Broadcast Products

DVB-T/H COFDM Modulators ✓

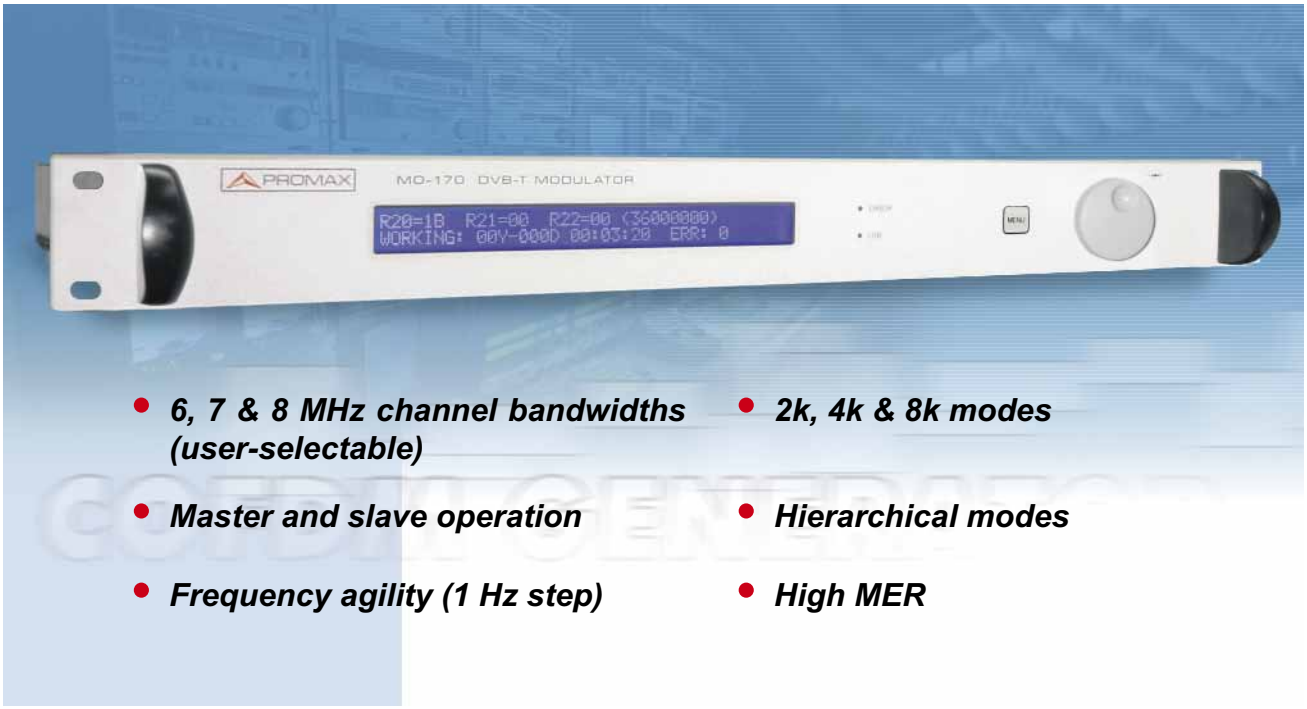
Transport Stream Recorders & Players ✓

Professional Signal Combiners and Splitters ✓

Remote Monitoring Systems ✓

PROMAX

MO-170 DVB-T/H Modulator



- ***6, 7 & 8 MHz channel bandwidths (user-selectable)***
- ***2k, 4k & 8k modes***
- ***Master and slave operation***
- ***Hierarchical modes***
- ***Frequency agility (1 Hz step)***
- ***High MER***

DVB-T and DVB-H (*) Modulator MO-170 General overview

The **MO-170** is a general purpose **DVB-T/H modulator** contained in a 19" 1U chassis. The unit has three selectable MPEG-2 TS inputs (two serial ASI inputs and one parallel SPI input).

Either of these inputs can be used to modulate the COFDM signal in both **hierarchical** (one TS input) and **non-hierarchical** (two TS inputs) modes. An additional **test TS** can be generated internally in the modulator. This allows to generate compliant DVB-T/H signals even in the absence of a valid TS input.

In ***slave*** mode, the useful bit rate at the TS input to the COFDM modulator has to be the one defined in ETSI EN 300 744 for each choice of DVB-T/H transmission parameters.

When using hierarchy, the user has to choose which TS (HP or LP) the selected TS input is mapped to. The other hierarchical TS is generated internally as a PRBS test sequence.

In ***master*** mode, the **MO-170** is able to work with any incoming bit rate as long as this is strictly lower than the value given in the DVB-T/H specification for the modulation parameters in use. The input TS bit rate is adapted to the useful bit rate required by the DVB-T/H signal by stuffing the TS with NULL packets (packet stuffing). This stuffing process alters the sequence of PCR values embedded in the TS. These values have to be re-stamped for the resultant PCR jitter to remain within the limits specified by the DVB. In hierarchical modes, operating the MO-170 as master has the added advantage over the slave mode of being able to use any of the three TS inputs as the HP input, LP input or both.

The modulator can be configured to generate any of the transmission modes listed in the DVB-TH specification. In hierarchical modes, the HP and LP streams can be encoded with different convolutional code rates. The channel bandwidth can be set by the user to 6, 7 or 8 MHz as required by the application. Several test modes are available in the **MO-170** (blanking of carriers, single tone output, test TS generation, CBER and VBER injection).

DVB-H only features are 4k carriers, two extra TPS signalling bits (time slicing and MPE-FEC), native/in-depth symbol interleaving and selectable transmitter cell ID.

The operation of the **MO-170** is done via the front panel LCD display and controls. The modulator can be easily configured by navigating through the intuitive set of menus.

(*): DVB-H operation available as an option

MO-170 DVB-T/H Modulator

*The **MO-170** is a multi-purpose DTT modulator providing a complete test suite which can be used to perform measurements at different points on the DVB-T signal chain. The wide selection of test options available in the **MO-170** makes it the perfect companion for anybody interested in checking and validating a variety of critical aspects throughout the DVB-T system.*

- It includes a wide range of test functions such as:
  - Internally generated test TS.
  - Carrier blanking.
  - Single carrier generation.
  - Controlled insertion of errored bits to emulate a given BER before or after the Viterbi decoder.

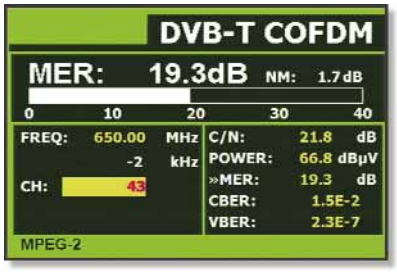
- The **MO-170** includes other novel features as an option (***OP-170-E***):
  - Addition of white Gaussian noise with selectable C/N.
  - Simulation of fixed and mobile multipath channels with up to 6 taps of variable amplitude, delay, phase and Doppler frequency.

- **DVB-H** is also possible as an option.

These and other features present in the **MO-170** simplify the set-up of complex test systems and allows measurements over real conditions without having to spend a fortune.

Test Transport Stream

When out-of-service tests are required the **MO-170** can be used standalone, internally generating a test TS consisting of NULL packets filled up with PRBS payload data. If the tests do not involve displaying a picture on a monitor, no external transport stream input is needed. The **MO-170** automatically synthesises the bit rate needed to operate the modulator depending on the DVB-T parameters in use.

