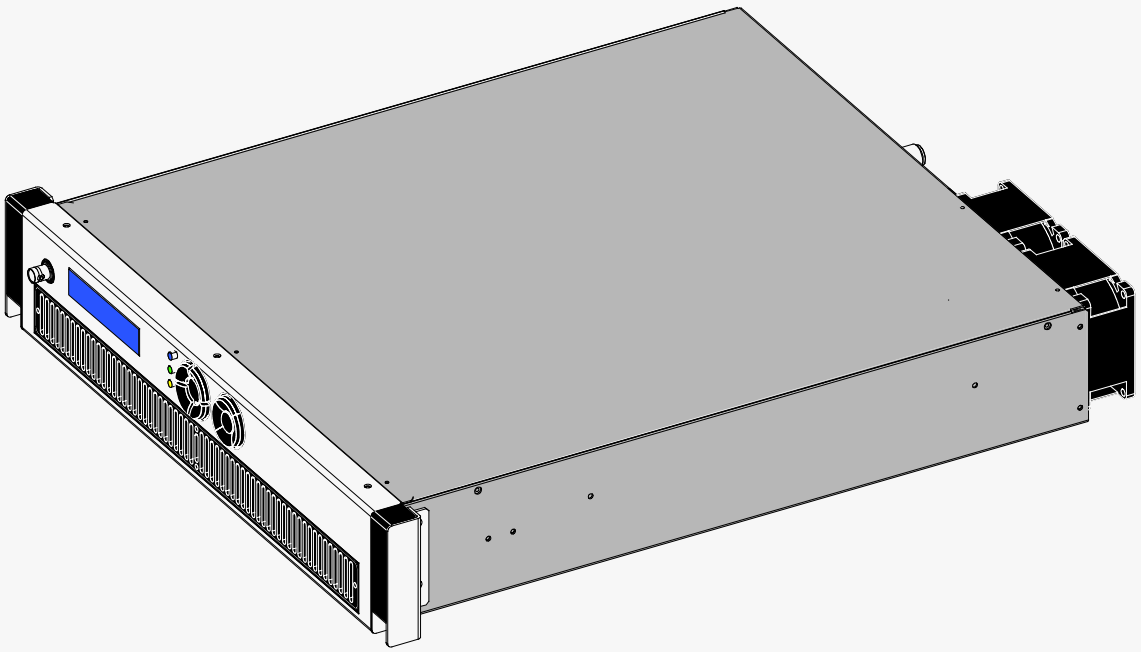
IEC LINE

COMPACT TRANSMITTERS



VHF/UHF **air cooled** 2HE

Itelco recently updateded its range of compact solid UHF and VHF transmitters.

The compact IEC transmitter line of 50-100-200-250 and 300W models, are perfect for LPTV applications, and are capable of delivering up to 400W ps ATV / 250W avg DTV and (300Wavg DAB) in VHF B. III; according to the models.

At the earth of the IEC design is a new multi-standard modulator card that includes all the modulation, control and supervision.

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, DVB-T2, ATSC, ATSC 3.0, 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, is able to receive up to four MPEG-2 Transport Streams. *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.*

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 linear distortions of the output filter) and a predistortion function (to compensate 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 maintainis the accuracy of the external one without discontinuity.*

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

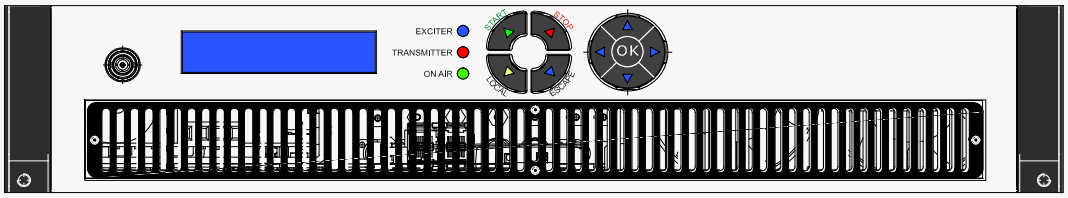
The control and supervision of the exciter are monitored and controlled via graphical display and keyboard, remotely through SNMP (v1/v2c/v3) and via a detailed and advanced Web Server. All parameters available on the display can be accessed remotely. *The remote control and supervision are possible by means of Web browser displaying HTML pages and 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 (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:*

