PRODUCT REVIEW

ICOM IC-756PROIII HF/6 Meter Transceiver

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On the tongues of Amateur Radio equipment watchers everywhere is this question: "Is the IC-756PROIII really $800[1] better than the PROII?" We'll attempt to shed some light on that issue here. In the interest of full disclosure, subsequent to my review[2] of the IC-756PROII, my wife Jean, N1MJC, purchased one for me. Given that things have not changed awfully much between the PROII and the PROIII, this review will concentrate on the new features and substantive improvements in this newest version of the IC-756 line. You may wish to read or reread the PROII review to get familiar with the general flavor of this radio, assuming you need to.

While the IC-756PROII was built on the framework of the original IC-756PRO (and somewhat less so on the original, more conventional IC-756, which used crystal filters), a significant development intervened between the PRO II and this latest Roman numeral increment. This was ICOM's release of the *very* high end IC-7800, which replaced the worthy and venerable IC-781 in the manufacturer's lineup. ICOM says it has back-engineered some of the '7800's design features into the PROIII. That said, however, the IC-756PROIII is *not* an IC-7800 *lite*.

As one might realistically expect, the PROIII incorporates several improvements over the PROII, which it supplants in the ICOM Amateur Radio equipment lineup. Better yet, it adds some terrific features and the new 60 meter amateur band.

More Pages = Better Radio?

If it's any indication of advancement, the *Instruction Manual* for the PROIII grew by 32 pages from its predecessor's and went from a center-staple booklet to one with a binding like *QST*'s. While it generally tracks the PROII's manual, the PROIII manual is better organized, and the all-important table of contents is in a larger, easier-to-read, typeface. It even includes a brief foreword that extols the virtues of the PROIII, which includes several notes inherited from its immediate predecessor.

These features include claimed *+30 dBm class* third-order intercept on 20 meters and improved third-order intermodulation distortion characteristics, a real-time spectrum scope plus a *mini-scope* function, RTTY demodulator and RTTY message memory transmit and expanded ability to adjust SSB transmission bandwidth. Details to follow.

Almost Identical Twins

Put the PROII and the PROIII side by side and remove their model numbers and you'd be hard put to tell them apart. With one tiny exception, the front-panel labeling is identical, and the 5 inch TFT color display looks only slightly different.

Sherlock Holmes style, I grabbed my large magnifying glass and closely compared the PROII and PROIII displays. While some colors on the later radio's display type look a bit different (the green in one display type choice was more *minty*, for example), the displays are essentially identical. If anything, the contrast is a bit more stark and the hues a bit more vivid on the PROIII. It's hard to improve on an already-terrific display.

Bottom Line

If you liked the PROII, you'll like the PROIII even more—but you will have a tough choice about whether or not to upgrade.

By the way, aside from a few graphical changes or enhancements on the newer model's included documentation, the two transceivers' block diagrams are nearly an exact match.

The Mini-Scope

One complaint from PROII users has been that you could not have the very useful spectrum scope display up on the screen while, for example, accessing the digital voice recorder (DVR) or CW memory keyer screens or any of the menus or metering functions. With the PROII you *can* control the DVR or CW memory keyer with the spectrum scope enabled via an external button box ICOM tells you how to construct in the manual.

No need to head for the junk box and workbench with the PROIII, however. Here's where that "tiny exception" to the front-panel labeling of the PROII vs the PROIII comes into play. Just press and hold the PROIII's now-dual function MAIN/SUB button, which has a new M.SCOPE label right above it, and a miniature version of the spectrum scope pops onto the display (see Figure 4).

After having spent a lot more time with the PROII and the PROIII, including one CW contest, I have to say I've grown quite fond of and even reliant upon the spectrum scope. Having it readily accessible on this latest PRO iteration in the form of the mini-scope is a real plus. The spectrum scope displays even weaker signals, and it presents you with a real-time picture of just what's on the band—including noise—and where.

Press the HOLD key, and you can tune

[1]Approximate cost difference in respective street prices as of December 2004.

