

Listening And Looking In On The Bands

Ever since I first had the great pleasure of using the first Digital Signal Processing (DSP) equipped Amateur Radio transceiver to come my way, I've watched the growth - and complexity of provided 'extras' - increase at an amazing rate. First came better DSP, followed by the introduction of the first relatively simple spectrum scopes and now there's built-in RTTY decoding. What next I ask?

When I got the opportunity to try the latest h.f. and 50MHz main transceiver from Icom I'd just moved house. My old home had plenty of space for antennas and, although I can have some at my new home, my antenna erecting abilities are now extremely limited. So, I'm now active on the band using very simple wire antennas and my portable 'long wire' and dipole arrangements for use from my car.

I've evaluated the IC-756PRO from my new home on power levels ranging from 5 to 100W on c.w. and s.s.b. and also from my new vehicle at around 25W. Incidentally - the power limitation when working from my car is because I am very concerned that I could trigger the 'air bags' on my VW 'Sharan' diesel automatic MPV estate car at any time and particularly when I'm parked and operating in my favourite /P ('stroke Parked') mode.

The VW handbook for my 'Sharan' clearly states that r.f. levels in excess of 10W **inside the vehicle** can cause problems. So, when using long wires (with the possibility of r.f. in the car) I keep the power well down. What it doesn't say in the handbook is whether or not this

level applies when the car is parked with engine and electrics off and without the alarm system activated. No doubt some reader will help me in this respect but



● A new perspective on the bands - The IC-756PRO provides the operator with a new dimension and many exciting facilities.

in the meantime, when I'm evaluating any portable/mobile transmitting equipment on behalf of readers I'll be very careful!

What's On Offer?

So, what's on offer with the Icom IC-756PRO? Well, to answer the question let's take a look at what I regard to be the most important features and design elements.

However, I will not be 'listing' such things as the memory functions and other items as they are covered in the manufacturer's specification at the end of this review.

The main receiver provides general coverage from around 30kHz (this will probably vary from receiver to receiver) to 60MHz with separate, dedicated Amateur Radio band coverage. The receiver is described as a triple conversion superhet with, of course, the DSP stage (which now seems to be generally accepted as such) being considered as the last i.f. stage.

The first i.f. is 64.455MHz, the

second is 455kHz with the final being 36kHz. The last i.f. stage is, of course, where the all-important DSP is undertaken.

As supplied, the receiver is capable of a.m., c.w., s.s.b. and n.b.f.m. reception. When the Radio Teletype (RTTY) function is selected, the receiver switches into frequency shift keying (f.s.k.) mode.

The transmitter is capable of a maximum output of 100W in the c.w., s.s.b., RTTY and narrow band frequency modulation (n.b.f.m.)

mode (5 to 40W a.m.) and is - according to the specifications - continuously variable from 5 to 100W.

However, although I found on my power meter that the lowest power output I could select was 5W (give or take any inaccuracy from my thermistor-headed terminated power meter), somewhere in the manual - I definitely read it somewhere - it states that it's actually 8W!

On the facilities side, the IC-756PRO is certainly in the 'impressive' league! On top of a

Cost:	RRP £2399, M.S. price £2099
Company:	Martin Lynch & Sons
Contact:	Martin Lynch
Web site:	www.hamradio.co.uk

Rob Mannion G3XFD has been enjoying the newly introduced Icom IC-756PRO transceiver. Rob says "I've found it fascinating to be 'Listening & Looking In' on the bands". So, read on to find out what he's discovered!

Rob Mannion G3XFD has been the Editor of PW for nearly 11 years. He's a keen 'portable' operator on both the h.f. and v.h.f. bands.

● Fig. 1: 'Looking in on frequency'. The main display on the Icom IC-756PRO provides a great deal of information plus a built-in RTTY screen (see text).



