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ICOM IC-R3 Communications Receiver

Reviewed by Steve Ford, WB8IMY
QST *Managing Editor*

When you unpack this little hand-held receiver, your eyes are drawn immediately to the 2-inch color TFT screen. Despite the fact that the 'R3 offers coverage from 495 kHz to 2.450 GHz (816 to 902 MHz is blocked), the first thing most users want to do is watch TV!

Very well. Let's watch TV.

You press the green **POWER** button to bring up the radio, jab the ▶ arrow on the four-way front-panel switch (the user manual refers to this as the *joystick*) until you see channel numbers on the smaller monochrome sub LCD display then, while holding the **FUNC**tion button on the side of the unit, press and hold the ▲ arrow on the joystick. The color screen springs to life and you're watching television! I dialed up channel 3, which has a strong signal in my area, and was treated to a crisp, colorful display. The audio volume is adjusted easily enough by tapping on the joystick button. The IC-R3 also sports a composite audio/video output jack so that you can port the signals to a much larger monitor if you become tired of the 2-inch image.

The only thing that detracted from the otherwise excellent picture was a single red pixel in the display that was continuously on. The pixel appeared as a miniscule dot in the upper middle portion of the screen. The dot wasn't visible all the time; it depended on the nature of the image being displayed. For example, the dot disappears into flesh tones, but is very obvious against a blue sky. A paragraph on the first page of the manual—under "Cautions"—explains that this is not due to a malfunction or failure and is typical for displays of this type.

In addition to broadcast television, you can watch amateur television (ATV) on the 'R3. The rig is capable of displaying FM or AM ATV. In this country, most ATV is AM, but the manual was written under the assumption that *all* amateur TV is FM. This can be a little confusing at first. Just make sure you read the instructions for "TV Frequency (AM TV) Receiving." I tried the 'R3 on the output of a 70-cm ATV repeater located about 10 miles away, but with its 22-inch telescoping antenna, the screen showed nothing but snow. No surprises there. Without a directional antenna you'd need to be practically on top on an ATV repeater to receive it. On the other hand, I was able to view FM TV picked up from a neighbor's 900 MHz remote video link (with the neighbor's permission, of course!).

Bottom Line

The ICOM IC-R3 communications receiver is more than just another scanner. With live video reception—of broadcast and amateur television, and short range RF-based video systems—ICOM opens up a new frontier for the progressive wide spectrum scanner enthusiast.

Below the main and sub LCD displays, there is a row of four buttons. We've already mentioned the **POWER** button. Above and to the right is the **V/M**/**SKIP** button, which is used to toggle between VFO and memory modes, start the memory write process, adjust a memory channel's skip setting, register a frequency to be skipped while searching and edit the alphanumeric tags. The **MODE**/**SET** button is used to change the receive mode, change the step size and enter or leave the SET mode. Finally, we have the **SQL**/**ATT** button, which is used to open the squelch, set the squelch level, set the attenuator level and enable duplex receive. Even the VFO knob has several functions. It is used to change the current VFO frequency, change the currently displayed memory bank and/or channel, and change the value of SET mode parameters.

At the Low End of the Spectrum

You can prowl the AM broadcast band with the 'R3, or sample shortwave broadcasts above 1700 kHz. The audio quality is acceptable, within the limitations of its compact 1-inch diameter speaker (much better with headphones). Sensitivity and selectivity was average if you use the telescopic whip antenna. I plugged my HF longwire antenna into the 'R3 and, of course, signal levels jumped considerably. So did the tendency for the receiver to overload. Fortunately, ICOM had the foresight to include the 4-step attenuator (6, 10, 15 and 30 dB). In all fairness, the 'R3 is intended as a hand-held, portable receiver; it isn't designed to perform like a tabletop unit when connected to an outdoor antenna.

Getting around the bands is a matter of selecting the desired frequency segment with the joystick button, then spinning the VFO knob. You can change the tuning steps up to 1 or even 10 MHz to speed the process (the minimum tuning step is 5 kHz). The faster you twist the VFO knob, the faster you zip across the frequencies. A direct-entry keypad would have been a nice addition to the 'R3, although it would have definitely increased the size of the radio. Even so, the huge 400-memory capacity gives you the abil-

