Product Reviews

January 2022

Product Reviews:

Baofeng GT-5R Dual-Band Handheld Transceiver;

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Wire Strippers for the Amateur Workshop (Klein Tools 1003, Klein-Kurve 1019, Gardner Bender GST-70M, Capri Tools 20021, Irwin Vise-Grip 2078300);

SOTABEAMS ContestConsole for Icom Transceivers

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Product Review

Baofeng GT-5R Dual-Band Handheld Transceiver

Reviewed by Steve Ford, WB8IMY
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Bottom Line

Baofeng's GT-5R complies with FCC requirements. It lacks some features of more expensive handheld radios and can be challenging to program without software, but its low price may make it attractive.

According to Baofeng's online advertising, their GT-5R transceiver departs from its predecessors in one particularly important way: "100% legal version with the compliant transmit range and spurious emission, complies with FCC Equipment Rule Part 15B and Part 90."

Baofeng's introduction of a transceiver that can only transmit on amateur frequencies is a positive development. Still, there is the matter of spectral purity. Over the years, the ARRL Laboratory has repeatedly found a high percentage of Baofeng transceivers tested by the Lab to be noncompliant with FCC emission requirements.

According to Baofeng, this issue has been remedied in the GT-5R. Did they succeed? More about that later.

Dual Bands, and More

The tiny Baofeng GT-5R can almost disappear in a shirt pocket, or within the palm of your hand. Despite its size, the GT-5R offers dual-band functionality at output power levels specified at 1 W or 4 W (see Table 1 for ARRL Lab measurements).

The frequency ranges include 144 to 148 MHz, and 420 to 450 MHz, and as Baofeng has stated, the GT-5R will not transmit outside of these ranges. It will receive between 136 and 174 MHz and 400 and 480 MHz, but if you enter a frequency outside the amateur bands and press the push-to-talk button, nothing happens other than the sound of the error beep.

The GT-5R package includes an 1,800 mAh lithium-ion battery and a desktop charger (see Figure 1). An optional 3,800 mAh battery is available. On a full charge, the battery seemed capable of powering the radio for many hours, depending on how much transmitting is taking place, and at what power level. There is also a battery-saving function that can place the GT-5R in one of four sleep/wake cycles. The trans-

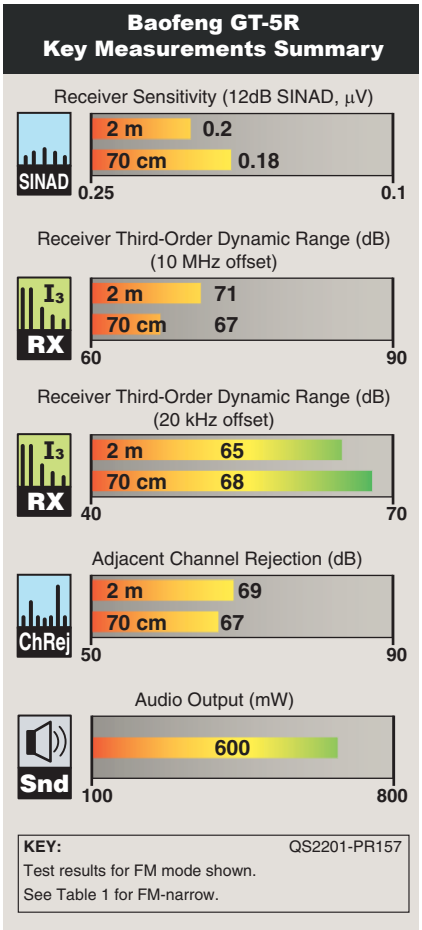

Table 1
Baofeng GT-5R, S/N 21GT5-R- 0000087 FCC ID: 2AJGM-UV5R

Manufacturer's Specifications	Measured in ARRL Lab
Frequency coverage: 144 MHz – 148 MHz 420 MHz – 450 MHz.	Receive:136 MHz – 174 MHz and 400 MHz - 520 MHz. Transmit: 144 MHz – 148 MHz and 420 MHz – 450 MHz.
Modes of operation: FM, FM-N (FM-Narrow) (25 kHz/12.5 kHz bandwidth).	As specified.
Power requirements: 7.4 V dc, ± 20% (1800 mAh battery supplied).	Receive: 45 mA (min. volume, lights off); 350 mA (max. volume, lights on). Power off, < 1 mA. Transmit (high/low): 146 MHz, 1.50/0.77 A 440 MHz, 1.51/0.83 A
Receiver	**Receiver Dynamic Testing**
FM sensitivity: For 12 dB SINAD, 0.20 µV.	For 12 dB SINAD: 146 MHz, 0.20 µV (FM), 0.16 µV (FM-N). 440 MHz, 0.18 µV (FM), 0.16 µV (FM-N).
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz offset: 146 MHz, 65 dB, 440 MHz, 68 dB. 10 MHz offset: 146 MHz, 71 dB, 440 MHz, 67 dB.
FM two-tone, second-order IMD dynamic range: Not specified.	146 MHz, 47 dB; 440 MHz, 75 dB.
Adjacent-channel rejection: 65/60 dB.	20 kHz offset (FM/FM-N): 146 MHz, 69/75 dB; 440 MHz, 67/70 dB.
Squelch sensitivity: Not specified.	Squelch range, 146 MHz, 0.1 – 0.25 µV; 440 MHz, 0.13 – 0.35 µV.
S-meter sensitivity: Not specified.	For four bars, 146 MHz, 0.39 µV; 440 MHz, 0.35 µV.
Audio output: 1000 mW.	600 mW into 8 Ω at 10% THD THD at 1 V_{RMS}, 1.5 %.
Transmitter	**Transmitter Dynamic Testing**
Power output: 4 W / 1 W (5 W max.).	At 8.15 V (full charge), High/Low: 146 MHz, 4.1/1.2 W 440 MHz, 3.3/0.8 W.
Spurious signal and harmonic:	146 MHz: >65 dB (low), >70 dB (high). 440 MHz: >78 dB (high and low). Complies with FCC spectral purity requirements.
Transmit-receive turnaround time (PTT release to 50% of full audio output): Not specified.	Squelch on, S-9 signal: 146 and 440 MHz, 150 ms.
Receive-transmit turnaround time (TX delay): Not specified.	146 MHz, 83 ms; 440 MHz, 69 ms.

