

**ULTRAHIGH FREQUENCY DETECTOR OF  
SEMICONDUCTOR COMPONENTS  
(NON LINEAR JUNCTION DETECTOR)**

**«LORNET-36»**

**USER MANUAL**



# USER MANUAL

## 1. Introduction

A handheld detector of semiconductor components «LORNET-36» (further the detector) is used for search and detection of electronic devices both in active and switch-off state.

Operating of the detector is based on the property of semiconductor components re-emit the 2<sup>nd</sup> and the 3<sup>rd</sup> harmonics when radiating them by a probing UHF signal. It is assumed that maximum response time of semiconductor components of artificial origin is at the 2<sup>nd</sup> harmonic of the probing signal. When radiating oxide films of natural origin maximum response time is at the 3<sup>rd</sup> harmonic of the probing signal.

«LORNET-36» detector enables to make analysis of the response time of the objects radiated both by the 2<sup>nd</sup> and the 3<sup>rd</sup> harmonics of the probing signals giving the possibility to identify electronic devices and natural oxide semiconductors reliably.

«LORNET-36» finds the best receiving frequency channel free from noise automatically enabling to operate the device in complicated electromagnet conditions. Digital processing of a demodulated signal used enables to get maximum sensitivity.

Using of parabolic antenna having great amplification coefficient (20dB at a frequency 3600MGz) allowed to increase detecting distance of the nonlinear components and provide their exact localization in area. For more handiness the detector is equipped with laser illuminating the spot the antenna is directed on.

There are two types of the signals emitted:

1 Pulse modulation of carrier frequency with on-off time ratio of 160 (Pulse);

2 Pulse modulation of carrier frequency with on-off time ratio of 20 (CW).

CW mode is intended for listening of the detected signal by earphones in order to expose functioning analog radio-microphone and to use effect of acoustic feedback for easy search.

Mode of automatic control of output power simplifies actions of an operator.

«LORNET-36» can display signal levels of the 2<sup>nd</sup> and the 3<sup>rd</sup> harmonics at LED panel simultaneously. Besides, level of the 2<sup>nd</sup> or the 3<sup>rd</sup> harmonics can be estimated in turn aurally by click repetition rate, reproducing via a built-in loudspeaker or wireless earphones.

## 2. Technical Parameters

2.1. Types of the signal emitted:

3 Pulse modulation of carrier frequency with on-off time ratio of 160 (Pulse);

4 Pulse modulation of carrier frequency with on-off time ratio of 20 (CW).

2.2. Carrier frequency is fixed with pitch of 13 MHz within 3581,5 ... 3607,5 MHz. Frequency selection is automatic. Possibility of emitting at carrier frequency with minimum noise in a path of the receiver of the 2<sup>nd</sup> harmonic is provided.

2.3. Maximum emitting power with on-off time ratio of 160 (Pulse) no less than 18 W.

2.4. Maximum emitting power with on-off time ratio of 20 (CW) no less than 12 W.

2.5. Emitting power is controlled automatically or manually. Dynamic control range is 22 dB from maximum value of output power, and is separated into 11 levels.

2.6. The amplification coefficient of transmission antenna on frequency 3600 MHz no less than 20 dB, the width of diagram direction on level minus 3 dB does not exceed 16 degrees.

2.7. Sensitivity of receivers no less than minus 110 dBm (first LED illuminating).

2.8. Tuning frequency of receivers is equal to double and triple frequencies of receivers and amount 72163 ... 7215 MHz and 10744,5 ... 10822,5 MHz.

2.9. Dynamic range of the receiving path is less than 40 dB.

**2.10.** Time of continuous operating with built-in lithium-Ion battery at maximum emitting power is not less than:

- 3 hours for pulse mode (Pulse),
- and 2 hours for CW mode (CW).

