СИГНАЛ–Т

ST 171
JAMMER DETECTOR

TECHNICAL DESCRIPTION AND
OPERATING MANUAL

CONTENT

1 INTRODUCTION

Present document contains information necessary for the proper use of ST171. Carefully read it before using ST171 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

ST171 is designed for detection of:

- Cellular jammers (blockers)
- GPS/GLONASS receiver jammers (blockers)
- Ultrasonic and electromagnetic jammers of sound recording devices, dictaphones etc.

Additional features:

- Detection logging
- Environment snapshot at detection moment
- Location fixation at detection moment
- Base stations signals spectrogram indication in 900 and 1800MHz, sonic and ultrasonic ranges.

3 COMPLETE SET

The product includes the following components:

1 Receiving module ST171R
2 Charger
3 «USB micro – USB» cable
4 Warranty
5 USB flash drive

4 DESIGN AND OPERATION

4.1 Detection channels

ST171 have two detection channels:

Radio
Audio

Radio channel is intended for detection of:

- Cellular jammers (blockers)
- GPS\GLONASS receiver jammers
- Recording interference creation devices with using of high frequency radio emitters (electromagnetic Dictaphone jammers)

Receiving part and primary signal processing of radio frequency channel is realized in receiving module ST171R (hereinafter – RM).

Audio channel is intended for detection of recording interference creation devices with using of ultrasonic and acoustic emitters (ultrasonic and acoustic Dictaphone jammers)

This channel is realized with using of circuitry of android device itself.

4.2 Control and indication

Control and indication of work results is done by using of Android device – smartphone or tablet. Data transfer between smartphone and RM is done using BLUETOOTH connection. Alarm signal – vibrating and display indication.

Special knowledge for device operation is not required. It is enough to select needed working mode and and further installation will be done automatically.

For advanced users additional settings are provided.

4.3 Operation modes

ST171 have three operation modes: «**Office**» «**Car**» and «**Manual**».

First two modes are automatic and don't require any special knowledge. «**Manual**» mode is intended for advanced users and allows "fine" tuning of the device.

4.4. Field of use

Field of use depending on operation mode:

4.4.1 «Office»

- Visit to the premises, where, imperceptibly for others, it is necessary to control presence of cellular jammers or Dictaphone blockers.

4.4.2. «Car»

- Stationary control of cars for cellular blockers or GPS receivers presence on entry/exit of the parking area. In this case RM is installed in security booth or any other place nearby the barrier.

- Stationary control for cellular blockers or GPS receivers in cars moving along a highway, street etc.

- Search of cellular blockers or GPS receivers, installed in stationary car, for example in stolen one. Car can be as inside the garage, as on open area.

Features of wok in these modes will be described in «Working with ST171» section

4.5 Receiving module ST171R

ST171R (RM) consists of radio receiver, which can receive signals in cellular base stations, GPS receivers, Dictaphone blockers, control module and BLUETOOTH module blockers ranges.

Case is made from shockproof polycarbonate.
On side surface located:

- **Turn-on button,** intended for turn-on/turn off of the RM
- **microUSB connector**, intended for battery charging and RM software update.
- **Battery indicator** («CHARGE»). See «Battery charging»
- **Status indicator** («STATUS»)

Waiting for Bluetooth connection	Flashing one time per second
Connection established	Indicator is on permanently, disappearance of indication one time per second

Optionally provided with a clip for fastening on clothes or a tripod.

Turning-on of the RM is done by long press on turn-on button for around 5 seconds. When releasing «STATUS» indicator should flash one time per second. If indication is absent, battery should be charged.

Turning-off of the RM is done:

- By pressing После нажатии «CLOSE AND EXIT» button in application, installed on android device. «STATUS» indicator should disappear what means turning-off of the RM
- After exit from the application without pressing «CLOSE AND EXIT» button or turning-off of the smartphone, RM with turn off automatically after 1-2 minutes

4.5.1 Powering of the RM

Powering of ST171 is done from built-in Li-ion battery.
Battery charge level is displayed as sign in «**RADIO CHANNEL**» window: «Batt XX%».
100% corresponds to full charged battery.
When discharging to 10% this value will blink.
Working time with full charged battery is more than 2 hours

4.5.1.1 Battery charging

Connect charging device to micro USB connector of RM and charging adapter to the 220V mains.

Charging process corresponds with permanent flashing of CHARGE» indicator. When charging is done indicator will turn off.

Time of full charge with turned off RM is around 2 hours.

4.5.2 Software update

Using Windows PC, select on manufacturers site: www.signal-t.ru needed software version. Connect RM to PC with USB cable. Run installation program.
Control download process on PCs display.

