

The ICOM IC-775DSP Transceiver

BY LEW McCOY*, W1ICP

The ICOM IC-775DSP transceiver is a top-of-the-line ICOM product. I have had the 775 for quite some time and have really given it a thorough testing.

Before getting into the review, however, I would like to say that I have been testing and reviewing equipment for articles for more years than I like to think about. Actually, it was 40 years ago when I first did reviews for *QST*. I was employed in the Technical Department of the ARRL at the time. Our goal in those days was to really wring out a piece of equipment, checking characteristics such as ease of use, but primarily testing the technical aspects of gear. I note that now some reviews tend to be very difficult for today's amateur to comprehend. Many of us do not even understand the terms used to describe the various aspects of modern equipment. In plain, simple language, it takes a real hot-shot engineer to even begin to understand what the reviewer is talking about. In many cases (in my opinion) the reviewer completely misses the point. Numerous graphs and charts to show a product's characteristics often will only completely confuse the reader, and I feel sometimes they are unnecessary. Why unnecessary? Simply because modern design has reached a point where one doesn't have to be too concerned about stability, or third-order distortion, or keying quality. Let's give credit where it is due: The manufacturers are very capable and do a good job.

The Basics

Let's try to look at the IC-775 from a different viewpoint, one I hope everyone understands—that is, primarily from an operating standpoint. The IC-775DSP is an extremely exotic piece of equipment. Incidentally, "DSP" stands for Digital Signal Processing. The term "bells and whistles" has been much abused by reviewers, but in this case it is deserved. Basically, the unit is a self-contained, 200 watt transceiver with a built-in power supply. The transmitter covers the 160 through 10 meter bands and in addition offers a general-coverage receiver.

Here are some more basics, and then we'll go into the discussion of performance and features that should appeal to every amateur. The transceiver is 16³/₄"W × 6"H × 15¹/₂"D and it weighs 37 pounds. Its power supply is self-contained. I have included the page from the manual that shows all the specifications (fig. 1)—and there are plenty—if you would like to study the details. I also might add that the transceiver I tested met or exceeded all the specs given by ICOM.

The IC-775DSP is really a joy to operate. It

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The ICOM IC-775DSP transceiver.

takes some getting used to because there are so many features available. The instruction manual is extremely detailed with many illustrations included. It's 8¹/₂" × 11" and 63 pages. I spent considerable time studying the manual and the transceiver to familiarize myself with

all the features. As a writer myself, I have always been irked by those writers who assume that the reader automatically understands what they are saying. Such is not always the case. For example, I find that buying and using software can be extremely frustrating. I bought a



This closeup view shows the right side of the front panel of the IC-775DSP. On the readout dial, the term "NR" at the left indicates that the noise reduction of the DSP action is operating. This view shows the transceiver set up as "Dualwatch," whereby both usable frequencies are shown. The one at the left is for the main tuning and the one at the far right is the setting of the other VFO. The tuning knob for this setup is the large knob below. Along the far right of the panel are the filter switches just above the Twin PBT tuning control. At the bottom is the RIT/TX control.

■ GENERAL

- Frequency coverage:

Receive	100 kHz – 29.990 MHz
Transmit	1.800 – 1.999999 MHz* ¹
	3.500 – 3.999999 MHz* ²
	7.000 – 7.300 MHz* ³
	10.100 – 10.150 MHz
	14.000 – 14.350 MHz
	18.068 – 18.168 MHz
	21.000 – 21.450 MHz
	24.890 – 24.990 MHz
	28.000 – 29.700 MHz

*¹ 1.830–1.850 for Spain version;
1.810–1.850 for France version;
1.815–1.835/1.850–1.890 for Germany version

