

# ME222T-PRO 222MHz TRANSVERTER



**ME222T-PRO** is the new 222MHz version of our popular transverters. We can provide it for USA market.

In the new high performance 222MHz transverter we built in the best Mini Circuits dual ballanced mixer the HJK-251H, high dinamic range PGA-103+ preamplifier and an IF amplifier (ASF240 from ASB) Transverter has low noise, combined with very good dynamic range on receiving section.

You can find the block diagram of the base 100mW transverter unit [here](#).

The built in AXTAL high stability and low phase noise TCXO provide easy work also on digital modes as well.

The transverter can work between 222-226MHz with low RX NF and high OIP3. The Mitsubishi RF module provides good IMD signal and 30W output power.

Before of first operation, [check the setup description](#)

## Local Oscillator

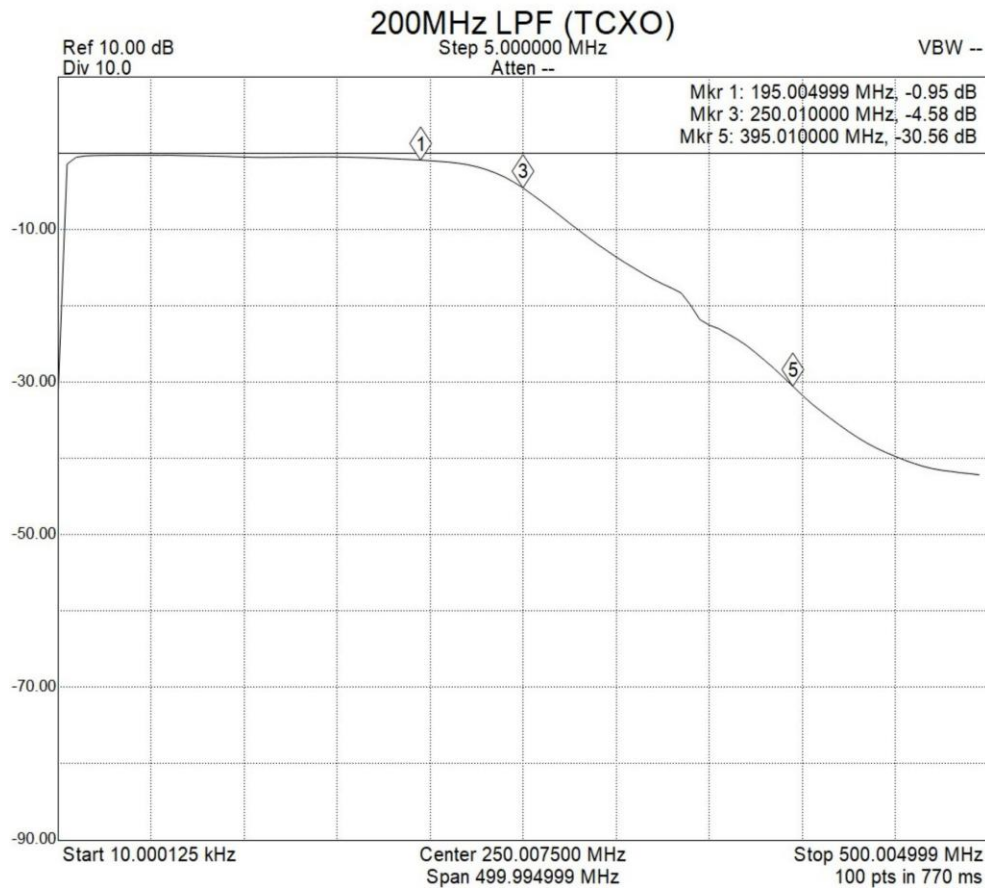
The high stability [AXLE208B type TCXO](#) by AXTAL (+/- 0.5ppm btn 0-50 degr. C) with low phase noise gives +3dBm signal on 194.000MHz.

The TCXO frequency can be adjusted with inner trimmer capacitor (+/-2ppm) but it's not necessary because the stability is better than +/-1ppm/Year.

TCXO stability and the phase noise is better than most modern transceiver's phase noise.

The max. output signal of the LO is about +20dBm, produced by GVA84 and ASB [ASL550](#) 3rd generation MMIC. The built in 5th order band filter provides clear output signal.

