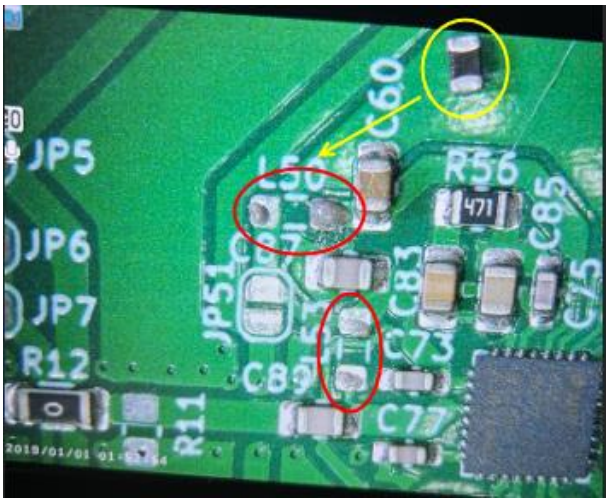
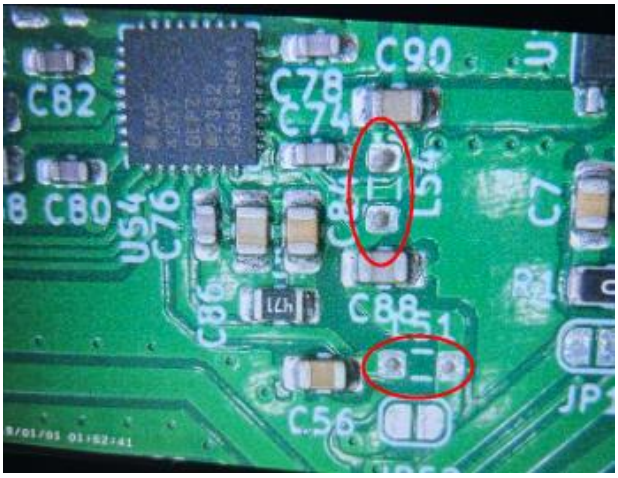
The examples shown in this document illustrate one method of soldering SMD parts. These images resulted from the construction of a PA0MHE control board which is used in tandem with the “XP” Wavelab 23 GHz module to assemble a 24 GHz amateur radio transverter.

SMD parts *can be soldered by hand* without the use of a hot plate and the board illustrated here did require hand solder “touch up” on U3 after using the hot plate method. Also, L50 was manually desoldered and a new part was placed/soldered after locating the “open” at L50 during initial synthesizer lock checks (see description & photo at end of document).

Solder paste was applied to pads for L50 and L53 (circled red) Right hand pad for L50 has excessive paste. L50 component (circled yellow) will be placed on pads next.



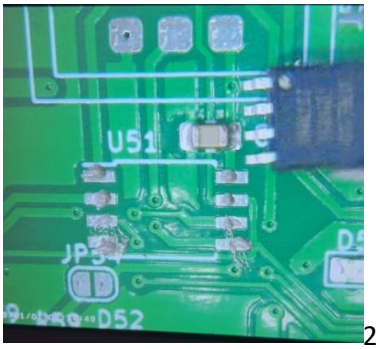

Solder paste applied to pads for L54 and L51 (circled red). This example of solder paste application is about right.



Some videos to help

1.Placing the ATTINY85 on pads primed with solder paste.

https://youtube.com/shorts/euPIJfmPVO0?si=E6BqaUZgK5ik79Lk



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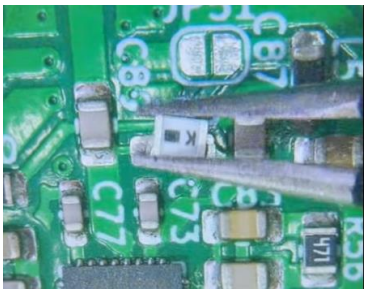
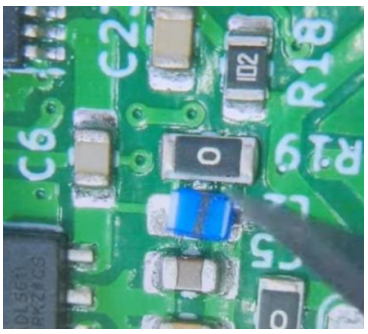
2.Placing inductor L53 on pads primed with solder paste.

