



Product Reviews

February 2015

Product Reviews:

[Icom ID-5100A Dual Band VHF/UHF FM Transceiver](#)

[YouKits TJ2B Handheld HF Transceiver](#)

[Heil HM-12 Base Station Microphone](#)

[Rig Expert WTI-1 Wireless Transceiver Interface](#)

Mark J. Wilson, K1R0, k1ro@arrl.org

Icom ID-5100A Dual Band VHF/UHF FM Transceiver

Icom's top dual band mobile transceiver includes the latest D-STAR features.

Reviewed by Rick Palm, K1CE
QST Contributing Editor
k1ce@arrl.net

Icom's newest addition to the family of D-STAR digital and analog FM transceivers is the ID-5100A 2 meter/70 centimeters dual band mobile. In addition to a full range of analog FM features, the radio has D-STAR digital voice (DV) and data capability with Icom's latest enhancements. The ID-5100A has a large LCD touchscreen display, two independent receivers and up to 50 W output on both bands. The wideband receiver covers 118 to 137 MHz (AM mode), 137 to 174 MHz, and 375 to 550 MHz. It also has an SD card slot for voice and data storage and a built-in GPS receiver. The control head and main unit are separate and cannot be joined into one unit. Several optional mounting brackets are available, as are the UT-133 Bluetooth board and VS-3 Bluetooth headset.

First Impressions

Upon opening the box, my immediate reaction was one of relief to see the large display screen. Perhaps following smartphone industry trends toward larger displays, this screen (at 5.5 inches wide by 2 inches tall) is easier to read than previous models and allows for less clutter. It's easier to quickly discern the radio's settings and status. This holds true even while the radio is in dual watch mode, when two channels are monitored at the same time — one on the left-hand side of the screen and the other on the right.

After admiring the display, I was pleased to see the incorporation of touchscreen technology, which was inevitable following trends in the digital device market and



inclusion on Icom's IC-7100 HF/VHF/UHF transceiver.

The monochrome touchscreen isn't the same as we've come to expect with smartphones and tablets — you don't swipe/flick inputs, or pinch in and out. Rather, the user interface is highly utilitarian. It's easy to operate and program by touching or pushing (for one second) on the various icons, menu selections, frequency readout numbers, and words. Characters are large enough even without my reading glasses. The display can also be customized for brightness, contrast, automatic dimming, backlight, and other characteristics in the menus. It would be nice to see a color screen in future models (I like that feature on my IC-7000). On the other hand, now I'm a bit less happy with my IC-7000's smaller screen size.

Bottom Line

The ID-5100A dual band mobile transceiver is fully featured and incorporates the latest D-STAR digital voice and data enhancements, yet its touchscreen and menu system are easy to use.

My third reaction was that it's easy to set up the radio and get it on the air quickly.

Connect four cables — mic, power, controller to main unit, and antenna — and you are good to go. The ID-5100A is intuitive to use, but to get at the power of the radio's many features and functions, you'll need to review the documentation. There are two manuals — a *Basic Manual* and the *Full Manual*. No real hardship here — the instructions are organized and easy to read and use, with cartoon characters that demonstrate the particular function at hand. I used the printed copy of the *Basic Manual* as a guide, and then turned to my laptop for the *Full Manual* (PDF format) with browsing functionality, search capability, and links to various sections in the text.

The ID-5100A is another great step forward in D-STAR radio functionality, and most importantly, user friendliness — something Icom has been working on with recent models. As noted in my review of the ID-51A dual band handheld last year, I was involved as a user early on in D-STAR development here in the southeastern US. It seemed to take off more quickly here than in other parts of the country, thanks to the work of a few dynamic individuals such as ARRL Southeastern Division Vice Director Mike Lee, AA6ML, who personally conducted many seminars at club meetings and “Elmered” individual operators at conferences and on the air.

My initial experience with D-STAR was one of frustration after I installed the DV chip in my IC-2200H more than 10 years ago. Programming and operating the '2200H on D-STAR took some patience. Its successors each included improvements,

and the ID-5100A represents the zenith of this evolution, in my opinion. It is such a pleasure to operate.

Interesting Features

A central feature of the ID-5100A is the incorporation and application of a GPS receiver, one that does not require an external antenna. It enables the “Near Repeater” in the D-STAR repeater (DR) mode to find and select the closest D-STAR repeater, based on the operator’s location and the repeater’s GPS coordinates stored in the radio. The ID-5100A adds the feature of searching for nearby FM repeaters (in the DR mode only, however). The repeater listings are downloadable from Icom’s website in a .csv format file and need to be saved on an SD card. The SD card is then inserted in the radio’s card slot, and the data uploaded to the radio. The radio then searches for the nearest repeaters by the operator’s location and coordinates listed in the repeater database.

The DV repeater list is comprehensive, but the FM repeater list, while an excellent idea, is far from extensive and cannot be searched in the FM mode (DR mode only). For example, there are only three FM repeaters listed for Florida! One alternative is to export a list of desired repeaters from ARRL’s *TravelPlus* software and use RT Systems programming software to load the list in the ID-5100A.

D-PRS Features

A major new feature is a set of add-ons to the D-PRS function, which is similar to the popular Automatic Packet Reporting System (APRS) developed by Bob Bruninga, WB4APR, and indeed can be interfaced to the APRS network with a gateway and laptop. As the operator transmits a digital voice signal to the D-STAR repeater, an option to co-transmit slow-speed digital data (DD) along with the transmitter’s GPS position can be executed to furnish various basic information sets, depending on the group selected: Object, Item, or Weather.

