RM Italy KL-500 PA

last modified: 30. Aug. 2004

Frequency	HF
Input energy/power	10-34 A
Input power	1-15 W
Input power SSB	2-30 W
Output power	300 W Max
Output power SSB	600 W PEP Max
Mode	AM-FM-SSB-CW
Fuse	3x12 A
Output power level	6
Size	170x295x62 mm
Weight	1,6 Kg
Antenna preamplifier	26 dB

http://www.rmitaly.com

These simple modifications make a nearly high-tech PA out of a stock KL-500 which is originally designed for simple CB operations and has no temperature stable BIAS or output low-pass filter. And the switchable 6-position input power attenuator is a real shit as the input SWR raise up to more than 6:1 on most of the positions !
Some ideas are from Hans-Joachim Pietsch (DJ6HP), published in the german ham radio magazine "FUNKAMATEUR 09/2003, p.928-929" and "FUNKAMATEUR 10/2003, p.995".

Jörg Sander (DF3OJ) sells an additional "update PCB" now which adds an electronic PTT-switch and 6 switchable bandpass filters. A great and must-have add-on !!!

→ www.df3oj.de → **PA500UP** or **PA500UP-817** (for Yaesu FT-817)

I got the first PCB of his brand new PA500UP-817 to be the "beta-tester" and the results of my modified KL-500 and the add-on PA500UP-817 are real great.

Hope you enjoy it.

Best 73,
Jochen Heilemann ---DG2IAQ---

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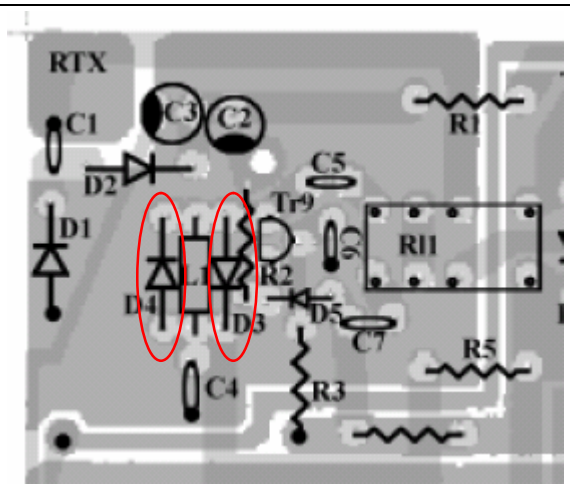
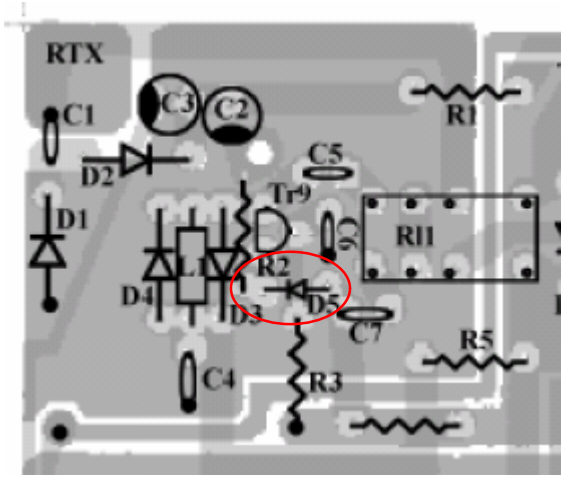
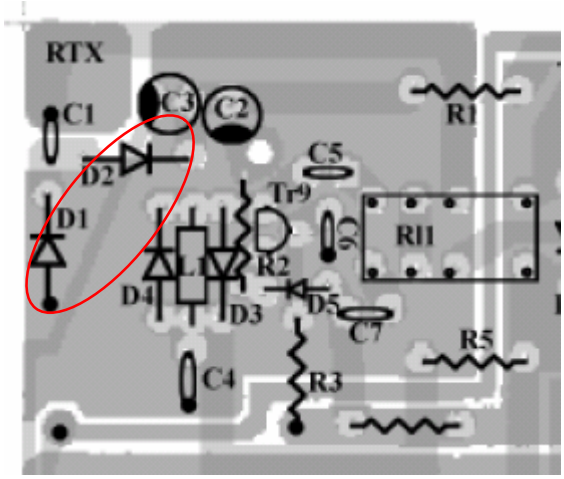
Modifications:

All modifications are referring to PCB v2.00 !!

