MSQ-800 Operating Manual

Wavetek™ Series Field Meter

JDSU

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Table of Contents

Section 1: General Information

1.1 Introduction   The purpose of this Operating Manual is to introduce the design, function, and basic instructions related to operation and servicing of the MSQ-800.

MSQ-800 is designed for testing and adjustment of television and broadcasting distribution networks as well as of separate components of such networks, or other electronic devices. The MSQ-800 allows measurement of analog and digital channel levels, as well as digital QAM modulation parameters, MER and BER, for DVB-C channels.

The MSQ-800 can be used both in a lab setting, powered by an external power source, and in the field, powered by batteries or a vehicle's cigarette lighter outlet.

Performing regular maintenance procedures ensures the continued reliability of the MSQ-800. Refer to Section 5: Maintenance for the maintenance procedures and the intervals in which they should be performed.

The following abbreviations are used in this manual:

PC   - Personal Computer

LCD   - Liquid Crystal Display

DVB-C   - Digital Video Broadcasting - Cable

BER   - Bit Error Ratio

MER   - Modulation Error Ratio

QAM   - Quadrature Amplitude Modulation

1.2 Safety Precautions

Before operating the MSQ-800, make sure you thoroughly inspect the product and carefully read the related documentation to get acquainted with all safety markings and instructions.

> **WARNING**
>
> **Only trained service personnel aware of the hazards involved should perform repairs on the MSQ-800.**

> **CAUTION**
>
> **Tuning the MSQ-800 and replacing components influencing the accuracy of measurements without authorized service personnel is strictly prohibited. The components used in the MSQ-800 are purpose-made and their replacement results in inaccurate operation of the MSQ-800. To prevent the possibility of mechanical damage to the MSQ-800, follow the instructions for storage and transportation (see Section 7: Storage and Section 8: Transportation).**

Section 2: General Description and Principles of Operation

2.1 Function   The MSQ-800 measures the video carrier level, V/A ratio, and C/N ratio of analog channels, and the channel power for digital channels. For DVB-C signals MSQ-800 performs measurements of reception quality parameters: modulation error ratio (MER), bit error ratio (BER) before and after Reed-Solomon decoder (Pre & Post), and constellation diagram (via computer application MSQ-PC). MSQ-800 features AutoPlan™, the automatic defining of digital channel settings (channel frequency, symbol rate, and modulation type). The MSQ-800 also allows the measurement of the direct (DC) and alternating voltage (AC) of the remote power supply of TV and broadcasting distribution networks. Connect the MSQ-800 to a PC running the MSQ-PC software application to access additional modes.

Refer to Figure 1.1 and Figure 1.2 for pictures of the MSQ-800.

Figure 1.1
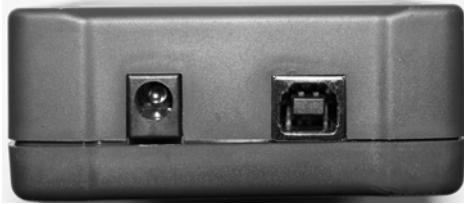
Figure 1.2

2.2 Package Contents

The MSQ-800 package includes:

a MSQ-800 MicroStealth QAM. . . . . 1 pc

b Rubber Boot . . . . 1 pc

c NiMH, AA Batteries . . . . 4 pcs

d "F"-"F" Adapter . . . . 1 pc

e 12V/1.25A Charger . . . . 1 pc

f Reference Card. 1pc

g Quick Start Guide . . . . 1 pc

h Calibration Certificate . . . . 1 pc

Section 3: Preparation for Operation

Perform an external examination to make sure your MSQ-800 is free from any visible physical or mechanical damage.

Upon receipt of the package, check the availability of the items contained in it against the list provided (Section 2.2 Package Contents).

If the MSQ-800 has been stored in an extreme environment, which exceeds the rated operating conditions, place the unit inside a temperature controlled facility corresponding to normal operating conditions of the analyzer for 2 hours prior to operation.

Section 4: Operation Procedure

4.1 Controls and Indicators

Figure 1.1 illustrates the location of controls, indicators and connectors. These elements have the following functions:

a «**F1**», «**F2**», «**F3**» function keys enable the commands corresponding to icons shown on bottom line of the screen of the MSQ-800

**b** «⌂ EXIT» key allows for returning to a previous menu level

c «**AUX**» key enables auxiliary functions

d «▲», «▼», «◄» and «►» arrows allow to edit the current operation mode

e «⌂ ENTER» key enables the current command

f «①» key switches the power of MSQ-800 on/off

g «▲ SHIFT» key enables auxiliary functions

h «⎓ 12V DC 600mA» connector is for connection to an external power source

i «**USB** ⭠⬈» connector is for interoperability with MSQ-PC

j «**INPUT**» connector is for signal input, "F"-male connector

4.2 Preparation for Measurements

Before operating your MSQ-800, carefully read this Operating Manual and familiarize yourself with the location of the controls and indicators of the MSQ-800 (Section 4.1 Controls and Indicators).

To operate the MSQ-800 using an external power source, connect the charger to the port located on the bottom of the MSQ-800 and then to the power source.

To operate the MSQ-800 in stand-alone mode, powered by the batteries, push and hold the «⏻» key until the LCD backlight turns on.

The following message appears on the screen (Figure 4.2.1):

Figure 4.2.1

The screen displays the name and model of the MSQ-800. After approximately 1 second, the MSQ-800 opens the main mode selection menu (Figure 4.3.1), further referred to as Main menu.

When you turn the MSQ-800 on for the first time, the channel template selection mode opens (Figure 4.2.2).