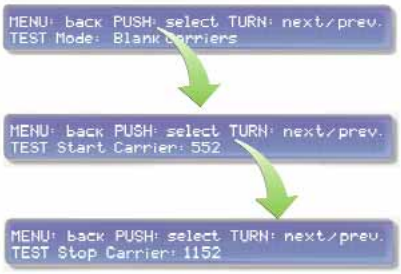


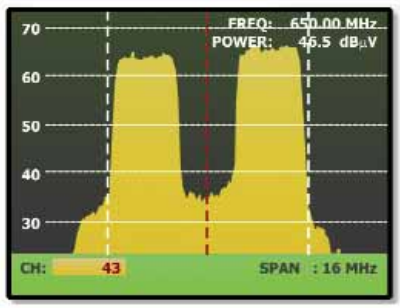
Sample of a test signal with PRBS payload data

When a moving picture is required the **GV-998** can be used to supply a test pattern through the ASI or SPI input.

Signal level alignment and in-band noise measurements *(OP-170-E option)*

Blanking a set of contiguous carriers within the COFDM spectrum can help in measuring the levels of in-band noise (intermodulation products, Gaussian noise). The **MO-170** allows to vary the width of the spectrum hole as well as its location within the channel.





Spectrum hole unveilling the presence of intermodulation products within the channel

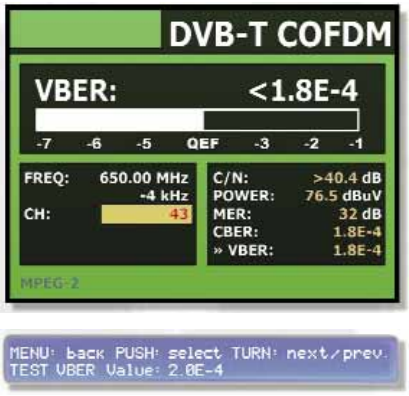
COFDM signal power is measured by taking the average of the power within the channel. To simplify the process of aligning signal levels across a transmission or reception chain, the **MO-170** can generate a single central carrier whose peak power is 3 dB above the average power of the DTT signal.

Getting your Bit Error Ratios right

A **unique feature** of the **MO-170** is the insertion of bit errors in different stages of the DVB-T modulation chain. This can help to check the accuracy of the BER estimation algorithms implemented in high-end professional receivers.

A Channel BER (CBER or BER before the Viterbi decoder) ranging between 7.6×10^{-6} and 1.25×10^{-1} is generated by modifying the sequence of bits at the input to the constellation mapper. The **MO-170** is also able to generate a Viterbi BER (VBER or BER after Viterbi) going from 3.7×10^{-9} to 6.2×10^{-2} by properly processing the bits at the output of the Reed-Solomon encoder. The main advantage of this technique when compared with varying the C/N to get the

desired CBER or VBER, is its high resolution and unparalleled accuracy.



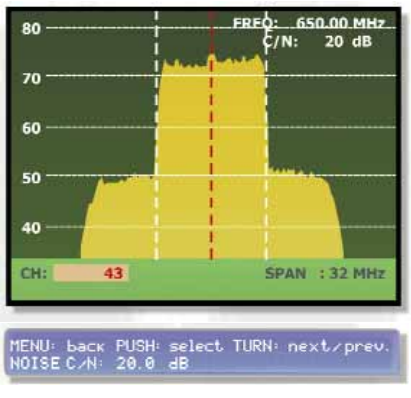
QEF VBER insertion in the MO-170 and BER measured by the TV EXPLORER

Start making noise

(OP-170-E option)

A traditional set-up for measuring DVB-T performance versus C/N typically includes a source of wide-band white Gaussian noise, an RF power meter plus selective channel filter or a spectrum analyser, and a varying number of high-precision variable attenuators and directional couplers. The C/N generation function available in the **MO-170** makes this kit no longer required and allows a much simpler configuration.

In the **MO-170**, white Gaussian noise with twice the bandwidth of the DVB-T signal is digitally added to the COFDM signal. C/Ns between 3 and 40 dB in steps of 0.1dB can be selected. In addition, the RF signal level (COFDM and noise combined) can be further attenuated from 0 to 60 dB in 1 dB steps. This provides the means to either keep the signal power constant whilst varying the C/N (e.g. to plot the BER vs. C/N of a demodulator), or to keep the C/N constant whilst varying the signal power (e.g. to find the sensitivity of a receiver).



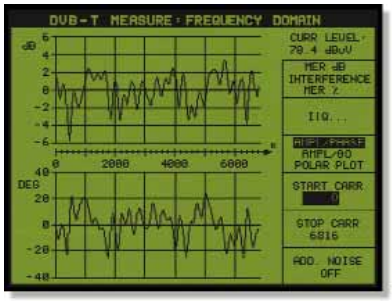
*QEF VBER insertion in the **MO-170** and BER measured by the **TV EXPLORER***

The DVB-T signal may be switched off while the noise is still on, and vice versa. This way, noise and signal average powers can be measured externally using the appropriate equipment so as to verify the selected C/N reading. The fact that both noise and signal are digitally synthesised has the added benefit of generating C/Ns **with a precision that is difficult to achieve in a traditional assorted test set-up**.

Fixed/mobile multipath channels, SFN/MFN simulation and more *(OP-170-E option)*

COFDM was the modulation chosen for digital terrestrial TV broadcasting because of its superior performance in dynamic and static multipath channels.

A **novel feature** in the **MO-170** is the possibility of simulating channels with up to 5 echoes (plus the main path) of variable attenuation (0 to 40 dBc in 0.1 dB steps), delay (0 to 445 ms), phase (0º to 359.9º with resolution of 0.1º) and Doppler frequency (zero for fixed channels and ranging between -830 Hz and + 830 Hz in 0.1 Hz steps for mobile channels).

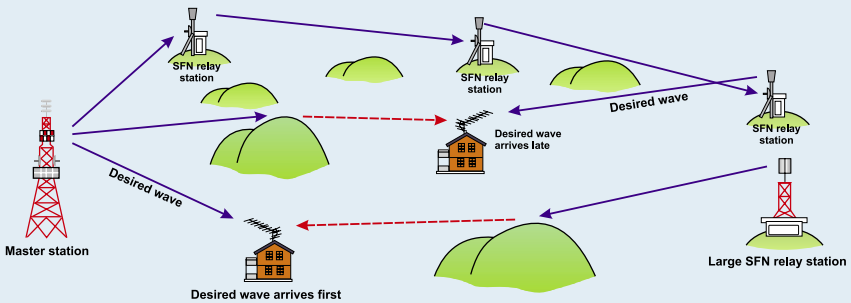


*Amplitude and phase of fixed Ricean channel F1 simulated with the **MO-170***

Among other applications, the channel simulator can be successfully used to simulate the following scenarios:

- Pre-echoes in a SFN or, in general, any power delay profile found in practice in single (MFN) & multiple transmitter (SFN) networks.
- Static channels corresponding to roof-top fixed and portable reception. In particular, good 6-ray approximations can be generated for the F1 and P1 channels defined in Appendix B of document ETSI EN 300 744. Other 6-path profiles are those defined in Appendix K.2 of document ETSI TR 101 290.
- Mobile channels with pure Doppler shift. An example of this is the 0 dB echo profile proposed in Appendix K.3 of document ETSI TR 101 290.

The channel simulator may be used in conjunction with the C/N generator to evaluate the performance of a DVB-T system for a pre-defined multipath channel as a function of the amount of additive noise present in the channel.



Multipath interference outside the guard interval in digital terrestrial broadcasting

MO-170 DVB-T/H Modulator

✓ Test modes

- Blank a number of carriers (start index to stop index) within the COFDM ensemble. This allows to measure in-band intermodulation and quantisation noise.
- Generate the pilot carriers only (continual and TPS).
- Generate a single carrier at the central frequency whose level equals the average COFDM output power or is set to the maximum available. This is intended for signal level alignment.
- Test Transport Stream packet generation using PRBS sequences of length 15 or 23 embedded within NULL packets (ETSI TR 101 290).
- Test PRBS generation at the input to the mapper following the guidelines of document ETSI TR 101 290.
- Bit error injection at the input to the constellation mapper (results in a non-zero CBER before the Viterbi decoder) or at the input to the convolutional encoder (results in a non-zero VBER before the Reed-Solomon decoder).

