02.10.2023

# ME6T-PRO  50MHz Transverter

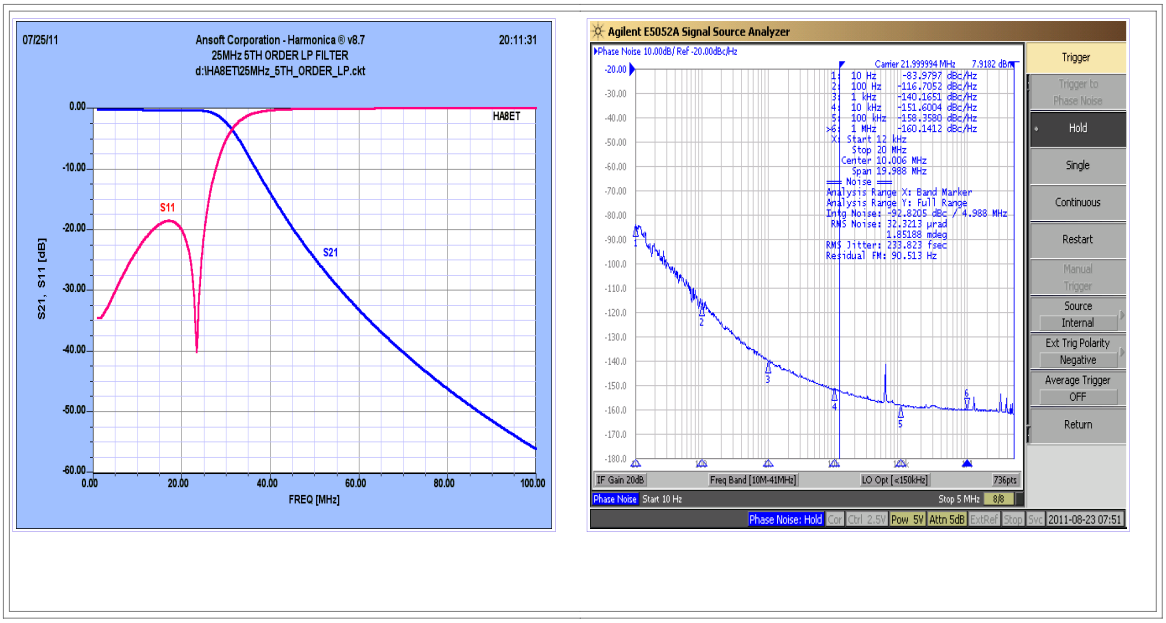

## ME6T-PRO High Performance 6m transverter

After the successful ME6-T transverter project we decided to build the -PRO version of this transverter. The ME6T-PRO is a new generation high performance transverter with modern 3rd generation components, has low noise,very good dinamic range on receiving section and clear and very stable transmitting signal. You can find the block diagram of the mixer unit here.
The built in military class low phase noise TCXO provides easy work also on digital modes. The transverter can work between 50-52MHz  with low RX NF and high OIP3.
The used Mitsubishi RF module provides good IMD signal and 30W output power. Special thanks for HA8ET for the RF simulations and the most RF design.

### Local Oscillator

The high stability **TC23-5T** type TCXO (<1ppm btn 0-50degr. C) with low phase noise gives 3dBm signal on 22.000MHz. The TCXO frequency is possible adjust with inner trimmer capacitor(+-2ppm) but it's not necessary because the stability is better than +-1ppm/ Year.
The output signal of the LO is about +17dBm, it produce the ASB **ASL550** 3rd generation MMIC. The clear output signal provides the built in 2x 5th LP filter.
The output signal of the LO is clear, the 2nd harmonics is lower than -60dB.

The simulated caracteristics of the 5th LPF filter: The measured 22.000MHz TCXO phase noise:

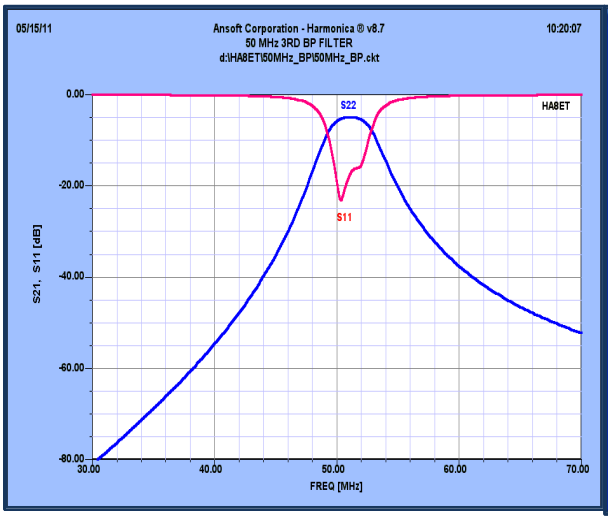



The +17dBm output signal we can check on M3 measure pin. This signal is attenuated by -10 and -3dB attenuators to the TX and RX ballance mixers.
We using **SRA-1H** type +17dBm RX mixer. Optional +23dBm **SBY2-S** type is available too.
On case the optional +23dBm military class RX mixer the AT3 attenuator after TCXO is shorted.
The TX and RX LO signals you can check on M2 and M1 points with DC voltmeter.

