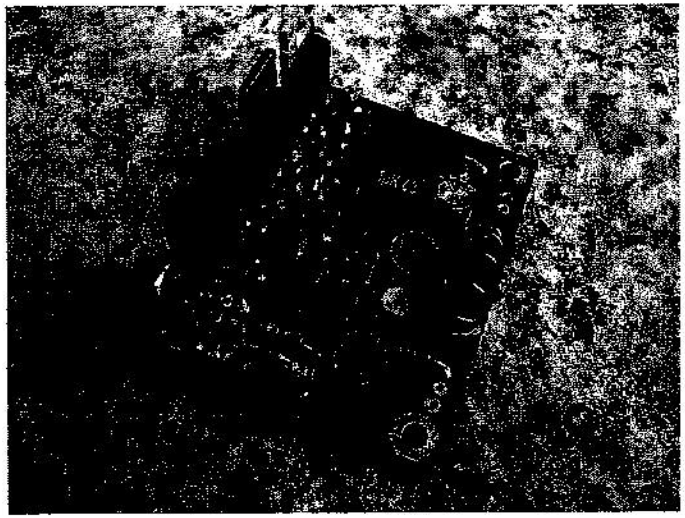
DL-QRP-AG



Baumappe QRP-PA2008

english version

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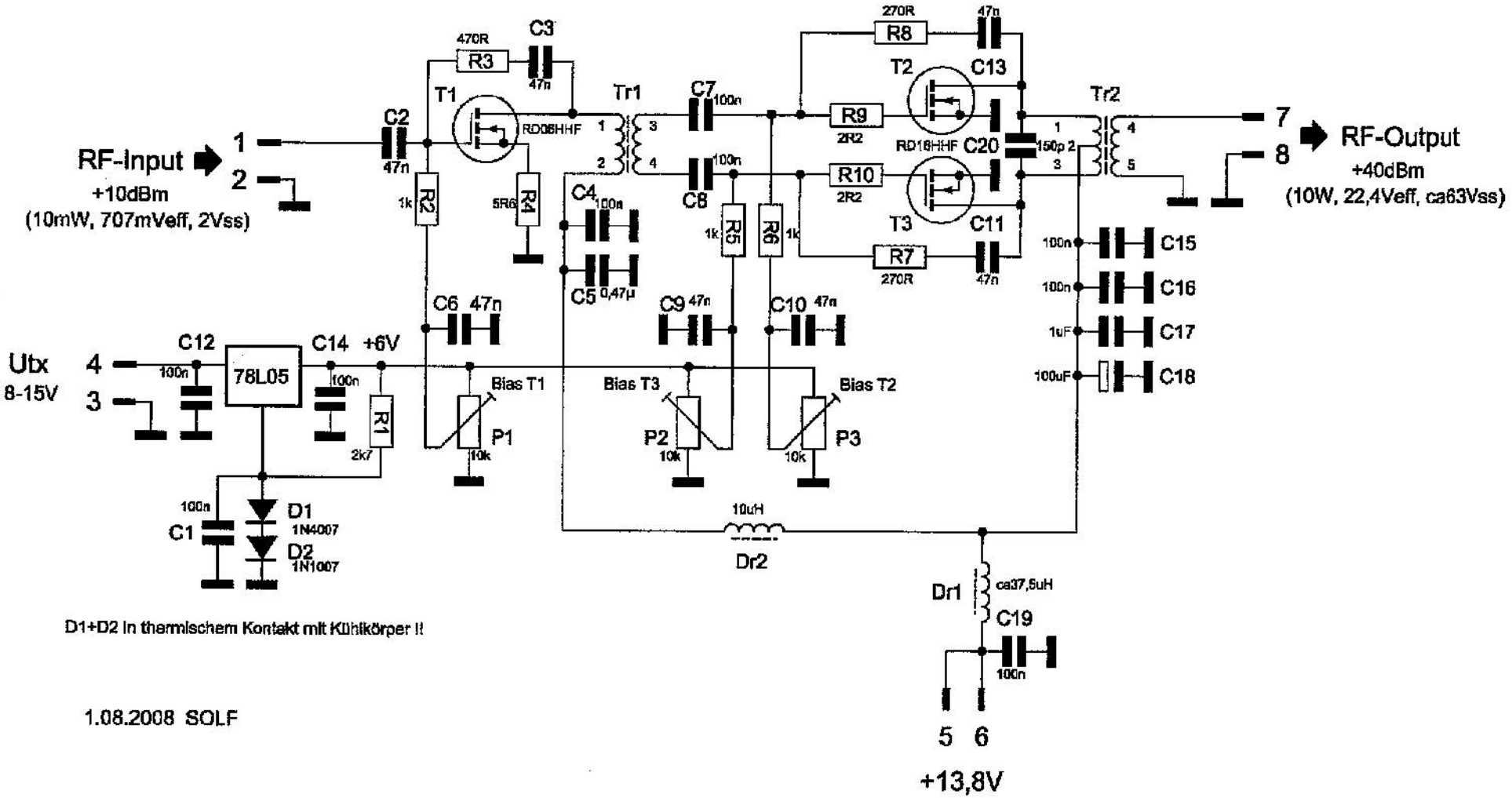
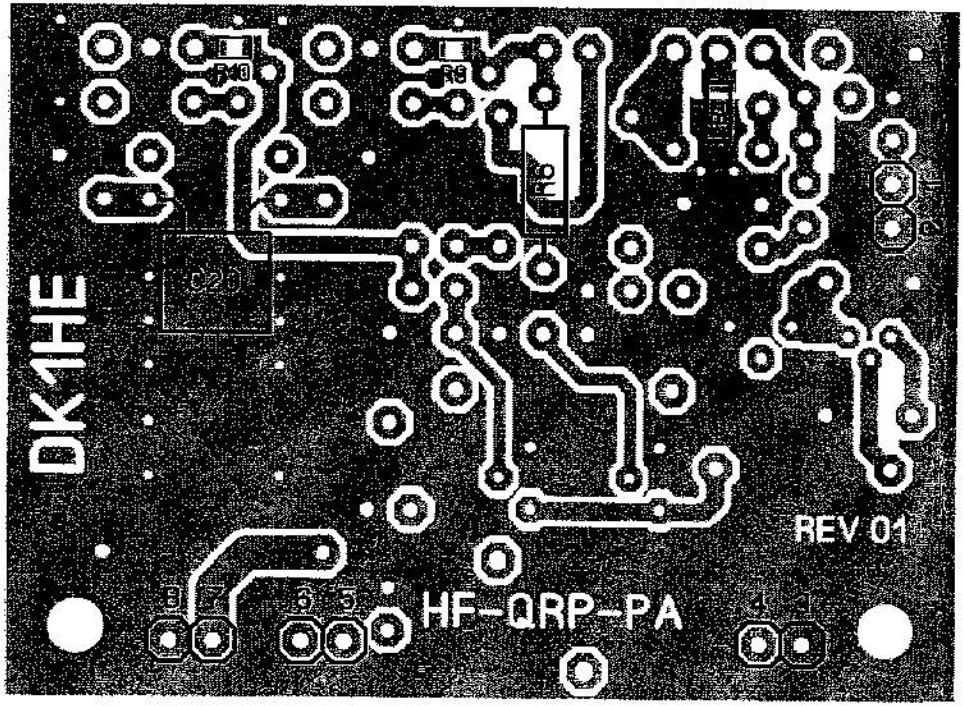
Handbucherstellung: FIservice Peter Zenker DL2FI email:dl2fi@QRPproject.de Version 1.1

DK1HE KW-QRP-PA



D1+D2 in thermischem Kontakt mit Kühlkörper !!

1.08.2008 SOLF



Start at the bottom side of the PCB, you will have to solder some SMT parts there. The connectors PIN 1 to PIN 8 are only used if you will connect our QRP-PA2008 to another system dirctly by correponding plug connectors. if you have to use wires don't use connectors but solder the wires directly to the pcb.