1.	**Remove D3/D4** This prevents the excessive noise level of the RX-Amp. You get much cleaner signals than before by using the RX-Amp.	
2.	**Change D5 to a BAT85 lownoise schottky diode or similar.** This prevents the excessive noise level of the RX-Amp. and adds some more input sensitivity. A 1N5711 would also be OK but you won't have the additional better sensitivity.	
3.	**Change D1/D2 to BAT85** This adds a higher sensitivity to the RF Detector of the PTT switch (RF VOX). This only makes sense by using a QRP rig, like the Yaesu FT-817, which only can give an input power level of 5 watts on maximum.	

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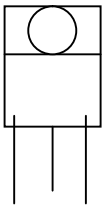
4. **Make a stable and temperature stabilized BIAS supply.**

Unsolder **R12** on the upper side where it's connected to the +12V line. Insert a 78S09 fix volt regulator instead. You have to cool the 78S09 so you can mount it on the inner side of the heat sink.

78S09:



Input Gnd Output

I added two 1nF capacitors from input/output to ground to prevent RFI problems.

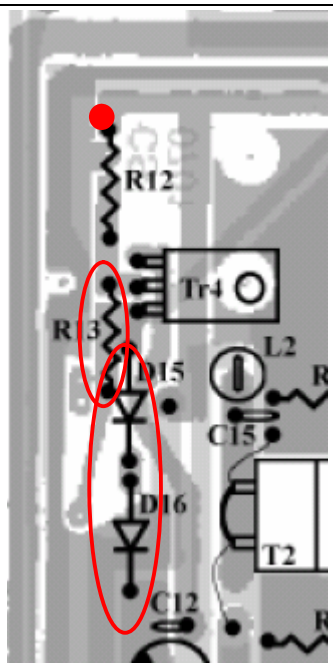
Remove **R13** and replace it by a 500 ohms 10-turn precision variable resistor.

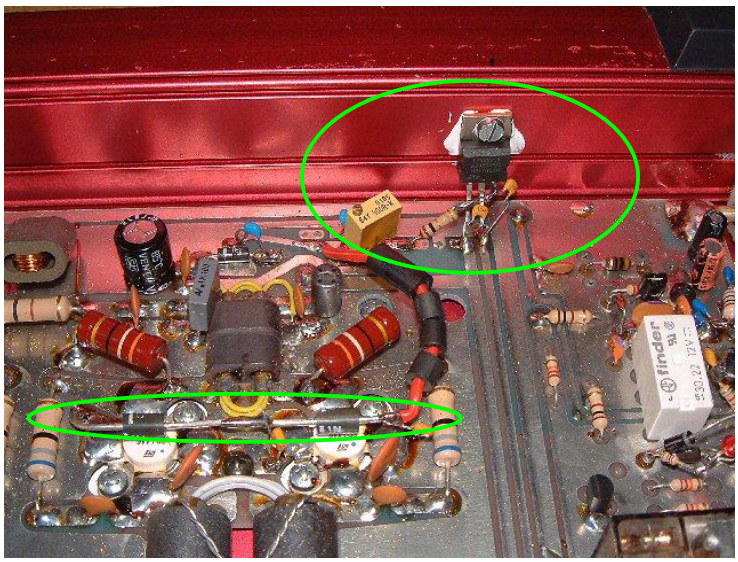
Remove diodes **D15 + D16** and solder them in serial over the PA transistors **Tr5 + Tr6** to get a thermal connection. Add a capacitor of each 1nF from the connection D15/D16 and D15/R13 to ground to prevent RFI.

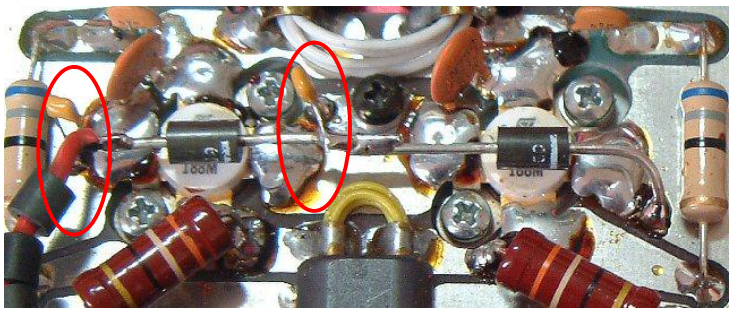
You don't need the RF chokes over the red wire, but as I tried out the first time I wanted to be on the safe side and I wanted to prevent oscillation. But it's not necessary.

Here you can see the both 1nF to ground. As I removed D15/D16 I changed to bigger 1N5404 instead of the original 1N4004, but that's not necessary too. You can use the removed D15/D16 (1N4004) of course.

Finally add some heat-conductive paste over the diodes to get a better temperature connection.







After this you have to **align the 500 ohm pot** to a **total current consumption of the PA** of about **2A** (only PTT, without any RF input signal). This BIAS works great.