[2]R. Lindquist, "ICOM IC-756PROII HF/6-Meter Transceiver," Product Review, *QST*, Feb 2002, pp 70-75.

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to other signals frozen on the display. That's excellent for those times you're looking for activity on bands like 6 meters, where openings can be, well, sporadic.

Moving Beyond Tone Controls

One really cool new feature on the PROIII is enhanced ability to tailor your transmit audio beyond this model's line equalization controls. In addition to the PROII's capability to adjust SSB TX TONE in the bass and treble ranges of the communications audio spectrum, with the PROIII you can dial in customized upper and lower transmit bandwidth (TBW) roll-off frequencies for the wide, mid and narrow ranges.

While the PROIII's TBW choices are *not* unlimited, they do allow for low-end selections for each range of 100, 300 or 500 Hz; on the high end, they're 2500, 2700 or 2900 Hz. This means the absolute maximum SSB transmit bandwidth is 2.8 kHz, a tad less than the PROII. The narrowest TBW remains 2.0 kHz. According to its *Instruction Manual*, the PROII offers *fixed* 2.0, 2.6 and 2.9 kHz transmit bandwidths.

Shunning Shortened Dits

One unheralded PROIII improvement that CW operators will appreciate and most certainly ponder in terms of the cost of "upgrading" from the PROII is in the newer model's keying (see Figure 2). The PROII, as we noted in our earlier review, shortens the *dits* when the radio is in full-break-in mode. ICOM has totally eliminated this defect in the PROIII, and it was a bit of a surprise to find that ICOM never mentions this fact anywhere in its advertising. Both radios sound just fine in semi-break-in (VOX) mode, however.

"+30 dBm Class" Third-Order Intercept Point

ICOM's advertising for the PROIII trumpets what it calls "+30 dBm-class third-order intercept point" performance on 20 meters. This would put it on a par with some of the best receivers we've ever run through the Lab. Third-order intercept (TOI) is a number that many like to use as an all-in-one performance benchmark, since its value derives both from the receiver's sensitivity and its front-end selectivity (specifically, two-tone, third-order IMD dynamic range). The more positive the number, the better, and TOI figures can also be negative.

Although the PROIII *Instruction Manual* doesn't specify the advertised TOI number, an ICOM *Product Guide*, originally in Japanese, spells out the measurement conditions: 100 kHz spacing (wider than our Lab's widest 20 kHz spacing measurement), preamps off and a 2.4 kHz filter bandwidth.

Nonetheless, under the least stringent measurement standard the ARRL Lab uses, the PROII came pretty close to meeting the +30 dBm mark. At 20 kHz spacing, we calculated the TOI at +25 dBm on 14 MHz with both preamplifiers turned off. That works out to a slightly less than a 5 dBm improvement over the PROII, all other things being equal.

Under the same conditions at 5 kHz spacing—something much more akin to *real-world* amateur conditions (and this time well within the passband of the receiver's 15 kHz roofing filter)—we determined the PROIII's TOI to be –17 dBm, 1.8 dB better than the –18.8 dBm we calculated for its predecessor.

Preamps Similar to the IC-7800's—but Does it Matter?

A primary reason I zeroed in on the yardstick of third-order intercept point is because ICOM's literature focuses on the PROIII's reworked preamps, noting they "use the same basic circuit design as the IC-7800 preamplifiers." According to ICOM, preamp 1 is "a noiseless feedback design with push-pull amplifiers" that

