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ICOM IC-706 MF/HF/VHF Transceiver

Edited by **Rick Lindquist, KX4V** • Assistant Technical Editor

ICOM IC-706 MF/HF/VHF Transceiver

Reviewed by Rus Healy, NJ2L
ARRL Technical Advisor

The ICOM IC-706—the first radio to pack 160 through 2 meters, all modes, plus general-coverage receive in a very compact box—is creating *lots* of excitement. It excites mobile HF operators because of its size and detachable front panel. It excites Field Day operators, DXpeditioners, and many others looking for a second rig because it's small and light (though perhaps a tad heavy and a bit too power hungry for serious backpacking). It excites a lot of people because it's got 6 and 2 meters and is relatively inexpensive, considering its features. It excites ICOM because the IC-706 is the only radio of its kind on the market. And it excites nearly everyone else because it's new. (Let's face it—new products excite almost every ham, regardless of whether we think they're something we really want to buy.)

Does this little radio warrant all this excitement? I'll give you an answer, but not until we've looked at what the IC-706 really *is* and *isn't*.

Briefly described, the IC-706 is a small, lightweight transceiver primarily intended for mobile operation that likely will also find itself as a well-used second banana in many home stations. Although other manufacturers claim to have the smallest HF rigs, the IC-706 actually takes up the least space of the pack and includesVHF! This tiny radio puts out 100 W from 160 through 6 meters and 10 W on 2 meters. In addition, it receives from 300 kHz to 200 MHz and transmits and receives within the ham bands on all the usual modes (AM, CW, NBFM, SSB, RTTY). ICOM points out the radio offers true FSK for data modes. It also receives wideband FM, and it has scanning capabilities. Plus, it has a built-in keyer, 101 memories, a very clever system of menus, function keys that give access to the menu choices, and several multifunction buttons. The only front-panel knobs are the main tuning knob and two pairs of concentric controls. The **RF/SQL** control serves as either the RF gain or squelch control, depending on mode and initial menu setting. The use of function keys and multifunction buttons reduces front-panel clutter.

The IC-706 has features typically found only in higher-end, full-size radios—such as the ability to listen to CW on upper or lower sideband, full QSK, VOX with independent delay settings for each mode, adjustable CW offset with tracking sidetone pitch (*yes!*), a set of first-in/first-out scratch-pad memories, a speech compressor with adjustable gain, software settings to tailor the SSB transmit-audio response for your voice and microphone, and other creature comforts. The '706 supports computer interfacing, as all ICOM MF/HF radios have for a long time; you need the optional CT-17 CI-V Level Converter to hook it to your PC. It also provides a band-data output to operate external accessories such as ICOM linear amplifiers and the EX-627 remote antenna switch. To top it off, it's built rock-solid.

The diminutive package makes this radio's capabilities even more impressive. The chassis is a die-cast heat sink onto which the radio's circuit boards mount. This makes cooling practical with a small, centrally located cooling fan. It also makes the radio inherently rugged.

The IC-706 comes with a full set of accessory connector plugs, an extra mike connector, a relatively long power cord for its 12-V dc input, and a hand-held microphone. The microphone uses an 8-pin RJ-45 connector that can be plugged in on the bottom edge of the detachable front panel (below the tuning knob), or to a jack on the rear panel of the transceiver body. This connector type is unusual for this product class. ICOM offers an adapter cable (OPC-589) to allow using other ICOM microphones with the IC-706, but they don't include it with the radio, which would have been nice. You also need to be careful with the connector. When plugged into the front panel, the connector protrudes about $^3/_8$ inch below the panel, so it's at relatively high risk for damage.

BOTTOM LINE

One of the most exciting new products to come along in years, the IC-706 not only packs 160 through 2 meters in a little box but manages to squeeze in plenty of features, including a speech processor and keyer.

The Menu System

Many of the IC-706 buttons have a common theme: Push the button briefly and get one action, press and hold it for two seconds and get another. For example, when pressed briefly, the **P.AMP/ATT** button kicks in the front-end receiver preamplifier and lights a green LED inside the button. Press and hold the same button and the 20-dB attenuator switches in and the button LED turns red. Once either of these functions is selected, a quick poke will turn off whichever function is selected, along with its LED. In similar fashion, the **TUNER/CALL**, **TS**, **DISP**, **RIT**, **MODE** and **LOCK** buttons have two or more functions.

