1

Eddystone 730/4 Receiver

Philip Moss M0PBM gets to grips with the Eddystone 730/4.

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I purchased this from an advert in *RadCom* (RSGB's member's magazine) for the outstanding sum of £20. I knew it was minus its case, but was said to work, which was true within limits.

On collection I found a set in a cardboard case. Well, it's better than nothing one may say, keeps out the dirt at least. The set was demonstrated and, yes, a sound came out. I would later have trouble at first repeating this.

The set in the photos isn't mine partly because I sold it for use as a prop on a film set, would you believe, and partly as an unmolested set is more informative. The set photographed here, **Fig. 1**, is the one in Comms Corner at the British Vintage Wireless and Television Museum, Dulwich. This set dates to 1959.

Initial State

No case and no sound. The front panel although properly lettered, was brown SRBP, and the BFO and phasing controls, which should be rotaries, were toggles. Some of the knobs were not original. There were many missing valve cans, as almost all should have covers, including the crystal calibrator crystal, which was missing. Looking underneath it was immediately clear an idiot had been at work, one of those idiots who though I doubt they could build a one-valve radio properly, think they are qualified to modify and 'improve' a fully developed professional product, and one which is rather tightly packed at that.

The main damage apart from the missing controls was around the PSU. The mains transformer did not seem to properly fit its hole, did not have the expected voltage selector on the top, was not grey as everything else was, and looked small, though it does not get very hot. I later confirmed it had been replaced. The last owner had bought it without a transformer. The mains connector and DC connector were not there, but an IEC connector had been substituted, not well done. Having seen a good version I know the mains transformer should be an unpotted C-core type of generous dimensions. This may have failed or been 'nicked' for another project. While the set normally ran off mains, provision was made for running off an external vibratory PSU, connection being by a Jones plug at the rear. Predictably this was mainly for the Military to use. Unusually it did not get a military designation as an R-something. As ever, I have found *Louise Meulstee's Wireless for the Warrior, Vol three Reception sets* very useful, though I do also have the manual.

The noise limiter silenced the set if turned on. The phasing switch did the same. The sound on its internal speaker (itself another modification) was very poor even at low level. I noted it was wired across outer and centre-tap of the 600Ω output. I moved it to the 2.5Ω output, but it wasn't much better.

A check of valves revealed some of my problems. The 6AL5 (EB91), V9 double diode for meter and noise limiter was replaced with a pentode. Surprisingly it proved a poor substitute! It also was probably responsible for doing the poor meter in. It had gone open circuit. The output valve V15 was a CV136, an EF91 look-alike. It should be a proper output pentode, a 7D9 (6AM5). I have

Photo 1: The Eddystone 730/4.
Photo 2: A view with the lid open.
Photo 3: The tuning gang.
Photo 4: The chassis bottom, note the RF section.


2

one somewhere, but instead fitted a 6AQ5, of which I had five new ones. I say had. Due to my negligence, I didn't check the pin-out properly. It isn't quite compatible. It has two control grid connections, one on the screen pin of the proper valve. Bang went a brand new valve. I then moved the G2 connection and tried again. It draws considerably more current than the original, as expected. I am going from a 1.4W valve to a 4.5. I then added a 4.7kΩ screen resistor, which I expected to drop a lot of volts. The valve should draw 7mA, but it only dropped a couple of volts. I also had to fit a new cathode bypass capacitor. It had been 'changed' already and was hanging on wires as too big for the retaining clip. I found one which fitted. The output is still distorted though. It did receive many stations, and with its very high gearing, it is easy to separate stations.

The front panel apart from having a substitute legend panel also had the control for shifting the tuning scale missing, and although the button for the crystal calibrator was still there, the switch had gone along with its wiring. The crystal assembly itself had a wire loose. Another oddity, there is a cover over the tuning gang, but it is black. It has no spare holes in it, but it should carry a clip and trimming tool, and a clip with spare fuses. Someone has gone to the trouble of making up a new cover, and has even mounted the crystal assembly straight! However, another appalling botch was to twist off one of the terminals on the mode switch, for a function that wasn't needed.