Figure 4.2.2

This mode allows you to select the channel template corresponding to the region of the planned operation of your MSQ-800. Use the « ◀ » and « ▶ » arrows to select the template from the following list: China, PAL B/G, PAL Ireland, PAL UK, SECAM D/K, France SECAM-L. To confirm your choice, press the **«F3»** key **(Ok)**. After the selection is made, the MSQ-800 returns to normal operation using the selected channel template. Once the channel template has been selected, this screen will not appear again. If you need to change the channel template later, use the Setup mode described in Section 4.6 Setup.

To open the help message, press the **«F2»** key **(Help)**. To close it, press the « 🔛 EXIT » key.

To exit from the channel template selection mode, press the **«F1»** key **(Skip)**. The MSQ-800 switches to normal operation, but the next time the MSQ-800 is turned on, the channel template selection screen will appear again.

4.3 Measurement Procedure

4.3.1 General Information

The MSQ-800 features an on-screen menu to select modes of operation. The icons of the menu correspond to various functions. The Main menu appears on the screen after the MSQ-800 is powered up.
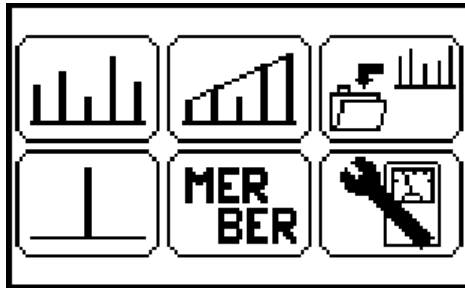

Figure 4.3.1

The Main menu shown in Figure 4.3.1 contains six icons corresponding to the following functions:

1 SCAN measurement. . . . . ⟨lılıl⟩

2 TILT measurement . . . . ⟨ıııll⟩

3 AUTOTEST . . . . ⟨📁llıl⟩

4 LEVEL measurement . . . . ⟨⊥⟩

5 MER/BER measurement . . . . ⟨**MER BER**⟩

6 Configuration . . . . ⟨🔧🖼⟩

To select the desired function in the Main menu, press the «▲» or «▼» arrow to move the corresponding icon to the bottom line of the screen. Then press the function key (**«F1»**, **«F2»**, **«F3»**) under the icon. Press the «⟨EXIT⟩» key to return to the Main menu.

To open the Configuration menu, activate the Configuration ⟨🔧🖼⟩ function. The Configuration menu appears on the screen.
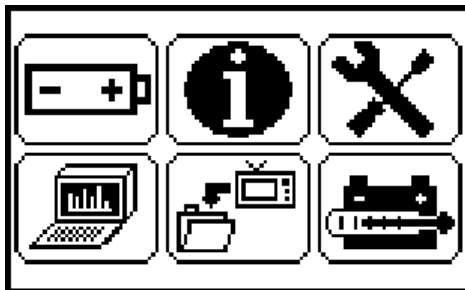
Figure 4.3.2

The Configuration menu shown if Figure 4.3.2 contains six icons corresponding to the following functions:

1 Battery Level Status . . . .

2 About Device . . . .

3 Setup . . . .

4 PC Connection. . . . .

5 Channel Plan Settings . . . .

6 Self-Test . . . .

Press the « 🔲 » key to return to the Main menu.

The MSQ-800 offers four modes to measure TV signal parameters:

> **a** Signal level and TV channel power in channel or frequency tuning, as well as alternating and direct voltage at the input of the MSQ-800 in LEVEL mode
>
> **b** TV channel levels in SCAN mode
>
> **c** TV channel level tilt in TILT mode
>
> **d** DVB-C signal reception quality parameters MER/BER

To activate the required mode in the Configuration menu (Figure 4.3.1), press the «▲» or «▼» arrow to move the corresponding icon to the bottom line of the screen and press the «**F1**», «**F2**» or «**F3**» key. Press the « 🔲 » key to return to the Main menu.

4.3.2 LEVEL Measurement Mode

The ⬜ icon in the Main menu refers to LEVEL measurement mode. In this mode the user can measure TV channel level parameters in Channel mode (Ch) and signal levels by frequency in Frequency mode (Freq).

The screen view in channel parameter measurement mode is shown in Figure 4.3.3 for the analog channel, and in Figure 4.3.4 for the digital channel.
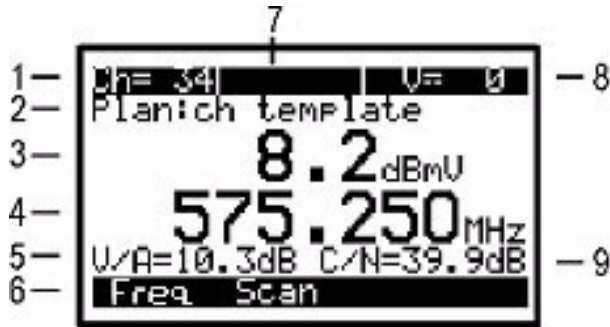
Figure 4.3.3

The following data is shown on the screen:

1 — channel number

2 — selected channel plan name

3 — channel level measured in dBmV, dBuV or dBm

4 — selected frequency in MHz

5 — V/A ratio in dB

6 — command line with commands activated by the **«F1»**, **«F2»** or **«F3»** keys

7 — channel name

8 — direct voltage or effective alternating voltage at the input of the MSQ-800, at 50/60 Hz frequency, in V

9 — C/N ratio in dB.
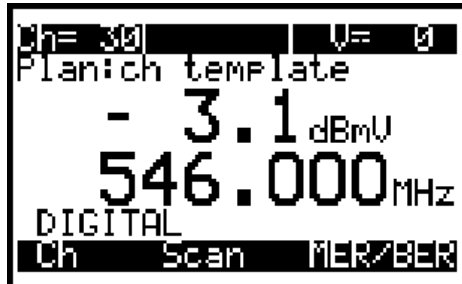
Figure 4.3.4

When the digital channel level is measured you will see DIGITAL instead of V/A or C/N on the screen.

