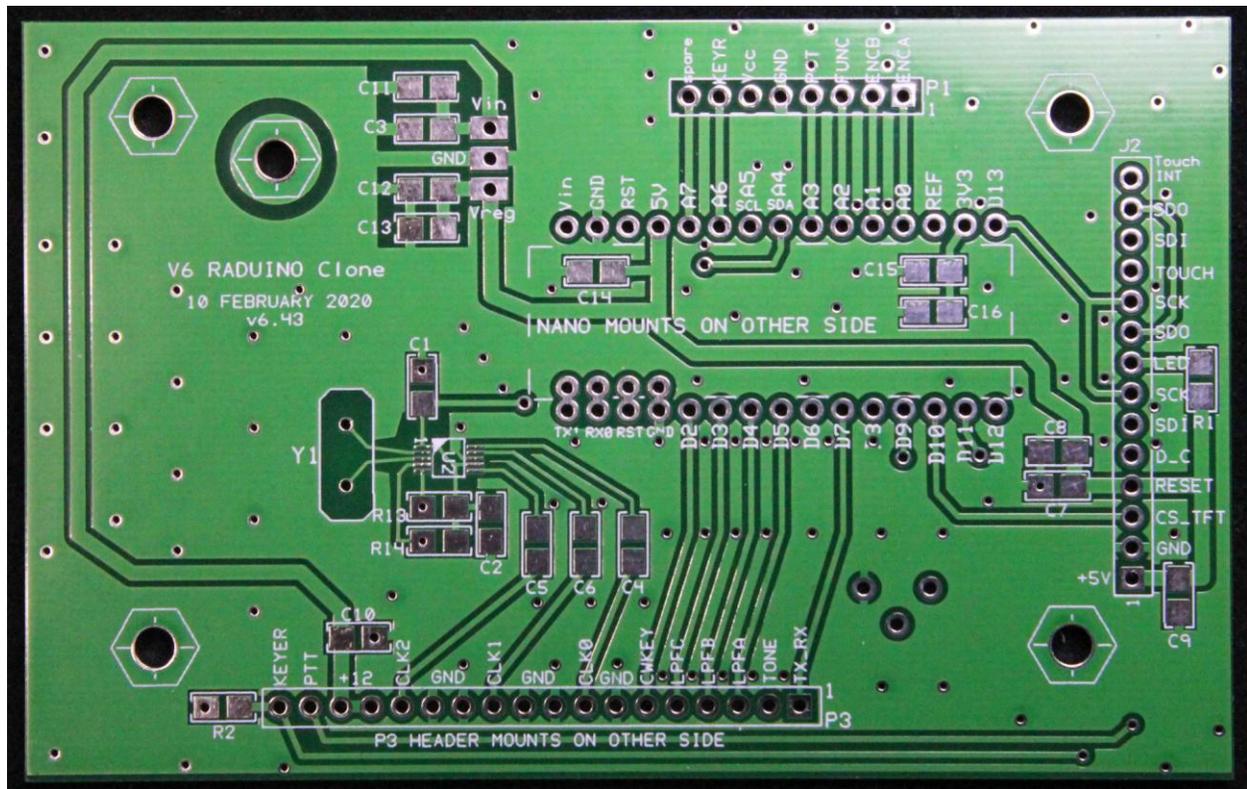


Construction Manual

“Triumvirate Skonk Worx” (TSW) Raduino Clone Kit for the HF Signals uBITX Version 6 Transceiver Version 6.43

