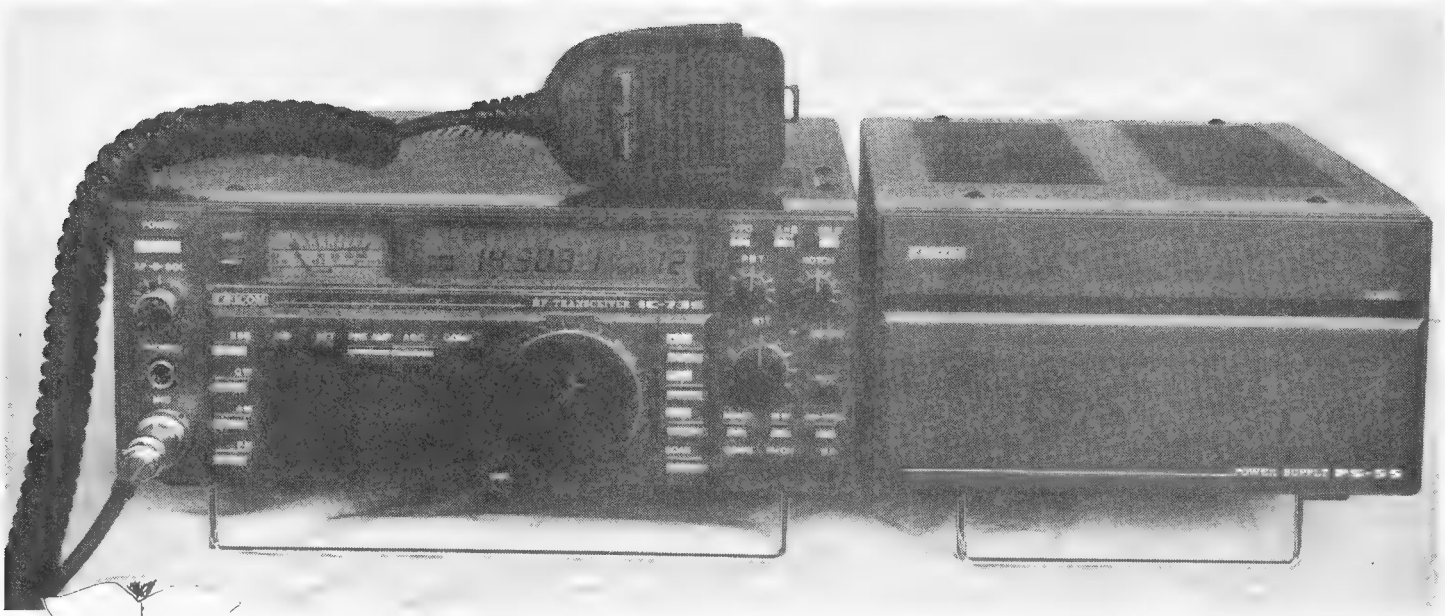


EQUIPMENT REVIEW

Ron Cook VK3AFW
TECHNICAL EDITOR

ICOM IC-735 ALL MODE HF TRANSCEIVER

The IC-735 replaces the well known Icom IC-730. It seems that the days of transceivers that only cover the amateur bands on receive have long gone and the 735 therefore has a general coverage receiver. The 730 appeared on the Australian market in early 1982 and was reviewed in the April 1982 issue of Amateur Radio. It has continued in production ever since and I believe that there has been a steady demand for it. It has been regularly advertised in American magazines but it is quite a while since I have seen a local advertisement for it.

In its basic concept, the 735 fills the same role as the 730 with a compact transceiver for portable or mobile operation, fully solid state no tune up design with amateur band coverage from 160 to 10 metres and operates from a 13.8 V DC source. It is packaged in a cabinet of identical dimensions to the 730, 94mm high, 241mm wide and 239mm deep (less projections) but weighs less, 5.05kg as against 6.4kg for the older model.

