

Low-Power Transceiver Kits You Can Build

By Rick Lindquist, KX4V

Has the once-hallowed ham radio art of homebrewing fallen by the wayside in an era of ready-to-use equipment? Not judging by the booming market in low-power transceiver kits embraced and enjoyed by many hams—and especially by those in the QRP community.

Here's proof that good things come in small packages. Our selection represents a cross section of available kits, ranging from simple and easy to sophisticated and complex. Kit prices here vary accordingly, from around \$75 to more than \$300, depending on options. We built, tested and used the G-QRP Club GQ40; the Gary Breed transceiver; the Oak Hills Research OHR-400; the S&S TAC-1; the Small Wonder Labs Green Mountain 20; the Wilderness Radio NorCal 40A; and the Wilderness Radio Sierra. Prototype versions of some of these transceivers have appeared in *QST* and in *The ARRL Handbook*.

Why build it yourself? The big reasons are to save money and to gain the satisfaction that comes from assembling your own gear. Some of our contributors have built literally dozens of kits like these. As Jeff Gold, AC4HF, put it, "I find building kits to be therapeutic and much cheaper than many other forms of relaxation." Regular kit builders also will tell you it's a lot easier to customize or modify a homebuilt kit to make it do what *you* need it to, rather than tearing into a factory-built job (and possibly voiding the warranty).

All of these kits proved to be fun projects. You don't need special tools for building or tune-up, just the standard kit-building tools (diagonal cutters or "dikes," small needle-nose pliers, and a 25 or 30-W soldering iron). In most cases, alignment requires a VTVM or DVM, maybe a frequency counter or well-calibrated receiver, a low-power wattmeter and a dummy load.

G-QRP CLUB GQ40

The GQ40 is a newcomer to the kit scene in the US. It's a single-bander—20-meter and 40-meter versions are available. I built the 40-meter kit. Although I've put some projects together over the years—including a few simple transmitters, keyers and antenna tuners—it's been ages since I built a kit of any kind. I think the Heath HW-7 was my last. I had little experience winding toroidal coils, which intimidated me at first but turned out to be not so bad. I took my time with this little kit, which consists of a single PC board, a handful of external controls and jacks and a plain aluminum case. (A power on-off switch is optional.) This is not a kit for the rank beginner. If you've got a simpler kit or two under your belt, you'll have no trouble with this one, and I found the results *well* worth the toil and trouble of building it.

This little set has a superhet receiver, six-pole crystal filtering and a vernier tuning dial, and it puts out up to 7 W of RF (continuously variable from zero to the maximum). It's capable of full-break-in (QSK). It's very unpretentious in its stock form. *You* paint and label the aluminum box and front panel to suit your tastes and pocketbook. You can also adjust the tuning range. As built, it covers approximately 150 kHz of the band. I modified mine to cover approximately 50 kHz. Overall, in some respects, I found this a bit more like a real homebrew project than a kit.

Sheldon Hands, GW8ELR, puts up this kit in Wales, so some terminology in the 20-page instruction pamphlet may be a tad strange to American eyes. One "fits" components to the board, which has a component side and a "track" side. You soon get used to the Britishisms (like "whilst") that crop up, too. Unless you plan to convert millimeters to inches, get yourself a metric ruler. The information on how to identify the components was highly useful. My eyes aren't what they used to be, so I found wearing a binocular magnifier very helpful in making certain I "fitted" all the components in their correct places on the fairly crowded board. You simply stuff the components by groups (ie, all capacitors, all resistors, etc) onto the board, wire up the external components, tune it up and put it on the air. Oh, you do have to drill a few holes to mount the tuning cap.

Occasionally, the instruction sheet called for an item the kit did not include. Usually, though, it was something right at hand—a scrap of wire, a capacitor or two. The parts appeared to be of good quality, and the quality of the fiberglass and silk-screened board was average. The thing I disliked most was having to solder some component leads to the top (ground-plane) side of the board. This often obscured or destroyed the silk screening for components yet to be installed. In some cases, I nearly ran out of room to solder to the ground plane. There are several outboard components to wire (to pins you install first), but these all fit and install nicely on the predrilled front or rear panels.

The circuit uses a doubly balanced hot-carrier type mixer. The transistor driving this gets quite hot. A heat sink is not supplied, so you have to fashion one yourself or check out your junk box. I made one out of a scrap of aluminum flashing metal.

Once I got the radio together (working a few hours at a time over a period of several weeks), I checked for mistakes, then went through the “test and alignment” steps in the manual. All the preliminary measurements indicated it was okay to apply power for the big smoke test. The oscillator came right up (once I put 12 V on the terminals instead of 6 V!), and I got the transmitter to function. But the receiver was pretty numb. I huddled via telephone with Bill Kelsey of Kanga US (which distributes the kit in this country; Bill had just built his own GQ40). It turned out to be a missed connection on the crystal filter. A little dab of solder and the radio really came to life!