Selecting, editing, and transmitting the Object set includes the specific position of the transmitter, an event notice, earthquake information, satellite track information, and so on. A time stamp can be added to the Object set signal. The Item set transmits specific position data, not containing a time stamp. Position information such as a traffic accident, lighthouse, antenna or DV access point location, and so on, can be transmitted. The Weather set includes weather in-

Table 1
Icom ID-5100A, serial number 05001442

Manufacturer’s Specifications	Measured in ARRL Lab
Frequency coverage: Receive, 118 – 137 MHz (AM), 137 – 174, 375 – 550 MHz (FM); transmit, 144 – 148, 430 – 450 MHz (FM).	Receive and transmit, as specified.
Modes: FM, digital voice, data, AM (receive only).	As specified.
Power requirements: Receive, 1.8 A (max audio), 1.2 A (standby); transmit, 13 A (max power) at 13.8 V dc \pm 15%.	At 13.8 V dc: Receive, 630 mA (max audio no signal, for each receiver), 660 mA (max volume, no signal, both receivers), 450 mA (standby). Transmit, 146 MHz, 10.0/5.5/3.4 A (hi/med/low), 440 MHz, 12.0/6.7/3.5 A (hi/med/low). Operation confirmed at 11.7 V.
Receiver	Receiver Dynamic Testing†
Sensitivity: FM (12 dB SINAD), <0.32 μ V (137 – 160 MHz), <0.56 μ V (160 – 174, 375 – 400 MHz), <0.32 μ V (400 – 550 MHz); AM (10 dB S/N), < 0.56 μ V (118 – 137 MHz).	FM (12 dB SINAD), 0.12 μ V (144 and 440 MHz); 0.12 μ V (weather band); AM (10 dB S+N/N), 0.54 μ V.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz offset, 146 MHz, 68 dB*; 440 MHz, 70 dB*. 10 MHz offset, 146 MHz, 80 dB, 440 MHz, 78 dB.
FM two-tone, second-order IMD dynamic range: Not specified.	146 MHz, 80 dB, 440 MHz, 107 dB.
Adjacent-channel rejection: Not specified.	20 kHz offset, 146 MHz, 68 dB; 440 MHz, 70 dB.
Spurious response: Not specified.	IF rejection, 146 and 440 MHz, >135 dB. Image rejection, 146 MHz, 92 dB (A), 107 dB (B); 440 MHz, 79 dB (A), 88 dB (B).
Squelch sensitivity: 0.13 μ V (144/430 MHz).	At threshold, 146 MHz, 0.08 μ V, 2.95 μ V (max); 440 MHz, 0.1 μ V, 3.27 μ V (max).
S-meter sensitivity: Not specified.	For full-scale signal, 146 MHz, 2.66 μ V; 440 MHz, 3.02 μ V (both receivers).
Audio output: 2 W at 10% THD into 8 Ω .	2.15 W at 9% THD into 8 Ω . THD at 1 V RMS, 1.3%.
Transmitter	Transmitter Dynamic Testing
Power output: 50, 15, 5 W (hi, med, low) at 13.8 V dc \pm 15%.	At 13.8 V dc (hi/med/low): 146 MHz, 50.0/15.2/5.6 W; 440 MHz, 45.0/12.2/3.3 W
Power output at minimum specified operating voltage: Not specified.	At 11.7 V dc (hi/med/low): 146 MHz, 46.5/14.7/5.5 W; 440 MHz, 43.3/12.0/3.2 W
Spurious signal and harmonic suppression: >60 dB.	>70 dB, meets FCC requirements.
Transmit-receive turnaround time (PTT release to 50% of full audio output): Not specified.	Squelch on, S9 signal, 146 MHz, 75 ms; 440 MHz, 77 ms.
Receive-transmit turnaround time (“tx delay”): Not specified.	44 ms, for 146 and 440 MHz.
Size (height, width, depth): control panel, 3.2 x 7.2 x 1.4 inches; main chassis, 1.5 x 5.8 x 7.8 inches (including protrusions). Weight, control panel, 0.6 lb; main chassis, 2.9 lb.	
Price: ID-5100A, \$750; UT-133 Bluetooth board, \$100; VS-3 Bluetooth headset, \$150.	

†The A and B receivers measured identically unless noted.
*Measurement was noise limited at the value indicated.

formation from a connected meteorological monitoring device.

Your information is displayed on the receiver's radio display during a QSO, and if the other operator has incorporated digital data on his or her signal, you will see it on your screen. With an interface program and cable, you can plot the other operator's information on a map screen. You can also plot routes on a map screen from saved GPS coordinates in the log.

Dual Watch Mode

In the dual watch mode, the user can monitor two bands/frequencies simultaneously, including two band monitoring in the DV mode. For example, you can monitor your local D-STAR repeater in the sub receiver position on the right half of the screen, while operating DV simplex in the main receiver position on the left half of the screen. The display screen is so large that it is easily readable, even with all of that status information shown.

My normal configuration is to have my local D-STAR repeater/gateway on the main band position on the left, and my local ARES analog FM repeater on the right. I can monitor both repeaters at the same time. When there is activity on one of the repeaters that I am interested in, I can quickly (with a touch of the screen) convert the radio screen to the single watch mode so that the active repeater's status (signal strength, frequency information, and other parameters) takes up the full screen. The dual watch left side band becomes the A band in the single watch mode, and the dual watch right side band becomes the B band in the single watch mode. The whole thing worked great for me.

Memory Manager: Easy Street

There are multiple ways of entering memory channels as discussed, but the MANAGE MEMORY function selectable from the main menu, and the BANK SELECT from the QUICK menu work are efficient methods of managing your frequency/channel selections.

