



## Product Review and Short Takes from QST Magazine

March 2005

### Product Reviews:

ICOM IC-756PROIII HF/6 Meter Transceiver

Ameritron ALS-600S HF Amplifier with Switching Power Supply

Feedback

### Short Takes:

ICE Model 475-3 AC Line Filter

Copyright © 2005 by the American Radio Relay League Inc. All rights reserved.

## PRODUCT REVIEW

# ICOM IC-756PROIII HF/6 Meter Transceiver

Rick Lindquist, N1RL  
ARRL Senior News Editor

On the tongues of Amateur Radio equipment watchers everywhere is this question: “Is the IC-756PROIII really \$800<sup>1</sup> 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<sup>2</sup> 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

<sup>1</sup>Approximate cost difference in respective street prices as of December 2004.

<sup>2</sup>R. Lindquist, “ICOM IC-756PROII HF/6-Meter Transceiver,” Product Review, *QST*, Feb 2002, pp 70-75.



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

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 measure-

**Table 1**  
**ICOM IC-756PROIII, serial number 3201064**

### Manufacturer's Specifications

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.

Power requirement: Receive, 3.3 A (max audio); transmit, 23 A (max).

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

### Receiver

SSB/CW sensitivity, bandwidth not specified, 10 dB S/N: 1.8-30 MHz, <0.16  $\mu$ V; 50-54 MHz, <0.13  $\mu$ V.

AM sensitivity, 10 dB (S+N)/N, 1-kHz tone, 30% modulation: 10 dB S/N: 0.5-1.8 MHz, <13  $\mu$ V; 1.8-30 MHz, <2  $\mu$ V; 50-54 MHz, <1  $\mu$ V.

FM sensitivity, 12 dB SINAD:

28-30 MHz, <0.5  $\mu$ V;  
50-54 MHz, <0.32  $\mu$ V.

Blocking dynamic range: Not specified.

Two-tone, third-order IMD dynamic range: Not specified.

Third-order intercept: Not specified.

Second-order intercept: Not specified.

FM adjacent channel rejection: Not specified.

FM two-tone, third-order IMD dynamic range: Not specified.

ment 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

### Measured in the ARRL Lab

Receive<sup>1</sup> and transmit, as specified.

Receive, 3.4 A;  
transmit, 21 A. Tested at 13.8 V.

As specified.

### Receiver Dynamic Testing

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

Preamp off / one / two

1.0 MHz 3.7  $\mu$ V / N/A / N/A

3.8 MHz 1.3 / 0.52 / 0.46  $\mu$ V

50 MHz 1.7 / 0.65 / 0.51  $\mu$ V

For 12 dB SINAD:

Preamp off / one / two

29 MHz 0.6 / 0.26 / 0.21  $\mu$ V

52 MHz 0.58 / 0.37 / 0.2  $\mu$ V

500 Hz filter: 20 kHz 5 kHz

Preamp Preamp

off/one/two 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

500 Hz filter: 20 kHz 5 kHz

Preamp Preamp

off/one/two 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

20 kHz 5 kHz

Preamp Preamp

off/one/two 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

Preamp off/one/two, +73/+71/+68 dBm.

20 kHz spacing, both preamps on:

29 MHz, 76 dB; 52 MHz, 76 dB.

20 kHz spacing, both preamps on:

29 MHz, 76 dB\*; 52 MHz, 76 dB.

10 MHz channel spacing:

52 MHz, 108 dB.

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 I is "a noiseless feedback design with push-pull amplifiers" that

## Manufacturer's Specifications

S-meter sensitivity (S9 signal): Not specified.

Squelch sensitivity: SSB, CW, RTTY, <5.6  $\mu\text{V}$ ;  
FM, <1  $\mu\text{V}$ .

Receiver audio output: 2 W into 8  $\Omega$  at 10% THD.  
IF/audio response: Not specified.

Spurious and image rejection: HF and 50 MHz  
(except IF rejection on 50 MHz): 70 dB.

## Transmitter

Power output: HF and 50 MHz: SSB, CW, FM,  
100 W (high), 5 W (low);

AM, 40 W (high), 5 W (low).