Joe Bottiglieri, AA1GW ♦ Assistant Technical Editor

Table 1
ICOM IC-R3, serial number 01372

Manufacturer's Claimed Specifications	*Measured in the ARRL Lab*
Frequency coverage: Receive, 0.5-816, 902-2450 MHz.	As specified.
Modes of operation: FM, WFM, AM, AM-TV, FM-TV.	As specified.
Power requirements: 0.73 A (maximum volume, TV on, 4.5 V dc); 3.6-6.3 V dc.	0.76 A (maximum volume, no signal), tested at 4.5 V dc.
Size (HWD): 4.7 × 2.4 × 1.3 inches; weight, 10.6 oz.	
AM sensitivity (10 dB S/N): 0.5-5 MHz, 5-30 MHz, 1.0 μV; 118-136 MHz, 0.8 μV; 1.4 μV; 222-330 MHz, 1.0 μV.	10 dB S+N/N, 1-kHz tone, 30% modulation, 1.0 MHz, 1.0 μV; 3.8 MHz, 0.6 μV; 53 MHz, 0.56 μV; 120 MHz, 0.7 μV; 146 MHz, 0.65 μV; 440 MHz, 0.9 μV.
FM narrow sensitivity (12 dB SINAD): 1.6-5 MHz, 0.32 μV; 5-470 MHz, 0.25 μV; 470-800 MHz, 0.45 μV; 800-2000 MHz, 0.56 μV; 2000-2300 MHz, 1.0 μV; 2300-2450 MHz, 1.8 μV.	FM narrow, 12 dB SINAD: 29 MHz, 0.25 μV; 52 MHz, 0.2 μV; 146 MHz, 0.28 μV; 223 MHz, 0.25 μV; 440 MHz, 0.35 μV; 902 MHz, 0.55 μV; 1246 MHz, 0.43 μV; 2400 MHz, 1.1 μV.
FM wide sensitivity (12 dB SINAD): 76-108 MHz, 175-222 MHz, 1.0 μV; 470-770 MHz, 1.8 μV.	100 MHz, 0.9 μV.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz offset: 29 MHz, 44 dB; 52 MHz, 45 dB; 146 MHz, 52 dB*; 440 MHz, 47 dB*; 906 MHz, 47 dB*; 1246 MHz, 43 dB*. At 10 MHz offset, 146 MHz, 56 dB; 440 MHz, 51 dB.
FM adjacent channel rejection: Not specified.	29 MHz, 60 dB; 52 MHz, 56 dB; 146 MHz, 52 dB; 440 MHz, 48 dB; 906 MHz, 47 dB; 1246 MHz, 46 dB.
Spurious and image rejection: Not specified.	First IF rejection: 146 MHz, 38 dB; 440 MHz, 37 dB; 906 MHz, 65 dB; 1246 MHz, 91 dB; 2400 MHz, 69 dB; image rejection: 146 MHz, 61 dB; 440 MHz, 37 dB; 902 MHz, 45 dB; 1246 MHz, 81 dB; 2400 MHz, 8 dB.
Squelch sensitivity (threshold): Not specified.	At threshold: 29 MHz, 0.53 μV; 52 MHz, 0.41 μV; 146 MHz, 0.91 μV; 440 MHz, 1.3 μV; 906 MHz, 3.6 μV; 1246 MHz, 0.37 μV.
S-meter sensitivity: Not specified.	S9: 52 MHz, 1.2 μV; 146 MHz, 2.5 μV; 440 MHz, 3.8 μV; 903 MHz, 9.7 μV; 1246 MHz, 0.95 μV.
Audio output: 100 mW at 10% THD into 8 Ω.	104 mW at 10% THD into 8Ω.

Except as noted, all dynamic range measurements were taken using the ARRL Lab standard spacing of 20 kHz.

*Measurement was noise limited at the value indicated.

ity to store just about every frequency destination you're likely to need. The 'R3 also allows you to attach a 6-character name to each memory channel for quick reference. Without a keypad, however, entering the characters is a tedious, multistep operation that involves hopping through the alphabet with the VFO knob and the joystick button. An optional cable and *Windows* software kit is available for programming the memories with your PC, but I wasn't able to test this feature.

Back Above 30 MHz

The 'R3 really shines above 30 MHz because you can bring the main (color) screen into play as a multifunction display (below 30 MHz, only the sub LCD is available). The frequencies are *much* easier to read on the color display. In addition, you can toggle a combination S meter/volume display, a sweeping bandscope, or an interesting "direction finding" function that temporarily displays and stores S meter readings (for about 5 seconds) as you search for your target. Why the main display is not made available below 30 MHz is puzzling.

I found myself skipping and tuning through a number of VHF, UHF and microwave bands. Switching to FM, I monitored a couple of 6-meter amateur repeaters. FM broadcast reception was quite good, but not in stereo, unfortunately.

AM aeronautical signals seemed a bit sparse, for some reason. Even the local air traffic-control frequencies were relatively quiet. This could have been a function of the 'R3's stock antenna. Connecting the radio to an outdoor groundplane antenna brought a marked increase in signals.

With the included antenna, the 'R3 offered average performance on the 2-meter amateur band, and on public service frequencies between 148 and 450 MHz. The signals had to be moderately strong to be listenable on the 'R3. For example, I was able to monitor local police and fire communications easily enough, but transmissions from AMTRAK railroad units 10 miles away—that I can usually hear on the expanded receive portion of my amateur hand-held—were inaudible. The 'R3 was also unable to pick up the amateur FM repeater satellites UO-14 and AO-27 when using its telescoping whip. The

Figure 1—The IC-R3's color TFT main display—available only above 30 MHz—is capable of presenting a tremendous variety of information in several different formats and your choice of eight background colors. This "Simple screen" displays just the bare essentials. The sub LCD shows similar information when the main LCD is off.

Figure 2—The main display's "Multi-function" screen adds visual indications of the squelch setting, the signal strength and the volume level to those shown on the "Simple screen." In this photo, the receiver is in the memory mode. Memories can be assigned alphanumeric labels ("W1AW/R" in this example) to aid identification.

outdoor groundplane antenna made a big difference in all of these instances.

As you'd expect, the higher I tuned in frequency, the less activity I encountered. In fact, I heard nothing above about 1200 MHz. My microwave oven was able to raise quite a racket on the radio, though!

Speaking of racket, the 'R3 has a multifunction squelch control that goes a long way toward preserving your sanity. The squelch can be locked open, set to use one of nine programmable levels or placed in "automatic mode." If you are listening to weak signals that may not otherwise make it past the squelch, you can use the **SQL** button to force the squelch to remain open.

Scanning

Scanning is one of the 'R3's strong suits. At the most basic level you can opt to scan the entire coverage range of the radio, or only within the selected band. The most useful scanning function for me was the *program scan* where I specified the start and stop frequencies, and had the 'R3 scan repeatedly between those two points. You can program up to 25 pairs of stop and start frequencies in memory. If you keep encountering birdies or other unwanted signals during a scan, you can lock out those annoyances with the *frequency skip* function.

The 400 memory channels are divided into 8 banks with 50 channels each. In the memory scan mode you can breeze through all of the memories, or only through the 50 within one of the banks. There is a skip function here, too. You can program the R3's memory scan to jump over certain memory channels (ones that are perpetually busy, for instance). And like all good scanners, the 'R3 includes a *priority watch* that allows you to monitor one frequency for activity while scanning through others.

