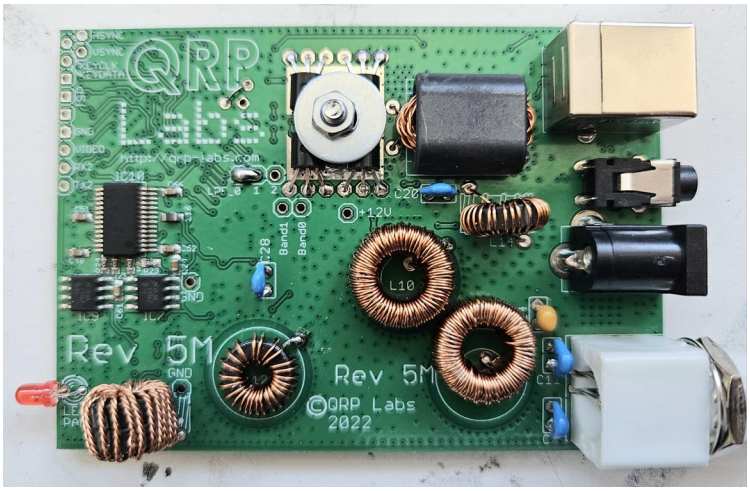
QRP Labs

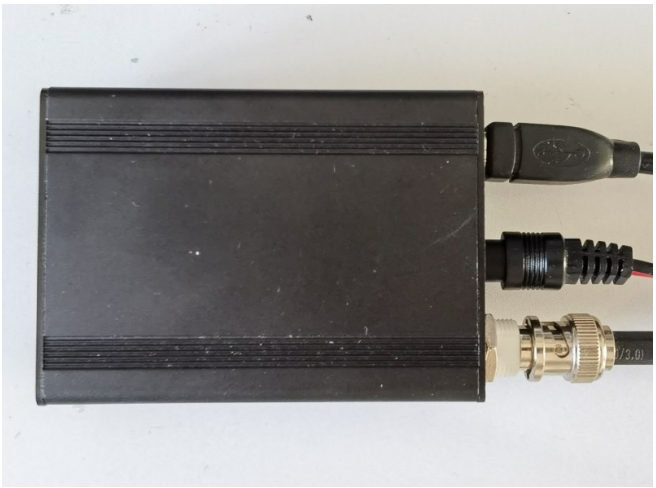
QDX-M

QDX-M: QRP Labs Digital Xcvr - Monoband

2200m-specific assembly notes

--- PCB Rev 5M ---





Contents

1. Introduction

This manual is supplementary to the main assembly manual and describes specific instructions pertaining to the 2200m version of the transceiver. Read the main assembly manual first.

MF and LF transceivers present specific challenges to the designer. Large inductances are required, which require either large number of turns on toroids or higher permeability cores; the latter however, suffer increasing risk of saturation as the frequency decreases, making it difficult to obtain sufficient spectral purity.

The constructor must be aware that the assembly of the MF and LF QDX-M variants is more challenging than at HF, and follow these instructions carefully. Typically, constructors involved in 2200m operations will already have discarded all hope of an easy life.

2. Capacitors and inductors

The following table lists the capacitors and inductors specific to the 2200m QDX-M:

