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QST Compares: Mobile 2-Meter FM Transceivers
(Alinco DR-112T; Azden PCS-7000H; ICOM IC-229H; Kenwood TM-241A; Yaesu FT-2400H)

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By James W. ("Rus") Healy, NJ2L

Judging by your collective response to *QST*'s recent venture into comparative reviews of Amateur Radio products, it seems that we just can't print enough of them! So, this month, we visit a very popular class of equipment: high-power 2-meter FM mobile transceivers. We chose offerings from each major manufacturer and rounded up a group of eager ARRL HQ staff reviewers to put each of them through their paces for two weeks. The reviewers included *QST* Features Editor Brian Battles, WS1O; Deputy Field Services Manager Luck Hurder, KY1T; Associate Technical Editor Joel Kleinman, N1BKE; Field Services Manager Rick Palm, K1CE; and—of course—ARRL *Repeater Directory* Editor Jay Mabey, NUØX.

The field includes the Alinco DR-112T, Azden PCS-7000H, ICOM IC-229H, Kenwood TM-241A and Yaesu FT-2400H. Part of the reason why we chose to review this specific class of 2-meter radios is that some of them come in other versions—lower power or covering other bands—that are essentially the same in all areas except RF performance. This review should help you draw appropriate conclusions about those models.

Here's what the reviewers found, in alphabetical order by manufacturer.

ALINCO DR-112T

The second-least expensive of the reviewed radios, the DR-112T represents a general improvement for Alinco. The reviewers praised the radio's simple programming and operation, and also complimented its small size and ruggedness. Not as strong are the '112's receiver audio and display: The speaker rattles at audio levels required in most mobile installations; the display is prone to glare, and its LED elements have only one brightness level. The front-panel keys aren't illuminated, and one evaluator thought them a bit small. Oddly, during scanning the radio displays the last memory channel number selected before scanning is started.

On the other hand, the front-panel layout passes the acid test: The reviewers report that the radio's design lets you quickly shift your eyes from the road to the radio and back while you're driving.

The reviewers received good transmitted-audio reports, but generally weren't happy with the microphone supplied with the DR-112T. Bulky and oddly shaped, with touch-tone pad buttons and up/down buttons that are easily pressed unintentionally, the mike can stand some improvement. The '112's power on/off and high/low button positions can't be determined when the radio is unpowered (ie, when the car isn't running). This means that you can easily commit the cardinal sin of mobile radio operation: accidentally starting your car with the radio turned on.

Alinco has recently improved the instruction manuals for some of its equipment, but the DR-112T is still on the waiting list for this. Like many older Alinco manuals, the DR-112T's documentation is skimpy and lacks detail, especially in describing the radio's scanning functions. Its installation information, though, is quite good.

Table 1 shows not only that the DR-112T includes a good collection of features, but that the other players on this field are somewhat better equipped. Generally, the DR-112T performs solidly for a very reasonable price. You can't get your hands on a dependable 50-watt 2-meter rig for much less money, and once you've gotten used to the '112, as WS1O has found after a year of using one in his car, you may find it to be a pleasant and reliable radio.

AZDEN PCS-7000H

Like the Alinco DR-112T, the PCS-7000H is an inexpensive radio. As a matter of fact, at $309 (direct from the importer, Amateur Wholesale Electronics), it's the least expensive rig in this comparison. (Most of the other radios are sold through retailers at discounted prices. Even considering typical discounts, the Azden is at the low end in terms of price.) Sporting the highest measured RF output of all the radios in this lineup (almost 58 watts), the '7000H also competes solidly with the other radios in terms of features, size and weight.

The reviewers found the PCS-7000H's backlit LCD display generally easy to read, although it isn't a model of legibility in high-ambient-light conditions. The receiver audio also got relatively high marks, satisfying all but one reviewer with its output level and clarity. Transmitted audio received compliments, too. The reviewers liked the '7000's panel design and deemed

