

CABLERANGER

FIBER-COAXIAL DOCSIS ANALYZER




-O MI 2125 -



SAFETY NOTES

Read the user's manual before using the equipment, mainly "**SAFETY RULES**" paragraph.

The symbol  on the equipment means "**SEE USER'S MANUAL**". In this manual may also appear as a Caution or Warning symbol.

WARNING AND CAUTION statements may appear in this manual to avoid injury hazard or damage to this product or other property.

USER'S MANUAL ELECTRONIC VERSION

You can access instantly to any chapter by clicking on the title of the chapter in the table of contents.

USER'S MANUAL VERSION














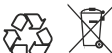
Manual Version	Web Published Date	Firmware Version
F2.1	April 2018	1.14.9

■ Please update your equipment to the latest software version available.

SAFETY RULES

- * The safety could not be assured if the instructions for use are not closely followed.
- * Use this equipment connected only to systems with their negative of measurement connected to ground potential.
- * The AL-103 external DC charger is a Class I equipment, for safety reasons plug it to a supply line with the corresponding ground terminal.
- * This equipment can be used in Overvoltage Category I installations and Pollution Degree 2 environments.
- * External DC charger can be used in Overvoltage Category II, installation and Pollution Degree 1 environments.
- * When using some of the following accessories use only the specified ones to ensure safety:
 - Rechargeable battery
 - External DC charger
 - Car lighter charger cable
 - Power cord
- * Observe all specified ratings both of supply and measurement.
- * Remember that voltages higher than 70 V DC or 33 V AC rms are dangerous.
- * Use this instrument under the specified environmental conditions.
- * When using the power adaptor, the negative of measurement is at ground potential.
- * Do not obstruct the ventilation system of the instrument.
- * Use for the signal inputs/outputs, specially when working with high levels, appropriate low radiation cables.
- * Follow the cleaning instructions described in the Maintenance paragraph.

SAFETY SYMBOLS

	DIRECT CURRENT		ON (Supply)
	ALTERNATING CURRENT		OFF (Supply)
	DIRECT AND ALTERNATING		DOUBLE INSULATION (Class II protection)
	GROUND TERMINAL		CAUTION (Risk of electric shock)
	PROTECTIVE CONDUCTOR		CAUTION REFER TO MANUAL
	FRAME TERMINAL		FUSE
	EQUIPOTENTIALITY		EQUIPMENT OR COMPONENT TO BE RECYCLED

DESCRIPTIVE EXAMPLES OF OVER VOLTAGE CATEGORIES

- * **Cat I**: Low voltage installations isolated from the mains.
- * **Cat II**: Portable domestic installations.
- * **Cat III**: Fixed domestic installations.
- * **Cat IV**: Industrial installations.

CAUTION: The battery used can present danger of fire or chemical burn if it is severely mistreat. Do not disassembly, cremate or heat the battery above 100 °C under no circumstances.

TABLE OF CONTENTS

1. INTRODUCTION	1
1.1. Description	1
2. SETTING UP	3
2.1. Package Content	3
2.2. Power	3
2.2.1. First Charge	3
2.2.2. Charging the Battery	3
2.2.3. Charge / Discharge times	4
2.2.4. Usage Tips	5
2.3. Equipment Details	6
2.4. Switching On / Off	8
2.5. Icons Table	9
2.6. Controls	10
2.7. General Settings	10
2.8. Firmware Update	10
3. MEASUREMENT	12
3.1. Spectrum Analyzer (cable & FO)	12
3.2. Scan (cable & FO)	14
3.3. Tilt (cable & FO)	17
3.4. DOCSIS Analyzer	19
3.4.1. DOCSIS DOWNSTREAM SPECTRUM ANALYZER (cable & FO)	20
3.4.2. DOCSIS BONDING GROUP (cable & FO)	23
3.4.3. RANGING (cable)	24
3.4.4. DOCSIS REGISTERING (cable)	25
3.4.5. IPTV (cable)	27
3.4.6. VoIP (cable)	29
3.4.7. DOCSIS BROWSER (cable)	31
3.5. External CM / Upstream Spectrum (cable)	33
3.6. Upstream Test (cable)	35
3.7. AC / DC Input Voltage (cable)	37
3.8. Optical Power Meter (FO)	38
4. TOOLS	41
4.1. Edit Channel Plan	41
4.2. Demodulator	49
4.3. Analog Video Carrier / HUM	51
4.4. Screenshot	52
4.5. Datalogger	54
5. SPECIFICATIONS	56
6. MAINTENANCE	66
6.1. Instructions for Returning by Mail	66
6.2. Considerations about the TFT Screen	66
6.3. Cleaning Recommendations	66

FIBER-COAXIAL DOCSIS ANALYZER

CABLE RANGER

1 INTRODUCTION

1.1 Description

The **CABLE RANGER** is the latest introduction in our CATV analyzer product range. It is an hybrid analyzer (for both fibre optics and coaxial cable) for the installation, configuration and maintenance of interactive video and data services at high speed over TV networks based on the DOCSIS standard. It also allows the qualification of VoIP and IPTV services.

The **CABLE RANGER** includes an optical measurement input allowing field technicians not only to perform optical power measurements but also to do all the RFoG related RF measurements thanks to the built-in optical to RF converter.

The **CABLE RANGER** incorporates the most advanced functions in accordance with the updates to the latest version of the DOCSIS 3.0 protocol, including channel bonding technology, which are the latest technology implemented by operators in the cable data networks.

The **CABLE RANGER** has all the functions necessary for an easy installation of any service offered by cable. In addition, its intuitive menu, its adjusted weight and strength, makes it ideal for fieldwork. The **CABLE RANGER** features a 7" professional grade resistive type touch-screen with excellent brightness and superior image sharpness that can also be used wearing gloves. The instrument is powered by an internal rechargeable battery.

In the design of the **CABLE RANGER** it has dedicated particular attention on making a practical and precise instrument, as easy to use. The touch interface allows direct access to different modes of operation and once there, it is easy to modify any parameter of the measurement.

All this makes the **CABLE RANGER** in a magnificent tool for installing and maintaining HFC (Hybrid Fibber Cable) / CATV, analog and digital systems. Being also very useful for testing DOCSIS data transmission systems.

In addition, the instrument provides Ethernet, USB and mini-USB port slots to connect to external devices, to download data and to update firmware.

Here are some of the most important functions in the **CABLE RANGER** . Spectrum Analyzer, Scan, TILT and DOCSIS Analyzer functions are performed through coaxial input and are also available for optical fiber thanks to the optical-electric converter (with the exception of Cable Modem emulation). .



Figure 1.

The **Spectrum Analyzer** function provides an analysis of the full band and allows changing the reference level and the span among others.

The **Scan** function shows the level of all active channels in the channel plan through a bar chart.

The **TILT** function measures the tilt in dB obtained from the difference in level between four carriers. It is useful for equalizing the line.

The **DOCSIS Analyzer** measures downstream, upstream and constellation. It also can emulate the Cable Modem using the internal Cable Modem. The internal cable modem functions are Ranging, Registering and IP access.

The **External Cable Modem** function connects the equipment to an external cable modem. It extracts a sample of the Upstream signal displaying its spectrums on screen.

The **Upstream test** function creates a test signal that allows you to analyze and equalize the transmission band (fix mode or sweep mode).

The **Optical Power Meter** function measures the optical power and other RFoG (Radiofrequency-over-Glass) measurements.

In addition, it includes other tools such as datalogger, screenshot, channel plan editor, etc.

In short, implementation of all these functions into an light instrument, ergonomic design and robust, makes the **CABLE RANGER** into a productive and efficient fieldwork tool for the installer.

2 SETTING UP

2.1 Package Content

Check that your package contains the following elements:

- **CABLE RANGER** Analyser.
- External DC charger.
- Power cord for external DC charger
- Car lighter charger.
- "F" Adapters
 - "F" / f - BNC / f Adapter. (2 u.).
 - "F" / f - "F" / f Adapter (2 u.).
- Support belt.
- Carrying bag.
- Monopode.
- Transport suitcase.
- Quick Start Guide.

NOTE: Keep the original packaging, since it is specially designed to protect the equipment. You may need it in the future to send the analyser to be calibrated.

2.2 Power

The **CABLE RANGER** is powered by a 7.2 V built-in rechargeable Li-Ion battery of high quality and long operation time. This equipment can operate on battery or connected to the mains using a DC adapter. An adapter is also supplied to use with the power connector car (cigarette lighter)..

2.2.1 First Charge

The equipment comes with the battery half charged. Depending on the time elapsed from first charge and environmental conditions may have lost some of the charge. You should check the battery level. It is advisable a first full charge.

2.2.2 Charging the Battery


Connect the DC power adapter to the equipment through the power connector on the left side panel (see figure).



Figure 2.

Then connect the DC power adapter to the mains via the mains cord. Ensure that your mains voltage is compatible with the adapter voltage.

For a fast charging of the battery is necessary to switch off the equipment.

If the equipment is ON, the battery charging will be slower, depending on the type of work you are doing. When connecting the equipment to the mains the mains connected symbol  appears inside the battery icon.

The CHARGER led indicator shows the battery status:

- **Red:** Battery charging.
- **Off:** Battery full charge.

When switching on the equipment, the battery voltage is checked. If the tension is too weak to start, the equipment does not start up. In this case please charge the battery immediately.

2.2.3 Charge / Discharge times

Average charging time with the equipment off (fast charge):

- 3 hours to achieve an 80% charge.
- 5 hours to achieve an 100% charge.

With the equipment on (slow charge):

- 5 hours to achieve an 80% charge.
- 8 hours to achieve a 100% charge.

Average discharge time:

- With the battery at full charge the average battery time is 3 hours.
- With the battery at 80% charge the average battery time is 2 hours.

2.2.4 Usage Tips

The battery is losing storage capacity as you go through its life. Contact your **PROMAX** distributor when necessary to replace the battery.

To prolong battery life the user should follow these tips:

- In case of providing a long inactivity period of the equipment it is advisable to make every 3 months a charge / discharge cycle and a subsequent partial charge (40% aprox.).
- It is advisable to keep it in a cool place and away from heat.
- You should avoid keeping the battery for a long period of time at full load or fully discharged.
- There is not necessary to wait to fully discharge before a charge because these batteries have no memory effect.

2.3 Equipment Details



Figure 3. Front View.



Figure 4. Side View.



Figure 5. Top View.

2.4 Switching On / Off


► Switching On:



- 1 Press the on/off button located on the side of the equipment.
- 2 The boot screen appears. After the system load, the last screen before shutdown appears.

► Switching Off:

1 There are two options:

■ **Option 1:** Press the on/off* button located on the side of the equipment.

A gray screen with a red power off icon  will appear. Click on this icon to turn off the equipment or outside the icon to cancel power off.

■ **Option 2:** Press on the menu icon  located at the screen upper right corner. Next press on the power off icon at the bottom right corner. A gray screen with a red power off icon  will appear. Click on this icon to turn off the equipment or outside the icon to cancel power off.

2 The equipment keeps its last status which is recovered when power on.

2.5 Icons Table




















TOUCH ICONS	INDICATIVE ICONS
 Screenshot	 Cable measures
 Back to previous screen	 Fibre optics measures
 Back to main screen	 USB flashdrive connected and detected
 Access to screenshots	 Connected to Ethernet network
 Access to dataloggers	 Battery charging
 Access to user manual	 Battery not charging. Green level indicates battery left
 Access to settings menu	 Low battery
 Switch off	
 Increase value	
 Decrease value	
 Edit value	
 Select parameter	

Figure 6.

*. In case of crashing, press and hold on/off button until it turns off.


2.6 Controls

The equipment can be fully operated using the touch panel..

These actions can be done through the touch panel:

- **Menu Selection.**
- **Frequency or channel selection.**
- **Frequency or channel scroll.**
- **Reference level scroll.**
- **SPAN selection.**
- **Virtual keyboard writing (numerical and alphabetical).**

2.7 General Settings

From the Home screen, clicking on the menu icon  you Access General Settings:

- **Edit channel plan:** It allows you to edit a channel plan (refer to "Edit Channel Plan" chapter).
- **Language:** It allows you to select a language among English, Spanish, French or German.
- **Time:** It allows you to select time format (12/24) and set time.
- **Date:** It allows you to select date format (ddmmaa/mmddaa) and set date.
- **Sound:** It allows you to set sound level and enable or disable beep.
- **Display:** It allows you to set backlight level.
- **Equipment information:** It shows serial number, software version and other technical data.
- **Ethernet Configuration:** It allows you to select type of connection (manual/DHCP/Bridge) and network data (IP, Netmask, Gateway, DNS1, DNS2).

2.8 Firmware Update

Keep your device up to date for the latest improvements and features. Follow us on social networks (twitter, Facebook, linkedin, Google+) to get information about updates and latest news. To update follow these steps:

- 1 Use a USB flash drive in FAT32 format.

- 2 Click [here](#) to download file with the latest firmware available or download from the download area at PROMAX website (www.promaxelectronics.com).
- 3 Copy the update file (update_usb.tar) to the flash drive root (do not unzip the file).
- 4 Turn OFF the **CABLE RANGER** and insert the flash drive into the USB port.
- 5 Turn ON the **CABLE RANGER**. The update process start automatically. Wait until the equipment turns OFF.
- 6 Remove the flash drive.
- 7 Press the ON/OFF button for more than 5 seconds until the equipment turns OFF.
- 8 Turn ON again.

3 MEASUREMENT

3.1 Spectrum Analyzer (cable & FO)



► Description

The **SPECTRUM ANALYZER** function shows on screen the spectrum of the signal received through the input connector.

This function shows signals in frequency band so user can detect any problem and also measures level and demodulates signal.

User can select span and reference level by selecting a frequency or channel. He also can select detector type (maximum / minimum peak), measurement units and other parameters.

► Operation

- 1 Connect signal to the input connector:
 - **Cable:** universal connector for F/F or F/BNC adapter.
 - **Fiber Optics:** SC-APC connector.
- 2 Access home screen by pressing the HOME key .
- 3 Select **SPECTRUM ANALYZER** function according to input signal (cable or fiber). Press function on the left side of the screen for FIBER OPTICS or on the right side for CABLE.
- 4 **SPECTRUM ANALYZER** function opens.
- 5 Press DEMOD to demodulate signal and show constellation.
 - **CHANNEL tuning:** According to type of channel / channel plan it can demodulate digital, analogue or DOCSIS.
 - **FREQUENCY tuning:** According to demodulation type.
- 6 Press **HOME**  key to get back to the main screen.

