

Audio Restoration and LED Upgrade Grundig Satellit 700 Portable Radio

This particular model, with a first-series early-production 6-digit Serial number, was made in Portugal for the British market in the early 1990's, and is a very well-made unit, capable of long-life, with satisfying sound.



The internal components are of high quality from reputable manufacturers, which is a pleasure to see. There are however, numerous problematic issues, common also to the Satellit 500, with which it shares many components and circuits.

The Grundig Satellit 500/700 models also share some common tuning circuits with the legendary Sony ICF-2010, however the Sony had a far more efficient implementation of these circuits, and therefore one of the more important modifications in this Satellit 700, in fact brings these circuits (almost) in line with the Sony standard.

Cosmetics and user-friendliness are no less important, and those are manifested in the Yellow LED upgrade for the display panel.

There are other circuit modifications which may be done, but IMO, the benefits are relatively insignificant given the required investment of effort, so they were not done. Described here are the most important modifications, which will give the biggest payback for this moderate level of invested effort.

Disclaimer – you modify your radio at your own risk. I take no responsibility whatsoever, for any changes / damage you may make.

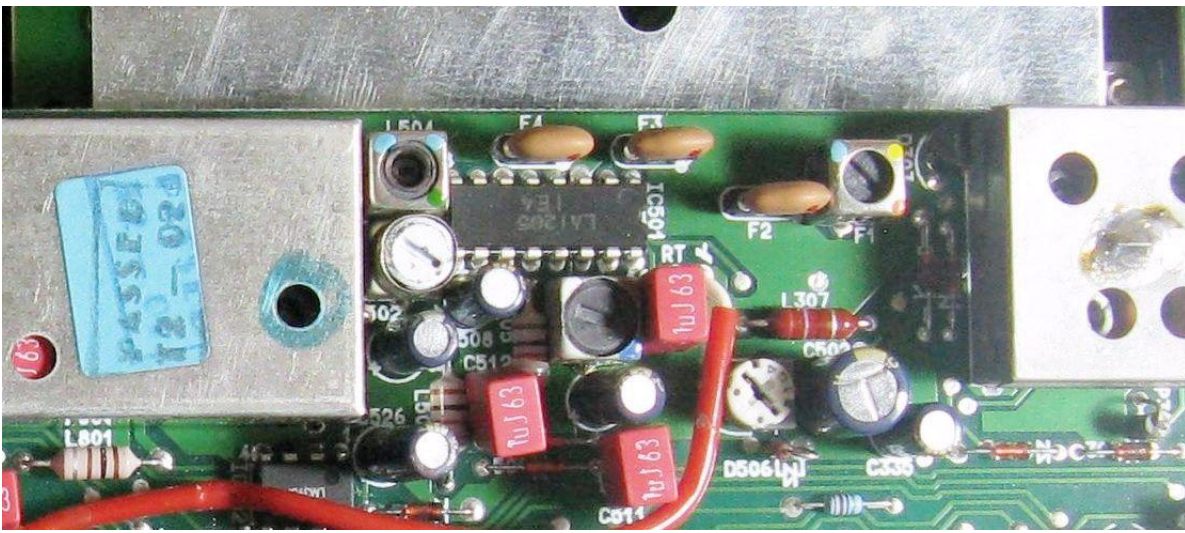
For enhanced clarity, circuit boards are shown with the metal shields removed. The metal shields are reinstalled at the end of the project, before final reassembly and calibration.

The modifications comprise 8 categories. You may choose to make any or all of these modifications, to suit your own needs.

- ### 1. Replacement of troublesome Trimmer capacitors C127 and C138

Due to the European station spacing of 50KHz (the transmission frequencies are located 4 times closer together than in North America), a Euro-spec circuit must be much more selective to be able to listen clearly to the stations. To enable clear reception of the closely spaced stations, I removed the 3 original wide 10.7 MHz filters F2 F3 F4, and replaced them with narrow Murata 150 kHz units SFELF10M7JAA0-B0. When this radio was manufactured, filters with this level of selectivity were not yet available.

