EKSELANS BY ITS

METEK HD

USER MANUAL

METEK

USAGE RECOMMENDATIONS AND SAFETY STIPULATIONS

	Pay special attention to the exclamation mark, which is used to indicate possible risks to people or to the equipment itself.
	Preste especial atención al símbolo de consejo el cual se usa para indicar recomendaciones interesantes relacionadas con el equipo

Pay special attention to the advice symbol which is used to indicate interesting recommendation related with the equipment.

- The equipment is designed to be operated both indoors and outdoors. Avoid the entry of dirt and water at all times. The meter can withstand slight splashes of water, but there is the possibility of water penetrating the interior.
- Do not subject the meter to extreme temperatures nor operate it in temperature ranges which do not fall within the range of 0ºC to 40ºC.
- Do not subject the field meter to external forces; Do not use it as a support nor climb it.
- Do not cover those spaces intended for ventilation. It must be possible to keep the internal electronics ventilated.
- Do not try and change the battery by your own means. Take it to the technical service of the manufacturer.
- Handle the equipment with great care, as because it is a field meter, it is a sensitive measurement instrument.
- Respect the purpose of the communication ports; Do not use them for any other purposes.
- Keep your equipment clean.

Electrical risk

Under normal usage conditions, this meter does not entail any electrical risk. It may be used at installations with an overvoltage category.

- Check that its current power adapter is in good condition. Said power adapter is class II. For safety reasons, it must be connected on electrical lines with an earthing socket.
- Only carry out measurements in systems whose measurement negative is potentially connected to earth.
- Take into account the electrical margins specified both for voltages and for radio frequency.
- Remember that voltages exceeding 70VDC or 33Vrms are potentially hazardous to people.

The equipment is fitted with an internal input signal attenuator. This allows the adjustment of the signal level to the optimum level required by the demodulator automatically or manually.

Do not inject RF signals which, as a whole, exceed 130dBµV. By way of a reference, there may be 10 DVB-T channels with a signal level of 120 dBµV or 30 DVB-T channels with a signal level of 115 dBµV.

Do not inject signals with a direct current exceeding ± 30 VDC.

Manual version

This manual was edited in April 2019 and it based on the FW version number: 1.09.1660.

Consult Annex III, History of firmware updates in order to be up-to-date with the latest equipment functionalities.

Table of Contents

1. Packet content

The original packet contains:

- Professional field meter DVB-S/S2, DVB-T/T2, DVB-C METEK HD.
- Charging cable for car.
- Power adapter 15V – 2,5A.
- F-type female adapter – F-type interchangeable
- F-type female adapter - IEC female.
- Carrying case.

Accessories included in the packet

We would recommend you to keep the original packaging as it is ideal for its transport by third parties. In this eventuality, also place it inside another box to protect it.

The products marked by this logo must not be thrown away. They must be taken to a specialised recycling point.

The packaging of this product is totally recyclable and manageable by a waste control system

2. Introduction

Metek HD is the first generation of field meters developed for Ekselans by ITS wholly in Europe. It is designed to cater for the current needs of telecommunications' professionals and to be a tool, which is functional, practical and simple and adapted to present and future Codecs transmission standards.

3. Equipment description

The professional field meter Metek HD is an item of equipment designed for the measurement of radioelectric signals transmitted according to DVB-S/ S2, DVB-T/T2, DVB-C standards. It also allows the measurement of signals on the mobile telephony bands Lte1/ 4G and Lte 2/ 5G. The meter carries out measurements of the power signal level percentage for WiFi 2,4GHz (IEEE 802.11 b/g/n)

The meter displays three types of information: the specific measurements of each signal, spectrum display and video reproduction (sound and image). This information shall be represented whenever signals are used which comply with the standards whereby the meter is specified both for transmission DVB-S/S2, DVB-T/T2, DVB-C and encoding: MPEG2, MPEG4, HAVC.

The meter is endowed with ergonomics especially designed for smooth operation in the field. Both its weight, key layout and connectors and features of the screen facilitate high performance and professional effectiveness.

One of its main features is the possibility of browsing by means of a group of programmes or by frequency. In the former case, according to the group selected when moving around the channels, only the channels which belong to the group are tuned, thereby facilitating speedier browsing. If browsing by frequency, the user may directly enter a frequency or move around all the channels.

Browsing by group is useful when we have few channels on the band of interest (satellite, terrestrial or cable) and we wish to check that their measurements are correct.

Another fundamental aspect regarding this professional meter is that it incorporates an automatic variable, high-precision hardware attenuator. The objective thereof is to allow the measurement of high radiofrequency signal powers, to conveniently measure signals with a high dynamic and to carry out measurements with precision. The attenuator can be adjusted so that it works automatically or affixed to a specific value.

The equipment is fitted with a satellite tuner capable of detecting DVB-S2 transmissions in multistream, measuring them and viewing their contents. This feature makes it a good partner for carrying out advanced satellite installations.

The equipment allows WiFi detection at 2.4GHz. The name is shown of the SSID available and its basic settings.

As regards its multimedia functions, it can store screen captures and reproduce the contents of a connected USB memory.

The field meter METEK HD

3.1. Upper side

This side only has an F-type male connector. It is best to leave the adapter connected which it is wished to use (typically, F-type female-F-type female).

This adapter must be replaced if there is any suspicion that it does not make a good contact with the cable connected.

At all times protect the male F connector of the meter itself.

Detalle del lateral superior

3.2. Left side

On this side, we can find the following connections:

Details of the left side

- Power supply input Use this connector to charge the field meter
- HDMI output. The connector is specified in accordance with the standard HDMI 1.4A. Use this connector if you wish to see and hear the content of the image on another screen.
- Female USB connector. The connector is specified in accordance with the standard
- 2.0 and it may supply up to 1A. It is designed for the connection of an external memory and it may reproduce its multimedia files, save screen captures or save any .TS files received.
- Port RS.232 (at Jack connector). Reserved for the internal use of the technical service.

3.3 Lower side

The speaker is on the lower panel. It emits sounds related with the interaction with the meter and reproduces the audio of the tuned video.

3.4 Panel frontal

The following elements are on the front panel:

Details of the front panel

3.4.1. Screen

The screen has a resolution of 1024 x 600 pixels and a size of 7”. Its high luminosity is ideal under adverse lighting conditions. Its large size also facilitates the reading of the measurements and the viewing of the spectrum and image.

3.4.2. Light sensor

This photodetector shall allow the meter to adjust the screen brightness, adapting its luminosity to the environmental conditions.

3.4.3. LED status Indicators

POWER	This indicates whether the meter is on, suspended or off **Static**: On **Off**: Totally off with minimum consumption of battery **Flashing**: The meter is suspended. Note that in this status the battery is used* **Around 50% less than when it is on*
RF POWER	This indicates whether the device is receiving power in the frequency tuned
LOCK	This indicates whether the device is hooked up to a signal
CHARGE	This indicates whether the device is charging

3.4.4. Lower button panel

NUMERICAL VALUES	These allow values like frequencies to be entered directly
MENU	Accesses the main menu
OPTIONS	Accesses the possible options in the context of the present screen
BAND	This allows you to switch standard and band rapidly. Note that the CABLE band may cease to be shown in accordance with the RF adjustments
ESC	Go back
	This allows a screen capture to be taken and for it to be saved in the external USB memory

3.4.5. Upper button panel

	This turns off, suspends and turns off the device Press for 2s: This turns off / turns on the equipment Press for 1s when on: This suspends the equipment Press for 1s when suspended: This turns on the equipment **The configuration of these buttons can be modified under: configuration > off mode*
	Switches to the monitor mode. In this status the image can be seen as well as its features. Press this button consecutively to show them or otherwise
	Switches to the spectrum analyser mode. When pressed, the values to be displayed, both in terms of the level and frequency, are preconfigured.
	Switches to the measurements mode. In this status, the measurements are viewed pertaining to the transmission band which is being worked on and also a smaller box where the image can be seen as well as the programme constellation or information. (Press left – right to switch the information contained in this box)

3.4.6. Wheel

An element for interaction with the meter is the wheel. It allows values to be adjusted and confirmed by pressing it.

The wheel is endowed with acceleration detection. In other words, once it detects a growing inertia, the jumps in the values which it is increasing or decreasing, increase too.

The direction of the wheel may be adjusted so that it is clockwise or anti-clockwise. See chapter 5.6. Configuration (System adjustments).

3.4.7. Cursors

Cursors  allow movement around the menus and similar screens.

When in spectrum mode, horizontally, they allow the span to be increased and decreased.

When it TV mode, vertically, they allow the programme to be changed and horizontally they allow the volume to be adjusted.

3.5. Power supply

The field meter is fitted with a 7.4V - 7800mAh battery. This endows it with autonomy of around 6h without powering other equipment connected to the RF input (LNB, mast amplifier,…)

The batteries may be charged both using the meter on or off. If it is working, the charging time shall be greater.

When it is working, the LED POWER will remain on.

When it is suspended, the LED POWER shall flash.

During the battery charging process, the LED CHARGE will remain on until it has been charged, at which time the LED will turn off.

 Note that in the suspended status (and not off) there is higher battery consumption than that if it is off. In any case, in the suspended status it consumes around 50% less than when it is on.

Fully charging the battery with the adapter supplied may take 6h. Take this into account before proceeding with installation.

In the event that the equipment fails to respond to the buttons, you can keep button pressed  for 2 seconds. In this case, it shall be turned off and it may be restarted normally.

4. First steps

Before starting, fully charge the meter. Upon leaving the factory, the battery is fully charged but it may be flat when it arrives.

When starting it up, the EK logo will appear on the screen whilst finishing the loading of the firmware that will allow you to work with the meter. You may use the “suspend” function to make this boot-up process quicker. Note that in the suspended status, battery consumption will be higher than when it is totally off.

Carry out the desired preconfigurations so that you have it adjusted to your preferences.

Before plugging in the cable with the input signal, pay attention to where you plug it in. Check that the DC and power levels do not exceed the maximum limits specified for the meter

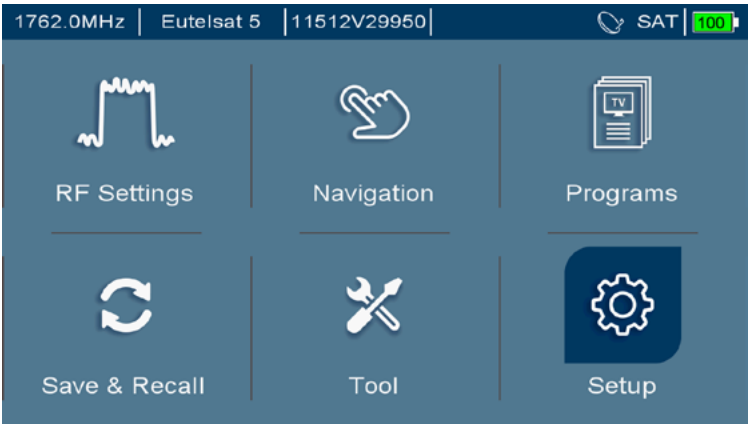
Remember that the equipment is protected from voltages of up to ±30 Vdc, but bear in mind that if the line is live and it is powered with the meter, this will cause a malfunction. In the same way, it is not recommended to connect a radiofrequency signal level higher than 130 dBµV.

