IT-089

DVB-T/T2 SIGNAL ANALYZER

OPERATING MANUAL

PLANAR

Revision 1.1 of May, 2014

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1. PRODUCT FAMILY GENERAL INFORMATION

IT-08 is a multifunction handheld compact lightweight measurement instrument incorporating two components. One of the components, MB-08 Base Unit, remains invariable and provides color display, control and powering (from batteries or mains adapter) features. The other component, MC-08x, is one of the removable modules, which determine measurement functions of the whole instrument.

IT-08 is capable to satisfy all your requirements in radio, cable and satellite, analog and digital TV measurements.

According to your measurement target, you can easily and quickly plug in one of the modules into the Base Unit and perform the needed measurements. So, replacing the modules you can obtain options featuring the following different applications:

IT-081 TV Level Meter (MC-081 module plugged-in), 5 to 900 MHz range. Measurement of level, video-audio and carrier-noise ratios;

IT-082 Digital Satellite Meter (MC-082 module plugged-in), 950 to 2150 MHz range. Measurement of BER and MER values for digital satellite (QPSK DVB-S). Powering LNB SAT. DiSEqC generator;

IT-083 DVB-S/S2 Signal Analyzer (MC-083 module plugged-in), 950 to 2150 MHz range. Measurement of BER and MER values for digital satellite (QPSK/8PSK DVB-S/S2). Powering LNB SAT. DiSEqC generator;

IT-084 TDR Cable Reflectometer (MC-084 module plugged-in) for identification and precision fault location in cables up to 1,600 m in length. Resolution 0.1 m;

IT-086 Optical Power Meter (MC-086 module plugged-in), measuring at –50 dBm to +23 dBm range and wavelengths 1310 and 1550 nm.

IT-087 DVB-C Signal Analyzer (MC-087 module plugged-in), 5 to 900 MHz range. Support of DVB-C and ITU-T ANNEX A/C. Measurements for analog channels: carrier level, C/N and V/A ratios and for digital channels: channel power, MER, BER, and constellation diagram.

IT-088 DVB-T Signal Analyzer (MC-088 module plugged-in), 5 to 900 MHz range. Support of DVB-T and DVB-H with COFDM modulation. Measurements for analog channels: carrier level, C/N and V/A ratios and for digital channels: channel power, MER, BER, and constellation diagram.

IT-089 DVB-T/T2 Signal Analyzer (MC-089 module plugged-in), 45 to 900 MHz range. Support of DVB-T/T2 modulation. Measurements for analog channels: carrier level, C/N and V/A ratios and for digital channels: channel power, MER, BER, constellation and echo diagrams. Powering of antenna amplifier.

Now we are pleased to offer you the nine above modules, but the number is supposed to grow in the nearest future. You can purchase MB-08 Base Unit accompanied by any of the modules, currently required, at your option. Later on, you can acquire any other module(s) to expand your measurement abilities.

IT-08 GENERAL FEATURES (similar for all the IT-08 family instruments):

MB-08 dimensions (WxHxD) ....90 x 200 x 55 mm

MC-08x dimensions (WxHxD) ....60 x 70 x 27 mm

IT-08 weight ....0.6 kg (including batteries)

Keypad.. made of rubber

Display ....color graphic LCD 320x240 pixels with backlight
Power supply

Internal... NiMH AA rechargeable batteries, 2100 mAh (6 pcs)

External...12V/1.2A mains adapter

PC compatible interface...USB port

Operating temperature... −10 to +50 °C

User firmware update ....through USB interface from PC or the MC-08x Removable Module

2. GENERAL DESCRIPTION AND PRINCIPLE OF OPERATION

2.1 Introduction

This Operating Manual is intended for introducing the design, functions, and basic instructions related to operation and servicing of the IT-089 DVB-T/T2 Signal Analyzer (Analyzer).

The IT-089 is designed for control and adjustment of television and broadcasting distribution networks as well as of separate components of such networks, or other electronic devices. The Analyzer allows measurement of channel power and parameters of TV signal with analog and digital (DVB-T/H/T2 standard) modulation.

The Analyzer can be used both in laboratory, powered by an external power source, and in field, powered by batteries.

The reliability of the IT-089 is ensured by fulfillment of regular maintenance procedures. These procedures and their intervals are described in Section 5.

In this manual the following abbreviations are used:

PC - Personal Computer

CD - Compact Disk

LCD - Liquid Crystal Display

ADC - Analog-to-Digital Converter

FEC - Forward Error Correction

IF - Intermediate Frequency

MER - Modulation Error Ratio

BER - Bit Error Rate

QPSK - Quadrature Phase Shift Keying

QAM - Quadrature Amplitude Modulation

COFDM - Coded Orthogonal Frequency Division Multiplexing

DVB-T - Digital Video Broadcasting – Terrestrial

DVB-H - Digital Video Broadcasting – Handheld

DVB-T2 - Digital Video Broadcasting – Terrestrial generation 2

2.2 Safety Precautions

Thoroughly inspect the product and carefully read the related documentation to get acquainted with all the safety markings and instructions before you start to operate the Analyzer.

WARNING Only trained service personnel aware of the hazards involved should perform repair on the Analyzer.

CAUTION Tuning the Analyzer and replacement of the components that influence the accuracy of measurements without service personnel is strictly prohibited, since the components used in the Analyzer are purpose-made and their replacement will result in inaccurate operation of the Analyzer. To exclude the possibility of mechanical damage to the IT-089, the instructions regarding the storage and transportation (see Sections 7 and 8) of the Analyzer must be observed.

2.3 Function

The IT-089 DVB-T/T2 Signal Analyzer belongs to the family of IT-08 measurement instruments and is designed for measurement of the parameters of DVB-T, DVB-H and DVB-T2 (hereinafter DVB-T/H/T2) standard TV signal.

The Analyzer offers the following measurement modes for analog channels: video carrier level, video carrier to audio carrier (V/A) ratio, and video carrier to noise (C/N) ratio. For digital channels the measurement modes are the following: channel power and C/N ratio. For DVB-T signals IT-089 offers measurement of reception quality parameters: modulation error ratio MER, bit error ratio BER before and after Viterbi decoder, packet error rate after Reed-Solomon decoder, constellation diagram, and channel impulse response (echo diagram). For DVB-T2 signals the Analyzer allows measurement of the following parameters: MER, BER before and after LDPC decoder, packet error rate after BCH decoder, constellation diagram, and echo diagram. IT-089 features automatic defining of the settings of DVB-T/H/T2 signals (number of subcarriers, guard interval, FEC, channel bandwidth, and modulation type).

The IT-089 can be connected to a personal computer to access additional modes. The IT-089 operates in spectrum analyzer mode displayed on the built-in LCD. The Analyzer allows to measure direct and alternating voltage of the remote power supply of the TV and broadcasting distribution networks.

The appearance of the Analyzer and its components are displayed in figures 2.1 and 2.2.

Figure 2.1

Figure 2.2

This Operating Manual is made in accordance with the hardware version 02.80.02 for MB-08 Base Unit and firmware version 01.02.00.12/01.00.00.03 for IT-089.

2.4 Environmental Conditions

Normal operating conditions:

    a) ambient temperature 23±5 ºC;
    b) relative air humidity 55±25%;
    c) atmospheric pressure 84-106 kPa (630-795 mm Hg);
    d) voltage transients correspond to installation category CAT. II.

Rated operating conditions:

    a) ambient temperature from -10 to 50 °C;
    b) relative air humidity not greater than 90% at 25 ºC temperature;
    c) atmospheric pressure 84-106 kPa (630-795 mm Hg).

2.5 Package Contents

The Analyzer package includes:

    a) MB-08 Base Unit .... 1 pc;
    b) MC-089 Removable Module .... 1 pc;
    c) Carrying Case .... 1 pc;
    d) NiMH, AA Batteries ....6 pcs;
    e) 12V/1.2A Mains Adapter .... 1 pc;
    f) "F"-"F" Adapter .... 1 pc;
    g) USB Cable   .... 1 pc;
    h) Car Lighter Adapter.. 1 pc;
    i) Rubber Holster .... 1 pc;
    j) Operating Manual.. 1 pc.

The Removable Module (if supplied separately) package includes:

    a) MC-089 Removable Module 1pc;
    b) "F"-"F" Adapter 1pc;
    c) Operating Manual.. 1pc.

2.6 Specifications

Operating frequency range..45 to 900 MHz

Frequency resolution .... 125 kHz

Channel allocation standard .... China, PAL B/G, PAL Ireland, PAL UK,

.... Secam D/K, France, NCTA, Australian, Australian SBAND

Input parameters:

Input impedance within operating frequency range ....75 Ohm

AC input voltage for frequencies over 45 MHz ....3 V

AC and DC input voltage for frequencies under 45MHz.. 1 V

Built-in attenuator.. 20, 40 dB

Return loss, no less than .... 14 dB

Analog modulation signal level measurement range...30 to 120 dBµV

Digital modulation signal level measurement range..40 to 120 dBµV

Measurement level resolution .... 0.1 dB

Level measurement accuracy under normal operating conditions .... ±1.5 dB

Level measurement accuracy within operating temperature range .... ±2.2 dB

Measurement channel bandwidth for -3 dB level .... 230 ± 60 kHz

DVB-T/H signal parameters:

    channel modulation .... COFDM

    subcarrier modulation QPSK,QAM16,QAM64

    channel bandwidth .... 7, 8 MHz

    number of subcarriers 2k, 8k

    guard interval 1/32, 1/16, 1/8, 1/4

    hierarchical modulation .... α=1, α=2, α=4

    FEC 1/2, 2/3, 3/4, 5/6, 7/8

DVB-T2 signal parameters:

    channel bandwidth .... 7, 8 MHz

    standard specification v1.2.1

    number of subcarriers 1k, 2k, 4k, 8k,16k, 32k

    broad channel bandwidth mode .... Yes

    guard interval 1/128, 1/32, 1/16, 1/8, 1/4, 19/128, 19/256

    pilot subcarriers allocation .... PP1 – PP8

    PLP stream subcarriers modulation type .... QPSK, QAM16, 64, 256

    PLP constellation rotation .... Yes

    BB-frame size of PLP-stream 16k, 64k

    PLP-stream FEC 1/2, 2/3, 3/4, 3/5, 4/5, 5/6

MER measurement range (for QAM64 modulated PLP) .... 16 to 35 dB

MER measurement resolution .... 0.1 dB

MER measurement accuracy within 50 to 110 dBµV level range .... ±2.0 dB

BER measurement range:

    DVB-T signal BER before Viterbi decoder .... 1.0×10^{-2} to 1.0×10^{-6}

    DVB-T signal BER after Viterbi decoder .... 1.0×10^{-3} to 1.0×10^{-8}

    DVB-T2 signal BER before LDPC decoder .... 5.0×10^{-2} to 1.0×10^{-6}

    DVB-T2 signal BER after LDPC decoder .... 1.0×10^{-4} to 1.0×10^{-8}

Allowable frequency offset:

for DVB-T signal... ±0.5 MHz

for DVB-T2 signal... ±0.1 MHz

Frequency indication.. 6 characters on LCD

Channel number indication .... 3 characters on LCD

Signal level indication .... 4 characters on LCD

Warm-up time, less than...10 min.