[ ] R10 2R2 SMD 0805
[ ] R9 2R2 SMD 0805
[ ] R4 5R6 SMD 1206

[ ] R6 1k Cut the wires of the resistor at the upper side of the pcb as short as possible.

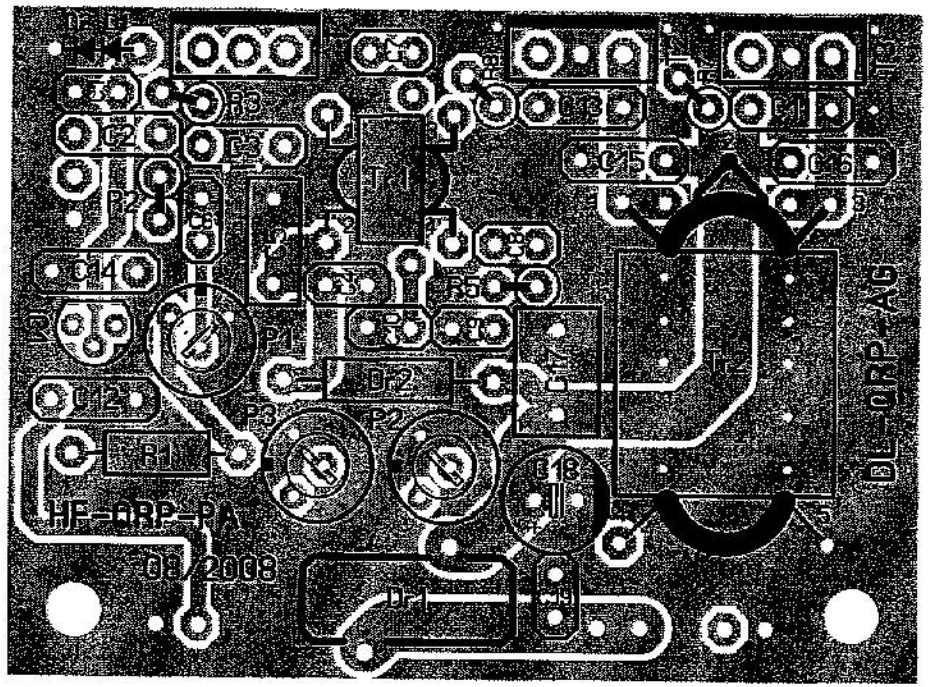
[ ] C20 150pF MICA Kondensator. Don't exchange against another Cap. We need an Q as high as possible at this place, this will be given only with the MICA type.

Now turn around the PCB and go ahead with the parts on the upper side.

Start installing the low profile parts, in this case the caps.
It helps to orientate if you start with C1. Take care to hold the wires of all parts as short as possible. The wires of some caps must be flattened or bent to the correct spacing before you can install them. Installed caps must sit as close as possible above the pcb

The number inside the brackets shows the nominal value of the cap (e.g. 104 means 100nF = 0.1 uF, normally you find the same number on the caps body.

[ ] C1 100nF (104)
[ ] C2 47nF RM5 (473) (bend cap wires to correct spacing)



[ ] C3 47nF RM5 (473) (bend cap wires to correct spacing)
[ ] C6 47nF(473)
[ ] C14 100nF RM5 (104) (bend cap wires to correct spacing)

[ ] C5 0.47uF Folienkondensator RM5
[ ] C12 100nF RM5 (104)

Now go ahead in the back right corner of the PCB:

[ ] C7 100nF (104)
[ ] C4 100nF (104)
[ ] C10 47nF (473)
[ ] C9 47nF (473)
[ ] C8 100nF (104)
[ ] C13 47nF (473)RM5 (bend cap wires to correct spacing)
[ ] C15 100nF (104) (bend cap wires to correct spacing)
[ ] C11 47nF (473) RM5 (bend cap wires to correct spacing)
[ ] C16 100nF (104)RM5 (bend cap wires to correct spacing)
[ ] C17 1uF Folienkondensator

