TE-3000

TV & SATELLITE ANALYZER

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	Software Version
1.0	November 2014	15.4

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**.

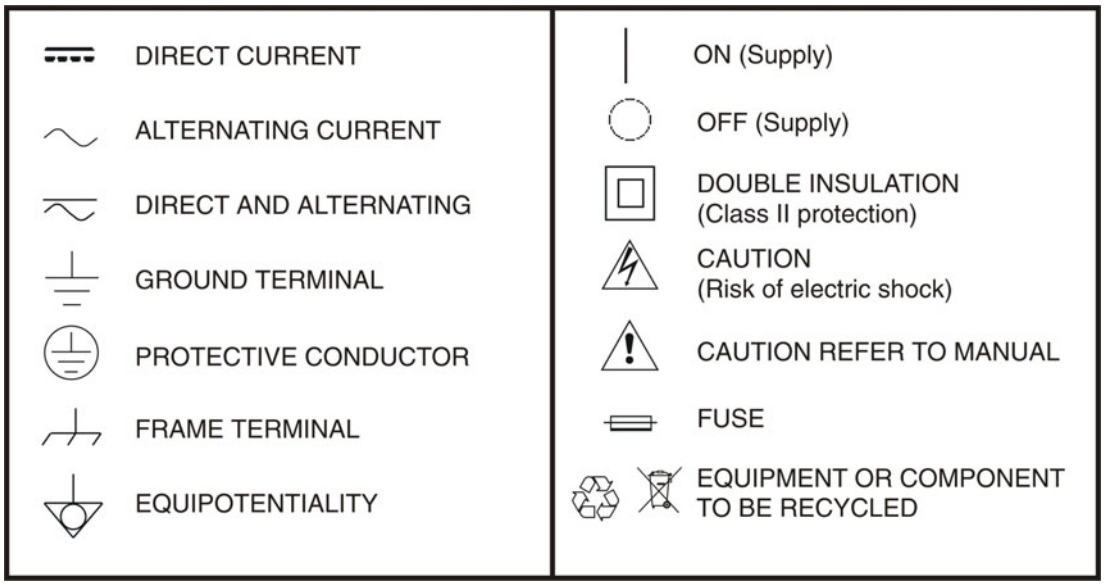
* When using the power adaptor, the **negative of measurement** is at ground potential.

* **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:



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.

TABLE OF CONTENTS

TE-3000
TV & SATELLITE ANALYZER

1 INTRODUCTION

1.1 Description

The new **TE-3000** is the sixth generation of field meters that **ATCi** 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 **TE-3000** 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 **TE-3000** is a universal analyzer that covers several of the most popular standards, 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, DAB/ DAB+ and GPS (see these options on the manual annex).

1 *Trademark of the DVB - Digital Video Broadcasting Project.*

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

The **TE-3000** 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.

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 software updates and upgrades for free.

Figure 2.

2 SETTING UP

2.1 Package Content

Check that your package contains the following elements:

- TE-3000 Analyzer.
- 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 bag.
- USB On-the-go (OTG)(A) Male - Mini USB (B) Male cable.
- USB cable (A) Female - Mini USB (B) Male cable.
- 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 analyzer to be calibrated.

2.2 Power

The **TE-3000** is powered by a 7.2 V built-in rechargeable Li-Ion battery of high quality and long operation time.

This equipment can operate on battery or connected to the mains using a DC adapter. An adapter is also supplied to use with the power connector car (cigarette lighter).

2.2.1 First charge

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

2.2.2 Charging the battery

Connect the DC power adapter to the equipment through the power connector on the left side panel (see figure 3).

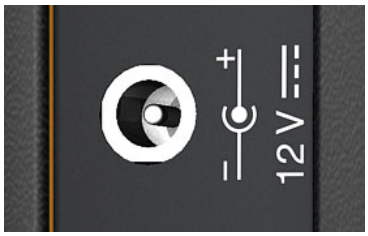


Figure 3.

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

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

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

When the equipment 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.

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

2.2.3 Charge/discharge times

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

- 3 hours to achieve an 80% charge.
- 5 hours to achieve 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 battery full charge the average battery time is 5:30 hours.
- With the battery 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.

2.2.5 Usage Tips

The battery is losing storage capacity as you go through its life. Contact your **ATCi** 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.

2.3.2 TE-3000 SPECTRUM ANALYZER

Figure 7.

Lateral view

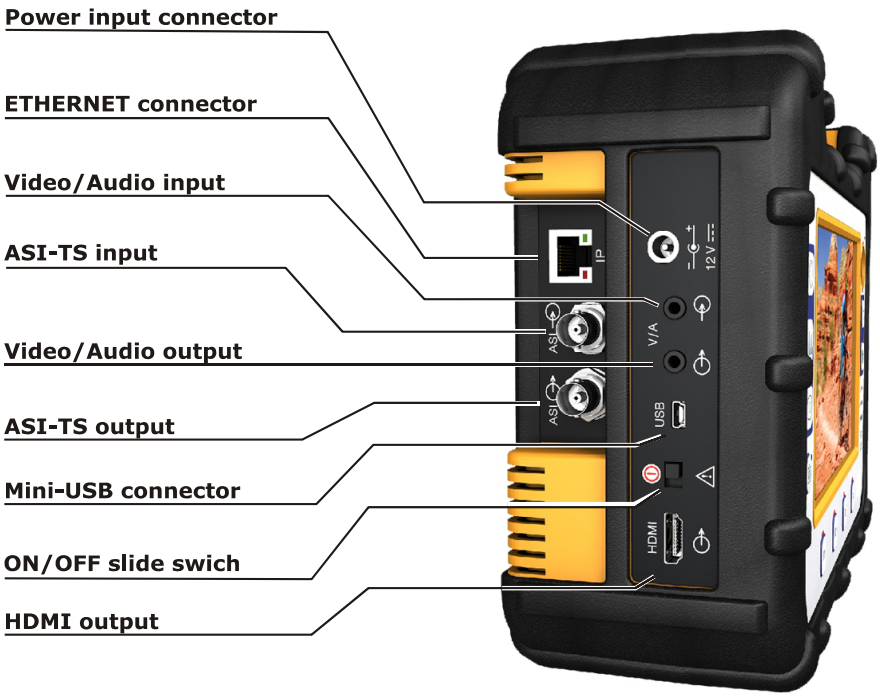


Figure 8.

Top view

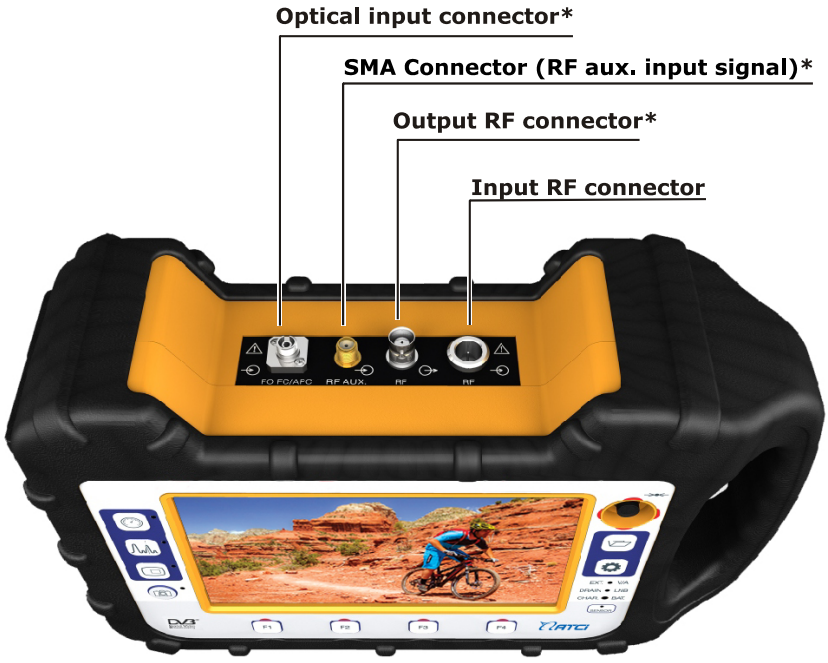


Figure 9.

*** Optical Option.** Refer to annex.

- **Bottom view**

Figure 10.

2.4 Switching On/Off the equipment

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

► **Switching On**:

1. Slide 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 boot screen (user can select the boot screen from "Preferences" menu) appears and also a progress bar that indicates the system load. At the top left corner it shows the equipment model and the installed software release detected.
4. After the system load, the last screen before shutdown appears.

► **Switching Off**:

1. Slide 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.

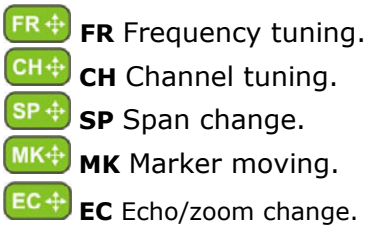
► **Reset**:

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 equipment turns off automatically.

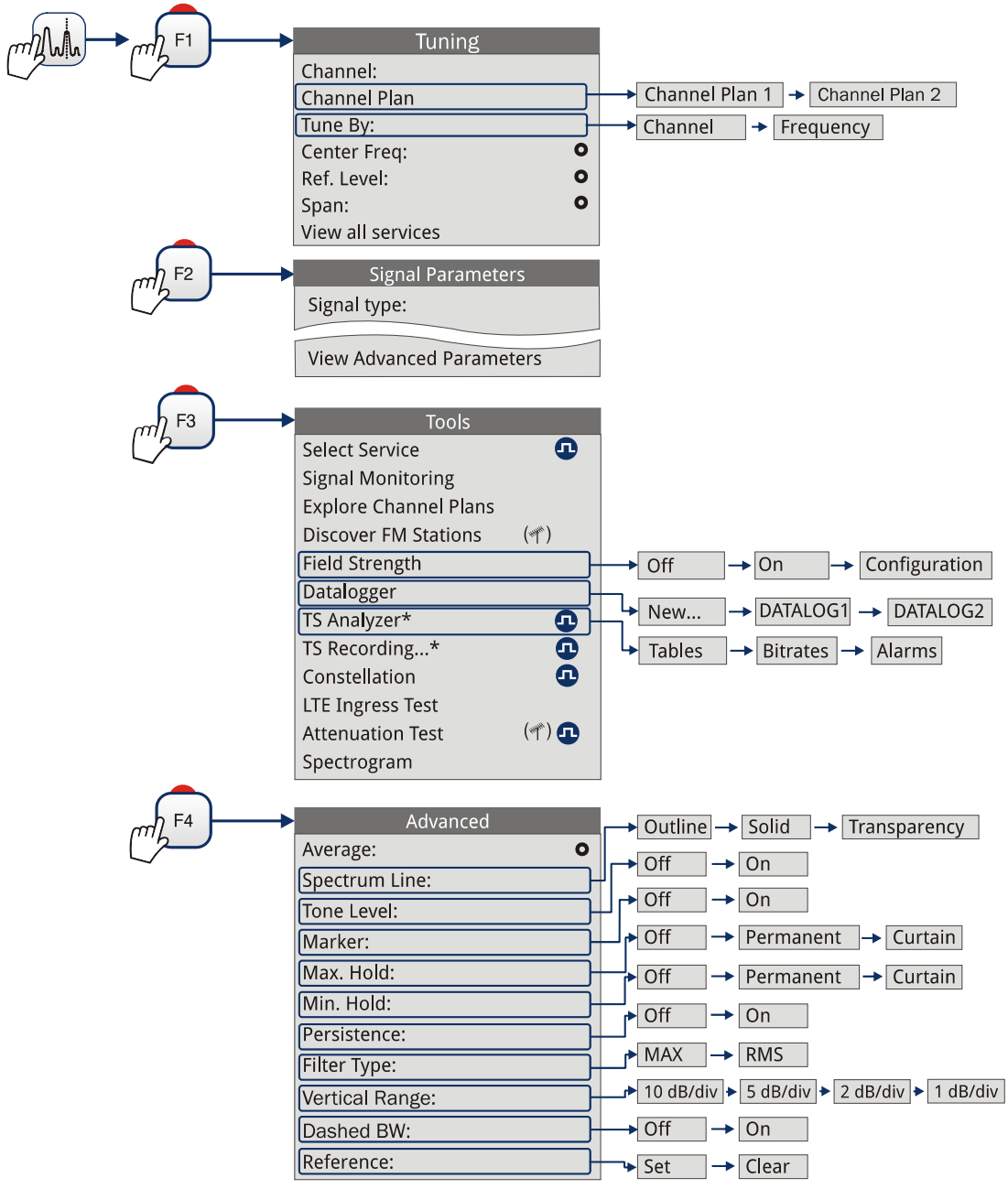
2.5 Screen Icons and Dialog boxes

On the screen are some icons that provide useful information to the user about the current status of the instrument.

	**Battery charging.**		**Warning.**
	**Battery not charging. Yellow level indicates charge left.**		**USB flash drive inserted.**
	**Battery not charging, time left indicator.**		**LTE filter enabled.**
	**USB in serial port mode.**		**Current installation.**
			**GPS locked.** **GPS unlocked.**
	**Satellite band.**		**SATCR commands enabled.**
	**Current voltage, 22 kHz signal and LNB power level.**		**Jess commands enabled.**
			**5 GHz RF Auxiliary Input.**
	**Terrestrial band.**		Multi-function Joystick enabled. Two-letter code indicates the exact function:
	**Compressed installation.**		
	**OK.**		
	**Searching.**		
	**IPTV signal source.**		

2.6 Menu Tree

SPECTRUM ANALYZER MENU



Only available for **digital channels**

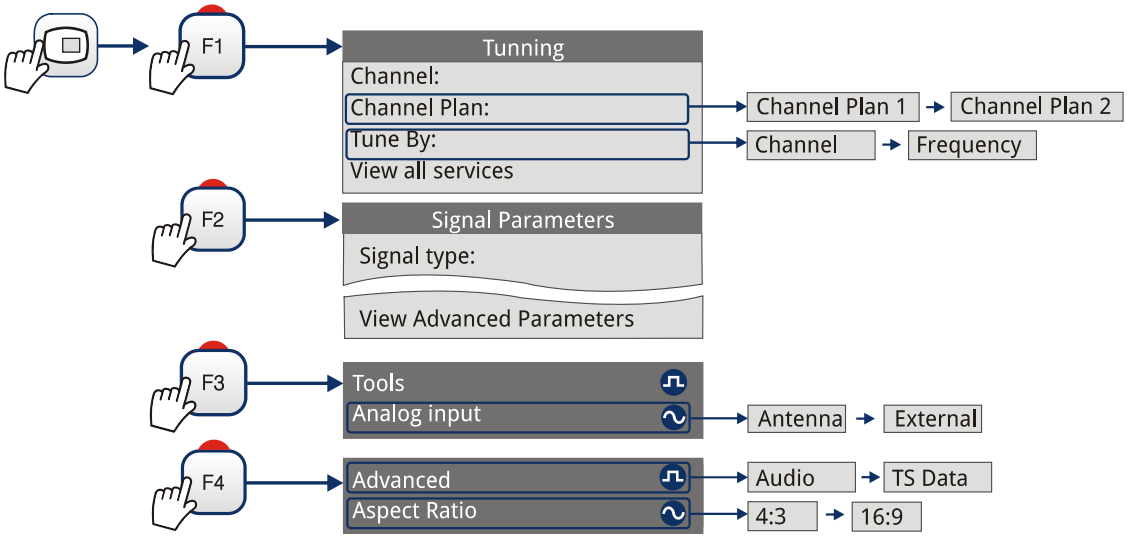
Only available for **analog channels**

Option available for **terrestrial band**

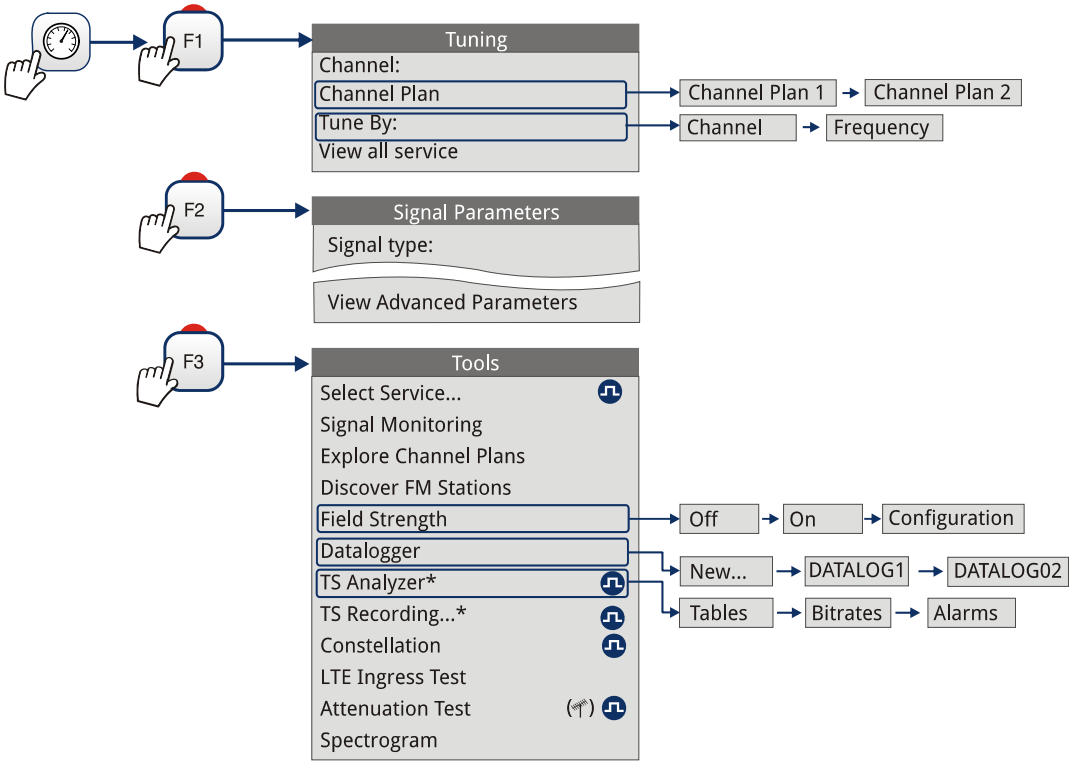
Option available for **satellite band**

*only available for TE-3000

TV MENU



MEASUREMENT MENU



Only available for **digital channels**

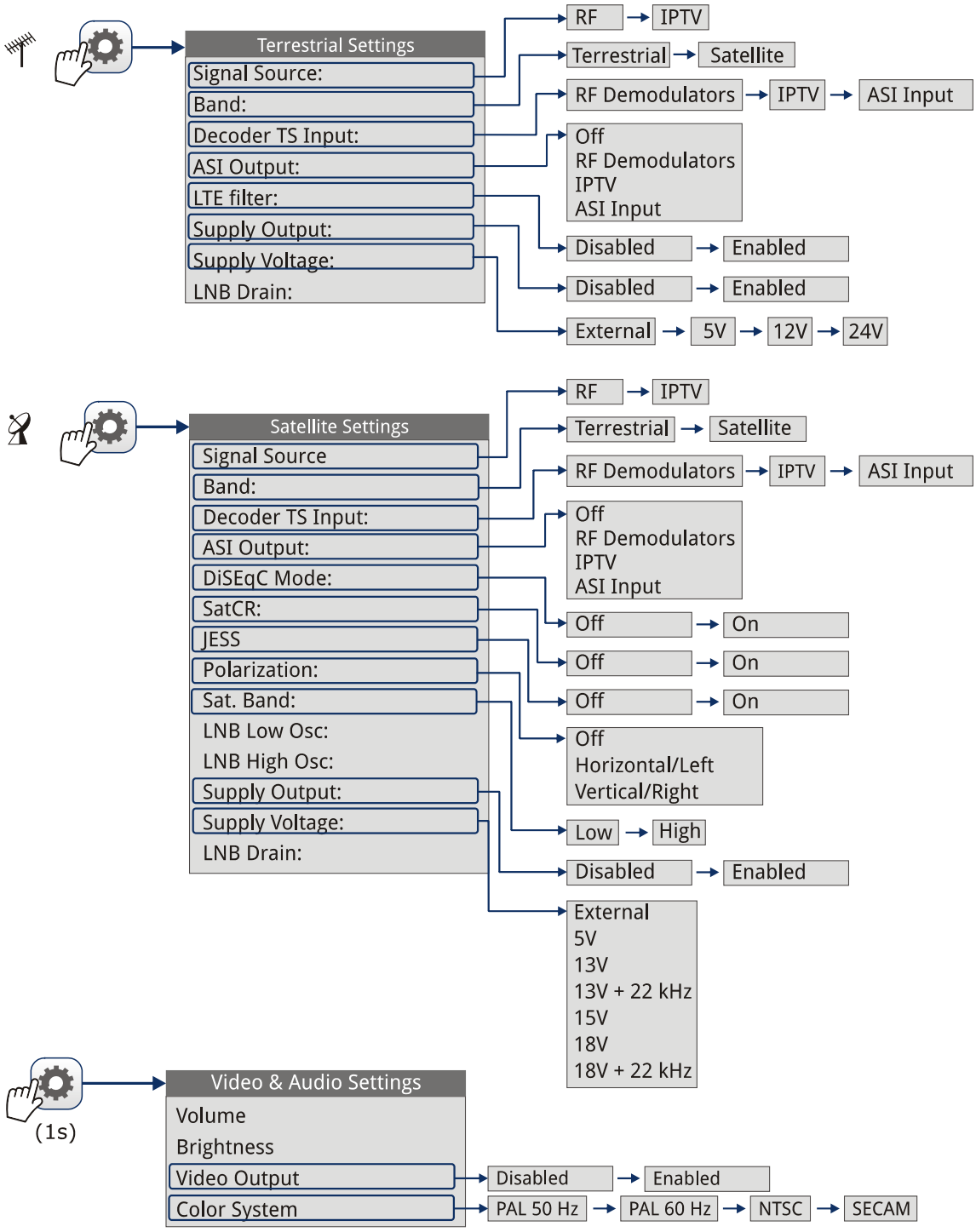
Option available for **terrestrial band**

Only available for **analog channels**

Option available for **satellite band**

*only available for TE-3000

SETTINGS MENU

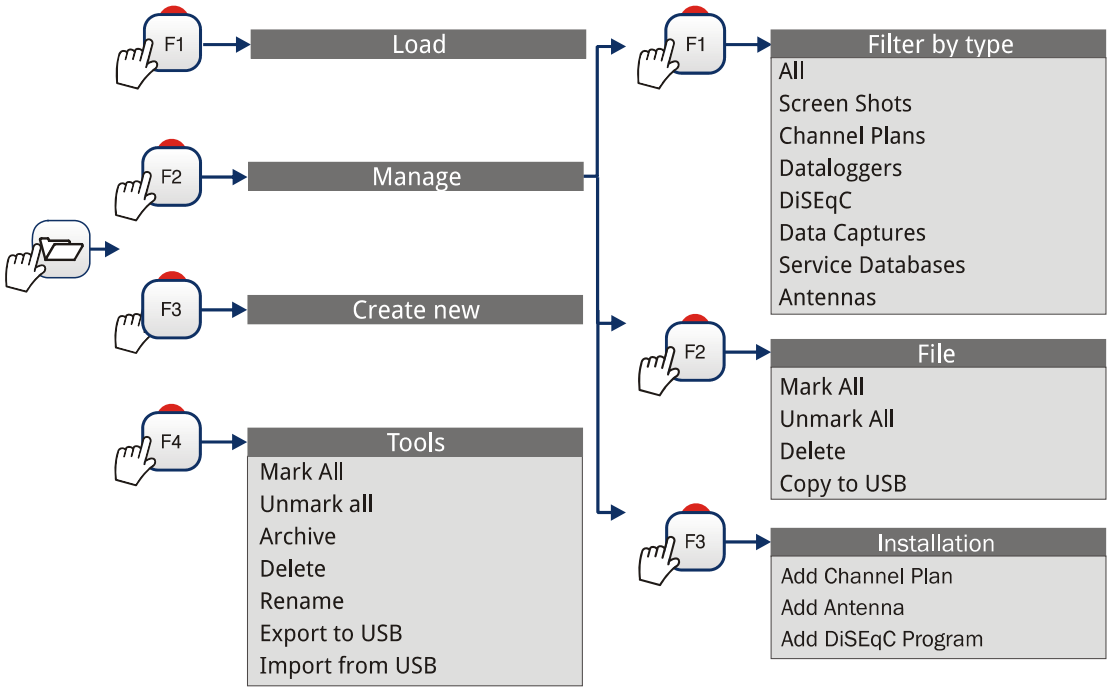


Option available for **terrestrial band**

Option available for **satellite band**

*only available for TE-3000

INSTALLATIONS MANAGEMENT



PREFERENCES MENU

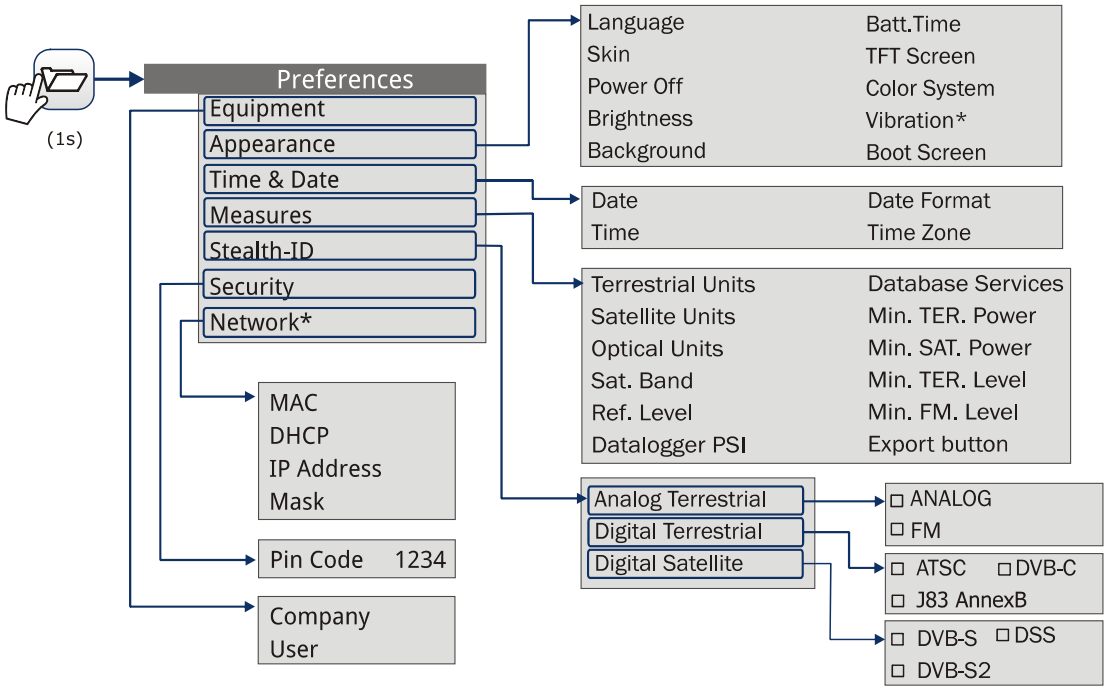


Figure 11.

*only available for TE-3000

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.

The menu navigation includes hints that appear when the cursor is placed on a disabled (greyed) option for a while. This hints help the user to understand why an option is disabled and what to do to enable it.

The equipment can be fully operated using both the touch panel* (even using wearing gloves) and the conventional keyboard.

For measurement and navigation through the menus, the equipment has the touch panel, 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 Touch Screen*

The control software is designed in such a way that the meter can be fully operated using both the touch panel and the conventional keyboard:

- **Menu Selection**.
- **Frequency or channel selection**.
- **Frequency or channel scroll**.
- **Virtual keyboard writing**.

Each touch on the screen is associated with a physical vibration. This vibration can be enabled or disabled through the option "Vibration" in the "Preferences" menu.

*only available for TE-3000

► Menu Selection

User can operate on the menus on screen: drop-down menu, select an option, accept or exit a message, and so on, just touching on the option.

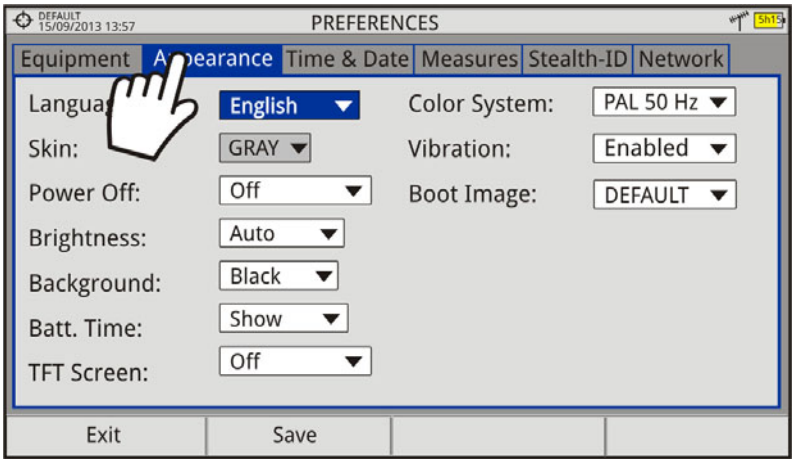


Figure 12.

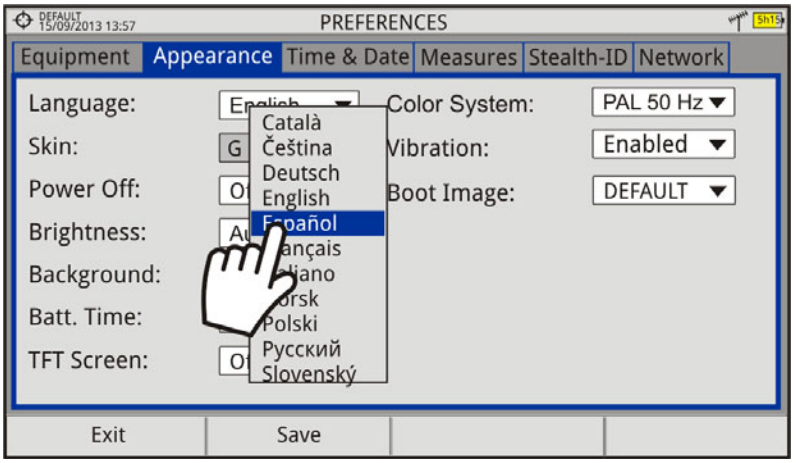


Figure 13.

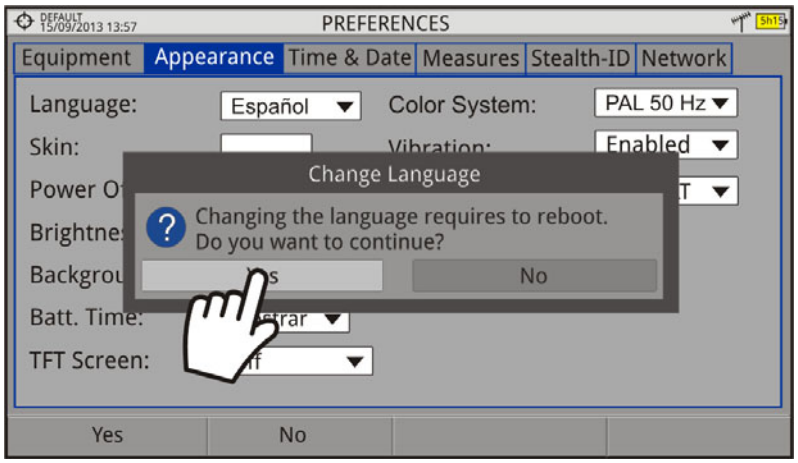


Figure 14.

► Frequency or Channel Selection

At the Spectrum Analyzer mode, user can select a channel or frequency by tapping on the frequency or channel.

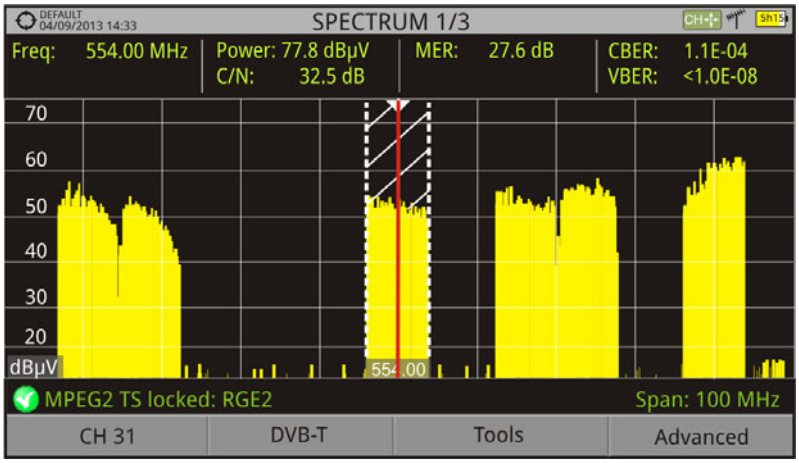


Figure 15. First screen (channel locked).

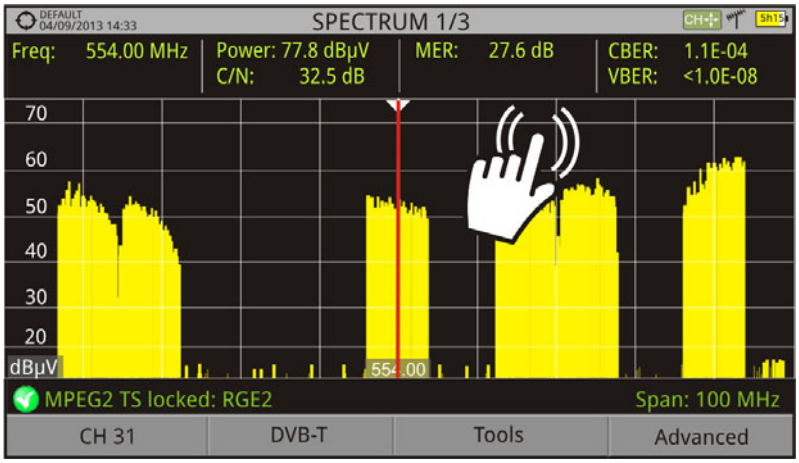


Figure 16. Tap on the new frequency.

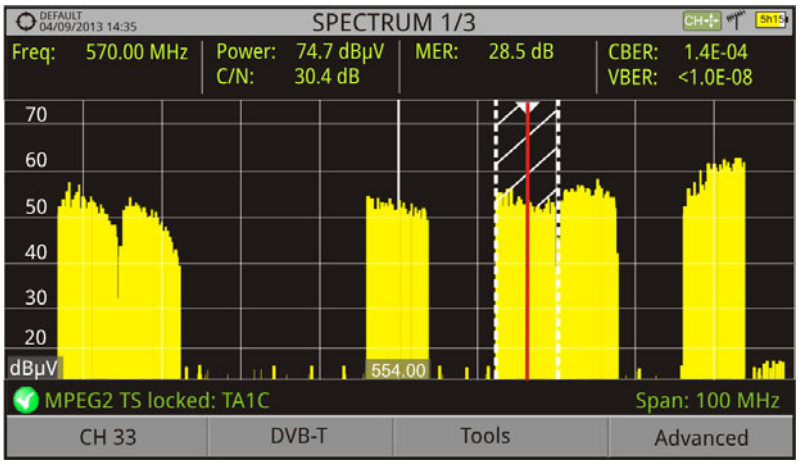


Figure 17. The cursor moves to the frequency.

► **Frequency or Channel Scroll**

At the Spectrum Analyzer mode, user can scroll through frequency or channels by dragging and dropping his finger on the screen.

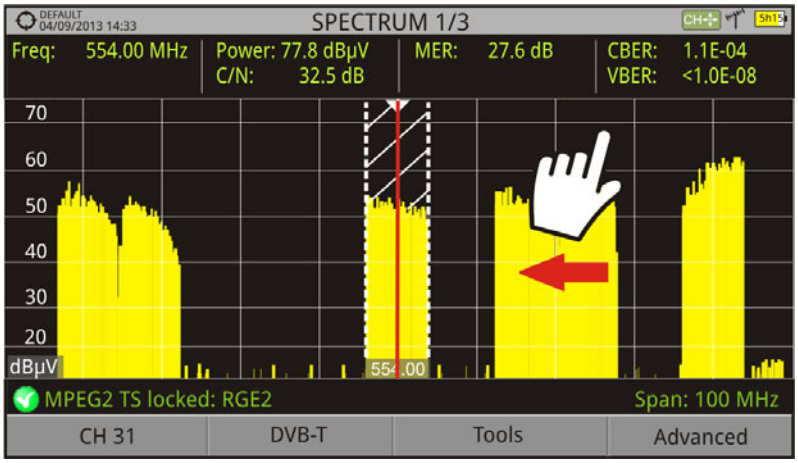


Figure 18.

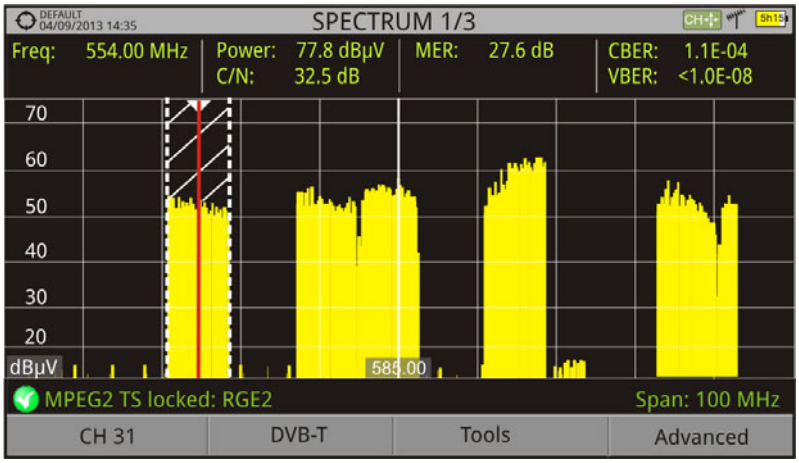


Figure 19.

► **Virtual keyboard/keypad writing**.

User can type directly on the on-screen keyboard or keypad.

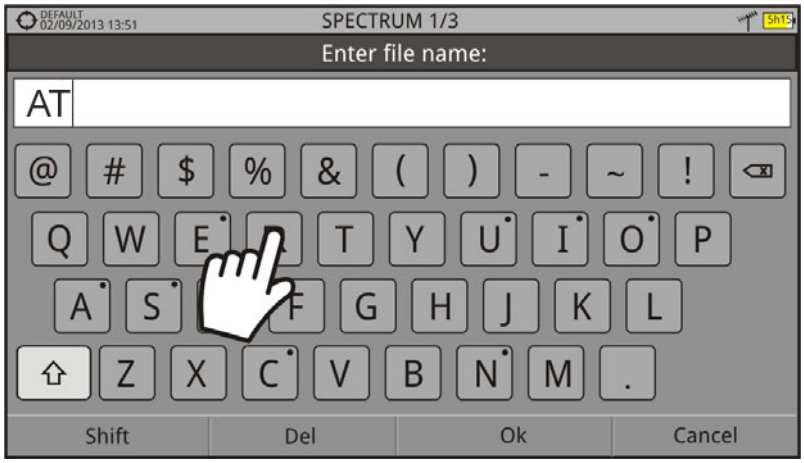


Figure 20.

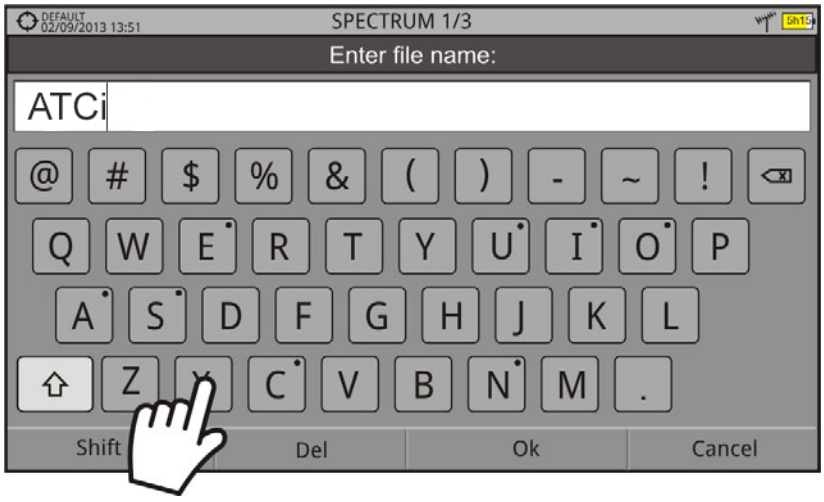


Figure 21.

2.7.2 Joystick

Joystick positions are five:

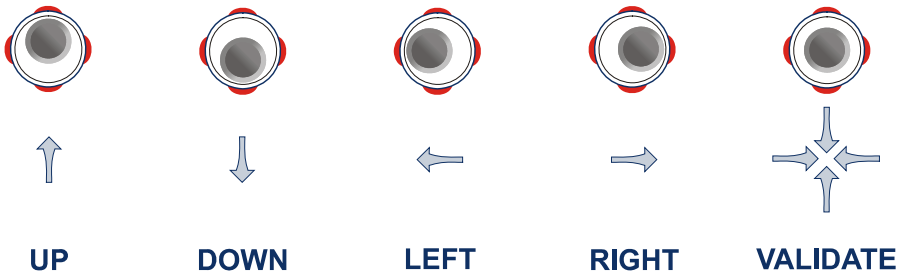


Figure 22.

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.

In the **SPECTRUM ANALYZER** mode, the joystick has the following functions:

- ► **CH** or **FR**: Channel change (CH) or frequency (FR) change (according to the tune selected: tune by channel or tune by frequency).
- ► **SP**: Span change.
- ► **MK**: Marker moving (if marker is enabled).

Figure 23.

Using the **ECHOES** tool, the joystick is also multifunctional:

- ► **CH** or **FR**: Channel (CH) change or frequency (FR) change (according to the tune selected: tune by channel or tune by frequency).
- ► **EC**: Echo change.

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

2.7.3 Keyboard shortcuts

► **Management Keys**

There are two Management keys. Each one has two different functions according to the pressing time:

Short press: It shows the list of installations and the menus to manage them.

Long press: It shows the preferences menu.

Short press: It shows the menu of terrestrial or satellite settings (according to the selected band).

Long press: It shows the Video & audio settings.

► **Export / Reference key** 

Depending on how long you press this key, it has two different functions:

Short Press: Pressing this key for less than one second on the Spectrum Analyzer mode, it holds on screen the current waveform as a reference. It is equivalent to go to the option "Reference - Set" from the "Advanced" menu.

Long press: Pressing this key for one second it makes a capture of what it is shown on screen at the time.

The capture may be from the screen image, from the measurement data or from both.

The type of capture, either screen, data, or both can be set in the "**Export button**" option which is on the label "**Measures**" in the "**Preferences**" menu.

More information in the chapter "**Export key**".

► **Mode keys**

On the left side there are 3 keys to access the equipment modes.

Measurement Mode key.

Spectrum Analyzer Mode key.

TV Mode Key.

The active function on screen is indicated by the LED next to the mode key.

Pressing a key repeatedly provides access to a different view within the same mode. Each view is shown at the top. When reaching the third view it returns to the first view. For some signals (analog, generic) not all the views are available.

