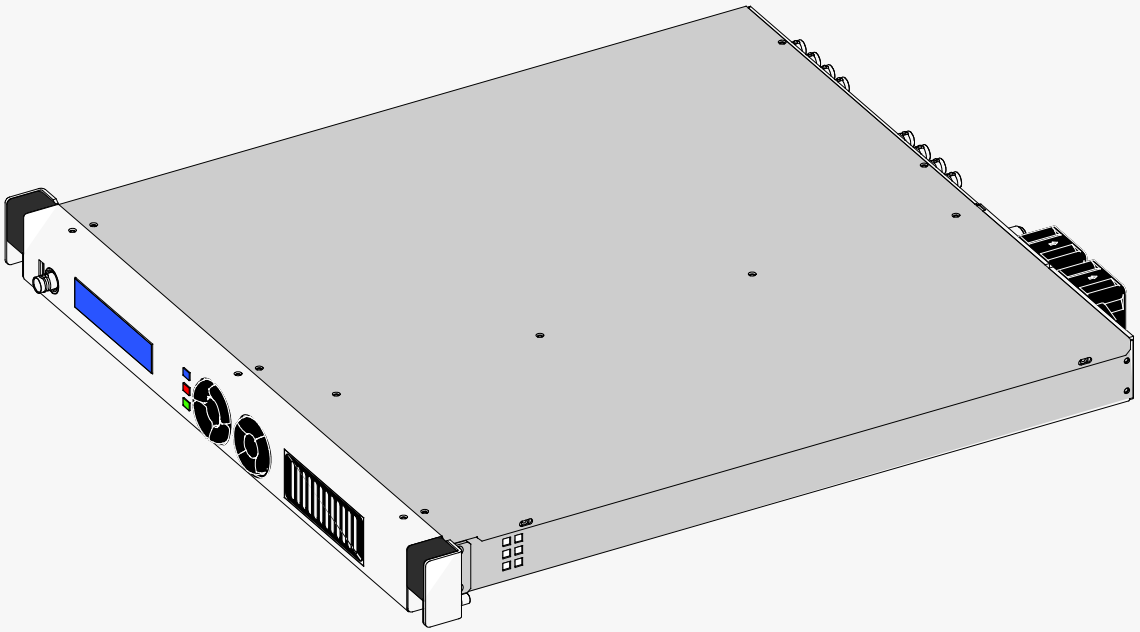
MEX-II

MULTIMODE EXCITER



VHF/UHF **air cooled** 1HE

The core of MEX II 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 (DAB+ in VHF B.3), 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 modulator card includes the inputs to implement the adaptive pre-correction and the transmitter output power measurement (fwd/rfl power meter).

Changing the modulator card the exciter can also operate as ***gap filler*** *or* ***repeater.*** *For these models, the modulator is equipped with an RF receiver.*

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 exciter 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.*

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 MEX I operation in a Single Frequency Network (SFN).