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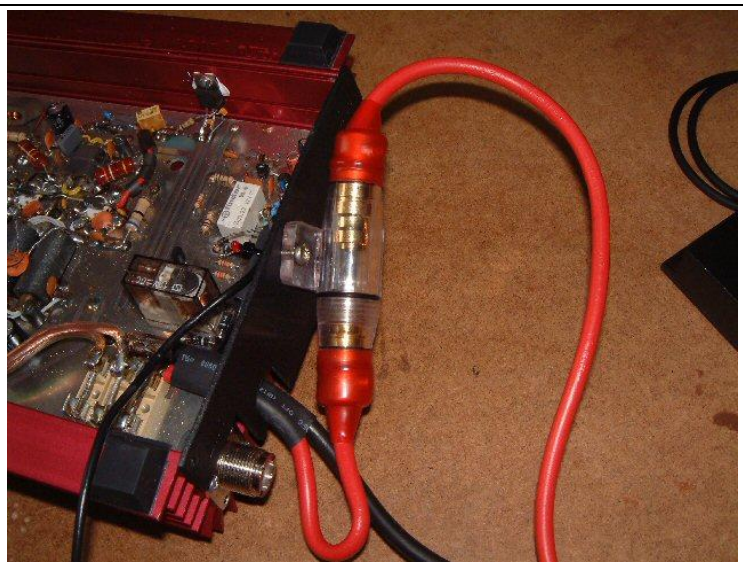
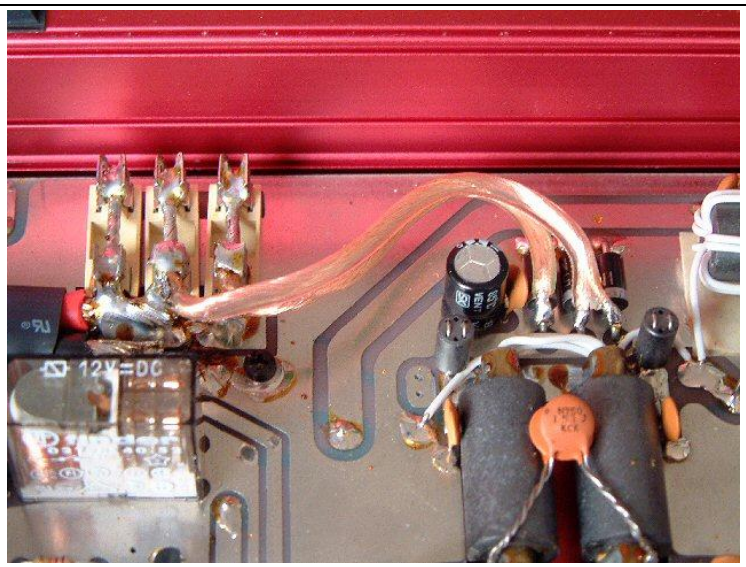
5.	**Replace the three 12A-fuses with one 40A audio highpower fuse.** **Change the power cord to one with a larger diameter.** This prevents losses on the power cord and makes the power supply on the inner side of the KL-500 more stable on the modulation or power peaks..	
6.	**Remove the loss of the internal fuses holder.** The internal fuses holder for the original 3x 12A fuses has a loss of up to 3 volts (!!) on a power consumption of 40A. So I bridged the 3 fuse holders with thick wire and soldered additional strong wires from the plus pole to the cathodes of D12/D13/D14 to "widen" the diameter of the PCB line (which is on the down side).	
7.	**Add a lownoise fan to the top of the PA.** This reduces the heat up of the PA. I'm using a low noise fan with an integrated temperature detec-tor and variable speed. like: Papst Variofan 8412 NGMLV	

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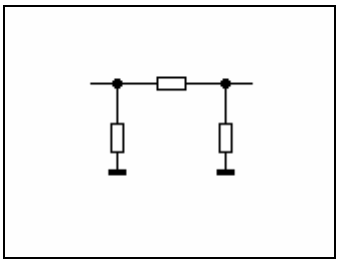
PA500UP
PA500UP-817 from DF3OJ, Jörg Sander

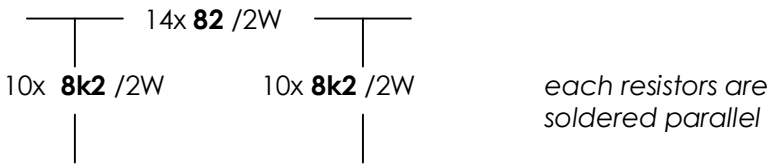
This add-on PCB adds a 50 ohms "-4dB" attenuator to the RF input line and 6 switchable RF bandpass filters to the output line of the PA. And it has a PTT electronic too which works parallel to the internal RF VOX circuit.
Cause of the proper 50 ohms input termination (-4dB attenuator, 50 ohms in/out) and the lowpass filters the modulation with the PA gets real great and clean. The TRX always see a correct 50 ohms connection on the input of the PA.

