SIGNAL-T

ST 167 "BETTA"

ST167W5

SEARCH RECEIVER

TECHNICAL DESCRIPTION AND OPERATING MANUAL

CONTENT

1 INTRODUCTION

Present document contains information necessary for the proper use of ST167, ST167W5 (hereinafter – ST167, if isn't otherwise noted). Carefully read it before using and keep it as your further reference manual.

The information contained in this document is subject to change without notice.

The manufacturer reserves the right to make changes in the unit design as long as they do not decrease its consumer properties.

2 FUNCTIONALITY

ST167 is designed for:

• Detection, identification and localization of the sources of the following types of signals: cellular standards (cellular phones and modems SDMA450, GSM 900, 1800, 3,4 and 5G), wireless data transmission (WLAN 2.4 and 5GHz , BLUETOOTH) and microcellular wireless communication standard DECT.

All the devices mentioned above hereafter are referred to as **DRT** (digital radio transmitters).

Spectrogram standards indication is provided, including channels separation in 3G, 4G, WLAN and DECT standards.

Data transmission intensity analysis is provided for the WLAN standard.

Special SMS detection mode is provided.

Furthermore, BASE STATIONS signal level indication in CDMA450, GSM 900, 1800, 3, 4, 5G and DECT standards is possible.

- Access points(routers) indication, their name, MAC address, used channel number and signal level in WLAN 80.1 (a,b,g,n) range (only for ST167W5).

- Detection and measurement of frequency, demodulation (AM and FM) and locating of the sources of analog signals (hereinafter referred to as **ART**, i.e., analog radio transmitters). You can choose the threshold, the scanning range and the sound control of the demodulated signals.

- Blockers (jammers) detection of GSM and GPS standards

- External devices control, including additional indication devices and jammers/blockers of cellular and wireless data transfer (Additional optional - the letter "**R**" is added to the device name).

- Vibrating alert (Additional optional - the letter "**V**" is added to the device name).

Round the clock monitoring of radio environment while registering the information on the detected signals in non-volatile memory of the unit.

Special software application «ST167 Analyzer» extends unit configuring possibilities, visualizing and saving the data.

3 SPECIFICATIONS

3.1	Frequency range, MHz	50-6000
3.2	Threshold sensitivity, dBm	-90 (1000MHz) - 70 (5000MHz)
3.3	Input signal max level, dBm	10
3.4	Bandwidth, MHz	1, 8, 20
3.5	Frequency measuring accuracy, kHz	10
3.6	Max relay contacts resistance, Ohm*	25
3.7	Max relay contacts current, mA*	100
3.8	Indication	color OLED display, 160X128
3.9	Internal power supply	Li-pol acc. battery 3.6 V
3.10	Current consumption, mA	450
3.11	Dimensions of the main unit, mm	90x54x21
3.12	Dimensions of the package, mm	120x70x70

*Only for devices with letter "**R**"

4 COMPLETE SET

The product includes the following components:
1. Main unit
2. UHF antenna
3. USB cable
4. Charger/power supply
5. Two-wire cable 0.2m with connector for connection to the relay contacts*
6. USB flash drive with the software and "Technical description and operating manual"

*Only for devices with letter "**R**"

5 DESIGN AND OPERATION

ST167 is a superheterodyne receiver with digital control and a color OLED display.

It detects signals with digital data transmission protocols, and the entire frequency band of analog signals.

The detection of **DRT** signals is carried out by successive scanning of the chosen standards frequency ranges. The user choses the detection threshold and the number of desired frequency ranges. Signal identification is based on the analysis of the frequency ranges and time parameters of the detected signal.

The detection of **ART** signals is carried out by scanning a predetermined band in the frequency range from 50 to 6000MHz. Demodulation is possible for the AM and FM signals, and their frequency is indicated in the screen.

5.1 OPERATION MODES

ST167 has four modes of operation: "**AUTO**", "**MANUAL**", "**SEARCH**", "**LOG VIEW**" and "**SMS/GPRS**".

Fifth mode are analysis of Wi-FI and Bluetooth networks (only for ST167WB).

5.1.1 The **"AUTOMATIC"** mode is a sequential analysis of user-selected DRT standards and **search within a given range of analog signals.** The signals exceeding a predetermined threshold are shown in the screen, and the information on the detected signals is recorded in the event log.

5.1.2 The **"MANUAL"** mode provides the ability to control one user selected DRT standard, locate its source and search for ART signals in the selected frequency range. This mode provides indication of the timeline, as well as the view of base stations levels.

5.1.3 The "**SEARCH**" mode is scanning and locating ART signals. Provided sound control signals from the AM and FM modulation.

5.1.4 **"LOG VIEW"** Viewing the event log of the unit operation in the **"AUTOMATIC"** mode. The time and type of the event, its duration and the signal level are displayed.

5.1.5 The «**SMS/GPRS**» mode designed for the detection of SMS/GPRS messages of GSM 900, 1800 and 3G 2100MHz standards.

5.1.6 **WIFI networks** mode is intended for Wi-FI (802.1a,b,g,n) networks analysis.

5.2 LABELS AND SEALING

The marking is on the nameplate mounted on the back cover of the main unit. It presents the unit name, serial number, space for marking the full name of the unit and the manufacturer's logo, applied by the intaglio method.

5.3 PACKAGING

The unit components are transported and stored in a rectangular box 120X70X70 made of corrugated cardbo

6 ST167 OPERATION

6.1 CONTROLS AND INDICATORS

6.1.1 INDICATION

The unit operation results are shown on the OLED color display with the resolution of 160X128.

Power supply status indicator (see 6.2) is shown in all modes in the upper right corner of the display (see fig.1), as well as the enable/disable sound control (for volume control see 6.1.2) and a clock

The line at the bottom of the screen displays associative alpha-numerical characters for:

Fig.1

- **DRT**:

    9 – GSM900 (B8)

    18- GSM1800 (B3)

    D-DECT

    3G- CDMA450 (B31), 3G-2100 (B1), 3G-900 (B8)

    4G – 3G/4G1800 (B3), 4G-2600(B7) 4G-800(B20), 4G-2600TDD (B38), 4G-2000TDD (B34), 4G2300TDD (B40), 4G-850 (B26), 4G-1900TDD (B39)

    5G – 5G-3500 (B78-1, B78-2, B78-3)

    W- WLAN 2.4, WLAN 5

    B- BLUETOOTH

- Data exchange intensity   **T**

- Blockers detection option   **J**

- Search for **ART** signals   **S**

        The standards selected for analysis are displayed in black, those not selected in gray. The default standards are GSM1800, 3G 2100, 4G2600, Wi Fi 2400 and DECT.

6.1.2 CONTROLS

The power switch is located on the side surface of the main unit. When you turn on the unit (Position "**ON**") the following message is briefly displayed:"ST167 Version X.X", where X.X is the software version of the main unit. Functions of the buttons are as follows:

← →	Select standards and scroll through menu items and events in the banks of events in the **"LOG VIEW"** mode
▶/ᴧ	Access to change the volume level. Choose between indication of a level scale or a spectrogram and demodulator selection in the **"SEARCH"** mode
⊕/←	Choose the ""SEARCH"" mode. Return to the previous MENU. Back to the **"SEARCH"** mode**.** Selecting a separate indication of the channels in the standard 3G.
⟳	Choose between the **"AUTOMATIC"** and **"MANUAL"** modes
⊞ ←	Enter the menu. Confirm your choice. Switch between banks in the **"LOG VIEW"** mode

6.2 POWER SUPPLY

The ST167 works from the built-in Li-Pol battery or power supply unit/charger.

The battery charge level is displayed in the icon ▬▬ . When the icon is completely shaded the battery is fully charged, when bleached and flashing - the battery is low.

When the battery is completely discharged, you'll see the message "LOW BATTERY" displayed on the screen for ten seconds.

Fully charged battery life is about 4 hours.

6.2.1 Charging the battery

Connect the charger/power supply unit to the ST167, and to the electric system of 220V.

