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Icom IC-7100 HF/VHF/ UHF Transceiver

Plays well at home and away!

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The Icom IC-7100 certainly made a splash when it was first announced in 2012. The radio was eye-catching, with a slanted standalone display unit that was new to ham radio. Was it supposed to replace the IC-7000? We had to cool our heels a bit waiting for type acceptance and all the final pre-shipment details to be worked out, but the North American model finally started appearing in American shacks around the middle of 2013.

From the ads, it wasn't clear whether this was a radio that took the IC-706 mobile dynasty to a new level or a miniaturized desktop radio like the IC-746, which the 7100's backlit LCD resembles. As it turns out, the IC-7100, ham radio's first "touchscreen" transceiver, is a little of both; performance is on par with its bigger cousins while the separate RF "brick" and detachable controller are aimed at the portable and space-challenged ham.

Not content just to repackage existing features, Icom has also added a USB interface for audio and control to make digital modes a one-cable operation, an SD memory card to save the radio configuration (and more), an interface for GPS data, and extra support for D-STAR menus and memories. The composite video output of the IC-7000 has been dropped but the 7100's display is bigger. It's a powerful package for the price. Adam Farson, VA7OJ/AB4OJ, has prepared a nice comparison of the 7000 and 7100 feature sets in his report on the 7100.[1]

Extra Perspectives

Being an IC-7000 owner, I am already "tuned in" to many of the IC-7100's features and "the Icom way." What would a ham think about the 7100 if he or she approached it without that background? I operate competitively and have certain expectations for what I find useful — how would a ham with different experiences feel about the radio? To find out, I asked my friend, Kevin Williams, KWØKW, to give the radio a try for a while, too. Mobile maven Alan Applegate, KØBG, also weighed in

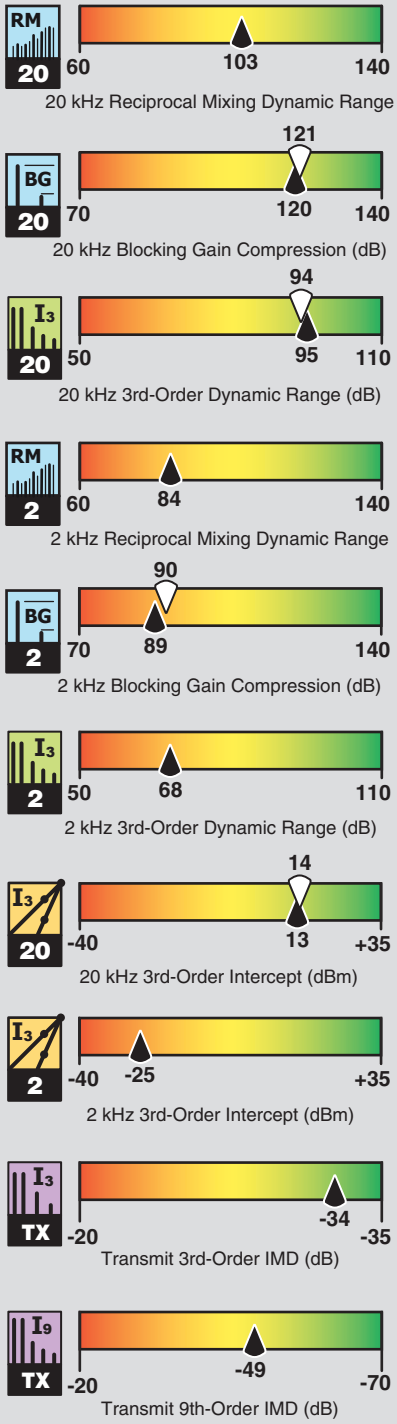
[1]A. Farson, VA7OJ/AB4OJ, "IC-7100 User Evaluation & Test Report," **www.ab4oj.com/icom/ic7100/7100notes.pdf**.

Bottom Line

The IC-7100 is the newest member of the venerable IC-706 dynasty of portable/mobile all-stars, yet it has the chops to be a base station. Its good performance and attractive separate operating controller make it an excellent choice for the space-challenged ham. The integration of D-STAR and digital-ready features mean that this is a radio looking to the future.

Figure 1 — The Icom IC-7100 main unit rear panel will look familiar to owners of recent Icom transceivers. It has connections for interfacing with a computer, external power amplifier, antenna and station accessories, as well as mic and speaker jacks and an Ethernet-type connector for the control head cable.

Key Measurements Summary



PR086

Key:
80 M
20 M

Dynamic range and intercept values with preamp off.

Intercept values were determined using -97 dBm reference

See the digital edition of *QST* for the VHF/UHF Key Measurements summary.