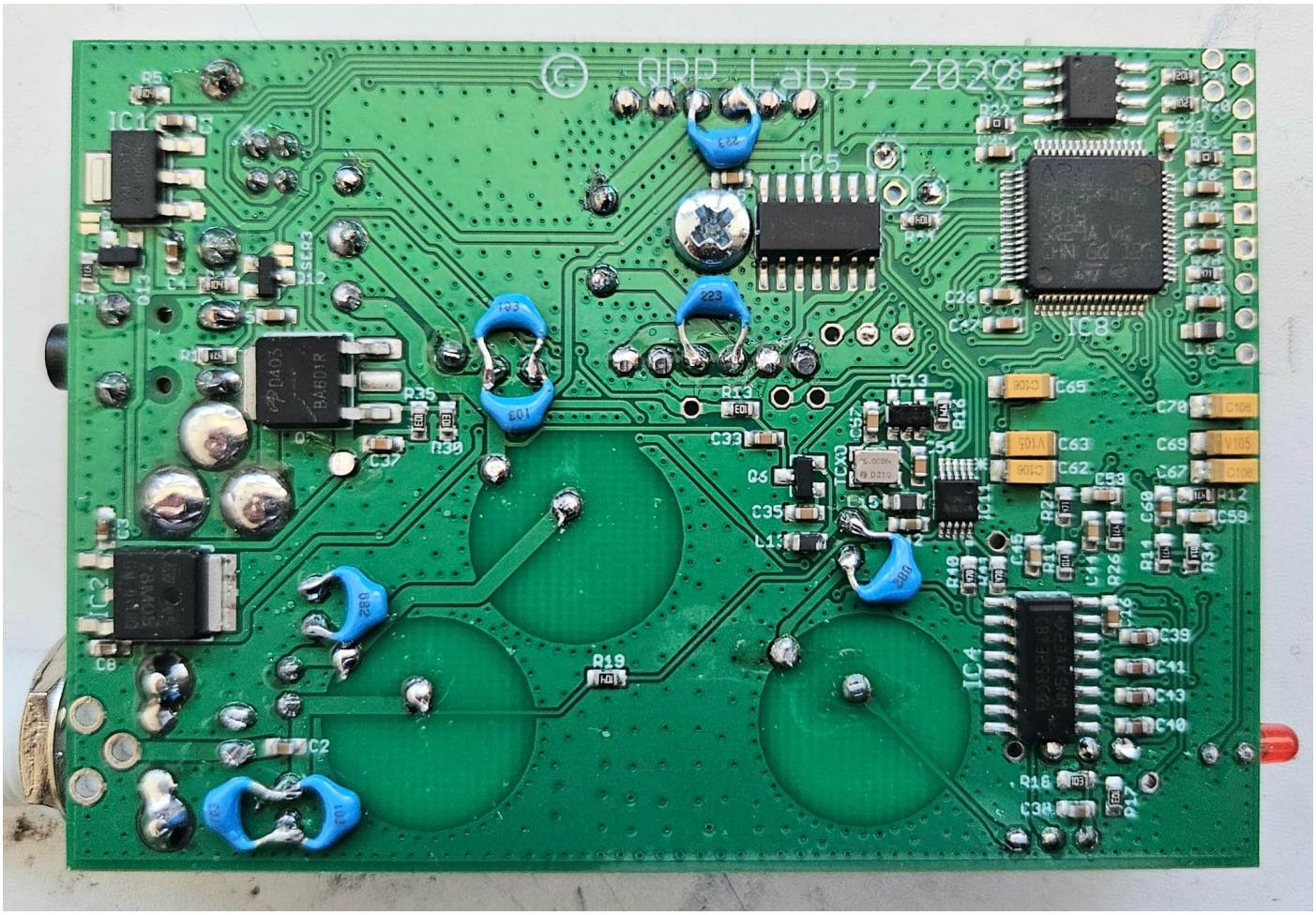
Component	Value
C7	Three 10nF (code “103”)
C11	2700pF (code “272”)
C14	47nF (code “473”) in parallel with 6,800pF (code “682”)
C20	Three 10nF (code “103”)
C28	10nF (code “103”) in parallel with 6,800pF (code “682”)
	22nF capacitor across each Drain-Source (two C’s not on main schematic), (code “223”)
L4	T50-6 (yellow) with 112 turns (47.6 uH)
L10	T50-6 (yellow) with 117 turns (53.0 uH)
L12	FT37-43 (black) with 24 turns
L14	FT37-43 (black) with 17 turns
T1	BN61-202 WTST binocular with 13:13 turns
T2	Two FT37-43 (black) with 20 turns trifilar

Capacitors

Start with the installation of the capacitors since there are the smallest components. Note that some of the capacitors are made up of two or three capacitors in parallel. It is recommended to install one in the PCB in the normal way (insert component from the top, solder, then clip excess lead length); and the remaining parallel capacitor(s) on the underside of the board.

In doing so, the constructor must exercise good care to avoid short-circuits, solder blobs or dry solder joints. Inspect all work with a jeweller's loupe or other optical magnification, after soldering on each capacitor. It's recommended to have the capacitor ID labels facing upwards so you can easily check your work later. Capacitor leads should be kept short and tidy. There is not much clearance to the bottom of the enclosure, so capacitors need to be installed lying flat on the board surface. Take care to clip the wires and solder cleanly, to avoid the possibility of any leads accidentally shorting against the enclosure floor when the PCB is mounted inside the enclosure.

The following picture shows the underside of a 2200m QDX-M board with the extra parallel capacitors installed. Note the 22nF capacitors (code "223") installed between the Drain and Source of each pair of transistors, being the middle two of the row of 6 transistor pads.



