Product Review & Short Takes Columns from *QST* Magazine

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Product Reviews

ICOM IC-746PRO HF/VHF Transceiver

Short Takes

Timewave Technology PK-232/PSK Upgrade

ICOM IC-746PRO HF/VHF Transceiver

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It appears that ICOM is not yielding any momentum in the all-DSP transceiver quarter. Quick on the heels of the all-DSP IC-756PROII (see "Product Review," *QST*, Feb 2002) comes what might be called the economy model, the IC-746PRO, also a DSP-filters-only transceiver. By and large, we hailed the original IC-746 (see "Product Review," *QST*, Sep 1998) as a transceiver that had plenty to offer serious and casual operators alike. When my brother was looking to break out of the vacuum-tube era, he picked up a '746 and has been extremely happy with his choice.

But for optimum performance the original IC-746 required optional (and pricey) crystal filters. With the IC-746PRO, you at least can save the trouble, and the expense, of filtering up the radio. In addition, you'll end up with a lot more flexibility and features formerly available only on the more expensive '756PRO and 'PROII models—and even some not available at all till now.

Even with them sitting side-by-side, it takes a keen eye to distinguish the original '746 from its 'PRO update. The outward changes are pretty subtle, only revealed by close inspection. Inside the box, however, ICOM has grafted DSP filtering onto the already-capable IC-746 framework. The results are gratifying. Not only did ICOM end up making a good box better, they added a few unique features to boot. Let's zoom in on the new IC-746PRO and see how ICOM has again raised the bar for the competition.

A Poor Man's IC-756PROII?

The original IC-746 represented the next logical step after their innovative and extremely popular IC-706 compact/mobile transceiver series. For the '746, ICOM bundled HF plus 6 and 2 meters in a desktop package with a big display screen and lots of creature comforts. It recalled ICOM's top-end IC-781 and closely resembled the much more recent IC-756. With its full reliance on DSP, the new IC-746PRO seems now to owe more to the IC-756PRO and 'PROII, however. Indeed, ICOM's ads have been touting the fact that the '746PRO shares "the same powerplant as the '756PROII," and—particularly for the budget-conscious—this makes the choice between the '746PRO and the '756PROII all the more difficult.

No, there's no delicious color screen or throwback (nostalgic?) analog meter, but the IC-746PRO offers performance (see Table 1) that's comparable with that of its pricier sibling, and includes all-mode 2-meter capability that even the IC-756PROII neglected to add. The IC-746PRO features essentially all of the same bells and whistles found on the original model plus most of those that the '756PROII offers. There are a few new wrinkles too, and ICOM fixed at least a couple of things we'd faulted on the original model.

What's New?

Outwardly, a couple of labels have been changed on the front panel. Where the '746 had an APF/ANF (automatic peak filter/automatic notch filter) button label, the '746PRO now bears an A/NOTCH label. The APF is history—but with the new DSP system, you won't miss it. Additionally, the SPEECH button on the '746 now is a CALL button (to let the operator quickly access a favorite frequency); the old LOCK button—now labeled LOCK/SPCH—serves a dual function. The discerning eye will notice some cosmetic changes too. The MENU button, once black, now is gray; the four buttons adjacent to it, once gray, now are black (yes, we had the same reaction). Keypad button labels are more prominent. The XFC key is now a fashionable teal shade. The bold, easy-to-read monochrome LCD display remains.

The '746PRO incorporates several niceties we soon won't be able to live without. These include enhanced transmit-audio tailoring, a receive audio "equalizer" (of sorts), an adjustable noise blanker, an SWR plotter and "sharp" and "soft" filter shaping—something we first saw on the '756PROII—plus excellent DSP noise reduction and auto and manual IF-level DSP notches.

A lot of the '746 basics remain unchanged, however. If you're coming in late or aren't that familiar with the original '746, we'd *strongly* advise you to check out the earlier reviews of the '746, the '756PRO and the '756PROII (all product reviews are available to members via the ARRL Web site, **www.arrl.org**). Much of the discussion of DSP in our '756PROII review applies equally to this transceiver.

Bottom Line

ICOM has bestowed the digital magic already applied to its IC-756PROII to this updated economy model—which continues to offer all-mode HF, 6 and 2-meter capability. The IC-746PRO also incorporates some novel features not yet available elsewhere.

Selectivity!

The introduction of the ICOM "PRO"

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series of transceivers finally may have nudged Amateur Radio across the great digital filter divide—at least on a grand scale. Our equipment appears to be advancing into an era where DSP not only stands ready to subsume IF filtering roles once considered the sole domain of analog crystal and mechanical filters but perform multiple other signal-enhancing tasks only dreamed of a few years ago. This shift to DSP filters is what distinguishes the IC-746PRO from its predecessor. The radio's 32-bit floating point IF digital signal processing coupled with a 24-bit analog-to-digital/digital-to-analog converter yields the digital equivalent of dozens of filter selections at the push of a button or the twist of a knob.

What does this mean in practical terms? *Selectivity, selectivity, selectivity*! To get an idea of how far we've come in the past 70 years or so, an ad in a late 1920s call sign book we've got at ARRL Headquarters trumpets the attainment of "10 kc selectivity." Imagine!

On the original '746, your ability to enhance selectivity was limited to the number of optional crystal filters you could afford and/or fit in the radio—two optional in the 9-MHz IF and one optional in the 455-kHz IF. Each filter can cost as much as $150. With three optional filters installed, and assuming my math is correct, this works out to a maximum of six filter choices—if you count "no optional filter" in either IF as one of the choices. And accessing all of the various permutations and combinations will send you back to the menu. The only DSP selectivity enhancements available were the notch filter and automatic peak filter.