As has become common with MF/HF radios, several functions (24 in the '706) are settable at power-up by pressing a button while turning on the radio. ICOM calls this the Initial Set mode. These functions determine whether a key-press-confirmation beeper is turned on; enable or disable the automatic-power-off function and select the time delay; select the peak-hold function for the LCD meter; change the backlight intensity; set the language (English or Japanese) and speed used by the optional speech synthesizer; configure various scanning fea-

Table 1

ICOM IC-706, serial no. 02104

Manufacturer's Claimed Specifications	***Measured in the ARRL Lab***
Frequency coverage: Receive, 300 kHz to 200 MHz; transmit, 1.8-2; 3.5-4; 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; 144-148 MHz.	Receive and transmit, as specified (see text).
Modes of operation: SSB, CW, AM, NBFM, WBFM (receive only), RTTY.	As specified.
Power requirement: Receive, 1.5 A (squelched); transmit, 20 A (max).	Receive, as specified; transmit, 17 A (max), tested at 13.8 V.
Receiver	*Receiver Dynamic Testing*
SSB/CW sensitivity, bandwidth not specified, preamp on, 10 dB (S+N)/N: 1.8-30 MHz, 50-54 MHz, 144-148 MHz, <0.16 μV.	Minimum discernible signal (noise floor), 500 Hz filter: *Preamp off* / *Preamp on* 3.5 MHz –128 dBm / –140 dBm 14 MHz –123 dBm / –139 dBm 50 MHz –126 dBm / –139 dBm 144 MHz –137 dBm / –143 dBm
AM sensitivity, 10 dB S/N, bandwidth not specified, preamp on: 0.5-1.8MHz, <13 μV; 1.8-30 MHz, <2 μV; 50-54 MHz, <2 μV; 144-148 MHz, <2 μV.	10 dB (S+N)/N, 1-kHz tone, 30% modulation, narrow filter disabled. *Preamp off* / *Preamp on* 1.0 MHz 45 μV (–74 dBm) / 14 μV (–84 dBm) 3.8 MHz 2.4 μV (–99 dBm) / 0.6 μV (–112 dBm) 50 MHz 3.0 μV (–94 dBm) / 0.6 μV (–112 dBm) 120 MHz 1.8 μV (–102 dBm) / 0.8 μV (–109 dBm) 144 MHz 0.8 μV (–109 dBm) / 0.5 μV (–113 dBm)
NBFM sensitivity, 12 dB SINAD: 28-29.7 MHz, <0.5 μV; 50-54 MHz, <0.3 μV; 144-148 MHz, <0.3 μV.	For 12 dB SINAD: *Preamp off* / *Preamp on* 29 MHz 2.9 μV (–98 dBm) / 0.4 μV (–115 dBm) 50 MHz 2.3 μV (–100 dBm) / 0.3 μV (–117 dBm) 144 MHz 0.6 μV (–112 dBm) / 0.2 μV (–121 dBm)
WBFM sensitivity, 12 dB SINAD: 76-108 MHz, <10 μV.	*Preamp off* / *Preamp on* 100 MHz 2.0 μV (–101 dBm) / 1.0 μV (–107 dBm)
Blocking dynamic range: Not specified.	Blocking dynamic range, 500 Hz filter: *Preamp off* / *Preamp on* 3.5 MHz 104 dB* / 106 dB* 14 MHz 102 dB* / 104 dB* 50 MHz 102 dB* / 103 dB* 144 MHz 93 dB* / 99 dB
Two-tone, third-order IMD dynamic range: Not specified.	Two-tone, third-order IMD dynamic range, 500 Hz filter: *Preamp off* / *Preamp on* 3.5 MHz 90 dB* / 88 dB* 14 MHz 88 dB* / 87 dB* 50 MHz 86 dB* / 86 dB* 144 MHz 83 dB* / 84 dB*
Third-order input intercept: Not specified.	*Preamp off* / *Preamp on* 3.5 MHz +7.1 dBm / –7.9 dBm 14 MHz +9.2 dBm / –8.6 dBm 50 MHz +3.0 dBm / –9.9 dBm 144 MHz –12.5 dBm / –17.0 dBm
Second-order intercept point: Not specified.	Preamp off, +81 dBm; preamp on, +44 dBm.

tures; select duplex offsets and whether VFOs can be tuned while the radio is in split mode; select optional filters; set up computer-control parameters; and a few other things that are rarely changed.

Items likely to be modified more often are available by pressing and holding the **DISP** button. These include keyer speed; paddle wiring (you can even use the up/down buttons on the mike as a paddle, if you choose); RF power output (L, 1-9 and H); mike gain; CW offset/sidetone pitch (300 to 900 Hz in 100-Hz steps); VOX delay; CW semi-break-in delay; RTTY tone, shift (170, 200 or 425 Hz) and keying polarity; CTCSS tone; and keyer dot-to-dash ratio.

