

## Equipment Review

# ICOM IC-736 HF/50 MHz Transceiver

Reviewed by Ron Fisher VK3OM\*



The ICOM IC-736 HF/50 MHz transceiver.

I often wonder if manufacturers of amateur equipment ever read reviews published in various magazines around the world. With the introduction of the IC-736 I am beginning to think they just might. Why? Well, most of my predictions in my review of the IC-737 in the August 1993 issue of *Amateur Radio* have come about in the new IC-736. The only thing I got wrong was the type number. I guessed it would be the IC-739. If you have a copy of August 1993 *Amateur Radio*, get it out as a comparison between the IC-737 and 736.

In basis, the difference between the two is the addition of an inbuilt AC power supply and 100 watts of RF on six metres. There are other improvements as well, but more about them later. Appearance is identical to the IC-737 and all the excellent features of that model have been retained in the 736. The superb LCD multi function readout is retained. This is possibly the clearest display being produced at the present time. But, if you don't have a copy of the IC-737 on hand, let's make a clean start and give you a full description of the new IC-736.

### IC-736 Features and Facilities

The IC-736 is a reasonably large transceiver but not as big as, say, the ICOM IC-765. Dimensions, excluding a few projections on the rear panel, are 330 mm wide, 111 mm high and 285 mm deep. The overall weight is 10.5 kg. When you consider that all of this includes an all band transceiver that also covers six metres, a built-in AC power supply and an automatic antenna tuner which also operates on six metres, then you will have some idea of just what can be done these days. It is by far the most compact and lightest transceiver on the market with all of those facilities. In fact, it might well be the only transceiver of any type to include all of this.

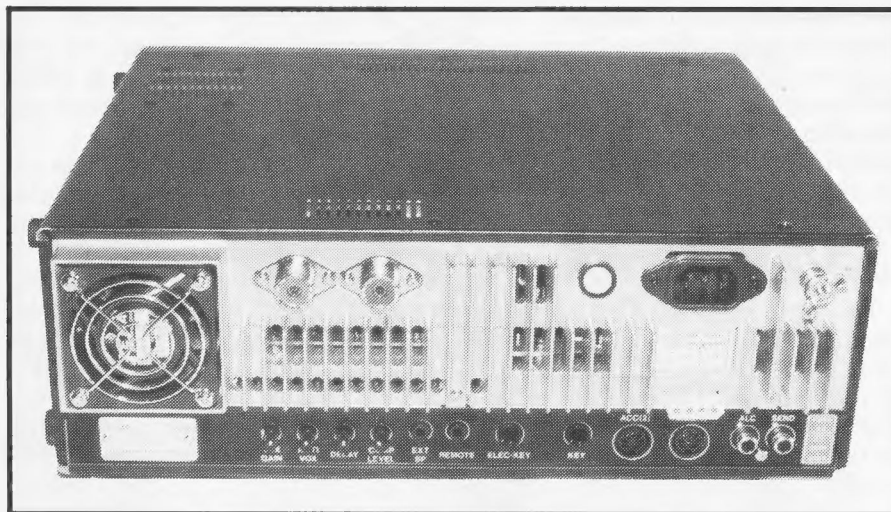
The light weight is helped by the fact that the power supply is of the switched mode type. ICOM is one of the very few amateur gear manufacturers who have consistently produced high quality switched mode power supplies. I know that opinions are divided on these supplies but at least this one works very well indeed. Only time will tell on its reliability but my guess is that it will be OK.

One of my complaints with the IC-737 was the lack of metering. This has been greatly improved on the IC-736. Front panel metering selection is available for power output, SWR and ALC with the meter switching to "S" meter on receive. All of this is not perfect but lots better than the earlier model. The various metering positions are selected in sequence by pushing the "meter" button which has now been added to the front panel.

Another of my complaints with the IC-737 was the lack of an RF gain control. The IC-736 has one but in the strange way that Japanese manufacturers seem to think, the RF gain has been positioned on the front panel as a very minor control. I have always been of the opinion that RF gain should be with the AF gain. For some reason ICOM (and others) prefer the squelch control to be ganged with the AF gain. I wonder why? At least now there is an RF gain which works well despite its poor positioning and the extremely small size of the control knob.

