

## Equipment Review

# The Icom IC-7000 HF, VHF, UHF all mode transceiver

Ron Fisher VK3OM and Eric Buggee VK3AX.

Ron VK3OM and Eric VK3AX give Icom's new IC-7000 a good hard look and find it a worthy successor to the IC-706

## Ron Fisher VK3OM

How time flies. Believe it or not, the Icom IC-706 is now over ten years old. It only seems like yesterday that I wrote my review of the first IC-706. With its removable front panel and full coverage from 160 to 2 metres, it was set to change the concept of compact transceivers. And it certainly did. Over the next ten years it was steadily improved, first with improved transmit audio, then with increased power on two metres, then with optional DSP, and finally with the addition of 430 MHz plus DSP as a standard feature. While all this happened, the price actually came down several hundred dollars.

Over that ten year period, Icom must have sold thousands of them and they are still in production. Mike Harrison, manager of the amateur radio division of Icom Australia, told me that he expects the IC-706 to remain in production for at least another year and, with its several hundred dollar price advantage over the new IC-7000, to remain a strong seller.

## Enter the IC-7000

Over the last ten years, Icom have been at the forefront in developing DSP based radios. Also, displays have gone from black on green to full colour high definition with multiple functions. I guess it stands to reason that the new IC-706 replacement would incorporate all of this. It certainly does, but also with many surprises that I hadn't expected.

Let's have a quick run down on what you will find in the new IC-7000. First, the frequency coverage is as expected - 160 through to 6 metres with 100 watts output. 2 metres runs at 50 watts output and 430 MHz has 35 watts output. This is up a useful 10 watts from the IC-706. All modes are there and these are: SSB, CW, AM, FM (both wide and narrow) and RTTY.



Photo 1 – An IC-706MkIIIG on top of the reviewed IC-7000.

The wide FM is handy for reception of FM broadcasts and to keep up with the sound of your favourite TV shows while out on the road. There was a story around a while ago that the IC-7000 could actually receive TV video. The review transceiver we have certainly won't and I can find nothing in the very complete manual about this facility. (However, modification information is available on the Internet. *Ed.*)

The most outstanding feature of the IC-7000 is the display, now in full colour and your choice of background colour: it can be changed from black to blue, and then from positive to negative. It is also possible to display the screen on your TV receiver by connecting the video-out

socket on the back panel to the video-in socket of your TV set. Icom's advertising even shows it connected to a video display on a car dashboard.

The front panel is of course removable for remote operation and two different length separation cables are available as options. The DC power cable and connector have changed. Just when we were getting used to the six pin DC connector, Icom have decided to change this to a four pin connector and socket. Unfortunately, this meant that I was unable to try the 7000 mobile in the car. I am wired up for a six pin radio as are most of my DC power supplies. I note with interest that an American company already has a four to six pin adapter

available to overcome this problem. I wonder if Icom might make one available. But, more to the point, why did they make this change?

The IC-7000 follows the physical format of the IC-706 very closely. Most dimensions are the same except that the length of the main cabinet is 20 mm shorter and the weight of the IC-7000 is slightly less. But, put the two transceivers together with the power switched off and its hard to pick the difference. However, turn them on and there is no mistaking the full colour display on the IC-7000.

The front panel layout has also changed from the IC-706. Firstly, the display is slightly smaller, and the two concentric controls to the left have been moved to the extreme left. Both of these changes allow for space on either side of the display to locate eight keys that give dedicated control of commonly used functions. One quick touch turns the function on and off while a longer touch allows adjustment of that function. The band up/down buttons are much bigger and easier to activate and extend right to the edge of the front panel.

If you thought the IC-706 was lacking in memory capability, you should note that the IC-7000 has over five hundred which should keep you busy filling them up. These can be tagged with alphanumeric labels just in case your memory is not as good as the IC-7000 memory.

