

Polysomnographs

Electroencephalograph-recorders "Encephalan-EEGR-19/26" with SW Somnological studies "Encephalan-PSG"

Polysomnographic studies are the main method of diagnosing sleep disorders – insomnia, hypersomnia, parasomnia, narcolepsy; respiratory disorders – sleep apnea syndrome, snoring and concomitant heart rhythm disorders, as well as neurological and psychosomatic disorders – epilepsy, "restless legs" syndrome, etc.



- Stationary and portable expert class polysomnographs
- Recorded signals and calculated parameters are in accordance with the recommendations of AASM*
- Video monitoring is synchronized with recorded signals
- Telemetric and Autonomous study modes

* AASM – American Academy of Sleep Medicine



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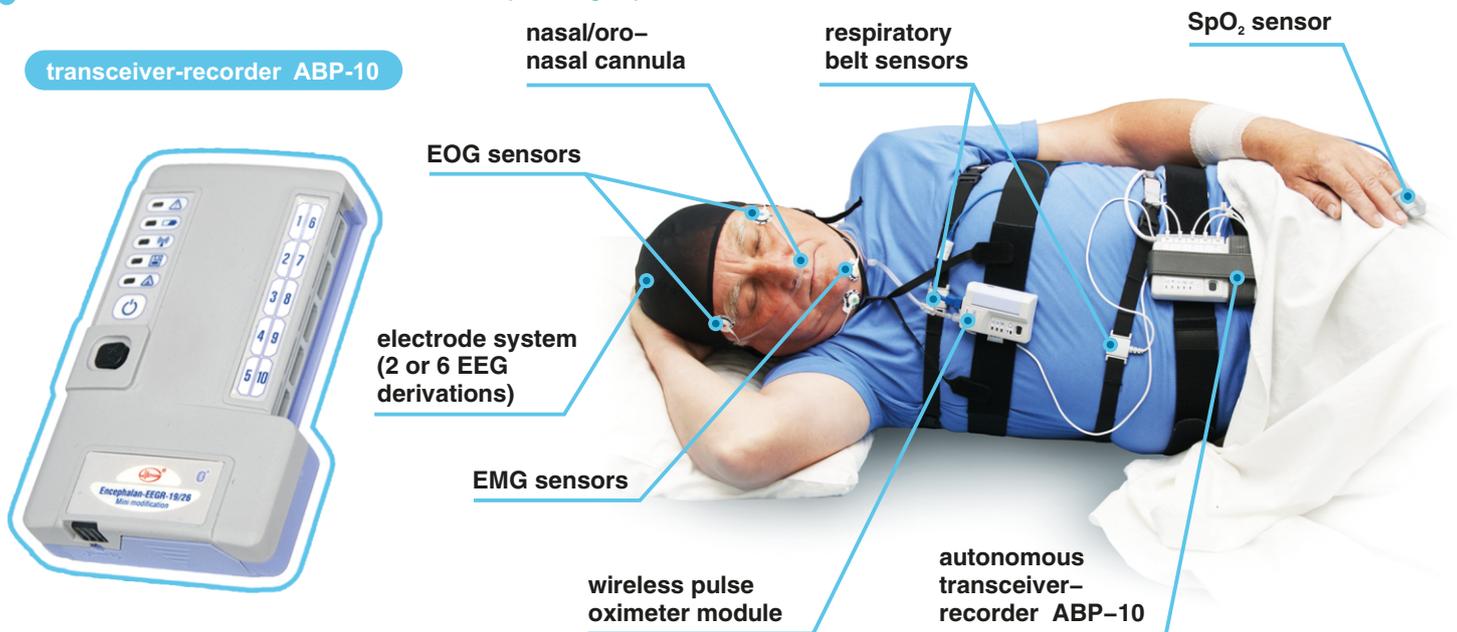


The modular concept of portable encephalograph–recorders "Encephalan–EEGR–19/26" with SW Somnological studies "Encephalan–PSG" allows forming different variants of polysomnographs, from a simple low–cost one to an expert–class polysomnograph with synchronized video monitoring.

