ST 167 “BETTA”
ST167W
ST167R
ST167WR
SEARCH RECEIVER

TECHNICAL DESCRIPTION AND OPERATING MANUAL

CONTENT

1 INTRODUCTION

Present document contains information necessary for the proper use of ST167, ST167W, ST167R and ST167WR (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, 3G), wireless data transmission (WLAN 2.4 and 5GHz , BLUETOOTH, 4G 800 and 2600MHz) 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, 3G, 4G and DECT standards is possible.

- Access points(routers) indication, their name, MAC address, used channel number and signal level in WLAN 2.4GHz range (only for ST167W and ST167WR)
- 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 (only for ST167R and ST167WR)

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	25-6000
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
3.13 Gross weight	

*Only for ST167R and ST167WR

4 COMPLETE SET

The product includes the following components:

1. Main unit
2. UHF antenna
3. USB cable
4. Charger/power supply
5. USB flash drive with the software and "Technical description and operating manual"

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 25 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 is WiFI networks (only for ST167R and ST167WR).

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 WiFI networks analysis in 2.4GHz range

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 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 cardboa

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.

Fig.1

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:

- **DRT** standard**:** **45 -** CDMA450**, 9** – GSM, **3G**- 3G (UMTS), **D**-DECT,**W**- WI- FI (WLAN), **B**- BLUETOOTH, **L** - 4G (LTE).
- Data exchange intensity **T**
- Blockers detection option **J**
- Search for **ART** signals **S**

By default, all options except search analog signals **(S),** jammers detection **(J)**, 3G 900 and WLAN 5GHz are selected.

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
	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 (2100MGts), WLAN (2.4 and 5 GHz) and DECT.
	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  .

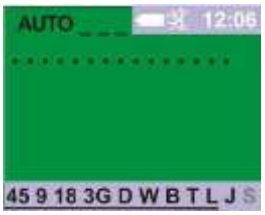


Fig.2

In the resulting window (Figure 3) 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).

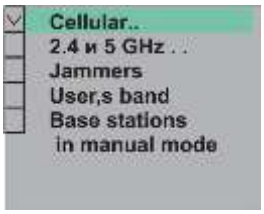


Fig.3

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. .

Fig.4

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).**

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.

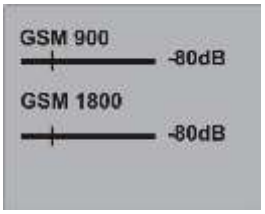


Fig. 5

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).

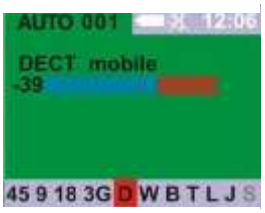


Fig. 6

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.

- 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 pressing the buttons or . Press these same buttons to select the required standard.

Note, when the symbol «**3G**» is glowing by pressing the select button you will sequentially select two frequency ranges of the chosen standard, in the range of 1920-2170MHz ("3G-2100") and the range of 900MHz ("3G-900"). Ability to work in a range of "3G-900" not selected by default. To enable it, select "Band.. .." - "Cellular ..» - «3G-900."

Also, with lighted symbols «**L**» »- press the select button will lead to the selection sequence 4G-2600 and 4G-800.

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, indicated correspondingly in the top of the screen.

When the blockers detection option symbol **«J»** is glowing. By pressing the buttons 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).

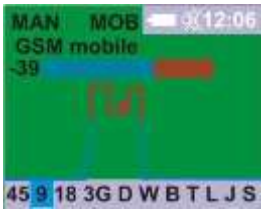


Fig. 7

Pressing the button provides a transition to a spectrogram with a frequency range corresponding to this standard (except CDMA, BLUETOOTH and blockers). For standard DECT, 3G, WLAN and 4G provided adaptation of the image of the spectrogram to the channel numbers of those standards. 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.

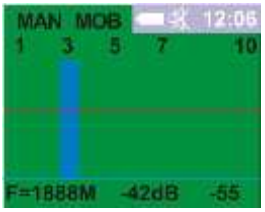


Fig.8

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).

