Product Reviews

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Icom IC-R30 Portable Communications Receiver,

HecKit QRP Wattmeter Kit,

K1EL Systems WKmini USB CW Keyer,

Garmin inReach Mini Satellite Communications Device

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Product Review

Icom IC-R30 Portable Communications Receiver

Reviewed by Steve Ford, WB8IMY
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Wide-coverage reception is common these days. Transceivers of all types, including some low-cost models, routinely boast of extended receive ranges. It's even possible to turn your computer into a dc-to-daylight software-defined receiver with a bit of free software and an inexpensive USB dongle.

Less common are wide-coverage, dedicated receivers that don't depend on assistance from any other devices, including computers. Fewer still are the radios designed to bring optimum performance to the task of receiving signals, while being so compact they fit in a coat pocket with room to spare. The Icom IC-R30 is one of these rare creatures.

The IC-R30 covers 100 kHz to 3.5 GHz in a handheld package that weighs just over 10 ounces with the battery and the antenna, and it does so with performance that rivals radios several times its size. Within its broad coverage, you can listen to AM, SSB, CW, FM (wide and narrow), D-STAR, NXDN, and APCO 25 (Phase 1) communications. The IC-R30 also offers the ability to monitor digital private mobile radio (dPMR) and digital convenience radio (DCR), although you'll only find those signals in Europe and Japan, respectively.

Bottom Line

Icom's IC-R30 handheld receiver covers a wide range of bands from LF through microwaves, with reception of a wide range of analog and digital modes.

Out of the Box

The IC-R30 is supplied with a 27-inch telescoping antenna that is more articulated than an ordinary whip. It rotates at two separate points near the base, allowing you to position the antenna exactly where you need it, even if that means collapsed and slung down along the side of the radio. The antenna screws into a female SMA connector, which also allows you to connect an external antenna with an appropriate adapter.

The package also includes a drop-in charger. Slide the radio into the charger and wait for the green LED to indicate that its lithium-ion battery is charged and ready to go.

I was pleasantly surprised to discover a USB cable in the box as well. Many radio manufacturers require users to source their own USB cables, but Icom made an exception with the IC-R30. The USB connection is particularly useful in this radio, as we'll discuss later.

Table 1
Icom IC-R30, serial number 16002021

Manufacturer's Specifications	Measured in the ARRL Lab
Frequency coverage: Receive only, 100 kHz to 822 MHz. 851 to 867 MHz, and 896 to 3305 MHz (cellular blocked).	As specified.
Modes of operation: *A Band ≤1,300 MHz:* FM, FM-N, WFM, AM, AM-N, LSB, USB, CW, CW-R, D-STAR (DV), P25, dPMR, NXDN-VN, NXDN-N, DCR. *A Band, >1,300 MHz:* FM, FM-N, WFM, AM, AM-N. *B Band:* FM, FM-N, AM, AM-N, D-STAR (DV), P25, dPMR, NXDN-VN, NXDN-N, DCR.	As specified (-N = narrow).
Power requirement: 3.6 V dc (supplied battery), charged via USB cable. 330 mA (typical), 200 mA (standby), 100 mA (power saving). BP-293 battery case (3 AA cells) optional.	With supplied battery (4.1 V dc, full charge): At maximum volume, backlights on, 560 mA; backlights off, 500 mA; standby, lights off, 226 mA; battery saver on, 130 mA.
Receiver	**Receiver Dynamic Testing**
SSB/CW sensitivity: 10 dB S/N, 495 kHz – 1.9 MHz, 0.4 µV; 1.9 – 148 MHz, 0.25 µV; 430 – 450 MHz, 0.32 µV.	Noise floor (MDS), CW mode: 137 kHz, –120 dBm; 475 kHz, –128 dBm; 1.0 MHz, –134 dBm; 3.5 – 70 MHz amateur bands, –137 dBm; 144, 222, and 432 MHz, –138 dBm; 902 MHz, –137 dBm; 1296 MHz, –128 dBm.
AM sensitivity: 10 dB S/N, 495 kHz – 1.9 MHz, 2.2 µV; 1.9 – 30 and 118 – 136 MHz, 1.4 µV.	10 dB (S+N)/N, 1 kHz tone, 30% modulation: *Frequency* *AM* *AM-N* *Frequency* *AM* *AM-N* 0.198 MHz 2.75 µV 2.26 µV 15.1 MHz 0.63 µV 0.53 µV 1.020 MHz 0.81 µV 0.66 µV 29.0 MHz 0.78 µV 0.64 µV 3.885 MHz 0.58 µV 0.46 µV 50.4 MHz 0.58 µV 0.48 µV 6.160 MHz 0.53 µV 0.47 µV 120.0 MHz 0.78 µV 0.63 µV 7.490 MHz 0.52 µV 0.44 µV 144.4 MHz 0.53 µV 0.43 µV
FM sensitivity: 12 dB SINAD, 3.5 kHz deviation, 28 – 222 MHz, 0.4 µV; 222 – 1300 MHz, 0.56 µV; 1300 – 2700 MHz, 1.8 µV; 2700 – 3305 MHz, 18 µV. WFM (wide FM), 76 – 108 MHz, 1.8 µV.	For 12 dB SINAD, 3 kHz deviation, 1 kHz tone: *Frequency* *FM* *FM-N* *Frequency* *FM* *FM-N* 29 MHz 0.23 µV 0.21 µV 223 MHz 0.14 µV 0.13 µV 52 MHz 0.16 µV 0.14 µV 440 MHz 0.14 µV 0.13 µV 70 MHz 0.18 µV 0.16 µV 902 MHz 0.22 µV 0.21 µV 100 MHz 0.67 µV (FM Wide) 1.3 GHz 0.40 µV 0.22 µV 146 MHz 0.14 µV 0.13 µV 2.0 GHz 0.71 µV 0.65 µV 162 MHz 0.14 µV 0.13 µV 3.0 GHz 1.68 µV 1.46 µV
S-meter sensitivity: Not specified.	For full-scale bar graph reading: 14 MHz, 1.33 µV; 50 MHz, 1.48 µV; 146 MHz, 2.75 µV; 440 MHz, 2.37 µV; 902 MHz, 1.99 µV; 1296 MHz, 2.63 µV; 2 GHz, 3.59 µV; 3 GHz, 4.16 µV.
Blocking gain compression dynamic range: Not specified.	At 14 MHz, 20 kHz spacing, 88 dB.*
Reciprocal mixing dynamic range: Not specified.	At 14 MHz, 20 kHz spacing, 65 dB.*
Two-tone, third-order IMD dynamic range: Not specified.	20 kHz spacing: 14 MHz, 66 dB; 50 MHz, 75 dB; 144 MHz, 67 dB; 432 MHz, 58 dB.
Second-order intercept point: Not specified.	14 MHz, –11 dBm; 21 MHz, –5 dBm; 50 MHz, +29 dBm; 144 MHz, +43 dBm; 432 MHz, +23 dBm.
FM adjacent channel rejection: Not specified.	20 kHz spacing, FM/FM-N: 29 MHz, 58/62 dB; 52, 146, 440 MHz, 59/63 dB.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz spacing, FM/FM-N: 29 MHz, 58/62 dB,† 52, 146, 440 MHz, 59/63 dB.† 10 MHz spacing, FM/FN-N: 29 MHz, 65/62 dB; 52 MHz, 69/75 dB; 146 MHz, 56/60 dB; 440 MHz, 61/67 dB.
Squelch sensitivity: AM, 495 kHz – 1.9 MHz, 2.2 µV; 1.9 – 30 and 118 – 136 MHz, 1.4 µV. FM, 28 – 222 MHz, 0.4 µV; 222 – 1300 MHz, 0.56 µV; 1300 – 2700 MHz, 1.8 µV; 2700 – 3305 MHz, 18 µV. WFM (wide FM), 76 – 108 MHz, 5.6 µV.	Minimum to maximum squelch range: FM, 29 MHz, 0.38 – 1.13 µV; 52 MHz, 0.34 – 1.08 µV; 146 MHz, 0.73 – 2.26 µV; 440 MHz, 0.51 – 1.57 µV. FM narrow, 29 MHz, 0.43 – 1.32 µV; 52 MHz, 0.4 – 1.29 µV; 146 MHz, 0.88 – 2.72 µV; 440 MHz, 0.6 – 1.88 µV.
IF/audio response: Not specified.	Range at –6 dB points: CW, 375 – 1825 Hz; USB, 462 – 2562 Hz; LSB, 242 – 2625 Hz; AM: 350 – 4245 Hz.

