

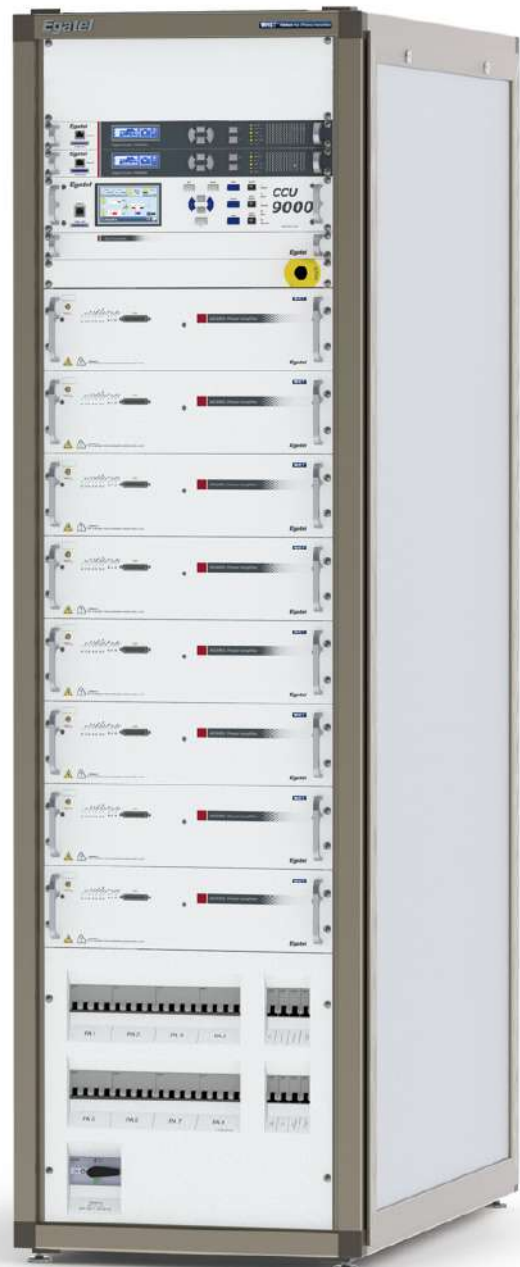
TLWH7800[®]

WHET[®] Wideband High Efficiency Transmitters

HIGH EFFICIENCY · ULTRA-WIDEBAND

UHF TV Transmitters
Liquid cooled

Maximum return
on investment



Egatel

TLWH7800[®] Series

New generation transmitters

The TLWH7800 transmitters series represents a step ahead in the technology of high power UHF liquid cooled transmitters. Provides the optimal solution to operators that want to deploy or extend a TV network globally.

They offer an efficiency up to 42%, providing broadcasters with a high economic benefit.

They are equipped with the most advanced technology in signal processing and wideband-high efficiency power amplifiers. They offer a power range from 1.7 KWrms to 12.5 KWrms for COFDM standards and from 2.5KWrms to 19.5KWrms for ATSC.

They feature a power-to-size and performance-to-reliability ratios that allow the signal broadcasting with the highest quality. Its compact and modular design as well as its high energy efficiency facilitate the installation and maintenance, thus significantly reducing the total expenditures over the life of the transmitter for the broadcast operator.

Table of models

TLWH7800 Series *	TLWH7802	TLWH7803	TLWH7804	TLWH7805	TLWH7808	TLWH7816
Power (before the filter) COFDM	1.7 KWrms	2.5 KWrms	3.3 KWrms	4.2 KWrms	6.5 KW	12.5 KWrms
Power (before the filter) ATSC	2.5 KWrms	3.7 KWrms	5 KWrms	6.2 KWrms	10 KW	19.5 KWrms
Number of amplifiers	2	3	4	5	8	16
Number of Racks	1	1	1	1	1	2
Output RF connector	EIA 1 5/8"	EIA 1 5/8"	EIA 1 5/8" or 3 1/8"	EIA 3 1/8"	EIA 3 1/8"	EIA 4 1/2"

(*) The models are referenced according to standard: TLWH78xx - DVB-T/H/T2, TLWH78xxB - ISDB-T/TB, TLWH78xxA - ATSC
Example: TLWH7808B - 6.5 KWrms ISDB-T/TB. Other configurations of output power and number of amplifiers, on request.

