ICOM IC-7800 HF and 6 Meter Transceiver

Joel R. Hallas, W1ZR
Assistant Technical Editor

The ICOM IC-7800 has been the subject of much speculation and discussion since it was announced at the 2003 Dayton Hamvention. This radio fills the spot at the top of ICOM's Amateur Radio lineup formerly held by the now aging IC-781. In our view the somewhat larger and heavier than usual enclosure contains more than just a *radio*. Included are a 200 W HF and 6 meter multimode transceiver, power supply, antenna tuner, RTTY and PSK31 transmit and receive terminal units, and *two* DSP-based high performance receivers. These are all coupled with a multifunction automated display and control system presented on a 7 inch color TFT display.

In consideration of the multiple facets, we brought together a team of reviewers to push at the edges of multiple performance envelopes of the IC-7800. Overall performance specifications have been first measured and recorded by ARRL Lab Engineer Michael Tracy, KC1SX. The receiver performance and system operability in a harsh environment have been evaluated by Dave Patton, NN1N, a top contester. Digital mode performance has been checked out by Steve Ford, WB8IMY, and the 6 meter capabilities have been evaluated by 6 meter aficionado Dennis Motschenbacher, K7BV. Each of these "specialists" has described their experiences to give you an indication of how the equipment performs in their specialized environments.

First Impressions

On first impression this radio stands out from the crowd in a number of respects. First there's the price, more in the neighborhood of a compact car than typical ham equipment. Next there's the size and weight—this is a large and heavy radio that won't be confused with the recent trend toward pocket-sized models. Then there's the display, a knockout of color and information a step beyond other ham radio transceivers.

Perhaps the second impression is even more stunning. ICOM has made an attempt to set a new level of performance and offer features well beyond those of other radios. In the area of performance, ICOM has set a new standard in the important dynamic range area. In the feature department, ICOM has included almost every operating mode and convenience imaginable.

Getting a Grip On It

This is a serious radio, at 55 pounds, it outweighs its predecessor by 4 pounds. The manual recommends using two people to move it, and that might be a good idea, especially if you have tight corners. Fortunately a pair of easily removable heavy cast combination handles and rack mounts are provided that make moving it somewhat easier, although they made me wish it could be put it down on its back panel without breaking connectors. It also takes up some serious space, although considering all that's included in the single box it is a reasonable implementation. I put it in my shack in place of my full-size transceiver and had to move neighbor equipment to make space. One nice feature: This radio doesn't slide when you push a button or plug in the phones!

So What Does it Do?

What *doesn't* it do might be easier to answer.

That Display!

I mentioned the stunning display as a major contributor to first impressions. Its beauty is a lot more than skin deep and is well worth a detailed look. ICOM has dedicated one of the four DSP chips to display functions, and it pays off, as shown in Figure 1. What caught almost every observer's eye early on was the ICOM implementation of virtual D'Arsonval moving coil meters. We've all seen the various attempts at metering on display screens, going from the group of dashes to meter shaped curved display elements. You wouldn't confuse any of these with a real meter, although it can be argued that for many functions they are adequate.

ICOM spent a long time studying and emulating the ballistics of a moving coil meter with the result that you almost can't tell that their meters aren't real. Only by looking from the side and realizing that there isn't any space between the "needle" and the scale do you understand that you're not seeing what you thought. According to ICOM, this is not just a matter of vanity. They are preparing for the time when mechanical meters will no longer be available. There is another advantage—meters are often the most fragile part of a radio and you'll never bend this needle around the pin! If you don't like the pair of large "meters" provided, you can select narrow edge type or bar meters instead (Figure 2).

Other display functions are notable. The fully functional real-time spectrum scope can be set to work on either receiver, so you can monitor activity on 10 meters while you work 20, for example. The spectrum width can be adjusted and the display can stay fixed or track your tuning. In either case cursors show you where you are on each receiver, if within range. The transmitted spectrum can be monitored as well. Menu selections are not just in text, but in many cases also show the shape of what you are adjusting.

If you find the 7 inch display too small, perhaps due to vision limitations, or if you

Bottom Line

ICOM delivers its entry into the top of the line transceiver sweepstakes with a radio that seems to do it all.

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Figure 1—The normal IC-7800 display showing the emulated D'Arsonval meters above the spectrum scope.

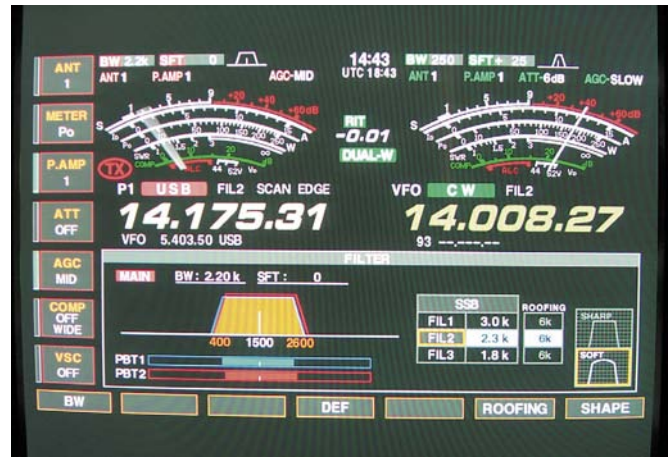

Figure 3—The graphical menu for setting preferred bandwidths for the DSP IF filters.

want to demonstrate to multiple users—or even if you just want to watch band conditions from across the room—there's a jack on the back for a standard computer monitor hookup. When the monitor is connected, the standard display still functions, so you can use both. I found that this worked well for the screen photos for this article, for example.