On the air, it keyed nicely (I checked on my “big” transceiver), and it heard very well. I hooked up with a couple of DX stations right off the bat, then worked a few state-siders. I had some friends with very critical ears listen carefully to the keying, and they gave it good grades.

This is a nice little package, maybe not as slick looking right out of the box as some other kits, but with a hot receiver, great filtering and lots of audio—enough to drive a speaker (and there’s room in the cabinet for one).—*Rick Lindquist, KX4V*



G-QRP Club GQ40

Size: (HWD) 2.95.96.9 inches; weight: 1.6 lb.

Power requirements:

Typical tuning range:

Spectral purity:

Minimum discernible signal:

Blocking dynamic range:

Two-tone dynamic range:

IF/audio response:

Audio output power:

Price class:

Measured in the ARRL Lab

Transmit, 1.2 A (max); receive, 190 mA (max volume, no signal), tested at 13.8 V.

50 kHz (after modification; see text). Power output (max): 7 W (typical).

Meets FCC requirements for spectral purity.

−127 dBm.

127 dB.

91 dB.

Range at −6 dB points (bandwidth): 528-1098 (570 Hz).

1.6 W at 10% THD into 8 W.

\$160.

GARY BREED TRANSCEIVER

The Gary Breed 20-meter transceiver is one of my favorite designs and has led me to build six Breed rigs. My particular unit came from A&A, which no longer sells the Gary Breed transceiver. However, a very similar kit still is available from 624 Kits in South Carolina. This design has appeared in *QST* (December 1990 and January 1991), and in *The ARRL Handbook*. The transceiver's size and weight make it suitable for backpacking and mobile use.

This 5-W, VFO-controlled CW transceiver has a single-signal superhet receiver, AGC, IF and audio filters, semi-break-in T/R switching, sidetone, S meter, speaker and other nice features. At the heart of this transceiver is the Motorola MC3362 chip, originally designed as an FM receiver IC. 624 offers this kit for 80, 40, 30, 20, 17 or 15 meters.

Tuning is accomplished with varactor diodes and two potentiometers. Wires and coax connect the two printed circuit boards to each other and to off-board components. An SO-239 connector and a quick-connect power connector are on the rear panel. There's a speaker inside the top of the cabinet.

The kit is not overly complicated. It contains several hundred parts. The boards are assembled first, then fastened to the bottom of the case.

You also have to install some external components and do some additional wiring. The 624 Kits version has pre-wound coils. First-time assembly and alignment of the kit took me about 15 hours.

Alignment is simple and straightforward, taking less than an hour. The audio filter is centered at 850 Hz, and you use the S meter to make the receive-offset oscillator adjustment. Transmit board alignment begins with trimmer pot adjustments to set the timing of the T/R relay and the sidetone volume. You also need to adjust the transmit mixer and offset oscillator. That's it!

This radio is reliable and powerful enough to enjoy rag chewing, under average band conditions. This radio does not provide full QSK, but the T/R delay can be set for quick turnaround.

The cabinet is the right size, and the boards and controls are well positioned and easy to reach. There's plenty of volume to drive the speaker or a set of earphones, but I'd prefer that the speaker be front-firing. The sidetone is adequate but lacks the bell-like note of sine-wave oscillators. The combination of the four-pole crystal IF filter and the audio filter provide excellent signal selectivity. The audio-derived AGC works well, and the S meter reasonably indicates relative signal strength.

The Gary Breed transceiver is an excellent little rig. Features such as tight crystal filtering and superb audio filtering, easily selectable band coverage, adjustable T/R switching, fine tuning and built-in speaker move it to the front of the class. The absence of digital frequency display, full band coverage, full QSK and RIT are soon forgotten after you make your first contact with this little rig.—*Don Shipman, W3RDF*



Gary Breed Transceiver (A&A model tested)

Measured in the ARRL Lab

Size (HWD): 3×6.1×7.6 inches; weight: 1.6 lb.

Power requirements:	Transmit, 1 A (max); receive, 30 mA (max volume, no signal), tested at 13.8 V.
Typical tuning range:	40 kHz.
Power output:	7 W (typical).
Spectral purity:	Meets FCC requirements for spectral purity.
Minimum discernible signal:	-120 dBm.
Blocking dynamic range:	91 dB.
Two-tone dynamic range:	69 dB.
IF/audio response:	Range at -6 dB points (bandwidth): 603-1145 Hz (542 Hz).
Audio output power:	140 mW at 10% THD into 8 W.
Price class:	\$150.

OAK HILLS RESEARCH OHR-400

The OHR-400 is a four-band transceiver (80, 40, 30 and 20 meters) with an RF preamplifier, a four-pole crystal filter and a selectable four-pole audio filter. The kit contains three printed circuit boards plus an optional keyer board. The boards are among the best I've seen. They are solder-masked and have terrific silk screening. There is *no* question which parts go where. Parts on the receiver board are fairly well packed, so the top-notch silk screening is a definite plus. The cabinet is very high quality, has a great finish and is beautifully screened. It offers full-break-in (QSK) with sidetone. These and other niceties—like pre-wound coils—make Oak Hills kits very enjoyable to build. The rig is *big* for a QRP transceiver. It would be OK for portable use, but not for backpacking.

