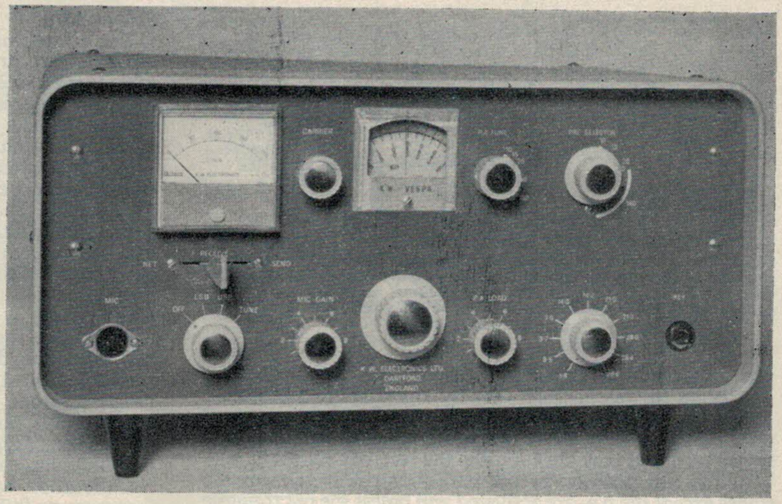
Review

THE KW ELECTRONICS VESPA S.S.B. TRANSMITTER



Reviewed by B. D. A. Armstrong, G3EDD*

KW Electronics Ltd. is a company which has gained recognition in a world Amateur Radio market. Its products can be heard on the air on all the h.f. bands.

A new equipment recently announced by KW Electronics is the Vespa s.s.b. transmitter and one has been loaned to the Society by the manufacturer for review. The Vespa is similar to the transmitter portion of the KW2000 transceiver and at a cursory glance could be mistaken for it. The front panel layout is in fact almost identical to the KW2000.

A block diagram of the Vespa is shown in Fig. 1. The 455 kc/s filter is a mechanical type manufactured by Kokusai.

The circuit of the Vespa is of the double mixing type in which the s.s.b. signal at 455 kc/s is first mixed with a 2·5-2·7 Mc/s signal from the v.f.o. and then with the output of a crystal controlled oscillator to produce the correct carrier frequency. Since only 200 kc/s segments are covered, a number of crystals are required to give full coverage of all the amateur bands. KW Electronics have decided to limit themselves to 11 second oscillator crystals, with the result that portions of the 15 and 10m bands are not covered.

Mechanically, the Vespa is lightweight and almost entirely of aluminium. The power supply unit is separate and is enclosed in what is termed on the leaflet as a light weight cover. The cover of the unit submitted for review was in fact thick cardboard which looked most out of place. The leaflet, perhaps sensing this, suggests that the power unit can be kept out of sight under the operating table. There are only two catches to this. First, the interconnecting cable is very short, and secondly the low power switch for legal operation on 160m is mounted on the power unit.

Unfortunately KW were not able to supply a proper handbook at the time. In lieu of this, provisional operating instructions, a sales leaflet and a circuit were supplied. The technical information was thus embryonic to say the least. A note in the provisional instructions did promise the proper handbook when available.

The circuit was inaccurate and had no component values. There was no circuit for the power unit. It would not be easy to fault-find and it is to be hoped that KW issue a good handbook without delay.

After this review was written, the proper handbook was sent by KW. The new handbook contains plenty of information so servicing and alignment should now present no problem. Values have now been added to almost all components on the circuit, but again no power supply diagram was included. Most of the circuit errors have been removed.

The handbook text is presented on duplicated sheets and the layout diagrams are crude. However, technically, the handbook is good.

The heater circuit, no doubt with mobile operation and voltage drop in mind, is arranged for 12 volts. Examination of the heater network showed that in theory there was slight unbalance and the two dial lights were used in parallel to assist balance. This is bad practice since the life of a dial light is notoriously bad.

Neither the main unit nor the power unit had any component identification on the chassis. This made it very difficult to follow the already unhelpful circuit. None of the fuses on the power unit are marked with function or value and the correct position of the low power switch for 160m operation had to be found by experiment.

The main dial and band change were marked in frequency but the drive and p.a. tuning controls were marked in wavelength.

