

PRODUCT REVIEW

Yaesu FT-450 HF and 6 Meter Transceiver



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The FT-450 is Yaesu's latest entry in the HF/50 MHz transceiver field. It's a sturdy and competent general-purpose radio in the under \$1000 price class. It's generously endowed with an array of features, a few borrowed from its more vaunted brethren. It is *not* a mini FT-2000, however, as some Internet wags have speculated. Let's take a closer look at what it has to offer.

In broad strokes, the FT-450 is a lightweight, compact — but not *too* compact — multimode 100 W transceiver that will do yeoman's duty in a variety of Amateur Radio applications, including portable (but probably *not* mobile) operation and HF or 50 MHz beacon service. It has two VFOs, gobs of memories, general coverage receive and scanning capability and, in the unit we reviewed, a snappy optional automatic antenna tuner. Digital signal processing (DSP) in the 24 kHz second IF handles filtering and interference-rejection tasks and the FT-450 features a 10 kHz roofing filter — that's 5 or 10 kHz narrower than many transceivers. The radio also integrates audio level speech compression and DSP transmit audio tailoring (equalization) for phone operation, a digital voice recorder and a CW keyer with three memories. Like some other Yaesu radios, the FT-450 includes a Morse code trainer. As the *Operation Manual* suggests, "you can improve your CW proficiency whether or not the bands are open."

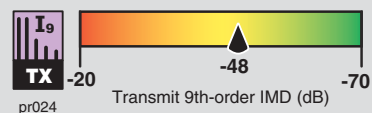
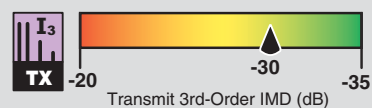
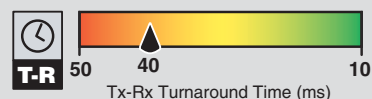
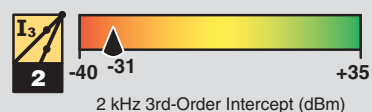
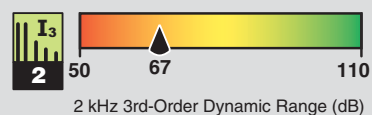
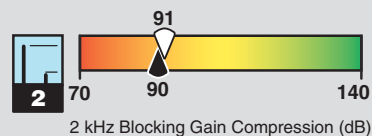
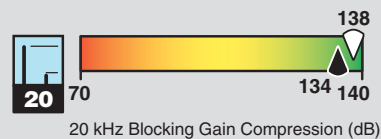
Physical Attributes

The FT-450's monochrome "black-nega" LCD display dominates the front panel. It deserves high marks for being especially easy to read; the ample, albeit segmented, white numerals for the frequency readout and current VFO setting are visible from a distance of several feet. On the downside, the FT-450 has neither a bail nor extendable front feet to raise this excellent display to a comfortable viewing angle.

The smallish main tuning knob is less impressive, especially given the rather commodious front panel. Most purchasers' comments I saw on the Internet expressed a strong desire for a larger knob. The tuning "dimple" is virtually useless, but the knob's nicely rubberized grip makes it possible to twirl it from its outer circumference with thumb or index finger. The FT-450 does not provide a way to enter a frequency directly nor does it have band-stacking capability.

There are four display brightness levels, plus an OFF position to conserve power. I felt the display looked anemic at any setting other than 4, and it's always possible to see the non-illuminated legends in the background. The FT-450 incorporates a neat frequency annunciator, a convenience for the vision impaired or for operating with the display dark. Just press a button, and a female digital voice *verrrrrrry* deliberately ticks off the frequency setting — within one decimal place — one numeral at a time. "She" also indicates the mode setting and, using an alternate menu setting, adds the S-meter reading.

Key Measurements Summary



Key:
Dynamic range and intercept values with pre-amp off.
Intercept values were determined using -97 dBm reference.