The IC-746PRO's DSP engine changes everything. It makes available the equivalent of up to 51 standard-bandwidth filters, each in soft or sharp flavors (hence a marketing-oriented individual might want to claim "102" filter choices). With the IC-746PRO, you can dial up SSB and CW bandwidths ranging from 3.6 kHz down to a razor-thin 50 Hz, selectable via the front-panel system of menus and function buttons, and you'll never have to spring for or install another optional filter again. Such a deal!

The "soft" filter shape—which we first encountered with the '756PROII—rounds the sharp shoulders of the digital filter and imputes mellower sounding audio on SSB; on CW you won't notice much difference except slightly less ringing at narrow filter bandwidths. One slight advantage of the "soft" filters is that they seem to offer better SSB readability at narrower bandwidths—right down to about 1.2 kHz! And up until now you've probably considered 1.8 kHz a "narrow" SSB filter! (Remember that vaunted "10 kc" bandwidth?)

You can customize three quick filter choices for SSB and for CW, each selectable from the front-panel FILTER button. For example, you'd probably want wide, medium and narrow filters for each mode—say 2.8, 2.4 and 1.8 kHz on SSB and maybe 800, 500 and 250 Hz for CW. But you don't *have to* go that route. If you'd rather have a choice of narrow, very narrow and extremely narrow, you can do that. It's *your* call, because there are plenty of filter choices to go around.

Even after you've set up your basic filter selections it's super simple to change bandwidths on the fly or to further customize for current conditions using the DSP TWIN PBT (twin passband tuning) controls. These let you narrow the IF passband from either side and/or shift its position, so once you have selected one of your "standard" filters, you can tweak further using the TWIN PBT. Push the PBTC button to promptly clear any twin PBT settings.

For AM and FM, there are three fixed filter bandwidth selections—3, 6 and 9 kHz on AM (the IF shift remains available) and 7, 10 and 15 kHz on FM (no IF shift available).

For RTTY reception, the choices are 250, 300, 350, 500 or 1 kHz, plus there's a twin-peak filter (TPF) you can kick into play for additional QRM-fighting capability on that mode. The IF shift function continues to work in that mode as well.

Side by Side by Side

Of course, we had to see how the IC-746PRO stacks up with the original model as well as how it compares to the IC-756PROII, with which it shares much in common. This was an interesting exercise. It was confusing too, because not all of the PRO models share the same features.

The original '746 incorporated limited DSP features such as noise reduction and notching, but these operated on the audio-frequency level, not at the IF. We've already discussed what this means in terms of filter flexibility. The souped-up DSP engine in the '746PRO also makes possible many of the other features or enhancements the original model does not have:

- IF manual and automatic notch filters, just as on the '756PRO and 'PROII. These were AF-level DSP on the '746.
- A variable noise blanker level. Its lack in the '746 was something we'd "lamented" in our review. Now, you can insert only as much blanking as you need, minimizing the signal-degrading side effects. This was a feature that first appeared in the 'PROII.
- Three AGC settings—fast, mid, slow—plus the ability to choose from 13 time-constant settings for each AGC level in SSB, CW, RTTY or AM modes! (FM has a fixed time constant.) You can turn off the AGC if you wish. This is yet another feature "inherited" from the '756PRO and 'PROII. The original '746 offered only fast and slow AGC settings with fixed time constants—or off.
- The ability to select a transmit passband filter. You can pick wide (2.8 kHz), mid (2.4 kHz) and narrow (2.2 kHz) transmit passbands depending on your operating style, say wide or mid for casual operation and narrow for cutting through the contest or DX pileups. The original '746 did not offer an equivalent feature.
- Adjustable transmit audio treble and bass response. This is something we enjoyed on the '756PRO and 'PROII models, but only in a limited fashion on the original '746. ICOM variously calls this a "microphone equalizer" (a bit of overstatement) or a "microphone tone control" (more accurate). In essence, the TCN menu item lets you adjust bass and treble response of your transmit audio over a range of +5 dB to –5 dB on each scale (default is 0 dB). This lets you customize the transmit audio to suit just about any voice. The original '746 had a more rudimentary transmit tone control.
- The TCN menu item also reveals a receive tone control that operates in a similar fashion to the transmit audio adjustment. The '746 offered no equivalent feature.
- A voice squelch (VSC) and conventional squelch are standard on the IC-746PRO, and VSC is a feature that's new with this model. More later on this very cool enhancement.
- The CW memory keyer on the IC-746PRO now is controllable via both the front panel (as in the earlier model and the IC-756PRO and 'PROII) as well as via an external accessory. The down side is that you'll have to construct the accessory interface yourself. The up side is that with the external control interface, you can control the memory keyer while keeping other menus up on the screen instead of the memory keyer interface. CW memories hold up to 50 characters, and the '746 memory keyer remains so easy to program that even those with no knowledge of Morse code can do it. It's also fun to use and handles such things as incremental serial numbers and so-

Table 1
ICOM IC-746PRO, serial number 01484

Manufacturer's Claimed Specifications	Measured in the ARRL Lab
Frequency coverage: Receive, 0.03-60; 108-174 MHz; transmit, 1.8-2, 3.5-4, 7-7.3, 10.1-10.15, 14-14.35,18.068-18.168, 21-21.45, 24.89-24.99, 28-29.7, 50-54, 144-148 MHz.	Receive and transmit, as specified[1].
Power requirement: Receive, 3.0 A; transmit, 23 A (maximum).	Receive, 1.9 A; transmit, 20 A. Tested at 13.8 V.
Modes of operation: SSB, CW, AM, FM, AFSK.	As specified.

