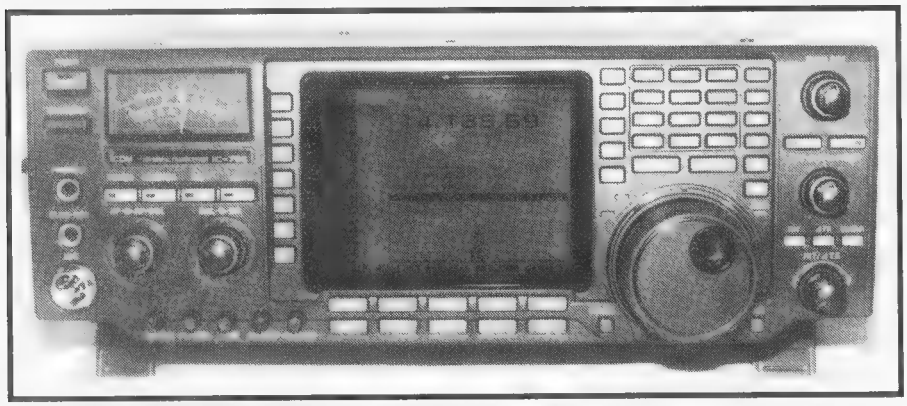
■ Equipment Review

The Icom IC-756 All Mode HF & Six Metres Transceiver

*Reviewed by Ron Fisher VK3OM**



Icom IC-756 transceiver.

As the Icom advertisements say, *"For the Ham who's always wanted an IC-781"*. You remember the IC-781, of course. It was the big Icom with the CRT display in the middle of the front panel. It also had a BIG price tag to go with it. I believe that it is, in fact, still available at around $15,000 (on special order only). Stand back a few metres and you might almost mistake the new IC-756 for a 781. However, at a retail price of $3,700, you will certainly find the IC-756 more affordable.

This price tag puts the new Icom into direct competition with a wide range of transceivers from the other two manufacturers of the big three. But perhaps the main one it will compete against is the Yaesu FT-1000MP at just $250 more, which includes a built-in AC power supply but not the six metre coverage of the IC-756.

Features and Facilities

The IC-756 incorporates just about everything you would expect to find in a top-line transceiver. The one exception is a built-in AC power supply. There is no provision at all for a self-contained power supply and just no room to fit it in with the existing physical design. The transceiver requires a standard 13.8 volt 20 amp power source which is connected via a standard 6 pin DC plug.

The IC-756 transmits and receives all modes. These are SSB, CW, AM, FM and RTTY. The frequency coverage on receive is 30 kHz to 60 MHz continuous, with transmissions restricted to the various amateur bands. Tuning is in either one Hz or ten Hz steps, selectable in one, five, nine or ten kHz segments. Each amateur band has direct access with a dedicated button. In addition, you can enter any frequency directly from the keyboard.

The IC-756 has a Dual Watch feature which allows the reception of two different frequencies within any one amateur band. There is only one tuning control but this can be assigned to either receiver. Without doubt the most dominant feature is the display. I will look later at the extraordinary range of facilities that it has, but firstly a description of the display itself.

It is an LCD, but uses a dot matrix system to build up the information. It measures 110 mm wide and 83 mm high and looks quite different to the LCDs we have become used to in amateur equipment. In fact, it looks very similar to the display on my dedicated word processor.

The background colour is a silvery white with purple characters. Both the brightness and contrast are adjustable via the menu system. After initial switch-on, the display takes a few minutes to come up to normal brightness. Back to the display later and on with the numerous features of this exceptional transceiver.

When you think of new HF transceivers these days, you naturally expect some form of digital signal processing. The IC-756 has both transmit and receive DSP. On receive there is adjustable noise reduction, an automatic notch filter for use on SSB, and an audio peak filter for CW operators.

Transmitted SSB audio has very comprehensive low and high response tailoring. Both ends are adjustable +/-12 dB to produce almost any required sound. The DSP operates, as usual, at a very low frequency IF of 15.625 kHz. There are twin pass-band-tuning controls which allow the operator to adjust both sides of the selectivity curve independently.

One of the important features of the 756 is the solid construction. The transceiver is built into a specially designed diecast frame. It is divided into compartments to both improve the shielding and the rigidity of the whole assembly. The construction is reflected in the weight, which is a solid 10.5 kg. The overall size is slightly larger than the average transceiver in the class, being 340 mm wide, 111 mm high and 285 mm deep.

