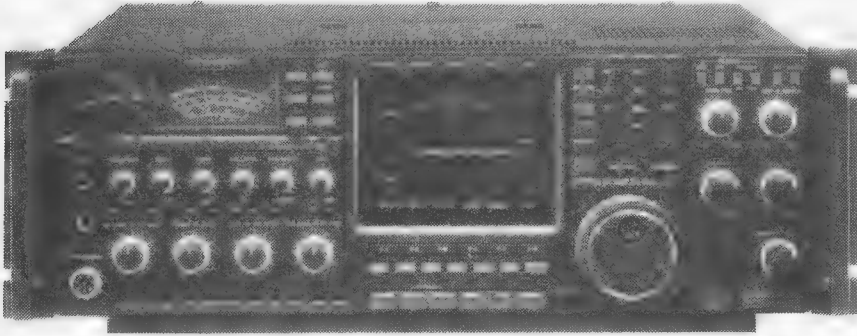




Equipment Review

ICOM IC-781

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This is not a cheap transceiver! It is Icom's pacesetter with many features others will want to copy. It seems to be the ultimate home station for the HF operator; it has everything in one box — AM, SSB, CW, RTTY, AMTOR and Packet (with external TU) for all amateur bands from 1.8 to 30 MHz and a general coverage receiver tuning 0.1 to 30 MHz.

You can see the signal in the band up to 100 kHz away from your operating frequency on the inbuilt spectrum display, and you can listen to two frequencies at once. When you change bands the inbuilt ATU almost instantly retunes to a preset frequency and antenna combination.

Add to this an output power of 150 watts, a dynamic range of 105 dB, a most extensive display capability, and many, many other features and the reason for Icom's excitement about this transceiver become apparent.

FACILITIES

The most obvious and unusual feature of this luxury transceiver is the 125 mm (5 inch) CRT Multi-function Display in the middle of the front panel. It displays the frequencies of the dual VFOs to 10 Hz, the status of many of the controls, the contents of the memory, two menu screens, 17 operational screens, and can show in sharp, amber display 94 symbols, including letters, numbers and punctuation marks. Because of the vast range of items displayed by the screen further comment is made later.

The bottom half of the screen can be used to display the RF spectrum 25, 50 or 100 kHz either side of the VFO frequency. The relative strength and individual spectrum of each signal present can be instantly viewed. The screen also acts as a terminal monitor when an external terminal unit for RTTY, Packet or AMTOR is used.

There are 99 memory channels, two scan edge frequencies, and the ability to attach notes up to 10 characters long to each channel are provided. Five daily timers can be set to turn the set on and off this allowing you to record (via the recorder remote plug) your favourite program whilst away from the shack.

Two clocks, useful for setting at local time and UTC, are provided.

As mentioned earlier, there is an inbuilt ATU which automatically tunes for a low SWR and goes to a preset tune condition when you change bands.

A new direct digital synthesis frequency generator allows very rapid shift from receive to transmit frequencies and is well suited to Packet, etc. Full or semi-break-in operation is provided.

Two PLL circuits are included to allow tuning of the band whilst monitoring that rare DX station on another frequency in the same band. This is known as the *Dual Watch* facility. A fine scan mode allows slow tuning without stopping which is useful for monitoring of CW and SSB signals.

Passband tuning is yet to appear on all rigs: this set has dual passband tuning for use in tandem on the second IF of 9 MHz and the third IF of 455 kHz. This should be a boon to the contester.

The output power is greater than any other solid-state transceiver on the market today — 150 watts. The power supply and heat-sinking are designed for 100 percent duty cycle operation. The 105 dB dynamic range is exceptional.

The noise blanking system allows control of blanking threshold and blanking interval to eliminate ignition and other sharp impulse noise or longer pulses from the woodpecker or even key clicks of nearby CW signals.

A nice feature is the band stacking register which gives the operator the ability to store a frequency, change bands and tune to check propagation and then return to the original operating frequency without using the second VFO.