Instructions are unambiguous and step-by-step, but not in the hand-holding “put part R3 in hole in section 1A” way Heath used to do it. Separate sections for each board list all the components and include a schematic and an enlarged overlay. Parts for each board are bagged and separated by type, such as resistors and capacitors.

I found no unwelcome surprises, but this is not a beginner's project. The boards were a pleasure to solder. The plated-through holes make for strong connections. I'd suggest taking the extra time to make sure parts are in the right places, since plated-through boards are harder to unsolder. Also, use a magnifying glass and check the bottom of each board before proceeding to the next one.

Alignment was not difficult. The initial frequency setup went very quickly. Three of the four bands came up exactly on frequency with no adjustments necessary. Getting the fourth right was a matter of adjusting a trimmer capacitor. The only time-consuming adjustment was that of a coil and a trimmer to get the correct VFO bandspread.

To finish fine-tuning the receiver, I took it to my shack and hooked up an antenna. I put the rig on 20 meters using a gel cell for power. While connecting the antenna, I heard EA3DKR calling CQ, so I gave him a call. Carlos came right back. (Who needs all those other alignments?) Other DX followed, and I worked anyone I heard, even DX that was really weak. I had long QSOs—with no problems—on every band the radio offers.

The rig is *very* easy to use. You flip on the switch (a red indicator tells you it's alive), turn the big knob on the front to select the frequency, and transmit. The dial is very smooth. There is a knob to switch bands and another for the built-in keyer speed. Selectivity is very sharp: you have to be very careful or you can tune right past the station. Sensitivity seemed adequate. The radio copied weak signals about as well as my commercial rig. The panel has labeled numbers every 15 kHz and markers halfway between. An OSC OUT jack provides the local oscillator signal for a frequency counter or display.

I liked the separate jacks for a straight key and keyer paddles. I can leave both paddles and straight key hooked up and switch mid-QSO if I want. I also liked the center detent on the RIT. However, the rear-apron POWER LEVEL control would be more

convenient on the front panel. Another neat feature is the TUNE/OPERATE switch, which keys the transmitter for tuning.—*Jeff Gold, AC4HF*



Oak Hills Research OHR-400

Measured in the ARRL Lab

Size (HWD): 4.3×8.5×8.3 inches; weight: 3.7 lb.

Power requirements:

Transmit, 1.4 A (max); receive, 290 mA (max volume, no signal), tested at 13.8 V.

Typical tuning range:

150 kHz.

Power output:

5-8 W (typical; varies by band).

Spectral purity:

Meets FCC requirements for spectral purity.

Minimum discernible signal:

80 m, -134 dBm; 40 m, -136 dBm; 30 m, -135 dBm; 20 m, -137 dBm.

Blocking dynamic range:

119 dB (80 m); 122 dB (20 m)*

Two-tone dynamic range:

86 dB (80 m); 89 dB (20 m)*

IF/audio response:

Range at -6 dB points (bandwidth): Wide: 775-920 Hz (145 Hz); narrow: 774-907 Hz (133 Hz)

Audio output power:

101 mW at 1% THD into 8 W.

Price class:

\$320.

*Only bands tested.

S&S ENGINEERING TAC-1

The TAC-1 is a single-band, microprocessor-controlled, synthesized transceiver with an LCD display. This is *not* a kit for a first-time builder, and you'll definitely have to master the art of soldering. Versions for 40 and 80 meters are available. I built the 80-meter kit. It covers 3500 to 3750 kHz in either 1-kHz or 100-Hz steps.

Parts packaging is outstanding. It beats anything I've seen, including Heathkits. This kit has a small, front-panel board and the larger main board. The cabinet, boards and parts are top quality. There's a parts package for each board, and components (diodes, resistors, etc) are in individual, labeled packages. Additional care is taken to prevent a parts mixup by isolating and labeling individual parts. All toroidal coils are prewound, dressed and individually packaged.

The kit has two silk-screened, solder-masked, glass-epoxy printed circuit boards connected by ribbon cable. There's no wiring. All jacks and controls are PCB mounted. A shaft encoder drives the LCD readout. The boards and the shaft encoder are connected by ribbon cables. There are only four screws in the entire kit. The 75-page manual leads to a finished rig and an understanding of how it works. S&S Engineering estimates building time at around 16 hours.

The case is made from vinyl-coated steel and extruded aluminum with silk-screened front and rear panels. Receiver current drain (220 mA) is a little steep (much of it powers the readout). The rig has full (relay-less) QSK keying. The receiver is a single-signal superhet with IF and switchable AF filtering.