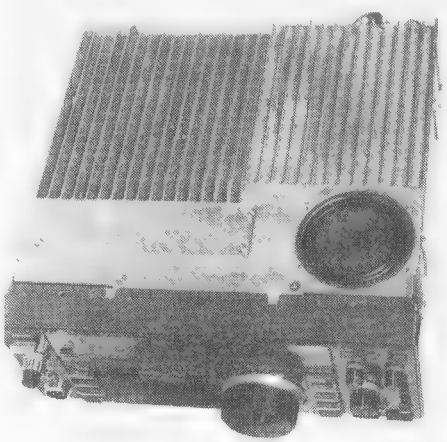
The big difference is what is inside the cabinet. First is the general coverage receiver. This covers from 100kHz to 30 MHz. Tuning is continuous over this range with the choice of stepping in 1 MHz segments or in amateur band segments. Add to this an all mode capability for AM, FM, SSB and CW and you can see we have a very complete package. All controls are on the front panel.

If you refer to the review of the 730, you will see there were a few complaints about the accessibility of controls under the top hatch. This hatch has disappeared and all of the lesser used controls are on the front panel behind a drop down semi-transparent plastic panel. Very neat. Also commented on was the matching AC power supply in fact did not match. Instead of presenting a smooth line up, it looked more like the side elevation of a camel train. But no more, Icom have produced a power supply, the PS-55, which matches the IC-735 in both size and colour. An automatic antenna tuner is also available in matching format.

Frequency, mode, VFO and memory information are presented by means of a large LCD display. To my knowledge, this is a first on an HF transceiver, but several excellent LCD displays have been used on VHF FM transceivers. In more detail, the display shows the following: *frequency display to 100Hz resolution, VFO A or B, mode of operation AM, FM, USB, LSB or FM, transmit or receive status, scan mode, memory channel selected and split frequency operation.* It is illuminated in a soft translucent green. The 'S' meter is also illuminated in a soft green but I found it lacking in contrast. Twelve memory channels are provided. Both mode and frequency information can be stored and each can be individually tuned across the full 30 MHz tuning range. In effect this gives 14 independant VFOs. All VFO and memory information is retained when the power supply is removed by use of an internal lithium battery.

The 735 has an excellent notch filter that can be used with any mode, including AM, and is quite capable of taking out the carrier on a local broadcast station. Other performance information is included in the test section of this review.

As mentioned earlier, the 735 is housed in much the same cabinet as the 730, however removing the top half of the cabinet reveals that the appearance is only skin deep. Underneath is a cast heat sink that takes up the entire depth of the transceiver. A miniature centrifugal fan mounted towards the front of the heat sink draws air in from the rear. The fan operates as soon as the transmitter is keyed and shifts to a higher speed after a few minutes operation. It is fairly quiet but to my ear operates at an annoying pitch.



The IC-735 with the top cover removed to reveal the heatsink and speaker.

Icom have sped up the tuning rate slightly from previous models as the 735 covers 2.5kHz per tuning knob revolution as against 2kHz on the older models. Turning the knob faster than about one revolution per second increases this to 5kHz per turn. One kHz stepping can be switch selected which gives a rate of 100kHz per knob revolution. An input to enable the 735 to be remote controlled by a computer is included called the 'Advanced Remote Control System'.

It is claimed that frequency, mode, VFO A/B selection and memory selection can be controlled by the computer when an appropriate interface is used. There is no information on what this is. It is also stated that the serial port uses a standard 1200 Baud data rate.

Let's look a little closer at the scanning and memory system. The 735 has twelve memories which store both frequency and mode. The memories are fully tunable, it is not necessary to transfer them to one of the VFOs, just select the required memory and tune up or down in the usual way. The memories are selected by first pushing the 'MEMO' button and then selecting the required channel with the memory up/down buttons. Unfortunately memories cannot be changed by using the up/down buttons on the microphone. This only causes the frequency of the memory to change. Pushing the scan button starts the memory scan with a hold time on each of about two seconds. It is possible to scan the complete memories or scan in any selected mode. Memories 11 and 12 can be used to set the limits of a programmed band scan. In general the scanning works quite well and certainly very much better than the scanning in the IC-745.