Following there is an example of the views available for each mode (examples extracted from a digital terrestrial signal):

Measurements

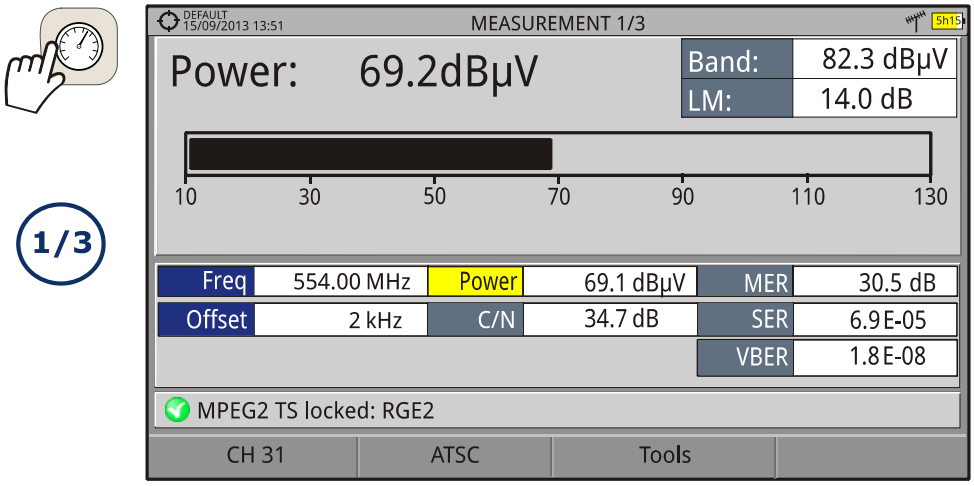


Figure 24. FULL MEASUREMENT

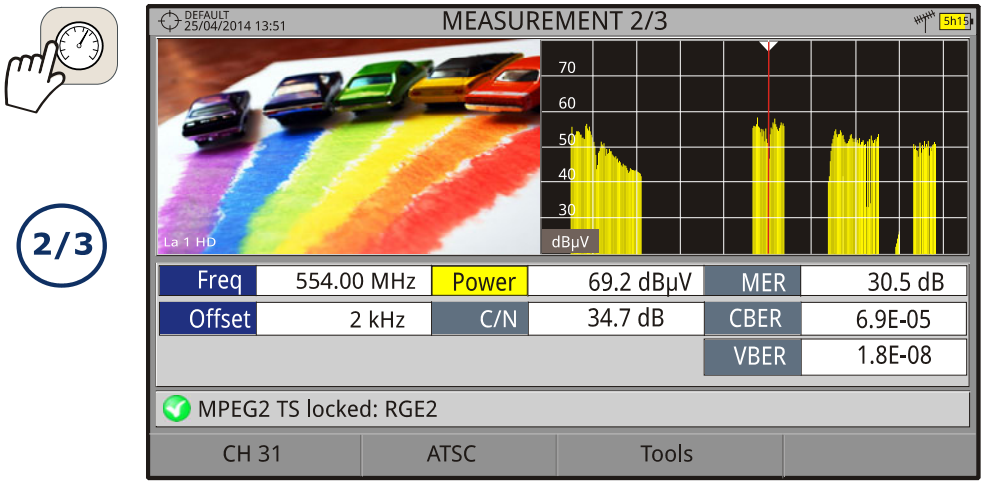


Figure 25. MEASUREMENT + TV + SPECTRUM

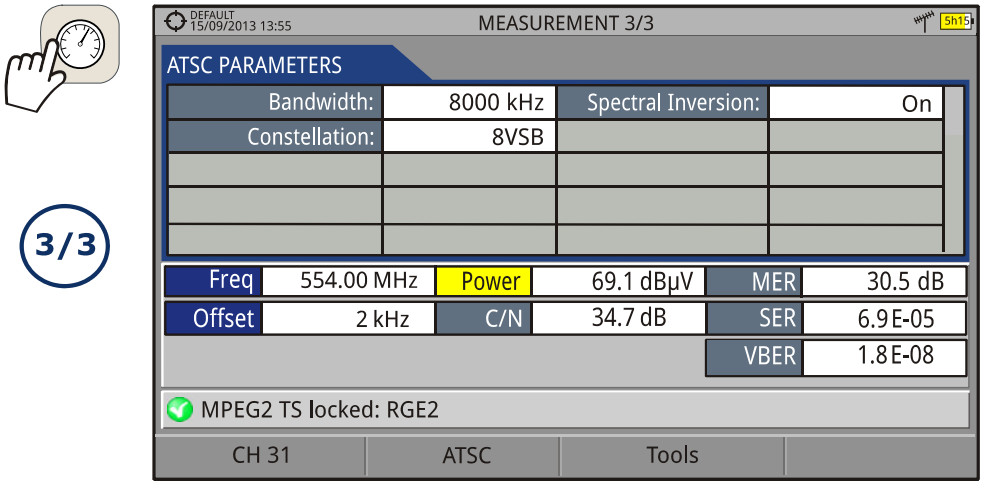


Figure 26. MEASUREMENT + PARAMETERS

Spectrum Analyzer

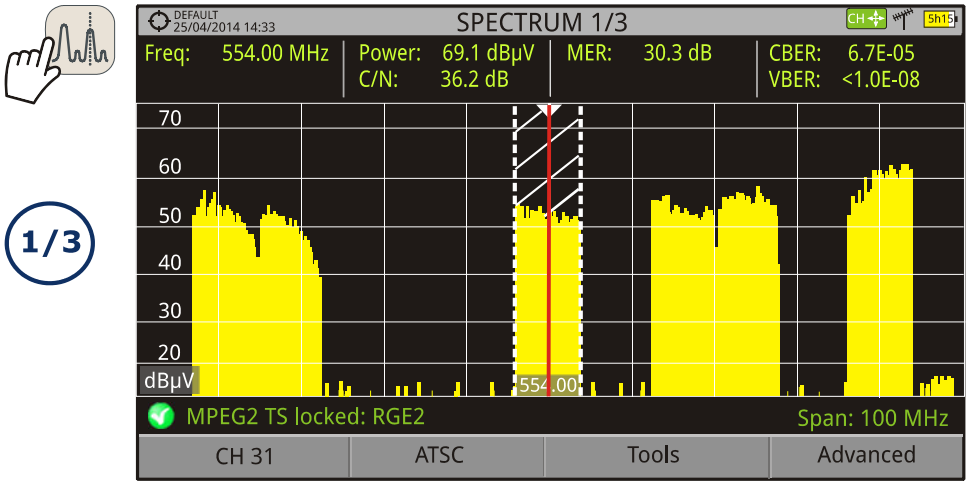


Figure 27. SPECTRUM + MEASUREMENT

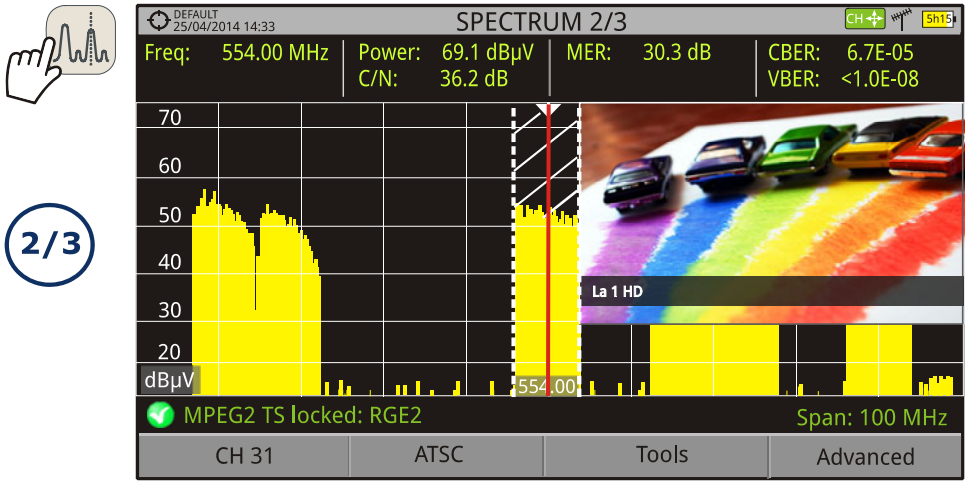


Figure 28. SPECTRUM + MEASUREMENT + TV

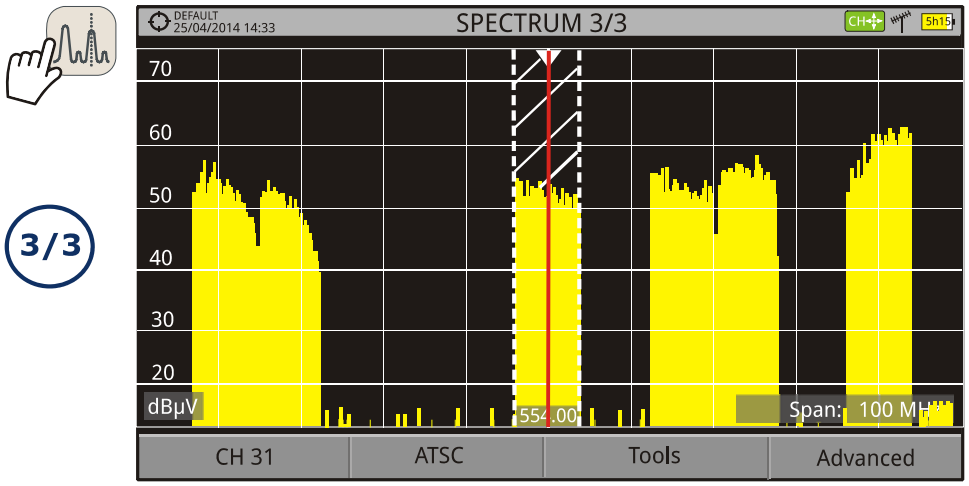


Figure 29. FULL SPECTRUM

TV Mode

Figure 30. FULL TV

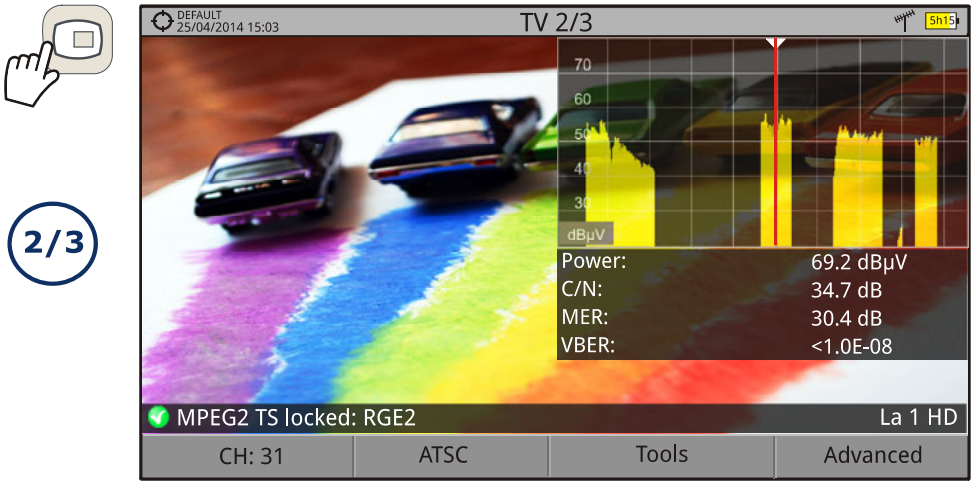


Figure 31. TV + SPECTRUM + MEASUREMENT

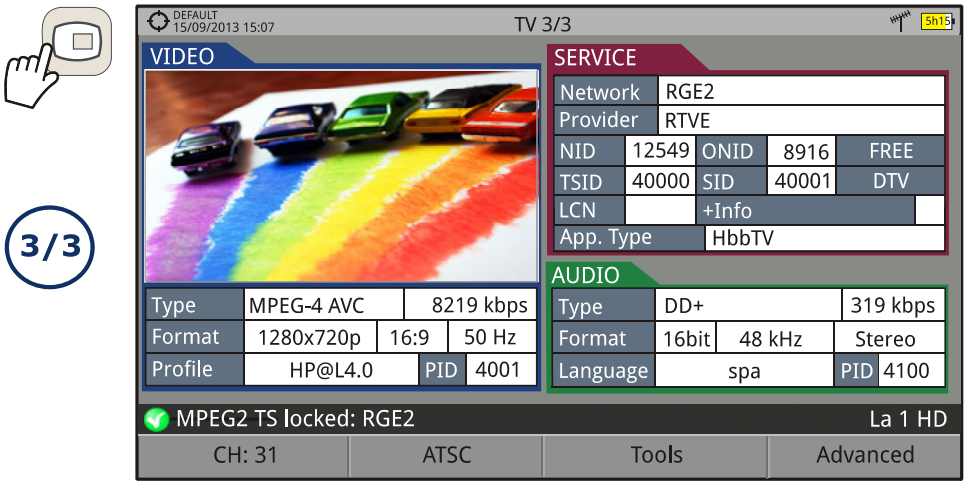


Figure 32. TV + SERVICE DATA

2.7.4 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.

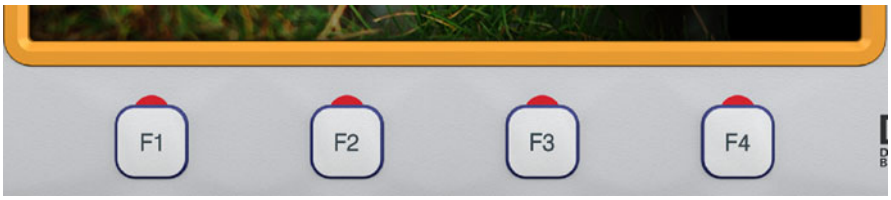


Figure 33.

2.7.5 Virtual Keyboard

When a user needs to enter or edit a text (from an image, Channel Plan, etc.), a screen with a virtual keyboard appears as shown at the figure.

Figure 34.

To edit the file name user should follow these steps:

1. Place the cursor over the text box where the name appears.
2. Move the cursor to place it next to the letter that user wants to edit.
3. Press on the virtual keyboard to edit.

To delete a letter, move the cursor to the right side of the letter and then press the joystick on the Delete key  or press F2 (Del).

To enter an upper case letter press first F1 or press on the  key. To block upper case press F1 or press on the  key twice consecutively. To return to lower case press F1 or the key again.

Keys with a point at the top right corner give access to special characters, by keeping pressed for one second on the key.

After editing press F3 (Ok) to validate the name and continue the process or F4 (Cancel) to cancel.

2.8 StealthID Function: Signal Auto-identification

The **StealthID** function of the **TE-3000** is a signal identification function performed automatically by the equipment without any user intervention.

The equipment tries to identify the channel or frequency of the input signal it receives, and according to the band selected by the user, it applies identifying criteria according to the standards of that band. When the equipment recognizes in the input signal the identification parameters of a standard, it decodes the signal and shows the data of that signal on the screen.

The identification system tries to lock the first signal using the modulation defined in the channel plan for that signal. If after five seconds it fails to lock with that modulation, it starts the wheel for automatic detection. If then it locks in a modulation other than indicated, it generates an internal temporary channel plan to accelerate tuning the same channel later on.

Then, the user only has to follow these steps in order to identify a signal:

1. Press the **Preferences** key for 1 second.
2. In the **StealthID** tab, select the signal types to auto-identify (see "Menu tree" figure 7). By default all them are selected. Press the F2 key to save the changes made and the F1 key to exit the **Preferences** screen.
3. Press the **Settings** key.
4. Select the band (terrestrial or satellite).
5. Select a channel or frequency to identify.
6. The bottom of the screen shows the message "**Searching for signal**" and the standard transmission checking. Wait a few seconds for the equipment to identify the signal. User can force the auto-identification of a signal by pressing the F2 key and selecting the type of signal from the menu.
7. When the equipment identifies the signal a text shows the detected signal type.
8. Press F2 (Signal Parameters) to see the signal parameters.

2.9 Equipment Settings and Configuration

2.9.1 Settings Menu

Press the **Settings** key to access the settings menu.

Depending on the selected band, the menu may be different.

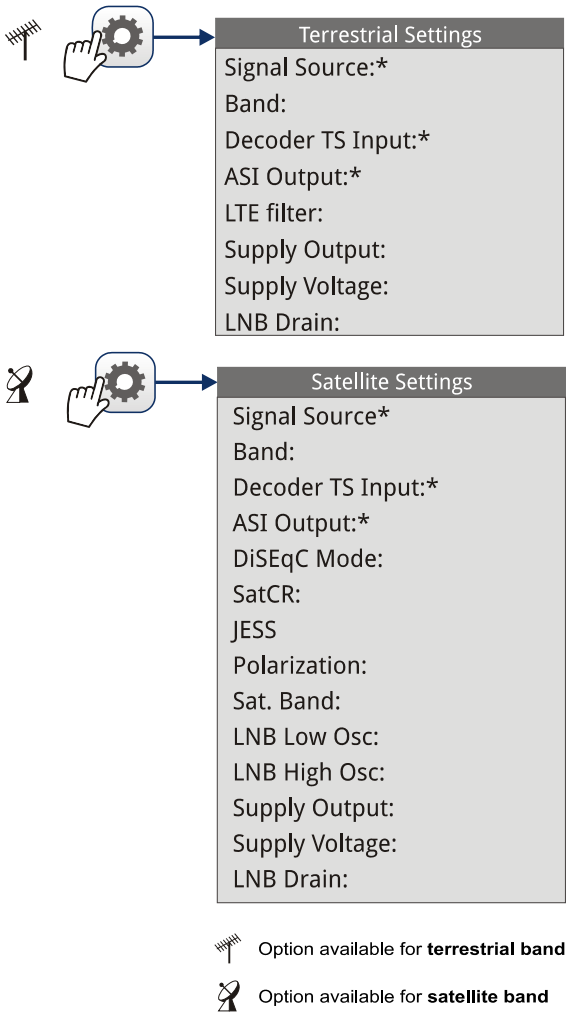


Figure 35.

A brief explanation of each option available on the menu:

► **Signal Source***

It allows the user to select the signal coming into the equipment between the RF input for RF signal and the IPTV input for TV over any type of IP packet based distribution network.

*only available for TE-3000

► **Band** (available for satellite and terrestrial band).

It allows the user to select between terrestrial or satellite frequency band.

► **Decoder TS Input***

It allows the user to select the transport stream coming into the equipment between the RF Demodulators, IPTV input, ASI input and the transport stream played from the TS Recording tool.

- **RF Demodulators**: (This option is available only if RF is selected as a Signal Source). The TS extracted from the RF signal by means of the internal RF demodulator. The RF signal can come from digital terrestrial, satellite or cable.
- **IPTV**: (This option is available only if IPTV is selected as a Signal Source). The TS extracted from the IPTV signal.
- **ASI Input**: The TS coming directly through the ASI-TS input connector.
- **Recorded TS**: The TS comes from the one being played and previously recorded with the TS Recording tool (warning: this option is automatically selected each time a recorded TS is played. Disable it once the TS playing has finished).

► **ASI Output***

It allows the user to select the signal source for the TS-ASI packets going out through the equipment ASI Output. User can select among Off, RF Demodulators, IPTV and ASI Input. This transport stream can feed the signal to other devices.

- **Off**: ASI Output disabled.
- **RF Demodulators**: (This option is available only if RF is selected as a Signal Source). The signal through ASI Output is the TS extracted from the RF signal by means of the internal RF demodulator. The RF signal can come from digital terrestrial, satellite or cable.
- **IPTV**: (This option is available only if IPTV is selected as a Signal Source). The signal through ASI Output is the TS extracted from the IPTV signal.

*only available for TE-3000

- **ASI Input**: TS-ASI packets coming from ASI input connector go out through the ASI output connector.

► **External power supply** (available for terrestrial and satellite band)

It enables or disables the power supplied to external units such as preamplifiers for antennas in terrestrial television or LNBs and FI simulators in the case of satellite TV.

When this option is enabled the equipment applies at the output the voltage selected by the user in the Supply Voltage option (see below). When this option is disabled the equipment does not apply the voltage to the output but it will behave as if it did.

► **Supply voltages** (available for terrestrial and satellite band)

It selects the voltage to be applied to an external unit.

Available voltage options change depending on the selected band.

Voltage available for terrestrial band is: External, 5 V, 12 V and 24 V.

Voltage available for satellite band is: External, 5 V (for devices working with 5 V such as GPS active antennas), 13 V, 13 V + 22 kHz, 15V, 18 V, 18 V + 22 kHz.

In the External supply voltage option the power supplier to the external units is the power supplier of the antenna preamplifiers (terrestrial television) or the satellite TV receiver (collective or domestic).

► **LNB Drain** (available for terrestrial and satellite band)

The LNB drain option shows the voltage and current flowing to the external unit. If there is any problems (e.g. short circuit), an error message appears on the screen ('SHORTCIRCUIT'), a warning beep sounds and the equipment will not supply power. The equipment does not return to its normal operating state until the problem is solved .During this time the equipment checks every three seconds if there still the problem, warning with an audible signal.

The DRAIN LNB light indicator is lit if current is flowing to the external unit.

► **LTE Filter** (only available for terrestrial band)

It enables or disables the LTE filter (see section: "LTE Interference Test"). When the LTE filter is enabled an icon will appear at the top right of the screen.

► **DiSEqC Mode** (only available for satellite band)

It enables or disables DiSEqC mode. DiSEqC (Digital Satellite Equipment Control) is a communication protocol between the satellite receiver and accessories of the satellite system (see chapter "CONNECTING TO EXTERNAL DEVICES").

► **SatCR** (only available for satellite band)

It enables or disables the SatCR function (Satellite Channel Router) to control devices of a satellite TV installation that supports this technology (see chapter "CONNECTING TO EXTERNAL DEVICES").

► **JESS** (only available for satellite band)

It enables or disables JESS mode (JULTEC Enhanced Stacking System) to control devices in a satellite TV installation which must be compatible with this technology (see chapter "CONNECTING TO EXTERNAL DEVICES").

► **Polarization** (only available for satellite band)

It allows the user to select the signal polarization between Vertical/Right (vertical and circular clockwise) and Horizontal/Left (horizontal and circular anti-clockwise), or disable it (OFF). In tuning mode the Polarization option can not be changed.

► **Sat Band** (only available for satellite band)

It allows the user to select the High or Low band frequency for satellite channel tuning. In channel tuning mode the Band Sat can not be changed.

► **LNB Low Osc.** (only available for satellite band)

It defines the local oscillator frequency for the LNB low band. When a channel plan is selected but LNB oscillator values are not properly selected, a warning is issued.

► **LNB High Osc.** (only available for satellite band)

It defines the local oscillator frequency for the LNB high band (up to 25 GHz). When a channel plan is selected but LNB oscillator values are not properly selected, a warning is issued.

2.9.2 Video & Audio settings

Press the Settings key for one second to access the Video & Audio settings menu.

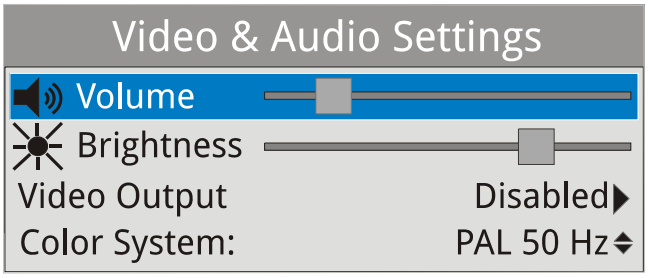


Figure 36.

A brief explanation of each option available on the menu:

- **Volume**

  It increases or decreases the volume of the speaker audio output by moving the joystick to the right (+ volume) or left (- volume).

- **Brightness**

  It increases or decreases the screen brightness by moving the joystick to the right (+ brightness) or left (- brightness).

- **Video Output**

  It enables or disables the video output through the audio/video connector (see chapter "CONNECTING TO EXTERNAL DEVICES").

- **Color System**

  The coding system used in analog transmissions. Available options are: PAL 50 Hz, PAL 60 Hz, NTSC and SECAM.

2.9.3 Preferences Menu

You access the **Preferences** menu by pressing the **Installations Management** key for one second. The options are grouped in tabs as follows:

- **Equipment**: Equipment information.
- **Appearance**: Equipment customization options.
- **Date & Time**: It allows the user to change date and time zone.
- **Measures**: It allows the user to choose between several units of measure among other parameters.
- **StealthID**: It allows the user to select the set of signal types being used while auto identifying any modulation type.
- **Network***: Network parameters to edit.
- **Security**: It allows to edit the PIN code.

*only available for TE-3000

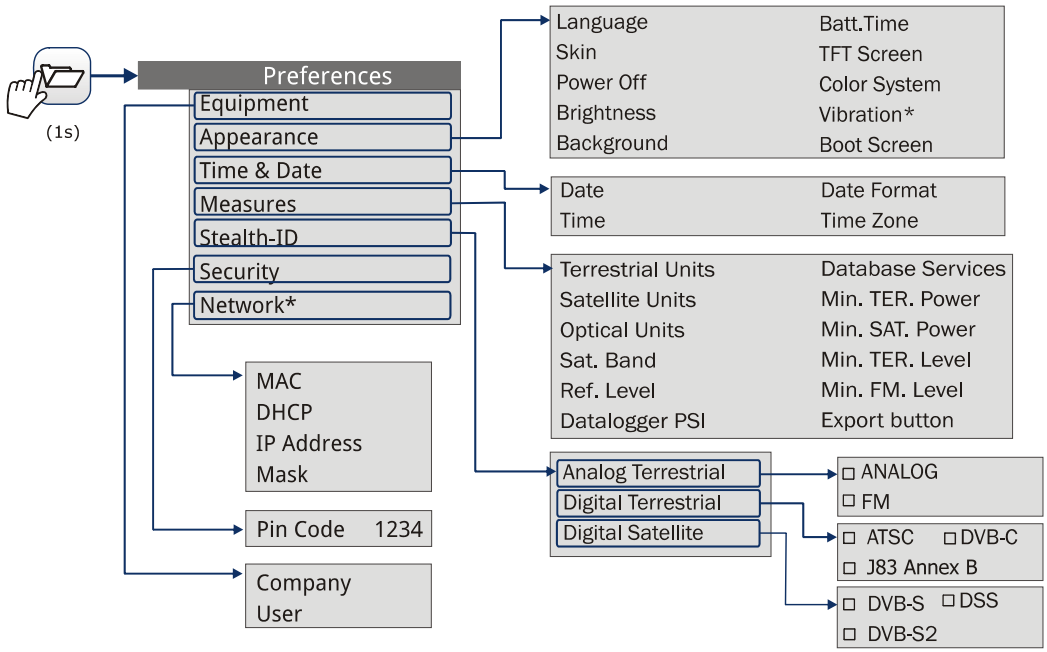


Figure 37.

To navigate between tabs move the joystick left or right. To navigate between the options within the tab move the joystick up or down.

Press F1 **Exit** to exit Preferences.

Press F2 **Save** to save changes.

A brief explanation of the options available in each tab:

► **Equipment information**:

- **Provider**: Provider's name.
- **Name**: Equipment's name.
- **Serial number**: Unique identification number for this equipment.
- **Release**: Version of the software installed on the equipment.
- **Date**: Date of the software installed on the equipment.
- **Free memory**: Free size of the flash memory installed on the equipment / Size of the flash memory installed on the equipment.
- **Company**: Name of the company which owns the equipment (editable by user; protected by PIN code). This field appears on the boot screen.
- **User**: Name of the equipment's user (editable by user; protected by PIN code). This field appears on the boot screen.

*only available for TE-3000

► **Appearance Options**:

- **Language**: Language used on menus, messages and screens. Available languages are: Spanish, Catalan, English, German, French, Czech, Italian, Norwegian, Polish, Russian and Slovak. Once the new language is selected, the equipment shows a warning message and re-starts in order to load the new language.
- **Skin**: Colors used on the screen.
- **Power Off**: It allows the user to select the time to power off, which is the time after which the equipment shuts down automatically unless user press any key.
- **Brightness:** User can select between two options:
  - **Manual**: The display brightness is adjusted manually using the brightness setting (see section **Video and audio settings**).
  - **Automatic**: The display brightness is automatically adjusted according to the light received by the sensor.
- **Background:** It allows the user to select the background color on the display screen. Options available are: white, green, red, black and blue.
- **Battery Time**: It hides or shows the remaining battery time. Remaining battery time is displayed on the inside of the battery level icon.
- **TFT Screen**: User can select a time after which the TFT screen turns off, but the equipment is still running normally. The screen turns on by pressing any key. Time options are: off, 1, 5, 10 or 30 minutes.
- **Color System**: The coding system used in analog transmissions. Available options are: PAL 50 Hz, PAL 60 Hz, NTSC and SECAM.
- **Boot Screen:** User can select the image that appears when the equipment is booting.
- **Vibration***: User can turn the vibration on or off. When the vibration is ON the user feels a vibration when touching the screen.

*only available for TE-3000

- **Time & Date Options**:
  - **Date**: It allows the user to edit the date. Press the joystick for edit mode.
  - **Time:** It allows the user to edit the time. Press the joystick for edit mode.
  - **Date Format:** It allows the user to change the date format, which is the order in which is shown day (DD), month (MM) and year (YYYY or YY).
  - **Time Zone:** It allows the user to select the time zone where he is.
- **Measures Options**:
  - **Terrestrial Units**: It allows the user to select the terrestrial measurement units for the signal level. Available options are: dBm dBmV and dBµV.
  - **Satellite Units**: It allows the user to select the satellite measurement units for the signal level. Available options are: dBm, dBmV and dBµV.
  - **Optical Units**: It allows the user to select the optical measurement units for the signal level. Available options are: dBm.
  - **Satellite Band**: It allows the user to select the type of satellite band used between Ku/Ka band and C band.
  - **Reference Level**: It allows the user to select the type of reference level adjustment between manual (modified by the user) or automatic (selected by the equipment).
  - **Datalogger PSI**: If you select the option "**Capture**", when datalogger is working it captures the service list of each channel. This process slows the datalogger, but provides additional information that can be downloaded in XML files. To disable this option select "**Don't capture**".

- **Database services**: When it is enabled, it saves all the services been detected in the current installation. There is a database for services in terrestrial band and another for services in satellital band. Services are included automatically when the signal is locked. If enabled, these services will be displayed on the "**View all services**" option in the **Tuning** F1 menu. When disabling the option all services in the database of the installation will be deleted.
- **Min. TER. Power**: It sets the minimum power for a terrestrial digital signal to be identified.
- **Min. SAT. Power**: It sets the minimum power for a satellite digital signal to be identified.
- **Min. TER. Level**: It sets the minimum level for a terrestrial analog signal to be identified.
- **Export button**: It allows the user to select the data to be exported when pressing the export key among the following options: screen only, data only or both. More info in the "Export key" chapter.

► **StealthID Options**:

It allows the user to select the set of signal types being used while auto identifying any modulation type. More information in the "StealthID function" chapter.

► **Network Options***:

Network parameters that user has to fill out in order to identify the equipment into a data network. This is necessary to receive IPTV signal (refer to IPTV chapter for more information). Network parameters are MAC, IP Address and Mask. There is also the possibility to enable the DHCP protocol for proper IP configuration. DHCP is the standard procedure to get the proper IP address when the unit is first connected to a network. That feature contributes to make things easier to installers when debugging network access.

► **Security Options**

It allows the user to change the PIN code that gives access to protected data fields. The default PIN code is "1234". To change the PIN, first enter the current PIN code, then enter the new PIN.

In case the user forgets the PIN, after the third attempt, call ATCi at 480-844-8501.

*only available for TE-3000

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-identification function (for more information refer to "StealthID 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.

- Advanced Television System Committee (ATSC) Standard
- Digital multi-program systems for television, sound and data services for cable distribution (J83 Annex B)
- Digital Satellite Television First Generation (DVB-S)
- Digital Satellite Television Second Generation (DVB-S2)
- Digital Satellite Television, exclusive for DirecTV (DSS)
- Digital Cable Television First Generation (DVB-C)
- Generic [1]
- Analog terrestrial TV
- Analog Terrestrial FM

[*] For this signal type refer to "Generic Signal" paragraph.

3.2 Operation

1. Connect the **RF** input signal to the equipment.
2. Select through the "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.

3.3 Screen Description

Views for digital signals are:

MEASUREMENT 1/3: FULL MEASUREMENT

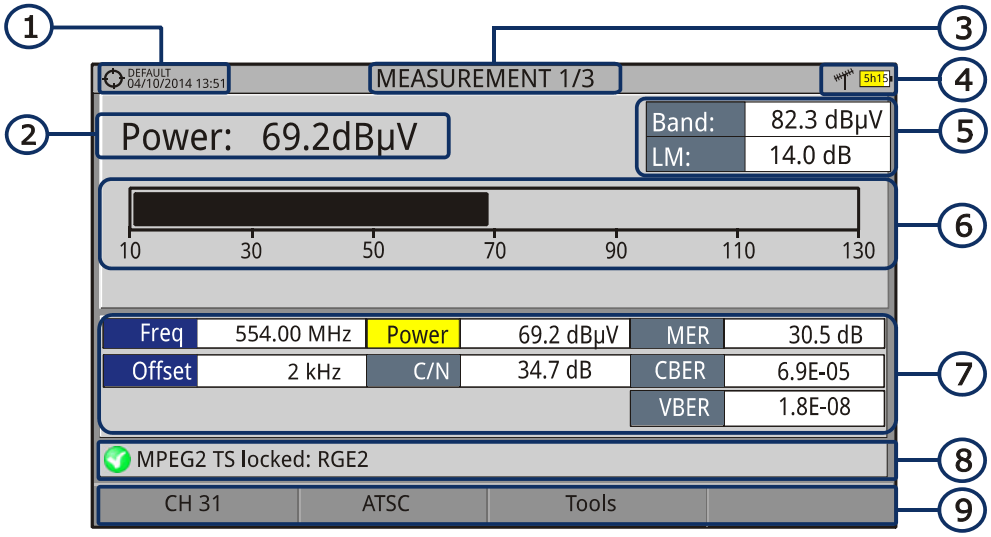


Figure 38.

1. Selected installation, date and time.
2. Measurement value of the selected parameter.
3. Number of view/total views.
4. Selected band, battery level.
5. Total power detected over the whole selected band (terrestrial or satellite). It also shows the link margin measurement. The total power can be used to know when it is close to saturation. The link margin is the margin of safety remaining for a good reception.
6. Graphical measurement of the selected parameter.
7. Measurement values for the type of locked signal.
8. Signal status (searching/locked/multiplex name).
9. Softkeys menus.

- **Joystick up/down**: It changes selected parameter.
- **Joystick left/right**: It changes channel/frequency.

MEASUREMENT 2/3: MEASUREMENT + TV + SPECTRUM

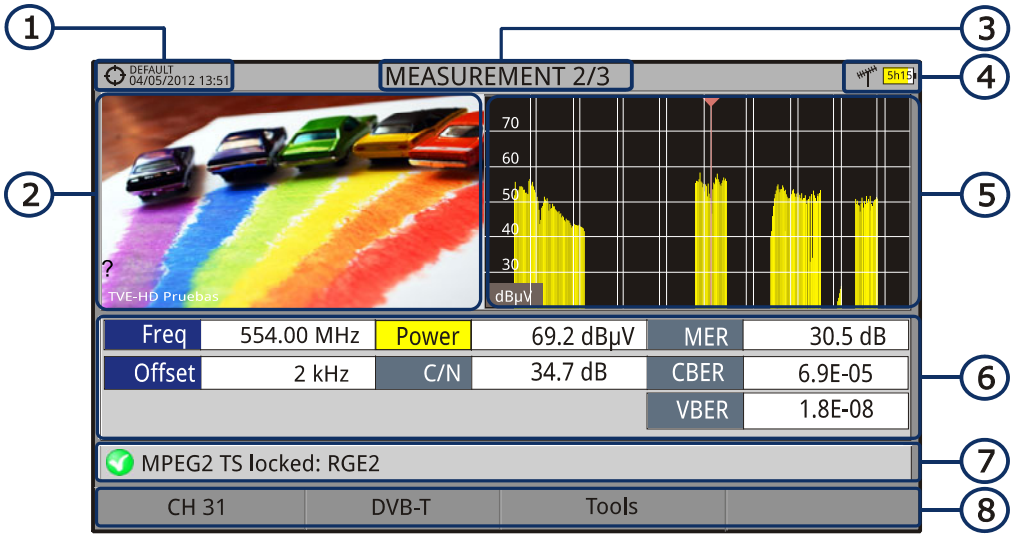


Figure 39.

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

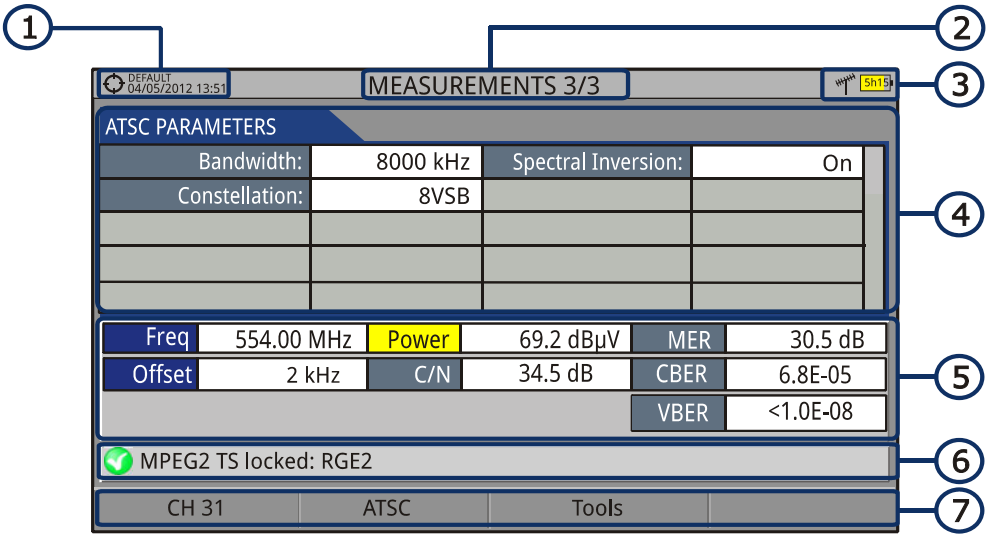


Figure 40.

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 the measurement parameters for each type of signal.

3.4 GENERIC Signal

This a special digital signal that the equipment does not demodulate. It can be used for special signals as DAB/DAB + or COFDM modulation with narrow BW.

In this type of signal the user can select the signal bandwidth by accessing the "Signal Parameters" menu on the F2 key.

The power measure and C/N ratio is calculated according to the bandwidth selected by the user. The triple cursor shows on screen the BW selected by the user.

4 SPECTRUM ANALYZER 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 ANALYZER** key that displays the signal spectrum received through the RF input connector.

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

Thanks to the auto-identification or StealthID function, the system is constantly identifying the signal it receives (for more information refer to "StealthID" function). When it detects the signal type, it locks it and displays the information.

4.2 Operation

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

Available views are:

SPECTRUM 1/3: SPECTRUM + MEASUREMENT

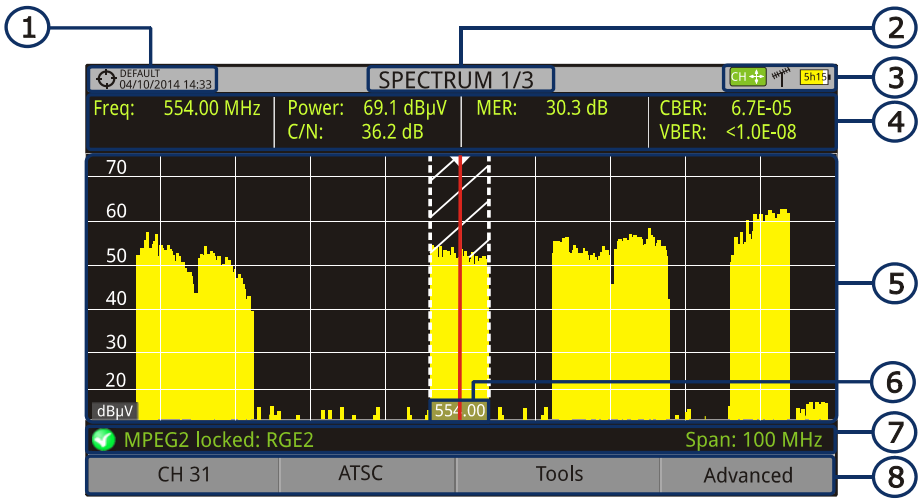


Figure 41.

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. Centre frequency and cursor. It also shows the bandwidth of a digital locked signal.
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):

  SP: SPAN change.

  FR or **CH**: Frequency change or channel change.

  MK: Marker change (if marker is ON).

SPECTRUM 2/3: SPECTRUM + MEASUREMENT + TV *

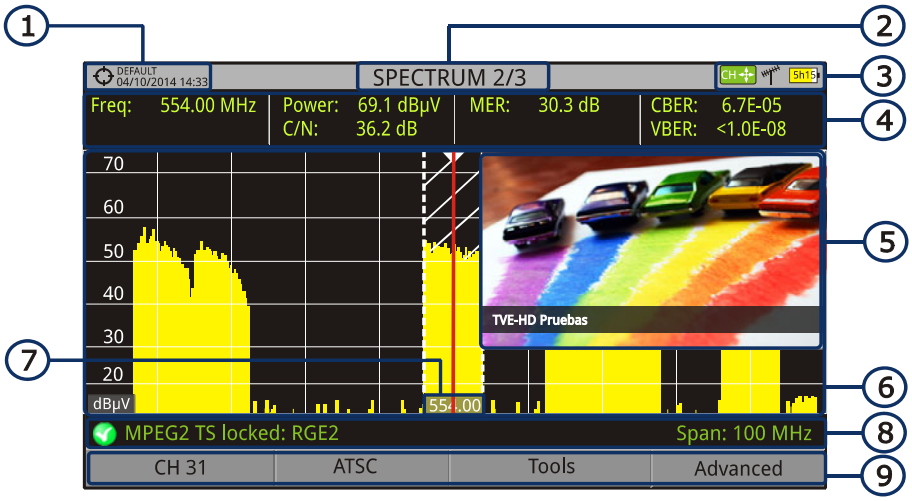


Figure 42.

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. Centre frequency and cursor. It also shows the bandwidth of a digital locked signal.
8. Signal status (searching/locked/multiplex name/selected span).
9. Softkeys menus.

- **Joystick up/down**: It changes the reference level.
- **Joystick left/right** (depending on the joystick active mode):

  SP: SPAN change.

  FR or **CH**: Frequency change or channel change.

  MK: Marker change (if marker is ON).

* Only available for **digital channels**.

SPECTRUM 3/3: FULL SPECTRUM

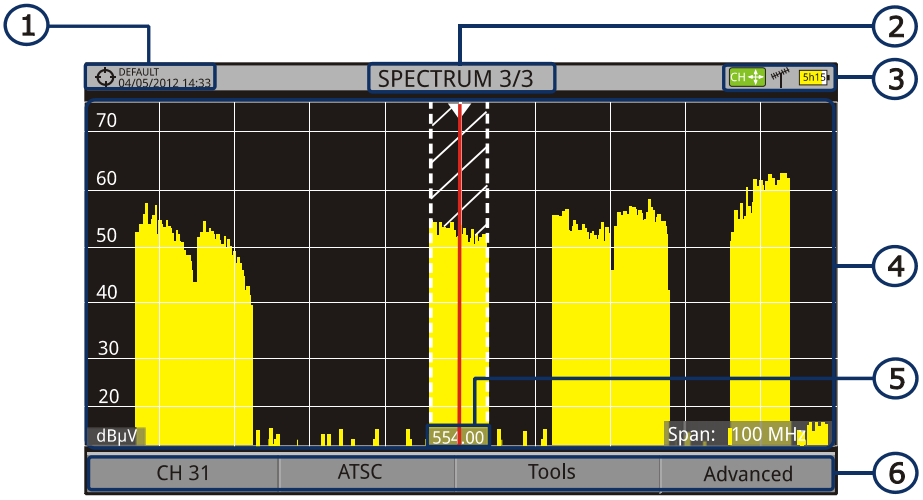


Figure 43.

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. Centre frequency and cursor. It also shows the bandwidth of a digital locked signal.
6. Softkeys menus.

- **Joystick up/down**: It changes the reference level.
- **Joystick left/right** (depending on the joystick active mode):

  SP: SPAN change.

  FR or **CH**: Frequency change or channel change.

  MK: Marker change (if marker is ON).

4.3 Full Spectrum screen description

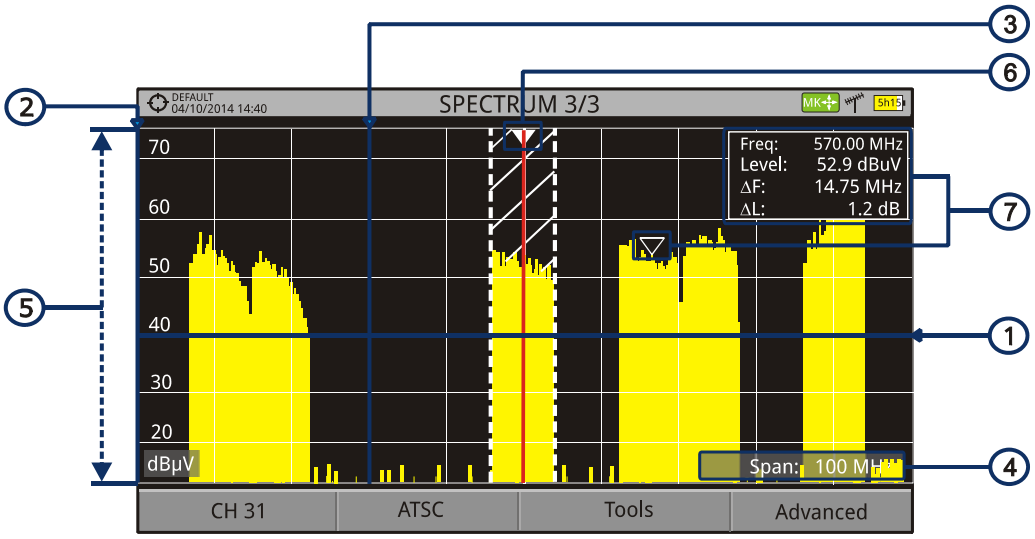


Figure 44.

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" option in the 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.

When a digital signal is detected, there is a triple cursor that shows the frequency for the signal locked and two vertical lines that shows the bandwidth of the digital carrier.

In the case of a GENERIC signal, the bandwidth shown is the one selected by the user on the "Signal Parameters" menu when pressing the F2 key.

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.

This option can be enabled using the "Marker" option from the Advanced menu (F4 key). To change use the joystick (left, right) in MARKER (MK) mode.

The window Marker shows the following data:

Freq: Frequency where is placed the marker.
Level: Power level at the frequency where is placed the marker.
ΔF: Difference of frequency between the marker and the main cursor.
ΔL: Difference of power level between the marker and the main cursor.

8 **Centre frequency**

Frequency at which the screen is centered. This frequency can be set through the **Tuning** F1 menu. It also changes when moving the cursor.

4.4 Joystick Operation

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

The active mode of the joystick appears as an icon 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.

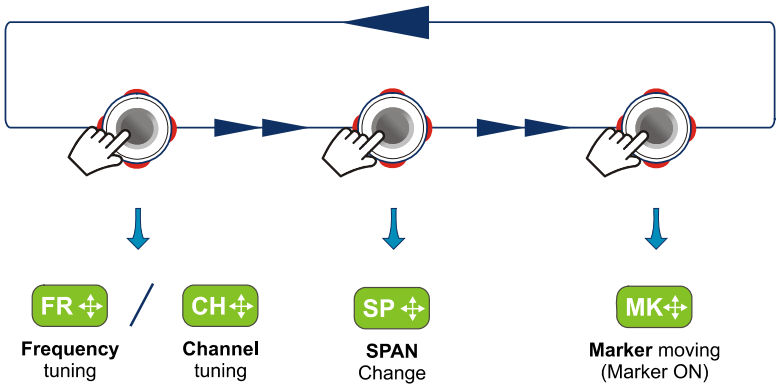


Figure 45.

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 TUNE BY F1 menu to select the type of tuning.

To show the **Marker** mode, it must be ON. 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 active mode.

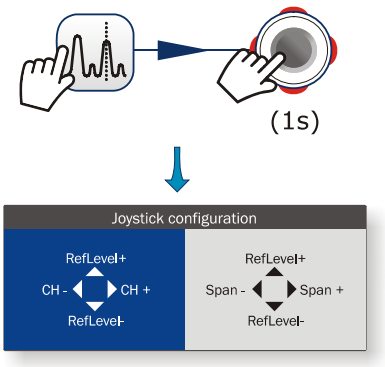


Figure 46.

4.5 Specific Options

Access by the F4 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. The **Transparence** option shows the outline in yellow and the background in a softer yellow.

- **Tone Level**: This option produces a tone that changes according to the input level of the signal so the tone is sharper if the level increases and deeper if the level decreases.

- **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).
  When the Marker is ON at the top right corner a window pops up with the following data:
  Freq: Frequency where is placed the marker.
  Level: Power level at the frequency where is placed the marker.
  ΔF: Difference of frequency between the marker and the main cursor.
  ΔL: Difference of power level between the marker and the main cursor.

- **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.

- **Min. Hold**: (Off/Permanent/Curtain). It allows the user to display the current signal with the minimum values measured for each frequency. The **OFF** option disables this function. The **Curtain** option displays the minimum values in green for a moment with the current signal. The **Permanent** option maintains minimum signal on the screen. This option is useful for detecting interferences in TV cable or identify deterministic interference in analog and digital channels.

- **Persistence**: When active, the signal is displayed on a colored background. The signal prior to current signal persists for a while before disappearing so the user can see how the signal changes easily.

- **Filter Type**: (Max / RMS). It allows the user to select between maximum peak detector or RMS detector. The maximum peak detector is mainly used for analog modulated signals, while the RMS option is the right choice for digital modulated signals. The MAX peak detector is mostly used for analog modulated signals, while the RMS is the proper choice for digital modulations. The maximum peak detector causes the noise floor to rise, according to the RMS to peak ratio. That same effect causes digital signals to apparently grow in level when maximum peak detector is used.

- **Vertical Range**: It allows to adjust the vertical scale on screen. Available values are 1, 2, 5 and 10 dB per division.

- **Dashed BW**: When it is ON the channel bandwidth area is hatched by lines.

- **Reference**: (Set / Clear). It memorizes the current trace on screen, which can be used as a reference for further comparison. It may be also very helpful for visually measure the gain or attenuation in a TV distribution network. To delete the reference, select the "clear" option. It can also be activated by a short press on the export key in the Spectrum Analyzer mode.

To edit or select any parameters of these described above, follow these instructions:

1. Place over and press on the option.
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 gets a black blackground.
4. Move up/down to select one option. To move between figures press right/left and to change it press up/down.
5. When finished press again or any function key to exit.

4.6 Locking a signal

1. Connect the cable with the input signal to the **RF** 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. A triple cursor shows the detected BW for a digital carrier.
7. The equipment automatically detects transmission parameters of the signal and makes the corresponding measurements.

4.7 Satellite Identification

The spectrum analyzer makes easier the fieldwork for engineers when working with SNG mobile units and VSAT communications, since it allows adjusting transmission-reception systems. It also has several functions to identify satellites that avoid any possibility of error. When the signal is locked it identifies the satellite and shows on screen its name.

Often satellite operators request to look for the "Beacon" signal, as a method of satellite identification. This signal is easily identified by the equipment, because it has high resolution, high sensitivity and short sweep times.

Below are two BEACON screenshots signals, with a little span and a bandwidth of 100 kHz resolution, all with a sweep time of 90 ms.

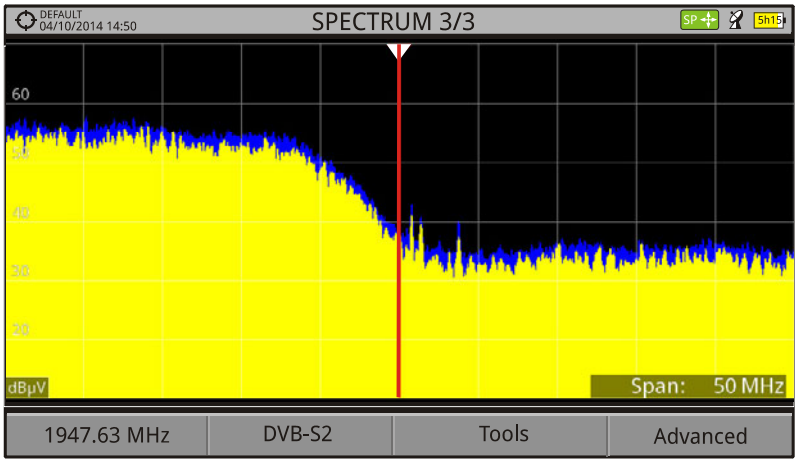


Figure 47.

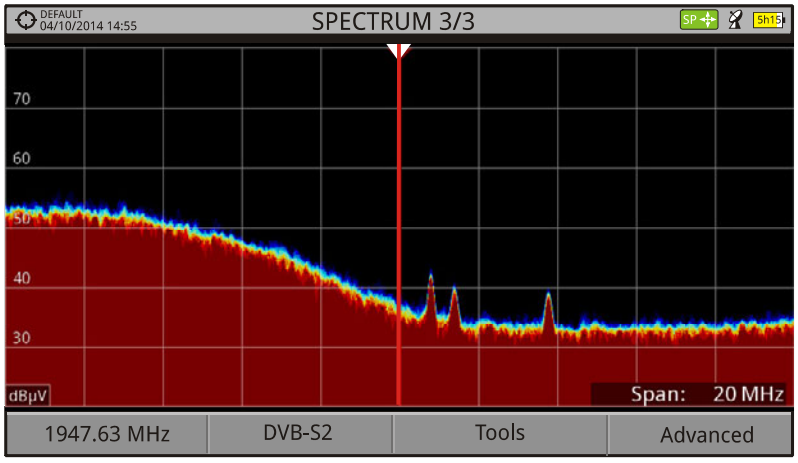


Figure 48.

More data for installations with satellite signals in annex "How to point a dish antenna."