For the use with the Yaesu FT-817 (5W) and my SGC SG-2020 (20W) I changed the input attenuator from the stock "-4dB" to "-1dB" to get a higher output level. As seen in the KL-500 datasheet the PA could get an input drive up to 30 watts, but I won't go up to this edge.

Input attenuator



My "-1dB" attenuator consists of:



By using 2W resistors the theoretical input power level could be much, much higher than the needed 20W, so you can use 1W or 0,5W instead.

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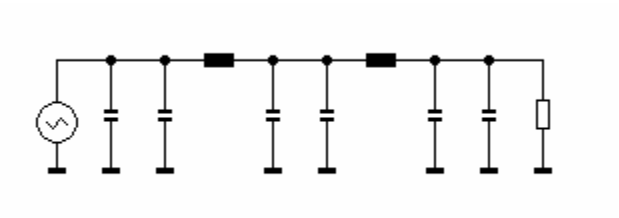
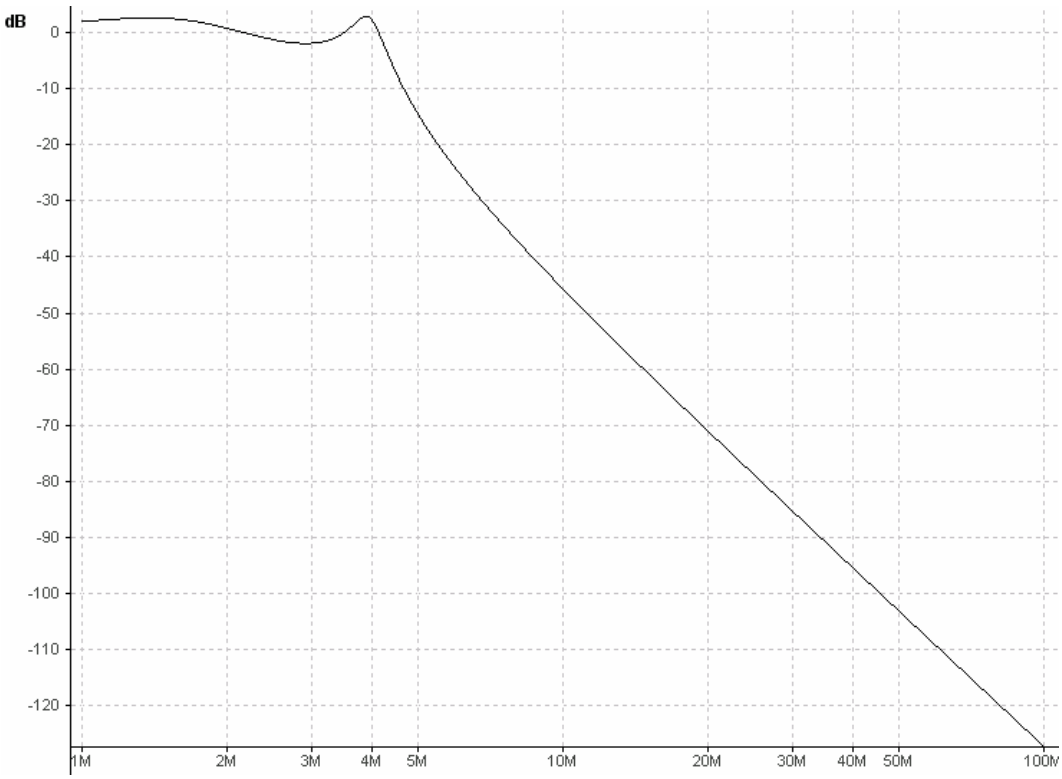
Output lowpass filters.



Each of the 6 lowpass filters are switched via a relay in/out the output line of the PA. Below you can see some plots of each filter stage.

