EB5AGV's JRC JST-245 page

http://www.jvgavila.com/jst245.htm

Welcome to my ***JRC JST-245*** HF/6m Transceiver page!

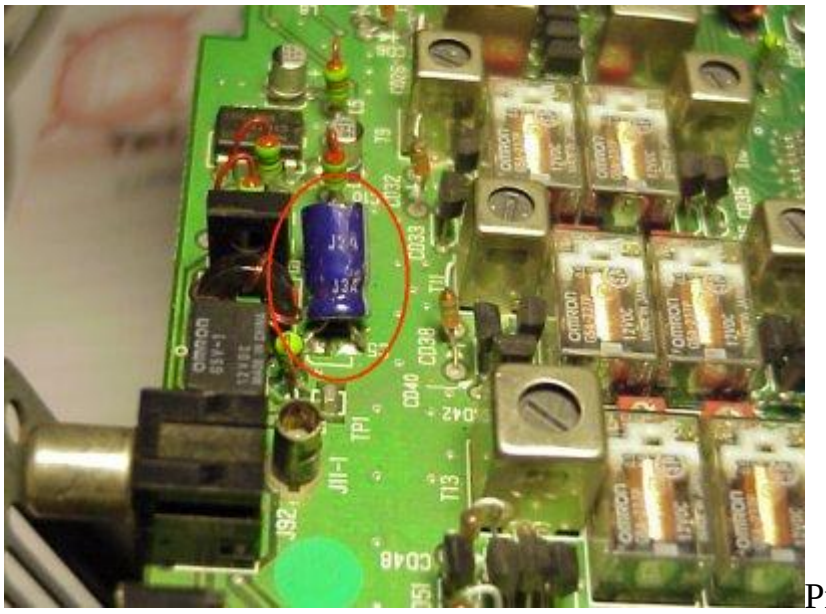
JRC JST-245 HF/6m Transceiver

The beginning

Most of my repairs have some curious story behind them and, this time, it was not different!. All started when a ham friend took a JRC JST-145 to my shop *to add some parts from a 'similar' parts rig* he had (which turned out to be a JST-245). Parts were no less than the Auto Tuner circuits (three PCBs and some cabling), as it was an option on the JST-145 but standard on the JST-245. With the 145 came also a Service Manual and a User Manual, valid for both 145 and 245.
So I tried to get the auto tuner working but it seemed to be defective. One day, just in case I could do something else with the parts unit at home, owner took it to my shack. It was a JST-245, with the Auto Tuner assemblies removed (obviously!), missing Main Power Supply, missing screws and somewhat dirty. He told me it had previously been at several shops but it had been impossible to repair.

 Auxiliary Power Supply (and missing Main PS!)

As I had already played with the JST-145 and I knew its wonderful low-hiss receiver was exactly the same in the JST-245 (except for the 50MHz band, only present in the 245), I felt it was a pity to trash that unit. I looked in detail and there were clear signs of some job done to it. And it was not a very good one!

 Previous work sample

A more detailed analisys of the rig's condition revealed the following:

- SERIOUS PROBLEMS
  - Unworking (and badly butchered, including some missing components) Main Power Supply
  - Faulty auto tuner (checked in the working JST-145)
  - Faulty PA (hard short on power supply line; about 0.2 Ohm!)
  - Deaf receiver

- NOT SO SERIOUS PROBLEMS
  - Main tuning knob had no rubber band
  - Wrong cover screws
  - Broken speaker
  - Damaged PA fans wiring

I tried to power it directly with 60Vdc (as the Main Power Supply generates that voltage to feed the Auxiliary PS and Power Amplifier Unit). Incredibly, set fighted to power up and I could hear some noise coming from the (cone broken) speaker. Everything digital seemed to be working fine. I could receive signals generated with another transceiver (checked in several bands) and also directly from my Hewlett Packard HP-8640B, but set was definitely deaf. And I mean DEAF: it needed about 100mV (!) at the antenna terminal to move the S-meter!

So, as only useful part for the poor JST-245 was not working and owner wanted to sell his JST-145, I offered him some money (not too much but, considering rig's condition, a fair price!). And the orphan rig was mine :-). This was the birth of a true Winter Project!

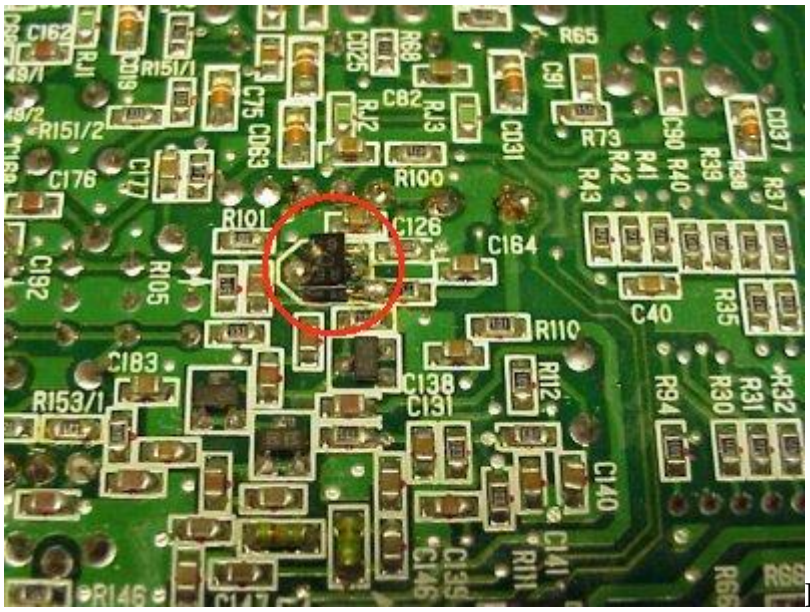
First works on the rig: some light ahead

Finding an starting point in this kind of repairs is somewhat difficult due to the large amount of work to do. But it seems natural to start with the receiver section so I did that way. Armed with the Service Manual and, after reading a bit of the 'Japglish' (Japanese-English) text depicting how receiver worked, I decided to remove RX/TX circuit from the chassis, as most problems seemed to be located there. It is a large PCB, which fills most of the transceiver horizontal area. It is mostly SMD but there are also some PTH (pin through hole) components and a lot (and I mean a lot!) of connectors going to it.

RX/TX Unit partial view

Looking at the RX/TX PCB, it was evident somebody had been there before, also on the other (solder) side, which was plenty of SMD parts. Just by optical exploration, I found that several components had been replaced with sometimes better and sometimes worse workmanship: some were barely visible and other were loosy jobs. All in all, a lot of work had been put on it by somebody but, obviously, had not completely fixed the rig... so I had a real challenge ahead!

Some diodes, which turned out to be SMD double units, were replaced with non-SMD parts (just one diode!). But checking schematics I found that one section of the diode was unused so replacement could still be good. This was the case of CD146 (HSM88S). Another replaced diode was CD152 (RD5.1M-T1B, a 5V1 zener). Several other parts were just replaced and checked fine with the DVM in diode mode, as TR11 and TR72 (2SC2712Y), TR9, TR84 and TR100 (2SC3398). Other parts seemed replaced but could not be checked that way, as IC35 (UPC2002H). I also found some missing parts as CD169 (1SS184) or C640 (33pF ceramic cap). There was a damaged transistor, TR6 (2SC2954) and an associated resistor R102 (15 Ohm) which was open. These are shown in next picture.



