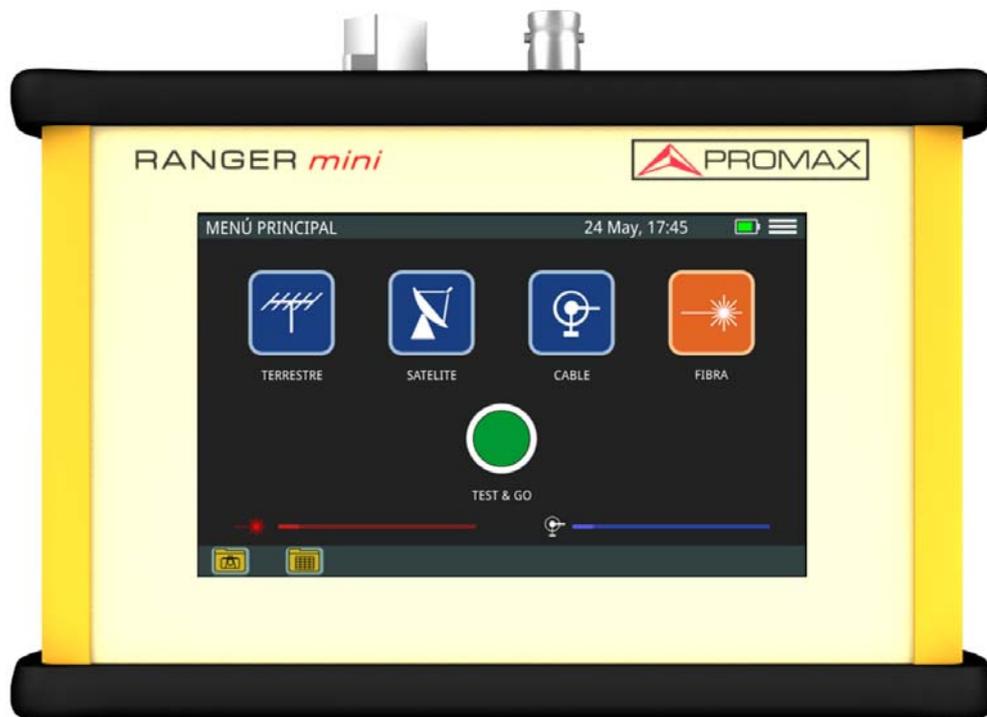


# RANGER *mini*

DIGITAL MULTI SYSTEM ANALYZER



-0 MI 2150 -



## 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.

Click on the arrow  at the top right page to return to the table of contents.

Click on the **link** or scan the **QR code** inside de video boxes  in order to play a tutorial video\*.

## USER'S MANUAL VERSION

Manual Version	Date	Firmware Version
F3.1	May 2023	10.2.10

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

### WHAT'S NEW on manual F3.1

- New: Datalogger accuracy option (["Datalogger - Test & Go" on page 56](#)).

### WHAT'S NEW on manual F2.0

- Improvement: Video-tutorials inserted along the manual (["MULTIMEDIA CONTENT" on page 322](#)).
- New: New interface (["Equipment Details" on page 7](#)).
- Improvement: Channel selection by name (["? Screen Description" on page 19](#)).

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\*. Video-tutorials are made with the CABLE RANGER meter, which belongs to the same family as the RANGER MINI, and it shares the same user interface and some functions. The RANGER MINI, as the lowest model in the family, may not have some functions available.



- Improvement: Threshold limits on screen (["? Screen Description" on page 19](#)).
- New: Offset (["? Settings Menu" on page 20](#)).
- Improvement: TILT measurement for digital channels (["Tilt" on page 36](#)).
- Improvement: For SCAN, change of marge reference using settings option (["? Settings Menu" on page 20](#)).
- Improvement: Reordering of measurement chapter (["MEASUREMENT" on page 14](#))
- New: webControl to create and edit channel plans (["WEBCONTROL" on page 58](#)).
- New: Practical example of How to tune a RF signal (["RF Signal Tuning" on page 12](#)).
- New: Speed Test for downstream and upstream (["? SPEED TEST Screen Description" on page 31](#)).

## 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
- \* 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.

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# *DIGITAL MULTI SYSTEM ANALYZER*

## **RANGER mini**

### 1 INTRODUCTION

#### 1.1 Description

The **RANGER mini** is the latest introduction in our TV analyzer product range. It is a multi system analyzer that can work in terrestrial, satellite and cable transmission systems. It can also be expanded to work with optical fibre.

The **RANGER mini** has all the functions necessary for an easy installation of any service. In addition, its intuitive menu, its adjusted weight and strength, makes it ideal for fieldwork.

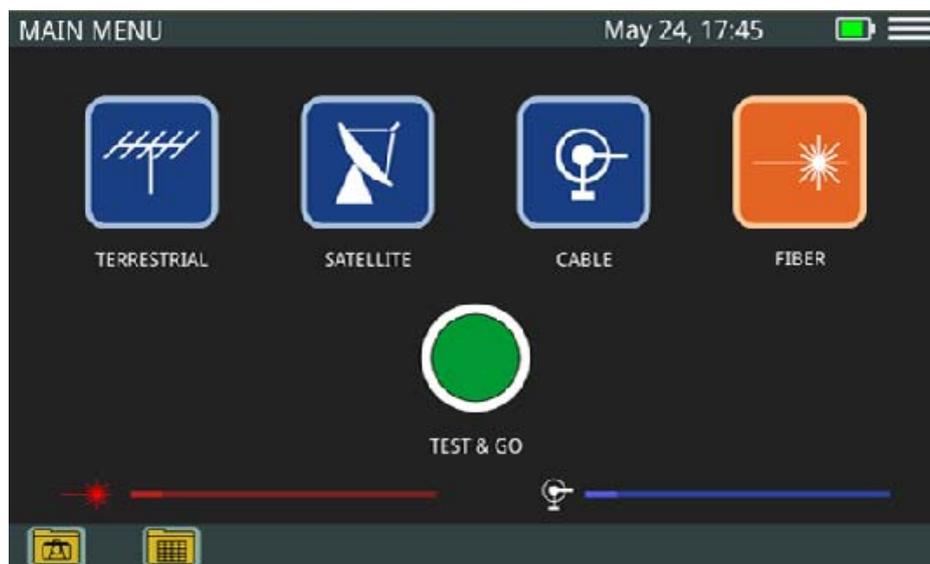
The **RANGER mini** features a 5" professional grade resistive type touch-screen with excellent brightness and superior image sharpness. It includes a case with a touch pen to make easy browsing around the menus. The instrument is powered by an internal rechargeable battery.

In the design of the **RANGER mini** 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 **RANGER mini** in a magnificent tool for installing and maintaining all kind of systems: Terrestrial, satellite and CATV. Being also very useful for testing DOCSIS data transmission systems. There is also available an expansion to measure optical fibre.

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

Here are some of the most important functions in the **RANGER mini**.



**Figure 1.**

The **RANGER mini** includes all the necessary functions to carry out the installation of any service in terrestrial, satellite or cable systems, including fiber optics if this option is installed. Each system has a series of helpful tools for each task.

The **Spectrum Analyzer** function provides an analysis of spectrum in the band corresponding to the system selected. It can demodulate each signal and show its constellation. Reference level and span can be set by user.

The **Upstream** function provides an analysis of upstream spectrum in the band between 5 and 205 MHz, which allows you to easily detect problems in that band, such as impulse noise.

The **Scan** for terrestrial and cable 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 **Voltmeter** function automatically identifies the voltage type (DC or AC) at the input and the frequency in case of alternating voltage.

In addition, it includes other tools such as datalogger, screenshot, channel plan editor and to connect to a external device (PC, tablet) via Ethernet.

The **RANGER mini** can be expanded with an optical input allowing field technicians not only to perform optical power measurements but also to do all the RFoG measurements using a built-in optical to RF converter.



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



[Introduction to RANGER MINI](#)

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## 2 SETTING UP

### 2.1 Package Content

Check that your package contains the following elements:

- RANGER *mini* Analyser.
- External DC charger.
- "F" / f - "F" / f Adapter (1 u.).
- Transport suitcase.
- Touch pen.
- 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 RANGER *mini* is powered by a 7.6 V built-in rechargeable LiPo battery of high quality and long operation time. This equipment can operate on battery or connected to the mains using a DC adapter.

#### 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 downside panel (see figure).



**Figure 2. Power input and Charge Indicator + ON / OFF Button**

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 led indicator next to the ON/OFF button 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 4 hours.
- With the battery at 80% charge the average battery time is 3 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.

1 TFT Touch Screen.

	<a href="#">Main Menu</a>	S C A N
--	---------------------------	------------------

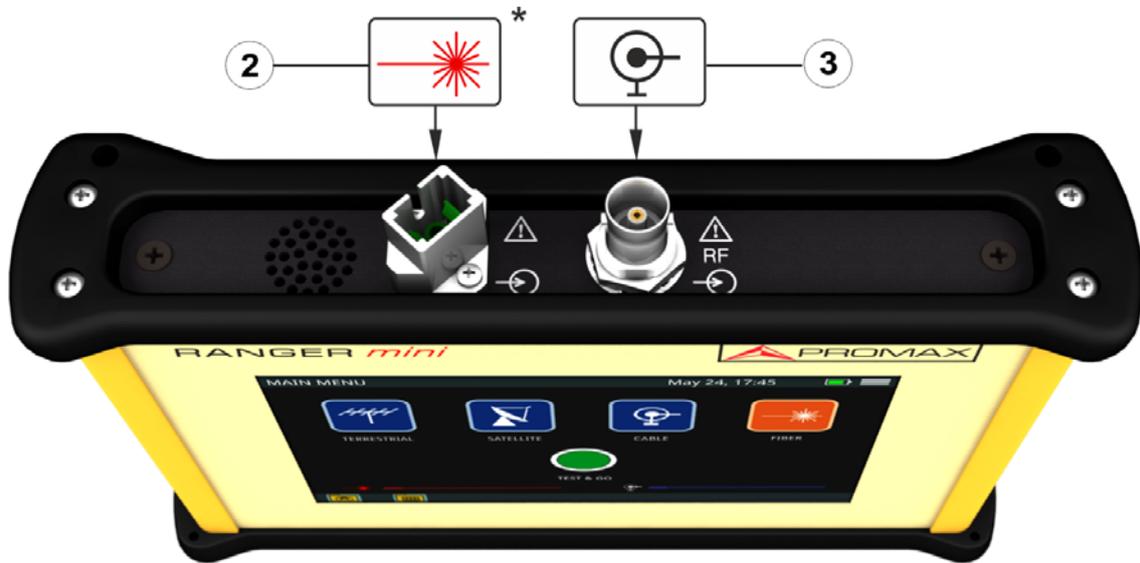


Figure 4. Upside View.

- 2 SC-APC connector\* (fibre optics signal input).
- 3 Universal connector for F/F or F/BNC adapter (cable input with RF signal).

\*. optional. Contact PROMAX for more information.



**Figure 5. Downside View.**

- 4 Ethernet connector for network.
- 5 USB connector for flashdrive device.
- 6 12 V DC power input connector.

## 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 downside 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	 USB flashdrive connected and detected
 Back to previous screen	 Connected to Ethernet network
 Back to main screen	 Battery charging
 Access to screenshots	 Battery charged
 Access to dataloggers	 Low battery
 Access to settings menu	 Terrestrial
 Switch off	 Satellite
 Edit value	 Cable
 Select parameter	 Fiber

Figure 6.

## 2.6 Controls

The equipment is operated only using the touch panel.

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



These actions can be done through the touch panel:

- Menu Selection.
- Frequency or channel selection or edition.
- 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 the general settings:

- **Language:** It allows you to select a language among English, Spanish, French or German.
- **Date:** It allows you to set date.
- **Time:** It allows you to select time format (12/24) and set time.
- **Sound:** It allows you to set sound level and enable or disable beep.
- **Auto power off:** It allows you to enable or disable auto power off option.
- **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).
- **Test&Go configuration:** It allows you to set the datalogger settings when pressing on Test&Go (Scan, DBG or TILT measurements).
- **Web Server:** It shows the IP to connect to the remote application.

## 2.8 Firmware Update

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

- 1 Use a USB flash drive in FAT32 format.
- 2 Download the file from the download area at PROMAX website ([www.promaxelectronics.com](http://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 **RANGER mini** and insert the flash drive into the USB port.
- 5 Turn ON the **RANGER mini**. The update process starts automatically. Wait until finished.
- 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.

## 2.9 RF Signal Tuning

This sections explains briefly how to tune a RF signal using a channel plan.

For more details about operation and setting parameters refer to the other chapters.

- 1 Connect the RF input signal cable to the RF input connector with the adapter F/F or F/BNC.
- 2 Access the main screen by pressing **HOME**  and select the measurement type **TERRESTRIAL**, **SATELLITE** or **CABLE**.
- 3 Select **SPECTRUM ANALYZER** option on terrestrial or cable (for satellite it will access directly).
- 4 Press on the **MENU** icon  at the upper right corner and select **Edit channel plan** to get into the screen that allows you to select, create and edit channel plans.
- 5 Select a recommended channel plan for your country (check available channels in the meter and the area for each one in the annex ["CHANNEL PLANS" on page 74](#)).
- 6 Press on the box that shows the current channel plan. It will deploy a dropdown menu with a list of available channel plans. Select one of them.
- 7 Once you select a channel plan, exit pressing key .
- 8 Select a channel to tune. To select a channel press on the box to the left (where it shows the current channel and channel plan). Then a list will appear with all available channels. On the other hand, if you press long on this box, it will appear a virtual keyboard to input your channel.



- 9 In case of **SATELLITE** signal, press on the MENU icon  at the upper right corner and select the LNB option in order to check if the proper option is selected (for more details refer to ["Satellite Measurement" on page 22](#)).
- 10 In case of **CABLE** signal, press on the DBG box and select a channel that belongs to a DBG (for more details refer to ["Cable Measurement" on page 26](#)).
- 11 Set the **REFERENCE LEVEL** pressing on keys **UP** and **DOWN** at the left of the screen.
- 12 Set **SPAN** pressing on keys + and + at the lower center. The recommended Span for a terrestrial signal is 50 MHz and for a satellite signal is 100 MHz.
- 13 If everything is right, it will tune the channel. The cursor is placed on the channel center and two vertical lines indicate the channel bandwidth. It also shows **Power** and **MER** measurement.
- 14 To see **CONSTELLATION** and other related measurement press on the **System** box.
- 15 In case **there are not a proper channel plan**, you can create a new one from the one recommended for your area. To do this select the option 'Automatically create a channel plan by measuring the network' (for more details refer to ["Edit Channel Plan" on page 46](#)).



## 3 MEASUREMENT

### 3.1 Introduction

The meter can measure different types of signals and standards:

- Terrestrial measurement: DVB-T, DVB-T2 and ISDB-T standard.
- Satellite measurement: DVB-S y DVB-S2 standard.
- Cable measurement: DOCSIS standard for CATV networks.
- Fibre Optics\* measurement: RF optical converter for HF networks.

The main screen shows each icon that gives access to the tools for each signal.

At the lower part there are two horizontal bars that show the level signal for the RF input (right) or fibre optics (left).

Following sections show how to operate with tools for each type of signal.

### 3.2 Terrestrial Measurement

The meter has three tools to analyze terrestrial signal:

- Spectrum.
- Scan.
- Input voltage.

