IFR 1500 AM/FM power supply repairs

Yves OESCH / HB9DTX, 12. January 2022

Few years ago I could save an old IFR 1550 service monitor device from the garbage can. It is used very infrequently, nevertheless, recently, it was totally impossible to switch it on. Worth mentioning, it is possible to supply the device directly with 11-16V DC. This doesn't change the problem: silent device. Only a small relay click was audible, but not other sign of life. Both fuses were OK, so the problem was located somewhere deeper...

Figure 1: IFR FM-AM 1500

I opened the case by unscrewing the 4 large screws at the bottom of the device, removed the back frame and slid it out of its cabinet.

Rather quickly it appeared that the front panel switch was OK, but the power supply unit (PSU) was not providing the necessary voltages to the rest of the device.

Indeed removing the power supply unit is not very complex, once one knows which screws to loosen… indeed it is sufficient to remove 3 screws from the back side, as well as the "large shielding cover" that protect the many interconnect coaxial cables on the bottom side of the device. The power supply it kind of glued to the back panel with heat-transfer compound, so some force might be applied to remove it. The 12-poles cable connector (11 of which are populated) is a bit reluctant to be disconnected, but using small flat screwdrivers both sides of the connector it is possible to loosen the anti-traction safety mechanism of the connector.

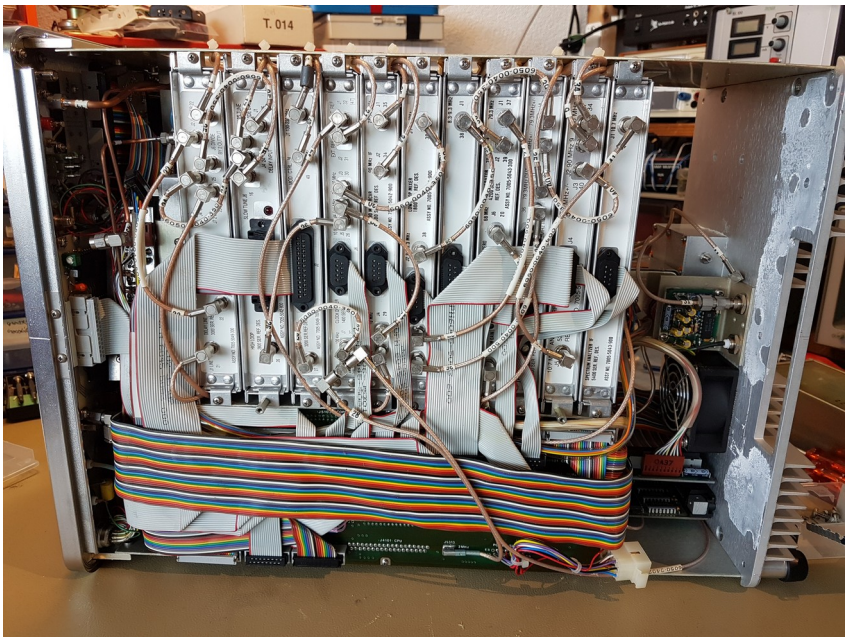

Figure 2: Internal view of the IFR-1500 (bottom side), Shielding plate, battery and power supply already removed

There might still be a bulky integrated rechargeable battery pack rated 12V / 5Ah in the device. Disconnect it as well. As the battery is probably totally dead, it is highly recommended to remove it permanently from the device to avoid possible chemicals leakage. The battery is not necessary for proper device operation. 2 long screws accessible from the back panel go all through the battery pack and maintain it in place.