Spurious-signal and harmonic suppression:  
 $\geq 50$  dB on HF,  $\geq 60$  dB on 50 MHz.

SSB carrier suppression:  $\geq 40$  dB.

Undesired sideband suppression:  $\geq 55$  dB.

Third-order intermodulation distortion (IMD)  
products: Not specified.

CW keyer speed range: Not specified.

CW keying characteristics: Not specified.

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

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

Composite transmitted noise: Not specified.

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.

<sup>1</sup>Sensitivity degrades below 150 kHz.

<sup>2</sup>Varies with passband tuning and pitch control settings.

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-ef-  
ficiency 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 mag-  
netic saturation. "Large inductors can  
handle both strong signals and weak sig-  
nals with lower distortion," ICOM's  
PROIII advertising brochure asserts.

Additionally, in the band-pass filter  
stage, the PROIII employs "low-distort-  
ion diodes with wide frequency charac-

## Measured in the ARRL Lab

Preamp off / one / two  
14.2 MHz: 53 / 15 / 6.8  $\mu\text{V}$ ;  
50 MHz: 37 / 9.3 / 4.7  $\mu\text{V}$ .

At threshold, preamp on:  
SSB, 3.7  $\mu\text{V}$ ;  
FM, 29 MHz, 0.25  $\mu\text{V}$ ;  
52 MHz, 0.25  $\mu\text{V}$ .

2 W at 10% THD into 8  $\Omega$ .

Range at -6 dB points (bandwidth):  
CW (500 Hz): 342-857 Hz (515 Hz)<sup>2</sup>;  
USB: 232-2724 Hz (2492 Hz);  
LSB: 236-2730 Hz (2494 Hz);  
AM: 95-3305 Hz (3210 Hz).

First IF rejection, 14 MHz, 103 dB;  
50 MHz, 86 dB;  
image rejection, 14 MHz, 121 dB;  
50 MHz, 106 dB.

## Transmitter Dynamic Testing

HF: CW, SSB, FM, typically 110 W high,  
<1 W low;

50 MHz: 100 W high, <1 W low;  
AM, typically 37 W high, <1 W low.

HF, 58 dB; 50 MHz, 67 dB.

Meets FCC requirements.

>70 dB.

>70 dB.

See Figure 1.

6 to 48 WPM.

See Figure 2.

S9 signal, 24 ms.

SSB, 24 ms; FM, 10 ms.

Unit is suitable for digital modes.

See Figure 3.

teristics" 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 fil-  
ter 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 notice-  
ably better signal-to-noise ratio.

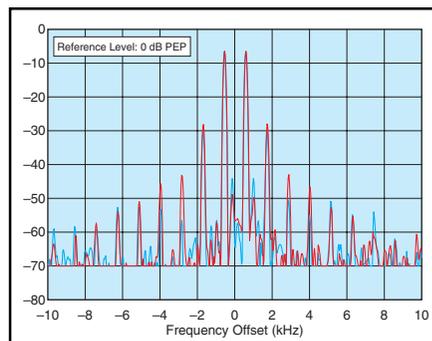


Figure 1—Worst-case spectral display of the IC-756PROIII transmitter during two-tone intermodulation distortion (IMD) testing on HF. The worst-case HF third-order product is approximately 31 dB below PEP output, and the worst-case fifth-order is approximately 51 dB down. The transmitter was being operated 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.

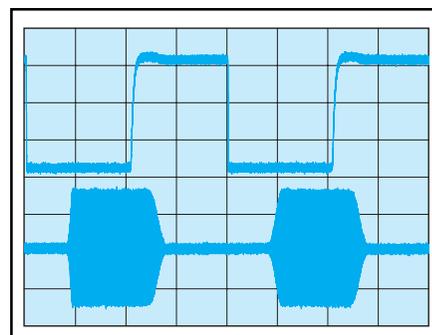


Figure 2—CW keying waveform for the ICOM IC-756PROIII showing the first two dits in full-break-in (QSK) mode using external keying. Equivalent keying speed is 60 WPM. The upper trace is the actual key closure (first closure starting at left edge of figure); the lower trace is the RF envelope. Horizontal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