**2.11.** Weight of the device equipped does not exceed 1,6 kg.

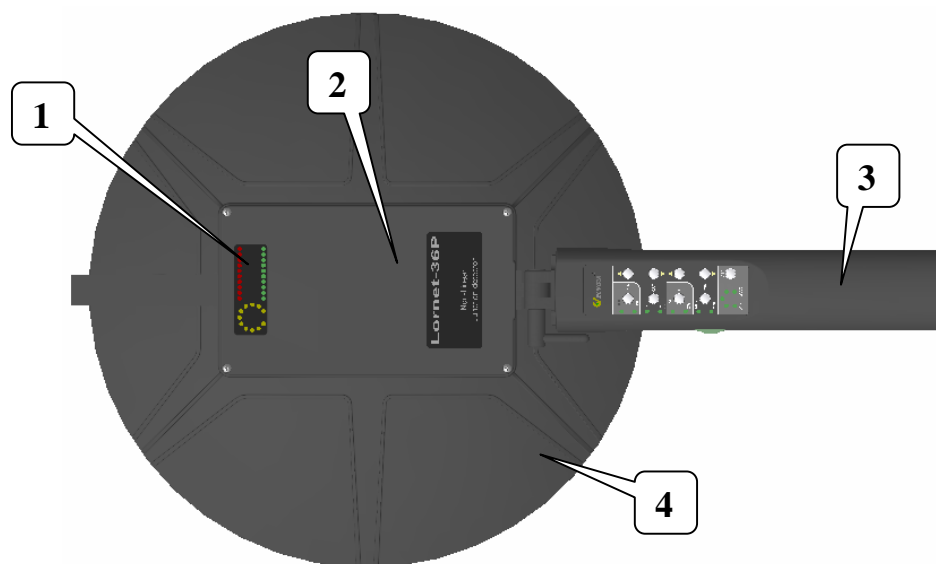
**2.12.** Operation condition:

- ambient temperature  $5 \square 40$  °C.
- pressure is not less than 450 mm of mercury.

### 3. Structure Of The Device, Design And Accessories

**3.1.** The device consists of the units and accessories listed in the Table:

Name	Q-ty
1. A receiving-transmitting antenna unit combined with a control panel and built-in lithium-Ion battery.	1
2. A charger for batteries.	1
3. A mains adapter for charger.	
4. Wireless telephones, radio receiving device and headphones.	1
5. User's manual and passport.	1
6. Package	1



Appearance of the device is shown in Fig. 1, where:

- 1 – LED indicator;
- 2 – A receiving-transmitting antenna unit combined with an indicator;
- 3 – Control panel with a built-in battery;
- 4 – A parabolic antenna.

Wireless earphones, chargers and additional batteries are not shown in the figure.

#### 4. Purpose Of Basic Units Of The Detector

4.1. A receiving-transmitting antenna unit with built-in LED indicators is used for:

1 Analysis of interfering load of receiving path of the device, which is made at each turn-on of the detector transmitter, also automatic selection of optimal channel of detector work. Therefore, during operating when an interfering signal appears (under complicated electromagnet conditions) it is necessary to turn the detector transmitter off and then to turn it on from time to time, hence selecting optimum frequency automatically, enabling the best sensitivity and detection range of semiconductor components.

2 Formation of UHF signal, receipt and digital processing of the 2<sup>nd</sup> and the 3<sup>rd</sup> harmonics of radiation frequency. Simultaneous display of signal levels of the 2<sup>nd</sup> and the 3<sup>rd</sup> harmonics enables to differ signals of artificial semiconductors, which are a part of electronic devices, from natural corrosive ones, appearing at oxidation of connecting points of various metals, for sure.

3 Demodulation of response time of the 2<sup>nd</sup> and 3<sup>rd</sup> harmonics, their amplifying to the level required for tapping both to earphones and inner dynamic. The possibility to control amplification at 20 dB is provided. Tapping of demodulated signals of the 2<sup>nd</sup> and 3<sup>rd</sup> harmonics is made by an operator in turn.

4 Display of levels of a detector power (1), signals of the 2<sup>nd</sup> (2) and 3<sup>rd</sup> (3) harmonics (Fig. 2).

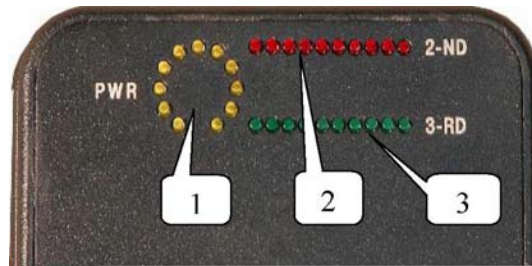


Fig. 2

4.2. Hinge joint of the receiving-transmitting antenna unit with a knob is designed for transformation the unit into transportation position. (see Fig.3). Besides, it helps an operator to fix antenna position convenient for search.