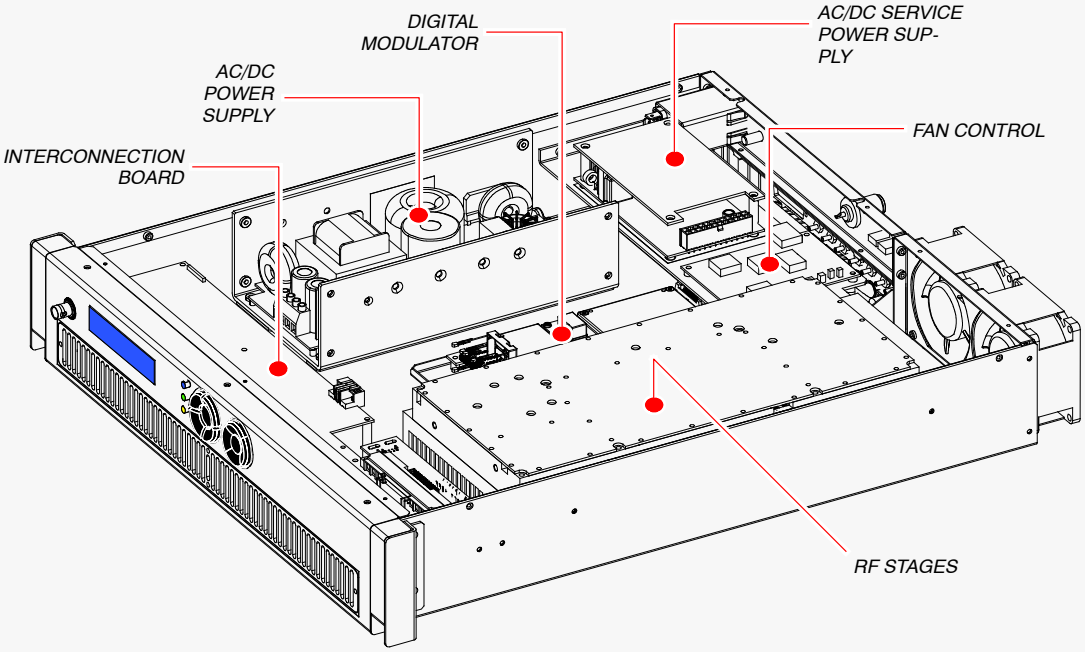
- *Administrator: full control;*
- *Operator: operative settings;*
- *Observer: exciter check and some simple settings.*

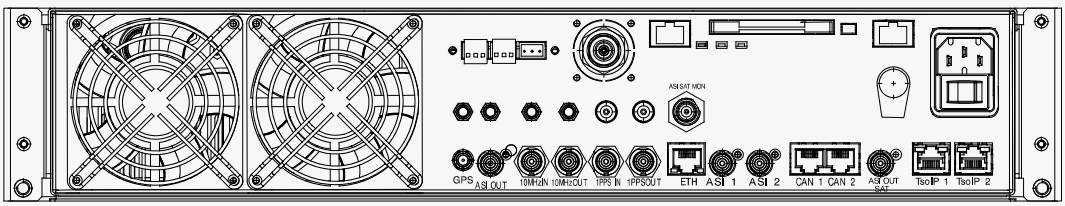
All IEC firmware are upgradable via Ethernet port (also remotely).

MAIN FEATURES

- **Multi-Standard operation** (DVB-T/H/T2, ATSC, ATSC 3.0, ISDB-T/Tb, Analog, DAB+)
- **Dual-Cast** operation (*optional*)
- **IEC** (digital modulator)
- **Fully broadband** on UHF (up to 690Mhz)
- **Low power consumption**
- **Doherty technology**
- **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
- **RX SAT with CAM Board** (option)