Receiver

Manufacturer's Claimed Specifications	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; 144-148 MHz, <0.11 µV.	Noise floor (MDS), 500 Hz filter:
AM sensitivity, 10 dB S/N: 0.5-1.8 MHz, <13 µV; 1.8-30 MHz, <2 µV; 50-54, 144-148 MHz, <1 µV.	10 dB (S+N)/N, 1-kHz tone, 30% modulation:
FM sensitivity, 12 dB SINAD: 28-30 MHz, <0.5 µV; 50-54 MHz, <0.32 µV, 144-148 MHz, <0.18 µV.	For 12 dB SINAD:
Blocking dynamic range: Not specified.	Blocking dynamic range, 500-Hz filter:
Two-tone, third-order IMD dynamic range: Not specified.	Two-tone, third-order IMD dynamic range, 500-Hz filter:
Third-order intercept: Not specified.	

Noise floor (MDS), 500 Hz filter:

	Preamp off	*Preamp one*	*Preamp two*
1.0 MHz	–122 dBm	NA	NA
3.5 MHz	–132 dBm	–140 dBm	–142 dBm
14 MHz	–132 dBm	–140 dBm	–142 dBm
50 MHz	–128 dBm	–138 dBm	–141 dBm
144 MHz	–133 dBm	–142 dBm	NA

10 dB (S+N)/N, 1-kHz tone, 30% modulation:

	Preamp off	*Preamp one*	*Preamp two*
1.0 MHz	5.9 µV	NA	NA
3.9 MHz	1.6 µV	0.62 µV	0.51 µV
53 MHz	2.1 µV	0.93 µV	0.6 µV
146 MHz	1.3 µV	0.53 µV	NA

For 12 dB SINAD:

	Preamp off	*Preamp one*	*Preamp two*
29 MHz	0.56 µV	0.25 µV	0.22 µV
52 MHz	0.86 µV	0.34 µV	0.21 µV
146 MHz	0.49 µV	0.18 µV	NA

Blocking dynamic range, 500-Hz filter:

Spacing	*20 kHz Preamp off/one/two*	*5 kHz Preamp off/one/two*
3.5 MHz	124/121/117 dB	100/96/93 dB
14 MHz	125/123/118 dB	100/98/93 dB
50 MHz	127/124/121 dB	101/99/96 dB
144 MHz	114*/112*/NA	100/88/NA

Two-tone, third-order IMD dynamic range, 500-Hz filter:

Spacing	*20 kHz Preamp off/one/two*	*5 kHz Preamp off/one/two*
3.5 MHz	97/95/91 dB	76/73/71 dB
14 MHz	97/96/92 dB	75/74/71 dB
50 MHz	98*/96*/92 dB	77/75/73 dB
144 MHz	84/89/NA	75/62/NA

Spacing	*20 kHz Preamp off/one/two*	*5 kHz Preamp off/one/two*
3.5 MHz	+13.7/+2.6/–5.5 dBm	–17.6/–28.7/–33.7 dBm
14 MHz	+13.5/+3.7/–4.0 dBm	–19.5/–29.3/–35.5 dBm
50 MHz	+18.9/+6.1/–3.1 dBm	–12.6/–25.5/–31.6 dBm
144 MHz	–6.9/–8.6/NA	–20.4/–49.1/NA

called "cut" numbers for contest exchanges.

- The IC-746PRO now synchronizes SSB and CW tuning, so you can toggle between modes on a given frequency without having to retune. This isn't something you'll use a lot, but it's very welcome when you do need it.
- Like the '756PRO and 'PROII, the '746PRO now offers a "data mode" for SSB and includes a 1/4 fine-tuning function in data modes. The SSB data mode setting disconnects the audio input via the microphone connector, turns off the speech compressor and resets the transmit bandwidth, treble and bass controls to their default settings. The '746PRO also incorporates the built-in RTTY decoding feature we enjoyed in the IC-756PRO and 'PROII.
- Something new to the PRO series is the swept SWR graph feature introduced with the '746PRO. We'll have more to say about this terrific feature later.
- Setting the speech compressor level in the original '746 required reaching around to the back panel to adjust a little knob. In the 'PRO version, this is a front-panel accessible menu item.

Totally Excellent

The IC-746PRO is as much (maybe even more) fun to use than the original. There's the excellent (but, in this case, monochromatic) LCD display, of course—just as in the original '746. Important features are all accessible

Manufacturer's Claimed Specifications	Measured in the ARRL Lab
Second-order intercept: Not specified.	Preamp off/one/two, +72/+70/+54 dBm.
FM adjacent channel rejection: Not specified.	20-kHz channel spacing, both preamps on: 29 MHz, 77 dB; 52 MHz, 77 dB; 146 MHz, 73 dB.
FM two-tone, third-order IMD dynamic range: Not specified.	20-kHz channel spacing, both preamps on: 29 MHz, 77 dB*; 52 MHz, 77 dB*; 146 MHz, 73 dB*. 10-MHz channel spacing: 52 MHz, 113 dB; 146 MHz, 97 dB.
S-meter sensitivity: Not specified.	S9 signal at 14.2 MHz: preamp off, 82 μV; preamp one, 28 μV; preamp two, 12 μV; 50 MHz, preamp off, 126 μV; preamp one, 30 μV; preamp two, 15 μV; 144 MHz, preamp off, 58 μV; preamp on, 6.4 μV.
Squelch sensitivity: SSB, CW, RTTY, <5.6 μV; FM, <1 μV.	At threshold, preamp on: SSB, 6.2 μV; FM, 29 MHz, 0.07 μV; 52 MHz, 0.11 μV; 146 MHz, 0.09 μV.
Receiver audio output: 2 W into 8 Ω at 10% THD.	2.3 W at 10% THD into 8 Ω.
IF/audio response: Not specified.	Range at –6 dB points, (bandwidth): CW (500-Hz filter): 329-917 Hz (588 Hz)[2]; USB: 60-2918 Hz (2858 Hz); LSB: 60-2929 Hz (2869 Hz); AM: 76-3058 Hz (2982 Hz).
Spurious and image rejection: HF and 50 MHz, (except IF rejection on 50 MHz), 70 dB; 144 MHz, 60 dB.	First IF rejection, 14 MHz, 123 dB; 50 MHz, 121 dB; 144 MHz, 86 dB; image rejection, 14 MHz, 124 dB; 50 MHz, 118 dB; 144 MHz, 121 dB.
Transmitter	**Transmitter Dynamic Testing**
Power output: SSB, CW, FM, 100 W (high), 5 W (low); AM, 40 W (high), 5 W (low).	HF: CW, SSB, FM, typically 110 W high, 2 W low; AM, typically 39 W high, 1 W low; 50 MHz: CW, SSB, FM, typically 103 W high, 2 W low; AM, typically 39 W high, 1 W low; 144 MHz: CW, SSB, FM, typically 98 W high, 2 W low; AM, typically 39 W high, 1 W low.
Spurious-signal and harmonic suppression: ≥50 dB on HF, ≥60 dB on 50 and 144 MHz.	HF, 58 dB; 50 MHz, 65 dB; 144 MHz, 67 dB. Meets FCC requirements for spectral purity.
SSB carrier suppression: ≥40 dB.	As specified. >60 dB.
Undesired sideband suppression: ≥55 dB.	As specified. >67 dB.
Third-order intermodulation distortion (IMD) products: Not specified.	See Figures 1 and 2.
CW keyer speed range: Not specified.	6 to 40 WPM.
CW keying characteristics: Not specified.	See Figure 3.
Transmit-receive turn-around time (PTT release to 50% audio output): Not specified.	S9 signal, 18 ms.
Receive-transmit turn-around time (tx delay): Not specified.	SSB, 34 ms; FM, 12 ms. Unit is suitable for use on AMTOR.
Composite transmitted noise: Not specified.	See Figures 4 and 5.

