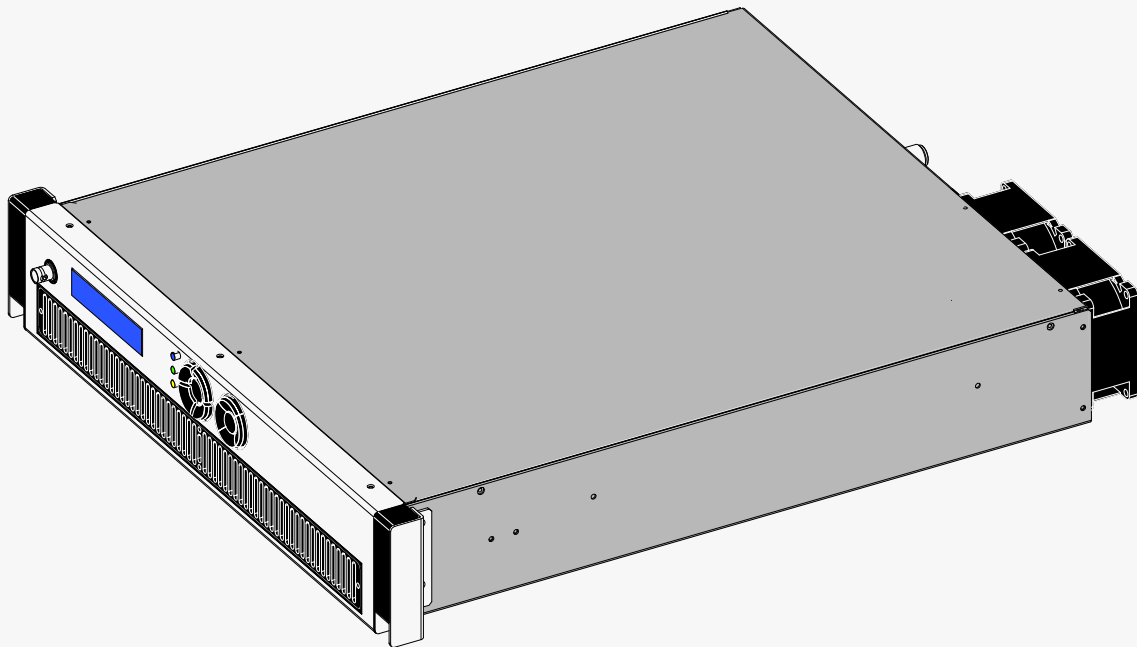


IEC **LINE**

COMPACT TRANSMITTERS



VHF/UHF



air cooled

2HE

Itelco recently renewed its range of compact solid state transmitters for broadcasting market, both in VHF and in UHF frequencies.

The compact transmitter line (IEC), that perfectly meets low power solution requirements, is capable of delivering up to 200Wps both for ATV and DTV (280Wavg ATSC).

The core of IEC is represented by a new modulator card that implements all the modulation, control and supervision functions.

All operations necessary for the generation of a high quality RF signal, in accordance with all analog television standards (ATV) B/G/D/K/M/N (including NICAM) and digital television standards (DTV) DVB-T/H, ATSC, ATSC 3.0, DVB-T2, ISDB-Tb, are completely performed by a Real Time Digital Signal Processing using a FPGA. By loading two different firmware in the memory card, the modulator can operate as Dual Cast, with the possibility to switch from analog to digital transmission with a simple command (local or remote).

In addition to the standard ATV and DTV inputs, when the exciter operates in one of the DTV modes, a Giga Bit Ethernet (GbE) port, able to receive up to four MPEG-2 Transport Streams, can be integrated. The exciter can be equipped with a RF receiver with two available inputs to implement the adaptive pre-correction and the transmitter output power measurement (power meter).

The modulator card includes also an input for the measurement of the reflected power.

The baseband digital I/Q signal generated by the FPGA is directly converted to RF (bands I, II, III, IV and V) by means of a RF DAC. In DTV mode, a pre-equalization function (to compensate for linear distortions of the output filter) and a predistortion function (to compensate for non linear distortions of the high power amplifier) are available, both using fully automatic adaptive algorithms.