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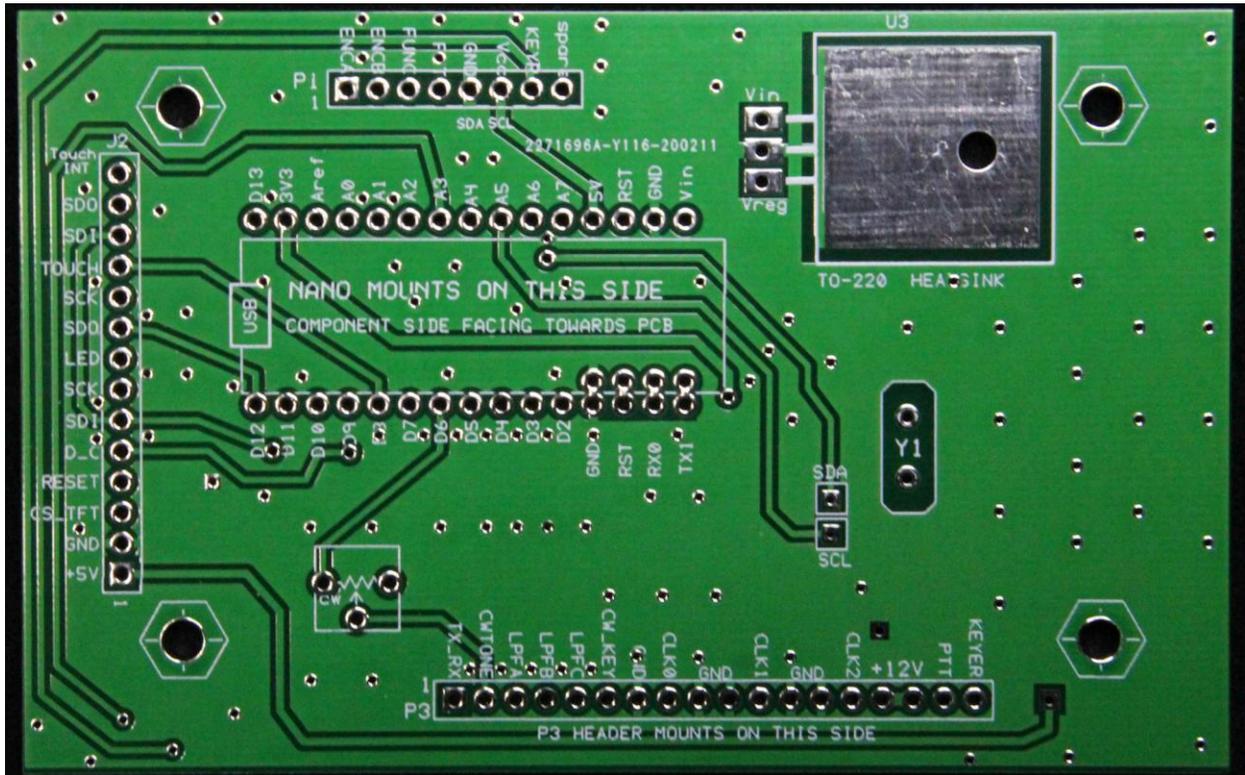
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TSW Raduino Clone V6.43 Bare PCB Front Side

In response to the fact that some of the new users of HF Signals’ latest kit, the uBITX Version 6 have accidentally damaged the “Raduino” plug in card or somehow rendered it inoperable, and HF Signals doesn’t have replacements readily available for sale at this time, TSW has quickly moved to fill that gap with our “Clone” of the V6 Raduino. It’s laid out a bit differently but fits the same

footprint as the original factory board with the display mounted so it will easily install and fit in the really nice case that is included in the uBITX Full Kit from HF Signals (the \$200 version). Bear in mind this “clone” is not intended to be something “better” than the factory Raduino, only a convenient replacement for a broken one at this time.



TSW Raduino Clone V6.43 Bare PCB Back side

Except for the very small Si5351 clock/vfo IC, we chose to use all 1206 size resistors and capacitors to make kit construction a bit easier for those who don't like to work with the smaller (0805 and smaller) surface mount components. It was decided that all the V6.39 (and possibly later) kits will already have the Si5351 soldered in place and checked for proper connections to ensure the highest probability of successful kit completion and operation. The CPU for our “clone” can either be an Arduino NANO programmed to the Factory's original V6.1 code which will be included with the kit or an optional PJRC Teensy 40 that can be used by purchasing one of TSW's Teensy 4 to NANO plug-in adapters. TSW does NOT provide a programmed Teensy 4.0, the user has to order it from PJRC

and program it themselves). For the advantages of using a Teensy 4.0 with the V6 Raduino (either the factory Raduino or TSW's Clone) see Appendix E, this manual.