Bottom Line

The FT-450 is a sturdy and competent general-purpose HF/50 MHz radio suitable for home station or portable operation. It's well endowed with features and performance for a radio in this price class, but the multifunction controls and menus took some getting used to.

The front panel is largely devoid of knobs — just four, in addition to the main tuning knob. As a result, some knobs serve multiple functions. At least initially, this may steepen your learning curve. Access to most functions is via the radio's two dozen push buttons. That's not counting the multifunction DSP/SEL knob, which also works as a pushbutton for certain settings. More on that later.

At first I found it a little confounding to get this radio up and running without having to refer to the manual. Even after I was more familiar with it, I kept the book close at hand. Your experience may vary, of course.

Legends above front-panel controls are in white capital letters, while blaze orange labels adorn push buttons. All are easy to read, provided sufficient light is flooding the front panel, since the buttons are not backlit. More obscure are the raised, but unpainted, letters identifying the 3.5 mm KEY and PHONES jacks, leaving them virtually indistinguishable from the black background in the upper left-hand corner.

This is a nit in the greater scheme of things, however. More to the point: Several FT-450 owners posting to the Internet expressed the desire for a second key jack on the rear apron, and a few wanted ¼ inch jacks (as erroneously shown in the manual) instead of 3.5 mm for KEY and PHONES. My CW paddles have a ¼ inch plug, so I made up my own adapter for the key jack since I couldn't find one in the junk drawer.

The display includes a "flow chart" of sorts that depicts the receive signal path, starting with the antenna. This chart indicates current ATT/IPO (attenuator and preamp), NB and AGC button settings. It also includes an R.FLT graphic that suggests there might be a choice of roofing filters. As the manual points out, however, the R.FLT indicator "is always turned on." The chart's antenna symbol will blink if the internal automatic antenna tuner cannot find a reasonable match.

Manifold Menus

Working in concert, the DSP/SEL knob and the F (function) button offer access to the FT-450's hidden assets, available via one of the unit's 65 menu choices (you can set the menu to display only the 19 most commonly used items). Pressing and holding the F button opens the menu, the DSP/SEL control lets you make your selection and a final press and hold of the F button clinches the deal. Some may argue that more common functions ought to be accessible outside of the menu system, and it is possible to delegate the C.S. (custom switch) key to access almost *any* menu item — or several front-panel buttons for that matter.

Table 1
Yaesu FT-450, serial number 7F030194

Manufacturer's Specifications

Frequency coverage: Receive, 0.03-56 MHz; transmit, 1.8-2, 3.5-4, 5.3305, 5.3465, 5.3665, 5.3715, 5.4035, 7-7.3, 10.1-10.15, 14-14.35, 18.068-18.168, 21-21.45, 24.89-24.99, 28-29.7, 50-54 MHz.

Power requirement: 13.8 V dc; receive, 1.5 A (signal present); transmit, 22 A (100 W out).

Modes of operation: SSB, CW, AM, FM, FSK, AFSK.

Receiver

SSB/CW sensitivity, 2.4 kHz bandwidth, 10 dB S+N/N: 1.8-30 MHz, 0.25 µV; 50-54 MHz, 0.2 µV.

Noise figure: Not specified.

AM sensitivity, 6 kHz bandwidth, 10 dB S+N/N: 1.8-30 MHz, 2 µV; 50-54 MHz, 1 µV.

FM sensitivity, 15 kHz bandwidth, 12 dB SINAD: 28-30 MHz, 0.5 µV; 50-54 MHz, 0.3 µV.

Blocking gain compression: Not specified.

Reciprocal Mixing (500 Hz BW): Not specified.

Two-Tone IMD Testing**

Band/Preamp	Spacing	Input level
3.5 MHz/Off	20 kHz	-35 dBm -21 dBm
14 MHz/Off	20 kHz	-35 dBm -21 dBm 0 dBm
14 MHz/On	20 kHz	-43 dBm -26 dBm
14 MHz/Off	5 kHz	-57 dBm -32 dBm 0 dBm
14 MHz/Off	2 kHz	-65 dBm -40 dBm 0 dBm
50 MHz/Off	20 kHz	-30 dBm -17 dBm

Measured in the ARRL Lab

Receive, as specified (sensitivity degrades below 1 MHz). Transmit, as specified.