A calculator-like keyboard allows entry of frequencies to 10 Hz, to select any amateur band directly, and to call up any of the 99 memories. A marker oscillator is provided and is most useful when used in conjunction with the spectrum display.

Nine filters are provided and can be cascaded to give superior selectivity for CW and RTTY. Wide and narrow filters can be independently selected for SSB. To eliminate annoying heterodynes an IF notch filter is available.

The CW audio pitch can be altered without altering the operating frequency. Separate re-

ceiver and transmitter incremental tuning is provided with the offsets being shown on the screen. An audio peak filter improves CW reception and an electronic iambic keyer operating up to 60 WPM is built-in for the keen CW operator.

A preamplifier can be switched in to increase sensitivity on quiet bands and up to 30 dB attenuation, in 10 dB steps, can be switched in. A continuously variable RF gain control is also provided.

In addition to the usual volume control, separate treble and bass tone controls are provided to tailor the audio response to your requirements.

A meter of sensible proportions monitors power output, SWR, ALC, compression level, IC and Vc.

VOX operation is catered for, as is full or semi break-in CW. As befits a transceiver of this quality, provision is made to monitor the transmitted signal regardless of mode.

The dial knob allows tuning in either 10 Hz steps and 5 kHz per revolution, or 1 kHz steps and 500 kHz per rotation. In the 10 Hz per step mode rapidly turning the knob gives 10 kHz per revolution. An optional speech synthesiser is available to announce the selected frequency.

Of course, there is an RS232 port for communication with a computer if required.

TECHNICAL MATTERS

There are a number of different technical features in this transceiver. The first impression gained from looking at the circuit diagram is the vast amount of digital circuitry associated with the monitoring, display, frequency and general control functions. In fact, RF amplifiers, mixers, tuned circuits, etc, make up less than 50 percent of the circuit.

The signal to be received can be selected to pass from the antenna socket directly to the receiver or via the antenna tuning unit. A local oscillator rejection filter and switched attenuators come next, followed by one of the 11 bandpass filters. A 1.6 MHz highpass filter is added for all frequencies above 1.6 MHz.

New in amateur transceivers, is the use of PIN diodes as variable attenuators even though they have been in use for over 20 years in military and commercial equipment. In this unit, they are used to provide AGC control by adjusting the input signal after the filters and before the RF amplifier or mixer.

The RF amplifier uses two FETs in push-pull and can be switched in when the band is quiet and signals are weak.

Balanced mixers are used to obtain the 105 dB dynamic range quoted. There are two receive mixers, one for the main signal and the second for the Dual Watch frequency. The relative level of these signals is adjusted via PIN diodes on the output of the mixers. The first IF frequency is 46.5 MHz and there are two filters on this frequency in the receive mode.

Conversion is made to the second IF of 9 MHz without further amplification. For FM reception, the signal is amplified, limited and converted to 455 kHz for further filtering and demodulation. For the other modes there is some amplification first, followed by pre-filtering, the noise gate and

then a selection of any one of four filters, or a bypass position for wide band reception. Conversion to the third IF of 455 kHz then occurs and again one of four filters can be used. The signal is then converted to the fourth IF frequency of 10.7 MHz where the notch filter operates. After amplification, either a product detector or a diode detector is used for SSB/CW or AM demodulation respectively.

The noise blanker has the facility of providing a variable width blanking period thus increasing its effectiveness against the "woodpeckers".

There are two bandpass tuning controls which operate independently, one on 455 kHz and the other on 9 MHz. This facility, combined with the cascade filters, notch and audio peaking filter, gives unsurpassed QRM reducing ability.

The transmitted signal is generated initially at 455 kHz and is heterodyned to 9 MHz, then to 46.5 MHz, and finally to the signal frequency before amplification to the 150 watt level. Seven filters precede the SWR detector and the signal then passes through one of these directly to the antenna connector or via the automatic tuner.