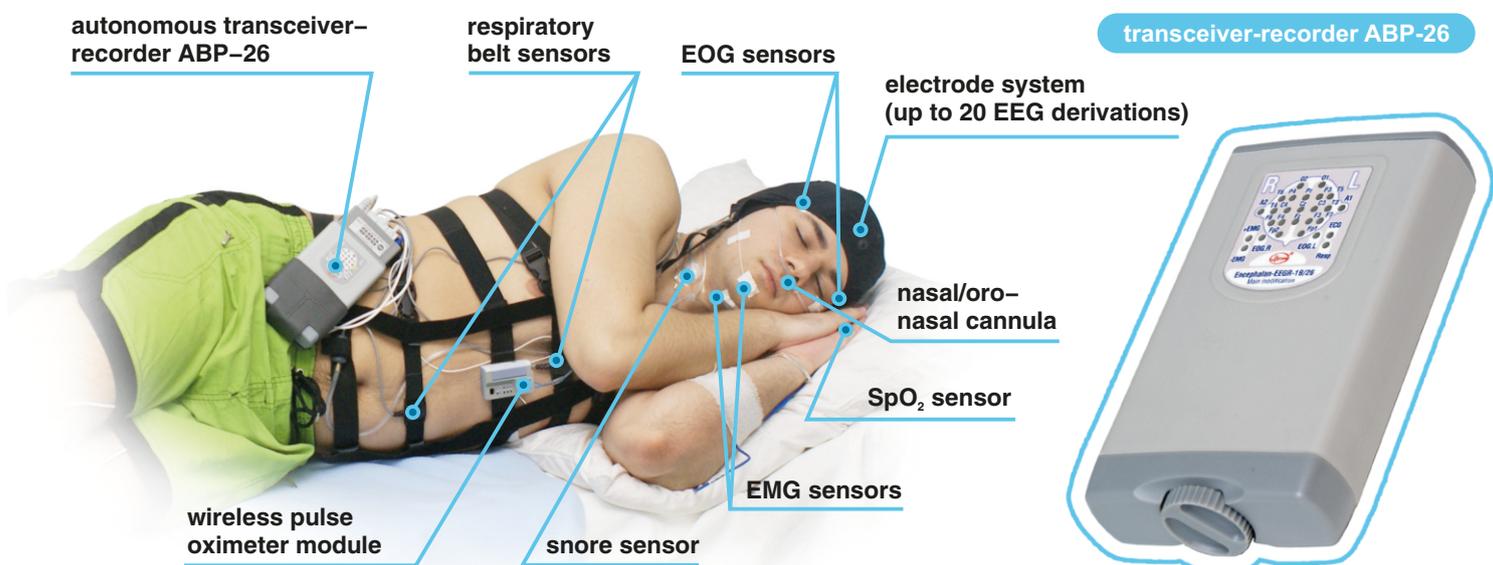
Portable wearable electroencephalographs "Encephalan" are the best way to provide comfortable polysomnographic studies in a hospital ward, at patient's home, as well as at a stationary polysomnographic center. During the study, the patient is not limited in movement and can, if necessary, get out of bed and even leave the room (for example, to WC), while PSG data recording will not be interrupted due to the wireless connection of the polysomnograph to record data to the computer, as well as recording to the internal memory card of the patient transceiver–recorder.

Variants of portable (mobile) application of polysomnographs when placing autonomous patient transceiver–recorders ABP-10, ABP-26 or ABP-26 with POLY-10 (ABP-10 in POLY-10 mode) on the patient's belt or next to the patient

Models: "AT-Somno", "AT-Somno-Video"
Modification "Mini" of electroencephalograph



Models: "AT", "AT-PSG", "AT-PSG-Video", "AT-PSG-Video-Poly"
Main modification of electroencephalograph



Models: "AT", "AT-PSG", "AT-PSG-Video-Poly"

The main modification of electroencephalograph with the ability to register 32 EEG derivations

Cap MCScap with EEG electrodes



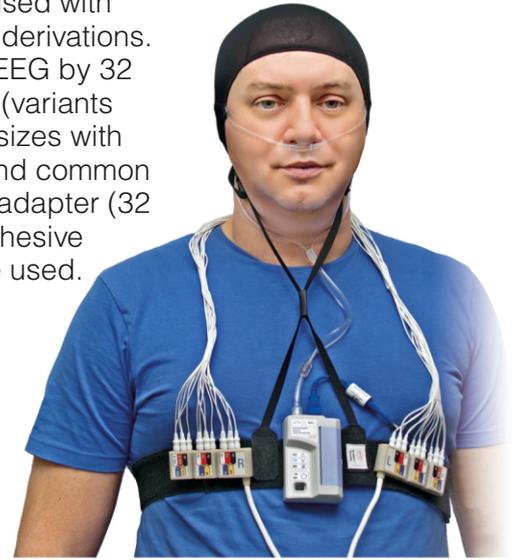
ABP-10 in Poly-10 mode



Transceiver-recorder ABP-26

Adapter cable

The patient's transceiver-recorder ABP-26 is used with POLY-10 module to register additional 10 EEG derivations. For long-term comfortable registration of EEG by 32 derivations, EEG recording caps MCScap (variants CLINIC or SLEEP) of different sizes with preinstalled EEG electrodes and common connector or cable adapter (32 EEG) with single adhesive electrodes are used.

