



Doctor Pulse

Dr.Pulse

3Dpulse technology

Version 3D-pulse 2.0

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1. Introduction

1.1. General information

Dr.Pulse program is installed on phones with Android OS (version 4.0 or higher) and is designed to :

- measurement and control parameters and heart rate variability, the research performance of the cardiovascular system;
- the study of the functional state of man in the measurement and control of the parameters of the volume pulse;
- alert the user in case the measured parameters of heart rate variability (HRV) of the established norms.

Dr.Pulse program measures the pulse wave at the tip of the user's fingers with the help of a television camera and a mobile phone 's built-in phone LED backlight.

The measured pulse wave shows a change in blood flow in capillaries and various areas of a finger using standard mathematical processing methods used for the study of heart rate variability. The user can choose the size of the area for the measurement of the pulse wave, and processing algorithm. A significant amount of measured pulse waves (at least 20) and functionally independent computation algorithms pulse (density, color, rate of change) provide independent at least 500 samples per second pulse when the frame rate of the television camera is not less than 25 Hz.

With the help of their mobile phone and the program Dr.Pulse you get the possibilities of modern research laboratory for the study of the health, well-being and disclosure of reserves of the organism .

Analysis of heart rate and heart rate variability (HRV) is carried out according to methodical recommendations, prepared to assist the practitioner [doctors](#).

1.2. System requests for smartphones

- | | |
|-----------------------------|------------------------|
| • Operation system | Android 4.1 and higher |
| • Processor frequency | 600 MHz and higher |
| • Operation memory | 128 Mb and more |
| • Video size, not less | 640 x 480 pixels |
| • Video frequency, not less | 25 f/s |
| • Internet connection | HTTP protocol |

2. Dr.Pulse program installation

Обратите внимание: Перед началом установки программы Dr.Pulse на Ваш смартфон необходимо выполнить следующие действия:

NOTE: Before starting Dr.Pulse program installation on your smartphone, follow these steps:

1. Check the connection of the smartphone to the Internet.
2. Before you start the installation on the phone to create a Google account e-mail system, create your own e-mail address with ****@gmail.com format for program activation.
3. Dr.Pulse program is paid and before activation is necessary to buy a working version of the program on www.psymaker.ru site . When you purchase the program you must specify the email address specified on the phone: ****@gmail.com.
4. Not later than 30 minutes (usually within 5 minutes) after the purchase on your e -mail address will first report to make you order Dr.Pulse program.
5. After successful payment of purchase on the specified e- mail address will come a second message, which will include links to the boot program file and a link to the file to describe the program.
6. Next, the link to download DrPulse.apk file on your phone and open the downloaded file.
7. On the question of the smartphone OS for permission to install the program Dr.Pulse, answer "Install".
8. After the installation in the smartphone's menu system icon appears



Dr.Pulse Dr.Pulse

and you will be asked to immediately open the program by clicking on " Open" , or postpone the first launch the program by clicking "Finish" .

Note, before you start the program you need when you first start to produce its activation through the Internet.

2.1. Dr.Pulse program activation

Before you start working with the program is necessary to make its activation through the Internet:

1. Run the first start from the program Dr.Pulse smartphone menu.

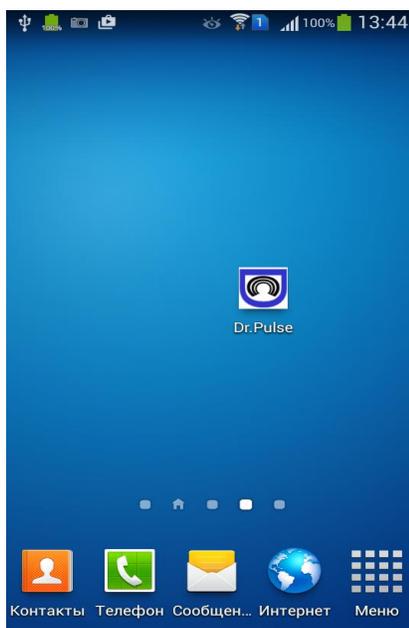


Fig.1. Dr.Pulse program icon in the phone's menu system.