5 TV MODE

5.1 Introduction

On the left side of the front panel there are three functions keys, 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, thanks to the StealthID function of automatic identification, automatically identifies and demodulates the 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. If it locks the signal, 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 and it shows the icon for scrambled signal. In the case of an analog 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.

5.3 Screen Description

5.3.1 TV MODE: TV views

Views for TV mode are:

TV 1/3: FULL TV

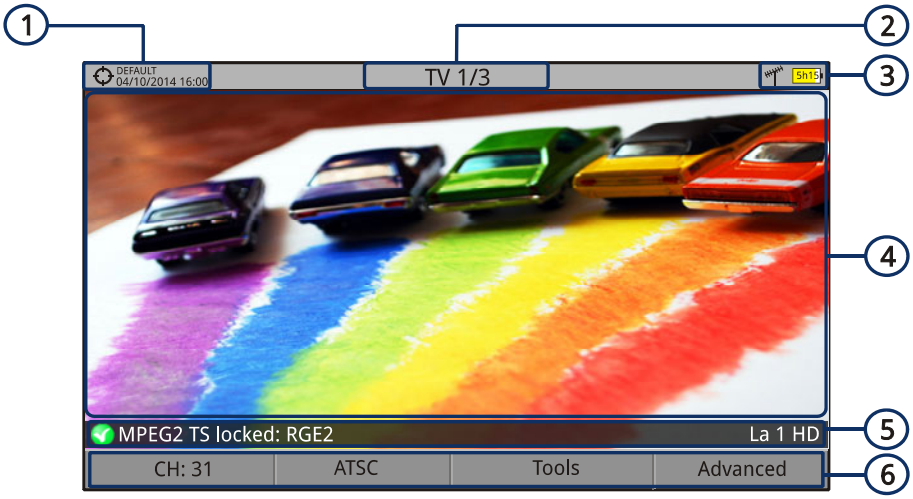


Figure 49.

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) and name of the selected service.
6. Softkeys menus.

- **Joystick up/down**: It changes service.
- **Joystick left/right**: It changes channel/frequency (depending on the tuning mode).

TV 2/3: TV + SPECTRUM + MEASUREMENT

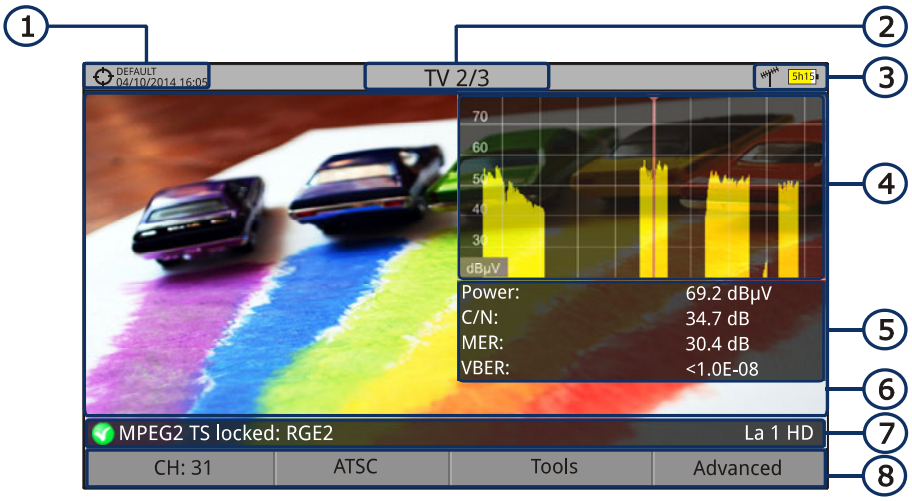


Figure 50.

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) and name of the selected service.
8. Softkeys menus.

- **Joystick up/down**: It changes service.
- **Joystick left/right**: It changes channel/frequency (depending on the tuning mode).

TV 3/3: SCREEN TV + SERVICE DATA

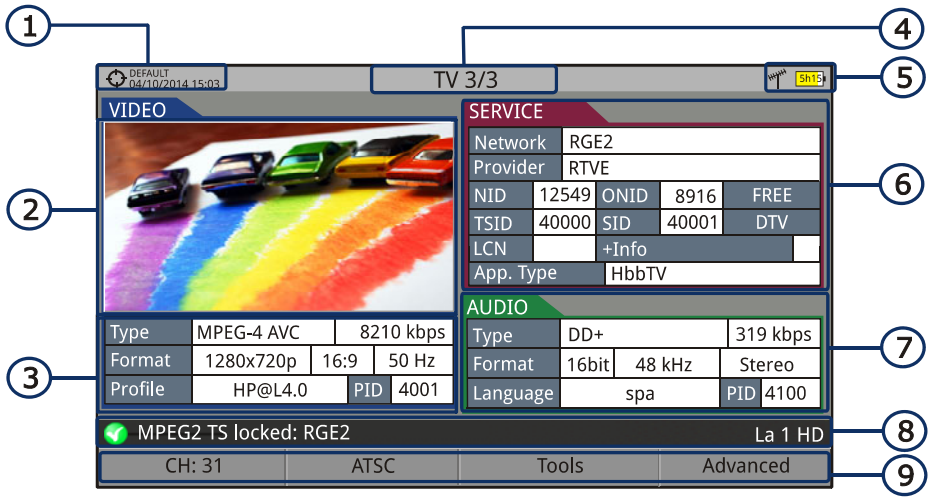


Figure 51.

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.
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.
   - ► **App. Type**: Type of detected interactive service (HbbTV, MHP, MHEG...).
   - ► **LCN**: Logic Channel Number. It is the first logic number assigned to the first channel in the receiver.
   - ► **+Info**: Additional service information.
   - ► **FREE/ SCRAMBLED**: Free/scrambled transmission.
   - ► **DTV/DS**: 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 Signal status (searching/locked/multiplex name) and name of the selected service.

9 Softkeys menu.

► **Joystick up/down**: It changes service.

► **Joystick left/right**: It changes channel/frequency (depending on the tuning mode).

5.3.2 TV MODE: Radio views

Radio views are:

RADIO 1/3: AUDIO RADIO

Figure 52.

RADIO 2/3: AUDIO RADIO + SPECTRUM + MEASUREMENTS

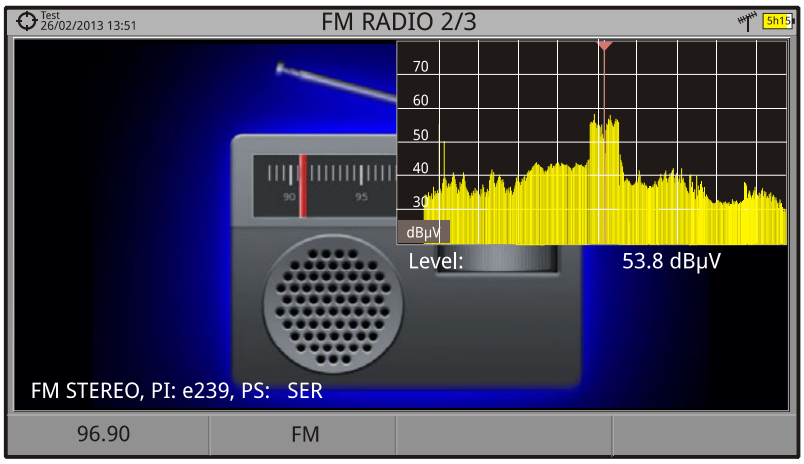


Figure 53.

RADIO 3/3: AUDIO RADIO + RDS DATA

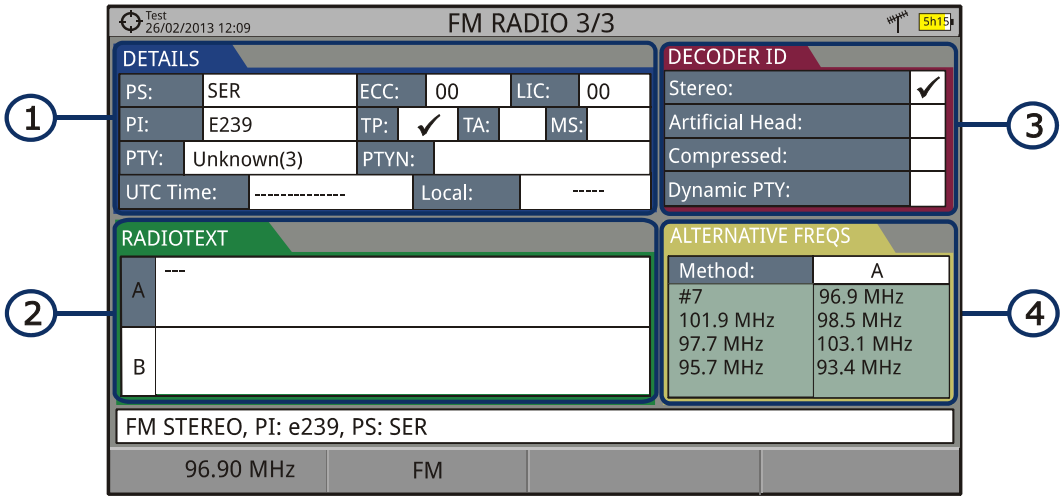


Figure 54.

It shows the most representative RDS data. RDS data are:

1 **Details**: It has the following fields:

- **PS**: Program service.
- **PI**: Program Identification.
- **PTY**: Program type.
- **UTC Time**: Universal time.
- **Local**: Local time.
- **ECC**: Extended country code.
- **LIC**: Language Identification Code.
- **TP**: Traffic program.
- **TA**: Traffic announcement. Music
- **MS**: switcher.

2 **Radiotext**: Extra text information.

3 **Decoder ID** (decoder identifier): It identifies different operation modes of the decoder.

4 **Alternative freqs**: It shows alternative frequencies and total number.

5.4 Specific Options

► Analog Signal

This option is available only if the detected or selected signal is ANALOG.

Pressing the F3 key it allows selecting the type of analogue input, between antenna (via RF connector) and external (via V/A input connector).

To get an external analog signal use the A/V input (see figure 5).

► Aspect Ratio

This option is available only if the detected or selected signal is ANALOG. It allows the user to select the image aspect ratio (4:3; 16:9).

► Advanced

It gives access to two options:

- **Audio**: It allows the user to select among the audio tracks available.
- **TS Data**: It shows the IRG data descriptor. If the signal contains this carrier identifier, this option will be enabled. If the signal does not contain this identifier, the option will be disabled (for more information refer to section "IRG descriptor").

5.5 IRG Descriptor

The analyzer is compatible with IRG recommendations and it can extract the Carrier ID information and display it conveniently showing all the details.

This information is useful to identify the interference, thanks to the carrier ID. This identifier provides enough information to detect the interference source (customer name, contact data, geo coordinates, etc.) and allows the operators to communicate directly with the RFI source to resolve the incident.

IRG descriptor function is available only for signals containing the carrier identifier. To access this feature:

1. Connect the **RF** input signal to the equipment.
2. Tune the channel that produces interferences.
3. Access to **TV** mode.
4. Press the **Advanced** menu F4.
5. Select the **TS Data** option. If the signal has a carrier identifier, this option is enabled. If the signal does not contain this identifier, this option is disabled.
6. The **IRG descriptor** window is displayed with the data about the provider (see figure below).

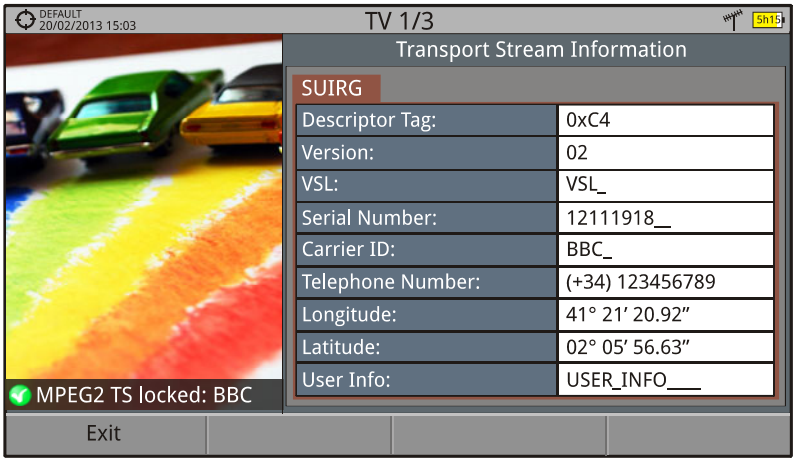


Figure 55.

6 GENERAL MENU OPTIONS

At the bottom of the screen four menus are accessible via the softkeys or programmable 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.

In general, these options are the same for all modes (Measure, Spectrum Analyzer and TV).

The specific options for a mode are placed in the menu "Advanced" pressing the 

key. For more details about these options go to section "Specific Options" in the chapter.

Next each one of these menus is described.

6.1 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 by" option.
- **Channel Plan**: This option allows the user to select a channel plan from the ones available for the current installation.
- **Tune by**: It allows the user to select between tuning by channel (selecting a channel or channel by channel with the joystick) and tuning by frequency (selecting a frequency or step by step with the joystick).

- In case of **tuning by channel**, 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.

- When using tune by channel on satellite, the polarity parameters (horizontal/vertical and left/right) and satellite band (high/low) are selected automatically by the equipment, according to the channel plan enabled and cannot be changed by the user. To change these parameters, the user may switch to frequency tuning. But the user can change the voltage output while in a channel plan, as long as none has been defined in that same channel plan. For instance, if a standard channel plan is being used like the CCIR, there is now need for switching to frequency tuning mode or make special channel plans for using active antennas.
- 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.

► **Centre Frequency**: This option is available only for the Spectrum Analyzer mode. 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.

► **Reference level**: This option is available only for the Spectrum Analyzer mode. 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 pushing the joystick up or down.

► **Span**: This option is available only for the Spectrum Analyzer mode. 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.

► **View all services**: This option only appears if the **Database services** option is enabled in the **Preferences** menu.
This option displays a window with a list of services that have been detected in the current installation.
The list shows service name, provider, SID (stream identifier) and an icon that shows its type (radio, tv) and if it is scrambled. When hovering on the service for one second it displays a hint window with more information.
If user presses the joystick on a service, it will access that service.
When disabling the **Database services** option, all services in the installation will be deleted from the list.
At the bottom of this option are shown the softkeys with these functions:

Cancel: It exits the option.

Filter List: It shows several options to filter the list of services: By access (Free Only, Scrambled Only, All); By type (All, TV, Radio); Search by name (filtered by the name); Reset list (it restarts the list as at first) Service filtering is persistent until reseting.

Page Up: It jumps one page up.

Page Down: It jumps one page down.

6.2 F2: Signal Parameters

Access by the F2 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. Press joystick to select the standard or any function key to exit without selecting.

► **View Advanced Parameters**: It shows the TPS parameters (Transmission Parameters Signalling) for the locked signal according to the modulation standard. This option is available only when these parameters are detected.

- The remaining transmission parameters are detected demodulating the locked signal.
- In case of a DVB-S2 signal, there will be some special settings for this type of signal. They are:

  Physical Layer Scrambling or PLS is used in DVB-S2 as a way to improve data integrity. A number called the "scrambling sequence index" is used by the modulator as a master key to generate the uplink signal. This same number must be known by the receiver so that demodulation is possible.

  Most satellite transponders use PLS 0 as a default value but there are some transponders that use other values.

  If it is a multistream signal, it will appear an option that enables filtering by the input stream identifier (ISI) and to select the stream to demodulate.

  In case of a Generic signal, the menu shows an option to select the signal bandwidth.

6.3 F3: Tools

Access by the F3 key. It shows the Tools menu. Tools that are not available for the current locked signal are disabled. Tools are:

- **Select Service:** It displays the list of services available in the multiplex tuned, with the service name, icons that identify the service type, SID (stream identifier) and LCN (logic channel number).

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

	Digital TV service	HD	**High Definition** TV service
	Digital radio	1010	**Data**
	Scrambled service		

- **TS Analyzer***: This tool allows the user to make a comprehensive analysis of the Transport Stream (TS) contained in a tuned signal.
- **TS Recording***: This tool can capture in real time the received transport stream (TS) contained in the received signal.
- **Signal monitoring**: This tool allows the user to monitor a signal by measuring its power, MER and C/N. All this data, can be downloaded to a PC and exported to a file for later analysis.
- **Explore channel plan**: It explores the selected channel plan. Tune by channel must be selected.
- **Constellation**: It displays the constellation of the locked signal.
- **LTE Ingress Test**: It enables the detection of signal interferences coming from mobile phones.
- **Attenuation test**: This feature allows the user to easily check the response of the telecommunications installations before antennas and headers are working.
- **Echoes**: It detects the echoes that may appear due to the simultaneous reception of the same signal from several transmitters.

*only available for **TE-3000**

- **Datalogger**: It creates a file in which are stored measurements. This file belongs to the selected current installation.
- **Spectrogram**: This function shows a graphical representation of the spectrum superimposed over time of a channel or frequency selected by the user.
- **Discover FM Stations**: This function scans the FM band and creates a FM channel plan from scratch. Scanned frequency range is from 87 to 108 MHz.
- **Field strength**: This tool allows the equipment to measure as a field strength meter.

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

7 TOOLS

7.1 TS Analyzer*

7.1.1 Description

This tool allows the user to make a comprehensive analysis of the Transport Stream (TS) contained in a tuned signal. The signal can be received through any of the equipment inputs: TS -IN, RF, IP, CAM module and terrestrial and satellite demodulators. This feature gives a great flexibility to process the signal in multiple ways, so the equipment becomes a portable laboratory for the analysis of digital signal.

This tool can be of great interest to research centres, broadcasting operators, universities or training centres as well as to installers that want to expand their technical knowledge or training in analysing the smallest unit of a digital signal transmission.

This tool has three main functions:

- **Tables**: It shows all the metadata carried in the corresponding PSI/SI tables in a tree diagram so user can deploy its content to the detail.
- **Bitrates**: It shows the bitrate information for each program in real time, in a graphical way and also shows the percentage contribution of each one to the total TS.
- **Alarms**: It shows a list of alarms that warn about any possible failure in the TS layer according to the three priority levels described in the TR 101 290 measurement guidelines by the DVB group.

7.1.2 General Operation

The Transport Streams (TS) Analyzer tool is available for all DIGITAL signals.

1. Connect the digital signal to any input of the equipment.
2. Select the channel or frequency and tune the signal.
3. Press the Tools key F3.
4. Select the TS Analyzer option.
5. A drop down menu appears with three options: Tables, Bitrates and Alarms. Select your option.

*only available for **TE-3000**

6 While starting, the TS Analyzer takes few seconds to detect and identify the TS signal, and then the results appear on screen.

7 An error message pops up if the signal does not contain any TS or if the TS cannot be found. In this case, check the signal.

The following describes in detail each one of these functions.

7.1.3 Table Analyzer

► **Description**:

This function displays the TS tables as they are captured. The system shows the tables in a tree diagram for easy browsing with the joystick. All components and contents of tables can be consulted by deploying the nodes. So the user can analyse the tables and see in detail what is being transmitted and if the information is properly encapsulated. This tool requires detailed knowledge about the contents of these tables.

► **Screen Description**:

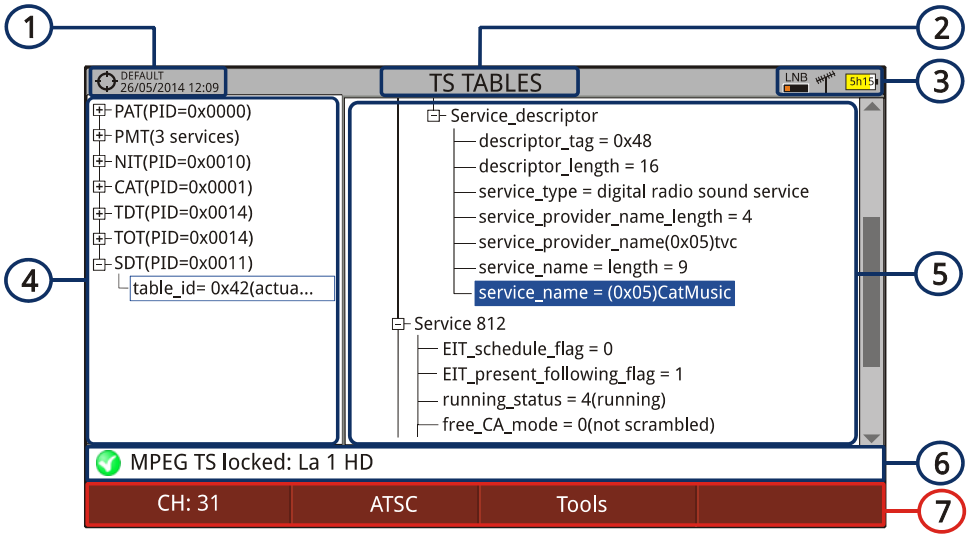


Figure 56.

1 Selected installation; date and time.

2 Selected function.

3 Selected band; battery level.

4 Main Table Tree.

5 Detail TableTree.

6 Signal status (searching/locked/multiplex name).

7 Softkey menus.

- Joystick **left/right**: It changes between Main menu tree and Detail menu tree.
- Joystick **up/down**: It moves along the tables in the tree.
- Joystick: Pressing on a node with the symbol ⊞ deploys the tree. Pressing on a node with the symbol ⊟ it closes the tree.
- Advanced F4: It shows the "**Restart Analysis**" option which makes a new detection and updating of the TS tables.

- **Tables Description**:

  Below is a brief explanation of the main tables that can appear in the detection of a TS. For more details we recommend to consult the these guidelines ETSI TR 101 211.

  There are two generic groups of tables:

  - **PSI** (Program Specific Information) **Tables**: These tables are specified by the MPEG-2 standard worldwide. They are used by all the digital transmission standards. The TS analyzer detects all the PSI tables.
  - **SI** (Service Information) **Tables**: These tables are specified by the standard used in the area or country (in this case DVB). These tables are more detailed and imply a higher level of information relating to the PSI tables. The TS analyzer detects the most important SI tables.

    The PID (Packet Identification) code next to the name of the table is a 13-bit code that identifies each packet type and therefore to what kind of table corresponds.

- **PSI Tables**:

  PSI tables are:

  - **PAT** (Program Association Table): It is a master table that lists all services found in the TS being transmitted. It also points the table where are specified each one of the services.
  - **PMT** (Program Map Table): It is a table that identifies all the components within a service (video, audio and/or data).
  - **NIT** (Network Information Table): Optional table with information about TS and multiplex of a given network. The content in detail is described in the tables used by the digital standard (DVB in this case).

- **CAT** (Conditional Access Table): Table that controls the scrambling of a service.

► **SI Tables**:

Most important SI tables are:

- **NIT** (Network Information Table): It is a master table used by the broadcasting network to manage the services. It provides logic network info by grouping several TS together and adding tuning information for all network services. In the case of a satellite provides information about its channels. It also contains the LCN descriptor that provides information to order the services.

- **BAT** (Bouquet Association Table): It is a table containing information required to group a set of services or content, which is related for commercial reasons (packs of a particular distribution platform, packs of a particular film genre or sport, etc.).

- **SDT** (Service Description Table): It is a table with a description of each service, providing a service name and other related information such as head-end and service details, if it is scrambled or not, if it is radio or tv, the provider, etc.

- **EIT** (Event Information Table): Table that provides information on events (program or programs being broadcasted) in a given service. It is the basis for building an EPG (Electronic Program Name), the program guide shown on TV.

- **TDT** (Time and Date Table): Table that provides UTC (Universal Time Coordinated) coded as MJD (Modified Julian Date) that means, time and date at the current moment and universal.

- **TOT** (Time Offset Table): Table that provides the time offset related to UTC in order to calculate the local time. It also provides information on daylight saving time changes.

7.1.4 Bitrate Analyzer

► **Description**:

This function shows the TS bitrate in a graphical way, and also by numbers and percentage. A pie graph, which is updated in real time, shows the evolution of the bitrate distribution for each one of the services in the tuned multiplex. It also allows selecting any of the services to check its composition, which is also shown in bar graph.

This function allows the user to compare between television services and to check the bitrate used by each one. User can observe dynamically the variation that when changing the transmission content. Another use may be to identify the amount of null packets and therefore to know the amount of available payload by the multiplex.

► **Screen Description**:

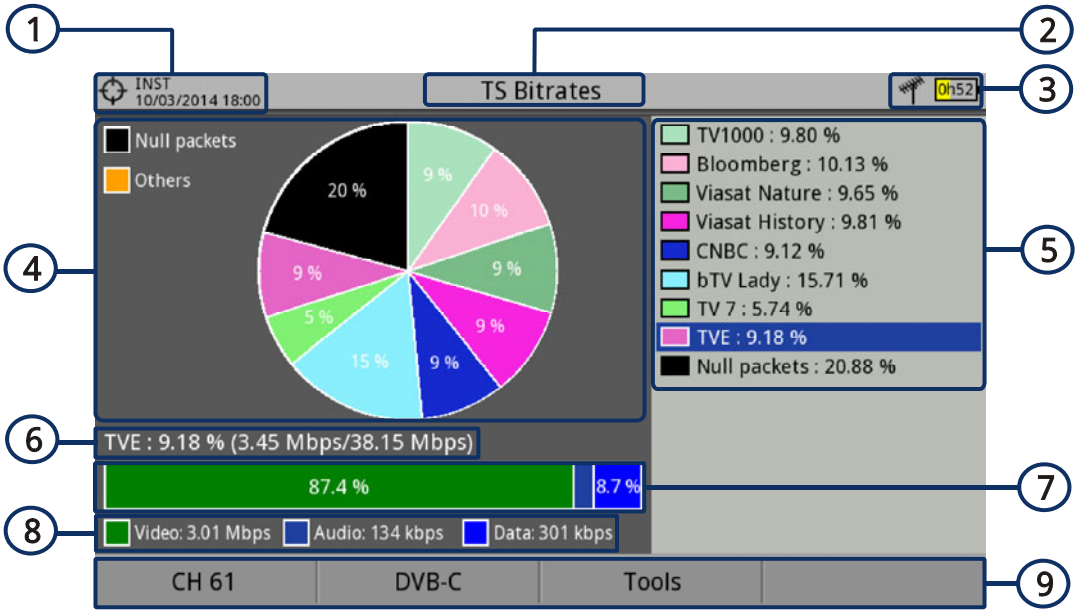


Figure 57.

1. Selected installation; date and time.
2. Selected function.
3. Selected band; Battery level.
4. Pie Chart. The graph represents and shows the percentage of each service on the total bitrate for the tuned channel. The colors of the graph correspond to the services detected. They are shown on the right side of the screen. Services with a very low percentage are grouped with the legend "Others".
5. Detected services. It shows all the services identified in the tuned multiplex and the percentage of each service relating to the total bitrate.
6. Detail of the Selected Service: Service name and percentage related to the total bitrate (bitrate/total bitrate).
7. Bar graph representing the bitrate percentage for each component (video, audio, data).
8. Video bitrate, audio and data.
9. Softkey menus.

- ► Joystick **up/down**: It moves among detected services.
- ► Joystick: Pressing on a service it will show details of the selected service.
- ► Advanced F4: It shows the "**Restart Analysis**" option which makes a new detection and updating of the TS tables.

7.1.5 Alarms

► **Description**:

This tool monitors the TS. It is a dynamic tool as it displays in real time the evolution of the TS and the alarms that may occur. The priority levels of alarms are set according to the recommendations by technical standards TR 101 290.

► **Screen Description**

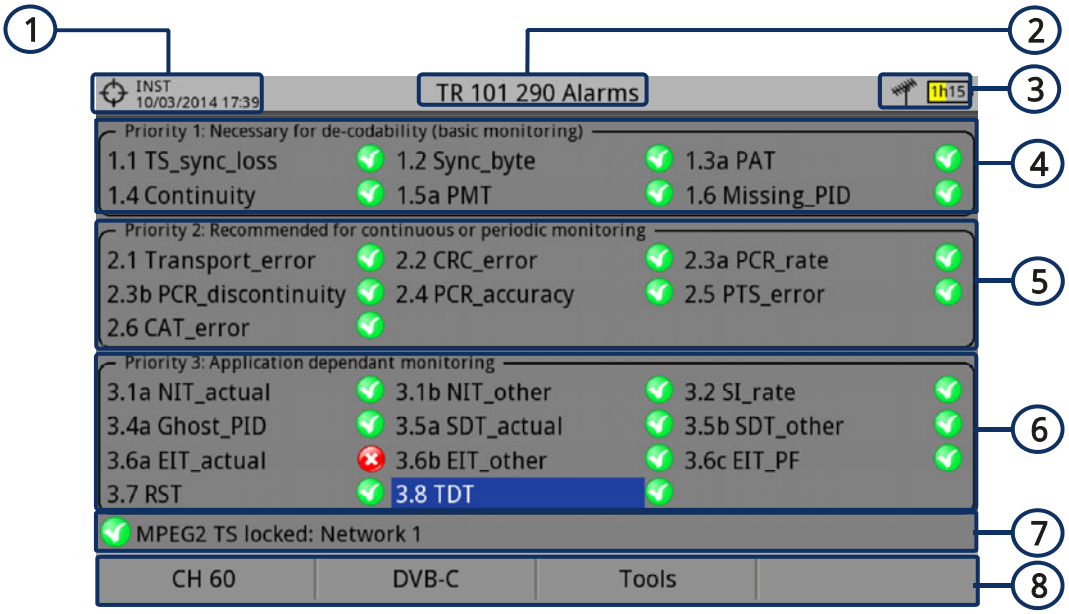


Figure 58.

1. Selected installation; date and time.
2. Selected function.
3. Selected band; Battery level.

4 **Priority 1**: High level security parameters. These are alarms that make the TS vulnerable and avoid them to be received. The parameters at this level must be correct for the TS to be decoded. If any of these parameters fails the information cannot be recovered and therefore the signal cannot be decoded.

5 **Priority 2**: Medium level security parameters. These are alarms recommended by DVB for continuous or periodic monitoring of TS and ensure quality of transmission parameters. The alarm in any of these parameters does not prevent the receiving but it is indicative of a possible problem.

6 **Priority 3**: Low level security parameters. These are parameters that are not harmful but are required for getting the most from the receiver capabilities. They ensure that the receiver can extract in the best conditions the TS information especially when there are additional features such as the program guide or the services list.

7 Signal status (searching/locked/multiplex name).

8 Softkey menus.

► Joystick **up/down**: It moves among alarms and highlights one on blue background.

► Advanced F4: It shows the "Restart Analysis" option which makes a new detection and updating of the TS tables.

► Icons are:

 OK.

 Warning.

 Error.

7.2 Transport Stream Recording *

7.2.1 Description

This tool captures in real-time transport stream received by any of its inputs: RF, ASI or IP, for example a DTT channel. The recording is stored in an internal dedicated memory of 1 GB. After recording, it can be played on the equipment itself as if it were a live received signal. The recording time depends on the bit rate of the transport stream, but by reference to a DVB-T signal of 19.9 Mbps, six minutes of transmission can be stored.

7.2.2 Operation

Transport Stream recording is available for all **DIGITAL** signals.

To access the **Transport Stream recording** tool:

1. Connect the signal to any of the equipment inputs.
2. Access the **SETTINGS** menu and in the **Source Signal** option select between IPTV or RF.
3. Access the **SETTINGS** menu and in the **Decoder TS Input** select from where comes the transport stream: RF, IPTV or ASI Input.
4. Press F3: Utilities and select the option TS Recording.
5. It shows the screen for TS recording / playback.
6. Start recording by pressing the **RECORD** key.
7. End recording by pressing the **STOP** key.
8. To play the recorded transport stream press the **PLAY** key.
9. During the playback of the transport stream it can be analyzed by the TS Analyzer tool as if it was received live. All services encapsulated in the transport stream are also available in the TV mode.
10. When playback ends verify that the Decoder TS Input option in the Settings menu is properly set in order to receive the corresponding type of signal.

*only available for **TE-3000**

- Only one transport stream can be recorded, regardless of size.
- When a new transport stream is recorded, the previous one, if any, is deleted.

The **TS Recording** screen is described below:

Figure 59.

1. Selected installation; date and time.
2. Selected band; Battery level.
3. Recording / playback image.
4. Recording / Playback time elapsed.
5. Control Keys:

   : Recording.

   : Rewind.

   : Stop.

   : Forward.

   : Play.

6. File information window that reports about file duration, the recording date and maximum bit rate.
7. This window reports about the recording source.

8 This window reports about available space and total space.

9 Softkey menus.

► **Joystick Left/Right**: Navigation through the control keys.

7.2.3 Menu options

In the bottom of the screen are two options accessible via the softkeys.

F1 It exits the tool.

F2 It erases the internal memory dedicated to record transport stream, prior a confirmation message.

7.3 Constellation

7.3.1 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.

7.3.2 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. Press the F3 key (Tools).
4. Select **CONSTELLATION**.
5. The **CONSTELLATION** of the tuned signal appears.

Constellation screen description:

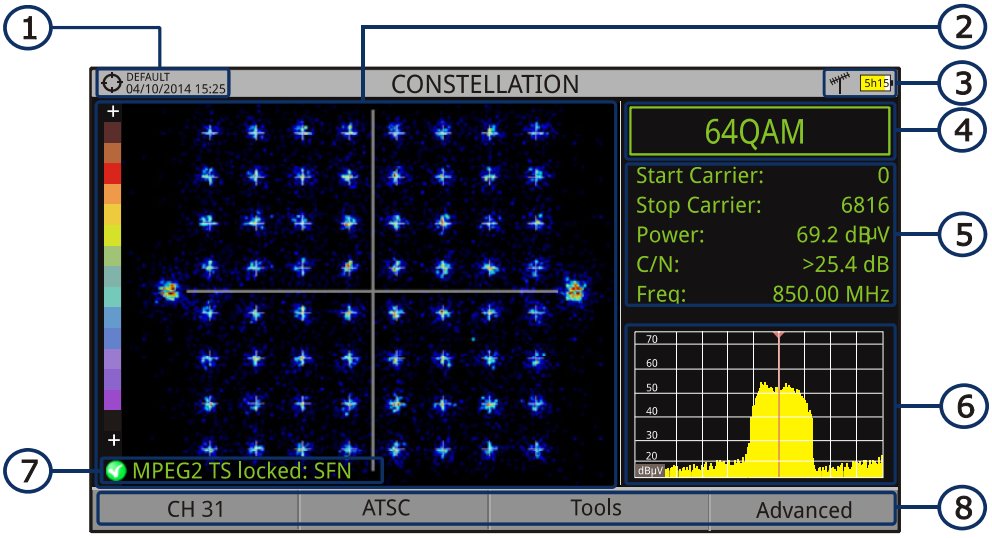


Figure 60.

1 Selected installation; date and time.

2 Constellation window.

The color 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 color 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 with respect to the full grid (see advanced menu for types of grid) 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: Start Carrier, Stop 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 (depending on the tuning mode).

7.3.3 Menu Options

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, accesses the tuning menu and allows selecting the channel plan.

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 to set the constellation tool. 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.
- **Persistence:**

  It allows the user to set the level of persistence, which is the lapse of time the signal stays on the screen before disappearing. Available options according to the persistence level are: low, medium, high or permanent.
- **Zoom:**

  It allows the user to select a quarter (I, II, III or IV) where apply the zoom in. To come back to normal view select **All**.
- **Start Carrier/Stop Carrier:**

  This option allows selecting the range of carriers to be displayed between the first and last.
- **Clear:**

  This options clears all symbols in the whole constellation window.

7.4 LTE Ingress test

7.4.1 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 measurements 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.

7.4.2 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. Press the F3 key (Tools).
4. Select the **LTE Ingress Test** mode.
5. Enable/disable the **LTE** filter pressing the key F4: Filter ON/OFF.
6. The Lte icon on the screen upper right corner means the filter is enabled.

This function displays measurements obtained with 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 enables or disables the filter.

The following describes the **LTE** display:

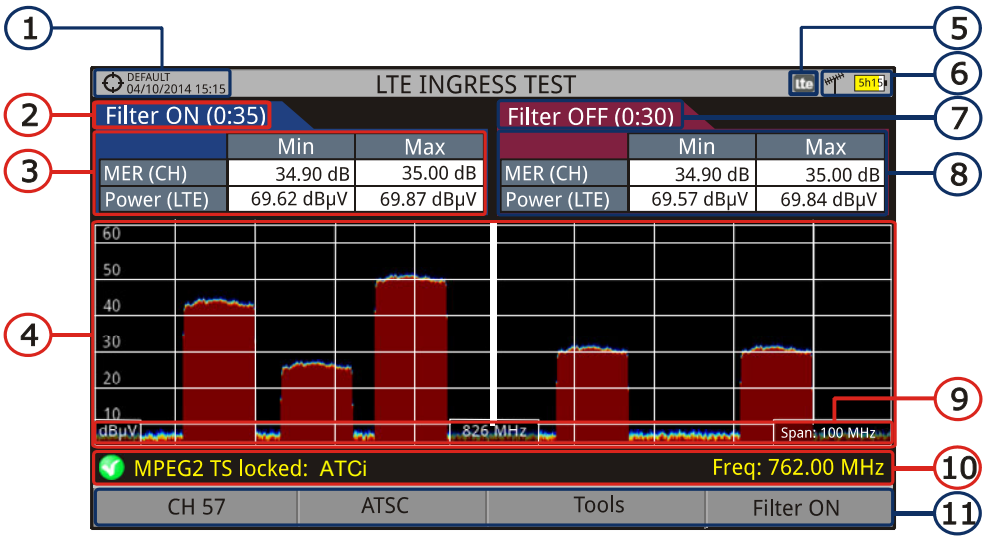


Figure 61.

1. Selected installation; date and time.
2. Elapsed time with filter ON.
3. Measurement with filter ON: MER (minimum and maximum for channel) and power (minimum and maximum power for all the signals present in the LTE band; both upload and download).
4. Signal with **LTE** filter enabled (ON) or disabled (OFF).
5. Identifier icon of the **LTE** filter ON.
6. Selected band; battery level.
7. Measuring time with filter OFF.
8. Measurement with filter OFF: MER (minimum and maximum for channel) and power (minimum and maximum power for all the signals present in the LTE band; both upload and download).
9. Measurement units/centre frequency/span (span: 10 MHz/division).
10. Signal status (searching/locked/multiplex name).
11. Softkeys menus.

7.4.3 Menu options

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 allows selecting the channel plan and the channel where apply the LTE ingress test.

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

It displays the Tools menu.

It enables (ON) / disables (OFF) the LTE filter.

7.5 Spectrogram

7.5.1 Description

This function shows a graphical representation of the spectrum superimposed over time of a channel or frequency selected by the user. During the Spectrogram, maximum and minimum of several measures and time are registered. This tool is especially useful to analyse the behaviour of a spectrum over time, because sporadic and indeterminate anomalies can be detected.

7.5.2 Operation

The Spectrogram tool is available for all signals.

1. Connect the **RF** input signal to the equipment.
2. Select a channel or frequency.
3. Select the **SPAN** within the spectrogram will be displayed.
4. Press the **Tools** key F3.
5. Select the **Spectrogram** option.
6. It shows the **Spectrogram** of the signal.
7. To exit this function press any key of mode (**TV** mode, **Spectrum** mode or **Measurement** mode). All data registered is cleaned after leaving.

While using the Spectrogram function, if the signal unlocks, timer and measurement registered will clean and they will start to register when the signal is locked again.

The following describes the **SPECTROGRAM** screen:

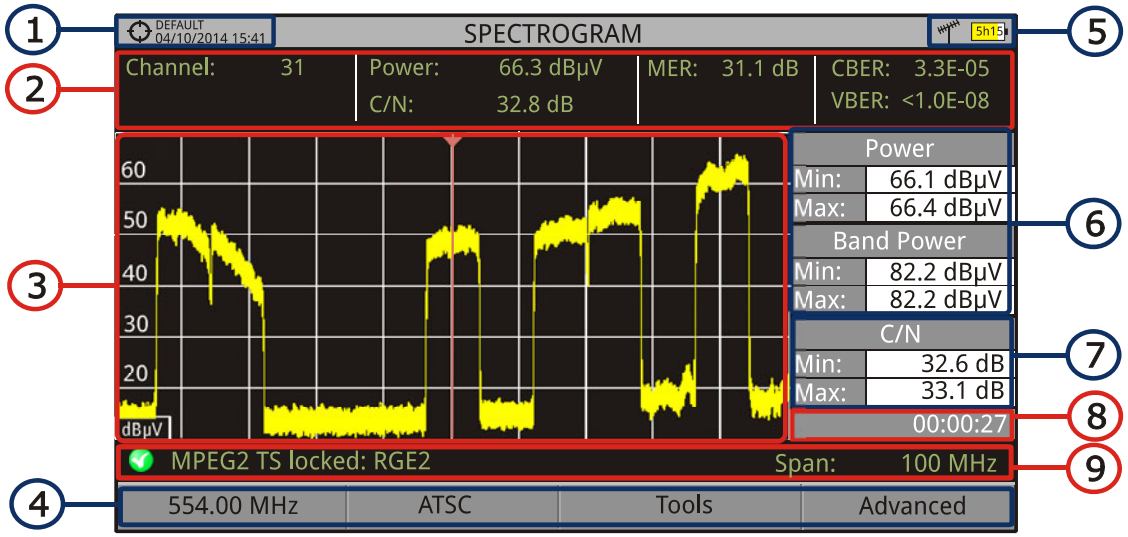


Figure 62.

1. Selected installation; date and time.
2. Measurement values for the signal tuned at the frequency/channel selected.
3. Spectrum over time at the selected span.
4. Softkeys menus.
5. Selected band, battery level.
6. Maximum and minimum values of signal power and band power over time.
7. Maximum and minimum value of the measure selected by the user in the option "User measure".
8. Elapsed time.
9. Signal status (searching / locked / multiplex name / selected span).

X Axis: Span (MHz)
Y Axis: Power

► Joystick does not have any function in this tool.

7.5.3 Menu options

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.

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

- **User measure**:
  It allows the user to select the measure to view on screen among the several available for each type of signal.

- **Details**:
  It allows the user to view on screen the date and time when maximum and minimum measures were reached. To quit this view press the key 

.

- **Clear measures**:
  It cleans the spectrogram and measures and it restarts the timer.

7.6 Attenuation Test

7.6.1 Description

This feature allows the user to easily check the response of the telecommunications installations before antennas and headers are working. It allows the user to evaluate the response along the complete range of frequencies by measuring the losses (attenuation) in the distribution of TV signals, comparing reference levels at headend output and at each house antenna plugs.

7.6.2 Operation

Attenuation test function is available for all signals.

1. In **Settings** select the terrestrial or satellite band.
2. Press the **Tools** key F3.
3. Select the **Attenuation Test** option.
4. The **Attenuation Test** function for the signal appears on screen.
5. First, set the parameters before the test, pressing the **Advanced** F4 key: Frequencies of pilot signals (pilot 0, pilot 1 and pilot 2), maximum attenuation and threshold attenuation (see more details in the next section).
6. Then it is necessary to **Set References**. This requires a signal generator. We recommend to use of one of the ATCi's signal generators: **RP-050**, **RP-080**, **RP-110** or **RP-250** (depending on the frequency band).
7. Connect the generator and the equipment where the origin of the signal distribution is in the installation (antenna, headend, etc.) or connect the generator directly to the RF input of the equipment. If necessary, the equipment can feed the generator using the "Supply Output" option from the **Settings** menu .
8. Active the signal generator and in the equipment, press the **Set Reference** key F2.
9. Once are set the references for the pilot signals, let the signal generator connected to the source point of the distribution system and take measurements in each user access point with the equipment.
10. In each measurement a message over each pilot signal indicates whether the measure "Pass" or "Fail" according to the parameters set.

11 The measurement data from the **Attenuation Test** can be saved through the **Datalogger** tool. To do this, when creating a new datalogger, in the option "Include Attenuation Tests", select Terrestrial and/or Satellite. Then, the user must perform a datalogger from the test point where he is performing the attenuation test. The data will be saved and can be checked and transferred to a PC. For more information, see "Datalogger" section under the "Tools" chapter. Also measurement data or screen image can be exported by pressing the **Export**  key (see more details in section "Export key") and after that display the images or download the data files (in XML format).

The following describes the **Attenuation Test** screen:

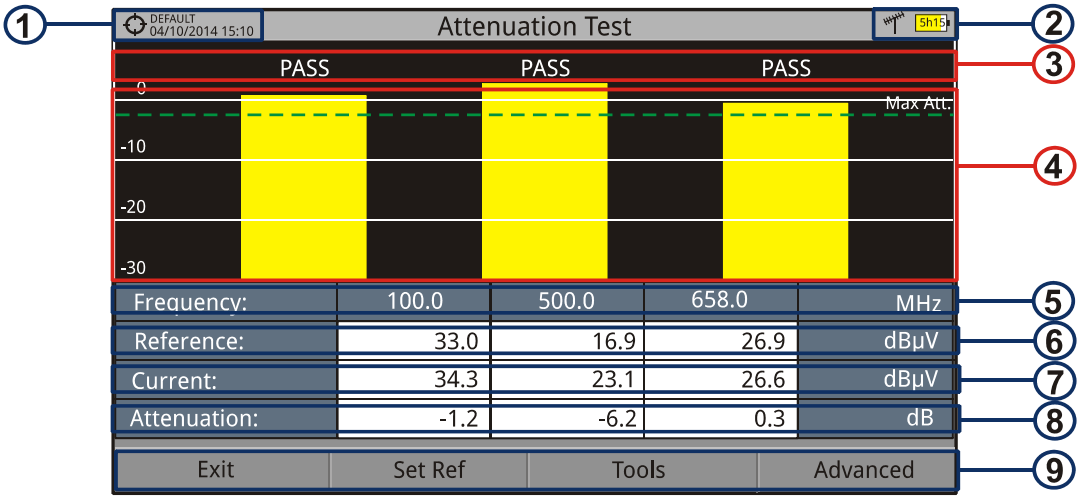


Figure 63.

1. Installation selected, date and time.
2. Selected band; battery level.
3. Status message depending on the attenuation level.
4. Power level of the signal.
5. Signal Frequency (MHz).
6. Power level of the reference signal obtained when setting the reference and used to calculate the attenuation level (dBµV).
7. Power level of the test signal at the user access point (dBµV).
8. Attenuation level (dB); Attenuation = Reference – Current.
9. Softkeys.

X-axis: Pilot signals
Y-axis: Power

- **Joystick**: The joystick does not have any function in this tool.

7.6.3 Menu Options

In the bottom of the screen are four menu accessible via the softkeys.

Exit: Exits the tool.

Set Reference: Pressing this option the current power values are captured and they are assigned as reference values.

Tools: It access the Tools main menu.

Advanced: It access the Advanced menu.

In the **Advanced** menu there are five parameters to set the attenuation test. They are:

- **Threshold Attenuation**:
  It defines the maximum difference that may exist between the pilot signal of higher level and the pilot signal of lower level. All pilot signals out of this range will be removed and not used as a pilot signal during the measurement process.

- **Maximum Attenuation**:
  It sets the attenuation level used by the equipment to show on screen if the signal passes or fails. When the attenuation level is below this value the message on screen is "**PASS**" and when it is above this value is "**FAIL**".

- **Pilot 0**:
  It defines the frequency of the pilot signal 0 (MHz).

- **Pilot 1**:
  It defines the frequency of the pilot signal 1 (MHz).

- **Pilot 2**:
  It defines the frequency of the pilot signal 2 (MHz).

7.7 Signal Monitoring

7.7.1 Description

This tool allows the user to monitor a locked signal over time, measuring its power, MER and C/N. All this data can be downloaded to a PC and exported to a file for later analysis.

7.7.2 Operation

The Signal Monitoring tool is available for all signals.

1. In **Settings** menu select the terrestrial band.
2. Access the **SPECTRUM** mode and tune the signal for monitoring.
3. Press the **Tools** key F3.
4. Select the **Signal Monitoring** option.
5. The **Signal Monitoring** function appears on screen.
6. Before starting the monitoring, access the **Configuration** option in the **Advanced** menu F4 for settings (more details in next section).
7. After settings, access the **Advanced** menu F4 and press on **Start** to start the signal monitoring.

   In **Automatic** mode, the equipment takes samples automatically. In **Manual** mode each time the user presses the joystick the equipment takes a sample.
8. Access the **Advanced** menu F4 and press on **Stop** to finish the signal monitoring. Data obtained is automatically stored.
9. Access the data by pressing the **Installation List** key to check that the monitoring data file has been saved. This file is a "Data Capture" type. To manage the data, see below the section "Data File Processing".