Size (height, width, depth, including protrusions): 6.2 × 2.3 × 1.2 inches. Antenna length, 7.2 inches collapsed, 27.7 inches extended. Weight: 10.4 ounces with battery and antenna.

*AGC could not be disabled for this test (AGC is normally disabled during dynamic range testing).
†Measurement was noise limited to the value indicated.

The ARRL Laboratory charged the IC-R30 for testing prior to sending it to me, so there was little else to do but remove it from the box, attach the antenna, and turn it on. Using just the telescoping antenna indoors, I didn't expect much on the signal front. I tapped the direct frequency entry button on the keypad, punched in 10 MHz, and then selected the AM mode. I was immediately greeted by the dulcet tones of National Institute of Standards and Technology station WWV coming in loud and clear.

I wanted to know how the IC-R30 and its indoor antenna would handle the challenge of 40-meter amateur SSB. After switching to lower sideband and entering 7.255 MHz, I was pleased to hear the East Coast Amateur Radio Service (ECARS) net. This initial test took place while seated on the first floor living room of an aluminum-sided house. I was impressed.

SSB demodulation was crisp, clear, and stable, every bit the match for my regular station transceiver. Moving down to CW, reception was equally impressive, although the IC-R30 lacks the ability to adjust the IF or audio bandwidths for a narrow CW passband.

I dialed in 7.074 MHz USB and ran an audio cable from the earphone jack to the microphone input on my laptop. After booting up the *WSJT-X* software and making a few adjustments, I found myself decoding all the FT8 signals I could see in the waterfall display.

Because I hadn't yet opened the manual (yes, I am one of those people), I discovered one feature entirely by accident. While adjusting the side buttons to increase the volume, my finger strayed briefly onto the power button. The IC-R30 startled me by speaking aloud and announcing the frequency and mode. A quick press is all it takes to trigger it. This would be especially helpful for the visually impaired.

As I explored further, I discovered that like any communications receiver worthy of the label, the IC-R30 includes adjustable RF gain and a multi-step attenuator. These functions really come in handy when you connect the radio to an external antenna. The IC-R30 is designed to expect lower signal levels from the telescoping whip antenna, so it is prone to overload when you connect a superior skyhook. When listening to medium-wave AM, the radio relies on its internal ferrite bar antenna, but even with this antenna, the front end can overload.

