

■ Equipment Review

Yaesu FT-900 All Mode HF Transceiver

Reviewed by Ron Fisher VK3OM*



FT-900 transceiver with front panel attached, and HM-31 microphone.

After a long delay, Dick Smith Electronics have decided to introduce the FT-900 to the Australian market. The FT-900 has been available on overseas markets now for nearly two years, although the Australian version is an updated model fitted with a Collins 455 kHz mechanical filter in place of the more usual ceramic filter.

The FT-900 slots between the FT-840 and the FT-990 and, with the recently introduced FT-1000MP, gives Yaesu one of the widest ranges of HF transceivers on the Australian market.

FT-900 Features And Facilities

The FT-900 is a direct descendent of the FT-890 and has inherited many of the FT-890's excellent features; however, it also perpetuates a few of its mistakes.

The main feature of the FT-900, setting it apart from the earlier model, is the remotable front panel. The FT-900, however, is not a miniature transceiver

like the TS-50, IC-706 or DX-70. It is a normal size transceiver, identical to the FT-840, FT-890 and the old FT-757. The actual dimensions are 238 mm wide, 93 mm high and 253 mm deep, with a total weight of 5.3 kg.

About two thirds of the front panel can be removed for remote installation. This remote section contains all of the essential operating controls, leaving such things as the direct frequency entry pad, keyer controls, microphone gain and RF power controls, MOX, VOX and AGC selectors, and the headphone socket, on the remaining section of the front panel. The remotable panel contains an excellent LCD which gives frequency readout, a multi-function bar graph metering system, mode and VFO indicators, and the memory channel indicator. Controls include audio gain and squelch, notch and IF shift, clarifier control, plus 21 push buttons that control power, meter selection, mode selection, VFO and memory selection, and

up/down buttons for band selection.

The microphone is also connected to the remote panel section via an eight pin telephone modular plastic connector. Connection of the remote front panel to the main chassis of the transceiver is via a single eight-pin sliding connector which mates when the remote panel is clipped on to the transceiver. There are no messy cables and plugs to tangle; Yaesu have got their remote system right first off.

Unfortunately, a remote cable was not included with our review transceiver, so I can only guess that it would work well. The remote cable is available as an option and the kit includes a mounting bracket for the panel.

Transceiver technical features include a receiver with full general coverage from 100 kHz to 30 MHz with all modes available. The transmitter has an output of 100 watts on all HF amateur bands from 160 to 10 metres, but not including 6 metres. Again, the transmitter has provision for all modes which include SSB, CW, AM and FM.

An automatic antenna tuner, which can be installed in the transceiver, is available as an extra cost option. This was not included in our review transceiver so, unfortunately, I cannot comment on its performance.

The inclusion of a "Collins" mechanical filter in the 455 kHz IF section is interesting. I would guess that many newcomers to the hobby might not have heard of mechanical filters or know how they work. Let me give a quick explanation. Mechanical filters were developed in the early 1950s to provide a solution to the problem of achieving a selectivity curve with a flat top and very steep sides. In those days crystal band pass filters had not been developed to any extent and high frequency filters of, say, 5 and 8 MHz were unknown. The Collins Company in the USA developed a series of filters which operated at 455 kHz for use in their 75A series receivers. The filters used input and output transducers with disk resonators in between. Bandwidths of 300 to 6000 Hz were available. However, with the introduction of high performance crystal filters, mechanical filters became less common.

The filter used in the FT-900 does not

give any indication of just where it was manufactured. The type number is certainly of Collins origin but there is also a Yaesu part number on it. Regardless of this, it works very well. Its performance would be very much better than the original ceramic filter installed in the earlier series, but how much better than the optional crystal filter available at the time is hard to say.

The bandwidth of the mechanical filter is rated at 2.75 kHz and, as we will see later, the response is very smooth and flat. Optional filters are available for CW operation with bandwidths of 250 and 500 Hz but no narrow SSB filters are available. The optional filters are not easy to install. A circuit board has to be removed and the new filter soldered in place. The FT-840 and the new FT-1000MP use plug-in filters which can be installed in seconds.

Several useful operating aids are included. For the receiver, an IF shift and a notch filter help to reduce interference. A receiver front-end single position attenuator and a switch to bypass the receiver RF stage (the IPO or intercept point optimisation) control strong signal inputs that might cause receiver overload. There is no RF gain control. A receive-only clarifier, which has a range of +/- 9.9 kHz, is included but, as we shall later see, has one serious problem.

On the transmit side, a speech processor gives the audio a very worthwhile boost. Yaesu call this a

frequency shift processor. The carrier oscillator can be adjusted from -300 to +500 Hz to set the audio response to suit any particular taste. Our on-air tests were carried out with this set to -100 Hz which gave the best audio balance using the supplied MH-31 microphone.

