

# HD RANGER/ +


## TV & SATELLITE ANALYSER





## 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 VERSION

Version	Date	Firmware Version



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








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## 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.

\* Symbols related with safety:

	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.



# TV & SATELLITE ANALYSER **HD RANGER/+**

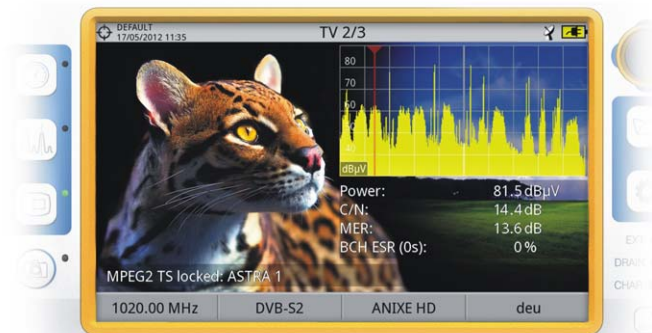


## 1 INTRODUCTION

### 1.1 Description

The new **HD RANGER/+** is the fifth generation of field meters that **PROMAX** launches. As each new generation, it represents an evolution from the previous, since it integrates the latest technological innovations and develops applications for the new demands and needs that have emerged in recent years.

The new **HD RANGER/+** has been created with the aim to make easy the user experience. From its ergonomic design and stylized lines to the reduction of keys and the easy use of its interface, everything has been designed so the user has a simple tool to use but powerful and useful.



**Figure 1.**

The **HD RANGER/+** is a universal analyser that covers TV standards of the DVB family, as well as formats such as MPEG-2 or MPEG-4 and Dolby audio. There is also the possibility of an extension to work in fibre optics installations.

Besides the basic functions of TV meter and spectrum analyser for terrestrial and satellite band, it provides additional tools, such as the detection of 4G signal interferences (some of its working frequencies are close to the TV bands), the diagrams constellations or the echoes detection.

The **HD RANGER/+** has an application to manage data generated at each installation. This feature helps the user to manage information generated so he can access it at any time or download it to a PC for further analysis.

The **HD RANGER/+** has been designed and developed entirely in the European Union. A multidisciplinary team of highly qualified professionals has dedicated effort and commitment to the development of a powerful, efficient and reliable tool. During the manufacturing process, all used materials have been subjected to a strict quality control.

In an effort to facilitate its work to professionals, our long experience ensures an after sales quality service, which includes updates and upgrades for free.



Figure 2.

## 2 SETTING UP

### 2.1 Package Content

Check that your package contains the following elements:

- **HD RANGER/+** Analyser.
- External DC charger.
- Mains cord for external DC charger.
- Car lighter charger.
- "F" Adapters (3 units).
  - "F" / H - BNC / H Adapter.
  - "F" / H - DIN / H Adapter.
  - "F" / H - "F" / H Adapter.
- Support belt and carrying cover.
- USB On-the-go (A) Male - Mini USB (B) Male.
- USB cable (A) Male - Mini USB (B) Male.
- 4V / RCA Jack Cable.
- 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.

\* Supplied only with the **HD RANGER +** model. Optional Accessory on request for **HD RANGER**.

## 2.2 Power

The **HD RANGER/+** is powered by a 7.2 V built-in rechargeable Li-Ion battery of high quality and long duration.

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 not necessary 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 3).



**Figure 3.**

Then connect the DC power adapter to the mains via the mains cord (3). 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.

When the computer is connected to the mains, the CHARGER indicator remains on. This indicator changes its colour according to the percentage of battery charge:

- RED** Less than 80% of charge.
- ORANGE** Between 80% and 90% of charge.
- GREEN** 100% full charge.

If the battery is weak, the battery disconnection circuit will prevent the equipment starting 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 a 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 external supply disabled):

- With the equipment full charge the average battery time is 5:30 hours.
- With the equipment at 80% charge the average battery time is 4 h.

### 2.2.4 Smart control battery

The built-in battery of the equipment is of the "smart" type, which means that reports its state of charge. This information is displayed inside the battery icon in the form of the average time available. In this way the user can know at any time the remaining battery level.

The remaining time charge that appears is calculated according to the work that has been doing. If you activate the external supply of the equipment, the average time would be reduced according to the increase in consumption that occurs.

4h21



### 2.2.5 Usage Tips

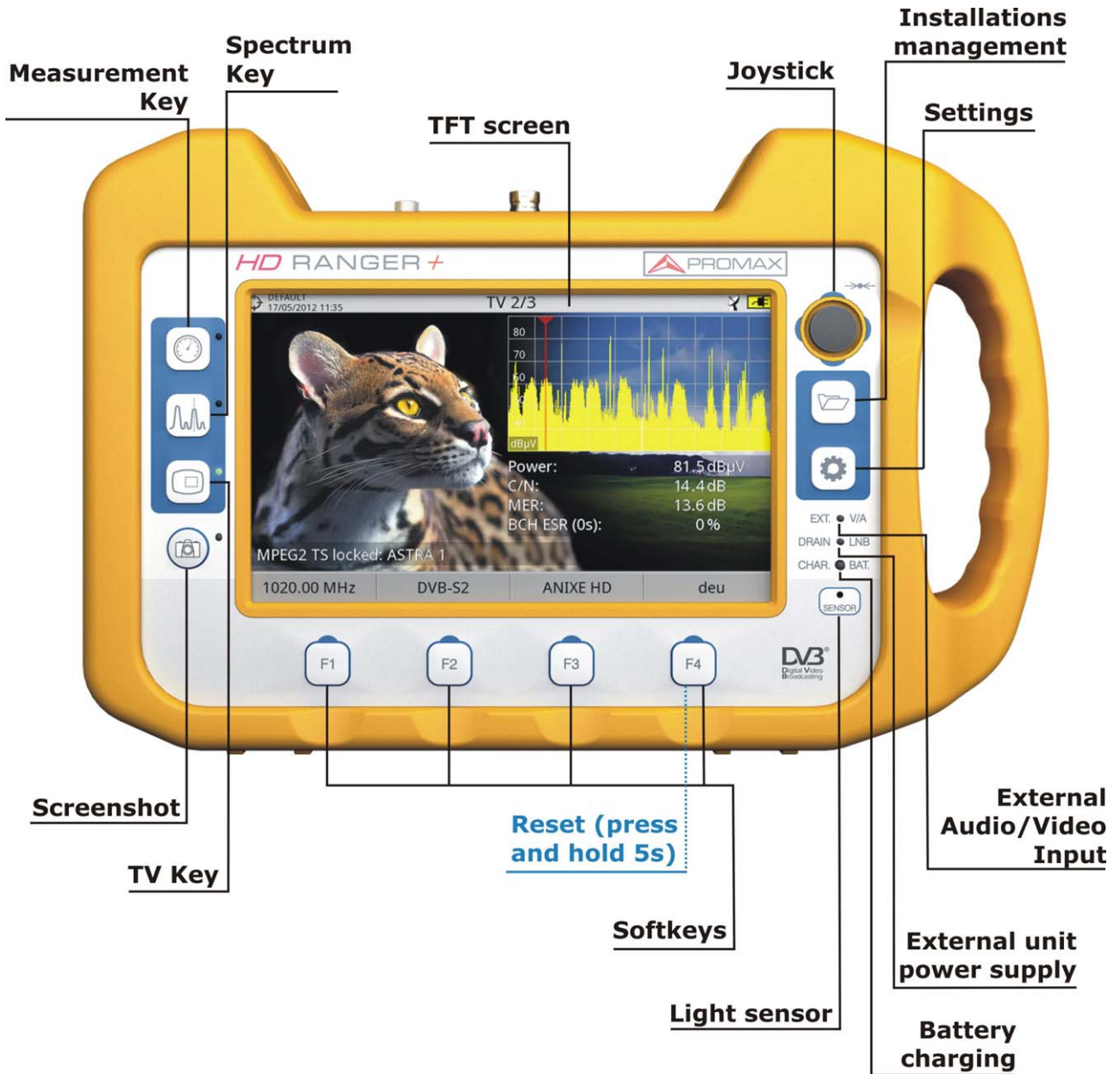
The battery is losing storage capacity as you go through its life. Contact your **PROMAX** distributor when necessary to replace the battery.

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**

■ **Front View**



**Figure 4.**

■ Lateral view

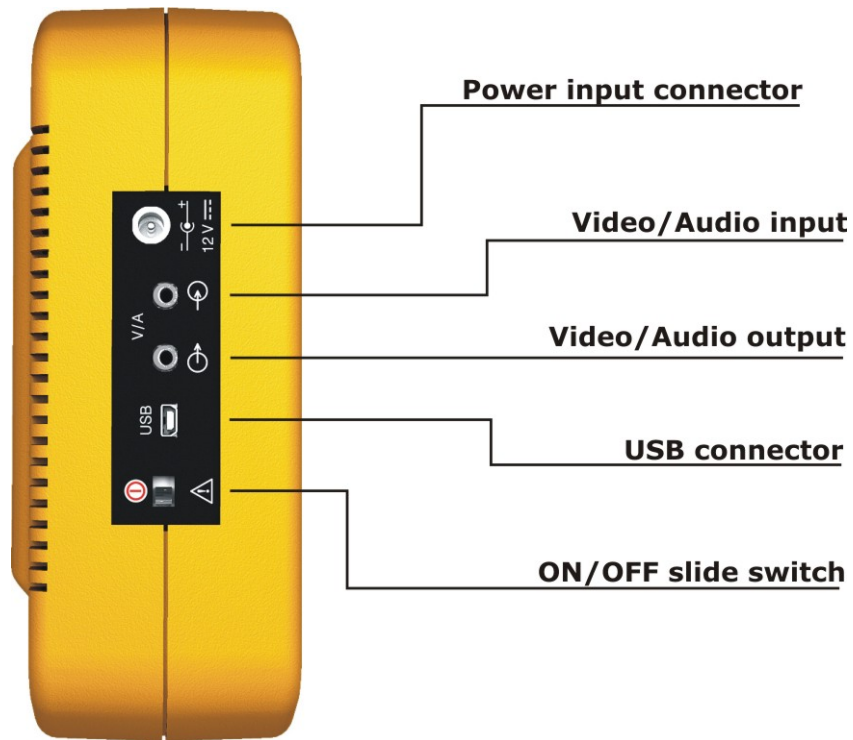


Figure 5.

■ Top view

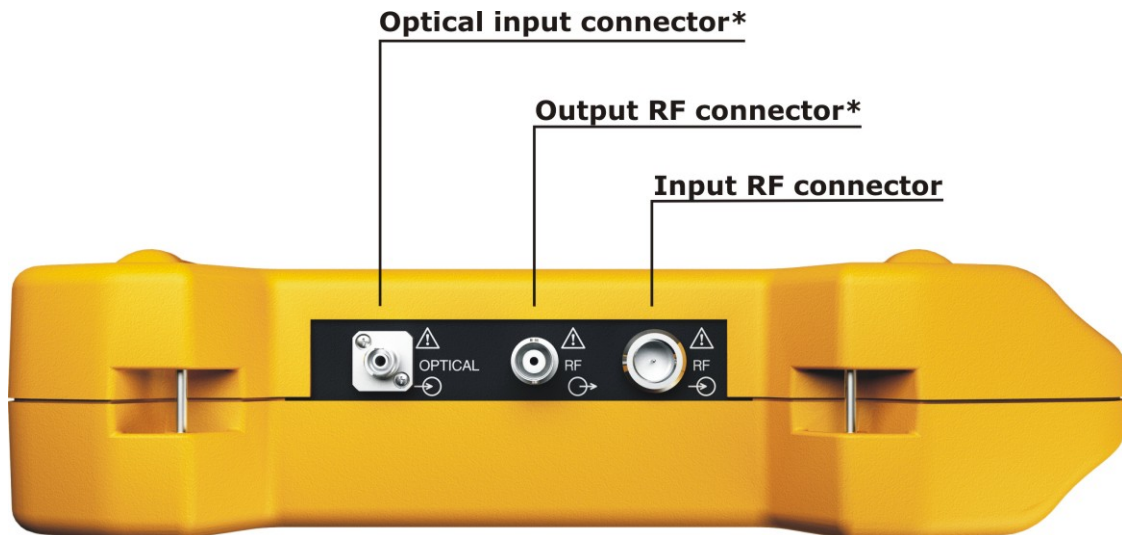


Figure 6.

\* Optical Option.



## 2.4 Switching On / Off the equipment

This analyser is designed for use as a portable equipment and it does not require any previous installation.

### ► Switching On:


- 1 Slide up for a while (approximately one second) the power slide switch located on the left side of the equipment.
- 2 When all indicators light up at once release the switch, which returns to its rest position.
- 3 The starting display picture appears and also a progress bar that indicates the system load.
- 4 After the system load, the screen before last shutdown appears.

### ► Switching Off:

- 1 Slide up for a while (approximately one second) the power slide switch located on the left side of the equipment.
- 2 When the screen goes off release the switch, which returns to its rest position.
- 3 The starting display picture appears and the progress bar showing the system shutdown progress.















### ► Reset:

- 1 Press the **F4** key for 5 seconds. The equipment automatically turns off. Use only in case of system crash.

In the **PREFERENCES** menu  (press 1s), **APPEARANCE** tab, option "**Off**" the user can activate the automatic shutdown option, selecting a waiting time (time without pressing any key) after which the meter turns off automatically.

## 2.5 Screen Icons and Dialog boxes

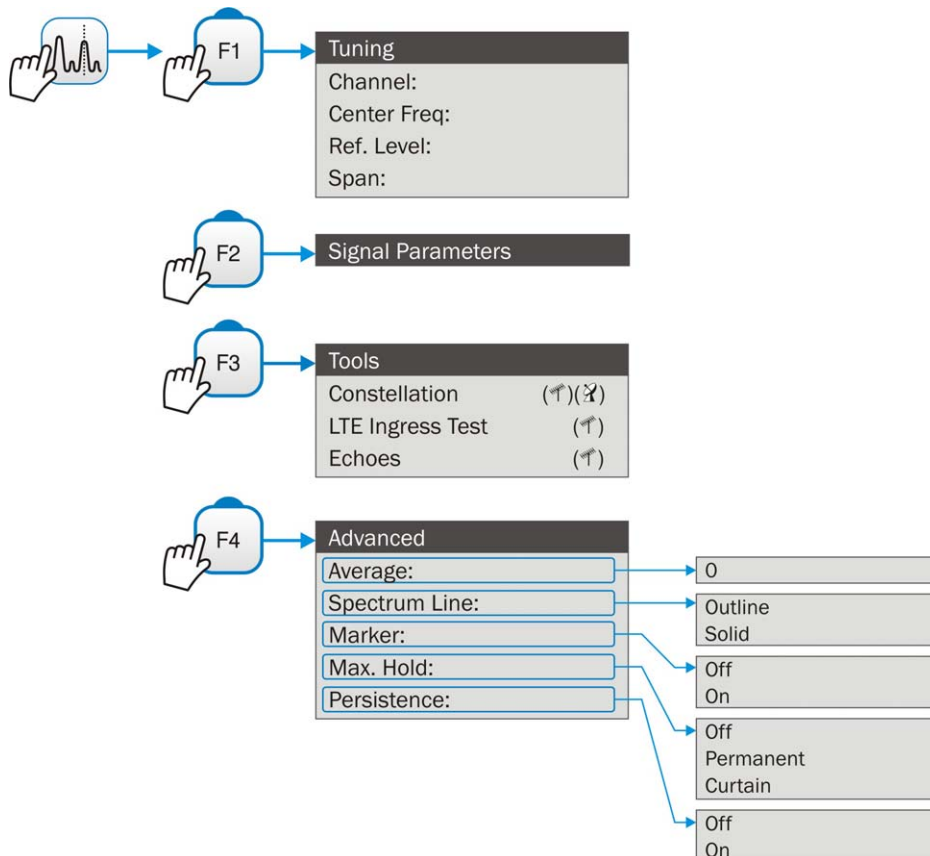
At the top of the screen there is the status bar. On the right are icons that provide useful information to the user about the current status of the instrument.