Size (height, width, depth): 4.3 × 2.3 × 1.25 inches (including protrusions). Antenna length: 5.75 inches. Belt clip, add 0.2 inches to depth. Weight: 7.5 ounces.

ceiver "wakes up" whenever a signal is present, though you may occasionally miss the first second or two.

The LCD shows the frequencies for the A and B VFOs as well as battery status. You switch between VFOs using the A/B button. The display is small and may present a challenge those with visual impairments. Fortunately, the GT-5R has a well-designed voice enunciator that warns when the battery is low, in addition to imparting other bits of helpful information. It "speaks" in clear, unaccented English and is quite easy to understand.

Audio volume is controlled by the sizeable knob on the top of the case, which also serves as the power on/off switch. The GT-5R has plenty of audio punch, but it is easy to drive the tiny speaker into distortion. The squelch level is adjusted via the menu system. The factory setting is 3, which I found to be somewhat high; a setting of 2 or even 1 was better for casual listening

You can also open the squelch by pressing and holding the **MONI** button on the side of the radio. If you give this button just a brief press, the GT-5R lights a white LED at the top of the case that is intended to serve as a flashlight. Press the **MONI** button again and the LED will begin pulsing, presumably as a kind of visual beacon. When you consider that many amateurs carry their handheld radios while hiking, this could be a useful feature.

Figure 1 — The GT-5R package includes a desktop charger, earphone/transmit-receive switch, and belt clip.

If you grow tired of listening to amateur radio communications, the GT-5R offers FM broadcast enjoyment. On the same side of the radio as the **PTT** and **MONI** buttons, you'll find an orange button with the curious label **CALL**. I suspect this button has a different function in non-amateur versions of the GT-5R, but in this version, it activates FM broadcast reception (monaural audio only).

According to the user guide, if you press and hold the **MONI** button while in the FM broadcast mode, it will activate an "alarm" function. With this function active, you can tune to your favorite FM broadcast station with the up/down arrows and listen, but if a signal appears on whichever ham frequency you've designated within the active band, the GT-5R will switch automatically. This worked as described, but it added an annoying ticking sound as the radio frequently checked for amateur signals. I preferred my FM listening without this feature; another press of the **MONI** key turned it off.

An orange **VFO/MR** button on the front of the radio switches between what the voice enunciator calls the "channel" and "frequency" modes, or what the guide refers to as "memory" or "VFO" modes respectively. In the frequency mode, the frequencies of both selected bands appear in the display, but only the active band — the band selected with the **A/B** button — can be heard.

The GT-5R offers a dual-watch function that will scan continuously between the two displayed frequencies. When a signal appears at either frequency, the scan will halt for as long as the signal is present. Keep in mind, however, that this is not the same as continuous, simultaneous reception at two different frequencies. That option isn't available in the GT-5R.

The GT-5R's scanning feature is typical of what you'll find in other radios. It can scan across a selected frequency range or through the programmed memory channels. You can also select whether the scan stops for a period of time when it detects a signal or remains on the frequency until the signal disappears.

Memories and Programming

The GT-5R offers 128 memory channels. The user guide states that it is possible to save frequency information manually to a given memory slot, but it refers the reader to a nonexistent "Manual programming" section for details about how to accomplish this. Those instructions are actually in the "Advanced features" section under the headings "Simplex Channels" and "Duplex Channels."

The duplex channel programming discussion is potentially confusing. The guide seems to assume that you'll be setting up a nonstandard or possibly cross-band duplex frequency arrangement. And it is important to note that Baofeng's definition of "duplex" is really half duplex; the GT-5R can't transmit at one frequency while simultaneously receiving at another.

When the guide addresses manual setup for repeater operating, you discover that you must first enter the menu system and select the transmit offset, such as +600 kHz or –600 kHz, before punching in the receive frequency. Unlike many transceivers, the GT-5R does not determine this offset automatically according to the receive frequency. If you set up the radio for, say, 147.36 MHz with an offset of +600 kHz and then tune down to 146.64 MHz, you'll notice that the offset is still set to +600 kHz. You'll need to go back into the menus and change the offset to –600 kHz.

Without question it is much easier to program the GT-5R using a computer. The manual devotes a few pages to describing how to program the transceiver using the free *CHIRP* software (**chirp.danplanet.com**), complete with examples. Baofeng sells an inexpensive USB programming cable that you simply connect between your computer and the earphone/mic jacks on the radio. (Be sure to push the plug firmly into the GT-5R until you feel and hear a solid *click*.)

Using *CHIRP,* I was able to set up several memory channels within minutes. This included designating seven-character alphanumeric tags for each channel, a programming feature that is *only* accessible with software.