Construction:

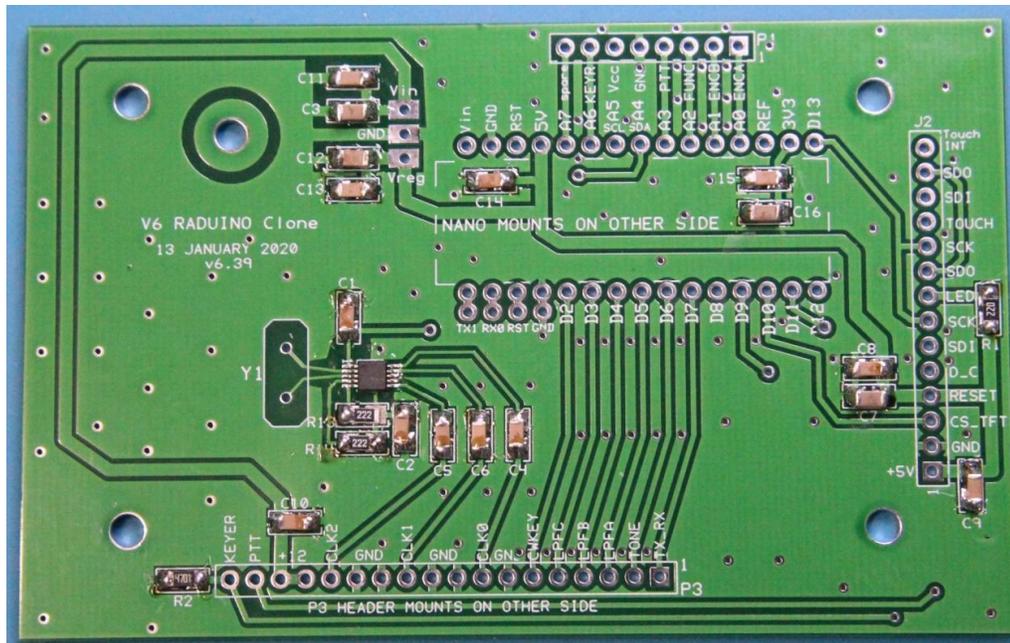
1. The first thing you want to do is inventory the supplied parts for the kit against the "bill of materials" located in an appendix to this document. If any are missing contact Jim, W0EB via email, w0eb@cox.net and let him know what you are missing. The missing part(s) will be sent quickly.
2. The first actual construction step will be to carefully install all of the capacitors. Start with the 0.1 uF 1206 ceramic capacitors which are C1, C2, C4, C5, C6, C8, C10, C11, C13, C14 and C15. Unfortunately SMD capacitors are not marked so be careful to remove them from the packaging and install each value in the sequence used in this manual.

The easiest way to install these is to first apply a small amount of solder to one of its 2 pads. Pick up a capacitor very carefully with a pair of tweezers and place it next to that solder blob. Heat the solder to melt it while carefully sliding one end of the component onto that pad and once positioned remove the soldering iron. Once the joint has cooled, carefully solder the other end. This technique should be used for all the surface mount (SMD) capacitors and resistors.

3. Install C9, the 1.0 uF 1206 ceramic capacitor, using the same technique described in step 2.
4. Install the four 10 uF, non-polarized 1206 ceramic capacitors C3, C7, C12 and C16 like the others.
5. Now that you have the capacitors installed, go back and check each one to insure both ends have been soldered properly and there are no shorts to