https://youtube.com/shorts/4iMFXN1mRAQ?si=pA_LqBgIKnoHdcVW



3. Tweaking position of inductor L2 using X-acto knife on pads primed with solder paste.

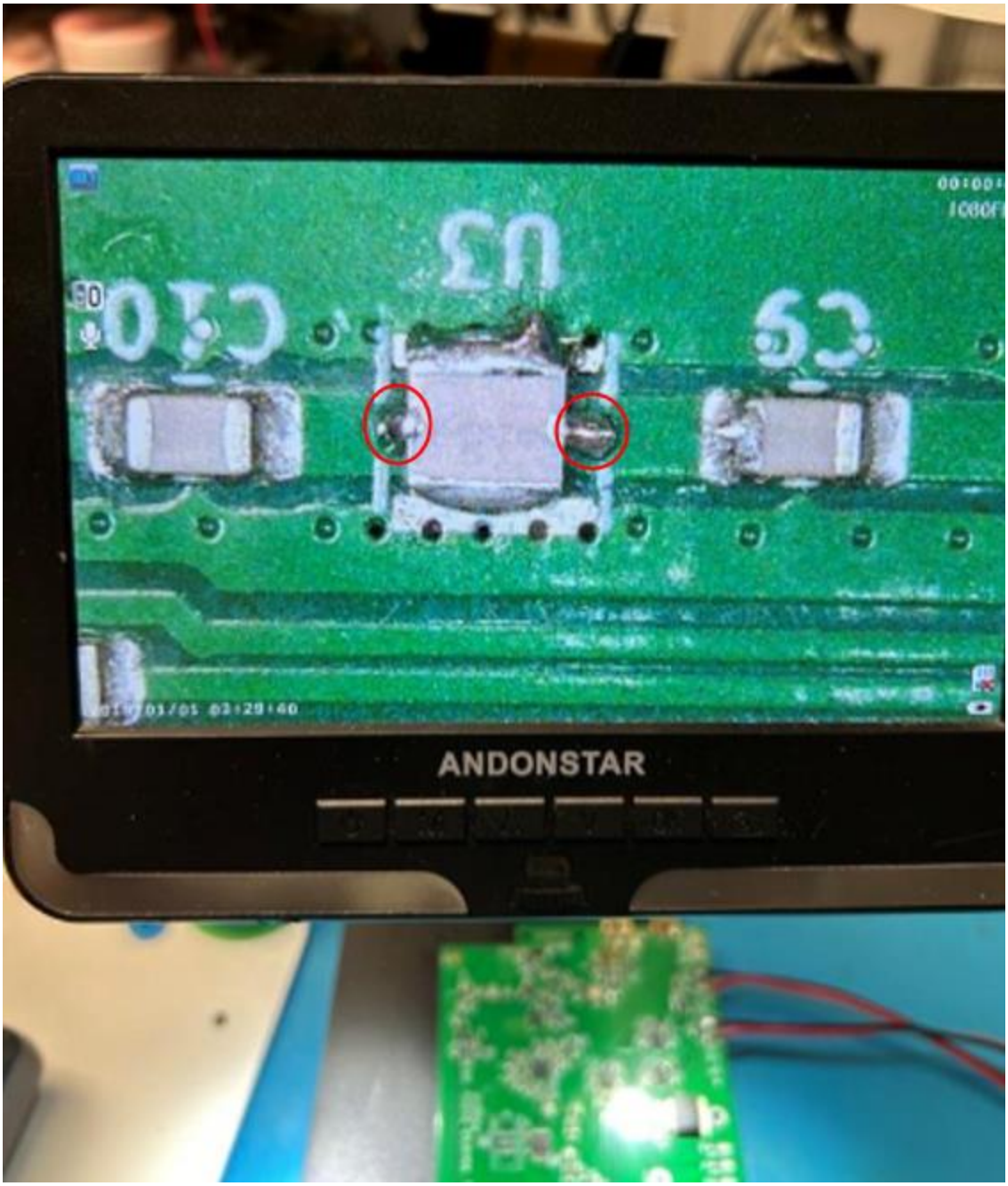
https://youtube.com/shorts/ng72JkhUx5k?si=B-gHDX6O3btdjJZL



After all solder paste has been applied to pads and the parts have been placed, the board is placed on a hot plate with temperature set to 116 C.


Testing the temperature of the board in Fahrenheit. Should come up to approximately 230-240 degrees F. Once at temperature a hot air gun set to 800 F is used to cause solder to flow. The tip of the hot air gun is held approx. 2-3 inches above the board and the hot air flow is directed to the parts that require soldering. The tip is held perpendicular to the board to reduce the tendency  of the airflow to move a part. The tip of the hot air gun has an opening of 4 mm.