2. Click "Activate" in the pop-up window

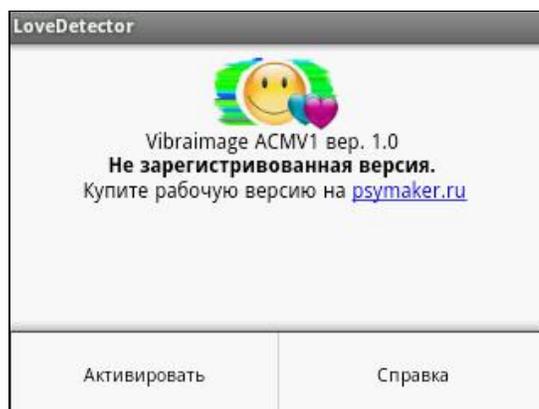


Fig.2. Dr.Pulse program before activation

3. Next, you need to validate the input e-mail address by clicking on a line with the address email:

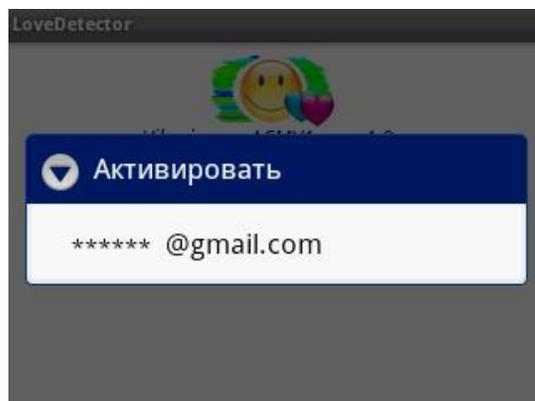


Fig.3. Confirm your email address

4. After successful activation program will start

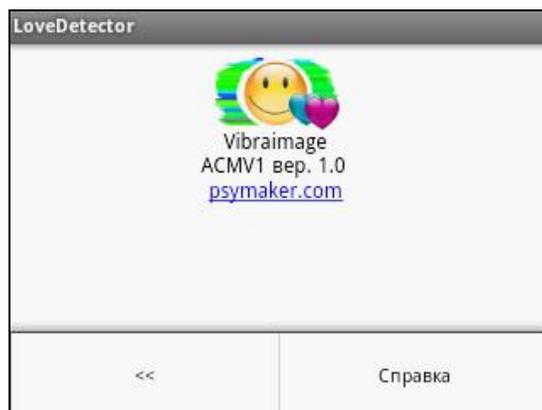


Рис.4. The program is ready to work.

3. Dr.Pulse Manual

After Dr.Pulse start opens the window with license confirmation, than opens the operating window of program.

