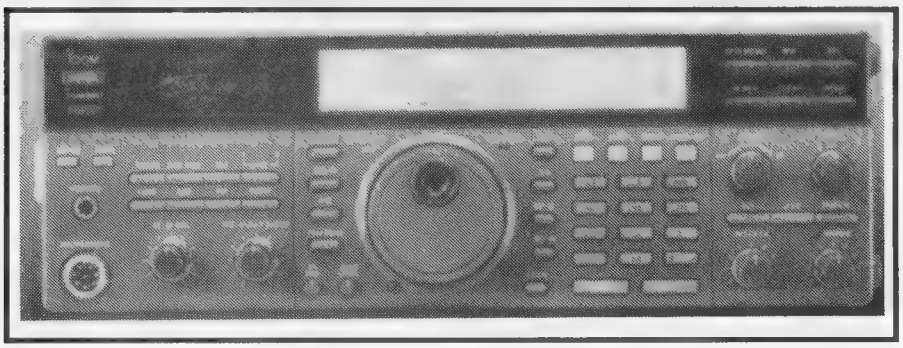
EQUIPMENT REVIEW
ICOM IC-737 HF All Band All Mode Transceiver

Ron Fisher VK30M checks out the newest medium priced rig from ICOM.*



The new ICOM IC-737 is the first ICOM 12 volt powered transceiver to incorporate an automatic antenna tuner. However, its features don't start or end with this. I would describe the IC-737 as the rig with the super memory system. In this respect alone, it leaves most of its contemporaries in the shade. Just where to place the IC-737 into the scheme of things is a bit more difficult. Is it designed for mobile use or is it a new dedicated base station? I must admit that I am not sure. Over the course of this review I will describe all its features and let you be the judge.

IC-737 Features and Facilities

At first sight I was rather surprised at the size of the transceiver. It is actually 24 mm wider than the old IC-751 although the height is 4 mm less. Overall dimensions are 330 mm wide, 111 mm high and 285 mm deep. In actual volume this is slightly less than the IC-751. Of course we have to make allowance for the built-in antenna tuner but then it doesn't have provision for an inbuilt AC power supply as in the IC-751.

The IC-737 is also jet black in colour. Quite a startling change from the old ICOM colour scheme. I think it looks great. The LCD multi purpose display is the largest and most readable that I have ever seen. The main frequency display numerals are just over one cm high. The rear illumination is bright orange in colour. In contrast the "S" meter is rather dull and hard to read. The display intensity can be adjusted by an internal preset control, but only down, not up.

So much for appearance, let's see what the IC-737 does. The transmitter covers all amateur bands from 160 to 10 metres. The receiver has full general coverage from 30 kHz to 30 MHz (guaranteed range is 500 kHz to 29.995 MHz). Operating modes are SSB, CW, AM and FM. The standard transceiver has three filters, a 2.1 kHz for SSB, a 6 kHz for AM and 12 kHz for FM. Four narrow CW filters are offered as options.

Two operating at 455 kHz give either 500 or 250 Hz band width and two for the 9 MHz IF give the same widths here. ICOM recommend that either one or two of the same band width should be installed. They were not included in our review transceiver so I am unable to comment on their performance.

Of course the IC-737 includes most of the essential features of a 1990s transceiver. Let's run through the list. On the receiver side, there is a switchable preamp plus a 20 dB attenuator. There is fast and slow AGC selection but no provision to switch the AGC off. Also there is no RF gain control. On the QRM management side of things, there is bandpass tuning and a notch filter. The latter is of the audio type as distinct from the more up market IF type but, as we will later see, it is most effective. Tuning has the usual ICOM smoothness. The actual tuning knob seems to be similar to the one used on the top line IC-765 and 781. Normal tuning rate is in 10 Hz steps which gives a tuning rate of 2 kHz per knob revolution. However, if you find this too slow, the stepping rate can be changed to either 20 or 50 Hz. The tuning rate is then four and ten kHz per knob revolution. In a similar way, the one kHz stepping rate initiated by the "TS" button can be programmed to any required step. For instance, a 9 kHz rate can be selected for broadcast band tuning. The tuning rate also changes with the receiving mode. This is ten Hz steps for SSB and CW and 1 kHz steps for AM and FM. However, 10 Hz, or whatever minimum has been selected, can be chosen for AM and FM by giving the "TS" button a push. Of course the IC-737 uses ICOM's superb direct digital synthesiser system which gives remarkably clean tuning. The lack of clicks and plops is noticeable after using older equipment.

