done by injecting microvolt calibration signals of different amplitudes and frequencies into the input of the respective EEG machines and then computing correction curves to exactly match the amplifier characteristics of the norms and discriminant functions. The units of comparison are in microvolts and a match within 3% is generally achieved. The NeuroGuide research team double checked the amplifier match by computing FFT and digital spectral analyses on calibration signals used to acquire the norms with the calibration signals used to evaluate a given manufacturers amplifiers.**

Historical QEEG Normative Databases Scientific Standards: **A review of the history of QEEG normative databases was published in Thatcher, R.W. and Lubar, J.F. History of the scientific standards of QEEG normative databases. In: Introduction to QEEG and Neurofeedback: Advanced Theory and Applications, T. Budzinsky, H. Budzinsky, J. Evans and A. Abarbanel (eds)., Academic Press, San Diego, CA, 2008. A copy of the publication can be downloaded at: https://www.appliedneuroscience.com/PDFs/History_of_QEEG_Databases.pdf**

QEEG Normative Database Publications and Validations

Bosch-Bayard J, Valdes-Sosa P, Virues-Alba T, Aubert-Vazquez E, John ER, Harmony T, Riera-Diaz J, Trujillo-Barreto N.(2001). 3D statistical parametric mapping of EEG source spectra by means of variable resolution electromagnetic tomography (VARETA). Clin Electroencephalogr., 32(2):47-61.

Coburn, K.L., Lauterback, E.C., Boutros, N.N., Black, K.J., Arciniegas, D.B. and Coffey, C.E. (2006). The value of quantitative electroencephalography in clinical psychiatry: A report by the committee on research of the American Neuropsychiatric Association. J. Neuropsychiat. and Clin. Neurosci. 18: 460-500.

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