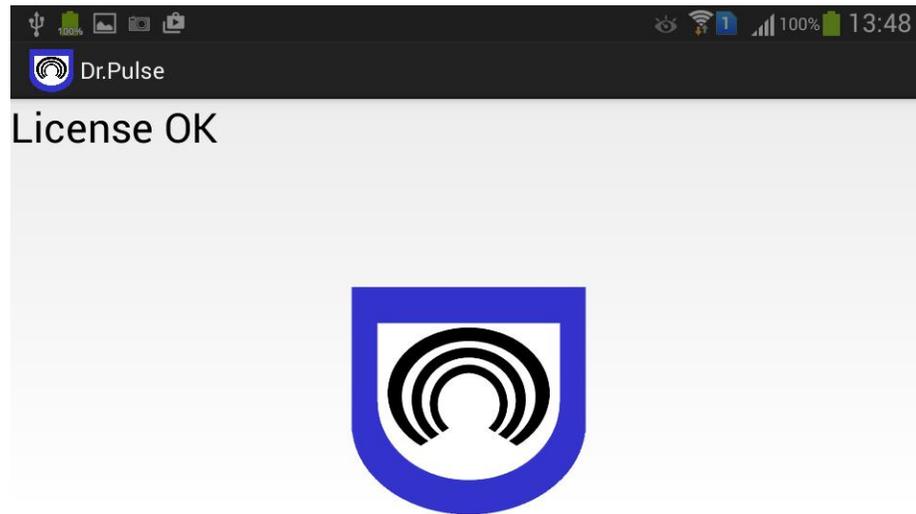


Fig.5. First window Dr.Pulse program

3.1 Pulse waves mode (Values)

After opening of the main program window visualization Values user must install a finger on the lens of the television camera mobile phone, and the telephone LED backlight (flash) must be pressed with a finger. When properly installed, the finger on the mobile phone screen will be observed pulse curves, showing the real-time pulse wave depending on the installed options (Fig 6):

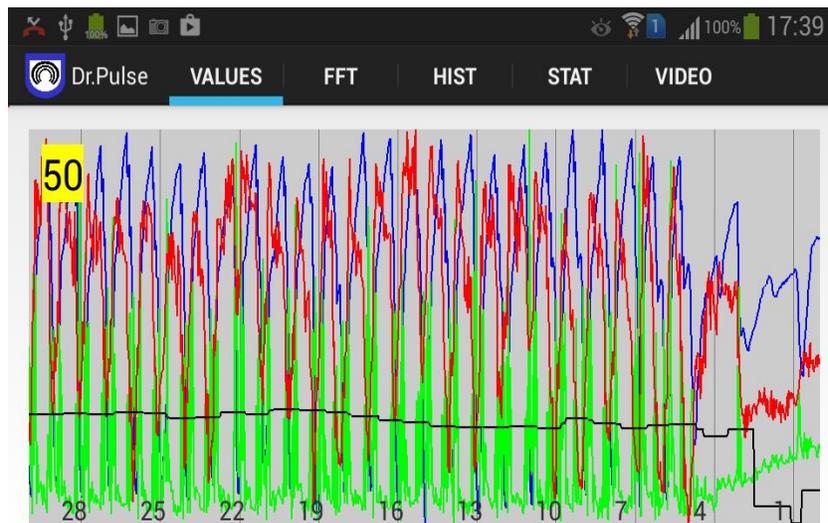


Fig.6. Values window

The basic settings menu can be accessed by clicking the Settings button on the phone:



Fig.7. Values settings

Plants in a row Camera (Figure 8) allow a variety of camera and turn on the backlight. Naturally, the finger should be placed on the selected camera to measure heart rate. The need for lighting is determined by the ambient light. On a bright sunny day exterior lighting may be enough to produce stable pulse wave, in this case, it is advisable not to include the flash. When there is insufficient ambient light should turn on light from the phone.

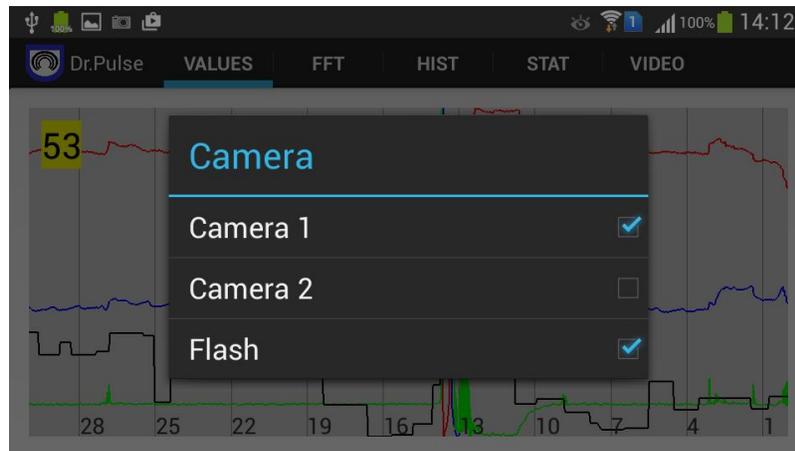


Fig. 8. Camera line settings

Settings in the Settings bar (Fig. 9) allow you to set or disable the high-pass filters for the display of pulse waves, change the timeline and processing algorithm. Possibilities change processing algorithms are different for different program windows.

