



ST131 Analyzer Pro

Version 1.0.10

User's Manual

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PURPOSE

ST131.S Analyzer Pro software is designed for operation as a part of ST131.S "PIRANHA II" device and it provides PC analyzing of the signals received from the main unit through the USB cable.

SYSTEM REQUIREMENTS

Processor: dual core processor with CPU operating frequency of 2000 MHz or more;
RAM: 1024 MB or more;
Display: 1024x768 at least, a wide screen type monitor is recommended;
Ports: USB 2.0 x 1;
Operating system: Windows 7, 8, 10

PROGRAM INSTALLATION

To install the program you should run **ST131.SAnalyzerProSetup-x_x_x.exe** file where **x_x_x** – number of the version.

After start the program will display a language selection dialog box. Press **OK**.

Then installation wizard welcome window appears. Press **Next**.

In the next window it is possible to select a folder where the program will be installed. Select a folder or use a folder by default. Press **Next**.

Then a folder in Start menu selection window appears. Select a folder or use a folder by default. Press **Install**.

The program will be installed and **installation wizard complete** window appears. A checkbox **Run ST131.S Analyzer Pro** enables starting of the program after completion of operation of the installation wizard. A checkbox **Install driver** will enable to install the USB driver for the device, if it is not installed. Press **Finish**. The program has been installed.

CONNECTION

Connect the main unit of ST 131.S to USB port of the PC by the connection cable.

In case of loss of the connection with the device the program automatically offers to switch over to demo mode. It is possible to switch over to this mode manually – in menu **File** -> **Demo mode**. There is no data exchange when using demo mode and diagrams display synthetic demo data.

INTERFACE

Channel list box similar to the list in the ST131 main unit is displayed when starting the program.

Then selection of channels is also available in drop-up menu in the right bottom corner of the main program window.

The main program window is divided into three panels – for three operating modes of the ST131.s device correspondingly. FULL RANGE mode data is displayed at the top. Lower left panel is used for BAND mode data. DEMODULATION mode indication is displayed below on the right. Name of the program, its version and current



channel are indicated in the header of the main window of the program.

The program supports Russian and English languages for interface. Russian language is selected by default if the language of the operating system is Russian, in other cases English language is selected. Forcible select a language is possible through menu **View -> Language**.

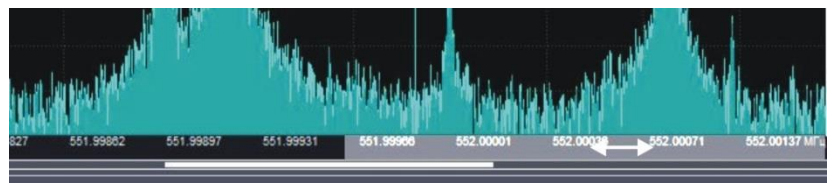
Color pattern of the program diagrams can be changed by the dialog box **Tools -> Preferences**. The **"Apply"** button enables see new colors of the diagrams promptly without closing this box.

Menu **Help** provides access to the present manual and information about version of the program.

OPERATIONS WITH DIAGRAMS

The diagrams in all panels and modes operate similarly.

Scales are placed at the left and below. The diagram itself as well as the scales is sensitive to tracking and to mouse wheel.



Horizontal scale (X scale) is divided into two parts. When pointing the cursor the corresponding area is highlighted and the cursor changes its form accordingly. A left part is responsible for left border of the image while a right part is responsible for the right one.

Vertical scale (Y scale) is divided into three parts. A lower part controls the lower border, a middle part controls both borders synchronously, and an upper part controls the upper border.









Image borders can be changed by four methods:

- Use of the mouse cursor. For this you should set the cursor on the scale, press a left button of the mouse and while holding the button move the mouse in required direction. Move to the right results in decrease of the initial (if the cursor is placed in the left part) or end (the cursor in the right) of the visible frequency range. Move to the right results in increase of initial or end of the visible frequency range vice versa.
- In case of pointing the cursor on the diagram and pressing and holding the left button of the mouse move the mouse in required direction a visible part will be moved together with the cursor within the full range.
- Use of the mouse wheel. For this you should set the cursor on the scale and scroll the wheel of the mouse. Use of the mouse wheel results in prompt changing of the width of the displayed section of the range as to selected central frequency. This is so called an electronic magnifier. Place a cursor of the mouse on the desired section of the diagram and increase or decrease displayed frequency range by scrolling the wheel.
- Use of the dialog box. This box is called by double click on any place of the scale.

In the oscillogram the middle part of the vertical scale is responsible for vertical shift of the diagram without changing the scale. The middle zone in the BAND panel is divided by a dotted line. The upper part shifts the first diagram (I component of the IQ signal) while the lower part shifts the second diagram (Q component of the IQ signal). It allows separating of the graphs for more convenient analysis.

CONTROL BUTTONS

The control buttons common for all panels are listed below:

-  **Pause/Resume.** It stops new data displaying. It enables viewing of the graph in details and carrying out of cursor measurements. Repeated pressing on the button resumes displaying of incoming data.
-  **One Step Update.** Pressing on the button results in single refreshing of the graph.
-  **Spectrum.** The signal spectrogram is shown on this panel.
-  **Waterfall.** The colored spectrograms in real time are shown on this panel.
-  **Oscilloscope.** The signal in time domain is shown on this panel.
-  **Reset.** It returns of the graph settings by default (maximal dynamic and frequency ranges).
-  Adjust to the level of noise
-  **A Auto-detection of the range by Y axis.** It sets up a visible range by vertical in such way that a maximal peak in the spectrogram occupies the whole height of the window.

RIGHT MOUSE BUTTON

Clicking the right mouse button on the diagram calls a context menu. A concrete set of commands of this menu depends on panel, channel and displaying mode. The following options are possible:

Enable Delta Cursor This option enables relative measurement on the graph. Cursor measurements can be carried out by horizontal line and vertical line as well. In oscilloscope mode a frequency is computed also on the basis of the measured period of time.

Set Max Freq As Band Window Center. In this option the maximum frequency in current range is determined and set up as a central frequency in the BAND panel. It is necessary to point out that for the channel "RADIO 30-4400 MHz" only visible range is taken into account while the full range is used for all other channels.

View measurements... This option displays a window with the results of the measurements of the signals in various interpretations. There is a button **Select** in the window intended for selection of necessary measurements. A set of measurements depends on the panel and displaying mode. A complete list of the measurements including comments is given in the Appendix 1.

Add to Archive... This option allows to add the current panel image to archive and/or recording of the signal. More detailed information is given in the corresponding section of this manual.

Export as Text... This option enables creation of a text file containing digital values of the current signal. The obtained file can be used, for example, for construction of graphs in Excel program.

