

4th European Congress
*“Medicine in Space and in Extreme Environments
Achievements for Health Care on Earth“*

Lecture Berlin, 25.10.2007

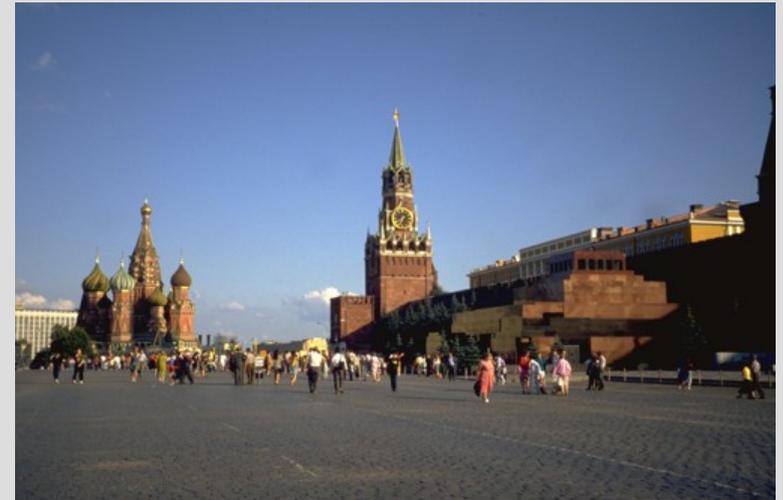
“A new telemedical system
for application in the cosmos and on Earth“



Vienna



Office Park
Headquarters
Telovital GmbH
Vienna



Moscow

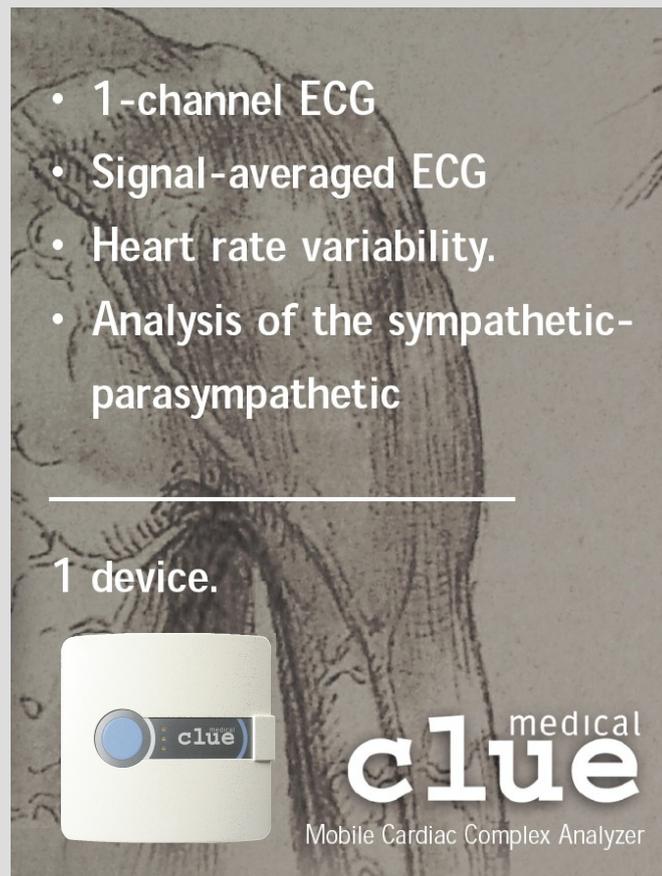


Prof. Joachim Schlund

Director Telovital GmbH Vienna

Professor of Telemedicine at the Russian Academy of medical and social rehabilitation Moscow

The system „clue medical“, a mobile cardiac complex analyzer was developed in cooperation with the IMBP Moscow

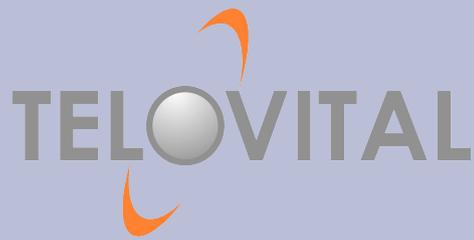


The task for the development of “clue medical” was:

High precision and performance with the smallest possible dimensions as well as ease of use.

Ability of application for flying personnel under extreme conditions, including a cosmic application, high-performance sport, mountain-climbing, submarine, and many more.

Broad applicability for normal medical cases at highest global mobility of data transfer via everyday communication systems, particularly mobile radio.