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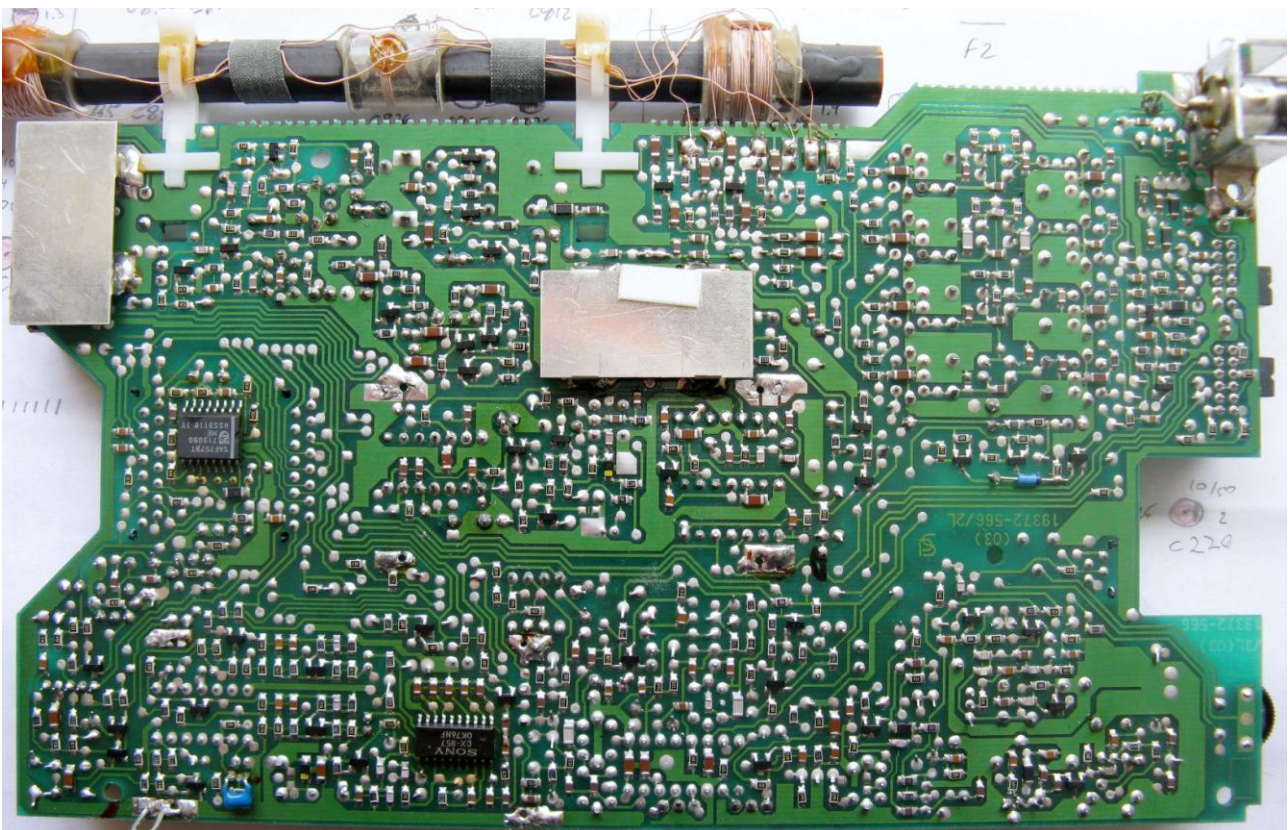


3. Conversion of the Tuning circuit to Sony ICF-2010 standards

CC817 is a 10nF 0805 SMD ceramic capacitor. This must be changed to a 1nF 102 capacitor. Because of its importance to the circuit's stability, I selected a TDK 1nF NP0/C0G high-precision ceramic leaded (not SMD) unit. The metal shield must be removed to install this capacitor, visible (blue) at the bottom left, and there is sufficient clearance under the shield, when mounting the new capacitor flush with the PCB.

Visible to the right of the TDK capacitor, is the Sony CX-857 PLL Oscillator IC.

To the left of the capacitor, is a tab which I installed for easier attachment of my calibration probes. That was removed prior to reassembly.