The operating instructions quite rightly recommend that the main unit is soundly connected to ground. There

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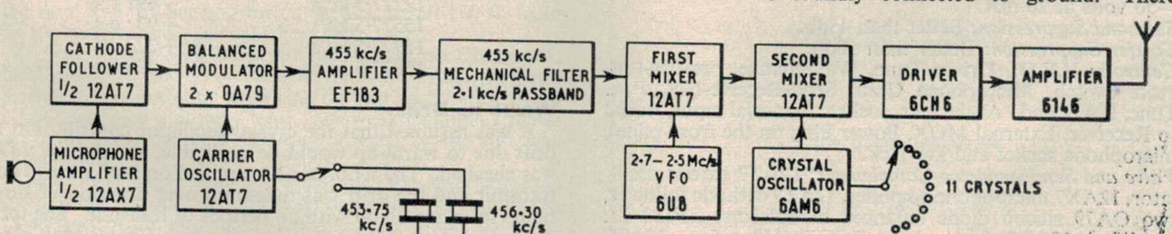

Fig. 1. Block diagram of the KW Vespa

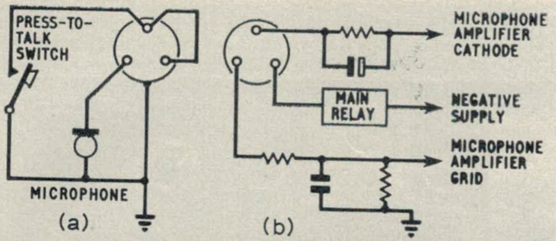

Fig. 2. The transmit-receive switching in the KW2000 makes special provision for avoiding feedback while netting. When the press-to-talk switch (a) is left off, the microphone amplifier cathode is connected to the negative supply via the relay coil, thus biasing the stage to cut-off.

was, however, no grounding lug on the chassis or case.

A point to watch, when making any internal adjustment or repairs, is that in the standby condition h.t. is present on all stages. A negative voltage is applied to all the r.f. stages such that they are cut off in the receive condition.

In the NET position of the main control switch, all the stages except the p.a. are activated and unless the microphone is disconnected, feedback will occur. KW overcome this problem in a method that is worthy of note—see Fig. 2. The negative relay switching supply from the " cold " side of the relay is connected to the microphone amplifier cathode thus biasing the stage to cut off. The press-to-talk switch connects both to earth. In the Vespa ripple from the relay supply was induced into the microphone amplifier due to common impedance coupling. Although this is effectively attenuated by the sideband filter, it could cause cross modulation of speech and thus the purist may prefer to use a double pole press-to-talk (PTT) switch.

No microphone is supplied and there is little help in the handbook to decide what type to use. The microphone used for the tests was an e.m. type with a mean output of about 30mV on close talking.

MANUFACTURER'S TECHNICAL SPECIFICATION

Bands covered: 1·8-2·0, 3·5-3·7, 3·7-3·9, 7·0-7·2, 14·0-14·2, 14·2-14·4, 21·0-21·2, 21·3-21·5, 28·0-28·2, 28·4-28·6, 28·6-28·8 Mc/s.
Physical Dimensions: Transmitter—13¾ in. × 5⅞ in. × 10½ in. deep (cabinet maximum dimensions); A.c. power supply —8 in. × 5⅞ in. × 10½ in.
Weight: Transmitter—18 lb. approx.; A.c. p.s.u.—25 lb.
Microphone Input: High impedance; three pin socket for press-to-talk switch.
Power Input: S.S.B. 90 watts p.e.p.; C.W. 75 watts; A.M. 45 watts.
Power Supply: 200-250 volts or 105-250 volts a.c., 45-65 c/s.
Power Requirements: 12 volts at 2·5A, 700 volts at 120 mA (average), 200 volts at 150 mA, —90 volts at 20 mA, —20 to —50 volts at 20 mA.
Sideband Suppression: Better than 45db.
Carrier Suppression: Better than 50db.
Controls: V.F.O., Driver Tune, Wavechange, OFF-USB-LSB-TUNE Switch, Microphone Gain, Send-Receive-Net, P.A. Tune, P.A. Load. At the rear, sockets for aerial input, Aerial to Receiver, External MOX, Power Plug on the front panel, microphone socket and key jack.
Valve and Semiconductor Complement: 12AT7 carrier oscillator, 12AX7 microphone amplifier, 12AT7 cathode follower, two OA79 silicon diode balanced modulators, EF183 i.f. amplifier, 12AT7 first mixer, ECF82/6U8 v.f.o., 12AT7 second mixer, 6AM6 crystal oscillator, 6CH6 driver, 6146 p.a.
Price: £110. Power supply extra at £25.