Perhaps the most impressive aspect of the IC-7000 is the DSP and, in particular, the IF DSP. The IC-7000 has two DSP chips to produce amazing control over the IF selectivity in both receive and transmit. There are no optional filters - they are all built in and easily activated via the menu. There are something like forty selectivity options with different bandwidths selectable for each mode. DSP also controls the twin bandpass filters. This allows the selected selectivity to be narrowed on either side to remove interference. The effect of this is outstanding.

DSP also controls the AGC system and the notch filter that can give up to 70 dB rejection to two signals at the same time.

As with the IC-706, the DSP also provides noise reduction to improve signal-to-noise ratio. This is adjustable in sixteen steps. In addition, the noise blanker is now controlled by DSP with both the level and width adjustable. It was reasonably effective in reducing

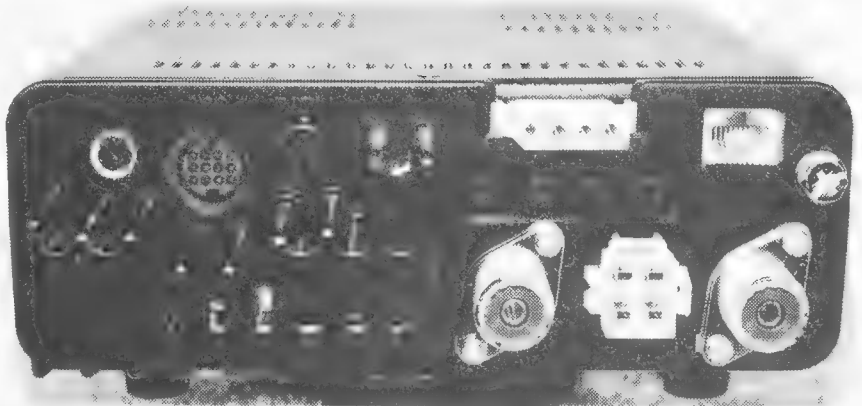


Photo 2 – The rear panel of the IC-7000.

the “woodpecker” signal often heard on 40 and 80 metres in the evening in the eastern states.

Other features controlled by the DSP include a voice recorder that provides four playback memories such as “CQ contest from VK3OM”. There is a total of 90 seconds recording time available for four different announcements. The same system also allows you to record incoming signals with up to a total time of 25 minutes.

Our vision impaired friends will be pleased to hear there is a built-in voice synthesizer that announces operating frequency, mode and signal strength. Also handy for mobile operators to help them keep their eyes on the road.

## The HM-151 microphone

This new microphone from Icom is quite a handful. With 25 buttons it gives control over functions that are not available from the transceiver itself. Fifteen of the buttons give direct access to each of the amateur bands. In addition to this, three band-stacking registers come up with extra pushes of each band button. While the microphone is large, it has a nice feel when handled. The audio quality it produces is another story which I will cover later in this review. If you have a spare IC-706 microphone it will work with the IC-7000 but does not have the control features of the HN-151. The key pad of the

microphone is illuminated in a soft green for night time operation.

## Getting to grips with the menu system

Having owned an IC-706 for a few years I thought the IC-7000 would be easy to master. However, I found it to be quite a challenge.

The two rotary controls to the left of

*Ron VK3OM continues on page 27*



Photo 3 – The back of the HM-151 microphone.

Eric Buggee VK3AX's assessment

**Tests on Icom IC-7000 transceiver** serial No: 0801172.

**Sensitivity tests for: MDS, 10 dB S/N & RF input at S9 "S" Meter indication.**

*All input levels stated in micro-volts ( $\mu\text{V}$ ) and power level in dBm at the antenna input.*

