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Product Review

CommRadio CTX-10 80 – 10 Meter QRP Transceiver

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Software-defined radio (SDR) technology has been a boon to radio amateurs everywhere. Perhaps no other community has benefitted more from this advance than QRP (low-power) operators. The current crop of small, multimode, multiband HF transceivers occupy little space without sacrificing features, and they make it easier for hams to operate portable when on vacation or transmitting from parks, mountain summits, or other sought-after locations in numerous portable operating awards programs.

CTX-10 Overview

The CommRadio CTX-10 SDR transceiver is the follow-up to their CR-1 SDR receiver and its successor, the CR-1a, reviewed in the December 2014 issue of *QST*. The CTX-10 packs a lot of radio into its small, durable case, which is about 6 inches square and weighs just over 2 pounds. Despite the lightweight package, the radio feels quite rugged, and it seems like it could withstand the abuse trail radios sometimes inadvertently receive.

The CTX-10 can transmit on 80 to 10 meters, using CW, SSB, and USB-DATA sound card modes, such as FT8. Transmit power can be adjusted to three different levels: 1, 5, or 10 W. The radio includes a general-coverage receiver from 150 kHz to 30 MHz. The receiver offers AM reception, so you can use it for short-wave broadcast listening.

Many features that active amateurs expect are available in the CTX-10, including adjustable AGC (fast/medium/slow/off), a built-in antenna tuner, and a CW keyer (3.5 – 50 WPM, non-iambic). The filter bandwidth is set automatically by mode, but you can override that with manual settings. Available choices are CW, 0.5/1/1.8/2.2/2.6 kHz; SSB, 1.8/2.2/2.6 kHz, and AM, 5/7.5/15 kHz.

Figure 1 shows the rear panel. The CTX-10 can accommodate a miniature stereo phone plug for a paddle to control the internal CW keyer, or for use with an external keyer or straight key. The CTX-10 offers semi-break-in operation with a fixed delay (no QSK/full-break-in capability). The transmit-receive relay is quiet, with a slight audible clicking.

The rear-panel microphone input is a standard RJ45 plug, compatible with the Yaesu MH-31A8J or MFJ-290MY

Bottom Line

The CTX-10 is a rugged, easy-to-use radio that should be considered by someone looking for a lightweight portable station. With its low power consumption, the internal batteries last quite a while, eliminating the need for an external battery on typical day trips.

Figure 1 — The CommRadio CTX-10 rear-panel connections.

handheld microphones. Microphone gain is fixed, but there is some internal speech processing and a noise gate to limit background noise. In addition to helping with wind noise, for example, the noise gate helps conserve battery power.

Power can be supplied by any standard 13.8 V power supply, or from the unit's built-in lithium batteries. A nice feature is the built-in smart charger for the batteries, which automatically charges the cells whenever the rig is connected to a power supply with at least 5 V dc; charging occurs whether or not the radio is turned on.

As expected for modern QRP field radios, the current draw is impressively low, even during transmit. Unless you are planning on extended operating in the middle of nowhere, this helps to ensure that no external power supply is needed, saving weight for other station accessories. The ribbed, die-cast enclosure functions as the radio's heatsink. It is convection cooled, and no fan is required.

The CTX-10 uses a standard six-pin mini-DIN **ACC** port for an interface for digital modes. It has pins for audio in/out and transmit-receive control (ground-to-transmit), as well as contacts for switching an external amplifier or other device.

The USB receptacle is used for firmware updates to the CTX-10. Additionally, this jack provides IQ data output from the receiver and bidirectional radio control capabilities for use with other software. The USB jack is not a powered port.

The CTX-10 is easy to use, with a minimum of controls and settings. The front-panel keypad offers pushbutton **BAND** and **MODE** selection, as well as left and right arrows and a **STEP** button that controls the tuning rate. A tuning knob and multifunction knob round out the front panel selections. The multifunction knob serves as a volume control and on/off switch (push and hold).