Table 1
ICOM IC-7100, serial number 02001506

Manufacturer's Specifications	Measured in the ARRL Lab
Frequency coverage: Receive, 0.03 – 200, 400 – 470 MHz; transmit, 1.8 – 2.0, 3.5 – 4.0, 5.255 – 5.405, 7.0 – 7.3, 10.1 – 10.15, 14.0 – 14.35, 18.068 – 18.168, 21.0 – 21.450, 24.89 – 24.99, 28.0 – 29.7, 50 – 54, 144 – 148, 430 – 450 MHz.	Receive and transmit, as specified.
Power consumption: receive, 1.2 A (max audio); transmit, 22 A (100 W) at 13.8 V dc ±15%.	At 13.8 V dc: Receive, 870 mA (max brightness, max volume, no signal), 840 mA (backlights off); transmit, 4.7 A (min RF output), 19 A (typical) at 100 W RF output. Operation confirmed at 11.7 V (72 W output).
Modes of operation: SSB, CW, AM, FM, DV.	As specified (AM receive only at 144 – 148 and 430 – 450 MHz).
Receiver	**Receiver Dynamic Testing**
CW sensitivity, 10 dB S+N/N: 0.15 µV (1.8 – 29.995 MHz), 0.12 µV (50 – 54 MHz), 0.15 (70 MHz), 0.11 µV (144/430 MHz).	Noise floor (MDS), 500 Hz DSP bandwidth: *Preamp* *Off* *1* *2* 0.137 MHz –119 –125 –126 dBm 0.475 MHz –126 –136 –138 dBm 1.0 MHz –128 –139 –140 dBm 3.5 MHz –130 –139 –140 dBm 14 MHz –130 –138 –140 dBm 50 MHz –130 –140 –142 dBm 70 MHz –129 –138 –140 dBm 144 MHz –134 –143 dBm 432 MHz –132 –143 dBm
Noise figure: Not specified.	Preamp off/1/2: 14 MHz, 17/9/7 dB; 50 MHz, 17/9/5 dB. Preamp off/on, 144 MHz, 13/4 dB; 432 MHz, 15/4 dB.
AM sensitivity, 10 dB S+N/N: 13 µV (0.5-1.8 MHz), 2.0 µV (1.8-29.995 MHz), 1.0 µV (50/70, 144, 430 MHz).	10 dB (S+N)/N, 1-kHz tone, 30% modulation, 6 kHz DSP bandwidth: *Preamp* *Off* *1* *2* 1 MHz 2.54 0.78 0.65 µV 3.8 MHz 2.32 0.73 0.57 µV 50 MHz 2.11 0.68 0.57 µV 120 MHz 2.14 0.65 µV 144 MHz 1.44 0.51 µV 432 MHz 2.14 0.54 µV
FM sensitivity, 12 dB SINAD: 0.5 µV (28-29.7 MHz), 0.25 µV (50/70 MHz), 0.18 µV (144/430 MHz).	For 12 dB SINAD, 3 kHz deviation, 15 kHz bandwidth: *Preamp* *Off* *1* *2* 29 MHz 0.74 0.21 0.18 µV 52 MHz 0.65 0.22 0.18 µV 70 MHz 0.79 0.28 0.24 µV 146 MHz 0.47 0.16 µV 162 MHz 0.47 0.16 µV 440 MHz 0.65 0.16 µV
Blocking gain compression dynamic range: Not specified.	Blocking gain compression dynamic range, 500 Hz DSP bandwidth: *20 kHz offset* *5/2 kHz offset* *Preamp off/1/2* *Preamp off* 3.5 MHz 121/120/121 dB 91/90 dB 14 MHz 120/116/114 dB 90/89 dB 50 MHz 121/119/120 dB 91/90 dB 144 MHz 128/122 dB 97/93 dB 432 MHz 127/118 dB 94/94 dB
Reciprocal mixing dynamic range: Not specified.	14 MHz, 20/5/2 kHz offset: 103/85/84 dB.
ARRL Lab Two-Tone IMD Testing	See Table 2.
Second-order intercept point: Not specified.	Preamp off/1/2, 14 MHz, +45/+45/+45 dBm; 50 MHz, +55/+47/41 dBm; 144 MHz, +37/+51 dBm; 432 MHz, +91/+91 dBm.
DSP noise reduction: Not specified.	10 dB.
Notch filter depth: Not specified.	Manual notch, >70 dB; auto notch: 50 dB. Attack time: 100 ms.

