Modifying a Motorola MTX9250 for full 33cm band coverage

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Getting on to the 33cm band generally means getting your hands on some ex-commercial 900 MHz two way radio equipment, programming it for ham frequencies, and if necessary modifying the hardware to suit. Choosing a Motorola MTX9250 handheld radio for 33cm use is, in general terms, a good choice as they don't require hardware modifications, only frequency reprogramming. This is true if you only need 902 MHz TX / 927 MHz RX repeater operation. However for those who would like to use simplex allocations at the bottom end of the band, wish to monitor repeater inputs, or otherwise make full use of the entire band, some hardware modifications of the MTX9250 will be required as the RX VCO does not typically cover below around 925 or perhaps 920 MHz. Transmit coverage in the MTX9250 is already quite wide, typically covering the entire 896 to 941 MHz and everywhere in between. Described here is the simple modification required to permit the RX VCO to successfully lock down to at least the bottom end of the 33cm band.

Standard disclaimers apply: All care but no responsibility taken for the accuracy of this information, or how you make use of it. If you damage your radio or render it inoperative, its entirely at your own risk.

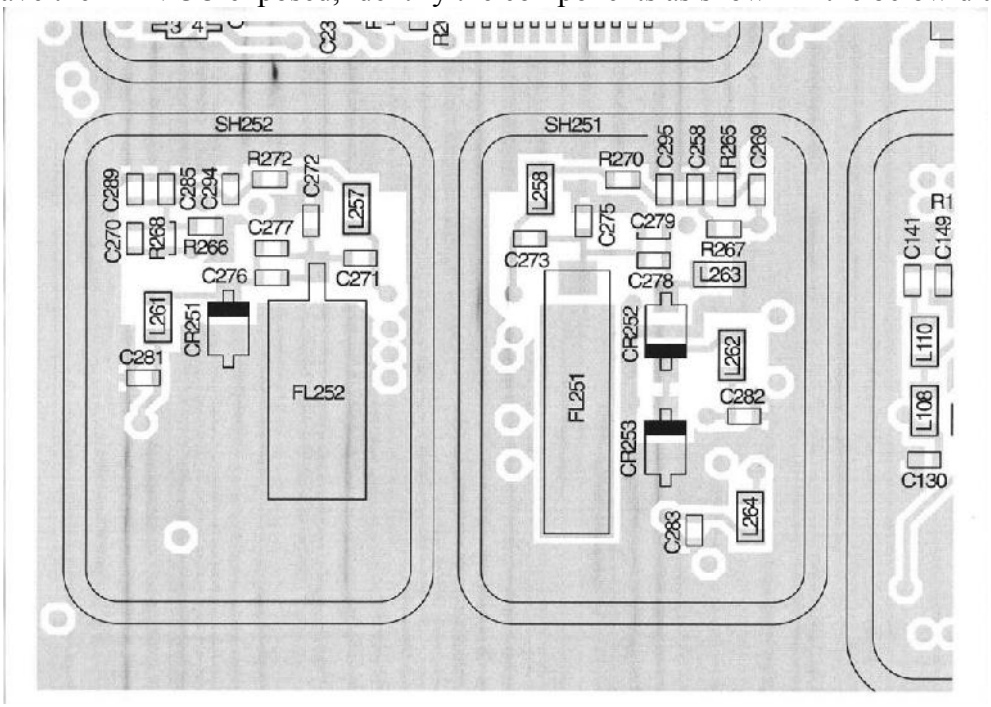
It is assumed that you'll already have tackled the problem of getting the Motorola CPS software to accept frequencies suitable for 33cm ham operations, and that you have all your desired frequencies programmed in. For those frequencies at which the RX VCO can not cover, the MTX9250's display will show FAIL001, indicating synthesiser unlocked.