EXCITER
TRANSMITTER
ON AIR
START
STOP
OK


DIGITAL MODULATOR
AC/DC SERVICE POWER SUP-PLY
AC/DC POWER SUPPLY
FAN CONTROL
INTERCONNECTION BOARD
RF STAGES

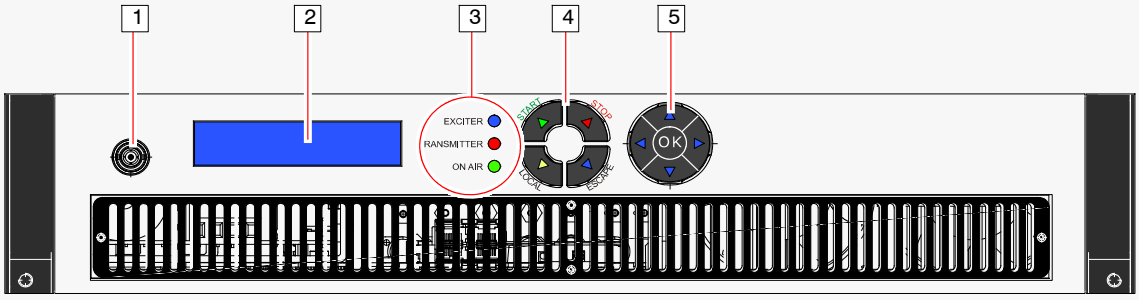

GPS
ASI OUT
10MHzIN
10MHzOUT
TPS IN
1PPSOUT
ETH
ASI 1
ASI 2
CAN 1
CAN 2
ASI OUT SAT
TsoIP 1
TsoIP 2

SPECIFICATIONS

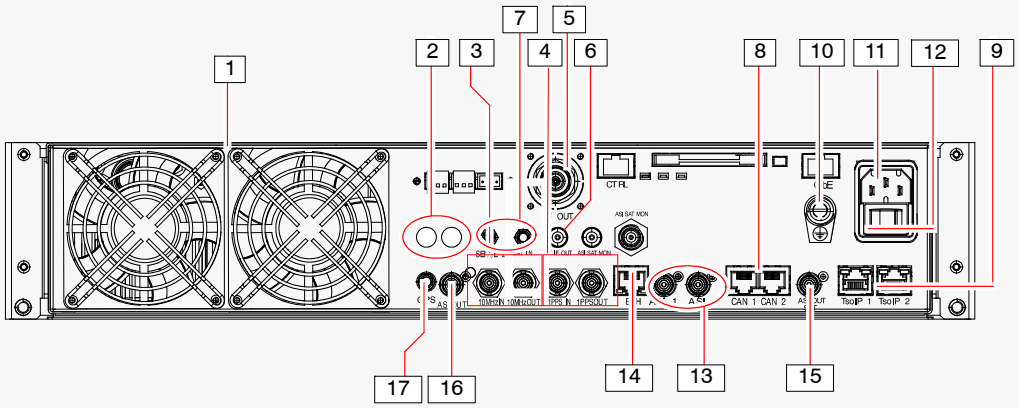
GENERAL/ENVIRNOMENTAL CONDITIONS	
Operating temperature range	0°C to +55°C
Storage temperature range	- 55°C to +70°C
Relative humidity	0% to 95% (non condensing) at 45°C
Altitude a.s.l.	up to 3000 m
Ambient air pressure:	65kPa to 105kPa
Safety	EN 60215 / EN 60950
EMC	EN 301489
AC REQUIREMENTS	
AC supply (Feller connector)	90 to 264V ~
Frequency	50/60Hz
Power factor	> 0.95
Efficiency (COFDM) Typ.	*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 - 690MHz (UHF/BIV - V) Doherty 470 - 860MHz (UHF/BIV - V) AB Class option
Frequency step	1 Hz
RF Output	
Connector	N female
Impedance	50Ω
Return Loss	> 16 dB
Spectrum polarity	selectable inverted/non - inverted
Nominal output power	up to VHF 400 Wp.s. - UHF 400 Wp.s. ATV up to VHF 280 W_{avg} - UHF 250 W_{avg} DTV up to VHF 300 W_{avg} - DAB+
Adjustable to nominal level	- 7 to +1 dB
Stability at nominal level	± 0.25 dB
PAPR reduction	L1 - ACE/P2 - TR with T2 version 1.2.1 and 1.3.1 (HW and Fw prepared for L1 - ACE only, L1 - ACE and TR only, L1 - ACE ACE and TR)
Spurious Emissions	< - 60 dBc with filter
Harmonic Emissions	< - 60 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	$\pm 1 \cdot 10^{-8}$ (0 to 70°C) $\pm 5 \cdot 10^{-10}$ per day (after 30 day) $\pm 1 \cdot 10^{-7}$ 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 tranmsitter 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 acive (*not included*)
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 (Typ.)
MER	> 35 dB (DAB > 30 dB)
Carrier Suppression	> 30dB (typical > 35 dB)
Amplitude inbalance	< 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	1 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	1 XLR mini 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	1 XLR mini 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



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	Led indicator (*RED/BLUE*); indicates IEC status according to the colours, as follows: ▪ *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	Led indicator (*RED/BLUE*); according to the colour, it shows the RF output status, as follows: ▪ *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	This indicator is active only when IEC operates in "N+1" system configuration and shows that the unit is on air. ☞ *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.*
4		Keyboard. It allows *starting/stopping* the unit and setting *local/remote* operating mode. *ESCAPE* key allows quitting from current menu.
5		Controller keyboard. It allows accessing the menu (listed on right-hand side of the display) and setting the functioning parameters of the unit. Accessing the menu and setting of the parameter is as follows: - "◀" 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 (*before filter*; 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		*NOT USED*
7	SENSE 1/SENSE 2	SENSE, 1*; NOT USED* SENSE 2*;* Connectors (SMA female); RF input signal from directional coupler located after the RF cavity filter to allow the automatic Linear Precorrection
8	CAN1/CAN2	Connectors (RJ- 45); allow the connection to a ***C****ontroller* ***A****rea* ***N****etwork* serial bus.
9	GbE	Connectors (RJ- 45); IP inputs. Connector (RJ- 45); TsoIP 1/2 input. It also can be used for *Ethernet* control and monitoring over TCP/IP.
10		Grounding screw of unit frame.
11/12		Line socket with the associated mains breaker.
13	ASI1/2	Connectors (BNC female); DVB serial type MPEG2 Transport Stream inputs.
14	ETH	Connector (RJ- 45); it allows *ethernet* control and monitoring over TCP/IP of the unit and TsoIP 1 input (*if configured)*.
15	ASI OUT	Connector (BNC female);); ASI output when the (option) RX SAT with CAM is installed in the IEC transmitter.
16	ASI OUT	*NOT USED*
17	GPS	Connectors (SMA female);input of the signal from GPS.

this page is intentionally left blank

DACTA BROADCAST SRL
Orvieto production plant
Via dell'Innovazione 4
05018 - Orvieto (TR) - ITALY
phone: +39.0763.960300
e-mail: info@itelco.it
website: www.itelco.tv
Issue L/05.23