IT-089 can be powered by:

AC circuit with 100-240 V voltage, 50±0.5 Hz frequency with no more than 5% harmonic content, via 12V/1.2A Mains Adapter

external DC source with 12 ± 0.6 V voltage, and no more than 0.5 V ripple;

batteries with capacity of at least 2100 mAh.

Current consumed from external power source or batteries, less than...................................... 0.8 A

Power supply voltage for external devices 12V

Built-in power supply for external devices, no less than.. 1.5W

Continuous stable operation under normal conditions

(when powered by external source), no less than..24 hrs

Battery life under normal conditions (2100 mAh battery capacity), no less than ....6 hours

Mean time between failures, no less than ....10,000 hours

Average service life, no less than..5 years

Dimensions ....200x90x55 mm

Shipping dimensions...400x300x90 mm

Weight..0.6 kg

Weight in package ....2.2 kg

2.7 Design and Operation Overview

2.7.1 Principle of Operation

The DVB-T/H/T2 Signal Analyzer is a receiver of DVB-T/H/T2 signals with demodulation of the input signal to the MPEG-2 or MPEG-4 transport stream. The input level measurement path is a superheterodyne receiver with triple frequency conversion. Modulation error ratio MER and constellation diagram are measured in the process of COFDM signal demodulation based on vector analysis. Bit error rate BER in digital stream is determined by means of analysis of Viterbi decoder (BER before Viterbi decoder) and Reed-Solomon decoder (BER after Viterbi decoder and packet error rate after Reed-Solomon decoder) for DVB-T channel, and LDPC decoder (BER before LDPC decoder) and BCH decoder (BER after LDPC decoder and packet error rate after BCH decoder) for DVB-T2 channel. Channel power is measured by means of analog-to-digital converter after signal peak detection at the output of logarithmic detector of the third IF amplifier.

The principle of spectrum analyzer is based on sequential analysis method with spectrum indication on the LCD of the Analyzer or the PC.

The view displayed on the screen in DVB-T reception quality parameters measurement mode is the numeric values of the measured digital parameters (MER, BER before and after Viterbi decoder, PER after Reed-Solomon decoder). The view displayed on the screen in DVB-T2 reception quality parameters measurement mode is the numeric values of the measured digital parameters (MER, BER before and after the LDPC decoder, PER after BCH decoder). The constellation diagram mode shows the graph of the quadrature components of the demodulated signal in the amplitude-phase plane. The DVB-T and DVB-T2 pulse response measurement mode shows the graph of signal levels delayed against the base signal levels vs delay value. The mode of signal level measurement in a frequency point displays the numeric value of the signal level, V/A and C/N ratios for analog signals, and actual signal power for signals with digital modulation.

2.7.2 Block Diagram

The block diagram of IT-089 is shown in figure 2.3.
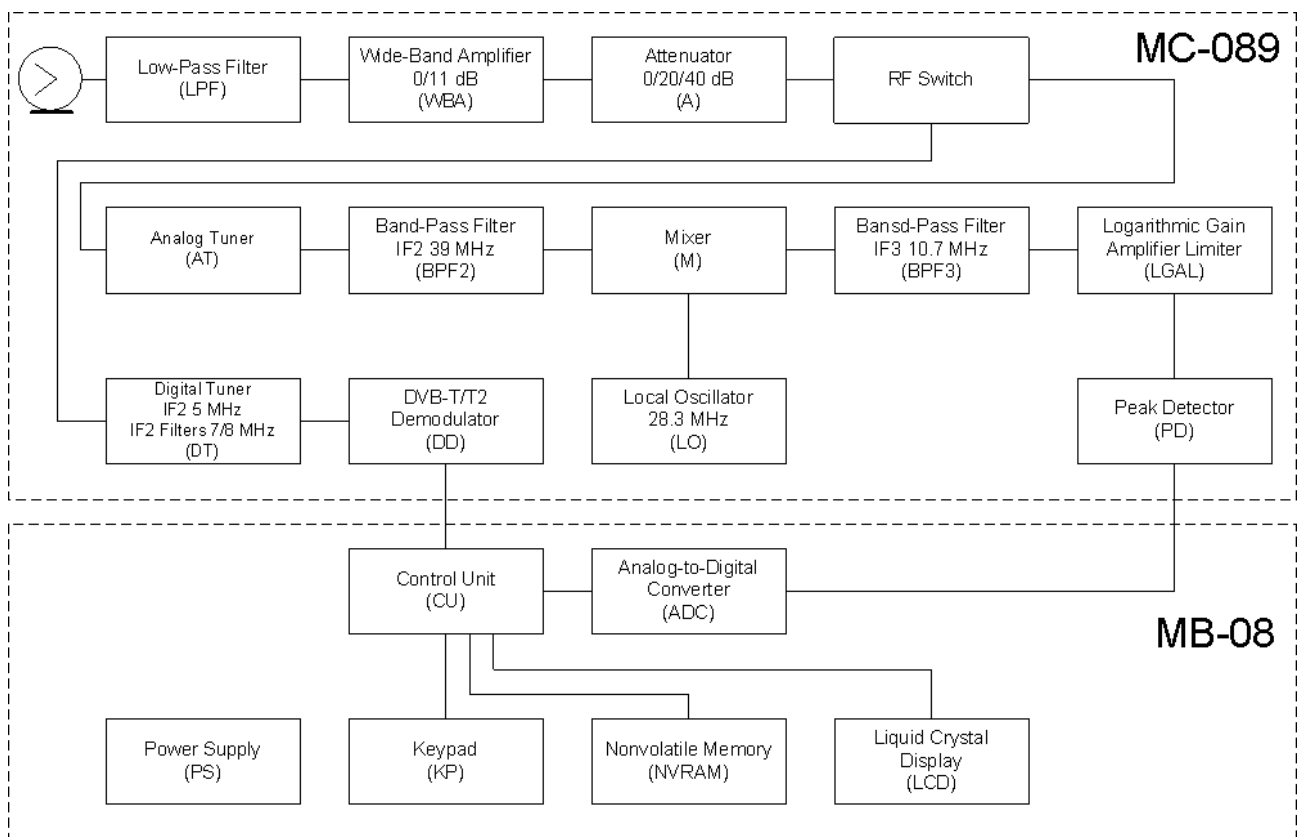
Figure 2.3

After the Low-Pass Filter (LPF), the input signal if necessary is strengthened by the Wide-Band Amplifier (WBA) or reduced by the Attenuator (A). Then it is converted into the 39 MHz second IF signal by the Analog Tuner (AT) in the level measurement mode or into 5 MHz by the Digital Tuner (DT) in the DVB-T/H/T2 signal demodulation mode.

The Analog Tuner is a superheterodyne receiver with double frequency conversion. The first IF is 1220 MHz, the second IF is 39 MHz.

In the level measurement path the second IF signal is filtered by the Bandpass Filter (BPF1) and converted in the Mixer (M1) into the third IF signal, and further filtered at the 10.7 MHz frequency by BPF2, which determines the receiver frequency band.

Logarithmic Gain Amplifier Limiter (LGAL) performs logarithmation and signal detection.

Peak Detector (PD) allows measuring video carrier level by means of Analog-to-Digital Converter (ADC). The digital code of the input signal peak level logarithm is defined as a real value and corrected in accordance with the calibration table of the Control Unit (CU) microcontroller.

In DVB-T/H/T2 signal demodulation mode a digital tuner is used. The tuner is a superheterodyne receiver with double frequency conversion. The first IF is 0 Hz, the second IF is 5 MHz. The second IF signal is filtered by the bandpass filter, integrated in the tuner, enters the DVB-T/H/T2 demodulator, which performs demodulation and measurement of the signal parameters. Measurement results are processed by the control unit.

The Control Unit receives the commands from the user entered via the Keypad, processes the data, displays them on the LCD, and also controls the operation with the external PC.

The nonvolatile memory (NVRAM) stores the calibration coefficients set by the manufacturer, Data Logger records, and service information.

The Power Supply (PS) forms the required voltages either from batteries or from an external power source.

2.7.3 Component Arrangement

The IT-089 is made up of two components. Both modules are contained within plastic shockproof sectional housings. MC-089 Removable Module is plugged in the Base Unit and connected to it via specific connector.

The front panel of the Base Unit contains a keypad and a color graphical display. The right panel has a USB port and an external power source connector. The Removable Module connector is located on the back panel. The Removable Module has an input male 75-Ohm F connector and the connector for connection to the Base Unit.

3. PREPARATION FOR OPERATION

Perform external examination to make sure your IT-089 is free from any visible mechanical damage.

When you receive the package, check the availability of the items contained in it against the list provided (see Section 2.5).

If the IT-089 has been kept in the environment other than the rated operating conditions, leave your Analyzer in facilities with normal operating conditions for at least 2 hours prior to operation.