1.8 MHz (Pos.6):



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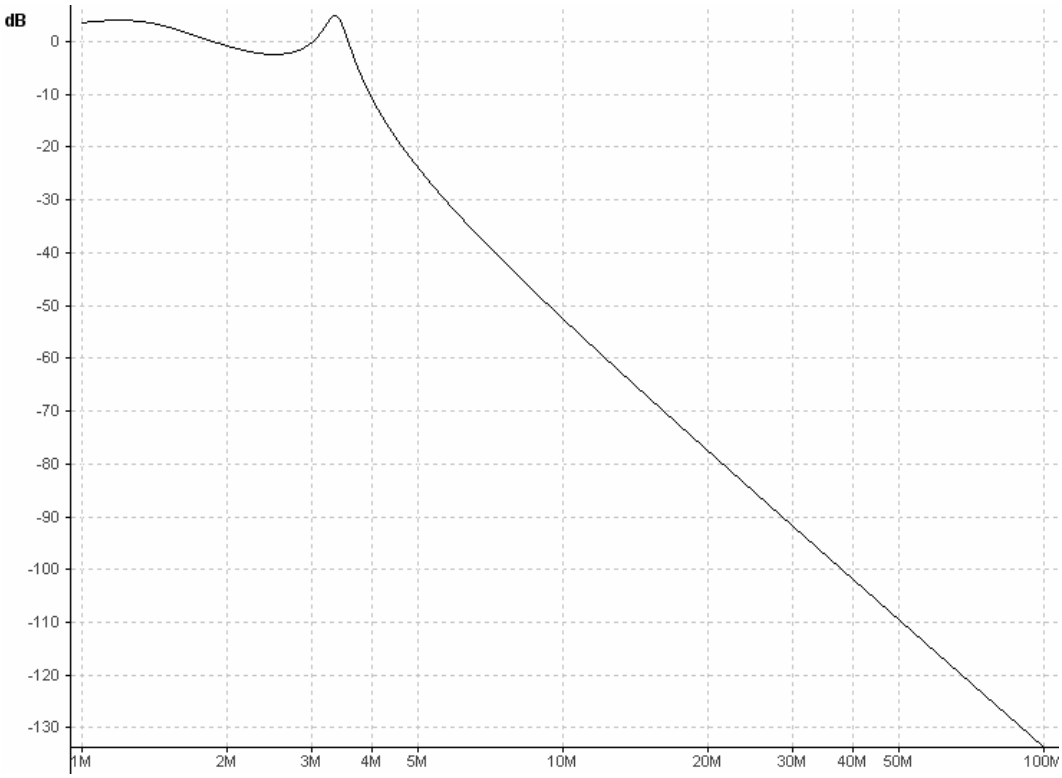
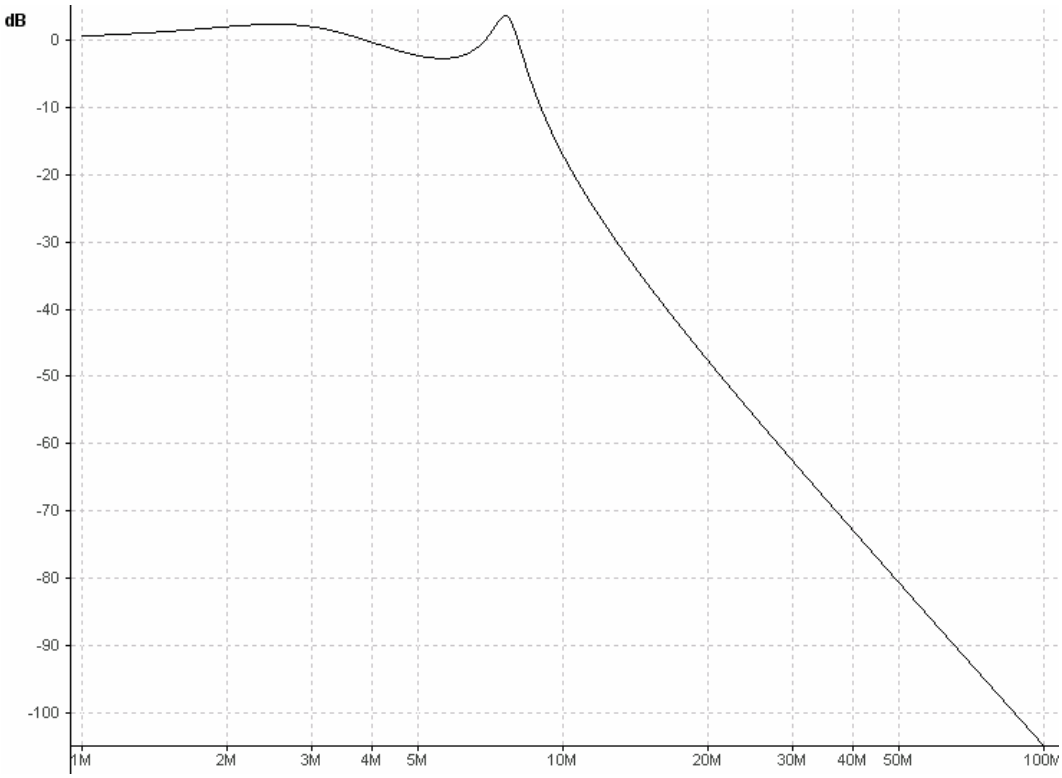
3.6 MHz (Pos. 5):