The unit is equipped with an internal 10 MHz reference that can be locked to an external one. In case of external reference loss, the system keeps on generating the internal reference maintaining the accuracy of the external one without discontinuity.

Its compactness, modularity and redundancy have been applied to the design of the transmitter as well as of the cooling system. IEC transmitter line is characterized by:

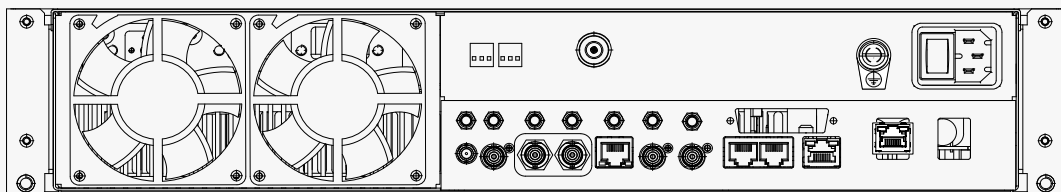
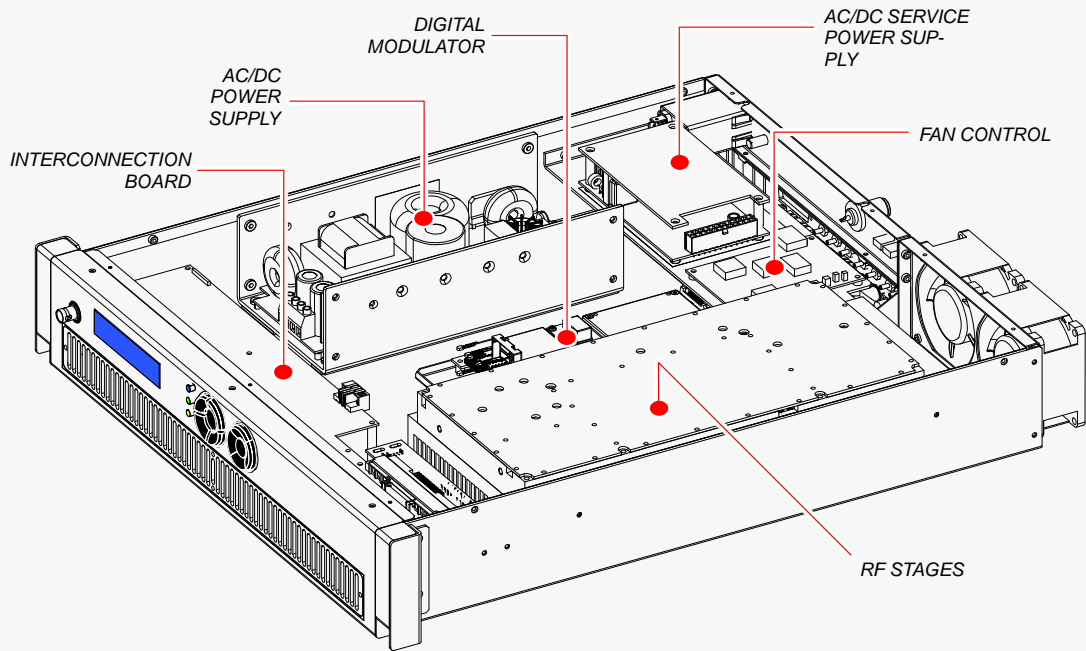
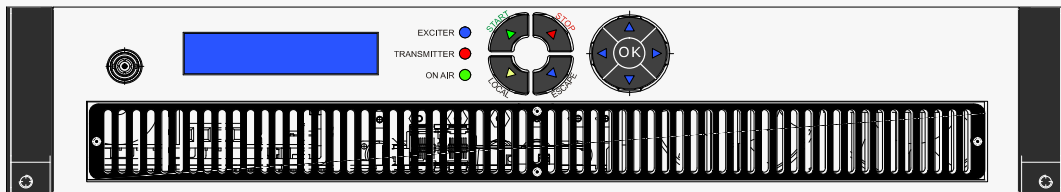
A software routine estimates the frequency and time drift allowing the RF muting when these drifts overcome a settable threshold. When the external reference returns, a software procedure assures a soft re-lock without discontinuity. An internal GPS receiver is available to provide a high accuracy frequency reference and to allow IEC operation in a Single Frequency Network (SFN).

