

Four State QRP Group Nouveau 75A QRP AM Transceiver Kit

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Several CW transceiver kits are available for the QRP (low-power) operator who wants to build their own. A few operate on SSB and digital modes. For the kit builder who wants something different, check out this microprocessor-based low-power transceiver that uses amplitude modulation (AM) only, and covers the 75-meter band. Designed by David Cripe, NM0S, who has developed several kits offered by the Four State QRP Group, the Nouveau 75A is a replacement for a popular Retro 75 offered years ago by Dave Benson, K1SWL, from Small Wonder Labs. (We reviewed the Retro 75 kit in the October 2010 issue of *QST*.)

Overview

The main circuit board for the Nouveau 75A comes with approximately 80% of the parts pre-installed (these are surface-mounted devices — SMDs). The rest of the components are primarily through-hole components that you install and solder. The board is clearly marked with component designations that correspond to the layout shown in the assembly manual. A pre-assembled four-digit LED frequency display board mounts behind the front panel.

The nominal 5 W carrier output (20 W PEP) is available from approximately 3.6 to 4.0 MHz, although most AM activity takes place in the upper part of the band. Extended receive coverage from 3.0 to 6.2 MHz is available with reduced sensitivity, as shown in Table 1. The unit is powered by 11 to 14 V dc at up to 2.5 A. The kit comes with an enclosure you put together and is complete with a microphone.

A power jack, BNC antenna connector, and power switch are located on the back panel. A microphone jack and microphone gain control are on the left side of the front panel, with the receive audio gain control and



encoder to select the frequency on the lower right side of the front panel.

The Best of Both Worlds — Analog and Digital

The PDF instruction manual is available for download from the Four State QRP Group website. It includes detailed assembly instructions, a schematic diagram and PC board layout, theory of operation, and operating hints.

In a classical AM transmitter, a big and heavy iron core transformer or choke is used to provide amplitude modulation. The Nouveau 75A instead uses a highly efficient class G modulator circuit to provide modulating audio to a class E final amplifier — an IRF510 MOSFET.

The transceiver uses a microcontroller-driven Si5351 phase-locked loop (PLL) for the variable frequency oscillator (VFO). The PLL generates the transmit frequency directly, set by the front-panel rotary encoder and displayed on the LED. In receive, the microcontroller sets the PLL to 5.5 to 6 MHz, with a 2 MHz intermediate frequency (IF). Tuning steps are 1 kHz from 3.5 to 4 MHz, and 5 kHz above and below that range.

The mixing circuit is interesting because the IRF510 final amplifier is also used as the mixer. In the receive mode, dc voltage is removed from the transmitter final amplifier, and the 6 MHz VFO signal is applied to the gate of the IRF510. The MOSFET behaves as a switching mixer and downconverts the 75-meter receive signal to the 2 MHz intermediate frequency, where it is amplified and demodulated. Bandwidth filtering (6 kHz) is provided by three ceramic resonators.

Bottom Line

The Four State QRP Nouveau 75A kit goes together quickly and results in an attractive low-power 75-meter AM transceiver that works well for local and regional contacts.

Table 1
Four State QRP Group Nouveau 75A, s/n 0180

Manufacturer's Specifications

Frequency coverage: Transmit, 3.605 – 3.995 MHz.
 Receive, 3.0 to 6.2 MHz.

Mode: AM.

Power requirements: 11 – 14 V dc. Receive, 120 mA.
 Transmit, 600 mA unmodulated; typically
 2.5 A at peak RF power output.

AM receiver sensitivity: Not specified.

Audio response at 6 dB points: Not specified.

RF power output: 5 W carrier, 20 W PEP.

Harmonic and spurious suppression: Not specified.

Transmit intermodulation distortion (IMD): Not specified.

Size: 2.2 × 5.3 × 4.5 inches, including protrusions. Weight: 12.8 ounces.

*Audio filter shaping suggests shallow filter shaping; mid and high frequencies are present but reduced. More test data from the ARRL Lab is available from www.arrl.org/qst-in-depth.

Measured in the ARRL Lab

As specified.

As specified.

At 13.8 V dc: Receive, 151 mA (maximum volume),
 125 mA (minimum volume). Transmit, 897 mA with
 unmodulated carrier; 1.92 A at peak RF power output.