Table 1

ICOM IC-756PROIII, serial number 3201064

Manufacturer's Specifications	*Measured in the ARRL Lab*
Frequency coverage: Receive, 0.03-60; 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.	Receive[1] and transmit, as specified.
Power requirement: Receive, 3.3 A (max audio); transmit, 23 A (max).	Receive, 3.4 A; transmit, 21 A. Tested at 13.8 V.
Modes of operation: SSB, CW, AM, FM, FSK, AFSK.	As specified.
Receiver	***Receiver Dynamic Testing***
SSB/CW sensitivity, bandwidth not specified, 10 dB S/N: 1.8-30 MHz, <0.16 μV; 50-54 MHz, <0.13 μV.	Noise floor (MDS), 500 Hz filter: Preamp off / one / two 1.0 MHz –124 dBm / N/A / N/A 3.5 MHz –133 / –140 / –142 dBm 14 MHz –131 / –139 / –141 dBm 50 MHz –132 / –140 / –142 dBm
AM sensitivity, 10 dB (S+N)/N, 1-kHz tone, 30% modulation: 10 dB S/N: 0.5-1.8 MHz,<13 μV; 1.8-30 MHz; <2 μV; 50-54 MHz, <1 μV.	Preamp off / one / two 1.0 MHz 3.7 μV / N/A / N/A 3.8 MHz 1.3 / 0.52 / 0.46 μV 50 MHz 1.7 / 0.65 / 0.51 μV
FM sensitivity, 12 dB SINAD: 28-30 MHz, <0.5 μV; 50-54 MHz, <0.32 μV.	For 12 dB SINAD: Preamp off / one / two 29 MHz 0.6 / 0.26 / 0.21 μV 52 MHz 0.58 / 0.37 / 0.2 μV
Blocking dynamic range: Not specified.	500 Hz filter: 20 kHz *Preamp* off/one/two; 5 kHz *Preamp* off/one/two 3.5 MHz 122/119/115; 102/98/95 dB 14 MHz 121/119/113; 101/98/93 dB 50 MHz 120/116/112; 100/96/92 dB
Two-tone, third-order IMD dynamic range: Not specified.	500 Hz filter: 20 kHz *Preamp* off/one/two; 5 kHz *Preamp* off/one/two 3.5 MHz 102/101/100; 78/74/72 dB 14 MHz 103/100/99; 77/74/71 dB 50 MHz 99/98/97; 76/73/71 dB
Third-order intercept: Not specified.	20 kHz *Preamp* off/one/two; 5 kHz *Preamp* off/one/two 3.5 MHz +24/+15/+7; –18/–29/–35 dBm 14 MHz +25/+14/+5; –17/–29/–35 dBm 50 MHz +21/+8/+1; –19/–30/–38 dBm
Second-order intercept: Not specified.	Preamp off/one/two, +73/+71/+68 dBm.
FM adjacent channel rejection: Not specified.	20 kHz spacing, both preamps on: 29 MHz, 76 dB; 52 MHz, 76 dB.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz spacing, both preamps on: 29 MHz, 76 dB*; 52 MHz, 76 dB. 10 MHz channel spacing: 52 MHz, 108 dB.

Manufacturer's Specifications	Measured in the ARRL Lab
S-meter sensitivity (S9 signal): Not specified.	Preamp off / one / two 14.2 MHz: 53 / 15 / 6.8 μV; 50 MHz: 37 / 9.3 / 4.7 μV.
Squelch sensitivity: SSB, CW, RTTY, <5.6 μV; FM, <1 μV.	At threshold, preamp on: SSB, 3.7 μV; FM, 29 MHz, 0.25 μV; 52 MHz, 0.25 μV.
Receiver audio output: 2 W into 8 Ω at 10% THD.	2 W at 10% THD into 8 Ω.
IF/audio response: Not specified.	Range at –6 dB points (bandwidth): CW (500 Hz): 342-857 Hz (515 Hz)[2]; USB: 232-2724 Hz (2492 Hz); LSB: 236-2730 Hz (2494 Hz); AM: 95-3305 Hz (3210 Hz).
Spurious and image rejection: HF and 50 MHz (except IF rejection on 50 MHz): 70 dB.	First IF rejection, 14 MHz, 103 dB; 50 MHz, 86 dB; image rejection, 14 MHz, 121 dB; 50 MHz, 106 dB.
Transmitter	**Transmitter Dynamic Testing**
Power output: HF and 50 MHz: SSB, CW, FM, 100 W (high), 5 W (low);	HF: CW, SSB, FM, typically 110 W high, <1 W low; 50 MHz: 100 W high, <1 W low;
AM, 40 W (high), 5 W (low).	AM, typically 37 W high, <1 W low.
Spurious-signal and harmonic suppression: ≥50 dB on HF, ≥60 dB on 50 MHz.	HF, 58 dB; 50 MHz, 67 dB. Meets FCC requirements.
SSB carrier suppression: ≥40 dB.	>70 dB.
Undesired sideband suppression: ≥55 dB.	>70 dB.
Third-order intermodulation distortion (IMD) products: Not specified.	See Figure 1.
CW keyer speed range: Not specified.	6 to 48 WPM.
CW keying characteristics: Not specified.	See Figure 2.
Transmit-receive turnaround time (PTT release to 50% audio output): Not specified.	S9 signal, 24 ms.
Receive-transmit turnaround time (tx delay): Not specified.	SSB, 24 ms; FM, 10 ms. Unit is suitable for digital modes.
Composite transmitted noise: Not specified.	See Figure 3.