When you open LEVEL mode, the channel plan name is indicated by "**Plan:**" on the second line from the top while operating in Level mode. If the channel plan has not been selected, in this position you will see **ch template**. When the LEVEL function is activated, the MSQ-800 measures the parameters of the TV channel which was last selected in one of the measurement modes. The channel property DIGITAL/ ANALOG corresponds to the selected channel plan. If the channel plan has not been selected, the modulation type is determined automatically.

Three parameters are measured for analog channels. Video carrier level is measured in the frequency point defined according to the channel allocation standard for operation without channel plan. If the channel plan has been selected, the frequency point is taken from this channel plan. To determine V/A ratio, the MSQ-800 measures the audio carrier, which is defined according to the channel allocation standard. The V/A value is displayed on the screen in position 5 (Figure 4.3.3).

To measure C/N ratio the MSQ-800 performs measurement in the frequency point with the lowest content of the useful components of Radio Frequency (RF) signal within the channel bandwidth. If a channel plan has been selected the measurement frequency is defined by the channel plan. If a channel plan has not been selected, it will be defined according to the channel allocation standard. C/N ratio appears in position 9 (Figure 4.3.3). The C/N ratio is calculated by the following formula:

$$C/N = Uch - Unoise - 10Lg (Bch/Bm) - K$$

C/N   - carrier to noise ratio value

Uch   - actual channel power

Unoise   - noise level

Bch   - digital channel bandwidth

Bm   - measured channel bandwidth

K   - correction coefficient

For digital channels the MSQ-800 uses the integration method to measure signal power within the channel bandwidth. The MSQ-800 calculates the average value by measuring the power within all of the channel bandwidths in 125 kHz increments. It then recalculates power values into an actual power value using the following formula:

$$Uch = 10Lg (U_1{}^2 + U_2{}^2 + ... + U_N{}^2) + K,$$
$$N = Bch/0.125,$$

Uch   - actual channel power

$U_1...\ U_N$ - measured level in Volts

N   - number of frequency points within the channel bandwidth

Bch   - digital channel bandwidth

K   - correction coefficient

The digital channel bandwidth value is determined by selected channel template.

Digital channel parameters (central frequency, bandwidth) are taken from the channel plan or determined automatically if no channel plan has been selected. To increase the accuracy of the measurement operating with a channel plan, set the channel parameters (Section 4.4.2 Channel Plan Editor) to their optimal values.

The range of voltage measurement at the MSQ-800 input is from 10 to 100 V. The absolute error of the measurement is lower than ±1.5 V. The measured value of the voltage is indicated in position 8 (Figure 4.3.3). If the voltage is direct (DC), V= appears on the screen, if it is alternating (AC) then V~ appears.

To measure channel parameters, use the « ◀ » and «▶» arrows to select the required channel.

If no channel plan is selected, use the « ◀ » and «▶» arrows to switch to any channel according to the appropriate TV standard (Section 4.6 Setup). Once a signal is detected, the MSQ-800 automatically determines the channel type, noise measurement frequency, and digital channel bandwidth.

If one of the channel plans has been selected (Section 4.6 Setup), tuning is performed between the channels of the plan. In this case the channel name from the channel plan is shown in position 7.

You can access other measurement modes using the function keys. The **«F1»** key activates the mode of signal level measurement in a frequency point. The **«F2»** key opens SCAN mode (Section 4.3.3 SCAN Measurement Mode). The **«F3»** key opens MER/BER measurement mode (Figure 4.3.5) if the selected channel is digital.

Figure 4.3.5 shows the screen in the signal level measurement in a frequency point.
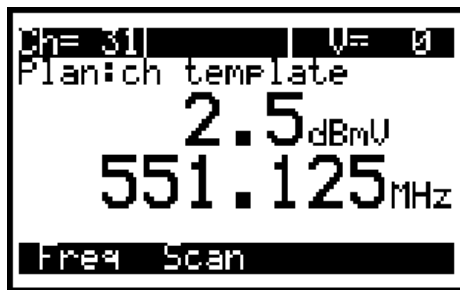
 Figure 4.3.5

In this mode, V/A ratio, C/N ratio as well as the DIGITAL message are not displayed.

In the signal level measurement in a frequency point mode the level is measured at the selected frequency. This mode is indicated by a Freq message in the command line. Tuning to the frequency is performed in 125 kHz increments using the « ◀ » and «▶» arrows.

Using the **«F1»** and **«F2»** keys you can select channel parameter measurement mode or switch to SCAN mode (Section 4.3.3 SCAN Measurement Mode).

4.3.3 SCAN
Measurement Mode

The ⎍⎍⎍⎍ icon in the Main menu refers to the SCAN measurement mode. This mode displays the signal levels as a bar graph. See Figure 4.3.6.
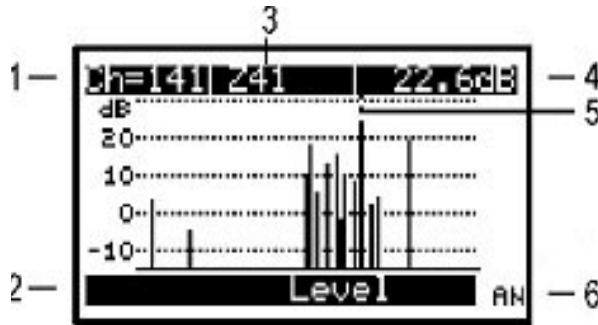
Figure 4.3.6

The following data is displayed on the screen:

1 — number of channel indicated by marker

2 — command line with commands activated by **«F1»** or **«F2»** keys

3 — channel name

4 — measured level of channel indicated by marker, in dBmV, dBuV or dBm

5 — marker

6 — channel status AN/DG (analog/digital)

Use the « ◄ » and «►» arrows to navigate the marker.

