



Product Review and Short Takes from QST Magazine

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ICOM IC-208H Dual-Band FM Transceiver

Reviewed by Joe Carcia, NJ1Q
W1AW Station Manager

Earlier this year, I had fun reviewing the Yaesu FT-2800M 2 meter FM transceiver. So I was quite pleased when the IC-208H presented itself as another radio (this time a dual-bander) I got to take home and play with.

Some dual band mobile radios include bells and whistles such as cross-band operation. While some find that of use, this radio is for those looking for basic radio function and corresponding straightforward and intuitive operation out of the box.

Since this rig will probably end up in a mobile setting, its relatively small size (approximately 6x2x8 inches) makes this an easy task. As with most mobile rigs, the '208H comes equipped with a mounting bracket and complete hardware. If you wish to remote mount the body of the transceiver, a separation cable for the control head is included.

As with radios of similar design, the chassis is sturdy aluminum, shaped in the form of a heatsink. Given its small size and 55 W maximum output on VHF (50 W maximum on UHF) you need a little heatsinking to dissipate all that heat!

The Radio at a Glance

Right away, you can see the simplicity of the rig's design. There's the standard fare of knobs—VOL, SQL, BAND and so on. The five backlit buttons on the bottom of the display allow for selecting the VFO or memory, scanning, priority, tone (CTCSS), transmit power, offset, monitor and DTMF tones. The five buttons serve dual functions.

The DIAL, VOL and SQL knobs are plastic (non-rubber coated) and have a decent feel to them. The DIAL knob is detented, but the feel is pretty tight, and there's no concern about flying past a desired frequency. Above and below the DIAL knob you'll find two buttons. One is for controlling the menu system and the LOCK function, and the other is for memory writing. A release latch for the control head is on the main body of the transceiver, located to the right of the DIAL knob. The PWR button is located between the VOL and SQL knobs. This particular button is not backlit when power is applied, how-



ever. In dim light, you may find yourself feeling around for it a bit, at least until you get used to the radio.

Looking left to right on the rear of the radio, you first see the miniature 6-pin DIN connector used for 1200/9600 baud packet (depending on which pin you use). Next, an 1/8 inch jack for an external speaker and the power line pigtail that terminates to a 2-pin standard locking power plug. Next to the power line is the cooling fan. The antenna connector (a standard SO-239) located on the opposite side of the fan is chassis-mounted and rounds out the back of the radio. The speaker is located beneath the radio, so you'll want to use the mounting bracket to lift the bottom of the rig for the most audible sound..

The packet, external speaker and antenna connectors have a small part of the radio's heat sink located above them. However, the close proximity of the heat sink does not impede access to these connectors.

The LCD display is approximately 1x2 inches and displays all the various functions. The display has clear, easy to read letters and numbers. When you first activate the radio, you get a nice amber screen. If you don't like that color, you

can change it to yellow or green. This change is performed as part of the SET function. And yes, you can change the brightness level as well!

As mentioned above, the DIAL knob is also used to change between the bands. Band changing (7 band segments in all) is accomplished by depressing the BAND button, located in the middle of the DIAL. While the small function buttons are always backlit green, the BAND button color changes in step with the display.

Powering Up

When power is applied you're greeted with the last frequency in use. (This is a good thing, especially if you have a four-year old interested in radios, such as we do. You'd know if the radio was played with!) In the case of the '208H, the default frequency was 146.010 MHz. A quick glance at the manual on how to change frequency, and I was ready to work my favorite repeater. A call on that machine gave me my first signal report. Although I was using just a simple ground plane antenna, the station gave me a good report, but noted that the audio seemed just a bit too low—that I almost seemed to be talking far away from the mic. I changed the microphone sensitivity (in the SET mode) to high (the default is low), and this change improved the audio. Her audio didn't sound that bad either. It was clear and readable. Even with the volume cranked all the way, understanding the station was no problem. Trips to other repeaters (and simplex operation) yielded similar audio results.

Bottom Line

ICOM offers another easy-to-use VHF-UHF radio, this one with 55 W of punch in a small package.

Table 1
ICOM IC-208H, serial number 0501278

Manufacturer's Claimed Specifications

Measured in the ARRL Lab

Frequency coverage: Receive, 118-174, 230-550, 810-1000 MHz (cell blocked); transmit, 144-148, 430-450 MHz.

Receive, as specified; transmit, 144-148, 420-450 MHz.

Power requirement: Receive, 1.0 A (max audio); transmit, 12 A (high power).

Receive, 0.62 A; transmit, 11.4 A. Tested at 13.8 V.

Modes of operation: FM, AM (receive only).

As specified.

Receiver

Receiver Dynamic Testing

AM sensitivity, 10 dB S/N: 118-174 MHz, 0.45 μ V; 230-300 MHz, 0.79 μ V; 300-500 MHz, 0.63 μ V.

AM, 10 dB S+N/N: 120 MHz, 0.41 μ V.

FM sensitivity, 12 dB SINAD: 118-174 MHz, 0.18 μ V; 230-300, 500-550 MHz, 0.32 μ V; 300-500 MHz, 0.22 μ V; 810-1000 MHz, 0.45 μ V.