✓ Control interface

- Pushable rotary control on the front panel with navigation key and LCD display.
- Two LEDs indicating the power and synchronisation status of the equipment.
- RS232 DB9 male connector.

✓ Options

OP-170-H Compatibility with DVB-H

DVB-H is defined mostly for mobile digital TV reception. The most important differences with the normal DVB-T are among others:

- It accepts IP encapsulated packets in the Transport Stream.
- It can be used with 4K carriers as a trade off between capacity and tolerance to multipath reception.
- It can be broadcast in 5, 6, 7 and 8 MHz bandwidth channels.

With this option we can now test DVB-T as well as DVB-H receivers with one single test generator.

OP-170-P Output power of 6 dBm

The standard version of the **MO-170** has an output power of 0 dBm in IF and -30 dBm in RF. For those applications that require more output power this option offers +6 dBm in RF. IF remains at 0 dBm for that is quite a standard value.

Having more RF output power is not only useful for test purposes but it is also very interesting when the **MO-170** COFDM modulator is used as part of a signal distribution network.

OP-170-E Noise and echoes generator

Thanks to this option we can add noise, echoes or simulate multipath static reception or doppler effect on a standard DVB-T channel.

This is the ideal option for a STB and iDTV test bench for it allows you to simulate a large number of broadcast conditions without leaving your lab.

OP-170-S SNMP Control

It is very useful when **MO-170** is used to form a complex test or signal distribution system to have the possibility to use one single control protocol for all the equipment involved. SNMP (Simple Network Management Protocol) is nowadays a standard in this type of applications.

MO-170 DVB-T/H Modulator

SPECIFICATIONS	
INPUTS	
MPEG-2 Transport Stream	Two DVB-ASI inputs, 75 Ω female BNC One DVB-SPI input, LVDS DB-25 TS packets of length 188 or 204 bytes (automatic detection) Support for burst and continuous packet modes
Operating modes	
Master	Input TS bit rate strictly below the value given in the DVB-T specification Packet stuffing for bit rate adaptation and PCR re-stamping are carried out automatically
Slave	Input TS bit rate constant and equal to the value given in the DVB-T document (no stuffing). Tolerance ± 1 ‰
IF Output	
Type	50 Ω BNC female connector
Frequency range	Variable from 31 to 36 MHz in 1 Hz steps (Remote Control only); fixed at 36 MHz when RF output is off
Spectrum polarity	Selectable via front panel controls
Power level (average)	-22 dBm (85 dBmV) fixed
In-band amplitude ripple	< 0.5 dB
In-band group delay ripple	<10 ns
Frequency stability	20 ppm
Out-of-band spectral characteristics[1]	
@ ± 3.805 MHz	0 dBc
@ ± 4.25 MHz	-39 dBc (2k), -47 dBc (8k)
@ ± 5.25 MHz	-52 dBc
Level of harmonics and spurious	≤ -50 dBc
MER[2]	> 40 dB
RF Output	
Type	50 Ω N-type female connector
Frequency range	From 45 and 875 MHz in 1 Hz steps
Spectrum polarity	Selectable via front panel controls
Power level (average)	-82 to - 22 dBm in 1 dB steps (+6 dBm optional)
Frequency stability	20 ppm
MER	> 32 dB
SSB phase noise	≤ -87 dBc/Hz @ 2 kHz
DVB-T/H Parameters	
IFFT size	2k, 8k, 4k (optional)
Guard intervals	1/4, 1/8, 1/16, 1/32
Code rates	1/2, 2/3, 3/4, 5/6, 7/8
Constellations	QPSK, 16 QAM, 64 QAM
Hierarchical modes	16 QAM and 64 QAM constellations with constellation ratio a= 1, 2 or 4
MFN operation	Available
Channel bandwidth	6, 7 and 8 MHz (user selectable)

Test Modes	
Carrier blanking	Blank a number of carriers (start index to stop index) within the COFDM ensemble. This allows to measure in-band intermodulation and quantisation noise
Pilot carriers	Generate the pilot carriers only (continual and TPS)
Single carrier	Generate a single carrier at the channel central frequency whose level equals the average COFDM output power or is set to the maximum available. This is intended for signal level alignment
TS packet generation	Internal generation of test TS using PRBS sequences of length 15 or 23 embedded within NULL packets as specified in document ETSI TR 101 290
PRBS generation	Map a PRBS sequence into constellation points following the guidelines of document ETSI TR 101 290
Bit error injection	Inject bit errors at the input to the constellation mapper (results in a non-zero CBER before the Viterbi decoder) or at the input to the convolutional encoder (results in a non-zero VBER after the Viterbi decoder).
Control Interface	RS-232C (SNMP optional)
Noise Generator (option)	
Bandwidth	Flat within twice the bandwidth of the DVB-T signal (±1 dB of flatness within the DVB-T bandwidth)
C/N	3 to 40 dB in 0.1 dB steps (noise power varies whilst the COFDM signal power remains constant)
Channel Simulator (option)	
Number of taps	6 echoes, which may be switched on/off individually
Profiles	Pure Doppler shift or constant phase (e.g. profiles F1 and P1 specified in document ETSI EN 300 744)
Amplitudes	0 to – 40 dBc in 0.1 dB steps
Delays	0 to 447.9 ms in steps of 100 ns - 8 MHz channels 0 to 511.9 ms in steps of 100 ns - 7 MHz channels 0 to 597.2 ms in steps of 100 ns - 6 MHz channels
Doppler	– 830 to 830 Hz in 0.1 Hz steps
Phase	0 to 359.9° in 0.1° steps
Power supply	
Voltage	90 - 250 VAC
Frequency	50 - 60 Hz
Consumption	20W
Mechanical features	
Dimensions	19” wide 1U high rack chassis
Weight	6.3 kg

1 Frequencies are referred to the central frequency for an 8 MHz channel. Peak levels measured using a 10 kHz bandwidth are referred to the carriers located on either side of the spectrum. Values shown are the worst case and correspond to guard intervals of 1/32.

2 Value measured in master mode. In slave mode, the MER is greater than 38 dB for 8 MHz channels, and around 35 dB for 7 and 6 MHz.

MO-170 for Digital TV Signal Distribution

The upcoming switch off for analogue channels combined with the drift towards production of flat screen televisions is moving the demand high for TV sets with integrated DTT receiver, called ***iDTV****.*

The move is attractive to users for many reasons: it is an opportunity to get a larger screen display without having to place a huge box in the living room; the chance to get both the ***DTT receiver*** *and* ***TV set*** *integrated without need for another external box and with only one remote control; the need for a better picture quality which is a must because even small impairments of the analogue signal are magnified on large screens…*

From the technical point of view, there are a number of applications other than pure broadcasting, that see in the ***COFDM modulation*** *a* ***solution*** *to specific problems. We can describe a few:*

The distribution of the DTT signal other than at a broadcast level have a limitation, **the cost of the modulators**. **PROMAX** is offering a **low cost** solution, the **MO-170**, so that you can be at the forefront of technology when you build your TV networks..

ENG for extreme TV transmissions

It is a better alternative than traditional modulation systems for mobile applications such as ENG vans and helicopters due to its improved multi-path performance and the intrinsic modulation scheme. The COFDM signal transmits the infomation through 6817 carriers (for 8k system). If some carriers are lost, the missed data can be easily recovered by error coding.

An extreme case is the performance in on-board cameras at F1 race cars. Other single carrier digital modulation solutions like QPSK or QAM have a worse response for these applications.

MO-170 Digital Terrestrial TV replaces Analogue TV

Distribution inside buildings, hospitals, ships, trains, planes...

