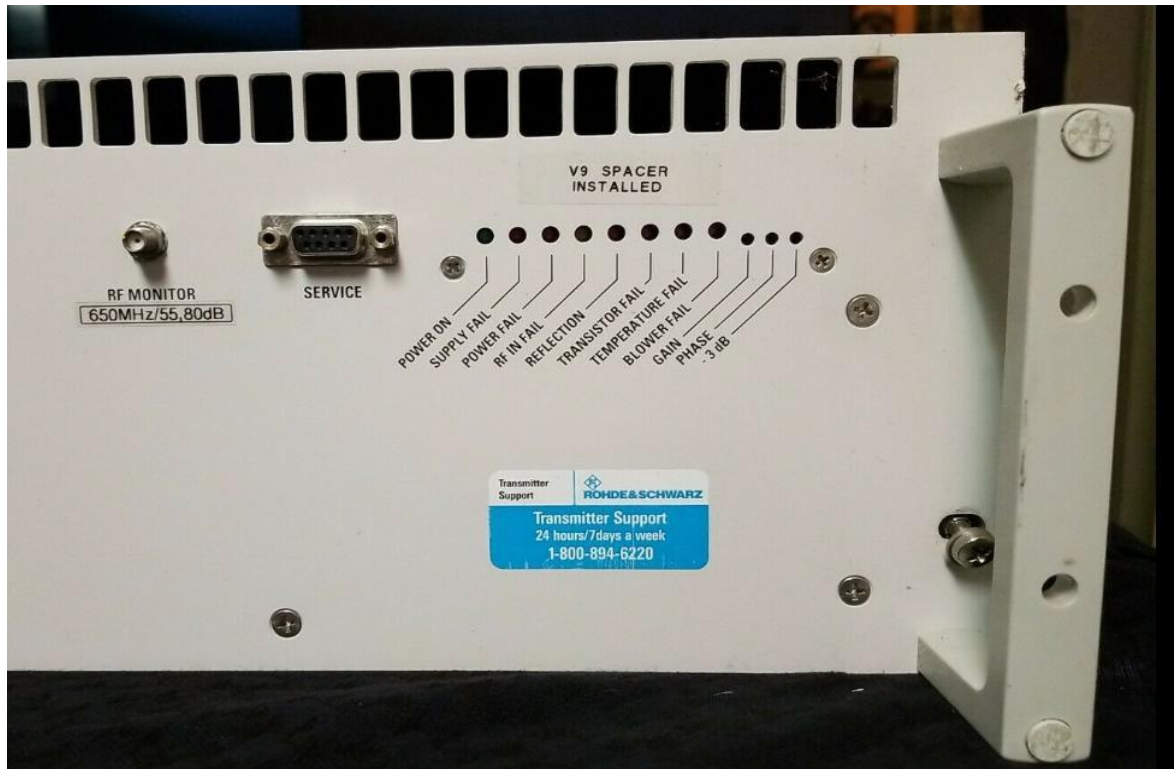


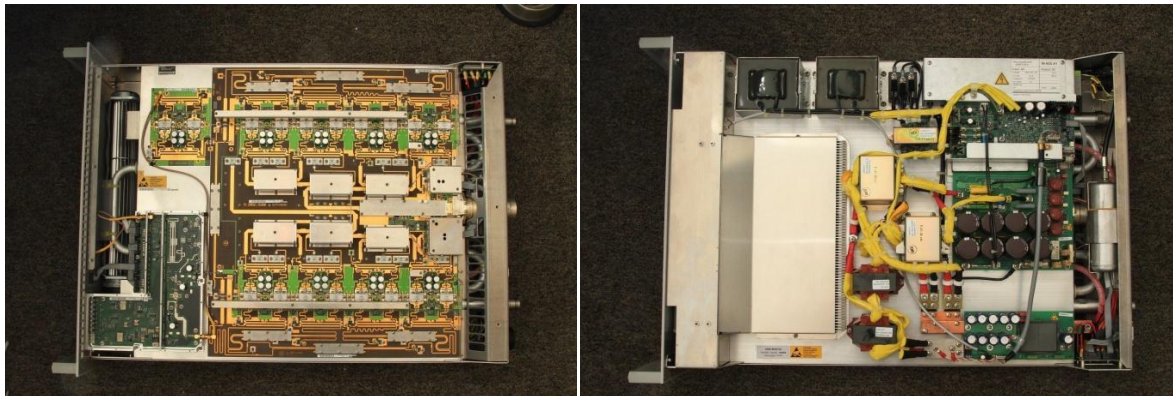
MODIFICATION of R&S VH602A2 WATER COOLED AMPLIFIER to 432MHz