Once an input signal has been connected, choose the working band (satellite, terrestrial or cable) using the BAND button

From this point onwards, you can intuitively start making the most of your field meter. For a netter performance, we urge you to keep reading the next few sections of this manual.

5. Menu

Using the MENU key it is possible to access all the functions and adjustments of the field meter.

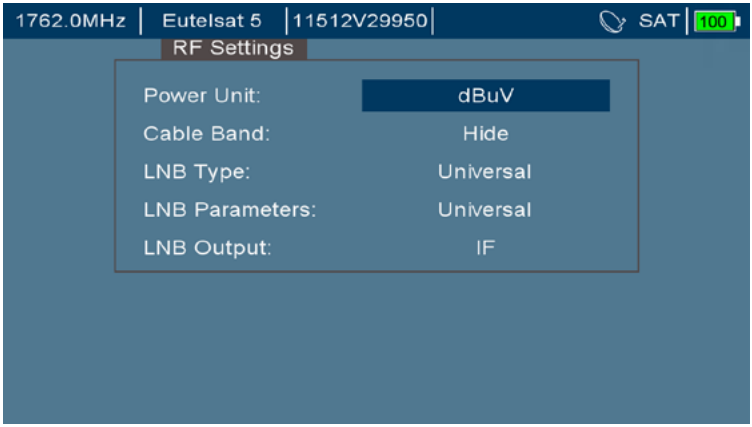


Options of the main menu

5.1. Radiofrequency adjustments

On this menu it is possible to adjust the following settings on the terrestrial band:

- Power Unit. Choose between dBµV and dBm.
- Cable Band. If it is a band which is not usually used, with this option you can ensure that it is not connected during the switching with the key BAND.
- LNB Output. This indicates the original frequency (RF) before having been converted by the LNB to an intermediate frequency (IF). The original RF signal is calculated using the information from the local oscillator.
- LNB Type: Universal, Unicable, DCSS, Quattro, Digiturk
- LNB Settings: Universal, 9.750/10.750, 5.150/5.750, 5.750/5.150



RF adjustments screen

Note that according to the work band, the options of each menu may vary

5.2. Browsing

The field meter offers two browsing modes:

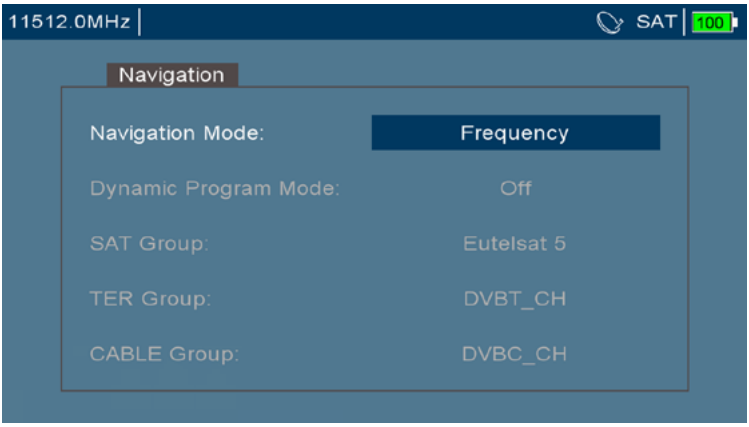
- Frequency mode. The meter tunes a frequency either entered by means of the numerical keyboard or using the wheel.
- Programme Mode. The meter tunes the channels to be found in the plans created (or those which may be created by the user). A plan is a list of channels (frequencies) without necessarily being all of them.

Browsing by frequency is rapid if we know the frequencies to be analysed. Browsing by programme is useful when working with a specific radioelectric signal such as: In a zone where specific terrestrial channels are received, when working with the channels of a cable operator network or when usually working with a satellite and only some specific transponders need to be measured. These channels are grouped together by forming a group which we must select to

work with it. One group is created for each band (Terrestrial, satellite and cable).

On the main menu, by pressing programmes we can create, modify and delete new programmes and groups. It is also possible to create them by browsing: Once a programme has been tuned, it is possible to add it to a defined group. The groups may be associated with a browsing band (SAT, TER and CABLE Group).

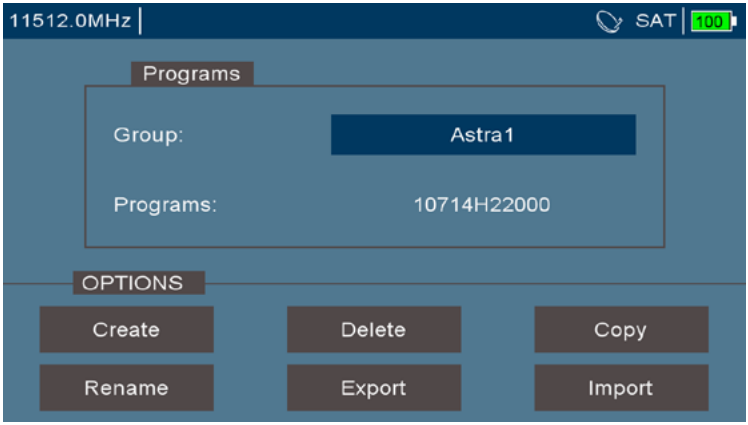
When working in programme mode, it is possible to work in dynamic mode. The dynamic mode stores the measurement and viewing settings of a certain channel. In this way, the viewing or measurement shall always be carried out in line with the latest tuning of said channel.



Browsing Screen

5.3. Programmes

When on the main menu, by pressing the programmes option, it is possible to make adjustments to the programmes and groups stored at the meter.



Programme screen

Selecting a group or programme, press the OPTIONS key and then decide what to do with it. The export and import options allow storage or loading from an USB memory.

5.4. Saving and loading

From the main menu, we can access the save and load option. This allows us to carry out information transfer operations between the meter, a connected USB memory and the field meter itself.

Saving and loading screen

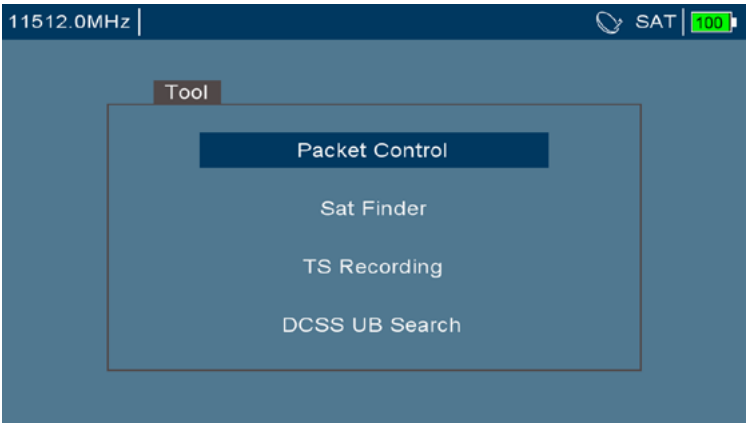
- USB. This allows the browser to be opened which accesses the files contained in the USB memory.
- Copy of the system to USB. This allows the storage of the present values of the field meter.
- Restore system from USB. Read the file stored on the USB memory with the adjustments and configurations stored in this file.

These two previous functions are useful if several installers use the same field meter. Before leaving it, the system can be copied in a file on the USB memory. Once received, used and characterised by a third party, the system may be restored from the USB memory.

- Restore the present group. It allows a group to be left in the same condition as when it was generated.
- Factory values This initialises those values adjustable by the user as if none had been edited.

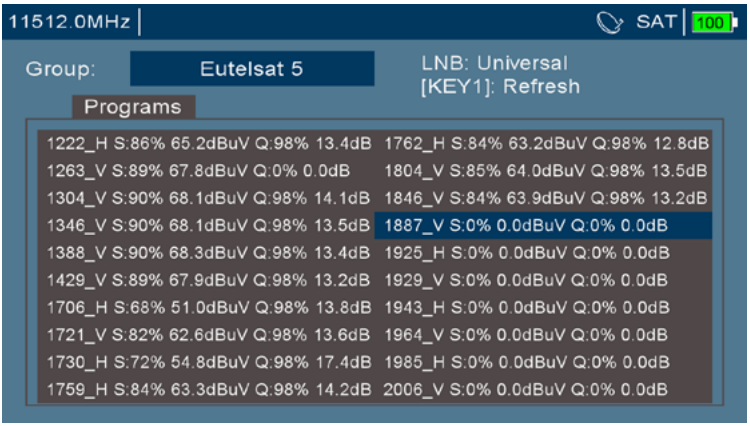
5.5. Tools

In the main menu, by pressing the tools option, it is possible to use the different functionalities offered by the meter.



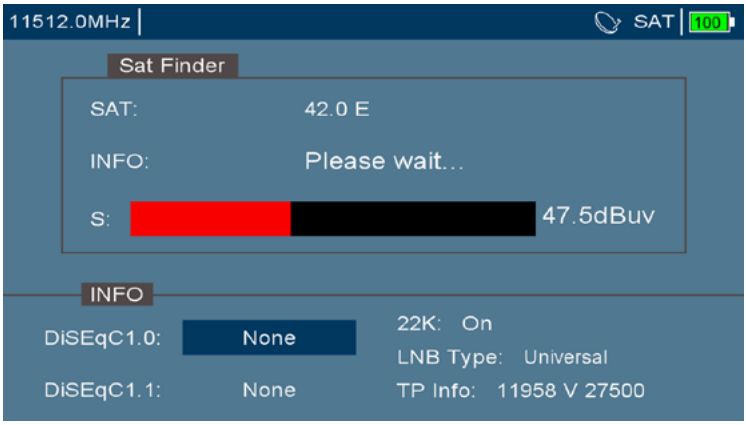
Tools screen

- Packet control. This allows the determination of the quality of the video packets received. It is a cyclical process.



Measurement of the satellite packets received from this group

- Satellite finder. This serves the purpose of identifying the satellite to which we are connected.