*² 3.500–3.800 for Spain, France and Germany versions

*³ 7.000–7.100 for Spain, France and Germany versions
- Mode : SSB, CW, RTTY, AM, FM
- Number of memory : 101 (99 regular, 2 scan edges) channels
- Antenna impedance : 50 Ω nominal
- Usable temperature : –10°C to +60°C; range +14°F to +140°F
- Frequency stability : Less than ±200 Hz from 1 min. to 60 min. after power ON. After that, rate of stability change is less than ±30 Hz/hr. at +25°C; +77°F. Temperature fluctuations (0°C to +50°C; +32°F to +122°F) less than ±350 Hz.
- Power supply requirement:

120 V type	100 – 120 V AC
230 V type	220 – 240 V AC
- Power consumption :

Transmit	max. power	760 VA
Receive	squelched	140 VA
	max. audio output	150 VA
- Dimensions : 424(W) × 150(H) × 390(D) mm
16¹¹/₁₆(W) × 5²⁹/₃₂(H) × 15¹¹/₃₂(D)¹
(projections not included)
- Weight : 16.5 kg; 36.4 lb (without DSP unit)
16.7 kg; 36.8 lb (with DSP unit)

■ TRANSMITTER

- Output power : SSB, CW, RTTY, FM 5 – 200 W
AM 5 – 50 W
(continuously adjustable)
- Spurious emissions : Less than –60 dB
- Carrier suppression : More than 40 dB
- Unwanted sideband : More than 55 dB
- Microphone impedance : 600 Ω

■ RECEIVER

- Receive system : SSB, CW, RTTY, Quadruple-conversion superheterodyne
AM
FM Triple-conversion superheterodyne
- Intermediate frequencies: (Unit: MHz)

MODE	SSB	CW, RTTY	AM	FM
1st	69.0115	69.0106	69.0100	69.0100
2nd	9.0115	9.0106	9.0100	9.0100
3rd	0.455	0.455	0.455	0.455
4th	10.6950	10.6950	10.6950	–

- Sensitivity (Preamp 1 ON):

SSB, CW, RTTY	100 – 500 kHz	Less than 2.0 μV
(10 dB S/N)	1.8 – 29.99 MHz	Less than 0.16 μV
AM (10 dB S/N)	0.5 – 1.8 MHz	Less than 13.0 μV
	1.8 – 29.99 MHz	Less than 2.0 μV
FM (12 dB SINAD)	28 – 29.99 MHz	Less than 0.5 μV
- Squelch sensitivity (Preamp 1 ON):

SSB, CW, RTTY,	Less than 3.2 μV at threshold
AM	
FM	Less than 0.32 μV at threshold
- Selectivity (Normal filter selection):

SSB	More than 2.4 kHz/–6 dB
	Less than 4.0 kHz/–60 dB
CW, RTTY	More than 500 Hz/–6 dB
	Less than 1.0 kHz/–60 dB
AM	More than 6.0 kHz/–6 dB
	Less than 20.0 kHz/–60 dB
FM	More than 15.0 kHz/–6 dB
	Less than 30.0 kHz/–60 dB
- Spurious and image : More than 70 dB rejection ratio
- Audio output power : More than 2.6 W at 10% distortion with an 8 Ω load
- RIT/ΔTX : ±9.999 kHz
variable range

■ ANTENNA TUNER

- Matching impedance range: 16.7 – 150 Ω unbalanced
(Less than VSWR 3:1)
- Minimum operating : 8 W
input power
- Tuning accuracy : VSWR 1.5:1 or less
- Insertion loss : Less than 1.0 dB
(after tuning)

Fig. 1— The specifications for the transceiver as published by ICOM. The unit met or exceeded all these specs in my tests. Note the antenna tuner specs. In my tests I used a multiband antenna that was less than 3 to 1 impedance match for 50 ohms. The built-in tuner handled this antenna extremely well.

very large book that describes DOS (disk operating system). When I installed DOS into a computer, I found that all the files were compacted and had to be expanded before they could be used. I went through that book page by page and searched the index, but there

wasn't a single word about how to do this. A friend told me to use the "EXPAND" command, but there wasn't a word about that command in the book! The manual for the IC-775DSP doesn't have this problem. Common amateur radio abbreviations are spelled out so you know

exactly what is being described. This is an excellent manual and a credit to ICOM.