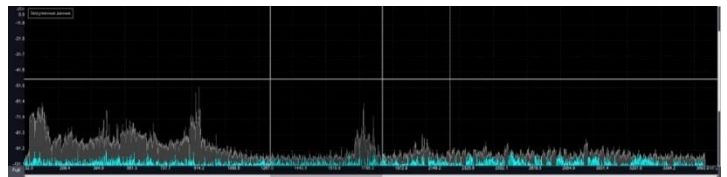
Export as Image... This option enables saving of the current graph image in JPEG format.

Save data... This option enables saving of the graph data as a file for following use in the ST131 Analyzer Pro program.

Load data... This option enables data loading for displaying in the current window. A way of data displaying depends on selection in sub-menu **Data Operation**. When loaded data are displayed the message "**Loaded data**" appears in the left upper corner of the graph.

Data Operation. When the data have been loaded, this option enables selection of these data displaying mode:

- **Pause.** The uploaded data are displayed in the window simply.
- **Combination.** The uploaded data are imposed on current data from the device.
- **Difference: signal-data.** A difference between current data from the device and the data imported from the file is displayed.



- **Difference: data-signal.** A difference between the data imported from the file and current data is displayed.
- **Cancel Data Operation.** This option cancels the previous data operations.

The following item appears when displaying "waterfall":

Show Spectrum. It switches on displaying of spectrogram (at the top) and "waterfall" (at the bottom) on the current panel.

When displaying oscillogram the following items appear:

Enable autoscale. If this option is switched on, the minimum and maximum vertical limits of the oscillogram are computed basing on the signal. Any attempt to change the vertical limits results in switching off of automatic tuning.

Enable trigger. If this option is ON, the threshold level, exceeding of which stops displaying of newly incoming data, is displayed by red line.

Set trigger level here – set the trigger (threshold) level to the position of the right-click with the mouse.

On the vector diagram in the BAND panel there is an item **Show in a separated window**. Selection of this command transfers displaying this vector diagram into a separate window while a spectrogram is displayed at the place of the vector diagram.

FULL RANGE panel

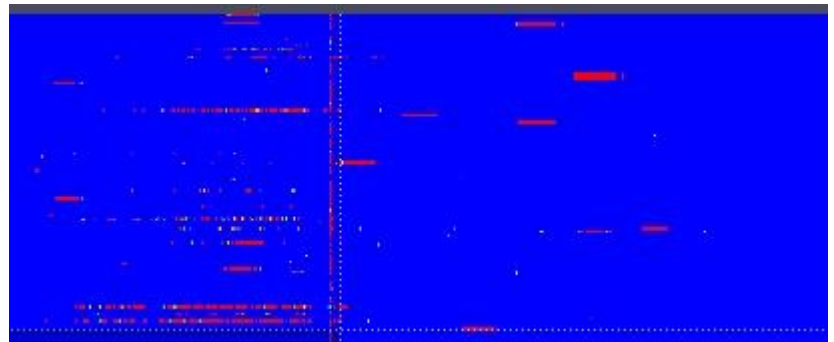
This panel is intended for displaying and analyzing the signals of the FULL RANGE mode. White vertical cursor line of the central frequency of the BAND panel is displayed on the graph of the spectrogram and "waterfall" in FULL RANGE panel. The borders of the selected BAND (to be selected in the BAND panel) are indicated by dotted red lines.

Waterfall

This option displays the change in the signal spectrum over time and is a color projection of the signal amplitude onto the time-frequency plane. Red is the maximum signal level, blue, respectively, is the minimum.

This type of viewing helps to detect and identify the signals which have random frequency and duration (for example, FHSS — **f**requency-**h**opping **s**pread **s**pectrum).

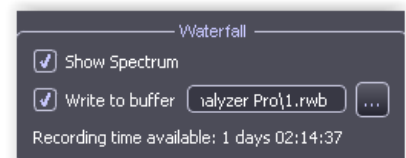
The figure shows the BLUETOOTH signal which can be considered as the FHSS signal (channel width is 1MHz).



When you first time turn this mode, on the top right corner of the window spectrogram message box appears indicating the total recording time.

Total time: 0:09:12

To be able to save and view the waterfall with the desired duration, it is necessary to save the data to a temporary file. For this set the checkbox "**Record Buffer**" and specify the location of the file on disc in the "**Options**". This entry is designed for operational work and not saved after shutdown the program.



During recording to the buffer the added information appears in the upper right corner and shows how much time is necessary for a visible window of waterfall.

Total time: 0:01:46
Visible time: 0:00:41

This value can be changed by scrolling the mouse wheel in the lower third of the vertical scale (the mouse pointer will change to <->).

For scrolling of the waterfall move the mouse pointer to the center of the vertical scale (the mouse pointer will change to <->) and rotate the mouse wheel.



The total time can be zeroed by pressing on .

The display duration of the signal on the waterfall does not depend on the lifetime of the signal on the spectrogram (on the spectrogram it can be different depending on the used detector).

By default, the waterfall and spectrogram displays together, but spectrogram can be turned off using the context menu of the right mouse button and removing the checkbox **"Show the spectrum."**

For taking cursor measurements the running waterfall can be stopped by pressing the pause button (recording signal is not interrupted).

BAND panel

This panel is intended for displaying and analyzing the signals of the BAND mode.

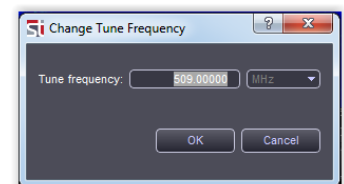
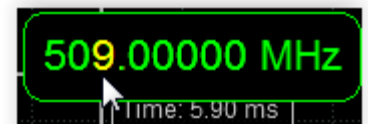
There are two ways to select the center frequency of the band. The first one is to click the mouse pointer over the FULL RANGE panel. The band will display as vertical white lines.

The second option is to manually enter the frequency.

The current central frequency of the BAND is displayed in the frame in the upper part of the graph.

When pointing the cursor on the number position marking the value of the central frequency of the BAND it is highlighted by yellow color. In that moment mouse wheel scrolling changes the number and hence the central frequency of the band. Such method enables fast changing of the frequency at specified accuracy.

Alternative option is to click by the left button of the mouse inside the frame and enter the required frequency in the dialog box.



A drop-down list **"BAND"** enables selection of the bandwidth. A set of the bands is different in different channels.

Vector diagram

Vector diagram is a representation of the signal in polar coordinates in the complex plane.