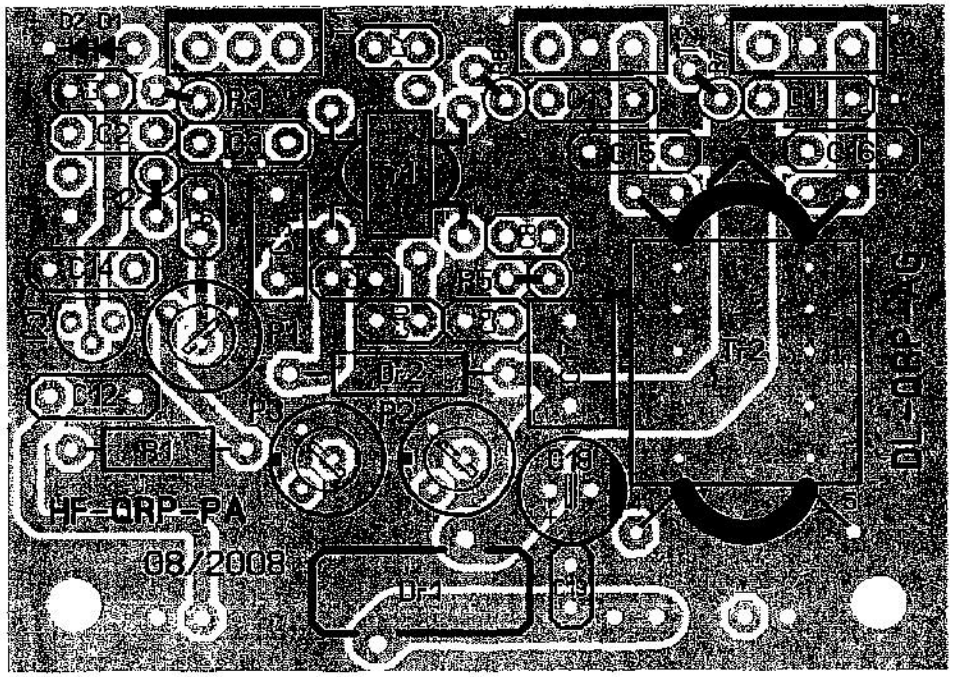
C18 is a polarized electrolytic cap. It is marked with a band of minus signs, the longer leg is the plus connection.
[ ] C18 100uF
[ ] C19 100nF (104)

Now the resistors. We dont´t talk about the colour bands in this manual becaus our axpierience is that they too often are interpreted wrong. 15% of grown up men are colour blind and dont´t know it :-)
We recommend to measure each resistor with an Ohmmeter

Start in the back left corner
[ ] R3 470R upright
[ ] R2 1k upright
[ ] R1 2k7 flat in board

The next two resistor ar 2 Watt types, but they are onla a little bit larger then the standard 0,65W resistors.

[ ] R8 270R upright
[ ] R7 270R upright
Not so easy to locate, in the middle of the PCB another standard resistor:



[ ] R5 1k

Now the SMCC Choke in the middle of the pcb:
[ ] DR2 10uH SMCC

in front and left of it 3 precision trimm potentiometers:

[ ] P3 10k
[ ] P2 10k
[ ] P1 10k

Most parts are installen, leaving only the semiconductors and 3 induktivities.

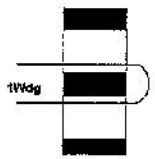
Choke DT1 must andle a lot of current, so we do not use a SMCC choke but a power choke wound using 0,7mm wire on a 0,5" ferrite torroid. It´s a FT50-43 (FT stands for Ferrite, 50 means 0,5", 43 is the material number.

Wind 10 turns using 0,7mm wire. Remember: you must count the number of turns inside the torroid!
The ends of the wire must be tinned very carefully. In the past we found that most mistakes are made here. Check carefully that the part of the wire which is inside the solder lug is tinned completely before you solder.