For 12 dB SINAD, 144, 430 MHz, 0.15 μ V.

FM adjacent channel rejection: Not specified.

20 kHz channel spacing: 146 MHz, 63 dB; 440 MHz, 66 dB.

FM two-tone, third-order IMD dynamic range: Not specified.

20 kHz channel spacing: 146 MHz, 64 dB;* 440 MHz, 66 dB;* 10 MHz channel spacing: 146 MHz, 92 dB; 440 MHz, 78 dB.

FM two-tone, second-order IMD dynamic range: Not specified.

91 dB.

S-meter sensitivity: Not specified.

S9 indication: 146 MHz, 1.8 μ V; 440 MHz, 2.2 μ V.

Squelch sensitivity: < 0.13 μ V.

At threshold: 146 MHz, 0.07 μ V; 440 MHz, 0.10 μ V.

Receiver audio output: 2 W at 10% THD into 8 Ω .

2.4 W at 8.5% THD into 8 Ω .¹

Spurious and image rejection: 60 dB.

First IF rejection, 146 MHz, 96 dB; 440 MHz, 104 dB; Image rejection, 146 MHz, 128 dB; 440 MHz, 79 dB.

Transmitter

Transmitter Dynamic Testing

Power output (H/M/L), 144 MHz: 55/15/5 W; 430 MHz, 50/15/5 W.

146 MHz, 53 / 15 / 4.8 W; 440 MHz, 45 / 15 / 4.2 W.

Spurious-signal and harmonic suppression: 60 dB.

VHF, UHF, 72 dB. Meets FCC requirements.

Transmit-receive turnaround time (PTT release to 50% audio output): Not specified.

S9 signal, 146, 440 MHz, 164 ms.

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

146, 440 MHz, 44 ms.

Bit-error rate (BER), 9600-baud: Not specified.

146 MHz: Receiver: BER at 12 dB SINAD, 9.0×10^{-5} ; BER at 16 dB SINAD, $< 1.0 \times 10^{-5}$; BER at -50 dBm, $< 1.0 \times 10^{-5}$; transmitter: BER at 12-dB SINAD, 1.3×10^{-3} ; BER at 12 dB SINAD + 30 dB, 4.0×10^{-4} .
440 MHz: Receiver: BER at 12 dB SINAD, 7.7×10^{-5} ; BER at 16 dB SINAD, $< 1.0 \times 10^{-5}$; BER at -50 dBm, $< 1.0 \times 10^{-5}$; transmitter: BER at 12 dB SINAD, 4.5×10^{-4} ; BER at 12 dB SINAD + 30 dB, 2.4×10^{-5} .

Size (height, width, depth): 1.6x5.6x7.3 inches; weight, 2.6 pounds.

Note: Unless otherwise noted, all dynamic range measurements are taken at the ARRL Lab standard spacing of 20 kHz.

*Measurement was noise limited at the value indicated.

¹Volume control is stepped; next higher step produced 12% THD.

This rig operated well on 440 MHz as well as on 146, and the 50 W on that band may be a real plus for some. In this area the activity level on 440 didn't allow exhaustive testing, but contacts through the local 440 repeater yielded good reports.

I operated mobile for a few days and found the rig performed as expected. Even with sunlight streaming through the windshield, I was still able to read the LCD screen, although glare was there.

I did notice that the viewing angle was a bit critical. I found that while I could

see the display clearly when looking down at it or head on, it appears to wash away when viewed from an angle. The user might take this into consideration when mounting the radio in a vehicle. When operating mobile, I found receive audio was relatively clear. Tooling about on the highway with the window opened didn't affect my hearing other stations too much.

Running at 5 W (LOW) the heat sink got just a tad warm. In my truck, I noticed it got warmer still running at a slightly higher power (there are three

power levels—55 [50 on UHF], 15 and 5 W). Since the top of the radio consists of nothing but small heat sink fins, the heating will probably be of little consequence, assuming there's good airflow.

The cooling fan should take care of any additional heat buildup. I did find the operation of the fan to be just a tad annoying. As stated in the manual, the fan has two settings: "on all the time" and automatic. The former is pretty self-explanatory. However, when set to automatic, the fan starts at the beginning of a

transmission, and will continue to run for two minutes or until the internal temperature reaches a preset level, whichever comes later. So if you key the rig for five seconds, the fan runs for two minutes. Consequently, if you transmit for, say, five minutes, the fan will run all that time, including the two minutes after, and probably any additional time thereafter until the temperature has settled down.

While no one commented on hearing the fan during transmissions, you can hear it, especially if the outer operating environment is open or lacks noise. It would be preferable if the fan had more settings. On the other hand, overcooling minimizes the possibility of burnout.

Since heat buildup can be an issue no matter what the fan settings, this should be a consideration when finding a mounting location for the '208H. The operating manual talks about proper mounting procedures to reduce heat build-up.

Speaking of mobile operation, something I like to do on occasion when reviewing radios is sit in the parking lot here at ARRL Headquarters and perform a casual test for IMD. I'll tune the radio to a repeater frequency not that distant from WIAW's 2 meter code practice/bulletin frequency (147.555 MHz) to see if the station blasts through. Measuring and specifications aside, sometimes real life applications offer the best insight. As expected, I didn't hear WIAW's 150 W signal on the repeater frequency. I took this as a sign that the radio's apparent third order IMD dynamic range is quite good. The results from the ARRL Lab are given in Table 1.