Features

Let's discuss some of the common features found on most transceivers these days before



This is the left side of the front panel. There are lots of controls, and they take a little getting used to. At the upper left are the preamp controls and the meter reading switch. Below those are the tuner controls, one for either antenna input. Then there are the keyer controls, followed by noise blanker controls, then AGC and compressor controls. At the bottom left are the AF/RF, Balance/Tone, NR (noise reduction level), and Squelch, followed by Mic gain and PWR controls.

getting into the many more unusual aspects of the IC-775DSP. We'll start with the meter and meter switch.

There are six switch positions available to read various functions. First, SWR reads the standing wave ratio on the line to the input (or output) of the unit. Next, the PO power output shows the relative RF power output in watts. The ALC (Automatic Level Control) indication is followed by COMP, which shows the compression level being used. The IO shows the drain current on the final FET, and the last position, VO, indicates the drain terminal voltage of the final FET.

There is a built-in antenna tuner which will match any load from 16.7 ohm to 150 ohms down to an SWR of 1.5 to 1 or less. I employ several antennas; one is a five-band beam that has some wide SWR curves on certain bands. The IC-775DSP brought the SWR down to well within the desired range on all frequencies. The tuner is completely automatic and tunes very quickly, an important feature for contest operation when band changing is necessary.

To give you a quick example of one DX/contest-operating feature, there are two frequency displays—the main display and a secondary display. Either display can be tuned individually. They are labeled the **Dualwatch** function. For example, you can program one of the tuning controls for an automatic CW DX call, activate that calling function, and then tune the secondary control to see where the DX station is listening. A simple instantaneous switch puts your transmit signal on the desired frequency. To elaborate on this function, the memory keyer memorizes and retransmits three different CW keying operations of often-used information such as rig, antenna type, location, etc. (or contest exchange). There are approximately 40 characters and 101 memories available.

One of the main features of this transceiver is the **Dualwatch**, which allows you to receive two signals on the same band at the same time. You can, for example, monitor a DX station who

is operating off his frequency. Even more important, the main and sub-frequencies are completely independent and can be controlled with different tuning dials (which include independent dial lock functions). These functions really expand your operating ability. For example, in DX or contest operating you can set up one transceive operation on the desired station while you keep operating on another frequency. Also, as you can see from the photos, the display is very easy to read for both setups.

Another outstanding operating function is the triple stacking register. With this setup you have the equivalent of three VFOs on each band. Three separate registers allow you to memorize the three frequencies and modes used on each band. You simply push the **Band** key once to call up the last used frequency and mode, push the switch twice to call up the frequency and mode used before that, and push it three times to use the frequency and mode before that. This may sound a bit complicated as you read about it, but it only takes minutes to become familiar with this very nice feature.

Still another operating feature is the "Channelized quick split function." This permits the quickest possible method of operating split frequency for DX or net operations. No dial rotation is necessary; simply pushing switches will set split-frequency operation over a range of ± 99 kHz in a 1 to 99 kHz step channel operation.

I mentioned the built-in antenna tuner earlier, and another word or two is in order. The tuner uses an automatic preset memory that includes all bands (160 meters, too). When you change bands, the tuner automatically sets itself, so no tuning is required.

Let's now discuss the DSP (Digital Signal Processing) feature and the IC-775DSP. DSP is a fairly new concept in transceiver design, and while the technical aspects are complicated, what it does is simple.

