

Product Review Column from *QST* Magazine

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QST Compares: Tiny 2-Meter Hand-Held Transceivers

(Alinco DJ-191; ICOM IC-T22A; Kenwood TH-22AT; Standard C108A; Standard C178A;
Yaesu FT-10R/A16; Yaesu FT-11R)

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Product Review

Edited by Rick Lindquist, KX4V • Assistant Technical Editor

QST Compares: Tiny 2-Meter Hand-Held Transceivers

By Glenn Swanson, KB1GW
Educational Programs Coordinator

Can you say “tiny,” boys and girls? The radios we reviewed all are less than six inches tall, not counting knobs and rubber duckie antennas, making them the smallest commercially produced 2-meter Amateur Radio transceivers ever! This month, we compare seven subminiature offerings that put a whole new spin on portability. Most slip easily into your pocket. How long before the first 2-meter wrist radio? Only Dick Tracy knows for certain, but things surely seem headed in that direction. For this review, we look at the Alinco DJ-191, the ICOM IC-T22A, the Kenwood TH-22AT, the Standard C108A and C178A, and the Yaesu FT-10R and FT-11R.

As reviewed, these radios had “standard” NiCd battery packs installed, putting them in the 1.5 to 4-W power category. Except for the little C108A, these units all are capable of approximately 5 W power output (and a bit more receive audio) either with optional larger batteries or by using an external power source, such as a cigarette-lighter connection in the car or a power supply at home. However, we reviewed these units just as you might buy them—right off the shelf, with no options installed—as supplied by the manu-



Table 1
2-Meter FM Transceiver Features

	Alinco DJ-191	ICOM IC-T22A	Kenwood TH-22AT	Standard C108A	Standard C178A*	Yaesu FT-10R/A16	Yaesu FT-11R
Expanded VHF reception	Y	Y	Y	Y	Y (plus UHF)	Y	Y
Aviation band reception (AM)	N	M	N	Y	Y	N	Y
Memory channels	40	40/80 selectable	40	20	40 (200 opt.)	30 (99 opt.)	150
Memory cloning	Y	N	Y (wireless)	N	N	Y	Y
Memory names	N	Y	N	N	N	Y	Y
Programmed scan	N	Y	N	Y	Y	Y	Y
Power-output choices	H/L	H/L	H/L/EL	N	H/M/L/EL	H/L3/L2/L1	H/L3/L2/L1
Standard battery capacity (mAh)	700	600	600	N/A	700	650	600
12 V ready?	Y	Y	Y	N	Y	Y	Y
Low-battery indicator	Y	N	Y	N	Y	Y	Y
Automatic repeater offset	N	Y	Y	N	N	Y	Y
Paging (code or tone squelch)	Y	Y	Y	N	Y	Y	Y
Priority channel monitoring	N	Y	Y	Y	Y	Y	Y
DTMF autodial memories (#)	Y (9)	Y (5)	Y (5)	N	Y (10)	O	Y (10)
CTCSS encoder	Y	Y	Y	Y	Y	Y	Y
CTCSS decoder	O	O	O	N	Y	O	O
Antenna connector type	BNC	BNC	BNC	SMA	BNC	SMA	BNC
Suggested retail price	\$246	\$279	\$340	\$269	\$459	\$339	\$389
Typical selling price (as of 3/96) [†]	\$220	\$236	\$265	\$225	\$395	\$250	\$308

Key

Y = Standard

O = Optional

N = Not available

N/A = Not applicable

M = Modifiable via keypad (see dealer)

*Offers 70-cm transmit capability at ≈50 mW output.

[†]Typical selling prices represent an average of prices quoted by several dealers who advertise in QST. They do not include rebates, coupons or specials that manufacturers may offer.

facturer. Only our Alinco DJ-191 and the Yaesu FT-11R came standard with charger stands. All the others, except the C108A (it runs off 2 AA-size batteries) had charger cubes you plug into the wall, but charger stands are available as options.

All of these radios have some common standard features, including a battery saver mode, automatic power off, band and memory scan and a display lamp for nighttime operation.

In all cases, manufacturers outfitted these radios with weatherproofing to resist moisture and dirt. This includes rubber flaps to cover various jacks when not in use, and tight-fitting, rubberized coverings on PTT and other buttons. Alinco even put a gasket around its topside tuning knob.

In addition to having review team members comment on receive and transmit audio performance, two operators aurally compared transmit and receive audio on each unit under more controlled conditions. Radios were identified only by number, so the other operator did not know which he was hearing. Tests were conducted using a fully charged standard battery and the internal speaker. (We did not use an external speaker, but that might improve the sound in some cases.) After one run-through, the operators switched positions and retested the group. Their observations closely matched.

Hand-helds, especially single-banders, are no big whoop these days. Almost everybody's got one. But these bantam baubles caught the imagination of our reviewers, who ran the gamut from a grizzled ham radio veteran with 38 years of hamming under his belt, to a relative newcomer with two years ham radio ex-

perience! Several who didn't want a new H-T beforehand changed their minds after using these little guys! Just a few days into the review process, one tester actually rushed out and bought one of the seven sets we evaluated. Others are looking to "upgrade" to pocket-sized hand-helds.

This review incorporates valuable feedback received from these HQ staff members: Assistant Technical Editor Rick Lindquist, KX4V; Field Services Department Manager Rick Palm, K1CE; Senior Assistant Field Services Manager Jay Mabey, NU0X; Educational Activities Assistants Peter Budnik, KB1HY, and Andrea Sadler, N1PYI; ARRL Lab Supervisor Ed Hare, KA1CV, and Lab Test Engineer Mike Gruber, WA1SVF. Let's take a look at what these Amateur Radio operators found in the world of tiny 2-meter hand-helds.

Alinco DJ-191

If you're looking for a basic, simple H-T that's not bogged down with features you don't need or will never use, the Alinco DJ-191 could be for you. The review team's consensus was that this was the most user-friendly radio of the pack. (It's also the least expensive.) It has just one knob on top for tuning and to select memories and subaudible tones. You can also enter a frequency directly using the keypad. Volume and squelch are set using **UP** and **DOWN** pushbuttons. Its huge display window, the largest of the group, looks almost like the screen on one of those mini-TVs—a real plus!