The CW operator has been given quite a bit of thought by the designers. Provision has been made

Front panel of the unit with the 'hatch' open to display all the controls.

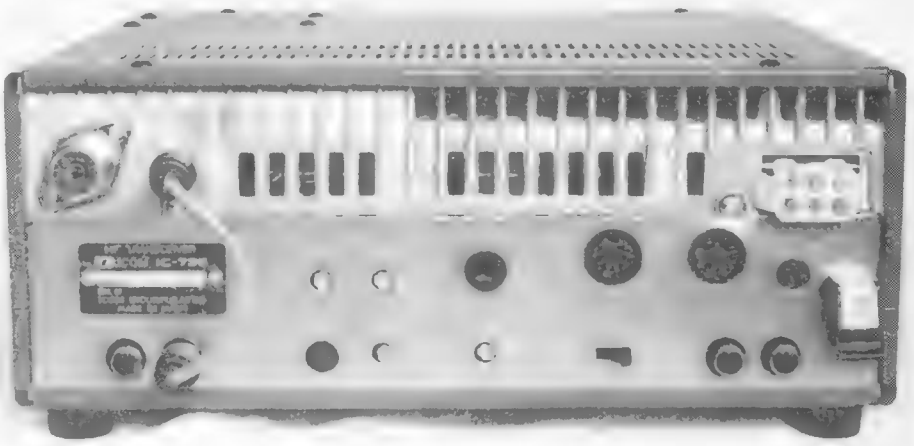
for the optional inclusion of an electronic keyer unit and full break-in keying is built-in. There are no relays, all switching being solid state. This makes full QSK possible and also gives smooth and silent VOX operation on SSB.

A sharp CW filter is a standard fitting with switching to use either this or the normal SSB filter for CW operation. Squelch is useable with all modes although its main purpose is with the FM mode. I feel that one of the few mistakes Icom made was to gang this control with the audio gain. The more logical RF gain is hidden with the lesser used set and forget controls behind the flip down plastic panel. These two should be reversed.

Some of the other handy additional features include: *receiver tone control, adjustment for dial light brilliance, power output switch to give either the normal 100 watts or 50 watts (a handy feature for novice operators), CW side tone volume control, 25kHz marker, scan timer switch and scan speed selector.* All of these controls are not available from the front panel, some like the tone and sidetone adjustments are accessible through holes in the cabinet while others require the top or bottom of the cabinet to be removed.

However I am leaving the best (I think) to last. For the first time since the IC-701, the 735 stays on the same frequency when modes are changed. This is something that I have commented on in each of my Icom reviews over the years. Now if only the R-71 had this same feature.

Well, with all of that, what should the 735 have? Only one thing that I can see; a handle! Here it is, a perfect portable transceiver that just invites you to pick it up and travel, but it takes two hands. The 751 and 745 both have a handle, the 735 should have one as well.



TECHNICAL DETAILS

Unfortunately the only technical information supplied with the review transceiver was a rather hard-to-read photo copy of a block diagram. With the aid of a new pair of bi-focals, the following was discerned. Antenna input to the receiver is via the attenuator and a high pass filter to the eight band pass filters. The high pass filter is by-passed for broadcast and long wave reception. The preamp is now diode switched. The 730 preamp was relay switched and was inclined to trouble with intermittent contacts. Push/pull 2SK125s are used in both the preamp and the first mixer. The conversion set up is 70.45 MHz first IF to 9.01 MHz where the main filters are located. The notch filter is also at this frequency. Third IF is at 455 kHz with an additional limiter and detector for FM reception. Band pass tuning is at 9.01 MHz and uses a VXO to shift this IF frequency in relation to the 455kHz IF.

For transmit, carrier generation is at 9.01 MHz. Two carrier oscillator crystals are employed, one for AM, FM and USB, the other for LSB, CW receive and CW transmit. The actual frequencies being slightly shifted to suit.

