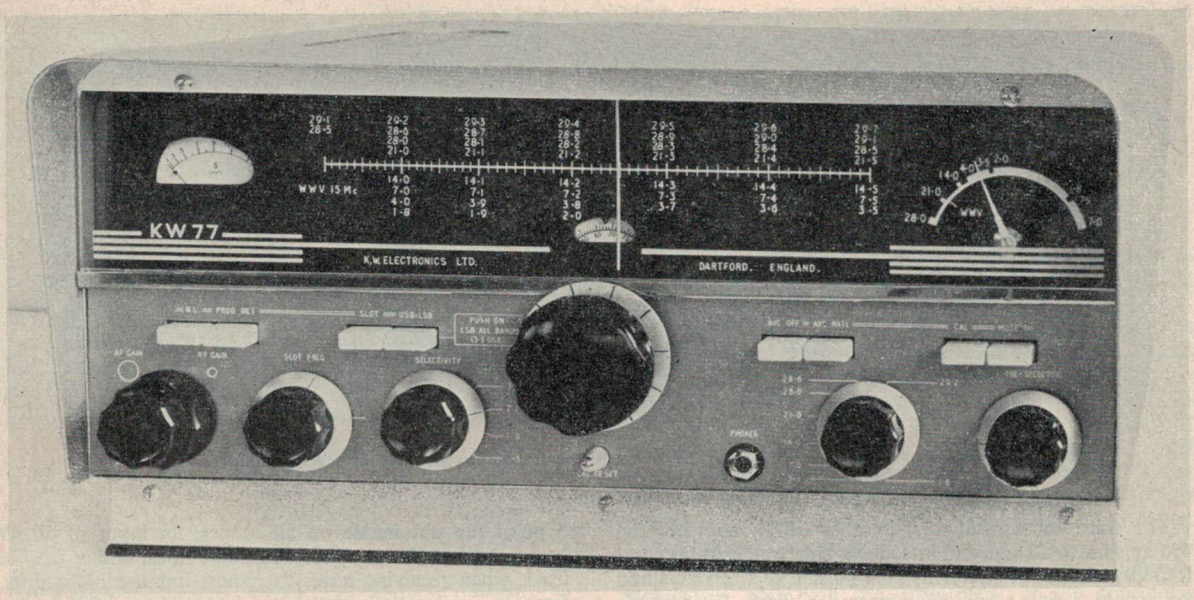


The KW77 Communication Receiver

Reviewed by R. F. STEVENS, G2BVN * and G. C. FOX, A.M.I.E.E., G3AEX †

WITH the ever increasing number of stations now active on the h.f. amateur bands it is essential that the stability of both transmitting and receiving equipment should be of a high order. Whilst there have been a considerable number of communication receivers designed for radio amateur use and manufactured in the UK, the KW77 is the first receiver to incorporate triple conversion with a crystal controlled first oscillator providing that high degree of stability required for present day operation. With the shift in popularity from a.m. to s.s.b., the selectivity characteristics of a suitable receiver are more demanding, and the four bandwidths offered by the KW77 represent a successful attempt to cater for the reception of c.w., s.s.b. and a.m. signals.

* Chairman, Technical Committee. † Member, Technical Committee.

The receiver covers all amateur bands from 1·8 to 30 Mc/s in segments of not greater than 600 kc/s. The r.f. stage uses an EF183 frame grid pentode, the input circuit being designed for 50 to 80 ohm coaxial cable. The grid circuit is peaked by a panel control independent of the main tuning.

The first oscillator is the triode section of an ECF82 which uses seven crystals to provide appropriate frequencies for the pentode mixer section to convert incoming r.f. signals to the first tunable i.f. of 3·5 to 4·1 Mc/s which is covered by a stable 6BE6 mixer-oscillator working 455 kc/s above the first i.f. signal. Between the second and third mixers there is a slot filter designed to reduce heterodyne interference, the control for which moves a notch of some 40db across the passband of the receiver.