The R&S VH602A2 2KW peak output power ex. analog TV amplifier is available from several sources.(EBAY,surplus dealers etc.) This water cooled amplifier has own 3 phase power supply and we can use it on 432MHz without any RF parts modification. Buying such a surplus amplifier is a very good choice to EME operation if you have a 3-phase network.

We need to build in the input/output RF relays, we need to solve the relays and the amplifier PTT switching and the cooling. The 16pcs LDMOS devices will work in STBY mode on RX, and in AB2 class under TX. Usage is also possible remotely with simple external control unit.

Photos of original power amplifier:



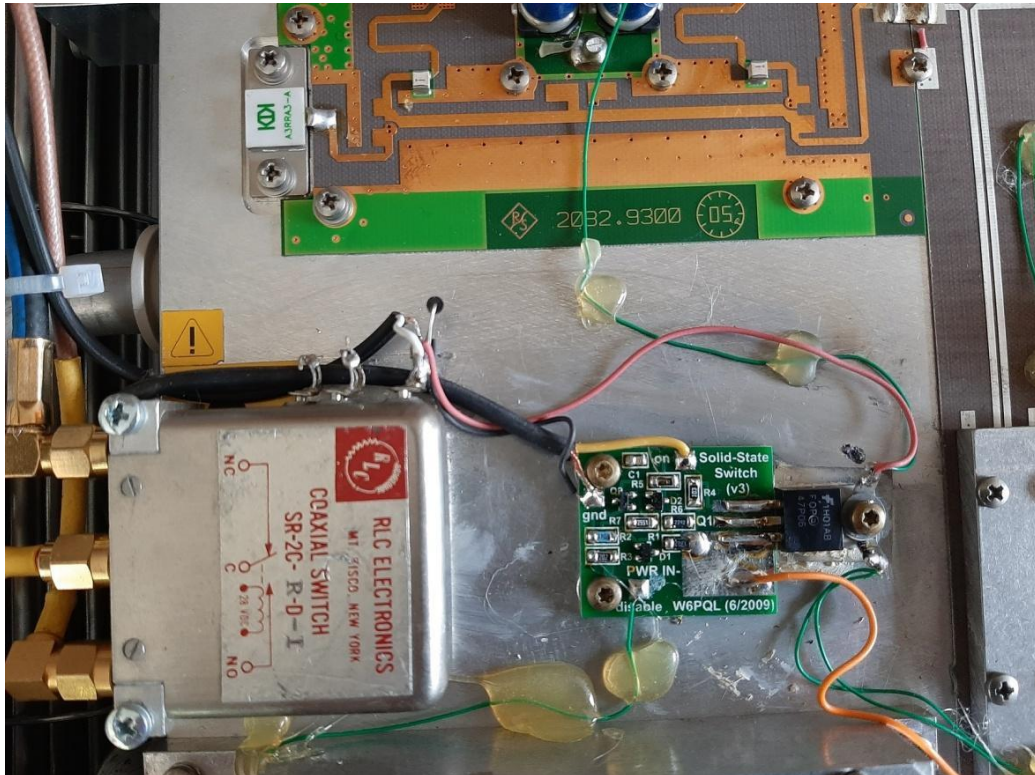
1. Building in the input coax relay and the W6PQL FET switch.

We need to remove the top cover only to the needed modification. The built in 3 phase PS works perfectly from 400V. Not easy to find a special R&S 3 phase plug, but we can remove the original and we can connect the lines easy directly to the inside connector. (4 wires, 3 phase and the GND)

We have enough place inside to mount the input SMA type coax relay and we have enough free place is available for W6PQL type FET switch as well.