Another set of menus, most of which have three selections each, includes frequently used items. One of these menus is always displayed below the radio's frequency readout. The menu selections are mode-sensitive; the radio doesn't display choices related to the CW break-in mode during voice operation. Similarly, it hides the speech compressor and VOX enable/disable functions during CW and data modes. The various menus are selected by the **DISP** button and the **MENU** button, and you make individual menu choices using the **F-1**, **F-2** and **F-3** keys. For example, one menu contains the choices **SPL** (split), **A/B** (VFO toggle) and **A=B** (VFO equalize). Further, when you're in split mode, the **SPL** function key becomes an **XFC** key, which lets you view and/or tune the transmit VFO frequency. I found the text labels given to each menu choice intuitive; after a bit of time with the radio, most review team members were making menu selections easily and quickly. Although the menu system did confound a few users, I feel it is so clever and effective that it really sets this radio apart from its competition.

One of the radio's menu choices is the meter function during transmit. You can select forward power, SWR or ALC. Just press the button and watch your selection take effect on the display. Many other menu choices work this way as well, and the instant feedback makes the radio fairly easy to learn. A novel feature in the IC-706 is a band scope, which gives you a small graphical LCD-dot display of the band activity over a segment centered around your frequency. You choose whether each dot represents 0.5, 1, 2, 5, 10 or 20 kHz. When you stop the scanning and tune the receiver, the dot corresponding to your present location in the last sweep shows you where you are with respect to the signals on the display. For the most part, however, this feature is a novelty, partly because the receiver audio is muted during band-scope sweeping. But the band scope can help you find the loud station that's splattering all over the band or to see quickly whether a band is open.

The IC-706 may be a relatively difficult radio for beginners to learn because of its many multifunction buttons and initially intimidating menu system. Some knowledge of personal computers will really ease the learning curve, as will, of course, experience with other modern radios. I skimmed the manual once before starting out and seldom referred

Manufacturer's Claimed Specifications	*Measured in the ARRL Lab*
FM adjacent channel rejection: Not specified.	29 MHz: 70 dB; 52 MHz, 68 dB; 146 MHz, 60 dB, at 20 kHz channel spacing, preamp on.
FM two-tone, third-order IMD dynamic range: Not specified.	29 MHz: 68 dB*; 52 MHz, 69 dB*; 146 MHz, 63 dB*, at 20 kHz channel spacing, preamp on.
S-meter sensitivity: Not specified.	S9 signal at 14.2 MHz: preamp off, 46 μV; preamp on, 3.8 μV; 50 MHz, preamp off, 28 μV; preamp on, 3 μV; 146 MHz, preamp off, 6 μV; preamp on, 0.7 μV.
Squelch sensitivity: SSB, <5.6 μV; FM, <0.3 μV, preamp on, at threshold.	At threshold, preamp on: FM, 29 MHz, 0.2 μV; 50 MHz, 0.15 μV; 146 MHz, 0.09 μV; SSB, 14 MHz, 0.9 μV.
Receiver audio output: >2 W at 10% THD into 8 Ω.	2.5 W at 10% THD into 8 Ω.
IF/audio response: Not specified.	Range at –6 dB points, (bandwidth): CW-N (500 Hz filter): 314-821 Hz (507 Hz); CW-W: 295-2334 Hz (2039 Hz); USB-W: 378-2537 Hz (2159 Hz); LSB-W: 294-2333 Hz (2039 Hz); AM-W: 241-2850 Hz (2609 Hz). AM-N: 230-2290 Hz (2060 Hz).
Spurious and image rejection: ≥70 dB on HF; not specified on VHF.	First IF Image Rejection: *Preamp off* / *Preamp on* 14 MHz 87 dB / 106 dB 50 MHz 109 dB / 102 dB 144 MHz 114 dB / 117 dB First IF Rejection: *Preamp off* / *Preamp on* 14 MHz 96 dB / 115 dB 50 MHz 77 dB / 79 dB 144 MHz 93 dB / 86 dB
Transmitter	*Transmitter Dynamic Testing*
Power output: HF & 50 MHz: SSB, CW, FM, RTTY 100 W (max), 5 W (min); AM, 40 W (max), 2 W (min); 144 MHz SSB, CW, FM, RTTY, 10 W (max), 1 W (min); AM, 4 W (max), 1 W (min).	HF & 50 MHz: CW, typically 100 W (max), <2 W (min); SSB, typically 101 W (max), <2 W (min); varies slightly from band to band. AM, typically 34 W (max), <1 W (min). FM, typically 97 W (max), <2 W (min). 144 MHz: SSB/CW, typically 10 W (max), <1 W (min); AM, 3 W (max), <1 W (min); FM, 10 W (max), <1 W (min).
Spurious-signal and harmonic suppression: ≥50 dB on HF, ≥60 dB on VHF.	As specified. Meets FCC requirements for spectral purity.
SSB carrier suppression: >40 dB.	As specified.
Undesired sideband suppression: >50 dB.	As specified.
Third-order intermodulation distortion (IMD) products: Not specified.	See Figures 1 and 2.
CW keyer speed range: Not specified.	6 to 60 wpm.
CW keying characteristics: Not specified.	See Figure 3.
Transmit-receive turnaround time (PTT release to 50% audio output): Not specified.	S9 signal, 15 ms.
Receive-transmit turnaround time (tx delay):	SSB, 9.8 ms; FM, 40 ms.
Composite transmitted noise: Not specified.	See Figures 4 and 5.
Size (height, width, depth): 2.3×6.7×7.9 inches; weight, 5.5 pounds.	