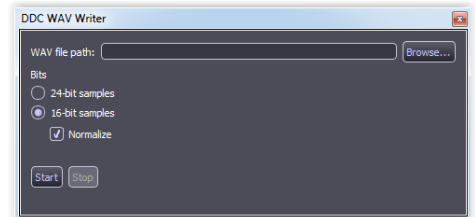
The resulting vector module represents the instantaneous amplitude signal and an angle - the current value of the phase.

The analysis of the trajectories of the vector allows to identify the multi-positional amplitude-modulated, phase-modulated and mixed-amplitude-phase-modulated signals. Such species include, for example, ASM, PSK and QAM modulated signals.

Signals with constant amplitude, for example, FM will appear as a circle with center at the origin.

RECORDING a WAV audio file


Access to the recording window provides by clicking on the **"Write WAV..."** button. The band IQ signal will be recorded with the I and Q quadrature components as the right and left channel of the WAV file in stereo format. The original IQ signal has a 24-bit resolution. For compatibility with software that only works with 16-bit data there is a selection of recording mode: **"24-bit samples"** or **"16-bit samples"**. If you select 16 bits, the upper 16 bits of the original 24-bit data will be recorded in the WAV file.





If you select the **"Normalize"** option, the system will work similar to a system with AGC (Automatic Gain Control) and it will convert the signal amplitude in recording WAV file so that the available bit (16 or 24 bits) is used as efficiently as possible. Sampling rate of the recorded WAV file corresponds to the selected bandwidth. The maximum possible sampling rate is 6.8MHz. The recording data can be dropping out periodically depending on the bandwidth and performance of the computer. The lower the selected bandwidth and the higher the performance of your computer, the less likely dropping-out. For example, a signal with a bandwidth of 100 kHz and below should be no loss of recording on all modern computers. A signal with a bandwidth of 300 kHz and above can be recorded with gaps. Information about the current number of lost data is indicated in the recording process. This value will depend on the performance of the computer and the number of launched applications.

DEMODULATION panel

This panel is intended for displaying and analyzing of the DEMODULATION mode signals. The center frequency and the band of the analyzed signals correspond to the BAND panel. The DEMODULATION panel is equipped with few additional buttons:

 **Sound** This button enables/disables reproduction of sound for demodulated data. Sound reproduction is possible for the band values not exceeding digitization frequency of your sound card (192 kHz usually). If several sound cards are installed in the system then you may select what sound card should be used for audio output.

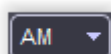
 **Disable FULL RANGE.** This button is intended for stop displaying of the signals in the FULL RANGE panel. It is necessary for sound reproduction and TV signal decoding without pauses in case of insufficient performance capacity of the PC.

 **Octave filters.** This button enables signal level displaying with use of the octave and one third octave filters. It is possible to use these filters for the data of the full range when using acoustic channel mode.

"Auto-zero" button specifies the lower limit of level displaying in accordance with the current minimal level. The upper limit of the displayed levels is regulated by **"Max. range"** field.



When the number of the filters is too high to be arranged in the window horizontal scrolling is activated. Press a left button of the mouse and move it for scrolling.



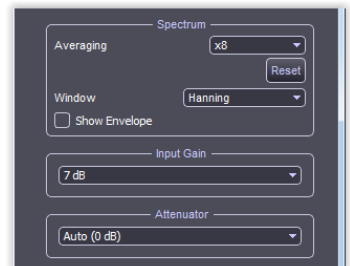
Demodulator selection box. It provides access to select the type of demodulation.

OPTIONS

Options window is called by pressing the **Options** button in each panel. In this case an additional options window appears; this window has three sections – one section per panel.

Capacities, which are common for all panels:

- **Averaging** – a type of spectrum averaging. The list of averaging types is given in the Appendix 2.
- **Reset** – reset of the averaging results and start of the new cycle.
- **Window** – selection of the window type for FFT (Fast Fourier Transform).



Selecting the type spectral window is a compromise between spectral resolution of adjacent signals, accuracy of the spectral resolution and spectral leakage. Windows are listed in order to improve the spectral resolution and spectral leakage reduction.

- **Input gain** - selection the input gain of the main unit's amplifier.

FULL RANGE mode options

- **Input gain** - Input amplifier gain value
- **Attenuator** (only for "RADIO 30-6000 MHz" channel). It provides manual setting of the attenuator value for the UHF converter.
- **Commutation** (only for WIRE channel). It specifies contact pairs of RJ-45 connector.

BAND mode options

"Tune Off Mirror Channel". It allows to find out which signals in the BAND panel are real, and which are mirror ones. Press the button few times (not more ten times). The true signal will be present on the spectrogram regardless of the number of clicks. If the signal is disappeared, that means it is a false signal.

DEMODULATOR mode options

"Sound" – selection of audio signal parameters:

- **"Audio device"** - It enables selection which of the audio devices, installed in the system, should be used for sound reproduction.
- **Use AGC** (automatic gain control). It switches on automatic gain control. If this option is disabled then gain can be controlled by the wheel control placed below.

OSCILLOSCOPE options

"Combine N buffers". This option enables increase of scanning time pro rata to specified N number.

VECTOR DIAGRAM options

"Line drawing". If this option is ON the points on the diagram are connected by the line. This option is OFF by default.

"Number of samples" – a number of signal samplings involved in vector diagram formation. Potential values are from 256 to 4096. The value equal to 4096 is the value by default.

ST182

ST182 provides:

- cellular networks operators (2,3,4G) analysis include detect of false base station
- Wi-Fi networks analysis (2.4 and 5GHz)

The ST182 consists of a radio receiver (ST182R) and software (ST182Analyzer).

ST182R provides the reception of radio signals in the frequency ranges of cellular base stations and WiFi networks, analysis and data transfer to a PC.



Preparation for work

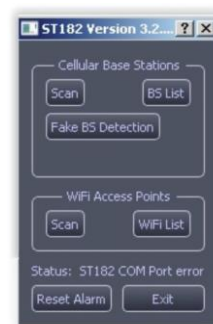
1.1 Connect the ST182R using a USB cable. Check that the "STATUS" indicator blinks twice every second.

1.2 Click on "ST182".

The main program window will appear on the screen.

The "Status" indicator on ST182R will change to flash once per second.

The "Status" line will display the following message: "Connection established, ST182R initialization process is in progress." After a few seconds, the inscription will change to "ST182 READY". This means that the device is ready for use.



5.1.4 Button assignment:

"**Scan**" - launch of the BS and WiFi network analysis process

"**BS list**" - access to the list of detected BS

"**Fake BS Detection**" - access to the control and indication window of detection of false BS
"**WiFi list**" - access to the list of detected WiFi networks

"**Reset Alarm**" - reset detection indication.

"**Exit**" – exit from software

Work with ST182

To start the analysis process, click on the "Scan" button (s). The color of the button (s) will change to light gray. An inscription "Cycle .." will also appear informing about the number of analysis cycles.