Parts are installed in order of their height (those closest to the board's surface are installed first), diodes first, then resistors, then sockets, etc. You simply select the part in the order it appears in the parts list, find where it belongs by looking at the parts placement chart, shape the leads, insert it into the board and solder it in place. One of the best features of the TAC-1 is the board layout, which is almost devoid of jumpers. Once the boards are stuffed and wired, you're ready for the smoke test!

Aligning the synthesizer and D/A converter requires the greatest patience and attention to detail so that the display reflects the actual frequency. You need a frequency counter, a digital VOM and a signal source to align the transceiver. (S&S even includes parts to build an RF probe.) I ran into a problem when I started to align the receiver. Audio was getting into the microcontroller and locking up the display. S&S was very responsive, and we traced the problem to a test-point jumper I had improperly installed. (One benefit of a problem is that it forces you to study the circuit and to understand what is going on.) Installing the keyer was simple and straightforward, taking less than an hour.

Operating the TAC-1 is one of the finer joys in life. As one who uses little rigs in remote settings quite often, I had come to consider some drift as inevitable. This is not the case with the TAC-1, however, because there simply *is* no drift. The TAC-1 is pleasant to look at and a pleasure to operate. It has only five controls on the front panel. The rear panel contains a BNC connector for the antenna, the power jack, key jack, paddle jack and a pushbutton switch for the keyer. When you turn on the main power switch, the display first shows 3.5 (MHz.), then displays 560.0 (kHz). It's nice to have a rig fire up on the QRP calling frequency!

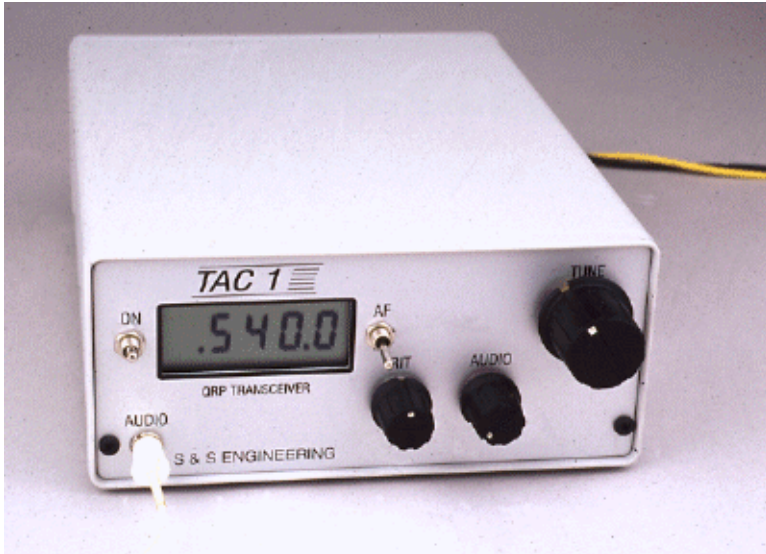
Each click of the main tuning knob moves the frequency 1 kHz, and one revolution of the knob equals 32 kHz. A slight push on the knob sets the tuning to 100-Hz steps. There's plenty of volume to drive a set of earphones. The op-amp audio filter provides an audio bandpass (for the 600-Hz audio signal) of about 200 Hz. The RIT has a center detent and lets you tune the receiver about 100 Hz each side of the centered frequency. The four matched crystals in the IF-filter limit the passband to about 600 Hz.

The QSK is very smooth without clicks and fast enough to hear a breaker between words at 30 wpm. You can connect a paddle and a bug or a straight key or even a keyboard to the TAC-1 at the same time, allowing the operator to switch between keying methods.

I had many good ragchews using a long wire. The 5 W was more than adequate to maintain solid contacts, and I received many favorable comments about the signal. I compared the receiver with others in my shack, using the same antenna and switching rapidly between the two units. I found the TAC-1 more pleasant to listen to than most of the others, and equally sensitive.

The TAC-1 is a winner. Its silky-smooth sidetone, RIT, relay-less QSK, IF and switchable audio filters, abundant audio gain, digital display and keying options help put this radio in the winner's circle. The only things I'd add would be the ability to tune in 10-Hz steps and to have the keyer save its settings after you turn off the power.—*Don Shipman, W3RDF*





S&S Engineering TAC-1

Measured in the ARRL Lab

Size (HWD): 2.5×5.5×7.5 inches; weight: 1.9 lb.

Power requirements:

Transmit, 1.1 A (max); receive, 220 mA (max volume, no signal), tested at 13.8 V.

Typical tuning range:

250 kHz.

Power output (max):

5 W (typical).

Spectral purity:

Meets FCC requirements for spectral purity.

Minimum discernible signal (filter in):

−134 dBm.

Blocking dynamic range:

109 dB.

Two-tone dynamic range:

79 dB.

IF/audio response:

Range at −6 dB points (bandwidth): Wide, 388-964 Hz (576 Hz); narrow, 569-755 Hz (186 Hz).