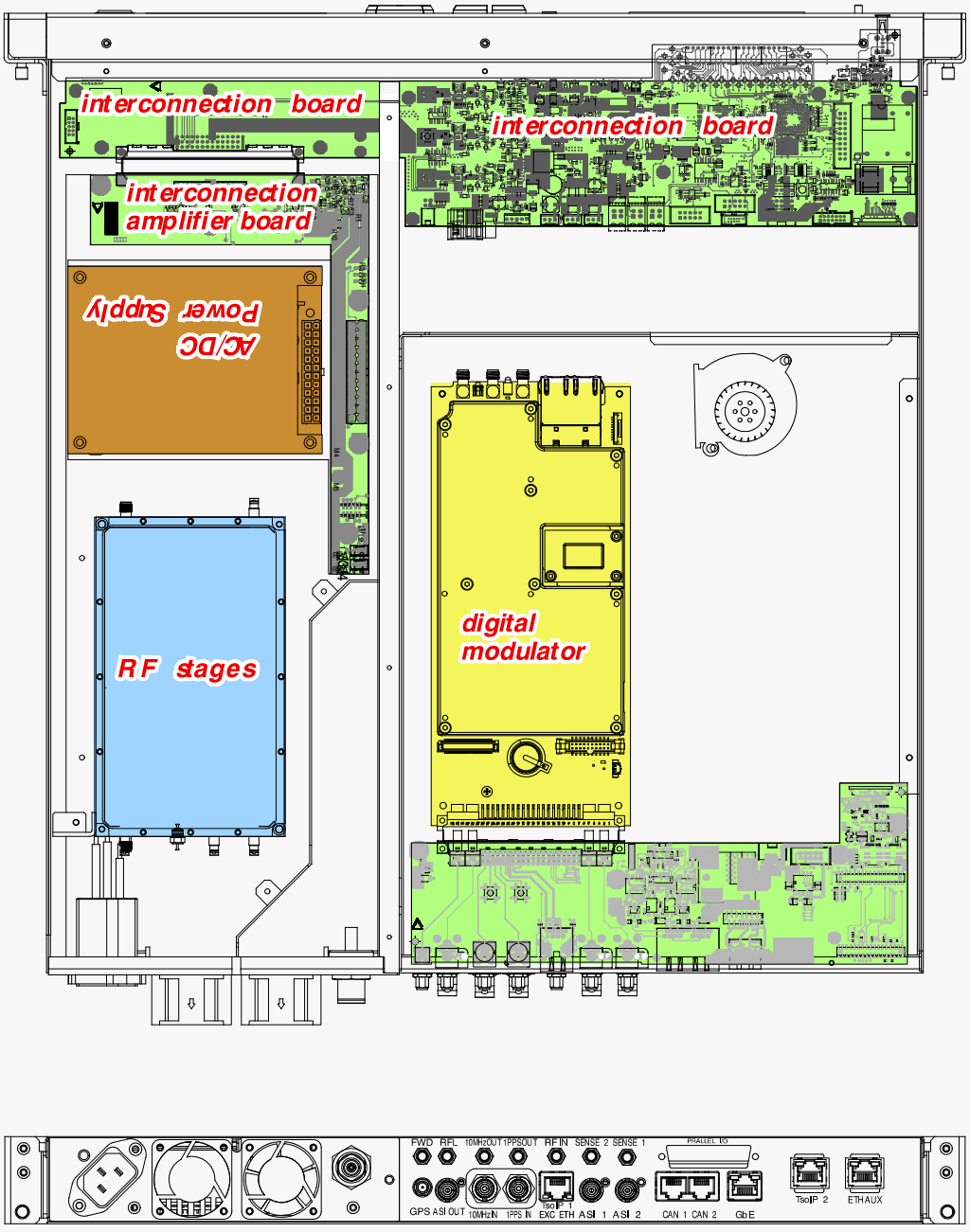
The control and supervision of the exciter are guaranteed locally with graphical display and keyboard, remotely through SNMP (v1/v2c/v3) and Web Server on Ethernet interface. All parameters available on the display can be accessed remotely. *The remote control and supervision are possible by means of 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 exciter 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.*