With its standard EBP-37N 4.8-V battery pack in place, the Alinco DJ-191 is the tallest radio of the group, a little under 6 inches in

height. It's also got the largest keypad. After using some of the other, shorter radios in this group, a few reviewers felt it would be nice if the DJ-191 were a bit smaller, and this is possible if you get the slightly lower capacity "slim" EBP-33 4.8-V battery pack. One reviewer suggested that if you want a radio that gives you the feel of a portable cellular telephone, this is it! The mike is below the keypad like a telephone handset's, too. Overall, the folks who used it called it well-made and with a solid "feel" to it.

The controls are laid out logically, and the ease of programming the radio's 40 memories (plus one call-channel memory) garnered plenty of kudos. Some felt that memory channel programming was simple enough to make the DJ-191 a good choice for beginners.

To the special delight of those whose eyesight "ain't what it used to be," the LED frequency readout features large, clear, easy-to-see, ⁵/₈-inch-high digits, and the display window is pleasantly uncluttered. Although the display lacks brightness or dimmer controls, the review team consistently rated the display legibility as "very good" under both bright sunlight and low-lighting conditions. The display shows the numerical volume (or squelch) setting when you push the **UP** or **DOWN** button. For nighttime viewing, the lamp illuminates both the display window and the keypad buttons, a big plus.

On the air, transmitted audio sounded a little rolled off on the high-frequency and low-frequency ends, but it was clean, with little popping and distortion. This radio sounds better if you don't try to close-talk the mike. The receiver's audio output was rated as good, and the radio exhibits little

Alinco DJ-191, serial number 7000825

Manufacturer's Specifications

Frequency coverage: Receive, 137-174 MHz; transmit, 144-148 MHz.

Power requirements: 4.8-13.8 V dc. Receive, ≈50 mA (squelched); transmit, ≈1 A (max) with standard EBP-37N 4.8-V battery pack.

Size (height, width, depth): 6×2.3×1.1 inches. Weight: 10.5 oz.

Receiver

Sensitivity: 12 dB SINAD, 0.158 μV, 144-148 MHz.

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

Adjacent-channel rejection: Not specified.

IF rejection: Not specified.

Image rejection: Not specified.

Squelch sensitivity: Not specified.

Audio output: >200 mW at 10% THD into 8 Ω, supply voltage not specified.

Transmitter

Power output (H / L): 1.5 W / ≈0.3 W with standard EBP-37N 4.8-V battery pack; 5 W at 13.8 V.

Spurious signal and harmonic suppression: ≥60 dB.

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

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

Measured in ARRL Lab

Receive, 130-174 MHz; transmit, as specified.

Receiver Dynamic Testing

For 12 dB SINAD: 0.16 μV.

20 kHz offset from 146 MHz, 58 dB.
10 MHz offset from 146 MHz, 65 dB.

20 kHz offset from 146 MHz, 57 dB.

99 dB.

65 dB.

0.09 μV at threshold.

151 mW at 10 % THD into 8 Ω with standard EBP-37N 4.8-V battery pack; 218 mW at 13.8 V.

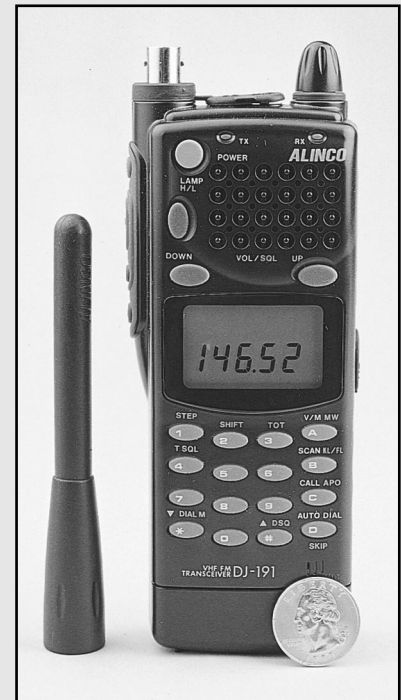
Transmitter Dynamic Testing

2 W / 0.5 W with standard EBP-37N 4.8-V battery pack; 5.4 W at 13.8 V.

As specified. Meets FCC requirements for spectral purity.

Squelch off, S9 signal, 136 ms.

72 ms.



distortion even at higher volume levels.

The concise, 28-page *Instruction Manual* offers plenty of clear and easy-to-find information. A quick-reference section gets you promptly on your way. Although it did not say how to use the radio on packet, one team member found his HTX-202 TNC-to-radio cable worked just fine with the DJ-191.

In addition to the large, legible display and the ease of programming, the review team found other features to their liking. Another hit was the radio's *two* push-to-talk (PTT) buttons—one for low power and the other for high power! This lets you use high power to get into a repeater, then, as you get closer to the machine, to switch to low power (to conserve batteries) just by moving your thumb to the **L PTT** low-power switch.

Reviewers also liked the radio's ability to store the power level you'd like to use along with other memory information. Program in a favorite repeater, and the next time you dial up its memory channel, your DJ-191 will be set for the power level you normally need to access that machine!

Our team put few check marks on the negative side of the ledger. One reviewer wished that volume control were implemented via a knob instead of by using push buttons, but others liked that feature. Another felt that the 1.5 W on high-power and 300 mW on low power wouldn't be enough, but he liked the fact that you could power the DJ-191 from a 12-V source for 5 W output.

What our team liked the most about the DJ-191 overall, however, was its ease of use. One reviewer called it "idiot-proof," while another termed it "a very good basic radio." A third reviewer noted that the DJ-191 does not indulge in "lots of fancy bells and

whistles." One ham who spent some time with the Alinco DJ-191 perhaps summed it up best: "Alinco did a real good job of keeping the radio simple to operate—making it a pleasure to use."

Manufacturer: Alinco Electronics Inc, 438 Amapola Ave, Unit 130, Torrance, CA 90501; tel 310-618-8616; fax 310-618-8758.

