JUMA 100W PA – RF Amplifier

Greg Mew – VK4GRM

Contents

Purpose 1
General Instructions 1
RF Amplifier Module 3
General 3
Amplifier circuit 3
Current sense 3
Bias supply circuit 3
Temperature sensing circuit 3
Schematic Diagram 3
Parts List and Assembly instructions 6
Soldering 6
Tools 6
Resistors 8
Capacitors 9
Inductors and Semiconductor Devices 11
Ferrites and Transformers 13
Other Hardware 20
Testing 33

Figure 1 Juma 100W PA as delivered 1
Figure 2 Juma 100W PA Kit Component Bags 2
Figure 3 RF Amplifier Schematic 4
Figure 4 RF Amplifier PCB layout 5
Figure 5 RF Amplifier Component Bags 5
Figure 6 VK4GRM - RF Amplifier PCB - Resistors after installation 8
Figure 7 VK4GRM - RF Amplifier PCB - Capacitors after installation 9
Figure 8 Tantalum Capacitor Polarisation Marking 10
Figure 9 Ferrite Beads 10
Figure 10 SOT23 Semiconductors 11
Figure 11 VK4GRM - RF Amplifier PCB small component installation 12
Figure 12 RF Amplifier PCB small component installation 12
Figure 13 Transformer T1 ferrites and the brass tubes. Smooth the inside edges of the tubes if needed. 14
Figure 14 Solder T1 tubes with the ferrite beads. Solder the pin header connectors 14
Figure 15 Peel one end of the thinner PTFE wire and solder the beginning of the wire. 15

Figure 16 Wind the turns by pushing and gently pulling the wire four times thru both tubes. 15
Figure 17 Cut and peel the other end of the wire and solder the end point of the T1 winding. 16
Figure 18 Transformer T2 ferrites and the brass tubes. Smooth the inside edges of the tubes if needed. 16
Figure 19 Solder the transformer T2 brass tubes with ferrites. 17
Figure 20 Peel one end of the thicker PTFE wire and solder the beginning of the wire. 17
Figure 21 Wind the turns by pushing and gently pulling the wire four times thru both tubes. 18
Figure 22 Cut and peel the other end of the wire and solder the end point of the T2 winding. 18
Figure 23 Solder L3 with two copper wires thru the ferrite bead. Solder also GND jumper near T2. 19
Figure 24 Mount the four M3, L-20 mm spacers to the Heatsink. 22
Figure 25 Fit the Red tube through the holes in the Heatsink and feed the Fan wires through. 22
Figure 26 Install the fan with the finger shield to the heatsink. (Finger shield missing in this picture). 23
Figure 27 The Finger shield is shown in this picture. 23
Figure 28 Thermal Grease 24
Figure 29 Apply thermal grease to the heatsink as shown in the picture 24
Figure 30 Smooth the grease over the shown area 25
Figure 31 I extended the distribution of the thermal grease over all of the heatsink area. 25
Figure 32 Prepare the Q3 by folding the legs of the transistor as shown. 26
Figure 33 Place the rear plate. Apply thermal grease to the back of Q3 and install Q3. Place the PCB spacer tubes 26
Figure 34 Fix the PCB. Tighten the screws loosely and align the board, the rear plate and the heatsink 27
Figure 35 VK4GRM - PCB fixed in place with the rear plate and the heatsink. 27
Figure 36 Put the fan wires thru the rear plate and solder the fan wires 28
Figure 37 Apply thermal grease to the final transistors. 28
Figure 38 Mount the final transistors Q1 and Q2. Tighten the screws loosely and align all 29
Figure 39 Tighten alternately all the screws and solder Q1 and Q2 legs. Use large soldering tip iron 29
Figure 40 Check all the screws and solder Q3 legs. Solder the power resistors R5 and R6. 30
Figure 41 VK4GRM Amplifier Module. 30
Figure 42 Cut and peel the red and black wires. Crimp and solder to the connector pins. 30
Figure 43 Snap in the power supply connector to the rear panel. 31
Figure 44 Snap the connector pins to the connector. Cut, peel and solder the wires to the PCB. 31
Figure 45 Completed amplifier module. 32
Figure 46 VK4GRM - Completed amplifier module. 32
Figure 47 VK4GRM - Completed amplifier module – Rear View. 33

Purpose

This document describes the build and testing of the JUMA PA100-D in a step by step process with thoughts and ideas based on my build of the 100W PA. Most of the graphics are from the JUMA website[1] and are placed in the order of the build as it progressed. Other photographs are those taken by myself during the build of my PA100-D.

This document aggregates the information provided on the JUMA website into a single document with additional commentary by myself. Thanks also to Ed (WA4MZS) for review comments which have been included.

Each section of the document provides the schematic diagram, the PCB layout, parts list and then the installation instructions. Testing of the PA100-D is in the latter part of the document.

The document is divided up into separate documents on each board that has to be built and with a final section on the testing I conducted on the PA100-D.

General Instructions

The kit arrived well packed in a cardboard box as shown in Figure 1 The first thing you should do on receipt of your kit is to check that all of the components are there. I found that the two 34 mm brass tubes were missing from my kit and emailed JUMA for the tubes. These were quickly shipped by Kari, OH7FVG and arrived in the mail after a short wait.

Figure 1 Juma 100W PA as delivered

[1] http://www.jumaradio.com/juma-pa100/

The individual components in the kit are all bagged in plastic bags with individual lists of what is in each bag as shown in Figure 2. The box and heatsink are included in the cardboard box as well.

Figure 2 Juma 100W PA Kit Component Bags

RF Amplifier Module

General

The amplifier module provides the gain for the 100 watt output in all ham bands from 1.8 MHz to 28 MHz. The amplifier PCB (refer to Figure 4) is mounted into the rear panel including the heatsink and the temperature controlled fan. The nominal supply voltage is 14 VDC and the maximum current is over 20 A. The DC supply input is protected against over voltage and reverse polarity with the transil diode D1. The connections to the other PA100 modules are done with two flat ribbon cables. The supply voltage coming from the DC connector is fed with four soldered wires.

Amplifier circuit

The circuit diagram for the RF Amplifier is provided in Figure 3. The input transformer T1 transforms the 50 ohm impedance to the low impedance level for the bipolar RF transistors. The passive components R1, R2, R3, C1, C3, C4 with the feedback resistors R5 and R6 provides a frequency correction to achieve a flat frequency response over the 1.8 MHz to 30 MHz range. The bipolar RF power transistors Q1 and Q2 are working in class AB in a push-pull configuration. The output transformer T2 transforms the low ohmic collector impedance back to 50 ohm level. The RF transistors are cooled using a temperature controlled fan on the heatsink in the rear panel.

Current sense

The very low ohmic resistor R7 is in the current path of the power transistor collector current. This resistor is a SMD 2512 size and there are four solder pads to achieve a four wire "Kelvin" connection to the current sensing resistor. The differential voltage across the resistor is fed to the main board to detect the collector current. The current reading is further wired to control board for indication and over current protection.

Bias supply circuit

The bias supply voltage is referenced to the P/N junction voltage of the transistor Q3 which is installed on the heatsink. This provides a negative temperature compensation for the final transistors. The bias adjustment is done with the trimmer resistor R18. During transmission the bias voltage is connected to the final transistors with the MOSFET Q4. The bias voltage is buffered with the OPAMP A1-A and transistor Q5 and fed to the base via the inductors L1 and L2.

Temperature sensing circuit

The transistor Q3 is also used as a temperature sensor. The P/N junction voltage is processed with the OPAMP A1-B to provide a 0 to2 VDC level which corresponds 0ºC to 100ºC temperature range. The trimmer resistor R14 is used to offset adjustment of the temperature reading. The temperature signal is fed via the main board the control board for indication, the fan speed control and over temperature protection.

Schematic Diagram

The RF amplifier is the first module to be built. The schematic diagram for the RF amplifier is provided in Figure 3 and the PCB layout is shown in Figure 4.

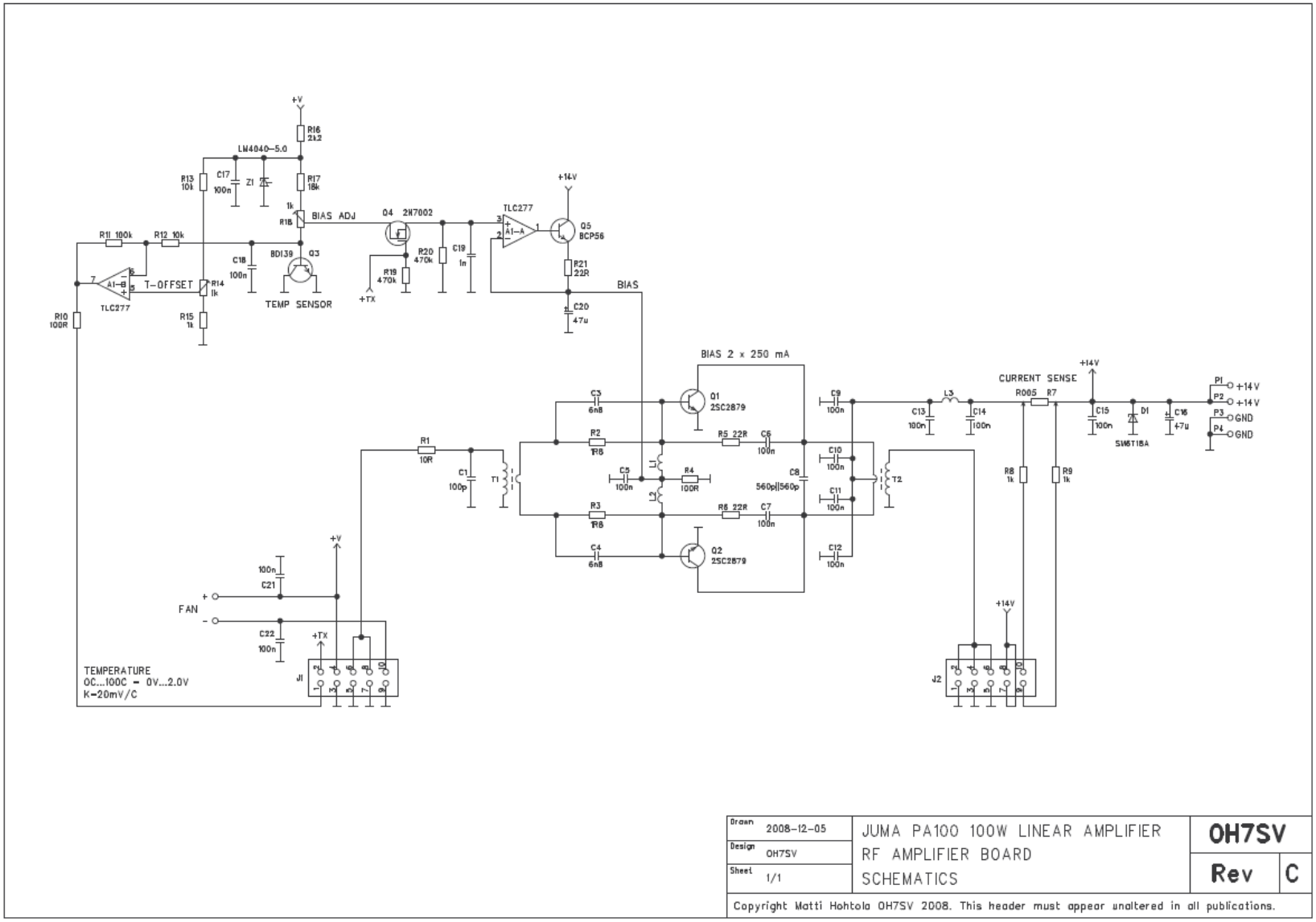

Figure 3 RF Amplifier Schematic

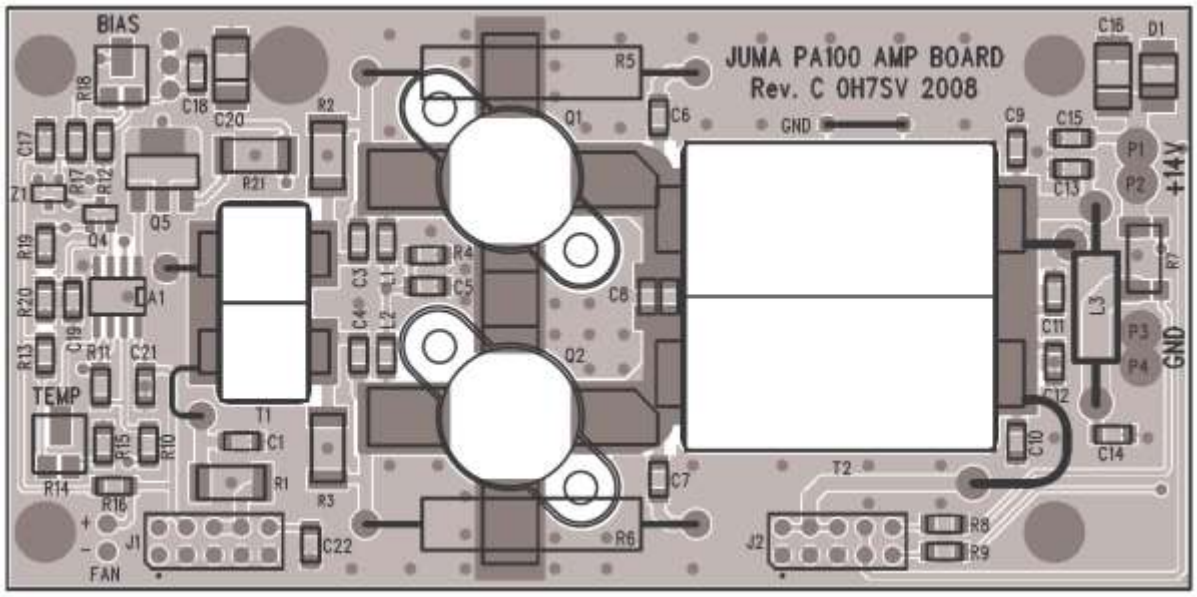

Figure 4 RF Amplifier PCB layout

The individual packs of components making up the RF amplifier module are shown in Figure 5. There are seven bags each labelled X of 7.

Figure 5 RF Amplifier Component Bags

Parts List and Assembly instructions

The parts list is provided as an Excel spreadsheet and an important item to note here is that it also provides the order of installation of the parts. I missed this on my first read of the instructions on the website. The components should be assembled in the order shown in the spreadsheet. The lists shown for each of the component types in the following sections follow the order provided in the Excel spreadsheet.

I find it useful to tick off each component as it is soldered into the board so that you know exactly where you are up to. Further it is useful to sort out the components on removal from the bag and to place them in the order that they will soldered onto the board. For all resistors I measured the value using a multimeter to confirm that it is the correct component.

Soldering

As nearly all of the components are SMD it is useful to develop some skills in mounting these components. I place the component into position using a small set of tweezers and then use a drip of Multicore X32-15i No Residue Flux on one end of the component. Generally this wicks under the component and does both sides. One end of the component can then be soldered. If it is not straight then hold the component gently with the tweezers and heat the soldered end to position it correctly. The other end can then be soldered. I did find with this approach you occasionally got a boiling of the solder flux which flipped the component over. Fortunately it never went very far and was easily put back in place.

