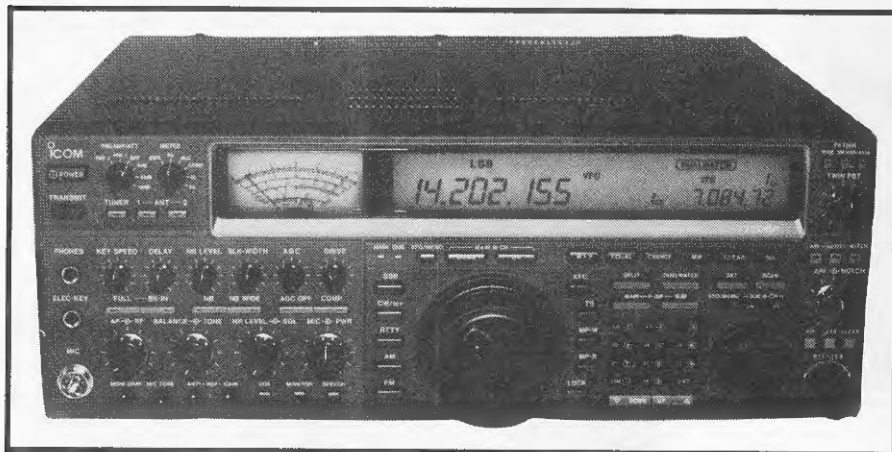


■ Equipment Review

ICOM IC-775 DSP HF All Mode Transceiver

Reviewed by Ron Fisher VK3OM.



ICOM IC775 DSP HF Transceiver.

What Is It?

The ICOM IC-775 DSP is a new top line transceiver. It takes over from the now aging IC-765. Of course, the IC-781 is still the highest priced transceiver that ICOM produce but this is only available on special order at a price of around \$13,000. No stocks of this transceiver are available in Australia. The IC-775 DSP retails at \$7849.65 which puts it out of reach of many amateurs but, for those lucky enough to afford one, it has a multiplicity of facilities that are not available in many other transceivers. Of course, in time, many of the unique features of a top line transceiver will filter down to lower priced equipment.

The IC-775 comes in two levels of sophistication, the IC-775 and the IC-775 DSP. The DSP equipped model will be the only one available in Australia. It makes more sense to build the DSP unit in than to offer it as an optional extra. After all, if you are spending over \$7,000, why not spend a bit extra and have the benefit of digital signal processing for both transmit and receive. I think this would be money very well spent.

Features

The IC-775 is a full featured base station transceiver. It transmits on all the HF amateur bands from 160 to 10 metres with a power output in excess of 200 watts. The receiver section covers all frequencies from 100 kHz to 30 MHz and, like the transmitter, has all mode capability. In addition, there is a second receiver built-in which allows you to listen on two separate frequencies at the same time.

A switched mode power supply is also built-in to allow operation from normal AC mains power. There is no provision for operation from a 13.8 volt DC power source. The switched mode power supply helps to keep the size and weight of the IC-775 down but, even so, it weighs in at 16.7 kg and measures 424 mm wide, 150 mm high and 390 mm deep. This is exactly the same size as the earlier IC-765 and almost 1 kg less in weight. But the new IC-775 has double the transmitter power output.

The fluorescent display on the old IC-765 has been updated with a large LCD similar to the display of the

IC-736/IC-738. However, the information the display provides to the user is vastly increased over the two lower priced models. We will cover the facilities provided later in this article.

Probably the most interesting aspect of the new transceiver is the digital signal processor. Facilities available with the processor include receiver noise and heterodyne reduction, and independent adjustment of transmitted and received bandwidth with separate settings for high and low frequency response. The transmitted signal is generated from the DSP to produce low distortion audio on SSB and AM and clean carrier for CW.

A new feature for ICOM is the provision of twin pass-band tuning controls. This allows independent adjustment of the high and low frequency ends of the received band pass. There is also a manual notch filter which doubles as an audio peak filter. However, separate controls are included for each function.

Of course one of the highlights of the IC-775 DSP (as with most of the current ICOM range) is the incredible memory system. To start with, there are one hundred and one programmable memories. Channels one to ninety nine can accept frequency and mode while memories 100 and 101, actually labelled P1 and P2, can be used to set the band edges for the programmed scan function. As usual, all memories are tunable so you can tune away from them with the normal main tuning control but return to the memorised frequency at the touch of a button. In addition, there are two VFOs with the usual facilities for split operation.

