CONTENTS

I. Personal and clinical data

Name (family name, given name)	**Sample report**
Date of birth (Day.Month.Year)	30/03/1995
Gender (M-male, F-female)	
Handed (L- left, R – right)	
Diagnosis	Severe chronic anxiety and social phobia; major depression in partial remission, panic disorder; rule out OCD
Reason of having QEEG assessment	hundreds of complaints
Medication	lexapro 10 mg q day; seroquel 12.5 mg prn anxiety; ambien 10 qhs just prn insomnia;
Source of referral	Doctor AAAAAA
Report date	11-3-2012

II. Conclusion:

The background alpha is seen at 9-10 Hz, with mu seen centrally at 10-11 Hz. There are transient semi-rhythmic slower changes seen at the frontal midline overlying the anterior cingulate, as well as bi-temporally. The theta/beta ratio is increased significantly at the fronto-central midline and temporally. The mu noted is a normal neurological variant, though it is also reported disproportionately in those with mirror neuron disturbances frontally. The temporal slower content suggests a local disturbance in areas involved in comprehension as well as memory. The cingulate issues are consistent with the report of anxiety as well as OCD/ODD/perseverative disorders.

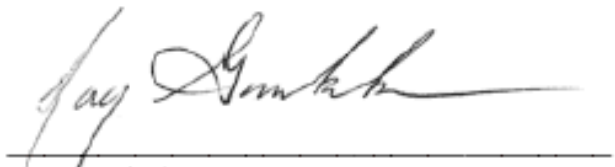
III. Recommendations for therapy:

Based on these findings, the vertex SMR training should be considered for general stabilization. The posterior temporal training may be added symptomatically**. The midline suppression training may be used to target the anterior cingulate, as well as whenever needed to counter-act any under-activation noted due to the SMR type training. The faster beta suppression band is intended to catch any EMG activity noted during the training.

The specific frequencies, montages, and the sequencing of sessions will likely require modification based on client response. Suggestions may be implemented differently depending on instrumentation used. All decisions regarding implementing these suggestions are the responsibility of the practitioner. *I recognize the need for on-going consultation and welcome discussion concerning clinical progress of individual patients, or related questions and suggestions.*

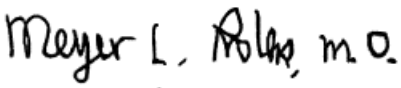
	Active	Reference	train	inhibit
1	C4	Pz	(12-15)	(4-11) + (22-30)
2	T5 and/or T6**	Cz	(12-15)	(4-11) + (22-30)
3	Fz	Linked ears	none	(4-11) + (22-30)

** The T5 is for language and linear logic comprehension, as well as verbal memory. T6 is more oriented to spatial and emotional contextual comprehension, such as facial expression and body language, as well as non-verbal memory.



Jay Gunkelman

Quantitative report reviewed by:



Meyer L. Proler, M.D.
Diplomate, A.B.C.N., in Evoked Potentials and Electroencephalography
Certified by A.B.E.N., with special competence in Quantified EEG.

IV. Report: description of the QEEG and ERPs data.

1. Procedures of EEG recording and analysis.

EEG was recorded digitally and converted by means of the WinEEG software[1] from 19 electrodes (Fp1, Fp2, F7, F3, Fz, F4, F8, T3, C3, Cz, C4, T4, T5, P3, Pz, P4, T6, O1, O2 sites in the International 10-20 system) with a 0.3 – 70 Hz frequency range in the following conditions: 1) eyes opened (EO) – at least 3 minutes, 2) eyes closed (EC) – at least 3 minutes.

The data were stored on the hard disk and processed offline by means of WinEEG software. The software is based on the 30 years experience obtained in the laboratory at the Institute of the Human Brain of Russian Academy of Sciences (director Prof. Dr. Juri Kropotov).

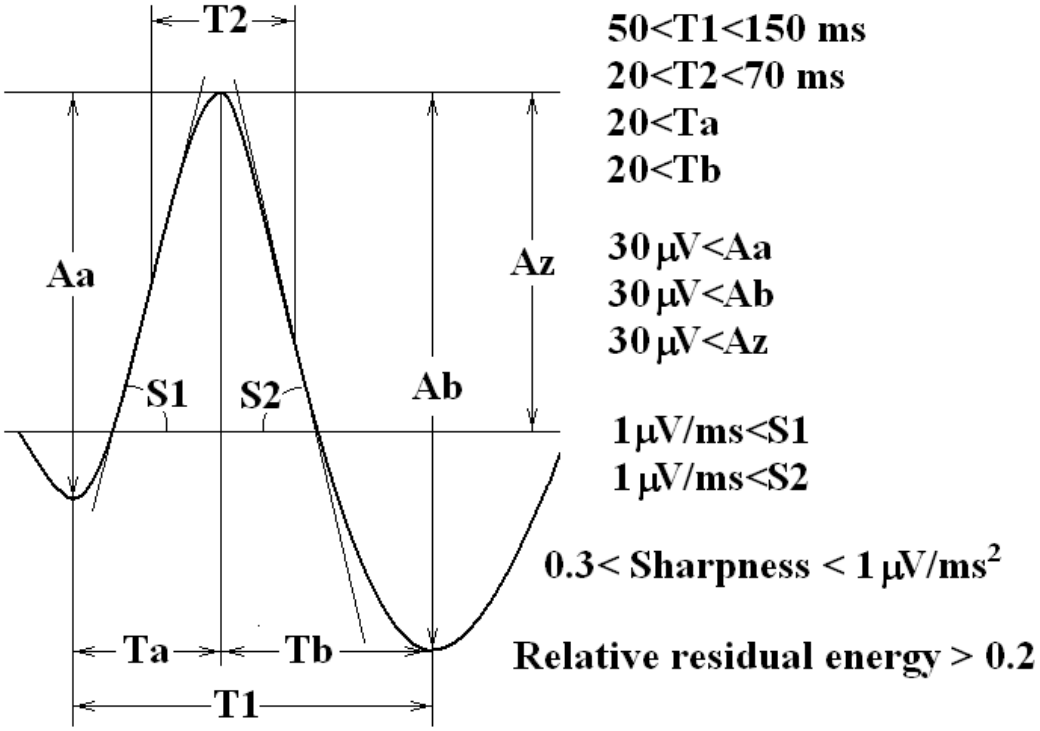
Absolute and relative magnitude spectra and coherences in all conditions computed and compared with the corresponding parameters from the Human Brain Institute (HBI) normative database. The normative database includes data of about 1000 healthy people of 7-89 years old age. EEG was recorded in Chur, Switzerland (under supervision of Dr. Andreas Mueller) in the Institute of the Human Brain, St. Petersburg, Russia (under supervision of Prof., Dr. Juri Kropotov).

[1] The analysis software is hardware independent and can read any EEG files recorded in ASCI, European data format (EDF), universal data format (UDF).

2. Search for paroxysms

Visual inspection of raw EEG was made in order to search for paroxysmal patterns that pop out of the background EEG. Besides the visual inspection an automated spike detection was performed.

The method of automated spike detection is based on temporal parameters of spikes as well on spatial location of the corresponding spike dipole[2]. The amplitude-temporal parameters have defined on the basis of comparison spike detection by the program and by experienced experts on the data base of more than 300 EEG recordings in epileptic patients. There are three characteristics that define a spike or a sharp wave in EEG. They are paroxysmal character, high degree of sharpness and short duration. These parameters are presented in Fig[3].



The relative residual energy for dipole approximation of the detected spike is chosen less than 0.2. For this client the automatic spike detection was performed on EEG in the common average montage for both eyes open and eyes closed conditions.

NO statistically and clinically significant spikes were observed.

[2] P.Y.Ktonas Automated spike and sharp wave (SSW) detection. In Methods of analysis of brain electrical and Magnetic signals. EEG handbook (revised series, Vol 1) A.S.Gevins and A.Remond (Eds). 1987, Elsevier Science Publishers B.V. 211-241 pp

[3] The parameters are taken from the paper Ktonas P.Y. Automated spike and sharp wave (SSW) detection. In Methods of analysis of brain electrical and Magnetic signals. EEG handbook (revised series, Vol 1) A.S.Gevins and A.Remond (Eds). 1987, Elsevier Science Publishers B.V. 211-241 pp.)