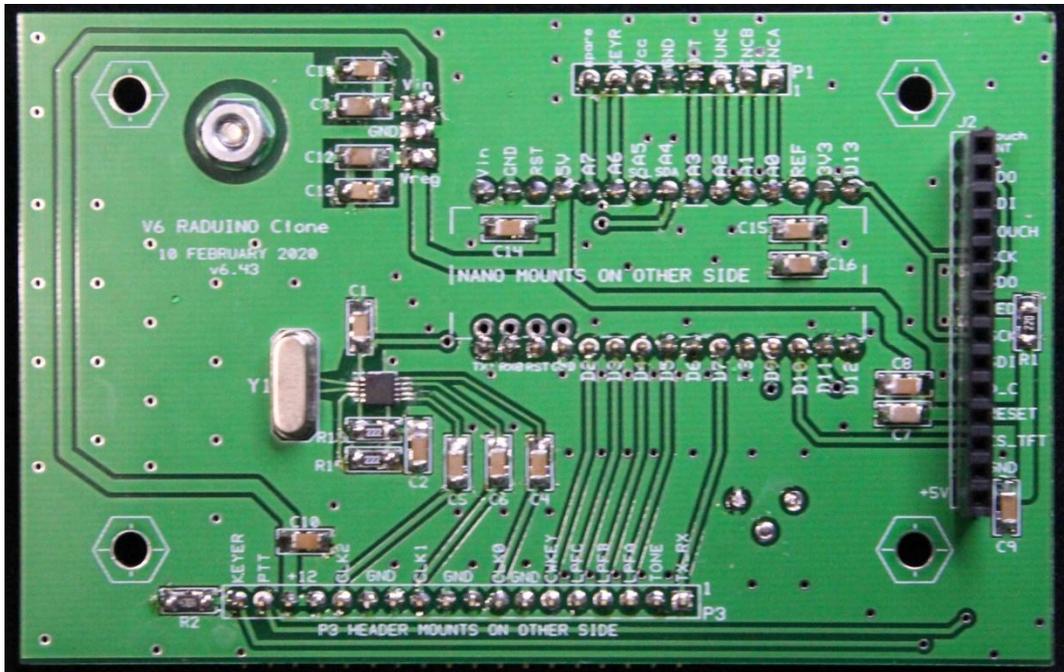
ground or to other nearby components or PC traces.

6. Install the two 2.2K 1206 SMD resistors (marked 222), R13 and R14 located right under U2 (the Si5351 IC) using the same technique you used for installing the capacitors. They are labeled as R13 and R14 as a holdover from a previous schematic and to set them apart from the other 3 resistors that will be installed next, this is not a typographical error on the schematic.
7. Install R1, the 22 ohm (marked 220) SMD resistor located next to the display socket J2 on the right hand side of the board.
8. Install R2, the 4.7K 1206 SMD Resistor (marked 4701) located on the bottom left of the PCB next to the “Keyer” pad for plug P3
9. Install RS the 5K Sidetone level adjust trimpot on the back side of the board just under the NANO outline. Solder & check the 3 pins on the opposite side of the board.
10. That completes the hardest part of constructing this kit. All other components will be of the larger, through-hole variety. Before continuing, go over all component positioning and solder joints to make sure they are correct.



TSW Clone board with all SMD components soldered in place (pix is of older board).

11. Y1, the 25 MHz crystal. Insert it from the same side of the board as all the surface mount components are on. The solder pads on the underside of the crystal have been made deliberately small so the through-hole plating won't short out to the crystal's protective can. Turn the board over and solder one of the pins. Check to see the crystal is tight to the board. If not, heat that connection again while pressing down on the crystal until it is tight, then solder the other terminal, clip the leads short to the board and check for good connections and no shorts.
12. J2, the 14 pin female display connector. Insert it into the 14 holes on the front side of the PCB but turn the board over and solder the pins on the back side. Solder 1 pin first and check that the connector is perpendicular. Reheat the pin and reposition it as necessary. Once you're satisfied that everything is the way you want it, solder the remaining pins and check to make sure you get them all and there are no pins shorted to each other or ground (except of course, the ones that are supposed to be grounded – HA HA).