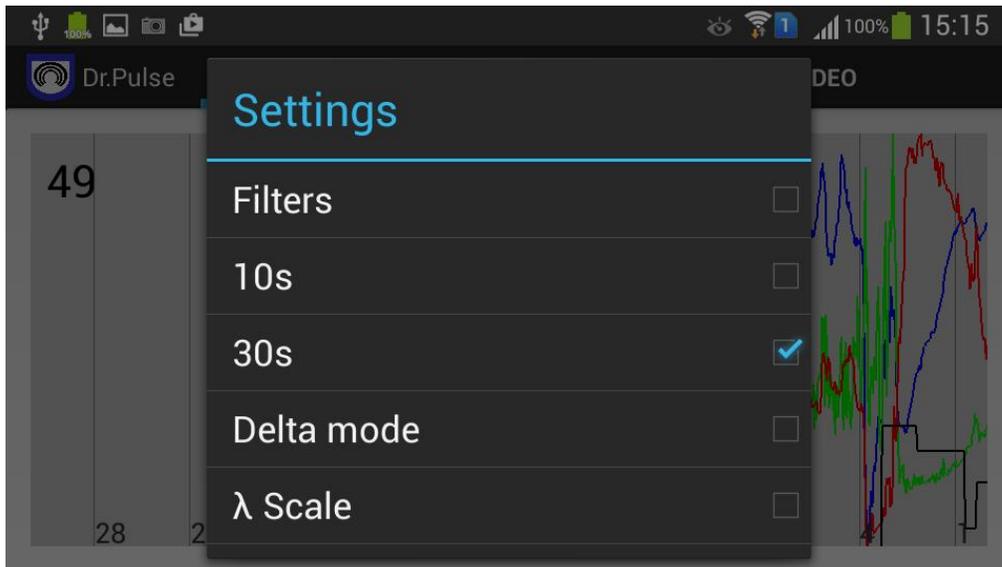


Fig. 9. Settings window

Plants in a row Show (Fig. 10) allow you to set and select the pulse wave output for display in the main window Values program visualization. Tag mounted on pulse string, outputs the temporal dependence of the pulse determined by ALL pulse wave, regardless of the number of pulse waves outputted for display in the main window.

