

Equipment Review:

Icom IC-7600

HF – 6 m all mode transceiver

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At first glance, the IC-7600 HF – 6 m transceiver would appear to be an upgrade from Icom's very successful IC-756 series, but with a newer look. However, do not underestimate this rig. It has many extra features and improvements from the last of the IC-756 series, the IC-756 Pro III, and owes many of its new features to the IC-7700 rather than being a further development of the IC-756 Pro III.

The IC-7600 is similar in size and weight to the IC-756 Pro III. Its dimensions are 340 mm wide by 116 mm high and 279.3 mm deep, and mass is 10 kg. Like the Pro III, the IC-7600 runs 100 watts output on HF and 50 MHz, has a built-in ATU, features a colourful TFT screen dominating the front panel, and does not have an in-built power supply.

However, amongst a number of new features, the IC-7600 has three 'roofing' filters at the first IF, a faster speed DSP (separate DSP units for the receiver/transmitter and for the spectrum scope), and an improved DSP Noise Blanker (the NB in the IC-756 Pro III was analogue).

As with the earlier IC-756 series, the IC-7600 specifications state a requirement for an external 13.8 volt, 25 amp power supply. However, during our tests, which used several different power supplies, it seems that, although the specifications indicate the rig requires 23 amps maximum on transmit, it worked quite comfortably on a standard 20 amp PSU on SSB.

If you intend to use an older PSU, rather than a new Icom PSU, with the IC-7600, beware of the need to have one of the new standard DC four pin connectors! Hopefully, these new style power connectors can be obtained from Icom and their dealers.

Those who have used any of the IC-756 Pro series transceivers will immediately feel comfortable with the IC-7600. The front-panel layout is quite similar to that of the IC-756 Pro III, with the exception that the slightly larger TFT display now takes up some of the space previously used by the analogue meter (which now, in digital form, is incorporated in the TFT screen).

The IC-7600 is of robust construction with a solid die-cast chassis and well-ventilated back panel. The sheet-steel case is finished in a fine black finish and is fitted with a handle on the left side. The front panel has a smooth, black matte surface and all controls are very clearly labelled. The front feet under the case are solid and can be flipped up to enable the IC-7600 to be angled upward

for better viewing of the front panel screen and controls.

What can the IC-7600 do?

At first glance of the owner's manual, and the transceiver in action, it seems that the IC-7600 will do just about anything a radio amateur is looking for in a top-notch HF – 6 m transceiver. For example, the IC-7600 includes a dual watch facility (which enables reception on two frequencies within the same amateur band), a very useful facility indeed for the keen DXer and contester, and one which was, strangely, not offered with the higher specification IC-7700.

This rig has so many features that it is not feasible for us to comment in detail on each one. However, here are some of the more important features.

The first thing that strikes you about the IC-7600 is the colourful and clear display which dominates the front panel. This screen size has increased from that used in the IC-756 Pro III to 14.73 cm diagonal and now has a resolution of



Photo 1 - The IC-7600 HF - 6 m all mode transceiver

400 by 240 pixels. The most important thing about the screen that the reviewers noticed was that, unlike the Pro III screen, this one is at full brightness immediately after switch-on. However, it was slightly 'grainy' when compared to the screen on the IC-7700.

The main tuning knob has a knurled Neoprene ring, is heavily weighted and turns very smoothly without any side-play, and has adjustable tension. The tuning rate steps can be easily adjusted in multiple settings from 25 kHz to as low as 1 Hertz.

Another interesting feature is the digital metering which is now included in the TFT screen rather than being a separate analogue meter. It can be switched to resemble a standard analogue meter, an edgewise meter or a bar graph. In the transmit mode the metering can indicate either RF power out in percentage, SWR, ALC level, speech compression level, drain current of the final amplifier MOSFETs, voltage on the final amplifier MOSFETs, and the PA compartment temperature. The IC-7600 metering can also be switched to display all transmit parameters simultaneously in a bar graph presentation.

For radio amateurs not used to the current state of digital meters, when using the IC-7600 metering system in the simulated analogue mode, at first glance it is hard to accept that you are not watching an analogue meter.

Unlike the IC-756 Pro III, which employs a triple conversion receiver, the IC-7600 uses a double-conversion superheterodyne system, with IFs at 66.455 MHz and 36 kHz. Although more difficult to implement, this double conversion system is intended to considerably reduce signal distortion.

Suffice to say, received signal quality on the IC-7600 is outstanding.

A high stability master oscillator is used which makes for a very frequency accurate and stable transceiver.