The DTT is based in COFDM modulation which is an intrinsically robust method of transmitting signals.

Its **rugged nature** allows signal distribution direct from the head-end to the receiver with minimum need for line amplifiers.

Using a television with an integrated receiver, there is no need for extra external set top boxes at the reception site and reception is **direct to the iDTV**. This becomes a very tidy solution in buildings and it becomes a powerful alternative in those places where space is a critical issue like hospitals, ships, etc.

Wireless distribution for various applications

Safety when the environmental conditions require a wireless transmission

Information systems in airports, stadiums, congresses, etc use standard iDTVs to display information.

Security systems where wires are to be avoided or difficult to lay down.

MO-170 for Digital TV Signal Distribution

Television on the road

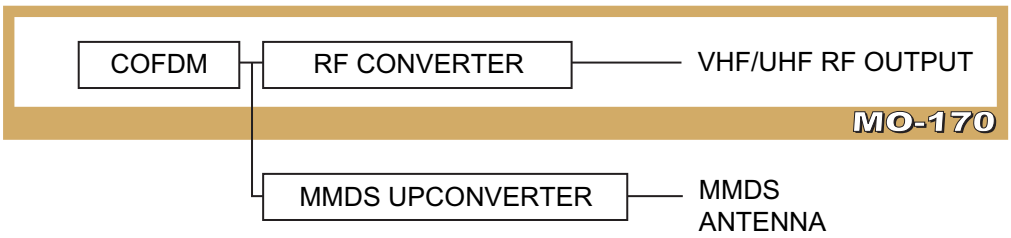
One rising application is the DVB-H, defined to solve the issue of the transmission in moving conditions. Here the OFDM modulators are needed again because of its multi-path performance.

The purpose is to solve the reception in cars, trains, etc but mainly the reception in mobile devices such as phones, PDAs, etc.

Microwave links

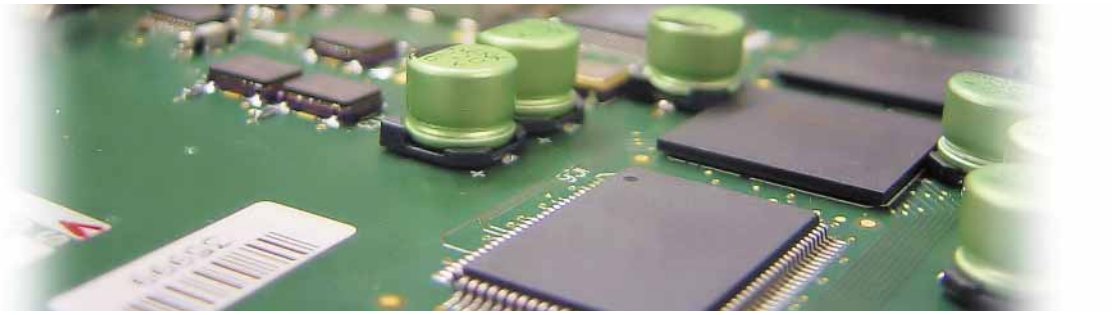
The OFDM modulation is also the type chosen to implement some **Microwave link** schemes. They are normally using COFDM modulation at 2 GHz and over for transmission and down-conversion into the UHF band for distribution and **direct to the iDTV**. In this systems, the use of iDTV receivers facilitate the reception of microwave links and UHF simultaneously.

MMDS transmitters



A COFDM modulator can be an important part of many RF systems. That would be the case of modern digital MMDS transmitters for example. MO-170 accepts TS through ASI or SPI interfaces. Signal is then modulated into IF at 36 MHz and later on to RF anywhere in the VHF and UHF bands.

IF or RF outputs can be further processed in RF to obtain any output frequency, i.e. 2,4 GHz, suitable for the MMDS application. We'd like to point out that we are also interested and we have already marketed the COFDM modulator as an **isolated module to OEM transmitter producers**.



MO-180 DVB-T/H Modulator for SFN & MFN Broadcasting

- ***Built-in Precorrector***
- ***10 MHz GPS reference input.***
- ***SNMP compatible***
- ***6 dBm output power (option)***

The **MO-180** is an SFN/MFN DVB-T/H modulator fully compliant with the DVB-T/H specifications ETSI EN 300 744 v1.5.1 (including annex F referring to DVB-H), ETSI TS 101 191 v1.4.1 (SFN synchronisation) and ETSI EN 300 468 v1.6.1 (DVB-SI). The unit is contained in an standard 19" 1U chassis.

The modulator has two DVB-ASI Transport Stream (TS) inputs and one DVB-SPI TS input. It also has a 1 pps and a 10 MHz input which, together with the MIP packet embedded in the transport stream, are used for SFN synchronisation purposes. A loop-through 10 MHz output is available as well.

In MFNs we can operate the modulator in master and slave modes. In slave mode the modulator is locked to the incoming TS data rate, which is defined in document ETSI EN 300 744 for each choice of DVB-T/H transmission parameters. In master mode the modulator is locked to either the internal 10 MHz TCXO or to an external 10 MHz reference. The input bit rate has to be strictly smaller than the value given in the DVB-T/H specification. The **MO-180** drops or inserts NULL TS packets as required to adapt the bit rate to the required value.

PCR re-stamping is implemented to minimise the impact of the bit rate adaptation process on the timing jitter of the MPEG-2 TS multiplex.

In SFN mode, the modulator can be synchronised with the external 10 MHz GPS reference or with the incoming TS data rate. A loss of sync with the external 10 MHz reference can be used to make the modulator lock to the input TS rate, and vice versa. This means that disruptions to the output IF/RF COFDM signals are minimised. Periodic or aperiodic MIP packets are constantly monitored so as to dynamically adjust the delay of the modulator. In non-hierarchical transmissions the modulator seamlessly switches between ASI inputs when it detects a sync loss on the currently selected TS input. An additional test TS can be generated internally. This allows to generate compliant. DVB-T/H signals even in the absence of a valid TS input.

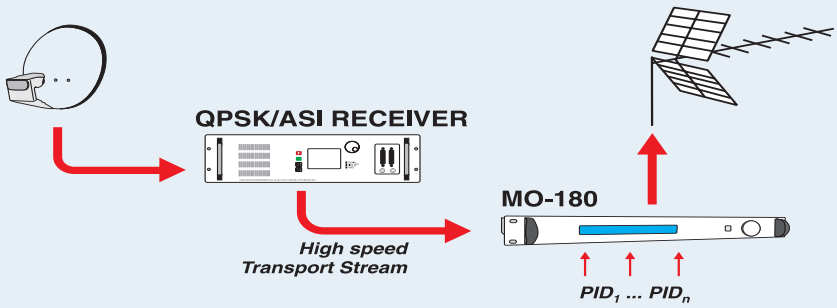
The channel bandwidth can be set to 5, 6, 7 and 8 MHz with no variation in performance. The DVB-T/H signal is output in both IF (36 MHz, 0 dBm) and RF (45 MHz to 875 MHz, at -27 dBm with the option of going up to 6 dBm) with a resolution of 1 Hz. The polarity of the spectrum may be set to normal or inverted.

The **MO-180** supports 2k, 4k and 8k modes and non-hierarchical and hierarchical transmissions. Several test modes are available (blanking of carriers, single tone output, test TS generation, CBER and VBER injection). The MER typically measured in IF is above 41 dB. In RF we measure MERs greater than 35 dB.

PID Filtering

Transport streams coming from satellite receivers (QPSK) contain normally a high number of services and have too high bit rate to be connected to a COFDM modulator directly.

MO-180 has a PID FILTERING function. This allows to enter a high speed transport stream, coming from a satellite receiver for instance, to the modulator ASI input at once. It is possible then to select a certain number of services from the original transport stream by entering their PID's on the **MO-180** dedicated menu. The selected services are filtered and will not be modulated.