RT Systems (**www.rtsystemsinc.com**) sells a version of their excellent programming software that is compatible with the GT-5R, but you must purchase the

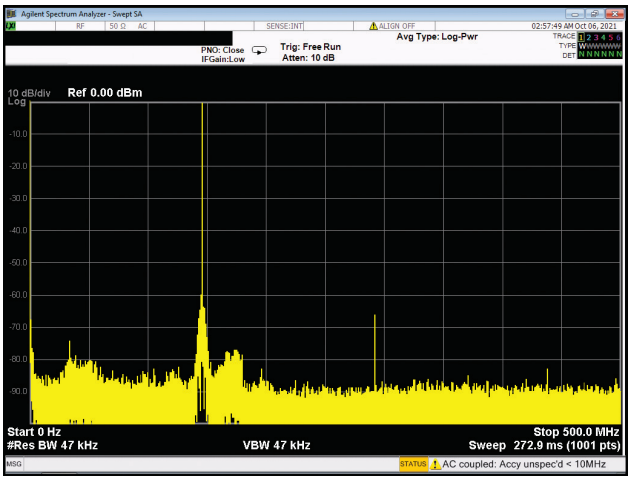

Figure 2 — Worst-case spectral display of the Baofeng GT-5R transmitter output. Power output is 1.1 W on the 146 MHz band. This plot shows the output spectrum from 0 to 500 MHz. The second harmonic is down 66 dB from the carrier, and the third harmonic is down 72 dB. The vertical scale is 10 dB per division.

package that includes the RT Systems programming cable. Their software will *not* work with the Baofeng cable.

Testing and Operating

ARRL Laboratory test results are shown in Table 1 and Figure 2. As you can see, the GT-5R met FCC requirements for spectral purity. In terms of sensitivity, the GT-5R underperformed compared to more advanced transceivers, but considering the selling price, this wasn't a surprise.

Using the Baofeng with its flexible antenna, I was able to access several local repeaters. The GT-5R did seem to be less sensitive than other handheld transceivers I've tried. On occasion I had to hold the radio in specific positions to get a full-quieting signal, even from machines not far from my area. When connected to a better antenna, such as my dual-band ground plane, reception improved considerably. Adding a superior antenna, however, also increased overload interference and this was apparent on some frequencies.

Signal reports were good, including evaluations of my transmit audio. It is worthwhile to mention that the GT-5R includes a voice-operated switch (VOX) function. While it can be a bit sensitive, it was handy for hands-free operating.

Despite its shortcomings, the GT-5R is a competent transceiver for casual use. It lacks the features and performance of more expensive handheld radios, but for some amateurs the GT-5R's low price may tip the balance in its favor. It ultimately comes down to the functionality and performance you require versus how much you're willing to pay.

Manufacturer: Baofeng, Fujian Province, China, **www.baofengradio.com**. Review radio purchased from Radioddity, 6945 Speedway Boulevard, Suite H102, Las Vegas, NV 89115; **www.radioddity.com**. Price: $25.

West Mountain Radio CBA V Battery Analyzer

Reviewed by Phil Salas, AD5X
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In the November 2013 issue of *QST*, I reviewed the West Mountain Radio CBA IV Battery Analyzer. The CBA V is the next generation of this device.

CBA V Overview

The CBA V measures 2.8 × 3 × 3.5 inches — identical in size to the CBA IV. It is a software-controlled, constant-current load box with an integral heatsink and fan, and it's powered and controlled from your computer via the included USB cable. The software permits testing and analyzing all current battery chemistries up to 57 V. Anderson Powerpole connectors provide the battery interface.

Bottom Line

The West Mountain Radio CBA V lets you know the health of any of your battery packs, regardless of chemistry.

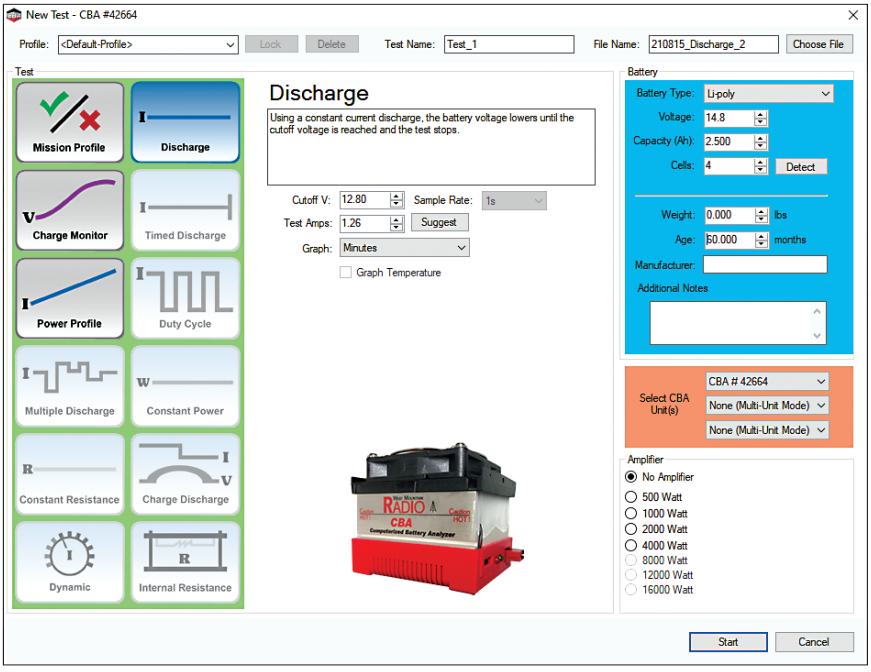

Figure 3 — This is the LiPo battery start-up screen in the CBA V software. Test parameters and information about the battery under test are shown in the center and right-hand sectors. The panel on the left shows available tests.

The analyzer measures battery voltage versus time for a continuous load up to 150 W or an intermittent one up to 200 W. The software automatically senses the battery cell count, provides a safety check of the proposed test rate, and recommends a minimum safe discharge voltage. The data is displayed graphically in amp-hours (Ah), watt-hours (Wh), or minutes. You can overlay multiple battery graphs for comparison, and the graphs can be saved and printed. You can print test labels for your batteries that show the last time they were tested and how they performed, although only Dymo brand printers are currently supported. Finally, there is a "calibrate current" adjustment for improved accuracy at very low discharge rates or for critical applications.

