

EQUIPMENT REVIEW

Yaesu FRG-100 HF Communications Receiver

Ron Fisher VK3OM* investigates the latest receiver from Yaesu.



It seems that most amateur equipment manufacturers base their communications receiver design on an existing transceiver. Yaesu have always been different in this respect and have produced receivers that fit into a particular market niche. To go back to the beginning, the original FRG-7 was a runaway favourite in the low cost field. Rumour has it that the idea behind the FRG-7 was suggested to Yaesu by an Australian distributor when the South African Barlow failed to produce an updated version of the XCR-30, the receiver that set new standards in low cost performance in the early 1970s. While the XCR-30 worked well, it didn't look like a communications receiver. The FRG-7 looked right and worked well, particularly on SSB. The FRG-7000 followed with the added feature of a digital readout plus better selectivity for SSB. The FRG-7700 followed with updated design. The thirty bands 1 MHz wide were switch selected and no front end tuning was required. Yaesu also offered several popular accessories including a VHF converter and an antenna tuning unit. The FRG-7700 is an excellent choice on the secondhand market.

The FRG-8800 brought Yaesu receivers into the fully synthesised

age. Now with continuous tuning right through the HF spectrum and of course a generous supply of memories. I am not sure if Yaesu intend to continue production of the FRG-8800 or whether the new FRG-100 will take over.

If I had been asked a few months ago to give an opinion on what a new Yaesu receiver would look like, I would have predicted that it would resemble the FT-890 amateur transceiver, but not so. The FRG-100 is a brand new design aimed at the lower price end of the professional style receiver range.

So, what is the FRG-100? What does it do and how well does it do it? The FRG-100 has full coverage from 50 kHz to 30 MHz. It receives AM, USB, LSB, CW and, as an option, FM. Three filters are included as standard, a 2.7 kHz for SSB, and 4 and 7 kHz for AM. CW reception uses the SSB filter but Yaesu offer a 500 Hz filter for improved reception as an optional extra. A large and clear LCD displays the frequency readout, memory channel selection and most of the status indicators. The most surprising feature of the FRG-100 is that it does not incorporate a power supply. The receiver requires 12 to 14 volts at about 1.5 amps. There is also no

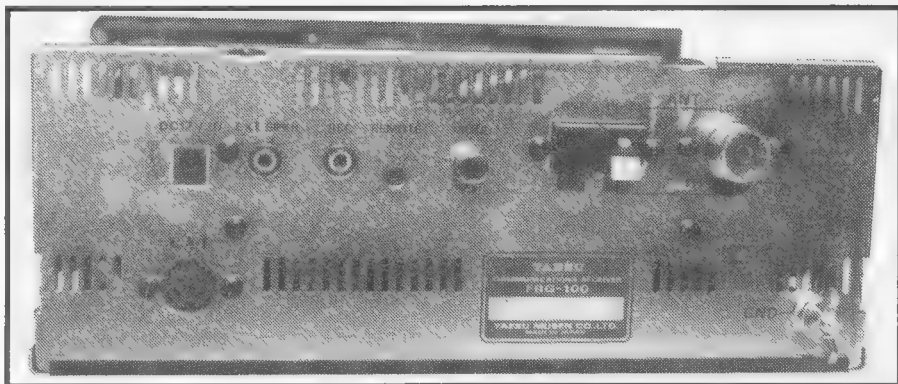
provision for battery operation and, with the 1.5 amp drain, you would need a bit more than a stack of torch batteries to keep it going for any length of time. A rather flimsy DC cord is supplied with the receiver. Yaesu do produce a wall type power supply to suit but with Dick Smith's current practice of not importing power supplies it seems unlikely we will see this here. The next surprise is the size. I had seen photos of the receiver before seeing the real thing but that didn't prepare me for the diminutive size of the FRG-100. The overall size is 238 mm wide, 93 mm high and 243 mm deep. Weight is 3 kg. A carry handle is provided on the right hand side of the cabinet.