The control and supervision of the exciter are guaranteed locally with graphical display and keyboard, remotely through SNMP (v1/v2c/v3) and Web Server on Ethernet interface. All parameters available on the display can be accessed remotely. The remote control and supervision are possible by means of Web browser displaying HTML pages (independent from platform). HTML pages can use SSL encryption techniques on HTTPS connections. SMTP is used for events notification (such as SNMP TRAP) to five different destination addresses. The NTP protocol provides synchronization of the internal RTC (Real Time Clock) with one or more NTP servers. The unit is regulated by three access levels that determine the action possibilities based on the user level:

- Administrator: full control;
 - Operator: operative settings;
 - Observer: exciter check and some simple settings.
- All IEC firmware are upgradable via Ethernet port (also remotely).

MAIN FEATURES

- **Multi-Standard operation** (DVB-T/H/T2, ATSC, ATSC 3.0, ISDB-T/Tb, Analog)
- **Dual-Cast** operation (*optional*)
- **IEC** (digital modulator)
- **Fully broadband** on UHF frequencies
- **Low power consumption**
- **Doherty technology** (*optional*)
- **Extremely compact** design
- **Easy installation** and maintenance
- **Modular** design
- **Latest LDMOS** technology for RF stages
- **Adaptive pre-correction**
- **2 ASI** inputs
- **2 GbE** available inputs (*optional*)
- **Video input** 2 BNC connect. (for analog)
- **Audio input** 2 XLR connect. (for analog)
- **SNMP version 2 / Web Server** remote control
- **CAN-bus** internal communication
- **Internal GPS** for SFN operation (*optional*)
- **Remote** software/firmware upgrade
- **USB port** for HPA section
- **High efficiency** air cooling system
- **Seamless inputs** between ASI and/or IP (with priority) all combinations in SFN