4. OPERATION PROCEDURE

4.1 Controls and Indicators

The location of controls, indicators and connectors is shown in figures 2.1 and 2.2. These elements have the following functions:

a) **F1, F2, F3, F4** functional keys are intended for enabling the commands corresponding to the icons shown on the screen of the IT-089;

b) ⏻ key turns the power of the Analyzer on/off. Illuminated key indicates that the power is supplied from an external power source;

c) **AUX** key opens the menu with additional set of functions for **F1, F2, F3,** and **F4** keys;

d) **MENU/ENTER** key selects the current command or returns to the previous menu level;

e) ▲, ▼, ◄, and ► arrows allow editing in the current operation mode;

f) alphanumeric keypad allows entering text or numeric data;

g) ⎓ **12VDC** connector provides connection to an external power source;

h) **USB** port provides connection to computer;

i) **INPUT** connector is for the test signal input, F-type connector.

4.2 Preparation for Measurements

Before you start to operate your IT-089 make sure to carefully read this Operating Manual as well as to inspect the location of the controls and indicators of the Analyzer (see Section 4.1).

To prepare your Analyzer for operation with the external power source proceed as follows:

a) unlock the Carrying Case and take the Analyzer and the Mains Adapter out;
b) connect the MC-089 Removable Module to the MB-08 Base Unit, if they were stored separately;
c) connect the Mains Adapter to the connector located on the side panel of the IT-089 and then to the power source;
d) press and hold down the ⏻ key until the LCD backlight turns on.

To prepare your IT-089 for operation in stand-alone mode, powered by the batteries, proceed as follows:

a) unlock the Carrying Case and take the IT-089 out;
b) connect the MC-089 Removable Module to MB-08 Base Unit, if they were stored separately;
c) press and hold down the ⏻ key until the LCD backlight turns on.
d) If the Removable Module firmware version is other than the firmware installed, the IT-089 will start the program installation process automatically once the Analyzer is switched on. The loading process is indicated by corresponding message on the Analyzer screen.

CAUTION Do not switch the power off while the firmware is being loaded! This may lead to the loss of capability of loading the firmware onto your Analyzer without the use of a PC.

If the Removable Module firmware version is the same as the installed firmware, the IT-089 will start to check the Removable Module after the power has been switched on. After successful check, the following message (see figure 4.1) will appear on the screen:
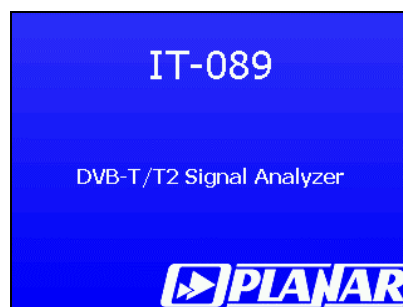
Figure 4.1

The screen will show the name and type of the Analyzer. In a few seconds, either the main mode-selection menu (main menu) will appear on the screen (see figure 4.2), or the last previously used measurement mode, if the quick access option has been enabled (Section 4.5.3).

Select the operating mode using the interactive menu on the LCD screen. This menu represents a number of icons, each icon referring to a certain mode. The view of the main menu is shown in figure 4.2.
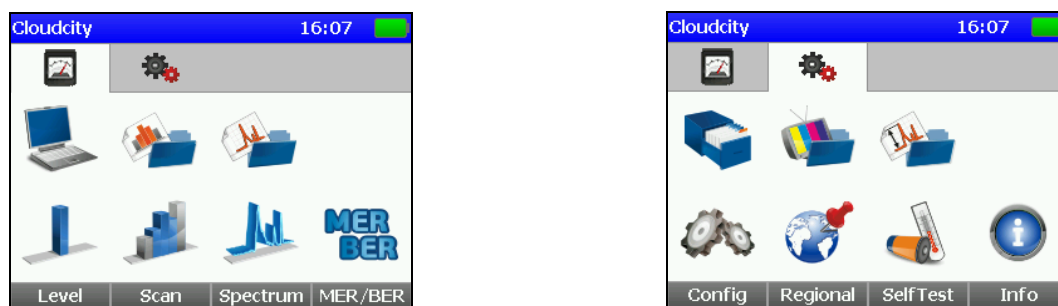
Figure 4.2

There are two sets (tabs) of icons: measurement icons and configuration icons. You can switch between the tabs using the ◄ and ► keys. To select the required mode, set the corresponding icon at the bottom of the screen. The names of the modes will appear above each functional key. Press the required functional key to enter the mode. To return to the main menu, press the **MENU/ENTER** key.

To make sure that the Analyzer is operating properly, perform the procedure described below.

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In the main menu select the tab with configuration icons ⚙️ in the main menu and enter the **Regional** 🌐 mode. Select the row with the required parameter using ▲ and ▼ keys, and set the following values by ◄ and ► keys:

- **Language:**   **English (or Язык: Русский)**
- **Ch template:**   **Secam D/K**
- **Level unit:**   **dBuV**

Press **MENU/ENTER**. Then enter the **Ch.plan** mode 📺. Select the first **All channels** row using ▲ and ▼ keys and press **F4/Select**. Press the **MENU/ENTER** key again.

In the main menu select the tab with the icons of measurements 📟 by the ◄ and ► keys and set the **Level** 📊 icon at the bottom of the main menu screen using the ▲ and ▼ keys. Press the corresponding functional key. The screen of the signal level measurement in frequency point will appear (figure 4.4). Press the **F1/Settings** key. Select the row with the required parameter using the ▲ and ▼ keys and then set the following values by the ◄ and ► keys:

- **Attenuator:**   **Auto**
- **Tuning:**   **Chan.**
- **Ref. level:**   **Auto**
- **Scale:**   **10dB**
- **Max level:**   **Off**
- **Averaging:**   **Off**
- **AMP powering:**   **Off**

Set the measurement frequency to the frequency of the video carrier of the 25th TV channel by successive pressing the **2**, **5** and **MENU/ENTER** keys. The frequency value will show **503.250 MHz**, and the channel number will show **CH 25**. To return to the main menu, press the **MENU/ENTER** key.

4.3 Measurement Procedure

4.3.1 General Information

The IT-089 offers the following six measurement modes:

a) measurement of signal level in the frequency point and of TV signal parameters, as well as measuring direct voltage at the input of the Analyzer in the **Level** measurement mode;
b) signal spectrum measurement in the **Spectrum** mode;
c) TV signal parameter measurement in the **Scan** mode;
d) TV signal level tilt measurement in the **Tilt** mode;
e) TV signal level ripple measurement in the **Limit** mode;
f) measurement of DVB-T/H/T2 channels reception quality in the **MER/BER** mode.

The c), d) and e) modes refer to the **Scan** measurement group. Pressing the ▲ and ▼ keys in the main menu (figure 4.2), move the icon of the required mode at the bottom of the screen. The icons correspond to the modes as follows:
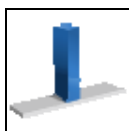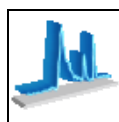
Level	Spectrum	Scan	MER/BER

To complete the selection of the mode, press the functional key, which is under the required icon. Press **MENU/ENTER** key to return to the main menu. In all the measurement modes the screen view has common elements and configurations, see figure 4.3.
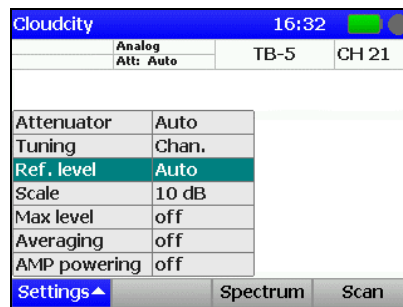
Figure 4.3

The top panel on the screen shows the selected channel plan name, current time, battery remaining indicator and amplifier powering indicator. If the channel plan is not selected, the line will show **All channels** message, and in this case the channel modulation type is determined automatically. In other case, all channel parameters are taken from the selected channel plan.

Amp powering indicator appears only in the measurement and data logger modes during scanning. In case the Amp powering mode cannot be enabled (line voltage is detected or the power source supplies incorrect voltage), the indicator turns red and the Analyzer gives a warning beep. After exiting the measurement mode, the Amp powering status is saved, and the mode will be automatically enabled next time you activate the measurement mode.

The lower left part of the panel shows the current mode settings and TV signal parameters. The name of the channel and its number are displayed one after another in the right part of the panel.

In the functional keys panel, the **F1** key opens the settings menu, the **F2** key activates additional auxiliary functions, **F3** and **F4** are for quick switching between the measurement modes.

AUX key opens the menu with the additional set of functions. You can activate any of these functions by pressing **AUX** and successively pressing the corresponding functional key. In 3 seconds or after pressing **AUX** one more time, the menu with the usual set of functions will appear on the screen again.

To adjust the settings of the measurement modes, press **F1/Settings**. The pop-up menu contains a list of parameters which can be changed. Use the ▲ and ▼ keys to select the required parameter, and set the value by the ◄ and ► keys. The list of parameters and their available values is as follows:

a) **Attenuator** Selecting the input attenuation value.
- **0 dB**   Input attenuator off
- **20 dB**   Input attenuator 20 dB
- **40 dB**   Input attenuator 40 dB
- **Auto**   Automatic selection of the input attenuation value

b) **Tuning.** Setting the frequency tuning mode.
- **Chan**   Frequency tuning by channels
- **Freq**   Tuning by frequency with the 125 kHz step

c) **Ref.level** Setting the magnitude scale position.
- **Manual**   The scale position is set manually by the ▲ and ▼ keys
- **Auto**   The scale position is set automatically

d) **Scale** Setting the division value of magnitude scale.
- **2 dB**   2 dB per division
- **5 dB**   5 dB per division
- **10 dB**   10 dB per division

e) **Max level** Showing the maximum level on the graphic indicator.
- **Off**   The maximum level is not shown
- **On**   The maximum level is additionally shown above the level bar

f) **Averaging** Showing the signal level value after averaging.
- **Off**   Averaging off
- **x4**   Averaging off
- **x8**   Averaging over the last 8 measurement reports

g) **Amp Powering** Amplifier powering mode.

