

PRODUCT REVIEW

Ten-Tec R4020 Two Band CW QRP Transceiver



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Ten-Tec has introduced two new transceivers in their line-up for low power (QRP) operators. Each model covers two bands. The Model R4020 includes full coverage of the 40 and 20 meter bands, while the R4030 covers 40 and 30 meters. Both radios are designed primarily for CW operation but can also receive SSB.

These radios are the result of a design by BD4RG from China who first introduced the model HB-1 with several revisions soon following. It originally was a kit but later was offered as an assembled unit. That design covered three bands — 40, 30 and 20 meters. These two band versions are manufactured to Ten-Tec's specifications, but are not made by Ten-Tec at their factory in Tennessee. In their introduction of these radios, Ten-Tec stated that they were offering these radios as a service to the QRP community.

We received the R4020 40/20 meter version of the radio to check out and try on the bands. This radio is sophisticated and offers quite a few features for the QRP operator. It's a long way from the simple QRP gear many of us enjoyed years ago, such as the classic

Tuna Tin 2 transmitter. The ARRL also tested an R4030 (40/30 meter) with results similar to those shown in Table 1.

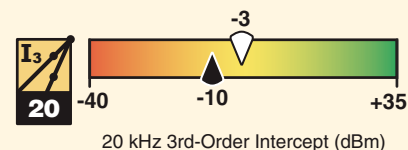
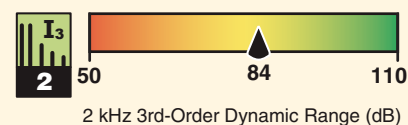
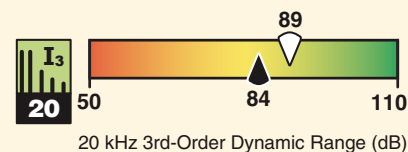
Sturdy Construction

The first thing you notice when handling the radio is that it features a sturdy steel case. It should hold up well to physical abuse. The transceiver weighs in at slightly less than a pound without internal batteries and is classified as a trail friendly radio (TFR) designed to lay flat on your operating position. It sports a bright blue, easy to read LCD that shows the frequency, mode, power supply voltage, S-meter level, RIT setting and power output when transmitting.

The top (front) panel includes the MAIN TUNING dial, VOLUME control and four push button switches plus a separate slide power switch. The MAIN TUNING dial and the four push buttons have multiple uses to enable selection of the various modes and functions.

One of the side benefits of using a frequency synthesizer is that in addition to the full coverage of the two specific amateur bands it also allows 5 to 16 MHz continuous general coverage in the receive mode for shortwave listening. So while the 40/20 version won't transmit on 30 meters, you can still tune around the band in the receive

Key Measurements Summary



pr055

Key:

Intercept values were determined using -97 dBm reference

40 M

20 M

mode. If you try to transmit on 30 meters (or anywhere outside the 40 and 20 meter ham bands), there is no output and the display will show a flashing TX ERROR message.

The radios have 20 memories to store your favorite frequencies and modes to allow quick changes. The main tuning steps can be changed by pressing the tuning knob to switch between 100 Hz or 1 kHz. For quick excursions, press and hold the tuning knob for 2 seconds to change the tuning step to 100 kHz.

The MAIN TUNING knob is also used to control the RIT. To enter the RIT mode, simply press the RIT/MOD button (a dash will be displayed) and turn the MAIN TUNING knob for your desired offset. An up or down arrow will be displayed to show the direction. This

Bottom Line

The Ten-Tec R4020 is a QRP CW transceiver with a variety of convenience features. It can operate from internal batteries, so add a paddle, headphones and antenna and head for your favorite portable location.

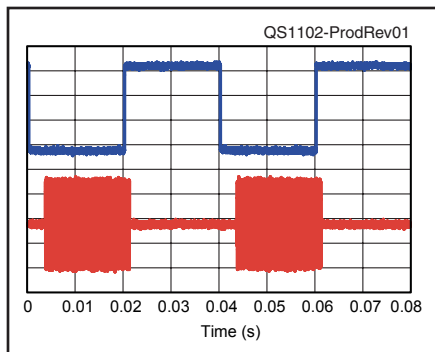


Figure 1 — CW keying waveform for the R4020 showing the first two dits in full break-in (QSK) mode using external keying. Equivalent keying speed is 60 WPM. The upper trace is the actual key closure; the lower trace is the RF envelope. (Note that the first key closure starts at the left edge of the figure.) Horizontal divisions are 10 ms. The transceiver was being operated at 5 W output on the 7 MHz band.

