

Goobay 67269 LNB Modification

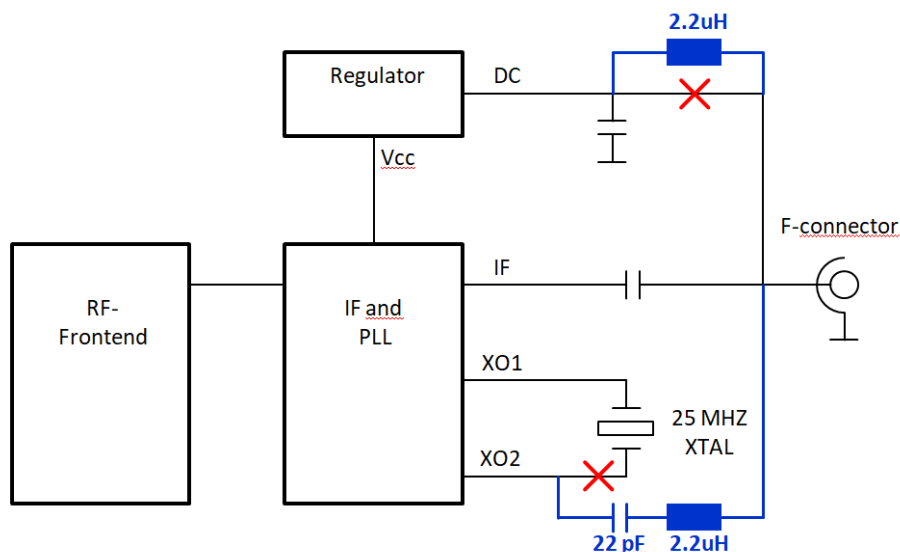
DH1DA - Armin Duft - dh1da(at)darc.de - Last update: 2019-10-01

This paper describes my method to modify the Goobay LNB for external reference. This is based on my personal experience and every attempt to follow these instructions is at your own risk. Some special tools and experience with small SMT components are necessary to carry out this mod. The goal is to implement a single cable solution where power, received signal and reference are fed through a single coaxial cable. At the other end of the cable a good reference oscillator with a “triplexer” is needed to complete the system.

The modification was done on 2 LNB’s. The first device was bought from “Reichelt” for less than 4€ in December 2018. The second device was bought from “Pollin” for 3,35€ in September 2019. Some minor differences were visible, however not relevant for this mod.

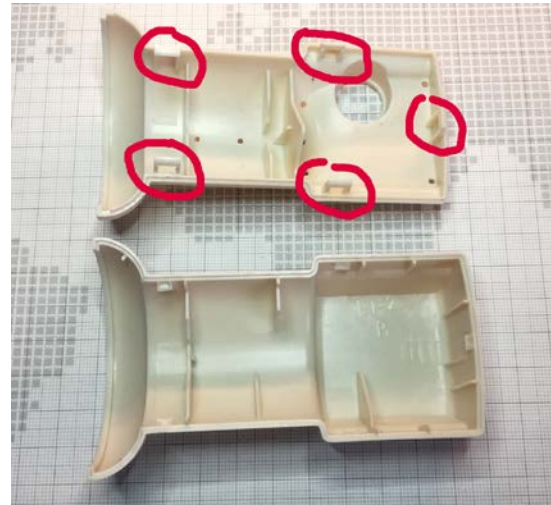


The block diagram shows the basic schematic of the LNB. The modifications are drawn in red and blue colour. No components need to be removed, only 2 PCB tracks have to be cut and 3 SMT components added.