If no channel plan has been selected, all channels of the channel allocation standard are displayed on the screen. Channel modulation type is determined automatically when you open the mode and what is shown by the progress indicator (channels scanning). The modulation type of the channel indicated by the marker is shown in position 6 while the measurement is being performed.

If one of the channel plans has been selected, the scanning is only performed over the selected channels. Navigation by using the « ◄ » and «►» arrows is only fulfilled within the selected channel plan. The channel name is displayed in position 3, modulation type is displayed in position 6.

In SCAN mode the MSQ-800 applies an estimating method to determine the digital channel level. The estimating method measures the signal level in the central point of the channel and then recalculates it into a channel level value using the the following formula.

$$Uch = Um + 10Lg\ (Bch/Bm) + K$$

Uch   - actual channel power

Um   - measured level in the central point

Bch   - digital channel bandwidth

Bm   - measured channel bandwidth

K   - correction coefficient

This method helps accelerate the measurement process but gives additional error when the digital channel has high ripple.

The graph reference level shown in Figure 4.3.6 is automatically set to the channel with the maximum level.

Use the function keys to access other measurement modes. If the selected channel is digital, the **«F1»** key opens MER/BER measurement mode (Section 4.3.5 MER/BER Measurement Mode). The **«F2»** key opens the LEVEL measurement mode (Section 4.3.2 LEVEL Measurement Mode) in either analog or digital mode.

4.3.4 TILT Measurement Mode

The ⎡⏹⎤ icon in the Main menu refers to the TILT measurement mode. This mode displays signal levels as vertical bars and the tilt line between the peaks of the two selected channels. See Figure 4.3.7.
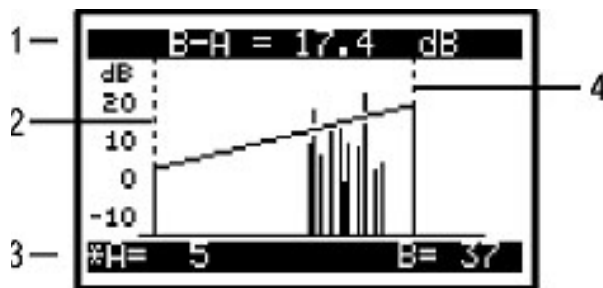
Figure 4.3.7

The following data is displayed on the screen:
1 — channel tilt value between A and B markers

2 — A marker

3 — marker setting command line with current status indication

4 — B marker

Use the «◄» and «►» arrows to adjust the marker position and the **«F1»** and **«F3»** keys to select the marker. The selection is indicated by an asterisk in the command line.

If no channel plan is selected, all channels of the channel allocation standard are displayed on the screen. Channel modulation type is determined automatically when you open the mode and what is shown by the progress indicator (channels scanning).

If one of the channel plans has been selected, the scanning is only performed over the selected channels. Navigation by using the «◄» and «►» arrows is only fulfilled within the selected channel plan.

The graph reference level shown in Figure 4.3.7 is automatically set to the channel with the maximum level. The marker positions are saved into memory and restored once you open TILT measurement mode again.

4.3.5 MER/BER
Measurement Mode

The MER/BER icon in the Main menu refers to MER/BER measurement mode. This mode displays the table of the parameters featuring the input DVB-C signal quality. See Figure 4.3.8.

Figure 4.3.8

The following data is displayed on the screen:

1 — channel number

2 — selected channel plan name

3 — selected frequency + frequency shift in MHz

4 — modulation type QAM64 or QAM256 / Symbol rate in Msps

5 — MER value in dB

6 — preBER value

7 — postBER value

8 — command line with commands activated by the **«F1»** or **«F3»** keys

9 — channel name

10 — demodulator status

When this mode is activated, or tuning to a channel is performed, the MSQ-800 starts the input signal synchronization process, which is indicated by a progress bar in position 10. The LOCK message appears in position 10 once synchronization is achieved. Some time later MER, preBER and postBER measured values appear in positions 5, 6, 7.

To measure channel parameters, select the required channel using the « ◄ » and « ► » arrows.

If no channel plan is selected, use the « ◄ » and « ► » arrows and switch to any channel according to the appropriate TV standard (Section 4.6 Setup). Once a signal is detected, the MSQ-800 automatically determines the modulation type, symbol rate and spectrum inversion.

If one of the channel plans has been selected (Section 4.6 Setup), the tuning is performed between the digital channels of the plan. In this case the channel name from the channel plan is shown in position 9. The channel parameters are taken from the channel plan. If the selected channel plan does not include any digital channels, tuning to channels is not performed.

You can access other measurement modes using the function keys. The **«F1»** key activates SCAN measurement mode (Section 4.3.3 SCAN Measurement Mode). The **«F3»** key activates LEVEL measurement mode (Section 4.3.2 LEVEL Measurement Mode).

4.4 Autotest

4.4.1 General Information

The Autotest function provides automation of measurement and result recording procedures. The MSQ-800 offers two Autotest tools; Channel Plan Editor and Channel Autotest. The memory capacity allows you to save up to 16 channel plans (up to 112 frequency points per plan), and up to 130 Channel Autotest files (with maximum number of channels). The MSQ-800 allows you to view the saved data in stand-alone mode or by using a PC.