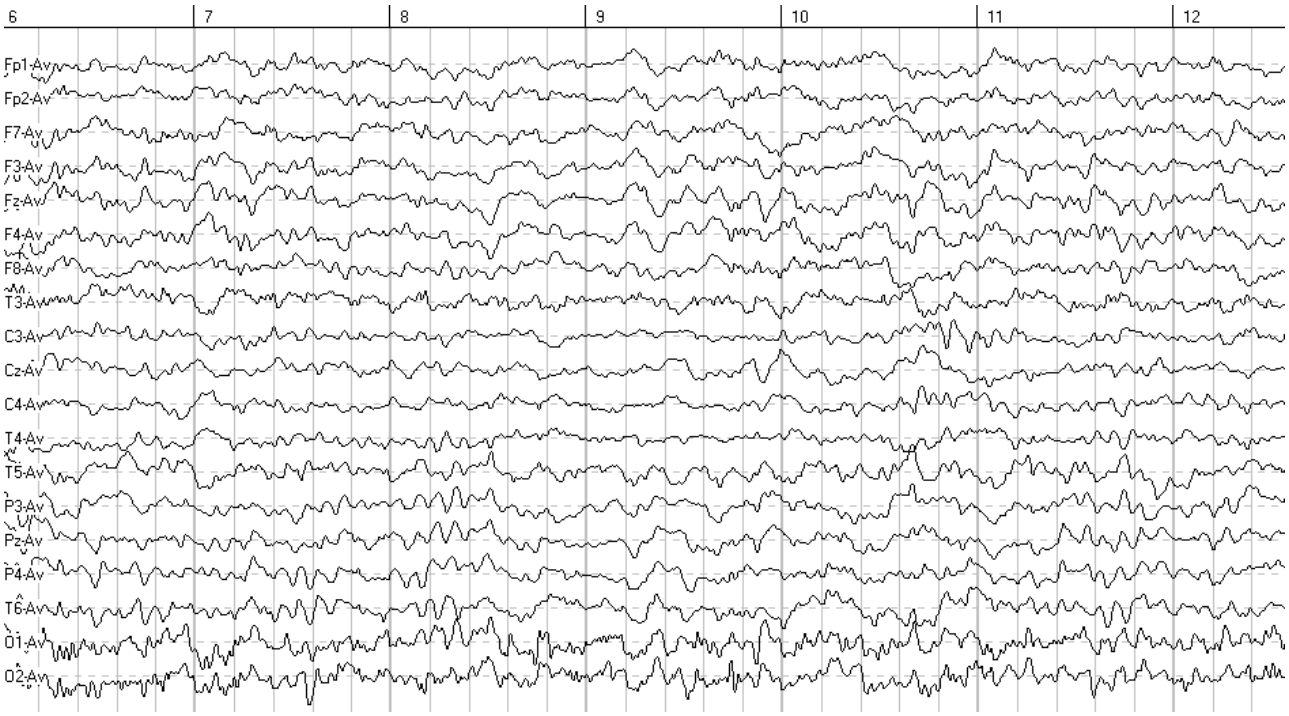
3. Eyes Open – background EEG rhythms.

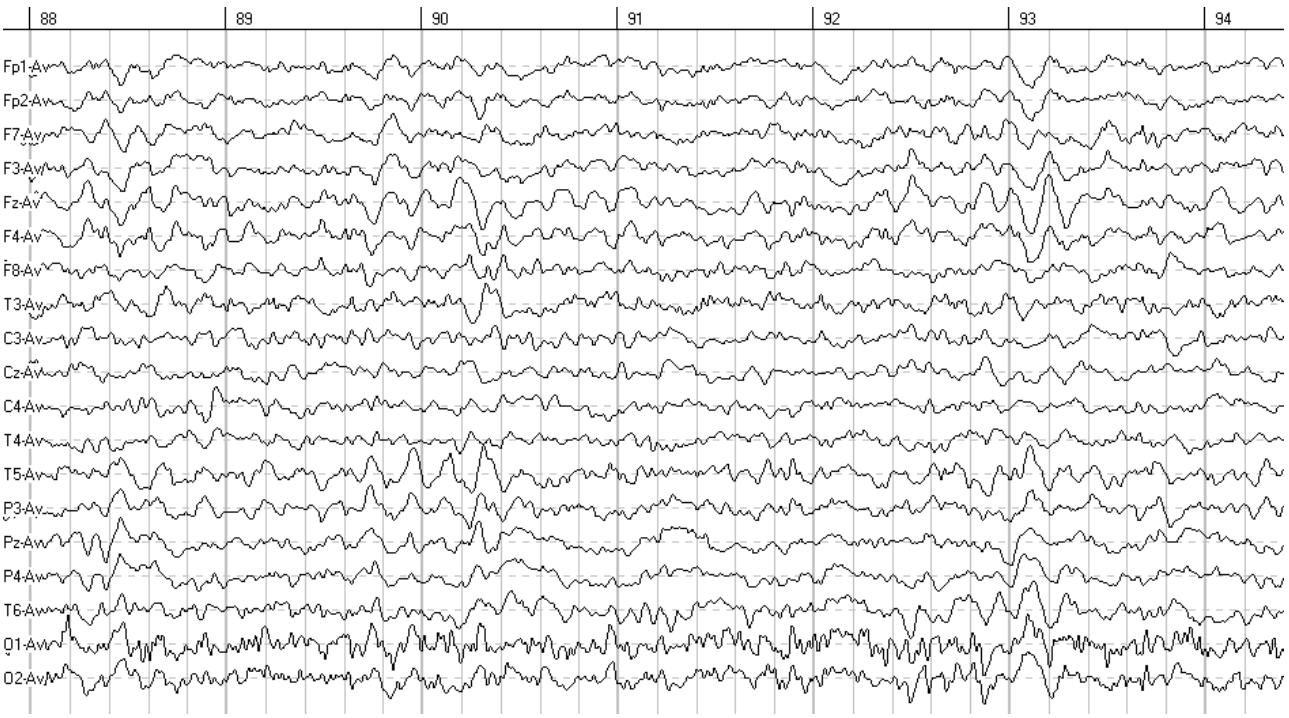
Fragments.

Two fragments of EEG recorded in Eyes Opened (EO) condition in a reference-free montage - "common average" are presented below. This montage will be further referred to as the data base montage.

Scale: 50 mcV/cm, speed – 30mm/sec, time constant – 0.3 sec, low frequency filter – 30 Hz. Vertical and horizontal eye movement artifact correction was done by means of Independent Component Analysis (ICA)

Note: muscle artifacts at:
O1, O2

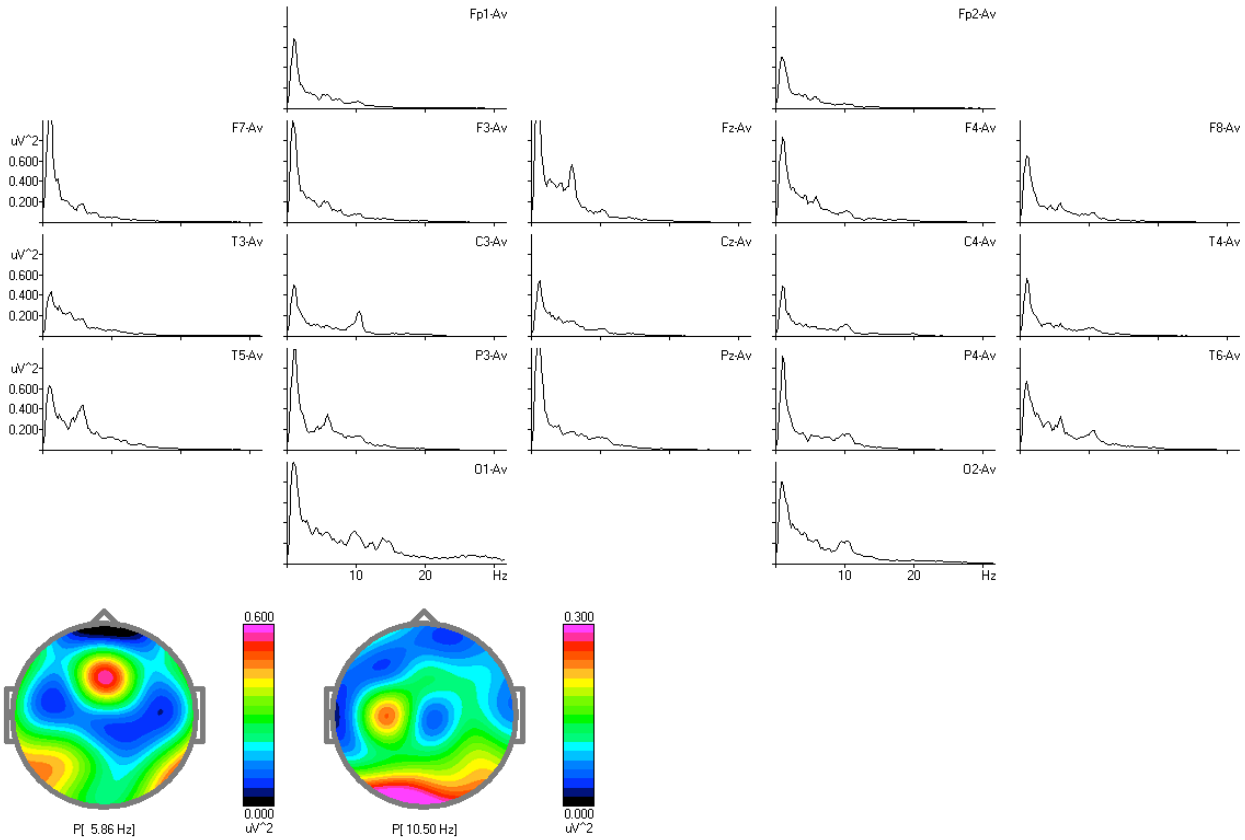




Spectra (EEG power vs. EEG frequency) in Eyes Open condition

for all 19 electrodes in the database montage are presented below. The spectra are computed as follows[4]: 1) The interval in EO condition is divided into equal parts (epochs). The length of an epoch is 4 s. Overlapping of the epochs is set to 50% so that the first 50% of each epoch overlaps the final 50% of the next epoch. 2) To suppress energy infiltration through boundaries of epochs, each epoch is filtered by the Hanning time window. 3) The power spectra are computed by means of "fast Fourier transformation" (FFT) algorithm. 4) Finally the averaged (over time of recording) spectra are calculated for each EEG channel separately.

