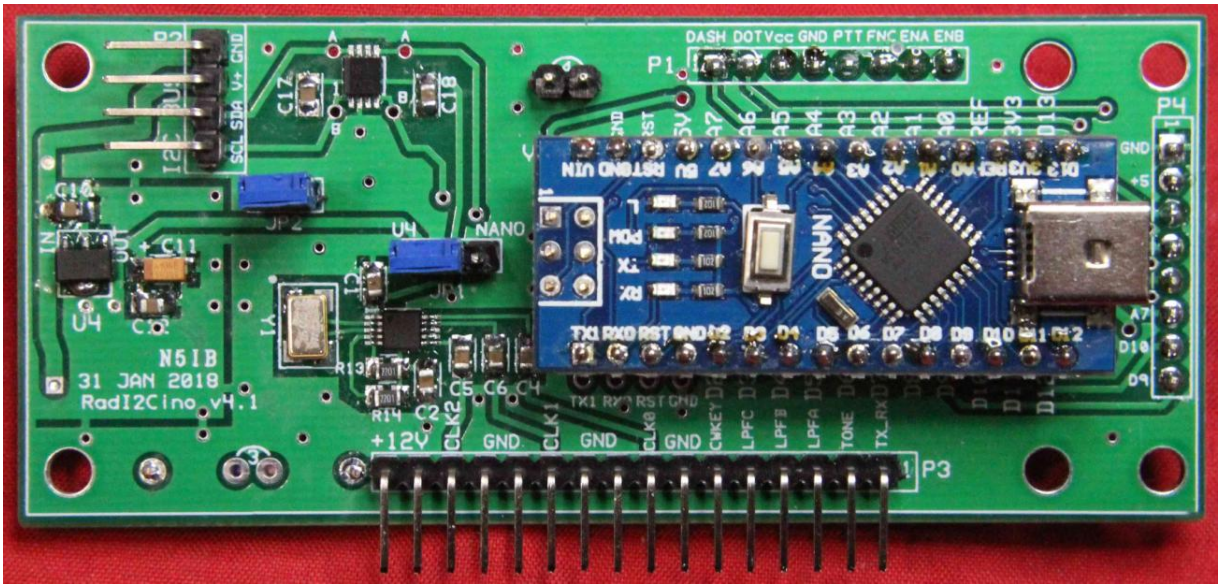
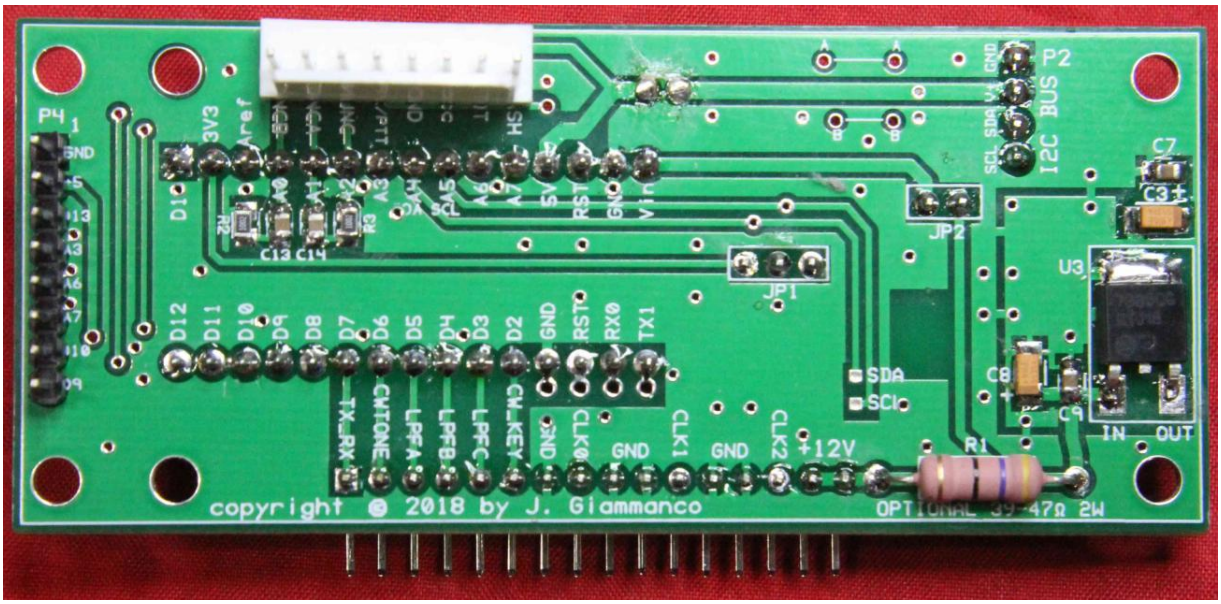
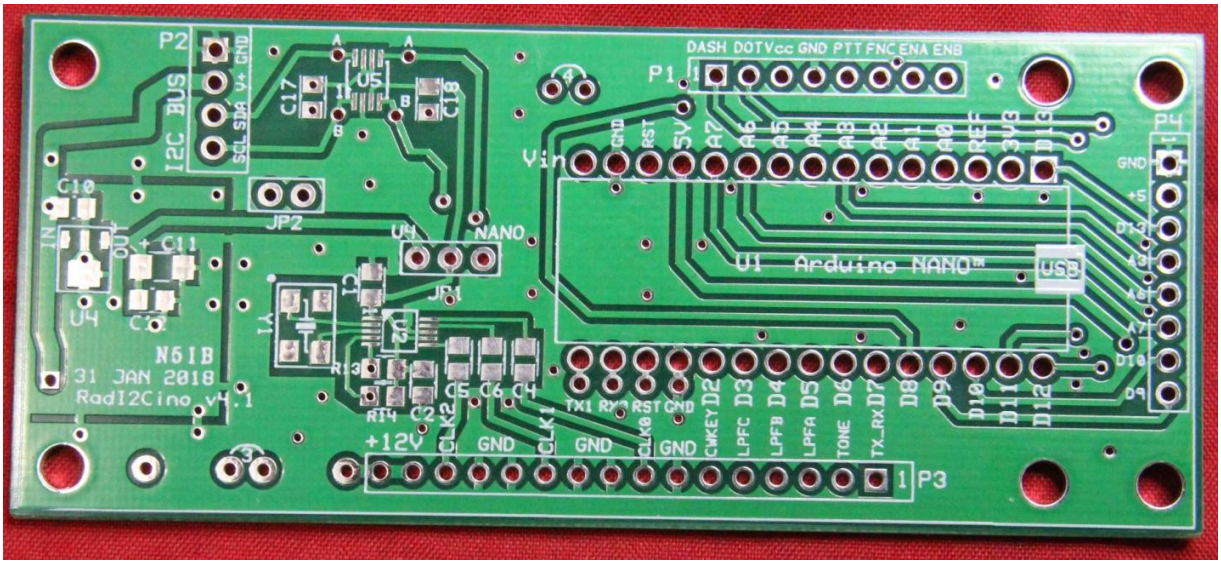
Introducing N5IB and W0EB's "**RadI2Cino**" Replacement for the uBITX Transceiver's "Raduino"