Design

This set strikes me as being very conservative, or to put it another way, somewhat backward for the time it was designed. It was 1957 by the date on the manual. The line-up is like so many wartime sets: two RF pentodes, polygrid mixer, two IF amplifiers and a separate LO (local oscillator). It is single conversion with a typical low IF of 450kc/s. There is nothing new about the switched IF bandwidth, crystal filter or phasing control. It does have a voltage regulator for the oscillators. With 15 valves it could have been dual-conversion, and a higher IF would have improved the image performance, but with post-war higher *Q* coils they could still have kept the bandwidths, and the final reduction is achieved at AF anyway.

As in the CR 100, as an example of many, the mixer has too many electrodes: here a 6BE6 is used. This was intended as a self-oscillating mixer. A pentode would have reduced noise, cost and spares inventory. A double triode balanced mixer would have cost no more but reduced the noise much further. The use of two RF amplifiers seems excessive. There are two reasons for having pre-mixer gain: to drown the noise of the mixer, and to reduce image reception. Higher IF does the latter better, and the noise of this mixer would be far lower than the wartime 6K8/ECH35/X65. The cost of the tuned RF stage is high, so there would be a clear benefit here in only having one. I think they probably looked at war-time sets, especially the CRs, and simply came up with a newer version. Cut development cost and time. An oddity was the placing of the headphone socket on the left-hand side of the set. Not particularly convenient, and also if one wants to rack the set, it would be very difficult to use.

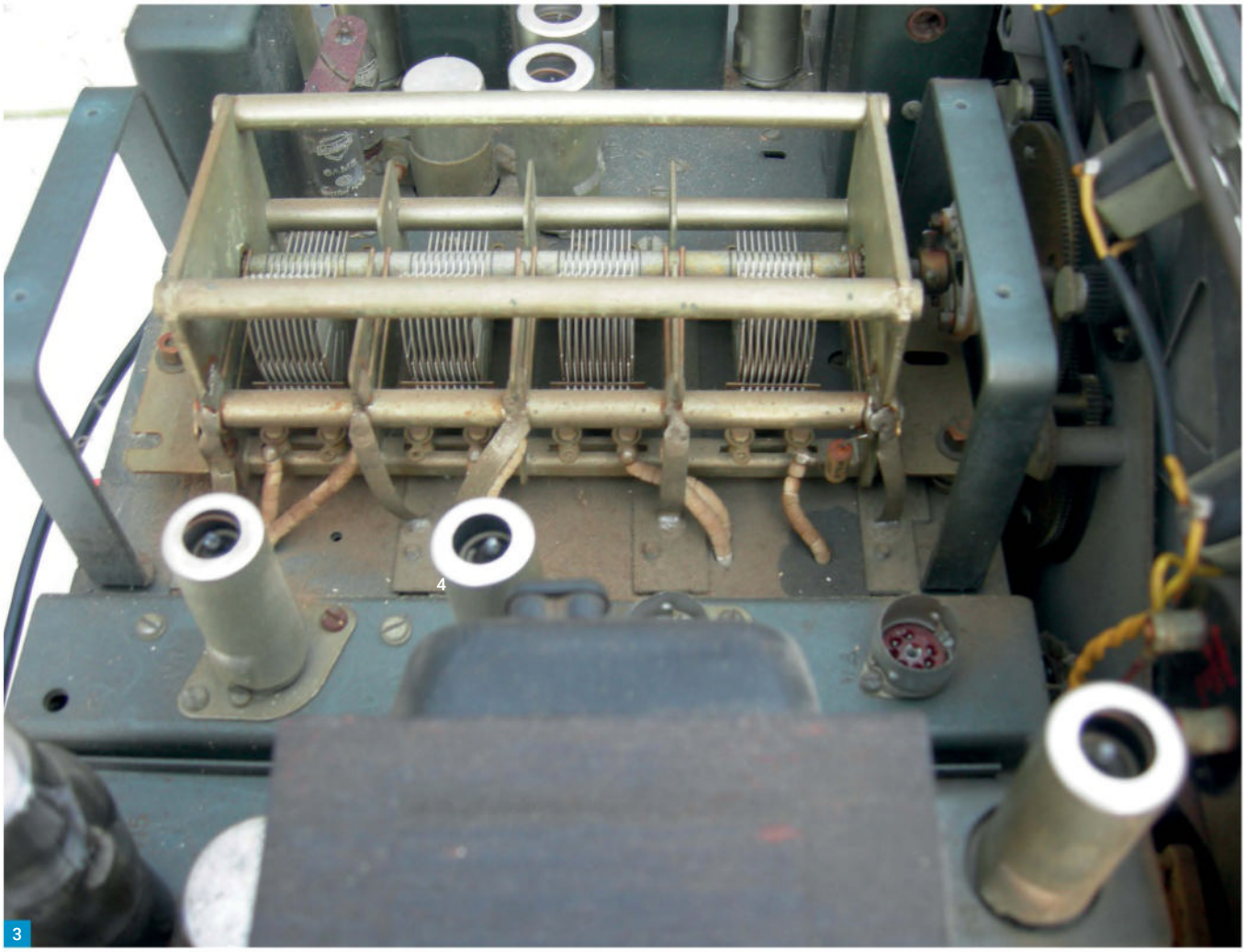
The valve line-up is as follows: the two RF amplifiers, the two IF amplifiers and the BFO are CV454 = 6BA6 (EF93). Mixer is CV453, 6BE6 (EK90), Detector and AGC, and in the other one, noise limiter and meter protection, CV140, 6AL5 (EB91). A triode connected CV2524, 6AU6 is used as cathode-follower to give a buffered IF output. AF pre-amp is CV491, 12AU7 (ECC82), there being switched inductive, narrow audio filters between the halves, then AF output is CV136, 6AM5 (EL91). The crystal calibrator is CV138, 6AM6, (EF91, Z77), rectifier CV1863, 5Z4G (R52), and finally CV216, VR150/30. As usual I have put the European types in brackets.

