

■ Equipment Review

Icom IC-746 HF + 6 m + 2 m 100 Watt Transceiver

Reviewed by Ron Fisher VK3OM
24 Sugarloaf Road
Beaconsfield Upper VIC 3808

Yes, that's right! All amateur bands right through to two metres and with 100 watts output on all bands!

It seems that the IC-706 has grown up. Not only that, but you also have a transceiver with all wanted features including Digital Signal Processing and 100 plus memories. What more would you need in the shack?

For most amateur operators this single transceiver would take care of 99.9% of their operating requirements. Having said that, there is one thing you may not want to do with the IC-746 and that is use it mobile. You could, of course, but I, for one, would prefer to use an IC-706 with its diminutive size and removable front panel.

The IC-746 is primarily a base station but, as it requires an external 13.8 volt DC supply, it could be used mobile if you could find room to fit it in. Icom do not have a mobile mounting bracket to go with it so you would have to devise a mounting system to suit your vehicle; also, there is no remote control facility and the front panel is firmly fixed on with no chance to remote it. Of course, it would make a superb portable set-up.

Again I have enlisted the help of John Patterson VK3ATQ to provide some expert help with measurements, and comments on six and two metre performance.

IC-746 Features and Facilities

At first sight, the IC-746 has a different appearance from most transceivers that we have become used to. The cabinet is almost square. This means that it will take up much less width on your operating

desk compared with most older transceivers. The actual dimensions are 287 mm wide by 316.5 mm deep and 120 mm high.

An important feature of the IC-746 is the solid construction. The transceiver is built into a specially designed diecast frame. It is divided into compartments which improve the shielding and rigidity. Construction is based on the earlier successful IC-756. The IC-746 weighs in at 8.9 kg.

The outstanding feature of the transceiver is the LCD. This measures a whopping 105 mm wide by 70 mm high and conveys an enormous amount of information to the operator. A quick look at the close-up photograph gives an idea of just what is available.

As mentioned before, the IC-746 has transmit capability on all amateur bands from 160 metres right through to the two metre band. The receiver has full

coverage from 30 kHz to 60 MHz, and then from 108 to 174 MHz. It's nice to see that Icom have provided receive capability between 30 and 50 MHz to allow six metre operators to check the MUF for openings.

The 108 to 174 MHz range includes all manner of interesting things to listen to, including the aircraft band. One feature carried on from earlier Icom models is the band scope feature. The IC-756 transceiver reviewed in an earlier issue of this magazine had a superb band scope facility. Unfortunately, the one in the IC-746 is not well implemented. I will have more to say about this in the "on the air" section of the review.

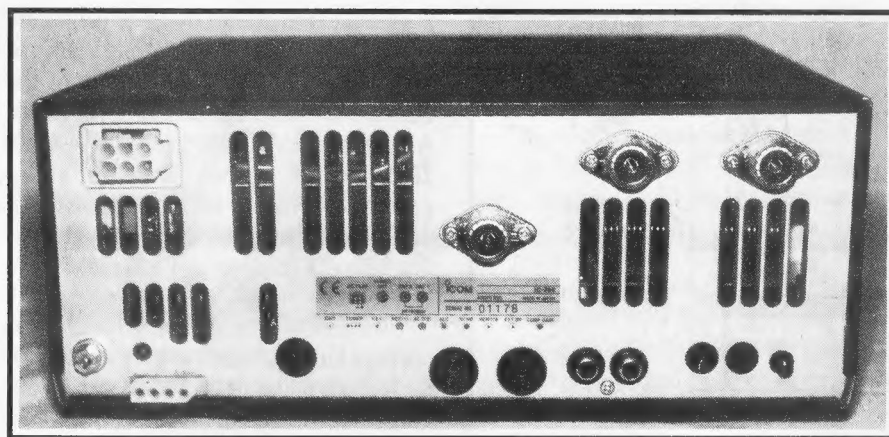
Naturally, the IC-746 has Digital Signal Processing to improve readability of incoming signals. It has three functions. One, noise reduction for use on all modes; two, automatic notch filter to eliminate heterodynes for SSB reception; and three, an automatic peak filter with selectable bandwidths of 80, 160 and 320 Hz for CW operation. The centre frequencies of these slots are also adjustable.

Another of the very nice features is the twin passband tuning. This enables the selectivity to be narrowed from both sides at the same time. You can watch the effect on a special segment of the main display.

Of course, the IC-746 is loaded with memories. There are 99 standard memories, two scan edge setting memories plus a call channel. However, it doesn't end there. There are five quick



Front view of the IC-746.



Rear panel of the IC-746.