EEG rhythms are expressed in form of spectra peaks. Maps of EEG rhythms with their frequencies are presented at the bottom.

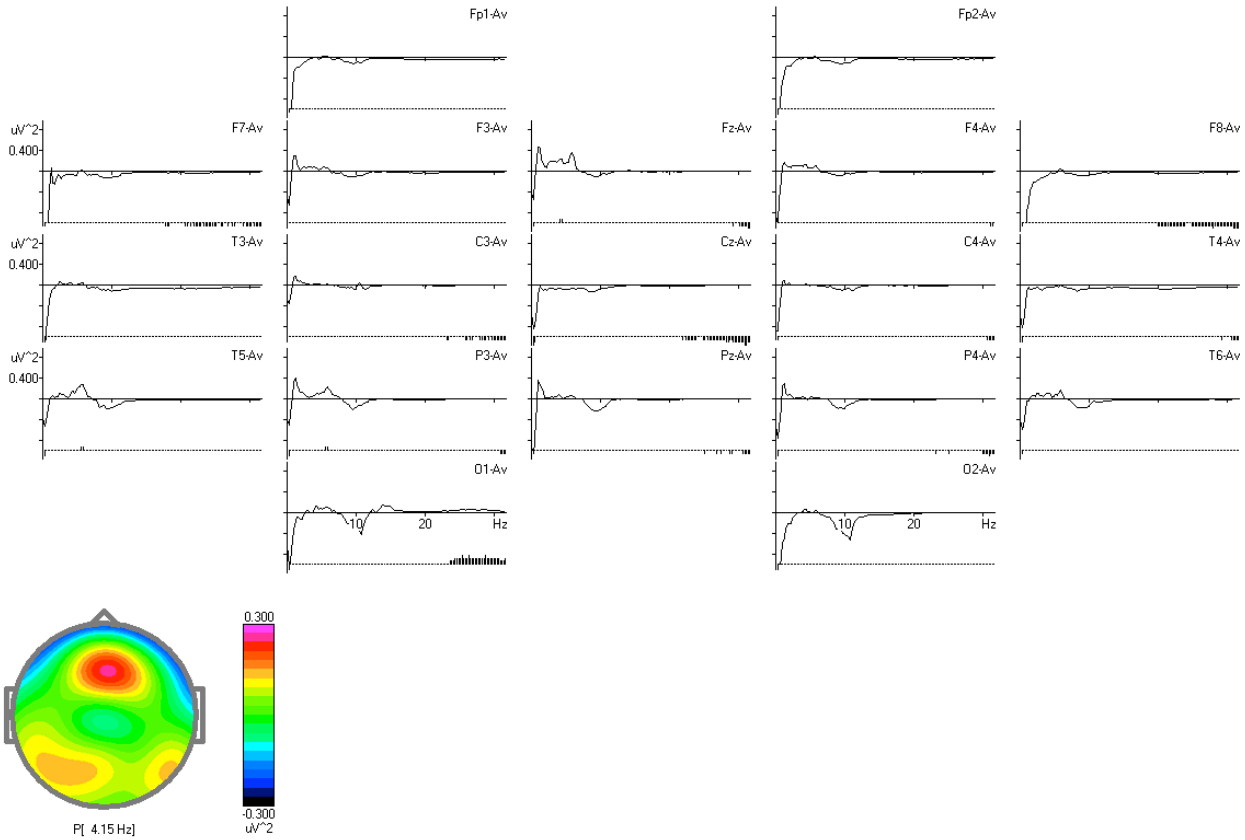


[4] J.Bendat, A.Pirsol «Random data. Analysis and measurement procedure», John Wiley and Sons, NY 1986, 540 pp

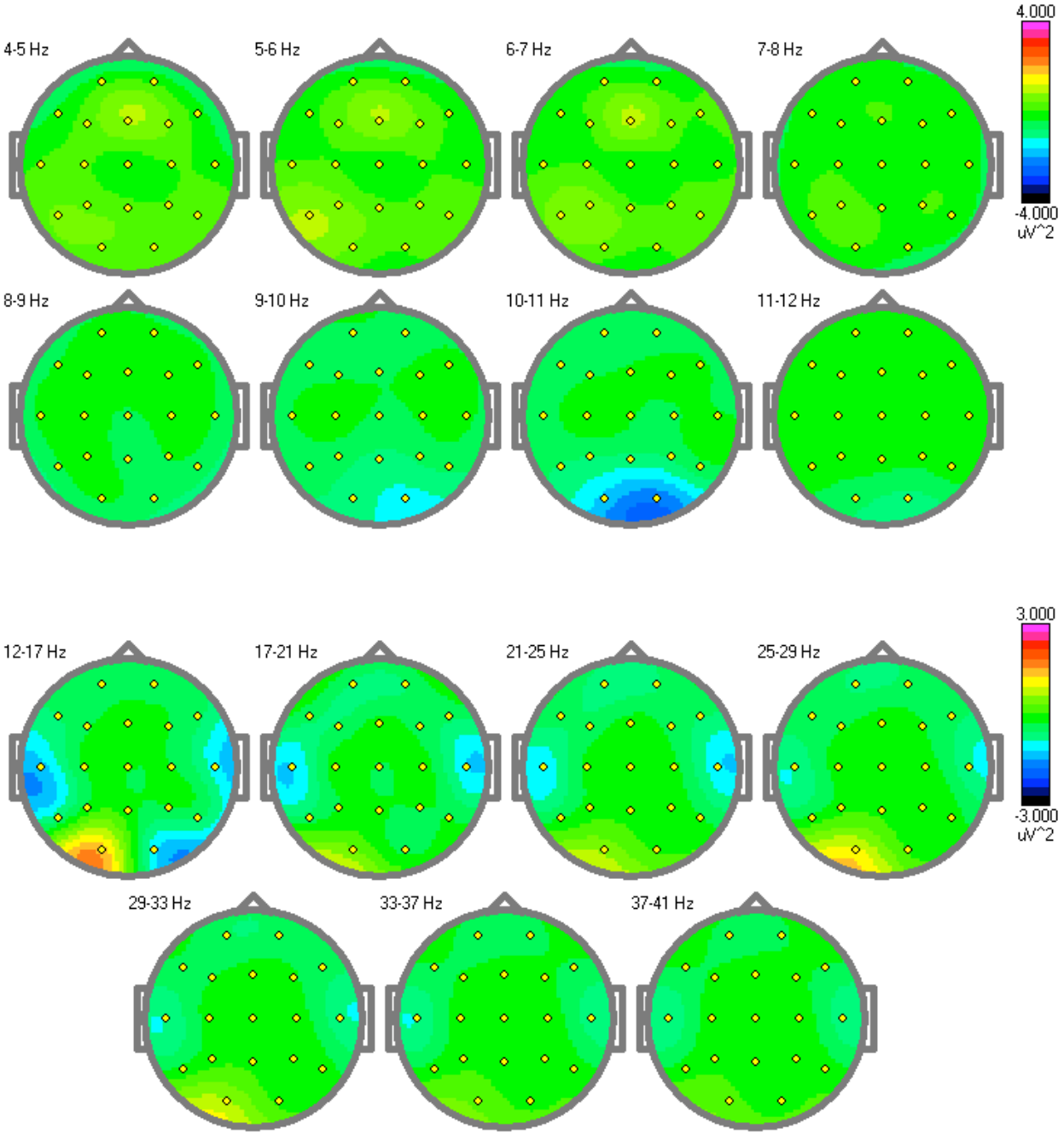
Spectra differences: patient-norms. Absolute EEG power.

The bins with statistically significant (t-test) differences are marked by bars at the bottom of each curve. The smallest ones correspond to $p<0.05$ (z-score>2), the largest ones - to $p<0.001$ (z-score>3), the medium ones – to $p<0.01$ (z-score>2.6).

Topographies of significant deviations from normality are presented at the bottom.



Maps for absolute power spectra deviations from normality in 1 Hs windows (uV^2)



Spectra differences: patient-norms. Relative EEG power.

Relative amplitude was computed as a ratio of the EEG amplitude in the corresponding frequency to the EEG amplitude averaged over 3-30 Hz[5] range. The bins with statistically significant (t-test) differences are marked by bars at the bottom of each curve. The smallest ones correspond to $p<0.05$ (z-score>2), the largest ones - to $p<0.001$ (z-score>3), the medium ones – to $p<0.01$ (z-score>2.6).