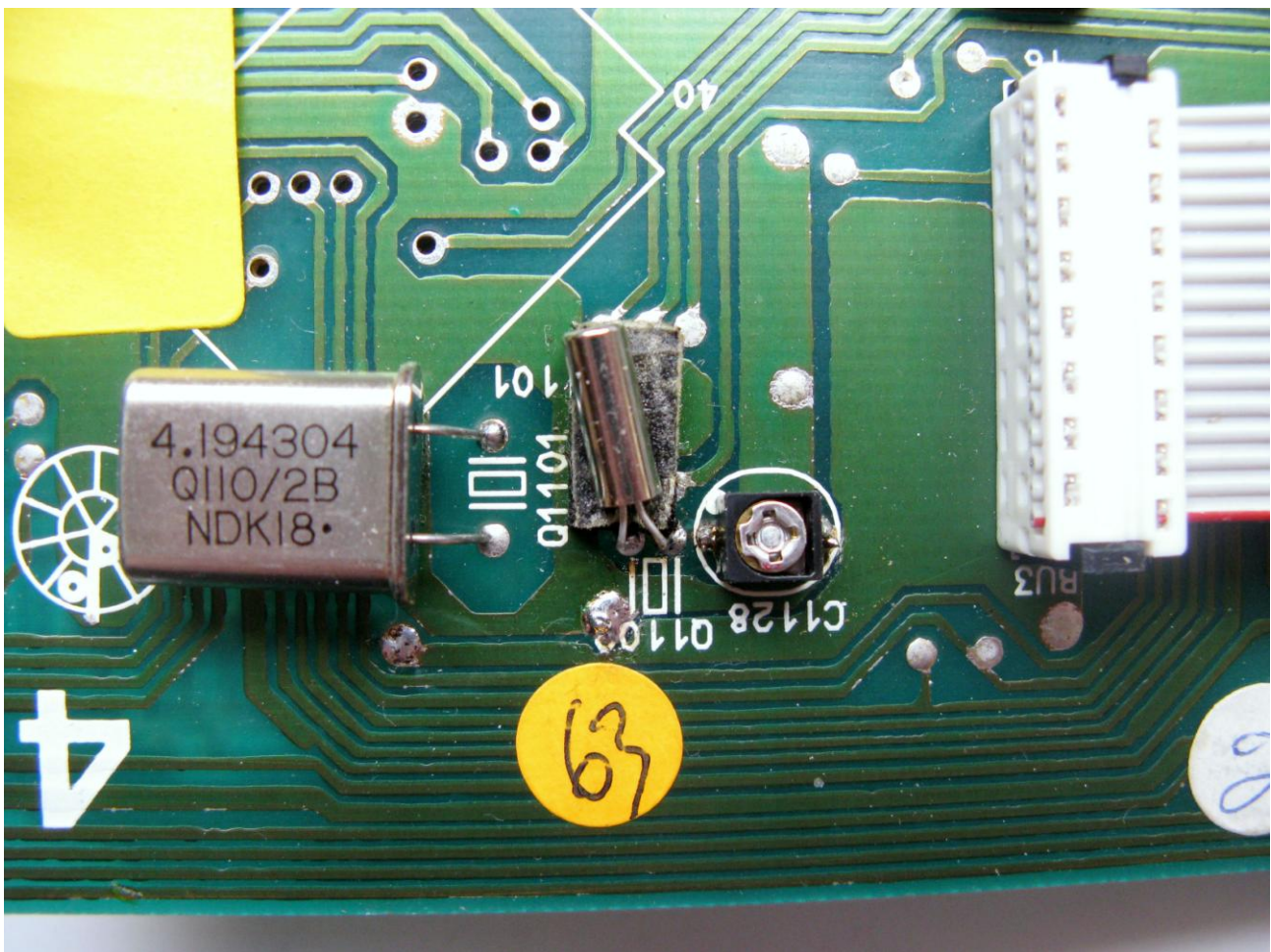
4. Replacement of the 32.768KHz crystal

This crystal controls the central Clock Frequency, and must be set exactly to within 1Hz, for all the functions to operate according to specification. I selected a Fox 32.768KHz 6pF 20ppm high-precision crystal, for which I needed to replace the Trimmer capacitor C1128 as well, in order to match the crystal's 6pF capacitance requirements.

Just like ceramic capacitors, Trimmer capacitors are available in varying grades of stability. I selected a Murata NP0-grade 3-10pF TZB4 trimmer.

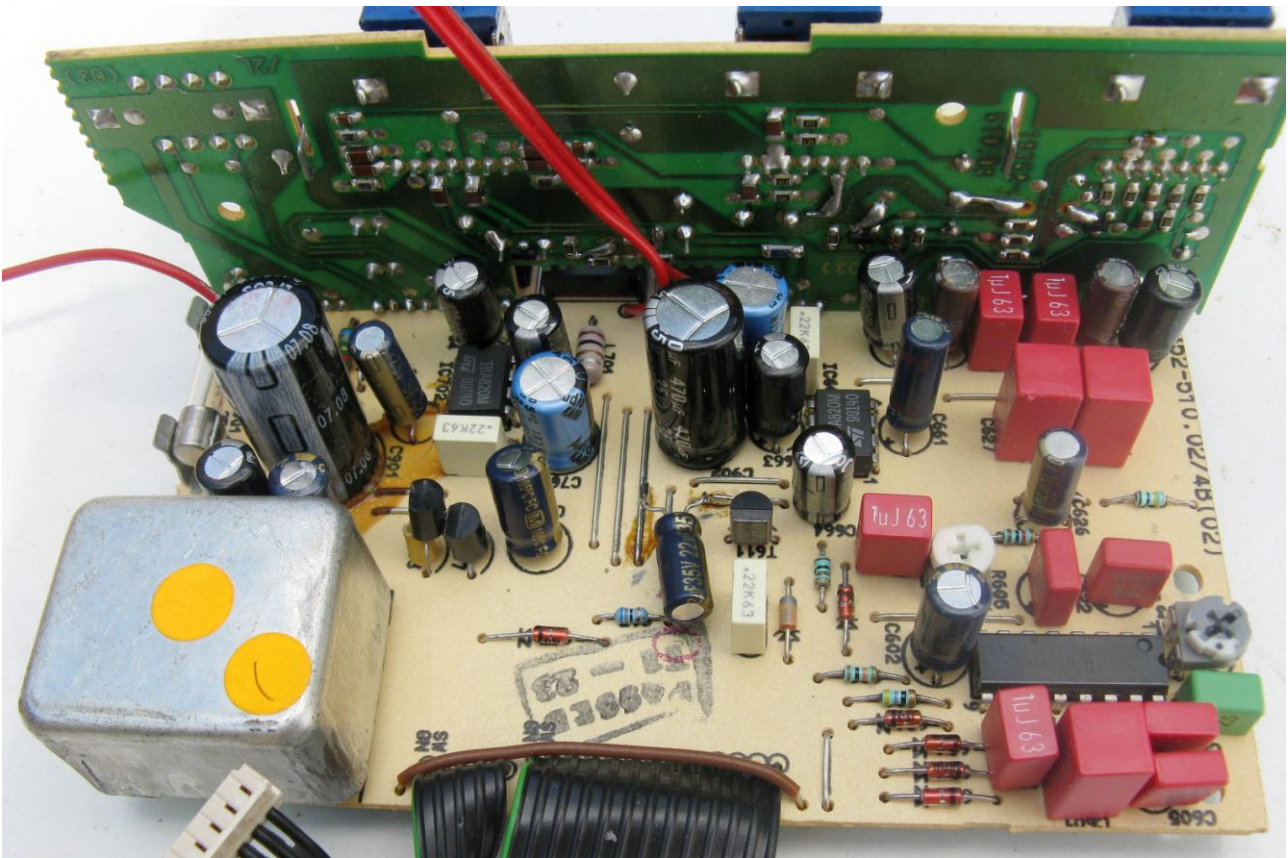
This is an SMD unit, as no regular leaded trimmers were available, according to my specification. This is not an issue at all – I simply solder leads onto the SMD pads, in order for this to fit into the regular 5mm-pitch mounting holes.