CTCSS Features

You can program the 'R3 to respond to specific subaudible tones (CTCSS)

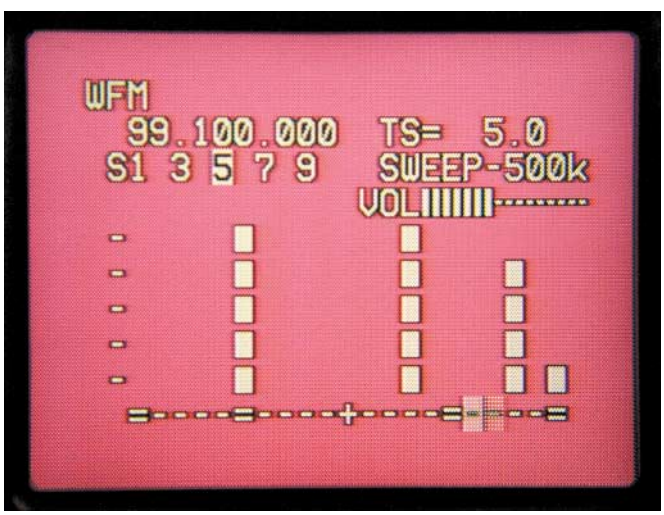


Figure 3—The "Band scope" screen. This feature provides a plot of signal strength versus frequency. The range of the sweep can be set to any of five values from 10 kHz to 1 MHz. The receiver can be commanded to continuously sweep the range or to make a single sweep and then stop.

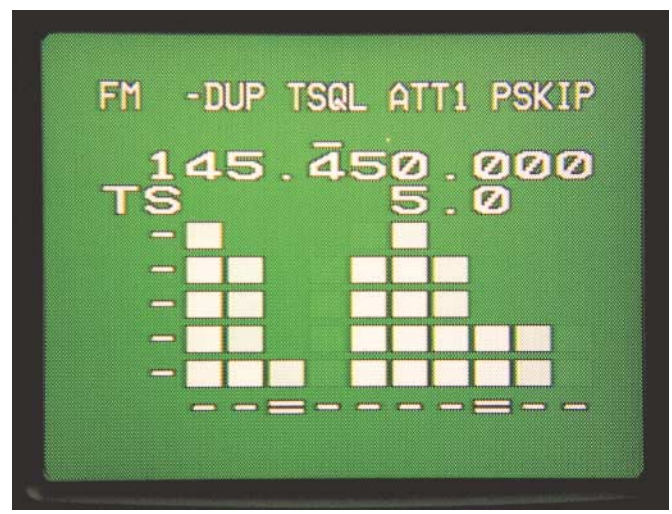


Figure 4—The IC-R3 also offers a unique "Direction finding" feature. The signal strength versus time (in 0.3-second intervals) is continuously plotted. Connect a directional antenna, aim for maximum signal strength and you'll have a likely heading to the signal source. The 'R3's 4-step attenuator can be very handy for this application.

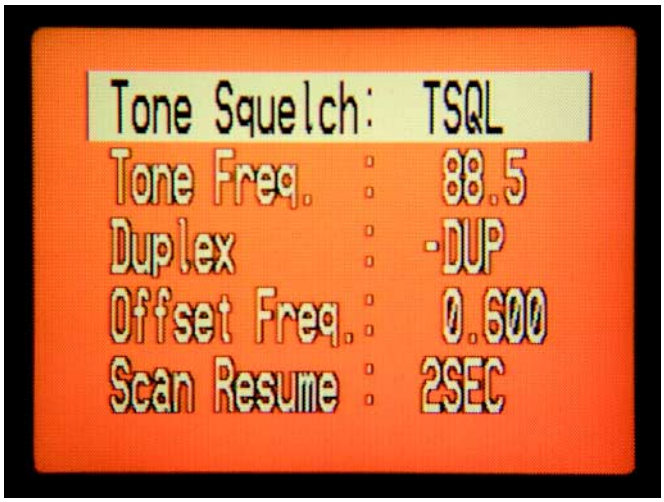


Figure 5—The "Set mode" screen provides convenient viewing of the state of several menu settings simultaneously. The menu contains a total of 18 parameters. The main encoder dial is used to scroll up and down through the list. When the main display is off, the same menu choices can be displayed—one item at a time—in the sub LCD.

Figure 6—The "TV screen." This image of Tom Brokaw—obviously exhausted after weeks of presidential election coverage—was captured from broadcast television. The image shown on the screen of the IC-R3 in our lead photo is live ATV from the lobby of HQ using a 70-cm ATV transmitter and an inexpensive camera.

with its *tone squelch function*. I programmed the radio to remain silent until it received a signal from a nearby FM repeater that included the 88.5 Hz CTCSS tone. The radio obediently sat there, silent as the Sphinx, until it suddenly "opened" with audio from the repeater. With the *pocket beep* feature the 'R3 will also flash its display and beep when it receives the correct tone. You say you don't know what CTCSS tone the repeater is using? The 'R3 can tell you that with its *tone scan*. When tone scanning the 'R3 can automatically set the CTCSS tone for a given memory channel, but as soon as you switch off that channel you'll find that the tone frequency shifts to the *previously* programmed value. For a permanent setting you need to change the CTCSS programming of the memory channel by editing its data, copying it to the VFO and then writing it back to that memory channel.

Power

The issue of power is important if you are considering the 'R3. You can power the radio from the supplied Lithium-Ion battery pack, from 3 AA alkaline batteries or from an external dc power source. While it's natural to fall in love with 'R3's color LCD and TV tuner, this feature is also its greatest weakness when it comes to power consumption.

If you use the battery pack with the main LCD frequency display mode active (but not tuning TV channels), you can expect about 2 hours of listening time before the battery is depleted. But if you decide to watch TV, your battery life will drop considerably. Turn off the main LCD altogether and use only the sub LCD along with the battery save feature, and your available time jumps to more than 25 hours!

I'd recommend that you activate the battery saver function to get the most out of your power source. If you are listening to a single frequency and there is no activity for 5 seconds, the power saver kicks on and initiates a cycle where the 'R3 "sleeps" for a short time, then "awakens" briefly to monitor the frequency before returning to sleep once more. The automatic power off feature is also handy if you seem to have trouble remembering to turn off your 'R3. The APO will shut the radio down if you do not use it after 30, 60, 90 or 120 minutes.