Table 1
CommRadio, CTX-10, v.1210, serial number 0034

Manufacturer's Specifications	Measured in the ARRL Lab
Frequency coverage: Receive, 0.15 – 30 MHz; transmit, 80 – 10 meter amateur bands.	Receive, and transmit, as specified.* Transmit from 5.330 to 5.4035 MHz on 60 meters.
Power requirement: 5 to 20 V dc. Internal battery is three #18650 Li-ion cells, 4.2 V at 2.6 Ah (each).	At 13.8 V dc: Transmit, 2.98 A (max), 2.2 A (typical) at 10 W; 930 mA typical at 1 W; receive, 270 mA (max audio and backlight), 265 mA (minimum light); power off (charging), 25 mA.
Modes of operation: SSB, CW, AM (receive only), sound card data modes.	As specified.
Receiver	**Receiver Dynamic Testing**
Sensitivity: –135 dBm (CW, 500 Hz BW); –110 dBm (SSB, 2,600 Hz BW).	Noise floor (MDS), 500 Hz bandwidth: 0.475 MHz, –87 dBm; 1.0 MHz, –117 dBm; 3.5, 14, and 28 MHz, –133 dBm.
Noise figure: Not specified.	14 MHz, 14 dB.
AM sensitivity: Not specified.	10 dB (S+N)/N, 1 kHz tone, 30% modulation, 7.5 kHz bandwidth: 1.0 MHz, 11.9 µV; 3.88 MHz, 1.44 µV; 29.0 MHz, 2.21 µV.
ADC overload level: Not specified.	>+10 dBm.
Blocking gain compression dynamic range: Not specified.	Blocking gain compression dynamic range, 500 Hz bandwidth: 20/5/2 kHz spacing: 65/65/65 dB.
Reciprocal mixing dynamic range: Not specified.	Not measured. See Lab Notes.

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

Band	*Spacing*	*Measured IMD Level*	*Measured Input Level*	*IMD DR*
3.5 MHz	20 kHz	–133 dBm –97 dBm	–73 dBm –35 dBm	60 dB
14 MHz	20 kHz	–133 dBm –97 dBm	–73 dBm –37 dBm	60 dB
14 MHz	5 kHz	–133 dBm –97 dBm	–73 dBm –37 dBm	58 dB
14 MHz	2 kHz	–133 dBm –97 dBm	–75 dBm –37 dBm	58 dB

Access to most features is controlled by menus. The multifunction knob also doubles as the menu selector — press the knob momentarily and the menu appears. Rotate the dial through the various menu options. Once you reach the option you wish to modify, press the knob momentarily, and then rotate it to adjust the settings for that option. Press the knob again momentarily to return to the previous menu layer.

Two common features available on most modern transceivers that I found absent from the CTX-10 were dual VFOs and receiver/transmitter incremental tuning (RIT/XIT). If you were looking to add to your QRP DXCC totals by working that next big DXpedition, you'd better hope you can work them simplex. In addition, while certainly not a requirement for a QRP radio, operation on 6 meters would be a nice addition. During the summer sporadic-E season, contacts can be had with extremely modest stations if the band is open.

Field Testing

As a QRP portable operator with a penchant for lightweight stations, I had the pleasure of using the CTX-10 on several portable occa-

Manufacturer's Specifications	Measured in the ARRL Lab
Second-order intercept point: Not specified.	14 MHz, +23 dBm, +21 MHz, +83 dBm.
S-meter sensitivity: Not specified.	S-9 signal, 79.6 µV; scaling, 6 dB/S-unit.
IF/audio response: Not specified.	Range at –6 dB points:* CW (500 Hz BW): 234 – 1,164 Hz; USB (2.6 kHz BW): 40 – 3,031 Hz; LSB (2.6 kHz BW): 242 – 3,039 Hz; AM (7.5 kHz BW): 2 – 4,550 Hz.
Receive processing delay time: Not specified.	9 ms.
Audio output power: 0.8 W (8 Ω load).	0.5 W at 2.1% THD. THD at 1 V_{RMS}, 2%.
Transmitter	**Transmitter Dynamic Testing**
Power output: 10, 5 or 1 W.	As specified.
Spurious-signal and harmonic suppression: Not specified.	Typically 59 dB. Worst case, 43 dB (10 meters). Complies with FCC emission standards.
Third-order intermodulation distortion (IMD) products: Not specified.	3rd/5th/7th/9th order, 10 W PEP: –24/–40/–50/–57 dB (typical) –25/–40/–51/–53 dB (worst case, 60 m) At 5 W PEP output: –28/–54/–57/–61 dB (14 MHz)
CW keyer speed range: 5 – 50 WPM.	3.5 to 50 WPM.
CW keying characteristics: Not specified.	See Figures 2 and 3.
Transmit-receive turnaround time (PTT release to 50% audio output): Not specified.	S-9 signal, AGC fast, SSB, 62 ms; CW, 9 ms.
Receive-transmit turnaround time (TX delay): Not specified.	50 ms.
Transmit phase noise: Not specified.	See Figure 4.
Size (height, width, depth): 2.1 × 5.6 × 7.5 inches, including protrusions; weight, 2.2 lbs.	
Second-order intercept points were determined using S-5 reference.	