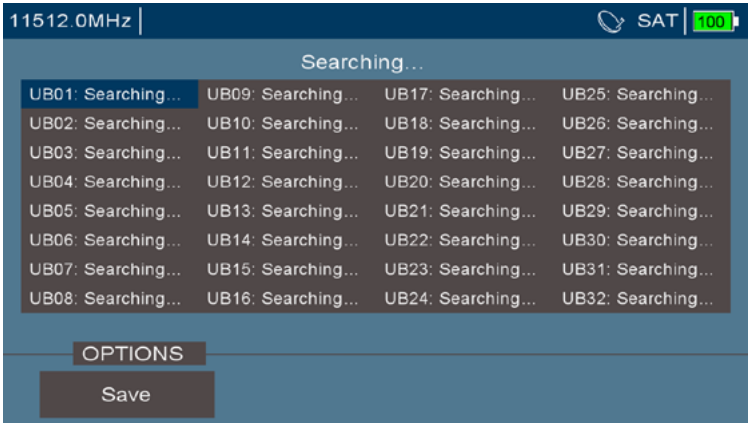


Identification of satellites in progress process

- . TS Recording. Once tuned with a programme, it allows .TS files to be saved in the USB memory connected. To finish the recording, press the ESC key

  A USB memory must be used which supports continuous write speeds exceeding 10 MBps and specified as at least USB 2.0

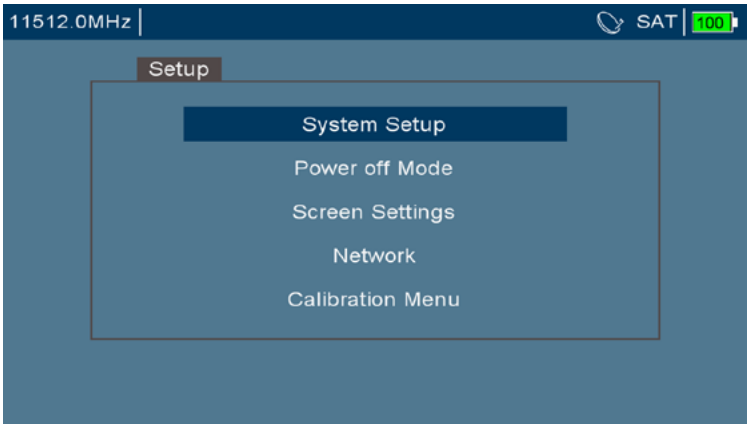
- DCSS UB Search. This allows the detection of the different carriers that DCSS multi-switch connected to the meter is capable of generating. In order for this tool to work, the multiswitch must be compatible with the DiSEqC 2.0



DCSS carrier search

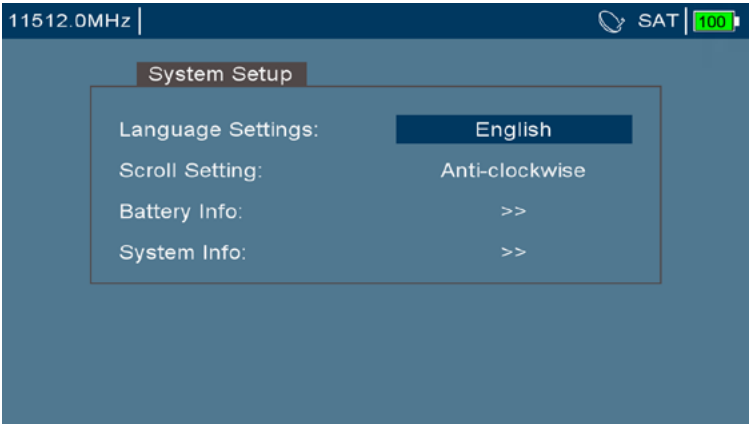
5.6. Configuration

From the main menu, we can access the configuration option. This allows us to make adjustments to the field meter and see its status.

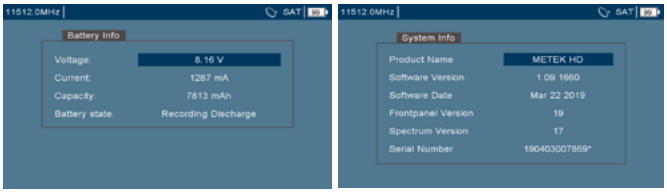


Configuration screen

- System adjustments. This allows the application and determination of basic settings for interaction with the meter such as language, wheel direction, battery status and meter information (serial number, software versions, software date,…)



System adjustments screen

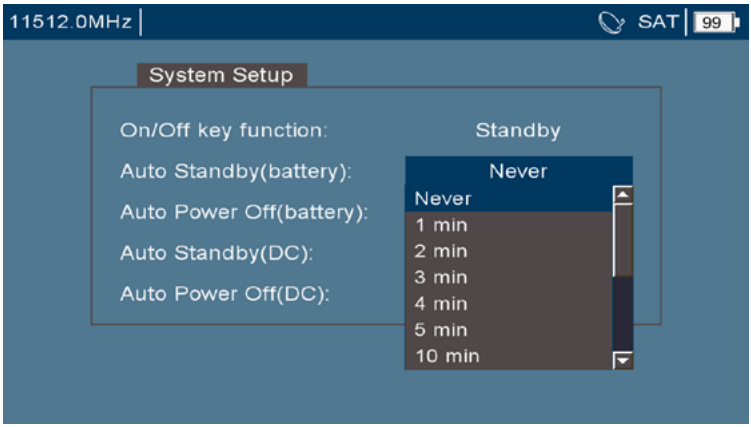


System adjustments screen / Battery and system information

- Off mode. This allows the determination of under what conditions the field meter is turned off and on for battery optimisation.

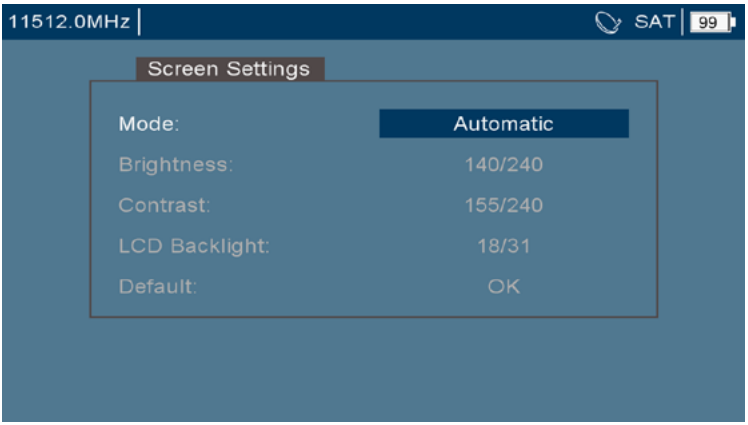
  - **ON/OFF key function:** This allows the configuration of the way in which the equipment is turned off. By default, when the equipment is on, by pressing the button, the equipment becomes idle. It can be configured in such a way that when pressing the button, the equipment is turned off directly

  - The **automatic idle and off** modes allow configuration of whether the meter will switch to idle mode or if it will be turned off automatically after a time of inactivity. The first two adjustments are for the meter in battery mode, whilst the latter two are for the case in which the meter is powered by the external power supply source.



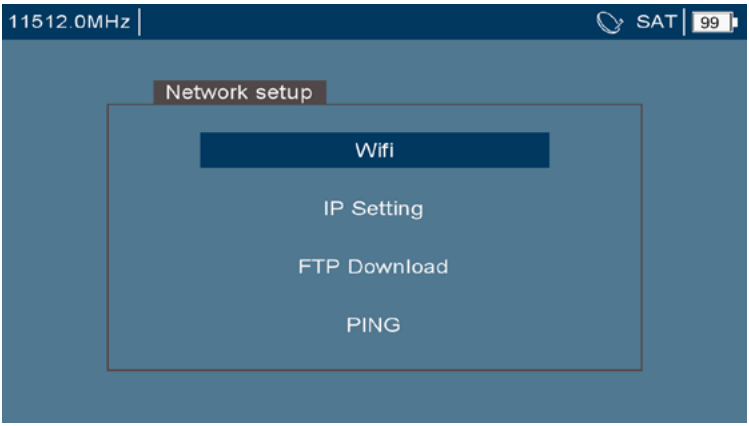
Adjustments screen in off mode

- Screen adjustments. This allows the adjustment of the screen automatically or by default (Brightness, contrast, lighting).



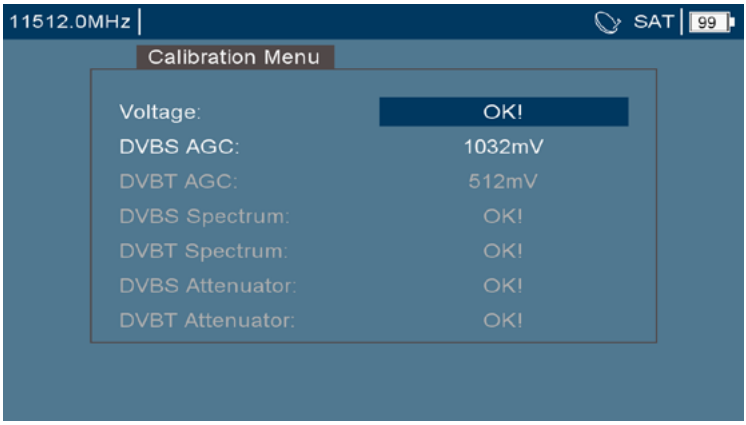
Screen adjustments screen

- Network. This allows basic functions to be carried out in a WiFi environment. Detection of WiFi networks, Configuration of the WiFi interface, downloading of ftp files or carrying out of ping on the network itself.



Screen with network functions

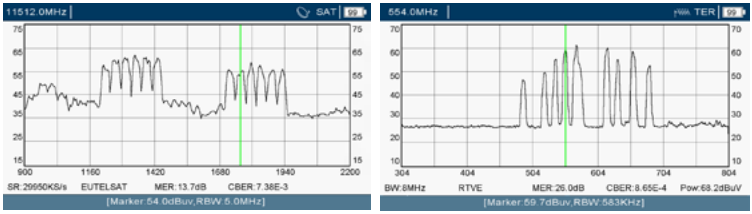
- Calibration menu. This offers advanced options for device calibration.



Calibration screen

6. Spectrum mode

This function allows the viewing of the signal levels in the frequency domain. It is a basic function of the meter's operations for the interpretation of the signals present on the line.



Satellite and terrestrial signals spectrum

When the carrier is connected, the following settings are indicated at the spectrum base (in accordance with the working band): Symbol rate, MER, CBER, Power and Operator.

6.1. Selection of channel or frequency

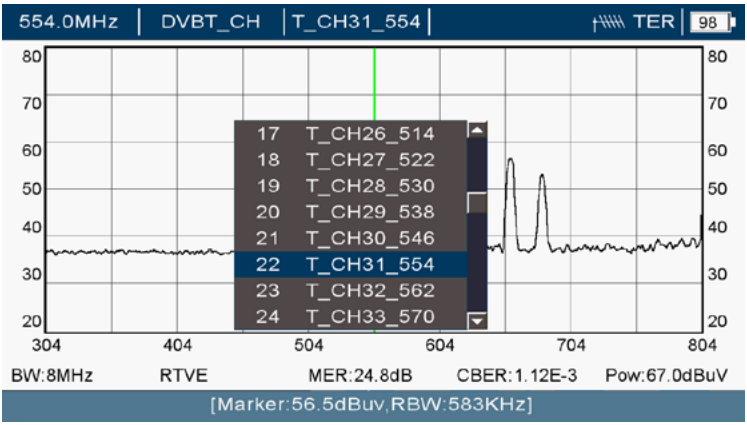
When selecting a frequency, the field meter will try to demodulate it by measuring its levels. Note that according to the associated standard, you will try to select a bandwidth which forms a channel (and not just one single frequency). With satellites we talk about transponders and for terrestrial and cable we refer to mux.

