IC-7000 User Evaluation Trip Report

By Adam M. Farson VA7OJ/AB4OJ

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Introduction: This report describes the evaluation of IC-7000 S/N 0501264 at Icom America Inc. in Bellevue WA from a user perspective, as well as a "short list" of RF lab tests performed on the radio. I was able to spend a number of hours in front of the IC-7000 at the Icom ham-shack, and thus had the opportunity to exercise the radio's principal features and evaluate its on-air behavior.

1. **Physical "Feel" of the IC-7000:** The IC-7000 is smaller and lighter than the IC-706MkIIG (20 mm shorter, 2.3 vs. 2.45 kg). I found the overall feel of the main tuning knob and other controls very smooth and pleasant; the detented position of the tuning-dial brake is a nice touch.

   I would personally have preferred the oblong, backlit buttons as encountered on the IC-706 and IC-703 front panels to the shiny plastic bezel with its flat keys surrounding the TFT display screen. The small dot in the center of each key (except MENU up/down) was a little confusing to me, as it resembled an LED which I expected to light when pressing the key.

   The toggling PBT/Memory Channel-RIT function was easy to use once I grew accustomed to it. This is certainly a very good way of saving front-panel space without hurting the radio's ergonomics. It should also be noted that all memory and call channels are tuneable; the stored frequency can be temporarily changed in memory mode via the tuning knob or HM-151 keypad. This operation resembles that on other Icom HF transceivers.

   The radio is solidly constructed and superbly finished. It conveys a smooth, precise feel.

2. **TFT Display:** The display is a thing of beauty! Although it is relatively small (2.5" diagonal), I found the display very attractive to look at and highly legible. The image is sharp, bright and colorful. Even the "fine print" text associated with meter displays is reasonably easy to read. The display is very configurable, and can be set up to present the operating frequency in a large font with very little other information. This uncluttered view is optimum for mobile use, as it is not distracting. ***Screenshots:*** *http://www.qsl.net/ab4oj/icom/ic7000/images/graphics.wmv*

   Filter settings and feature activation are displayed via on-screen icons. Some of these are quite small, but I found them easily readable. Given the small screen size, the spectrum scope, RTTY, SWR plotter and other specialized displays are surprisingly comfortable to view. Menu navigation is quite easy, even as compared to the IC-706MkIIG or IC-703.

   I found the pop-up screens activated by certain controls convenient and legible. They stay visible sufficiently long for the user to absorb their "message".

The IC-7000 has a video output which can be connected to an external monitor. The screen image on a 15” diagonal TFT flat-panel monitor is striking and extremely legible, although there is noticeable pixelation of small characters. For mobile operation, an inexpensive 7” diagonal flat-panel TV monitor can be connected to the radio.

3. **On-Air Narrow Filter Check:** For a quick check, I performed the ***W8LX Test*** by tuning in WWV on 15 MHz, and selecting a 50 Hz CW filter. *http://www.qsl.net/ab4oj/icom/w8lx.html* As described in the test procedure, I was able to separate out the carrier, tone sidebands and ticks of the WWV signal without mutual degradation. I did observe a little more ringing than I had when running this test on the IC-756Pro III.

4. **BPF vs. Non-BPF Filters:** As in the IC-756Pro series and the IC-746Pro, the IC-7000 allows the user to select two additional shape factors *(BPF = 1.2 and non-BPF = 1.5)* for 500 Hz or narrower filters, in addition to the SHARP and SOFT* shape-factor selections.

   To configure a BPF filter, select a 500 Hz or narrower CW, RTTY or SSB-D filter with Twin PBT zeroed. Unlike the IC-756Pro series, the IC-7000 does not display a BPF icon, but the filter pop-up shows a graphic of the form _[]_. To set up a non-BPF filter, select a filter with BW > 500 Hz, and reduce BW to 500 Hz via Twin PBT. The filter pop-up graphic will now be of the form _/_.

   ** I found that the 500 Hz CW SOFT shape-factor setting attenuated a signal at 520 Hz offset slightly more than the SHARP setting.*

5. **MNF (Manual Notch Filters):** Both tuneable notch filters are inside the AGC loop, and are very effective. In a test with WWV, F1 notched out the carrier and F2 the fundamental of the tone. Unlike the case of the IC-756Pro series, ANF (Automatic Notch Filter) and MNF can be activated together. The combination of ANF, MNF and Twin PBT places a powerful QRM-management toolset in the operator’s hands.

6. **RTTY Receive Features:** I tuned in an RTTY QSO on 20m. The RTTY Decoder captured the transmitted text flawlessly, and the “waterfall” and baseband spectral display were excellent for fine tuning. I found it remarkable that such a compact transceiver could incorporate this level of sophistication in RTTY reception. Again, I did not find the screen overcrowded, even with the RTTY displays active. It would be great if these displays could also be made available for PSK31.

7. **NR (Noise Reduction):** The DSP NR functionality works very well. In SSB mode, the noise level at the receiver audio output is reduced further even when increasing NR level from 9 to 15 *(60 to 100%)**. As NR level is increased, there is some loss of “highs” in the received audio; this is as expected, and is more severe for NR > 9. The measured noise reduction in SSB mode at the NR setting for optimum readability (8 to 9) was about 15 dB, vs. 18 dB in the IC-756Pro III.