4.4.2 Channel Plan Editor

The ⌷ icon in the Configuration menu refers to this mode. The mode allows you to view, edit, delete, and create channel plans. See Figure 4.4.1.
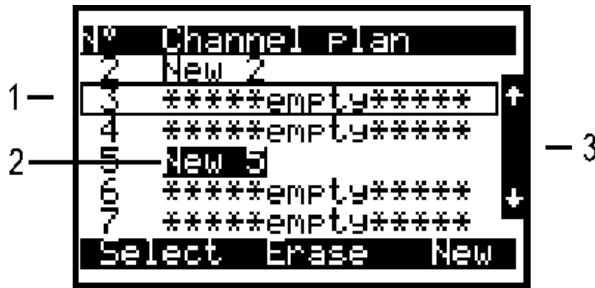
Figure 4.4.1

The list of channel plans and commands in the command line appears on the screen. The first column is the channel plan index number, and the channel plan name is shown in the next column.

Using the « ▲ », « ▼ » arrows you can select a channel plan from index number 1 to 16. The selected channel plan is framed (position 1). The scroll bar is along the right-hand side of the screen (position 3). The second column is a plan name of up to 15 characters in length. This name is assigned by the user during creation and can be edited later by the MSQ-PC program. If the channel plan is not available, it is indicated by *****empty***** message. The bottom line shows the commands that can be activated by the function keys. If a channel plan has been selected in Section 4.6 Setup, its name is highlighted in an inverse color (position 2).

The following is a list of available commands:

1 Select. Activate by pressing the «**F1**» key. Allows you to view and edit the selected channel plan.

2 Erase. Activate by pressing the «**F2**» key. Allows you to delete the selected channel plan.

3 New. Activate by pressing the «**F3**» key. Allows you to create a new channel plan in automatic mode.

4.4.2.1 Channel Plan Editing

To view and edit a channel plan, select the required channel plan and press the «**F1**» key. See Figure 4.4.2.

 Figure 4.4.2

The table represents a list of channels that make up the channel plan. The top line divides the table into columns. The first column is the frequency point number (from 1 to 112). The second column is the number of the TV channel covering the frequency point. The third column displays the channel modulation type as either analog or digital. The fourth column is the channel name of up to 6 characters. The bottom line shows the commands that can be activated by the function keys. These commands are as follows:

1 Select. Activate by pressing the «**F1**» key. Allows you to view and edit the selected frequency point.

2 Save. Activate by pressing the «**F2**» key. Allows you to save the channel plan and exit the table.

3 Erase. Activate by pressing the «**F3**» key. Allows you to delete the selected frequency point.

To edit a frequency point, select the required channel by using the
« ▲ »and « ▼ » arrows (the selected line will be framed, position 1).
Then press the **«F1»** key. The table of frequency point parameters
shown in Figure 4.4.3 appears.
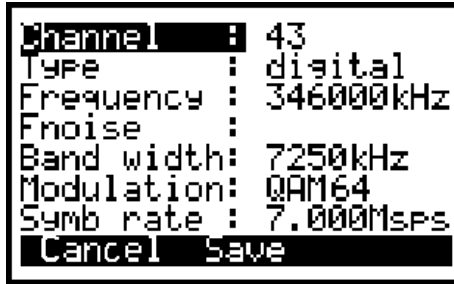
Figure 4.4.3

The seven parameters available for editing are as follows:

1   Channel: channel number

2   Type: channel type: analog/digital

3   Frequency: frequency of the video carrier for analog channel or
central frequency for digital channel

4   Fnoise: frequency shift for C/N ratio measurement for analog
channels. Can be adjusted from -8000 to +8000 kHz in 125 kHz
increments

5   Band width: channel bandwidth (for digital channels). Can be
adjusted from 5000 to 8000 kHz (but not wider than defined by the
channel template) in 125 kHz increments

6   Modulation: modulation type of digital channel. Available values
are QAM64 or QAM256. The «------» symbol indicates unknown
modulation type

7   Symb rate: symbol rate of digital channel. Can be adjusted from 5
to 7 Msps

The initial values of the parameters are set during automatic detection
of a channel plan and can be edited using the frequency point editing
function.

When a new channel plan is created (Section 4.4.2.3 Channel Plan Creating using Autoplan™) the channel parameteres are automatically set to the following values:

1 For analog channels the frequency is set to video carrier value. The noise measurement frequency defaults to 1125 kHz lower than the video carrier (-1125 kHz).

2 For digital channels the frequency is set to the central frequency of the digital channel. The channel bandwidth defaults to the value according to the active channel template.

Use the « ▲ », « ▼ » arrows to fine tune a parameter and use the « ◄ », « ► » arrows to scroll to the required values.

To save the frequency point press the **«F2»** key **(Save)**. To quit the function without saving changes press the **«F1»** key **(Cancel)**. Always check all of the parameters after the channel plan has been set. It is more convenient to determine the parameters in the spectrum measurement mode using a PC. In case of incorrect (or non-optimal) settings, fine tune the parameter manually. Otherwise, it can lead to errors in channel parameters measurements or in Autotest.

To exit from the channel plan editing mode and save the changes press the **«F2»** key **(Save)**. Pressing the « ⬆ EXIT » key confirms saving any changes and exiting from the mode. Keep in mind that when you save changes to, or delete a channel plan, all Autotest files with the corresponding channel plan are deleted.

To delete the selected frequency point press the **«F3»** key.

4.4.2.2 Channel Plan Erasing

To erase a channel plan, select the required channel plan and press the **«F2»** key. The confirmation request dialog appears. To stop erasing press the **«F3»** key. To confirm erasing of the plan press the **«F1»** key.