“memopad” memories which can be expanded to ten, if required, via the menu system.

Each band selection button stores three different frequencies in a band stacking system and, of course, you also have two VFOs to add to the overall versatility of the transceiver.

The keen CW operator has not been forgotten either. There is an in-built four channel memory keyer with 50 characters. A multi function electronic keyer is also included.

There is a CW pitch control and the transceiver has full break-in capability. Add all of this to the above features and it adds up to very versatile operation.

Naturally, there is an automatic antenna tuner built in which works on all bands up to 50 MHz. The ATU has its own memory backup which allows frequencies to be pre-set.

IC-746 On the Air

Connect up your 13.8 volt DC supply and an antenna, and away you go. As is usual, the LCD takes a minute or so to come up to full brightness but when it does you will see one of the clearest displays around. Both the contrast and the brightness are adjustable via the menu system.

There are three SO-239 sockets on the back panel of the IC-746 for multiple antenna connections. Two of these are shared between normal HF and 50 MHz antennas while the third, which is well separated (see back panel photo), is dedicated to the two metre amateur band as well as the 108 to 174 MHz receiver. Switching between the two HF sockets is controlled via a front panel button, or a

particular socket can be dedicated to any band or group of bands.

The tuning is typical Icom, that is very smooth. There are several tuning rates to chose from; one Hertz steps, ten Hertz steps and one kHz steps. However, this goes a stage further via the menu system where you can choose steps of 0.1, 1, 5, 9, 10, 12.5, 20 and 25 kHz. It is also possible to assign a particular step size to a particular mode.

A nice feature carried on from the IC-756 is the combination RF gain and squelch control.

Via the menu again, it is possible to set this single control as an RF gain only, a squelch control only, or a combination of both by using half the rotation of the control for each function.

Reports on the transmitted SSB signal were more complimentary than I have had for a long time with an Icom transceiver. There is a “tone” control for the transmit audio response which is not quite as elaborate as the one in the IC-756.

The IC-746 control allows the band pass to be shifted up and down slightly. Most listeners were unable to detect very much difference in either extreme of the setting. The curves of the response published in Fig 1 show why this is so. I recommend you set the menu to give maximum high frequency response and you won't go too far wrong.

Table 1

| | | | | | | | | | | | |
|-----------------|-----|-----|------|------|------|------|------|------|------|------|-------|
| MHz | 1.8 | 3.6 | 7.1 | 10.1 | 14.2 | 18.2 | 21.2 | 24.0 | 28.5 | 51.0 | 146.0 |
| Pwr (watts) | 120 | 115 | 110 | 110 | 107 | 105 | 105 | 100 | 100 | 95 | 95 |
| ATU (watts) | 100 | 100 | 105 | 100 | 95 | 97 | 95 | 95 | 90 | 85 | na |
| IC (amps) | 20 | 18 | 19 | 17 | 18.5 | 17 | 20 | 21 | 19 | 18 | 17.5 |
| IC & ATU (amps) | 19 | 18 | 19.5 | 17 | 18.5 | 18 | 19 | 21 | 20 | 18 | na |

The IC-746 is supplied with an MH-36 hand microphone and I also used an SM6 desk microphone which, as usual, was rated slightly the better of the two.

The IC-746 also has an RF speech processor to give the transmit audio a boost. John Patterson gives his opinion: “The processor worked well but the audio was not as ‘punchy’ as the reference transceiver. Close in, most liked the 746 but, for weak signal work, the reference transceiver was more readable.” The processor is adjustable via a rear panel control but there is no metering to set the clipping level.

Talking about metering, the display gives bar graph metering for ‘S’ meter, transmitter power output, ALC and SWR. While transmitting, power, ALC and SWR can be monitored at the same time.

The receiver audio quality through the internal speaker was reasonable. The quality has a slightly hollow sound but an external speaker (an Icom SP3) produced a great improvement.

Now for a few comments on the operation of the DSP. The action of the automatic notch filter is excellent on SSB as is the peak filter on CW. In fact, the peak filter works so well that you might well find you can live without the optional CW filter. The noise reduction is another matter. It did make a small improvement copying CW signals through noise, particularly when used with the peak filter and the normal noise blanker. However, trying to eliminate noise from SSB signals was another matter.

I must be honest but I could not find a situation where an unreadable signal could be improved. I look forward to the next generation of Digital Signal Processing noise reduction.

Finally, let's look at the band scope. From the advertising literature you might get the idea that it works like the excellent band scope in the IC-756 (see the review in May 1997 *Amateur Radio*).