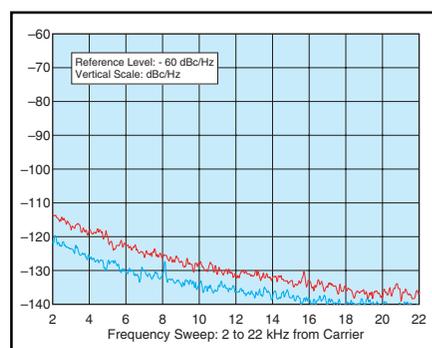


Figure 3—Worst-case tested HF spectral display of the IC-756PROIII transmitter output during composite-noise testing at 14 (blue) and 50.2 MHz (red). Power output is 100 W. The carrier, off the left edge of the plot, is not shown. This plot shows composite transmitted noise 2 to 22 kHz from the carrier..

## Quickie Comparisons

The *QST* Product Review of the IC-7800<sup>3</sup> 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.

<sup>3</sup>J. Hallas, “ICOM IC-7800 HF and 6 Meter Transceiver,” Product Review, *QST*, Feb 2004, pp 64-70.

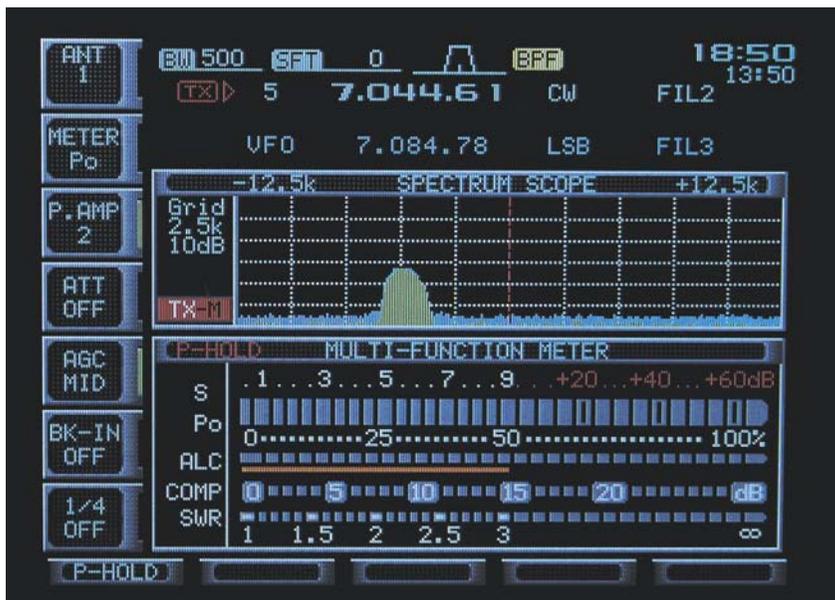


Figure 4—Close-up of the ICOM IC-756PROIII display in MSCOPE mode viewing the spectrum scope and the multifunction meters. Note the dual clocks.

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 orange 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](http://www.icomamerica.com). Price: \$2999.99.

# Ameritron ALS-600S HF Amplifier with Switching Power Supply

Walt Stinson, W0CP

ARRL Foundation Director

Is measuring watts per pound any way to evaluate amplifiers? If so, the ALS-600S just moved way up in the ranking. With its new switching power supply, the overall weight of the amplifier and power supply has dropped almost in half, from 44.5 to 22.5 pounds. Wary of back strain from moving amplifiers around the shack, my first reaction upon picking up the amplifier from UPS was “where’s the other box?” The amplifier and power supply were shipped in one outer box, with a total shipping weight of just 36 pounds.

## So What’s in this Little Box?

The ALS-600S is an upgrade of the popular ALS-600.<sup>4</sup> The only difference between the two models is the power supply. In fact, the new power supply is perfectly compatible with earlier ALS-600 RF decks and can be purchased separately. If that were all there is to it, this review could end here. However, the ALS-600S is so much lighter than its predecessor that it deserves a fresh look.