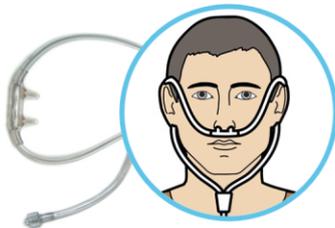


Wireless pulse oximeter module (WPM)



The module is included into all polysomnographs and provides registration of: blood oxygen (SpO_2), photoplethysmogram (PPG), movement activity (move) using a built-in accelerometer, respiratory airflow by pressure (P-flow) from the nasal or oronasal cannula. With the help of a special adapter for the CPAP device, the airflow from the CPAP mask can be connected to the WPM airflow channel.

WPM and SW Somnological studies "Encephalan-PSG" also provide the calculation of: perfusion index (Perfl), the position of the patient's body (BP), snoring intensity (from the P-flow sensor).



Nasal and oronasal cannulas

T-adapter with tube for connection of airflow sensor by pressure to the CPAP mask of the device



Soft reusable SpO_2 sensors of various sizes

Modules to enhance the capabilities of polysomnographs



Poly-10 polygraphic module (ABP-10 in Poly-10 mode)



Poly-4 polygraphic module



Wireless respiratory sensors module (WRM)

In basic sales packages of polysomnographs (see below), the hardware uses electrode systems for 2 (modification "mini") or 6 EEG derivations and connection of necessary sensors for polygraphic channels directly to patient transceiver-recorders ABP-10 and ABP-26.

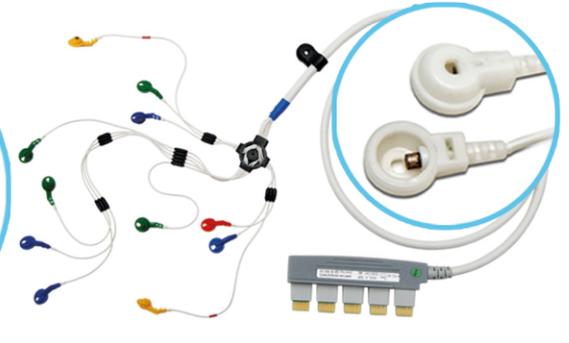
When increasing the EEG registration channels to 6 in the "Mini" modification and up to 20 or 32 in the main modification, the sales package should include additional polygraphic modules for sensors that provide registration of signals and parameters in polysomnographic studies.

EEG electrode sets ES-EEG-10/20 "Encephalan-ES"

Sets are used for high-quality long-term registration of EEG, EOG and EMG and include contact gel sets and sets with adhesive EEG electrodes. Electrodes from sets for electrode gel are fixed in special eyelets of a textile EEG-cap, and sets with adhesive electrodes are fixed by means of electrode paste EC2 or similar. The sets include electrodes for EEG, EMG and ECG. The electrode conductors are assembled into a cable and have a group connector for the ABP-26 or ABP-10. When using the electrode system ES-EEG-4-1 (cup) for "Mini" modification and the electrode system ES-EEG-6-3 (cup), the connection of sensors for polygraphic channels is carried out directly to the patient transceiver-recorders ABP-10 and ABP-26.



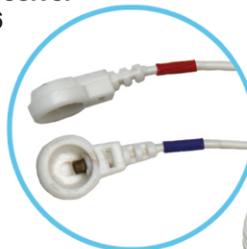
Electrode system with electrodes for contact gel



Electrode system with adhesive cup electrodes

Set of adhesive cup EEG electrodes with touchproof connector type

Connectors of patient transceiver-recorders ABP-10, ABP-26 for touchproof EEG, EMG and EOG electrodes



EEG electrodes



Adhesive paste

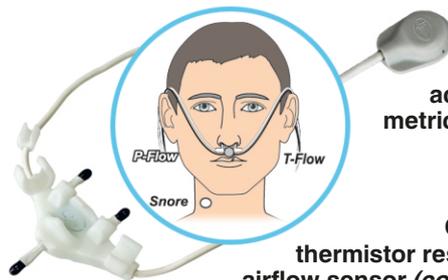
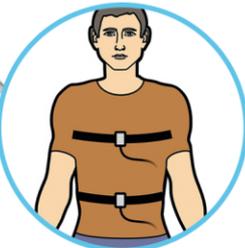