To select a frequency, the channel may rotate both with the wheel or by entering a number with the numerical keyboard.

6.1.1. Mediante botones

If in frequency mode, enter the numerical value of the frequency to be tuned and press OK

If in programme mode, when pressing a numerical button, a window is opened where you can select the following channel to be tuned:



Details of the selection of the channel in programme mode

6.1.2. By means of the wheel

When in frequency mode, if you are near the frequency to be tuned, you can keep going forwards or backwards using the wheel.

When in programme mode, by turning the wheel, you will go forward or back to the next channel recorded in the programme.

By changing frequency, we will move along the spectrum. Note that when browsing by programme, in the central position of the screen, the frequency selected shall be viewed whilst when browsing by frequency, the cursor will move forwards and backwards in the spectrum.

6.2. Adjustment of the range of frequencies (span)

The span is the set of frequencies that can be seen on the screen. A high span will allow the whole spectrum to be viewed rapidly and to get an idea of the total radiofrequency signal being received. A reduced span will allow you to notice details about specific frequencies.

The possible span values depend on the working band and they are:

Satellite	10, 20, 50, 100, 200, 500, 1200 MHz
Terrestrial	10, 20, 50, 100, 200, 500, 950 MHz
Cable	10, 20, 50, 100, 200, 500, 950 MHz

The adjustment of this range is carried out by means of:

- The frequency or channel tuned
- Allows the span to be expanded
- Allows the span to be reduced

6.3. Resolution filter

This filter is a fundamental element in the spectrum. It shows us the distance between two carriers which it is capable of discerning. With high values, we will have a very low resolution and with low values we will have a higher resolution, weighing up the power between few frequencies. Its possible values are:

Satellite	100KHz, 200KHz, 500KHz, 1Mhz, 2Mhz, 5Mhz
Terrestrial	36KHz, 72KHz, 145KHz, 291KHz, 583KHz, 1166KHz
Cable	36KHz, 72KHz, 145KHz, 291KHz, 583KHz, 1166KHz

The adjustment of this filter is automatic to ensure an optimum sweep time in accordance with the span selected. So bear in mind that if high resolution is required, you must have selected a reduced span.

A narrow resolution filter will show the carriers with a lower level than a broad filter.

The level shown on the marker is the level detected with the resolution filter selected. The power measurement shown is the power of the channel and it does not depend on the resolution filter selected.

6.4. Adjustment of the level

The reference level is the maximum signal value we can observe without distorting the measurements. We will see this level on the left of the spectrum shown.

This is adjusted automatically in line with the level of the radiofrequency signals displayed on the screen with the automatic attenuators of the meter. The maximum attenuation is 45dB and is adjusted in 5dB steps.

It is possible to determine the attenuation of the input signal manually. This is useful with poorly equalised signals or with high levels falling outside the working band. The set of input signals displayed on the screen can be attenuated 0, 5, 10, 15, 20, 25, 30, 35, 40, 45 dB.

The adjustment of the attenuator is separate for each band: You can be on theterrestrial band with the manual attenuator and on satellite band with the

automatic attenuator. Each time you change band, the attenuator will be adjusted.

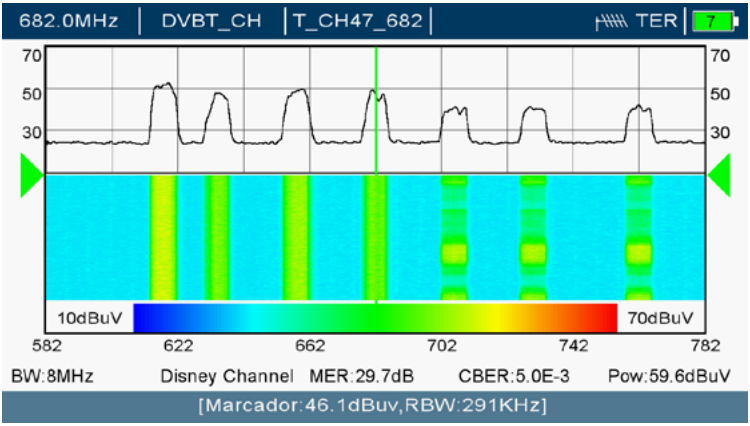
6.5. Spectrogram

This function allows you to view the signal level on a bandwidth (the screen as a whole) over time (around 2 minutes).

This function is interesting for seeing changes in signal level over time. Some of its applications are:

- Detection of undesired signals (intermodulation, interferences)
- Viewing of the signal during the adjustment of active equipment
- Effects on the line after connecting more signals
- Detecting fluctuations in signal level

A typical application is the detection of fadings.



Effect of a fading whereby the three high channels suffer variations in their signal level.

6.6. Max hold function

The max hold function allow the maximum signal level to be captured obtained during the observation period. With this status, a line is overlapped in real time and a second line, accumulating the maximum value obtained for each frequency.

Its use is usually deployed to:

- Measure the maximum level attained by a signal
- Detect sporadic interferences
- See the level difference achieved after adjusting the gain or slope of a line amplifier (of particular interest with satellites).

The image below shows the capture of a 4G interference:

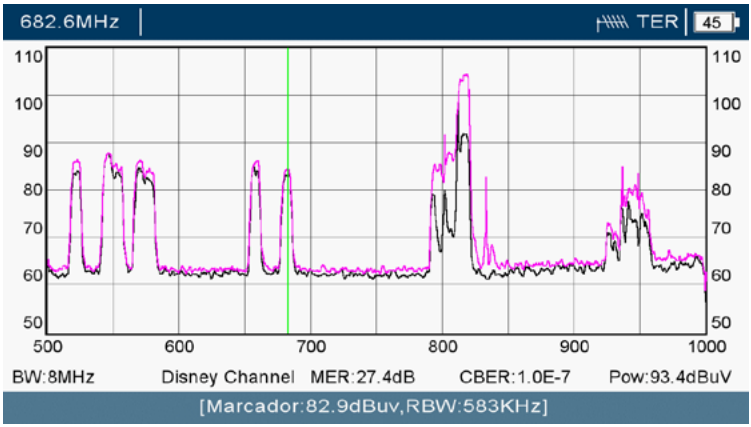


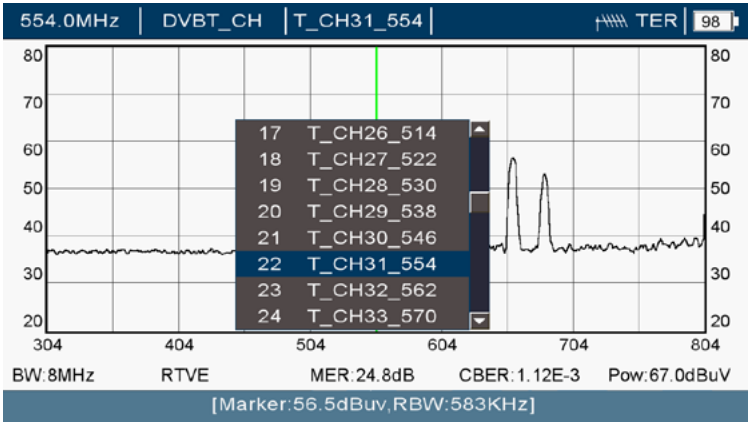
Image with seven TDT muxes and the maximum peaks of 3G/4G mobile telephony.

Put the attenuator in manual mode if you observe that the accumulated signal disappears and start the trace again. This occurs because the dynamic (difference between the maximum and minimum signal measured) is higher. By setting it, you will manage to accumulate the maximum levels.

6.7. Detector

The meter provides three ways of detecting the radiofrequency signal: RMS, average and peak.

The peak measurements are usually deployed to detect spurious signals. The average measurements are usually deployed to average out the noise level of the channel and finally, the RMS measurements are used to measure the power of the channel (this is the most usual case).



Selection of the RF signal detector type

7. Measurements mode

After pressing the button, all the specific measurements of the channel can be viewed that is being tuned (Satellite, terrestrial or cable). If a signal is being tuned with the appropriate levels, this shall be connected and the measurement values are provided.

7.1. Readings

Readings are provided in a summarised manner on a single screen with the option of seeing several interpretations of the signal simultaneously.

The readings are vital to understand and adapt the installation we are carrying out. They allow us to outline any possible problems and we go backwards (to the antenna) or forwards if everything is correct.

Consult Annex III to see the expected levels at the socket recommended for each standard.

The following measurements are offered:

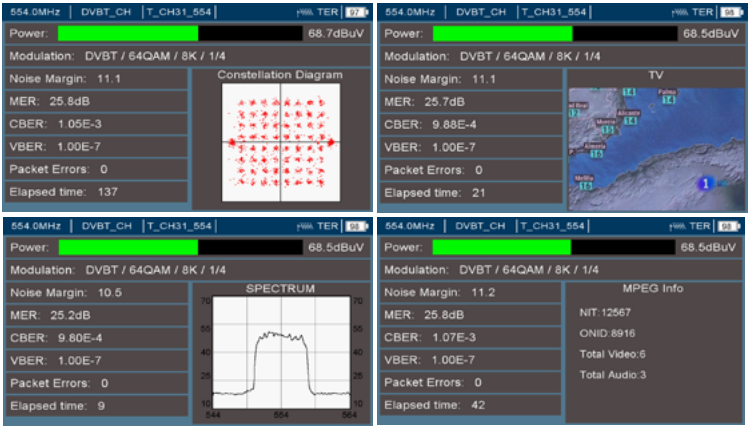
- Power. The bar indicates the power level measured on this frequency (channel) and it remains green if the signal is connected. An appropriate value is desirable in line with the measurement point of the installation.
- Modulation. This indicates the digital modulation and other specific settings (in accordance with the standard) detected.
- Noise margin. This indicates the higher tolerable noise level before losing tuning with the signal. A high value is desirable. When reaching 0dB, the image starts to pixelate.
- MER. This indicates the modulation error rate. A high value is desirable.
- CBER. This indicates the bit error rate of the channel (Before applying any correction). A low value is desirable. By way of example, a value of 4.3E-6 is lower than a value of 2.1E-5 and thus better.
- VBER. This indicates the bit error rate of the resulting signal (after applying a correction). A lower value than the previous one is desirable. By way of example, a value of 4.3E-6 is lower than a value of 2.1E-5 and thus better.
- Erroneous packets. This indicates the data packets that cannot be corrected but which are discarded with an error. In extreme cases, these are caused by burst type errors which pertain to a short time period of the transmission. Note that by carrying out connections physically with the antenna cable, erroneous packets may be caused at the time of connecting and disconnecting. A zero value is desirable.