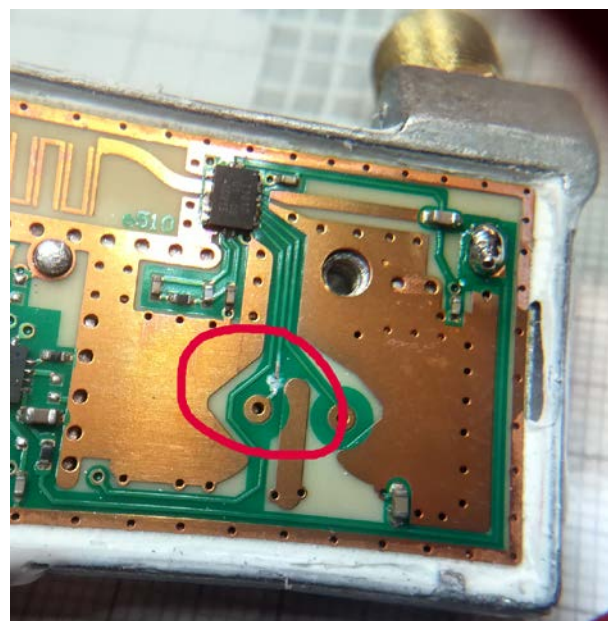
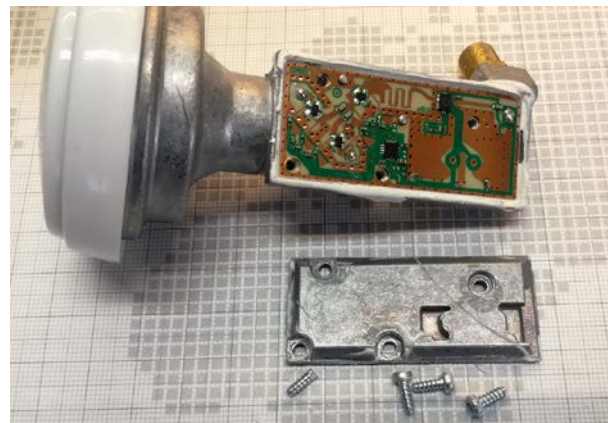
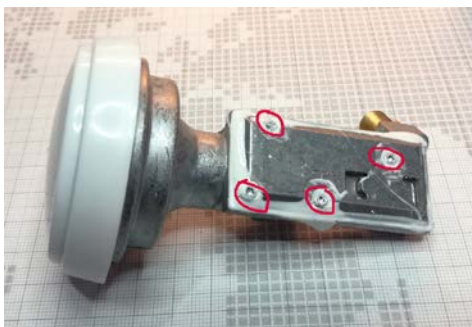


Disassembling the device

The white plastic cover is held together by 5 clips, which can be opened without damage if some care is taken. Do not remove the front cover (radome).



To get access to the PCB, remove the white sealant from the 4 screws and around the aluminium cover. The screws are "Torx T8". They are a bit hard to turn and one screw had to be removed with a drill press and a 5mm drill bit. After this the aluminum cover can be taken off.



