SIGNALS DESCRIPTION

A1.1		DIGITAL signals

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

	DVB-T Parameters

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

► **Spectral inversion**
It detects if the input signal has been inverted.

► **FFT Mode**
It defines the number of modulation carriers between values 2k, 4k and 8k.

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

► **Constellation**
Modulation used by the carriers. It also defines the noise immunity of the system (QPSK, 16-QAM and 64-QAM).

► **Code rate**
Also known as Viterbi ratio. It defines the ratio between the number of data bits and the total number of bits transmitted (the difference corresponds to the number of control bits for the detection and recovery of errors).

► **TS Hierarchy**
The DVB-T standard gives the possibility of TDT transmissions with hierarchical levels, that is, the simultaneous transmission of the same program with different image qualities and levels of protection to different noises, so the receiver can switch to a signal of lesser quality when reception conditions are not optimal.

■ **Power**

Measured power over the entire bandwidth of the channel.

■ **C/N**

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

■ **MER**

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

■ **BER** (VBER/CBER)

It is the system error rate. In a system of digital terrestrial signal reception, after the COFDM decoder two methods of error correction are applied. Each time an error correction is applied on the digital signal, the error rate changes, so if the error rate is measured at the demodulator output or after Viterbi or at the Reed-Solomon decoder output, different error rates are obtained.

■ **CBER**

BER measurement for digital signal before the error correction (BER before FEC).

■ **VBER**

BER measurement for digital signal after error correction (BER after Viterbi).

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

■ **PER**

Measurement associated to VBER. It is an errored packet counter, plus a total time counter, accounting for total packets lost over a given period of time.

A1.1.2	**Digital TERRESTRIAL Television SECOND Generation (DVB-T2 standard/COFDM modulation)**

The **DVB-T2** demodulator version allows working with Base (standard version) and Lite (mobile devices version) profiles.

	DVB-T2 Parameters

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

► **Spectral inversion**
It detects if the input signal has been inverted.

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

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

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

► **Constellation**
COFDM modulation with constellations QPSK, 16QAM, 64QAM, 256QAM.

► **Constellation rotation**
It detects if the constellation is rotated (ON) or not (OFF).

► **Code rate**
It defines the ratio between the number of data bits and the total number of bits transmitted (the difference corresponds to the number of control bits for the detection and recovery of errors).

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

DVB-T2 Measurements

■ **Power**
Measured power over the entire bandwidth of the channel.

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

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

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

■ **BER** (CBER/LBER)
It is the bit error rate. There are two measurements related to BER:

   ■ **CBER** (Channel Bit Error Rate):
   BER of the signal after the COFDM demodulator and before applying the error correction or FEC (Forward Error Correction).

   ■ **LBER** (LDPC Bit Error Rate):
   BER after been applied the LDPC (Low-density parity-check) error correction.

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

A1.1.3		**Digital SATELLITE Television FIRST Generation (DVB-S standard/QPSK modulation)**

	DVB-S Parameters

► **Channel Bandwidth**
It displays the channel bandwidth from 1.3 MHz to 60.75 MHz.

► **Spectral inversion**
It detects if the input signal has been inverted.

NEW! ► **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. The symbol-rate can be set manually.

► **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.

- **PER**
  Measurement associated to VBER. It is an errored packet counter, plus a total time counter, accounting for total packets lost over a given period of time. In DVB-S, CBER is not to measure when PER is evaluated.

A1.1.4	**Digital SATELLITE television signal of SECOND generation (DVB-S2 standard/QPSK/8PSK modulation)**

	DVB-S2 Parameters

► **Channel Bandwidth**
It displays the channel bandwidth from 1.3 MHz to 60.75 MHz.

► **Spectral inversion**
It detects if the input signal has been inverted.

NEW! ► **Symbol Rate**
It represents the number of times the signal status changes in a period of time. The bandwidth is related to this parameter. The symbol-rate can be set manually.

► **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.

► **TS clock**
It displays a warning when the TS clock is too high.

	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.

A1.1.5	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)

■ **PER**

Measurement associated to VBER. It is an errored packet counter, plus a total time counter, accounting for total packets lost over a given period of time.

| A1.1.6 | | **Digital CABLE television signal of SECOND generation (DVB-C2 standard/COFDM modulation)** |

| | **DVB-C2 Parameters** |

► **Channel Bandwidth**
It is the channel bandwidth between 6 MHz, 7 MHz and 8 MHz.

► **Spectral inversion**
It detects if the input signal has been inverted.

► **Guard Interval**
It corresponds to the dead time between symbols; its purpose is to detect echoes due to multi-paths. This parameter is expressed in terms of the symbol duration: 1/64 or 1/128.

► **Constellation**
COFDM modulation with constellations QPSK, 16QAM, 64QAM, 256QAM, 1024QAM, 4096QAM. The constellation refers to all the selected PLP data.

► **Code rate**
It defines the ratio between the number of data bits and the total number of bits transmitted (the difference corresponds to the number of control bits for the error detection and recovery): 2/3, 3/4, 4/5, 5/6, 8/9, 9/10.

► **DSLICE id**
DSLICE identifier. A DSLICE is a data packet containing a group of several PLPs.

► **PLP id**
PLP (Physical Layer Pipes) identifier. Layers are used by the system to transmit compressed data such audio, video and more.

DVB-C2 Measurements

Power
Measured power over the entire bandwidth of the channel.

C/N
Carrier/Noise 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/LBER**)
System error rate. In DVB-C2 makes use of two codes to correct errors that are the LDPC (Low Density Parity Check) codes combined with BCH (Bose - Chaudhuri - Hocquengham) to protect against high levels of signal noise and interferences. On screen, under LBER measurement the number of iterations LDPC is shown, that is, the number of times the LDPC decoder for error correction has to pass through the signal and the ESR (Error Second Ratio) that indicates the percentage of time with errors after the BCH. Error correction is internal with BCH or external with LDPC. The internal error correction provides basic minimum load while the outer error correction is a correction with additional load. Also the PER measurement is displayed, which is the number of erroneous packets, that is, packets received during the measurement time and not correctable by the demodulator.

CBER (Channel Bit Error Rate)
BER of the signal after passing through the COFDM demodulator and before applying the error correction or FEC (Forward Error Correction).

LBER (LDPC Bit Error Rate)
BER of the signal after applying the correction errors LDPC (Low-density parity-check).

A1.2   ANALOGUE signals

A1.2.1   Terrestrial band

Analogue TV

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

► **LEVEL**
Indication of the carrier level of the tuned video.

► **C/N**
Ratio between the modulated signal power and noise power for the same bandwidth (depending on TV standard).The modulation error ratio (MER), used in digital systems is analogue to the Signal-Noise (S/N) ratio in analogue systems. 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.

Analogue FM

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

A1.2.2 | **Satellite band**

Analogue TV

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

► **Level**
  Measurement of the tuned carrier level.

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