Time elapsed. This indicates the time since the demodulator tuned a signal. It is shown to relate it to the erroneous packets. It is desirable that during the measurement time which has elapsed, there have not been any erroneous packets.

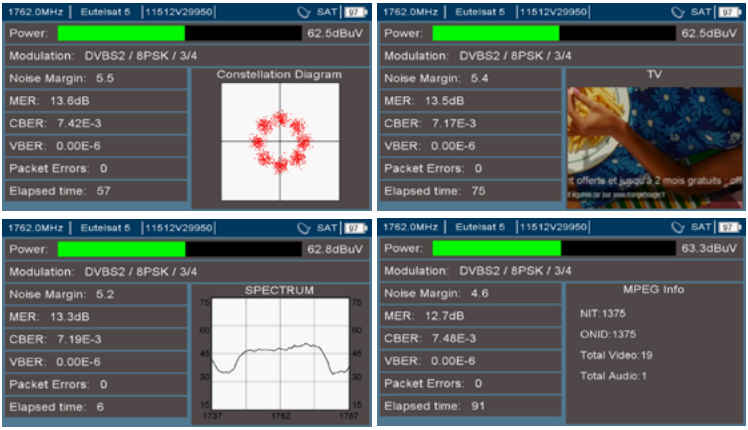
When the measurements are viewed alongside the video image, it is not 26ES possible to change the programme nor adjust the volume. You must

enter TV mode with the key in order to be able to see and hear this information.
Using the – , buttons, you can change the information shown on the right-hand screen, being able to display:

- The constellation of the signal received
- Video of the signal received
- Spectrum of the channel tuned
- Information of the signal received.



Display of miscellaneous information on the right-hand screen of the DVB-T signal



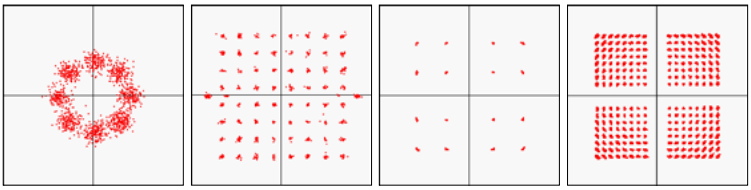
Display of miscellaneous information from a signal DVB-S2 signal

7.2. Spectrum

This allow the visual display of the signal form. It is useful to understand whether it arrives with enough quality or whether it may have absorptions or attenuations which cause incorrect signal quality levels.

7.3. Constellation

The constellation is used to observe the reception of those symbols modulated in radiofrequency. Its appearance is closely linked to the MER measurement.



Constellations of various modulation types: 8PSK, COFDM, 16QAM and 256QAM

7.4. Video

This allows the display of the final signal in the same way as it would be seen on a TV. It serves as an aid to see whether the installation is correct or not, though it is not final as it is possible actuations may be carried out to improve the quality of the radio frequency signal that carries this video signal.

7.5. Programme information

This indicates the NIT and ONID values characteristic of the network from which we are receiving. These are characteristic of the network operator. Note that if there is signal processing equipment at your installation (transmodulator), it is possible that these settings have been modified.

It also indicates the number of services included on this radiofrequency channel (video and radio).

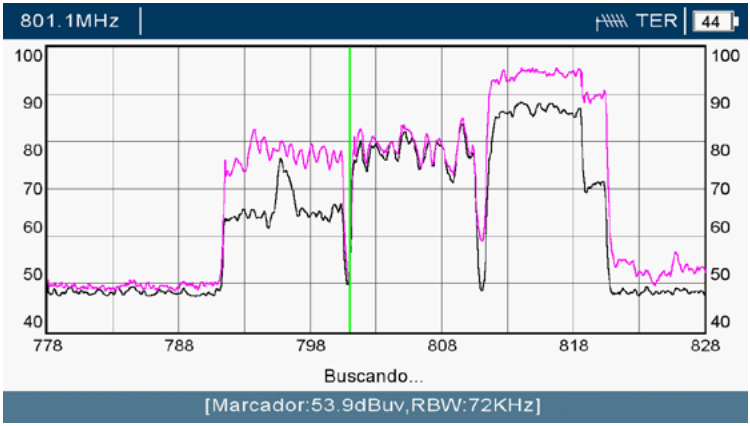
7.6. Lte band measurement

Thanks to the spectrum expanded to 1 GHz, it is possible to carry out measurements of the power received from the telephony signal, whether 4G or 3G (and in the future, 5G). At present, these technologies for the mobile network have these frequencies reserved:

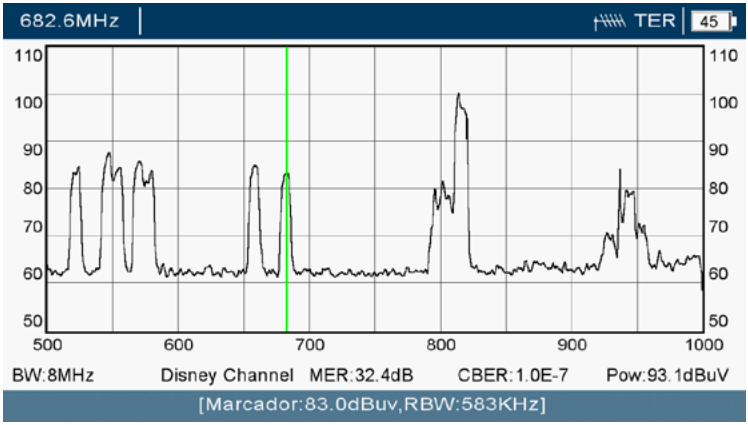
		Uplink	Downlink
	3G (GSM900)	890 - 915 MHz	935 - 960 MHz
Lte1	4G (Band 700)	832 - 862 MHz	791 - 821 MHz
Lte2	5G	694 - 790 MHz	

The uplink channel is the one used by mobile terminals to send the data to the base station. The downlink channel is the return channel. Note that all mobile terminals linked to a base station deploy these channels using TDMA techniques

With the meter we can see the spectrum received (either on the antenna or at the socket) and measure the powers. Bear in mind that these powers, besides being able to generate interferences, may reduce the performance of the amplifiers installed on the distribution network via the coaxial cable of the building.



Measurement at the head of an interfering signal 4G. (The downlink channels are observed)

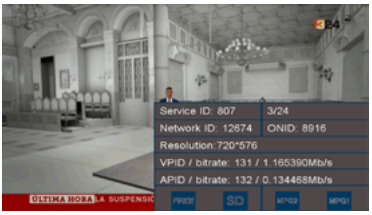


Measurement at the head including 3G and 4G signals
(The downlink channels are observed at DVB-T channels)

The level shown on the marker is the level detected with the resolution filter selected. The power measurement shown is the power of the channel and it does not depend on the resolution filter selected.

8. TV Mode

By pressing the , key, you can see and hear the video signal. Visually, you can observe whether there are any pixellations in the signal measured.



Display of the video with or without information superimposed

By default, information about the signal type is provided. To get rid of this superimposition, press the .key again. Press it again so that it appears again.

To change programme, press and . To adjust the volume and

If the signal is encoded (Encrypted), a superimposed indicator will appear.

METEK is endowed with the latest Codecs for signal decoding (both its video and audio). In the event of not interpreting any of them, consult whether the Codec of the signal is compatible with those of the meter.

This is interesting in the case of measuring the output of a satellite to terrestrial transmodulator. If good MER and BER settings are measured at the transmodulator output, but the signal keeps pixellating, we will think that the problem lies with one of these three points: A) the quality of the satellite signal received and we will have to make readjustments to the orientation of the parabolic antenna. B) The transmodulator output modulation (it will need to be adjusted). C) An excessive number of services (bandwidth) and in this case it will be necessary to reduce the number of services on each RF output channel.

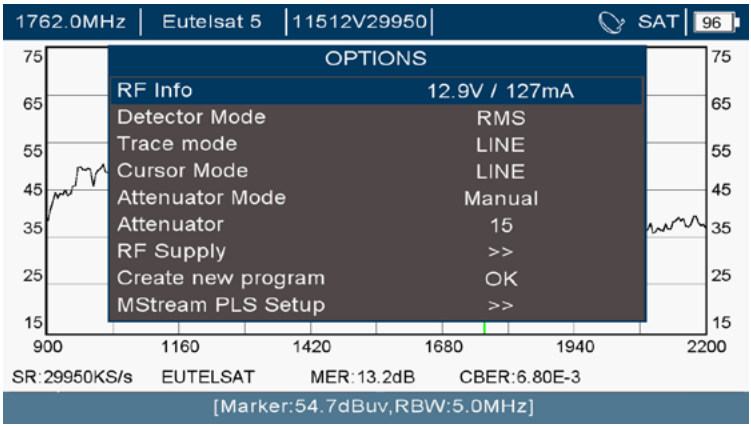
9. Options

When in any working mode (spectrum, measurement, TV), it is possible to enter the options which will allow us to make adjustments to the information displayed in the screen. Press the OPTIONS key to see them:

9.1. Options for the spectrum

After pressing the OPTIONS button, when in spectrum mode, we can observe different related settings, either informative or adjustment.

Depending on the band where the meter is (Satellite, terrestrial or cable), these parameters may vary slightly.

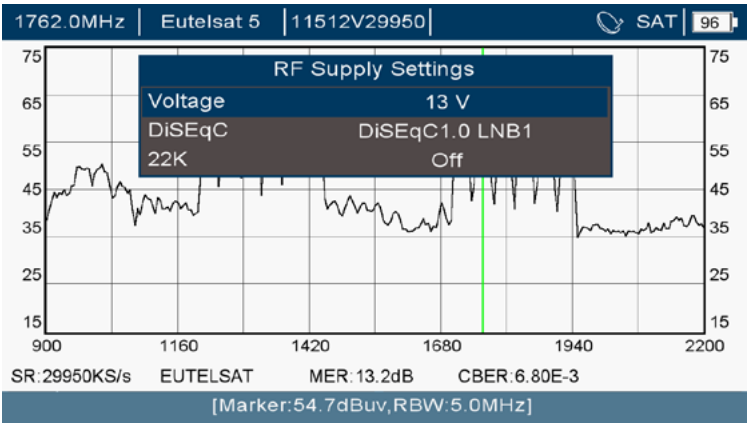


Possible options in spectrum mode when on the satellite band

- RF information. This measures with high precision the voltage available at the meter input and the current which is circulating through it. In line with the DC charge (Ohmic resistance) of the installation: LNB type, DiSEqC switches, coaxial cable length, this consumption will be lower or higher. It is an indicative setting.