	<b>Battery charging.</b>		<b>USB flash drive inserted</b>
	<b>Battery not charging.</b> Yellow level indicates percent charge left		<b>LTE filter enabled.</b>
	<b>Battery not charging, time left indicator</b>		<b>Current installation.</b>
	<b>USB in serial port mode</b>		Multi-function Joystick enabled. Two-letter code indicates the exact function:
	<b>Satellite band.</b>		<b>FR</b> Frequency tuning
	<b>Terrestrial band.</b>		<b>CH</b> Channel tuning
			<b>SP</b> Span change
			<b>MK</b> Marker moving

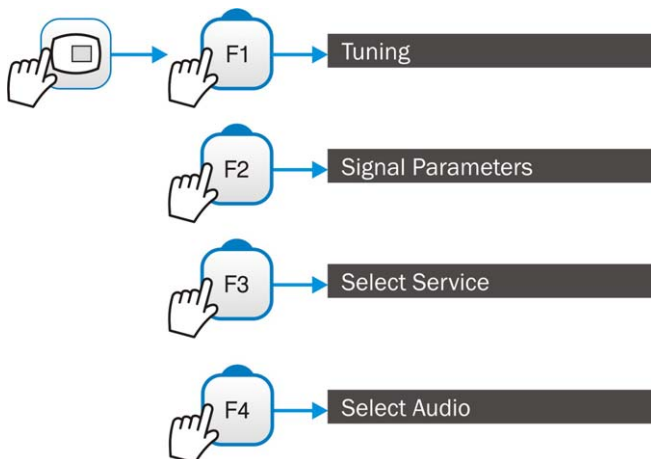
2.6 Menu Tree



SPECTRUM ANALYSER MENU

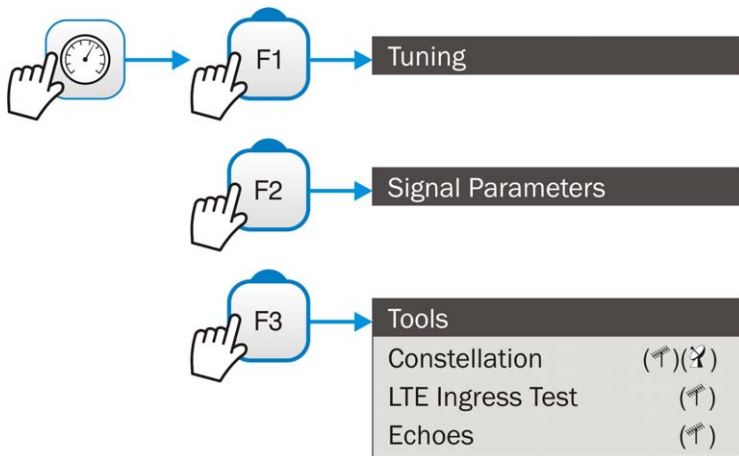


TV MENU

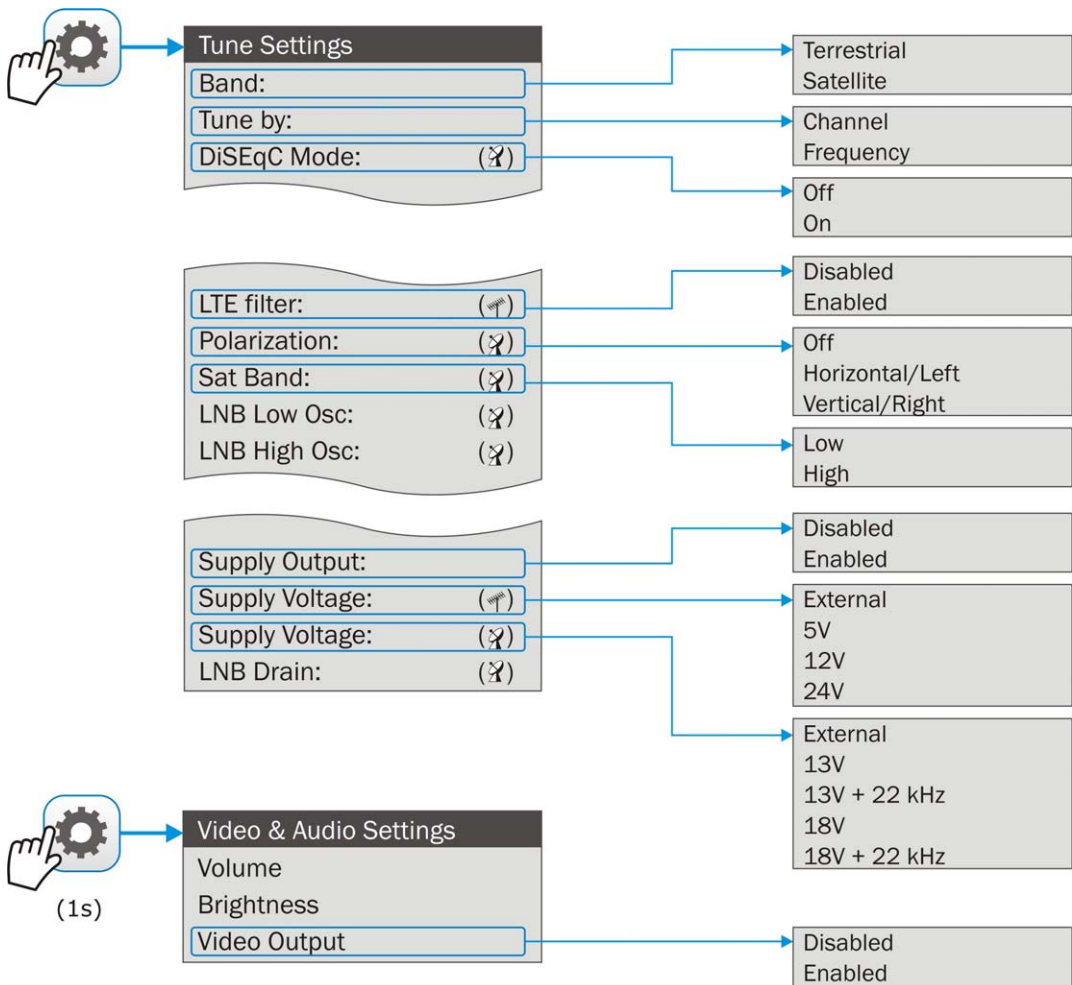




### MEASUREMENT MENU



### SETTINGS MENU





INSTALLATIONS MANAGEMENT / PREFERENCES MENU

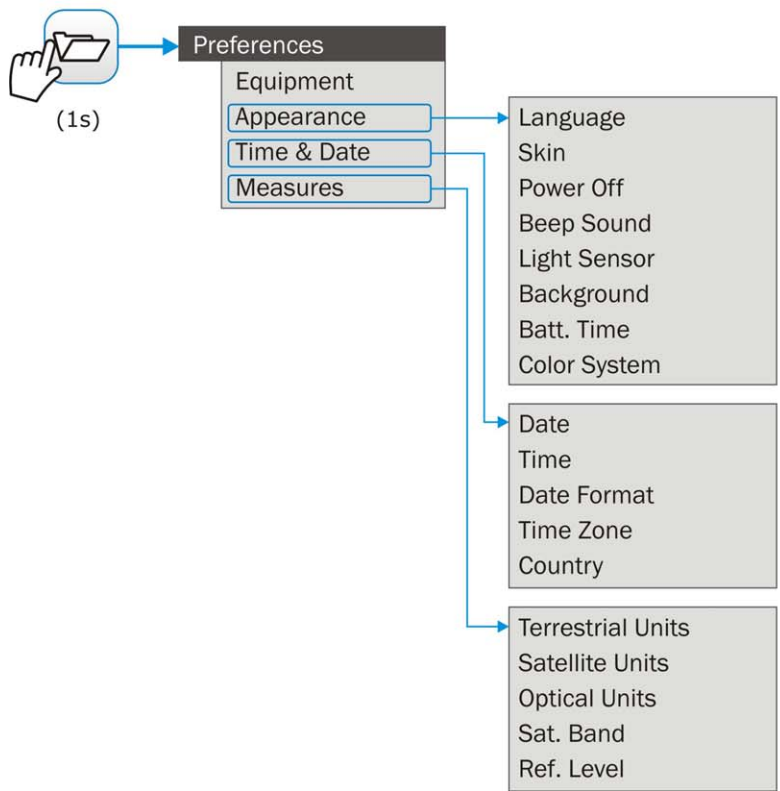
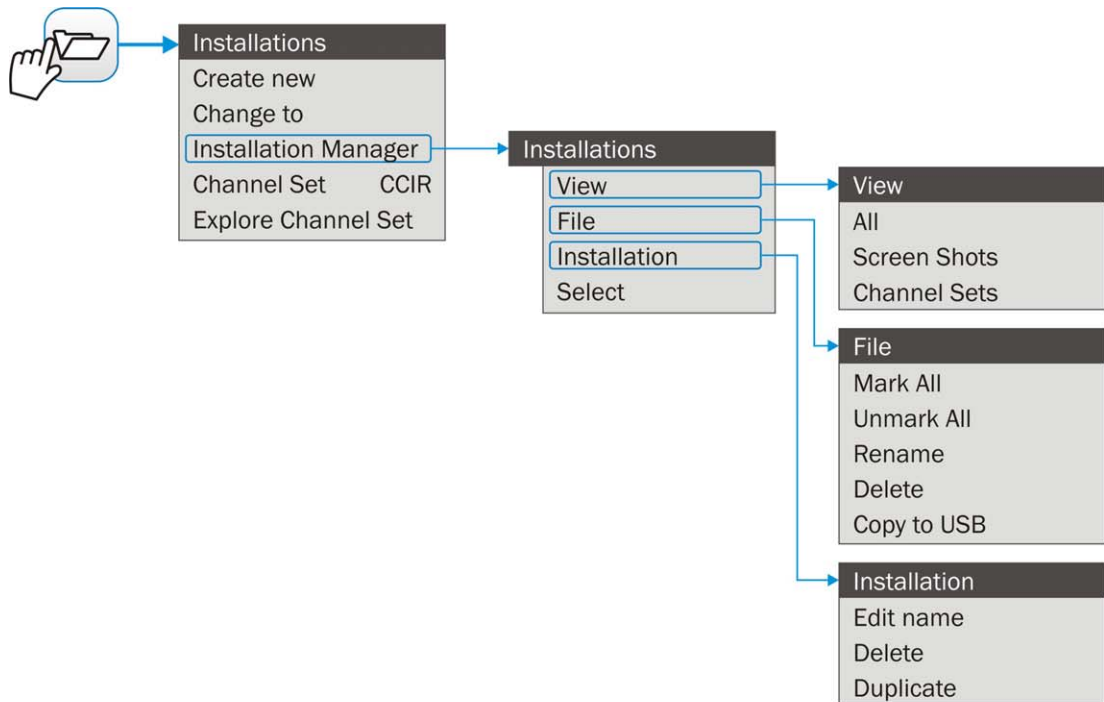


Figure 7.

## 2.7 Controls

The equipment has been designed to be an easy tool to use. For this reason the number of keys has been reduced and these are grouped by function.

For measurement and navigation through the menus, the equipment has a joystick, 4 programmable keys (softkeys) and 6 direct access keys (shortcut keys).

Next the use of each one of them is described:

### 2.7.1 Joystick

Joystick positions are five:

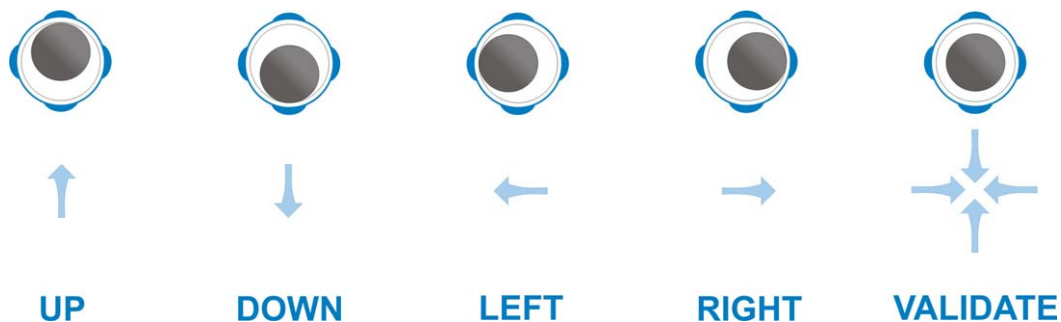


Figure 8.

In the **SPECTRUM ANALYSER** mode, the joystick is multifunctional, that is, each time you press its function changes. The user can see the active function according to the icon that is displayed at the upper right corner of the equipment, as shown in the image. The functions are:



- CH:** Channel tuning.
- FR:** Frequency tuning.
- SP:** Span change.
- MK:** Marker moving.

Figure 9.

According to the selected function, the joystick will do a specific action.

## 2.7.2 Keyboard shortcuts

### ► Function keys

On the left side there are 3 keys to access the most important functions of the equipment.



**Measurement key.**



**Spectrum Analyser key.**



**TV Mode Key.**

Pressing a key repeatedly provides access to a different view within the same function.

Each view is shown at the top. When reaching the third view it returns to the first view.