The original mains transformer was multi-tapped on the primary, and C-core, but the Museum's example, and it is the original fitted when made, is a conventional one, by Parmeko, and appearing adequate, but tapped only for 110 and 220/230V. These had a reputation for burning out, and with such a poor selection, no wonder. As my mains makes it to 250V on occasion, no surprise it ran hot, even when not on long, and not in the heat of summer. Manufacturers do have this nasty habit of trying to shave costs off products, with frankly predictable results. Any fool can quickly ruin a company's reputation, it takes a long time and effort to establish one in the first place.

The Museum's set came to me for checking. Seemed OK: needed very little attention except a spectacular design fault. On wide bandwidth it overloaded horribly on Medium Wave broadcast stations. Clearly the AGC was ineffective. I spent a long time trying to find a fault, until I looked at an alternative circuit. There should have been a resistor in the IF cathodes switched in for the widest bandwidth to reduce the gain, as the closer coupling means the wider the bandwidth the higher the gain. There is for the next lower bandwidth, but not the widest. They added one later, but how could they have made such a gross design error? Did they never try the set on air? Did they not measure the AGC effectiveness and overload point? How does a major professional manufacturer drop such a clanger? So, resistor added and all was well.

The IF Transformers

I think the IF transformers deserve their own paragraph. If you believe the circuit diagram, they are variably tuned. The use of symbols is incorrect. The tuning is fixed apart from the normal adjustment. What is variable as I found when I managed to prise the can off one, is that the coupling is mechanically variable. The lower coil slides up and down on rails! The two coils are mounted sideways on to each other, and the lower one can only be adjusted in the highest selectivity, ie lowest, position. This seems to me a very expensive way of doing things. Also, as there are flying



3

leads that connect this coil to fixed connections, there is the chance of these joints failing due to being moved about too often. Surely the switched link winding is a much better way of varying the coupling. I have once seen mechanically variable coupling in a very old domestic radio, but I thought that an obsolete way of doing things, transmitters aside.