For the CW operator, an electronic keyer is in-built with a front panel speed control. Reverse sideband switching helps the operator to dodge QRM. Either semi or full break-in operation can be selected. Transmitter power output is adjustable from the maximum of 100 watts or so down to QRP levels. Finally, a thoughtful feature; the tilt bail that lifts the front of the transceiver has a rubber cover which will protect the finish of your desk top.

FT-900 on the Air

The first thing needed to put the FT-900 on the air is a 20 amp, 13.8 volt DC power supply. A generous length DC lead, terminated with a standard six pin plastic connector, is supplied with the transceiver. Dick Smith Electronics no longer import Yaesu power supplies, so you won't be able to purchase the matching FP-800. However, there is some good news with power supplies. See the D-3800 power supply review elsewhere in this issue.

The first thing noted when the FT-900 is switched on is the display. It has a bright orange background with black figures. It's quite startling. Three tuning

rates are selectable via the menu system and give 2.5, 5, or 10 Hz steps. I must say that I much prefer slow tuning rates so the 2.5 Hz step rate is to my liking. I cannot say the same about the tuning knob, which is small and not well placed. I guess this is caused by the constraints of the remote front panel. It is, however, very smooth and has a good spinning action.

Two often-used controls are very close to the tuning knob. These are the VFOA/B button and the clarifier control. I found that I often knocked the tuning off-frequency when using these controls. Also, for base station use, the tuning knob is too high. However, if a remote front panel is essential, then this is a small price to pay.

Speaking about the clarifier, this is another fault carried over from the FT-890. There is one main problem. If you are offset by, say, 5 kHz there is no way to cancel this except by turning the clarifier control back to the zero setting, which might involve several revolutions of the control. Strange, to say the least. It would seem to have been a simple thing to provide a second function on the clarifier button to clear the offset back to zero.

In general, the receiver sounded very good within the constraints of the rather small top-mounted speaker. I would recommend an external speaker for home-station use and, of course, it would be essential for mobile use if the main transceiver section is remotely mounted.

The slightly wider selectivity provided by the Collins filter shows up with excellent SSB audio quality; however, the audio response on AM reception was very poor (see later test report). I actually found that AM sounded better with SSB selected and the carrier tuned to zero beat. I suspect that Yaesu are using excessive audio tailoring after the AM detector which may well be modifiable.

Band changing is very easy with several methods available. With the front panel attached for base-station use, you have the greatest choice. The keyboard at the bottom right of the front panel provides direct access to each amateur band and, of course, with the direct digital synthesiser used in the FT-900, the last used frequency on each band



FT-900 transceiver with the front panel detached.

returns each time. The same keyboard allows direct frequency entry by pushing the "ENT" button and then entering each digit in turn.

On the remote panel section, bands are changed via the up/down buttons. Either amateur bands or general coverage stepping is controlled by the HAM/GEN button situated under the display. With HAM selected, again the last used frequency on that particular band is returned. Also, there are two VFOs which allow two bands or two frequencies on the same band to be selected with the push of a button. The FT-900 has 100 memories, all of which are fully tunable up or down from the memory frequency. Ten of these memories can be set to provide upper and lower frequency limits for use in the "scan" function.

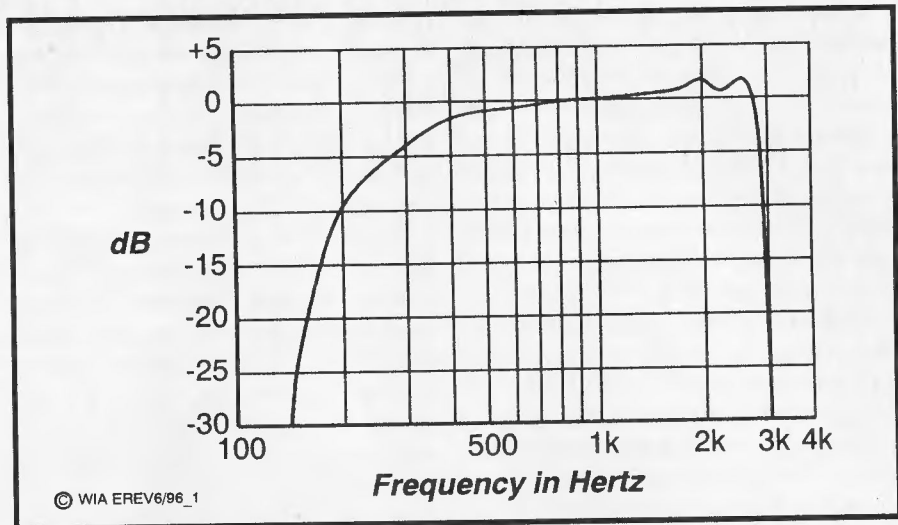
SSB transmission tests were carried out using the supplied HM-31 hand microphone. As the microphone connection is via an eight pin telephone-type connector, I was not able to test the transceiver with other Yaesu microphones that I have, but quality reports were very good with the HM-31.