To begin, disassemble the MTX9250 to gain access to the PCB. Unscrew the antenna, remove the battery, and pull of the talk-group selector and volume knobs. Turn the radio over so the back of the radio is facing you, and using a flat blade screw driver, lever out the bottom of the metal backplate. Tilt out the inner assembly from the bottom a little, then pull down on the assembly so that the talk-group selector and volume control shafts clear the top of the outer case. Be careful of the interconnecting ribbon cable as you do this. Next, you'll want to remove these ribbon cables from the PCB; do this by using a very small flat blade screwdriver to tilt up & unlock the retaining 'collar' of these ribbon connectors… done correctly the ribbon cable should almost fall out of its connector with minimal effort.

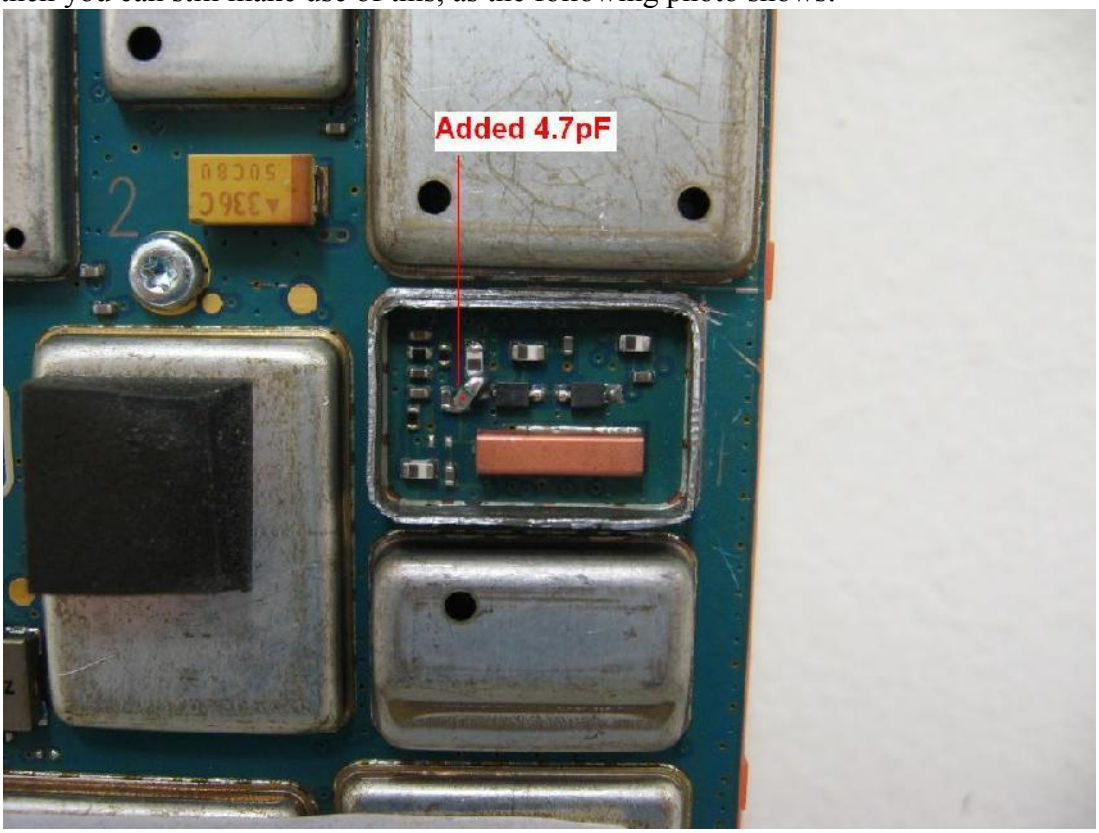
Next, identify the RX VCO, as shown in the below photo:

Now comes the hard part: removing the RX VCO shield or can. Using special purpose hot air tools would be ideal, but since I don't have these at my disposal, I opted for using a Dremel tool to cut off the top of the can to access the RX VCO components.