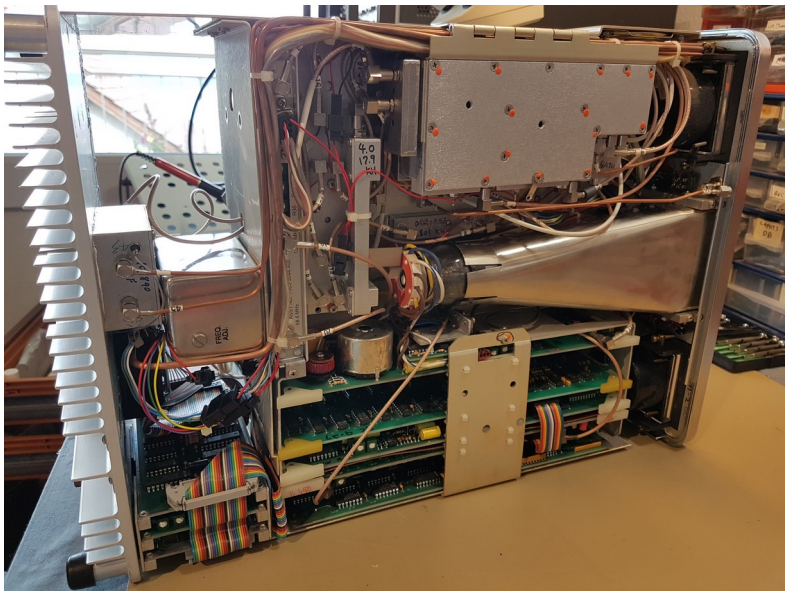

Figure 3: View of the top side of the device

Thanks to http://www.repeater-builder.com/test-equipment/aeroflex/aeroflex-index.html I could download a copy of the service manual including schematics.

Removing several more screws to open the PSU made the power supply PCBs accessible. **In order not to take any risk, it is highly preferable to use the 11 - 16 DC voltage input, instead of the 230 AC which can be seriously dangerous!**
The current drawn on this supply might be as high as 8A so a decent lab power supply is required for proper operation.

The forum https://groups.io/g/IFR-Monitors is definitively worth reading through. In particular this very useful tip was found here: By connecting the gray wire pole (AC Power select, Pin 3 of the PSU cable connector) to GND, the PSU is be activated. No need for other connection. So easy debugging outside the IFR-1500 gets possible this way.

The different supplies (+5V, +12V, -12V) all come from a single multi-windings switching transformer driven by power MOS transistors cabled in parallel.

