

New School Ham Radio Club Receiver Project

by Gordon Gibby KX4Z

In Alachua County, we have only one known grade school ham radio club, sponsored by Bob Lightner W4GJ -- an impressive club at the Lofton Center that routinely turns in great scores in suitable youth radio contests. Carol Chesney KG4FEX has also made some forays during substitute teaching to introduce technology in the school. So when I discovered a "flex period" open for clubs at the little private school where I volunteered to teach Chemistry, I jumped on the chance to provide more STEM club opportunities to younger students!

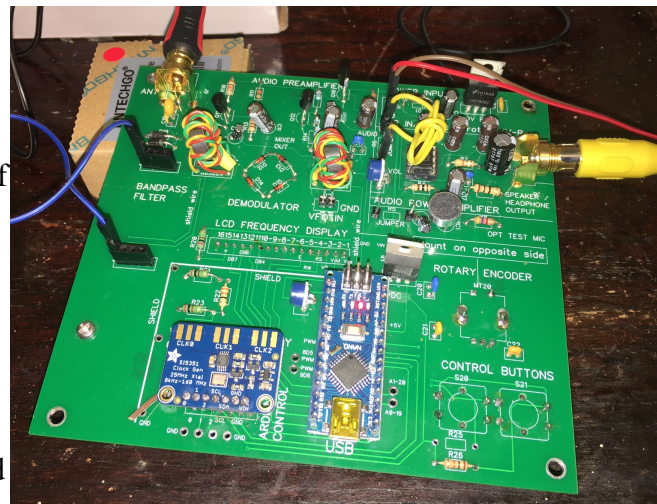
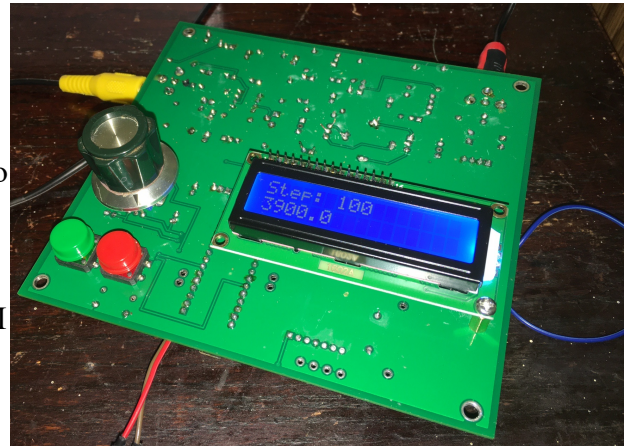
I was able to offer TWO weekly STEM-type clubs, one on "ham radio" and the other on "computer programming." The ham club is oriented toward broad radio technology, rather than being an overtly "license test club." The programming club is currently oriented toward Arduino microcomputer programming -- a chip that has been used in several ham radios, including the very successful uBitx series.¹

What kind of project would give all these students some real HANDS-ON experience? I decided to try to build a **School Receiver** -- a direct conversion, single printed circuit board radio, one of the simplest types of SSB / CW / AM receivers possible.

Ashhar Farhan publicized a "DC40" design² that was easily upgraded to utilize an Arduino-controlled Si5351 digital VFO. A bit of homebrewing and we have a printed circuit design! With a small bit of adjustment to a programming constant, the crystal-derived Si5351 gives rock solid frequency readouts. The digital VFO feeds into a simple 4-diode balanced (de)modulator and the output is plain analog AUDIO -- that then gets amplified by a 3-transistor preamp, and sent to the speaker or headphone by the popular LM386 integrated circuit.

The entire receiver fits on a 5-1/2 x 5" printed circuit board, and is broken into separate sections for modular construction. I spread out components a bit to make it easier work for new builders. First the 3-terminal 9 and 5 volt regulators, then the audio power amplifier. A board-based electret mic allows students to immediately test and enjoy their audio amplifier! Then add the Arduino and demodulator and preamp modules.

My first build turned out to work far, far better than I expected! Good sensitivity, and easy tuning of SSB voice, CW and data signals.³ Even with audio-coupling to a laptop, I was decoding



1 <https://www.hfsignals.com/>

2 Farhan: <https://web.archive.org/web/20171109081542/http://www.phonestack.com/farhan/dc40.html>

3 CW Reception: <https://qsl.net/nf4rc/2021/CWreception.MOV>

FT8 with ease. This simple receiver is double-side-band, so you can receiver either USB or LSB. It wouldn't be your choice for a crowded contest, but great for just casual listening. A mechanical rotary encoder gives it a "big-radio" feel with a digital frequency display that is always right on. There are sockets for qrpkits bandpass filters -- but it does pretty well even without them.

The middle- and high-school radio students are having great fun soldering a module at a time on two boards right now, for most of them, their first soldering experience.

The programming club is having a slower start, just working on understanding downloading files, and compiling with the free Arduino Integrated Development Environment (IDE).⁴ Their "computer-savvy" was a little less than I expected, so this is a big learning experience for them! The school's robotics mentor is VERY interested in their progress, to allow them to move to the Arduino from PIC controllers

A parts list⁵, Gerber PCB files (ready to have fabricated)⁶, and a bare-bones Arduino IDE sketch⁷ are available at no cost. Parts availability is variable this year, but many of the parts can be found in quantity packs on Amazon, making the cost even lower.

Next comes a simple cabinet, a sound-card interface, and possibly a transmitter!

4 Arduino free IDE download: <https://www.arduino.cc/en/software>

5 Parts List: <https://qsl.net/nf4rc/2021/BillOfMaterials.ods>

6 Gerber files (zipped): <https://qsl.net/nf4rc/2021/ZippedGerberRadio.zip>

7 Arduino Sketch: https://qsl.net/nf4rc/2021/sketch_sep24a.ino