Fig. 3

Fig. 3:

- 1- A knob of a hinge;
- 2- Hinge joint;

**4.3.** A control panel is used to control operating of the detector. It consists of a case combined with a battery and fixed on the telescopic arm. A control board, buttons for operating modes control and display LEDs are in the case. Control buttons are divided into two groups by functional feature: «AUDIO» placed in the upper half of the panel and «POWER RF», in the lower part. Control panel is shown in Fig.4.

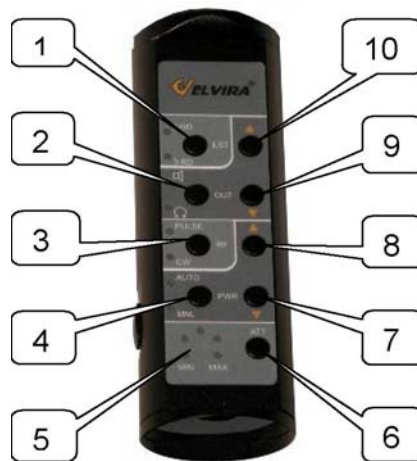


Fig. 4

1 – Indicators and **LSTN** button for switching of acoustic display to output on the 2<sup>nd</sup> or 3<sup>rd</sup> harmonics.

2 – **OUT** button and indicators for switching acoustic output to earphones or a built-in loudspeaker.

3 – **RF** button and indicators for switching emission types of a probing signal (CW – continuous, PULSE – pulse).

4 – The following buttons are referred to «POWER RF» group: indicators and **PWR** button for turn on/off a transmitter of the probing signal. When it is turned on an automatic mode of output power control (AUTO) is set by default. To switch over to a manual mode of output power control (MNL) press one of **LEVEL** buttons when a transmitter is turned on. To return to an automatic mode turn a transmitter off and then turn it on.

5,6 – Indicator and **ATT** button for control of frequency receivers of the 2<sup>nd</sup> and 3<sup>rd</sup> harmonics. Luminescence of each LED indicates reduction of receivers' frequency at 4 dB. Hence, maximum frequency reduction by an ATT button can arrange 20 dB.

7,8 – **LEVEL** buttons for control of emitted signal power in MNL mode. It is possible to set required power level by pressing **LEVEL** button in AUTO mode before a probing signal transmitter is turned on.

9,10 – **Volume** buttons for volume control.

An indicator functions of control panel. Continuous light of the indicator corresponds to «ON» position, absence of light – «OFF» position. Simultaneous flickering of all indicators on the panel shows that a battery is discharged, it needs to be replaced.

**4.4.** On the **side** surface of the control panel (see 1 in Fig. 5) a slide-type power switch is placed. A slide position corresponding to «ON» is marked by a contrast point.

**4.5.** Batteries charging is made by a mains adaptor and mains charger for batteries included into delivery set. Use of other charging devices is not permitted. It is necessary to put the pin cutoff point into detector handle butt-end.

**4.6.** When switching charger into plug socket, the red light illuminates on case of charger, while charging. After full battery charging red light is turning off and green light illuminates. Charging time of completely discharged operative accumulator does not exceed 5 hours.

**4.7.** Wireless telephones consist of a receiving device and earphones. Appearance of a receiving device and position of control units are shown in Fig.5

Operating order of a receiving device.

1 Using a mains adaptor included into delivery set, make full charging of a built-in battery by charge indicator.

Use of another mains adaptors are forbidden.

2 Connect head phones through a corresponding socket of a receiving device.

3 Turn a receiving device ON by a slide-type switch (control by a turn-ON indicator).

4 Using volume control set comfortable volume level.

5 If a receiving device is turned on when the detector “Lornet-36” is off, then there is only a noise signal in the head phones at higher volume. After turning on acoustic indicator signals corresponding to operating mode of the detector appear in the earphones.