10 dB (S+N)/N, 1 kHz tone: At 3.88 MHz, 18.8 μ V; 3.1 MHz,
 19.1 μ V; 4 MHz, 29.5 μ V; 5 MHz, 43.6 μ V; 6.1 MHz, 298 μ V.

312 to 2144 Hz (3664 Hz BW).*

Maximum RF output at 13.8 V dc: 6.6 W carrier, 25.4 W PEP.

60 dB. Meets FCC requirements for spectral purity.

IMD products down 60 dB at 3 kHz from carrier.

Most functions are controlled by the microprocessor. A brief description of the software functions is included in the instruction sheets.

Putting It Together

Upon opening the shipping box, I noticed the contents are packed — really packed. There is probably not a fraction of a cubic inch not filled with the main PC board, display board, two bags of parts, hardware envelope, speaker, microphone, and enclosure pieces. It's helpful to keep the components in the bags they came in. The finished kit is shown in Figure 5.

The Four State QRP website includes the PDF of the instruction manual, along with separate PDFs with better-quality versions of the schematic diagram and PC board layout/part placement guide. I found that the labels on the schematic and PC board layout were a bit small when printed on 8.5 × 11 inch paper. For maximum clarity, you may want to view these illustrations on your PC monitor, where you can zoom in.

Following the manual, assembly is fairly straightforward. There are, however, a few things to note.

■ Follow the directions very carefully when mounting Q1, Q3, and Q11 with their heatsinks.

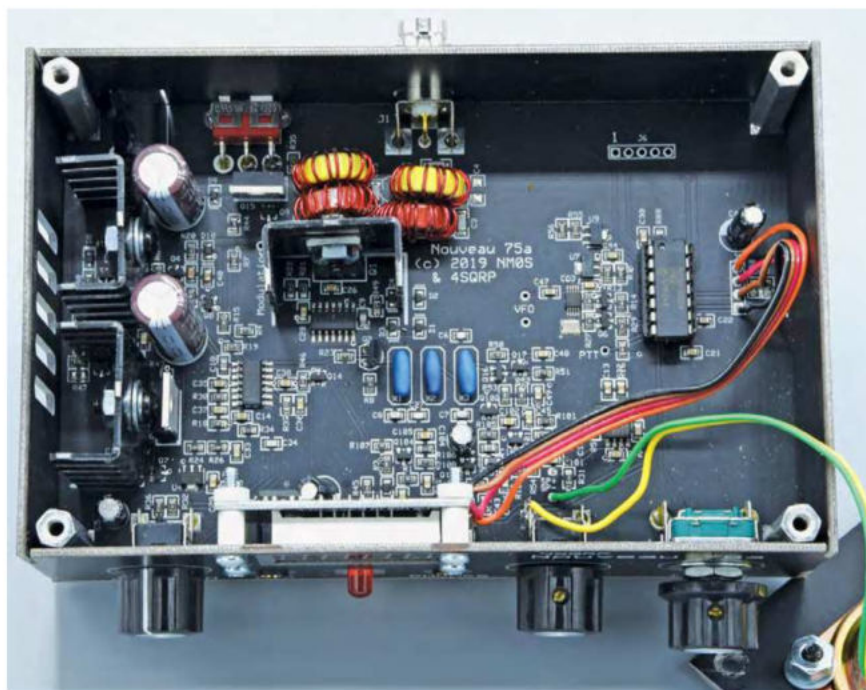


Figure 5 — The finished Nouveau 75A in its case. The four-digit display module is mounted behind the front panel and shows the transmit frequency in 1 kHz increments. A four-conductor cable connects the display to the main board. The speaker mounts to the top cover.

■ Clear nail polish is included in the list of needed tools, but not used in any of the steps.

■ The wire for the toroid inductors is fairly stiff. You might find it easier to wind the toroids from the center. As an example, for 19 turns, place the center of the wire inside the toroid and wind 10 turns on the core in one direction, and wind the remaining nine turns on the rest of the core.

On the Air with the Nouveau 75A

Bob Allison, WB1GCM

After Paul, N1II, finished building the Nouveau 75A kit, I had the opportunity to use it over a weekend. One of my 80-meter antennas is a full-size dipole, with the center only 18 feet above ground. This is used as a one-hopper, near-vertical incidence skywave (NVIS) antenna. Such antennas work great for radiating RF energy straight up, with the refracting signal raining down over a 200-mile circle. This circular pattern has been confirmed with many on-air signal reports. An NVIS antenna can work well with low-power transmissions on the 75/80-meter band, especially just after sunrise and before sunset.