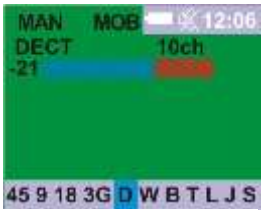


Fig.9

The choice of channels carried out by buttons and .

Return to the previous display - press. .

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).

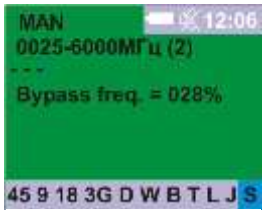


Fig.10

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 = 028%** "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.

Algorithm of work when analyzing ART signals, in general, the following: Analysis of the presence of the signal is carried in current of a maximum of five cycles and the detection of a maximum of 15 signals. After that, each of them is given a weighting factor. Factor consists of two components: the total residence time of the signal above a predetermined threshold level and the value of the excess over the threshold.

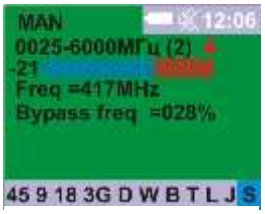


Fig.11

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

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  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 

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  and  buttons.

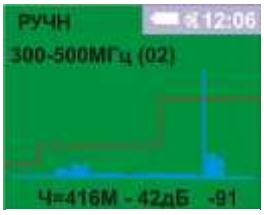


Fig.13

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

6.5 "SEARCH" OPERATION MODE

Determine the location of the radiation source or switch on the audio monitoring in the "**SEARCH**" mode by pressing the button. Thus "**MAN**" will change to "**SRCH**" (Fig. 14).

Fig.14

If the signal has already been detected in the "**MANUA**L", then going to the "**SEARCH**" mode will automatically be transferred to this mode (Figure 14).

In the case, if the signal exceeds the set threshold, its frequency is displayed, the signal is recorded, and the scanning stops, i.e. 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.

Differences from the "MANUAL" mode:

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

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.
- Indication the signal level will be displayed even if it has fallen below the threshold. This allows to search for the source of signals. .

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)).

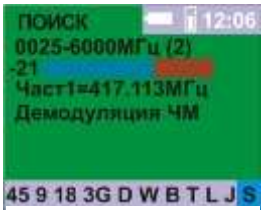


Fig.16

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

Fig.17

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. 3 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).

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.

Fig.18

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.

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.

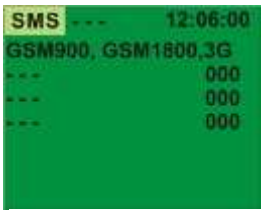


Fig.19

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.

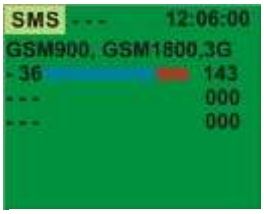


Fig.20

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

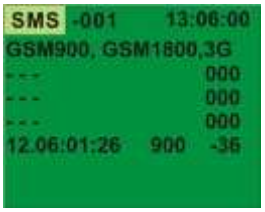


Fig. 21

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 «Wi-Fi» OPERATING MODE (only for ST167W and ST167WR)

Entering this mode is done by choosing «WiFi networks» in MENU.

Returning to the MENU is done by pressing  button.

After pressing  button sign: «Searching for Wi Fi networks» will appear for the short time. After the end of the search line «NO NETWOKS for current threshold» or list of detected networks will appear at the bottom part of the display.

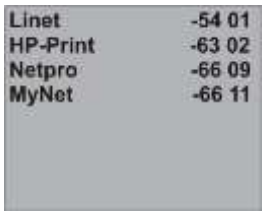


Fig.22

Network detection threshold is set in MENU: «Threshold..» ..» - «2.4GHz» - «WiFi networks ».

Example of detected networks (Wireless Access Point- WAP) list is shown on the fig.22. Here, first line is for network name (Linet), then signal level (in dBm) from this network WAP and last number is for channel number. List of networks, by default, is updating continuously with periodicity of once per 2 sec.

For WAP selecting, press  button, select with  and  etc. If number of selected networks is bigger than 8 (8 lines fit on the display) than browsing of networks, which didn't fit on the display is done by pressing  button.