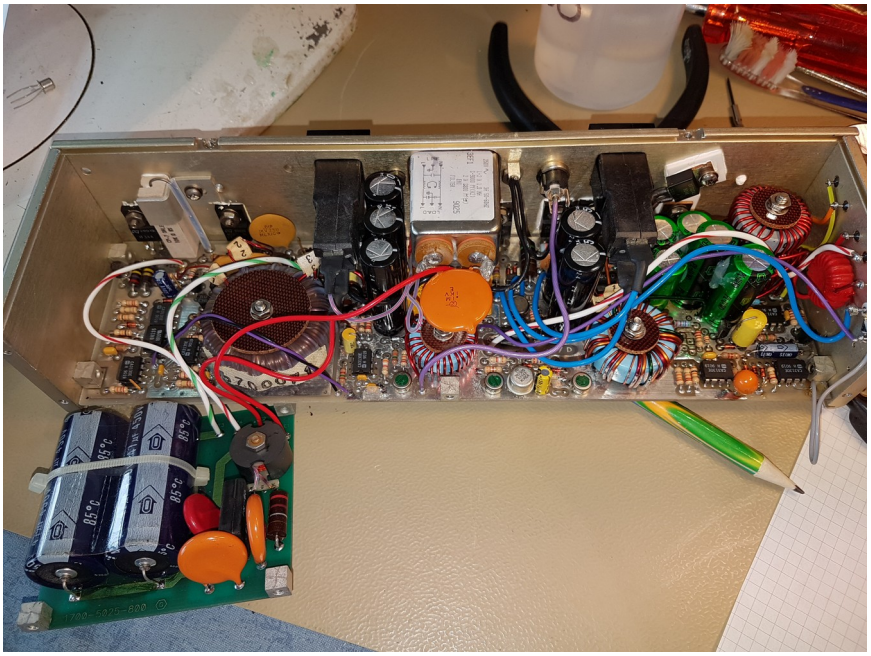

Figure 4: Power SupplyUnit (PSU) board with cover removed

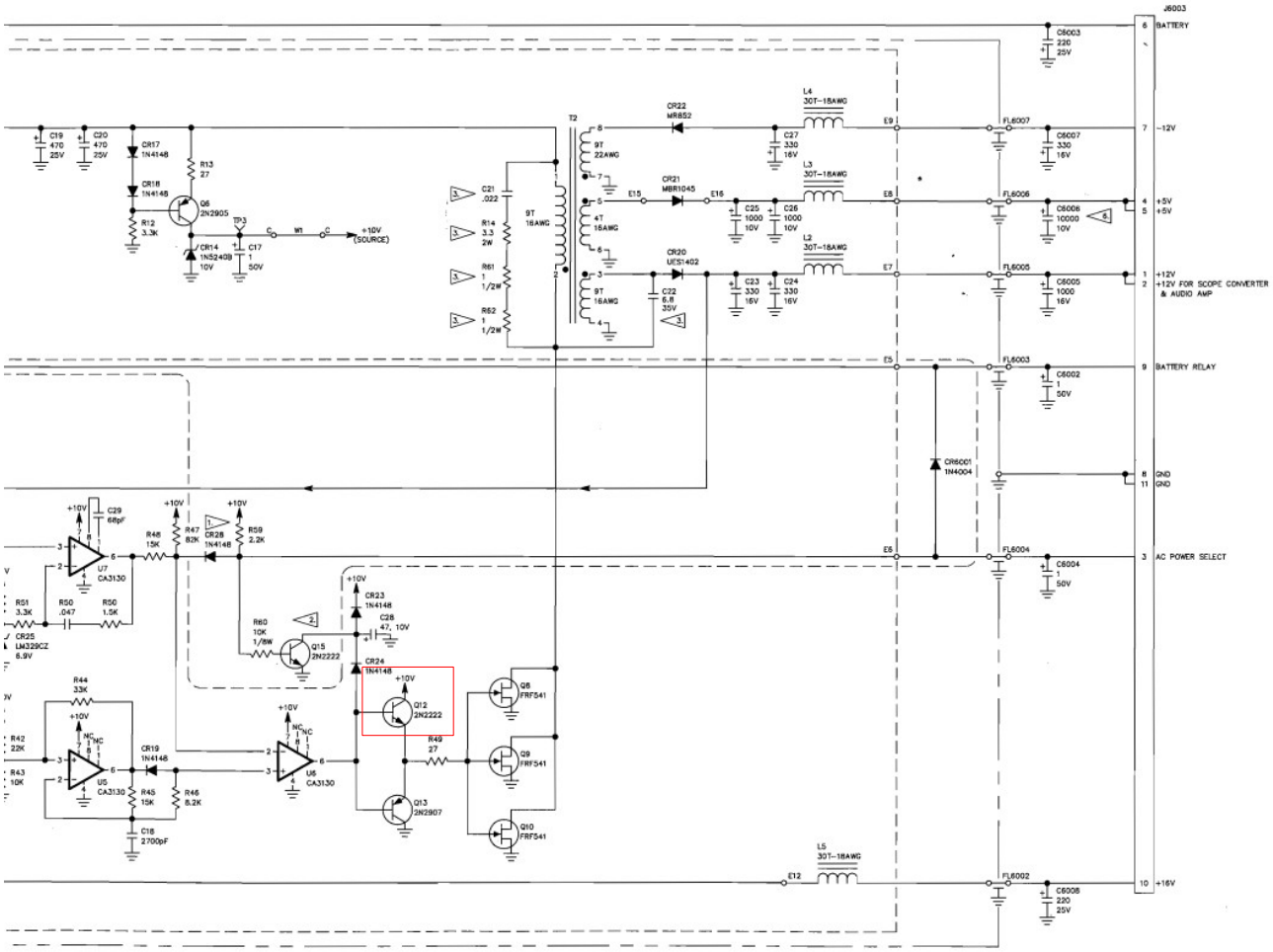

Figure 5: Extract of the power supply schematic from the service manual. In red the defective transistor.

