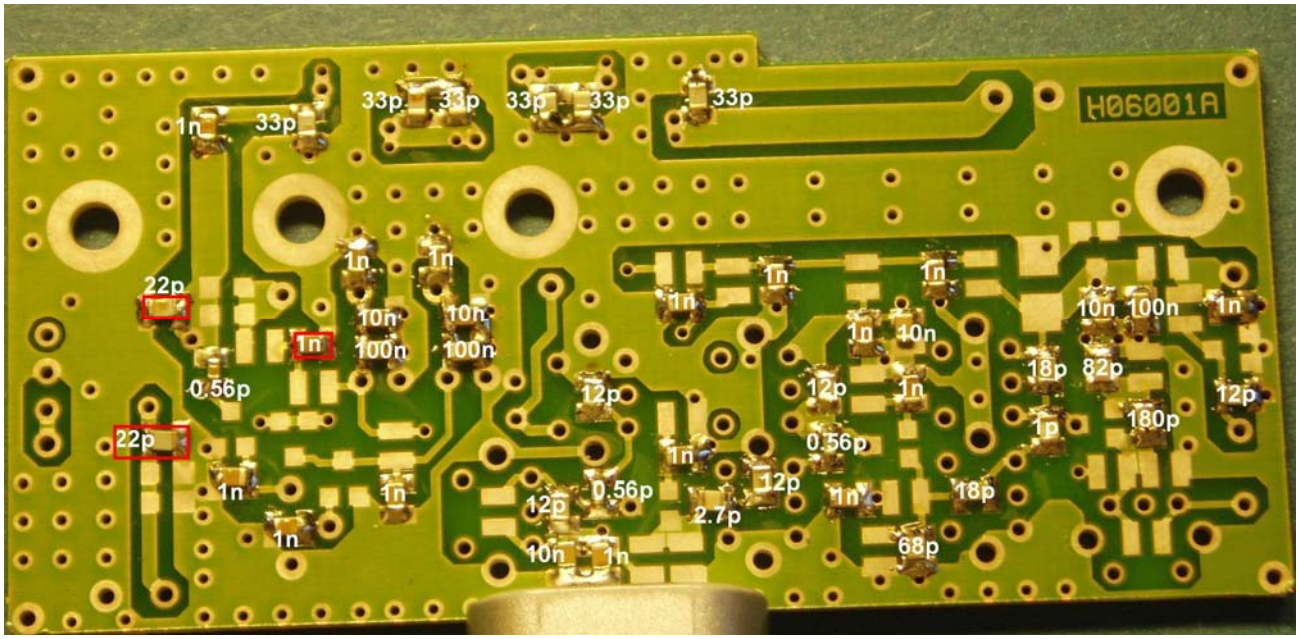
OZ4HZ 144MHz TX Assembly Instruction.

(version 1.0 pcb H06001A)

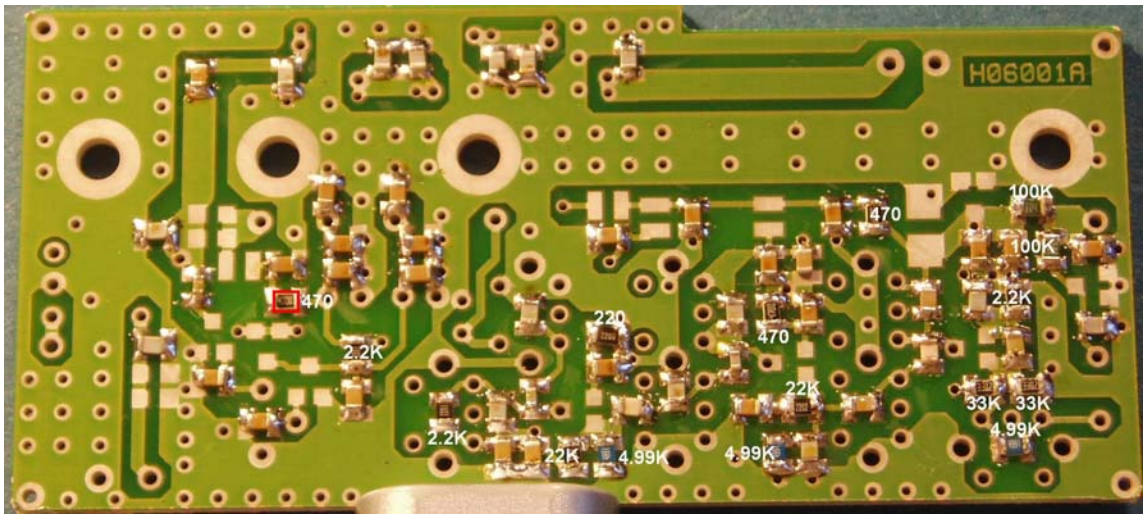
The TX part of the TXtracker uses mostly SMD components so experience with SMD assembly is recommended. A very fine guide to working with SMD can be found at :

www.geocities.com/vk3em/smtguide/smtguide.htm

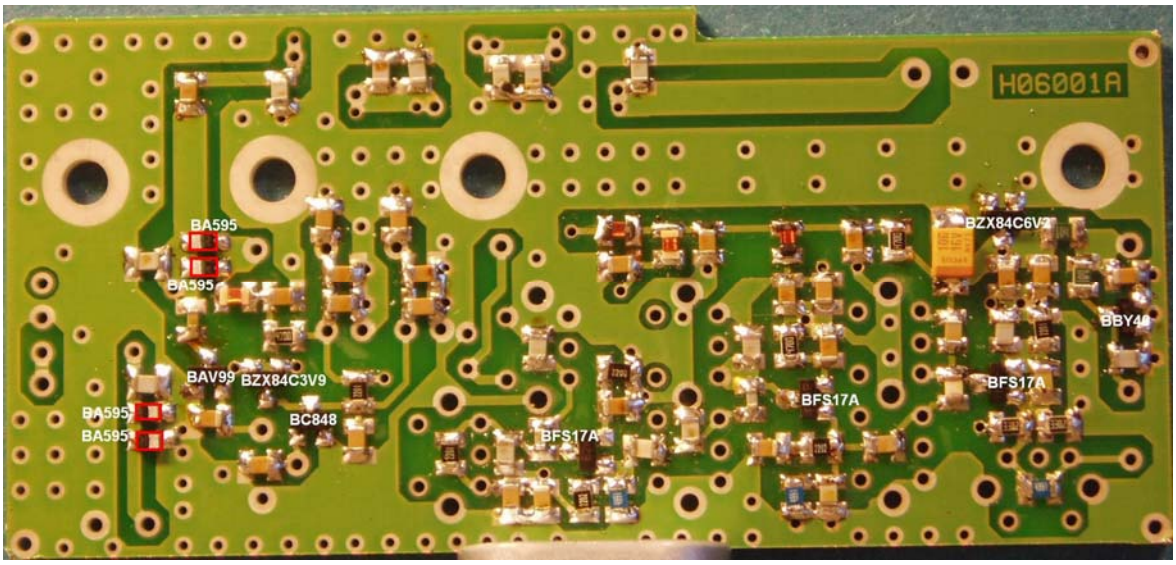
You will need a pencil-type soldering iron with a small tip, some thin solder (0.5mm), a pair of diagonal cutters ,a pair of tweezers and alignments tools for the coils. I recommend you follow the list of assembly below. Components in **red (used for RX/TX switching)** are used in a tracker with TX and RX and can be omitted in a tracker with TX only. Diodes D3 and D4 are then replaced with a short piece of wire or a solder bridge.