While the 'R3 is off and connected to external power with the rechargeable pack installed, the LCD indicates "HI V" and the battery level indicators cycle through their display states. This continues while the battery is being charged. The 'R3 senses when the battery is completely charged and stops charging at that point. It can take 13 to 15 hours to completely charge a fully discharged battery pack. A 2.5-hour rapid charger—the BC-135—is available as an optional accessory.

I ran into trouble when I tried to use the 'R3's "ac adapter" to power the unit. When I turned the power on the main LCD began rapidly pulsing on and off. Further reading in the manual revealed that the included adapter is intended for battery charging only.

Conclusion

The TV tuner is clearly the star of the 'R3, and it delivers on its promise of a sharp color picture, but don't buy an 'R3 on this basis alone. This receiver is also a competent, versatile scanner that will provide years of listening enjoyment. Its shortwave performance isn't stellar, but it is more than adequate for casual broadcast listening.

My wish list for the next-generation IC-R3 (the 'R4?) would be an SSB receive mode, an AM synchronous detector, a numeric keypad and main LCD functionality below 30 MHz. The 'R3 may not be an Amateur Radio grade receiver throughout its entire frequency range, but it is a heck of a lot of fun.

Manufacturer: ICOM America, 2380 116th Ave NE, Bellevue, WA 98004; 425-454-8155; fax 425-454-1509; **75540.525@compuserve.com**; **www.icomamerica.com**. *Manufacturer's suggested list price:* $599. Typical current street price: $490. List prices of selected accessories: CS-R3 *Windows 95/98* programming software, $24; OPC-478 serial cable (computer to radio), $45; BC-135 desktop rapid charger, $80; CP-18A Cigarette lighter adapter, $30.

ICOM IC-PW1 Linear Amplifier

Reviewed by Mark Wilson, K1RO
QST *Editor*

A quick survey of the power amplifiers available to hams today reveals a wide variety of configurations and features. All will boost your signal, but they take different paths to produce the power. Some amplifiers use one tube, others use multiple tubes. Some tune themselves automatically, some you tune manually. The IC-PW1 from ICOM is a solid-state, no-tune amplifier that uses eight MRF150 power FETs to produce 1 kW output on all amateur bands from 160 through 6 meters. It's rated for a full 1 kW output on all modes, including RTTY. With a selling price around $5400, this amplifier is at the high end of the market, competing with auto-tune tube amplifiers from Alpha-Power[1] and ACOM[2], and with the solid-state Yaesu Quadra.

The 'PW1 is big, black cube that weighs in at 55 pounds. The power amplifier modules and heat sink, an antenna tuner, switching for up to 4 antennas, a 45-V, 40-A power supply and extensive control circuitry are all inside the box. Control, switching and metering functions are handled by the 'PW1's control head which is normally mounted to the front panel but can be removed and used remotely. The 'PW1 works best with a 200-240 V ac supply (15 A max), but you can run the amplifier from 100-120 V ac at reduced power (500 W out).

The IC-PW1 includes extensive protection circuitry. The amplifier will switch itself out of the circuit if the temperature, drain voltage, drain current, drive power or SWR exceed the limits, or if the transceiver and amplifier are set for different bands. Various LEDs on the control panel blink to give you an indication of the problem.

Rear Panel

The 'PW1's rear panel has connections for two transceivers. The instructions show how to use the amplifier with one ICOM transceiver with one antenna line; one ICOM transceiver with two antenna lines (for example, separate antenna jacks for HF and 6 meters); two ICOM transceivers; one ICOM transceiver and one non-ICOM transceiver; or two non-ICOM transceivers. You can use only one transceiver at a time, but this feature is handy if you regularly use more than one HF radio and don't want to continually swap wires. Or you might want to use the amplifier with one HF-only radio and one 6-meter radio.

There are two identical sets of rear-panel connections, one for each transceiver. If you're using an ICOM transceiver with the 'PW1, you just connect your radio to the 'PW1 with three supplied cables (each nearly 10 feet long). 1) Use the cable with PL-259s on each end to connect the antenna jack on your transceiver to **INPUT1** or **INPUT2** on the 'PW1. 2) Connect the supplied 7-pin DIN cable from the appropriate **ACC** jack on the back of the amplifier to the **ACC(2)** jack on the back of your transceiver. This cable handles TR switching, ALC and control signals. 3) Connect the 1/8-inch phone plug between the appropriate **REMOTE** jack on the 'PW1 and the **REMOTE** jack on the back of your transceiver. This is for ICOM's CI-V frequency control interface. When this cable is connected and the 'PW1 is in **AUTO** mode, the amplifier will automatically follow when you change bands on the transceiver. If you're not using an ICOM transceiver, the 'PW1 has phono jacks for TR switching and ALC.

The 'PW1 also offers connections for up to four antennas, and the amplifier's control circuitry remembers which antenna is used for each band. In my station, I used these connectors for my multiband beam (20-10 meters), 40-meter dipole, 80-meter inverted **V** and 6-meter Yagi.

Front Panel

The nerve center of the IC-PW1 is the control head that's mounted in the upper center of the front panel. The first thing I did when I got the amplifier home was disconnect the control head for remote mounting. That operation is detailed in the instruction manual and takes about 20 minutes. Like the ACC and CI-V cables, the supplied separation cable is nearly 10 feet long. This allowed me to place the 'PW1 on the floor under my operating desk, saving valuable table space. The wedge-shaped control head is about 8 inches wide, 3.5 inches high, and 2.5 inches deep. It fits nicely under the front of my computer monitor.

The control head includes two analog meters. One switches among power output, drain current and temperature. The other monitors collector voltage, SWR or ALC. In addition to the **POWER** switch on the left side, **TUNER** activates the internal antenna tuner and **AMP/PROTECT** places the amplifier in standby. On the right side is switching for transceiver 1 or 2 and the four antenna jacks. Finally, band information is along the bottom. There's an LED indicator for each band. You can switch bands using the **UP** or **DOWN** buttons, or place the amplifier in **AUTO** mode to follow band changes on an ICOM transceiver with CI-V interface.

