

Project Notes: Adding Capacitive touch keying to the QMX.

Goal of the Modification: Add the ultra-tiny K6ARK capacitive touch keyer mod to this radio. Why? Because I think that 10lbs of stuff in a 5lb sack is not enough. 10.1 pounds of stuff would be just right. Also, how cool it would be to have touch keying built into a QMX.

Challenges: There are basically three challenges to making this mod.

- 1) Where to put the board.
- 2) Where to put touch pads/posts.
- 3) How to assemble the radio with the mod.

Parts List:

- 1) The [K6ARK Capacitive touch PCB](#)
- 2) 4-40 Pan head bolt, QTY 2 (Believe I used 5/16") It was from [this kit](#).
- 3) 4-40 Acron Nut, QTY 2, [Pack of 10](#)
- 4) 30 ga wire – I used multiple colors from [this kit](#)
- 5) Kapton tape. I had on hand but previous bought [this kit](#).
- 6) VHB Tape to secure the board internally. I had on hand but previously [purchased here](#).
- 7) A [3D-print of my touch key bracket](#) (Recommend using PETG)

Placement of the PCB: Due to the small size of the K6ARK board, there were several places the board could mounted. Trying to solve the issue of how to assemble the board further drove the placement of the board. The board has seven connections. The TIP and RING signals are located on the underside of the main board. I chose to have the touch board located on the main board to avoid an having to modify any of the boards and to simplify the assembly. I choose to place the board on top of the USB connector. This is a great spot to put the board. With the QMX's very dense internal layout as well as the sandwich method of both the cards and the case in addition to finding space for where to put the board and the post you also have to be able to assemble the board.

Placement of the touch posts. This was interesting challenge as you have to think about how you operate and how to assemble the radio with the modification. I decided to take advantage of the case's clamshell design. I created a 3D print touch bracket that straddles the case wall at the junctions of the two halves of the case. The slot is sized for a snug fit to the case wall with no play after assembled. I decided to place the touch post bracket on the case the between the BNC jack and the L401 BPF directly across from T507. See Figure 1. In addition to this spot not having a component right next to the edge of the board (R522 is the closest), it allows you to hold the QMX in your left hand (BNC Jack pointed up) while keying the radio with your right hand. The 3D printed bracket allows for the 4-40 screws to be recessed into the part with the dit and dah signal wires being captured by the threads of the bolt.