On the transmit side the automatic antenna tuner covers all amateur bands including 160 metres and offers high speed tuning. A brand new feature is the provision of two antenna connectors. Two antennas can either be selected by a front panel switch or antennas can be automatically selected by the

transceiver band selection. A very neat idea.

The transmitter includes a speech compressor to add some bite to the signal. This has a front panel level control but there is no metering to get this right. On the subject of metering you get a choice of two readings only, "S" meter and relative power output. Nothing else. Actually, the red LED transmit indicator blinks with SSB modulation to indicate ALC action.

No VOX is included for SSB. However, the CW operator has been provided with an excellent full break in system. Really the only thing missing for the CW fan is an RF gain control and the ability to switch off the AGC. There is even an electronic keyer built in with speed control on the front panel.

Leaving the best to last, the memory system on the IC-737 is outstanding. There are 101 primary memory channels with recall via a dedicated rotary front panel control. But it doesn't end there. A separate "quick" memory gives another ten "Memo pads" These are for the contest operator to quickly pop in stations to be worked in order. ICOM's band stacking register has been refined and now gives two frequencies on each band when the "Band" button is pushed. It actually works out at 124 memory channels. That will take a bit of beating.

The main circuit board of the IC-737 with the bottom cover removed. The bracket at the top left takes the 455 kHz CW filter. Both CW filters plug in, soldering not needed.

IC-737 On The Air

All of the on air and technical tests were carried out using a matching ICOM PS-15 power supply. The AC power to this is switched from the transceiver "power" switch. The power supply cannot be operated in any other way and no auxiliary DC output terminals are provided. My PS-15 has been modified to overcome both of these problems.

Initial tests on receive showed that the IC-737 has an excellent receiver. It is quiet and the signals "jump out at you'. However, there are several parameters that should be set on initial switch-on. These include, "beep" on or off, one kHz tuning step for AM and FM on or off, (revert to 10 Hz steps). RIT and XIT range selectable +/–1.25 or 2.5 kHz. Scan resume setting allows the scan to stop for ten seconds on a signal or to stop scan altogether when a signal is found. Scan speed can be selected, high or low. Antenna selector may be switched on or off or operated automatically via the band switch. There are thirteen items that can be set in a similar manner. The setting procedure is simple. You hold down two buttons while powering up the transceiver, select the item with the up/down buttons and make your choice with the tuning control.

Back to the receiver. Frequency selection is comprehensive. Use the tuning knob (very smooth) with selectable steps of 10 Hz, 20 Hz or 50 Hz. Use the key pad to the right of the tuning control to enter your required frequency or select an amateur band direct from the same keypad with a single push. The up/down buttons on the transceiver step the tuning in one MHz "chunks" while the up/down buttons on the microphone step the tuning in 50 Hz steps. The main frequency display reads out to 10 Hz and, with the "Split" button, the frequency in the other VFO is also displayed. A very neat idea but with one slight disadvantage. The RIT/XIT readout disappears.

On the subject of RIT, when it is there, it reads out to 10 Hz. Very good, but the main frequency display stays put. I note when changing from upper to lower sideband that the frequency does not change. This is as it should be, but it took ICOM a long time to get around to this. The older rigs changed frequency by 3 kHz and no one ever seemed to be able to tell me why!

Received audio quality through the internal speaker was only fair. The internal speaker is only 55 mm in diameter. With my normal external speaker connected, the audio came to life and it was left connected for all of the remaining tests. The subjective sensitivity appeared excellent but the "S" meter was sluggish with the preamp switched out and almost totally inactive with the attenuator switched in. I think, in fact, that 20 dB attenuation is too much. With only a single attenuator setting, 10 dB would be a better figure. In fact, I found the receiver front end was almost "bomb proof" and the only time I needed to switch out the preamp, let alone switch in the attenuator, was on 80 metres at night.