Manufacturer's Specifications	Measured in the ARRL Lab
FM adjacent channel rejection: Not specified.	Preamp on: 29 MHz, 83 dB; 52 MHz, 81 dB; 144 MHz, 77 dB; 432 MHz, 72 dB.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz offset, preamp 2 on: 29 MHz, 81 dB; 52 MHz, 83 dB*; 144 MHz, 81 dB*; 432 MHz, 77 dB*. 10 MHz offset: 29 MHz, 110 dB; 52 MHz, 110 dB; 144 MHz, 83 dB; 432 MHz, 87 dB.
S meter sensitivity: Not specified.	S-9 signal, preamp off/1/2: 14 MHz, 50.0/16.6/10.6 µV; 50 MHz, 70.4/22.9/14.8 µV; 144 MHz, 13.8/3.12 µV; 432 MHz, 23.5/3.23 µV.
Squelch sensitivity: 5.6 µV (SSB), 0.3 µV (FM).	At threshold, preamp 2 on: FM, 29 MHz, 0.13 µV; 50 MHz, 0.14 µV; 144 MHz, 0.11 µV; 432 MHz, 0.18 µV; SSB, 3.84 µV (14.2 MHz).
Receiver audio output: >2 W into 8 Ω.	2.7 W at 10% THD into 8 Ω. THD at 1 V RMS, 0.17%.
IF/audio response: Not specified.	Range at –6 dB points, (bandwidth):** CW (500 Hz): 313 – 877 Hz (564 Hz); Equivalent Rectangular BW: 521 Hz; USB: (2.4 kHz): 90 – 2895 Hz (2805 Hz); LSB: (2.4 kHz): 92 – 2897 Hz (2805 Hz); AM: (6 kHz): 169 – 3176 Hz (6014 Hz)
Spurious and image rejection: Not specified.	First IF rejection, 14 MHz, 105 dB; 50 MHz, 117 dB; 144 MHz, 48 dB; 432 MHz, 115 dB; image rejection, 14 MHz, 93 dB; 50 MHz, 106 dB; 144 MHz, 72 dB; 432 MHz, >142 dB.
Transmitter	**Transmitter Dynamic Testing**
Power output: HF/50 MHz, 2-100 W (AM, 1-30 W); 144 MHz, 2-50 W; 432 MHz, 2-35 W.	HF and 50 MHz, 1.6-100 W typical (0.5-30 W AM); 144 MHz, 1.4-44 W; 432 MHz, 0.9-33 W.
Spurious-signal and harmonic suppression: HF, HF, >50 dB; 50 MHz; >63 dB; 144/430 MHz, >60 dB.	HF, ≥ 65 dB; 50 MHz, 67 dB; 144 MHz, 67 dB; 432 MHz, 63 dB. Meets FCC requirements.
SSB carrier suppression: >50 dB.	>70 dB.
Undesired sideband suppression: >50 dB.	>70 dB.
Third-order intermodulation distortion (IMD) products: Not specified.	3rd/5th/7th/9th order, HF, 100 W PEP, –34/–43/–45/–49 dB (worst case, 160 m), typically –39/–39/–46/–55 dB; 50 MHz, –29/–39/–45/–59 dB; 144 MHz, –28/–49/–57/–55 dB; 432 MHz, –25/–44/<–60/<–60 dB.
CW keyer speed range: Not specified.	5.6 to 49 WPM, iambic Mode B.
CW keying characteristics: Not specified.	See Figures 2 and 3.
Transmit-receive turnaround time (PTT release to 50% audio output): Not specified.	S-9 signal, AGC fast, 30 ms.
Receive-transmit turnaround time (tx delay): Not specified.	SSB, 22 ms; FM, 13 ms.
Composite transmitted noise: Not specified.	See Figure 4.

Size (height, width, depth): transceiver, 2.5 × 6.5 × 9.3 inches including protrusions; controller, 2.7 × 6.5 × 3.7 inches. Weight, transceiver, 5.1 lbs; controller, 1.1 lbs.

Price: IC-7100, $1600; MBA-1 controller bracket, $35; MBF-1 suction cup mount, $75; RS-BA1 remote control software, $100.

*Measurement was noise-limited at the value indicated.
**Default values, sharp setting (smooth setting is available). Bandwidth and cutoff frequency are adjustable via DSP. CW bandwidth varies with PBT and pitch control settings.

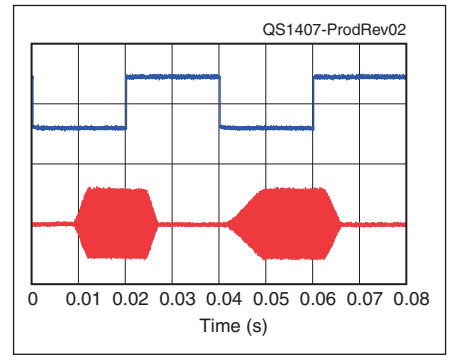


Figure 2 — CW keying waveform for the Icom IC-7100 showing the first two dits in full break-in (QSK) mode using external keying. Equivalent keying speed is 60 WPM. The upper trace is the actual key closure; the lower trace is the RF envelope. (Note that the first key closure starts at the left edge of the figure.) Horizontal divisions are 10 ms. The transceiver was being operated at 100 W output on the 14 MHz band.