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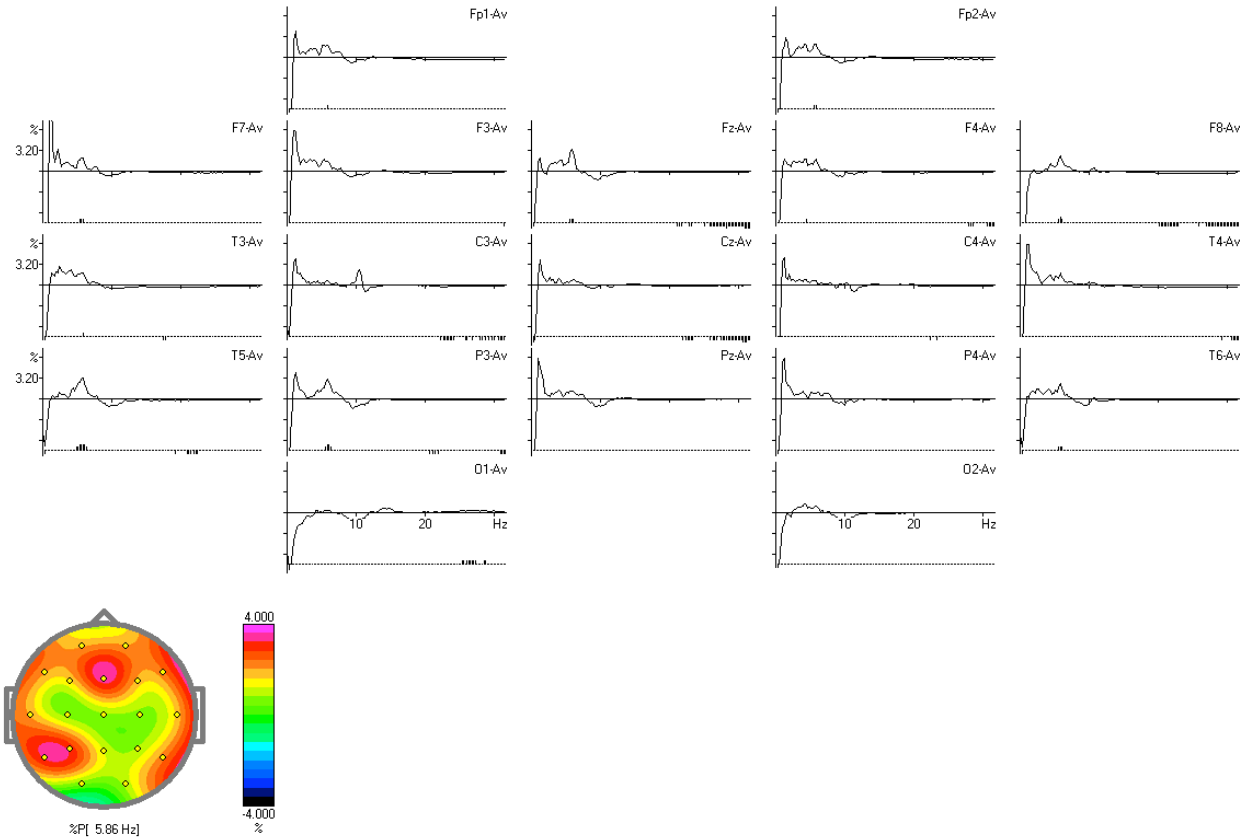
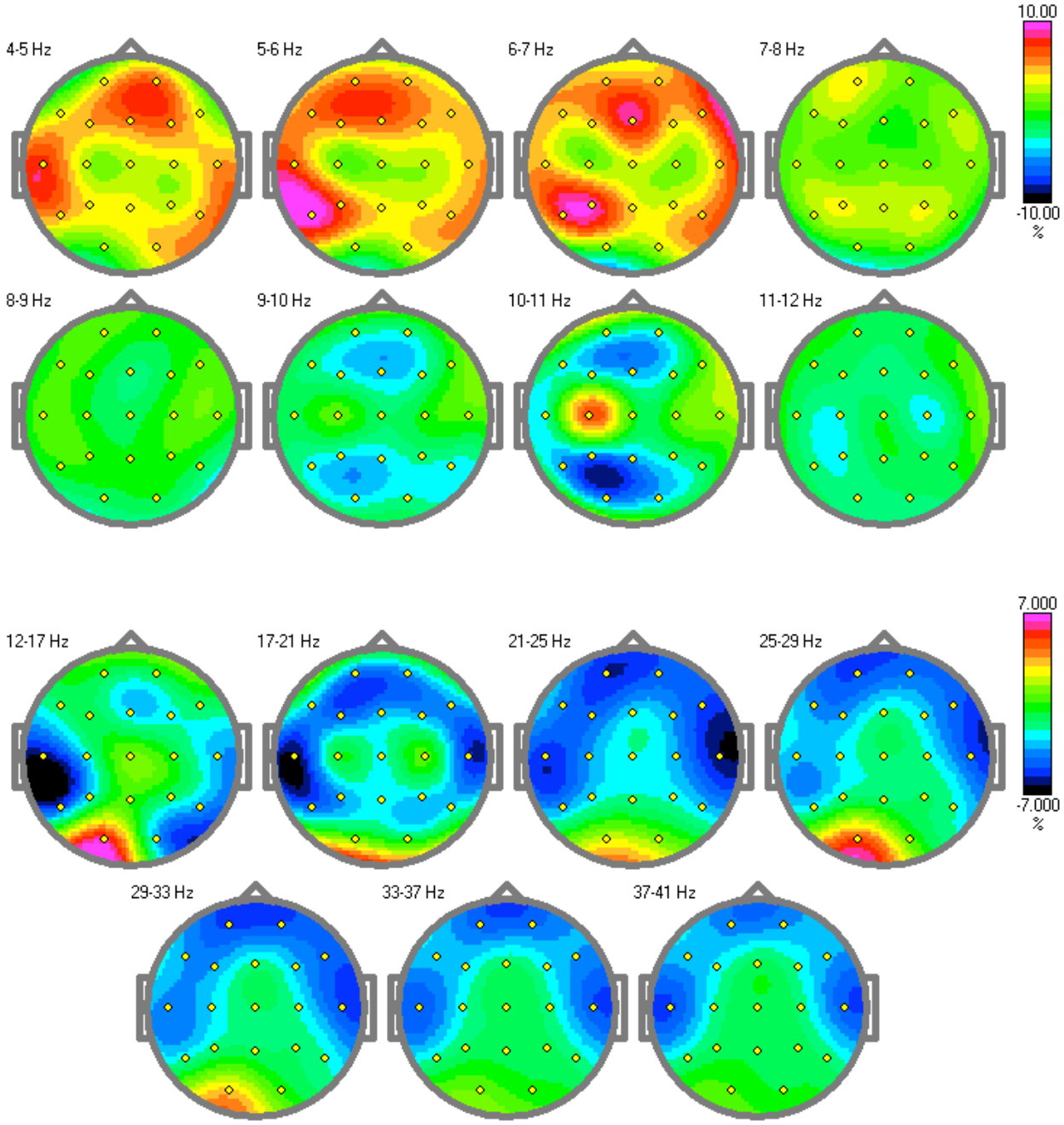


[5] EEG in the frequency band below 3 Hz is subjected to uncontrolled artifacts (such as movements) and has a low coefficient of replicate ability.

Maps for relative power spectra deviations from normality in 1 Hs windows.

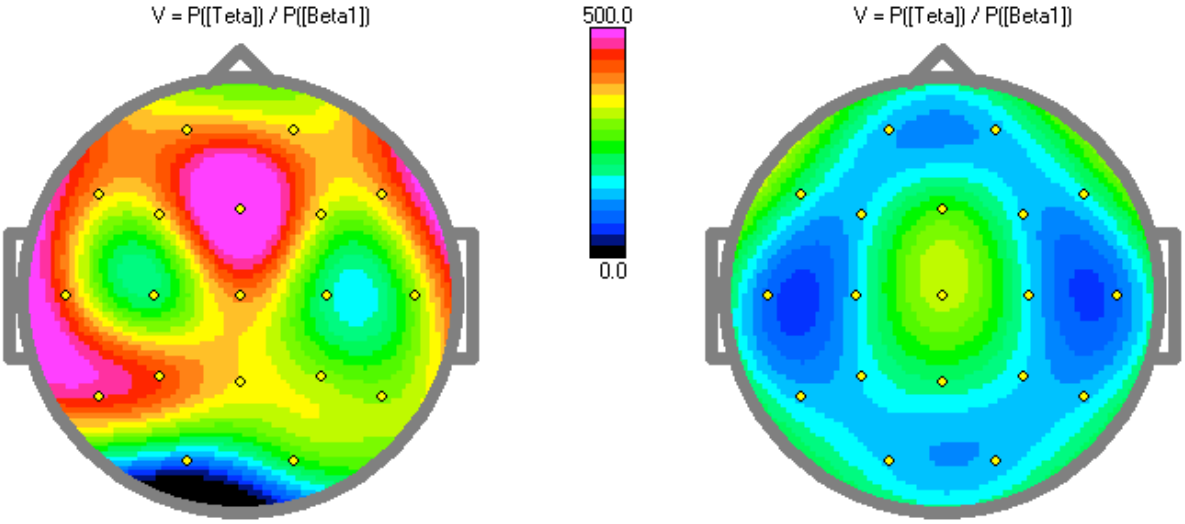


Map of theta/beta ratio.

Theta=4-8 Hz. Beta – 13-21 Hz. Left – patient, right – norms.

Theta beta ratio is called "inattention index" because it negatively correlates with age and positively correlates with errors in continuous performance tasks (such as TOVA – Test for variances of attention or IVA). In ADHD patients this index is elevated in comparison to norms[6].