The in-built speech processor adds quite a bit of bite to the transmitted audio and this, along with the ability to shift the carrier point relative to the filter, allows the operator to optimise the transmitted audio to suit individual voices.

The cooling of the FT-900 is very efficient. The entire top of the cabinet is part of the very efficient heat sinking system. However, I must admit to getting quite a shock when the cooling fan came on for the first time. It was louder than expected. The fan is thermostatically controlled, and under normal temperature conditions, only comes on infrequently. After a while I did get used to it. There is no doubt that it does its job well.

HM-31 Microphone

This is a brand new type for Yaesu and is supplied as standard equipment with the FT-900 and also the new FT-1000MP. It is quite comfortable to hold and the push-to-talk button operates a micro-switch which only needs light pressure to actuate. The microphone insert is a 600 ohm dynamic unit which produces



Transmit audio response of the FT-900 on 14.2 MHz, no compression, no ALC, 20 watts output at 1 kHz.

very acceptable audio quality. There are three up/down buttons recessed into the top front of the case with the centre button switching the "fast" tuning function on and off. I found these buttons rather difficult to use and would prefer to have them on the top. On the rear is a two position tone switch. Position one gives full frequency response, while position two gives a degree of bass cut. Most contacts preferred position two. The curly cord is connected via an eight pin modular connector to the microphone and also to the transceiver. The HM-31 supplied with the FT-1000MP uses a standard eight pin metal connector at the transceiver end. By the way, the HM-31 is made in China.

FT-900 On Test

I carried out the usual series of tests, starting with transmitter power output and current drain. These tests were conducted using a 13.8 volt regulated power supply which was, in fact, a Yaesu FP-707 which is possibly very near in design to the unobtainable FP-800.

| Band | Power Out | Current Drain |
|------|-----------|---------------|
| 1.8 | 109 watts | 17.0 amps |
| 3.6 | 106 watts | 16.8 amps |
| 7.1 | 106 watts | 16.8 amps |
| 10.1 | 105 watts | 16.8 amps |
| 14.2 | 107 watts | 17.0 amps |
| 18.1 | 103 watts | 17.5 amps |
| 21.1 | 105 watts | 17.0 amps |
| 24.9 | 102 watts | 17.5 amps |
| 28.5 | 100 watts | 17.5 amps |
| 29.5 | 97 watts | 18.0 amps |

With the power control set to minimum, the power output on all modes varied from 2.0 watts on 1.8 MHz down to 1.5 watts at 29.5 MHz. These are ideal levels for QRP operators.

The usual test for transmitter intermodulation distortion was carried out. Again this is done by comparing the distortion of the review transceiver with that of a transceiver that produces a known amount of distortion. The figure for the FT-900 was 22 dB compared with full SSB power output at 14.2 MHz. This is about average for a 12 volt powered transceiver although, as we have seen in previous reviews, some rigs are very much better in this respect.

The frequency response test for SSB transmit proved to be one of the best yet measured. The curve was within +/- 1 dB from 500 Hz to 2.8 kHz, with the -6 dB response at 250 Hz and 2.9 kHz and an extremely sharp cut-off above this; no doubt this was due to the excellent response of the Collins mechanical filter. Carrier and sideband suppression were also excellent, both being in the region of -50 dB.

The LCD readout for output power is very accurate in its reading. It is calibrated at 10, 25, 50, 100 and 150 watts.

Receiver Tests

The first receiver test was to check the S meter calibration. The S meter on the FT-900 is, of course, not a meter but a bar graph as part of the LCD. It is

calibrated at S1, 3, 5, 7, 9 and +20, 40 and 60 dB over S9. The results with both the attenuator and IPO switched out were:

| S Level | Input Required |
|----------|----------------|
| S1 | 2.5 μ V |
| S3 | 3.1 μ V |
| S5 | 6.3 μ V |
| S7 | 10.6 μ V |
| S9 | 80.0 μ V |
| S9+20 dB | 800.0 μ V |
| S9+40 dB | 10000 μ V |
| S9+60 dB | 0.07 V |

Switching from band to band, the signal input to give an S9 reading was:

| Band | Input for S9 |
|----------|--------------|
| 1.8 MHz | 70 μ V |
| 3.6 MHz | 80 μ V |
| 7.1 MHz | 80 μ V |
| 10.1 MHz | 80 μ V |
| 14.2 MHz | 80 μ V |
| 18.0 MHz | 80 μ V |
| 21.0 MHz | 100 μ V |
| 24.5 MHz | 100 μ V |
| 28/29.5 | 125 μ V |

The calibration for FM on 29.5 MHz was similar, with S9 requiring 100 μ V input. Squelch sensitivity for FM at 29.5 MHz was 0.1 μ V, with the receiver sensitivity for the same mode and frequency measured at 0.25 μ V for 12 dB SINAD with the preamp on and attenuator of – somewhat better than the specified 0.5 μ V.