4.5.3 LABELS AND SEALING

Labels and sealing look like 2 round plates located on back side of the device. It presents the unit name, serial number and the manufacturer's logo, applied by the intaglio method.

4.5.4 SPECIFICATIONS

Frequency range, MHz	901-907, 925-975, 1570-1580, 1795-1820
Dynamic range, dB	65
Interface	Bluetooth, USB
Internal power source	Li-ion battery 3.6V
Current consumption, mA, no more than	450
Degree of protection	IP54
Temperature range, C	-30/+30
Dimensions, mm	83X52x15
Weight, kg	0.06

4.6 Detection range

Detection range of low power portable cellular networks blockers on open space is about 10 meters, ultrasonic Dictaphone blockers – about 5 meters. For achieving maximum distance when holding RM in your hand don't close receiving antenna with your fingers. Antenna looks like rectangular conductive located on bottom side of the device. Also it is must be considered that antenna have maximum gain in direction perpendicular to the front plane of device.

4.7 Packaging

The unit components are transported and stored in a rectangular box 110X65X40 made of corrugated cardboard. There located: Name of the device an QR-code with short information about functionality and manufacturer of the device. Gross weight is 0.15kg.

5 Software

5.1 Software installation

Install application ST171 on android device from «Play.google.com» or «Play Market» application.

5.2 Description

Application consists from 5 sections:

- 2 main: **«GENERAL OPTIONS», «DETECTION».** Using of this assumes automatic and intuitive device setup with no need in special knowledge in signal analysis.
- 3 subsidiaries, intended for advanced users: radio frequency setup (**«RF Options»), ultrasonic settings («US Options») и «SPECTRUM».**

Manual selection of sections is done from list, which can be found by pressing on appropriate icons on top left and top right corners.

5.3 Section «GENERAL SETTINGS»

Working mode selection: «**OFFICE**», «**CAR**» or «**MANUAL**».

«STATUS» LED – when ticked-off indicator «STATUS» located on RM is not active. *Initially activated*.

«**Vibration**» - when ticked-off vibration is not active. *Initially activated*.

«**Keep awake in the foreground mode**» - when selecting this option with opened application display will not turn off. *Iinitially activated.*

«Alarm delay» - Delay is made for prevention of false alarms when moving the device. Delay period is about 3 seconds. Disabling delay is convenient for testing. *Initially disabled.*

*«***Take a photo when alarm***»* - when ticked-on during alarm a photo will be taken on smartphone camera. It can be useful in «CAR» mode in case of entering/exiting of cars on parking or during the blockers control of cars moving along the highway. Smartphone camera should be directed toward moving cars. Photos can be seen in Log of events. Initially disabled*.*

«*Get a location when alarm*» - when ticked-on location of the smartphone will be defined. Location data will be stored in Log of events with latitude, longitude and actual address.

«**Background mode and Notification**» When selecting this option application will work in background mode and with turned-off display. Depending on smartphone model this option can be unavailable.
When selecting this option notification icon(«ST») will appear in statusbar of the smartphone. When signal detected «Bell» notification will appear.

«Background Update Rate» - Background update rate of the RM is set. *Initially set for 2 seconds.*

«**Default**» - returns device to default settings.

5.6.4 «DETECTION» section

«**Office**» mode

Initially, this section appears after first application launch.

In this section 2 detection channels are used and displayed: «**RADIO CHANNEL**» и «**ULTRASOUND CHANNEL**».

In «**RADIO CHANNEL**» window RM work result is displayed.

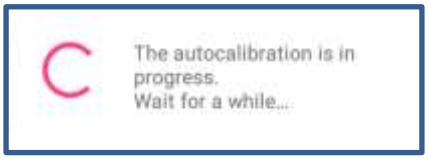
- «**GSM**» - Number of signals in GSM base stations range what corresponds to blockers frequency range.

These scales have 3 color gradients:

- Green – number and level of signals is minimal, device is ready for operation.

- Yellow – signals level is relatively high. In this case it is necessary to calibrate device corresponding with present electromagnetic situation. It can be done by pressing «**calibration**» button.

Message will appear:



After calibration again control signals level scales and if it is green, device is ready for operation.

When detecting signals from any sources in selected mode vibration will turn-on and blinking «ALARM» message will appear and signal level scale will become red.

