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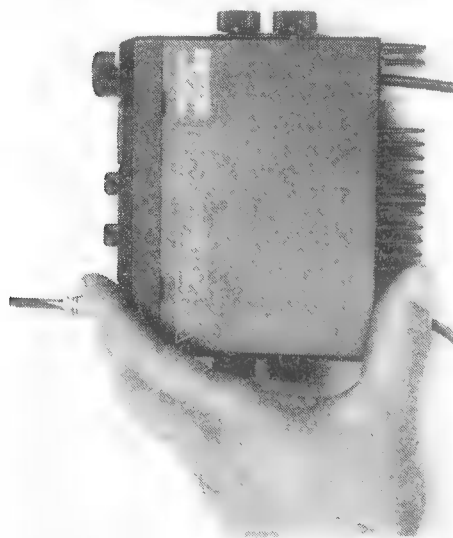
ICOM IC-28A TWO-METRE FM TRANSCEIVER

The Icom company has always been in the front ranks with their two metre equipment. If we look back over the years, there have been a few Icom transceivers that have, for the time, set new standards.

Certainly the IC-22 series must be included amongst these. The last of these, the 22S, must have been the best selling two metre FM transceiver of all time and, even today, are still sought after on the secondhand market. In later years, the IC-25 and IC-27 series have proven popular. The new IC-28 sets new standards for size and operating simplicity.

FEATURES

There is no doubt that the first impression of the 28A is the diminutive size. The depth is actually 50 mm less than the model it replaces, the IC-27A. Take a look at the photograph with my hand on it and you will get an idea of its size. Trying to fit a transceiver into a recent model car is often a matter of finding enough depth. A set would often fit under the dash-board if only that air-duct or whatever was not in the way. Here is the answer to the problem. In actual fact, the front panel size is slightly larger than the 27A — but let us look at the comparative sizes.



Note the compact size of the 28A. Try this with your two metre FM mobile.

The 27A is 38 x 140 x 191 mm (HWD), with the 28A 50 x 140 x 133 mm (HWD). Weight is only 0.95 kg against 1.2 kg for the older model.

Of course, size is not the only factor that comes into the choice of a new two metre transceiver, and, as we shall see later, the operation of this transceiver is also a delight.

At long last, Icom have developed a multi-function LCD display for the new rig, to replace the old LED readout. The old 25-A went from a red to green display and the 27-series continue with the green. However, while the green was better, it still suffered from a lack of readability under strong light conditions. The new display has overcome all these problems and, at the same time, gives the user a great variety of information. This includes: Frequency, Memory Selection and Memory Channel Selected, High or Low Output Power Selection, Memory Channel Skip Indication, Duplex Mode (\pm) Indicator, Offset and Tuning Step Memory Write Indicator.

Operation of the optional digital code squelch is also indicated, however this option was not supplied with our review transceiver.

The IC-28A has 21 memories which can be programmed for frequency and repeater offset or simplex operation. A memory skip can be entered to eliminate non-required channels when in the memory scan function. Frequency and memory selection is via the 'tuning knob' on the left-side of the front panel or via the up/down buttons on the microphone. VFO or memory operation is selected by the adjacent rocker switch.

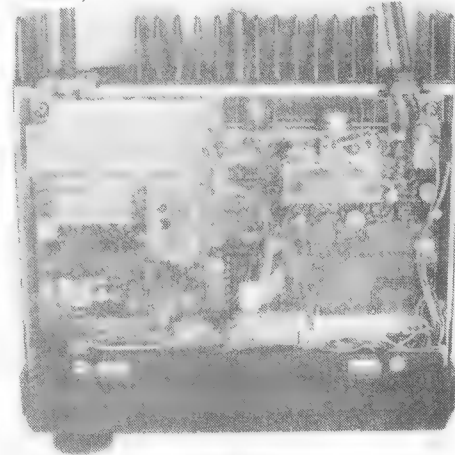
When in VFO mode, a variety of tuning steps can be selected. These are either five, 10, 15 or 25 kHz. For our Australian system, the 20 kHz stepping is ideal, with, perhaps, the five kHz steps as an option. The European version has the option of 12.5 kHz steps. When a band-scan is selected, the scanning rate follows the selected tuning rate. A priority or call channel facility is fitted which allows the selection of memory 21 with either VFO or memory operation in use. Unfortunately though, there is no priority alert, or sampling system, as there was with the old IC-27, or as provided with the recently reviewed Kenwood TM-2550A. With the 28A it is simply a method of selecting channel 21 without going through all the other memories to get there!