Receivers

This radio includes two identical fully competent receivers, each with a dedicated 32 bit DSP covering 30 kHz to 60 MHz. ICOM says that the design objectives of this receiver were to improve upon the state of the art. Our measurements confirm this in most respects. The important third-order intercept, a measure of dynamic range, came out better than we have seen at +37 dBm, close to ICOM's advertised 40 dBm (10 W!). We must confess that if there's much more improvement in this area it will become hard to verify with our current Lab equipment.

The two-tone third-order IMD, an indication of the capability to receive a weak signal near a strong one, was measured at 98 dB at 14.1 MHz with 20 kHz spacing and a respectable but not quite the best we've seen of 89 dB at 5 kHz spacing. Again, this data is representative of both receivers in or outside of the ham bands. We show the 20 kHz blocking dynamic range noise limited at an astounding 139 dB, among the best we've seen.

The receivers are completely independent, so each can be tuned to any frequency within the range and each can be set to the same or different antenna ports (four are available). There are speaker outputs for each channel, and with stereo headphones or speakers you can have one receiver pointed at each ear if you wish. Each has its own S-meter, so you can watch signal strength and switch between receivers as

Figure 2—Selecting the edge-view metering for variety (no you can't have one of each!).

appropriate, providing a kind of manually switched diversity, if your ears don't work well independently. Alternately, the audio can be combined with their separate audio gain controls into a single channel in phones or speakers. The internal speaker is an acoustic suspension unit that works very well.

Most receiver parameters can be set up to your liking using set and forget menus. Following your customization, selection is generally made using just the primary knobs and buttons. For example, receive selectivity can be preset for three values for each mode (including data, but not FM). Each filter is defined in a screen as shown in Figure 3, both in terms of bandwidth (in 100 Hz increments) and slope of skirts. Once set, a push of a button cycles among the three presets for that receiver and mode. While it's quite easy to change the definition, a temporary change can be made by adjusting the high or low edges of any filter using the dual PASSBAND TUNING knobs or the passband can be moved around to avoid interference using the same knobs. In addition to selectivity, the receiver DSPs can be used to set adjustable level NOISE BLANKING or NOISE REDUCTION independently. In addition an effective automatic notch filter that can notch three tones or heterodynes is provided.

Some receiver functions are set using mode-dependent button definitions appearing on the left edge and bottom of the display. These include selecting premixer gain with two levels or no preamp, selecting among the eight values of attenuation, changing the tuning speed to 1/4 the usual step size among others. The screen definitions are visible in Figure 3. As would be anticipated, the receiver includes the usual transceive control functions such as RIT/XIT (±10 kHz), split operation, reverse.... The dual receiver architecture makes it easy to listen to both transmit and receive frequencies while working split. Back in 1976, I used to do that with stereo phones, a Heath HW-101 transceiver and Drake 2B receiver. The IC-7800 makes this much easier and both receivers are a whole lot better!

Transmitter

The transmitter provides an effortless 200 W on all bands without an indication of working hard. I received good reports on both CW and SSB during my usual weekly skeds, confirming the data taken by Michael, KC1SX, in our Lab (Figures 4, 5 and 6). Once I had the gain and compression settings worked out, I received excellent reports on SSB using a loaner ICOM SM-20 desk microphone (no microphone is provided). The multiple metering option (shown in Figure 7) makes it easy to watch compression level and power output at the same time, so setup can be accomplished without the usual guesswork. Since DSP is used on the transmit as well as the receive side, it is possible to set the transmit speech bandwidth and shift the high or low response to tailor to conditions.

CW operation was a breeze with smooth and quiet full-break-in operation. The filter choices and passband tuning

made it easy to pull out the weak signals and the dynamic range paid off when there were strong signals in the vicinity.

I used the '7800 to check into the weekly Antique Wireless Association 75 meter AM net (Sundays at 4:30 PM EST on 3837 kHz), but conditions were so bad that my signal wasn't far enough above the noise in the Rochester, New York area to obtain an informative report, even with the linear on-line. Bob Heil and Joe Walsh had good results on AM during their visit to W1AW, so I'm sure it works fine on that mode if conditions permit. I didn't try the '7800 on FM. To make voice contesting easier, four voice message memories can be easily recorded as shown in Figure 8.

Odds and Ends

A nice feature of this radio is that once you have the settings set up the way you like, you can write them to a flash memory card that can be inserted in a slot on the front panel. This lets you not only allow others to use the rig without fear of losing your settings, but also lets you move to any '7800 (at a multi-position station, for example) without having to lose time setting it up your way.