The IC-R30 adds a capable automatic noise-limiting function and a separate noise blanker. The noise limiter is available when listening to AM, while the blanker is intended for SSB and CW.

Dual-Watch and Band Scope

The IC-R30 can receive two separate signals simultaneously with its dual-watch functionality, and it will show both frequencies in its 2 × 1.5 inch display as A or B bands that you can designate as either the main or subband (see Figure 1). You can listen to any frequency or mode on the A band, but only the 108, 146, 370, and 440 MHz segments on the B band.

There is a band scope you can activate within whichever band you've selected as the main band. It can sweep once, or continuously, through a range centered on the display frequency. The sweep range is equivalent to 15 times whatever you've chosen for the tuning step. The IC-R30 doesn't provide a touchscreen display, so the only way to stop the sweep and select an interesting-looking signal spike is to push the **CLEAR** button and then twist the dial to move the sweep marker to the target.

Memory Cards and Audio Files

On the side of the IC-R30, you'll find a slot for a microSD memory card. The radio uses this card to store various types of data, including frequency memories and audio files. You must supply a card for use with the receiver, but these are inexpensive and widely available. For this review, I used an 8 GB card.

You can remove the memory card and read the contents on your computer by placing the card in a USB adapter. However, in the IC-R30, you have an easier option — and this is where the USB cable comes into play.

Figure 1 — Receiving SSB on 20 meters on one VFO, and D-STAR on 70 centimeters with the other VFO.

If you attach the USB cable between the IC-R30 and your computer, your computer will recognize the radio's memory card as it would any other storage device, such as a disk drive. In my case, the computer decided that the IC-R30 would be Drive E. All I had to do was open Windows *Explorer*, and I could access everything on the card and write to the card as well. That's much more convenient than physically swapping cards and adapters.

As a bonus, the IC-R30 battery can recharge through the USB connection. The amount of power available at USB ports can vary, so some may be better chargers than others. I tried a few USB options, and while the battery charged in all cases, charging seemed faster with the dedicated Icom charger.

In addition to an automatic reception log, anything you can hear can be recorded and stored to the card for later playback, either through the radio itself or your computer. The IC-R30 stores audio in WAV format, which can result in some large files, but my 8 GB memory card had plenty of room.

There is software available from both Icom (available through dealers) and RT Systems (**www.rtsystemsinc.com**) that you can use to manage the IC-R30's memory contents. With all the available memories and frequencies (and modes) the radio can store, software makes it much easier to manage.

I didn't have an opportunity to try either software package during this review, but I performed one experiment with interesting results. In the memory menu, there is an option to export the memory contents as a CSV (comma-separated values) file. I did this, and then attempted to import the result into Microsoft *Excel*. It worked, and I was able to view and edit the memories in *Excel*, save the file, and then successfully load it back into the IC-R30. Using the Icom or RT Systems software would have been far more elegant, but it was great to see that there is an alternative.

GPS Receiver

As long as we're discussing memory card storage, this is a good time to introduce the fact that the IC-R30 has a built-in Global Positioning System (GPS) receiver. The GPS receiver seemed to be quite sensitive, and it was able to obtain a position fix quickly — even when I was using it indoors with just a window to access the open sky (see Figure 2).

The IC-R30 GPS can be used like any other GPS receiver to determine your position and log your travels. The GPS data can be saved to the memory card and exported for use in other applications, such as *Google Earth*.

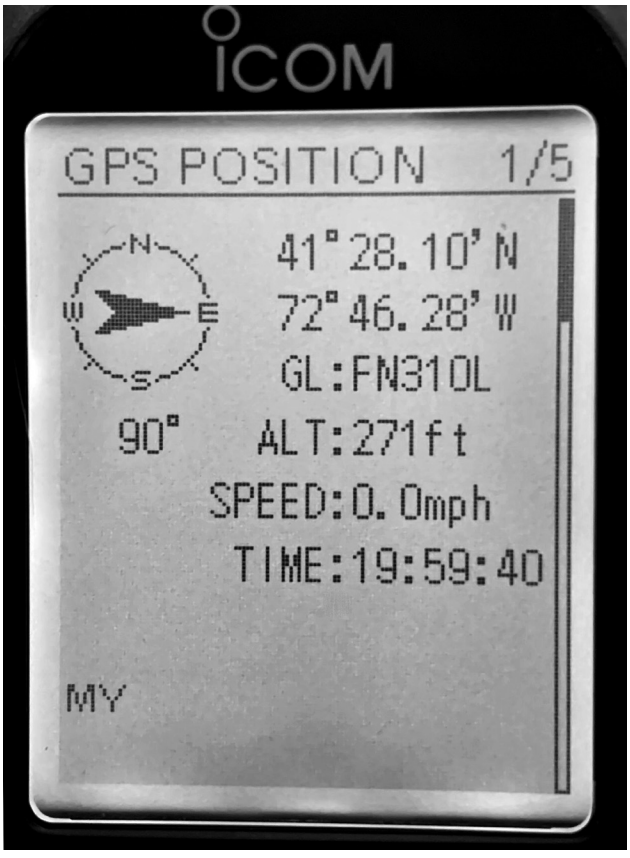

Figure 2 — The built-in GPS receiver seemed quite sensitive.

GPS logging has a practical application that I didn't discover until I had used the radio for a while. If you're roaming the countryside and tracking local signals, it helps to know where you were at a given time. Audio recordings are tagged with the date and time, making it possible to match recordings with your GPS log.