This small PCB will switch to TX the driver and the 2x8 FETs to linear operation, and can switch also the RF relays.

Mount of input relay and W6PQL switch:



The R&S PA worked originally from few mW driving signal. The preamplifier will out from service in the next.

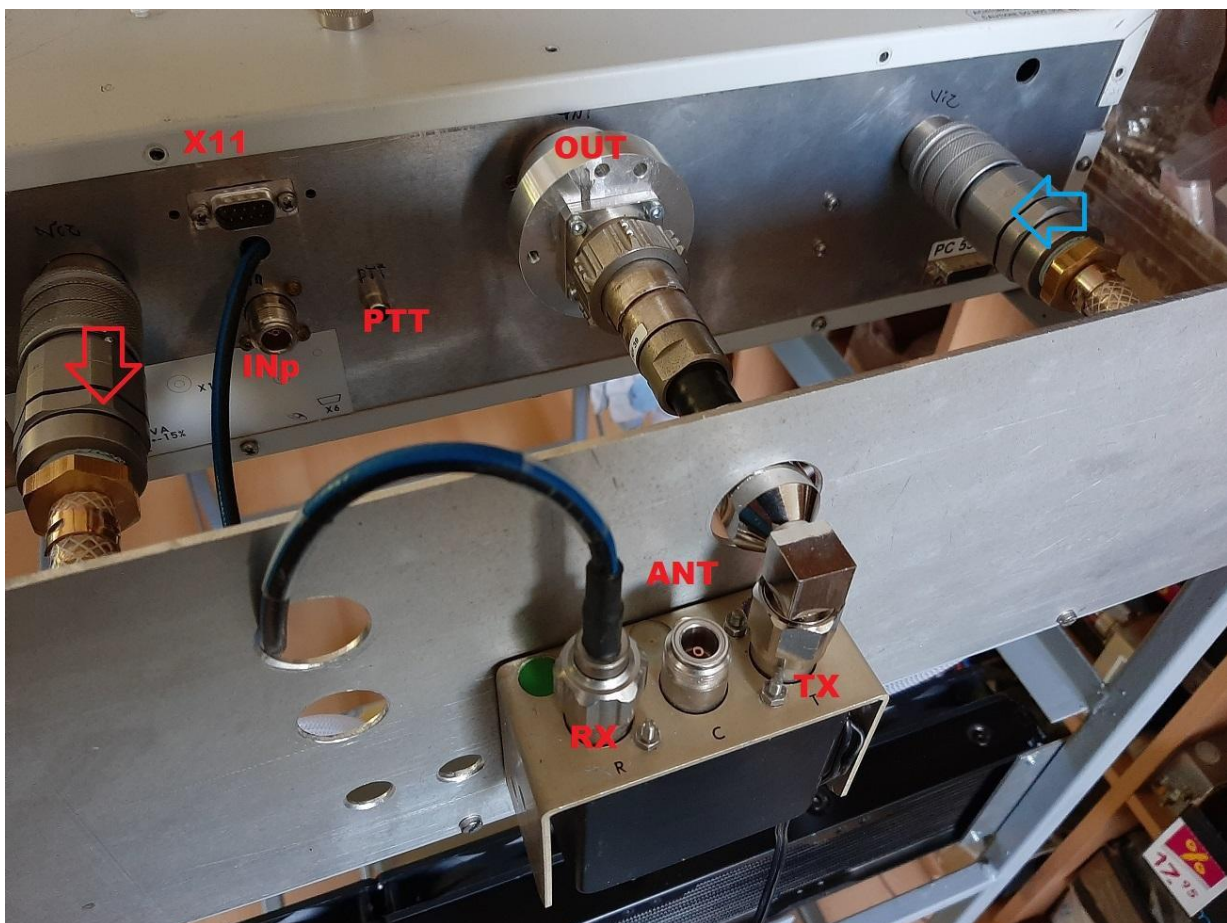
We need to use the 2x BLF861 driver. I put on an 6dB/25W attenuator (6..10dB is OK here) in the input coax line.