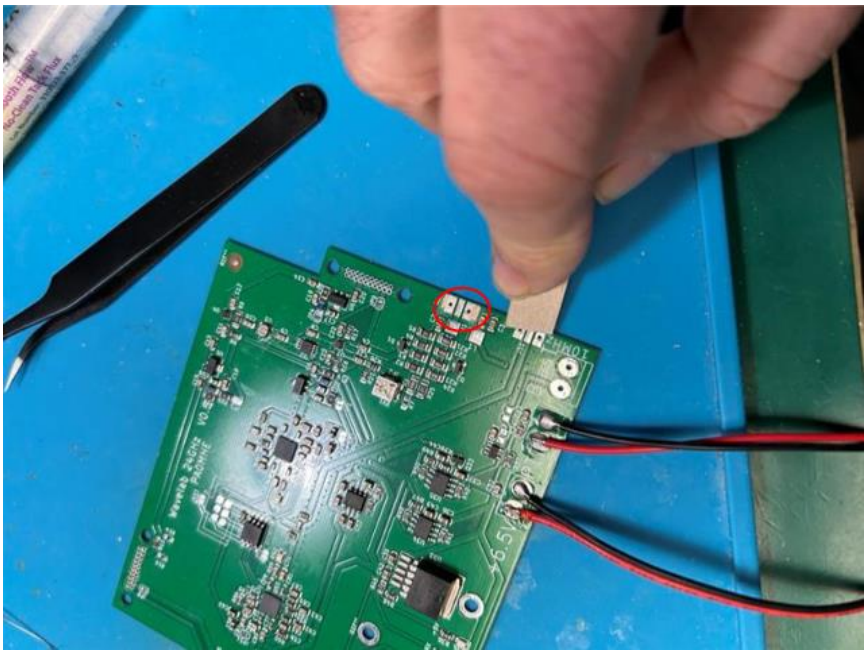
U3 part is challenging to “bridge” ports with solder. Align the part and manually solder (tack) the outside grounded edges first, then work on the ports. Check continuity from C9 to C10. There should be zero ohms between the filter side capacitor parts pads.

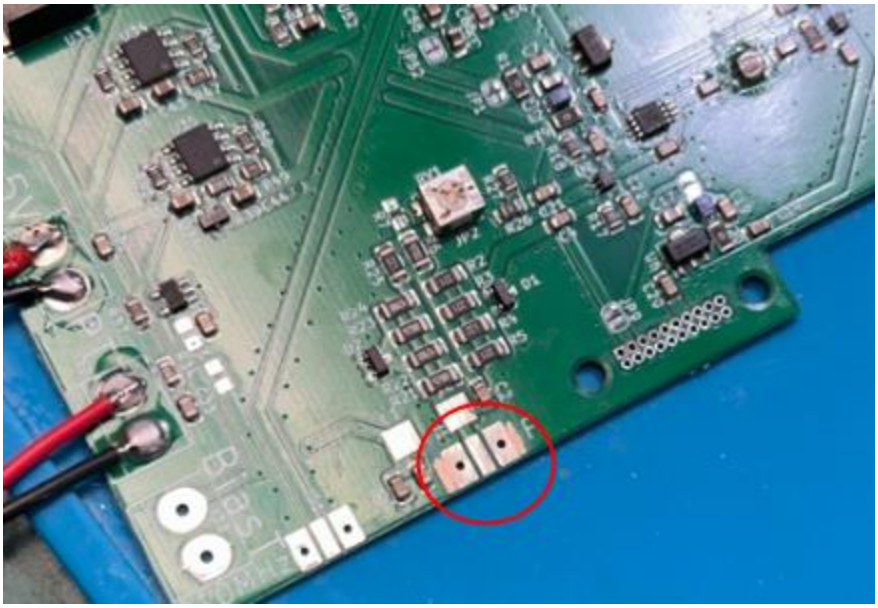


The ATTINY looks a little dry after the hot plate heated flow of solder paste but was OK in performance.


During the primary transmit mode DC voltage checks, pins 9-10 on J2 are required to be shorted which simulates feedback from the Wavelab module. I use a small diameter wire bent in a U-shape and inserted from below the board up through pins 9-10 to perform the short.