As regular leaded components become less available, we will need to be more creative to fit the newer and more commonly-available SMD components into the old-style TTH mounting holes of vintage equipment.

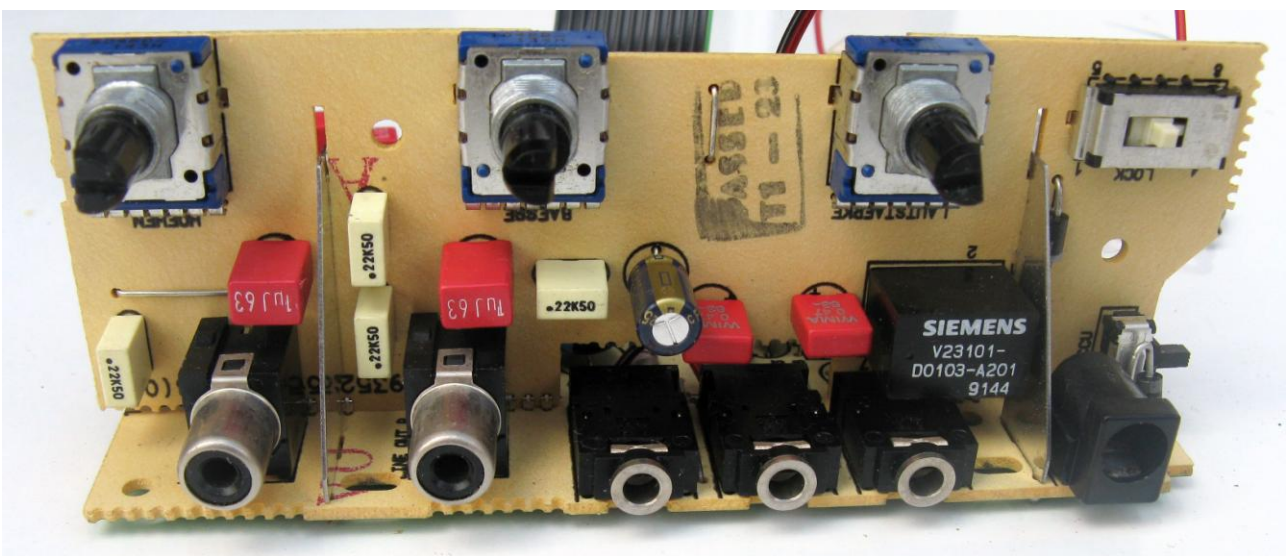


5. Upgrade of all electrolytic capacitors in Power Supply and Audio Signal Path

At the left, is the Power Supply circuit, which was upgraded with Epcos and Panasonic 105°C capacitors. At the right, is the Audio Signal circuit, which has Panasonic, Nichicon and Wima Audio-Grade capacitors.