ICOM IC-T22A

Here's a compact H-T just under 5 inches in height that has lots of features but is also easy to use and was judged well-made, rugged and sturdy to boot. "It seems like ICOM thought of everything," one reviewer raved. If you need maximum power and minimum size, this could be your choice. It has the highest standard-battery output of the group. During ARRL Lab testing, it exceeded its own 3.5-W specification. Hot off the charger, its initial power output was 5.3 W. After 60 seconds of continuous transmitting, it fell off to 4.5 W; after 90 seconds, it was still 4.3 W! This radio also has the longest rubber duckie of the group, 6.5 inches.

Our reviewers thought the controls on the IC-T22A were conveniently and sensibly laid out. Topside concentric controls for tuning or volume and for squelch are easily accessible. It's easier to use the **VOL** pushbuttons than to hold down the **MONI** button and turn the inner control (normally the tuning knob) to set the volume level. You can set the frequency using the knob or the keypad.

On the air, transmitted audio sounded a bit bassy, almost muffled, but also sibilant (over-emphasis on "S" and "Z" sounds) with some perceptible distortion. In receive, it has good, strong audio, although it lacks presence and distorts at higher volume levels.

Most team members found the IC-T22A's

1 3/16×1/2-inch display screen difficult to read due to glare in well-lighted areas. This display window has 1/4-inch-tall characters, but reviewers reported having to tilt the radio to just the right angle to read them. The radio offers two levels of LCD contrast, a thoughtful inclusion.

While review team members judged the IC-T22A simple to program, it seemed that the keypad took some getting used to. As the manual spells out, to program the IC-T22A, you have to hold in each necessary key for *precisely* one-half second and complete certain operations within two seconds, or start over from scratch. This issue was the only distraction in an otherwise easy-to-program radio.

Once over the programming hump, team members lauded the IC-T22A's other qualities. Specific items—like a handy, separate quick-reference guide, the ability to "name" memory channels (using up to six characters) and the fact that you don't need to press a "function" key to scan, led our reviewers to conclude that ICOM did a good job with the IC-T22A. Incidentally, the number of available memory channels depends on whether you want to use memory names or not. Using names, you have 40 channels of memory; without names, you have 80 memories. "Opening text" was a nice little bonus on the IC-T22A. This lets you store up to six alphanumeric characters—your call sign, for example—that appear when you power up the radio. (The default text, naturally, is "ICOM.")

The 42-page *Instruction Manual* is laid out clearly with basic functions up front that allow you to get on the air quickly. A section on "advanced" functions follows. Team members said it was never hard to find out

ICOM IC-T22A, serial number 005115

Manufacturer's Specifications

Frequency coverage: Receive, AM, 110-136 MHz; Receive, as specified; transmit, 140-150 MHz. FM, 136-174 MHz; transmit, 144-148 MHz.

Power requirements: 4.5-16 V dc. Receive, 150 mA (max); transmit, 1.4 A (max) at 13.5 V.

Size (height, width, depth): 4.3×2.3×1.1 inches. Weight (with BP-180 battery pack), ≈11 oz.

Receiver

FM Sensitivity: 12 dB SINAD, <0.16 μV, 144-148 MHz.

AM Sensitivity: Not specified.

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

Adjacent-channel rejection: Not specified.

Spurious and image rejection: >60 dB.

Squelch sensitivity: <0.16 μV at threshold.

Audio output: >200 mW at 10% THD into 8 Ω at 13.5 V.

Transmitter

Power output (H / L): 3.5 W / not specified, with standard BP-180 7.2-V battery pack; 5 W at 13.5 V.

Spurious signal and harmonic suppression: Not specified.

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

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

Measured in ARRL Lab

Frequency coverage: Receive, as specified; transmit, 140-150 MHz.

Power requirements: 4.5-16 V dc. Receive, 150 mA (max); transmit, 1.4 A (max) at 13.5 V.

Size (height, width, depth): 4.3×2.3×1.1 inches. Weight (with BP-180 battery pack), ≈11 oz.

Receiver Dynamic Testing

For 12 dB SINAD: 0.14 μV.

120 MHz, 0.7 μV for 10dB (S+N)/N.

20 kHz offset from 146 MHz, 61 dB.

10 MHz offset from 146 MHz, 80 dB.

20 kHz offset from 146 MHz, 60 dB.

IF rejection, 115 dB; Image rejection, 69 dB.

0.12 μV at threshold.

211 mW at <1% THD into 8 Ω, with standard BP-180 7.2-V battery pack; 245 mW at 13.5 V.

Transmitter Dynamic Testing

≈5 W / 0.4 W with standard BP-180

7.2-V pack; 5.3 W at 13.5 V.

>60 dB. Meets FCC requirements for spectral purity.

Squelch off, 90 ms.

≈125ms.



what you needed to know. The manual doesn't mention it, but one tester reported that the radio worked well on packet.

The IC-T22A very likely would suit both VHF veterans and newcomers alike.

Manufacturer: ICOM America Inc, 2380 116th Ave NE, Bellevue WA 98004; tel 800-858-6252; fax 800-858-0684.

Kenwood TH-22AT

Kenwood says it developed this series of H-Ts "to satisfy the requirements for a small hand-held that's simple to operate yet has superior performance." Kenwood succeeded, according to our review team. At about 4½ inches high and sporting a slender, 1-inch profile, the '22AT certainly falls well within the subminiature category. Users gave it overall good grades, especially for ease of programming. It's also the only radio of the group that has wireless cloning capability—great for clubs or multi-H-T families!

The reviewers also rated the TH-22AT as very sturdy with a "quality feel" to it. Indeed, the '22AT handled near-zero-degree weather during a ski trip to New Hampshire without complaint (something I couldn't say for myself—*brrrr!*). In addition, reviewers liked the unit's size, control layout, and front-panel keys that were "easy to press" unless you have "fat" fingers. In fact, several operators used the word "smooth" to describe how the transceiver's controls operated. Overall, reviewers praised Kenwood for building a radio with excellent fit and finish.