VHF and Beyond

The Icom IC-R30 truly excels in the world above 50 MHz. In particular, its scanning features are among the best I've seen in a long time. You can set up various types of scans and even combine them if necessary. For example, I set up one scan to search for analog FM signals between 146 and 148 MHz, and saved it with the memory label "2M FM." A while later, I configured a scan to look for D-STAR activity between 444 and 450 MHz and labeled it "DSTAR 444."

With the scan configurations stored in memory, I could trigger one or the other any time I wished. Moreover, I

could link the scans, repeatedly running the 2-meter FM sweep, followed by the 70-centimeter D-STAR scan.

The IC-R30 also offers a write-to-memory scan that sweeps through a given range and stores every active frequency in memory. To avoid storing a collection of annoying interference, you can activate the radio's Voice Squelch Control (VSC) that attempts to differentiate between voice activity and random noise. I found the VSC worked remarkably well at identifying real signals.

There was plenty of D-STAR activity to monitor in my area, but finding NXDN signals was a challenge. I did manage to briefly catch a ham NXDN repeater in action, but I had to be very patient.

Monitoring P25 presented a different challenge. My local police and fire departments use P25, but they are on trunking systems, where signals quickly appear and disappear on various frequencies. There are receivers that attempt to decode trunking control signals and track the frequency jumps accordingly, but the IC-R30 doesn't include this capability. Also, more public service agencies are switching to encrypted P25 systems. I turned up a few of these and heard nothing but gibberish.

The IC-R30 lacks the ability to decode digital mobile radio (DMR) signals, which is unfortunate given the rapid growth of amateur activity on that mode. It would have been interesting to eavesdrop on amateur radio DMR repeaters, and commercial operations as well. I wasn't able to use it to monitor any of the System Fusion C4FM activity in my area either.

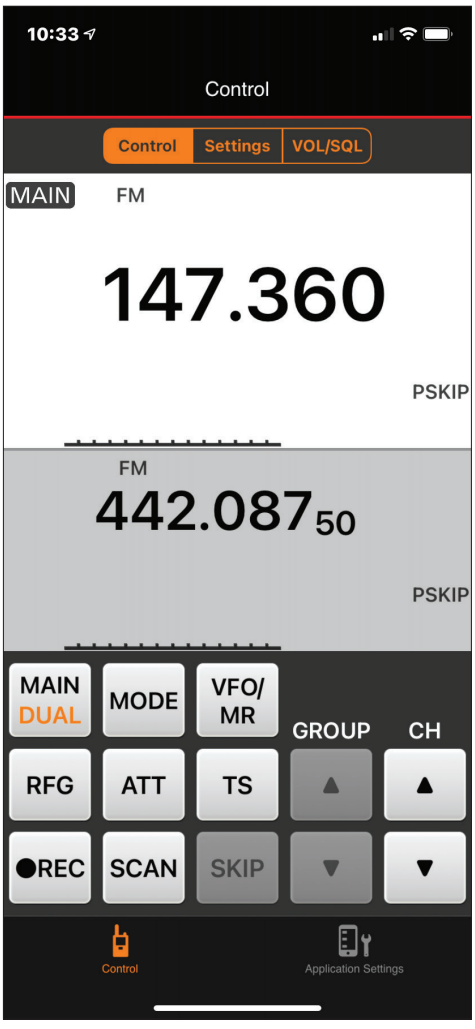

Figure 3 — You can control the IC-R30 via a free Icom app for either your iOS or Android mobile device.

Bluetooth Audio and Remote Control

The IC-R30 offers wireless Bluetooth connectivity for whatever devices you care to pair it with. I tried it with a pair of wireless headphones, and it was flawless.

The radio can also use its Bluetooth connection for remote smartphone or tablet control via either an iOS or an Android app. Both apps are available free of charge. For the review, I installed the iOS app in my smartphone and had no difficulty connecting to the IC-R30 (see Figure 3). From any location in my home, I was able to select frequencies, modes, and more.

The app doesn't stream the receive audio from the radio, which was initially disappointing. Then I remembered that many Bluetooth devices can support more than one simultaneous connection. So, I reconnected my wireless headphones to the IC-R30 and was delighted to discover that I could listen to signals and use the app to control the radio at the same time. Occasionally, the app control link would drop when I was doing something more involved than simply changing frequencies, but I was able to quickly reestablish the link. The audio stream was never interrupted during the control dropouts.

Conclusion

I'll be the first to admit that the IC-R30 is expensive. On the other hand, it helps to remember that you're paying for a marvel of the engineering art that has been squeezed into a remarkably small package. Yes, the lack of DMR may be a shortcoming for some, but for others, the IC-R30 will more than compensate with its array of features and outstanding performance.

Manufacturer: Icom America, 12421 Willows Rd. NE, Kirkland, WA 98034; **www.icomamerica.com**. Price: $600.

HecKits QRP Wattmeter Kit

Reviewed by Paul Danzer, N1II
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The HecKits QRP Wattmeter kit is specified for use from 2 to 30 MHz and has three power measurement ranges: 100 mW, 1 W, and 10 W. It comes with a custom aluminum case that is drilled for all of the controls and connectors, but is otherwise unfinished and unlabeled. A printable template for front- and back-panel labels is supplied if you wish to glue it on (I didn't try that). The unit can be powered by an internal 9 V battery or an external 12 V dc power supply.

Overview

The case measures approximately 4.7 × 4 × 4 inches (height, width, depth). The left-hand knob on the front panel selects forward or reverse power, and the right-hand knob selects the power range. The LED below the meter glows blue when the unit is turned on.