I used 60/40 solder because that is what I had, but Ed (WA4MZS) recommends Sn 63 / Pb 37 'eutectic' solder in lieu of the 60 / 40. The 'eutectic' solder transitions from liquid state to solid in less than 1° F. Hardly any chance of a bad / cold solder joint with a 'plastic' state as narrow as this.

I built a lot of this board using 1mm diameter solder and only purchased some 0.7mm solder later in the build. Ed found that a solder diameter of 0.020" / 0.5 mm was ideal and I would agree with this as even the 0.7mm solder that I used was found to be a bit large especially on the Digital Board. If you look carefully in the attached pictures, some of my components have probably more solder than is necessary for SMD components.

Note also I would recommend a 1 mm tip for your soldering iron. I was using a 2 mm tip initially and changed over to a 1 mm tip for later in the project.

Note also a temperature controlled soldering iron is essential for this sort of assembly work and well worth the investment if you intend to build a few kits. This is my second significant build, the first being a Genesis G59 all mode 16—6m Software Defined Radio Transceiver Kit[2].

Tools

I found the following tools useful for this project:

- Long nose pliers;
- Round nose pliers;
- Small adjustable wrench;
- Tweezers;
- Screwdrivers;
- Wire cutters;

[2] http://www.genesisradio.com.au/G59/

- Magnifying lamp (you need plenty of light on the subject);
- Magnifying headset. (I tended to use this the most);
- Soldering Station (temperature controlled) with a tip cleaner (I use both a wet pad and a metal wool style to keep the tip clean);
- Liquid flux (Multicore X32-15i No Residue Flux);
- 0.5mm Solder (refer to commentary on solder options)
- Solder wick (various sizes though 1 and 2mm work well), and
- Plenty of space on your work table. Mine got messy at times and when a very small SMD component flicks off on to your work area and you have to find it, it is good to not have too much on your work table.

Also access to the WWW to look up data sheets on components especially if you are unsure which orientation they need to go. Some of the SMD ICs now have a 45 degree slope on one side to provide orientation for pin 1 of the IC rather than a dot or an indent at the end.

Resistors

The resistors for the RF Board are listed in Table 1.

Table 1 PA100 RF Amplifier - Resistors

JUMA PA100 RF amplifier module part list for PCB Rev. C, update 2012-05-10 (assemble in this order)

Part number	Value / type	Qty	Description	Picture
R4 R10	100R	2	SMD resistor size 1206 1%	
R8 R9 R15	1k	3		
R16	2k2	1		
R12 R13	10k	2		
R17	18k	1		
R11	100k	1		
R19 R20	470k	2		
R2 R3	1R8	2	SMD resistor size 2512 1W 5%	
R1	10R	1		
R21	22R	1		
R7	0R005 (0.005 ohms)	1	SMD resistor size 2512 2W 1% Four pads on PCB, See pictures for soldering	
R14 R18	1k	2	Multi turn SMD side adjust trimmer resistor Bourns 3214J, 3214G, 3224J or 3224G	

The resistors are contained in the pack labelled JUMA PA100 RF Amp. Rev. C Pack 1 / 7

Assemble the resistors first onto the PA PCB as shown in Figure 6. NOTE that R7 has four pads and each pad needs to be soldered. NOTE also that R14 and R15 are multi turn potentiometers and need to be orientated correctly. The adjustment screw is at the top of the board as shown in Figure 6. Refer to the Testing section at the end of this document for set up information on R18.

NOTE: R5 and R6 the 22R 5W Resistors are not soldered at this stage as they need to be fitted after the transistors are fitted. These should be kept in their bag until required.

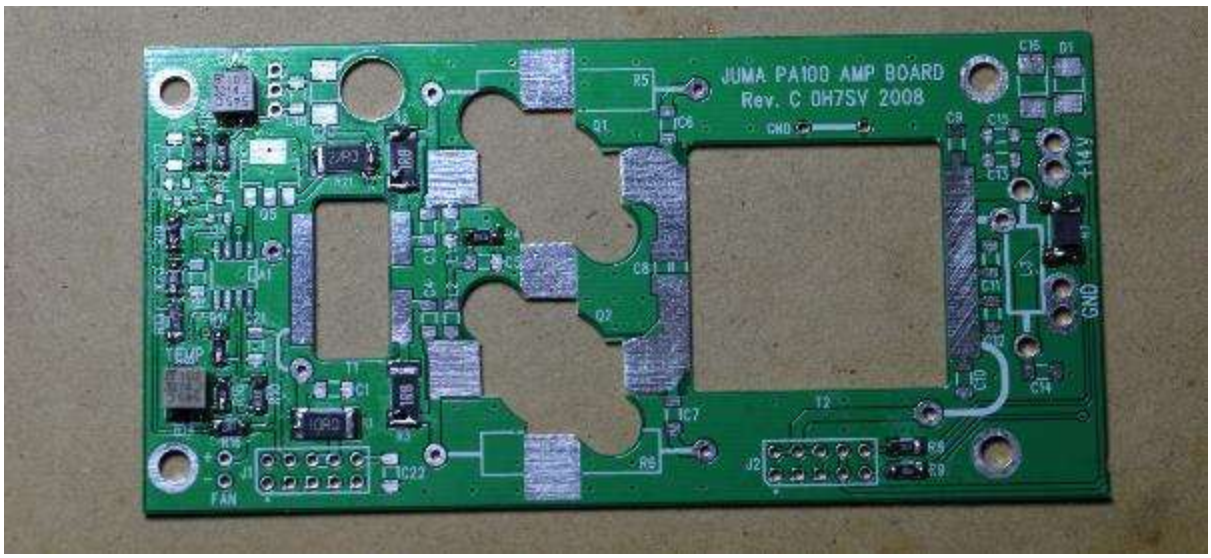

Figure 6 VK4GRM - RF Amplifier PCB - Resistors after installation

Capacitors

The capacitors for the RF Board are listed in Table 2. Unlike the resistors which are generally labelled with their values the capacitors are not labelled. Refer to the Marking Column in Figure 9 which shows how Juma have marked the capacitors to identify their individual values. Some have a red line, or a black line or nothing to indicate values. Some you have to determine based on the number of components provided. Eg the 100nF capacitors of which there are 14.

Table 2 PA100 RF Amplifier - Capacitors

C1	100p	1	Ceramic size 1206 C0G/NP0	
C8	2 x 560pF in parallel	2	Ceramic size 1206 C0G/NP0 **Two capacitors in parallel, see pictures**	
C19	1n	1	Ceramic size 1206 C0G or X7R	
C3 C4	6n8	2	Ceramic size 1206 C0G/NP0	
C5 C6 C7 C9 C10 C11 C12 C13 C14 C15 C17 C18 C21 C22	100n	14	Ceramic size 1206 X7R	
C16	10u/16V	1	Tantalum capacitor size C	
C20	47u/10V	1		

The capacitors are contained in the pack labelled JUMA PA100 RF Amp. Rev. C Pack 2 / 7

Assemble the capacitors on the PCB as shown in Figure 7.

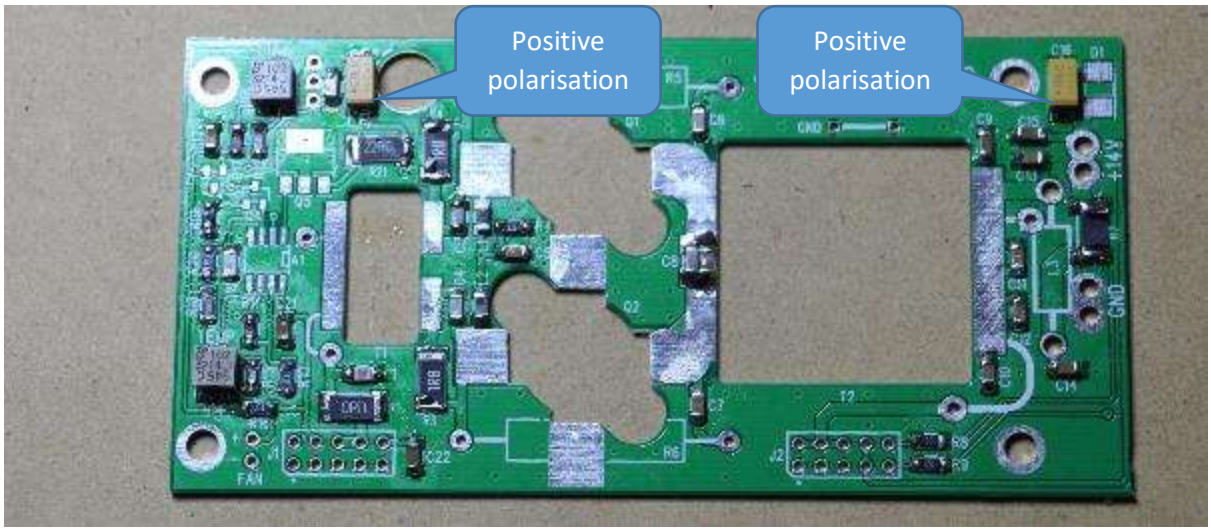

Figure 7 VK4GRM - RF Amplifier PCB - Capacitors after installation

Note that the two Tantalum capacitors are polarised and need to be correctly orientated on the PCB. The red bar on the capacitor shows the positive side of the capacitor and it should be orientated to the centre of the PCB as shown in Figure 7. Figure 8 shows this marking at the positive end of the tantalum capacitor in more detail.

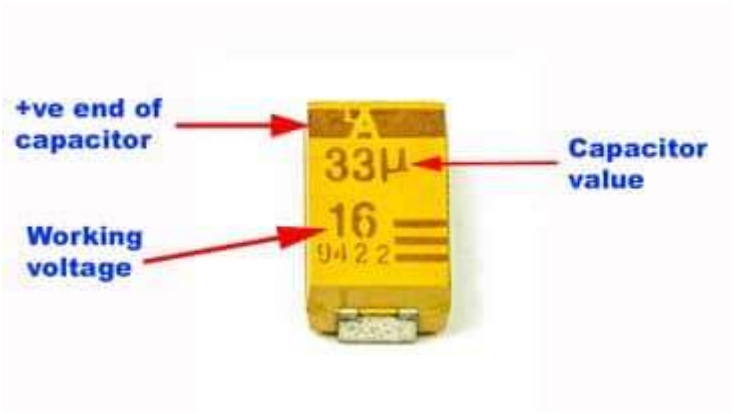

Figure 8 Tantalum Capacitor Polarisation Marking[3]

Note that C16 is provided as a 10uF 16V capacitor but the circuit diagram shows this as a 47uf capacitor. The Juma website photos show this as 10uF as shown in Figure 12.

Note also that the Capacitor pack contains two ferrite beads. These can be identified by the clear packaging or alternatively by measuring their resistance with a multimeter which gives a reading of around 1 ohm.

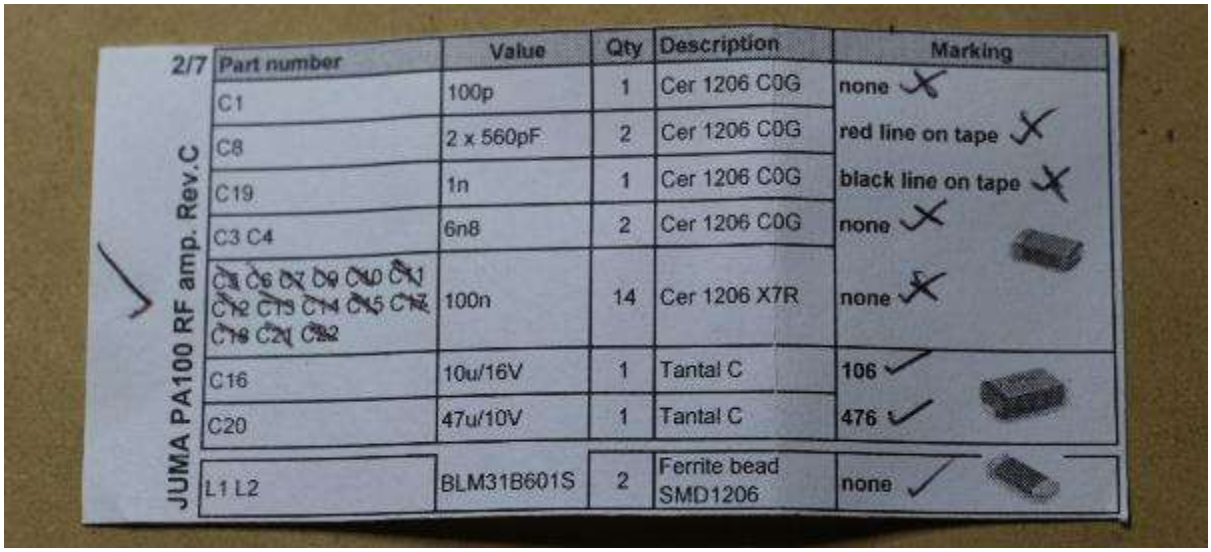

Figure 9 Ferrite Beads

[3] https://www.electronics-notes.com/articles/electronic_components/capacitors/tantalum.php

Inductors and Semiconductor Devices

The inductors and semiconductor devices for the RF Board are listed in Table 3.

Table 3 PA100 RF Amplifier Capacitors

L1 L2	Murata BLM31B601S or Murata BLM31AJ601S or Wurth 74279213	2	Ferrite bead SMD 200 mA 600 ohm@100 MHz Case size 1206	
Z1	LM4040-5.0	1	Voltage Reference 5V or LM385M3-5 SOT-23	
Q4	2N7002	1	MOSFET N-type SOT23 or similar Rds < 10 ohm	
Q5	BCP56	1	NPN transistor SOT223	
A1	TLC277	1	OPAMP CMOS SO8	
D1	SM6T18A	1	Transsil diode	

The inductors L1 and L2 are contained in the pack labelled JUMA PA100 RF Amp. Rev. C Pack 2 / 7 with the capacitors and the remaining semiconductor devices are contained in the pack labelled JUMA PA100 RF Amp. Rev. C Pack 3 / 7

Note that Z1 and Q4 have the same packaging: a SOT23 package. The only way to determine which is which is to read the markings on the packaging. The relevant markings are shown in the supplied parts list provided with the components. Refer to Figure 10 for the component labelling details, R5C and K72 respectively. Note mine appeared to be labelled R5O.