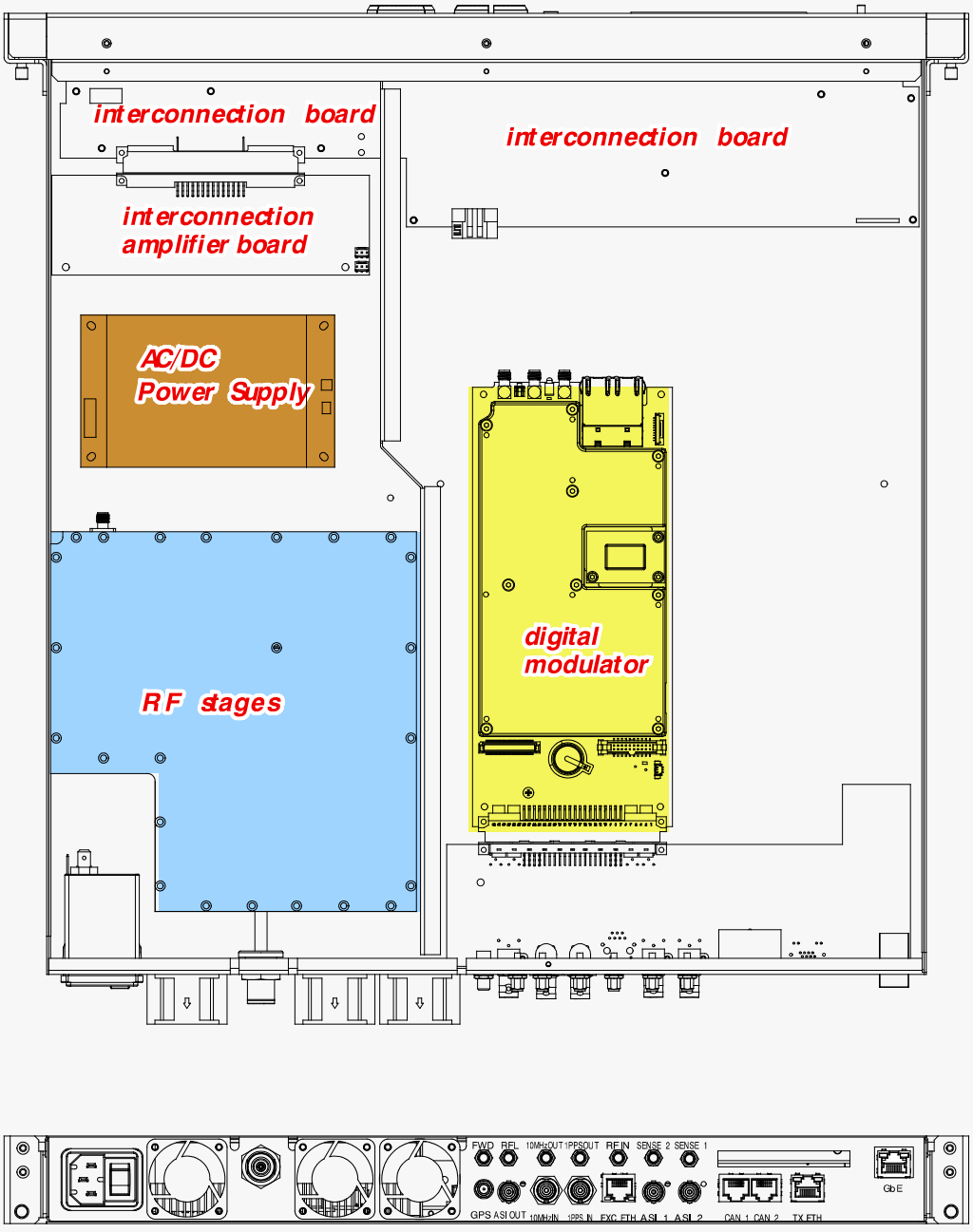
All exciter firmware are upgradable via Ethernet port (also remotely). The exciter is capable of interfacing with new generation Itelco equipment (Central Control Unit, HPAs, etc.) via 2 CAN Bus that ensure high reliable and robust data exchange. In order to maintain compatibility with previous generation equipment, the exciter is also provided with RS-232 and RS-485 connections. Optionally, it can be equipped with dry contact parallel interface.

MAIN FEATURES

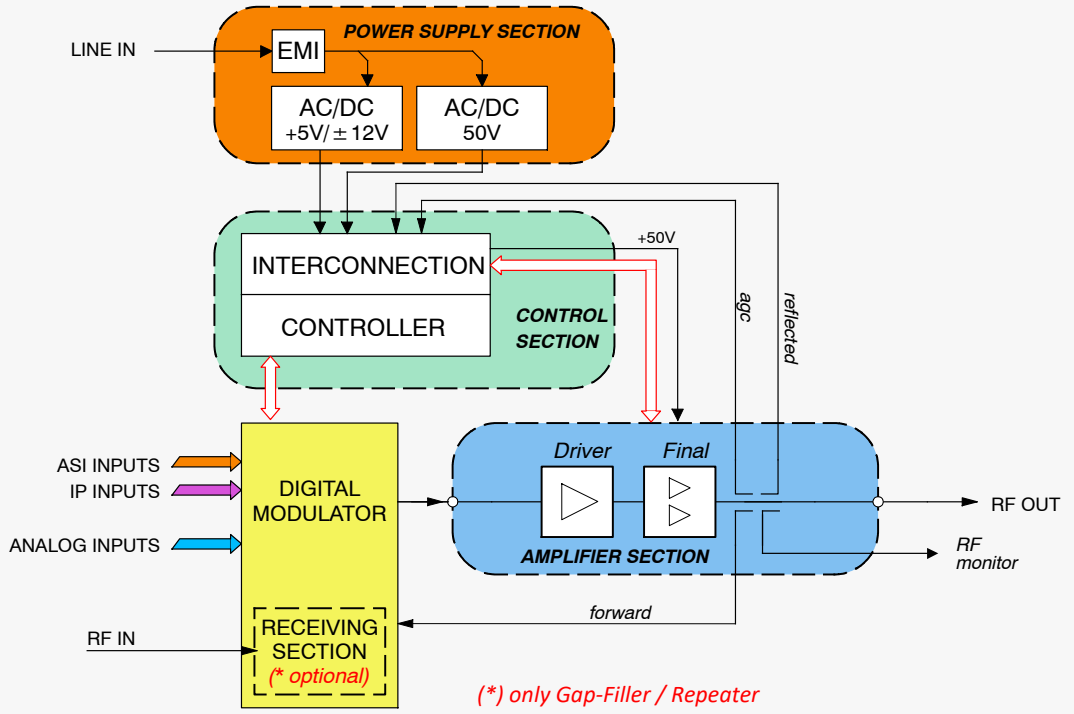
- **Multi-Standard operation** (DVB-T/H/T2, ATSC, ATSC 3.0, ISDB-T/Tb, Analog)
- **Dual-Cast** operation (*optional*)
- **Gap Filler or Repeater** operation (*optional*)
- **MEX-II** (digital modulator)
- **Fully broadband** on VHF/UHF freq
- **Low power consumption**
- **Doherty technology** (*only for 100W UHF model*)
- **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
- **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