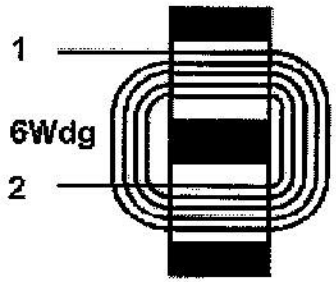
[ ] DR1 10 10 turns 0,7mm enameled wire on FT50-43

In the next step you will produce the transformers. I´s is easy, but again, you must do this step very carefully. The functionality of your PA extremly is determind by this transformers. Please follw the instrauction!

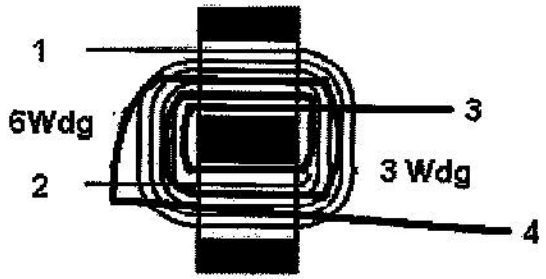
Transformer TR1 jas to transform the higher Drain-Impedance of T1 to the lower Gate-Impedance of T2/T3. That means down transformation. Because the PA is designed as a broardband PA (1-30MHz) we use a high permeable Ferrite double hole (pig nose) core. Going this way, we need only a small number of turns to get the high inductivity we need. TR1 needs 6 windings primary and 3 windings secondary.



Put the pignose on the table in front of you. The holes show left to right. Take 20cm of the 0.2mm enameled wire and feed it through one hole as shown in the picture. You get one turn if you feed the wire through one hole and back through the other hole.
Now through the first hole again and back through the other, that´s the second turn. Take care not to scrap the wire over the edge of the pignose, you may hurt the isolation laquer. Go on until you have completed 6 turns. (Dont be confused, the picture only show 5 turns!!



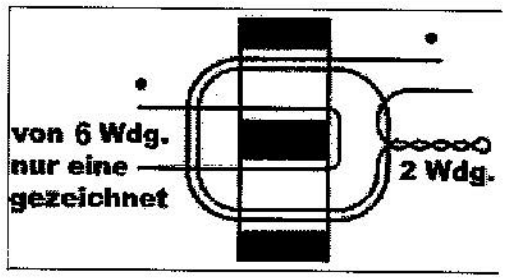
Now the secondary. This one will get 3 turns of the 0,3mm wire.
Take 15cm of the 0,3mm wire and start from opposite the primary. In case of the picture, this would be from right to left now. Feed the wire through one hole and back through the other, this is the first turn. Again through hole 1, back through hole 2- turn 2 is ready. Now turn number 3 and you made it.



Next step of preparing Tr1 is tinning of the wire. This time it is easier because the 0,2 and 0.3mm wire cann be tinned directly using the soldering iron. Again check if the wires inside the solder lug are tinned completely before you solder them. If you see the PCB in front of you, the primary shows left (marked 1/2) and the secondary show right (marked 3/4). While soldering hold the pig nose flat on the PCB by pulling it down with the 4 wire ends.

[ ] TR 1 Mini Doppellochkern BN43-2402
(1-2)6 turns 0,2mm wire (3-4) 3 turns 0,3mm wire

TR2 again is a pig nose transformer, but it´s bigger then TR1 because it must handle fully 10 Watt of power. It gets 2 plus 2 turns primary and 6 turns secondary which means an ompedance transformation of 1:9.
Again take care not to scrap the wire isolation. Take 25cm of the 0.5mm wire and wind 6 turns the same way you did making TR1. If ready, take anothe´25cm wire, start from the opposide of the pignose and wind 2 turns. The picture below shows TR1 with only 1 turn of the secondary. Now twist the remaining end of the wire you are just using to get a tap as you see it on the picture left. You must twist the tap as near to the bosy of the pig nose as possible. Ready? OK, go on with the open end of the wire, feed it throug hole marked with the dot and back



throug the other to complete turn 3, and again through both holes to make turn 4.
That completes TR2
If you lay TR2 in front of you you should see 2 wire ends at one side, thats the secondary and 3 wire ends at the other side, thats the primary.
Again all 5 ends must be carefully tinned next to the pig nos body. If they are tinned, place it on the PCB, feed the wires through the solder pads , pull down the body of TR2 flat to the PCB and solder all 5 wires.