Calling Through a Reflector

The ID-5100A incorporates the now ubiquitous commands associated with the dPlus reflector system that has evolved to become the default method of networking D-STAR users locally, regionally, nationally, and internationally. The dPlus commands such as the LINK and UNLINK REFLECTOR,

INFORMATION, and ECHO are very easy to implement by simply touching the TO field, selecting REFLECTOR, and touching the desired command.

Bluetooth Operation

An optional Bluetooth headset is available, as well as an app for Android devices for controlling the controller, sending text messages and photos in different resolutions, plotting positions on maps, and so on. There isn't an app for iOS devices yet, but I hope to see one someday for my iPhone 5. Android users should take a look at Icom's very cool RS-MS1 app in Google Play. There's an interesting and informative educational video on the Icom website's ID-5100A page for the radio, which devotes a good section on Bluetooth headset and smartphone device interface and applications. Don't miss it, when you are considering purchasing the radio. There is no TNC connector for this radio. Interface with APRS can be achieved through the Android device and app, or another interface gateway.

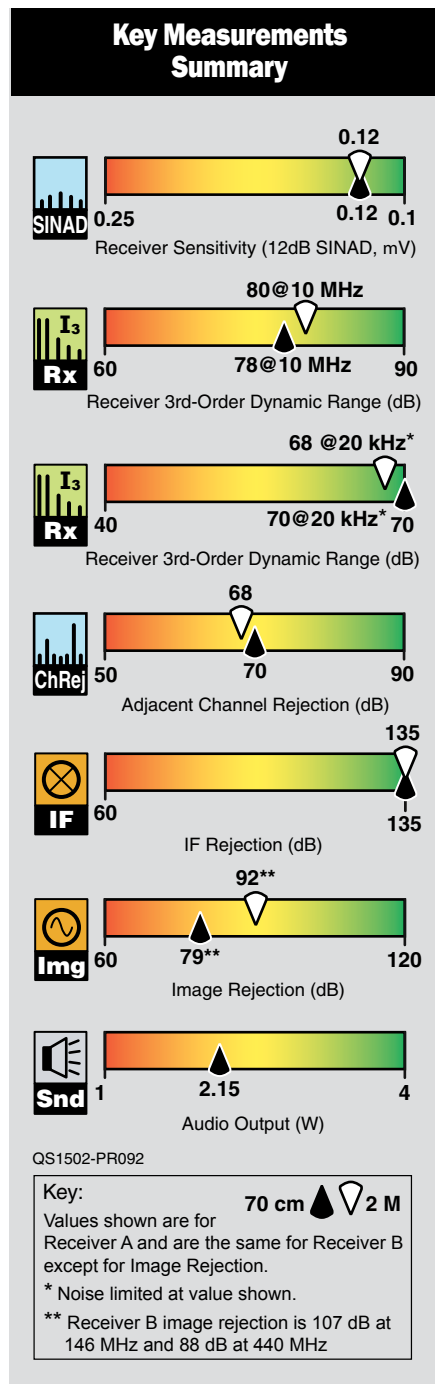
Operation and Menus

The ID-5100A, like most radios nowadays, is menu-driven with sets, subsets, layers, and sub-layers of operating parameters, all well-organized for user ease of access and use. Users can choose between different methods of menu access. There are several ways of sifting through and setting operating parameters based on user preference. A front panel MENU button gives access to the comprehensive set of parameters organizing by group and subgroups, including settings that are not adjusted regularly. A QUICK menu button gives access to commonly manipulated settings, and the quick menus are "smart," adapted and appropriate to each operating mode selected.

For the most part, operation is intuitive, especially if the operator already has D-STAR experience.

Audio Quality and Quantity

Reports on audio quality were fine. The operator can check his or her transmitted audio by two methods. By using the echo function on your local D-STAR repeater, you can hear audio repeated back. Or you can record transmissions (and indeed both sides of a complete QSO) by using the radio's record function (recordings are made onto an SD card that is inserted into a slot on the front of the main unit). You can evaluate your own audio and compare it



to others participating in the QSO. I tried both methods and the audio quality seemed good. The receiver's audio output was more than adequate, with little distortion at the highest volumes.

Memory Channels and Operation

The transceiver has 500 regular memory channels, 50 scan edge channels (25 pairs), and 4 call channels. Also, 26 memory banks, A to Z, can be used to store groups

of operating channels, and so on. Up to 100 channels can be assigned to a bank.

I programmed memory channels using the RT Systems (Broomfield, Colorado) software and cable. You can have memories uploaded and in use within minutes. Don't forget the important first step of downloading the existing radio settings and memories first, before you send your own file to the radio — you will lose a lot of existing data, such as the large D-STAR repeater list pre-programmed into the radio at the factory!

But Wait, There's More — Much More

The radio comes with two manuals, as I've already noted: The *Basic Manual* is 90 pages, and the *Full Manual* is a whopping 352 pages. Hence, there is no way to cover every aspect of this radio in a short review. I have attempted to concentrate on the new functions and to give the potential buyer a feel for whether or not this radio would be a good choice as a first D-STAR radio or an upgrade. The functions are extensive.

Wish List

At home, I always mount my radios to the desktop, and no mounting bracket was supplied with the ID-5100A. That's a small complaint. The bracket for the main unit is available online for about \$35. Icom offers a couple of options for the control head and suggests considering smartphone accessories, such as the RAM X-Grip, if you need a different solution.

Also, a video display output for monitoring the radio screen on a larger outboard display would be useful in an EOC or field operations center for the benefit of a larger audience. As discussed earlier, you could use an Android device with the Bluetooth interface for this purpose.

These are rather insignificant complaints. Overall I found that the radio is designed and programmed exceptionally well for user functionality and efficiency. There is ample opportunity for experimenting, playing, and just plain having fun!