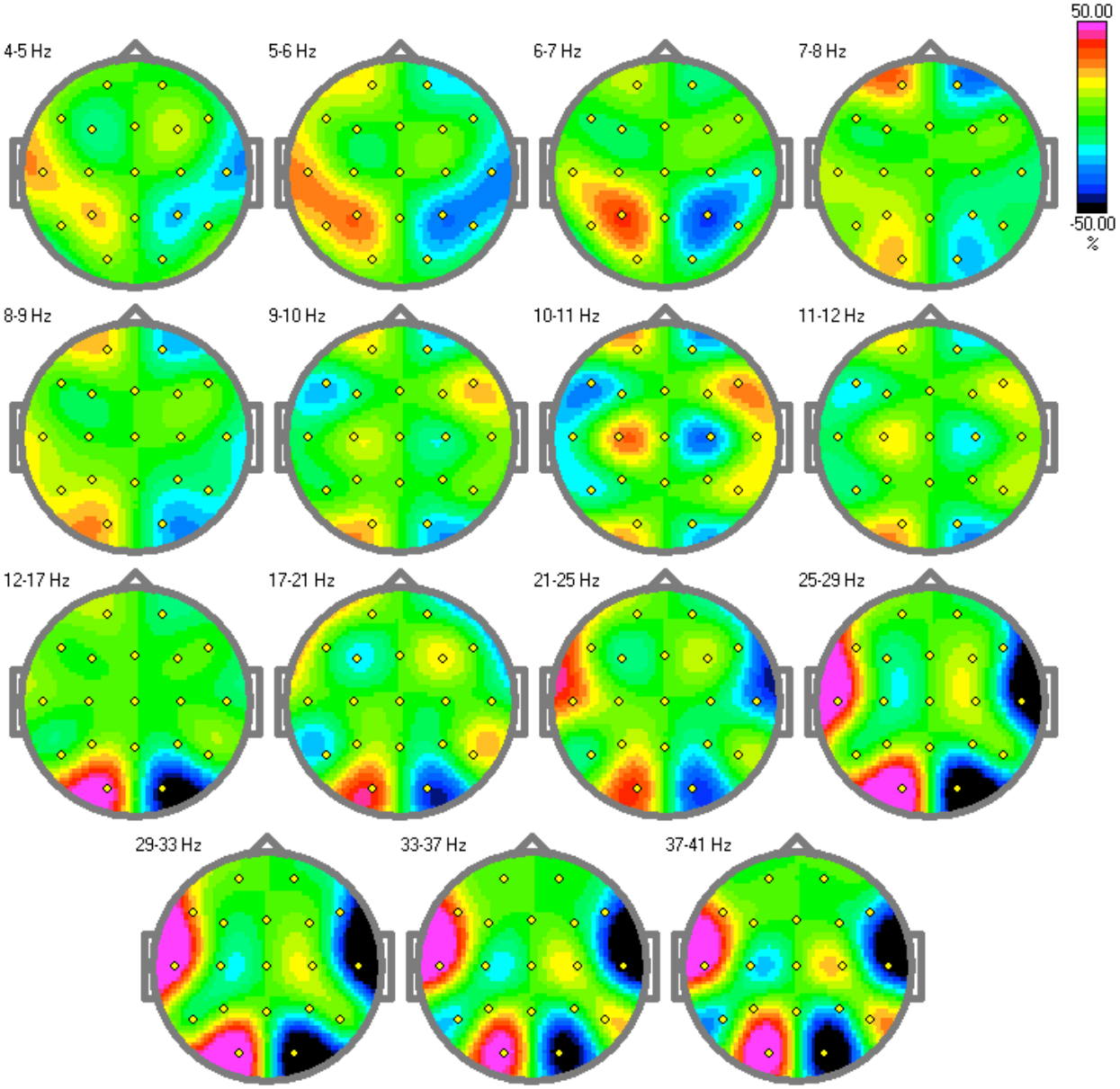
Note significant relative increase (about 150%) of this index at Cz in this patient in comparison to norms.



[6] Monastra et al., 1999

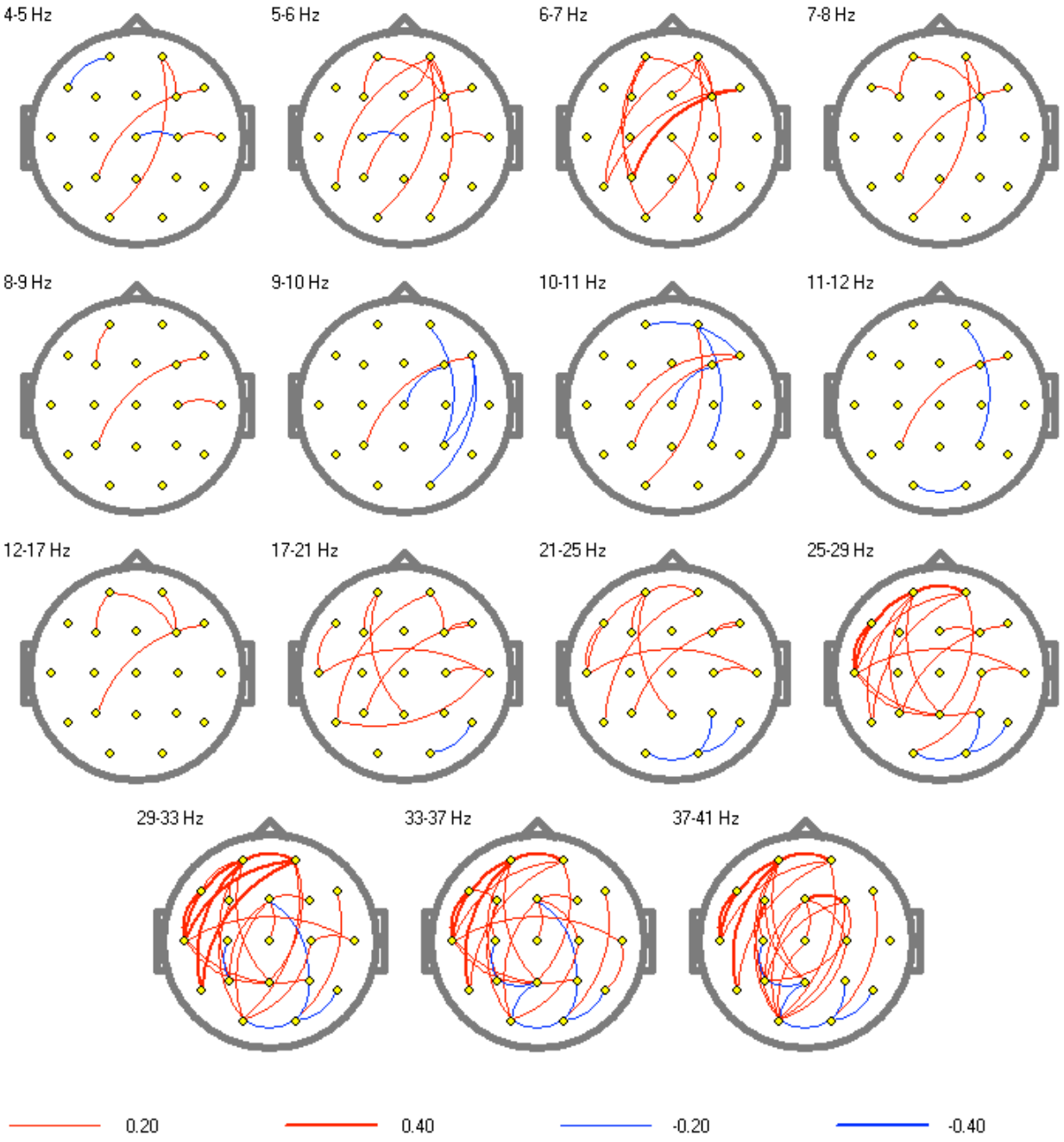
Asymmetry maps of power spectra in eyes open conditions for 1 Hz bands.

Note that an asymmetry higher than 50% may be a sign of abnormality[7].



[7] Asymmetry may be due to asymmetrical muscle, cardioballistic, or other artifacts which must be evaluated before making any interpretive conclusions.