Unfortunately, there is no RF gain control on the IC-737 so you have to rely on the effectiveness of the AGC. In general this performed very well but the slow decay time was too fast. Again, I suggest that RF gain take the place of the squelch control and that this be relocated as a minor front panel control. AM signals sounded

very clean but with rather limited top audio response. I must admit that ICOM have improved their AM reception quality over the last few years but they still have a little way to go.

No optional filters are offered for either SSB or AM reception. The band pass tuning worked well for SSB and I gather it can be used on CW if two CW narrow filters are installed. The notch filter was effective although the overall audio level appeared to drop when it was switched in (see test section). The notch operates in the receiver audio section and while it only removes the effect and not the cause it is none the less effective. Audio notch filters affect the audio quality much less than the IF types which seem usually to have a wide hole at the top of the notch.

Received audio power output was satisfactory, but tests showed that almost double the power is available with a four ohm load. If you intend to use the rig mobile, look for a four ohm extension speaker. It might make a worthwhile difference.

Transmitter tests were carried out using an HM-12 microphone. This was supplied with the rig in place of the specified HM-36. I am told that they have identical features.

Reports showed that the SSB quality was very intelligible but not startlingly good quality. Reports indicated a lack of low frequency response. I tried an SM-6 desk microphone and this was reported as sounding smoother but still lacking low frequencies.

The speech compressor was effective and added a worthwhile bite to the signal.

The transmitted wave form looked good on the scope and the usual tests for intermodulation distortion showed a slightly better than average result for a 12 volt powered rig. The speech compressor was effective and added a worthwhile bite to the signal without adding any noticeable distortion. There was plenty of microphone gain both with and without the compressor; most of the time the microphone gain was no higher than the 9 o'clock position.

AM and FM modulation were checked and found to be satisfactory. Again the quality was reported as very sharp and lacking low frequencies.

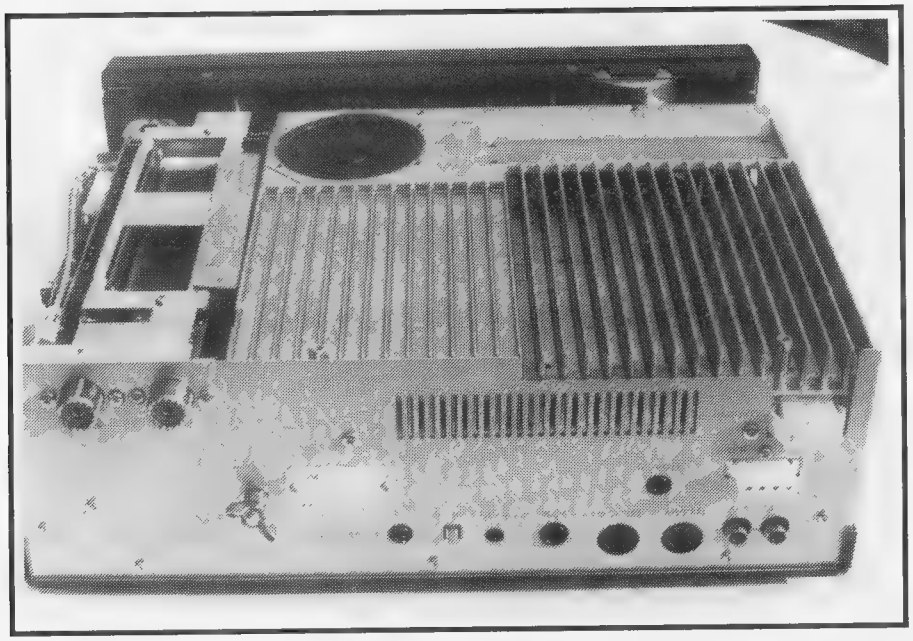
On CW, the IC-737 keyed smoothly with no reported clicks. The in-built keyer was not tested but the manual states it has a speed range of 7 to 41 wpm.

IC-737 On Test

I carried out the usual series of tests on the IC-737 starting with transmitter power output and current drain for both transmit and receive. Power output is variable on all modes via the small "RF PWR" control.