Charging is indicated by constant glow of the «▬▭▷», located on the side of the main unit. Once completed the indicator light goes out. Full charge when the unit is turned off takes about four hours.When the unit is turned on, the battery can be charged, too. Full charge in this case takes at least fourteen hours.

6.3 "AUTOMATIC" OPERATION MODE

Select this mode by pressing the ⟳ button. The label **"AUTO"** will appear in the upper left corner of the display.

To select standards that are displayed at the bottom of the display, perform the following steps:

- Press to ⊞← to enter the menu.

- Select by pressing ← and → the: "**Band..**"
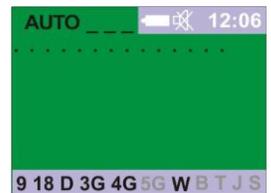
- Confirm your selection by pressing the ⊞←.

Fig.2

In the window that appears (Fig. 3), the first line, "Region," allows you to set cellular standards based on location. The list is being updated (See updates on the site).

Fig.3

Also, for automatic setting of standards, the **ST181 base station analyzer** is used.

In this windows can be excluded from the analysis completely all cellular standards pressing (uncheck line "**Cellular**..") or, if pressed again , enter into a detailed list of standards (Figure 4).

The name of a disabled standard in the bottom of the screen will be discolored.

To return to the display mode "**"AUTOMATIC"** " (Figure 2) successively press on.

.

If there are no signals, that has exceeded the predetermined threshold the indication corresponds to Fig 2.

Dotted line of variable length at the top of the screen indicates the serial view of frequency ranges of the selected signals, while a continuous black line at the bottom of the screen is an additional time period indication necessary to view the frequency range signals of the **ART (S).**

Fig.4

Duration of the view depends on the selected range and the bandwidth being analyzed. Maximum time corresponds to the full range and minimum bandwidth being analyzed. This option is selected by default. If you change these values the viewing time will decrease until the line disappears.

Threshold is made via the menu - "**Threshold ..**" and then select a desired standard. Selection of the threshold value can be selected individually for each standard **DRT**. The lower the number on the right side of the display - the higher the sensitivity.

Select the maximum sensitivity in the absence of false alarms from distant sources.
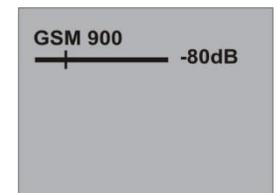
Fig. 5

When exceeding the set threshold of any of the signals, its level is displayed as a numerical value and the two-tone multi-segment scale (Fig.6). The segments corresponding to the value exceeding the signal level threshold, are displayed in red. The unit may simultaneously display three detected signals. Red lit symbol in the status bar is an additional indication of detection. This will happen if the signal persists for the time set with the submenu **("Log.."** > **"Min.duration**."). This setting is the same for all characters (see 6.9).
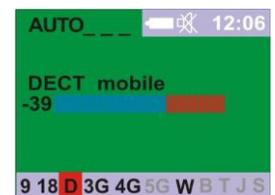
Fig. 6

Provided all standards and options, except analog signal search, are selected the total cycle time is 800ms. While 40ms is service intercharge (keyboard and display). Analysis time for GSM 900, 1800 and 3G frequencies is 40ms, for Wi-Fi and BLUETOOTH it equals to 150ms.

In order to increase the probability of detection, exclude unnecessary ranges.

In this mode the unit can work on schedule, automatically switching on, recording the detected signals and switching off at a specified time. Activate this option by following these steps:

• Set the time in accordance with the "TABLE 4" in the "MENU" > "System ..." > "Time .." > "Set clock..". When connected to a PC the time is set automatically using the "**ST167Analyzer**" application. When ST167 is switched off, the settings will be reset.

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• Set the schedule in accordance with the "TABLE 4" in the "MENU" > "System ..." > "Time.." > "Schedule.".
In the upper right corner you will see the "scheduled operation" icon: 🔔.

6.4 "MANUAL" OPERATION MODE

Select this mode by pressing the 🔲 button. The labels "**MAN MOB**" or "**MAN BAS**" will appear in the upper left corner of the display. The second option corresponds to the selection MENU > "Band" - "Base stations manual mode".
Moreover, while in the "AUTOMATIC" mode you can also switch to the "MANUAL" mode by pressin the buttons 🔲 or 🔲 . Press these same buttons to select the required standard.
It should be noted that when selecting the symbols "3G", "4G" and "5G", successive pressing of the button will lead to the selection of frequency ranges related to these standards (See clause 6.1.1.).
The same happens when the **«W»** symbol or the data exchange intensity measurement option **"T"** are selected. By pressing the buttons you will sequentially select 2.4 or 5GHz ranges.
When the blockers detection option symbol **«J»** is glowing. By pressing the buttons 🔲 or 🔲 you will sequentially select blockers of GSM or GPS signals.

In this mode, a two-color diagram with a signal level change over time change is displayed. The sections of the diagram where the signal level exceeds the threshold are shown in red (Fig. 7).

Fig. 7

Pressing the button 🔲 provides a transition to a spectrogram with a frequency range corresponding to this standard (except CDMA, BLUETOOTH and blockers). Figure 8 shows the screen displaying the signal levels immediately in all channels of standard DECT. Red line - the detection threshold.
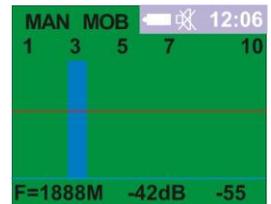The bottom line shows the frequency of maximum signal, level and the last digit is the average value of the signal level measured in all channels.

Fig.8

Displaying signal level is relatively the highest level. Therefore, when the signal level greater than the existing ones, the screen displays only it, weaker signals disappear. The threshold line is set with respect to the current level of the maximum signal and therefore also moves vertically according to the level of the maximum signal. For understanding focus on the meaning of the absolute maximum signal level expressed in dBm (the second number in the bottom line).
Pressing the button 🔲 provides a transition to view the signal level for each channel individually (Fig. 9).

The choice of channels carried out by buttons 🔲 and 🔲 .
Return to the previous display - press. 🔲 .

Fig.9

When the «S» character is selected, the unit analyzes the entire frequency range searching for analogue signals, i.e. ART units.

Choice «**S**» is not provided by default (symbol grayed). To activate it, select "**Band ..**" - "**User band**".

In this case there is a consistent and continuous scanning of a given frequency band in order to detect signals have exceeded the threshold of a relative.

The view in the absence of exceeding threshold by signal is presented on Fig 10. The top line shows the range and in brackets, the band of analysis (MHz).
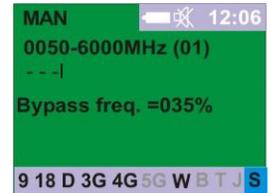
Fig.10

The threshold is set in the "**Threshold ..**" - "**User,s band**" (Table 2). Line threshold displayed on the spectrogram (Fig. 12).

Bandwidth and step - "**Settings ..**" - " **User,s band** " (Table 3).

The line "**Bypass freq = 035%** "informs that enabled a filter that excludes from the analysis the frequency band corresponding to the **DRT** (Table 6). This filter is enabled by default. Enable / disable the filter takes place through the menu (Table 3).

The numerical value of excluded frequencies, expressed as a percentage, is variable and depends on the frequency band.

This provides the search for analog signals avoiding the influence of such radiation sources as cellular base stations.

The level and frequency of the signal with the larger level to be displayed (Figure 11).
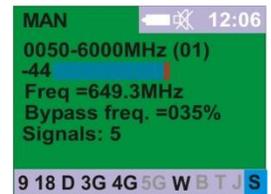
Fig.11

Additional information

The appearance of the red triangle in the top right corner of the display indicates the change in the gain of the internal amplifier. If the triangle pointing up, the gain decreases - to eliminate the overload when down, - increasing to the maximum value based on the level of noise and dynamic range in a given band.

Continuous display an upward triangle means finding a ST167 able to overload. Before eliminate it, any measure should be considered will be incorrect.