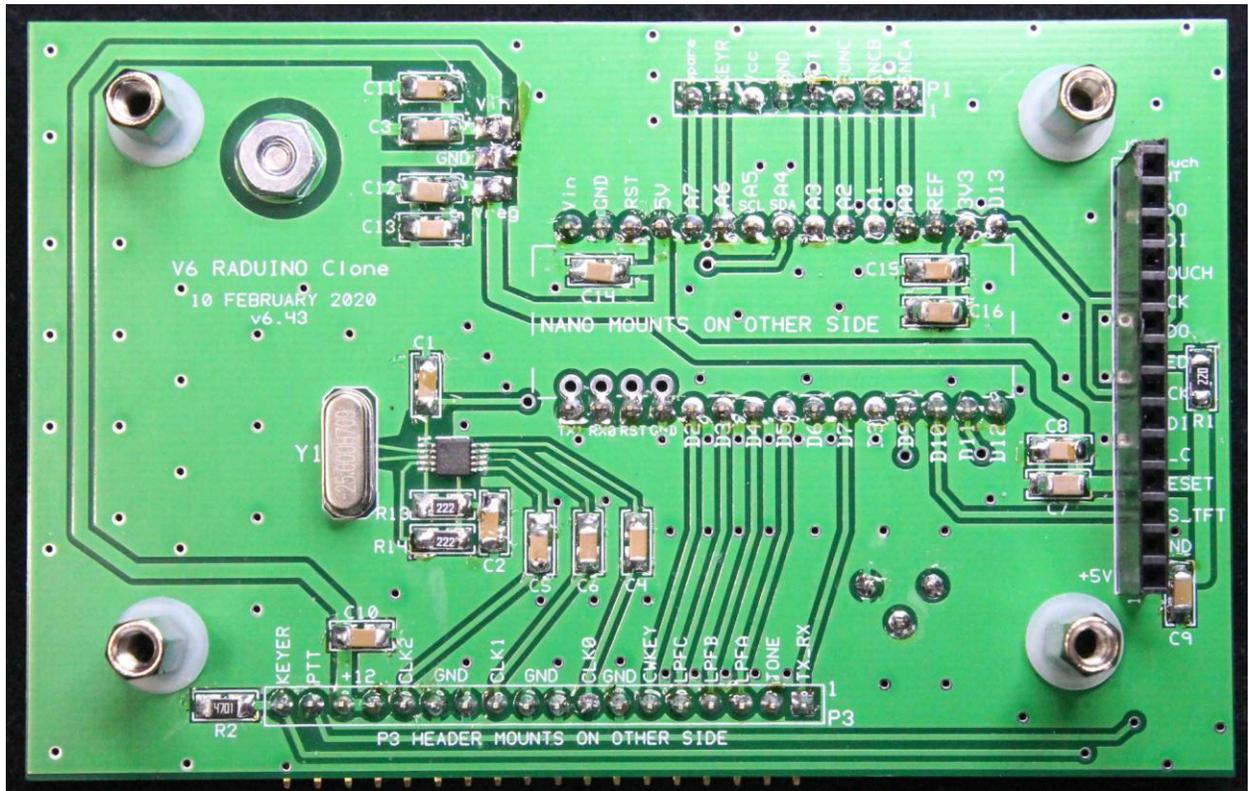
What the front side of the PC Board should look like when completed.

13. Turn the board over and install the two 15 pin female connectors that form the socket for U1, the Arduino NANO. Install one side first using the same technique to position them properly you did when installing J2 and when you are satisfied, install the other one (Use caution when soldering on this side of the board that you don't let the hot iron touch J2 (the display connector) or you may melt part of it and render it unusable.) Check the pins for proper solder and no shorts.

14. P1, the main "Controls" connector. This is actually a "molex" style, polarized connector. The pre-wired (from the factory) plug from the tuning encoder/pushbutton switch will plug into this connector. Insert the connector, with the solid, polarizing tab below the pins. (Refer to the photo on page 7 for correct mounting.) Insert it from the same side you mounted the NANO socket on. Solder one pin on the opposite side, heat that pin and reposition as/if necessary until you are satisfied it is sitting properly and then solder the remaining pins. Check your work as before.

15. P3, the 18 pin, right angle male connector. Insert the short ends of the 18 pin Male plug into the holes labeled P3 on the BACK side of the board. Turn the board over and solder one of the middle pins to tack it in place. Examine the positioning of the longer pins. They should protrude and the long ends should be parallel to the PC Board. If not, heat the pin you just soldered and carefully reposition P3 until its separator strip is flat to the PCB and the long pins are properly positioned. Once you are satisfied, solder the remaining pins and check your work. This completes the majority of the work.
16. On the back side of the PC board, carefully install U3, the 7805 voltage regulator and its heat sink. Insert the 7805 the bare metal on the backside will be in contact with the heat sink when finally mounted. Carefully bend the 7805 down so that the leads are curved and the tab's mounting hole mates with the mounting hole in the PC board. Place the heat sink under the tab and carefully position it so the provided 4-40 by ¼ inch screw will pass through the tab, the heat sink and protrude from the front side of the board. Put the 4-40 nut on this screw, make sure the heat sink is positioned within its outline on the back side of the PC board and the 7805's pins are inserted in their respective holes properly. Tighten the nut as snugly as you can without damaging the PC board. Solder the 7805's three pins, making sure the solder flows through the holes to the opposite side of the board as well to make sure the connections are nice and tight.
17. NANO. You need to solder the pins on the included, pre-programmed Arduino NANO. Take the pair of 15 pin male headers out of the NANO's package and carefully insert them into the 15 pin sockets on the back of the Clone PC board with the short pins sticking up.