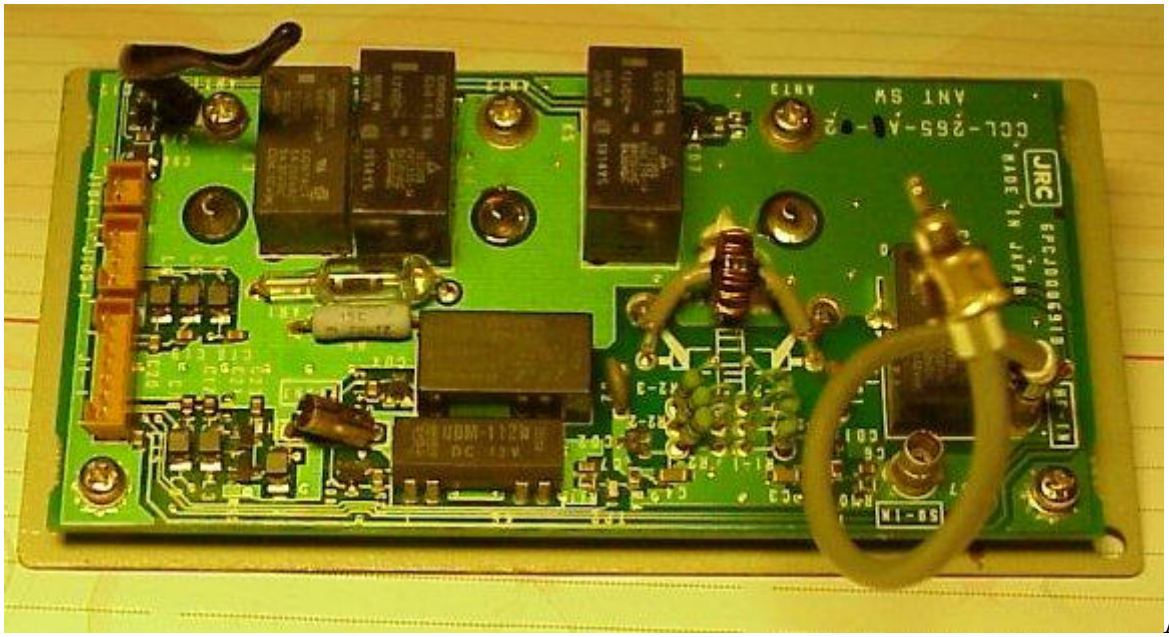
Damaged parts

Checking schematics I found that a damaged TR6 meant transmission chain was broken. Well, anyway, as Power Amplifier was shorted, it was not a big trouble. Other faulty or missing components were in non crucial stages (as VOX circuit) so they were not the cause of the rig deafness. I resoldered some components which had bad soldering jobs and also removed shorted TR6 and faulty R102. A new capacitor was also put in empty C640 location. I put back in the rig TX/TX module, connected about 50 connectors to it and, powering from an external 60Vdc supply, checked the rig. It had of course same failures than before but now I thought there was nothing seriously damaged and started following signal path. Armed again with the Hewlett Packard HP-8640B signal generator, I put the rig on 14.000MHz and checked signal at the RX/TX Unit input... and it was almost gone!. So, bypassing antenna connector and antena relays, I injected signal directly at RX/TX input and got an strong speaker output and S-meter indication :-)!.

Fastly, I checked all bands and found rig was basically working in all of them!. It could not be that easy (and, in fact, it was not!). That night I went to bed with an smile.

Finding the deafness culprit

I knew there was a problem in the Antenna Switch Unit so I took it out of the chassis.



Antenna Switch Unit

Checking schematics it was obvious that the signal did not flow through the main relay K2 (NR-HD-12V, a reed relay). So I took it out and replaced it by a bridge on its normally closed contacts. But rig kept deaf!... Checking a bit more, there was another relay shitching same time than K2 and it used a common transistor TR2 (2SC2712Y) to switch both. Of course, it was dead and was replaced by a BC857C. But there was still no signal on the RX/TX board!... This time it was a subbtle problem: having removed K2 relay, its coil was not in the circuit and this prevented the other relay to switch. I fixed this with a 1K resistor instead of the K2 coil and, finally, signal passed through relays. Good!

Receiver troubleshooting: AGC tales

Once here, I had an almost working receiver... and I say *almost* because it was slowly loosing sensitivity. It was exactly same effect than slowly reducing RF gain. So S-meter started to climb up to about S9. I had an inspiration and found that pressing AGC button for some seconds turned it OFF (yes, I should know it if I had carefully read the manual!). And, once AGC was OFF, receiver not longer reduced sensitivity. In fact, it

was working really fine and was able to hear up to -135dBm or so. As the JST-245 is a complex rig, AGC circuit is also a complex one, with a couple of analog bidirectional switch arrays controlling which components are on-line for each receiving mode (SSB, AM, FM, CW). Service manual did not help on this subject and schematics just shown IC16 and IC17 (both MC-14066B) sections but provided no indication about which modes activated them. I needed to find that, so I checked with the oscilloscope and got this table:

JST-245 AGC Switching

IC Section \ AGC	OFF	FAST	SLOW
IC16 A	0	0	0
IC16 B	1	0	1
IC16 C	0	1	1
IC16 D	0	0	0
IC17 A	0	1	1
IC17 B	0	0	0
IC17 C	0	1	1
IC17 D	0	0	0

As a sample, this means that section B of IC16 is only active when AGC is OFF. There were some sections (IC16A, IC16D, IC17B and IC17D) which selected other things. Playing with the rig I found that IC16A, IC16D and IC17D were active only if mode was AM.

RX/TX board IC16 and IC17

Ok, so this gave me some clues about what could be wrong. But checking sections which were only active with AGC FAST or SLOW did not revealed the problem. All seemed to work fine. Some more troubleshooting led to a more obscure failure: IC17D section, which was theorically active only in AM mode, slowly leaked in all modes, building up the voltage which reduced RF gain. Once I removed that section from the circuit,

opening a circuit trace, SSB and CW modes worked fine!. Of course, AM was not operative (S-meter fastly climbed to 9+60 if AGC was ON) but this was a minor problem by then. Hooray!

Checking all functions: some hidden failures

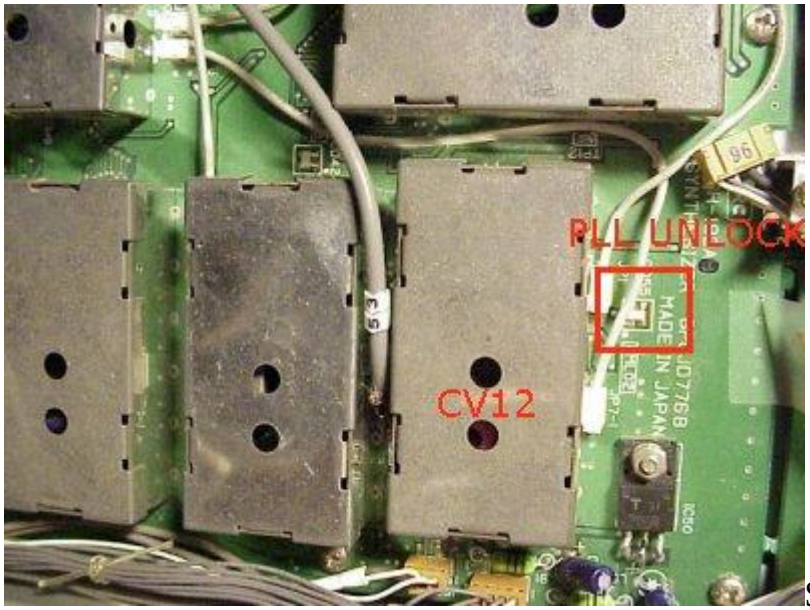
At this stage, I had a working SSB receiver and a partially working (only with AGC OFF) AM receiver. I started to check other functions. From another rig, I had an optional Monitor Unit available (this unit let's you monitor 9.455MHz IF on tranmission). So I installed it in the rig and hooked a Yaesu hand mike (curiously enough, some JRC rigs are pin to pin compatible with Yaesu microphones, including UP/DOWN buttons). I was amazed to find that it worked!. So TX chain, up to that point, was working. Great finding!. I checked up to the missing TR6 transistor (which is a 70MHz IF point) and signal went that far. Good!

VOX circuit, as there was a missing diode, did not work. COMPRESSOR worked fine, though. RF AMPLIFIER was also found working. I had not yet checked FM. Upon doing that, definitely, it did not work. Another thing to look at!

All in all, I was happy. So happy that I decided to check BBC at 9410kHz... I got no signal in AM nor in SSB!. Bad thing, as it was being received perfectly in my Yaesu FT-890. Then I checked, with a -73dBm (50uV) signal (S9 calibration level), all the receiver range. I found that it worked fine from 100kHz to 54MHz except for 7.500 to 9.999 kHz. Checking Service Manual, only reason to this seemed to be a faulty DDS (nooooo!) or some VCO trouble. Praying for the later to be truth I found that VCO check voltages were out of range (also, an unlock LED lighted when receiver was in the faulty frequency range). Just tweaking CV1 to CV6 trimmers in the Synthesizer Unit while monitoring voltages at test points got back a general coverage receiver :-)!


Synthesizer Unit

Now there was the FM trouble. As FM signals follow a different path and use also different oscillators, this time repair was also fast: when in FM mode, a LED announced an unlocked PLL. Adjusting CV12 trimmer brought back FM.



Synthesizer Unit: FM section

To be continued...