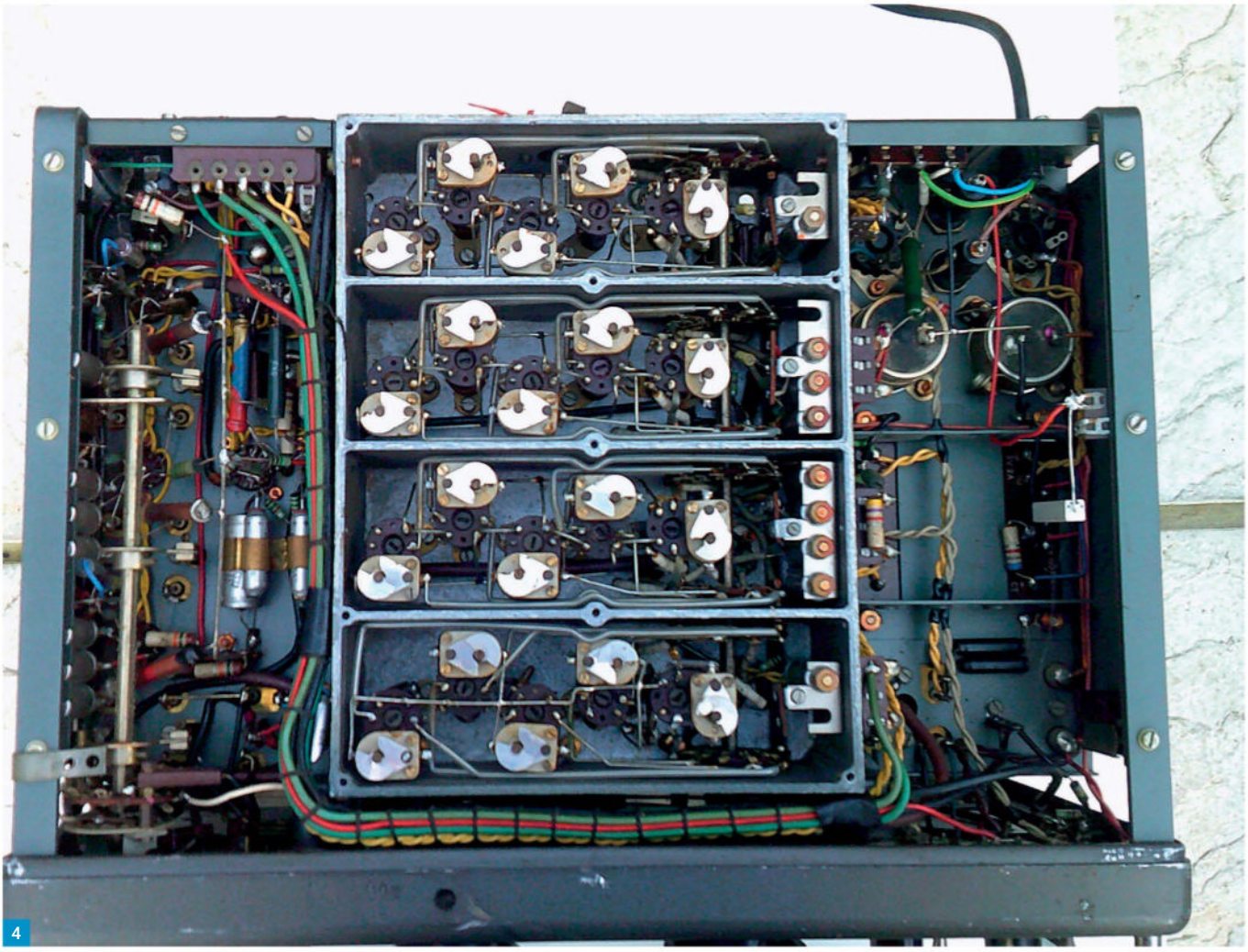
Build

Here the set scores well, and this is true of all Eddystones I have seen. It seems very solid. The centre of the set is a diecast aluminium four-section box, each section containing one of the tuneable stages, the RFs being at the rear, the oscillator at the front, **Fig. 2**. A raised channel in the casting carries all the valves, possibly to get their heat away from the tuned circuits. This does not seem an entirely convincing reason as the rise is only a few millimetres, but I cannot think of any other. The valves are on mounting plates, suggesting that the casting was for bigger valves such as Octal, and they avoided the cost of producing a new casting for the newer valves. The tuning capacitor has three mounting screws, all of which are adjustable for height, an unusual feature. Connections to the sections are by wires insulated by ceramic beads, not plastic, again very unusual, and again I am not sure why, **Fig. 3**. They are not more rigid than PVC wire would be, and the loss in PVC insulation is very low, so that is another reason gone. The earth connections are either on the same beaded wires, or on wide and very rigid strips, which in turn are not simply screwed to the aluminium box, but go to half-inch strips that go across the width of the capacitor and are screwed down in more than one place. There are a total of 12 connections to the capacitor, six being the earth strips, and two more being earths on beaded wires, with yet another brought through the chassis to join a wide strip, instead of being earthed under the chassis. They sure went to town on this! I do not know if they had severe instability problems with the prototype, or if this is all to maximise the *Q* of the circuits. At the front, there is a tubular ceramic capacitor to earth, which I suspect is thermal compensation for the LO. Access to all the top components is via the lid, **Fig. 4**.