Band	Pre-Amp in @ 10 dB S/N	Pre-Amp out @ 10 dB S/N	S Meter (for S9 indicated)	
			Pre-Amp in	Pre-Amp out
	$\mu\text{V}$ - dBm	$\mu\text{V}$ - dBm		
160 m	0.162 / -122.8 (MDS: 0.041 / -134.7)	0.531 / -122.5 (MDS: 0.155 / -125.8)	20.1 $\mu\text{V}$ / -80.0 dBm	92.0 $\mu\text{V}$ / -67.7 dBm
80 m	0.155 / -123.2 (MDS: 0.043 / -134.3)	0.437 / -114.2 (MDS: 0.89 / -128.0)	17.9 $\mu\text{V}$ / -81.9 dBm	80.1 $\mu\text{V}$ / -68.9 dBm
40 m	0.156 / -123.1 (MDS: 0.041 / -134.7)	0.434 / -114.2 (MDS: 0.082 / -128.7)	20.1 $\mu\text{V}$ / -81.0 dBm	88.5 $\mu\text{V}$ / -68.1 dBm
30 m	0.148 / -123.6 (MDS: 0.040 / -135.0)	0.395 / -115.1 (MDS: 0.079 / -129.1)	16.8 $\mu\text{V}$ / -82.5 dBm	79.6 $\mu\text{V}$ / -69.0 dBm
20 m	0.148 / -123.6 (MDS: 0.040 / -135.0)	0.386 / -115.3 (MDS: 0.077 / -129.3)	18.0 $\mu\text{V}$ / -81.9 dBm	80.3 $\mu\text{V}$ / -68.9 dBm
17 m	0.144 / -123.8 (MDS: 0.040 / -135.0)	0.380 / -115.4 (MDS: 0.77 / -129.3)	18.0 $\mu\text{V}$ / -81.9 dBm	76.7 $\mu\text{V}$ / -69.3 dBm
15 m	0.160 / -122.9 (MDS: 0.040 / -135.0)	0.426 / -114.4 (MDS: 0.078 / -129.2)	19.9 $\mu\text{V}$ / -81.0 dBm	76.7 $\mu\text{V}$ / -69.3 dBm
12 m	0.159 / -123 (MDS: 0.040 / -135.0)	0.424 / -114.5 (MDS: 0.081 / -128.9)	21.1 $\mu\text{V}$ / -80.5 dBm	86.3 $\mu\text{V}$ / -68.2 dBm
10 m (SSB)	0.094 / -127.6 (MDS: 0.036 / -136.0)	0.270 / -118.4 (MDS: 0.063 / -131.1)	16.1 $\mu\text{V}$ / -82.9 dBm	68.5 $\mu\text{V}$ / -70.3 dBm
10 m (FM)	0.213 / -120.5 (MDS: 0.083 / -128.6)	.572 / -110 dBm (MDS: 0.172 / -122.3)	18.9 $\mu\text{V}$ / -81.5 dBm	79.7 $\mu\text{V}$ / -69.0 dBm

\*AGC threshold: 1.4 to 1.5  $\mu\text{V}$ .

\*Varies as set warms up, as did MDS and sensitivity thresholds, variation approx 1dB.

AM sensitivity: (1.8 MHz) 0.9  $\mu\text{V}$  for 10 dB (s + n):n @. 30% mod depth.

All FM measurements were for 12 dB SINAD.

All SSB measurements were for 10 dB (s + n):n.

2 tone dynamic range (with pre-amp in) varied in the range from 82 dB at 1.8 MHz to 86 dB at 28 MHz.

2 tone dynamic range (with pre-amp out) varied in the range from 84 dB at 1.8 MHz to 88 dB at 28 MHz.

3<sup>rd</sup> order intercept (pre-amp in) varied in the range from -12 at 1.8 MHz to -7 dBm at 28 MHz.

3<sup>rd</sup> order intercept (pre-amp out) varied in the range from +3 at 1.8 MHz to +6 at 28 MHz.

**Notes**

All tests were conducted with the conditions and test equipment as noted below.

Receiver settings: SSB, 2.4 kHz sharp filter selected. FM: Standard 6 kHz filter. Noise blanker: Off. Noise reduction: Off.

Audio output: at maximum, prior to clipping.

Load: 8 Ohms 2.0 W. 2.3 W at 10% distortion.

Load: 4 Ohms. 2.5 W. 3.2 W at 10% distortion.

DC Voltage Supply: 13.8 V regulated.

Test equipment: Rohde & Schwarz CMT52 and CMT 54;

Radiocommunications test sets;

Bird 43 thru-line wattmeter; Bird 694

HF Termaline wattmeter; Bird 6154 VHF/UHF Termaline wattmeter.