*Performance from 150 to 530 kHz is not guaranteed due to the sampling IF and switching power supply signals falling within this range.

**Default values; bandwidth is adjustable via DSP.

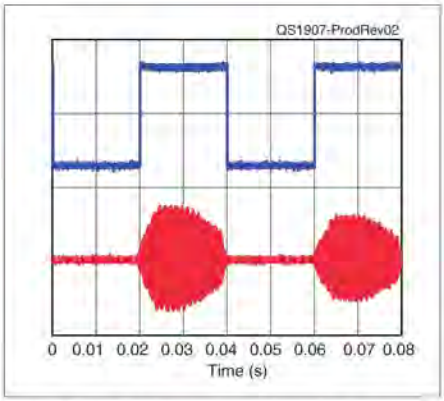

Figure 2 — CW keying waveform for the CommRadio CTX-10, showing the first two dits using external keying. Equivalent keying speed is 60 WPM. The upper trace is the actual key closure; the lower trace is the RF envelope. (Note that the first key closure starts at the left edge of the figure.) Horizontal divisions are 10 ms. The transceiver was being operated at 10 W output on the 14 MHz band.

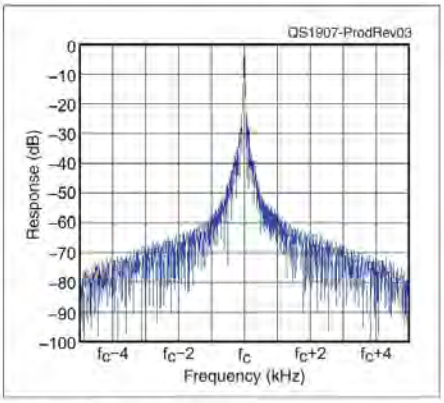

Figure 3 — Spectral display of the CommRadio CTX-10 transmitter during keying sideband testing. Equivalent keying speed is 60 WPM using external keying. Spectrum analyzer resolution bandwidth is 10 Hz, and the sweep time is 30 seconds. The transmitter was being operated at 10 W PEP output on the 14 MHz 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 decibels.

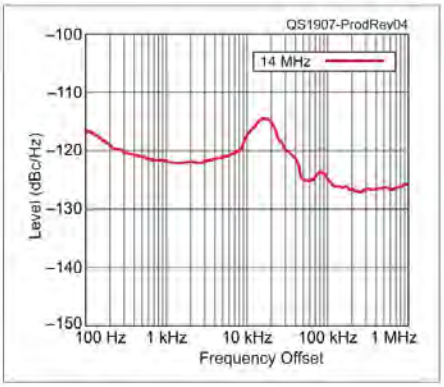

Figure 4 — Spectral display of the CommRadio CTX-10 transmitter output during phase-noise testing. Power output is 10 W on the 14 MHz band. The carrier, off the left edge of the plot, is not shown. This plot shows phase noise 100 Hz to 1 MHz from the carrier. The reference level is –100 dBc/Hz, and the vertical scale is 10 dB per division.

sions between January and March 2019. These included Winter Field Day, the ARRL DX Contest, and general operating activities. In every case, I only used the radio's internal batteries for power to simplify the setup.

My first operation was Winter Field Day. I set up at a high school parking lot, using a SOTABEAMS multiband dipole and a collapsible fiberglass mast, configuring the antenna in an inverted-V fashion (see Figure 5). I set up the radio on the passenger seat of my car, choosing to remain in the vehicle rather than brave the Connecticut winter weather.