The IC-736 covers all amateur bands including six metres with all modes available. Take your choice of SSB, CW, AM and FM. The transceiver is fitted with three filters as standard, a 2.1 kHz one for SSB and CW, a 6 kHz one for AM and a 12 kHz filter for FM. Four narrow CW filters are available as options. Two working at 455 kHz give either 500 or 250 Hz bandwidth and two for 9 MHz with the same bandwidths. ICOM recommend either one or two of the same bandwidth should be installed. They were not included in our review transceiver so I am unable to comment on their performance.

Another new feature on the IC-736 is one Hz tuning and readout. I guess it had to happen. I well remember when transceivers first featured 10 Hz readout. The one Hz tuning rate and readout is selected by pushing and holding down the "TS" button. In its standard state the stability and accuracy of the IC-736 is not quite up to a one Hz readout. Perhaps it might be with the optional high stability master oscillator. It would be interesting to see. However, it does give a very smooth and slow tuning



Rear view of the IC-736.

rate which would be excellent for digital modes.

Actually, the tuning system of both the IC-737 and 736 is one of the most comprehensive offered on any transceiver with the "TS" button being programmable for various tuning steps to suit all tastes.

On the transmit side, the automatic antenna tuner covers all amateur bands from 160 to 6 metres. There are, again, two antenna connectors, now of course more important with the six metre coverage. The selection of antenna connector is either via the front panel "ANT" switch or they can be programmed to operate from the band selection mode.

Again the transmitter includes a speech compressor to add some punch to the audio. The compressor control has been relocated to the rear panel to make way for more important controls. Unfortunately, the improved transmitter metering does not include a compression scale so its adjustment is still a bit hit and miss.

### IC-736 On The Air

I am going to reverse the usual procedure and put the transmitter tests first. For SSB I used the supplied HM-36 hand microphone and also an SM-6 desk microphone that I keep as spare. I will have a bit more to say about the HM-36 later in a separate, short review.

Like the IC-737, reports showed that intelligibility was good but the overall quality was not all that good. At least, now with ALC metering, it is easier to

set the transmitter up to avoid over driving. The speech compressor was most effective in adding some extra talk power to the signal and even appeared to improve the speech quality slightly. The main complaints with the audio were lack of low frequency response and a degree of harshness. It appears that the harshness is introduced in the low level stages of the transmitter as the actual signal is quite clean as far as intermodulation distortion is concerned.

---

*"The speech compressor was most effective in adding some extra talk power to the signal . . ."*

---

The SM-6 desk microphone was reported as having a smoother sound but still lacking in low frequency response. The transmitted wave form looked good on the scope and our IMD tests showed that the new high voltage final amplifier was distinctly better than the usual 12 volt operated final stages.

AM transmit quality was not checked this time. FM appeared to be OK but again with similar characteristics to the SSB audio reports. On CW the IC-736 keyed very smoothly with no reported key clicks or spreading. I used a normal straight key for my tests. The rig features full break-in keying.

The cooling system on the IC-736

is most effective. There are two large fans, one on the rear panel (see photo) and one internal. They are very quiet in operation.

Now to the receiver. The first thing noticed is the smoothness of the main tuning control. The RIT and XIT have a range of  $\pm 9.999$  kHz (yes, the RIT reads out to one Hz). They are controlled by two push buttons in a very ingenious manner. A quick push selects either function but if the button is held down for a second or so the offset returns to zero. Band selection is very straight forward with a button on the keyboard for each band. To include six metres the 29 MHz button on the IC-737 has been reallocated for 50 MHz on the IC-736 but, with the double band stacking register, you will probably not miss this.

The superb memory system of the IC-737 is again with us in the new rig. There are 101 memory channels which include 10 split memories and 2 scan edges. In addition there are the 10 memo pads for quick memory writing.

VOX is now fitted to the IC-736. The original IC-737 did not have this but it was later included in the IC-737A. The VOX controls are all mounted on the rear panel which is a little inconvenient but, once set up, they appeared to be very stable. I used the VOX for several contacts and none of them picked that I was, in fact, using VOX. Clipping of the first syllable was not noticed. If you use VOX (not many amateurs do these days) you will find it excellent.