Inductors

Next proceed with the installation of the simple inductors. L4, L10, L12 and L14 are ordinary single winding inductors. There are quite a few turns on them, take care to count the turns carefully. Each time the wire passes through the central hole of the toroid counts as one turn. The wire on L4 and L10 will not fit in a neat tidy single layer: there will necessarily be some overlap. Don't

worry about this. If you have an LC meter, it is reasonable (in this case) to measure the inductances of L10 and L4 and try to achieve 53uH and 47.6uH respectively.

Remember when installing the inductors that the most common fault is a failure to adequately remove the enamel insulation on the wire. The insulation could be scraped off, burned off with a lighter, or burned off with a blob of solder on your iron, but it MUST be removed at the joint so that a good electrical connection can be formed. It is recommended to check each joint after installation of each toroid, both with a loupe and also with a DMM to check that there is continuity across the toroid. Which means touching the DMM (in continuity beeper mode or resistance mode) probes on the solder blobs at each end of the toroid, or even better, another point nearby connected by a PCB trace. Take care not to simply touch the DMM probe on the end of the copper wire itself, which will not check your soldering!

Trifilar transformer T2

T2 is made of 20 turns trifilar wound. T2 in the 2200m version differs in that two FT37-43 (black) toroids are held together and the transformer is wound on them as a single double-thickness toroid. Please refer to the main QDX-M for the construction, installation and testing of this component – but remember that there are TWO FT37-43 held together, and 20 turns (not 10 as in the main QDX-M document).

Power transformer T1

To construct the power transformer T1, you need the document “PA transformer manual” which you may download from the main QDX-M web page http://qrp-labs.com/qdxm. However **the transformer for the 2200m version has some differences compared to the manual, so read the following paragraphs carefully**.

For the 2200m version of the QDX-M you must use the WTST “Weird Twisted Sisters Transformer” type described in section 3 of the manual. Do not use a simple conventional wound transformer and do not use the “RWTST” transformer. Your 2200m QDX-M will therefore require a 9V supply voltage. However, although the WTST transformer is stated to be designed for a 9V operated QDX-M, in fact the efficiency of the 2200m QDX-M is high and you could carefully experiment with higher supply voltages and hence power output. At 9V supply you will expect approximately 5W output give or take.

In the transformer manual, the WTST type has a turns ratio of 3:3. As in all current QRP Labs kits, 0.3mm wire is used for the transformer. But at 2200m to ensure adequate inductance without causing core saturation, a larger number of turns is required. The two lengths of wire should therefore be longer, we recommend 96 and 100 cm respectively.

The turns ratio for the 2200m transformer must be 13:13.

Take care not to nick or scratch the wire enamel which could causes shorts inside the transformer. The edges of the binocular core holes are sometimes quite sharp and using a large drill bit to gently de-burr the holes by hand twisting, is often a good idea.

Steps 1 to 5 of the WTST section describe winding 1.5 turns of twisted wire onto the binocular core - which becomes 3:3 turns with one winding center tapped, since the “wire” is actually two wires twisted together. In the case of the 2200m QDX-M transformer, having 13:13 turns, you should continue this process until you get to 6.5 turns (13 total). Each time the twisted wire goes through one hole, this is a half turn (which becomes a whole turn in the end since the wire is double).

