An AR Special
A Review of the ICOM IC22

Over the next few months 'Amateur Radio' will be presenting a series of reviews on a selection of the latest two metre FM transceivers. In advance we would like to thank the various distributors of this gear who have made these reviews possible.

The Icom IC22 is distributed by Maico Electronics of Mount Street, Heidelberg, Victoria. It is one of a wide range of VHF transceivers produced by Icom. Details on all Icom equipment can be obtained from the company.

The IC22 is a fully solid state transceiver designed to operate over any two megahertz section of the two metre band. It employs 23 transistors, 3 FET's, 3 IC's and 16 diodes. There is provision for 22 channels which should take care of future requirements of most operators. As we will later see, the circuitry employs some very interesting features many of which are not to be found in other pieces of contemporary gear. It is also one of the smallest of the currently available FM transceivers measuring only 2-9/32" high, 6-1/8" wide and 8½" deep. The weight is 4 pounds. Construction throughout is in light-weight aluminium with a plastic front panel assembly.

Finish is in black with the metal sections in a fine wrinkle paint and the front panel in a dull non-reflecting surface with matching knobs. To offset this the meter is brightly illuminated with sharp red and green calibrations. The channel selector numbers come up in green, plus red and blue transmit and receive indicators. An excellent mobile mount with a quick release facility is supplied, as is a good quality dynamic microphone. All necessary mounting hardware is included with the set. Transmitter output is rated at ten watts with one watt in the low power position.

Power required is a nominal 13.5 volts DC, and current drain is specified at 2.1 amps on high power transmit, 1.2 amps on low power and receiver 180 mA average.

IC22 CIRCUIT DESCRIPTION

Now for a closer look at the inside layout and circuitry of the 'black box'. Both transmitter and receiver are constructed on a common printed board with the twenty two crystal channels and their associated trimmers mounted on a separate board. This of course amounts to forty-four actual crystal positions and trimmers.

The receiver is a double conversion superhet with the first IF at 10.7 MHz and the second IF at 455 kHz. Ceramic filters are employed at both IF frequencies to provide a high degree selectivity. A 3SK40 dual gate MOS FET is used as the receive RF amplifier followed with a 2SK37 FET as the first mixer. Between these two stages

are five helical resonators to give a high rejection to strong out-of-band signals and to generally improve cross modulation characteristics. The 455 kHz IF stages use two transistors and one IC to provide a high degree of gain. An IC is also used as the complete audio output section. The receive indicator light glows when the mute is opened either with a signal or by operation of the mute control. With the audio control turned off, this light gives a visual indication of an incoming signal on the selected channel. Receiver frequency control is from a 15 MHz crystal multiplied by nine with two tripler stages. This is then mixed to give the first IF of 10.7 MHz. The DC supply to the receiver goes via an 8 volt series regulator.

One of the interesting features of the IC22 is the use of solid state switching. This is not only for the supply voltage switching but also for the antenna change over. For a while, you might miss hearing the usual snap of the relay as you push the transmit button.

The transmitter section is quite straight forward. Frequency control starts with an 18 MHz crystal oscillator, followed by one buffer stage, a diode phase modulator, then three doubler stages, two more buffers and the final stage. Audio for the transmitter is handled by one IC feeding from the 500 ohm dynamic microphone. The output of the IC feeds to the deviation control via a low pass filter. Between the deviation control and the output transformer is a deviation level selector. By shifting a flying lead connector from one connector post to the other, either wide or narrow deviation may be selected. This is in addition to the normal deviation control. Strangely, this adjustment does not rate a mention of any sort in the otherwise excellent instruction manual. Low power selection is accomplished by switching a 20 ohm 5 watt resistor in series with the supply voltage to the last buffer and the final stage. The front panel meter switches automatically from 'S' meter on receive to relative output meter on transmit.

THE IC22 ON THE AIR

The channel selector was difficult to read when the set was in place under a car dash board. There was also a considerable parallax error. To accurately determine which channel was selected, a straight-on view was needed.

This is due to the small size and close spacing of the channel numbers on the selector switch. Receiver audio quality appeared to be much better than is usual with transceivers of this size. This is no doubt due to the use of a 4 inch speaker mounted in bottom of the transceiver cabinet. Provision is also made to plug in an external speaker via a 3.5 mm phone jack at the rear of the cabinet. Actual audio output appeared to be on the low side for noisy situations. This was later confirmed when the audio output was measure Transmitted audio quality was clean and smooth, however, some reports indicated slightly on the bassy side. Deviation was set to the low position when the set arrived from the agents. This was changed to the high tapping and the deviation control reduced. This appeared to produce the best results.

Operation of the controls apart from the channel selector was excellent. The receive mute control operated with a smooth fading action as distinct from the sudden death action of many solid state sets. Audio gain could be left set at a normal point, with the power on/off switch separate and combined with the high/low power selector.

A useful feature of the IC22 is the ability to net the transmitter frequency to the receiver. After connecting a centre zero meter to the discriminator output which is available on the accessory socket at the rear of the cabinet, a jumper is connected

between two test points on the board. The transmit crystal trimmer is then adjusted for a zero reading on the meter. Obviously this only applies to simplex operation.

THE IC22 ON TEST

Transmitter output was measured with a Marconi RF power meter. With a 13 volts DC supply to the IC22, exactly 10 watts output was indicated in the high power position, and .8 watts in the low power position. The final and driver stages were trimmed but output could not be increased. The multiplier stages were not touched.