The PA can produce easy 1500W output with 13..14W input power. We do not exceed 15W driving power in case 6dB attenuator!

Sorry no enough free place for the output coax relay inside - we mounted it on the rear panel of the complete amplifier. We need to use stable RF relay with good isolation and need to have enough capacity to switch 1K5 on 70cm. R&S used an special output RF connector. No any normal RF connector fit to this connector, we need to use an home brew adapter to 7/16" female + a short 1/2" cable with 90 degr. N connector to RF relay. The N connector just enough for this output power we try to use only quality type.



Position of RF output coax relay:



2. Wiring

R&S uses every needed built-in protection circuit to the amplifier and you can see different faults on front page LEDs: Supply fail, Power fail, RF in fail, RFL, Transistor fail, Temperature fail, Blower fail.

The RF fail doesn't work without the preamplifier unit. The wiring is relatively simple:

We need to wire both relays parallel, Both relays receive voltage from W6PQL switch output, /red wire/- (together with 3x green wires to AB2 class operation)

The W6PQL input voltage is +32V connects directly to +32V line /pink wire/.

The PCB „ Start” point connects to PTT input connector /rear panel/, and the „Disable” to the protection circuit.

In case of any failure, this unit will send inhibit signal to W6PQL switch, you will see on the front page the cause of the failure, and the PA backs to RX status.

We can reset the failure (in most cases) once the problem is solved.

The reset works with external voltage from the X11 connector. (pin 3 receive + voltage if you push the reset knob)

The switch ON of PA is possible with external voltage from this connector. (pin 8 receive continuous + voltage)

If the PA is in RX position, and the Gate voltage doesn't exist you will see the transistor fail to sign on the frontpage LED! Do not panic it's normal.

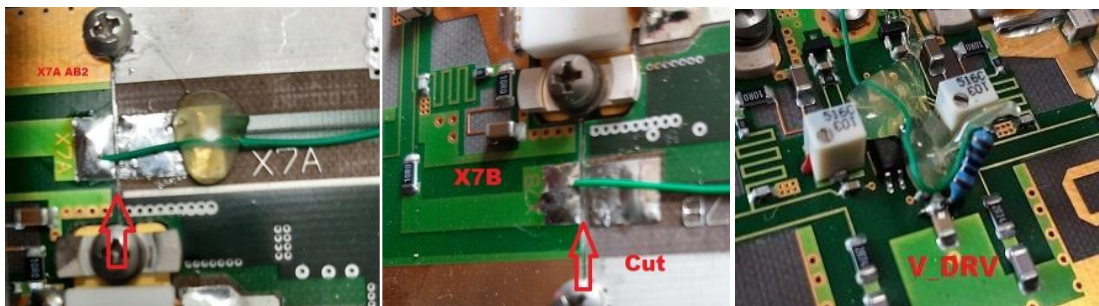
From frontpage X5/service connector/ we can get some reference voltages:

- V_DC out (pin7, +32V out across built-in serial 100 Ohm to control unit)
- PWR_out (pin3, FWD voltage to control unit)
- RFL_out (pin 9, Reflected voltage to control unit)
- TX_on(pin5 -instead I_DC-, modified, control unit ON LED)
- GND

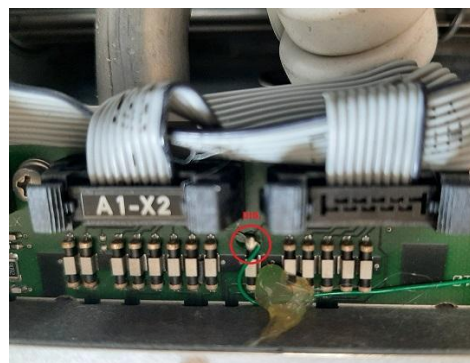
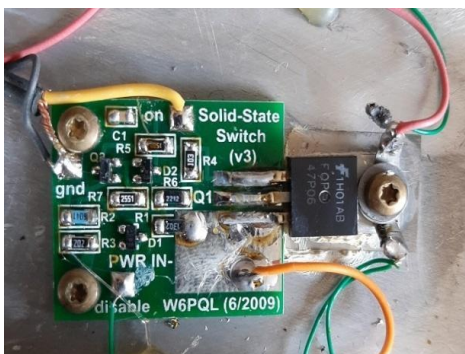
So, the X5 connector connects to another 8 pins female connector on a plate under the cooler blower unit on the rear frame, and we can connect it with a 5-6m shielded cable to the control box. The cooler unit also connects over another 8 pin connector to the control unit, because the water pump and the water cooler unit receive +24V voltage from the external control unit.