Size (HWD): 4.4"×13.4"×11.2"; weight, 21.1 pounds.

Note: Unless otherwise noted, all dynamic range measurements are taken at the ARRL Lab standard spacing of 20 kHz.

Third-order intercept points were determined using S5 reference.

*Measurement was noise-limited at the value indicated.
[1]Sensitivity degrades below 150 kHz.
[2]Varies with passband tuning and pitch control settings.

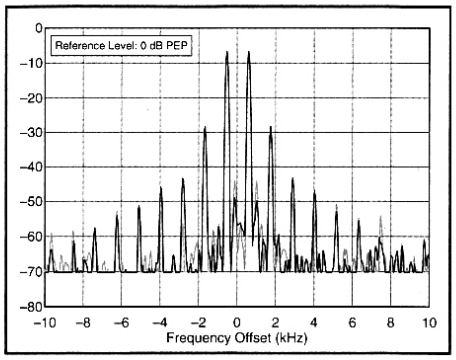

Figure 1— Worst-case spectral display of the IC-756PROIII transmitter during two-tone intermodulation distortion (IMD) testing on HF. The worst-case HF third-order product is approximately 31 dB below PEP output, and the worst-case fifth-order is approximately 51 dB down. The transmitter was being operated at 100 W output at 28.350 (blue) and 50.200 MHz (red). The 6 meter third-order product is approximately 28 dB below PEP output, and the fifth-order is approximately 44 dB down.

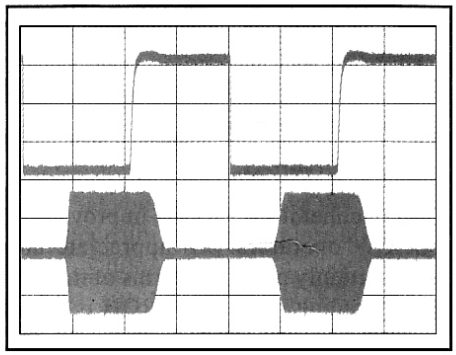

Figure 2—CW keying waveform for the ICOM IC-756PROIII showing the first two dits in full-break-in (QSK) mode using external keying. Equivalent keying speed is 60 WPM. The upper trace is the actual key closure (first closure starting at left edge of figure); the lower trace is the RF envelope. Horizontal divisions are 10 ms. The transceiver was being operated at 100 W output on 14.2 MHz.

yields "a high intercept point." Preamp 2 "uses bipolar transistors for higher gain" instead of a wideband IC, the manufacturer says, "ideal when you use separate low-efficiency receiving antennas such as small loops or Beverages"—antennas typically used on the lower bands.

Also Borrowed from the IC-7800

As it does in the IC-7800, ICOM says, it uses larger inductors in the PROIII's innards with cores less subject to magnetic saturation. "Large inductors can handle both strong signals and weak signals with lower distortion," ICOM's PROIII advertising brochure asserts.

Additionally, in the band-pass filter stage, the PROIII employs "low-distortion diodes with wide frequency characteristics" to minimize distortion products that might propagate throughout the radio.