As this transceiver is large, the front panel controls are of good size and are well spaced. There are also more of them than you will find on your standard transceiver. It's good to see that the AF and RF gain controls are concentric, not separated as on some of the other ICOM HF transceivers. A new control on this class of rig is a "tone" control. This provides top cut only, but is useful none the less.

The Preamp/Attenuator control has been changed. There are now two preamp selections. Preamp 1 gives 10 dB gain on all HF bands, while

preamp 2 gives an additional 16 dB gain above 21 MHz. The attenuator has been changed from 10 dB steps on the IC-765 to 6 dB steps. With three steps, this gives a maximum of 18 dB attenuation as against 30 dB on the old model. I would have preferred to have had at least four positions to give 24 dB cut and possibly five to bring it up to 30 dB. Carrying out antenna and IMD tests requires at least this amount of attenuation.

Again, there are two antenna connectors on the rear panel. These are controlled either by front panel switching or programmed via the band switching for automatic selection.

Missing from ICOM transceivers since the days of the old IC-745 has been the variable AGC decay control. I used a 745 for many years and always thought that this was the best thing ever put on a transceiver. For some reason it disappeared with the demise of the 745 and hasn't been seen since, until now, with the exception of the high priced IC-781. This control should be on all transceivers.

On The Air

The first thing noted with the IC-775 DSP is that the microphone is an optional extra. Luckily I have a couple of ICOM microphones tucked away for such emergencies. I usually like to include a short review on microphones supplied with transceivers; however, this will not happen in our current review. Perhaps ICOM might like to supply a few of their current series of microphones for separate review.

Considering the complexity of the front panel, the transceiver is very easy to get up and going. However, an hour spent reading the instruction manual beforehand is very worth while. Many functions are not self evident, in particular the "Set" mode where you can optimise 26 different functions. Let's look at a few of these.

The CW operator can set his preferred pitch from 300 to 900 Hz in 20 Hz steps. RTTY keying polarity can be reversed to give mark/space for either key open or closed. Transmitted and received bandwidth can be set independently. On receive,

the low frequency can be varied in 18 steps from 80 to 500 Hz. The high frequency cut can likewise be set to 14 frequencies between 1.5 and 3.3 kHz. The transmitted response can be varied in a similar way. Another nice feature for the CW operator is that the CW pitch mentioned above can be assigned to the squelch control for normal front panel operation. The squelch is then set to the full off position. You will have fun exploring all of the other variable parameters. When in the "Set" mode the various functions are identified on the main LCD so you can see what is happening.

The transceiver was used over a four day period on various antennas, including beams and long wires and, overall, the performance was faultless. Received audio quality was good on the internal speaker, which is mounted facing up in the cabinet top panel. Received audio quality using a good external speaker was top class.

For SSB operation I found that setting the band pass to 250 Hz at the low end and 2.5 kHz at the top end produced the best results. However, with ease of changing the response you can, of course, set it to your own taste. ICOM have carried over their two antenna connectors from the earlier 736/738. This is a great "why didn't they think about that before?" idea. If you run a tri-band beam for high frequencies and, say, a trap dipole for 80 and 40 metres, all your antenna switching can be carried out automatically by the transceiver. Also, with the above set-up you might find the automatic ATU ideal to flatten the SWR out to the band edges.

The twin band pass tuning controls now allow you to control the selectivity at both ends. With a single BPT you can cut either the low end or the high end but not both. With the twin BPT system one control can set the low end while the other sets the high end. The result is very effective QRM elimination. On the subject of interference rejection, the digital signal processor built into the IC-775 DSP does a magical job in removing heterodynes but not quite as good in removing random noise as compared to our external DSP unit. It's a start, but maybe ICOM needs to tap into

OUTBACKER[®]

H.F. Multi-band Mobile Antenna

80m to 10m

★ All bands on one whip
Other Bands Optional

No tuner required
Low v.s.w.r.