Table 1
Mobile 2-Meter FM Transceiver Features

	Alinco DR-112T	*Azden PCS-7000H*	*ICOM IC-229H*	*Kenwood TM-241A*	*Yaesu FT-2400H*
Expanded receiver coverage	Yes	Yes	Yes	Yes	Yes
Aircraft-band AM coverage	No	Yes	No	Yes	No
Memory channels	14	21	20	20	31
Band, memory and programmed-scan modes	Yes	Yes	Yes	Yes	Yes
Selected memory-channel lockout	Yes	No	No	Yes	Yes
Power-output selections	2	2	4	3	3
Automatic repeater-offset selection	No	No	No	Yes	Yes
Display intensity levels	1	1	4	4	*
Supply-voltage range	13.8†	11.7-15.9	11.7-15.9	11.7-15.9	12.4-15.2
Dimensions (H×W×D)	2×5.5×6.8	2×5.5×7.25	1.6×5.5×6.1	1.6×5.5×6.3	2×6.3×7.1
Weight (lb)	2.6	3	2.2	2.7	3.3
Suggested retail price	$339.95	$309	$462	$469.95	$419

*The FT-2400H has automatically adjusted, continuously variable display intensity.
†No range specified.

Alinco DR-112T, Serial Number 0002017

Manufacturer's Claimed Specifications	***Measured in the ARRL Lab***
Frequency coverage: 144-148 MHz.	Transmit, 144-148 MHz; receive, 130-169.99 MHz.
Receiver	*Receiver Dynamic Testing*
Sensitivity: Better than 0.16 μV (−123 dBm) for 12 dB SINAD.	−123 dBm.
Two-tone, third-order IMD dynamic range: Not specified.	20-kHz offset from 146 MHz, 73 dB.
Adjacent-channel rejection: Not specified.	20-kHz offset from 146 MHz, 64 dB.
Squelch sensitivity: Not specified.	At 146 MHz, −115 to −135 dB.
Receiver audio output: "About 2 W" at 10% THD.	2.6 W into 8 Ω at 10% THD.
Transmitter	*Transmitter Dynamic Testing*
Power output: 5 W, 45 W.	6.7 W, 49.8 W.
Spurious signal and harmonic suppression: Better than 60 dB.	As specified. The DR-112T meets FCC spectral-purity requirements for equipment in its power-output class and frequency range.
Transmit-receive turnaround time (PTT release to 90% of full audio output): Not specified.	Squelch on, 170 ms; squelch off, 120 ms.

the radio generally rugged.

Programming the PCS-7000H requires the manual; it's not an intuitive process. Once that's done, though, using this radio is quite easy. Azden's instruction manual is reasonably complete and clearly written, but has some rough spots where the text was apparently translated from the Japanese.

Among the PCS-7000H's biggest attractions is its wide receiver range, including an AM detector and aircraft-band coverage. This radio also has adjustable scan-hold time and a big microphone (some reviewers thought it *too* large) with an illuminated keypad. The reviewers were divided about the rig's ability to transmit DTMF tones without having the PTT switch closed; some liked the convenience and others found it to be an annoyance. The only way to stop transmitting a DTMF tone once you've accidentally pressed a key on the touch-tone pad is to turn off the radio; otherwise, you'll have to wait a few seconds for the tone transmission to stop. WS1O's suggestion of changing the radio's software to allow users to set up the rig to require PTT-switch closure before transmitting DTMF tones seems to make good sense.

The reviewers found useful the PCS-7000H's two banks of 10 memories each; they stored local repeater and simplex frequencies in one bank and used the other bank when traveling.

Our wish list for this radio includes a way to program it without first turning off the power; a slightly smaller microphone; and a front-panel tuning knob. Otherwise, complaints and suggestions were few. KY1T summed it up well when he deemed the PCS-7000H "a joy to operate."

ICOM IC-229H

The latest in ICOM's long line of small, high-power mobile VHF/UHF FM radios, the IC-229H was quite popular among the reviewers. They found it to be a rugged, feature-packed radio with a pleasing LCD frequency display (with four intensity levels) and adequate receiver audio. They weren't too happy with the rig's unlit controls, though. Programming and using the '229H is easy for those accustomed to earlier ICOM mobile rigs; others may find that it takes a few trips through the instruction manual to get comfortable with the radio. The manual is better than those of most others reviewed here, sporting good illustrations and organization and adequately covering programming and operation.

The reviewer team was also fond of the IC-229H's autodialer feature, but found it relatively easy to actuate unintentionally. One of this rig's stronger points is one it shares with the Kenwood TM-241A: You can program the IC-229H to perform a commonly used feature by remote control from the microphone.