The tuning rate is adjustable as low as 10 Hz, and the tuning rate will increase automatically when the tuning dial is rotated quickly, making sweeps across the band easy. The dial itself feels very lightweight; it *is* a QRP rig, after all. I thought the dial itself could be a bit heavier, to facilitate better one-hand tuning. As it was, I needed to hold the radio down with one hand as I tuned with the other. Creative operators will easily come up with a way to secure the radio from sliding around the picnic table while enjoying a day of radio fun.

Lab Notes: CommRadio CTX-10

Bob Allison, WB1GCM, ARRL Assistant Laboratory Manager

The CommRadio CTX-10 meets FCC requirements for harmonic and spurious suppression. Transmit IMD measurements showed higher-than-average third-order products, but acceptable seventh- and ninth-order products.

Initial testing of an early CTX-10 revealed a CW waveform with little rise and fall time, which resulted in key clicks. The manufacturer improved the waveform shaping and eliminated the key clicks, although the CW keying sidebands at 5 kHz away from the carrier are still about 10 dB higher than we would like to see. Transmit phase noise is acceptable.

On the receive side, the CTX-10 can hear signals at or below the noise in a typical, quiet RF location. (A noise floor of around –120 dBm is considered "rural quiet" for HF operation. On 80 – 10 meters, the CTX-10 will hear down to –133 dBm.) Though adequately sensitive, its third-order IMD and blocking gain compression dynamic ranges, as measured in our laboratory, are more suited to casual operation with antennas of modest gain. Even with the AGC disabled, one or more strong, adjacent signals will result in the reduction of speaker volume, and I was unable to measure the reciprocal mixing dynamic range (RMDR). The second-order IMD dynamic range is very good, so there should be no issues with two strong shortwave signals mixing to create false signals on an amateur band (example, 6 MHz + 15 MHz = 21 MHz).

Compliments to CommRadio for making their S-meter scaling 6 dB per S-unit and having a receiver processing delay time of only 9 milliseconds (the time between when a signal appears at the antenna jack and audio appears at the speaker or headphones).

Figure 5 — Operating from the car with a portable inverted-V antenna for Winter Field Day.

I made a lot of CW and SSB contacts and received good signal reports on both modes, even with only 5 W output. However, the radio seemed to have trouble with loud signals close to my operating frequency; there was a noticeable drop in volume when particularly strong signals were within a few kilohertz. While this may not be a problem during casual operating, in a contest environment with a number of closely spaced strong signals on the band, it was slightly problematic. (The CTX-10 blocking gain compression dynamic range is lower than we typically see with current radios. See Table 1 and the "Lab Notes" sidebar.)

The CTX-10 receiver has about ½ W audio output and fairly low distortion at comfortable listening levels. However, I noticed that the tiny internal speaker distorted easily with the audio turned up to hear signals in the noisy outdoor environment. I switched to headphones for much more comfortable listening. We later learned that early CTX-10s had mechanical issues with the speaker which have been corrected. CommRadio sent a revised CTX-10 that sounded fine even at high listening levels.

The internal battery life was quite good. I was out for a little over 4 hours, running 5 W and doing a fair amount of CQing, and still had about 40% battery left as I packed up to go home. If I had a more casual approach to operating with more listening and tuning around for contacts, the batteries would last even longer. This is more than enough power for an afternoon excursion.

I found the built-in antenna tuner adequate for my applications. With my antenna set for 30 meters, the tuner had little difficulty loading it on 20 meters. The antenna tuner is a nice addition for field operators, offering additional flexibility for those lightweight wire antennas without adding much additional weight.

ARRL DX SSB Contest

My next field test was during the ARRL DX SSB contest in early March. I set up using the same configuration as for Winter Field Day. Attempting to contact DX stations with 5 W output to a simple wire antenna on SSB is a challenge, even under the best of circumstances. We are still near the bottom of the 11-year solar cycle, which didn't help matters. Still, there were plenty of contacts with South American, Caribbean, and European stations to be had. I waited until Sunday afternoon, when most of the big, high-power home stations had made their contacts and the pileups were thinner.