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Apart from the ECG, the focus of medical interest are the dynamics of cardiovascular functioning, primarily the influence of the autonomic nervous system on the cardiovascular state under particular operational and stress conditions, as well as the regenerative ability.

Problems with the previous analyses and methodology: For the determination of these data the R-R distances derived from the ECG are subjected to an analysis of a Fast Fourier Transformation (FFT), both in the time domain (HRV) and the frequency domain. The parasympathetic nervous system is exclusively and indisputably associated with the frequency range. In low-frequency range the activities of both the sympathetic and the parasympathetic nervous system are captured. This complicates or rather distorts the exact assessment of the constituents of the spectral analysis, the balance derived thereof (quotient of LF and HF) and hence the diagnostics. As a result, clear statements about stress are only conditionally true. Therefore we have developed a new method to allow a specification of the assessment of the LF and HF shares of the spectrum, and thereby improved the diagnostics. The fact that so far the average heart rate was inadequately included in the analysis as important determining factor within the usual calculation was a fundamental realization and thus was taken as a basis for the method.

$$M_{LF} \cdot \left[\frac{\overline{f_H}}{70 \text{min}^{-1}} \right]^2 = M_{LF}^*$$

M_{HF}

sympathovagal balance $B = \frac{M_{LF}^*}{M_{HF}}$

and

sympathovagal balance $B = \frac{M_{LF}}{M_{HF}} \cdot \left[\frac{\overline{f_H}}{70 \text{min}^{-1}} \right]^2$

Algorithm for the assessment of
 The sympathetic and parasympathetic
 Influence in the form of spectral
 Measures,
 including balance

With this, statements about stress
 are evident.

Where:

M_{LF} spectral measured value for the LF frequency range

M_{LF}^* spectral measured value LF, **which represents a measure for the sympathetic activity and stress**, weighted with the square of the average heart rate

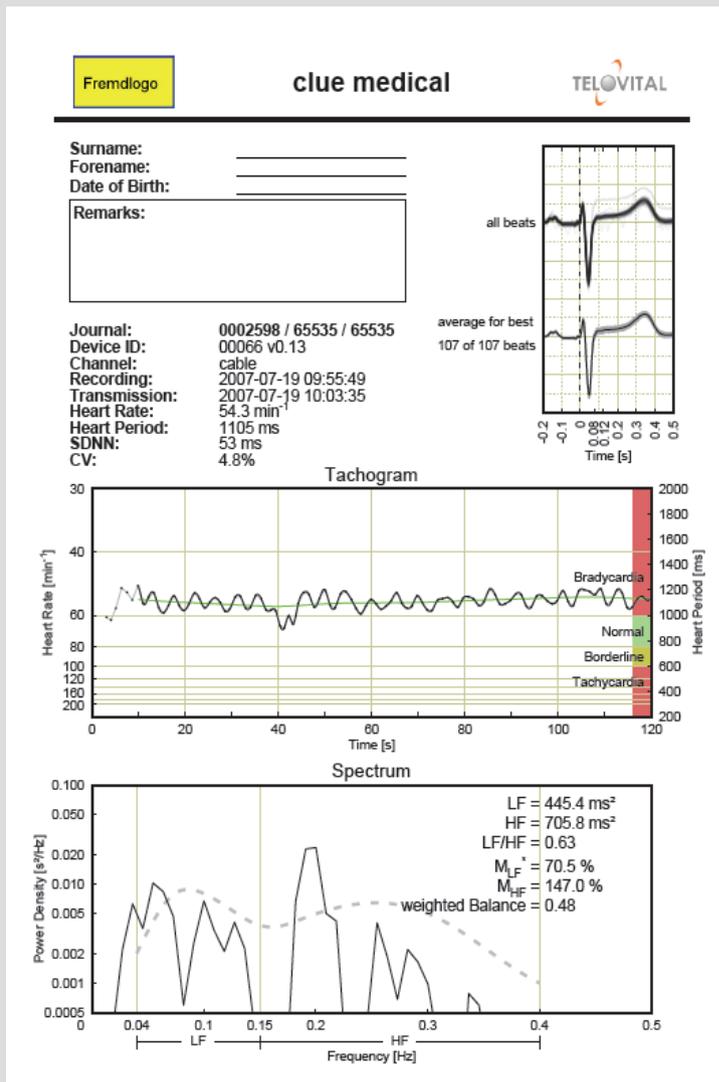
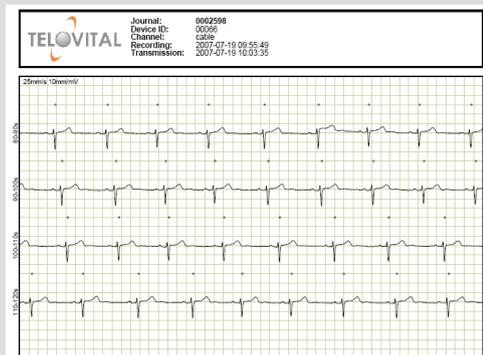
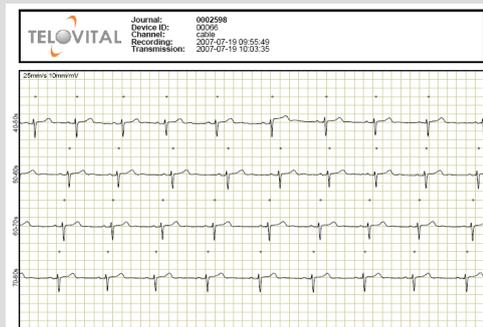
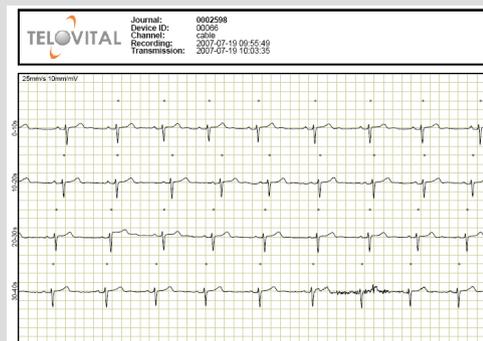
M_{HF} spectral measured value for the HF frequency range, which represents a measure for parasympathetic **activity, relaxation and recovery** (no weighting)