On my operating desk, the Nouveau 75A was completely overshadowed by my classic tube-type Heathkit DX-100 transmitter and Collins R-390 receiver that I often use for operating on 75-meter AM. I connected my antenna and 13.8 V dc power supply to the Nouveau 75A and tuned to the hub of AM operating activity, 3.885 MHz, where I heard a contact in progress. Both stations were quite strong. After listening a while, I politely broke in. Peter, K1PHG, in Brookfield, Connecticut, some 60 miles away, came back and gave a report of S-9 and "sounds okay."

Also on frequency was Brent, W1IA, in Derry, New Hampshire, about 95 miles away. Brent told me my transmit audio was tearing (clipped). This observation confirms the ARRL Lab measurements I made regarding the red LED indicator on the Nouveau 75A's front panel. The LED starts to illuminate when modulation approaches 100%, and talking with the LED fully illuminated when speaking will cause overmodulation. With the level properly adjusted so that the LED only illuminates a little on voice peaks, I received several reports of good audio and plenty of modulation.

I thanked Brent for his help, and then Bruce, W1UJR, in Wiscasset, Maine, called in from 198 miles away. He gave the Nouveau 75A and my low dipole a signal report of S-9 +10 dB. Having built three Nouveau 75A kits, Bruce was enthusiastic about the radio, noting its ease of construction and decent performance. He also confirmed that when using the microphone provided with the kit, the transmit audio consists of mostly mid- and high-frequency audio components. Audio quality enthusiasts take note: there is plenty of room for improvement with other microphones or audio processing devices.

Finally, Steve, KB1VWC, checked in from Falmouth, Massachusetts, 92 miles away with yet another S-9 signal report. After 45 minutes of "kit chat," using only 5 W of RF power output from the Nouveau 75A, it was time to move on. Before I signed off, I couldn't resist switching over to the DX-100 for a signal report. "10 dB over S-9," Steve reported. That's a 10 dB improvement for 200 extra pounds.

In the Lab, I found that the Nouveau 75A is a good candidate for use with a power amplifier, because of its low-transmit phase noise and good transmit intermodulation distortion (IMD) characteristics. Lab measurements indicated that the receiver sensitivity could be better, but there was plenty of signal out of the Nouveau 75A speaker for easy listening during my on-air AM contacts. Audio quality of the speaker is okay, but limited by its small size. I tried it with an external speaker, and found there was plenty of audio, and the sound quality was quite good. In addition to the amateur radio contacts, I used the Nouveau 75A to listen to time station CHU in Ottawa, Ontario, on 3.330 MHz, and WTWW in Nashville, Tennessee, on 5.085 MHz.

- The ribbon wire supplied in the kit I worked on was stranded wire, just a bit too big for the solder holes in the display module and one end of the speaker cable. You might consider substituting your own ribbon cable with a smaller gauge wire.

- Before assembling the enclosure, it's a good idea to power up the finished PC board and check it out.

- The enclosure is made from PC board material, with the front, rear, and side panels tack-soldered to the main PC board. When assembling the case, use both masking tape and rubber bands to hold the sides squarely in place while you solder.

- After assembly, there is a brief procedure to calibrate the receiver frequency setting by using a known signal source, such as a strong shortwave station. This step is important to ensure that the radio transmits and receives on the same frequency.

In Summary

After completing the kit, I sent it to Bob Allison, WB1GCM, in the ARRL Lab for testing. Bob enjoys operating 75-meter AM, and he tried it out (see the sidebar, "On the Air with the Nouveau 75A").

AM operators typically congregate near the high end of 75 meters. Look for stations around 3.885 MHz. Other frequencies may be more popular in your area, so tune around. There's a users' group online at 4sqr.groups.io/g/N75.

The Nouveau 75A is a fun little unit. Construction isn't difficult, and the finished unit is attractive and works well. It won't replace your 100 W home-station transceiver, but it is an interesting way to try 75-meter AM.

Manufacturer: Four State QRP Group,
www.4sqr.com. Price: \$114, plus shipping.