Using the IC-PW1

As shipped from ICOM, US versions of the 'PW1 do not work on 10 or 12 meters because of FCC regulations regarding amplifiers that could be used for CB. You have to remove a surface-mount diode on one of the PC boards to make your 'PW1 work on these bands. The diode is easily accessible with the top cover removed and the modification isn't particularly difficult. Contact ICOM's service department, send them a copy of your amateur license, and they will send the details.

You also have to provide a suitable connector for the ac line cord. The 'PW1 detects the line voltage and adjusts itself accordingly. You don't have to worry about switches or jumpers. We only used the 'PW1 with a 240 V ac source and did not try operation from 120 V. Before installing the connector, slip two provided ferrite cores over the outside of the line cord and secure them with wire ties. According to the manual, the ferrite cores help with RFI.

I used the IC-PW1 with my IC-746 transceiver. Hookup was simple with the three supplied cables. The only problem was getting the 'PW1 to recognize frequency data from the IC-746. The instruc-

Bottom Line

The ICOM IC-PW1 provides an effortless 1 kW of RF from 160 through 6 meters. It integrates especially well with ICOM transceivers, and it works so smoothly that you forget it's there.

[1]Product Review: "AlphaMax and AlphaRemote for the Alpha 87A," *QST*, Aug 2000, pp 73-73; Product Review: "ETO Alpha 87A MF/HF Linear Amplifier," QST, Jun 1992, pp 53-56.
[2]Product Review: "ACOM 2000A HF Linear Amplifier," *QST*, May 2000, pp 64-66.

Table 2
ICOM IC-PW1, serial number 01203

Manufacturer's Claimed Specifications	*Measured in the ARRL Lab*
Frequency Range (US units): 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,[1] 28-29.7,[1] 50-54 MHz.	As specified.
Power output: 1000 W PEP, all modes.[2]	As specified for SSB and CW.
Driving power required: 100 W maximum.	Typically 40 W (band dependent).
Input SWR: Not specified.	Typically 1.0:1.
Output matching: up to 3:1 SWR (2.5:1 for 6 meters).	As specified.
Spurious signal and harmonic suppression: 60 dB or HF, 70 dB for 6 meters.	60 dB on HF and 6 meters.
Intermodulation distortion (IMD): Not specified.	See Figure 7.
Primary power requirements: 100-120, 200-240 V ac.	
Size (HWD): 10.4 × 13.8 × 14.8 inches; weight, 55 lb.	

[1]See text.
[2]On 200-240 V ac, de-rated to 500 W on 100-120 V ac.

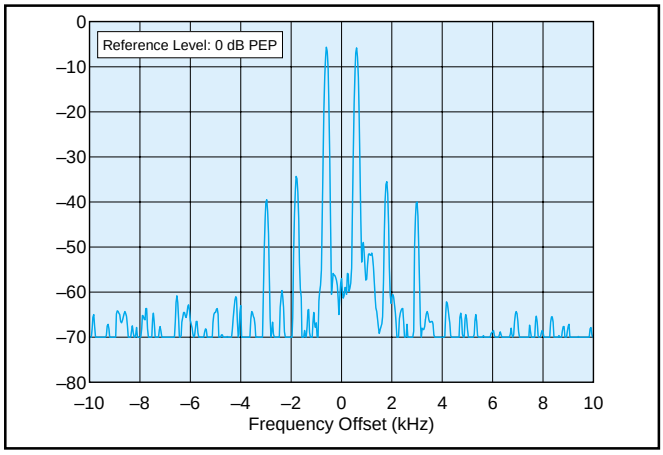


Figure 7—Worst-case spectral display of the ICOM IC-PW1 amplifier during two-tone intermodulation distortion (IMD) testing. The worst-case third-order product is approximately 36 dB below PEP output, and the worst-case fifth-order product is approximately 41 dB down. The amplifier was being operated at 1 kW at 14.010 MHz. The levels of the third- and fifth-order IMD products are higher than those we have observed on other recently reviewed tube-type amplifiers.

Figure 8—The rear panel of the ICOM IC-PW1 offers input, ALC, switching and control connectors for two separate exciters and outputs for up to 4 antennas.

tions are simple: Press and hold the **INPUT** switch on the amplifier's control head, turn the transceiver power on, and rotate the transceiver's frequency dial until the input LED quits blinking. Try as I might, I couldn't make the LED stop blinking. I finally discovered that the IC-746 has a menu option called "CI-V Transceive," and this must be set to "ON." Once I did that, it took only a few seconds for the transceiver and amplifier to communicate.

The instructions say that you should not connect the 'PW1 and transceiver to an ICOM CT-17 level converter for computer-controlled operation. Computer control of my transceivers is important to me, especially for use with contest logging software. We asked ICOM about this, and they came up with a way to use software with a 'PW1, IC-756PRO or IC-746 and CT-17. I was able to get this procedure to work with my IC-746 and *Writelog* contest software. Contact the service department at ICOM for information.

I connected a second radio, a Yaesu FT-1000D, to the amplifier using the second set of input connections. Again, hookup was simple using a piece of RG-58 for the antenna connection and a couple of phono cables for ALC and TR switching.

The rest of the setup went smoothly. The manual stresses the need to adjust the ALC so you don't damage the amplifier by overdriving it. This involves increasing the transceiver's power to full output while adjusting the ALC potentiometer on the back of the 'PW1 until the ALC meter is centered and the power output is 1 kW. This took a couple of back-and-forth adjustments of the transceiver's power control and the ALC pot, but once adjusted power output is consistently 1000 W on each band with 40-50 W drive.

The next step is to go through each band and select the appropriate antenna. The 'PW1 remembers which antenna you

Figure 9—The control panel can be removed from the front of the amplifier's cabinet and relocated up to 10 feet away (the remote cable and a blank cover plate for the amplifier front panel are provided).

last selected for each band, and whether or not the antenna tuner was used. After the initial setup, everything is pretty much automatic and you don't use the controls much.