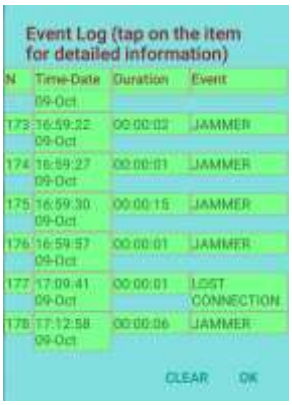
It must be noted, that for Dictaphone blocking high frequency radio emitters are also used. In ST171 is provided with function of detecting this kind of devices. This option can be activated in manual settings (see «RF Options») But, this frequency range and accordingly detection range of ST171 can be used by other radio transmitting devices (cellular phones, for example) what leads to false alarms.

In «**ULTRASONIC CHANNEL**» window sonic and ultrasonic «**REC**» range, which is used by Dictaphone blockers, signals level is indicated.

By pressing «**STOP and EXIT**» button application closure and torn-off of the RM is done.

By pressing «**LOG**» button transition to log of events is done.

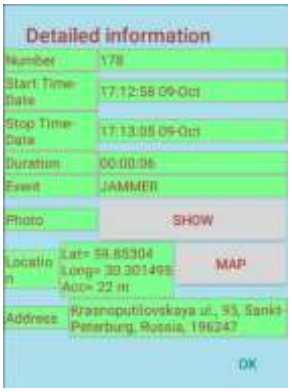
In case of absence of detected alarms «**LOG**» button is indicated halftone. In case of presence of detected alarms it is highlighted by red color and after pressing on this button transition to Log of events screen is done.



For detailed information about alarm press needed line.

When selecting in general settings *«**take a photo when alarm**»* in line sign «show» will appear. By pressing this sign photo will be shown on display.

When selecting in general settings **«get a location when alarm»** latitude, longitude and actual address will appear on display. By pressing «Map» sign location will be displayed on map.



«**CAR**» mode

By selecting «**CAR**» mode, differently from «**OFFICE**» mode, only one window displayed - «**RADIO CHANNEL**» which indicates:

- «**GSM**» - Number of signals in GSM base stations frequency range
- «**GPS**» - Signal level scale in range of GPS/GLONASS etc.

5.2.2.2 «RF Options» mode

In this section manual settings of radio frequency channels are done and intended for advanced users.

Whenever settings are changed when returning to «DETECTION» section mode name will change to «MANUAL» independently form previous mode – «OFFICE» or «CAR».

Sensitivity

By default maximum sensitivity is set, what is justified in most cases. Sensitivity decrease is necessary in two cases:

- Overload of RM («**Overload**» sign)
- inability of calibration – after calibration scale level is still high and sign «**Clogging**» is shown in top right corner.

Overload means presence of signal with level which is higher than dynamic range of RM.

Clogging – signals, exceeding threshold, fills 95% of frequency range

Frequency values list appears by pressing on «maximum» sign. Selecting of optimal sensitivity is done consistently: selecting «Above average» - calibration – signal scale and sign: «Overload» control. If high levels and/or «Overload» sign stays, go to next sensitivity decrease - «Below average» and repeat operation.

It must be noted, that decreasing sensitivity you decreasing detection range. For orientation, difference in detection range from between maximum and minimum sensitivity is about 2 times.

Fast scanning this option is intended for «CAR» mode in case of moving cars control. It allows to control cars on speed up to 100km/h (without this option it is up to 60km/h). When using this option analysis time decreases and accordingly increases number of false alarms. Because of that it is more efficient to use it on country roads with less number of base stations and immobility of RM.

Range selection

Primary information

Cellular network blocking is based on interference in receiving path of phone, what corresponds to base station frequency range. For reliable suppression blocker signals level must exceed base stations level on certain value and overlap all frequency ranges.

Base ranges for blockers are 9i00 and 1800MHz

Due to non-ideality of blockers characteristics as incomplete overlapping as conversely – out of range of blocking signal from base stations frequency range is possible

Presence of emitting beyond base station frequency range is used as additional factor for blocking detection. Deactivated as default. For activating this emitting detection «sub-GSM 900» and «sub-GSM 1800» settings must be ticked-on. But, in one of these ranges presence of other signals which don't belong to base stations is possible. In this case using of this feature is impractical.

In some cases, limitation of used ranges is possible.

For example, in «CAR» mode, in case of blockers presence control in cars on country roads. Usually, far from the city number of base station is minimal and as usual it is 900MHz range. *Presence of signals is displayed in sub item «SPECTRUM».* In this case, for achieving maximum sensitivity, only 1800MHz range is selected. Others are turned off.

When using «Office» mode by ticking on «REC900» setting detection of radio frequency Dictaphone blockers can be done if there are no any legal extraneous signals.