What's your Function?

Some might call me lazy, but I like the Auto Repeater function (often referred to as ARS, or *automatic repeater shift*, but not in this radio). While it defaults to on, this function is user-changeable. The radio is shipped with the certain frequency offsets (based on the band plan) already programmed. For example, in the US, the shift is generally ± 600 kHz on 2 meters. Depending on the part of the band, the shift can be either +600 or -600 kHz. As long as this function is on, the '208H will automatically determine the correct shift to use. This is pretty handy, especially if you are repeater hopping—as long as you are using machines with standard shifts.

I enjoy monitoring the NOAA broadcasts. As with many recent VHF Amateur Radio offerings, this radio has 10 preset NOAA channels and a Weather Alert option. The '208H can monitor selected weather channels for the emergency tone alert broadcast by NOAA during severe weather situations. This function can be

turned off in the SET menu.

The '208H also has the standard fare found in many transceivers: automatic power off, time-out timer (for those long-winded folk), priority watch monitoring and channel skip. If you like playing around with Menu functions, this rig's got 28 in all. You can change nearly everything from the Dial Step (5, 10, 12.5, 15, 20, 25, 30, 500, 100 and 200 kHz) to the CTCSS tone. The scanning function is accomplished by setting band scan limits, memory scan or programmed scanned frequencies.

If you wish to clone the programmed information from one IC-208H into another, this function is performed via the external speaker jack using the OPC-474 Cloning cable and CS-208 Cloning software.

Programming

Programming the radio or memories can be a bit tedious at first. For example, to program in a memory channel, you first make sure you're in VFO mode. You select your frequency, including any CTCSS tones, shift and so on. Next, you depress the S.MW/MW button (located beneath the DIAL knob). The M indicator and a channel number will blink. Rotate the DIAL knob until you reach your desired memory channel. Press the S.MW/MW button again for at least a second to read the data into memory.

While memory programming is pretty simple, other functions require a bit more "button pressing." So a good familiarization of the manual is the order of the day.

And about those Memories?

The '208H offers 512 memory channels. There are 500 channels assigned to 10 banks (A through J). The justification for these banks is ease of memory management. They're also part of a system ICOM calls the Bank Link System. You can pick and choose banks of memory for scanning.

The 12 other channels consist of 5 pairs of scan edges and 2 call channels. This does not include the weather channels since these particular frequencies are not user changeable within the radio. (You can program in a generic NOAA frequency if desired.)

You can assign an alphanumeric title to a memory channel. Selecting the letters and numbers is accomplished by using the DIAL knob and MW button. You get the full complement of uppercase letters, numbers and some punctuation marks.

The Versatile Microphone

The supplied microphone is the multi-function ICOM DTMF HM-133. Despite the fact that it feels like thin plastic, it

seems pretty sturdy. The keypad allows for direct frequency entry, in addition to a whole host of other functions. (In fact, most of the radio's functions can be controlled via the microphone.) Unlike some radios where you can simply begin punching in numbers, on this particular microphone you need to depress the ENT C button first. Otherwise, you'll either change a setting or two, or have the rig beep at you. A way around this is to lock the mic buttons (with the exception of the two function keys) in the menu. With the exception of the two function keys, this microphone is not programmable. However, the IC-208H can use microphones that can be programmed, such as the HM-118N. The buttons are backlit (green) all the time.

The coiled microphone cable extends a good 5 feet. Both ends of the cable terminate into RJ45 plugs. One plugs into the rig and the other into the microphone. (It's not a molded cable.) The mic jack (located on the front of the transceiver's main body) is a bit recessed, so thick-fingered folk may have a bit of a time connecting the mic.

Since receiver coverage goes beyond the regular 2 meter/70 cm spread, your entire operating frequency must be keyed in. For example, unlike some older rigs, the 14x.xxx/44x.xxx is not automatic. If you don't wish to use the microphone for frequency entry, you can of course use the DIAL knob.

The lettering on the mic buttons is red, black and green, depending on the function. Various buttons mirror the function buttons located on the transceiver. In some instances, you need to use the microphone buttons to program one function or another. In cases such as these, the manual will indicate a mic button is needed through the use of a small picture of the microphone next to the programming description.

Manual

The 80 page manual is laid out in an easy to read format. The manual starts off with the basic functions and leads the user into the more advanced features. The later pages are devoted to menu functions and programming. As long as users take the time to familiarize themselves with the manual, there should be little problem operating or programming the rig.

The initial installation section is a bonus, too. A few pages are devoted to such issues as RF field exposure, antennas and safety. Reviewing these pages beforehand will not hurt.

What I found interesting was an additional manual that contained nothing but "Ham Terminology." For example, if a ham

is uncertain about the term “Baud,” she can quickly look up this term in this manual. The plus side to this is that the operating manual is not crowded with additional pages devoted strictly to user terminology.