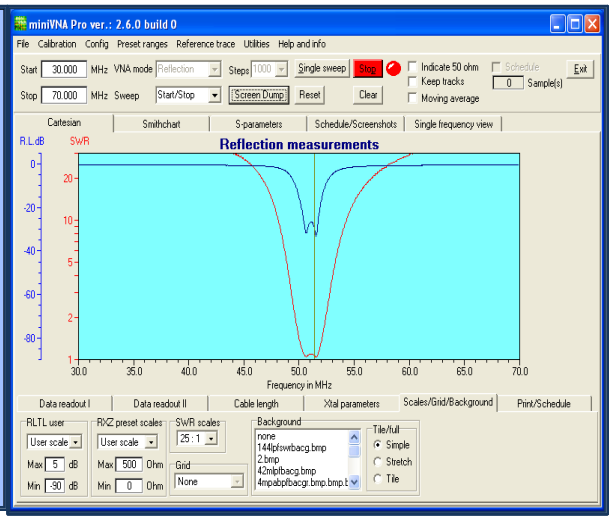
**RX**

The 50-52MHz input signal passes through the input filter to the input of MCL PGA-103+ LNA. The gain is approx. 20 dB, the noise figure is 0.8dB, the OIP3 is around 26dBm! PGA-103+ has an exceptional performance of low noise figure, high gain, high OIP3, and low bias current. 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 - it provides easy connect to the output to 3rd order BPF.

The simulated caracteristics of the 3rd BPF:

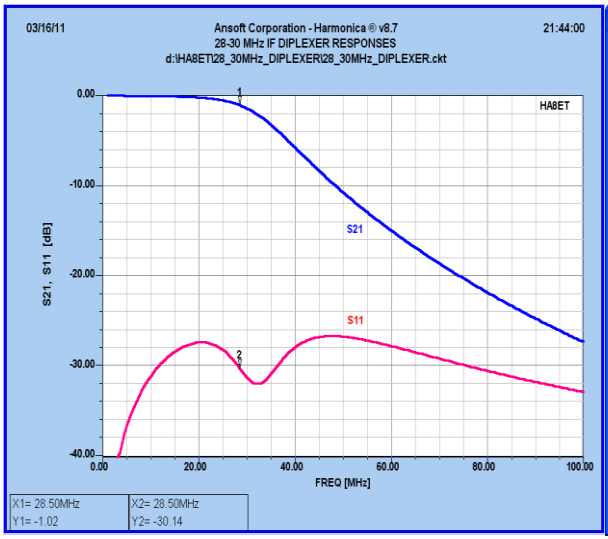



Measured 3rd order BPF refl. factor:

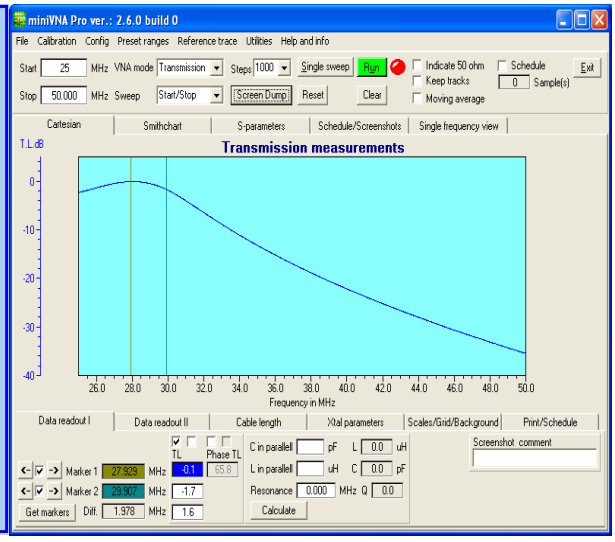



The 50-52MHz signal goes through on band pass filter providing a suitable selectivity. The balanced mixer MX1 mixes the input signal down to 28-30MHz loosing approx. 4dB in the process. The IF signal is amplified approx. 10 dB in a low noise high current J-FET's (2x J310). The final PI filter increases the selectivity considerably. The output signal is can set to optimal value with the RX gain potmeter.