Size (HWD): 4.7×13.3×12.5 inches; weight, 19.8 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 250 kHz.
[2]Varies with PBT and Pitch control settings.

via the menus now, and a few new features debut with this model.

Rating the Tuning

Let's face it. The main tuning knob is the control on any given transceiver that gets most of the action. That's probably why it's the always the *big* knob—the *knobbo de tutti knobbi*, the knob of all knobs. So, how the tuning feels, how it plays along with your operating habits, is pretty important. The IC-746PRO has retained the nice rubber-grip knob with a screwdriver-adjustable drag. It's got a spinner dimple too—if you're into that kind of thing.

Tuning rate is an important facet, and the IC-746PRO has taken advantage of advances in this regard implemented on earlier units, including the '706. On SSB, the tuning rate works out to 6 kHz per dial revolution. That doesn't sound speedy, but there are situations where you might want to slow it down even further. At first glance, there doesn't appear to be any way to do that. But wait! The IC-746PRO lets you read out the frequency to 1-Hz resolution! When that's enabled, the SSB tuning rate drops down to a leisurely 600 Hz per revolution.

On CW or RTTY, you want things even slower than that. The default rate is the same as for SSB, 6 kHz per spin of the dial. The 1/4 function—introduced on the IC-706MkII—drops the CW/RTTY tuning rate down to 1.5 kHz per revolution and—with the 1-Hz digit enabled—to a downright lazy 150 Hz per spin.

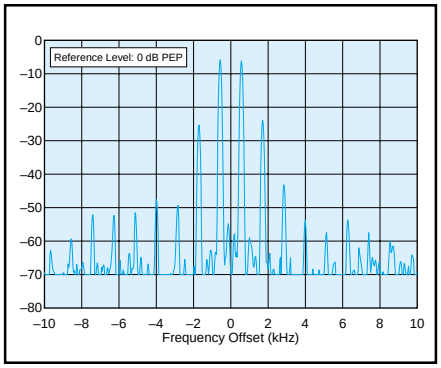


Figure 1—Worst-case spectral display of the IC-746PRO transmitter during two-tone intermodulation distortion (IMD) testing on HF. The worst-case third-order product is approximately 25 dB below PEP output, and the worst-case fifth-order product is approximately 44 dB down. The transmitter was being operated at 100 W output at 28.35 MHz.

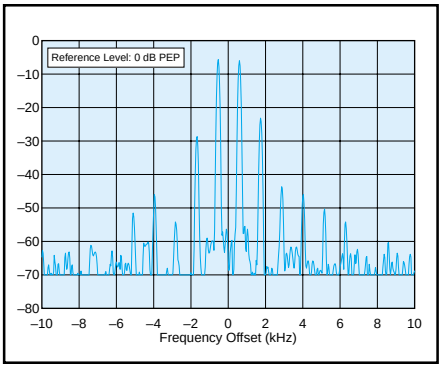


Figure 2—Worst-case spectral display of the IC-746PRO transmitter during two-tone intermodulation distortion (IMD) testing on VHF. The worst-case third-order product is approximately 24 dB below PEP output, and the fifth-order product is approximately 44 dB down. The transmitter was being operated at 100 W output at 144.2 MHz.

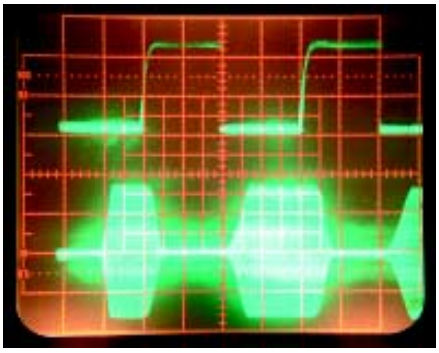


Figure 3—CW keying waveform for the IC-746PRO showing the first two dits in semi-break-in mode. The equivalent keying speed is 60 WPM. The upper trace is the actual key closure; the lower trace is the RF envelope. Horizontal divisions are 10 ms. The transceiver was being operated at 100 W output at 14.2 MHz. Note that the first dit is shortened.