The transmitter output is a very useful 25 watts and, considering the compact size of the unit, this is quite remarkable. A 45 watt output version is also available, but we did not have an opportunity to test this. On both versions, a five watt low-power output is selectable. With repeater operation, a

push of the squelch control gives a listen on input frequency facility. This does not lock on, so you cannot get yourself onto the wrong transmit frequency — a smart idea.

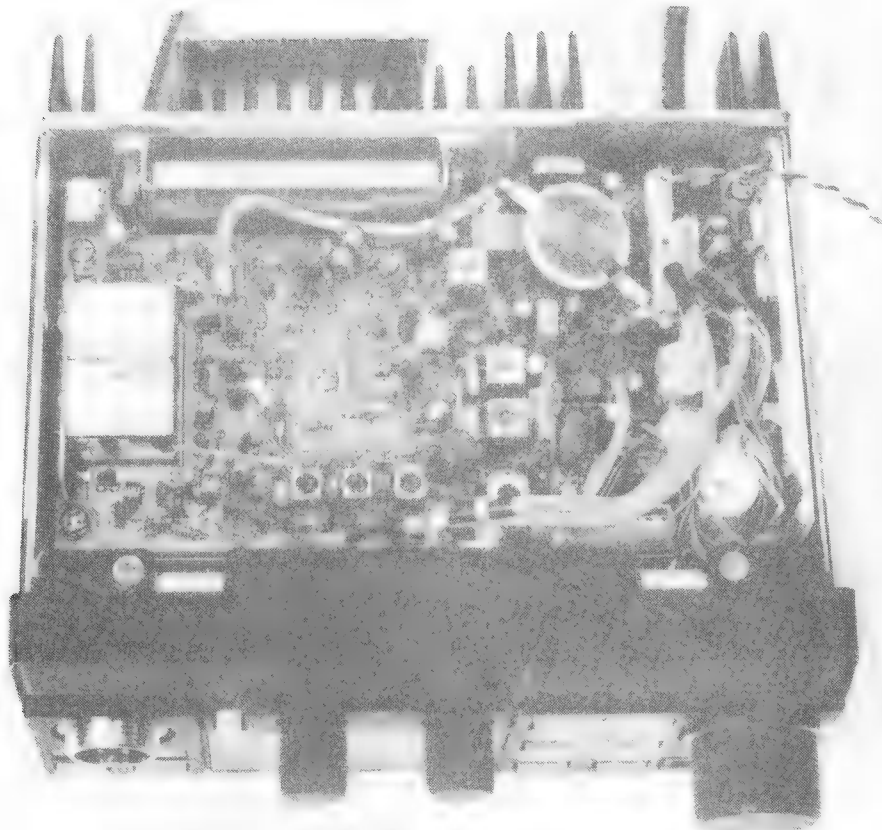
The internal construction is typically Icom. Most of the components are mounted on two large (relatively) circuit boards. These are separated by a central shielding plate which provides both good shielding and mechanical stability.

The circuit used appears to be fairly straightforward, but our details were obtained from the



Top View.





Bottom View. Note Lithium Battery in right-hand corner.

block diagram only as circuit and printed board layouts are, for some unknown reason, not supplied. I am not sure whether a workshop manual is available. Icom have been running rather slow with their repair manuals of late.

The receive signal goes to the 2SC3355 RF amplifier via the transmitter lowpass filter, diode antenna switch and switchband pass filter. The first IF is at 17.2 MHz; second is 455 kHz and a MC3357P IC performs the second conversion, IF amplification, FM detection and noise amplification for the squelch circuit. Transmitter output employs a module which is attached to the rather small heatsink at the rear of the cabinet.

Memory retention is powered by a lithium battery. As can be seen from the internal photographs, the battery is very accessible. However do not be tempted to play around with it. The manual suggests that battery replacement should be entrusted to your Icom service centre. It appears that the usual Icom back-up system is used. That is when the battery life is expired, the system has to be re-programmed by the service centre. Although, as Icom have been saying in their advertisements in American magazines, the battery life could well be in excess of the users life, time will tell!

Both the antenna and DC power connections are via flying leads. The antenna lead is terminated in an SO-239 line socket while the DC uses a locking two-pin plastic connector and a fuse in both the positive and negative leads. Unfortunately, the DC connector is a new type and not compatible with any of the previously used Icom DC connectors.