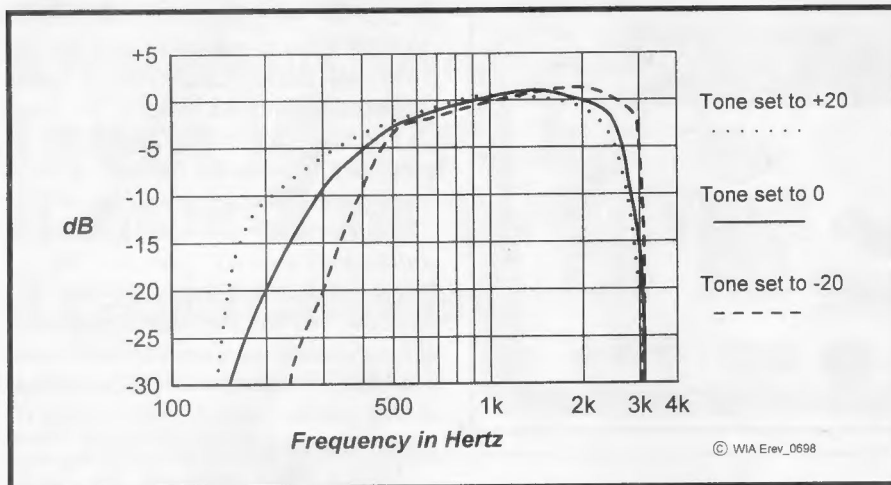


Fig 1 - Transmit audio frequency response of the IC-746 measured at 20 W output at 1 kHz USB on 14.2 MHz with no compression and no ALC reading.

Unfortunately, not so. It appears that, to build up a band picture, the receiver is put into a scan mode plus or minus from the tuned frequency. While this is happening the receiver goes dead. Not a sound. So you have a choice. Either listen to the signal coming in, or watch them coming in, but not the two together. So it will tell you what was there before you listen, but not what is there now. In short, forget about it.

IC-746 On Test

The first test, as usual, is the transmitter power output and current drain. This time I have also included the power output measured through the automatic antenna tuner (see Table 1). This was done with the transceiver connected to a 50 ohm load which would produce minimum losses; no doubt the losses would be somewhat higher when matching a load other than 50 ohms. However, it gives a picture of what to expect. Overall the losses were very low and would pass unnoticed on the air. I have also noted the total current drain both with and without the ATU.

If you intend to run full output FM on 6 or 2 metres you would need to make sure that your power supply is capable of supplying the current for the time you intend to hold the button down. Many power supplies are rated at 20 amps for short peak output only, and may not be happy with a continuous 20 amp drain.

Transmit intermodulation distortion was checked out at -25 dB with 100 watts output on 14.2 MHz. This is an average

figure for a transceiver running from a 13.8 volt DC supply.

Next on the list was measurement of the transmit SSB audio frequency response. A quick look at the graph (Fig 1) will show why there was very little difference in quality reports with the "tone" control set to either extreme.

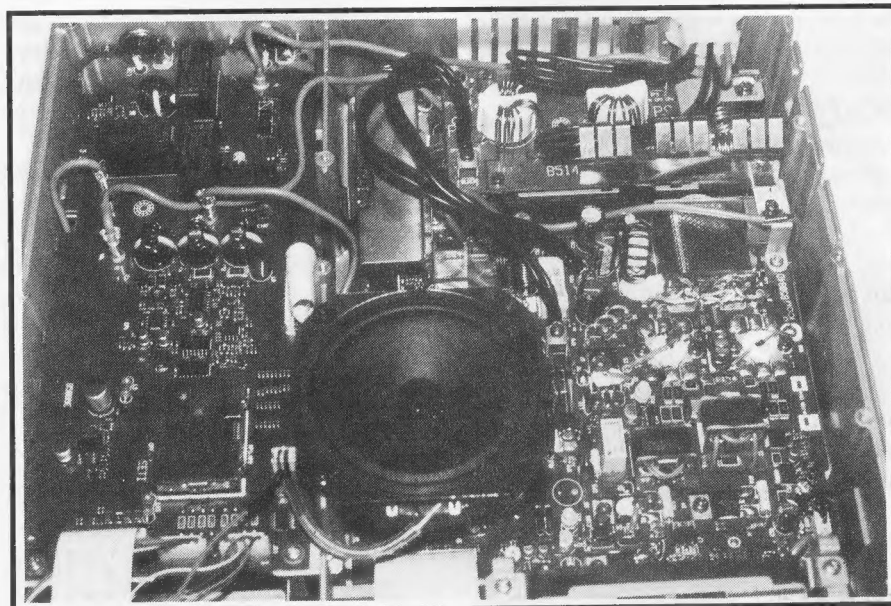
It might be a good idea to explain again how these graphs are produced. The procedure is very simple and most amateurs could try it on their own transceiver. The equipment required is a calibrated audio signal generator, an attenuator to reduce the output to microphone level, and a calibrated RF

power output meter with a full scale capability of about 30 watts. Feed the audio into the microphone input of the transceiver with the generator set at 1 kHz. Adjust the microphone gain to give about 20 watts RF output. Run the audio generator from 200 Hz to 3 kHz and plot the RF power output. Now simply convert this into dB relative to 1 kHz and there you are.