During the analysis, the STATUS indicator on the ST182R is permanently lit.

The analysis time for base stations of cellular communication is about two minutes, Wi Fi access points - about twenty seconds.

Changing the inscription from "cycle 1" to "cycle 2" indicates the end of the first analysis cycle and the availability of the list of detected networks and devices. To view them, click on "...List".

When new base stations or Wi Fi access points appear on the next, after the first, cycles, in the corresponding section, a blinking inscription "New found ..." will appear.

In the "List ..." new items will be highlighted in red.

To remove the inscriptions "New found" it is necessary to click on the "Reset Alarm" button. At the same time, highlighting of new elements in "Lists ..." will also disappear.

To stop scanning, click the "Scan" button again.

The list of detected base station cells is presented in the form of a list with columns:

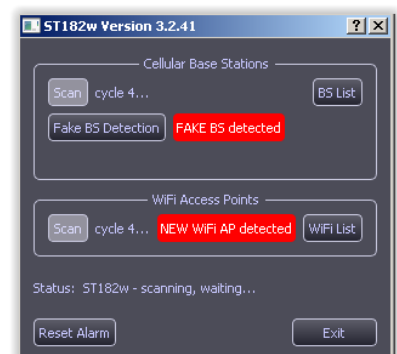
- cellular standard
- names of mobile operators
- cell frequency
- corresponding terminal frequency
- signal level from the cell,
- cell id
- location code


Number	Band	Operator	RFCN	Base Frequency, MHz	Mobile Frequency, MHz	Signal Level, dBm	Cell ID	Lac (Tac)
1	2G	Megafon	113	957.6	912.6	-47	16204	7839
34	2G	Megafon	113	957.6	912.6	-47	16204	7839
35	2G	Megafon	113	957.6	912.6	-47	16204	7839
36	2G	Megafon	113	957.6	912.6	-47	16204	7839
2	2G	Beeline	71	949.2	904.2	-57	16087	14782
33	2G	Beeline	71	949.2	904.2	-57	16087	14782
69	4G	Megafon	6350	811	852	-57	202075148	7814
70	4G	Yota	6350	811	852	-57	202075148	7814
4	2G	MTS	41	943.2	898.2	-58	14343	260
3	2G	Megafon	807	1864.2	1769.2	-58	16002	7839
71	4G	Megafon	1596	1844.6	1749.6	-58	202075354	7814
72	4G	Yota	1596	1844.6	1749.6	-58	202075354	7814
73	4G	Megafon	1596	1844.6	1749.6	-59	199696840	7814
74	4G	Yota	1596	1844.6	1749.6	-59	199696840	7814
58	3G	Megafon	10638	2127.6	1937.6	-61	8511808	7839
59	3G	Megafon	10662	2132.4	1942.4	-61	8487733	7839
5	2G	Beeline	646	1832	1737	-62	16083	14782
6	2G	Megafon	15	938	893	-63	16205	7839
84	4G	Megafon	3048	2649.8	2529.8	-64	202075288	7814
85	4G	Yota	3048	2649.8	2529.8	-64	202075288	7814
77	4G	Beeline	1414	1826.4	1731.4	-66	20091657	10878
28	2G	MTS	42	943.4	898.4	-66	26532	260
68	3G	Megafon	10687	2137.4	1947.4	-66	8496025	7839
86	4G	Megafon	3048	2649.8	2529.8	-66	201350144	7814
7	2G	Tele2	858	1874.4	1779.4	-66	10113	19686
87	4G	Yota	3048	2649.8	2529.8	-66	201350144	7814
80	4G	Megafon	2850	2630	2510	-67	201350147	7814
60	3G	Tele2	10563	2112.6	1922.6	-67	2062109	19686
75	4G	Tele2	1275	1812.5	1717.5	-67	199938829	19686
81	4G	Yota	2850	2630	2510	-67	201350147	7814
9	2G	Beeline	75	950	905	-68	16326	14764
82	4G	Megafon	2850	2630	2510	-68	202075278	7814
8	2G	Tele2	860	1874.8	1779.8	-68	93	19686
83	4G	Yota	2850	2630	2510	-68	202075278	7814
10	2G	Megafon	836	1870	1775	-69	2126	7839
76	4G	Tele2	1275	1812.5	1717.5	-69	199682317	19686
11	2G	MTS	29	940.8	895.8	-70	2881	260
67	2G	Tele2	10587	2117.4	1927.4	-70	7061712	10686

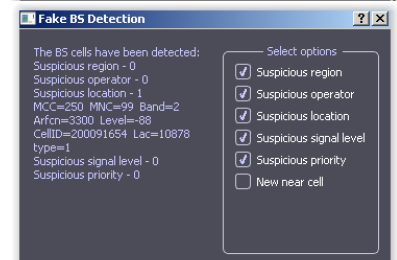
Clicking on the column name provides sorting by this attribute. When you click on **"Service Information"**, a list appears corresponding to the service message at the end of monitoring.

Clicking on **"Export to HTML..."** provides the ability to save data in the "HTML" format.

When a Fake BS is detected, a blinking message "FAKE BS detected" will appear.



When you click the button  , the "Fake BS Detection" window opens. It is divided into two subsections: Information (left part) - here you can find information about the detected BS cells according to the features set in the "Select options" subsection (right side).



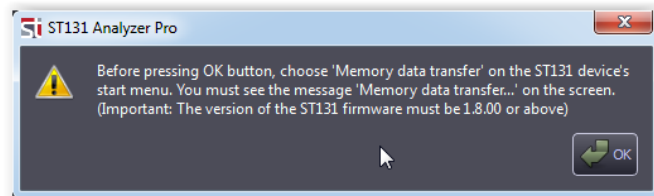
The list of detected Wi Fi access points consists of the following columns:

Number	Time/Date	Name	MAC Address	Signal Level, dBm	Channel	Authentication	Unicast Ciphers	Group Ciphers	RSN Capabilities	Country	Roaming (Mobility Domain)
9	18:32:39 22.06.2021	"HP-Print-91-Las...	BC85560D7791	-57	6	Open			0		
10	18:32:39 22.06.2021	"TechnoKlasof"	3408049CB195	-65	6	PSK/WPA2	TKIP/AES	TKIP	1	"AU"	
11	18:32:39 22.06.2021	"TP-Link_81E5"	909A4A9F81E5	-25	8	PSK/WPA/WPA2	AES	AES	0		
12	18:32:39 22.06.2021	"ysekVadraty.ru"	50FF20510A80	-65	9	PSK/WPA2	AES	AES	0	"RU"	3962
13	18:32:39 22.06.2021	"TP-Link_13EE"	50D4F73E13EE	-71	10	PSK/WPA2	AES	AES	0		
14	18:32:39 22.06.2021	"DanaherGuest"	E4AA50FF48E2	-82	11	Open			0	"RU"	9D7D
15	18:32:39 22.06.2021	"discosb1"	70F35A75E43D	-84	11	PSK/WPA2	AES	AES	12		
16	18:32:39 22.06.2021	"DanaherMobile"	E4AA50FF48E1	-83	11	EAP/WPA2	AES	AES	40	"RU"	
17	18:32:39 22.06.2021	"UnoTrans_5G"	D607897C44D2	-61	40	PSK/WPA2	TKIP/AES	TKIP	0	"RU"	
18	18:32:39 22.06.2021	"TP-Link_81E5_5G"	909A4A9F81E7	-32	40	PSK/WPA/WPA2	AES	AES	0		
19	18:32:39 22.06.2021	"GenPribor-5G"	EC43F6057D2	-81	44	PSK/WPA2	AES	AES	0	"US"	
20	18:32:39 22.06.2021	"smersh_5Ghz"	E4C32A46EDE6	-66	48	PSK/WPA/WPA2	TKIP/AES	TKIP	0	"RU"	
21	14:54:41 23.06.2021	"Neva"	D84732BA4092	-58	3	PSK/WPA2	AES	AES	0		
22	14:54:41 23.06.2021	"NAAG_INTR"	6C3B6BF3EA1B	-75	5	PSK/WPA/WPA2	AES	AES	0		
23	14:54:41 23.06.2021	"Gp"	149F3C00382	-73	6	PSK/WPA2	AES	AES	12		
24	14:54:41 23.06.2021	"RefService"	54A050DD8BAC	-82	6	PSK/WPA2	AES	AES	12		
25	14:54:41 23.06.2021	"ZTE Blade 20 5m...	B61C30864A99	-73	11	PSK/WPA2	AES	AES	12		
26	14:58:27 23.06.2021	"	58AC78784EC3	-79	1	PSK/WPA2	AES	AES	40	"DE"	
27	14:58:27 23.06.2021	"divpn43"	001C0F4CEE81	-92	1	PSK/WPA2	AES	AES	40	"RU"	
28	14:58:27 23.06.2021	"hmedia"	EC43F60668F0	-79	10	PSK/WPA2	AES	AES	0	"RU"	
29	14:58:27 23.06.2021	"DanaherNet"	E4AA50FF48E0	-78	11	EAP/WPA2	AES	AES	40	"RU"	9D7D

- **Number** – index number
- **Time/Date** – time and date of access point detection
- **Name** - the name of the network
- **Mac address** - mac address of the detected access point
- **Signal level** - signal level of the detected AP at the location of the ST182 receiving antenna.
- **Authentication** - type of authentication
- **Unicast Ciphers** - unicast encryption technology between access point and client
- **Group Ciphers** - multicast encryption technology between access point and client
- **Country** - Country for which this access point was made. Lack of data means "gray" device.
- **Roaming (Mobility Domain)** - Sign of roaming between APs. In this case, the AP must have the same number (in Figure 9D7D).

MEMORY

This option is used to transfer data from the ST131.S main unit to the ST131.S Analyzer Pro program. The results of analysis, graphs and detailed image pattern are transferred. In addition, the detailed image pattern can be transferred back to the ST131.S main unit after being loaded from the disc.



To get started with this option, click on the "Memory" button and then on the "Download from ST131.S» button. Follow the instructions in the information window. Select and confirm your choice in the "MENU" of the main unit: "SELECT CHANNEL:" then "Memory data transfer...". The message "Memory data transfer... To CANCEL, press any key... " should appear on the main unit screen.

Click on the «OK» button in the information window of the PC program.

The process of transferring data will begin. Percentage of the process is displayed in the info bar beneath the control buttons.

The data is divided into the three following tabs:

"Analysis List" - This tab gathers signals stored in the ST131.S main unit, as the result of the option "Analysis".

When you click on the right mouse button over the string, a sub-menu appears that allows you to do two actions: integrate the selected signal directly to the archive system of this program (the window "Archive") or delete it from the list.

"Spectrograms" - This tab gathers spectrograms stored in the ST131.S main unit, as the result of the option "Memory".

"Pattern" - This tab obtains the detailed image pattern created in the ST131.S main unit.

Clicking on the "Save..." button provides the preservation of the entire volume of the data in a file with the extension «.mem».

Clicking on the "Load..." button provides the loading of the saved data.

Clicking on the «Upload the pattern to ST131.S» button provides the uploading of the detailed image pattern stored in the PC

ARCHIVE

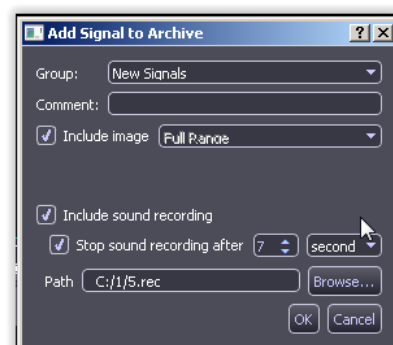
An archive is used for signal information storing. The Archive window is opened by clicking "**Archive**" button in the full range panel. When this window is opened receiving of data is disabled. Archive data include the results of real-time measurement and use of ANALYSIS and MONITORING functions.

Data for the archive is the result of real-time, used analysis and monitoring functions, as well as downloaded data from the main unit.

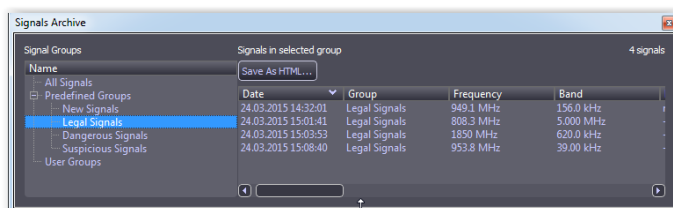
For real time, signals adding to the archive it is necessary while being in any of three panels to press the right button of the mouse and select an item "**Add to Archive**". In this case, a dialog box appears where it is possible to specify a group where the signal should be added, give comment, specify necessity of attaching of the graph image, recording of sound.

The sound should be recorded when the checkbox "Use AGC" is checked in the option "sound" window!

A checkbox "**Stop sound recording after**" enables limitation of duration of the recording by a time period indicated nearby.



A list Groups of signals is placed in the left part of the **Signals Archive** window. If "**All signals**" is selected, all signals from all groups and modes are displayed. Main groups section includes inbuilt groups: **Legal signals**, **Dangerous signals**, **Suspicious signals**. These groups cannot be renamed or deleted. User can add his own groups in the section "**User groups**".