By pressing the button ![button] you can drill to view the selected band spectrogram (Fig. 12). The bottom line shows frequency, level of the maximum signal and level of noise.

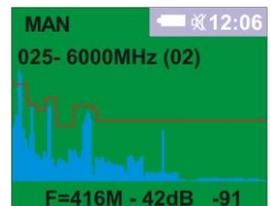Return to the scale indication by pressing the button ![button]

Red line is threshold.

Fig.12

In case of choosing in range segment analysis (fig.13) transition to full range with given band (200MHz on figure) is done by pressing ![left] and ![right] buttons.
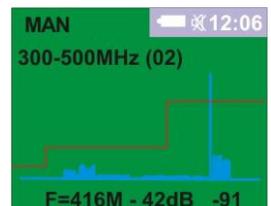
Fig.13

After detecting the signal of ART location of its source and audio control carried out in mode the "SEARCH".

6.5 "SEARCH" OPERATION MODE

Entrance to the "**SEARCH**" mode by pressing the ⊕ button.
Scanning is finished.

. The status of the detected signal will be displayed regardless of its level, even if it has fallen below the threshold level. This allows to directly search for the signal source.

Displaying more than one and up to five signals. You can view them by subsequent pressing on ▣◄ , in order of decreasing "weighting factor".

Fig.14

The accuracy of measurement of the frequency in this mode is higher as compared to the "**MANUAL**" and when transferring information about the signal the frequency recalculate will occur (See. Fig. 11 and 14).

Displaying the frequency at the first pass, there will be a delay of several seconds.
If detected signals at least five, on the place of the frequency signal is a dotted line (Fig. 15).

Fig.15

Stored signals will not be updated automatically (scanning is stopped).
Updates occur only ⊕ when pressed again.

The buttons ← and → help tune the signal frequency with increments of 5kHz.

By default, the demodulators are disabled. In this state, signal value is displayed, which helps search for the location of the radiation source. Press the ▶ button to select a demodulator. First you will select the amplitude demodulator (AM), second -- the frequency demodulator (FM). Once selected the demodulators, the indication level corresponds to the last measured value and does not change until the state "Demodulation OFF" is selected. This turns on the audio monitoring (the ⊠ icon changes to the ▌ icon (fig. 16).

Fig.16

Adjust the volume by pressing and holding the ▶ button for a few seconds before the indicator ▌ starts flashing. Change the volume while the indicator is flashing by pressing the buttons ← and → .

Finish the volume adjustment by pressing the ▶ button or wait for a few seconds before the icon ▌ stops flashing.

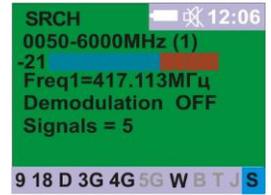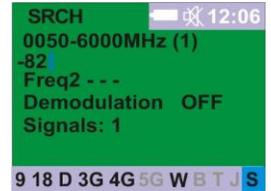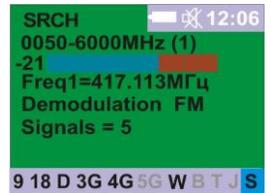Finish the search and return to the "**MANUAL**" mode by pressing the ↻ button.

6.6 "EVENT LOG" OPERATION MODE

In order to record information on the detected signal in the event log select the submenu "Event log" and tick the box "Record" by pressing ▣◄ . The symbol "**---**" in Fig. 2 changes to the event counter **"000"** (Fig. 17).

Note that event recording only starts when the signal exceeds a preset threshold for a time value not less than the one set in the submenu **"Log.."** > **"Min.Duration. "**(red light denotes signal in the status bar).

Fig.17

Once signal level falls is below the threshold, recording of a new signal will be possible only after a time period greater than the value set in the submenu **"Event log"** > **"Event delay".** This delay is the time interval during which after the advent of a new signal any subsequent level changes (signal disappearance and appearance) will be treated as one and the same signal. This feature helps prevent the Event log from filling with undue information of one signal, e.g. due to short-time shielding of the source.
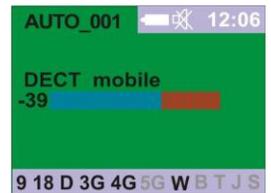
The Memory is organized in 30 banks with 999 events each. Bank number "1" always contains the newest events, bank number "30" -- the oldest ones. If necessary, start recording a new bank by selecting this option in the MENU. Bank record is produced be cycles: if overflown, new signals are recorded over the old ones.

Switch between the banks by presing the button ⊞◄┘ (BANK XX/YY, where XX is the number of the bank being viewed, YY is the number of active banks). Bank number "1" is always the one with the latest information.

The buttons ◄ and ► switch between numbers of events (Recording XX/YY, where XX is the number of the event being viewed, YY is the number of events in the bank). The events are numbered in accordance with the specified sorting criteria set via MENU). If you select the sorting options, other than sorting by time, the following message may appear: "Please wait while sorting..."

Exit the event viewer by presing the ▣◄ button.

This information is recorded in non-volatile memory of the unit and does not disappear after shutdown.

View the detected signals by selecting the "**View**" item in the "**Log..**" menu. If the event log has no events, you will see the following: "PROTOCOL IS EMPTY." Otherwise, the information on the detected signal is displayed on the screen such as shown in the Fig. 18.

Fig.18

6.7 «SMS/GPRS» OPERATION MODE

This mode is intended for short SMS messages and short messages in GPRS protocol, which are mostly used in vehicles tracking devices (trackers).
Entrance to this mode by choosing the line «**SMS/GPRS**" in the MENU.

To avoid missing messages in this mode, the simultaneous processing of data coming in three possible channels of transmission of SMS: 2G (GSM900 and GSM1800) and 3G is provided.

For that, in this mode, the processing time is minimized. The keypad is locked except the button exit -. ◄ Updating the screen information is reduced to about once every 8 sec.
To reduce false alarms processing data in each channel carried out through 15 seconds after the last detection.
If there is no signal screen view is shown in Fig. 19.

Fig.19

If a signal is detected on the screen will display the level and time of existence - a three-digit number to the right of the screen (Figure 20). 15 seconds interval is starting from this moment. If in this interval there will be more than one signal (duration of the signal doesn't matter in this case), then they will not be identified as SMS/GPRS message. It is made for a reason, that, for example, during the conversation radio transmission is made synchronously with audio signal in
a phone audiotrack. Pauses in conversation can give misrepresentation of several SMS messages during this interval.
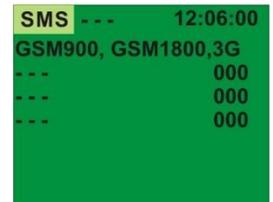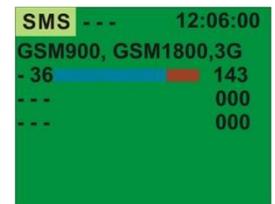

Fig.20

If the value does not exceed 250 conventional units (about 5 seconds), then the signal will be adopted for SMS or GPRS message, and is recorded in the bottom of the screen (Figure 21). If the duration of the signal is greater than this number, it will be classified as to the talks or transfer of streaming data, and at the end of the radiation will not be recorded in the memory of the product.

The number of simultaneously displayed on the screen SMS- three. Additionally, in the upper left corner of the screen displays the counter SMS. It displays the total number of detected SMS - up to 999
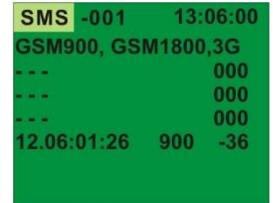
Fig. 21

During the operation in this mode threshold set up is important. It is desirable to set the maximum possible threshold level (lowest sensitivity). It will prevent message detection from distant sources and will reduce possibility of close signals masking (if, for example, new signal will be detected in 15 sec interval)

For threshold level estimation place ST167 on a board line of the controlled territory and send an SMS message from its center. Control level and frequency range of received signal («-36» and «900» on fig.21). Set threshold level value 5dB lower- «-41» in this case. For other frequency ranges «1800» и «3G» other threshold level might be needed.