Compare your results with some of the curves I have included with reviews over the last couple of years and see how your transceiver shapes up. A final point, keep the maximum power output to below 30 watts for a normal 100 watt output transceiver to eliminate compression effects produced by ALC action and make sure the processor is switched off.

The next test was to check the audio end of the transceiver. Specified audio power output is rated at "better than 2 watts" at 8 ohms with no distortion figures mentioned. Here are my findings: maximum audio output at 8 ohms was 2.2 watts; and at 4 ohms it was 3.6 watts, but both had very high distortion figures. At 10% distortion (a figure often mentioned in specifications) the power output was 1.8 watts and, at a more normal listening output level of 200 milliwatts, the distortion had dropped to an excellent 0.3%.

Current drain was next measured for receive operation only. With no audio



Top view of the IC-746 out of its case. The PA is to the right. Note the rigid die-cast frame.

output, drain was exactly two amps; with full audio output it was 2.2 amps. With normal listening level audio (100/200 milliwatts) the increase in drain over two amps was not discernible.

Receiver Sensitivity

Because of the very wide frequency coverage of this transceiver, and the undoubted interest that will be shown in the six and two metre performance, I called in the services of John VK3ATQ. John takes a keen interest in 6 and 2 metre DX and also has access to some very sophisticated test equipment.

First, the results on six metres. The noise figure was measured with no pre-amp, with pre-amp 1 and then pre-amp 2. With no pre-amp the noise figure was 4 dB; with pre-amp 1, 4.7 dB; and with pre-amp 2, 3.9 dB. The lower the figure the better, so it's interesting to see that, although the gain increases, the noise figure actually gets worse with pre-amp 1 and improves by only 0.1 dB with pre-amp 2.

Compared with John's usual transceiver, which has a noise figure of 2.5 dB with the pre-amp in, this means the difference between good readability and no readability. On two metres there is only one pre-amp. The noise figure with no pre-amp was measured at 5.4 dB, and with the pre-amp in, 1.8 dB. The latter figure is quite respectable but the figures show why the receiver sounded rather

deaf with the pre-amp switched out. As a comparison, John uses an Icom IC-275 on two metres and this has a noise figure of 1.5 dB, 0.3 dB better than the IC-746.

The absolute sensitivity on both bands was as follows. Six metres with no pre-amp, pre-amp 1 and pre-amp 2 measured -136, 135.5 and 136.3 dBm respectively, while on two metres 134.8 and 138.4 dBm were the respective figures.

John also had a few comments about the noise blanker action. With the beam lined up on the local power line noise, the IC-746 blanker reduced the hash from S7 to S2. However, his usual transceiver was able to bring it down to S0.5 which equates to several dB difference.

Sensitivity on the lower bands was, in all cases, equal to or better than the specified 0.16 μ v for 10 dB signal to noise ratio, and was very constant from band to band.

Next the S meter calibration and the pre-amp gain were measured. I did all of these tests at 14.2 MHz. The bar graph S meter is calibrated at S1, 3, 5, 7, 9 and +20, +40 and +60 dB.

The input required for a reading at these points with the pre-amps and the attenuator off was; 4 μ v, 5.5 μ v, 8.5 μ v, 20 μ v and 100 μ v for S9, and 700 μ v, 0.006 volts and 0.04 volts up to +60 dB. Pre-amp 1 has a gain of 10 dB and pre-amp 2 produces 24 dB gain.

The attenuator measured -20 dB and there is only one position available. The

overall gain of the receiver was very constant right across the amateur bands with no more than 2 dB variation noted.

The selectivity options available for the IC-746 are most interesting. No options were installed in our review transceiver. These things never are, unfortunately. I can therefore only speculate on their performance.

For the ardent CW operator there are two 500 Hz filters available, one for the 9 MHz IF, the other for the 455 kHz IF. However, the filters that I found most interesting are the wide SSB with 2.8 and 3.3 kHz bandwidth.