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- **Off**   Amp Powering off
- **12 V**   Amp Powering 12V/ 0.1A

4.3.2 Level Measurement Mode

In this mode the signal level in the frequency point and parameters of the TV channel are displayed on the screen. You can see the screen view in figure 4.4:
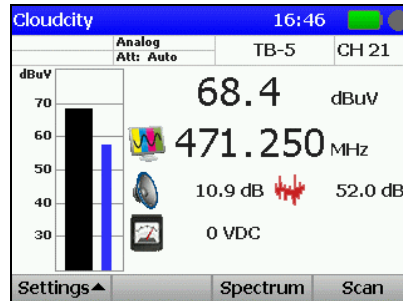
Figure 4.4

The screen displays the channel tuning frequency, the measured level value in graphical and digital representation, and also the TV channel parameters, such as V/A and C/N ratios.

The bottom line of the screen shows the value of the direct voltage at the input.

To perform tuning by channels or frequency, use the ◄ and ► keys. To enter the channel number or frequency from the keypad, select the corresponding tuning mode and use the alphanumeric keypad. To enter the number of a special channel, first press **C** key. After you have entered the number, press **MENU/ENTER**. If the number is incorrect, the previously saved channel number value will be restored after pressing the **MENU/ENTER** key. To enter the frequency value in MHz, use the alphanumeric keypad. After you have entered the number, press **MENU/ENTER**.

NOTE Pressing ◄ and ► keys when a channel plan is selected (4.4.2.1) will scroll the channels of the plan. You can tune to any channel by entering its number from the alphanumeric keypad. In this case the channel does not belong to the selected channel plan, its name will not be shown, only the number of the channel will be indicated on the screen. Tuning to the channels and their numbering will be fulfilled in accordance with the selected channel template (Section 4.5.2).

Depending on the selected measurement units, the measured level is indicated in dB related to 1 µV, 1 mV or 1 mW (Section 4.5.2). To define V/A and C/N ratios for analog channels, the IT-089 performs measurements in three frequency points. The first one is the video carrier frequency (or the frequency your Analyzer is set to). The second frequency point is the audio carrier frequency (for Secam D/K template this point is 6.5 MHz shifted up from video carrier frequency). The third one is the point 1.125 MHz shifted down from the first one. The measured V/A and C/N ratio will be indicated on the screen.

While operating by channel plan, the IT-089 offers the capability of selecting the frequency point for optimization of noise measurements (4.4.2.2).

For digital channels your Analyzer will perform measurement of actual channel power within the channel frequency band.

While performing measurements for digital channels, it is recommended to apply the mode of calculating the measured value with maximum averaging: **Averaging: x8**

This method ensures more consistent results for wideband signals.

To reset the maximum level value, press the **AUX** key to open the menu with the additional set of functions, and then press the **F4/Reset** key.

The remote cable power supply voltage is measured from 10 to 100 V. The absolute error of the measurement is lower than ±1.5V. The measured value of the voltage at the Analyzer's input are indicated on the screen in VDC units.

To switch to the **Spectrum** and **Scan** measurement modes, use the **F3** and **F4** keys.

If the current channel is defined as digital you can also switch to the **MER/BER** mode by pressing the **F2** key.

4.3.3 Spectrum Measurement Mode

This mode displays the signal spectrum. See the screen view in figure 4.5:
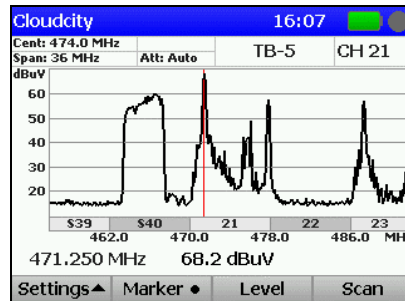
Figure 4.5

You can navigate the marker by the ◄ and ► keys, if the **F2** key value is displayed as **Marker**. To enter the channel number or frequency directly, use the alphanumeric keypad. After you have set the frequency in MHz, press **MENU/ENTER**. After pressing this key, the selected channel will be placed in the middle of the screen. You can set the position of spectrum scan screen by the ◄ and ► keys after setting the **Center** value for the **F2** key.

In addition to general parameters, you can also edit the following parameters to adjust these mode settings:

a) **Hold level**. Showing an additional trace with the minimum or maximum level on the screen.
   - **Off:** No trace is shown.
   - **Max:** Trace with the maximum level is shown.
   - **Min:** Trace with the minimum level is shown.
b) **Span**. Setting the frequency scanning range.
   - **18/36/72 MHz**: Available values of the scanning range.
c) **Scan mode**. Selecting the scanning mode.
   - **Quick:** Quick scanning.
   - **Precision:** Slow scanning that ensures maximum accuracy of the level measurements.
   - **Single:** Single scanning sweep. To start this sweep, press the AUX key to open the menu with the additional set of functions, and then press the F2/Run key.

To reset an additional trace line (**Min** or **Max**), press the **AUX** key to open the menu with the additional set of functions, and then press the **F4/Reset** key.

4.3.4 Scan Measurement Mode

This mode displays the signal levels as a bar-graph. The screen view is presented in figure 4.6:
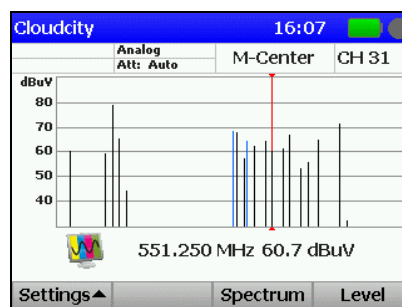
Figure 4.6

The tuning frequency and the channel level value indicated by the marker are shown under the level bar-graph. You can navigate the marker by the ◄ and ► keys. You can set the marker position directly by

entering the channel number using the alphanumeric keypad. After you have entered the number, press **MENU/ENTER**.

In addition to general parameters, you can also set the following parameters to adjust the mode configurations:

Hist. type. Selecting one of the Scan mode types.
- **Scan:** Measuring channel level.
- **Tilt:** Measuring tilt between the channels.
- **Limit:** Measuring ripple of channel levels.

The screen view of the **Tilt** mode is shown in figure 4.7.
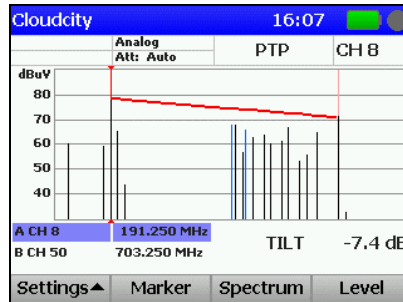
Figure 4.7

The **Tilt** mode displays the tilt line between two selected channels (markers A and B) and the difference between their levels. To choose the marker, press **F2/Marker**.

The screen view of the **Limit** mode is shown in figure 4.8.
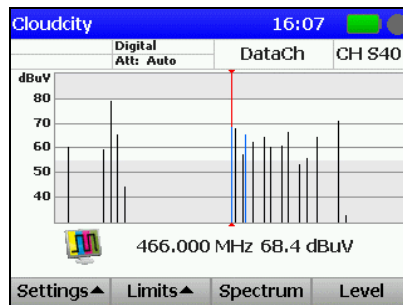
Figure 4.8

The **Limit** mode additionally displays the upper and lower limits of the channel levels. The upper and lower limits can be edited in the pop-up menu that appears after pressing the **F2/Limit** key.

4.3.5 MER/BER Measurement Mode

In this mode the screen displays the measured reception quality parameters of DVB-T/H/T2 channels both in digital and graphic representation (as vertical bars). Also the constellation diagram and echo diagram modes are available. The view of the screens is shown in figure 4.9:
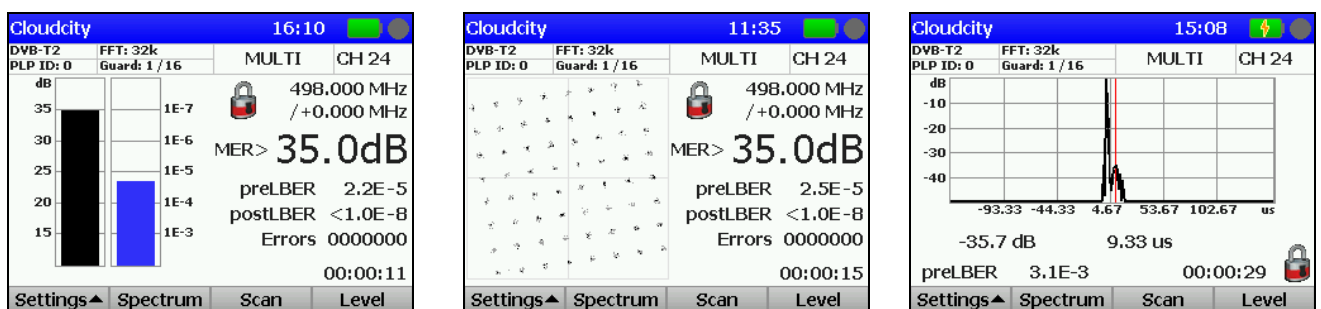
Figure 4.9

The following measured values and parameters are displayed on the screen:

a) Common parameters:
- channel type;
- FFT channel mode;
- DVB-T subcarrier modulation type or the current PLP stream number for DVB-T2;
- guard interval;
- tuning frequency;
- offset frequency;
- time from the moment of synchronization with the channel;
- modulation error ratio MER.

b) Measured DVB-T/H signal parameters:
- Bit error rate BER before Viterbi decoder (preVBER);
- Bit error rate BER after Viterbi decoder (postVBER);
- Erroneous packets counter after Reed-Solomon decoder.

c) Measured DVB-T2 signal parameters:
- Bit error rate BER before LDPC decoder (preLBER);
- Bit error rate BER after LDPC decoder (postLBER);
- Erroneous packets counter after BCH decoder.

In graphic representation the screen displays the MER value and one of the selected BER values in the **MER/BER** mode, the constellation diagram in the **Constel.** mode or the echo diagram in the **Echo** mode.