Diagrams of excessive (in red) or reduced (in blue) coherence



4. Eyes Closed – background EEG rhythms.

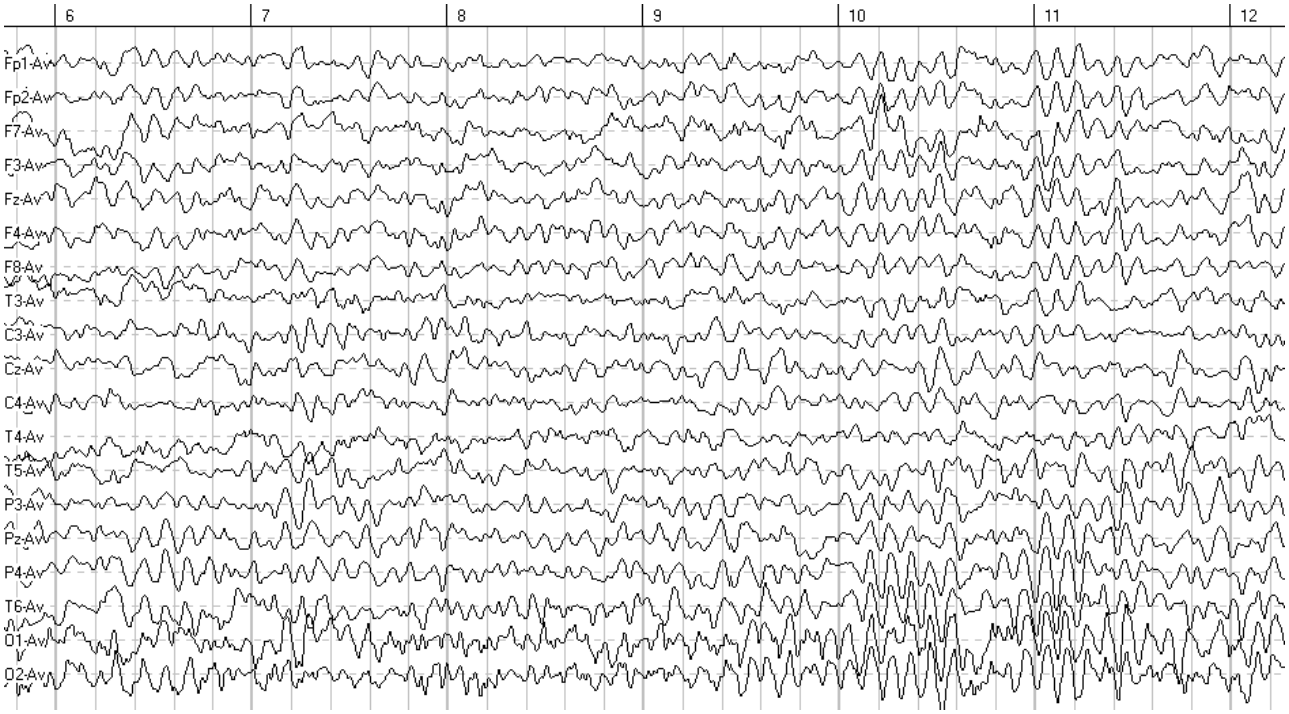
Fragments.

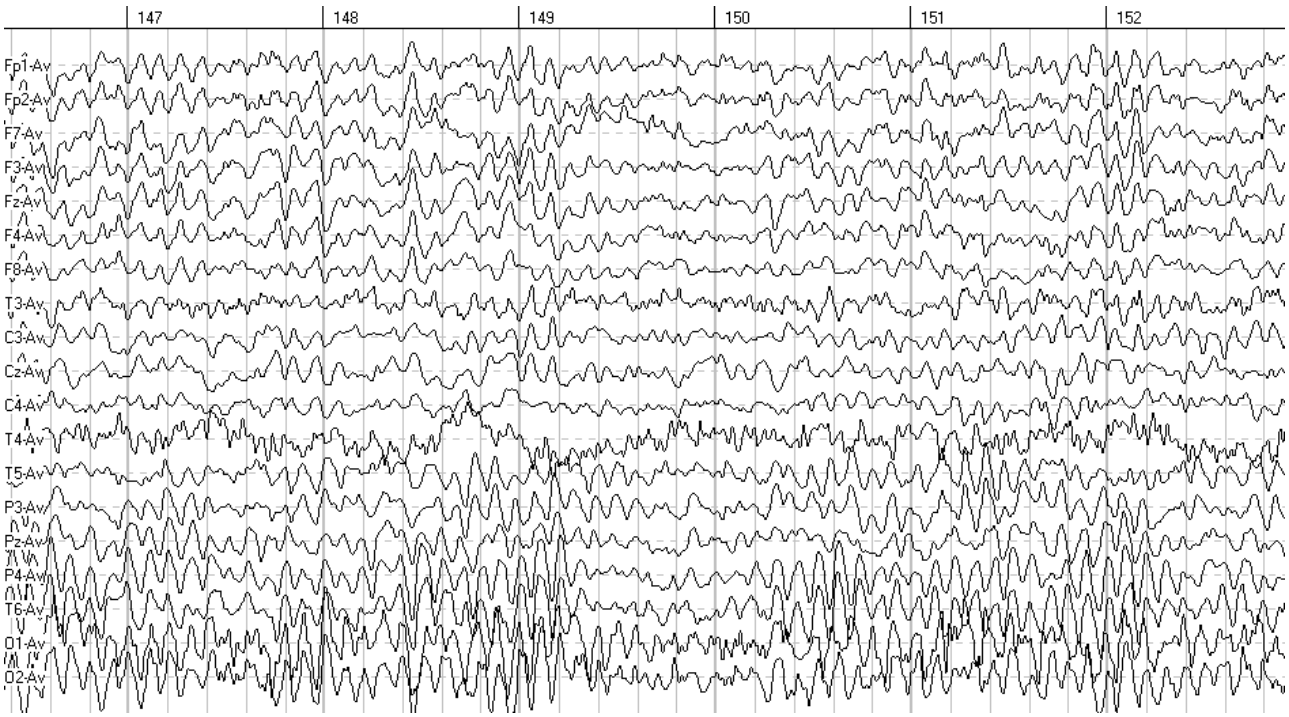
Two fragments of EEG recorded in Eyes Closed (EC) condition in a reference-free montage - "common average" are presented below. This montage will be further referred to as the data base montage.

Scale: 50 mcV/cm, speed – 30mm/sec, time constant – 0.3 sec, low frequency filter – 30 Hz. Vertical and horizontal eye movement artifact correction was done by means of Independent Component Analysis (ICA)

Note: muscle artifacts at:

T4





Spectra (EEG power vs. EEG frequency) in Eyes Closed condition

for all 19 electrodes in the database montage are presented below. The spectra are computed as follows[8]: 1) The interval in EO condition is divided into equal parts (epochs). The length of an epoch is 4 s. Overlapping of the epochs is set to 50% so that the first 50% of each epoch overlaps the final 50% of the next epoch. 2) To suppress energy infiltration through boundaries of epochs, each epoch is filtered by the Hanning time window. 3) The power spectra are computed by means of "fast Fourier transformation" (FFT) algorithm. 4) Finally the averaged (over time of recording) spectra are calculated for each EEG channel separately.

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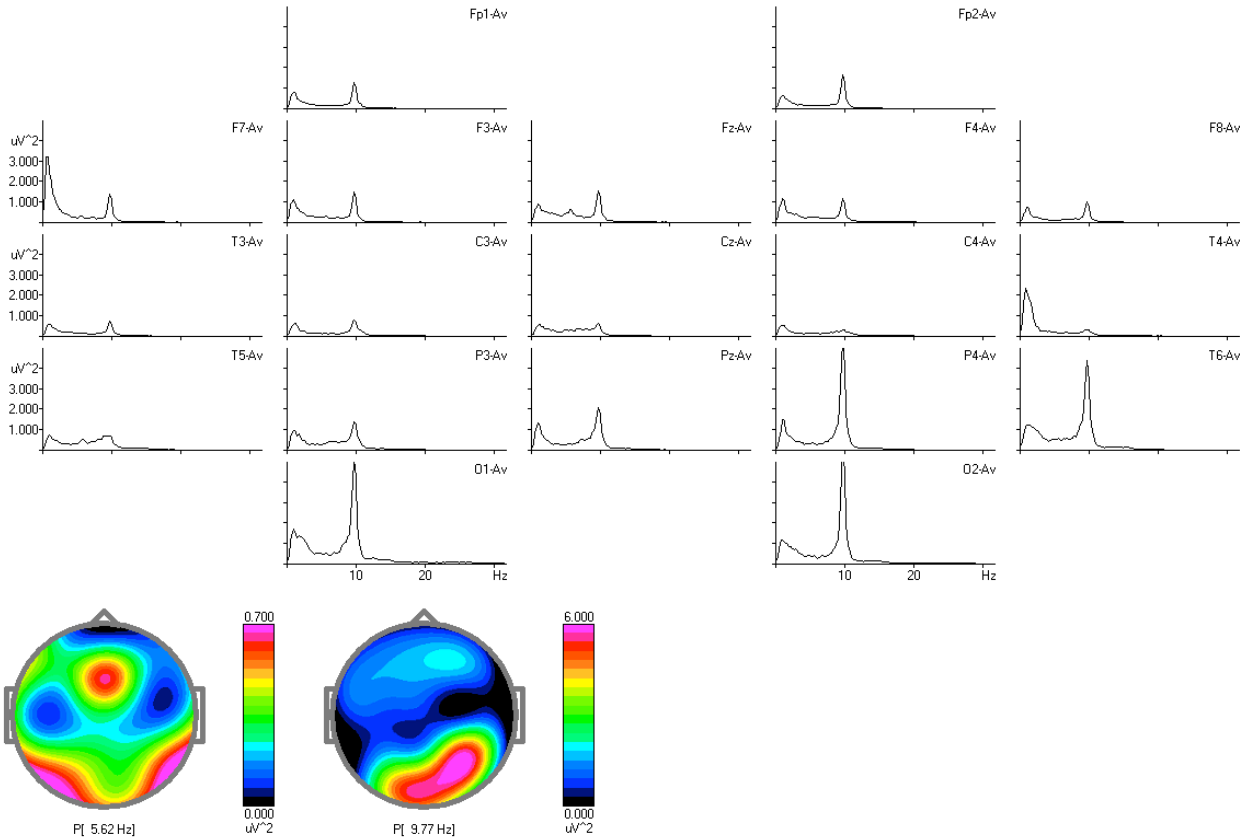

[8] J.Bendat, A.Pirsol «Random data. Analysis and measurement procedure», John Wiley and Sons, NY 1986, 540 pp

