

# THE "MINNIE" RTL SDR

By Nick GOCWA Sept 2012



Hi this is my latest design for a RTL-SDR communications receiver. The set amounts to little more than a switchable receive up converter. Although designed for the Realtek RTL2832U Chipset + Elonics E4000 tuner, it will work with any of the other compatible tuners. I would personally recommend SDR# as the control package for the dongle.

<http://sdrsharp.com/>

The frequencies from DC to ~1.7GHz are covered in two ranges:

High range ~60MHz to 1.7GHz (depending on tuner chip) with the normal gap around 1.1GHz

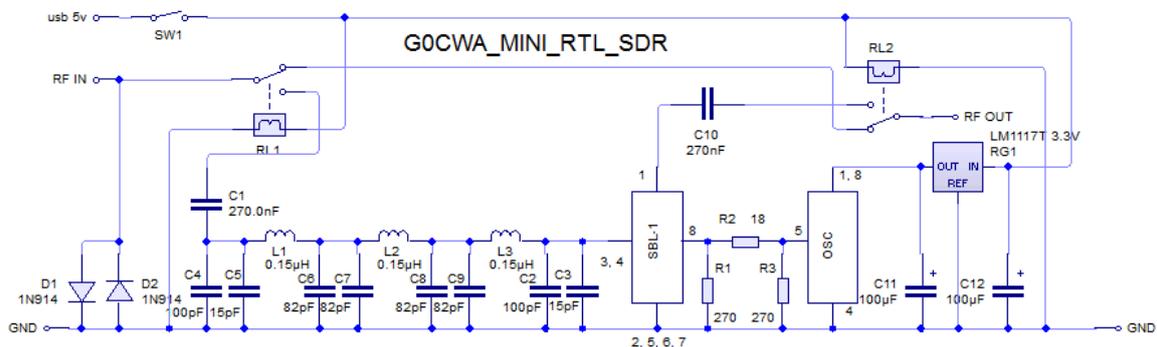
And

Low range DC to 60MHz.

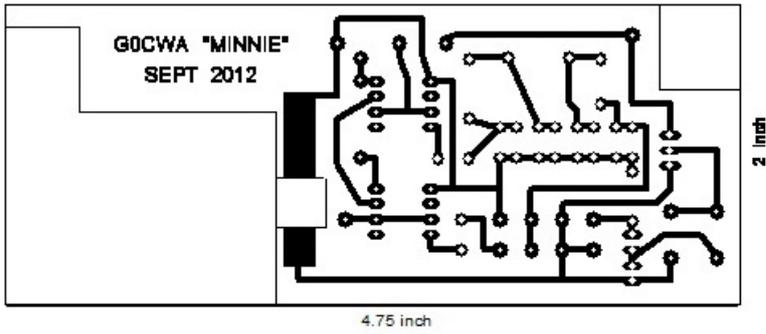
The main aim was to build a version of my designs to comfortably fit into a Lap top bag and be fully portable and powered from the PC USB port. The completed unit including a dongle fits into a small die-cast instrument case measuring only 55x25x125mm. To keep the circuitry size to a minimum I have not included any extras e.g. pre-amp or antenna switching etc.