Measurements



1/3

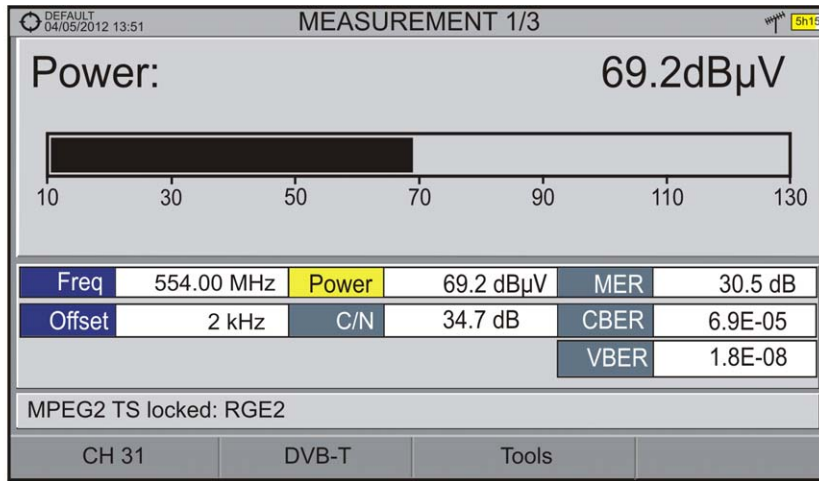


Figure 10.- FULL MEASUREMENT



2/3

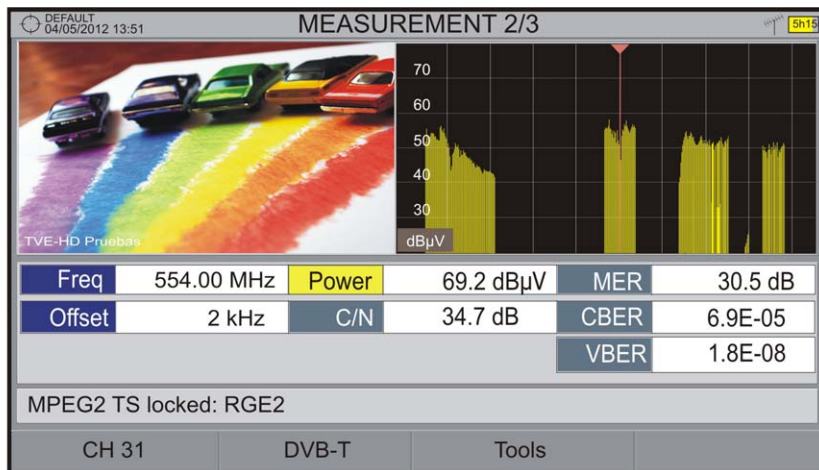


Figure 11.- MEASUREMENT + TV + SPECTRUM



3/3

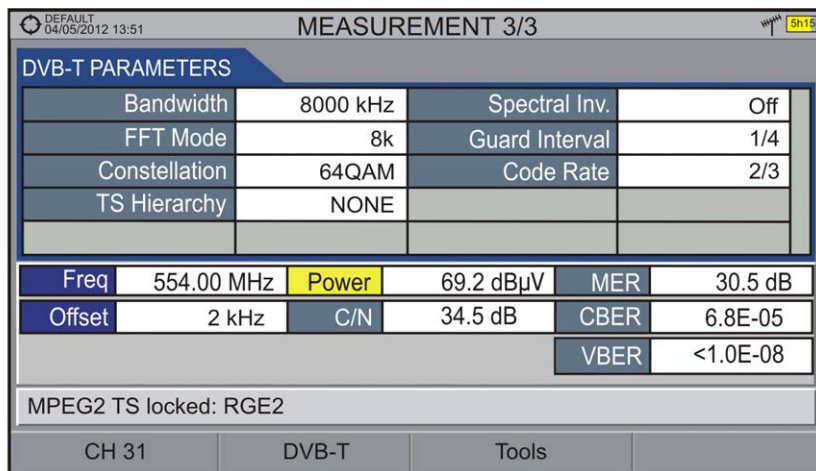


Figure 12.- MEASUREMENT + PARAMETERS





Spectrum Analyser



1/3

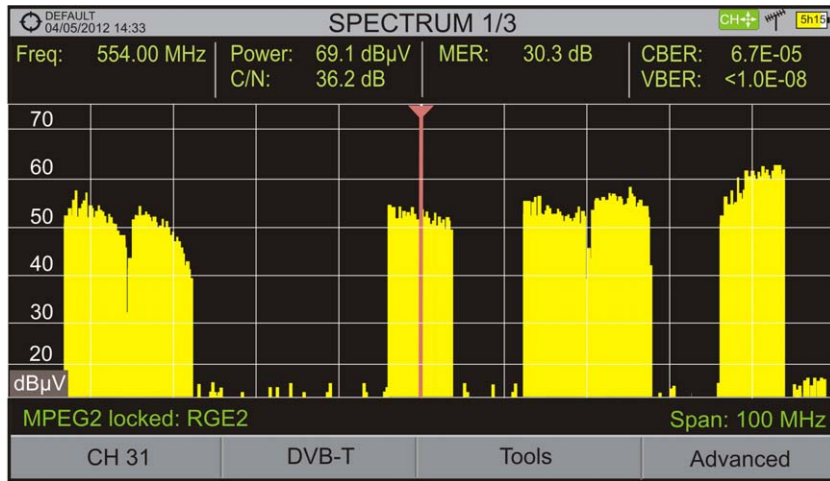


Figure 13.- SPECTRUM + MEASUREMENT



2/3

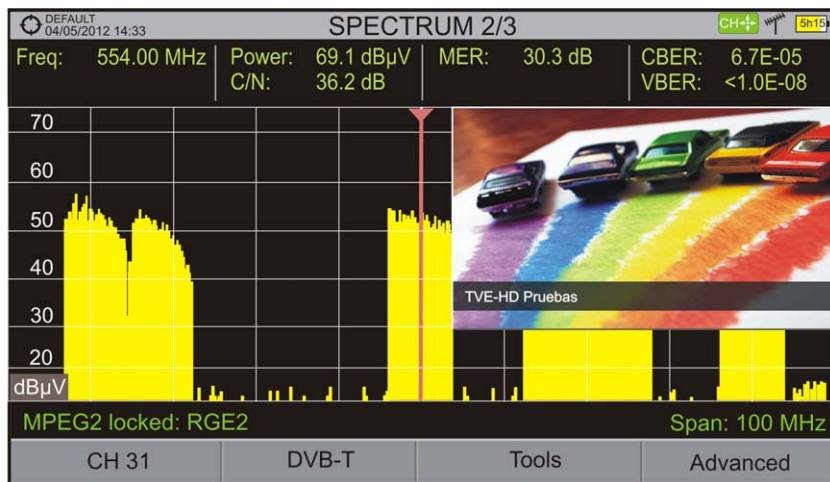


Figure 14.- SPECTRUM + MEASUREMENT + TV



3/3

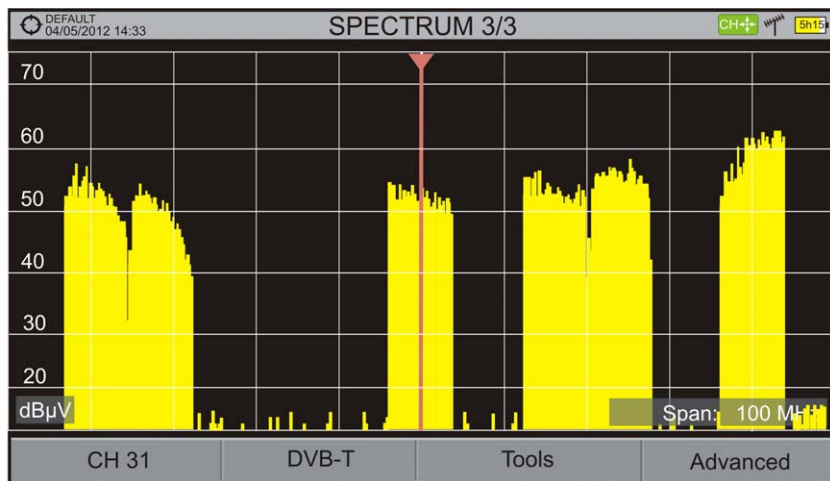


Figure 15.- FULL SPECTRUM



TV Mode



1/3

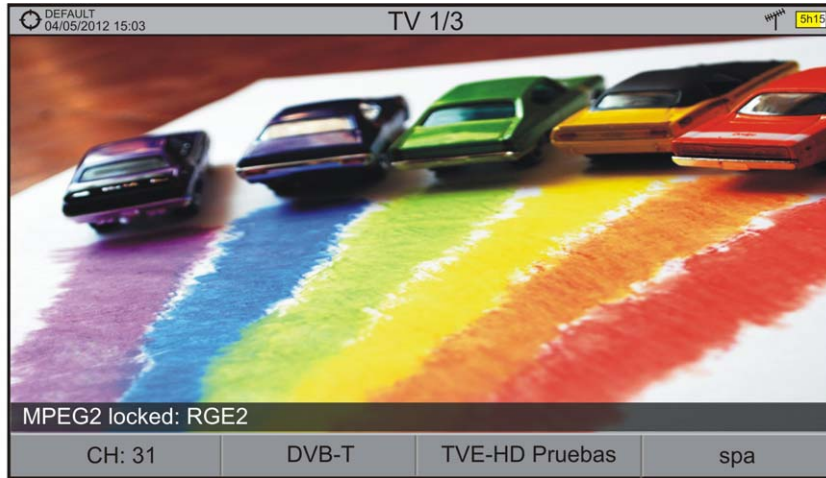


Figure 16.- FULL TV



2/3

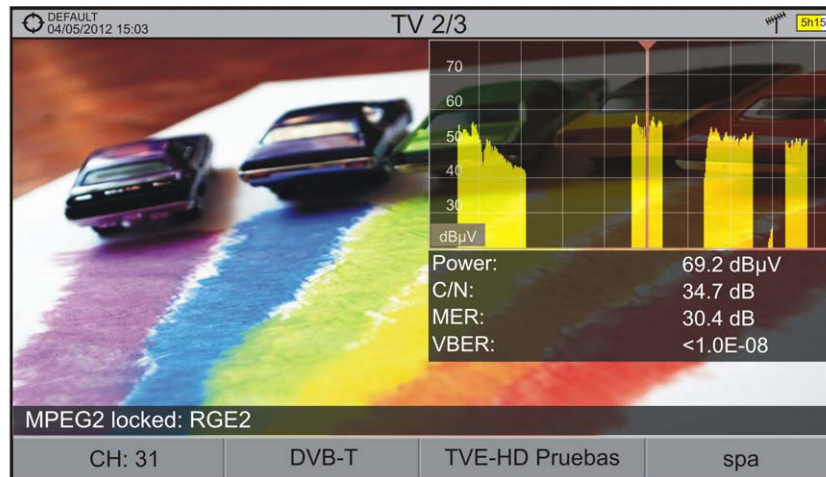


Figure 17.- TV + SPECTRUM + MEASUREMENT



3/3

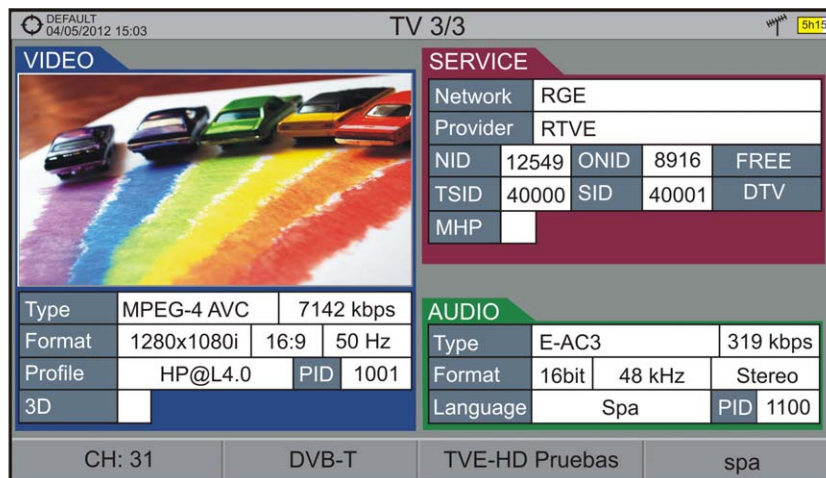


Figure 18.- TV + SERVICE DATA



**Snapshot key**

This key captures the screen currently being displayed and stores it in the memory of the equipment in PNG format. This screen can be displayed on the same instrument and if desired, downloaded to a computer.

► **Management Keys**

There are two Management keys:



**Settings.** It accesses the menus to configure the equipment.



**Installations Manager.** It accesses the menus to check measurement data.

2.7.3

**Softkeys**

There are four programmable keys, also called softkeys, numbered from F1 to F4.

Each key provides access to a menu. This menu varies depending on the function the user is working on the meter.

The menu is displayed on each softkey at the bottom of the screen.

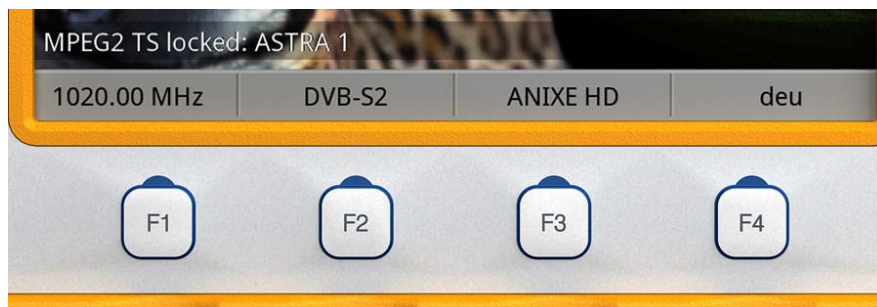



Figure 19.

## 3 MEASUREMENT MODE

### 3.1 Introduction

On the panel left side, the equipment has three functions keys, which give direct access to the three most important functions. One of them is the key **MEASUREMENT** () that measures the signal received through the RF input connector.

The user should connect a signal to the input and select the band, whether terrestrial or satellite. Then the auto stealth function locks the signal and demodulates it in real time, automatically detecting its characteristic parameters.

Having identified the signal, the equipment measures according to the signal type. All information about transponders or multiplex is automatically displayed without introducing any additional parameter identification.




Next there is a list of signals that the equipment can automatically detect. For more information about characteristics of each signal type refer to Annex 1: Signals description.

- Digital Terrestrial Television First Generation (DVB-T)
- Digital Terrestrial Television Second Generation (DVB-T2\*)
- Digital Satellite Television First Generation (DVB-S)
- Digital Satellite Television Second Generation (DVB-S2)
- Digital Cable Television First Generation (DVB-C)
- Digital Cable Television Second Generation (DVB-C2\*)
- Analogue terrestrial TV
- Analogue Cable TV
- Analogue Satellite TV
- Analogue Terrestrial FM

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\* Available only for **HD RANGER +**

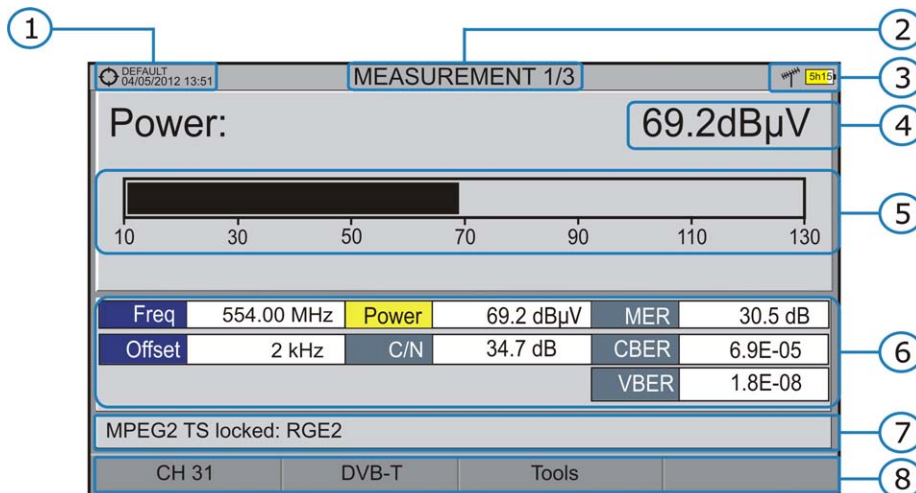
### 3.2 Operation

- 1 Connect the **RF** input signal to the equipment.
- 2 Select through the Tune Settings menu  the frequency band (terrestrial or satellite).
- 3 Access the **MEASUREMENT** option by pressing the  key.
- 4 Press again  to display the next view.

Views for digital signals are:



#### MEASUREMENT 1/3: FULL MEASUREMENT



**Figure 20.**

- 1 Selected installation, date and time.
- 2 Number of view / total views.
- 3 Selected band, battery level.
- 4 Measurement value of the selected parameter.
- 5 Graphical measurement of the selected parameter.
- 6 Measurement values for the type of locked signal.
- 7 Signal status (searching / locked/ multiplex name).
- 8 Softkeys menus.

► **Joystick up / down:** It changes selected parameter.



MEASUREMENT 2/3: MEASUREMENT + TV + SPECTRUM

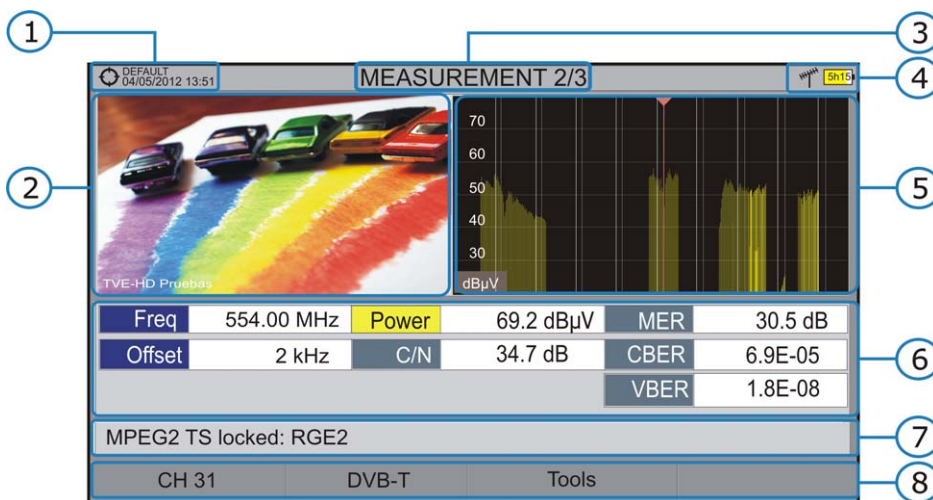


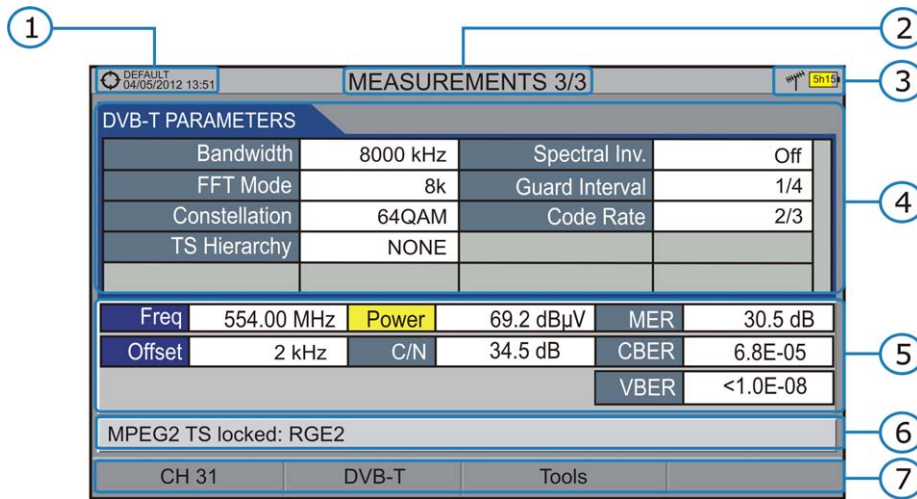
Figure 21.

- ① Selected installation, date and time.
- ② Image of the locked signal.
- ③ Number of view / total views.
- ④ Selected band, battery level.
- ⑤ Spectrum of the locked signal.
- ⑥ Measurement values for the type of locked signal.
- ⑦ Signal status (searching / locked / multiplex name).
- ⑧ Softkeys menus.

► **Joystick right / left:** It changes the selected channel / frequency.



**MEASUREMENT 3/3: MEASUREMENT + PARAMETERS**



**Figure 22.**


- ① Selected installation, date and time.
- ② Number of view / total views.
- ③ Selected band, battery level.
- ④ Demodulation parameters of the locked signal.
- ⑤ Measurement values for the type of locked signal.
- ⑥ Signal status (searching / locked / multiplex name).
- ⑦ Softkeys menus.

► **Joystick right / left:** It changes the selected channel / frequency.

"Signals description" annex describes in detail measurements for each type of signal.




## 4 SPECTRUM ANALYSER MODE

### 4.1 Introduction

On the left side, the equipment has three function keys, which give direct access to the three most important functions. One of them is the **SPECTRUM ANALYSER** key  that displays the signal spectrum received through the RF input connector.

The Spectrum Analyser mode allows checking the signals on the frequency band, to visually identify any anomalies and to measure the signal and display the image tuned.

### 4.2 Mode of operation

- 1 Connect the **RF** input signal to the equipment.
- 2 Select through the **Tune Settings** menu  the frequency band (terrestrial or satellite).
- 3 Access the **SPECTRUM ANALYSER** option by pressing the  key.
- 4 Press again  to display the next view.



Views for digital signals are:



## SPECTRUM 1/3: SPECTRUM + MEASUREMENT

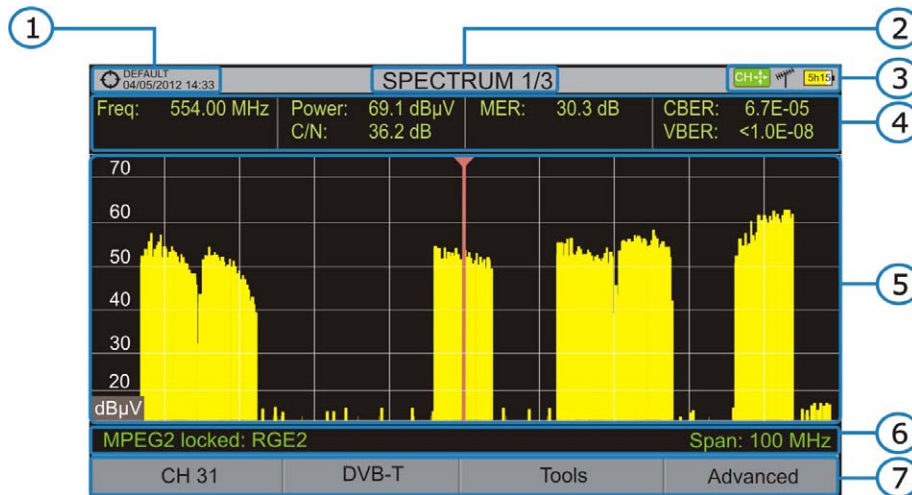
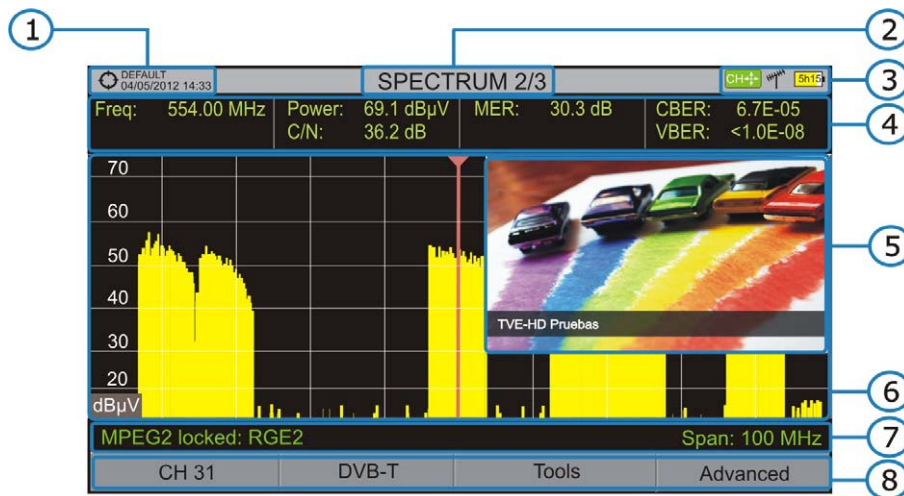


Figure 23.

- 1 Selected installation, date and time.
- 2 Number of view / total views.
- 3 Joystick active mode, selected band, battery level.
- 4 Measured values of the signal at the frequency / channel where is pointing the cursor.
- 5 Spectrum in the band with the selected span.
- 6 Signal status (searching / locked / multiplex name / selected span).
- 7 Softkeys menus.