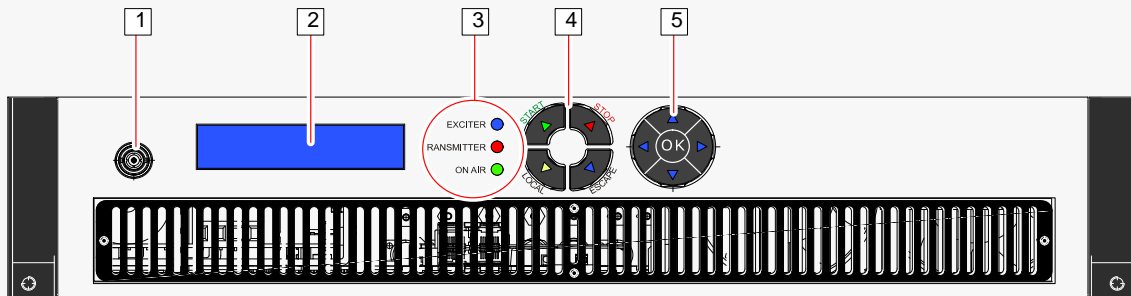




SPECIFICATIONS

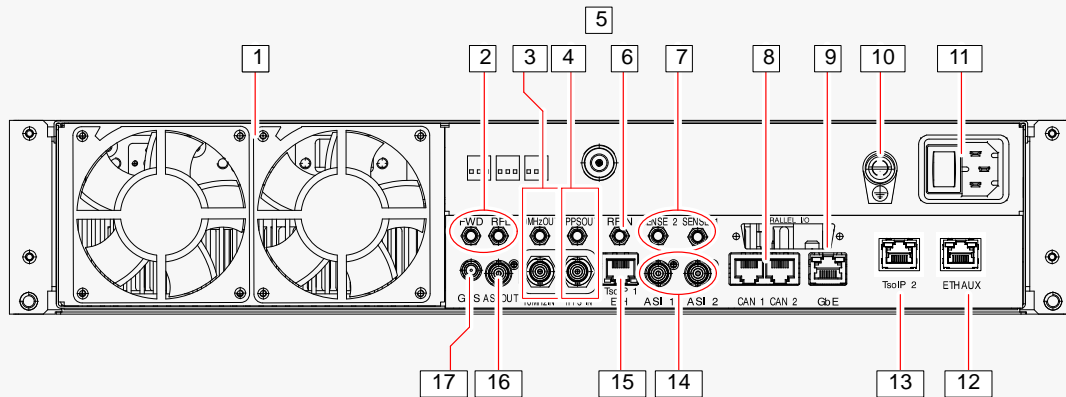
GENERAL/ENVIRONMENTAL CONDITIONS	
Operation temperature range	0°C to +55°C
Storage temperature range	-55°C to +70°C
Relative humidity	0% to 95% (non condensing) at 45C
Altitude a.s.l.	up to 3000 m
Ambient air pressure:	65kPa to 105kPa
Safety	EN 60215 / EN 60950
EMC	EN 301489
AC REQUIREMENTS	
AC supply (Feller connector)	90 to 264V ~ 90 to 253V for EC countries
Frequency	50/60Hz
Power factor	> 0.95
Efficiency (COFDM)	VHF: up to 25% class AB / 30% Doherty UHF: up to 20% class AB / 26% Doherty
MECHANICAL	
Frame:	standard 19" – 2HE
Overall Dimensions (wxhxd) (mm):	483x88x565
Weight (kg):	13
DISPLAYED STATUS	
	Listed in "Exciter Status" menu
PROTECTION CIRCUITS	
	Software based
RF	
Frequency range	174–254MHz (VHF/BIII) 470–862MHz (UHF/BIV–V) cl. "AB" 470–800MHz (UHF/BIV–V) Doherty
Frequency step	1 Hz
RF Output	
Connector	N female
Impedance	50Ω
Return Loss	> 16 dB
Spectrum polarity	selectable inverted/non-inverted
Nominal output power	250 Wp.s. ATV up to 200 W _{avg} DTV
Adjustable to nominal level	-7 to +1 dB
Stability at nominal level	± 0.25 dB
PAPR reduction	
Spurious Emissions	< -60 dBc (< -70 dBc with filter)
Harmonic Emissions	< -60 dBc (< -70 dBc with filter)
Amplitude flatness	< ± 0.25dB
10MHz Reference Input	
Connector	BNC female
Impedance	50Ω
Return Loss	> 20 dB
Output	1V ± 0.2 Vpp
Rise time	3 – 10 ns
Internal Reference Accuracy	± 1 · 10 ⁻⁸ (0 to 70°C) ± 5 · 10 ⁻¹⁰ per day (after 30 day) ± 1 · 10 ⁻⁷ per year
ASI INPUTS	
Connectors	2; BNC female/75 Ω, DVB ASI, TS 188/204 packets, continuous and burst mode
Input packet framing	188
Maximum input bit rate	50 Mbps


IP INPUTS	
Data Interface	10/100/1000bT
Protocols	UDP/RTP, SMPTE 2022, IGMP v2/v3
Connectors	2; RJ45
REMOTE INTERFACES	
Ethernet protocol	HTTP, NTP, SNMP, SSL
CAN Bus	for transmitter control system
GPS CHARACTERISTICS	
Connector	SMA
Frequency	1.575 Ghz (GPS) 1.602–1.603 Ghz (GLONASS)
Antenna Gain Range	0 – +32 dB
Antenna	passive or active (<i>not included</i>)
Antenna DC supply	OFF, 3V _{dc} or 5 V _{dc} ($\pm 0.5V$) selectable
Antenna DC current	50 mA max
Reference Accuracy	$\pm 1 \cdot 10^{-12}$
DIGITAL GENERAL DATA	
Shoulder	> 38 dB
MER	> 35 dB (DAB > 30 dB)
Carrier Suppression	> 30dB (typical > 35 dB)
Amplitude imbalance	< 0.1%
Quadrature error	< 0.1°
Quadrature error per carrier	–
Modulator processing delay	up to 250 ms depending on the operating mode
Crest factor	from 8.5 to 9 dB
DVB-T/H CHARACTERISTICS	
Input Bit Rate	according to ETS 30 744 in SFN Bit rate adaptation and PCR restamping in MFN
Standard	Fully compliant with EN 300 744, TS 101 191
IFFT	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
Interleaver	Native, in-depth
Constellation	QPSK, 16QAM, 64QAM
Hierarchical (alpha)	1, 2, 4
Network operation	MFN, SFN
Bandwidth	5, 6, 7, 8 MHz
DVB-T2 CHARACTERISTICS	
Inputs	2 BNC 75 Ω , DVB ASI, TS/T2-MI, 188/204 packets, continuous and burst mode, 2 RJ45 GbE
PLP Mode	A/B
T2 profile	Main and Lite, FEF support
PLP ISSY	ON/OFF
Standard	EN 302 755, TS 102 773; TR101 290, TS 102 831
Channel Bandwidth	1.7/5/6/7/8 MHz
PLP Management	1/8
PLP Constellation	QPSK, 16QAM, 64QAM, 256QAM
L1 Post Constellation	BPSK, QPSK, 16QAM, 64QAM
Constellation Rotation	Normal, Rotate
Guard Interval	1/128, 1/32, 1/16, 19/256, 1/8, 19/128, 1/4
FFT mode	1k, 2k, 4k, 8k, 16k, 32k (normal and extended)
Code rate	1/2, 3/5, 2/3, 3/4, 4/5, 5/6
FEC	Short (16k), Normal (64k)
Pilot pattern	from PP1 to PP8
Network type	MFN and SFN (relative timestamp), MISO/SISO