The ALS-600S utilizes four MRF-150 MOSFET RF output transistors. This device is used by many manufacturers in both transceivers and solid-state amplifiers (including the ICOM IC-7800 and IC-PW1, Yaesu Quadra and the discontinued Ten-Tec Hercules). It is a tried and true transistor, originally developed by Motorola and now produced by MA/COMM. Each device is rated at about 300 W of power dissipation. At the specified output of 600 W, the ALS-600 would require a minimum of 923 W of dissipation at 65% efficiency into 50  $\Omega$  load, so there’s some welcome headroom in this design. The ALS-600 RF deck was designed for Ameritron by Tom Rauch, W8JI, who also had a hand in engineering the noise filtering for the new SPS power supply.

Solid-state FET amplifiers have several obvious advantages. Because the output network is broadband, they do not require tuning. Operation is as easy as setting the correct frequency range on the band switch. Moreover, unlike tubes, the output devices do not deteriorate with use. High voltages are not present, so arcing is not a problem, and the MRF-150 is

<sup>4</sup>R. Lindquist, N1RL, “Product Review—Ameritron ALS-600,” *QST*, Aug 2001, pp 73-76.



said to have about the same high-order intermodulation distortion and momentary overload tolerance as vacuum tube finals. No-warmup operation provides an instant boost in power at the press of a switch.

With such advantages, one wonders why solid-state amplifiers aren’t more popular. One problem has been the power supply. Apparently, it has been easier and less expensive for manufacturers to build a high voltage, low current supply for tubes than to build a high current low voltage switching supply (with low RF noise) for transistors. Ironically, until now, the weight advantage of solid-state designs was lost in the conventional power supplies they employ.

Tunable tube amplifiers have some clear advantages of their own. The adjustable output networks they employ can be tuned to compensate for imperfect SWR and thus buffer the tubes from the “outside world,” which in amateur service can be pretty harsh at times. In solid-state amplifiers high SWR can cause current and power dissipation to exceed the rating of the output devices. So, RF power FETs, like those in the ALS-600S, require protection from excessive SWR to prevent heat damage. Of course, an antenna tuner can be used with antennas that do

not present a matched load, just as with solid-state transceivers.

## What Keeps it Going?

The ALS-600S employs several important protection schemes to improve reliability. At 70 W of reflected power, the amplifier will fault and automatically switch to standby. At 600 W output, this will occur when the SWR exceeds 2:1. With power output reduced to 300 W, the amplifier will fault at about a 3:1 SWR. Toggling the STANDBY switch puts the amplifier back into operation. One way to avoid switching into fault mode is to use the ALS-600’s automatic level control (ALC) system to reduce exciter power automatically when the SWR rises. This requires the connection of a shielded audio type cable between the exciter and the amplifier. The manual does a good job of explaining how to set up this system. The amplifier will also switch to fault mode if the band selector is set below the operating frequency. A thermal protection circuit will force the amplifier into standby mode when it senses excessive heat. The amplifier will remain in this mode until the operating temperature drops to a nominal range. Overheating can occur while employing extended duty cycle modes that tax the cooling system, or by exceeding the power dissipation rating of the final transistors—through overdriving or high SWR.

Ten and 12 meter operation requires the addition of a filter board (MOD-10MB), available from Ameritron for \$29.95 and a copy of an amateur license. We had a bit of a problem with our filter. The capacitors on the edge next to the meters (see Figure 6) were installed in such a way that the filter did not have

## Bottom Line

With its new switching power supply, the ALS-600 has become a great choice for those who like to travel with power, or even those who like to be able to move equipment in their stations without hurting their backs!

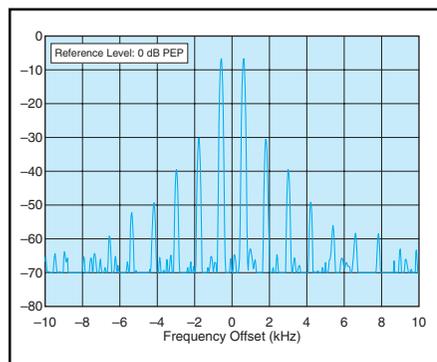
**Table 2**  
**Ameritron ALS-600, serial number**