4.4.2.3 Channel Plan Creating using Autoplan™

To create a new channel plan automatically in AutoPlan™ mode, connect the RF signal to the input of the MSQ-800, select the desired position of the plan in the table and press the **«F3»** key. The MSQ-800 will automatically begin scanning the channels based on the selected channel template set in the initial setup of the device. When a channel

is found, the MSQ-800 will determine if it is an analog or digital signal. If the signal is a digital QAM, it will also determine the channel's bandwidth, modulation type (QAM64 or QAM256) and symbol rate (Msps).

After the MSQ-800 has completed scanning all of the TV channels, it will switch to channel plan edit mode (Section 4.4.2.1 Channel Plan Editing). Edit the channel plan parameters if needed and save the plan to memory. If no channel plan has been detected, the list of all template channels will be displayed.

4.4.3 Channel Autotest

4.4.3.1 General Information

The Channel Autotest allows you to measure parameters of TV channels within a channel plan, to check cable network parameters against the limit plan, and save the check results into memory. This function allows you to view the measurement results and errors in different parameters and download the data onto your PC for further processing and report preparation.

4.4.3.2 Channel Autotest File Manager

The [icon] icon in the Main menu refers to this mode. This mode allows you to view, delete and create new Autotest files. See Figure 4.4.4 and Figure 4.4.5.

Figure 4.4.4

Figure 4.4.5

The table of Autotest files appear on the screen (Figure 4.4.4). The top row of the table (position 1) divides the table into columns. The first column represents the file numbers from 1 to 130. The second column is the file name. The third column is the result of the check against the limit plan. Figure 4.4.5 represents the list of the channel plan names corresponding to Autotest files. The bottom line (position 3) contains the list of commands that can be activated by the function keys. Press the « ◄ » and « ► » arrows to switch between the views of the screen. Press the « ▲ »and « ▼ » arrows to select the required file. The selection will be framed (position 2).

The following is a list of available commands:

1 Select. Activate by pressing the **«F1»** key. Allows you to view, update and check against the limit plans the selected file.

2 Erase. Activate by pressing the **«F2»** key. Allows you to delete the selected file or clear all the files.

3 New. Activate by pressing the **«F3»** key. Allows you to create new Autotest files.

4.4.3.3 Channel Autotest Operation

To view a Channel Autotest file, press the **«F1»** key. Scanning data table will appear on the screen (Figure 4.4.6 or Figure 4.4.7). Two views of the table are available, for basic and digital parameters. You can switch between these views by using the **«◄»** and **«►»** arrows.

The top line of the table (position 1) divides the table into the following columns.

Column 1 - channel number
Column 2 - channel name
Column 3 - video carrier level or digital channel level in dBuV, dBmV or dBm depending on the preset units
Column 4 - V/A ratio in dB
Column 5 - C/N ratio in dB

The bottom line (position 4) contains the commands that can be activated by the function keys.

The digital parameters screen (Figure 4.4.7) displays MER (in dB) or EVM (in %) and preBER values in the second and third columns accordingly. Analog channels are described as **analog**. If during digital channel measurement no QAM decoder synchronization is achieved, a **no lock** message appears in the line.

Press the **«▲»** and **«▼»** arrows to select the required frequency point. The selection will be framed (position 2).

The following is a list of available commands:

1 Run. Activate by pressing the **«F1»** key. Allows you to repeat the measurement of the selected Autotest file.

2 View. Activate by pressing the **«F2»** key. Allows you to view the measurement results in SCAN measurement mode (Section 4.3.3 SCAN Measurement Mode).

3 Limit. Activate by pressing the **«F3»** key. Allows you to view the limit plan parameters.

To scan a file press the **«F1»** key. The scanning process is indicated by a progress bar. After scanning is complete, the new values appear in the measurement result field of the screen. If the channel name is highlighted in an inverse color, errors have been detected in this channel during the check against the limit plan.

Figure 4.4.6

Figure 4.4.7

To identify the errors, activate the limit plan manager by pressing the
«F3» key. The table of limit plan parameters appear on the screen
(Figure 4.4.8).

Figure 4.4.8

This table represents the parameters used to verify the measurement results. You can only edit the parameters using a PC. The table contains 12 parameters:

1 **Lev Vid min.** Minimum value of video carrier level for analog channel. Default value: 0 dBmV.

2 **Lev Vid max.** Maximum value of video carrier level for analog channel. Default value is 15 dBmV.

3 **Lev Dig min.** Minimum value of digital channel level. Default value is -10 dBmV.

4 **Lev Dig max.** Maximum value of digital channel level. Default value is 15 dBmV.

5 **Video/Audio min.** Minimum value of V/A ratio. Default value is 10 dB.

6 **Video/Audio max.** Maximum value of V/A ratio. Default value is 17 dB.

7 **Video/Noise min.** Minimum value of C/N ratio. Default value is 43 dB.

8 **dL adjacent max.** Maximum value of ratio between the adjacent channel levels. Default value is 3 dB.

9 **Video/Dig max.** Maximum value of ratio between analog and digital channel levels. Default value is 25 dB.

10 **MER(QAM64) min.** Minimum value of MER for QAM64 modulation. Default value is 28 dB.

11 **MER(QAM256) min.** Minimum value of MER for QAM256 modulation. Default value is 32 dB.

12 **preBER max.** Maximum value of preBER. Default value is 1E-6. Values available are 1E-4, 1E-5, 1E-6, 1E-7, 1E-8, off. If the off value is chosen, preBER parameter will not be measured when the Autotest file is updated.

To check an Autotest file against an individual parameter, select the individual parameter by pressing the «▲» and «▼» arrows and the «⬆EXIT» key. This returns you to the file table. The frequency points, which failed the check against the selected parameter, are highlighted with the channel names in an inverse color. To check the file against some other parameter, open the limit plan manager again and make a new selection.

Press the «⬆EXIT» key to exit this mode. In the confirmation request dialog box press the **«F1»** key to save the results, or the **«F2»** key to quit without saving.