The built-in antenna tuner can match 15 to 150 Ω (3:1 SWR) on HF and 20 to 120 Ω (2.5:1 SWR) on 6 meters. The tuner does not work above 1950 kHz on 160 meters, but otherwise works across all bands. The tuner can be used when the amplifier is in standby; this is handy if you need a tuner and your transceiver does not have one built in. The tuner had no problem finding a match with any of my antennas, including my Cushcraft X7 multiband beam which works on 18 and 24 MHz but has an SWR greater than 3:1 on those bands.

In early IC-PW1s (before serial number 1165), you could not bypass the amplifier and use your transceiver barefoot without turning on the amplifier and using the **AMP/PROTECT** switch to put the amplifier in standby. ICOM changed the circuitry in current production 'PW1s so that when you turn on your ICOM transceiver, and the 'PW1 is off, some of the LEDs on the control panel light and some of the functions work. The **INPUT** and **ANT**enna switches work, as do the automatic band switching (if you have the CI-V cable connected), band **UP**/**DOWN** switches and metering. If you're using a non-ICOM radio, you need to apply 13.8 V dc to pin 7 of the 'PW1's **ACC** jack to use the antenna switching and bypass the amplifier when the power is off. ICOM does not offer an upgrade for older amplifiers.

The IC-PW1 is fairly quiet when you first turn it on. An additional fan kicks in whenever you transmit using the antenna tuner, adding a bit to the noise level. If you transmit for an extended period (say, for RTTY operation) the cooling fans switch to a higher speed and stay on (even in receive) until the temperature drops. I did find the 'PW1 a bit noisy with all of the fans on, but placing the amplifier on the floor and using headphones helped.

Overall I really liked the 'PW1, especially with the IC-746 transceiver. Once I had everything configured, it was like having a 1 kW transceiver. There is really nothing to do when using the amplifier—no band switching or tuning. Power output was always 1 kW, and the amplifier never went offline for any reason.

During the review period, I gave the 'PW1 a workout on all bands, including about 10 hours of operation in the OK RTTY DX Contest in mid-December. RTTY contesting is very hard on equipment because of extensive key-down transmit periods. I ran the amplifier at its full rated output during the contest with no problems.

It was especially nice having the 'PW-1's 6-meter capability when the band opened to Europe in mid-December. I was able to work several very weak stations who would have had trouble hearing me with my usual 100 W. Several operators used another IC-PW1 and an IC-756PRO to put W1AW on the air for both modes of ARRL November Sweepstakes. That combination worked so well that the ICOM IC-PW1 is now a permanent fixture at W1AW.

If you're in the market for a power amplifier, the IC-PW1 is worth a look, especially if you're using an ICOM transceiver that can take full advantage of the control circuitry. The 'PW1 does not run a full 1500 W legal-limit output like the tube-type auto-tune amplifiers, but it does include 6 meters, a wide-range antenna tuner and automatic antenna switching.

Manufacturer: ICOM America, 2380 116th Ave NE, Bellevue, WA 98004; 425-454-8155; fax 425-454-1509; **www.icomamerica.com**. *Manufacturer's suggested retail price*: $5995. Typical current street price: $5400.

Bid solicitations for Product Review equipment appear on page 69. QST

NEW PRODUCTS

HF/VHF/UHF MOBILE ANTENNA FROM COMET

◊ NCG Company is now distributing the Comet UHV-6 multiband mobile antenna. With HF, VHF and UHF capabilities, it's particularly well suited for use with multiband HF/VHF/UHF transceivers.

The UHV-6 comes complete with coils for 40, 15 and 10 meters. The mast section is resonant on 6 meters, 2 meters and 70 cm. Optional coils are available for 20 and 17 meters. As many as four HF coils can be attached at once, allowing instant access to up to seven bands.

The UHV-6 is terminated in a PL-259-type base connector and can be mounted on most vehicles using trunk lip or hatch/door edge mounts. The mast section is hinged, allowing the antenna to be folded over to provide clearance when entering garages or other low structures.

Comet offers a wide variety of diplexers, mounts and cabling kits. For additional information visit your favorite Amateur Radio products dealer or contact NCG Companies, 1275 North Grove St, Anaheim, CA 92806; tel 800-962-2611/714-630-4541; fax 714-630-7024; **micks@cometantenna.com**; **www.cometantenna.com**. QST

Array Solutions Swinging-Gate Side Mount

At the 1999 Dayton Hamvention, I noticed that Array Solutions had a few of their new "swinging gate" tower side mounts on display. By summertime, when it was time to improve my station antennas, I knew I needed one.

The swinging-gate side mount is intended to be used for side mounting antennas on Rohn 25-45-55 towers. Depending on the placement of the elements on the antenna you wish to use, you can get almost 300° of rotation. The mount looks much like a gate with one side close to the tower while the other swings about two feet outward (and most of the way around the tower).

Heavy Metal

The side mount comes packaged in two very heavy cardboard boxes. My first reaction was that it was heavier than the 4-element 20-meter Yagi I was about to haul up the tower—and it is. The actual weight of the assembly is 85 pounds. (In Dayton I saw one fall over and hit someone's leg pretty hard. Ouch!) The gate seemed much sturdier than the Rohn 25 tower I was going to install it on, so I assume the assembly will handle even heavier antennas. The entire side mount is made of thick galvanized steel and should last a very long time.

Assembly was reasonably straightforward—though a couple of U-bolt saddles were missing from the package. They were replaced by Array Solutions within a few days. I also had to use a small file to smooth out some of the galvanizing inside two of the holes—a 10-minute job. I used two pieces of 2-inch schedule-80 pipe for the two short masts (about 4 feet long).