I mentioned that this radio doesn't come with a microphone (or a keyboard, for that matter) and some reviewers were surprised, especially since a hand mic comes with the radios at the bottom of the ICOM line. On reflection this makes sense to me. I would be surprised if any '7800 purchaser would actually use a hand mic, preferring a tailored desk mic or headset. With all the usual hand mics, you just end up with a desk drawer full of unused ones such as I have, even with my modest station.

All in all, this is one very nice radio. I have a lot of trouble imagining any needed improvements, and if price were no object and I needed a new radio I would have a '7800 in my shack. Of course my current transceiver is only about 15 years old, so I should be set for a while yet!

Manufacturer: ICOM America, 2380 116th Ave NE, Bellevue, WA 98004; tel 425-454-8155; **www.icomamerica.com**. Street price: $10,599.

Table 1
ICOM IC-7800, serial number 0201062

Manufacturer's Specifications	Measured in the ARRL Lab
Frequency coverage: Receive, 0.03-60; transmit, 1.8-2, 3.5-4, 5.33, 5.35, 5.37, 5.40, 7-7.3, 10.1-10.15,14-14.35,18.068-18.168, 21-21.45, 24.89-24.99, 28-29.7, 50-54 MHz.	Receive and transmit, as specified.
Power requirement: 85-265 V ac.	Receive, 210 VA (max audio); transmit, 800 VA (200 W out).
Operating modes: SSB, CW, AM, FM, FSK, AFSK.	As specified.

Receiver	Receiver Dymanic Testing
SSB/CW sensitivity, 2.4 kHz bandwidth, 10 dB S/N: 0.1-1.8 MHz, 0.5 µV; 1.8-30 MHz, <0.16 µV; 50-54 MHz, <0.13 µV.	Noise Floor (MDS), 500 Hz filter: Preamp off / one / two 1.0 MHz –123 / –129 / –130 dBm 3.5 MHz –128 / –138 / –141 dBm 14 MHz –127 / –138 / –142 dBm 50 MHz –129 / –140 / –142 dBm
AM sensitivity, 6 kHz bandwidth, 10 dB S/N: 0.1-1.8 MHz, <6.3 µV; 1.8-30 MHz, <2 µV; 50-54 MHz, <1 µV.	10 dB (S+N)/N, 1-kHz tone, 30% mod. Preamp off/one/two 1.0 MHz 3.7 / 1.2 /1.0 µV 3.8 MHz 1.9 / 0.56 / 0.43 µV 50 MHz 2.0 / 0.63 / 0.52 µV
FM sensitivity, 12 dB SINAD: 28-30 MHz, <0.5 µV; 50-54 MHz, <0.32 µV.	For 12 dB SINAD: Preamp off/one/two 29 MHz 0.93 / 0.23 / 0.17 µV 52 MHz 0.69 / 0.22 / 0.18 µV
Blocking dynamic range: Not specified.	Blocking dynamic range, 500 Hz filter: 20 kHz Preamp off/one/two / 5 kHz Preamp off/one/two 3.5 MHz 139*/139*/135* / 114/113/107 dB 14 MHz 137*/138*/135* / 115/112/110 dB 50 MHz 139*/139*/136* / 111/105/102 dB
Two-tone, third-order IMD dynamic range: Not specified, 500 Hz filter.	Two-tone, third-order IMD dynamic range: 20 kHz Preamp off/one/two / 5 kHz Preamp off/one/two 3.5 MHz 105/104/101 dB / 88/86/84 dB 14 MHz 104/103/102 dB / 89/84/83 dB 50 MHz 93/90/90 dB / 83/82/80 dB
Third-order intercept: Not specified.	20 kHz Preamp off/one/two / 5 kHz Preamp off/one/two 3.5 MHz +37/23/11 / +19/8.6/0.75 dBm 14 MHz +37/21/11 / +22/7.7/0.5 dBm 50 MHz +20/8.0/4.6 / +14/0.5/–4.4 dBm

HF DIGITAL WITH THE IC-7800

Steve Ford, WB8IMY
Editor, QST

The IC-7800 is unique among amateur transceivers in its ability to transmit *and decode* RTTY and PSK31. A push of a button along the bottom of the LCD screen puts you in either the PSK or RTTY modes. When you press the DECODE button, you see a spectral display appropriate to the mode, along with an area for receive and transmit text.

PSK31

In the PSK mode, the receive audio spectrum display appears directly above a corresponding waterfall display. To the left is a circular phase indicator.

Anyone who has been around Amateur Radio long enough to remember the original PSK31 program for *Windows* created by Peter Martinez, G3PLX, will recognize the operation of the IC-7800 in the PSK mode. Although there is a waterfall display that looks quite a bit like *DigiPan* and similar programs, receiving a PSK31 signal with the IC-7800 is not as simple as clicking on the waterfall line of your choice. With the IC-7800, you are back to using the VFO knob to tune the signal. With the 1 Hz step mode active, you must carefully tune the IC-7800 until the signal lines up in either the spectral or waterfall displays. Even then, decoding may not begin until you tweak the knob a bit more to bring the lines in the phase circle into a more-or-less vertical orientation.