It was quickly found that the 10 V supply rail was not present. By cutting the PCB tracks here and there the problem could be located on the NPN/PNP pair of transistors Q12/Q13 which act as driver stage. They were holding the 10V rail to a much lower value, preventing proper drive of the power-MOS.

It was a bit tricky to unsolder both transistors. There was quite some oxidation on the PCB surface below those transistors. Cleanup using solder wick, isopropyl alcohol and an old toothbrush made the PCB look nice again.

A quick check of both NPN and PNP transistors using the “hfe” transistor test position of a suitable multi-meter showed that the NPN (original reference P2N2222) was dead (current gain was almost 0). A spare 2N2222 available in a drawer (having a different case, but still fitting on the print circuit board), was used for replacement

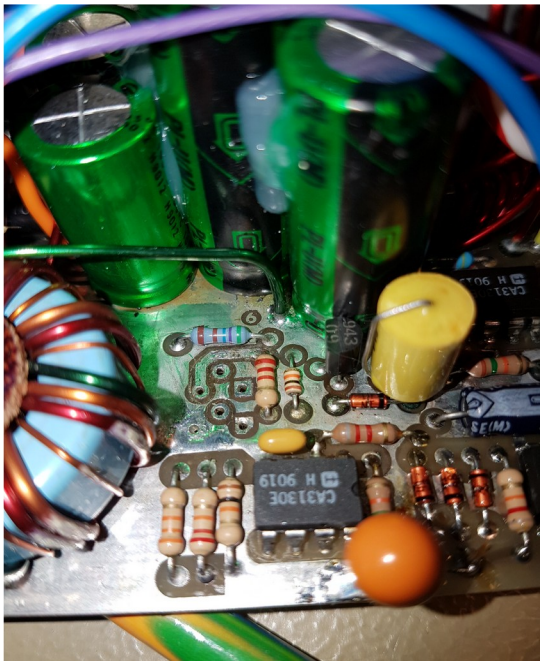

Figure 6: Q12 and Q13 de-soldered, PCB cleaned

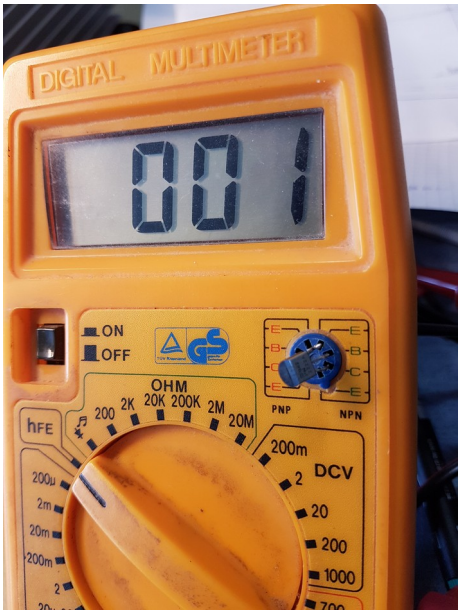

Figure 7: Defective P2N2222

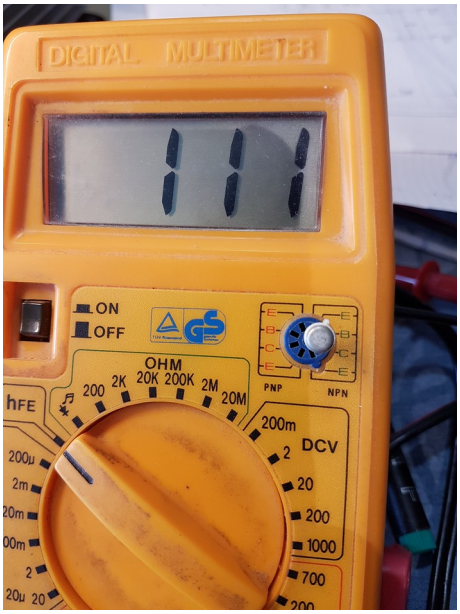

Figure 8: Replacement 2N2222

It is important to look carefully at the pinout on the PCB. There is a slight incoherence in the orientation drawing for Q12 and Q13 in the service manual. So checking which signal is physically present (10V, GND) on the actual tracks prevented any error when soldering the replacement device.