7.7.2.1 Settings

User can adjust some parameters on the Signal Monitoring:

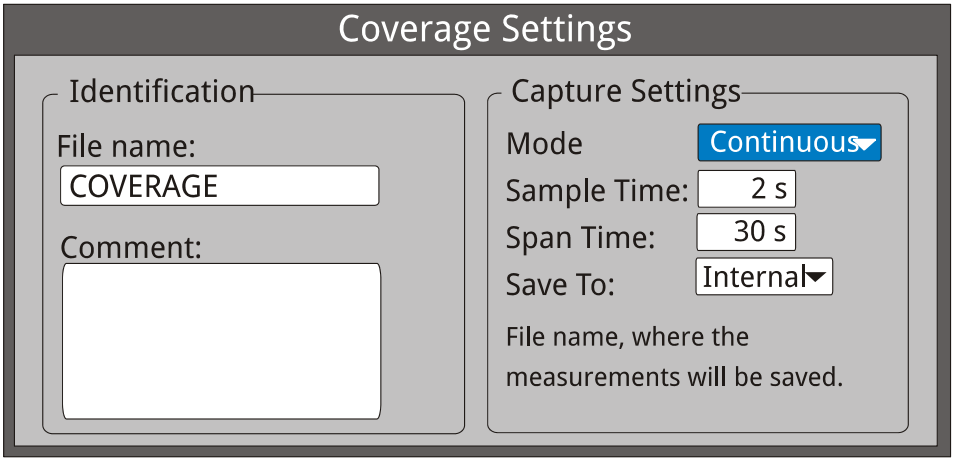


Figure 64.

- **File name**:

  User can give a name to the file where data is saved. All measurement that can be seen in the MEASUREMENT 1/3 screen (frequency, power/level, C/N, PLP identifier, MER, CBER, LBER and LM) will be stored on the data file. Be sure to change the file name when starting a new signal monitoring. If not, new data file will be saved on the last one.

- **Comment**:

  User can write some comments about the monitoring.

- **Mode**:

  There are **two** options: **Continuous** or **Manual**. In continuous mode a sample is taken automatically every sample time. In manual mode a sample is taken every time that user presses the joystick.

- **Sample Time**:

  Time between acquisitions. Only when working in continuous mode. Minimum time is 1 second.

- **Span time**:

  It is the width, in time, shown on screen for the X axis.

- **Save to**:

  There are **two** options: **Internal** or **USB**. For Internal option it saves the file with all data in the internal memory of the equipment. For USB option it saves the file with all data in a USB flashdrive connected to the micro-USB port of the equipment.

7.7.2.2 Screen Description

The following describes the **Signal Monitoring** screen:

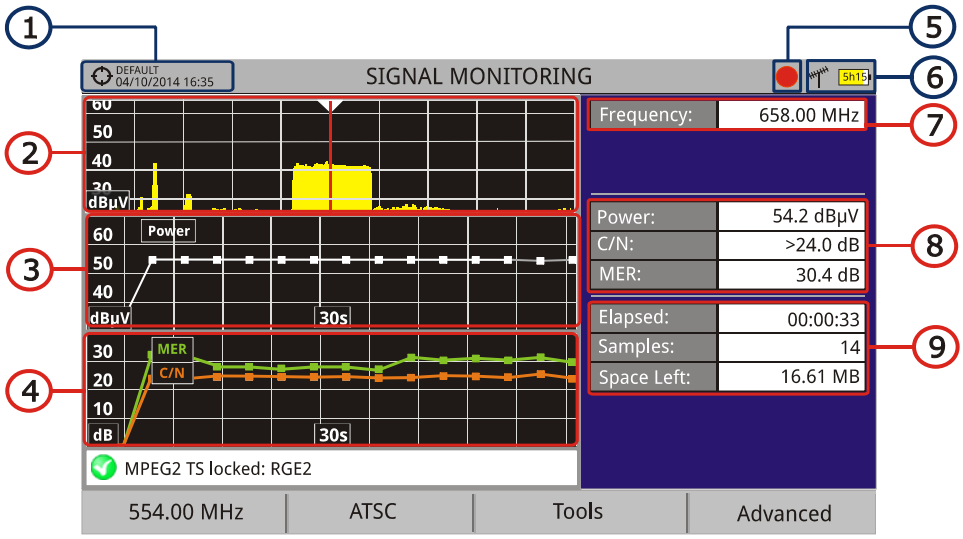


Figure 65.

1. Selected installation; date and time.
2. Spectrum.
3. Power measurement over time (shows span time).
4. MER and C/N measurement over time (shows span time).
5. Signal monitoring started.
6. LNB, Selected band; battery level.
7. Signal information window 1:

   Frecuency: frequency at which signal is locked.
8. Signal information window 2:

   Power, C/N, MER measurements of the signal over time. It shows on screen only the span time selected in settings.
9. Signal information window 3:

   Elapsed: Time elapsed since the beginning of the monitoring.

   Samples: Samples taken since the beginning of the monitoring.

   Space left: Space left in the memory to save data.

7.7.3 Menu Options

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.

In the **Advanced** menu there are some options for the **Signal Monitoring**. They are:

- **Start**: It starts the signal monitoring.
- **Stop**: It stops the signal monitoring.
- **Configuration**: It shows the settings window with some parameters. (see the "Configuration" section for more details).
- **GPS Status**: It shows a list and a graph with satellites detected to locate the GPS signal. It is also provided additional data such as longitude, latitude, date and universal time, visible satellites and GPS status (locked or not) (this option is available only for equipment with GPS, see annex OP-001-GPS).

7.7.4 Data file processing

7.7.4.1 Description

This document is an explanation about the process that is needed to be done in order to obtain a more comfortable view of the XML data obtained with **TE-3000** family equipment, when performing a Signal Monitoring.

Once you got the monitoring data, copy the XML data file from the equipment to a USB memory using the Installation Manager. See the equipment's documentation in how to get files from an Installation.

7.7.4.2 Obtaining an excel file

For this section, you must have at least Excel 2003 or newer version. Excel 2007 (or later) is highly recommended to avoid macro problems.

1. First of all we need to locate the XML data file in the folder from which we want to work. There are no requirements needed to be satisfied. A file named COVERAGE.XSL must be placed in the same data file folder. That second file allows proper data formatting when processed by Excel.

2. Select the XML data file and then right click with the mouse button on the file name.

3. Choose the option "**Open with**" and then select Excel 2007 (or the available version)

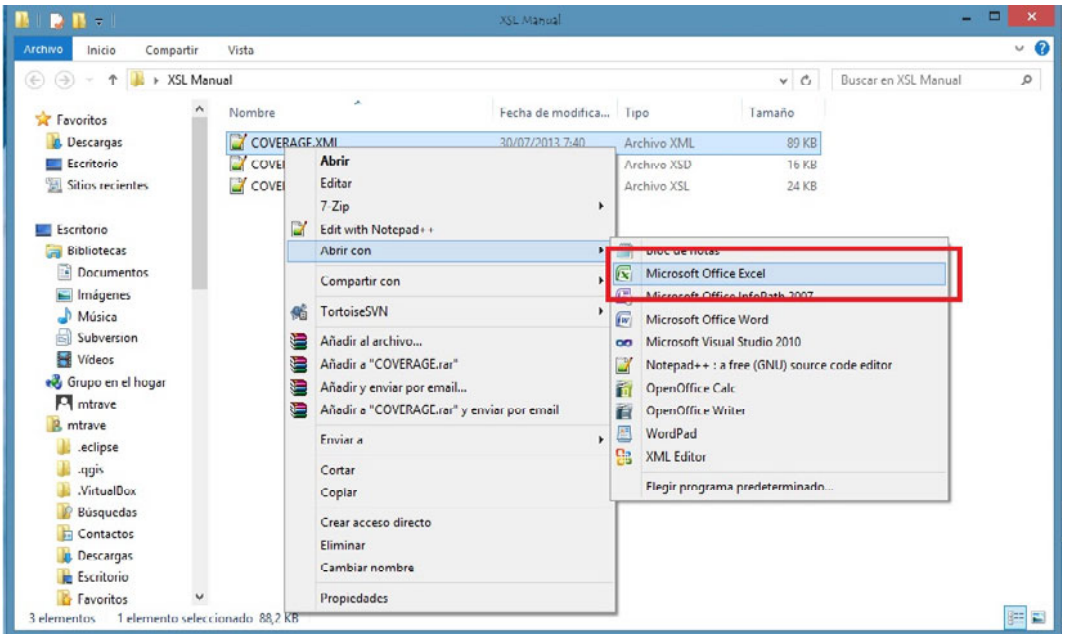


Figure 66.

4 When Excel tries to open the file it will ask you the import method to open the XML data file by this way:

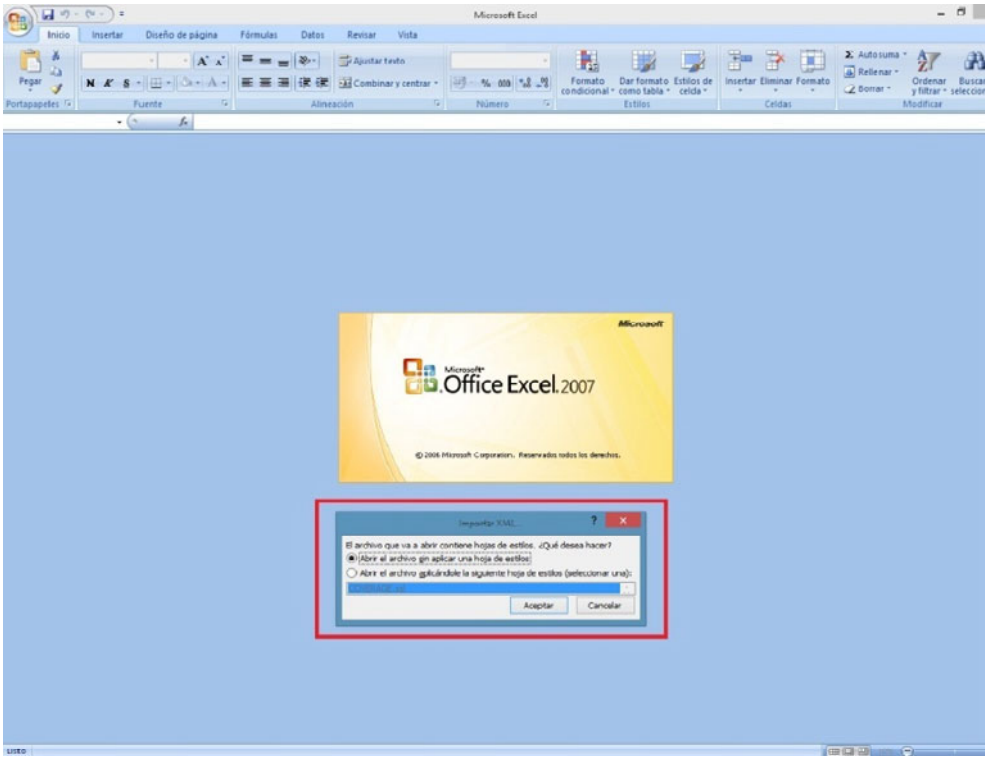


Figure 67.

5 You must choose the option in which a stylesheet is asked. It will appear as an option the "COVERAGE.xsl" file.

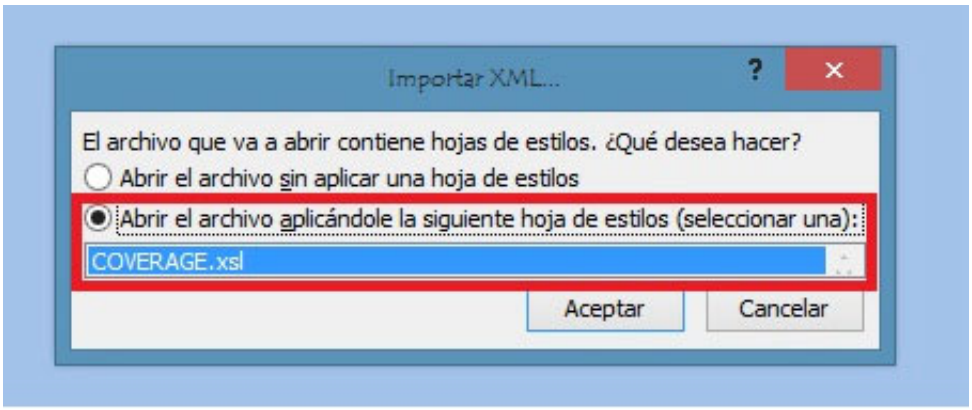


Figure 68.

6 Now Excel is opening the XML data file using the format that the XSL file is providing. This step could take few seconds depending on the size of the XML data file.

7 At this point, you should have an excel file with three different sheets. Each sheet corresponds to a different view of the same data:

- ✓ The first one will show you the generic signal information and the different coverage measures for each point acquired.
- ✓ In the second one, you will find the same data but presented in a table format, more user friendly for working with graphs based on each measured parameter.
- ✓ The third one provides data in a format adapted for geolocation. This is available only for users with GPS option (refer to annex OP-001-GPS).

8 Now save the data as a true excel file. No specific name or path is required, but you must remember the path.

7.8 Datalogger

7.8.1 Description

The Datalogger function stores automatically measurements in a file set by the user (name, channel plan), and associated to a specific installation. User can store for each datalogger measurements taken at different test points of the selected installation. Measurements are made for all channels in the active channel plan, both analog and digital.

7.8.2 Operation

To create a new datalogger:

1 First select one installation of the list of installations and load it pressing the "Load" key F1. An installation contains the channel plans and DiSEqC commands selected by the user and it stores dataloggers and screenshots made while it is selected (more information in chapter "Installations management").

2 Check the installation is selected. The name of the installation should appear on the upper left corner of the screen.

3 Press the F3: Tools key.

4 Press on the "Datalogger" option.

5 It displays a menu with the "New ..." option and a list of all dataloggers at the selected installation.

6 Select "New ..." to create a new datalogger or select the file name of an existing datalogger if the user want to save data on a specific datalogger already existing.

7 If "New ..." is selected, a installation wizard shows how to create a new datalogger. Follow its instructions (F4: Next to move to the next screen, F3: Previous to move to the previous screen or F1: Cancel to cancel).

8 When creating a new datalogger through the wizard, the user can give a name to the datalogger.

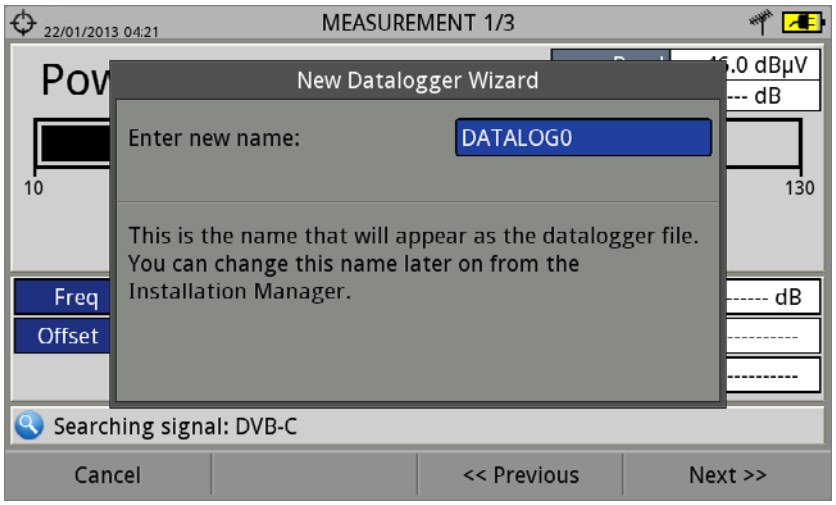


Figure 69.

9 Next, the user can select the terrestrial and/or satellite channel plan to use in the datalogger. The channel plans that are shown depends on the channel plans available for the current installation.

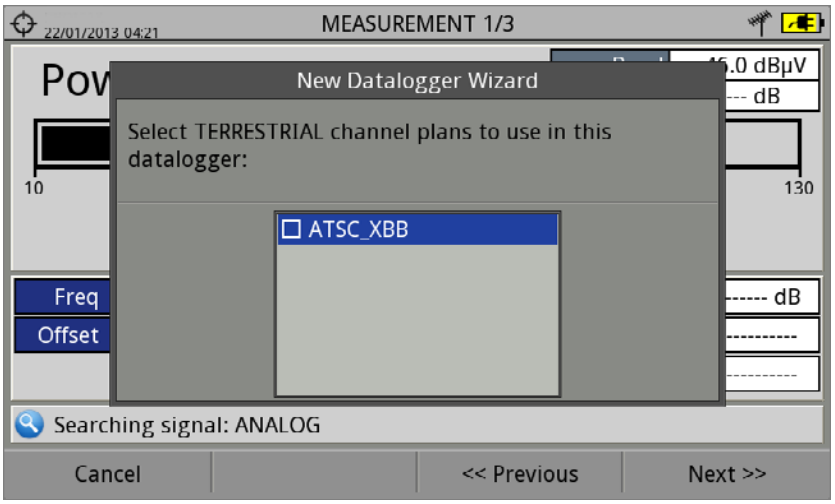


Figure 70.

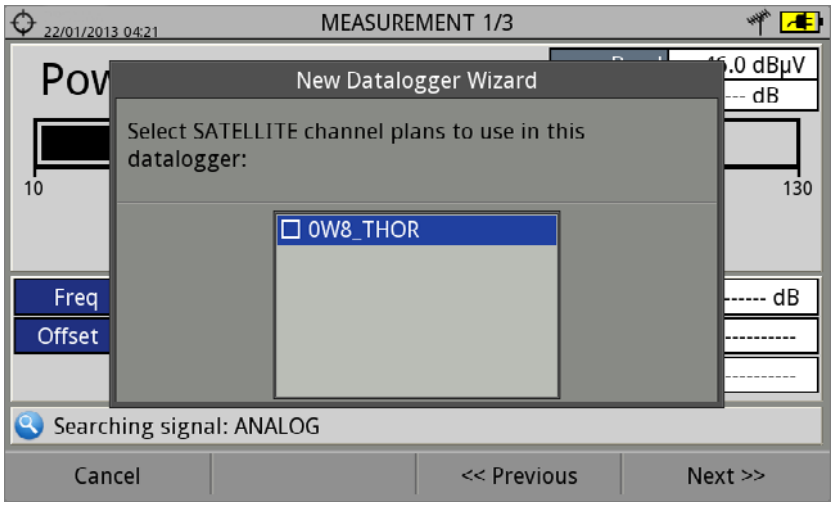


Figure 71.

10 In the next window, the user can select an option to capture de service list when performing the datalogger (this option slows down the process but provides more information). Another option allows the user to enable a pause between channel plans (the process stops until the user wants to carry on). There is also the option to perform a datalogger on the attenuation test, terrestrial or satellite (see section "Attenuation Test" under "Utilities" for more information).

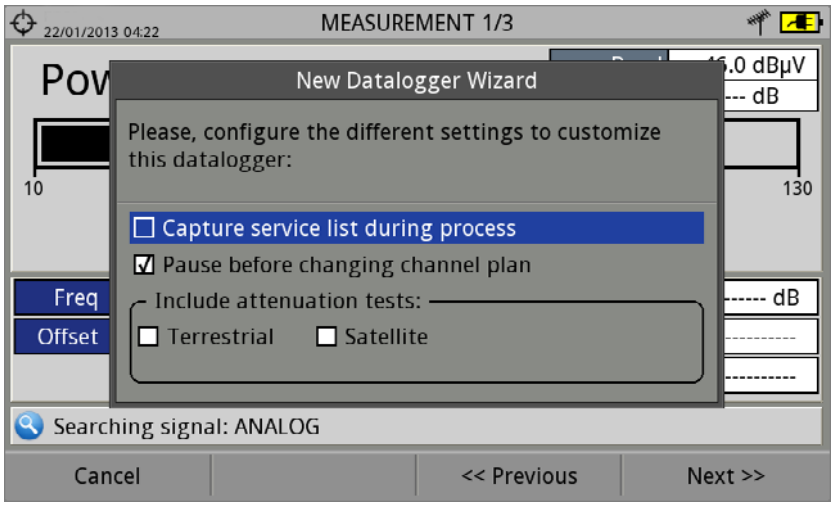


Figure 72.

11 At the last step, user can select to open the just created new datalogger (by default, this option is selected).

12 Once a new datalogger is created or selected an already existing one, it shows the datalogger viewer screen and measurements of test points can start.

13 If it is a new datalogger, in first place before starting the datalogger, user must create a new test point (see next section).

To start the datalogger:

1 After creating a new datalogger file or selecting an existing one, the user can start the datalogging process.

2 From the datalogger viewer screen, press the "Test point" key F4 and from the menu select an existing test point using the "Go to ..." option or "Create new ..." to create a new test point. If a new test point is created, user has to give it a name.

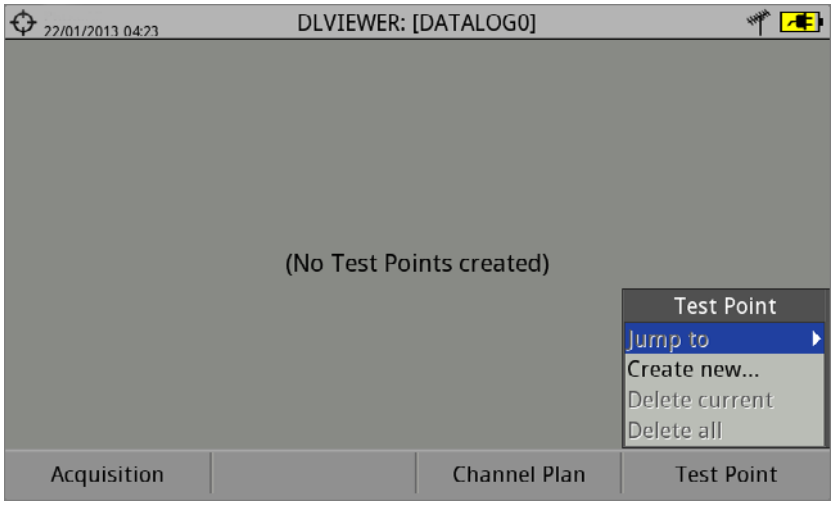


Figure 73.

3 Now datalogger is ready to start. Press the "Datalogger" key F1 and select "Start". The datalogger process starts, during which all the measurements of all channels that are part of the datalogger and also the attenuation test are saved.

4 During datalogger, it catches the list of available services of all channels in the channel plan that are part of the datalogger (if this option was selected when creating the datalogger or if the "Datalogger PSI" option is enabled in the Preferences menu). If there is a change of channel plan during datalogger there will be a pause (if this option was selected when creating the datalogger). User can pause and resume the datalogger process at any time by pressing on the key "Pause" F3. If the "Attenuation Test" option was included when creating the datalogger, these measures will also saved.

5 At the end it saves the data and allows watching the results on screen by channel plan/attenuation test. To change the view of channel plan or attenuation test data press on the F3 key. Data about terrestrial and satellite attenuation will appears as the option TER ICT and SAT ICT respectively.

6 It is also possible to download Datalogger files to a PC by the NetUpdate software (free download at http://www.atci.com/test-equipment.html). Once downloaded, the program can generate reports with these files. This is not possible with the datalogger files exported directly to a USB (without using NetUpdate). Information of Service lists are in the XML files downloaded to the PC.

► Description of Datalogger screens

The following describes the datalogger screen:

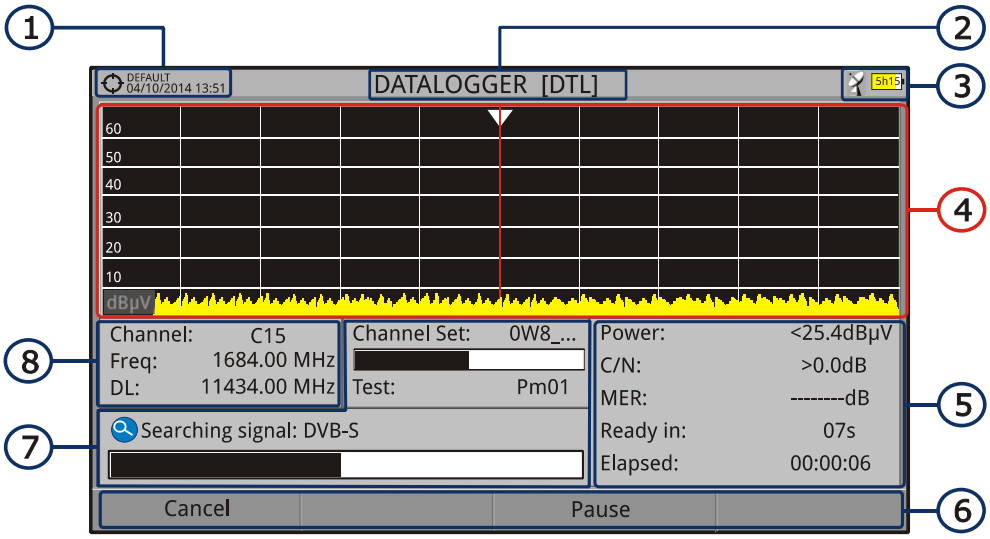


Figure 74.

1. Selected installation; date and time.
2. Current datalogger name.
3. Selected band; battery level.
4. Exploring the spectrum in real time.
5. Level/Power, C/N ratio, MER, time remaining to identify a channel, elapsed time since the start of the channel identification.
6. Softkey menus.

F1 **Cancel**
It cancels the datalogger.

F3 **Pause**
It pauses datalogger until the user resumes by pressing again.

7. Current channel plan, progress bar in the current channel plan, selected test point.
8. Channel, frequency and Downlink.

The following describes the display of data acquired:

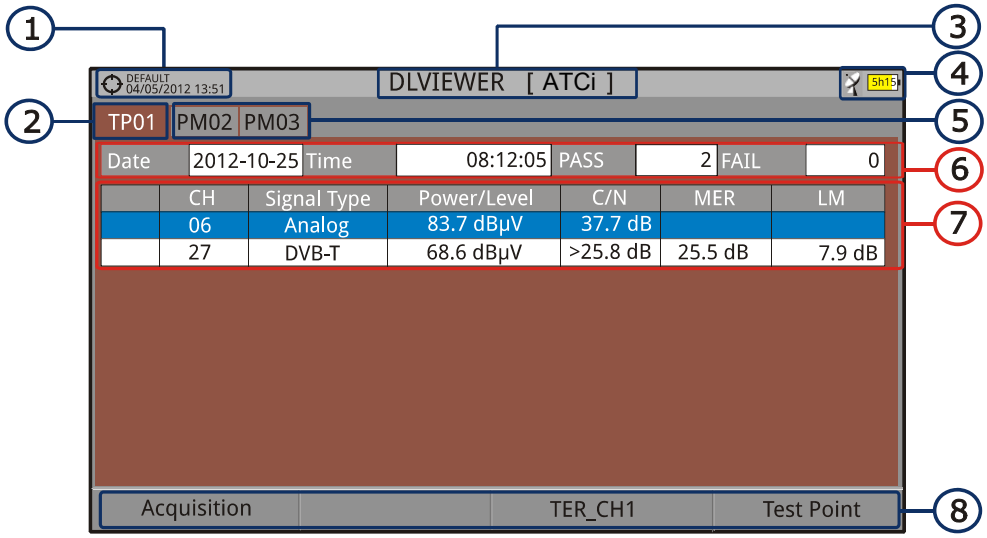


Figure 75. Channel Plan Datalogger.

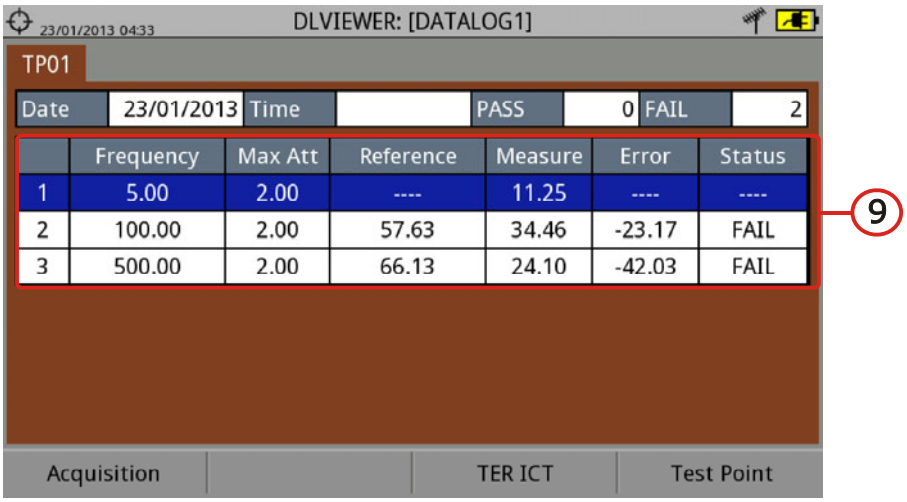


Figure 76. Attenuation test Datalogger.

1. Selected installation; date and time.
2. Tab identifying the displayed test point.
3. Current datalogger name.
4. Selected band; battery level.
5. Tab identifying each test point.
6. Date and time when the datalogger was created. Number of channels locked (PASS) or not locked (FAIL).

7 Data table with measurement data for each channel. In order from left to right: Color identifying if the channel has been locked (WHITE) or not locked (RED) channel; signal type; power/level; Carrier/Noise (C/N) rate; MER; Link Margin. Move the joystick up or down to navigate along the measurement data. Press the joystick on a channel to display the signal parameters.

8 Softkey menus.

9 Table with the measurement data for each pilot signal in the attenuation test. In order from left to right: number of pilot signal, pilot signal frequency, maximum attenuation allowed, reference level value, level value at the test point, error and signal status.

Acquisition

It contains two options:

Start: It starts the datalogger in the selected test point.

Clear: It deletes the data in the selected test point.

Channel plan

It displays a menu with the available channel plans to select the channel plan whose data want to be displayed. Channel plans available are those that have been selected during the creation of the datalogger.

Test Point

It contains four options:

Jump to: It allows selecting a test point.

Create New...: It creates a new test point.

Delete current: It deletes the current test point.

Delete all: It deletes all test points of the datalogger.

7.9 Export key

7.9.1 Description

It captures what is displaying at that moment.

The capture can be an image, measurement data or both. This is set through the **Preferences** menu ("Export button" option).

Data capture is saved in a XML file with all data, measurements and text, that is on screen at this time. The image is saved in a PNG file.

Data can be viewed later on through an external software.

7.9.2 Operation

► **Settings**

1. Press the "Management Installation" key for one second to enter "Preferences" menu.
2. Go to the label "**Measures**" and select your option in "**Export button**". There are three options available: Screen Only, Data Only or Screen+Data. "Screen Only" saves the screen image in PNG format. "Data Only" saves measurement data on screen in a XML file format. "Screen + Data" saves both screen and data.
3. Once selected, press F2 to save changes and F1 to exit "Preferences".

► **Capture**

1. Press the **Export** key for one second when on screen appears the screen to be captured. The LED next to key lights.
2. A progress bar shows the progress of the capture process. When finished, the screen is captured and the LED is OFF.
3. Then the virtual keyboard appears with the default name assigned to the file.
4. Edit the name if necessary (see section 2.7.4). Then press F3: OK to end the capture or F4: Cancel for cancellation.

► **Display**

1. To display the captured screen click on the **Installations Management** key .
2. Select the installation where the capture was done and press F2: **Manage**.
3. Press F1: **Filter by type**. Select the "Screen Shots" or "Data Captures" option. This will limit the list to the selected.
4. It appears a list of all the captures.
5. Move the joystick up or down to find the file to be displayed.
6. Leave the cursor on the file to be displayed. It appears a progress bar that lasts a few seconds, depending on the size. Then the capture appears.
7. To see the capture in full screen just press the F4: Options key and then on the menu press "View in Full Screen". To exit the full screen view press any softkeys.
8. To delete or copy the capture to a USB stick, select the captures by pressing the joystick, and then select the appropriate option from the menu F2: **File**.
9. Captures can also be viewed on a PC, by downloading the installation file using the NetUpdate software (see the NetUpdate manual for more information).

7.10 Explore Channel Plan

7.10.1 Description

This option performs a scan of the selected channel plan. It detects where active signals are in a channel plan and in which channels of the current channel plan signal is received. With this information it explores these channels with signal, looking for any broadcast and identifying them.

7.10.2 Operation

Explore Channel plan tool is available for all signals.

1. Connect the **RF** input signal to the equipment.
2. Press the **Tools** key (F3).
3. Select the **Explore Channel Plan** option.
4. The first screen of **Explore Channel Plan** appears.

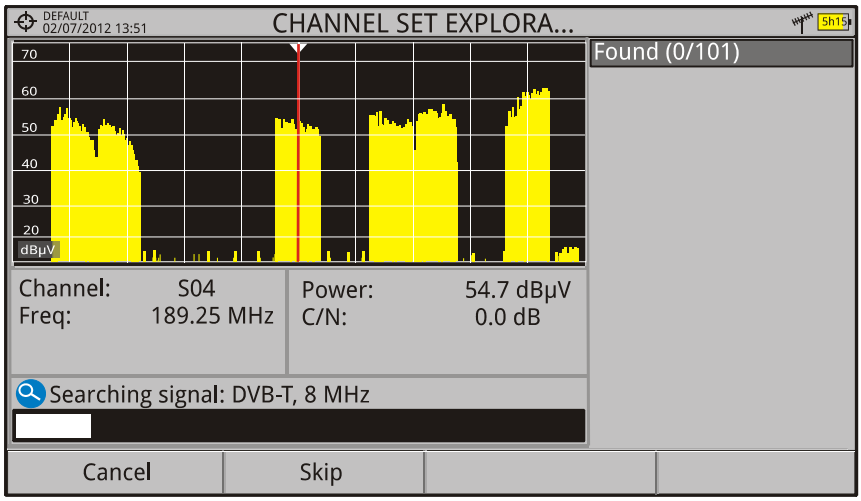


Figure 77.

6. After the exploration the following screen appears:

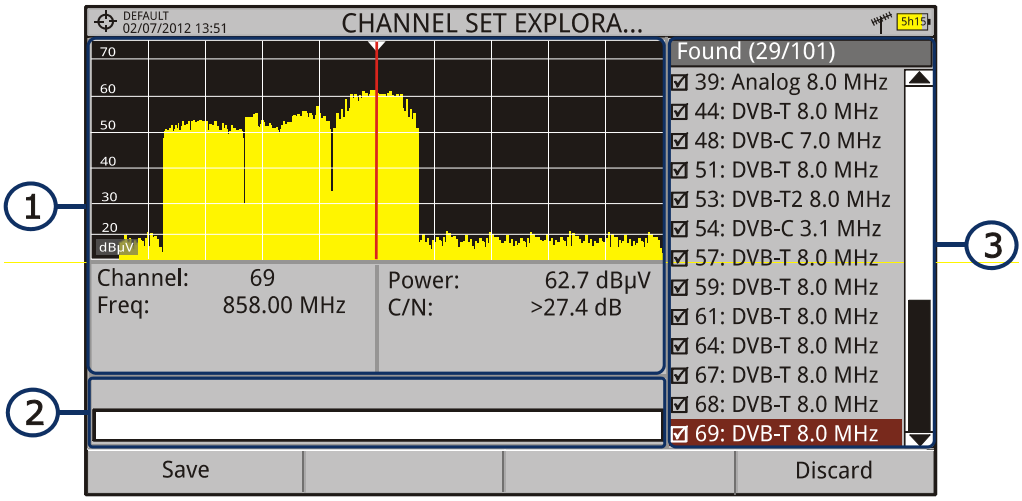


Figure 78.

The window is divided into three areas:

1. **Spectrum and Measurement**

   It shows the cursor scrolling through each of the channels of the channel plan. On the bottom of the screen the channel and frequency appears next to the Power/Level 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 plan**

   At the end of the process it shows the channels that have been detected during the channel plan exploration. In parentheses shows the number of detected channels to total channels of the channel plan. When moving the cursor through the channels, the spectrum and measurement windows are dynamically updated for the selected channel.

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

Cancel (during the process):

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

Save (at the end of the process):

This option appears at the end of the exploration process. It saves the results obtained during the exploration. The name of the original channel plan 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 plan is now available in the list of channel plans in the installation and can be used as any other channel plan. After saving it becomes the selected channel plan to work with.

Skip (during the process):

This option allows skipping the current channel and explore the next one in the channel plan.

Discard (at the end of the process):

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

7.11 Discover FM stations

7.11.1 Description

The **Discover FM Stations** tool scans the FM band and creates a FM channel plan from scratch. Scanned frequency range is from 87 to 108 MHz.

7.11.2 Operation

To scan the FM band:

1. Connect the **RF** input signal to the equipment.
2. Press the **Tools** key (F3).
3. Select the **Discover FM Stations** option.
4. The first screen of **Channel Plan Exploration** appears and the exploration starts.

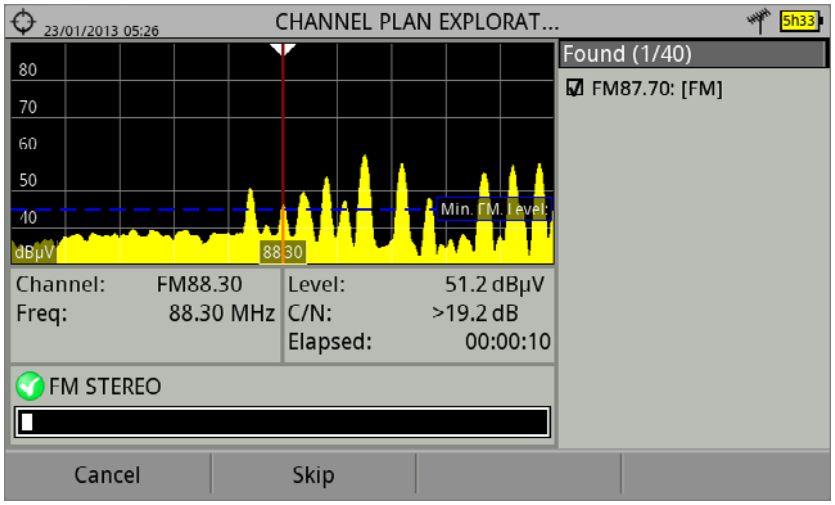


Figure 79.

5 After the exploration the following screen appears:

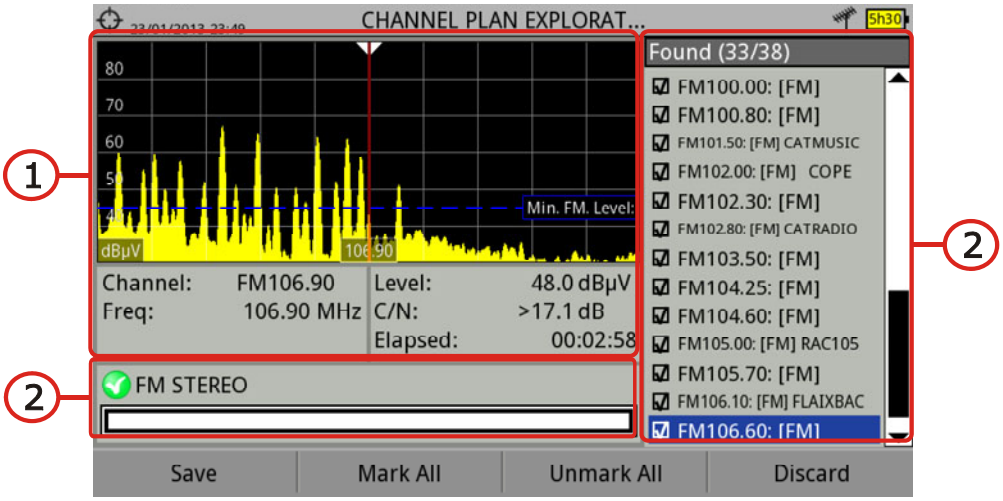


Figure 80.

The window is divided into three areas:

1 **Spectrum and Measurement**

It shows the cursor scrolling through each of the channels of the **FM** band. On the bottom of the screen the channel and frequency appears next to the Power/Level and the C/N ratio.

In the spectrum area there is the **Minimum FM Level**. This line is the minimum signal level required to identify the FM signal. The channels below that signal level will not be identified. It can be configured in the "Measures" tab in "Preferences" .

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 plan**

It shows a list with the channels being detected during the exploration of the FM band. At the top and between parentheses there is the number of detected channels to total channels. When moving the cursor through the channels, the spectrum and measurement windows are dynamically updated for the selected channel. User can mark / unmark the FM channels to save in the channel plan.

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

Cancel (during the process):

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

Save (at the end of the process):

This option appears at the end of the exploration process. It saves the results obtained during the exploration. The name of the original channel plan 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 plan is now available in the list of channel plans in the installation and can be used as any other channel plan. After saving it becomes the selected channel plan to work with.

Skip (during the process):

This option allows skipping the current channel and explore the next one.

Mark All (at the end of the process):

This option marks all the channels that appear on the channel list.

Unmark All (at the end of the process):

This option unmarks all the channels that appear on the channel list.

Discard (at the end of the process):

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

7.12 Field Strength

7.12.1 Description

This function allows the equipment to work as a field strength meter, measuring dBµV per meter. To perform this type of measurement is needed to enter the calibration parameters of the antenna being used to receive the signal.

7.12.2 Operation

The Field Strength tool is available for all signals received by the RF input.

1. Connect the **RF** input signal to the equipment.
2. Select a channel or frequency.
3. Press the **Tools** key F3.
4. Select the **Field Strength** option and in the drop down menu select **On**.
5. Select again the **Field Strength** option, now select the new option that appears, called **Configuration**.
6. In the configuration window enter the antenna calibration parameters, by hand or selecting one of the available antenna types (data of different antenna types should be imported by the user. Refer to the following section).
7. Now access the **Spectrum Analyzer** or **Measurement mode** to check the field strength measure shown as FSM (dBµV/m). This measure replaces the power.

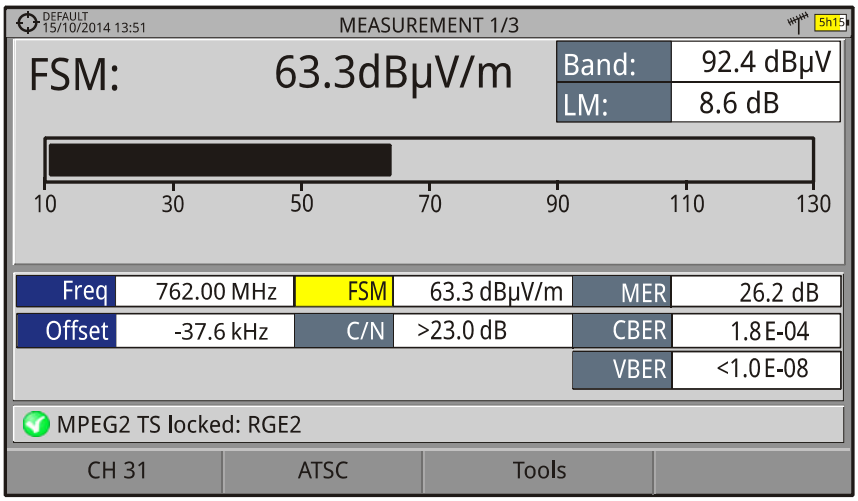


Figure 81.

8 Once finished, return to the **Tools** menu and in the **Field Strength** option select **Off**.

WARNING: Some tools (Constellation, Echoes, MER by carrier, Merogram ...) are disabled when the **Field Strength** option is enabled. Remember to turn off this option if you want to use these other tools.

7.12.3 Configuration

The Field Strength configuration option allows the user to enter the correction factors for the antenna and cable used when measuring the field strength.

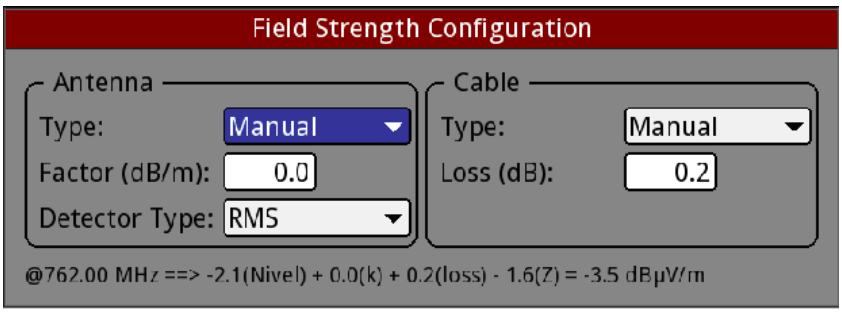


Figure 82.

Data fields to be filled are:

► **Antenna**

- **Type**: In this field the user can select the type of antenna between manual and any other type of antenna available. If you select the manual antenna, you must enter the correction factor by hand. If you select an antenna type then the correction factors associated with each frequency are applied. These data are defined in the antenna file imported by the user.

- **Factor**: This is the correction factor (K) for the antenna at the measurement frequency.

- **Detector Type**: (Max / RMS). It allows the user to select between maximum peak detector or RMS detector. The maximum peak detector is mainly used for analogue modulated signals, while the RMS option is the right choice for digital modulated signals.

► **Cable**

- **Type**: In this field contains the user can select the type of antenna between manual and any other type of cable available. If you select the manual cable, you must enter cable loss by hand.

- **Loss** (dB): In this field you must enter the estimated loss for the cable used to connect to the antenna.

In the bottom of the configuration window you can see the field strength in real time according to the current frequency and correction factors.

8 IPTV*

8.1 Introduction

IPTV stands for TV over IP networks. It actually means TV over any type of IP packet based distribution network. They can be referred to as LAN (Local Area Network), ethernet, computer networks, etc.. With the growth of LAN based TV distribution systems, having an IPTV input in your field strength meter becomes a handy feature.

The equipment allows you to receive television programmes coming from IPTV networks. Those programmes can be displayed on the screen together with other important service information.

Although some concepts are similar, signal quality assessment metrics is not the same in IPTV as it is in digital TV over radio frequency. The equipment offers you the measurements you need to understand, identify and correct the new problems that can be found in this new type of television distribution networks.

8.2 Operation

► Operation

1. Connect the IPTV input/output signal to the equipment through the Ethernet connector.
2. In the "Settings" menu, in the option "**Signal source**" select IPTV. The IPTV icon will appear at the screen corner.
3. Press the **F1** Multicast key. Set the server IP address and server port. The equipment automatically detects if it is UDP or RTP protocol.
4. Now the signal should appear on screen.
5. Access the **MEASUREMENT** or **TV** option by pressing the corresponding key to view measurement data and image. Press again to display the next view.

*only available for **TE-3000**

8.3 Screen Description

8.3.1 MEASUREMENT mode

IPTV views in **MEASUREMENT** mode are:

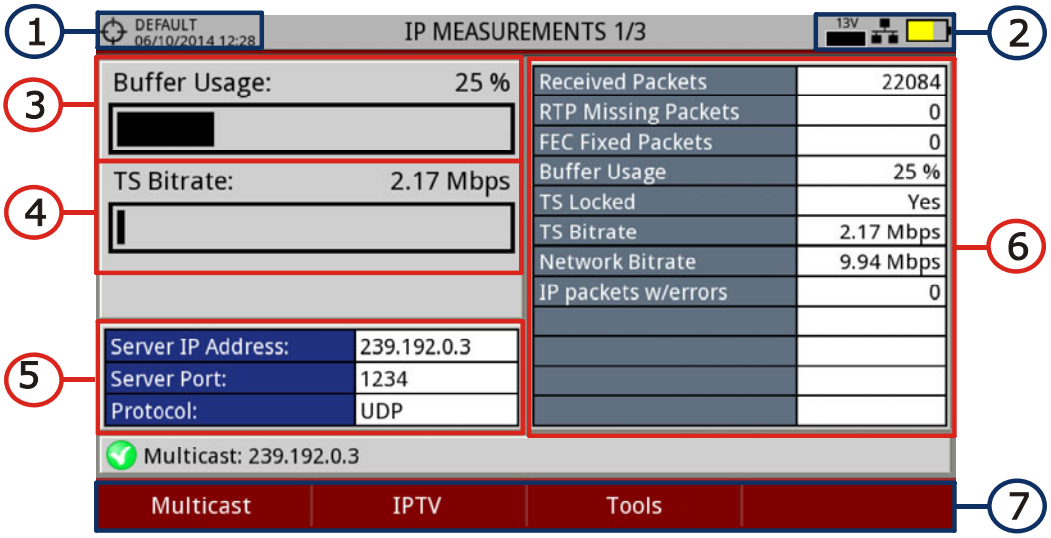


Figure 84.

1. Selected installation; date and time.
2. IPTV mode enabled; battery level.
3. Graphic bar "Buffer Usage" showing the internal multicast stream buffer usage.
4. Graphic bar "TS Bitrate" showing the recovered TS bitrate.
5. Server address data and communication protocol detected (UDP/RTP).
6. Measurement on the IPTV signal: received packets, RTP missing packets, FEC fixed packets, buffer usage, TS locked, TS bitrate, network bitrate and IP packets with errors.
7. Softkey menus.