My on-air experience was the same as during Winter Field Day, with the same difficulty with close-in signals. As expected, with my small signal, some contacts took a few exchanges to complete. It was nice to have the option of bumping my power up to 10 W when needed; that made several contacts possible that might not have been completed with 5 W.

While the CTX-10 does offer built-in compression and noise gate from the microphone jack, mic gain settings are not adjustable manually. I brought a boom headset with a mic element that has a narrowed, condensed frequency range for "punchier" contest-style audio. If I had a problem getting

through to a station with the Yaesu hand mic, I would switch to the headset mic and try again. In my thoroughly unscientific experiment, it seemed to make a difference in several (but not all) of my contacts. I was even able to contact a station in Hawaii on 20 meters — a very pleasant surprise, given my tiny setup.

FT8 Operation

With the explosion of the FT8 digital mode in the last couple of years, another tool had been added to the portable operator's arsenal. To test the CTX-10 on FT8, I went with the lightest computer I had — my 2010-vintage Netbook and a simple PC interface made by ARRL's W1AW Station Manager, Joe Carcia, NJ1Q. Note that newer laptops may not have jacks for audio in and out; it may be necessary to purchase an external USB sound interface to get the needed audio jacks.

The CTX-10 **ACC** jack has connections for audio in/out and PTT. Joe had some difficulty getting my Netbook to work with the **ACC** jack audio input, so he set about reconfiguring the interface to transmit via the RJ45 microphone jack. This worked flawlessly. He later found that the **ACC** jack setup worked as expected with a different computer at W1AW.

With the Netbook set up and working, I headed back to my favorite school parking lot for on-air tests with the same setup as my other operations (see Figure 6). I was decoding signals on 20 meters within minutes of parking, and using 5 W output, I logged my first contact with a station in Texas.

I saw plenty of European stations decoded on my FT8 screen, and I wanted to get one in the log. However, with only 5 W, I wasn't having much luck. Once again, having the ability to go up to 10 W if needed did the trick.

FT8 is a 50% duty-cycle mode (the sequence is transmit for 15 seconds, receive for 15 seconds), and with 10 W of transmit power, I noted that the radio's heatsink became warm to the touch for the first time while I had been testing it. No worries, as the CTX-10 is designed to handle 100% duty cycle.

I ended up logging 15 FT8 contacts in about 90 minutes of casual operating and calling CQ. FT8 and low-power portable operation are a great match. Obviously, this combination of power and transmit time used more battery power than my previous experiments. Even so, I had about 30% battery remaining after my FT8 session.

Figure 6 — The KX9X portable FT8 setup with the CTX-10 and Netbook computer.

Product Support

The CTX-10 *User's Manual* is available for download from the CommRadio website. In addition to instructions for using the radio, it includes a block diagram, some information about the design, and some tips for successful operation.

As with most modern transceivers, CommRadio has been working on improving the CTX-10 since its initial release. There have been several firmware updates to add features and improve operation. Registered owners receive emails with links to information about these changes, and the update process is not difficult. Update files are available from the CommRadio website.

CommRadio has also released two service bulletins to fix minor issues with the radio — one for the previously mentioned issues affecting speaker audio quality, and the second for whine from the switching power supply. These issues have been resolved in current production, and CommRadio will help previous customers under warranty.

Conclusions

The CTX-10 offers a lot of flexibility in a very small package. It offers adequate features, but the lack of RIT/XIT and/or dual VFOs is an obvious area for improvement. As we were wrapping up this review, CommRadio indicated that new firmware enabling split-frequency operation would be demonstrated at Hamvention. Check the website for firmware updates. At times, having 10 W RF output capability is a big plus.

Current consumption and battery life are excellent. The receiver plays well generally, but doesn't hold up well with strong signals close to your operating frequency. This should not be much of a problem for casual operators.

Manufacturer: CommRadio, Division of Aerostream Communications, New Castle, CO; **www.commradio.com**. Distributed by Universal Radio, **www.universal-radio.com**. Price: $999.

Visit https://youtu.be/rKWacsBG524 to see our review of the CommRadio CTX-10 80 – 10 Meter QRP Transceiver on YouTube.