MO-180 DVB-T/H Modulator for SFN & MFN Broadcasting

SPECIFICATIONS	MO-180
INPUTS	
MPEG-2 Transport Stream	Two DVB-ASI inputs, 75 Ω female BNC One DVB-SPI input, LVDS DB-25 TS packets of length 188 or 204 bytes (automatic detection) Support for burst and continuous packet modes
Operating modes	
Clock synchronisation	
Master MFN	Internal TCXO or external 10 MHz GPS reference. Input TS bit rate strictly below the value given in the DVB-T/H specification. Packet stuffing for bit rate adaptation and PCR re-stamping carried out automatically
Slave MFN	TS data rate equal to the value given in the DVB-T/H specification ± 0.1‰
SFN	External 10 MHz reference or input TS data rate
Additional features	Automatic seamless switching between ASI inputs in the event of a sync loss. DVB-SI NIT table may be updated (network ID, transmitter ID and transmitter centre frequency)
GPS inputs	50 Ω BNC female connector
10 MHz input	Selectable input impedance (50 Ω / High), 50 mV min to 3.3 V max
1 pps input	Active high or low, selectable impedance (50 Ω/High), 2 V min to 5 V max
IF Output	
Type	50 Ω BNC female connector
Spectrum polarity	Normal or inverted
Power level (average)	0 dBm average power
In-band amplitude ripple	< 0.2 dB
In-band group delay ripple	< 10 ns
IQ amplitude imbalance	< 0.02%
IQ quadrature error	< 0.02%
Central carrier suppression	< -55 dBc
Harmonics and spurious	< -60 dBc-
MER[2]	> 41 dB
Out-of-band spectral	
Frequency stability	20 ppm
characteristics[1]	
@ ± 3.805 MHz	0 dBc
@ ± 4.25 MHz	-46 dBc (2k), -56 dBc (8k)
@ ± 5.25 MHz	-56 dBc
RF Outputs	50 Ω N-Type female connector F-BNC
Frequency	45 to 875 MHz, adjustable (1 Hz steps)
Spectrum polarity	Selectable via the front panel controls
Avg. power level	From -27 dBm to -87 dBm (1 dB steps)
Harmonics and spurious	< -50 dBc
MER	> 38 dB
Phase noise	< -85 dBc/Hz @ 1 kHz typical
DVB-T/H parameters	
Carriers	2k, 4k, 8k
Guard intervals	1/4, 1/8, 1/16, 1/32
HP & LP code rates	1/2, 2/3, 3/4, 5/6, 7/8
In-depth DVB-H	
symbol interleavers	In 2k and 4k
Constellations	QPSK, 16QAM, 64QAM
Hierarchical modes	16QAM and 64QAM constellations with α = 1, 2 or 4
SFN and MFN operation	Yes
Pre-corrector	Non-linear, Crest Factor
TPS signalling	Cell ID, DVB-H's time slicing and MPE-FEC
Channel bandwidths	5, 6, 7 and 8 MHz
Modulation parameters	May be extracted from the MIP packet
Processing delays	
MFN	The static delay may be adjusted between 0 and 1 second with a resolution given by the DVB-T/H elementary clock period
SFN	Dynamic delay automatically calculated from the 10 MHz GPS reference, the 1 pps signal and the MIP packet embedded in the HP TS multiplex. The resolution is 100 ns ± 838.8 ms local delay offset may be added as long as the total delay is never greater than 1 s or lower than the inherent latency of the modulator. Synchronisation accuracy better than ±200 ns. Estimate of the network delay from the SFN adapter output to the modulator TS inputs.
Test Modes	
Carrier blanking	Blank a number of carriers (start index to stop index) within the COFDM ensemble. This allows to measure in-band intermodulation and quantisation noise
Pilot carriers	Generate the pilot carriers only (continual and TPS)
Single carrier	Generate a single carrier at the channel central frequency whose level equals the average COFDM output power or is set to the maximum available. This is intended for signal level alignment
TS packet generation	Internal generation of test TS using PRBS sequences of length 15 or 23 embedded within NULL packets as specified in document ETSI TR 101 290
PRBS generation	Map a PRBS sequence into constellation points following the guidelines of document ETSI TR 101 290
Bit error injection	Inject bit errors at the input to the constellation mapper (results in a non-zero CBER before the Viterbi decoder) or at the input to the convolutional encoder (results in a non-zero VBER after the Viterbi decoder).
Control interface	Ethernet RJ-45 connector (SNMP compatible)
Power supply	
Voltage	90 - 250 VAC
Frequency	50-60 Hz
Consumption	20 W
Mechanical specification	
Dimensions	19" wide 1U high rack chassis
Weight	6.3 kg

1 Frequencies are referred to the central frequency for an 8 MHz channel. Peak levels measured using a 10 kHz bandwidth are referred to the carriers located on either side of the spectrum. Values shown are the worst case and correspond to guard intervals of 1/32.

2 Value measured in master mode. In slave mode, the MER is greater than 38 dB for 8 MHz channels, and around 35 dB for 7 and 6 MHz.

TG-140 TS Recorder / Processor / Player

*The **TG-140** is a versatile **MPEG-2 Transport Stream recorder and player** that can be used in a great number of applications.*

It can record a transport stream continuously for several hours and then play it back later on at pleasure. Its recording capacity can be also split in plenty of shorter duration transport streams.

The Transport Streams can contain a single service or multiple ones so that the user can have full flexibility during the test phases of digital set top box or iDTV's design, manufacture or service.

Services included in the transport stream can be audio, video or data in **MPEG-2 or MPEG-4** formats and can correspond to **free to air** or **encrypted** programs in standard definition (**SDTV**) or high definition (**HDTV**).

The **TG-140** comes with preloaded test transport streams that can be selected using the device front panel controls. Thanks to the PC computer interface and the web server functions the users can also edit or tailor the transport streams to their specific requirements.

Example of a pre-recorded test program

The **TG-140** in combination with a digital modulator such as **MO-170** for DVB-T for instance becomes a highly flexible and affordable digital broadcast signal simulator.

The **TG-140** is a two units rack electronic equipment. The **TG-140** plays, records and processes Transport Stream files.

A Transport Stream is a sequence of bytes containing audio, video and data.

The **TG-140** contains software programs to play, record, analyze, demultiplex and build Transport Streams.

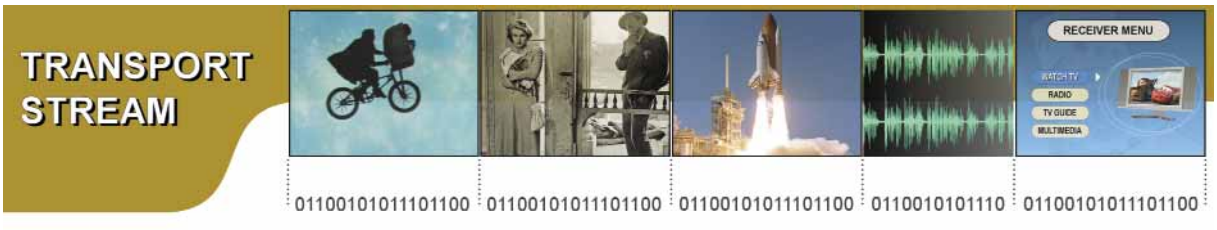
The **TG-140** has a hard disk with two partitions. One partition contains the operating system and the software. The other partition is where the Transport Stream files are stored. The equipment has two outputs and one input: one ASI output (Asynchronous Serial Interface), one SPI output (Synchronous Parallel Interface) and one ASI input.

The same data are sent to both outputs at the same time. The ASI uses a BNC type connector while the SPI uses a DB25.