The PLL unit supplies all of the conversion heterodyne frequencies and is controlled by the CPU. This is powered by a lithium battery which has an estimated life of five years, therefore all memories and VFO frequencies are retained when all DC has been removed from the transceiver.

Transmitter output is via six relay switched low pass filters.

THE IC-745 ON TEST

The following test equipment was used to produce our figures on the IC-745. Yaesu YP-150 terminating RF watt meter, Drake W-4 through-line watt meter, Kenwood SM-220 monitor scope, AWA F242A noise and distortion meter, Daven terminating audio output meter and a Marconi TF995A/5 RF signal generator.

Frequency Stability

In common with most modern equipment, the IC-745 is very stable. With synthesised VFOs drift that would have passed as acceptable a few years ago is now non-existent. Tested several times over three days, drift did not exceed 50Hz on the several frequencies checked.

Power Output

Power output was measured with the transceiver running from the matching PS-55 power supply. Under full CW output this was able to supply 13.8 volts to the 745. Power was measured under CW conditions, the PEP output was measured on the monitor scope and two tone audio was fed into the microphone socket with the resultant RF out measured on the watt meter and then multiplied by two to give PEP. The results were as follows:

BAND	CW OUTPUT	PEP OUTPUT From Scope	Two tone output by 2 to give PEP
1.8MHz	124 W	130 W	120 W
3.5MHz	124 W	130 W	120 W
7.0MHz	124 W	130 W	120 W
10.0MHz	124 W	130 W	120 W
14.0MHz	123 W	130 W	118 W
18.0MHz	123 W	130 W	118 W
21.0MHz	124 W	130 W	120 W
24.5MHz	124 W	130 W	122 W
28.5MHz	124 W	130 W	122 W

The response from band to band is excellent. The transceiver ran reasonably cool during these tests. Like its predecessor the IC-730, the cooling fan comes on as soon as the transmitter is keyed and stays on for a short time after transmission has stopped.

The scope pattern was clean even with the audio well up. The power control behind the transparent panel allowed the power to be varied from full output down to about six watts. Handy for QRP operation. Subjective tests of the transmitted audio quality was carried out in the three modes. SSB was rated as good. The review transceiver was supplied with an HM-12 hand microphone. An SM6 desk microphone was also tried. Opinion was that the SM6 had a more balanced response but both microphones sounded rather restricted. Transmitted quality in the AM and FM modes was rated as fair. Both had a slightly edgey quality and were not comparable to other equipment tested recently. At this time, there is no way of knowing if this is peculiar to this particular transceiver.

Receiver Tests

The extention speaker output was connected to the terminating audio power meter and the noise and distortion meter. The power meter was set to 8 ohms. Residual noise with the audio gain set at zero was 58.5dBm. This is quite a reasonable figure and somewhat better than previous Icom transceivers tested. Audio power output and distortion were next checked.

Output power	Distortion
5 watts	1%
15 watts	1.1%
20 watts	2.5%
38 watts	40%

These figures show the combined distortion from the product detector and the audio amplifier is very low up to the overload point. As a point of interest, I did this same test on an old FT-101 and found that the distortion was around 10 percent at less than 1 watt output. There is no doubt that modern transceivers sound very much better than their older relatives.

The received audio response in LSB mode was checked by tuning across the output of a crystal calibrator. The results were as follows:

100	200	300	400	1k	1.5k
10	-3	−1	0	0	−1
2.0k	2.2k	2.5k	2.7k	3.0k	
−2.5	−3.5	−5	−7	−26dB	

This is very smooth but could be shifted a bit further away from the filter to give a slightly better high frequency.

The AM receive frequency response was checked with the following results:

40	50	75	100	200	400
−9	−6	-4	−3	-1	0
1kHz	1.5	2.0	2.5	3.0	3.5
0	−1	−1	−2	−2.5	−5
4.0					
-8dB					

These are excellent figures for any AM receiver. Feeding a good quality external speaker the results are very pleasing. Add to this the excellent tuning characteristics and relative lack of clicking as the synthesiser changes frequency produces very good AM results. The SSB filter can be selected for AM reception if required by depressing the narrow button.