Azden PCS-7000H, Serial Number 080206

Manufacturer's Claimed Specifications	*Measured in the ARRL Lab*
Frequency coverage: Transmit, 140-150 MHz; receive, 118-136 MHz (AM), 136-174 MHz (FM).	As specified
Receiver	*Receiver Dynamic Testing*
Sensitivity: FM, better than 0.19 μV (−121 dBm) for 12 dB SINAD; AM, better than 1 μV (−107 dBm) for 10 dB S+N/N.	FM, −121 dBm, AM, −114 dBm.
Two-tone, third-order IMD dynamic range: Not specified.	20-kHz offset from 146 MHz, 66 dB.
Adjacent-channel rejection: Not specified.	20-kHz offset from 146 MHz, 74 dB.
Squelch sensitivity: Better than 0.12 μV.	At 146 MHz, −115 to −131 dB.
Receiver audio output: 2 W at 10% THD into 8 Ω.	2.9 W into 8 Ω at 10% THD.
Transmitter	*Transmitter Dynamic Testing*
Power output: 10 W, 50 W.	9.8 W, 57.8 W.
Spurious signal and harmonic suppression: Better than 60 dB.	As specified. The PCS-7000H meets FCC spectral-purity requirements for equipment in its power-output class and frequency range.
Transmit-receive turnaround time (PTT release to 90% of full output): Not specified.	Squelch on, 300 ms; squelch off, 300 ms.

Ironically, one of the '229H's strengths—its variety and number of features—also precipitates one of its shortcomings: Reviewers complained that the radio has too many buttons and controls on its front panel. Where other manufacturers use multifunction keys (with second functions actuated by an "F" key), ICOM uses small, separate front-panel buttons for each function. If, however, you're looking for a radio loaded with interesting features, such as telephone-number storage in memory, automatic redial, flexible scanning, programmable remote control, and a good selection of functions that can be operated from the microphone (memory reading and writing, for instance), the IC-229H may be hard to resist.

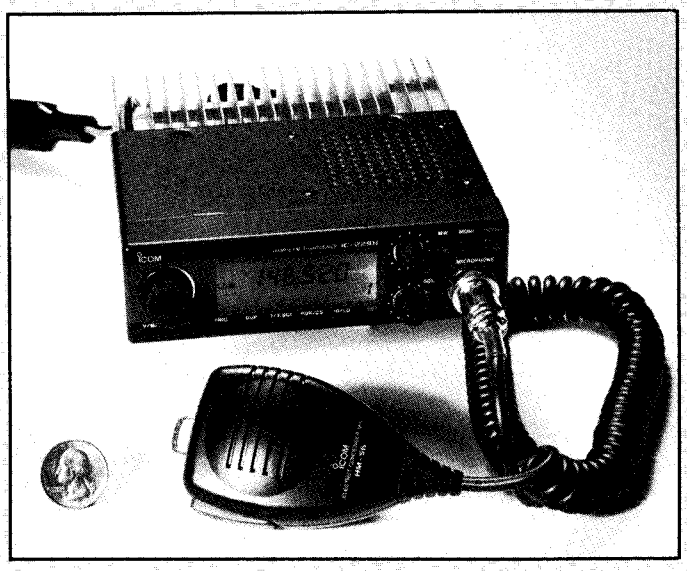
KENWOOD TM-241A

Another feature-rich small radio, the TM-241A drew many reviewer compliments for its good display, ease of use, handsomeness and uncluttered front panel. Its receiver audio, adequate and crisp, satisfied most of the reviewers. Because many of its functions are controlled by relatively few front-panel buttons, you'll need the manual close at hand to program this radio. The manual is exhaustively complete and clearly written.

The TM-241A's clear transmitter audio netted many unsolicited compliments. One of this radio's intriguing qualities is its time-out timer, which disables the transmitter after 30 minutes (!) of continuous transmission. Probably intended to protect the radio and power supply in the event of accidental key-down in unattended operation (such as a packet station), the timer is a good idea. But half an hour seems like a long time to let the transmitter run—a programmable delay would be more useful.

An option unique to the TM-241A is a digital-voice-recording unit that can store up to eight messages. With the optional $121.95 DRU-1 board installed, you can record received or microphone audio, set the radio to record received signals automatically (any signal or only that with the appropriate CTCSS tone), and can play back recorded signals via the radio's speaker or on the air. Another optional board gives the TM-241A paging capability. Like many hand-held transceivers, the '241A also has a selectable automatic power-shutoff circuit that turns the radio off after about three hours of inactivity.