<b>Manufacturer's Specifications</b>	<b>Measured in ARRL Lab</b>
Frequency range (US units): 1.5-22 MHz. <sup>1</sup>	As specified.
Power output: 600 W PEP, 400 W CW.	As specified for SSB and CW.
Driving power required: 100 W maximum.	Typically 100 W.
Input SWR: 1.5:1 maximum.	As specified.
Spurious signal and harmonic suppression: Not specified.	49 dB.
Intermodulation distortion (IMD): 25 dB.	See Figure 5.
RF unit power requirements: 50 V dc at 25 A, $\pm 14$ V dc at 1 A.	
Power supply power requirements: Strappable for 90 to 130 or 185 to 260 V ac.	11 A at 120 V ac.
RF unit size (HWD): 7.1"×9.5"×12", weight, 12.5 pounds.	
Power supply size (HWD): 6"×9"×14", weight, 10 pounds.	

<sup>1</sup>As shipped from the factory, operation on 12 and 10 meters is disabled. The ALS-600 can be modified for operation above 15 meters by the purchase of an optional kit. Information on this kit is available from Ameritron by written request, which should include a copy of the owner's valid Amateur Radio license.

enough clearance. ARRL Lab Engineer Michael Tracy, KC1SX, was able to remove, invert and reinstall the capacitors so the unit would fit as intended. Ameritron has identified the manufacturing problem and has corrected it for new shipments. If your filter doesn't fit, they request that you return it for a replacement.

After removing the top cover, the plug-in board was quickly and easily mounted to the main filter board with four screws. Figure 6 shows the board installed in the amplifier. When reinstalling the cover, I was careful to put the vent holes on the same side as the heat sink, as the proper alignment is not otherwise indicated. Full break-in (QSK) operation can be provided with the optional pin-diode switch,



**Figure 5—Worst-case spectral display of the Ameritron ALS-600S during two-tone intermodulation distortion (IMD) testing. The worst-case third order product is approximately 30 dB below PEP output, and the worst-case fifth order product is down approximately 40 dB. The transmitter is being operated at 600 W PEP output at 14.02 MHz.**

model QSK-5. We didn't test this feature.

### Taking the ALS-600S on the Road

I like to compete from outside the US in DX contests. DXpeditioners have long put a high value on reducing weight, and amplifiers traditionally present a problem. In late 2001, I acquired a commercial 50 V switching supply and mated it to the ALS-600 RF deck, just for fun. Jim McCobb, W1LLU, and I used this setup in the 2002 ARRL DX Phone Contest, racking up 4500 QSOs as V31DJ. Figure 7 shows the author operating his compact medium-powered travel station.

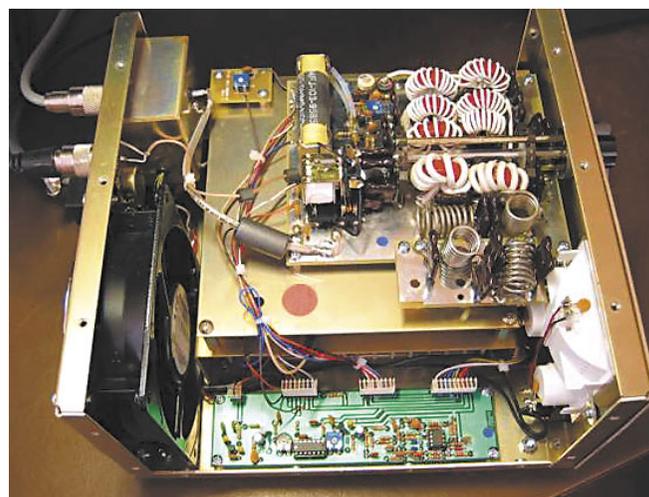
Switching power supplies are now standard fare for powering 12 V gear, but they haven't been used much for amplifiers. Aside from the 50 V requirement of the MRF-150, a big stumbling block is radiated noise. At V31DJ, interference

from the commercial switching supply was a problem on some frequencies, especially with the Yagi directly over the shack, and it cost us some contacts. This experiment made it quite clear that switching power supplies intended for amateur use require significant filtering that is absent in general purpose commercial units.