The CW filter is included as standard in the 735. The response was checked with the following results:

200	300	400	600	800	1k
−20	−15	−10	0	−10	−20dB

The band pass tuning was next measured. With the control central, the SSB response is normal. In the USB mode turning the control to the left reduced the high frequency response while turning right reduces the low frequency response. At 1.5k the selectivity could be adjusted to give −25dB. The same −25dB response could be obtained at 800Hz. It should be noted that you can have either one or the other, not both together. The action of this control is quite useful but not as effective as the Kenwood system that allows independant adjustment of both high and low frequencies.

Receiver sensitivity and 'S' meter calibration were then checked. Signal to noise ratio was tested at 14.2 MHz. At 1uV input the preamp switched out the S/N was 18.5dB. With the preamp in, it was 23dB. At 28.5 MHz 1uV S/N was 11dB preamp out and 16dB preamp in.

'S' meter calibration was measured with the preamp in, and even then it took a signal of 2uV to reach S1. From there up the following results were obtained:

S Meter Reading	Signal input	dB increase
1	2uV	
2	2.5uV	2dB
3	3.1uV	2dB
4	4uV	2dB
5	5uV	2dB
6	8uV	4dB
7	10uV	2dB
8	10.6uV	4dB
9	30uV	6dB
9+10dB	80uV	8dB
9+20dB	300uV	10dB
9+30dB	600uV	10dB

The meter actually reads to S9+60dB but signal input readings were not measured up to this level, but for interest a 10kW broadcast four kilometres away reaches this (preamp out).

With the preamp out, the S meter was very sluggish but the receiver performance was quite acceptable. The preamp has a measured gain of 10dB at 14.2 MHz and the 20dB attenuator was checked at exactly that figure.

The AGC performance was next to be measured. With the preamp in, an increase of signal input from 1uV to 10uV resulted in a 2dB audio output increase and then from there up to the limit of the RF generator, no further increase in audio resulted. With the preamp out, the 1uV to 10uV increase was 14dB, then no further increase in output level from there.

AGC decay time from an S9 signal was 5 seconds with AGC slow and 1 second with AGC fast.

Receiver front end performance was checked for adjacent strong signal handling. A signal was injected into the antenna socket 3kHz off frequency and noise increase measured. With 100uV (equal to about S9+10dB) there was 0dB, with 1mV 1.5dB and with 10mV 15dB. An excellent result.

The antenna input was terminated with a 50 ohm resistive load and the receiver tuned over its entire range. All spurious signals were noted. There were twenty eight but of these only three were of any consequence. These were 23.039 MHz which reached S4, 14.471 MHz, S1 and 9.011 MHz, S1. All others were below an equivalent level of .25uV.

To conclude our tests, the FM receive performance was checked. The tests were conducted on 28.5 MHz. At 1uV input, modulated at 1kHz to give 4kHz deviation, the signal to noise ratio was 6dB. It took a signal input of 4uV to open the squelch. As the specified squelch sensitivity is .3uV something seems to have gone wrong here.

INSTRUCTION MANUAL

Our review transceiver was supplied with a draft copy only. It did appear complete but only time will tell what appears in the manual supplied with equipment sold locally.

CONCLUSIONS

It is interesting to look at the 735 in relation to the older 745. In many ways, it out performs the 745. Broadcast band and long wave reception is vastly better, both from a quality and sensitivity point of view. Memory scan now works in a logical way (see comments on memory scan in the 745 review). There are very few points of criticism with the 735. It is a very versatile little transceiver. If only it had a handle! Perhaps a few comments about the matching PS-55 power supply might be of interest. This worked well throughout the tests with the exception of a slight amount of mechanical hum. But perhaps Icom might consider a few improvements. Firstly, there is no provision to supply DC to anything other than the 735 transceiver. Once you have invested in a good regulated supply it is handy to use it to supply a two metre FM transceiver or some other piece of station equipment. I use a PS-15 which I have modified to give auxiliary DC output and front panel AC switching so that it can be used with all units in the shack. Last point, what about a speaker in the front panel of the PS-55. There is room for one.