On the weaker side, the TM-241A's speaker faces upward—into the dashboard in most installations. Also, some reviewers complained that the radio's buttons are too mushy and small. Like the Azden PCS-7000H, the TM-241A receives from 118-136 MHz in AM mode, but this coverage isn't specified in the manual. Our mea-



ICOM IC-229H, Serial Number 011448

Manufacturer's Claimed Specifications	*Measured in the ARRL Lab*
Frequency coverage: Receive, 136-174 MHz; transmit, 140-150 MHz.	As specified.
Receiver	*Receiver Dynamic Testing*
Sensitivity: Better than 0.16 μV (−123 dBm) for 12 dB SINAD.	−123 dBm.
Two-tone, third-order IMD dynamic range: Not specified.	20-kHz offset from 146 MHz, 71 dB.
Adjacent-channel rejection: Not specified.	20-kHz offset from 146 MHz, 68 dB.
Squelch sensitivity: Less than 0.13 μV (−117 dBm).	At 146 MHz, −121 to −129 dB.
Receiver audio output: 2.4 W at 10% THD into 8 Ω.	2.9 W into 8 Ω at 10% THD.
Transmitter	*Transmitter Dynamic Testing*
Power output: 5 W, 10 W, 25 W, 50 W.	6.2 W, 10.9 W, 27.3 W, 49.7 W.
Spurious signal and harmonic suppression: Better than 60 dB.	As specified. The IC-229H meets FCC spectral-purity requirements for equipment in its power-output class and frequency range.
Transmit-receive turnaround time (PTT release to 90% of full audio output): Not specified.	Squelch on, 180 ms; squelch off, 140 ms.

surements of receiver sensitivity in this range indicate that the '241A isn't useful for weak-signal aircraft-band reception, but it should be plenty if you use it close to airports. On FM, inside the ham band, the receiver is plenty sensitive.

The only other common complaint the reviewers had about this radio is that because it has so many features, each button *must* perform several functions. For this reason, this radio may be more difficult than the others for newcomers to use.

YAESU FT-2400H

The most recently released rig in this batch, the FT-2400H has a deceptively simple front panel. Yaesu achieved this by covering several of the radio's less-used controls under a flip-down panel at the front panel's lower right.

Among this radio's strong points are its automatic display backlight level, good receiver-audio level and quality, straightforward programming and operation, excellent documentation (as we've recently come to expect from Yaesu), and ten more memory channels than any of the other radios reviewed here. The reviewers heaped praise on the FT-2400H, including compliments on the feel of its controls, microphone-operated scanning functions, easy transmit-offset selection, automatic repeater-offset selection (which the FT-2400H shares with the Kenwood TM-241A), and "namable" memories. That's right—you can attach a four-digit alphanumeric code to each stored repeater or simplex frequency; the names you give them can be displayed during operation. Clever.

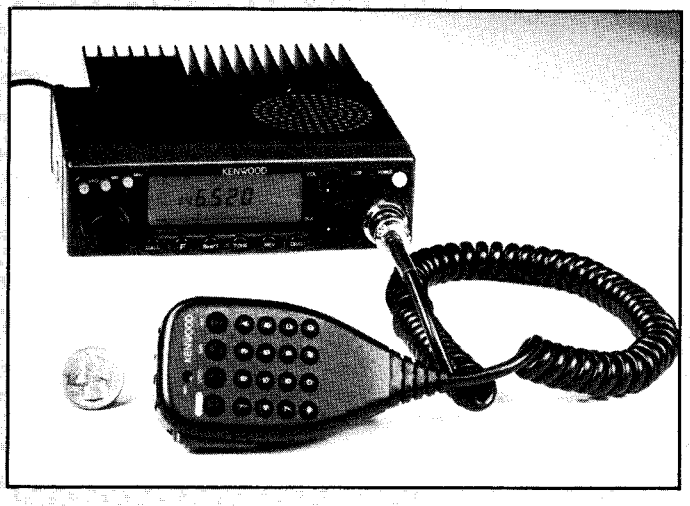
The '2400H is generally rugged, although one reviewer commented that the flip-down control cover is somewhat flimsy. Another didn't like the panel at all, preferring constant access to the controls normally hidden under it. Also, although some of the keys are illuminated, their labels aren't, which makes some night-time operations difficult.

N1BKE summed up his feelings thus: "The FT-2400H seems top-of-the-line to me. If it's in the same price range as the others, it's a great bargain." In fact, this radio lists for $419—right in the middle of the pack, and just slightly above the average price of the five radios reviewed here.