Threshold level set up is done in MENU- «Threshold..» and choosing of needed standard.

6.8 WORKING IN «WiFi» MODE (only for ST16W5)

Entering this mode is done by selecting «WiFi» line in MENU.

After Wi-Fi network selection, by pressing [icon] button, «Searching for Wi-Fi networks…» inscription will appear. When the search is over «No networks found with given threshold» or list of detected networks.
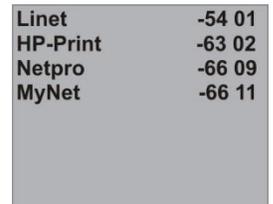
Network detection threshold is set in MENU: «Threshold..» - «2.4GHz» - «Wi-Fi networks ».

Fig.22

Networks list example (Wireless Access Point- WAP) is shown on fig.22. Here, in first line, network name (Linet) is shown, then signal level "-54" (in dBm) from WAP and last digit – channel number "1". For 2.4GHz range channels number is 13 (1-13). For 5GHz range - 36, 40, 44, 48, 52, 56, 60, 64, 100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140, 149, 153, 157, 161,165.

Network list, by default, updating with periodicity of 1 time in 4 sec. Forced update is done by pressing [icon] button.

For selecting WAP press [icon] and select by pressing [icon] and [icon] buttons. If number of detected networks is more then 8 (8 lines fit in window), then view of other networks is done by sequent pressing on [icon] button.
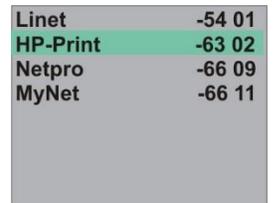
Fig.23

Three types of line color is available:

• Black – color of all detected WAP with selection of this mode (first cycle).
• Red – new WAP appeared with level, exceeding the threshold, given in MENU. Countdown starting point is moment of selection of this mode.

When new WAP detected, network list update stops and information on screen «freezes». It is done for showing even short time WAP appearance.

Fig.24

Resume update - click on [icon].
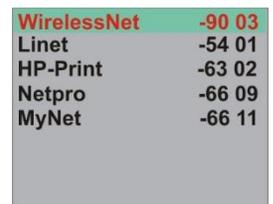
14

Also, update stops by pressing [→] button (appearance of selection rectangle on first line).

- Grey – color of WAP, which level is lower than noise level on given channel. This indication is shown for around 30 sec. During this time WAP status is being analyzed. If level will not increase higher than given in MENU – WAP disappears from list, if increases – line color will change to black.

For selected WAP analysis press [⊕◁] button.

Information about selected network will appear on screen: network name, MAC address, channel number and signal level from HS.

Signal level indication, unlike the other information, is not static. Level will change depending on moving of ST167 relatively to the WAP in real time.

Fig.25

After working with this screen and subsequent returning to W- iFi networks searching, line color will become black – WAP is not new anymore.

Returning to networks list – repeated pressing on [⊕◁] button.

By pressing on [🔢◁] button transition to signal level indication on this channel is done. And if on fig.26 we can see only WAP signal level, then on fig.27 signal level on given channel is shown and it consists of sum of signals:

- WAP (on fig. 26 it is - 63dBm)

- signals from devices, connected to selected WAP.

- signals from other radio emitting devices, using Wi-Fi range.

Fig.26

Ability of 2 signal level values operational control (fig.25 and 26) gives wide ability range for Radio emitting devices detection in WiFi network range (see additional recommendations)
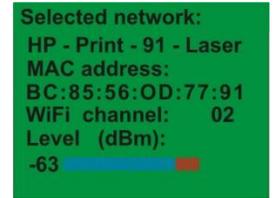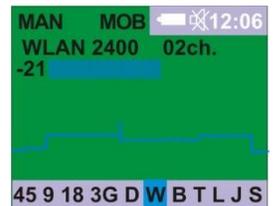
6.9 BASE STATIONS LEVEL MEASUREMENT

The ST167 is capable to measure level of base stations of the standards with transmit and receive channels divided by frequency (GSM900, 1800, 3,4G), as well as the level of DECT base stations based on signal timing analysis of the mentioned standards. For this select the **"MANUAL"** mode, enter the MENU, select **"Band**..." and tick the **"Base stations in manual mode"**. Return to the level indication screen by sequentially pressing [⊕◁] the "**MAN MOB**" inscription in the upper left corner will change to "**MAN BAS**" (Fig.27).
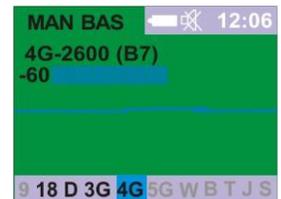
Fig.27

6.10 TRAFFIC

When the "**T**" symbol is selected, the unit provides the intensity value of transmission of any digital data in the 2.4 and 5GHz ranges (Fig. 28). This indicator DOES NOT show the level of the signal. The result can be in the range from 0% to 99%. The values <10% mean negligible data transfer activity. Values >50% correspond to a large stream of digital data. For example, this way you can detect the operation of a WLAN camera, which is characterized by a high volume of data being transmitted.

It should be noted that it is estimated data transmission and reception even large amounts of data (e.g. video) will not cause an increase in traffic.

Fig.28

15

6.11 BLOCKER (JAMMER) DETECTION

When the «**J**» sign is selected, the unit detects operating blockers of cellular GSM, GPS and GLONASS receivers. The GSM cellular blockers are detected by blocker broadband radiation in at least two different frequency ranges (900 and 1800MHz) of the base stations.

GPS and GLONASS blockers are detected by the analysis of the radiation in the receivers frequency range.

Separate selection of GSM or GPS blocking detection is provided in manual mode. By successive pressing ![arrow icon], the level of the GSM signal blocker is displayed first, then GPS.

Fig.29

6.12 EXTERNAL DEVICES CONTROL (only for devices with external device control option)

For external devices control built-in relay with control circuit is designed. Relay contacts are connected to the socket, which is located on the side of device. Setup is in subMENU «System..» - «Relay..».

There are two options for using this option:

- **External indication devices control**
- **Blockers/jammers control**

External indication devices control is done in «AUTOMATIC» mode. Wherein, relay contact closure is done immediately when threshold excess is done by one of the signals and shortcut of this signal will be backlighted by red (see 6.3).

Blockers/jammers control starts with celullar and wireless standards selection, which should be blocked (In case of possibility to it by blocker itself). GSM 900, 1800 and 3G standards can be seen on fig. 30
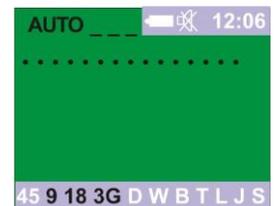
Fig.30

To suppress unwanted communication session blocker should have the following properties:

- *With separate channel transmission and reception (GSM, 3G, 4G) interference signal is done in base station frequency range, which match receiving frequency of mobile devices. In case of lack of frequency separation (DECT, WI FI) signal of suppressing should be cover all frequency range of this signal.*

- *Signal level should be higher than suppressed signal level on determined level.*

Blockers/jammers control is done by chosen standards analysis on presence of radio signals in a frequency range of remote terminals (phones). In case of signal presence ST167R relay contacts closes, that provides blocker activation and suppresion signal in frequency band of receiving channel will appear.

In case if blockers frequency range captures external terminals transmitting frequency range or in case of lack of frequency separation (DECT, WI FI) blocker will be permanently activated. To prevent this situation additional option is designed – mandatory periodic shut down of the blocker on time, needed for radio environment analysis. Time value can be selected in submenu «System..» - «Relay..» - «Relay timer..». Shut down time depends on blocker signal entering speed in receiving channel of the ST167R, turn on – choosing between blocker excess radio emission and turn on periodicity. By default, shut down time – 5sec, turn on – 2 min.

6.13 MENU

Enter the menu and confirm your selection by pressing the ⊞ button, exit by
. Select one of the five menu items:

"Band.." - signal selection (see Table 1).

"Threshold.." - setting the threshold for signal detecting (see Table 2).