Anritsu MS710E spectrum analyser.

AWAG232 low distortion oscillator; AWA F242 noise and distortion analyser.

Marconi TF893 audio output power meter.

## Ron Fisher VK3OM's review of IC-7000 continues

the display also operate as push buttons along with four "F" buttons under the display and the Menu/GRP button at the lower left of the display. A lift-out flow chart for the menu is supplied with the instruction manual and this proved to be very helpful in sorting it all out.

There are literally dozens of combinations that can be brought up on the display. One that I found interesting was the RTTY readout. If you are not already into digital modes, here is a chance to actually look in on it. The IC-7000 has a built in RTTY demodulator and decoder with a six line readout on the display. Unfortunately, however, you will need a computer with an RTTY program to transmit a signal.

### The IC-7000 on the air

With the menu set-up for SSB, I found the IC-7000 handled in a very similar way to the IC-706. I thought the received audio quality was slightly inferior to the IC-

706 when using the internal speaker, but improved very much when I connected my Icom IC-SP3 external speaker.

The internal speaker should be reasonable for mobile operation but its audio power handling capability appeared to be limited. Transmit bandwidth was set to maximum, 100 Hz to 2.9 kHz as suggested, but reports were not all that good. I even had reports of an echo effect and was asked if I had an audio monitor operating in the background. I tried the IC-706 microphone as a comparison but this appeared to be even worse although, when used with the IC-706, I have always had satisfactory reports. Eric VK3AX will have more to say on this later.

Transmit quality reports on two metres FM were better and, in fact, were comparable to my usual FM transceiver with a high quality desk microphone, so it appears that the IC-7000 microphone is not entirely at fault.

## The IC-7000 instruction manual

This is actually over twice the size of the IC-706 manual. You will now get the idea how difficult it is to tell the full story of the IC-7000 in five or six pages. The manual takes 20 chapters to tell the whole story: 1. Panel description; 2. Installation and connections; 3. Basic operation; 4. Receive and transmit; 5. Functions for receive; 6. Functions for transmit; 7. Voice recorder functions; 8. Memory operation; 9. Scan operation; 10. Antenna tuner operation; 11. Packet operation; 12. Clock and timers; 13. Set mode; 14. Maintenance; 15. Trouble shooting; 16. Optional units setting; 17. Control commands; 18. Specifications; 19. Options; and 20. Menu guide.

I have to admit that I haven't read the whole book. But, I can say that it is well set out and very readable, with plenty of charts and diagrams to help you through. Overall the book is well written,

### Eric Buggee VK3AX's assessment of IC-7000 continues:

## VHF/UHF: 50, 144, 440 MHz section tests:

Band	Pre-Amp in.	Pre-Amp out.	S Meter (for S9 indicated)	
	@ 10 dB S/N. μV - dBm	@ 10 dB S/N. μV - dBm	Pre-Amp in.	Pre-Amp out.
6 m (SSB)	0.049 / -133.9 (MDS: 0.038 / -135.5)	0.115 / -125.8 (MDS: 0.078 / -129)	9.22 μV / -87.7 dBm	32.3 μV / -76.8 dBm
6 m (FM)	0.152 / -123.3 (MDS: 0.060 / -131.4)	0.290 / -117.7 (MDS: 0.127 / -124.9)	8.84 μV / -88.1 dBm	30.3 μV / -77.4 dBm
2 m (SSB)	0.049 / -133.2 (MDS: 0.032 / -136.8)	0.133 / -122.5 (MDS: 0.068 / -130.4)	10.4 μV / -86.7 dBm	40.7 μV / -74.8 dBm
2 m (FM)	0.158 / -123.0 (MDS: 0.058 / -131.7)	0.370 / -115.6 (MDS: 0.128 / -124.9)	9.37 μV / -87.6 dBm	37.3 μV / -75.6 dBm
70 cm (SSB)	0.053 / -132.5 (MDS: 0.032 / -137.0)	0.155 / -123.2 (MDS: 0.169 / -122.4)	5.24 μV / -92.6 dBm	32.3 μV / -76.8 dBm
70 cm (FM)	0.171 / -122.3	0.450 / -113.9	5.12 μV / -92.8 dBm	31.2 μV / -77.1 dBm

VHF/UHF 2 tone dynamic range (pre-amp in) varied from 82 to 80 dB decreasing linearly on each higher band.