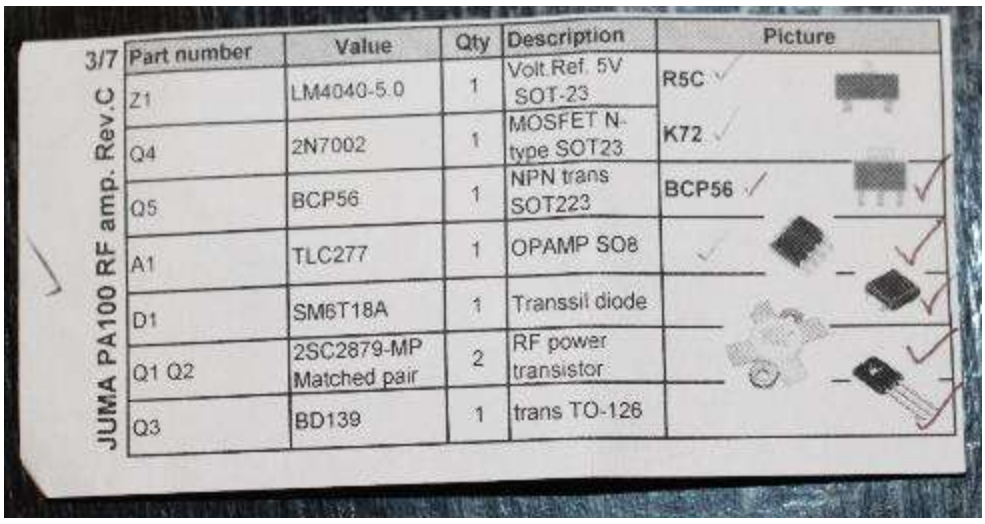

Figure 10 SOT23 Semiconductors

Take care with the TLC277 opamp. The stripe on the package is orientation towards the "A1" identification mark on the PCB.

NOTE: do not try to fit Q1, Q2 or Q3 at this stage as they need to be orientated with the mounting holes on the heatsink. Put these components back in their bag until needed.

Similarly for D1, the SM6T18A, is also a polarised device and the stripe on the package is orientated to the centre of the PCB. That completes the installation of the small components onto the PCB as shown in Figure 11 and brings our PCB up the same state as the PCB provided by JUMA on their website as shown in Figure 12.

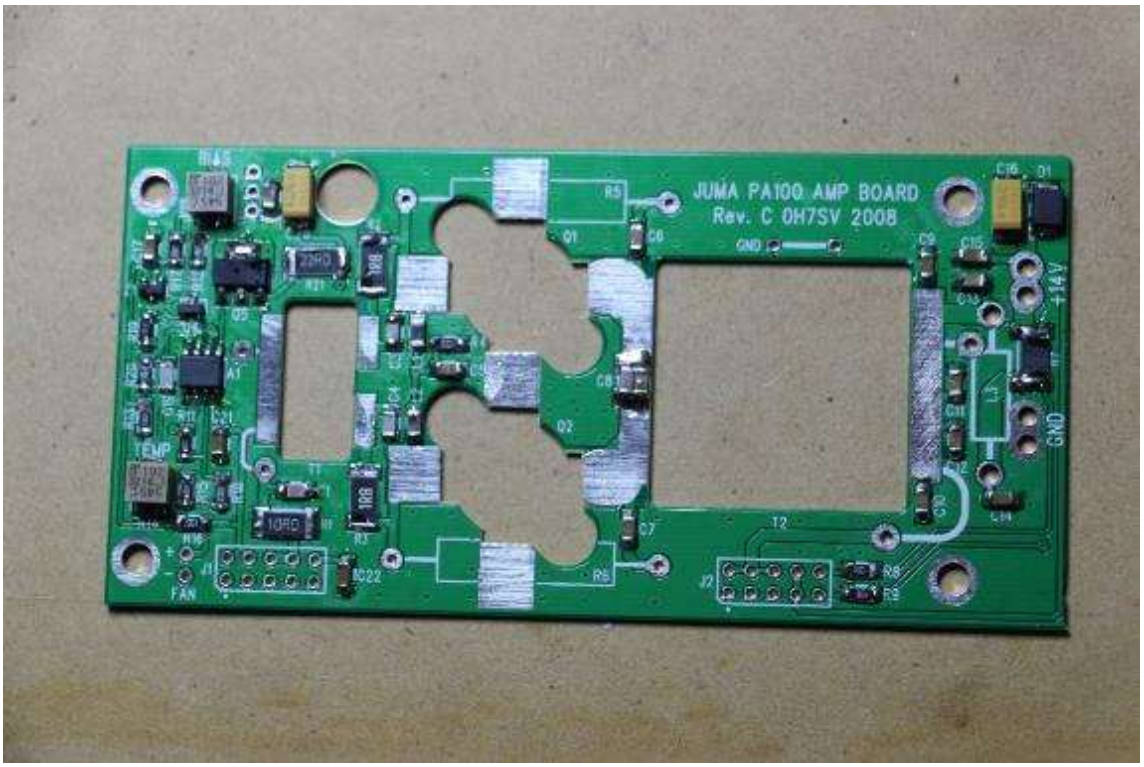

Figure 11 VK4GRM - RF Amplifier PCB small component installation

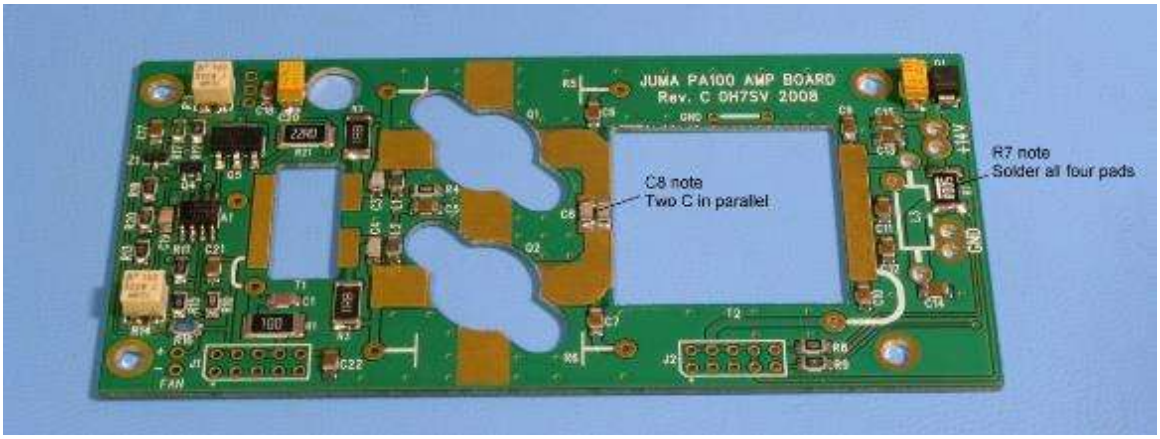

Figure 12 RF Amplifier PCB small component installation

Ferrites and Transformers

The ferrites and transformers for the RF Board are listed in Table 4.

Table 4 PA100 RF Amplifier - Resistors

J1 J2	Snippet of Tyco Electronics 5-826632-0, Farnell 3418560 or MOLEX 90131-0775, Farnell 9733680	2	PIN HEADER 2 x 5 pin max height 6.7 mm	
T1	Ferrite bead WURTH 74270112	2	Input transformer ferrite	
Brass tubes	OD 3/16" (or 4.76 mm) L = 12.5 mm, thin wall thickness	2	T1 secondary winding (one turn)	
PTFE insulated wire Multi wire type	Cross section area 0.22mm² AWG 24, Outer diameter 1.2 mm L = 0.50 m	1	T1 primary winding 4 turns See pictures for the instruction	
T2	Ferrite Bead Wurth 7427007	2	Output transformer ferrite	
Brass tubes	OD = 6 mm (or 7/32") L = 34 mm, thin wall thickness	2	T2 primary winding (one turn)	
PTFE insulated wire Multi wire type	Cross section area 0.597mm² AWG 20, Outer diameter 1.6 mm L = 0.50 m	1	T2 secondary winding 4 turns PTFE windings See pictures for the instruction	
L3	Ferrite bead WURTH 74270021	1	RF choke 2 x 0.8 mm wire through the ferrite bead See pictures	
Copper wire tinned	Diameter 0.8 mm, L = 20 cm		For L3 and GND jumper	

The Juma Web site shows plenty of images for the installation of the transformers and these are reproduced below with some modifications that I made as I installed the components.

The installation details are provided in the Figure labels.

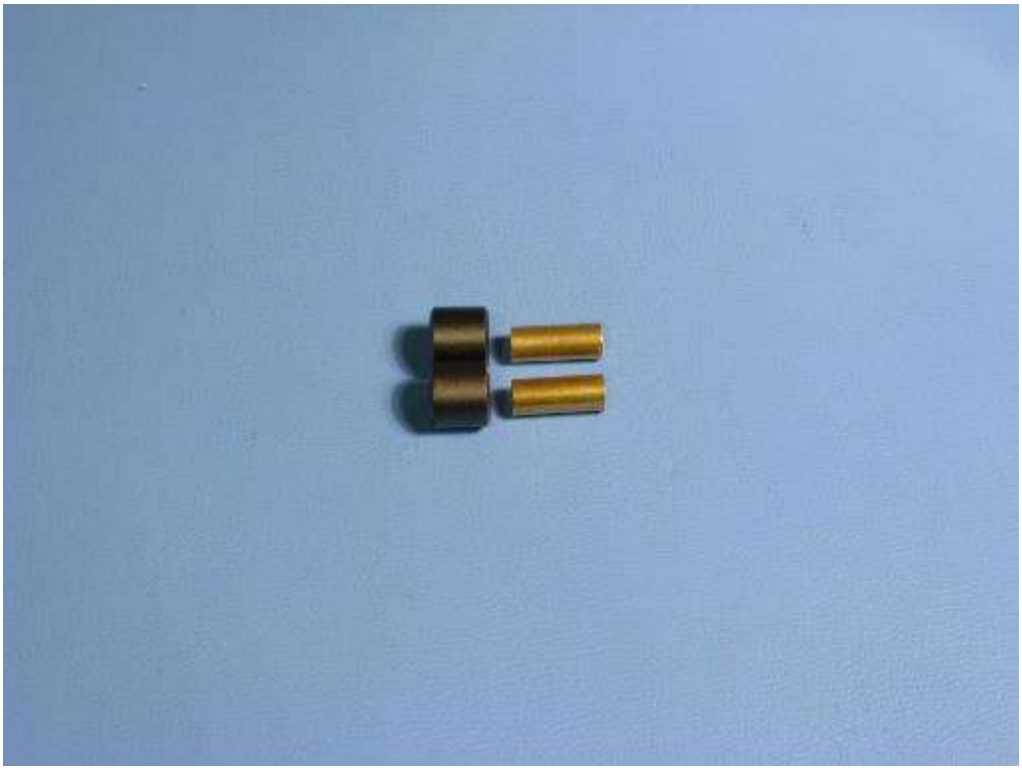

Figure 13 Transformer T1 ferrites and the brass tubes. Smooth the inside edges of the tubes if needed.

Note I ran a small circular file around each end of the tubes to remove any burs but generally they were OK.

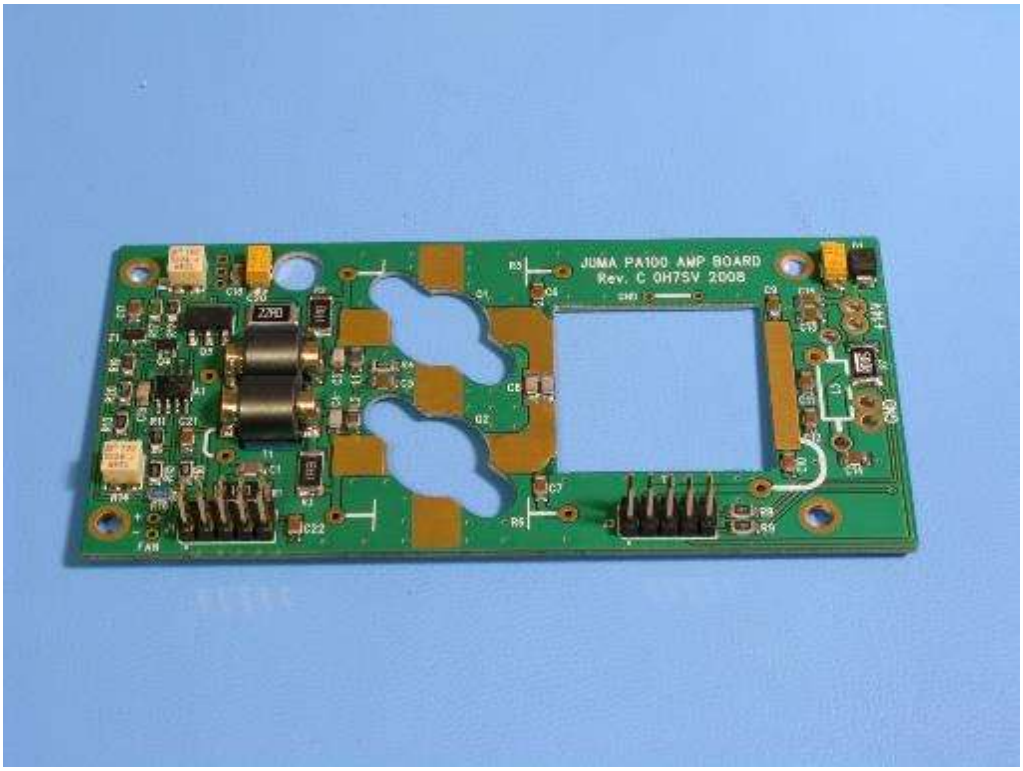

Figure 14 Solder T1 tubes with the ferrite beads. Solder the pin header connectors

Note I found that soldering the end of the tube that is towards the centre of the board was generally found to be the easiest. I tacked one end and then went to the other end to tack it in place making

sure that the tubes were aligned correctly. I used liquid flux on these tubes and the mating surface to ensure a good solder joint.

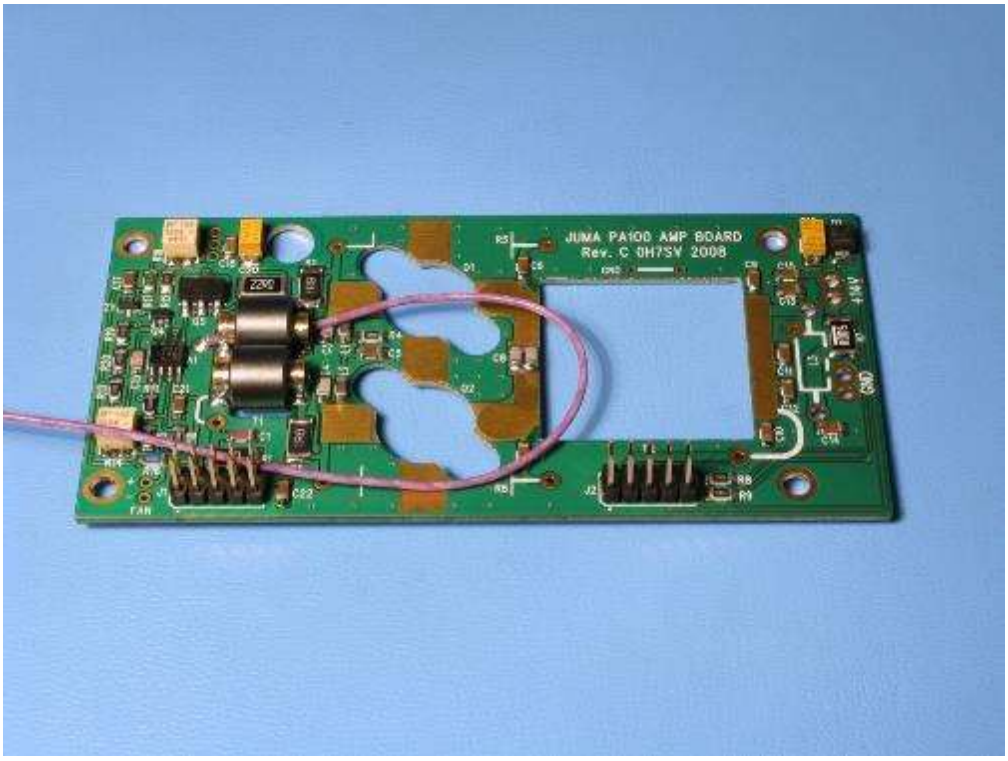

Figure 15 Peel one end of the thinner PTFE wire and solder the beginning of the wire.