Next each tool is described.

#### 3.2.1 Spectrum Analyzer

##### ► Description

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

This function shows signals in the frequency band so any problem can be detected easily. It also measures level and demodulates the tuned signal.

---

\*. Available as an option. Consult PROMAX.



User can adjust span and reference level directly on screen. User can also select trace type (max hold / min hold), measurement units and other parameters.

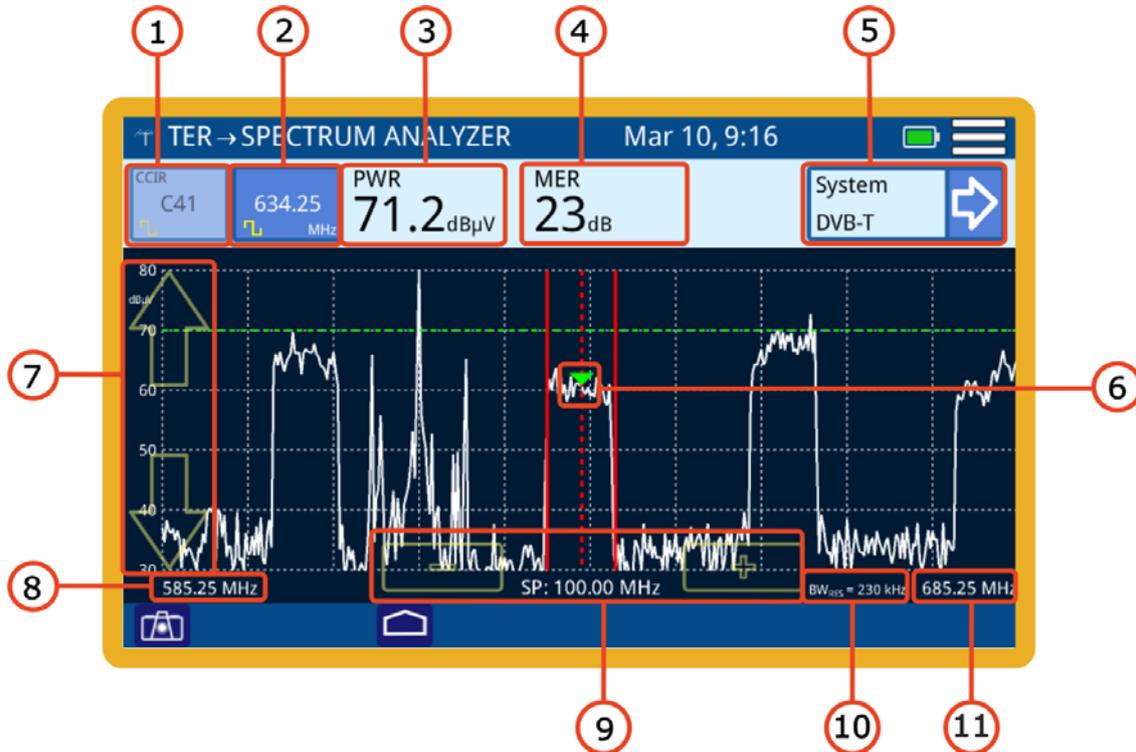


### ► Operation

- 1 Connect signal to the input through F/F or F/BNC adapter.
- 2 Access the main screen pressing on the HOME key .
- 3 Select the **TERRESTRIAL** function and then **SPECTRUM ANALYZER**. It shows the terrestrial spectrum analyzer screen in the band from 45 MHz to 1000 MHz.
- 4 Signal can be tuned by one of this ways:
  - **Tuning by CHANNEL:** Press on the Channel box and select one channel from the dropdown menu or long press on the box to enter the channel name (before that you must select or create a channel plan from the "Edit Channel plan" option).
  - **Tuning by FREQUENCY:** Press on the Frequency box and enter a frequency using the virtual numeric keypad.
- 5 To obtain more information about your signal press on the System box:
  - **When tuning by CHANNEL:** It applies demodulation parameters according to the channel plan for the tuned channel (see next).
  - **When tuning by FREQUENCY:** It applies demodulation parameters defined in the option "Frequency tuning" (see next).
- 6 Press **HOME**  key to exit.



► **Screen Description**



**Figure 7.**

- 1** Selected channel. At the top it shows the channel plan where the channel belongs. At the lower it shows the icon that identifies if the channel is digital or analogue. If tuning by channel its background colour will be dark blue. When pressing it allows you to select a channel:
  - Short press: it deploys a list of available channels.
  - Long press: it allows you to enter a channel via virtual keyboard.
- 2** Frequency selected. At the lower it shows the icon that identifies if the channel is digital or analogue. When pressing it allows you to change frequency through a virtual keypad. If tuning by frequency its background colour will be dark blue.
- 3** According to signal type (if offset is selected it appears in red):
  - Digital signal: Power for channel bandwidth or frequency.
  - Analogue signal: Level for channel or frequency selected.
- 4** MER measurement (only for digital channels).
- 5** System measurement: It shows the transmission standard for the tuned channel/frequency. When pressing it shows data from signal demodulation for digital channels or additional measurements for analogue signals (see next).
- 6** Marker for selected channel / frequency.
- 7** Arrows to change reference level.



- 8 Span lower frequency.
- 9 Arrows to increase / decrease span. Current span.
- 10 Bandwidth resolution.
- 11 Span upper frequency.

### ► Options Menu

There are some options at the bottom of the screen:

-  : Screenshot.
- CLEAR: It cleans maximum and minimum traces (if enabled).
- : Back to home screen.

### ► Settings

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

- **Edit channel plan:** It allows you to edit a channel plan and DOCSIS Bonding Group (refer to "Edit Channel Plan" chapter).
- **Units:** It allows you to select measurement units for power (dB $\mu$ V, dBmV, dBm). It also allows you to select the measurement unit plus a 20 dB offset (in order to simulate the 20 dB attenuation from test points in a network). When selecting a measurement unit with offset, it will appear in red on the power measurement box.
- **Reference line:** It allows you to select the reference line by numbers. Reference line allows you to define criteria in order to quickly accept or refuse channel levels.
- **Trace:** It allows you to select holding type of trace (maximal, minimum).
- **Frequency step:** It allows you to select frequency step (0.25 MHz, 1 MHz, 8 MHz, other value).
- **Filter:** It allows you to select a frequency filter (230 kHz, 2 MHz or Auto).
- **Frequency tuning:** It allows you to set parameters to demodulate signal when tuning by frequency. User must select bandwidth, type of signal (digital, analogue, FM or continuous wave) and other related parameters.
- **LNB:** It allows you to apply different voltages and frequencies to supply the LNB (only for satellite signals).



### 3.2.2 Scan

#### ► 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 through F/F or F/BNC adapter.
- 2 Access the main screen pressing on the HOME key .
- 3 Select the **TERRESTRIAL** function and then **SCAN**.
- 4 **SCAN** function opens. It shows a bar graph representing signal level or power for each one of the active channels in the channel plan.
- 5 Press **System** to demodulate the tuned signal.
- 6 Press **HOME**  key to exit.



► Screen Description

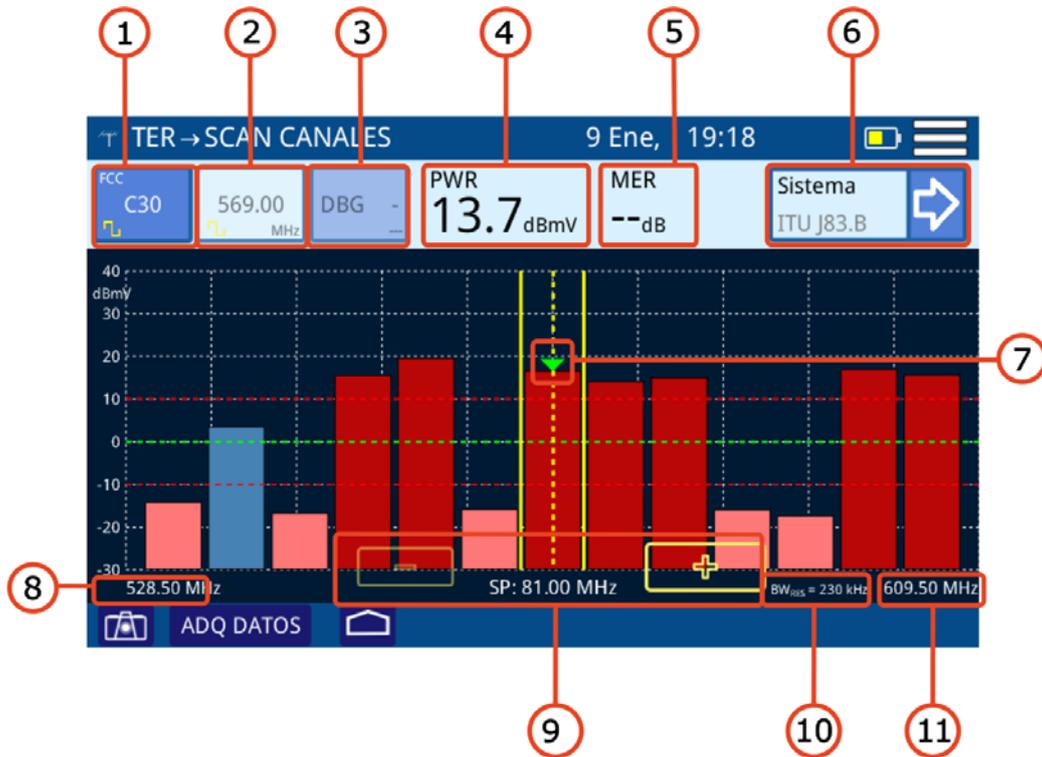


Figure 8.

- 1 Selected channel. At the top it shows the channel plan where the channel belongs. At the lower it shows the icon that identifies if the channel is digital or analogue. If tuning by channel its background colour will be dark blue.
  - Short press: it deploys a list of available channels.
  - Long press: it allows you to enter a channel via virtual keyboard.
- 2 Frequency selected. At the lower it shows the icon that identifies if the channel is digital or analogue. When pressing it allows you to change frequency through a virtual keypad. If tuning by frequency its background colour will be dark blue.
- 3 DOCSIS Bonding Group selected and carrier (if any).
- 4 According to signal type:
  - Digital signal: Power for channel bandwidth or frequency.
  - Analogue signal: Level for channel or frequency selected.
- 5 MER measurement (only for digital channels).
- 6 System measurement: It shows the transmission standard for the tuned channel/frequency. When pressing it shows data from signal demodulation for digital channels or additional measurements for analogue signals (see next).
- 7 Marker for selected channel / frequency. Vertical yellow lines show the channel bandwidth. Horizontal red lines show upper and lower threshold.



Channels over or below thresholds will be in dark or light color respectively. Channels inside threshold will be in blue or in dark if they belong to a DBG.

- 8 Span lower frequency.
- 9 Arrows to increase / decrease span. Current span.
- 10 Bandwidth resolution.
- 11 Span upper frequency.

### ► Options Menu

There are some options at the bottom of the screen:

- : Screenshot.
- **DATALOGGER**: It creates a datalogger with measurement data.
- : Back to home screen.

### ► 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 measurement units for power (dB $\mu$ V, dBmV, dBm). It also allows you to select the measurement unit plus a 20 dB offset (in order to simulate the 20 dB attenuation from test points in a network). When selecting a measurement unit with offset, it will appear in red on the power measurement box.
- **Reference line**: It allows you to select the reference line by numbers. Reference line allows you to define criteria in order to quickly accept or refuse channel levels.
- **Trace**: It allows you to select holding type of trace (maximal, minimum).
- **Frequency step**: It allows you to select frequency step (0.25 MHz, 1 MHz, 8 MHz, other value).
- **Filter**: It allows you to select a frequency filter (230 kHz, 2 MHz or Auto).
- **Frequency tuning**: It allows you to set parameters to demodulate signal when tuning by frequency. User must select bandwidth, type of signal (digital, analogue, FM or continuous wave) and other related parameters.
- **LNB**: It allows you to apply different voltages and frequencies to supply the LNB (only for satellite signals).
- **Measurement range**: It allows you to define the measurement range on screen. For field applications is recommended a range between 20 and 90



dB $\mu$ V. For other types of applications as head-end measurement or amplifiers output is recommended to adjust to the proper range.

### 3.2.3 Input Voltage

#### ► Description

The INPUT VOLTAGE or VOLTMETER function automatically identifies the voltage type (DC or AC) at the input, voltage and frequency in case of AC voltage.

#### ► Operation

- 1 Connect signal to the input through F/F or F/BNC adapter.
- 2 Access the main screen pressing on the HOME key .
- 3 Select the CABLE function and then **INPUT VOLTAGE**.
- 4 It shows on screen the **VOLTMETER** function.
- 5 Press **HOME**  key to get back to the main screen.

#### ► Screen Description

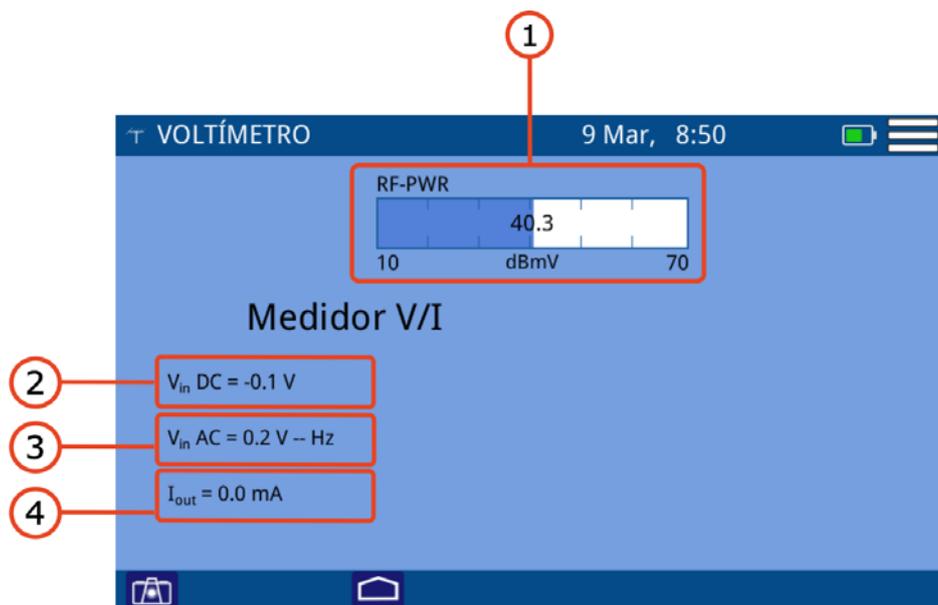


Figure 9.

- 1 RF-PWR: Full bandwidth power (it shows offset in red if it is enabled).



- 2 Vin DC: DC input voltage.
- 3 Vin AC: AC input voltage and frequency.
- 4 Iout: Current out.

### ► Options Menu

There are some options at the bottom of the screen:

- : Screenshot.
- : Back to home screen.

### ► Settings Menu

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

- **Units:** It allows you to select measurement units for power (dB $\mu$ V, dBmV, dBm). It also allows you to select the measurement unit plus a 20 dB offset (in order to simulate the 20 dB attenuation from test points in a network). When selecting a measurement unit with offset, it will appear in red on the power measurement box.

## 3.3 Satellite Measurement

The Spectrum Analyzer for satellite it allows you to analyze, demodulate and measure the most important parameters for satellite signal.