Rugged - Reliable
Dependable

Outbacker "Perth"
Outbacker OB8 "Classic"
Outbacker "Junior"

Heavy Duty Spring Mounts
Split Models
Trunk lip mounts
Helical Dipoles
Long wire Dipoles
Baluns

New from Europe, Recorded in Nashville

★ Music By the HAM BAND
14 amateur radio songs

Available on Tape for \$ 20 - CD \$30
Including Postage

Now available from :

MELBOURNE
Daysom Communications
Ph 03-5436444

ALICE SPRINGS,
Farmer Electronics
Ph 089-522388

DARWIN.
Integrated Technical Services
Ph 089-815411

SYDNEY
Emtronics
Ph 02-2110988

PERTH.
Tower Communications
Ph 4701118

ADELAIDE
DEALER WANTED

PERTH - Model

For further information, and for all International enquiries call us direct at :

TERLIN AERIALS
5 Yampi Way
Willetton W.A. 6155

Ph +61 (09) 3545444
Fax +61 (09) 3545455

NEW
VIDEO

Send \$ 5.00 for a 15 minute informational video
Refundable with every antenna purchase.

some of the USA technology to get things right.

The most used thing on a transceiver is, without doubt, the tuning control. Not only is the mechanical smoothness of the control important, but also what goes on behind the panel with the electronics is important. I think that ICOM have both factors exactly right. The tuning knob is large enough to provide a good "feel". With the smallest tuning step of one Hz the knob has a 500 Hz per revolution tuning rate. At this rate, the tuning is silky smooth. Push the "TS" button and the speed increases ten times. Push it again and you select one kHz steps to get to the other end of the band in a hurry.

For some years now, ICOM have produced the best memory systems in the game. The IC-775 DSP continues and improves on this. There is now a triple band stacking register which means you can recall the last three frequencies and modes used on a particular band which, in conjunction with the second receiver, gives unsurpassed band monitoring.

The second receiver, or "Dual Watch" as ICOM call it, works well but perhaps not as well as others. It shares the IF strip and front end band filters with the main receiver which means two things. Firstly, whichever mode is chosen for the main receiver is the one you get on the second receiver. You cannot, for instance, listen on the opposite sideband or on SSB and AM at the same time. Secondly, you can only use the second receiver within the band

chosen for the main receiver. This might extend a MHz or so but you cannot listen to, say, 3.5 and 7 MHz at the same time. Perhaps not too serious but I can think of many cases where full coverage with the second receiver would be useful.

For transmitter tests on SSB, I used two fairly old ICOM microphones, an HM-12 and an SM-6. If you were to purchase an optional hand microphone for your new ICOM you would get an HM-36 which, as far as I can tell, has identical characteristics to the HM-12. Both of my old microphones performed very well with IC-775 DSP. If it proved one thing it was that these microphones can produce excellent quality and any criticism of them in the past must have been due to the transceiver used with them. With the DSP band pass optimised the transmitted quality was high class.

Keen CW operators are well looked after. Some of the features they will appreciate are the CW reverse mode and the audio peak filter which, combined with the DSP automatic audio peak filter, produces superb audio selectivity that makes even weak signals stand out from the crowd. The DSP CW filter has a band width of 80 Hz which must surely be the narrowest CW filter ever. Combined with the one Hz tuning steps, this is very easy to use. You can also plug your key into the front panel socket, no more fumbling around the back.

On Test

I carried out the usual series of

tests on the IC-775 DSP, starting with transmitter power output. RF power output is variable on all modes via the front panel "Power" control. Minimum power output was about seven watts on all bands. I measured a minimum power output of 200 watts on 10 metres and a maximum output of 225 watts on 80 metres. Again, the IC-775 DSP specification does not include a figure for transmitter intermodulation distortion. The same IMD tests were carried out that we have used on previous HF transceiver tests. We arrived at a figure of -27 dB. This is not as good as the figure we obtained on the IC-736 in the July 1994 review. In fact, it seems that transmitter IMD figures have improved very little over the years. With all the improvements we have had, such as high voltage FET final amplifiers, why are we still around the -30 dB mark for average amateur transceivers?