Receive, 1.3 A; transmit, 18 A; tested at 13.8 V dc.

As specified.

Receiver Dynamic Testing

Noise Floor (MDS), 500 Hz bandwidth:

Preamp	Off	On
1.0 MHz	-107	-114 dBm
3.5 MHz	-133	-138 dBm
14 MHz	-132	-136 dBm
50 MHz	-126	-136 dBm

14 MHz, preamp off/on: 14/10 dB.

10 dB (S+N)/N, 1 kHz, 30% modulation:

Preamp	Off	On
1.0 MHz	12	4.5 µV
3.9 MHz	1.1	0.49 µV
50 MHz	2.2	0.52 µV

For 12 dB SINAD:

Preamp	Off	On
29 MHz	1.1	0.3 µV
52 MHz	1.0	0.26 µV

Gain compression, 500 Hz bandwidth:

	20 kHz offset Preamp off/on	5/2 kHz offset Preamp off
3.5 MHz	138/134 dB	92/91 dB
14 MHz	134/128 dB	91/90 dB
50 MHz	119/119 dB	80/* dB

20/5/2 kHz offset: -95/-89/-21 dBc.

Measured IMD level	Measured IMD DR	Calculated IP3
-133 dBm	98 dB	+14 dBm
-97 dBm		+17 dBm
-132 dBm	97 dB	+13 dBm
-97 dBm		+17 dBm
-36 dBm		+18 dBm
-136 dBm	93 dB	+3 dBm
-97 dBm		+9 dBm
-132 dBm	75 dB	-19 dBm
-97 dBm		+0 dBm
-34 dBm		+17 dBm
-132 dBm	67 dB	-31 dBm
-97 dBm		-11 dBm
-25 dBm		+12 dBm
-126 dBm	96 dB	+18 dBm
-97 dBm		+23 dBm

In addition, you can assign any one of a handful of other commonly used menu functions — mic gain or keyer speed, for example — to the DSP/SEL key.

Another convenient feature: It's possible via the menu to set up the radio to access only those bands and/or modes you typically operate. Yaesu calls these "My Bands" and "My Modes." For example, if you're contesting, you can deselect the non-contest

bands, 10, 17 and 12 meters. If you typically only operate SSB and CW and never plan to use FM, AM or data modes, you can set up your FT-450 to only select USB, LSB and CW when you punch the MODE buttons. The radio's two MODE buttons mean never having to step through every available mode, as some other radios make you do, to reach the one you want. This is especially handy if you commonly switch among just two or

Second-order intercept: Not specified.
 FM adjacent channel rejection: Not specified.
 FM two-tone, third-order IMD dynamic range: Not specified.

S-meter sensitivity: Not specified.

Squelch sensitivity: SSB, HF, 2.5 μ V; VHF, 1.0 μ V; FM, HF, 0.32 μ V; VHF, 0.16 μ V.

Audio output power: 1.5 W into 8 Ω at 10% THD.

IF/audio response: Not specified.

Spurious and image rejection: HF, 70 dB; 50 MHz, 60 dB.

Transmitter

Power output: HF & 50 MHz: SSB, CW, FM, 100 W (high); AM, 25 W (carrier).

Spurious and harmonic suppression: HF, >60 dB; VHF, 70 dB.

SSB carrier suppression: >60 dB.

Undesired sideband suppression: >60 dB.

Third-order intermodulation distortion (IMD) products: -31 dB PEP at 100 W.

CW keyer speed range: 4 to 60 WPM.

CW keying characteristics: Not specified.

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

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

Composite transmitted noise: Not specified.