Summary

When you buy any of these radios, you'll get a matching microphone, mobile-mounting bracket, power cord and documentation. Some also include spare fuses and connectors. For these radios, available options are relatively few, except for the Kenwood—several pieces of hardware are available to interface it with other Kenwood VHF/UHF transceivers. The sidebar lists manufacturer contact information and list prices for the accessories.

These radios provide yet another vivid example of modern construction quality and reliability. Almost all of them functioned reliably from the word go; the only exception was the Azden PCS-7000H: we got two radios with different problems—one with an audio oscillation and another



Kenwood TM-241A, Serial Number 20900798

Manufacturer's Claimed Specifications	***Measured in the ARRL Lab***
Frequency coverage: 144-148 MHz.	Transmit, as specified; receive, 118-136 MHz (AM), 136-174 MHz (FM).
Receiver	*Receiver Dynamic Testing*
Sensitivity: Better than 0.16 μV (−123 dBm) for 12 dB SINAD.	FM, −124 dBm; AM, −61 dBm.
Two-tone, third-order IMD dynamic range: Not specified.	20-kHz offset from 146 MHz, 71 dB.
Adjacent-channel rejection: Not specified.	20-kHz offset from 146 MHz, 71 dB.
Squelch sensitivity: Better than 0.1 μV (−107 dBm).	At 146 MHz, −122 to −134 dB.
Receiver audio output: More than 2 W into 8 Ω.	3.1 W into 8 Ω at 10% THD.
Transmitter	*Transmitter Dynamic Testing*
Power output: 5 W, 10 W, 50 W.	8.4 W, 13.1 W, 54.9 W.
Spurious signal and harmonic suppression: Better than 60 dB.	As specified. The TM-241A meets FCC spectral-purity requirements for equipment in its power-output class and frequency range.
Transmit-receive turnaround time (PTT release to 90% of full audio output): Not specified.	Squelch on, 176 ms; squelch off, 160 ms.

with a partial display failure—before we got one that worked right. To their credit, Amateur Wholesale Electronics immediately replaced the faulty radios and offered to reimburse us for return shipping of the broken units. The third radio performed flawlessly for the entire review period.

A repair technician at Amateur Wholesale Electronics told me that the most frequent cause of damage to mobile transceivers is starting the vehicle with the radio's power switch turned on. The supply-voltage spike that occurs when you start a car can have dire consequences. This brings up two points: Make it a habit to turn off *all* the electrical accessories in your car before you turn off the engine, and follow the installation instructions for your radio to the letter to protect your equipment and the radio's warranty.

Suggestions

In the course of evaluating these radios, the reviewers came up with some ideas that all of these radios' manufacturers (and others) could implement to make their rigs more valuable to consumers. One such idea is adding a separate connector (or connectors), preferably of some standard type and pinout, for packet-radio TNC connection. (This is now standard on MF/HF radios.) None of these radios includes such provisions; you have to interface a TNC to the radios' mike jacks and external-speaker connectors, making quick switching between packet and voice operation difficult. Fully supporting this idea could include adding a separate packet mode,

Optional Accessories

Those shown are manufacturers' suggested list prices.

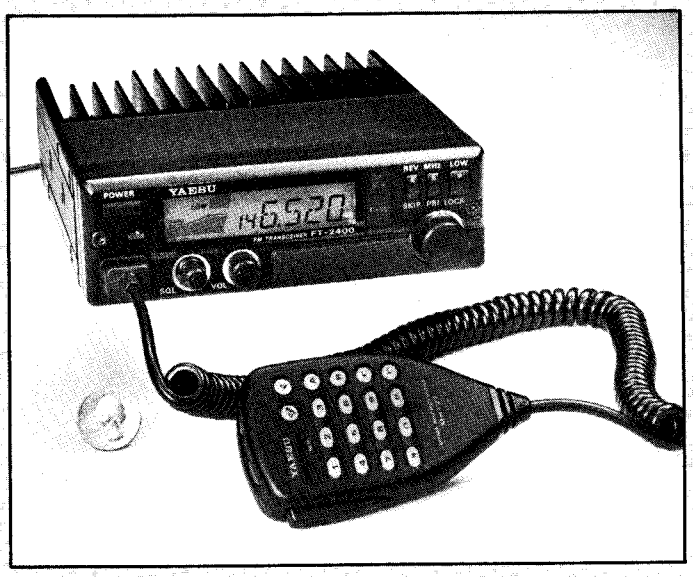
DR-112T: None. Contact Alinco Electronics, Inc, 20705 S Western Ave, Suite 104, Torrance, CA 90501, tel 213-618-8616.