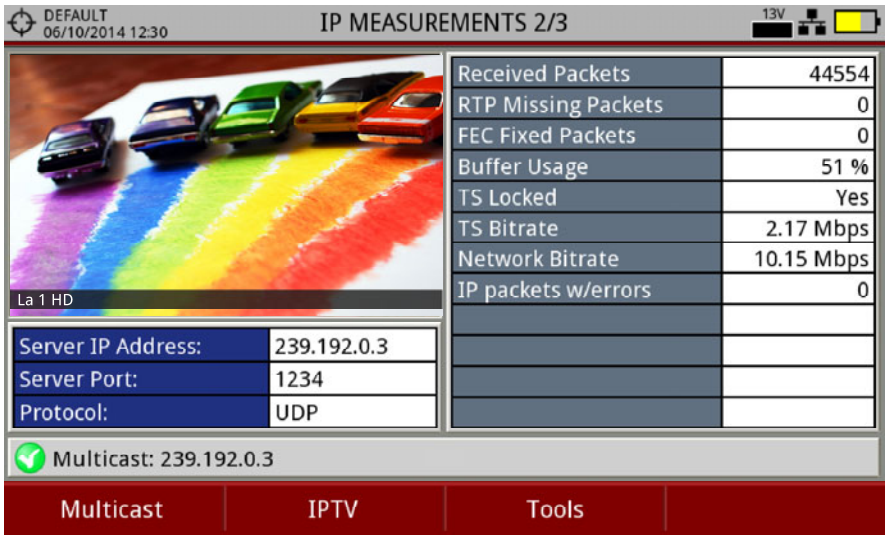


Figure 85.

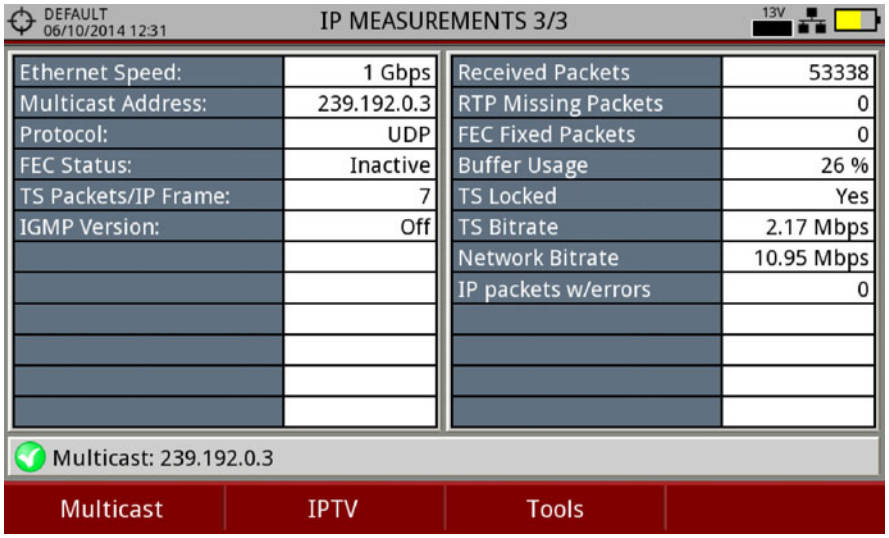


Figure 86.

8.3.2 TV mode

IPTV views in TV mode are:

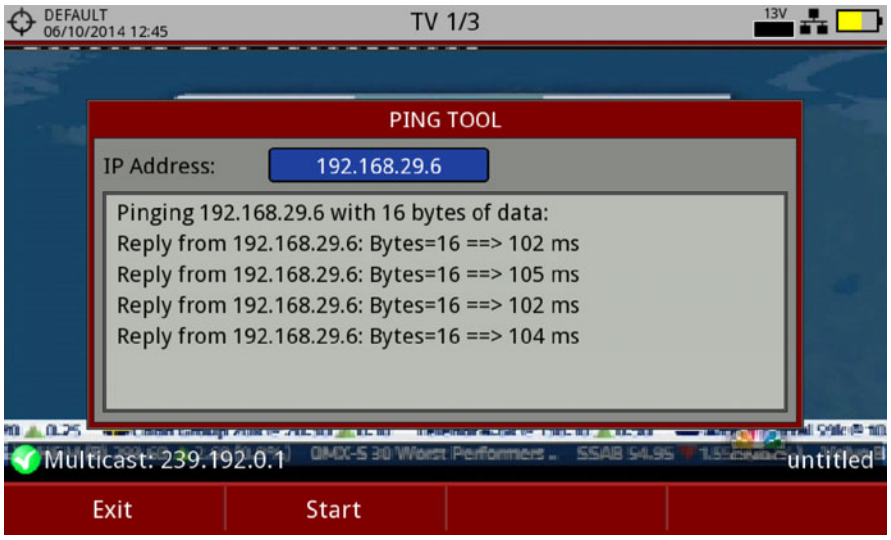


Figure 87.

8.4 Specific Options

8.4.1 Tools

Press **F3**: **Tools** to access the tools in the IPTV mode. The PING tool is the only one specific for IPTV. The other tools, TS Analyzer and TS Recording, are generic and its operation can be found in the "Tools" chapter.

The PING tool is a diagnostic tool to confirm if a given unit can get any response from another machine in the same network. To use it follow these steps:

1. Enter the IP address of the remote machine you want to check its communication.
2. Press **F2:** Start.
3. The equipment starts sending data packets to the IP address of the remote machine.
4. If it gets response, on screen appears the message "Reply from" with the response IP address, number of bytes received and time of response.

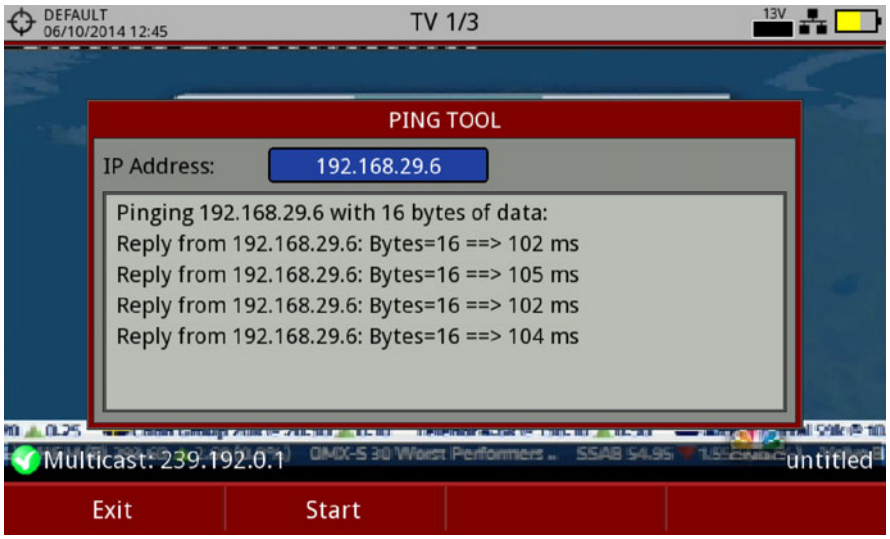


Figure 88.

5 To exit the tool press **F1:** Exit.

8.4.2 Tuning Options

The IPTV tuning options are on the **F1: Multicast** key. These options are available to receive a multicast signal. Multicast is an open broadcasting over IP in which the device only takes data packets with a specific address.

For multicast distribution the options are:

- **Server IP Address**: The IP address for the server to send.
- **Server Port**: The IP port for the server to send.
- **Recent Servers**: Information of last servers used to send the data.

8.4.3 Settings and Preferences

► **Preferences**

To access **Preferences** press the key for 1 second. Go to the **Network** options tab to fill out the network options to identify the equipment into a data network. This is necessary to receive IPTV signal. Network parameters are MAC, IP Address and Mask. There is also the possibility to enable the DHCP protocol for proper IP configuration. DHCP is the standard procedure to get the proper IP address when the unit is first connected to a network. That feature contributes to make things easier to installers when debugging network access.

► **Settings**

The IPTV settings when pressing the settings key are:

- **Signal Source**: It allows the user to select the signal coming into the equipment between the RF input for RF signal and the IPTV input. In this case select IPTV.
- **Decoder TS Input**: It allows the user to select the transport stream coming into the equipment. In this case select IPTV. If you want to save the transport stream received by the IPTV, select the IPTV input.
- **ASI Output:** It allows the user to select the way out for TS-ASI packets. User can select among Off, IPTV and ASI Input. This transport stream received by the equipment can feed the signal to other devices as well. In the case of IPTV option the TS-ASI packets go out through the IPTV connector. If you want to send to the output the transport stream from the IPTV signal, select IPTV.

9 INSTALLATIONS MANAGEMENT

9.1 Description

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. Measurements, channel plans, screenshots and any other data associated with the installation will be stored in the folder corresponding to that installation. 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 (named "DEFAULT").

9.2 Operation

1. To access the Installations menu press the key.
2. It shows up a window with a list of all available installations. On the softkeys appears the options to manage these installations.
3. To exit the list of installations press the key .

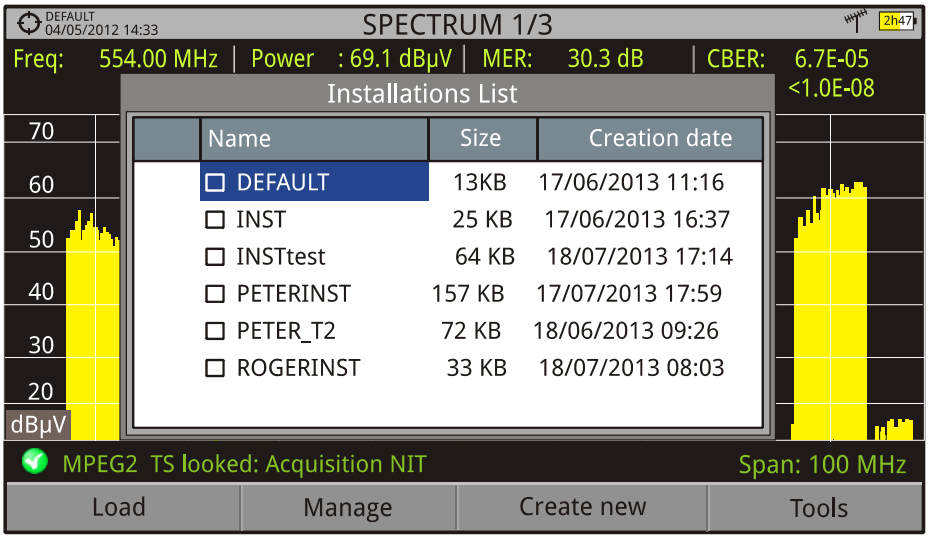


Figure 89.

There are the following options:

- **Load** F1: It loads the selected installation. To select a installation from the list, place the cursor on the installation and press the joystick, then press "Load" F1 to load it. Once loaded, the name of the installation appears on the upper left corner of the screen, accompanied by the symbol ⌖, that means that is the current installation. All measurements, screenshots, channel plans and other data since this moment will be stored in the current installation.
- **Manage** F2: It opens a window that displays all data of the current installation and from where they can be edited, changed or view (more details in section 9.3).
- **Create new** F3: It creates a new installation with the data introduced by the user (more details in section 9.4).
- **Tools** F4: It shows up a menu with some tools to use with the installations (see section 9.5).

9.3 Installation Management

In the list of installations, press on the option **Manage** F2 to access to the **Installation manager** screen:

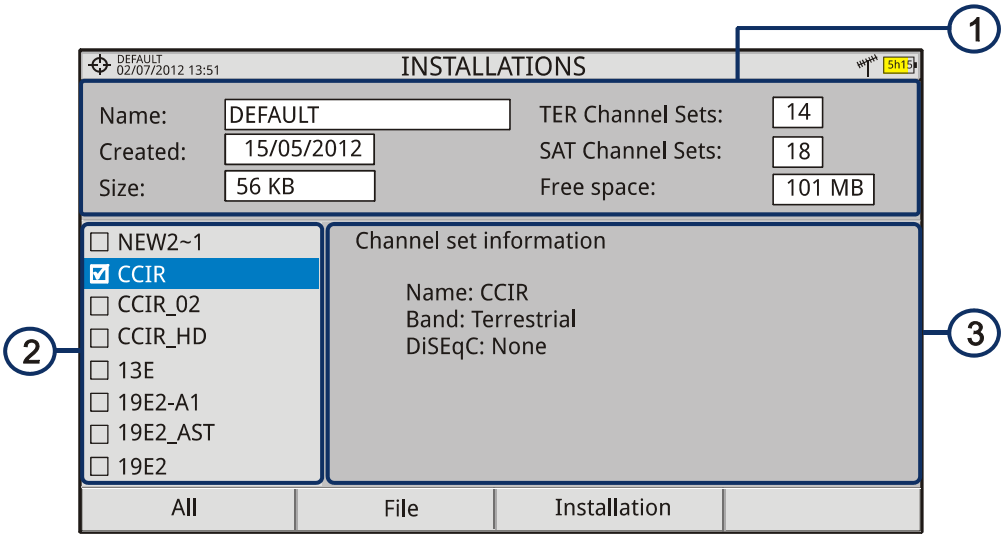


Figure 90.

The DEFAULT installation is the installation preinstalled on the equipment. It is like any other installation and it can load channel plans, DiSEqC programs, etc. The DEFAULT installation can not be deleted or renamed.

The window is divided into three fields:

1 **Installation data**

- It displays information about the installation using the following fields:
  - **Name**:
    Name of the current installation file.
  - **Created**:
    Date and time the current installation was created.
  - **Size**:
    Data size of the current installation.
  - **TER Channel Plans**:
    It shows the number of terrestrial channel plans in the installation.
  - **SAT Channel Plans**:
    It displays the number of satellite channel plans in the installation.
  - **Free Space**:
    It displays the amount of memory available.

2 **List of files area**

It shows all channel plans, screenshots, dataloggers, DiSEqC commands, data captures and service databases available for the selected installation.

To move along this file list move the joystick up or down.

Any of these files can be selected or deselected by pressing the joystick.

3 **Display area**

It is the area where the file, on which the cursor is placed at the file list, is displayed. The file is displayed only if the cursor is placed for a moment.

In the case of displaying a channel plan file, it shows the name, the band and the DiSEqC commands.

For a screenshot, it displays a thumbnail of the full screen, as captured.

In the remaining cases, it only shows the description of the file type.

The installation manager menu has four options linked with the softkeys. They are described below:

Filter by type

- **All**:
  On the list of files area it shows all type of files.
- **Screenshots**:
  On the list of files area it shows all available screenshots.
- **Channel Plans**:
  On the list of files area it shows all available channel plans.
- **Datalogger**:
  On the list of files area it shows all available dataloggers.
- **DiSEqC:**
  On the list of files area it shows all available DiSEqC commands.
- **Data Captures**
  On the list of files area it shows all available data captures.
- **Service Databases**
  On the list of files area it shows the service database available.

File

- **Mark All**:
  It marks all files on the list of files area.
- **Unmark All**:
  It deselects all files on the list of files area.
- **Delete**:
  It deletes all selected files on the list of files area.
- **Copy to USB**:
  If the name of the file to be copied is greater than 8 characters the system cuts it up to 8 characters. If the file name that has been cut matches with another one, the system will apply a number to distinguish them. For example, if two files called FILENAME01 and FILENAME02 are copied to an USB memory, their filenames will be cut to FILENA-1 and FILENA-2.

  To keep the file names with more than 8 characters it is recommended to export the complete installation using the "Export to USB" option (see "Tools" section).

  The Datalogger files copied to the USB cannot be used to generate reports by the NetUpdate program. To do this the datalogger files must be exported directly through the NetUpdate program (see the NetUpdate user's manual for details).

F3 **Installation**

- **Add Channel Plan**:
  It opens a window to add a channel plan, terrestrial or satellite, to the current installation.
- **Add Antenna**:
  It allows the user to add an specific antenna between the ones available. To import an antenna refer to "Field Strength" section in chapter "Tools".
- **Add DiSEqC Program**:
  It allows the user to select and add to the current installation any DiSEqC program available in the equipment.

F4 **Options**

- **See full screen**:
  This option only appears if user selects an image in the list of files. It displays the selected image full screen.
- **Diseqc program**:
  This option only appears if a satellite channel plan is selected in the list of files area. It allows the user to add a Diseqc program to the selected satellite channel plan from the list of diseqc programs available for the current installation.

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

9.4 New installation

In the list of installations, when selecting the option **Create New** F3 it runs the installation wizard that helps to create a new installation:

1. During the process, the user has the option to edit the default name assigned or import data from another installation.

2. The user can select the channel plans (terrestrial and satellite) that will be used in that installation. At least one for each band has to be selected.

3 For satellite channel plans the user can select the Diseqc commands associated to the installation and also the satellite band (Ku-Ka or C band) and the frequencies of the LNB Oscillator.

4 During the creation process the softkeys function are: Next (it goes to the next step), Previous (it goes to the previous step) or Cancel (it cancels the process).

5 When finish, the new installation created will be the current installation.

9.5 Tools

In the list of installations, when pressing the **Tools** F4 option it shows a menu with some options to edit the installation files:

- **Mark All**:
  It selects all installations in the list of installations.

- **Unmark All**:
  It deselects all installations in the list of installations.

- **Archive**:
  It compresses (using the ZIP algorithm) the selected installations to save more space. A zipped installation shows a box icon  at the left side in the list of installations. A zipped installation can be loaded as anyone else, but the load time can be slightly higher because previously it is unzipped automatically. Once the installation is unzipped the user must re-zip it if necessary. To transfer an installation file from the equipment to a PC, it must have been previously zipped.

- **Delete**:
  It deletes the selected installations and all the files associated to them. The DEFAULT installation cannot be deleted.

- **Rename**:
  It edits the name of the installation selected in the list of installations. The installation by default DEFAULT cannot be renamed.

- **Export to USB**:
  It saves the installations files selected in the list of installations to an USB stick connected to the instrument. The installation file is exported in zip format.

► **Import from USB**:
It imports installation files from a USB stick connected to the equipment. It has to use the same folder structure that is generated when exporting to USB.

9.6 Importing Data from USB

The data import tool allows the user to import data files in a simple way from an USB flash drive to the equipment.

Data available to be imported are:

- **Installations**.
- **Channel Plans**.
- **Antennas**.

How to import data from a USB flash drive:

1. Copy the file to be imported on a flash drive and plug it into the mini-USB port using the supplied cable. The file must be in the proper format so the system can recognize it.
2. Press the **Installation Management** key .
3. Press the F4 key "**Tools**".
4. Select the "**Import from USB**" option.
5. The Import Files window appears. Select the file and press the F4 key: "**Import**".

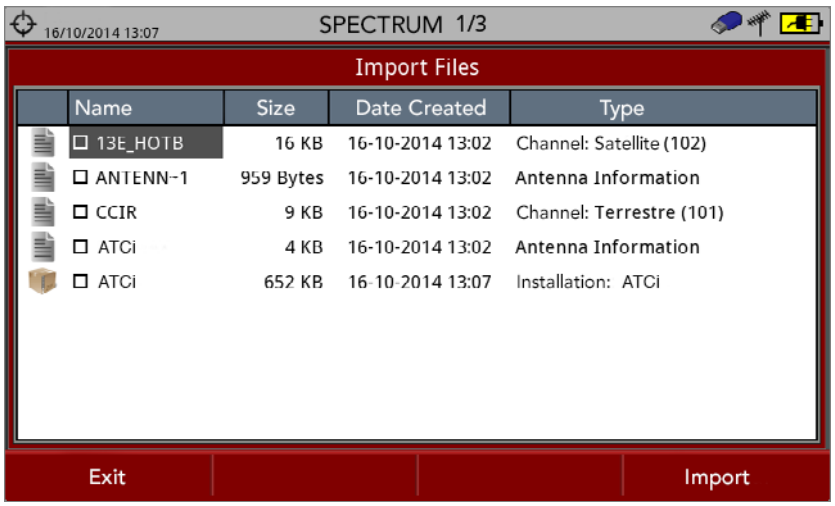


Figure 91.

6 If the file import is successful then a window shows a confirmation message.

10 CONNECTING TO EXTERNAL DEVICES

The **TE-3000** can interact with external devices, sharing information through its interfaces. Connection types are:

1. Input/output data interface via mini-USB connector to USB memory or PC.
2. Video/Audio analog output interface via **V/A** connector output.
3. Video/Audio analog input interface via **V/A** connector input.
4. DiSEqC, JESS and SatCR interface via **RF** connector.
5. Digital High Resolution Video/Audio interface via HDMI connector.
6. CAM modules input via Common Interface slot.
7. TS-ASI Input/Output via F connector.
8. IP network via 8P8C connector.

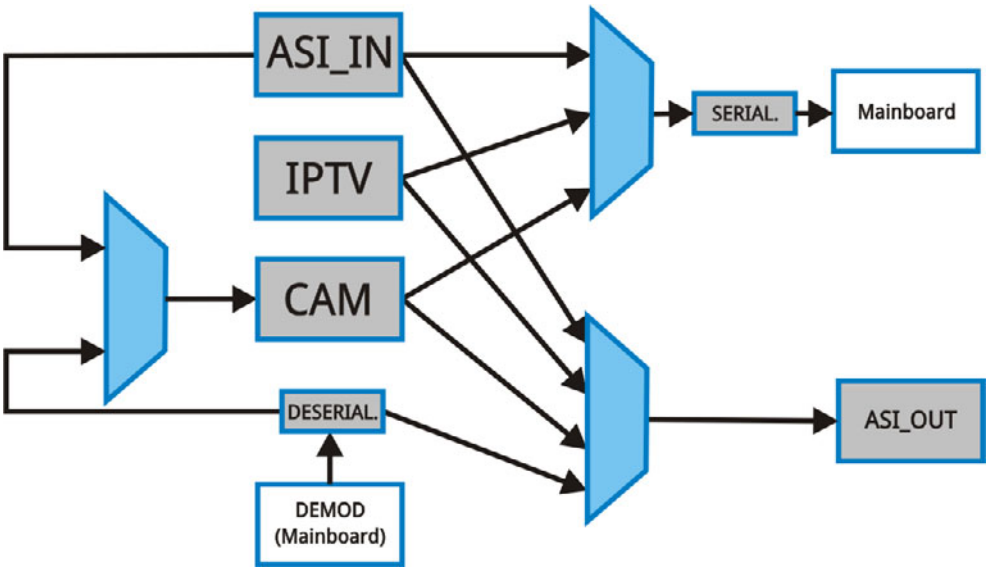


Figure 92.

Next is described each of these interfaces and their interaction with external devices.

10.1 Mini-USB connector

The equipment has a female mini USB port that uses a USB media specific protocol called "On-the-Go" (OTG abbreviated). This type of communication allows the equipment to work in two different ways depending on the device connected to the USB port: as a server (host) or device. More often, the **TE-3000** will work as a host when connecting a USB memory and as device when connecting to a computer. This feature makes the equipment in a much more versatile tool.

10.1.1 Connecting the TE-3000 (host) to an USB memory (device)

This connection allows the user to copy files (screenshots, channel plans, dataloggers, DiSEqC commands and others) and export/import installations from the equipment to the USB and vice versa.

To copy some select data from the installation:

1. Connect the CC-045 cable (USB (A) Female - Mini USB (A) Male) to the mini-USB socket (see figure 5) of the equipment.
2. Connect the USB stick to the female port of the cable.
3. USB icon should appear on the top right corner of the equipment. This icon indicates that an USB stick has been detected at the port.
4. Press the Installations key and select check the installation to download some of its data.
5. Press the key F2: Manage to access the data of the selected installation.
6. Press F1: Filter by type to select the type of list to view (list of all the files, only screenshots, only channel plans, only dataloggers or only DiSEqC commands).
7. Select the files from the list to be copied on the USB memory stick, by pressing the joystick or by pressing F2: File and selecting "Mark All" (it selects all files on the list displayed).
8. Once files are selected press F2: File and select the "Copy to USB" option. This option is enabled only if it detects that there is an USB connected to the equipment and if any file has been selected.
9. It shows a progress bar and a message informing that files are being copied to the USB.

10 When finish you can remove the cable with the USB stick memory directly from the equipment and connect it to a computer to view the files copied.

11 Default files are copied to the root directory of the USB memory. Screenshots appear with PNG extension and data with XML extension.

To export one or more complete installations:

1 Connect the CC-045 cable (USB (A) Female - Mini USB (A) Male) to the mini-USB socket (see figure 5) of the equipment.

2 Connect the USB stick to the female port of the cable.

3 USB icon should appear on the top right corner of the equipment. This icon indicates that an USB stick has been detected at the port.

4 Press the Installations key and check the installations to export.

5 Press the key F4: Tools and select Export to USB.

6 A progress bar and a message indicates that the files are being copied to the USB. The files are copied to the root directory of the USB in ZIP format.

7 When finished, the cable can be extracted directly with the USB stick and connect it to a computer to display the copied files.

8 Unzip the installation file to access the data.

To import one installation:

1 Connect the CC-045 cable (USB (A) Female - Mini USB (A) Male) to the mini-USB socket (see figure 5) of the equipment.

2 Connect the USB stick to the female port of the cable.

3 USB icon should appear on the top right corner of the equipment. This icon indicates that an USB stick has been detected at the port.

4 Press the Installations key and check the installation to export.

5 Press de key F4: Tools and select Import from USB.

6 A dropdown menu shows the installations identified in the USB memory. An installation can be imported if it has the same folder structure than when exporting. Select the installation to import from those available.

7 The import process starts. If the name of the installation matches with an existing one, it gives a warning before import.

10.1.2 Connecting a computer (host) to the TE-3000 (device)

This connection allows the communication between the equipment and a computer via an USB cable or using the program NetUpdate of ATCI.

NetUpdate program can be downloaded for free at http://www.atci.com/test-equipment.html

Connect the equipment to your computer using the cable CC-041 (mini USB male – USB male) supplied with the equipment.

For more information about the NetUpdate program, see the user's manual, which is available on the ATCi website.

10.2 V/A Output Connector

The V/A output connector allows connecting a video/audio analogue output signal. This connection allows you to switch between the image from the equipment to an auxiliary monitor by following these steps:

1. Connect the jack 4V cable to the video/audio output connector (see figure 5), ensuring that the plug is fully inserted.
2. Connect the opposite end (RCA connector) to the auxiliary monitor where video and audio of the equipment will be played.
3. Switch on the equipment and press the **Settings** key for 1 second.
4. In the **Video & Audio Settings** menu, enable **Video output**.
5. Then, the image on the equipment disappears and the auxiliary monitor shows a message asking for confirmation to switch the image.
6. Press the joystick to accept and the image will appear on the auxiliary monitor. If you do not press the joystick after ten seconds the image will return to the equipment.
7. To recover the image from the auxiliary monitor to the equipment, press the F1 key for two seconds.

10.3 V/A Input Connector

The V/A input connector allows connecting a video/audio analogue input signal. This connection allows the user to view an image on the equipment screen coming from an external source by following these steps:

1. Connect the supplied jack 4V cable to the video/audio input connector (see Figure 5), ensuring that the plug is fully inserted.
2. Connect the opposite end (RCA connector) to the source of video/audio.
3. Switch on the equipment and select the terrestrial and analog signal.
4. Select TV mode and press F3: Input.
5. From the menu, select "External". A message shows that the external input has been selected.
6. After a few seconds, the input image will be displayed on screen.
7. With the option F4: Aspect, you can select the aspect ratio of the image, between 4:3 and 16:9.

10.4 RF Connector

► **DiSEqC commands**:

The RF connector allows controlling an antenna using DiSEqC commands. DiSEqC (Digital Satellite Equipment Control) is a communication protocol between the satellite receiver and the installation accessories of satellite (switches, LNBs, etc.) proposed by Eutelsat, in order to standardize the diversity of switching protocols (13 to 18 V, 22 kHz) and meet the needs of the installations for the reception of digital TV.

1. Connect the RF cable (see Figure 6) to the RF connector for the input signal of the equipment.
2. Press the **Spectrum** key to access the spectrum analyzer mode.
3. Press the **Settings** key and select the satellite band.
4. From the **Settings** menu, select the polarization (horizontal/vertical) and the satellite band (high/low).
5. If necessary, enable the **Supply output** and select the supply voltage for the LNB.

6. Select the option **DiSEqC mode**.

7. Two new functions appear on the softkeys: Command F3 and Software F4. DiSEqC programs appear classified in categories or folders.

8. Select the command or program and press the joystick to send it to the antenna. These commands or programs allow the user to control an antenna (for more information about DiSEqC commands and programs see Annex 3).

► **SatCR commands**:

By means of function SatCR it is possible to control the devices of a TV satellite installation that are compatible with the SatCR (Satellite Channel Router) technology, which allows to concentrate downlink frequencies (slots) by an only cable. By this way each user using a slot can tune and decode any signal present in the satellite.

1. Connect the RF cable (see Figure 6) to the RF connector for the input signal of the equipment.

2. Press the **Spectrum** key to access the Spectrum analyzer mode.

3. Press the **Settings** key and select the satellite band.

4. Select the polarization (horizontal/vertical) and the satellite band (high/low).

5. If necessary, enable the **Supply output** and select the supply voltage for the LNB.

6. In the option SatCR, select ON to enable it. It appears the Sat CR icon at the top right corner.

7. Also in the SatCR option, select Configuration to access SatCR parameters.

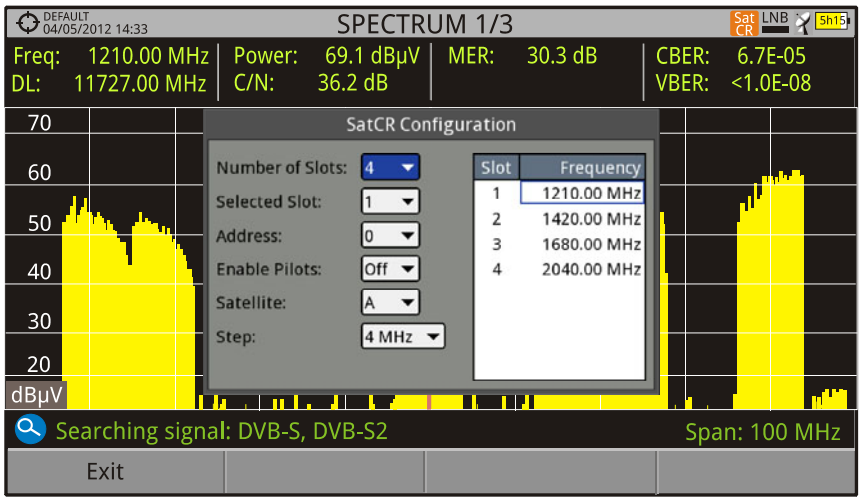


Figure 93. SatCR command screen.

The configuration window shows the options that user can modify: number of slots, slot selected, device address, pilot signal activation (when activating the SatCR device located in the headend, it emits a pilot signal with constant level for each downlink frequency to identificate available channels), selected satellite and frequency step. For each type of slot number unit there is a list of independent frequencies to select. The user may have separate frequencies for 2, 4 or 8 slots units and these values are not lost when switching from one type to another.

► **JESS commands:**

Through the JESS function is possible to control the devices of a TV satellite installation that are compatible with JESS technology (***JULTEC Enhanced Stacking System***). This technology has two main functionalities: one for configuring the JESS headends, and another for configuring the JESS sockets. JESS requires bidirectional DiSEqC capabilities. Although this equipment do not have such capability, a simpler way to blind configure JESS units has been implemented, without any confirmation other than spectrum reference. For more information about JESS technology, developed by JULTEC, refer to its website (http://jultec.de/).

1. Connect the RF cable (see Figure 6) to the RF connector for the input signal of the equipment.
2. Press the **Spectrum** key to access the spectrum analyzer mode.
3. Press the **Settings** key and select the satellite band. From the **Settings** menu, select the polarization (horizontal/vertical) and the satellite band (high/low).

4 If necessary, enable the **Supply output** and select the supply voltage for the LNB.

5 In the option **JESS**, select ON to enable it. It appears the JESS icon at the top right corner of the screen.

6 Now the JESS option shows a new menu. Select **Configuration** to access the JESS parameters. The user can select the power, central frequency, tone beacon and satellite for each band. The user can also select the number of user bands and the available satellites through the option "Configuration" on key F2.

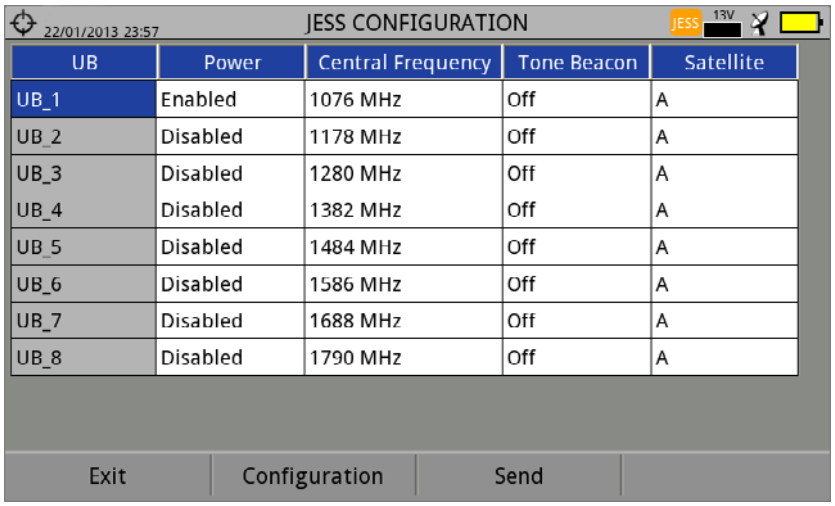


Figure 94.

7 Also from option JESS, select **Socket** to access the configuration of JESS socket. The user can select the user bands that should be enabled for the socket and to send them to configure the socket.

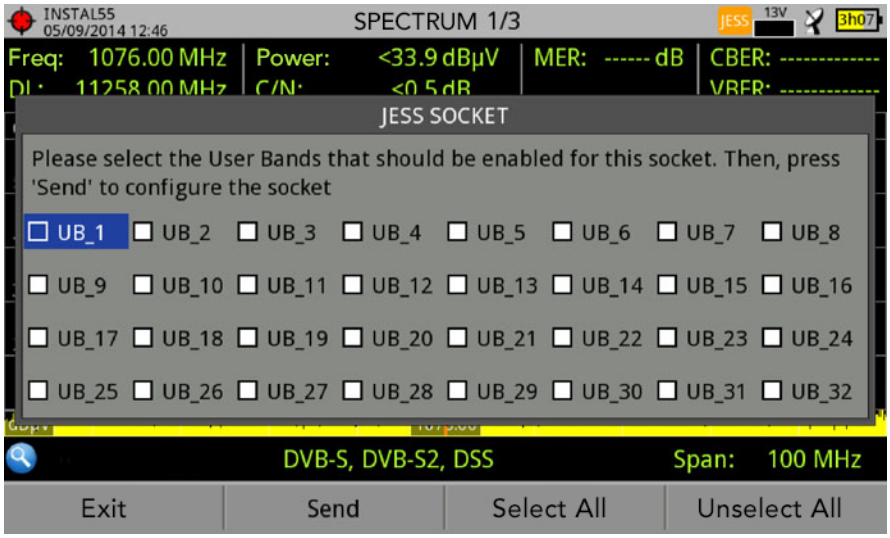


Figure 95.

8. Once JESS is configured, the user, through the F1 key "Tuning" can select the JESS user band.

10.5 HDMI Output

HDMI (High-Definition Multimedia Interface) is a compact audio/video interface for transmitting uncompressed digital data. HDMI supports, on a single cable, any TV or PC video format, including standard, enhanced, and high-definition video; up to 8 channels of digital audio; and a Consumer Electronics Control (CEC) connection. The CEC allows HDMI devices to control each other when necessary and allows the user to operate multiple devices with one remote control handset.

This connection allows the equipment to interface with other High Definition equipment. It can also be very useful to check proper operation of the client's TV while on a service call. Everything that can be seen on the meter's screen is available through the HDMI.

To switch between the image from the equipment to an auxiliary monitor by following these steps:

1. Connect the HDMI cable to the HDMI output connector (see figure 5), ensuring that the plug is fully inserted.
2. Connect the opposite end to the auxiliary monitor where video and audio of the equipment will be played.
3. Switch on the equipment and press the Settings key  for 1 second.
4. In the Video & Audio Settings menu, enable Video output.
5. Then, the image on the equipment disappears and the auxiliary monitor shows a message asking for confirmation to switch the image.
6. Press to accept and the image will appear on the auxiliary monitor. If you do not press after ten seconds the image will return to the equipment.

10.6 Common Interface Slot

This connection enables the conditional access (decryption) for encoded digital TV signals, in agreement with the DVB-CI (Common Interface) recommendation.

This technology supports all those decryption systems for which a valid CAM module exists, according to DVB-CI, with the corresponding subscriber card.

The equipment by means of Common Interface method offers the possibility of supporting various conditional access systems, so that video and/or audio broadcast by encrypted services (scrambled TV for subscribers) may be decoded following the SimulCrypt model. It provides a standard connector to insert CAM modules (Conditional Access Module), which allows a specific management for each codification system.

SimulCrypt is a process that supports various parallel conditional access systems, together with the encryption algorithms specified by DVB-CSA (Common Scrambling Algorithm) to control access to pay-TV services. The SimulCrypt broadcasts Transport Stream contains keys for various conditional accesses, thereby allowing reception by more than one type of decoder.

NOTE: The insertion of a CAM module or a SMART-CARD in a wrong position might produce the instrument malfunction and could generate damages to the equipment.

► **Operation**

1 Insert the subscriber Smart-Card in the CAM module.

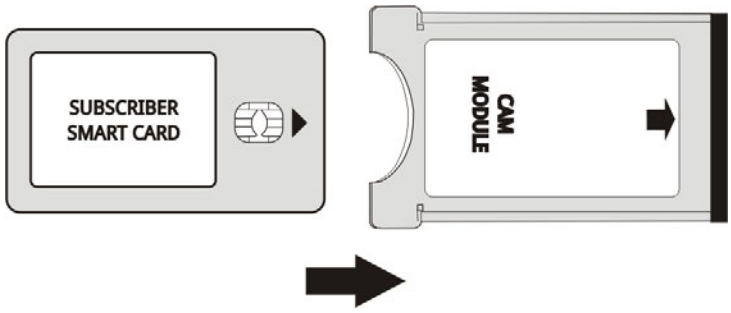


Figure 96. Subscriber Smart-Card and CAM module insertion.

2. Insert the CAM module in the Common Interface slot of the equipment. The CAM module connector is located on the equipment rear panel. Place the instrument on a stable surface and insert the module so the printed arrow appears on visible upper face, pressing until the extractor mechanism button becomes activated.

3. If the equipment detects the CAM module it shows a confirmation message.

4. Press the Settings key .

5. Select the **Common Interface** option.

6. By means of this option the user can navigate through the CAM module menu.

7. To extract an inserted CAM module, press the button from extractor mechanism and remove the module. If the equipment detects the CAM module extraction it shows a confirmation message.

10.7 TS ASI Input / Output

It is an asynchronous serial interface. It is the serial standard used for MPEG-2 TS, in multimedia equipment interconnection:

- Synchronous 270 Mbps data flow (up to 218 Mbps payload).
- Differential signal over coax interface.
- Allows intermediate node testing in broadcast and distribution infrastructures.

10.7.1 TS-ASI Input

The TS-ASI option is a key feature. You can monitor and analyze streams coming from satellite receivers, transport stream players, multiplexers, etc... It automatically detects whether the stream is composed of 188 or 204 bytes.

► **Operation**

1. Press the Settings key to access the settings.

2. Select the Decoder TS Input option. It shows up a menu to select the transport stream coming into the equipment between the RF Demodulators, IPTV and the ASI Input.

3. The RF Demodulators option (this option is available only if RF is selected as a Signal Source) extracts the TS from the RF signal by means of the internal RF demodulator. The RF signal can come from digital terrestrial, satellite or cable.
4. The IPTV option (this option is available only if IPTV is selected as a Signal Source) extracts the TS from the IPTV signal.
5. The ASI Input option gets the TS directly through the ASI-TS input connector.

10.7.2 TS-ASI Output

It can transmit in packet mode or burst mode. User can use the transport stream received by the equipment to feed the signal to other devices as well through the TS-ASI output.

► **Operation**

1. Press the Settings key to access the settings.
2. Select the ASI Output option. It allows the user to select the signal source for the TS-ASI packets going out through the ASI Output. User can select among Off, IPTV, RF demodulators and ASI Input.
3. The Off disables the ASI Output. If the RF Demodulators option (this option is available only if RF is selected as a Signal Source) is selected, the signal through ASI Output is the TS extracted from the RF signal by means of the internal RF demodulator. The RF signal can come from digital terrestrial, satellite or cable. If the IPTV option is selected (This option is available only if IPTV is selected as a Signal Source), the signal through ASI Output is the TS extracted from the IPTV signal. The ASI Input option enables the TS-ASI packets coming from ASI input connector go out through the ASI output connector.

10.8 IP network

Refer to IPTV chapter.

11.7 TE-3000

► Inputs and Outputs

Parameter	Value	Additional data
RF Input		
Connector Input type	F male	75 Ω
Maximum Signal	130 dBµV	
Maximum Input Voltage	50 V rms	DC to 100 Hz; powered by the AL-103 power charger
	30 V rms	DC to 100 Hz; not powered by the AL-103 power charger
	140 dBµV	Protected up to 30 seconds
Video/Audio Input/Output		
Connector Input	Multipole Jack	75 Ω
Connector Output	Multipole Jack	75 Ω
Sensibility	1 Vpp	75 Ω; positive video
Sound Input/Output		
Connector Input	Multipole Jack	75 Ω; same V/A input multipole jack
Outputs	Built-in speaker	
	Multipole Jack	75 Ω; same V/A output multipole jack
DVB-ASI Input/Output		
Connector Input	BNC female	75 Ω
Connector Output	BNC female	75 Ω
Bit Rate max	80 Mbit/s	
IP Interface		
Connector	RJ45	Also known as 8P8C. With Tx/Rx LED indication
Type	Ethernet 10/100/1000 Mbps	
Protocol	UDP/RTP	
Transmission	Multicast, IGMP v2 standard SMPTE 2022-1	
Protection	FEC standard SMPTE 2022-2	
Payload	from 1 to 7 Transport stream MPEG-2 packets	
USB Interface		
Connector	mini-USB	
Characteristics	OTG (On-the-go)	
	Mass storage host	Can read/write on flash drives
	Serial port emulation	
	USB CDC	Communications Device Class

Parameter	Value	Additional data
Monitor Display		
Monitor	7" TFT	Transmissive colour dot matrix type
Aspect ratio	16:9	
Dot Format	800 x 480 dots	(R,G,B)(W) x (H)
Brightness	700 cd/m^2	
External Unit Power (through the RF input connector)		
Terrestrial Supply	External, 5, 12 and 24 V	
Satellite Supply	External	Up to 500 mA
	13 V	Up to 500 mA
	15 V	Up to 500 mA
	18 V	Up to 500 mA
22 kHz signal Voltage	0.65 V ± 0.25 V	Selectable in Satellite band
22 kHz signal Frequency	22 kHz ± 4 kHz	Selectable in Satellite band
Maximum Power	At least 6 W for 13, 15, 18, 24 V	If you select 5V, the maximum power shall not excede 2.25 W (450 ma)
DiSEqC Generator	According to DiSEqC 1.2 standard	DiSEqC is a trademark of EUTELSAT

► Mechanical Features

Parameter	Value	Additional data
Dimensions	290x185x95 mm	WxHXD
Weight	2.2 kg	without options
Size	5.096 cm^3	

► Power Supply

Parameter	Value	Additional data
Internal battery	7.2 V; 13 Ah	Li-Ion Intelligent battery
Battery Operation Time	> 5 hours in continuous mode	No EXTERNAL supply active
Recharging time	3 hours up to 80%	Instrument off
External Voltage	12 V DC	Using only ATCi supplied accesories
Consumption	50 W	
Auto Power Off	Programmable	After the selected amount of minutes without operating on any control. Deactivable

► Operating Environmental Conditions

Parameter	Value	Additional data
Altitude	Up to 2000 m	
Temperature range	From 5 °C to 45 °C	Automatic disconnection by excess of temperature
Max. Relative humidity	80%	up to 31°C; decreasing lineally up to 50 % at 40 °C.

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

► Included Accesories

Parameter	Value	Additional data
1x CC-046	Jack 4V/RCA cable	
1x CC-041	Connection USB Cable On-the-go (A) Male – Mini USB (B) Male	
1x CC-045	USB Cable (A) Female – Mini USB (A) Male	
1x AA-103	Car lighter charger	
1x AL-103	External DC charger	
1x AD-055	"F"/H-BNC/H adapter	
1x AD-056	"F"/H-"DIN"/H adapter	
1x AD-057	"F"/H-"F"/H adapter	
	Mains cord	
1x CB-084	Rechargeable Li+ battery 7,2 V 13 Ah	
1x DC-300	Transport belt	
1x DC-302	Carrying bag	
1x DC-230	Transport suitcase	
	Quick Reference Guide	

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.