"Settings.." - settings for analog signals search and disable DRT identification (see Table3)

"Log.." - settings of the **"LOG VIEW"** mode (see Table 4).

"System .." - settings for the overall configuration of the unit (see Table 5).

"WiFi/Bluetooth" - entering WiFi and Bluetooth Access points detection mode (only for ST167WB)

"SMS/GPRS mode" - entrance to the detection mode of SMS messages

"РУССКИЙ ЯЗЫК" - choice of the Russian language

TABLE 1

Band			
Option	Description	Value	Default settings
Region	Select the region in which the devicde is used	«ALL», «Europe», «South Korea», «Americas»	Europe
Cellurar..	The choice of cellular ranges	B1 (2100), B2(2G-1900), B2(1900), B3 (2G-1800), B3(1800), B4 (AWS1), B5 (2G-850), B5 (850), B7 (2600), B8 (2G-900), B8(900), B20 (800), B26 (850), B28 (700), B31 (450), B32 (1500), B34 (2000), B38 (2600), B39 (1900), B40 (2300), B78-1, B78-2, B78-3 (3500)	B1 (2100), B3 (2G-1800), B3(1800), B4 (AWS1), B7 (2600), B8 (2G-900), B8 (900), B20 (800), B31 (450), B32 (1500), B38 (2600), B40 (2300), B78-1, B78-2, B78-3 (3500)
DECT	The choice of DECT	DECT, DECT6.0	DECT
2.4 и 5GHz	Choosing wireless standards and traffic evaluation	WLAN 2.4, BLUETOOTH , Traffic 2.4, WLAN 5, Traffic5	WLAN 2.4
Jammers	Selecting option "Blocker Detection"	Selected / Not Selected	Not Selected
Users band	Choosing option "Users band"		
Base stations in manual mode	Choosing option "Base stations in manual mode"		

TABLE 2

Threshold			
Option	Description	Value	Default settins
Cellurar	Setting cellular detection thresholds	from-90 to -5dB	Depending on standard
DECT	Set DECT detection threshold	from-80 to -5dB	-45dB
2.4GHz	Set WLAN 2.4GHz detection threshold		-45dB
	Setting the traffic2.4 GHz intensity threshold	from 1 to 100%	45%
	Setting the detection threshold of the WiFi and Bluetooth analyzer (WB option)	from -80 to -05dB	-90
5GHz	Set WLAN 5GHz detection threshold		-45
	Setting the traffic 5GHz intensity threshold	from 1 to 100%	45%
Bluetooth	Set Bluetooth 1 detection threshold	0-50%	20%
	Set Bluetooth 1 detection threshold	from - 80 to -45dB	-55dB
Jammers	Set GSM Blocker detection threshold	from-80 to -05dB	-60dB
	Set GPS Blocker detection threshold		
User's band		The excess of 5 to 20 dB relative to the mean value of the spectrum	10dB

TABLE 3

Settings			
Option	Description	Value	Default settings
User's band	Selection of range start/end and scanning bandwidth (increment)	Range 50-6000MHz Bandwidth 1,8 and 20MHz	50-6000MHz 1MHz
Bypass cellular and 2.4GHz	When searching for analog signals, cellular and 2.4GHz frequencies are excluded.	Selected / not selected	Selected

TABLE 4

LOG			
Option	Description		Default settings
View	When selected provides access to event log		
Record	Permits the entry record to the event log		Not selected
New bank	Transfer of records events in the new bank		
Sorting..	Sorting of records in event log following on the attributes	By time - in fact, without sorting, as the events come with time	Selected
		By level - sorting the maximum level in descending order	Not selected
		By the type of signal	Not selected
		By duration - sorting by event duration in descending order.	Not selected
Erase all	Erases all the information on the events.		
Min duration	Set the minimum duration of the event that riggers recording	0-10 sec with 1sec increments	1sec
Delay event	Set the duration between similar events that will be recorded in the event log as two separate events	2 sec – 1min with 1sec increments	10sec

TABLE 5

System			
Option	Description	Value	Default settings
Indication	**Bright** Sets the brightness level for the backlight	from 10 to 100% with increments of 10	50
	Screen OFF time *Set the time to automatically turn* off the screen after the any button was pressed last. The screen is turned on when a signal is detected or any button is pressed.	Selected / not selected (from 32 sec до 4 min)	2 min
	Sounds Beep confirmation for button stroke. Variable beep when a signal is detected.	Selected / not selected	Selected
Time	**Schedule..** Setting the schedule in AUTOMATIC MODE. Setting the time for a single or daily recording in the event log.	Turn ON/OFF 0-23hours Once or daily Selected / not selected	Not selected
	Set clock... Setting date and time. When the power is OFF the time is cleared.	Serial setting: HOURS (H), MINUTES(M), SECONDS (S), DAY (D) and MONTH.	00:00
	PC syns Automatic synchronization with the on your computer when using the "ST167Analyzer" application.	Selected / not selected	Selected
	Correction Setting of a daily clock correction	from -2 to +2 min with increments of one second per day.	00:00.
Relay	Turning on the relay, selecting options for the state of the relay contacts	Normally open Normally closed	Normally open
	Relay timer	Relay time on: 00sec – 2min Relay time off: 00sec – 2min	2min 3sec
Vibro	Using vibrating alert	Selected / not selected	Not selected
Fact. defaults	Reset ALL changes to its original state		

7 RECOMENDATIONS

7.1 GENERAL RECOMENDATIONS

- During surveillance devices search it should be considered that ST167 is intended for only RADIOTRANSMITTING devices search. Excluding this class of surveillance devices there are devices, which are using wirelines of different purpose, optical etc. They are using both in common with radio transmitting surveillance devices and independently.

- Before doing any search events, if possible, it is necessary to provide activation conditions both for remote control ART and DRT on basis wireless data transfer standards. Best variant is imitation of important meeting with appropriate sound. Real situation could be complicated due to, for example, hidden video camera presence.

- When searching DRT microphone sensitivity range should be considered. It is no more than 10 meters. Usually, DRT are placed as close as possible to the meeting point – inside of meeting table or interior which are nearby to it.

- Possible emission levels of modern ART and DRT are very wide. In general case it can be from Watts to tens microwatts. For example, emission power of classic ART with FM Modulation and range of few hundred meters is about tens milliwatts. Maximum power of GSM transmitter- 2W (with maximum distance from the base station). Minimum real power of 3G and 4G transmitters – microwatts (with minimum distance from the base station)
Extreme cases, both large and small are quite specific and rarely found. Particularly, it can be low power repeater, designed for signal transmission on distance of few meters outwards from the room and its subsequent transmission through other channels (wireline for example). In usual practice emission level is about milliwatts.

- ST167 is a broadband receiver providing signal receiving with wavelength from tens of meters to centimeters. Radio waves spread with such wavelength difference, especially in cities, is significantly different.

- Supplied HF antenna, certainly, isn't optimal for all frequencies. During absolute measurement it is recommended to use antennas, which are exactly corresponds to selected frequency range of the main block ST167.

- Detection of source location is made on base of receiving signal level scale increasing when approaching to the signals source location (amplitude method)
When signal level is above -40dBm, as usual, it means that device is very close (from centimeters to 1 meter) to the source.

- Real signal level can de different up to 10 times due to the only dimensional orientation of the receiving antenna measurement.

- Reflection of signals from walls, heating radiators, ceiling and interior can give false impression of signal level.

7.2 RECOMENDATIONS FOR DRT SEARCH

All "digital" standards are used for illegal data transmission. A lot of factors contribute to this, primary of them are:

- Availability
- Relatively low price
- Difficulty finding
- In most cases information receiving point can be anywhere in the world.

GSM 2,3,4 и 5G

To detect radio emissions from listening devices using cellular standards, it is advisable to exclude from the control all other standards. This will speed up the detection process, as standards are monitored sequentially.

Cell phones are working as a transmitter:

- In moment of connection with base station.

Fig.31

- In the presence of audio signal in audio path of the phone (talking) after connection.
- During data transfer (SMS).