Rear panel interfacing is, as usual with ICOM gear, comprehensive. In addition to the two antenna connectors there are two accessory sockets for connection to ICOM linear amplifiers and other options. Another socket is used for a TNC for data communication. If you wish to use a non ICOM linear amplifier two phono connectors provide relay control and ALC output. One very good point about the rear panel is that the heat sink does not protrude very far out so it is easy to reach over the top of the cabinet to make connections.

To summarise. The IC-736 is a delight to operate. The receiver is top quality on SSB and CW (with the optional filters), good on FM but could

be better on AM. As with the earlier IC-737, the receiver front end is bomb proof. The tuning will amaze you with its selectable one Hz steps (200 Hz per knob revolution). The transmitter puts out a very clean signal but with less than perfect SSB audio quality. CW transmission is first class and the whole transceiver runs very cool.

### ICOM MH-36 Hand Microphone

The microphone supplied with any transceiver is an important part of the whole setup. I intend to make a separate report on microphones in each review I do in future. The HM-36 is better known as the HM-12 which has been supplied with ICOM equipment over the last several years. The difference is that the HM-36 does not have the rear switch to disable the up/down buttons. It uses an electret element but, contrary to popular opinion, does not have a built-in pre-amp. There is an internal circuit board containing a few components to feed the required DC voltage to the electret microphone. The PTT switch bar operates a micro switch which gives an excellent feel. You know exactly when it operates. The microphone fits into the hand very well and the up/down buttons are easy to use.

However, the audio quality from this microphone has always left me in some doubt and I intend to do some modifications on the internal circuit in

the near future. I would like much more low frequency output and this might be possible with a change to the size of the microphone blocking capacitor. I will keep you posted. Sometime in the future, I hope I might be able to report on some other ICOM desk microphones.

### IC-736 On Test

I carried out the usual series of tests on the IC-736 but this time I looked at the six metre performance in some detail. However, as usual, I started with transmitter power output. As the transceiver is AC operated with no provision for external DC input, no tests for current drain were possible. Power output is variable on all modes via the small "RF PWR" control.

#### Power output CW Mode

##### Band Power Out

160	124 watts
80	120 watts
40	116 watts
30	115 watts
20	113 watts
18	110 watts
15	110 watts
13	110 watts
10	107 watts
6	100 watts

On SSB the PEP output was just slightly higher than the above figures. Maximum AM power output was 40 watts but I found it was necessary to reduce this to about 25 watts in order

to achieve 100% modulation. FM output was the same as the CW output and the IC-736 has a 100% duty cycle which means you can run full output all day.

The IC-736 specification does not include a figure for transmitter intermodulation distortion, but the advertising brochure does show a spectrum analyser graph of the IMD characteristics. Although the actual figure is not mentioned it appears to be about -30 dB referred to a two tone signal. The same IMD tests were carried out that we have used before on HF transceiver tests (see TS-50S review, *Amateur Radio* June 93) and we arrived at a figure of -32 dB which is 5 dB better than the IC-737. This improvement is due to two factors. The MOS-FETs in the driver and final stages of the transmitter, and the 50 volts applied to them courtesy of the built in AC power supply.