The wiring of units:

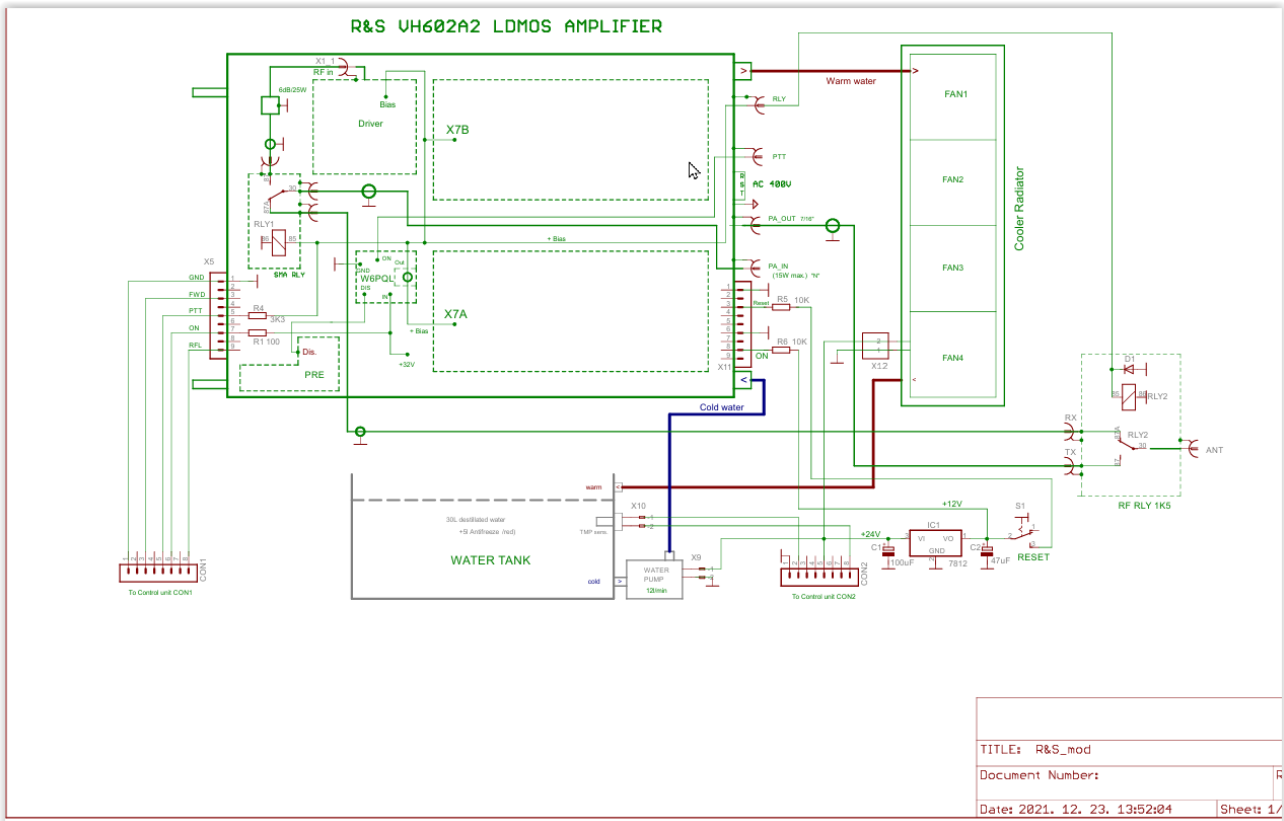
We cut at the first the original bias lines at X7A, X7B, and in the Driver unit./see the photos/ Every green wire connects to W6PQL switch circuit output.