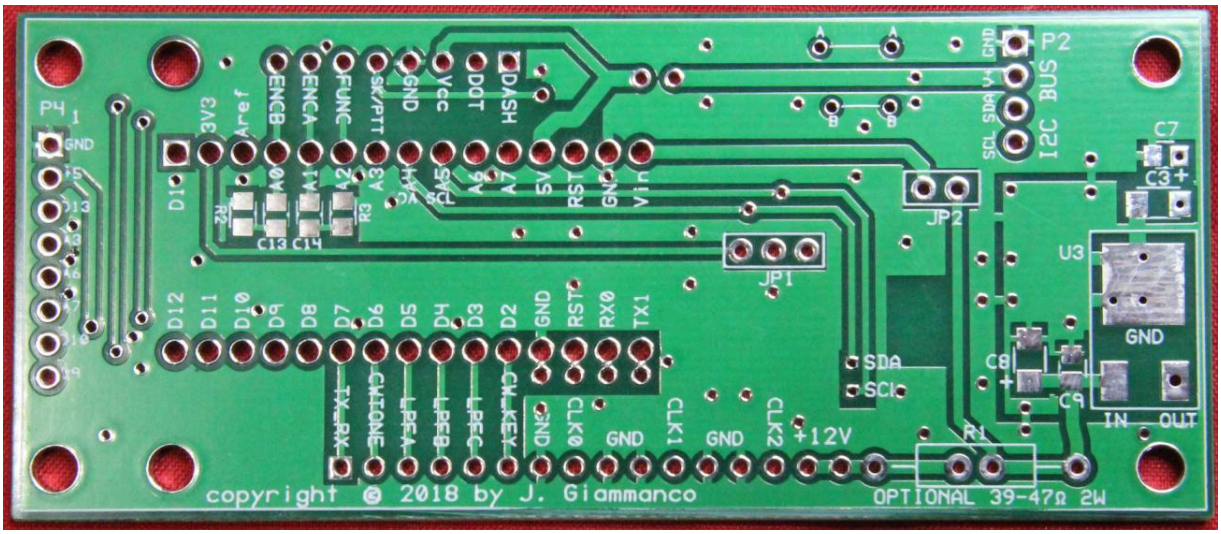


Front and rear views of a completed RadI2Cino





Front and rear views of the bare board



The “Micro BITX” transceiver short spelling “uBITX” designed by Mr. Ashhar Farhan of Hyderabad, India is being offered for sale by his company HF Signals through their website www.hfsignals.com. When I bought mine they were on sale for $109.00 US and you could chose free shipping via “India Post” or spend an extra $10 US and have it shipped by DHL Express. I opted for the DHL shipping as they claimed 7 days from the shipping date to my door. Well, DHL did better than

that. I ordered the rig on Thursday, December 14, 2017 and DHL delivered it the following Monday, the 18th. Not too shabby for the extra $10.

Well, the uBITX is a partial kit, which means you get the wired and tested main board, the "Raduino" controller card and all the controls, jacks and connectors to wire it up. Missing is any kind of case, this being left to the imagination of the user. I built mine into a nice enclosure offered by the 4 State QRP group and made out of PC board material.

I put it together exactly as their instructions said and it worked great on SSB but would not work on CW. I discovered an error in their wiring diagram. They had the CW Key connected to the "Ring" connection of the key jack rather than the "Tip" as is customary, at least in all the rigs I own. After correcting that error, it would work somewhat on CW but any contact resistance in the key caused erratic keying.

Here begins the evolution of the RadI2Cino (Pronounced "RAD ee too SEE no").

An attempt was made to use the input specified for the CW key paddles but due to differences in every Nano, using the original "Voltage Divider" idea on one analog input just didn't lend itself to decent CW with paddles.

I was corresponding with Jim Giammanco, N5IB and we decided we could come up with a better solution. Shortly, Ron Pfeiffer, W2CTX who is an outstanding programmer came on board. Since the software for the Raduino is "Open Source", Ron started rewriting the code and we grabbed a spare input (only one available) and used it for the Dash input with the original key wire for the dots. With a re-write of the keyer code this worked a whole lot better.

Ron had me publish the software. Immediately I started getting emails from a number of persons telling me we should not have used that spare wire as "they" were saving it for implementing an S meter and/or other metering circuits even though Ashhar basically said "coil that wire up and save it unless a use could be found for it". That prompted our early attempts at using the I2C bus which was already implemented on the Raduino but only to control the little Si5351A

Clock/VFO chip. I2C is kind of like a limited version of USB where each device on the bus has a unique address and if handled properly doesn't interfere with any of the other devices. Since the standard LCD display supplied with the uBITX used 6 digital I/O pins and the I2C bus uses only 2 and in this case Analog I/O pins A4 and A5 were used, we decided that if we were able to use the I2C bus to run the display we could free up those 6 Digital I/O's to handle the keyer and some other functions as well.

That got the project started. I made up a little perf-board for connection to the I2C bus that attached to the SDA and SCL lines by connecting to the A4 and A5 analog pins on the rear of the Raduino card where the pins of the Arduino Nano protruded. These, plus ground and +5 volts to power the display controller, display and backlight were brought to a 4 pin "DuPont" header to make cable connections to the new controller easy.