Reviewers called the TH-22AT's narrow display window "very small, difficult to read" and "minimal but adequate." While it was easy to make out the bold ⅜-inch numerical frequency information on the display, smaller

legends (used to indicate certain parameters such as output-power levels), were tough to decipher, even with excellent lighting.

The TH-22AT had the best resistance to intermod (two-tone, third-order IMD dynamic range) of the review group. It also received positive comments on its receive audio, with most reviewers saying it "sounds great" and was "very clean." It will distort at high-volume settings. On transmit, we found that the audio, while a bit constricted in frequency response, was clean. "Excellent audio" was a typical on-air report.

Most reviewers found programming the TH-22AT's 40 memory channels to be relatively effortless, and one even figured it out without looking at the manual. Another user especially liked the '22AT's "channel display function," which displays a channel number instead of a frequency. He felt this could come in handy while coordinating frequency usage during emergency or public-service events.

One interesting feature is the '22AT's automatic squelch threshold level. The transceiver automatically controls the squelch based on the measured noise level. You'd probably want to override this feature for listening to a weak signal on simplex. Otherwise, the automatic squelch might end up, as one reviewer observed, "responding to band noise rather than the actual signal."

The 75-page *Instruction Manual* won unanimous praise. Reviewers singled out the page devoted to "Your First QSO" as great for new hams. Even if you don't like to read instruction manuals, we'd recommend at least looking at this page to ensure a good beginning to your relationship with the TH-22A. Kenwood also deserves compliments for including a page of text—and later

in the manual a hook-up diagram—on how to use the '22AT on packet.

Other features our reviewers liked included the adjustable "time-out timer" (which some of the other transceivers also offer). This handy gizmo cuts your transmission short should you exceed the amount of transmitting time you've programmed in. One reviewer termed it "a great idea for those who tend to prattle on" during a QSO!

All told, the TH-22AT was certainly a favorite among our reviewers for combining plenty of useful features with ease of use and a compact case.

Manufacturer: Kenwood Communications Corp, PO Box 22745, Long Beach, CA 90801-5745; tel 310-639-5300.

Standard C108A

Standard's C108A—the "baby" of the pack, weighing in at less than 5 oz and measuring a tad over three inches high—was just too cute to resist. It's ultra-portable, perfect for a briefcase or clipping onto a belt (it's about the size of the average beeper).

Without exception, the C108A drew *ooohs* and *aaahs* merely for its tiny size, and it fits easily—even hides—in the average shirt pocket. Only its antenna gives it away. (Standard offers a dual-bander, the C508A, that's almost as small.) While the C108A is not in the same power class as the others we reviewed, it certainly held its own, and has features you wouldn't believe in a radio so petite.

Standard touts the C108A as ideal for "hamfests, picnics, conventions or working nearby repeaters." We'd agree with those limitations. With two AA-size (alkaline or carbon-zinc) batteries installed in the C108A, the ARRL Lab measured its full

Kenwood TH-22AT, serial number 60801063

Manufacturer's Specifications

Frequency coverage: Receive, 144-148 MHz; transmit, 144-148 MHz.

Power requirements: External supply, 5-16 V dc (13.8 V nominal); battery, 4-15 V (6 V standard); Receive, ≈45 mA (no signal); transmit, ≈1.3 A (max) at high-power setting.

Size (height, width, depth): 4.7×2.2×1 inches. Weight (with PB-32 battery pack), 10.2 oz.

Receiver

Sensitivity: 12 dB SINAD, ≤0.16 μV, 144-148 MHz.

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

Adjacent-channel rejection: Not specified

IF rejection: Not specified.

Image rejection: Not specified.

Squelch sensitivity: ≤0.1 μV at threshold.

Audio output: ≥200 mW at 10% THD into 8 Ω, supply voltage not specified.

Transmitter

Power output (H / M / L): ≈3 W / 0.5 W / 30 mW with standard PB-32 6-V battery pack; 5 W at 13.8V.

Spurious signal and harmonic suppression: ≥60 dB.

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

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

Measured in ARRL Lab

Receive, 136-174 MHz; transmit, as specified.

Receiver Dynamic Testing

For 12 dB SINAD: 0.14 μV.

20 kHz offset from 146 MHz, 76 dB.
10 MHz offset from 146 MHz, 83 dB.

20 kHz offset from 146 MHz, 59 dB.

112 dB.

85 dB.

0.07 μV at threshold.

281 mW at 10 % THD into 8 Ω, with standard PB-32 6-V battery pack; 281 mW at 13.8 V.

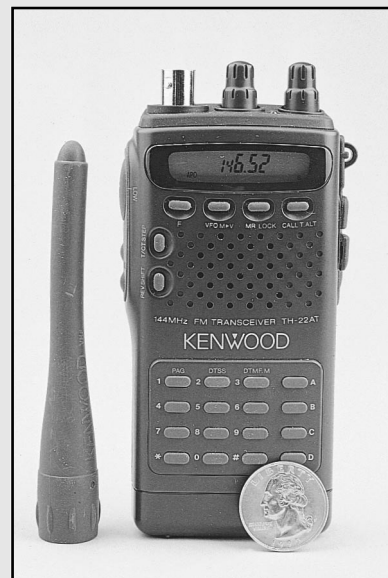
Transmitter Dynamic Testing

4 W / 0.4 W / 50 mW with standard PB-32 6-V battery pack; 5.5 W at 13.8 V.

As specified. Meets FCC requirements for spectral purity.

Squelch off, 100 ms.

48 ms.



power output at just under one-third of a watt! We got plenty of “mileage” out of each set of batteries, too. (Rechargeable batteries are optional.) Speaking of batteries, you might want to tape the battery cover in place. It comes off easily under normal jostling.

The relatively low power output certainly was an issue for some reviewers. With this in mind, reviewers judged the C108A as “super” for those times when you have a *direct shot* at a repeater. But you might have trouble getting into a repeater if you’re operating in the midst of “signal stoppers” such as rough terrain or tall buildings.

In the opinion of the review team, the 41-page *Owners Manual* packaged with the C108A, while complete and well laid-out, was flawed by a clumsy translation to English. One reviewer liked the ample use of “cute pictures” to convey certain information, however. Despite the mangled English, the *Owners Manual* was generally sufficient until it came time to *program* the C108A.