11.8 Measurement Mode

► ATSC

Parameter	Value	Additional data
Modulation	8-VSB	
Margin of power measurement	From 45 dBµV to 100 dBµV	
Measures	Power, SER, VBER, MER, C/N and noise margin	
Displayed data	Numeric and level bar	
Demodulation	16/32/64/128/256 QAM	
Symbol rate	10,762 Mb/s	
Code Rate	2/3	
Spectral inversion	ON, OFF	Auto

► J83 Annex B

Parameter	Value	Additional data
Modulation	COFDM	
Margin of power measurement	From 35 dBµV to 115 dBµV	
Measures	Power, BER, MER, C/N and noise margin	
Displayed data	Numeric and level bar	
Bandwidth	5, 6, 7 and 8 MHz	
Spectral Inversion	ON, OFF	Auto
Demodulation	64/256 QAM	
Symbol rate	5057 / 5361 kbauds	
Roll-off (α) factor of Nyquist filter	0.18 / 0.12	
Spectral inversion	ON, OFF	Auto

► DVB-C

Parameter	Value	Additional data
Modulation	QAM	
Margin of power measurement	From 45 dBµV to 115 dBµV	256QAM:42dBµV 128QAM: 39dBµV 64QAM: 36dBµV 32QAM: 33dBµV 16QAM: 30dBµV
Measures	Power, BER, MER, C/N and Link margin	
Displayed data	Numeric and level bar	
Demodulation	16/32/64/128/256 QAM	
Symbol rate	1800 to 7200 kbauds	
Roll-off (α) factor of Nyquist filter	0.15	
Spectral inversion	ON, OFF	Auto

► Analog TV

Parameter	Value	Additional data
Color System	PAL, SECAM and NTSC	
Standard supported	M, N, B, G, I, D, K and L	
Sensibility	40 dBµV for a correct synchronism	

► FM

Parameter	Value	Additional data
Tuning range	45 to 1000 MHz	
Tuning step size	10 kHz	
Sensitivity	5 dBµV	150 MHz (S+N/N = 40 dB)
Selectivity (mono)	± 200 kHz 25 dB	

► DVB-S

Parameter	Value	Additional data
Modulation	QPSK	
Margin of power measurement	From 35 dBµV to 115 dBµV	18 dBµV@2.15 GHz / 2 MSs; 30 dBµV@2.15 GHz / 27 MSs; 33 dBµV@2.15 GHz / 45 MSs
Measures	Power, CBER, MER, C/N and Link Margin	
Displayed data	Numeric and level bar	
Symbol rate	2 to 45 Mbauds	
Roll-off (α) factor of Nyquist filter	0.35	
Code Rate	1/2, 2/3, 3/4, 5/6, 7/8	
Spectral inversion	ON, OFF	Auto

► DVB-S2

Parameter	Value	Additional data
Modulation	QPSK, 8PSK, 16APSK, 32APSK	
Margin of power measurement	From 35 dBµV to 115 dBµV	8PSK: 24 dBuV@2.15 GHz / 2 MSs; 34 dBuV@2.15 GHz / 27 MSs
Measures	Power, CBER, LBER, MER, C/N, BCH ESR, Wrong Packets and Link Margin	
Displayed data	Numeric and level bar	
Symbol rate	2 to 45 MSps	QPSK, 8PSK, 16APSK, 32APSK
Roll-off (α) factor of Nyquist filter	0.20, 0.25 and 0.35	
Code Rate (8PSK)	1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10	
Code Rate (QPSK)	3/5, 2/3, 3/4, 5/6, 8/9, 9/10	
Spectral inversion	ON, OFF	Auto
Pilots	Presence Indication	

► DSS

Parameter	Value	Additional data
Modulation	QPSK	
Margin of power measurement	From 35 dBµV to 115 dBµV	
Measures	Power, CBER, VBER, MER, C/N and Noise Margin	
Displayed data	Numeric and level bar	
Symbol rate	20 Mbauds or variable	Auto detected
Roll-off (α) factor of Nyquist filter	0.20	
Code Rate	1/2, 2/3, 6/7 and AUTO	
Spectral Inversion	ON, OFF	Auto

11.9 Spectrum Analyzer Mode

► Digital Signal

Parameter	Value	Additional data
General Parameters		
Resolution filter	100 kHz	
Markers	1	It displays frequency, level indication, level difference, frequency difference
Reference Level	60 dBµV to 135 dBµV	Adjustable in steps of 5 dB
Spectrum range		Span, dynamic range and reference level are variable by means of arrow cursors
Terrestrial		
Tuning range	5 to 1000 MHz	Continuous tuning from 5 to 1000 MHz
Tuning mode	Channel or frequency	Channel plan configurable
Resolution	10 kHz	
Measurement range	10 dBµV to 130 dBµV	3.16 µV to 3.16 V
Measurement bandwidth	100 kHz	
Span	Full span-500-200-100-50-20-10 MHz	Full span (full band); selectable by joystick
Digital channels measures	Channel power, C/N	
Satellite		
Tuning range	950 to 2150 MHz	
Tuning mode	Intermediate frequency or downlink	Channel plan configurable
Resolution	10 kHz	
Measurement range	10 dBµV to 130 dBµV	3.16 µV to 3.16 V
Measurement bandwidth	100 kHz	
Span	Full span-500-200-100-50-20-10 MHz	Full span (full band); selectable by joystick
Digital channels measures	Channel power, C/N	According to modulation type

► Analog Signal

Parameter	Value	Additional data
General Parameters		
Attenuation scale	Auto-range	
Numerical indication	Absolute value according to selected units	
Graphical indication	Analog bar on screen	
Audible indicator	Pitch sound	Tone with pitch proportional to signal strength
Terrestrial		
Tuning range	5 to 1000 MHz	
Tuning mode	Manual	
Resolution	10 kHz	
Measurement range	15 dBµV to 130 dBµV	3.16 µV to 3.16 V
Measurement bandwidth	100 kHz	
Analog channels measures	Level, C/N, V/A	
Accuracy	±1.5 dB	25-120 dBµV; 45-1000 MHz; 22 °C ± 5 °C
Out of range indication	<, >	
Satellite		
Tuning range	950 to 2150 MHz	
Tuning mode	Intermediate frequency or downlink	Channel plan configurable
Resolution	10 kHz	
Measurement range	20 dBµV to 130 dBµV	31.6 µV to 3.16 V
Measurement bandwidth	100 kHz	
Analog channels measures	Level, C/N	
Accuracy	±1.5 dB	35-100 dBµV; 950-2050 MHz; 22 °C ± 5 °C
Out of range indication	<, >	

11.10 TV Mode

► Video

Parameter	Value	Additional data
Codecs	MPEG-1	
	MPEG-2	MP@HL (Main profile high level)
	MPEG-4 AVC H.264	High Profile Level 4.1; maximum bitrate 40 Mbps
Maximum Image Size	1920x1080x60i; 1280x720x60p/50p	
Minimum Image Size	352x240x30p; 352x288x25p	
Bitrate	40 Mbps	
Aspect Ratio	16/9; 4/3	
SI/PSI data	Service list and main PIDs	
HD Video Resolution	1080, 720 and 576	Progressive or interlaced
Conditional Access Type	Common Interface	By means the CAM module
HDMI output resolution	1920x1080	

► Audio

Parameter	Value	Additional data
Codecs	MPEG-1	
	MPEG-2	
	HE-AAC	
	Dolby Digital and Dolby Digital +	
Demodulation	According to the TV standard	
De-emphasis	50 µs	75 µs (NTSC)
Sound subcarrier	Digital frequency synthesis according to the TV standard	

► Transport Stream

Parameter	Value	Additional data
Communication protocol	UDP or RTP/UDP	
Packets	188 or 204 bytes	Automatic detection
Transmission	Packet or burst mode	
Methode	MULTICAST / IGMP version 2	
Payload	From 1 to 7 packets MPEG-2	
Video Info	Type, bitrate, format, aspect ratio, frequency, profile, PID	
Service Info	Network, provider, NID, ONID, scrambled/free, TSID, SID, LCN	
Audio Info	Type, bitrate, format, frequency, mono/stereo, language, PID	

11.11 Tools

► Constellation

Parameter	Value	Additional data
Type of Signal	ATSC (8-VSB), QAM -B/-A, DVB-C, DSS, DVB-S and DVB-S2	
Displayed data	I-Q graph	

► LTE Ingress Test

Parameter	Value	Additional data
Type of signal	ATSC	
Displayed data	LTE band plus quality parameters for a selected TV channel	

► Attenuation Test

Parameter	Value	Additional data
Test frequencies	3 selectable pilots	

► Datalogger

Parameter	Value	Additional data
Stored data	Signal type, modulation parameters, all measures available for the detected signal type, and time stamp	
Timestamp	Date and time at each measured channel	

11.12 IPTV

► Streams Multicast

Parameter	Value	Additional data
IP	224.0.0.0 to 239.255.255.255	
Ports	1024 to 65535	
Maximum bitrate	80 Mbit/s	

11.13 Transport Stream Analyzer

► Tables

Parameter	Value	Additional data
PSI Tables	PAT	Program Association Table
	PMT	Program Map Table
	NIT	Network Information Table
	CAT	Conditional Access Table
SI Tables	NIT	Network Information Table
	BAT	Bouquet Association Table
	SDT	Service Description Table
	EIT	Event Information Table
	TDT	Time and Date Table
	TOT	Time and Date Table

► Bitrate

Parameter	Value	Additional data
Maximum bitrate	80 Mbit/s	

► Alarm

Parameter	Value	Additional data
According to ETSI std TR101 290 V1.2.1		Sections 3.3, 3.9 and 3.10 (no measurements done)

11.14 Options

► Fiber Optics

Parameter	Value	Additional data
Selective Optical Power Meter		
Optical Measure bands	1310 nm ± 50 nm; 1490 nm ± 10 nm; 1550 nm ± 15 nm	
Connector	FC/APC	
Measurement Dinamic Range	- 49,9 dBm to +10 dBm	Accuracy ± 0,5 dB
Isolation between bands	> 45 dB	
Optical to RF Converter		
Dynamic range of conversion	From -5 dBm to +10 dBm	
Atenuación RF	ON = 15 dB; OFF = 0 dB	
RF band converted (Optical Cable and DTT links)	From 65 MHz to 1000 MHz	
RF band converted (Optical IF-Satellite Installations)	From 950 MHz to 5450 MHz	for universal optical LNB
RF output	From 65 MHz to 2150 MHz	
5 GHz RF Auxiliary input		
Connector	SMA	
Frequency bands	Band1 = De 2150 MHz a 3000 MHz	
	Band2 = De 3400 MHz a 4400 MHz	
	Band3 = De 4400 MHz a 5400 MHz	
Dynamic Range	45 -105 dBµV	ATT OFF
	60 - 120 dBµV	ATT ON
Conversion Gain	7 dB	
	-8 dB	
Flatness	+-5 dB	
Spurious	< 45 dBµV	(-65 dBm) typical
Intermodulation products	<15 dB typical	
Maximum input signal	RF: 120 dBµV; DC: 50 V	

► DAB/DAB+

Parameter	Value	Additional data
Combined antenna input	for Band III	
DAB sensitivity	up to -94 dBm typical	
Decodes audio services	up to 384 kbit/s	

► GPS

Parameter	Value	Additional data
Chipset	GSP3F	SIRF Start III technology
Frequency	L1, 1575.42 MHz	
C/A code	1.023 MHz chip rate	
Channels	20	
Accuracy Position	10 meters, 2D RMS 5 meters 2D RMS, WAAS corrected <5 meters (50%), DGPS corrected	
Velocity	0.1 meters/second	
Time	1 microsecond synchronized to GPS time	
Reacquisition	0.1 sec., average	
Snap start	1 sec., average	
Hot start	8 sec., average	
Warm start	38 sec., average	
Cold start	42 sec., average	
Altitude	18.000 meters max	
Velocity	515 meters/second max	
Acceleration	4g, max	
Jerk	20 meters/second, max	

12 MAINTENANCE ⚠

12.1 Considerations about the Screen

This paragraph offers key considerations regarding the use of the color 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.

12.2 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 Advanced Television System Committee (ATSC standard / 8-VSB modulation)

ATSC parameters

- **Channel BW**
  This parameters affects the frequency separation of the carriers. Its value is 6 MHz.

- **Spectral Inversion**
  This option enables spectral inversion to be applied to the input signal, though in the majority of cases it should be in the OFF position (not inversion).

- **Constellation**
  Modulation used by the carriers. It also defines the noise immunity of the system (8-VSB).

ATSC Measurements

- **Power**
  Channel power is measured assuming that power spectral density is uniform throughout channel bandwidth.

- **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.

- **SER**
  Measure of the number of erroneous segments divided by the total segments received.

- **VBER**
  BER (bit error rate) 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 correctable error per hour of transmission. This border is called QEF (Quasi Error-Free,) and corresponds to one error rate after Viterbi equal to 2x10E-4, or 2 bit errors per 10.000.

  This value is marked on the VBER. The VBER for acceptable signals should be to the left of this mark.

A1.1.2 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.

- **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**
  QPSK modulation for constellations with DVB-S signals.

- **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 ratio 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/VBER)
  It is the error rate. There are two measurements related to BER:

  - **CBER** (Channel Bit Error Rate):
    BER of the signal after the QPSK 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.

A1.1.3 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.

- **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**
  QPSK or 8PSK modulation for DVB-S2 signal constellation.

- **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).

- **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-S2 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 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 QPSK/8PSK demodulator and before applying the error correction or FEC (Forward Error Correction).

  - **LBER** (LDPC Bit Error Rate):
    BER after applying LDPC error correction (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.

A1.1.4 Digital Satellite System (DSS standard / QPSK modulation)

DSS Parameters

- **Channel Bandwidth**
  It displays the channel bandwidth.

- **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**
  QPSK modulation for DSS signal constellation.

- **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).

DSS 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 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 signal and the average noise power of the signal constellation.

- **LINK MARGIN**
  LM 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/VBER)
  It is the bit error rate. There are two measurements related to BER: CBER (Channel Bit Error Rate): BER of the signal after the 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).

A1.1.5 Digital CABLE television signal of FIRST generation (DVB-C standard/QAM modulation)

DVB-C Parameters

- **Bandwidth channel**
  It displays the channel bandwidth up to 9.2 MHz.
- **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 ratio 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)

A1.1.5 Digital multi-program systems for television, sound and data services for cable distribution (J83 Annex B)

J83 Annex B Parameters

- **Spectral inversion**
  If necessary, activates the Spectral inversion (On).

- **Modulation**
  It defines the modulation type 64 or 256.

J83 Annex B 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.

- **BER** (VBER/CBER)
  It is the system error rate. In a system of digital terrestrial signal reception, after the 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 2x10E-4, or 2 bit errors per 10.000.

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

A1.2 ANALOG signals

A1.2.1 Terrestrial band

Analog TV

In the measurement of analog 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 analog to the Signal-Noise (S/N) ratio in analog systems. T 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.

Analog FM

In the analog FM measurement mode signal, the display acts as an analog 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

Analog TV

In the measurement mode of analog 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 analog to the Signal-Noise (S/N) ratio in analog 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.

ANNEX 2 HOW TO POINT A DISH ANTENNA

A2.1 INSTALLING A SATELLITE DISH USING TE-3000

A2.1.1 A bit of history

That's it, a bit of history. First artificial satellite "Sputnik I" was launched 4th of October of 1957 by former Soviet Union. It was about the size of a basketball with a weight below 100 Kgrs but went down in history as the start point for the space age. For three weeks it was transmitting radio signals to the excited scientist on the ground that were gathering fundamental data for the launches to come.

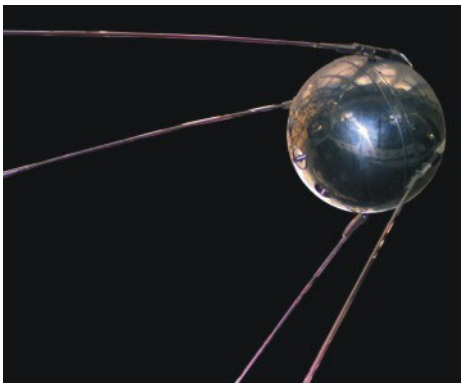


Figure A2.1.

The first telecommunications satellite was Telstar *I* launched in 1962. Some people refers to Echo *I* as the World's first in 1960 but it was a passive signal reflector as opposite to Telstar that carried electronics on board like today's satellites. It was also the first to use the modern transponder concept where the satellite "transposes" the up-link frequency (6,390 GHz in Telstar) to another down-link frequency (4,170 GHz in this case). Telstar *I* trans-mitter power was 3 Watts and the antenna was omnidirectional.

Figure A2.2.

The antenna used to receive the test transmission from Telstar *I* was a huge horn inside a bubble radome 48 metres high. Only four decades later we have broken all records and we have high power DBS geostationary satellites carrying a lot of digital transponders on board and we start to worry about space junk having thousands of satellites in orbit, plenty of them beyond its useful life. Satellites use highly efficient directional antennas and very high transmitters power, digital transponders, meaning in plain words that we can receive hundreds of TV channels with a small, fix, cheap, 60 cm dish.

Figure A2.3.

Modern broadcast satellites use geostationary orbits. This simply means that they could be seen from the ground hunging in the sky at the same exact position all the time and therefore receiving signals from them does not require complex steering systems. A piece of cake.

All we need to do to receive their signals with the enormous amount of programs they carry is to set up the satellite receiving antenna properly and to ensure that the signals are received with the proper quality levels…and here is where the **TE-3000** comes into action.

A2.1.2 The basics

A professional installer will instantly tell us from the top of his head what to have in the to-do-list if we want to install a satellite dish properly. Surely the list will require us to select the proper mount kit and dish size from the numerous options available in the market, pick a good location for the dish, free of obstacles to the south (in the north hemisphere) or to the north (in the south hemisphere), etc.

Other than the mechanical bits and pieces the dish is made of two clearly differentiated parts, the reflector and the LNB.

The reflector is passive and simply reflects signals from the satellite in such a way that the beam is collimated to the LNB's mounting point.

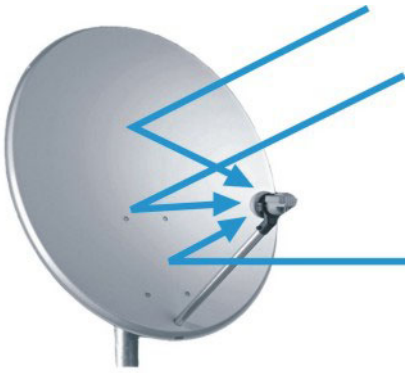


Figure A2.4.

The LNB (Low Noise Block-converter) is an active device fruit of the great evolution of RF circuit manufacturing and includes amplifiers, oscillators and frequency converters in a small low cost package. The first section is made of a device called *polarisation shifter* that receives one polarisation or the other depending on the supply voltage given to the LNB. This voltage is necessary to supply the active devices inside the LNB.

Signals broadcast from the satellites use two polarisations simultaneously. These can be LINEAR VERTICAL/HORIZONTAL or CIRCULAR LEFT/RIGHT depending on the type of transmitting antenna used in the satellite. The transponder frequencies for each polarisation are carefully selected to avoid interference to the other polarisation commonly referred to as the crossed polarisation. In general they are imbricate or in other words frequencies used in one polarisation are free in the crossed polarisation and viceversa.

	13 VDC	VERTICAL	CIRCULAR RIGHT
	18 VDC	HORIZONTAL	CIRCULAR LEFT

Modern universal LNB's use mostly linear polarisation and have also the capability to select a different input frequency range depending on a control signal called 22 kHz switching tone which is overlapped with the supply voltage.

SUPPLY VOLTAGE	POLARISATION	BAND
13 VDC	VERTICAL	LOW
18 VDC	HORIZONTAL	LOW
13 VDC + 22 kHz	VERTICAL	HIGH
18 VDC + 22 kHz	HORIZONTAL	HIGH

In other words our LNB will output a different set of satellite transponders depending on which supply voltage we use.

Figure A2.5. An example of LNB (Low Noise Block-converter)

A2.1.3 Coarse dish alignment

We can use different techniques to find out where in the sky the satellite we want is located. They can be anything from a pure guessing game to a sophisticated procedure.

The satellites we are interested in are all positioned in a geostationary orbit above the earth's equator. Each of them has a fix given position in that orbit, something like a street number, that we can know from various sources. Orbital position is an important datum so it is commonly part of the name as well.

Websites like http://www.lyngsat.com/ or http://www.satcodx.com/ offer plenty of useful information about the satellites we are talking about.

For example ASTRA 19E refers to ASTRA satellite which is positioned at 19 degrees East in the orbit.

Knowing where we are in terms of latitude and longitude is also easy. We can read that information from a map or even from our car's navigation system if we have one.

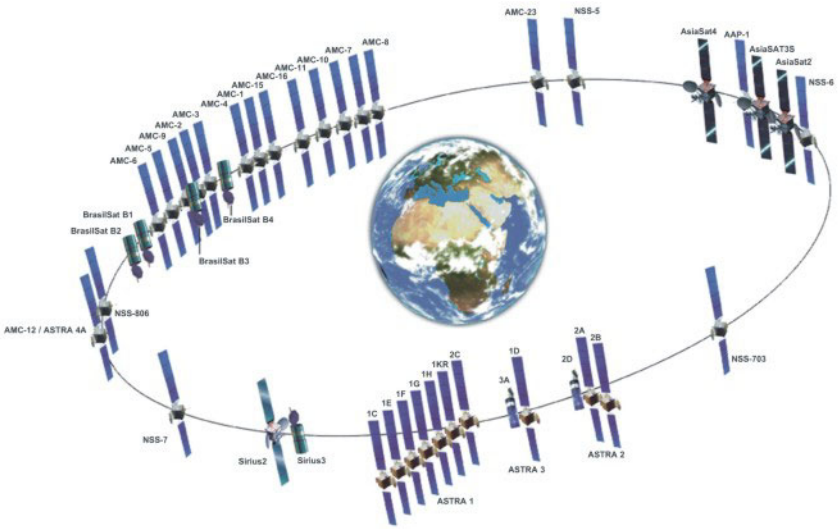


Figure A2.6.

With this information in hand we can calculate the elevation and azimuth we should put on the dish to begin our coarse antenna alignment. There are formulas to do that but some websites are again quite useful. There are also free mobile applications, as Dish Aligner, which calculates the elevation and azimuth and also your current location determined by the GPS of the mobile phone. This one is especially interesting for you can select the satellite you want and then position yourself on a graphical map:

http://science.nasa.gov/realtime/jtrack/3d/JTrack3D.html/

For example if we take ASTRA (19E position) and select a location somewhere in Germany:

- Latitude: 50 degrees North
- Longitude: 12 degrees East

The required elevation and azimuth for the dish are:

- Azimuth: 170 degrees
- Elevation: 31 degrees

Elevation must be measured from the horizontal level (may be using an inclinometer) and azimuth from magnetic north (with a compass) there are some applications for smartphones, as mentioned above, that include compass and inclinometer, although it should be noted that the measurements made by mobile phone may be affected by interferences from the antenna itself. It is normally more practical to start with azimuth moving the dish horizontally and then look for the elevation.

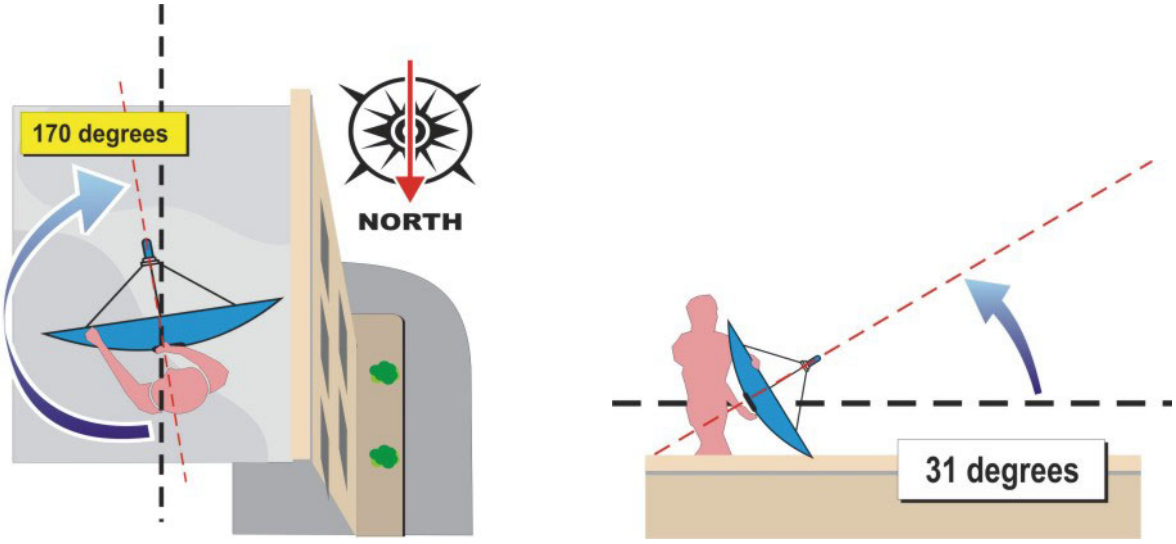


Figure A2.7.

A2.1.4 Knowing what satellite we are on

And the **TE-3000** comes into action. Our dish is now more ore less "looking" in the direction where we presume our "bird" is parked. With the **TE-3000** connected to the output of the LNB we select satellite frequency range, antenna alignment mode, span of 200 MHz and set the power supply voltage to one of the possible values. We will take for example 13 VDC, which will take us to the VERTICAL polarisation and LOW band. We can use 80 dBµV for the reference level for we can change that at pleasure depending on the amount of signal we get.

Something will come up on the **TE-3000** screen. It will normally be a weak signal that may come from the desired satellite or from the neighbour ones for the dish is not properly tuned up yet. Swing the dish slightly horizontally and vertically until a decent signal is shown on the screen.

There we have a satellite but which one is it? Most probably the signals we are looking at are digital transponders from the unknown satellite. The **TE-3000** can be operated in frequency or channel modes.

Tune any of those digital channels in frequency mode using the joystick and the markers shown on the screen. The **TE-3000** will tell you what satellite and/or orbital position you are on in a matter of seconds !

If we are unlucky and this is not the satellite we want then we only need to move the dish slightly to pick the signal from the next satellite and repeat the process.

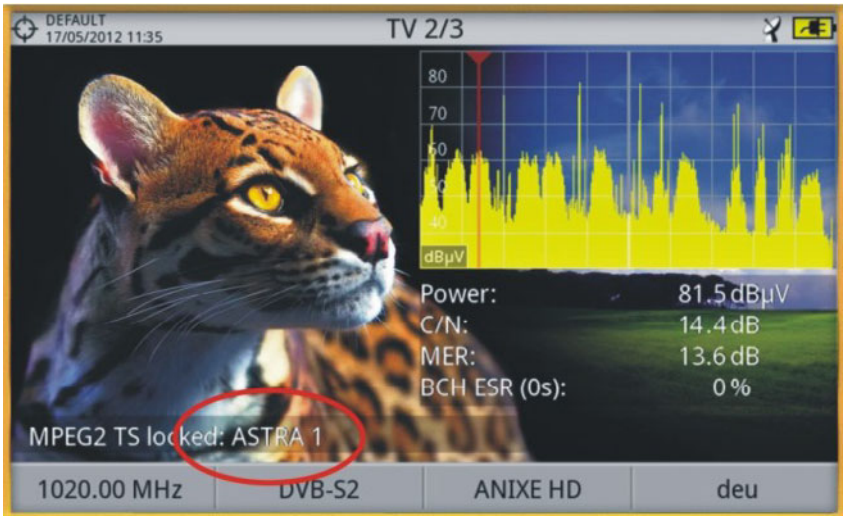


Figure A2. 8.

A2.1.5 Fine tuning the dish

Once we know for certain that we are on *ASTRA 19E* it is time to make fine adjustments to the dish to optimise the alignment. There are two goals to achieve. On the one hand we want to receive the maximum amount of power possible and on the other hand we need to make sure we minimise the interference from the crossed polarisation.

In order to maximise the received signal power we need only to move the dish's azimuth and elevation very carefully ensuring that the display of the spectrum analyzer show us the highest values possible.

As you move the dish's position you will see the signal change on the spectrum analyzer. Cross-polarisation is adjusted by rotating the LNB on its axis. As you do so you will see on the **TE-3000** screen how the channels interfering from the opposite polarisation go up and down the objective being to leave the LNB in such a position that those channels are as low as possible.

A2.1.6 Testing signal quality

The **TE-3000** is the ideal instrument for quick and effective checks of signal quality not only because it shows all measurements in one single screen but also because the meter doesn't require bothering configuration processes.

- **Option 1: Frequency mode**

  I can tune in frequency mode all channels coming up in the screen, all of them or the most representative ones only. We can move our cursor in frequency mode, in spectrum, through out the band. When we stop on a channel, the meter will acquire all the settings needed to measure the channel without bothering us. Then pressing the measurement button and voilà.

- **Option 2: Channel mode**

  I can select channel mode and a satellite channel table from the list. The **TE-3000** has several of them preloaded but this can be changed using software application.

  Once we select the desired table, *ASTRA 19E* in this case, we can browse the channels at once. There are channel tables grouped by polarisation or band or those with all channels in the satellite.

A2.1.7 Look what we've got

The **TE-3000** can also display the free to air programs available in the satellite. That is very practical not so much for the picture itself but for amount of interesting data related to the transponders we can display as well. This includes:

Tuned video information.

- **TYPE**: Encoding type and video transmission rate.
- **FORMAT**: Resolution (horizontal x vertical), aspect ratio and frequency.
- **PROFILE**: Profile level.
- **PID**: Video program identifier.

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.
- **LCN**: Logic Channel Number. It is the first logic number assigned to the first channel in the receiver.
- **+Info**: Additional service information.
- **FREE/ SCRAMBLED**: Free/scrambled transmission.
- **DTV/DS**: Standard type of transmission.

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.

At any time it is possible to display the SERVICE LIST pressing the F3 key and show all the programs and services available within the tuned channel. Selecting one particular channel or service becomes very intuitive.

ANNEX 3 DiSEqC COMMANDS

A3.1 DiSEqC introduction

The **DiSEqC™** (Digital Satellite Equipment Control) is an open protocol created by Eutelsat in 1997 as a communication standard between satellite TV receivers and external peripherals. The DiSEqC™ communications are based on the control commands, which travel combined with power voltage through the coaxial cable that leads the TV signal. The compatible peripherals and receivers detect these commands and react in agreement with such.

A **DiSEqC™** command is a digital command represented by a succession of binary messages: "0" and "1" obtained when modulating the 22 kHz signal.

The **DiSEqC™** usually is used in the satellite TV facilities in order to use different types of switchers, through the coaxial cable that leads the TV signal.

A3.2 To begin: The Universal LNB

The Universal LNB is the simplest and most used LNB. This allows the signal reception coming from one single satellite.

TWIN (2 independent outputs), QUAD (4 independent outputs) and OCTO (8 independent outputs) versions exist in the market. Each output is independent from others and can be connected to a different receiver.

An universal LNB is controlled by means of a power voltage and a 22kHz signal, sent through the RF cable, which allows us to switch between the different bands and polarities, according to the following table:

'Standard'	'TWIN'	'QUAD'*	'OCTO'
			
1 satellite only 1 receiver	1 satellite only 2 receivers	1 satellite only 4 receivers	1 satellite only 8 receivers

Power	Band	Polarization(linear / circular)
13 V	Low	Vertical / Right
18 V	Low	Horizontal / Left
13 V + 22 kHz	High	Vertical / Right
18 V + 22 kHz	High	Horizontal / Left

* Not to confuse with LNB Quattro used in collective facilities.

Note: The LNB accept a very wide range of values for these voltages, usually 10-14.5V (for 13V) and 15.5-20V (for 18V).

In the **TE-3000** the band and the polarisation selection can be done from different menus (all the different ways indicate dare equivalent):

Menu	Line
External units power supply	13 V, 18 V, 13 V+22kHz, 18 V+22kHz
Configuration	Band: High / Low Polarization: Vertical / Horizontal
DiSEqC	Band: High / Low Polarization: Vertical / Horizontal

A3.3 DiSEqC™ around the world

The use of **DiSEqC™** devices requires to know previously which commands are acknowledged by these ones, since it will determine the wiring diagram of the different elements, as well as the way as they can be controlled. This information must be provided by the device manufacturer.

Following appear the **DiSEqC™** devices more usually installed in the individual and collective facilities.

A3.4 In the individual facilities

A3.4.1 Tone-burst switcher (2 inputs – 1 output)

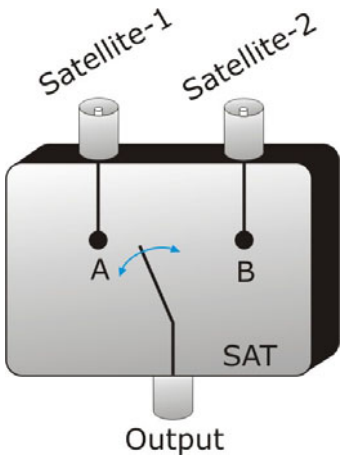


Figure A3. 1.

It is the simpler **DiSEqC™** switcher. This one uses the « SAT A/B » commands and allows to switch between two different Universal LNB:

Command	Selected input
SAT A	Satellite 1
SAT B	Satellite 2

These switchers are transparent to the LNB's (13V, 18V, 22 kHz) commutation commands. Then, once chosen the satellite with the SAT command, the corresponding LNB can be used in a normal way. (see Universal LNB).

Note: There are switchers of 2 inputs and 1 output in which other **DiSEqC™** commands are used, such as POSITION or OPTION, to allow more complex assemblies. Refer to the manufacturer technical information to make sure which are the commands to use.

A3.4.2 Monobloc LNB

A Monobloc LNB is a module composed by 2 Universal LNB connected by a Tone-burst switcher (2 inputs – 1 output). So, it can be managed in the same way.

Also TWIN (2 independent outputs), QUAD (4 independent outputs) and OCTO versions exist (8 independent outputs). In this case, each output is controlled in a different way from the rest.

Important: If it is desired to use Monobloc LNB with **DiSEqC™** switchers, is necessary to make sure that these are compatible.

Figure A3. 2.

A3.4.3 DiSEqC™ Switcher with 4 inputs and 1 output

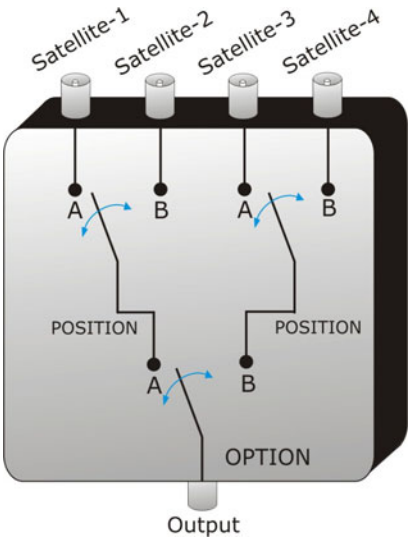


Figure A3. 3.

This switcher allows the signal reception from four independent Universal LNBs (coming from 4 different satellites) on a single receiver.

As it is possible to observe in the attached scheme, there are "OPTION" and "POSITION" switchers in cascade. In order to switch it, will be necessary to send an OPTION command and later a POSITION command that yields, therefore, a total of 4 possibilities.

Note: the manufacturers usually assure the compatibility with the Tone-burst commands (SAT A/B) so that the second stage can be switched as much using a «POSITION A/B» command as using a «SAT A/B» command. This allows us then to use the switcher like a Tone-burst type with 2 inputs and 1 output.

With the **TE-3000** it is very easy to use this type of switcher, because it incorporates a specific «OPT / POS»command:

TE-3000 Command	Combination of DiSEqC™ Commands send	Selected input
OPT/POS A-A	Option A + Position A	Satellite 1
OPT/POS A-B	Option A + Position B	Satellite 2
OPT/POS B-A	Option B + Position A	Satellite 3
OPT/POS B-B	Option B + Position B	Satellite 4

These switchers are transparent to the LNB's (13V, 18V, 22 kHz) switching commands. Then, once the satellite is chosen by means of the SAT command, the corresponding LNB can be used in a normal way. (see Universal LNB).

A3.5 In the collective facilities

The most frequent satellite signal distribution system in the small collective facilities is the "BIS-switched". This technology implies to use the "Quattro" type LNBs (not to confuse with the "QUAD" type) and also supports specific multiswitches for this type of facilities.

A Quattro-LNBis a LNB with 4 outputs that provides in a separated way the four frequency bands (vertical low, vertical high, horizontal low and horizontal high). These four signal scan then be distributed in the building through multiswitches.

Figure A3. 4.

The signal is distributed in the network by means of **multi-outlet multiswitches**. The number of inputs and outputs is variable. The number of inputs depends on the number of satellites (LNB).Usually a multiswitch includes also an input for the TV terrestrial signal. The number of outputs depends on the number of terminals (receivers) that can be connected to the multiswitch. In addition, **multiswitch in cascade** incorporate pass connectors to be able to distribute the signal and thus to connect several multiswitch in cascade mode and therefore to give access to more users.

Figure A3. 5.

► **Examples of multiswitch**

	SAT Inputs	TER Inputs	Satellites	Terminals
Multiswitch 9/4	8	1	2	4
Multiswitch 5/16	4	1	1	16
Multiswitch 17/16	16	1	4	16
...	...	...	...	...

We will not consider the input of terrestrial TV, since this does not take part in the satellite signal. Also the following indicated examples do not show more than a single output. In the case of several outputs, the own operation scheme is reproduced for each one of them, because they are independent of the others.

A3.5.1 Multiswitch (1 satellite)

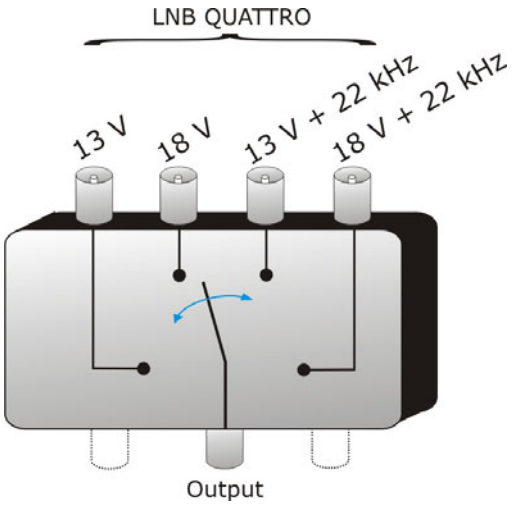


Figure A3. 6.

In the **DiSEqC™** menu of the **TE-3000**, select the band and the polarisations desired and send the SAT A command, as it is indicated in the following table:

Band	Polarization	Command
Low	Horizontal	SAT A
Low	Vertical	SAT A
High	Horizontal	SAT A
High	Vertical	SAT A

Very important: Whenever you wish to change of band or polarisation, it is necessary to send the SAT A command at the same time, since multiswitch does not respond to the habitual switching commands for a LNB (13V/18V/+22kHz): it is necessary the complete **DiSEqC™** sequence to cause the commutation.

A3.5.2 Multiswitch (2 Satellites)

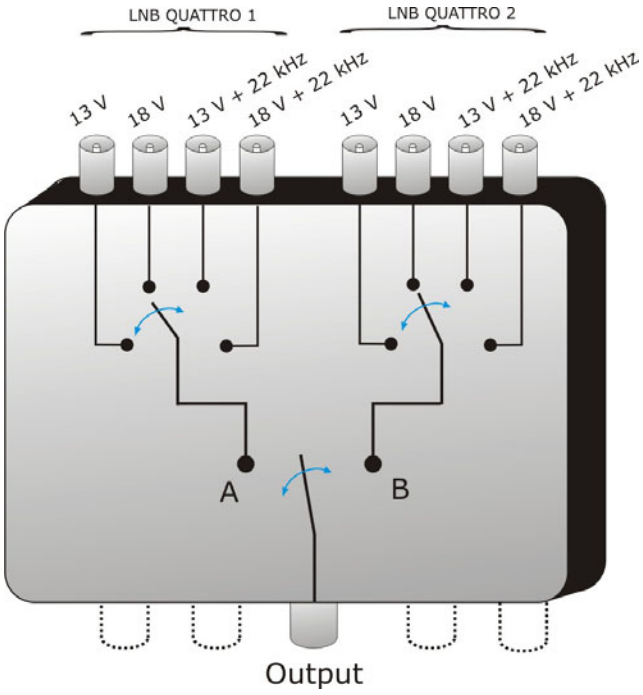


Figure A3. 7.

This type of multiswitch is used usually to switch the Astra 19º and Hotbird 13º satellites.

As in the previous case, if for a certain satellite it is desired to change of band or polarisation, it is not sufficient with changing the corresponding parameter, but in addition it is necessary to send the command SAT A/B corresponding to cause the switching (even if one does not change of satellite).

Band	Polarization	Command	Output
Low	Horizontal	SAT A	Satellite-1
Low	Vertical	SAT A	Satellite-1
High	Horizontal	SAT A	Satellite-1
High	Vertical	SAT A	Satellite-1
Low	Horizontal	SAT B	Satellite-2
Low	Vertical	SAT B	Satellite-2
High	Horizontal	SAT B	Satellite-2
High	Vertical	SAT B	Satellite-2

A3.5.3 Multiswitch (4 Satellites)

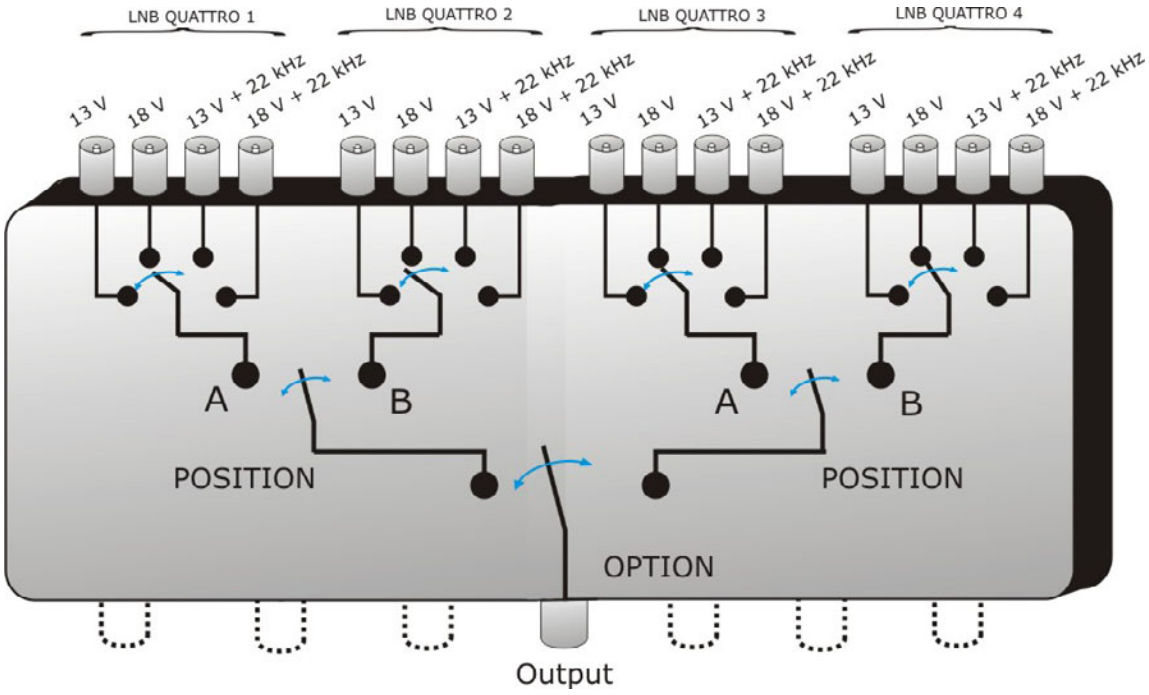


Figure A3. 8.

This type of multiswitch allows to distribute the signal coming from 4 different satellites. It uses a combination of OPTION, POSITION, Polarisation and Band commands. The equipment allows to use easily this type of multiswitch thanks to the « OPT/POS » command, which sends the OPTION et POSITION commands in the necessary order. Like in the others multiswitch, if itis wanted to change of band or polarisation, if the satellite is even he himself, is necessary to send OPT/POS command to cause the commutation again.

Band	Polarization	Command	Satellite
Low	Horizontal	OPT/POS A-A	Satellite-1
Low	Vertical	OPT/POS A-A	Satellite-1
High	Horizontal	OPT/POS A-A	Satellite-1
High	Vertical	OPT/POS A-A	Satellite-1
Low	Horizontal	OPT/POS A-B	Satellite-2
Low	Vertical	OPT/POS A-B	Satellite-2
High	Horizontal	OPT/POS A-B	Satellite-2
High	Vertical	OPT/POS A-B	Satellite-2

Band	Polarization	Command	Satellite
Low	Horizontal	OPT/POS B-A	Satellite-3
Low	Vertical	OPT/POS B-A	Satellite-3
High	Horizontal	OPT/POS B-A	Satellite-3
High	Vertical	OPT/POS B-A	Satellite-3
Low	Horizontal	OPT/POS B-B	Satellite-4
Low	Vertical	OPT/POS B-B	Satellite-4
High	Horizontal	OPT/POS B-B	Satellite-4
High	Vertical	OPT/POS B-B	Satellite-4

A3.6 DiSEqC programs and commands in the TE-3000

► **Commands**

The **Commands** option allows executing any of the following commands:

COMMAND
SAT AB-A
SAT AB-B
SWITCH OPTION AB-A
SWITCH OPTION AB-B
DISABLE LIMITS
LIMIT EAST
LIMIT WEST
DRIVE ROTOR
GOTO
HALT
STORE
RECALCULATE
SWITCH 1A
SWITCH 1B
SWITCH 2A
SWITCH 2B
SWITCH 3A
SWITCH 3B
SWITCH 4A
SWITCH 4B
POWER
RESET
STANDBY

► Programs

There are eight predefined programs that execute basic functions to control an universal switch with two or four inputs. It also has more programs that control installations with 8 or 16 satellite antennas using SPAUN devices or switches Commited/Uncommited. Whenever a **DiSEqC™** program is sent, the commands that correspond to the equipment status in relation to the Horizontal or Vertical polarization and High or Low frequency band are also sent. This allows assuring that the installation status is the one indicated by the equipment.

DiSEqC Programs
16x1 LNB01 U1A2A/OpA_PoA
16x1 LNB02 U1A2A/OpA_PoB
16x1 LNB03 U1A2A/OpB_PoA
16x1 LNB04 U1A2A/OpB_PoB
16x1 LNB05 U1B2A/OpA_PoA
16x1 LNB06 U1B2A/OpA_PoB
16x1 LNB07 U1B2A/OpB_PoA
16x1 LNB08 U1B2A/OpB_PoB
16x1 LNB09 U1A2B/OpA_PoA
16x1 LNB10 U1A2B/OpA_PoB
16x1 LNB11 U1A2B/OpB_PoA
16x1 LNB12 U1A2B/OpB_PoB
16x1 LNB13 U1B2B/OpA_PoA
16x1 LNB14 U1B2B/OpA_PoB
16x1 LNB15 U1B2B/OpB_PoA
16x1 LNB16 U1B2B/OpB_PoB
8x1 LNB1 U1A/OptA_PosA
8x1 LNB2 U1A/OptA_PosB
8x1 LNB3 U1A/OptB_PosA
8x1 LNB4 U1A/OptB_PosB
8x1 LNB5 U1B/OptA_PosA
8x1 LNB6 U1B/OptA_PosB
8x1 LNB7 U1B/OptB_PosA
8x1 LNB8 U1B/OptB_PosB
LNB4 (Sw1A-OptB-PosB)
LNB8 (Sw1B-OptB-PosB)
Position AB-A
Position AB-A
Sat A (Toneburst)
Sat B (Toneburst)
Switch Uncom.1/AA
Switch Uncom.1/AB
Switch Uncom.1/BA
Switch Uncom.1/BB
Switch Uncom.2/AA
Switch Uncom.2/AB
Switch Uncom.2/BA
Switch Uncom.2/BB

ANNEX 4 REMOTE CONTROL COMMANDS

A4.1 Introduction

The design of **TE-3000** based on a microprocessor, allows data to be exchanged between the equipment and a remote controller (usually a personal computer) via USB. By this way, data can be obtained from the equipment and also control it remotely. These data can be stored and subsequently processed for use in maintenance work. Furthermore, the remote control allows tracking and monitoring installations.

A4.2 Protocol for communication between the TE-3000 and a PC

This protocol is controlled by software and is using a virtual serial port over an USB interface. Data and information are exchanged using messages consisting of ASCII alphanumerical characters. This method ensures easy carrying between different types of personal computers.

To activate the virtual serial port, a special driver must be installed. The driver is included with the purchased instrument.

► **Connections**

The cable between the **TE-3000** and the PC is supplied with the equipment.

You need at least **Windows XP** to work with **TE-3000**. Drivers only work for Windows operative systems. What drivers do is to create a virtual COM port, so the software application can "see" the equipment.

A4.3 Operation Mode

The **TE-3000** accepts remote commands at any time, which the instrument is on. That is, it is not necessary to put the instrument in special remote control mode; rather, this mode is selected immediately when it detects a complete command during the time necessary for its execution. The protocol communication is as follows:

1.- **TE-3000** transmits a XON code (11H) every second. The aim is to indicate to any possible remote device that the equipment is ready to receive data.

2.- At this moment, data streams can be sent it. Each data stream is composed by:

- **a.** Stream beginning: '*' (code 2AH).
- **b.** Set of characters that describe data message.
- **c.** CR (carriage return, code 0DH).

3.- Once a data stream has been sent, will be received a XOFF (code 13H) indicating that the transmission is stopped.

4.- Next, in case of correct message an ACK (acknowledge, code 06H) is expected or a NAK (not acknowledge, code 15H) in the opposite case.

5.- If the sent message requires answers it will be sent at this moment.

6.- Once completed the data stream transmission, the **TE-3000** will send a XON (code 11H) indicating that already it is prepared to receive a new data stream.

A typical communication chronogram would be as follows:

	PC (REMOTE CONTROLLER)		**TE-3000**
1)		<------	XON
2)	*?TV<CR>	------>	
3)		<------	XOFF
4)		<------	ACK 5
5)		<------	*TV0<CR>
6)	wait…		
7)		<------	XON

(all characters are transmitted in ASCII code).

Commands should always be sent in capital letter and cannot be edited online, i.e., once a character is received it is stored in the **TE-3000** buffer and cannot be rectified by sending an erase code.

Commands in remote control are divided into two groups, orders and interrogations. Orders modify a variable or the equipment status. Interrogations respond with information concerning equipment status or the value of a variable. For interrogative command, it is necessary to add the character ´?´ after the character '*'.

A4.4 Virtual Serial Port Configuration

In order to ensure error-free communication between the computer and the **TE-3000** you must programme following communication parameters into the control console via USB:

Rate:	115200 bits/s
Data bits:	8 bits
Parity:	No
Stop Bits:	1

A4.5 Remote commands table

Remote Commands	Short Description
BATTERY	It provides information about the battery actual status
CAPTURE	It makes and read screen captures
CAPTURE READ	It reads a file with the current screen capture
DISEQC	It gets a list of available diseqc programs and can send a specific one
EQUIPMENT POWER OFF	It shutdowns the equipment
EQUIPMENT SN	It provides the serial number of the equipment
INSTALLATION	It provides information about all the installations
INSTALLATION CURRENT	It provides information about the current installation
INSTALLATION CURRENT CLEAR	It removes all files of the current installation. The installation itself is not remove, only its contents
INSTALLATION CURRENT REMOVE	It removes the files of the same type in the current installation
INSTALLATION FILE	It reads an "xml" file of the current installation and sends it to a PC
INSTALLATION FILE ZIP	It reads an "xml" file of the current installation and sends all the installation files zipped to a PC
INSTALLATION PC FILE	It sends a file of the current installation to the PC
INSTALLATION PC ZIP	It sends a file from a PC to the equipment zipped with all files of the installation
INSTALLATION REMOVE	It removes an installation
IP CONFIG	It sets IPTV parameters
LNB	It provides / configures the LNB output
LTE	It provides / configures the LTE filter status
MEASURE	It provides information of all active measurements
MODE	It provides / sets the operation mode of the equipment
NAM	It provides the program name
PRINT SCREEN	It makes a screenshot in PNG format
PSI	It provides / configures services
PSI SERVICE	It provides / configures services
RTC	It provides / sets date and time
SIGNAL	It provides / configures the signal type
SPECTRUM	It configures the span and/or the reference level
TS	It selects the input and output transport stream
TUNE	It provides / configures the frequency
TUNE CH	It provides / configures the channel
TUNE PLAN	It configures a channel plan
VER	It provides the version of the main software application
VIDEO	It configures the video source

Name	**BATTERY**		
Description:	It provides information about the battery current status.		
Question:	*?BATTERY *parameter*		
Response:	*BATTERY *parameter_resp*		
	parameter	*parameter_resp*	Description *parameter_resp*
	<empty>	LEVEL, PERCENT, TIME, SMART BATTERY, CHARGER	It provides a complete set of information about the battery current status (see the following parameters for an explanation).
	LEVEL	XXXXmV	It provides the voltage level in mV.
	PERCENT	XX	It provides the charge remaining as a percentage.
	TIME	XXmin	Provides an estimation of the remaining time of functioning. The time is given in minutes. Message CHARGER_CONNECTED will be the answer if the charger is connected.
	SMART_BATTERY	XXX	It answers YES or NO depending if there is a smart battery or not.
	CHARGER	XXX	It answers ON or OFF depending if charger is connected or not.