Simulated chracteristics of diplexer unit:



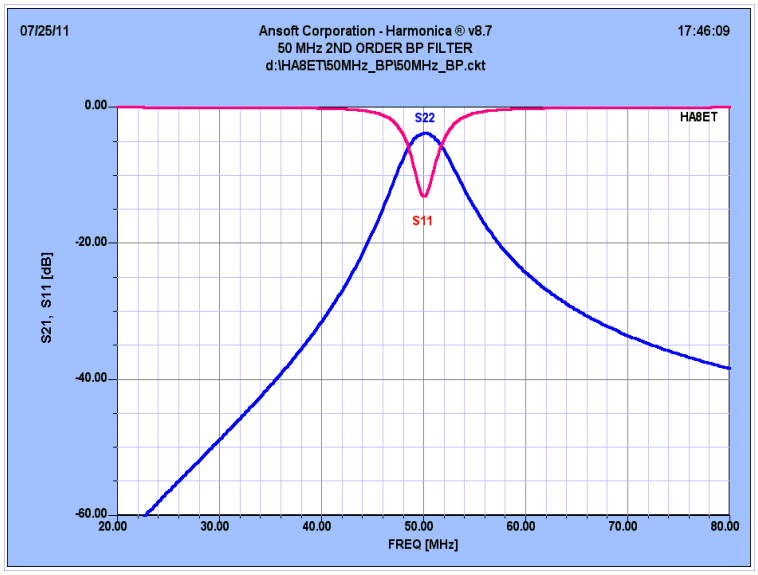

The measured diplexer unit:



**TX:**

The transmit mixer, MX2 only needs approx. min. -10dBm 28 MHz IF signal from the transceiver. A suitable level can be achieved by adjusting by P2 (TX) 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 the potmeter P1 on the attenuator unit across the slots of the top cover. The 50MHz TX signal behind the MX2 mixer is filtered through a two-stage band-pass filter before being amplified in a BF996.

Simulated characteristics of the 2nd order BPF:

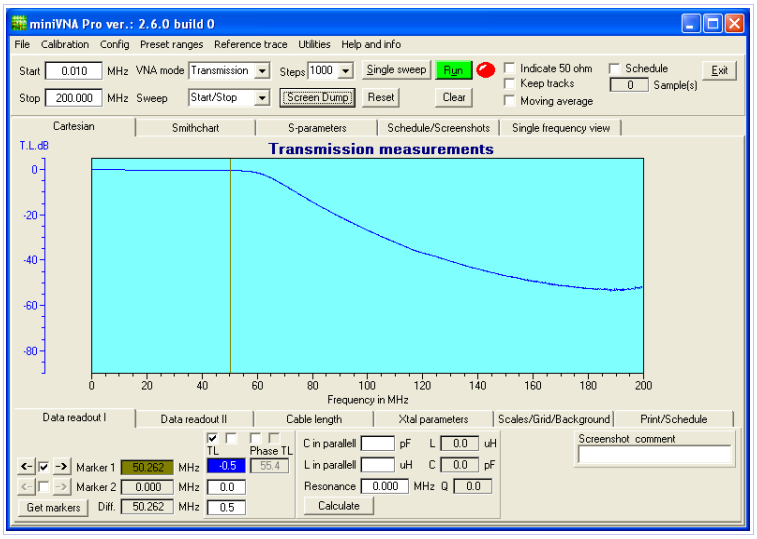



The G2 of the BF996 connecting to the ALC circuit on the control unit and to the rear panel PWR poti. We can reduce the final output power to about 5-6Watts.
The controlled gain BF996 amplifier continues the final ASL550 amplifier to a level exceeding more than 100 mW. Through the final pi-filter we can reduce the harmonics of the TX signal.

## 6m module PA unit

We constructed >25W output amplifier to the base transverter unit. It's built with RA30H0608M Mitsubishi module, by Mitsubishi datasheet and applications.
The output signal of the transverter drives the RF module over -2dB attenuator. We set the RF module to AB1 class by a simple circuit applicated by Mitsubishi.
The output signal can reach the 6m UHF type ant connector across a harmonics filter and a built in G5-V2 relay.
The final unit has MONI output to check the output power connecting to the control unit LED bargraph PWR meter and ALC circuit.
The PA contains simple temperature sensor to check the temperature of the heatsink.