Next it is explained how it works.

	<a href="#">Satellite Function</a>	
---	------------------------------------	---

### 3.3.1 Spectrum

#### ► Description

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

This function shows signals in the frequency band so any problem can be detected easily. It also measures level and demodulates the tuned signal.



User can adjust span and reference level directly on screen. User can also select trace type (max hold / min hold), measurement units and other parameters.

### ► Operation

- 1 Connect signal to the input through F/F or F/BNC adapter.
- 2 Access the main screen pressing on the HOME key .
- 3 Select the **SATELLITE** function. It shows the satellite spectrum analyzer screen in the band from 900 MHz to 2700 MHz.
- 4 To supply the LNB, press on the MENU icon  at the top right corner and select the LNB option. Select one option to supply. Previously confirm that there is no voltage.
- 5 Signal can be tuned by one of this ways:
  - **Tuning by CHANNEL:** Press on the Channel box and select one channel from the dropdown menu or long press on the box to enter the channel name (before that you must select or create a channel plan from the "Edit Channel plan" option).
  - **Tuning by FREQUENCY:** Press on the Frequency box and enter a frequency using the virtual numeric keypad.
- 6 To obtain more information about your signal press on the System box:
  - **When tuning by CHANNEL:** It applies demodulation parameters according to the channel plan for the tuned channel (see next).
  - **When tuning by FREQUENCY:** It applies demodulation parameters defined in the option "Frequency tuning" (see next).
- 7 Press **HOME**  key to exit.



► Screen Description

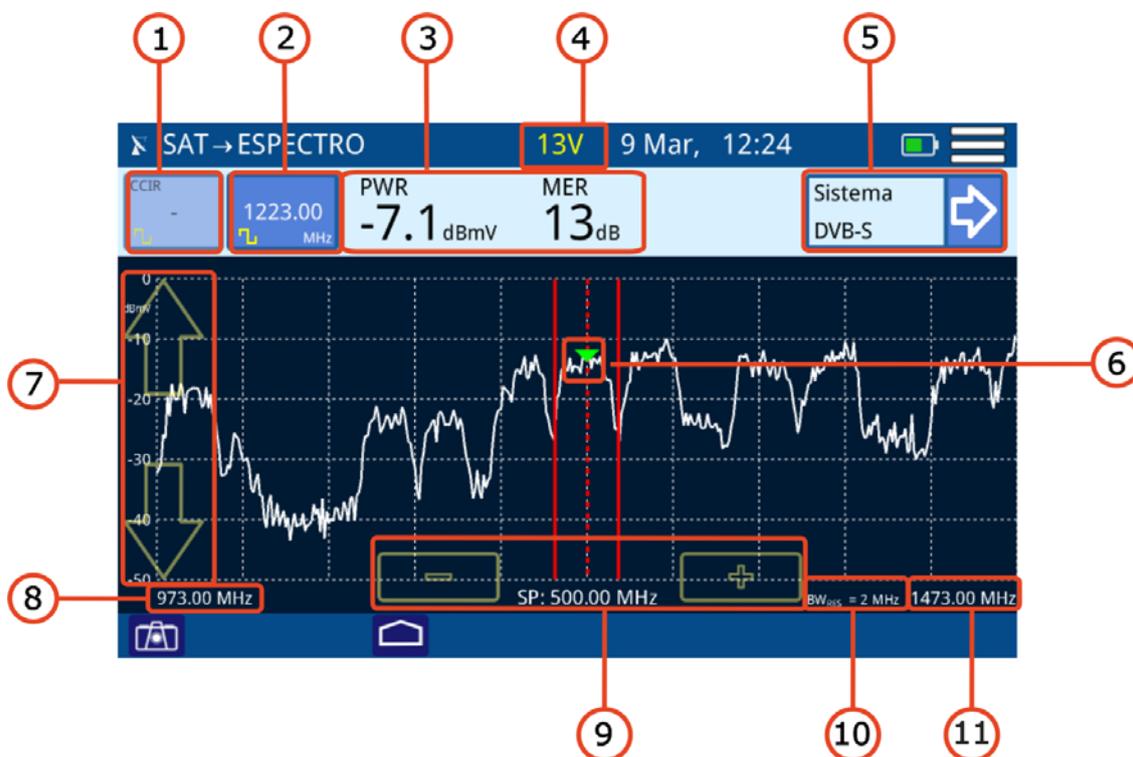


Figura 10.

- 1 Selected channel. At the top it shows the channel plan where the channel belongs. At the lower it shows the icon that identifies if the channel is digital or analogue. If tuning by channel its background colour will be dark blue. When pressing it allows you to select a channel:
  - Short press: it deploys a list of available channels.
  - Long press: it allows you to enter a channel via virtual keyboard.
- 2 Frequency selected. At the lower it shows the icon that identifies if the channel is digital or analogue. When pressing it allows you to change frequency through a virtual keypad. If tuning by frequency its background colour will be dark blue.
- 3 According to signal type (if offset is selected it appears in red):
  - Digital signal: Power for channel bandwidth or frequency.
  - Analogue signal: Level for channel or frequency selected.
- 4 LNB power supply.
- 5 System measurement: It shows the transmission standard for the tuned channel/frequency. When pressing it shows data from signal demodulation for digital channels or additional measurements for analogue signals (see next).
- 6 Marker for selected channel / frequency.
- 7 Arrows to change reference level.



- 8 Span lower frequency.
- 9 Arrows to increase / decrease span. Current span.
- 10 Bandwidth resolution.
- 11 Span upper frequency.

### ► Options Menu

There are some options at the bottom of the screen:

-  : Screenshot.
- CLEAR: It cleans maximum and minimum traces (if enabled).
- : Back to previous screen.

### ► Settings Menu

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

- **Edit channel plan:** It allows you to edit a channel plan and DOCSIS Bonding Group (refer to "Edit Channel Plan" chapter).
- **Units:** It allows you to select measurement units for power (dB $\mu$ V, dBmV, dBm). It also allows you to select the measurement unit plus a 20 dB offset (in order to simulate the 20 dB attenuation from test points in a network). When selecting a measurement unit with offset, it will appear in red on the power measurement box.
- **Reference line:** It allows you to select the reference line by numbers. Reference line allows you to define criteria in order to quickly accept or refuse channel levels.
- **Trace:** It allows you to select holding type of trace (maximal, minimum).
- **Frequency step:** It allows you to select frequency step (0.25 MHz, 1 MHz, 8 MHz, other value).
- **Frequency tuning:** It allows you to set parameters to demodulate signal when tuning by frequency. User must select bandwidth, type of signal (digital, analogue, FM or continuous wave) and other related parameters.
- **LNB:** It allows you to apply different voltages and frequencies to supply the LNB.



### 3.4 Cable Measurement

The meter has these tools to analyze cable signal:

- Spectrum.
- Return band analyzer.
- Scan - Scan DBG.
- Tilt.
- Input voltage.

Next each tool is describe.

#### 3.4.1 Spectrum

##### ► Description

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

This function shows signals in the frequency band so any problem can be detected easily. It also measures level and demodulates the tuned signal.

User can adjust span and reference level directly on screen. User can also select trace type (max hold / min hold), measurement units and other parameters.

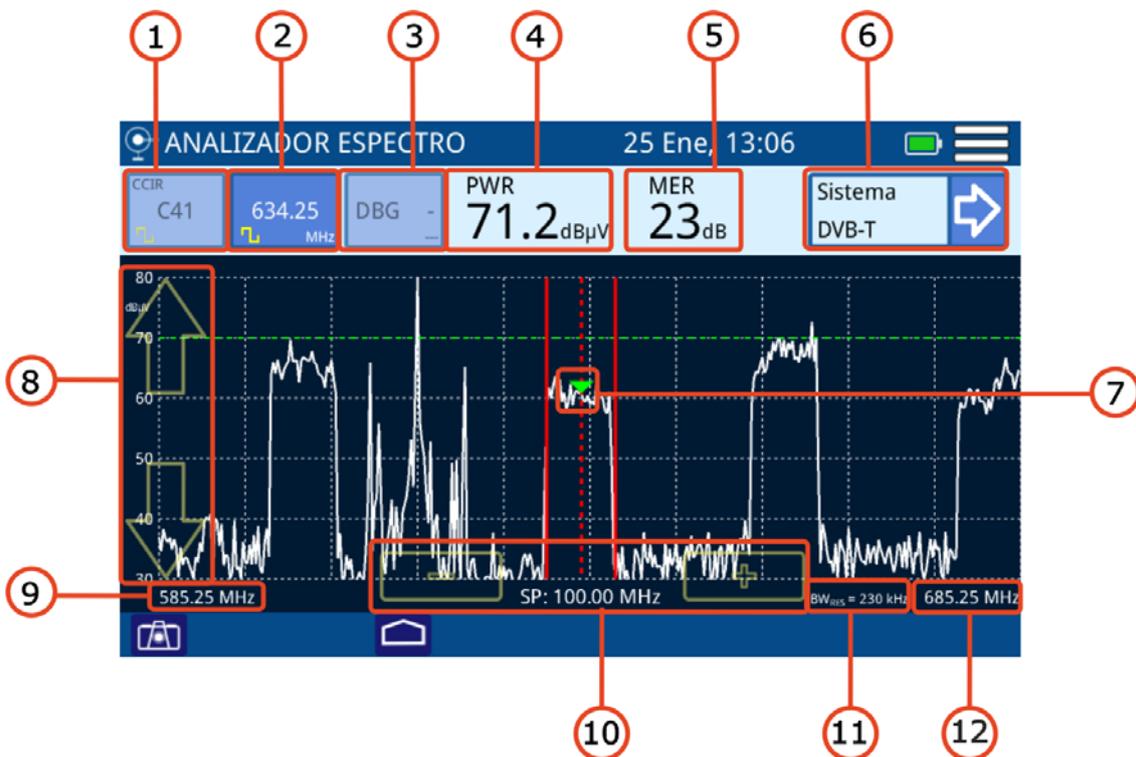
##### ► Operation

- 1 Connect signal to the input through F/F or F/BNC adapter.
- 2 Access the main screen pressing on the HOME key .
- 3 Select the **CABLE** and then **SPECTRUM**. It shows the spectrum analyzer screen for terrestrial cable in the band from 5 MHz to 2700 MHz.
- 4 Signal can be tuned by one of this ways:
  - **Tuning by CHANNEL:** Press on the Channel box and select one channel from the dropdown menu or long press on the box to enter the channel name (before that you must select or create a channel plan from the "Edit Channel plan" option).
  - **Tuning by FREQUENCY:** Press on the Frequency box and enter a frequency using the virtual numeric keypad.
  - **Tuning by DBG:** Select a DBG group and carrier to tune.



- 5 To obtain more information about your signal press on the System box:
  - **When tuning by CHANNEL:** It applies demodulation parameters according to the channel plan for the tuned channel (see next).
  - **When tuning by FREQUENCY:** It applies demodulation parameters defined in the option "Frequency tuning" (see next).
- 6 To see a channel with carriers from the DBG (Docsis Bonding Group), select a channel belonging to the DBG (for cable transmissions according to DOCSIS standard) and press DBG option.
- 7 Press **HOME**  key to exit.

► **Screen Description**



**Figure 11. Downstream Spectrum**

- 1 Selected channel. At the top it shows the channel plan where the channel belongs. At the lower it shows the icon that identifies if the channel is digital or analogue. If tuning by channel its background colour will be dark blue. When pressing it allows you to select a channel:
  - Short press: it deploys a list of available channels.
  - Long press: it allows you to enter a channel via virtual keyboard.
- 2 Frequency selected. At the lower it shows the icon that identifies if the channel is digital or analogue. When pressing it allows you to change



frequency through a virtual keypad. If tuning by frequency its background colour will be dark blue.

- 3 DOCSIS Bonding Group selected and carrier.
- 4 According to signal type (if offset is selected it appears in red):
  - Digital signal: Power for channel bandwidth or frequency.
  - Analogue signal: Level for channel or frequency selected.
- 5 MER measurement (only for digital channels).
- 6 System measurement: It shows the transmission standard for the tuned channel/frequency. When pressing it shows data from signal demodulation for digital channels or additional measurements for analogue signals (see next).
- 7 Marker for selected channel / frequency.
- 8 Arrows to change reference level.
- 9 Span lower frequency.
- 10 Arrows to increase / decrease span. Current span.
- 11 Bandwidth resolution.
- 12 Span upper frequency.

### ► Options Menu

There are some options at the bottom of the screen:

-  : Screenshot.
- CLEAR: It cleans maximum and minimum traces (if enabled).
- : Back to home screen.

### ► Settings Menu

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

- **Edit channel plan:** It allows you to edit a channel plan and DOCSIS Bonding Group (refer to "Edit Channel Plan" chapter).
- **Units:** It allows you to select measurement units for power (dB $\mu$ V, dBmV, dBm). It also allows you to select the measurement unit plus a 20 dB offset (in order to simulate the 20 dB attenuation from test points in a network). When selecting a measurement unit with offset, it will appear in red on the power measurement box.
- **Reference line:** It allows you to select the reference line by numbers. Reference line allows you to define criteria in order to quickly accept or refuse channel 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.
- **Filter:** It allows you to select a frequency filter (230 kHz, 2 MHz or Auto).
- **Frequency tuning:** It allows you to set parameters to demodulate signal when tuning by frequency. User must select bandwidth, type of signal (digital, analogue, FM or continuous wave) and other related parameters.

### 3.4.2 Return Band Analyzer (Upstream)

#### ► Description

The **Return Band or Upstream** function shows the upstream spectrum in the band between 5 and 205 MHz allowing to detect impulse noise.

User can adjust span and reference level for the frequency or channel tuned.

It is also available de Speed Test tool that allows you to check connection speed to Internet in both channels upstream and downstream.

	<a href="#">Upstream Test and Input Voltage</a>	S C A N 
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#### ► Operation

- 1 Connect signal to the input through F/F or F/BNC adapter.
- 2 Access the main screen pressing on the HOME key .
- 3 Select the **CABLE** and then **RETURN BAND ANALYSER**. It shows the spectrum analyzer screen for terrestrial cable in the return band (aka Upstream) in the range between 5 MHz and 205 MHz.
- 4 To go to a frequency press on the **Frequency** box and enter a frequency through a virtual keypad.
- 5 From this function you can go to the **Speed Test** tool pressing on **SPEED**.
- 6 Press **HOME**  key to exit.