Benefits and key features

1. Leading efficiency wideband transmitters

- Doherty Technology
- Wideband advantages
- Economic benefit

2. Flexible configurations, compact design

- TE9000 Series Exciter
 - Advanced integrated features
 - QoS analyzer
 - Adaptive Digital Precorrection
 - Crest factor reduction
 - TSoIP inputs
- Control Unit CCU9000
- Power amplifier AWH801

3. Quick start-up and easy operation

- Instantaneous configuration via SD card
- Powerful Web Server to manage and monitor the transmitters

4. Optimum cooling system

- Efficient and reliable

5. Service and support

- Rigor and professionalism

Leading efficiency wideband transmitters



TLWH7800 Series
Model: TLWH7808

Doherty Technology

Transmitter's energy efficiency is a key factor for network operators by the time of selecting TV transmitters. The main reason is the energy cost, since after ten years of operation it can represent up to three times the initial investment.

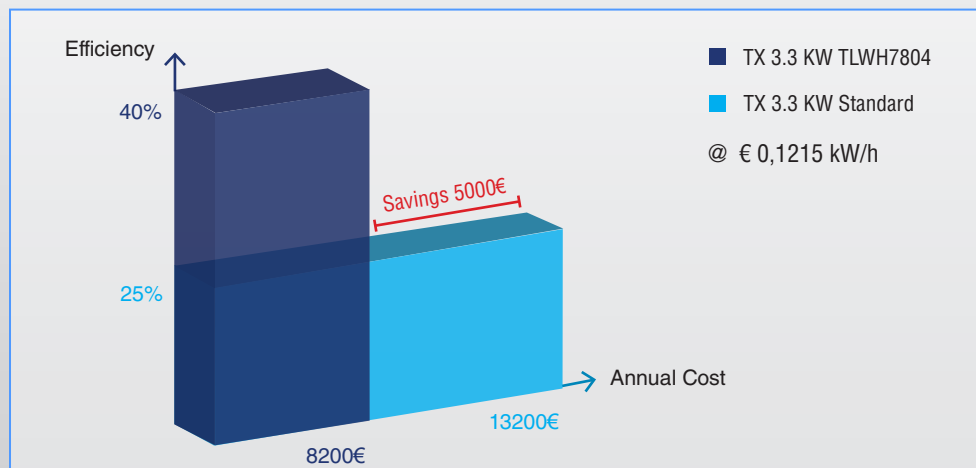
With the adoption of Doherty Technology in TV transmitters it was possible to boost energy efficiency values up to 42%, representing an improvement of almost 50% over traditional technology transmitters.

Furthermore, higher energy efficiency leads to an enhancement of other important aspects that also have an impact on the network cost. By dissipating less energy, the cooling system load is reduced and so the transmitter form factor. Thus, more amplifiers can be integrated in a single rack. In other words, more power in less space.

Despite all its advantages, classical Doherty topology has an inconvenient: It is an inherently narrowband technology. It involves that so far, the power amplifiers had to be precisely adjusted to work optimally in their RF channel. Therefore, when a channel change was requested, the network operator had to modify the power amplifiers or replace them with new ones. Obviously, this also greatly complicates the maintenance tasks, management and logistics of spare units.

Energy efficiency improving in wideband TV transmitters

The arising costs from electricity bill can be up to three times the equipment acquisition cost after ten years of operation.



Wideband advantages

The TLWH7800 series, equipped with wideband Doherty technology, overcomes the drawbacks of classical Doherty transmitters while keeping all the benefits. Thus definitively ends with trade-offs. You don't need to waste frequency agility to optimize energy efficiency.

TLWH7800 transmitters reach an energy efficiency of up to 38% for COFDM and 42% for ATSC waveforms. The efficiency is maintained throughout the UHF range, so no adjustment is required in the power amplifiers at the time of changing the RF channel of operation. Moreover, with the wideband technology there is only one reference for the power amplifiers, which drastically simplifies the management of spare parts.