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Product

The Icom IC-756PRO HF & 50MHz transceiver - containing 32 bit floating point, i.f. DSP and also featuring digital twin pass band tuning, real time spectrum scope, dual-watch, a.g.c. loop operation, digital i.f. filter, low distortion r.f. type, speech compressor, built-in RTTY demodulator/dual-peak APF as well as built-in a.a.t.u. and much more.

Accessories

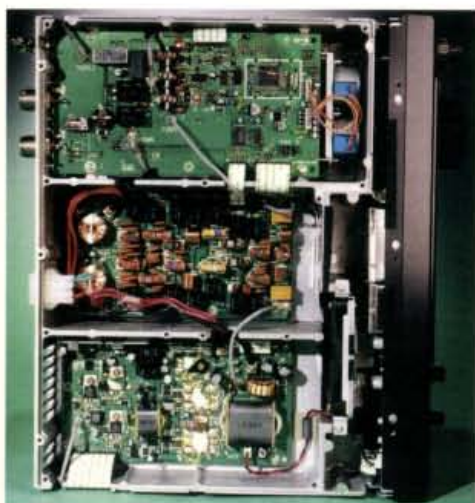
Supplied accessories: d.c. power cable; hand microphone; spare fuses; c.w. keyer plug.

Pros & Cons

Pros: Excellent DSP facilities, selectivity and ease-of-use receiver and transmitter. Greatly improved three colour l.c.d. main display. Excellent 'real time' 'spectrum scope' (Panoramic adapter' type facility). Very interesting built-in RTTY decoder and screen display.

Cons: Main display could do with slightly increased 'brightness' levels. Viewing angle of small RTTY screen critical for comfort and distance. Some front panel controls 'slightly fiddly'.

● Fig. 2: Where have they hidden all the electronics? An inside (top) view of the Icom IC-756PRO where the advanced use of surface-mount technology gives a false impression of what is actually 'under the bonnet'! Note the very substantial inter-compartment screening which is provided by die-cast aluminium sections.



user-friendly DSP 'third i.f.', the transceiver comes fitted with a much improved 'spectrum scope' which many will class as a 'panoramic adapter' type display - you'll see what I think of this 'window to the bands' later in this review.

The layout of the front panel is also well thought out and, even as a left-hander, I found it reasonably easy to use. The only real 'niggle' I have regarding the front panel controls is with the size and positioning of the **MIC GAIN, RF POWER, COMP** (Compression), **KEY SPEED** and **BK-IN DELAY** (c.w. 'break-in') knobs, which I feel are too small and 'fiddly'. However, the designers obviously consider that these controls are not constantly used - and can be positioned where they are and made smaller. I can understand their reasoning and what they've done, although I would like to have seen them slightly larger.

The main three colour l.c.d. type display on the transceiver is excellent and very informative - but doesn't 'dazzle' you with too much comprehensive information. However, although the display is excellent (it's the clearest I've seen recently), I feel that even with the maximum level of 'brightness' selected, there's not a lot of 'reserve'.

In other words, I feel that the display could be a little brighter. Although provided I kept the rig out of the direct sunlight (especially when operating 'portable' from my car), it wasn't a major problem.

As I've said, the display is one of the clearest that's come my way recently and once Icom have adjusted the 'brightness' levels, I feel sure it will be absolutely perfect. Incidentally, I'm only mentioning this fact because I really do appreciate the excellence of the IC-756PRO's display and that it's a major consideration when you're considering

a new rig - it only needs a little 'tweaking' from Icom to get it 'just right'.

Built-In RTTY Decode

As I mentioned at the start of this review, the IC-756PRO comes complete with a built-in RTTY decoder, capable of resolving Baudot (mark frequency 2125Hz, shift frequency 170Hz, at 45bps). A rather limited facility, the 'RTTY Gang' might consider - but I can tell you that after using the facility, I've had my 'appetite whetted' for RTTY again!