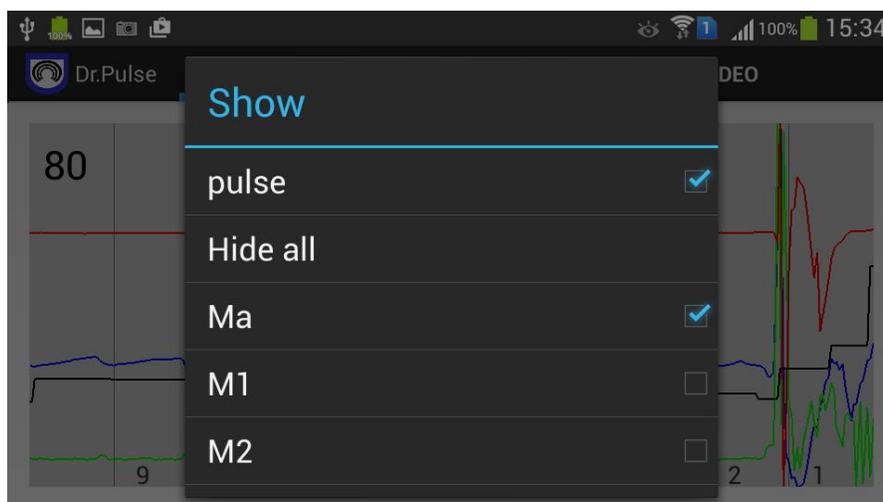
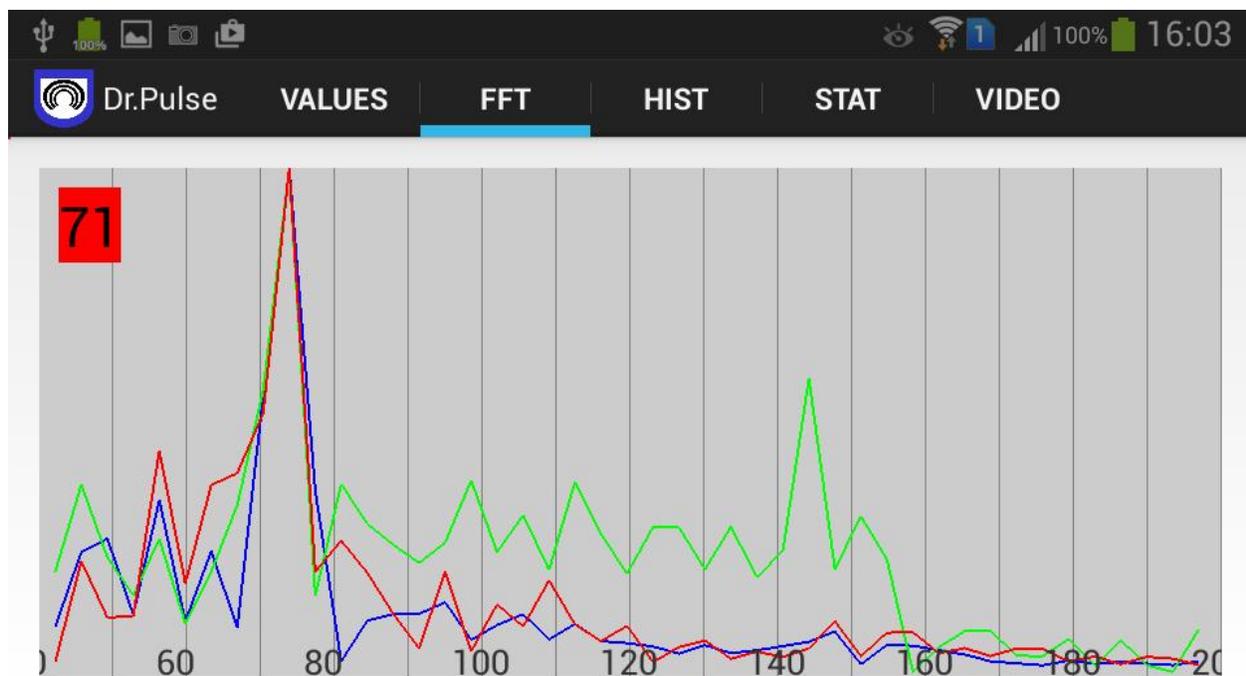


Fig. 10. Show settings

3.2 Frequency analysis mode (FFT)

Fast Fourier transform allows to build and analyze the frequency components of the measured pulse wave and the real-time visualization of the frequency dependence of the pulse waves in the colors identical to the pulse wave outputted Values in mode.



Puc. 11. Pulse waves frequency window

The results of the base frequency pulse measurements and frequency components of the pulse as low-frequency and high-frequency signals, informatively reflect the state of human health and is one of the factors used in the calculation of the integral health status.

3.3 Pulse histogram mode (Hist)

Pulse histogram mode (Fig. 12) shows the number of pulse counts for the measured values of the set time. The dimension of the bottom of the histogram scale - beats per minute, the histogram is displayed in black color and graphics. Time accumulation histogram is adjusted in the settings. Black graph of the histogram represents the distribution of the average median estimate of pulse counts obtained for all of the pulse wave. Color histograms show a similar distribution to the selected color of the pulse wave. Red histogram shows the distribution of blood in color relative to the color chart shown in the upper scale of the histogram.