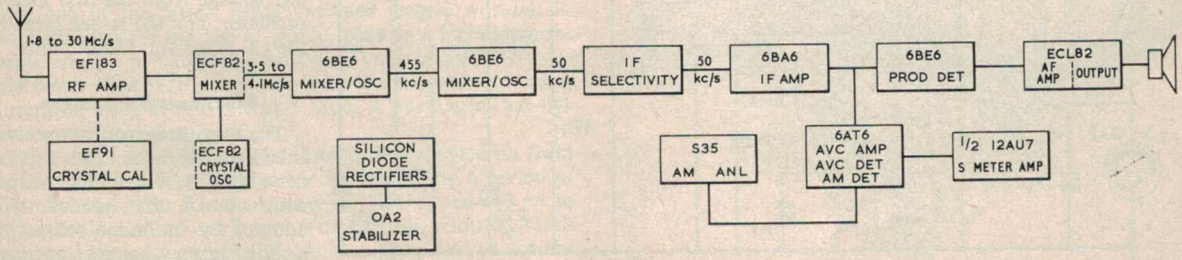
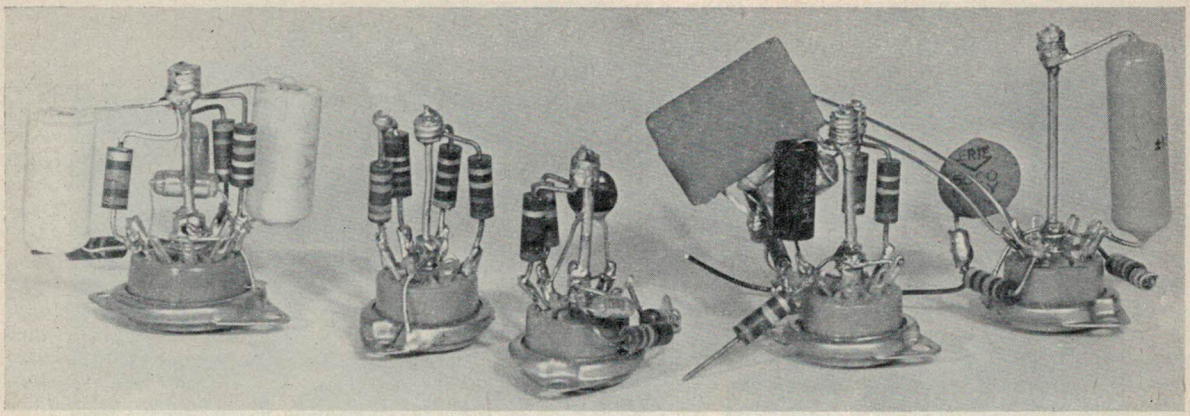


Fig. 1. Block diagram of the KW77 amateur bands communications receiver.



Extensive use is made in the KW77 receiver of sub-assemblies mounted on the valveholders.

The third mixer/oscillator, another 6BE6, converts the 455 kc/s i.f. to 50 kc/s and introduces sideband selection and four degrees of i.f. selectivity: 0·5 kc/s, 1 kc/s, 2·1 kc/s and 3·8 kc/s at — 6db, all provided by an L/C filter. After amplification by a 6BA6 the 50 kc/s i.f. signal is fed to a product detector (for c.w. and s.s.b.) and to a diode detector (for a.m.), the function switch selecting the output for audio amplification.

The product detector circuitry (Fig. 2) incorporates an audio filter designed to cut off sharply at 3,000 c/s and is followed by the two sections of an ECL82 as the audio amplifier. The loudspeaker is automatically muted when headphones are plugged in and the use of a low impedance type headset is recommended.

Amplified a.g.c. with fast attack and either fast or slow decay is applied to the r.f. amplifier, first mixer and i.f. amplifier. Comparative S meter readings based on 6db per S point are obtainable on all modes, an input of 50 μV being equal to S9. A diode automatic noise limiter may be used, when receiving a.m., to reduce impulse noise interference.

The power supply can accommodate inputs of between 110 and 250 volts a.c. and uses four silicon diodes as the rectifier elements together with an OA2 stabilizer providing a 150 volt h.t. line, and eliminating the peak voltage surge at switch on which would otherwise occur with indirectly heated valves and instantaneous units such as silicon diodes.

