

# THE FL-50 S.S.B. TRANSMITTER

## INTRODUCTION

During the past ten years or so Australia has seen the introduction of commercial Amateur equipment being handled in quantity by agents. This has aided an increase in the use of commercially manufactured equipment by Australian Amateurs. Equipment is available from various countries of manufacture, there being several competing with one another.

A relative newcomer to the Australian market, but no newcomer to Amateur equipment design and manufacture is the Japanese Yaesu Musen Company (pronounced Yayso Mosen), whose Australian agent is Bail Electronic Services.

Yaesu Musen manufacture Amateur Radio equipment exclusively and they have a wide range of equipment with different capabilities and functions. The equipment reviewed here is one of their lower-cost lines meant for the Amateur on a low budget.

Several units of the FL-50 were made available by the agent. This was done to enable comparisons to be made between the performances of individual units. The FL-50 has been made to compete with the low cost market and sells at \$225 including sales tax. A matching v.f.o., the FV-50, is available for full band coverage.

## GENERAL DESCRIPTION

As with most equipment, facilities and complexity are directly proportional to price. Thus some facilities that are incorporated in higher priced equipment are not included in this design. An internal v.f.o., v.o.x. and selectable sidebands are not incorporated features of this model. The power capability is also less than higher priced models. But nothing else, it seems, has been sacrificed to lower the price. The rest of the review will affirm this.

The FL-50 is a complete, five-band transmitter for s.s.b., c.w. and a.m. The transmitter has an internal v.x.o. which allows approximately 10 Kc. shift. Crystals are extra by order. The power input to the final is nominally 50w. (d.c.). Sideband generation is by the filter method using a five-crystal lattice filter on 5173.9 Kc. and a carrier crystal on 5172.4 Kc. This gives u.s.b. output. The correct sideband for the band in use is automatically selected by the proper heterodyne frequency in the v.x.o. or external v.f.o. (See block diagram.)

A calibrated meter (and switch) enables the cathode current of the p.a. to be read as well as r.f. output (from diode detector).

Transmitter control is normally p.t.t. via suitable push-button microphone. There is provision on the chassis for including v.o.x. circuitry if so desired.

Internal a.l.c. is taken from the p.a. and applied to the 5 Mc. amplifier (see block diagram). The p.a. uses a single 6JS6A tube.

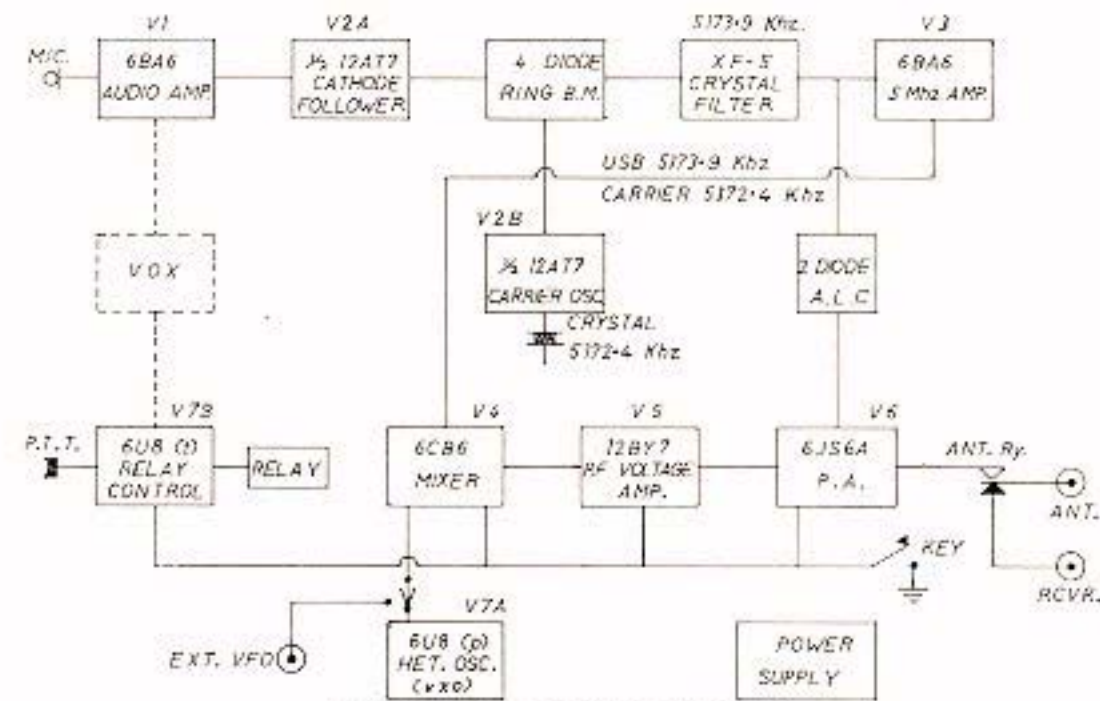
The carrier level control is a front panel control which enables carrier to be re-inserted at the grid of the 5 Mc. amplifier. Thus the level of carrier can be set to any desired level for tuning, and for a.m. or c.w. operation. Straight or break-in operation is available for c.w. work.