The **TG-140** includes a Data Compact Flash. These types of storage devices are prefered in some

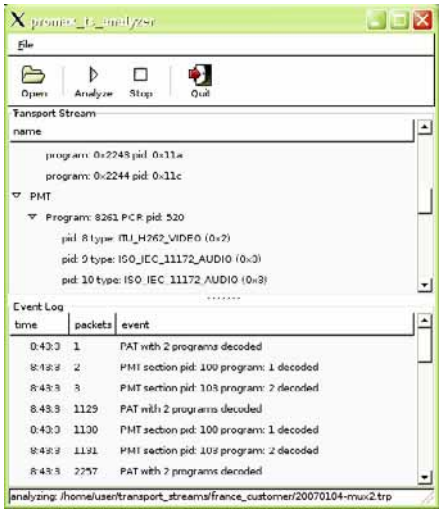
TG-140 TS Recorder / Processor / Player

applications where the transport streams are played back for long periods of time because, as opposite to hard disks, they have no mechanical moving parts and offer improved longer term reliability. The information contained in the **TG-140** can be backed up using the rescue Compact Flash slot although it can also be saved on an external massive storage device using ethernet interface.



Remote control

The **TG-140** can be easily operated using the front panel keys, rotary knob and display. External PS2 mouse, keyboard and SVGA monitor can be used for a more comfortable graphic interface operation. It is also possible to control the **TG-140** from a PC computer via the ethernet interface. The access to the device can be locked by password when security issues are important.



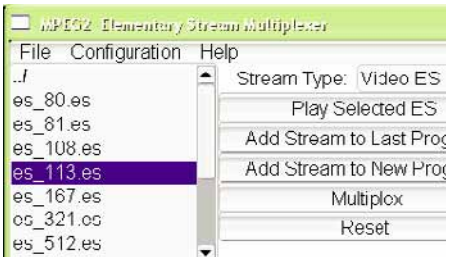
SPECIFICATIONS

Inputs
- ASI transport stream
- Maximum data rate 150 Mb/s

Outputs
- ASI transport stream
- SPI parallel transport stream
- Maximum data rate 90 Mb/s

Storage capacity
- Hard disk 160 GB
- 15 hours of 20 Mb/s T S

PC computer connection
- USB interface
- Ethernet interface



Portable TS Recorder / Processor / Player TG-130

*The **TG-130** is a portable version of the transport stream recorder and player. It is battery operated and it can be very useful when transport streams need to be recorded or played in the field where electrical power may not be available or easy to access. It comes with a rubber shock protector and a soft carrying bag.*

TD-500 Professional Signal Combiner & Splitter

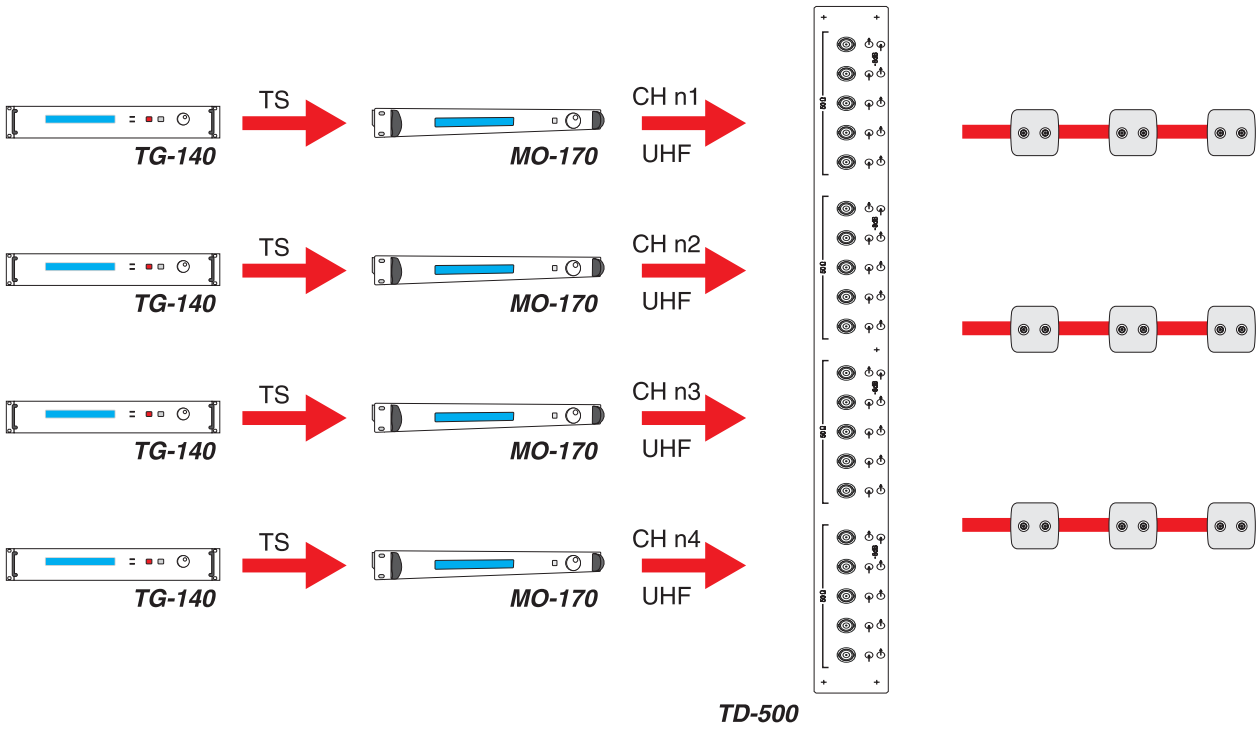
The **TD-500** is a professional RF signal combiner and splitter that comes in a 19" 1U height rack format. It includes two idental groups of 4 inputs to 1 output that can be also used reversed (1 input splitted to 4 outputs). The frequency range is from 45 MHz to 875 MHz and the average insertion loss is:

- From 45 MHz to 50 MHz 6.9 dB (typ), 7.3 dB (max)
- From 50 MHz to 450 MHz 7.3 dB (typ), 8.1 dB (max)
- From 450 MHz to 900 MHz 8.1 dB (typ), 9.3 dB (max)

Following is an example of one among many of the possible applications of the **TD-500**, **MO-170** and **TG-140**. In this case we propose a complete digital television (DTT) head-end system to generate all signals required for a flat screen production plant or to allow multiple channel content playback in a hotel or cruise ship.

The transport streams recorded in the **TG-140**'s can simulate programs from all over the world in different formats. They are modulated in COFDM by the **MO-170**'s and then combined into a single RF output by **TD-500**.

MO-170 can also simulate a real broadcast reception environment no matter what the application is. The possibility to simulate echoes or pre-echoes for example is fundamental for testing of DTT receivers in extreme conditions. On other applications robustness of COFDM modulation and low cost of receivers are two good reasons to choose DTT for content delivery.



Monitoring systems: PROWATCH Telmo

The **PROWATCH** product family is made of various models that can be tailored to meet specific customer monitoring requirements. The **Telmo** is a product that will go embedded inside the transmitter system.

Since **PROMAX** launched the **PROWATCH Deide** we had a growing presence in the market of remote monitoring systems with a product range designed thanks to our wide experience in TV and radio measuring instruments.

These products are adapted to customer needs and have a focus on remote measurements and surveillance turn key solutions for analogue and digital television and radio signals.

The **PROWATCH Telmo** offers high functional specifications in a reduced space as well as high integration simplicity in already existing installations.

The **PROWATCH Telmo** basic system has been created for remote control and measurement of Digital Terrestrial TV (DTT) signals. Its main purpose is the remote monitoring of the quality of this type of signals, alarm generation based on the different types of impairments detected and carrying out of basic monitoring functions over the transmitting station where installed.