Operations with groups are possible in the context menu after pressing the right button of the mouse while being in the section "**Signals group**":

- **Add group** – addition of a new group into the section **User group**.

The signals from selected groups are shown in the right part of the window. The following information is contained concerning each signal: date of addition, group, signal frequency, signal band, signal peak level, comment, availability of images, and availability of records, channel and sources (real-time mode, analysis, monitoring or downloaded data from the main unit).

In the right part of the window is a button "**Save as HTML ...**", which intended to preserve the archive data in HTML format, and a list of signals from the selected group.

Operations with signals are possible in the context menu by pressing the right button of the mouse:

- **Go to Frequency** It retunes the device to assigned frequency and close archive window.

- **Play sound recording** It enables play of sound of the recorded signal (in case of availability of the record).

Reproduced signal is displayed in all three panels in such a way as the signal incomes from the device in real time. When reproducing an additional window appears that shows a reproducing progress, and it is possible to stop and repeat reproduction of the signal in this window.



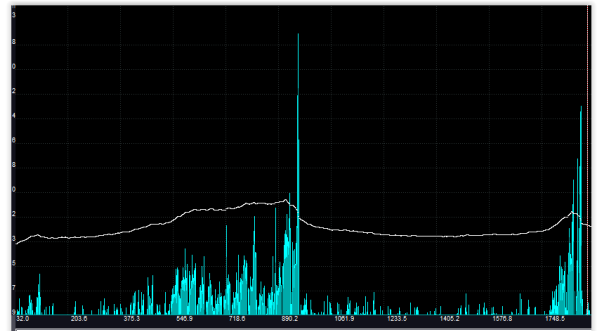
- **View image.** It enables to view the images associated with the signal (if available). The image is displayed in the corresponding box in the form of a static picture.
- **Sound Playback.** It enables listening of the demodulated signal.
- **Set Comments.** It enables changing of the comments related to signal.
- **Delete.** It enables deleting of the signal from the archive. The images and record associated with this signal are deleted together with the signal. It is impossible to restore deleted signal.

ANALYSIS

Analysis means comparison of the spectrum with the threshold level specified by the user. The threshold level can be specified as an absolute value in dBm as well as it can be specified as an excess in dB over the template computed basing on averaging of the specified number of spectrum.

Analysis window is opened by clicking **"Analysis"** button in the full range panel.

A threshold line is displayed on the full range spectrum when the window is opened.

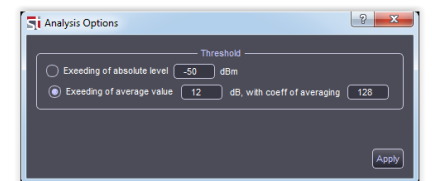


Pressing **"Analyze"** button actuates conducting of one-time analysis of the spectrum. Repeated pressing the button results in conducting analysis related to the previous result. The signals that were absent in the previous analysis are marked by red color. The signals that have disappeared in the new analysis are marked by blue color. If in the result of the analysis some signals have been detected, the full range spectrum changes its form. The whole spectrum becomes semitransparent while detected signals are displayed in common way. In this case a peak frequency of the range is displayed over these sectors in the frames.

Frequency	Bandwidth	Level	Comment
36.621 MHz	4.883 kHz	-71.8 dBm	
51.279 MHz	2.441 kHz	-77.7 dBm	
1.051 MHz	2.441 kHz	-87.2 dBm	
1.260 MHz	2.441 kHz	-85.4 dBm	
1.521 MHz	4.883 kHz	-85.5 dBm	
1.571 MHz	7.324 kHz	-81.3 dBm	
1.680 MHz	2.441 kHz	-80.8 dBm	
2.913 MHz	2.441 kHz	-79.8 dBm	
3.000 MHz	2.441 kHz	-82.5 dBm	
3.179 MHz	2.441 kHz	-77.8 dBm	
3.210 MHz	2.441 kHz	-79.1 dBm	
3.251 MHz	4.883 kHz	-78.4 dBm	
3.311 MHz	2.441 kHz	-77.9 dBm	
3.320 MHz	2.441 kHz	-76.3 dBm	
3.353 MHz	2.441 kHz	-77.8 dBm	
3.368 MHz	2.441 kHz	-75.0 dBm	
3.411 MHz	4.883 kHz	-74.8 dBm	
3.411 MHz	2.441 kHz	-75.7 dBm	
3.450 MHz	2.441 kHz	-73.6 dBm	
3.420 MHz	2.441 kHz	-75.5 dBm	
3.441 MHz	2.441 kHz	-74.7 dBm	
3.500 MHz	2.441 kHz	-74.6 dBm	
3.500 MHz	2.441 kHz	-71.3 dBm	
3.708 MHz	2.441 kHz	-72.2 dBm	
3.708 MHz	2.441 kHz	-72.2 dBm	
3.800 MHz	2.441 kHz	-70.4 dBm	

Options. It allows to specify the parameters of the threshold line.

"Exceeding of absolute level XX dBm". Selection of thresholds is a straight line with its installation on the spectrogram, at the value "XX", relative to noise level.



"Exceeding of average value XX dB, with coefficient of averaging YYY". The choice of the threshold as a broken line that exceeds the signals at the XX dB. This variant is effective when the difference of signal levels is high, for example, when analyzing the wide frequency band. Averaging coefficient YYY determines the value of smoothing threshold line. For example, if it is equal to "1", the threshold line will repeat exactly the level of the current signals and in this case, formally will never exceeded over a given threshold level. A value of "1000" - it will a straight line.

Save – to save the results of the analysis as HTML document.

Clear – to delete the results of the analysis.

Legend – meanings of the color marks.

By clicking on the the right mouse button on the row with the detected signal context menu appears:

- **Add to Archive.** It adds selected signal to the archive.
- **Delete Record.** It deletes a row from the results.
- **Go to 2nd harmonic, Go to 3rd harmonic.** It retunes to the second and third harmonics of the selected signal.

MONITORING

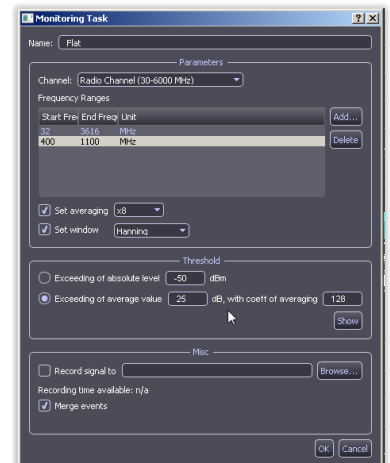
This function enables execution of tasks according to the preliminary specified criteria and time schedule.