Once you have the signal properly tuned, the received text begins to flow. The type is small, so good eyesight is helpful (the alternative is to make use of the '7800's ability to send its display to a larger external monitor). The IC-7800's automatic frequency control (AFC) is aggressive enough to maintain solid copy under difficult conditions. By pressing the FILTER button, you can narrow the IF passband in steps down to as low as 50 Hz. My technique was to

Manufacturer's Specifications	Measured in the ARRL Lab
Second-order intercept: Not specified.	Preamp off/one/two, +98/+87/+84 dBm.
FM adjacent channel rejection: Not specified.	20 kHz chan. spacing, both preamps on: 29 MHz, 81 dB; 52 MHz, 78 dB.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz chan. spacing, both preamps on: 29 MHz, 66 dB; 52 MHz, 65 dB. 10 MHz chan. spacing: 52 MHz, 103 dB.
S-meter sensitivity: Not specified.	S9 signal, 14.2 MHz: preamp off, 58 μV; preamp one, 16 μV; preamp two, 7.2 μV.
Squelch sensitivity: SSB, CW, RTTY, <5.6 μV; FM, <1 μV.	At threshold, preamp on: SSB, 0.68 μV; FM, 29 MHz, 0.07 μV; 52 MHz, 0.08 μV.
Receiver audio out: 2.6 W into 8 Ω at 10% THD.	2.7 W at 10% THD into 8 Ω.
IF/audio response: Not specified.	Range at –6 dB points, (bandwidth): CW (500 Hz bw): 316-883 Hz (567 Hz)[1] USB: 82-2883 Hz (2801 Hz); LSB: 83-2885 Hz (2802 Hz); AM: 134-3110 Hz (2976 Hz).
Spurious and image rejection: HF & 50 MHz, (except IF rejection on 50 MHz): 70 dB.	First IF rejection, 14 MHz, 118 dB; 50 MHz, 111 dB; image rejection, 14 MHz, 121 dB; 50 MHz, 80 dB.
Transmitter	**Transmitter Dynamic Testing**
Power output: HF & 50 MHz: SSB, CW, FM, 200 W (high), 5 W (low); AM, 50 W (high), 5 W (low).	HF: CW, SSB, FM, typ. 205 W, <2 W low; AM, typically 52 W high, <2 W low; 50 MHz: CW,SSB, FM, typ. 195 W, <2 W low; AM, typically 54 W, <2 W low.
Spurious-signal, harmonic suppression: ≥60 dB on HF, (≥70 dB on 50 MHz.	HF, 63 dB; 50 MHz, 70 dB. Meets FCC requirements.
SSB carrier suppression: ≥63 dB on HF, ≥73 dB on 50 MHz.	As specified.
Undesired sideband suppression: ≥80 dB.	As specified.
Third-order intermodulation distortion (IMD) products: Not specified.	See Figure 4.
CW keyer speed range: Not specified.	6 to 48 WPM.
CW keying characteristics: Not specified.	See Figure 5.
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, 12 ms; FM, 12 ms. Unit is suitable for use on digital modes.
Composite transmitted noise: Not specified.	See Figure 6.

Size (height, width, depth): 5.9×16.7×17.2 inches; weight, 55 pounds.

Third-order intercept points were determined using S5 reference.

*Measurement was noise-limited at the value indicated.
[1]Varies with PBT and Pitch control settings.

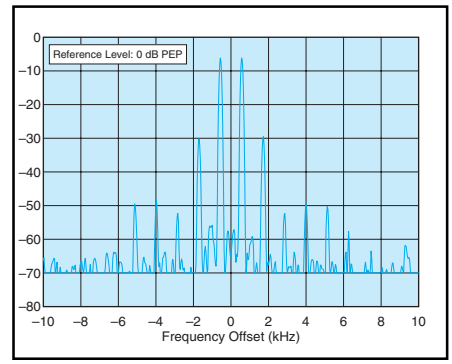

Figure 4—Worst-case spectral display of the ICOM IC-7800 transmitter during two-tone intermodulation distortion (IMD) testing. The worst-case third-order product is approximately 30 dB below PEP output, and the worst-case higher order products are down approximately 50 dB. The transmitter was being operated at 200 W PEP output at 14.250 MHz.

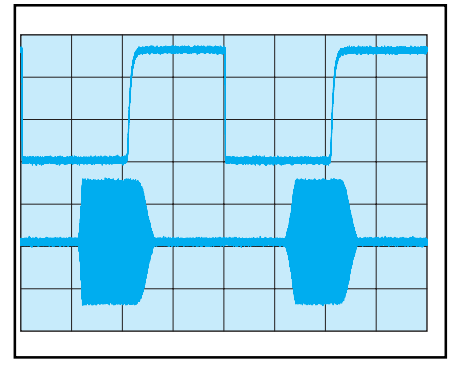

Figure 5—CW keying waveform for the ICOM IC-7800 showing the first two dits in full-break-in (QSK) mode using external keying. Equivalent keying speed is 60 WPM. The upper trace is the actual key closure (starting at left edge of plot); the lower trace is the RF envelope. Horizontal divisions are 10 ms. The transceiver was being operated at 200 W output at 14.02 MHz.

tune in a station calling CQ, and then narrow the IF to 250 Hz once the conversation was underway. This had a dramatic effect on nearby interference.