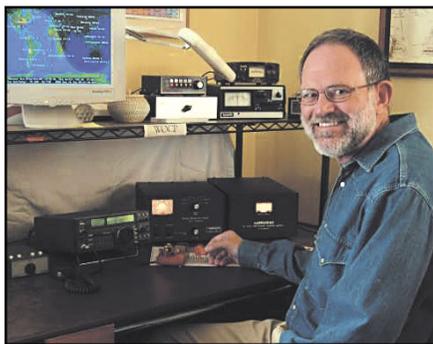
Operating 160 through 10 meters in the multi-operator, single-transmitter class, we unintentionally abused the ALS-600 in just about every possible manner. Nonetheless, I am happy to report that the amplifier faulted only when it was supposed to. It protected itself from our boneheaded, sleep-deprived band changing maneuvers, and otherwise kept on trucking. One quick toggle of the standby switch was all it ever took to reactivate the amplifier after a fault shutdown. Outside the contest, this amplifier demonstrated its attributes on the non-contest bands, as well. We also gave it a good workout on CW and PSK31, throttling the power back to 500 W, as recommended in the manual. Unlike past trips, after a while I found myself not worrying about damaging this amplifier. It seems quite capable of looking out for itself.

### Behind Door Number Two

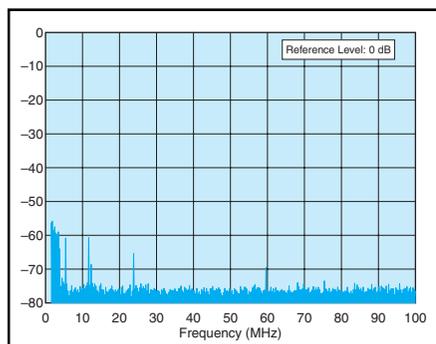
The ALS-600SPS switch mode power supply provides 50 V at 25 A maximum (1250 W) for the MRF-150s and  $\pm 14$  V at 2 A for other circuits. There is a separate 12 V supply for the current surge relay, which also supplies +12 V dc at 200 mA maximum to an auxiliary jack on the rear panel of the RF deck. Jumpers allow input voltages from 90 to 135 V ac or 185 to 260 V ac. In the USA, the correct setting will almost always be 120 or 240 V, and all my operation was at 120 V on an ordinary 15 A household circuit. The SPS interconnects with the RF deck using a



**Figure 6—Interior view of the ALS-600S RF deck. The 10 and 12 meter filter board is attached to the lower right corner of the top board, adjacent to the white meter housing.**



**Figure 7—The author making contacts from his lightweight portable medium power station.**



**Figure 8—RFI measurements of switching power supply.**

6 foot cable with Jones connectors. This power supply uses active regulation, as compared to choke regulation in the conventional unit. As a result, the supply voltage is more stable, which keeps the output transistors happy. The supply has a meter on the front panel and, in operation, no sag was apparent in the voltage at full output. I found that the fan noise from the switching supply was higher than from the conventional supply or the RF deck. Fortunately, the interconnecting cable is long enough to locate the supply on the floor. This arrangement frees up some desk space while reducing annoying fan noise.

### The Results are In

I am happy to report that the ALS-600SPS is a big improvement over the commercial unit I used three years ago. The benefits of engaging a talented RF engineer, who is also a ham, to refine the power supply design are readily apparent when comparing the radiated noise level of the SPS to the commercial unit. I couldn't hear any noise at all from the SPS on the vertical or quad located in the yard next to my shack. I then connected a piece of wire to my transceiver's antenna jack and laid the wire on top of the SPS. I could hear every wall wart in my shack loud and clear, but tuning through the bands and switching the

'600S on and off it took me a few minutes to find one barely audible signal from this switching supply. The ARRL Lab EMI measurements are shown in Figure 8. Kudos to Ameritron.

On the air contacts reported the expected increase in signal strength when the ALS-600 was switched on line. One S unit is nominally 6 dB, although the actual calibration varies quite a bit among various receiver models. At 600 W output, the calculated increase in strength over a 100 W transceiver will be about 8 dB. Notably, at 1500 W output, legal limit, the amplifier will only provide another 4 dB of signal strength—less than an additional S unit.