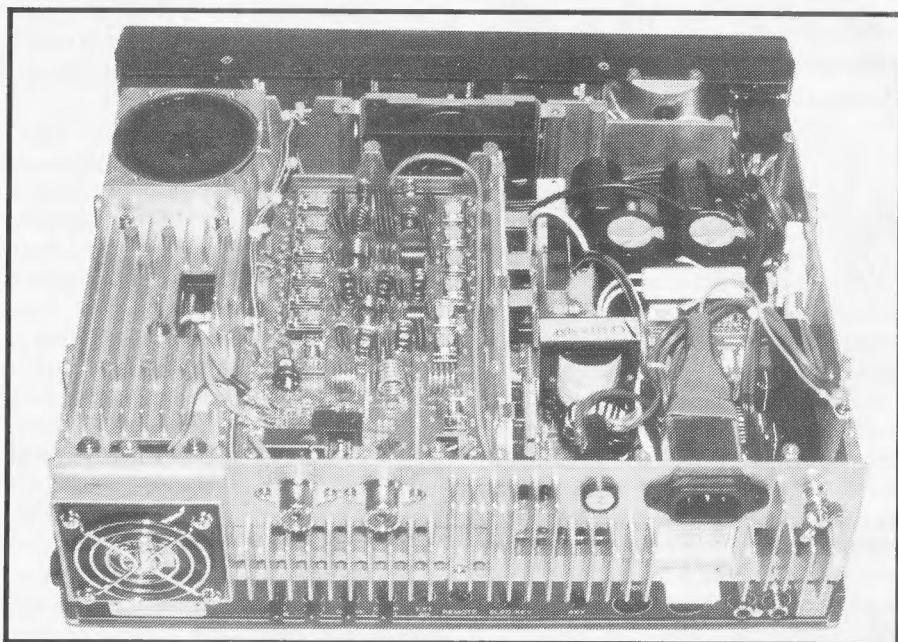
### Receiver Tests

Firstly, the "S" meter calibration was checked. I did two sets of figures, one at 14.2 MHz and the second at 51 MHz. The difference is surprising. I had the pre-amp switched in and used the USB mode.

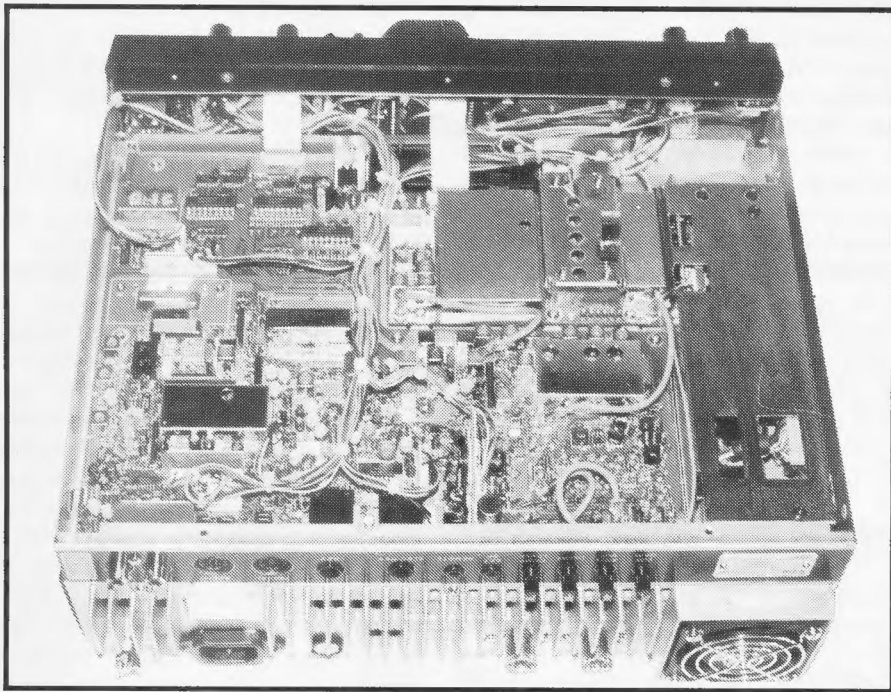
"S" Reading	14.2 MHz	51 MHz
S1	1.4 $\mu$ V	.38 $\mu$ V
S2	1.6 $\mu$ V	.45 $\mu$ V
S3	2.0 $\mu$ V	.6 $\mu$ V
S4	2.7 $\mu$ V	.75 $\mu$ V
S5	3.6 $\mu$ V	1.0 $\mu$ V
S6	5.0 $\mu$ V	1.3 $\mu$ V
S7	7.0 $\mu$ V	1.8 $\mu$ V
S8	12 $\mu$ V	2.5 $\mu$ V
S9.	20 $\mu$ V	5.0 $\mu$ V
+20dB	280 $\mu$ V	—
+40dB	2000 $\mu$ V	—
+60db	.015 V	—

I did not make any measurements on 51 MHz above S9. Readings for S9 between 1.8 and 30 MHz were consistent with a maximum variation of less than 2 dB. The pre-amp was measured at exactly 10 dB and the attenuator at -20 dB.

AGC threshold was about 1.5  $\mu$ V and increasing the output of the signal generator to full level produced an audio output increase of less than .5 dB, an excellent figure. The AGC action was very well controlled but I would have preferred a slightly slower decay time for SSB. With an RF gain



Top view of the IC-736 with the top cover removed.