ICOM also says the PROIII's 64 MHz roofing filter is a fundamental type rather than an overtone type. Its bandwidth is still 15 kHz. The manufacturer claims that a monolithic fundamental crystal filter has a better shape factor and is "less susceptible to intermodulation distortion under strong-signal conditions." This might account for the better dynamic range numbers at 20 kHz spacing.

Overall, the receiver *is* a bit quieter. The PROII and the PROIII both can hear the same signals quite ably, but when it comes down to crunch time, the PROIII has the edge because it yields a noticeably better signal-to-noise ratio.

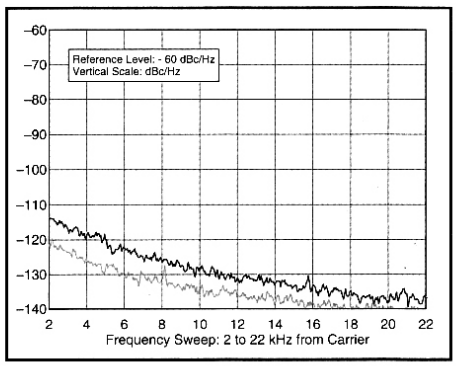

Figure 3— Worst-case tested HF spectral display of the IC-756PROIII transmitter output during composite-noise testing at 14 (blue) and 50.2 MHz (red). Power output is 100 W. The carrier, off the left edge of the plot, is not shown. This plot shows composite transmitted noise 2 to 22 kHz from the carrier..

Quickie Comparisons

The *QST* Product Review of the IC-7800[3] noted an "astounding blocking dynamic range of 137 dB (noise limited)". The TOI on this high-end sibling weighed in at +37 dBm on 14 MHz at 20 kHz spacing and at +22 dBm at 5 kHz spacing, both measured with the preamps off. Although even the IC-7800's preamps degraded performance, the TOI never *quite* fell into the negative range on 14 MHz. The related two-tone, third-order IMD dynamic range measurements on the IC-7800 were 104 dB at 20 kHz (89 dB at 5 kHz).

For purposes of comparison, the best third order dynamic range we've measured at both spacings were in a somewhat more expensive ham bands only unit than the PROIII. It registered a TOI of +20 dBm at *both* 20 kHz and 5 kHz spacing on 14 MHz, preamp off. Turning on the preamp dropped it to +9.9 dBm at both spacings. The corresponding dynamic range measurements were 95 dB at 20 kHz and 92 at 5 kHz. In fairness it should be noted that a ham bands only receiver is much easier to build with good IMD performance than a general coverage receiver with its first IF in the VHF range.

A very popular transceiver with the contesting crowd, and a lower cost radio than the PROIII, had TOI on 14 MHz of +17.9 dBm at 20 kHz spacing, and –6.1 dBm at 5 kHz spacing, preamps off. The corresponding dynamic range measurements were 98 dB at 20 kHz and 73 dB at 5 kHz.

In summary, the PROIII ends up with third order receive performance incrementally better than a PROII, not as good as an IC-7800 (no surprise, I'm sure) or the best in the business, but better than some of its recent competition. It ended up about where I would have expected.

Just Because We Could?

One noteworthy feature of the PRO series has been the ability of these transceivers to decode RTTY. ICOM took this to the next level in the PROIII by adding the capability to transmit RTTY, but only from memories. While this sounds like a really neat thing, it's not quite enough to enable normal RTTY operation.

Think about it: You *could* program some text into the eight RTTY transmit memories, including, of course, your call sign, name, QTH and some other stock phrases. But to transmit the *other* station's call sign, you'll need to be a real whiz.

[3]J. Hallas, "ICOM IC-7800 HF and 6 Meter Transceiver," Product Review, *QST*, Feb 2004, pp 64-70.