Name	**CAPTURE (MAKES SCREEN CAPTURE)**	
Description	It builds a file with the current screen data in xml or png format.	
Configuration	*CAPTURE FORMAT=format	
	format	Description *format*
	PNG	It makes a screen capture in PNG format.
	XML	It makes a screen capture in xml format.
Note:	Before saving the file, this command deletes the previous made capture.	

Name	**CAPTURE READ**	
Description:	It reads a file with the current screen capture (see command CAPTURE)	
Question:	*?CAPTURE BLOCK=*bbbb <CR>*	
Response:	*CAPTURE SIZE= *size*	
	bbbb	Description *bbbb*
	nnn	bbbb is the number of bytes sent in each data block. The file data is sent in blocks, every block is confirmed with an ACK. The value 'bbbb' can be a decimal one (if starts by 0 to 9, like 1234) or in hex format, if started by "0x" followed by hex characters (like in 0x3FF).
	size	Description *size*
	nnn	Size in bytes (nnn) of file. Decimal value.
Protocol:	PC→*?CAPTURE BLOCK=bbbb <cr> RANGER→ Xoff It checks if file exists then it sends ACK, otherwise it sends NACK + Xon and aborts the command. RANGER→*CAPTURE SIZE=size. RANGER→Xon. PC→ ACK. RANGER→Xoff. RANGER→block1 + crc (1 byte) + Xon. PC→ It Calculates the block crc if correct send ACK. RANGER→ If detect ACK then send Xoff. RANGER→block2 + crc2 (1 byte) + Xon. PC→ It Calculates the block crc if correct send ACK. .... Until last block.	

Name	**DISEQC**	
Description:	It gets a list of available diseqc programs and can send a specific one.	
Question:	*?DISEQC PROGRAMS<CR>	
Response:	*DISEQC PROGRAMS= PROGRAMS=nn *program_name*	
	Response	**Description** *lnb_resp*
	PROGRAMS=nn *program_name*	nn is the number of available programs the name description of the available programs
Configuration:	*DISEQC PROGRAM=program_name	
	Program_name	**Description *program_name***
	POS_AB_A POS_AB_B etc…	It sends the diseqc program name. This program must exist in the current installation. Check the available programs with *?DISEQC PROGRAMS

Name	**EQUIPMENT POWER OFF**
Description	It shutdowns the equipment
Order	*EQUIPMENT POWEROFF

Name	**EQUIPMENT SN**	
Description	It provides the serial number of the equipment	
Question	*?EQUIPMENT SN	
Response	*EQUIPMENT SN = *equipment_resp*	
	equipment_resp	Description *equipment_resp*
	nnn	Unique numeric code that identifies the equipment

Name	**INSTALLATION**		
Description	It provides information about all the installations		
Question	*?INSTALLATION *install*		
Response	*INSTALLATION *install_resp*		
	install	*install_resp*	Description *install_resp*
	<empty>	NUMBER=nn	Number (nn) of installations
	CURRENT	NAME=name	Name (name) of current installation
		TER-CH=nn	Number (nn) of terrestrial channel plans in the current installation
		SAT-CH=nn	Number (nn) of satellite channel plans in the current installation
		DISEQC=nn	Number (nn) of DISEQC programs in the current installation
		SCREEN=nn	Number (nn) of print screens in the current installation
		DATALOGGER=nn	Number (nn) of dataloggers in the current installation
		SP=nn	Number (nn) of spectrum captures in the current installation
		MER=nn	Number (nn) of captures MERxcarrier in the current installation
		ECHOES=nn	Number (nn) of echo captures in the current installation
		CONSTELLATION=nn	Number (nn) of constellation captures in the current installation
	NUMBER=nn	NAME=name	Name of the installation with index "nn"

Name	**INSTALLATION CURRENT**		
Description	It provides information about the current installation		
Question	*?INSTALLATION CURRENT *current=nn*		
Response	*INSTALLATION NAME=*current_resp*		
	current	Description *nn* (decimal value)	Description *current_resp*
	<empty>	<empty>	Available data from the current installation
	TER-CH	Terrest. channel plan index	Terrestrial channel plan name with "nn" index
	SAT-CH	Sat. channel plan index	Satellite channel plan name with "nn" index
	DISEQC_PROGRAM	DISEQC program index	DISEQC program name with "nn" index
	PNG	Print screen file index	Print screen file name with "nn" index
	DATALOGGER	Datalogger index	Datalogger name with "nn" index
	SPECTRUM	Capture index	Spectrum capture name with "nn" index
	CONSTELLATION	Constellation index	Constellation capture name with "nn" index
	ECHOES	Capture index	Echo capture name with "nn" index
	MER	Capture index	MER capture name with "nn" index
	NUMBER	Installation index	Installation name with "nn" index

Name	**INSTALLATION CURRENT CLEAR**
Description	It removes all files of the current installation. The installation itself is not remove, only its contents
Order	*INSTALLATION CURRENT CLEAR

Name	**INSTALLATION CURRENT REMOVE**	
Description	It removes the files of the same type in the current installation	
Order	*INSTALLATION CURRENT REMOVE *tag=name*	
	tag	Description *tag*
	SPECTRUM	Spectrum capture file
	TER-CH	Terrestrial channel plan file
	SAT-CH	Satellite channel plan file
	DISEQC_PROGRAM	DISEQC program file
	PNG	Print screens file
	CONSTELLATION	Constellation capture file
	ECHOES	Echo capture file
	MER	MER x carrier capture file
	DATALOGGER	Datalogger file
	SPECTROGRAM	Spectrogram file
	MEROGRAM	Merogram file
	TS	Transport stream file
	name	Description *name*
	<empty>	It removes all files belonging to the same type, which is determined by the *tag*
	abcd	It removes the file with name ("abcd") of the type indicated by the *tag*

Name	**INSTALLATION FILE**	
Description	It reads an "xml" file of the current installation and sends it to a PC	
Question	*?INSTALLATION CURRENT *tag=name* BLOCK=*bbbb*	
Response	*INSTALLATION SIZE=*size*	
	tag	Description *tag*
	SPECTRUM	It reads spectrum captures in the current installation
	TER-CH	It reads terrestrial channel plans in the current install
	SAT-CH	It reads satellite channel plans in the current install
	DISEQC_PROGRAM	It reads DISEQC programs in the current installation
	PNG	It reads print screens in the current installation
	CONSTELLATION	It reads constellation captures in the current install
	ECHOES	It reads echo captures in the current installation
	MER	It reads MER x carrier captures in the current install
	DATALOGGER	It reads datalogger in the current installation
	SPECTROGRAM	It reads spectrograms in the current installation
	MEROGRAM	It reads merograms in the current installation
	TS	It reads transport stream in the current installation
	name	Description *name*
	abcd	Name ("abcd") of the capture. In case of a DATALOGGER tag, the name could be the header file of a datalogger or the file name of a test point (datalogger.xml or datalogger/tp.xml).
	bbbb	Description *bb*
	nnn	Byte (nnn decimal) size to which the file will be divided to be send
	size	Description *size*
	nnn	File byte (nnn decimal) size when send

Name	**INSTALLATION FILE ZIP**	
Description	It reads an "xml" file of the current installation and sends all the installation files zipped to a PC	
Question	*?INSTALLATION CURRENT ZIP BLOCK=*bbbb*	
Response	*INSTALLATION SIZE=*size*	
	bbbb	Description *bb*
	nnn	Byte (nnn decimal) size to which the file will be divided to be send
	size	Description *size*
	nnn	File byte (nnn decimal) size when send

Name	**INSTALLATION PC FILE**	
Description	It sends a file of the current installation to the PC.	
Order	*INSTALLATION CURRENT tag=*name* SIZE=*size* BLOCK=*bbbb*	
	tag	Description *tag*
	SPECTRUM	Spectrum captures files to the current installation
	TER-CH	Terrestrial channel plans files to the current install
	SAT-CH	Satellite channel plans files to the current instal.
	DISEQC_PROGRAM	DISEQC programs files to the current installation
	PNG	Print screens files to the current installation
	CONSTELLATION	Constellation captures files to the current install
	ECHOES	Echo captures files to the current installation
	MER	MER x carrier captures files to the current install
	DATALOGGER	Datalogger files to the current installation
	SPECTROGRAM	Spectrograms files to the current installation
	MEROGRAM	Merograms files to the current installation
	TS	Transport stream files to the current installation
	name	Description *name*
	abcd	Capture name ("abcd").
	size	Description *size*
	nnn	File byte (nnn decimal) size when send
	bbbb	Description *bbbb*
	nnn	Byte (nnn decimal) size to which the file will be divided to be send

Name	**INSTALLATION PC ZIP**	
Description	It sends a file from a PC to the equipment zipped with all files of the installation	
Order	*INSTALLATION ZIP NAME=*name* SIZE=*size* BLOCK=*bbbb*	
	name	Description *name*
	abcd	Name ("abcd") of the installation
	size	Description *size*
	nnn	Byte (nnn decimal) size of the file when send
	bbbb	Description *bbbb*
	nnn	Byte size (nnn decimal) of blocks that will be send from the ZIP file

Name	**INSTALLATION REMOVE**	
Description	It removes a installation	
Order	*INSTALLATION NAME= *name* REMOVE	
	name	Description *name*
	abcd	Installation name ("abcd")

Name	**IP CONFIG**		
Description:	It provides / configures the IP parameters such as: DHCP option, MAC address, IP address and subnet MASK.		
Question:	*?IP *ip_option*		
Response:	*IP *ip_option*=*ip_resp*		
	ip_option	*ip_response*	
	<empty> MAC DHCP ADDRESS MASK	MAC, DHCP, IP and MASK MAC address DHCP protocol enabled / disabled IP address Subnet MASK	
Configuration:	*IP *ip_option*=*ip_config*		
	ip_option	*ip_config*	Description *lte_conf*
	DHCP ADDRESS MASK	ON OFF www.xxx.yyy.zzz www.xxx.yyy.zzz	It enables DHCP protocol It disables DHCP protocol It sets IP address It sets Subnet mask

Name	**LNB**		
Description	It provides / configures the LNB output		
Question	*?LNB *lnb*		
Response	*LNB *lnb = lnb_resp*		
	lnb	**Description** *lnb_resp*	
	OUTPUT ENABLE VOLTAGE CURRENT AVAILABLE UNDERVOLTAGE OVERCURRENT SHORTCIRCUIT DRAINLED	Current selected output LNB enable (ON) or disabled (OFF) Last measurement of the LNB output voltage Last measurement of the LNB output current Available output with the current configuration Under voltage alarm Overvoltage alarm Short circuit alarm LED DRAIN lit (ON) or not (OFF)	
Configuration	*LNB *lnb = lnb_conf*		
	lnb	***lnb_conf***	**Description *lnb_conf***
	ENABLE ENABLE OUTPUT	ON OFF nnn	Enables the LNB. Disables the LNB. LNB output voltage (*nnn* must be one of the available options seen on the command *?LNB AVAILABLE)

Name	**LTE**	
Description	It provides/configures the LTE filter status	
Question	*?LTE	
Response	*LTE *lte_resp*	
	lte_resp	Description *lte_resp*
	ON OFF	LTE filter enabled LTE filter disabled
Configuration	*LTE *lte_conf*	
	lte_conf	Description *lte_conf*
	ON OFF	It enables the LTE filter It disables the LTE filter

Name	**MEASURE**	
Description	It provides information of all active measurements	
Question	*?MEASURE *measure*	
Response	*MEASURE *measure=measure_resp units*	
	measure	Description *measure_resp*
	<empty> POWER LEVEL C/N V/A MER CBER VBER LBER LM = < >	All the active measures Digital channel power Analog channel level C/N of the measured channel (dB) Video/Audio carrier ratio MER measurement value CBER measurement value VBER measurement value LBER measurement value Link Margin value Measurement within scale Measurement under the value shown Measurement over the value shown
	units	Description *units*
	dB dBm/dBuV/dBmV	Measurement units for C/N, V/A, MER Measurement units for POWER, LEVEL

Name	**MODE**	
Description	It provides/sets the operation mode of the equipment	
Question	*?MODE	
Response	*MODE *mode_resp*	
	mode_resp	Description *mode_resp*
	TV	TV mode
	TV+SP+MEASURE	TV mode with spectrum and measurements
	TV+PARAMETERS	TV mode with TS parameters
	SP	Spectrum mode
	SP+MEASURE	Spectrum mode with measurement
	SP+MEASURE+TV	Spectrum mode with TV and measurement
	MEASURE	Measurement mode.
	MEASURE+TV+SP	Measurement mode with TV and spectrum
	MEASURE+PARAMETERS	Measurement mode with demodulator parameters
	ECHOES	Echoes tool
	CONSTELLATION	Constellation tool
Configuration	*MODE *mode_conf*	
	mode_conf	Description *mode_conf*
	TV	TV mode
	TV+SP+MEASURE	TV mode with spectrum and measurements
	TV+PARAMETERS	TV mode with TS parameters
	SP	Spectrum mode
	SP+MEASURE	Spectrum mode with measurement
	SP+MEASURE+TV	Spectrum mode with TV and measurement
	MEASURE	Measurement mode
	MEASURE+TV+SP	Measurement mode with TV and spectrum
	MEASURE+PARAMETERS	Meas. mode with demodulator parameters
	ECHOES	Echoes tool
	CONSTELLATION	Constellation tool

Name	**NAM**	
Description	It provides the program name	
Question	*?NAM	
Response	*NAM *nam_resp*	
	nam_resp	Description *nam_resp*
	abc	It provides the program name "abc"

Name	**PRINT SCREEN**	
Description	It makes a screenshot in PNG format	
Configuration	*PRINT SCREEN=*printscreen_conf*	
	=printscreen_conf	Description *=printscreen_conf*
	<empty> =abc	It gives a name by default It gives the name "abc"

Name	**PSI**	
Description	It provides / sets services	
Question	*?PSI	
Response	*PSI STATUS=status_resp NUMBER= number_resp ONID=onid NID=nid TSID=tsid NETWORK=name	
	status_resp	Description *status_resp*
	ACQUIRED IN_PROGRESS FAIL STOPPED	Acquired services of channel (in this case, service information is not shown). Acquiring services of channel (in progress). Acquisition failed. Acquisition stopped.
	number_resp	Description *number_resp*
	nn	Number of services
	Services information	Description *service information*
	ONID NID TSID NETWORK	Original Network id Network id Transport Stream id Name of service network
Configuration:	*PSI SERVICE= *index_conf* [AUDIO=*index_audio*]	
	index_conf	Description *index_conf*
	nn	Index of service. Selecting service from the index service.
	index_audio	Description *index_audio*
	nn	Index of audio. OPTIONAL: [AUDIO=xx].
Configuration:	*PSI SID= *service_id_conf* [AUDIO=index_audio]	
	service_id_conf	Description *service_id_conf*
	nn	Service id. Selecting service from the service id.
	index_audio	Description *index_audio*
	nn	Index of audio. OPTIONAL: [AUDIO=xx].

Name	**PSI SERVICE**	
Description	It provides / configures services	
Question	*?PSI SERVICE=*service*	
	service	Description *service*
	CURRENT nn	Current service Index of service
Response	*PSI SERVICE=*ss* NAME=*name* PROVIDER=*provider* SID=*sid* TYPE=*type* SCRAMBLED=*lcn*	
	response	Description *response*
	ss *name* *provider* *sid* *type* *scrambled* *LCN*	CURRENT for current service or index of service. Service name Service provider Service id Type of service (radio/tv/data) Service (service scrambled) or No (service free) Logical channel number
Question	*?PSI SERVICE=CURRENT AUDIO	
Response	*PSI NUMBER=*nn* AUDIO=*aa* PID=*pid* BITRATE=*bitrate* TYPE=*type* FORMAT=*format* LANGUAGE=*language*	
	response	Description *response*
	nn *aa* *pid* *bitrate* *type* *format* *language*	Audios number Index of audio PID number Bitrate in kbps Type of audio (MPEG-1, DD, DD+...) Format of audio (Stereo/Mono...) Language of audio
Question	*?PSI SERVICE=*service* AUDIO	
Response	*PSI NUMBER=*nn*	
	response	Description *response*
	nn	Audios number
Question	*?PSI SERVICE=*service* AUDIO=aa	
Response	*PSI NUMBER=*nn* AUDIO=*aa* PID=*pid* TYPE=*type* LANGUAGE=*language*	
	response	Description *response*
	nn *aa* *PID* *TYPE* *LANGUAGE*	Audios number Index of audio PID number Type of audio (MPEG-1, DD, DD+…) Language of audio

Question	*?PSI SERVICE=CURRENT VIDEO	
Response	*PSI PID=*pid* BITRATE=*bitrate* TYPE=*type* RESOLUTION=*resolution* FORMAT=*format* FRAME=*frame* PROFILE=*profile*	
	response	Description *response*
	pid *bitrate* *type* *resolution* *format frame* *profile*	PID number Bitrate in kbps Type of video (MPEG-2,H264,...). Resolution of video. Format of video (16:9/4:3...) Freq Profile level
Question	*?PSI SERVICE=xx VIDEO	
Response	*PSI PID=*pid* TYPE=*type*	
	response	Description *response*
	pid *type*	PID number Type of audio (MPEG-2, H264,...)
Question	*?PSI SERVICE=*service* DATA	
Response	*PSI NUMBER=*nn*	
	response	Description *response*
	nn	Number of datas
Question	*?PSI SERVICE=*service* DATA=dd	
Response	*PSI NUMBER=*nn* DATA=*dd* PID=*pid* TYPE=*type*	
	response	Description *response*
	nn *dd* *pid* *type*	Number of datas Index of data PID number Type of data (txt, subtitles, data...)

Name	**RTC**		
Description	It provides/sets date and time		
Question	*?RTC *rtc*		
Response	*RTC *rtc=rtc_resp*		
	rtc	*rtc_resp*	Description *rtc_resp*
	TIME DATE FORMAT	DATE=date TIME=time FORMAT=format hh:mm:ss DD/MM/YYYY DD/MM/YY MM/DD/YYYY YYYY/MM/DD	It shows current date, time and date format Hours:minutes:seconds day/month/year day/month/year (last two digits) month/day/year year/month/day Selected format
Configuration	*RTC *rtc= rtc_conf*		
	rtc	*rtc_conf*	Description *rtc_conf*
	TIME DATE FORMAT	hh:mm:ss DD/MM/YYYY DD/MM/YY MM/DD/YYYY YYYY/MM/DD	Hours:minutes:seconds Date according to the selected format day/month/year day/month/year (last two digits) month/day/year year/month/day

Name	**SIGNAL**		
Description	It provides/configures the signal type		
Question	*?SIGNAL *signal*		
Response	*SIGNAL *signal=signal_resp*		
	signal	Description *signal_resp*	
	TYPE	Signal standard type	
	CR	Current code rate	
	BANDWIDTH	Signal bandwidth	
	SR	Signal symbol rate	
	SP	Spectral inversion enabled (ON) or disabled (OFF)	
	MODE	Measurement of the FFT in a COFDM modulation	
	GI	Measurement of the guard interval	
	CONSTELLATION	Constellation type	
	HIERARCHY	DVB-T hierarchy	
	COLOR	Type of color coding	
	STANDARD	Analog standard type	
	RATE	Field frequency	
Configuration	*SIGNAL *signal=signal_config*		
	signal	*signal_config*	Description *signal_config*
	TYPE	DVB-T	Terrestrial signal standard
		DVB-C	Cable signal standard
		ANALOG	Analog signal standard
		DVB-S	Satellite signal standard
		DVB-S2	Satellite signal standard (2d generation)
	COLOR	PAL	PAL coding color
		NTSC	NTSC coding color
		SECAM	SECAM coding color
	STANDARD	BG	Analog standard type BG
		DK	Analog standard type DK
		I	Analog standard type I
		N	Analog standard type N
		M	Analog standard type M
		L	Analog standard type L

Name	**SPECTRUM**		
Description	It configures the *span* and/or the reference level		
Configuration	*SPECTRUM *spectrum=spectrum_config*		
	spectrum	*spectrum_config*	Description *spectrum_config*
	REF	nn.n	Value (nn.n) of the reference level in units of the current band
	SPAN	nnnF	nnn= span value number F= Order of magnitude for the span. F values: <empty> = 1 K= 1 x 10 E3 M=1 x 10 E6 G=1 x 10 E9

Name	**TS MUX CONTROL**	
Description:	It selects the input and output transport stream	
Configuration:	*TSMUX, DECODER=*decoder_input*, OUT=*asi_out*	
	decoder_input	Description *decoder_input*
	DEMOD ASI_IN IPTV	Input from demodulators. Input from ASI_IN. Input from IPTV (when equipment is on a IPTV mode I.E. IPTV+TV).
	asi_out	Description *asi_out*
	OFF DEMOD ASI_IN IPTV	No ASI output signal. Output from demodulators. Output from ASI_IN. Output from IPTV (when equipment is on a IPTV mode I.E. IPTV+TV).

Name	**TUNE**	
Description	It provides/configures the frequency	
Question	*?TUNE	
Response	*TUNE BAND=*band_resp* FREQ= *freq_resp*	
	band_resp	Description *band_resp*
	TER SAT	Terrestrial band Satellite band
	freq_resp	Description *freq_resp*
	nnnK	nnn=Number value for the frequency; K= (kHz)
Configuration	*TUNE BAND= *band_conf* FREQ= *freq_conf*	
	band_conf	Description *band_conf*
	TER SAT	Terrestrial band Satellite band
	freq_conf	Description *freq_conf*
	nnnF	nnn= Number value for the frequency F= Order of magnitude for the frequency F values: <empty> = 1 K= 1 x 10 E3 M=1 x 10 E6 G=1 x 10 E9

Name	**TUNE CH**	
Description	It provides/configures the channel	
Question	*?TUNE CH	
Response	*TUNE BAND= *band_resp* PLAN=*plan_ resp* CH= *ch_ resp*	
	band_resp	Description *band_resp*
	TER SAT	It means that channel belongs to the terrestrial band It means that channel belongs to the satellite band
	plan_resp	Description *plan_resp*
	xyz	Alphanumeric code that identifies the channel plan
	ch_resp	Description *ch_resp*
	xyz	Alphanumeric code that identifies the channel
Configuration	*TUNE *ch_conf*	
	ch_conf	Description *ch_conf*
	CH=xyz CH NEXT CH PREV	"xyz" is an alphanumeric code that identifies a channel It increases +one channel It decreases –one channel

Name	**TUNE PLAN**	
Description	It configures a channel plan	
Configuration	*TUNE PLAN= *plan_conf*	
	plan_conf	Description *plan_conf*
	xyz	Alphanumeric code that identifies a channel plan

Name	**VER**	
Description	It provides the version of the main software application	
Question	*?VER	
Response	*VER *ver_resp*	
	ver_resp	Description *ver_resp*
	x.yy.zzz	Alphanumeric code that identifies a version

Name	**VIDEO**		
Description	It configures the video source		
Configuration	*VIDEO *video= video_conf*		
	video	*video_conf*	Description *video_conf*
	SOURCE SYSTEM	INTERNAL EXTERNAL PAL_50 Hz PAL_60 Hz NTSC SECAM	It enables internal video source It enables external video source It enables the video system selected It enables the video system selected It enables the video system selected It enables the video system selected

ANNEX 5 OP-002-PS: OPTICAL + 5 GHz RF AUXILIARY INPUT OPTION

A5.1 GENERAL

A5.1.1 Description

This annex contains operating instructions for the next option:

OP-002-PS: Selective Optical Power Meter +
Optical to RF Selective Converter + 5 GHz RF Auxiliary Input.

The evolution of the telecommunications market, more and more demanding in quality standards, speed, services and so on and also economical and competitiveness factors has changed the trend in telecommunications installations, and increasingly, fibre-optics is being imposed on traditional ADSL twisted-pair copper lines.

For this reason and in anticipation of an increase of fibre-optics installations, this option has been developed. It is applicable to the TE-3000 analyzers and allows adapting it in order to work with fibre-optics networks.

This optical module expansion includes two separate functions: The selective optical power meter and the selective optical to RF converter.

The selective meter option allows measurements on optical fibre networks, which are necessary to certify an installation according to the parameters set by local policies.

The optical to **RF** selective converter has a photosensor for each wavelength, which obtains the **RF** signal carried by each one. With this module, user can measure terrestrial or cable (up to 1 GHz) networks or optical **LNB** for satellite antennas (up to 5.45 GHz), so that the installer does not need any additional equipment to measure this type of installations.

The 5 GHz RF auxiliary option can be used among other applications for direct connection to optical LNBs with 5.4 GHz output.

This expansion module is available for **TE-3000** unit (both for new equipments or to upgrade equipments owned).

A5.2 DESCRIPTION OF INTERNAL OPERATION

The selective meter consists, in first place, of a selective triple filter for 1310, 1490 and 1550 nm signals. The filter separates each wavelength and each one leads to an independent circuit with a photosensor, which obtains the **RF** signal that it carries. Next, a circuit measures the optical signal power received by the photosensor. The **RF** signal obtained for each wavelength goes to a band switch.

The band switch receives a signal and converts it to a frequency within the RF band (65 — 2150 MHz). In the case of a terrestrial/cable signal the signal is not converted since that signal is within the RF range.

After the conversion, the **RF** signal output is connected to the analyzer input connector and the measurement is performed in the usual way to an RF signal. In the conversion, bear in mind that for every unit of optical attenuation (one dB), occurs two dBs of power loss in **RF**. As an example, every 3 dB of optical attenuation for each splitter are equivalent to 6 dB of power loss for **RF**.

The following diagram explains graphically how works the module:

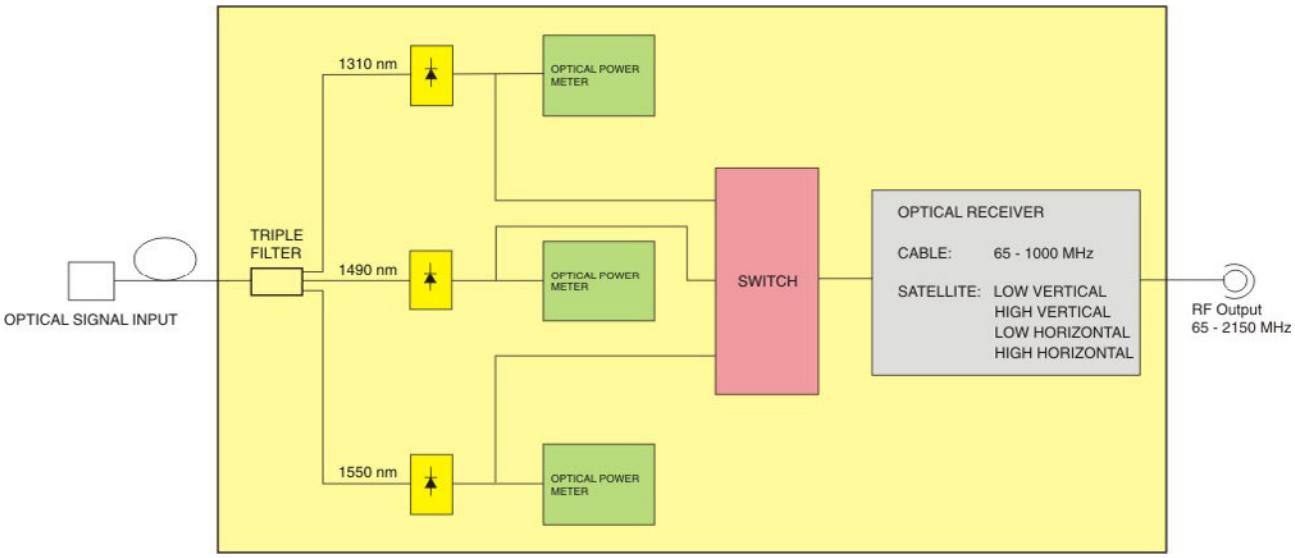


Figure A5.1.

A5.3 Fiber optical test

A5.3.1 Description

The optical function of this module allows the user to certify a telecommunication installation by calibrating the signals at the installation and then measuring them in each of the user access points.

The **TE-3000** with optical module can measure simultaneously and in a selective way the three wavelengths used in optical fiber (1310, 1490 and 1550 nm). It has a selective receiver with a filter for each band that makes a real and very stable measurement of each wavelength. With this feature, user will be able to certify any installation according to the telecommunications infrastructure policies.

A5.3.2 Operation

To access the **FIBER OPTIC TEST** tool:

1. Connect the **optical input** signal to the optical input of the equipment.
2. Enter the **MEASUREMENT** or **SPECTRUM** mode.
3. Press the **TOOLS** key F3.
4. Select the **FIBER OPTIC TEST** option.
5. It appears the screen to perform the **FIBER OPTIC TEST** on the signal.

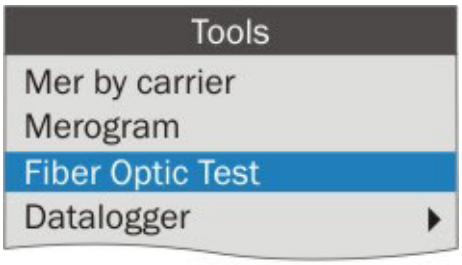


Figure A5.2.

Next it is shown the screen to perform the fiber optic test:

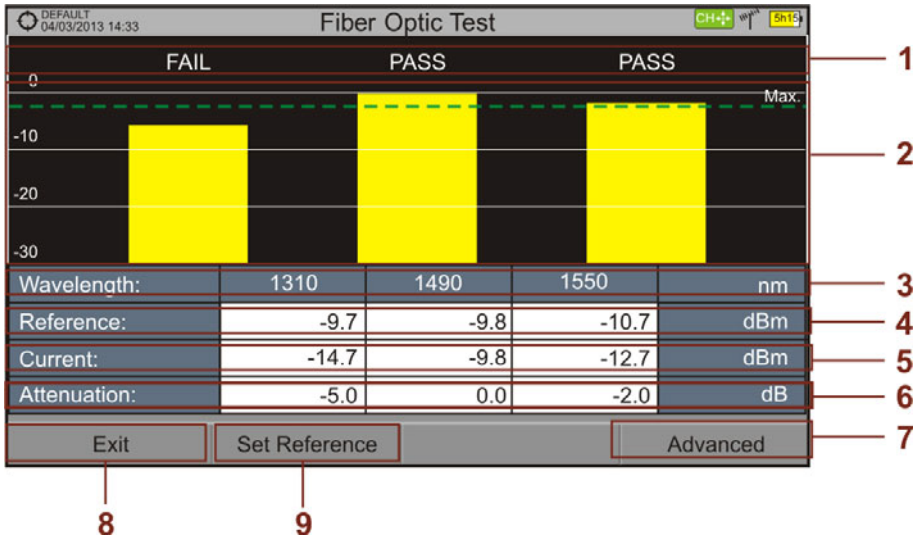


Figure A5.3.

1. Status message depending on the level of attenuation.
2. Power level of the signal.
3. Wavelength of the signal (nm).
4. Power level of the reference signal, which is used to calibrate and calculate the attenuation level (dBm).
5. Power level of the test signal at the user's access point (dBm).
6. Attenuation level (dB); Attenuation = Current - Reference.
7. "**Advanced**" key to access these options: Threshold attenuation and Max. attenuation (see Max. dashed line).
8. "**Exit**" button to exit the screen.
9. "**Set Reference**" key to calibrate the reference signal.

A5.3.3 Menu options

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

It exits the tool.

When pressing this key it uses the current values of power as a reference values.

It accesses the Advanced menu.

In the **Advanced** menu there are two parameters to configure the fiber optical test. They are:

- **Threshold Attenuation**:
  It defines the maximum difference that can exist between the reference signal with the highest power level and the reference signal with the lowest power level. Any signal out of this range will be deleted and not used as a reference signal during the measurement process.

- **Max. Attenuation**:
  It defines the attenuation level used by the field meter to display the status message on screen. If the attenuation level is below this value the status message will be "**PASS**" and if it is above this value the status message will be "**FAIL**".

A5.3.4 Example of a practical application in order to certify an installation by using the TE-3000

Next there is a step by step example to certify a telecommunication installation of optical fiber by using the TE-3000 optical module.

To make the required certification it is necessary:

- **TE-3000** with the optical module.
- A signal generator of the three wavelengths used in fiber optical installations in order to calibrate and measure (**PROLITE-105**).
- A pigtail with a **FC** to **SC** adapter.

► **Step 1. Capturing reference measurements.**

1. Connect the **SC** pigtail end connector to the **PROLITE-105** output connector.
2. Connect the **FC** end of the pigtail to the optical input of the **TE-3000** (see figure below).
3. Turn on the **PROLITE-105** and the **TE-3000**.
4. In the **TE-3000**, from the **SPECTRUM** or **MEASUREMENT** screen, press F3 key to access the **Tools** menu.
5. Select the **FIBER OPTIC TEST** option and press the *joystick*.
6. In the **PROLITE-105**, press once the **SEQ** key to select the **SIMULTANEOUS** mode. This mode simultaneously sends three wavelengths signals.
7. In the **TE-3000**, press the F2 key **Set Reference**. All current values are captured, which will be used as reference values.
8. Now, user can proceed to **Stage 2** in order to measure the attenuation at each user's access point.

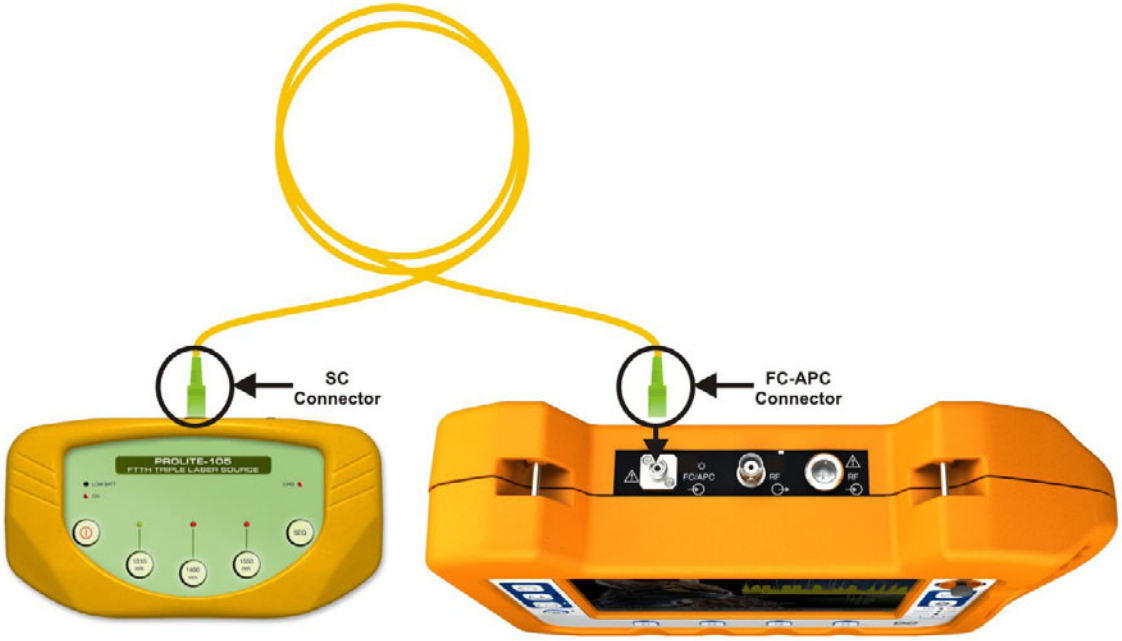


Figure A5.4.

► **Step 2. Attenuation Test Measurement.**

1. Connect the **PROLITE-105** in a source node of the transmission optical network, for example in a free strip of the main telecommunications cabinet of the building.
2. Keep the **PROLITE-105** in simultaneous mode for generating signals, so it **SIMULTANEOUSLY** generates all three wavelengths (1310 nm, 1490 nm and 1550 nm).
3. Connect the **TE-3000** to a receiving node of the optical network that is going to be measured, such as for example in a **UAP** (User Access Point).
4. Using the **TE-3000**, check measurements on the **FIBER OPTIC TEST** screen.

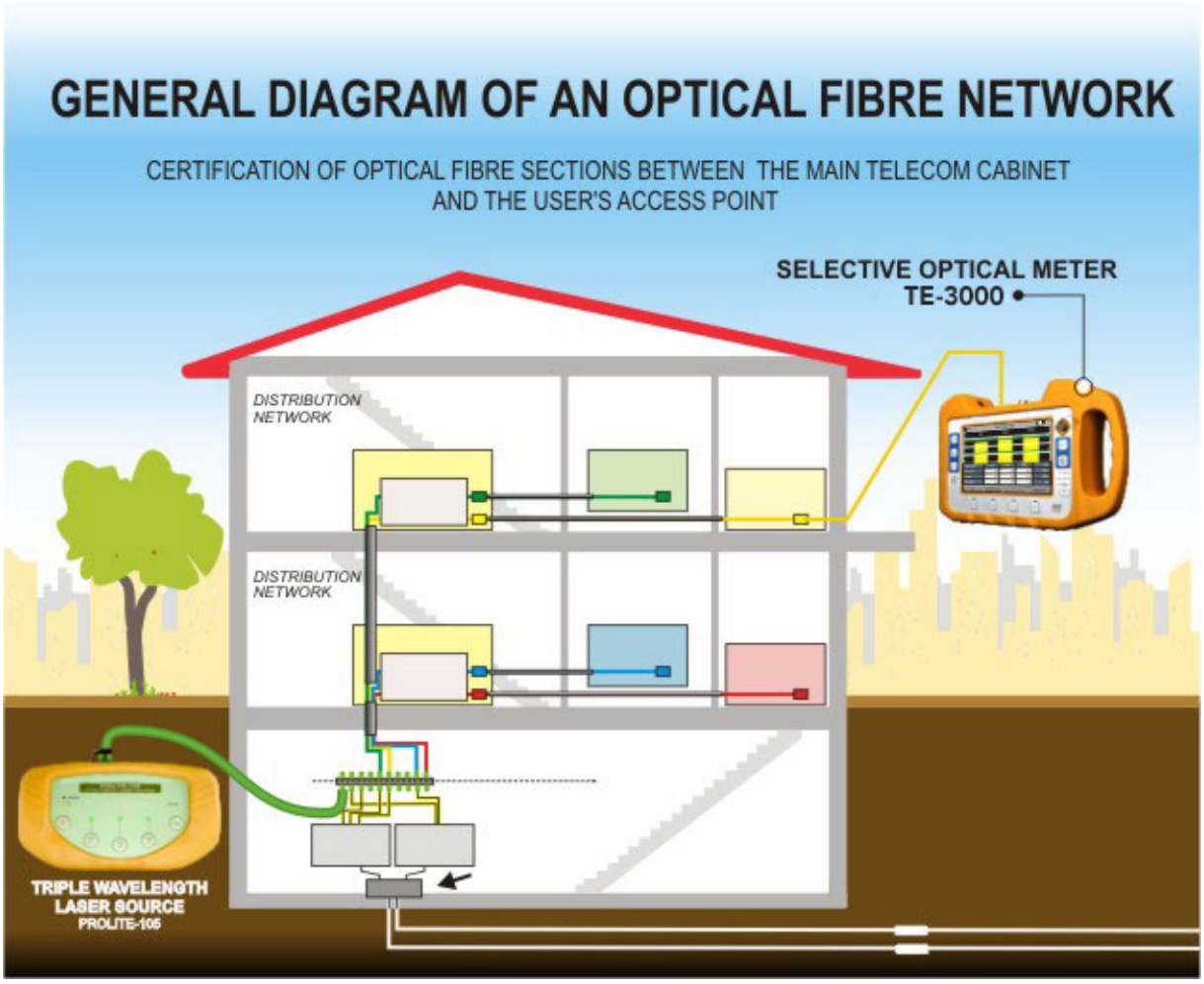


Figure A5.5.

A5.4 Selective optical to RF converter

A5.4.1 Description

The selective optical to **RF** converter has a filter that separates each wavelength and directs it to an independent circuit with a photosensor, which obtains the **RF** signal that carries. The **RF** signal obtained for each wavelength passes to a band switch.

The band switch receives a signal and converts it to a frequency within the **RF** band (65 — 2150 MHz). In the case of a terrestrial / cable signal the signal is not converted since that signal is within the **RF** range. After the conversion, the **RF** signal output is connected to the analyzer input connector and the measurement is performed in the usual way to an **RF** signal. In the conversion, bear in mind that for every unit of optical attenuation (one dB), occurs two dBs of power loss in **RF**. As an example, every 3 dB of optical attenuation for each splitter are equivalent to 6 dB of power loss for RF.

A5.4.2 Operation

Signal connection to use this option is as follows:

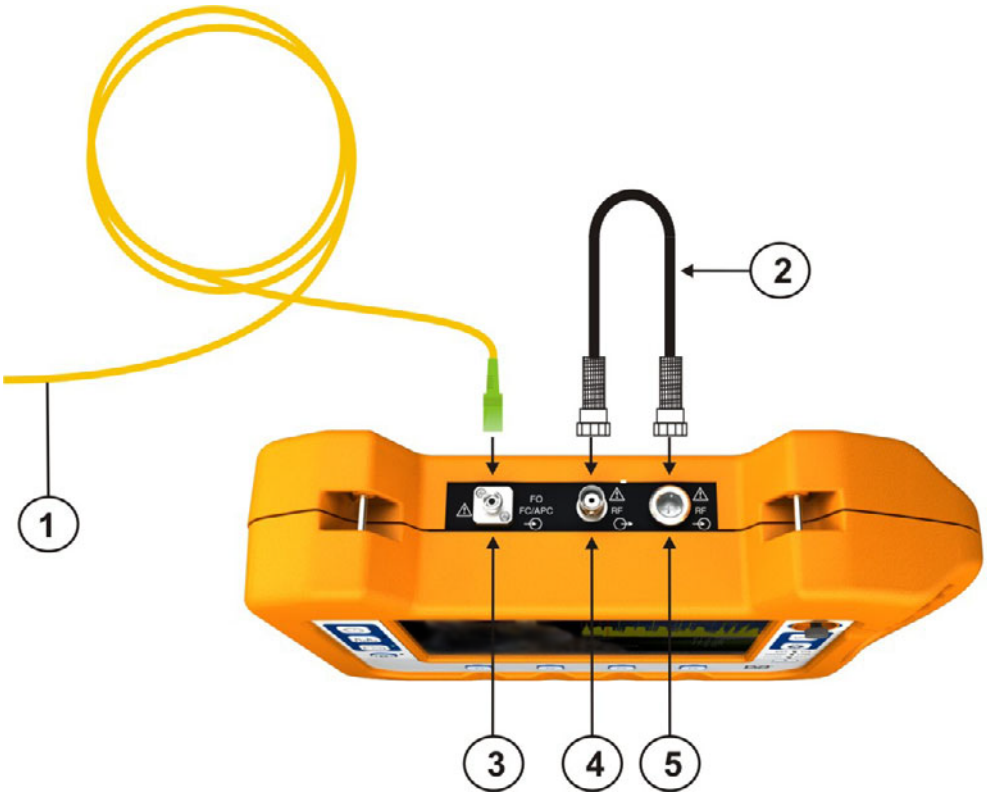


Figure A5.6. Upper panel of **TE-3000** (with this option installed).

1. Pigtail adapter (supplied with the module) with input optical signal.
2. Cable (supplied with this expansion module) with RF signal.
3. **FC—APC** input connector for optical signal.
4. Output BNC connector for the RF signal converted from optical.
5. Universal Connector for F/F or F/BNC adapter input for RF signal (coming from the optical conversion).

A5.4.3 Configuration

After the connection is made, the user can use the equipment for measurement of optical signals as if they were **RF** signals. Steps to measure a signal are as follows:

1. Press the Settings key and select the corresponding band, whether terrestrial (for optical link) or satellite (for optical LNB). In the case of a satellite optical signal and frequency tuning, user has to select the signal type, characterized by the band (low/high) and the type of polarization (vertical/horizontal). In the case of a satellite optical signal and channel tuning, the parameters are defined by the channel (refer to the Settings menu section for more details).
2. Select the **Optical module** option and press the joystick.
3. It appears a window to enable the optical module and to configure additional parameters.
4. Select **Enable**.
5. At the top right area of the screen appears the **OPT** icon meaning there is external power.
6. It appears a window with some setting parameters.

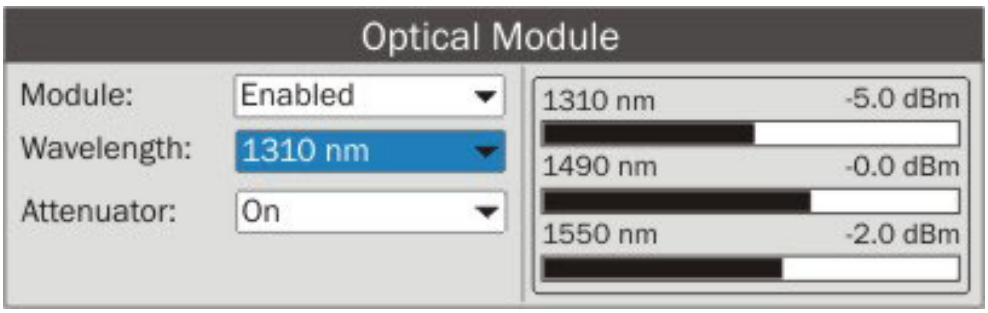


Figure A5.7.

In this window appears the level power for each wavelength and also the user can set two parameters:

- **Wavelength**:

  Wavelength selection at the **RF** output by the user among the three wavelength available: 1310, 1490 and 1550 nm.

- **Attenuator**:

  When the attenuator is ON is 15 dB RF attenuation. When the attenuator is OFF is 0 dB RF attenuation. The attenuator must be adapted to the installation according to the RF power (modulation index).

Also, on the right side appears the selective power in dBm for each wavelength.

A5.5 5 GHz RF Auxiliary Input

A5.5.1 Description

The **TE-3000** optical fiber option comes along with a 5 GHz RF auxiliary input which can be used among other applications for direct connection to optical LNBs with 5.4 GHz output. This RF input covers three bands:

Band I	From 2150 MHz to 3000 MHz
Band II	From 3400 MHz to 4400 MHz
Band III	From 4400 MHz to 5400 MHz

A5.5.2 Operation

Figure A5.8.