Protective cover-caps for EEG electrodes

ABP-26 transceiver-recorder with EEG-20 connector and EEG electrodes

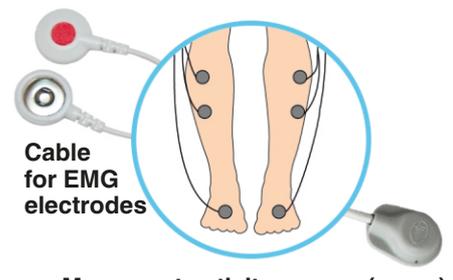
Main types of sensors for PSG studies

Piezoresistive belt respiratory sensors (thoracic and abdominal)



Snore accelerometric sensor

Oronasal thermistor respiratory airflow sensor (compatible with airflow cannulas)



Cable for EMG electrodes

Movement activity sensor (move)



Inductive belt respiratory sensors: thoracic and abdominal (not applicable for WRM)



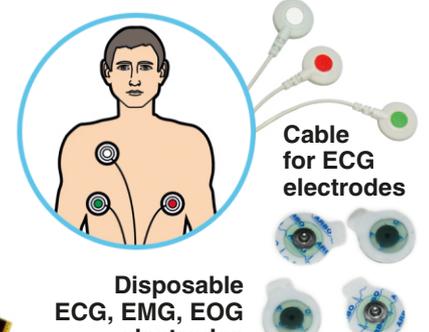
Envelope EMG sensor



Wetness sensor



Temperature sensor



Cable for ECG electrodes

Disposable ECG, EMG, EOG electrodes

Basic packages of polysomnographs "Encephalan-EEGR-19/26"

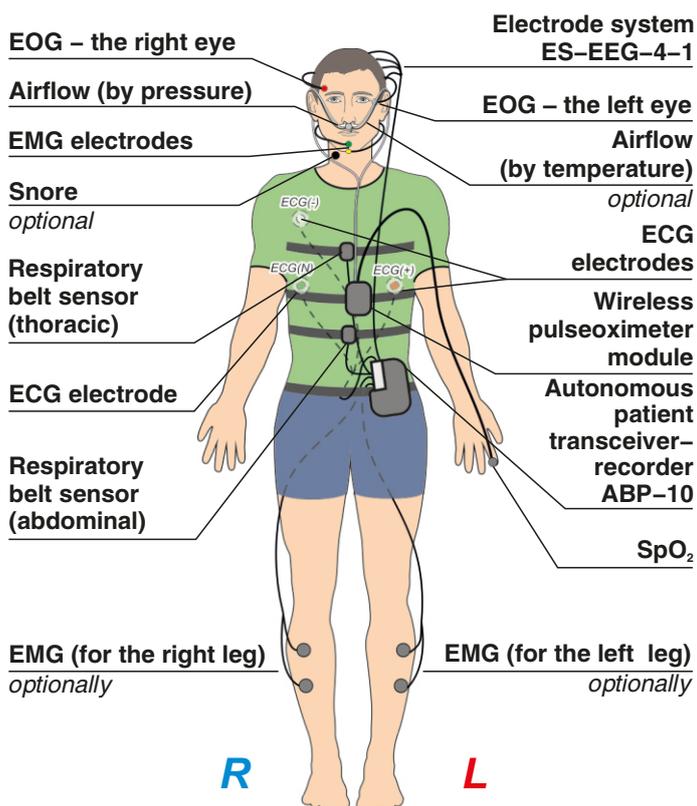
Model "AT-Somno" (modification "Mini")

10-channel patient transceiver-recorder ABP-10 with electrode system ES-EEG-4-1 (cup) for registration of:

- 2 EEG, 1 chin EMG, and 2 EOG;
- ECG, RespEff (thoracic), RespEff (Abdominal), T-flow, snore or EMG (left leg). EMG (right leg) – optional – by 5 polygraphic channels of ABP-10.

Pulseoximeter module (standard configuration) for registration of:

- SpO₂, PPG, PR, Perfl, P-flow, snore (from P-flow sensor), movement (general), body position.