I enquired from Icom if these were installed would it be possible for the SSB transmit signal to be routed through them to improve the audio quality. However, they were unable to answer the question.

I would like to hear some high quality SSB; sometimes I think modern transmitters restrict the bandwidth a bit too much. There are also narrow SSB filters with bandwidths of 1.9 kHz at 9 MHz and 1.8 kHz at the 455 kHz IF. Installation of the optional filters appears to be quite easy with no soldering required. I hope that one day I might have the chance to give an opinion on their operation.

IC-746 Instruction Manual

While the operation of modern transceivers is often fairly self evident, the time will come when you will need to read the book. As an example, there is no way that the "set" mode could be sorted out without reference to the manual.

The IC-746 manual runs to 85 pages and, apart from a few typographical errors, is very well written. There are clear instructions on the installation of the optional filters, the voice synthesiser unit and the high stability master oscillator.

Again, as seems usual these days, there is no technical description or circuit diagram supplied.

However, you will find more information in a concise form in the advertising brochure.

Again, a plea! Would it be possible to put a heavier cover on instruction manuals. They seem to get dog-eared very quickly.



A close-up of the LCD on the front of the IC-746

IC-746 Conclusions

Overall, I found the IC-746 a very likeable transceiver. It offers a combination of facilities not easily available in any other transceiver.

Both the transmit and received audio quality in all modes is very satisfactory.

However, if you are looking for top performance on six metres you might have to look somewhere else. I guess you could consider a mast-head pre-amp.

The band scope is, unfortunately, a dead loss. It looks good in the advertising brochure but doesn't live up to its promise.

The list price of the IC-746 is \$3,700 but I have noted that dealers are advertising it for somewhat less than this. Dash in and pick up a bargain.

Our review transceiver was supplied by Icom (Australia) Pty Ltd. Further information is available direct from Icom or from any of their dealers throughout Australia.

ar

Time, Gentlemen, Time!

An Australian company, HPM Technologies, has launched the world's most advanced time system, Telechron.

It is pending an international patent and is a "wireless" clock. That is, the clocks are stand-alone units which are

automatically corrected for time at least four times per day from a paged radio signal.

Accuracy is better than 250 milliseconds.

[From the Australian newspaper via Qnews]

High Charge for a Telephone Call

Owning a cellular telephone can get you arrested. Just as the trucker recently found out when he was taken into custody in Los Angeles because another driver thought his telephone was a gun.

According to news reports, the incident took place in late March. California Highway Patrol officers arrested the unnamed truck driver early in the morning on the southbound Interstate 405 freeway at Imperial Highway. This, after the driver of a sports utility vehicle reported the trucker had pointed a weapon at him.

Police say that the big-rig driver pulled out a cellular phone to make a call. The other motorist thought it was a gun and he called for help on his cell phone. The truck driver was initially charged with allegedly brandishing a firearm at another motorist. He was released after investigators determined the object was a cellular phone, not a gun.

[via published and broadcast news reports and Amateur Radio Newslines]

ar



Radio and Communications

INCORPORATING AMATEUR RADIO ACTION AND CB ACTION

Published by
ACP ACTION,
Locked Bag 12,
Oakleigh,
Victoria 3166
(03) 9567 4200

FREE BONUS:
DICK SMITH
ELECTRONICS
CATALOGUE!

What an issue! This month we interview **Dr Andrew Thomas PhD, VK5MIR**, aboard the orbiting **Mir Space Station** — it's easily the most comprehensive interview we've yet seen of this remarkable Australian — plus we talk to **Dick Smith, VK2DIK** and get his life story as well! And then there's the **FT-847!**

June's R&C is simply a "must buy" item this month. Only \$4.70 gets you going...

- REVIEW... Yaesu FT-847. How could one radio cover ALL HF bands plus 6, 2 and 70? Read this...
- DXing from Banaba. One of our contributors lives there. A DX Paradise? Maybe, but life's tough...
- THE CONSTRUCTION ZONE: VK3AFQ presents another great project — an AGC for DC receivers.
- FEEDBACK. Your letters are back, and after last month's WIA report... well, people want some action!
- REVIEWS: 'Equipment briefs' on some MFJ Mighty Fine Junk. Try DSP and a couple of ATU tuners! Cheap!
- As usual, we have our three DX columns, mods and more... the best stories and regulars every month!

Don't miss out — **RADIO and COMMUNICATIONS** is great reading for amateurs!
Check your local newsagent today!

(PS. We also have the biggest collection of radio-oriented Classified adverts in the country. There's lots of them because they work so well. Ask your newsagent to keep a copy for you each month, or ring 1800 25 2515 for subscription details. Hurry — you might miss something!)