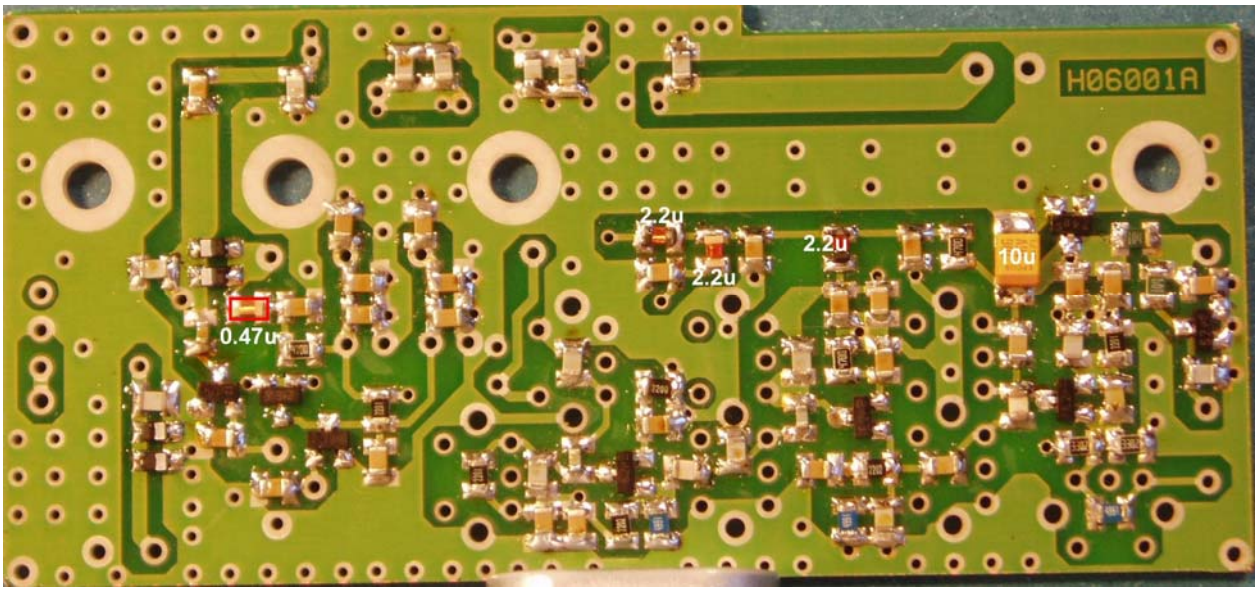
Step 1	Start installing the following SMD capacitors :
C1, C12, C17, C18, C20, C22, C23, C25, C26, C27, C31, C32, C35, **C39**, C40	1nF capacitor size 805 or 603
C9, C19, C24, C28, C36	10nF capacitor size 805 or 603
C10, C29, C37	100nF capacitor size 805 or 603
C2, C13, C15,C21, C50	12pF capacitor size 805 or 603
C3	180pF capacitor size 805 or 603
C4	82pF capacitor size 805 or 603
C5,C7	18pF capacitor size 805 or 603
C6	1pF capacitor size 805 or 603
C8	68pF capacitor size 805 or 603
C14, C34, C49	0.56pF capacitor size 805 or 603
C16	2.7pF capacitor size 805 or 603
C41, C42, C43, C44, C45, C46	33pF capacitor size 805 or 603
C47, C48	**22pF capacitor size 805 or 603**



Step 2	Continue with the SMD resistors :
R1, R2	100 Kohm resistor size 805 (RC12H)
R3, R9, R17	4.99 Kohm resistor size 805 (RC12H)
R4, R5	33 Kohm resistor size 805 (RC12H)
R6, R14, R17	2.2 Kohm resistor size 805 (RC12H)
R7, R10, **R16**	470 Ohm resistor size 805 (RC12H)
R8, R11	22 KOhm resistor size 805 (RC12H)
R13	220 Ohm resistor size 805 (RC12H)

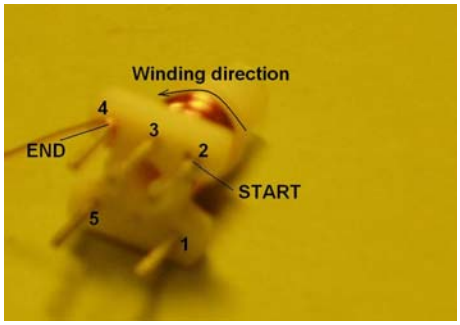


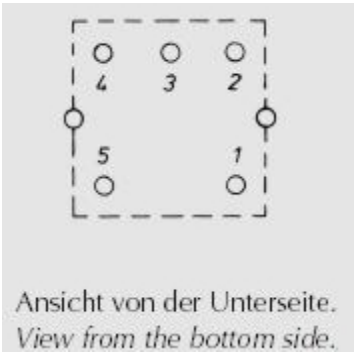
Step 3	Continue with the semiconductors :
Q1, Q2, Q3	BFS17A
Q4	BC847, BC848 , BC849 or similar
D1	BBY40
D2	BZX84C6V2
D3, D4	**BA595 mark polarity (Bold white mark = cathode) or short wire**
D5, D6	**BA595 mark polarity (Bold white mark = cathode)**
D7,8	BAV99 (double diode)
D9	BXZ84C3V9

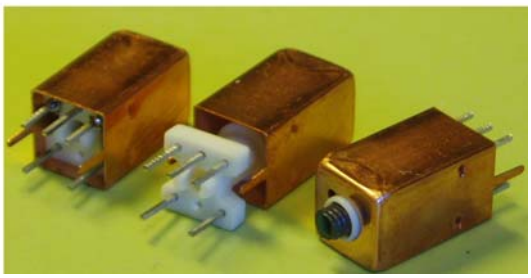


Step 4	And then continue with the last SMD components on the bottom layer.	
Dr1, Dr2, Dr3		2.2uH choke size 805
Dr4		**0.47uH choke size 805**
C11		10uF/16V Tantalum capacitor pay attention to polarity

And now to the coil winding part ! (If you don't have the ready made coils from TOKO)







NEOSID 7.1S coilform used for L1-L7

SMD 56nH coil used for L8-L11

All coils (except L8-L11) are wound on a NEOSID 7.1S type coil assembly with F40 or F100b ferrite screw core.

