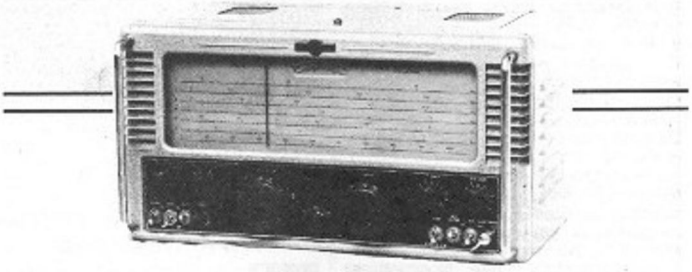
EDDYSTONE 888



A classic receiver described by Ken Williams

As I described in *'The Eddystone Story'* (*Amateur Radio*, September, 1984), prior to the 1939-45 war Stratton and Co produced a series of receivers using 'straight' (ie not superhetrodyne) circuitry, which gained the firm a considerable reputation for quality and reliability.

About 1939, the company designed their first commercial communications receiver, the 358X, and based on this experience, in the years following the end of WWII, produced a number of excellent, moderately priced receivers for both professional and amateur operators.

Starting with the 504 and the rather less expensive 640, these pieces of equipment all exhibited the hallmarks of quality – good electrical design coupled with sound mechanical engineering.

To many operators, the ultimate of these was the 888A which was introduced in the late 1950s.

In this, the traditional Eddystone features of a large, easily-read dial and silky flywheel tuning were allied to a sensitive double superhet circuit of great stability and superb selectivity.

Returning to use one of these receivers after a gap of many years, I have been amazed by its performance and, although by modern standards it is lacking a little in sensitivity on 10 and 15 metres, on lower frequencies I am of the opinion that it can more than hold its own with equipment presently available.

The circuit

The traditional design principles of superhetrodyne receivers dictated that the intermediate frequency should be high to ensure adequate image rejection, but low to provide adequate adjacent channel selectivity.

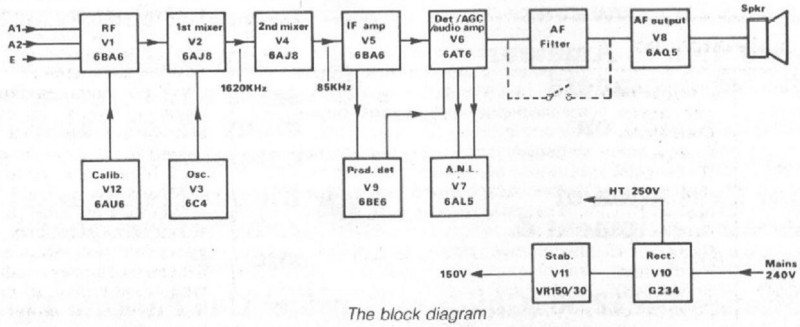
Until the introduction of high frequency crystal filters, these conflicting demands were resolved by the use of two or more intermediate frequencies. Following this principle, the 888A is a double superhet.

The 888A tunes the six pre-WARC amateur wavebands between 1.8 and 30MHz, with each covering the majority of the 12 inch horizontal tuning scale.

The input to the receiver comprises two aerial and earth terminations, a common arrangement at that time. When a balanced aerial is used (such as a dipole with balanced twin feed), the two aerial connections marked A1 and A2 are used, but for unbalanced feed (such as coaxial feeder) the centre core attached to A1 and A2 is connected to the screen and earth. A series tuned circuit tuned to the first intermediate frequency is connected between A1 and A2 to act as an IF rejector circuit.

The signal then feeds, via the wavechange switch, to the radio frequency (RF) stage. This utilises a 6BA6 vari-mu pentode in a conventional circuit. In the cathode of this stage a potentiometer forms the RF gain control and an additional fixed resistor, normally short-circuited, serves to reduce the sensitivity of the receiver when the crystal calibrator is being used.

The signal then passes from the RF stage to the frequency changer, where it is mixed with a local oscillation to



The block diagram

produce an intermediate frequency of 1620KHz.

This stage uses two valves – an ECH81 (6AJ5) as a frequency changer and, to ensure optimum stability, an EC91 (6C4) as the local oscillator. The 1620KHz IF signal derived in this stage then passes to a second frequency changer, again using an ECH81, which converts the signal to 85KHz. At this frequency the signal is amplified by a 6BA6 before being demodulated.

The two 85KHz IF transformers each incorporate variable coupling between their two tuned circuits. At maximum selectivity the coupling is critical, giving a bandwidth of approximately 1KHz for CW operation, whilst at the minimum selectivity position overcoupling broadens the bandwidth to 5KHz for amplitude modulated telephony. Between these extremes the bandwidth is continuously variable.

The second diode of the 6AT6 second detector is capacitively fed from the anode of the 6BA6 IF stage and provides an automatic gain control voltage to each of the previous stages.