The top and bottom gate supports attach tightly to the tower (different hardware is supplied for the Rohn 45-55 model). Your rotator is attached to the lower mount of the gate itself. The mount is pre-drilled for the Tailtwister 6-hole pattern, which is also compatible with the Ham IV rotator pattern. The bottom of the antenna mast on one side of the gate goes into the top of the rotator. You'll want to secure the bottom mount first and only loosely attach the top mount until the gate is in place. Rehearse this maneuver at the base of the tower so you won't have to do it more than once when you're finally in the air. Also, because the side mount does not allow you to turn your antenna the full 360°, you'll have to decide what direction you can live without and install the mount accordingly.

Once you have the mount attached and tightened down, try turning it with your rotator, making sure it turns freely in each direction. (The mount includes a bearing for smooth operation.) When you're satisfied that everything is operating normally, mount your antenna on the outside mast of the swinging gate. Again, you'll want to make sure it turns freely from end to end, and that you have it aligned correctly to match your rotator control box indication.

The gate and mounting brackets awaiting assembly.

The swinging gate mount and Yagi (middle portion of photo) completely installed on the tower.

Before you decide to buy a side mount, you'll want to run some calculations to make sure the antenna you plan to install will actually fit in the space available. Sometimes those guy wires are closer than they look.

If you become really ambitious about using the side mount, there's even a way to add additional brackets and longer masts. In the end, you could actually have antennas installed from the bottom of your tower all the way to the top. Contact Array Solutions for more information.

Conclusion

Overall, I'm pleased with the Array Solutions swinging-gate side mount. It gives me the extra flexibility of having a separate rotatable antenna partway up my tower.

Manufacturer: Array Solutions, 350 Gloria Rd, Sunnyvale, TX 75182; tel 972-203-2008; fax 972-203-8811; **www.arraysolutions.com/**. *$359.—Tom Frenaye, K1KI* QST

STRAYS

CRYSTAL RADIO DX CONTEST

◊ The third annual International "Elmer Memorial" Crystal Radio DX Contest will take place from 1200 UTC on Friday, February 16 to 1200 UTC on Sunday February 25. Contest rules are available on line at **www.thebest.net/wuggy/**. You can also obtain a copy of the rules by sending a self-addressed, stamped envelope to: Crystal Radio DX Contest, c/o O. Pool, WB4LFH, 216 Hermitage Way, St Simon Island, GA 31522.

Logikey K-3 Memory Keyer

Just what the world needs. Another CW memory keyer. Both of my HF radios have built-in keyers, and I use my computer to send CW for contesting. With all of that capability already available, the Logikey K-3 by Idiom Press would have to offer something special to earn a spot on my operating table. After using it for several months, I think it does.

The K-3's layout is deceptive. There are six pushbuttons across the cabinet top and a single knob labeled **SPEED** on the front panel. That's it. It's not until you read the manual and play with the K-3 for a while that you appreciate all it can do. The layout is simple because you program the keyer using Morse code commands sent by paddle. You can ask for current keyer settings and program or change functions. More on this in a moment.

Keyer Functions

At the most basic level, the K-3 is an iambic keyer with speeds from 5 to 60 WPM. The speed control is nice and linear and the speed is easy to control, but I just don't need the highest or lowest speeds for my normal operating. So I changed it to 15 to 40 WPM using one of the function commands. It's easy: Press and release the two left-hand buttons. The K-3 responds by sending "F" in Morse code. I respond with "R1540" sent from the paddle and now I have a keyer that works from 15 to 40 WPM with a speed control that allows fine adjustments within that range. If I want to know the exact speed, I press and release the two right-hand buttons to enter the inquiry mode. The K-3 sends "?" and I respond with "S" from the paddle. The K-3 sends one or two digits indicating the speed. It's really quite clever, and it's not hard to remember often-used functions.

The K-3 offers full control over keying characteristics. You can enable automatic character spacing, set weighting, send a continuous tone for transmitter tuning and turn the internal monitor on or off. If you operate full break-in (QSK) and your transceiver truncates characters, you can use the "keying compensation" function to improve the sound of your on-air CW. There are also 10 options for setting keyer timing and dot and dash memories. After playing with these options, I settled on the defaults.

Memory Functions

The K-3 really shines in the memory department. You can have either six memories of 255 characters each, or three banks of six memories for a total of 18 (85 characters each). What's really amazing is what you can do with the memories — a lot more than just remember what you sent. Using "embedded functions" you can program a message to include a contest serial number. Serial number options allow zeroes to be sent as "O" or "T," nines to be sent as "N," and suppression of leading zeroes. If you have a broken contact or a dupe you don't want to log, press the middle two buttons and the contest serial number is automatically backed off by one, so that you don't need to reprogram the serial number generator. Other options allow you to repeat a contest exchange without incrementing the serial number. You can program a pause or suspend a message to insert text sent from the paddle. You can program a message to call another message. You can speed up or slow down various pieces of a message or make slight adjustments to inter-character or inter-word spacing to make copy easier (for example, to spread out a call sign like K5SES).

Making it Play

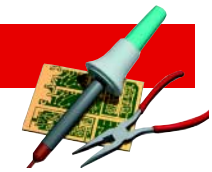
To use the keyer you'll need a paddle and cable, a 12-V dc supply and power cable, and a cable to the key jack on your transceiver. RadioShack had everything, but a cable set (model HK-3) is available. The K-3 doesn't have an on-off switch, but current drain is so low when the keyer's not in use that some operators just use a battery pack. There's a 5-V regulator built in, and six AA cells (9 V) work just fine.

The instruction manual is excellent. In addition to a full description of the functions and examples of how to use them, the manual offers a tutorial that's broken into three very well written sessions. The first session explores setup and basic operation. By the end you can send CW and program messages. The second session gets into using the inquiry and function modes to set the keyer up for your tastes. The third lesson gets into embedded functions and more advanced features. There are detailed explanations of the options, and you're encouraged to try everything and see what effect the various settings have. You can try anything you like and you won't screw it up. When you're done playing around, press pushbuttons 1-3-4-6 to return the K-3 to its default settings.