ON-THE-AIR

I used the 28-A over a period of two months, both mobile and as a base station. During that period, in excess of 7000 kilometres were covered over all sorts of roads, both good and bad, and with temperatures up to the mid-30s in the northern Flinders Ranges, South Australia. This was one of the hardest tests that I have subjected a review transceiver to and it came through with first-class results.

On the original installation, one lesson was quickly learned. *Don't* try to run the transceiver from the car cigarette lighter socket. I found in two cases that the 28-A does funny things when it does not have a good earth to the car body. At the time, I was also using a magnetic base antenna which did not actually make any electrical connection to the car. I must be fair and say that the Icom Instruction Book states that a direct connection to the car battery is required. So be warned — do the job properly.

With the 21 programmable memories, the IC-28A is about the easiest two metre FM transceiver to use that I have ever seen. It is certainly more straight-forward to use than the old IC-22S. I found that once the required channels had been programmed into the memory, I used the memory mode all the time. The VFO can be used to scan the band in your preferred selectable steps, either via the 'tuning' knob or from the up/down buttons on the microphone. The up/down button on the front panel does not produce the same effect as the microphone buttons. In the VFO mode, they give a one MHz up- down step, while with memory mode selected, it will step up or down to the next memory, but will not initiate a scan situation, which the microphone buttons will. It is therefore more convenient to use the microphone for either scanning or memory selection.

The microphone also has a small scan-inhibit switch on the back. Transmit audio reports were always very good. It seems that the overall audio gain has been carefully selected as almost no mobile noise is audible on the transmitted signal. Quality is sharp and crisp with just a very slight trace of sibilant distortion.

On receive, the audio output was only just adequate under average mobile conditions. If yours is a noisy car, you will certainly need an external extension speaker and, in even a quiet car, it would be recommended. The actual received audio from the tiny internal speaker is surprisingly good, but it was unable to take the full output of the receiver without considerable distortion.

There are several nice features on the transceiver that make operating a pleasure. The push-on, push-off power switch on the volume control

and the push to select repeater reverse operation on the squelch control are two that come to mind.

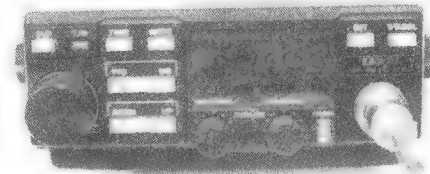
The memory scan is a very useful system. As each busy channel is encountered, the scan pauses for about 10 seconds before the scan resumes. If you want to stop on that channel, it is only necessary to quickly push either the PTT button or one of the up/down buttons.

Should any memory channel require skipping, this can be selected with a push of the 'step' button. The word *Skip* will now appear in the bottom righthand corner of the LCD display and those channels will be passed-over during the scan operation.

The receiver seemed to be very free from cross-modulation from nearby commercial and strong amateur signals. It was possible to leave the receiver scanning without the annoyance of unwanted spurious signals stopping the scan. The actual receiver circuit is very simple and straight-forward. The RF stage, which is a 2SC3355, is fed from a two-stage input filter. The first mixer, a 2SK125 FET, converts to the first IF at 17 MHz. The second IF is at 455 kHz. Two filters, one two-section crystal filter at 17 MHz and a ceramic filter at 455 kHz, take care of selectivity. The general coverage receiver's performance was excellent with the only point of criticism being a small degree of ignition noise break-through. This appeared on both strong and weak signals at about the same level. Perhaps this indicates a slight lack of limiting in the 455 kHz IF section. In actual practice, it did not prove to be too annoying.

Several options are available for the IC-28A. These include a base station AC power supply, the PS-45. This is a compact switch mode supply that can deliver eight amps output at 13.8 volts. Two different base station microphones are compatible with the IC-28, the SM-10 and the SM-8. In actual fact, the older Icom SM-5 and 6 microphones work very well with the transceiver, but they lack up/down scanning buttons which are essential for the actual scanning operation.

Three mobile microphones are available in addition to the standard HM-12. These are the HS-15, which is a flexible type microphone and can be fixed to a convenient point in the car. The IC-HM16 and 17 are speaker microphone units. The 17 has a tone-burst unit built-in for European repeater operation. Digital code squelch and tone squelch units are also available. I wonder when these will be built in as standard. When this does eventually happen, and so long as all of the Japanese manufacturers produce compatible units, these systems might become popular. Time will tell. None of the above options were supplied with our review transceiver and so therefore were not tested for this review.