For AM signals diode detection is used, but for SSB or CW operation the output from the detector diode is open circuited and the audio taken from V9, a 6BE6 pentagrid valve which operates as a product detector. It is interesting to note that this term had not come into general use at the time of manufacture of the receiver and in the Eddystone leaflet the stage was called a 'CW/SSB converter'.

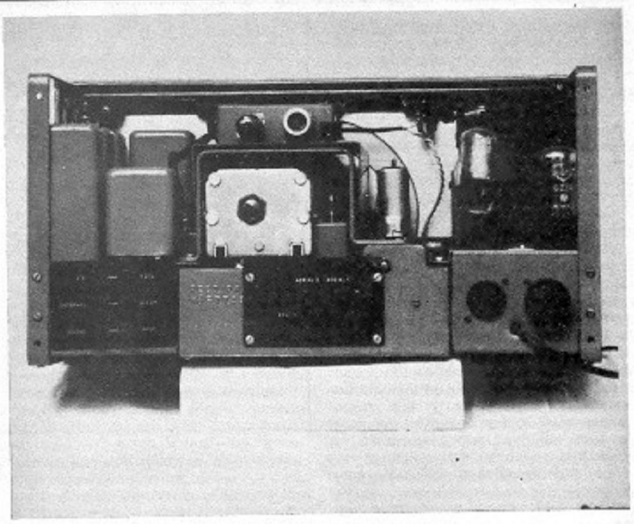
The triode section of the 6AT6 operates as a conventional audio frequency amplifier and, unusually for a communications receiver, an external audio input is provided. This stage is fed directly from the product detector or from the diode detector via a double diode series noise limiter (V7).

The output of the 6AT6 then drives the 6AQ5 audio output stage. Between these, however, is a switchable audio filter, tuned to 1KHz, for CW operation. This gives a total bandwidth of just over 100Hz at the 10dB point.

The circuit is completed by a valve rectifier (GZ34), a VR150/30 stabiliser for the HT of the various oscillators and a 100KHz crystal calibrator stage.

No S-meter is fitted to the receiver but an octal socket is fitted at the rear to feed an external meter for which a circuit diagram was provided, although Eddystone could supply a ready constructed item mounted in a matching die-cast box.

A further octal socket on the rear of the receiver permitted operation from external power supplies, eg for portable operation.



Mechanical construction

On seeing the 888, two features immediately impress the viewer (see photo). Firstly, unlike so much modern equipment, the case is of solid diecast construction and secondly, the exceptional length of the frequency scales.

Beneath the frequency scale the controls are symmetrically laid out, these being dominated by two large knobs, the left hand one being the bandswitch and the right hand the tuning.

Above these are two pairs of smaller knobs which control (left to right) RF gain, BFO tuning, IF gain and AF gain. Below, arranged in two sets of four controls along the lower edge of the facia are (again left to right) mains on/off, send/receive, AGC on/off, crystal calibrator, AM/SSB, AF filter in/out, noise limiter and bandwidth. Between the two large knobs on a lower level is a local oscillator adjustment for use when calibrating the tuning scales.

On opening the case the impression of rugged construction persists. The complete coilpack and tuning assembly are mounted on a solid diecast frame and the remaining circuitry seems to almost fill the (by present standards) generously sized cabinet.

Due to this extremely rugged construction the receiver is surprisingly heavy. Ventilation, however, is quite good and considering the high packing density and number of valves, the equipment remains surprisingly cool even after prolonged operation.

In contrast with many modern receivers, the 888 requires a period of acclimatisation to obtain optimum results.

This is largely due to the lack of automatic gain control when receiving SSB or CW and the consequent necessity to achieve an optimum balance between the RF, IF and AF gain controls. This very weakness, however, gives rise to one of the great strengths of the receiver for, when this balance is achieved, conditions for good cross modulation performance also exist with obvious advantages.

In the demodulation of SSB, the incoming signal at intermediate frequency is mixed with a locally produced oscillation to form an assymetric amplitude modulated signal, which is then demodulated.

Should the level of this incoming signal approach that of the locally generated oscillation the effect will be the same as an overmodulated amplitude modulated signal. In modern receivers this effect is prevented by the action of the AGC system. However, on receivers

Valve Types and Functions

V1	6BA6	Radio frequency amplifier
V2	6AJ8	1st mixer (signal frequency to 1620KHz)
V3	6C4	Oscillator
V4	6AJ8	Frequency changer (1620KHz to 85KHz)
V5	6BA6	IF amplifier
V6	6AT6	AM demodulator, AGC and first audio
V7	6AL5	Noise limiter and S-meter diodes
V8	6AQ5	Audio output stage
V9	6BE6	Product detector for SSB and CW
V10	GZ34	Rectifier
V11	VR150/30	Stabiliser
V12	6AU6	Crystal calibrator oscillator

such as the 888, which were designed when SSB was in its infancy, the control of gain is in the hands of the operator.