Figure 1: Touch Panel Bracket Location

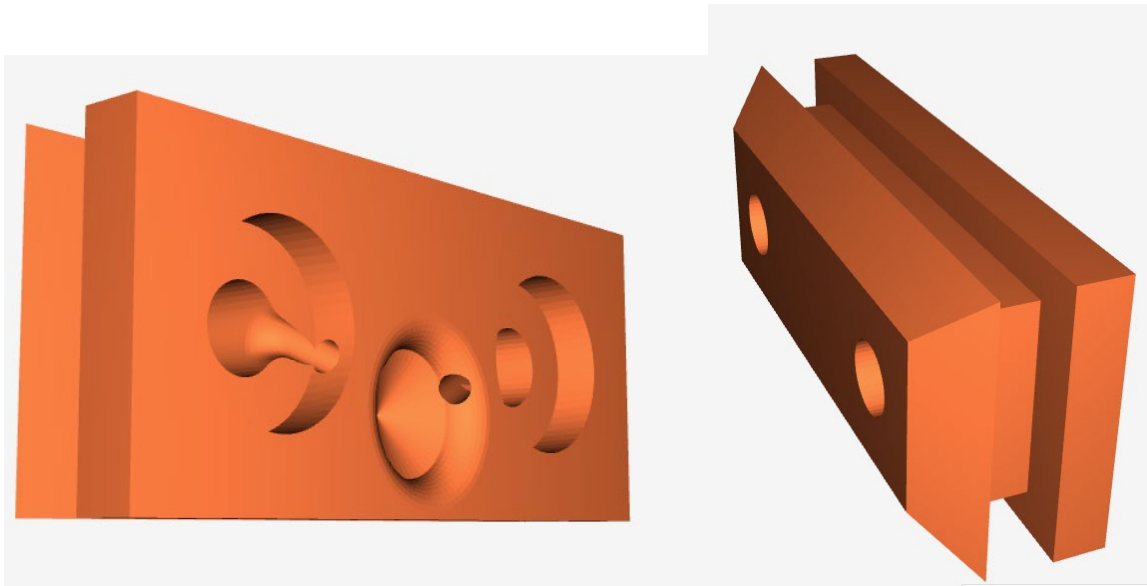


Figure 2: Touch Panel bracket

Before starting this modification, put your QMX into practice mode. The touch circuit is very sensitive and if you cross the dit or dah wires during assembly it may have your QMX go into transmit as soon as you turn it on after the mod. Once you verify everything is operating properly after the mod, then you can take the QMX out of practice mode.

Modifying the Case: The horizontal center of the printed bracket was placed 19mm from the BNC end of the case without the end plate on the case. Vertically the bracket ended up slightly below the center of the seam of the clamshell case. Here is my recommended method for making the cuts.

1. Take measurements of the slot in the bracket your 3D printed bracket. 3D printers may have some calibration variances so use the measurement of your bracket. You may want to print two of the brackets. One to use while doing all the fitting and then a fresh one once you have the slots completed.
2. Focus on the top half of the clamshell to start. Using the width measurement of your bracket mark the case for that width center on your chosen location. (For my mod, the opening was centered 19mm in from BNC end of the case).
3. Using your favorite cutting tool for detail work (Dremel, keyhole saw, hacksaw, etc...) cut out the opening in just the tongue portion of the case. I would cut to the inside of your marks. Using a small file, "sneak" up on your marks. Using your 3D printed bracket test the side-to-side fit until you can snugly get it to go into the opening you cut. Since we are not cutting down into the full thickness of the case at this point, the bracket will be loose in the in-out direction.
4. Once you have a nice snug side-to-side fit, you can start cutting down into the full thickness of the upper half of the case. There is about 11.3mm of clearance between the two PCBs in this area and touch key bracket is 10.5mm at the vertical shoulders so there is some wiggle room for placement. The distance between bracket groove and the shoulder is 2.5mm. I recommend measuring 3mm down from the upper PCB as your depth of cut. Once again "sneaking up" on that depth is the safest way to go. When done with this step the bracket should fit very snugly up to the slot for the upper PCB. (See Figure 3, red arrow) Take your time and pause if you feel yourself starting to want to rush.
5. With the bracket installed into upper enclosure, use a caliper to measure the distance between the shoulder of the tongue on the upper half of the case to the groove on your printed bracket. This will be the depth of your cut into the lower half of the case. (See Figure 3, blue arrow)
6. Remove your printed bracket from the upper half of the case and mate the two halves of the case together without any of the PCBs installed. Align the two halves together (you can screw on an endplate if they want to slide around) and transfer the slot mark from the tongue half onto the groove half.

7. Cut the slot into the bottom half of the case down to the depth you measured in step 5. Again, I recommend you sneak up on the measurement and test fit often as you go. When done with step, the case halves should fit together completely with your bracket installed. Your bracket should not have any play.
8. While holding the case halves together with the bracket installed verify that the end plate screw properly line at each end.
9. A bonus check would be to fully reassembly your QMX to verify that you do indeed have clearance at this point. Pay close attention to the clearance of R522