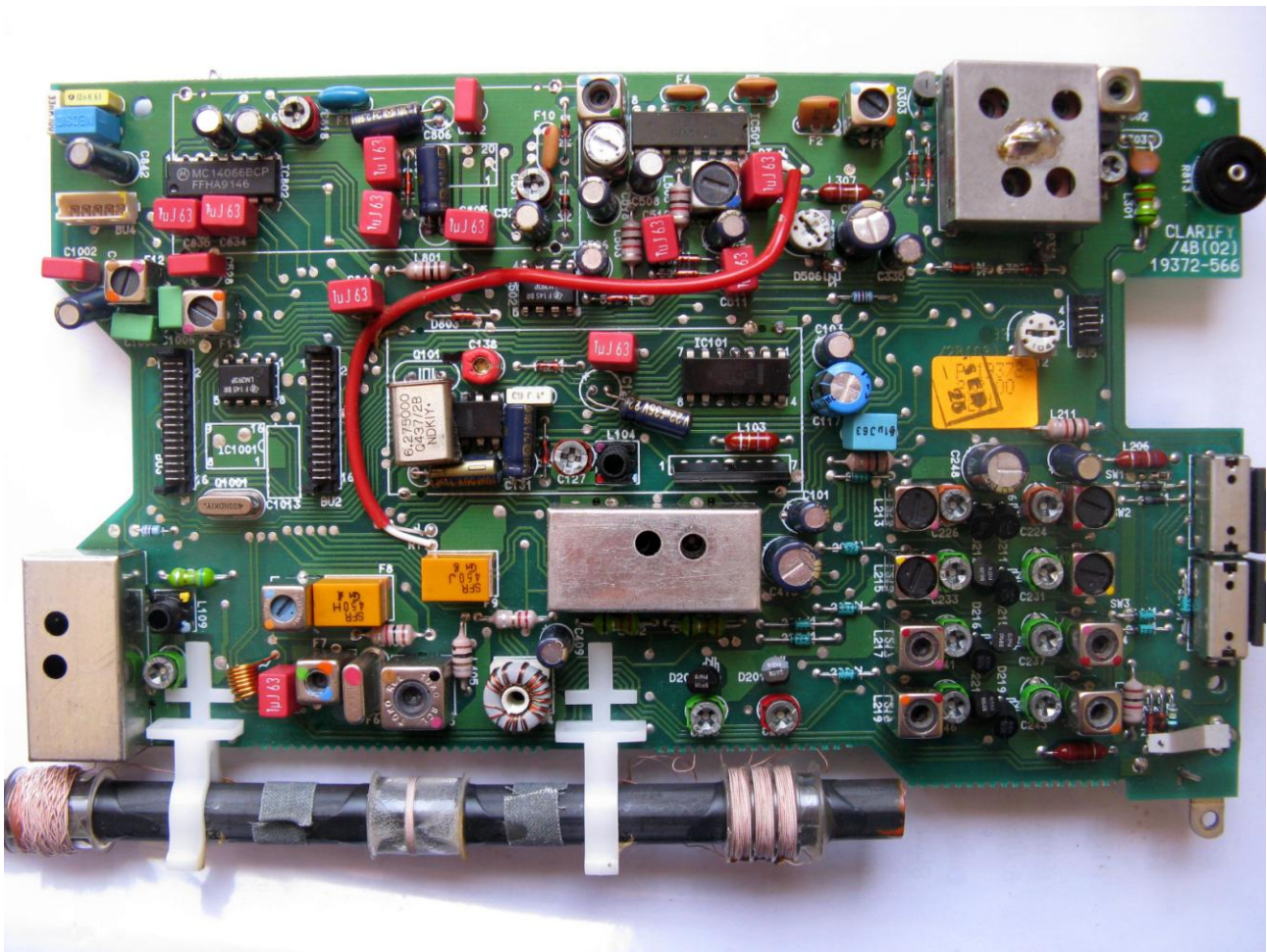


Below are the Tone and Volume potentiometers, with the Wima Audio-Grade Film capacitor upgrades



6. Upgrade of all electrolytic capacitors in RF Tuning circuit

For best performance, all the old and partially dried-out original electrolytic capacitors have been removed. I replaced them with Vishay, Panasonic and Nichicon 105°C capacitors, and wherever feasible, also Wima Red high-precision film capacitors.



7. Replacement of the Display LED's

The original 2 LED's are very dim, and their replacement provides one of the most significant enhancements to the level of user-enjoyment.

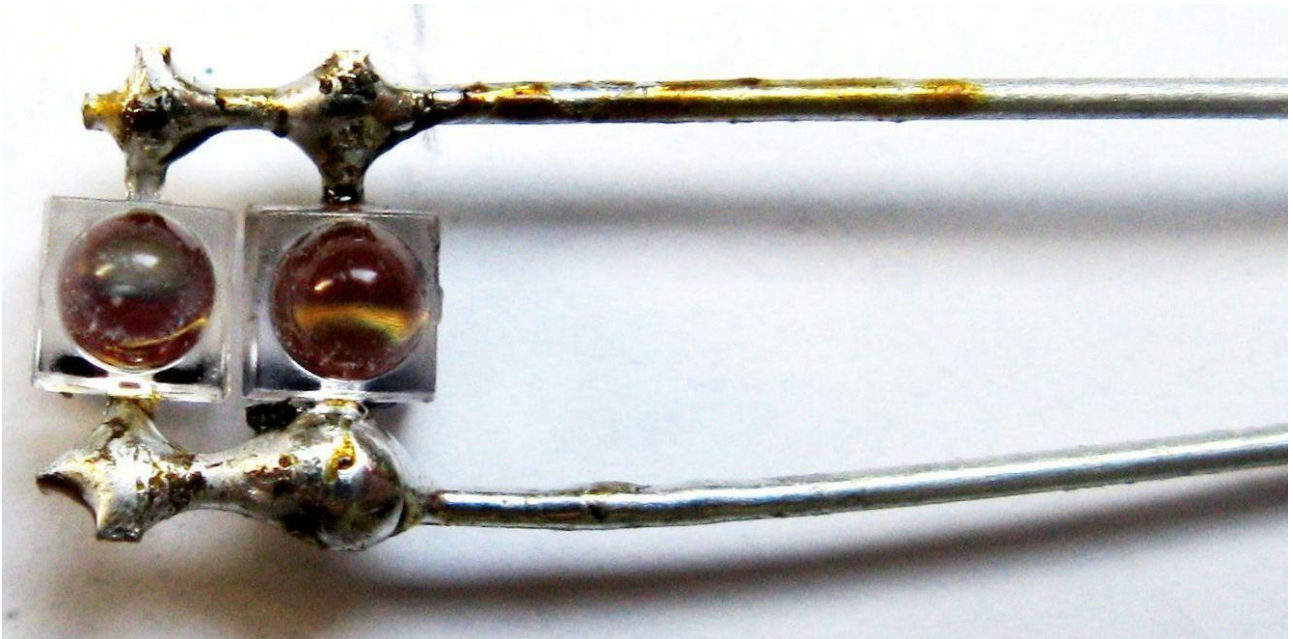
Many studies have shown that the Yellow spectrum is the most strain-free color range, and easiest on the eyes, in order to minimize fatigue.