All other time phone working in a receiver mode.

Emitted power of listening devices with GSM transmitter, and as a result its detection range depends from base station distance. As farther- then bigger will be emitted power. In cities detection range of GSM900/1800 is up to 10 meters and farther. Emitted power of devices with 3G transmitter is significantly lower and, respectively, detection range will be much smaller.

DECT

For listening and data transfer mobile phones with room listening or "Baby monitor" function can be used.
In ST167 in case of maximum signal level indication in all DECT frequency range separated signal indication for phones and base stations functions is intended.
There is no such separation on the spectrum. Spectrum using for unauthorized DECT signals detection is based on principle, that both devices, as only appeared ones and already available will use free channels for the broadcast. For searching of its source channel number should be remembered, selectively they are shown on the upper part of display, by pressing [icon] go to channel level indication(fig. 9) and by pressing [icon] and [icon] buttons needed channel can be chosen. Next, moving with ST167 by looking on signal level indication (increasing- decreasing) source location can be determined.

«Usual» base station and phone detection range is about 5 meters.

WLAN

This standard can be used for video surveillance, audio information transition, data transmission, both in real time and with accumulation, compression and subsequent transfer in uncertain time moment (for example, at night).
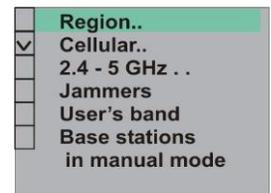
WLAN signals detection with ST167 is done by selecting «WLAN» («**W**» sign) DRT standard on lower line of the display. After selecting consistent WLAN standard channels scanning will start.

As it seen from « Brief technical information» amount of channels in 5GHz range is three times bigger than amount of channels in 2.4GHz, which leads to considerable time needed for this range analysis.

Three main types of communication organization will be considered:

- Through the router/WAP: «Smartphone – router – remote device (next «RD») – PC, video camera etc.

- Straight: «Smartphone – RD» - Wi Fi Direct.

- Using of smartphone as an access point with subsequent data transfer in 2,3 and 4G networks.

Three main methods RD detection is considered:

1. Based on displacement of ST167 for detection of active at search moment RD location.

2. Using of AUTO mode with stationary position of ST167. Given method is used, for example, for visitors RD presence.

3. Using of EVENT LOG mode for RD detection, implementing accumulated data transfer in uncertain period of time.

For second and third methods using of special software "ST167 Analyzer" is expediently

1 method

RD detection with using of ST167 is only possible if RD is active – data transfer. For this, if possible, search should be done during worktime with important meeting imitation. *But, if in moment of search event there are will be covert surveillance, for preventing its detection it possibly will be deactivated.*

If possible, turn off "your" routers and disable WLAN connection on all PCs and peripherals: printers etc. Arrange ST167 nearly at the center of controlled zone.

Select, in manual mode, «**W**» and 2.4GHz frequency range. On display (Fig.32) signal level with maximum value is indicated (result of subsequent channles scanning).

This level can be a sum of several signals from:
- WLAN routers/access points
- RD
- BLUETOOTH connection in data receive-transition mode (see BLUETOOTH)
- Radio emitting devices of other standards, for example from information retrieval devices with transmitting frequency of 2.4GHz.

Fig.32

Go to 5GHz range (deactivated by default). For activating go to MENU – RANGE - 2.4 and 5 GHz – WLAN 5. For information output in this frequency range press

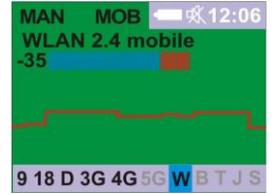button. Returning to 2.4GHz – press .

Fig.33

If signal level in both ranges is close to -70dB and lower, it means that there are no any "usual" access points and RD connected to them in a radius of 20m (inside the house in a urban conditions).
Additionally, control signal level in other territory points. If when approaching to a wall signal level is slightly increases – it means that there are Wi FI device in adjoining room, if increase is sharp – more than 10dB, presence of radio transmitting devices is possible as well on a territory, as and directly behind the wall. Source of this signals can be low-power device, using WI FI or other radio standards, including BLUETOOTH.

By pressing button to visible 2.4 and 5 GHz ranges spectrogram indication can be done. This will allow to estimate total amount of used channels (fig.34). Transition to total indication is done by second press of button. In a lower line Value of central frequency (in MHz), channel with max level (-2462MHz on fig. 38), numerical value of maximum level signal (-30dB) and noise level (-82) is indicated.
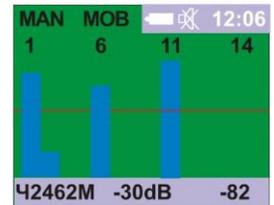
Fig.34

ST167 is able to work with each channel individually. It is made by pressing , as from the total signal level indication (fig.32) as from spectrogram indication (fig.34).

Transition back to total indication – second pressing of .

In both cases transition to signal level indication will be done on channel with maximum signal level (fig.35).
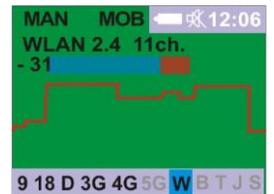
Fig.35

Subsequent channel selection is done by .

2 method
Place ST167 as close as possible to the visitors on condition of visual contact with ST167 display or working with ST167Analyzer software – Screen of Windows PC/Tablet/Smartphone
If possible, place "your" routers, WLAN video cameras as far from ST167 as possible (or disable them).
In "AUTO" mode select only "**W**".
Set threshold 5dB higher than displayed signal level. Turn off sound if needed.

3 method

In "AUTO" mode select only "**W**"
Set threshold 5dB higher then displayed signal level.
Turn on permission for event log record (see 6.6)

Set up time: "MENU" – "System" – "Time" – "Set clock".

Brief technical information

WIFI connection, considered to the tasks, solvable by ST167, have these characteristics:
- Router/access point emits always, RD only at data transfer moment.
- During data transfer from RD to PC with router using, there are will be signals on one channel (frequency range) from 2 sources – RD itself and router.
- Channel number can be set up manually or change automatically depending on network congestion.
- Used frequency ranges (2.4 and 5GHz) are unlicensed (ISCM). Protection level from other signals influence is high enough, that gives an opportunity of sharing of this frequency range with other data transfer standards (BLUETOOTH for example). This fact can be used for hiding of data transfer channel by third-party devices.
- Shared WIFI networks analysis software can't guarantee 100% detection of WIFI connections due to the wide hiding opportunities on software level.

- **WIFI 2.4GHz range**
  Total amount of channels in this range – 14. In Russia 13 and 14 channels are not in use. In USA 11-14 channels are not in use, what makes impossible to use, for example, Iphone with this channels.

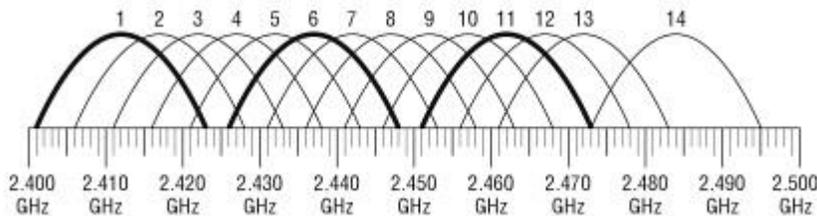| Channel	Central frequency, GHz	Channel	Central frequency, GHz	Channel	Central frequency, GHz	Channel	Central frequency, GHz	Channel	Central frequency, GHz
1	2.412	4	2.427	7	2.442	10	2.457	13	2.472
2	2.417	5	2.432	8	2.447	11	2.462	14	2.484
3	2.422	6	2.437	9	2.452	12	2.467		

Fig.35

As it can be seen from the picture, 1,6 and 11 channels are not intersecting.