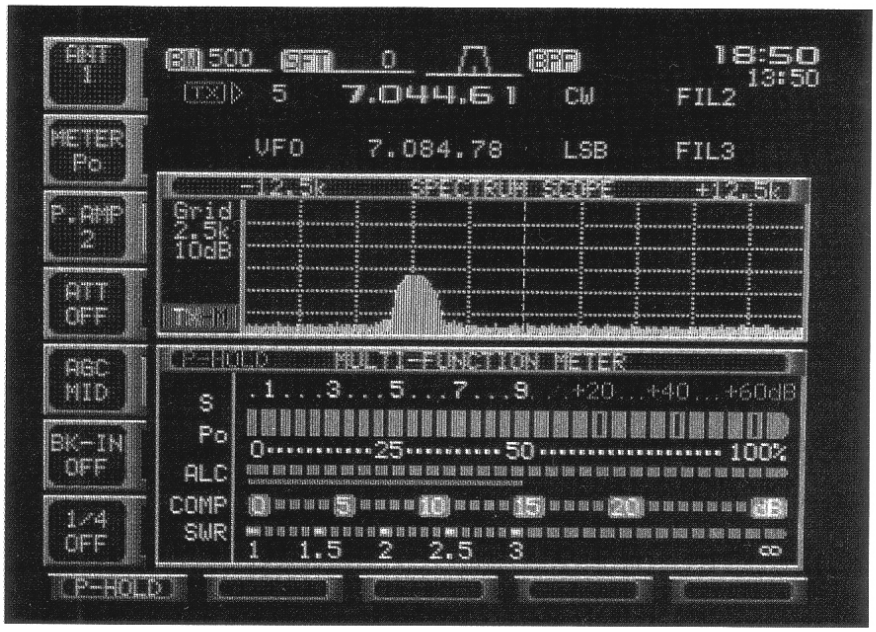

Figure 4—Close-up of the ICOM IC-756PROIII display in MSCOPE mode viewing the spectrum scope and the multifunction meters. Note the dual clocks.

Programming the RTTY and CW keyer memories and applying memory names all work the same way: You select the appropriate programming function, then literally dial in the appropriate text, numerals and punctuation using the tuning knob. By the way, ICOM has included the commat symbol (@) among the CW memory keyer programming choices.

ICOM's slightly changed the font on the RTTY decode screen. On the PROII it's an orangey color. I found the white lettering on the PROIII much easier on the eyes. Also, the decode set functions now are on an associated menu available from the RTTY decode screen. This means not having to go to the regular "others" menu to change settings as you did on the PROII.

60 Meter Operation

As mentioned, the PROIII includes operation on the USA's newest HF band, 60 meters. ICOM conveniently programmed the five frequencies now available into the first five conventional memories and made the appropriate changes to the band-pass filtering to accommodate the new band. A little warning: The PROIII's memories are very easy to overwrite; fortunately, the manual provides the correct 60 meter tuning frequencies if you inadvertently wipe out any of them, as I did.

Two, Two, Two Clocks in One!

A minor but perhaps welcome new doodad on the PROIII is the addition of a second digital clock on the radio's display. Now you can instantly know the correct time (assuming you set the clock properly) in two different zones just by looking at the radio.

Parting Shots

If I were to add anything to the next PRO (if there is one), it would be—as already suggested—2 meter capability. As with the PROII, a TUNE button would be helpful.

Finally, I'd like to see ICOM put a beefier set of linear-switching contacts on the PRO series. Using the radio with many linear amps requires purchasing a third-party accessory or rolling your own external switching device.

Is it Worth It?

Whether or not we've answered the "$800 question" depends on the value you place on the various improvements and features ICOM has incorporated into the PROIII. Among transceivers in this price class, the PROIII is a capable performer and, as far as we've been able to determine, reliable.

I ran my PROII and the new PROIII side-by-side (actually, top-by-bottom). During a contester-crowded band, the PROIII had a slight performance advantage—typically not enough to tell much, if any, difference when switching back and forth between the two radios. The main exception was on the very weakest signals. To me, some of the enhanced features and, because I'm a CW operator, the improved keying, were more important.

Manufacturer: ICOM America, 2380 116th Ave NE, Bellevue, WA 98004; tel 425-454-8155; **www.icomamerica.com**. Price: $2999.99.