The rear panel (see Figure 4) has two miniature toggle switches. One selects peak or average power reading, and the other selects the internal battery or coaxial external dc power connector. The BNC connectors are for connection to the transceiver and dummy load or antenna.

The design uses a directional coupler that you make from two identical pieces of thin coaxial cable and two toroid cores. There are two identical sections to the coupler, one selectable for forward power and the other for reverse power. Directional couplers of this general design are described in detail in the "Test Equipment and Measurements" chapter of *The ARRL Handbook* and the "Antenna and Transmission Line Measurements" chapter of *The ARRL Antenna Book*.

For average power measurements, the output of the directional coupler is sent through a 1N34A germanium diode, op amps, and a variable resistor to an ammeter. The gain is set so the voltage from the directional coupler reads full scale, 10 W, on the meter. On the other two scales (1 W and 100 mW), the directional coupler voltage and a fixed voltage are added in one of the op amps to provide full-scale readings. These voltage additions are set during the brief alignment procedure.

For SSB peak power measurements, the directional coupler output produces a modulated dc signal. An additional op amp rectifies and integrates the modulated signal.

Putting It Together

The kit consists of a main PC board, a small PC board for the 9 V dc regulator and bypass capacitors, and several parts mounted on the front and rear panels (see Figure 5).

The manual is supplied as a PDF emailed from HecKits. I found it handy to print several of the color illustrations. To keep track of where I was in the assembly procedure, I made an additional copy of the PC board layout and lightly colored over each part as I mounted it in the main board.

Before starting the build, I copied the main parts list from the instruction manual, overlaid it on a piece of

Bottom Line

The HecKits QRP Wattmeter offers 10 W, 1 W, and 100 mW measurement scales and covers 2 to 30 MHz. It's accurate over its specified power ranges after calibration, which is best done using another power meter of known accuracy.

Figure 4 — The rear-panel switches select peak/average power readings and internal battery/external dc power. The BNC connectors are for the transceiver and load or antenna.

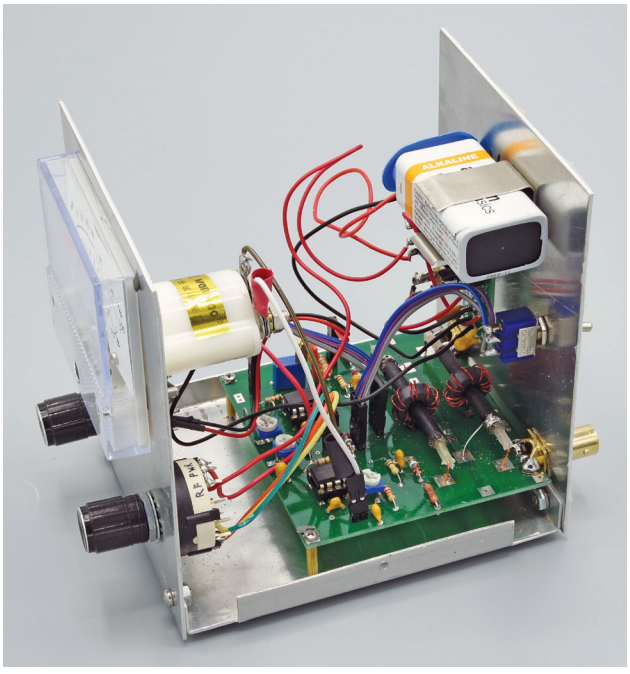

Figure 5 — The main PC board mounts on the bottom of the case, with the small regulator PC board and 9 V battery on the rear panel. The switches and meter connect to headers on the main PC board, and the BNC connectors are soldered directly to the board.

foam board, sorted the small parts by value, and inserted them in the foam-backed list. The resistors all use the standard color codes. The capacitors are quite small and may be marked in values with industrial coding — for example, 10 µF is marked as 106, and 2.2 µF is marked as 225. The manual includes information on identifying components, but you should measure the value if you're in doubt.

The PC board is good quality, with solder mask and some component labels. All components go on the front of the PC board. Several sets of two-pin and three-pin headers are used to connect to the meter and various connectors and controls on the front and rear panels.

Very specific directions are given to wire the two front-panel switches. While they look identical from the outside, one is set for two positions and the other for four positions. They are hand-marked in pen and cannot be interchanged. A ring detent sets the number of allowable positions. If this ring loosens, the manual explains how to reset the detent. A color photo is used to explain the switch wiring.

You must also wire the two toroids. They are identical, with 12 turns of wire on each. You can start at one end and wind all 12 turns, or if you wish, start in the middle and wind six turns on each side. You may find it easier to uniformly space the turns with the six-turn approach. The wire used for the toroids is enamel-covered. You can just tin the ends, and the burnt enamel will simply wipe off.

Before mounting the board in the case, there is one modification I would suggest. If you expect to use the 9 V battery for power, consider mounting the battery clip on the outside of the rear panel instead of the inside. You will have to drill a hole and mount a grommet to carry the battery connecter leads through the rear panel, but with this modification you won't have to open the case every time you replace the battery.

Final Steps

The instruction manual shows two options for calibrating the meter. One method compares readings on the HecKits meter with a wattmeter of known accuracy. Because of component tolerances and variations between the 1N34A diodes used in the coupler, this method will give the best accuracy.

The other method uses a digital multimeter to measure very precise calibration voltages at a test point on the PC board. (These values are for 14.25 MHz, according to the manual.) Install the 9 V battery and a removable jumper used for the calibration mode. Set the unit to measure 10 W average forward power and adjust a multiturn variable resistor for 2.118 V at the test point. Then adjust another variable resistor for a 10 W full-scale reading. Repeat these steps with 0.679 V for the 1 W scale and 0.214 V for the 100 mW scale. Finally, remove the test jumper.