► Screen Description

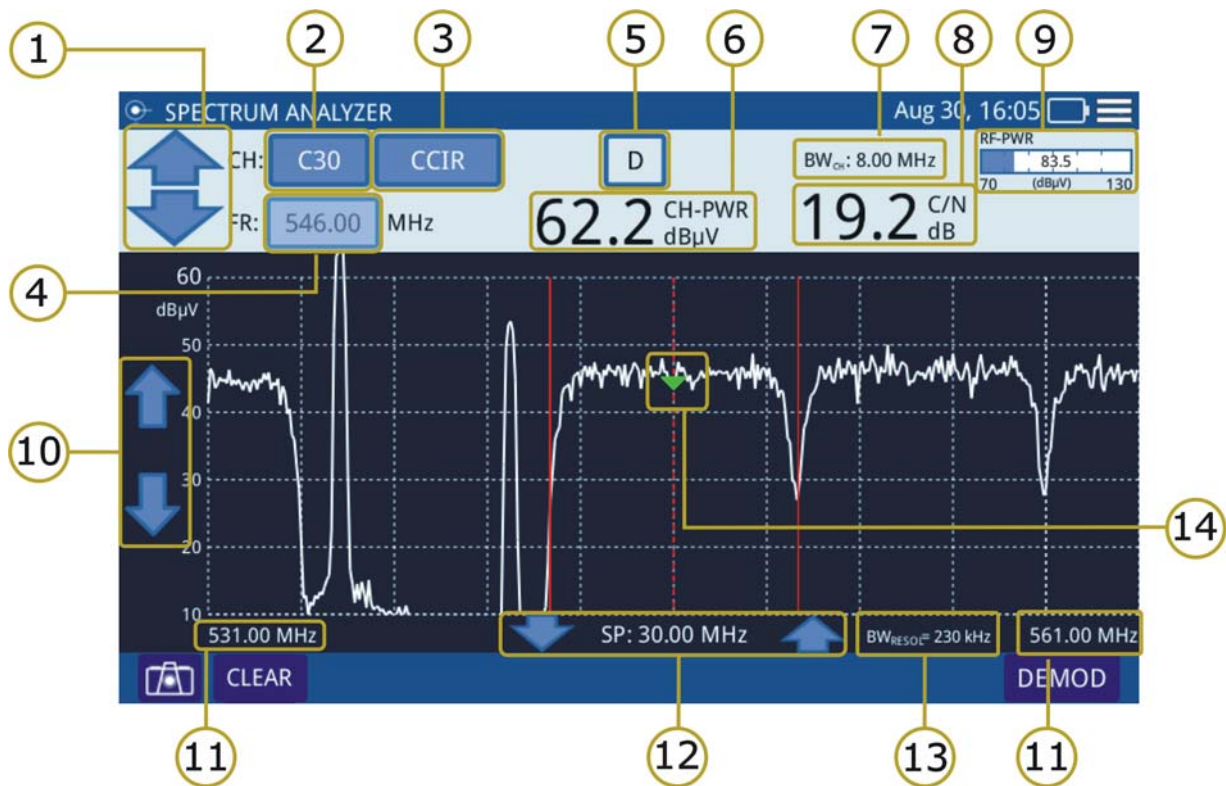



Figure 7.


- 1 Arrows to increase / decrease value of the selected parameter (channel or frequency). When a parameter is selected its background color is stronger.
- 2 Selected channel. When pressing on it deploys a list of available channels.
- 3 Selected channel plan. When pressing on it deploys a list of available channel plans.
- 4 Frequency selected. When pressing on it pops up a virtual numeric keypad to edit frequency.
- 5 It shows if the selected channel is digital (D) or analogue (A).
- 6 Channel bandwidth power.
- 7 Bandwidth of the selected channel. It is delimited by two vertical lines.
- 8 Carrier/Noise ratio of the channel.
- 9 Full band RF cable power. In FIBER OPTICS it also shows full band of fiber optics cable.
- 10 Arrows to change reference level.
- 11 Span lower and higher frequency.
- 12 Arrows to increase / decrease span. Current span.
- 13 Bandwidth resolution.
- 14 Selected marker for channel / frequency.

► Options Menu

There are some options at the bottom of the screen:

-  : Screenshot.
- **DEMOD A:** Demodulator (refer to "Demodulator " chapter).

► Settings

Click on the MENU icon  at the upper right corner to access the Settings menu. The **SPECTRUM ANALYZER** function has these options:



- **Edit channel plan:** It allows you to edit a channel plan and DBG (refer to "Edit Channel Plan" chapter).
- **Units:** It allows you to select measurement unit for power (dBuV, dBmV, dBm).
- **Reference line:** It allows you to select the reference line by numbers (-60 dBmV to +70 dBmV). Reference line allows you to define criteria in order to quickly accept or refuse channels levels.
- **Trace:** It allows you to select holding type of trace (maximal, minimum).
- **CTB/CSO:** It allows you to set parameters to measure intermodulation distortion CTB/CSO (Composite Triple Beat / Composite Second Order) that has a big influence on the net quality.
- **Frequency step:** It allows you to select full span maximum frequency (0,25 MHz, 1 MHz, 8 MHz, other value).
- **Full span maximum frequency:** It allows you to select full span maximum frequency (900 MHz, 1700 MHz, other value).
- **Wavelength (only for FO):** It allows you to select wavelength (1310 nm, 1490 nm, 1550 nm, 1590 nm).
- **Detector:** It allows you to select detector type (maximum, minimum).
- **Tuning frequency demodulation:** It allows you to set parameters to demodulate tuned frequency. User must select type of signal (digital, analogue or FM) and related parameters

3.2 Scan (cable & FO)

► Description

The **SCAN** function shows on screen signal level in graphic bar format for each one of the active channels in the selected channel plan.

► Operation

- 1 Connect signal to the input connector:
 - **Cable**: universal connector for F/F or F/BNC adapter.
 - **Fiber Optics**: SC-APC connector.
- 2 Access home screen by pressing the HOME  key.
- 3 Select **SCAN** function according to input signal (cable or fiber). Press function on the left side of the screen for **FIBER OPTICS** or on the right side for **CABLE**.
- 4 **SCAN** function opens.
- 5 Press **DEMOD** to demodulate signal and show constellation.
- 6 To quit press **HOME**  key.

► Screen Description

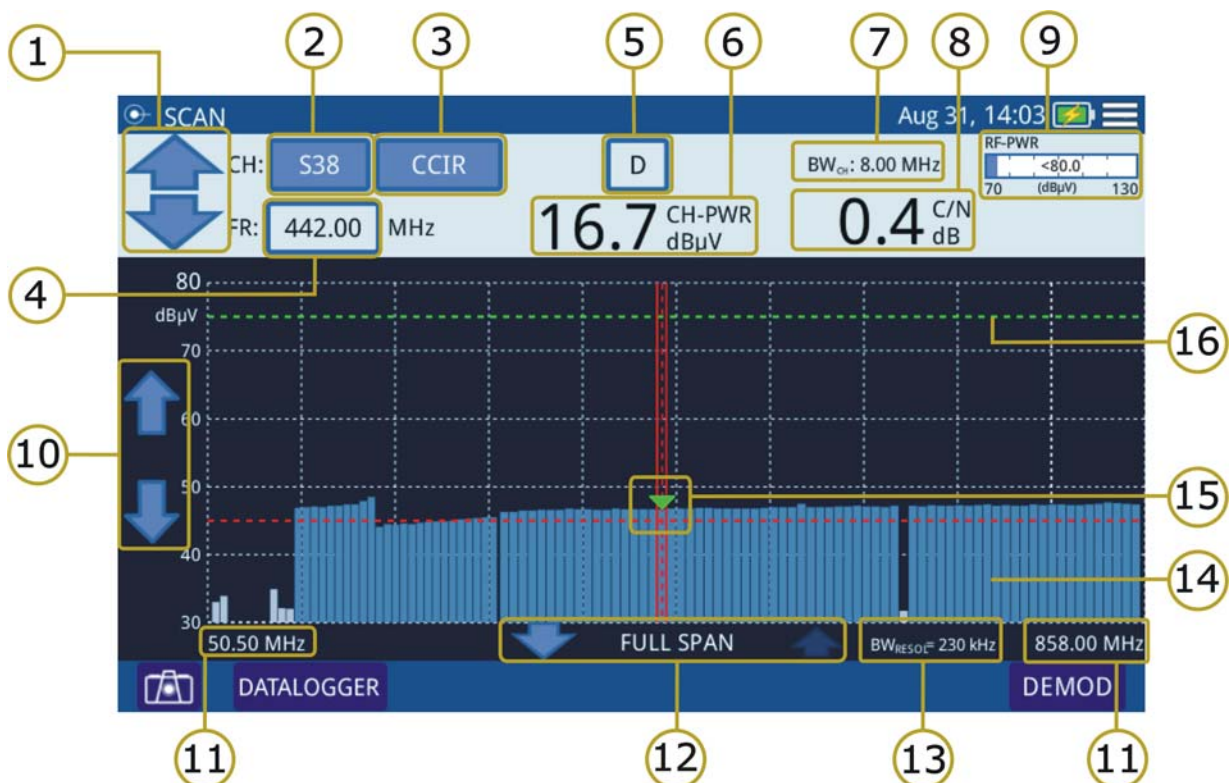



Figure 8.

- 1 Arrows to increase / decrease value of the selected parameter (channel or frequency). When a parameter is selected its background color is stronger.
- 2 Selected channel. When pressing on it deploys a list of available channels.


- 3 Selected channel plan. When pressing on it deploys a list of available channel plans.
- 4 Frequency selected. When pressing on it pops up a virtual numeric keypad to edit frequency.
- 5 It shows if the selected channel is digital (D) or analogue (A).
- 6 Channel bandwidth power.
- 7 Bandwidth of the selected channel. It is delimited by two vertical lines.
- 8 Carrier/Noise ratio of channel.
- 9 Full band RF cable power. In FIBER OPTICS it also shows full band of fiber optics cable.
- 10 Arrows to change reference level.
- 11 Span lower and higher frequency.
- 12 Arrows to increase / decrease span. Current span.
- 13 Bandwidth resolution.
- 14 Selected marker for channel / frequency.
- 15 Reference level. Maximum and minimum threshold.
- 16 Bar graph representing signal level for each one of the active channels in the channel plan.

► Options Menu

There are some options at the bottom of the screen:

-  : Screenshot.
- **LOGGER**: It creates a datalogger with measurement data.
- **DEMODO**: Demodulator (refer to "Demodulator" chapter).

► Settings Menu

Click on the **MENU**  icon at the upper right corner to access the Settings menu. The **SCAN** function has these options:

- **Edit channel plan:** It allows you to edit a channel plan and DBG (refer to "Edit Channel Plan" chapter).
- **Units:** It allows you to select a measurement unit for power (dBuV, dBmV, dBm).
- **Reference Line:** It allows you to select the reference line by numbers (-60 dBmV to +70 dBmV). Reference line allows you to define criteria in order to quickly accept or refuse channels levels.
- **Threshold:** It allows you to define minimum and maximum levels. Only channels between these levels will show on screen.

3.3

Tilt (cable & FO)



► Description

The **TILT** function is a test to measure tilt in order to equalize the line. **TILT** is the difference in amplitudes between the minimum and maximum frequency that the system can compensate.

The **TILT** function displays on-screen, graphically and numerically, the difference in level between any four frequencies previously defined as pilots. This function works for upstream and downstream band.

Typically, CATV networks transmit two pilot signals at the beginning and at the end of the band. These two pilots and two more are the ones that can be tuned simultaneously on the screen. By this way you can evaluate the losses slope and therefore readjust equalizers of the amplifiers in order to compensate these losses and ensure a flat response along the band.

► Operation

- 1 Connect signal to input connector:
 - **Cable:** universal connector for F/F or F/BNC adapter.
 - **Fiber Optics:** SC-APC connector.
- 2 Access home screen by pressing the HOME  key.
- 3 Select the **SCAN** function according to input signal (cable or fiber). Press function on the left side of the screen for **FIBER OPTICS** or on the right side for **CABLE**.
- 4 **TILT** function opens.
- 5 Press on the lower right corner to switch between upstream and downstream band.
- 6 Press **HOME**  key to get back to the main screen.

► Screen Description

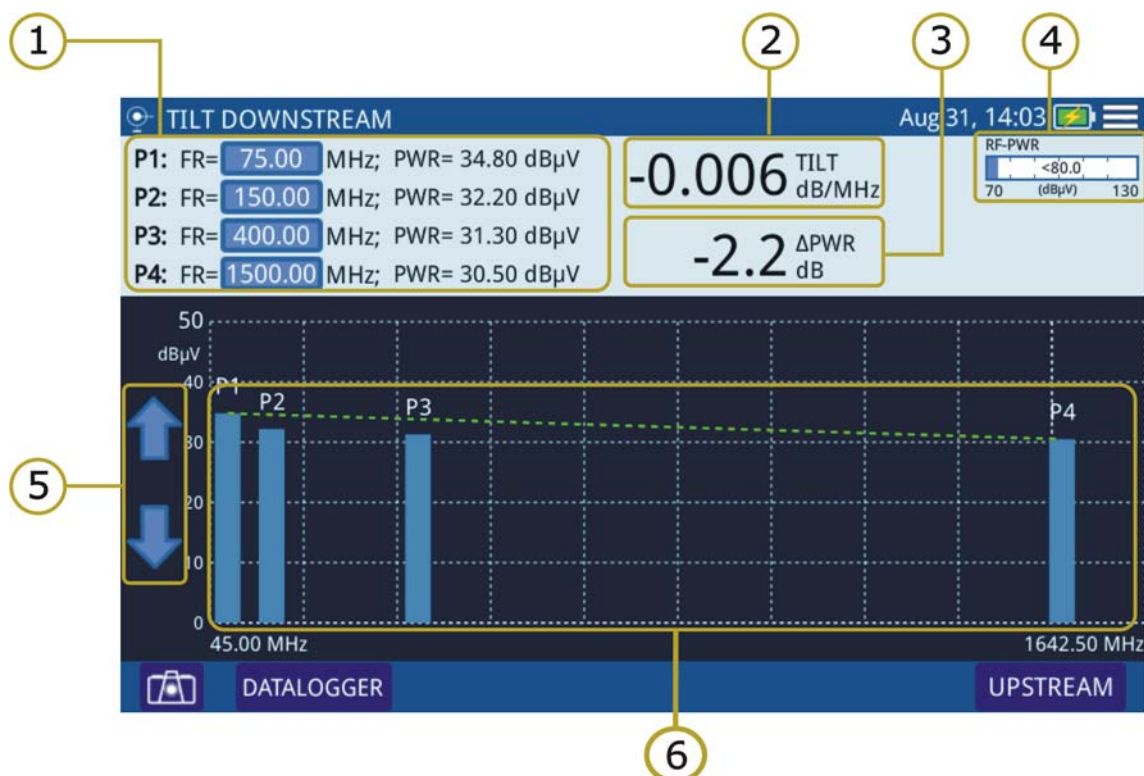



Figure 9.

- 1 P1/P4: End pilot signal. It shows pilot signal frequency and power.
P2/P3: Intermediate pilot signals. It shows pilot signal frequency and power. Press on frequency to change its value.


- 2 TILT: Inclination rate in dB per MHz.
- 3 Power difference between P1 and P4.
- 4 Full band RF cable power. In FIBER OPTICS it also shows full band of fiber optics cable.
- 5 Arrows to change reference level.
- 6 Bar graph showing signal level for each pilot signal and TILT.

► Options Menu

There are some options at the bottom of the screen:

-  : Screenshot.
- **LOGGER**: It creates a datalogger with measurement data.
- **UPSTREAM/DOWNSTREAM**: It allows you to switch between upstream and downstream band. The current band appears on the top of the screen.

► Settings Menu

Click on the  MENU icon at the upper right corner to access the Settings menu. The **TILT** function has these options:

- **Units**: It allows you to select a measurement unit for power (dBuV, dBmV, dBm).

3.4 DOCSIS Analyzer

► Introduction

DOCSIS ANALYZER includes several functions to know how works a DOCSIS / EURODOCSIS 3.0 transmission data system. It can emulate a Cable Modem by using its internal Cable Modem.


The **DOCSIS DOWNSTREAM SPECTRUM ANALYZER** shows spectrum of a signal in the Downstream band.