The Remote control and Monitoring Unit, **PROWATCH** (RMU), is composed of a compact module powered at 48V which is easy to integrate in the existing infrastructure of any transmitter, repeater or gap-filler. This module is available both in rack format as well as in a compact box for wall mount on a DIN rail.

From an electronic point of view, the unit is based on the most advance circuits for DTT signal tuning, demodulation and measurement. Such design warrantees processing speed, stability and measurement reliability.

The unit, once it has been configured, works as an autonomous element. Configuration can be modified by remote control making it not necessary to install a permanent user interface (display, keyboard…)

PROWATCH Telmo includes a serial port for data transmission to the remote monitoring location. A simple protocol is used to obtain information on system status, alarms generated or configuration data.

As an example of one of the possible tailored applications, a **PROWATCH Telmo** can monitor 6 DTT multiplexes and generater ALARMS and WARNINGS depending on signal level, **VBER** or **MER**.

Spectrum Monitoring systems: PROWATCH Deide3

PROWATCH Deide3 *offers key solutions in the scope of measurement, supervision and monitoring of digital & analogue TV/ Radio signals.*

Monitoring systems

PROWATCH Deide3 consists of a remote monitoring system, based on three basic elements:

- Client Equipment with browser
- Remote Control Unit (RCU)
- Measurement Unit (MU)

A key part of this system is the use of communication standard protocols so that a client can accede to any MU from any place by means of a standard web browser without requiring the installation of proprietary software. The characteristics that offer the new **PROWATCH Deide3** equipments, allow the design of a centralised system through a Remote Control unit able to manage the different Stations or Measurement Units.

The system **PROWATCH Deide3**, is able to detect and to identify analogue and digital signals, besides it can carry out an automatic spectrum monitoring with possibility of remote control. Thanks to the versatility of its design, the system

offers a wide range of possibilities.

The unit of measurement is constituted by a **PROLINK-4C *Premium***, which offers the most advanced features including a processor to perform a network connection using the SNMP protocol. This one station is called Measurement Unit (MU).

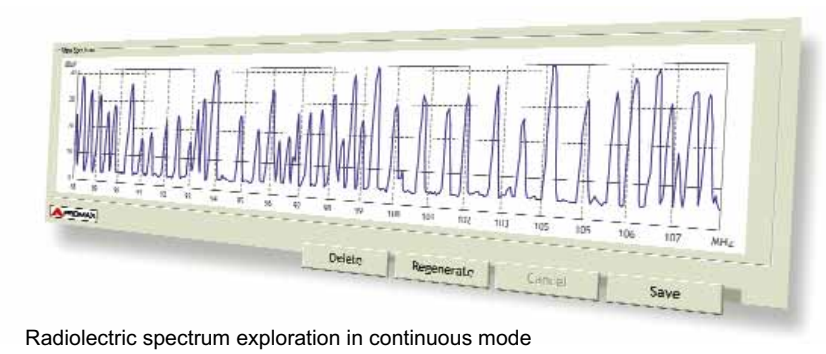
In the other end of the connection is located the RCU. A computer, properly authorised and a management application compose this station. This last one specifically includes functions developed in accordance with the end-user. Based on this configuration, the RCU can carry out numerous actions:

- Obtain status information about the Measurement Unit.
- System task scheduler, single or periodically measurements are programmed.
- Datalogger in real-time and statistics of measuring processes. (Historical).
- Real-time measurements.
- Measuring process control (varying operation parameters).
- Display data results (alarms, historical, system status…).
- Remote and automatic updating manager: Downloading new versions for MU applications (Updates).
- Video and audio data streaming for TV/radio tuned signals.
- Alarm generator via email.
- RCU and MU access control.
- MU priority manager and users group generation.
- Secure Module (Watchdog).

Spectrum Monitoring systems: PROWATCH Deide3

Monitoring the radioelectric spectrum

A special case of great interest is the monitoring of the radioelectric spectrum that allows the detection of **new signals or nonauthorised**, as well as the verification of the **transmission quality** for all carriers. The measurement unit MU, alert right away of anyone of these assumptions on the basis of definable limits.



Radiolectric spectrum exploration in continuous mode

How it works?

- The system performs a spectrum reference sweep.

  (The type and origin of each one of the carriers is identified and stored in a Database as a spectrum-reference).

- Later, continuous spectrum sweeps are done.

  (The results of each one of these sweeps will be match with the reference one in order to generate alarms when anomalies are detected).

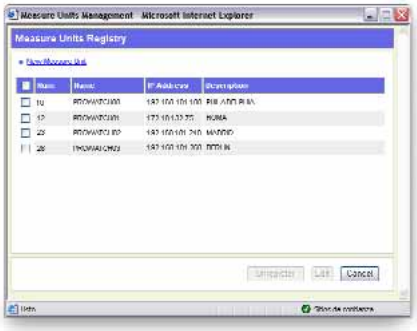
By means of the automatically comparison of sweeps of the electrical spectrum radio, the database of previously identified stations and the pre-established quality limits during the process, can yield to one of these events:

- A new carrier is detected.

  (If it is not identified in the reference sweep, the system generates an alarm).

- The level of one or several carriers fluctuates.

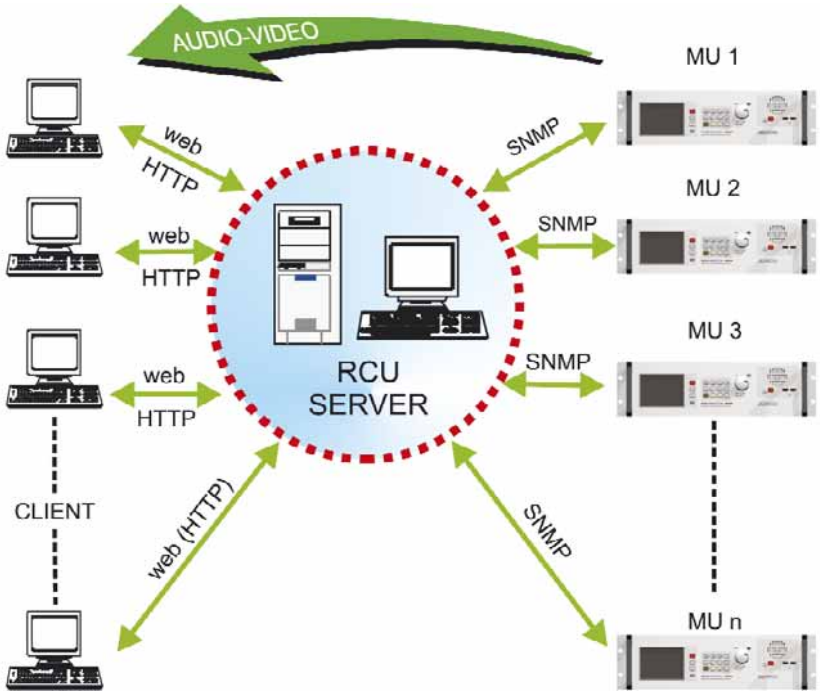
  The system registers the affected transmitter or transmitters and generates an alarm. The system can be set so that it sends warnings using the email.



Remote control

Several MU can be managed from the Remote Control unit even when are located thousand km far away by using the different protocols based on TCP/IP (SNMP, HTTP, MAIL (SMTP), FTP…).

In this graph, it is possible to observe the Measurement Units operating connected through a network by means of HTTP (Web) protocol between the client and RCU and SNMP between the RCU and the Measurement Unit that manage them and receive the required data.



The system **PROWATCH Deide3** allows to connect a GPS unit through a USB port, which uses NMEA protocol. This GPS unit is a part of the MU and reports accurate data to locate system application measurements. Thanks to the global positioning system included in the **PROWATCH Deide3** equipments, it is possible to know in real-time, and with a highest accuracy, in which geographic world point, is placed each one of the measurement equipments. This is a very interesting characteristic in those cases that are generated alarms.