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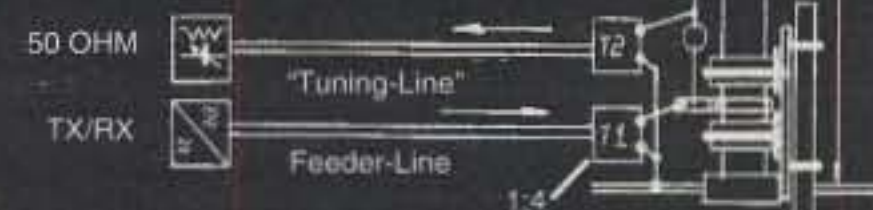
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signal-to-noise ratio is achieved, providing clean, clear audio in SSB, easy to copy RTTY, and clear SSTV reception. DSP has the feature of pulling very weak signals out of the noise. In the beginning, DSP was used in the audio chain. Just recently, however, the process was moved to the IF (intermediate frequency), where the signal is processed. The IC-775DSP employs a digital modulator/demodulator constructed using a 90-degree phase shifter and radically new architecture. This provides consistently reproducible, clear transmission in SSB and high-quality reception of SSB signals.

Notch filters to take out undesired carrier notes have become a way of life in amateur radio. The **Notch** function in the IC-775DSP is a joy to listen to. Beat signals are notched out automatically with the DSP system; there is no need to tune them out with a notch control.

On CW, under crowded conditions a digital narrow filter can be kicked in, providing an 80 Hz, ultra-narrow CW filter. This effectively cuts nearby interference and pulls out the desired signal with improved signal-to-noise ratio. Another feature for CW work is an adjustable low- and high-pass filter. You can set the desired audio characteristics for transmit and receive independently using these filters. The LPF can be adjusted to 18 levels and the HPF to 14 levels.

Now we get into interference and rejection features. Twin passband tuning (PBT) electronically narrows the receiver intermediate frequency passband width in order to reduce interfering signals that overlap the edge of the IF passband. With twin passband filters you can electronically shift the center frequencies of the 455 kHz and 9 MHz IF filters separately or together for really clear reception during crowded band conditions.

The IC-775DSP has a very cute feature that really is a godsend for CW operators. It is called



The IC-775DSP transceiver is a really nice box that puts out a 200 watt signal. The various mode switches are just to the left of the main tuning dial. The readout panel is clear and very easy to read.

the **CW Reverse Mode**. This simply means that via a front-panel switch, if you have a CW signal alongside the signal you are trying to copy, you simply hit the switch and you will be listening on the other side of zero beat—away from the interfering signal. I used this control a great deal during a contest, and believe me, it is really a big help.

In addition to an automatic notch filter, there is a manual notch filter. The manual IF notch allows you to cut out a very strong undesired signal that the AF notch won't touch. This notch provides 45 decibels of attenuation—much more than enough to kill the undesired signal.

The noise blanker is what I would term excellent. Just this morning I had some kind of electrical noise that sounded like line noise. It was

running about an S7 on the meter. I turned on the noise blanker and bingo! The noise was gone. I did find some types of noise that I could not get rid of, but with the DSP adjusted I reduced the noise to a noninterfering level.

I suppose I should mention drift and warm-up time, because that's an old hat that went into any receiver product review. Well, there is no drift—period. ICOM has come up with a mixerless phase locked loop that is a completely new ball game when it comes to stability. They have what is called a direct digital synthesizer that operates without the use of a mixer. Only one reference crystal is required, and this makes stability unbelievably good.

How about the tuning rate? There are two speeds. With the slower speed and the new phase-locked-loop system, you can tune to a one Hz rate. The high-speed tuning moves you across a band with a few turns of the tuning knob.

There are also two levels of preamp gain to provide gain for weak-signal reception. In addition, there are three levels of signal attenuation on the same panel switch. How well this attenuation system performs is interesting. With radio conditions improving on the higher bands, 20 and up, a strong signal can mess up adjacent signals. The attenuation control has a great effect on cleaning up that problem. The actual gain and signal reduction figures are 10 dB for the first preamp and 16 to 18 dB for the second preamp. The RF attenuator will knock down a signal by 6, 12, or 18 dB.

The CW functions are many. There is a built-in memory keyer that provides three separate channels with an automatic repeater function. Each channel is capable of storing up to about 40 characters. These can be transmitted automatically. This is a big operating advantage during contesting or just general operating. You can store exchange numbers, or your QTH, name, type of rig and antenna, etc. When I mentioned earlier that this rig really has bells and whistles, I meant it!