To perform tuning by channels, use the ◄ and ► **keys** or enter the channel number directly from the keypad. To enter the number of a special channel, first press **C** key. After you have entered the number, press **MENU/ENTER**. If the number is incorrect, the previously saved channel number value will be restored after pressing the **MENU/ENTER** key.

After tuning to the channel is complete, the Analyzer will determine the modulation parameters and will perform channel synchronization, which is indicated on the screen as a circular progress indicator. In case the signal level is low, the ▬ icon will appear on the screen. After parameters measurement is complete, their values will appear on the screen. If synchronization with the channel is lost, the screen displays the last measured values. To switch between the PLP streams for DVB-T2 channels, use the ▲ and ▼ keys or the **PLP** menu in the additional set of functions.

You can also set the following parameters to adjust the mode configurations:

a) **View mode**   Selecting one of the representation modes.
- **MER/BER:**   Representation of MER and BER values as vertical bars.
- **Constel.:**   Representation of the constellation diagram.
- **Echo:**   Representation of the echo diagram.

b) **Max level**   Showing of maximum level value for MER and BER parameters.

c) **BER graph.**   Selecting one of the BER values for graphical representation.

The additional set of functions has the following functions available:

a) **F1/ Info**   Viewing a detailed table of channel parameters and current PLP;

b) **F2/ Zoom**   Viewing second quadrant of the constellation diagram;

c) **F3/ PLP**   Table of PLP selection for DVB-T2 channel;

d) **F4/ Reset**   Resetting max level at the bar-graph and data of the constellation diagram.

4.4 Data Logger Function

4.4.1 General Information

Data Logger is intended for automation of the procedure of recording the measurement results. There are four data logger directories: Channel Plan List, Limit Plan List, Channel Data Logger, and Spectrum Data Logger. The data logger memory is common for all the directories and is of a dynamic type. The memory capacity allows to save up to 32 channel plans, up to 8 limit plans, up to 200 channel data logger pages, and up to 200 spectrum data logger pages. The Analyzer allows viewing the saved data off-line or by means of a computer. To check the data logger memory, the IT-089 offers memory manager mode. This mode allows testing, free resources determination, and formatting of the memory.

To select between the data logger modes, use arrows and functional keys. In the main menu select the required page with icons by ◄ and ►, then set the icon of the required mode at the bottom of the screen by the ▲ and ▼ arrows, and press the corresponding functional key. The icons correspond to the modes as follows:

Measurement tab	Configuration tab		
Channel Tests Spectrum Tests	Channel Plans	Limit plans	File Manager
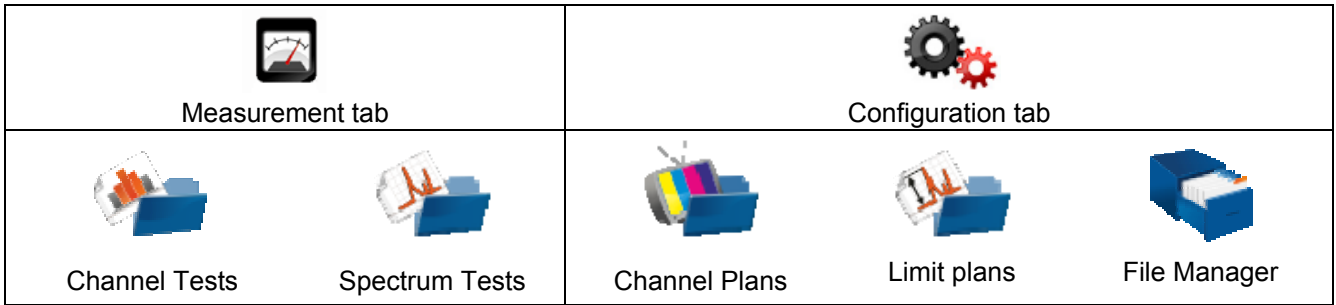
4.4.2 Channel Plans

4.4.2.1 Channel Plan List

This mode allows performing all the operations with channel plans: viewing, editing, deleting, and creation of new pages. See the view of the screen in figure 4.10.

The table contains the plan name and the date of its creation or editing. The channel plan installed in the Analyzer is marked by the ✓ icon. The plans in the table are sorted by name. The top row of the table always contains **All channels** plan, which corresponds to the channel template. If this plan is installed, the Analyzer will be operating without the channel plan.

Figure 4.10

Press **F1/Plan** to open the pop-up menu with the list of available commands:

    a) **Edit**   Viewing and editing the selected channel plan.
    b) **Rename**   Editing the channel plan name.
    c) **Delete**   Deleting the selected channel plan.

You can also add a new channel plan by pressing **F2/Add**, and install the selected plan by **F4/Select**.

4.4.2.2 Editing Channel Plan

The screen view of the channel plan table is shown in figure 4.11:

Figure 4.11

The table contains channel number, channel name, tuning frequency and modulation type.

The following commands can be accessed by the functional keys:

a) **F1/ Edit**   Editing the selected channel.
b) **F2/ Add**   Adding a new channel.
c) **F3/ Delete**   Deleting the selected channel.

The screen view of the channel parameter editing mode is shown in figure 4.12:

Cloudcity	16:46 ▭
Parameter	Value
Type	Analog
Channel number	26
Frequency	511.250 MHz
Channel name	HTB
Audio carrier	6.500 MHz
Noise frequency	-1.125 MHz
Ch ◀	▶ Ch

Cloudcity	08:21 ▭
Parameter	Value
Type	DVB-T2
Channel number	23
Frequency	490.000 MHz
Channel name	Vex
DVB bandwidth	8 MHz
Default PLP	0
PLP for ch. test	⤵
PLP modulation	⤵
Ch ◀	▶ Ch
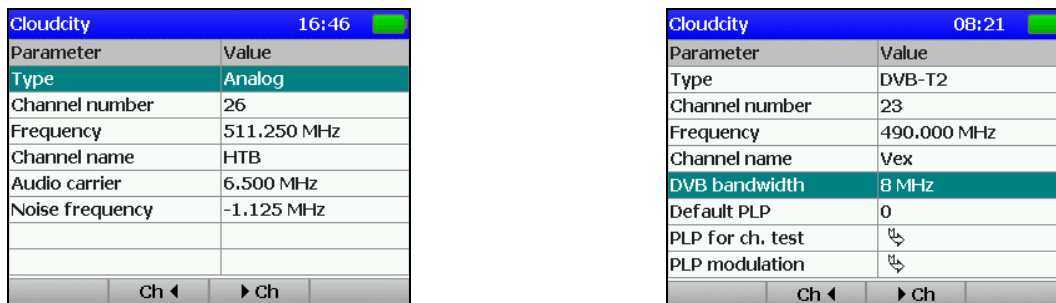
Figure 4.12

The sets of channel parameters depend on the modulation type.

The following parameters are common for all types of channels:

a) **Type**: Channel modulation type. Possible parameter values: **Analog** - channel with analog modulation, **DVB-T** - channel with DVB-T modulation, **DVB-T2** - channel with DVB-T2 modulation, **Digital** - channel with unknown digital modulation;
b) **Channel number:** Channel number according to the channel template (see Section 4.5.2)
c) **Frequency:** Tuning frequency for channel in MHz. Value can be changed within the channel allocation bandwidth with a 0.125 MHz step;
d) **Channel name:** Channel name.

Specific parameters:

a) **Analog**:
   - **Audio carrier:** Frequency of the audio carrier. Can be selected from the following values: 4.5/5.0/5.5/6.0/6.5 MHz frequency shift. If you select Off value, V/A parameter for the channel will not be measured.
   - **Noise frequency:** Frequency shift for C/N ratio measurement. The available range is from –8 up to +8 MHz with a 0.125 MHz step. The zero value is shown as Off. In this case the C/N parameter for the channel will not be measured.
b) **DVB-T:**
   - **DVB bandwidth:** Channel bandwidth. The following values are available: 7MHz, 8MHz;
   - **Modulation:** Subcarrier modulation type. The following values are available: QPSK, QAM16, QAM64;
   - **FFT mode:** Number of OFDM subcarriers. The following values are available: 2k, 8k;
   - **Guard interval:** Value of a relative guard interval. The following values are available: 1/32, 1/16, 1/8, 1/4;
c) **DVB-T2:**
   - **DVB bandwidth:** Channel bandwidth. The following values are available: 7MHz, 8MHz;
   - **Default PLP:** PLP stream number for DVB-T2 channel, which is to be synchronized by default in the MER/BER measurement mode, and for measurement with the external PC. Parameter value is changed in accordance with the list of the channel PLP streams;
   - **PLP for ch. test:** PLP streams numbers for DVB-T2 channels (up to 8 streams), the MER and BER quality parameters of which are to be measured in the Channel Data Logger mode. If the channel has only one PLP stream, its number will be shown, and it cannot be changed.
   - **PLP modulation:** PLP streams modulation for DVB-T2 channel, the MER and BER quality parameters of which are to be measured in the Channel Data Logger mode. If the channel has only one PLP stream, its modulation will be shown, and it can be changed to one of the following values: QPSK, QAM16, QAM64, QAM256.
d) **Digital** (digital channel with unknown modulation):
   - **Bandwidth:** Channel bandwidth. Available values: 5 to 8 MHz with a 0.250 MHz step;

- **Noise frequency:** Frequency shift for C/N ratio measurement. The available range is –8 up to +8 MHz with a 0.125 MHz step. The zero value is shown as Off. In this case the C/N parameter for the channel will not be measured.

The initial values of the parameters are set during the automatic defining of the channel plan and can be edited by the user. To fine tune a parameter, select it by the ▲ and ▼ keys. Then scroll to the required values by the ◄ and ► keys, or enter them using the keypad.

Using the F2 and F3 keys you can scroll through the channels without exiting the channel parameter editing mode.