Note: Dynamic-range measurements are made at the ARRL Lab standard signal spacing of 20 kHz.
*Measurement was noise-limited at the value indicated.

Expanded Product Review Test Results Report Available

The ARRL Laboratory offers a 30-page test results report on the IC-706 that gives in-depth, detailed technical data on the transceiver's performance, outlines our test methods and helps you to interpret the numbers and charts.

The report includes spectral purity charts and receiver sensitivity figures for *all* bands, all CW keying waveforms and other facts to help you make an informed buying decision. The report even includes a summary of how this radio stacks up with similar, previously tested units.

Request the IC-706 Test Results Report from the ARRL Technical Department. It's $7.50 for ARRL members and $12.50 for nonmembers, postpaid.

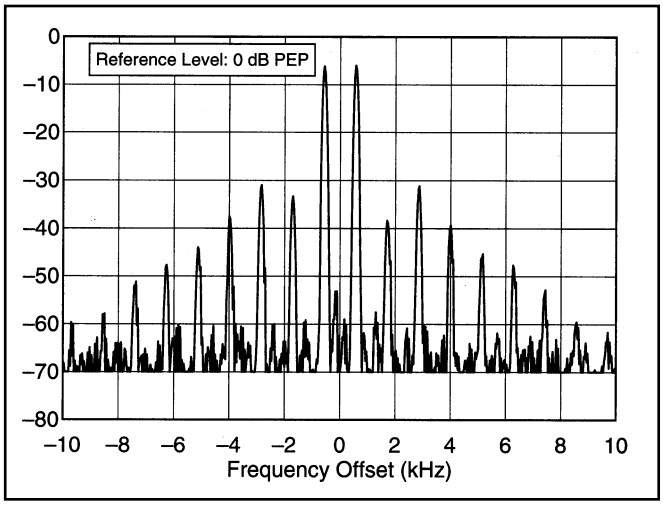

Figure 1—Worst-case HF spectral display of the IC-706 transmitter during two-tone intermodulation distortion (IMD) testing. The worst-case third-order product is approximately 33 dB below PEP output, and the worst-case fifth-order product is down approximately 31 dB. The transceiver was being operated at 100 W PEP output at 14.2 MHz.

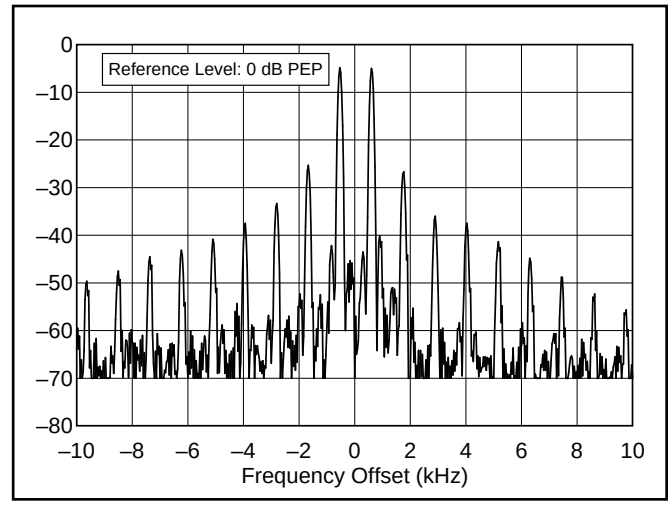

Figure 2—Worst-case VHF spectral display of the IC-706 transmitter during two-tone intermodulation distortion (IMD) testing. The worst-case third-order product is approximately 25 dB below PEP output, and the worst-case fifth-order product is down approximately 33 dB. The transceiver was being operated at 100 W PEP output at 50.2 MHz.