Final Thoughts

Anyone considering the ID-5100A as a first D-STAR radio will benefit from a good understanding of the D-STAR system network, and especially of the four main programmable parameters that are at the heart of the

system. In that subset, the URCALL field, with its myriad commands and modes, is the most critical to understanding and enjoying the system. So, before charging ahead with a new D-STAR radio, locate a good source of information (there is a plethora on the Internet) and bone up on it so you'll be able to enjoy this radio out of the box.

In closing, I'd like to thank Mike Lee, AA6ML, and the Northeast Florida D-STAR Repeater Network for their support for the system here in this region, and especially the KJ4RYH D-STAR repeater/gateway, which I used extensively during this review and for just plain having fun!

Manufacturer: Icom America, 12421 Willows Rd NE, Kirkland, WA 98034; tel 800-872-4266; fax: 425-454-1509; www.icomamerica.com.



See the Digital Edition of QST for a video overview of the Icom ID-5100A dual band VHF/UHF FM transceiver.

YouKits TJ2B Handheld HF Transceiver

Reviewed by Bob Allison, WB1GCM
ARRL Senior Test Engineer
wb1gcm@arrl.org

Most of us are familiar with the communication range of VHF/UHF FM handheld transceivers. Depending on terrain, VHF/UHF handhelds can have a range of up to 100 miles (sometimes more), thanks to repeaters. Simplex operation, however, can have a limited range of only a few miles. Greater distances can be achieved by using a small Yagi antenna, for example, and many amateurs enjoy mountaintopping using this combination.

Using the ionosphere as a reflector, an HF handheld transceiver has a potential range

of a thousand miles or more, but has the inherent problem of operating at much longer wavelengths where antennas tend to be large. Large antennas limit mobility, while smaller, specialized HF antennas have their own challenge of limited efficiency.

Bottom Line

The YouKits TJ2B handheld SSB QRP transceiver covers 60, 40, and 20 meters. When signals are strong, you can attach a short loaded whip and make contacts while walking and talking, but you'll have better results with a larger antenna.

HF handhelds are not too common, but I operated a 40 meter handheld transceiver during a previous Product Review.¹ Using a small magnetic loop antenna, I had limited success walking and talking and wished for a handheld with other bands. My wish was eventually granted with the arrival of a YouKits TJ2B at the ARRL Laboratory.

Overview

The Youkits TJ2B is a fully functional SSB (only) handheld transceiver that transmits on the 60, 40, and 20 meter amateur bands and receives from 3 to 18.2 MHz.

¹Notes appear on page 65.



RF power output is less than 5 W on all bands. Power is provided by an internal 1400 mAh lithium-ion battery (included), or an external 12 V dc source. The TJ2B has a built-in condenser microphone and speaker. The case is made of solid steel, with the total package weighing about 1.5 pounds. My TJ2B came with a rather snug-fitting simulated canvas carrying case, an external hand microphone, a wall charger, and a dc power cord (Figure 1). YouKits has offered the TJ2B as a kit, but we purchased an assembled unit for the review.

A Closer Look

At first glance, the TJ2B is a plain looking black box with white lettering. There are only two knobs and seven switches for controls. The front panel has a $\frac{3}{16}$ by $1\frac{3}{8}$ inch, two-line LCD with a green backlight. The backlight is rather dim, but sufficient for low light environments. The backlight cannot be turned off. In direct sunlight, the display is very easy to read. Below the display are four momentary pushbuttons. The MOD pushbutton is for

Table 2
YouKits TJ2B, serial number N/A

Manufacturer's Specifications		Measured in the ARRL Lab			
Frequency coverage: Receive, 3 – 18.2 MHz; transmit, 60, 40, 20 meter amateur bands.		Receive, 3.0 – 18.168 MHz; transmit, 5.33 – 5.4035, 7 – 7.3, 14 – 14.35 MHz.			
Power requirement: 10.5 – 12.5 V dc.		At 12 V dc: transmit, 915 mA (typical); receive, 300 mA.			
Modes of operation: LSB, USB, CW (receive only). As specified.					
Receiver		Receiver Dynamic Testing			
Sensitivity: 0.3 μ V (–117 dBm).		Noise floor (MDS), SSB mode: 5.3 MHz, –118 dBm; 7.2 MHz, –111 dBm 14.2 MHz, –110 dBm.			
ARRL Lab Two-Tone IMD Testing*					
<i>Band</i>	<i>Spacing</i>	<i>Measured Input Level</i>	<i>Measured IMD Level</i>	<i>IMD DR</i>	<i>Calculated IP3</i>
14 MHz	20 kHz	–46 dBm –40 dBm	–110 dBm –97 dBm	64 dB	–14 dBm –12 dBm
14 MHz	5 kHz	–46 dBm –40 dBm	–110 dBm –97 dBm	64 dB	–14 dBm –12 dBm
Second-order intercept point: Not specified.		14 MHz, +27 dBm.			
IF/audio response: Not specified.		Range at –6 dB points: CW: 370-2305 Hz (1935 Hz) USB: 371-2415 Hz (2044 Hz) LSB: 370-2305 Hz (1935 Hz).			
IF and image rejection: Not specified.		IF rejection: 7 MHz, 77 dB, 14 MHz, 83 dB (IF = 9 MHz). Image rejection, 52 dB (typ).			
Transmitter		Transmitter Dynamic Testing			
Power output: 5 W.		At 12 V dc: 5.3 MHz, 4.4 W; 7.2 MHz, 2.3 W; 14.2 MHz, 1.4 W PEP**			
Spurious-signal and harmonic suppression: Not specified.		5.3 MHz, 43 dB; 7.2 MHz, 61 dB; 14.2 MHz, 45 dB. Complies with FCC emission standards.			
SSB carrier suppression: Not specified.		USB, 59 dB; LSB, 53 dB.			
Undesired sideband suppression: 80 dB.		USB, 36 dB; LSB, 47 dB.			
Third-order intermodulation distortion (IMD): Not specified.		3rd/5th/7th/9th order: 5.3 MHz, –26/–39/–48/–47 dBc; 7.2 MHz, –20/–37/–42/–44 dBc; 14.2 MHz, –22/–41/–41/–50 dBc.			
Transmit-receive turn-around time (PTT release to 50% audio output): Not specified.		S-9 signal, 18 ms.			
Receive-transmit turn-around time (tx delay): Not specified.		7 ms.			
Size (height, width, depth): 8.5 × 2.8 × 1.5 inches, including protrusions. Weight, 1.3 lb (with internal battery).					
Price: \$329 assembled and tested.					
*Second-order intercept points were determined using S5 reference.					
**RF power output was typically 200 mW lower with 10.5 V dc battery voltage.					