There is a built-in electronic keyer that has a programmable computer control (which controls the computer dot/dash ratio). The ratio can be adjusted from 2.8 to 1 to 4.5 to 1. Also, the polarization of the iambic paddle can be reversed in **Set** mode. This is convenient in con-

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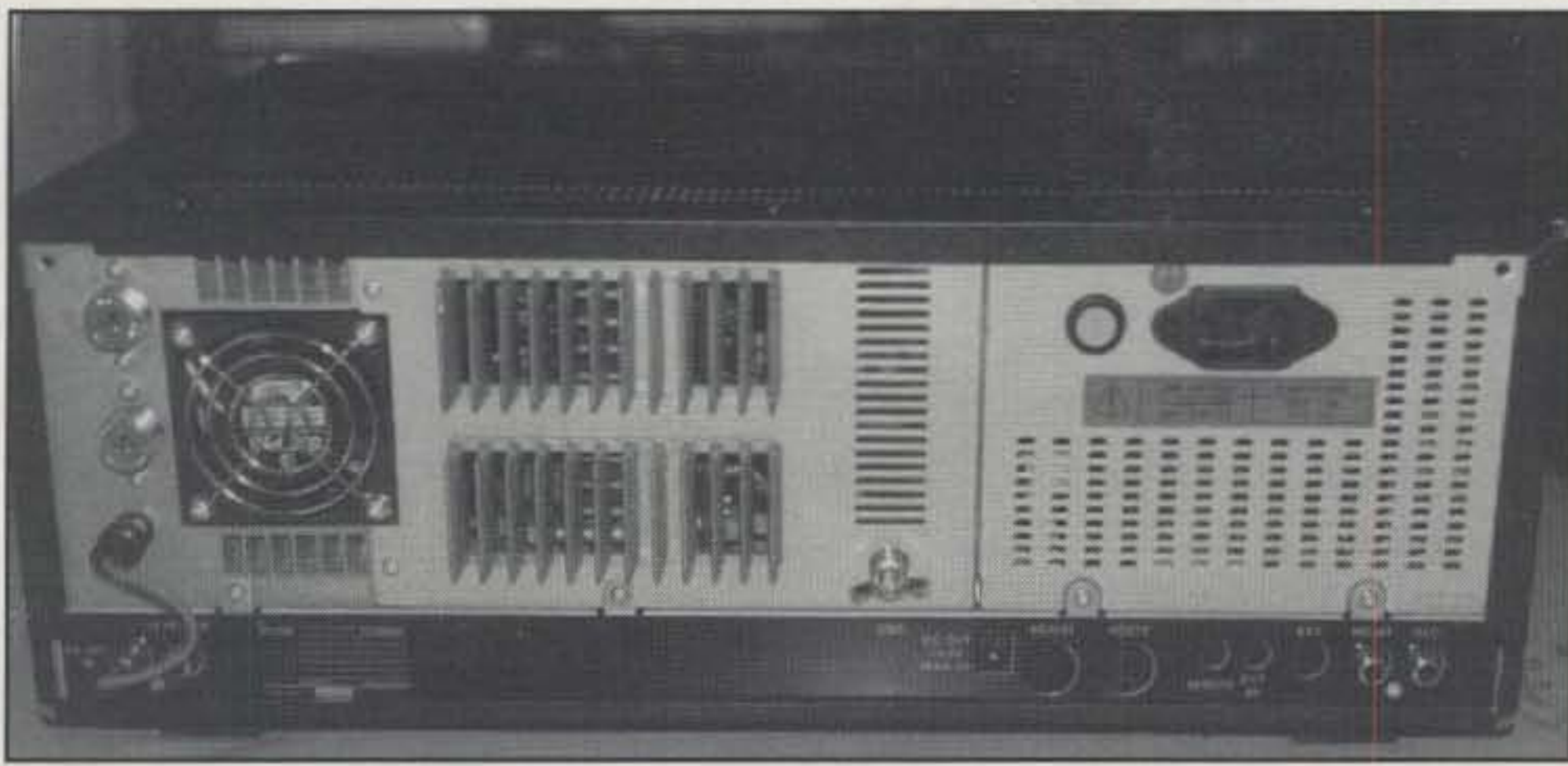
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In this rear view the two antenna input/outputs are visible at the upper left. The jack at the lower left is for a transverter/x-verter input/output. Over on the right side are two accessory sockets, for data communications and automatic antenna tuner, TNC, etc. To their right is a key jack, external speaker, and T/R control relay jack. Also available on the back is a 13.8 VDC, at 2 amp terminal. Another jack is for ALC input.