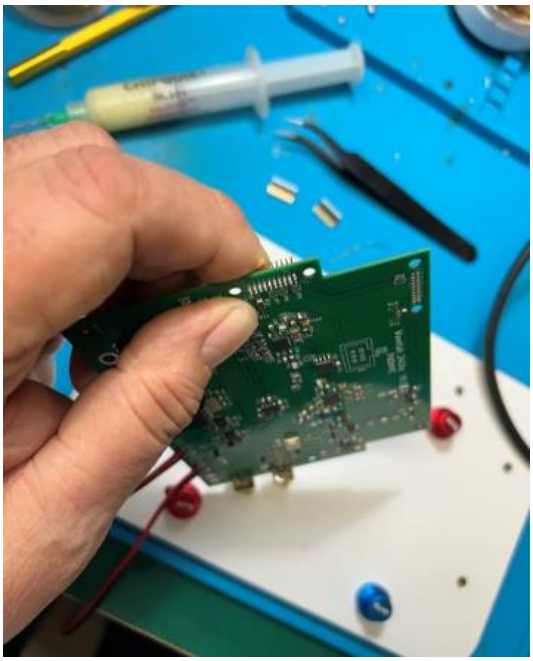
Some kits of parts contain an SMA connector larger than the ground footprint on the pad. I use a nail file to rough up the board and expose the copper on both sides of the SMA connector to ensure a good ground connection is made when the connector is soldered in place.



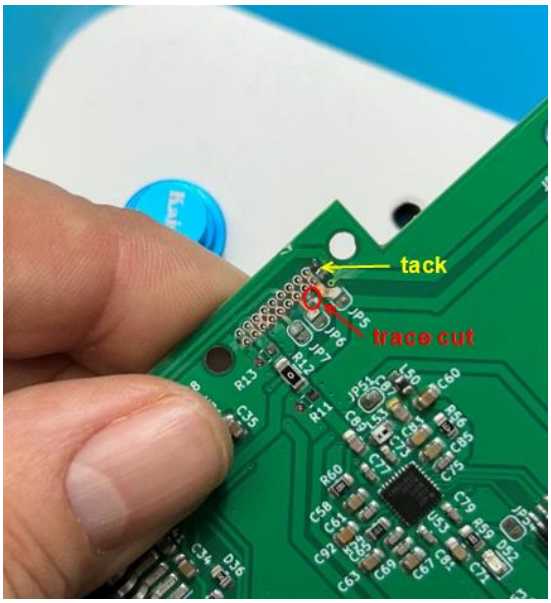


At this point in construction, the board has passed all DC checks, the synthesizers are locking correctly and generating two frequencies correctly. I will rough up the edge pin connectors pads (J2, J3, J4) with a nail file in preparation for soldering the header pins.

Holding the header pin from below the board (don't hold pins you intend to heat) check the alignment of the pin set to the board and then tack solder a few pins to hold the pin header in place.



The yellow arrow points to the pins that can be tack-soldered on J2. Also in this image is seen the trace cut (circled red) which disables the module pin attenuator in the PA stage. This allows for a slightly higher 24 GHz output power. More detail on the pin attenuator mod can be found on page 53 of the document located here:
https://www.ntms.org/files/Jul2023/Wavelab%2024%20GHz%20project%20KM5PO%20230526%2050up.pdf

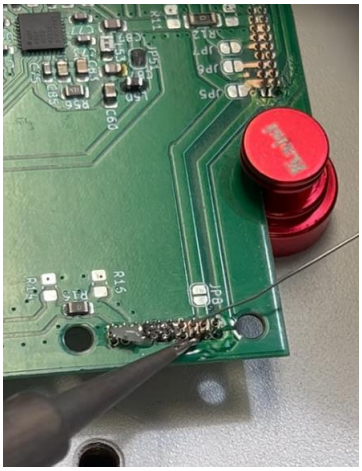


For connector J3, 5 pin sets are grounded and make good pins to tack-solder the header in place.

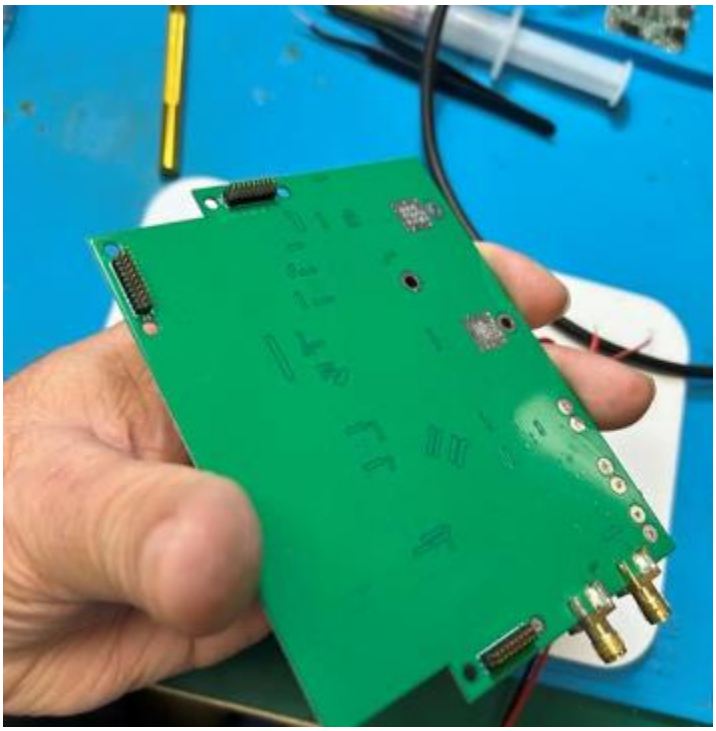

For connector J4, pins 19-20 make good pins to tack-solder the header in place.