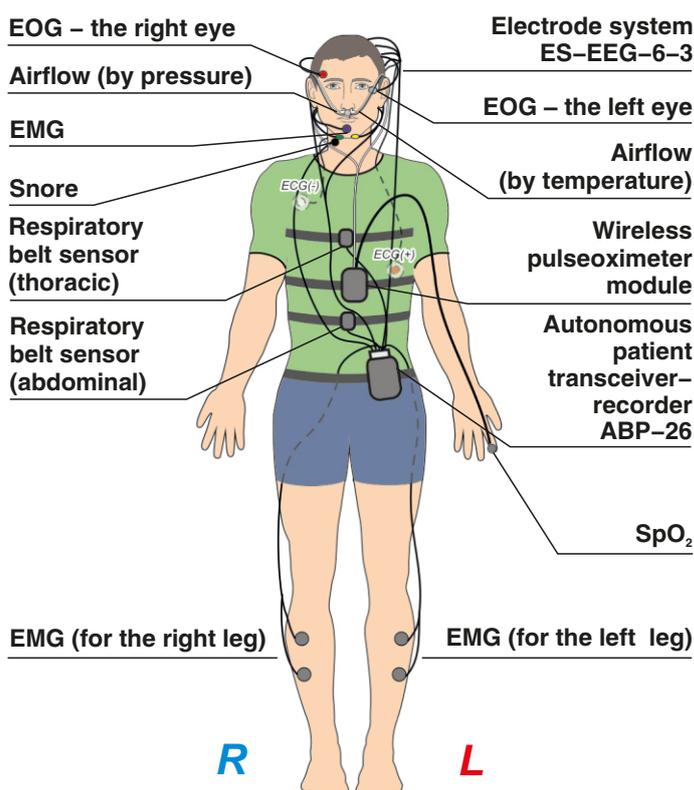
Model "AT-PSG" (main modification)

26-channel patient transceiver-recorder ABP-26 with electrode system ES-EEG-6-3 (cup) for registration of:

- 6 EEG, 3 EMG from the chin derivations, 2 EOG, 1 ECG;
- Respiratory Effort (thoracic), Respiratory Effort (abdominal), T-flow, snore, EMG (left leg), EMG (right leg) by 6 polygraphic channels of ABP-26 via the connector of the electrode system.

Pulseoximeter module (standard configuration) for registration of:

- SpO₂, PPG, PR, Perfl, P-flow, Snore (from P-flow sensor), movement (general), body position.



Using different types of electrode systems' sets from "Encephalan-ES", EEG recording caps MCScap, as well as different sets of single cup electrodes, additional modules and sensors for PSG studies from the electroencephalograph "Encephalan-EEGR19/26", customer can choose "basic", "optimal", "professional" or "professional 32-EEG" sales package.

(See "Quick guide to choosing a polysomnograph sales package" on the "i" button at the top of the site medicom-mtd.com) or customise PSG system configuration.

Video equipment kit for EEG / PSG-video monitoring and software "Encephalan-Video"

Polysomnographs of 1, 2 types in both mobile and stationary versions in PSG studies are recommended to be supplemented with a videomonitoring kit for the analysis of various pathological phenomena and manifestations in sleep in order to visually analyze general movement activity, fine movement skills of the limbs, paroxysmal, seizure activity, manifestations of respiratory disorders, snoring simultaneously and synchronously with recorded physiological signals.



Video equipment kits (with 1, 2 or 3 cameras) for polysomnographs can be supplied in stationary (with one or two cameras), mobile or autonomous versions and provide synchronization of video data with polysomnographic study's data.

Detailed information see in a specific brochure

SW Somnological studies "Encephalan-PSG" and SW for EEG studies "Encephalan-EEGR", which, harmoniously and effectively complementing each other, provide high-quality signals record, useful tools for visual and automated analysis, as well as all the necessary processing, data presentation and generation of protocols of PSG studies in accordance with the standards and recommendations of the AASM. **The powerful EEG processing system, which complements SW "Encephalan-PSG",** includes various types of quantitative EEG analysis methods for accurate and complete neurophysiological diagnosis.