DBG function shows power of channels and carrier belonging to DOCSIS BONDING GROUP.

RANGING (also known as a CABLE MODEM EMULATOR) is a tool to adjust transmission parameters at the CM, such as frequency and power in order to get a stable and aligned communication between CM and CMTS.

DOCSIS REGISTERING allows you to register your equipment in the network. Once registered you can check it with IPTV, **VoIP** and **BROWSER** tools.

► Operation

- 1 Connect signal to the input connector:
 - **Cable:** universal connector for **F/F** or **F/BNC** adapter.
 - **Fiber Optics:** SC-APC connector.
- 2 Access home screen by pressing the HOME  key.
- 3 Select **DOCSIS ANALYZER** function according to input signal (cable or fiber). Press function on the left side of the screen for **FIBER OPTICS** or on the right side for **CABLE**.
- 4 **DOCSIS DOWNSTREAM SPECTRUM ANALYZER** function opens.
- 5 To analyze a **DOCSIS BONDING GROUP**, select a **DBG** and then press on **DBG**.
- 6 To perform a **RANGING** (also called **CABLEMODEM Emulation**) from the internal **CABLE MODEM** of the equipment press on **RANGING** (this function is only available for CABLE). The **RANGING** generates an UPSTREAM signal at the frequency and power required to connect to the CMTS.
- 7 Then, to work as CABLEMODEM giving and receiving information, it is necessary to register on the network. Once registered you will be able to perform the tests of IPTV, VoIP and Web Browser.
- 8 For more information about **DOCSIS ANALYZER** functions refer to next sections.

3.4.1 **DOCSIS DOWNSTREAM SPECTRUM ANALYZER (cable & FO)**

► Description

DOCSIS DOWNSTREAM SPECTRUM ANALYZER shows signal spectrum in the Downstream band.

► Screen Description

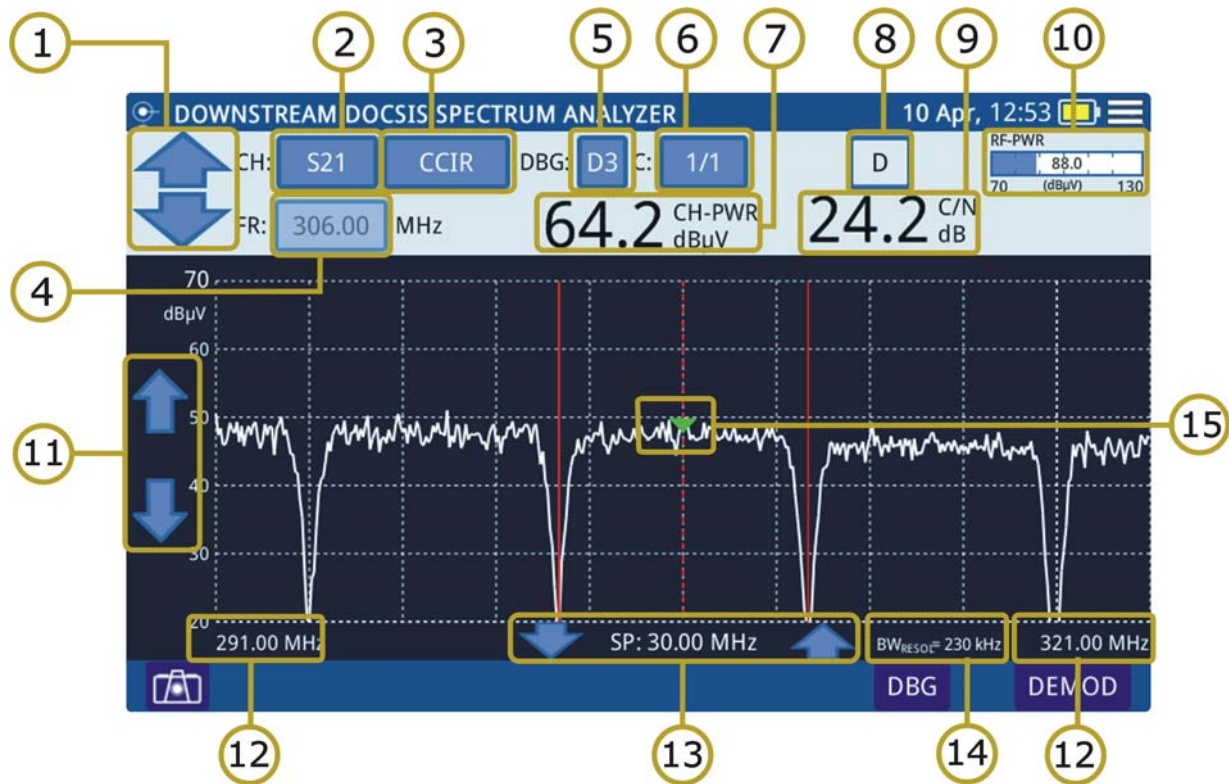



Figure 10.

- 1 Arrows to increase / decrease value of the selected parameter (channel or frequency). When a parameter is selected its background color is stronger.
- 2 Selected channel. When pressing on it deploys a list of available channels.
- 3 Selected channel plan. When pressing on it deploys a list of available channel plans.
- 4 Frequency selected. When pressing on it pops up a virtual numeric keypad to edit frequency.
- 5 DBG (DOCSIS Bonding Group). If channel selected belongs to a DBG, it appears on this box. Pressing on it deploys a list of DBG available for the channel plan selected.
- 6 C: Carrier for DBG selected / Number of DBG channels.
- 7 It shows if the selected channel is digital (D) or analogue (A).
- 8 Channel bandwidth power.
- 9 Carrier/Noise ratio of channel.
- 10 Full band RF cable power. In FIBER OPTICS it also shows full band of fiber optics cable.
- 11 Arrows to change reference level.
- 12 Span lower and higher frequency.

- 13 Arrows to increase / decrease span. Current span.
- 14 Bandwidth resolution.
- 15 Selected marker for channel / frequency.

► Options Menu

There are some options at the bottom of the screen:

-  : Screenshot.
- **CLEAR**: It clears spectrum trace (this options is available if trace was hold previously).
- **DBG**: It opens DOCSIS BONDING GROUP screen (see next section).
- **RANGING** (only for CABLE): It enables RANGING function (see next section).
- **DEMODO**: Demodulator (refer to "Demodulator" chapter).

► Settings Menu

Click on the  MENU icon at the upper right corner to access the Settings menu. The **DOCSIS DOWNSTREAM SPECTRUM ANALYZER** function has these options:

- **Edit channel plan**: It allows you to edit a channel plan and DBG (refer to "Edit Channel Plan" chapter).
- **Units**: It allows you to select measurement unit for power (dBuV, dBmV, dBm).
- **Reference Line**: It allows you to select the reference line by numbers (-60 dBmV to +70 dBmv). Reference line allows you to define criteria in order to quickly accept or refuse channels levels.
- **Trace**: It allows you to select holding type of trace (maximal, minimum).
- **CM information**: Information about the cable modem.
- **Frequency step**: It allows you to select frequency step (0.25 MHz, 1 MHz, 8 MHz, other value).
- **Full span maximum frequency**: It allows you to select full span maximum frequency (900 MHz, 1700 MHz, other value).
- **Detector**: It allows you to select detector type (maximum, minimum).
- **Wavelength (only for FO)**: It allows you to select wavelength (1310 nm, 1490 nm, 1550 nm, 1590 nm).

3.4.2 DOCSIS BONDING GROUP (cable & FO)

► Description

DBG function shows power for each channel and carrier belonging to DOCSIS BONDING GROUP.

► Screen Description

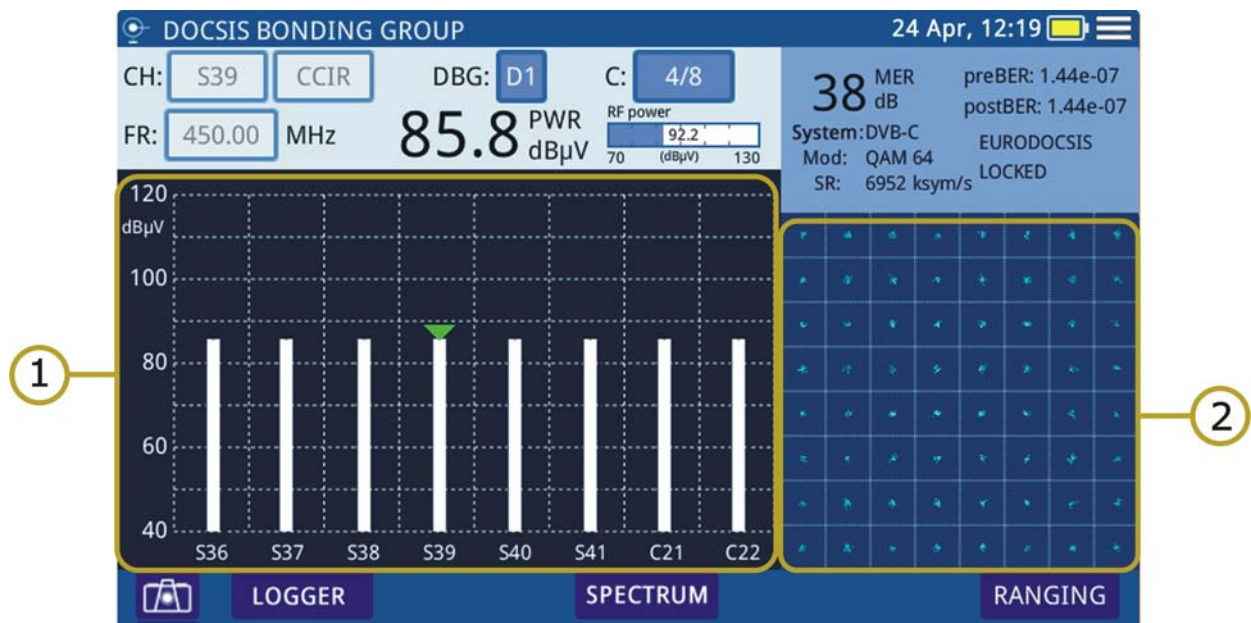


Figure 11.


- 1 Power for each DBG carrier. Arrow on the bar indicates carrier selected.
- 2 Constellation Diagram.

► Options Menu

There are some options at the bottom of the screen:

- : Screenshot.
- **LOGGER**: It creates a datalogger with measurement data.
- **SPECTRUM**: It returns to the DOCSIS DOWNSTREAM SPECTRUM ANALYZER function (see previous section).
- **RANGING**: (only for CABLE) It enables the RANGING function (see next section).
- **CLR IQ**: It clears Constellation Diagram.

► Settings

Click on the **MENU**  at the upper right corner to access the Settings menu. The DOCSIS BONDING GROUP function has these options:

- **Edit channel plan:** It allows you to edit a channel plan and DBG (refer to "Edit Channel Plan" chapter).
- **CM Information:** It shows information about software and MAC address of CableModem.
- **Power at CMTS:** It sets minimum level power to receive from the CMTS (Cable Modem Termination System).

3.4.3 RANGING (cable)

► Description

The RANGING function (also called CABLEMODEM emulation) connects internal **CABLEMODEM** of the equipment to CMTS and generates an UPSTREAM signal. Tune a carrier from SPECTRUM or DBG then press RANGING to connect to CMTS. Equipment shows frequency and power required to connect to the CMTS.

► Screen Description

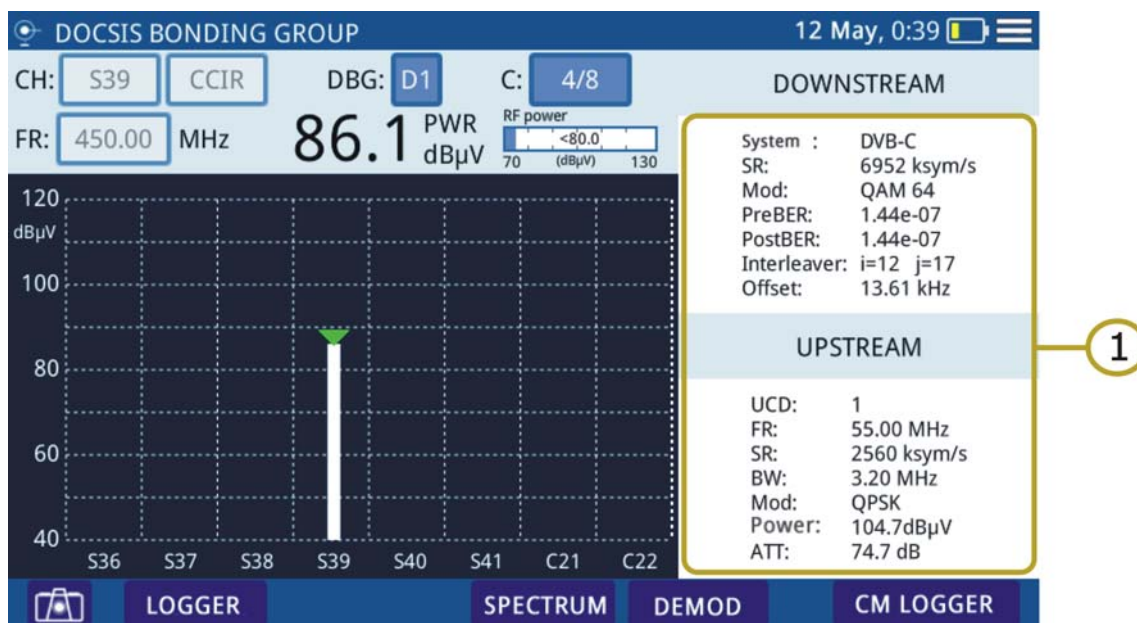


Figure 12.

- 1 Downstream and Upstream channel ranging.

► Downstream


- System: Transmission standard.
- SR: Symbol Rate.
- MOD: Modulation.
- MER: Modulation Error Ratio.
- PreBER: Error ratio before correction.
- PostBER: Error ratio after correction.
- Interleaver: Improvement of error correction performance.
- Offset: Offset for tuning frequency.

► Upstream

- UCD: Upstream Channel Descriptor.
- FR: Channel frequency.
- SR: Symbol Rate.
- BW: Channel bandwidth.
- MOD: Modulation.
- Power: Channel power to CMTS.
- ATT: Channel attenuation to CMTS.

► Options Menu

There are some options at the bottom of the screen:

-  : Screenshot.
- **ESPECTRO: SPECTRUM:** It returns to the DOCSIS DOWNSTREAM SPECTRUM ANALYZER function (see previous section).
- **DEMODO:** Demodulator (refer to "Demodulator" chapter).
- **REGISTRO CM:** DOCSIS REGISTERING function opens (see next section).

3.4.4 DOCSIS REGISTERING (cable)

► Description

It is necessary to register your equipment in the CMTS network to access functions to check VoIP, IPTV and Browser. When registering, Downstream and Upstream features are shown on screen.