As with all other Icom DSP transceivers, the IC-7600 offers fully configurable receiver IF selectivity filters for all modes of operation. Three default filter selections are available for each mode, with continuously variable bandwidth available via the Filter Menu. In addition, there are selectable Sharp and Soft shape factors available for SSB and CW.

The IC-7600 is fitted with 15, 6 and 3 kHz roofing filters at the 64.455 MHz first IF. The Filter Menu allows any one of the three roofing filters to be used with each of the three IF filter selections.

The DSP-based twin Pass-Band-Tuning controls operate in exactly the same manner as on the IC-756 Pro series and are very effective in reducing signal and noise interference to the received signal. Numerical and diagrammatic bandwidth displays on the TFT screen facilitate use of this feature.

Icom have provided new features in the IC-7600 for the CW enthusiast. The APF/TPF button selects the Audio Peak Filter (APF) in CW mode, and the Twin Peak Filter (TPF) in RTTY mode. The APF offers Sharp and Soft shape factors, and three bandwidth selections, WIDE, MID or NAR BW by pressing and holding the button.

The spectrum scope on the IC-7600 has been upgraded in several aspects from the IC-756 Pro III. The scope span has been increased to +/- 250 kHz, which is the same as the IC-7700 and the IC-7800, and the minimum

bandwidth has been decreased to 100 Hz, again in line with the IC-7600 and the IC-7800. Also, the scope's speed is now adjustable.

Incidentally, having used the spectrum scope feature on several Icom review rigs in recent times, the reviewers always find it difficult to go back to a transceiver which does not have this facility.

The tuneable manual notch filter, which is inside the AGC loop, is extremely effective with a stop band attenuation of at least 70 dB. Whereas the notch width was fixed in the IC-756 Pro III, the manual notch filter in the IC-7600 has three width settings. This manual notch filter suppresses an interfering heterodyne before it activates the AGC.

The auto notch filter comes into play after the AGC, and suppresses single and multiple tones. However, strong undesired signals can still cause AGC action. The manual notch filter and the auto notch filter are mutually exclusive and the auto notch filter is inoperative in the CW mode.

The DSP noise reduction facility works as well as that in the IC-756 Pro III, and is very effective. As expected, when the noise reduction level is increased, there is a slight loss of high frequencies in the received audio.

The IF-level DSP-based noise blanker is a strong feature of the IC-7600. It is extremely effective in suppressing fast-rising impulse noise spikes before they stimulate AGC action, many of which would otherwise cause AGC clamping. The noise blanker threshold, depth and width are adjustable, and it works rather well in conjunction with the noise reduction facility. Strong adjacent

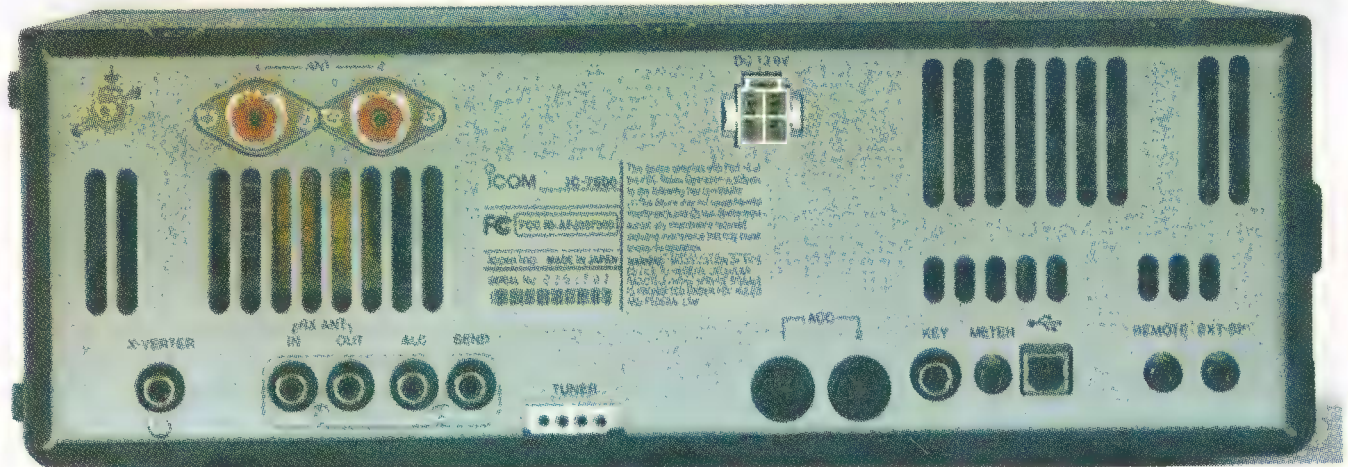


Photo 2 - IC-7600 back panel

signals can still create modulated distortions in the receiver, so only use of the minimum level of noise blanking is needed to reduce the noise impulses to a satisfactory level.