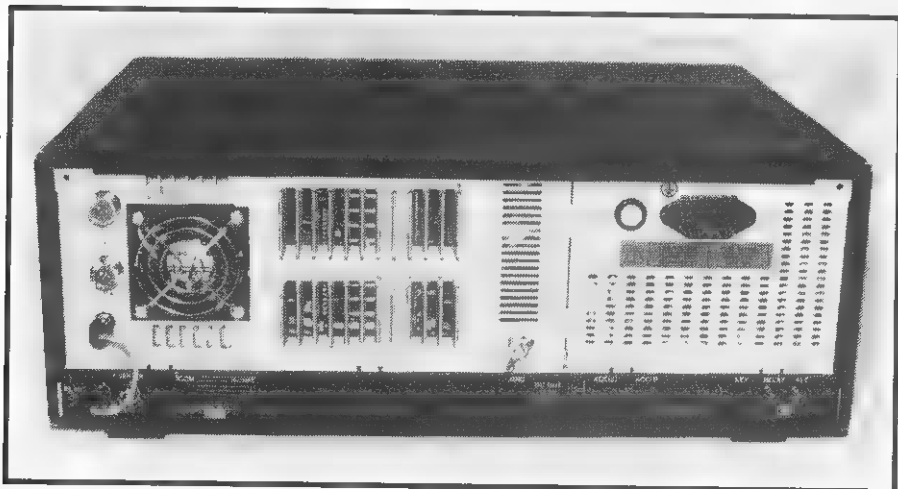
Receiver Tests

The first test was for "S" meter calibration. This was carried out at 14.2 MHz with the preamp switched off.

"S" Reading	μV input
S1	2.0 μV
S2	2.2 μV
S3	2.5 μV
S4	2.8 μV
S5	3.8 μV
S6	5.4 μV
S7	9.0 μV
S8	18.0 μV
S9	30.0 μV
+ 10 dB	120 μV
+ 20 dB	420 μV
+ 30 dB	1600 μV
+ 40 dB	5500 μV

The preamp gain was measured at 10 dB and the 6 dB steps of the attenuator were spot on. Preamp 2 was also spot on at 16 dB. AGC threshold was about 2.0 μV and increasing the signal generator to full output produced an audio output increase of less than one dB. AGC action was very smooth. The variable decay control could produce a range of 8 seconds from S9 (maximum delay) to less than 1 second at minimum delay. In between these, you should be able to find a setting that will suit your taste. It is also possible to switch the AGC off, which should please CW operators.

Receiver sensitivity was measured



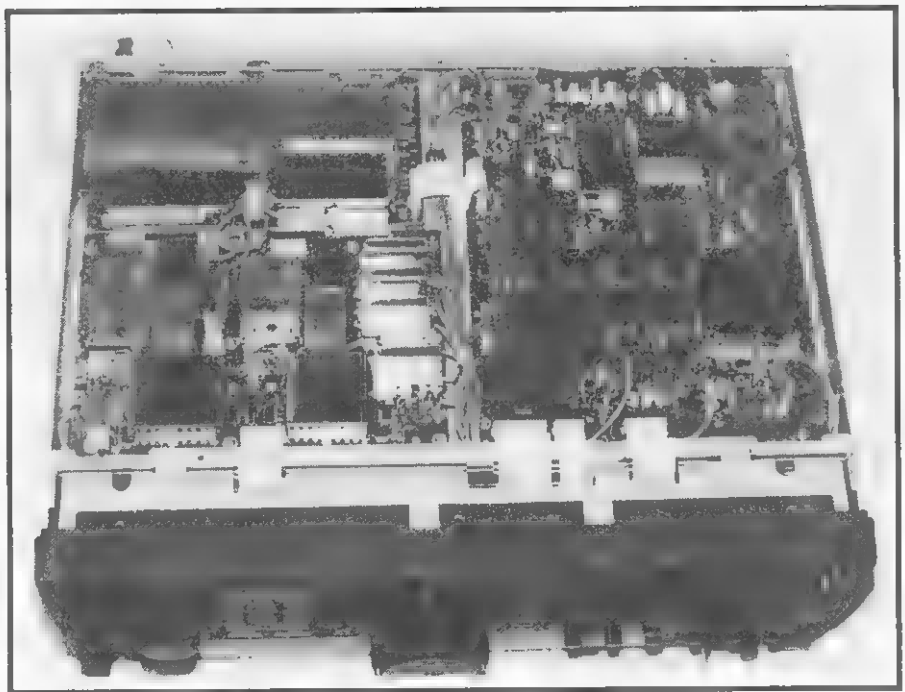
The uncluttered rear panel of the IC-775 DSP.

in the SSB mode at 14.2 MHz with the preamp switched out. It was $0.14 \mu\text{V}$ for 10 dB SINAD, which is identical to the figure obtained with the IC-736 (*Amateur Radio*, July 94). AM sensitivity again was the same as the IC-736 at $2 \mu\text{V}$ for 10 dB S/N (30% modulation). Both of these figures are spot on with the specified sensitivity.