L1 : 19 ¼ turns with enamelled copper wire 0.2 mm diameter with F40 ferrite core
Start removing approx. 5 mm of the insulation of the wire and tin it with a hot soldering iron.
Twist the tinned end a few times around pin 2 and put 19 ¼ turns on the coil form.
(The ¼ turns comes from starting at pin 2 and ending on pin 4)
Once again remove approx. 5 mm of insulation of the wire, tin it and twist it around pin 4.
Now gently solder the wire to the pins (2 and 4) using little solder and take care because the coil form (made of plastic) gets soft if the soldering takes too long . Then put the can on as show on the picture and screw the ferrite core (F40) into the coil form.

L2,L3 : 12 ¼ turns with enamelled copper wire 0.2 mm diameter with F40 ferrite core.
Use the same procedure as mentioned above.
Starting point is pin 2 and ending point pin 4. Ferrite core is F40

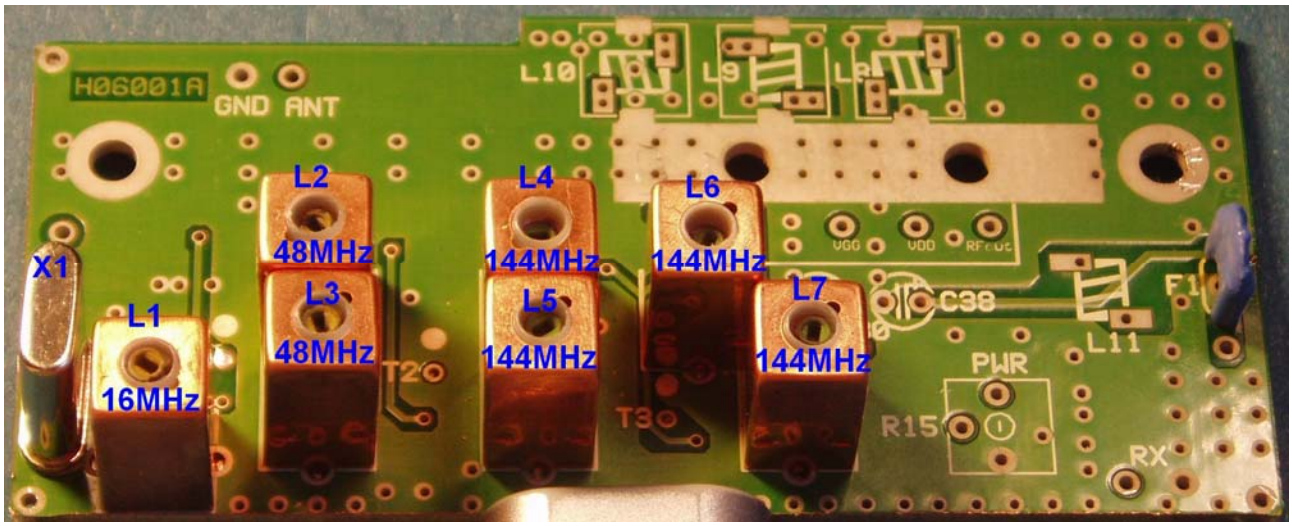
L4,L5, : 3 ¼ turns with enamelled copper wire 0.2 mm diameter with F100b ferrite core.
L7 Use the same procedure as mentioned at L1.
Starting point is pin 2 and ending point pin 4. Ferrite core is F100b

L6 : 1 ¼ + 3 ¼ turns with enamelled copper wire 0.2 mm diameter with F100b ferrite core.
This coil is different because it has 2 windings.
Using the same procedure as mentioned before – start with 1 ¼ turns, pin 5 as starting point and pin 1 as ending point. Continue with the next winding with 3 ¼ turns starting at pin 2 and ending at pin 4. Ferrite core is F100b

L8,L9,
L10,L11 : 8 turns internal diameter 2mm with enamelled copper wire 0.4 mm diameter (see picture)

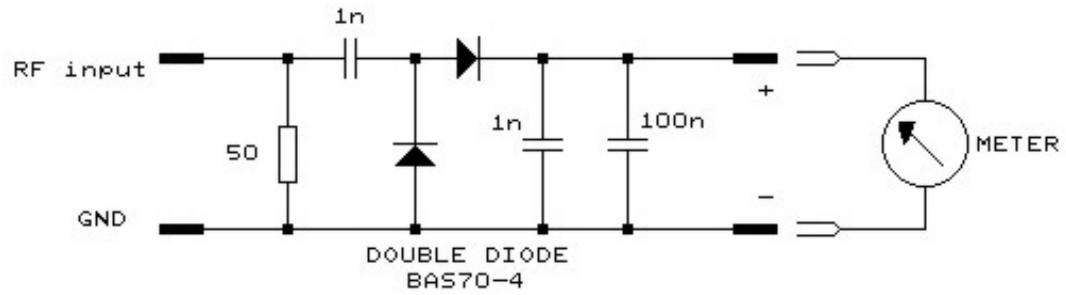
And once again components in **red (used for RX/TX switching)** are used in a tracker with TX and RX and can be omitted in a tracker with TX only.

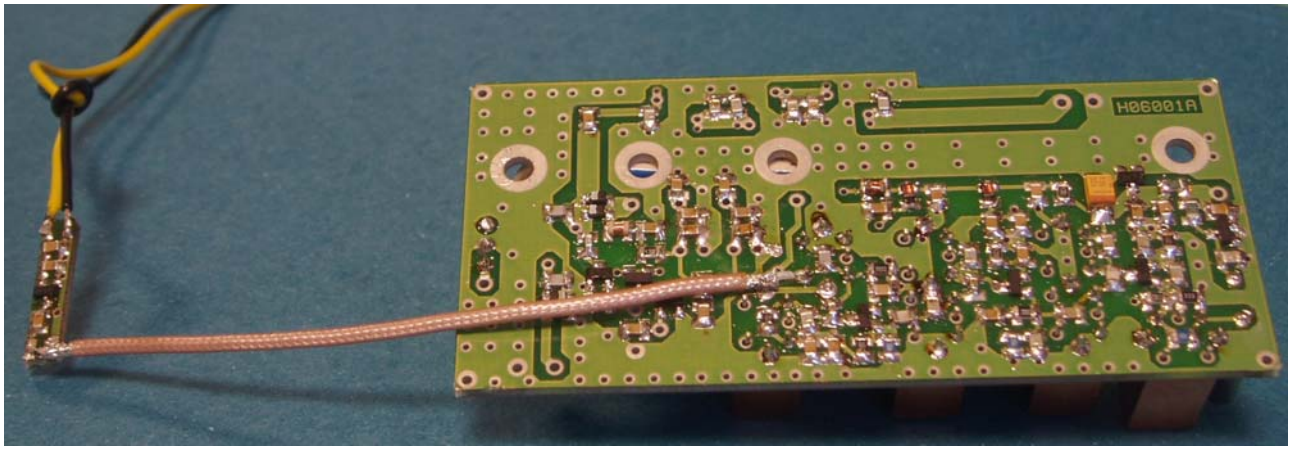
On the top side install the following components:				
L1	NEOSID F7.1S coil F40	or	TOKO	113CNS 2255HM
L2,L3	NEOSID F7.1S coil F40	or	TOKO	113KN 2K241DC
L4,L5,L7	NEOSID F7.1S coil F100b	or	TOKO	113SN 2K180BM
L6	NEOSID F7.1S coil F100b	or	TOKO	113SN 2K180BM
F1	10 nF T-filter marked (103)			
X1	X-tal 16.08889 MHz (for 144.800 MHz)			