ISDB-T/Tb CHARACTERISTICS	
Guard Interval	1/32, 1/16, 1/8, 1/4
Modes	QPSK, 16QAM, 64QAM
ISDB-T TRX modes	Mode 1, Mode 2, Mode 3
Time Interleaving	supported
Frequency Interleaving	Intersegment/intrasegment
Selectable inner code rates	1/2, 2/3, 3/4, 5/6, 7/8
Hierarchical transmission	up to 3 levels
Network models	MFN, SFN
Test Modes	Single Carrier, PRBS
Input Data Format	3 ASI, 1 GbE
ATSC CHARACTERISTICS	
Input mode	ASI or SMPTE-310, selectable
Standard supported	A/153 (ATSC MH) – A/110:B and A/110:2011 (ATSC SFN)
ATSC 3.0 CHARACTERISTICS	
Input mode	Ethernet RJ45 (IP Gigabit)
System bandwidth	6 MHz, 7 MHz, 8 MHz
Multiple PLP	64 PLP
PLP modulation	QPSK, 16QAM, 64QAM, 256QAM, 1024QAM, 4096QAM
PLP LDPC code rate	2/15, 3/15, 4/15, 5/15, 6/15, 7/15, 8/15, 9/15, 10/15, 11/15, 12/15, 13/15,
FFT Size	8K, 16K, 32K
Guard intervals (samples)	192, 384, 512, 768, 1024, 1536, 2048, 2432, 3072, 3648, 4096, 4864
Pilot pattern	SP3_2, SP3_4, SP4_4, SP6_2, SP6_4, SP8_2, SP8_4, SP12_2, SP12_4, SP16_2, SP16_4, SP24_2, SP24_4, SP32_2, SP32_4
Signalling FEC Type	Modes 1 to 7 for L-Basic and L1-Detail
Network modes	MFN & SFN
ANALOG TV SPECIFICATIONS	
Tv Standards	B/G/D/K/K1/M/N
Colour Systems	PAL, NTSC, SECAM
Video Input Interfaces	2 BNC 75Ω, 1Vpp ± 6 dB. Manual Gain or AGC on ITS line, DC Restore, White Limiter (85–95%), Sync Restore (20–30%)
Audio Input Interfaces	2 XLR 600Ω/5 KΩ, balanced/unbalanced, 0 dBm–6 dB +21 dB. In wideband mode input 2 works up to 120 KHz (MPX).
Additional Audio Input Interfaces	1 BNC 50Ω/5KΩ for MPX (up to 120 KHz) and 1 BNC 50Ω for auxiliary services for standard M
NICAM audio interfaces	2 XLR 600Ω/5 KΩ, balanced/unbalanced, 0 dBm ± 10 dB
NICAM data interfaces	1 BNC TTL 728 Kbit/s external data, 1 BNC TTL 728 KHz external clock