The IC-7600 has dual AGC loops with Slow, Mid and Fast settings which can be menu adjusted for optimum effect. Press and hold the AGC button on the left hand edge of the TFT screen for one second, and the AGC decay timing menu pops up on the screen, enabling setting of the timing range on each of the Fast, Mid and Slow positions of AGC. Each mode of operation has settings specifically for that mode.

In practice, the AGC is very smooth in operation and does not seem easily susceptible to strong signal overload. The stated third order intercept point for the IC-7600 is +30 dBm, with a dynamic range of 104 dB, which is an excellent result for a mid-range HF transceiver. However, it should be noted that the third order intercept point remains the same as the IC-756 Pro III, which is 10 dBm down on that achieved with the IC-7700 and the IC-7800.

The IC-7600 has two USB ports. The USB port on the front panel can be used to connect a USB memory stick for reading/storing a wide variety of the transceiver's information and data, and inputting updated firmware, as well as connecting a USB keyboard for RTTY and PSK operations. The USB connector on the rear panel of the IC-7600 is used to connect the transceiver to a PC (personal computer). This is the only connection required between the IC-7600 and the PC – no interface is required. Download the Icom USB driver from the Icom website and you can be on the air with computer control of the IC-7600.

Note, however, that, unlike the IC-7700, the IC-7600 does not have a video output connector to enable use of an external monitor.

The IC-7600 has a built-in receive and transmit audio equaliser which has separate bass and treble adjustments for a total of 121 combinations. This

enables you to adjust the tonal quality of your transmitted voice signal as well as the receiver audio. In addition, on transmit the bandwidth is selectable from 100, 200, 300, and 500 Hz at the low-pass edge, and 2500, 2700, 2800, and 2900 Hz at the high-pass edge, respectively. Three types of high and low combinations can be stored in the memory as favourite settings. With this flexibility, the transmitted audio quality is adjustable to your preference.

On transmit a DSP based speech compressor is available which increases average RF output power up to 20 dB of compression, although the reviewers found that about 5 dB of compression was sufficient.

For the CW enthusiast, a straight key or external keyer can be connected to a ¼ inch (6.35 mm) jack on the back panel, or a keying paddle can be connected to a ¼ inch jack on the front panel to use the inbuilt keyer. Full and semi break-in is available with a front panel adjustment for delay.

With use of the twin PBT (pass band tuning) controls, you can narrow the receive filters for CW down to 50 Hz with an excellent shape factor and steep skirts, and no suggestion of ringing. This is where DSP filtering scores in comparison with standard IF filters.

The IC-7600 has a total of 101 tuneable memories including two scan edge memory channels which are used for setting edges for programmed scans.

The remaining 99 memories, which can hold one frequency and one mode in each channel, are tuneable and can be transferred to the VFO. In addition, each band has three stacking registers which store all operating parameters selected for that frequency.

As with the IC-756 Pro III, the IC-7600 incorporates a digital voice recorder which provides 90 seconds of recording from four memories for transmit messages. On receive a button push enables the last 30 seconds of received audio to be stored in each of an additional 20 memories for playback, a total of 200 seconds!

Another interesting feature of the IC-7600 is the Auto Tune system which tunes the displayed frequency automatically when an off-frequency signal is received within the range of ±500 Hz on CW or ±5 kHz on AM. The IC-7600 also has an automatic frequency control for use with PSK. If a PSK signal is received within the AFC tuning range (default is 15 Hz) the decoder automatically tunes into the signal.

Also, the IC-7600 enables stand-alone PSK and RTTY operation (no need to connect a PC). The received signal decodes on the TFT screen, the outgoing message can be sent from a keyboard plugged into the USB port, and a built-in 'waterfall' display and vector tune indicators help to tune in the signals. There are also transmit memories for messages than can be sent at the touch of a key.

Incidentally, CW operators are catered for very well with the IC-7600. Quite apart from sharp DSP filtering, and the Audio Peak Filter, the IC-7600 incorporates full QSK operation and a smooth electronic keyer.

There are three antenna connections on the rear panel of the IC-7600, two for transceive operation and one for receive only. These antenna connections are manually selectable from the front panel, but can also be locked into the band memories. In addition, there is a connection for an external transverter.