Using an attached keyboard, I was able to easily fill the type-ahead buffer as the other station was transmitting. The text scrolls up and out of view as you type. When you're ready, you press the F12 button on the keyboard to transmit, and then press F12 again to toggle back to receive.

The IC-7800 also offers macros that you can set up to automatically transmit strings of text (such as a CQ) at will. You can also alter the text font color and other parameters.

RTTY

RTTY operation is similar to PSK31. When you select the RTTY mode, the spectral and waterfall displays remain, but they include two vertical lines to indicate the mark and space frequencies as shown in Figure 9.

The IC-7800 seemed to perform well with weak RTTY signals. For example, it was able to decode a very weak signal from RN6AH/P on 20 meters that was otherwise barely visible in the display. Weak-signal reception is greatly enhanced when you activate the Twin Peak Filter (TPF). This tight filter specifically peaks the 2125 and 2295 Hz mark/space frequencies. The effect was impressive!

As with PSK31, you also have macro memories available in the RTTY mode. It is interesting to note that in both the RTTY and PSK modes the received text

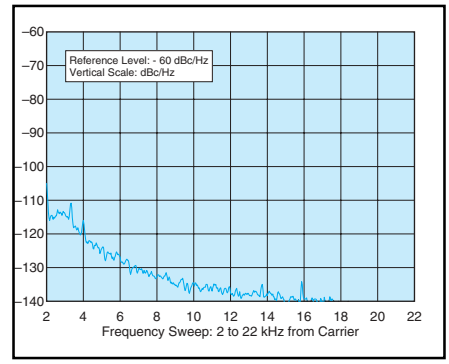

Figure 6—Worst-case spectral display of the ICOM IC-7800 transmitter output during composite-noise testing. Power output is 200 W at 50.02 MHz. The carrier, off the left edge of the plot, is not shown. This plot shows composite transmitted noise 2 to 22 kHz from the carrier.

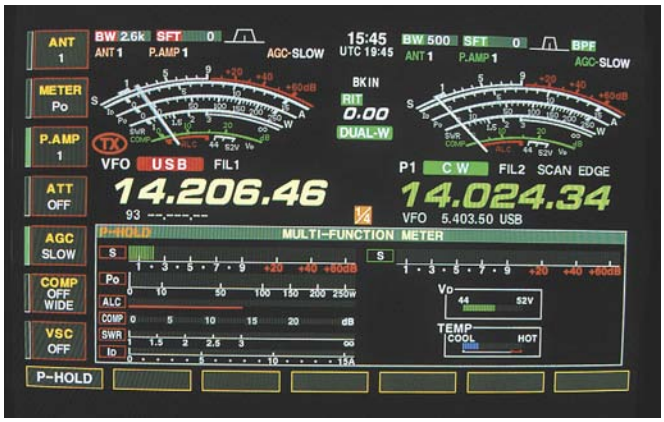

Figure 7—The display providing a view to all metering functions simultaneously.

Figure 8—Voice recorder setup menu.

can be saved to the memory card. The manual doesn't state the card's capacity, but it is probably considerable.

With both AFSK and FSK capability, the IC-7800 would make an excellent RTTY contest rig, especially with its dual receivers (SO2R, anyone?). Of course, to use the IC-7800 with popular RTTY contesting software such as *WriteLog*, you'll need to use a separate computer.

HF Digital With a Separate Computer

Most HF digital enthusiasts use sound card-based software to operate their favorite modes. The computer sound card not only generates the transmit signal, it decodes the receive signal. All you have to do is provide a path for audio to and from the radio, as well as a means for allowing the computer to switch the radio between transmit and receive.

If you want to operate modes other than RTTY or PSK31, or if you want to use software for special RTTY or PSK31 applications such as contesting, you'll need to connect your computer to the radio. The IC-7800 offers the usual analog audio inputs and outputs, but it also offers something unique in the ham world: *fiber-optic* S/P-DIF (Sony/Philips Digital Interchange Format) ports. I was eager to try them for this review, so I managed to get my hands on a Creative Labs MP3+ external USB sound card for use with my laptop. The MP3+ is a small sound-card box with both analog *and* fiber-optic inputs and outputs.

The fiber optic cables connected easily to the S/P-DIF ports on the back of the IC-7800. (With the radio on, you see an eerie red glow at the other end of the output cable.) With the MP3+ connected to my laptop, I booted up my *MixW* multimode software and switched the '7800 to PSK mode.