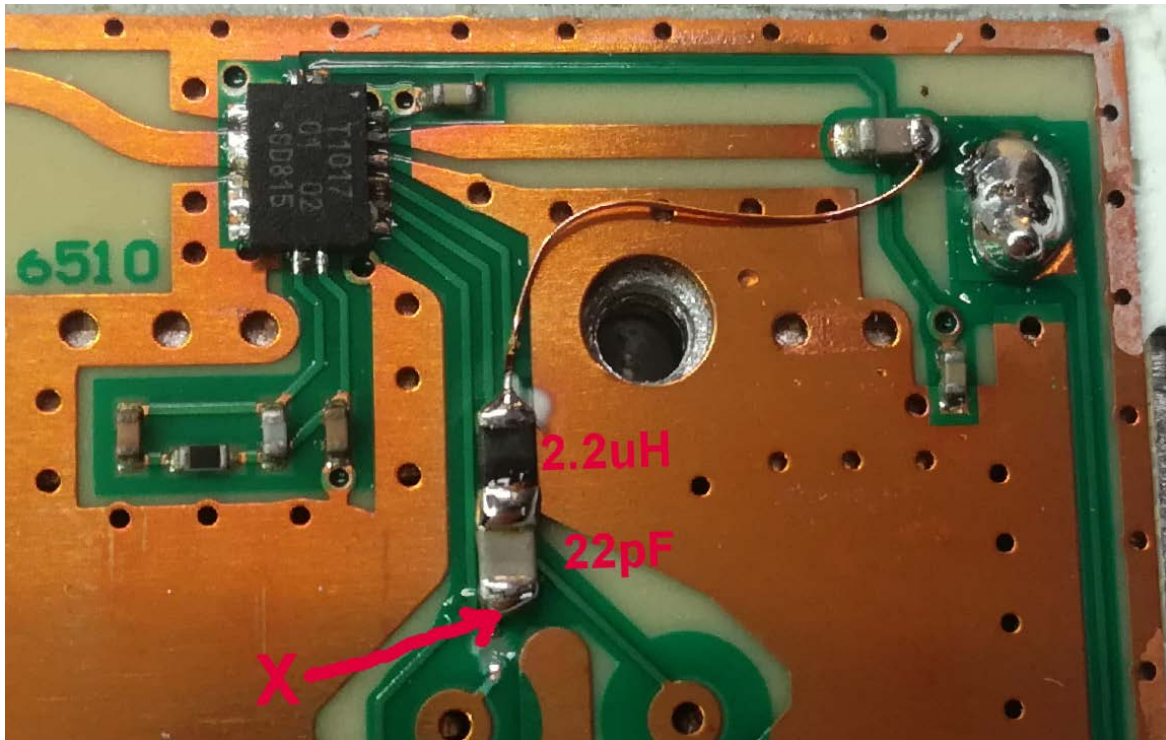
XTAL modification

The receiver contains 2 integrated circuits. First the NXP TFF1017HN/N1, which is an integrated mixer oscillator PLL for satellite LNB. Second the TI TPS65233 LNB voltage regulator with I2C interface.

The 25MHz crystal is on the bottom side of the PCB. It is not necessary to remove the crystal, which saves the difficult and risky exercise of removing the PCB from the housing. For the modification only one copper trace must be cut.

The external 25MHz reference signal is injected through the F-connector. From there a short enameled wire conducts the signal to a series resonant circuit consisting of 22pF and 2,2uH.

The capacitor is soldered to the cut trace marked "X". The green surface is not conductive, however care must be taken, that the solder joints and the SMT components do not touch the large copper areas.