7 MHz (Pos. 4):



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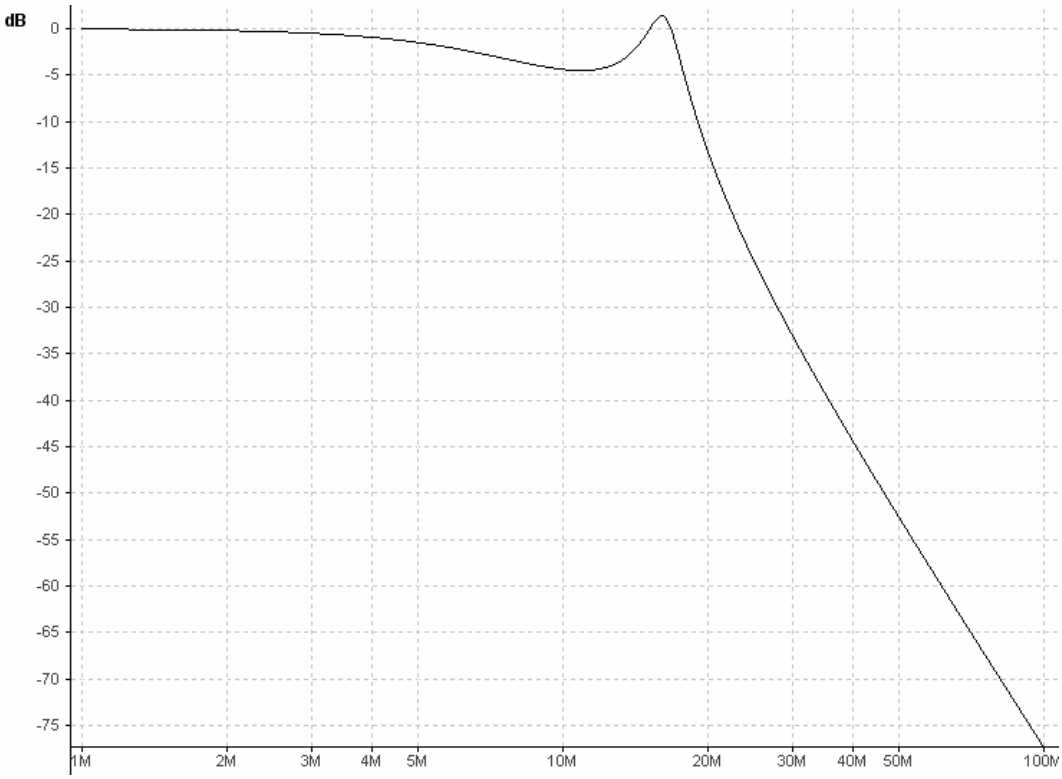
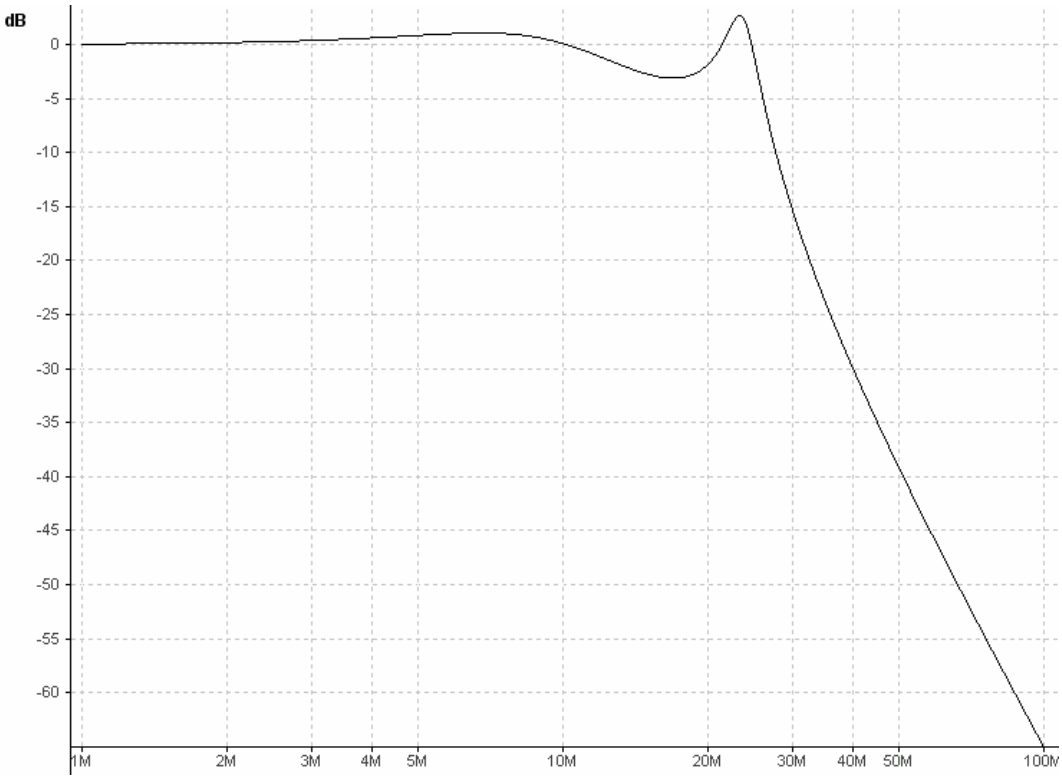
10 MHz (Pos. 3):