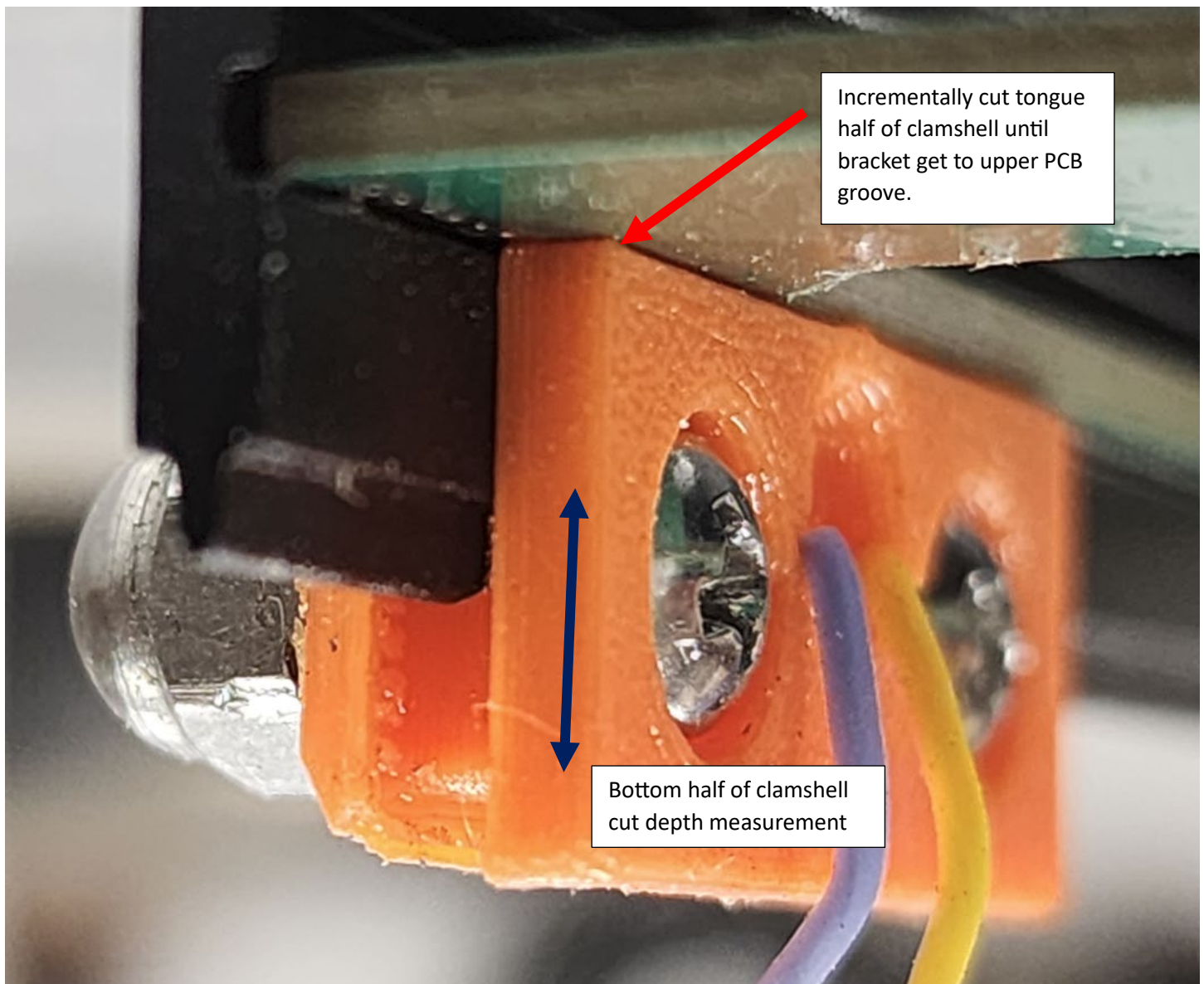


Figure 3: Placement of bracket on the clamshell

V+ and GND Connections: The K6ARK touch key board can accept 3 to 18V. There are many spots to pick up power on the main board. I recommend picking up +12V at Q507 source and ground at PTT Jack. These are right under where the touch board will be mounted. Soldered in those wires with plenty of length prior to mounting the touch key board. (See Figure 4)