*3W**avg** to 25W**avg*** MEX*II typical layout*

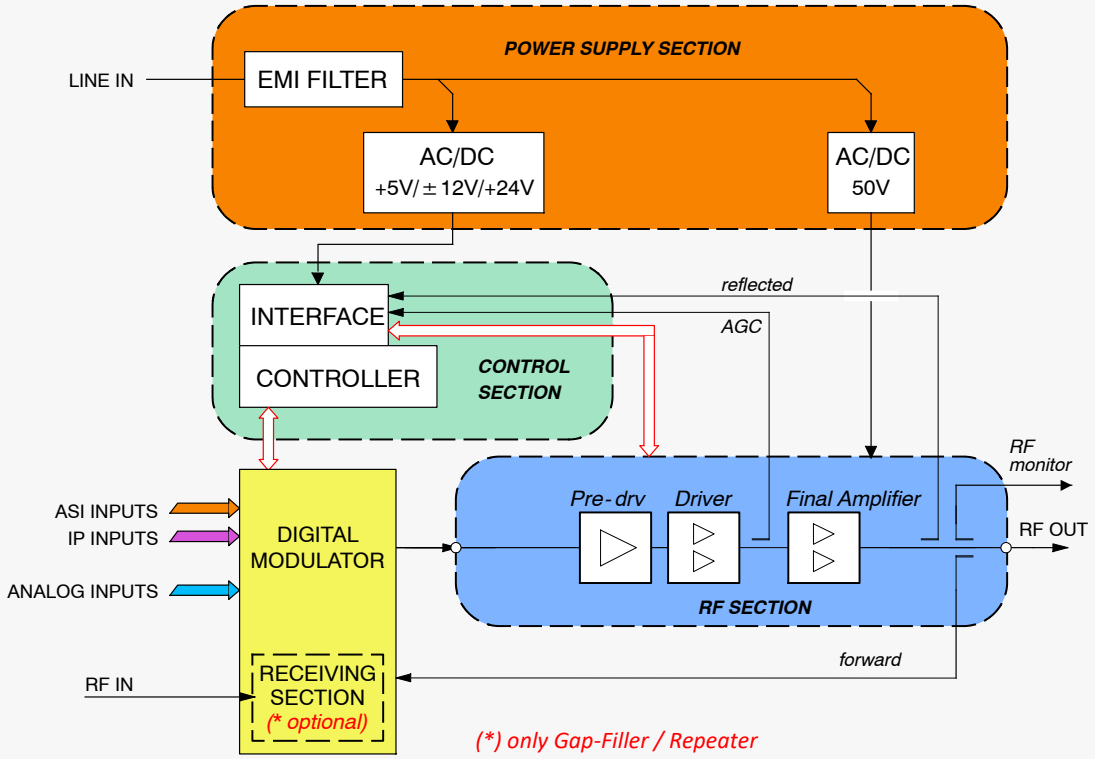


50/100W$_{avg}$ MEXII typical layout



MEX*II* 3 to 25W models

MEX*II* *50/100*W models



MEX II simplified block diagram

SPECIFICATIONS

GENERAL/ENVIRNOMENTAL 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	> 0.98
MECHANICAL	
Frame:	standard 19" - 1HE
Overall Dimensions (wxhxd) (mm):	483x43.5x565
Weight (kg):	6
DISPLAYED STATUS	
	Listed in "Exciter Status" menu
PROTECTION CIRCUITS	
	Software based
RF OUTPUT	
Frequency range	174 to 254MHz (VHF/BIII) 470 to 862MHz (UHF/BIV- V)
Frequency step	1 Hz
RF Output	
Connector	N female
Impedance	50Ω
Return Loss	> 16 dB
Spectrum polarity	selectable inverted/non- inverted
Nominal output power	*DTV* / *ATV* $3W_{avg}$ / $10W_{p.s.}$ $5W_{avg}$ / $10W_{p.s.}$ $10W_{avg}$ / $15W_{p.s.}$ $25W_{avg}$ / $50W_{p.s.}$ $50W_{avg}$ / $150W_{p.s.}$ $100W_{avg}$ / $150W_{p.s.}$
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 (< - 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	$\pm 1 \cdot 10^{-8}$ (0 to 70°C) $\pm 5 \cdot 10^{-10}$ per day (after 30 day) $\pm 1 \cdot 10^{-7}$ per year

RF INPUT	
Frequency range	30- 1000MHz (1 Hz resolution)
Connector/Impedance	SMA female/50Ω
Return Loss	> 16 dB
Input Level	30- 100 dμBV (from - 77 dBm to - 7 dBm)
Input Noise Figure	< 8 dB @gain max. (typical 6.5 dB)
Immunity to other channels • adj. ch N ± 1 analog signal sync/OFDM • digital signal OFDM/OFDM • other ch.: analog signal sync/OFDMOFDM • analog signal OFDM/OFDM	 > 40 dB (*) > 30 dB (*) > 46 dB (*) > 40 dB (*) (*) *measured as threshold for QEF reception, mode=8K, 64QAM,CR2/3*
Selectivity	> 65 dB attenuation outside f_0 ± 4.2 Mhz (*dipending on selectivity- filter choice*)

Input- to- output performances

MER degardation vs. RF input level and loop gain (typical measurement @474Mhz)

Loop gain 0 dB (no Echo) - Echo Canceller active