An example of the information placement in the analysis and processing



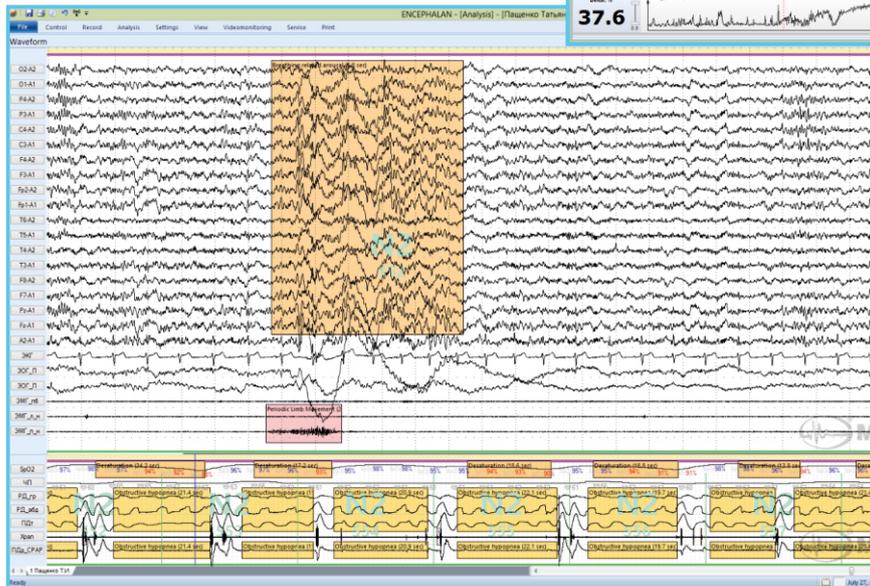
- Expert **hypnogram (1)** is built by a specialist in the process of visual analysis of **signals (2)** using a handy interface of hot keys or by selecting large fragments of recorded data with a pair of markers. The program has the option to automatically build a hypnogram, which can be used for rapid processing of PSG studies.
- **Trends (3)** give an idea of the dynamics of recorded data and calculated parameters during long-term registration in a compressed form, which significantly accelerates the visual analysis of large data sets obtained in PSG studies.
- During the processing of the study, various **sleep events (4, 5)** are identified manually or automatically in relation to the time intervals and channels to which they relate, in particular, microarousals, K-complexes, sleep spindles, periodic limb movements, respiratory disorders: various forms of apnea, hypopnea, episodes of desaturation, etc.
- **Dynamics of body position (6)** is presented in the form of a graph and is considered in reports forming.
- **The presentation form of the detected events (4, 5)** on the native signals is determined by the selected settings for the convenience of visual perception. Detected events are used to calculate sleep

statistics and generate reports.

- The compressed representation of **sleep events (4)** on the same time scale with **hypnogram (1)** and **trends (3)** contributes to complex visual analysis of a PSG study, and navigation of the study provides the possibility of synchronized transition to the fragment of **native signals (2)** interesting to the doctor for additional analysis.
- **Audio and video data (7)** allow assessing the patient's condition, movement activity, the intensity of snoring and sounds in the process of study, which helps to take into account movement artifacts during processing, as well as more accurately and reliably analyze various manifestations of sleep such as snoring, apnea, etc.
- **Presentation of sleep event statistics** in the form of automatically formed **table with summarized information (8)** on events (quantity, indices of total sleep time (TST) and total recording time (TRT), maximal, average, minimal duration), in the form of **table of detected events (9)** with specifying their type, duration and time connection to the study, sleep stages and body position for each episode, as well as **pie-charts (10)** on sleep events connected to sleep stages and body position.

Basic features of polysomnographs

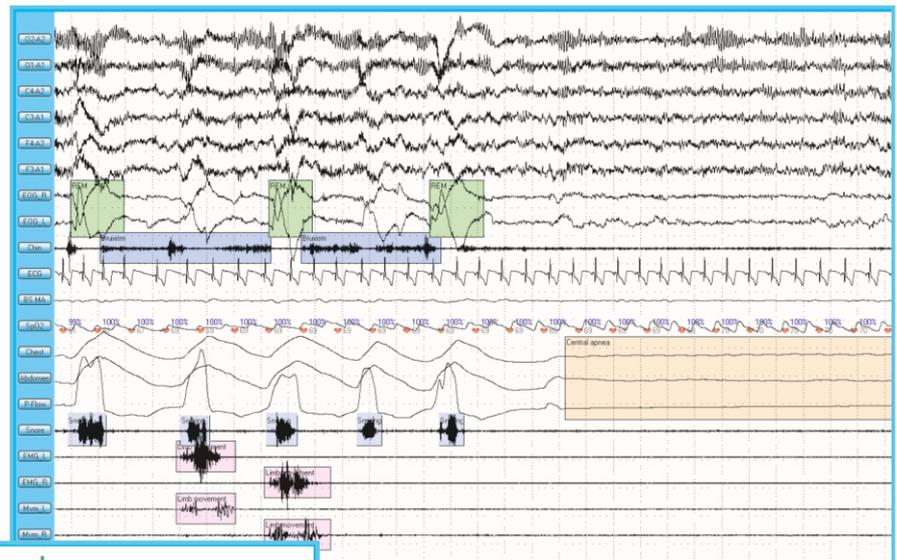
- **Dual-monitor mode of operation during study and processing.**
- **The display of trends of physiological parameters dynamics** (indices of brain activity rhythms, heart rate, frequency and depth of breathing, conditional respiratory minute volume, oxygen saturation, SpO₂, PR, parameters of muscles tone, CPAP pressure, etc.) **in one time scale** with hypnogram, the trend of body position and a compressed representation of episodes of sleep events (right figure).