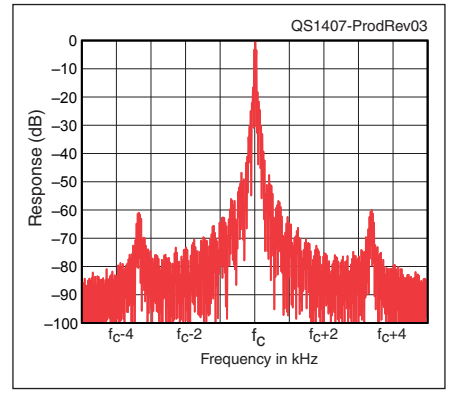


Figure 3 — Spectral display of the Icom IC-7100 transmitter during keying sideband testing. Equivalent keying speed is 60 WPM using external keying. Spectrum analyzer resolution bandwidth is 10 Hz, and the sweep time is 30 seconds. The transmitter was being operated at 100 W PEP output on the 14 MHz band, and this plot shows the transmitter output ±5 kHz from the carrier. The reference level is 0 dBc, and the vertical scale is in dB.

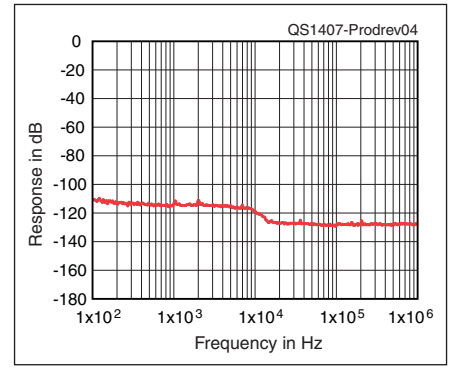


Figure 4 — Spectral display of the Icom IC-7100 transmitter output during composite-noise testing. Power output is 100 W on the 14 MHz band. The carrier, off the left edge of the plot, is not shown. This plot shows composite transmitted noise 100 Hz to 1 MHz from the carrier. The reference level is 0 dBc, and the vertical scale is in dB.

with his impressions. The comments and observations of both have been worked into this review.

As with most of the major radios, the IC-7100 has spawned users groups and forums across the Internet and around the world. There is a great deal of accumulated wisdom to be had on the features and capability of almost any radio. A little time using with a search engine will likely be well spent. If you do choose to join one of the user communities, be smart and search the group archives for answers *before* you jump in and ask previously addressed questions. It's just plain good "netiquette."

How It Goes Together

If you are familiar with the IC-7000 or similar radios, you'll find few surprises in assembling and installing the two-piece IC-7100, consisting of the controller (where the display is) and the main unit (where the RF is). The controller connects to the main unit with a cable that *looks* like an Ethernet cable but is not! Use *only* the Icom cable, which is plenty long enough. The cable's connector at the main unit looks a little fragile, but I didn't experience any problems with it. Try to install the main unit so that cables don't get yanked or pulled.

The microphone, key, and speaker can plug into either the controller or main unit — a nice touch for flexibility. The main unit was similarly easy to get rolling for a simple installation. Everything that plugged into my IC-7000 (CI-V computer interface, antennas, tuner interface, key, speaker) plugged into the IC-7100 without modification. From opening the box to pushing the PWR button (on the AF control) took about 15 minutes and I only had to open the manual to check the layout of the main unit's rear panel, shown in Figure 1.

I did not use the radio with an amplifier, but all the necessary control signals are present in the main unit's ACC connector. The manual has two important cautions about use with an amplifier, noting that the inductive switching transients may damage the internal transistor if a clamping diode is not used. Using a clamping diode can affect amplifier switching time, so be wary. You may have to adjust the TX DELAY control parameter to allow everything to switch before RF is applied to the amplifier. Using high power may also require you to suppress common-mode current on the control cable with a ferrite bead choke. Icom supplies a split-core ferrite, but the mix is not specified. Five turns through a #31 mix bead or toroid create an effective choke at HF.

