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The Eddystone EC10 Mk 2

Philip Moss M0PBM takes a look at this once popular transistorised communications receiver.

This small, compact receiver was kindly given to me by the then Chairman of the British Vintage Wireless & Television Museum, Dulwich. I am known there for my interest in such things, which makes me really the only one, though we now have a small collection of such radios, including several 'iconic' ones, to use an over-used expression.

Overview

The radio is intended for battery operation, using six D-cells, though a mains PSU was available, which will fit in the battery-box. There was also an external supply for 12 and 24V DC. I didn't have it, and as I had no intention of buying one, built my own in the space, leaving a connector for an external DC input, also. The radio has distinct Eddystone features from times gone by (as if this set wasn't itself from such a time). I first encountered one around 1975, though probably the Mark1. By this I mean the rack-handles, which all the pre-Marconi take-over sets had, and the scale which was adopted a very long time ago, a few very old sets having semi-circular scales.

The radio has five bands, and as is usual Eddystone practice, Band 1 is the highest frequency. Coverage is as follows: Band 1 18 to 30Mc/s, Band 2 8.5 to 18Mc/s, Band 3 3.5 to 8.5Mc/s, Band 4 1.5 to 3.5Mc/s, Band 5 550 to 1500kc/s. Calibration accuracy is said to be 1% on all ranges. Temperature stability is <1:10,000 per degree C. Sensitivity is quoted as >15dB SNR for 5µV input for bands 1-4, falling to >15dB for 15µV on band 5, although that is measured via a 400Ω resistor. Image rejection is quoted as 20dB at 18Mc/s and 50dB at 2Mc/s. The product of only one tuned RF amplifier.

The Mk 2 version added additional features: a fine-tuning control, using a varicap diode across the local oscillator (LO) tuning capacitor, and I thought also a stabilised supply for much of the RF circuitry, especially the LO, but it turns out that this was on the Mk 1, and I had previously been mis-informed. However, the use of a shunt diode wastes valuable battery power. If they had used a series-regulator circuit, no current would be wasted. The resultant voltage would be lower (it is anyway at 6.5V), but then the oscillator could be designed to run say at 5V.

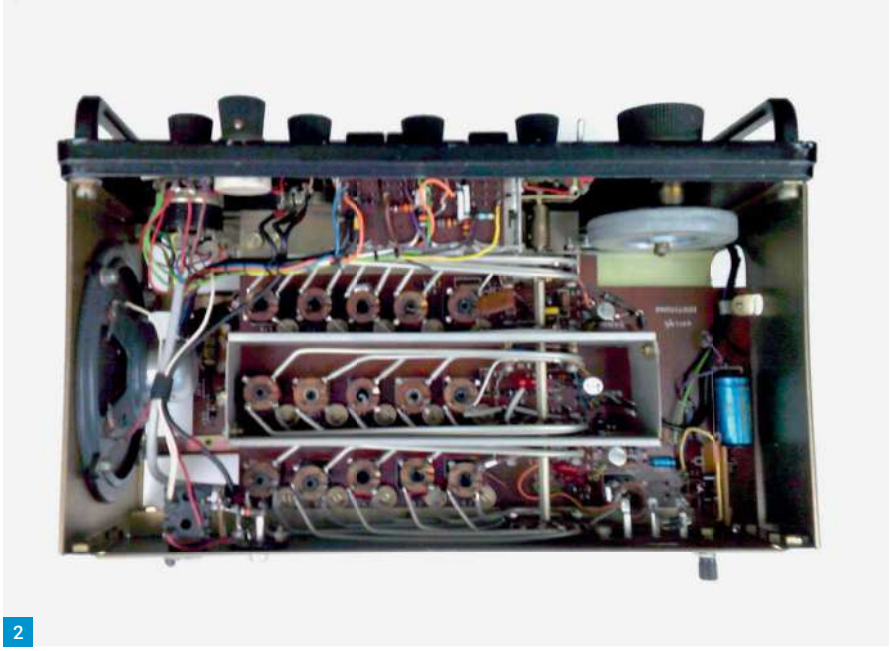
Mine has been modified to have a transistorised supply to the LO, and while it is inelegant the way it's done, I have left it as it seems to do no harm. As it happens the whole supply is now regulated by a 7809 IC regulator in my mains PSU. Other changes in the Mk 2 are the inclusion on the left-hand side of the tuning scale of a signal meter, in the opposite bottom corner to the rotary logging scale, marked 0 to 100, with every digit marked with a dash on the scale, for use in conjunction with the 1 to 500 bottom line on the tuning scale. On the subject of power consumption, it consumes 36mA with output power less than 50mW and 180mA at 0.5W, with another 90mA for the dial lamps. These are only on if holding down the non-latching switch. I have wired across that as power is from the mains.

The Circuitry

The aerial input is for either 75Ω balanced or unbalanced, for band 1 to 4, and 400Ω for band 5, again bal/unbal. These are stated as nominal so I would guess they were not very stable with frequency. A device is fitted for earthing one input socket for unbalanced use, and there is a high-impedance terminal for use on all bands, intended for short telescopic aerials. There is an available option kit of a specific aerial and fitting kit. The Hi-Z input is coupled by a 3pF capacitor directly to the tuned circuit, as is typical, thus bypassing the aerial transformer primaries. All the input circuits are the same configuration – double-wound transformers, with an impedance step-up into the tuning capacitor, but a tap for the transistor's base. There are two opposed-parallel DD006 diodes across the balanced aerial input terminals to protect the RF amplifier against excessive voltage. All have a trimmer capacitor. All RF/IF transistors are OC171s, including the BFO. These were useable at least up to band 2 VHF, ie our FM broadcast band. The IF is the very typical 465kc/s. The RF amplifier is used in common-base configuration.