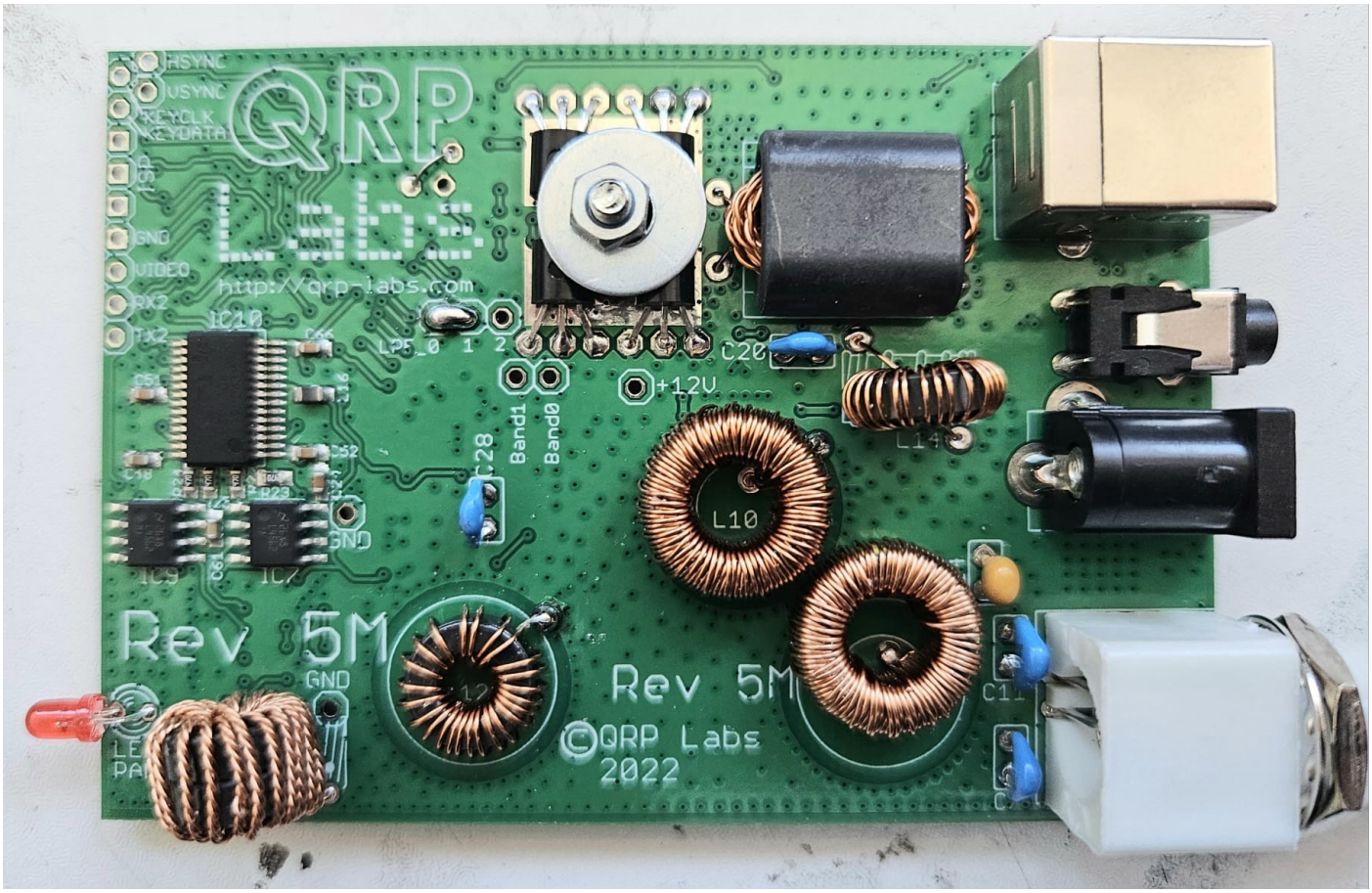
The remaining procedure for the transformer is the same as the rest of the WTST instructions, and refer to the main QDX-M manual for the installation and testing of the PA transformer; these instructions apply equally to the 2200m QDX-M PA transformer.

To re-iterate:

1. The 2200m QDX-M transformer must be a WTST type for 9V operation.
2. It is the same as the HF transformers except that it has a 13:13 turns ratio (instead of 3:3 for the HF transformer).
3. Remaining assembly, installation and testing is the same as the PA transformer manual and main QDX-M assembly manual.

Other components

Continue with the remainder of the assembly as per the main QDX-M manual (connectors, LED, transistors). Below is an example result:



3 Configuration

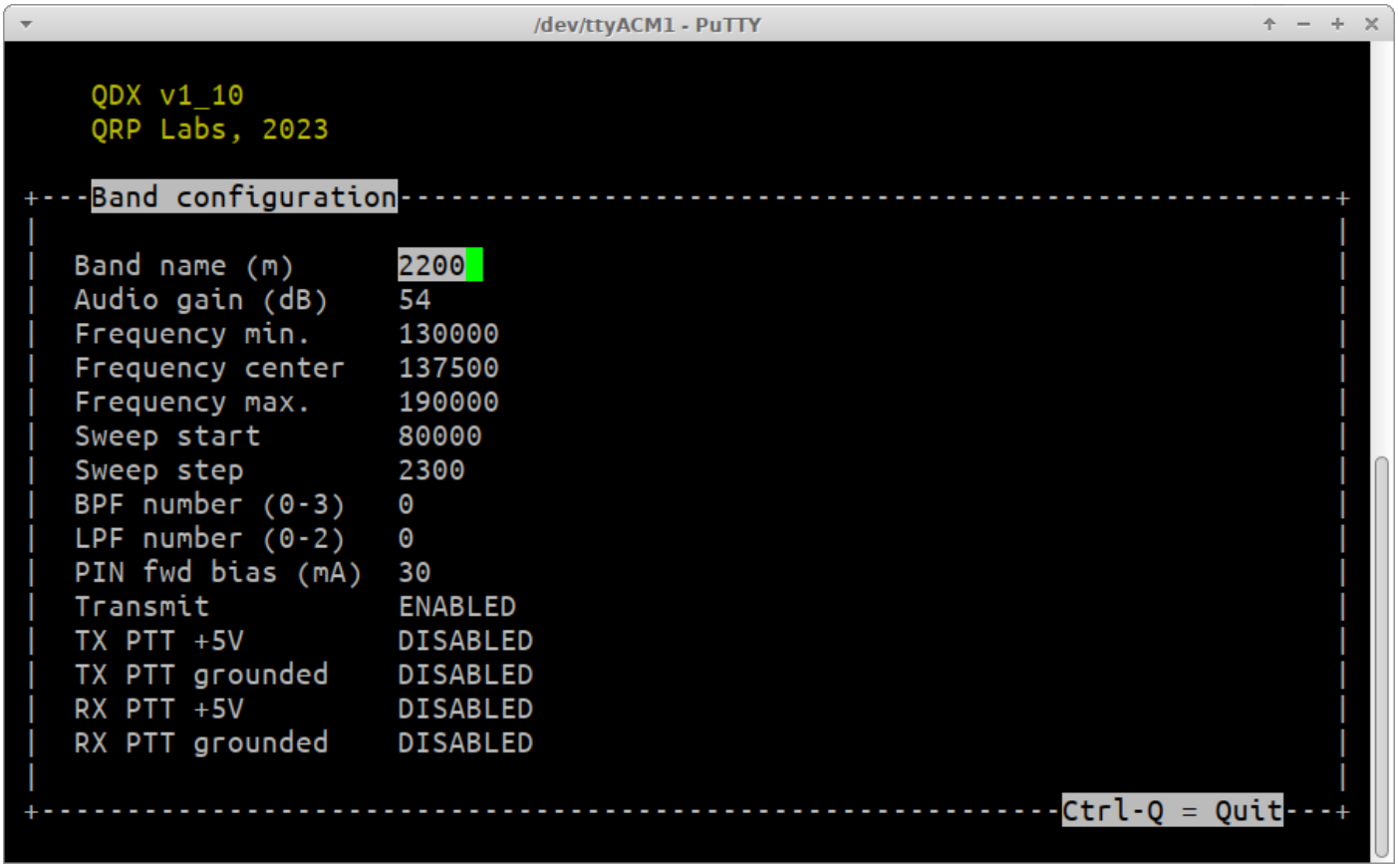
The main QDX-M manual describes jumper configurations to select the band. This is not yet set up in the QDX firmware so you need to connect a terminal emulator and configure the 2200m QDX-M manually. Refer to the main QDX operating manual for instructions on how to connect a terminal emulator to your QDX-M, running on a PC connected to your QDX-M with an appropriate USB cable.

If you connect a jumper wire diagonally between two of the three holes as shown in the above picture, right under the ‘P’ of the “QRP Labs” logo in the top left of the board; then if you connect a jumper wire between pads labelled ‘0’ and ‘1’ right under the ‘s’ character of the “QRP Labs” logo, when the board is first powered up, there will be a single column configuration for 80m. This is easy to edit to 2200m.

You also need to make sure you are running the latest firmware version. The firmware version is displayed at the top of the terminal emulator screen. Please refer to the main QDX page http://qrp-labs.com/qdx to download the latest firmware if necessary, following the firmware update procedure described in the operating manual.

The Band Configuration screen must be edited for proper operation of the 2200m QDX-M. Chagne the “Band name (m)” parameter to “2200”. This is crucial! It must be exactly “2200” to ensure proper operation of the receiver at this low frequency. Edit the “frequency min”, “frequency center”, “frequency max”, “sweep start” and “sweep stop” parameters as shown below.

Note that if you ever execute a Factory Reset, it will be necessary to re-edit the parameters on the Configuration and Band configuration screens, appropriately for 2200m operation.



The BPF number, LPF number and PIN fwd bias cells have no meaning for the QDX-M because it is single band and there is no band switching. So you can ignore those.

You also need to visit the main “Configuration” screen and edit the “Default frequency” cell to 137500.