I also think that Icom have 'made a rod for their own back' here in that now they've provided the RTTY facility ... just how long can we expect to wait for built-in FAX, Packet and SSTV? All are possible with modern software packages and I really don't think it will be long before 'updates' are available to

operating distance away from the front panel - at arm's length - the screen was perfectly readable. However, I did get an extra 'crick in the neck' - and here lies my only real criticism of the RTTY facility!

For prolonged RTTY 'watching' (can you be said to be a 'viewer' I wonder?) I think the transceiver should be mounted (or propped up) at around 30° from the horizontal. (This is in addition to the 'lift' provided by the built-in 'legs', which are mounted just behind and underneath the main front panel).

I experimented with the rig and found that, at 40°, the screen was just about at the correct angle for myself. In saying that though, I must admit that the arthritis in my neck causes extra discomfort.

The main display, including frequency display, spectrum scope, etc., isn't really dependent on the angle for viewing - but for comfortable observation of the fairly

"I've had my 'appetite whetted' for RTTY again!"

enable fortunate '756PRO owners to equip their transceivers.

I was delighted (and not a little surprised) to see just how much Amateur Radio RTTY there's to be 'seen' on h.f. nowadays. I was fortunate in this respect because several contests seemed to bring up RTTY operators from all over Europe and, in fact, there seems to be a particular interest in RTTY from the former Soviet Union countries - fortunately, they seem to conduct their QSOs mainly in English. I spent many happy hours working on my main computer with the Apple Macintosh screen to my left and the Icom IC-756PRO's screen directly in front of me.

I was able to sit and work and 'look in' on many QSOs and pick up some tips where the DX was to be found. It was nice to see just how polite the operating practice is on RTTY, perhaps it's time I really got active on the mode myself!

The built-in RTTY decoder and (small - because it is a small viewing area) screen built into the main display is clear and relatively easy to read. In fact, at the normal sort of

small RTTY 'print out' display - I consider that a careful choice of viewing angle is essential. However, having said that, I found the facility absolutely fascinating and it again demonstrates the trend to the 'everything in one box' dream of the manufacturer's engineering design team - perhaps?

With RTTY 'threshold' selection and the ability to select 'Reverse' mode, the decoder is capable of providing a useful monitoring facility and good quality, error-free reception is possible for long periods. In fact, most of the errors were obviously being made by the operators, in the same way I have to apologise to readers for my keyboard mistakes on E-mailed letters.

The IC-756PRO's RTTY facility certainly made me remember the old days when, whilst I was in the Royal Navy, I often had to work near clattering mechanical teleprinter machines. What a difference between them and the modern equipment - I await the next development with interest and think that FAX and SSTV

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might be welcome!

I was most impressed when the (much slower and nowhere near as sensitive and useful) earlier versions of the 'spectrum screen' appeared on previous Icom equipment. However, as you would expect ... things are getting much better and the spectrum scope's display is now approaching what I would expect from a reasonably priced spectrum analyser screen.

With the new facility on the '756PRO, the spectrum scope's presentation is constantly on the move (unless you 'freeze it' of course) and is obviously 'breathing'. (By 'breathing' I mean that you can see the display constantly responding to the slightest variation on the amplitude of the signals it's receiving).

Gone are the obvious 'digital steps' of previous displays - this one really does seem 'alive'. In other words, the spectrum display on the screen really does seem as responsive to rapid variations in signal levels, etc., in the same way you would expect a spectrum

analyser or 'panoramic' adapter display to be.

In use, the display is so quick that you can now very easily see the wide band interference from thermostats, etc., as their high amplitude signals appear across the screen. You can also see the various 'ionosonde' sweep transmissions as they travel quickly across the screen.

You'll also be able to see the spectral display of the many other transmissions in the bands we use and share. Perhaps like me you may also wonder just what we share our bands with!

From observing the regimented internationally agreed frequency channels of the short wave broadcasters, to seeing those annoying 'carrier swishers' in operation on 7MHz (where most of them seem to operate), you'll see much to help you.