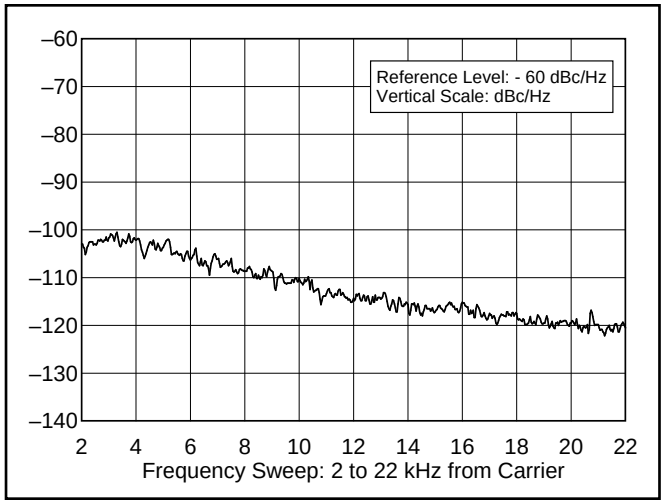

Figure 4—Worst-case HF spectral display of the IC-706 transmitter output during composite-noise testing. Power output is 100 W at 14 MHz. The carrier, off the left edge of the plot, is not shown. This plot shows composite transmitted noise 2 to 22 kHz from the carrier.

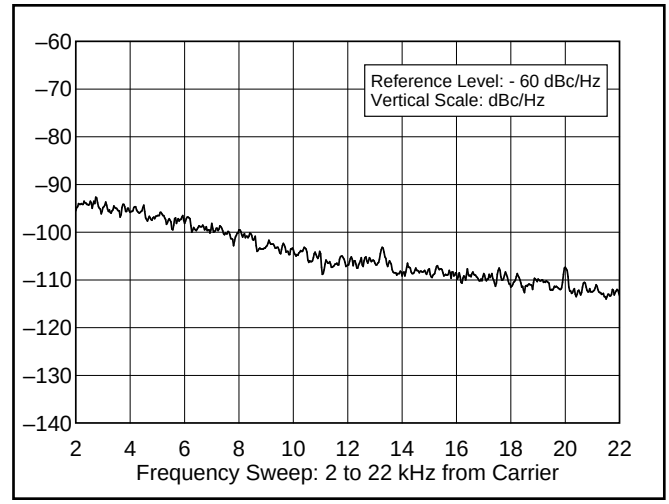

Figure 5—Worst-case VHF spectral display of the IC-706 transmitter output during composite-noise testing. Power output is approximately 10 W at 144 MHz. The carrier, off the left edge of the plot, is not shown. This plot shows composite transmitted noise 2 to 22 kHz from the carrier.

to it afterward. In about two evenings of DX chasing, I felt entirely comfortable with the radio. I think it's a good idea to use it for perhaps a dozen hours or more before taking it mobile, just to be on the safe side. With the menu system's capabilities and reuse of keys and knobs for multiple functions, you can easily wind up getting the radio into a state that takes a minute of concentration to get out of.

Speaking of mobile operation, you can read the display easily from a variety of angles and under all but the brightest ambient lighting conditions. Also, the panel layout was obviously designed to make finding the controls and buttons by feel as easy as possible. Study the front-panel layout for a moment, and you'll see what I mean.

Getting Around the Spectrum

The IC-706 has no bandswitch, band-select buttons or direct-frequency-entry keypad. You negotiate the spectrum using the tuning knob and a function button labeled **TS,** for *tuning step.* By pressing **TS** once, two arrows appear over the megahertz digits of the display. In this mode, rotating the tuning knob steps you through the ham bands. If you press and hold **TS** for a moment, one of the arrows disappears, and the one above the 1-MHz digit remains. Now you're in 1-MHz-step mode. Pressing **TS** from there moves the arrow to the 1-kHz digit. Now you can tune in an appropriate tuning step depending on the current operating mode (CW, FM, etc). Pressing and holding **TS** for a moment in this case brings up a menu that lets you select that tuning step, in kilohertz, for the selected mode. One more quick press of the **TS** button removes the arrows. Now you're in normal tuning mode, with about 2 kHz per revolution for SSB and CW operation. If you press and hold **TS** once more, the radio turns on its 1-Hz tuning digit. (The radio can tune at the 1-Hz rate throughout its range.) Now you're tuning at a ridiculously slow 200 Hz *per knob revolution.* This tuning rate may be handy during HF packet operation or other especially tuning-critical digital modes, but it's not often useful during HF SSB or CW operation.