Table 2
Icom IC-7100, serial number 02001506

ARRL Lab Two-Tone IMD Testing (500 Hz DSP bandwidth)*

Band/Preamp	Spacing	Input Level	Measured IMD Level	Measured IMD DR	Calculated IP3
3.5 MHz/Off	20 kHz	–36 dBm –23 dBm	–130 dBm –97 dBm	94 dB	+11 dBm +14 dBm
14 MHz/Off	20 kHz	–35 dBm –24 dBm 0 dBm	–130 dBm –97 dBm –15 dBm	95 dB	+13 dBm +13 dBm +8 dBm
14 MHz/1	20 kHz	–46 dBm –32 dBm	–138 dBm –97 dBm	92 dB	0 dBm +1 dBm
14 MHz/2	20 kHz	–50 dBm –35 dBm	–142 dBm –97 dBm	92 dB	–2 dBm –4 dBm
14 MHz/Off	5 kHz	–60 dBm –52 dBm 0 dBm	–130 dBm –97 dBm –6 dBm	70 dB	–25 dBm –29 dBm +3 dBm
14 MHz/Off	2 kHz	–62 dBm –53 dBm 0 dBm	–130 dBm –97 dBm –8 dBm	68 dB	–28 dBm –31 dBm +4 dBm
50 MHz/Off	20 kHz	–36 dBm –24 dBm	–130 dBm –97 dBm	110 dB	+11 dBm +13 dBm
144 MHz/Off	20 kHz	–46 dBm –34 dBm	–134 dBm –97 dBm	88 dB	–2 dBm –2 dBm
430 MHz/Off	20 kHz	–44 dBm –31 dBm	–132 dBm –97 dBm	88 dB	0 dBm +2 dBm

*ARRL Product Review testing includes Two-Tone IMD results at several signal levels. Two-Tone, Third-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. Intercept points were determined using –97 dBm reference.

How It Plays

The IC-7100 may be physically small but the associated compromises are well-hidden. The IC-7000's coverage of all bands from 1.8 through 440 MHz (except 222 MHz) continues. CW — my favorite mode — was silky smooth in both semi and full break-in. Figure 2 shows the keying waveform, which seems a little soft on that second "dit," but I didn't notice anything on the air. The waveform is also free from overshoot or artifacts that drive amplifiers and adjacent channel users nuts. Figure 3 shows the keying sidebands during operation — compared to the IC-7000, the noise is about 5 dB higher at 1 kHz from the carrier and the noise spurs at ±3.5 kHz are higher, as well, which is a little surprising. Lowering output noise might be worth a software fix to the DDS subsystem. (You can update the firmware without sending the radio back to Icom.)

SSB operation was as expected from my experience with the IC-7000 and the simple hand mic seemed to work just fine. Mobile users may want the more capable "remote control" HM-151 microphone. A boomset-style mic and headphones combo will also work fine but may need an adapter for the radio's modular-style mic plug. One feature I did try — the IC-7100 also has the popular ability to record CW and voice messages for use during contests, net operation, and for other repetitive activities. It helps when chasing a big W1AW portable pileup! All of the voice messages plus any audio you record are stored on the SD card as .WAV files. You can also save RTTY data, QSO information, and the entire radio configuration as a backup or to personalize the radio for different operating styles.

Strong-signal receiver performance often takes the biggest hit when a radio is jammed into a small package. Luckily, we have both the ARRL Lab measurements and a year-long on-the-air receiver test program known as the W1AW Portable Centennial Operations. Comparing the Lab's numbers for both the IC-7000 and the IC-7100, we can see a definite and useful improvement in the two-tone third-order intermodulation distortion dynamic range (IMD DR).[2] For wide-spaced signals, the 7100's IMD DR on 14 MHz is 95 dB, compared with the 7000's 88 dB, and for the more intense 2 kHz signal spacing (such as are encountered in big DX pileups and contests), IMD DR is 68 dB, a 5 dB jump from the 7000. The latter figure is still well below top-drawer performance but comparable to the older IC-761 and IC-756 PRO desktop models according to Sherwood Engineering's excellent receiver test program (**www.sherweng.com/table.html**).

The Lab noticed that during blocking tests, strong nearby signals would quiet the receiver even with the AGC turned off and this may be an oddity of how the AGC function is implemented in the DSP-centric receiver. Another unexpected item is that on 2 meters, the second-order intercept point went *up* with the preamp turned ON — this didn't happen on any other band. Neither are debilitating in any way, just different than expected.

Phase noise generated by a transceiver's frequency synthesizer system (usually a direct digital synthesizer — DDS — in modern rigs) has been getting needed attention in recent years. Phase noise can compromise a receiver's strong-signal performance (measured by the reciprocal mixing dynamic range test — RMDR) and cause problems for other nearby stations as operators at multi-station Field Day events well know! RMDR data for the IC-7000 is not available but the IC-7100 does outperform the recent IC-9100 all-band/all-mode transceiver.[3] A spectral plot of the IC-7100's transmitted noise in Figure 4 shows that performance is about the same as the IC-7000 out to about 10 kHz from the carrier and then better by approximately 10 dB up to 1 MHz separation. Compared to other recent HF radio models, the 7100 is competitive or better in transmitted noise performance, although serious VHF/UHF weak-signal operators will want better phase noise on both receive and transmit. (Also see the previous note about keying sidebands.)