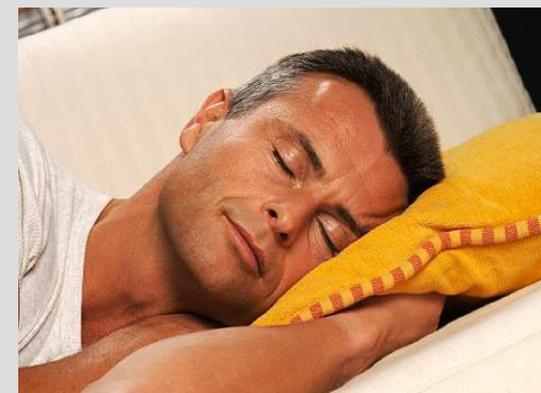
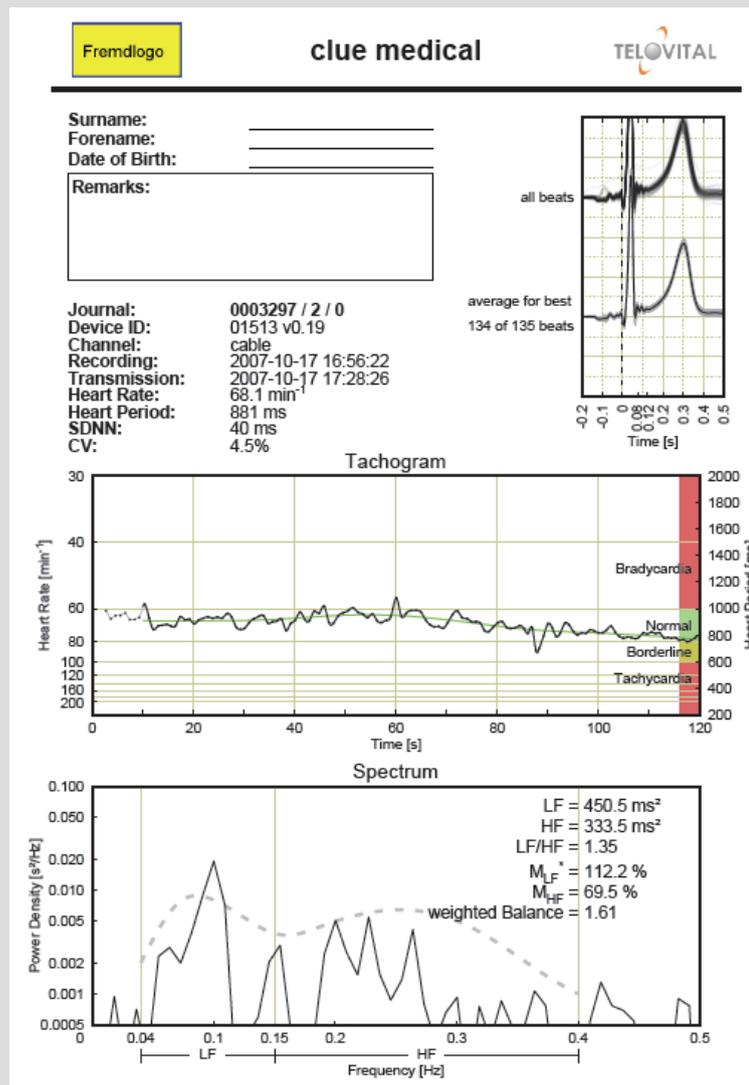
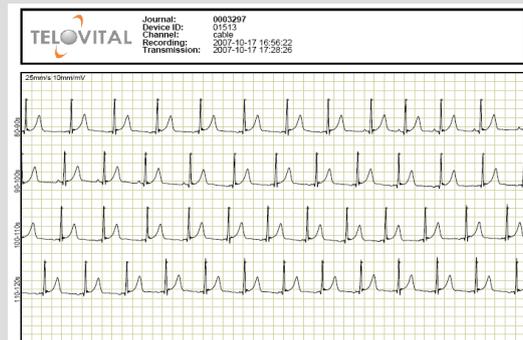
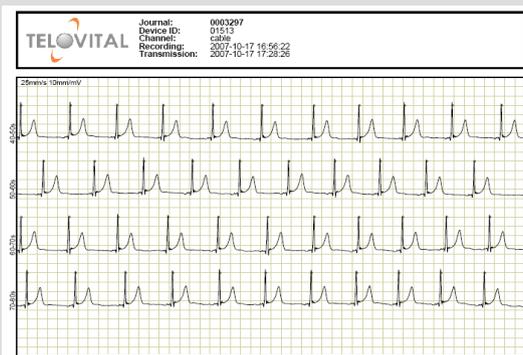
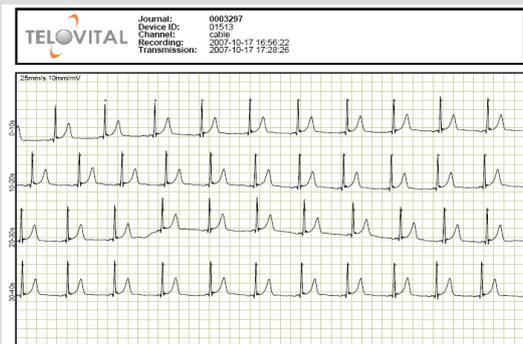
B **sympathovagal balance as the area ratio of the LF and HF range weighted with the square of the average heart rate**