Size (height, width, depth): 3.3 \times 9 \times 8.5 inches; weight, 7.9 pounds (not including power supply or accessories).

Price: FT-450, \$900; FT-450 with automatic antenna tuner, \$1000.

*On 6 meters, at 2 kHz offset, the receiver gain compressed by 1 dB at a level 36 dB above the noise floor; however, it did not compress further until a level of about 76 dB above the noise floor.

**ARRL Product Review testing now includes Two-Tone IMD results at several signal levels. Two-Tone, 3rd-Order Dynamic Range figures comparable to previous reviews are shown on the first line in each group. The "IP3" column is the calculated Third-Order Intercept Point. Second-order intercept points were determined using -97 dBm reference.

†Measurement was noise-limited at the value indicated.

‡Varies with pitch control setting.

Preamp off/on: +63/+31 dBm.**

20 kHz offset, preamp on: 29 MHz, 83 dB; 52 MHz, 81 dB.

20 kHz offset, preamp on: 29 MHz, 83 dB; 52 MHz, 81 dB;† 10 MHz offset: 52 MHz, 99 dB.

S9 signal at 14.2 MHz: preamp off, 88 μ V; preamp on, 30 μ V; 50 MHz, preamp off, 467 μ V; preamp on, 33 μ V.

At threshold, preamp on: SSB, 14 MHz, 1.5 μ V; FM, 29 MHz, 0.14 μ V; 52 MHz, 0.26 μ V.

1.9 W at 10% THD into 8 Ω .

Range at -6 dB points, (bandwidth): CW (500 Hz): 369-1035 Hz (666 Hz),‡ Equivalent Rectangular BW: 561 Hz; USB: 367-2190 Hz (1823 Hz); LSB: 400-2330 Hz (1930 Hz); AM: 266-1976 Hz (1710 Hz).

First IF rejection, 14 MHz, 100 dB; 50 MHz, 56 dB; image rejection, 14 MHz, 83 dB; 50 MHz, 93 dB.

Transmitter Dynamic Testing

HF: CW, SSB, FM, typically 106 W high, 4 W low; AM, typ. 25 W high, 3 W low; 50 MHz: CW, SSB, FM, typ 101 W high, 4 W low; AM, typ. 24 W high, 2 W low.

HF, 62 dB; VHF, 60 dB. Meets FCC requirements.

HF, 62 dB; VHF, 61 dB.

HF, 68 dB; VHF, 63 dB.

3rd/5th/7th/9th order (worst case band): HF, -30/-37/-42/-48 dB PEP; VHF, -29/-41/-59/-70 dB PEP.

8 to 70 WPM.

See Figures 1 and 2.

S9 signal, 40 ms.

Unit is not suitable for use on AMTOR.

SSB, 20 ms; FM, 16 ms.

See Figure 3.

three modes and don't care to deselect any available modes.

In addition to being the key that unlocks the menu, the F button activates the secondary functions of the six "command buttons" (as Yaesu calls them) grouped on the upper right-hand side of the front panel. For example, to turn on VOX — a secondary function on the VOX/STO button — you first press the F key, then VOX/STO. Writing to one of the

radio's 500 memories entails pressing the F key, using the DSP/SEL knob to pick the desired memory then pressing and holding the MW/VM button. The FT-450's memories store operating frequency and mode; bandwidth, attenuator, preamp, contour, DNR (digital noise reduction), and notch settings; repeater shift and CTCSS tone.