What I saw on the *MixW* waterfall display was astonishing. The receive audio showed up in the usual blue texture, but beyond the scrolling "wall" there was nothing but blackness—no odd artifacts, no indications of ground-loop-induced hum. See Figure 10 for that view.

I tuned a PSK31 signal on the '7800 display, then did the same in *MixW*. Watching them side-by-side, it seemed as though *MixW* was a little bit better in signal decoding than the IC-7800's built-in decoder, but the difference was marginal.

During RTTY operation, the performance of both the IC-7800 decoder and *MixW* were essentially identical. I tried *MMTTY* against the IC-7800 and the result was the same.

The only gripe I have about using an external computer with the IC-7800 is the fact that you must use an interface to implement transmit/receive switching. Although there is an RS-232 jack on the back of the IC-7800, you can't use it to key the transmitter without a "level converter" such as the optional ICOM CT-17. The VOX circuit in the IC-7800 will not respond to audio on the accessory jacks, or data on the S/P-DIF input, so that switching possibility is unavailable as well. Your only remaining option is manual transmit/receive using the MOX button on the '7800 front panel.

If you want to use the IC-7800 with your HF digital software, you'll still need a switching interface between your computer's COM or USB port and the IC-7800. This is a common state of affairs for most transceivers, but I didn't expect to encounter it in the IC-7800.

THE IC-7800 IN WPX CW

Dave Patton, NN1N
Special Assistant to the ARRL CEO

It had been a long time since I hauled Amateur Radio equipment from my vehicle to my shack, knowing that the equipment was more valuable than the vehicle. It was 1984 then, and my new Kenwood TS-930SAT and companion TL-922 overpowered my 1980 Datsun. Last week, when ARRL's new IC-7800 found its way to my shack, it slightly overpowered my 2003 Pontiac.

I still have and use my Kenwood equipment, and frankly, have found few rigs that were better than the TS-930 overall. I love that radio, and how great it sounds, hears and looks, and how easily it is operated. I slid it over on the desk and hefted the IC-7800 up next to it. The IC-7800 weighs about the same as the '930, but it is larger. It takes up much more of the depth of the desktop.

After making some simple hook-ups to the radio, and powering it on, I sat back and stared at it for a few minutes. Then I couldn't help it. I went upstairs and found my wife Carol, KB1GAT, and dragged her downstairs to simply look at this rig. It is gorgeous. It feels and looks and plays like a $10,599 radio should. Your attention is drawn to the 7 inch TFT screen like a moth to a light. Carol wanted to know how I was going to come up with $10,599.

I planned to spend some time with the '7800 during the CQ WPX CW Contest. My plan also included not using the rather extensive looking manual, and just see how I could get along with the rig based on my background using most of the rigs on the market over the past 20 years. I have used the ICOM IC-756 and '756PRO radios for a few contests, and I think that helped, because I had no trouble whatsoever using the '7800. I turned it on, hooked it up to the AL-1200 amplifier, and called a CQ. Then I ran the resulting pileup easily and efficiently. I started with my outboard keyer. After an hour I hooked up my Bencher paddle directly to the rig and used the internal keyer. No problems making that adjustment.

The abstract for this little article can be summed up in one sentence: I can't find anything wrong with this radio, and it is so easy to use, and sounds so good and hears so well that it is the best radio I have ever used. To be complete, I should mention I haven't yet used the new Ten-Tec Orion, another contender.

K9EID and WB6ACU Test the '7800 in the DX 'Test

Bob Heil, K9EID, and Joe Walsh, WB6ACU, were able to operate the IC-7800 from W1AW during the 2004 ARRL Phone DX Contest. Here are Bob's impressions of the radio:

Joe and I were able to really put the IC-7800 through its paces while we were there. There were never fewer than six stations operating simultaneously and it was important to me to pay close attention to how the '7800 receiver handled itself under those serious conditions. It passed my tests with flying colors.

The one thing that Joe and I kept coming up with was how smoothly it operated. The controls are all in the right place and they *feel* good. The controls feel like good old time Allen Bradley pots that we used in mixing consoles in the '70s. Nice and smooth. Larger knobs, laid out conveniently—I liked that.

The receiver was very sensitive and yet with all of the filter selections, you can narrow it down and it doesn't sound like an accordion. It has a robust sound to it compared to other receivers I have used. The same goes for the transmit audio. The Heil Classic sounded beautiful on it as did my new Heil Pro-Set Quiet Phone with the HC-5 element.

On Saturday night, Joe and I began operating on AM and worked nearly 100 AM stations in about 6 hours. It was the most fun we had the entire weekend. Each and every one of the heavy duty AM operators from the East Coast raved about the transmit audio. With the 12 (that's twelve!) equalizers (EQ) in the '7800, we were able to dial in just the right response and it stood right beside the plate modulated signals on the band. I loved the fact that they (finally) listened to some of our suggestions when planning the '7800—one being that the *receiver* should have EQ as well as the transmitter. Well, this receiver does—three of them. One is for SSB, one for AM and one for FM. The transmitter has the same—separate EQ for SSB, AM and FM. Two band EQ on each bringing the total number of EQ controls to 12. Just wonderful and about time!