Nice, Simple, Powerful

I like that the IC-208H is not so overwhelmed with additional features that it is intimidating to use. Those extra func-

tions are great for hams who enjoy using them. But, for the average ham who is looking for a simple dual-band FM transceiver with just enough bells and whistles, this rig fits the bill. And the 55 W capacity on VHF is welcome in a relatively small radio.

As an aside, I’m also glad to see more radios are including (as a matter of course) weather channels. Given that

many hams are involved with SKYWARN and other similar activities/operations, the weather alert function (used in conjunction with the priority watch function) further enhances a ham’s ability to get the job done in times of need.

Manufacturer: ICOM America, 2380 116th Ave NE, Bellevue, WA 98004; tel 425-454-8155; fax 425-454-1509; www.icomamerica.com. Price: \$329.95.

Yaesu VX-2R Miniature Dual-Band Handheld Transceiver

*Reviewed by Brennan Price, N4QX
Assistant Technical Editor*

Look at the picture. Note the size of the quarter compared to the size of the radio. It’s about the size of the speaker, and the speaker takes up a sizeable portion of the front panel. Yes, small handheld transceivers are nothing new, but even now, one can’t help but marvel at the size of the smallest of them. The VX-2R inspires such marveling at first sight.

The little handheld looks quite a bit like Yaesu’s earlier VX-1R, the half-watt, dual-band transceiver introduced at 1997’s Dayton Hamvention and reviewed by Steve Ford in the April 1998 issue of *QST*. There are differences, however. The VX-2R is actually a shade thinner at 3.2x1.9x0.9 inches (the VX-1R has a depth of a full inch). What’s more, the VX-2R offers added RF punch: with the included 3.7 V lithium ion battery, Yaesu specifies 1.5 W output on 144 MHz and a full watt on 440 MHz. Performance in the ARRL Lab indicates that our unit of the VX-2R came close (see Table 2).

The front panel keys are sparse—there are only seven of them. The left-hand side of the radio sports the push-to-talk and monitor keys and also houses the power button (see Figure 1). The resistance of the on/off key is significant compared to the other buttons on the radio, making an accidental turning on or off unlikely. The unusual placement of the power key also allows the front-panel buttons to be reasonably sized.

Tuning is accomplished exclusively through the DIAL (multifunction knob) on the right-hand side of the top of the radio. Tuning steps vary from the usual five to as much as 100 kHz in eight factory-set increments.

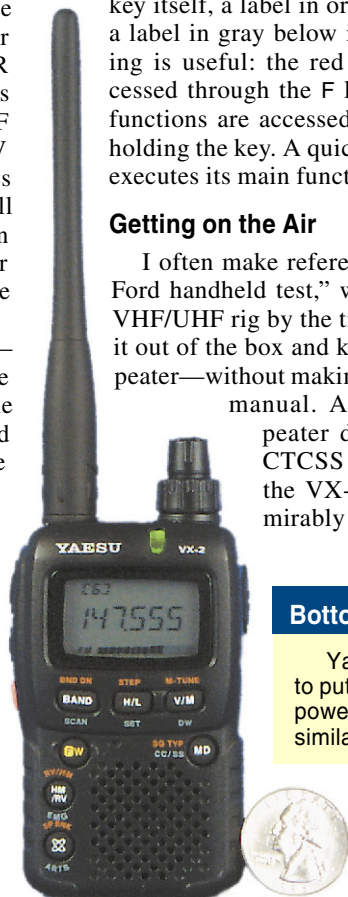
The user can also use a default tuning setting for each band. Tuning in 1 MHz steps can be enabled by pressing the F key before turning the DIAL.

An interesting note about the VX-2R’s F key: it need not be held down to be effective, unlike similar keys on other Amateur Radio handhelds. Instead of pressing and holding the key to choose an alternate function, one toggles an F indicator on and off by pressing the key. Given the small size of the ’2R’s face, this is a good feature. A fingertip pressing and holding the F key could have occupied a significant amount of space.

Each of the other six front-panel keys has three labels: a label in white on the key itself, a label in orange above it and a label in gray below it. This color coding is useful: the red functions are accessed through the F key, and the gray functions are accessed by pressing and holding the key. A quick press of the key executes its main function.

Getting on the Air

I often make reference to the “Steve Ford handheld test,” which measures a VHF/UHF rig by the time it takes to get it out of the box and key up the local repeater—without making reference to the manual. As long as the repeater doesn’t require a CTCSS tone for access, the VX-2R performs admirably on the Ford test.



Bottom Line

Yaesu has managed to put significantly more power into a package similar to its tiny VX-1.

Once a CTCSS tone (or, alternately, a DCS code) must be set, however, the situation becomes murkier.

A CTCSS tone must be set in two steps. First, the SQ TYP setting must be set for TONE or DCS. Then, the appropriate tone or code must be chosen from the menu items found under the SET function. The menu has 48 items, and the CTCSS tone is placed inconspicuously at item 44. Until the user gets used to all of



Figure 1—There’s the power button! The bright orange button on the side panel is hard to miss. The placement and increased resistance of the on/off key is a good feature, allowing added space on the front panel and minimizing accidental turnings on and off.