Video: Soldering header pins – shaking hands can get it done!

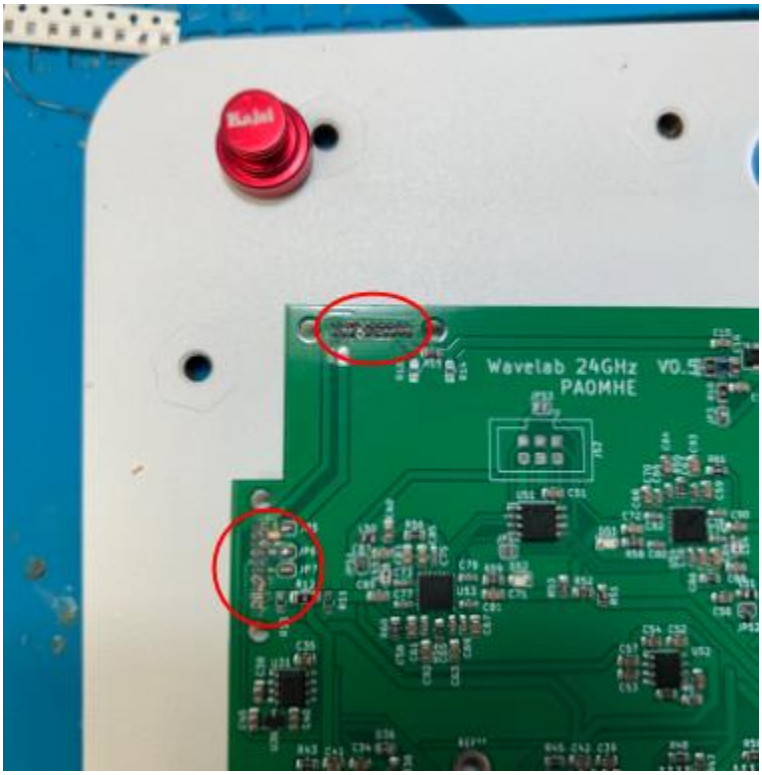
https://youtube.com/shorts/3z8DgnW3jVk?si=jOxP2TLyoU9X4CXI



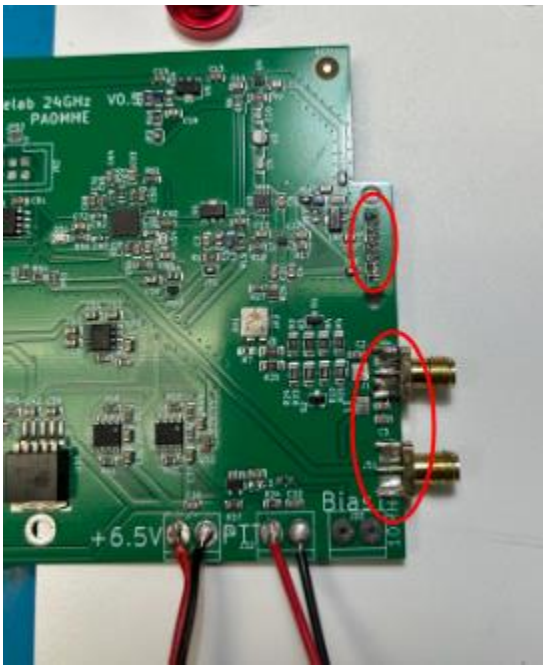
Once pin headers are soldered in place, check the alignment with the board.



Header pins are complete, all jumpers closed.



SMA connectors soldered in place.




In troubleshooting the lack of lock on U53 an unexpected voltage drop across L50 was observed. L50/C60 are on the chip enable pin of the U53 synthesizer which needs to see 3.3v. The voltage at L50/C60 was 2v but the voltage at L50/JP51 was 3.3v. It was obvious that L50 had lost it's low resistance and needed to be replaced. Note that in this condition, U53 drew the normal amount of current because Vcc is supplied through other chip pins. Once L50 was replaced, the synthesizer was enabled and locked immediately.