Controls on the receiver have been simplified with rotary controls provided for tuning, volume, squelch and memory selection. All functions are selected via twenty four push buttons and these include power on/off, front end attenuator, noise blanker, AGC fast/slow selection, four mode selection buttons, memory selection, VFO memory change over, clock setting and frequency band up/down selection.

In addition to this, many functions are selectable or can be changed to suit the operator by holding down certain buttons while turning on the power switch. The main tuning control is about 40 mm in diameter and while it is weighted, it lacks a good fly wheel effect. It does have a convenient finger hole which is a big help in spinning up and down the bands.

The FRG-100 On The Air

Overall, the receiver was a delight to use. The tuning rate on SSB and CW is 5 kHz per knob revolution and 50 kHz per revolution with AM reception. Both of these can be speeded up by ten times by pushing the "Fast" button. Band changing is via the Up/Down buttons to the right of the tuning control. This is normally in 100 kHz segments but again by selecting the "Fast" function this steps up to one MHz segments. The receiver is programmed to switch rapidly between the various short wave broadcast bands via the Up/Down buttons. This is enabled by holding the "Set" button then the



Rear panel view of the Yaesu FRG-100.

“Up” button. Now with “Fast” selected the Up/Down buttons will step in sequence the 15 broadcast bands. This includes the standard broadcast band and the European long wave band. Unfortunately, no similar system is provided to step between the various amateur bands.

The FRG-100 uses direct digital synthesis which gives very clean tuning. If you have been used to an older synthesised receiver, this will be very apparent when tuning AM signals. There is a distinct lack of clicks and plops and the tuning sounds as smooth and clean as your 1950s valve receiver!

AM performance was especially good with the choice of wide and narrow selectivity. Both of these have been well optimised. Many receivers switch to the SSB filter in the narrow position which is too narrow. AM audio quality was quite good but, as our tests show, the distortion is too high at high percentage modulation. While this will not worry many owners, a reduction of distortion down to one or two percent could make a substantial difference to AM reception. SSB reception was excellent. The product detector has low distortion and the slightly wider

than normal bandwidth gives better than average audio quality. The inbuilt speaker gives acceptable audio quality, but connecting my normal station speaker made a very marked difference.

Two antenna input connectors are provided on the rear panel. An SO-239 for 50 ohm input and a pair of terminals for high (450 ohm) impedance input. A switch located on the rear panel between the two connectors allows switching between them. This allows two antennas to be connected to the receiver at the same time, say a dipole for short wave reception and a long wire for broadcast and general reception. Unfortunately, the switch is a miniature type which is sub mounted below the surface of the rear panel. It is necessary to use a ball point pen or a miniature screw driver to operate it and you have to be able to see it to do this. Why not a standard size slide switch mounted just below the top of the rear panel or, better still, a button on the front panel?

While on the antenna input side of things, a six and twelve dB attenuator is switchable from the front panel. When both are pushed together, they add to give 18 dB attenuation. The

front end of the FRG-100 has excellent strong signal handling capability so the attenuator won't be needed very often. Yaesu haven't provided an RF gain control. Over the last few months I have bemoaned the lack of an RF gain in some of the new transceivers, but in the case of a general coverage receiver in this class I feel the lack of an RF gain is justified.

Two connections interface with a tape recorder. The “Rec” output is a constant level of 40 mV peak and uses a standard 3.5 mm socket. A second socket supplies remote switching for the tape recorder. This uses a 2.5 mm socket. Both are located on the rear panel. The remote switching operates with the squelch control. When a signal opens the squelch, the switch operates and turns the recorder on.

Two clocks can be set for two time zones in either 12 or 24 hour modes. As long as the external power supply is left connected, the clocks are displayed even when the receiver is switched off, although there is no display illumination until the receiver is turned on again. The display and “S” meter illumination can be dimmed from the normal level. On our review receiver, the illumination of the main display and the “S” meter appeared rather different with the meter having a higher level of brightness compared to the LCD.

The memory facilities are very comprehensive. There are fifty standard memories plus two others to set scanning limits. Scanning can be set to cover all memory channels or in groups of ten. It is also possible to lock out any memories not required during scanning operations. A priority channel facility allows any memory to be checked every five seconds while the receiver is operating on another frequency.