Monitoring function is carried out by pressing the **"Monitoring"** button in the full range panel or by F6 key on the keyboard.

Analyzing algorithm is the same as in case of one-time analyzing (see previous section).

When the window is opened a threshold line is displayed on the full range spectrum.

The list of tasks for monitoring is shown in the upper part of the window. Monitoring control elements are placed in the bottom part of the window.



Press the button **"Add"** for adding a new task. The **"Monitoring task"** window appears.

A field **Name** is intended for assigning a name for the task.

Items selected in the group **Parameters** are channel for monitoring and frequency range.

Averaging and FFT window type can be specified as well. Current channel and whole frequency range are selected by default. In case if averaging and window type have not been specified, the current values at the moment of execution of the task are used. It should be noted that if any specific values for averaging or window type have been specified in the previous task these values will be applied in the next tasks.

The threshold parameters are specified in the **Threshold** group. Meaning of these parameters is similar to the meaning in analysis. Pressing the button **"Show"** refreshes indication of the threshold in the spectrum.

The **"Misc"** group:

"Record signal to" will enable recording of the signal during the monitoring process. When adding found signal into the archive, the recording will be attached to that signals.

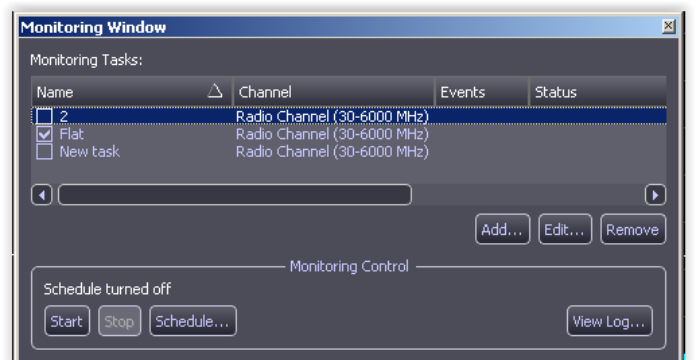
"Merge events" will enable the mode when nearby signals will be merged into one signal (if the events are arranged closer together than 10% of the width of the first signal).

Pressing **OK** button will add a new task and select it automatically for execution.

If there is a need to change some parameters of already existing task you should press the button **Edit**.

Remove button is used for deleting the task from the task list.

Monitoring Control box is intended for Monitoring control.



Pressing **Start** button enables beginning of monitoring, while pressing **Stop** button enables termination of monitoring. Only the tasks marked by checkboxes in the left side are executed. The tasks are executed in series. It is impossible to make any operations with the task list when executing the task.

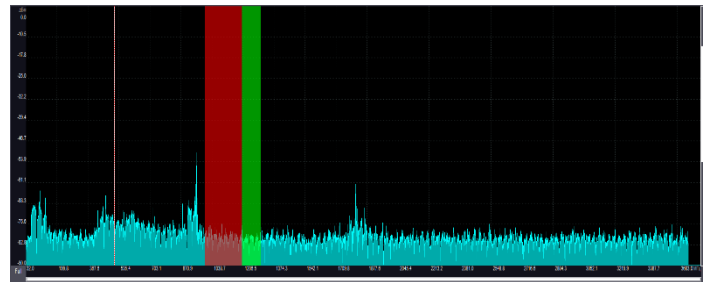
The results of monitoring are recorded into the log. Viewing the log is possible by pressing **View Log** button. Log window is being refreshed every 10 seconds by default. It is possible to switch off automatic refreshing capability and make refreshing manually by means of the **Refresh** button. It is possible to sift out unnecessary records by means of **Filter** button. It is possible to delete all records from the log by means of the **Clear** button. It is possible to save the log in HTML file by the **Save** button.

There is **Add to Archive** command in the context menu that enables addition of the signal to the archive. You should pay attention that attachment of image or record in this mode is impossible. It is possible to add a record to the archive through the parameters of the task only. The **Schedule** button is used for specifying the monitoring start time-schedule. Possible start options include: daily, on specific day, on specified days of the week. A time period when it is necessary to carry out monitoring is specified as well.

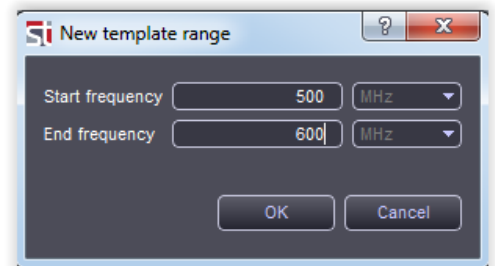
TEMPLATES

This option is designed to create a single or group of signals, which should be excluded from the results in the analysis and monitoring modes.

To open the templates window, press the "Templates" button (or press F7 on your keyboard).



Templates are created after clicking on the "Add..." button and specifying the start and end frequency in the "New template range" window.



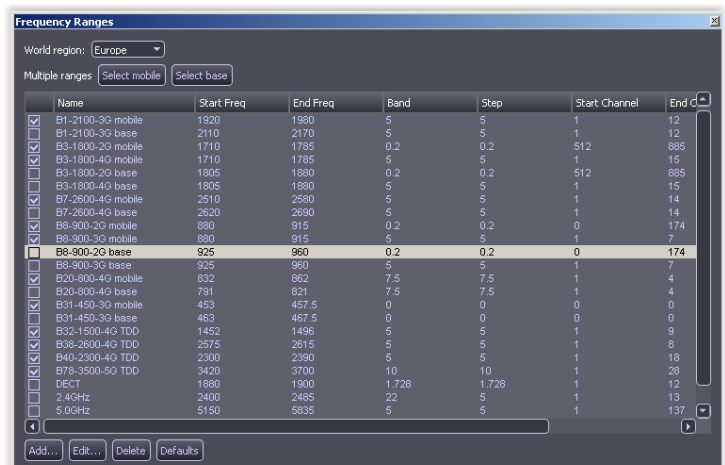
The created template can be saved and then loaded by using the "Load ..." and "Save ..." buttons. Loaded template is displayed as a separate part in the list and with a different color on the diagram. Separately loaded templates can be enabled or disabled by clicking on checkboxes on the left side.

RANGES

By pressing the "Ranges" button you can activate the "Frequency Ranges" window.

This option is a quick way to view frequencies relating to standards for cellular and wireless data transmission. The averaging of signals is optimized for each band. The multiple indication of standards are provided.