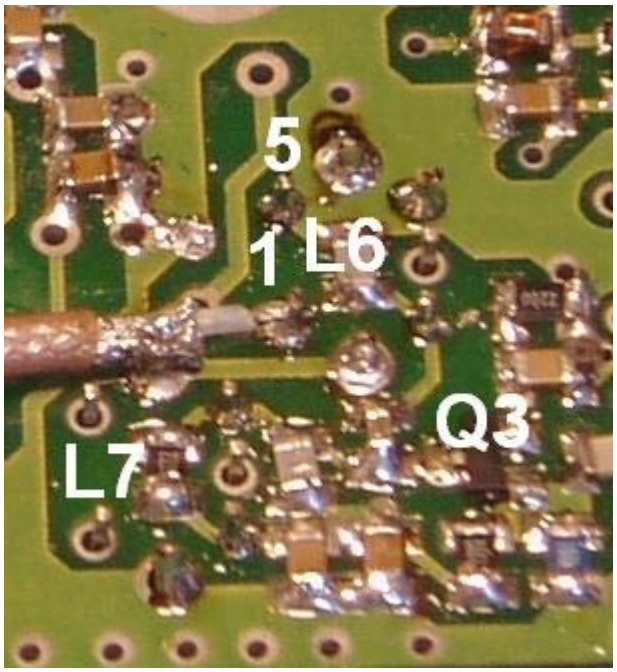
Now its time to make adjustment of the low power part of the transmitter. First make a careful visual inspection of the pcb (use a magnifier or microscope) to check for missed connections and solder bridges between the pads. For adjusting the low power part of the transmitter the following test equipment is required:

DC power supply 12V ,min 2 A
Multimeter for DC measurements.
RF voltmeter ,Spectrum analyzer or just a diode detector as shown below.
50 Ohm dummy load or a 47 Ohm / 51 Ohm resistor
Frequency counter capable to measure at least 150 MHz.

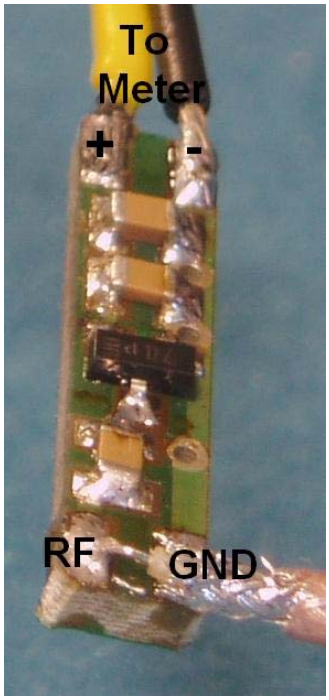




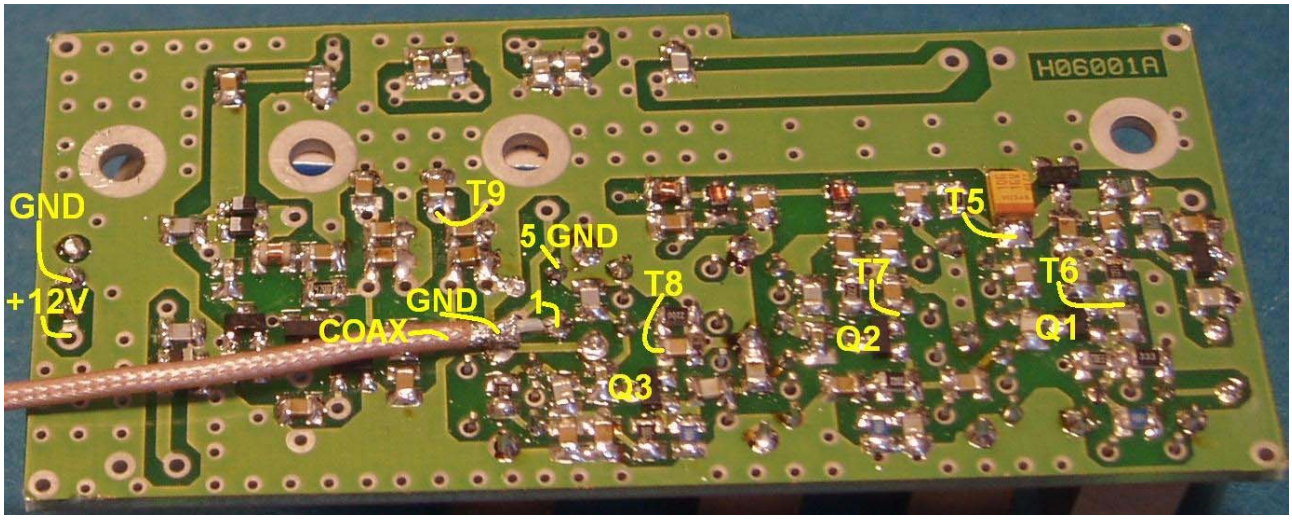
Diode detector connected to output of L6



Close up view of diode detector connected to output of L6



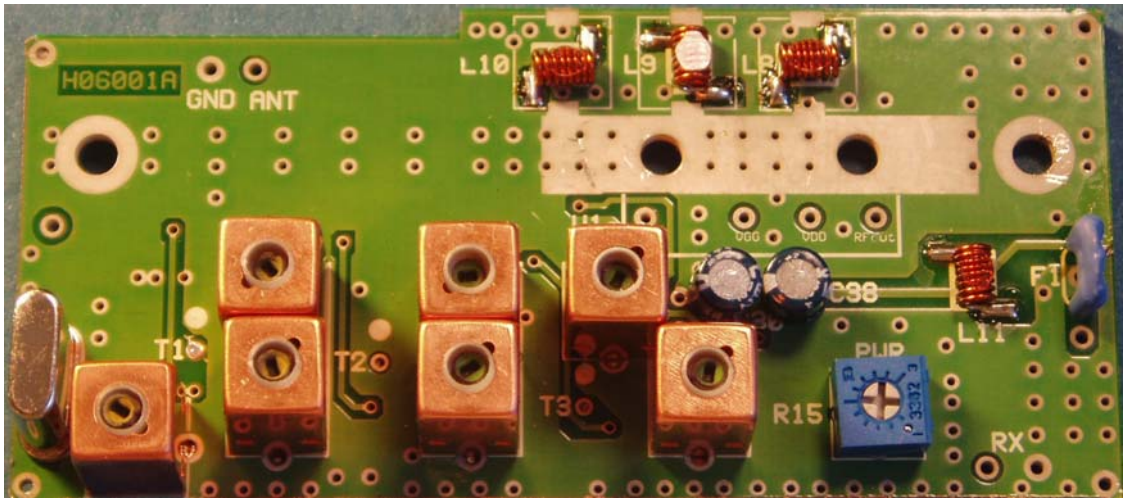
Diode detector as show.