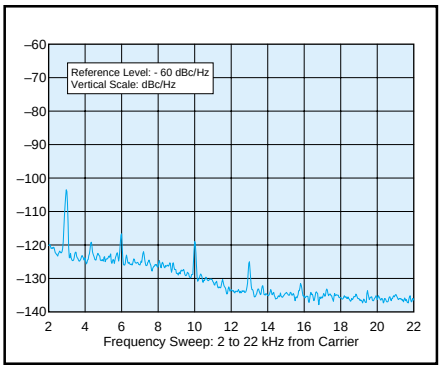


Figure 4—Worst-case tested spectral display of the IC-746PRO transmitter output during composite-noise testing on HF. Power output is 100 W at 3.52 MHz. The carrier, off the left edge of the plot, is not shown. This plot shows composite transmitted noise 2 to 22 kHz from the carrier.

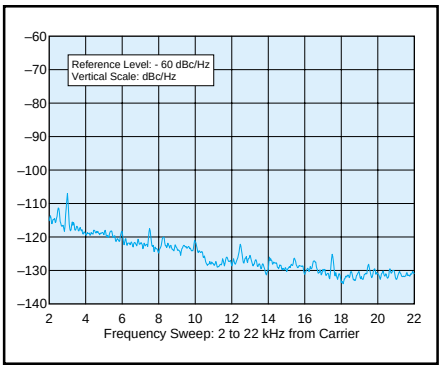


Figure 5—Worst-case tested spectral display of the IC-746PRO transmitter output during composite-noise testing on VHF. Power output is 100 W at 144.02 MHz. The carrier, off the left edge of the plot, is not shown. This plot shows composite transmitted noise 2 to 22 kHz from the carrier.

Split Operation

DXers will appreciate how easy the IC-746PRO makes it to operate "split." The split-frequency system is excellent, and you'll never be in doubt about your transmit frequency, because it's right there on the display. There's a lot of flexibility here, too.

If you prefer, the *Quick Split* set menu function lets you program a "standard" split (such as the typical "up 2" for working DX). The only stumbling block here is that the radio expects you to enter a desired split in megahertz (eg, 0.0020 for 2 kHz), not in kilohertz. Unless you're paying close attention to the decimal place, you could wind up way off your intended mark. Pressing and holding the SPLIT button for a second puts your standard split into play. If the DX pulls a fast one and starts listening up, say 4 kHz, you can equalize the VFOs (press and hold the A/B button for a second), hit F-INP, quickly punch in the correct split (up or down) on the keypad, press the SPLIT button, and you're set (this can be done about as rapidly as it takes to read the description off the page).

If you like the old-fashioned method and want to find a good transmit frequency among the madding crowd, equalize the two VFOs on the DX frequency, swap to the other VFO, seek a clear spot, swap VFOs again and hit SPLIT. Then, to check (and/or change) transmit frequency again, simply swap VFOs.

Pressing the XFC button also lets you momentarily check or adjust your transmit frequency. In that case, the transmit frequency display reads out the amount and direction of the split—thus eliminating the need for messy on-the-fly mathematical computations. The XFC button is conveniently located at around the 11 o'clock position of the main tuning knob; if you're dexterous enough, you can push it and adjust the knob with the same hand. If you're clumsy, just engage the split lock and dial lock functions and push the LOCK/SPCH button. Then, accidentally releasing the XFC button while still turning the tuning knob won't change your receive frequency, but you'll still be able to change your transmit frequency.

Scanning Features

The IC-746PRO has some terrific scanning features, which include programmed and memory (all or selected) scans and something called a ΔF scan—my particular favorite. Press the ΔF button on the menu and you can pick an SPN (span) of 5, 10, 20, 50, 100 or 500 kHz or 1 MHz to scan (from the center frequency). This is handy for a quick look at a piece of spectrum you might want to tune across. There are two scan speeds—high and low. Push the FIN button, and scanning temporarily drops to 10 Hz steps. You can scan for CTCSS and DTCS codes too.

The clever *voice squelch control* (VSC) feature is not just an extremely useful adjunct to scanning, it's a superb standalone feature that works on all voice modes. When VSC is enabled, the radio checks all signals for "voice components" before it breaks squelch (the VSC squelch is separate from the manually adjustable carrier-operated squelch). Anyone who's grown tired of hearing a scanner stop on unmodulated signals emanating from leaky cable systems, repeater kerchunkers and the like can see how desirable VSC could be.

VSC also works on SSB! Enable VSC and tune across a phone band and you won't hear any of the "white noise" or tuner-uppers (or is it "tuners upper"?) between busy frequencies—just actual

signals with voices. It will work even on relatively weak signals, but you might find it annoying when the VSC squelch cuts in and out on a marginal signal.

Graphing Your SWR

Using the built-in LCD SWR "meter," you can read your antenna system's SWR directly. "Yeah, so what?" you say. I can do that with my current radio. Okay, the IC-746PRO also lets you *plot* your SWR. How cool is *that*? You can plot between 3 and 13 points (odd numbers) in 10, 50, 100 or 500-kHz steps. Push the F1 button to start and then repeatedly press PTT or TRANSMIT as many times as necessary to fill the graph with little vertical bars.

You use the main tuning dial to move a little caret beneath each plot point to determine which frequency the bar represents. The horizontal scale, while not calibrated, represents points between an SWR of 1:1 and 4:1, so you can get a visual idea of where your antenna system is resonant and/or how much bandwidth you've got to play with.

This is a very nice feature, but be sure to check for activity at the test point frequencies before you make your measurements, and ID on each of these frequencies when the test is completed.