I calibrated the review unit using a multimeter and sent it to the ARRL Lab for evaluation. Test Engineer Bob Allison, WB1GCM, compared readings with the Lab's calibrated HP-437B micro-wattmeter and attenuator test setup. Bob found that at 14 MHz, the HecKits meter read about 25% lower than the Lab's instrument. After recalibrating the HecKits meter to match the Lab setup, Bob found measurements to be very accurate across the power settings. Actual calibration voltages for the review unit measured 2.546, 0.805, and 0.243 V, but this will likely vary from unit to unit.

At this point, you can connect the HecKits wattmeter to your QRP transceiver and measure the output power. You can also calculate the SWR on your feed line using the forward and reflected power values and one of the online calculators. Some additional photos of the kit components and construction are available from **www.arrl.org/qst-in-depth**.

Manufacturer: HecKits, 1302 Highland Dr., Cedar Park, TX 78613; **heckits.com**. Price: $120 plus shipping.

K1EL Systems WKmini USB CW Keyer

Reviewed by Mark Wilson, K1RO
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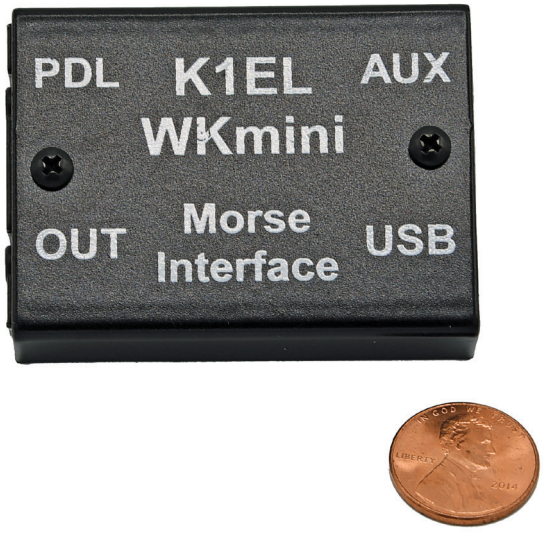
While putting together a portable station for outdoor operating, I acquired a laptop for logging and operating digital modes, such as FT8. For many years, I have used a K1EL Systems WKUSB Winkeyer in my home station. The keyer plugs into a computer USB port and sends perfectly timed CW from many logging and contesting programs, regardless of what other tasks the computer may be performing at the same time.

In looking for a similar solution for my portable station, I found that K1EL Systems has a slimmed-down option — the WKmini. This tiny device offers many of the features of my desktop keyer in a sturdy aluminum case measuring just ⅝ × 2¼ × 1¾ inches. The WKmini has no switches, no pushbuttons for the memories, no speed control, no monitor speaker, and no internal batteries. Everything is controlled by the host software, the transceiver provides the sidetone, and power comes from the USB port. Table 2 shows some of the WKmini's features.

Setting It Up

On the left side, the WKmini has two ⅛-inch stereo phone jacks. One is for the keyer paddle, the other for output to the transceiver. The ring terminal on the output jack can set in software as another keyer output, or as a PTT switch, or for FSK RTTY keying with the latest WinKeyer firmware (more on this later). The right side has an auxiliary jack that is not used, and a mini-B USB jack for connection to the computer. For convenience, I ordered the optional cable set, which includes a USB cable, a cable with ⅛-inch stereo plugs on each end, and a ⅛-inch to ¼-inch stereo adapter for the CW key jack on my radio.



The WKmini uses an FTDI USB driver, and the first step before plugging the WKmini into your PC is to install the driver if it's not already present in your system. The manual offers detailed instructions for locating and installing the driver. Once the driver is installed and the WKmini plugged in, the keyer will be available on a virtual COM port. Although you can locate COM ports using the Windows Device Manager, K1EL Systems offers a utility called *WKscan* that

Bottom Line

K1EL's WKmini is a slimmed-down version of the popular USB WinKeyer for applications where a computer provides power and software control of the settings and messages. Deleting the speed control, message pushbuttons, sidetone speaker, and internal batteries shrinks the WKmini package considerably.

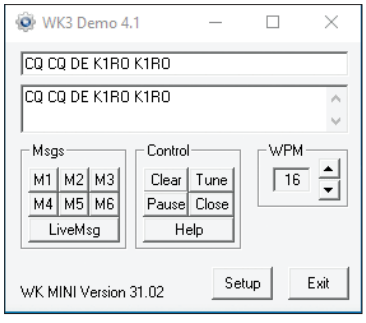
Table 2
Selected WKmini Features

Adjustable speed 5 to 99 WPM
Adjustable weighting
Adjustable keying compensation
Adjustable letter spacing
Adjustable dit/dah ratio
Optional auto spacing
160-character input buffer
Adjustable PTT lead in and tail delays
Iambic A, B, Ultimatic, and bug paddle modes
RTTY FSK transmit with WK3.1
Solid-state relay output rated at 60 V at 200 mA
Metal enclosure with RFI filtering
ESD protection on paddle input
Meets FCC and CE emissions requirements

▲**Figure 6** — The optional cable kit includes a USB cable, a keying cable, and an adapter for the typical ¼-inch key jack.

displays all serial ports in the system. In my case, it showed up as **com4 - WKmini 31.2**, and so COM 4 is the serial port where my applications need to look for the Winkeyer.