On one 14MHz s.s.b. QSO I was getting 'splatter' from an extremely strong southern European station. One glance at the spectrum scope told me where he was relative to my indicated centre frequency on the

same display - and it was a moment's work to adjust the DSP to eliminate the problem. Very satisfying indeed!

On The Air

The transceiver soon proved itself 'On The Air' and I was able to get it set-up and working very quickly indeed. The more complicated the rig nowadays, the more likely you'll have to get your nose stuck into the manual (always a good idea anyway) and to this end the 80-page plus manual is extremely easy-to-use and very well prepared. However, the '756PRO is 'user friendly' in that respect and after initial switch on I only had to wait for the DSP to calibrate itself, a process which only takes ten seconds.

Operating on 7MHz under very crowded conditions and with a high level of static I found the transceiver



Fig. 3: Close-up view of the power amplifier (p.a.) stage board. Note again the substantial die-cast alloy chassis.

proved itself very worthy. The 'whistlers' and 'carrier swishers' that seem to live on this band - usually only bothering s.s.b. QSOs - aren't a problem with the DSP facilities.

One QSO I listened to on 7MHz (a Special Event station was involved) was plagued with one character who was on frequency most of the time. However, I think the Special Event station was equipped with a DSP fitted rig so, like me, they weren't bothered by the nuisance!

Because the IC-756PRO is fitted with many ceramic band-pass filters (there are no 'traditional' quartz crystal filters fitted) and the transceiver relies on the very high frequency first i.f., the (as already mentioned) many band-pass filters and the final 'digital' (DSP) i.f. - the results are, in my opinion, astounding. For some years now I've thought that the DSP-equipped Kenwood TS-870 was unbeatable - but now I think the performance has at last been overtaken.

The Kenwood TS-870, in my opinion, was the first Amateur Radio DSP-equipped transceiver to treat the digital processing as one of the intermediate frequencies (rather than just an 'add-on' unit on the same chassis). However, I now regard the IC-756PRO to be its worthy challenger in this respect.

Operating on 3.5MHz on c.w. and s.s.b. under very noisy conditions, I found it possible to complete QSOs whereas I'd have no chance with my Alinco DX-70TH, unless I was using an add-on DSP unit. The '756PRO's 'Twin Passband Tuning' (complimented by a helpful 'mimic' diagram on

Manufacturers' Specifications

General

Frequency coverage:	Receive: 0.030-60.000MHz
	Transmit: 1.800-1.999MHz
	3.500-3.999MHz
	7.000-7.300MHz
	10.100-10.150MHz
	14.000-14.350MHz
	18.068-18.168MHz
	21.000-21.450MHz
	24.890-24.990MHz
	28.000-29.700MHz
	50.000-54.000MHz
Mode:	u.s.b./l.s.b./c.w./RTTY/a.m./f.m.
No. of memory channels:	101 (99 regular, 2 scan edges)
Antenna connector:	SO-239 x 2 and phono (RCA; 50Ω)
Temp. range:	-10°C to +50°C
Freq. stability:	less than ±0.5ppm 1 min. after power on (-10 - 50°C)
Freq. resolution:	1Hz
Power supply:	13.8V d.c. ±15%
Power consumption:	Transmit: Max. power = 23A
	Receive: Standby = 3.0A (typical.)
	Max. audio = 3.5A (typical.)
Dimensions:	340(w) x 111(h) x 285(d)mm (projections not included)
Weight:	9.6kg (approx.)
ACC 1 connector:	8-pin DIN connector
ACC 2 connector:	7-pin connector
CI-V connector:	2-conductor 3.5(d)mm
Display:	5inch (diagonal) TFT colour l.c.d.
Transmitter	
Output power: continuously	- 50-100W (s.s.b./c.w./RTTY/f.m., adjustable)
	- 5-40W (a.m., continuously adjustable)
Modulation system:	s.s.b. PSN modulation
	a.m. low power modulation
	f.m. phase modulation
Spurious emission:	50dB (h.f. bands)
	60dB (50MHz band)
Carrier suppression:	40dB
Unwanted sideband suppression:	55dB
TX variable range:	±9.999kHz
Microphone connector:	8-pin connector (600Ω)