The FRG-100 is computer compatible and several pages of the manual are devoted to this.

The FRG-100 on Test

I put the receiver through our usual series of technical tests. These were carried out with the receiver powered from a 13.8 volt regulated power supply. The sensitivity was checked first.

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Federal Office of your new
callsign? Use the form on the
reverse side of the Amateur
Radio Address Flysheet.**

Sensitivity Frequency	Sensitivity SSB for 10 dB SINAD	Sensitivity AM 10 dB SINAD	"S" 9
50 kHz	6 μ V	30 μ V	300 μ V
150 kHz	1 μ V	3 μ V	70 μ V
500 kHz	1 μ V	3 μ V	70 μ V
1.0 MHz	1 μ V	3 μ V	50 μ V
1.8 MHz	0.2 μ V	0.5 μ V	19 μ V
3.6 MHz	0.2 μ V	0.5 μ V	19 μ V
7.0 MHz	0.18 μ V	0.4 μ V	19 μ V
10 MHz	0.18 μ V	0.4 μ V	20 μ V
14 MHz	0.18 μ V	0.4 μ V	30 μ V
18 MHz	0.2 μ V	0.55 μ V	32 μ V
21 MHz	0.22 μ V	0.6 μ V	40 μ V
24 MHz	0.26 μ V	0.65 μ V	42 μ V
28 MHz	0.3 μ V	0.7 μ V	58 μ V

The next test was for "S" meter linearity. This was checked at 14.2 MHz in USB mode.

'S" Meter Reading	Signal Input.
S1	1.4 μ V
S2	1.6 μ V
S3	1.8 μ V
S4	2.2 μ V
S5	2.8 μ V
S6	4.5 μ V
S7	7 μ V
S8	14 μ V
S9	30 μ V
+ 20 dB	250 μ V
+ 40 dB	240 mV
+ 60 dB	1800 mV

The AGC threshold was about 2 μ V with the audio output increasing less than 0.5 dB above this level. Maximum audio output could be obtained with an RF input of 1.2 μ V.

Selectivity was checked for the three installed filters.

SSB	AM/narrow	AM/wide
-6 dB 2.6 kHz	6.8 kHz	8.5 kHz
-40 dB 3.6 kHz	10.5 kHz	12.5 kHz

With the equipment I used to produce these figures, synthesiser noise limited me to the -40 dB measurements.

The audio output impedance is specified as 4 to 8 ohms with 1.5 watts into 4 ohms at 10% distortion. Our measurements produced 1.5 watts at 10% distortion with an 8 ohm load and 2.1 watts at 10% distortion with a 4 ohm load.

Distortion on SSB and CW at 0.5 watts output was 1% and on AM with 30% modulation distortion with 1 kHz modulation was 1.5% and with 90% modulation it had increased to 4.8%.

Frequency response was checked in the AM narrow and wide modes.

	50 Hz	75 Hz	100 Hz	250 Hz	500 Hz	1 kHz	1.5 kHz	2.5 kHz	3 kHz
Wide	-9 dB	-3.5 dB	-2 dB	+1 dB	+2 dB	0 dB	-1 dB	-5 dB	-8 dB
Narrow	-9 dB	-3.5 dB	-2 dB	+1 dB	+2 dB	0 dB	-2.5 dB	-15 dB	-20 dB