The use of the **GPS** is optional in the **PROWATCH Deide3** system. When the application includes the control by GPS position, the operation can be activated or be deactivated, modifying the configuration of the system.

Spectrum Monitoring systems: PROWATCH Deide3

Measurement Units

The Measurement Unit is designed for 19 " rack assembling. It has built-in: the power supply general system, the measurement equipment, a processor based on an industrial PC and a device to digitalize and compress video and audio.

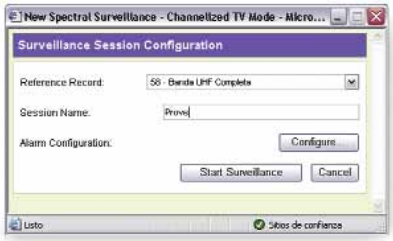
The processor has available several peripherals, which are necessary to the system control: hard disk, USB ports, Ethernet and serial port, keyboard adapter, and display and interface for the control of the specific hardware to capture audio and video.

The processor is based on an Embedded PC of high performance and very low consumption. This allows an easy use with portable units or those applications in which the equipment set must be powered through a battery system.

Monitoring Points

The Measurement Unit can be optionally used in local mode, adding to it a display and a keyboard. This possibility allows that the **ProWatch DEIDE3** system be deployed in portable units or monitoring points attended by technicians, facilitating the daily task of anomalies detection, and without discard the possibility of providing data to a centralised control system (RCU).

The number of Measurement Units, which can be managed by the **ProWatch DEIDE3** system, depends only on the network capacity and the application type executed in the RCU.



Customized application

The control application has several software modules on which the customized final application is made up. These basic modules determine the type of applications to be run.

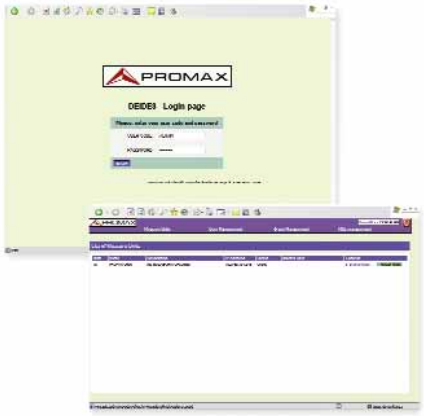
- Equipment measurement control module:

  It does available for the application all the remote control commands included in the **PROLINK-4** ***Premium*** measurement equipment.

- MySQL Database manager:

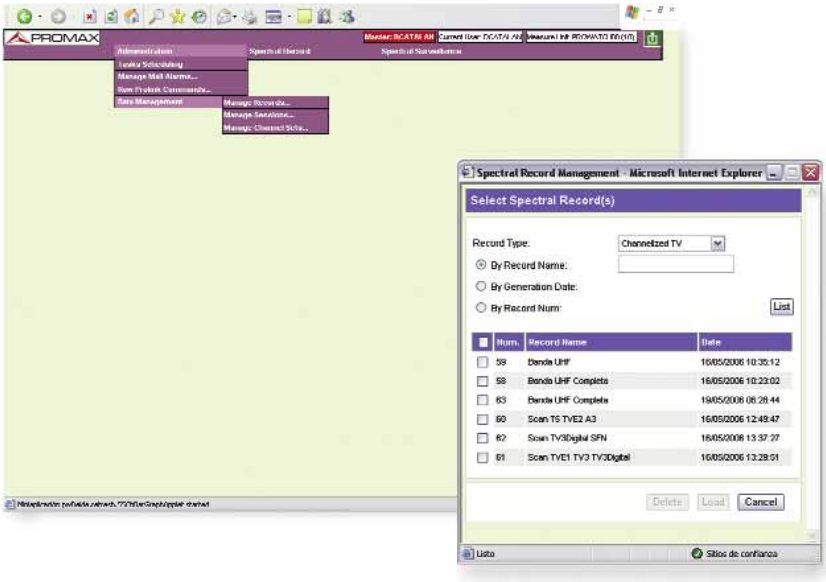
  It allows the remote access to the MU to be managed through basic functions: SETH, GET and TRAP. It is the base for the Measurement Unit remote control.

- HTTP web server: Provides the services required to manage the UM by means of a web browser.



- SNMP Agent: It allows the remote access to the MU to be managed through basic functions: SETH, GET and TRAP. It is the base for the Measurement Unit remote control.

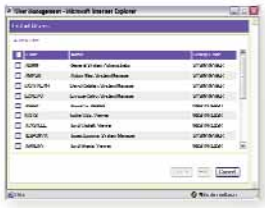
- MIB Files: Together with SNMP agent, they determine the MU remote control capacities. It has three basic files: The MIB of direct access to the database, a MIB of direct access to measurement equipment and a MIB to accede to the Autonomous Management Module generated in according to each application.



Spectrum Monitoring systems: PROWATCH Deide3

- Task scheduler module (CRON): It manages the accomplishment of the diverse tasks corresponding to programmed measurements and monitoring, in a single or periodically form.

- Secure Module (WATCHDOG): It provides the capacity to reinitiate the **PROWATCH Deide3** equipment Operating System periodically with the possibility of carrying out backups of data.



- Versions management: The system is able to download via FTP the update files in a remotely and automatically form.

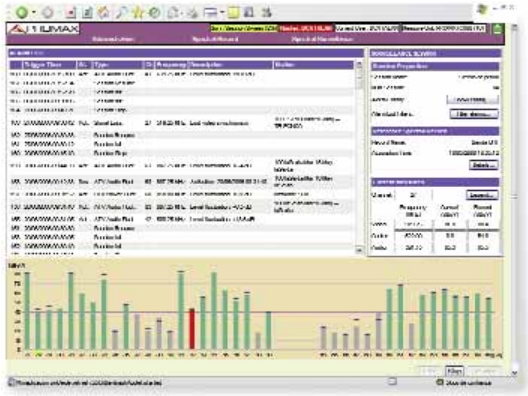
- MAIL manager module (SMTP): It provides the capacity to send electronic mail messages based on the detected alarms and set by the user.

- Users manager module: It allows to register the users login/logout, as well as to modify their priorities. The users can be grouped and be classified according to their responsibilities and system access level.

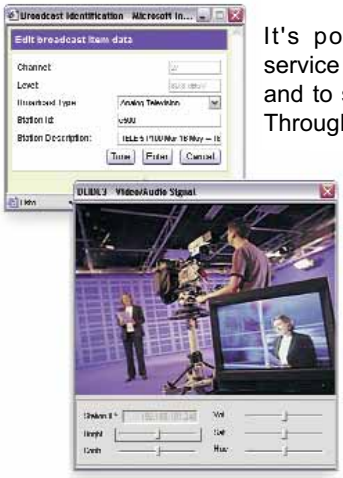
Identification of the carriers detected in the band

During the spectrum monitoring, at any moment it appears a spectrum representation or a graph representing the levels of all the carriers, according to the user preferences.

In the graph appears, followed by a color code, all band channels, including the busy channels and those that shows any problem (transmission nonidentified, reception low quality due to some problem, etc).



Selection, tuning and visualisation



It's possible to access to the service list from a digital multiplex and to select any desired channel. Through the display and the loudspeaker built-in you can watch and hear the aerial transmission.

The remote control mode allows transmissions of audio (VoIP) and video (Streaming Video) through the network for any channel under test as well as to supervise it from a control centre.

Network full supervision.

In order to use the **PROWATCH** equipment remote control mode it is necessary to have previously registered in a database all the control network equipments.

Each one of the equipments must have a unique address IP and a descriptive name to allow the connexion using the network

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