- **Visual data analysis, automatic and manual detection** and color display of signs of epileptiform activity, microarousals, sleep spindles, K-complexes, sawtooth waves, periodical (PLM) and single limbs movements, various types of respiratory disorders (central, obstructive or mixed apnea, hypopnea, RERA), desaturations, snoring, body movements and other events.

On the left there are data of the PSG study using the model "AT-PSG-Video", sales package "optimal" of the main modification of encephalograph "Encephalan-EEGR-19/26".

On the right there are PSG studies performed using the model "AT-Somno", sales package "professional" of the modification "Mini" of electroencephalograph "Encephalan-EEGR-19/26": 6 EEG derivations, a standard set of data from the module of WRM, additional Poly-4 module for EMG sensors and legs movement activity sensors, the WRM module for thoracic and abdominal belt airflow sensors, oro-nasal respiratory sensor and snore sensor. Colored areas on the signals indicate episodes of central apnea, limb movements, snoring and bruxism.



- **Manual hypnogram building** using a quick transition to the necessary fragments and the mode of building trends of the necessary parameters, **as well as automatic hypnogram building**, according to the original algorithm based on fuzzy logic with the possibility of training and editing.
- Display of hypnograms, sleep events, changes in body position in a single time scale (on the left).



Study reports and protocols

● The PSG study report is generated automatically in Word format according to a user-configurable template. The report includes an editable verbal description of the polysomnographic study with the identified signs of various disorders, automatically generated on the basis of sleep stages statistics and episodes of sleep events.

● The report contains:

- a hypnogram graph,
- a compressed representation of sleep events,
- trends of calculated parameters and body position.

● The report displays in table and graph form:

- the main sleep parameters (TRT, TST, sleep efficiency, latency to sleep stages),

Sleep statistics

Study information	
Calculated parameter	
Date of recording	
Light off (HH:MM)	
Light on (HH:MM)	
Total recording time (TRT) (HH:MM)	
Total sleep time (TST) (HH:MM)	
Sleep onset (HH:MM)	

Sleep data

Sleep latency, min	
N1 latency, min	
N2 latency, min	
N3 latency, min	
REM latency, min	
Sleep efficiency, %	
Awakenings	
Wake after sleep onset (WASO), min	

Body position statistics

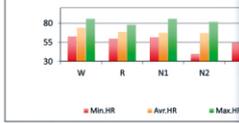
Body position	Duration	% fr
Supine	02:41:00	
Left	01:02:30	
Right	01:18:10	
Chest	00:52:20	

Cardiac statistics

Minimal HR level	
ECG events	
Tachycardia	10
Bradycardia	114
Asystole	0

HR by sleep stages, bpm

Sleep stage	Min. HR	Avr. HR
W	63	74
REM	60	69
N1	62	68
N2	40	67
N3	55	69

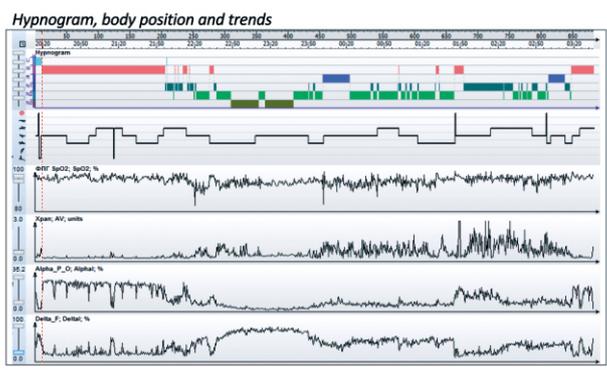


SleepLab MTD str. Frunze 68, Taganrog, Russia, 347900

Doctor	Dr. Samuel Brainsample
Patient	Mrs. Podgorny
Sex	F
Age	58
Birth date	18.03.1961
Equipment	*Encephalan-EEGR-19/26* AT-PSG-Video-Poly
Method	Polysomnographic study
Channels configuration	ES-EEG-19-3(ECG) Poly-10(2ResPef / 2EMG / T-Flow / Snore) WPM(SpO2, P-Flow, BodyPos)
Study date	11.11.2019 12:46:50

Study description

Obstructive sleep apnea syndrome was severe, AHI = 75.2/h (N<5). Total number of respiratory events – 378, of which obstructive apneas – 134, mixed apneas – 0, central apneas – 0, hypopneas (also OBS and central) – 244. Maximum duration of obstructive apnea – 52 s. Respiratory disorders recorded mainly on the back. Presence of snoring, number of episodes – 2096, snoring index – 417.1/h. Minimum SpO2 level – 77% (N>90%). Mean SpO2 was normal – 95.4% (N>92%). Sleep onset latency was increased – 103 min (N 6–10 min). Sleep efficiency reduced – 69.1% (N>90%). Stage duration N1 increased – 27.0% (N 3–8%). Stage duration N2 normal – 46.8% (N 45–55%). Stage duration N3 normal – 14.8% (N 15–20%). Stage duration REM reduced – 11.4% (N 20–25%). Arousal index – 17.7/h (N<21). Most arousals were related to respiratory events. Periodic limb movement disorder was severe, PML index – 61/h.