The W6PQL Switch unit wiring and the „Disable” connecting:



Modification schematics:



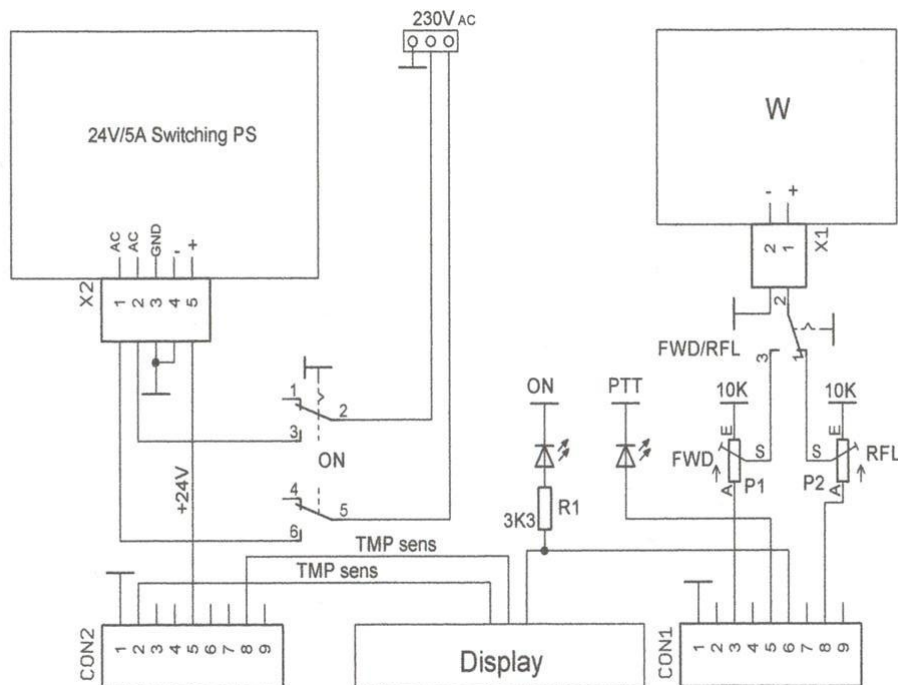
3. The simple Control unit:

We using the PA remotely from another room. You can switch ON the PA and can see the FWD and reflected output power on the meter(calibrated in W) we can see the actual water temperature as well. PS voltage is visible on a color screen.

The PTT and PA status is visible on LED. The control unit is built-in ALU enclosure and connects with 5-6m long shielded 8 pol cables to the PA unit.



Control unit:



4. Mechanical construction

The equipment we placed in an angular frame.

The frame can be moved, to employ wheels at the bottom. The water tank contains 30liters distilled water as well as 5 liters of antifreeze type R15+ (red).