## Characteristics of the 5th order 200MHz LPF filter:



We can check the +20dBm output signal on M3 measuring pin. This signal is attenuated by -10dB to the TX balance mixer (**CSYM-1815**).

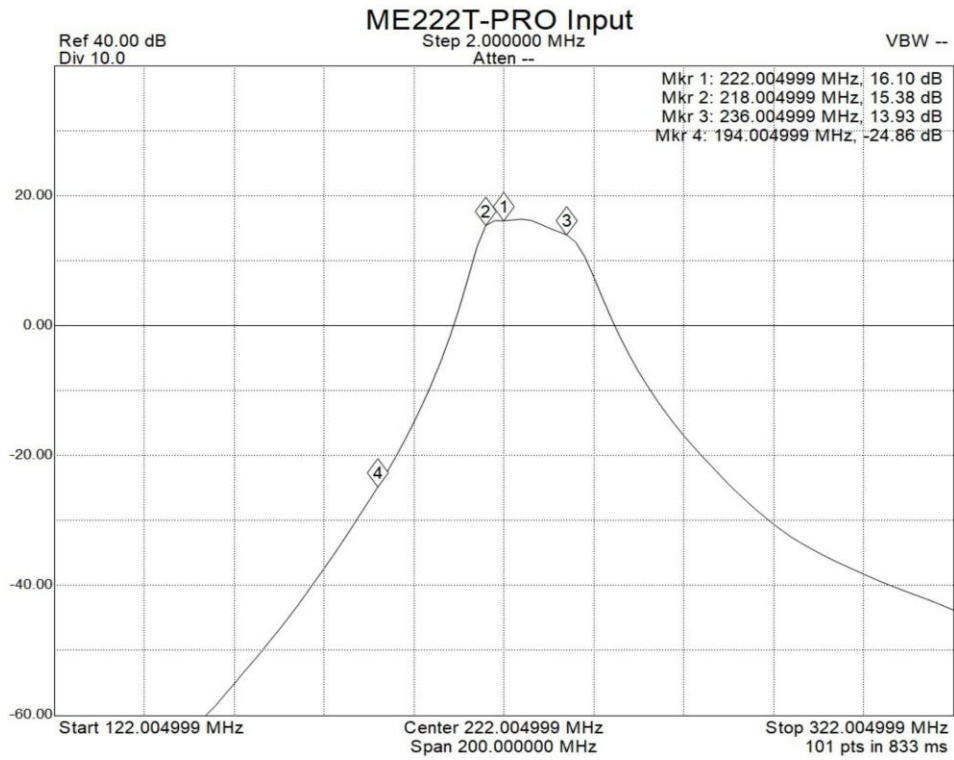
We are using **HJK-251H+** type (+32dBm OIP3) mixer in the RX side. We can check the real RX and TX LO signals on M2 and M1 points with DC voltmeter as well.

### **RX/TX**

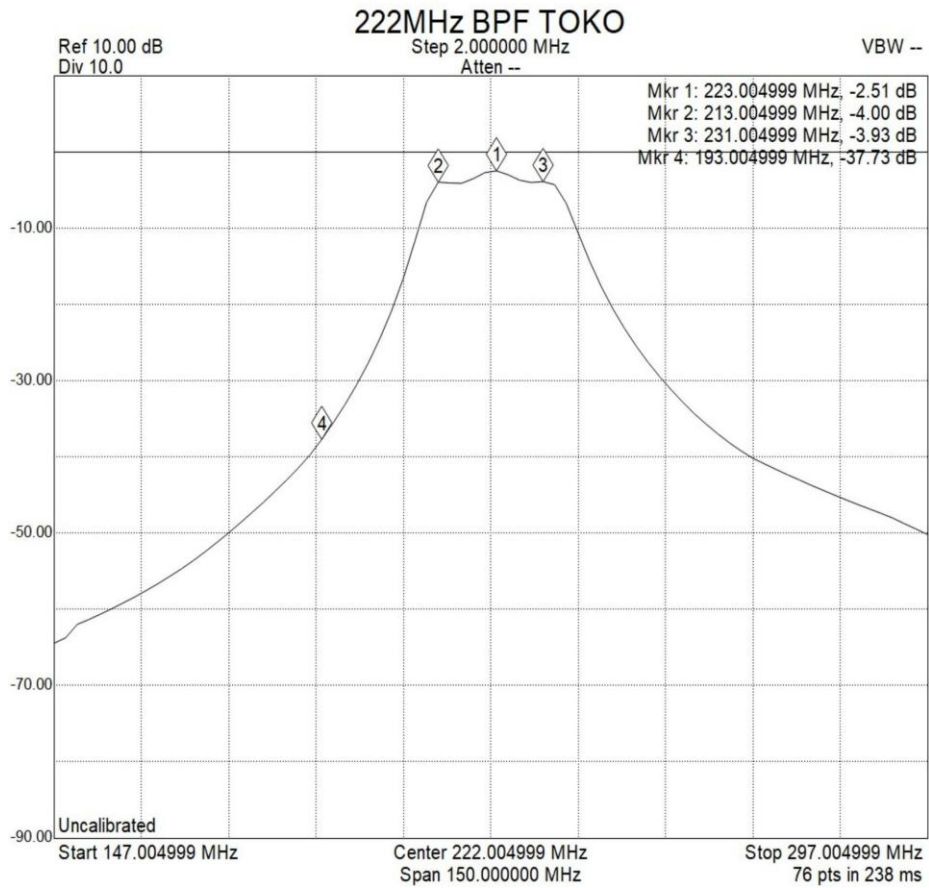
The 222-226MHz input signal passes through the input filter to the input PGA103+ LNA. The gain of this stage is approx. 16dB, the noise figure is 1.3dB, the IIP3 is min. +3dBm.