Audio output power:

14 mW at 10% THD into 8 W.

Price class:

\$200, kit.

SMALL WONDER LABS GREEN MOUNTAIN 20

This transceiver is a mini-kit, containing the printed-circuit board and most components necessary to construct a 20-meter CW superhet QRP transceiver. It features a varactor VFO, four-section crystal filter, full-break-in (QSK), RIT and an accurate transmit offset. It uses a “classic” design, with NE602 mixers, an MC1350 IF amplifier and an LM380N audio-output stage that delivers a whopping 1.5 W—more than enough to comfortably drive a speaker. Kits are also available for 40, 30, 20, or 15 meters.

This kit represents an excellent value for its performance, but it is probably not for the rank beginner. It is a “board-level” kit, supplying only the components that mount to the printed-circuit board. The builder supplies a cabinet, off-board components and connectors. I found a nice Hammond cabinet in the Lab’s “junque box” and bought all the panel potentiometers and connectors at a local Radio Shack.

When the kit arrived, I gleefully opened the box and found a big bag of parts, a printed circuit board, a few parts nicely segregated into small manila envelopes, and a manual. I am an experienced kit builder, so the first thing I did was to read the manual.

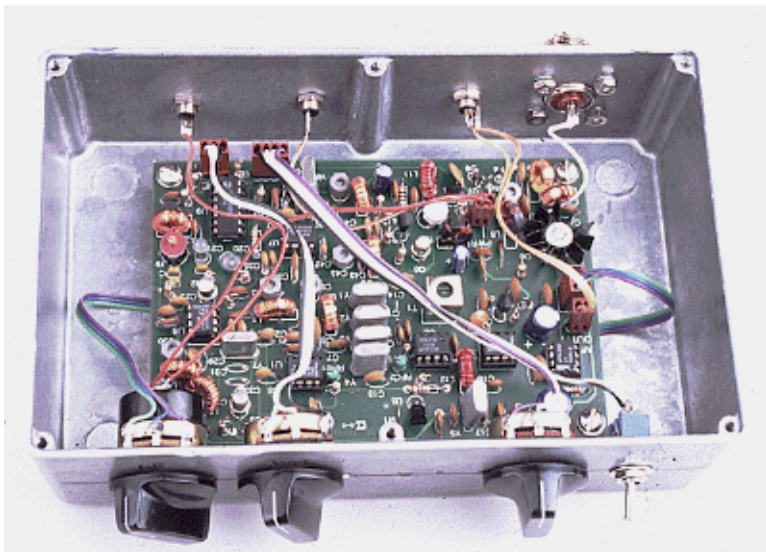
The construction manual can make or break a kit, especially for a beginner. This one starts off on the right foot, with a personal note from the kit designer, Dave Benson, NN1G. Right off the bat, I found a few helpful hints such as how to count turns on toroids and a warning that the two types of ferrite material are not interchangeable. An experienced builder will have no trouble using the schematic, parts lists and component-placement diagrams to construct the kit. Most of the assembly instructions are *not* detailed, however. For instance, one section essentially tells you to install the IC sockets, then the rest of the parts. On the other hand, more complex steps—winding toroids and mounting the surface-mount MMIC—are spelled out in some detail.

It took me about four hours to wind all the coils and assemble the printed-circuit-board components. It took another two to drill the chassis, get everything installed and hook it up on the test bench. I spent another hour carefully aligning the receiver and transmitter and got it ready for the Lab tests. The receiver worked just fine. On transmit, however, I saw some spurious signals that were down only about 25 dB from the carrier, just shy of the 30 dB that FCC regulations require. A quick phone call to Dave Benson and an evening on his test bench solved the problem. Dave replaced Q5 with a J309 FET, improving the performance of the internal band-pass filter. (He will make the change on the next batch of kits he puts together.) On our kit, this solved the spectral problem, but slightly reduced the output power.

After hooking it up to an antenna at our HQ club station, W1INF, I heard a few DX stations booming in. To hear for myself what it sounded like, I used the station's IC-765 with a 6-inch antenna attached as a receiver. The GM-20 was about S9 + 20 dB. On frequency, the keying sounded nice. I cranked the keyer speed up to maximum (about 60 wpm) and sent a string of dits. They were crisp and clean even at high speed. However, when I tuned the receiver up and down the band, I did hear some key clicks, indicating that the keying is quite sharp.

On receive, the unit is a gem! It is nice to have such selectivity in such an inexpensive QRP kit. I could hear the weak ones right next to the strong ones, with band noise setting the lower limit, not the receiver's sensitivity. While the dynamic-range figures are not as good as a kilobuck transceiver, I heard no signs of overload or intermod under normal operating conditions. The potentiometer controls the frequency smoothly, with no sudden jumps in frequency. The manual suggests using a vernier drive on the main tuning control. I tuned in a strong station and tested the mechanical stability of the unit (a very scientific test, I assure you). While I did observe some microphonics, the unit stayed on frequency quite well when subject to mechanical vibration.