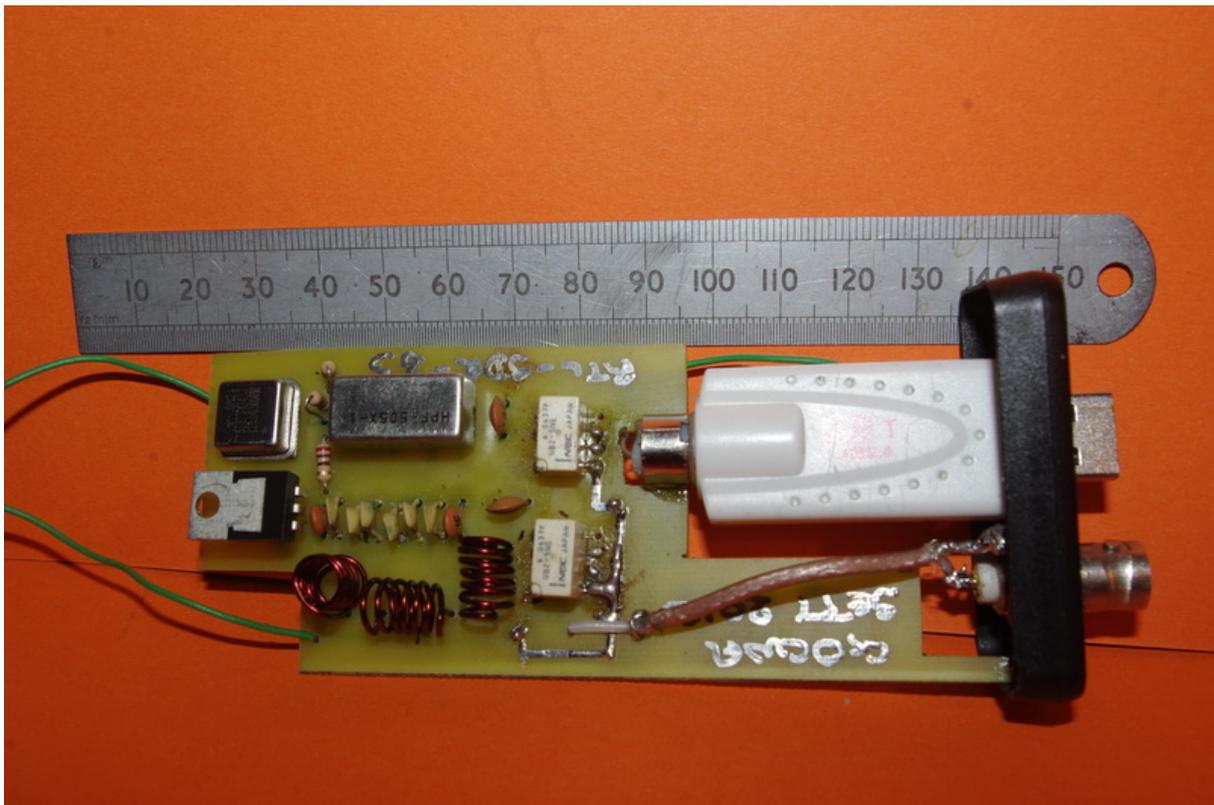
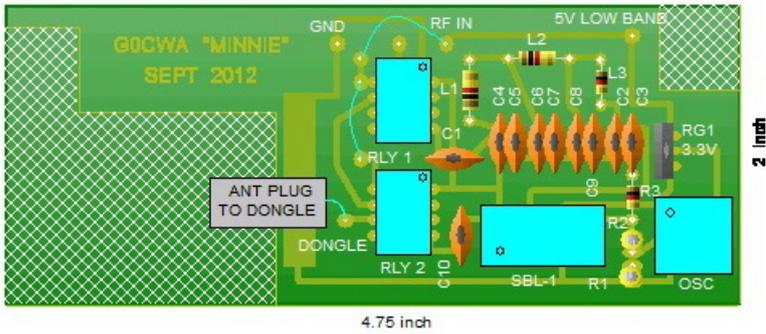
There is nothing clever or particularly original in the design with one exception the use of a 125MHz conversion oscillator so avoiding the VHF broadcast band on the output and reducing any sensitivity issues. The 5V supply is taken off the dongles USB connector by opening up the dongle case, carefully, and soldering a fine insulated wire to the appropriate USB connector pin taking this out through a small opening cut in the side of the dongle case.