14 – 18 MHz (Pos. 2):



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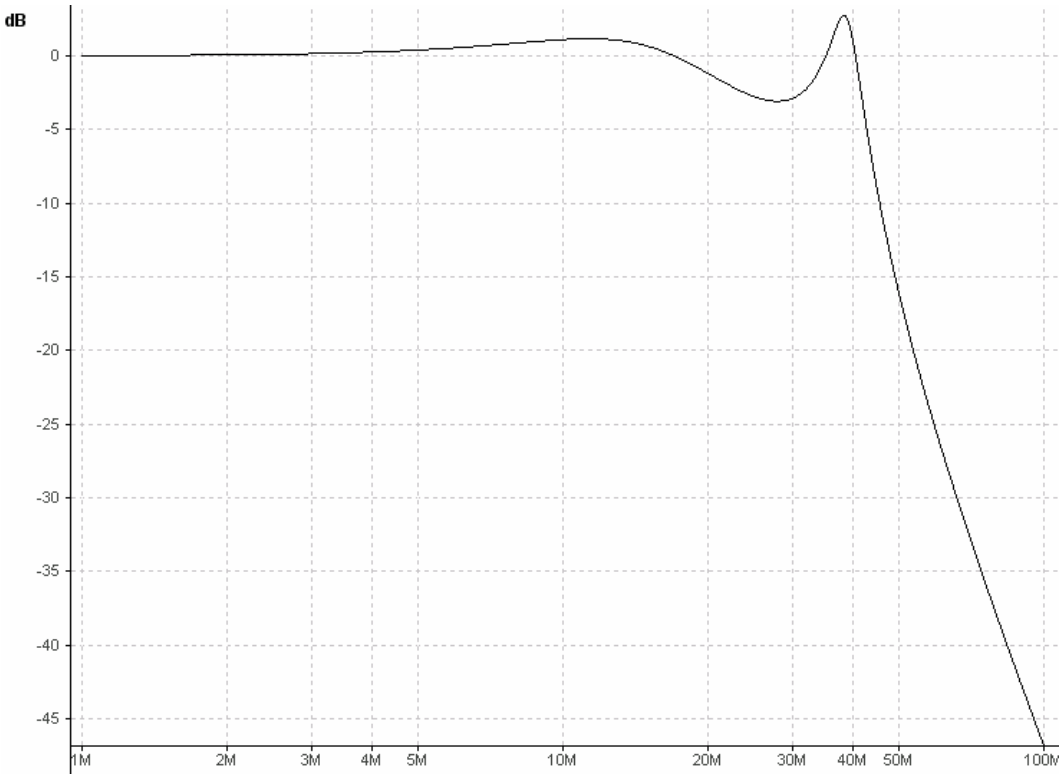
21 – 28 MHz (Pos. 1):



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Audio Files

Here're some audio test files on which you can hear the clarity and improvement of the PA. Unfortunately I'm monitoring the audio with the MIC IN socket of my soundcard which has a build-in AGC. So the real difference on the "weak signal" file is much greater than can be heard here.

Audio file with strong signals.
The FT-817 is connected to a dummyload and produces S9+40 with 5W and about S9+60 with 150/200 watts. You can hear the clarity and additional "dynamic" of the class AB operation.

Audio file with weak signals.
The FT-817 is connected to a dummyload and produces S1 with 5W and about S9 with 150 watts. This goes up to S9+5 with about 200 watts. The true improvement can't be heard here cause of my recording AGC.