Interface „clue medical“ with

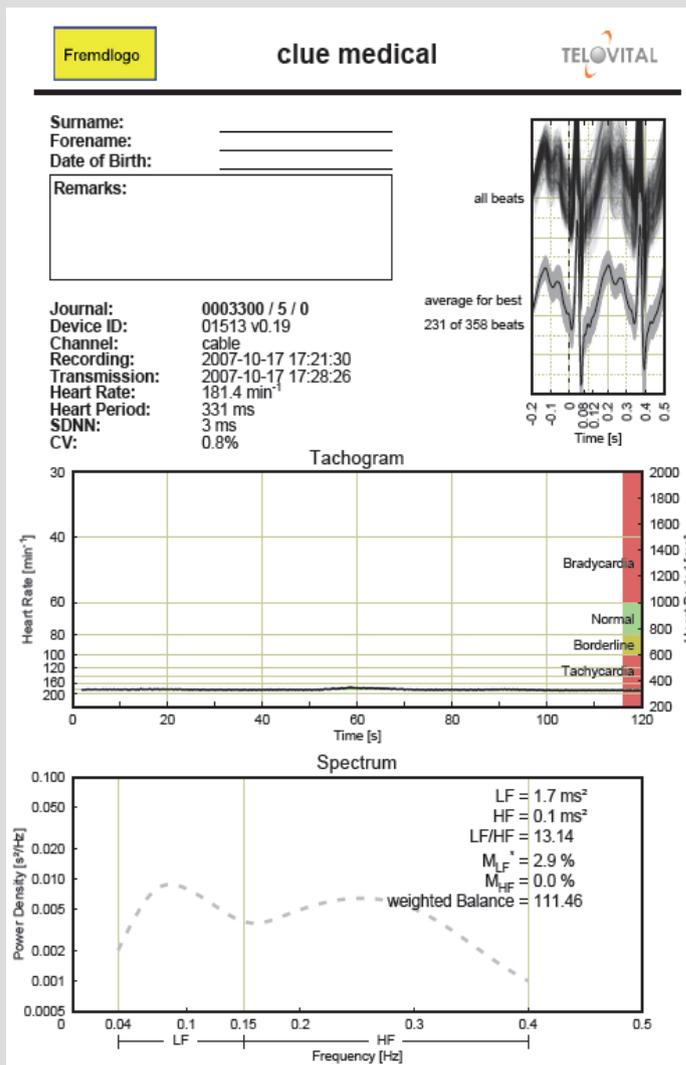
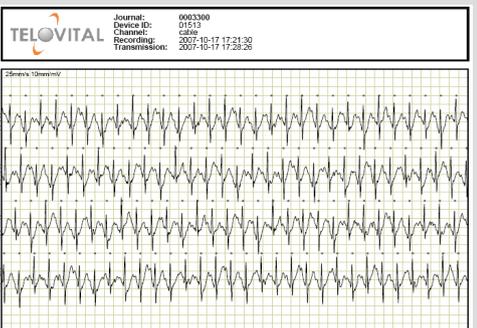
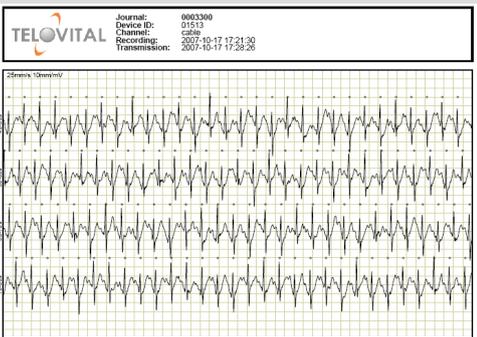
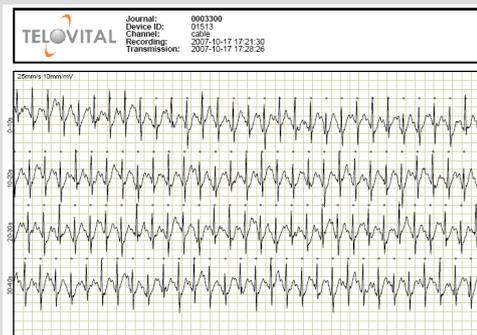
- ECG transferred via signals