[2]M. Wilson, K1RO, "Icom IC-7000 HF/VHF/UHF Transceiver," Product Review. *QST,* May 2006, pp 64 – 71.
[3]R. Lindquist, WW3DE, "Icom IC-9100 MF/HF/VHF/UHF Transceiver," Product Review, *QST*, Apr 2012, pp 51 – 57.

Mobiling and Touch Screens

To be clear, the primary operating controls for the IC-7100 such as the VFO, volume, filter settings, and squelch/RF gain are the usual knobs. Some of the button-controlled functions work with knobs, as well, or are OFF/ON toggles. These can be operated by feel and quick glances, as we are used to. What of the touch screen functions, though?

Every new type of operating interface takes some getting used to, and there is certainly a learning curve in using the new touch screen. However, even after I became reasonably proficient at changing bands, operating split, switching between VFOs and memories, I still had to look at the display to do it. There is no tactile feedback in a touch screen like there is with buttons. For anything beyond very simple use of the controls, it was necessary to look at the radio for several seconds. On the road this is unsafe, pure and simple, just like texting. The IC-7100 may be the first but there will surely be other touch screen radios. Don't put others at risk just to operate the radio — pull over.

On the Air

Actual on-the-air testing was a lot of fun. As an IC-7000 owner, the organization of the controls and menus made sense and I was quickly able to put the 7100 on the air and start making QSOs. The big pileups for W1AW were in full swing, plus there was FT5ZM as well as other DXpeditions to chase. With an A/B switch, I could compare the 7100 to another high-performance desktop transceiver in almost real time. Deliberately tuning to the densest and strongest areas of the low-band pileups where signals were strongest, I could definitely tell when I was listening to a top-of-the-line receiver in terms of blocking, noise, and signal clarity. Away from a pack of S-9+40 dB signals pounding in, the IC-7100 was a very capable performer, indistinguishable from the "big" radio.

I have really grown to like DSP filters in all of the recent radios. Once you've gotten used to how a rig manages filter shape and cutoff frequencies (high/low or center/width) adjustment seems almost unconscious. Kevin and I both liked the graphic that pops up to show you what you're changing and how. It becomes very easy to quickly isolate the signal you want — or don't want — and "make it so!"

In my urban environment, I contend with a lot of pulse noise, carriers, and just plain "junk." This is also an issue during mobile operation, so I wanted to see how the 7100's noise blanker (NB) and noise reducer functions performed. Turning on noise blanker was fairly effective for some of the power line noise and the occasional ignition noise I encountered on the road. (If you want a good sample of ignition noises, park at an interstate rest area for a while.) Noise reduction (NR) performed by the IF DSP system is also surprisingly effective and can really take a bite out of the snap-crackle-and-pop that is so prevalent these days, making difficult copy much easier with few "artifacts" introduced, even with the NR level at maximum. (It helped me copy FT5ZM's weak signal more than once.) Finding the right levels is where the touch-and-hold feature of the controller buttons are most useful. Holding down NB or NR brings up an adjustable level controlled by the main VFO knob. Adjust to taste and then press the button again to return to normal operation — easy and natural, which means you're more likely to optimize their performance and get the most out of the radio.

On the VHF and UHF bands, most of my operating is on the local repeaters and simplex channels. I also spent some time on 6 meter SSB, but in late winter, so there was not much action on that particular band. The IC-7100 handles FM operation with ease — there are 500+ channels, after all. If you're interested in using the IC-7100 to replace your mobile VHF/UHF FM rig, it will work just fine. The 7100 supports useful options like TONE SCAN (to find the access tones that mystery repeater is using) and AUTO-REPEATER with selectable offsets by band. Scanning both memory channels and a range of frequencies is also supported.

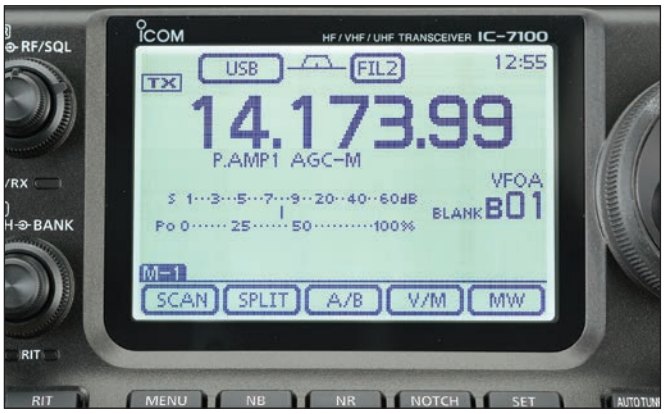


Figure 5 — The IC-7100's screen is larger than that on the IC-706 and IC-7000. Touching various spots on the screen such as the soft keys across the bottom or the frequency display brings up menus or changes settings.