There are four versions of the CBA V, as shown in Table 2. In addition to increased accuracy, the CBA V Pro versions include a remote sensing cable for measuring voltage reading offsets — useful for high-current tests or long battery cables. The CBA HR is designed to evaluate small cells and batteries of 0.7 to 10 V at load currents from 1 mA to 1,000 mA, in increments of 1 mA. There are also a few other options available that extend the CBA V for industrial applications. These include optional amplifiers to permit testing in 500 W load increments up to 2,000 W, and an optional CBA Charger that interfaces the CBA V with a user-provided battery charger to automatically switch between charge and discharge cycles for battery lifetime testing.

CBA Software

The current software package can be downloaded from **www.westmountainradio.com**. It has been enhanced to permit testing and analyzing batteries using all current battery chemistries, including lead-acid, NiMH, NiCad, several lithium varieties, and others. The same software is used for the CBA II through the CBA V (the original CBA requires different software). The CBA V also has some hardware enhancements over previous versions. These include increased maximum load (up to 200 W), a tri-color LED for improved operational and fault reporting, an easy-access automotive-type fuse, and the external voltage sensing and thermal probe for the Pro version.

An optional Extended Software license adds duty cycle, constant power, multiple discharge, and constant resistance test capability. The Extended Software license also adds the ability to graph the battery temperature when the optional temperature probe is connected.

The software is supplied on a CD-ROM, but check the West Mountain Radio website for a later version. Soft-

Table 2
CBA V Versions

Version	Discharge Range	Accuracy	Max. Voltage	Price
CBA V	1 – 200 W	~2%	57 V	$190
CBA V Pro	1 – 200 W	<1%	57 V	$230
CBA V Pro 100 V	1 – 200 W	<1%	100 V	$250
CBA HR	1 – 10 W	1%	10 V	$160

Table 3
Transceiver Current Requirements

	QCX-mini (5 W)	Xiegu G90 (20 W)
Receive	70 mA	500 mA
Transmit, key-down	400 mA	5.0 A
Transmit, key-up	70 mA	2.0 A

ware installation is trivial, involving just a few prompted mouse clicks. However, at the time of this review, loading the driver was a problem because it didn't have the required Microsoft Driver Signature Verification on 64-bit machines with Windows 8.1 or later. When I loaded the driver I got a message saying that the file was corrupt or tampered with. I contacted West Mountain Radio technical support, and almost immediately received a link to a work-around that allowed me to load the driver. As this issue of *QST* was going to press, West Mountain Radio has indicated that the driver issue has been resolved.

Finally, you should select **UPDATE FIRMWARE** under the CBA **DEVICES** tab. If the host computer is connected to the internet, the software will automatically find the latest version of firmware and install it in the CBA V. Also note that once the software is loaded, it will automatically check for software updates whenever the CBA program is re-started.

Using the CBA V

How you use the CBA V will depend on your selection of batteries and requirements. I wanted to evaluate batteries I use for portable low-power operation with two transceivers — a QCX-mini for 20-meter CW, and a Xiegu G90 20 W multiband, multimode HF radio. The current requirements for these two radios are shown in Table 3.

The QCX-mini operates full break-in (QSK) — that's why the key-up current is the same as the receive current. For the G90, I set break-in time to 500 milliseconds, as I don't like to hear a lot of transmit-receive relay clicking.

In portable operation, I turn my radio on with the specific purpose of making contacts. My portable operation is approximately 50% listening and 50% operating (QSO time). During a contact, I assume 50% receiving and 50% transmitting times. Finally, the CW duty cycle using the standard PARIS format is key-down 44% of the time, and key-up 56% during the transmission. Adjust the receive-only versus QSO time fraction of time based on your particular operation. In my case, going with the 50% listening and 50% QSO time, I determined the average battery current (Avg I) as follows:

Avg I = RX Time + QSO Time

RX time = 0.5 × RX Current

QSO Time = 0.5 [0.5 × RX Current + 0.5 (0.44 × TX Current + 0.66 × Key-Up Current)]

This is probably conservative, as you are likely to transmit a little less than that because of pauses between words and sentences. So using the above equation, the average current for the QCX-mini would be 164 mA, with a peak current of 400 mA. The G90 has an average current draw of 1,255 mA with a peak of 5 A. I rounded up the average currents to 170 mA and 1260 mA, respectively, as the CBA V software has a 10 mA minimum step setting.

The batteries I tested are shown in Table 4. The alkaline and NiMH AA-size batteries are new, with 10 of each installed in battery holders to reach the desired voltage. I have two of the Power Sonic lead-acid batteries, both removed from a failed garage door opener backup system. The LiPo battery is about five years old and has been used extensively for portable operation with my Elecraft KX3 transceiver.

The lead-acid and LiPo batteries were tested at 1,260 mA because these batteries would be used with the G90 transceiver at 20 W and should easily source the required 5 A peak transmit current required. The AA-size alkaline and NiMH batteries were tested at 170 mA, because these should be able to handle the 400 mA peak transmit power of the QCX-mini transceiver. I have a Thunder AC680 intelligent multifunction charger that permits selecting the battery type, number of cells, and charging current. It also has a balance input for lithium batteries.

I first evaluated the lead-acid and LiPo batteries. Figure 3 shows the setup menu for the LiPo battery. While most of the test information is automatically sensed and suggested, I set the actual battery amp-

Table 4
Batteries Analyzed

	Number of cells/ Amp-hours	Nominal Voltage	Discharged Voltage	Charged Voltage
Alkaline/ AC Delco Ultramax	10 AA cells / ?Ah	15 V	10 V	16 V (new)
NiMH/ PowerOwl	10 AA cells / 2.8 Ah	12 V	10 V	13.5 V
Lead Acid/ Power Sonic	6 cell / 5 Ah	12 V	9 V	14.8 V
LiPo/ Floureon	4S2P / 6.2 Ah*	14.8 V	12 V	16.8 V

*4S2P = two 4-cell packs in parallel

hour and test current discharge rates for my specific batteries and application. Once you press **START**, the CBA V software will check the battery and begin the test.