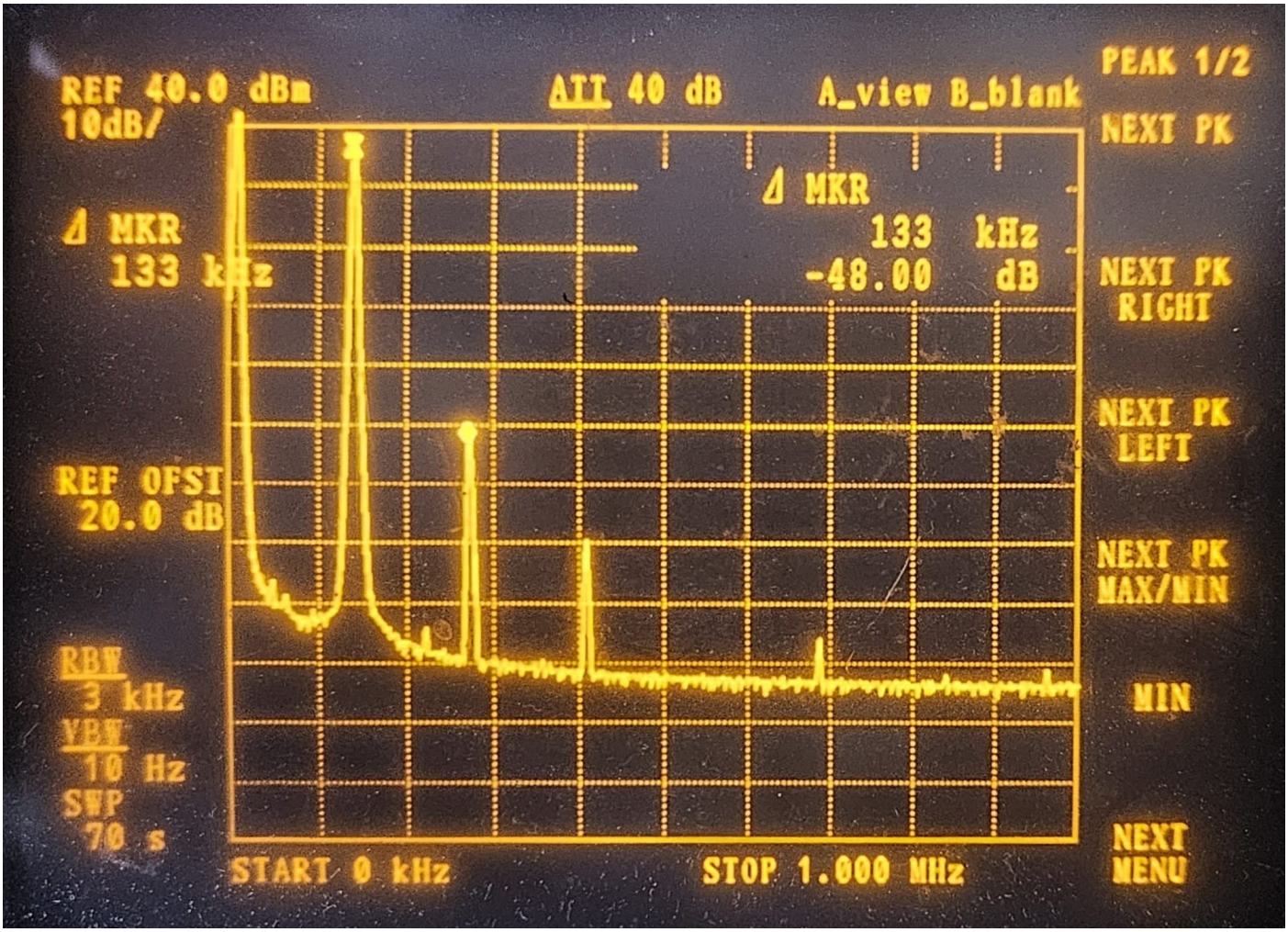
After this, power down your QDX-M and re-boot it, then re-connect the terminal emulator.

4 Adjustments and performance evaluation

Always test the transmitter first. A 9V supply should suffice to produce approximately 5W output. Use the “Transmitter test” screen and press the ‘T’ key on your keyboard to transmit. You should measure around 5W of RF power output.