► Screen Description

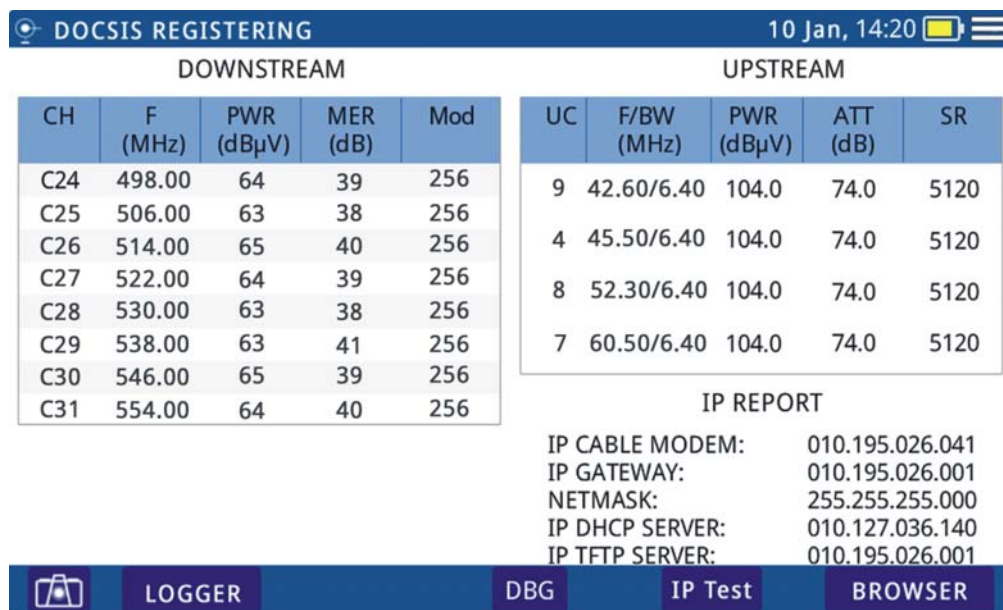


Figure 13.

Downstream


- CH: Channel.
- F: Frequency.
- PWR: Power.
- MER: Modulation Error Ratio.
- MOD: Modulation.

Upstream


- UC: Upstream Channel.
- F /BW: Frequency and bandwidth channel.
- PWR: Power.
- ATT: Channel attenuation.
- SR: Symbol Rate.
- IP REPORT: Report showing IP devices when registering.

► Options Menu

There are some options at the bottom of the screen:

-  : Screenshot.
- **DBG**: It opens DOCSIS BONDING GROUP function (see previous section).
- **Test IP**: It opens IP TEST (VoIP/IPTV)function (see next section).
- **BROWSER**: It opens DOCSIS BROWSER function.

► Setting Menu

Click on the **MENU**  icon at the upper right corner to access the Settings menu. The DOCSIS REGISTERING function has these options:

- **CM Information**: It shows information about software and MAC address of CableModem.

3.4.5 IPTV (cable)

► Description

The IPTV test function performs an analysis of quality parameters for this type of service. The optimization of these parameters guarantees the best quality of service. In addition, knowledge of network conditions is important to install and fix other problems.

► Screen Description

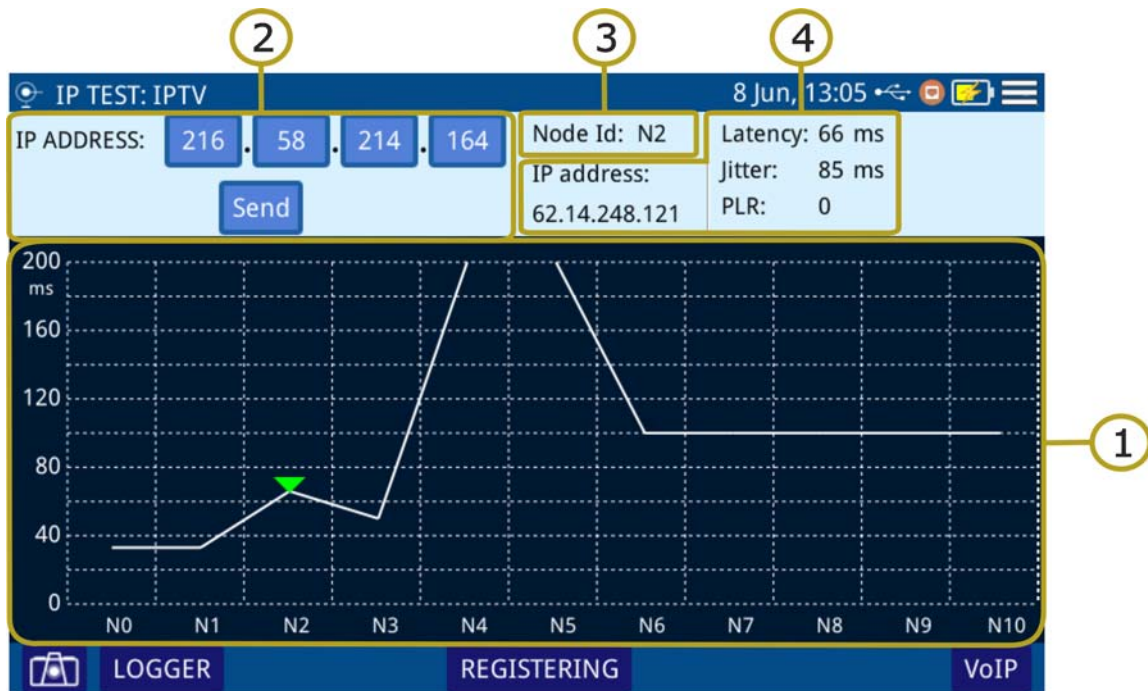



Figure 14.


- 1 Graphic with nodes and time (ms) of test signal.
- 2 It allows you to enter an IP address where sending the test signal.
- 3 Node: node selected.
- 4 It shows some parameters obtained from test:
 - IP address: Test IP.
 - Latency: Delay due to transport or processing.
 - Jitter: Variation of latency over time.
 - PLR (Packet Loss Rate): Percentage of lost packets over total sent packets.

► Options Menu

There are some options at the bottom of the screen:

-  : Screenshot.
- **LOGGER**: It creates a datalogger with measurement data.
- **REGISTER**: It returns to the DOCSIS REGISTERING function (see previous section).
- **VoIP**: TEST IP VoIP screen opens (see next section).

► Settings Menu

Click on the MENU  icon at the upper right corner to access the Settings menu. The IPTV function has these options:

- **Nominal Polling Interval:** Time interval (ms) between successive requests.
- **RTPS (Real Time Polling Service):** It enables / disables RTPS service.

3.4.6 VoIP (cable)

► Description

The **VoIP** function performs a comprehensive analysis of the network based on parameters defined by UGS, which guarantees the best quality of service. It analyzes several parameters that can affect quality of communication such as latency, jitter, lost packets, MOS and R value.

► Screen Description

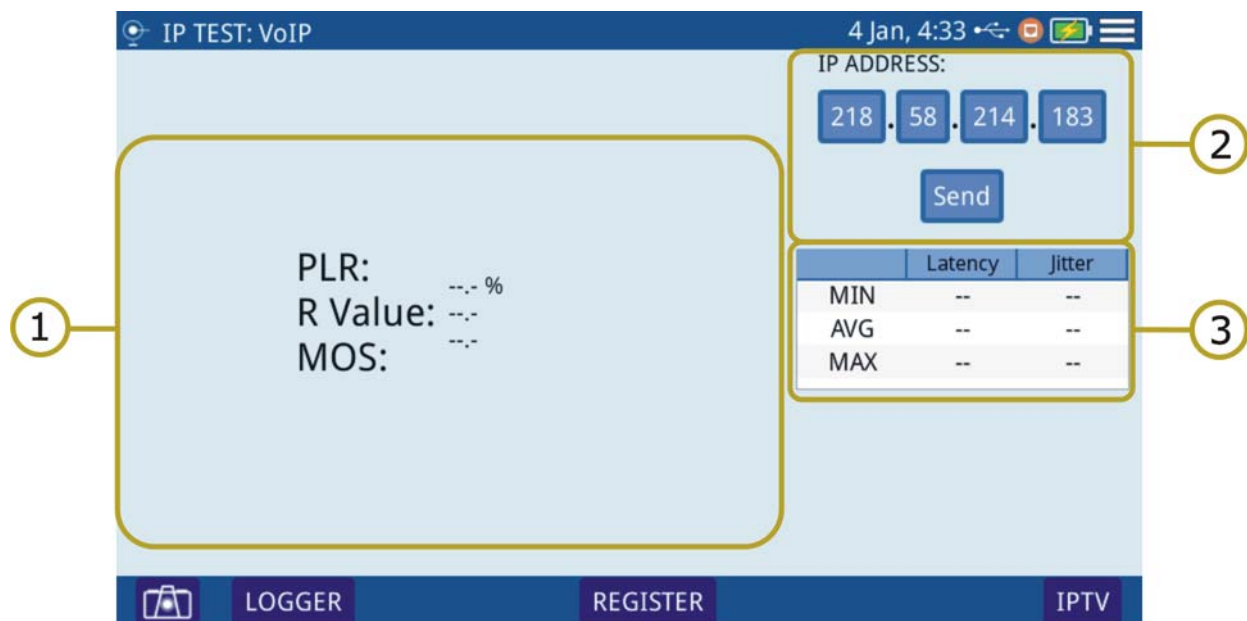



Figure 15.

- 1** It shows values obtained during test.
 - **PLR (Packet Loss Rate):** It is the percentage of lost packets over total sent packets.
 - **R VALUE:** It shows a number or score, that is used to quantitatively express the subjective quality of speech in communications systems. Can range from 1 (worst) to 100 (best).
 - **MOS (Mean Opinion Score):** It is a numerical indication of the perceived quality of received media after compression and/or transmission. The MOS is expressed as a single number in the range 1 (lowest quality) to 5 (highest quality).
- 2** Enter IP address to test and press send.
- 3** It shows minimum, average and maximum measurements of these parameters:
 - **Latency:** It is the time delay due to transport or processing.
 - **Jitter:** It is time variation of latency inside the network.

► Options Menu

There are some options at the bottom of the screen:

-  : Screenshot.
- **LOGGER**: It creates a datalogger with measurement data.
- **REGISTER**: It returns to the DOCSIS REGISTERING function (see previous section).
- **IPTV**: IPTV function opens (see previous section).

► Settings Menu

Click on the **MENU**  icon at the upper right corner to access the Settings menu. The **VoIP** function has these options:

- PING Settings:
 - PING data length.
 - PINGS number.
- Quality of Service (UGS) settings:
 - Unsolicited Grant Size.
 - Nominal Grant Interval.
 - Tolerated Grant Jitter.
 - Codec.

3.4.7 DOCSIS BROWSER (cable)

► Description

DOCSIS BROWSER allows you to check web browsing.

► Screen Description

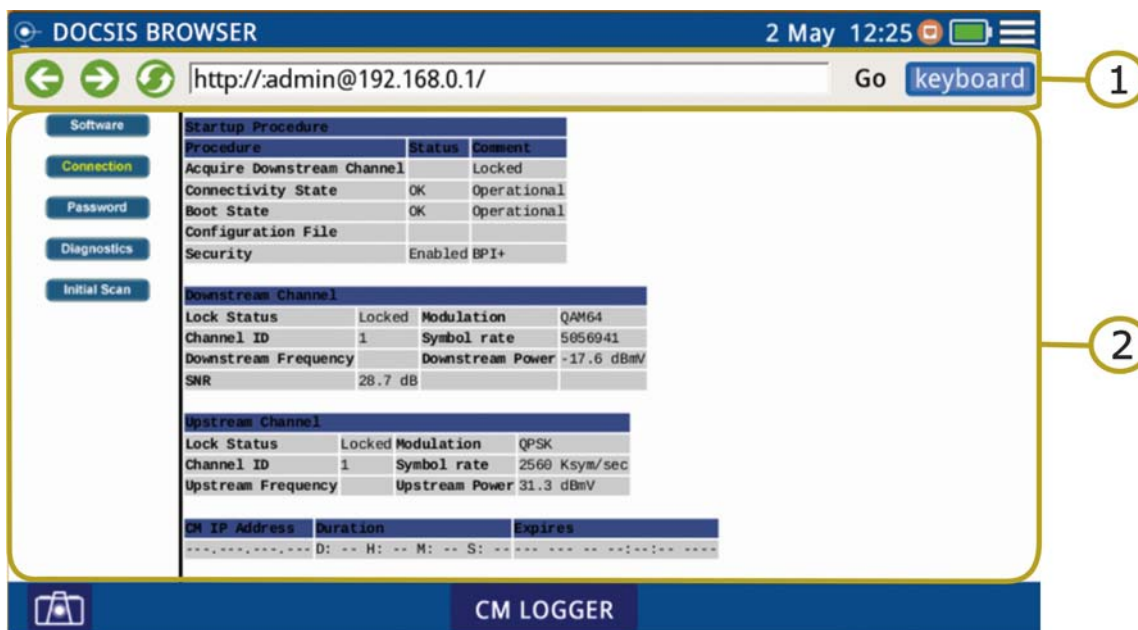





Figure 16.


1 Barra de Navegación.

-  Previous page.
-  Next page.
-  Reload page.
- URL bar: enter address and press Go.
- Keyboard: It shows virtual keyboard to enter URL.
- User / Pass : Password and user to enter CM administrator page.

2 Browser screen.

► Options Menu

There are some options at the bottom of the screen:



-  : Screenshot.
- **CM REGISTER**: It returns to the DOCSIS REGISTERING function (see previous section).

3.5 External CM / Upstream Spectrum (cable)

► Description

The External CM / Upstream Spectrum function extracts a sample of the upstream signal and displays its spectrum on the screen. Connect the CABLEMODEM to the "EXT CM" input and the cable from the CMTS to the "RF" input. The equipment works as a bypass and the display shows the transmission signal (bursts) from the CABLEMODEM to the CMTS. It is recommended to enable the peak detector to view bursts better.

► Operation

- 1 Connect signal to input connector:
 - **Cable:** universal connector for F/F or F/BNC adapter.
 - **External CableModem:** universal connector for F/F or F/BNC adapter.
 - **External CableModem:** Ethernet (ETH) connector.
- 2 Access home screen by pressing the HOME key .
- 3 Select **EXT. CM / UPSTREAM** function.
- 4 A continuación, aparecerá la pantalla de la función CM EXTERNO / ESPECTRO UPSTREAM.
- 5 Connect ethernet cable of CABLEMODEM and press BROWSER. Enter CABLEMODEM IP to browse to the CABLEMODEM web service.
- 6 Press HOME  to get back to the main screen.