Follow my track layout and use top quality miniature co-ax for maximum sensitivity I used silver plated. Do NOT use single strand wire for any RF signals as these dongles are very sensitive to mismatches and unless you are very lucky will shut down and work poorly, if at all. Note I have presented the track layout as an X-ray view, remember to mirror it if needed for the copper side



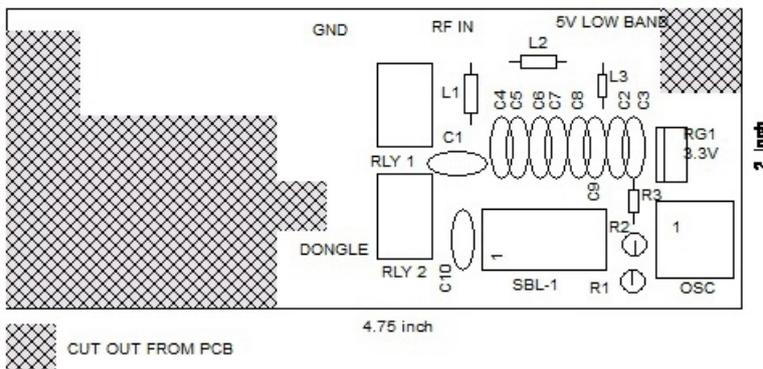
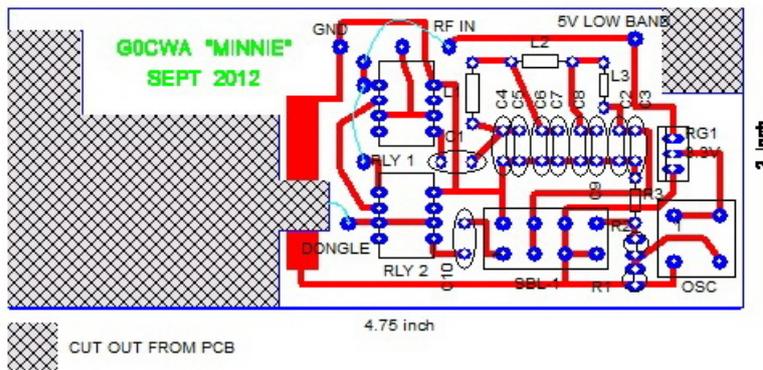
You may notice that D1, D2, C11 and C12 do not appear on the PCB top they are actually soldered on the underside of the board to save space. There are also two wire links on the top of the PCB to add.



The RF input to the dongle is via a connector shown in the “real world” PCB layout diagram above. This connector was “scavenged” from a cheap plastic bodied co-ax plug which is soldered to the PCB in a small slot. TAKE NOTE the connector is soldered on both sides bridging the two earth pads to complete the ground track to both sides of the PCB; the centre pin is connected via a small piece of copper wire to the PCB.

The only problem I had was when switching between the receive bands sometimes the dongle would lock up, this was due to the current demands of the relays and smoothing caps I managed to “cure this problem” by reducing the values of C11 and C12 anything above 100 nF should be ok.

The actual PCB dimensions and cut-outs suited both my box and gave sufficient clearance for the dongle, antenna socket and switch. Adjust these to suit your case etc.



The coils are all 6.5 turns of ~1mm diameter copper wire 0.25 inch diameter by 0.4 inch long, the relays are both NEC/TOKIN UB2-5NE 5V Coil DP Ch-over types although any similar equivalent ones may be used. The regulator is an LM1117T 3.3V unit. The crystal oscillator is a 3.3V 125MHz crystal oscillator module, any oscillator module frequency above 60MHz can be used but I can't guarantee the receivers performance or immunity to de-sensitisation/interference from the VHF broadcast bands.

For any further information about operation and performance check my MK2 design write up also on this site at

<http://makearadio.com/visitors/nick-sdr2.php>

Enjoy this design hope you find it of use, as always I can be contacted at:

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The Radio board and QRZ forums

Please only contact me via these routes if you have any questions, I can't guarantee to reply otherwise as I can't see every reference to my sets.

Enjoy the design 73 for now Nick G0CWA

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