When the LiPo test was complete, I evaluated the two lead-acid batteries. I overlaid the three graphs because these batteries would all be used in my G90 20 W application. As I suspected, the amp-hour capacities of all three batteries had dropped off due to their age and use. The LiPo battery had about 3.8 Ah of capacity, and the lead acid batteries had about 3 Ah. This is not too bad, as it means I can get about 3 hours of use with each battery when using my G90. Figure 4 shows the results plotted versus minutes at the 1,260 mA average current.

Next, I tested the 10-cell NiMH battery pack with the CBA V at the 170 mA average current expected for my QCX-mini transceiver. These batteries were purchased new, and claimed to have 2.8 Ah of capacity. I charged the 10-cell AA NiMH pack with my Thunder AC680 smart charger. The results were horrible! I ran three separate tests after recharging the 10-cell battery pack. The first test showed the battery pack to only have about 0.8 Ah of capacity. But this got significantly worse with each charge/discharge cycle as you can see in Figure 5.

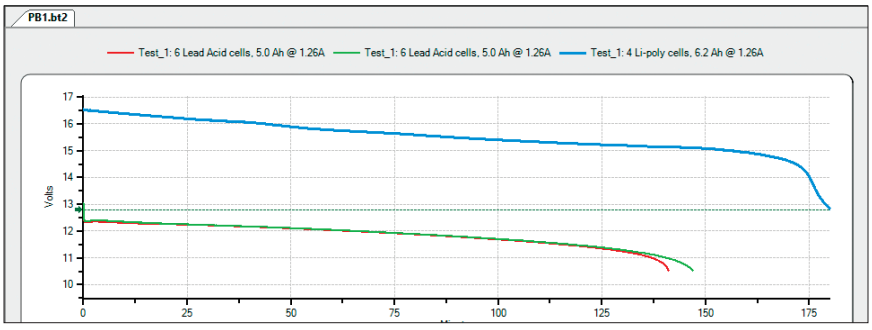

Figure 4 — This plot shows minutes of use at 1,260 mA average current draw; test results are for the LiPo (blue trace) and lead-acid (red and green traces) batteries.

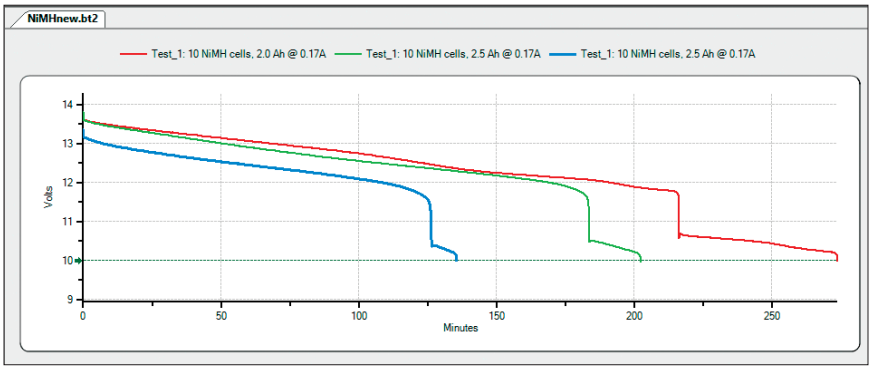

Figure 5 — As described in the text, the initial results for the pack of 10 NiMH AA cells at 170 ma average current grew worse over three charge/discharge test cycles. By the third cycle (blue trace), the battery pack would provide just over 2 hours of operation for the QCX-mini.

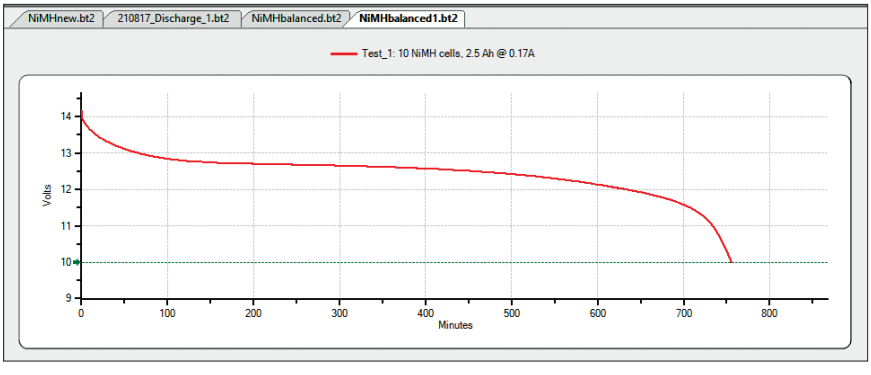

Figure 6 — After individually charging and balancing the 10 NiMH AA cells on a different charger, re-running the test at 170 mA revealed that the battery pack had enough capacity to power the QCX-mini for more than 12 hours.

I couldn't believe these batteries were that bad, and so I looked at the individual battery voltages when charged and discharged. I found a noticeable difference in the voltages among the batteries at both levels, so I wondered if these batteries need to be balanced.

I purchased the recommended PowerOwl AA/AAA NiMH charger (about $15 from Amazon), which charges up to eight batteries individually. There is an LCD screen that shows the status of the individual batteries. This charger uses an external USB power supply source, and the charging current is then divided by the number of batteries that are being charged, so it does take a while to charge the batteries.