On SSB, I obtained 600 W output on SSB voice peaks. The theoretical output limit of the amplifier is about 700 W, but it's a good idea not to push it to the limit to keep the distortion products at a low level. Operators on adjacent frequencies will thank you. Operation on RTTY is possible, but it's advisable to keep the output power below 300 W unless an auxiliary fan rated at 80 CFM is utilized.<sup>5</sup> With the fan, the rating goes up to 500 W (with a duty cycle of 2 minutes on, 1 minute off). The standard power supply has a front panel RTTY switch to reduce the high voltage to 30 V and the maximum output to about 275 W. The SPS lacks this feature, so it's necessary to reduce the drive power or get a fan when using digital modes.

### There is Some Room

Over time, I came to greatly appreciate the size, weight, reliability and simplicity of this amplifier. My wife Mary, KØZV, also enjoyed using the amplifier, especially when chasing DX. Still, there are a few improvements I would like to see. Automatic band switching capability would add greatly to the appeal of this amplifier by leveraging the convenience of "no-tuneup." Another plus for CW operators would be a built-in full-QSK arrangement.

I'd definitely like the power supply to be smaller. There appears to be enough room in both the RF deck and SPS to shave another 10 to 20% off the dimensions. This might reduce weight even more. The SPS meter is a nice touch but it seems unnecessary and could be sacrificed in the interest of reducing size and weight.

The lamps in the RF deck and in the power supply meters seem overly bright. The lamps in my original unit burned out after a couple of years. I replaced them with super reliable LEDs. Now that white ones are available, I think LEDs should be standard for meter illumination. The

<sup>5</sup>Pabst 4530Z, part number 410-3140, \$43.

owner's manual, while including comprehensive schematics and operating instructions, lacks a concise specifications page. It includes a brief addendum for the switching power supply, but no schematics. Otherwise, the manual has not been updated for the '600S.

In designing any amplifier there are engineering trade-offs. In the real world there is no *perfect* amplifier. In the past, the desire to achieve high performance and low price has necessitated trade-offs of space and weight. A steady improvement in technology through the ensuing years has permitted size to shrink and weight to drop. For the most part, these advances have not been as evident in amplifiers as they have been in transceivers. For the sake of our backs, it's time for that to change. Hopefully, we'll see more examples in the future. There's nothing fun about lugging around a 60 pound amplifier—or paying excess baggage charges. But now, fellow contesters and DXpeditioners, the ALS-600S makes it possible to pack a transceiver and 600 W amplifier that together weigh less than 30 pounds.

*Manufacturer:* Ameritron, 116 Willow Rd, Starkville, MS 39759; tel 662-323-8211; [www.ameritron.com](http://www.ameritron.com). Price: ALS-600S amplifier with switching power supply, \$1428; ALS-600SPS switching power supply upgrade, \$629; Filter board for 10 and 12 meter operation, \$29.95 (with amateur license); QSK-5, \$349.95. 

## Going Once, Going Twice...

The ARRL-purchased equipment listed below is for sale to the highest bidder.

Details of equipment offered and bidding instructions can be found on the ARRL members' Web page at [www.arrl.org/prauction](http://www.arrl.org/prauction). The following items are available for bid in the March auction:

- Yaesu FT-857D mobile HF/VHF/UHF transceiver
- Yaesu MH-59 remote control microphone
- Emtron DX-1d HF linear amplifier
- SGC SG-211 60 W portable auto-tuner
- Palstar AT4K balanced/unbalanced HF antenna tuner
- MFJ-616 speech intelligibility enhancer
- Diamond MX-72D HF to 2 meter and 70 cm diplexer



## ICE Model 475-3 AC Line Filter

This review process didn't begin in the usual way. Normally, we identify an item that we think might be of interest to you, then purchase the item and put it to the test. The catalyst for this "Short Takes" review, however, was a problem that cropped up in my home station.

I had just upgraded my station computer with a new power supply. The older 350 W model wasn't handling the strain of all the goodies I was adding to the machine, so I decided to install a shiny new 500 W supply. The new power supply worked wonderfully. Mission accomplished—or so I thought.

Settling in for an afternoon of hamming, I switched on my transceiver and selected the 17 meter band. To my astonishment, I was greeted with a blast of noise. As I tuned across the band, the obnoxious roar remained continuous at S6 signal levels. My rig had been effectively rendered deaf as a post.