changing modes — CW (receive only), LSB, and USB. The A/B button is the VFO A/B control. Though the TJ2B has two VFOs, there is no provision for split operation. The V/M button is for toggling between VFO mode and memory mode. When in

memory mode, rotating the TUNE knob selects various memory channels previously stored in the memory. The MEM pushbutton is for memory storage. Dial to the desired frequency in either VFO, then press the MEM button. Rotate the TUNE knob to the



Figure 1 — Accessories that came with the YouKits TJ2B.



Figure 2 — The power switch, PTT switch, charging jack, and headphone jack are arranged along one side of the case.

desired memory channel. Store the frequency by pressing MEM again. There are a total of 40 memory channels.

A little more than halfway down, on the left side of the front panel is the speaker. Its slotted opening is rather small, only about $\frac{5}{8}$ inches square.

On the left side of the case (Figure 2) is a three position power switch labeled EXT, OFF, BATT. Beware: this switch inadvertently moves downward to the BATT position, turning the transceiver on, when the TJ2B is removed from the supplied (snug) carrying case. Below this switch is the CHG (charging) jack. The supplied wall-mounted charger has an LED that glows red when charging and green when the internal battery is fully charged. Below the charging jack is a $\frac{1}{8}$ -inch stereo PH (headphone) jack and the push-to-talk button.

The TJ2B uses a sturdy BNC connector for an antenna (no antenna is supplied).

Also located at the top of the case is an external microphone jack, the AF GAIN control and the TUNE control. The TUNE control also has a momentary switch that, when pressed downward, allows the user to select of tuning step per detent in 1 Hz, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz, or 1 MHz increments.

The right side of the case has a slotted $\frac{5}{8}$ -inch square opening for ventilation. I felt some warmth at that spot after the unit had been on for a while. Below the vent is the external dc input jack. Because of the open vent and exposed jacks, the TJ2B should not be operated in the rain and should be protected from condensation.

Laboratory Testing

The sensitivity of the YouKits TJ2B is adequate for QRP operation. On 20 meters, the noise floor was at the -110 dBm level. Though not as sensitive as most mobile or tabletop HF transceivers, it is sensitive

enough to hear the moderate to strong stations that typically can be contacted with QRP power. Other receiver performances are not as good as most other HF receivers, but are adequate for the type of operation that this handheld transceiver is intended for: portable or temporary operation, using a simple antenna with little, zero, or negative gain compared to a dipole. Though we measured the TJ2B's RF output at less than its specified 5 W, it's still plenty for making contacts, as I will later explain. Transmit IMD (intermodulation distortion) measured worse than typical HF transceivers, but on-air tests with a nearby receiver indicated only a hint of distortion, by ear, while speaking into the built-in microphone.

The Fun Part

At home, my antenna farm is rather modest. I mostly use an inverted L antenna for the low bands and an elevated vertical antenna for 20, 15, and 10 meters (three radials per band, up 25 feet). I especially like the vertical, since I can run coax directly to it from my backyard garden shed. Many evenings were spent inside, operating the TJ2B with a dim overhead incandescent bulb and a paper log. Even though this unit was measured with only 1.4 W PEP RF output power on 20 meters, I was able to contact nearly all the moderate to strong DX stations heard from Europe and South America when conditions were good. One of my best moments on 20 meters was breaking a large pileup of stations calling W1AW/Ø, in Nebraska. Operator Joe Eisenberg, KØNEB, picked me out of the din and was pleased to hear my QRP power amid the kilowatts.

The inverted L worked very well on 40 meters, where usually I could talk to every station that came loudly through the speaker. Most operators contacted did not believe I was running 2.3 W PEP. I worked a friend on 60 meters, just to make sure all was okay there. A reminder: exercise care in tuning to the correct 60 meter channel frequency.

I was also able to chat with a few stateside operators who had a bit more time for questions, such as, "How is my audio quality?" When asked, the response was always "good." I found that it was best to speak directly in front of the internal microphone, three to four inches away. Audio out of the small speaker is clear and loud enough to do the job, except in locations with high background noise.



Figure 3 — MFJ's 1840T (40 meters) and 1820T (20 meters) single band telescoping whip antennas both collapse to just over 10 inches for easy transportation.



Figure 4 — Kathy Allison, KA1RWY, listening on 20 meters during the ARRL Phone Sweepstakes on a cold November day.

The internal battery held up well. Typically I operated in 3-hour intervals and would then charge it after each session. With the supplied 1400 mAH battery and measured current consumption, I would guess operating time would be about 4 hours, maybe a bit less, depending on transmission time.