► Screen Description

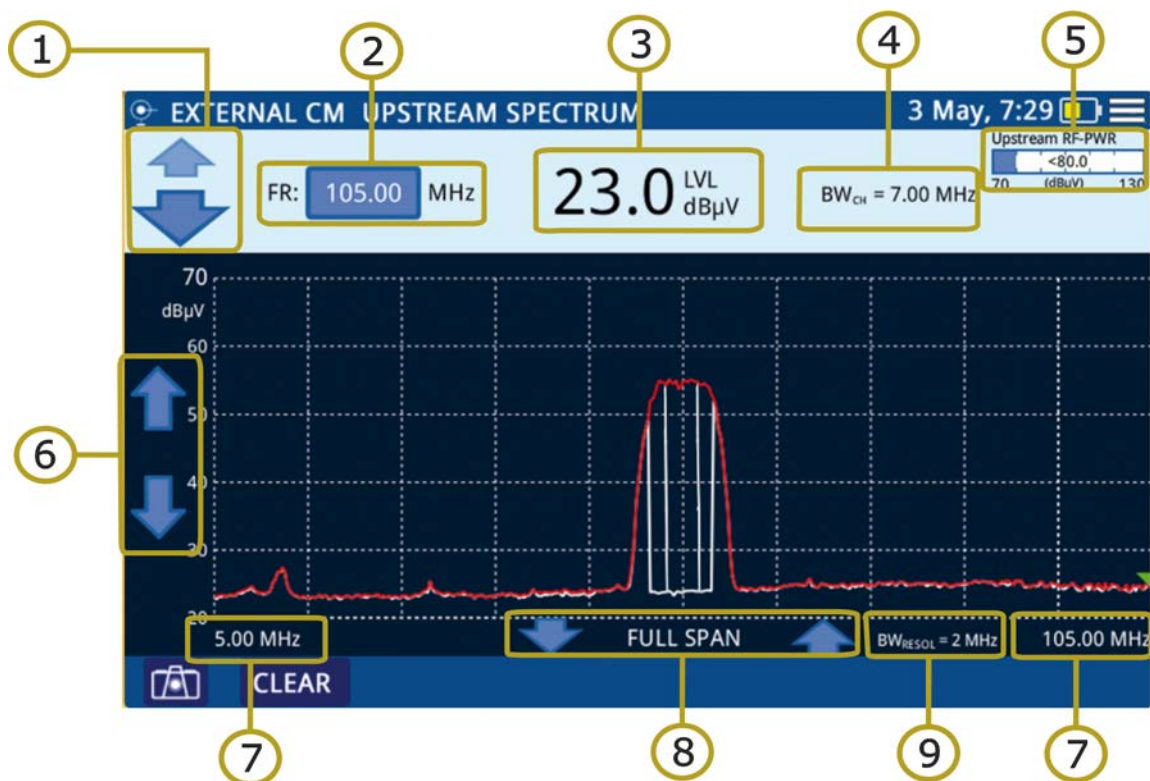


Figure 17.


- 1 Arrows to increase / decrease value of the selected parameter (channel or frequency). When a parameter is selected its background color is stronger.
- 2 Frequency selected. When pressing on it pops up a virtual numeric keypad to edit frequency.
- 3 Power level at selected frequency.
- 4 Channel bandwidth.
- 5 Full band RF cable power.
- 6 Arrows to change reference level.
- 7 Span lower and higher frequency.
- 8 Arrows to increase / decrease span. Current span.
- 9 Bandwidth resolution.

► Options Menu

There are some options at the bottom of the screen:

-  : Screenshot.
- **BROWSER**: It opens DOCSIS BROWSER function.

► Settings Menu

Click on the **MENU**  icon at the upper right corner to access the Settings menu. The EXT. CM / UPSTREAM function has these options: .



- **Frequency step:** It allows you to select frequency step (0.25 MHz, 1 MHz, 8 MHz, other value).
- **Full span maximum frequency:** It allows you to select full span maximum frequency (900 MHz, 1700 MHz, other value).
- **Detector:** It allows you to select detector type (maximum, minimum).
- **Channel bandwidth:** It allows you to change channel bandwidth.

3.6 Upstream Test (cable)

► Description

The TEST UPSTREAM GENERATOR function, generates a test signal to check Upstream traffic. The device retrieves the signal configuration from the last working session and displays it on the screen.

► Operation

- 1 Connect signal to input connector:
 - **Cable:** universal connector for F/F or F/BNC adapter.
- 2 Access home screen by pressing the **HOME** key .
- 3 Select **UPSTREAM TEST** function.
- 4 **TEST UPSTREAM GENERATOR** function opens.
- 5 Press **HOME**  key to get back to the main screen.

► Screen Description

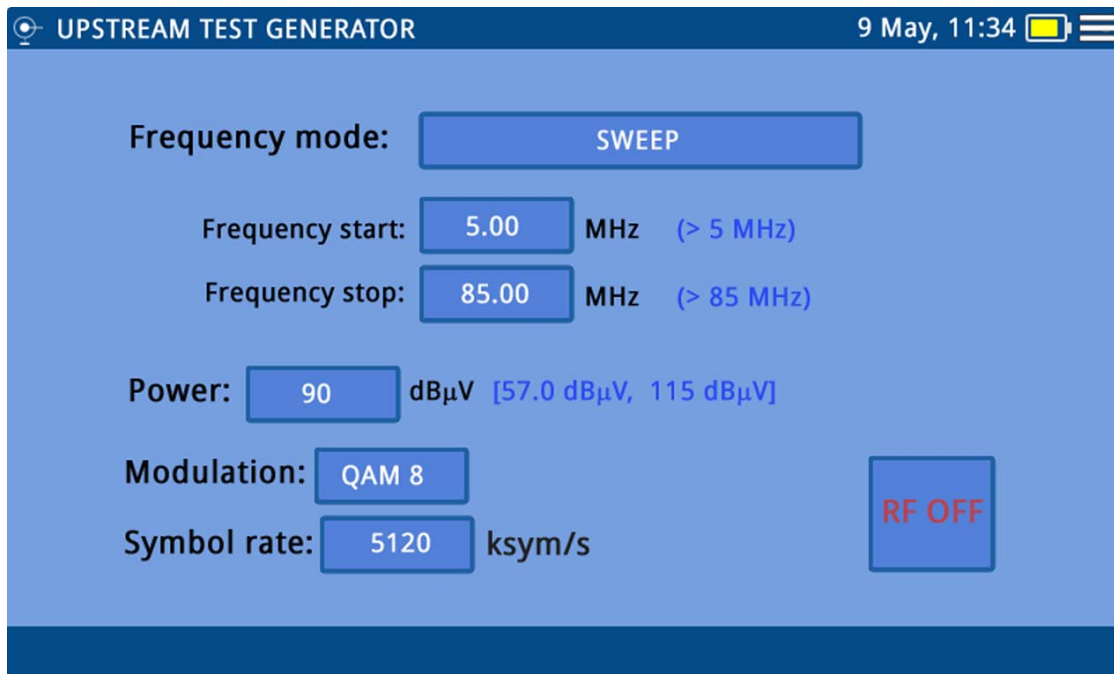



Figure 18.

Parameters to set UPSTREAM signal:

- Frequency mode: Select between Sweep or Fix.
- Frequency start: Select start frequency (only for Sweep mode).
- Frequency stop: Select stop frequency (only for Sweep mode).
- Frequency: Select frequency (only for Fix mode)
- Power: Select power level for signal.
- Modulation: Select modulation type for signal.
- Symbol Rate: Select symbol rate for test signal.
- RF OFF /ON: Enables or disables test signal.

► Settings Menu

Click on the **MENU**  icon at the upper right corner to access the Settings menu. The UPSTREAM TEST GENERATOR function has these options:



- **Units:** It allows you to select measurement unit for power (dBuV, dBmV, dBm).
- **CM Information:** It shows information about software and MAC address of CableModem.

3.7 AC / DC Input Voltage (cable)

► Description

The AC / DC input voltage function automatically identifies the voltage type (DC or AC) at the input and the frequency in case of alternating voltage.

► Operation

- 1 Connect signal to the input connector:
 - **Cable:** universal connector for F/F or F/BNC adapter.
- 2 Access home screen by pressing the **HOME** key .
- 3 Select **INPUT VOLTAGE** function.
- 4 INPUT AC/DC VOLTAGE function opens.
- 5 Press **HOME**  key to get back to the main screen.

► Screen Description

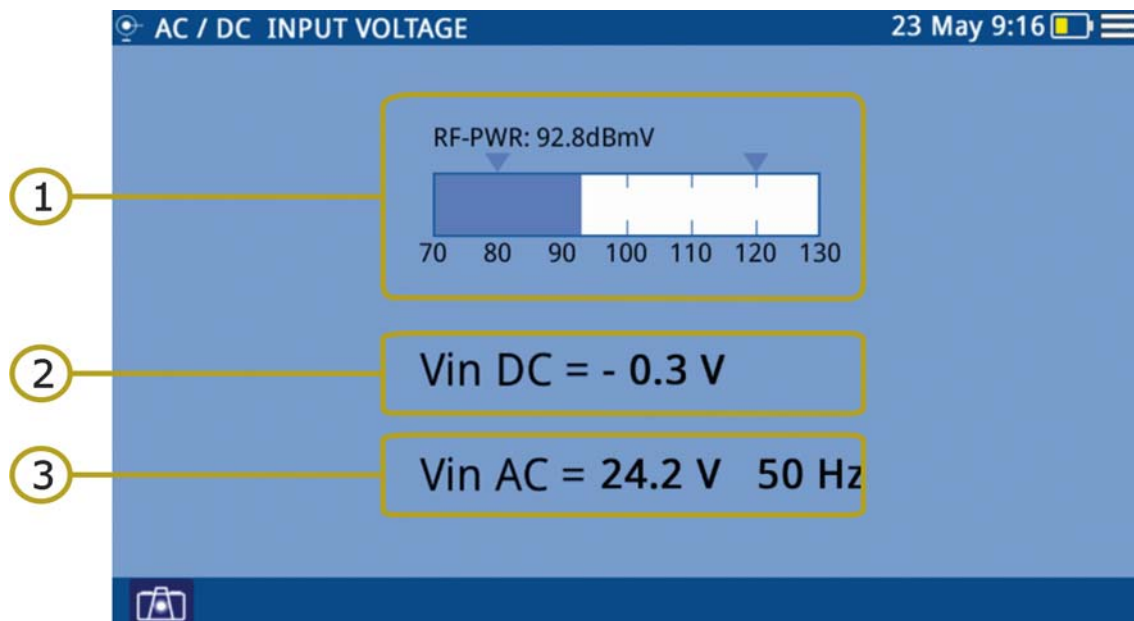



Figure 19.

- 1 RF-PWR: Full bandwidth power.
- 2 Vin DC: DC input voltage.
- 3 Vin AC: AC input voltage and frequency.

► Settings Menu

Click on the  **MENU** icon at the upper right corner to access the Settings menu. The INPUT AC/DC VOLTAGE function has these options:



- **Units:** It allows you to select measurement unit for power (dBuV, dBmV, dBm).

3.8 Optical Power Meter (FO)

► Description

The OPTICAL POWER METER function measures power for each wavelength by means of a meter calibrated to four wavelengths.

► Operation

- 1 Connect signal to the input connector:
 - **Cable**: universal connector for F/F or F/BNC adapter.
 - **Fiber Optics**: SC-APC connector.
- 2 Access home screen by pressing the HOME key .
- 3 Select **OPTICAL POWER METER** function.
- 4 OPTICAL POWER METER, function opens.
- 5 Press **HOME**  key to get back to the main screen.

► Screen Description

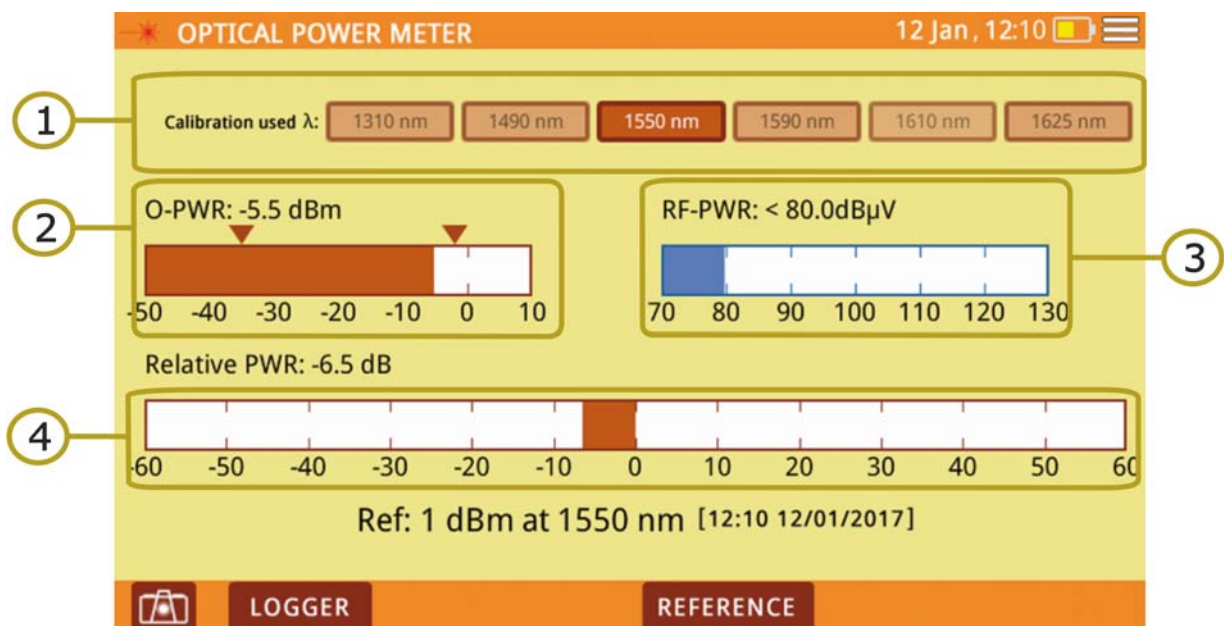



Figure 20.


- 1 Calibration used: Select wavelength for power measurement.
- 2 O-PWER: Graphical bar and value of optical power with high and low threshold. Threshold values can be selected on settings menu.
- 3 RF-PWR: Graphical bar and value of RF power.
- 4 Relative Power: Graphical bar and value of power signal loses. It is equal to:
Relative Power = Reference value - Attenuation.

► Options Menu

There are some options at the bottom of the screen:

-  : Screenshot.
- **DATALOGGER**: It creates a datalogger with measurement data.
- **REFERENCE**: It allows you to save current power value as reference value.

► Settings Menu

Click on the **MENU**  icon at the right corner to access the Settings menu. The **OPTICAL POWER METER** function has these options:

- **Units**: It allows you to select a measurement unit for power (dBuV, dBmV, dBm).
- **Define optical thresholds**: It allows you to define, select and save up to 6 sets of threshold values.

4 TOOLS


4.1 Edit Channel Plan

► Description

Channel plan editor allows to edit and create channel plans, and also to edit DBG (Docsis Bonding Group) channels.

► Operation

Channel plan editor is available in **ANALYZER** and **SCAN**.

- 1 Select channel plan on main screen.
- 2 Access menu by pressing on .
- 3 Press on "Edit Channel Plan" option.
- 4 Wait until EDIT CHANNEL PLAN screen opens.
- 5 Press on any parameter / value to edit. To scroll down use the scrolling bar on the right side. Channel selected is in blue background color.
- 6 Press on a parameter to edit. If the parameter is a number, it shows up a virtual keyboard to edit that value. If the parameter value is a text, you should press several times on it to switch among different options.
- 7 Once edited, press on Return key and it appears a window with options: "Save" (it saves changes and exits), "Don't save" (it does not save changes and exits), "Cancel" (it does not saves changes and does not exit).