   **On the IC-756Pro III, there is no further noise reduction when NR level is increased above 60%.*

8. **NB (Noise Blanker):** I found the IC-7000 NB somewhat less effective than that of the IC-756Pro III. The 75% setting will attenuate repetitive power-line noise fairly well. NB works best in conjunction with NR.

9. **Transmit Audio Adjustments:** The IC-7000 offers 3 TBW (transmitted occupied bandwidth) selections – WIDE, MID and NAR. As in the IC-756Pro III and the IC-7800, the lower and upper cutoff frequencies of the audio response are individually adjustable for all 3 selections, and can easily be reset to default values.

   Unlike other Icom IF-DSP radios, the IC-7000 does not offer a ***bass/treble equalization*** set menu. I assume that this feature was not included due to the anticipation that the supplied HM-151 microphone/control head will be used with the IC-7000.

10. **Brief "On-Air" Report:** In the course of a 20m SSB QSO with Marty KA7GKN, we determined that the "best-sounding" settings (using the HM-151) were WIDE TBW with compression off. (At my home IC-756Pro III station, I normally use a Heil GM-5, with MID TBW and 5 to 6 dB compression.) The received audio sounded surprisingly good on the IC-7000's internal speaker. I observed that the radio became quite warm to the touch, but not too hot to hold onto.

    Tuning around the busy 20m US SSB sub-band with preamp and RF attenuator both OFF, I found the adjacent-channel selectivity and strong-signal behavior excellent. At no time did strong signals appear to "crush" the front end.

    The IC-7000 was connected to a tri-band Yagi for 20m, and to a horizontal loop for 40m.

11. **Spectrum Scope:** The IC-7000 spectrum scope is similar to that of the IC-746Pro, in that it "borrows" the receiver momentarily to sample signal amplitudes during a sweep interval. The SLOW mode "steals" the receiver for 100 mS every second. It will display an approximate overview of the selected band segment, but does not present a real-time band-occupancy image. The sampling action interrupts the received audio briefly, but does not significantly degrade intelligibility.

    The FAST mode yields a quasi-real-time approximate band-occupancy image, but the rapid sampling rate destroys the intelligibility of the received audio almost completely. The single-shot (1-sweep) FAST mode is less disruptive, as it simply mutes the receiver for about 200 mS.

    Some means of triggering a single-shot fast sweep from the "scope off" state would be desirable, to allow the capture of a quick band-occupancy snapshot.

12. **SWR Plotter:** This feature allows the operator to measure and display load SWR over a preselected frequency range. SWR is displayed against frequency in the form of a histogram, with the acceptable range in green and excessive SWR in red. The SWR plotter can be used in conjunction with an autotuner such as the Icom AT-180 or AH-4, or with a manual antenna tuner. It will then show whether the tuner is matching the load correctly over the entire range.

13. **Quick, subjective comparison:** At one point, I connected the IC-706MkIIG and the IC-703 to the station antennas, and tuned them across 20m SSB. This little test left me with the impression that the older radios' analogue IF filtering, limited NR capability, lack of tuneable notch filters and indifferent noise blanker made the older compact transceivers seem quite crude by comparison to the IC-7000.

14. **Conclusion:** After about 5 hours' worth of "cockpit time" on the IC-7000, I am very favorably impressed by its solid, refined construction, smooth operating "feel", impressive array of features and excellent on-air performance. This is a lot of radio in a very compact package.

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Adam M. Farson, VA7OJ/AB4OJ
e-mail: farson@shaw.ca
http://www.qsl.net/ab4oj/

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Appendix 1: MDS and Reciprocal Mixing Noise Tests

As performed in the Icom America Engineering Lab, Bellevue WA, on November 22, 2005

1. **MDS (Minimum Discernible Signal)** is a measure of ultimate receiver sensitivity. In this test, MDS is defined as the RF input power which yields a 3 dB increase in the receiver noise floor, as measured at the audio output.

   Test Conditions: CW mode, 500 Hz filter, preamp off & on, RF attenuator off, NR off, NB off.

Preamp	OFF	ON
Freq. kHz	**MDS dBm**	**MDS dB**
14100	-138	-149
3600	-139	-147

2. **RMN (Reciprocal Mixing Noise)** occurs in a superheterodyne receiver when the noise sidebands of the local oscillator (LO) mix with strong signals close in frequency to the wanted signal, producing unwanted noise products at the intermediate frequency and degrading the receiver sensitivity. Reciprocal mixing noise is a measure of LO spectral purity**.**

   In this test, a strong "undesired" signal is injected into the receiver's RF input at a fixed offset above the operating frequency. The RF input power is increased until the receiver noise floor increases by 3 dB, as measured at the audio output. The reciprocal mixing noise parameter, expressed as a figure of merit, is the difference between this RF input power and measured MDS. The test is run with preamp off. The higher the value, the better the RMN performance.

   Test Conditions: CW mode, 500 Hz filter, preamp off, RF attenuator off, NR off, NB off.

Freq. kHz	Offset kHz	RMN dB
14100	2	90
	3	95
	5	98
	10	100
3600	2	94
	3	101
	5	*
	10	106

** Invalid reading (probably due to internal desensing.)*