► RETURN BAND Screen Description

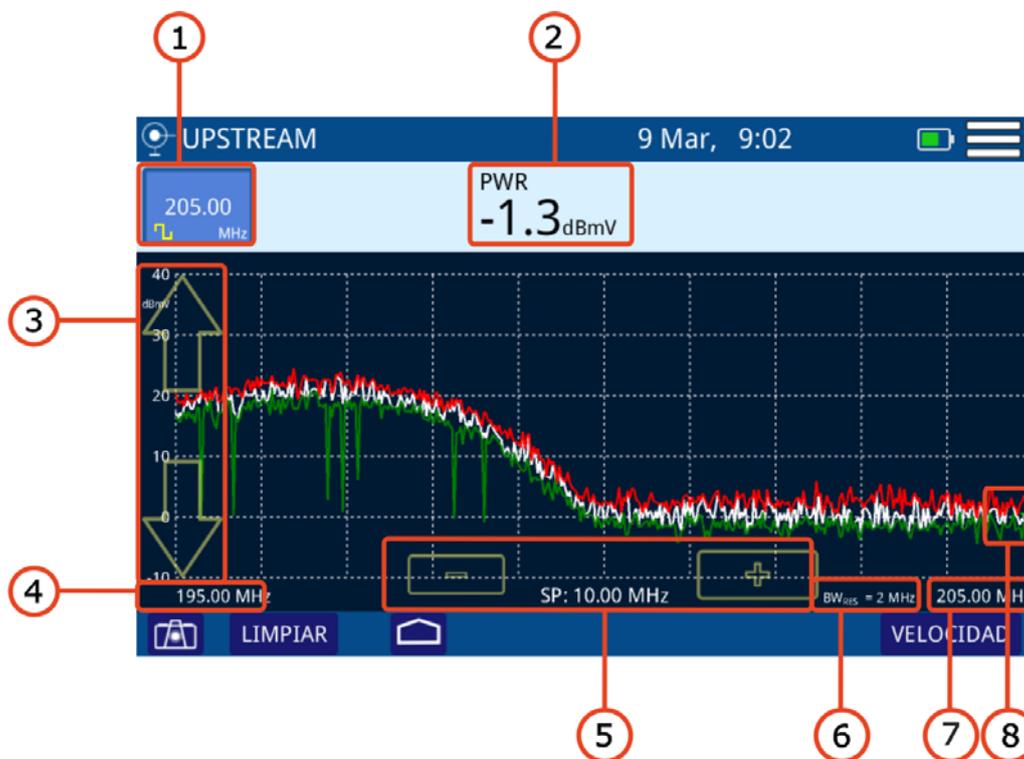


Figura 12.

- 1 Frequency selected. When pressing on it pops up a virtual numeric keypad to edit frequency.
- 2 Level at the selected frequency (if offset is selected it appears in red).
- 3 Arrows to change reference level.
- 4 Span lower frequency.
- 5 Arrows to increase / decrease span. Current span.
- 6 Bandwidth resolution.
- 7 Span upper frequency.
- 8 Marker at the selected frequency.



### ► SPEED TEST Screen Description



**Figura 13.**

- 1 Press START to start the speed test. It measures the speed for the upstream and downstream channels. It also gives data from the service provider.

### ► Options Menu

There are some options at the bottom of the screen:

-  : Screenshot.
- CLEAR: It cleans maximum and minimum traces (if enabled).
-  : Back to home screen.

### ► Settings Menu

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

- **Units:** It allows you to select measurement units for power (dB $\mu$ V, dBmV, dBm). It also allows you to select the measurement unit plus a 20 dB offset (in order to simulate the 20 dB attenuation from test points in a network). When selecting a measurement unit with offset, it will appear in red on the power measurement box.



- **Reference line:** It allows you to select the reference line by numbers. Reference line allows you to define criteria in order to quickly accept or refuse channel levels.
- **Frequency step:** It allows you to select frequency step (0.25 MHz, 1 MHz, 8 MHz, other value).
- **Trace:** It allows you to select holding type of trace (maximal, minimum).
- **Filter:** It allows you to select a frequency filter (230 kHz, 2 MHz or Auto).

### 3.4.3 Scan

#### ► 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.

	<a href="#">SCAN, Datalogger and TILT</a>		S C A N
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#### ► Operation

- 1 Connect signal to the input through F/F or F/BNC adapter.
- 2 Access the main screen pressing on the HOME key .
- 3 Select the CABLE function and then SCAN/TILT.
- 4 **SCAN** function opens. It shows a bar graph representing signal level or power for each one of the active channels in the channel plan.
- 5 Press **System** to demodulate the tuned signal.
- 6 Press **HOME**  key to exit.



► Screen Description

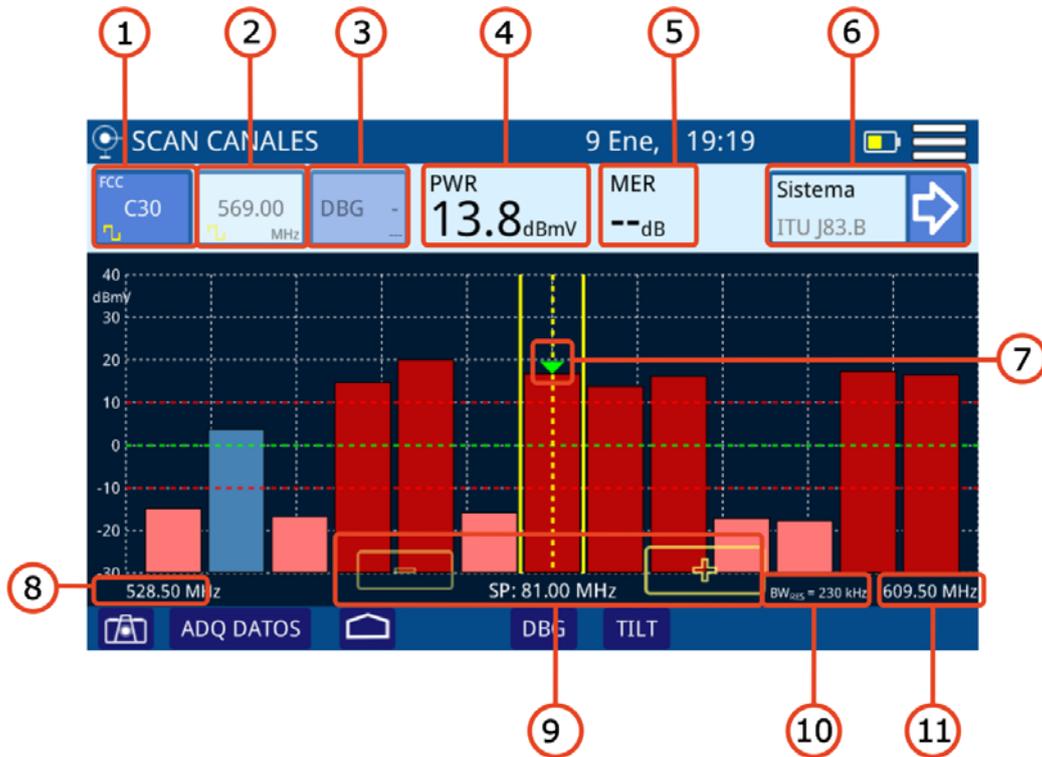


Figure 14.

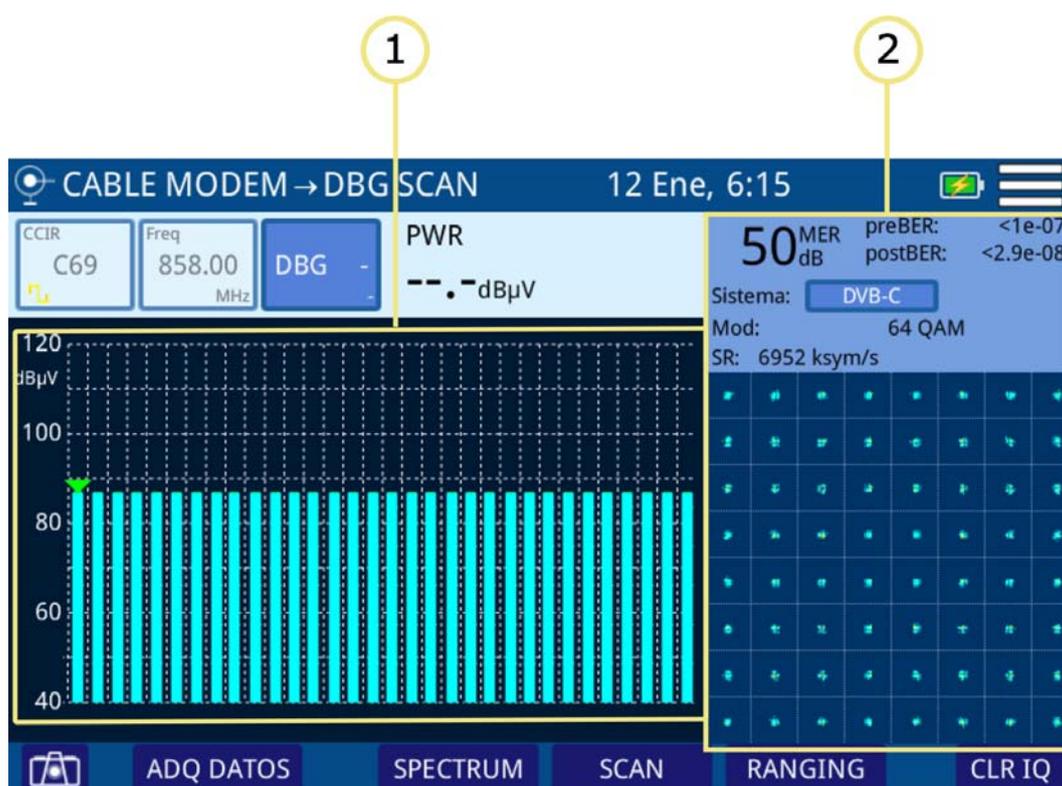
- 1 Selected channel. At the top it shows the channel plan where the channel belongs. At the lower it shows the icon that identifies if the channel is digital or analogue. If tuning by channel its background colour will be dark blue.
  - Short press: it deploys a list of available channels.
  - Long press: it allows you to enter a channel via virtual keyboard.
- 2 Frequency selected. At the lower it shows the icon that identifies if the channel is digital or analogue. When pressing it allows you to change frequency through a virtual keypad. If tuning by frequency its background colour will be dark blue.
- 3 DOCSIS Bonding Group selected and carrier (if any).
- 4 According to signal type:
  - Digital signal: Power for channel bandwidth or frequency.
  - Analogue signal: Level for channel or frequency selected.
- 5 MER measurement (only for digital channels).
- 6 System measurement: It shows the transmission standard for the tuned channel/frequency. When pressing it shows data from signal demodulation for digital channels or additional measurements for analogue signals (see next).
- 7 Marker for selected channel / frequency. Vertical yellow lines show the channel bandwidth. Horizontal red lines show upper and lower threshold.



Channels over or below thresholds will be in dark or light color respectively. Channels inside threshold will be in blue or in dark if they belong to a DBG.

- 8 Span lower frequency.
- 9 Arrows to increase / decrease span. Current span.
- 10 Bandwidth resolution.
- 11 Span upper frequency.

► **SCAN CANALES DOCSIS BONDING GROUP**



**Figura 15. DOCSIS Bonding Group**

- 1 Power for each DBG carrier. The arrow on the bar shows the selected carrier.
- 2 Constellation diagram and measurement of the channel pointed by the marker.

► **Options Menu**

There are some options at the bottom of the screen:

- : Screenshot.
- **DATALOGGER**: It creates a datalogger with measurement data.
- : Back to home screen.



- **DBG / SCAN:** It changes between DBG / SCAN function.
- **TILT:** It accesses the TILT function.

### ► 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 measurement units for power (dB $\mu$ V, dBmV, dBm). It also allows you to select the measurement unit plus a 20 dB offset (in order to simulate the 20 dB attenuation from test points in a network). When selecting a measurement unit with offset, it will appear in red on the power measurement box.
- **Reference line:** It allows you to select the reference line by numbers. Reference line allows you to define criteria in order to quickly accept or refuse channel levels.
- **Threshold:** It allows you to define high and low threshold level. On screen are represented as a two red horizontal lines.
- **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.
- **Measurement range:** It allows you to define the measurement range on screen. For field applications is recommended a range between 20 and 90 dB $\mu$ V. For other types of applications as head-end measurement or amplifiers output is recommended to adjust to the proper range.

	<a href="#">DOCSIS Measurement and analyzer</a>	S C A N 
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### 3.4.4 Tilt

#### ► 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 pilot signals at the beginning and at the end of the band. These pilots signals and other intermediate signals can be tuned simultaneously on the screen. By this way you can evaluate the losses tilt and therefore readjust equalizers of the amplifiers in order to compensate these losses and ensure a flat response along the band.

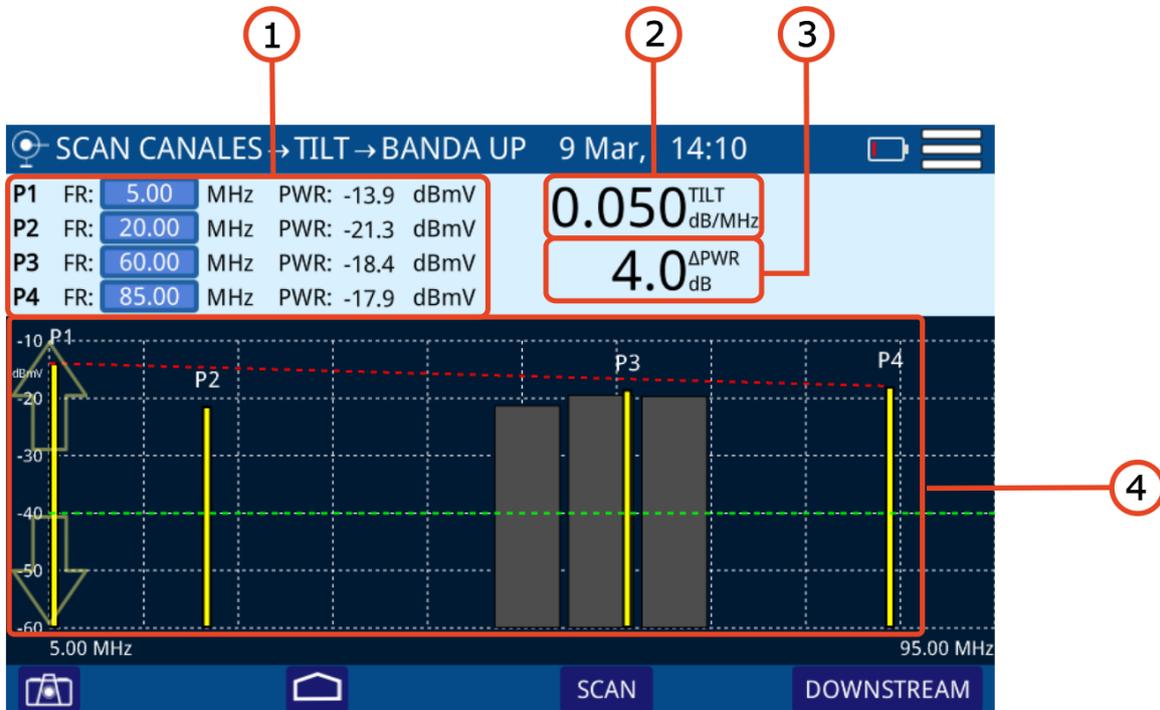
TILT measurement can be done on both analogue and digital channels.

#### ► Operation

- 1 Connect signal to the input through F/F or F/BNC adapter.
- 2 Access the main screen pressing on the HOME key .
- 3 Select the **CABLE** function and then **SCAN/TILT**.
- 4 Press on the **TILT** option on the lower part of the screen.
- 5 It opens the **TILT** function screen.
- 6 Press on the lower right corner to switch between Upstream and Downstream band.
- 7 Press **HOME**  key to exit.



► **Screen Description**



**Figure 16.**

- 1 It shows pilot signals frequency and power. Press on frequency to change its value.
  - P1/P4: End pilot signals.
  - P2/P3: Intermediate pilot signals.
- 2 TILT: Inclination rate in dB per MHz.
- 3 Power difference between P1 and P4.
- 4 Bar graph showing signal level for each pilot signal and TILT.