► Screen Description

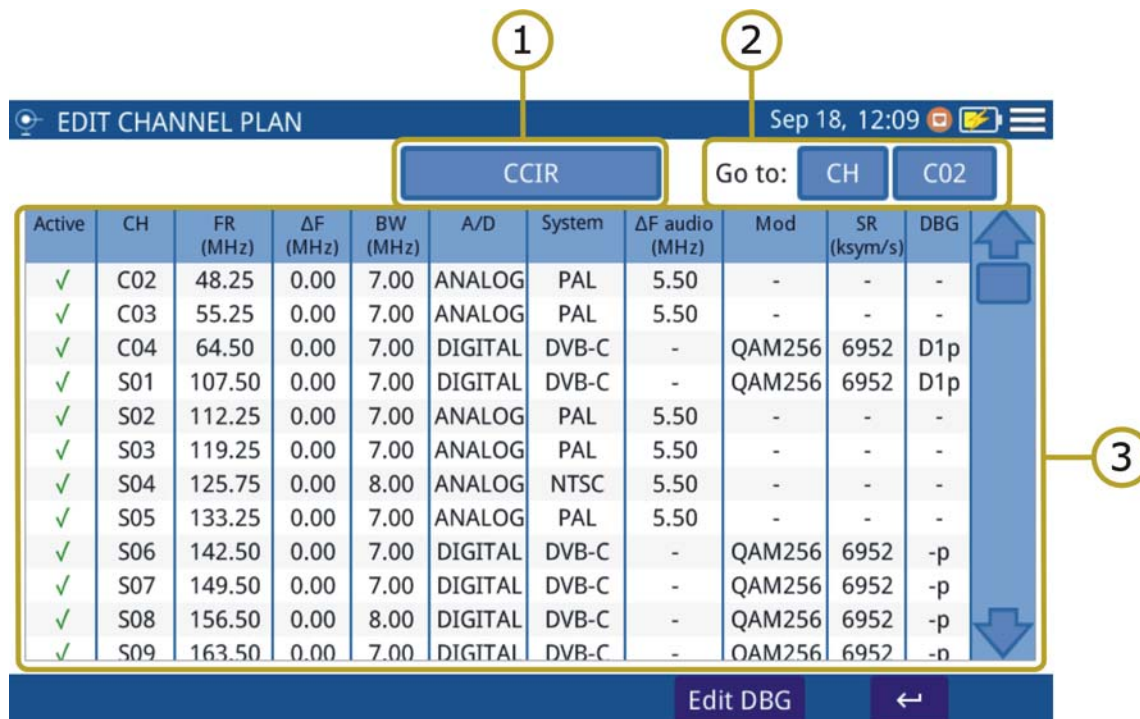


Figure 21.


- 1 Channel plan selected. Press on this box to select another channel plan.
- 2 Go to: Press on this box to switch between CH (channel) and FR (frequency) and to select a channel or frequency.
- 3 Channel table.

Parameters on channel table are:


- CH: Channel.
- F (MHz): Channel frequency (MHz).
- ΔF (MHz): Offset of tuned frequency for channel (MHz).
- BW (MHz): Bandwidth of channel.
- A/D: It indicates if channel is analogue (A) or digital (D).
- System: It indicates transmission standard (DVB-T/T2, ISDB-T, ITU J83-T, PAL/BG, D3.0, D2.0, E-D2.0, E-D3.0, DVB-C, /C2).
- ΔF Audio (MHz): Offset of tuned frequency for audio (MHz).
- Mod: It indicates modulation type (QAM16, QAM32, QAM64, QAM128, QAM256, QAM512).
- SR: Symbol rate.
- DBG: It shows primary carrier for DBG.

► Options Menu

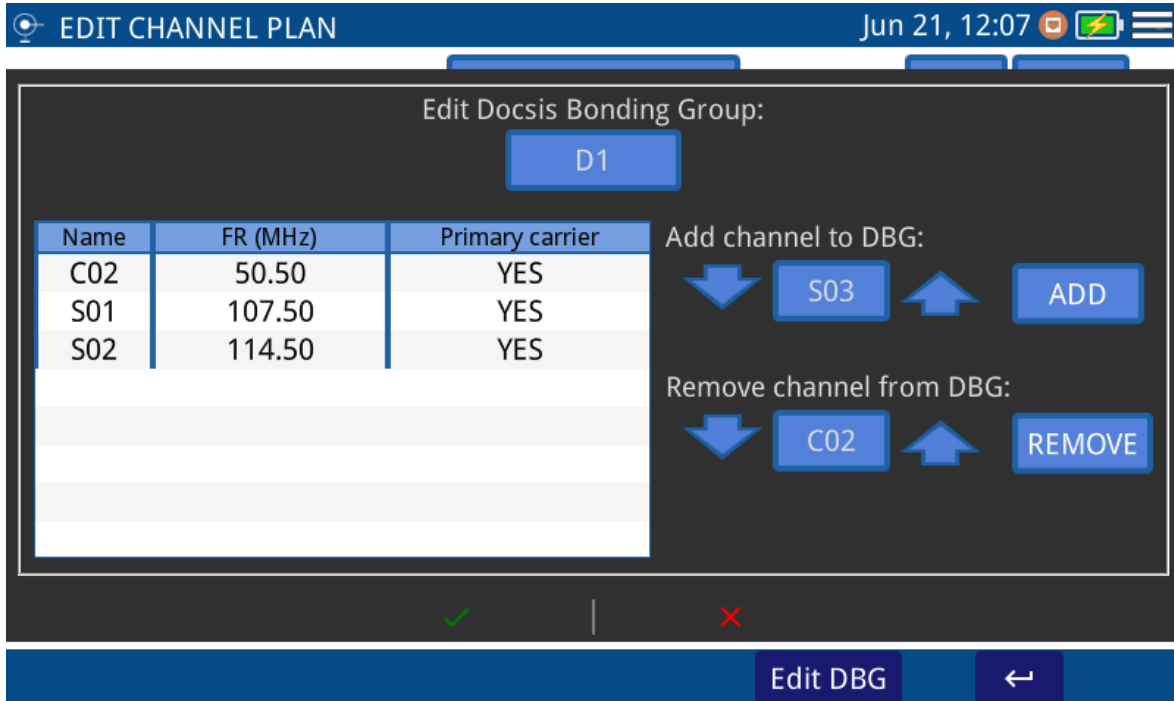
There are some options at the bottom of the screen:

- **EDIT DBG**: Opens the DBG editor screen (see next section).
- : Back to main screen.

► Settings Menu

Click on the MENU  icon at the upper right corner to access the Settings menu. The EDIT CHANNEL PLAN function has these options:

- Add new channel: It adds a new channel for a channel plan (for standard channel plans it is not allowed).
- Remove channel: It removes selected channel.
- New channel plan: It creates a new channel plan. There are three options (see next section:
 - Create a channel plan from an existing one.
 - Create automatically a channel plan from HFC network.
 - Create a channel plan from void pattern.
- Remove channel plan: It removes current channel plan.

► EDIT DOCSIS BONDING GROUP Screen Description

EDIT CHANNEL PLAN Jun 21, 12:07

Edit Docsis Bonding Group:

D1

Name	FR (MHz)	Primary carrier
C02	50.50	YES
S01	107.50	YES
S02	114.50	YES

Add channel to DBG:

↓ S03 ↑ ADD

Remove channel from DBG:

↓ C02 ↑ REMOVE

✓ | ✗

Edit DBG ←

Figure 22.

- Edit Docsis Bonding Group: Press on the box to select DBG to edit.
- Add channel to DBG: Press on arrows or on the box to select one channel and then press on ADD to add to DBG.
- Remove channel to DBG: Press on arrows or on the box to select one channel and then press on REMOVE to remove from DBG.
- Primary Carrier: Press on Primary Carrier column to define if that channel is a primary carrier or not.

► Create a Channel Plan from an existing one

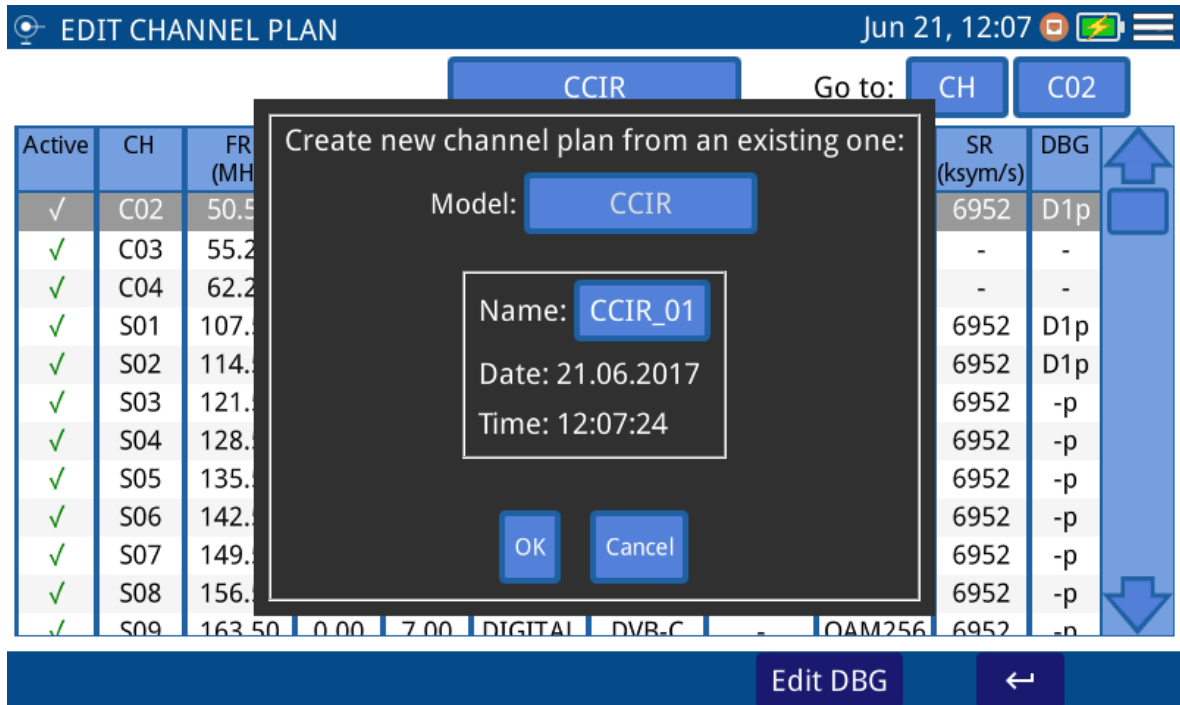


Figure 23.

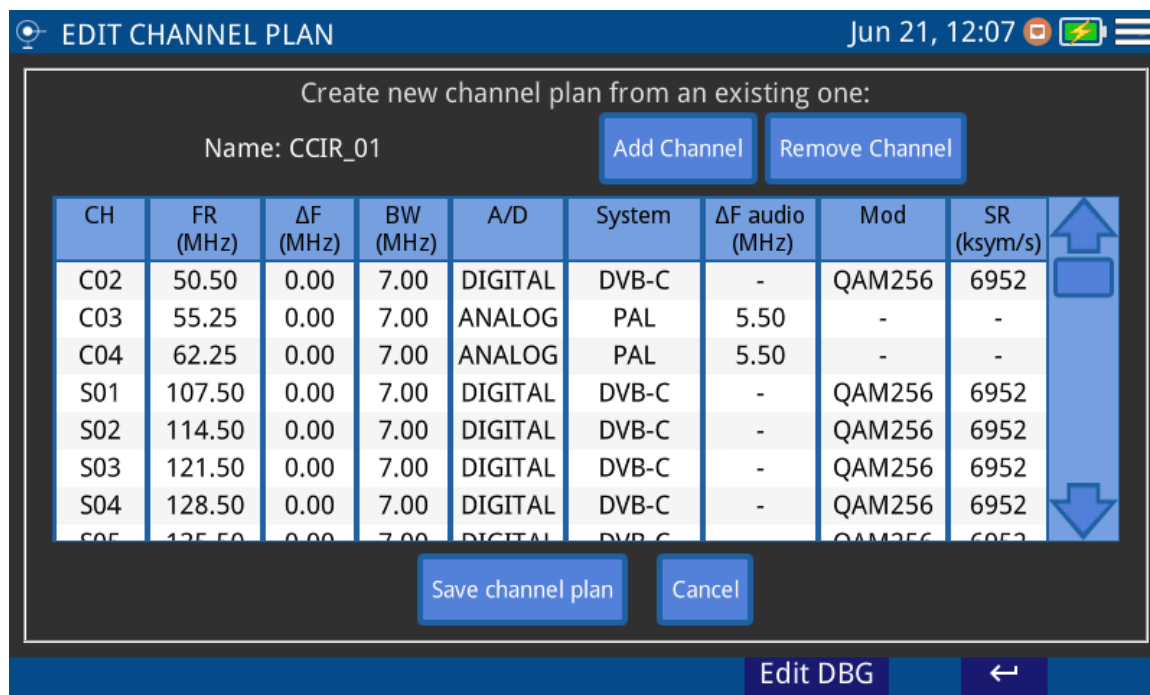


Figure 24.

- 1 Press on box "Model" to select a channel plan as a model to create a new one.
- 2 Press on box "Name" to give a name to the new channel plan.
- 3 Press "OK" to create a new channel plan or "Cancel" to exit.
- 4 At the next screen, press on "Add Channel", "Remove Channel" to edit channel plan. When finish, press on "Save channel plan" to save changes or "Cancel" to exit without saving.

► Create automatically a channel plan from HFC network

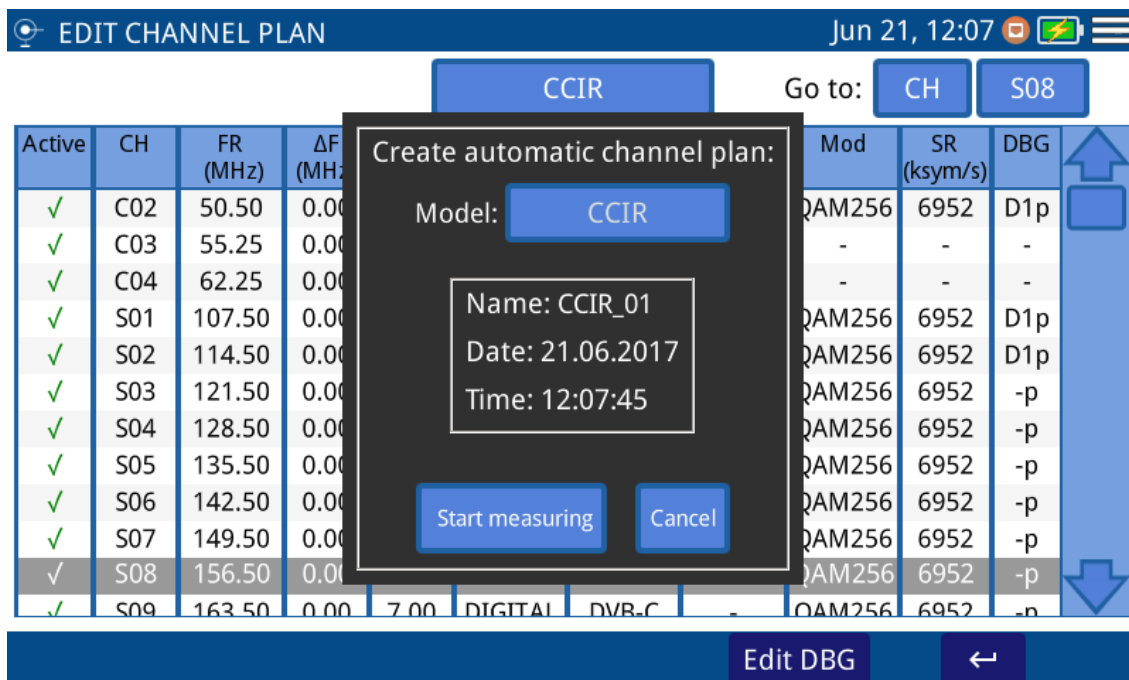





Figure 25.

EDIT CHANNEL PLAN Jun 21, 12:08   

Create automatically a channel plan:

Name: Date: 21.06.2017 Time: 12:08:16

CH	FR (MHz)	ΔF (MHz)	BW (MHz)	A/D	System	ΔF audio (MHz)	Mod	SR (ksym/s)	DBG	
S39	450.00	0.00	8.00	DIGITAL	DVB-C	5.5	QAM256	6952	-	

Figure 26.