Breathing disorders statistics

Events	Qty	Duration, s	% from TST
O. apnea	134	47	15,6
C. apnea	0	0	0,0
M. apnea	0	0	0,0
Apnea total	134	47	15,6
O. hypopnea	244	80	26,5
C. hypopnea	0	0	0,0
Hypopnea	0	0	0,0
Hypopnea total	244	80	26,5
A+H	378	127	42,1

Events	On back	On back Index /h.	Not on back
O. apnea	118	44,0	16
C. apnea	0	0,0	0
M. apnea	0	0,0	0
Apnea total	118	44,0	16
O. hypopnea	83	30,9	161
C. hypopnea	0	0,0	0
Hypopnea	0	0,0	0
Hypopnea total	83	30,9	161
A+H	201	74,9	177

HR statistics

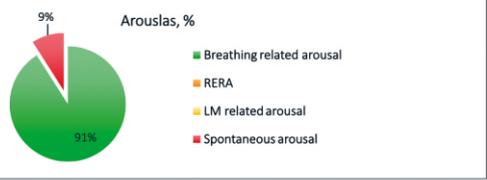
Event	On back	Not on back
Snore		
HR by sleep stages		
During N1	452	
During N2	845	
During N3	584	
During REM	215	

Limbs movements statistic

Limbs movements (LM including PLM)	
Events	Qty.
LM	14
Sleep stages statistics	
During N1	3
During N2	4
During N3	0
During REM	3
Body positions statistics	
On back	11
Not on back	3
Right	3
Chest	0
Left	0

Arousals statistics

Arousals	Qty.	Index/h	Dur., s	Avr. dur., s	Max. dur., s	%
Breathing related arousal	81	16,1	11	8	17	91
RERA	0	0,0	0	0	0	0
LM related arousal	0	0,0	0	0	0	0
Spontaneous arousal	8	1,6	1	8	13	9
All arousals	89	17,7	12	-	-	100

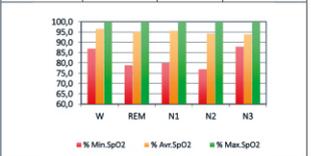


SpO2 statistics

SpO2 baseline	96	Minimal SpO2 level	77	Average SpO2 level	95
Event	Qty.	Index/h.	Duration, s.	Avr. dur., s.	Max. dur., s.
Desaturation	407	81,0	143	21	112
Critical SpO2 value	3	0,4	18	6	8

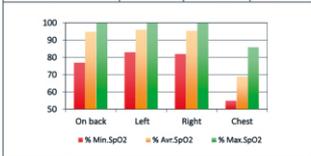
SpO2 by sleep stages, %

Sleep stage	Min. HR	Avr. HR	Max. HR
W	87	97	100
REM	79	95	100
N1	80	96	100
N2	77	94	100
N3	88	94	100



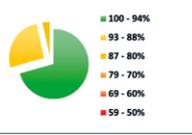
SpO2 by body positions, %

Body position	Min. HR	Avr. HR	Max. HR
On back	77	95	100
Not on back	55	92	100
Left	83	96	100
Right	82	96	100
Chest	55	69	86



SpO2 values distribution

Value	Time (min.)	Time (% from TST)
100 – 94%	211	70
93 – 88%	78	25,9
87 – 80%	10	3,3
79 – 70%	0	0
69 – 60%	0	0
59 – 50%	0	0
< 50%	21	7



Desaturations

Value	Quantity
3 – 4%	165
5 – 10%	182
11 – 15%	47
16 – 70%	13

○ the most significant events indices (apnea-hypopnea index (AHI), respiratory disturbance index (RDI), indices of arousals, snoring and PLM) and statistics of sleep stages;

○ significant information about heart rate, arousals, respiratory disorders (differential analysis of the predominance of central or obstructive apnea and hypopnea, considering positional dependence);

○ oxygen saturation statistics (SpO₂ and desaturations);

○ data on limb movements (LM, PLM to determine the severity of "restless legs syndrome");

● Additional reports on pathological manifestations detected on EEG with "Encephalan-EEGR" software.

Contact information

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