The DSP/SEL knob is as central to the radio's operation as the main tuning knob

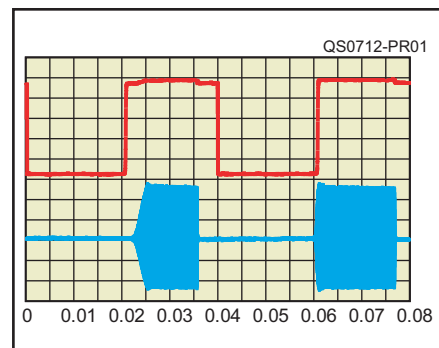


Figure 1 — CW keying waveform for the Yaesu FT-450 showing the first two dits in full break-in (QSK) mode using external keying. Equivalent keying speed is 60 WPM. The upper trace is the actual key closure; the lower trace is the RF envelope. (Note that the first key closure starts at the left edge of the figure.) Horizontal divisions are 10 ms. The transceiver was being operated at 100 W output at 14.2 MHz. The first dit is noticeably shortened.

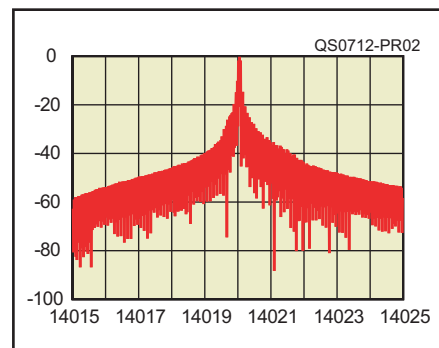


Figure 2 — Worst-case spectral display of the Yaesu FT-450 transmitter during keying sideband testing. Equivalent keying speed is 60 WPM using external keying. Spectrum analyzer resolution bandwidth is 10 Hz, and the sweep time is 30 seconds. The transmitter was being operated at 100 W PEP output at 14.2 MHz.

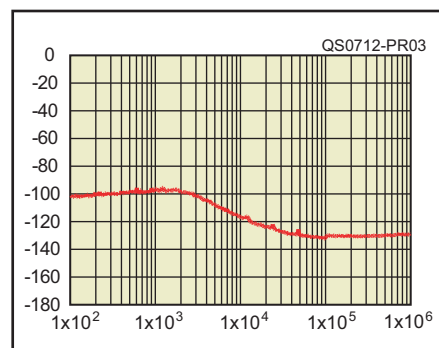


Figure 3 — Worst-case spectral display of the Yaesu FT-450 transmitter output during composite-noise testing. For the black trace, power output is 100 W at 14.2 MHz. The carrier, off the left edge of the plot, is not shown. This plot shows composite transmitted noise 100 Hz to 1 MHz from the carrier.

and controls a wider range of functions than its big brother. Aside from its menu role, the DSP/SEL knob selects the desired DSP function — you can only adjust one at a time — and it provides a means to dial up memory channels and to make fast frequency excursions — at a menu selectable rate.

The DSP Package

The digital signal processing package is the nerve center of the FT-450's interference abatement capabilities. The front-panel's DSP button steps through CONTOUR, NOTCH, DNR and WIDTH settings, and these are reflected via a graphic display visible below the S-meter. Contour, a DSP filter enhancement found on the FT-2000 series and other higher-end Yaesu transceivers, is arguably the FT-450's most effective feature. It operates a bit like the Q multipliers of yesteryear by either nulling or peaking (at a choice of low or high gain level) signals within the receiver's passband. Judicious use of the CONTOUR control can yield dramatic results, with formerly difficult signals to copy — phone or CW — suddenly standing Q5 out of the noise.

The FT-450 does not have an automatic notch filter, but the manual notch is very effective. It incorporates a coarse and fine adjustment, so using the notch can entail a bit of dial cranking to move the NOTCH graphic across its display. There are 11 possible coarse settings, which indicate the notch's approximate position within the passband. Then you can fine tune for the desired notch within each coarse range. With the FT-450's contour and notch capabilities, it's possible to do some rather creative filter shaping!

DNR works very well. There are 11 possible algorithm settings, and it takes some tinkering to get the right one for a given situation. Employing a more aggressive setting can render SSB signals bassy and a bit distorted. Using DNR, I was able to minimize atmospheric noise from an incoming weather front while listening on SSB.

The WIDTH function sets the IF bandwidth, and it's mode dependent. The DSP filters seem to work well and do not impart a disagreeable level of digital distortion or ringing.