6m final LPF filter:




## CONTROL UNIT

To check the output power we use a LED bargraph unit with LM3419 integrated circuit built on DP6 control unit. On this PCB we found also the high current DC relay, the ALC circuit with LM358, and the circuit of the external fan speed regulator. The external( optional) fan's speed is 50% when we are on RX. On case long TX periods when the final module heatsink temperature is higher the circuit modify the speed of the DC fan's.
The speed is depend from the heatsink temperature.We can calibrate the normal fan speed with the P2 poti, the ALC level with the P3 poti.
The LEG-12 relay is switching the Vpp voltage to the PA unit. The calibration of the output power is possible with P1 pwr poti on the unit.
NC contact of the relay gives +13.8V voltage across the J6 jumper (on the SW/att unit) to EXTRA-6 or similar mast head low noise preamplifiers.

## Switch/attenuator panel

Lot of people want to use different IF level transceivers from home or /portable. The jumperable attenuator can solve the problem on case high level or low lever output transceivers.
You can set ON or OFF the 5W attenuator, and you can select easy between single or dual cable IF operating with the built in jumpers.
The unit contains a switching circuit to the PTT external PA's (red colour RCA, SND output, can switch max +50V,200mA).
The PTT circuit uses two MJD127 for TX switching, when the PTT input is grounded. (you can find it on the transverter unit).
It is intended to the antenna relay and the external PA SND transistor (BD237). The circuit has sequencer: it's delays the TX key while activates the antenna relay immediately and also the external PA relay. This means that the TX output is delayed approx. 50 ms after the antenna relay is activated.
The antenna relay of the ME6T-PRO and the external PA switches without any TX signal present.

**Position of built in attenuator jumpers**

| **Low PWR IF input (-10..+27dBm) 2x IF cable connection** | | **Low PWR IF input (-10..+27dBm) 1x IF cable connection** |
|---|---|---|
| J1 | ON | ON |
| J2 | OFF | ON |
| J3 | OFF | OFF |
| J4 | OFF | ON |
| J5 | ON | OFF |

| **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 |

If you using single IF cable between your radio and the transverter you need to connect it to transverter IFin BNC.
In this case the IFout connector is not in use.
**Don't forget to connect the PTT cable between radio SND (send) connector and ME6T-PRO PTT input! Otherwise the IF power (5W) kills the transverter IF output part. The output is protected by antiparallel diodes but it not helps in case high IF powers!**
**Never use more than 5W IF level to the attenuator!**

## Construction:

The base transverter is built on a 1,5 mm double sided glass-fibre epoxy PCB is fitted into a standard metal sheet box measuring 148 x 74 x 30mm.
PA unit is fitted into 148x55x30mm standard box. Both is fitted with SMD technics too.
The external box of the transverter is constructed from 1mm painted iron plate. The heatsink is 150x55mm ALU heatsink material.
If you use the ME6T-PRO continuously on digital modes you can order optional fan module (2pcs 50x50mm DC fans on holder plate).
No overheating problem on case normal room temperature and CW, or SSB and contest mode.
On the front panel we can find the ON/OFF switch, the PWR poti (can reduce the output power back to 5- 6Watts to external PA's) and the LED bar graph power meter.

# TECHNICAL PARAMETERS

| | |
|---|---|
| Frequency range | 50-52MHz |
| IF frequency range | 28-30MHz |
| Emission modes | CW, SSB, FM, Digital |
| I/O impedance | 50 Ohm/unbalanced, Ant-"UHF" , IF 2x BNC |
| Operating temp. range | 0-+50C |
| LO accuracy @ 20C | LO accuracy @ 20C |
| LO accuracy @ 0-50C | +/-1ppm PDI TCXO |
| Input voltage | 13.8V +/-5% |
| Power consumption | 0.45A on RX, 5.5A/TX |
| IF power input | -20...+37dBm |
| IF input VSWR | 1:1,1typ, max 1:1,3 |
| Output PWR | 30W, variable from 5W to peak PWR |
| TX harmonics | min. -70dB |
| IM3 | -33dBc/ 25W output |
| PTT control | Contact closure to GND |
| SND output | Open collector, +50V/1A max. |
| RF VOX | Available, starts >27dBm IF input |
| RX noise figure @ 20C | 1.3dB (overall) |
| RX gain | max 22dB (variable) |
| RX OIP3 | typ. +25dBm, min. +22dBm |
| RX IIP3 | typ. +3dBm |
| Image rejection | >85dB |
| Dimensions | 240x260x70mm ( incl. optional fans) |
| Weight | 1.6kg |
| Case | Iron plate, @1mm |