The IC-7600 has an inbuilt, fast acting automatic antenna tuning unit which matches antennas ranging from 16.7 to 150 ohms unbalanced to the transceiver required 50 ohms. On 50 MHz the ATU matches from 20 to 125 ohms. In other words, the ATU will match a VSWR of up to 3:1; on 50 MHz it will match a VSWR of up to 2.5:1.

On the air

The review transceiver was put on the air from both reviewers' radio shacks. In a nutshell, both reviewers were very impressed with this rig except for, initially, the SSB transmit audio quality. The only microphone available was the supplied HM-36 handheld unit. When using the transceiver's default settings, the transmitted audio seemed lacking in high frequency response and produced muffled audio.

However, after playing with the transmitted bandwidth settings (on the low frequency end you can set the cut-

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off at either 100, 200, 300 or 500 Hz; and at the high end you can select the cut-off to be either 2500, 2700, 2800 or 2900 Hz) and the shaping of the transmit audio response with the microphone DSP equaliser, the end result was quite acceptable.

We would have liked to be able to try the IC-7600 with one of Icom's quality desk microphones, the SM-20 or the SM-50. We are sure that this would have considerably improved the 7600's transmit audio quality over the best achieved with the HM-36 handheld microphone.

Although there are just under 70 controls on the front panel of the IC-7600, and many of the functions, particularly the setting up of operating parameters, are menu driven, nevertheless the reviewers found operation of the transceiver was quite intuitive compared to some other transceivers we have reviewed in recent years. If you have used any of the modern era Icom transceivers, you will feel quite at home with the IC-7600.

Of course, most of the settings available on the IC-7600 are 'set and forget', so in actual on-air operation of

the transceiver, only a small handful of the available controls will be in regular use.

On receive the IC-7600's performance was most impressive. The quality of the recovered audio on SSB was very good, even when using the inbuilt speaker pointing upwards in the top of the transceiver's case. A good quality external speaker improved the received audio quality even further. AM reception was excellent although we found that the AM broadcast stations sounded better in the 6 kHz bandwidth setting than in the 10 kHz setting.

It was also noted that the IC-7600 ran much cooler in operation than the IC-756 Pro III, even after a prolonged period of transmitting.

Incidentally, the 173 page instruction book that comes with the transceiver is quite comprehensive and covers everything that a user needs to know about using the equipment. A quick scan of this manual would be very desirable before firing up the IC-7600.

Conclusions

Both reviewers were extremely reluctant to part with the IC-7600. Quite apart

from the usual excellent facilities one expects from a transceiver of this quality, the features that stand out in the minds of the reviewers include the outstanding receive audio quality, the effectiveness of the DSP noise reduction, and the usefulness of the spectrum scope.

Although it is a complex example of modern, leading edge communication technology, the IC-7600 is a very easy transceiver to use, and provides an incredible number of adjustments to enable the operator to 'personalise' just about every aspect of receiving and transmitting.

This rig is an excellent example of Icom's dedication to continual improvement in amateur radio equipment, and is a very worthy successor to the IC-756 Pro III.

By shopping around, you should be able to purchase a new IC-7600 from around \$5000 to \$5500.

Our thanks to Icom Australia in Melbourne and, in particular, Kitty Mau for making the IC-7600 available for review.

Photos by Bill Roper VK3BR



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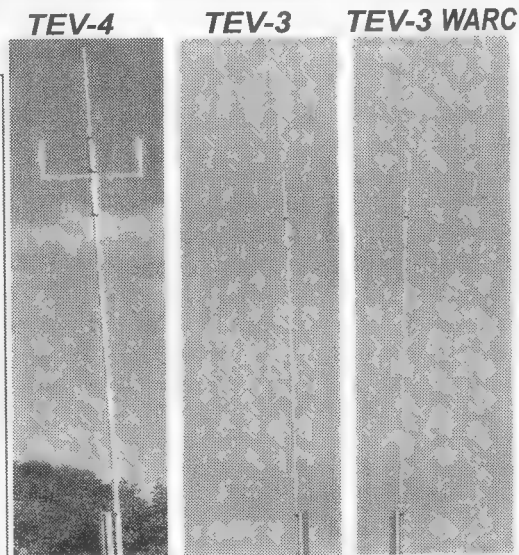
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FREQUENCY	7, 14, 21, 28 MHz	14, 21, 28 MHz	10, 18, 24 MHz
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FEED IMPEDANCE	50 ohm	50 ohm	50 ohm
Max. RADIAL LENGTH	10.7 metres	5 metres	7.5 metres
SWR	1.5 or less	1.5 or less	1.5 or less
POWER RATING	1 kW	1 kW	1 kW