On-the-air reports were just about what one would expect with about 2 W. I made a few quick contacts before my lunch break was over. I can't wait to take it portable to see how it plays from a campsite in the forest. I haven't been very active of late; perhaps putting together a fun kit that works so well will be just the shot in the arm needed to get me back into the swing of things.—*Ed Hare, KA1CV*



Small Wonder Labs Green Mountain 20

Measured in the ARRL Lab

Size (LW): 4.75×3.5 inches; weight: 3.5 oz (board only).

Power requirements:	Transmit, 510 mA (max); receive, 42 mA (max volume, no signal), tested at 13.8 V.
Typical tuning range:	80 kHz.
Power output:	1.8 W (typical).
Spectral purity:	Meets FCC requirements for spectral purity.
Minimum discernible signal:	-127 dBm.
Blocking dynamic range:	109 dB.
Two-tone dynamic range:	86 dB.
IF/audio response:	Range at -6 dB points (bandwidth): 319-1280 Hz (961 Hz).
Audio output power:	1.5 W at 10% THD into 8 W.
Price class:	\$75.

WILDERNESS RADIO NORCAL 40A (REV. B)

This NorCal 40A is a very small single-band (40-meter) CW transceiver designed with the camper or backpacker in mind. Best of all, it makes a great beginner's kit! It is very straightforward in construction with no off-board jumpers or wiring. The manual is excellent, very well laid-out and easy to read. Parts and PC board are outstanding, and the package includes everything needed to make the radio work. Wilderness Radio pays attention to detail. The parts and boards are high-quality (plated-through holes and solder masked), and even the four crystals for the IF filter were hand-matched prior to shipment to ensure a tight 400-Hz bandwidth. The two-tone blue case is attractive, too, with silk-screened letters and clips on the side to allow easy access.

My building experience spans more than 30 years (my first kit was a Heathkit GR-91 superregen receiver in 1961!), so this kit was a real pleasure, even relaxing. The hardest part was winding toroids, a job I hate! (*You might love it, however.—Ed.*) The easiest part was getting the radio to work. It fired up the first time out! I started making contacts immediately. Signal reports (using the rig at just under 2 W output from a 12-V battery) were 559 to 579 on my full-size 80-meter Zepp. Subsequently, I raised the power output to 3 W by modifying the PA and replacing the final transistor (more on this later).

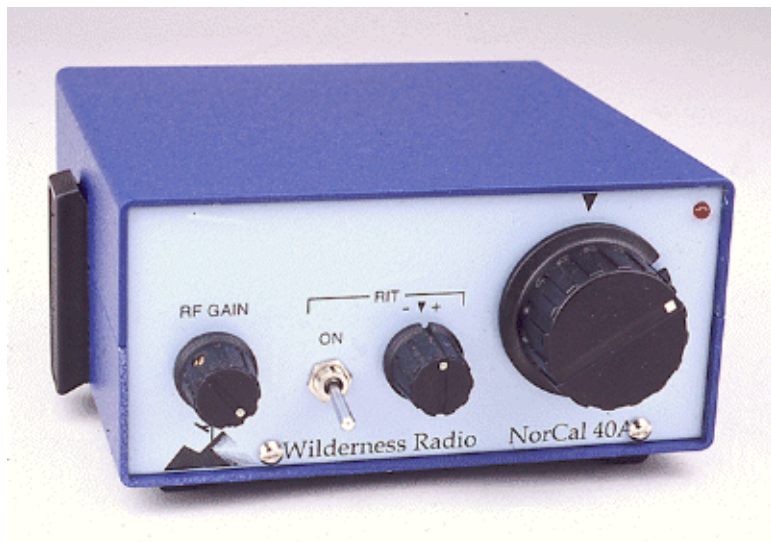
The single outstanding feature of the NC-40A is its receiver. It's extremely sensitive, and the IF passband is tight (about 400 Hz). This combination makes you think you're using a much more complex rig. The single-conversion, superhet performs like gang-busters, surpassing my expectations by several orders of magnitude. Power consumption is super-low. A small gel cell lasts an entire weekend in the bush. The NorCal 40A is really a backpacker's delight.

The lone calibration mark on my rig is a tiny dot that indicates the QRP calling frequency, 7040 kHz. You could easily construct a calibrated dial ring, however. The controls are ultra simple: an RF gain control, RIT on-off switch, RIT control and main tuning control are on the front panel. The rear panel holds the antenna jack, power on/off, key and phone jacks. My entire station fits inside a small padded CD bag I got on sale.