The stability factor is always kept more than unity over the application band in order system environment. Impedance of the MMIC is 50 Ohm both I/O side - it provides easy connect on the output 5th order BPF. Every filters was simulated and calculated by HA8ET [www.ha8et.hu](http://www.ha8et.hu)

**The input stage characteristics :**

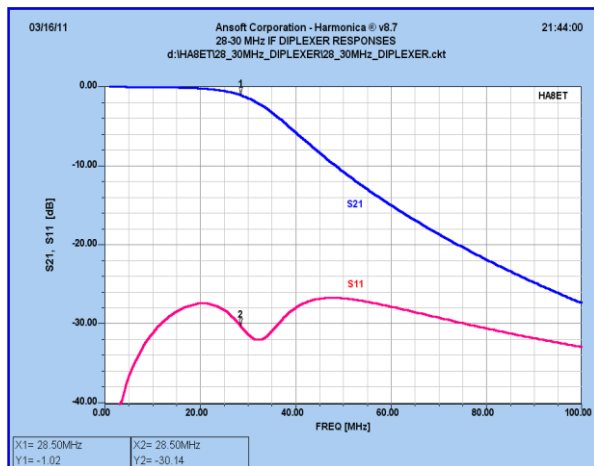


**The measured characteristics of the 5<sup>th</sup> order BPF :**

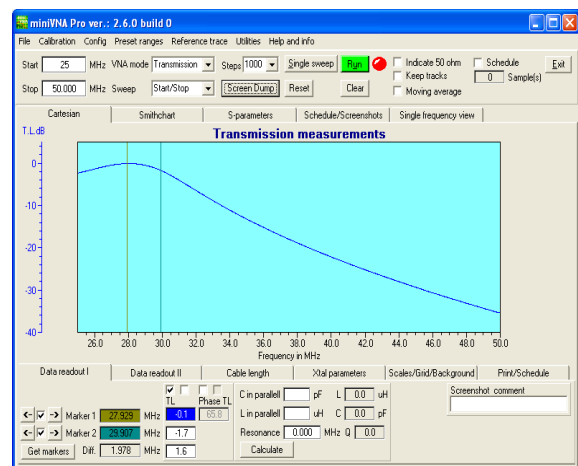


The 222-226MHz signal goes through the band pass filter providing a suitable selectivity. The balanced mixer MX1 mixes the input signal down to 28-30MHz losing approx. -3dB in the process. The IF signal is amplified by approx. 17dB in a low noise, high dynamics ASB ASF240 IF amplifier. The final PI filter increases the selectivity considerably. The output signal is can set to optimal value with the RX gain potentiometer.