4.4.3.4 Channel Autotest File Erasing

To erase a Channel Autotest file, select the required file and press the **«F2»** key. The confirmation request dialog box appears. To cancel erasing, press the **«F2»** key. To confirm erasing of the selected file, press the **«F1»** key. To confirm erasing of all files, press the **«F3»** key.

4.4.3.5 Channel Autotest File Creating

To create a new Channel Autotest file, select the required file and press the **«F3»** key. The channel plan selection screen opens. Press the «▲» and «▼» arrows to select the channel plan to be scanned. Press «⬆ENTER». The limit plan selection screen appears. Press the «▲» and «▼» arrows to select the limit plan to be used for the check. Press «⬆ENTER». Memory in the MSQ-800 can store up to 10 limit plans prepared on a PC and uploaded.

The screen displays the Autotest table with initial values (Figure 4.4.6). You can then perform all of the operations described in Section 4.4.3.3 Channel Autotest Operation; such as scanning, checking against a limit plan, and saving the file into memory.

4.5 Device Status Mode

4.5.1 General Information

The ⊟ icon refers to this mode. The self-test mode allows you to check the performance of the components of MSQ-800 and its functional condition.

Figure 4.5.1

The table in Figure 4.5.1 represents the following parameters to be checked:

1 **Temperature.** Temperature inside the MSQ-800

2 **Bat voltage.** Voltage of the battery

3 **Bat charge.** Battery level status

4 **Program mem.** Firmware status

5 **Calib table.** Calibration table status

6 **Ch plan mem.** Channel plan memory status

7 **AutoTst mem.** Channel Autotest memory status

8 **Devices.** Internal device status

4.5.2 Temperature
This function checks the temperature inside the MSQ-800. Temperature is the main environmental factor that influences the accuracy of measurements. Use the temperature parameter to check the accuracy of measurements of the signal level. If the temperature value is within the allowed range of -10 to 50°C (14 to 122°F), **Ok** status is displayed at the end of the parameter line. If the temperature is not within this allowed range, **Ok** status is not displayed. If temperature «---» value is displayed, this indicates the temperature measuring device is faulty. In this case, contact the service center.

4.5.3 Battery Level Status
The battery voltage and battery level status parameters allow you to check the battery condition. Perform this check when operating in stand-alone mode (power supply switched off). If the measured battery voltage is higher than 4.4 V, **Ok** status is indicated, if the voltage is lower than 4.4 V, **Low** status is indicated. The voltage is then recalculated into the battery level status value in percent, which helps estimate the remaining operating time for the MSQ-800. It should be noted that when ambient temperature decreases, the battery capacity also decreases. Take this into account when estimating the operating time of the MSQ-800.

4.5.4 Firmware Status
This function checks the firmware status of your MSQ-800. The **Ok** status is displayed if no errors are detected. The **Error** status is displayed if an error is detected. If an error is detected, reinstall the firmware.

4.5.5 Calibration Table Status
This function checks the calibration table status. The **Ok** status is displayed if no errors are detected. The **Error** status is displayed if an error is detected. If an error is detected, contact the the local technical assistance center (TAC).

4.5.6 Channel Plan and Channel Autotest Memory Status
This function shows the free memory in percent for each memory type.

4.5.7 Internal Device Status
This program checks the condition of the MSQ-800 components. The **Ok** status is displayed if no errors are detected. The **Error** status is displayed if an error is detected. If an error is detected, contact the service center.

4.6 Setup   The ⬚ icon in the Configuration menu refers to this mode. The setup mode allows you to modify the general parameters of the MSQ-800.
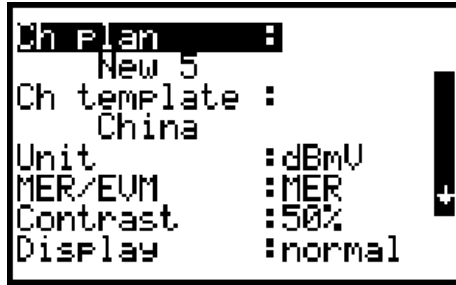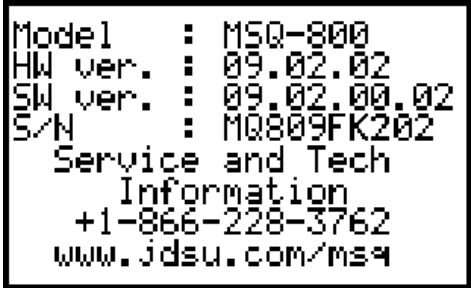

Figure 4.6.1

The table in Figure 4.6.1 represents the following settings:

1   **Ch plan.** Select channel plan from the available channel plans (Section 4.4.2 Channel Plan Editor). **ch template** is displayed if a channel plan is not selected

2   **Ch template.** Select channel template. Available settings are China, PAL B/G, SECAM D/K, PAL UK, PAL Ireland, and France SECAM-L

3   **Unit.** Select measurement units for the signal level: dBuV, dBmV, dBm

4   **MER/EVM.** Select MER (dB) or EVM (%)

5   **Contrast.** Set LCD contrast from 0 to 100%

6   **Display.** Select display mode. Available settings are normal - white characters in the blue background and reverse - blue characters in white background

7   **Sound.** Select key pressing sound. Available settings are off - silent and type1, type2, type3 - three types of sound.

4.7 Information   The ![info icon] icon refers to this mode. The Information function allows you to determine the MSQ-800 model, serial number, modification and firmware version. See Figure 4.7.1.

 Figure 4.7.1

The data for your MSQ-800 is displayed in the upper part of the screen:

1   Model. MSQ-800 model

2   HW ver. Hardware version

3   SW ver. Firmware version

4   S/N. MSQ-800 serial number

The service center telephone number and the link to the webpage describing the MSQ product is located in the lower part of the screen.