The front feet are a new design. They flip down to raise the front panel for improved viewing, or flip up if you prefer the flat look. Quite a neat idea.

Again, as expected in mid-priced transceivers, there is a built-in automatic antenna tuner. This is fast acting and has a built-in memory which re-tunes the ATU every 100 kHz after the tuner has been used on a particular band. There are two antenna connectors which can be assigned to any particular band, a very handy feature.

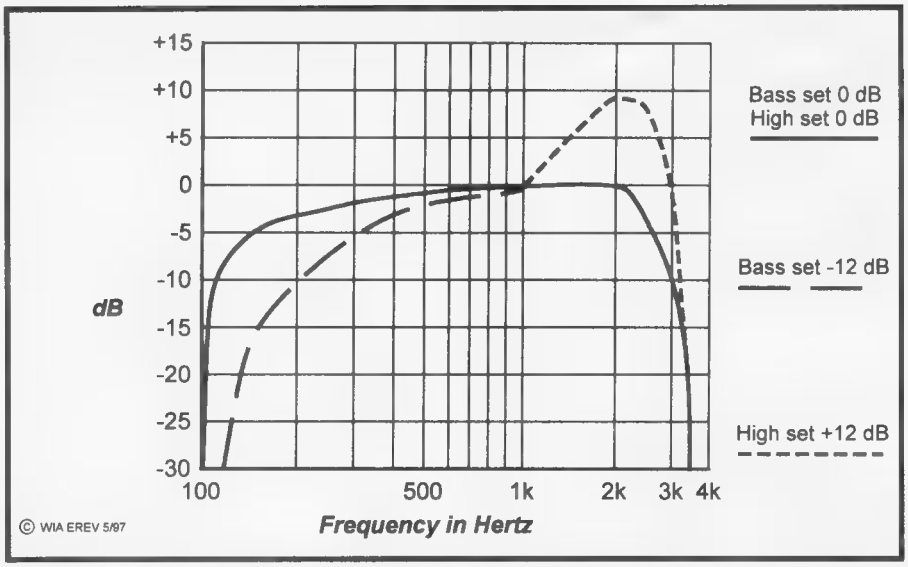


Figure 1 – The Icom IC-756 transmit audio response at 14.2 MHz, no compression, power output 10 watts at 1 kHz reference.

On The Air

To keep everything in the family, I used my old Icom PS-15 power supply to put the IC-756 on the air. No instruction book was available when I first borrowed the transceiver so I had to "fly" it by intuition. However, having had some experience using the IC-706, it proved to be very easy to operate, although I had to wait for a minute or so for the display to come up to normal intensity.

The tuning control is extremely smooth in its action and, with the tuning rate set for one Hz steps, you get 500 Hz per knob revolution. Set the TS button for 10 Hz steps and the tuning rate increases to 5 kHz per knob revolution. For general tuning around you will find the 10 Hz steps ideal but, for sorting out weak signals on a crowded band, the one Hz steps are superb.

Received audio quality on the internal speaker was good, and excellent on my normal external speaker. The same applied to AM reception, except that, with a good external speaker, the quality was the best-ever I have heard from an amateur transceiver.

One of the nice features on the IC-756 is the RF gain/squelch control. Via the menu system it is possible to set this control as an RF gain only, squelch control only, or a combination of both. How, you may ask, can this be done? Simply by using half the travel of the potentiometer for each function. Very neat!

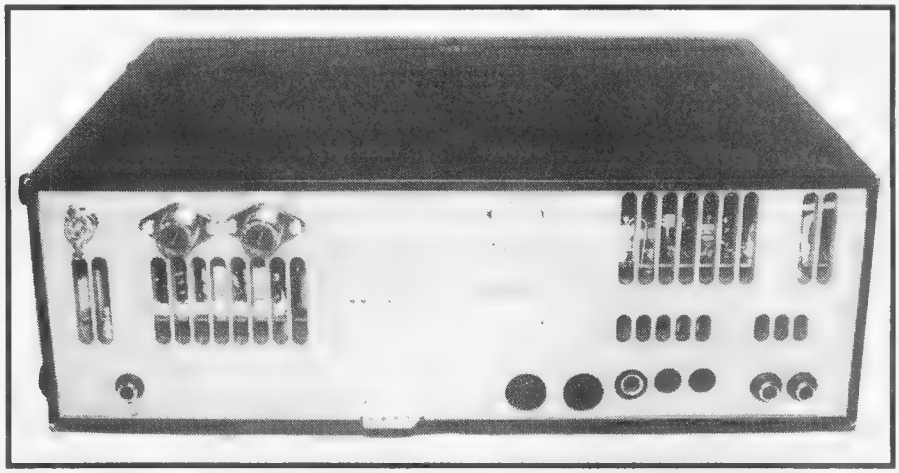
Reports on the transmitted SSB signal were not as encouraging as I expected they might be. As usual, I tried it out on the Travellers Net co-ordinators and got a rather lukewarm response. I used both an Icom handheld microphone and an SM6 desk microphone. In general, the desk microphone was preferred. I finally listened to the transceiver operating from another amateur's shack so I could make a decision myself. My opinion is that it sounds flat and somewhat lifeless. Sure, you can increase both the high and low end of the audio band-pass but this didn't have the effect that I thought it should. The audio was certainly improved with the processor in use but it still didn't have the bite I thought it should have. Maybe the IC-756 is designed to use a microphone with different characteristics to the two that I have. Perhaps one day I might get the chance to try the new SM-20.

