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The KW Electronics KW2000A

AFTER reviewing a series of imported equipment it was a pleasant change to receive an equipment from a British manufacturer, KW Electronics Ltd. of Heath Street, Dartford, Kent. The KW2000A s.s.b./c.w. transceiver has been in production for several years, and enjoys an international reputation; in fact, it is almost a rare event to listen to the h.f. bands for very long without hearing a station using one. The price complete with separate a.c. power supply is £220, and for £40 a 12 volt d.c. power unit is also available, but this was not submitted for review. The input voltage polarity must, incidentally, be stated when ordering.

General Description

The KW2000A is probably the only popular h.f. transceiver which incorporates the 160m band. The other bands which are covered are 80m through 10m, but on the higher frequency bands, full coverage is not provided, portions missing being 21·2–21·3 Mc/s, 28·2–28·4 Mc/s and 28·8–29·7 Mc/s. The reason for this is the use of a 200 kc/s tuning range which necessitates a large number of first oscillator crystals, and so low cost switches limit this number to eleven.

The receiver is a double superhet with crystal controlled first mixer, and the arrangement is almost identical to the Collins KWM2. The first i.f. is broadband to cover 2·955–3·155 Mc/s and the v.f.o. covers 2·500–2·700 Mc/s to give the 455 kc/s second i.f. The main selectivity is provided by a Kokusai mechanical filter.

*Member of RSGB Technical Committee.

The transmitter is conventional and the final amplifier is a pair of 6146 valves in parallel. A.l.c. is provided and is taken from the rectified final grid r.f. voltage and fed to the 455 kc/s i.f. amplifier. Both upper and lower sideband operation is provided, but no provision is made for carrier insertion.

The v.f.o. dial is calibrated at 1 kc/s intervals and the tuning knob skirt has 14 marks. The tuning rate is approximately 13 kc/s per turn. Calibration is accomplished by moving the tuning dial cursor to the required position.

VOX with anti-trip is fitted and is also used to key the transmitter on c.w. when fed from a keyed internal audio oscillator.

A 100 kc/s crystal calibrator is supplied as standard.

The valve heater circuit is a series parallel arrangement with the exception of the v.f.o. and h.f. crystal oscillator heaters which are fed from a separate line via a series resistor in the power supply.

The rear apron of the transceiver has two coaxial TV type aerial sockets, one for a separate receiver aerial if required and the other for a common aerial. Also on the rear apron is an octal socket which contains connections for external MOX, a key, external loudspeaker (in addition to that on the 15 way p.s.u. interconnection socket) and a pair of contacts on the VOX relay which are made on transmit. It is surprising that there is no conventional jack socket for a Morse key—a sign of the times?

Perforated aluminium is used for the main case. The chassis is also aluminium.

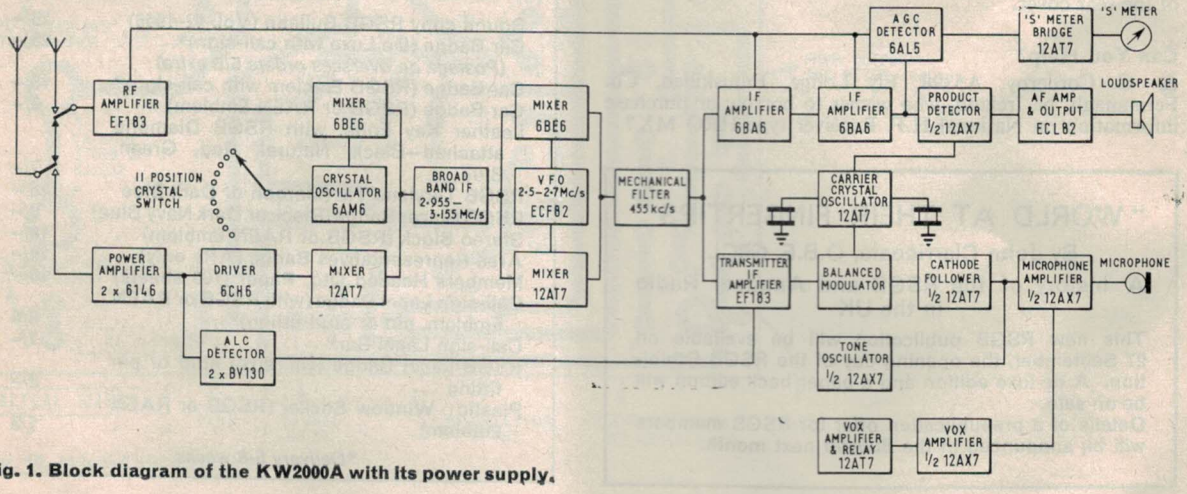
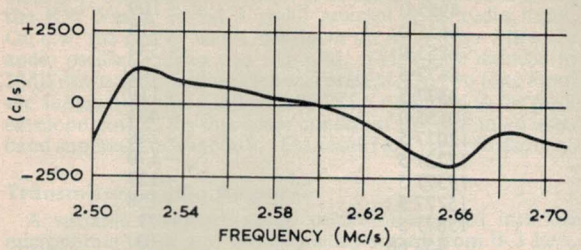