Once I had all 10 AA batteries charged in this new charger, I put the batteries back into the 10-cell AA pack and re-ran the CBA V analysis. As you can see in Figure 6, performance was significantly improved to about 2.1 Ah. That is less than the 2.8 Ah capacity advertised for these batteries, but it is much better

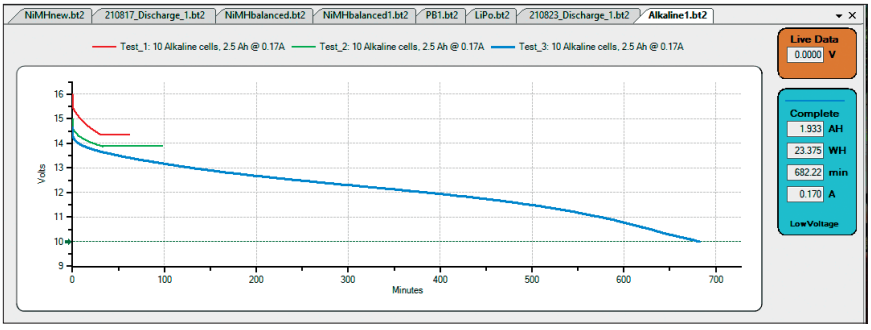

Figure 7 — This screen shows testing of the 10-cell AA alkaline battery pack at 170 mA using the Append feature of the CBA V. The first part of the test lasted about 1 hour (red trace), followed by about 90 minutes (green trace), and finally running the battery pack to depletion (blue trace).

than before and should still give me more than 12 hours of operation with my QCX-mini.

Without the CBA V, I would have just charged the 10-cell pack with my Thunder AC680 charger and been disappointed with the results. The lesson is that when used in a multi-battery pack, AA NiMH batteries need to be balanced for best performance. Incidentally, I found an error in the amp-hour calculation for NiMH batteries. I've informed West Mountain Radio and hope it that will be corrected before this review is published.

The last test was with the Delco Ultramax 10-cell AA-size alkaline batteries. These batteries are advertised to be used for high-current operation, though they don't specify an amp-hour capacity. For this test, I wanted to show the Append feature of the software. This permits you to start and stop tests, but then show the results of the individual tests. As you can see in Figure 7, I first ran the load test for about 1 hour. Then I stopped the test and appended a new test that ran for about 1.5 hours. Then I appended these tests with my final test, which ran until the battery pack was depleted. As you can see, subsequent tests all started at the stopped voltage of the previous tests as expected. The total capacity of this alkaline pack was more than 2.2 Ah. That will give me a lot of QCX-mini operating time!

Conclusion

The West Mountain Radio CBA V is a sophisticated, yet relatively inexpensive battery analyzer for amateur and commercial battery evaluation. My only gripe is that it currently supports only Dymo label printers (I have a Brother unit — West Mountain Radio has indicated that they would try to support other printers upon request). If you want to know what your batteries are capable of, and where they are in their lifetime, the CBA V is worth considering.

Additional images for this review are available from **www.arrl.org/qst-in-depth**.

Manufacturer: West Mountain Radio, 1020 Spring City Dr., Waukesha, WI 53186; **www.westmountainradio.com**. Price: $190.

Wire Strippers for the Amateur Workshop

Reviewed by Paul Danzer, N1II
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One of the most popular tools in a ham's workshop is a wire stripper. After reviewing the many choices available online, we selected five that looked useful, ranging in price from about $10 to $30. Some include additional features such as crimping capability for wire terminals.

I tried each of the wire strippers with a variety of typical workbench wire sizes and types as shown in Table 5. In some cases, a stripper didn't work well with a particular type of wire. On large wire sizes, for example, sometimes it cut the insulation as expected, but was difficult to slide the cut segment off the wire. Typically, this happened when trying to strip more than ½ inch of insulation. For example, the insulation on #12 solid THHN electrical wire is particularly rugged and can be tough to remove.

Klein Tools 1003 Compact Wire Stripper and Cutter

The Klein Tools 1003 shown in Figure 8 is the simplest and least expensive tool reviewed here. This type of wire stripper/cutter has been around for ages and is similar to other tools that are widely available. The Klein version weighs just over 2 ounces and is rated to handle #12 to #26 AWG solid wire and #14 to #28 AWG stranded.

Figure 8 — The Klein Tools 1003 offers minimal cost, minimal weight, and minimal features — but works well enough to just toss into your tool box.

The adjusting screw with retaining nut on the handle limits how far the jaws can close. Slide the screw toward the bottom of the handle, and the jaws close tighter to strip #26 or #28 AWG wire. Move the screw toward the tip for larger wire. Properly adjusted, the screw allows stripping of most common wire sizes without nicking the conductor. With practice, though, you can often apply the right pressure to safely cut insulation without adjusting the screw. More expensive versions of this basic tool incorporate a circular disk with an offset to adjust the jaws for various wire sizes.

I found that for larger wire sizes, I sometimes had to twist the stripper blade around the wire to cut the thick insulation all around the metal conductor. This tool wasn't as easy to use as some of the other units while stripping the insulation on the #12 AWG wire from BX cable or the #12 AWG solid THHN wire. It also had difficulty with #26 AWG Teflon insulated wire.

This inexpensive utility tool will suffice if you don't have to strip a lot of wire.

Manufacturer: Klein Tools, **www.kleintools.com**. Price: $10.

Klein-Kurve 1019 Wire Stripper/ Crimper/Cutter Multi Tool

The Klein-Kurve 1019 shown in Figure 9 is rated to strip #10 to #26 AWG solid and #12 to #28 AWG stranded wire. The stripping jaws have two scales, one for stranded wire and the other for solid wire. The tool weighs about 6 ounces, and the curved, padded handles are comfortable to use. The jaws pivot smoothly. It successfully stripped all of the wire types listed in Table 5, although it required some effort to slide the insulation off the #12 AWG solid THHN wire.

The jaws include a section at the base for cutting wire, and the tips are serrated to use as gripping pliers. The tool can also be used as a crimper for insulated and non-insulated terminals, with one slot for each type regardless of wire size. You might get better results by using a single-purpose crimping tool with slots sized

Figure 9 — The Klein-Kurve 1019 is very comfortable to use. The two sides of the cutting jaws are calibrated differently for solid and stranded wire.