Unlike transceivers that permit continuous adjustment of the DSP bandwidth, the FT-450 offers just three fixed settings per mode. In SSB these are 1.8, 2.4 and 3.0 kHz. On CW, the choices are 500 Hz, 1.8 kHz and 2.4 kHz. For AM, you can select 3.0, 6.0 or 9.0 kHz, and on FM, 2.5 and 5.0 kHz. The simple front-panel width graphic makes it hard to tell just which setting is in play.

On CW, the narrow 500 Hz setting, which the ARRL Laboratory determined to

be closer to 600 Hz, will prove too wide for some circumstances, and 1.8 and 2.4 kHz are too wide for most situations. Better options for CW might have been something on the order of 250, 500 and 800 Hz.

The three SSB choices are appropriate and work well on phone. The data modes use the SSB filters as well, so you're stuck with a rather broad "narrow" filter of 1.8 kHz when operating PSK31 or RTTY. That's true for FSK or AFSK RTTY, unlike some radios that allow use of the CW bandwidth filters for FSK.

A separate IF SHIFT control lets you shift the center of the receive passband to avoid QRM. As noted, the DSP functions act upon the 24 kHz second IF, and the NOTCH, WIDTH and SHIFT functions clearly operate within the AGC loop (it's possible to view their effect via the S meter).

Getting on the Air with the FT-450

The first time I powered up the FT-450, a random staccato frying or popping noise began issuing from the top firing loudspeaker. The radio was connected to a dummy load at the time, so this wasn't a matter of mere "background" noise. The apparent culprit is some sort of DSP artifact, and judging from complaints posted by other FT-450 owners, they *all* do this (Yaesu *has* corrected a reported problem with hum on transmitted audio in early production units). The DSP hash seems worst when the attenuator and the preamp are off (IPO enabled) and the bandwidth is at its narrowest setting. Once you connect an antenna, the background noise overwhelms the DSP noise. The DSP noise didn't affect normal operation. For example, the FT-450 made it possible for me to work 3B7C on 40 meter CW, since my own transceiver was on the fritz.

For SSB, the FT-450 offers a generous selection of 10 different transmit audio equalization curves, including a "flat" response. A little experimenting on the air or via the radio's monitor will yield the optimum choice. Each menu selection includes a helpful graphic display of the approximate audio response curve.

As with many other functions, you turn the monitor on or off by assigning it to the C.S. button, but the front panel does not indicate when it's active. As the manual warns, unwelcome feedback can result if the monitor is on while listening on a speaker. The radio's AF GAIN control sets the monitor level. Of course, if you've already assigned *another* function to the C.S. button, you can't quickly enable or disable the monitor either. It is possible to assign the monitor (and other transceiver functions) to the buttons of an optional Yaesu microphone, however.

Although it's not readily obvious —

you'll have to read the manual — there is an audio compressor. It's enabled via the MIC GAIN menu, which offers three settings: LOW, NOR and HIGH. Audio compression is disabled at the LOW setting but enabled at the NOR (factory default) and HIGH positions. As with other settings on the FT-450, parameter flexibility is limited to the choices the menu offers. The manual does not indicate compression level in decibels, but it's easy to observe the diminished dynamic range via the power output meter with the compressor online.

There are *two* digital audio recorders. One will record and play back (but not transmit) up to 20 seconds of received audio. The other is a digital voice recorder (DVR) that can store up to 10 seconds of user-provided audio — a CQ or quick contest-type report, for example. Including these features is a nice touch for a radio in this price class, but I found the voice memories rather clumsy to use. They rely on assigning first the recording operation, then the playback operation to the radio's much-overworked C.S. button, which can handle just one function at a time. Any other function you may have assigned the C.S. button will be lost for the duration.