4.4.2.3 Creating New Channel Plan

To create a new channel plan in auto mode, supply the signal to the Analyzer input and press F2 in the channel plan list. Enter the plan name in the dialog and press MENU/ENTER. Then select Amp Powering mode by the ◄ and ►keys and confirm the selection by pressing MENU/ENTER. After the Analyzer has completed scanning all the TV channels, it will switch to channel plan editing mode. After you have edited the channel parameters (see Section 4.4.2.2) and exited this mode, save it into the memory. You can also edit the channel plan name, if necessary (see Section 4.4.2.1).

4.4.3 Limit Plans

4.4.3.1 Limit Plans List

Limit plans contain the criteria for checking the channel parameters and are employed during measurements in the Channel Data Logger mode.

This mode allows performing all the operations with limit plans: viewing, editing, deleting, and creation of new pages. See the view of the screen in figure 4.13.

The table contains the limit plan name and the date of its creation or editing. The plans in the table are sorted by name. The top row of the table always contains the **Default** plan, which is not available for editing.

Cloudcity	16:32
Name ▼	Modified
Default	
Limit Plan 1	01.01.01
Limit Plan 2	25.09.13
Plan ▲	Add

Figure 4.13

Press **F1** to open the pop-up menu with the list of available commands:

a) **Edit**   Viewing and editing the selected limit plan;
b) **Rename**   Editing the limit plan name;
c) **Delete**   Deleting the selected limit plan.

Also you can add a new limit plan by pressing **F2/Add.**

4.4.3.2 Editing Limit Plan

The screen view of the limit plan is shown in the figure 4.14:

Figure 4.14

The table contains the TV channel parameters and the upper and lower limits which are compared with the measured parameters in the channel data logger.

The following parameters are represented in the table:

a) **Min Video Level** The minimum possible value of the analog channel level.
b) **Max Video Level** The maximum possible value of the analog channel level.
c) **Min V/A** The minimum possible value of V/A ratio.
d) **Max V/A** The maximum possible value of V/A ratio.
e) **Min C/N** The minimum possible value of C/N ratio.
f) **Max Adj. Channels Delta** The maximum possible value of difference between the adjacent channel levels.
g) **Max Level Delta** The maximum possible value of difference between the channel levels.
h) **Max An/Dg Delta** The maximum possible value of difference between the levels of digital and analog channels.
i) **Min Digital Level** The minimum possible value of signal level for digital channels.
j) **Max Digital Level** The maximum possible value of signal level for digital channels.
k) **Min Digital C/N** The minimum possible value of C/N ratio for digital channels.
l) **Min MER DVB-T/QPSK** The minimum possible MER value for DVB-T channels of the QPSK modulation.
m) **Min MER DVB-T/QAM16** The minimum possible MER value for DVB-T channels of the QAM16 modulation.
n) **Min MER DVB-T/QAM64** The minimum possible MER value for DVB-T channels of the QAM64 modulation.
o) **Max DVB-T/preVBER** The maximum possible value of BER before Viterbi decoder for DVB-T channels.
p) **Max DVB-T/postVBER** The maximum possible value of BER after Viterbi decoder for DVB-T channels.
q) **Min MER DVB-T2/QPSK** The minimum possible MER value for DVB-T2 channels of the QPSK modulation.
r) **Min MER DVB-T2/QAM16** The minimum possible MER value for DVB-T2 channels of the QAM16 modulation.
s) **Min MER DVB-T2/QAM64** The minimum possible MER value for DVB-T2 channels of the QAM64 modulation.
t) **Min MER DVB-T2/QAM256** The minimum possible MER value for DVB-T2 channels of the QAM256 modulation.
u) **Max DVB-T2/preLBER** The maximum possible value of BER before LDPC decoder for DVB-T2 channels.
v) **Max DVB-T2/postLBER** The maximum possible value of BER after LDPC decoder for DVB-T2 channels.

To fine tune a parameter, select it by the ▲ and ▼ keys, and then scroll to the required values by the ◄ and ► keys. You can switch off checking of any limit plan parameter in the channel data logger by setting it to **OFF**.

4.4.3.3 Creating New Limit Plan

To create a new limit plan, press **F2**. Enter the plan name in the dialog and press **MENU/ENTER**. Edit the limit plan parameters or its name, if necessary.

4.4.4 Channel Data Logger

4.4.4.1 General Information

The Channel Data Logger is intended for TV channel parameter measurement in accordance with one of the channel plans, and for checking their correspondence to the selected limit plan. The Analyzer allows saving the measurement and check results into the memory with time and date thereof. The Channel Data Logger allows viewing the measurement results and errors in different parameters, and uploading the data onto your PC for further processing and report preparation.

4.4.4.2 List of Channel Data Logger Pages

This mode allows performing all the available operations with the channel data logger pages: viewing, deleting and creating of new pages. See the screen views in figure 4.15:

Figure 4.15

The screen shows the list of channel data logger pages. For each page the following information is shown: status, page name, date and time of updating, the names of the related channel and limit plans.

Press **F1/Page** to open the pop-up menu with the list of available commands:

a)	**Open**	Checking the selected page.
b)	**Graph**	Viewing the selected page in the Scan Mode.
c)	**Delete**	Deleting the selected plan.

Press **F2/Add** to add a new page, press **F3/Run** to start the page scanning (measurement), and press **F4/Sort** to select the page sorting type (by the date of the last updating, by status or by the page name) in the table.

The status icon shows the page state:

⚪	Grey indicator	Page created, but not scanned
🔴	Red indicator	Page scanned, errors found
🟢	Green indicator	Page scanned, no errors found

After pressing F3/Run the screen will display a table with parameters set in process of Channel Data Logger creation and with an active AMP Powering indicator. In this case you have to select the Amp Powering mode: Off - scanning (measurement) mode without Amp Powering, 12V - scanning mode with the 12V/0.1A power source.

4.4.4.3 Viewing and Checking Channel Data Logger Page

See the screen view of the channel data logger page in figure 4.16. The table contains the channel number, name and frequency, and also the measured parameters. If any errors are found in the channel parameter values, this channel number will be shown against the red background.

If the current channel is digital, the **D** value will be shown in **V/A** parameter field. Dashes in the value field mean that this parameter measurement is turned off in the channel plan or that it is not measured for this type of channel. The nolock 🔓 icon in the **MER**, **preBER**, **postBER** value field for the digital channel shows that the channel synchronization has not been achieved during the measurement.

For DVB-T2 channels with several PLP streams, the first line shows the signal level, and the rest lines show the measured digital parameters of the streams. The quantity of measured PLP streams and their

numbers are assigned in the channel plan (see Section 4.4.2.2). If the DVB-T2 channel has only one stream, all measurements will be displayed in one line, and the PLP number will not be indicated.

Figure 4.16

The following commands can be accessed by the functional keys:

a) **F1/ Info**   Viewing the detailed channel data.
b) **F2/ Graph**   Viewing the table in the Scan mode.
c) **F3/ Run**   Scanning the channel data logger page.

To identify the errors after the limit test, open the table of the detailed channel data (**F1**). The test parameter table will appear on the screen (figure 4.17).

Figure 4.17

In this table you can see the parameters for the measured data to be verified with according to the limit plan, and also the measured parameters of the current channel. The line above the table header indicates the number, name and type of channel and the number of the PLP stream. The parameter value field is highlighted in red if it failed the limit test. If the parameter measurement is turned off in the channel plan, the parameter value will not be displayed. If the parameter test is turned off in the limit plan, it will have "**---**" value in the limits field. Using the ◄ and ► keys, you can scroll through the channels without exiting the test parameter table. To switch between the channels with errors, use the **F2** and **F3** keys.

4.4.4.4 Deleting Channel Data Logger Page

To delete a channel data logger page, select Delete command in the drop-down menu. The confirmation request screen will appear. After confirmation the page will be deleted from the Analyzer memory.

4.4.4.5 Creating New Channel Data Logger Page

To create a new channel data logger page, press **F2**. The page creation window will appear on the screen (see figure 4.18).

Figure 4.18

To create a page, it is necessary to enter its name, select the channel and limit plans, and select the input attenuator mode.

4.4.5 Spectrum Data Logger

4.4.5.1 General Information

Spectrum data logger is intended for measuring the signal spectrum in the defined frequency band and recording the measurement results to the Analyzer memory with the date and time thereof. Spectrum data logger allows viewing the measurement results and uploading the data to your PC for further processing and report preparation.

4.4.5.2 List of Spectrum Data Logger Pages

This mode allows performing all the operations with the spectrum data logger pages: viewing, deleting and creating of a new page. See the screen views in figure 4.19.
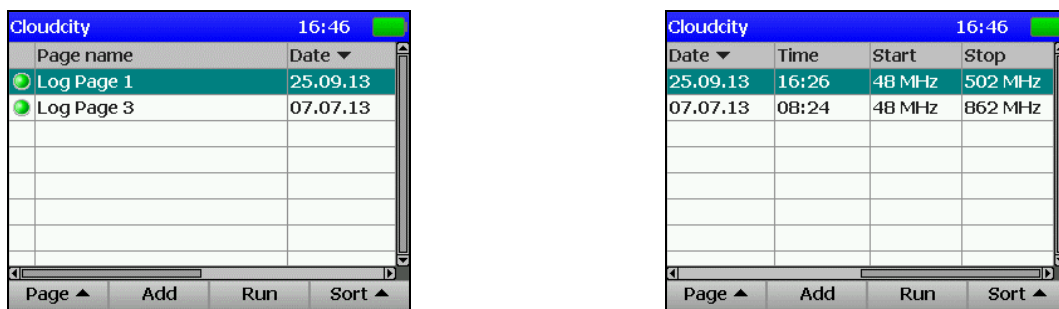
Figure 4.19

The screens show the list of spectrum data logger pages. For each page the following information is presented: status, page name, date and time of updating, and frequency scanning range.

Press **F1** to open the drop-down menu with the list of available commands:

   a) **Graph**   Viewing the selected page.
   b) **Delete**   Deleting the selected page.

Press **F2/Add** to add a new page, press **F3/Run** to start the page scanning (measurement), and press **F4/Sort** to select the page sorting type (by the date of the last updating, by status or by the page name) in the table.