Thanks to Icom Australia who kindly supplied this review transceiver.

EVALUATION AND ON AIR TEST OF THE ICOM IC-735 HF TRANSCEIVER — Serial No 0021

APPEARANCE

Packaging
*** Carton with foam inserts, but not up to other Icom equipment.*
Size
**** About as small as they come.*
Weight
**** Slightly less than its predecessor.*
External finish
**** Clean appearance and well finished.*
Construction quality
*** Good quality boards and wiring. Reasonable accessibility.*

FRONT PANEL

Location of controls
**** Top marks. Some are hard to get at but excellent layout for front panel size.*
Size of knobs
*** Small front panel means small controls, but mostly satisfactory.*
Labelling
**** Very clear.*
Status Indicators
**** New LCD display very comprehensive, but no indicators for many functions.*

VFO ACTION
Tuning Knob
**** Smooth action. Adjustable drag.*
Tuning Rate
*** Better than previous Icoms, but still a bit slow.*
Digital readout
**** New LCD display very good. 100Hz resolution spot on frequency.*
VFO stability
**** Less than 100Hz total drift.*

RECEIVER OPERATION
Memories
**** 12 tunable memories. Very useable memory scan also select ed mode memory scan.*
Band pass tune
*** Quite useful.*
Notch Filter
**** Works well for all modes.*
Spurious responses
**** Quite a few, but mostly very low level (see test section).*
'S' meter
*** OK with preamp in, sluggish with it out.*
AGC performance
**** Good action. No pumping detected.*
Signal handling
***** No cross mod heard except when noise blanker selected with maximum blanking.*
RIT
*** +/- 900Hz. No XIT. No frequency indication. Leaves you in the dark.*
Sensitivity
***** Excellent. See test section.*
Preamp/attenuator
***** Independently controlled. Gives good choice.*
RF gain
** Works well. Difficult to get at.*

NOISE BLANKER
Woodpecker
**** Excellent blanking, but introduces cross modulation.*
Ignition and general electrical noise
*** Works well, but level adjustment critical to avoid cross modulation.*

QUALITY OF RECEIVED AUDIO
Internal speaker
*** Very small speaker but well baffled giving quite fair quality.*
External speaker
NA Appears that no matching speaker available. Very good on my usual station speaker.
AM received quality
***** Special mention, it's excellent.*
Headphone output
**** Stereo phones compatible. Good level.*
Cooling fan noise
***** Does not operate in receive mode except after long transmission.*

TRANSMIT OPERATION
CW and PEP output
***** Excellent — See test section.*
Audio response
*** Good on SSB, fair on AM and FM.*
ALC action
**** Very good, no flat topping.*
Compressor
*** Audio processor only but quite effective if not pushed too hard.*
Metering
*** ALC, relative output and SWR.*
Relay noise
***** None. Solid state switching.*
VOX operation
***** Excellent and no clattering relays. Use it you will like it.*
CW operation
**** Full QSK. CW filter good sidetone.*
Cooling
*** Runs quite cool. Fan operates continuously in transmit mode with audible sound.*

MANUAL
Owners Handbook
NA Only rough copy available at time of review.

Rating Code: Poor * Satisfactory **
Very Good *** Excellent ****

AR

75th Nostalgia

"THE NIGHTINGALE SINGS"

A TRIBUTE TO THE LATE BILL MOORE VK2HZ

Ted Gabriel VK4YG
PO Box 245, Ravenshoe Qld. 4872

I first met Bill Moore in a Japanese Prisoner of War camp in Batavia (Djakarta) in 1942, when thousands of Australians from the three services laid down their arms after fighting a bitter rearguard action to defend their country against the tide of war which had engulfed Malaya, Singapore and the Dutch East Indies.