Power Output CW Mode

Band	Power out
160	105 watts
80	105 watts
40	105 watts
30	105 watts
20	100 watts
18	100 watts
15	100 watts
13	100 watts
10	95 watts.



The uncluttered rear panel and extensive heat sink of the IC-737 — note the two SO-239 antenna connectors.

Power output in the AM mode was spot on 40 watts on all bands. Minimum power for all bands was about 8 watts.

It was noted while doing these tests that the relative output indication on the meter calibrated in % output was, in fact, spot on at the 100 and 50 points but seemed to be rather vague at the 25 and 10 points. Current drain on receive was 1.5 amps with no audio output and 1.8 amps with maximum audio output. On transmit with full CW power output the current drain was 19 amps. All of these tests were carried out using a 13.8 volt regulated supply. PEP output in the SSB mode was slightly more than the above figures.

The IC-737 specification does not give a figure for intermodulation distortion, so the same tests as were carried out on the TS-50 (AR June 93, page 19) were tried. We came up with a figure of -27 dB which is reasonable for a 12 volt powered solid state transceiver. For comparison, a mobile type transceiver which I frequently use in my shack came up about 3 dB worse than the IC-737.

Receiver Tests

Firstly, the "S" meter calibration was checked.

Preamp out			Preamp in		
S	1	5 μV	S	1	1.5 μV
	2	6 μV		2	1.8 μV
	3	7 μV		3	2.0 μV
	4	9 μV		4	2.6 μV
	5	12 μV		5	3.4 μV
	8	30 μV		8	10 μV
	9	51 μV		9	15 μV
	+20	400 μV		+20	120 μV
	+40	4 mV		+40	1 mV
	+60	40 mV		+60	10 mV

These test were carried out on 14.2 MHz in the USB mode.

The meter calibration was again checked. In the FM mode on 29.5 MHz.

Preamp out			Preamp in		
S	9	1.8 μV	S	9	.5 μV
	+60	5.0 μV		+60	1.5 μV

In other words, the S meter reads full scale on any but the weakest signals. The attenuator was measured at −20 dB.

AGC threshold was about 1 μV and increasing the RF output of my signal generator to maximum increased the audio output by only .5 dB. AGC decay time from S9 was about 1.5 seconds with "slow" selected and about .5 seconds with "fast" selected.

Receiver sensitivity was measured in the SSB mode at 14.2 MHz with the preamp in. I found it to be 0.16 μV for 8 dB SINAD. This is 2 dB less than the specified figure. On the other hand, the AM sensitivity bettered the specified figure by a wide margin. At 2 μV I measured 14 dB SINAD as against the specified 10 dB. The FM sensitivity was measured at 29.5 MHz. It was 0.5 μV for 14 dB SINAD, bettering the specification by 2 dB. The squelch threshold on SSB was 1.6 μV and on FM 0.1 μV. Just as a point of interest, the sensitivity was checked at 500 kHz and 50 kHz in the AM mode. It was 4 μV and 250 μV for 10 dB SINAD respectively. Sensitivity was +/− 1 dB from 1.8 to 30 MHz.

An audio output meter was connected to the external speaker socket and power and distortion were checked. The specified load impedance is 8 ohms but tests were also carried out with a 4 ohm load. At 8 ohms maximum output was 2.5 watts, a fraction less than the specified 2.6 watts. However, distortion was 25% at 2.5 watts. It dropped to 10% at 2 watts. Distortion on SSB, 1 kHz tone at 250 milliwatts was 1.5%. With a 4 ohm load maximum output increased to 3.9 watts and 2 watts power was delivered with a very creditable 2% distortion. An RF input to the receiver of 0.7 μV was needed to produce maximum audio output.

The audio frequency response on SSB was checked. The -6 dB points were at 150 Hz and 2.5 kHz. 2.75 kHz was -8 dB. The curve was very smooth with a gradual roll off at the high end starting at about 1.5 kHz. There was a slight difference in the response between USB and LSB possibly due to the setting of respective carrier oscillators.