RF input level	MER @ RF input	MER @ RF output
- 27 dBm	46.3 dB	42.6 dB
- 37 dBm	45.1 dB	42.6 dB
- 47 dBm	39.6 dB	42.6 dB
- 57 dBm	39.6 dB	39.9 dB
- 67 dBm	34.0 dB	32.3 dB
- 72 dBm	29.0 dB	27.3 dB

Loop gain 5 dB (Echo 5 dB above wanted signal) - Echo Canceller active

RF input level	MER @ RF input	MER @ RF output
- 27 dBm	46.3 dB	40.5 dB
- 37 dBm	45.1 dB	40.6 dB
- 47 dBm	39.6 dB	40.4 dB
- 57 dBm	39.6 dB	38.8 dB
- 67 dBm	34.0 dB	32.0 dB
- 72 dBm	29.0 dB	27.1 dB

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

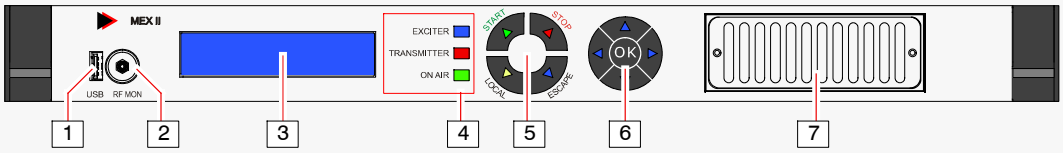
IP INPUTS	
Connectors	2; RJ45
Data Interface	10/100/1000bT
Protocols	UDP/RTP, SMPTE 2022, IGMP v2/v3

REMOTE INTERFACES	
Connectors	5; RJ45
Ethernet	3; RJ45 (for web service; protocol HTTP, NTP, SNMP, SSL)
CAN Bus	2; RJ45 connectors 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} (±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 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 PP8r
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, 2 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



1 USB connection used only by *Itelco* for maintenance purposes. *Do not use for communication with DVB- T2 modulator.*

2 RF MONITOR Monitor connector (SMB female); it allows monitoring the RF output signal of the unit.

3 LCD display of the unit; displays information and data relevant to the functioning of MEX *II* (4 lines x 30characters).

4 EXCITER Led indicator (green/red); indicates MEX status according to the colours, as follows:

BLUE	MEX is delivering its nominal RF output power;
BLUE (blinking)	warm up at the switching- on (approx. 30sec); within this time interval all alarms are inhibited;
BLUE/RED (blinking)	*warning* condition of MEX (MEX is still working);
RED	failure condition of MEX (no RF ouput power);
OFF	MEX is in *STOP* condition (*EXCITER RF OFF*).