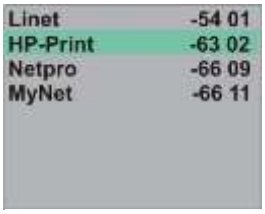


Fig.23

Three types of line color is available:

- Black – color of all detected WAP in this mode (first cycle) and if WAP signal level from the moment of last update isn't fell below the threshold, specified in MENU.
- Red – new WAP is appeared with level exceeding the specified in MENU threshold. Moment of selecting this mode is an initial reference point.

Network list update will stop when new WAP are detected and information on the screen «freezes». It is made for excepting the loss of even short time appeared WAP.

Forced update - pressing  button.

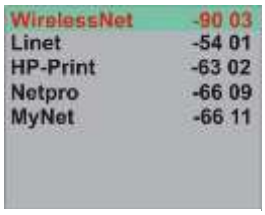


Fig.24

- Gray – Color of the WAP, which level become lower than noise level on this channel. This indication is seen for about 20 sec. During this time WAP condition analysis is done. If signal level isn't increased upper then specified in MENU – WAP will disappear, if increased- line color will change to black.

If the signal level remains below the threshold - WAP will disappear from the list, if increased - line color will change to black

Returning to the network list – repeated press of  button.

Update will stop:

- Automatically, when new WAP is detected (red color line). It provides new WAP information fixation and it further analysis.
- When pressing  button (Selection rectangular on the first line appear)

Network search renewal can be done only after pressing  button.

For selected WAP analysis press  button.

Information about selected network will appear: name, MAC address, channel number and WAP signal level.

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

After working with this screen and subsequent returning to WIFI search line color will become black – WAP is no longer new one.

After pressing button transition to signal level indication on given channel will be done. And, if on fig 25 we can see only signal level from WAP, in this case (fig. 26) signal level on given channel is indicated as a sum of signals:

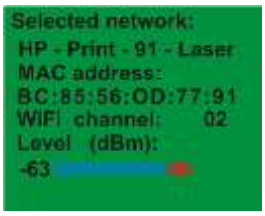


Fig.25

- WAP (on fig.25 it is -90dB)
- Signals from the devices connected to given WAP
- Signals from other radio emitting devices, which are using same WIFI frequency range.

Ability to control 2 values of signal level (fig 25 and 26) provides sample opportunities for RT search in WIFI network range (see additional recommendations).

Fig.26

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 (CDMA450, GSM900, 1800, 3G900, 2100 and LTE), as well as the level of DECT and WLAN 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"** option by pressing the button. Return to the level indication screen by sequentially pressing the "**MAN MOB**" inscription in the upper left corner will change to "**MAN BAS**" (Fig.20).

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. 11). 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.

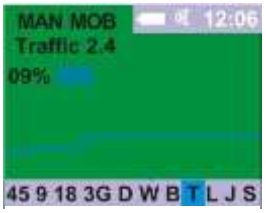


Fig.28

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.

6.12 EXTERNAL DEVICES CONTROL (only for ST167R and 167WR)

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).

Fig.29

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 ST167W/ST167WR 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/ST167WR, turn on – choosing between blocker excess radio emission and turn on periodicity. By default, shut down time – 5sec, turn on – 2 min.

6.11 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 networks" - entering WiFi Wireless Access points (2.4GHz) detection mode (only for ST167W and ST167WR)

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

"Русский" - choice of the Russian language

Fig.31

TABLE 1

Band			
Option	Description	Value	Default settings
Cellular..	CDMA 450	Выбрано/не выбрано	Selected
	GSM 900		
	GSM 1800		
	DECT		
	3G-2100		
	3G-900		Not selected
	4G-2600		Selected
	4G-800		
2.4 and 5GHz.	WLAN 2.4		
	BLUETOOTH		
	Трафик 2.4		
	WLAN 5		Not selected
	Трафик 5		Selected
Jammers			Not selected
Users band			
Base stations in manual mode			