You can program dozens of memory channels with the same information (frequency, offset, tone options) as for any regular mobile radio, using the touch-screen menus or programming software. Each memory can be tagged with a 16-character name, as well. The radio is supported by RT Systems (**rtsystemsinc.com**) programming software to handle setting up all of those channels. (The IC-7100 is not currently supported by the open-source *CHIRP* as of April 2014.)

The output on 2 meters is 50 W and on 70 centimeters, 35 W, via the ANT 2 connector so you don't have to disconnect or switch between an HF and a VHF/UHF antenna. The only drawback to using the IC-7100 as both an HF rig and a VHF/UHF FM mobile is that it only does one at a time!

Where Does This Go?

I have to admit that when I took the radio out to install in my small SUV, there was some head-scratching as I contemplated the controller. Swapping the main unit of the radio under the passenger seat for my IC-7000's RF unit was a piece of cake. (Note that plenty of airflow clearance is needed around the main unit to prevent overheating — use the supplied mounting bracket.)

On the other hand, my IC-7000's control head was a more familiar rectangular slab that was relatively easy to hang on the vehicle's dashboard console. The IC-7100's controller looks like it wants to "sit" on something — so I sat it on the dash (in the driveway only — see the sidebar about mobile risks) which turned out to be a poor location. The screen looks best and is easiest to see in daylight if it is directly in your line of sight, not pointed at the ceiling. Contrast also suffers when viewed significantly off-axis, a common problem with LCDs that the IC-7000 solved with a color TFT screen. You also need to be able to see the button labels, at least until you get them memorized.

Seated on the down-slanted part of the dash, it wanted to slide off. I mounted the controller on the suction-cup mount — ah, much better — but the controller took up as much visual space as a larger GPS unit might. With the controller aligned properly and using the lighted buttons I could easily reach up and operate the radio. Nevertheless, I think the controller would be much better situated off of the windshield and down by the gear shift on a gooseneck mount. Do not succumb to the temptation of using one of the "bean bag" bases or leaving the controller loose! In an accident or air bag deployment it would be a dangerous object flying around in the vehicle. Mount the controller securely.

I liked being able to plug in the microphone and key to either the main unit or controller. Having the mic or key plugged into the main unit might be a better choice than the controller in some mobile setups. Audio from the speaker was so-so on the road when competing with road noise. I recommend an external speaker or use an audio jumper cable to connect to your vehicle audio system if it has an AUX input.

Navigating Those Menus

While the tradition of "one-function, one-button" remains strong in ham radio, some of the dreadnought-class rigs are starting to look like accordion buttonboards! To make small radios practical, menus of control settings have become a necessity. Some manufacturers do this better than others! Icom has paid attention and in progressing from the original IC-706 to the IC-7100 has organized the menus so that for most operation, you never have to "go deep" to access the control you might quickly need. For example, RF power adjustments are accessed with one touch-and-hold gesture. Less frequently adjusted items are further down in the lists.

If you plan on using the radio with a PC, you can get around the menus by using the *RS-BA1* remote control software, which puts quite a few of the missing buttons on a virtual front panel. You may have to use a mouse, but at least you won't wear the letters off! The IC-7100 is also supported by *Ham Radio Deluxe* (**www.ham-radio-deluxe.com**) and various remote-station software packages.

Regardless of how you plan to use the radio, though, it is important that you spend some time getting used to the menus and setting the various controls to a preferred value or status. Kevin noted, "There is so much customization available that everyone should be able to find a 'happy place' with this rig. Learning those menus is the key to success. Once I started to get up the learning curve, things began to fall into place for me." Amen! You can't get the most out of a radio without knowing what the various controls do.

Who knows, you might find that you actually *like* not having everything attached to a button! For example, Kevin really liked the main VFO knob's speed- and mode-sensitive tuning rate and one-touch control of tuning step size: "I also love the ability to switch into Quick Tuning mode with a touch on the screen (Hz, kHz or MHz steps)…you can really haul [your frequency] to the other end of the band — even on 10 meters!" One observation — after chasing W1AW and some other DX around the bands, Kevin and I both wonder why a VFO A/B pair couldn't be saved in scratchpad memory if the split function is active.

There is one drawback to the touch screen and that is access to the visually impaired. While the touch screen started to feel natural to my button-trained fingers, I realized that would not be of much use if I couldn't see it. The IC-7100 has a built-in voice synthesizer to read out S-meter levels and mode but that's hardly enough to operate the rig. Perhaps some enterprising soul out

there will write a software application that could act as a visual operating assistant for hams who can't see the radio well enough to operate it by touch.