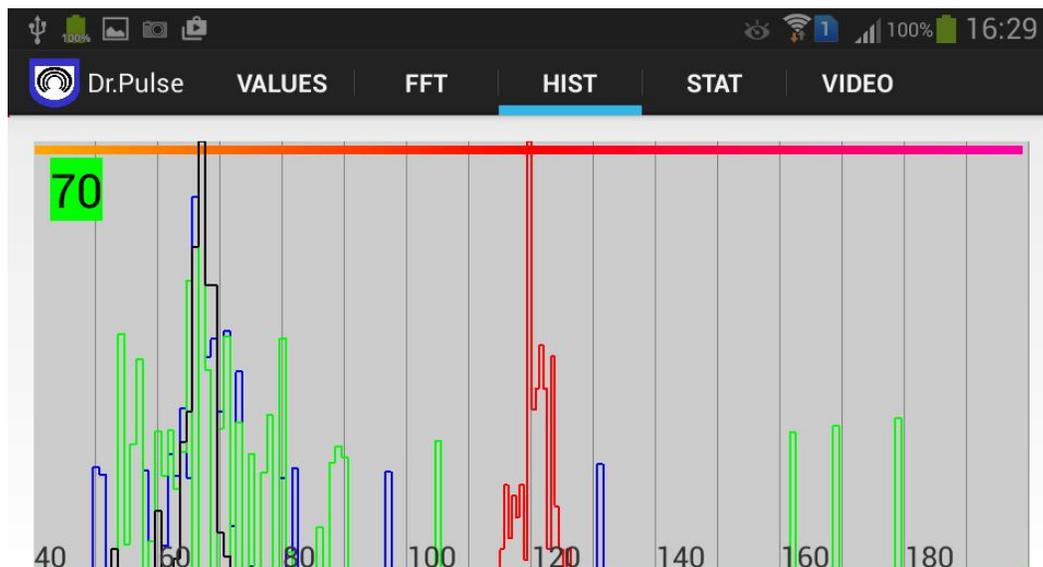
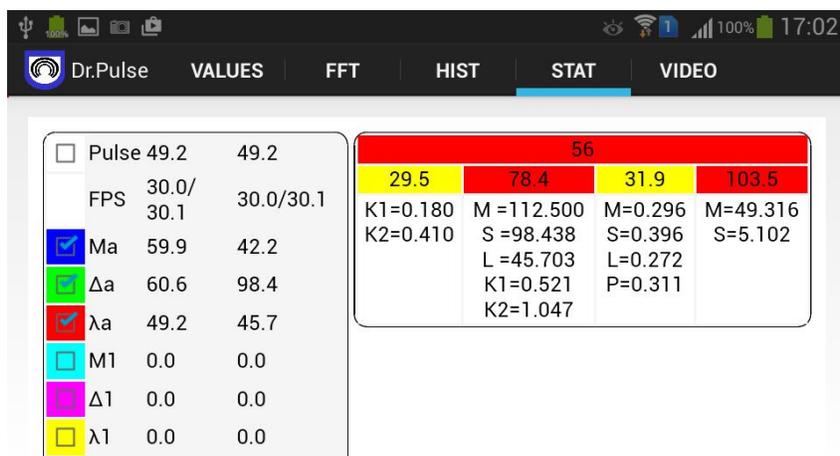


Fig. 12. Pulse histogram mode

3.4 Pulse statistics mode (Stat)

In pulse mode, statistics and indicators are determined by determining the level of health and the body's reserves. The overall health is determined by the four local factors (indicators), which are controlled by the right-hand table and highlighted in color (Fig. 13).



Puc. 13. Pulse statistics mode. Unsatisfied health index.