The status icon shows the page state:

| | Grey indicator | Page created, but not scanned |
| | Green indicator | Page scanned |

After pressing F3/Run the screen will display a table with parameters set in process of Spectrum Data Logger creation and with an active AMP Powering indicator. In this case you have to select the Amp Powering mode: Off - scanning (measurement) mode without Amp Powering, 12V - scanning mode with the 12V/0.1A power source.

4.4.5.3 Creating New Spectrum Data Logger Page

To create a new spectrum data logger page, first press **F2**. Parameter selection screen will appear (figure 4.20). It is necessary to enter the page name, the scan limits, attenuation value, and the type of the saved trace.

The scan limits can be set by frequency or by channel numbers. You can select the method of scan limit setting by **F3**. You can either select the limits by the ◄ and ► keys, or enter the required values from the

alphanumeric keypad. The **Detector** parameter determines the type of the spectrogram: instantaneous (**Sample**), mean (**Average**), maximum (**Max**) or minimum (**Min**) spectrum values can be determined.

After tuning of all the parameters is finished, press **F1/Ok**. To cancel the page creation, press **F4/Cancel**.

Cloudcity	16:46
Page name	Log Page 4
Start	48 MHz
Stop	574 MHz
Attenuator	Auto
Detector	Average
AMP powering	off

| Ok | | Freq. ● | Cancel |

Figure 4.20

4.4.6 Memory Manager

4.4.6.1 General Information

The Analyzer is equipped with nonvolatile NVRAM device for the storage of various data of the Data Logger. The memory can contain different types of files. For IT-089 Analyzer these are: channel plan list, limit plan list, channel data log, and spectrum data log. Different configurations of IT-08 may have other file types located in the memory.

The memory Manager allows viewing the list of file types and the number of files pertaining to each type, and also formatting the memory (erasing all files).

CAUTION Please be careful when operating the Memory Manager. Incorrect actions may lead to partial or total data loss.

4.4.6.2 Operating Memory Manager

The [icon] icon in the main menu corresponds to the Memory Manager mode. See the view of the memory manager screen in figure 4.21:

Cloudcity		16:46
Free memory: 237824b (93%)		
#	File type	Files
19		0
20	ch.plan IT-089	3
21	ch.log IT-089	2
22	sp.log IT-089	2
23	lm.plan IT-089	2
24		0

| Delete | | | Format |

Figure 4.21

The table displays the file types and the number of files of each type.
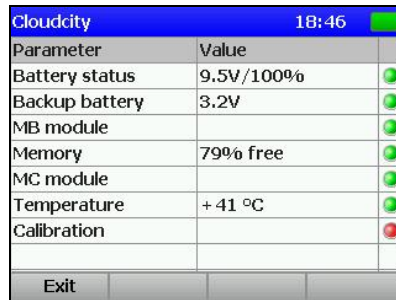
Press **F1/Delete** to delete all files of the same type, and press **F4/Format** to format (clear) the memory.

4.5 Self-Test and Configuration Modes

4.5.1 Self-Test

4.5.1.1 General Information

To check the performance of the components of IT-089 and their functional conditions, self-test mode can be used. The [icon] icon in the main menu corresponds to this mode. See the screen view in figure 4.22:


Figure 4.22

The table displays the following parameters to be checked:

a) **Battery Status**   Voltage and remaining capacity of the battery.
b) **Backup Battery**   Voltage of the standby battery.
c) **MB Module**   Condition of the Base Unit.
d) **Memory**   Remaining capacity of the Data Logger NVRAM.
e) **MC Module**   Condition of the Removable Module.
f) **Temperature**   Temperature inside the Removable Module.
g) **Calibration**   Condition of the correction factor tables.

4.5.1.2 Battery Condition

The voltage and remaining capacity parameters are intended for checking the battery condition. Check the battery condition when operating in off-line mode (power supply switched off). If the measured battery voltage is greater than 6.6 V, the green indicator will be displayed in the status position. If the voltage is less than 6.6 V, then the indicator will be red. The voltage will then be recalculated into the remaining battery capacity value in percent, which will help you to estimate the time remaining for the Analyzer to operate. You should consider that with decrease of air temperature, the battery capacity also decreases. This should be taken into account when estimating the operating time of the Analyzer.

4.5.1.3 Backup Battery Voltage

Backup battery voltage parameter is intended for checking the built-in battery. The backup lithium battery has a rated value of 3 V. If the measured battery voltage is greater than 2.5 V, the green indicator will be displayed. If the voltage is less than 2.5 V, the indicator will be red. The battery is intended for power supply to the system clock and the memory (for saving the current Analyzer settings). If the indicator turns red, the IT-089 should be sent to the repair service to have its battery replaced.

4.5.1.4 Checking Base Unit

This program checks the condition of the Base Unit components. If the test does not detect any error, the green indicator is displayed in the status position. If an error has been detected, the indicator will be red, and in this case the Analyzer should be sent to the repair service to have the defects corrected.

4.5.1.5 Checking Data Logger NVRAM

This program checks the condition of the Data Logger nonvolatile memory, NVRAM. If the test does not detect any error, the green indicator is displayed in the status position. Otherwise the indicator will be red. If the remaining capacity is less than 5%, it is recommended to delete the irrelevant files from the memory.

4.5.1.6 Checking Removable Module

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This program checks the condition of the Removable Module components. If the test does not detect any error, the green indicator will be displayed in the status field. If an error has been detected, the indicator will be red, and in this case the Analyzer should be sent to the repair service to have the defects corrected.

4.5.1.7 Removable Module Temperature

The parameter is intended for checking the temperature inside the Removable Module. Temperature is the main environmental factor, which influences the accuracy of measurements. To check the accuracy of measurements of the signal level, use the temperature parameter. If the temperature value is within the allowed range (from – 10 to + 50 ^{0}C), then the green indicator will be displayed in the status field. If the temperature is beyond this allowed range, the indicator will be red.

4.5.1.8 Calibration

This program checks the condition of the correction factor tables. If the test does not detect any error, the green indicator will be displayed in the status field. If an error has been detected, the indicator will be red, and in this case the Analyzer should be sent to the repair service to have the defects corrected.

4.5.2 Setting Regional Parameters

Regional parameter setting is intended for the Analyzer configuration in accordance to the local conditions and for the user convenience. The ![icon] icon in the main menu corresponds to this mode. The screen view is shown in figure 4.23:

Cloudcity	16:46
Parameter	Value
Language	English
Ch template	Secam D/K
Level units	dBuV
Echo units	km
Time format	24h
Date format	DD.MM.YY
Temperature units	ºC
Save	Cancel

Figure 4.23

The table contains the following parameters which are available for editing:

a) **Language**   Selecting the user interface language.
b) **Ch template**   Selecting the channel allocation standard.
c) **Level units**   Selecting the signal level measurement units.
d) **Time format**   Selecting the time display format.
e) **Date format**   Selecting of the date display format.
f) **Temperature units** Selecting of the temperature measurement units.

Use the ▲ and ▼ keys to select the required parameter, and set its value by pressing the ◄ and ► keys.

4.5.3 User Interface Setting

The parameter configuration program is intended for setting the common mode of the Analyzer operation. The ![icon] icon in the main menu corresponds to this program. See the parameter configuration screen view in the figure 4.24:

Figure 4.24

The following parameters in the table are available for editing:

a) **Theme**   Selecting the colors for the user interface elements.
b) **Key sound**   Setting the key pressing sound or turning the sound off.
c) **Volume**   Adjusting the audio indication volume.
d) **Date**   Setting the date.
e) **Time**   Setting the time.
f) **Clock adjustment**   Adjusting the clock.
g) **Auto power off**   Setting the mode of the Analyzer automatic switching off.
h) **Auto backlight off** Setting the automatic backlight switching off mode.
i) **Quick start**   Setting the Analyzer switching on.

You can select the parameters by the ▲ and ▼ keys, and set their values by the ◄ and ► keys.

The **Auto power off** parameter allows to automatically switch off Analyzer after the selected time interval from the moment of the last pressing of any key.

The **Auto backlight off** parameter allows to automatically decrease the LCD backlight brightness after the selected time interval from the moment of the last pressing of any key. This mode allows saving the battery energy.

The **Quick start** parameter is for selecting the method of switching the Analyzer on. If this parameter is set to **off**, the **Main menu** appears on the screen after the Analyzer is switched on. If the parameter value is **on**, then the last previously used measurement mode appears on the screen after the Analyzer is switched on.

4.5.4 Identification Data Readout

Identification data readout program is intended for determining the serial numbers of the modules of the

Analyzer, their modifications and firmware versions. The icon in the main menu corresponds to this mode. The screen views are shown in the figure 4.25:

Figure 4.25

You can switch between the information screens for the Base Unit and Removable Module using the ◄ and ► keys.

4.6 Operation Controlled by PC

4.6.1 General Information

You can control operation of your IT-089 TV Signal Analyzer via PC. For connection to PC use the **USB** connector on the right panel of your Analyzer. The IT-089 package contains the cable for connection to PC and a CD with the software, which allows performing the following operations:

a) Measuring level, carrier to noise (C/N) ratio and video to audio (V/A) ratio for analog channels, and level, MER and BER parameters, and constellation diagram for digital channels.
b) Measuring the spectrum within an arbitrary frequency band (from 45 to 900 MHz).
c) Viewing and saving data logger pages.
d) Editing channel plans.
e) Saving and documenting measurement results.
f) Viewing and editing limit plans.
g) PC Configuration Requirements.

4.6.2 Minimal System Requirements for Your PC

a) Microsoft Windows XP or higher operating system.
b) RAM capacity: 128 MB.
c) 25 MB of hard drive free space.
d) USB 2.0 support.