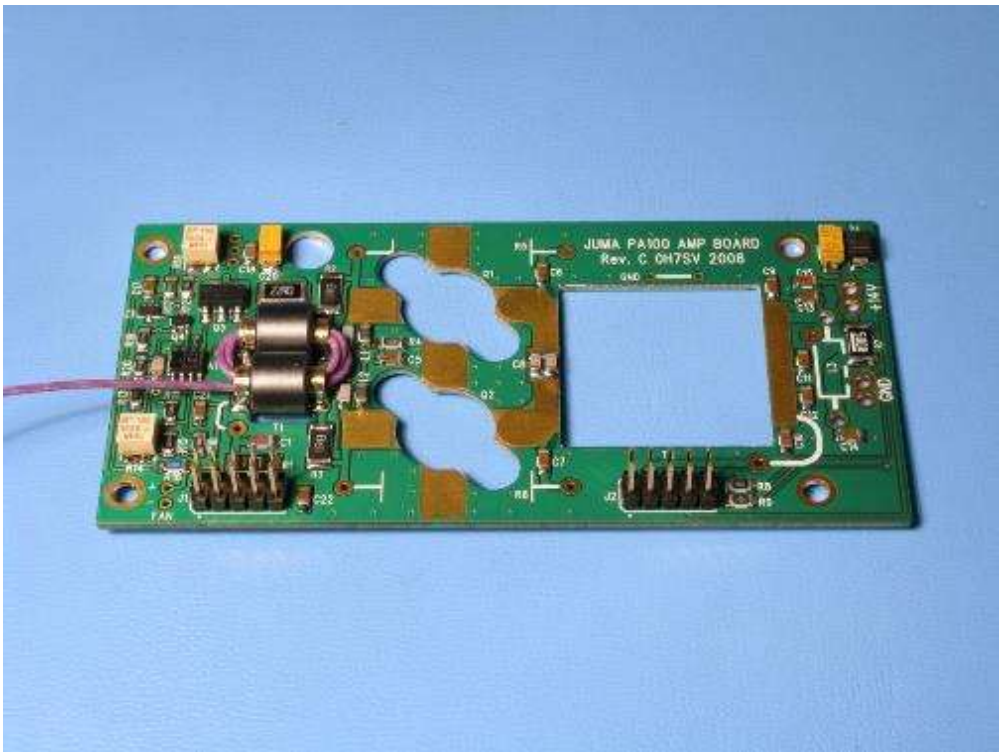

Figure 16 Wind the turns by pushing and gently pulling the wire four times thru both tubes.

There is plenty of the PTFE wire for T1. Note that from past experience it is important to take care and wind the four turns tightly into the tubes. Pull each wire through and hold it taught when you feed it through for the next turn to make sure that you have tight turns.

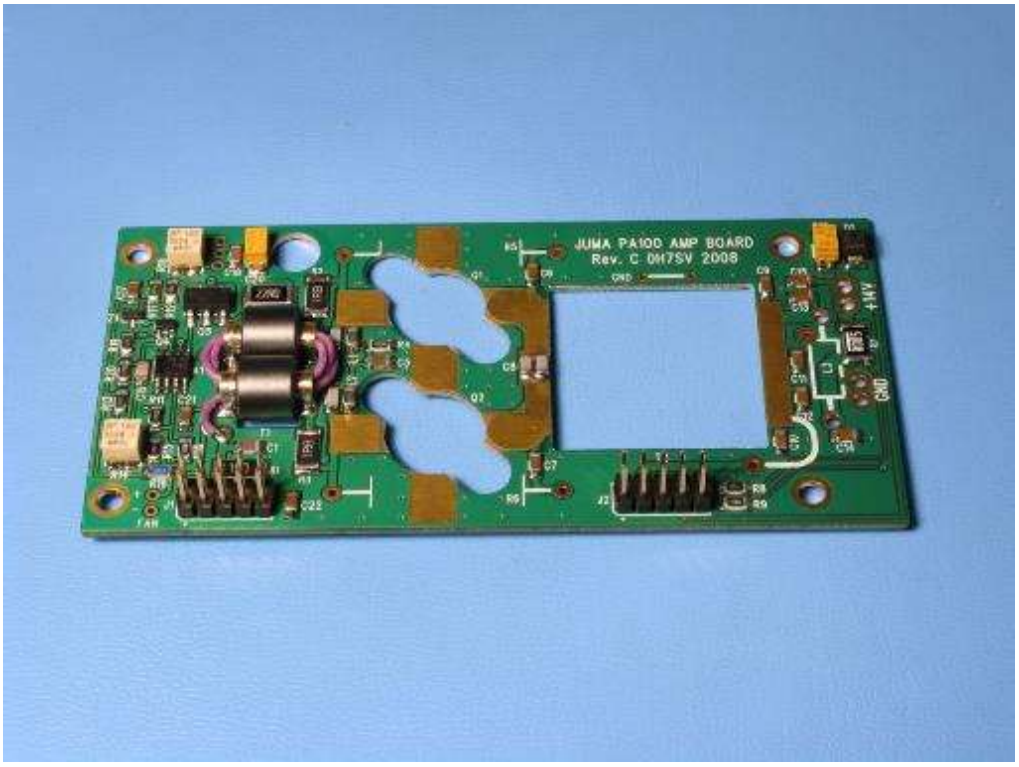

Figure 17 Cut and peel the other end of the wire and solder the end point of the T1 winding.

Figure 18 Transformer T2 ferrites and the brass tubes. Smooth the inside edges of the tubes if needed.

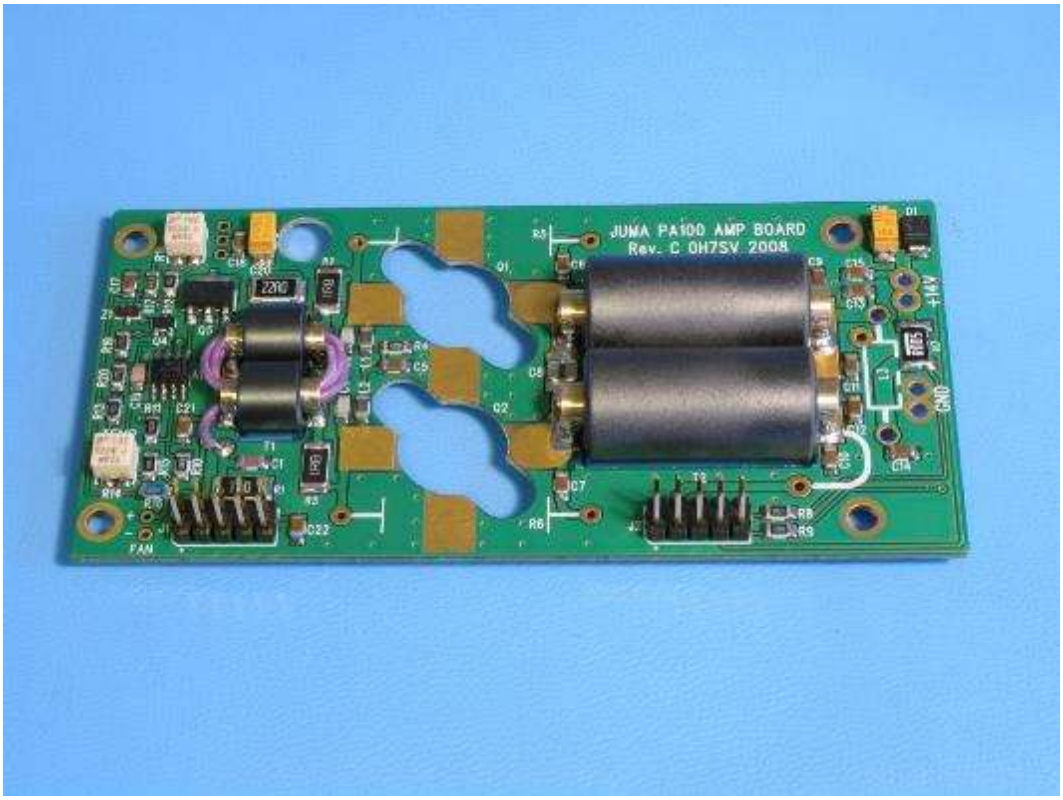

Figure 19 Solder the transformer T2 brass tubes with ferrites.

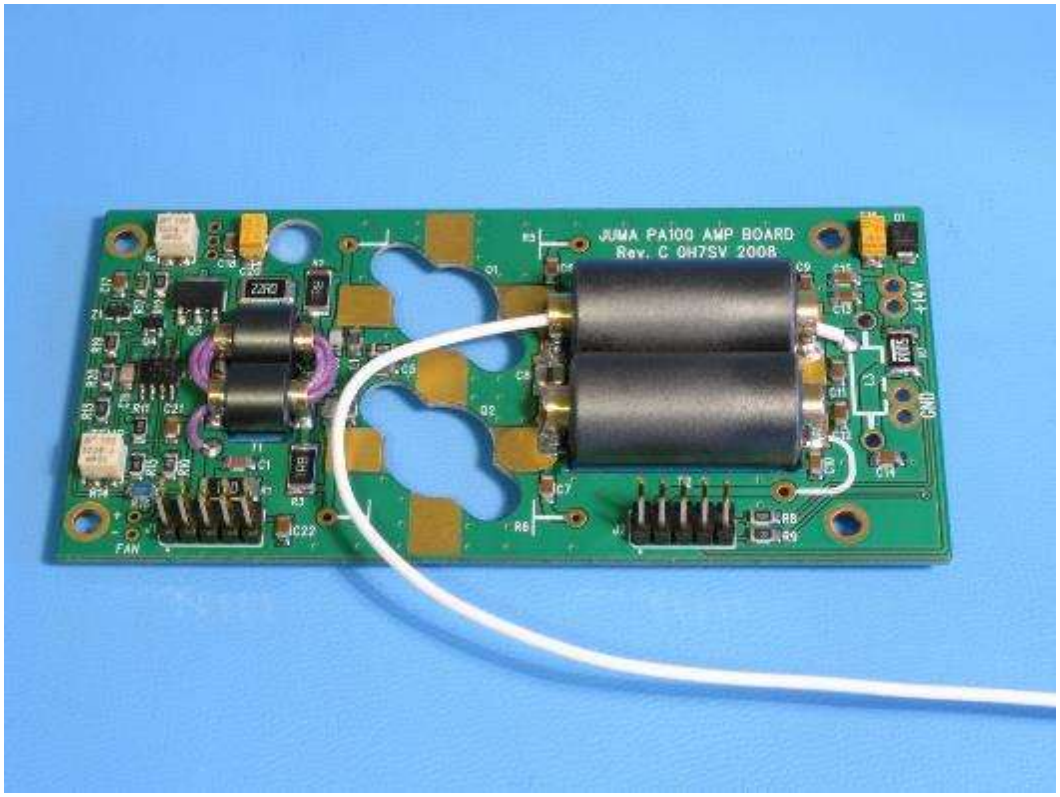

Figure 20 Peel one end of the thicker PTFE wire and solder the beginning of the wire.

Note a similar process was taken with T2 both for the installation of the tubes and also the four turns making up the transformer winding.

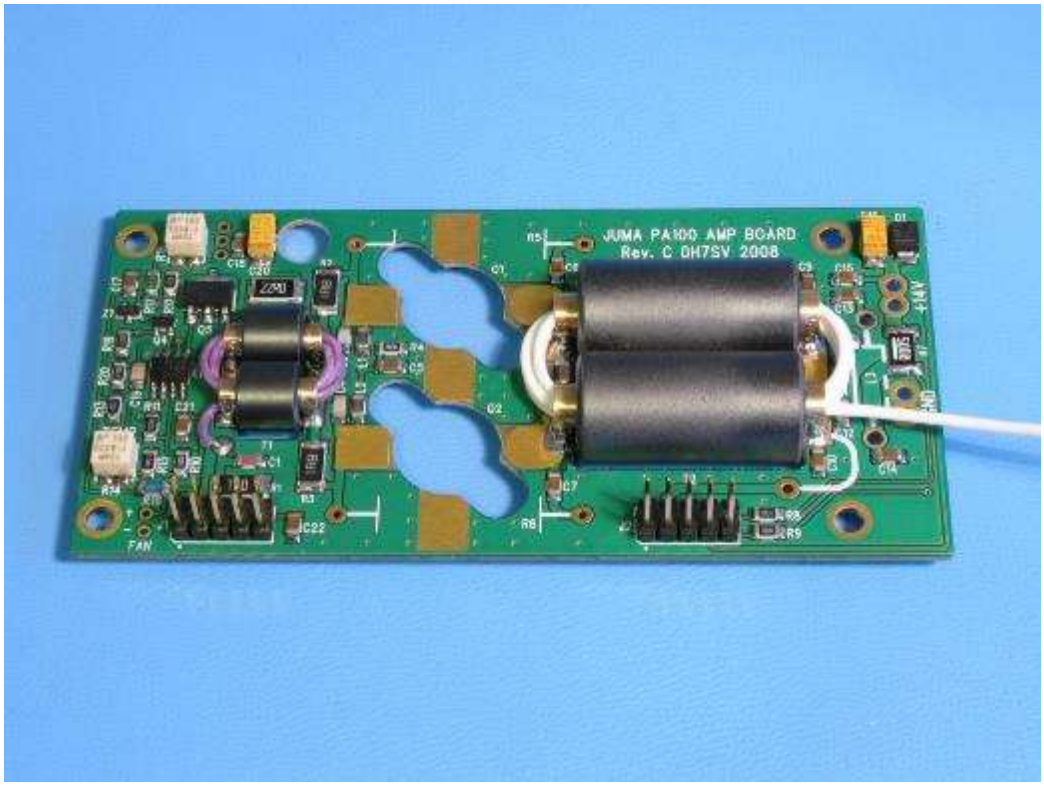

Figure 21 Wind the turns by pushing and gently pulling the wire four times thru both tubes.