The red color indicates a significant deviation of the measured pulse parameters of the established norms for each of the 4 factors and the upper integral health indicator (Fig. 13).

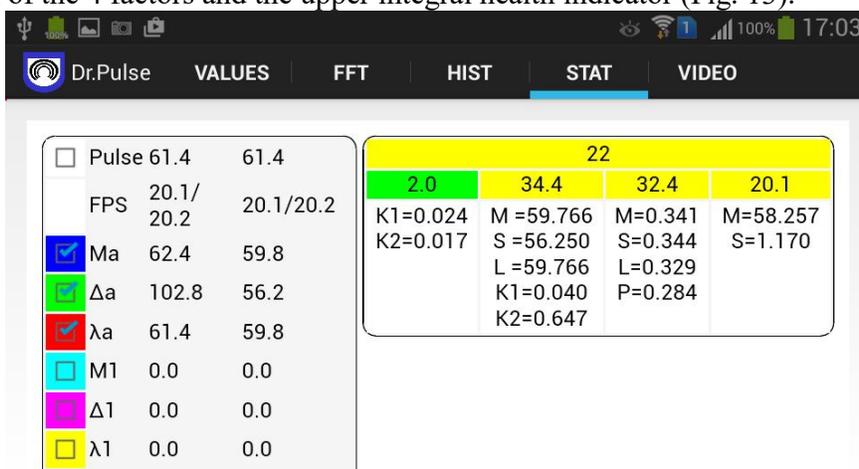


Fig. 14. Pulse histogram mode. Okay health indicator

The yellow color indicates a certain deviation from the norm, which is not critical (Fig. 14).

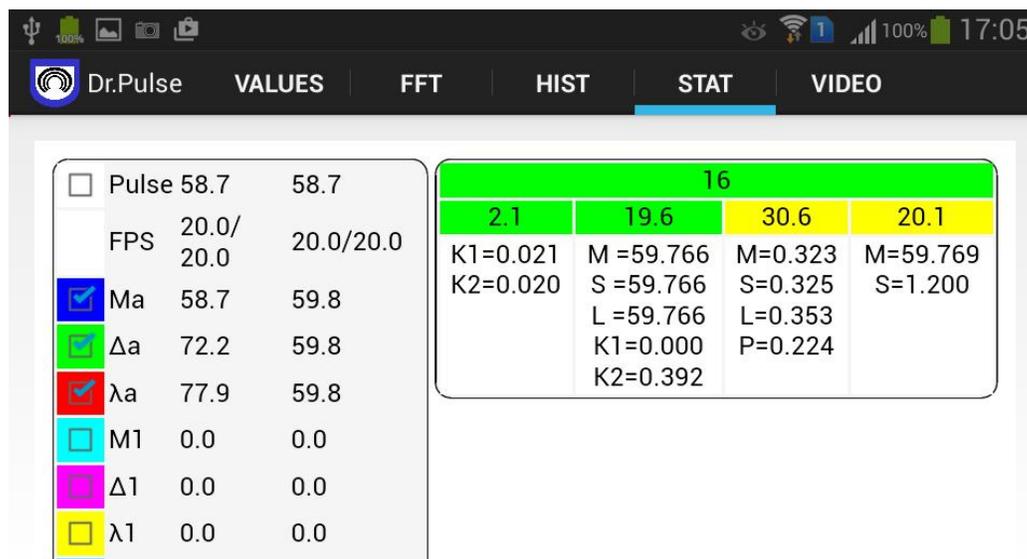


Fig. 15. Pulse histogram mode. Integral health index is normal.

Green light indicates the normal functional state of regulatory systems of the person. At the same time, to achieve green integral index of health, does not necessarily have all the green indicators. Perhaps for part indicators have slight variations, for example, as shown in Fig. 15.