I selected 15 meters and discovered the same howl throughout the band. Could it be the computer? It hadn't troubled me before, but there was always the first time. I shut down the PC and the noise vanished. Ah-hah!

Following textbook RFI hunting procedures, I rebooted the PC and began disconnecting its rat's nest of cables, one by one. Even after I removed the last cable, however, the noise remained unabated. Either I had a signal on the computer's ac line from the power supply, or the interference was somehow leaking from the computer case itself. I suspected the new power supply.

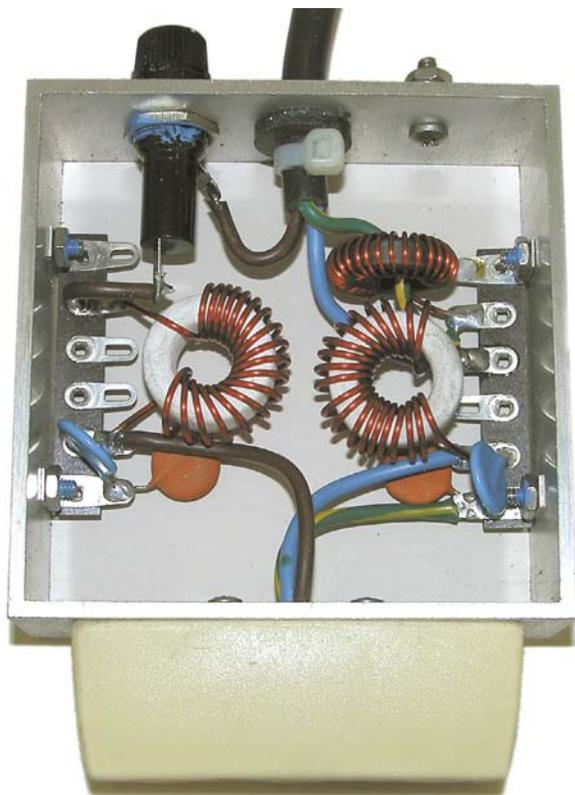


Figure 1—An inside view of the ICE 475-3 ac line filter.



Figure 2—My transceiver display before applying the ICE 475-3 (A) and after (B). Notice that the S-meter display has dropped from S6 to S1.

### To the ARRL Lab for Help

The next day I sought the help of Mike Gruber, W1MG, in the ARRL Laboratory. Mike is the Lab's electromagnetic compatibility (EMC) and radio frequency interference (RFI) specialist.

He listened to my tale of woe, and then reached into a large desk drawer. "Take this home and try it," Mike said as he handed me a metal box with a dangling ac power cord. It was the International Communication Engineers model 475-3 ac line filter.

### The Model 475-3

The ICE 475-3 filter is not a complicated device. It is simply designed to provide inductive isolation, overvoltage control, capacitive decoupling and interference control of both common mode and differential mode signals. Figure 1 shows the interior view.

The 475-3 is specified to handle up to 25 A, so it is adequate for most ham applications. Forty amp models are available as well. The 475-3 is relatively compact at 4 inches square. It includes a 6 foot molded line cord and three 3-wire outlets.

### The Results

I plugged the 475-3 into the wall outlet and plugged my computer's ac power cord into the 475-3. My transceiver was tuned to a quiet frequency on 17 meters and a gentle hiss issued from the speaker. It was the decisive moment.

Holding my breath, I pushed the POWER button on the PC. The fans revved. The PC speaker beeped as the motherboard began booting up. I turned to the transceiver and heard ... nothing. The S meter was still indicating S0 to S1 and the gentle hiss was still gentle. Hallelujah! Figure 2 shows the actual before and after results on 17 meters.

I switched to 15 meters—still quiet. I switched through every band from 80 through 70 cm and was rewarded with the sweet sound of RFI silence. The continuous roar had been vanquished.

### Conclusion

The ICE 475-3 is not inexpensive, but the performance value is considerable. This rugged filter is extremely well designed and manufactured. It may not be a cure-all in every case, but my results were dramatic.

*Manufacturer: Industrial Communication Engineers, Ltd, PO Box 18495, Indianapolis, IN 46218-0495; tel 317-545-5412; [www.iceradioproducts.com](http://www.iceradioproducts.com). \$66.*