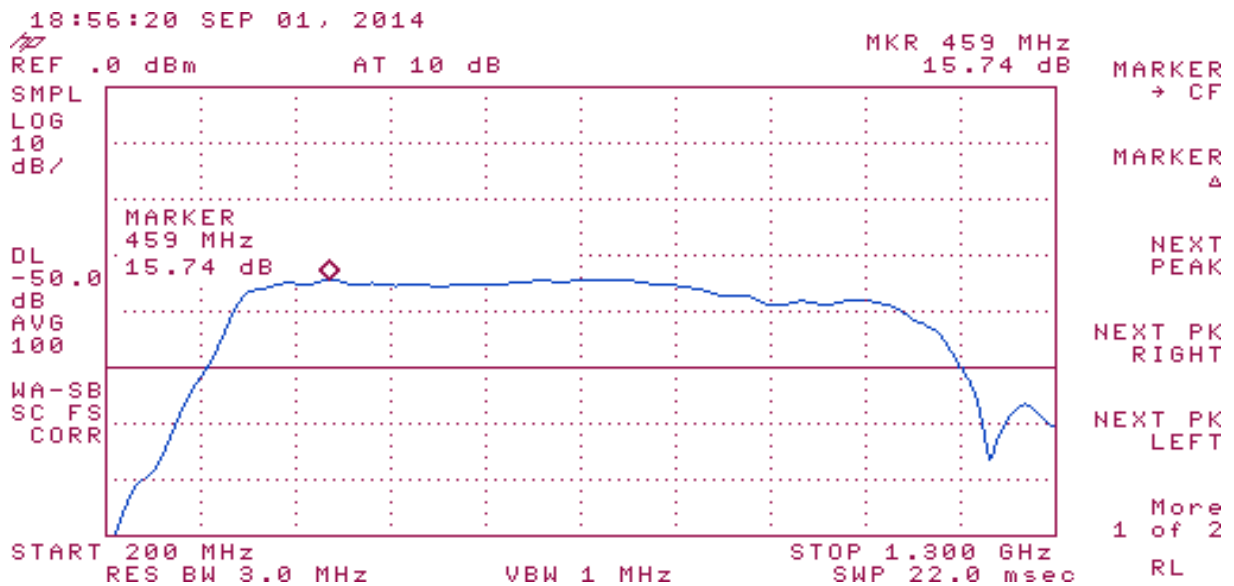
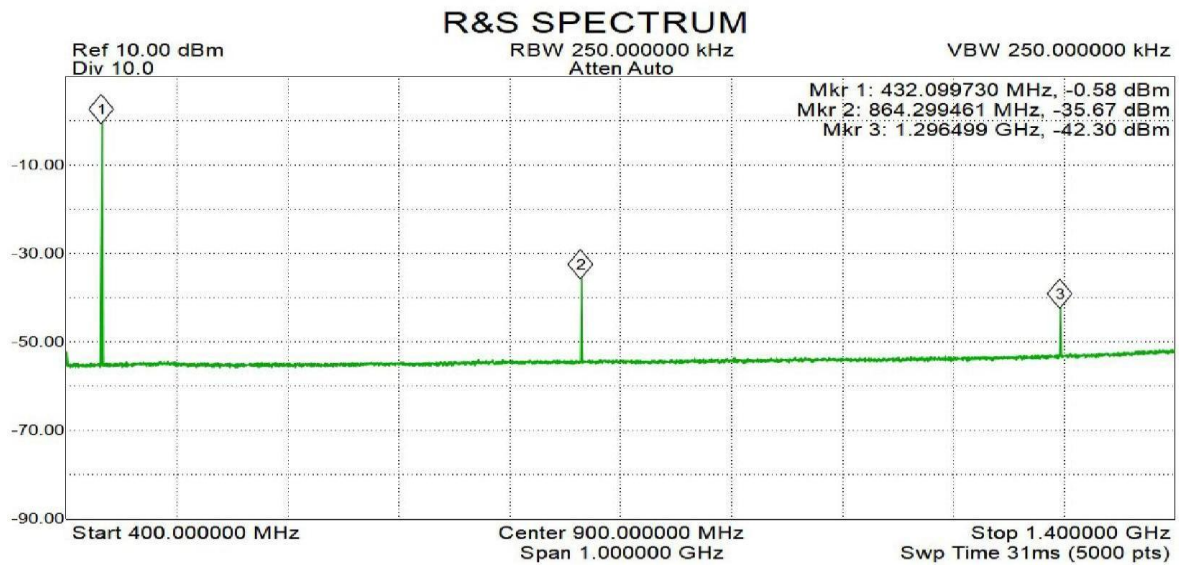
The cooling unit is a computer processor cooler with 4pcs 120x120mm silent 24-volt fans.

The pump that can transport 700 l water/h is made by China. We assembled a 2pcs aluminum heat sink on side of the water tank for better cooling.

Few photos from construction:



5. Measurements:



5. Conclusion

This wideband amplifier works very stably. The water temperature never exceeded 35C under EME operation. Every protection circuit works fast and fine. The 2nd harmonics is about -35dB the third is below -40dB at 1000W output, so an LPF filter is recommended. Never exceed 15W driving power and 1500W output power.

Thanks to everyone who helped me implement this project.