As a longtime CW operator, I was pleased to see Yaesu had included full-break-in keying (QSK), but its implementation in the FT-450 was not quite the way I would have liked it. Not only is the internal keying relay annoyingly noisy, the QSK itself is poor due to the radio's slow turnaround time. While it works okay at, say, 10 or 15 WPM, you'd be hard pressed to hear another station break your transmission at speeds of 25 to 35 WPM. ARRL Laboratory testing showed that the FT-450's CW keying is very hard (see Figure 1), and in QSK, the first element is shortened slightly.

The internal keyer works well, although ARRL Laboratory testing determined that the front panel CW speed readout is inaccurate, mainly at the lower and upper limits of its range, which turned out to be from 8 WPM to an amazing 70 WPM! The readout is in the ballpark at more conventional sending speeds, however.

"Beacon mode" includes the capability to program three canned Morse messages; this is what passes for a CW memory keyer in the FT-450. You select the text characters one at a time via the menu, not by sending them. This feature may be sufficient to call CQ or handle a canned message but, like the DVR, getting to these memories is inconvenient and again involves — you guessed it — programming the C.S. key.

There's no separate knob for receive incremental tuning (RIT), which Yaesu calls a "clarifier." The clarifier uses the main tuning knob. There is no provision for transmit

incremental tuning. Pressing the CLAR button for one second clears the setting.

Split is very simple to use, and you can quickly and easily swap VFOs to listen on your transmitting frequency (or program the C.S. key to go there on a press-and-release basis). There's also a "Quick Split" mode you can set up for an instant split in the range of ± 20 kHz. Then, press and hold the STEP/SPLIT key, and you're in business.

You'll have to dig into the *Operation Manual* a bit to find out how to get on 60 meters with the FT-450. As explained in the book's "Memory Operation" section, Yaesu has programmed the 60 meter channels (plus USB operating mode) into a discrete set of memory channels. Similar to the implementation in the FT-857 and FT-897, the FT-450 displays the "channel center" frequency rather than the tuning frequency most transceivers show — in other words, 5332.0 kHz as opposed to 5330.5 kHz for the first channel. While this may confuse some users, FT-450 owners can rest assured that the radio will transmit and receive on the *correct* channel frequencies on USB.

For FM operation on 10 or 6 meters, the FT-450 is equipped both for simplex and repeater work. It can run full power on FM. Features for this mode include CTCSS tone squelch and tone scanning.

AM operation is at the usual 25 W carrier level. This corresponds to 100 W, the maximum power a radio limited to 100 W PEP can run without distortion.

The FT-450 can operate AFSK or FSK for RTTY. Packet, PSK31 and other sound card modes also are possible using AFSK. A rear-apron DATA jack provides access to the necessary connections for both AFSK and FSK, but it's not possible to adjust the input level to the DATA jack via the radio for data modes. Yaesu recommends reducing the radio's power output during extended RTTY operation.

All told, it can involve a bit of button pushing and control twisting to enable various functions. Getting comfortable with all of this can be unsettling at first. Even so, becoming familiar with the FT-450 is no more daunting than learning how to operate some other transceivers in this price class; the ICOM IC-706 series with its multiple menus comes quickly to mind. After just a few days with the FT-450, I was able to enable split mode and some other functions literally in the dark (but with the display illuminated) and *without* my reading glasses!

The Numbers Game

While not a competition-grade transceiver, the FT-450 acquitted itself pretty well during ARRL Laboratory testing in the parameters that count most (see Table

1). In terms of the Key Measurements Summary chart we include with each transceiver Product Review, the FT-450 pretty much equaled the FT-2000D reviewed in October 2007 in terms of 20 kHz blocking gain compression, and it slightly bested the more expensive transceiver at 2 kHz bandwidth. Same for third order dynamic range testing: The radios tested equally well at both 20 kHz and 2 kHz spacings at 14 MHz.