Place the NANO over the pins so the USB connector is between the main PC board and the NANO and the USB connector points to the side away from the regulator. Carefully solder the 30 pins to their respective pads on the NANO making sure you get good solder connections to all 30. See the picture on page 10 of this manual for proper orientation. Once all pins are

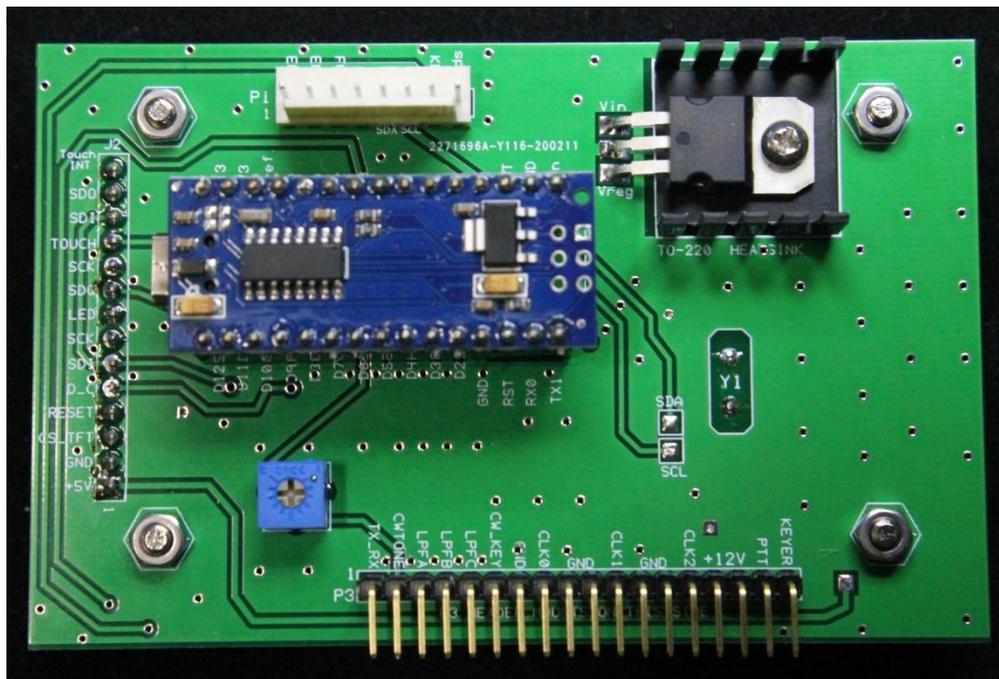


Front side of PC Board showing alternate standoffs and plastic washers correctly installed .

Display. The 2.8 inch ILI9341 TFT display that was supplied with your original uBITX V6 kit should be installed on this board unless it has been broken somehow. If it can't be used, you will have to procure a new display. The ones I use here in the US are by "HiLetGo" and are available for about \$14 on Amazon.com Make sure they are the ones WITH TOUCH as they sell a cheaper one that does NOT have the touch screen. Once you get a new display, the first thing you need to do is check the back of the display board. There is a "solder blob" jumper called J1. The ones that come from Amazon do NOT have this jumper shorted by solder. You first need to drop a solder blob on this jumper as it puts the display's 3.3Volt regulator in circuit. The main power to the display is +5 Volts so the 3.3V regulator needs to be in circuit or the display could be destroyed. Without it, it will not work for sure.