Decoding RTTY

Unless you're like the John Travolta character in the movie *Phenomenon*, you'll need some kind of TNC or sound card software to decode RTTY. One of the great features ICOM added when it introduced the IC-756PRO was a built-in RTTY decoder. We lauded this inclusion but lamented that ICOM did not also include the ability to plug in a keyboard and transmit RTTY as well. The IC-746PRO also includes this feature, but—sorry—still no transmit. Nevertheless, it's great for checking on what's there without having to boot up a computer—or if you're just doing some monitoring in or out of the amateur bands. You can see up to three lines of text, freeze the text at the push of a button, pick from 1275, 1615 and 2125-Hz mark and 170, 200 or 425-Hz shift settings, and read normal or reverse signals—all without having supernatural powers.

The Numbers Never Lie

Given the lineage of the IC-746PRO, you'd probably figure that the performance numbers (see Table 1) would be pretty much the same across the line. And you would be right. Let's take the nickel tour of how some of the more critical '746PRO numbers line up with those of the original '746 and the IC-756PROII.

All three of these models are plenty "hot" in the front end. Sensitivity (noise floor) numbers were essentially the same across the board—in the vicinity of –131 dBm on 20 meters with the preamp off. We registered mild surprise when we compared blocking dynamic range numbers, which represent the receiver's ability to distinguish between the weakest and strongest signals. Again looking at 20-meter numbers, we measured 125 dB (preamp off, 20-kHz spacing) on the IC-746PRO and 122 dB on the original '746—pretty much a dead heat. Our IC-756PROII came in at 118 dB at 20-kHz spacing, however.

We've recently begun also measuring the "close-in" dynamic range, using 5 kHz as the standard spacing. Here, the IC-746PRO came in at 100 dB, the same number posted by the IC-756PROII.

Getting down to the two-tone, third-order IMD dynamic range numbers, we found little difference among the three units on 20 meters at the 20-kHz spacing (preamp off)—it ranged from 97 dB on the two 'PRO models and 99 dB on our original '746. The close-in numbers for the two 'PROs were essentially identical too (we consider a 2 or 3 dB difference to be within sample-to-sample variation or measurement error).

We were pleased to learn that the two-tone, third-order IMD dynamic range numbers for the '746PRO compared quite favorably with a competitor's well-known transceiver that's become the gold standard for many DXers and contesters. When we'd reviewed the "gold standard" unit a few years ago, we came up with 97 dB on 20 meters (at 20-kHz spacing). That same radio measured an impressive 142 dB of blocking dynamic range, and the sensitivity (noise floor) was –128 dBm. A later, and related, model turned in a blocking number of 129 dB and a two-tone, third-order dynamic range figure of 101 dB.

We encountered another pleasant surprise when we looked at the '746PRO's first IF rejection numbers for 20 meters. It measured 123 dB, while the original '746 came in at 100 dB and the 'PROII at 94 dB. The IC-746PRO also topped the line in terms of image rejection at 124 dB. The comparable number in the original model was 120 dB; it was 110 dB in the 'PROII. The IC-746PRO also seems to do a slightly better job than its predecessor in terms of SSB carrier suppression.

Unfortunately, one number we'd like to have seen change greatly in the IC-746PRO did not—two-tone, third-order transmit IMD. This number indicates whether the unit will generate undesirable intermodulation products that can lead to splatter. On the worst-case band—10 meters in both cases—third-order products were down by about 23 dB in the original '746 and about 25 dB in the 'PRO. In contrast, the IC-756PROII's worst-case third-order products were down 30 dB—not terrific but getting there. The third-order numbers were about the same on the worst-case VHF band, 2 meters.

On the positive side of the ledger, the IC-746PRO did a better job than the original model in suppressing fifth-order products on the worst-case bands—by about 7 dB on 10 and about 9 dB on 2 meters. (Fifth-order products were down about 40 dB in the '756PROII on its worst-case band HF band, 10 meters; that unit does not have 2 meters.)

Transmitted phase noise on the worst-case band—80 meters on the IC-746PRO and 20 meters on the IC-746—was slightly worse in the 'PRO model, which also exhibited a few prominent spikes.

All This and VHF Too!

If you're trying to decide whether to purchase the IC-746PRO or the IC-756PROII, one of the most important factors—maybe the only factor for a lot of ops—is the inclusion of both the 6 *and* 2-meter bands on the IC-746PRO. The antenna tuner even works on 6 meters, and the '746PRO registers some decent performance numbers on that band, too, with 98 dB of two-tone, third-order dynamic range (77 dB close-in). No slacker there!

Two-meter performance numbers are not quite as impressive as those on 6, but the '746PRO still offers plenty of sensitivity and better FM sensitivity (about 0.5 µV) than on either 10 or 6 meters. The preamps offer additional sensitivity without overly compromising the dynamic range on VHF too.

For repeater work, you can set separate "standard" splits for 10, 6 and 2 meters, and it can be set up to track the US band plan standard in terms of whether the split is plus or minus. There's a tone encoder, and the radio will even encode, decode and display monitored CTCSS or—new with the 'PRO model—DTCS tones. Fifty CTCSS and 104 DTCS tones are supported.

The 100 memories store offset, CTCSS/DTCS tone and other parameters. The IC-746PRO also lets you apply names of up to nine alphanumeric characters (numerals, upper and lower-case letters and punctuation) to memories, and it's very simple to do.

The front-panel's new CALL button retrieves a preferred "call" channel. We say "channel" because once you push the button to go there, the IC-746PRO does not let you use the tuning dial, band keys or keypad to change frequency (you *can* use these controls if you select the "call" channel via the MEM-CH knob). For this reason, most users probably will program in a favorite VHF simplex or repeater

channel, although it could be used for an HF net frequency as well.

The IC-746PRO is 9600-baud packet ready.

Grumblings

Maybe it's a carryover from my radio broadcasting days, but I like to hear my voice in the headphones when I operate SSB. The IC-746PRO includes a monitor that's enabled by a little pushbutton on the front panel apron. Pushing and holding the MONITOR button for a second lets you set the level, but even at 100% it's not loud enough. To really hear it well, you have to also crank up the AF GAIN control to a point where received audio is likely to be uncomfortably loud. Then again, I didn't much like the monitor in the IC-756PROII either.