While Yaesu boasts a 3 kHz maximum bandwidth for SSB reception and up to 9 kHz for AM, the IF/audio response, as measured in the ARRL Laboratory (see Table 1) indicated a much narrower pass-band at the default (middle) filter settings. In particular, the AM bandwidth of 1710 Hz is pretty tight, especially given the default 6 kHz filter setting. On SSB, the widest (3 kHz) setting increases the high-end cutoff by about 100 Hz and lowers the bottom end by about 150 kHz. There's plenty of audio, however, and the filter skirts are fairly broad, so what comes out of the speaker (or into headphones) by and large is acceptable "communication grade" audio.

On the transmit side, the ARRL Laboratory swept the transmitter response at the default 2.4 kHz bandwidth setting for USB. The -6 dB response extended from 309 to 2317 Hz for a bandwidth of 2008 Hz. The -60 dB response was 116 to 3015 Hz, or 2900 Hz bandwidth. At least a couple of stations suggested the FT-450's audio on transmit tended to be on the treble side.

Puffs and Pans

- The CW training feature was a lot of fun to use. The radio offers three sending modes, and speed is determined by the keyer's speed setting. You can set up the trainer to send only numeric characters, only alphabet characters or a combination of both. It sends five-character code groups, and it displays what it sent afterward.

- Some users considered the radio's "step mode" ATT/IPO feature inconvenient and possibly confusing, mainly because IPO ON really means the radio's preamplifier is *off*. It takes a little getting used to, and popping through the four setting combinations possible on HF will yield one that fits the bill.

- The radio includes a "Quick Memory Bank" (QMB) feature that can store just one set of operating parameters. This is handy during contests, where you might want to bookmark the location of a new multiplier until the pileup dies down. Several more QMB registers would be useful.

- The noise blanker (NB) is quite effective. It readily vanquished the heavy ignition noise from my boat's V-8 engine on 20 meters, although it was somewhat less successful doing this on 30 or 40 meters.

- Yaesu did not include a carrying handle with the FT-450, but you can purchase one for less than \$20. Unfortunately, you cannot buy a support bail or front-leg extenders at *any* price.

- The FT-450 thoughtfully incorporates a TCXO (temperature-compensated crystal oscillator) to maximize frequency stability. This is an option in many other radios.

- Rear apron jacks to interface the FT-450 with accessories, such as a PC for data mode operation, an external antenna tuner or a linear amplifier, are mini-DIN connectors. You'll have to supply your own plugs, and, by all accounts, the 10-pin mini-DIN plug to access the linear amplifier jack on the rear apron can be hard to come by.

- The FT-450 has a single SO-239 antenna jack on the rear apron. Some users wished for two (one for HF, one for 6 meters).

- The continuously running cooling fan is *extremely* quiet, and the radio never got more than mildly warm during hours of use.

- Rear apron jacks to interface the FT-450 with accessories, such as a PC for data mode operation, an external antenna tuner or a linear amplifier, are mini-DIN connectors. The 10-pin mini-DIN plug to access the linear amplifier jack on the rear apron can be hard to come by, so in response to customer requests, Yaesu now offers the correct plug with pigtail leads. Part number is T9207451.

- The *Operation Manual* is fairly well executed, but it contains some fractured English as well as some outright errors. Ours came with one erratum on a small, loose sheet.

- The internal antenna tuner does its job very quickly! It can be set to tune only on transmit or on transmit and receive, and it works on 6 meters.

- The *Operation Manual* indicates you can control the FT-450 via an RS-232 serial connection to a computer, but you'll need to download the *FT-450 CAT Operation Reference Book* from www.yaesu.com for details. The Web site also has instructions and files for updating the radio's firmware via the serial connection. More to the point: Few newer computers even offer RS-232 serial connections, so you may need a USB to serial adapter.

Finale

The FT-450 will find a home as a suitable first transceiver for the new ham on a budget. It also will make a satisfactory backup or emergency service radio, perhaps as part of a standard "Go Kit." It may even find a place on the road or even on the high seas, although it's a bit large for the typical mobile installation. It would be ideal for the RV owner, however.

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