Electronic key connector:	3-conductor 6.35(d)mm
Key connector:	3-conductor 6.35(d)mm
Send connector:	Phono (RCA)
ALC connector:	Phono (RCA)

Receiver

Receive system:	Triple conversion
Intermediate frequencies:	1st: 64.455MHz
	2nd: 455kHz
	3rd: 36kHz
Sensitivity (typical):	s.s.b./c.w./RTTY (10dB S/N) = 0.16µV (1.80-29.99MHz)*1 and 13µV (50.0-54.0MHz)*2
	a.m. (10dB S/N) = 13µV (0.5-1.799MHz), 2µV (1.80-29.99MHz) and 1µV (50.0-54.0MHz)
	f.m. (12dB SINAD) = 0.5µV (28.0-29.99MHz) and 0.32µV (50.0-54.0MHz)
	*1 Pre-amplifier 1 is ON. *2 Pre-amplifier 2 is ON.
Squelch sensitivity:	s.s.b./c.w./RTTY - less than 5.6µV (Pre-amp OFF)
	f.m. - Less than 1µV
Selectivity:	s.s.b./RTTY (BW: 2.4kHz): more than 2.4kHz/-6dB
	less than 2.8kHz/-60dB
	c.w. (BW: 500Hz): more than 500Hz/-6dB
	less than 700Hz/-60dB
	a.m. (BW 6kHz): more than 6.0Hz/-6dB
	less than 15.0Hz/-60dB
	f.m. (BW: 15kHz): more than 12.0Hz/-6dB
	less than 20.0Hz/-60dB
Spurious & image rejection ratio:	more than 70dB (except i.f. through on 50MHz band)
AF output power (at 13.8V d.c.)	more than 2.0W at 10% distortion with an 8Ω load
RIT variable range:	±9.999kHz
PHONES connector:	2-conductor 6.35(d)mm
External SP connector:	2-conductor 3.5(d)mm/8Ω
Antenna Tuner	
Matching impedance range:	h.f. bands: 16.7-150Ω unbalanced (less than v.s.w.r. 3:1)
	50MHz band:
	20-125Ω unbalanced (less than v.s.w.r. 2.5:1)
Minimum operating input power:	8W
Tuning accuracy:	v.s.w.r. 1.5:1 or less
Insertion loss (after tuning):	less than 1.0dB

Listening And Looking In On The Bands

Summary

I feel sure the IC-756PRO is a model we'll be seeing many facility updates provided for in the future. In fact, like the Kenwood TS-870 became a few years ago

- I feel that the '756PRO will become another 'classic' and I look forward to having one in my shack to update!

Try as I might, even if I had ten pages in *PW*, I still couldn't do full justice to the achievements of the Icom designers so far. So, all I can do is to suggest that you try the 'hands on' approach by visiting an Icom dealer. I can only give you a short 'taster' of the technology invested in this transceiver - to appreciate it yourself you'll have to see it in action!

● My thanks go to:

Martin Lynch & Sons Ltd.
140-142 Northfield Ave
Ealing
London W13 9SB
Tel: 0208-566 1120
FAX: 0208-566 1207
E-mail:
sales@MLandS.co.uk

For the loan of the
IC-756PRO.

£2399
(RRP)
£2099
(ML&S price)

the main l.c.d. screen which indicated how the filter was configured, also proved very helpful.

Up on 14MHz I experienced the usual problems of QRM on the International

Beacon Project's frequency. Here, the various beacons around the world are subject to frequent interference from adjacent channel h.f. Packet stations.

In fact, the Packet transmissions sometimes drift right down onto the Internationally agreed beacon frequencies themselves. When this happens there's not much you can do, but provided the Packet transmissions **aren't right on top of the relatively low powered beacon frequency** (where, of course, the various beacons 'step down' to milliwatt power levels from their original 100W output), any operator of the IC-756PRO should find reception much easier.