Connect an RF voltmeter with a 50 Ohm load (Spectrum analyzer or diode detector) via a coax cable to pin 1 and 5 on L6 as show on the picture.
Make a 12V power connection to the pcb as shown. Use a multimeter to check current consumption (approx. 30 mA) and the DC voltage at the test points shown :

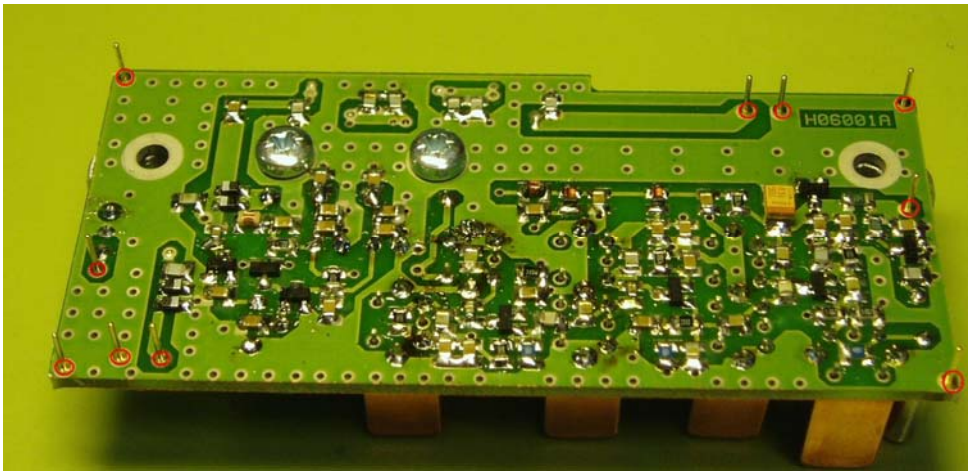
	Before adjustments	After adjustments
T5 (voltage to OSC)	: 6.2 V	6.2 V
T6 (emitter Q1)	: 2.4 V	2.3 V
T7 (emitter Q2)	: 1.6 V	2.1 V
T8 (emitter Q3)	: 1.4 V	2.7 V
T9 (bias for U1)	: 3.9 V	3.9 V

Adjust all cores so they are aligned with the top of the coilforms as shown on the picture above. On the RF voltmeter (or diode detector) there should be a small reading.
Adjust all the coils for max. voltage in the sequence L2 ,L3,L4,L5,L7 and L6. Repeat this until the output power is approx. 20 mW (+13 dBm) . Using an RF voltmeter this is approx. 1V (rms reading) and with the diode detector approx. 2.3 V (Remark ! The diode detector is measuring p-p voltage).
Connect a frequency counter to the output of L6 (pin 5 and 1 again) and adjust L1 to the transmitting frequency (i.e. 144.800 MHz).
Now the first test is done and the output from the low power part of the transmitter is OK. Disconnect the power supply and the coax cable to L6 and continue with assembling the rest of the parts.

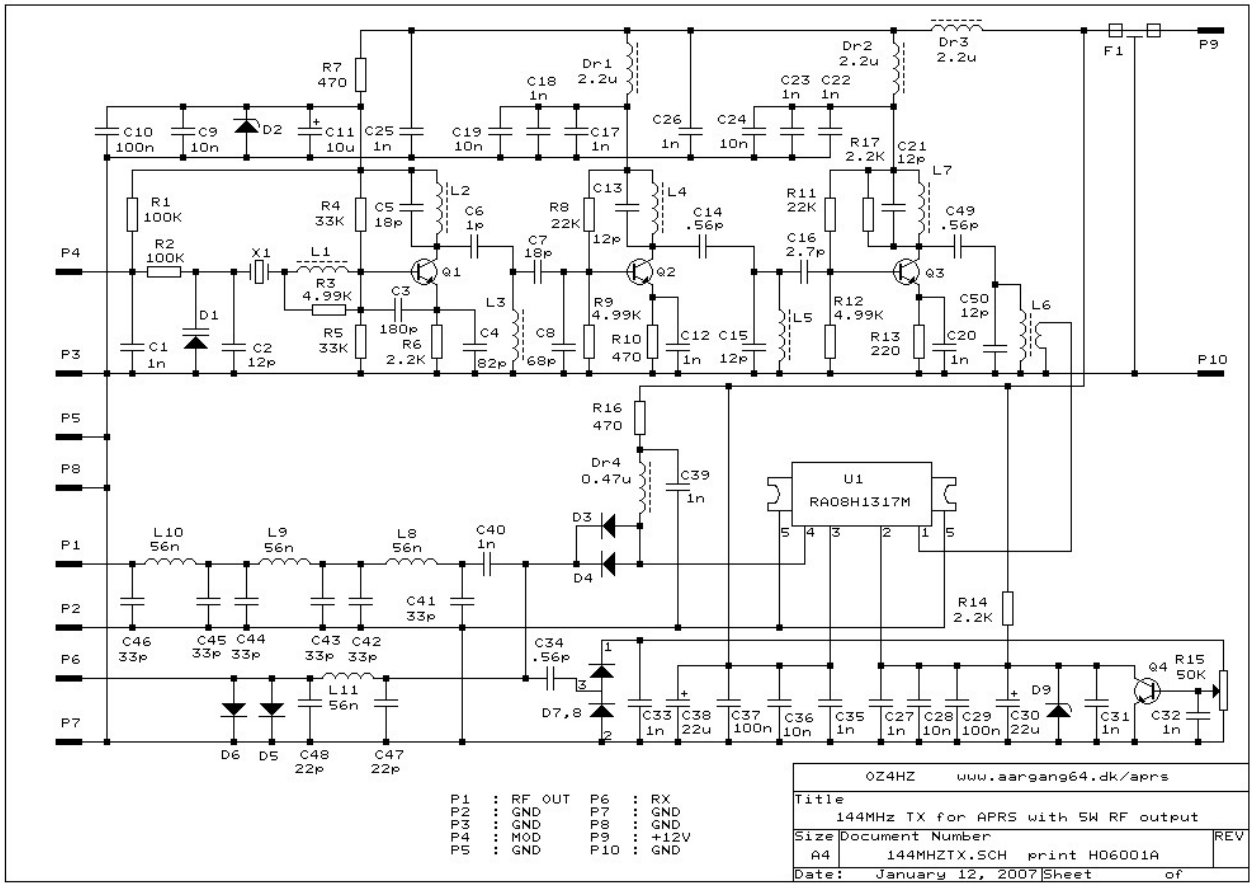


Continue with the components on the top layer.	
R15	50 KOhm variable resistor marked (503)
C30,C38	22uF/16V capacitor pay attention to polarity
L8,L9,L10,L11	56nH SMD coil