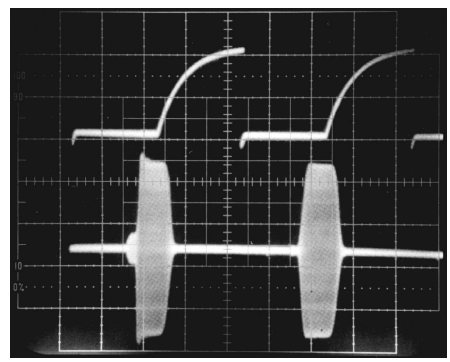

Figure 3—CW keying waveform for the IC-706 in the full-break-in (QSK) mode, showing the first and second dits. The equivalent keying speed is approximately 60 wpm. The upper trace is the actual key closure; the lower trace is the RF envelope. Horizontal divisions are 10 ms. The transceiver was being operated at 100 W output at 14.2 MHz. Note the significant shortening of both dits. In the semi-break-in mode, only the first dit is shortened.

In every tuning step mode, the radio increases its step size the faster you rotate the main-tuning knob. A sliding lever to the right of the main tuning knob lets you adjust its drag, from free-spinning to fairly tight. (I prefer a mid-level setting for home-station operating and the tightest position for mobile operating.) The knob is large enough to easily locate and use, and is well-placed for right-handed operators. In combination with the intuitive memory system, this tuning scheme is an excellent space-saving measure with lots of built-in flexibility.

Operating Impressions

I operated this radio on MF, HF and VHF, and did a lot of listening. I also enlisted help from others whose interests differ from mine—such as VHF FM—and whose antenna systems better show the radio's performance on some bands. Here's how it shakes out.

MF/HF

With its optional 500-Hz CW filter and IF shift, the IC-706 gives you the basic tools to work HF DX and contests, and it sounds better than just about anything made more than a decade or so ago. A graphical display can be enabled to show the IF shift. The synthesizer, though not as super-clean as the bigger ICOM radios, is quiet. ARRL Lab data show third and fifth-order audio IMD products down 30 dB or so using the slow AGC setting. Based upon the many evenings I spent chasing low-band DX and having SSB chats on busy bands, I can say that the IC-706 is pleasant to use, doesn't falter badly in strong-signal conditions and should suit most DXers and some contesters as a second radio or traveling companion.

As with any other receiver, this one has weak points that become evident when you slam it with lots of strong signals. The attenuator comes in handy in these situations. With mediocre wire antennas, though, the preamplifier brings the receiver to life. Judicious use of the attenuator and RF gain control can make listening to the IC-706 comfortable under most band conditions. ARRL Lab data (Table 1) show how the radio holds up with the standard battery of weak and strong-signal tests. Generally, its sensitivity in the ham bands is very good. Its IMD dynamic range is average, hovering around 90 dB on HF and falling into the low 80s on 2 meters. Third-order input intercept tells more of the story, though—it's above 0 dBm on several bands with the preamplifier off. This is quite good. It's why the IC-706

doesn't completely choke under strong-signal conditions, as some other radios in its class do. In short, the receiver is capable, but not outstanding. Given its IF-filter options and dual-conversion scheme—which doesn't allow additional filtering at a lower IF than 9 MHz—this is understandable.

To get good receiver audio from this radio, an external speaker is a must. The top-firing internal speaker is tinny-sounding, as you might reasonably expect from a unit this small. On the other hand, the radio drives an external speaker just fine. Behind the front panel is a switch that lets you choose whether you'll connect a speaker or headphones to the front panel. The switch removes the headphone attenuator, giving you higher audio levels for a given AF gain setting with a speaker. It also changes the jack from stereo (for headphone use) to mono—a nice touch. The radio also has a rear-panel speaker jack, and line-level audio is available at the rear-panel 15-pin accessory connector for a packet TNC or multimode communication processor.

Among other functions for data applications, this connector also provides an amplifier key-line output (closure to ground) and ALC input. The radio will not key an amplifier relay directly. You need an external relay or switching circuit like the one in *QST*, November 1995, p 84, "Cure for the 'Missing First Dot' Problem…"

The receiver audio sounds just fine in headphones. It's not excessively hissy (you can listen in comfort with hi-fi headphones), and the AGC characteristics are quite good. Overshoot on strong signals in fast AGC mode is barely noticeable, except on extremely strong signals (S9 + 40 dB or more). Fast AGC is also relatively pleasant during SSB operation, which can be an asset on crowded bands.

Several reviewers, myself included, found the noise blanker less than useful most of the time. One tester who used the transceiver during the ARRL November CW Sweepstakes reported lots of "Rice Krispies" (snap, crackle and pop) with the noise blanker switched in on a fairly busy band. During mobile operation, the noise blanker worked fine on low-level ignition noise, but that's about all. ICOM says the noise blanker is primarily designed to combat ignition noise, and it may work okay in *your* car. It is not adjustable.