Bill was a quiet, friendly man who had a cheery smile for everyone who met him.

What has this to do with nightingales you may ask? relax and I will explain.

Bill was an RAAF radar officer serving in Malaya and when Singapore fell he was evacuated to Java.

After the capitulation and while allied servicemen were being rounded up he quietly collected radio components from wrecked aircraft and other equipment and smuggled the parts into the camp in Batavia.

From these components, with typical amateur ingenuity, he constructed a receiver powered by torch batteries which could be easily dismantled for shifting from one camp to another.

It was this receiver that brought the war news to Australian POWs working on the notorious Burma-Thailand Railway of Death, it gave hope in the days of gloomy despair, and lifted the morale of those cut off from their homeland and loved ones.

Without doubt this man's skill and concern for his fellow man gave many the will to survive this terrible ordeal.

"A Nightingale Sang in Berkeley Square" was a wartime tune made popular by Glenn Miller and his orchestra and the phrase; the "Nightingale Sings" was chosen as a code name for the extremely dangerous task of receiving the news from the BBC in India or Radio Australia and passing it on to the troops.

Since the Japanese use the word "newsu" to mean news this word was strictly taboo as were 'radio' or 'wireless'.

Accordingly the code word; "The Nightingale Sings" meant that there would be news before 'lights out' that evening.

The operator, Corporal Arch Caswell, RAAF, who was later awarded the British Empire Medal for his work, would retire under his mosquito net, produce the earphone from its hiding place, switch on the receiver and listen to the news.

While he was doing this there would be several unobtrusive "cockatoos" on watch to see that no guards approached the hut undetected.

Nothing was ever written down, the operator memorised what he heard and then sought out a certain officer who also memorised what he heard and then informed the Australian Senior Officer.

After the evening meal all officers in charge of working parties were called to the CO's quarters to receive orders for the next day and were then told the news.

The officers then went to their groups to prepare work lists for the next day and passed on the "Nightingale's Song" to their men.

Very strict discipline was necessary to protect the lives of those engaged in this dangerous operation, all men were to hear the news and then "forget it," anyone heard discussing it later would be immediately put on a charge and denied access for a long time.

No Australians were caught but an English officer found with a secret radio in one camp was beaten to death — those responsible were later executed after a War Crimes Trial.

Moving from one camp to another meant that the receiver had to be dismantled and the parts distributed amongst several people and concealed in such a way as to evade searches by the Japanese.

Some very ingenious methods were used, parts were concealed in musical instruments, in bags of rice, in hollowed out timber of boxes, in shoes or boots, while the torch batteries were concealed in bamboo carrying poles.

One particularly crafty move was made by concealing parts in the Japanese officer's telephone equipment which was not searched and which was maintained by Australian signals men since neither the officers' staff or the Japanese Military Police, the "Kempei Tai", understood much about this gear.

Considerable discretion had to be exercised when some Japanese, trying to improve their knowledge of English, would discuss items of news published in their propaganda newspaper with the prisoners.

After the midget submarine raid in Sydney Harbour several of us were accosted by a Japanese triumphantly waving his newspaper and saying; *"Nippon submarine torpedo centre pylon of Sydney Harbour Bridge!"*

After several minutes of feigned amazement and careful discussion one of our group produced an old postcard of the famous bridge and showing it to the guard said, *But as you can see there is no centre pylon under the Sydney Harbour Bridge".*

"Ah so", he replied, *"Nippon Submarine captain No 1 shot!"* (you could not win!)

Farewell Bill Moore VK2HZ, the man who made it possible, the Australian Servicemen who heard the "Nightingale's Song" — salute you.

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PHOTOGRAPHIC WINNER 1984-85

The winner of the $100 worth of Agfa film and/or video tapes was Sam Voron VK2BVS for his collection of photographs on page 21. April AR