Fig. 1. Block diagram of the KW2000A with its power supply.

THE TESTS

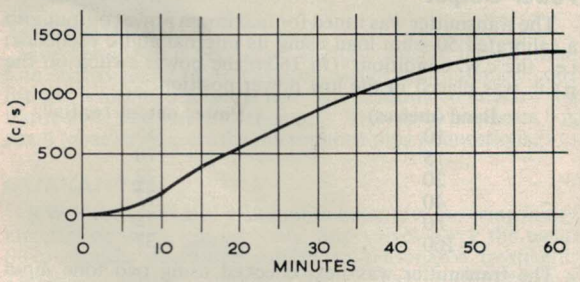
V.F.O.



Nominal Frequency Mc/s	Error (c/s)	Linearity reference Mid-scale (c/s)
2·500	−1105	−1269
2·520	+1356	+1192
2·540	+848	+684
2·560	+768	+604
2·580	−117	+281
2·600	+164	0
2·620	−364	−528
2·640	−1345	−1509
2·660	−1881	−2045
2·680	−756	−920
2·700	−1125	−1289

Before this test was run the scale cursor was aligned by using the crystal calibrator at 2·600 Mc/s. The error of +164 c/s at mid-scale can be accounted for by the combination of resettability performance and first crystal frequency error since the 100 kc/s calibrator harmonic is injected at the aerial terminal. The linearity was adequate but not as good as might be expected over such a small tuning range. Backlash and resettability were measured as in previous reviews and were both about 300 c/s. On switching from upper sideband to lower sideband the v.f.o. frequency has to be offset by the difference in frequency between the carrier crystals (2·71 kc/s), and this is done by shorting a coupling winding on the v.f.o. inductance with a small relay. The offset was measured at both ends of the v.f.o. range: at 2·5 Mc/s it was 2583 c/s and at 2·7 Mc/s, 2787 c/s. The effect of the INDEPENDENT RECEIVER TUNE CONTROL was to pull the frequency by +5066 c/s and −7675 c/s. This control can be switched to pull the transmit frequency (ITT), or both together (IRTT)—an unusual feature. The final v.f.o. test was drift from switch on.

The results are as follows:



Elapsed time from cold start	Frequency drift
1 minute	+26 c/s
2 ,,	+33 c/s
5 ,,	+44 c/s
10 ,,	+176 c/s
15 ,,	+405 c/s
30 ,,	+848 c/s
45 ,,	+1234 c/s
60 ,,	+1369 c/s

Stability was reached in just over 45 minutes.