► **Joystick up / down:** It changes the reference level.

► **Joystick left / right** (depending on the joystick active mode): It changes span / frequency or channel / marker position.


**SPECTRUM 2/3: SPECTRUM + MEASUREMENT + TV**

**Figure 24.**

- 1 Selected installation, date and time.
- 2 Number of view / total views.
- 3 Joystick active mode, selected band, battery level.
- 4 Measured values of the signal at the frequency / channel where is pointing the cursor.
- 5 Image of the tuned signal.
- 6 Spectrum in the band with the selected span.
- 7 Signal status (searching / locked / multiplex name / selected span).
- 8 Softkeys menus.

► **Joystick up / down:** It changes the reference level.

► **Joystick left / right** (depending on the joystick active mode): It changes span / frequency or channel / marker position.



SPECTRUM 3/3: FULL SPECTRUM

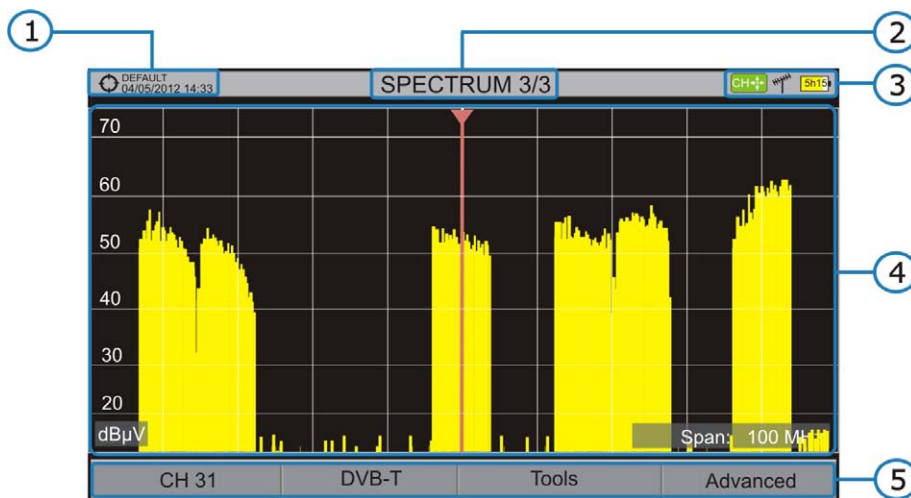


Figure 25.

- 1 Selected installation, date and time.
- 2 Number of view / total views.
- 3 Joystick active mode, selected band, battery level.
- 4 Spectrum in the band with the selected span.
- 5 Softkeys menus.

4.3 Description in detail of the FULL SPECTRUM screen

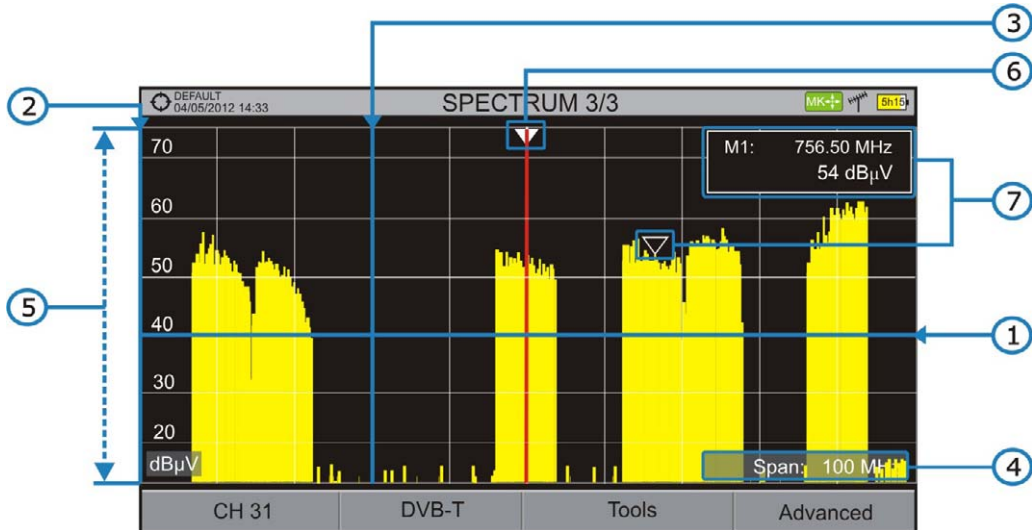


Figure 26.

1 **Horizontal reference line**

It indicates the signal level.

2 **Vertical axis**

It indicates the signal level.

3 **Vertical reference line**

It indicates the frequency.

4 **SPAN**

It is the frequency range displayed on the horizontal axis.

The current span value appears at the bottom right of the screen. To change use the joystick (left, right) in span mode (SP) or change it by the "span" Tuning menu (F1 key).

Span values available are: Full (full band), 500 MHz, 200 MHz, 100 MHz, 50 MHz, 20 MHz and 10 MHz.

5 **Reference Level**

It is the power range represented on the vertical axis.

To change use the joystick (up, down; 5 dB steps).

This equipment has an option to activate the automatic adjustment of the reference level, so it detects the optimal reference level for each situation. This option can be enabled or disabled through the **PREFERENCES** menu and **Measures** tab.

**6 Cursor**

Red vertical line that indicates position during the channel or frequency tuning.

To change frequency / channel use the joystick (left, right) in FR mode (tuning by frequency) or CH mode (tuning by channel).

**7 Marker**

It is a special cursor that can be placed on a given frequency to check the power in this point.

To change use the joystick (left, right) in MARKER (MK) mode.

This option can be enabled using the "MARKER" option from the Advanced menu (F4 key).

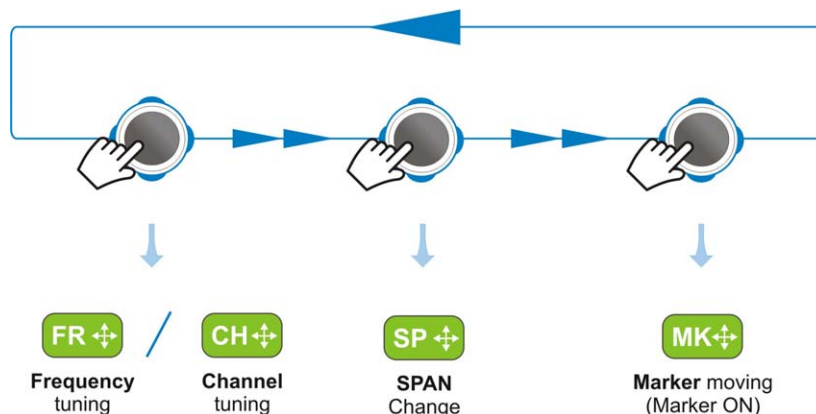
**4.4 Joystick Operation in SPECTRUM ANALYSER mode**

In the **SPECTRUM ANALYSER** mode, the joystick can make different actions depending on its active mode.

The active mode of the joystick appears as an icon in the toolbar at the top right of the screen. Available modes are:

- ▶ **Frequency tuning.**
- ▶ **Channel tuning.**
- ▶ **SPAN change.**
- ▶ **MARKER moving.**

To change the active mode press the joystick.



**Figure 27.**

Pressing left or right will take appropriate action according to the active mode.

Pressing up or down will change the reference level regardless the active mode.

The frequency or channel tuning mode will appear depending on the selected tuning type. Access the ADJUST menu to select the type of tuning.

To show the **MARKER** mode, it must be active.

Access the **ADVANCED** menu (F4) to activate the **MARKER**.

Pressing the joystick for 1 second, a box appears explaining the joystick modes available. From here user can also select the mode.

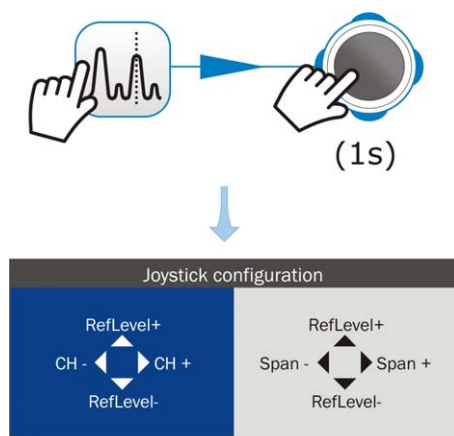






Figure 28.


## 4.5 Menu options for the SPECTRUM ANALYSER

At the bottom of the screen four menus are accessible via the function keys.


- 
It displays the channel where is pointing the cursor and gives access to the tuning menu.
- 
It displays the selected transmission standard and gives access to the signal parameters menu.
- 
It displays the Tools menu.
- 
It displays the Advanced menu.

Next each one of these menus is described.

#### 4.5.1 F1: Tuning

Access by the function  key. It contains the options to tune a channel.

The tuning menu consists of the following options:


► **Channel / Frequency:** It displays the channel / frequency pointed by the cursor. Tuning type (channel / frequency) is selected by means of the "**Tune settings**" menu .

- In **channel tuning**, it allows selecting a channel from the active channel plan:
  - 1 Place over the **Channel** option and press the joystick.
  - 2 A box appears with all channels of the active channel plan and its frequency.
  - 3 Move the joystick on the box to select a channel.
  - 4 When finished press joystick to save the selected value or any function key to exit without saving.
  - 5 The cursor will place on the selected channel and it will appear on the **F1** option. The channel can be changed directly with the joystick in CH mode.
- In case of **tuning by frequency**, the frequency can be edited:
  - 1 Place over the **Frequency** option and press the joystick
  - 2 The option is highlighted in yellow to indicate it is in edit mode.
  - 3 Move the joystick left / right to move between the figures and up / down to change the figure.
  - 4 When finished press joystick to save the selected value or any function key to exit without saving.
- The frequency can be changed directly with the joystick in FR mode.

- ▶ **Central Frequency:** It displays the value of the central frequency on the screen. To edit:
  - 1 Place over the **Frequency option** and press the joystick.
  - 2 The option is highlighted in yellow to indicate it is in edit mode.
  - 3 Move the joystick left / right to move between the figures and up / down to change the figure.
  - 4 When finished press joystick to save the selected value or any function key to exit without saving.
  
- ▶ **Level of reference:** It displays the reference level. To edit:
  - 1 Place over the **Reference Level** option and press joystick.
  - 2 The option is highlighted in yellow to indicate it is in edit mode.
  - 3 Move the joystick left / right to move between the figures and up / down to change the figure.
  - 4 When finished press joystick to save the selected value or any function key to exit without saving.
  - The **Reference Level** can be changed directly with the joystick up or down.
  
- ▶ **Span:** It shows the span, which is the frequency range displayed on screen. To edit:
  - 1 Place over the span option and press the joystick.
  - 2 The option is highlighted in yellow to indicate it is in edit mode.
  - 3 Move the joystick left / right to move between the figures and up / down to change the figure.
  - 4 When finished press joystick to save the selected value or any function key to exit without saving.
  - The span can be changed directly with the joystick in **SP** mode.




#### 4.5.2 F2: Signal Parameters

Access by the  function key. It allows selecting the standard transmission and displays the parameters for signal transmission.

This menu allows selecting the transmission standard:

- ▶ **Type of signal:** It displays the selected standard. It allows selecting another standard in the same band (terrestrial or satellite):
  - 1 Place over the **Signal Type** option and press the joystick.
  - 2 It displays a menu at the right with the transmission standards.
  - 3 Move the joystick up / down to select a standard.
  - 4 When finished press joystick to select the standard or any function key to exit without selecting.
- The remaining transmission parameters are detected demodulating the locked signal.


#### 4.5.3 F3: Tools

Access by the  key. It access to the Tools menu. This menu can change depending on the type of selected standard. Tools are:

- ▶ **Constellation:** It displays the constellation of the locked signal.
- ▶ **LTE Ingress Test:** It enables the detection of signal interferences coming from mobile phones.
- ▶ **Echoes:** It detects the echoes that may appear due to the simultaneous reception of the same signal from several transmitters.

For more information about these features, see "**Tools**" chapter.

#### 4.5.4 **F4: Advanced**

Access by the  function key. It allows selecting among several parameters to display the spectrum.

The advanced menu consists of the following options:

- ▶ **Average:** The user can select the amount of signal values to be used to set the average signal value to be displayed on screen. The larger the average value, the more stable the displayed signal appears.
- ▶ **Spectrum Line:** It defines the spectrum display. Outline option displays the spectrum outline. The Solid option displays the contour of the spectrum with solid background.
- ▶ **Marker:** It allows enabling / disabling the marker. This marker is displayed on screen with the shape of an arrowhead, showing on screen some information about the frequency and power level where it points. You can move left / right by the joystick in **MK** mode (press the joystick until the icon **MK** appears).
- ▶ **Max. Hold.:** (Off / Permanent / Curtain). It allows the user to display the current signal with the maximum values measured for each frequency. The **OFF** option disables this function. The **Curtain** option displays the maximum values in blue for a moment with the current signal. The **Permanent** option maintains maximum signal on the screen. This option is especially useful for detecting sporadic noises.

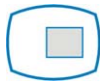
To select a parameter:

- 1 Place over the option and press the joystick.
- 2 The data field gets into the edit mode, indicated by the yellow background.
- 3 A menu is displayed at the right with some options or if it is numeric, a number darkens.
- 4 Move the joystick up / down to select one option. To move between figures press right / left and to change it press up / down.
- 5 When finished press joystick or any function key to exit.


#### 4.6 Location of a signal with the SPECTRUM ANALYZER

- 1 Connect the cable with the input signal to the **RF IN** input connector.
- 2 Press the **SPECTRUM** key. The spectrum of the signal is displayed.
- 3 Adjust the span (recommended value for a terrestrial signal 50 MHz and for a satellite signal 100 MHz). The current value of the span is at the right bottom of the screen.
- 4 Find the frequency of the signal by moving the joystick left or right to move sweeping the entire band.
- 5 If you know the channel change the tuning by frequency to tuning by channel. The channel mode allows you to navigate from channel to channel, using the selected channel plan.
- 6 When the channel is locked information appears at the bottom left of the screen.
- 7 The equipment automatically detects transmission parameters of the signal and makes the corresponding measurements.

## 5 TV MODE





### 5.1 Introduction

On the left side of the front panel there are three functions, which give direct access to the three most important functions. One is the **TV MODE** key  which displays the resulting image from decoding received RF signal.

**TV MODE** demodulates the TV signal received by the RF input, so the user can check the signal on the screen. It shows information about the channel and its services.

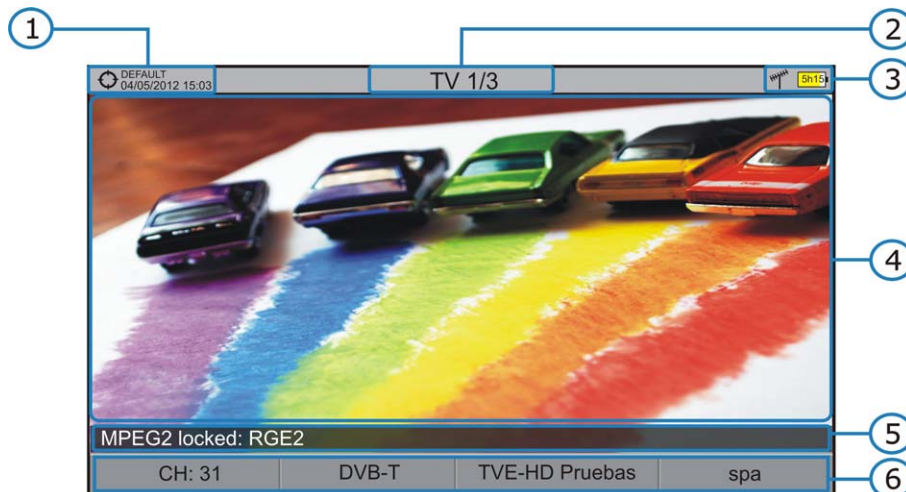
### 5.2 Operation

- 1 To access the **TV MODE** option, press the  key.
- 2 The screen shows the tuned signal demodulated.  
For digital carriers, the first service of the terrestrial multiplex or satellite transponder appears. In case the signal is scrambled the image will not appear.  
In the case of an analogue signal, tuned signal will appear.
- 3 To access the next view (if digital signal) of the **TV MODE**, press the  again. At the last view it will return back to the first.

Views for the digital signal are:



**TV 1/3: FULL TV**



**Figure 29.**

- ① Selected installation; date and time.
- ② Number of view / total views.
- ③ Selected band, battery level.
- ④ Tuned service image.
- ⑤ Signal status (searching / locked / multiplex name).
- ⑥ Softkeys menus.

- ▶ **Joystick up / down:** It changes service.
- ▶ **Joystick left / right:** It changes channel / frequency.