The transmitter cooling was very effective. The large fan is mounted a short distance behind the front panel (see photo) and comes on as soon as the transmitter is keyed. It is very quiet in operation.

The meter is clearly illuminated and reads ALC, SWR and power output while in transmit and, of course, S units when receiving. I noted that the power output readings were spot-on. There is, unfortunately, no metering for compression when the speech processor is used. The illumination is adjustable via the menu system.

The amount of information contained in the display is quite amazing. Let's run through a few of them. Take a look at the close-up photo of the display. The top line shows the status of the filters selected for the mode in use for both the 9 MHz and 455 kHz IFs. Next in line is a graphical representation of the twin band-pass filters. Last is a 24 hour clock which can be programmed to switch the transceiver on and off. Down the left hand side is the status of the seven buttons to the left of the display. The top half of the main display area contains the VFO, mode and memory information.

The bottom half is possibly the most interesting section. It switches between several different setting modes but the best one of them all is the "Spectrum Scope". This gives a graphical picture of what is going on over a range of frequencies either side from the centre or tuned frequency. This display can be set



The uncluttered rear panel of the IC-756.

to three different band widths, +/- 12.5, 25 and 50 kHz.

The vertical grid equates to signal strength with each segment equal to 10 dB. It certainly works better than the band scope on my old SM-220.

Other options in this part of the display include memory channel information, which can include frequency and an alphanumeric tag, filter information, selection and level setting for the transmit audio frequency response, monitor and beep level, and display illumination.

The CW operator hasn't been forgotten either. The transceiver has a built-in memory electronic keyer with fully adjustable keying speed and keying weight. Also, the ratio of dot-space-dash can be set to the operator's preference. Again, all the information is displayed on the screen to set these parameters. There is also a range of optional CW filters, although I found that the twin band-pass tuning controls could sharpen the selectivity to the point that would satisfy most casual CW operators.

Finally, a few comments on the operation of the DSP filtering. This has two functions, noise reduction and an automatic notch filter. The notch filter works like magic. Of course, you can only use it on SSB. If you try it on CW it might notch out the signal you want to listen to.

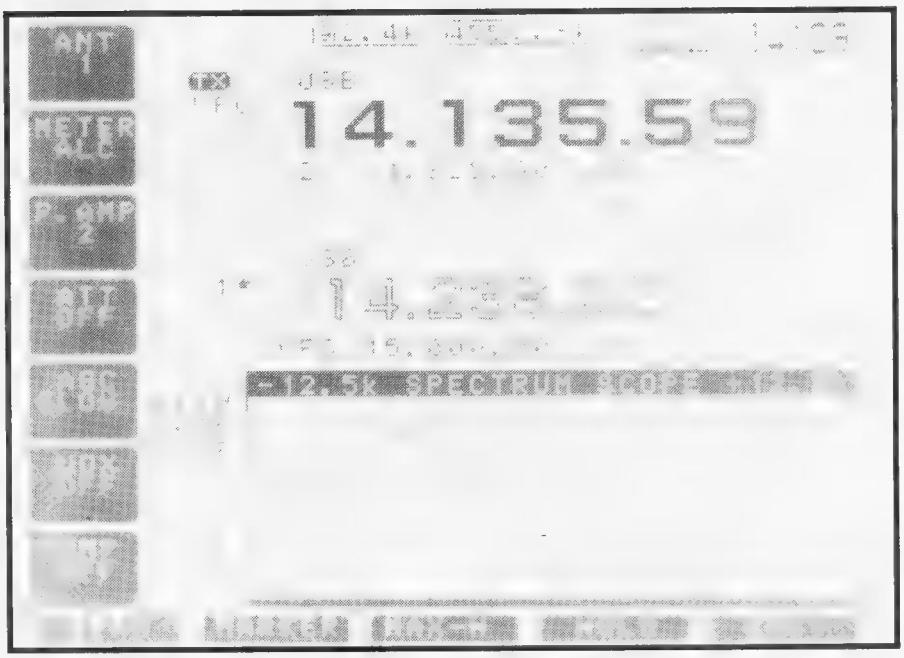
The noise reduction facility has an adjustable threshold and seems to work fairly well, although I found in many cases that the noise blanker was superior. However, at times the two together produced better results.