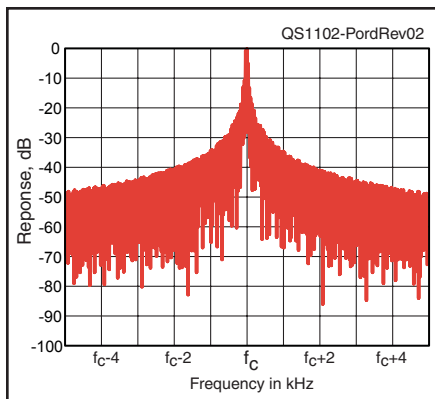


Figure 2 — Spectral display of the R4020 transmitter during keying sideband testing. Equivalent keying speed is 60 WPM using external keying. Spectrum analyzer resolution bandwidth is 10 Hz, and the sweep time is 30 seconds. The transmitter was being operated at 5 W PEP output on the 7 MHz band, and this plot shows the transmitter output ± 5 kHz from the carrier. The reference level is 0 dBc, and the vertical scale is in dB.

feature also allows split frequency operation. In the RIT mode, the tuning ranges are 10 Hz and 100 Hz.

To change modes, press and hold the RIT/MOD button for 2 seconds. The radio cycles through CW to USB to LSB.

The ATT/IF button permits turning the attenuator off and on. When on, the S in the S-meter portion of the display will change to A. Pressing ATT/IF for 2 seconds will enable you to enter the IF bandwidth change mode. Once in this mode, click the button to switch among the various widths provided — 400, 500, 700 or 900 Hz for CW and 1.6, 1.8, 2.0 or 2.2 kHz for SSB. The audio bandpass on CW is shifted higher than on most radios, about

Table 1
Ten-Tec R4020

Manufacturer's Specifications

Frequency coverage: Receive, 5-16 MHz; transmit, 7.0-7.3, 14.0-14.35 MHz.

Current drain: Transmit, 550-950 mA (depending on supply voltage); receive, 55 mA (no signal), 9-14 V dc (internal 8 AA batteries or external supply).

Modes of operation: transmit, CW; receive, SSB and CW.

Receiver

Sensitivity: Not specified.

Noise figure: Not specified.

Blocking gain compression: Not specified.

Measured in the ARRL Lab

Receive, as specified; transmit, 6.9953-7.3042, 13.9967-14.3550 MHz.

With 13.8 V dc external power: receive, max audio, no signal, 50 mA; transmit, 740 mA. With battery power: receive max audio, no signal, 50 mA; transmit 620 mA at 12 V dc. Minimum operating voltage, 7.3 V dc at 1.5 W output.

As specified.

Receiver Dynamic Testing

Noise floor (MDS), 500 Hz filter 7 and 14 MHz, -130 dBm

17 dB

Not measured.*

ARRL Lab Two-Tone IMD Testing (500 Hz bandwidth)

Band	Spacing	Input Level	Measured IMD Level	Measured IMD DR	Calculated IP3
7 MHz	20 kHz	-41 dBm	-130 dBm	89 dB	+4 dBm
		-34 dBm	-97 dBm		-3 dBm
14 MHz	20 kHz	-46 dBm	-130 dBm	84 dB	-4 dBm
		-39 dBm	-97 dBm		-10 dBm
		0 dBm	-1 dBm		-1 dBm
14 MHz	5 kHz	-46 dBm	-130 dBm	84 dB	-4 dBm
		-39 dBm	-97 dBm		-10 dBm
		0 dBm	-1 dBm		-1 dBm
14 MHz	2 kHz	-46 dBm	-130 dBm	84 dB	-4 dBm
		-39 dBm	-97 dBm		-10 dBm
		0 dBm	-1 dBm		-1 dBm

Second-order intercept point: Not specified.

14 MHz, +19 dBm.

S-meter sensitivity: Not specified.

S9 signal at 14.2 MHz: 3.05 μ V.

Receiver audio output: 100 mW into 8 Ω .

100 mW maximum at 1.6% THD into 8 Ω .

IF/audio response: Not specified.

Range at -6 dB points (bandwidth): CW (500 Hz filter): 741-1252 Hz (511 Hz); Equivalent Rectangular BW: 521 Hz; USB: 746-1805 Hz (1059 Hz); LSB: 735-1814 Hz (1079 Hz).

Spurious and image rejection: Not specified.

First IF rejection, 14 MHz, 53 dB; image rejection, 40 dB.

Transmitter

Power output: 13.8 V dc external supply, 5 W; 12 V dc (internal AA batteries), 4 W.

Spurious-signal and harmonic suppression: Not specified.

Transmitter Dynamic Testing

13.8 V dc external supply, 7 MHz, 5.0 W, 14 MHz, 4.5 W; 12 V dc (internal AA batteries), 7 MHz, 3.4 W, 14 MHz, 3.2 W.

>53 dB. Meets FCC requirements.

CW keyer speed range: Not specified.

6 to 36 WPM.

CW keying characteristics: Not specified.

See Figures 1 and 2.

Receive-transmit turnaround time (tx delay): Not specified.

116 ms.

Composite transmitted noise: Not specified.

Not measured.†

Size (height, width, depth): 2.2 $\times$ 5.5 $\times$ 4.2 inches, including extrusions.

Weight: 15.8 ounces (without batteries); 1.5 pounds, including batteries.

Price: \$249

*The AGC could not be turned off. Blocking gain compression and reciprocal mixing measurements must be made with the AGC off.