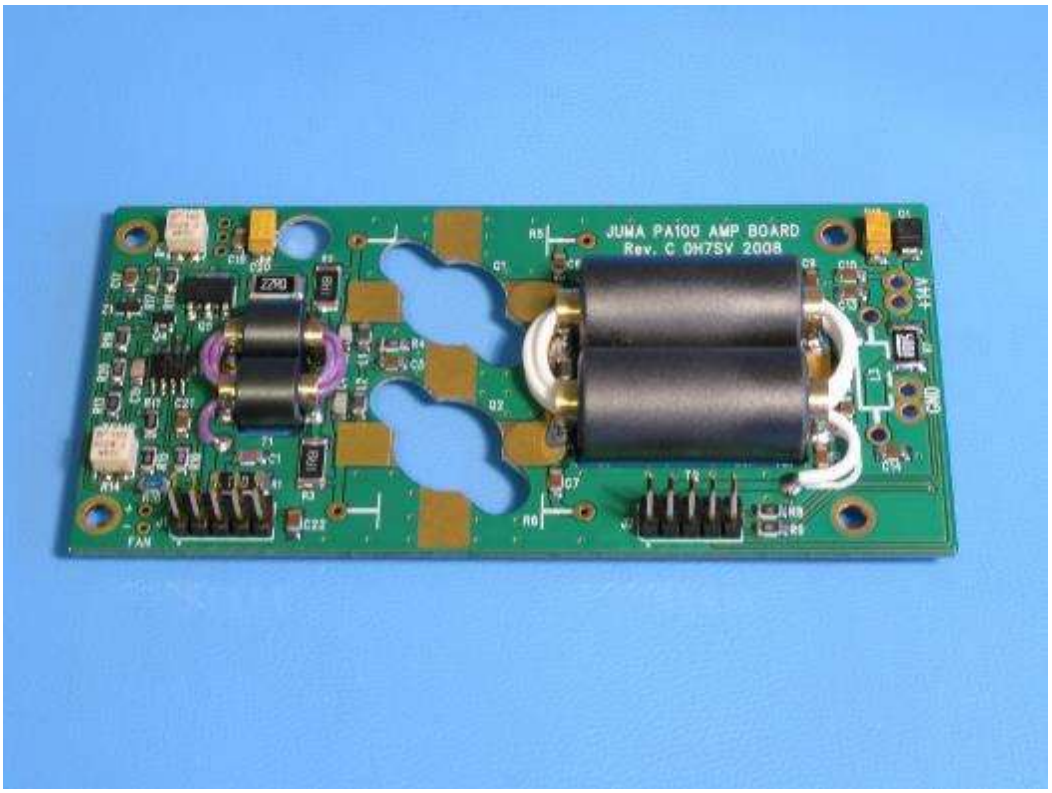

Figure 22 Cut and peel the other end of the wire and solder the end point of the T2 winding.

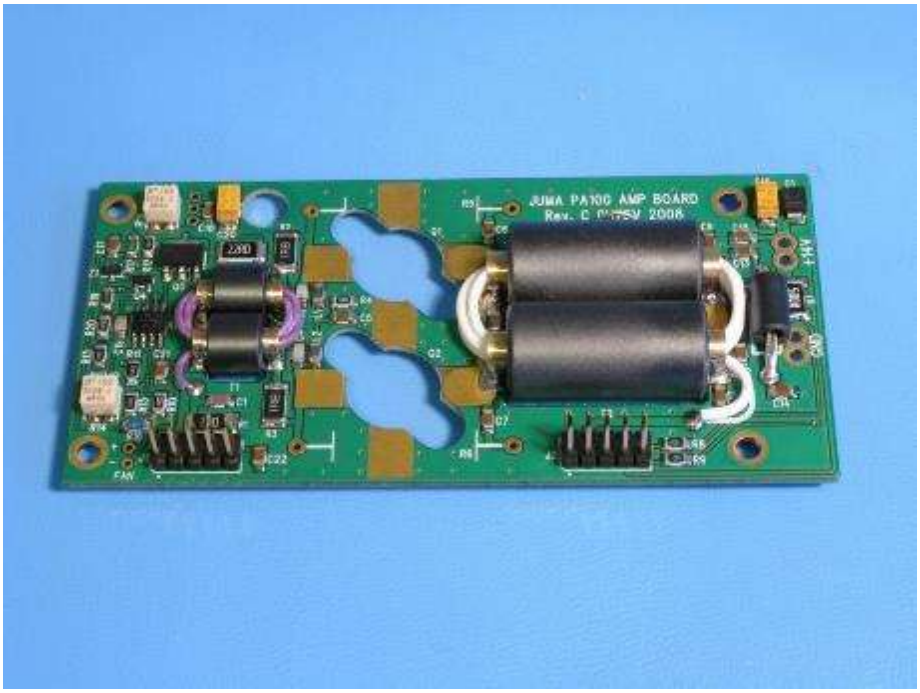

Figure 23 Solder L3 with two copper wires thru the ferrite bead. Solder also GND jumper near T2.

Note don't forget the GND jumper just seen above T2 in Figure 23. It is connected to ground at both ends and makes a ground connection point for testing purposes.

Other Hardware

The other hardware is listed in Table 5.

Table 5 PA100 RF Amplifier – Other Hardware

Part number	Value / type	Qty	Description	Picture
Heatsink	Fischer SK92/50SA 100mm x 50mm x 40mm Newark Part Number 34M8489	1	Drilled and machined for PA100	
Spacer Hexagonal male/female	M3, L=20 mm **Hex size max 5 mm !** **Narrow-necked type**	4	Fan to heatsink fixing	
DC Fan	12VDC, 1-1.5W 50mm x 50mm x 10mm Mounting holes dist 40 x 40 mm	1	Fix to heatsink and wire via the holes in the heatsink. See pictures	
Finger guard	Mounting holes dist 40 x 40 mm	1	Fan protection	
Pan head machine screw Pozidriv No1	M3 x 16mm	4	Fan to heatsink fixing	
Heat shrink	L = 6 cm, unshrunk D = 4 mm	1	For fan wires protection See pictures	
Thermal paste syringe	Heat transfer compound		For TR1, TR2, TR3 and between heatsink and rear panel	
PA100 rear panel	Machined Al rear plate	1		
Q3	BD139	1	NPN transistor case TO-126 See pictures for fixing	
Washer plain type	M3	1	TR3 fixing	
Pan head machine screw Pozidriv No1	M3 x 10mm	1	TR3 fixing	
Circular spacer	L = 3 mm, for M3 screw Brass or aluminium	4	Amp board to rear panel spacing	
PCB		1	JUMA pa100 amp PCB	
Tooth lock washer	M3	4	PCB fixing	
Pan head machine screw Pozidriv No1	M3 x 12 mm	4	PCB fixing	
Q1 Q2	2SC2879-MP Matched pair	2	RF power transistor Note! Use thermal paste. Fix before soldering	

Part number	Value / type	Qty	Description	Picture
Tooth lock washer	M3	4	TR1, TR2 fixing	
Cheese head slotted machine screw	M3 x 10mm **Note! Head dia max 5.5 mm**	4	TR1, TR2 fixing	
R5 R6	22R	2	Axial resistor, metal oxide 5W Max length 28 mm	
Power supply socket panel model + 4 male pins	JST type LL	1	Two terminals for +14V and two terminals for GND See pictures	
Wulti wire	D 1.5 mm2 colour RED L = 200 mm		Positive wires from DC supply socket to amp PCB	
Wulti wire	D 1.5 mm2 colour BLACK L = 200 mm		GND wires from DC supply socket to amp PCB	

NOTE that the hardware in the kit is mostly ‘Posidrive’ and a ‘Posidrive’ screwdriver should be used rather than a ‘Phillips’ if you have these available as the ‘Phillips’ can damage the ‘Posidrive’ fasteners after repeated removals and insertions.

To install the fan follow the steps identified in the Figure labels below.

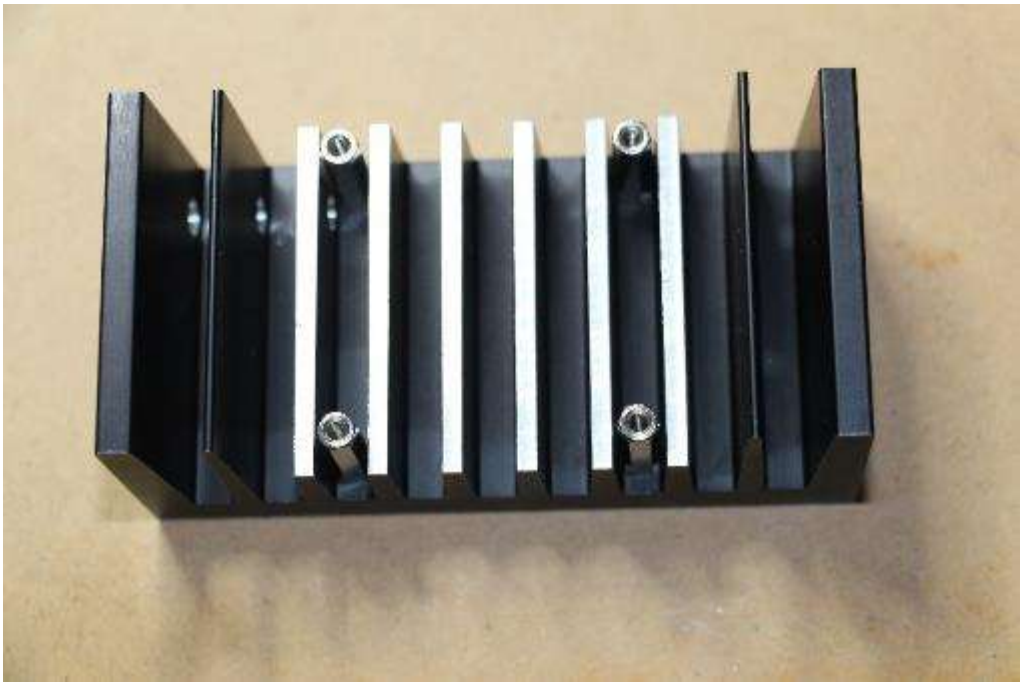

Figure 24 Mount the four M3, L-20 mm spacers to the Heatsink.

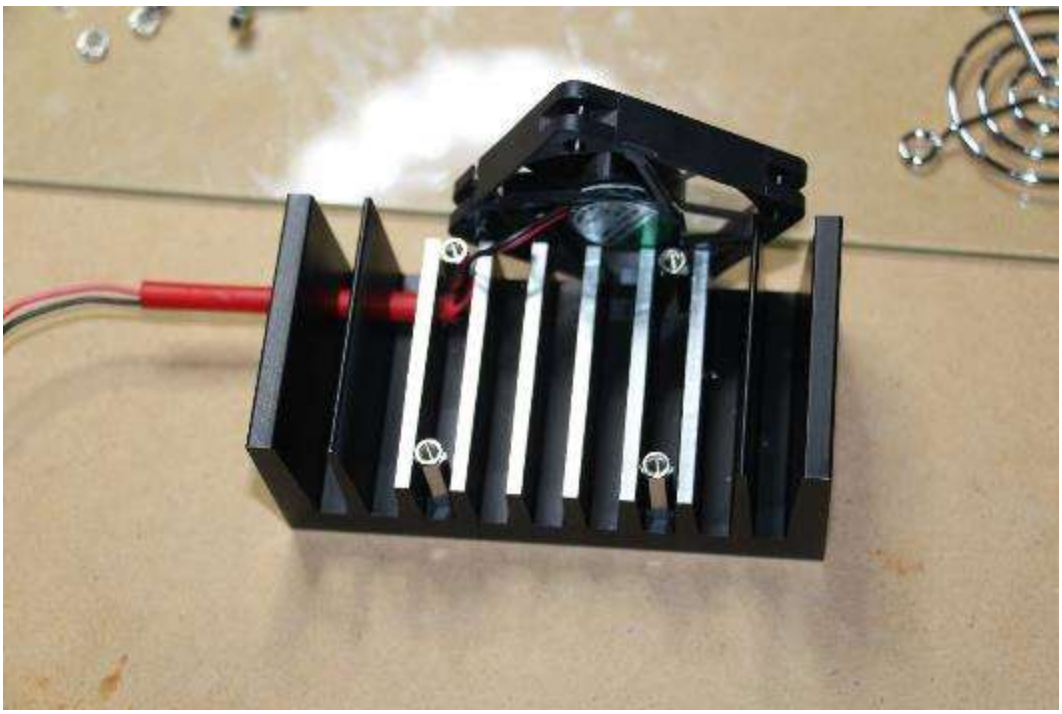

Figure 25 Fit the Red tube through the holes in the Heatsink and feed the Fan wires through.

Note that the wires from the fan need to be unhooked from the small mounting clip and fed into the red tube.

Note Juma PA100 RF Amp. Rev.C Sheet 7 of 7 calls this heatshrink but it does not appear to be to me. It is more like a plastic tube, much stiffer than heatshrink.

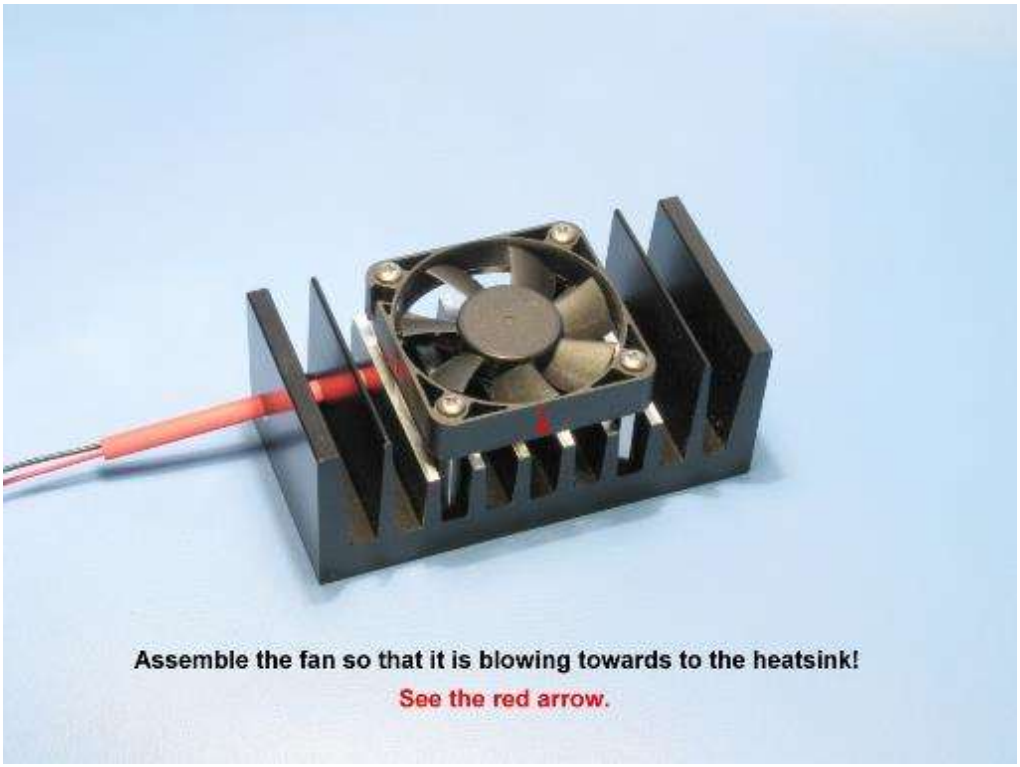

Figure 26 Install the fan with the finger shield to the heatsink. (Finger shield missing in this picture).