Table 5
Wire Types Tested

Type	Size (AWG)
THHN — solid*	12
Single conductor from BX cable — solid**	12
THHN — stranded*	14
Single conductor from NM cable — solid***	14
Window line feed line conductor — solid	18
Plastic insulated hookup — solid	18
Plastic insulated hookup — solid	20
Plastic insulated hookup — solid	22
Mil-spec Teflon insulated — stranded	22
Teflon insulated — stranded	26

Notes
*THHN (thermoplastic high heat nylon coated wire) is a soft-drawn copper wire used in electrical wiring. The stranded version is also popular for amateur antennas.
**BX is a multiconductor armored cable used in electrical wiring. The insulation on each conductor is a very thick composite material.
***NM is a multiconductor cable with non-metallic sheathing used in electrical wiring (also known by the trade name Romex).

for different size wire terminals. The Klein-Kurve also crimps type B low-voltage connectors typically used to butt-splice telephone wires, as well as Scotchlok IDC connecters. I didn't test either of these connectors.

One additional feature is a built-in screw cutter for shortening #6-32 and #8-32 machine screws. The threaded holes for the cutter are located just below and to the side of the center jaw pivot. It worked well on a #6-32 brass screw, cutting the screw to length and repairing the thread at the cut as I backed the screw out of the tool. Cutting #8-32 screws required a lot more hand strength.

Manufacturer: Klein Tools, **www.kleintools.com**. Price: $20.

Gardner Bender GST-70M Multi Tool with Circuit Alert

The Gardner Bender GST-70M shown in Figure 10 is similar to the Klein-Kurve and weighs about 7 ounces. The packaging says that the tool can strip #8 to #20 AWG solid or stranded wire. However, separate markings on the jaw indicate #8 to #20 AWG solid and

Figure 10 — The Gardner Bender GST-70M is similar to the Klein-Kurve 1019 but includes a Circuit Alert non-contact sensor for checking for live ac circuits. The Circuit Alert module is locked into the upper handle in this photo.

#10 to #22 stranded. The handles are about ⅝ inch farther apart than the Klein-Kurve, and so it was not as comfortable to use for someone with smaller hands. Also, the jaws did not pivot smoothly.

The stripping function worked well on #14 AWG to #20 AWG wire. On several tries, I had to twist the stripper around in a circle to strip #12 AWG solid wire. It did not strip #22 AWG solid but worked fine with #22 AWG stranded (consistent with the markings on the jaws). As with the Klein-Kurve, it required some effort to slide the insulation off the #12 AWG solid THHN wire.

The area just below the stripping section is a wire cutter. There is also a screw cutter for six different screw types, ranging from #4-40 to #10-32. I found it difficult to use for even the smallest screw size, probably because it was difficult to get a solid grip with the widely spaced handles.

The crimpling function has three slots — #22 to #18 AWG terminals, #16 to #10 AWG terminals, and one labeled **COAX** that looks about right for type F connectors for RG-6 coaxial cable. As with the screw cutter, crimping terminals required a great deal of finger strength.

The Circuit Alert feature is a voltage sensor that is handy for working around house wiring. It looks like a flash drive and snaps into one of the handles. The sensor is convenient to use without removing it from the handle, or you can detach and use it separately. Place the Circuit Alert near a wire carrying 50 to 600 V ac, press the button, and it sounds a tone and lights up if voltage is present.

Manufacturer: Gardner Bender, **www.gardnerbender.com**. Price: $30.

Capri Tools 20010 Precision Wire Stripper

The Capri Tools wire stripper shown in Figure 11 is very similar to a tool that I have had for more than 20 years. The Capri 20010 weighs about 12 ounces, and

Figure 11 — Capri Tools 20010 is a conventional wire stripper design with jaws calibrated for a variety of wire sizes. Replacement blades and blades for other wire sizes are available. The included stopper for setting repeatable strip lengths is not shown.

it is rated for #8 to #20 AWG solid wire and #10 to #22 AWG stranded wire. It could not strip the #22 AWG solid test wire successfully, but did strip #22 AWG stranded wire. It also easily stripped the #12 AWG solid THHN wire. The handles have a soft plastic cover, and the tool is comfortable to use. Replacement blades and blades for other wire sizes are available.

As seen from the front, there are two sets of jaws. As you squeeze the handles, the left-hand jaws grip the insulated wire. The right-hand jaws cut the insulation. As you squeeze further, the jaws separate horizontally and the cut section of the insulation slides off to the right. This last step was especially nice for separating the insulation from the #12 solid THHN wire.

An envelope included in the package held several small parts whose purpose was not apparent (nor were there any instructions). A call to the manufacturer revealed that the parts are used to make an adjustable stopper that allows you to set the length of the stripped wire end. This add-on works very well if you need to strip a large number of wires uniformly. With the stopper in place, the wire sizes marked on the jaw are obscured, so you have to estimate which jaw opening is applicable for your wire size.

Manufacturer: Capri Tools, **capritools.com**. Price: $30.

Irwin Vise-Grip Self-Adjusting Wire Stripper (2078300)

The Irwin Vise-Grip wire stripper shown in Figure 12 has two sets of jaws, similar to the Capri Tools unit. Unlike the other wire strippers in this review, the jaws of the Irwin Vise-Grip have no calibrated markings corresponding to various wire sizes. This unit uses the left-hand jaws to grip the wire, and the right-hand set of jaws are self-adjusting. Simply put the wire in the jaws, and the tool adjusts automatically to cut the insulation and slide it off the wire.

Figure 12 — The Irwin Vise-Grip 2078300 is a self-adjusting stripper that does not require you to know the wire size ahead of time. The yellow stopper in the figure is set to the maximum length of ¾ inch, and it swivels out of the way for longer strip lengths.