**Bottom view of the IC-736 with the bottom cover removed.**

control now included this can be compensated for quite easily.

Receiver sensitivity was measured in the SSB mode at 14.2 MHz with

the pre-amp in. It was  $.14 \mu\text{V}$  for 10 dB SINAD, a slight improvement over the IC-737. AM sensitivity was the same as the IC-737,  $2.0 \mu\text{V}$  at 14 dB

SINAD. Sensitivity at 51 MHz, again in the SSB mode, was  $.12 \mu\text{V}$  for 10 dB SINAD. I thought this time a frequency response run on AM might be of interest. I was not happy with the sound of AM on the IC-737 and the 736 didn't sound any better. Here are the results. A modulation depth of 30% was used.

100 Hz 250 Hz 500 Hz 1 kHz 1.5 kHz 2 kHz 2.5 kHz 3 kHz  
-16 dB -6 dB -1dB 0 dB -1 dB -3 dB -8 dB -15 dB

Not exactly hi-fi is it? I know we are talking about a communications receiver but I think it should be better than this.

The next tests were for audio power output and distortion on SSB and CW. An audio power meter and a noise and distortion meter were connected to the external speaker socket on the rear of the IC-736. The specified load impedance is 8 ohms but tests were also carried out with a 4 ohm load. Maximum audio power at 8 ohms was 3.4 watts and at 4 ohms this increased to 4.8 watts. Of course the distortion was very high at these figures but the specified 2.6 watts at 10% distortion was easily

Electronics Software Compendium  
**1000's of programmes  
on a disk!**

**\$40**  
including postage



"Possibly the best collection of shareware for amateurs ever collected" is how one amateur who saw this CD-ROM described it — and he wasn't kidding! Hundreds of megabytes of high quality programmes for all aspects of electronics and amateur radio.

Complete with easy search capability and convenient unarchiving system.

## Australian Callbook now on disk!

Now, for the first time the complete listing of Australian amateur licensees is available on disk. Complete with access software which enables searches by name, street or postcode also enables you to edit the database to include your own up-to-date information.

Requires IBM-PC or compatible with hard-disk. Supplied on 3.5" high density floppy disk.

**BUCKMASTER**  
HamCall CD-ROM April 1994 Edition  
U.S. and International Call Book



**\$75**  
including postage

For the most complete electronically accessible callbook listings available this is the product you need! HAMCALL has 101 countries (including USA & Canada) on a single CD-ROM disk.

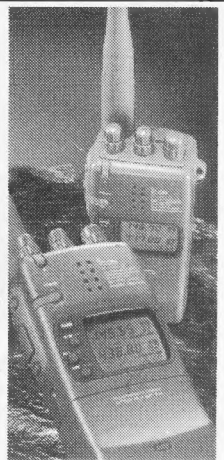
This collection is accessible directly from log programmes such as Ham-Windows and can also be used with a variety of BBS systems.

Australia not included in this edition.

**\$32.50**

including postage

**ICOM**  
**Super Special**



If you missed out in May, we now have some more of these amazing radios at this special price!

These ICOM W21A Dual band transceivers are the bargain of the year!

You get:

- ☆ Battery capacity indicator
  - ☆ Remote control capability from speaker mic
  - ☆ Large display with 24hour clock
  - ☆ 5 power settings 5W to 15mW
  - ☆ Extended receiver coverage
  - ☆ Dial select steps for fast tuning
- and you get ICOM's full twelve month warranty!

**\$599!**

All for only:

**DAYCOM**

**37A Fenton Street, Huntingdale 3166**

Bankcard, MasterCard **Phone (03)543-6444**  
& Visa all welcome **FAX (03)543-7238**

COMMUNICATIONS Pty. Ltd. Copyright © 1994 Daycom Communications Pty. Ltd. All rights reserved. Prices do not include freight or insurance and are subject to change without notice. ACN 061 819 949

met. Note that this is a slight improvement over the IC-737. However, the best is yet to come.

At an output of 250 milliwatts the distortion at 1 kHz was only .3%. This is the best that I have ever measured on an amateur transceiver.