- Tachogram
- Spectrum
- ECG

of a test person





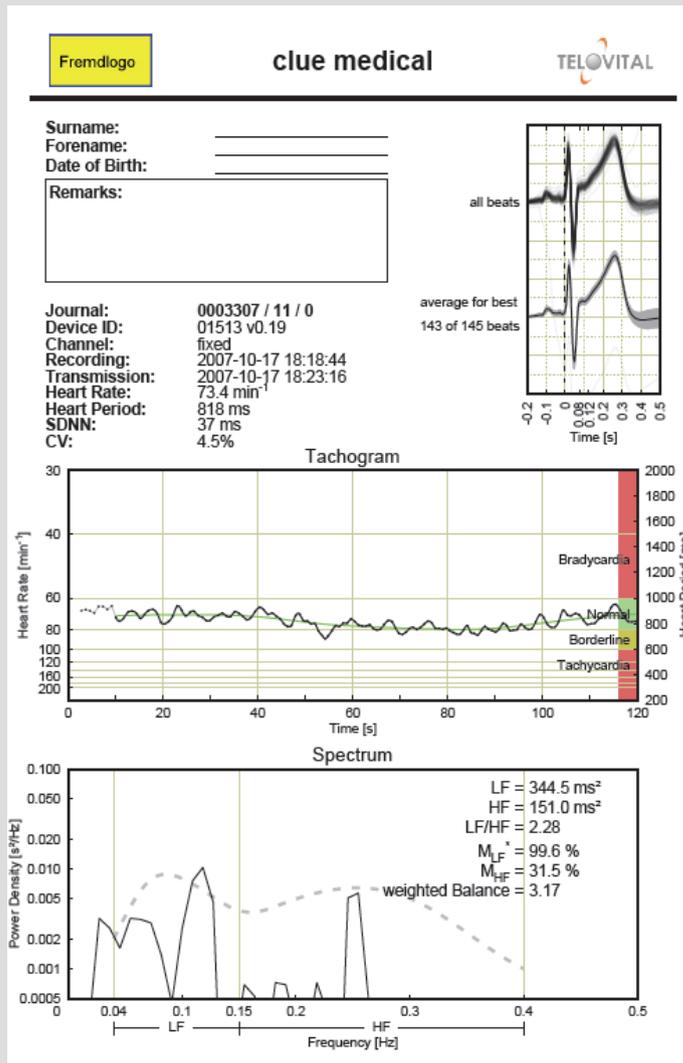
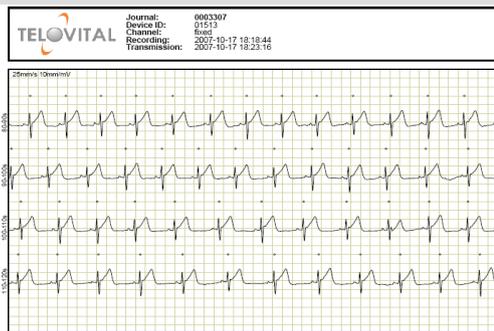
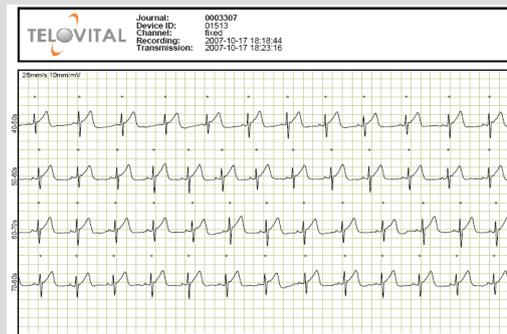
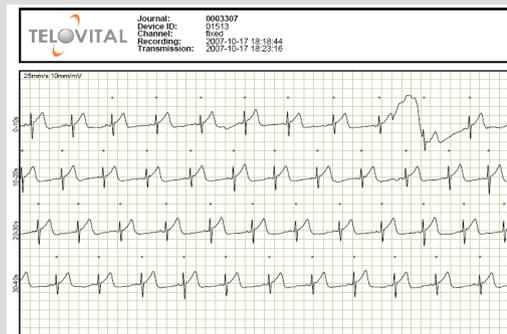
prior to stress