- 1 Connect to the HFC network.
- 2 Press on box "Model" to select a channel plan as a model to create a new one.
- 3 Press on "Start measuring".
- 4 When finish press on "Name" box to edit the channel plan name. Press on "Save channel plan" to save changes or "Cancel" to exit without saving.

► Create a new Channel Plan from scratch



Figure 27.

- 1 Press on box "Name" to give a name to the new channel plan.
- 2 At the next screen, press on "Add Channel", "Remove Channel" to edit channel plan. When finish, press on "Save channel plan" to save changes or "Cancel" to exit without saving.

4.2 Demodulator

► Description

Demodulator provides the most important measurements technicians need to assess digital QAM channel quality. Constellation diagram is a simple and graphical way to identify signal impairments which impact MER and ultimately BER. An ideal QAM channel for example will be represented by a set (constellation) of very sharp dots. These dots will become small dot clouds to indicate the presence of noise or other signal degradation sources. In addition to constellation diagram it also measures MER, preBER and postBER simultaneously with the spectrum trace.

► Operation

DEMODULATOR is available for digital signals of functions **SPECTRUM ANALYZER** and **SCAN**.

- 1 Select channel or frequency and tune it.
- 2 Press on "DEMOD" option.

► Screen Description

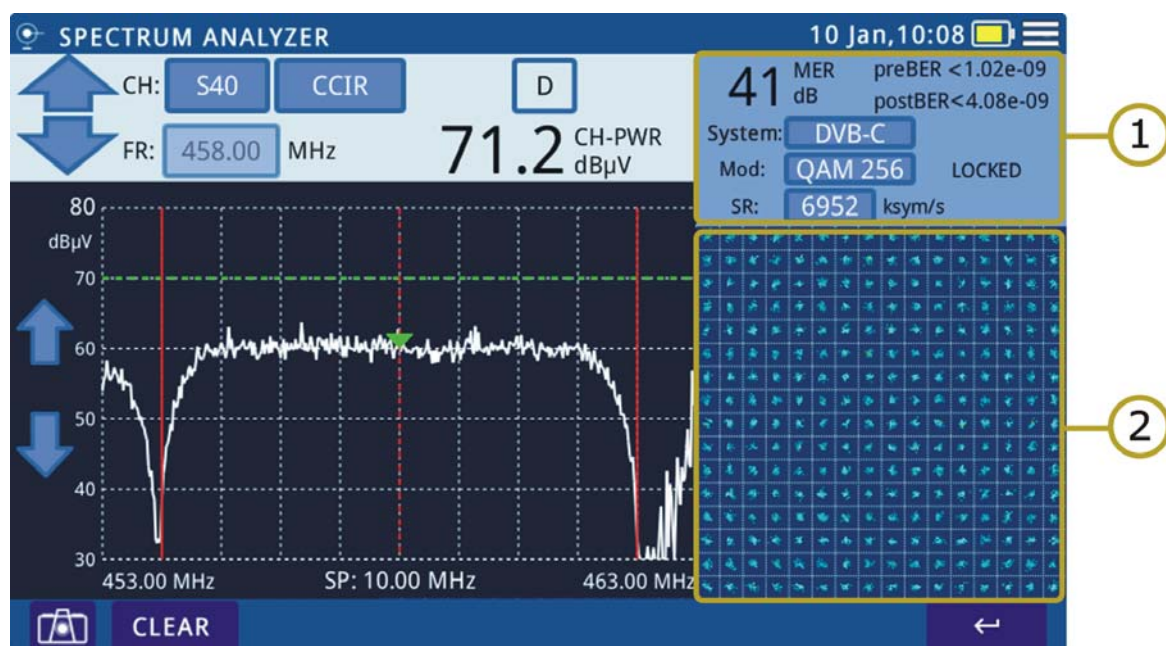



Figure 28.

- 1 Demodulated Signal Data.
 - MER for tuned channel.
 - pre-BER (BER before correction).
 - post-BER (BER after correction).
 - Transmission standard. Press to switch.
 - Modulation type. Press to switch.
 - Signal status LOCKED / UNLOCKED.
 - Symbol rate. Press to switch.
- 2 Constellation Diagram (I-Q diagram).

► Options Menu

There are some options at the bottom of the screen:

- **CLR IQ:** It clears constellation.
-  Back to previous screen.

4.3 **Analog Video Carrier / HUM**

► Description

The equipment can measure video carrier signal level, Video/Audio and C/N ratio and **HUM** in analog mode. This is all shown alongside the screen together with the spectrum analyzer graphic. The **HUM** is buzz at low frequency modulation that affects video analogue carriers, producing a distinctive hum. The **HUM** value up to 2% is considered acceptable. Above this value is not acceptable and it should take appropriate countermeasures.

► Operation

HUM is available for analogue signals in these functions: **SPECTRUM ANALYZER** and **SCAN**.

- 1 Select channel or frequency and tune it.
- 2 Press on "DEMODO" option.

► Screen Description

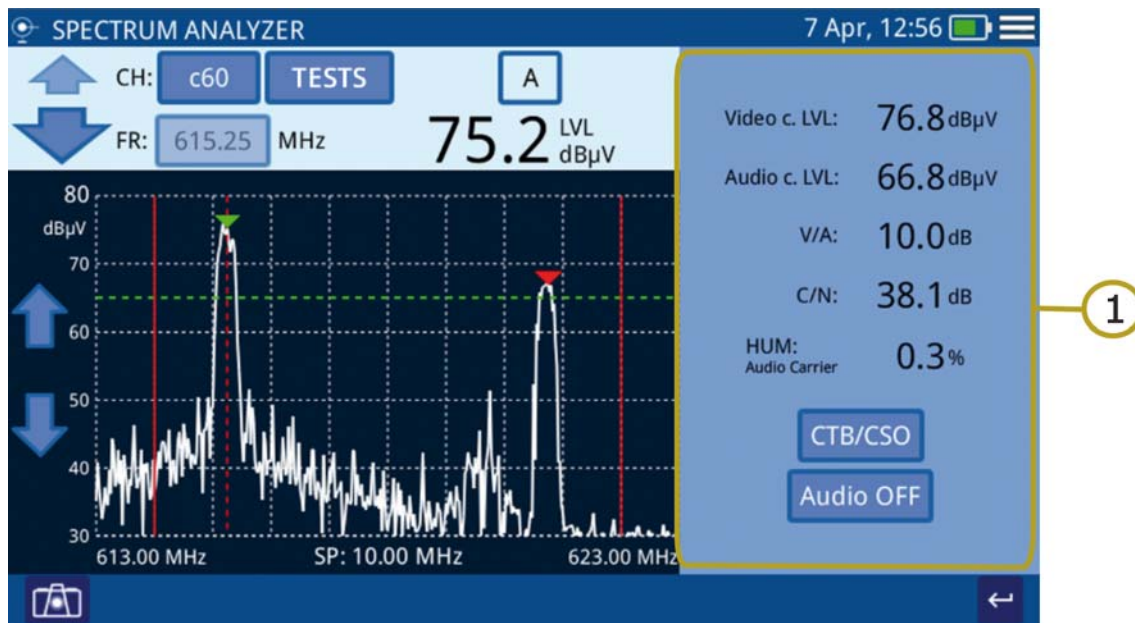


Figure 29.

1 Analogue Video Carrier / HUM.

- Video c.LVL: Level of video carrier.
- Audio c.LVL: Level of audio carrier.
- V/A: Video/Audio ratio.
- C/N: Carrier/Noise ratio.
- HUM: Audio carrier.
- CTB/CSO: Intermodulation product measurement.
- Audio OFF/ON: It enables / disables audio and to set audio level.

4.4

Screenshot

► Description

It saves a screenshot of current screen that can be downloaded to a USB flashdrive.

► Operation

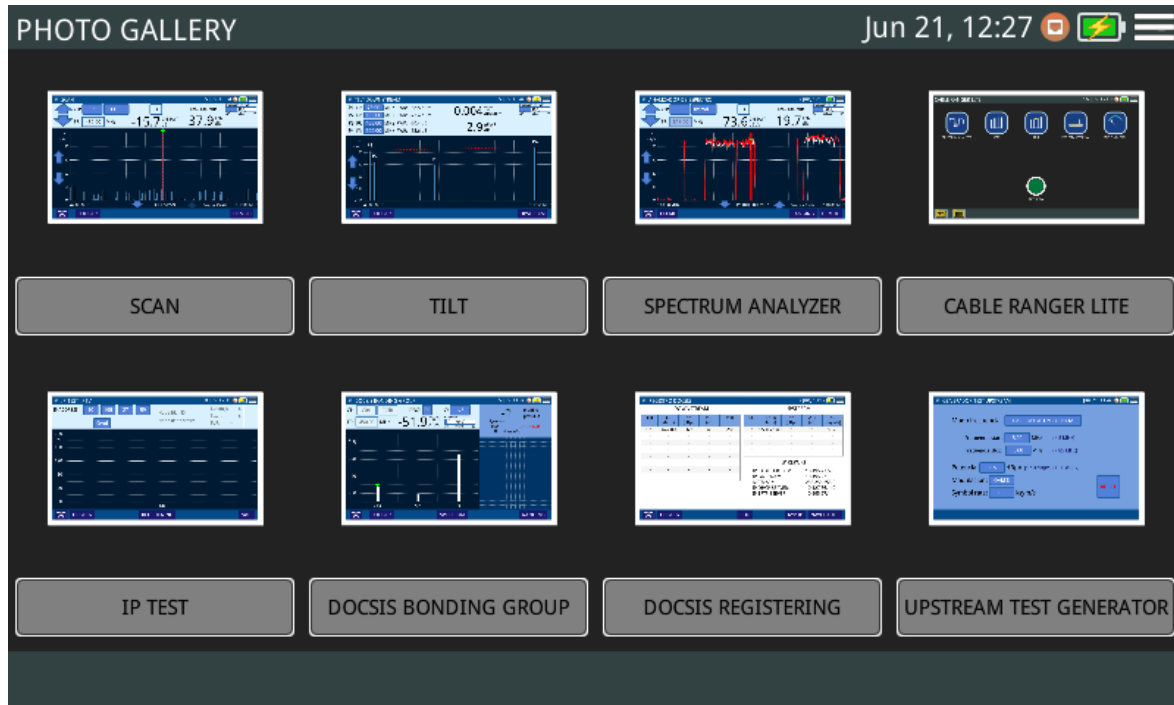




Figure 30.

Screenshot is available almost all functions.

- 1 To take a screenshot press on photo camera icon  at the lower left corner.
- 2 It pops up a window with a screenshot miniature and some options: "Save and close", "Save and go to gallery" and "Cancel". Press your option.
- 3 To access the photo gallery with all the screenshots, from home screen press on icon  at the lower left corner.
- 4 Inside Photo Gallery, screenshots are classified by function.
- 5 Press on the corresponding folder and then on the image to view the screenshot.
- 6 To copy screenshots connect a USB flashdrive on USB port and press on menu option  and the on "Save in USB".
- 7 To remove a folder, go to the Photo Gallery, press on option menu  and then on "Remove". Now select the folder to remove and confirm.

- 8 To remove a single screenshot, see the screenshot fullscreen, press on option menu  and then on "Remove" and confirm.

4.5 Datalogger

► Description

Datalogger function can logger automatically several measurements depending on the selected function, including signal level and channel power, carrier/noise, BER and MER for all channels in a specific channel band.

► Operation

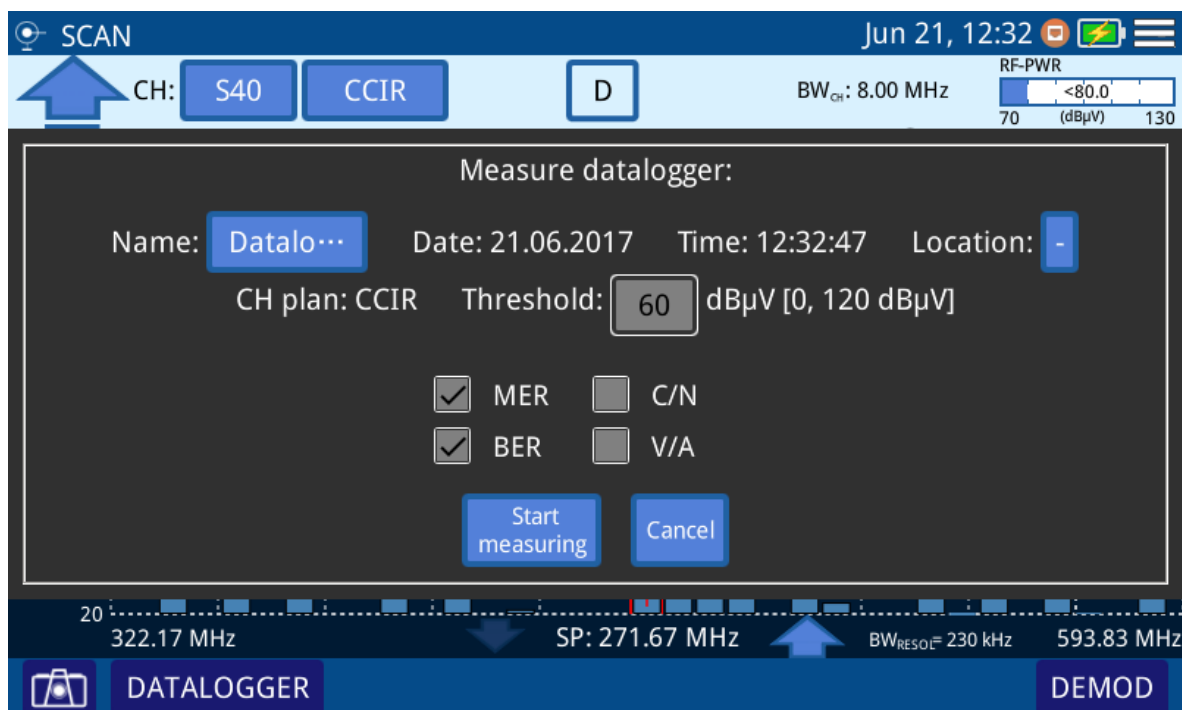





Figure 31.

- 1 To start datalogger, press on DATALOGGER at the left lower corner inside the tool. You can also press on "Test & Go" at the home screen, it is equivalent perform a datalogger from the SCAN function.
- 2 A window opens with several setting options. You can edit boxes with colour background (name, location, threshold...) when pressing on it. Check the box to select measurements and press on "Start Measuring" or "Cancel".
- 3 It starts datalogger.

- 4 After finish, press on "Save and close", "Save and go to datalogger" or "Cancel".
- 5 To access datalogger, go to home screen and press on  icon at the lower left corner.
- 6 Datalogger are classified by function.
- 7 Press on any folder, then press on the datalogger to see data.
- 8 To remove a folder with dataloggers or a single datalogger, press on the menu option  and then on "Remove". It shows a window where to select a folder or datalogger to remove. Select and accept.
- 9 To copy a folder with dataloggers or a single datalogger to a USB memory in first place insert a USB memory in the USB slot. Press on menu option  and then press on "Save on USB". It shows a window with the path where are the files to be copied. Confirm to save.