test operating for some of the real hot-shot operators. Also, the front panel has an electronic key jack and the back panel has a normal key jack. Again, connect a paddle to the front jack and computer keying equipment to the rear jack; this makes a great contest convenience! In addition, the IC-775DSP permits adjustment of the CW pitch from 300 Hz to 900 Hz in 20 Hz steps. Choose a pitch that you find comfortable to operate with.

In my testing I married the IC-775DSP to a

computer that had a contest operator's program installed. An interface (optional) was used for the computer control. Also, I ran a keying line from one of my serial ports. It was my first operation in a contest where the computer did 99 percent of the work. By simply pushing a button on the keyboard, I sent a contest CQ. When a station called me, I typed in his call and then pushed another button and his call and report were sent. The computer did all the logging, score keeping, and so on. I have

to admit it was a lot easier than the old days when we ran multi-op with one assistant logging all the contacts. The IC-775DSP did an amazingly good job in this operation.

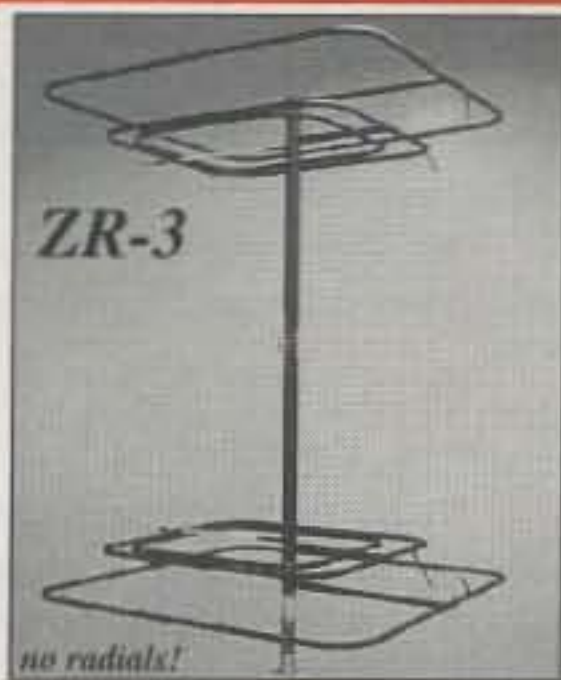
As to DSP and so forth—the digital signal processor digitally separates the desired signal from noise components before the signal enters the audio processor. In other words, it operates at an intermediate frequency. An outstanding signal-to-noise ratio is achieved, and weak-signal reception is improved immensely.

As mentioned earlier, the digital notch function is outstanding. Any interfering heterodynes are automatically cancelled out. This alone proves the efficiency of digital signal processing. This is also true with the ultra-narrow CW filter. During pile-ups and while trying to receive weak signals, the ultra-narrow (80 Hz) digital filter does a marvelous job.

Summary

It is obvious from this review that I am very much impressed with the IC-775DSP. Frankly, it is what many of us dreamed of years ago. Back in those early days when we had HROs, Hammarlunds, and so on, we considered them pretty good receivers. Many of us then liked to prophesize what eventually would come about in receiver design, but none of us could have imagined a transceiver with the many fine features that this one has.

The IC-775DSP is a product of ICOM America, Inc., 2380 116th Avenue NE, Bellevue, WA 98004. It has an amateur net price of \$4,760.00. ■



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