Those little "stem controls" on the lower front-panel apron leave something to be desired. Unless you're directly face-to-face with the radio, you can't read the labels (they're partially blocked by the stems). Fortunately, the only control you're likely to need routinely (KEY SPEED) is on the right-hand end of the row; the others will be set-and-forget items for most operators.

It's still way to easy to confuse the F1-F5 buttons with the MENU, mode and FILTER buttons located immediately beneath them, but we also can understand ICOM's reluctance to redesign the front panel during this update. The IC-756PROII suffers from the same shortcoming. At the very least, ICOM might want to consider sharply contrasting shades and labeling for these sets of buttons. They all look far too much alike. Operator beware!

We'd griped about the fact that in the full-break-in (QSK) mode, keying was a bit "choppy" on the original '746 when sending at higher speeds—in excess of 30 WPM or so—and this is still the case with the 'PRO. This does not occur in semi-break-in (VOX) mode, however, where no relay is involved. This particular shortcoming recalls the less-than-ideal QSK keying of the IC-706 series.

If you're planning to switch a linear amplifier other than ICOM's IC-PW1 with the IC-746PRO, be advised that the "send" relay contacts can handle 16 V/500 mA maximums. Some amplifiers require huskier switching capabilities. ICOM can provide a schematic for an external transistor switching circuit for those situations.

There's only one level of receiver RF attenuation—20 dB. For most operators with relatively modest antenna systems, this will not prove to be a disadvantage. But the single stage of attenuation might prove to be either too much or—in the case of the station with the better-than-average antenna system—not enough. Just for the record, the IC-756PROII offers a three-step attenuator—6, 12 and 18 dB.

DXers and contesters often want to be able to connect separate receive antennas—such as low-band Beverages—to their transceivers. Unfortunately, you're out of luck with the new '746PRO. It does not offer this capability.

Competent Compromise

Just where does the IC-746PRO fit in the greater scheme of things? This new-and-improved model has even more to offer than the original in terms of features and performance, so it's also more difficult to pigeonhole. It would be a giant step forward for the casual operator who's running say, an older mid-level transceiver or maybe an IC-706 (and the IC-746PRO will seem familiar to the '706 crowd) and has been looking for something to handle a bit more demanding operating regimen. It's a great standby or second radio for the seasoned contester or DXer (and it puts all-mode VHF in the shack). For the value-conscious operator who has limited space and/or wants an all-in-one box, look no further. Only extremely discriminating or particular operators—who usually have more money to spend anyway—likely would be happier consuming higher on the food chain.

Manufacturer: ICOM America, 2380 116th Ave NE, Bellevue, WA 98004; 425-454-8155, fax 425-454-1509; **amateur@icomamerica.com**; **www.icomamerica.com**. Manufacturer's suggested list price: $2265. Typical current street price: $1900. Manufacturer's suggested list prices for selected optional accessories: UT-102 voice synthesizer unit (announces frequency, mode and S-meter reading): $74; CT-17 CI-V level converter (for computer control): $169. QST

NEW PRODUCTS

DIGITAL-MODE SOUND CARD INTERFACE FROM MFJ

▫ Designed to meet the needs of the ever-increasing ranks of digital-mode operators, MFJ's new MFJ-1275 sound card audio interface handles audio I/O and PTT switching tasks between your rig and computer sound card. Required software, cables and a power plug are included. The '1275 provides fully automatic operation with audio-derived and PTT T/R switching, is said to eliminate hum- and RFI-inducing ground loops and works with all transceivers that use round eight-pin or modular mike connectors.

Using the supplied software, users can operate PSK31, packet, APRS, AMTOR, RTTY, SSTV and CW (meteor-scatter and others). When the interface is switched off, normal transceiver operation is maintained. When digital operation is selected, all connections are made between your rig and your computer, and isolation transformers protect against ground loops, noise and distortion.

Other features include PTT override, serial port or VOX T/R switching, level controls for TX and RX audio, stereo and mono inputs, off-air recording capability, a monitor switch and more. Internal jumpers allow the '1275 to be used with a wide variety of mikes and radios with no soldering required. The interface requires 12 V dc. The MFJ-1275 is for rigs that use eight-pin round mike connectors, and The MFJ-1275M is for rigs that require RJ-45 "LAN cable" plugs.

Prices: $89.95 (MFJ-1275/1275M, including all necessary cables and a power plug); $14.95 (MFJ-1312B ac adapter). For more information, contact your favorite Amateur Radio products dealer or contact MFJ, 300 Industrial Park Rd, Starkville, MS 39759; tel 800-647-1800, fax 662-323-6551; **mfj@mfjenterprises.com**; **www.mfjenterprises.com**.

FEEDBACK

▫ In "9-11-01: A Dedication to Public Service" (Apr 2002, p 28), the narrative attributed to Ryan Jairam, AB2MH, was actually submitted by AB2MH but was written by Mike Bartmon, KF2EO.

▫ Concerning the letter from Jim Piper, KD6YKL (Mar 2002, p 24), the kind words are much appreciated, but please correct the record. I did not work for FEMA. I did work for the New York City Red Cross, for Jay Ferron, N4GAA, for whom I was the Red Cross Radio Night Shift Supervisor 9/12 to 9/20, 2001. I agree wholeheartedly with Jim's plea for old hands as well as new hams to get involved with ARES.—*Bart Lee, KV6LEE*

▫ Re my article ("A Quality Sound Card Interface for ICOM Rigs," Mar 2002, p 31) the muting of the front panel mike connector is a feature of the IC756PRO rather than the interface itself. Most (probably all) of the older ICOM rigs will *not* mute the front panel mike connector while running digital modes even though they use the ACC(1) connector and are otherwise compatible with the interface.—*Bob Lewis, AA4PB* QST

Timewave Technology PK-232/PSK Upgrade

Timewave Technology has created a soundcard interface board for the old, reliable PK-232 multimode controller. When it is teamed with *PKTERM* software from Creative Software Services you can be on the air with PSK31 in no time, not to mention the other sound card digital modes.