### Measuring of diplexer and 28MHz LPF unit:



Characteristics of diplexer unit



Characteristics of 28MHz IF amp. & LPF filter

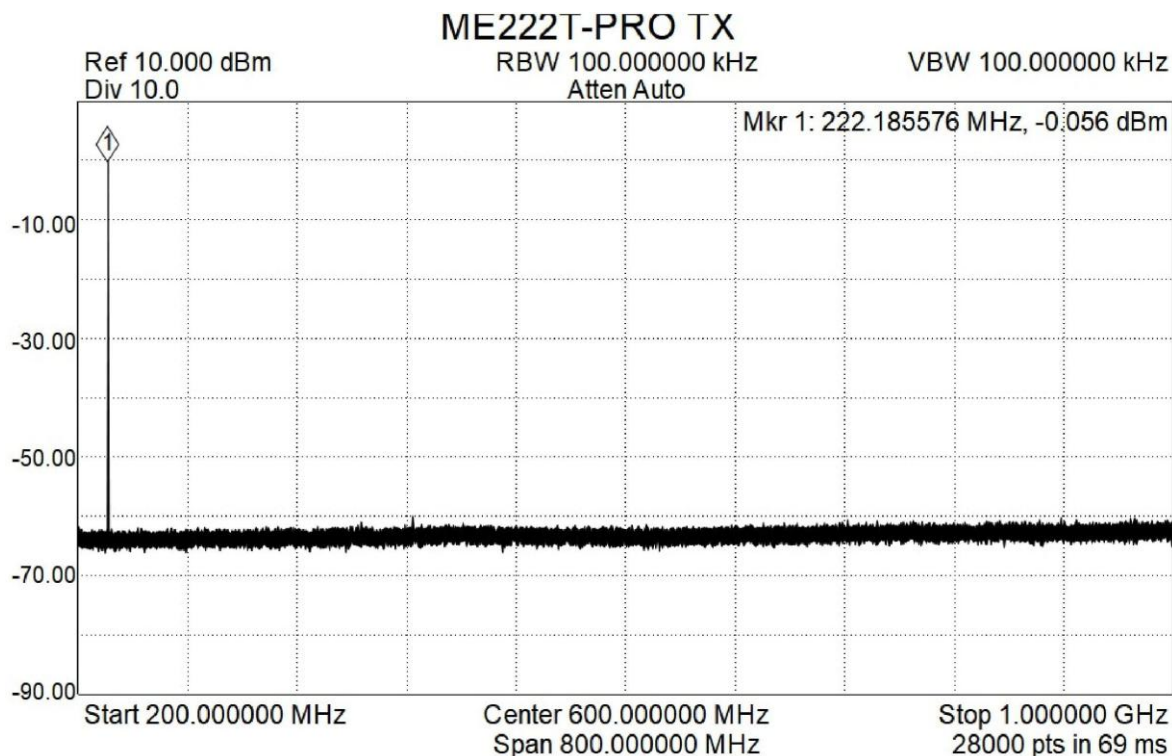
### Diplexer full [simulation](#)

The transmit mixer, MX2 only needs approx. 0dBm 28 MHz IF signal from the HF transceiver. A suitable level can be achieved by adjusting P2 (TX gain) in the attenuator. Lot of transceivers has lower or much higher IF output level. To solve this problem we built in an additional jumperable and variable 5W/-20dB attenuator. You can switch on/off easy the attenuator with different jumpers.

The fine level setting possible with a potentiometer P1 on the attenuator unit, across the slots of the top cover with screwdriver.

We solved very low level IF out problem of most ICOM etc. radios (-20dBm transverter output level). We built in +15dB gain jumperable [IF amplifier](#), so ME222T-PRO is usable easy to this radio types. The 222MHz TX signal behind the MX2 mixer is filtered through a three-stage band-pass filter before being amplified in a BF966.

## ME222T-PRO spectrum:



The G2 of the BF966 connects to the ALC circuit on the control unit and to the front panel PWR potentiometer. We can reduce the final output power to about 5-6 Watts.

The controlled gain BF996 amplifier continues the final ASL550 amplifier to a level exceeding more than 100 mW. Through the final pi-filter we can reduce the harmonics of the TX signal.

## 222MHz module PA unit

We constructed >25W output amplifier to the base transverter unit. It's built with RA30H2127 Mitsubishi module, by Mitsubishi datasheet and applications.