TRANSMITTER Led indicator (green/red); it is active only when MEX operates also as control logic of the transmitter where it is housed. According to the colour, it shows the transmitter status, as follows:

BLUE	the transmitter is delivering its nominal RF output power;
BLUE/RED (blinking)	*warning* condition of the transmitter (transmitter is still working);
RED	failure condition of the transmitter (no RF ouput power);
OFF	when the transmitter is in *STOP* condition.

ON AIR Led indicator (green); *NOT USED*.

5 

Push- buttons; allow setting the operating conditions of the unit:

START Push- button; it is active only if *local* functioning mode has been set. Under this condition, it operates as follows:

- *if MEX operates only as exciter* starts the unit;
- *if MEX operates as TX CTRL LOGIC* starts TX.

When pushed, the associated green led, lights up.

STOP Push- button; it is active only if *local* functioning mode has been set. Under this condition, it operates as follows:

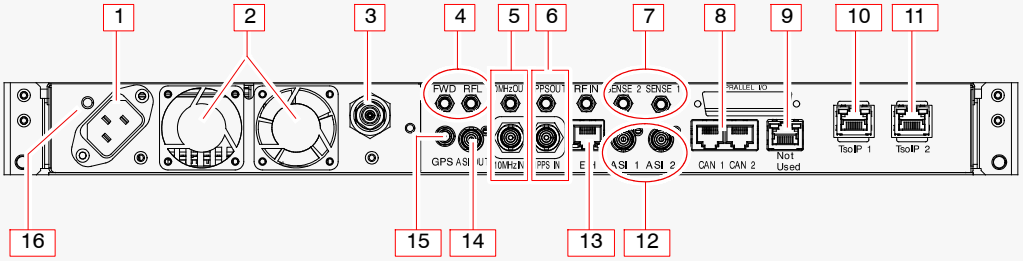
- *if MEX operates only as exciter* switches- off the unit;
- *if MEX operates as TX CTRL LOGIC* switches- off TX.

When pushed, the associated red led, lights up.

ESCAPE Push- button; it allows to quit from current menu.

LOCAL/REMOTE Push- button which allows *local/remote* control of the equipment. When *local* mode is selected, “START” and “STOP” push- buttons and the keyboard are enabled. When *remote* mode is selected, “START” and “STOP” push- buttons and the keyboard are disabled.

6		Controller keyboard. It allows accessing the menu (listed on right- hand side of the display) and setting the functioning parameters of MEX. Accessing the menu and setting of the parameter is as follows: - "▲" and "▼" arrows select the menu; once accessed the menu, select the parameter to be changed; change the values of the parameters inside a menu. - "◀" and "▶" arrows allow scrolling the pages of each menu. - "OK" key is used to enter the selected menu and to confirm the setting carried out.
7		Grid for the inlet of the cooling air of the unit.



MEX*II* 3 to 25W models

(the references are still valid for 50/100W models)

1		Line socket.
2		Extractor fans of the exhaust air.
3		Connector (N female); RF signal output of MEX *II*.
4	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)
5	10MHz OUT	Connectors (SMA female); output of 10MHz reference signal.
	10MHz IN	Connector (BNC female); input of 10MHz reference signal.
6	1PPS OUT	Connectors (SMA female); output of 1PPS reference signal.
	1PPS IN	Connector (BNC female); input of 1PPS reference signal.
7	SENSE 1/SENSE 2	*NOT USED*
8	CAN1/CAN2	Connectors (RJ- 45); allow the connection to a ***C**ontroller **A**rea **N**etwork* serial bus.
9	Not Used	Connector (RJ- 45); *NOT USED.*
10	TSoIP 1	Connector (RJ- 45); TSoIP 1 input. It also can be used (*if configured*) for *ethernet* control and monitoring of the unit over TCP/IP.
11	TSoIP 2	Connector (RJ- 45); TSoIP 2 input. It also can be used (*if configured*) for *ethernet* control and monitoring of the unit over TCP/IP.
12	ASI1/2	Connectors (BNC female); DVB serial type MPEG2 Transport Stream inputs.
13	ETH	Connector (RJ- 45); it allows *ethernet* control and monitoring over TCP/IP of the *modulator*.
14	ASI OUT	*NOT USED*
15	GPS	Connectors (SMA female);input of the signal from GPS.
16		Grounding screw of the frame.

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itelco

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