I made a few changes to my NC-40A that I picked up from the NorCal quarterly newsletter, *QRPP*. First, I installed two small-diameter brass rods (tapped and drilled for hardware) beneath the PC board for added strength to the end panels. This improves stability and durability. Then, I replaced the final transistor with a Motorola MRF-237 and made a few changes to the output network. This yielded another watt or so. I also added some "creature comforts," including a power-on LED on the front panel and a Curtis chip keyer inside the radio. (Wilderness Radio now supplies a keyer/frequency counter kit, the KC-1, that's ideal for such applications. See below.—*Ed.*)

The '40A is an absolute joy to use. It is simple to build, and the design is nonin-timidating. Once familiar with the individual circuit operations, anyone with rudimentary electronics knowledge could troubleshoot the rig with little problem. It is small,

lightweight, easy to use, ultra-portable and well worth the price. As a first kit for newcomers, I would give it very high marks. By the way, Wilderness Radio customer support is great, if you ever need it. —Rich Arland, K7YHA



Wilderness Radio NorCal 40A (Rev. B)

Size (HWD): 2.2×4.6×4.5 inches; weight: 15 oz.

Power requirements:

Typical tuning range:

Power output:

Spectral purity:

Minimum discernible signal:

Blocking dynamic range:

Two-tone dynamic range:

IF/audio response:

Audio output power:

Price class:

Measured in the ARRL Lab

Transmit, 300 mA (max); receive, 28 mA (max volume, no signal), tested at 13.8 V.

40 kHz.

3 W (typical, after modification; see text).

Meets FCC requirements for spectral purity.

−137 dBm.

108 dB.

89 dB.

Range at −6 dB points (bandwidth): 526-797 Hz (271 Hz).

336 mW at 10% THD into 8 W (with AGC minimized).

\$130.

WILDERNESS RADIO SIERRA

You could call the Wilderness Radio Sierra the big brother to the tiny NorCal 40A, and it's also a super performer that rates a "10" in my book. This is an excellent kit for builders with one or two simpler kits under their belts. I was able to put the radio and the nine band modules together in a couple of days. Less-experienced builders will want to take their time, however.

This attractive little radio provides a couple of watts on all HF bands, has few controls and room for add-ons. It's really simple. In addition to a horizontally oriented meter, the front-panel includes a smooth, vernier-driven tuning dial, RF and AF gain controls,

an RIT control and an RIT on-off switch and a headphone jack. That's it!

The kit contained nothing unexpected, but be prepared to wind a *lot* of toroids (yuck!). The high-quality, plated-through boards are densely populated with parts, so you need to pay close attention to what you're doing. It's a pain to remove parts after they're soldered!

The kit consists of the main board and individual modules for your favorite bands (I got them all). To change bands, you pop the top using the two little snaps on each side of the case, pull out the band module and plug in the one you want (sort of like plug-in coils way back when.—*Ed*). The instructions and manual were outstanding, as was the support from Wilderness Radio. I had a problem with the 30-meter module, and Bob Dyer and Wayne Burdick helped me through it (turned out to be a bad solder connection).

I used a digital frequency counter, a general-coverage receiver, VOM, a calibrated wattmeter and my ears to align and calibrate the Sierra. The receiver performance and the QSK provide strong competition for my Ten-Tec Argonaut 515. In fact, I was able to hear a 20-mW beacon in North Carolina from my Pennsylvania QTH with the Sierra that I could not hear with the Argonaut 515. The receiver *seems* quieter, too. Dial readout is only to the nearest 5 kHz, but I added a Wilderness Radio KC-1 keyer/frequency counter (see below), so I can spot my frequency to the nearest 1 kHz now.

I used the radio in the 1996 ARRL International DX Contest (CW) and managed to work 36 countries on three bands. Overall, I'm almost halfway to DXCC with this little rig (now to collect the QSLs). On-the-air reports have been favorable, and one friend called it "the sweetest CW rig" he'd ever heard me use—and he's heard several!

Under crowded band conditions, I found the performance was quite good. I kept tightening down the internal variable IF bandwidth control (ABX) as needed, but otherwise, I ran it at approximately 400-Hz bandwidth most of the time and noted little or no "blowby" from extremely loud stations. (The manual explains how to modify the radio to make the ABX a front-panel control.)

While I use the Sierra for a "home station" rig, it's also a great backpacker's rig. Its small size, high efficiency and low current drain make it a natural for camping, hiking and "wilderness" excursions. Just take along the band modules you want. It might even be suitable as a mobile CW rig, although it lacks a noise blanker.—*Rich Arland, K7YHA*



Wilderness Radio Sierra

Measured in the ARRL Lab

Size (HWD): 2.6×6.3×5.3 inches; weight: 2 lb.

Power requirements:

Transmit, 300 mA (max); receive, 52 mA (max volume, no signal), tested at 13.8 V.

Typical tuning range:

145 kHz.

Power output:	2-3 W (typical; varies by band).
Spectral purity:	Meets FCC requirements for spectral purity.
Minimum discernible signal:	160 m, -126 dBm; 80 m, -128 dBm; 40 m, -126 dBm; 30 m, -136 dBm; 20 m, -131 dBm; 17 m, -138 dBm; 15 m, -129 dBm.
Blocking dynamic range:	103 dB (80 m); 110 dB (20 m)*
Two-tone dynamic range:	85 dB (80 m); 88 dB (20 m)*
IF/audio response:	Range at -6 dB points (bandwidth): As tested, 187-959 Hz (772 Hz).**
Audio output power:	53 mW at 10% THD into 8 W.
Price class:	\$215, basic kit.