TABLE 2

Threshold			
Option	Описание	Value	Default setting
GSM	GSM 900	От -80 до -05 dB	-65 dB
	GSM 1800		
CDMA-3G-4G	CDMA450		-75 dB
	3G	От -90 до -05 dB	-60 dB
	4G	От -80 до -05 dB	-25
DECT	DECT		-45 dB
2.4ГГц	WLAN		-45 dB
	BLUETOOTH		-55 dB
	TRAFFIC VOLUME	От 1 до 100%	45%
5ГГц	WLAN	От -80 до -05 dB	-45
	TRAFFIC VOLUME	От 1 до 100%	45%
Blockers	Blockers GSM	От-80 до -05 dB	-60
	Blockers GPS		
User's band		The excess of 5 to 30 dB relative to the mean value of the spectrum	10 dB

TABLE 3

Settings			
Option		Value	Default settings
User's band	Selection of range start/end and scanning bandwidth (increment)	Range: 25-6000MHz Increments: 2, 5, 10,15 and 20 MHz	25-6000MHz 2MHz
Identif. is OFF	Disable identification for GSM, DECT, BLUETOOTH, WLAN standards	Selected / not selected	Not selected
Bypass cellular and 2.4GHz	Exception when searching analog signals for DRT frequency ranges	Selected / not selected	Selected

TABLE 4

Event log			
Option	Value		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 the event log following one of 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. This will open an additional request: Are you sure? Press  for Yes, ANY OTHER button for Cancel." Once finished the operation, the message "The event log is deleted" appears. If not erased, in case the memory allocated for event is overflown, the unit automatically erases the oldest information bank.		
Min. duration	Set the minimum duration of the event that triggers recording.	0-10 sec with 1sec increments	05sec.
Events delay	Set the duration between similar events that will be recorded in the event log as two separate events	02sec - 2min with 1sec increments	10sec

TABLE 5

System			
Option	**Description**	**Value**	**Default settings**
Language	Language selection	English / Russian	Russian
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 button was pressed last	(From 8 seconds to 2 minutes, with 8 sec. increments) rightmost position of the label corresponds to 99min. 99sec.	99.99
	Sounds Beep confirmation for button stroke. Variable beep when a signal is detected	Selected / not selected	Selected
Time	**Schedule** Scheduling in the "**AUTOMATIC**" mode. The signals detected in each session are recorded in separate banks	Time settings in hours from 0 to 23 Once or daily	09-17h Daily
	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 (M).	Not selected
	PC syns Automatic synchronization with the clock 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.
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.

- ST 167 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

Wireless digital data transfer standards which ST167 was designed to work with are shown on table 6. Certainly, it isn't full list and depends both from geographical position and telecommunication market condition.

TABLE 6

	STANDARD	DRT FREQUENCY RANGE (MHz)	Frequency bandwidth and channels distribution(MHz)
1	**CDMA IMT-MC -450**	453-457.5 Phone (transmission) 463-467.5 Base (reception)	**1.5**
2	**GSM-900/3G**	880-915- transmission 925-960- reception	**25** (124 channels of 200kHz)
3	**GSM- 1800**	1710- 1785- transmission 1805- 1880- reception	**75** (374 of 200kHz)
4	**DECT**	1880-1900	**20 (**10 channels with 1.728MHz interval)
5	**UMTS (3G)**	**3G1** 1920-1935 (transmission) **3G2** 1935-1950 **3G3** 1950-1965 **3G4** 1975-1980 **3G1** 2110- 2125 (reception) **3G2** 2125-2140 **3G3** 2140-2155 **3G4** 2155-2170	**5**
6	**IEE802.11b,g,n**	2400-24835	**80** (13 channels of 20MHz with 5MHz step. 1, 6 и 11 – do not overlap).
7	**BLUETOOTH**	2400-2480	**80** (79 channels of 1MHz)
8	**LTE FDD**	792-822(transmission) 832-862(reception) 2500- 2570 (transmission) 2600- 2680 (reception)	From **1.4** to **20**
9	**IEE802.11a,h,g,n**	5035-5980	196 channels of 20MHz with 5MHz step. (34, 40, 44, 48, 52, 56, 60, 64 –do not overlap).

All mentioned 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.