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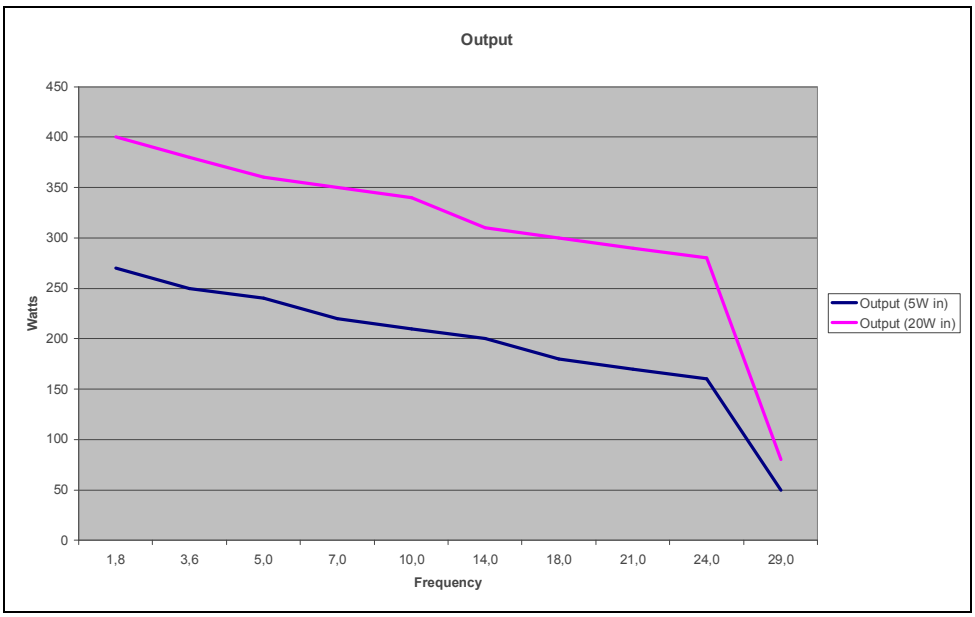
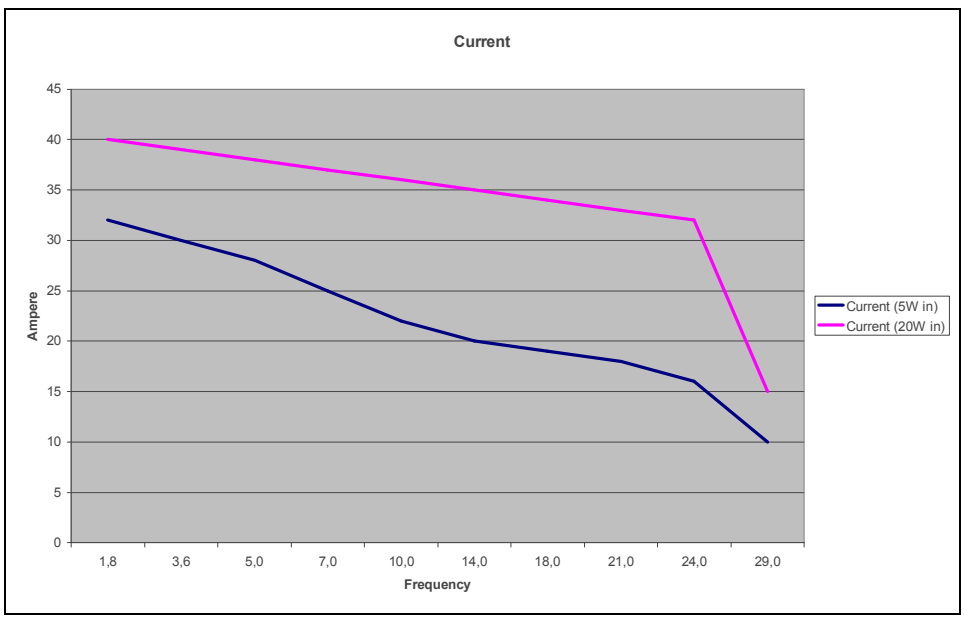
Output and power supply data

This chart only refers to my own PA500UP-817 version which works with a "-1dB attenuator" and has all the modifications above. Measurements on a 13,8V/40A power supply.

Band	Frequency (Mhz)	Output (5W in)	Current (5W in)	Eff. (5W in)	Output (20W in)	Current (20W in)	Eff. (20W in)
160m	1,8	270	32	61%	400	40	72%
80m	3,6	250	30	60%	380	39	71%
60m	5,0	240	28	62%	360	38	69%
40m	7,0	220	25	64%	350	37	69%
30m	10,0	210	22	69%	340	36	68%
20m	14,0	200	20	72%	310	35	64%
17m	18,0	180	19	69%	300	34	64%
15m	21,0	170	18	68%	290	33	64%
12m	24,0	160	16	72%	280	32	63%
10m	29,0	50	10	36%	80	15	39%





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This modifications mostly need to be done by a electronic specialist who had enough practise and who has knowledge in SMD soldering. **You do the modifications on your own risk !**

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