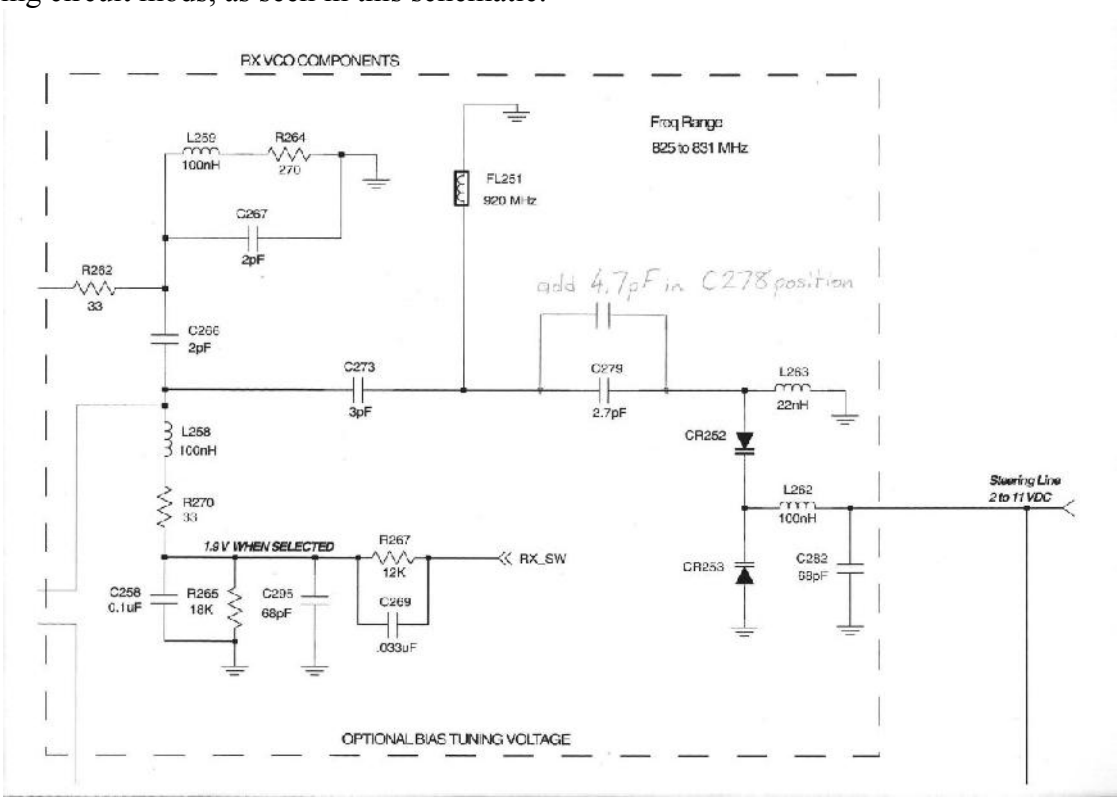
Once you have the RX VCO exposed, identify the components as shown in the below diagram:



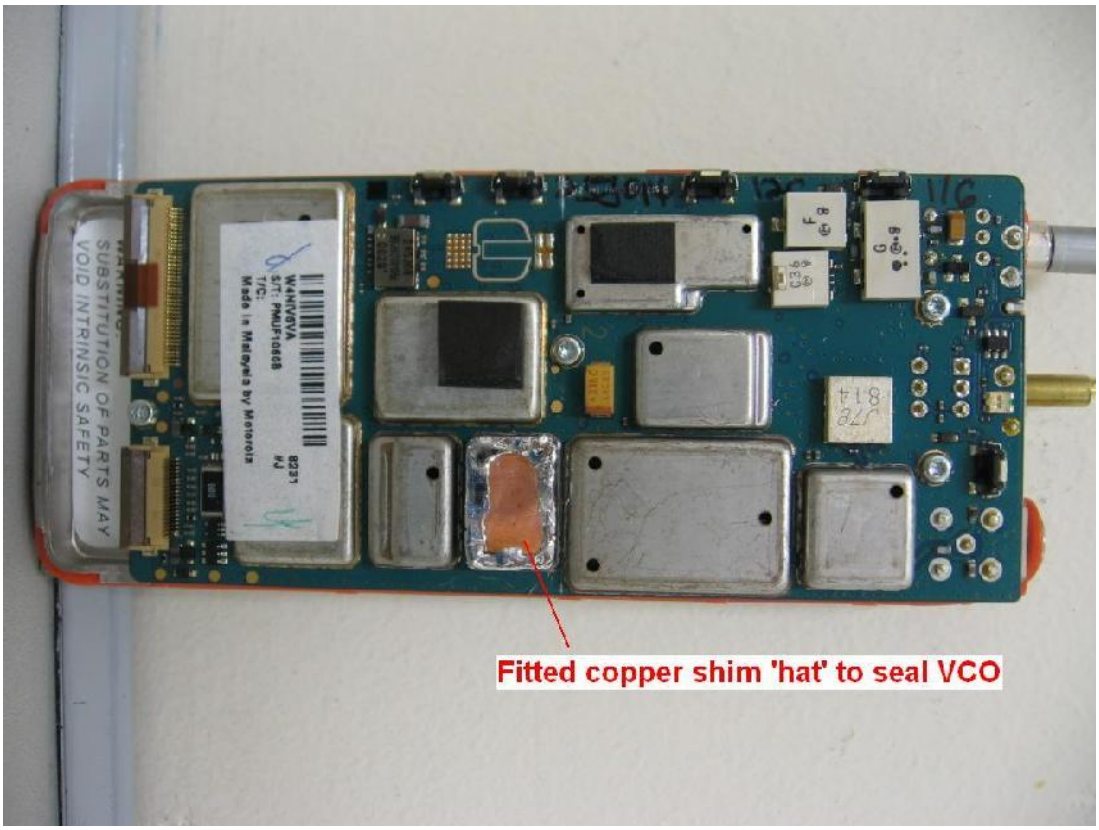
Note that even though C278 is shown as being present, in actual production radios, this component is missing. It is this position that you'll be soldering a 4.7pF SMD chip capacitor. Obtaining a 4.7pF chip cap of the right size (0402) would be useful, but if all you can obtain is the next size up (0603) then you can still make use of this, as the following photo shows:



To solder in this tiny SMD chip capacitor will require a low wattage and very fine tipped soldering iron, and some very fine solder. Don't fool yourself, a standard size soldering iron tip simply will not do. A magnifying lens to assist in seeing the area you're soldering will be a great help… I use a loupe or magnifying eye monocle myself. Once soldered in, you'll have achieved the following circuit mods, as seen in this schematic:



If you have it, clean up the area with some solder flux removing spray and electronic grade cleaning fluid. Now it is time to seal up the VCO shield. If you've cut off the top of the shield, use some copper shim to make a 'hat' over the shield and solder it on. This is what my finished product looked like:



Reassemble the radio, and enjoy full RX VCO coverage. My MTX9250 now receives at least 896 to 941 MHz, and it probably could go even further, but I didn't test the outer limits.

Before the mod, the MTX9250 manages to open the mute at -124dBm or 0.14uV across 935 to 941 MHz. After the mod, the mute continues to open at 0.14uV from 920 to 940 MHz, and drops about 1dB of sensitivity for every 1 MHz below 920 MHz, until at 902 MHz the mute opens at -108dBm or 0.89uV. If you want better sensitivity, the pair of 3-pole ceramic block filters (seen above as the item with J78 814 printed on it, another filter like it is on the other side of the PCB) can be replaced to types that have a better frequency response lower in the 900 MHz band; 890 to 915 MHz types are common. As to wether you should keep your existing filter or retrofit a new one, it depends on your own requirements, as fitting new filters will generally trade off sensitivity up around 927 MHz.

It must be mentioned that this modification has only been tested on MTX9250 variants that use a 73.35 MHz 1st IF. Versions that use a 109.65 MHz 1st IF have not been tested with this modification, but the overall result is expected to be the same with the very same modification for those radios. I would be pleased to receive your feedback on how this mod works with a 109.65 MHz 1st IF variant.

I hope this modification is of some use to 33cm band users.