5 SPECIFICATIONS

5.1 Spectrum Analyzer

► Frequency

Parameter	Value	Additional Data
Tuning Range	From 5 to 1700 MHz	1200 MHz/ DOCSIS, 1700 MHz/DOCSIS 3.1
Tuning Mode	By Frequency or by channel	
Frequency step	0 KHz	
Bandwidth resolution	230 kHz, 2 MHz	
Accuracy	20 ppm	
Sweep time	600 ms full band	

► Amplitude

Parameter	Value	Additional Data
Dynamic range	-50 dBmV to 60 dBmV	
Screen range	50 dB	
Max Input level	70 dBmV	
Resolution	0.1 dB	
Accuracy	± 2 dB	
Input impedance	75 Ohms	
Units	dBmV, dBuV, dBm	

► Measurements: Frequency tuning mode

Parameter	Value	Additional Data
Level	- 50 dBmV to 60 dBmV	Peak detector level measurement from marker
Audio demodulation	Analog FM	
C/N	>50 dB for level >10 dBmV	Selectable noise frequency marker
HUM	1-15 % , ± 1 % accuracy	For CW carriers

► Measurements: DIGITAL Channel tuning mode

Parameter	Value	Additional Data
Power	From -40 dBmV to 60 dBmV	Power measurement in the channel bandwidth by integration method

► Channel Demodulation

Parameter	Value	Additional Data
QAM Systems compatibility	DVB-C, ITUJ83 Annex B and C	
SR	1000-7000 ksym/s	
MER	From 24 dB to 43 dB for QAM16,32,64,128,256 and QPSK	Accuracy ± 2 dB

Parameter	Value	Additional Data
BER	Pre BER (Before RS): From 10 E-2 to 10 E-10	Post BER (After FEC): From 10 E-2 to 10 E-10
Constellation Diagram	For all systems with x2, x4 zoom	
Lock range	-20 dBmV to 60 dBmV	

► Measurements: Analog Channel Demodulation

Parameter	Value	Additional Data
Video Carrier Signal Level	From -45 dBmV to 60 dBmV	

► Channel Demodulation

Parameter	Value	Additional Data
Audio Carrier signal level, A/V	0- 30 dB (for PAL, SECAM or NTSC standard)	
C/N	48 dB for input level > 10 dBmV	
HUM (over audio carrier)	1-15%, 1% accuracy	
CTB/CSO	60 dB dynamic range. (In channel with removed carrier or out of channel selecting a not used channel)	± 3 dB accuracy
Sound	broadcast FM demodulation from internal speaker	

► Configuration Menu

Parameter	Value	Additional Data
Channel Plan	Yes	
Standard TV Channel plans	CCIR,EIA,HRC,IRC,OIRL,FCC up to 10	
Customized Channel plan	Up to 30	
Units	dBmV, dBuV, dBm	
Reference Line	from -60 dBmV to 120 dBmV	
Trace	normal, max hold and min hold	
Frequency step	from 10 kHz to 100 MHz	
Top Frequency	900 MHz, 1700 MHz or selectable	

5.2 Scan

► Frequency

Parameter	Value	Additional Data
Tuning Range	Full frequency band occupied by selected Channel plan	
Tuning Mode	by channel	
Bandwidth resolution	230 kHz	

► Amplitude

Parameter	Value	Additional Data
Dynamic range	-50 dBmV to 60 dBmV	
Screen range:	50 dB	
Max Input level:	70 dBmV	
Resolution:	0.1 dB	
Accuracy:	± 2 dB	
Input impedance:	75 Ohms	
Units:	dBmV, dBuV, dBm	

► Measurements: DIGITAL Channel

Parameter	Value	Additional Data
Power	From -40 dBmV to 60 dBmV	Power measurement in the channel bandwidth by integration method at the marker. Represented by vertical blue bars

► Channel Demodulation

Parameter	Value	Additional Data
QAM Systems compatibility	DVB-C, ITUJ83 Annex B and C	
SR	1000-7000 ksym/s	
MER	From 24 dB to 43 dB for QAM16,32,64,128,256 and QPSK	Accuracy ± 2 dB
BER	Pre BER (Before RS): From 10 E-2 to 10 E-10	Post BER (After FEC): From 10 E-2 to 10 E-10
Constellation Diagram	For all systems with x2, x4 zoom	
Lock range	-20 dBmV to 60 dBmV	

► Measurements: Analog TV Channel

Parameter	Value	Additional Data
Video Carrier Signal Level	From -45 dBmV to 60 dBmV	Represented by vertical white bars

► Channel Demodulation

Parameter	Value	Additional Data
Audio Carrier signal level, A/V	0- 30 dB (for PAL, SECAM or NTSC standard)	
C/N	48 dB for input level > 10 dBmV	
HUM (over audio carrier)	1-15%, 1% accuracy	
CTB/CSO	60 dB dynamic range. (In channel with removed carrier or out of channel selecting a not used channel)	± 3 dB accuracy
Sound	broadcast FM demodulation from internal speaker	

► Configuration Menu

Parameter	Value	Additional Data
Channel Plan	Yes	
Standard TV Channel plans	CCIR,EIA,HRC,IRC,OIRL,FCC up to 10	
Customized Channel plan	Up to 30	
Units	dBmV, dBuV, dBm	
Reference Line	from -60 dBmV to 120 dBmV	
Units	dBmV, dBuV, dBm	
Reference Line	from -60 dBmV to 120 dBmV	
Thresholds	Max and Min limits for quality evaluation	

5.3 Tilt

► Downstream

Parameter	Value	Additional Data
Frequency:	Four selectable tuning frequencies (pilots) from 45 MHz to 1700 MHz	
Tuning resolution:	10 kHz	
Bandwidth resolution	230 kHz	
Dynamic range:	-50 dBmV to 60 dBmV	
Screen range:	50 dB	
Max Input level:	70 dBmV	
Resolution:	0.1 dB	
Measurements:	Level of four selected frequencies	± 0 to 30 dB/ MHz (Tilt) between two selected pilots
Resolution:	0.1 dB	

► Upstream

Parameter	Value	Additional Data
Frequency:	Four selectable tuning frequencies (pilots) from 45 MHz to 1700 MHz	
Tuning resolution:	10 kHz	
Bandwidth resolution	230 kHz	
Dynamic range:	-50 dBmV to 60 dBmV	
Screen range:	50 dB	
Max Input level:	70 dBmV	
Resolution:	0.1 dB	
Measurements:	Level of four selected frequencies	± 0 to 30 dB/ MHz (Tilt) between two selected pilots
Resolution:	0.1 dB	

► Configuration Menu

Parameter	Value	Additional Data
Units	dBmV, dBuV, dBm	
Select two pilots for Tilt	Pbottom / Ptop	

5.4 DOCSIS Analyzer

► Frequency

Parameter	Value	Additional Data
Tuning Range	From 90 to 1700 MHz	
Tuning Mode	By Frequency or by channel	
Frequency step	10 KHz	
Bandwidth resolution	230 kHz, 2 MHz	
Accuracy	20 ppm	
Sweep time	600 ms full band	

► Amplitude

Parameter	Value	Additional Data
Dynamic range	-50 dBmV to 60 dBmV	
Screen range	50 dB	
Max Input level	70 dBmV	
Resolution	0.1 dB	
Accuracy	± 2 dB	
Input impedance	75 Ohms	
Units	dBmV, dBuV, dBm	

► Measurements: Frequency tuning mode

Parameter	Value	Additional Data
Level	- 50 dBmV to 60 dBmV	Peak detector level measurement from marker
Audio demodulation	Analog FM	
C/N	Selectable noise frequency marker	
HUM	1-15 % , ± 1 % accuracy	For CW signals

► Measurements: DIGITAL Channel tuning mode or DBG carrier mode

Parameter	Value	Additional Data
Power	From -40 dBmV to 60 dBmV	Power measurement in the channel bandwidth by integration method

► Downstream DOCSIS Channel Demodulation

Parameter	Value	Additional Data
Systems compatibility:	DOCSIS 2.0, DOCSIS 3.0	
MER	From 27 dB to 40 dB	
BER	Pre BER (Before RS): From 10 E-2 to 10 E-10	Post BER (After FEC): From 10 E-2 to 10 E-10
Constellation Diagram	For all systems with x2, x4 zoom	
Lock range	-20 dBmV to 60 dBmV	

► Others

Parameter	Value	Additional Data
DOCSIS BONDING GROUP (DBG)	1-8 graphic bar channels representation	
RANGING PROCESS	DOWNSTREAM/UPSTREAM CABLE MODEM measurements to fix Upstream power and Frequency	
REGISTERING PROCESS	8 Downstream channels x 4 upstream channel table representation	Full IP address
BROWSER	Allow internet acces	
IPTV, VOIP test	Packet transmission for PLR, lattency, jitter Rvalue and MOS	

► Configuration Menu()

Parameter	Value	Additional Data
Channel Plan	Yes	
Standard TV Channel plans	CCIR,EIA,HRC,IRC,OIRL,FCC up to 10	
Customized Channel plan	Up to 30	
Units	dBmV, dBuV, dBm	
Reference Line	from -60 dBmV to 120 dBmV	
Trace	normal, max hold and min hold	
Frequency Step	form 10 kHz to 100 MHz	
Top Frequency	900 MHz, 1700 MHz or selectable	

5.5 Upstream Generator

► Tuning Range

Parameter	Value	Additional Data
Tuning range:	From 5 to 85 MHz	
Dual mode:	Fix frequency or sweep	
Resolution	100 kHz	
Accuracy	±5 kHz	
Carrier level	from 60 to 115 dBuV (1 dB step)	
Level accuracy	±3 dB	

Parameter	Value	Additional Data
Modulation	QPSK, 16QAM, 32QAM, 64QAM	
SR	From 160 ksym/s to 5120 ksym/s	

► Configuration Menu

Parameter	Value	Additional Data
Units:	dBmV, dBuV, dBm	
CM information:	SW MODEM, MAC ADDRESS	

5.6 External Cable Modem Upstream Spectrum Analyzer

► Frequency

Parameter	Value	Additional Data
Tuning Range:	From 5 to 85 MHz or 5 to 200 MHz (DOCSIS 3.1)	
Tuning Mode:	By Frequency Resolution: 10 KHz	
Bandwidth resol:	230 kHz, 2 MHz	
Accuracy:	20 ppm	

► Amplitude

Parameter	Value	Additional Data
Dynamic range:	-50 dBmV to 60 dBmV	
Screen range:	50 dB	
Max Input level:	70 dBmV	
Resolution:	0.1 dB	
Accuracy:	± 2 dB	
Input impedance:	75 Ohms	
Units:	dBmV, dBuV, dBm	

► Configuration

Parameter	Value	Additional Data
Trace	Max hold and min hold	
Upstream band	Docsis 2.0 upstream band/ Docsis 3.0 upstream band	
Channel bandwidth	CW, 5 MHz, 7 MHz or selectable	

5.7 Input Voltage and RF Power Meter

► RF Power Measurement

Parameter	Value	Additional Data
Frequency band	5-1700 MHz	
Power accuracy:	± 3 dB	

► Input Voltage Measurement

Parameter	Value	Additional Data
VDC	1-90 V	
VAC	1-30 V _r	
Frequency measurements	from 10 Hz to 200 Hz,	± 2 % accuracy

► Configuration Menu

Parameter	Value	Additional Data
Units:	dBmV, dBuV, dBm	

5.8 Optical Measurement

► Optical Power Meter

Parameter	Value	Additional Data
Optical Band	1100 nm – 1700 nm	
Connector	SC-APC	
Dynamic range	- 50dBm to 10 dBm (0.5 dB accuracy)	
Calibrated wavelength	1310, 1490, 1550, 1625 nm	

► Optical to RF Converter

Parameter	Value	Additional Data
Optical band	1100 nm – 1700 nm (Optical band pass filter as especial option)	
RF band	45 MHz to 1700 MHz	
Dynamic range	-15 dBm to 10 dBm	
Operation	RF from optics internally redirect TO SPECTRUM ANALYZER, SCAN, TILT and DOWN stream DOCSIS analyzer	

5.9 General Specifications

► Inputs and Outputs

Parameter	Value	Additional Data
Coax 1	Yes	
Coax 2	Yes	
Optical	Yes	
USB 1	Yes	
USB 2	Yes	
Ethernet	Yes	
VDC	Yes	
Touch Monitor Display	Yes	

► Mechanical Features

Parameter	Value	Additional Data
Dimensions	290 x 185 x 65	
Weight	1.6 kg	

► Power Supply

Parameter	Value	Additional Data
Internal battery	7,2 V; 6,6 Ah Li-Ion	
Battery Operation Time	> 2.5 hours in continuous mode	
Recharging Time	3 hours up to 80% turned off	
External Voltage	12 V DC	
Consumption	40 W	
Auto Power Off	No	

► Operating Environmental Conditions

Parameter	Value	Additional Data
Altitude	Up to 2.000 m	
Temperature range	From 5°C to 40°C	
Max. Relative Humidity	80 %	up to 31°C, decreasing lineally up to 50% at 40°C

NOTE: Equipment specifications are set in these environmental operating conditions. Operation outside these specifications are also possible. Please check with us if you have specific requirements.

► **Included Accesories**

Parameter	Value	Additional Data
	DC Adapter, DC car adapter, F connector (2), carrying case, suitcase, Quick reference guide	

6 MAINTENANCE

6.1 Instructions for Returning by Mail

Instruments returned for repair or calibration, either within or out of the warranty period, should be sent with the following information: Name of the Company, name of the contact person, address, telephone number, receipt (in the case of coverage under warranty) and a description of the problem or the service required.

6.2 Considerations about the TFT Screen

This paragraph offers key considerations regarding the use of the colour screen, taken from the specifications of the manufacturer.

In the TFT screen, the user may find pixels that do not light up or pixels that are permanently lit. This should not be regarded as a defect in the TFT. In accordance with the manufacturer quality standard, 9 pixels with these characteristics are considered admissible.

Pixels which are not detected when the distance from the surface of the TFT screen to the human eye is greater than 35 cm, with a viewing angle of 90° between the eye and the screen should not be considered manufacturing defects either.

It is advisable a viewing angle of 15° in the 6.00 o'clock direction in order to obtain the optimum visualization of the screen.

6.3 Cleaning Recommendations

The equipment consists of a plastic case and a TFT screen. Each element has its specific cleaning treatment.

► Cleaning the TFT Screen

The TFT screen surface is VERY DELICATE. It has to be cleaned with a soft fabric cloth (cotton or silk), always making the same move from left to right and from top to bottom, without putting pressure on the screen.

The TFT screen has to be dry-cleaned or with a product specifically designed for TFT screens, by slightly dampening the cloth. NEVER use tap or mineral water, alcohol or conventional cleaning products, because they contain components that can damage the screen.

Turn off the equipment to locate dirt on the screen. After cleaning, wait a few seconds before turning on.

► Cleaning the Plastic Case

The equipment has to be disconnected before cleaning the case.

The case must be cleaned with a solution of neutral soap and water, using a soft cloth dampened with this solution.

Before use, the equipment has to be completely dry.

Never clean with abrasive soaps, chlorinated solvents or aromatic hydrocarbons. These products may degrade the case.



PROMAX ELECTRONICA, S.L.

Francesc Moragas, 71-75

08907 L'HOSPITALET DE LLOBREGAT (Barcelona)

SPAIN

Tel. : 93 184 77 00 * Tel. Internacional: (+34) 93 184 77 02

Fax : 93 338 11 26 * Fax Internacional: (+34) 93 338 11 26

<http://www.promax.es>

e-mail: promax@promax.es