Sensitivity on the lower bands was measured at 14.2 MHz USB. At 0.25 μ V I measured 16 dB SINAD as against the specified 12 dB, again an excellent figure. The received frequency response

for SSB was essentially the same as I measured for SSB transmit. The AM receive response was measured with the following results:

| Frequency | Response |
|-----------|----------|
| 100 Hz | -12 dB |
| 200 Hz | -3 dB |
| 400 Hz | 0 dB |
| 800 Hz | 0 dB |
| 1.0 kHz | 0 dB |
| 1.5 kHz | -2 dB |
| 2.2 kHz | -6 dB |
| 2.5 kHz | -8 dB |
| 2.7 kHz | -9 dB |
| 2.8 kHz | -10 dB |
| 3.0 kHz | -12 dB |

As you can see from this, the AM response is actually inferior to the SSB response at the high frequency end. The low end is slightly extended but the overall -6 dB response of 150 Hz to 2.2 kHz is very poor.

Receiver Audio Power Output and Distortion

Yaesu receiver audio output impedance is four ohms as distinct from the eight ohms used by most of the other manufacturers. It's important to note this if you intend to connect a speaker that you might have in the junk box. Maximum power will be reduced by using an eight ohm speaker.

Maximum power output is 2.2 watts at 7% distortion. This exceeds the specified 1.5 watts at 10% by a generous margin. With the output reduced to normal listening level of around 100 milliwatts, the distortion dropped only

0.6%. A minimum signal of 1.5 μ V is required to produce maximum audio power. With an eight ohm load connected, the power output drops to 1.5 watts at 15% distortion.

FT-900 Instruction Manual

If there is one thing that deserves the highest praise with the FT-900, it is the instruction manual. The general quality of the printing and reproduction of photographs is excellent. This is a manual that you will actually enjoy reading and, when finished, you will know all about your transceiver. However, one small item lets it down. I would like to see heavier and better quality paper used for the covers. The existing covers are little heavier than the internal pages and I think would soon become dog eared. A full schematic diagram is supplied. I score the FT-900 manual 9 out of 10.

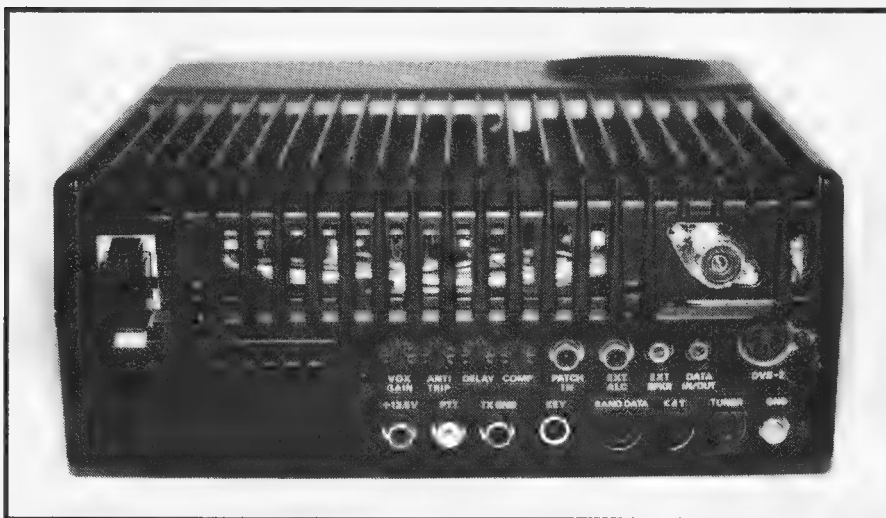
FT-900 Conclusion

I would have to rate the FT-900 as a very competent transceiver. Using it as a home station, you will find most of the facilities that are needed for general operating. To make use of the remote front panel, you will need the optional YSK-900 separation kit and possibly the ATU-2 automatic antenna tuner. The six metre cable supplied with the separation kit should enable placement of the transceiver proper in the boot of the car. I feel it is too large to slide under one of the front seats; however, this probably depends on your car.

Our review transceiver was supplied to us by Dick Smith Electronics to whom all enquiries should be directed. The FT-900 is priced at \$1995. The YSK-900 separation kit is priced at \$99.95 and the auto ATU is \$499.

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Rear panel of the FT-900.