Digital Operation and D-STAR

One of the radio's nicest features is the USB interface that supports both rig control *and* two-way audio simultaneously. This feature is becoming more and more common. It totally eliminates the rat's nest of cables, interfaces, and adapters that are usually required to get going with digital modes like RTTY, PSK31, or MFSK. You'll have to be capable of directing your PC to use the USB audio stream recognized and supported by the Icom driver — usually an "audio device" configuration item in the operating system.

The IC-7100 is also supported by contest logging and other specialty logging software. The exact details of connecting and configuring will depend on what type of PC software you choose, of course. A RTTY encoder/decoder is built-in so you can operate on that mode without any kind of supporting PC. (Note that if you plan on digital operation, which often requires transmission at 100% duty cycles, be sure the main unit receives adequate cooling air flow as specified in the manual!)

D-STAR also receives excellent treatment in the IC-7100. D-STAR is on my "to-do" list (along with numerous other things) and I suspect it is for a lot of other hams. While I understand the system and how it works technically, I just haven't taken the time to grapple with the setup and learning curve to make it part of my ham life. If I had an IC-7100, that would probably change pretty fast because Icom has gone out of its way to make the radio easy to configure and use with the D-STAR system. For example, the 7100 comes pre-configured with an extensive list of D-STAR repeaters already stored in the radio. Press the DR button, touch the FROM field, then select REPEATER LIST followed by the region in which you live. With the TO field defaulting to CQCQCQ, you are ready to make a call.

As with most everything, there are plenty of online videos to help you understand the IC-7100 and its many features. The configuration and use of the D-STAR functions are no exception. Start by familiarizing yourself with how D-STAR works and its vocabulary. The YouTube (**www.youtube.com**) videos by fellow *QST* contributor Gary Pearce, KN4AQ, are well done. Search for "ARVN DSTAR" to find them. After you are ready to start, a YouTube search for "IC7100 DSTAR" will turn up more videos to get you going on the radio. There are 900 memories for D-STAR information on the 7100, so you have plenty of room for navigating this growing worldwide system!

Remote Control Software and Controller

The software that comes with the radio is fairly easy to install on a PC in your shack, connected to the IC-7100 by the USB cable. (The USB cable provided with the software does not work with IC-7100, which requires a mini-USB at the radio end. We used the cable provided with the radio.) You will also need to download a driver from the Icom website. The process is similar to installing printer drivers.

Once the software is running, you get a full-sized front panel with *lots* of buttons and knobs as described above. Just mouse over a control and roll the thumbwheel. Some functions are performed more easily than on the radio (filter configuration) and some are not available (Quick Tune and manual frequency entry, for example). Nevertheless, this is a good way to learn about the radio, configure it, and then head out for mobile or portable operation. In my opinion, third-party control software will probably provide better functionality and more frequent updates, but it's good that Icom provides a starter package.

You might also want to try the RC-28 User Remote Encoder, which is basically a knob that interfaces to the PC and substitutes for the radio's VFO knob. It does return a lot of the "radio feel" when using the PC.

Documentation

With all the features, a comprehensive instruction manual could easily be long and unwieldy, so it is separated into two sections. The 96-page introductory manual helps you get the radio unpacked, configured, and on the air for basic operation. The four-times larger Advanced Instruction manual is provided on CD-ROM and covers everything in detail. The CD-ROM also includes the radio's schematic diagrams.

The basic parts of both manuals are detailed and consistent in how instructions are presented. When describing the radio's into advanced functions, the English can be a little bit shaky. This is where user's groups and online tutorials can be very helpful. Having edited manuals in the past, I know how hard it is to write instructions that are properly understood by all readers! Icom adds yellow "sticky notes" and highlights to the manual to help emphasize and explain certain items, as well. Both manuals could really use an index, although the PDF search function will usually find what you need.

Summary

As the IC-706 product family expands through the IC-7000 and now the IC-7100, Icom has contributed a fine example of the "porta-base" radio. This size and style of radio is well-matched to frequent portable operation and as a small station at home. It is well-suited for regular CW/SSB operation and the USB interface makes digital operation much simpler. Pre-configured for D-STAR operation, you can explore the D-STAR system with ease, as well. Recognizing the changing ham and ham station, the IC-7100 is a radio for a sweet spot we are just discovering.

Manufacturer: Icom America, 12421 Willows Road NE, Kirkland, WA 98034; tel 800-872-4266; fax: 425-454-1509; **www.icomamerica.com**.

See the Digital Edition of *QST* for a video overview of the Icom IC-7100 HF/VHF/UHF Transceiver.