4.8 Battery Operation   The MSQ-800 is powered by four NiMH batteries. One battery measures 14.5 x 49.5 mm and has a battery capacity rating of no less than 1600 mAh and no greater than 1900 mAh.

To determine the battery level status, use the self-test function of the MSQ-800 (Section 4.5.3 Battery Level Status). When the effective charge level of the battery drops to the critical point you will hear a warning beep. This signifies that the time of operation until total battery discharge is a few minutes.

To charge the batteries in an external battery charger, turn the MSQ-800 off. Open the cover of the battery compartment using a screwdriver. Carefully remove the batteries. Charge the batteries in a charger appropriate to the battery type you are using.

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

⚠️ **WARNING**

Incorrect installation of the batteries may lead to damage to the MSQ-800 or the batteries. Do not use alkaline batteries or batteries of any other type than specified.

To charge the batteries without removing them from the MSQ-800, connect the MSQ-800 to an external 12 V DC power source, such as the supplied charger, or to your vehicle's 12 V cigarette lighter socket. The MSQ-800 will switch on in operating mode.

The MSQ-800 determines the optimal mode of battery charging based on battery charge status. The charging of fully discharged batteries takes approximately 12 hours.

The 🔋 icon in the auxiliary menu refers to the charging manager function.
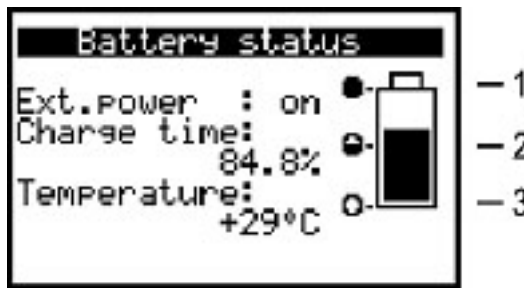
 Figure 4.8.1

The screen shown in Figure 4.8.1 displays the following three parameters:

1   Ext.power. Availability of external power source. If powered from an external power source, the value is **«on»**. If powered by the batteries, the value is **«off»**.

2   Charge time. Charging time in percent. 12 hours correspond to 100%.

3   Temperature. Temperature inside the MSQ-800.

Battery charging automatically turns on when an external power source is connected to the MSQ-800. The protection circuit cuts off the charging process when the temperature in the battery compartment is higher than 50°C (122°F). It is important to not charge the batteries when the ambient temperature is greater than 35 - 40°C (95-104°F). The temperature value will blink on the screen when the temperature is higher than 40°C (104°F). We do not recommend charging the batteries under high temperature conditions.

After the batteries are fully charged, the MSQ-800 cuts off the battery charge current. The charging progress is indicated in the right-hand part of the screen as a filling battery.

If no external power supply is used, the indicator shows the battery level status (Figure 4.8.1):

Top 1 - fully charged

Middle 2 - partly charged

Bottom 3 - fully discharged

Section 5: Maintenance

Follow the instructions in this Operating Manual for the proper operation, storage and shipment of the MSQ-800.

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

Section 6: Troubleshooting

Defect detection: The MSQ-800 fails to switch on in stand-alone mode.

1 *Possible reason:* Extremely low charge, malfunction, improper installation, of one or more of the batteries.

Methods of correction: To check the MSQ-800 condition, connect the charger. If the MSQ-800 switches on, check the battery voltage in self-test mode (Section 4.5.3 Battery Level Status). Low voltage (less than 4.4 V) is evidence that one or more batteries are discharged (or malfunctioning). Voltage that is higher than normal (greater than 7 V) indicates that one or more of the batteries are malfunctioning. The batteries should be charged (Section 4.8 Battery Operation) or replaced if bad.

2 *Possible reason:* Firmware failure.

Methods of correction: Re-install the firmware.

Defect detection: The MSQ-800 fails to switch on in stand-alone mode, but the LCD backlight is on.

1 *Possible reason:* The program has frozen.

Methods of correction: Push and hold the « $\boxed{①}$ » key for 5 seconds. The MSQ-800 will switch off. Release the key and switch the MSQ-800 on again.

Defect detection: High error at level measurements in some or all of the channels.

1 *Possible reason:* Wear of the RF input adapter.

Method of correction: Replace the RF input adapter with a known good adapter.

2 *Possible reason:* Incorrect channel plan setting, making the MSQ-800 tune to an offset video carrier point.

Method of correction: Adjust the channel plan (Section 4.4.2.1 Channel Plan Editing).

3 *Possible reason:* Incorrect selection of the channel template.

Method of correction: Check that the correct channel template was selected in Setup mode (Section 4.6 Setup).

Section 7: Storage

Store the MSQ-800 at temperatures between -20 to 40°C (-4 to 104°F), with a maximum non-condensing relative humidity of no more than 90% at 30°C (86°F).

Section 8: Transportation

Ship the MSQ-800 in any closed vehicle at temperatures from -20 to 40°C (-4 to 104°F), maximum non-condensing relative humidity 90% and atmospheric pressure of 84 to 106.7 kPa (630 to 800 mm Hg).

Cargo holds, railway cars, containers, and truck beds used for shipment of the MSQ-800 should be free from any traces of cement, coal, and corrosive chemicals. When shipped by air the MSQ-800 should be kept in aircraft sealed compartments.

Section 9: Enviromental Conditions

Normal operating conditions:

a ambient temperature 18 to 28°C (64 to 18°F)

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 (14 to 122°F)

b relative air humidity no greater than 90% at 25°C (77°F) temperature

c atmospheric pressure 84-106 kPa (630-795 mm Hg)

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