TECHNICAL SPECIFICATION—KW2000A

GENERAL

Mode	Single sideband suppressed carrier (A3J) and c.w. (A1)
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
Ambient Temperature Range	−10°C to +40°C
V.F.O. Stability	With constant input voltage to p.s.u., better than 200 c/s after warm-up period of 30 minutes
Independent Receiver/Transmitter Tuning	±6 kc/s from v.f.o. setting
Power requirements	Fixed station 200–250 volts, 45–65 c/s Mobile station 12·6 volts d.c. nominal
Power Consumption	(**Fixed Station**) approximately 320 watts on transmit
Current Drain	(**Mobile**) 10 amps receive; 10–28 amps transmit

DIMENSIONS IN CABINET

Transceiver	6¼ in. high; 13⅞ in. wide; 13½ in. deep
A.C. Power Unit	6¼ in. high; 7⅜ in. wide; 13 in. deep
12V D.C. Power Unit	5¼ in. high; 4⅝ in. wide; 8 in. deep

WEIGHTS

Transceiver	18 lb approximately
A.C. Power Unit	24 lb approximately
12V D.C. Power Unit	6½ lb approximately

RECEIVER

Reception modes	(i) S.s.b. (either sideband selectable) (ii) A.m. (exalted carrier either sideband) (iii) C.w.
Input Impedance	50/75 ohms
Sensitivity	Better than 1μV for 500 mW output
Signal-to-Noise Ratio	Better than 15db signal plus noise-to-noise ratio at 1μV input
Output Impedance	3 ohms
Selectivity	Nominal 2·4 kc/s at 6dB better than 5 kc/s at 60dB
A.F. Output	1·5 watts
Spurious	Less than 1μV equivalent aerial signal.

TRANSMITTER

Emission	S.s.b. (either sideband selectable); c.w. (break-in keying)
Type of Service	S.s.b.—continuous; c.w.—50 per cent duty cycle
Carrier Suppression	50dB down relative to maximum output
Unwanted Sideband	45dB down relative to maximum output
Mic. Input	High impedance
Audio response	300–2600 c/s ±6dB
Output Impedance	20–300 ohms approximately on all bands
Anode Power Input	180 watts p.e.p. on s.s.b. 150 watts on c.w.
Keying	Break-in
Second Harmonic	40dB down from output signal
Third Order Distortion	30 dB down from output signal

RECEIVER

Signal-to-Noise Ratio

The signal-to-noise ratio was measured at 1μV p.d. input. The results were good and consistent varying from 22dB on 40m to 27dB on 15m.

Sensitivity and Audio Output

The claimed sensitivity of better than 500 mW with 1μV input was very conservative on the equipment tested. On

all bands more than 2 watts was measured. At the claimed a.f. output of 1·5 watts distortion was negligible and overload started to commence at 2·5 watts.

Strong Unwanted Signal Handling

Blocking was checked by using two signal generators. One was set to the receiver tune frequency at such a level to give 14dB signal-to-noise ratio. The second signal generator was set 20 kc/s from the receiver tune frequency and its level increased until the signal-to-noise ratio was degraded by 3dB. The unwanted signal was between +74 and +92dB, according to band, for blocking to take place. These results are excellent particularly in view of the high overall available gain.

Intermodulation was measured by feeding in two strong signals 10 kc/s apart on the 10m band and looking for an intermodulation product 10 kc/s above the upper frequency signal and 10dB below the lower frequency signal. The unwanted signals were in excess of S9 + 40 (+50dB) before the S meter would move off the stop. This is good.

A.G.C.

The a.g.c. was checked on 14·3 Mc/s with the following results:

Signal Input Relative to 1μV P.D.	Audio Output Rel. to Test Level at 1μV P.D.
+20dB	+4dB
+40dB	+7dB
+60dB	+12dB
+80dB	+15dB

This performance, although not as good as the best of the equipments previously reviewed, is adequate.

The S Meter

The handbook gives 50μV input for S9 and states that a figure of 6dB per S point can be taken as correct for all practical purposes.

An S meter setting control is provided so that the S meter is set to zero with the aerial terminal shorted to ground. This control was not touched for the test.