CDMA450, GSM 900 -1800, 3G

For **listening devices, which are using cellular standards or phones emission detection**, it is expedient to left only these standards (CDMA 450, GSM 900, 1800 и 3G) and exclude others. It will speed up the detection process due to the fact, that standard control is done successively.

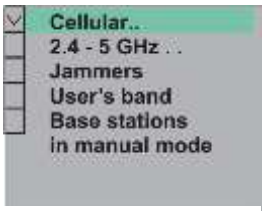


Fig.32

For that press , *select "**Range..**" and untick «2.4 и 5GHz»*

Next, go to «Cellular» line and press twice button..

In opened window untick DECT and 4G

Fig.33

*After returning to detection indication window((consistent pressing the button) on a lower line of the display will only four titles left:"**45**", "**9**", "**18**" and **3G**, others will be blacked out.*

During one transmission used standards can change for different reasons, for example, transmission starting in 900 MHz range can change to 1800MHz.

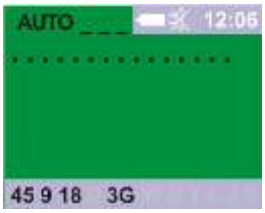


Fig.34

Modern phones are working as a transmitter:

- In moment of connection with base station.
- 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 go to channel level indication(fig. 9) and by pressing and 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.

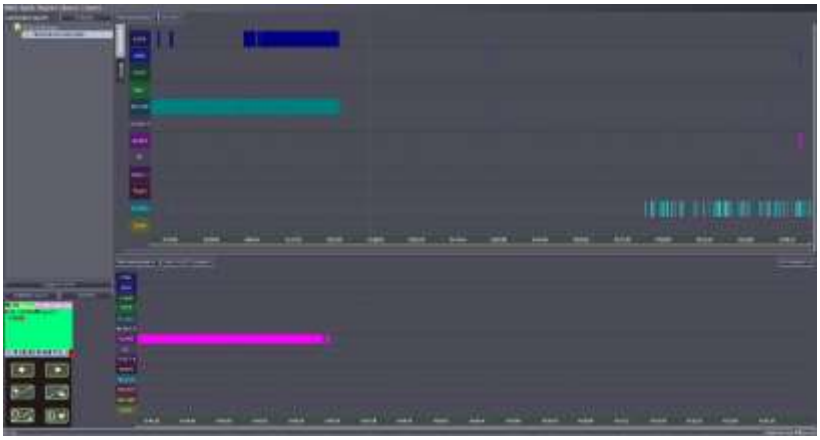
Three main types of communication organization will be considered:

- Through the router/WAP: «Smartphone – router – RD (next «RD»)*
  *RD – device connected to WIFI – PC, video camera etc
- Straight: «Smartphone – RD» - Wi Fi Direct.
- Using of smartphone as an access point with subsequent data transfer in 2,3,4G 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.36) 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.

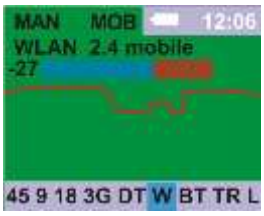


Fig.36

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.37

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.38).

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.

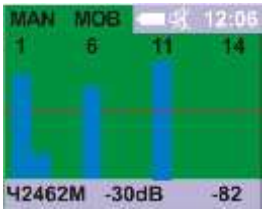


Fig.38

Also, more detailed information can be seen with using of WIFI network analysis software as inSSIDer, Acrylic etc.

fig.39

ST167 is able to work with each channel individually. It is made by pressing  , as from the total signal level indication (fig.37) as from spectrogram indication (fig.38).

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.40).

Fig.40

Subsequent channel selection is done by  .

When working with individual channel there are ability for more delicate analysis of WLAN network. Particularly, ability to determine position of RD relatively to router (receiving-transmission is done on one channel). For that it is necessary to have information about router signal level on position of ST167. This information can be found in two ways:

- When using ST167W or ST167WR, go to WIFI analysis mode for 2.4GHz range (see 6.8).