**ARRL Product Review testing now includes Two-Tone IMD results at several signal levels. Two-Tone, 3rd-Order Dynamic Range figures comparable to previous reviews are shown on the first line in each group. The "IP3" column is the calculated Third-Order Intercept Point. Second-order intercept points were determined using -97 dBm reference.

†Composite noise test not completed. Transmit frequency changed more than the 1 Hz during testing, causing a PLL unlock on the test fixture.

750 to 1250 Hz for the 500 Hz filter. There is no adjustment to the IF, other than bandwidth. The sidetone is fixed at about 700 Hz.

While transmitting, the R4020 will display the approximate power output. The letter S on the dial will change to P followed with a series of vertical bars. Each three bars represents approximately 1 W of output power.

Internal Keyer

Either a straight key or paddles can be used with this transceiver. It has an automatic function that determines which type of key is connected. At power-up, you will hear the keyer send the letter A if a paddle is connected or the letter M if a straight key is connected.

The built in keyer has a range of approximately 6 to 36 WPM. To set the speed, press the CQ/SET button for approximately 2 seconds and the letter S will be heard, then release the button. Within 5 seconds, push the paddle to the dot side to increase the keyer speed or to the dash side to decrease the keyer speed. When finished, again press the CQ/SET button quickly to exit. The letter E will be heard.

The R4020 keyer has just one memory, which is preset to call CQ. To activate it, press the CQ/SET button quickly causing it to send CQ CQ CQ DE (your call sign three times) PSE K. Hitting the CQ/SET button for 1 second at any time during the CQ cancels it. To enter your call sign, press the CQ/SET button for about 2 seconds, you will hear the letter S. Continue to hold down the button until you hear the letter I, then release it and send your call sign with the paddle as usual. When done, a short click of the button will exit the setup, confirmed by hearing the letter E, or it will automatically exit. The PSE K format may be a bit different than many are used to, but it indicates the polite culture the designer comes from.

To turn off or cancel the automatic call CQ function, simply press the CQ/SET button

and hold for about two seconds, you will hear the letter S. Continue to hold down the button until you hear the letter I, then continue to hold it down until you hear the letter C, and then release the button. Push the paddle to the dash side to cancel the automatic call CQ function; OFF will be heard. If you want to restore this function, after reentering, push the paddle to the dot side to turn it back on.

This automatic CQ function is operational while using paddles but not during straight key use. A tune feature is also available while using paddles.

On the Air

As shipped, the radio arrives with the two battery packs enclosed within the radio. The user is required to wire up the packs. It is highly recommended that you remove the packs before plugging in an external power supply to ensure that no damage to components occurs. While using the internal battery pack, our lab measured 3.4 W out on 40 meters and 3.2 W out on 20 meters. The output is closer to 5 W with an external 13.8 V supply.

How does it work in the shack? I was very favorably impressed with its operation and had no trouble making contacts with North Carolina, Pennsylvania, Florida, Oklahoma, Kentucky, Indiana, Ohio and Georgia among others in a leisurely operating timeframe in the evenings on 40 meters. This was with a basic 40 meter dipole only about 20 feet high. (There is no built-in antenna tuner, so you'll need to arrange for one if you use a nonresonant antenna.) The full break-in (QSK) was smooth with few thumps.

The tuning dial is of the mechanical indent style and there is a bit of play in the shaft/bearing arrangement. I wish that the tuning dial operation were smoother.

It is certainly nice to be able to monitor the supply voltage, especially while using the internal pack. I opted to go to an external 12 V battery when the internal pack dropped

to 10 V, although the lab test indicated 1.5 W out with the supply down to 7.3.

A plus with the LCD frequency display is being able to know exactly where you are on the band, unlike some other QRP transceivers with imprecise frequency displays. While monitoring LSB activity on 40 meters, I wished phone transmitting capabilities were available on this model as copy was so good. Note that the Lab measured SSB bandwidths significantly narrower than the 2.2 kHz filter setting would indicate.

Audio and sidetone volumes were adequate with my headphones. There is no built in speaker, but it would be no trick to use amplified computer speakers to supply plenty of audio. One of the cautions is not to use a mono audio plug.

I found that putting a small spacer under the rear of the unit and tilting it up made for better viewing of the display in the home shack atmosphere. In the field many operators prefer the horizontal position. An accessory tilt bail might be a good addition.

The radio comes with a six page instruction manual plus schematic diagram. A slightly more comprehensive manual would be a nice touch.

The QRP world is very exciting. The enthusiasm of the QRP group is remarkable, resulting in a lot of experimentation and plain tinkering. Changes and revisions to the various radios available happen frequently and new designs appear often.

I would urge those who say "life is too short for QRP" to take another look at what's available now and give it a try. The R4020 is a good way to get started. Overall it's a very nice performing radio. Since it comes assembled, tested and with a warranty, it should prove to be a winner.

Manufacturer: Ten-Tec Inc, 1185 Dolly Parton Parkway, Sevierville, TN 37862, 800-833-7373; www.tentec.com; sales@tentec.com.