At 11 ounces, this tool is heavy, but the padded handles feel comfortable in hand. It's rated to strip #10 to #24 AWG wire, and there is an adjusting mechanism for wire sizes smaller than #20 AWG. I was able to strip all of the wire types shown in Table 5 successfully, without any adjustment. It worked fine with the #26 AWG Teflon-insulated stranded wire and the #12 AWG THHN wire that were problematic for some of the other tools in this review. The only wire that I had difficulty with was a piece of #14 AWG wire taken from a length of Romex cable.

The yellow assembly shown in Figure 12 is a plastic stopper that you can use to set the length of insulation to strip off. It's adjustable from about ¼ to ¾ inches, and it swivels out of the way if you don't want to use it. This feature worked well for me, but several reviews on Irwin's website indicate that the stopper is prone to damage.

Below the pivot point is a wire cutter and slots for crimping insulated and uninsulated terminals for #10 AWG to #22 AWG terminals. Similar to other units tested, it required some hand strength to crimp the terminals securely.

Manufacturer: Irwin Tools, **www.irwin.com**. Price: $22.

SOTABEAMS ContestConsole for Icom Transceivers

Reviewed by Steve Ford, WB8IMY
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As much as I enjoy my Icom IC-7300 transceiver, there are times when I wish I could extend some of its features to make them a bit more convenient to use. This is particularly true for the voice, CW, and RTTY memory-keying functions.

These memories are intended to alleviate some of the work involved in sending the same information — such as your call sign — over and over. You simply record the desired information into one of the transceiver's memories and send it with a tap on the touchscreen.

It's the touchscreen tapping that tends to become problematic, though. The virtual buttons on the screen are not large, so it is easy to tap the wrong one. Of course, using the touchscreen also means you must have the radio within your arm's reach. Also, the buttons take up space on the screen that I'd rather use for the spectrum display or other features.

The SOTABEAMS ContestConsole solves this issue by using the IC-7300's external keypad feature to move all the touchscreen tapping to an external box

Bottom Line

The SOTABEAMS ContestConsole moves the Icom transceiver memory controls off the touchscreen and onto an external keypad that can be placed in a convenient spot at the operating position.

Figure 13 — The ContestConsole connections.

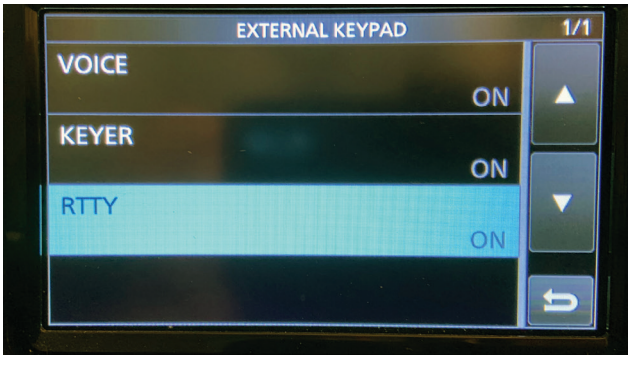

Figure 14 — This screen is used to set the IC-7300 to use an external keypad for CW, SSB, and RTTY.

that measures only 4.25 × 2.75 × 1.5 inches. The ContestConsole offers eight sizeable pushbuttons: four for memories 1 through 4, **PTT** (push to talk), **TUNE**, and two for **FREQUENCY DWN/UP**.

Your microphone or headset plugs into a rear-panel eight-pin **MIC** jack (see Figure 13). On the same panel you'll also find a 3.5-millimeter jack for an auxiliary microphone and another for a foot switch or other manual PTT switch. The socket labeled **TUNE** is for the antenna tuner command function. With the optional cable connected between the **TUNE** socket and the transceiver, you can operate an external antenna tuner with a push of the top-panel **TUNE** button. I didn't evaluate that function during this review.

Although the ContestConsole was intended originally for use with the popular Icom IC-7300, it will work with many other Icom radios. The complete list may be found on the SOTABEAMS website.

Simple Setup

The first step in setting up the ContestConsole is to let the transceiver know that you're using an external keypad. In the IC-7300, you simply go to the **CONNECTORS** screen, tap **EXTERNAL KEYPAD**, and then toggle CW, Voice, and RTTY to "on," assuming you intend to use all three memory groups with the ContestConsole. (See Figure 14.)

A 20-inch cable at the back of the ContestConsole plugs into the transceiver's microphone jack, and your microphone plugs into the ContestConsole. That's all there is to it.

Using the ContestConsole

With the ContestConsole attached and your transceiver properly configured, press one of the blue memory buttons (**M1** – **M4**) to transmit the contents. I used the ContestConsole during an SSB contest to send my call sign and exchange. With a press of a button, my transceiver switched to transmit, and my prerecorded voice issued forth. This saved considerable wear and tear on my vocal cords.

I also used the ContestConsole to send my call sign and exchange during a recent CW competition. Again, it made memory keying much easier.

Should you need to transmit without sending the contents of the memories — such as when you're operating voice and want to say something other than your canned messages — just press the **PTT** button. I found the **FREQUENCY** buttons handy for a quick change of frequency when the need arose. One button press increments the frequency by whatever step you've selected in your transceiver menu (such as 10 kHz). If you press and hold the **UP** or **DWN** buttons, the frequency will keep incrementing up or down until you release the button.

Although the ContestConsole is designed for contest operating, I found it useful anytime I wanted to use memory keying. It would be a godsend when you're making repeated calls in the hope of breaking through a DX pileup. It would also be a significant help during operations such as Parks On The Air, Summits On The Air, or even special-event stations — any application where you need quick, convenient access to your transceiver voice, CW, or digital memories.

Manufacturer: SOTABEAMS, **www.sotabeams.co.uk**. Distributed in the United States by DX Engineering; **www.dxengineering.com**. Price: $85.99. Optional Tune Lead CC-LEAD-KT; $12.99.