With pre-amp out, 2 tone dynamic range improved from 83 dB @ 50MHz to 86 dB; at 144 MHz the improvement was from 83 to 85dB; and at 440 MHz the improvement was from 80 dB to 85 dB.

VHF/UHF 3<sup>rd</sup> order intercept (pre amp in) varied from -13 dBm at 50 MHz to -18 dBm at 440 MHz.

VHF/UHF 3<sup>rd</sup> order intercept (pre-amp out) improved to -2 at 50 MHz, -2.5 at 144 MHz, and to -1 dBm at 440 MHz.

All other test conditions as stated for preceding HF section tests were applicable to the VHF/UHF tests.

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## Ron Fisher VK3OM's review of IC-7000 continues

well presented and appears to cover all operating aspects in a clear manner.

However, one thing that is missing is any form of technical description. For instance, there is no block diagram. The only hint of technical information is in the

specifications. I am sure that in 155 pages a few pages of technical description could have been fitted in.

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## Eric Buggee VK3AX's assessment of IC-7000 continues

### Power output test results

2 tone power		Intermodulation products		
Band	Output	Harmonics	3 <sup>rd</sup> order	5 <sup>th</sup> order
160 m	103 W	-61 dB	-28 dB	-39 dB
80 m	103 W	-62 dB	-28 dB	-39 dB
40 m	103 W	-64 dB	-28 dB	-36 dB
30 m	104 W	-72 dB	-31 dB	-36 dB
20 m	102 W	-62 dB	-35 dB	-35 dB
17 m	104 W	-72 dB	-31 dB	-35 dB
15 m	104 W	-67 dB	-29 dB	-35 dB
12 m	102 W	-69 dB	-30 dB	-35 dB
10 m	105 W	-67 dB	-27 dB	-35 dB
50 MHz	97 W	-70 dB	-26 dB	-36 dB
144 MHz	53 W	-61 dB	-27 dB	-48 dB
440 MHz	35 W		-68 dB	-24 dB

### Notes

Intermodulation products were measured with respect to PEP.

Transmitter audio frequency distortion measured as less than 1%.

Microphone input sensitivity measured to be < 8 mV for full output.

Transmitter FM deviation: 3 kHz.

Carrier suppression measured: >68 dB.

Opposite sideband suppression measured: >70 dB at 1.5 kHz.

Tx/Rx turn-around measured at 13 mSec for SSB; 12 mSec for FM.

All other test conditions as stated for preceding HF section tests were applicable to the VHF/UHF tests.

## Eric VK3AX— General comments from on-air use of IC-7000 at 160 and 80 m

Comments on audio as received by local operators is that they were in general unimpressed by what they were hearing. Reports ranged from, "sounds like you have a cold!" to "you sound like you are talking down a drainpipe". Others reported that the audio sounded as if there was an echo from the room to an edge that was as though the audio chain in the transmitter were on the verge of tipping over into feedback.

With more time available to play with adjustments to mic gain settings and Tx filter shaping, along with other settings available, this could most have likely been sorted, but I stayed with the factory default settings due to minimal time available on-air with the rig.

On the plus side this is a very easy radio to use. The controls and features are logically arranged and, with the layered menus, are simple and easy to use. If you are familiar with the IC-706 MK2 or 2G then it is intuitive.

The display is an absolute delight to use - every operational feature you need to review is on screen.

The multi-colour display and the resolution are brilliant in every sense of the word. Even those with age-challenged eyesight should have no difficulties due to the excellent resolution offered by the screen.

All round, this rig is a very worthy successor to the IC-706MKIIG.

Top marks to Icom for a value – and feature – packed radio.

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