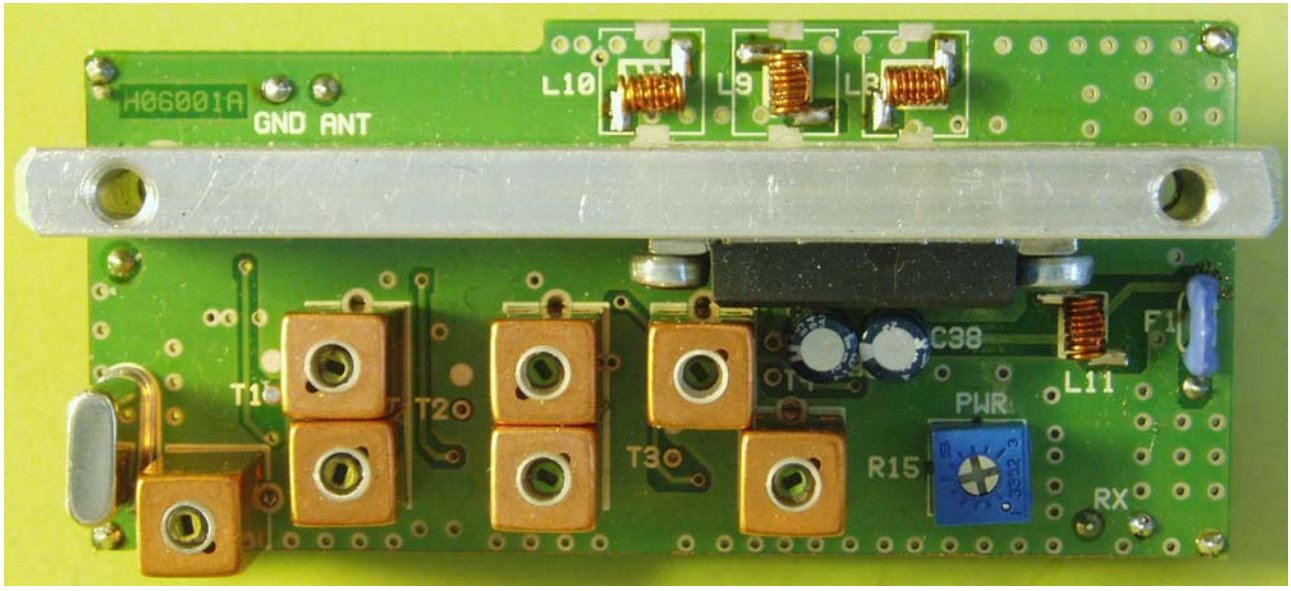
Assemble the RF power module (RA08H1317M) on the heat sink as shown on the picture. Put a small amount of heat sink compound between the RF module and the heat sink. Assemble the RF module to the pcb as shown below. To the left is shown the gold plated pins for interconnection to the TXtracker main board. Assemble all the pins (10 pcs.) to the pcb (marked red) an solder them on the **TOP** side of the pcb.



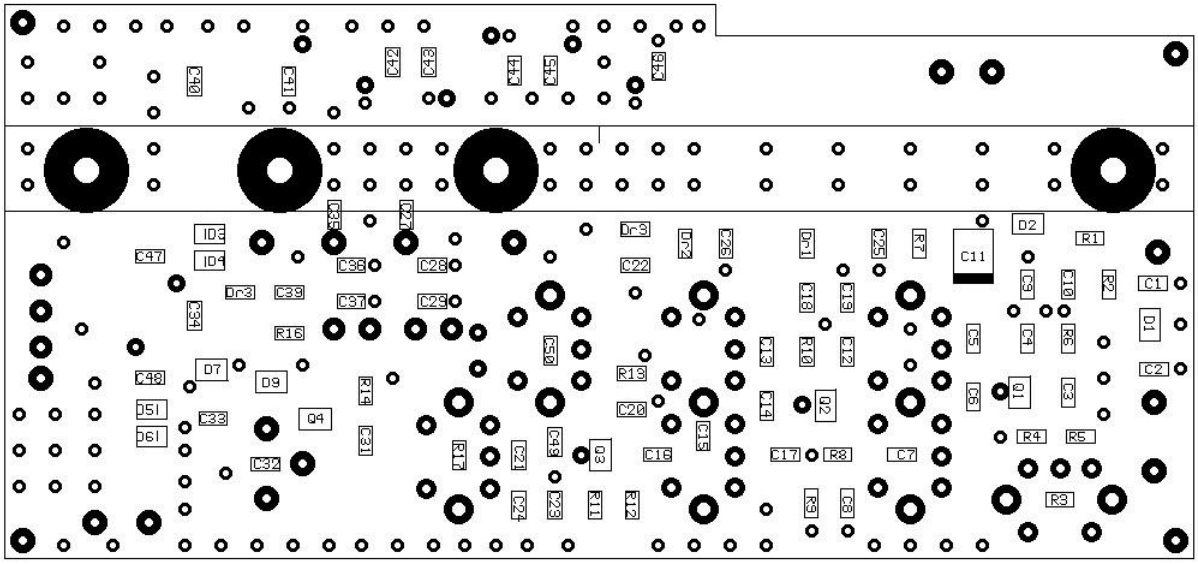
For final adjustment look at TXtracker Assembly Instruction.