An example that illustrates the benefits of wideband Doherty amplifiers is the N+1 configuration. With classic Doherty technology, each main transmitter must be perfectly adjusted to its transmission channel in order to get the maximum efficiency. On the other hand, the reserve transmitter must be able to replace any of the main transmitters.

Therefore, it can not work in Doherty mode and its energy efficiency is lower. As a consequence, the design of the power supply network of the entire system becomes more complex. Moreover, it is necessary to handle different types of power amplifiers, depending on they are for main or reserve transmitters.

Since all TLWH7800 transmitters comprising an N+1 system are identical, mains and reserve, the power consumption of the whole system is optimal and homogeneous. Furthermore, working with just a unique reference leads to reduction in the maintenance and logistics cost.

Economic benefit

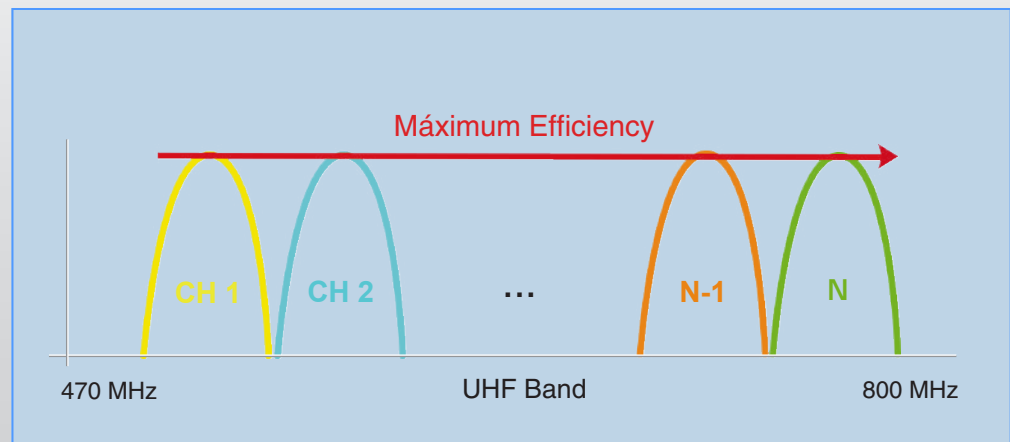
The high energy efficiency of the TLWH7800 transmitters provides an immediate economic benefit to operators. As an example, taking a transmitter of 3.3kW with a standard efficiency of 25% as the basis and considering the average price of industrial energy in Europe (0.1215€ / kWh), then the cost related to the annual consumption is approximately 13.200€

The same transmitter operating in high efficiency mode and featuring additional techniques for crest factor reduction may reach an efficiency of 40%. This means that in this new situation, the cost of the annual consumption of the transmitter is 8,200€. Therefore, the savings are approximately 5.000€ per year. What is more, as increasing the number of transmitters in the network and the higher is their output power, the highest economical saving.

We can conclude that network operators save money as soon as the TLWH7800 transmitters enter in operation.

Efficiency optimization throughout the UHF band

TLWH7800 Series transmitters as part of N +1 system, main and reserve, are identical. The associated cost with equipment replacement is reduced and simplified.



Flexible configurations and compact desing

The TLWH7800 series provides maximum versatility and flexibility. Customers can choose from a multitude of different configurations to get the one that best suits their needs.

The LDMOS-50 volts transistors technology, the optimum design of the amplifier stage and adaptation networks allow achieving excellent power density, allowing each amplifier to deliver an output power of 850W for COFDM (1300W for ATSC) in just three and a half height units. A single rack of 42U can accommodate 6.5kW (COFDM) transmitter (10kW for ATSC).

To adapt to the demands and the customer needs, the transmitters up to 4.2kW (COFDM) or 6.2kW (ATSC) can be supplied with integrated cooling system in the transmitter rack or in an external cabinet.