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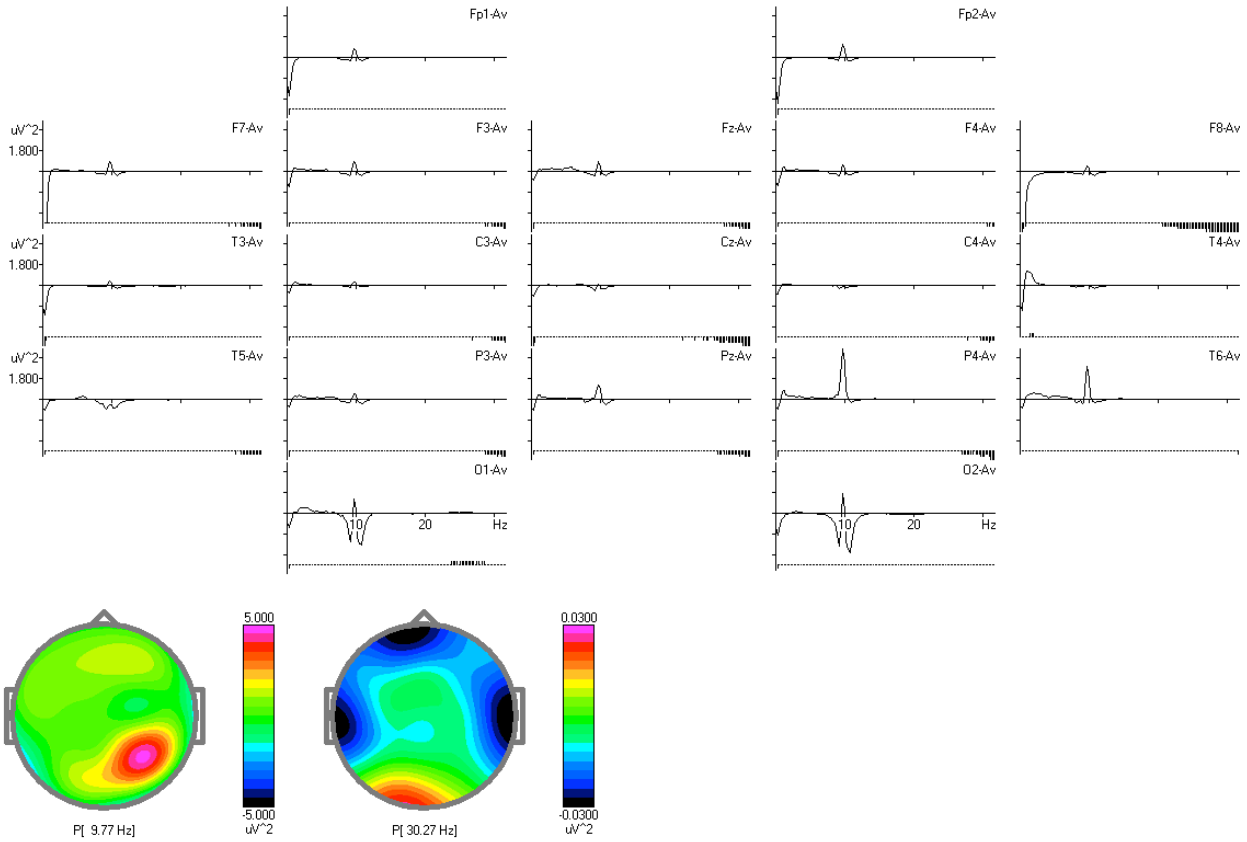

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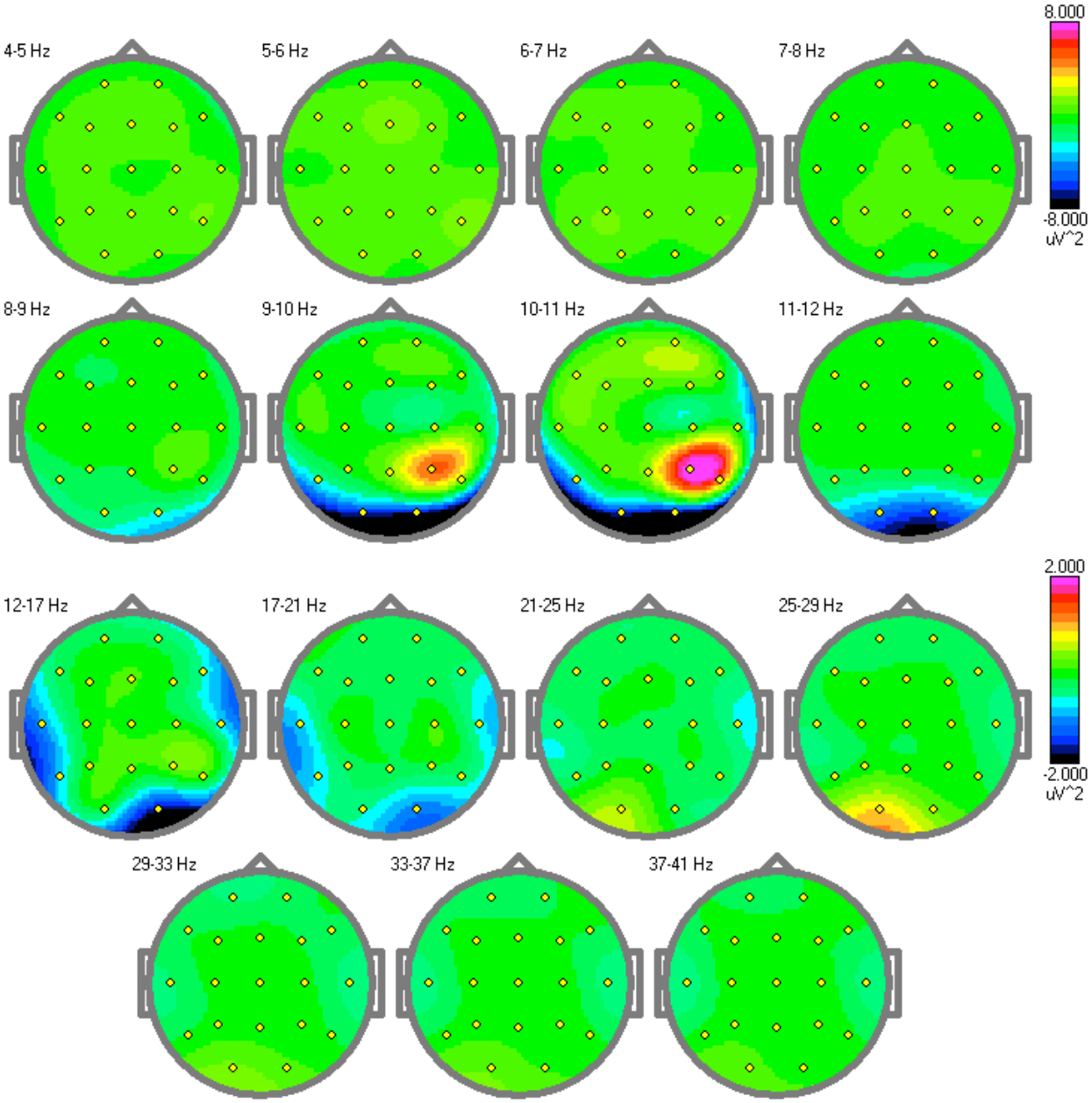