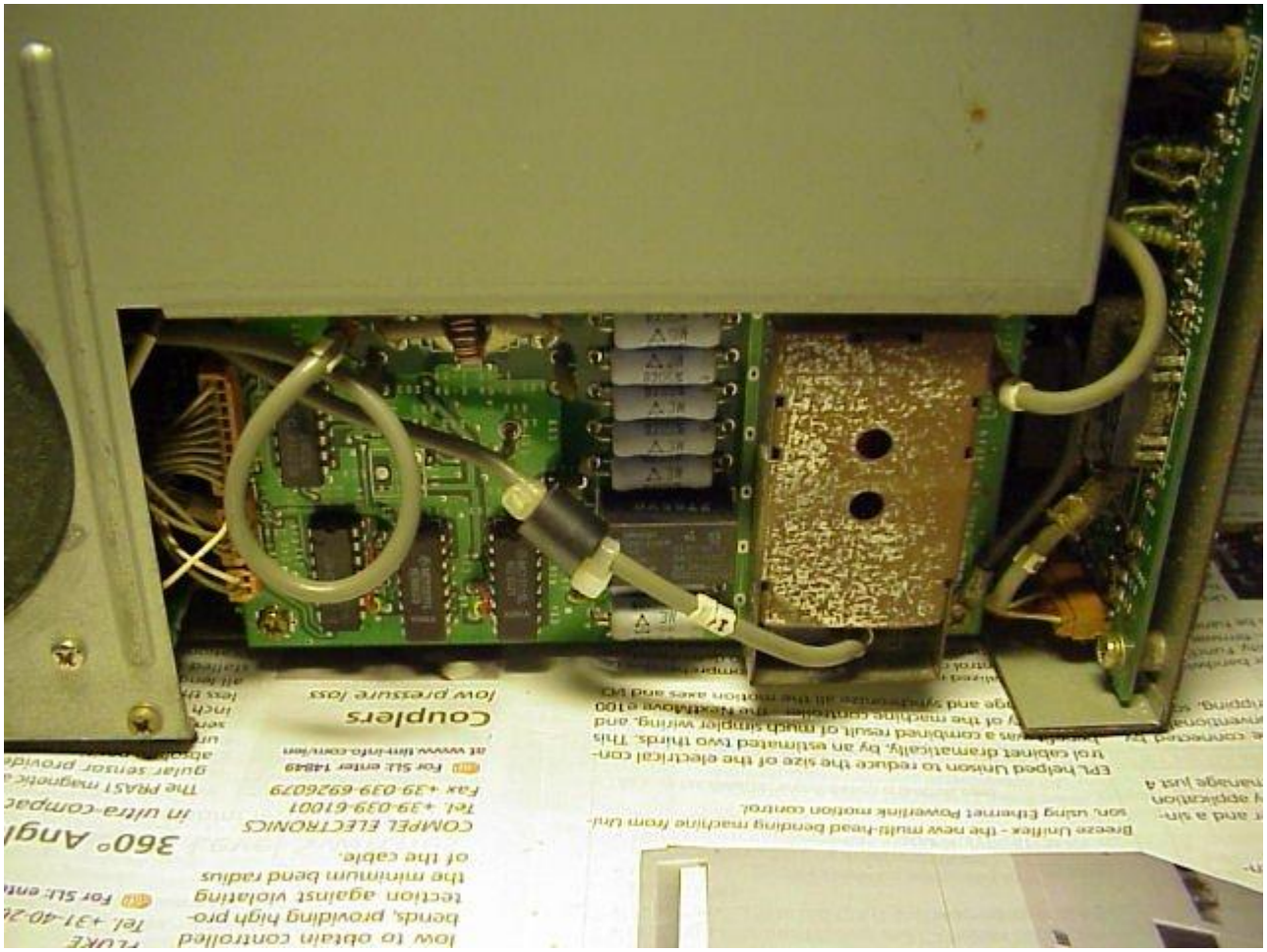
And it continues MORE THAN TWO YEARS LATER!

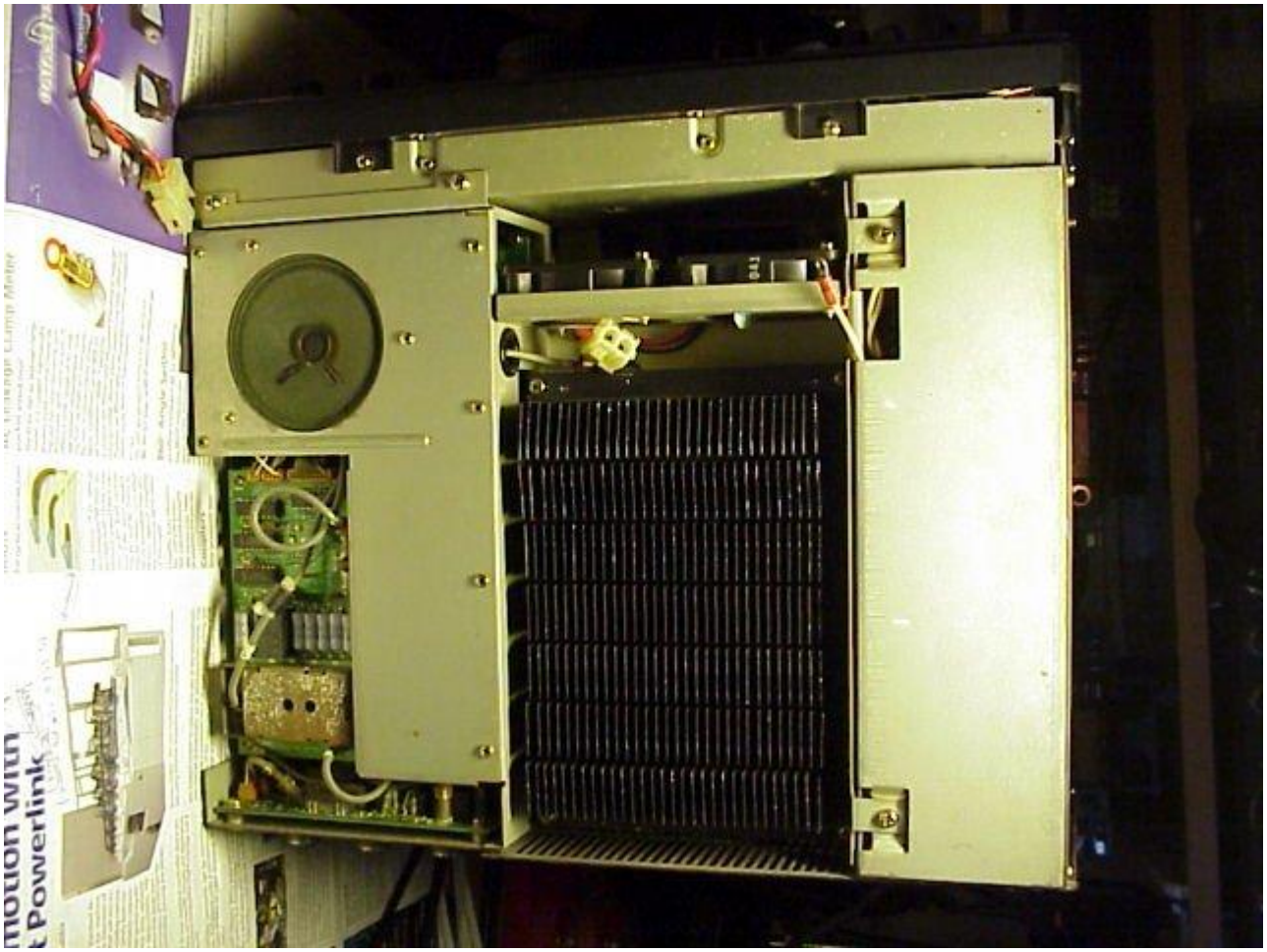
JST-245 v2: resurrection

Yes, at the beginning of August 2007 I got an e-mail from a ham in Canary Islands who had a damaged JST-245. We talked by phone and we agreed in an swap, so I got **another faulty 245!**

This time, what was for sure unworking was (surprise!) the main power supply and also secondary power supply. Both had been fried connecting the unit to 240VAC, being internally jumpered for 120VAC. All other parts *could* work but, as someone had been playing to get it working, using a PC power supply and other tricks, we were not sure.