Installation

The first step is selecting the proper upgrade board. AEA produced several versions of the PK-232, and Timewave is producing another one now. The upgrade kit you need will depend upon the PK-232 you own. I own what is called the "Middle Version" PK-232MBX, so this review is specifically about the model A.06217 PSK upgrade kit. To determine which upgrade kit you need, check the Timewave Web site at **www.timewave.com**. There are three available and they all function the same way. The difference is in how the upgrade board installs in the PK-232. The upgrade uses the external modem port on the PK-232 for connection to the sound card. You will not be able to use the sound card connection and an external modem at the same time.

My installation went smoothly. The wires were the right lengths and all of the holes matched up well. The upgrade board fit neatly within the PK-232.

Testing

The upgrade package comes with a program called *ModemSwitch*. This program allows you to switch your PK-232 between sound card modes and traditional modes. It also provides a manual transmit button for sound card modes that do not yet support PTT directly through the PK-232 upgrade. *ModemSwitch* provides a dumb terminal that can be used to send commands to the PK-232. When you switch to "TNC" you will need to close *ModemSwitch* before opening your TNC software or your computer will become confused about which program is controlling the COM port. It can be left running (and even provide PTT) when in sound card mode. Be sure to download the latest version of the free *ModemSwitch* software from the Timewave Web site. *ModemSwitch* requires the TNC to be in "Terminal Mode" to communicate. In *PKTERM* you can set the PK-232 to "Return to Terminal Mode on Exit." This setting is under the Mode selection in the VHF packet window.

I fired up the *ModemSwitch* software and switched the PK-232 to "Soundcard" and fired-up *AO-40RCV*, the sound card software by AE4JY that allows hams to decode the PSK telemetry beacon from the OSCAR 40 satellite (**www.qsl.net/ae4jy/ao40rcv.htm**). *AO-40RCV* said I needed to reduce the input audio. I moved a jumper on the upgrade board from JH3 to JH4 (Section 2 of the instructions) and it worked beautifully. Some of the noise that always used to be present on the waterfall display with my direct soundcard connection was gone.

Using *ModemSwitch* I switched the PK-232 back to "TNC." Much to my chagrin none of the old modes worked. Everything looked like it was working including the tuning indicator, but no text appeared on my screen. I uninstalled the upgrade and everything worked just fine again. I reinstalled the upgrade and e-mailed Timewave with my symptoms several times over a couple of weeks, but didn't receive a reply. One quick phone call saved the day. They answered the phone on the first ring and in less than a minute the technician talked me through the problem. It turned out that the header connector uses pins that slice through the insulation of the wires to make contact. A gentle push without spreading the connection resulted in good contact. All of the original modes were back.

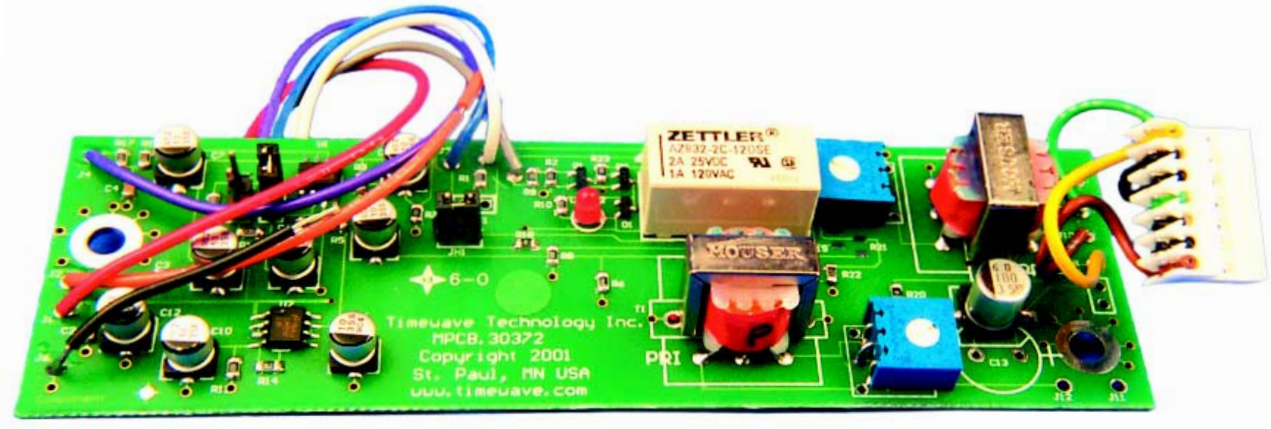
PKTERM

I completed the final tests of my modified PK-232 with the latest version of *PKTERM*, available from Creative Software Services. This versatile software package has several new features in addition to your old favorites. A demo version and upgrades for registered owners are available from **www.cssincorp.com/pkterm/**. *PKTERM* for *Windows* is *the* program for running the PK-232. I think the most impressive new feature is PSK31 operation. It is fully integrated; just click on PSK on the tool bar and the PK-232 switches automatically to sound card mode. The familiar PSK display comes up and you are working PSK31.

Conclusion

Timewave's PK-232/PSK upgrade makes an ever-increasing library of digital mode software available to the PK-232 user. As time goes on, more authors will be taking advantage of the keying and other functions available for sound card software using the PK-232/PSK connection. The PSK upgrade is a great way to get even more out of your PK-232.

Manufacturer: Timewave Technology, 501 W Lawson Ave, St Paul, MN 55117; tel 651-489-5080; **www.timewave.com**; *$69.95.* QST



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