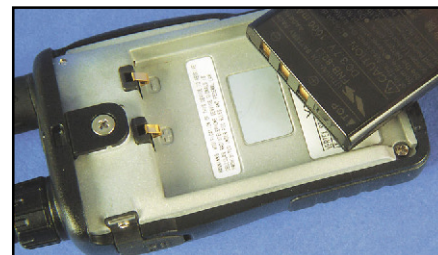


Figure 2—The 3.7 V lithium ion battery slides into the back of the radio, as shown. A plastic cover slides over it and latches into place.

Table 2
Yaesu VX-2R, serial number 3G022409

Manufacturer's Claimed Specifications	Measured in the ARRL Lab
Frequency coverage: Receive, 0.5-999 MHz (cell blocked), transmit, 144-148, 430-450 MHz.	Receive and transmit, as specified.
Modes: FM, AM (receive only), WFM (receive only).	As specified.
Power requirements: 5.5-7.0 V dc; receive, 0.15 A; transmit, 1.8 A (max, high power).	Receive, 0.37 A (max volume, no signal); transmit, 1.5 A, tested at 6 V dc.
Receiver	Receiver Dynamic Testing
FM sensitivity: 12 dB SINAD, 30-54 MHz, 0.35 μ V, 54-76 MHz, 1.0 μ V, 137-140 MHz, 0.2 μ V, 140-150 MHz, 0.16 μ V, 150-174 MHz, 0.2 μ V, 300-350 MHz, 0.5 μ V, 350-400 MHz, 0.2 μ V, 400-470 MHz, 0.18 μ V, 800-999 MHz, 1.5 μ V; WFM, 76-108 MHz, 1.5 μ V, 174-222 MHz, 1.0 μ V; 470-540 MHz, 1.5 μ V; 540-800 MHz, 3.0 μ V.	For 12 dB SINAD, 29 MHz, 0.23 μ V; 52 MHz, 0.32 μ V; 146 MHz, 0.16 μ V; 222 MHz, 1.2 μ V; 440 MHz, 0.14 μ V; 902 MHz, 3.5 μ V; WFM, 100 MHz, 0.54 μ V.
AM sensitivity: 10 dB S/N, 0.5-30 MHz, 3.0 μ V, 108-137 MHz, 1.02 MHz: 1.2 μ V; 3.9 MHz, 0.4 μ V; 14 MHz, 0.44 μ V; 53 MHz, 0.78 μ V; 120 MHz, 0.44 μ V; 146 MHz, 0.42 μ V; 440 MHz, 0.4 μ V.	10 dB S+N/N, 1 kHz tone, 30% modulation, 1.5 μ V.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz offset: 29 MHz, 33 dB;* 52 MHz, 35 dB;* 146 MHz, 46 dB;* 440 MHz, 46 dB;* 902 MHz, 49 dB;* 10 MHz offset: 146 MHz, 67 dB; 440 MHz, 57 dB.
FM two-tone, second-order IMD dynamic range: Not specified.	146 MHz, 81 dB.
Adjacent-channel rejection: Not specified.	20 kHz offset: 29 MHz, 33 dB; 52 MHz, 35 dB; 146 MHz, 46 dB; 440 MHz, 46 dB; 902 MHz, 49 dB.
Spurious response: Not specified.	IF rejection, 29 MHz, 3 dB; 52 MHz, -1 dB; ¹ 146 MHz, 99 dB; 440 MHz, 101 dB; 902 MHz, 57 dB; image rejection, 29 MHz, 78 dB; 52 MHz, 62 dB; 146 MHz, 79 dB; 440 MHz, 52 dB; 902 MHz, -5 dB. ¹
Squelch sensitivity: Not specified.	At threshold, VHF, 0.086 μ V; UHF, 0.093 μ V.
Audio output: 100 mW at 10% THD into 8 Ω .	138 mW at 8% THD into 8 Ω . ²
Transmitter	Transmitter Dynamic Testing
Power output: With FNB-82LI battery pack—VHF, 1.5 W high, low not specified; UHF, 1.0 W high, low not specified. With external 6.0 V dc supply—VHF, 3.0 W high, low not specified; UHF, 2.0 W high, low not specified.	With FNB-82LI battery pack—VHF, 1.4 / 0.12 W, UHF, 0.81 / 0.07 W, With external 6.0 V dc supply—VHF, 2.8 / 0.16 W, UHF, 1.8 / 0.1 W.
Spurious signal and harmonic suppression: VHF and UHF, 60 dB.	VHF, 66 dB; UHF, 72 dB. Meets FCC requirements.
Transmit-receive turnaround time (PTT release to 50% of full audio output): Not specified.	Squelch on, S9 signal, VHF, 65 ms; UHF, 70 ms.
Receive-transmit turnaround time ("tx delay"): Not specified.	VHF, 3.8 ms; UHF, 4.5 ms.
Size (height, width, depth): 3.2×1.9×0.8 inches; weight, 4.6 ounces.	

¹A negative IF or image response indicates that the receiver responded more to the spurious signal than one that was on frequency. This can occur in small wideband receivers due to the simplicity of the filter circuitry.

²Maximum volume.

*Measurement was noise limited at the value indicated.

this, reference to the 76 page operating manual is a necessity.