The rear apron has sockets for antenna (SO239) and receiver control, switched by an internal antenna (c/o) relay. Also sockets for FV-50 power and r.f. leads are mounted on rear chassis. The p.a. bias adjustment pot. is also on the rear apron.

gives a 0.005% stability figure but if crystals of greater stability are used (i.e. 0.001%) then this is achieved.

The output frequency of the crystal oscillator, and thus the transmitter, varied slightly between individual units. This was attributed to the fact that different 6U8A tubes have different input capacities coupled with different stray (wiring) capacitance in the different units. It was rarely more than 5 Kc. from the marked crystal frequency.

A socket on the front panel facilitates changing of crystals. A switch next to



BLOCK DIAGRAM OF FL-50 TRANSMITTER

CRYSTAL OR V.F.O. RANGE		POWER SUPPLY	
3.5 Mc Band	8,672.4 Kc. to 9,767.4 Kc.	High Voltage	Plus 500V.
7	12,172.4 .. 12,272.4 ..	Low Voltage	Plus 250V.
14	9,927.6 .. 9,177.6 ..	Regulated	Plus 150V.
21	15,927.6 .. 16,277.6 ..	Regulated	Minus 100V.
28	22,927.6 .. 24,527.6 ..		

## HANDBOOK TECHNICAL SPECIFICATIONS

Type of Emission: c.w., a.m. and s.s.b. (l.s.b. on 80 and 40 metres, and u.s.b. on 20, 15 and 10 metres).

Operation: Push to talk.

Power input: 50w. d.c.

Output Impedance: 50 to 120 ohms.

Frequency Range: 3.5-3.8 Mc., 7-7.5 Mc., 14-14.5 Mc., 21-21.5 Mc., 28-30 Mc.

Frequency Stability within 0.005%.

Carrier Suppression: -50 db.

Sideband Suppression: -50 db.

Distortion Products: -30 db.

Audio Response: 300 to 2,700 c.p.s., ripple within  $\pm 3$  db.

Power Requirement: a.c. 100/110/117/200/220/234v., 50/60 c.p.s., approx. 100 vA.

Cabinet Size: 6" x 13" x 10 $\frac{1}{2}$ ".

Net Weight: 23 lbs.

## V.X.O.

The stability of the crystal used is the main factor here. The handbook

this socket enables an external v.f.o. to be switched in.

The shift attainable with ordinary HC6/U crystals is generally around 10 Kc. A variable capacitor coupled to a large hand-span knob on the front panel facilitates this. Special low capacity crystals are obtainable which enables the frequency to be pulled 20 to 50 Kc. They have to be "tailor-made" though for individual units for reasons given above.

## CARRIER AND UNWANTED SIDEBAND SUPPRESSION

One unit was checked, on 21 Mc., and the following figures obtained relative to full power output.

Carrier Suppression:

Switch on, -58 db.

After 15 minutes, -63 db.

Unwanted Sideband:

Switch on, -50 db.

After 15 minutes, -50 db.

The carrier suppression on other units was as good as or only slightly degraded (6-8 db.) from these figures.

The unwanted sideband suppression was as good as this, with minor fluctuations, for other units.

Carrier suppression was measured relative to full power output with audio applied. The carrier suppression was degraded about 4-5 db. with two-tone signal applied.