TV 2/3: TV + SPECTRUM + MEASUREMENT

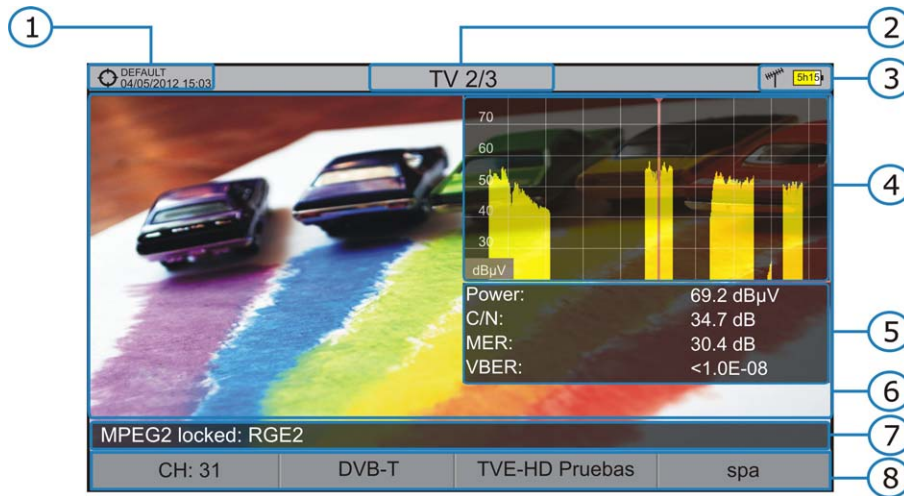


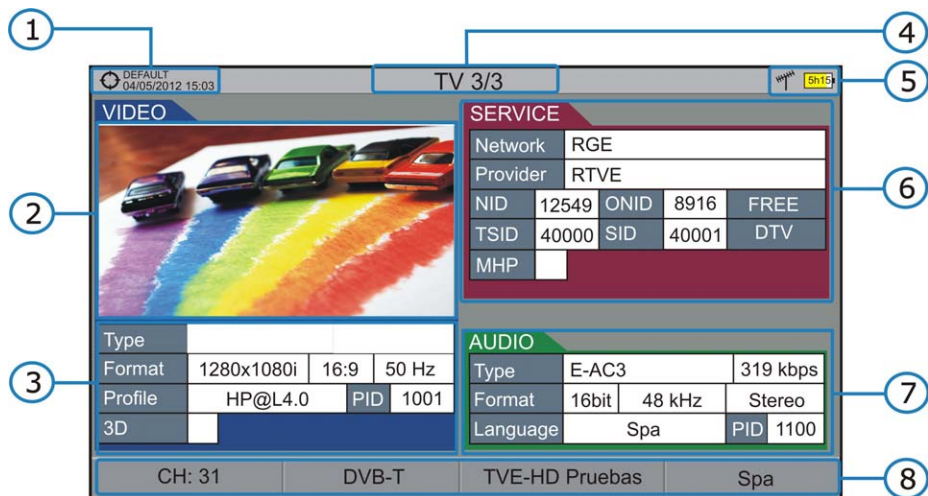
Figure 30.

- 1 Selected installation; date and time.
- 2 Number of view / total views.
- 3 Selected band, battery level.
- 4 Tuned service image.
- 5 Spectrum.
- 6 Measured values of the signal in the frequency / channel the cursor is pointing.
- 7 Signal status (searching / locked / multiplex name).
- 8 Softkeys menus.

- ▶ **Joystick up / down:** It changes service.
- ▶ **Joystick left / right:** It changes channel / frequency.



**TV 3/3: SCREEN TV + SERVICE DATA**



**Figure 31.**

- 1 Selected installation; date and time.
- 2 Tuned service image.
- 3 Tuned service information.
  - ▶ **TYPE:** Encoding type and video transmission rate.
  - ▶ **FORMAT:** Resolution (horizontal x vertical), aspect ratio and frequency.
  - ▶ **PROFILE:** Profile level.
  - ▶ **PID:** Video program identifier.
  - ▶ **3D:** Application of 3D technology.
- 4 Number of view / total views.
- 5 Selected band; battery level.
- 6 Tuned service information.
  - ▶ **NETWORK:** Television distribution network (Terrestrial). Orbital position (Satellite).
  - ▶ **PROVIDER:** Program provider name.
  - ▶ **NID:** Network identifier where the signal is distributed.
  - ▶ **ONID:** Identifier of the original network where the signal originates.
  - ▶ **TSID:** Transport stream identifier.
  - ▶ **SID:** Service Identifier.
  - ▶ **MHP:** Interactive service.
  - ▶ **FREE / SCRAMBLED:** Free / scrambled transmission.
  - ▶ **DTV/DS/ ANALOG:** Standard type of transmission.

- 7 Tuned audio information.
  - ▶ **TYPE:** Type of audio encoding and transmission speed
  - ▶ **FORMAT:** Service audio format. Bit depth; sampling frequency; sound reproduction.
  - ▶ **LANGUAGE:** Broadcasting language.
  - ▶ **PID:** ID of the audio program.
- 8 Softkeys menus.
  - ▶ **Joystick up / down:** It changes service.
  - ▶ **Joystick left / right:** It changes channel / frequency.

### 5.3 Menu Options for the TV MODE

#### 5.3.1 F1: Tuning

It displays the frequency or channel tuned.

It allows editing frequency or change channel in the active channel plan. (see how to select a frequency or channel on chapter 4.5.1).

#### 5.3.2 F2: Signal Parameters

It shows the parameters of the tuned signal.

It displays the menu to select the standard of the channel plan. (see how to select a standard on chapter 4.5.2).






#### 5.3.3 F3: Service / Analogue signal

##### ▶ Digital Signal

It displays the list of services available in the multiplex tuned, with information about the service type and the identification number.



Icons that appear next to the service name identify the features of the service. The meaning is given in the following table:

	<b>Digital TV service</b>		<b>High Definition TV service</b>
	<b>Digital radio</b>		<b>Data</b>
	<b>Scrambled service</b>		

▶ **Analogue Signal**

It allows selecting the type of analogue input, between antenna and external. To get an external analogue signal use the A/V input (see figure 5).

**5.3.4 F4: Audio / Aspect Ratio**

▶ **Digital Signal**

It gives access to a list of available audio tracks in the selected service.

▶ **Analogue Signal**

It allows selecting the aspect ratio of the signal tuned (4:3; 16:9).

## 6 TOOLS

### 6.1 Constellation

#### 6.1.1 Description

The constellation diagram is a graphic representation of the digital symbols received over a period of time. There are different types of constellation diagrams according to the modulation type.

In the case of an ideal transmission channel without noise or interference, all symbols are recognized by the demodulator without errors. In this case, they are represented in the constellation diagram as well defined points hitting in the same area forming a very concentrated dot.

Noise and interferences cause the demodulator to not always read the symbols correctly. In this case hits are dispersed and create different forms which can visually determine the type of problem in the signal.



Each type of modulation is represented differently. A 16-QAM signal is shown on screen by a diagram of a total of 16 different zones and a 64-QAM signal is represented by a diagram of 64 different zones and so on.

The constellation diagram shows in different colours the density of hits and includes features to zoom, move and delete the display on screen.

#### 6.1.2 Operation

The constellation is available to all **DIGITAL** signals, both **TERRESTRIAL** and **SATELLITE**.

To access the **CONSTELLATION** tool:

- 1 Connect the **RF** input signal to the equipment.
- 2 Tune to a digital signal from satellite or terrestrial band.
- 3 Enter the **MEASUREMENT**  or **SPECTRUM** mode .
- 4 Press the **F3** key (Tools).
- 5 Select **CONSTELLATION**.
- 6 The **CONSTELLATION** of the tuned signal appears.

Constellation screen description:

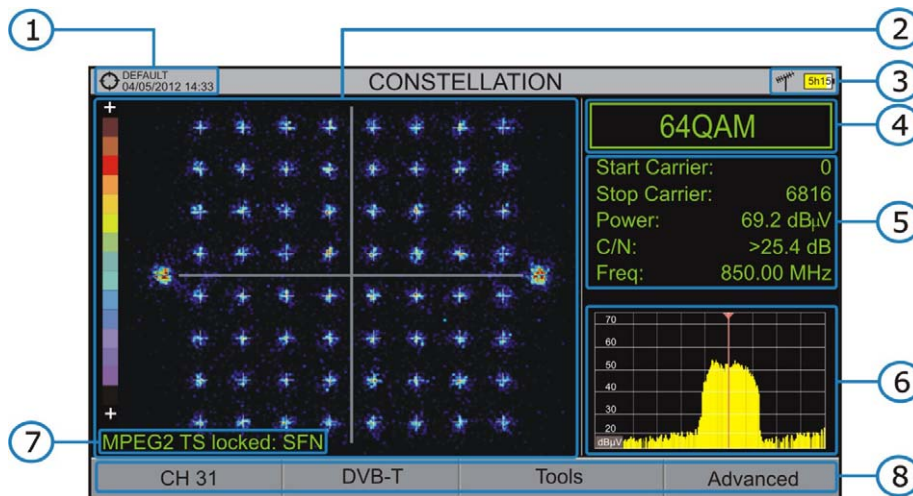


Figure 32.

- 1 Selected installation; date and time.
- 2 Constellation window.  
The colour scale placed at the left side indicates the signal quality in a qualitative way by a gradation of colours proportional to the density of symbols concentrated in a given area. The colour scale ranges from black (no symbols) to red (highest density).  
Greater dispersion of the symbols indicates higher noise level or worse signal quality signal. If there is symbols concentration, this is indicative of good ratio signal / noise or absence of problems.
- 3 Selected band, battery level.
- 4 Constellation modulation.
- 5 Data Window.  
The data shown are first Carrier; end Carrier, Power, C/N and frequency / channel.
- 6 Spectrum of the tuned signal.  
Spectrum is displayed with the span selected at the **SPECTRUM** mode.
- 7 Signal status (searching / locked / multiplex name).
- 8 Softkeys menus.

Joystick **Left / Right**: Frequency / Channel change.

### 6.1.3 Menu Options for Constellation tool

On the bottom of the screen there are four menus accessible via the function keys.



It displays the channel / frequency where is pointing the cursor and accesses the tuning menu.



It displays the selected transmission standard menu and accesses the signal parameters.



It displays the Tools menu.



It displays the Advanced menu.

In the Advanced menu there are some options for the constellation configuration. They are:

#### ► Grid type:

- **Full Grid:** The grid where the constellation is displayed is a complete grid.
- **Cross Grid:** The grid where the constellation is displayed is made of crosses.

#### ► Start Carrier / Stop Carrier:

The transmission of any digital channel consists of about 8,000 carriers, of which 6,817 are useful. These are divided in signalling carriers and data carriers. This option allows selecting the range of carriers to be displayed between the first and last.

## 6.2 LTE Ingress test

### 6.2.1 Description

**Long Term Evolution** is a new standard for mobile networks. This mobile communication standard uses a frequency band close to the bands used by television. For this reason it can cause interferences.

The LTE Ingress Test identifies this type of interferences in a television distribution system, so that they can be compared on the same screen the reception with LTE filter and without LTE filter and thus if there is any interference it can be detected and take appropriate action to fix it.

## 6.2.2 Operation

The **LTE Ingress Test** input is available to all **DIGITAL TERRESTRIAL** signals.

To access the **LTE Ingress Test** tool:

- 1 Connect the **RF** input signal to the equipment.
- 2 Tune a digital signal of the terrestrial band.
- 3 Enter the **MEASUREMENT** mode or **SPECTRUM** mode .
- 4 Press the **F3** key (Tools).
- 5 Select the **LTE Ingress Test** mode.
- 6 Enable / disable the **LTE** filter.

This function displays on the same screen measurements obtained with the LTE filter or without LTE filter. Measuring the signal with filter or without filter is not done simultaneously, but alternately, by means of the F4 key that activates or deactivates the filter.

The following describes the **LTE** display:

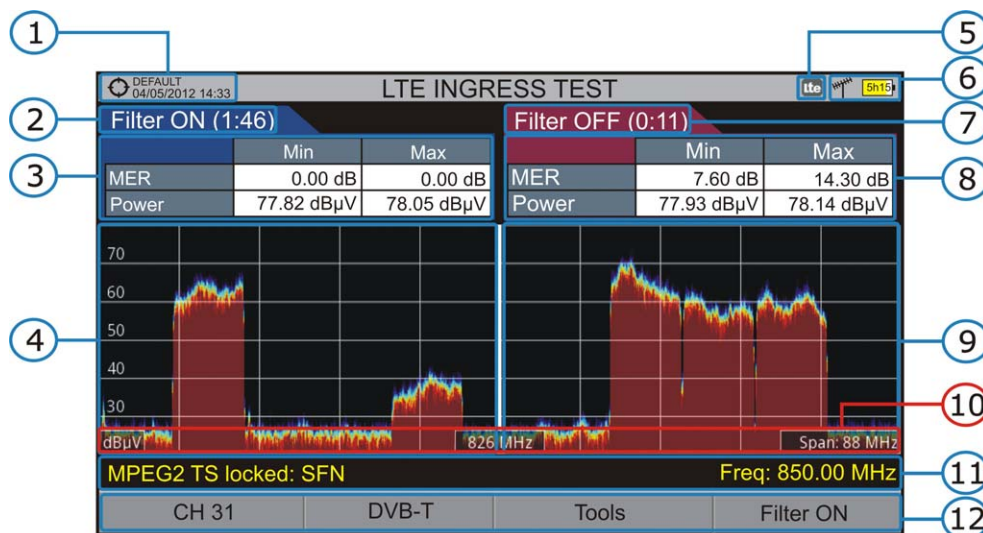






Figure 33.

- 1 Selected installation; date and time.
- 2 Elapsed time with filter ON.
- 3 Measurement with filter ON: MER (minimum, maximum) and power (minimum, maximum).

- 4 Signal with **LTE** filter ON.
- 5 Identifier icon of the **LTE** filter ON.
- 6 Selected band; battery level.
- 7 Elapsed Time with filter OFF.
- 8 Measurement with filter OFF: MER (minimum, maximum) and power (minimum, maximum).
- 9 Signal with LTE filter OFF.
- 10 Measurement units / centre frequency / Span.
- 11 Signal status (searching / locked / multiplex name).
- 12 Softkeys menus.

### 6.2.3 Options Menu for the LTE Ingress Test tool

On the bottom of the screen there are four menus accessible via the function keys.

- 
 It displays channel / frequency and access the tuning menu.
- 
 It displays the selected transmission standard menu and accesses the signal parameters.
- 
 It displays the Tools menu.
- 
 It enables / disables the filter LTE.

## 6.3 Echoes

### 6.3.1 Description

The **Echoes** option shows the response in time of a digital terrestrial channel and therefore it can detect echoes that can occur due to the simultaneous reception of the same signal from several transmitters with different delays and amplitudes.



Another cause that may cause echoes is reflection of the signal on large objects, as buildings or mountains. This may be the explanation that having a good C / N and a good signal, the BER does not reach the minimum value.

With the **Echo** function is possible to know the distance from where the equipment is to the transmitter or the object that caused the echo. Thus, the installer can minimise the effect that the echo may cause on the installation, reorienting the antenna and reducing the effect of received echoes.

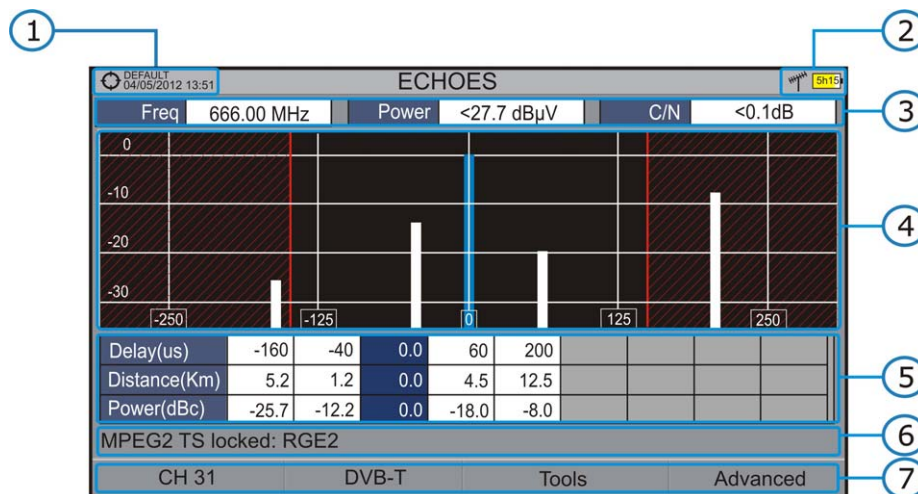
This function is only available for **DVB-T** and **DVB-T2**. Therefore, previously have to configure the apparatus for the reception of such signals.

### 6.3.2 Operation

Echoes function is available for **DVB-T** and **DVB-T2** signals.

- 1 Connect the **RF** input signal to the equipment.
- 2 Tune a **DVB-T** or **DVB-T2** digital signal at the terrestrial band.
- 3 Enter the **MEASUREMENT** mode  or **SPECTRUM** mode .
- 4 Press the **F3** key (Tools).
- 5 Select **ECHOES**.
- 6 The **ECHOES** function of the tuned signal appears on screen.

The following describes the **ECHOES** screen:



**Figure 34.**

- 1** Selected installation; date and time.
- 2** Selected band, battery level.
- 3** Main signal data: Frequency, Power and C/N.
- 4** **ECHOES** Diagram.

The display shows a graphical representation of the echoes. The horizontal axis of the graph corresponds to the delay in receiving the echo on the main path (the stronger signal). The vertical axis represents the attenuation of the echo in dB on the main path.

- 5** Data box with main data regarding echoes.

In the list of echoes it shows the power, the delay in microseconds and the distance in kilometres to the echoes.

- 6** Signal status (searching / locked / multiplex name).
- 7** Softkeys menus.

- ▶ **Joystick left / right (CHANNEL mode)**: It changes the channel.
- ▶ **Joystick left / right (ECHOES mode)**: It moves cursor over the echoes window.
- ▶ **Joystick up / down (ECHOES mode)**: It changes Zoom.

Remember to press the joystick to change the **ECHOES** mode to **CHANNEL** mode.



### 6.3.3 Menu Options for the Echoes tool

At the bottom of the screen there are four menus available via the function keys.



It displays the channel / frequency where is pointing the cursor and access the tuning menu.



It displays the selected transmission standard menu and accesses the signal parameters.



It displays the Tools menu.




It displays the Advanced menu. The ZOOM option changes the zoom on the echoes windows. Zooms are 1x, 2x, 4x and 8x.


## 6.4 Installations Management

The Installations Management is a program embedded in the equipment that allows the user to easily create a file (installation) to individually store and manage data for each installation. Installation measurements are stored in its corresponding folder. These measures can then be displayed and downloaded to a PC.

If the user does not create any file installation, the equipment stores measurements in the installation file that is preinstalled by default.

To access the Installations menu press the  key.