There are two schools of thought when it comes to handheld operation. I generally subscribe to the school that prefers to look up repeater parameters in directories and set them as I need them in the VFO mode. On a handheld such as the '2R, however, a radio's memory capability becomes critical, since the small size

of the radio precludes direct frequency entry. Yaesu has improved their new mini-handheld by providing 900 conventional memory settings, up from the 194 available on the VX-1R. In 1998, we praised the VX-1R's memory capability as "more than enough." An appropriate description here would be much more than enough.

Each memory stores all the parameters the FM enthusiast needs: input and out-

put frequencies, CTCSS tone or DCS code, power level and alphanumeric label (limited to six characters). Repeaters with nonstandard splits can be programmed into memory using a special procedure that does not require changing the offset in the menu. The procedure is somewhat tricky and not at all intuitive, but very effective, as I was able to program some area 1 MHz split repeaters with ease.

The Battery and the Receiver

The battery is enclosed in a thin compartment along the back of the radio (see Figure 2). A latch on the bottom of the radio holds the compartment cover in place. Users should not try to close the latch without the cover in place, because it comes loose easily, and indeed fell off the radio when I was exploring the battery compartment.

Once the compartment is opened, the remarkably thin battery can be lifted out. At an impressive 1000 mAh capacity, the battery was more than sufficient for hours of normal operation at the VX-2R's low power outputs.

The ARRL Lab results for the VX-2R are reported in Table 2. Like its older, less powerful brother, the VX-2R also doubles as a wide-range receiver, covering the AM, narrow FM and wide FM modes from the MF broadcast band all the way up to 1 GHz. However, the radio's performance peaks on the Amateur Radio bands for which it is optimized. Many handheld radios have limitations receiving below the VHF amateur bands, and the VX-2R is no exception. Yaesu has better options if you're looking for wide receive capabilities, such as its bulkier, more substantial (and more expensive) VX-7R. The spurious response results were also credible for the designed bands of operation, but somewhat surprising for some of the bands outside of 2 meters and 70 centimeters.

A second unit happened to be on hand and was checked in the ARRL Lab for key receiver parameters. While generally similar, it had about 4 dB better IMD and adjacent channel performance in the VHF/UHF ham bands than the test unit.

A very small radio that costs less than \$200 will inevitably have limitations. Yaesu has concentrated on maximizing the VX-2R's performance on the two transmitting bands, and users should keep this in mind.

Lots of Features in a Little Package

A number of features from the Yaesu line of handhelds are incorporated within the menus of the VX-2R. The radio is compatible with the Automatic Range Transponder System. When set properly, an alarm will sound when weather alerts are received on NOAA frequencies. Yaesu's convenient Smart Search feature, handy for rapidly storing active frequencies into memory, is present in full force. Access to the wide range of features is through an extensive menu system, and digging into the manual is advisable to avoid errors.

Like Yaesu's other recent FM offerings, an "atom" key is prominently featured on the front panel. Users of repeaters networked through Yaesu's WIRES system (www.vxstd.com/en/wiresinfo-en) will use this key to enable access, in accordance with instructions from the manual. Autopatch facilities may be accessed through DTMF trans-

missions, despite the lack of a keypad. Nine autodial memories are provided, and are very useful for storing frequently used access codes. Manual dialing is possible, but the process for sending each tone is about as complicated as you would expect for a radio without a keypad.

It's amazing how far mini handheld technology has come in the last few years. When the VX-1R was hailed as the radio that "beats it all for a fun toy" in the April 1998 issue of *QST*, dual-band handhelds its size were unheard of. Despite its meager half-watt output and somewhat limited (by today's standards) memory capabilities, it was a popular seller at more than \$300.

In contrast, the VX-2R is even smaller, offers more features, more memories and more transmit power—three times as much off its battery on 2 meters. The added power is significant; 1.5 W can make a noticeable difference in signal clarity when using a repeater. This added punch takes the VX-2R out of the "fun toy" category, despite its tiny size.

We closed the '1R review in 1998 with the observations of one of our testers: "Dick Tracy wrist radios are only a bit of battery technology away." We're not quite there yet, but the VX-2R brings us a step closer by improving in some ways the ground broken by its older brother.

Manufacturer: Vertex Standard USA, 10900 Walker St, Cypress, CA 90630; tel 714-827-7600; fax 714-827-9100; www.vxstdusa.com. Price: \$199.95.

MFJ-267 Dry Dummy Load with SWR/Wattmeter

By Dave Hassler, K7CCC
Assistant News Editor

How often have you been annoyed by the use of the National Tune-Up Frequency? You know...the frequency that's about 700 Hz away from you, no matter where you happen to be in the band!

Further, how often have you been guilty of using the NTUF, even at low power? Well, fellow hams, there's a device out there that can help turn the National Tune-Up Frequency into a ghost town and make the bands (more or less) tuner-upper-free: the venerable dummy load.

Although decidedly mundane, a dummy load is a necessary part of any decently equipped amateur station. As the product's name states, the recently introduced MFJ-267 Dummy Load with SWR/Wattmeter is a dual-purpose accessory: a dry dummy load its specs say is capable of handling the legal limit of 1500 W—



Bottom Line

While ARRL Lab tests show that more accurate wattmeters are on the market, the MFJ-267 is the only one with a built-in dummy load—and a pretty nice one at that.

albeit for 10 seconds—and a cross-needle SWR/power meter. The dummy load can handle frequencies from dc through 60 MHz, an added boon for the 6 meter operator.