Programming the C108A for both basic operating—and its 20 memories—was a bit of a chore for several on the review team. While the manual conveys the necessary programming steps, it makes you jump from page to page to find required information. Add several steps to enter the desired operating parameters (such as repeater offsets), and it becomes a bit cumbersome.

While the review team judged the display window’s frequency readout and menu choices fairly easy to read, they found it hard to see if the tiny repeater offset indicators were set to plus (+) or minus (–), or what several other small display legends indicated.

On the air, we judged transmit audio as very good and clean, with only occasional pops and sibilance. Its receive audio is clear, if a little tinny, but there’s not much of it (the radio cranks out not quite 90 mW of audio).

A convenient, side-mounted volume control sets volume level.

Some reviewers also would have liked a continuously adjustable squelch instead of the two menu choices, **SHL Hi** or **SHL Lo** (the low setting is recommended for normal use). A rotary squelch knob would be a welcome addition. Most reviewers would have preferred the more-common BNC-type connector to hook up an external antenna. (On the other hand, the C108A is most fun when it’s not tethered in one spot.)

The review team praised Standard for making the C108A amazingly small and light, and rated it as “rugged,” especially considering its size. Many felt it would be the perfect traveling companion and great for just listening. The ’108A has four scan modes, and since it tunes from 100 to 175 MHz, you can eavesdrop on the AM “aircraft” band or check NOAA weather radio, for example, while you’re waiting for your flight. However, keep the relatively low transmitter output power in mind when deciding to press this set into service for critical two-way communication.

Power limitations aside, nearly everyone who used the C108A enjoyed their time with this pint-size transceiver, because it was so much fun to have around.

Manufacturer: Standard Amateur Radio Products Inc, PO Box 48480, Niles, IL 60714; tel 312-763-0081; fax 312-763-3377.

Standard C178A

While not nearly as small as its little sibling C108A, the Standard C178A hand-held, at a bit under 5 inches tall, offers a lot in a very sturdy little package, including limited 70-cm capabilities (more on that later). The review team was pleased with the construction and control layout of the C178A. One reviewer said that it not only had “the best overall ruggedness and general polish” of the

group, but that its quality was “a cut above the rest.” The C178A is also the most expensive radio of the group, but it’s the only one that offers both CTCSS encode *and* decode as a standard feature.

This radio took a trip to Minnesota in the dead of winter. It easily withstood the rigors of travel and the –30° F temperatures.

The C178A has a nice, large, easy-to-grab **SELECTOR** knob (for tuning and other functions) and a single set of concentric controls on top. The faster you turn the **SELECTOR** knob, the greater the tune rate, a nice touch. The large outer knob is the volume control. The semi-recessed inner knob is the squelch control. The antenna interferes a bit with the use of the concentric controls. The keypad consists of round buttons, and you can use them to directly enter a frequency. In conjunction with the **FUNCTION** button, the keypad buttons also control other features.

Reviewers found the radio easy to program and the manual helpful. The fact that it’s such a complex (or feature-laden) radio prompted comments like “Don’t throw out the operating manual with the packing materials!” The C178A is not a read-the-manual-once-and-forget-it radio!

One of the radio’s neatest features is its limited dual-band capabilities. Standard calls the radio a “hybrid” rather than a dual-bander, but the C178A hears quite well on 70 cm (it has expanded UHF receive, too) and offers flea-power transmit capability—a whopping 50 mW! This might work fine for a local machine or even to get away from the madding crowd and simplex at a hamfest.

The 72-page *Owners Manual* won rave reviews from most users, especially for its comprehensive index and generous use of graphics. But other reviewers chided Standard for the manual’s “awkward language” and frequent misspellings in some places, no

Standard C-108A, serial number UO30290

Manufacturer’s Specifications

Frequency coverage: Receive, 144-148 MHz; transmit, 144-148 MHz.

Power requirements: 2.2-3.5 V dc (2 × AA battery). Receive, 30 mA (no audio); transmit, ≈210 mA.

Size (height, width, depth): 3.2×2.3×1 inches. Weight 4.6 oz.

Receiver

FM sensitivity: 12 dB SINAD, 0.16 μV, 144-148 MHz.

AM sensitivity: Not specified.

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

Adjacent-channel rejection: Not specified

IF rejection: Not specified.

Image rejection: Not specified.

Squelch sensitivity: 0.1 μV at threshold.

Audio output: ≈100 mW at 10% THD into 8 Ω.

Transmitter

Power output: ≈230 mW.

Spurious signal and harmonic suppression: ≥60 dB.

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

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

Measured in ARRL Lab

Receive, 100-140 MHz, AM; 140-175 MHz, FM; transmit, as specified.

Receive, 30 mA (no audio); transmit, ≈210 mA.

Receiver Dynamic Testing

As specified.

120 MHz, 0.3 μV for 10 dB (S+N)/N.

20 kHz offset from 146 MHz, 63 dB.

10 MHz offset from 146 MHz, 66 dB.

20 kHz offset from 146 MHz, 60 dB.

95 dB.

67 dB.

As specified.

88 mW at 10 % THD into 8 Ω.

Transmitter Dynamic Testing

290 mW.

As specified. Meets FCC requirements for spectral purity.

Squelch off, 65 ms.



doubt a result of its having been translated into English. The manual includes a diagram showing how to use the C178A on packet.

The C178A's display was judged easy to view under *most* lighting conditions, but it suffered a bit in bright sunlight. Its bold ³/₁₆-inch characters are readable at several feet under average lighting, however. The C178A's battery-charge level icon is always displayed and gives a running indication of where your batteries stand, instead of just letting you know when the charge is low. Reviewers judged this very helpful to prevent those sudden and unexplained disappearances from the repeater.

On-air testing revealed that the C178A's transmit audio was very good to excellent, while its receive audio was judged as merely adequate. Possibly because of its tiny speaker, you could not turn up the volume very high before audio became buzzy and distorted.