As a result of the use of a crystal controlled first oscillator and common tunable i.f. the dial calibration is linear on all bands. Minor correction may be necessary when switching bands and this may be accomplished with the aid of a panel mounted calibration adjustment which uses the variable capacity effect of a diode (introduced by potentiometer variation of the applied h.t. voltage) applied to the 3·5 to 4·1 Mc/s tuned circuit through a 5 pF fixed capacitor. A built-in crystal calibrator (Fig. 3) supplies 100 kc/s marker points throughout the tuning range of the receiver and provision is also made for the reception of the 15 Mc/s signal from WWV. Muting terminals, intended to be connected to an external relay, are provided on the rear apron of the chassis and muting is effected by removing h.t. voltage from the first mixer/oscillator, and the screen grids of the r.f. stage and i.f. amplifier.

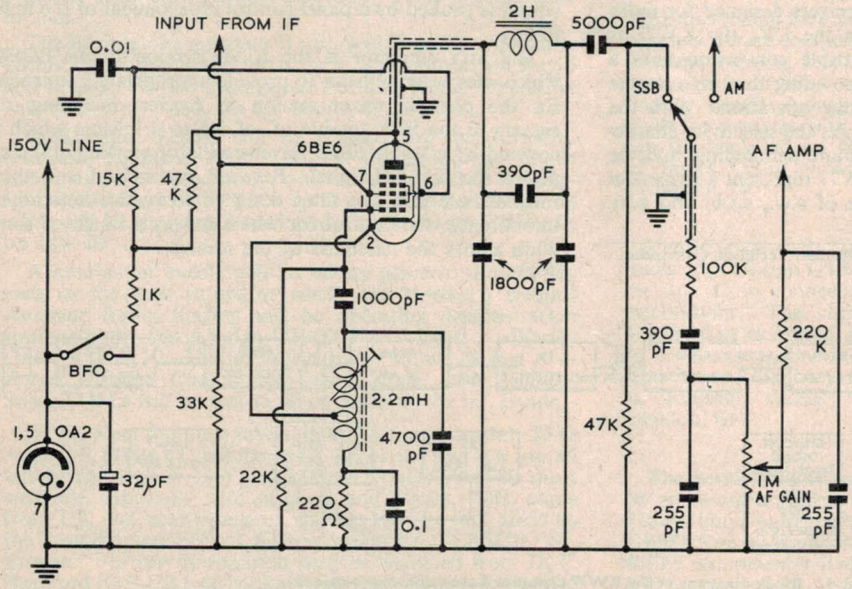


Fig. 2. Circuit of the product detector and audio filter.

Mechanical Features

The overall size of the receiver is 16 in. × 6¾ in. × 12 in. and the net weight is 30 lb. The cabinet, which is of the hooded type adopted by the manufacturer, is finished in grey hammertone and a front support is provided which gives a small backward tilt to the

front panel. A modified Eddystone type 898 dial is employed and the virtues of this geared drive do not require further amplification. A 9 in. scale, directly calibrated in frequency, is available for each band together with a logging scale for resetting to any spot within a band. The panel marking of white on grey or black background are clear and unambiguous.

Operation

The eight frequency bands covered are: 1·8 to 2·0, 3·5 to 4·1, 7·0 to 7·5, 14·0 to 14·5, 21·0 to 21·5, 28·0 to 28·5, 28·5 to 29·1 and 29·1 to 29·7 Mc/s. A check on the signal-to-noise ratio and image response on the various bands was made with the bandwidth control set at 3·8 kc/s, a.g.c. " on " and r.f. gain at " maximum." Amongst the figures obtained were the following:—

Frequency	*Input for 10db Signal-to-Noise Ratio*	*Image Ratio*
1·8 Mc/s	0·7 μV	84db
3·5 Mc/s	1·0 μV	72db
7.0 Mc/s	1.6 μV	83db
14·0 Mc/s	1·4 μV	79db
21·0 Mc/s	1·4 μV	84db
28·0 Mc/s	1·0 μV	61db
29·1 Mc/s	1·0 μV	81db

The sensitivity figures for the l.f. edge of the bands as shown above indicate a high degree of consistency over the

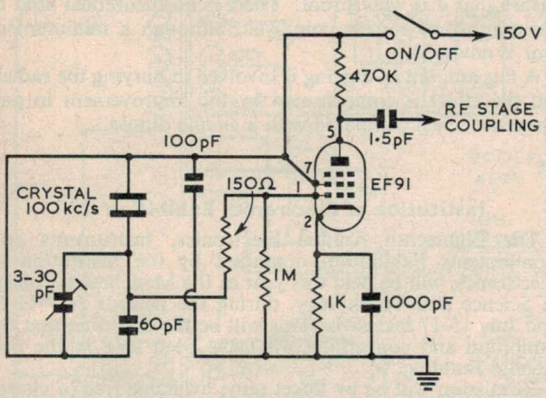


Fig. 3. The crystal calibrator used in the KW77 to provide marker signals every 100 kc/s.