Comprehensive assessment of the functional state

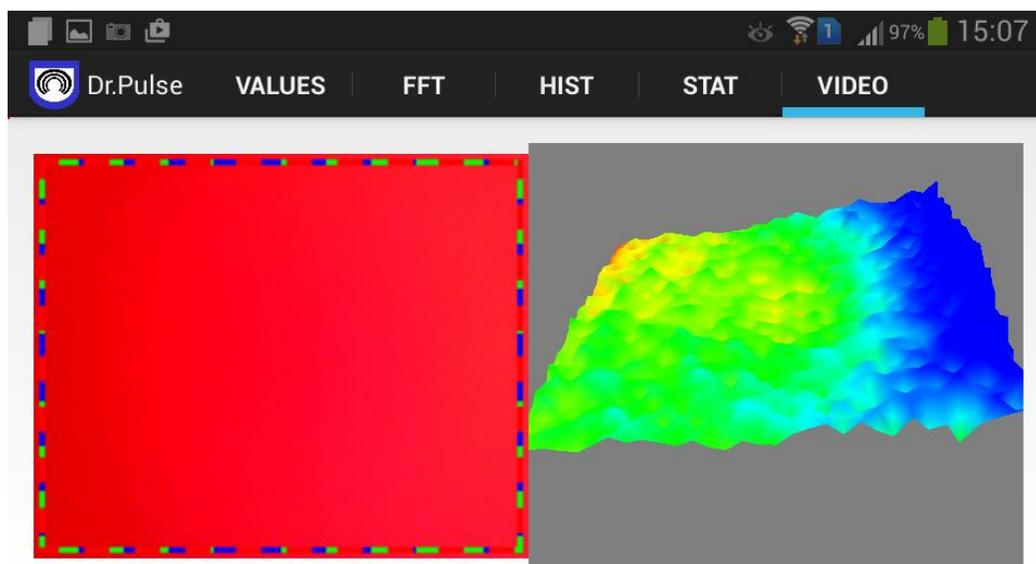
Comprehensive assessment of heart rate variability is aimed at the diagnosis of functional states. HRV analysis is a method of non-specific (nenozologicheskoy) diagnostics. However, assessment of the totality of its indicators and their dynamics in repeated surveys can direct diagnostic search in the right direction and helps to clarify the functional and prognostic component of clinical diagnosis. Changes in the autonomic balance as activation of sympathetic component are considered as non-specific reaction in the adaptive response to various stress influences.

One method to evaluate these reactions is to calculate the index of activity of regulatory systems (PARS). It is calculated in points by a special algorithm that takes into account the statistics, histograms indicators and data spectral analysis of RR. PARS allows us to differentiate varying degrees of tension of regulatory systems and to assess the adaptive capacity of the body (P.M. Baevsky, 1979). Calculation PARS performed by the algorithm, consider the following five criteria:

- A. The total effect of the regulation in terms of pulse rate (PR).
- B. The total activity of regulatory mechanisms for the standard deviation - SD (or the total power of the spectrum - TP).
- C. Vegetative balance a range of indicators: John, RMSSD, HF, IC.
- G. Activity vasomotor center, regulating vascular tone, power spectrum of slow waves of 1st order (LF).
- D. The activity of cardiovascular subcortical nervous center or suprasedgmental levels of regulation on the power spectrum of slow waves of 2nd order (VLF).

3.5 Video mode (Video)

Video mode is designed for the visualization and understanding of volumetric pulse process (Fig. 16). In video mode, you can visually observe the three-dimensional movement of the pulse wave in the finger of the user to change the color and fullness of blood in the capillary vessels of the fingers (left screen). On pseudo color 3D picture of pulse waves are proportional to the change in the signal intensity in each video item (right screen) .



Puc. 16. Pulse Video mode. Color and 3D pseudocolor visualization of capillary pulse

Display zones on by processing the pulse wave is allocated colored dotted line corresponding to the eye-catching graphics pulse. At various mathematical processing is carried out on the same area are superimposed dotted lines. For example, in Fig. 16 illustrates that the processing is carried out 3mya algorithms all over the field.

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