The audio frequency response for SSB was measured with the -6 dB points at 250 Hz and 2.5 kHz with a high end roll-off of -10 dB at 2.75 kHz. I next measured the effectiveness of the notch filter. When reporting on the IC-737, I noted that there was a drop of 6 dB as soon as the filter was switched in. This problem has been eliminated. There is only a .5 dB drop in audio level on the IC-736 when the filter is switched in. The overall range of the notch filter is 500 Hz to 3 kHz and the overall notch depth was measured at -28dB.

Finally, I did an extended test on frequency stability and readout accuracy. Over a several hour period the drift did not exceed 40 Hz. With the one Hz readout on the IC-736 it was easy to follow any drift that occurred but I would like to try a transceiver fitted with the optional CR-282 high stability crystal unit. I still wonder why equipment manufacturers don't fully option transceivers for reviewers to test. If they don't do this, just how do they evaluate these options themselves. I can't imagine that they wouldn't want

to try them out. The same thing applies to CW filters. The only time we get to evaluate them is when they are included as standard which is not too often these days.

With the exception of the AM receive frequency response, the performance of the IC-736 is almost beyond reproach. The SSB transmit quality is not to my liking but perhaps this is a matter of opinion. Many amateurs contacted reported that it sounded fine. However, I think that ICOM should take a hard look at this aspect of their transceiver's performance.

### IC-736 Instruction Manual

The IC-736 instruction manual is typical of all ICOM manuals. It is clear and to the point with no frills. With the exception of some clear photos at the rear of the book that indicate many of the adjustment points and location of the main circuit boards, all other illustrations are line drawings. In many ways, these line drawings are clearer than photos.

In general, operating instructions are very well covered and I would recommend that new owners should read the manual first off. Many of the rig's functions are not self evident and you just might miss out on many things that will add to the pleasure of operating this fine transceiver.

Unfortunately, ICOM still deny us an insight into the technical aspects of how this transceiver works. Again, I score the manual eight out of ten.

### IC-736 Conclusions

The changes that ICOM have made to the IC-737 to convert it into the IC-736 have produced a completely new class of transceiver. I imagine that ICOM must be wondering about the future of the big and expensive IC-765 which, in comparison to the IC-736, is now looking very outdated. In the same way, the IC-736 must now make the IC-737 redundant. By the time you add the cost of a power supply, the obvious way to go is to spend the little extra and go for the IC-736 with all the extra benefits that it offers. If the transmitted audio quality is to your liking then the IC-736 is the best value base station transceiver on the Australian market. It is, of course, compatible with the full line of ICOM ancillary equipment that includes linear amplifiers, automatic antenna tuners (not really needed with the IC-736), microphones and external speakers.

The IC-736 sells for \$3692.43. My thanks to ICOM (Australia) Pty Ltd and Duncan Baxter for the loan of the review transceiver.

*\*24 Sugarloaf Road, Beaconsfield Upper, VIC 3808*

ar

## WIA News

### Audience boost for Radio Australia

Australia's shortwave broadcaster, Radio Australia, is aiming to boost its listening audience round the world with the completion of a \$9.5 million transmitter facility at its Cox Peninsula site outside Darwin in the Northern Territory.

Two new 250 kW transmitters were officially turned on in late May by Senator Bob Collins, Minister for Primary Industries and Energy, standing in for the Minister for Communications, Mr Lee.

This brings the number of transmitters at the site to five, three

of which will be operational at any one time. Senator Collins said the new transmitters will ensure Australia's voice is heard reliably in many countries of the world.

The new transmitters, built by the French communications specialist Thomcast, feature a fully solid-state drive chain right through to the single vacuum tube output stage, and a full solid-state modulator.

They replace 1969 vintage transmitters built by the Collins company. An ironic twist of fate that Senator Collins commissioned the Collins transmitters' replacement.

### Same hat, new name

David Wardlaw VK3ADW, the WIA's Federal International Regulatory and Radiocommunication Study Group (RSG) Coordinator, in his report to the annual Federal Convention recommended a name change to his position owing to the considerable changes occurring in the structure and operations of the International Telecommunications Union.

His recommendation was adopted by the Federal Convention and David is now the ITU Conference and Study Group Coordinator.