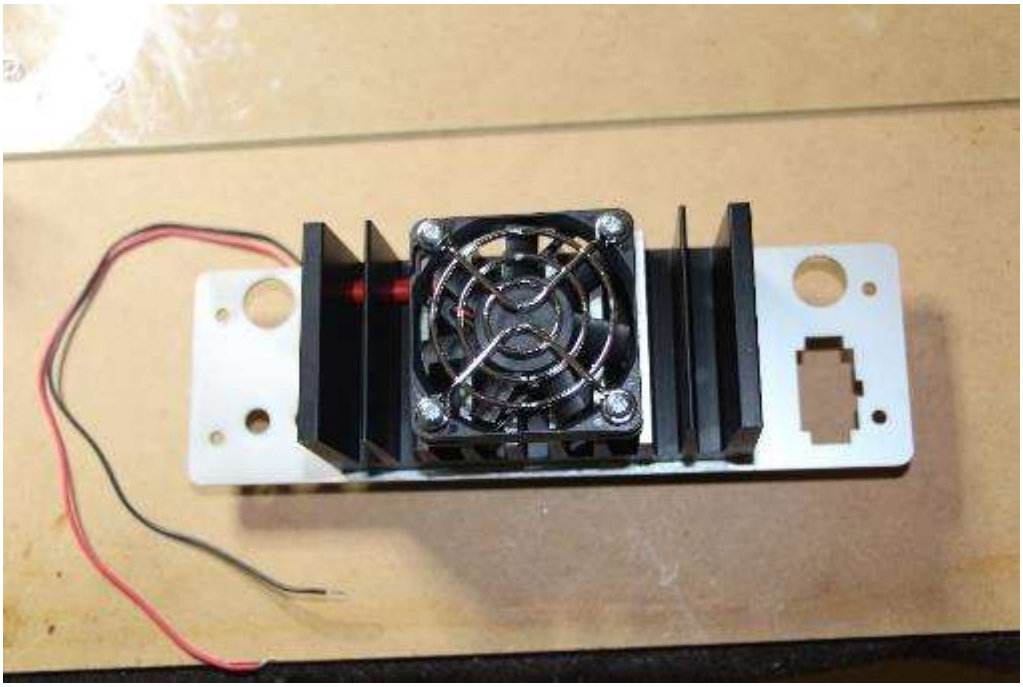

Figure 27 The Finger shield is shown in this picture.

- A

- B

Figure 28 Thermal Grease

NOTE my kit came with a small tube of thermal grease as shown in Figure 28-B. Figure 28-A shows the Thermal Grease identified on the Juma Website.

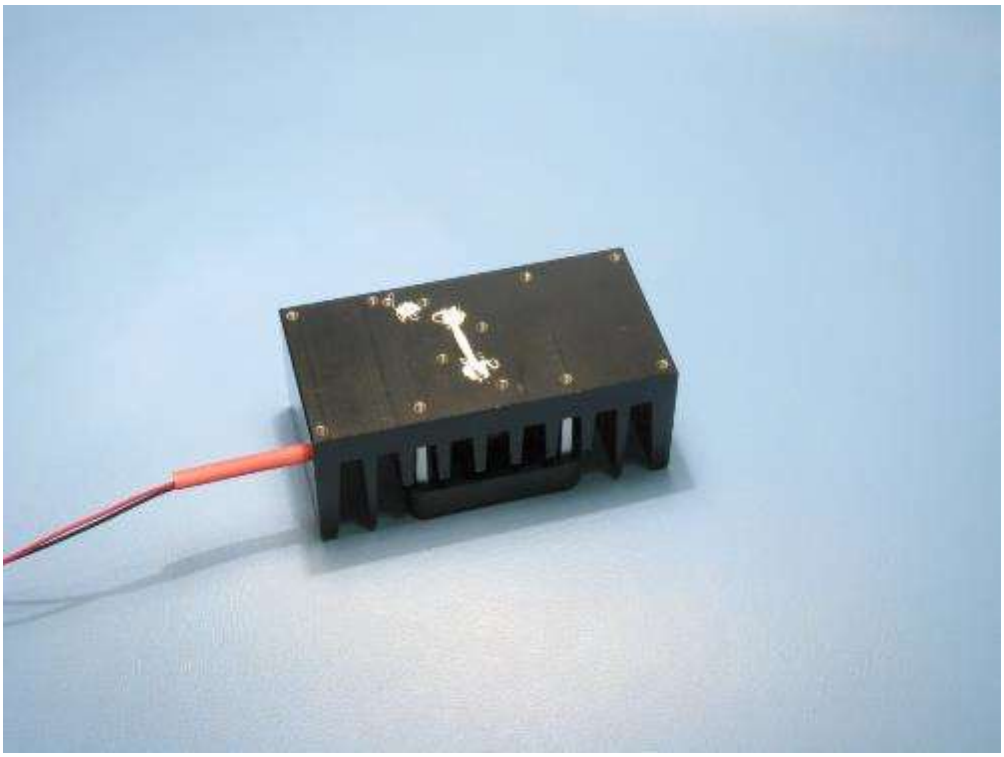

Figure 29 Apply thermal grease to the heatsink as shown in the picture

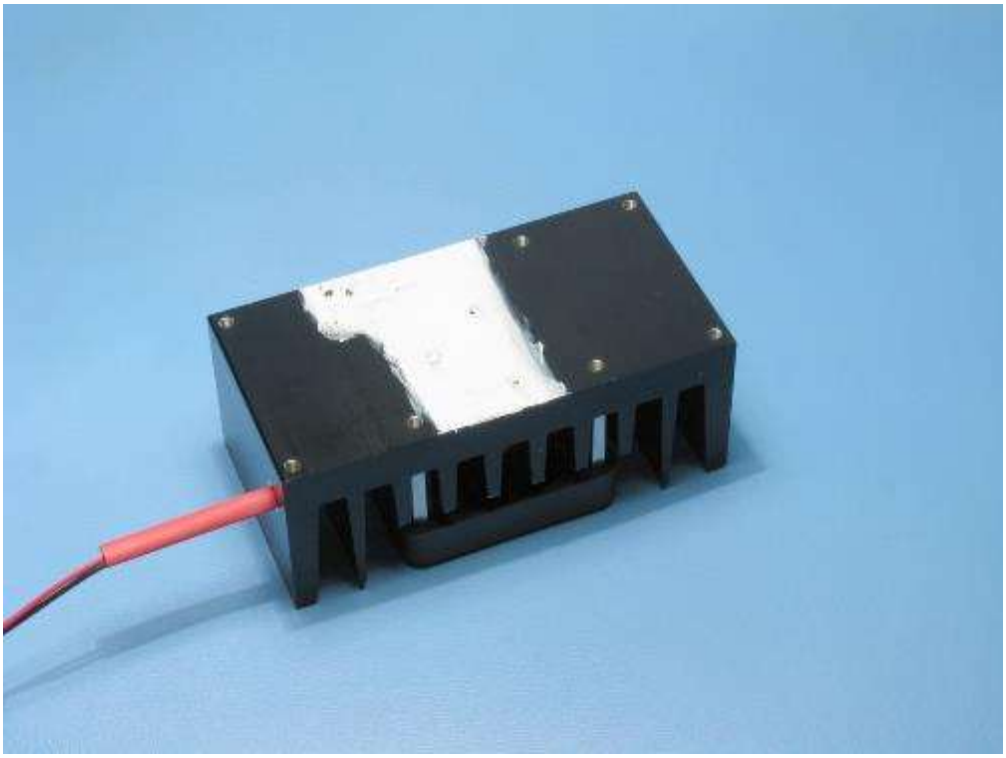

Figure 30 Smooth the grease over the shown area

Note I ended up putting the thermal grease over the complete heatsink as shown in Figure 31 as this will help transfer the heat into the back plate as well and provide a larger area for dissipation of heat. Some will ooze out around the edges and this should be wiped up with a tissue to prevent making a mess.

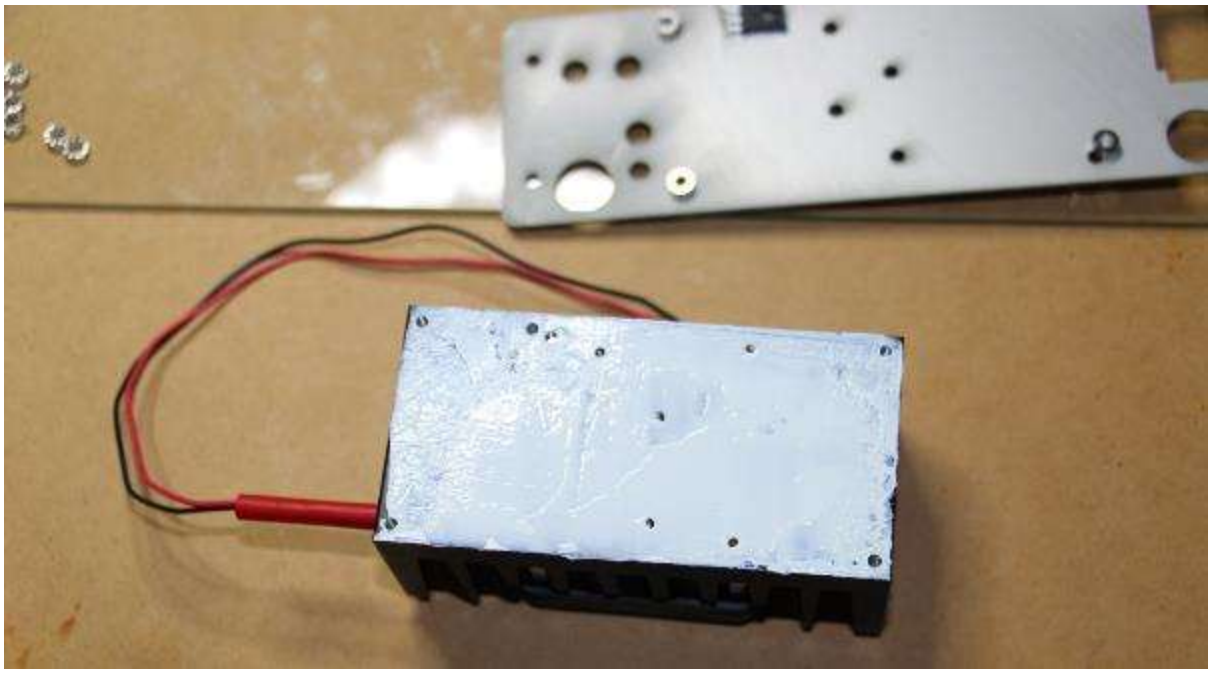

Figure 31 I extended the distribution of the thermal grease over all of the heatsink area

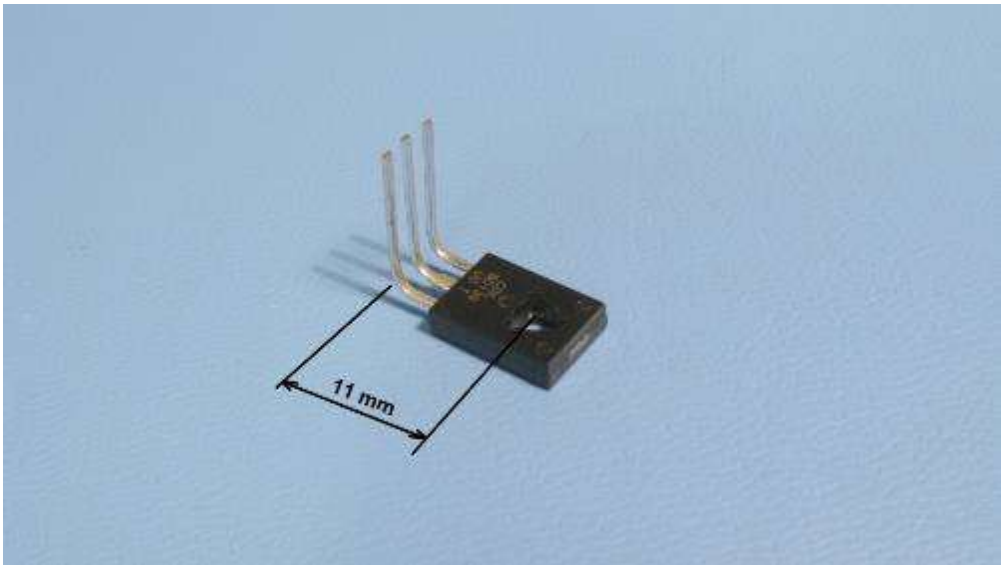

Figure 32 Prepare the Q3 by folding the legs of the transistor as shown

Note I measured the 11 mm up from the centre of the mounting hole and marked the leads with a marker and bent them gently using a pair of round nose plyers. The dimension was spot on for connection to the holes in the PCB.

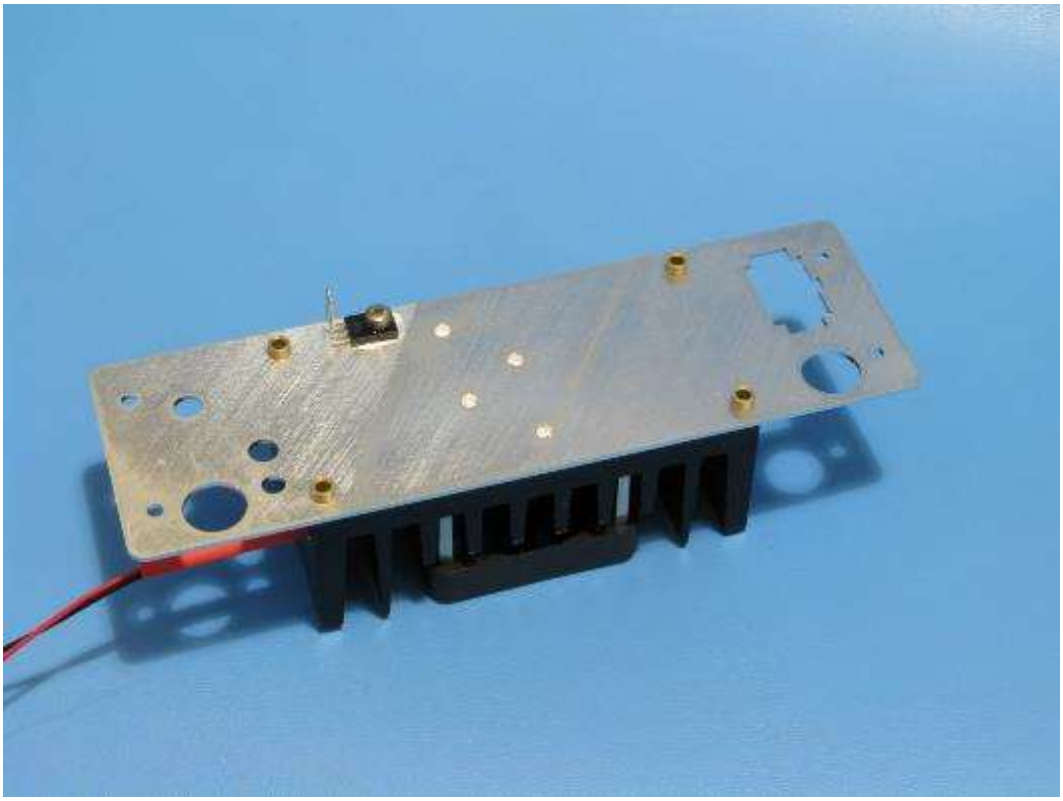

Figure 33 Place the rear plate. Apply thermal grease to the back of Q3 and install Q3. Place the PCB spacer tubes

Note Figure 33 shows Q3 being held in place with a Philips head screw. In JUMA PA100 RF Amp Rev.C Pack 4 of 7 5 Cheese head, slotted (Allen head) screws are provided and these are the ones that I have used. There is also a single nylon washer provided in the kit and it goes on Q3.