■ TE9000 Series Exciter

Advanced integrated features

The exciter is ready to work with the major international TV standards: DVB-T/H, DVB-T2, ISDB-T/TB, ATSC MH/SFN. They are equipped with advanced features to accelerate the start up, ease the operation and monitoring as well as to optimize the transmitted signal.

QoS analyzer (DVB-T and DVB-T2)

The TE9000E6 exciter integrates a HW demodulator to provide Shoulders, MER, BER and PER values. This feature allows to evaluate the quality of the signal in real time and to access this information remotely through the Web server or an SNMP client. Therefore, it saves unnecessary trips to unattended sites and the use of an external analyzer to check the output signal of the transmitter.

Adaptive Digital precorrection

The adaptive digital precorrection system enables the equalization of the signal easily and quickly. It can be activated manually, by a programmed trigger or it can run continuously and adaptively. The processing power of the precorrector allows to achieve unbeatable Shoulders and MER values, ensuring the highest quality in the transmitted signal.

TE9000 Series Exciter

It integrates a HW demodulator to provide Shoulders, MER, BER and PER values



Crest factor reduction

The TE9000E6 exciter offers for all OFDM standards the advantage of crest factor reduction implemented by a proprietary technology, that allows without any negative impact on MER, to reduce the signal crest factor enhancing the transmitter efficiency.

TSolP inputs

The exciter has an integrated Transport Stream over IP receiver able to manage two ASI streams over a Gigabit Ethernet bus. The switching between the two inputs is fully automatic and Seamless. Thus, operators get both economic and space savings avoiding the installation of an external receiver.

CCU9000 Control Unit

All of the components of the transmitter have been designed following a policy of design focused on ensuring an always-on-the-air TV service. The transmitters have multiple options of redundancy, such as N + 1 or Dual-Drive systems, and several power modules for power amplifiers, all with the aim of ensuring the availability of the TV service.

CCU9000 Control Unit

It manages and monitors the operation of the entire transmission chain, switching between exciters / amplifiers / transmitters manually or automatically



The CCU9000 Control Unit can control and monitor Egatel transmitters as well as transmitters from other manufacturers. With a footprint of only two units, it manages and monitors the operation of the entire transmission chain, switching between exciters / amplifiers / transmitters manually or automatically, as needed. It includes a high resolution TFT graphical display to check at a glance the transmitter status.

The CCU9000 monitors and controls the liquid cooling system. The main window of either Control Unit or the Web Server shows a graphical representation of the refrigeration unit and all information related to its operation.

One or more authorized users may monitor and manage the transmitters remotely using a powerful Web Graphical user Interface or an SNMP agent.

AWH801 Power amplifier

The design of power amplifiers of the TLWH7800 transmitters family is based on LDMOS 50-volt transistors technology. They provide a compact design, high efficiency and excellent linearity, getting high energy savings. To increase the efficiency offered by Broadband Doherty configuration, the supply voltage of the transistors can be adjusted through control unit increasing the efficiency for all digital standards. This mechanism considerably boosts efficiency when working at reduced power.

The amplifiers are self-protected by having circuits that control the input level, output power and other critical parameters such as the temperature of the amplifier or the reflected power. The protection system automatically lowers the output power of the amplifier any time the default threshold is exceeded, preventing an amplifier damage. Those parameters, along with the values of consumption of the transistors as well as the generated alarms are sent through a data bus to both the exciter and the Control Unit, where they can be checked at any time through the display, making the monitoring and maintenance tasks easier.

They have a redundant power supply system composed by three power supplies, so that the fault of one does not suppose any output power reduction.

The heat generated is conducted through the liquid cooling system to a heat exchanger which can be located both outside and inside the cabinet where the transmitter is installed.

AWH801 Amplifier

It has circuits that control critical parameters such as the temperature of the amplifier or the reflected power



Quick start-up and easy operation

■ Instantaneous configuration via SD card

Both the exciter as the control unit include an SD card to store the whole configuration of the transmitter, so the start up of a new transmitter or the configuration of a spare unit is done in seconds. It is also particularly useful to put in operation N+1 systems quickly.