Portable

The TJ2B certainly worked with my full-sized antennas, but my antennas are not designed for *walking and talking*. I decided to try a telescoping whip antenna from MFJ. These antennas are designed for use on single HF amateur bands, and I purchased the MFJ-1840T for 40 meters and the MFJ-1820T for 20 meters (Figure 3). Each antenna is 53 inches long when fully extended and collapses to slightly over 10 inches, for convenient storage.

Whip antennas do not work effectively without a counterpoise. I confirmed this by placing each whip antenna, one at a time, atop of our Lab's MFJ-259B antenna analyzer. Like the TJ2B, the MFJ-259B has a metal case. A reasonable dip in SWR on the desired amateur band can only be achieved when both hands are firmly grasping the 259B's metal case. With a whip on the TJ2B, I found that I needed to grasp the metal case with both hands for the lowest SWR and for best reception. In

this case, my body acts as the counterpoise. When placed on a table, alone, received signals drop considerably. For fixed portable operation, a quarter-wave counterpoise wire will help to negate this effect but it's not practical to trail a long piece of wire while walking.

I tested the TJ2B with the MFJ whips in the ARRL Phone Sweepstakes contest, an event that certainly gives anyone the opportunity to make contacts, even with low power and a compromise antenna. My wife Kathy, KA1RWY (an ARRL staff member), accompanied me while I operated the TJ2B/whip antenna combination on the Sunday of the event (Figure 4). I completed six contacts on 20 meters; all were short skip of 400 miles distance or so. On

40 meters, I could hear several stations that were within 200 miles, but not one could hear me well enough to make a complete Sweepstakes contact. It was a bone-chilling experience, with the temperature in the upper 30s and no mid-day sunshine to give us a glimpse of warmth. After one hour of operating, we agreed it would be better to operate the TJ2B on Field Day in June than during November Sweeps in Connecticut.

Later, in the afternoon of that day, we met up with *QST* Product Review Editor, Mark Wilson, K1RO, on 40 meters. Mark's signal was exceptionally strong with my home station equipment, so I thought it was time to try the TJ2B/whip combination once more. I dashed out to the front yard in my socks and was rewarded with a report of 3 by 3 — weak, but audible and enough to make the 104 mile sky-wave trip.

Critique

There were no showstoppers for me while testing or using the TJ2B. However, some operating features could be a bit better. The tuning step feature is backward. Each time the tuning knob is pressed downward, the tuning step *increases*. I like to tune with 1 kHz per knob click and then use a slower tuning rate as I approach a signal. This technique allows me to find the strongest stations on the band, quickly. I spent a lot of time pressing the tuning knob, cycling through 10 kHz, 100 kHz, 1 MHz, and 1 Hz tuning rate steps in order to get to 10 Hz or 100 Hz tuning steps.

There is a loud pop from the speaker when transitioning from transmit to receive. While the pop is annoying from the speaker, it's rather painful while wearing headphones, so I do not recommend headphone operation.

Current consumption of 300 mA while



See the Digital Edition of *QST* for a video overview of the YouKits TJ2B Handheld HF transceiver.

receiving is a bit high for the TJ2B's 1400 mA internal battery. While I'm sure I could get a spare battery, you have to remove four small Phillips head screws in order to change it. The screws can easily be lost in the field. Finally, my unit did not attain its specified power output. While I enjoyed many hours of fun and amazement, having an extra 3 dB of power on 20 meters would have been helpful when using the whip antenna.

Conclusion

The YouKits TJ2B is a usable 60, 40, and 20 meter SSB QRP transceiver for fixed or portable operation, provided the operator has an adequate antenna system and an understanding of HF propagation. The TJ2B will walk and talk on 20 meters, when propagation is good. Operation on 40 and 60 meters really needs a bigger antenna than the typical portable whip. A

favorable environment, such as operation at the shore of an ocean, may give better results than in rocky woods. With this reasonable expectation and patience, the user will enjoy this handheld transceiver that has the potential to span thousands of miles.

Manufacturer: YouKits, 1736 Arborwood Dr, Oshawa, ON L1K 0R6, Canada; tel 647-205-2808; www.youkits.com.

Heil HM-12 Base Station Microphone

Reviewed by Joel R. Hallas, W1ZR
QST Contributing Editor
w1zr@arrrl.org

The HM-12 is a new addition to the Heil Sound line of Amateur Radio base station microphones. It shares the form factor of the earlier Goldline microphone series, with the Gold Elite and GMV models still offered by Heil.² Unlike the Goldline mics, the HM-12 includes a single wide-range dynamic element, and has a black rather than gold windscreen.

Included with the HM-12 is a foam windscreen that can be slipped over the metal windscreen that surrounds the element and a clip type adapter that can be attached to the usual mic stand with $\frac{5}{8}$ inch by 27 threads. No cable is provided, but the rear end of the mic includes a four-pin XLR connector designed to mate with Heil's CC-1 connecting cables, available to match most transceivers. Remarkably, at this writing, this high quality microphone is the least expensive of those in Heil's lineup.

Hooking It Up

Using their online adapter selector, I ordered a Heil CC-1-K cable to mate with the front panel 8-pin round MIC connector on my Elecraft K3 transceiver. The cable also includes a $\frac{1}{4}$ inch in-line jack that can be used with a foot or hand push-to-talk (PTT) switch. There were no issues about connections and everything worked fine out of the box(es).

Unlike some studio-style mics, the HM-12 includes a PTT button on the mic barrel (see photo). This works fine and can be used in parallel with the external PTT connection provided. If you use VOX rather than PTT, the switch does not need to be



depressed for the audio to pass through. The external PTT will likely be your favorite if you use a boom arrangement, while the on-mic PTT works well on a desk stand or if you choose to slip the mic from its friction-mount clip and use it as a hand mic — there's a lot of flexibility here.