Receiver sensitvity was next checked using a Marconi FM signal generator. At .5uV, 27dB of quieting was measured with signal to noise ratio at the same input showing 30dB. These are excellent figures. With the mute control set at maximum sensitvity, the receiver opened up at a level of .5uV — 8dB. With the mute hard on, it took only .5uV + 2dB to open the receiver.

The 'S' meter was checked for calibration with the following results.

Meter Reading	Sig. Gen. Setting
0	.5uV
1	1.25uV
5	4.0uV
9	100.0uV

Above 9 on the scale, the increase flattened off with the 9 to 40dB over only showing an increase of 12dB.

Receiver audio power output was measured by feeding the output to a dummy load and measuring the voltage with a VTVM. At the onset of audible distortion, .5 watts was indicated. This is well below the specified 1.5 watts, however this could be due to the fact that steady tone was used in our test. With speech output, more power could possibly be delivered.

Receiver selectivity was measured with an input of .5uV. At this level, the receiver accepted +/— 7 kHz deviation with low distortion. It was noted though, that at lower inputs, the deviation acceptance decreased somewhat, so that many stations with normal modulation tended to sound slightly distorted. This is caused by the shape factor of the filter used in the 455 kHz IF strip. If required, a better filter can be easily substituted, as the printed board is drilled to accept the top quality Matura ceramic filter.

Current drain was checked with 13.0 volts applied to the set. With full output the receiver drain was 500 milliamps. In the muted off position the drain was 300 milliamps. This is a little higher than the specified 180 milliamps. High power transmit drain was spot on at 2.1 amps.

INSTRUCTION MANUAL

In general this is well written with only a very few omissions. Printed circuit board layouts are included, as is the circuit diagram and block layout.

Maintenance, including alignment details, is covered in three short paragraphs.

SERVICE FACILITIES

In view of the lack of service information supplied, it must be assumed that most owners will rely on the dealer to provide this. Maico Electronics are well qualified in this area. They hold comprehensive spares and also stocks of crystals for all the popular channels at very reasonable prices.

In conclusion, I would like to acknowledge the help of Peter Linden VK3BX in formulating test figures for the IC22.

VK3OM

SPECIFICATIONS

GENERAL:
Frequency coverage—144.00 to 146.00 MHz or 146.00 to 148.00 MHz.
Number of Transistors and Diodes—Transistors 23, FET 3, IC 3, Diodes 16
Modulation Type—F3
Power Voltage—DC 13.5V plus-minus 15% negative ground
Current Drain—Transmit: HI (10W) average 2.1A, LOW (1W) average 1.2A
Receive average—180mA
Antenna Input—50 ohms
Size 2-9/32" high x 6-1/8" wide x 8-1/2" depth
Weight—4 lbs.

TRANSMITTER:
RF Power Output—HI 10W, LOW 1W
Frequency Control—Crystal (18 MHz) multiplied x 8
Maximum Frequency Deviation—Adjustable between 3 to 16 kHz
Audio Input— 500 ohms.
Modulation System—Variable reactance phase modulation
Microphone—500 ohms — Dynamic microphone with push button switch

RECEIVER:
Reception Frequencies—22 channels for 2 meter band
Reception System—Double Superheterodyne
Intermediate Frequencies—1st intermediate: 10.7 MHz, 2nd intermediate: 455 kHz.
Sensitivity—a. Better than 0.4 uV 20 db quieting, b. S plus N/N at 1 uV input, 30 db or more
First IF—10.7 MHz
Second IF—455 kHz
Spurious Response—minus 60 db
Spurious Gain—minus 60 db, or less
Squelch—Adjustable 5 to minus 15 db
Band width—plus-minus 8 kHz/minus 6 db point, plus-minus 15 kHz/50 db
Audio Output Power—1.5W
Audio Output Impedance—8 ohms
Frequency Control—Crystal (14 MHz) multiplied x 9 ●

HIGH RISE ANTENNA

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Living in a large block of home units can certainly have problems for the Radio Amateur wishing to boost his signal with a beam antenna.

Eric VK2BEK, has solved this problem nicely. He resides in a 13 storey block of units in Elizabeth Bay, N.S.W., and was given permission by the owners to erect an antenna on the roof. The proviso being that the structure of the building was not interfered with, and no TVI was caused.

The photograph on the front cover and those attached show how this was done efficiently and at moderate cost.

He obtained from a plumber, a base supporting 'cross', into which 4 pipes are screwed at right angles. A flange was welded to the base to hold a 1½ inch diameter mast.

Into the cross were screwed 4 pieces of 1 inch (inside diameter) pipe 5 feet long. The vertical mast is 12 feet high including the rotator, and is screwed into the flange. Concrete blocks, each 1 cubic foot and welghing approximately 100 lbs. were made with a groove in one side to fit over the base pipes.

Guy wires are run from the concrete blocks to the rotator, and the whole assembly is extremely rigid. Eric is confident that the strongest winds in the area will not tip the antenna over.

The beam is a Hy-Gain TH3 Junior, and behind it can be seen an 18AVT which is used for 40 and 80 metres.

It all works very well, and thanks to a low pass filter and antenna tuning unit, there have been no complaints of TVI.

Eric suggests that other high rise home unit or flat dwellers could obtain permission for a similar structure. ●