1 SMA Connector (RF aux. input signal).

A5.5.3 Configuration

The user can use the equipment for direct connection to optical LNB with 5.4 GHz output. Steps to measure it are as follows:

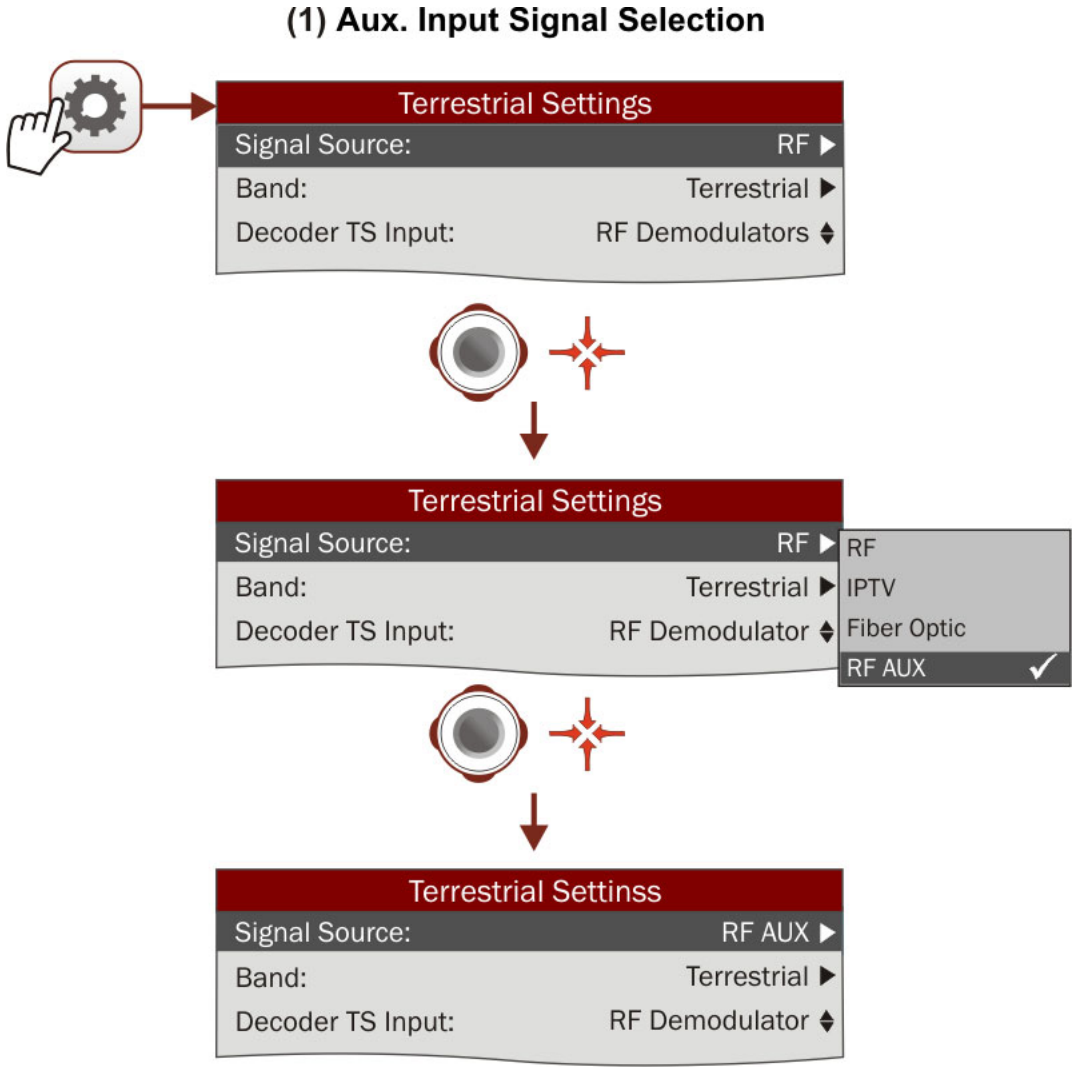


Figure A5.9a.

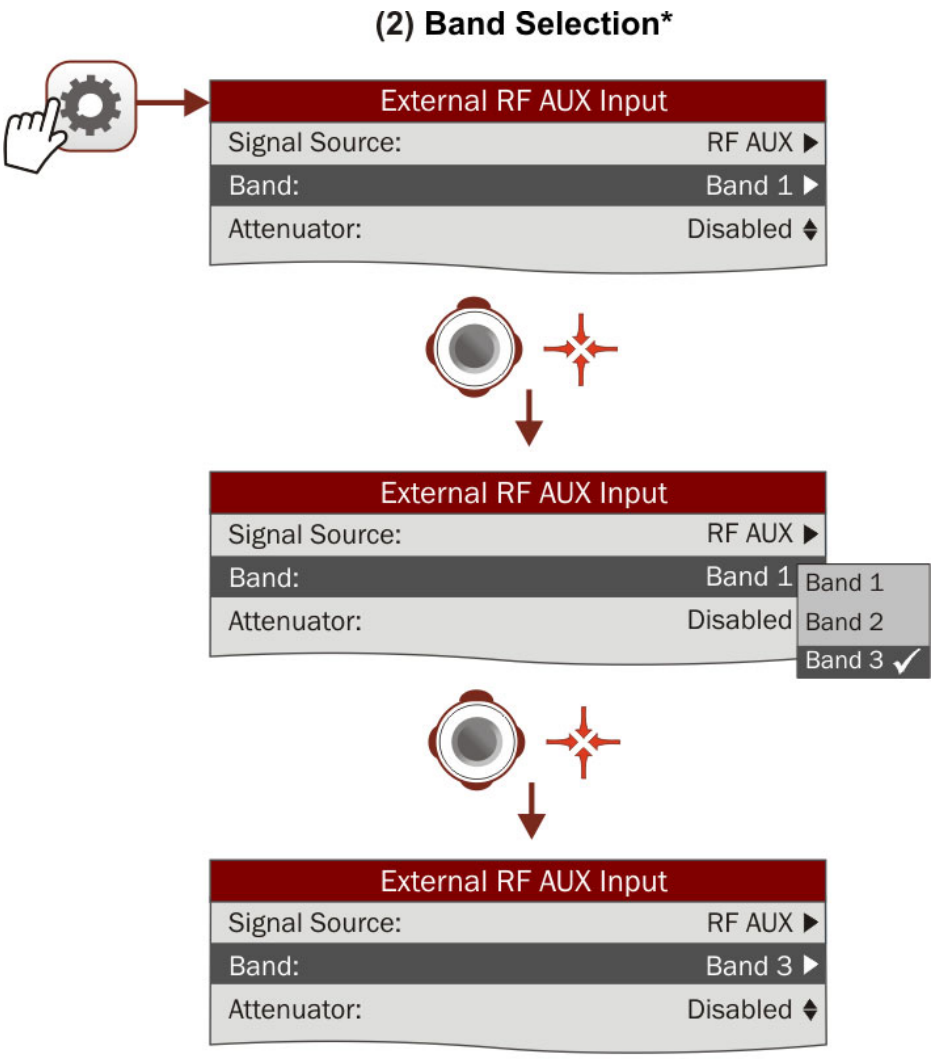


Figure A5.9b.

* Band 1: 2150 - 3000 MHz; Band 2: 3400 - 4400 MHz; Band 3: 4400 - 5400 MHz.

A5.5.4 Screen Description

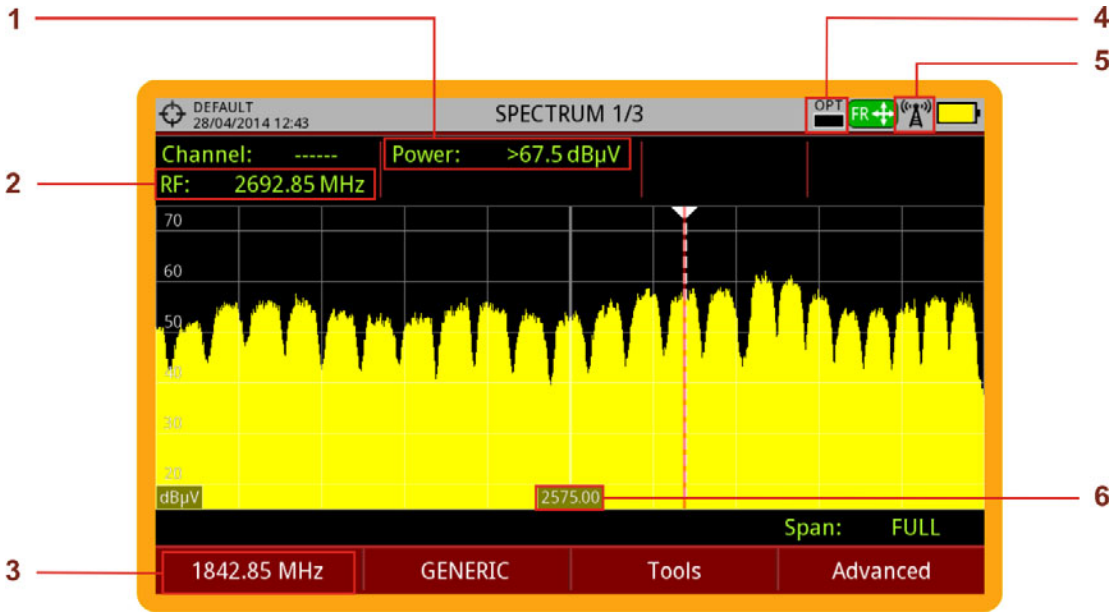


Figure A5.10.

1. RF Aux. Input Signal Power.
2. Auxiliary Frequency Input.
3. Input Signal Frequency.
4. LNB Optical Power Level.
5. RF Auxiliary Input Enabled.
6. Center Frequency.

ANNEX 6 OP-002-GPS: SIGNAL COVERAGE OPTION

A6.1 GENERAL

A6.1.1 Description

This annex contains operating instructions for the next option:

OP-002-GPS: Signal coverage analysis with GPS for **TE-3000**

This option allows the user to check signal coverage by measuring its power, MER and C/N. The position where all these measurements are taken is determined by a GPS receiver. All this data, measurements and GPS position can be downloaded to a PC and exported to a file for later analysis.

Please, read the user's manual of the equipment for detailed information about general operation, specifications and other data.

A6.2 Signal Coverage Analysis

A6.2.1 Operation

The Signal Coverage tool is available for all signals.

1. Connect the GPS receiver to the equipment.
2. In **Settings** menu select the terrestrial band.
3. Access the **SPECTRUM** mode and tune the signal for coverage study.
4. Press the **Tools** key F3.
5. Select the **Signal Coverage** option.
6. The **Signal Coverage** function appears on screen.
7. Before starting the signal coverage analysis, access the **Configuration** option in the **Advanced** menu F4 for settings (more details in next section).
8. After settings, access the **Advanced** menu F4 and press on **Start** to start the signal coverage analysis.

   In **Automatic** mode, the equipment takes samples automatically according to settings (see next section). In **Manual** mode each time the user presses the joystick the equipment takes a sample. Measurement are linked to the GPS reference.
9. Access the **Advanced** menu F4 and press on **Stop** to finish the signal coverage analysis. Data obtained is automatically stored.
10. Access the data by pressing the **Installation List** key to check that the monitoring data file has been saved. This file is a "Data Capture" type. To manage the data, see below the section "Data File Processing".

A6.2.2 Settings

User can adjust some parameters on the Signal Coverage analysis:

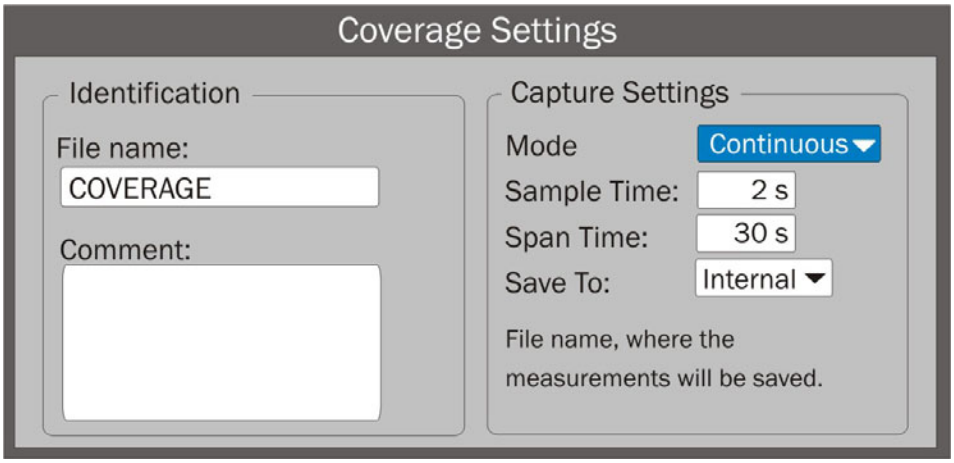


Figure A6.1.

- **File name**:

  User can give a name to the file where data is saved. All measurement that can be seen in the MEASUREMENT 1/3 screen (frequency, power/level, C/N, PLP identifier, MER, CBER, LBER and LM) will be stored on the data file. Be sure to change the file name when starting a new Signal coverage analysis. If not, new data file will be saved on the last one.

- **Comment**:

  User can write some comments about the study.

- **Mode**:

  There are **two** options: **Continuous** or **Manual**. In continuous mode a sample is taken automatically every sample time. In manual mode a sample is taken every time that user presses the joystick.

- **Sample Time**:

  Time between acquisitions. Only when working in continuous mode. Minimum time is 1 second.

- **Span time**:

  It is the width, in time, shown on screen for the X axis.

- **Save to**:

  There are **two** options: **Internal** or **USB**. For Internal option it saves the file with all data in the internal memory of the equipment. For USB option it saves the file with all data in a USB flashdrive connected to the micro-USB port of the equipment.

A6.2.3 Description of signal coverage screen

The following describes the **Signal Coverage** screen:

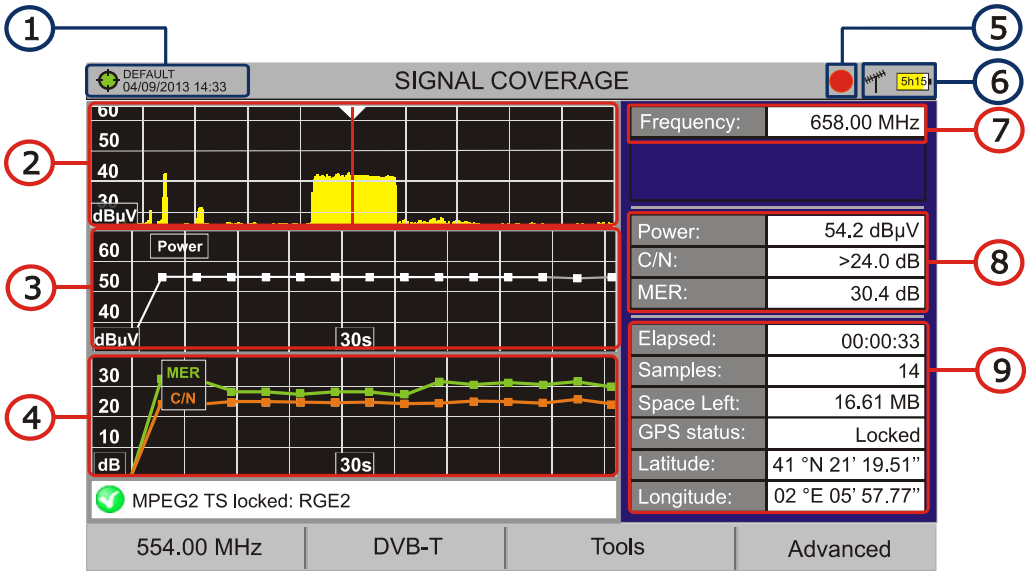


Figure A6.2.

1. Selected installation; date and time. The "Current installation" green indicates the system has locked the GPS signal. The "Current installation" in red indicates that the system has not locked the GPS signal.
2. Spectrum.
3. Power measurement over time (shows span time).
4. MER and C/N measurement over time (shows span time).
5. Signal coverage started.
6. LNB, Selected band; battery level.
7. Signal information window 1:

   Frecuency: frequency at which signal is locked.
8. Signal information window 2:

   Power, C/N, MER measurements of the signal over time. It shows on screen only the span time selected in settings.

9 Signal information window 3:

Elapsed: Time elapsed since the beginning of the coverage study.

Samples: Samples taken since the beginning of the coverage study.

Space left: Space left in the memory to save data.

GPS status: It shows if the GPS receiver is locked or unlocked.

Latitude, **Longitude**: It shows the latitude and longitude at the current position, if GPS is locked. Measurement are linked to the GPS position.

A6.2.4 Menu Options

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.

In the **Advanced** menu there are some options for the **Signal Coverage**. They are:

- **Start**: It starts the signal coverage study.
- **Stop**: It stops the signal coverage study.
- **Configuration**: It shows the settings window with some parameters.

► **GPS Status**: It shows a list and a graph with satellites detected to locate the GPS signal. It is also provided additional data such as longitude, latitude, date and universal time, visible satellites and GPS status (locked or not).

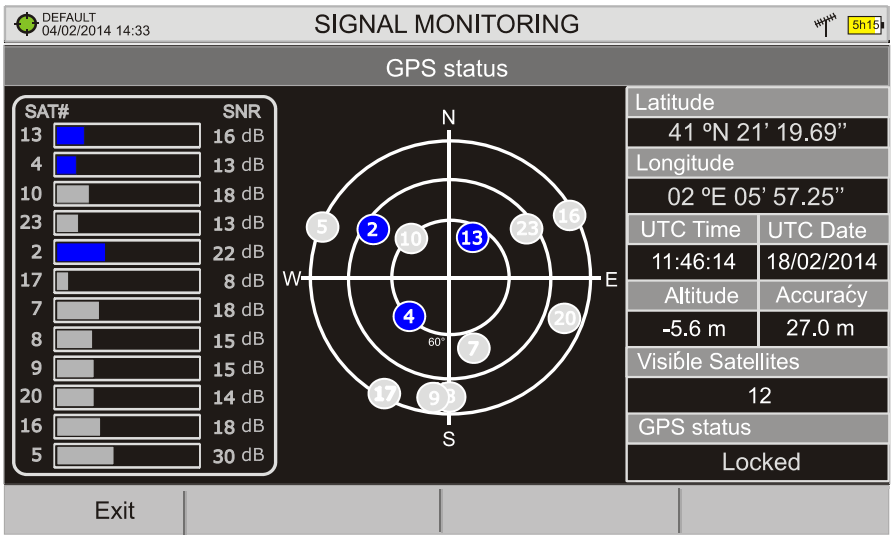


Figure A6.3.

A6.3 Data File Processing

A6.3.1 Description

This document is an explanation about the process that is needed to be done in order to obtain a more comfortable view of the XML data obtained with **TE-3000** family equipment, with GPS option, when doing a Signal Coverage analysis.

Once you got the coverage data, copy the XML data file from the equipment to a USB memory using the Installation Manager. See the equipment's documentation in how to get files from an Installation.

A6.3.2 Obtaining an excel file

For this section, you must have at least Excel 2003 or newer version. Excel 2007 (or later) is highly recommended to avoid macro problems.

1 First of all we need to locate the XML data file in the folder from which we want to work. There are no requirements needed to be satisfied. A file named COVERAGE.XSL must be placed in the same data file folder. That second file allows proper data formatting when processed by Excel.

2 Select the XML data file and then right click with the mouse button on the file name.

3 Choose the option "**Open with**" and then select Excel 2007 (or the available version)

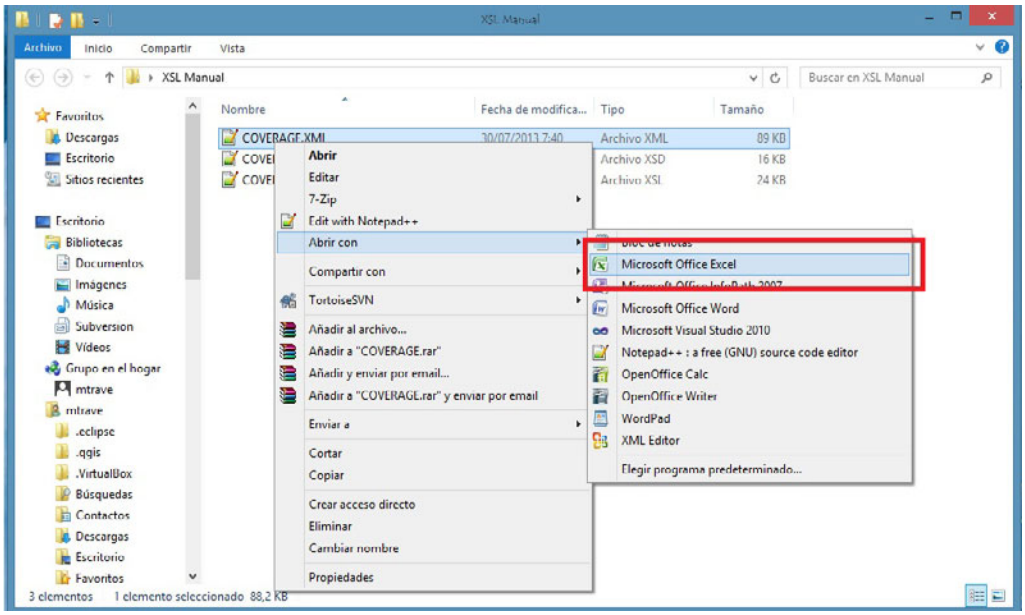


Figure A6.4.

4 When Excel tries to open the file it will ask you the import method to open the XML data file by this way:

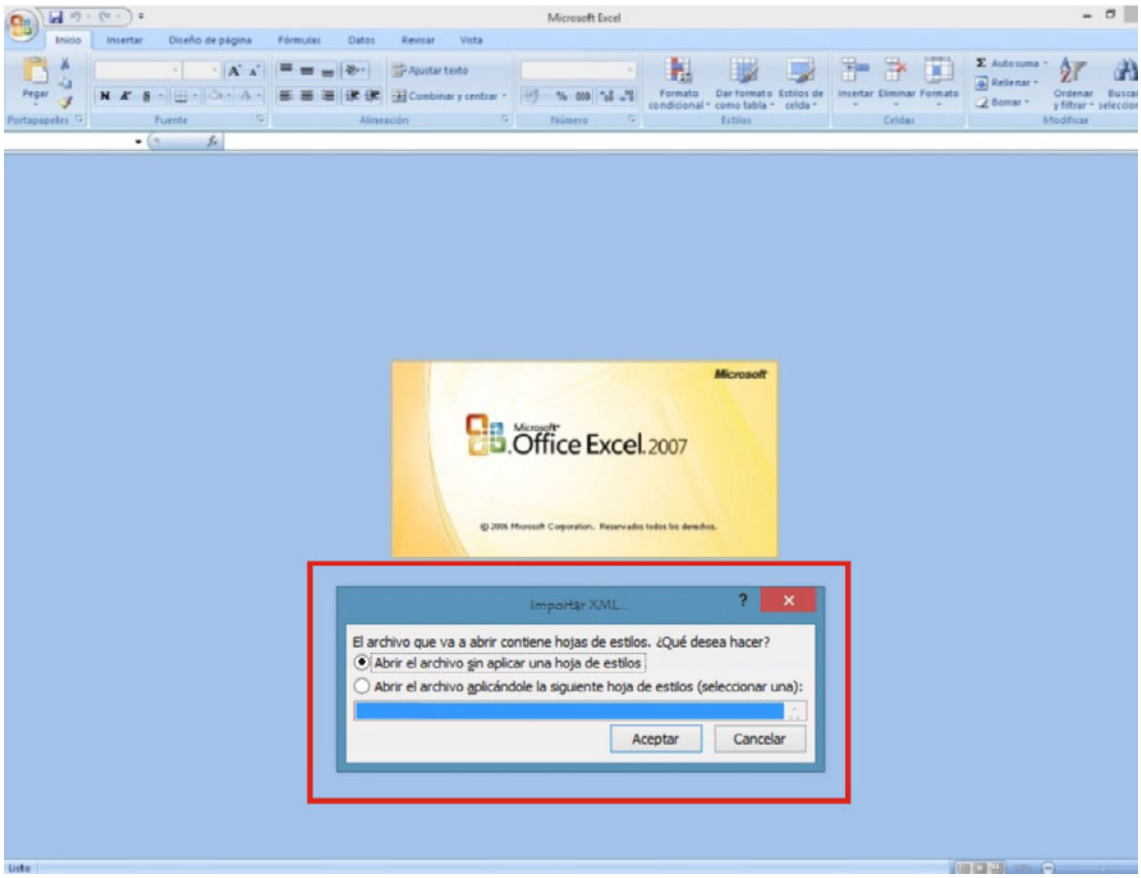


Figure A6.5.

5 You must choose the option in which a stylesheet is asked. It will appear as an option the "COVERAGE.xsl" file.

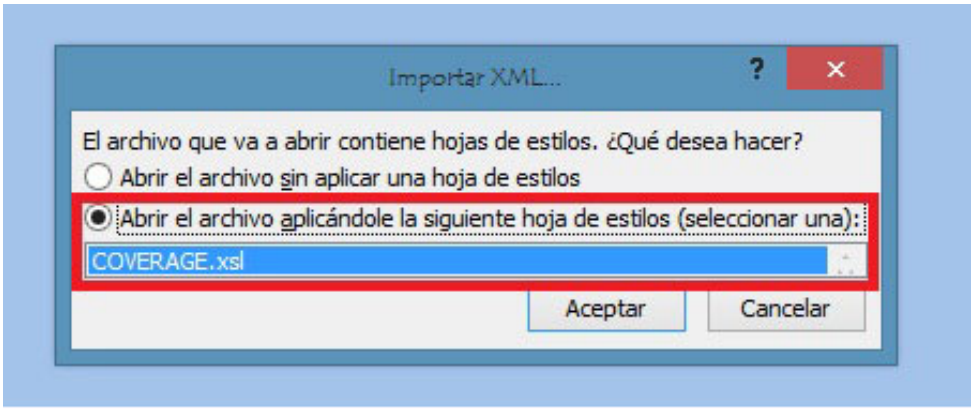


Figure A6.6.

6 Now Excel is opening the XML data file using the format that the XSL file is providing. This step could take few seconds depending on the size of the XML data file.

7 At this point, you should have an excel file with three different sheets. Each sheet corresponds to a different view of the same data:

- ✓ The first one will show you the generic signal information and the different coverage measures for each point acquired.
- ✓ In the second one, you will find the same data but presented in a table format, more user friendly for working with graphs based on each measured parameter.
- ✓ The third one provides data in a format adapted for geolocation. Information is shown in terms of parameters required for presenting the measured data as a map layer (latitude, longitude, id, description and an icon identifier number) as required for GIS and Google Earth technologies. This third sheet is formatted mainly to be compatible with main Google Earth format converters available in Internet.

8 Now save the data as a true excel file. No specific name or path is required, but you must remember the path.

A6.3.3 Presenting measurements in Google Earth

For this process **Google Earth** must be installed on the computer and internet connection will be needed.

1 Open a web browser and then search for a converter from Excel file to KML file, for instance, googling "excel to kml" (a kind of XML file used by Google Earth) We propose this one (and this is the one we will explain in detail in the following example explanation).

Navigate to: http://www.earthpoint.us/ExcelToKml.aspx

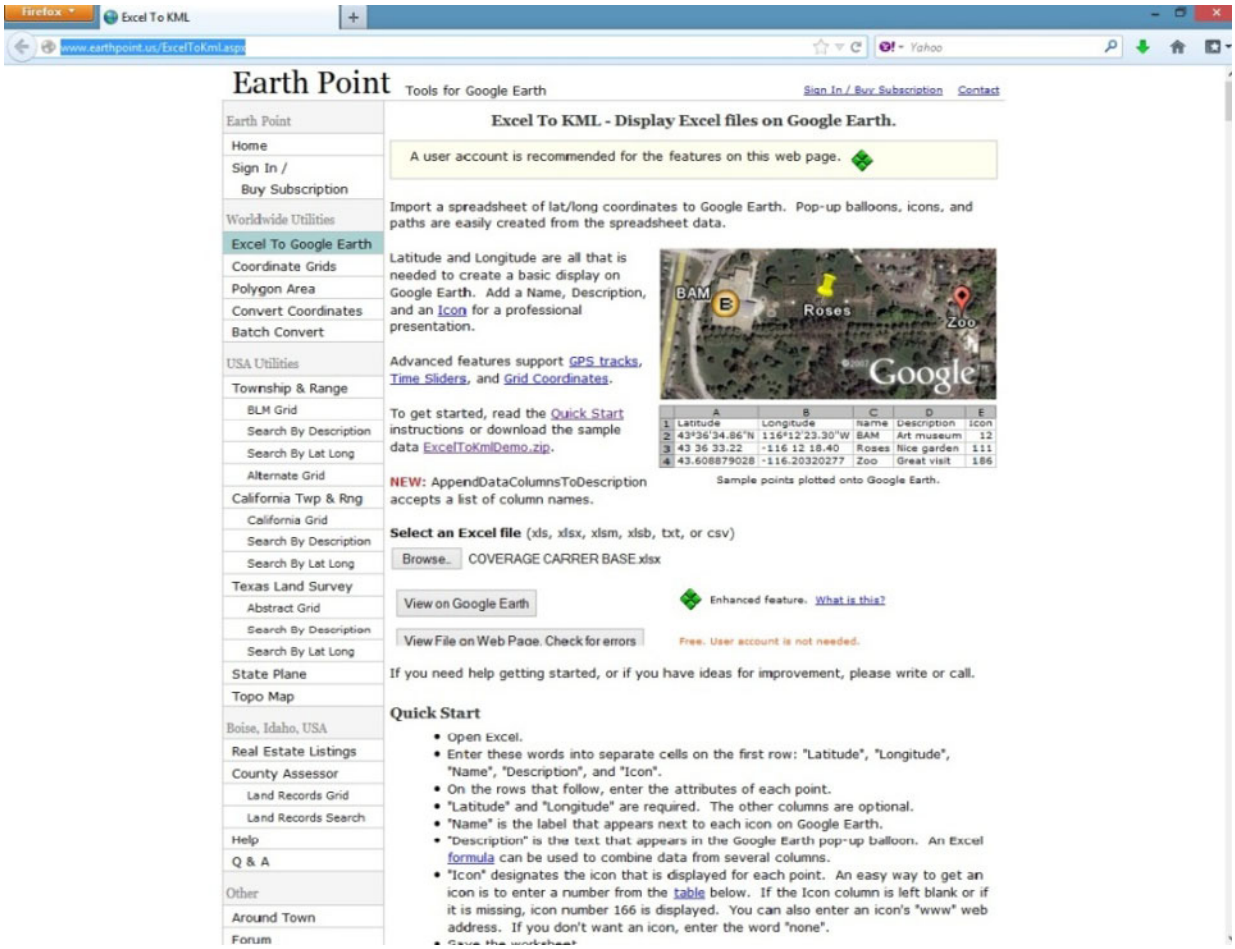


Figure A6.7.

2 Click on the **BROWSE** icon:

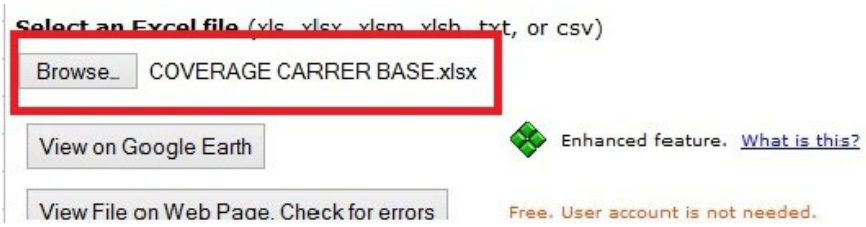


Figure A6.8.

3 A new window will appear in which you will be able to search the Excel file you saved in the step number 9 of the previous section of this document.

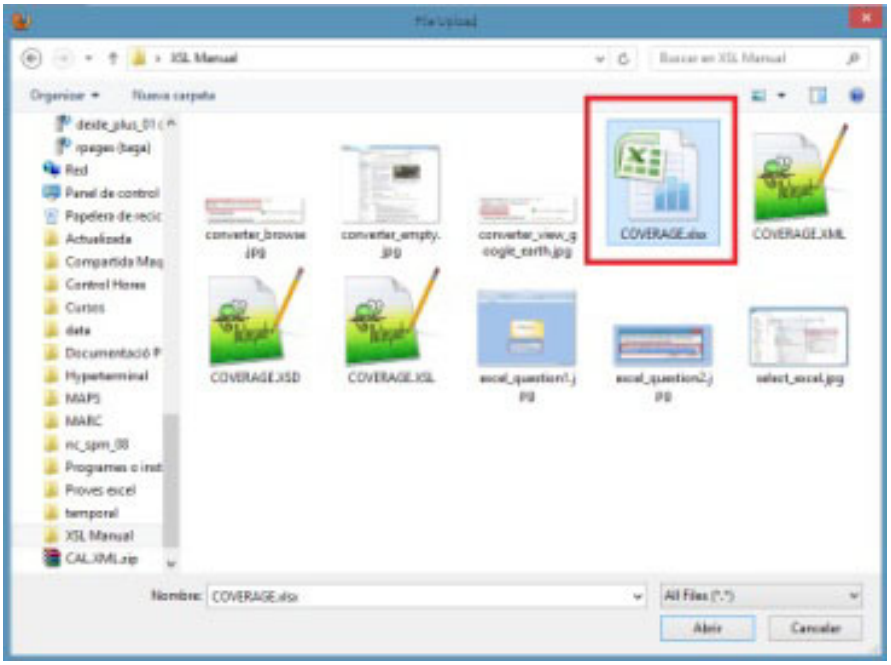


Figure A6.9.

4 After doing the file selection click on the option **VIEW ON GOOGLE EARTH**:

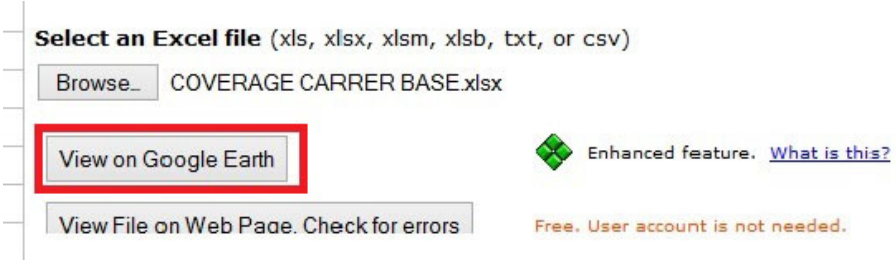


Figure A6.10.

5 The web page will perform the file conversion and then will ask if you want to save the resulting file or just open it using Google Earth software. Select **OPEN WITH** Google Earth.

Figure A6.11.

Google Earth will try to open the three different excel sheet explained before in this document (see step 8 from Excel opening process for XML data file in the previous section of this document). The first one is not using the format that the converter is expecting and will generate an error. The second and the third one will represent the coverage measurement points, but only the third one will be with the really suitable format.

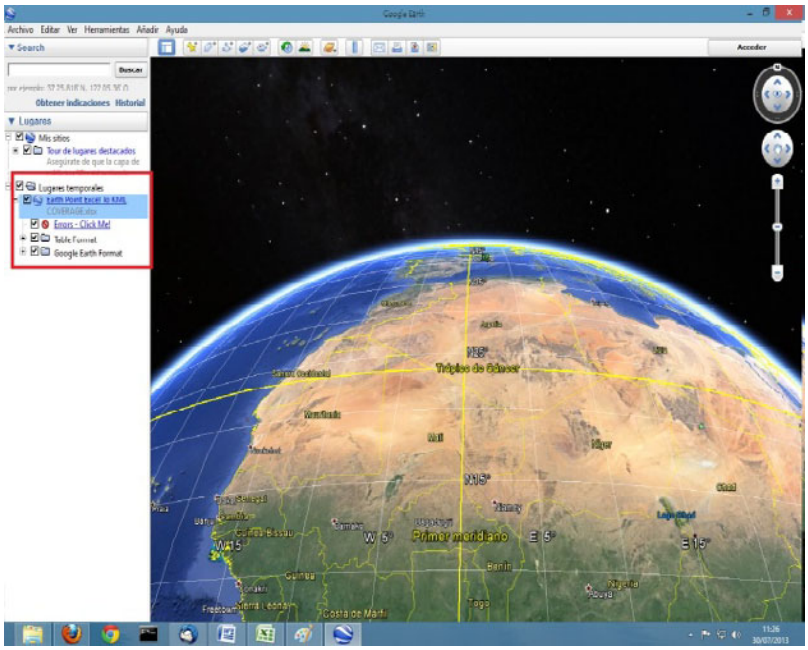


Figure A6.12.

6 Disable the first and the second sheets for a more comfortable view, and click over the third one.

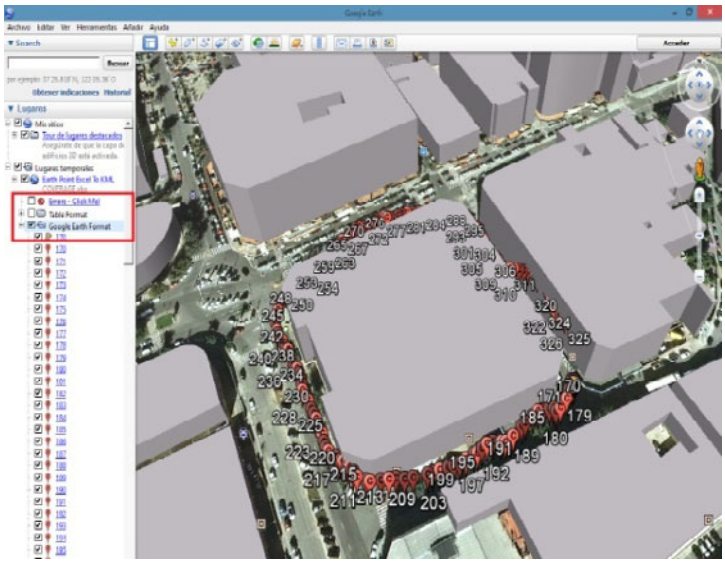


Figure A6.13.

7 The yellow flag symbol mark the first and the last coverage measure point. The other measurement points will be presented as a C symbol.

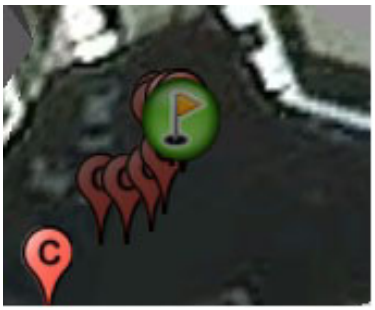


Figure A6.14.

8 Every point will show the POWER and MER measurements, when selected.

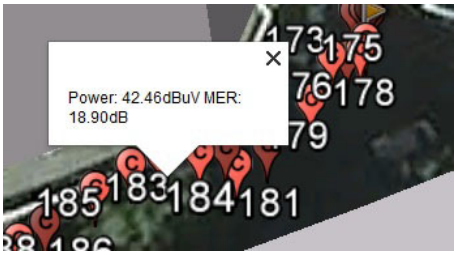


Figure A6.15.

Finally, the KML file generated with the procedure described here can be used directly with most of the GIS tools, to import such data into a layer over a GIS map.

ANNEX 7 OP-002-DAB: DAB/DAB+ OPTION

A7.1 Description

This annex contains instructions for the following option:

OP-002-DAB: DAB/DAB+ signal analysis.

This option allows the user to detect, measure, analyse and visualise digital radio **DAB** and **DAB+** .

The **DAB** (Digital Audio Broadcasting) is a digital radio standard, designed for both home and portable receivers to broadcast terrestrial and satellite audio and also data. It works with Band III and L-Band frequencies.

The **DAB+** is an evolution of DAB using the AAC + audio codec. It also includes Reed-Solomon error correction, which makes it more robust. DAB receivers are not compatible with DAB+ receivers.

A7.2 Operation

1. Connect the RF input signal to the equipment.
2. Select the frequency band (terrestrial or satellite) by means of the "Settings" menu.
3. Access the **MEASUREMENT**, **SPECTRUM ANALYSE**R or **TV MOD**E by pressing the corresponding key.
4. Lock the DAB/DAB+ signal.
5. If you want to enable auto-detection function for DAB/DAB+, go to "Preferences" by pressing the key for 1 second and in the Stealth -ID tab select the **DAB/DAB+** option.

A7.3 MEASUREMENT Mode

Views for **DAB/DAB+** signal in **MEASUREMENT** mode are:

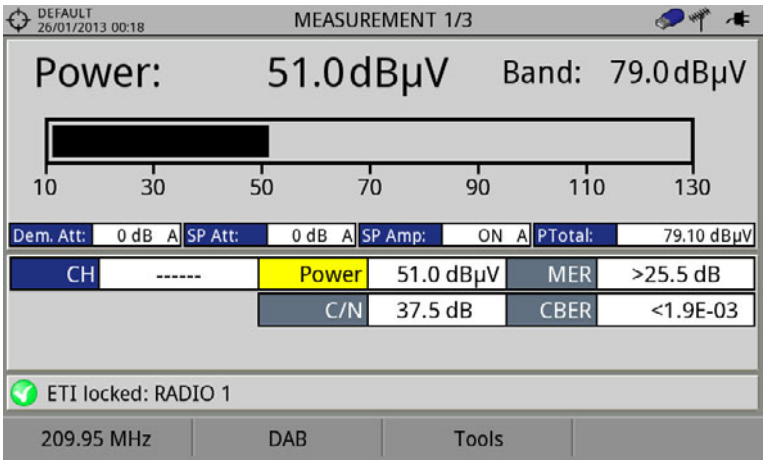


Figure A7 1. Measurement 1/3

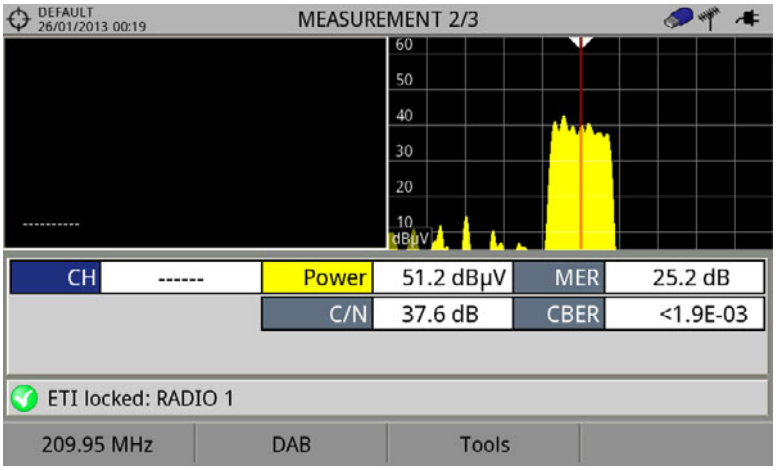


Figure A7 2. Measurement 2/3

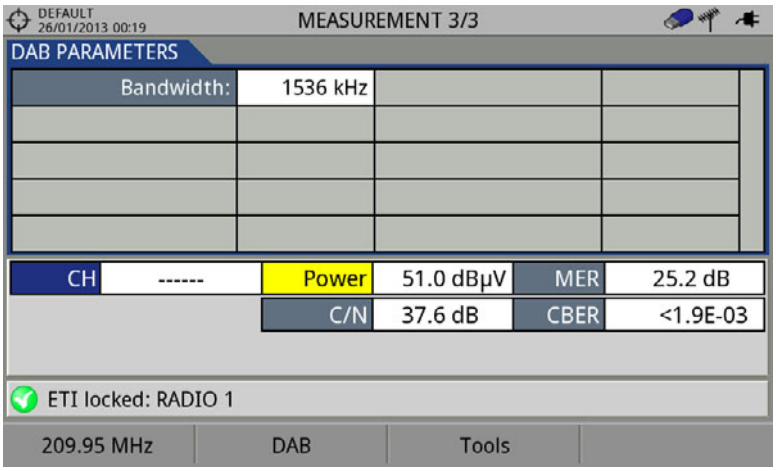


Figure A7 3. Measurement 3/3

A7.4 SPECTRUM ANALYZER Mode

Views for **DAB**/**DAB+** signal in **MEASUREMENT** mode are:

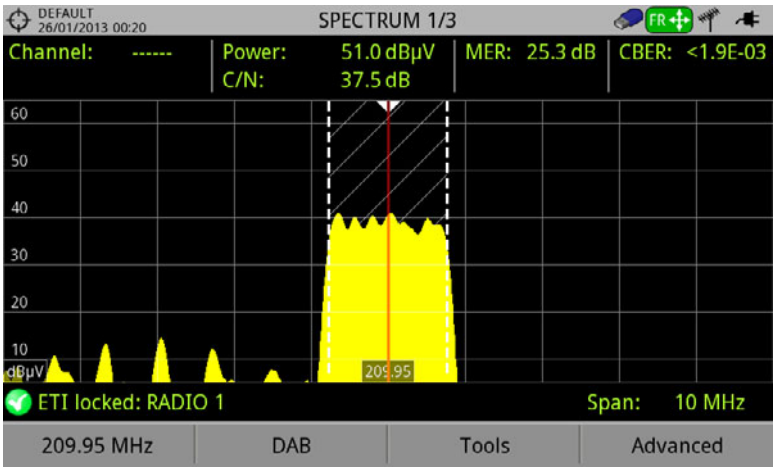


Figure A7 4. Spectrum 1/3

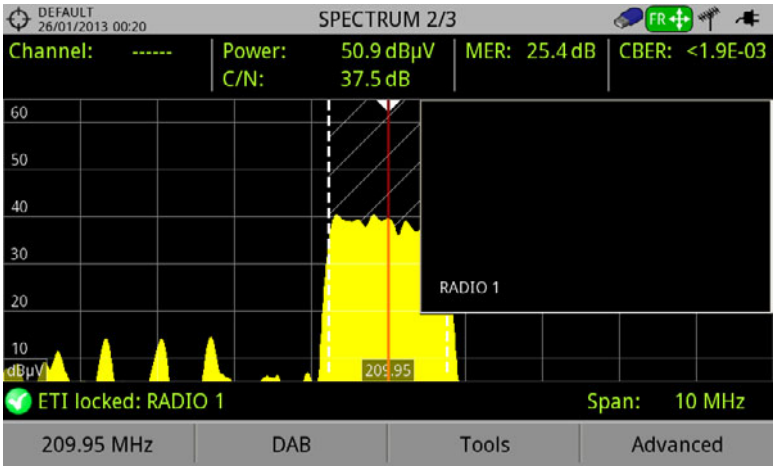


Figure A7 5. Spectrum 1/3

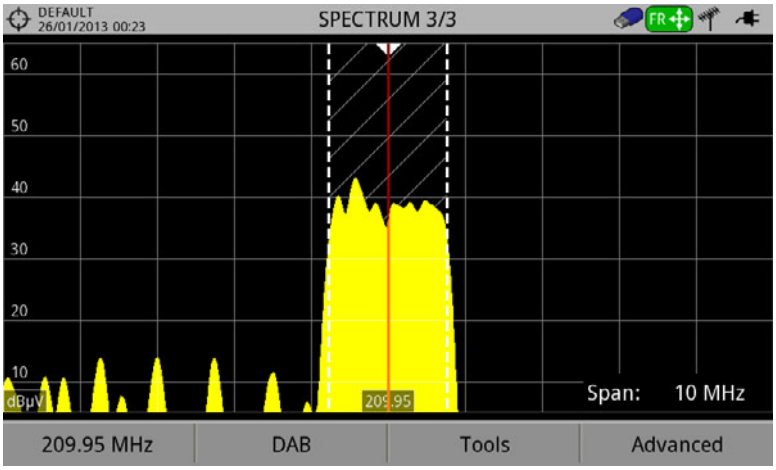


Figure A7 6. Spectrum 1/3

A7.5 TV Mode

Views for **DAB**/**DAB+** signal in TV mode are:

Figure A7 7. TV 1/3

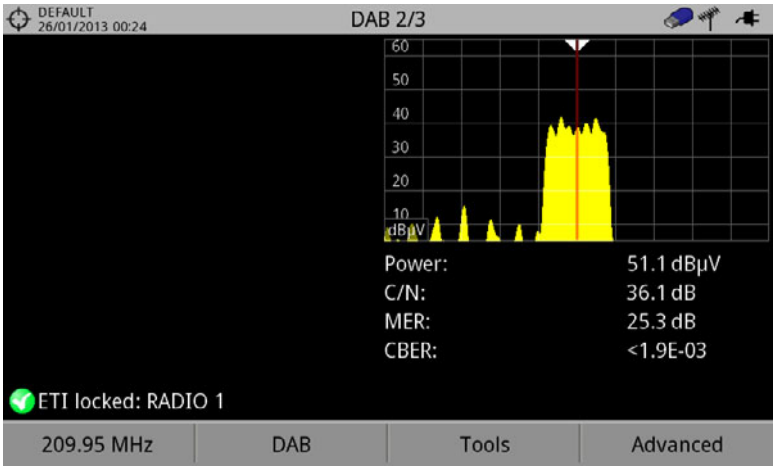


Figure A7 8. TV 2/3

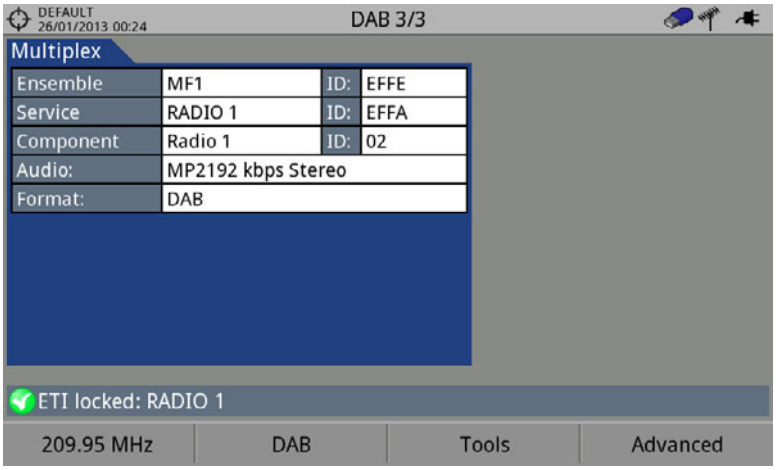


Figure A7 9. TV 3/3