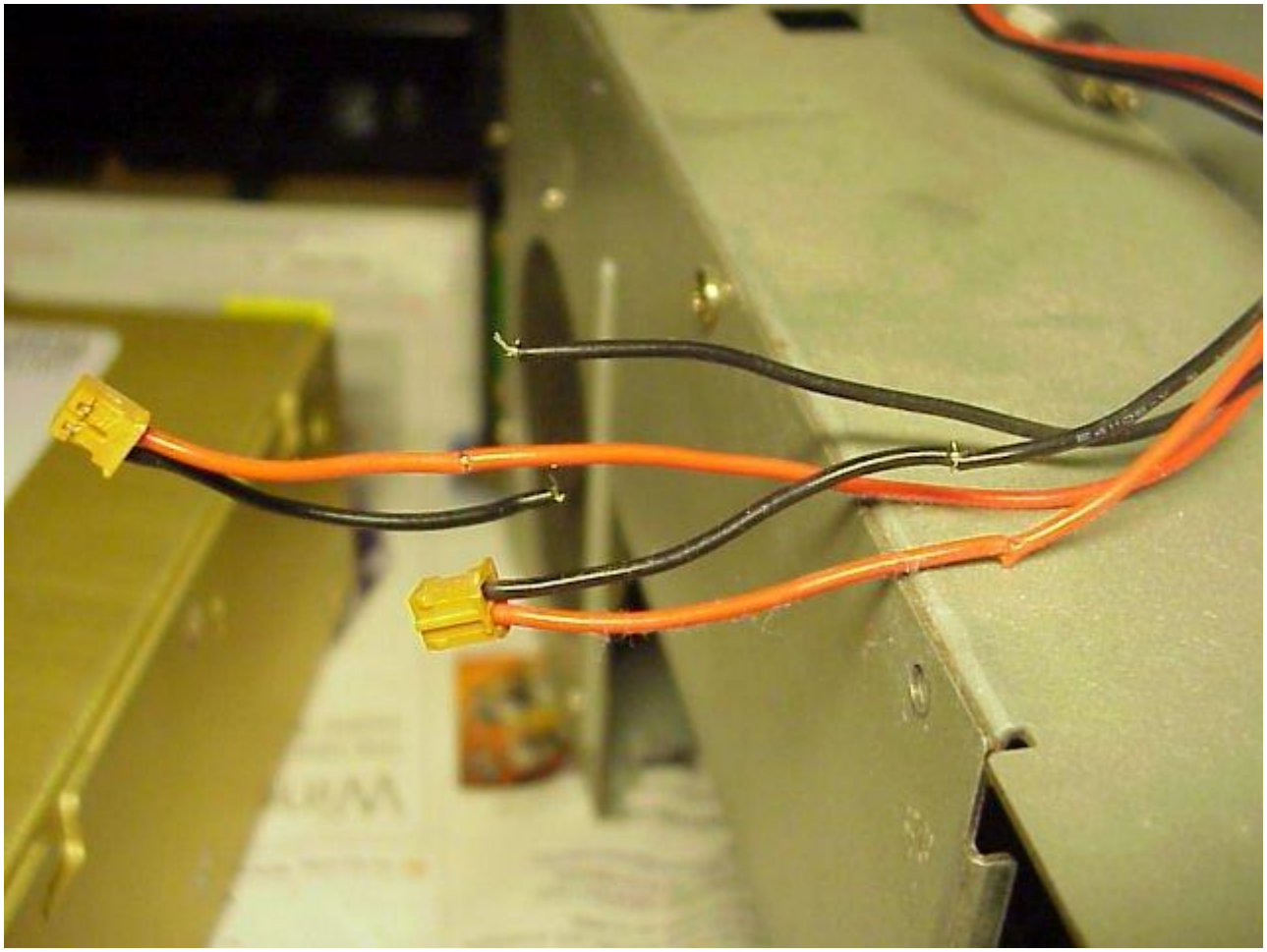
Unit finally arrived and what I found was a nice front panel, with just some scratches in the frame and a generally nice looking unit, except for some oxide in metal parts (*later I found that it had been used in a merchant ship*). It was a more recent unit than mine (serial RG03571 versus RG01346), made about 1995. Here you have some pictures of this unit:



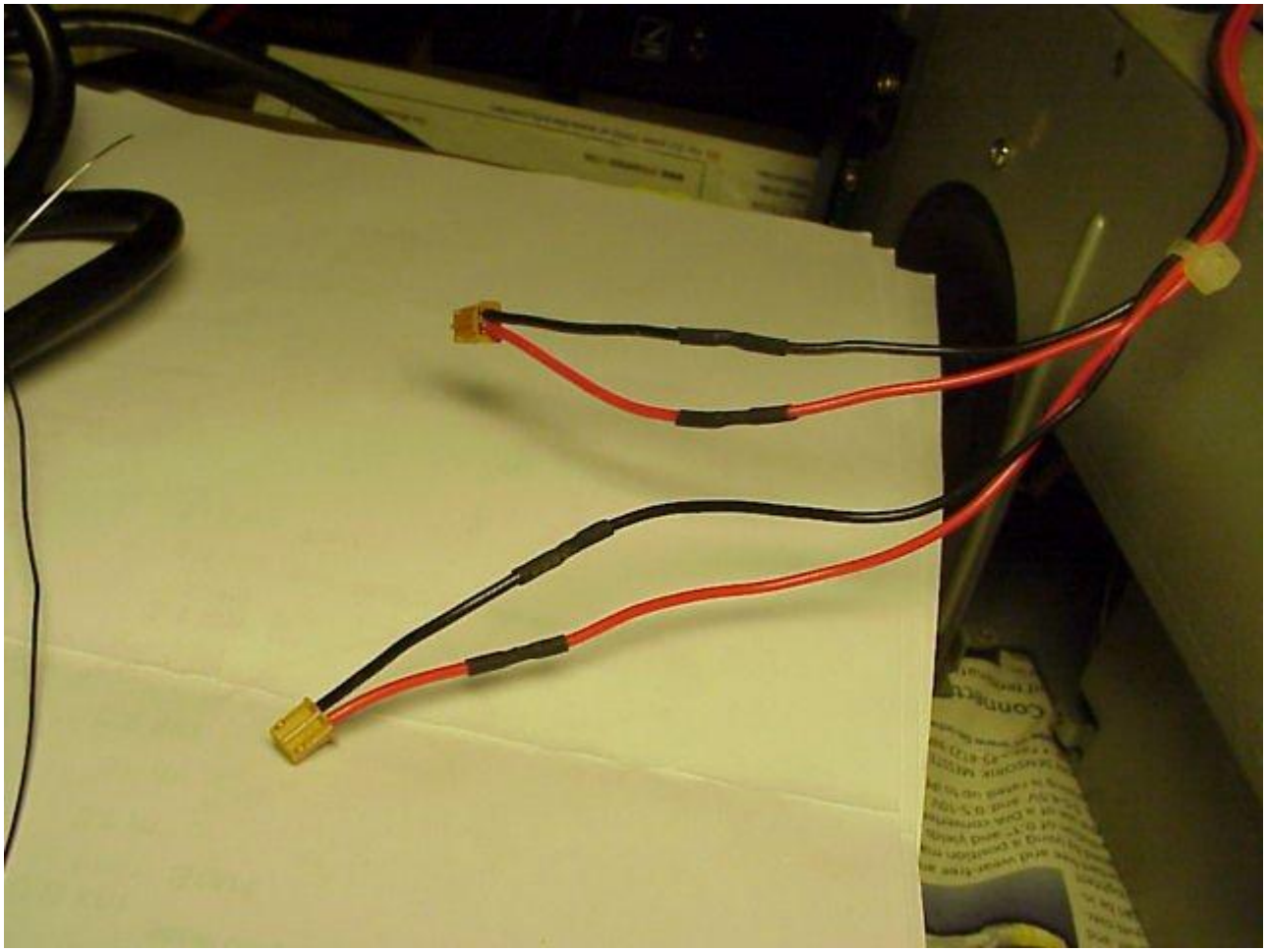


I decided to keep my first unit as a base for the project, as it had a bit better front panel, was cleaner and also had almost no oxide.

My 245 was almost working on receive and transmitting a faint signal (just what is needed at the input of the Power Amplifier (PA) unit)... so I could check easily the new PA module in my unit. If it was faulty, most of the joy would vanish... But first I needed to fix some damage in the PA fans, which somebody had crushed and almost cut:

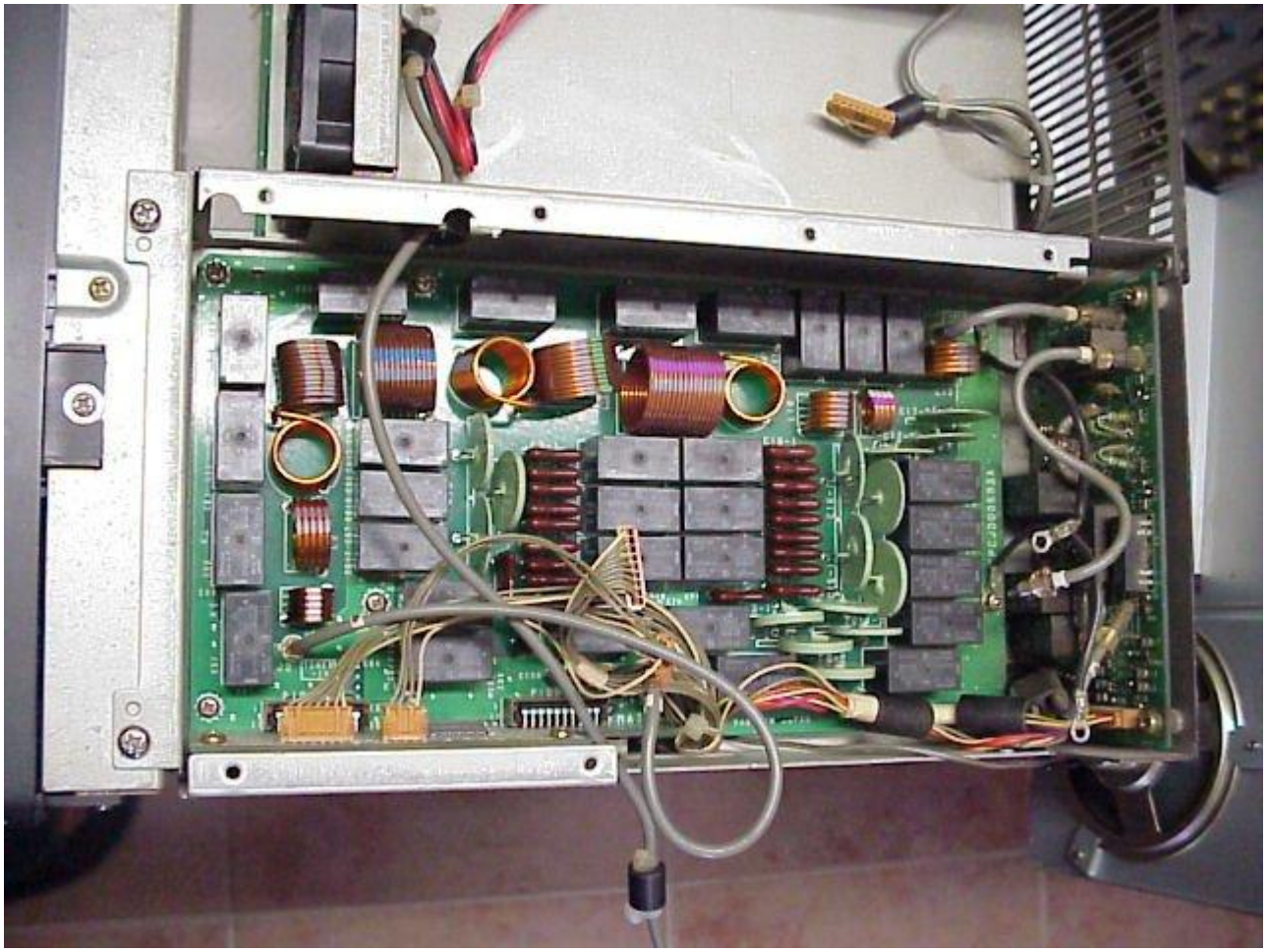


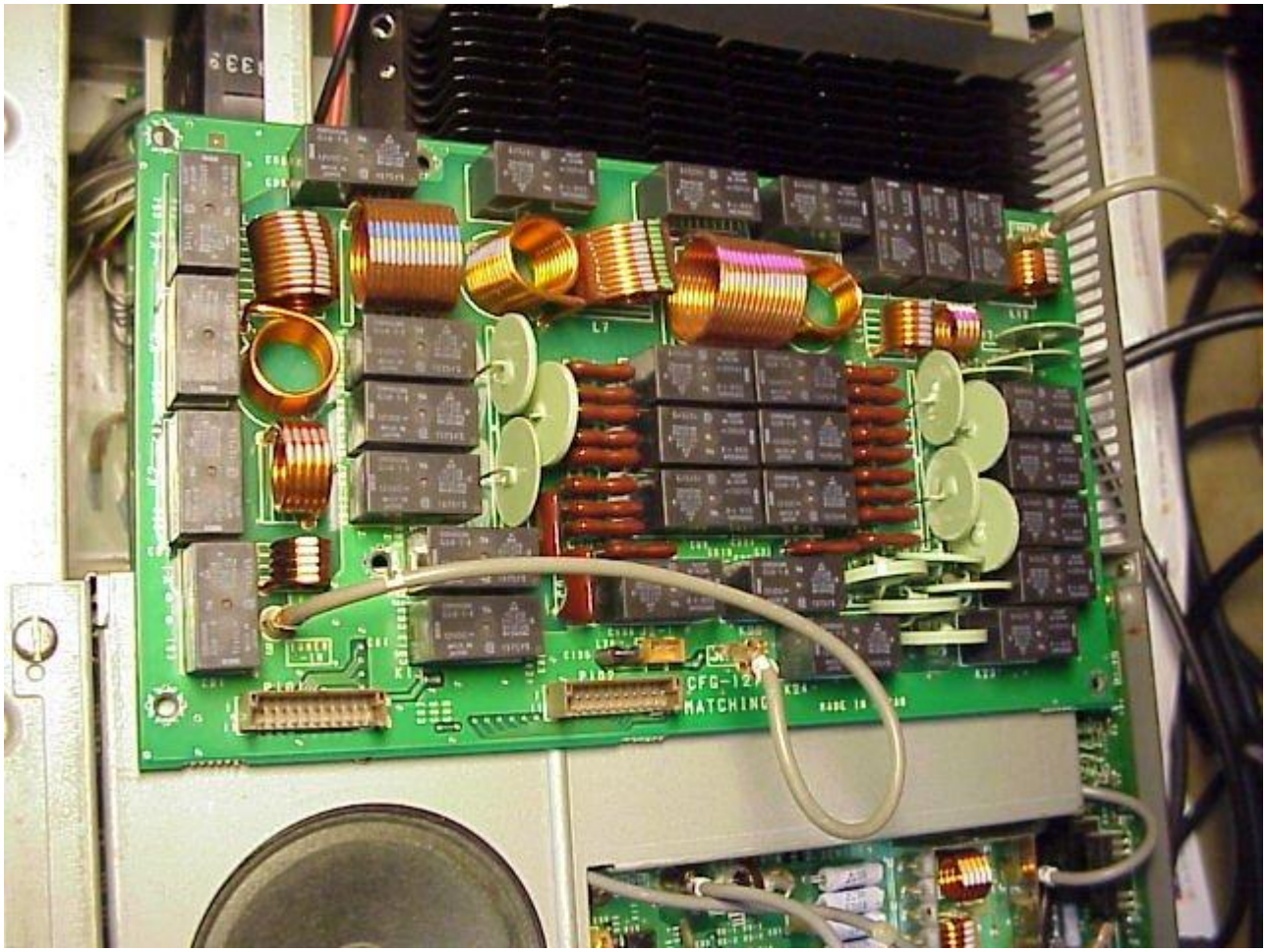
I cut, soldered and added some heat-shrinking tube:



I put the PA module on its place, powering it from the external 48VDC/15A ASTEC power supply and put a dummy load and my trusty Bird 43 online... **BINGO!!!**. I got a sweet 150W power output!!!. I did some checkings and even fans run when PA got hot. In few moments I did some QSOs in 40 meters with my *new* rig and its **NVT-57** hand mike (which also came with second unit). Things started to look fine!

Next step was to check all transceiver functions. And then some problems arised: microphone PROCessor didn't work. And I found that I was using the rig WITHOUT ANY OUTPUT BAND-PASS FILTERING!. Yes, as Auto Tuner (AT) in my unit was faulty (I had checked it in a JST-145), I had removed it and connected directly the PA output to the antenna relays PCB... well, so it was the turn for checking again the old AT, just in case. And, as I suspected, it didn't work. I replaced it (all three PCBs: first sensor one and then relays and control ones) and ended with a working AT. Another milestone covered!. Here you have some pictures of the process:



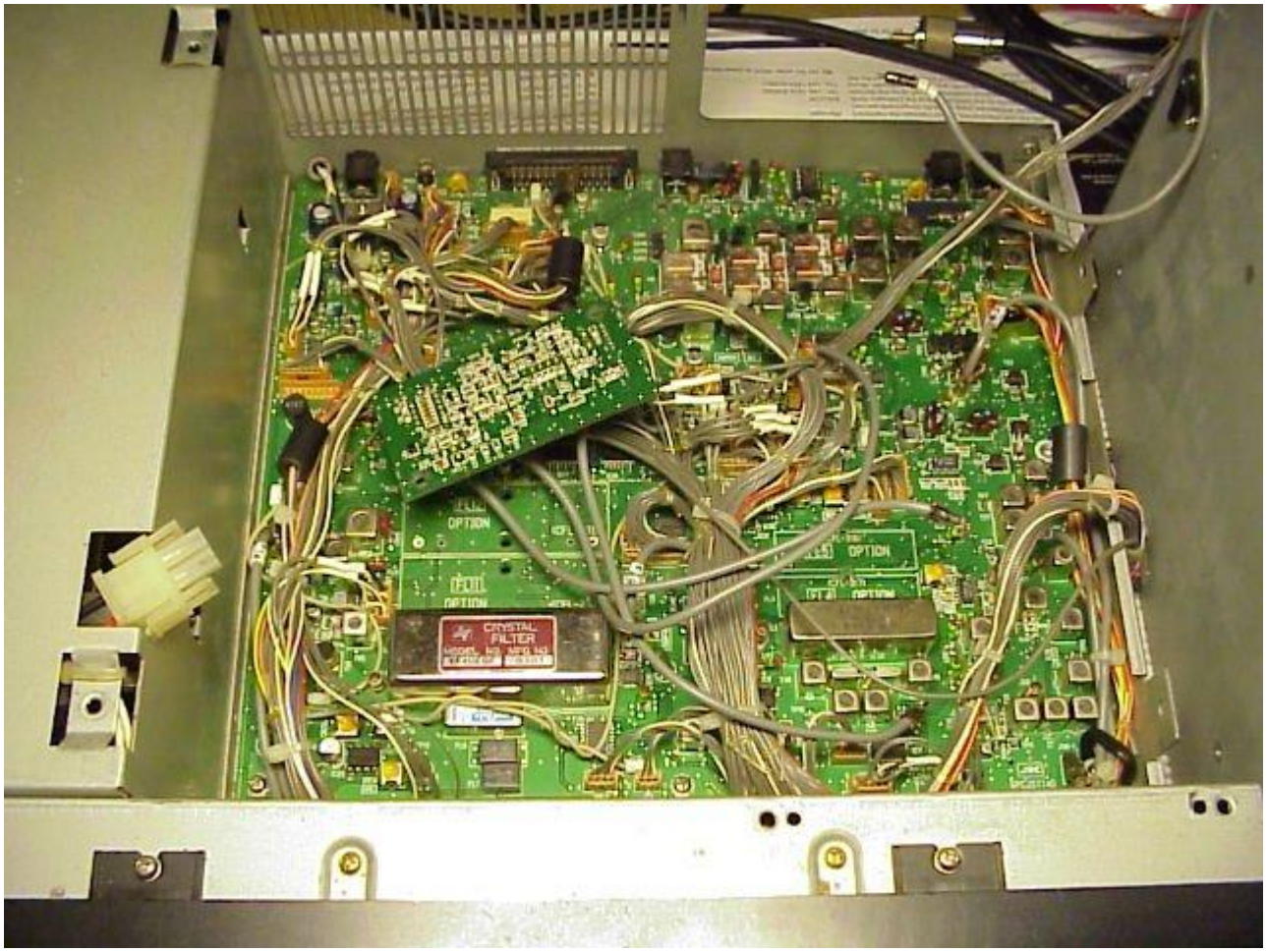


It worked fine on my Windom antenna. There is a problem with the 245 SWR indication: it is taken *before* AT so you don't know the SWR *after* the AT. But I found an easy way to know it did something: an external watt meter showed improvement (a bit more power) when AT was ON.

Ok, so now my *JRC hybrid* worked fine on TX (I did a couple more QSOs in 20 and 40 meters)... but it still had some problems: unworking PROC and unworking AM mode (with AGC ON it just kept muted and with AGC OFF it distorted and had too low volume). I checked the RXTX BOARD in the second unit. It looked fine and was a newer revision than mine (D versus B). So I got out all the connectors (about 50 or so!). They are numbered, which saves lots of time doing it by yourself. Here you have the RXTX unit once it was out of the second 245:

My 245 had an extra filter on it (in FL-10 position):

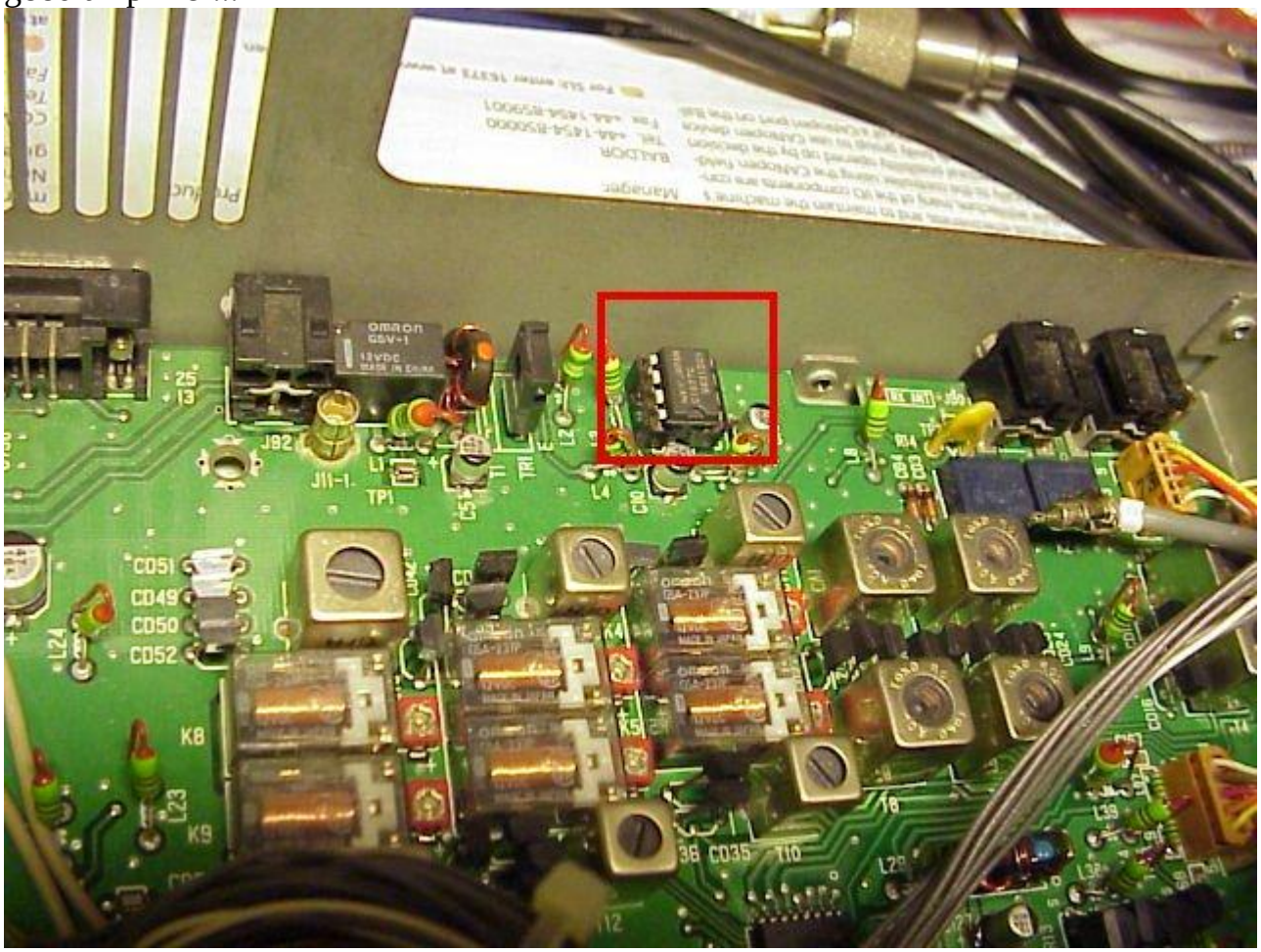
So I carefully removed it (not easy as it is a multilayer circuit and has huge ground layers), translated it to the *new* RXTX board and put it back in place (not forgetting to toggle the DIP switch which tells the CPU it has the FL-10 filter), along the MONitor UNIT:



Well, if all was fine in the new RXTX unit (a big assumption!), now I should have a completely working transceiver, except for the external power supply... but, not, it was fine on RX (all modes, including AM!) and even PROC worked (meter showed its function). But there was NO power output. ZERO. None. :-(

Then one of the worse moments in the repair happened, as I was eager to find the problem... I was not able to locate the Service Manual, and I looked for two long hours!. I am sure it should be somewhere in my shack (which is, despite high volume of items, very well organized). But no way!. So, as a last resource, I looked in the WEB for info and located a poor quality schematics which included a block diagram. As I had already fixed my 245 (but some years and some hundred repairs ago!), looking at the block diagram, I thought almost in first moment in the uPC1677 amplifier. I checked input and output and, yes, it was KO!. Luckily, my other unit had same failure and I had placed the replacement in a socket. So I removed bad one, put a socket and plugged the known-