Unlike a number of MFJ's previous products with meters (I own a couple, including the MFJ-941E VersaTuner), the 267 requires 12 V dc to operate the active meter circuitry—it's not just for the meter lamp. I had a little 300 mA wall wart that had a properly wired coaxial plug ready to go, so I popped into the jack in the back, patched it in after my tuner and I was ready for a test.

But first...Uruguay!

I figured I'd go to the more-or-less midpoint of the unit's range for a test. There's a lot of room to play on 10 meters, the band had been dead for months and the tiny amount of RF that got radiated out of the dummy load would



Figure 3—The rear panel of the MFJ-267 wattmeter and dummy load. Notice that the switch sending the input to the antenna or the dummy load is here, making the user reach around.

harm no one. As I spun past 28.5 MHz, I heard a short burst of audio. I tuned back and sure enough, there was a station in Uruguay calling CQ. Of course, the friendly thing to do is forget about the test for a minute and work the DX! After a pleasant, quick chat of a couple minutes, I moved further up the band to start my testing.

The switch to select the dummy load or bypass to your antenna is the only control on the back panel, making it necessary to reach over the 10.5 inch long cabinet and trip the rocker switch (see Figure 3). I had plenty of room to get my hand in there, but I had the meter on a tabletop. If it's wedged into a hutch, it may be difficult to get to the switch, so plan accordingly. The unit needs to have good airflow around it for cooling, so this may not be much of a problem. Still, a front panel switch would be more convenient.

I got a 1.25-to-1 SWR reading while tuning into the dummy load at 28.880 MHz. That's as flat as it would get, while the quite accurate meter in the Japan Radio Corporation JST-245 transceiver showed a flat 1-to-1 ratio at 20 W out. That's consistent with MFJ's claim of SWR reading capability below 1.3:1 at 30 MHz. The reading on the MFJ came more in line with the JRC as I went down in frequency. Finally, I cranked the radio up to 150 W and keyed down for a minute. No heat at all seemed to come out of the dummy load, although I can't imagine why anyone, in real operating/tuning, would ever drop a carrier for a minute like that anyway.

It was mighty nice to have the ability to switch between peak and average metering, tuning up with the former setting and operating with the latter. The meter

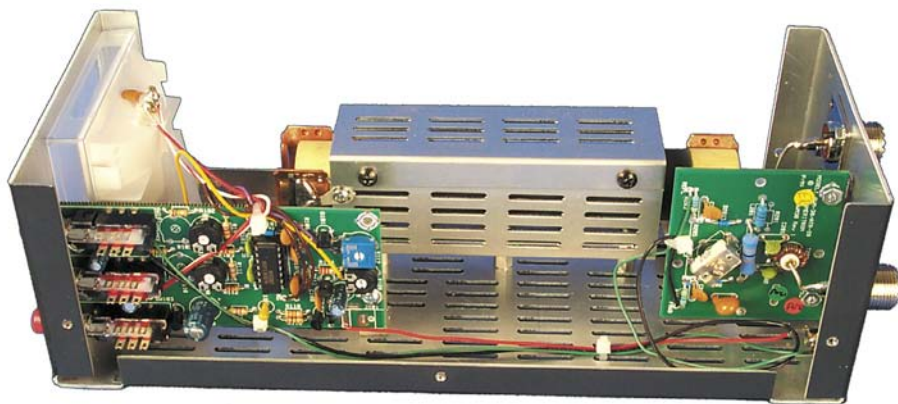


Figure 4—The interior of the MFJ-267. The ends of the dummy load resistor can be seen poking out the ends of the interior box. The circuitry you see is active—12 V dc must be applied for the meter to function.

Table 3
MFJ-267 Wattmeter and Dummy Load

Frequency Range: 1.8-54 MHz
Power Range(s): 300/3000 W
PEP Measurement: Active

Actual Forward Power Frequency (MHz)	Measured Forward Power (Average/Peak)			
	2	14	28	50
5 W CW	10/10	10/10	10/10	10/10
5 W 50%	-/2.2	-/2.5	-/2.3	-/2.1
100 W CW	125/125	125/125	125/125	125/125
100 W 50%	-/130	-/125	-/130	-/125
100 W Two-Tone	-/130	-/130	-/130	-/125
100 W Voice	-/150	-/150	-/140	-/135
1 kW CW	1300/1300	1400/1400	1400/1400	-/†
1 kW 50%	-/1600	-/1600	-/1550	-/
1 kW Two-Tone	-/1300	-/1350	-/1600	-/
1 kW Voice	-/1650	-/1500	-/1650	-/
SWR Accuracy	Measured SWR			
1:1 SWR	1:1	1:1	1:1	1:1
2:1 SWR	2:1	2:1	2:1	2.1:1

Insertion Loss <0.1 dB <0.1 dB <0.1 dB 0.12 dB

†An amplifier for 6 meters was not available at the time of testing.