Firstly, I tried conventional 5mm round leaded LED's, but they were not bright enough, so I decided to try high-intensity SMD LED's instead. I achieved optimum results with 2 pairs of 2 LED's (total 4 LED's), in parallel, and this is what I describe here. I selected Vishay VLDY1235R, capable of up to 50mA Forward Current. My final configuration runs them at 14.5mA, so they are definitely not stressed, and should last a lifetime.

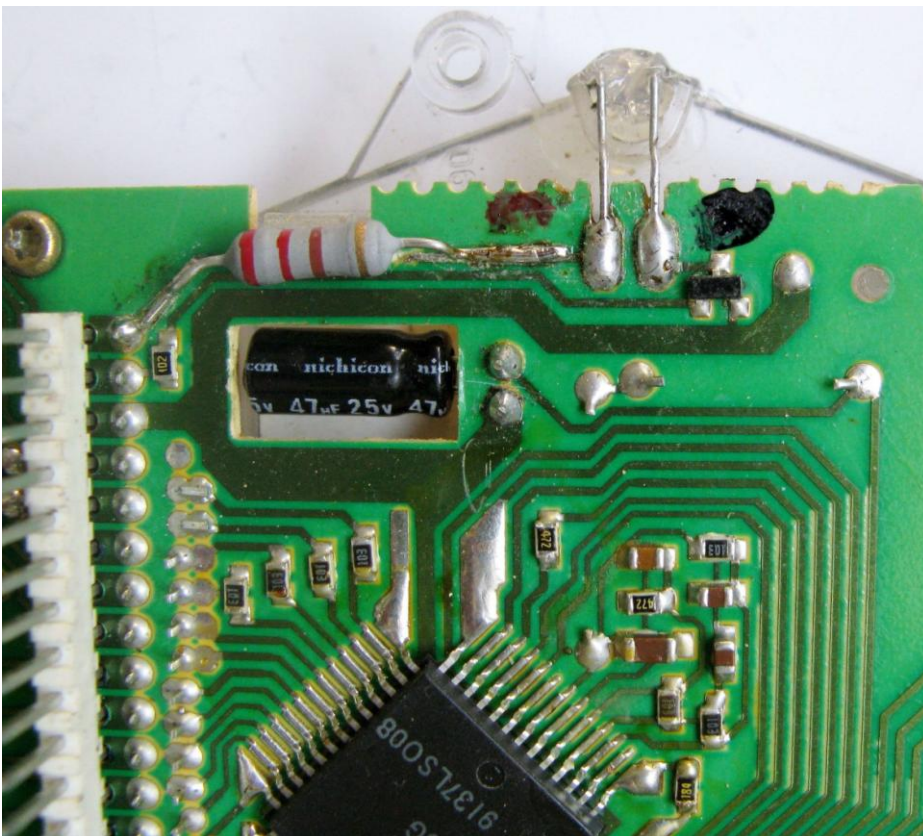
The LED pair, on the Left side of the LCD Display, illuminates when DC power is connected through the Power Socket at the Left side of the Radio.

Both LED pairs, on the Right and on the Left sides of the LCD Display, illuminate when the On / Off button is depressed.