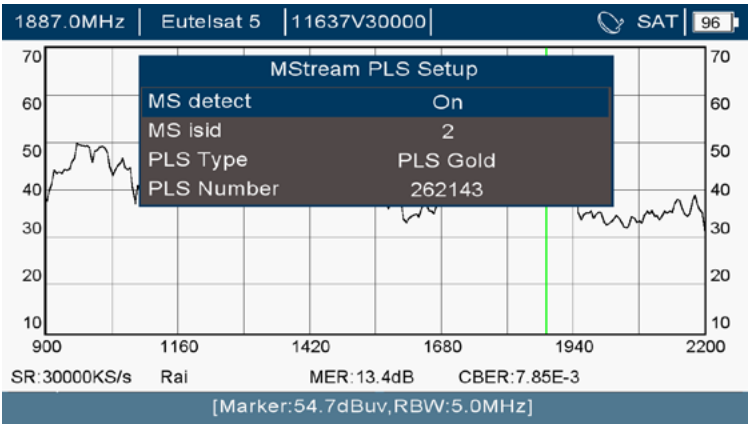
  In the event of a short circuit, the meter shall stop generating voltage. Check your network. If it doesn't need to be powered from the meter, just select 0V as the power supply voltage.

- Detector mode. The way in which the RF signal is captured. Consult chapter 6.7. Detector for further information.
- Line mode. This indicates how the RF signal is represented. Line, max peak or spectrogram. It will usually be online and the signal level is represented thereby. Consult chapter 6.5. Spectrogram for further information.
- Cursor mode. This indicates how the vertical markers are represented.
- Attenuator mode. This allows selection between the manual attenuator and the automatic attenuator. Observe whether it is in programme mode, automatic browsing as a specific value may be stored for each channel.
- RF attenuator. This allows the desired attenuation level to be set when using the manual attenuator.
- RF power supply. This allows am output power supply to be forced to mast amplifiers, line amplifiers and LNBs and switching between them using the DiSEqC protocol. Consult the power supply values in the technical features' table. It also allows the selection of the work band, forcing or turning off the tone at 22KHz.



Selection of antenna power supply

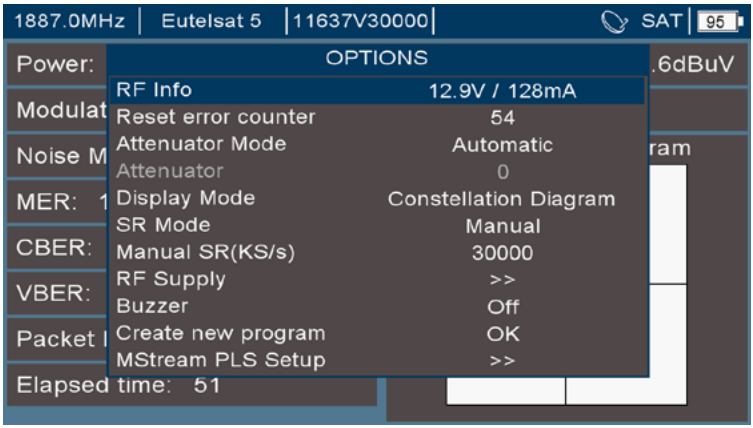
- This allows the current programme to be added to a group of programmes.
- Mstream PLS adjustments. This allows the determination of the autodetection of multistream services with a DVB-S2 transmission. Bear in mind that the demodulation of the latter is slightly slower than a conventional DVB-S2 transmission.



Adjustments to the multistream settings

9.2. Options for the measurements

After pressing the OPTIONS button, when in TV mode, we can observe different related settings, either informative or adjustment:



Possible options in measurements mode when on the satellite band

- RF information. This measures with high precision the voltage available at the meter input and the current which is circulating through it. In line with the DC charge (Ohmic resistance) of the installation: LNB type, DiSEqC switches, coaxial cable length, this consumption will be lower or higher. It is an indicative setting.

  In the event of a short circuit, the meter shall stop generating voltage. Check your network. If it doesn't need to be powered from the meter, just select 0V as the power supply voltage.

- Reset error meter. This allows the resetting to zero of the number of erroneous packets and the measurement time
- Attenuator mode. This allows selection between the manual attenuator and the automatic attenuator. Observe whether it is in programme mode, automatic browsing as a specific value may be stored for each channel.
- Representation mode. This allows selection of the screen to be displayed in the lower right-hand quadrant. To choose between: TV, spectrum, measurements, programme information
- SR mode. This allows selection between autodetection of the symbol rate or being able to set it manually
- Manual SR (KS/s). This allows the manual entering of the symbol rate (if it has been enabled in this way in "SR Mode").
- RF power supply. This allows am output power supply to be forced to mast amplifiers, line amplifiers and LNBs and switching between them using the DiSEqC protocol. Consult the power supply values in the technical features' table. It also allows the selection of the work band, forcing or turning off the tone at 22KHz.
- Buzzer. This allows the activation of the speaker so that the user receives the results of the interaction with him.

- Create programme. This allows the tuned programme to be added to a group
- Mstream PLS adjustments. This allows the determination of the autodetection of multistream services with a DVB-S2 transmission. Bear in mind that the demodulation of the latter is slightly slower than a conventional DVB-S2 transmission.

9.3. Options for TV mode

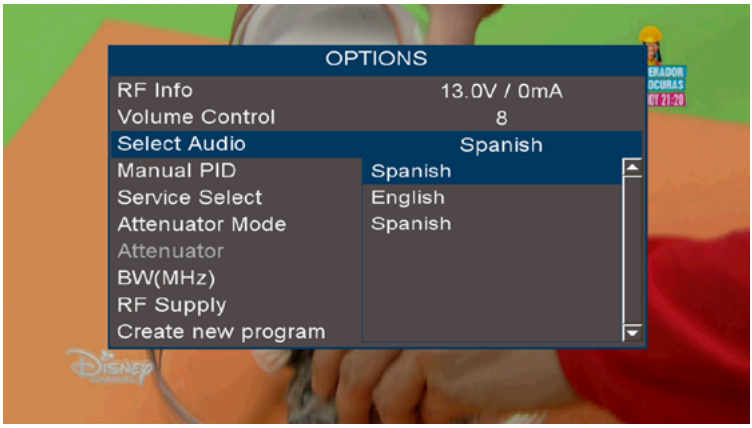
After pressing the OPTIONS button, when in TV mode, we can observe different related settings, either informative or adjustment:

Possible options in TV mode when on the satellite band

- RF information. This indicates the voltage available at the meter inlet and the current which is circulating through it. Depending on the DC charge of the installation (LNB type, DiSEqC switches, length of the coaxial cable), this consumption will be lower or higher. It is an indicative setting.

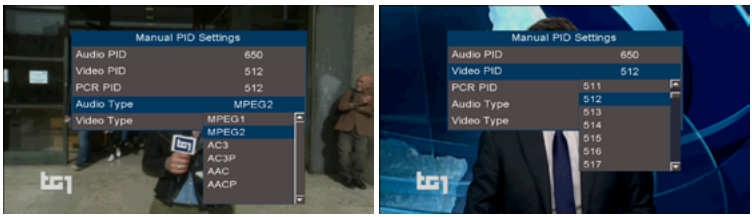
  In the event of a short circuit, the meter shall stop generating voltage. Check your network. If it doesn't need to be powered from the meter, just select 0V as the power supply voltage.

- Volume control. Adjust the speaker volume level. You can also Use the keys ◄ and ►.
- Select audio. If the service contains more than one audio, it allows switching between those available:



Selection of the audios of a programme

- Manual PID. If the service does not provide sufficient information for the receiver to be able to find the PID, they may be put on this screen. It also allows the Codec to be affixed with which the video and audio digital information are encoded:



Selection of the video and audio PID of a programme and its Codecs

- Select service. This allows the service to be changed (including audio and video) of all those that are on this radiofrequency channel.
- Attenuator mode. This allows selection between the manual attenuator and the automatic attenuator. Observe whether it is in programme mode, automatic browsing as a specific value may be stored for each channel.
- RF attenuator. This allows the desired attenuation level to be set when using the manual attenuator.
- Symbol rate. This allows the symbol reception speed to be set. As a general rule, the demodulator may determine this. Should this not be the case, it can be entered manually.
- RF power supply. This allows an output power supply to be forced to mast amplifiers, line amplifiers and LNBs and switching between them using the DiSEqC protocol. Consult the power supply values in the

Selection of antenna power supply

- Create programme. This allows the current programme to be added to a group of programmes.
- Mstream PLS adjustments. This allows the determination of the autodetection of multistream services with a DVB-S2 transmission. Bear in mind that the demodulation of the latter is slightly slower than a conventional DVB-S2 transmission.

10. Updating of equipment firmware

We recommend that you keep the meter up-to-date. Updates include improvements to the software to facilitate handling for the telecommunications' installer. They also include any changes there may have been in the satellites. Hence, the identification of satellites will always be more reliable.

To update your meter:

- Download the latest version available at the website www.ek.plus. The update is contained in a .BIN file.
- Save this file on a USB memory
- Insert the USB memory at the meter and locate the file using Save and load / USB
- Locate the file in the directory and confirm it
- Once the updating process has finished, it shall be rebooted.

Annex IV documents the versions and improvements of each software published

11. TECHINCAL INFORMATION

TECHINCAL INFORMATION	
Monitor Display	7-inch TFT
Dots Pixels	1024*600
The lithium battery	7.4 V 7800 mAh 57.7 Wh
RF Input	F Male connector,75 Ω
Video/Audio output	HDMI Output
External Units Power supply	
Satellite band	0 V, 5 ~ 24 V (Steps1 V)
22KHZ singal	Selectable in Satellite Band
Diseqc generator	Diseqc 1.0/1.1/2.0
Terrestrial Band	0 V, 5 ~ 24 V (Steps1 V)
Battery Operation Time	6 hours
Power off current	<2 mA
VEDIO DECODING	
DECODING	MPEG1, MPEG-2 MP@ML, H.264, VC1, DV, MPEG-4, H.265 (1080p@60fps)
AUDIO DECODING	
DECODING	MPEG-2 layer I and II (Musiccam), MPEG4 AAC
OUTPUT MODE	Mono, Dual Channel, Stereo, Joint Stereo
METER NAVIGATION MODE	
Satellite	
Frequency Range	950~2150MHz
Support Measurement parameter	Channel power, Noise margin, MER, CBER, VBER, TS Errors, Constellation
Symbol rate	1 ~ 55 MS/s
Power resolution	0.1 dB
Power Accuracy	±1.8 dB
MER range	>25 dB
Power range	20~120 dBμV
Demodulation	DVB-S/S2 QPSK, 8PSK, 16APSK, 32APSK, ACM / VCM

Terrestrial	
Frequency Range	51 ~ 1000 MHz
Support Measurement parameter	Channel power, Noise margin, MER, CBER, VBER, TS Errors, Constellation
Symbol rate	6 MHz, 7 MHz, 8 MHz
Power resolution	0.1dB
Power Accuracy	±1.8 dB
MER range	>35 dB
Power range	30~120 dBμV
demodulation	DVB-T/T2 COFDM
Cable	
Frequency Range	51 MHz ~ 1000 MHz
Support Measurement parameter	Power, CBER, VBER, MER, Constellation
Symbol rate	6 MS/s