K1EL also offers a utility called *WK3demo* that you can use to adjust keyer parameters and store and send messages (see Figures 7 and 8). This worked great for exploring the various keyer settings.



▶**Figure 7** — K1EL's *WK3demo* software offers an easy way to check out the WKmini's many features. It can even be used as a memory keyer to record and play messages. The lower (larger) window shows text to be sent, and it appears in the upper window as it is sent. *WK3demo* Version 4 also supports the FSK RTTY keying features added in WinKeyer Version 3.1.

On the Air

The WKmini uses an optically coupled solid-state relay rated at up to 60 V and 200 mA for keying the radio, so it will handle any modern transceiver. The paddle input dits and dahs can be swapped to match your wiring, and the keyer supports iambic A and B, Ultimatic, and bug modes.

K1EL's website lists more than three dozen ham radio logging, contesting, and Morse code programs that are WinKeyer-compatible. The manual includes detailed, well-illustrated instructions for setting up the WKmini with *N1MM+ Logger*, *Ham Radio Deluxe*, *N3FJP AC Log*, *fldigi*, and *MRP40*. I quickly set up *AC Log* and *WriteLog* on my laptop to use the WinKeyer on COM4 for sending CW, with the logging apps controlling the CW sending speed and memory message contents. Some applications, such as *AC Log*, allow control of weighting and other keyer parameters.

An interesting feature of WinKeyer version 3.1 is the ability to generate an FSK (frequency shift keying) signal for RTTY operation. In the RTTY mode, the ring terminal (PTT) of the output jack connects to the FSK keying input on your transceiver (usually found on one of the multi-pin accessory jacks). The manual includes

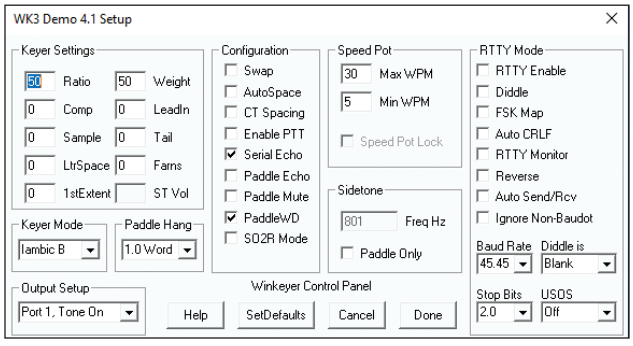


Figure 8 — The *WK3demo* Version 4 setup screen for adjusting both CW and RTTY keying parameters. Some compatible logging and CW programs offer similar setup screens.

detailed instructions for setting up *N1MM+ Logger*, *fldigi*, and *WK3demo V4* to use the WKmini for sending FSK RTTY. You'll still need a RTTY decoder for receiving, for example *N1MM+ Logger* integrated with *MMTTY* or *2-Tone*, or *fldigi*'s built-in RTTY decoder. Some transceivers have RTTY decoders built in as well.

The WKmini instruction manual is excellent. Along with the utilities and support files available from K1EL's website, you should have no trouble setting up and using the WKmini to generate perfect CW. Firmware can be updated via the USB cable as new versions become available.

Manufacturer: K1EL Systems, **www.k1elsystems.com.** Price: $64 plus shipping; $74 with a cable kit.

Garmin inReach Mini Satellite Communications Device

Reviewed by Bruce Prior, N7RR
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A crucial part of our radio amateur heritage is helping other people in distress. When people depend on us to transmit and deliver an accurate emergency message, we accept the challenge.

I enjoy backcountry hiking and operating from portable locations for Summits on the Air (SOTA), often in remote areas that are out of cell phone range. Even non-emergency messages can be important for friends and family, such as getting delayed, experiencing bad weather, or having a flat tire.

Global Satellite Communications

Because of the combination of the Amateur Packet Reporting System (APRS) and FM and skywave (HF) amateur radio gear in my backpack, I initially avoided adopting global satellite communications. With the appearance of a shirt-pocket satellite communicator, the Garmin inReach Mini, I decided to take the plunge and carry the small device on my backcountry adventures. Including the antenna, the Mini's dimensions are 3.9 × 2.04 × 1.03 inches, and it weighs 3.5 ounces.

The inReach Mini, shown at actual size. [Photo courtesy of Garmin International]

No license is required for inReach users. In contrast with amateur radio, inReach devices will not operate without paying subscription fees. All inReach subscription plans begin with a $19.95 subscription activation fee. The cheapest contract fee is $143.40 per year for a bare-bones Safety Plan. It's $299.40 per year for a Recreation Plan, and $599.40 per year for an Expedition Plan. For more details about the various plans, visit Garmin's website and look under the "Outdoor Recreation" tab.

The inReach system uses the Iridium satellite constellation. The 66 active Iridium satellites are placed in near-polar orbits in six orbital planes, which means that they are somewhat easier to access the closer the user is located to the North Pole or the South Pole, but the system still operates satisfactorily on or near the equator. Those low-Earth orbit (LEO) satellites use frequencies between 1.616 GHz and 1.6265 GHz. Propagation in that spectrum can be attenuated under dense forest cover and in deep valleys, which means that users may have to wait a short spell until another satellite appears.

Bottom Line

Garmin's inReach Mini satellite communications device offers a safety net for amateurs hiking and operating portable from remote locations for programs such as Summits on the Air (SOTA).