It must be noted, that depending from selected detection channels different alarm indication rules are used:

- Alarm indication will happen when new signal appears in any of ranges if it is the only one selected.
- In «GSM» range, with 2 subranges selected («GSM 900» and «GSM1800»), alarm indication will happen when signal will reach alarm level on both subranges at one time.

- In «GSM» range, with 2 subranges selected («GSM 900» and «subGSM900»), alarm indication will happen when signal will reach alarm level on any of these subranges
- All subranges «GSM», «GPS» and «REC900» are independent from each other.

5.2.2.2 «US SETTINGS» section

Primary information

Feature of modern Dictaphone blockers is emitting of:

- *Acoustic signal in 2 frequency ranges: ultrasonic, inaudible by human ear (usually it is signals with 24kHz frequency) and sonic – in upper part of audible range (usually it is signal with frequency of 18kHz)*
- *Radio frequency signal with 900MHz frequency range*

These signals ca radiate as simultaneously, well as separately. Usually they are modulated by chaotic interference, consisting from, for example, random fragments of human speech.

In this section setup of acoustic signal detection is done.

Sensitivity – determines sensitivity of audio path of smartphone. Selecting of this depends on needed detection range and presence of «legal» signals in selected frequency range.

Upper frequency bound determined by «**Quantization**» option. Maximum value depends from smartphone model. For getting the frequency value selected number must be divided by 2.

Lower frequency bound is selected in «**Lower frequency**» option.

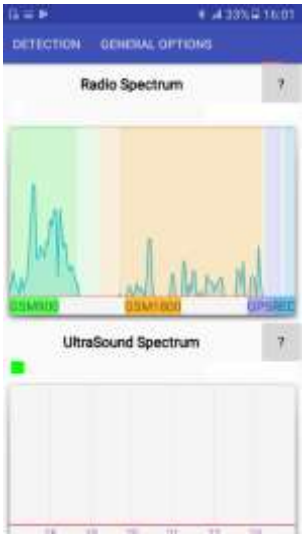
17-24kHz frequency range is set by default.

«**FFT size**» - This option determines spectral resolution of displayed spectrogram.

5.2.2.2 «SPECTRUM» section

In this section spectrograms of radio signals are shown in frequency range of:

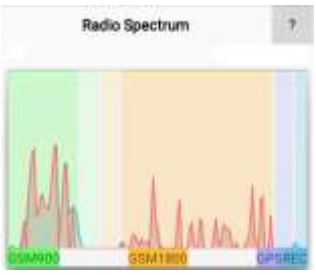
- Cellular base stations and accordingly blockers
- GPS/GLONASS receivers
- Electromagnetic Dictaphone blockers.



These spectrograms are located in upper part of section called «**Radio Spectrum**». Given picture is typical for city, where from left to right:

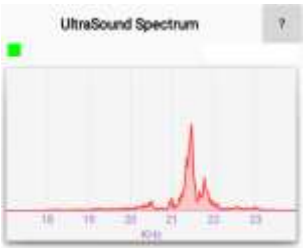
- Allotted by dark-green color «GSM900» - cellular base stations frequencies of 900MHz range.
- Light-green line(sub-GSM900) – frequency range, adjoining to the upper frequency value of cellular base stations of 900MHz range.
- Light-brown line(sub-GSM1800) – frequency range, adjoining to the lower value of cellular base stations of 1899MHz
- Allotted with brown background - «GSM1800» - cellular base stations frequencies of 1800MHz
- «GPS» – GPS/GLONASS receivers frequencies
- «REC» - Radio frequency Dictaphone blockers frequencies.

Especially informative signals indication after calibration. In this case on display spectral regions excluded from analysis are indicated by red color. Exclusion flag is big signal level.



In lover part of section («**Ultrasonic spectrum**») sonic range frequencies are shown.

On picture signal of ultrasonic Dictaphone blocker is shown.



6 WORKING WITH ST171

6.1 First turn-on

Turn on the RM by pressing turn-on button for about 5 seconds. When button released «STATUS» indicator should blink about 1 time per second. If it doesn't happen, battery should be charged.

Allow Bluetooth connection on your smartphone («settings» - «Connections» - «Bluetooth» - «turned-on»).

Connect RM to your smartphone by selecting in «Bluetooth» section «ST171» line. Confirm access key by pressing «OK» sign.

Run «ST171» application by pressing  **icon.**

Information window «DETECTION» will appear on display in «Office» mode with blinking «SEARCHING» sign.