Measurements on 14 Mc/s showed the following:

Meter Reading	dB rel. to 1μV P.D.
Standing reading S2·5	
S3	+2
S4	+6
S5	+10
S6	+15
S7	+19
S8	+24
S9	+29
S9 + 20	+50
S9 + 40	+60

The variation with band showed:

Frequency	dB relative to 1μV P.D. to show S9
1·8 Mc/s	+27
3·5 Mc/s	+28
7·0 Mc/s	+28
14·0 Mc/s	+29
21·0 Mc/s	+34
28·0 Mc/s	+31

The Crystal Oscillators

No trimmers are provided on any of the crystal oscillators except the 100 kc/s calibrator.

The following results were obtained:

Nominal Frequency (kc/s)	Error (c/s)
4955·0	+109
6655·0	+414
6855·0	+534
8677·5	+161
8577·5	+119
10155·0	+484
12077·5	+248
12227·5	−170
15577·5	+127
15777·5	+158
15877·5	−77
453·68	+10
456·39	−1
100·00	−3·6 c/s

The 100 kc/s crystal was checked to see if it would pull on to frequency. It would. Although 3·6 c/s may appear to be a very small error, it amounts to over 1 kc/s on 10m. At the commencement of testing the calibrator was usually very slow to start and sometimes failed to. However, the sluggishness gradually cleared and by the time all of the tests were complete there was no trouble, but there was a pronounced chirp on switch on.

The crystal frequency errors were lower than those recorded in many of the other reviews.

Birdies

The top two 10m sections and the top 80m section were free. All the other segments had either one or two very low level responses. The only birdy which approached the specification level of 1μV was on about 7·05 Mc/s but this response would not be detectable with an aerial connected.

Spurious Responses

With a first i.f. in the 3 Mc/s region a somewhat limited first i.f. rejection might be expected when tuned to the 80m band—the rejection was in fact 52dB. On the 160 and 40m bands the rejection was better than 80dB and on 20, 15 and 10m better than 100dB which is very satisfactory. The first image rejection was also checked, and this varied from 48dB on 15m to 84dB on 160m.

TRANSMITTER

Power Output

The transmitter was tuned for maximum power output into a calibrated 50-ohm load using its internal audio oscillator, i.e., the c.w. condition. On 160m the power switch on the p.s.u. was placed in the low power position.

Band (metres)	Power output (watts)
10	55
15	70
20	72
40	77
80	72
160	37

The transmitter was next checked using two tone input on 1 and 1·8 kc/s. The audio input was increased until the spectrum analyser indicated 25dB intermodulation products.

Band (metres)	Peak Envelope Power Output (watts)
10	60
15	94
20	84
40	92
80	108
160	50

Carrier and Unwanted Sideband Suppression

During the two tone tests, the carrier and unwanted sideband was checked on 28 Mc/s. The carrier suppression, like the KW Vespa varied a small amount with audio input. On c.w. the carrier was 47dB down on full power when the audio oscillator drive was removed. This figure reduced to 30dB down when audio drive was present. On two tone input the suppression was 42dB with 25dB i.p.s referred to the peak envelope power. In this latter condition the unwanted sideband suppression was 50dB. The results are very satisfactory.

Transmitter Audio Response

A variable frequency audio oscillator was fed into the microphone input and the frequency varied from 0–3 kc/s. The −3dB points were at 260 and 2400 c/s with a ripple of 1·4dB.

TVI

The only TVI trouble was with channel 1, where the received TV signal was weak. The 14 and 21 Mc/s bands caused wipe out, but with a high pass filter in the TV lead, and low pass in the KW2000A lead, the trouble cleared. On 7 and 28 Mc/s, transmissions caused slight pattering on channel 1 which cleared with a high pass filter in the TV lead. Channels 5, 6 and 11 were clear without the need for extra filters. These results are very good.

The Power Supply Unit

The p.s.u. is in a separate matching case and also contains the loudspeaker. The two transformers are mounted on a steel chassis; one transformer handles the p.a. h.t. and the other provides 13V a.c., bias and low h.t. Mains taps are 240/250, 230/220 and 200/210V a.c. All the electrolytic capacitors were well within their voltage rating under all conditions. The a.c. input lead is three core, about 68 in. long and the 34 in. screened interconnection lead is terminated in a 15 way Painton 159 series socket.