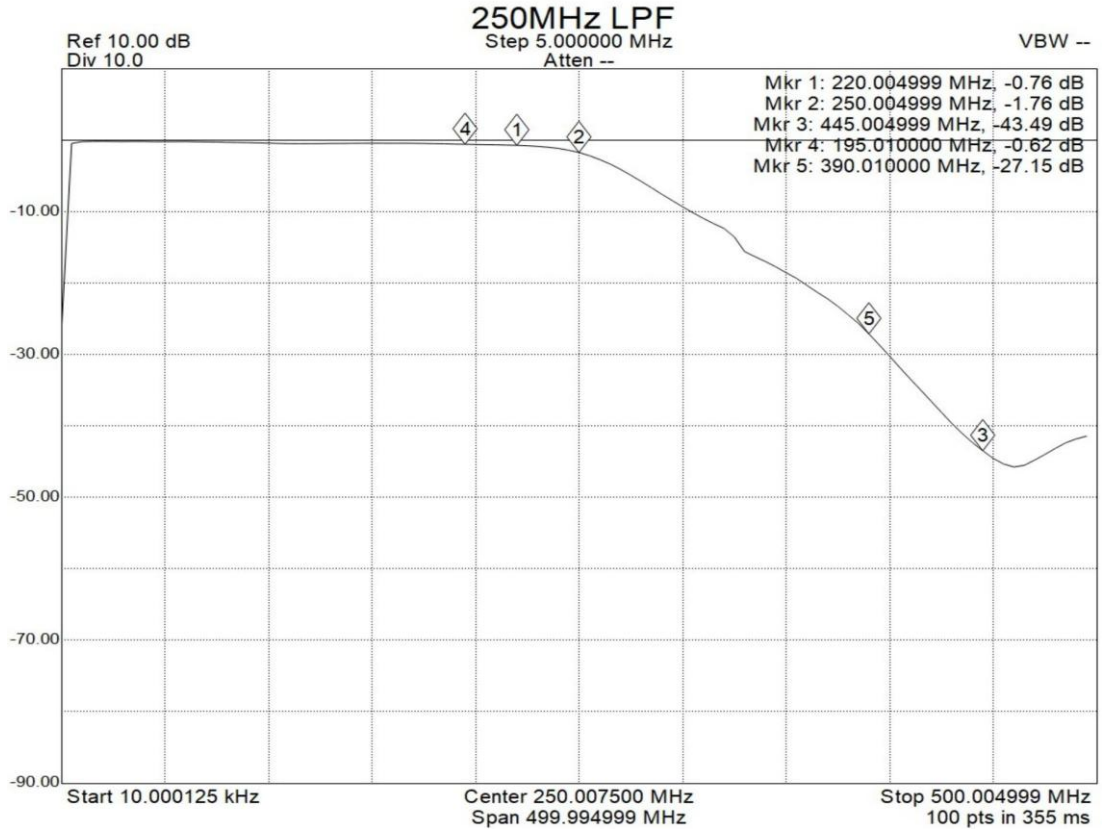
The output signal of the transverter drives the RF module across -3dB attenuator. We set the RF module to AB1 class by a simple circuit applied by Mitsubishi.

The output signal is going to "N" type 222MHz ANT connector, across a harmonics filter and a built in NEC EB2-12NU type SMD RF relay.

The final unit has MONI output to check the output power connecting to the control unit LED bar graph PWR meter and ALC circuit.

The PA contains simple temperature sensor to check the temperature of the heatsink. The external heater fan module is an option in case the 30W model.

# Characteristics of final PA LPF filter



## **CONTROL UNIT**

In order to monitor output power, we use an LM3419 based LED bar graph, implemented on the DP6 control unit. You can find the high current DC relay too on this PCB, together with the ALC circuit and the circuit of the external fan speed regulator. The external (optional) fan's speed is reduced by 50% during RX state.

In case of long TX periods, when the final PA module's heatsink temperature exceeds normal, than the circuit increases the speed of the DC fan. The speed depends on the heatsink temperature. We can calibrate the normal fan speed with the P2, the ALC level with the P3 potentiometer.

The LEG-12F relay is switching the  $V_{pp}$  voltage to the PA unit. The calibration of the output power on the bar graph, is possible with P1 PWR potentiometer on the DP6 unit.

## **Switch/attenuator panel**

Lot of people using different IF level transceivers from home or /portable operation. The jumper selectable attenuator solves this problem; let it be either high or low level IF signal transceiver.

You can either set ON or OFF the 5W attenuator, what is more, you can also easily choose single or dual cable IF operation with these built in jumpers.

The unit contains switching circuit associated to the external PA's (red color RCA, SND output, (capable to switch max +50V, 1A).