Help in an Emergency

Emergencies don't just happen in the backcountry. They can take place at home or work or while traveling. Carrying an inReach device routinely means that we can use it wherever we find ourselves, and that's especially helpful in areas without cell phone coverage.

The most notable feature of an inReach device is the recessed SOS button, which initiates a text dialogue with the International Emergency Rescue Coordination Center (IERCC) in 210 languages or dialects. IERCC dispatchers can notify local authorities about a rescue request. With more information received from a user, rescue missions can be better prepared to render appropriate assistance. Any inReach owner can request rescue services for other people.

SOS should be invoked only for a genuine emergency. In some jurisdictions, rescues can be expensive for rescued people, so Garmin also sells rescue insurance packages. Rescue insurance is also available to members of the American Alpine Club for human-powered backcountry activities.

Using the inReach Mini

When I was first getting started with inReach, I accidentally set the wrong language in my Mini, so I had to reset the unit. Instructions for resetting are printed permanently on the back of the Mini. Instructions for both sending an SOS alert and for canceling such an alert are also printed on the device.

A GPS receiver in the inReach Mini keeps track of the user's location, plus speed and direction of travel. Waypoints with geographical coordinates and elevations can be saved. Routes of travel can be recorded and reversed for a return trip. Access to the Garmin Earthmate app with topographical maps for smartphones is included with the purchase of any inReach device. Garmin also sponsors an internet facility called MapShare to share routes with others.

Messages can be composed directly on the inReach Mini in uppercase and lowercase, but a limited number of buttons makes text composition time consuming. An inReach unit can be paired with a smartphone via Bluetooth to make manual data entry more efficient. The maximum text length for inReach messages is 160 characters, including recipient contact information. Longer texts need to be divided into more than one message.

Standard messages can be composed ahead of time on the Garmin Explore website and are then synchronized with the handheld device. An inReach owner can send unique text messages to other inReach units, to email addresses, to telephone texting facilities, and to social media. Communication is entirely via text.

You can store three preset messages to be sent multiple times at no extra cost. Here are my three preset messages:

- Heading to planned destination. All is well.
- Staying here overnight. All is well.
- Coming home soon. All is well.

Quick text messages can be saved on a handheld unit to make composition more efficient. I use the inReach Safety Plan, so I am limited to 10 routine sent and received messages per month without extra charge. I have defined the following additional quick text messages for convenience:

- Will be delayed one day or more. All is well.
- Continuing to another SOTA summit. All is well.
- Vehicle trouble. Please dispatch tow truck to this location.
- Thirsty. Please dispatch water to this location.
- Hungry. Please dispatch food to this location.
- Shivering cold. Please dispatch sleeping bag & dry clothes & shelter to this location.
- Injured. Cannot move from this location. Request evacuation.
- Badly sick. Request either medical treatment at this location or evacuation.
- Helicopter landing OK at this location.
- Helicopter landing not possible at this location. Long cable required for rescue.

Clicking the link on a recipient's computer shows the inReach location on a map. Clicking + or – increases or decreases the map scale. Clicking **MORE** yields location coordinates, speed, course, elevation, and battery condition for the inReach device. Text conversations can take place among specified inReach users, even if they are located very far from each other.

Owners of an inReach device can also receive text messages from designated sources, but those received messages are charged modest fees which accrue to the owner's inReach account. Messages include location information about the sender, and specified inReach users can navigate to that location. Basic or premium weather forecasts keyed to a specific location are available.

Figure 9 — N7RR's backcountry station includes an Elecraft KX2 for HF operation, a Kenwood TH-D72 dual-band handheld with APRS, RAVPower USB power bank, Garmin inReach Mini, as well as a canister of extremely effective bear spray to defend himself against North American predators like cougars and bears. [Margaret Prior, K7MWP, photo]

Battery Life

The rechargeable lithium-ion inReach Mini battery is limited to 1.25 Ah capacity. There are a number of ways to increase battery life, but I don't want to get caught in the backcountry with my device drained of power. So, I carry an external rechargeable battery that weighs considerably more than the Mini itself (15.3 ounces), but it is fairly economical. It's called the RAVPower 32000 mAh three-port USB power bank (see **www.ravpower.com**). That external battery can recharge the Mini and other devices, such as smartphones and headlamps. Figure 9 shows the gear I typically carry on a backcountry operation.

Final Thoughts

Using inReach is not amateur radio, but it can enhance other activities, and in a true emergency, the device could be crucial without the time delay of setting up a skywave amateur radio antenna, finding an accessible amateur repeater, or checking into an amateur traffic net. For non-emergency situations, radio amateurs have many more ways of communicating than inReach users do. I encourage any outdoor enthusiast to earn an amateur radio license.

I also recommend that hams carry a 2-meter handheld while enjoying the outdoors. Signals at 2 meters can penetrate forested regions better than UHF or microwaves, and 2-meter repeaters are usually available near urban areas. For FM simplex operating, the 146.52 MHz national calling frequency is available. The adventure FM simplex frequency is 146.58 MHz, and off-road 4 × 4 drivers often use 146.46 MHz, but that frequency is used as a repeater output in some areas.

For radio amateurs and non-radio amateurs alike, a satellite communicator like the Garmin inReach Mini could be vital. With one of the higher-level plans that include more text messages and more transmitted tracking points, backcountry SOTA operators have a way for hunters to track their progress or to send a spot announcing that they are on the air.

Manufacturer: Garmin International, 1200 E. 151st St., Olathe, KS 66062; **www.garmin.com**. Available from many retailers and online sources. Price: $350 (requires additional subscription for service).