I also wished for more optional filtering. Since ICOM offers 250 and 500-Hz CW filters and a 1.9-kHz SSB filter (in addition to the stock 2.8-kHz SSB filter), I'd like to have had the chance to install more than one filter at a time in the radio, but there's only one optional filter slot. It seems a shame that although ICOM offers a high-stability TCXO option for this radio, it doesn't give you a spot for a second optional filter. At least it's easy to change the filter, depending on the kind of operating you're doing on a given weekend or outing.

As you'd expect, small, monolithic filters operating at a relatively high IF (9.01 MHz) can't provide great ultimate rejection. The result is that the strongest signals, particularly on the low bands, are audible many kilohertz away. (This effect is known as filter *blowby*.) Most of the time, the blowby can be greatly reduced by using the rig's 20-dB attenuator.

Even casual CW operators will want one of the optional CW filters. Why? With only the SSB filter, the receiver doesn't mask the audio image ("the other side of zero beat"). In other words, you can tune in CW signals from either side—but only *one* side is correct. If you tune in from the wrong direction, you'll be transmitting on a frequency that is twice your CW offset away from the desired frequency—and if the other station is using a narrow filter, he may not hear you at all. Which side you should tune from depends on whether you've selected to receive CW on upper or lower sideband (**CW-R** and **CW**, respectively).

On transmit, the radio got good reports on SSB and CW. I listened to my keying in another radio and got some critical reports in QSK CW operation. Up to 30 wpm, there was little or no difference in the keying between full and semi-break-in modes. Above that speed, dits were shortened considerably (see Figure 3), but QSK CW could still be copied up to 60 wpm (the internal keyer's upper limit). The TR relay chatter got on my nerves during QSK operation, however. On sideband, the speech processor does a nice job of making your transmitted signal more readable without adding harsh artifacts. The '706 is easy to adjust for good-sounding SSB operation and smooth VOX action, although the recessed VOX and compressor-gain pots on the right side of the radio are inconvenient to use.

The radio's fan runs all the time, which can be moderately annoying for home-station operation. Although the fan is fairly quiet, the radio's small size makes fan noise more distracting than it would be in a larger radio. When you transmit in any mode and at any power level, the fan steps up to a higher speed. It cycles quickly with the TR relay in QSK and high-speed semi-QSK CW, which is initially distracting but becomes less so over time. I'd prefer a thermostatically controlled fan that only runs when thermal conditions call for it. A radio this small dissipating over 100 W during full-power transmission requires quite a bit of breathing room to stay cool. I strongly recommend not mounting it too close to your dashboard or anything else that will prevent air from freely circulating around the radio.

VHF SSB, CW, and Narrowband FM

Up to 60 MHz and within the 2-meter ham band, the IC-706 has all the functionality and receiver sensitivity you'd expect in a multimode transceiver. One hundred watts is certainly a bonus on 6 meters, also. (Consider how much you had to spend just a few years ago to get a 6-meter-only multimode transceiver in this power class.) In addition to all the SSB/CW operating features available below 29.7 MHz, the radio provides a full suite of FM features as well. For instance, a narrow FM filter (8 kHz), CTCSS tones (including the European standard, 1750 Hz) for accessing repeaters are standard, you can store repeater offsets in its memories, and so forth. It also can do crossband split operation. One limitation, which follows from the radio's use of two antenna connectors (one for 300 kHz to 60 MHz and the other for 60 to 200 MHz) is that the SWR metering function works only up through the 6-meter ham band.

The IC-706 is not problem-free in VHF operation. For example, strong signals in the FM broadcast band from 88 to 108 MHz show up and, with the exception of 2 meters, clobber most other VHF signals, such as the National Weather Service stations at 162 MHz. The preamplifier really aggravates this situation, causing the interference from FM stations to entirely cover the desired signal. (We're not talking about a weak weather station, either. The one I tuned in was full quieting on a Radio Shack weather radio using a partially extended whip antenna.) Which brings us to...

VHF Wideband FM and Receiving Any Mode from 60 to 200 MHz

Except for the 2-meter, FM broadcast and aircraft bands, the IC-706 suffers from really poor sensitivity in much of the 60 to 200-MHz range. The manual hedges on this aspect by stating that ICOM does not guarantee the specifications outside the amateur bands. But let's face it: *lots* of people are interested in this radio's performance outside the ham bands. Here's what we found.