- **WIFI 5GHz Range**

Channel	Central frequency, GHz	Channel	Central frequency, GHz	Channel	Central frequency, GHz	Channel	Central frequency, GHz	Channel	Central frequency, GHz
34	5.17	52	5.26	108	5.54	147	5.735	163	5.815
36	5.18	54	5.27	112	5.56	149	5.745	165	5.825
38	5.19	56	5.28	116	5.58	152	5.755	167	5.835
40	5.2	58	5.29	120	5.6	153	5.765	171	5.855
42	5.21	60	5.3	124	5.62	155	5.775	173	5.865
44	5.22	62	5.31	128	5.64	157	5.785	177	5.885
46	5.23	64	5.32	132	5.66	159	5.795	180	5.905
48	5.24	100	5.5	136	5.68	160	5.8		
50	5.25	104	5.52	140	5.7	161	5.805		

Disjoined channels (20MHz width) in Russia are 36, 40, 44, 48, 52, 56, 60 and 64.

- Max authorized RD signal level (2.4 GHz) is 20dB (100mW), router – 26dB (400mW). Max RD working distance – up to 400m. In building, with acceptance of weakening given in table, is about 50 meters.
- Used frequency ranges are concerns to microwave radiation and have relatively high weakening when passing through the buildings. For 2.4GHz range the following values can be seen:

Element	Weakening, dB
Window glass	3
Window glass with metallization	6
Wood wall	12
Interior wall	18
Bearing wall	22
Concrete floor/cealing	22

More of that, when signal passing the wall on 25 degrees its losses doubles, but with angle of 2 degrees wall width for the signal becomes more than 20 times bigger.

TRAFFIC

For traffic indication, data transfer should be implemented (Downloading is considered as data receiving and not detected by ST167). Average level of working with internet traffic – up to 10%. Depending on WLAN camera type and dynamics of image change, traffic can be from 10% to 100%.

BLUETOOTH

The use of this standard is possible, for example, in the option of transmitting audio information using a BLUETOOH headset.

The radiated power of devices of this standard varies from relatively high - tens of milliwatts (data transfer) and hundreds of microwatts (wireless headset cell phones). An additional detection complexity is the FHSS with a band of 1 MHz in the entire ISM band 2.4 GHz - 80 MHz (79 channels).

Setting

Before setting up, turn off all sources of Bluetooth signals - smartphones, headphones, speakers, etc. Switch to manual Bluetooth mode.

The setting takes place in the submenu "Bluetooth" (submenu "Threshold .." - "Bluetooth"). Two sliders are used for tuning

The separation of the settings into two parts is due to the need to separate the Bluetooth signal from WiFi having the same frequency range. After detecting the sum of these signals (exceeding the threshold is set to "Bluetooth 2"), a mathematical operation is performed which results in the probability of finding the Bluetooth signal in the sum of these signals (the probability threshold is set to "Bluetooth 1"). The threshold levels are set high by default - approximately for an office in the area of which at least ten WIFI routers work (Fig. 36).
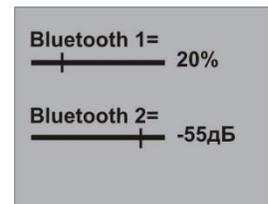

Рис.36

To achieve the maximum detection range, the displayed probability value should be about 5%, with the minimum threshold "Bluetooth 2" for these values. The leftmost position of the "Bluetooth 2" slider corresponds to the minimum threshold (maximum sensitivity), the right, respectively, to the maximum threshold and minimum sensitivity.

7.3 RECOMENDATIONS FOR ART SEARCH

It is expedient to make primal signal analysis before ART source detection with the aim of excluding benign signals. Signs of benign signals are: modulation absence, tele and radio audio signals presence, different radio conversations, which are clearly not related to the examinee room.

All other signals, having signs of modulation presence, including «digital» ones, should be determined as dangerous, even if there are no any connection between room and listened sounds.

In general, using of sound control, as Bugging devices identification method currently limited. Classic bugging devices are designed with using of analog modulation methods (Frequency modulation in most cases) are listened and identified, but with «digital» modulation correlation between sound background of room and listened signal is missing.

Frequency band choosing (from 2 to 20MHz available) is done considering the minuteness of analysis. As wider the range, then faster the analysis, but noise level will be higher (respectively detection ability of small signals will be lower)

Information about ST167 ART detection abilities is shown on TABLE 7. It contains dependence from the radio transmission device emitted power, located on a specific distance from ST167 and signal level on ST167 display. This data is for 1000MHz frequency. This table data is estimates and do not pretend on formal measurements.

Distance, m	0.1mW	1 mW	10 mW	100 mW
1	-50	-40	-30	-20
5	-	-50	-45	-25
7	-	-60	-40	-30
10	-	-70	-60	-35

Frequency range selection is determined by information about DRT frequencies. Due to the features of radio waves distribution and cost, most widespread DRT are working in frequencies of 100MHz-2GHz.

Frequency range values and band affect on total analysis time: in range of 25-6000MHz and frequency tuning step of 2MHz it is about 13 sec, in 100-2000MHz – about 5 sec. With frequency tuning step of 20MHz – less than 1 sec.

7.4 SMS/GPRS DETECTION

This mode is intended, in general, for trackers (devices, designed for vehicles tracking). These devices receiving information about device location through GPS channel and sending it through GSM or GPRS channel. SMS transfer is mostly done by trackers user.

For GPRS transfer characteristically data transfer with predetermined time intervals and showing of vehicle location on a map (on a tracker manufacturers site).

Trackers detection is complicated by:

- Shortness of being in radio broadcast of SMS.

- Uncertainty of broadcast time. Depending on tracker model possible variants are from periodic data transfer with fixed time period (easiest for detection) to data transfer on demand.

- Undefined place of tracker on vehicle. It can be integrated inside of vehicle interior or be attached outside – on a bumper or underbody, connected by strong magnets.

- Usage of blockers with aim of forced tracker activation is not always effectively. Depending on GSM module, used

  General recomendations:

- Probability of transmission increasing during movement of the vehicle.

- Farther the base stations from the tracker, bigger the emission level, accordingly bigger the detection probability.
- For false alarms decreasing, all GSM source signals around the vehicle should be minimized during search process.

7.5 BLOCKER/JAMMER DETECTION

Blockers can be used for channel signals, GSM alarm systems signals, vehicle alarms suppression.

8.1 SOFTWARE «ST167Analyzer»

8.1.1 Purpose

The "ST167 Analyzer" (hereinafter referred to as the software) is intended for:

- graphical display of the result of operation the ST167 in real time;
- control ST167 from a PC;
- loading and displaying, in both graphical and textual format, the result of operation in the "EVENT PROTOCOL" mode.

8.1.2 PC requirement

Operating Systems: Windows 7 and later

Display Resolution: 1024x768 or more

8.1.3 Interface

The main program window consists of four panels:

- **The lower right panel displays real-time data.**

- **The upper right panel displays data from the archive.**

- **The top left is for creating archive files**

- **The bottom left is a virtual ST167**

The lower right panel provides an indication of the ST167 in real time in graphical form:

At the top of the window are the buttons:

● **"Maximize**" provides the extension of this panel in full screen.

● **"Clear" -** deletes the accumulated data and starts accumulation again.

● **"Save" -** when the button is pressed, the result of the ST167 operation will be written to the file. At

   clicking the existing file again will overwrite it with the addition of new information.

● **"Autoscroll" -** enables automatic scrolling to the end of the chart as new data arrives

Depending on which mode "**AUTO**" or "**MANUAL**" ST167 is in, the way the information is displayed in this panel will change.

In the "**AUTO**" mode, the active detection channels (GSM900, GSM1800, WLAN, etc.) are shown along the Y axis. The X axis is the timeline. When the product detects a signal in a channel, a colored rectangle will appear on the diagram. The position and length of the rectangle depend on the start time and duration of the event. For example, if at 18:00 a signal was recorded on a GSM900 channel lasting 15 seconds, then a rectangle opposite the inscription "GSM900" will appear on the diagram, which will start at 18:00:00 on the X scale and end at 18:00:15 .

The absolute length of the rectangle depends on the scale along the X axis.

In "**MANUAL**" mode, the diagram displays a graph of the signal level in the selected channel (blue line) together with the threshold level (red line).