Power resolution	0.1 dB
Power Accuracy	±1.8 dB
MER range	>35 dB
Power range	30~120 dBμV
demodulation	DVB-C QAM,J83 Annex C QAM
SPECTRUM NAVIGATION MODE(DSP)	
Frequency Range	Terrestrial&Cable:50 ~ 1000 MHz
	Satellite: 900 ~ 2200 MHz
Reference Level	Terrestrial&Cable: 60 ~ 110 dBμV in 5 dB steps
	Satellite: 60 ~ 110 dBμV in 5dB steps
Accuracy	±1.8 dB
Span	Terrestrial&Cable: 10, 20, 50, 100, 200, 500, 950 MHz
	Satellite: 10, 20, 50, 100, 200, 500, 1200 MHz

RBW	Terrestrial&Cable: 36, 72, 145, 291, 583, 1166 KHz	
	Satellite: 100 KHz, 200 KHz, 500 KHz, 1 MHz, 2 MHz, 5 MHz	
FFT/Sample Size	1024 Points	
INTERFACE		
Left side interface	HDMI 1.4A	
	USB 2.0 (MAX 1 A)	
	RS232	
	DC IN	
Top interface	TUNER	3 tuners in 1(DVB-S2,DVB-T2,DVB-C)
Buttons on panel	4 LED lights	On /Off, Charge, Lock, RF Power
	24 Buttons	(TV, Spectrum, Meter, Options, Menu, Band, Up, Down, Left, Right, Enter, Esc, 0-9 Power)
Housing (cabinet)	Dimensions	269 mm (L) x 187 mm (W) x 62.5 mm (H)
Accessories	Adapter	15 V-2,5 A
	Car charger	Yes
	Carrying bag	Included (space for tools and pocket)
	F female to female connector	Yes

Annex I. Definitions

8PSK	"8-Phase Shift Keying". Digital modulation where each of the 8 symbols carries three bits of information. As it is a phase modulation (robust), it is used for channels such as satellite and it is used for downlink on DVB-S2.
C Band	Radio spectrum range intended for downstream transmissions falling between 3.7 and 4.2 GHz. The local oscillator frequencies for this band are: 5,150MHz and 5,750 MHz.
DAB Band	Range of the terrestrial radio spectrum intended for commercial digital radio broadcasts. The frequencies assigned in Spain are 195 to 216 MHz (8A at 10D) and from 216 to 223 MHz (11A at 11D)
FM Band	Range of the terrestrial radio spectrum intended for commercial analogue radio broadcasts. It includes the frequencies from 87.5 to 108 MHz.
Ku Band	Radio spectrum range intended for downstream transmissions. In Europe, it includes frequencies from 10.7 to 11.7 GHz (Low band) and 11.7 to 12,75 GHz (High band). The local oscillator frequencies for this band are: 9,750MHz and 10,750 MHz.
UHF Band	Radio spectrum range falling between 300 and 3000 MHz (3 GHz) used for terrestrial transmissions. In radiated systems it is typically deployed for terrestrial broadcasting of the TV signal and mobile telephony.
VHF Band	Radio spectrum range falling between 30 and 3000 MHz (300MHz) used for terrestrial transmissions. Its transmissions include: Aeronautic, maritime, analogue and digital commercial radio communications. In irradiated environments conducted by coaxial cable we find Docsis or Ekoax.
ISM Bands	Radio spectrum ranges defined internationally by the ITU intended for industrial, scientific and medical applications. Its applications include: 13.56 MHz (aeronautic), 27.12 MHz (radioamateurs), 433.92 MHz (radioamateurs and short-range devices), 2.45 GHz and 5.8 GHz (Wireless networks) or 245 GHz (Radiolocation and astronomy)
CBER	Erroneous bit rate before applying corrections. It is defined as the number of erroneous bits out of the total bits received in the measurement interval. What matters is that it has a low value so that the errors are minimal. By way of example, 4.3E-6 (4.3·10-6) is better than 2.7E-5 (2.7·10-5).
CCIR	"Comité consultatif international pour la radio". International Radio Consultative Committee. Now called ITU-R (International Telecommunication Union - Radio). It is an international body which reports to the United Nations' Organisation (UNO) whose purpose is to regulate the radio spectrum, orbital resources and to develop telecommunications' standards to make an effective use of the spectrum.
COFDM	"Coded Orthogonal Frequency Division Multiplexation". . Method for making the most of a frequency channel where the information is divided up between various carriers which do not interfere with each other.
Constellation	Graphic representation of the symbols which are received when demodulating a digital modulation. Each symbol is a set of bits. Depending on the density of the modulation, the symbols are more grouped (transporting more bits by unit of time) or more separated (increasing the robustness of the signal vis-vis noise and interferences).
dBm	Power level referred to 1mW expressed in dB. Its use is common when talking about radiofrequency receivers and transmitters and as it is expressed in dB, logarithmically, with just a few digits it is possible to represent a broad range of linear values.
dbµV	Voltage level referred to 1uV expressed in dB. It is very common for measurements in telecommunications' installations on reception networks. As it is expressed in dB, logarithmically, with just a few digits it is possible to represent a broad range of linear values.
DCSS	"Digital Channel Stacking System". Solution for the distribution of several satellite transponders to several receivers, using the same coaxial cable, irrespective of the band and polarity of the transponder.
Network address	Identifier of an item of network equipment in a TCP/IP environment which makes it unique on this network.

DiSEqC	"Digital Satellite Equipment Control". Communication protocol between satellite receivers and satellite signal distribution equipment (LNB, Diseqc switches, multiswitches) designed for controlling switches and positioning motors. It is based on a pulsed signal for frequency 22 KHz and 0.65Vpp. There are different versions: 1.0 (For 4 sources), 1.1 (For 16 sources), 1.2 (For 16 sources and a rotation shaft). The standards 2.X add bidirectionality to the above.
DVB	"Digital Video Broadcasting". European standard for digital video broadcasting (Digital Audio Broadcasting). This represents a set of standards jointly published by the ETSI, CENELC and EBU.
Espectro	Physical concept which defines the energy distribution of electromagnetic waves. The spectrum extends from the frequencies with a shorter wavelength (gamma rays) to frequencies with a longer wavelength such as radio waves, as well as visible light and terrestrial TV broadcasts.
FDMA	"Frequency Division Multiple Access". . Technique for making more efficient use of the channel where different frequencies are used to send information.
FEC	"Forward Error Correction". . Additional information which is added to a digital signal to make it robust vis-à-vis possible transmission errors of the channel. A 2/3 FEC means that 1 in every 3 bits is redundant. This increases the demodulation capacity of the receiver but it reduces the working capacity of the channel.
FTP	"File Transfer Protocol". A communication protocol for file transfer between systems connected to an TCP/IP network, based on a customer-server architecture.
H.264	Regulation which defines a high-compression video Codec, also known as MPEG-4 Part 10 / AVC developed by the ITU-T and ISO/IEC. Accepts resolutions of up to 4096x2304.
H.265	The standard succeeding H.264, also called MPEG-H Part 2 and commonly known as HEVC ("High efficiency video coding"). Developed by the ITU-T and ISO/IEC. It is compatible with ultra high-definition video (UHD), accepting resolutions of up to 8192x4320.
IEEE	"Institute of Electrical and Electronics Engineers". Professional association mainly dedicated to standardisation in the technological fields of telecommunications, electronics, computing, electricity and similar.
IF	"Intermediate frequency". The intermediate frequency generated in a demodulator. In the case of satellite communications, this is the result of having reduced a high frequency signal (Ku band transponder) to a frequency falling between 950 and 2150 MHz.
ITU-R	"International Telecommunication Union - Radio". It is an international body which reports to the United Nations' Organisation (UNO) whose purpose is to regulate the radio spectrum, orbital resources and to develop telecommunications' standards to make an effective use of the spectrum.
LCN	"Logical Channel Number". Identifier used to map a programme at a DVB receiver position.
Lte	"Long Term Evolution". Standard for high-speed mobile communications which allows peaks of 300 and 75 Mbps for downloads and uploads, respectively. Its impact on broadcasting has meant the liberalisation of the frequency bands used for broadcasting to support these transmissions.
Noise margin	In digital communications, it indicates the admissible noise level before not being able to demodulate the signal.
Network mask	Pattern or number of bits which serves, with regard to an IP address, to identify the network and the hosts connected to this network.
MER	"Modulation Error Rate". . Measurement used to quantify the quality of a digital transmission over the transmission channel. It affords a linear relationship between the signal power and the error power and it is expressed in dB. Effects such as noise, low image frequency rejection, phase noise, carrier suppression or distortion contribute to the degradation of the demodulated signal. Closely linked to the graphic representation of the constellation.
Modulation	In telecommunications, it is the process of varying any parameter of a carrier signal (frequency, amplitude or phase) in function of a modulating signal. The result is a robust modulated signal to be sent to the channel with the modulator information.

MPEG	"Motion Picture Experts Group". Group of experts formed by the ISO / IEC to create a set of standards for video and audio compression.
Multistream	With satellite communications, a resource which offers DVB-S2 that allows an independent number of transport streams or IP streams to be added transparently.
Mux (Múltiple)	In the context of distribution via DVB-T/T2, it refers to a frequency channel in the spectrum. Its origin lies in the temporary combination of different sources of audio and video to shape a sole data stream (PES) on baseband prior to being modulated.
Network ID	In DVB, carrying network identifier.
NIT	"Network Information Table". Table defined in the DVB standard where there is the information required for tuning the channels of a service provider
ONID	"Original Network ID". Identifier of the network operator that sends the transmissions. All the operators of a country should use the same ONID.
Erroneous packets	In the context of DVB, they are transport stream packets (TS) which have been discarded, as they could not be corrected after a transmission with errors.
PID	"Packed Identifier". 13 bits field of a transport stream (TS) which describes the information carried by the packet.
PING	Tool deployed on TCP/IP networks for the diagnosis of its status, quality and speed. When carrying out a ping, packets are launched between two hosts of a network.
Polarity	Angle formed by the electromagnetic field with the ground when being transmitted from a terrestrial or satellite transmission antenna.
QPSK	"Quadrature Phase Shift Keying". . Digital modulation which carries two bits per symbol commonly used on satellite links.
Resolution	Number of pixels in both dimensions that a screen may show or contains a video source. A resolution 1920x1080 indicates 1920 pixels per line and a total of 1080 lines.
SID	"Service Identifier". Field which identifies a service within a transport stream (TS).
SPAN	In the context of a spectrum analyser, frequency bandwidth which is displayed on the screen.
SSID	"Service Set Identifier". In the local area networks defined by IEEE 802.11, defining a set of network devices which operate with the same wireless network parameters.
Symbol Rate	In communications, the baud rate is referred to. It measures the speed at which groups of bits are transmitted.
TDMA	"Time Division Multiple Access". Technique for accessing the channel through time division. The information at the final baseband is the combination of other information combined over time..
Tone 22 KHz	Signal used for the distribution of a satellite signal which allows the selection by the receiver of the low or high band of a transponder of the Ku band.
Transponder	In telecommunications, it is a device that receives a radio signal, processes it and sends it again. Typically on networks, it is used to define a DVB-S/S2 download channel.
Transport Stream	In the context of audio and video, reference is made to an information container which encapsulates different elemental packets with error correction and synchronisation
USB	"Universal Serial Bus". A standard communication bus for communicating electronic devices and powering them electrically. The 3.0 standard allows a transfer speed of 4.8Gbps.
VBER	"Viterbi BER". Erroneous bit rates having applied corrections (Viterbi). It is defined as the number of erroneous bits out of the total bits received in the measurement interval. What matters is that it has a low value so that the errors are minimal. By way of example, 4.3E-6 (4.3·10-6) is better than 2.7E-5 (2.7·10-5).
Viterbi	Algorithm for decoding convolutional codes to determine and correct any possible transmission errors. Used in DVB-S/S2/T/T2/C transmissions. Related with FEC.