On Test

As usual the first test was for transmit power output and DC current drain.

Band (MHz)	Power Output	Current
1.8	110 W	16 A
3.5	105 W	17 A
7.0	105 W	16 A
10.1	105 W	16 A
14.2	100 W	17.5 A
18.1	100 W	17 A
21.1	100 W	18 A
24.5	100 W	15 A
28.5	95 W	17 A
51.5	100 W	21 A

The above power output was measured in the CW mode with 13.8 volts applied to the transceiver. PEP output when using SSB was exactly the same as the CW output when checked on an oscilloscope. FM power on 29.5 and 52 MHz was the same as the CW output power on those bands. With the RF power control at minimum, the average power on all modes was about 2.5 watts with the current drain at 6 amps.



The large LCD display set to the Spectrum Scope mode.

Next on the list was to estimate the transmitter intermodulation distortion. My tests showed this to be –27 dB compared to 100 watts PEP output at 14.2 MHz. This is a better-than-average result for a 12 volt powered amateur transceiver, but well down on the best I have measured.

Finally, power output was checked with the automatic antenna tuner matching a simulated 3:1 SWR at 14 MHz. The loss measured was about five watts with 100 watts output which is a reasonable figure.

As is often the case, the most interesting test was the overall SSB transmit frequency response measurement. This is a complete about-turn for Icom. The response with the DSP tone control set to zero showed the –6 dB points to be at 140 Hz and 2.6 kHz, with a very smooth curve in between.

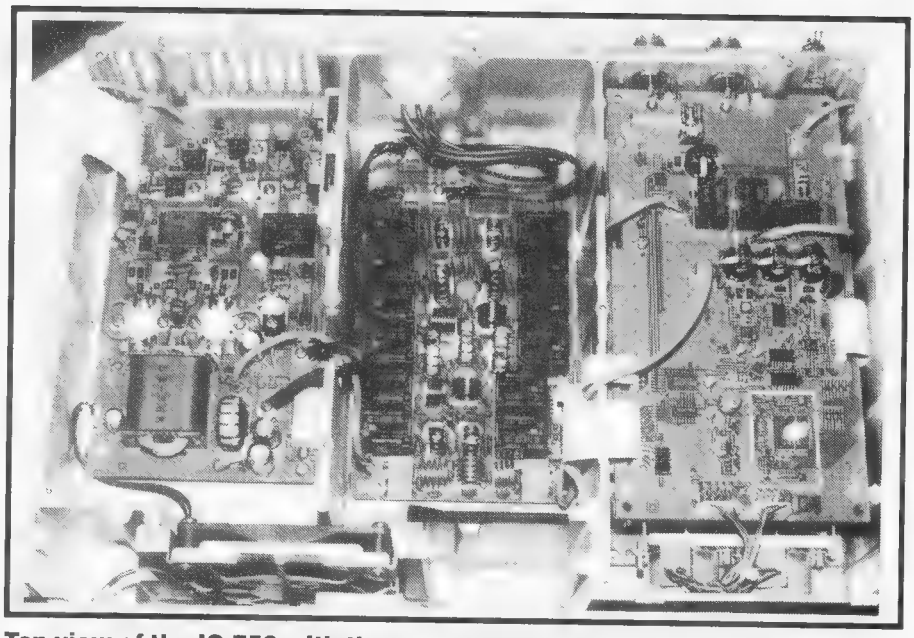
Compare this to the test I did on the IC-706, published in the November 1995 issue of *Amateur Radio*. The difference in the low frequency response, in particular, is dramatic. The curves also show the effect of the tone controls. I have only shown the bass cut and the treble boost as I feel these will be the settings most used. At the high end I measured a peak of +9 dB at just above 2 kHz with the response extended to 3.1 kHz for the –6 dB point. The low frequency roll-off with the tone control set to –12 dB is very smooth and gentle with the 6 dB point moved up to about 300 Hz.