19. Insert the display's 14 pin male connector into J2 and make sure its 4 corner holes rest on and match up with the threaded holes in the female ends of the standoffs. Locate the four 3 by 5mm standoffs and insert the male end through the 4 corner holes in the display and screw them into the standoffs that are mounted to the main PC board. Snug these but do not over tighten them or you may damage the display. This completes your TSW V6 Raduino Clone kit.

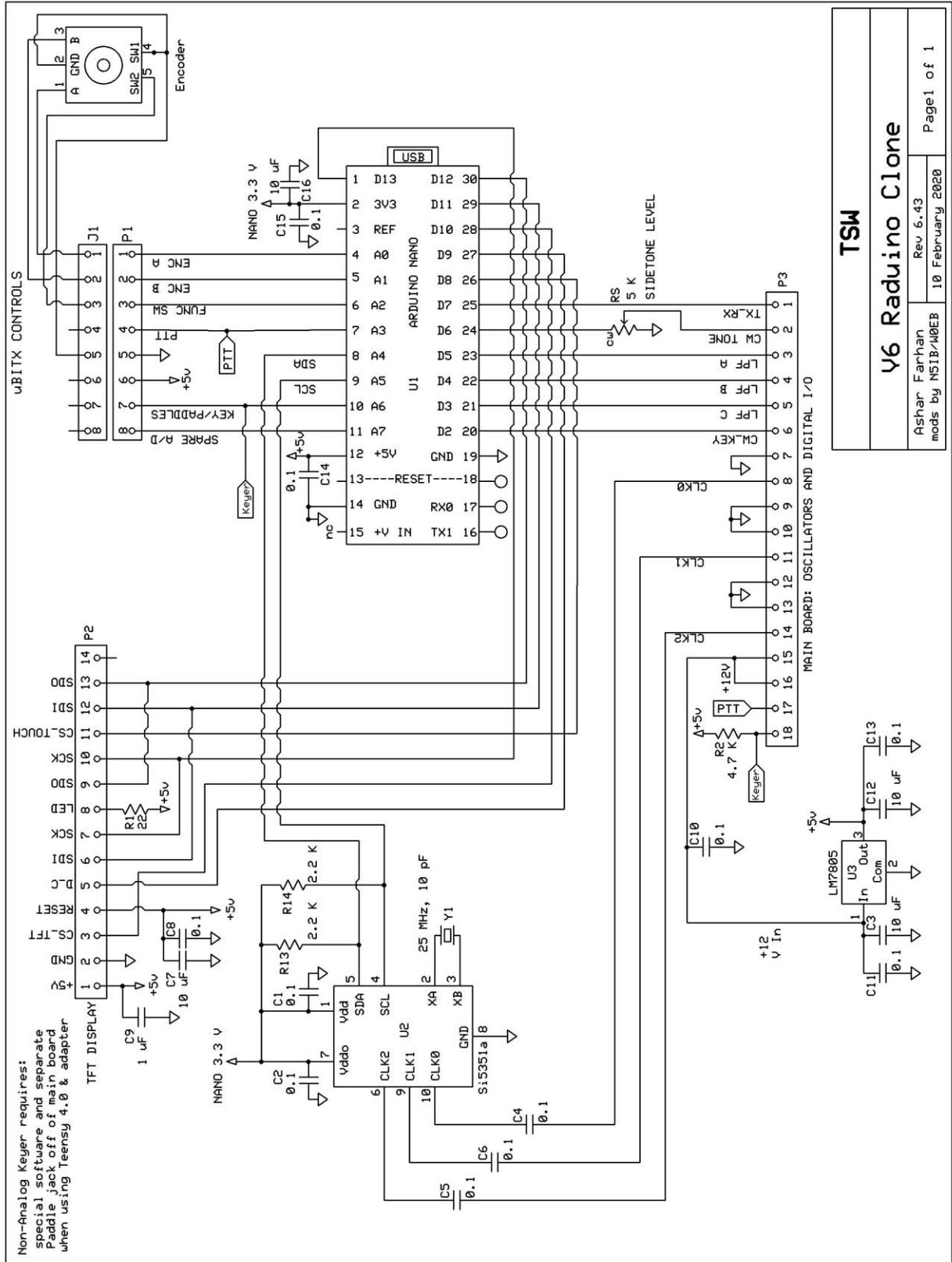
The (included with this kit) NANO CPU has been supplied with the factory's Latest version 6.1 software from "Git Hub", pre-loaded. You will have to calibrate the Raduino to your uBITX radio's main board. Hopefully you can find the instructions for the factory's calibration routine on the HF Signals website.