I certainly found reception of the beacons easier with the IC-756PRO and, whereas this was done by carrying out quick comparison tests, under the conditions in question - even with the narrow filters fitted on the DX-70 - I found it very difficult to copy the beacons ... it was usually possible to resolve a signal with the IC-756PRO's DSP filtering.

The success over the QRM was partly due to the ability to alter the bandwidth of the DSP i.f., Add to this the Notch Function, Noise Reduction and DSP Noise Blanker and you've got a formidable electronic armoury at your disposal!

Received audio quality is excellent and I didn't notice any of the 'switchy' (obviously reconstituted analogue sounds, often the result of a poor choice of 'sampling' rates when using Digital to Analogue converters) audio effects as I have experienced with other DSP equipped receivers. I also had very favourable comments on the quality of the transmitted audio.

Incidentally, although the built-in



● Fig. 4: Photograph illustrating the rear panel of the Icom IC-756PRO transceiver. Unusually, this transceiver has a centrally-mounted panel with details of the various sockets, rather than having them individually marked.

loudspeaker is more than adequate for communications work, I found that when listening to short wave broadcasting stations - which I enjoy doing - the extension loudspeaker socket was useful. Here, by using a larger external speaker listening to the h.f. broadcasters became a real pleasure.

Although around half of my QSOs were on s.s.b., I feel that if I owned an IC-756PRO myself I'd probably end up using it on c.w. more than 'phone. It's a delight use on c.w. and despite the built-in electronic keyer, which I found to be very convenient - I used my favourite 'Kent' 'straight' key. But if I kept the rig there's no doubt that I'd end up using the 'memory' keyer which no doubt will prove ideal for contest working, with such facilities as incremental serial numbering built-in.

The automatic antenna tuning unit (a.a.t.u.) on the IC-756PRO was a surprise. It's so quiet in operation that apart from the transmission appearing on the spectrum scope's centre frequency display there's not much to see or hear as it works.

However, I found the a.a.t.u. worked very well and it matched into my 'long wire' for 7MHz and into a good selection of antennas including my set of Pro-AM mobile whips for 3.5, 7, 14, 18 and 21MHz. The manufacturers aren't keen on promoting the a.a.t.u.s for use with 'long wire' antennas but generally they do work very well indeed in my experience.

Apart from several pre-arranged QSOs on 50MHz I found no activity on the band - but the IC-756PRO proved itself on the next band down - 28MHz in no uncertain manner. In fact, I had more QSOs on 'Ten' than any other band because it seemed 'wide open' for the whole of the review period.

The increasingly popular n.b.f.m. mode on 28MHz is attracting a lot of operators nowadays and using 10W or so I was able to work all over Europe. I think that the receiver gave a good account of itself on the n.b.f.m. mode.

In Rob's Shack?

So, finally I come to the 'crunch time' where I must convey my opinions - to the best of my ability - as to whether I would like to own an IC-756PRO myself. And simply stated - it has to be a 'Yes'.

During the *PW* 'Into the future' talk at the London Show on Sunday 12th of March, a reader in the audience said that I (G3XFD) "Rarely gave a bad review" - and although, as you've already read, I have had some criticisms of this transceiver - I'm again not in a position to criticise the manufacturers in any major sense. This is because, for the money, I think the IC-756PRO is an excellent performer and it's good value, especially when you consider the many advanced features.

Having just bought myself an almost new, specially adapted car, this transceiver is out of my price range. But when my finances have recovered I shall give very serious thought indeed to buying one. The much improved spectrum 'scope', the excellent DSP, and very many other facilities packed into a very reasonably-sized rig make the IC-756PRO very desirable indeed. However, for myself ... I think the greatly improved spectrum 'scope' has got to be one of the most desirable additions, waiting to go on my operating desk!