Optimum results

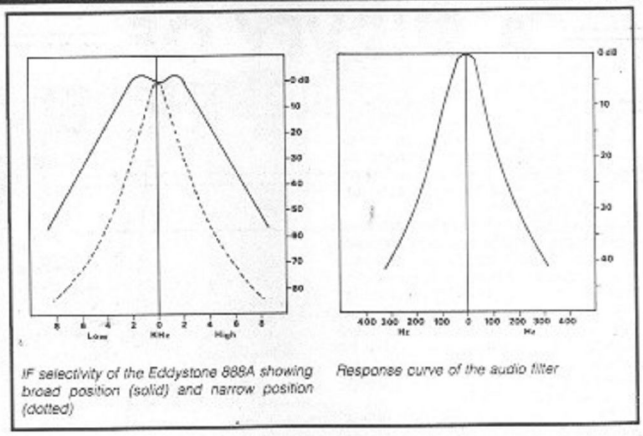
In general it will be found that optimum results are obtained when the AF gain is quite high, the IF gain is set about half way and the RF gain is advanced sufficiently to bring the loudest signals on the band just below the point of limiting. Overall control of gain can then be achieved by use of the IF gain control.

The 888 was originally designed when amplitude modulation was the common form of transmission. As a result of this the design called for a maximum bandwidth of about 5KHz. This, of course, is far too wide for SSB reception but the selectivity adjustment is continuously variable and if a position of about two thirds maximum is selected this will be found adequate, although the shape factor of the response curve does not remotely compare with modern equipment.

For CW operation the selectivity control is advanced to maximum, giving a bandwidth of 1KHz at the 10dB points. This is adequate for most conditions, but if congestion gets really bad, Eddystone have provided another weapon in the armoury – an excellent audio filter which is so sharp that it can find gaps on forty metres on a Sunday morning!

Bandspread

The tuning and frequency scales on the 888 could hardly be bettered. Almost 12 inches of bandspread is available on each of the six amateur bands covered and, to ensure their accuracy, a crystal calibrator is also fitted. Any discrepancy found may be corrected by a panel mounted trimmer. The tuning control is backed with a heavy flywheel which gives a silky feel and also makes possible a very rapid move from one end of the band to the other.



IF selectivity of the Eddystone 888A showing broad position (solid) and narrow position (dotted)

Response curve of the audio filter

RF tuning

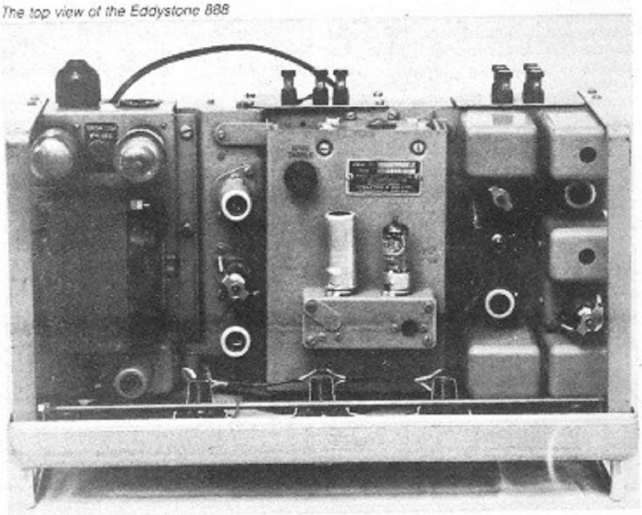
On changing band it is often necessary to retrim the RF tuning. This is achieved by a small trimmer inside the cabinet which is accessed by lifting the hinged top cover. This is the subject of my only real criticism of the equipment, bearing in mind its date of design. I feel that this control could, and should, have been brought to the front panel as its present position makes mounting in a console impossible.

At present I am considering whether to modify the receiver to extend this control to the front panel or to put up with the inconvenience in order to leave the receiver in 'collectors condition'.

In the accompanying leaflet Eddystone provide no sensitivity figures, so it was not possible to compare my sample of the receiver with the original specification. However on a qualitative check, as might be expected from a receiver of this vintage, I found the performance more than adequate on the lower frequency bands but lacking a little in sensitivity on 10 and 15 metres.

Overall, and in particular on the lower bands, I find the 888 a delight to use and I unhesitatingly recommend it for any SWL or radio amateur who requires an amateur bands receiver.

The top view of the Eddystone 888



Comparison

Finally, two questions must be asked. Firstly, can it be maintained? The obvious thought is for the availability of replacement valves. All, however, are available through the pages of the various radio magazines. Secondly, does the 888 compare with the Drake 2B which I described last year? The answer to this is yes and no! The shape factor of the IF circuits on the 2B seem to be superior to the 888, with obvious advantage during SSB reception.

At maximum selectivity however, the 888 seems sharper and the assistance of the audio filter makes the superiority even more evident. In fairness though, it must be remembered that the 2B was described without the Q-multiplier or audio filter add-on units. In sensitivity and stability I found little to choose between the two receivers.

If pressed to make a choice between the two receivers, I think that the final decision would be made on price and availability rather than technical merit.

On the secondhand market the 888 can be purchased at a cost of between £35 and £75. Despite this low price, it will easily out-perform most new receivers costing up to several times as much and consequently must be seriously considered as a 'best buy'.