How It Plays

My usual base station desk mic is built around a Heil HC-5 element. This provides a crisp presence with a tonal boost that suits my voice and sounds good both in my monitor and to distant stations without additional equalization, although that can make it even better for some users. The HC-5, and its DX and contest-oriented brother, the HC-4, go back to the days before audio equalization was commonly available in many radios. As with the later HC-6 that we discussed in the Product Review of the Heil Pro Set Elite Headset, the HM-12 provides a flat broadcast style response (the HM-12 is specified at 80 – 14,000 Hz) that begs for processing to obtain whatever response is needed for your voice and the characteristics needed for your operating style.³

The specifications note that a front-facing cardioid pattern is provided with 35 dB of attenuation from the rear. While we can't measure this, it is worth noting that this feature helps avoid transmitting radio fan noise as well as making the setup of anti-VOX less critical, depending on speaker location.

Fortunately, the Heil Sound website provides recommended starting points for equalization settings in most equalizer-equipped radios for most of their mics. I cranked in their recommended settings to

Bottom Line

The Heil Sound HM-12 brings a professional grade base station microphone to Amateur Radio at an affordable price. The microphone element has the range required to allow use of your audio equalizer to make you sound the way you want.

the K3's 8-band equalizer, and sure enough, the audio went from sounding rather flat to the bright sound I have come to like from the HC-5. Those who like additional processing can use the Heil-recommended starting settings as kick-off points and expand from there. On-air reports agreed that my audio sounded very smooth and natural. I made a quick sked with Bruce Moore, N1ZU, who lives in the next town and knows the sound

of my voice in person. He recognized my voice without difficulty on the air.

Documentation

Included in the box was a single folded page containing information and specifications about the microphone and a half page showing accessories. The sheet also included warranty information. As noted, additional information on connection

arrangements and radio equalizer settings is provided on the Heil website.

Manufacturer: Heil Sound Ltd, 5800 North Illinois, Fairview Heights, IL 62208; tel (618) 257-3000; www.heilsound.com. Price: \$71. CC-1 four-pin XLR female to radio cables, \$39. Bases, boom stands, and PTT foot and hand switches also available.

RigExpert WTI-1 Wireless Transceiver Interface

Reviewed by Steve Ford, WB8IMY
QST Editor
wb8imy@arrl.org

The practice of controlling Amateur Radio stations over the Internet has been gaining in popularity in recent years. This has been driven largely by property restrictions that often make it next to impossible to erect a sizable antenna system — or any antenna system. In addition, we have substantial numbers of hams living in apartments, condominiums, and assisted living facilities where installing outdoor antennas may not be practical.

Fortunately, thanks to widespread Internet connectivity, antenna-compromised amateurs now have an alternative. They can establish stations at distant locations — locations free from antenna restrictions — and use the Internet to operate these stations remotely. The ARRL has even published a book on the topic: *Remote Operating for Amateur Radio*.

However, one of the complications involved in setting up a remote-control system is that not only do you need a computer at the operator's location, you also need one at the remote site. The site computer provides the necessary link to the transceiver for control. It may also support a VoIP (Voice over Internet Protocol) application such as *Skype* to send audio back and forth.

This approach to remote hamming certainly works, and it is described in detail in *Remote Operating for Amateur Radio*, but having a full-fledged PC or Mac at the remote site adds a layer of complexity. Now you have a distant computer that has to be maintained regularly, a computer



that is also vulnerable to software glitches, hard drive failures, and so on. A more efficient, reliable solution would be to remove the desktop or laptop middleman from the equation entirely.

Enter the RigExpert WTI-1

The RigExpert WTI-1 looks like little more than a plastic module, so small (a mere 4 × 3 × 1 inches) that you can easily hold it in the palm of your hand. Don't be deceived by its compact enclosure, though. This little unit packs considerable processing power.

The WTI-1 is essentially a miniature computer dedicated to a single task: remote transceiver control. It connects to the keying and computer-control ports on the radio and in turn connects to the Internet via a wireless Wi-Fi link.

RigExpert offers a number of pre-wired cables for various transceivers to make the rig connection as simple as possible. For this review we used a Kenwood TS-2000 transceiver and purchased the appropriate cable from RigExpert. The WTI-1 also comes with a wall cube power supply, although you could also choose to run the unit from your own dc power source.

The WTI-1 provides complete transceiver control *including audio*.

With the WTI-1 you won't need separate hardware or software to operate phone or sound-device-based digital modes. The WTI-1 also supports FSK keying for RTTY and even CW operation. To send CW, you can use CW keyboard software at the operator end, or the operator can use any remote keyer with WinKey protocol. (A separate COM port is created in the system to support the WinKey data exchange.)

A remote station built around a RigExpert WTI-1 needs only three additional components: a transceiver, an antenna, and a wireless Internet connection. Imagine, for example, a small waterproof box at the remote site. Inside the box would be a compact transceiver, a power supply, and the WTI-1. The only connecting cables would be an ac power line from the home and the coaxial cable to the antenna. Assume that our imaginary box is close enough to the house to connect to its Wi-Fi system and *voila!*, you have a simple Internet controlled station.

Installing the WTI-1

You need a computer to do the initial setup of the WTI-1, but you only need it once. The printed instructions that accompany the WTI-1 lead you through the steps.

The instructions notwithstanding, you'll need to have a basic understanding of how *ports* function in computer systems (or you will need a friend who does). You must assign the WTI-1 ports for PTT keying, CAT (transceiver control), and so on. It is important to make note of these because the software at the operator's end of the

path will need to be configured to use these same ports.