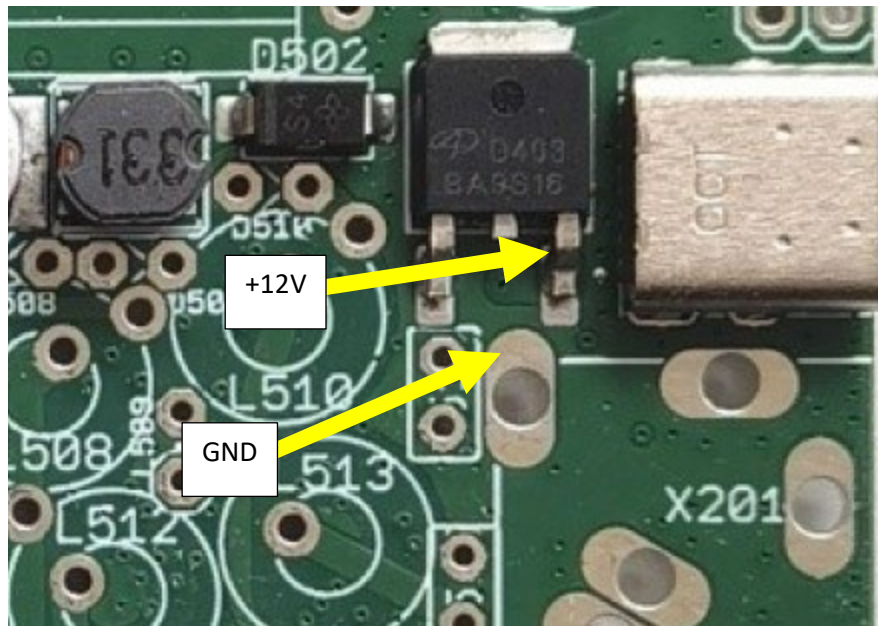


Figure 4: +12V and Ground Connections for the touch key board

Mount the touch key PCB board: The board was mounted on top of the USB jack and the PTT jack. 3M VHB tape was used to affix the board to the top of the USB jack. Two layers of the tape will be needed to account for the height difference between the two jacks. The board just rests on top of the PTT jack. (See Figure 5)