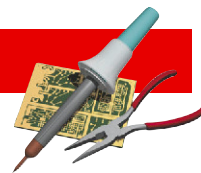
is fair sized and quite easy to read. The high and low scales are set at 3000 and 300 W, respectively, so this particular meter would not be ideal for low-power operation (see Table 3 for the meter accuracy results from the ARRL Lab). [MFJ expressed surprise at the results reported in Table 3, since each unit is calibrated at the factory to 10-20% accuracy. If the results shown in Table 3 were found in a customer unit, it would be recalibrated under the warranty.] That doesn't mean you still couldn't use the dummy load and another meter, however. The QRO crowd should be aware that the resistor in the dummy load can take 750 W for 30 seconds, maximum, and 1500 W for 10 seconds, with a 2 minute

rest between key-down periods. The ARRL Lab did confirm the 1500 W capacity of the '267—it passed this potentially destructive test with flying colors.

At \$149.95, you're paying for the convenience of having a reasonably accurate peak/average power/SWR meter and a dummy load capable of taking a bit of power all in one package; in comparison, the MFJ-250 1 kW oil-filled dummy load and MFJ-815B meter together would cost \$139.90 (although a switch and coax cables would be required to make a fair comparison).

Manufacturer: MFJ Enterprises, 300 Industrial Park Rd, Starkville, MS 39759; 800-674-1800; www.mfjenterprises.com. \$149.95.





Oak Hills Research WM-2 QRP Wattmeter

QRP is a Q-signal meaning “decrease power,” but to a growing community of radio amateurs, it means a great deal more. These hams, known as *QRPers*, have dedicated themselves to the art of low-power operating at less than 5 W output—sometimes *much* less. *QRPers* use commercial and kit-built transceivers, as well as homebrew rigs of their own design, to communicate over great distances using as little RF as possible. If you think it takes towers and kilowatts to work the world, you’ve never tried QRP.



When every bit of RF counts, it helps to know how much power your radio is generating. Most commonly available wattmeters can’t measure output accurately below 10 W, and certainly not in the milliwatt range. You can sink big bucks into a professional-grade wattmeter to do the job, but there are affordable alternatives—such as the WM-2 from Oak Hills Research.

The WM-2

The Oak Hills Research WM-2 was designed specifically for the QRP operator. This compact 4½ × 3½ × 4-inch wattmeter measures forward and reflected power down to 5 mW from 300 kHz to 54 MHz with an accuracy of 5% of full scale.

By using the front-panel rotary switch, you can select from three full-scale power ranges of 10 W, 1 W or 100 mW. The WM-2 sports a large 3-inch meter, so it is easy to read. The



The WM-2 kit on the kitchen table, ready for assembly.

WM-2 can be powered from an external 12-V dc source, or from a 9-V internal battery. A slide switch on the rear panel selects the power options.

The WM-2 kit instructions are extremely well written. Even a novice builder can assemble and test the meter in a few hours. Best of all, you don’t need an RF source to calibrate the WM-2. The calibration process consists of setting three voltages with a voltmeter. The kit is complete with a cabinet, PC board and all components.

Assembly and Operation

Assembling the WM-2 was painless. There are no surface-mount components and the PC board is “open” enough to allow easy parts placement and soldering. You have to wind two toroids for the RF sampling section, but the instructions provide excellent guidance.

The instructions also warn you to check your work carefully before you enter the final phase, which involves installing the PC board into the cabinet. Heed this advice. It isn’t pleasant to undo a nest of wiring just to extract the PC board to fix an “oops” that you discovered too late. Take my word for it—I omitted a resistor, which I noticed *after* the board was installed!

The kit includes two adhesive overlays that add a nice touch to the look of the WM-2. Be sure to follow the instructions about carefully cleaning the chassis before applying the overlays. Oils and other chemicals can interfere with the adhesives. When you’re ready, it is just a matter of peeling off the backings and placing the overlays. The adhesive is powerful, so you need to make sure the overlays are “on target” before you allow them to make contact. With sufficient attention to detail, you end up with a wattmeter that looks like it was assembled at the factory. A set of adhesive rubber feet finish the job.

The estimated assembly time is four hours and that’s exactly what I needed to put together the WM-2. I calibrated the meter with my inexpensive RadioShack pocket VOM. The calibration can be tedious because you are sometimes measuring fractions of a volt and adjusting potentiometers to bring that voltage to an exact value. It only takes a slight twitch of the alignment tool to send the voltage rocketing above or below the target. Patience and a steady hand are required.

Once my WM-2 was calibrated, I brought it to the ARRL Laboratory for an accuracy measurement. Sure enough, the WM-2 met its accuracy specification of 5% of full scale. That’s impressive considering what I used to calibrate it!

In regular use with my Yaesu FT-817 transceiver, the WM-2 has been a gem. I leave it in the line at all times and find it particularly helpful when adjusting output for various digital modes. When I am running QRP with PSK31, for instance, I can easily monitor my RF output and tweak it as necessary. It’s fun to drop the output to less than a watt and marvel at what I can still work.

Manufacturer: Oak Hills Research, 2460 S Moline Way, Aurora, CO 80014; tel 800-238-8205 (orders only); www.ohr.com. \$89.95.