These figures are very good and show that the handbook specifications are somewhat conservative.

Many higher priced transmitters do not claim or attain these figures for carrier and unwanted sideband suppression.

#### DISTORTION PRODUCTS

All distortion products were more than 36 db. below full output on two-tone test signal. This is very good.

#### R.F. POWER OUTPUT

The following figures are an average for the units measured:—

80 Metres	62 Watts
40 "	64 "
20 "	62 "
15 "	57 "
10 "	56 "

Average p.e.p. output = 60.2 watts.

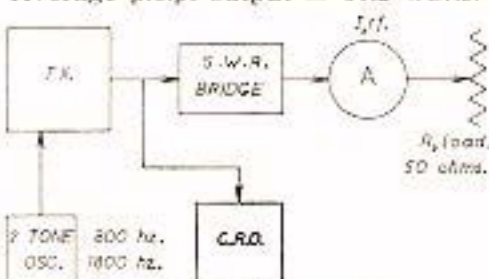


Fig. 1.—Power Measurements.

The single 6JS6A p.a. appears to be doing a good job. It appears to be operating in class AB2 and measurements indicate that the anode efficiency is around 60 to 65%.

This indicates a well-designed p.a. and efficiently constructed tank circuit.

Power output was measured as shown in Fig. 1.

The method used was:

- (1) Transmitter tuned up as per the handbook.
- (2) Two-tone oscillator then applied.
- (3) Tuning touched up.
- (4) Two-tone level adjusted so that pattern on c.r.o. is not quite flat-topping.
- (5) Measurement of  $I_{AV}$  then taken.
- (6) Calculate  $P_m$ :  
$$P_m = I_{AV}^2 \times R_L$$
- (7) Calculate p.e.p.:  
$$\text{p.e.p. out} = 2 P_m$$

#### OVERALL FREQUENCY RESPONSE

This was measured by applying an accurate audio oscillator to the mic. input and setting the transmitter to maximum output with a 1 Kc. signal applied to the audio. The output of the transmitter was then measured and subsequent readings referred to this.

The results are shown in Graph 1 for one unit that was measured. It can be seen that the response "rolls off" a little sooner than expected on the low frequency side as the -3 db. point is at 650 c.p.s. rather than around 300 c.p.s. as mentioned in the handbook specifications. This may be owing to the carrier crystal being a little low in frequency.

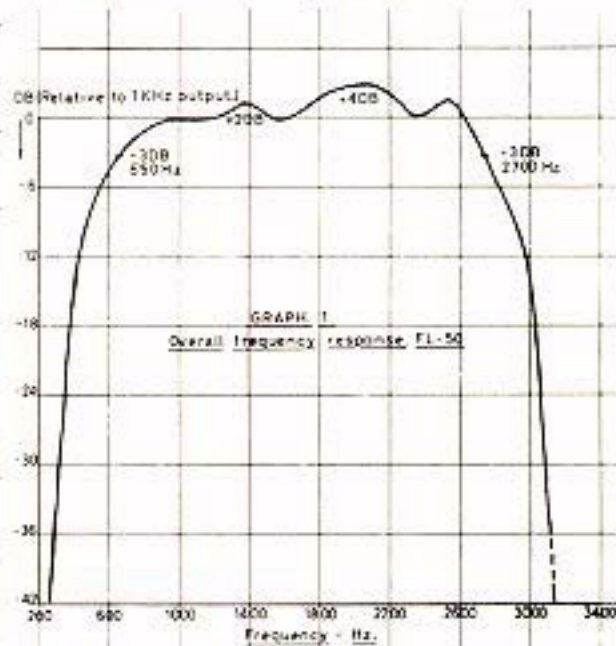
The upper -3 db. point is at 2700 c.p.s. as per the handbook.

The ripple is well within -3 db. as mentioned in the handbook specifica-

tions (i.e. 6 db. peak-to-trough). In this case, the ripple is only 4 db. peak-to-trough or  $\pm 2$  db. ripple.

The bandwidth is a little narrower than expected, but is nevertheless very good. On-the-air reports give "good quality", "easy to resolve" to "excellent".