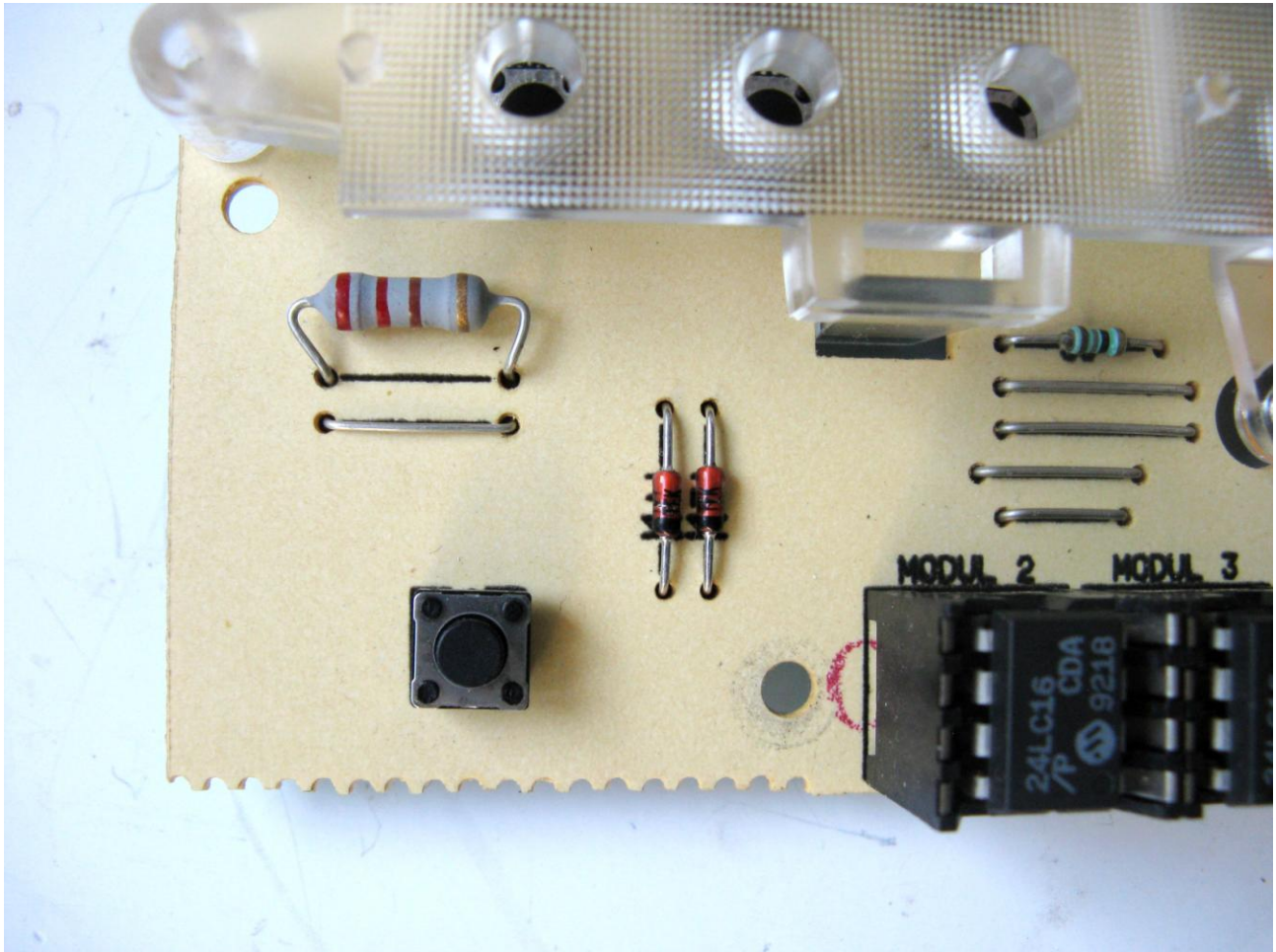
Shown here is one pair of the 2 SMD LED's soldered in parallel, with the cathode marked with a black stripe at the rear of the LED's. Both pairs are identical.



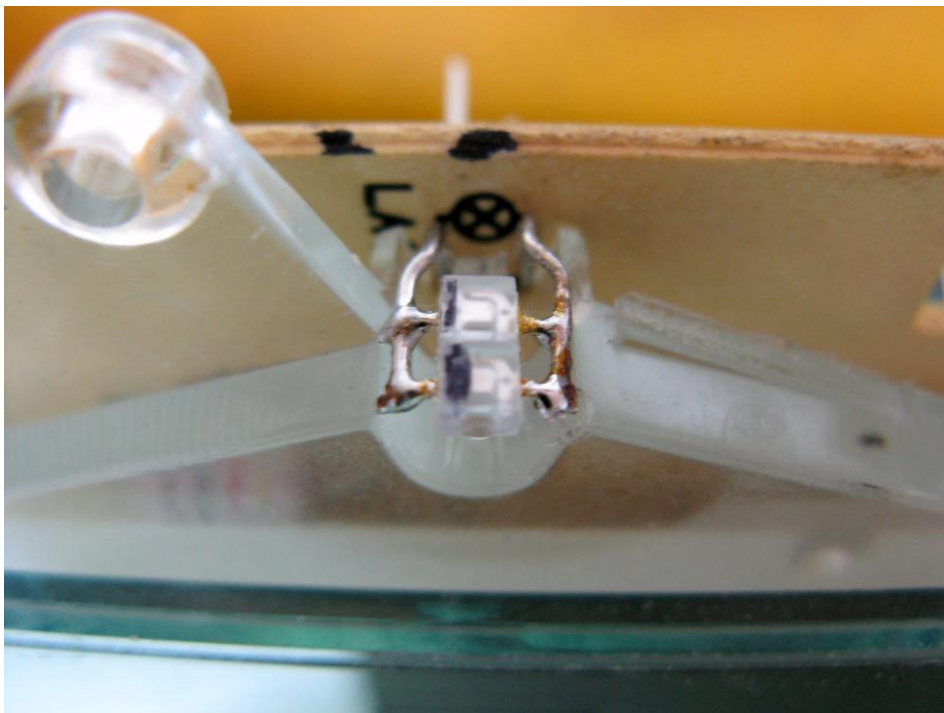
At the LCD Display's Right side, at its rear, the copper trace delivering DC voltage to the LED must be cut, and a 220 Ω resistor soldered in order to bridge the cut trace. This drops the 5VDC circuit voltage to the 1.8VDC required to deliver 14.5mA to the pair of LED's.