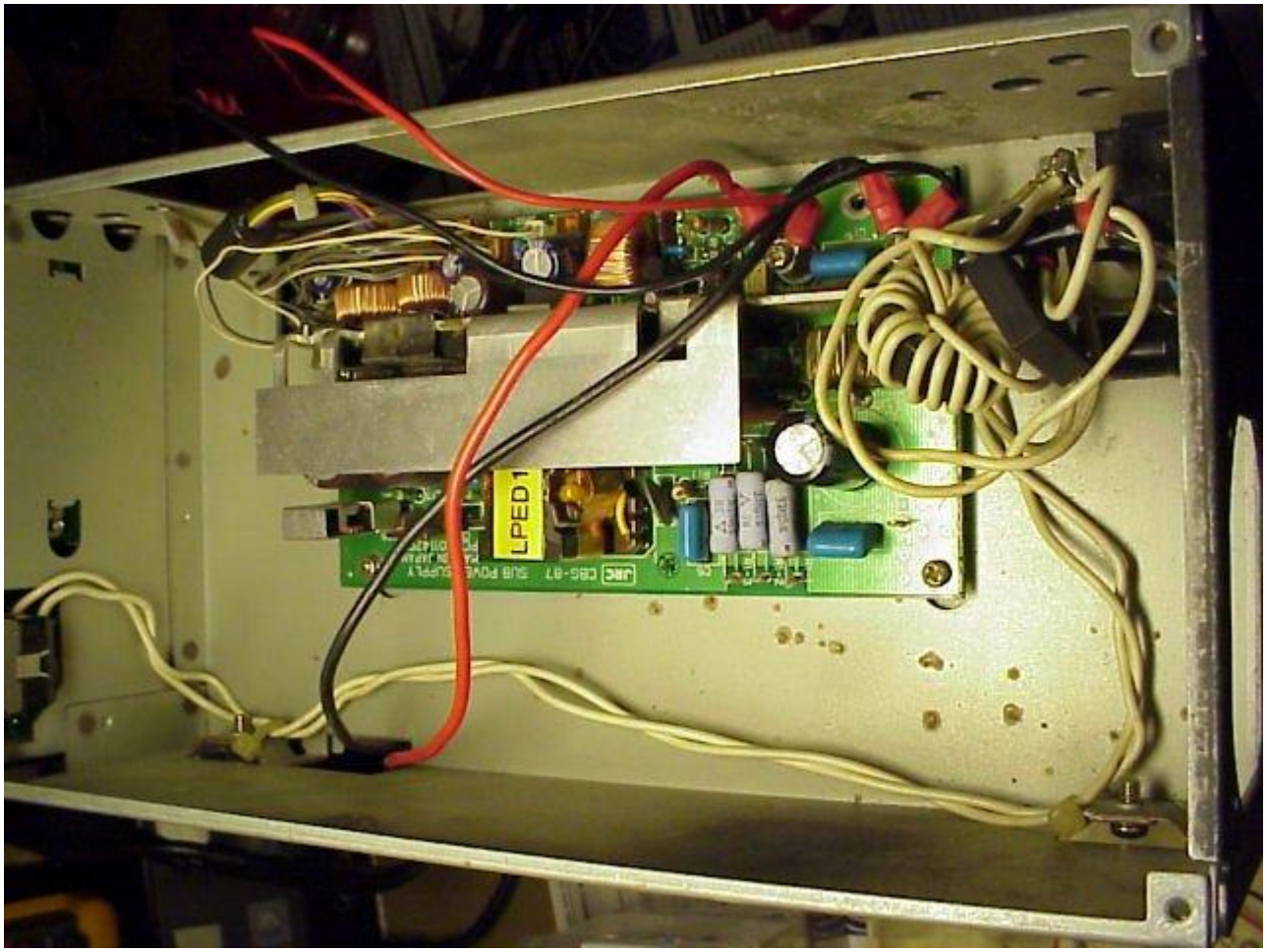
good amplifier...