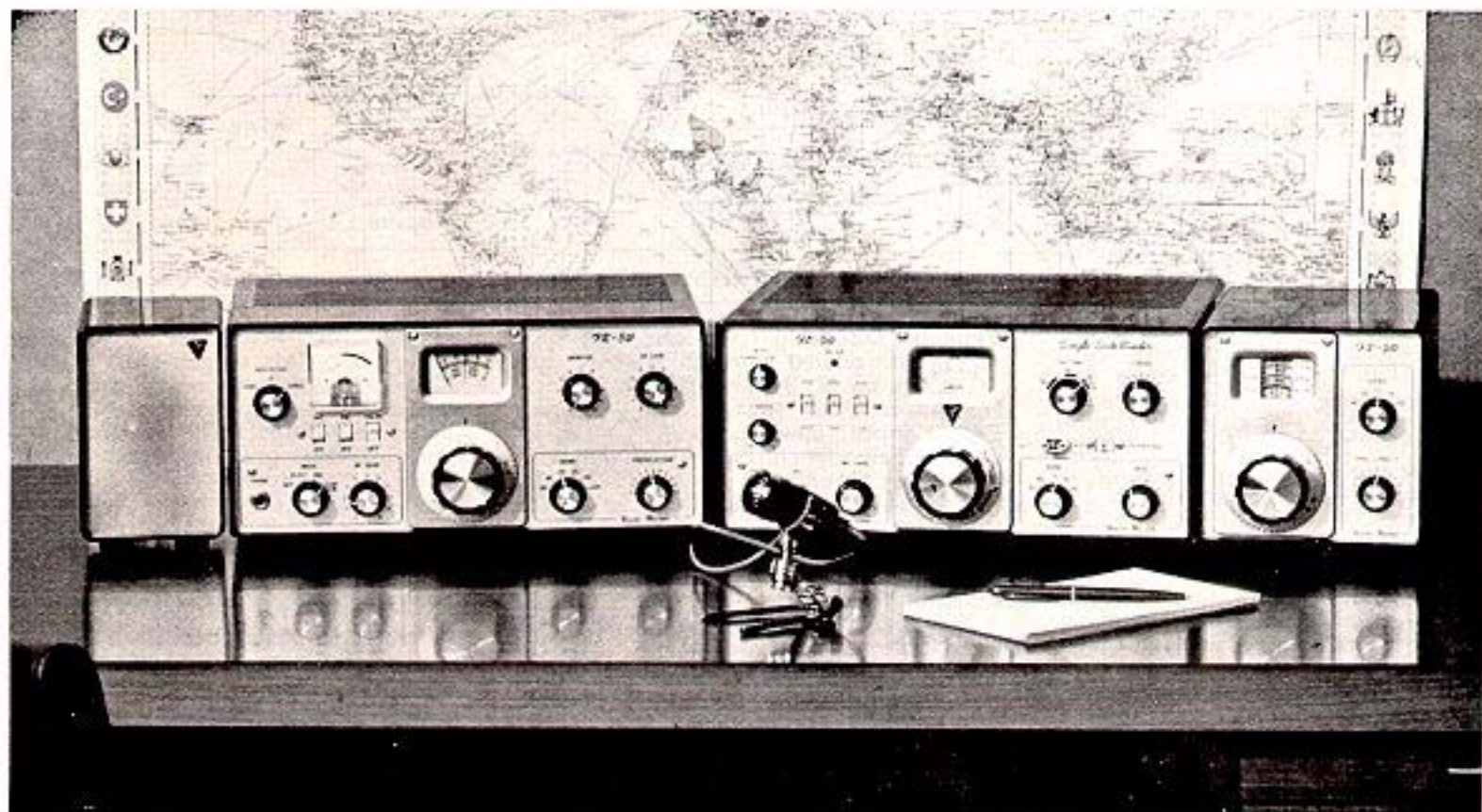
These results indicate a well designed and constructed crystal filter.



#### T.V.I.

It appears that this little rig does not radiate spurious signals which are sufficiently strong to cause t.v.i.! Need I say more?

The FL-50 is a straightforward, single conversion design and, as such, reduces the possibilities of spurious output signals to a minimum.



The Yaesu Musen "50" Series (left to right): SP-50 Speaker, FR-50 Receiver, FL-50 Transmitter, and FV-50 VFO.