Completed V6 Raduino clone shown from the front side, ready to plug in and use.

Appendix B: Schematic Diagram



Appendix D: Bill Of Materials

<u>Item</u>	<u>Name/component #</u>	<u>Source</u>
___ PC Board	TSW V6 Raduino Clone Board	TSW (w0eb.com)
___ Capacitor	C1, 2, 4, 5, 6, 8, 10, 11, 13, 14, 15 0.1 uF size 1206 Ceramic SMD	Digi-Key 399-C1206C104K5RAC7800CT-ND
___ Capacitor	C9, 1.0 uF size 1206 Ceramic SMD Cap	Digi-Key 399-8148-1-ND
___ Capacitor	C3, C7, C12, C16 10 uF NP 1206 SMD	Digi-Key
___ Resistor	R1, 22 Ohm 1/4W 1206 SMD	Digi-Key
___ Resistor	R2, 4.7K 1/4W 1206 SMD	Digi-Key
___ Resistor	R13, R14, 2.2K 1/4W 1206 SMD	Digi-Key
___ Trimpot	RS 5K Cermet Trimpot	Tayda SKU A-610
___ IC	U2, Si5351a Clock/VFO IC already soldered on PCB & checked	Mouser 634-Si5351A-B-G-T
___ Crystal	Y1, 25 MHz parallel mode 10 pF load crystal	Tayda A-215
___ U1	Arduino NANO, Unprogrammed	TSW (w0eb.com)
___ Connector	P1, 8 pin polarized Molex male plug	Tayda SKU A-810
___ Connector	P3, 18 pin right angle Male DuPont	Tayda SKU A-199
___ Connector	J2, 14 pin Female Du Pont (Display conn.)	Tayda A-1669, cut off 1 pin.
___ Connector	U1 two 15 pin Female Du Pont (NANO)	Tayda A-1669 All pins intact
___ U3	LM 7805 3 pin TO-220 5V, 1 Amp Voltage Regulator	Mouser 511-L7805CV
___ Heatsink	TO-220 Heat Sink for 7805	Mouser 532-507302B00
___ Hardware	4-40 by ¼" screw and 4-40 nut	Local Hardware
___ Hardware	Four 3mm by 11 mm Standoffs & Nuts	HF Signals
___ Hardware	Four 3mm by 4mm Standoffs	HF Signals

Appendix E: Miscellaneous

The main advantages to purchasing the TSW Teensy 4.0 to NANO adapter and TSW's available firmware for it (see the TSW Website @ www.w0eb.com for adapter details) are the improvements in touch screen operation, far easier to use calibration routines, vastly improved lmbic keyer operation, much more available program space and a super fast CPU compared to the NANO's CPU.

The Teensy 4.0 has a 600 MHz ARM processor (NANO is 16 MHz) Teensy has 512K of program and stack memory where the NANO only has 32K just to name a few.

Using the Teensy 4.0 with either the factory V6 Raduino or TSW's V6 Raduino clone speeds up the display to the point where it paints almost instantly, there is no repainting of the screen between any of the main operations, no blinking or repainting when tuning the uBITX, improved menus and many-many more improvements too numerous to mention here. All of these improvements HAVE been tested and proven in an actual Version 6 uBITX kit.

Unfortunately we can only offer our Raduino Clone in kit form as we do not have HF Signals resources for building and testing them. We have tried to make the construction of the kit(s) as easy as possible and most people who have even basic kit building skills should have very little problems constructing them.

WOEB

Credits:

Manual Author and Photograpy:

Jim Sheldon, WOEB, TSW Project Coordinator.

PC Board design:

Jim Giammanco, N5IB, PC Layout Engineer.

Programmer:

Ron Pfeiffer, W2CTX, TSW Master Programmer.



The TSW V6 Raduino Clone board operating in W0EB's 3D Printed "test" chassis, using TSW's Teensy 4.0 to NANO adapter (available separately through TSW's website, www.w0eb.com).