■ Powerful Web Server to manage and monitor the transmitters

The flexibility and versatility present in the design of all modules is revealed once again allowing the transmitters to be fully managed remotely.

For this purpose, besides the SNMP protocol, the exciter integrates the most powerful and friendly Web Server on the market. The Graphical User Interface (GUI) divides the screen into two parts. All the blocks that make up the transmitter chain are shown in the upper half. A simple color coding is used to check instantly the status of individual blocks. To read or modify any parameter, just click and drag the corresponding block to drop it in the bottom of the screen, where the parameters of up to to three different blocks can be displayed. The GUI has been designed to never lose sight of the transmitter status.

The screenshot displays the Egatel Exciter Web GUI for a TE9000E6 unit. The interface is divided into several sections:

- Header:** Includes navigation tabs (Home, System, Users, Close session), unit ID (TE9000E6 [EXCITER]), date/time (30/10 10:34), and the Egatel logo.
- Exciter Status:** Shows 'TX ON INTERLOCK' and key metrics: Output frequency (650.000.000 Hz), Forward power (1.7 kW), and Reflected power (0 W).
- Block Diagram:** A central flow diagram showing the transmitter chain:
 - RECEPTION:** Includes AS11, AS12, TSxIP1, TSxIP2, and TEST INPUT.
 - MODULATION:** Contains a Coder and OFDM block.
 - PRECORRECTION:** Features Linear and Non-Linear blocks, with an Adaptive block below.
 - RF:** Shows the Exciter RF Output and Transmitter stage control.
 - AMPLIFIER STAGE:** Displays '2 x AWH801' and Amplifier stage control.
- Configuration Panels:**
 - Reference:** Settings for Reference mode (10 MHz) set to AUTO, Ref. Impedance (10MHz) set to HIGH, No reference Mute Time (s) set to 1, PPS Active Edge set to RISE, PPS Impedance set to HIGH, and PPS Trigger Level (Volts) set to 27.
 - RF Output:** Shows Output Frequency (650.000.000) and Pout Exciter attenuation (dB) set to 5.0. A Measures section shows Exciter Output Power (dBm) set to 5.
 - Transmitter stage control:** Includes ON/OFF Transmitter (ON), Transmitter nominal Power (W) set to 1700, and VREF Transmitter (Volts) (0W) set to 4.0 with Up/Down buttons.
- Footer:** Includes 'Remove' and 'Assign' buttons.

Exciter Web GUI

Optimum cooling system

The transmitters of TLWH7800 series are equipped with a liquid cooling system that allows heat to go over great distances with less volumetric flow and difference temperature than traditional air cooling systems. Thereby dissipating heat efficiently and noiseless.



TLWH7804 with internal cooling

■ Efficient and reliable

Optionally, the cooling system can be accommodated inside the transmitter rack to ease the installation in confined spaces.

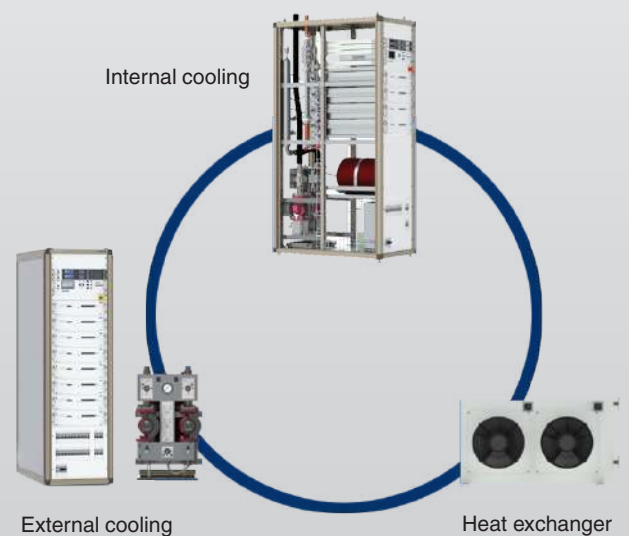
The cooling system consists of a pumping unit including two series-connected pumps and a heat exchanger that can be located in both outside and inside the transmitter room.