The quality of AM broadcast reception was very much better than the earlier models. It seems that there is far less audio response tailoring employed in the IC-775 but, if you prefer bassy sounding audio, the "Tone" control will produce the desired result. It is a straight top cut control producing -4 dB at the centre and -8 dB full on, both at 2 kHz.

Audio power output measured, with the extension speaker socket terminated with an 8 ohm load, was 2.7 watts maximum and 2 watts for 10% distortion. This is a little less than the specified output. However, by using a 4 ohm speaker the output increases to a maximum of 4.2 watts and 3.0 watts for 10% distortion. Distortion with around 250 milliwatts output (a little above normal listening level) was only 0.6%. While this is an excellent figure, it is higher than I measured on the IC-736 at 0.3%.

Frequency readout accuracy and



Underneath view of the IC-775 DSP with the case removed.

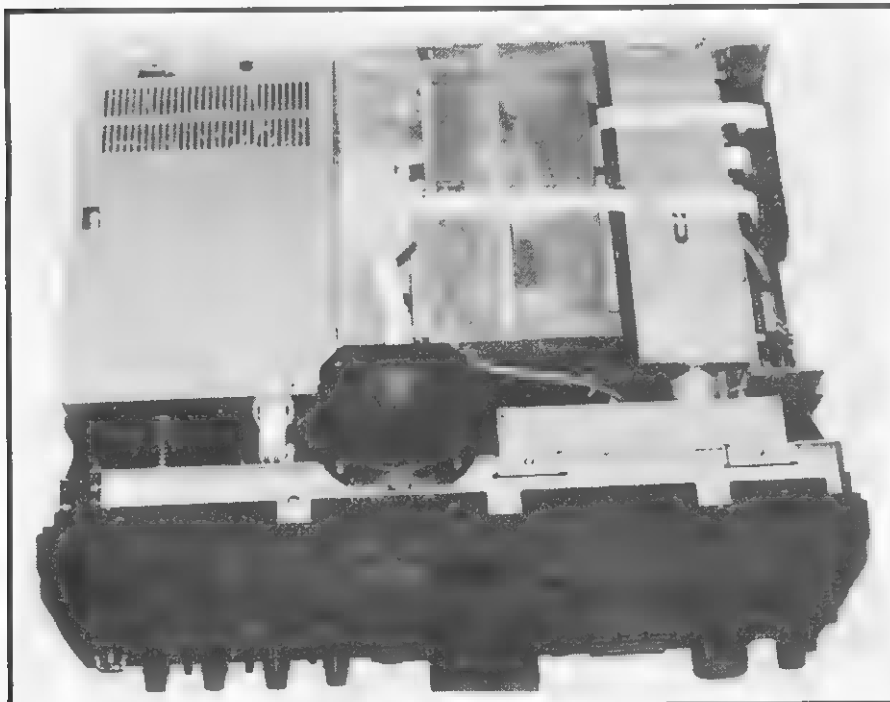
stability are superb. With the one Hz readout selected the total estimated error in the readout and total drift did not exceed ± 5 Hz. If the optional high stability crystal oscillator (the CR-282) had been installed, this would have reduced to about ± 1 Hz. In basis, if someone tells you that you are not on the frequency you say

you're on, then they must have access to some rather fancy measuring equipment.

With the exception of the transmitter intermodulation distortion, the performance of the IC-775 DSP is beyond reproach. As opposed to some earlier ICOM transceivers, I find that both transmitted and received audio quality are very much to my liking. However, I feel that a transceiver in this price range should have much better IMD performance. Commercial equipment is, in general, 10 dB better than the best amateur equipment. Why?

Instruction Manual

The instruction manual supplied covers both the standard and the DSP versions of the transceiver. The 63 page book has excellent coverage of the operation and functions of the rig. A full circuit diagram is included as a loose separate insert. There are dozens of line drawings to illustrate the operation procedures. However, if you want an overview of the facilities that the transceiver has, you will need to get hold of the advertising brochure. Perhaps ICOM assume you have obtained this before your purchase of the transceiver. So, I come back to my old grouch. Why not include a few pages of technical information that would at least cover



A top view of the IC-775 DSP with the case removed.