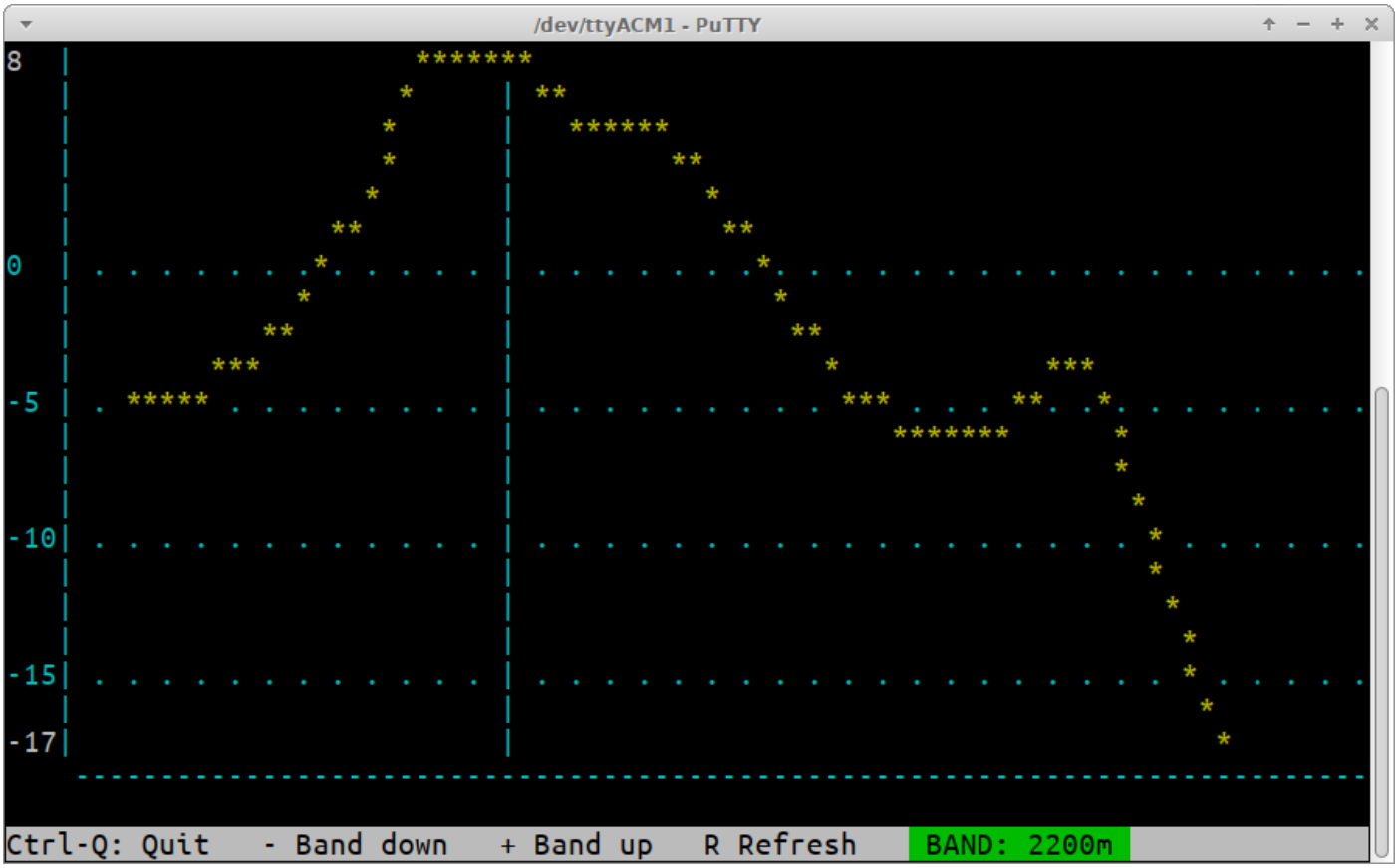
The efficiency of the power amplifier is high. Normally we would not recommend using a QDX-M at more than 5W output; however in this case you could probably experiment with higher supply voltages, without damaging the RF power transistors. A good indication of whether the PA transistors are under stress is to observe the current consumption during transmit. If, during a prolonged key-down, this current starts to drop, this indicates the PA transistors are getting very hot, which is changing their operating characteristics, and they are under stress.