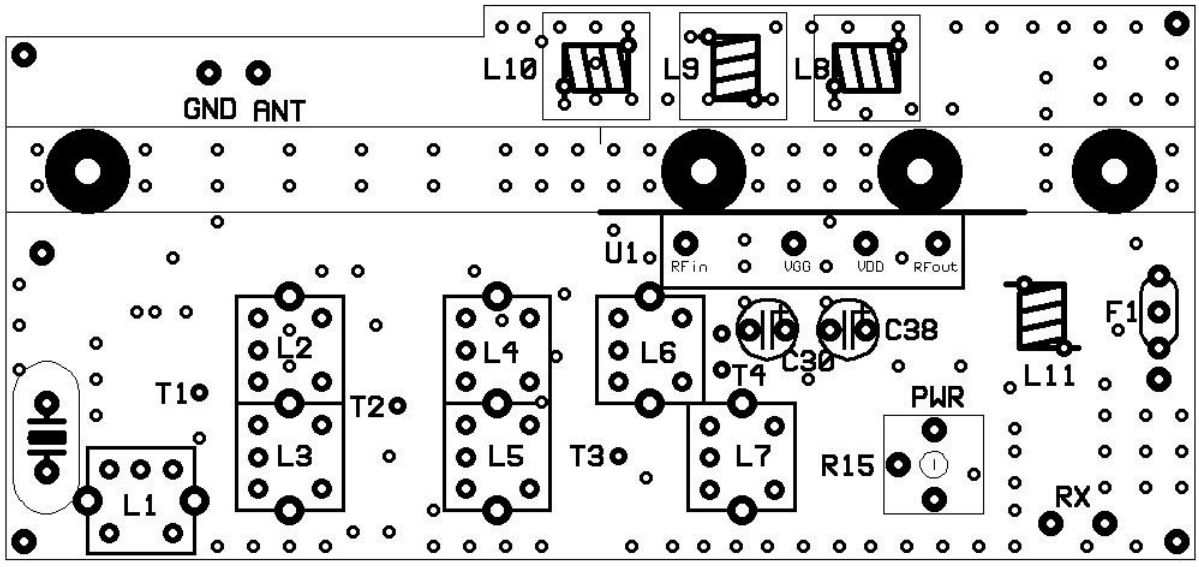
Schematic of 144MHz TX



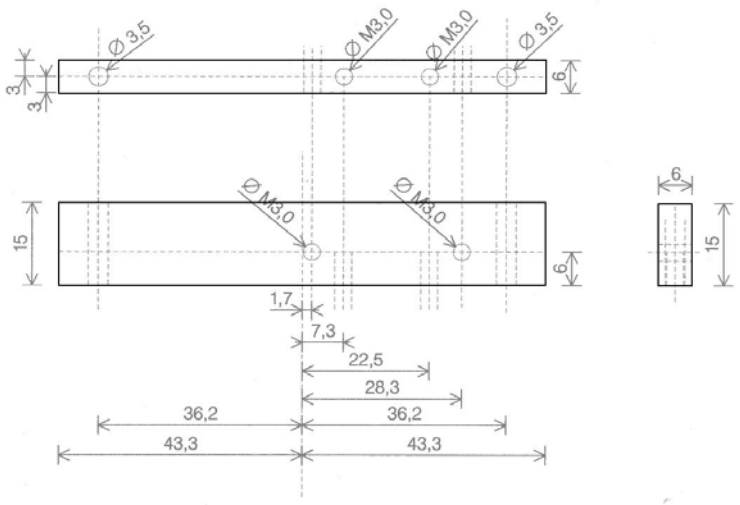
144 MHz TX from top



144 MHz TX PCB Bottom layer.



144 MHz TX PCB Top layer.



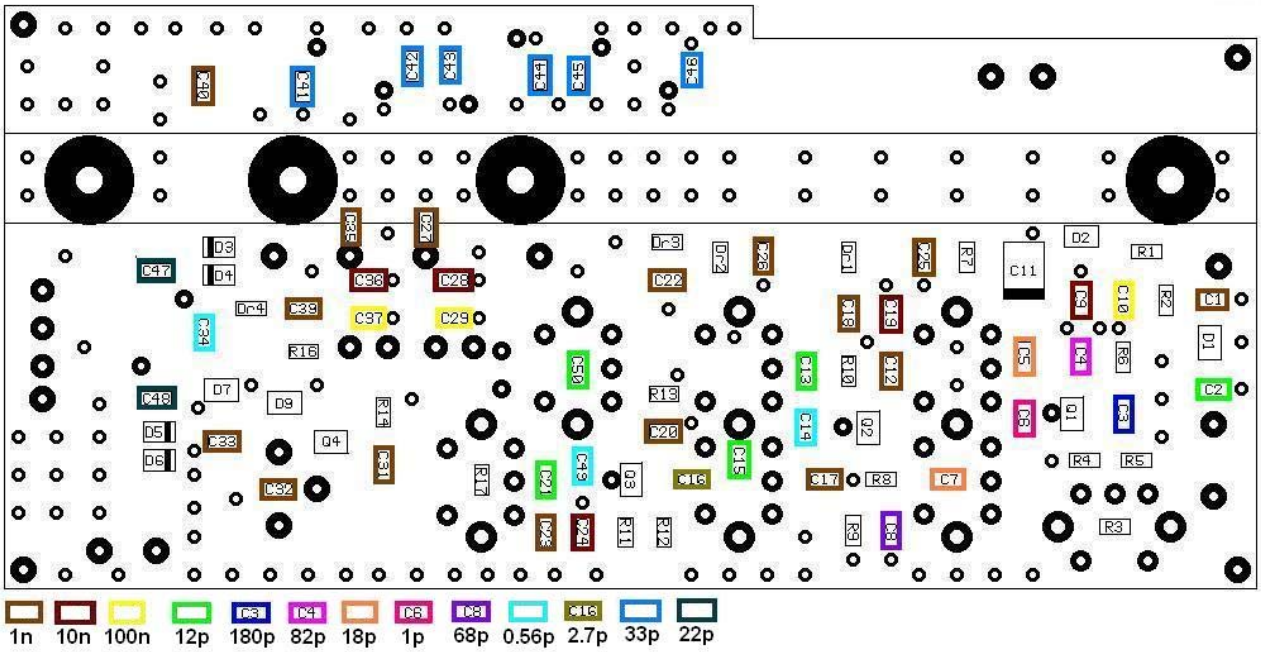
Heatsink for power module

Material : Al profile 15x6 mm

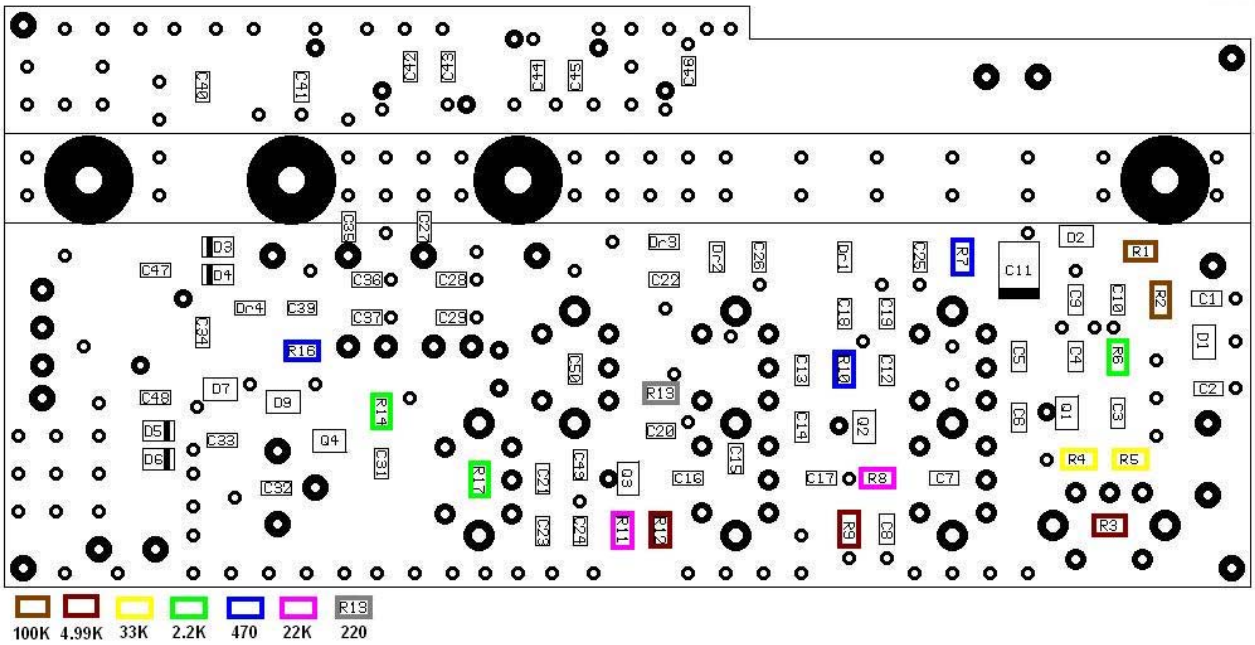
Length 86.6 mm