Joe and I also experimented with the second receiver as a diversity receiver and found this useful, although with antennas farther apart than at W1AW it would have been even better. We also noted that the '7800 ran for 24 hours and never got more than lukewarm—*never hot*—and that included six hours of AM carrier at about 80 W!

The '7800's notch filter was superb. The twin pass band tuning is excellent as well. Operating in the contest, the triple stacking of the band memories coupled with the read and write functions as on prior ICOM rigs is invaluable. You can switch between three and four stations in split seconds without ever having to turn the main dial. A feature for contesting that is most appreciated. The band scope also goes along with that and is so very handy.

The other great situation with the '7800 is that we *never* had to refer to the operating manual. If you can operate their PRO, you can dive right into the '7800.

All in all, I found this to be an excellent transceiver with wonderful features—many that we haven't found or used yet. It certainly answers the quest of anyone who wants or needs this higher quality radio.—*Bob Heil, K9EID*

Bob Heil, K9EID (foreground), and Joe Walsh, WB6ACU, operating from W1AW with the IC-7800 and Heil Classic Pro microphone during the ARRL DX Contest.

Before the contest, and while setting up the rig, the first thing that struck me as positive was the fact that in order to hook up my AL-1200 amp to the '7800, all I had to do was connect an audio cable with RCA plugs to each box. That was it. No DIN plugs or external relays needed.

The second thing that drew my attention was the sensitivity of the receiver. Tuning up 20 meters at the slowest tuning rate, I marveled at what I could hear. Stopping and listening to the pileup calling OJØVR, I was able to hear calling US stations on back scatter that I don't believe I would have heard on the '930. The pile-up wasn't very big, but I sensed a "depth" to the frequency that made me feel like I was hearing layers of signals that normally fall into a "mush layer." I tried changing the AGC attack speed, and was happy to notice that it didn't make any noticeable difference in how well I could hear stations calling. So then I decided to work OJØVR myself. He was operating split and listening 1 kHz higher. I turned on the DUAL WATCH so I could listen to the calling frequency as well as his transmit frequency, and hit the split button. Wow! Cool. There is a narrow, somewhat bright, white LED that is dead-in-the-middle of the rig right on top of the monitor screen. There is no way you can miss that you are operating split. And the radio also spells it out for you on the screen. I worked the OJØ on one call with the 200 W output. I also noticed at about this time that the radio reported both local and GMT time on the monitor.

The contest started for me on 80 meters at 0000Z. My goal was to tune up the band and find my boss, Dave Sumner, K1ZZ, who was operating from A61AJ. A61AJ was going to be close to sunrise and I thought I had a chance to work him because there weren't very many US stations on the band this early. The band was packed with Europeans for the first 40 kHz! Conditions were good, obviously, as my antenna is just a dipole at 40 feet. There were quite a lot of static crashes from thunderstorms in the region, but they were not rapidly occurring. I easily worked every station I called. I noticed that the '7800's AGC was working perfectly and the static crashes were not an issue. Tuning by a very loud NY4A I also noticed that it was no trouble to copy European stations within a kHz on either side. When I reached about 3.526 MHz, I found and worked A61AJ, who was S9, with one call. No other US stations were calling, but I had no trouble hearing the numerous European stations in the pile-up.

I then moved to 40 meters briefly, and tuned the band. Changing bands is easy. There are 3 band-stacking registers per band, and it was fun to set them every 30 kHz or so, for quick movement across a band. Then I went to 20. The first thing I noticed was received key clicks. With the tuning rate set slow, it seemed like I was hearing key clicks for about 20 kHz as I tuned across the offending stations. The receiver is so sensitive that you can pick up the clicks earlier than I think I would have noticed on the '930 or most other rigs. In reality, I was only tuning about 1-2 kHz around the clicky radios, but it seemed more irritating to me than ever before. I felt that I could have slid right up next to the clicky station and start CQing if there were no clicks. The first frequency I found on which to CQ was just below a station with horrible key clicks. That must have been why it was available. I quickly adjusted the variable passband tuning, which essentially uses the DSP to narrow the passband. At 400 Hz, the frequency was pretty useable. As I started getting answers to CQs, I decided to hit the CW mode button and put the mode into CW reverse. Doing so helped me hear some of the calling stations more easily by reversing the CW carrier point. This was a fun experience. What can I play with next to help me hear? The notch filter also worked brilliantly. I

Figure 9—IC-7800 in RTTY mode, copying with internal decoder.