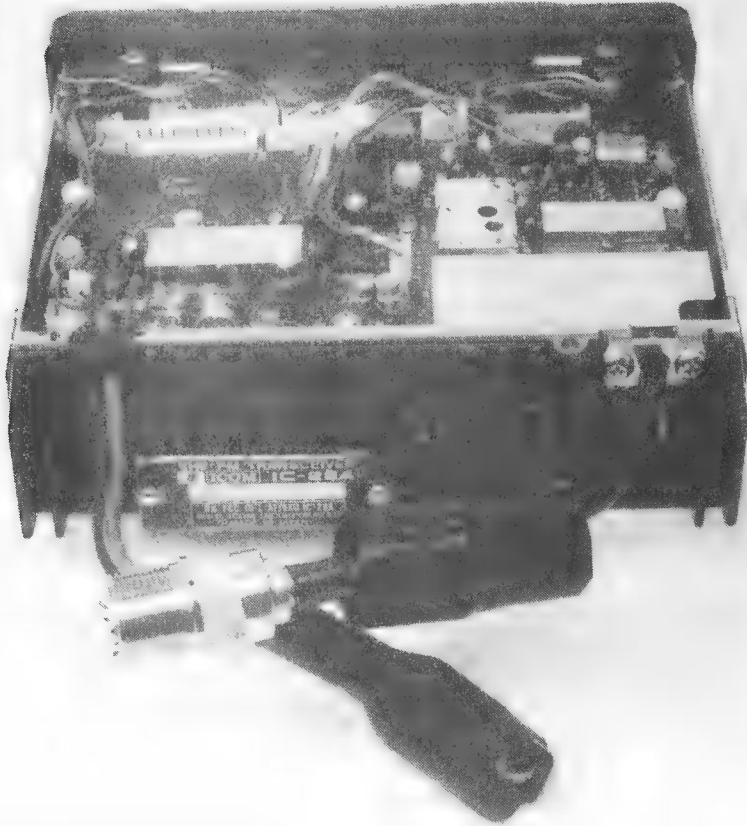
Front view.

ON-TEST

The following test equipment was used to produce the figures obtained during our tests. Yaesu YP-150 and Marconi TF-957/1 terminating RF watt meters; Marconi TF-995A/5 signal generator; AWA F242A noise and distortion meter and a Davern audio power output meter. All tests were carried out with a regulated 13.8 volts applied to the transceiver, unless otherwise stated, and all tests were carried out at 146 MHz.

Transmit Power Output

With high power selected, the output was constant right across the entire band at 30.5 watts. With low power selected, it was exactly on five watts, gain right across the band. As a test, the supply voltage was reduced to 11 volts. Operation of the transceiver was still quite satisfactory and the high power output was 22 watts.



Rear view showing Flying Lead Connections for Antenna and DC Power.

Current consumption at 13.8 volts and high power output was 5.2 amps, with 2.5 amps in the low power position. It is possible that the low power output setting is adjustable as it was with Icom's previous models, but no mention is made of this in the instructions.

Receiver Tests

The S-meter calibration was checked first. The LCD bargraph display has nine divisions up to S9 and five divisions above this for S9+. The following results were obtained:

S1	1.00 μ V		
S3	1.25 μ V	2 dB	
S5	1.600 μ V	2 dB	
S7	2.00 μ V	2 dB	
S9	2.50 μ V	2 dB	
S9+	3.10 μ V	End of Scale	

This works out at just one dB per S-point. I often hear amateurs on two metres giving reports to other stations on the basis of six dB per S-point, but as we have seen over the last few reviews, this is just not so. The most that can be said for the IC-28 S-meter is, that it will sometimes tell you if you are receiving a signal, but as may usable signals are below one μ V, this will not always be true.

Receiver sensitivity was checked. With the signal generator set at three kHz, deviation with a one kHz steady tone modulation, the 12 dB SINAD came up at 0.2 μ V. The squelch sensitivity at the point of threshold was just a whisker under 0.1 μ V and with the squelch right off, signals were audible down to an estimated 0.01 μ V.