Among the radio's plethora of features is a nifty, built-in clock, which can display either 12 or 24-hour format. It also has a "wake-up" timer that you can program to turn the radio on at a predetermined time. (One reviewer was quite surprised while at home one weekend when the radio *suddenly came on*, all by itself! Someone who had used the radio before him apparently had set the wake-up timer!) The radio also has a time-out timer to limit transmission length. Overall, the review team gave the C178A good grades for its solid construction, plenty of useful features and great transmit audio.

Manufacturer: Standard Amateur Radio

Products Inc, PO Box 48480, Niles, IL 60714; tel 312-763-0081; fax 312-763-3377.

Yaesu FT-10R

This chunky little set fits pleasantly in your palm. Coming in at just over 4 inches high, the Yaesu FT-10R is a compact radio that—via optional keypads—offers plenty of flexibility. The number of memories depends on the keypad. Ours had the A-16 keypad, with 30 memories, but optional higher-end keypads offer 99 memories, and one even has a digital voice recorder module!

For the most part, the review team liked the general fit and finish of the FT-10R, and one reviewer commented that it *looked* like it would hold up under rough use. In fact, Yaesu markets the same radio, channelized, for commercial two-way use, which could explain its adjacent-channel rejection figure of 67 dB, right behind its sibling FT-11R. One interesting difference with this radio as opposed to the rest in this group: the antenna is located on the *right*-hand side of the radio, leading some reviewers to suggest that this radio might be a good choice for a "lefty." Some reviewers would have preferred a BNC-type connector instead of the SMA-type.

The display window was rated only "fair" under normal room lighting; using the built-in display lamp, team members judged it as only "somewhat readable" in total darkness. The display lens helps (digits appear ³/₁₆-inch tall). However, in less-than-ideal lighting conditions, the numbers ever-so-slightly

blend into the display's background, which turns orange when illuminated.

Setting the all-important squelch is a menu function. Changing it is a bit involved. First, you press the inner top dial, normally used for tuning (the outer concentric control is for volume). Then, you use the same knob to page to **SQL**. Press it again and turn it to adjust the setting. Press **PTT** to enter the change. It's not as complicated as it sounds, once you get the hang of it. Having the squelch as a separate control would have been a major improvement, however. The FT-10R has two VFOs. With the A16 keypad, you have to use the knob to change frequency. The higher-end keypads allow entry of frequency.

One reviewer deemed manually programming memories in the Yaesu FT-10R as "not easy—especially for a new ham," while another user reported being unable to program the set at all! It's a bit tricky, as a third reviewer found out: "Once I learned how to push the buttons correctly, it was fairly easy to program the radio. When they say press a key for one-half second, press the key for one-half second!" If you press each button "smartly" while moving along, you won't have any problems, but the keypad is the most tightly spaced of the group, so you have to press carefully too. Otherwise, you might find the radio doing things you didn't intend.

You can program the radio *very easily* using your PC and Yaesu's optional Windows-compatible software (ADMS-1B, \$39 including cable), a valuable feature not men-

Standard C-178A, serial number UO40040

Manufacturer's Specifications

Frequency coverage: Receive, 110-175; 320-475 MHz; transmit, 144-148; 438-450 MHz

Power requirements: External supply, 2.3-15 V dc; battery, 2.3-15 V (7.2 V standard). Receive, 40 mA (squelched); transmit, 900 mA (max) at high-power setting with standard CNB171 7.2-V battery pack.

Size (height, width, depth): 4.9×1.9×1.3 inches. Weight (with CNB171 battery pack), 12.5 oz.

Receiver

FM sensitivity: 12 dB SINAD, 0.16 μV, amateur bands only.

AM sensitivity: Not specified.

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

Adjacent-channel rejection: Not specified.

IF rejection: Not specified.

Image rejection: Not specified.

Squelch sensitivity: 0.1 μV at threshold.

Audio output: 200 mW at 10% THD into 8 Ω. supply voltage not specified.

Transmitter

Power output: 144-148 MHz, H / M / L / EL, 2.8 W / 2.5 W / 350 mW / 50 mW; 438-450 MHz, ≈50 mW with standard CNB171 7.2-V battery pack; 144-146 MHz, 5 W at 13.8 V.

Spurious signal and harmonic suppression: 146 and 440 MHz, >60 dB.

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

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

Measured in ARRL Lab

Receive: VHF, 100-200 MHz; UHF, as specified, with reduced sensitivity noted at range extremes); transmit, as specified.

Receiver Dynamic Testing

For 12 dB SINAD: VHF, 0.14 μV; UHF, 0.16 μV.

120 MHz, 0.47 μV for 10 dB S+N/N.

20 kHz offset from 146 MHz, 66 dB; 20 kHz offset from 440 MHz, 68 dB; 10 MHz offset from 146 MHz, 76 dB; 10 MHz offset from 440 MHz, 70 dB;

20 kHz offset from 146 MHz, 60 dB.

20 kHz offset from 440 MHz, 58 dB.

146 MHz, 79 dB; 440 MHz, 85 dB.

146 MHz, 78 dB; 440 MHz, 20 dB.

146 MHz, 0.05 μV at threshold; 440 MHz, 0.08 μV at threshold.

263 mW at 10% THD into 8 Ω with standard CNB171 7.2-V battery pack; 263 mW at 13.8 V.

Transmitter Dynamic Testing

144-148 MHz, 3.2 W / 2.5 W / 0.4 W / 74 mW;

438-450 MHz, 50 mW with standard

7.2-V battery pack; 144-146 MHz,

5.1 W at 13.8 V.

As specified. Meets FCC requirements for spectral purity.

Squelch off, 60 ms.

55 ms.



Yaesu FT-10R, serial number 5K040431

Manufacturer's Specifications

Frequency coverage: Receive, 140-174 MHz; transmit, 144-148 MHz.

Power requirements: 3.5-12 V dc. Receive 50 mA (squelched, at 9.6 V); transmit 1.2 A (max at 9.6 V). Size (height, width, depth): 3.8×2.3×≈1.3 inches. Weight (with standard FNB-40 6-V battery pack), 11.4 oz.

Receiver

Sensitivity: 12 dB SINAD, 0.16 μ V, 144-148 MHz.