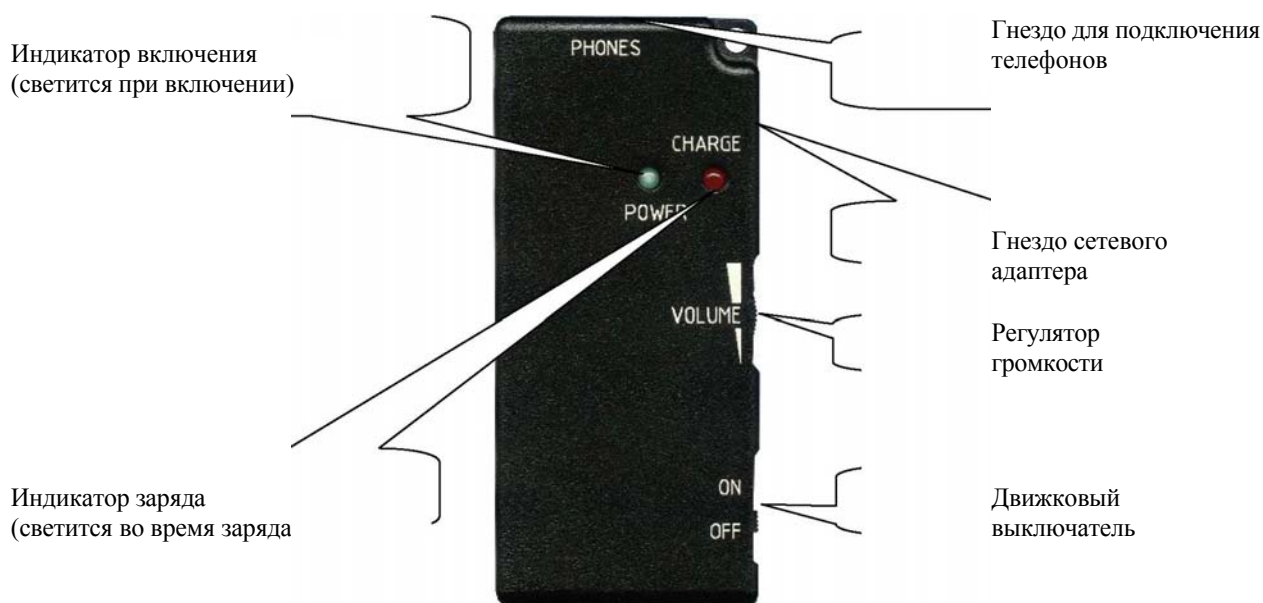


Fig. 5

## 5. Safety Measures

**5.1.** By requirements of electric safety the detector is referred to protection class 1.

**5.2.** Persons having taken instructing for safety measures while operating electric devices and measuring devices with open radiators of RF-energy are permitted to work.

**5.3.** Density level of power flow UHF radiation of “Lornet-36” is shown in Table:

Measurement	Mode	Distance <sub>avg.</sub> $\mu\text{W}/\text{cm}^2$	Distance <sub>max</sub> $\mu\text{W}/\text{cm}^2$
Maximum radiation direction	Pulse	3,6	9,36
	CW	44,1	77,8
Backward semisphere; 0,3m	Pulse	0,19	1,7
	CW	1,88	7,7

Note: data received using electromagnetic radiation indicator P3-31.

**5.4.** Direction of the antenna at people nearby on being under radiation is not recommended.

## 6. Operating Order

**6.1.** Remove the detector from the package, charge a battery if necessary. While transporting the device at negative temperature it is necessary to keep the device at room temperature not less than 30 min, not turning the device on.

**6.2.** Turn «LORNET-36» on by a power switch placed on the knob. At that 2<sup>nd</sup> and 3<sup>rd</sup> indicators on the control panel light, indicating that power of the detector is turned on. One yellow LED should light on the antenna unit (a circle scale of power indicator of the probing signal). Its initial position corresponds to maximum power of the probing signal. Here a probing signal transmitter is off (it is turned on after pressing PWR button only). Indicators of the 2<sup>nd</sup> and 3<sup>rd</sup> harmonics should not light (flashing of the first LEDs of 2<sup>nd</sup> and 3<sup>rd</sup> of scales is permitted).

**6.3.** Turn a probing signal transmitter on pressing PWR button. Here a pulse mode of the transmitter and an automatic mode of signal power switch on. Probing signal power changes according to signal level at the input of the receiver 2<sup>nd</sup> harmonic. In the given mode sound information of the 2<sup>nd</sup> harmonic signal response is put to the dynamic or head phones.