The menu consists of the following options:

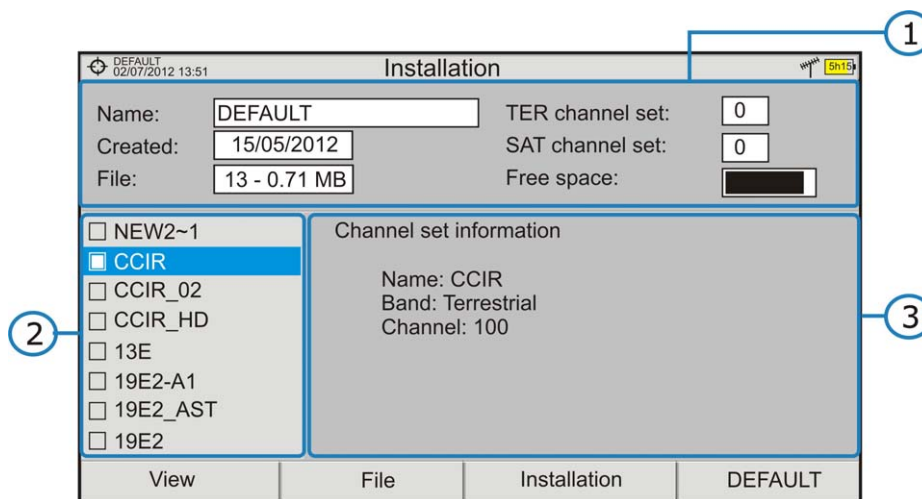
- **Installation wizard:** It opens a wizard to create a new installation file.
- **Change to:** It displays a menu with all the installations files created and allows the user to select the installation to save measurements. Installation selected appears on the upper left corner of the screen, next to the time, accompanied by the symbol .
- **Installation Manager:** It opens a window showing all data of the selected installation and allows editing it (more details in the next section).
- **Channel Set:** It displays a menu with all associated channels set to the selected installation. The user has to select the one is going to work with.

- **Explore**

**Channel Set:** It explores the selected channel set (see section 6.4.2).

## 6.4.1 Installation Manager

When accessing the **Installation Manager** the following screen appears:



**Figure 35.**

The window is divided into three fields:

### 1 Installation data

- It displays information about the installation using the following fields:
  - ▶ **Name:**  
Name of the installation file.
  - ▶ **Created:**  
Date installation was created.
  - ▶ **File:**  
Number of files the installation has and total size.
  - ▶ **TER Channel Sets:**  
It shows the number of terrestrial channel sets used in the installation.
  - ▶ **SAT Channel Sets**  
It displays the number of satellite channel sets used in the installation.
  - ▶ **Free Space**  
It displays the amount of memory available for the selected installation.

## 2 List of channel sets and screenshots

It shows all channel sets and / or screenshots available for the selected installation.

Any channel set or screenshot can be selected or deselected pressing the joystick.

## 3 Display area

It is the area where the selected file is displayed, both channel set and screenshots.

In the case of displaying a channel set file, it shows the name, the band and the number of channels of the channel set on which the cursor is placed.

For a screenshot, it shows the full screen, as captured. Screenshots are saved with PNG extension.

At the bottom there are four function keys. Each one displays a menu. They are described below.



### VIEW

- ▶ **All:**  
It displays all available channel sets and screenshots.
- ▶ **Screenshots:**  
It shows all available screenshots.
- ▶ **Channel Sets:**  
It shows all available channel sets.



### FILE

- ▶ **Mark All:**  
It marks all files in the list of channel sets and screenshots.
- ▶ **Unmark All:**  
It deselects all files in the list of channel sets and screenshots.
- ▶ **Rename:**  
It renames a selected file.
- ▶ **Delete:**  
It deletes all selected files.
- ▶ **Copy to USB:**  
It saves selected files on a USB stick connected to the instrument.

F3

**INSTALLATION**

- ▶ **Edit name:**  
It edits the name of the currently selected installation.
- ▶ **Delete:**  
It deletes the name of the currently selected installation.
- ▶ **Duplicates:**  
It allows double the currently selected installation.

F4

**CURRENT INSTALLATION**

This function key displays the name of the current installation. Pressing the key, a menu displays available installations so the user can switch installation.

To get out from the Edit Installation tool press any key to access MEASUREMENT, SPECTRUM or TV mode.

6.4.2

**Explore Channel Set**

This option performs a scan of the selected channel.

When accessing the **Explore Channel Set** option appears the following screen:

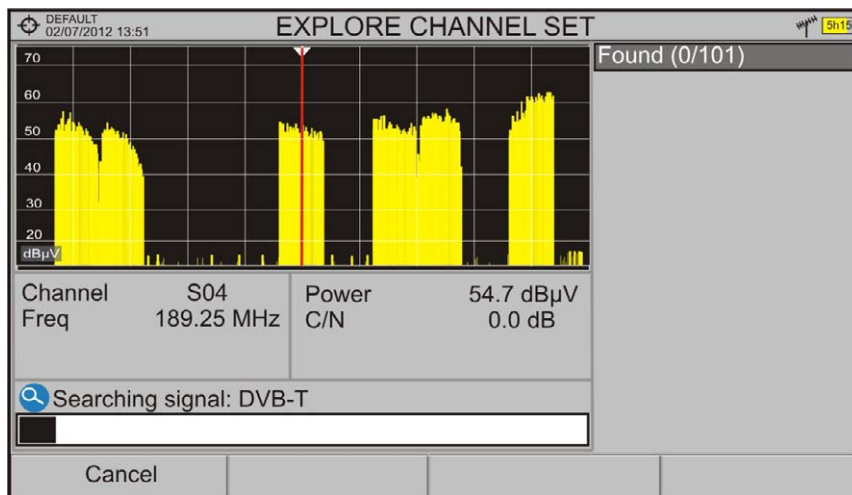


Figure 36.

After the exploration the following screen appears:

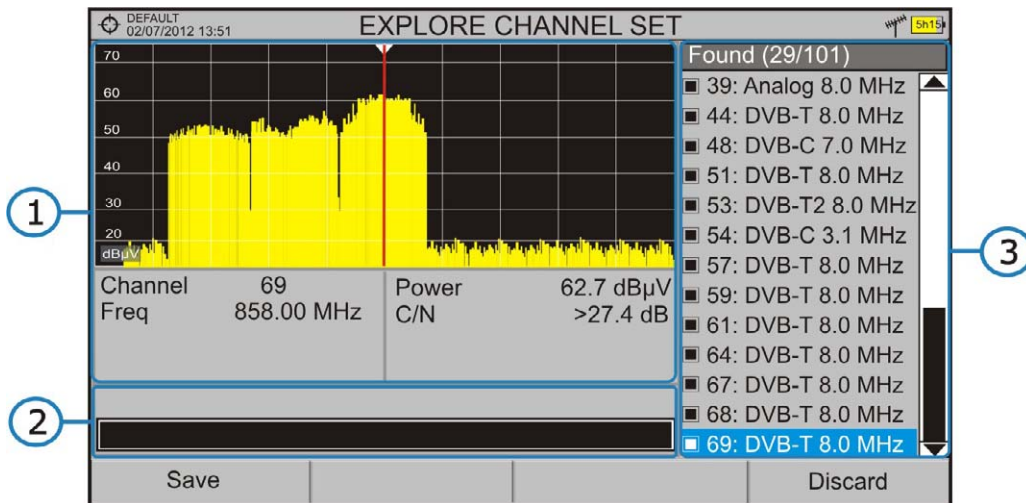


Figure 37.

The window is divided into three areas:

- 1 Spectrum and Measurement.**

It shows the cursor scrolling through each of the channels of the channel set. On the bottom of the screen the channel and frequency appears next to the Power and the C / N ratio.
- 2 Progress Bar.**

It shows the signal type detected and the scan progress in real time. At the end a box shows a message informing the exploration process has finished.
- 3 Channel set.**

At the end of the process it shows the channels that have been detected during the channel set exploration. In parentheses shows the number of detected channels to total channels of the channel set.

At the bottom are the function keys. They are detailed below.



**Cancel:**

This option appears only while performing the exploration process. It cancels the exploration before finish. When pressing, a confirmation message appears before cancelling.

**Save:**

This option appears at the end of the exploration process. It saves the results obtained during the exploration. The name of the original channel set is assigned to the new one by default and the user can modify the name using the virtual keyboard that appears prior to saving. The new channel set is available through the Installation editor in the corresponding installation.

**Discard:**

This option appears at the end of the exploration process. It discards the results obtained from the exploration.

## 7 SPECIFICATIONS

### 7.1 Specifications *HD RANGER +*

#### CONFIGURATION FOR MEASURING LEVEL AND POWER

<b>TUNING MEASURE</b>	Digital frequency synthesis. Continuous tuning from 5 to 1000 MHz and from 950 to 2150 MHz. (Terrestrial and Satellite respectively).
<b>TUNING DEMODULATOR</b>	Digital frequency synthesis.
<b>Terrestrial TV &amp; FM bands</b>	From 45 to 860 MHz.
<b>Terrestrial tunable range</b>	From 5 to 1000 MHz.
<b>Satellite TV band</b>	From 950 to 2150 MHz.
<b>Tuning modes</b>	Channel or frequency (IF or downlink at satellite band). Channel plan configurable on demand.
<b>Resolution</b>	10 kHz.

#### RF INPUT

<b>Impedance</b>	75 $\Omega$ .
<b>Maximum signal</b>	130 dB $\mu$ V.
<b>Maximum input voltage</b>	
<b>DC to 100 Hz</b>	50 V rms (powered by the AL-103 power charger). 30 V rms (not powered by the AL-103 power charger).
<b>5 MHz to 2150 MHz</b>	140 dB $\mu$ V (protected up to 30 seconds).

#### DIGITAL SIGNALS MEASUREMENT

##### MARGIN OF POWER MEASUREMENT

<b>COFDM</b>	From 35 dB $\mu$ V to 115 dB $\mu$ V.
<b>QAM</b>	From 35 dB $\mu$ V to 115 dB $\mu$ V.
<b>QPSK/8PSK</b>	From 35 dB $\mu$ V to 115 dB $\mu$ V.

## MEASUREMENTS

<b>DVB-T (COFDM)</b>	Power, CBER, VBER, MER (up to 35 dB), C/N and Link margin.
<b>Presentation</b>	Numeric and level bar.
<b>DVB-T2 (COFDM)</b>	Power, CBER, MER (up to 35 dB), C/N, LBER, BCH ESR, LDPC Iterations and Wrong Packets.
<b>Presentation</b>	Numeric and level bar.
<b>DVB-C (QAM)</b>	Power, BER, MER (up to 35 dB), C/N and Link margin.
<b>Presentation</b>	Numeric and level bar.
<b>DVB-C2 (COFDM)</b>	Power, CBER, MER (up to 35 dB), C/N, LBER, BCH ESR, LDPC Iterations and Wrong Packets.
<b>Presentation</b>	Numeric and level bar.
<b>DVB-S (QPSK)</b>	Power, CBER, VBER, MER (up to 30 dB), C/N and Link margin.
<b>Presentation</b>	Numeric and level bar.
<b>DVB-S2 (QPSK/8PSK)</b>	Power, CBER, LBER, MER (up to 30 dB), C/N, BCH ESR, Wrong Packets and Link Margin.
<b>Presentation</b>	Numeric and level bar.

## DVB-T SIGNAL PARAMETERS

<b>Carriers</b>	2k / 8k.
<b>Guard Interval</b>	1/4, 1/8, 1/16, 1/32.
<b>Code Rate</b>	1/2, 2/3, 3/4, 5/6, 7/8.
<b>Modulation</b>	QPSK, 16-QAM, 64-QAM.
<b>Bandwidth</b>	6, 7 and 8 MHz.
<b>Spectral inversion</b>	ON, OFF (AUTO).
<b>Hierarchy</b>	Indicates hierarchy mode.
<b>Cell ID</b>	Detected from transmitter station.
<b>TPS signalling</b>	Time slicing, symbol interleave and MPE-FEC.



**DVB-T2 SIGNAL PARAMETERS**

<b>Carriers</b>	1k, 2k, 4k, 8k, 8k+ EXT, 16k, 16k+ EXT, 32k, 32k+ EXT.
<b>Guard Interval</b>	1/4, 19/256, 1/8, 19/128, 1/16, 1/32, 1/128.
<b>Bandwidth</b>	5, 6, 7 and 8 MHz.
<b>Spectral Inversion</b>	ON, OFF (AUTO).
<b>Pilot Pattern</b>	PP1-PP8.
<b>Code Rate PLP</b>	1/2, 3/5, 2/3, 3/4, 4/5, 5/6.
<b>PLP Constellation</b>	QPSK, 16QAM, 64QAM, 256QAM.
<b>PLP Constellation Rotation</b>	ON / OFF (AUTO).
<b>PLP ID</b>	0-256.
<b>ID CELL</b>	Detected from transmitter station.
<b>Network ID</b>	Detected from transmitter station.
<b>T2 System ID</b>	Detected from transmitter station.

**DVB-C SIGNAL PARAMETERS**

<b>Demodulation</b>	16/32/64/128/256 QAM.
<b>Symbol rate</b>	1800 to 7200 kbauds.
<b>Roll-off (<math>\alpha</math>) factor of Nyquist filter</b>	0.15.
<b>Spectral inversion</b>	ON, OFF (AUTO).

**DVB-C2 SIGNAL PARAMETERS**

<b>Carriers</b>	4k.
<b>Guard Interval</b>	1/64, 1/128.
<b>Bandwidth</b>	6 and 8 MHz.
<b>Spectral Inversion</b>	ON, OFF (AUTO).
<b>Code Rate PLP</b>	2/3, 3/4, 4/5, 5/6, 8/9, 9/10.
<b>PLP Constellation</b>	64QAM, 256QAM, 1kQAM and 4kQAM.
<b>Dslice ID</b>	0-256.
<b>PLP ID</b>	0-256.
<b>ID cell</b>	Detected from transmitter station.
<b>Network ID</b>	Detected from transmitter station.
<b>T2 System ID</b>	Detected from transmitter station.

## DVB-S SIGNAL PARAMETERS

<b>Symbol rate</b>	2 to 45 Mbauds.
<b>Roll-off (<math>\alpha</math>) factor of Nyquist filter</b>	0.35.
<b>Code Rate</b>	1/2, 2/3, 3/4, 5/6, 7/8.
<b>Spectral inversion</b>	ON, OFF (AUTO).

## DVB-S2 SIGNAL PARAMETERS

<b>Symbol rate (QPSK)</b>	2 to 45 MSps.
<b>Symbol rate (8PSK)</b>	2 to 45 MSps.
<b>Roll-off (<math>\alpha</math>) factor of Nyquist filter</b>	0.20, 0.25 and 0.35.
<b>Code Rate (QPSK)</b>	1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10.
<b>Code Rate (8PSK)</b>	3/5, 2/3, 3/4, 5/6, 8/9, 9/10.
<b>Spectral inversion</b>	ON, OFF (AUTO).
<b>Pilots</b>	Presence indication.

## TOOLS

### CONSTELLATION DIAGRAM

<b>Type of signal</b>	DVB-T, DVB-T2, DVB-C, DVB-C2, DVB-S and DVB-S2.
<b>Presentation</b>	I-Q graph.

### ECHOES ANALYSER MODE (DVB-T / DVB-T2 / DVB-C2)

<b>Measurement range</b>	Depends on the standard, carrier and guard interval.
<b>Delay</b>	0.1 ms to 224 ms. Typical configuration (DVB-T 8K, GI = 1/4)
<b>Distance</b>	0.3 km to 67.2 km. Typical configuration (DVB-T 8K, GI = 1/4)
<b>Power range</b>	0 dBc to -30 dBc. Typical configuration (DVB-T 8K, GI = 1/4)
<b>Time scale</b>	1/3 symbol period

### DATALOGGER function<sup>1</sup> (Automatic measurement acquisition and storage)

<b>Stored data</b>	Signal type, modulation parameters, all measures available for the detected signal type, and time stamp.
<b>Timestamp</b>	Date and time at each measured channel.

### LTE INGRESS

<b>Type of signal</b>	DVB-T, DVB-T2, DVB-C, DVB-C2, DVB-S and DVB-S2.
<b>Presentation</b>	LTE band plus quality parameters for a selected TV channel.

<sup>1</sup> Using NetUpdate4 software application with a Windows PC platform.

**SAT IF TEST Function<sup>2</sup> (IF distribution network response for satellite band)**

Test frequencies 3 selectable pilots.

**ATTENUATION TEST Function<sup>3</sup> (Signal distribution network response for terrestrial band).**

Test frequencies 3 selectable pilots.

**VIDEO & AUDIO**

<b>Format</b>	MPEG-2 (MP@HL) (Main Profile High Level). MPEG-4 AVC H.264.
<b>Aspect Ratio</b>	16 / 9 or 4 / 3.
<b>SI /PSI data</b>	Service list and main PIDs.
<b>HD Video Resolution</b>	1080, 720 and 576, progressive or interlaced.
<b>Audio</b>	MPEG-1, MPEG-2, HE-AAC, Dolby Digital and Dolby Digital Plus.

**ANALOGUE SIGNALS MEASUREMENT**

**LEVEL MEASUREMENT**

<b>Measurement range</b>	
<b>Terrestrial TV &amp; FM bands</b>	15 dB $\mu$ V to 130 dB $\mu$ V (3,16 $\mu$ V to 3,16 V).
<b>Satellite TV band</b>	20 dB $\mu$ V to 130 dB $\mu$ V (31,6 $\mu$ V to 3,16 V).
<b>Attenuation scale</b>	Auto-range.
<b>Numerical indication</b>	Absolute value according to selected units.
<b>Graphical indication</b>	Analogue bar on screen.
<b>Measurement bandwidth</b>	100 kHz.
<b>Audible indicator</b>	Pitch sound. A tone with pitch proportional to signal strength.
<b>Accuracy</b>	
<b>Terrestrial bands</b>	$\pm 1,5$ dB (25-120 dB $\mu$ V, 45-1000 MHz) (22 °C $\pm$ 5 °C).
<b>Satellite band</b>	$\pm 1,5$ dB (35-100 dB $\mu$ V, 950-2050 MHz) (22 °C $\pm$ 5 °C).
<b>Out of range indication</b>	<, >.

**RF MEASUREMENTS**

<b>Terrestrial bands</b>	
<b>Analogue channels</b>	Level, Video-Audio ratio, Carrier-Noise ratio.
<b>Digital channels</b>	Channel power, Carrier-Noise ratio.
<b>Satellite band</b>	
<b>Analogue channels</b>	Level and Carrier-Noise ratio.
<b>Digital channels</b>	Channel power and Carrier-Noise ratio.