I was impressed with the K-3. It's helped me to improve my CW sending, and its capabilities go well beyond anything built into my transceivers. Although I use my contest software for sending CW during the contest, I hook up the K-3 in parallel for manual sending when I'm not quick enough on the keyboard. The additional memories come in handy for variations on the CQ and for times when I want to send the exchange more slowly without stepping through a bunch of preset speeds in my software. If you're serious about CW, take a close look at the K-3. If you like rolling your own and want to save some money, a K-3 partial kit (the CMOS Super Keyer III) is available. See the Idiom Press Web site for details.

Manufacturer: Idiom Press, PO Box 1025, Geyserville, CA 95441; **www.idiompress.com**. *Suggested retail price: K-3, $129.95; HK-3, $10.95. Available directly from Idiom Press or from selected Amateur Radio dealers.* QST

Mark Wilson, K1RO ♦ QST Editor



ChromaSound

I've been waiting for a software package like this one. I knew it was just a matter of time.

The ubiquitous PC sound cards have been slowly invading various niches of Amateur Radio, taking over functions that were once the exclusive domains of dedicated station accessories. First the sound cards stormed into the digital front, elbowing their way past stand-alone multimode data processors and doing RTTY, slow-scan TV, CW, PSK31 and more. It only stands to reason that the next stand-alone station accessory to be confronted by the sound-card invasion would be digital signal processing (DSP) audio processors.

Meet *ChromaSound*

ChromaSound is a DSP program for *Windows* that essentially allows your PC to do all of the things an outboard audio processor can do—and more. Setup is simple—you route a receive-audio cable from your transceiver to the **MIC** or **LINE** input of your sound card. That's all there is to it.

ChromaSound processes your audio and plays it back through your computer speakers. Think of your receive audio as a fire hose spewing what you want to hear, along with a lot of what you *don't*. With *ChromaSound* you can custom design audio filters to enhance the sounds you want to hear while rejecting everything else. You can design high-pass, low-pass, band-pass and band-reject filters of your liking. Creating a filter with *ChromaSound* is so easy, anyone could do it. You just select the filter type you want, then click and drag your mouse cursor to adjust the filter skirts and attenuation. You can even add various levels of noise reduction.

The process of creating filters is actually fun. I found myself running around the bands, sampling various signals and applying the *ChromaSound* filtering. You can see some examples in the accompanying images. (Figures 1 and 2 show a "before and after" comparison test.) If you create a filter profile that you want to save (an SSB filter that you think is ideal, for instance), you can slide your mouse cursor from the filter screen to the array of "buttons" below. Release the cursor over a blank button and *ChromaSound* will prompt you to enter a label name. Once you've done this, the filter is saved for future use. *ChromaSound* also comes with pre-design filters for various modes that you can select by clicking on the buttons.

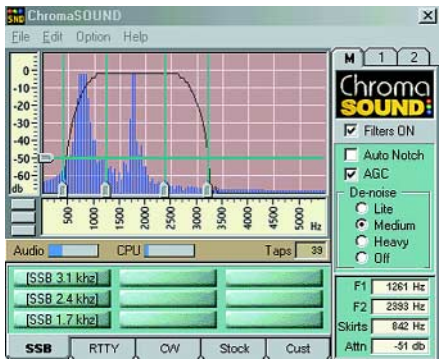


Figure 1—(Before) Two CW signals, both within the 842-Hz filter I've set up.

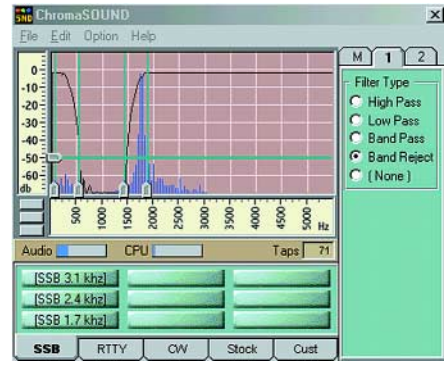


Figure 2—(After) Now I've applied a notch filter to delete the lower of the two CW signals.

ChromaSound Specifications

Sampling rate: 11,025 samples/second, 16-bit mono
Dynamic range: 96 dB (maximum, depends on sound card)
Internal precision: 64-bit IEEE format floating-point
Latency (delay): 140 ms minimum (5-20 ms in DirectX version)
Filter Designer: 60 dB maximum attenuation, 100-Hz skirts
DSP algorithms: FIR, ALE, LMS, FFT, some proprietary
Filter phase-response: Linear phase, MA type
Win32 contexts: 2 processes, 6 threads total in current version

Great for CW and Phone Operators

ChromaSound works especially well with CW signals, which is not surprising since DSP techniques can create some very sharp filters. *ChromaSound* is capable of creating filters as narrow as 100 Hz with remarkably vertical skirts. I was able to set the software up to allow a specific CW signal through the filter to the exclusion of virtually everything else. The only drawback is the latency of the DSP. This means that there is a slight delay between the time the receive audio reaches your sound card and the time the processed result actually reaches your speakers. The delay is only about 140 ms, but that is enough to be disconcerting if you are listening to your radio and your speakers simultaneously. The delay can also make tuning difficult, so I found it was easiest to tune the radio to the desired signal *first*, then turn down the rig volume and crank up the PC speakers.

The benefit of narrow filtering aren't quite as profound with SSB signals, but it is still impressive. If you tighten up the *ChromaSound* audio filter a little, then add some de-noising, the audio quality suffers, but the intelligibility increases.

Computer Requirements

ChromaSound demands a fair amount of processor muscle, so you'll need a 200-MHz Pentium or better for best results running *Windows 95/98/ME*. You also need a 16-bit full-duplex sound card, but most modern sound cards meet this requirement. I used a 266-MHz system for this review.

ChromaSound is the first of what may be a long line of sound-card DSP software products for audio processing. *ChromaSound* gives you performance that rivals outboard hardware audio processors, but at a substantially lower price.

Manufacturer: Silicon Pixels. ChromaSound *is shareware and a demo can be downloaded free at* **www.siliconpixels.com**. *Registration cost is $50.* QST

Steve Ford, WB8IMY ♦ Managing Editor