during stress



post stress



**About the technical
concept:**

For illustrative purposes

Solid electrodes and
adhesive electrodes for
stress conditions,
infrared/ acoustics

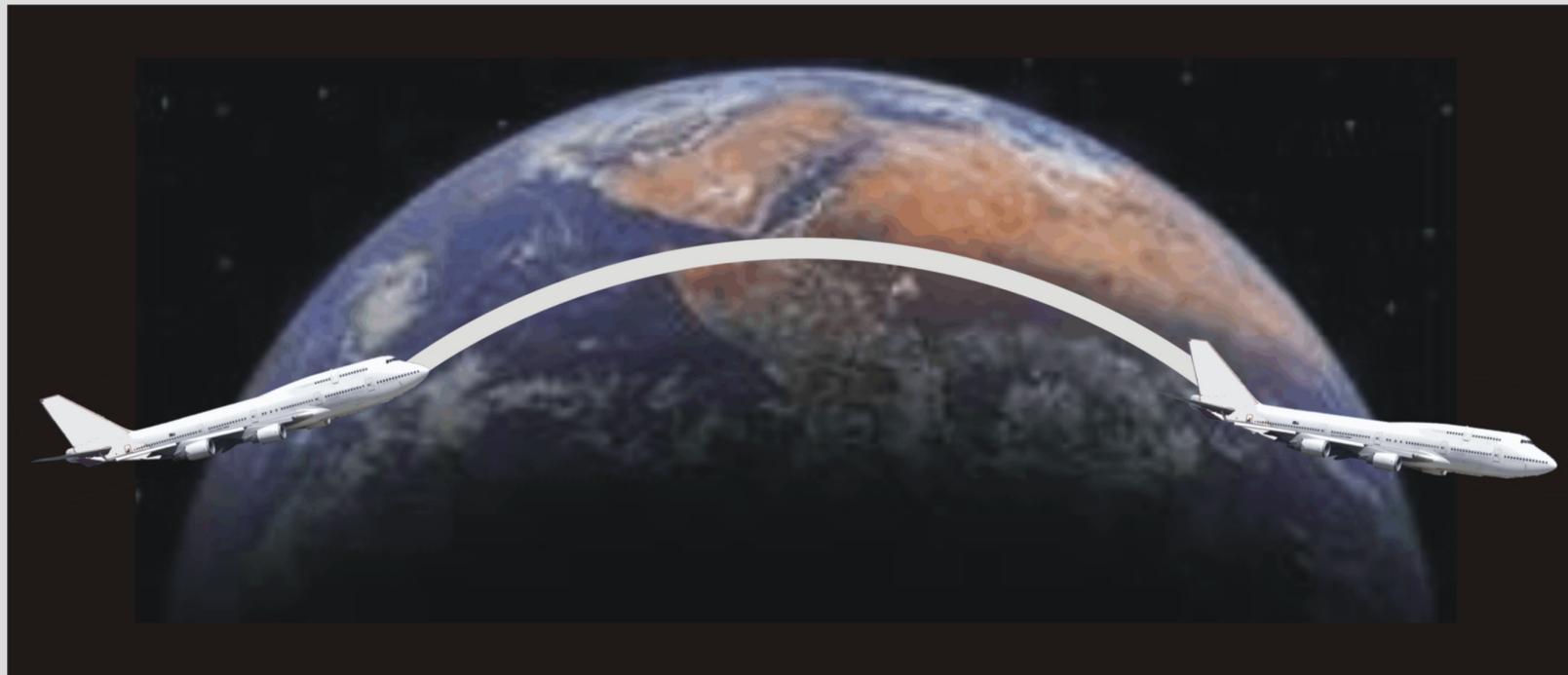


Recording time normal 2min. or 30 sec Send / Analyze

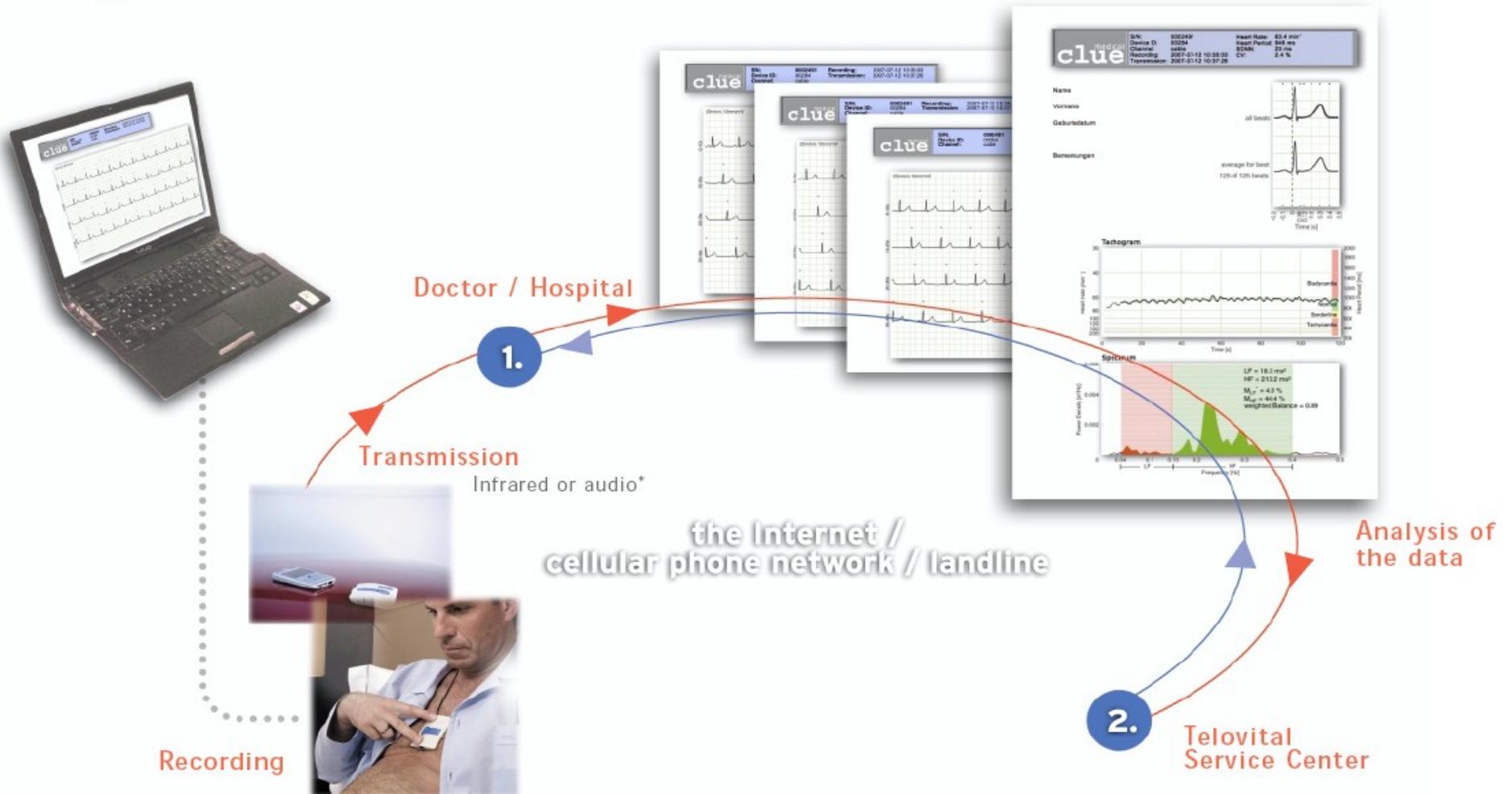
For stress examination or various specific functions, especially for the determination of heart rate variability (HRV) and regulation of the sympathetic/ parasympathetic nervous system, recording times of up to 24 hours are possible, including the recording of individual ECG sections and data transmission via mobile radio for analysis.