The PTT circuit uses two MJD127 devices on the transverter unit for the RX/TX switching. TX when the PTT is grounded.

The PA circuit includes a sequencer, providing suitable delay in the TX key signal when activating first the relays of the external PA relay, then the antenna relay and RF module first stage of the transverter. This means that the TX output is delayed approx. 50 ms after then antenna relay is activated.

The antenna relay of the ME222T-PRO and the external PA switches without any TX signal present.



**Position of built in attenuator jumpers**

Low PWR IF input (-20..+27dBm) 2x IF cable connection		Low PWR IF input (-20..+27dBm) 1x IF cable connection
J1	ON	ON
J2	OFF	ON
J3	OFF	OFF
J4	OFF	ON
J5	ON	OFF(ON- 2nd RX)

High PWR IF input (27..+37dBm) 2x IF cable connection		High PWR IF input (27..+37dBm) 1x IF cable connection
J1	OFF	OFF
J2	ON	ON
J3	ON	ON
J4	OFF	ON
J5	ON	OFF (ON-2nd RX)

If you use single IF cable between your radio and the transverter, you connect it to transverter IFin BNC. In this case the IF-out connector is not in use. If you want to use a 2nd (e.g. SDR) RX, then switch J5 into ON state. (Only in case of single IF cable mode!)

**Don't forget to connect the PTT cable between radio SND connector and ME2T-PRO PTT input! Otherwise the IF power (5W) kills the transverter IF output part (single IF cable high IF power version). The output is protected by antiparallel diodes but it does not help in case high IF power! Never apply more than 5W IF level to the attenuator!**

In order to protect the RX of those who forget to connect the PTT line, we built in an IF RF VOX circuit in the new version.

**The RF VOX interacts at an IF level exceeding +27dBm, but only in case single IF cable mode.**



## Construction

The base transverter is built on a 1,5 mm double sided glass-fibre epoxy PCB; it is fitted into a standard metal sheet box measuring 148 x 74 x 30mm.

PA unit is fitted into 148 x 55 x 30mm standard box. Both are manufactured with SMD technics. The external box of the transverter is constructed from 1mm painted ALU plate. The heatsink is 150x55mm ALU heatsink material.

If you use the ME222T-PRO continuously on FSK mode you can order [optional fan module](#) (2pcs 50x50mm DC fans on holder plate).

No overheating problem occurs in case normal room temperature while operating on CW, or SSB and contest mode.

You can find on the front panel the ON/OFF switch, the LED bargraph power meter the PWR potentiometer. The latter reduces the output power to a desired level, down to to 5-6 Watts to drive an external FET PA's.

## TECHNICAL PARAMETER

Frequency range	222-224MHz
IF frequency range	28-30 MHz
Emission modes	CW, SSB, FM, Digital
I/O impedance	50 Ohm Ant: „N” type, IF BNC, separate RX ”N”
Operating temp. range	0- +50 °C
LO accuracy @20 °C	0.5ppm standard, AXTAL TCXO
Input voltage	13,8V +/- 5%
Power consumption	0,55A on RX, 5,5A/TX ( 7A max)
IF power input	-20....+37 dBm
IF input VSWR	1:1,1 typ, max 1:1,1:1,2
Output PWR nominal	30W RF, variable btn ~5W to 30W
Output PWR setting	Built in potentiometer on front page.
TX harmonics	< -70dB
IM3	Better than -33dBc/25Watt output
PTT control	Contact closure to GND
SND output	Open collector, +50V/1A max.
RF VOX	Available, starts at >27dBm IF input
RX noise figure@20 °C	<1.3dB (overall)
RX gain max	24dB , (variable, 12-24dB)
RX OIP3 typ.	+25 dBm,
RX IIP3 typ.	+3dBm,
RX IF mixer	HJK-251H (+32dBm by MCL)
TX mixer	CSYM 1815 (+17dBm) by MCL
Image rejection	>80dB
Display	LED bar graph
Displayed functions	FWD power
Protection	Ant.VSWR > 2,2 protected by ALC
Protection display	No
Reset function	No
Meter's accuracy	< 5%
Sequencer	50mSec.delay at basic TX mixer
Dimensions	240x250x70 mm (incl. optional Fans)
Weight	2.1kg w/h Fan unit
Case	ALU plate, @1mm