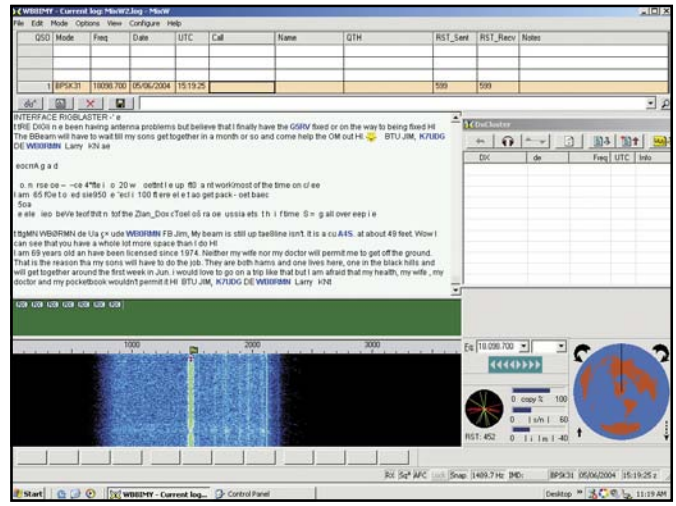

Figure 10—*MixW* waterfall display while connected to IC-7800 via fiber cables. Note the lack of artifacts or ground-loop-induced hum.

felt confident that I could slide into any frequency and get going easily.

The next day I turned the rig on and was looking for signals on 20. The big screen TV upstairs puts out some hash all across the bands and causes problems for me on the high bands because my Yagi is on the roof not far above the TV. When I found a signal that was right at the edge of the S3 hash from the TV, I turned on the noise reduction switch, and suddenly the signal became copiable. The noise wasn't diminished a whole lot, but there was a noticeable improvement on marginal signals. Later, I also learned to use the audio peak filter to pull up that weak CW signal and make it copiable while before it was not. If you hold down the APF button, you can cycle between three passband widths of 80, 160 and 320 Hz. What a difference it makes.

As I ran stations during the contest, I found only one thing that bothered me. Every time I went to clear the RIT back to zero, I discovered that I had to hold the button in for about half a second to make that happen. It was slightly irritating. During my next break I opened up the manual and discovered that you can easily change the function of the RIT CLEAR button to immediately clear upon a touch. The default setting forces the op to hold it in.

While admiring the front panel again after the contest, I decided that the layout of all the buttons and knobs was done perfectly and to maximum advantage. In the places where you can't get your fingers, there aren't any controls. The extendable feet make the front panel easily accessible.

There are many other features to this radio that I haven't tried yet. I want to plug in the keyboard with a USB plug and use it to program the memories for the keyer. I need to listen to 6 meters, and then try the built-in demodulators for PSK31 and RTTY. And the voice keyer and audio recorder, and the flash memory card for storing settings…

"Dear, can we trade the car in on one of these babies?"

THE IC-7800 ON 6 METERS—WEAK SIGNAL

Dennis Motschenbacher, K7BV
ARRL Sales and Marketing Manager

As the current resident 6 meter fanatic at ARRL, I was asked to take the IC-7800 home and see how it performed on its one VHF band. My comments, therefore, are focused on only that band based on my experience in the ARRL June VHF Contest.

I am delighted to report that I was able to not only learn how to effectively employ the IC-7800, I did it by *first* reading the instruction manual. The manual was obviously written for plug and play nontechnical types like me. Setting the rig up to meet my intended usage on 6 meters was not only easy, in the process I was introduced to the many very useful features of the IC-7800 that might have otherwise escaped my attention.

I immediately noted that the IC-7800 dealt nicely with two of my biggest challenges on this VHF band, manmade noise and the multitude of "birdies" (spurious signals) that haunt 6 meter operators. I found the NOISE BLANKER and NOISE REDUCTION controls allowed me to totally eliminate my particular version of local power line noise. I also quickly noted that a birdie from my digital rotor control was not audible when I listened on the IC-7800.

I decided to set up both receivers on the band so that I could keep a constant ear on the international calling frequency (50.110 MHz) while running on another frequency or searching for new stations. The setup of the two receivers was easy and offered a lot of flexibility. The second receiver performed as advertised, picking up a weak signal that alerted me to a short opening to the Caribbean that otherwise would have been missed while I ran much stronger stations elsewhere up the band.

I had arranged meteor scatter contest skeds using a weak signal digital mode (WSJT). The signal "pings," measured in milliseconds, heard off the meteor trails can be very weak but the combination of the sensitive software and extraordinary performance of the IC-7800 made my skeds a cake walk, adding new multipliers with ease.

On the other side of the scale, numerous very strong adjacent signals were encountered. One particularly annoying fact about VHF contesting is the presence of very strong mountain top stations parking themselves only 2 kHz away from the Domestic Calling frequency of 50.125 MHz. That proximity guarantees that any attempt to hear stations calling on the calling frequency will be difficult if not impossible—with most rigs. I had good success silencing the distraction of our local mountain topper, using the PASSBAND TUNING and proper filter selection.

I received unsolicited complementary reports on my audio, some noting that it made me "punch through" even though my signal was weak. In summary, my short test drive with the IC-7800, while not exercising all of the capabilities of this extremely flexible radio, proved to me that, out of the box, it was a true winner. It appears to me that the IC-7800 has a huge amount of performance and fun to offer.

See the Product Review Auction Web at **www.arrl.org/prauction** *for the latest equipment up for bid including the Kenwood TS-480SAT HF and 6 meter transceiver.* QST