<sup>2</sup> Function to be used with RP-250 or RP-050 IF multiple pilot generator.

<sup>3</sup> Function to be used with RP-250 or RP-080 multiple pilot generator.

## SPECTRUM ANALYSER MODE

### Measurement range

**Satellite band** 10 dB $\mu$ V to 130 dB $\mu$ V (3.16  $\mu$ V to 3.16 V).

**Terrestrial bands** 10 dB $\mu$ V to 130 dB $\mu$ V (3.16  $\mu$ V to 3.16 V).

### Measurement bandwidth

**Terrestrial** 100 kHz.

**Satellite** 100 kHz.

### Span

**Terrestrial** Full span (full band) - 500 - 200 - 100 - 50 - 20 - 10 MHz selectable.

**Satellite** Full span (full band) - 500 - 200 - 100 - 50 - 20 - 10 MHz selectable.

### Markers

1 with frequency and level indication.

### Reference level

65 dB $\mu$ V to 135 dB $\mu$ V, adjustable in steps of 5 dB.

### Measurements

#### Terrestrial bands

**Analogue channels** Level, C/N, V/A.

**Digital channels** Channel power, C/N, MER and BER (according to modulation type).

#### Satellite band

**Analogue channels** Level, C/N.

**Digital channels** Channel power, C/N, MER and BER (according to modulation type).

### Spectrum range

Span, dynamic range and reference level are variable by means of arrow cursors.

## ANALOG TV MONITOR DISPLAY

### Monitor

7 inches TFT. Transmissive colour dot matrix type.

### Aspect ratio

16:9.

### Dot format

800  $\times$  (R,G,B) (W)  $\times$  480(H).

### Brightness

700 cd/m<sup>2</sup>.

## TV STANDARD

### Colour system

PAL, SECAM and NTSC.

### Analogue TV standard supported

M, N, B, G, I, D, K and L.

### Analogue TV sensibility

40 dB $\mu$ V for a correct synchronism.

**BASE BAND SIGNAL**

**VIDEO**

<b>Codecs Video</b>	DVB: MPEG-2 (MP@HL) (Main Profile High Level). MPEG-4 AVC H.264 (High Profile Level 4.1).
<b>V/A input</b>	Multipole jack (75 W).
<b>Sensibility</b>	1 Vpp (75 W) positive video.
<b>V/A output</b>	Multipole jack (75 W).

**SOUND**

<b>Input</b>	Same V/A multipole jack (75 W).
<b>Outputs</b>	Built in speaker, same multipole jack.
<b>Codecs Audio</b>	MPEG-1, MPEG-2, HE-AAC, Dolby Digital and Dolby Digital Plus.
<b>Demodulation</b>	According to the TV standard.
<b>Analogue TV de-emphasis</b>	50 μs, 75 μs (NTSC).
<b>Sound subcarrier</b>	Digital frequency synthesis according to the TV standard.

**USB INTERFACE**

“USB On-the-go” for remote control and file transfer.  
 Mass Storage Host: The equipment can read / write on Flash drives.  
 USB CDC: (Communications Device Class).

**EXTERNAL UNIT POWER**

<b>SUPPLY</b>	Through the RF input connector.
<b>Terrestre</b>	External or 5/12/ and 24 V.
<b>Satélite</b>	External 13/15/18 V (up to 500mA).
<b>22 kHz signal</b>	Selectable in satellite band)
<b>Voltage</b>	0,65 V ± 0,25 V.
<b>Frequency</b>	22 kHz ± 4 kHz.
<b>Maximum power<sup>4</sup></b>	At least 6 W for 13/15/18/24 V and 2.5 W for 5 V.
<b>DiSEqC GENERATOR<sup>5</sup></b>	According to DiSEqC 1.2 standard.

<sup>4</sup> If you select 5V, the maximum power shall not exceede 2.25 W (450 mA).

<sup>5</sup> DiSEqCTM is a trademark of EUTELSAT.

**POWER SUPPLY**

<b>Internal Batteries</b>	7.2 V 13 Ah Li-Ion intelligent battery.
<b>Autonomy</b>	> 5 hours in continuous mode (no EXT supply active).
<b>Recharging time</b>	3 hours up to 80% (instrument off).
<b>External Voltage</b>	12 V DC (using only PROMAX supplied accessories).
<b>Consumption</b>	35 W.
<b>Auto power off</b>	Programmable. After the selected amount of minutes without operating on any control. Deactivable.

**OPERATING ENVIRONMENTAL CONDITIONS**

<b>Altitude</b>	Up to 2000 m.
<b>Temperature range</b>	From 5 to 45 °C (Automatic disconnection by excess of temperature).
<b>Max. relative humidity</b>	80 % (up to 31°C), decreasing lineally up to 50% at 40 °C.

**MECHANICAL FEATURES**

<b>Dimensions</b>	290 (W) x 185 (H) x 65 (D) mm.
<b>Weight</b>	1.9 kg. (Total size: 3.487 cm <sup>3</sup> ).

**INCLUDED ACCESSORIES**

<b>1x CC-046</b>	CABLE JACK 4V/RCA.
<b>1x CC-041</b>	Connection USB Cable On-the-go (A) Male – Mini USB (B) Male.
<b>1x CC-045</b>	USB Cable (A) Female – Mini USB (A) Male.
<b>1x AA-103</b>	Car lighter charger.
<b>1x AL-103</b>	External DC charger.
<b>1x AD-055</b>	"F"/H-BNC / H adapter.
<b>1x AD-056</b>	"F"/H-"DIN"/H adapter.
<b>1x AD-057</b>	"F"/H-"F"/H adapter.
<b>1x CA-005</b>	Mains cord.
<b>1x CB-083</b>	Batería recargable Li+ 7,2 V 13 Ah.
<b>1x DC-300</b>	Transport belt and small accessory bag.
<b>1x DC-230</b>	Transport suitcase.

**RECOMMENDATIONS ABOUT THE PACKING**

It is recommended to keep all the packing material in order to return the equipment, if necessary, to the Technical Service.

## 7.2 Specifications *HD*RANGER

### CONFIGURATION FOR MEASURING LEVEL AND POWER

<b>TUNING MEASURE</b>	Digital frequency synthesis. Continuous tuning from 5 to 1000 MHz and from 950 to 2150 MHz. (Terrestrial and Satellite respectively).
<b>TUNING DEMODULATOR</b>	Digital frequency synthesis.
<b>Terrestrial TV &amp; FM bands</b>	From 45 to 860 MHz.
<b>Terrestrial tunable range</b>	From 5 to 1000 MHz.
<b>Satellite TV band</b>	From 950 to 2150 MHz.
<b>Tuning modes</b>	Channel or frequency (IF or downlink at satellite band). Channel plan configurable on demand.
<b>Resolution</b>	10 kHz.

### RF INPUT

<b>Impedance</b>	75 $\Omega$ .
<b>Maximum signal</b>	130 dB $\mu$ V.
<b>Maximum input voltage</b>	
<b>DC to 100 Hz</b>	50 V rms (powered by the AL-103 power charger). 30 V rms (not powered by the AL-103 power charger).
<b>5 MHz to 2150 MHz</b>	140 dB $\mu$ V. (protected at least for 30 seconds).

### DIGITAL SIGNALS MEASUREMENT

#### MARGIN OF POWER MEASUREMENT

<b>COFDM</b>	From 35 dB $\mu$ V to 100 dB $\mu$ V.
<b>QAM</b>	From 45 dB $\mu$ V to 110 dB $\mu$ V.
<b>QPSK/8PSK</b>	From 44 dB $\mu$ V to 114 dB $\mu$ V.

## MEASUREMENTS

<b>DVB-T (COFDM)</b>	Power, CBER, VBER, MER.
<b>Presentation</b>	Numeric and level bar.
<b>DVB-C (QAM)</b>	Power, BER, MER, C/N and Link margin.
<b>Presentation</b>	Numeric and level bar.
<b>DVB-S (QPSK)</b>	Power, CBER, VBER, MER (up to 30 dB), C/N and Link margin.
<b>Presentation</b>	Numeric and level bar.
<b>DVB-S2 (QPSK/8PSK)</b>	Power, CBER, LBER, MER (up to 30 dB), C/N, BCH ESR, Wrong Packets and Link Margin.
<b>Presentation</b>	Numeric and level bar.

## DVB-T SIGNAL PARAMETERS

<b>Carriers</b>	2k / 8k.
<b>Guard Interval</b>	1/4, 1/8, 1/16, 1/32.
<b>Code Rate</b>	1/2, 2/3, 3/4, 5/6, 7/8.
<b>Modulation</b>	QPSK, 16-QAM, 64-QAM.
<b>Bandwidth</b>	6, 7 and 8 MHz.
<b>Spectral inversion</b>	ON, OFF (AUTO).
<b>Hierarchy</b>	Indicates hierarchy mode.
<b>Cell ID</b>	Detected from transmitter station.
<b>TPS signalling</b>	Time slicing, symbol interleave and MPE-FEC.

## DVB-C SIGNAL PARAMETERS

<b>Demodulation</b>	16/32/64/128/256 QAM.
<b>Symbol rate</b>	1800 to 7200 kbauds.
<b>Roll-off (<math>\alpha</math>) factor of Nyquist filter</b>	0.15.
<b>Spectral inversion</b>	ON, OFF.

## DVB-S SIGNAL PARAMETERS

<b>Symbol rate</b>	2 to 45 Mbauds.
<b>Roll-off (<math>\alpha</math>) factor of Nyquist filter</b>	0.35.
<b>Code Rate</b>	1/2, 2/3, 3/4, 5/6, 7/8.
<b>Spectral inversion</b>	ON, OFF (AUTO).



**DVB-S2 SIGNAL PARAMETERS**

<b>Symbol rate (QPSK)</b>	2 to 45 MSps.
<b>Symbol rate (8PSK)</b>	2 to 45 MSps.
<b>Roll-off (<math>\alpha</math>) factor of Nyquist filter</b>	0.20, 0.25 and 0.35.
<b>Code Rate (QPSK)</b>	1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10.
<b>Code Rate (8PSK)</b>	3/5, 2/3, 3/4, 5/6, 8/9, 9/10.
<b>Spectral inversion</b>	ON, OFF (AUTO).
<b>Pilots</b>	Presence indication.

**TOOLS**

**DATALOGGER function<sup>1</sup> (Automatic measurement acquisition and storage)**

<b>Stored data</b>	Signal type, modulation parameters, all measures available for the detected signal type, and time stamp.
<b>Timestamp</b>	Date and time at each measured channel.

**SAT IF TEST Function<sup>2</sup> (IF distribution network response for satellite band)**

<b>Test frequencies</b>	3 selectable pilots.
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**ATTENUATION TEST Function<sup>3</sup> (Signal distribution network response for terrestrial band).**

<b>Test frequencies</b>	3 selectable pilots.
-------------------------	----------------------

**VIDEO & AUDIO**

<b>Format</b>	MPEG-2 (MP@HL) (Main Profile High Level). MPEG-4 AVC H.264.
<b>Aspect Ratio</b>	16 / 9 or 4 / 3.
<b>SI / PSI data</b>	Service list and main PIDs.
<b>HD Video Resolution</b>	1080, 720 and 576, progressive or interlaced.
<b>Audio</b>	MPEG-1, MPEG-2, HE-AAC, Dolby Digital.

<sup>1</sup> Using NetUpdate4 software application with a Windows PC platform.  
<sup>2</sup> Function to be used with RP-250 or RP-050 IF multiple pilot generator.  
<sup>3</sup> Function to be used with RP-250 or RP-080 multiple pilot generator.

## ANALOGUE SIGNALS MEASUREMENT

### LEVEL MEASUREMENT

#### Measurement range

**Terrestrial TV & FM bands** 15 dB $\mu$ V to 130 dB $\mu$ V (3.16  $\mu$ V to 3.16 V).

**Satellite TV band** 20 dB $\mu$ V to 130 dB $\mu$ V (31.6  $\mu$ V to 3.16 V).

#### Attenuation scale

Auto-range.

#### Numerical indication

Absolute value according to selected units.

#### Graphical indication

Analogue bar on screen.

#### Measurement bandwidth

100 kHz.

#### Audible indicator

Pitch sound. A tone with pitch proportional to signal strength.

#### Accuracy

**Terrestrial bands**  $\pm 1,5$  dB (25-120 dB $\mu$ V, 45-1000 MHz) (22 °C  $\pm$  5 °C).

**Satellite band**  $\pm 1,5$  dB (35-100 dB $\mu$ V, 950-2050 MHz) (22 °C  $\pm$  5 °C).

#### Out of range indication

<, >.

### RF MEASUREMENTS

#### Terrestrial bands

##### Analogue channels

Level, Video-Audio ratio, Carrier-Noise ratio.

##### Digital channels

Channel power, Carrier-Noise ratio.

#### Satellite band

##### Analogue channels

Level and Carrier-Noise ratio.

##### Digital channels

Channel power and Carrier-Noise ratio.

## SPECTRUM ANALYSER MODE

### Measurement range

<b>Satellite band</b>	10 dB $\mu$ V to 130 dB $\mu$ V (3.16 $\mu$ V to 3.16 V).
<b>Terrestrial bands</b>	10 dB $\mu$ V to 130 dB $\mu$ V (3.16 $\mu$ V to 3.16 V).

### Measurement bandwidth

<b>Terrestrial</b>	100 kHz.
<b>Satellite</b>	100 kHz.

### Span

<b>Terrestrial</b>	Full span (full band) - 500 - 200 - 100 - 50 - 20 - 10 MHz selectable.
<b>Satellite</b>	Full span (full band) - 500 - 200 - 100 - 50 - 20 - 10 MHz selectable.

### Markers

1 with frequency and level indication.

### Reference level

65 dB $\mu$ V to 135 dB $\mu$ V, adjustable in steps of 5 dB.

### Measurements

#### Terrestrial bands

<b>Analogue channels</b>	Level, C/N, V/A.
<b>Digital channels</b>	Channel power, C/N, MER and BER (according to modulation type).

#### Satellite band

<b>Analogue channels</b>	Level, C/N.
<b>Digital channels</b>	Channel power, C/N, MER and BER (according to modulation type).

### Spectrum range

Span, dynamic range and reference level are variable by means of arrow cursors.

## ANALOG TV MONITOR DISPLAY

<b>Monitor</b>	7 inches TFT. Transmissive colour dot matrix type.
<b>Aspect ratio</b>	16:9.
<b>Dot format</b>	800 × (R,G,B) (W) × 480(H).
<b>Brightness</b>	700 cd/m <sup>2</sup> .

## TV STANDARD

<b>Colour system</b>	PAL, SECAM and NTSC.
<b>Analogue TV standard supported</b>	M, N, B, G, I, D, K and L.
<b>Analogue TV sensibility</b>	40 dB $\mu$ V for a correct synchronism.

## BASE BAND SIGNAL

### VIDEO

<b>Codecs Video</b>	DVB: MPEG-2 (MP@HL) (Main Profile High Level). MPEG-4 AVC H.264 (High Profile Level 4.1).
<b>V/A input</b>	Multipole jack (75 Ω).
<b>Sensibility</b>	1 Vpp (75 Ω) positive video.
<b>V/A output</b>	Multipole jack (75 Ω).

### SOUND

<b>Input</b>	Same V/A multipole jack (75 Ω).
<b>Outputs</b>	Built in speaker, same multipole jack.
<b>Codecs Audio</b>	MPEG-1, MPEG-2, HE-AAC, Dolby Digital.
<b>Demodulation</b>	According to the TV standard.
<b>Analogue TV de-emphasis</b>	50 μs, 75 μs (NTSC).
<b>Sound subcarrier</b>	Digital frequency synthesis according to the TV standard.

## USB INTERFACE

"USB On-the-go" for remote control and file transfer.

Mass Storage Host: The equipment can read / write on Flash drives.

USB CDC: (Communications Device Class).

## EXTERNAL UNIT POWER

<b>SUPPLY</b>	Through the RF input connector.
<b>Terrestrial</b>	External or 5/12/ and 24 V.
<b>Satellite</b>	External 13/15/18 V (up to 500mA).
<b>22 kHz signal</b>	Selectable in satellite band)
<b>Voltage</b>	0.65 V ± 0.25 V.
<b>Frequency</b>	22 kHz ± 4 kHz.
<b>Maximum power<sup>4</sup></b>	At least 6 W for 13/15/18/24 V and 2.5 W for 5 V.
<b>DiSEqC GENERATOR<sup>5</sup></b>	According to DiSEqC 1.2 standard.

<sup>4</sup> If you select 5V, the maximum power shall not exceed 2.25 W (450 mA).

<sup>5</sup> DiSEqCTM is a trademark of EUTELSAT.

**POWER SUPPLY**

<b>Internal Batteries</b>	7.2 V 13 Ah Li-Ion intelligent battery.
<b>Autonomy</b>	> 5 hours in continuous mode (no EXT supply active).
<b>Recharging time</b>	3 hours up to 80% (instrument off).
<b>External Voltage</b>	12 V DC (using only PROMAX supplied accessories).
<b>Consumption</b>	35 W.
<b>Auto power off</b>	Programmable. After the selected amount of minutes without operating on any control. Deactivable.

**OPERATING ENVIRONMENTAL CONDITIONS**

<b>Altitude</b>	Up to 2000 m.
<b>Temperature range</b>	From 5 to 45 °C (Automatic disconnection by excess of temperature).
<b>Max. relative humidity</b>	80 % (up to 31°C), decreasing lineally up to 50% at 40 °C.

**MECHANICAL FEATURES**

<b>Dimensions</b>	290 (W) x 185 (H) x 65 (D) mm.
<b>Weight</b>	1.9 kg. (Total size: 3.487 cm <sup>3</sup> ).