My on-air tests were carried out using an ICOM SM-6 desk microphone and an HM-12 hand microphone. No microphone was supplied with the review transceiver. I would certainly like to test the elegant looking SM-20 desk microphone which Icom offer as an option.

Receiver Tests

As usual, the first test was to check the S meter calibration. It was nice to get back to an analogue meter again. For the same incoming signal, it's possible to get several different readings on the S meter. There are three positions of attenuation and two levels of pre-amplification.

The attenuator gives -6, -12 and -18 dB and the pre-amps give +10 dB each, or a total of 20 dB. My basic measurement was taken with both the pre-amps and the attenuator switched off. The figures were taken at 14.2 MHz.



Top view of the IC-756 with the cover removed. Note the large cooling fan to the left immediately behind the front panel.

S Meter Reading	Voltage Input
S1	3.2 μV
S2	3.8 μV
S3	4.5 μV
S4	6.0 μV
S5	8.0 μV
S6	12 μV
S7	19 μV
S8	30 μV
S9	54 μV
S9+10 dB	280 μV
S9+20 dB	.0015 volt
S9+40 dB	.008 volt
S9+60 dB	.045 volt

With pre-amp one switched in, the S9 figure drops to 18 μV and, with pre-amp two in, this drops again to 6.1 μV. Naturally, with the attenuator in, the amount of RF input to produce S9 will rise.

The band to band figures for S9 (pre-amp and attenuator out) were as follows:

Band (MHz)	Signal (μV)
1.8	49
3.6	50
7.1	45
10.1	56
14.2	54
18.1	54
21.2	61
24.8	74
28.5	72
52.0	80

The S meter reads the same on all modes for a given RF input. Receiver sensitivity was checked at 14.2 MHz. At the time I did this I did not have a copy of the specifications and took the input level as 0.2 μV. Later, when I did receive an instruction book, I noted that the level should have been 0.16 μV. However, I don't think the difference is great. I measured the following results.

With pre-amp 2 on – 0.2 μV 12 dB S/N
With pre-amp 1 on – 0.2 μV 11 dB S/N
With pre-amp out – 0.2 μV 10 dB S/N

The sensitivity was very consistent right across the whole range, including six metres.

The receiver audio output was terminated with an eight ohm power meter and a noise and distortion meter with the following results. Maximum audio output was 2.6 watts with 16% distortion. The 10% distortion was at 2.2 watts output which exceeds the specified two watts for this amount of distortion. However, when the audio was reduced to a normal listening level of about 100 milliwatts the distortion did not drop below 2.5%. I am surprised at this high level. I would have expected this to be 1% or less. Although the specification is met, at normal levels this is the highest distortion I have measured for some years. However, I doubt that it will worry you very much unless you are a very critical CW operator.

Maximum audio output required an RF input of 3 μV or more and the residual noise generated in the audio amplifier was measured at 75 dBm. You won't be troubled with hum or noise if you use headphones.

The received SSB audio response, like the transmitted response, was excellent. Using the 2.8 kHz filter, the 6 dB points were at 200 Hz and 2.8 kHz with very little variation in between. However, the big surprise was the AM audio response. With the full 15 kHz bandwidth selected, the 6 dB points were at 60 Hz and 5 kHz. With a good external speaker connected, broadcast stations sounded as good as my hi-fi system.

The Instruction Manual

Unfortunately, I did not receive the instruction manual until a few days before I completed this review. To add to the problem, when it did come it was only a photo copy and most of the text had been reduced to half-size to save space. On this basis I would rather reserve comments until such time as I see the real thing full size. It appears to be typical Icom and well done. There was no circuit diagram or block diagram included with the copy supplied to me.

Conclusions

The IC-756 certainly has a lot to offer. If you purchase a matching power supply you will be up for a total of around $4,300. For a little less you can purchase a Yaesu FT-1000MP and the decision to pick the right one would be difficult. For a little more the Kenwood TS-870 could also be a contender but I feel it has been left behind by the newer models. There is a full list of options available to match your new IC-756 including narrow CW filters, narrow SSB filters (1.9 kHz), and even a wide SSB filter of 3.3 kHz. I would like to hear the latter in operation. Like many new transceivers you will have plenty to play with even if the bands are dead.

Our review transceiver was supplied by Daycom Communications Pty Ltd. For more information contact Daycom or Icom Australia Pty Ltd direct.

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