► **Options Menu**

There are some options at the bottom of the screen:

- : Screenshot.
- **DATALOGGER**: It creates a datalogger with measurement data.
- : Back to home screen.
- **SCAN**: Access the SCAN function.



- **UPSTREAM/DOWNSTREAM:** It allows you to switch between upstream and downstream band. The current band appears on the top of the left corner.

### ► 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 measurement units for power (dB $\mu$ V, dBmV, dBm). It also allows you to select the measurement unit plus a 20 dB offset (in order to simulate the 20 dB attenuation from test points in a network). When selecting a measurement unit with offset, it will appear in red on the power measurement box.
- **Measurement range:** It allows you to define the measurement range on screen. For field applications is recommended a range between 20 and 90 dB $\mu$ V. For other types of applications as head-end measurement or amplifiers output is recommended to adjust to the proper range.

## 3.4.5 Input Voltage

### ► Description

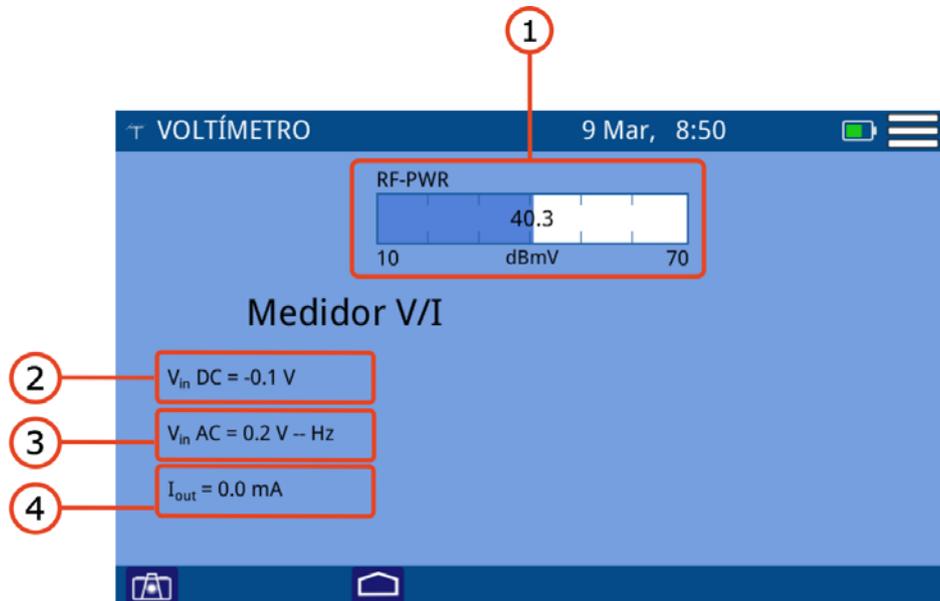
The INPUT VOLTAGE or VOLTMETER function automatically identifies the voltage type (DC or AC) at the input, voltage and frequency in case of AC voltage.

### ► Operation

- 1 Connect signal to the input through F/F or F/BNC adapter.
- 2 Access the main screen pressing on the HOME key .
- 3 Select the CABLE function and then INPUT VOLTAGE.
- 4 It shows on screen the VOLTMETER function.
- 5 Press **HOME**  key to exit.



### ► Screen Description



**Figure 17.**

- 1 RF-PWR: Full bandwidth power (it shows offset in red if it is enabled).
- 2 Vin DC: DC input voltage.
- 3 Vin AC: AC input voltage and frequency.
- 4 I<sub>out</sub>: Current out.

### ► Options Menu

There are some options at the bottom of the screen:

- : Screenshot.
- : Back to home screen.

### ► Settings Menu

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

- **Units:** It allows you to select measurement units for power (dB $\mu$ V, dBmV, dBm). It also allows you to select the measurement unit plus a 20 dB offset (in order to simulate the 20 dB attenuation from test points in a network). When selecting a measurement unit with offset, it will appear in red on the power measurement box.



### 3.5 Fibre Measurement<sup>a</sup>

a. Available as an option. Refer to PROMAX for more information.

The **RANGER mini** has an expansion option to install an input for optical measurement. This option allows field technicians to measure optical power and RFoG (RF over Glass) using an optical to RF converter.

The meter has these tools to measure and analyze optical signal:

- Spectrum.
- Return band.
- Scan
- Tilt.
- Satellite.
- Optical power.

All these tools for fibre optics, with the exception of Optical Power, work the same as for RF signal, and they were explained in previous sections.

Next the Optical Power measurement tool is explained.

#### 3.5.1 Optical Power

##### ► Description

The OPTICAL POWER METER measures power for each wavelength using a meter that can be calibrated for 6 different wavelengths.

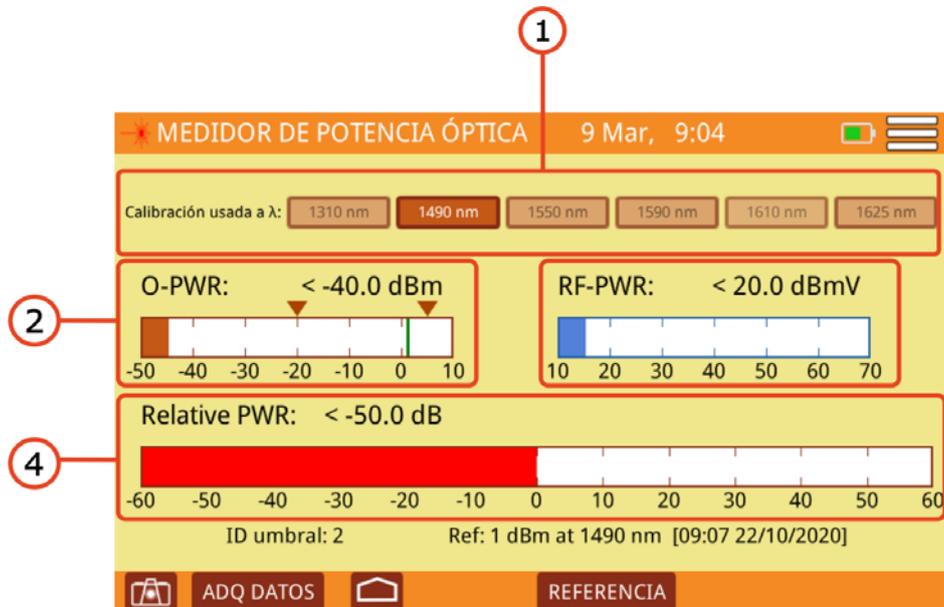
	<a href="#"><u>Optical Power Meter</u></a>	
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##### ► Operation

- 1 Connect a signal to the input through the SC-APC connector.
- 2 Access the main screen pressing on the HOME key .
- 3 Select the **FIBRE** function and then **OPTICAL POWER METER**.
- 4 It shows on screen the **OPTICAL POWER METER**.
- 5 Press **HOME**  key to exit.



## ► Screen Description



**Figura 18.**

- 1 Calibration used: Select wavelength to measure power.
- 2 O-PWR: Numerical and bar graphic for optical power measurement with arrow indicators for upper and lower threshold. THRESHOLD values can be edited on Settings menu.
- 3 RF-PWR: Numerical and bar graphic for power measurement for the whole cable.
- 4 Relative Power: Numerical and bar graphic that measures loss of power. It applies this formula:  $\text{Relative Power} = \text{Reference Value} - \text{Attenuation}$ .

## ► Options Menu

There are some options at the bottom of the screen:

-  : Screenshot.
- **DATALOGGER**: It creates a datalogger with measurement data.
-  : Back to home screen.
- **REFERENCE**: It allows to save the power current value as a reference value. The current reference is shown at the lower part of the screen.

## ► Settings Menu

Click on the  **MENU** icon at the upper right corner to access the Settings menu. The OPTICAL POWER function has this option:



- **Set optical threshold:** It allows you to define, select and save a group of values for minimal and maximum threshold (up to 8 groups). The selected threshold group ID it is shown at the lower part of the screen next to the reference.

## 3.6 Digital Signal Demodulator

### ► Description

Demodulator provides the most important measurements technicians need to evaluate the quality of a digital channel.

Constellation diagram is a simple and graphical way to identify signal impairments which impact MER and ultimately BER. An ideal 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 post V. BER simultaneously with the spectrum trace.

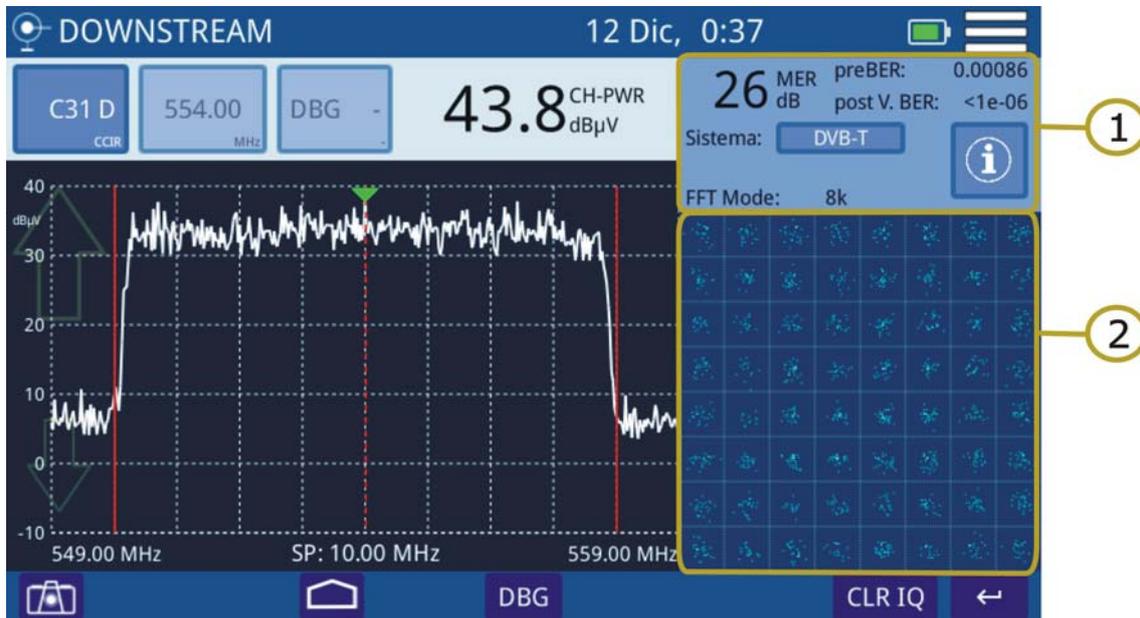
### ► Operation

DEMODULATOR is available for digital signals of functions **SPECTRUM ANALYZER (terrestrial, satellite and cable)** and **SCAN**.

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



► **Screen Description**



**Figure 19.**

- 1** Demodulated Signal Data.
  - MER for tuned channel.
  - pre-BER (BER before correction).
  - post-BER (BER after correction).
  - Transmission standard. Press to switch.
  - FFT Mode.
  - Press on "i" box to obtain more info.
- 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.



### 3.7 Analog Signal Demodulator

#### ► Description

The equipment can measure video carrier signal level, Video/Audio and C/N ratio, **HUM** and intermodulation products from an analogue signal. 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

This function is available for analogue signals in **SPECTRUM ANALYZER** and **SCAN**.

- 1 Select analogue channel or frequency and tune it.
- 2 Press on "**System**" option.
- 3 To set measurement parameters for intermodulation products (CTB/CSO) access the settings menu at the upper right corner.

#### ► Screen Description

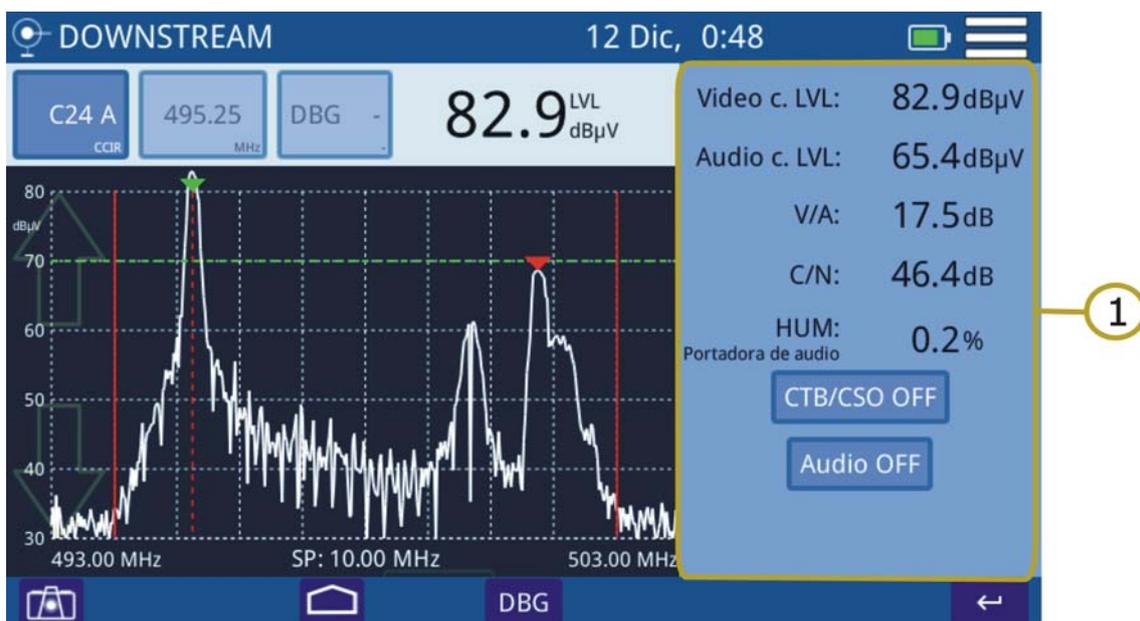


Figure 20.

- 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. Press to enable/disable.
- Audio OFF/ON: It enables / disables audio and to set audio level.



## 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.

You can also create and edit channel plans from an external device using the webControl application that is explained in the next sections.