To increase performance and reliability two fans of *Electronically Commutated* type (EC) are incorporated in the heat exchanger. In normal operating conditions, they work simultaneously and at a low rpm.

A dedicated control system manages and monitors the operation of the two series connected pumps and the fans of the heat exchanger as well. It also controls the speed of pumps and the revolution of fans, depending on the temperature of the fluid to improve the overall energy efficiency.

Cooling system options

The cooling system can be external or accommodated inside the transmitter rack to ease the installation in confined spaces



Service and support

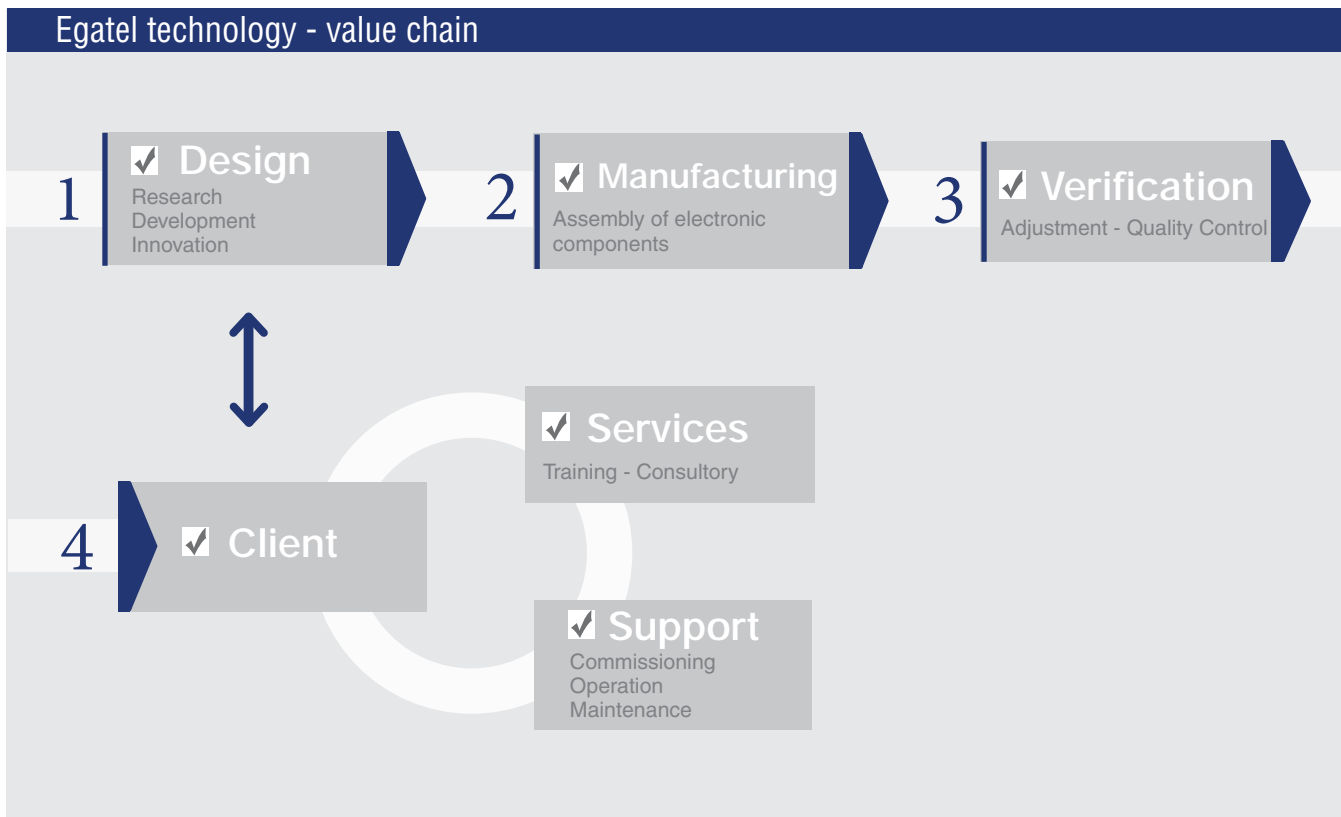
■ Rigor and professionalism

All processes that add value from the design stage to the manufacturing of the transmitters are carried out in-house. The company owns dedicated facilities for the mount of electronic components with several production lines equipped with the most advanced machines on the market. Therefore, the quality control throughout the production process is kept at Egatel, reaching the maximum reliability.