4.6.3 Software Installation

The installation of the required software is executed by the Install ViewIt08C.exe program, which performs all the actions necessary for saving the program to the computer hard drive:

a) Before installation, close the active application if it has been installed earlier. To proceed with installation you should log in under administrator's rights.
b) If you are using a CD for installation, place the CD into the disk drive. Wait till the CD menu appears on the screen and press **Install ViewIt08C**. If you received the software in a different way, just run the **Install ViewIt08C.exe** file.
c) After you have started the installation program, the installation wizard window will appear. Click **Next** to initialize installation.
d) Then select the folder in which you want to save the Analyzer program files. By default, the files are saved into **C:\Program Files\PLANAR\IT08C\ViewIT08C**. To save the files into a different folder, click the **Browse** button. Select the required path and click **OK**.
e) The following steps will be fulfilled automatically. If everything is correct, the information window indicating successful installation will appear on the screen. Click **Finish** to complete the installation.
f) After the installation has been completed, a new folder **PLANAR\IT08C\ViewIT08C** containing a shortcut for accessing the program will be created in the **Start** menu.

4.6.4 Starting Program

Connect the Analyzer to PC using the cable supplied in the package. Switch the power of the Analyzer

on and select the PC-controlled operation mode in the main menu. The icon corresponds to this mode.

For the first connection of the Analyzer to the PC, it is necessary to install the USB driver. To proceed with installation, you should log in under administrator's rights. Driver installation is executed by the standard Windows application. The driver files are located in the **Driver** folder of the Analyzer program directory (by default the path is **C:\Program Files\PLANAR\IT08C\ViewIT08C\Driver**). During installation select this folder for the required driver search.

To start the program on your PC,

a) find **PLANAR\IT08C\ViewIT08C** folder in the Windows program menu;
b) select **ViewIT08C** program.

4.7 Updating Firmware

4.7.1 General Information

The device offers the capability to update its firmware using personal computer. We go on with development of the devices and new firmware versions that provide new features. These new firmware versions come available for free download on our website www.planar.chel.ru in the section that describes the corresponding device from the IT-08 family.

The device firmware includes the operating system and the Removable Module application. The operating system is stored in the device Base Module and can be updated from the PC (see Section 4.7.2). The Removable Module application is stored in the Removable Module and also can be updated from the PC. Availability of the application on the Removable Module allows for its quick replacement without connecting the device to the PC (see Section 4.7.3).

Both the operating system and the Removable Module application have their unique version numbers of **X.X.X.X** format (e.g. *1.0.0.2*). File with the firmware build for downloading has the **itXXX_build_YYYYYY.bsk2** format, where **XXX** is the device type, and **YYYYYY** is the identification number of the build. For example, the file with the firmware build for IT-081 Analyzer dated February 28, 2012 will have the following name: **it081_build_120228.bsk2**. Also the file name may contain the reference of the firmware application to a certain device hardware version, and other data. The versions of the operating system and the Removable Module application are displayed in Identification Data Readout mode (see Section 4.5.4).

4.7.2 Updating Firmware via PC

To update your device firmware, proceed as follows:

a) copy the archive with new firmware version from our website (e.g. *it081_build_120228.zip*). This archive contains the firmware and accompanying information describing changes to it;
b) connect the device to USB port of your PC;
c) switch the power of the device on and select the mode of Operation Controlled by PC in the main

menu (the [icon] icon corresponds to this mode). If you cannot enter this mode, start the device in the mode of compulsory firmware updating. To run this mode, first press and hold "**.**" button, then turn the device on while still holding this button. If the loader is started successfully, the following message will appear at the top of the screen **IT-08 Bootloader v4.X**;
d) start **SoftwareManager** program;
e) in the **Device** drop-down list select the required device to update its firmware, and in the **File** window select the file with the new firmware version. The **File content** window with the list of available firmware versions will appear on the screen. To view the information about the required program (description, compatible hardware and software versions), click on its name. Then you will see the program information window (figure 4.26);
f) click **Update** to start the updating.

Figure 4.26

If the Analyzer functions properly, the USB-port cable is connected correctly, and the firmware to be downloaded is compatible with the Analyzer hardware, the process of program download onto your Analyzer will automatically start, and its progress will be indicated on the screen. After the download is over, the pop-up window will announce that the task has been successfully completed. The IT-089 will reboot and start operating similar to when it has been powered up.

CAUTION Do not interrupt the loading process. This can lead to malfunction of the Analyzer. If this does occur, repeat the process of program update.

4.7.3 Updating Firmware from Removable Module

The device features the possibility of saving the firmware into the memory of the Removable Module. The firmware is saved to the Removable Module automatically in the process of the Base Unit firmware updating from PC. Further on, when another Removable Module is plugged into the Base Unit, the device will automatically load the firmware from this Module in case the device has been operating with the Module of another type or if the versions of the Removable Module applications are different. The device will indicate the firmware loading process from the Removable Module by messages on the screen. After the firmware loading is finished, the device switches to the normal operating mode.

4.8 Battery Operation

The IT-089 is powered by a built-in power source with 6 NiMH AA batteries of 14.5x49.5 mm dimensions and no less than 2100 mAh capacity.

To determine the residual capacity of the batteries, use the Self-test program of the Analyzer (see Section 4.5.1). When the effective charge level of the battery drops to a critical point, you will hear the warning beep. This signifies that the time of operation until total battery discharge is approximately 5 minutes.

To charge the batteries in an appropriate charger, remove IT-089 from its Carrying Case. Make sure the Analyzer is switched off. Open the cover of the battery compartment. Carefully remove the batteries. The batteries must be charged in a charger, which is appropriate to the type of the batteries you are using.

When installing the batteries into the battery compartment, make sure that the polarity of batteries is correct. Close the battery compartment.

WARNING Incorrect installation of the batteries may damage the Analyzer or the batteries.

To charge the batteries without removing them from the Analyzer, connect the external DC power source included in the set, and power it. The batteries will keep recharging even if the IT-089 is switched off. The backlight of the Ⓘ key indicates that the power from the source is being supplied. In this case the full recharge will take from 12 to 14 hours. It is highly recommended to only recharge the batteries that are fully run-down. You should charge the batteries using the external power source once every 2-3 months in order to equalize the charge of batteries and thus increase their useful life.

5. MAINTENANCE

Required maintenance is limited to observation of instructions related to proper operation, storage, and shipment, which are supplied in this Manual and also minor defects correction.

Perform preventive inspections covering check of controls, reliability of the assembly, and the keypad condition after the warranty period has expired and annually since then.

6. TROUBLESHOOTING

Defect detection: After the IT-089 is switched on, nothing is displayed on the screen and there is no backlight.

Possible reason: Extremely low charge, malfunction, or one or several batteries missing.

Methods of correction: To check the IT-089 condition, connect the mains adapter. If the Analyzer switches on, check the batteries voltage using the self-test function (see Section 4.5.1). If the voltage is low (less than 6 V) it means that the battery or batteries are discharged, and if the voltage is high (more than 9 V) it means that the battery or batteries are faulty or missing. If the Analyzer switches on, the batteries have to be charged in case they are low (Section 4.8) or replaced if they are malfunctioning.

Possible reason: Firmware failure.

Methods of correction: Update the firmware from your computer (Section 4.7.2).

Defect detection: When the IT-089 is switched on, the following message is displayed: **Removable Module not plugged in.**

Possible reason: Firmware failure in Removable Module.

Methods of correction: Update the firmware applicable to the corresponding Removable Module from the external computer (Section 4.7.2).

Defect detection*:* High error at signal level measurements.

Possible reason: Incorrect setting of the input attenuation value.

Method of correction: Check the attenuator settings (Section 4.3.2). We recommend setting the mode of automatic selection of input attenuation.

Possible reason: Excessive wear of the RF input adapter.

Method of correction: Replace the input adapter by the proper one.

Possible reason: Incorrect setting of channel plan or channel allocation standard (template), which makes the IT-089 to tune to offset video carrier point. This can be tested in the spectrum analyzer mode.

Method of correction: Readjust the channel plan (Section 4.4.2). Check if the channel template is set correctly (Section 4.5.2).

Defect detection: The device does not turn off after pressing the ⏻ key briefly.

Possible reason: Firmware failure.

Method of correction: Press and hold the ⏻ key until the Analyzer turns off.

7. STORAGE

Store your IT-089 under the following conditions: environment temperature from -20 to +40 °C, relative humidity up to 90 % (at 30 °C).

8. TRANSPORTATION

The IT-089 must be shipped in any closed vehicle at temperature from -20 to +40 $^{\circ}$C, relative humidity 90% (at 30 $^{\circ}$C) and atmospheric pressure of 84 to 106.7 kPa (630 to 800 mm Hg).

Cargo holds, railway cars, containers, and truck beds, utilized for shipment of the IT-089 should be free from any traces of cement, coal, chemicals, etc. When shipped by air the products should be kept in aircraft sealed compartments.

9. LABELING

The serial numbers of Base Unit and Removable Module, which contain index number and date-of-manufacture code, can be found on the bottom panel of the respective item and also can be viewed on the display in identification data readout program (see Section 4.5.4).

10. WARRANTY INFORMATION

The manufacturer warrants the IT-089 DVB-T/T2 Signal Analyzer to conform to the specifications of this Manual when used in accordance with the regulations of operation detailed in this Manual.

The manufacturer will repair or replace without charge, at its option, any IT-089 DVB-T/T2 Signal Analyzer found defective in manufacture within the warranty period, which is twelve (12) months from the date of purchase. Should the user fail to submit the warranty card appropriately certified by the seller with its stamp and date of purchase the warranty period will be determined by the date of manufacture.

The warranty is considered void if:

a) the defect or damage is caused by improper storage, misuse, neglect, inadequate maintenance, or accident;
b) the product is tampered with, modified or repaired by an unauthorized party;
c) the product's seals are tampered with;
d) the product has mechanical damage.

The batteries are not included or covered by this warranty.

Transport risks and costs to and from the manufacturer or the authorized service centers are sustained by the buyer.

The manufacturer is not liable for direct or indirect damage of any kind to people or goods caused by the use of the product and/or suspension of use due to eventual repairs.

When returning the faulty product please include the accurate details of this product and clear description of the fault. The manufacturer reserves the right to check the product in its laboratories to verify the foundation of the claim.