[ ] Tr2 BN43-202 (1-2-3) 2 plus 2 turns 0,5mm
(4-5) 6 turns 0,5mm

Now the last part, the semiconductors.
In the schematig you find Diodes D1 and D2. They will not be placed on the PCB but on the Cooling block or at the back plane of your enclosure depending on how you will mount the PA. Their job is to stabilize qiescent current of the transistors if they get hot. Therefore both diodes must be placed very near to the transistors.

Prepare D1 and D2.

Put them on the table in front of. They should lay parallel, one kathode (the end marked with a bar) upwards, one kathode dowwards. Bend the upper wire of the left diode to right and the upper wire of the right diode left. Solder the bended wires together by leaving a gap of 2-3mm between the diodes. This gap you need tp place a screw between to screw the diode combinaton to the backplane later.

Now Transistor T1 It must be soldered with all the smaller part of it´s legs down to the PCB. Adjust it that it´s backside flushes with the edge of the PCB, it must be mounted 90 degrees to the PCB.
Solder and cut the legs at the bottom of the PCB just above the solder.

[ ] T1 RD06HHF

Do the same wit both PA Transistors

[ ] T2 RD16HHF
[ ] T3 RD16HHF

Lat part to install: Regulator IC1 left side of the PCB
[ ] IC1 78L05

Attention: NEVER ever use the PA without cooling for the Transistors, not even for a short test!!! We recommend to use thermal pads as provided with the kit.

After mounting all 3 Transistors to a cooling block or the backplane of your enclosure you may start the following test procedure.

[ ] adjust P1, P2 and P3 counterclockwise

[ ] Attach a power meter and a 50 Ohm Dummy Load at Point 7/8 (At least 10W)

[ ] Connect the PLUS Line of your 13,8V Powersupply to Point 5/6 of the PCB with an Amperemeter in serial. (all Voltages between 12 and 15V are ok, below 13,8V the resulting output will be lower than 10 Watt).

[ ] Connect the Ground Line of your Powersupply to PA2008 Ground

[ ] Connect NOTHING to RF Input Point 1/2 at this time!!

[ ] Connect Point 4 (UTx) to a positive Voltage of +8 to +15 V. A positive Voltage > 8V to ground at this point will sitche the PA to ON

The Amperemeter should show ZERO milliamps. Otherwise you should check all parts and the PCB if there are any shorts or other soldering failures.

[ ] Adjust slowly P1 clockwise until the Amperemeter shows 100mA. Leave it in this position

[ ] Adjust slowly P2 until the Milliamperemeter shows 200mA. Leave it in this position.

[ ] Adjust slowly P3 until the Milliamperemeter shows 300mA. Leave it in this position.

This procedure adjusted the quiescent current vor each Transistor to 100 mA.

[ ] Disconnect the switch Voltage from Point 6

[ ] Now connect your driver Transmitter to point 1/2. Use a short 50 Ohm coax like RG174. Adjust the output of your driver as close to zero as possible.

Keep the following procedure short. After maximum of 10 seconds you must give the PA a pause. Check temperature of T1 / T2 / T3 If they are getting really hot, give them a chance to cool down before your next try.

[ ] Swith the PA to ON using a positive +8 bis +15V at point 4.

[ ] Increase slowly the input power. Look at the Amperemeter and a powermeter. Current and output should invrease nearly parallel. If you reach the point of maximum drive, the current starts to increase much faster then the output. You should leave the system below this point because above zhe amount of harmonics and distortion will increase dramatically.

The maximum input power for QRP-PA 2008 is about 10 mW!!

Total Current PA _____

Output PA _____

Typical Output Power of this PA between 1,8 MHz and 30 MHz is about 10Watt at 13,8V if used as a linear amplifier. At 50 MHz we measured 5 Watt output. In practical use you must use a lowpass filter behind the PA!