Wideband FM operation *should* be a nifty inclusion in the IC-706. In addition to the FM broadcast band from 88 to 108 MHz, VHF TV channels 2 through 6 use audio subcarriers below 200 MHz that can provide enjoyable listening. ARRL Lab tests showed that the sensitivity was adequate in the FM broadcast band and for listening to AM aircraft-band transmissions around 120 MHz, but it dropped off sharply above that, with the exception of 2 meters. Even with the preamp on, the difference in 12-dB SINAD sensitivity between 146 MHz and 160 MHz is 43 dB. In other words, at frequencies much above the 2-meter band you'll be lucky to hear anything but very strong signals. At the 200 MHz upper limit, 12-dB SINAD sensitivity with the preamp on measured a dismal –28 dBm. In short, it won't replace your scanner in all likelihood.

ICOM explains that, above 60 MHz, the transceiver's front end switches from HF to VHF filters. The first VHF filter works from 60 to 144 MHz and 148 to 200 MHz. ICOM says it provides "steadily increasing attenuation" to keep strong signals like pager stations and TV carriers from interfering with FM broadcast band operation and to keep spurious signals from radiating via the antenna during receive. The second filter is used only for 144-148 MHz.

The IC-706 also has inferior selectivity on wideband FM. Stronger broadcast stations are quite audible at least 300 kHz from their center frequencies, which is a problem con-

sidering that the BC-band channel spacing is only 200 kHz. Also, undesired internal mixing causes these signals to affect much of the band. For example, a cursory check showed that one rather strong broadcaster at 95.1 MHz (I couldn't tell how strong the station really was, since the S meter doesn't work in this mode—neither does the squelch control) was clearly audible at six frequencies inside and outside the broadcast band, including 123.43 and 162.1 MHz. As if this weren't enough, every 100-kHz step in the receiver tuning inside the broadcast band generates an objectionably loud pop in the speaker or headphones.

Documentation

The manual is quite good. Well-illustrated and 56 pages long, it includes separate sections on using the IC-706 in each of its operating modes, covers accessory installation, antenna recommendations and even installing male UHF (PL-259) connectors on coaxial cables. ICOM also includes a quick-reference card that provides a condensed overview of the radio's menu system and helps you learn to operate it in short order. After you familiarize yourself with the manual, this card is all you should need to keep handy while learning to use the IC-706.

Technical Issues

Although ICOM has done a generally excellent job designing and building this radio, a few points need to be mentioned here, so you get the full picture. Perhaps most disturbing: the radio's transmitter IMD is poor at rated output on 6 and 2 meters. As a frame of reference, its performance is acceptable—but certainly not stellar—in the HF range, with third-order IMD products down approximately 33 dB at 100 W PEP output (see Figures 1 and 2). On 6 and 2 meters, the worst-case third-order IMD products at rated output are down 25 and 23 dB, respectively. But many higher-order products—while substantially down—remain fairly prominent. These can be the real killers in the IMD picture and generate undesirable splatter, especially when using an amplifier. A bit of redesign might correct this. It should be high on ICOM's priority list. This is the only serious fly in the IC-706 ointment.

In Sum

This is a very small, but very *charming*, radio. After initially being attracted to the IC-706 because of its size, most will catch on quickly and thoroughly enjoy the radio. The menu system does take a little getting used to, but I didn't mind its complexity or size. My advice? *Get your hands on* one of these radios before you decide whether to buy it. A few dozen minutes in front of any radio is worth many thousands of words and pictures. See it. Try it. *Then* decide. In my opinion, the IC-706 warrants all the excitement it has generated, but it's not for everyone. If you have an aversion to small radios, think it over thoroughly before buying a radio like the IC-706.

Thanks to Dave Hallidy, KD5RO; Jim Hastings, WA2EWU; Mike Rink, WB2HYP; Gary Sienkiewicz, W2TR; and Rick Lindquist, KX4V, for contributing to this review.

Manufacturer: ICOM America Inc, 2380 116th Ave NE, Bellevue, WA 98004, tel 800-858-6252. Manufacturer's suggested retail prices: IC-706, $1560; FL-100 500-Hz CW filter, $106; FL-101 250-Hz CW filter, $106; FL-223 narrow SSB filter, $84; AT-180 external automatic HF/50-MHz antenna tuner, $599; MB-62 mobile mounting bracket, $20; MB-63 front-panel mounting bracket, $14; OPC-581 11.5-foot cable (connects front panel to radio chassis for remote-mount operation), $48; UT-102 voice synthesizer (announces frequency and S meter level), $59; OPC-589 microphone adapter cable (adapts ICOM 8-pin mikes to IC-706 RJ-45 connector), $28. QST