When you hover over the X-axis area, the mouse pointer changes to a bidirectional arrow. If the accumulation has exceeded the width of the screen, then the minimum and maximum boundaries of the visible range can be changed. If you move the mouse cursor left or right with the left mouse button pressed near the beginning of the axis, the beginning of the range is adjusted, if near the end then the end of the range..

Right-clicking will bring up a context menu with a list of predefined visible ranges .
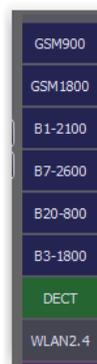
If scrolling of the chart is available, when you hover over the charting area, the pointer takes the form of a hand. If you press the left mouse button and, without releasing it, move the cursor to the right or left, the chart will scroll (a tooltip with the current coordinates of the cursor will appear near the cursor).

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When you select in the "MANUAL" mode the detection of analog signals "SCAN" in the upper right corner appears the button "SPECTRUM". When it is pressed, a window appears displaying the spectrogram of the selected frequency range.

The upper left panel is a tree of archive files. Files in the archive can be of two types:

• Files of the first type (the file name begins with "log_") are generated by clicking on the "Download" button in the upper right panel. These files contain the event log recorded earlier by ST167 in the "AUTO" mode. Each event bank is allocated in a separate file. Files are automatically named according to the template "log_dd_mm_hh_mm.ldf" (day, month, hour and minute of the first event in the bank).
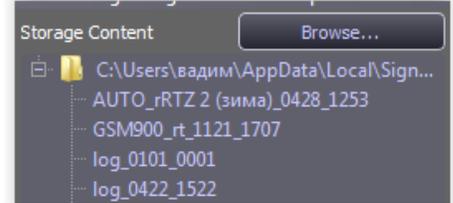
• Files of the second type (the file name contains "rt_") are generated when you click the "Save" button in the lower right pane. Files are automatically named according to the template "range_rt_dd_mm_hh_mm.rdf" (range, day, month, hour and minute of the first recording) and contain all the information received from ST167 in real time (approximately 3 measurements per second)

Using the "**New Folder**" button, you can create a folder in the current storage folder.

Using the "**Rename**" button, you can rename the selected file or folder.

Using the "**Delete**" button, you can delete the selected file or folder with all its contents.

The "**Browse ...**" button in the panel title allows you to select the folder that the program will use as an archive. By default, the archive is created in the user profile.

The upper right panel displays the contents of the file from the archive in graphical form ("Diagram" tab) or in the form of a list ("List" tab). Information is displayed on the screen when you hover over a file and press the left mouse button. The "List" view is relevant only for protocol files: files of the first type.

Displaying information and managing the "Diagram" window is similar to displaying and managing the lower right panel, with the exception of:

The "Number of events" field indicates the total number of events in the current protocol.

The List window displays the protocol of events from a file of the first type. Clicking on the column headings with the "^" icon will sort the list in ascending or descending order of the corresponding parameter.

The lower left panel is a virtual ST167. When the connection with the device is established, the ST16 7 is controlled using the mouse.

When clicked the main ST167 Menu dialog box appears.

For automatic selection of cellular standards, at the place of use of ST167, the device "**ST181 Base Station Analyzer**" is intended.
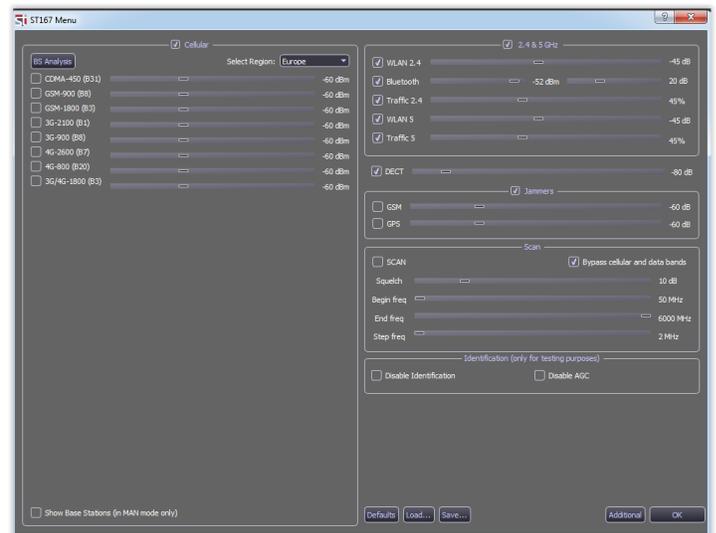
Menu settings can be saved ("Save ..." button) and loaded from a file ("Download ..." button). The menu file extension is ". mnu. "

The "**Wi-Fi networks**" button is also located here (applicable only for ST167WB). When it is pressed, the "Wi Fi network" window appears and the search for access points is automatically activated.

At the end of the search, a list of detected access points appears.
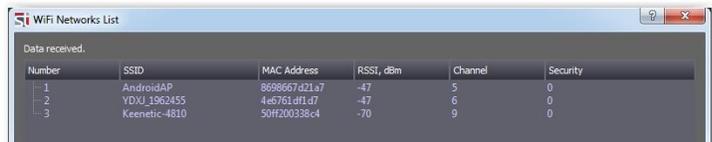
The analysis is carried out continuously until a new access point appears (highlighted in red). Then the scan stops.
Resume scanning - clicking on the "**New request**" button.

Data is saved in the "Excel" format after clicking on the button "Export data to CSV file (Excel)."

Pressing the "Additional" button opens the "Additional settings" window.
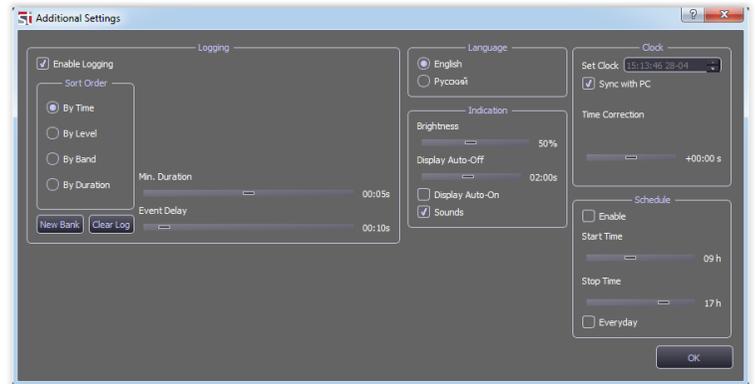
8.2 FIRMWARE UPDATE

Select the update version on the manufacturer's website http://signal-t.ru/files/ST167/proshivki/. Connect the ST167 to the computer using the USB cable. When prompted for driver installation, enable the installation.

Run the installer. Check the download process on the computer screen.

9 LIMITATIONS AND RECOMMENDATIONS

9.1 Transport and store the ST167 in standard packaging.
For long term storage, use a closed heated room with air temperatures from 10 to 35 C and humidity no more than 80%.
When transporting prevent from push or shock.

9.2 If the unit has suffered the temperatures below -5 C for more than 4 hours, switch it on only when   dry and without traces of fogging.

9.3 During operation protect the ST167 unit surfaces from concentrated moisture (rain, drizzle, snow).

9.4 Protect the display from prolonged exposure to the direct sunlight.

10 WARRANTY

10.1 The manufacturer ensures compliance of each unit to all technical requirements within 12 months from the sale date.

10.2 Within the warranty period the manufacturer shall provide free repair for the unit, its subsidiary and additional parts, up to full unit replacement, if necessary.

10.3 Gratuitous repair and adjustment or replacement are possible in case the consumer has followed the rules of use, transportation and storage, the unit and its subsidiary parts have no mechanical damage, and also thea warranty card filled in correctly.

10.4 Manufacturer provides services for post-warranty maintenance of the unit

11 ACCEPTANCE CERTIFICATE

The «ST167» unit, factory number _____, manufactured in accordance with the technical specifications, was accepted and found fit for service.

Seal

date (month/day/year)