*Only bands tested.

**Bandwidth is internally adjustable, 150-1500 Hz.

A Nifty Finishing Touch

Wilderness Radio, which has been among those in the forefront of kitting-up small, low-power transceivers for the backpacking and QRP communities, recently came out with a small accessory that's been getting raves from all who have encountered it. It's the KC-1 frequency counter/keyer kit, an amazing little device. It's a tiny memory keyer and frequency counter that burps out the frequency in Morse! I found one in my Christmas stocking this past year. The little board (2.5x0.8 inch) goes together in about a half-hour, but don't rush, because you need to solder very carefully. The chip is socketed. All components, which include two push-button switches and a potentiometer, mount on the board, which, in turn, can be panel mounted inside transceiver kits such as these.

In action, the KC-1 offers an iambic keyer (two modes, 8 to 50 wpm) with a partitioned message memory plus a "display-less" counter that reads frequency in three digits (you feed the Morse audio output to your radio). A "search" feature lets you enter a frequency in CW, and the unit will report in CW when you tune to that spot, so it's almost indispensable for those using radios with less-than-reliable dials. It hardly uses any power at all—just 3 or 4 mA at 7 to 16 V will run it. Instructions tell you exactly how to wire it up to most of the kits in this article. The complete kit from Wilderness Radio is \$44.50; partial kit is \$24.50, plus shipping and handling.

Now that you've had a chance to share our kit-building experiences here, order a transceiver kit that suits your needs and budget, warm up that soldering iron, and join the fun!

Where to buy:

G-QRP Club GQ40 kit, \$156; GQ20 kit, \$165, plus shipping. Kanga US, Bill Kelsey, N8ET, 3521 Spring Lake Dr, Findlay, OH 45840; tel 419-423-4604; e-mail kanga@bright.net.

Gary Breed transceiver complete kit, \$153.50; less enclosure, \$115, plus shipping (80, 40, 30, 20, 17 or 15 meters). 624 Kits, 171 Springlake Dr, Spartanburg, SC 29302; tel 803-573-6677.

Green Mountain 20 kit, \$75, postpaid (40, 30, 20 or 15 meters). Small Wonder Labs, Dave Benson, NN1G, 80 E Robbins Ave, Newington, CT 06111; tel 860-667-3536.

NorCal 40A kit, \$129; with KC-1 compatible panel, \$135; **Sierra**, basic kit, \$215; with any three band modules, \$295; all six band modules, \$369; band modules \$31 each; **KC-1 counter/keyer**, \$45, plus shipping. Wilderness Radio, PO Box 734, Los Altos, CA 94023-0734; tel, 415-494-3806.

OHR-400 kit, \$319.95; Keykit keyer, \$39.95, plus shipping. Oak Hills Research, 20879 Madison St, Big Rapids MI 49307; tel, 616-796-0920; e-mail ohrqrp@aol.com.

TAC-1 kit, \$199.95; assembled and tested, \$299.95 (80 or 40 meters); keyer, \$29.95, if purchased with TAC-1, plus shipping. S&S Engineering, 14102 Brown Rd, Smithsburg, MD 21783; tel 301-416-0661.

Our Contributors...

Rich Arland, K7YHA, of Wilkes-Barre, Pennsylvania, has been a ham for 33 years. A dedicated QRPer, Rich has written many articles and books on the fun of running low power and succeeding with it, including a trilogy, *Low Power Communications*, Vols. 1-3. He authored "Low-Power Contesting" in the March 1996 *QST*.

Jeff Gold, AC4HF, of Cookeville, Tennessee, has been a ham four years and has been building kits—mostly QRP transceivers and accessories—for a couple of years. He wrote "The Joy of Building," which appeared in *QST*, September 1993. He ranks his kit-building ability as "good" and says most of his kits work the first time.

Ed Hare, KA1CV, of Burlington, Connecticut, is the ARRL Laboratory Supervisor. Ed is a long-time QRP buff and occasional county hunter. First licensed in 1963, he has WAS with 250 mW and now is trying to do it again with 10 mW (30 states worked so far!).

Rick Lindquist, KX4V, of Granby, Connecticut, has been a ham since the dawn of the Heathkit era. He's a mobile CW enthusiast who also enjoys tinkering with QRP. He joined ARRL as an assistant technical editor in 1995 and edits Product Review and Happenings in *QST*.

Don Shipman, W3RDF, of North Myrtle Beach, South Carolina, has been licensed since 1950 and calls himself a "long-time homebrewer." He's built several QRP transceivers from kits and enjoys CW and QRP. In July, he plans to operate as OH0/W3RDF/QRP from Aland Island!