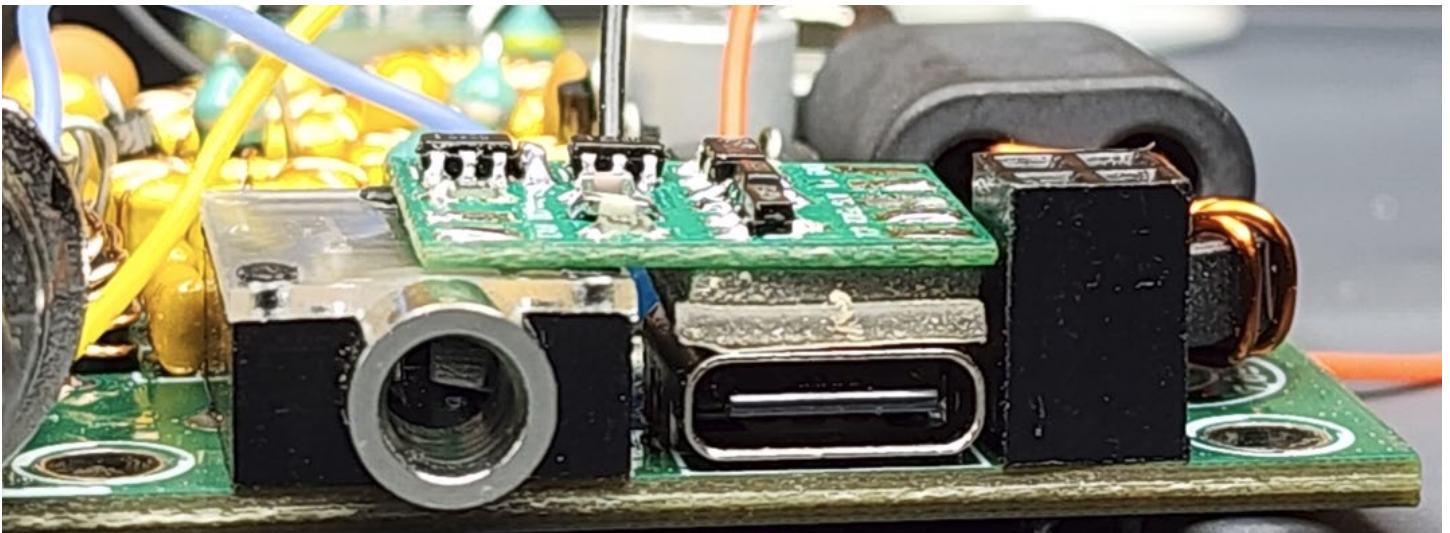


Figure 5: PCB board mounting location

Tip and Ring Connections: The TIP and RING signals are not available on the top side of the main board. I decided to hook to the connection points on the paddle itself vice using other component connections such as R218 or C220. I took advantage of the unused through holes at the BNC jack (these holes support different style jacks such as SMA) to pass two segments of the 30GA wire (BLU and YLW in may case) from the top to the bottom side of the board. The wires are a bit fiddly to get started through these holes. Bent and straight electronics tweezers can help with this effort. Route the wires to try and keep the wires as low profile as possible. Secure the wires to the board using Kapton tape to keep things tidy and low profile. (See Figure 6) If I was to do this mod again, I would route them slightly differently to avoid crossing the wires over one another.

Sleeve connection: The sleeve connection on the paddle jack of the QMX is grounded. The K6ARK CW touch board sleeve terminal is wired to the ground connection internally. The touch board, the QMX board and the paddle jack sleeve connection all at tied the ground. I found that a dedicated wire between the touch board and the paddle jack was not necessary.



Figure 6 – TIP and RING signal wire routing on bottom side of the board.

Touch Posts Bracket wiring: You should avoid having the dit and dah wires cross one another as they can trigger one or both of the dit and dah inputs of the touch key board. I had trouble getting the wires to not to cross when assembling the enclosure so I switched from the 30ga individual wires to small segment of computer ribbon cable I had laying around. The same thing could be achieved with some heat shrink or more careful routing than I originally performed.

- 1) Screw the 4/40 screw in and out of the hole a couple of times to establish the threads in the post holes then remove the screw. This is also a good time to make sure that you have the right amount of thread sticking on the far side for the acorn nut to tighten down on.
- 2) Cut off enough wire to enough wire to reach from PCB board to the bracket along with enough to work with.
- 3) Strip off enough wire at one end to reach from the center recess to the far side of the bracket. Carefully pass the bare wire from the center recess through the hole into the post screw hole. Get it to pass to the outside of the bracket. A needle may help to poke and fish to the far (out) side *(If using ribbon cable, you will need to do this steps 1-3 to both sides at the same time)*
- 4) Screw the 4/40 screw into the post hole. It will capture the bare wire and make the electrical connection
- 5) Use a utility knife to cut off the excess wire flush with the outside of the bracket.
- 6) Screw the 4/40 acorn nut onto the protruding screw
- 7) Repeat steps 1-6 for the other post.

Dit-Dah Signal Wiring: *(I learned CW left-handed and picked up using my right hand later. It was pretty easy to pick up with the right hand by flipping the paddle. My thumb of both hands are dahs, index finger are the dits.)* Correlate whatever post is going to be your “normal” dit. As mentioned before, you want to avoid crossing the wires over one another. I used some computer ribbon cable I had laying around but a few snippets of heat shrink would work as well. Leave enough length so you can manipulate the bracket into place during case assembly.