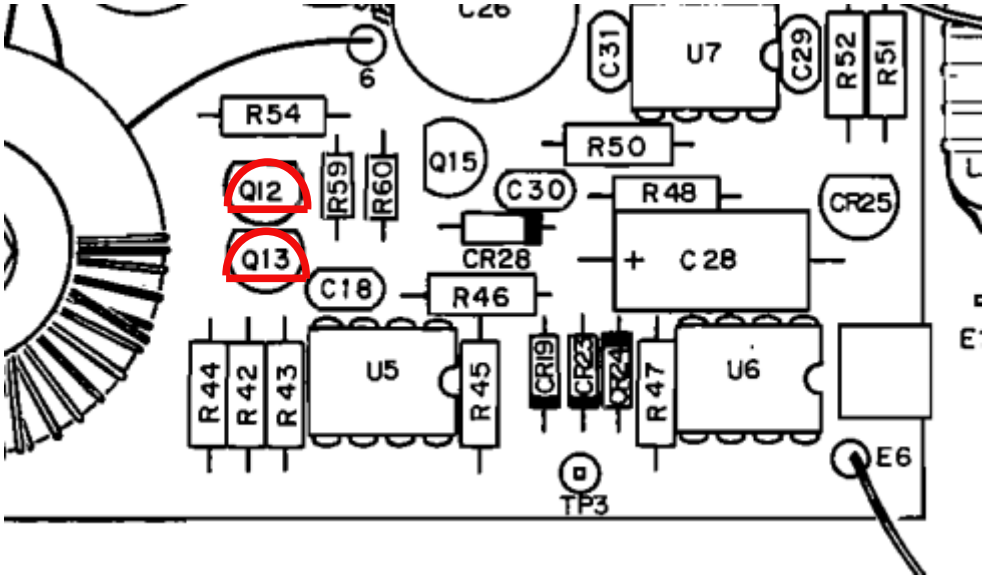

Figure 9: Component placement on the PSU board, showing wrongly oriented Q12 and Q13 (correct orientation in RED)

Once soldered, a check of the PSU showed all the needed supplies present.

Figure 10: New 2N2222 transistor in place

It remained to carefully re-assemble the PSU inside the IFR-1500. A bit of heat-transfer paste was used between the PSU and the main chassis of the device.

It was also noticed that the 7.5 A fuse tend to trip easily and got extremely hot. Indeed the current flow measured on the 13V DC supply easily goes above 8A for several tens of seconds at startup, and stabilized slightly below 7A. In this sense it is recommended to use a fuse allowing at lest 10A to pass (trials with 8A were unsuccessful)

Figure 11: IFR AM-FM 1500 after repairs of its power supply unit. (The fast camera aperture speed makes the spectrum analyzer display looks defective, but it is not the case in reality !)

Final notes:

- Although the description provided here seems straightforward, the path to nail down the guilty transistor was a bit more complicated. In particular the mechanical access (which screw to loosen and in which order) required quite some trials and errors.
- It is always very useful to browse the web before starting such a repair. Several posts in the forum mentioned above were very inspiring, and of course having the schematics on hand is invaluable.
- Old electrolytic capacitors tend to leak and loose their electrical properties over time. It might be a good idea to replace them all once the PSU is already open. Due to lack of time and spare parts on hand, this was not done (yet)
- Last but not least, 230V mains can be dangerous. If possible it is preferable to use the harmless DC input for all the tests with open covers.