All measures in mm

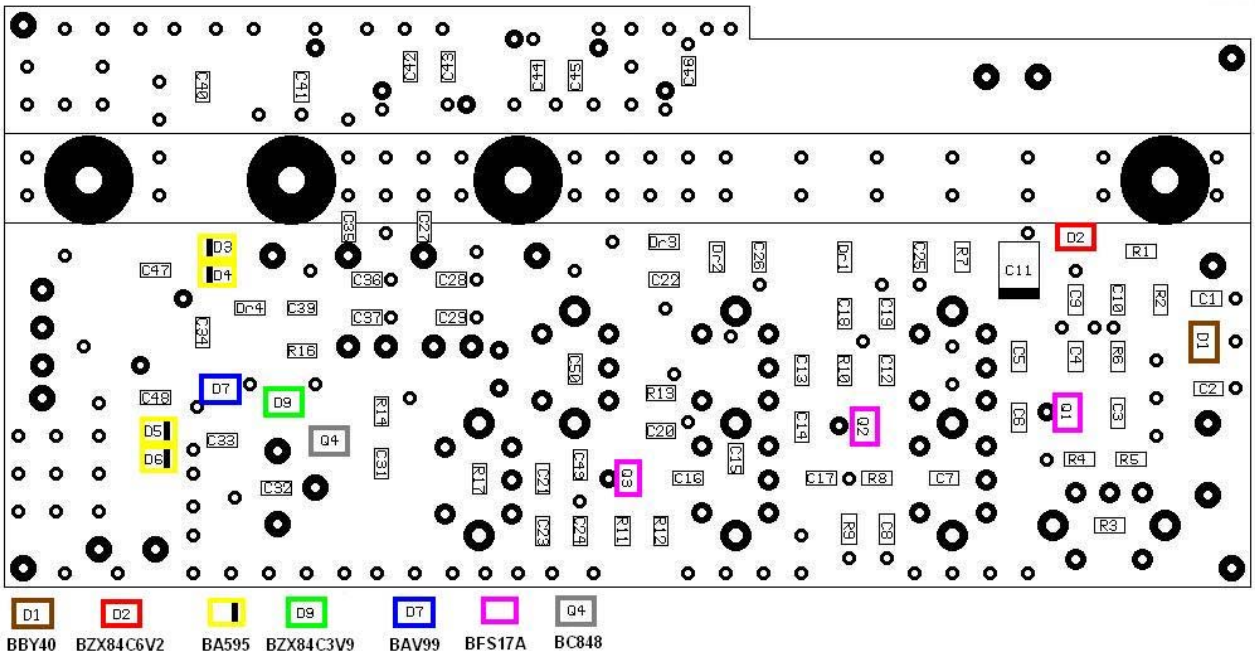
M3.0 = 3.0mm thread



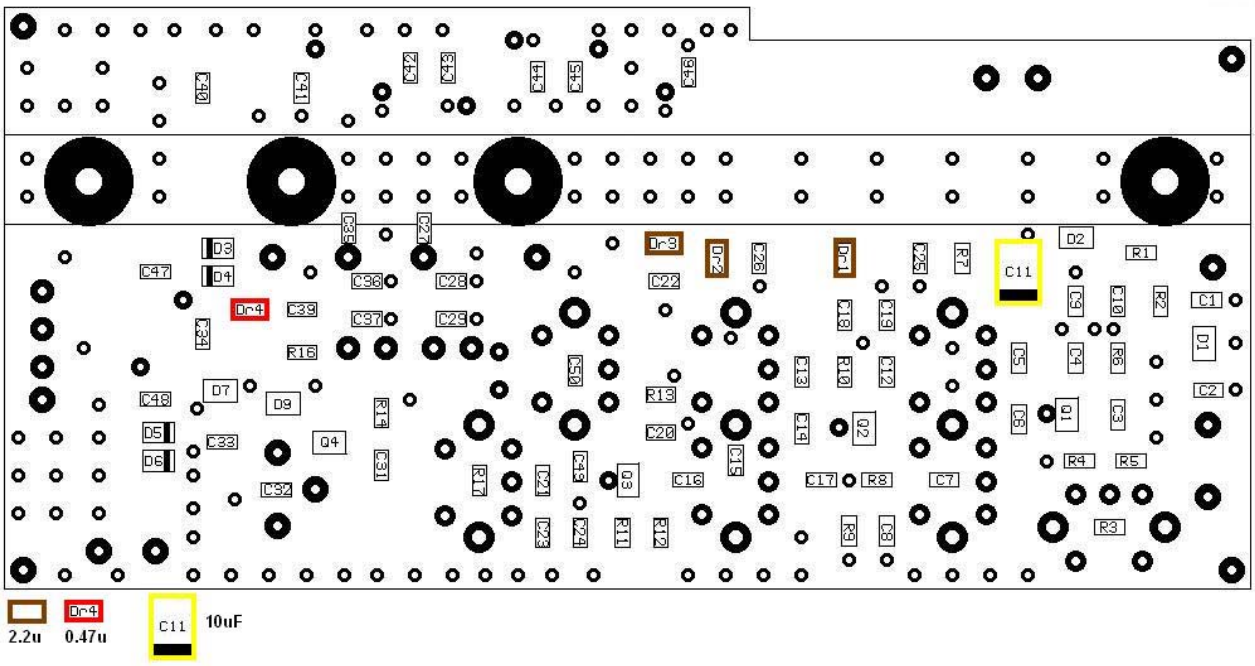
Assembly step 1: SMD capacitors on the bottom layer



Assembly step 2: SMD resistors on the bottom layer



Assembly step 3: SMD diodes and transistors on the bottom layer.



Assembly step 4: SMD chokes and tantalum capacitor.