**INCLUDED ACCESSORIES**

<b>1x CC-046</b>	CABLE JACK 4V/RCA.
<b>1x CC-041</b>	Connection USB Cable On-the-go (A) Male – Mini USB (B) Male.
<b>1x CC-045</b>	USB Cable (A) Female – Mini USB (A) Male.
<b>1x AA-103</b>	Car lighter charger.
<b>1x AL-103</b>	External DC charger.
<b>1x AD-055</b>	"F"/H-BNC / H adapter.
<b>1x AD-056</b>	"F"/H-"DIN"/H adapter.
<b>1x AD-057</b>	"F"/H-"F"/H adapter.
<b>1x CA-005</b>	Mains cord.
<b>1x CB-083</b>	Batería recargable Li+ 7,2 V 13 Ah.
<b>1x DC-300</b>	Transport belt and small accessory bag.

**OPTIONAL ACCESSORIES**

<b>1x DC-230</b>	Optional Transport case.
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**RECOMMENDATIONS ABOUT THE PACKING**

It is recommended to keep all the packing material in order to return the equipment, if necessary, to the Technical Service.



## 8 MAINTENANCE

### 8.1 Considerations about the Screen

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

In the TFT display, 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.

### 8.2 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.



## ANNEX 1

### SIGNALS DESCRIPTION

#### A1.1 DIGITAL signals

##### A1.1.1 Digital TERRESTRIAL Television FIRST Generation (DVB-T standard / COFDM modulation)

##### DVB-T Parameters

- ▶ **Channel Bandwidth**  
This parameter affects the frequency separation of the carriers. Its value is 6 MHz, 7 MHz or 8 MHz.
- ▶ **Spectral inversion**  
It detects if the input signal has been inverted.
- ▶ **FFT Mode**  
It defines the number of modulation carriers between values 2k, 4k and 8k.
- ▶ **Guard Interval**  
This parameter is the dead time between symbols; its purpose is to detect problems due to multipath echoes. This parameter is expressed in terms of the symbol duration: 1/4, 1/8, 1/16, 1/32.
- ▶ **Constellation**  
Modulation used by the carriers. It also defines the noise immunity of the system (QPSK, 16-QAM and 64-QAM).
- ▶ **Code rate**  
Also known as Viterbi ratio. It defines the ratio between the number of data bits and the total number of bits transmitted (the difference corresponds to the number of control bits for the detection and recovery of errors).
- ▶ **TS Hierarchy**  
The DVB-T standard gives the possibility of TDT transmissions with hierarchical levels, that is, the simultaneous transmission of the same program with different image qualities and levels of protection to different noises, so the receiver can switch to a signal of lesser quality when reception conditions are not optimal.

## DVB-T Measurements

- **Power**  
Measured power over the entire bandwidth of the channel.
- **C/N**  
Carrier / Noise ratio, where C is the received power of the modulated carrier signal and N is the received noise power. To measure it correctly the channel should be tuned at its centre frequency.
- **MER**  
Modulation error ratio with link margin (LM). The link margin indicates the safety margin respect to the MER level, measured for the degradation of the signal up to the QEF (Quasi Error Free) value. MER represents the ratio between the average power of the DVB signal and the average noise power of the signal constellation.
- **BER (VBER / CBER)**  
It is the system error rate. In a system of digital terrestrial signal reception, after the COFDM decoder two methods of error correction are applied. Each time an error correction is applied on the digital signal, the error rate changes, so if the error rate is measured at the demodulator output or after Viterbi or at the Reed-Solomon decoder output, different error rates are obtained.
- **CBER**  
BER measurement for digital signal before the error correction (BER before FEC).
- **VBER**  
BER measurement for digital signal after error correction (BER after Viterbi).

In order to have a reference about the image quality, it is considered that a system has good quality when it produces less than one un correctable error per hour of transmission. This border is called QEF (Quasi-English Error-Free,) and corresponds to one error rate after Viterbi equal to  $2 \times 10^{-4}$ , or 2 bit errors per 10.000.

This value is marked on the BER measurement bar. This the BER for acceptable signals should be to the left of this mark.

## A1.1.2

**Digital TERRESTRIAL Television SECOND Generation  
(DVB-T2 standard / COFDM modulation)****DVB-T2 Parameters****▶ Channel Bandwidth**

This parameter affects the frequency separation of the carriers. Its value is 6 MHz, 7 MHz or 8 MHz.

**▶ Spectral inversion**

It detects if the input signal has been inverted.

**▶ FFT Mode**

It defines the number of modulation carriers between values 1k, 2k, 4k, 8k, 8k + EXT, 16k, 16k + EXT, 32k, 32k + EXT.

**▶ Pilot Pattern**

There are several pilot patterns available from PP1 to PP8, which offer different features depending on the type of channel. Each pattern supports time and frequency variations up to the Nyquist limit. Limits depend on certain characteristics such as the receiver operation, if the interpolation is in frequency and time or just in time, and so on.

**▶ Guard Interval**

This parameter is the dead time between symbols; its purpose is to detect problems due to multipath echoes. This parameter is expressed in terms of the symbol duration: 1/4, 19/256, 1/8, 19/128, 1/16, 1/32, 1/128.

**▶ Constellation**

COFDM modulation with constellations QPSK, 16QAM, 64QAM, 256QAM.

**▶ Constellation rotation**

It detects if the constellation is rotated (ON) or not (OFF).

**▶ Code rate**

Also known as Viterbi ratio. Defines the ratio between the number of data bits and the total number of bits transmitted (the difference corresponds to the number of control bits for the detection and recovery of errors).

**▶ PLP id**

It is the PLP identifier. In the case of PLP Single mode identifies the input stream (0-255). In the case of PLP Multiple mode clients can choose the PLP ID to view.

## DVB-T2 Measurements

### ■ Power

Measured power over the entire bandwidth of the channel.

### ■ C/N

(Carrier / Noise) where C is the received power of the modulated carrier signal and N is the noise power received. To measure it correctly the channel should be tuned at its centre frequency.

### ■ PLP id

It is the PLP identifier. In the case of PLP Single mode identifies the input stream (0-255). In the case of PLP Multiple mode clients can choose the PLP ID to view.

### ■ MER

Modulation Error ratio with indication of Link Margin(LM). The link margin indicates the safety margin respect to the MER level, measured for the degradation of the signal up to the QEF (Quasi Error Free) value. MER represents the ratio between the average power of the DVB signal and the average noise power of the signal constellation.

### ■ BER (CBER / LBER)

It is the bit error rate. There are two measurements related to BER:

#### ■ CBER (Channel Bit Error Rate):

BER of the signal after the COFDM demodulator and before applying the error correction or FEC (Forward Error Correction).

#### ■ LBER (LDPC Bit Error Rate):

BER after been applied the LDPC (Low-density parity-check) error correction.

In a digital signal reception (DVB-T2), after the COFDM decoder two methods of error correction are applied. DVB-T2 uses two codes to correct errors that are the LDPC (Low Density Parity Check) combined with the BCH (Bose-Chaudhuri - Hocquengham) to protect against high levels of signal noise and interferences. Next to the measurement LBER is shown the number of iterations LDPC, that is, the number of times the LDPC error correction decoder has to pass through the signal and the ESR (Error Second Ratio) after 20 seconds of the BCH decoder. This measure indicates the percentage of time with errors after the BCH. Error correction is internal with BCH and external with LDPC. The internal gives basic error correction with minimum load while the external gives error correction with a correction additional charge.

A1.1.3

**Digital SATELLITE Television FIRST Generation  
(DVB-S standard / QPSK modulation)****DVB-S Parameters**

- ▶ **Channel Bandwidth**  
It displays the channel bandwidth from 1.3 MHz to 60.75 MHz. This parameter affects the frequency separation of the carriers.
- ▶ **Spectral inversion**  
It detects if the input signal has been inverted.
- ▶ **Symbol Rate**  
It represents the number of times that the signal status changes in a period of time. The bandwidth is related to this parameter.
- ▶ **Roll-Off Factor**  
Roll-off factor of Nyquist filter. It indicates the excess of bandwidth over the ideal bandwidth
- ▶ **Constellation**  
COFDM Modulation with QPSK constellations.
- ▶ **Code rate**  
Also known as Viterbi ratio. It defines the ratio between the number of data bits and the total number of bits transmitted (the difference corresponds to the number of control bits for the error detection and recovery). This value should be between 1/2, 2/3, 3/4, 5/6 and 7/8.

## DVB-S Measurements

- **Power**  
Measured power over the entire bandwidth of the channel.
- **C/N**  
(Carrier / Noise) where C is the received power of the modulated carrier signal and N is the noise power received. To measure it correctly the channel should be tuned at its centre frequency.
- **PLP id**  
It is the PLP identifier. In the case of PLP Single mode identifies the input stream (0-255). In the case of PLP Multiple mode clients can choose the PLP ID to view.
- **MER**  
Modulation Error ratio with indication of Link Margin(LM). The link margin indicates the safety margin respect to the MER level, measured for the degradation of the signal up to the QEF (Quasi Error Free) value. MER represents the ratio between the average power of the DVB signal and the average noise power of the signal constellation.
- **BER (CBER / VBER)**  
It is the error rate. There are two measurements related to BER:
  - **CBER** (Channel Bit Error Rate):  
BER of the signal after the COFDM demodulator and before applying the error correction or FEC (Forward Error Correction).
  - **VBER** (Viterbi Bit Error Rate):  
Measurement of the BER for the digital signal after error correction (BER after Viterbi).

In a system for receiving digital satellite signals (DVB-S) after the QPSK decoder two methods of error correction are applied. Each time an error correction is applied on a digital signal its error rate changes, so if we measure the error rate at the output of the QPSK demodulator or after Viterbi or after the Reed-Solomon output decoder, the error rates obtained are different.

A1.1.4

**Digital SATELLITE television signal of SECOND generation  
(DVB-S2 standard / QPSK/8PSK modulation)****DVB-S2 Parameters**

- ▶ **Channel Bandwidth**  
It displays the channel bandwidth from 1.3 MHz to 60.75 MHz. This parameter affects the frequency separation of the carriers.
- ▶ **Spectral inversion**  
It detects if the input signal has been inverted.
- ▶ **Symbol Rate**  
It represents the number of times the signal status changes in a period of time. The bandwidth is related to this parameter.
- ▶ **Roll-Off Factor**  
Roll-off factor of Nyquist filter. It indicates the excess of bandwidth over the ideal bandwidth.
- ▶ **Constellation**  
COFDM modulation with constellation QPSK, 8PSK.
- ▶ **Code rate**  
Also known as Viterbi ratio. It defines the ratio between the number of data bits and the total number of bits transmitted (the difference corresponds to the number of control bits for the error detection and recovery). The value will be between 1/2, 2/3, 3/4, 5/6 and 7/8.

**DVB-S2 Measurements**

- **Power**  
Measured power over the entire bandwidth of the channel.
- **C/N**  
(Carrier / Noise) where C is the received power of the modulated carrier signal and N is the noise power received. To measure it correctly the channel should be tuned at its centre frequency.

■ **MER**

Modulation Error ratio. MER represents the ratio between the average power of the DVB signal and the average noise power of the signal constellation.

Next to the MER appears the Link Margin (LM) measurement. The LM is equivalent to the noise margin (NM) and indicates the distance to the QEF (usually defined as a one lost packet per hour). The LM is measured in dB and its value corresponds to the safety margin that separates from the QEF. The greater is the LM better the quality signal. LM of negative values implies no reception or that video errors are starting to appear in the video or audio so clear. LM of 0 (zero) value will display a service and occasionally some artefact.

■ **BER (CBER / LBER)**

It is the bit error rate. There are two measurements related to BER:

■ **CBER** (Channel Bit Error Rate):

BER of the signal after the COFDM demodulator and before applying the error correction or FEC (Forward Error Correction).

■ **LBER** (LDPC Bit Error Rate):

BER after applying error correction LDPC (Low-density parity-check).

This standard makes use of two codes to correct errors that are the LDPC (Low Density Parity Check) codes combined with BCH (Bose-Chaudhuri - Hocquengham) to protect against high levels of signal noise and interference. Each time you apply an error correction to the digital signal, the error rate changes, so if we measure the error rate at the output of the QPSK/8PSK demodulator or after LDPC (Low Density Parity Check) decoder or at the BCH decoder output, error rates obtained are different.

Next to the LBER measure appears ESR (Error Second Ratio). This measures indicates the percentage of time with errors after BCH. The error correction is internal with BCH or external with LDPC. The internal error correction provides basic minimum load while the outer error correction is an additional correction with load. It also measures the PER, which is the number of erroneous packets, that is packets received during the measurement time not correctable by the demodulator.



A1.1.5

**Digital CABLE television signal of FIRST generation  
(DVB-C standard / QAM modulation)**

**DVB-C Parameters**

- ▶ **Bandwidth channel**  
This parameter affects the frequency separation of the carriers.
- ▶ **Spectral inversion**  
It detects if the input signal has been inverted.
- ▶ **Symbol Rate**  
It represents the number of times the signal status changes in a period of time. The bandwidth is related to this parameter.
- ▶ **Roll-Off Factor**  
Roll-off factor of Nyquist filter. It indicates the bandwidth excess over the ideal bandwidth.
- ▶ **Constellation**  
Modulation used by the carriers. It also defines immunity to the system noise (16QAM, 32QAM, 64QAM, 128QAM and 256QAM).

## DVB-C Measurements

- **Power**  
Measured power over the entire bandwidth of the channel.
- **C/N**  
(Carrier / Noise) where C is the received power of the modulated carrier signal and N is the noise power received. To measure it correctly the channel should be tuned at its centre frequency.
- **MER**  
Modulation Error ratio with indication of Link Margin(LM).The link margin indicates the safety margin respect to the MER level , measured for the degradation of the signal up to the QEF (Quasi Error Free) value. MER represents the ratio between the average power of the DVB signal and the average noise power of the signal constellation.
- **BER (CBER)**  
It is the system error rate. In a digital signal reception via cable, after the QAM demodulator an error correction method is applied, called Reed-Solomon. The error rate after correction is less than the error rate at the output of the QAM demodulator. For this reason the BER is given prior to error correction.
- **CBER**  
BER measurement for digital signal before the error correction (BER before FEC)

A1.1.6

**Digital CABLE television signal of SECOND generation  
(DVB-C2 / QAM modulation)****DVB-C2 Parameters**

- ▶ **Channel Bandwidth**  
It is the channel bandwidth between 6 MHz, 7 MHz and 8 MHz. This parameter affects the frequency separation of the carriers.
- ▶ **Spectral inversion**  
It detects if the input signal has been inverted.
- ▶ **Guard Interval**  
It corresponds to the dead time between symbols; its purpose is to detect echoes due to multi-paths. This parameter is expressed in terms of the symbol duration: 1/64 or 1/128.
- ▶ **Constellation**  
QPSK COFDM modulation with constellations, 16QAM, 64QAM, 256QAM, 1024QAM, 4096QAM. The constellation refers to all the selected PLP data.
- ▶ **Code rate**  
It defines the ratio between the number of data bits and the total number of bits transmitted (the difference corresponds to the number of control bits for the error detection and recovery): 2/3, 3/4, 4/5, 5/6, 8/9, 9/10.
- ▶ **DSLICE id**  
Identifier a DSLICE is a data packet containing a group of several LPDs.
- ▶ **PLP id**  
PLP (Physical Layer Pipes) identifier. Layers are used by the system to transmit compressed data such audio, video and more.

## DVB-C2 Measurements

- **Power**  
Measured power over the entire bandwidth of the channel.
- **C/N**  
(Carrier / Noise) where C is the received power of the modulated carrier signal and N is the noise power received. To measure it correctly the channel should be tuned at its centre frequency..
- **MER**  
Modulation Error ratio with indication of Link Margin(LM).The link margin indicates the safety margin respect to the MER level , measured for the degradation of the signal up to the QEF (Quasi Error Free) value. MER represents the ratio between the average power of the DVB signal and the average noise power of the signal constellation.
- **BER (CBER/LBER)**  
System error rate. In DVB-C2 makes use of two codes to correct errors that are the LDPC (Low Density Parity Check) codes combined with BCH (Bose - Chaudhuri - Hocquengham) to protect against high levels of signal noise and interferences. On screen, under LBER measurement the number of iterations LDPC is shown, that is, the number of times the LDPC decoder for error correction has to pass through the signal and the ESR (Error Second Ratio) that indicates the percentage of time with errors after the BCH. Error correction is internal with BCH or external with LDPC. The internal error correction provides basic minimum load while the outer error correction is a correction with additional load. Also the PER measurement is displayed, which is the number of erroneous packets, that is, packets received during the measurement time and not correctable by the demodulator.
- **CBER** (Channel Bit Error Rate)  
BER of the signal after passing through the COFDM demodulator and before applying the error correction or FEC (Forward Error Correction).
- **LBER** (LDPC Bit Error Rate)  
BER of the signal after applying the correction errors LDPC (Low-density parity-check).

## A1.2 ANALOGUE signals

### A1.2.1 Terrestrial band

#### Analogue TV

In the measurement of analogue signals in terrestrial band, measurements available are:

- ▶ **LEVEL**  
Indication of the carrier level of the tuned video.
  
- ▶ **C/N**  
Ratio between the modulated signal power and noise power for the same bandwidth (depending on TV standard). The modulation error ratio (MER), used in digital systems is analogue to the Signal-Noise (S / N) ratio in analogue systems. The Carrier level is measured by a quasi-peak detector (100 kHz BW). The noise level is measured with an average detector and corrected to refer it to the bandwidth equivalent to channel noise (according to its definition for the TV selected standard).
  
- ▶ **Video / Audio**  
Ratio between levels of the video carrier to audio carrier.

#### Analogue FM

In the analogue FM measurement mode signal, the display acts as an analogue indicator of signal representing the signal at the input. The equipment also demodulates the FM carrier (radio) and can be listened through the speaker.

**A1.2.2** **Satellite band****Analogue TV**

In the measurement mode of analogue signals in the satellite band, measures available are:

- ▶ **Level**  
Measurement of the tuned carrier level.
- ▶ **C/N**  
Ratio between the modulated signal power and noise power equivalent to the same bandwidth (as TV standard). The modulation error ratio (MER), used in digital systems is analogue to the Signal-Noise (S / N) ratio in analogue systems. The carrier level is measured by a quasi-peak detector (4 MHz BW). The noise level is measured with an average value detector (230 kHz) and corrected to refer it to the channel bandwidth .
- ▶ **Video / Audio**  
Ratio between levels of video carrier and audio carrier.