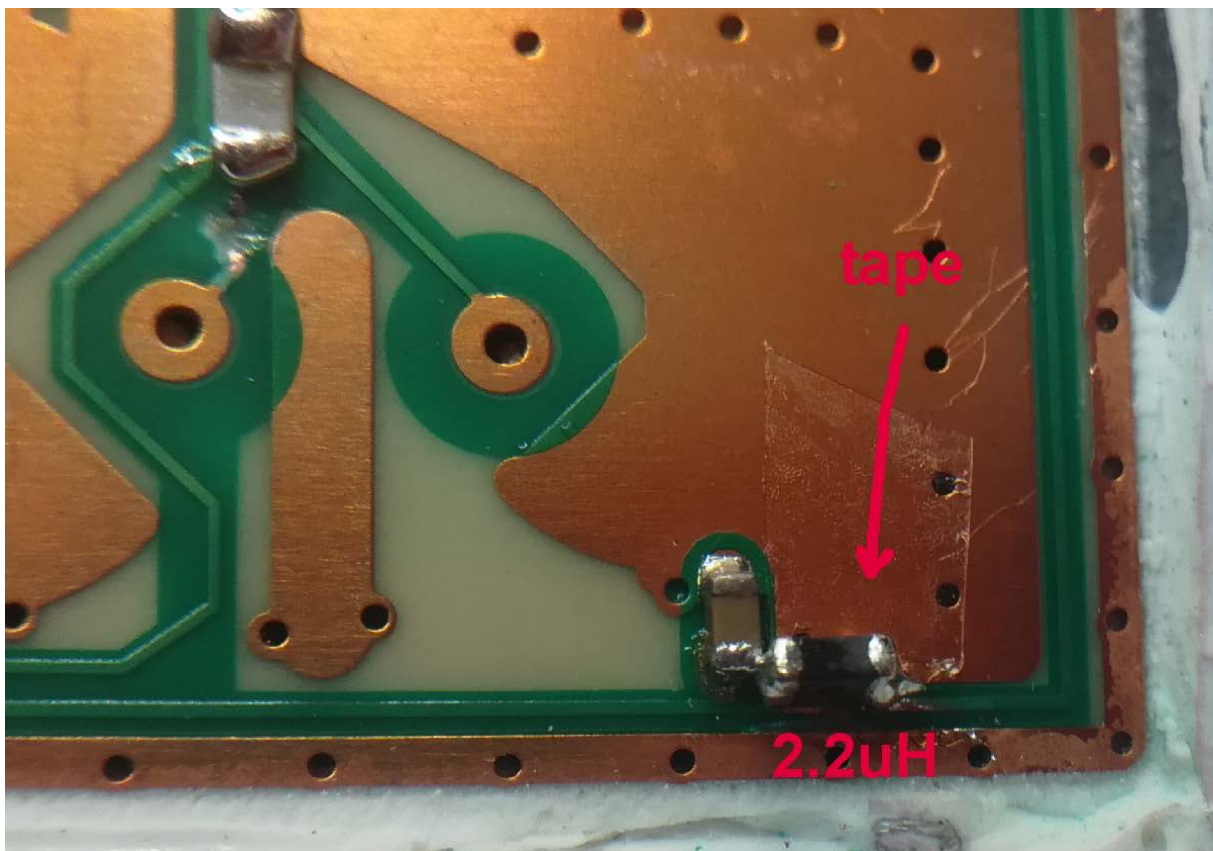
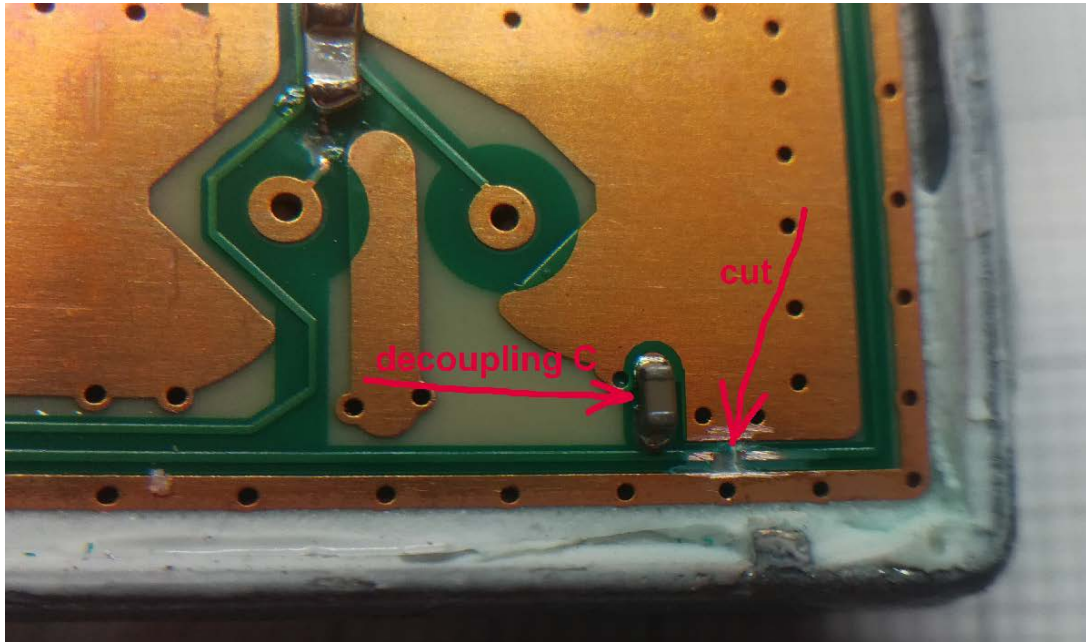


DC power modification

DC power coming from the F-connector is led through a thin copper trace to a large decoupling capacitor. This track has a high enough impedance to avoid leakage of the RF signal. However the 25 MHz reference signal is heavily loaded and the signal level would be too low for proper function. Therefore it is necessary to increase the impedance.