Inside the sections, the wiring is very neat and looks very solid. The switch wafers are conventional. I thought they may have been ceramic in a set where so much cost has been lavished on it (later mains transformers excepted!).

Repairing these sections would be a nightmare: I think they may have worked on the idea it would last long enough that it would be thrown away instead! Based on an estimated five-year service life with the first, professional owner they would be right. To get at most components would require an extensive strip-down, either that or a bodge. The 470kΩ grid leaks are creeping high, but I have no intention of replacing them unless I am forced to.

The rest of the set is built on two 'L' sections, bolted to the central diecast box. These carry the PSU and BFO, itself a sub-assembly in a grey box, on the left-hand side as seen from the front, and the IF, demodulator and AF sections on the right-hand side. The two can electrolytics in the PSU, which are generously rated (450V for the reservoir and 350V for the smoothing) relative to an HT of 275 highest, are sunk through the chassis, so that they are not exposed to the heat of the rectifier and regulator. The choke is an unusual shape being tall and slim, and mounted in the same size can as the IF transformers. There



4

is an unusual feature of an HT switch mounted over the tuning gang, which switches off the HT for the whole set. Its usefulness must be suspect given the poor accessibility and it does not leave the LO running, so it is not helpful in maintaining stability when used. You may just as well turn off the mains surely? OK, it comes on instantly, but surely would be liable to drift. On my set this is missing. Everything is grey, the chassis (not the casting) and all the boxed items above it. Front-panel controls are mounted directly on to the front panel. The front panel has the typical Eddystone vents down the sides, except they are false with no holes, just ribs. The handles were missing on my set.

All the many decoupling capacitors are metal tubular types, and are mounted onto brackets and then onto the chassis, in groups. Again, replacing these would be hard, though they probably won't need it for many years yet.

At each side there are steel 'U' loops secured to the front panel handle bolts, and the side chassis along top, bottom and rear. The set can be turned upside down or stood on either end using these. With the proper handles it will also stand face down.

Handbook

The set came with an incomplete photocopied handbook that covered other versions of the 730 as well. It had the circuits and test voltages but lacked detail. It occurred to me that **Michael O'Brien**, a fellow writer for the late *Radio Bygones* magazine, may have the full version, and we live not far apart. Yes, he did, and thanks to him for the loan. He also has the set but without the bodging mine has suffered.

The real thing is not impressive. 14 single sides of A4 plus the A3 circuit. It does not have the usual diagrams showing all component locations, and as mine has been got at I needed these. Its construction is also odd. The sheets are stapled at the top, not the margin. It doesn't look very authentic, but the cover is no copy.

Renovation

Voltages were checked and found low. It was obvious that there had been fiddling about with the resistors in the PSU. A 560Ω wirewound resistor had been added between rectifier and reservoir capacitor. This was removed. The main HT was now correct. The VR150/30 still didn't glow much and the 'regulated' voltage was not 150. R66, 2.7kΩ, had been replaced with 3kΩ, not very significant. R67, 4.7kΩ with 5kΩ, and R68, 22kΩ, with 2.7kΩ! It is very doubtful if any of these would have required replacing, and the reduction of R68 meant that the current drawn prevented the regulator striking, and the 100V needed for the screen grids of V3 was very much lower. All these were replaced with the correct values and the voltages were then spot on, with the regulator glowing fairly brightly.

Conclusion

If not built with love, then the set was certainly built with fine components and considerable care. An old and unadventurous design, but very well implemented. This must be its main feature. As I neither read CW, nor is this set now capable of normal operation for CW and narrow bandwidths, it is hard to determine how good a performer it would have been. Its low IF is not conducive to sparkling image performance, and the amount of gain before the main selectivity is not conducive to fine adjacent channel rejection, but I suspect it was a competent performer, and that it was reliable. It was also reasonably light and compact for its time. The serious AGC design fault though does cast a signifcant shadow. **PW**