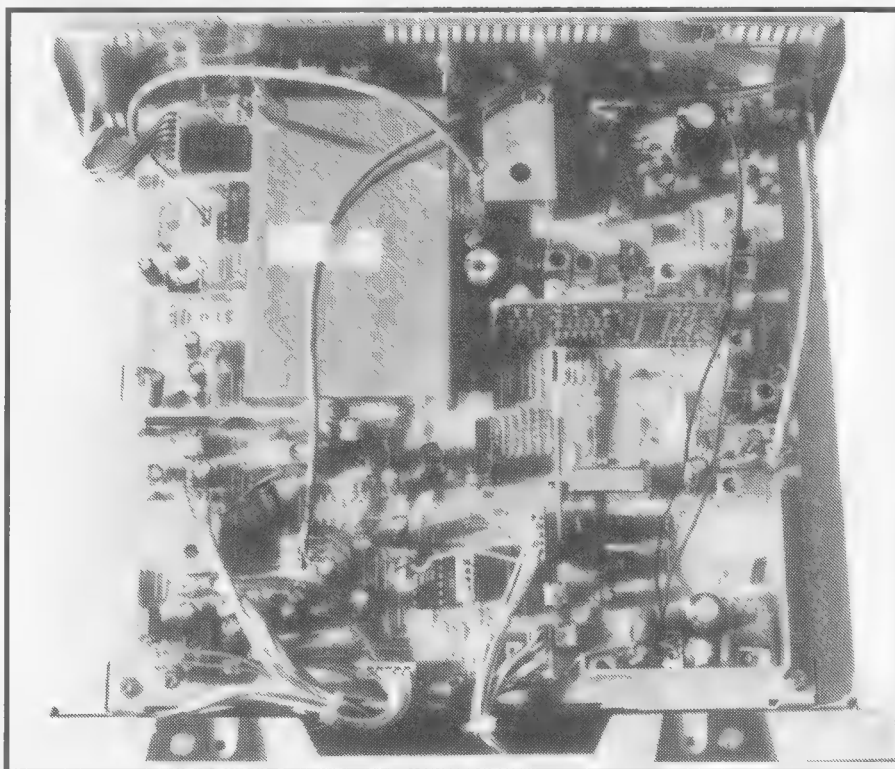
Receiver stability was checked over a long period of time and was found to be within 50 Hz of nominal at worst. Calibration of the readout was also within the above limits. This is excellent but can be improved by a factor of ten by fitting the optional high stability master oscillator, the TCXO-4.

Image and IF rejection were both excellent, all being better than -70 dB which is about the limit of my measuring equipment. Current drain at 13.8 volts was measured at 0.85

amps with no audio output and 1.2 amps at full audio output. A power supply of at least 1.5 amps output continuous would be needed to operate the receiver. The clock accuracy was checked over a three week period and was found to have gained two and a half minutes, not a very good result.

Over all, these figures are very good for a receiver in this price class. The SSB selectivity is a bit on the wide side and reflects on the low priced ceramic filters used in the 455 kHz IF. Much could be said for the AM selectivity; however, for general listening they are both quite adequate. Received audio quality is excellent in the SSB mode and good for AM. A better detector for AM with reduced distortion could make a worthwhile improvement. The internal speaker produced fairly good quality but a good external unit makes a startling improvement. Tuning ergonomics are excellent and the memory facilities should please everyone.

As delivered the receiver tunes down to 100 kHz not to 50 kHz as specified. Coverage down to 50 kHz can be enabled by pressing SSB and FM and then turning the power on. I



The FRG-100 with the top cover removed.

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could find no mention of this facility in the instruction book.

The FRG-100 Instruction Manual

Yaesu instruction manuals are certainly setting the standards these days. The presentation is first class and all operating parameters are fully covered. Of the thirty nine pages, fully five are devoted to computer control. Unfortunately, Yaesu do not offer a computer control program as an option. They state that, "owing to the variety of incompatible computers used by our customers", they cannot offer programs. I believe that Dick Smith staff have produced programs for some of the later Yaesu transceivers; maybe they will work up something for the FRG-100. While no technical data is included in the manual, apart from the specification, a full circuit diagram is included.

Conclusions

By the time you read this, supplies of the FRG-100 should be available from Dick Smith outlets. If they can maintain the price at \$999 with our rather sick dollar then this will represent excellent value. However, keep in mind, you will need a suitable power supply. The most suitable in the Dick Smith catalogue is the M9545 which is rated at 1.5 amps output and costs \$84.95.

The FRG-100 has an excellent combination of facilities. It has excellent sensitivity, adequate selectivity and very high stability. It's all put together in an attractive package. Sure you can spend more and get better performance in perhaps one area or another but not much relative to what you will have to spend.

Our review receiver was loaned by Dick Smith Electronics and all enquiries should be directed to their store nearest to you.

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