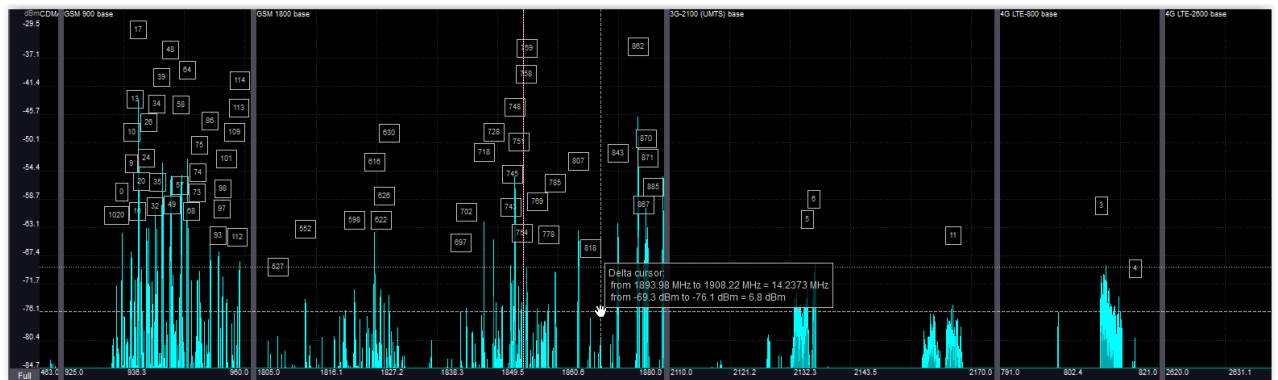
In the opened window you can choose region, that has its own list of standards.



Name	Start Freq	End Freq	Band	Step	Start Channel	End c
<input checked="" type="checkbox"/> E1-2100-3G mobile	1920	1980	S	5	1	12
<input checked="" type="checkbox"/> E1-2100-3G base	2110	2170	S	5	1	12
<input checked="" type="checkbox"/> B3-1800-2G mobile	1710	1785	0.2	0.2	512	885
<input checked="" type="checkbox"/> B3-1800-2G base	1710	1785	S	5	1	15
<input checked="" type="checkbox"/> B3-1800-4G base	1805	1880	0.2	0.2	512	885
<input checked="" type="checkbox"/> B3-1800-4G mobile	1805	1880	S	5	1	15
<input checked="" type="checkbox"/> B7-2600-4G mobile	2510	2690	S	5	1	14
<input checked="" type="checkbox"/> B7-2600-4G base	2620	2690	S	5	1	14
<input checked="" type="checkbox"/> B8-900-2G mobile	880	915	0.2	0.2	0	174
<input checked="" type="checkbox"/> B8-900-2G base	880	915	S	5	1	7
<input checked="" type="checkbox"/> B8-900-2G base	925	960	0.2	0.2	0	174
<input checked="" type="checkbox"/> B8-900-3G base	925	960	S	5	1	7
<input checked="" type="checkbox"/> B20-800-4G mobile	832	862	7.5	7.5	1	4
<input checked="" type="checkbox"/> B20-800-4G base	791	821	7.5	7.5	1	4
<input checked="" type="checkbox"/> B31-450-3G mobile	453	457.5	0	0	0	0
<input checked="" type="checkbox"/> B31-450-3G base	463	467.5	0	0	0	0
<input checked="" type="checkbox"/> B32-1500-4G TDD	1452	1496	S	5	1	9
<input checked="" type="checkbox"/> B36-2600-4G TDD	2575	2615	S	5	1	8
<input checked="" type="checkbox"/> B40-2300-4G TDD	2330	2390	S	5	1	18
<input checked="" type="checkbox"/> B78-3500-5G TDD	3420	3700	10	10	1	28
<input checked="" type="checkbox"/> DECT	1880	1900	1.728	1.728	1	12
<input checked="" type="checkbox"/> 2.4GHz	2400	2485	22	5	1	13
<input checked="" type="checkbox"/> 5.0GHz	5150	5835	S	5	1	137

Use the "Select mobile" and "Select base" buttons to automatically select the strings with the word 'mobile' or 'base' at the end of its name. You can also select each band individually by clicking on the checkbox on the left side.

The figure below shows the FULL RANGE panel when the **"Frequency Ranges"** window is activated.



The **"Add..."** button allows you to create your own frequency range.

The **"Edit..."** button opens the **"Frequency Range Edit"** window to change parameters of the highlighted range.

The **"Delete"** button deletes a highlighted string.

The **"Clear"** button erases the whole list.

The **"Default"** button provides reset the whole list to a "first start" state.

APPENDIX 1. The list of measurements

The measurement box shows some numerical parameters of the signal under study. To open the measurement box you may select **View measurements** line in the context menu of the corresponding panel.

The following measurements are possible:

- **Maximal frequency** – a value of the frequency of the maximal amplitude harmonic within the total frequency range.
- **Maximal frequency level** – a value of the maximal amplitude harmonic within the total frequency range.
- **Integral level** – an averaged value of the harmonic amplitudes within the total frequency range except amplitude peaks.
- **RMS level** – a root mean square (RMS) level of the signal at the input.
- **Peak-peak level** – a difference between the maximal and minimal levels of the signal at the input.
- **Maximal level** – a maximal level of the signal at the input.
- **Mean level** – arithmetical mean value of the maximal and minimal levels of the signal at the input.
- **Maximal cursor frequency** – a value of the frequency of the maximal amplitude harmonic within the selected frequency interval.
- **Maximal cursor frequency level** – a value of the maximal amplitude harmonic within the selected frequency interval.
- **Cursor integral level** – an averaged value of the harmonic amplitudes within selected frequency range except amplitude peaks

The measurements of the levels for the BAND panel are displayed for in-phased (denoted by I) and quadrature (denoted by Q) components.

APPENDIX 2. The list of the averaging modes

A mechanism of spectrum averaging makes possible detection of the stationary processes at the background of disturbances and noise as well as detection of short spectral peaks.

The following types of "averaging" parameter are possible:

- **Instant.** Instantaneous spectrum that is without averaging. Information about all previous spectra is lost.
- **x2, x4, x8, x16, x32, x64.** Linear averaging of the spectrum. An arithmetical mean spectrum is computed by N last implementations, where $N = 2, 4, 8, 16, 32, 64$. The bigger N results in longer accumulation of the changes and stronger decrease of the random harmonics in the spectrum. N instantaneous spectra participate in creation of the resulting spectrum.
- **Peak.** Peak averaging. It represents continuous memorizing of the harmonic maximal levels. Unlimited number of the instantaneous spectra is involved in creation of the resulting spectra until reset of the averaging results has been done. Such averaging allows detecting of the rare spectral peaks during a long time period.
- **Peak x8, x16, x32.** Quasi-peak averaging of the spectrum. Signals newly appeared are displayed as peak ones while disappearing signals are averaged.