Power Unit

The power unit is compact and full use is made of silicon diodes. Two transformers are used with mains tapping sockets for 200/210, 220/230 and 240/250 volts. The lack of a 110 volts range is rather surprising in view of KW's success in the export field. The multicore interconnecting lead, terminated in a Painton 159 series plug was only 27 in. long. The three core power lead was 5 ft. long. A possible source of trouble is the use of two 450 volts electrolytics in series across the main h.t. The balancing resistors are rather a high value: 330K/ohms. In the unit under test one of the electrolytics had 430 volts across it in the standby condition, with 240 volts a.c. applied to the 240/250 volt tap.

Calibration

The dial is mounted directly on the v.f.o. capacitor shaft and is calibrated 0-200 kc/s in 2 kc/s divisions. The cursor was well spaced from the dial, and it was difficult to avoid parallax errors. Cord drive is used from the main tuning control shaft, but in the event of breakage calibration would not be lost. Repair would necessitate removal of the v.f.o. assembly, but this is not a very onerous task.

Calibration error of the v.f.o. was measured at v.f.o. frequency as follows:

Scale reading	*Error—c/s*
0	−712
50	−577
100	−2344
150	−2196
200	−847

During the calibration tests on the unit concerned it was found that there was a random error of frequency at a given setting. This could not be entirely accounted for by backlash or setting errors. It may have been caused by poor bearings in the tuning capacitor. The scatter of frequencies measured by trying to set the dial to the same point several times was within 1 kc/s. This is not serious.

For the above readings the function switch was on u.s.b. On l.s.b. the carrier oscillator frequency is shifted to the other side of the sideband filter. In order to compensate for this, the v.f.o. frequency is automatically shifted by a relay which shorts out a coupling coil. The off-set was not quite correct but the error was fairly small; 80 c/s at one end of the v.f.o. range and 100 c/s at the other.

Altering the mains supply voltage by ±10 per cent resulted in a frequency change of about 40 c/s.

The frequency of all the crystals was measured and the errors recorded.

Crystal Frequency	*Error*
453·75 kc/s	+13 c/s
456·30 kc/s	+6 c/s
4955·0 kc/s	+230 c/s
6655·0 kc/s	+465 c/s
6855·0 kc/s	+571 c/s
10156·0 kc/s	−369 c/s
8577·5 kc/s	+269 c/s
8677·5 kc/s	+334 c/s
12077·5 kc/s	+514 c/s
12227·5 kc/s	+691 c/s
15577·5 kc/s	+93 c/s
15777·5 kc/s	+272 c/s
15877·5 kc/s	+458 c/s

Warm-up Drift

It was assumed that the crystal oscillator contribution to drift due to warm-up would be negligible, so only the v.f.o. was checked. The v.f.o. has h.t. applied on both receive and transmit and the drift was measured over a period of three hours from switch on with no periods of transmit. The total drift was about 800 c/s positive, of which 500 c/s took place in the first 15 minutes. During the last two hours the v.f.o. drifted just over 100 c/s positive.

Power Output

The power output of an s.s.b. transmitter for professional use is normally quoted in relation to the intermodulation products. For instance, a transmitter may give 50 watts at an intermodulation product level of 30db, but at 20db the power output could be 150 watts. In this case it was decided to set up the input power to that which is likely to be obtained from following the recommended tuning procedure.

The method of test was to feed two tones (650 c/s and 1 kc/s) into the microphone input. The transmitter was terminated in a calibrated wattmeter and an h.f. spectrum analyser was coupled into the load. The audio input was adjusted until the p.a. cathode current was 100mA (70 watts input). The intermodulation products and the power output were recorded. This power indication is a mean level and must be doubled to obtain the peak envelope power. The p.e.p. obtained in this manner is accurate within a small percentage provided the linearity is good.