ON THE AIR

The KW2000A was used on 20m and 15m but mainly on 10m. It was liked by the operators, handled well and tuned up quite easily once one got used to the rather sharp p.a. anode-tune adjustment. An old complaint—described by a ZS as "square bearings in the slow motion tuning control" seems to have been overcome. Some operators found the 200 kc/s sections and limited coverage annoying on 10m.

THE HANDBOOK

The handbook is very good and contains all the information that is likely to be required except a component code list and a mechanical parts list. The separate circuits for the transceiver and the power supply are on large sheets. A small loose sheet gives the microphone plug connections.

GUARANTEE

KW Electronics give a 12 month guarantee covering faulty material or workmanship only, and valves carry the usual three months guarantee subject to reasonable treatment. The labour cost of guarantee repairs may be charged at a reasonable rate. It is necessary to register the guarantee, by returning the card supplied, within two weeks of purchase. KW Electronics request that no equipment is returned to them without prior arrangement.

CONCLUSIONS

The KW2000A is primarily designed to meet the needs of the s.s.b. operator. The c.w. operator would need better selectivity, but the KW *Q* Multiplier has been successfully added as a simple home modification by some owners. The incomplete coverage of 15 and 10m is really the only slight criticism. KW have good reason to be proud of their product.

The Manufacturer's Comments

"On the whole the foregoing review is very satisfactory and does justice to an equipment which is British designed and manufactured to a price to suit the average pocket, and our compliments are directed to the authors. One point to which attention is drawn is the fact that some sections of some bands are missing. What we have tried to do is to provide sections of every band for c.w. and s.s.b. operation; the missing parts are usually occupied by a.m. signals. The only bands affected are 21 and 28 Mc/s but alternative or additional crystals are available and can be substituted easily as the holders are accessible under the lift-up lid of the cabinet. Circuit retrimming is not necessary. It should be noted that by limiting the v.f.o. tuning range to 200 kc/s, better bandspread facilities are provided in addition to excellent broadband responses of the associated circuits. Other comments we would like to make are as follows: the a.g.c. figures quoted, although stated to be adequate, are not to the standard usually achieved in this equipment, and this model is to be rechecked by us when it is returned to the factory. The component parts list will be included in future editions of the Handbook but at present the component values are marked on the circuit diagram. No mention was made of the side-tone facility for monitoring c.w. C.w. operators find this facility an absolute necessity and, of course, the speed of break-in c.w. can be adjusted by the vox control. We believe that in this piece of equipment more facilities are offered than in any other contemporary equipment in this price range. In conclusion, it may be of interest to some members to know that in some export models different frequency bands and panel markings are provided; for example, for USA and Canada the 75m 'phone band is included. Also, a.c. power supply units are available for 100 to 125 volts a.c. input, 60 cycles. The KW2000A is now in use in over 50 different countries."

R. G. Shears, G8KW

GB2RS SCHEDULE

RSGB News Bulletins are transmitted on Sundays in accordance with the following schedule:

Frequency	Time	Location of Station
3600 kc/s	9.30 a.m.	South East England
	10 a.m.	Severn Area
	10.15 a.m.	Belfast
	10.30 a.m.	North Midlands
	11 a.m.	North West England
	11.30 a.m.	South West Scotland
	12 noon	North East Scotland
145·10 Mc/s	9.30 a.m.	Beaming north from London
	10.00 a.m.	Beaming west from London
145·8 Mc/s	10.15 a.m.	Beaming south from Belfast
145·30 Mc/s	10.30 a.m.	Beaming north west from Sutton Coldfield
	11.00 a.m.	Beaming south west from Sutton Coldfield
145·50 Mc/s	11.30 a.m.	Beaming north from Leeds
	12 noon	Beaming east from Leeds

News items for inclusion in the bulletins should reach Headquarters not later than first post on the Thursday preceding transmission. Reports from affiliated societies and from non-affiliated societies in process of formation will be welcome.