In the meantime, W2CTX was re-writing the original software to use the I2C functions rather than the parallel display. We bought some very inexpensive I2C display controllers from Amazon for less than $2 apiece and found we had to remove 2 4.7K pull-up resistors to keep from frying the Si5351 chip. The pull-up resistors on the display controller put 5 volts on the I2C bus but the Si5351 doesn't have 5 volt tolerant input and can only handle maybe 3.5 or 3.6 volts. It's powered from the 3.3 volt supply pin on the Nano.

Upshot of all this, we were able to make this work and quite well. We used the now open digital I/O pins for the Dot, Dash, Hand Key and PTT lines and the keyer functioned at least 80 percent better doing it this way. Ron also found that he could double up the functions of SSB PTT and the hand key/external keyer input on a single digital I/O pin. This ultimately opened up the A3, A6 and A7 analog inputs for use by those who were complaining about us using their A7 "Spare" input for something other than what they intended.

Now, after we published this idea and the software to use it, we got a bunch of people mad because we changed the "hardware" of the stock uBITX. However, according to all available information, the uBITX was intended to be "Hackable" both in software and hardware by Ashhar Farhan's own words on the HF Signals

website. The complaining persons thought it wasn't right to modify the radio so that only "our" program would run on it and the originally supplied software wouldn't.

Our thoughts were that we were doing this for our own benefit and pleasure but the idea worked well enough that we decided to share it with the general public. None of us ever said it was anything but what it was. Our philosophy on this was, and still is, "You can like it, praise it, complain about it or do it yourself." That's really the beauty of "Hackable" open source software and hardware. Enough said on the subject.

On to the "RadI2Cino" (again, pronounced "RAD ee too SEE no").

Jim, N5IB is really, really good at printed circuit board layout and turning schematic diagrams into usable PC boards! He undertook the project with he and I batting back and forth ideas for some parts types and positioning, with software support and which of the digital I/O ports to use, coming from Ron and collectively we came up with this neat, almost drop in, replacement for the Raduino. It even uses the same plug and main wire connections as the stock Raduino so you don't have to make any more than minimal wiring changes to the uBITX connectors to utilize this card.

You do have to swap out the original display supplied with the uBITX for one that either has an on-board I2C controller or obtain a suitable controller that uses 4 wire input. Those wires are Ground, +5 volts, and the SDA/SCL signal lines of the I2C bus.

Additionally, you need to connect the dash (ring) pin of the key jack to the violet wire (spare) from the "Digital" plug and you need to connect your hand key input to the same wire (orange) that connects with the microphone's push to talk line. That and the revised software is basically all that's required for this to operate.

The software written for this board does also require the addition of only 1 extra push button switch for full functionality as it adds the ability to swap the A and B VFO's with a press of this button and by a longer press, also allows for SPLILT operation.

You can adapt your hand key plug to use the microphone's jack by wiring the contacts between the "Ring" and "Sleeve" (ground) connections or you can add a separate jack for the hand key.

Changes/enhancements incorporated in RadI2Cino v.s. the original Raduino.
The 16 pin LCD display header has been eliminated.
The LCD display contrast pot has been eliminated.
The 16 pin and 8 pin uBITX headers are retained and connect in the original fashion.
Arduino NANO I/O pin assignments have been rearranged to free up digital and analog I/O pins.

a) D8, D11, D12 now used for key, paddles, and PTT.
b) D10 used for an A/B split selection button.
c) D9, D13, A3, A6, A7 now available for other needs.

The LCD display is operated via an I2C bus connection.|

a) Contrast control is now part of I2C interface "backpack".
b) 4-line displays are supported.

The TO-220 5 volt regulator has been replaced by a surface mount 7805 1 amp regulator.
A surface mount 3.3 volt regulator has been added.
A 4-pin header has been added to give access to the I2C bus.
A logic level translator has been added to the I2C bus to protect the Si5351 clock chip.
Manufacturer-recommended RC de-bouncing for the rotary encoder phases has been added.
Provision is made for an optional dropping resistor to reduce regulator dissipation.
Several powering options are provided, selected by shorting jumpers.

a) power everything through the NANO via the uBITX +12V rail**
b) power the NANO from the uBITX +12V rail, and the rest via the 5V regulator**
c) power everything from the board mounted 5 volt regulator.
d) power the Si5351a from the NANO's 3.3 V output.
e) power the Si5351a from the on-board 3.3 V regulator.