After turning 3<sup>rd</sup> mode by pressing LSTN button automatic regulation of output power of the receiver will occur, depending on signal level at the input of the receiver 3<sup>rd</sup> harmonic. Sound information of the 3<sup>rd</sup> harmonic signal response is put to the dynamic or head phones.

To switch over to manual mode of power control of the probing signal (MNL indicator lights) press one of **LEVEL** buttons after a probing signal transmitter is turned on. Turn a probing signal transmitter off and then turn it on by pressing PWR button for reverse switch over.

If necessary to tap a response signal by the third harmonic turn 3<sup>rd</sup> mode on using LSTN button on the control panel.

Normally while operating in rooms with a lot of electronic devices, decrease level of the

probing signal for 2-4 points counterclockwise from the initial one. Optimum level of the probing signal is reached by experimental way.

**6.4.** Simultaneous flashing of all indicators on the control panel indicates that a battery is discharged and need to be replaced urgently. At that power should be turned off and a battery-replaced.

**6.5.** If a response signal for telephones needs to be tapped, switch over acoustic indication in a mode of head phones, for that press the corresponding button on the control panel and turn wireless phones on.

Attention:

- 1). Do not direct the antenna towards an operator and people nearby.
- 2). While operating the device observe state of batteries constantly replacing them in-time (by the indicator signal). The device must be kept in a charged state.
- 3). Charging should be done in a charger only, included to the delivery set.
- 4). Use of undue chargers are forbidden.

## **7. Search Recommendation**

**7.1.** If possible remove electronic devices from the room examined. If it is impossible examination should be done at decreased power emitted.

**7.2.** Set maximum power emitted and one of the operating modes of the receiver.

**7.3.** Direct an antenna on the surface examined using laser spot. Slowly moving antenna unit parallel to the surface examined and changing orientation of antennas, analyze change of nature of the signal received by the 2<sup>nd</sup> and 3<sup>rd</sup> harmonics by the indicator visually (aurally click repetition rate should be maximum).

**7.4.** Analysis of levels of the receiving signal reflected by the 2<sup>nd</sup> and 3<sup>rd</sup> harmonics is made by number of LEDs lit on the corresponding indicator scale.

**7.5.** Remove antenna unit from the surface examined or decrease output power and repeat measurements stated in cl.7.4. of the present manual. Decrease receivers' frequency by using ATT button for more exact localization and anti jamming.

**7.6.** When artificial p-n transition is found, as a rule, stable glowing of the indicator LEDs by the 2<sup>nd</sup> harmonic of the signal reflected. While rapping a supposed place of p-n transition, readings of LEDs do not change.

**7.7.** When natural p-n transition is found, there is stable light of LEDs of indicators by the 3<sup>rd</sup> harmonic of the signal reflected. While rapping the surface examined intensively, readings of indicators by the 3<sup>rd</sup> harmonic do change, as a rule.

The search technique offered does not contain all nuances in exact cases, and it is a recommendation only.



## **CERTIFICATE**

### **1. General**

- 1.1. Before operating study User Manual for «LORNET-36» thoroughly.
- 1.2. The Certificate is included to the delivery set and should be always near it.
- 1.3. If the device is sent for repair or other place during operation the Certificate is to be passed with the device.
- 1.4. Marks in the Certificate should be done in-time.
- 1.5. All records in the Certificate should be made by ink only, distinctly and carefully. Erasures, blots and corrections unauthorized are not permissible.
- 1.6. It is forbidden to make any notes or records on fields and a cover of the Certificate.

### **2. Delivery set**

Name	Q-ty	Serial No	Notes
A receiving-transmitting antenna unit with control panel	1		
A charger for a battery	1		
A mains adaptor	1		
Wireless phones included: a receiver and earphones	1		
User manual	1		
Certificate	1		
Package	1		
Option:			

### **3. Warranty**

- 3.1. Warranty period of «LORNET-36» detector is 24 months upon supply to the customer.
- 3.2. Expected life time is 6 years.
- 3.3. If the device fails during warranty period provided the customer follows all rules for operation, transportation and storage, the manufacturer is to make repair free of charge or replace the device.
- 3.4. Warranty does not cover power elements.