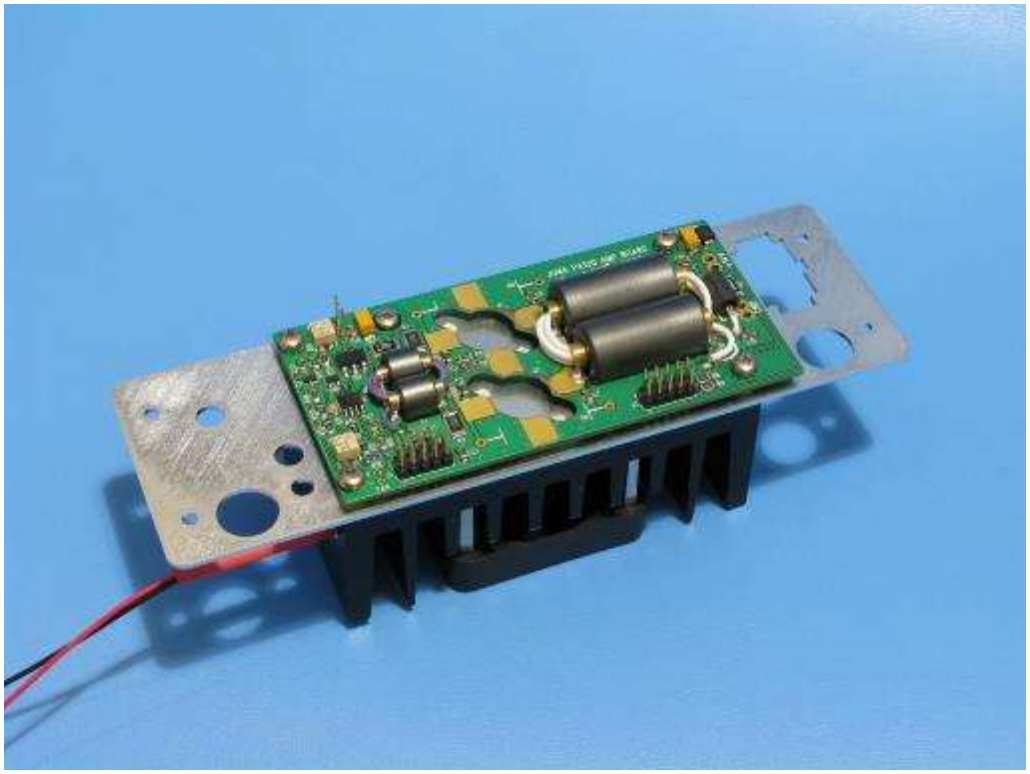

Figure 34 Fix the PCB. Tighten the screws loosely and align the board, the rear plate and the heatsink

Note the PCB is held in place using the four M3x12 Pz1 screws. As 8 lock washers have been supplied I have used 4 for the M3x12 Pz1 screws PCB on the mounting holes. Note the lock washers appear to be visible under the screws in Figure 34.

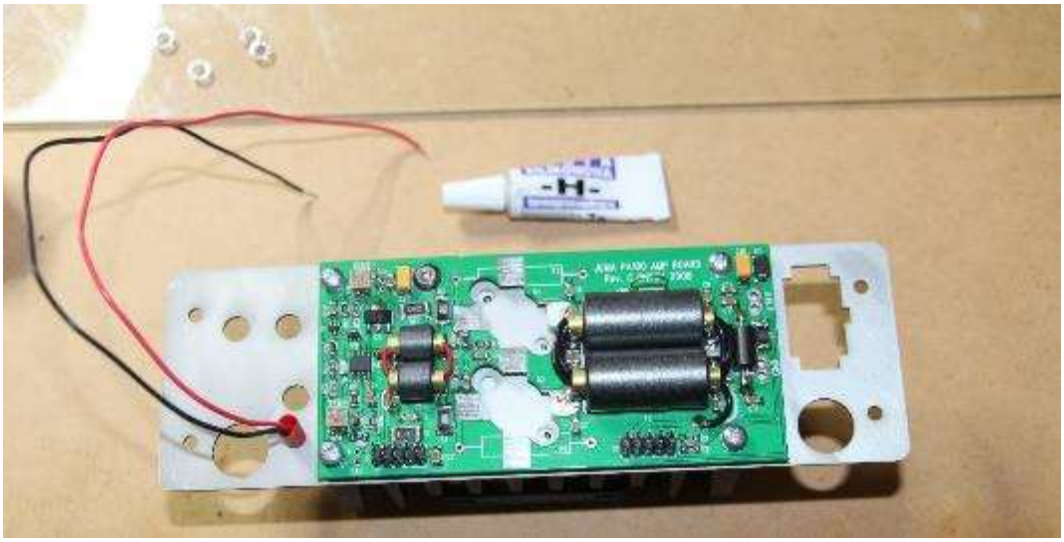

Figure 35 VK4GRM - PCB fixed in place with the rear plate and the heatsink

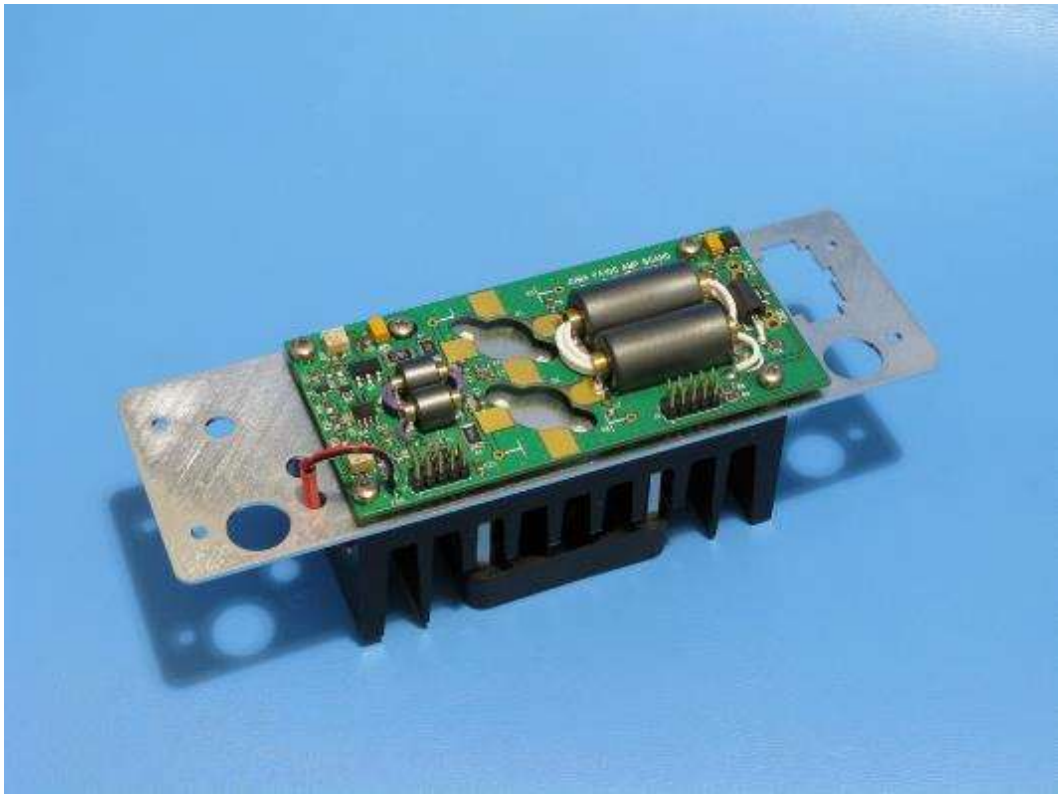

Figure 36 Put the fan wires thru the rear plate and solder the fan wires

Note that the heatshrink tube needs to be fitted through the hole first as shown in Figure 36.

Figure 37 Apply thermal grease to the final transistors

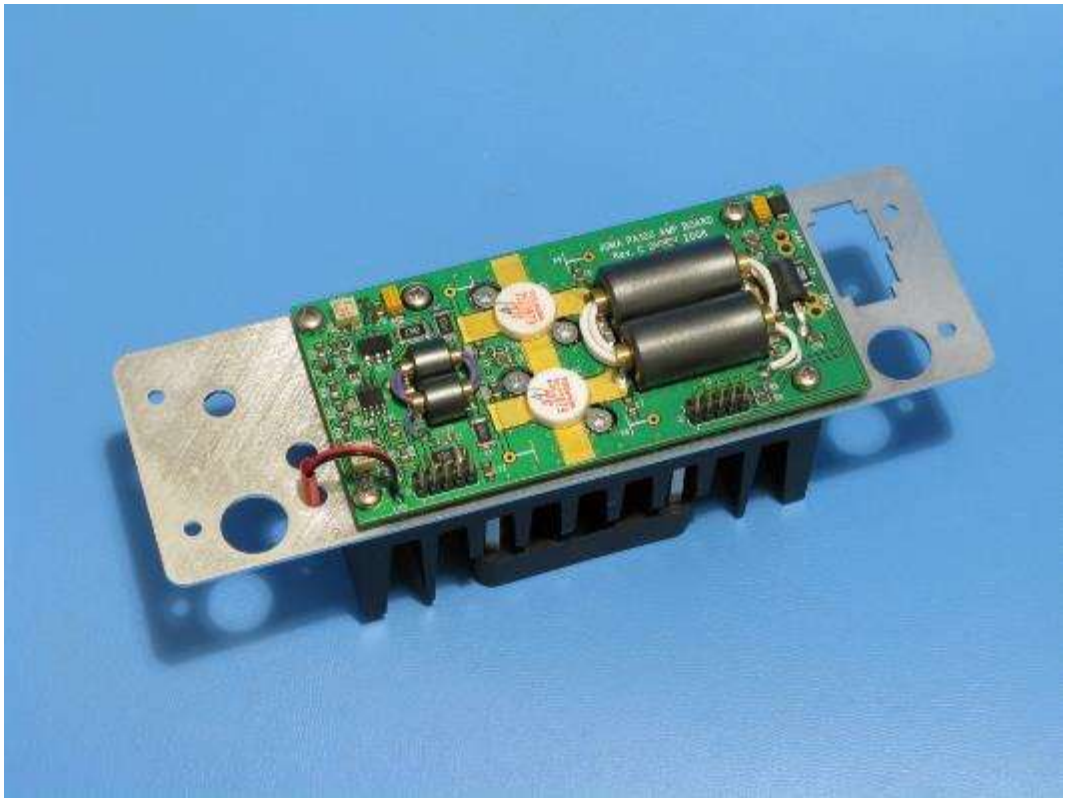

Figure 38 Mount the final transistors Q1 and Q2. Tighten the screws loosely and align all

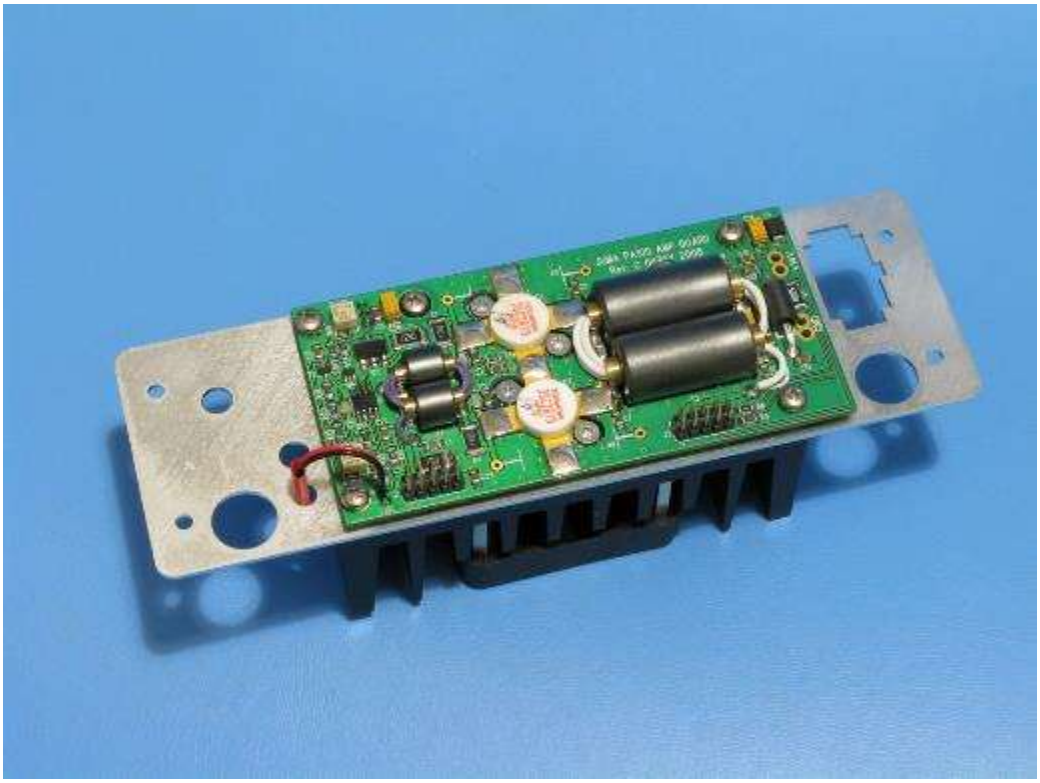

Figure 39 Tighten alternately all the screws and solder Q1 and Q2 legs. Use large soldering tip iron

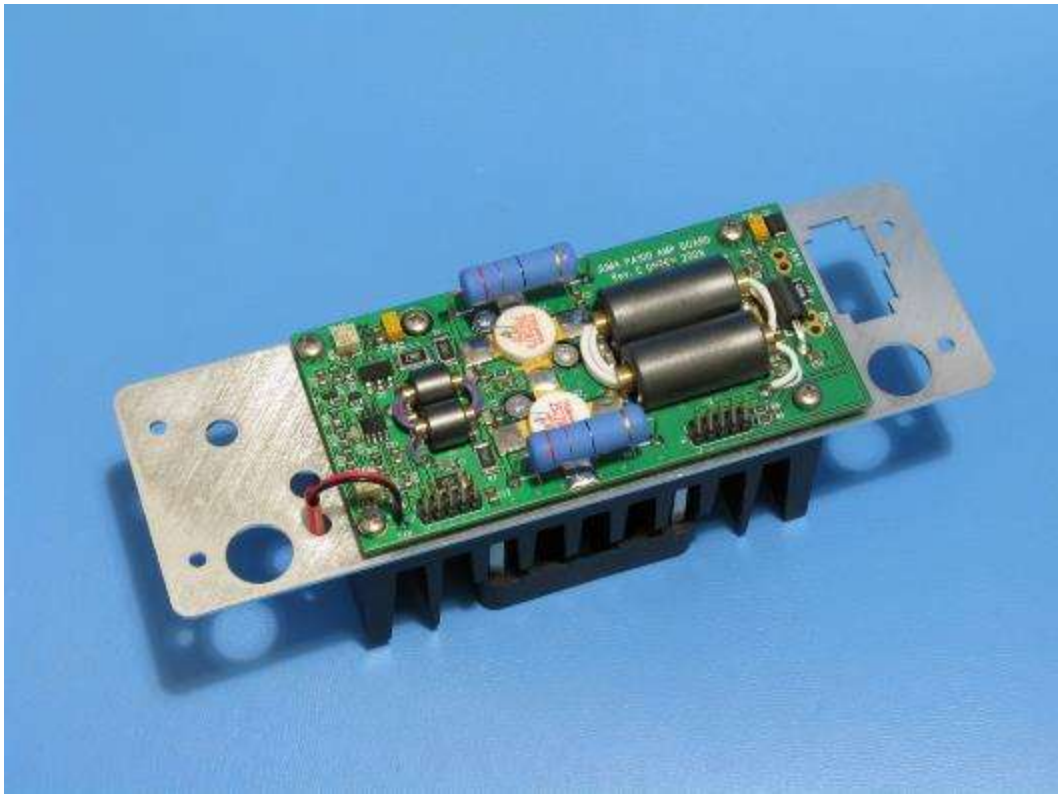

Figure 40 Check all the screws and solder Q3 legs. Solder the power resistors R5 and R6

Figure 41 VK4GRM Amplifier Module.