WiFi	"Wireless Fidelity". Technology which allows wireless communication between several devices that includes a set of standards from the 802 family of IEEE. For example, 802.11n (with a maximum link rate of 72-600 Mbps) or 802.11ax (with a maximum link rate of between 600 and 9608 Mbps).
x-QAM	"Quadrature Amplitude Modulation". . Digital modulation which carries n symbols (bit groups). It is usually deployed in high density 32, 64, 128, 256 on robust transmission channels

Annex II. Table of channels, frequencies and habitual measurements

	Band	CHANNEL	START	END	CENTRAL FREQUENCY
VHF (7 MHz)	B-I	2	47 MHz	54 MHz	50,50 MHz
		3	54 MHz	61 MHz	57,50 MHz
		4	61 MHz	68 MHz	64,50 MHz
	B-II (FM)	-	87,5 MHz	108 MHz	-
	Low	S2	111 MHz	118 MHz	114,50 MHz
		S3	118 MHz	125 MHz	121,50 MHz
		S4	125 MHz	132 MHz	128,50 MHz
		S5	132 MHz	139 MHz	135,50 MHz
		S6	139 MHz	146 MHz	142,50 MHz
		S7	146 MHz	153 MHz	149,50 MHz
		S8	153 MHz	160 MHz	156,50 MHz
		S9	160 MHz	167 MHz	163,50 MHz
		S10	167 MHz	174 MHz	170,50 MHz
	B-III (DAB)	5	174 MHz	181 MHz	177,50 MHz
		6	181 MHz	188 MHz	184,50 MHz
		7	188 MHz	195 MHz	191,50 MHz
		8	195 MHz	202 MHz	198,50 MHz
		9	202 MHz	209 MHz	205,50 MHz
		10	209 MHz	216 MHz	212,50 MHz
		11	216 MHz	223 MHz	219,50 MHz
		12	223 MHz	230 MHz	226,50 MHz
	High	S11	230 MHz	237 MHz	233,50 MHz
		S12	237 MHz	244 MHz	240,50 MHz
		S13	244 MHz	251 MHz	247,50 MHz
		S14	251 MHz	258 MHz	254,50 MHz
		S15	258 MHz	265 MHz	261,50 MHz
		S16	265 MHz	272 MHz	268,50 MHz
		S17	272 MHz	279 MHz	275,50 MHz
		S18	279 MHz	286 MHz	282,50 MHz
		S19	286 MHz	293 MHz	289,50 MHz
		S20	293 MHz	300 MHz	296,50 MHz
UHF (8 MHz)	Hyperband	S21	302 MHz	310 MHz	306 MHz
		S22	310 MHz	318 MHz	314 MHz
		S23	318 MHz	326 MHz	322 MHz
		S24	326 MHz	334 MHz	330 MHz
		S25	334 MHz	342 MHz	338 MHz
		S26	342 MHz	350 MHz	346 MHz
		S27	350 MHz	358 MHz	354 MHz
		S28	358 MHz	366 MHz	362 MHz
		S29	366 MHz	374 MHz	370 MHz
		S30	374 MHz	382 MHz	378 MHz
		S31	382 MHz	390 MHz	386 MHz
		S32	390 MHz	398 MHz	394 MHz
		S33	398 MHz	406 MHz	402 MHz
		S34	406 MHz	414 MHz	410 MHz
		S35	414 MHz	422 MHz	418 MHz
		S36	422 MHz	430 MHz	426 MHz
		S37	430 MHz	438 MHz	434 MHz
		S38	438 MHz	446 MHz	442 MHz

	Band	CHANNEL	START	END	CENTRAL FREQUENCY
UHF (8 MHz)	B-IV	21	470 MHz	478 MHz	474 MHz
		22	478 MHz	486 MHz	482 MHz
		23	486 MHz	494 MHz	490 MHz
		24	494 MHz	502 MHz	498 MHz
		25	502 MHz	510 MHz	506 MHz
		26	510 MHz	518 MHz	514 MHz
		27	518 MHz	526 MHz	522 MHz
		28	526 MHz	534 MHz	530 MHz
		29	534 MHz	542 MHz	538 MHz
		30	542 MHz	550 MHz	546 MHz
		31	550 MHz	558 MHz	554 MHz
		32	558 MHz	566 MHz	562 MHz
		33	566 MHz	574 MHz	570 MHz
		34	574 MHz	582 MHz	578 MHz
		35	582 MHz	590 MHz	586 MHz
		36	590 MHz	598 MHz	594 MHz
		37	598 MHz	606 MHz	602 MHz
	B-V	38	606 MHz	614 MHz	610 MHz
		39	614 MHz	622 MHz	618 MHz
		40	622 MHz	630 MHz	626 MHz
		41	630 MHz	638 MHz	634 MHz
		42	638 MHz	646 MHz	642 MHz
		43	646 MHz	654 MHz	650 MHz
		44	654 MHz	662 MHz	658 MHz
		45	662 MHz	670 MHz	666 MHz
		46	670 MHz	678 MHz	674 MHz
		47	678 MHz	686 MHz	682 MHz
		48	686 MHz	694 MHz	690 MHz
		49 (Lte2)	694 MHz	702 MHz	698 MHz
		50 (Lte2)	702 MHz	710 MHz	706 MHz
		51 (Lte2)	710 MHz	718 MHz	714 MHz
		52 (Lte2)	718 MHz	726 MHz	722 MHz
		53 (Lte2)	726 MHz	734 MHz	730 MHz
		54 (Lte2)	734 MHz	742 MHz	738 MHz
		55 (Lte2)	742 MHz	750 MHz	746 MHz
		56 (Lte2)	750 MHz	758 MHz	754 MHz
		57 (Lte2)	758 MHz	766 MHz	762 MHz
		58 (Lte2)	766 MHz	774 MHz	770 MHz
		59 (Lte2)	774 MHz	782 MHz	778 MHz
		60 (Lte2)	782 MHz	790 MHz	786 MHz
		61 (Lte1)	790 MHz	798 MHz	794 MHz
		62 (Lte1)	798 MHz	806 MHz	802 MHz
		63 (Lte1)	806 MHz	814 MHz	810 MHz
		64 (Lte1)	814 MHz	822 MHz	818 MHz
		65 (Lte1)	822 MHz	830 MHz	826 MHz
		66 (Lte1)	830 MHz	838 MHz	834 MHz
		67 (Lte1)	838 MHz	846 MHz	842 MHz
		68 (Lte1)	846 MHz	854 MHz	850 MHz
		69 (Lte1)	854 MHz	862 MHz	858 MHz

V1	V2	r=V2/V1	20 · log (V2/V1)
1 V	0,5 V	0,5	-6 dB
1 V	1 V	1	0 dB
1 V	2 V	2	6 dB
1 V	4 V	4	12 dB
1 V	6 V	6	16 dB
1 V	8 V	8	18 dB
1 V	10 V	10	20 dB
1 V	15 V	15	24 dB
1 V	20 V	20	26 dB
1 V	50 V	50	34 dB
1 V	100 V	100	40 dB
1 V	200 V	200	46 dB
1 V	500 V	500	54 dB
1 V	1.000 V	1.000	60 dB
1 V	2.000 V	2.000	66 dB
1 V	10.000 V	10.000	80 dB
1 V	20.000 V	20.000	86 dB
1 V	100.000 V	100.000	100 dB

VOLTAGE				POWER (over 75 Ω)	
V	mV	µV	dBµV	mW	dBm
4 V	4.000 mV	4.000.000 µV	132,0 dBµV	213,3 mW	23,3 dBm
2 V	2.000 mV	2.000.000 µV	126,0 dBµV	53,3 mW	17,3 dBm
1,5 V	1.500 mV	1.500.000 µV	123,5 dBµV	30 mW	14,8 dBm
1 V	1.000 mV	1.000.000 µV	120,0 dBµV	13,3 mW	11,2 dBm
0,5 V	500 mV	500.000 µV	114,0 dBµV	3,3 mW	5,2 dBm
0,10 V	100 mV	100.000 µV	100,0 dBµV	0,13 mW	-8,8 dBm
0,05 V	50 mV	50.000 µV	94,0 dBµV	33,33 uW	-14,8 dBm
0,01 V	10 mV	10.000 µV	80,0 dBµV	1,33 uW	-28,8 dBm
0,005 V	5 mV	5.000 µV	74,0 dBµV	0,33 uW	-34,8 dBm
0,001 V	1 mV	1.000 µV	60,0 dBµV	13,33 nW	-48,8 dBm
0,0005 V	1 mV	500 µV	54,0 dBµV	3,33 nW	-54,8 dBm
0,0001 V	0,1 mV	100 µV	40,0 dBµV	0,13 nW	-68,8 dBm
0,000050 V	0,05 mV	50 µV	34,0 dBµV	33,33 pW	-74,8 dBm

Number of channels	Level reduction
2	-3,0 dB
3	-4,8 dB
4	-6,0 dB
5	-7,0 dB
6	-7,8 dB
7	-8,5 dB
8	-9,0 dB
9	-9,5 dB
10	-10,0 dB
11	-10,4 dB
12	-10,8 dB
13	-11,1 dB
14	-11,5 dB
15	-11,8 dB
16	-12,0 dB
17	-12,3 dB
32	-15,1 dB

Annex III. Expected values at user outlet

		Analogue Radio (FM)	Digital Radio(DAB)	Terrestrial	Satellite	Cable
Signal level	dBµV	40 - 70	30 - 70	47 - 70		45 - 70
C/N	dB	≥38	≥18	≥25	DVB-S2 (QPSK) >12 DVB-S2 (8PSK) >14	≥28
MER	dB	-	-	>21 dB		
VBER	-	-	-	9E-5		9E-5

Annex IV. History of updates

1.09.1660 First version of software of meter

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