The extension speaker output was terminated with the power meter set at eight ohms. Power output of 2.2 watts produced 10 percent distortion and 2.5 watts, 20 percent. Somewhat more power is obtainable with a four ohm speaker connected. Up to about 3.5 watts with 10 percent distortion. Some comparative tests with an external speaker compared to the in-built speaker showed that it

little over one watt of audio power, confirming my earlier remarks for the need of an external speaker.

The overall frequency accuracy was checked as better than 50 Hz, which is the limit of proven accuracy of my counter.

The receiver audio response was checked with the -6 dB points occurring at 250 Hz and 3.5 kHz. The curve between these points was very smooth.

I was unable to do an accurate check on the receiver selectivity due to synthesiser noise upsetting measurements, but it would appear that the specified 12.5 and 25 kHz at -6 and -60 dB would be easily met. Certainly for our 25 kHz channel-spacing there would be no problems at all.

Finally, the receiver current drain was checked. This was 320 mA with the receiver squelched and 600 mA with full audio output of 1 kHz tone. It was noted during these tests, that the receiver performed quite well right down to 9.5 volts, although the audio power output was rather restricted at this low voltage.

The overall performance of the IC-28A is very good with the power output of the transmitter and the receiver sensitivity very well matched.

INSTRUCTION BOOK

The 28 page Instruction Manual is very well printed and presented. Nine sections cover the following:

Specifications, Features, Control Functions, Installation, Operation, Inside Views, Maintenance, Block Diagram and Options.

Section 10 is a schematic diagram which was, in fact, not supplied with the review transceiver. All the operating instructions are clear and easy to follow. There are many drawings showing the sequence of LCD readout displays for the setting-up of the various programming requirements.

With so many good points, it is a pity that Icom did not see fit to include a little technical information. At the time of writing, not even a workshop manual was available and Icom Australia do not know when it will be available.

CONCLUSION

Although the IC-28A is priced somewhat higher

than many other current two metre FM transceivers, it does have many advantages, particularly in the very simplified operation. The other important aspect is the very compact size. The general on-air performance is very good indeed, and probably the only point of criticism is the very small loud speaker, however, considering the overall size of the transceiver, it would be almost impossible to fit a larger one in. I was so impressed with the little rig that the review model is now a permanent part of my shack.

Our thanks to Icom Australia for the IC-28A used for this review and inquiries regarding price and availability should be directed to them or to one of their authorised agents throughout Australia.

EVALUATION AND ON-AIR TEST AT A GLANCE of the Icom IC-28A . . . Serial No 001284

APPEARANCE

Packaging

** Strong well presented carton with foam insert.

Weight and Size

*** One of the most compact 25 watt, two metre FM rigs yet seen.

External Finish

*** A real black-box, but neatly finished.

Construction Quality

*** Well put together with good looking circuit boards and wiring.

FRONT PANEL

Location of Controls

*** A very simplified panel layout. Easy to follow.

Size of Controls

** Tuning, volume and squelch are very accessible. Push buttons are small but well located.

Labelling

** Very good under well lit conditions, not so good in the dark.

RECEIVER OPERATION

Memories

*** With 21 memories that include offsets, one of the best.

S-meter

** Shows if you are receiving signal. (See test section).

Spurious Responses

** In most locations it is very clean. A few strange signals when operated in the city centre.

Sensitivity

*** Very good. See Test Section.

Received Audio

** Internal speaker is rather small and limited in a internal speaker is rather small and limited in audio output. With better external speaker it is quite reasonable.

TRANSMIT OPERATION

Power Output

Power Output

*** Excellent for size of transceiver. See test section.

Transmit Audio

** Sharp clear quality. Deviation well set-up.

Cooling

** Ran moderately cool for power output.

Metering

** LCD power output indication and on-air light.

Status Indicators

*** Plenty of information in the LCD readout.

Manual

Owners Book

** Excellent operating instructions. Poor technical information. No circuits or parts layout.

OVERALL RATING

*** With its excellent operating ergonomics, compact size, and good power output, it is one of the best available for mobile use.

RATING CODE

* Poor, ** Satisfactory, *** Very Good, **** Excellent

RPH GOING IN-BAND

Radio for the Print Handicapped stations in Brisbane, Canberra, Hobart, Melbourne, and Sydney will be allocated frequencies on the AM broadcast band. (They currently operate on either 1.620 or 1.629 MHz — just above the AM band which ends at 1.606.5).

This decision follows a review of RPH by the Department of Communications. Discussions will be held with RPH licensees to devise a time for the change.