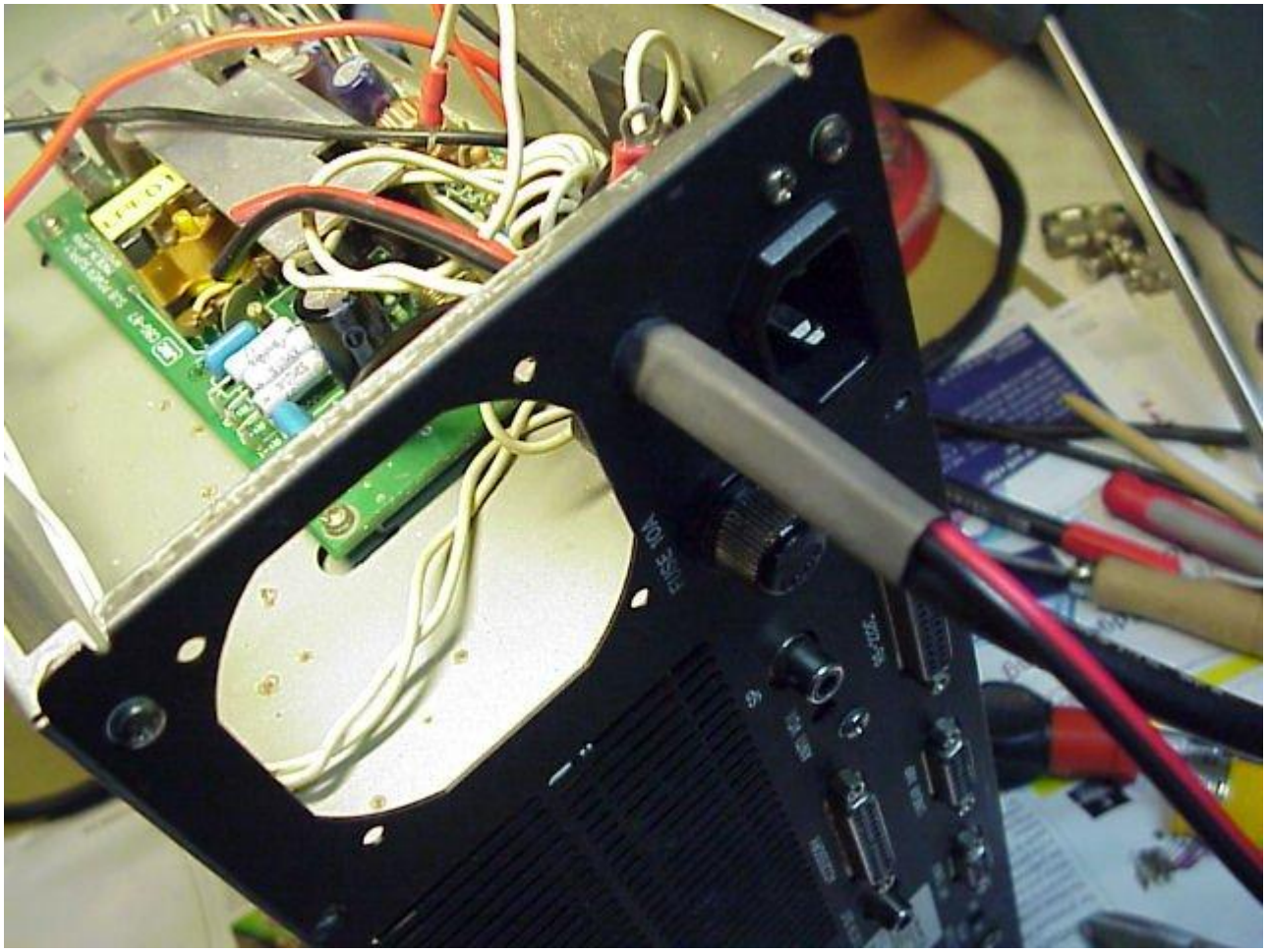


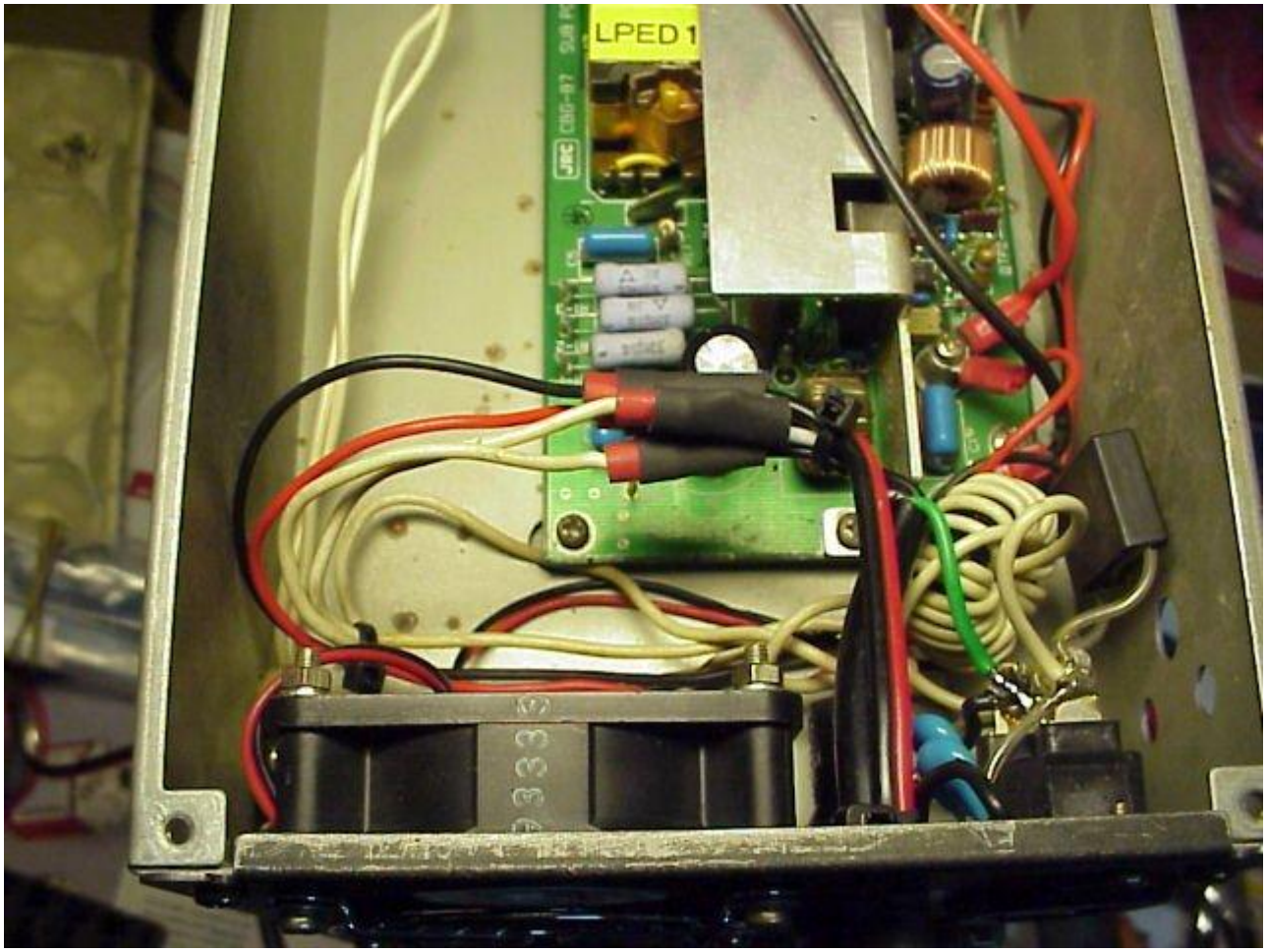
...and I got 50W output... where are my other 100W???... Thinking a bit I recalled a curious DIP switch, just side by side with the filter selection ones... it seems there is a way to select a REDUCED power output, which is controlled by a DIP switch and a variable resistor. So I toggled the DIP switch and, voila, 150W :-)!!!

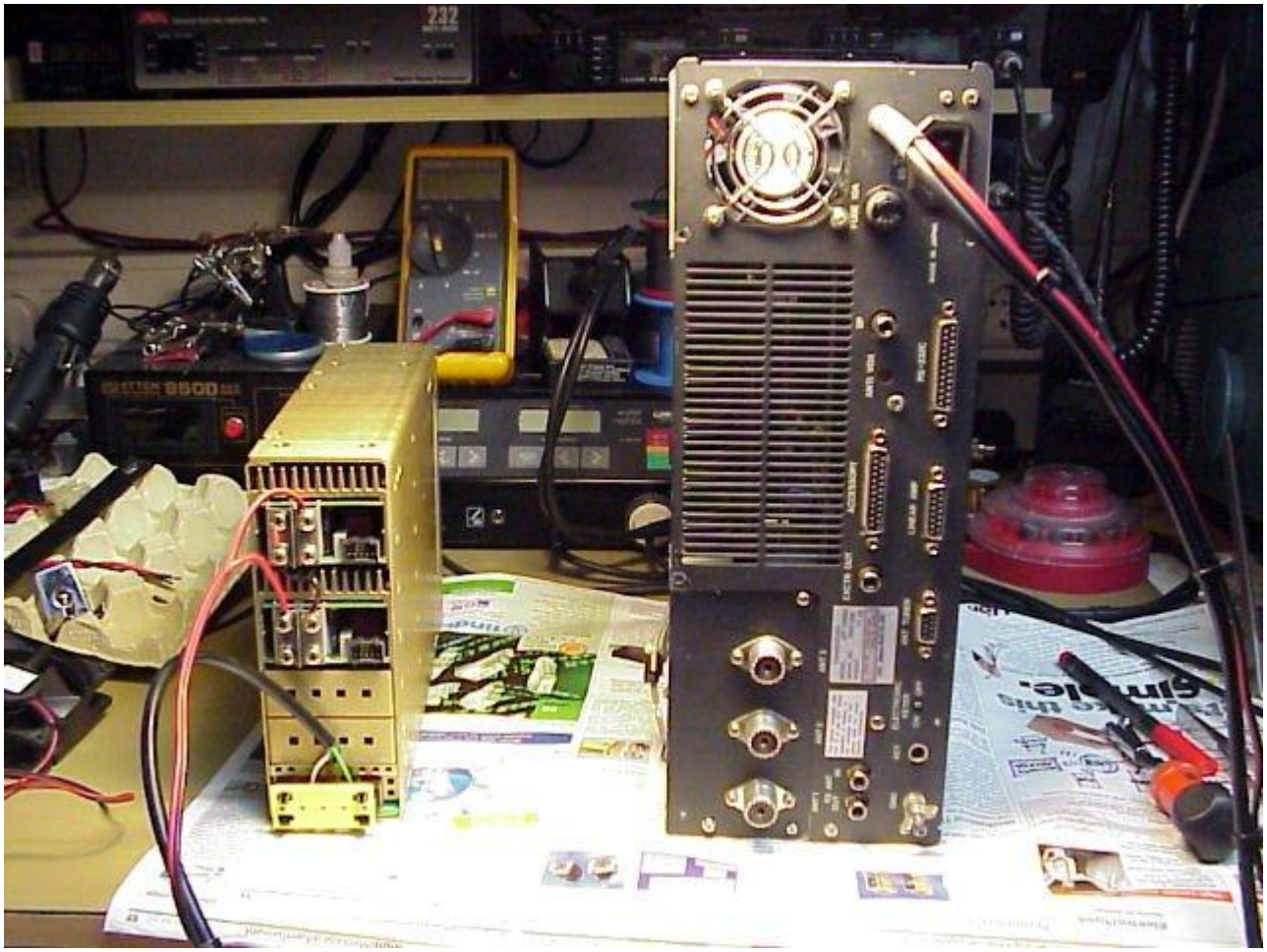
Once there I thought about repairing the internal power supply... well, I will probably attempt it in the future. But, knowing that it is the weakest link in the rig and that the external power supply I use is about three times more powerful (so it is in no way stressed), I decided to keep it this way by now. But I needed to do some work to have a FT-1000MP Mark-V-like external power supply. And best way I devised was to use the rig power switch to control the external power supply. So I would need a 4 wire cable: 2 for the VAC from the rig switch to the PS and 2 for the 48VDC from the PS to the rig. I needed to drill a 10mm diameter hole in the back of the rig for the cable, but I found this was a minor problem, as it could be later plugged with a cover, if needed. Here you have some pictures of this process:


ANT 1
RX ANT
OUT
IN
ANT 2
ANT 3
EXCTR OUT
ACCESSORY
ANTI VOX
SP
FUSE 10A
AC
GND
KEY
ELECTRONIC
KEYER
ON
OFF
ANT TUNER
LINEAR AMP
RS-232C
MADE IN JAPAN


LPED1


FUSE 10A


LPED 1



And here you have the final looking system:

And, finally, on its operating position:

All in all, I had a great time with this repair :-)!

By now, this is the end of the story... I will add more information as I work more on the JST-245. Thanks for reading!

In order to fix my *mule* unit, I need some material. Please, let me know if you can help me locating anything:

JRC JST-245 Parts Needed

- Main Power Supply metal mounting plate
- Main Power Suppy Unit (or a faulty one)
- Power Amplifier transistors: 2SK408 (6) and 2SK409 (6)