For the LCD's Display's Left side, above the Reset button at the bottom left of the keyboard panel, there is a pair of wire jumpers. One of them must be removed (not important which one), and a 220 Ω resistor installed to restore the power to the Left LED, but now at 1.8VDC.



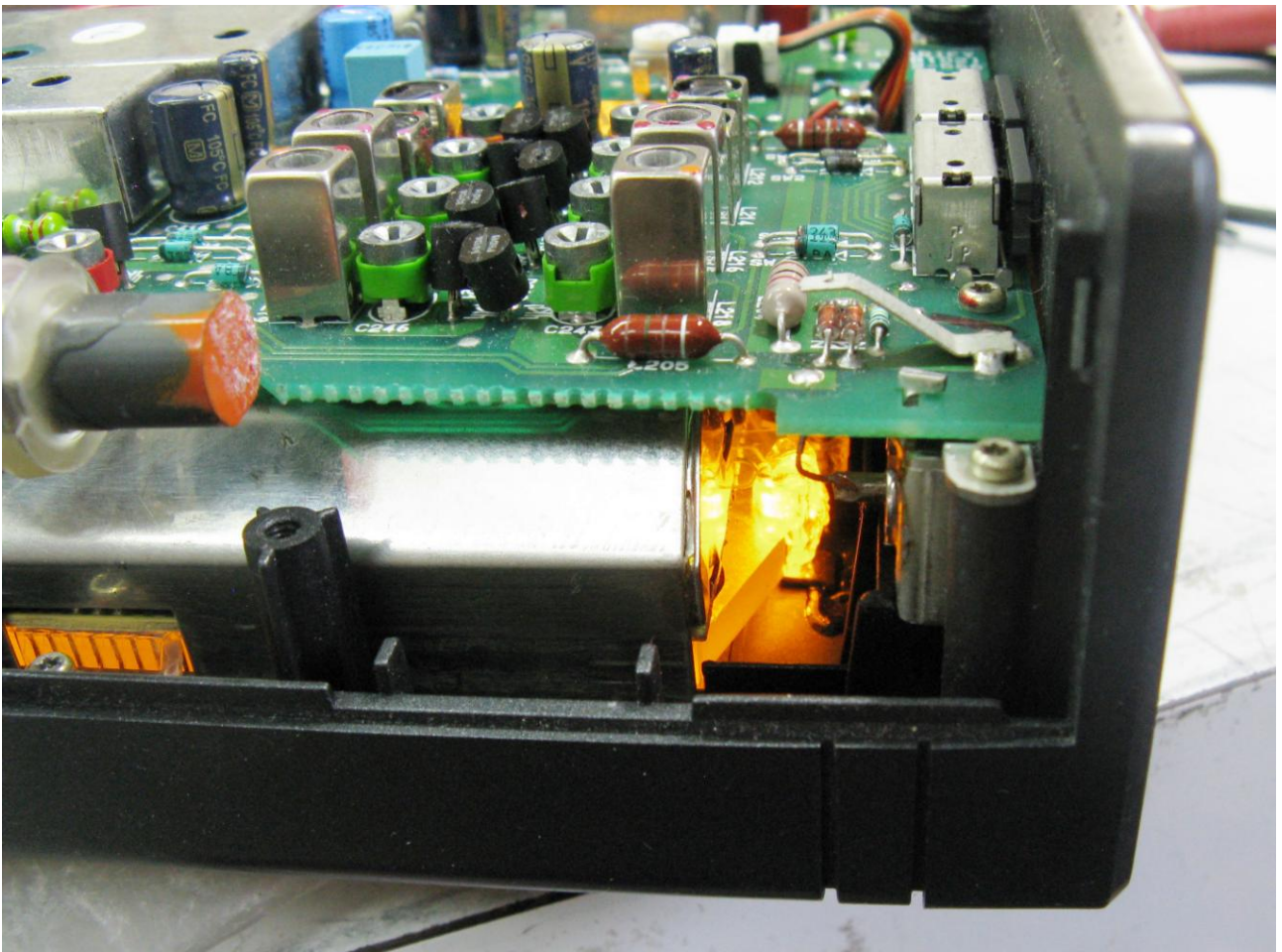
The LED assemblies may now be installed. The leads must be bent to fit correctly.



After soldering the leads to the PCB, squirt transparent hot-glue between the LED's and the clear acrylic body of the LCD Display. This assists the lateral dispersion of the LED light, so that the entire LCD Display panel is illuminated evenly.



At an easy low-stress current of only 14.5mA, the LED's are very bright, even for daylight, and enhance the contrast and readability substantially.



Here, a daylight photo; the DC power is connected at the socket, with the On / Off button at Off. Therefore ONLY the Left LED's are illuminated.



8. Complete Calibration and Alignment

The necessary equipment is an Oscilloscope, RF Signal Generator, Frequency Counter, and for optimal clear sound, a Distortion Meter.

According to the clear instructions in the Service Manual, I calibrate to lowest Distortion, which may NOT always be at peak signal. The context is that a listenable signal will always be listened to, but a noisy strong signal will not always find favor with the listener.

Overall, these modifications require a relatively low parts count, and deliver a substantial improvement in reception performance.

Parts for this restoration

Parts and advice are available for owners who wish to tackle this project by themselves.

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