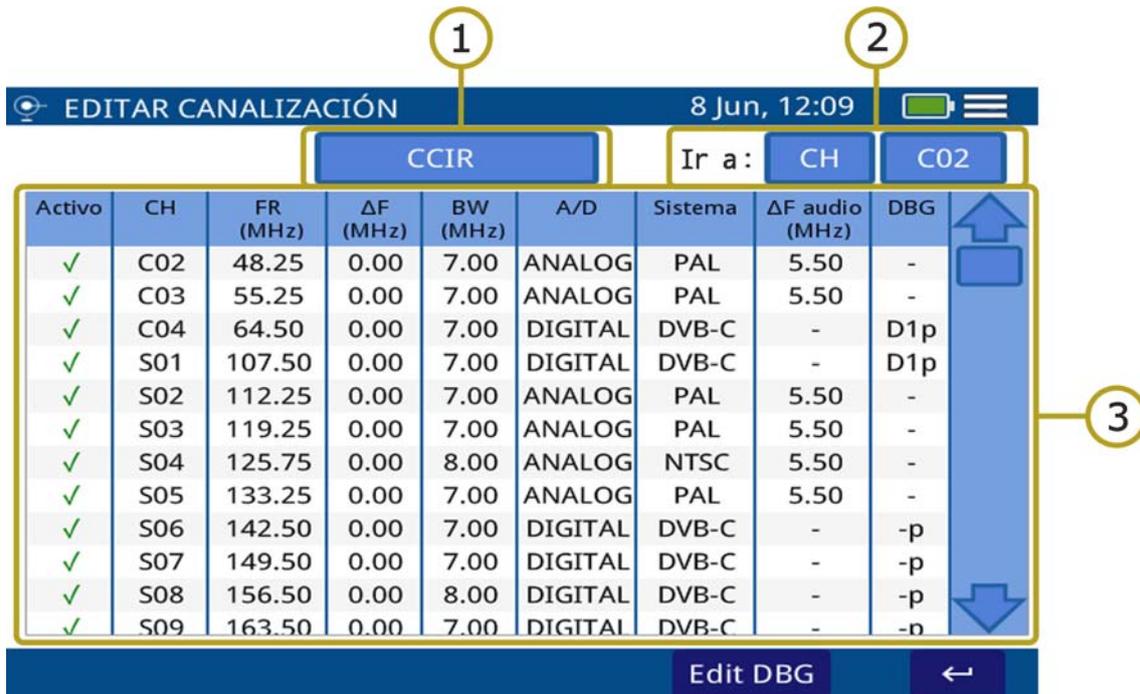
#### ► Operation

Channel plan editor is available for tools **SPECTRUM ANALYZER** and **SCAN** .

- 1 From the tool screen access settings menu by pressing on .
- 2 Press on "Edit Channel Plan" option to access channel plan editor.
- 3 To select a channel plan press on the channel plan name to dropdown a list of available channel plan. Select one of them.
- 4 Press on CH to switch between tune by channel or frequency.
- 5 Next to CH box press on the channel or frequency value to edit and select a specific channel or frequency. You can also select a channel moving along the channel plan list using the side scroll bar. The selected channel has a blue background.
- 6 Press on a parameter of the channel 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. Press on a parameter to edit or switch among options.

Parameters on channel table are:

- Active: To enable or disable channels.
- CH: Channel name.
- FR (MHz): Channel frequency (MHz).
- ΔF (MHz): Offset of tuned frequency for channel (MHz).
- BW (MHz): Bandwidth for 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 Annex B, PAL/NTSC/SECAM, DVB-C, DOCSIS 3.1, DVB-S/S2).
- ΔF Audio (MHz): Offset of tuned frequency for audio (MHz).
- 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.

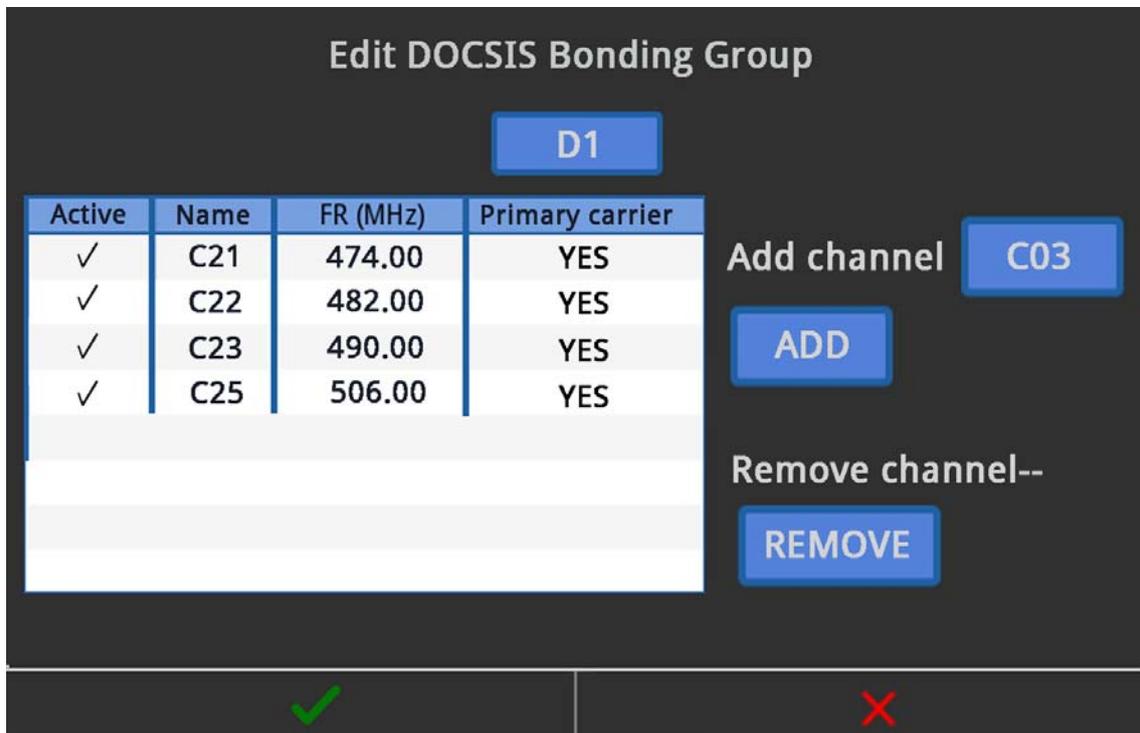
### ► Settings Menu

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):
  - Clone a channel plan from an existing one.
  - Automatically create a channel plan by measuring the network.
  - Create a new channel plan.
- Remove channel plan: It removes current channel plan.
- Import standard plan: It allows you to import a standard channel plan.



► **EDIT DOCSIS BONDING GROUP Screen Description**



**Figure 22.**

- Edit DOCSIS Bonding Group: Press on the box below to select a DBG to edit.
- Add channel: Press on the box next to “Add channel” to select one channel. Then press on ADD to add it to DBG.
- Remove channel: Press on one channel in the box to select it and then press on REMOVE to remove it from DBG.
- Primary Carrier: Press on Primary Carrier column to define if that channel is a primary carrier (YER or NO).



► Create a Channel Plan from an existing one

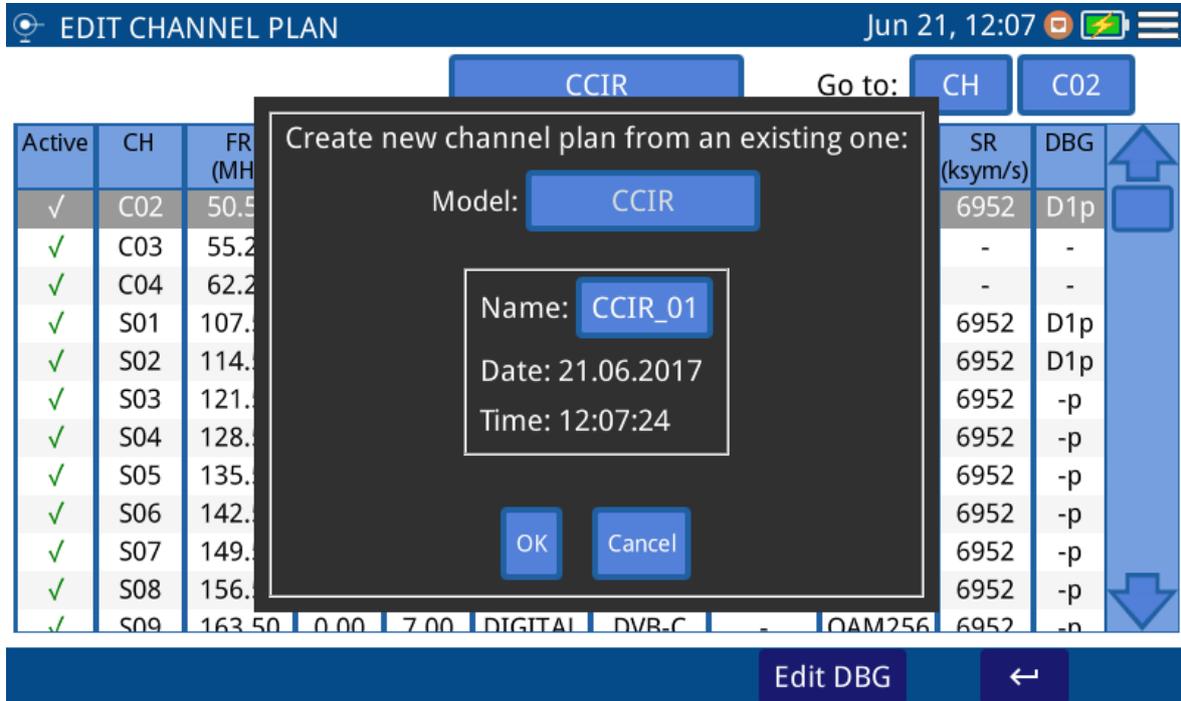
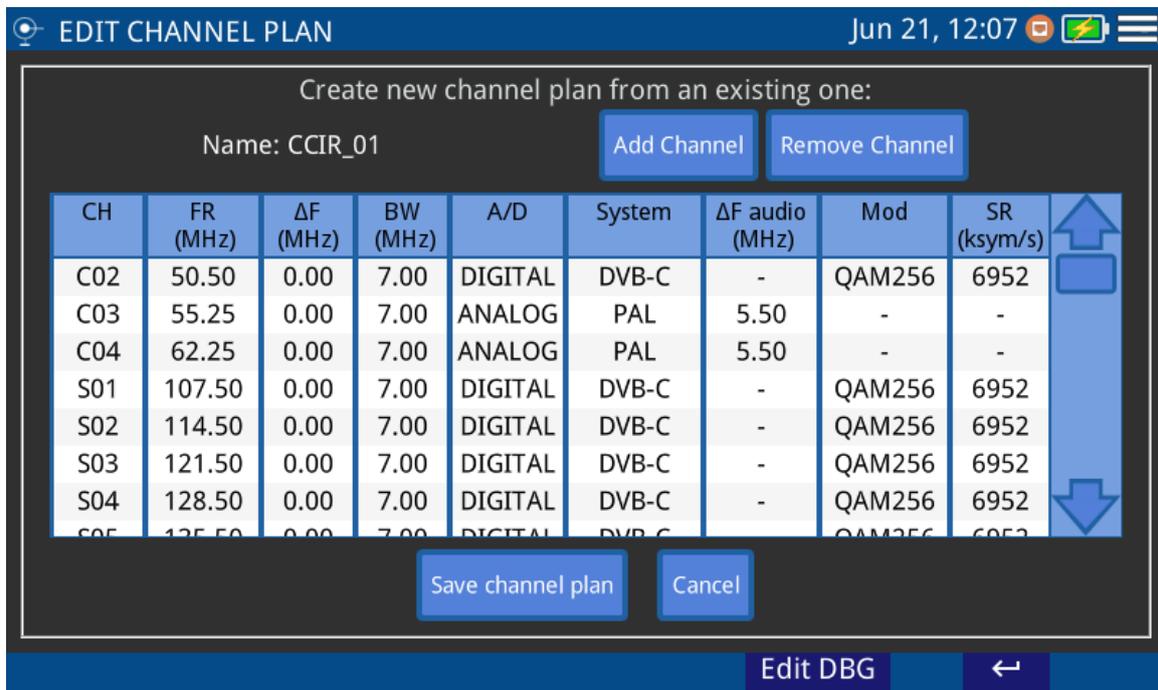


Figure 23.



**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

EDIT CHANNEL PLAN Jun 21, 12:07

CCIR Go to: CH S08

Active	CH	FR (MHz)	ΔF (MHz)	Mod	SR (ksym/s)	DBG
✓	C02	50.50	0.00	QAM256	6952	D1p
✓	C03	55.25	0.00	-	-	-
✓	C04	62.25	0.00	-	-	-
✓	S01	107.50	0.00	QAM256	6952	D1p
✓	S02	114.50	0.00	QAM256	6952	D1p
✓	S03	121.50	0.00	QAM256	6952	-p
✓	S04	128.50	0.00	QAM256	6952	-p
✓	S05	135.50	0.00	QAM256	6952	-p
✓	S06	142.50	0.00	QAM256	6952	-p
✓	S07	149.50	0.00	QAM256	6952	-p
✓	S08	156.50	0.00	QAM256	6952	-p
✓	S09	163.50	0.00	QAM256	6952	-p

Create automatic channel plan:

Model: CCIR

Name: CCIR\_01

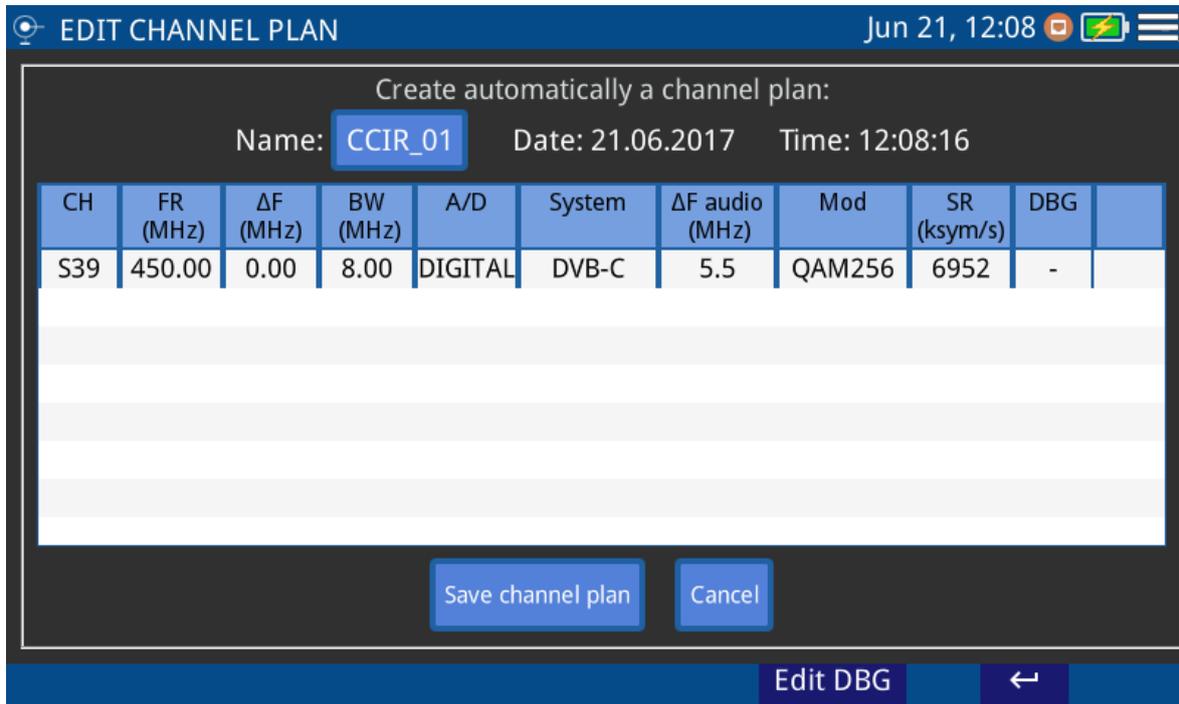
Date: 21.06.2017

Time: 12:07:45

Start measuring Cancel

Edit DBG ←

Figure 25.