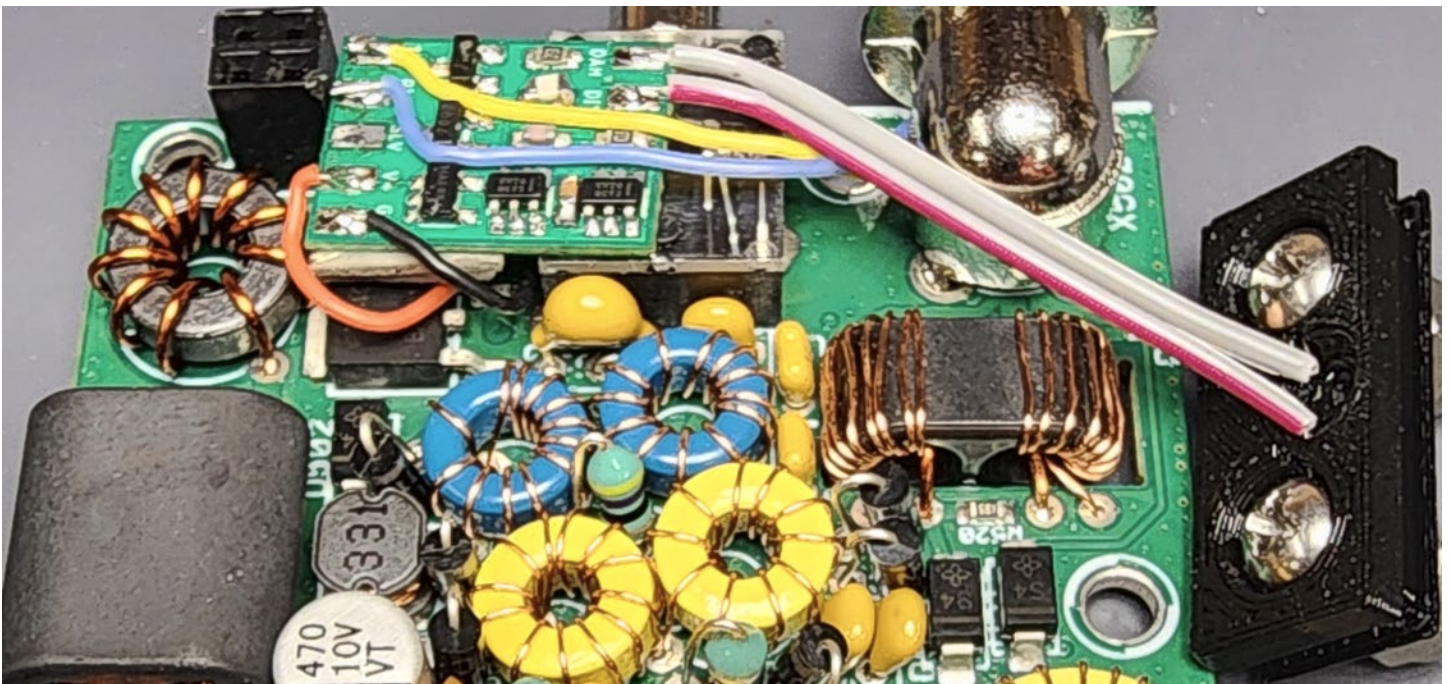


Figure 7 – Dit – Dah Wiring from bracket to board (The wire length could be just a touch shorter)

Assembling the case: Follow the normal assembly instructions in the QMX assembly instructions up through Step 6 (Sliding display board into upper enclosure) During Step 7 (Attaching main board front of enclosure) slide the touch key bracket into the slot you cut into the front half of the enclosure. During Step 11 (putting bottom/back enclosure on, you will need to make sure get bracket groove lined up in addition to the enclosure’s tongue and groove.

Final Bits: It can't hurt to put on a dummy load before the first power up, but if you put the QMX into test/practice mode before you started this project it should still be in test mode. Verify that the touch keying is working while in test/practice mode. After that test again with it out of test/practice mode with a dummy load on to make you are not getting RF feeding back into the keying circuit and causing problem.

Go do some of that on-the-air radio stuff!