The tuner can be preset to a favourite frequency in each band for the appropriate antenna so that, when you change bands, the antenna is matched virtually instantly without even putting a signal out.

The spectrum display takes the signal at 46.5 MHz immediately after the first mixer and converts it, firstly to 4.7 MHz, and then to 390 kHz where it is amplified, rectified by a logarithmic detector and converted to a digital signal by an analogue to digital converter. This is necessary as all video signals are controlled by a microprocessor system very much like the video generating systems used in some computers.

Such complexity would not be warranted for analogue signals alone, but the data terminal, message display and frequency display functions all demand a digital approach.

THE MULTI-FUNCTION DISPLAY

The range and quantity of information given on the display is incredible. Apart from the operating frequency mode, filter (wide/narrow), transmitter and receiver RIT offsets, selected memory channel frequency, mode, etc, in the top half of the screen, the bottom half shows either the

spectrum display, memory information, scan data, or clocks and timer.

Each of these alternative screens have their own menus (in the computer program sense), enabling the operator to review the set parameters and to change them as described. For example, both UTC and local times can be set and the station's call sign can be displayed. Notes of up to 10 characters can be added to each memory for recall later when the memory list function is operated.

In addition, the bottom half of the screen can be used to monitor ASCII data from an external terminal. Checking and altering the data format is done using the screen and a menu.

Some 20 pages of the handbook are devoted to screen related operations and, as this relies heavily upon diagrams, no attempt will be made to give further details here. There is so much more that can be done with a 125 mm (5 inch) CRT screen as compared to even the best of the LCD panel displays that any attempt to describe it all would only fall short. It can only be a matter of time before the flagship transceivers of the rival manufacturers also boast a CRT multi-function display.

ON AIR

It should be stated at the outset that this is a most complex piece of electronics and, even though the handbook is extensive and well written, more than one afternoon is required to learn how to use all the facilities built into the transceiver.

In fact, it may take quite some time to become completely familiar with all of the facilities offered.

It is quite imposing to sit down in front of such a large transceiver with a total of 106 front panel controls. However, the controls are relatively large and easy to operate, and there does not seem to be overcrowding. The tuning knob is smooth to operate and there is an adjustable brake to set the feel to your own touch.

The VDU display is fascinating and, if you become addicted to all the facilities, you may not get to the stage of actually transmitting for quite some time. This happened to the reviewers!

The receive facilities far surpassed those of any other amateur equipment used, particularly

in sorting out weak signals through heavy QRM. Even the bass and treble tone controls were found to be quite useful, and we wonder why other transceivers do not include this feature.

Reports on the quality of the transmitted audio, and the effectiveness of the speech processing, were well above average. The heavy duty power supply and 100 percent duty cycle final amplifier enabled high level processing to be used continuously.

After about a two minute warm-up, the VFO stability was well within the specifications of 15 Hz. The IF notch filter was very effective, without introducing any colouration of the received signal's audio, but seemed to drift slightly in the first two seconds after switch-on.

CONCLUSION

This must be, without any doubt, the most spectacular and sophisticated amateur transceiver manufactured to date. If money is no limit, and you want the best, then this is the transceiver for you. It will provide virtually any feature that you are likely to require in an amateur transceiver well into the foreseeable future, and may well be the standard against which other transceivers will be measured for a long time to come.

There were only two mildly disappointing aspects about the transceiver. Firstly, the engraved band markings on the keyboard keys were difficult to read. The alternative numeric functions were illuminated and easy to read. In-filling the engravings with bright white paint would help.

Secondly, although the unit is capable of displaying characters from a remote terminal, and has selectable shifts for RTTY, it requires an external terminal unit incorporating a mod/demod system. Considering the complexity of the system the company could have offered an option for RTTY (at least) requiring only a standard computer keyboard to be plugged in (the keyboard could be another option). One day these features will be available. What a pity we can't see them now!

The review transceiver was generously provided by the Australian importers, Icom Australia. They can be contacted at 7 Duke Street, Windsor, Vic.