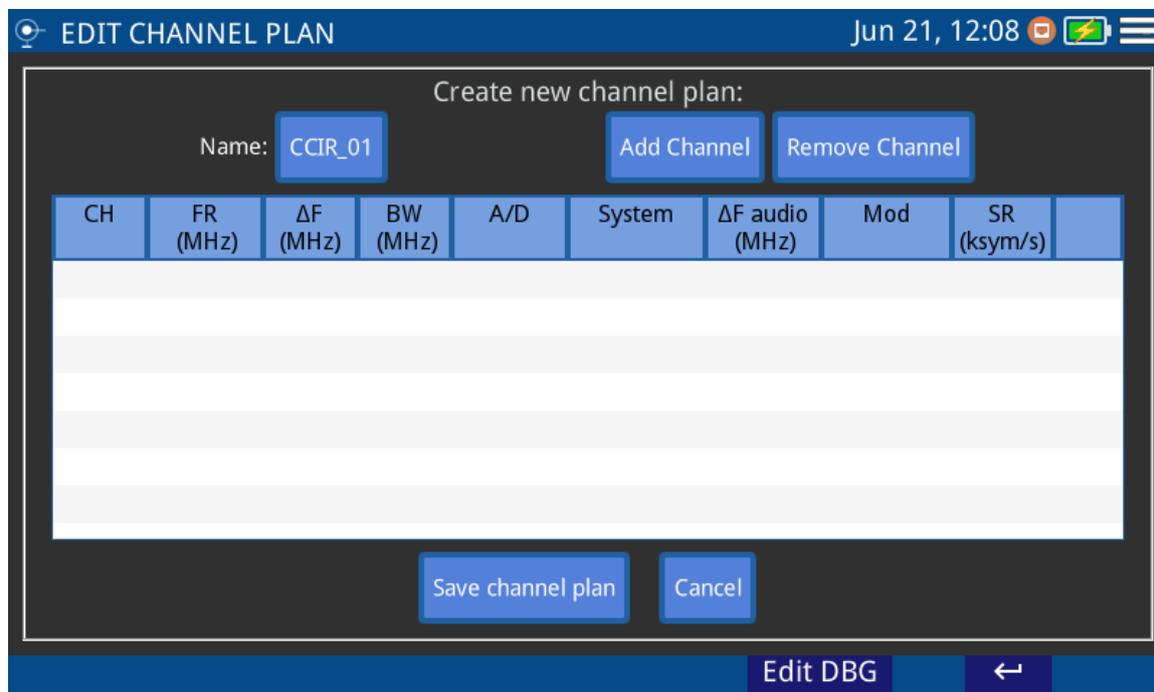


**Figure 26.**

- 1 Connect to the meter to a network.
- 2 Press on box "Model" to select a channel plan as a model to create a new one.
- 3 Select a power threshold from which a channel is valid to add it to a channel plan.
- 4 Select System between "Auto" (if you want to automatically detect the signal standard) or select a standard for the signal to detect.
- 5 Press on "Start measuring".
- 6 When finish press on "Name" box to edit the channel plan name.
- 7 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.
- 3 When finish, press on "Save channel plan" to save changes or "Cancel" to exit without saving.

## 4.2

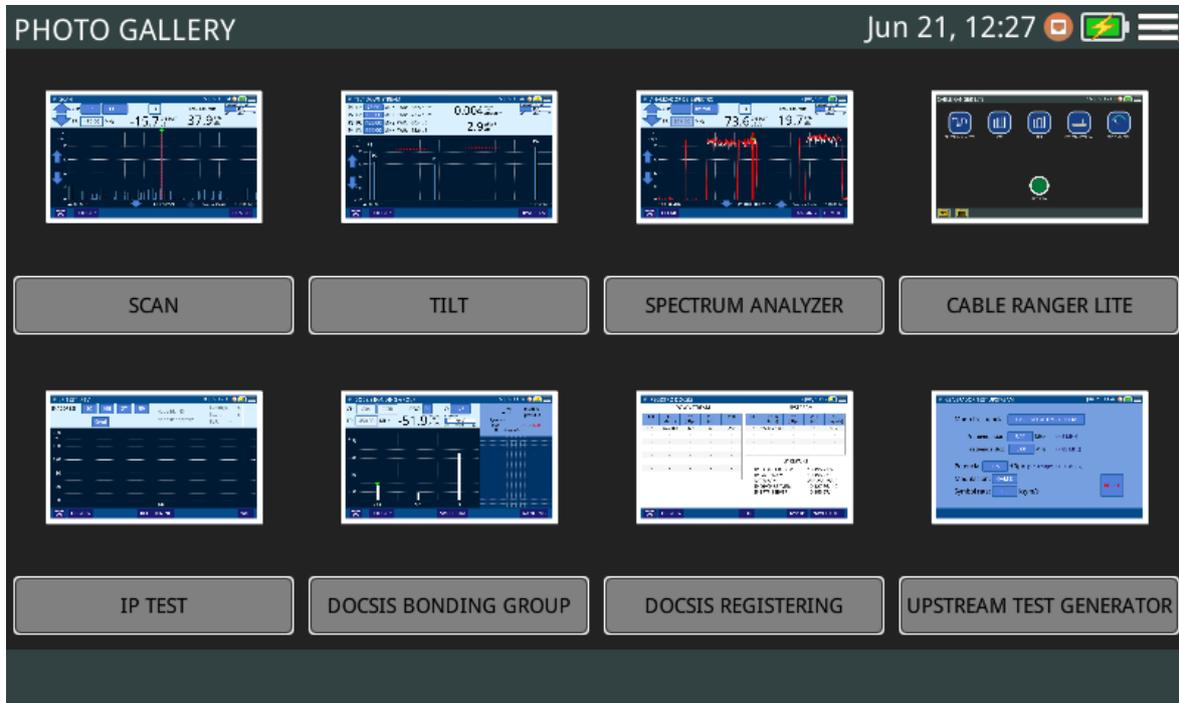
### Screenshot

► **Description**

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



► Operation



**Figure 28.**

Screenshot is available almost for 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.

### 4.3 Datalogger - Test & Go

#### ► Description

Datalogger function can made and save 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.

The Test & Go function is a shortcut in the home screen that starts a datalogger set by default in the Test&Go configuration option.

#### ► Operation

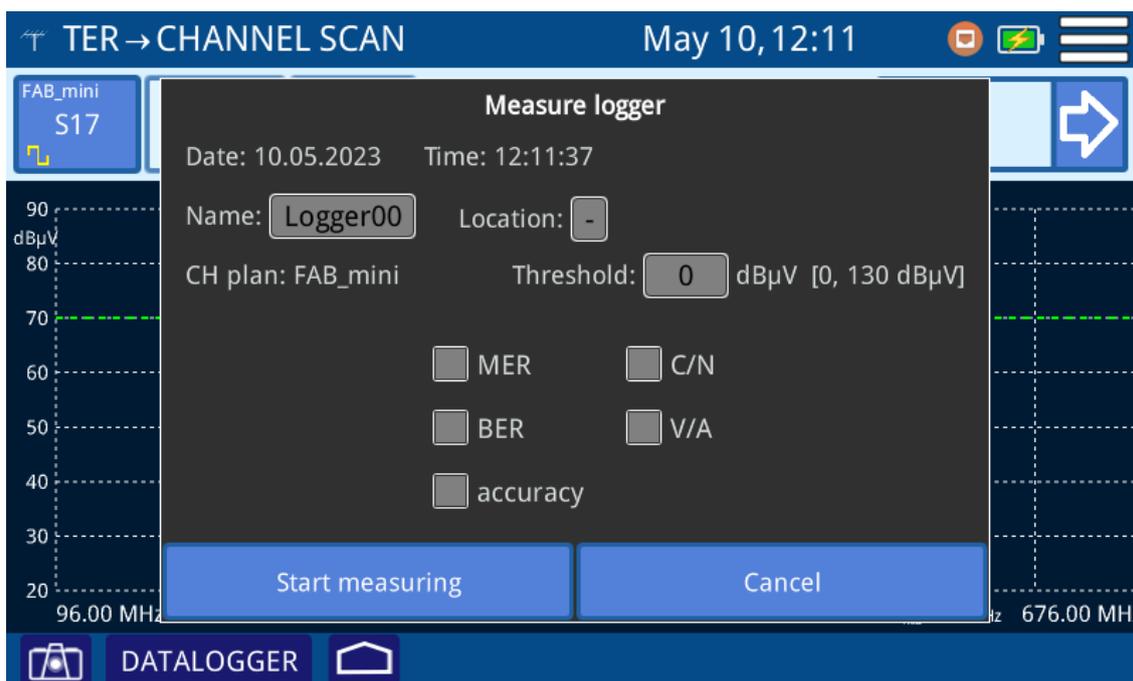


Figure 29.

- 1 To start datalogger, select a function and press on **DATALOGGER** at the left lower corner screen (if it is available).
- 2 You can also press on "Test & Go" at the home screen. In this case you must select the datalogger by default through the option **Test&Go configuration** from the settings menu in the main screen.



- 3 A window opens with several setting options. You can edit boxes (name, location, threshold...) when pressing on it. Check the box to select measurements (MER, C/N, BER, V/A). Check the option "accuracy" for a more accurate BER measurement (aprox. one decimal more accurate). The accuracy measurement takes more time, for this reason is recommended for channel plans with few channels.
- 4 Press "Start Measuring". It starts datalogger. Press "Cancel" to cancel the datalogger.
- 5 After finish, press on "Save and close", "Save and go to datalogger" or "Cancel".
- 6 To access datalogger library, go to home screen and press on  icon at the lower left corner.
- 7 In the library each datalogger is classified by function.
- 8 Press on any folder, then press on the specific datalogger to see data.
- 9 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.
- 10 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 WEBCONTROL

### 5.1 Introduction

The webControl function allows you to connect remotely to the meter in order to create channel plans and manage its files. The meter must be connected to a data network. To connect to meter from a remote access device use just a standard web browser.

Next section explains how to configure the meter to be able to connect remotely. Following sections explain each work mode.

### 5.2 Settings and Access

#### ► Meter Settings

- 1 The meter can be connected to a data network via an Ethernet cable. Press on the MENU icon  at the top right corner to access the settings menu.
- 2 Press on the option "Ethernet Configuration" to access network settings parameters. They are: Connection type (Manual, DHCP, Bridge), IP, Netmask, Gateway, DNS 1 and DNS 2.
- 3 If you connect the meter to a network with a router or server with Bridge or DHCP protocol enabled, then the network will set automatically the parameters in the meter. If not, follow the next steps to set the meter.
- 4 On "IP Address" box enter the meter IP. Use an IP in the same range used by your PC in the local network (if you do not know these data see "find out local network data" section). For instance, if the IP for your PC is 10.0.1.18, the meter must have a free IP in the same range, like 10.0.1.50.
- 5 In the "Mask" box, enter the mask value, which should be the same as the one used by the local network (usually 255.255.255.0; if you do not know these data see "find out local network data" section).
- 6 To connect the meter from an external network, fill in the "Gateway" with the info obtained from the local network. You can let DNS 1 and DNS 2 default data or select other ones.
- 7 Press on OK option to save data and re-start the meter.

#### ► Remote Access

- 1 Run a standard web browser (Chrome recommended) from a PC.

- 2 On the address bar write the address to remotely access the meter.
- 3 If the connection is successful, it should appear on screen the webControl welcome screen (see figure). This screen shows the meter model and serial number.

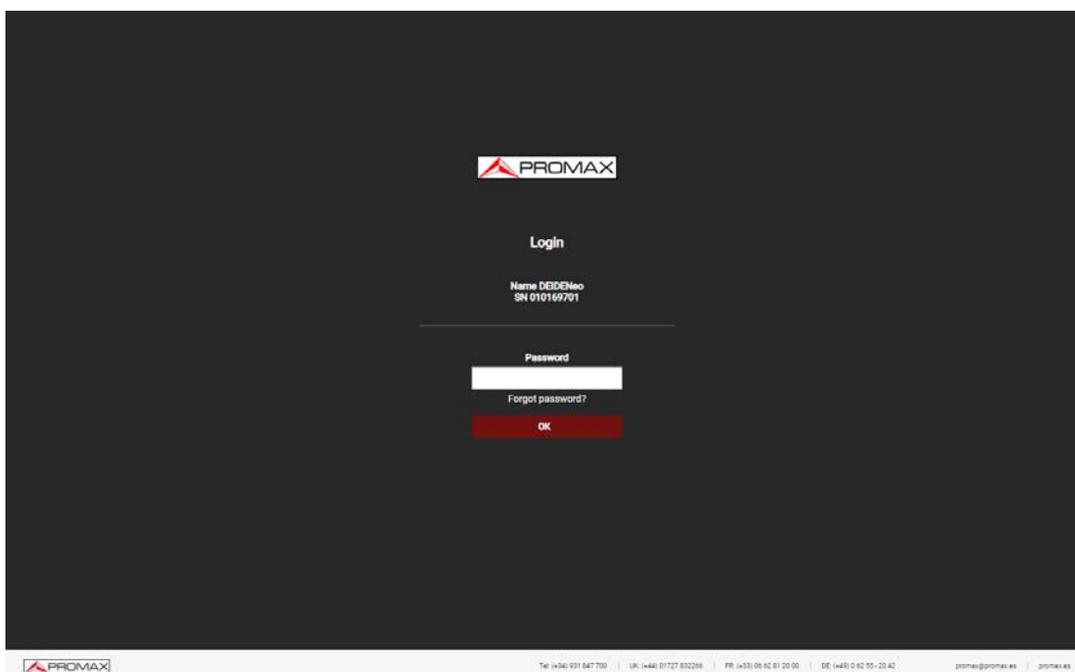


Figure 30.

- 4 Enter the password and press OK (password by default is **Password**).

**NOTE:** If you have follow these instructions and you fail to connect the webControl, please contact PROMAX technical assistance and we will help you (promax@promax.es).



## 5.3 Installations Management

### ► Description

Installations Management allows you to access the File Manager and the Create Channel Plan tool.

To access this screen, click on the Installations Management icon  .

At the top right corner there is the Config icon to access these options: About Equipment (name, serial number, provider, user, release/webControl version and company) and Logout.

### 5.3.1 File Manager

This function allows you to manage files inside an installation (channel plans, screenshots, dataloggers, etc.).



### ► File Manager Operation

- 1 Press on tab "File Manager" to access the file manager. Wait for few seconds to system to read all files from the meter.
- 2 All folders and files are shown on the left side of the window. The ChannelPlans folder contains all channel plans. The Screenshots folder contains all screenshots. The Loggers folder contains all dataloggers. When clicking on a folder it deploys its content in a tree shape. On the right area it shows the content of the selected folder.
- 3 The padlock icon on an item means that it cannot be removed. If the padlock is on a folder it also means that its content cannot be change (nor deleted or added).
- 4 To make any action on an item use the tools bar or deploy the options menu by pressing the right button of the mouse. Next are described the most common options.



► **Tools Bar:**

-  Back: Back to the previous screen.
-  Forward: Back to the posterior screen.
-  Upload: It transfers a document from your PC to the meter. It shows a window where you can drag files, paste URLs or images or select files or folders from your PC.
-  Open: It opens a folder or downloads the selected file.
-  Download: It downloads a folder or file to your PC. When it is a folder or multiple files, it downloads a zipped file in TGZ format.
-  Delete: It deletes the folder or file selected.

► **Options Menu (mouse right button):**

-  *Back*: Back to the previous screen.
-  *Go to parent folder*
-  *Reload*:
-  *Upload files*: It transfers a document from your PC to the meter. It shows a window where you can drag files, paste URLs or images or select files or folders from your PC.
-  *Empty the folders*: It removes all the content inside a folder.
-  *View*: It vies the file in list mode or icon mode.
-  *Sort*: To sort files by different atributes: by name, size, etc.
-  Select All: It selects all the files.
-  Invert selection: It reverts the current selection.
-  Get info: It shows some info about the selected file.