I next measured the effectiveness of the notch filter. The first thing noted was the overall audio level dropped 6 dB when the filter was switched in. However, it produced an excellent notch of -23 dB at 1 kHz and -29 dB at 2 kHz. The actual notch was quite narrow and had only a minimal effect on the audio quality. However, the 6 dB reduction in audio output with the filter selected was disturbing.

Next, the overall selectivity was measured for SSB and AM. The SSB measurement was 2.4 kHz for -6 dB and 4.2 kHz at -60 dB. This is 200 Hz wider than the specification but my measuring technique could well

account for this difference. The AM band width at -6 dB was 5.3 kHz with the -10 dB points at 3 kHz. This is a little narrower than the specification. The -40 dB bandwidth came in at 15 kHz, quite a bit sharper than the specified 20 kHz. In spite of this, AM quality sounded quite reasonable, obviously lacking in high frequency response but clean none the less.

Finally, I did an extended test on frequency stability and readout accuracy. Over a test running for several hours, the drift did not exceed 70 Hz. If you need something better than this, then the optional CR-282 high stability master oscillator might be just what you need. Overall, the technical tests confirm the excellent performance of the IC-737.

IC-737 Instruction Manual

The IC-737 instruction book is a sixty page, A4 size book. It seems that 60 pages are ideal to describe the operation of a modern amateur transceiver as other manufacturers seem to run to exactly the same size.

However, the ICOM manual steals a march on many others in that there are two excellent photos that give the positions of most of the necessary adjustment points. These include such things as the BFO frequency adjustments, the S meter S9 and full scale setting points. Also the minimum power adjust point is identified. I didn't try it, but guess it might be possible to bring the power down to genuine QRP levels. The contents of the manual include panel description, installation and connections, basic operation, function operation, memory channels, scans, maintenance and adjustment, options installation, troubleshooting, inside views, specifications and options. As usual there is no technical description. I would score the manual eight out of ten.

IC-737 Conclusions

Since starting to write this review, I have come to the conclusion that the IC-737 is really a base station with the option of using it mobile if you have a car with the room to fit it in. The excellent memory system makes it superb for amateurs who like to jump from band to band and chasing contacts in band packing contests. Pity I will have returned the rig to ICOM before the RD contest.

The overall performance on both transmit and receive is very good indeed but it lacks a few features that would make it into a top flight performer. Just how it fits into the current ICOM line up is another question. Is it designed to take the place of, say, the IC-735?

As far as the amateur market is concerned, I think it is. Of course the 735 is still a big seller for ICOM but not to amateurs. The Chinese Government will buy as many 735s as ICOM can produce and uses them for military communications, not necessarily on the amateur bands of course.

This then leaves the IC-728/729 for mobile operation and the IC-737 as a lower priced base station. This raises two questions. Will ICOM bring out a six metre version of the 737, perhaps called the IC-739? Next will they bring out a version of the IC-728 with a built in automatic antenna tuner? Unfortunately, my crystal ball has gone hazy so I cannot say!

Back to the present. The IC-737 is of course compatible with the wonderful line up of ICOM options such as external antenna tuners, mobile antennas, linear amplifiers and such. The IC-737 is priced at $2613.18 and this includes the built-in automatic antenna tuner. The optional CW filters are $237.80 for the 455 kHz 500 and 250 Hz units and $139.20 and $116 for the 9 MHz 500 and 250 Hz units respectively. Matching external speakers range in price from $69.60 to $214.60 for the SP-20 with built in switchable audio filters.

Three power supplies are available for the IC-737. The PS-15 at $440.80, the PS-30 at $800.40 and the PS-55 at $522.00. As far as I can see, none matches the IC-737 from the point of colour and size. Unfortunately, ICOM give very little detailed information on their options . The IC-737 is certainly recommended as an excellent performing transceiver. It has enough features to please most operators. My thanks to ICOM (Australia Pty. Ltd) and in particular to Duncan Baxter who kindly came down from "Ham Heaven" to arrange the loan of this transceiver.

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WIA News

New WIA Members

The WIA bids a warm welcome to the following new members who were entered into the WIA Membership Register during the month of June 1993.

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