This photograph shows the spectrum analyzer result (9.04V supply, 5.1W output):

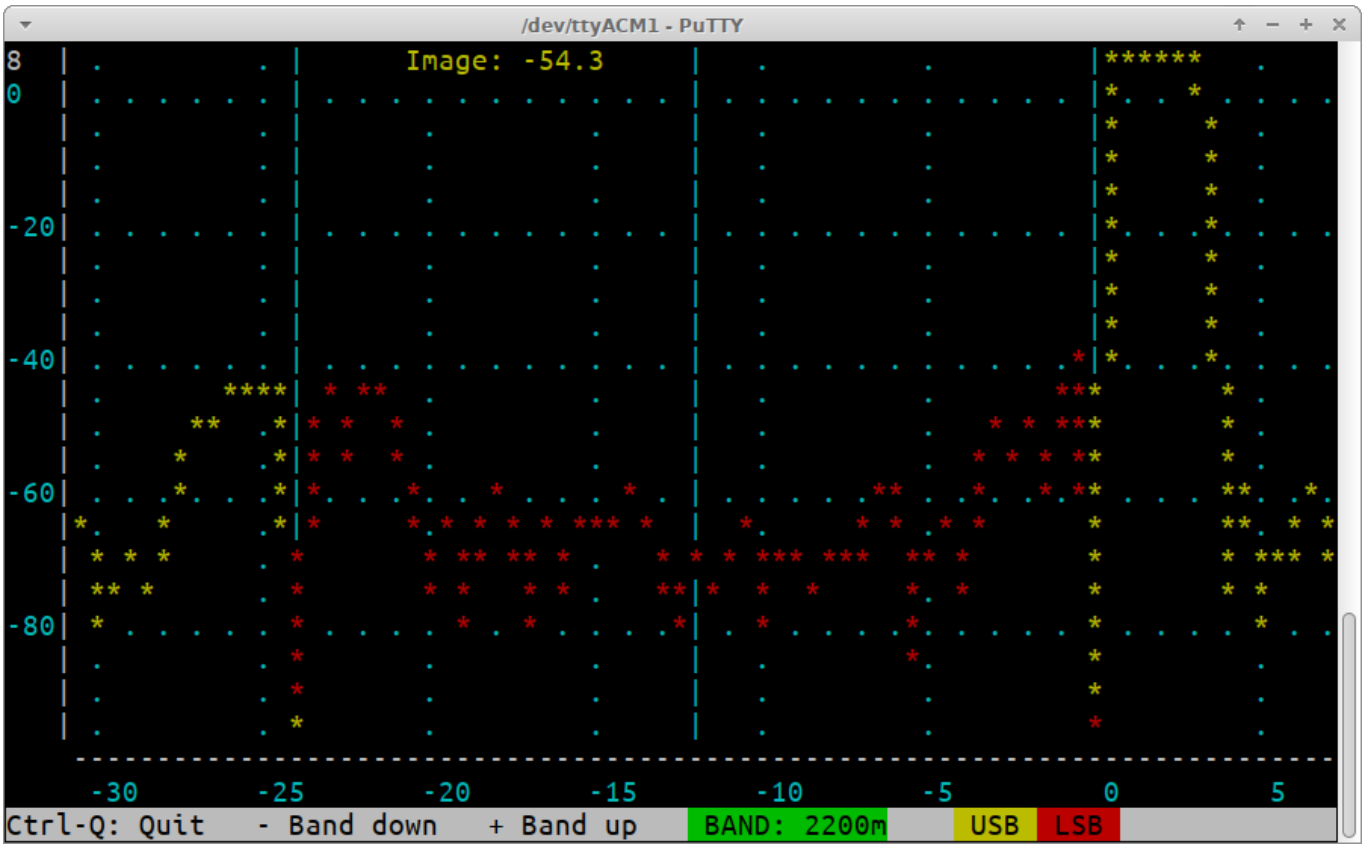


For testing the Receiver section, use the RF Sweep tool in the terminal. Note that the first RF sweep in the tool MAY have a firmware bug which causes inaccurate results. So you can press the ‘R’ key on your keyboard to re-run the RF Sweep.

There should be a peak somewhere near the band center frequency (indicated by the vertical dashed line) as shown below. It isn’t terribly critical if the peak occurs a bit to the right or left of this. But if you are a perfectionist you may wish to add or subtract a turn or two on L12 to move the peak to the left or right respectively.



You also should run the Image sweep, to check the image rejection of the receiver. The results should be something like below. There will be quite a lot of variation in the image measurement but if you have an image rejection very low, such as -3, -4, -5dB etc., that will probably indicate a winding issue or installation issue with the T2 trifilar transformer, or perhaps a defective multiplexer IC in the quadrature sampling detector.



The remainder of the assembly and operating procedures are the same as for the regular HF QDX-M transceivers, please refer to the normal manuals for these.

Acknowledgments

I am very grateful to Ross EX0AA who worked together with me on this low frequency QDX-M, Ross has done a lot of field testing, filter design and QDX-M builds to develop the final design.

5. Document Revision History

1.00	19-Sep-2026	First version version