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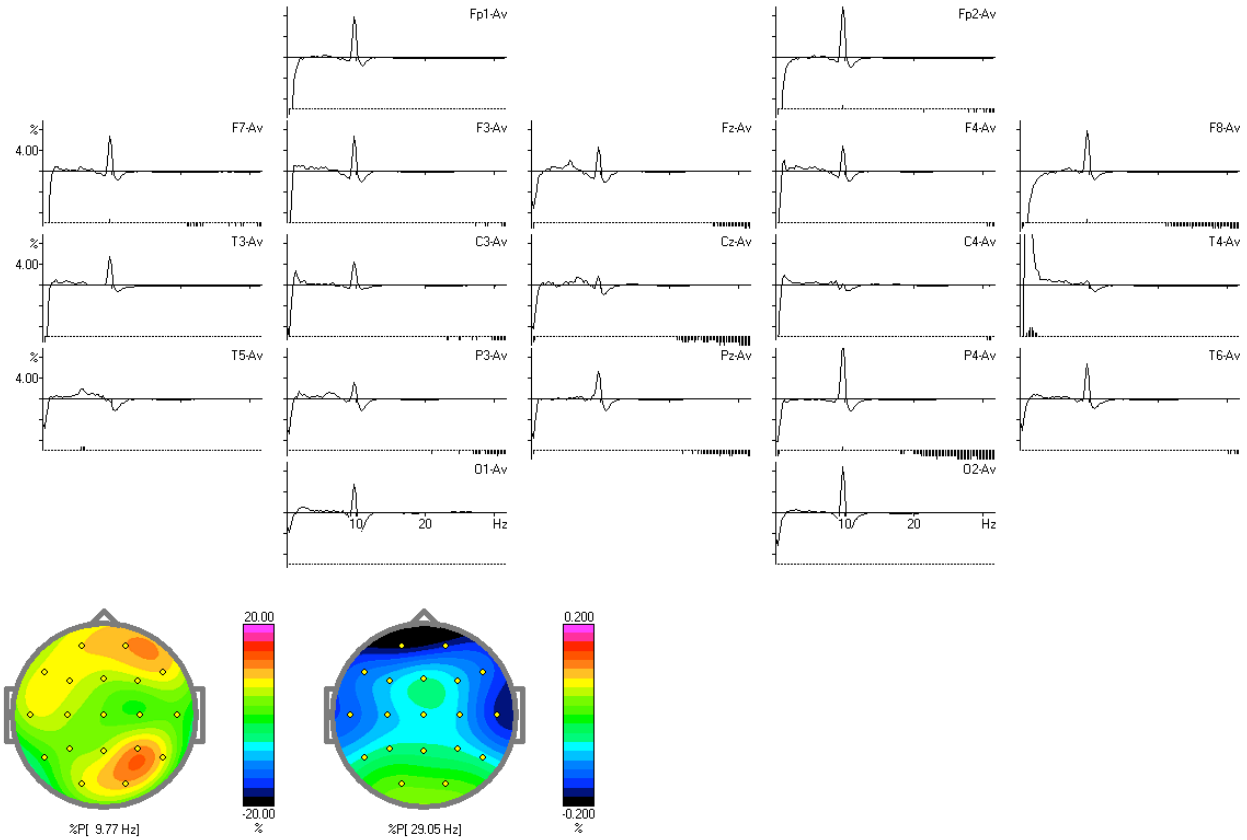
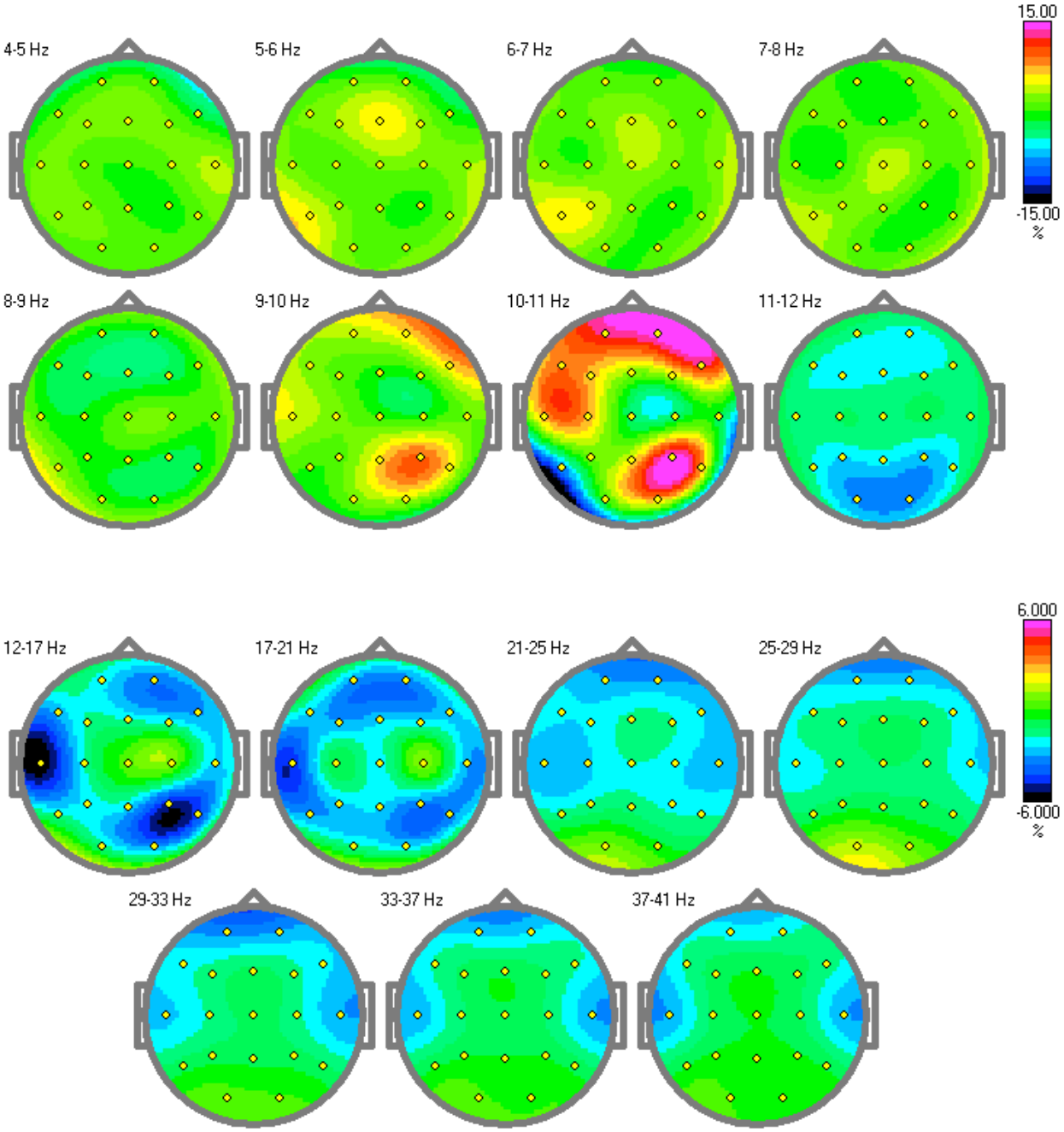


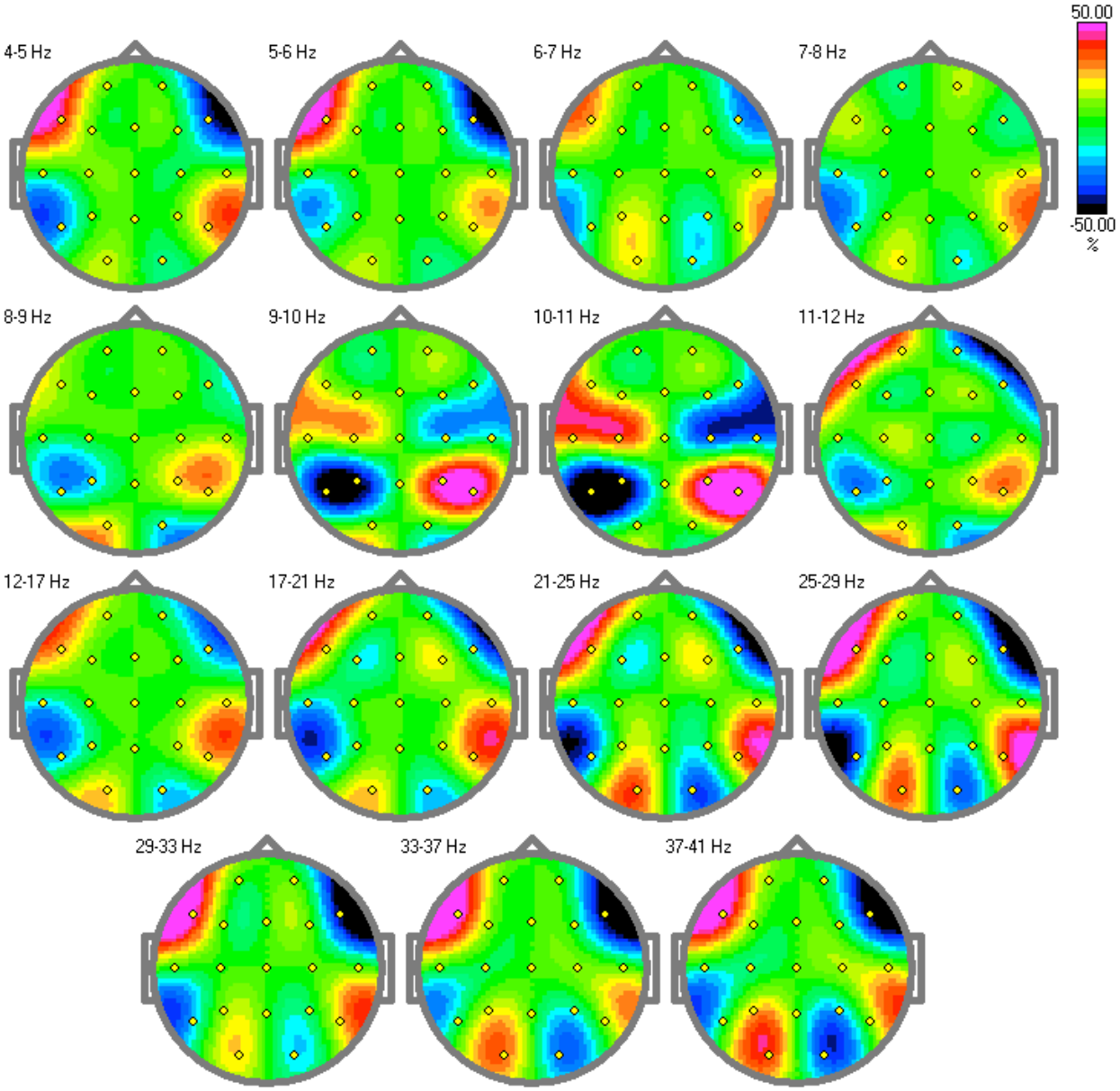
[9] EEG in the frequency band below 3 Hz is subjected to uncontrolled artifacts (such as movements) and has a low coefficient of replicate ability.

Maps for relative power spectra deviations from normality in 2 Hs windows.



Asymmetry maps of power spectra in eyes closed conditions for 2 Hz bands.

Note that an asymmetry higher than 50% may be a sign of abnormality[10].



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