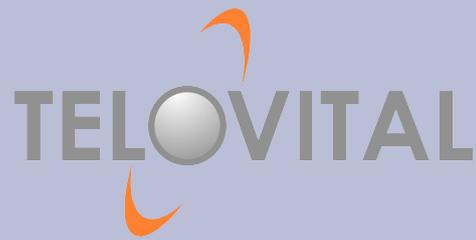
Examples:

- Utilization during long-distance flights on civilian or military aircraft
- Monitoring of the starting or landing phase of space flights
- Transmission during the flight phase or after a flight



The system flow.





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Examples of utilization in a civilian context

Cardiovascular diseases

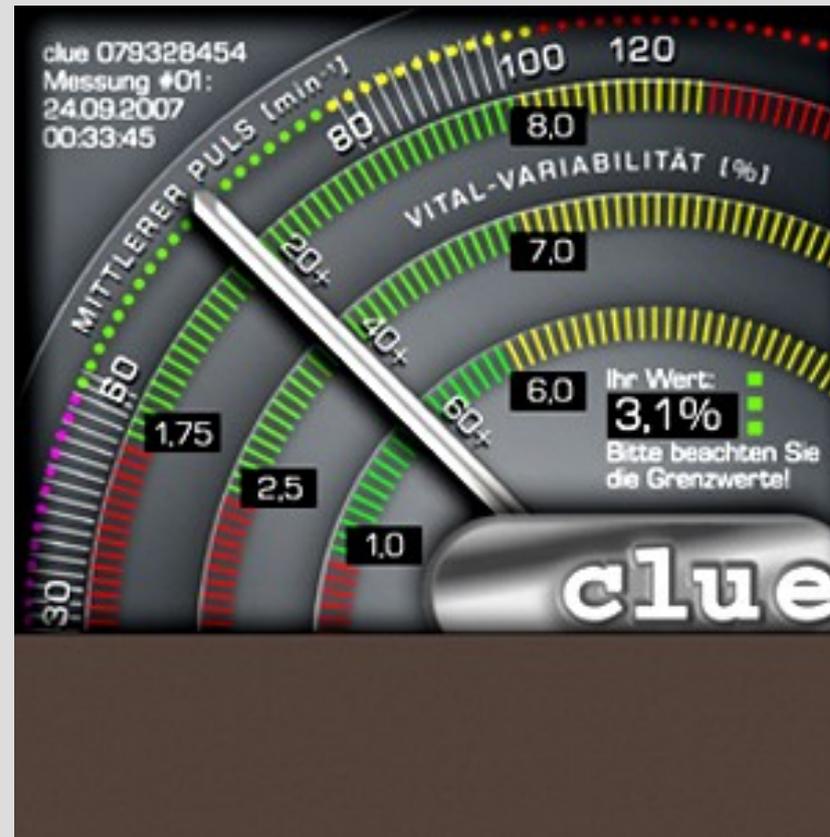
Diseases with a strong influence on the heart and peripheral vascular systems as well as dominance of the autonomous nervous system, such as

Diabetes mellitus, psychiatric und psychosomatic/ neurological conditions, chronic renal failure / dialysis patients, sleep medicine, pharmacology

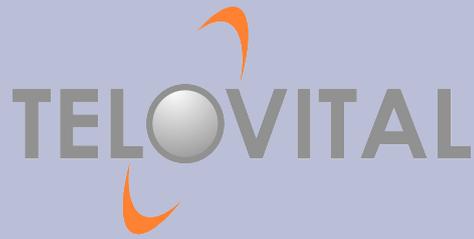
Sports/ sports medicine

Accompaniment as measuring and control device for therapy; therapeutic effect with regards to the increase of vagal tone and particularly all stress-related diseases

Outlook:



1. Derived from clue medical for better mastery of stress in everyday life
clue



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2. Measurement of stress in flight personnel in the civilian and military sectors
3. Mars 500

In the context of the further contractual cooperation of Telovital and the IMBP, integration into the project “Mars 500” and the utilization during various training programs for other space projects up to the application in orbit are planned and under way.

We are open for cooperation with interested parties

Thank you for your attention!