PCS-7000H: None. Contact Amateur Wholesale Electronics, 1040 Industrial Dr, Box 224, Watkinsville, GA 30677, 800-451-2397.

IC-229H: HM-56 autodial TTP microphone, $69; UT-50 tone-squelch unit, $45; UT-55 DTMF encoder/decoder, $32.50. Contact ICOM America, Inc, 2380 116 Ave NE, Bellevue, WA 98004, tel 206-454-7619.

TM-241A: DRU-1 digital recorder, $121.95; IF-20 interface for interconnecting four transceivers, $129.95; PG-4G control cable for full-duplex operation, $21.95; RC-10 remote control/handset, $240.95; RC-20 remote-control head, $129.95; TSU-6 programmable CTCSS decoder, $47.95. Contact Kenwood USA Corp, 2201 E Dominguez St, Long Beach, CA 90801-5745, tel 213-639-4200.

FT-2400H: FRC-6 DTMF pager unit, $34; FTS-17A CTCSS decoder unit, $53; SP-7 external speaker, $34. Contact Yaesu USA, Inc, 17210 Edwards Rd, Cerritos, CA 90701, tel 213-404-2700.



Yaesu FT-2400H, Serial Number 1E020287

Manufacturer's Claimed Specifications	***Measured in the ARRL Lab***
Frequency coverage: Transmit, 144-148 MHz; receive, 140-174 MHz.	As specified.
Receiver	*Receiver Dynamic Testing*
Sensitivity: Better than 0.2 μV (−121 dBm) for 12 dB SINAD.	−122 dBm.
Two-tone, third-order IMD dynamic range: Not specified.	20-kHz offset from 146 MHz, 75 dB.
Adjacent-channel rejection: Not specified.	20-kHz offset from 146 MHz, 74 dB.
Squelch sensitivity: Not specified.	At 146 MHz, −119 to −129 dB.
Receiver audio output: 2 W into 8 Ω at 10% THD.	2.5 W into 8 Ω at 10% THD.
Transmitter	*Transmitter Dynamic Testing*
Power output: 5 W, 25 W, 50 W.	5.8 W, 24.3 W, 47.5 W.
Spurious signal and harmonic suppression: Better than 60 dB.	As specified. The FT-2400H meets FCC spectral-purity requirements for equipment in its power-output class and frequency range.
Transmit-receive turnaround time (PTT release to 90% of full audio output): Not specified.	Squelch on, 100 ms; squelch off, 44 ms.

selected via a front-panel control. So many operators now use mobile VHF/UHF transceivers for packet radio that this subject will become harder for manufacturers to ignore in future generations of such equipment.

Another item that the reviewers mentioned: Separate memory banks make for convenient separation of local and road-trip frequencies. The Azden PCS-7000H works this way, and using it made the evaluators wish for the same thing in the other radios.

A third area in which all of these radios could use some help is receiver audio. More distortion-free audio output would make operating these radios in noisier mobile environments more pleasant. Along these lines, the best of the reviewed rigs is the FT-2400H; the worst is the DR-112T. Keep in mind, though, that an inexpensive external speaker cures most such ills; don't necessarily let our comments about receiver audio push your buying decision one way or the other, because we used these rigs only with their internal speakers.

The Reviewers' Choices

This category is filled with winning radios. The Alinco DR-112T is an inexpensive and rugged radio with a good reliability record. The Azden PCS-7000H has plenty of transmitter output for almost any routine mobile or home-station work, as well as wide receiver coverage and good general polish. These radios both represent good values, considering that their list prices are in the low-$300s range.

ICOM's IC-229H is a model of refinement. Three of the five reviewers deemed it their favorite, in fact. Another feature-loaded radio, the Kenwood TM-241A looks and seems like it's designed specifically to compete with the IC-229H. These two radios are nearly identical in size and shape, both are rugged, stylish radios that sport programmable microphone-mounted function keys, and both were labeled "classy" by the review squad. The TM-241A has more raw features, but both rigs have all of those that are important to most VHF/UHF FM-mobile-radio users. These rigs also represent the top end in price of the rigs reviewed here.

Centrally located in price, Yaesu's FT-2400H is a solid, high-quality performer that will probably pull lots of buyers toward its middle-of-the-pack price; for many hams, it may be the best value in this group.

As always, shop for your radios and accessories by reading everything you can about them, try to operate each one you're considering, and get hold of the instruction manuals for each one before making a decision. QST