Two-tone, third-order IMD dynamic range: >70 dB (offset not specified).

Adjacent-channel rejection: >70 dB (offset not specified).

IF rejection: Not specified.

Image rejection: Not specified.

Squelch sensitivity: Not specified.

Audio output: 500 mW at 10% THD into 8 Ω , with 9.6-V battery pack.

Transmitter

Power output (H / L3 / L2 / L1): 2.5 W / 2.5 W / 1 W / 100 mW with standard FNB-40 6-V battery pack; ≈5 W at 9.6 V.

Spurious signal and harmonic suppression: >60 dB.

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

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

Measured in ARRL Lab

As specified.

Receiver Dynamic Testing

For 12 dB SINAD: 0.14 μ V.

20 kHz offset from 146 MHz, 75 dB.

10 MHz offset from 146 MHz, 78 dB.

20 kHz offset from 146 MHz, 67 dB.

120 dB.

80 dB.

0.14 μ V at threshold.

328 mW at 10% THD into 8 Ω with FNB-40 6-V battery pack; 690 mW at 9.6 V.

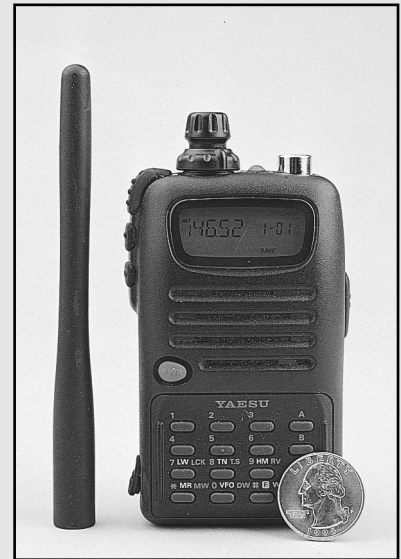
Transmitter Dynamic Testing

2.7 W / 2.7 W / 0.9 W / 120 mW with standard FNB-40 6-V battery pack; 4.6 W at 9.6 V.

As specified. Meets FCC requirements for spectral purity.

Squelch off, ≈60 ms.

≈35 ms.



tioned in our manual. This makes programming the FT-10R not just simple but fun! (It also works for the Yaesu FT-11R.) Once programming was out of the way, all users agreed that they liked the portability and overall ease of use of the FT-10R.

While the mechanics of manually programming the radio might have thrown some reviewers a curve or two, the 72-page manual pitches right over the plate. It offers clear, easy-to-find information, and one op commented that he especially liked the "Quick Start" section that explains the basics of using the radio for repeaters and simplex. The only negative remarks about the otherwise-excellent manual came from confusion over which "optional" material applied to the radio they had in front of them.

On receive, the FT-10R's audio output was deemed natural-sounding by the testers, and you could turn the volume up fairly high before serious distortion occurred. That's not surprising, because this radio has the most audio output of the crop—more than 300 mW with the standard battery. Most reviewers rated transmit audio as good and without distortion, but more constricted in frequency range and not as "punchy" as the other radios in the group.

A noteworthy feature on the FT-10R is its *Auto Range Transponder System (ARTS)*. When enabled, ARTS allows two FT-10Rs to automatically poll one another every 25 seconds using a subaudible signal. The radio displays "RANG," and beeps twice when the two radios are "within range" of each other. When you move out of range, the "RANG" display blinks until you move back into range. This is pretty clever and likely to come in handy while trying to keep in touch during a large hamfest, a hike or at public-service

events, for example. When using ARTS, you can program the radio to send your call sign in CW every 5 minutes, thus meeting FCC station-identification requirements.

The Yaesu FT-10R, overall, is a nice, small, rugged and capable radio, and the optional keypads offer additional additional features.

Manufacturer: Yaesu USA, 17210 Edwards Rd, Cerritos, CA 90703; tel 310-404-2700.

Yaesu FT-11R

The FT-11R, which Yaesu touts as the smallest H-T with a full-sized keypad, was among the favorites of the review team. It's about the same height as the FT-10R, but it's not as chubby looking. In fact, except for the C108A, the FT-11R is the slimmest of its peers! It also has the best adjacent channel rejection—67 dB.

The reviewers gave it high marks for being conveniently pocket-sized and for having lots of "polish" and a rugged, quality "feel." It has just one rubberized knob on its top. Other functions are handled by push-buttons or via the keypad. It has a convenient, one-touch front-panel **LOCK** switch to prevent "accidental" operations.

This set offers the most memories of the H-Ts in this group—150 in all! It also has expanded receive capability. You can use its single knob to change frequency, or you can enter a frequency directly using the keypad.

Display legibility was considered adequate under all lighting conditions—whether in bright sunlight or in the dark (using the display lamp). The versatile display not only includes a combination power-output and S meter, but it graphically displays volume level. When you illuminate the display, the radio's keypad also

lights up, a welcome feature.

As for ease of programming, the review team agreed it was about average. One op said using the function key in combination with the keypad digits to program the set "suited me very well." As with its sibling, the FT-11R can also take advantage of Yaesu's optional PC software that allows you to program the radio via your (Windows-equipped) personal computer. As with the FT-10R, this feature was not mentioned in our manual.

Receive audio was judged as "fine for low-noise conditions," although the audio became more tinny and distorted as the volume was turned up. On transmit, we found the audio generally good, but it was less natural-sounding than some of the other radios we tested and tended to distort when the operator moved close to the mike.

The 61-page manual supplied with the FT-11R includes an excellent table of contents. (Actually, Yaesu supplies *three* manuals with the FT-11R, in one binding. An English-language version is followed by Spanish and French, more than 180 pages all told.) The English manual followed Yaesu's tradition of clear, friendly, language. It allowed the review team to find needed information quickly. Of particular note is the "Quick Code Sheet" that offers a convenient reference to regularly used functions. As one reviewer said: "It made the documentation particularly useful. All radios should have one."

Most reviewers wished for a squelch knob rather than the function-key-shifted volume control method the FT-11R uses. This setup was deemed "difficult to adjust" by several reviewers. Users did like the fact that the radio offers two VFOs; very flexible scanning; a BNC-type antenna connector and the

ability to "name" memory channels.