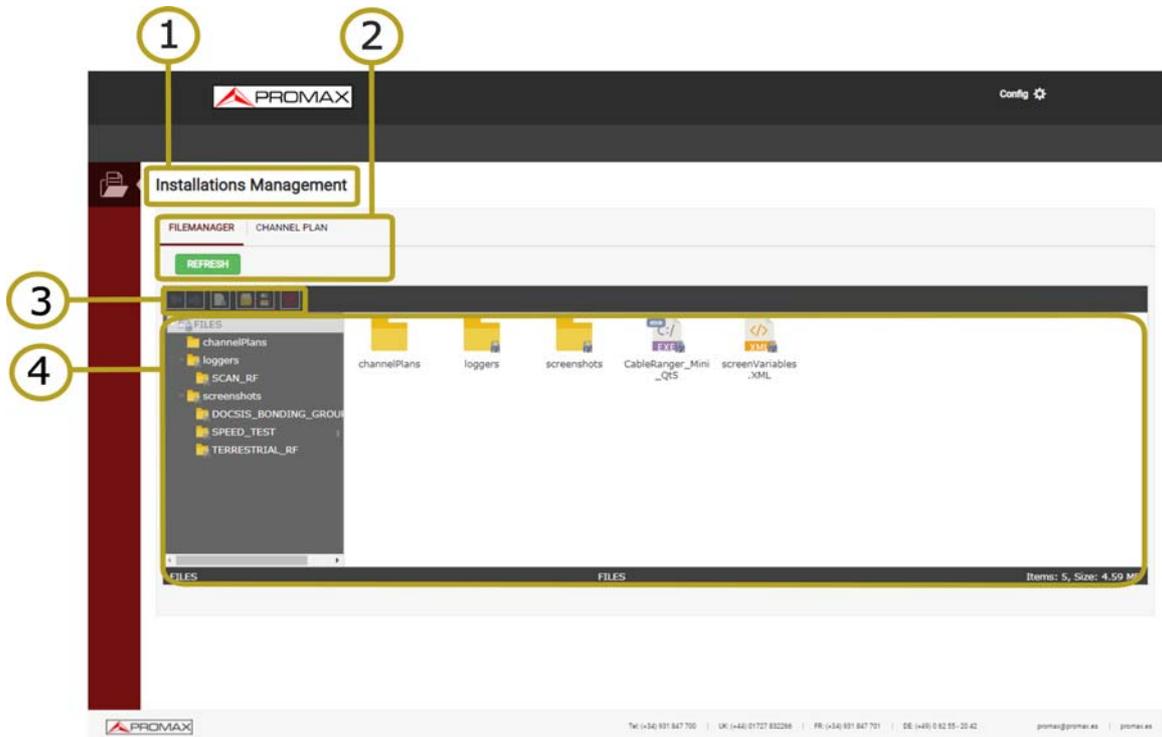


-  *Full Screen / Reinststate*: Zoom in or out the file window.
-  *Open*: It opens a folder or downloads the selected file.
-  *Download*: It downloads a folder or file to your PC. When it is a folder or multiple files, it downloads a zipped file in TGZ format.
-  *Preview*: It shows file info.
-  *Upload files*: It transfers a document from your PC to the meter. It shows a window where you can drag files, paste URLs or images or select files or folders from your PC.
-  *Delete*: It deletes the folder or file selected.
-  *Edit Channel Plan*: It allows editing a channel of the equipment. It only works if a channel plan file (XML extension) is selected. The channel plan files are located in the channelPlans folder (for more details see the next section).
-  *Create Report*: It generates a report in PDF format from a datalogger. Datalogger files are inside the loggers folder (for more details refer to nex section).

	<a href="#">Report generator</a>	S C A N  
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► **File and Installations Management Screen**



**Figure 31. File Manager**

- 1 Selected function (Installations Management).
- 2 Tabs to select the File Manager or the Channel Plan Creator.
- 3 Toolbar.
- 4 File navigation area.

**5.3.2 Channel Plan Creator**

This functions allows you to create a channel plan from scratch.

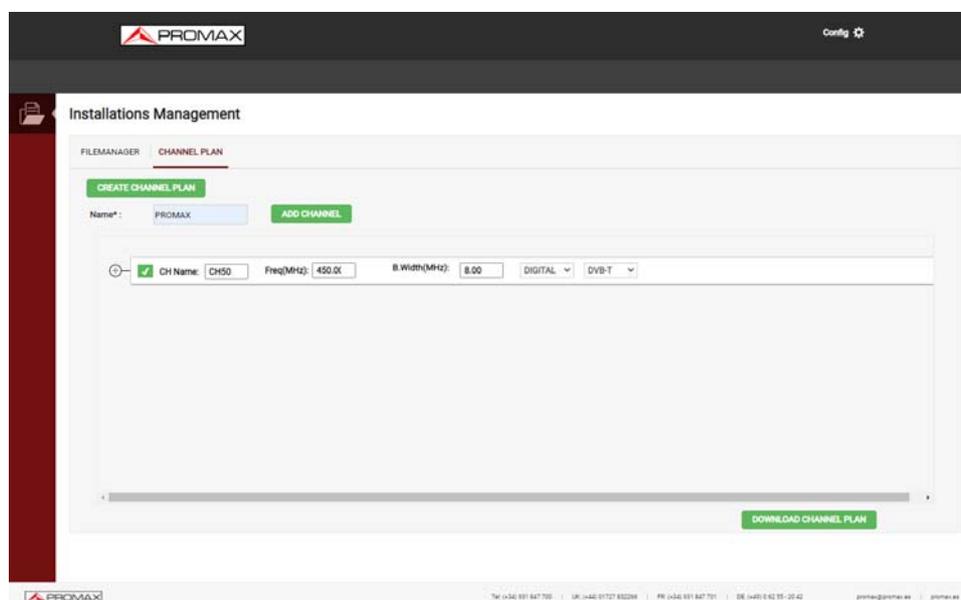
	<p><a href="#">Channel plan creator and editor</a></p>	<p style="writing-mode: vertical-rl; text-orientation: mixed; font-weight: bold; margin: 0;">SCAN</p>
--	--	---

► **Channel Plan Creator Operation**

- 1 Press on the "Channel Plan" tab to access the channel plan creator. Press on "Create Channel Plan" button.
- 2 In the box "Name" enter the channel plan name.



- 3 Press the "Add Channel" button and enter one by one each channel that made the channel plan. Enter channel name, frequency and signal type for each channel.
- 4 Edit each parameter by clicking on it.
- 5 Once finished press on "Download Channel Plan" to download it on your PC. By default the channel plan file is downloaded inside the folder "Downloads" in your PC. The file is in XML format.
- 6 To use the new channel plan, upload it by means of the File Manager (see previous section). It must be uploaded to the ChannelPlans folder. The channel plan will be available for you.



**Figure 32. Channel Creation**

### 5.3.3 Channel Plan Editor

This function allows you to edit channel plans.

#### ► Channel Plan Editor Operation

- 1 Files with channel plans are inside the ChannelPlans folder. Select the file that contains the channel plan to edit and press the right button on the mouse to select the "Edit channel plan" option.



- 2 The channel plan definition parameters and all the channels that form it will appear. From here you can edit any value by clicking on the box.
- 3 Channels can be modified by clicking on each parameter.
- 4 Once the channel plan is finished, click on "Download Channel Plan" to download it to the PC. By default the file with the channel plan is downloaded in the PC "Download" folder. The file is in XML format.
- 5 To use the channel plan on the meter use the File Manager to upload the XML file through the option "Upload files". It must be uploaded to the ChannelPlans folder. The channel plan will be available to use it on your meter.



## 6 SPECIFICATIONS

### 6.1 Spectrum Analyzer

#### ► Frequency

Parameter	Value	Additional Data
Tuning Range	From 5 to 2700 MHz	
Tuning Mode	By frequency or by channel	
Bandwidth resolution	230 kHz, 2 MHz	
Frequency Tuning Resolution	10 kHz	
Accuracy	20 ppm	
Sweep time	600 ms full band	

#### ► Amplitude

Parameter	Value	Additional Data
Measuring range	-50 dBmV to 60 dBmV	
Measuring range in screen	50 dB	
Max Input level	70 dBmV	
Resolution	0.1 dB	
Accuracy	± 2 dB	
Input impedance	75 Ohms	
Units	dBmV, dBμV, dBm	

#### ► 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 FM or CW carriers

#### ► DIGITAL Spectrum Analyzer (Cable and Terrestrial)

Parameter	Value	Additional Data
Tuning Range	From 10 to 2700 MHz	
Power	From -40 dBmV to 60 dBmV	Power measurement in the channel bandwidth by integration method
Compatibility	DVB-T/T2, ISDB-T, DVB-C, ITU J83 Annex B, DOCSIS 3.1 (3.0, 2.0)	
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	DVB-C/C2/T/T2,I.J43 Annex B, ISDBT	
Lock range	-20 dBmV to 60 dBmV	



## ► ANALOG Spectrum Analyzer

Parameter	Value	Additional Data
Tuning Range	From 10 to 2700 MHz	
Video Carrier Signal Level	From -45 dBmV to 60 dBmV	
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	

## ► DOCSIS

Parameter	Value	Additional Data
<b>Downstream Analyzer:</b>		
Power and Spectrum	DOCSIS 2.0/3.0/3.1	
MER / BER	DOCSIS 2.0/3.0/3.1	(MER estimated in 3.1)
Constellation	DOCSIS 2.0/3.0	
DBG Tuning	16 x 8 channels	
Upstream Analyzer	5 - 200 MHz	

## ► SATELLITE Spectrum Analyzer

Parameter	Value	Additional Data
Tuning Range	950 - 2150 MHz	
Spectrum and Power	DVB-S/S2	
MER / BER	DVB-S/S2	
Constellation	DVB-S/S2	
LNB Supply	13 / 18 / 22 kHz	

## ► 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, dBμV, dBm	
Reference Line	from -60 dBmV to 60 dBmV	
Trace	normal, max hold and min hold	
Frequency step	from 10 kHz to 100 MHz	
Top Frequency	900 MHz, 1800 MHz or selectable	

## 6.2 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, dBμV, dBm	

**► 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

**► DIGITAL Channel Demodulation**

Parameter	Value	Additional Data
Compatibility	DVB-C/C2/T/T2,I.J43 Annex B, ISDBT, J.382	
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	DVB-C/C2/T/T2,I.J43 Annex B, ISDBT, J.382	
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)	



Parameter	Value	Additional Data
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, dBμV, dBm	
Reference Line	from -60 dBmV to 120 dBmV	
Units	dBmV, dBμV, dBm	
Reference Line	from -60 dBmV to 120 dBmV	
Thresholds	Max and Min limits for quality evaluation	

**6.3** **Tilt**

► **Downstream**

Parameter	Value	Additional Data
Frequency:	Four selectable tuning frequencies (pilots) from 45 MHz to 1700 MHz	
Bandwidth resolution	230 kHz	
Frequency Tuning resolution	10 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	
Bandwidth resolution	230 kHz	
Tuning resolution	10 kHz	
Dynamic range	-50 dBmV to 60 dBmV	
Screen range	50 dB	



Parameter	Value	Additional Data
Max Input level	70 dBmV	
Resolution	0.1 dB	
Measurements	Level of four selected frequencies	$\pm 0$ to 30 dB/ MHz (Tilt) between two selected pilots
Resolution	0.1 dB	

#### ► Configuration Menu

Parameter	Value	Additional Data
Units	dBmV, dB $\mu$ V, dBm	
Select two pilots for Tilt	Pbottom / Ptop	

## 6.4 Input Voltage and RF Power Meter

#### ► RF Power Measurement

Parameter	Value	Additional Data
Frequency band	5-1700 MHz	
Power accuracy:	$\pm 3$ dB	

#### ► Input Voltage Measurement

Parameter	Value	Additional Data
VDC	5 - 100 V	
VAC	1 - 30 V	
Frequency measurements	from 10 Hz to 200 Hz,	$\pm 2$ % accuracy
LNB Supply Voltage	13 V, 18 V, 13 V + 22 kHz, 18 V + 22 kHz	

#### ► Configuration Menu

Parameter	Value	Additional Data
Units:	dBmV, dB $\mu$ V, dBm	

## 6.5 General Specifications

#### ► Inputs and Outputs

Parameter	Value	Additional Data
RF	Interchangeable F, BNC, IEC	
USB	Available	USB type A female



Parameter	Value	Additional Data
Ethernet	Available	
VDC	Available	
Touch Monitor Display	Available	

### ► Mechanical Features

Parameter	Value	Additional Data
Dimensions	177 x 117 x 30 mm	
Weight	0.7 kg	

### ► Power Supply

Parameter	Value	Additional Data
Internal battery	7.6 V; 3 Ah Li-Po	
Battery Operation Time	> 4 hours in continuous mode	
Recharging Time	3 hours up to 80% (turned off)	
External Voltage	12 V DC	
Consumption	12 W	
Auto Power Off	Available	

### ► 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
1 x	F connector	
1 x	Suitcase	
1 x	Touch pen (resistive)	
1 x	Transport belt	
1 x DG0332	Quick reference guide	
1x AL-122	100-240 V Mains Adapter	



## 7 MAINTENANCE

### 7.1 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.

### 7.2 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.

### 7.3 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.





## ii MULTIMEDIA CONTENT

The following table shows all the links to video tutorials included in this manual:

Chapter	Title	Link	QR Code
1. Introduction	Introduction to RANGER MINI	<a href="https://youtu.be/5TDTCrCelig">https://youtu.be/5TDTCrCelig</a>	
2. Setting Up	Main Menu	<a href="https://youtu.be/omlnvhaYD2k">https://youtu.be/omlnvhaYD2k</a>	
3. Measurement	Spectrum Analyzer	<a href="https://youtu.be/tf5VPxujKX8">https://youtu.be/tf5VPxujKX8</a>	
3. Measurement	SCAN, Datalogger and TILT	<a href="https://youtu.be/w9clA1horV4">https://youtu.be/w9clA1horV4</a>	
3. Measurement	Satellite function	<a href="https://youtu.be/ntbKkNfkcG8">https://youtu.be/ntbKkNfkcG8</a>	
3. Measurement	Upstream test and input voltage	<a href="https://youtu.be/y44dWTpRGG0">https://youtu.be/y44dWTpRGG0</a>	
3. Measurement	Optical power meter	<a href="https://youtu.be/9o3BCn8TytE">https://youtu.be/9o3BCn8TytE</a>	
3. Measurement	DOCSIS measurement and analyzer	<a href="https://youtu.be/Xi-0iIDhIRs">https://youtu.be/Xi-0iIDhIRs</a>	
5. webControl	File Manager	<a href="https://youtu.be/RAhiw04P2h8">https://youtu.be/RAhiw04P2h8</a>	
5. webControl	Report Generator	<a href="https://youtu.be/_EFG1LmqwCQ">https://youtu.be/_EFG1LmqwCQ</a>	
5. webControl	Channel Plan creator and editor	<a href="https://youtu.be/0Zg1dg7xZXg">https://youtu.be/0Zg1dg7xZXg</a>	



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