The following are the results of these measurements:

Frequency	*I.P. Level*	*P.E.P. Output*
1·8 Mc/s	24db	8 watts (loaded to 50mA)
3·5 Mc/s	24db	54 watts
7·0 Mc/s	18db	44 watts
14·0 Mc/s	26db	50 watts
21·0 Mc/s	25db	48 watts
28·0 Mc/s	26db	46 watts

Slight tuning adjustments made a difference to the intermodulation products and power output so that these results were not very repeatable, but this is typical of s.s.b. transmitters. In order to get the best possible settings for compromise between power output and intermodulation products in almost any s.s.b. transmitter, it is necessary to tune up with a spectrum analyser coupled in. The above results were obtained by " fiddling " for best power output rather than for best intermodulation products and consequently are considered quite good.

In changing from band to band the p.a. oscillated on several occasions, but showed no sign of regeneration if the controls were first set to the approximate positions indicated on the front panel.

A.M. Facility

The maker's recommended tuning procedure for a.m. operation suggests that the correct gain settings for this mode are best found by monitoring with a receiver. They are quite correct as the settings for carrier level and microphone are critical.

Spurious Emissions

Any transmitter will radiate frequencies other than the wanted: they may be harmonics of the carrier frequency or related to the internal oscillators or intermodulation products of both. It is very often these sorts of emissions which give rise to TVI.

The transmitter was tested at a location where Channels 1, 5, 6 and 11 were available, but none of these channels were at any great strength. Tests were carried out with the transmitter operating on 7, 14, 21, and 28 Mc/s both into a dummy load next to a TV set and into a vertical aerial 150 ft. from the TV aerials. No external filters were used.

The only trouble encountered was in fact on Channel 1. Slight picture break-up on speech peaks occurred on 21 and 28 Mc/s when radiating on an aerial and oddly enough on 14 Mc/s when on a dummy load. The weak Channel 1 signal was being received on a Channel 5 aerial so the test was rather severe.

These tests show that provided the TV installation is satisfactory, and operated in the service area, TVI is unlikely.

The level of the unwanted sideband signals was measured on a spectrum analyser during the power output test. It was better than −50db.

Carrier suppression was also measured during the power output measurement, and a spectrum analyser was used. Since the sideband filter is used to help reject the carrier, measurements were made on both sidebands. It was well within the claim of 50db provided modulation was not present. However, it was noticed that when modulation was applied the carrier level rose by at least 20db, presumably because audio was unbalancing the modulator.

A.F. Response

The overall audio response was measured by varying the frequency of an audio generator fed into microphone input and recording the r.f. power output.

Audio Frequency	*Rel. to 1 kc/s*	
	U.S.B.	*L.S.B.*
300 c/s	−5·8db	−5·8db
600 c/s	−0·6db	−0·6db
1500 c/s	−1db	−2·3db
2000 c/s	−3·5db	−5·4db

Immediately above 2 kc/s the response fell off very steeply. The slight asymmetry was probably due to a corresponding asymmetry in the sideband filter. No pass-band ripple was detected during this test.

On-the-Air Tests

What really matters to any prospective buyer is what happens when the Vespa is used. In between the measurements with test gear many contacts were obtained on 14 and 21 Mc/s with indifferent (but well matched) aerials. The Vespa was easy to use and brought several unsolicited comments on the good speech quality. No electrical failures occurred, but several of the tuning knobs started to crack either side of the Allen screw holes.

The spring loaded net switch brought two comments from operators. First, on the lower bands it was necessary to insert carrier to obtain an audible beat in the associated receiver, thus making netting a three-handed affair. Secondly, if the switch paddle was suddenly released, it would fly over through the receive position to the transmit position!

The Guarantee

The KW Vespa is guaranteed for 12 months from date of purchase by the original purchaser. The guarantee is not transferable to another user. KW Electronics or the dealer reserve the right to charge for labour, handling expenses and return carriage; the customer has to pay for carriage to the works. In the event of trouble, the purchaser would be wise therefore to send a letter in the first instance. Valves have only the normal three months guarantee with the usual proviso regarding misuse.

RSGB QSL BUREAU

WILL BE CLOSED

3 MAY to 23 MAY, 1966

Both dates inclusive

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