The international recognition achieved by the company is due not only to the supply of high technology products, but also to the wide range of services offered. They go a step beyond, with dedicated staff to provide full assistance during commissioning and normal operation or to offer qualified training, adding value and completing the process that begins when a customer trust in Egatel.

Each project is undertaken with the maximum level of commitment, accomplishing the delivery times and adapting to the demands of each customer, being aware of the importance of a professional attitude in their loyalty.

Egatel is integrated in Comsa-Emte, which is one of the biggest industrial groups in Spain within the sectors of infrastructure and technology. The group has a strong activity all around the five continents and it is established in 18 countries. The customers benefit from this wide international presence and the stability provided by a multinational company, guaranteeing local support and the purchase of Egatel equipment as a safe investment.



Technical specifications

Exciter	
DVB-T/H/T2	
Standard	EN300744, EN302304, EN302755, TS 102831, TS 102 773 (T2-MI)
Inputs	2xASI BNC (H), 75 ohm / TSolP 10/100/1000 RJ45.
FFT size	1K (DVB-T2), 2K, 4K, 8K, 16K (DVB-T2), 32K (DVB-T2)
Code rate	1/2, 2/3, 3/4, 5/6, 3/5 (DVB-T2), 4/5 (DVB-T2)
Guard interval	1/32, 1/16, 1/8, 1/4, 19/256 (DVB-T2), 19/128 (DVB-T2), 1/128 (DVB-T2)
Constellation	QPSK, 16QAM, 64QAM, 256QAM (DVB-T2). Rotated and no rotated (DVB-T2)
ATSC	
Standard	ATSC A/53, A/54, A/64, A/153, A/110B, A/110: 2011, SMPTE-310M
Inputs	2xSMPTE BNC (F), 75 ohm - 2xASI BNC (F), 75 ohm
Constellation	8VSB
Symbol rate	10.76 Msymbols/s
Data rate	19.39 Mbits/s
Trellis coding	2/3
Reed-Solomon encoder	207 / 187 / 10
ISDB -T/Tb	
Standard	ARIB STB-B31, TR-B14
Inputs	2xASI BNC (F), 75 ohm
FFT size	2K, 4K, 8K
Code rate	1/2, 2/3, 3/4, 5/6, 7/8
Guard interval	1/4, 1/8, 1/16, 1/32
Carrier spacing	4 KHz, 2 KHz, 1 KHz
Hierarchical modulation	Up to 3 layers
Constellation	QPSK, 16QAM, 64QAM, DQPSK
Clock and synchronization	
Internal clock	10 MHz
External reference	10 MHz BNC (H). Impedance = 50 ohm / high (configurable). Level = -5 a +10 dBm
1pps reference	BNC (H). Impedance = 50 ohm / high (configurable)
SFN	Resolution SFN = ± 100 ns. SFN configurable delay = ± 500 ms
Local and remote control	
Display	Local operation through the display and keyboard located on the front panel
RJ-45	Interface Ethernet network management for local and remote operation via SNMP agent and / or Web Browser
Parallel interface	Floating contacts for messages and commands
General	
Frequency range	UHF: 470 - 800 MHz (resolution: 1Hz)
Channel bandwidth	6, 7, 8 MHz plus de 1.7, 5 and 10 MHz for DVB-T2 ISDB-T/Tb , ATSC: 6 MHz
Cooling	Liquid - cooled
Power supply	Three-phase: 400VAC +/- 15%, 47 a 63Hz
Max. installation altitude	Up to 3000 m (> 3000 m on request)

Remark: To comply with the out-of-band regulations and with the required shoulder attenuation, the RF output of the transmitters must be connected to an appropriate filter.



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