Another noteworthy feature that's available if you plan to run full power with the FT-11R is "TX Save." You turn it on via the menu. Here's how it works: If the radio heard a full-scale signal on its last transmission and you key the transmitter but do not speak, the transceiver reduces power two levels (ie, from 5 W to 1.5 W). In addition, a sensor monitors internal temperature of the radio and, during 5-W operation, automatically cuts transmit power to the low setting to protect the radio if it gets too hot during extended transmission.

The FT-11R was a popular unit with our review team, and most of the folks who spent some time with it came away impressed by its capabilities.

Manufacturer: Yaesu USA, 17210 Edwards Rd, Cerritos, CA 90703; tel 310-404-2700.

Conclusions

If portability or compactness are important factors for you when considering an H-T, there's probably a radio here to suit your needs. In any case, your spouse can hardly argue that your radio "takes up too much room," because you can hide most of these away as easily as a wallet or a cellular telephone. If you're on the road a lot, any of these H-Ts would make great traveling buddies and fit in an overnight bag, purse or jacket pocket.

As always, we recommend you try before you buy. None of these radios is head and shoulders above the others, but there weren't any dogs in the group either. On the other hand, don't overlook the ARRL Lab test re-

sults that might call attention to capabilities you need in a 2-meter H-T, such as extra-sensitive receive capability, immunity to close-by repeaters or a little bit more power. Lots of accessories are available for these units, from bigger (or smaller) batteries to carrying cases. Check with your favorite dealer for prices and availability.

In terms of overall usability, it's hard to imagine where you'd be able to find so much fun and functionality in such small packages. Enjoy!

SOLICITATION FOR PRODUCT REVIEW EQUIPMENT BIDS

[In order to present the most objective reviews, ARRL purchases equipment off the shelf from dealers. ARRL receives no remuneration from anyone involved with the sale or manufacture of items presented in the Product Review or New Products columns.—*Ed*]

The ARRL-purchased Product Review equipment listed below is for sale to the highest bidder. Prices quoted are minimum acceptable bids, and are discounted from the purchase prices. All equipment is sold without warranty.

ICOM IC-706 MF/HF/VHF transceiver with optional FL-100 500-Hz CW filter (see Product Review, March 1996 *QST*). Minimum bid: \$918.

JPS ANC-4 noise canceller (see Product Review, February 1996 *QST*). Minimum bid: \$112.

MFJ-9420X 20-meter "Travel Radio" SSB transceiver with microphone and optional MFJ-415 CW adapter (see Product Review, February 1996 *QST*). Minimum

bid: \$185.

MFJ-8621 2-meter data transceiver with stock 145.01 MHz crystals and optional 145.71 MHz crystals (see Product Review, April 1996 *QST*). Minimum bid: \$95.

Yaesu FT-1000MP MF/HF DSP transceiver with optional YF-115C 500-Hz Collins mechanical filters in main and sub-receivers (see Product Review, April 1996 *QST*). Minimum bid: \$2006.

Sealed bids must be submitted by mail and must be postmarked on or before June 1, 1996. Bids postmarked after the closing date will not be considered. Bids will be opened seven days after the closing postmark date. In the case of equal high bids, the high bid bearing the earliest postmark will be declared the successful bidder.

In your bid, clearly identify the item you are bidding on, using the manufacturer's name and model number, or other identification number, if specified. Each item requires a separate bid and envelope. Please include a daytime telephone number. The successful bidder will be advised by telephone with a confirmation by mail. No other notifications will be made, and no information will be given to anyone other than successful bidders regarding final price or identity of the successful bidder. Shipping charges will be paid by ARRL. If you include a self-addressed, stamped postcard with your bid and you are not the high bidder on that item, we will return the postcard to you when the unit has been shipped to the successful bidder.

Please address bids to Bob Boucher, Product Review Bids, ARRL, 225 Main St, Newington, CT 06111-1494. **QST**

Yaesu FT-11R, serial number 5E230233

Manufacturer's Specifications

Frequency coverage: Receive, AM, 110-136 MHz; 144-148 MHz; FM, 138-180 MHz; transmit, 144-148 MHz.

Power requirements: 4-12 V dc. Receive, 140 mA (max, 11-V supply); transmit, 1.5 A at high-power setting (5 W).

Size (height, width, depth): 4.9x2.3x1 inches. Weight (with FNB-31 4.8-V battery pack), 9.8 oz.

Receiver

FM sensitivity: 12 dB SINAD, 0.158 μ V, 144-148 MHz.

AM sensitivity: Not specified.

Two-tone, third-order IMD dynamic range: >60 dB (offset not specified).

Adjacent-channel rejection: >64 dB (offset not specified).

IF rejection: Not specified.

Image rejection: Not specified.

Squelch sensitivity: Not specified.

Audio output: 200 mW at 10% THD into 8 Ω , with 11-V battery pack.

Transmitter

Power output (H / L3 / L2 / L1): 1.5 W / 1.5 W / 1.5 W / 300 mW with standard FNB-31 4.8-V battery pack; \approx 5W at 11 V.

Spurious signal and harmonic suppression: >60 dB.

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

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

Measured in ARRL Lab

Receive, as specified (with reduced sensitivity noted at lowest range); transmit, as specified.

Receiver Dynamic Testing

For 12 dB SINAD: 0.15 μ V.

120 MHz, 1.4 μ V for 10 dB (S+N)/N.

20 kHz offset from 146 MHz, 63 dB.

10 MHz offset from 146 MHz, 74 dB.

20 kHz offset from 146 MHz, 69 dB.

98 dB.

61 dB.

0.09 μ V at threshold.

151 mW at 10% THD into 8 Ω with standard FNB-31 4.8-V battery pack; 340 mW at 11 V.

Transmitter Dynamic Testing

2 W / 2 W / 1.8 W / 450 mW with standard FNB-31 4.8-V battery pack; 4.9 W at 11 V.

As specified. Meets FCC requirements for spectral purity.

Squelch off, 250 ms.

95 ms.