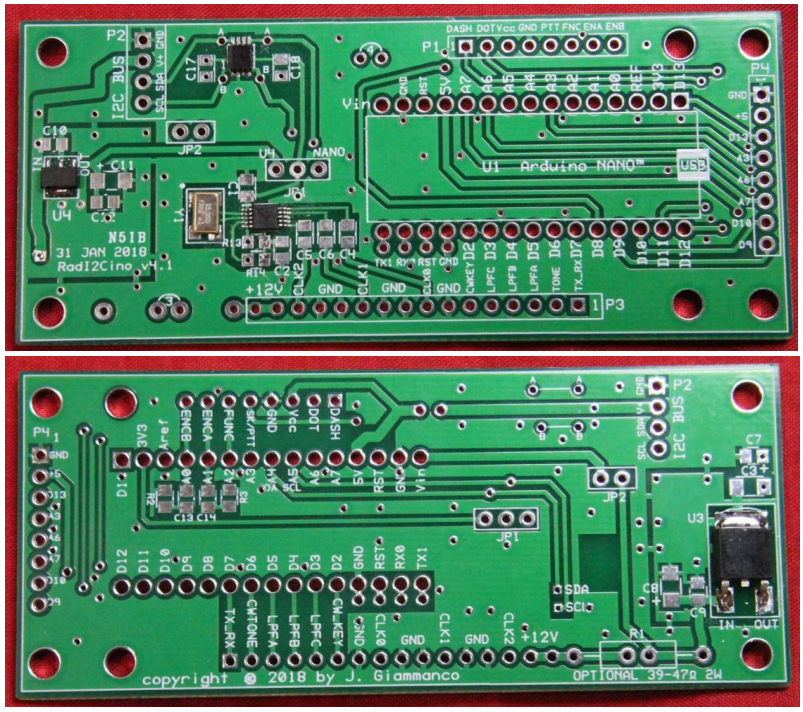
Though the PC board is slightly longer, mounting holes compatible with the LCD display are retained.
An additional 8 pin header is added for access to the newly free I/O pins.
Uncommitted PCB pads are provided to connect serial I/O and NANO Reset.
NANO mounting pads are intentionally oversized to allow for a low profile, machined pin, socket for the Nano.
Heavy use is made of silkscreened labels to identify signals and functions.

** If the optional dropping resistor is not used DO NOT EXCEED 12V when using these power options.

When the boards are made available, your purchase options will be:

1. Bare board only (pictures at the beginning of this document), which will come with a BOM (bill of materials) list and a comprehensive construction manual. The cost of this board is initially set at US $15, postage paid. For international customers the price will be $15 plus the cost of shipping. All customs duties and taxes will be the responsibility of the customer.

2. Partially completed board with all the surface mount semiconductors (the Si5351A clock chip, the surface mount 25 MHz crystal, the TXS0102 logic level translator and both the 3.3V and 5V regulators soldered in place. Like the bare board option, this will also come with a BOM and comprehensive construction manual. The price for this option will be US $45, postage paid. For international customers, the price will be US $45 plus the cost of shipping.



This is what the front and back of a delivered “Option 2” board will look like.

Even though it won’t be possible to do a complete operational test on option 2 boards, I will ensure that all connections to all the installed semiconductors are

properly soldered have good continuity to their pads and that there are no shorts between pins.

A “Zip” file containing the latest software for the RadI2Cino will be attached to the order confirmation email and any updates will be published on the BITX20@groups.io reflector and placed in the “Files” section of that site.

The BOM (bill of materials) contains the Mouser Electronics (www.mouser.com) part numbers for everything but the thirteen .1 uF chip capacitors and the 4 chip resistors (all 0805 size). Right now the boards are in very limited supply and we are still deciding if it’s feasible to market them. If there is enough demand they could be put into production in about a month’s time, maybe a little more.

If anyone is interested, please email me direct at the address given below. Please, do NOT send any money now to order one of these. You must contact me first to determine the current availability. For international customers, I must determine if it’s legal for me to export these to your country as the USA has some stringent export regulations on electronics even though these should not be a problem as they are just amateur radio equipment parts and all the components appear to be available from other than US sources.

Jim Sheldon, W0EB

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