Another critical aspect of installing the WTI-1 is the Internet connection. The remote station site will need a wireless access point, or more commonly, a wireless *router*. If you don't understand how routers function, you may need assistance when configuring and testing the WTI-1.

In a nutshell, most homes use routers these days to distribute access to the Internet within a household network. As the name suggests, a router "routes" data to and from the Internet to various computers and devices. It can do this with wired connections, wirelessly (Wi-Fi), or both.

Many devices can connect to the router simultaneously (especially via the Wi-Fi connection) and this allows everyone in the home to use their desktops, tablets, laptops, and smartphones with ease. As far as the router is concerned, the WTI-1 is just another "smart device" on the network.

However, connecting to the WTI-1 (or any other device on the home network) from the outside world is not quite as straightforward as it may seem. Routers come equipped with *firewalls* to protect the home network from hackers and other ne'er-do-wells that inhabit the Internet. Devices on the home network can breach the firewall to reach the outside world as needed; many do this automatically in ways that are transparent to the users. But to communicate with the WTI-1 you may need to access the home router and assign specific ports (yes, routers have ports too) for the traffic running to and from the device.

Using the WTI-1

The WTI-1 comes with a *Windows* application known as *ShackLink*. When installed on the operator's computer, *ShackLink* communicates with the WTI-1 and manages the incoming and outgoing audio streams. It can also be used to key the transceiver.

For this review, I installed *ShackLink* on my office PC at ARRL Headquarters. I configured it to "look" for the WTI-1 at my home Internet address and use the home router ports that I specifically set up for the WTI-1.

The instant I double-clicked my mouse cursor on the *ShackLink* icon, the software opened a path to the Internet, sought out the

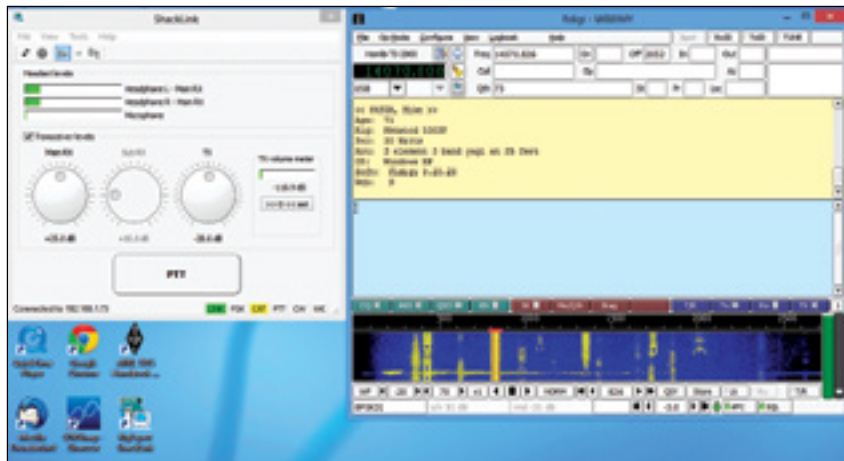


Figure 5 — Using the WTI-1 with *Fldigi* to make PSK31 contacts by remote station control.

WTI-1, and made the connection. Suddenly I had 40 meter audio blasting through my computer speakers (I had turned on the rig and tuned to the 40 meter phone band before leaving the house).

After plugging in a USB headset and reconfiguring *ShackLink* accordingly, it was a simple matter to make a brief phone QSO. All I had to do was click my mouse on *ShackLink's* oversized PTT button whenever I wanted to transmit.

It is important to point out that you will still need a separate rig control application running at the operator's location if you hope to tune the remote transceiver. This can be something as simple as the free DXLab *Commander* (www.dxlabsuite.com/commander/), or a more elaborate program such as *Ham Radio Deluxe* (www.ham-radio-deluxe.com). The WTI-1 instructions include specifics on how to use the device with several popular programs.

I also used the WTI-1 to do a bit of remote digital hamming. I happened to have *Fldigi* on my office PC, so I used that program to control the transceiver frequency and operate PSK31. The only trick was sharing the audio data between *ShackLink* and *Fldigi*, but *ShackLink* has its own "virtual audio cables" to make this easy. The supplementary instructions detail how to do this for various software applications.

With *ShackLink* managing the connection to the WTI-1, I was able to spend a few lunch breaks making PSK31 contacts by remote control. With the exception of a

couple of audio hiccups caused by the sheer volume of data traffic on the HQ network, the WTI-1's performance was flawless. See Figure 5.

An Easy Remote Solution

Once you're past the installation and testing phase, the RigExpert WTI-1 suddenly becomes "invisible." That is to say, you forget that it is there. And why not? After all, the hallmark of reliability in a device of this type is that you never have to think about it. The WTI-1 does not require further attention beyond the initial setup; it simply works.

It is also worthwhile to note that "remote" doesn't necessarily mean controlling a station that is many miles away. I enjoyed using the WTI-1 to operate my TS-2000 with my laptop computer while sitting out on the patio. If you're in a situation where you need to conceal your radio in your home, this type of remote control may offer a unique solution.

Manufacturer: Rig Expert Ukraine LTD, Yakira St 17A, 04119 Kyiv, Ukraine; www.rigexpert.com. Available from a number of North American distributors. Price: \$410. Pre-wired transceiver cable: \$50.

Notes

¹B. Allison, WB1GCM, "DZKit HT-7 40 Meter AM Handheld Transceiver," Product Review, *QST*, Nov 2012, pp 61 – 63.

²D. Henderson, N1ND, "Short Takes — Heil Sound Goldline Studio Microphone," *QST*, May 2000, p 52.

³J. Hallas, W1ZR, "Product Review — Heil Pro Set Elite," *QST*, May 2011, pp 50 – 51.