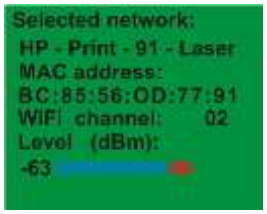


Fig.41

- When using ST167 or ST167R – Use WiFI networks analysis software like inSSIDer, Acrylic etc. (fig.39)

In a simple case (given channel is used only by one network, router is on maximum distance from ST167, one RD connected which is in a transmission mode and on a controlled territory) when router signal level is given (on figures it is -49dB) compare it with level, shown on fig.37 which is a sum of all signals on given channel (-31dB). It means, that ST167 is closer to the RD connected to this network. When approaching to the RD signal level will be higher and router signal will be lower.

So one can assume, that RD is very close and transmitting data to the router, located out of controlled territory.

In a complicated case: Given channel is used by several networks and routers of given networks are located as close as possible to the controlled zone (behind the wall, for example) and there are several RD connected to routers, firstly location of routers must be identified. For that, move ST167W/WR along the walls in "WIFI networks" mode or smartphone/tablet with WIFI networks analysis software and search for maximum signal level value.

All channels must be considered independently from ST167W/WR readout, in "WIFI networks" mode or WIFI networks analysis software. It is related with wide WIFI networks hiding abilities in analysis programs. It is also possible to other radio transmitting devices with other data transfer channels to use WIFI range.

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		

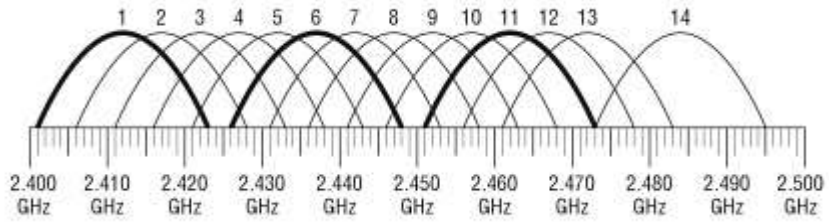


Fig.35

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

Using of this standard is possible, for example, in audio information transfer with using of BLUETOOTH headset.

Emitted power of such kind of devices varies from relatively high – up to tens of milliwatts (data transfer) and tens of milliwatts (mobile phone wireless headset). Additional difficulty in detection of such kind of devices is pseudorandom frequency restricting(PFR) with 1MHz band in all ISM 2.4GHz-80MHz range (79 channels)

When selecting "**B**" ST167 is identifying fact of connection attempt with BLUETOOTH device, leading and driven one. Connection establishment indication is done up to the moment of data (sound) transfer start.

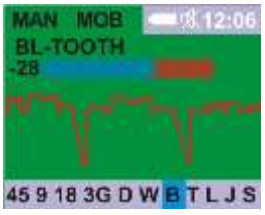


Fig.42

Data transfer indication is done by selecting "**W**".

In this case there are also emitting both from transmitting and receiving devices.

It must be noted, that when selecting "**W**" there are no time parameters indication of present in given band signal. There is this type of indication in "**B**".

Fig.43

LTE FDD (4G)

Signals have noise-like structure. It is used for audio and video data transmission. Simultaneous using of 3G and 4G standards is also possible.

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 OPERATION WITH A COMPUTER

First, install the software from the supplied Flash memory or from the manufacturer's website. Connect the main unit to the computer via USB cable. Run «Analyzer Network setup-X_X_X.exe». X_X_X is the version number. Select "ST167 Analyzer" in the "Components for installation" section. Once installed the program you will be offered to install drivers. Allow the installation.

8.1 «ST167 Analyzer» APPLICATION

This application is designed for:

- Display the results of ST167 operation in graphical form in real time;
- Complete control of ST167 from PC;
- Enhanced presets for the "MONITORING" mode;
- Load and display in both graphical and text format the results of ST167 operation in the "MONITORING" mode (event log).

8.2 SOFTWARE UPGRADE VIA INTERNET

At the manufacturer's website select the required update version (http://signal-t.ru/eng/files/st167/proshivki/).

Hold  to switch the unit on. «ST167-> PC» should appear in the screen.

Connect the ST 167 to a PC via USB cable.

Run the installer. Check the boot process on the PC 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)