complete coverage of the receiver, the results obtained in the 28 to 30 Mc/s band being particularly good. This range is now often used as the tunable i.f. for 144 Mc/s converters, and one of the latter, using Nuvistor stages, working in conjunction with the KW77 would result in a high performance unit. The manufacturer claims that image responses are better then 65db down, and, with the exception of measurements made at 28·0 and 28·5 Mc/s, it was found that this claim was more than justified.

The drift of the second oscillator when switched on from cold amounted to approximately 500 c/s during a period of 30 minutes. After this the change did not exceed 150 c/s in a further period of one hour. The r.f. gain control, which applies additional negative bias to the a.g.c. line, varied the second oscillator frequency by only 50 c/s when adjusted from maximum to minimum. The calibration of the tuning dial was accurate on all bands after setting up with the aid of the 100 kc/s calibration oscillator.

Evaluation of the selectivity characteristics produced the following figures with the a.g.c. switched off:

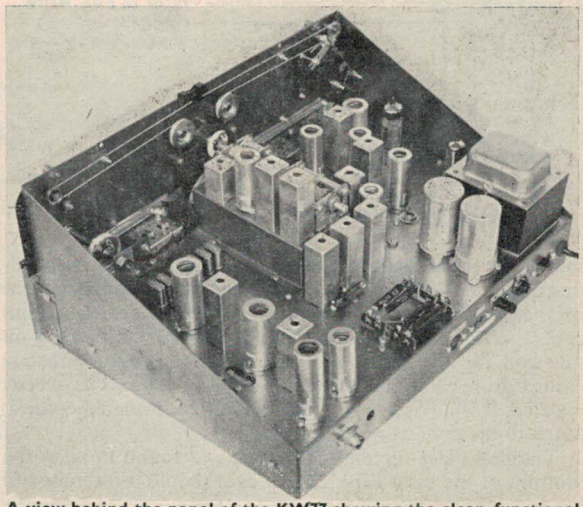
Selectivity Setting	*Bandwidth at —6db Point*	*Bandwidth at —60db Point*
0·5 kc/s	0·5 kc/s	±2·0 kc/s
1·0 kc/s	1·0 kc/s	±2·4 kc/s
2·1 kc/s	1·8 kc/s	±6·0 kc/s
3·8 kc/s	2·7 kc/s	±7·5 kc/s

Only two spurious responses (other than image) were observed, one at 14,075 kc/s and the other at 21,360 kc/s. The level of these was equivalent to an input signal of 2 μV.

To determine the a.g.c. characteristic the input signal at 3·5 Mc/s was varied from 10 μV to 10 mV and it was found that the a.f. output of the receiver varied by 6db. The maximum a.f. output for approximately 10 per cent distortion in a 3 ohm load was 1 watt at 1,000 c/s, whilst the frequency of cut-off of the audio filter was 2·5 kc/s, the rate of cut-off being 33db per octave. The tuned insertion loss of the slot filter was 34db when measured as the attenuation of 400 c/s modulation on a carrier as indicated on an a.f. output meter.

In actual use in a station the feel and general operability of the receiver were good, and the only slight difficulty experienced was with the adjustment of the concentric controls due to their proximity to the panel edge. Contacts were made on c.w. and s.s.b. using the KW77 and in conditions of severe interference the steep sided *L/C* filter characteristic was found to be a considerable asset, With very heavy interference the 1·0 kc/s bandwidth position could be used when receiving s.s.b. without the loss of vital intelligibility. The stability was beyond reproach and enabled c.w. signals to be held without difficulty over long periods using the 0·5 kc/s bandwidth setting.

The reviewer has had the opportunity of operating a wide selection of modern receivers of both UK and US origin, many commanding much higher prices, and, in his opinion, the KW77 leaves nothing to be desired by comparison. The KW77 is manufactured by K.W. Electronics Ltd., Vanguard Works, 1 Heath Street, Dartford, Kent.



A view behind the panel of the KW77 showing the clean, functional layout.