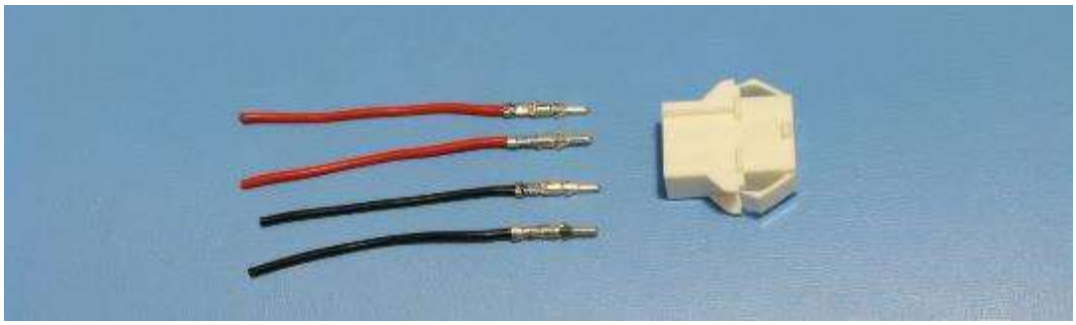

Figure 42 Cut and peel the red and black wires. Crimp and solder to the connector pins

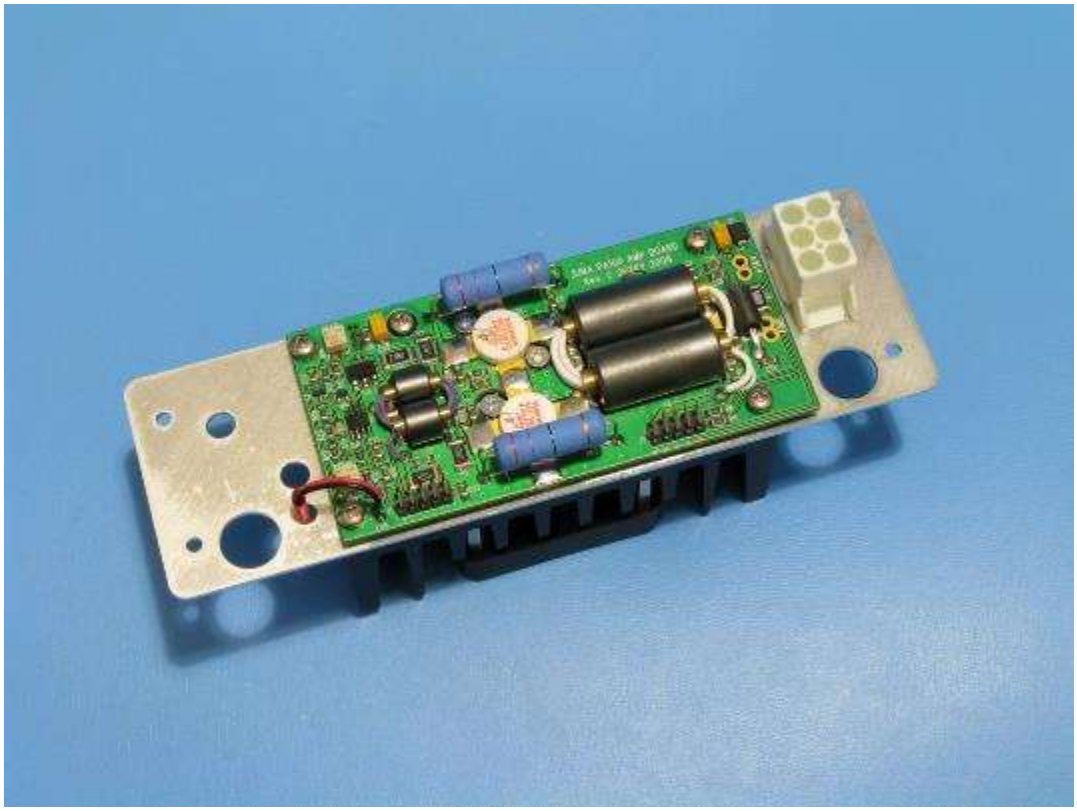

Figure 43 Snap in the power supply connector to the rear panel.

Make sure that you orientate the power connector the correct way.

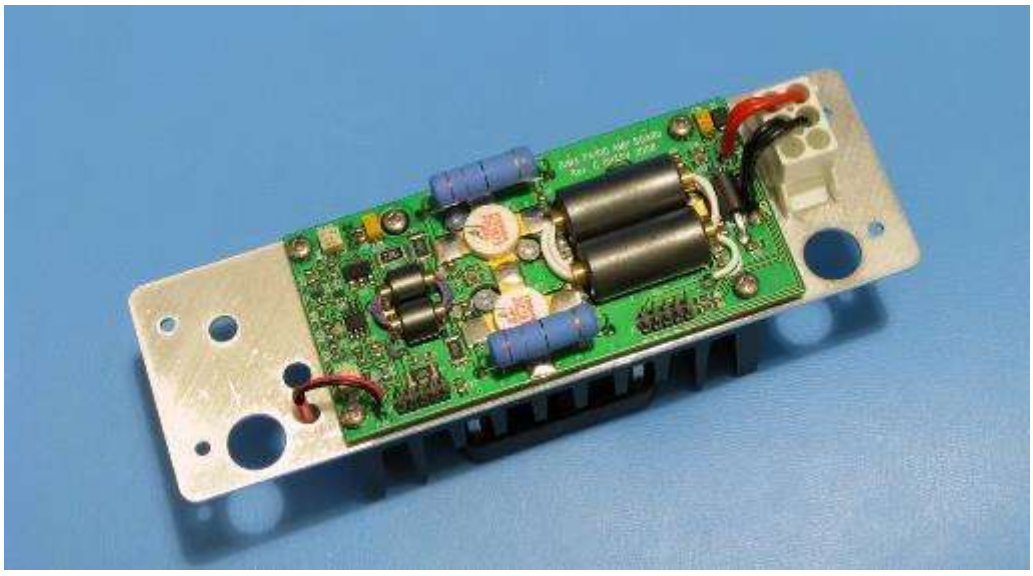

Figure 44 Snap the connector pins to the connector. Cut, peel and solder the wires to the PCB.

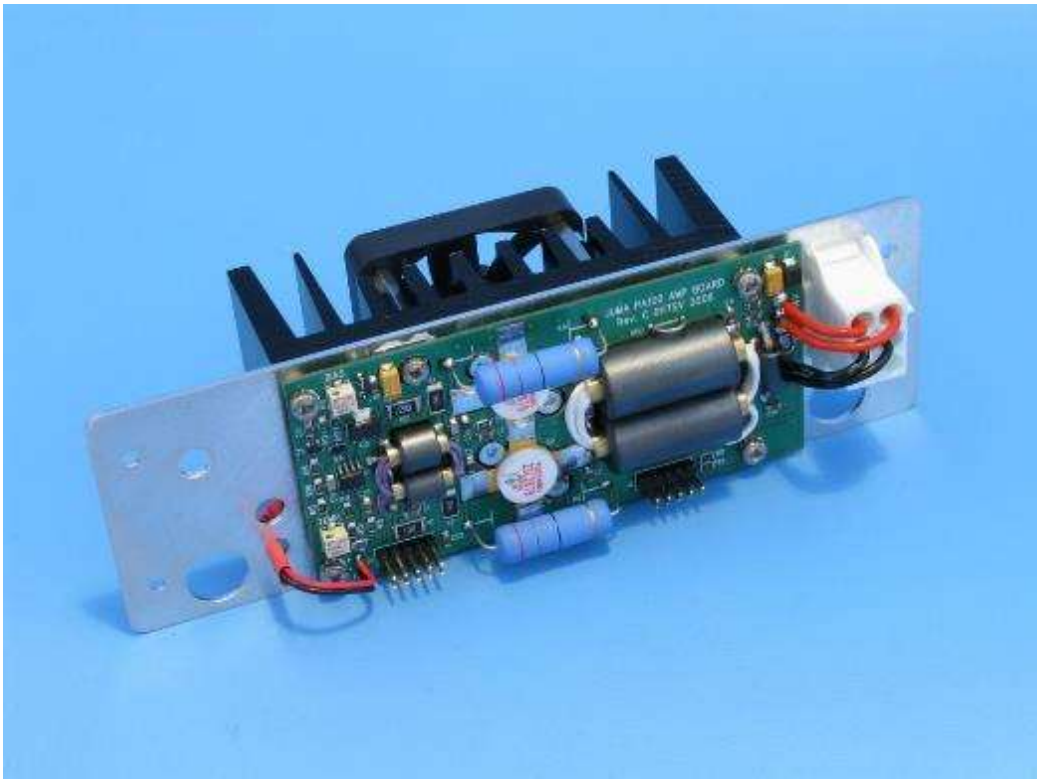

Figure 45 Completed amplifier module.

Important note!

Check that the wires are NOT contacting the rear plate when soldering the wires of RF transformers T1, T2, RF choke L3, fan wires, power resistors R5, R6 and power supply wires. Keep minimum of 1 mm spacing to the rear Aluminium plate.

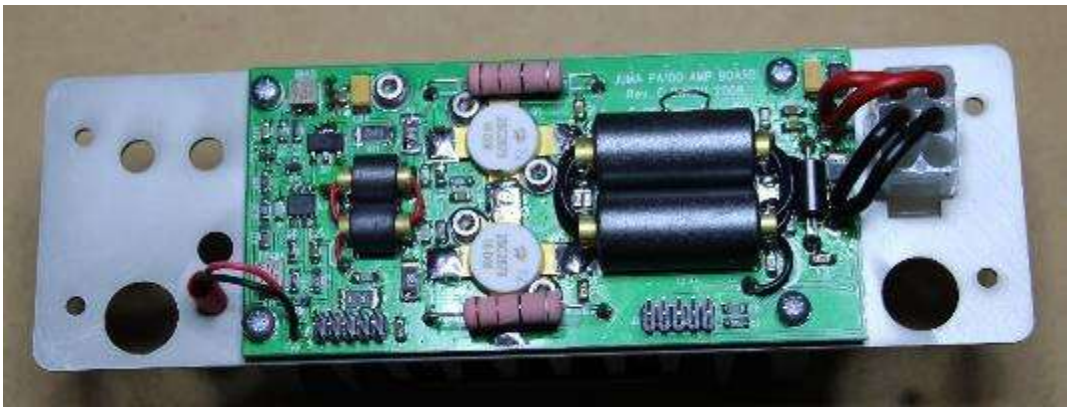

Figure 46 VK4GRM - Completed amplifier module.

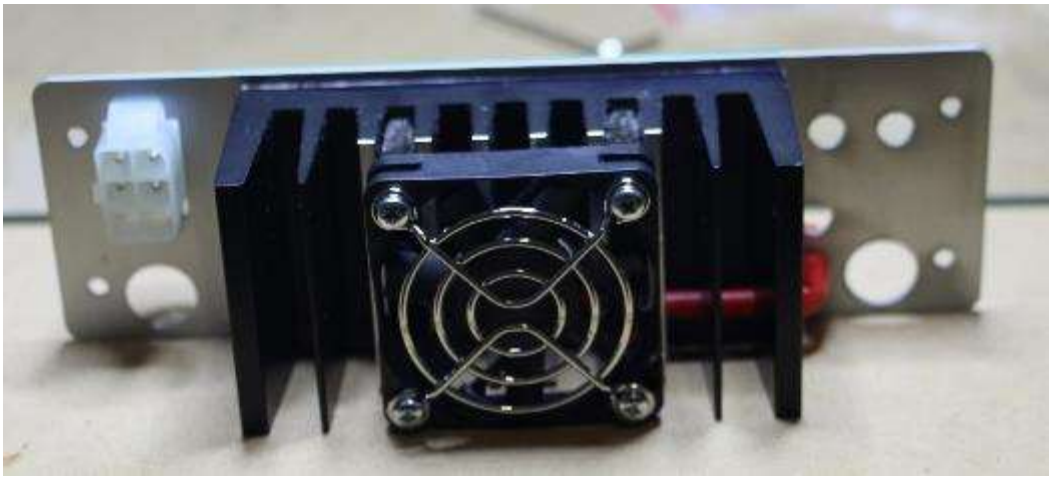

Figure 47 VK4GRM - Completed amplifier module – Rear View.

Testing

At this stage I suggest that you use a digital ohm meter to check the impedance between the +14VDC rail and the 0V rail to make sure that you have no shorts on the board.

Further it is recommended that the trim potentiometer, R18 be turned fully counter / anti clockwise to prevent possible excessive amplifier collector current on initial power up. On the Juma web site this is mentioned under 'JUMA PA100 RF Amplifier Module adjustments'. A resistance measurement from R18 (wiper or slide) to C18 should confirm the trimmer is full CCW (less than 10 Ω). I found that these trimpots are fairly stiff and you will need quite a small screwdriver to turn the adjustment screw.

I made the adjustment when I was ready to power up but it is much easier to do it now.

No other setup is necessary at this stage.

The next board is the Main Board Module. Refer to the file on assembly of the Main Board.