«STATUS» indicator on RM is blinking one time per second

Establishing connection will be done in few seconds. «STATUS» indicator will change its indication to reverse one: permanent flashing is interrupted 1 time per second and «SEARCH» sign disappears. Also, in upper left corner of «RF blocker detection» section blinking green square will appear (similarly to «US blocker detection » section).

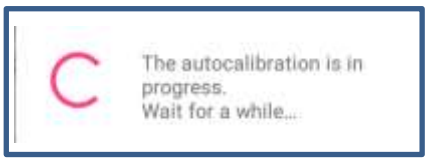
Unlikely, but possible can be situation of appeared «Overload» sign in upper right corner of the window. It means that RM is located in signals receiving field with very high level, exceeding dynamic range of the RM. It can happen, for example, in immediate affinity (few meters) for base station antenna. In this case, device is inoperative

If signals scales are green, then **device is ready for operation.**

In case if level scales are of yellow or red color make calibration.

For doing it press «Calibration» button.

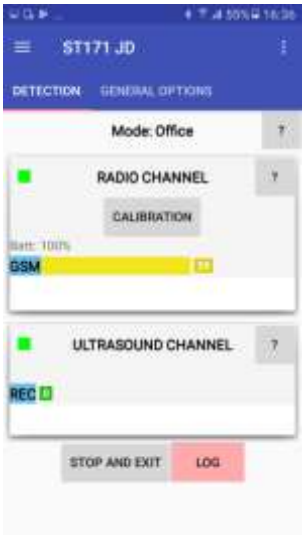
Message will appear:



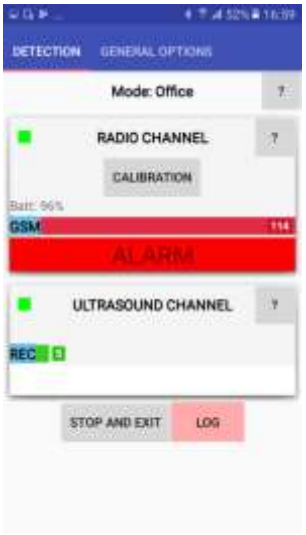
When calibration is done again control signals level scales and if it is green, device is ready for operation.

If after calibration signals level is still big and/or their amount overlapping all range (**Clogging**) there are 2 possible ways:
Reducing of sensitivity (see **«RF Options» mode**) and repeated calibration.

- Turn-off of ranges with high signal level and work with left ones. For example, in situation shown on a picture GSM1800 range is turning off.



When signal is detected from any source in selected mode vibration will turn-on and sign «ALARM» will appear on display and signal level scale will become red..



To end the work with the device press «STOP AND EXIT» button. RM will turn off automatically.

6.2 Features of use of the device

6.2.1 «Office» mode

Unlike from «CAR» mode in this mode ultrasonic Dictaphone blockers detection channel is activating and detection of GPS jammers is deactivated. *Radio frequency detection channel of Dictaphone blockers detection can be turned on in «RF settings» section.*

When using this mode before entering room it is necessary to control GSM signals level and, if necessary, calibrate. Distance on which this operation should be done should at least 5 meters and maximum distance depends from actual conditions – on building entry, floor etc.

Because of signals significant weakening calibration cannot be done in lifts and in actual room.

When carrying RM on clothes try to locate it on upper part – for example in breast pocket. Sensitivity decrease in this case can be up to 3 times.

6.2.2. «CAR» mode

Unlike «OFFICE» mode in this mode jammers detection channel is activated and ultrasonic Dictaphone blockers channel is deactivated.

Shielding properties of Car body can reduce blocker detection distance up to 5 times.

Brick garage reducing signal up to 5 times, metal one- up to 10 times.

In this way, the most difficult case will be detection of jammer located inside the car in metal garage.

It means, that for low power blockers, detection range of which is 10 meters on open space (see «Detection range»), reduces formally to 1 meter. In real life it means, that RM during search process should be located, if possible, as close as possible to the garage surface.

For achieving maximum detection distance in case of blockers detection in moving cars RM is better to place on tripod or on any elevation along the highway. It provides maximum time of car locating in detection zone of the RM.

When turning «**RF settings**» option called «Fast scanning» maximum car speed is increased up to 100km/h (if disabled – 50km/h)

Built-in RM receiving antenna have maximum sensitivity in direction perpendicular to the largest surfaces of RM.

7 LIMITATIONS AND RECOMMENDATIONS

Transport and store the ST171 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.

8 WARRANTY

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

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

8.3 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.

9 ACCEPTANCE CERTIFICATE

The «ST171» unit, factory number _____, manufactured in accordance with the technical specifications, was accepted and found fit for service.

_____

date (month/day/year)