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|---|---|--|
| 1 | RF MON | Connector (BNC; female) for monitoring the RF output signal (level labelled below). |
| 2 | | High contrast LCD display (blue–white with bright backlight). |
| 3 | EXCITER | <p>Led indicator (RED/BLUE); indicates IEC status according to the colours, as follows:</p> <ul style="list-style-type: none"> ▪ BLUE the exciter works correctly (RF ON); ▪ RED/BLUE . . . a warning condition of the exciter; ▪ RED a fault condition of the exciter; ▪ OFF the exciter is in STOP condition (RF OFF) and no warning condition is present; |
| | TRANSMITTER | <p>Led indicator (RED/BLUE); according to the colour, it shows the RF output status, as follows:</p> <ul style="list-style-type: none"> ▪ BLUE the unit is delivering the rated RF output power; ▪ RED/BLUE . . . a warning condition of the unit; ▪ RED a fault condition of the unit or “Low Power Out”; ▪ OFF the unit is in STOP condition. |
| | ON AIR | <p>This indicator is active only when IEC operates in “N+1” system configuration and shows that the unit is on air.</p> <p> The “exciter” and” transmitter” LEDs blink blue alternately at the switching–on. The blinking lasts about 1 minute and 20 seconds (40 sec for loading the software + 40 sec for the warm–up). During this time interval all alarms are inhibited.</p> |
| 4 |  | <p>Keyboard. It allows starting/stopping the unit and setting local/remote operating mode.</p> <p>ESCAPE key allows quitting from current menu.</p> |
| 5 |  | <p>Controller keyboard. It allows accessing the menu (listed on right–hand side of the display) and setting the functioning parameters of the unit.</p> <p>Accessing the menu and setting of the parameter is as follows:</p> <ul style="list-style-type: none"> – “◀” and “▶” arrows select the menus (shown between < and > symbols); once accessed the menu, they select the digit to be changed. – “▲” and “▼” arrows allow scrolling the parameters of each menu. – “OK” key is used to set the selected parameter and to enter the setting carried out. A confirmation is requested at the end of the operation, pushing “▲” arrow. |



1		Extractor fans of the exhaust air. The two fans have different characteristics (performances) because the left one cools the RF section while the right one cools the modulator and the power section.
2	FWD	Connector (SMA female; 50Ω/0dBm; +3/-7dBm); input connector of the forward power signal outgoing from an external directional coupler (<i>before filter</i> , for relevant measurement displayed on the front panel display).
	RFL	Connector (SMA female; 50Ω/0dBm; +3/-7dBm); input connector of the reflected power signal outgoing from an external directional coupler (for relevant measurement displayed on the front panel display)
3	10MHz OUT	Connectors (SMA female); output of 10MHz reference signal.
	10MHz IN	Connector (BNC female); input of 10MHz reference signal.
4	1PPS OUT	Connectors (SMA female); output of 1PPS reference signal.
	1PPS IN	Connector (BNC female); input of 1PPS reference signal.
5	RF OUT	Connector (N female); RF signal output of IEC.
6		<i>NOT USED</i>
7	SENSE 1/SENSE 2	<i>NOT USED</i>
8	CAN1/CAN2	Connectors (RJ-45); allow the connection to a Controller Area Network serial bus.
9	GbE	Connector (RJ-45); it can be used for <i>ethernet</i> control and monitoring over TCP/IP.
10		Grounding screw of unit frame.
11		Line socket with the associated mains breaker.
12	ETH Aux	Connector (RJ-45); it allows <i>ethernet</i> control and monitoring over TCP/IP of the <i>modulator</i> .
13	ETH/TSolP 2	Connector (RJ-45); TSolP 2 input. It also can be used for <i>ethernet</i> control and monitoring over TCP/IP.
14	ASI1/2	Connectors (BNC female); DVB serial type MPEG2 Transport Stream inputs.
15	TSolP 1/ETH	Connector (RJ-45); it allows <i>ethernet</i> control and monitoring over TCP/IP of the <i>modulator</i> and TSolP 1 input
16	ASI OUT	<i>NOT USED</i>
17	GPS	Connectors (SMA female);input of the signal from GPS.

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