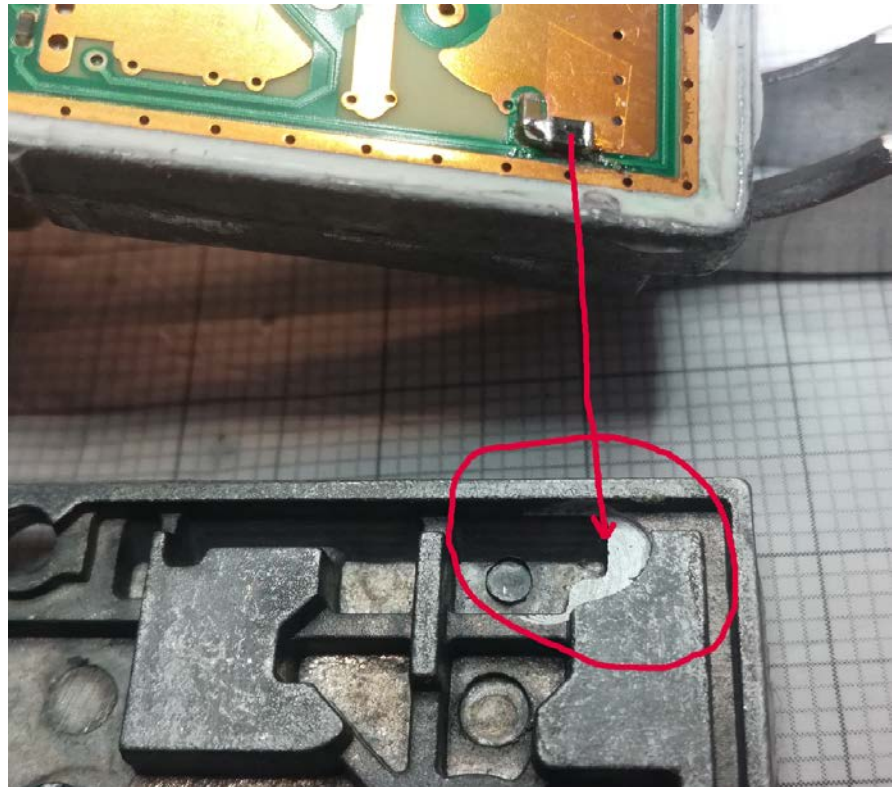
In some other LNB modification papers, a series resistor of 10 to 22 Ohms is proposed. A short test has shown that this basically works for high IF, like 432 MHz or 739 MHz. Unfortunately it does not allow the operation with a low IF, like 144 MHz, because this IF is "damped" by the capacitive load.

A better solution is the use of a series inductor, which forms a low-pass filter together with the decoupling capacitor. For simplicity a 2.2 μH inductor was chosen, which works fine for a wide range of IF frequencies. Furthermore a lower level of the reference signal is sufficient to lock the PLL oscillator.



The 2,2 μH inductor must be soldered to the capacitor and to the thin track leading to the F-connector. Use some adhesive tape under the inductor to avoid a shortcut with the large copper area. Positioning of the inductor is critical, because the space in the enclosure is very limited.

The aluminium cover needs some cutting to create space for the inductor and to avoid contact with the cover. This was done with a 4 mm end-mill in the drill press. A “Dremel tool” should work as well.



Check and reassembly

After a visual and electrical inspection the cover can be closed and sealed with silicone rubber adhesive sealant. Use a good amount to cover the screws as well.



Reference and IF frequencies

There is no specific IF filter in the LNB. There is only a RF filter for 10...12 GHz between the frontend and the IF-PLL-chip. Therefore it is possible to use any convenient IF frequency.

In the "low band mode" the PLL has a multiplication factor of 390 (without 22 KHz signal). Tests with external reference frequencies between 24.500 MHz and 26.400 MHz were successful on both modified samples. The range of one LNB was even wider. Probably further improvement is possible by tweaking the component values of the series resonant circuit.

Potential „HAM-Radio setups" are

Terrestrial communication:

25,4769 MHz x 390 → LO 9936MHz and means 10368 MHz is converted to 432MHz

26,2154 MHz x 390 → LO 10224 MHz and means 10368 MHz is converted to 144MHz

Or for QO-100 operation:

25,7872 MHz x 390 → LO 10057 MHz and means 10489,675 MHz is converted to 432,675MHz

26,5256 MHz x 390 → LO 10345 MHz and means 10489,675 MHz is converted to 144,675MHz