After two stages of IF amplification, the signal is detected by an OA90, which is also the automatic gain control (AGC) detector. The AGC line is fairly low impedance, so it can also drive the S-meter. The operation of the AGC isn't immediately obvious. The positive voltage derived is fed back to the first IF transistor (remember these are PNP transistors) where it counteracts the forward bias, thus reducing the current through it. That much is very conventional. However, there is a diode between the decoupled supply to that transistor's collector, and a tap on the primary of the first IF transformer. The supply to the mixer is also decoupled. Without AGC applied, the difference in these two supplies is such as to reverse-bias the diode, so it is effectively not there. When AGC cuts the current in the IF amplifier transistor, the supply to it increases as the voltage across the decoupling resistor

Photo 1: The EC10 Mk 2.
Photo 2: Underneath view.
Photo 3: Rear view, showing both PCBs.



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falls, the diode begins to conduct, and damps the signal across the first IFT in association with the diode's series resistor, the diode being an OA70. The AGC action is not good compared to valve sets of the time. An 80dB increase in input results in <12dB increase in output, taken at 6µV and 20Mc/s on range 1. All three IFTs have tuned primaries and have taps to match the collector Z into the tuned circuit. They are also taped on the secondary to present a low-Z to the transistor bases. The first two IFTs have tuned secondaries. The last IFT is not tuned on its secondary, and is a step-down to match into the load of the detector circuit. The bandwidth is stated as being down 6 and 40dB down at 5 and 25kc/s respectively. As ever, the circuits are too large to include: they would occupy three pages.

The controls are as follows, from the left, below the tuning scales: RF gain and on/off switch, AF gain, BFO pitch: marked with a 'u' on the LHS, and 'l' on the other: showing whether the BFO is running above or below the carrier frequency. Next is the large knob, predictably the tuning, which is flywheel loaded, and drives the rotary logging scale above. The step-down ratio is 110:1. The lower controls are Fine Tune, and the push-buttons are Filter (a selectable approximate 1kc/s AF filter for use when receiving CW), then BFO on/off, AGC on/off, and the non-latching dial lamp switch. The toggle, and Mk 2 addition, is the standby switch. This does not do the obvious and interrupt the supply to all but the oscillators, but merely desensitises the set. It has a spare pair of unconnected contacts for wiring to a transmitter for Rx/Tx changeover, there is a hole with a grommet for taking out a pair of thin wires. There is no headphone socket on the front, unlike the Mk 1, it is now on the rear, where next to it is added a phono socket for AF out to auxiliary equipment, connected before the volume control. The use of a rear 'phones socket is not very convenient.

The set came with photocopies of the original manual, and the Mk 2 supplement: they didn't rewrite the manual for the Mk 2 radio.

Construction

The set is constructed on two PCBs. The bottom PCB carries only the front-end circuits, thus only three transistors. It is however a complex board, for all the HF coils are on it. Despite being PCB construction, all the wiring to the coils and wafer switches is hard-wired, and because the aerial circuits float, there are two connections there. Also, because the secondaries are tapped, there are two more, so four wires per coil and three per interstage coil. A basic arrangement would only have two connections needing switching, with two earths, not needing switching. The LO switching using double-wound transformers is again more than usually complex. Getting all the wiring done onto the correct tags on the wafer would take considerable concentration, methinks! The wiring uses the same translucent sleeving that is reminiscent of the valve construction. Indeed, the whole assembly does, the difference being that sheet metal is used to screen the coils, not a diecast chassis. The rest of the circuits are on the upper PCB, with seven transistors.

The tuning drive isn't simple, either. There are a lot of pulleys in there, and the reduction gear, with the typical double wheels with spring loading to prevent backlash. The cabinet is welded steel, finished in grey metallic paint. The speaker is a 5in Audax.

Work

This radio worked straight off, so no repairs were needed. I checked the signal-to-noise ratios (SNRs) and found they were generally not quite up to specification but not far off and I decided to leave it alone. The type of carbon-

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went out /M for a few hours over the nights of 12 and 13 August, operating MS from IO84VS. I have a short homebrew 5-ele Yagi on my car and can run about 130W output on 2m. Although the Perseids where not particularly spectacular this year, they were still good over a number of days, I found. Even with my very modest equipment, signing /M, I completed with, F6BEG (JN25), LA0BY (JO59), OZ7UV (JN65), SP2ERZ (JO94), S50C (JN76), IV3NDC (JN65), S51AT (JN75), IV3GTH (JN65), DJ6AG (JO51), S57VW (JN76), DL8YE (JO32), S55AW (JN75), IW2HAJ (JN45), S58M (JN76), LY2R (KO15), S540 (JN75), 9A7W (JN85), 9A2TE (JN85), F4EZJ (JN05), 9A5M (JN95) and S50TA (JN76). For many, IO84 was a new square. I used FSK441 as I found that stations were more able to decode the weaker bursts from my lower power, providing greater sensitivity than MSK.

"Earlier on 2m, from home on 21/7, I worked EA8CXN (IL18), EA8JK (IL18) and EA8CSB (IL18) via tropo on FT8, all over 3000km distance. These events are rare for me living in the Eastern Midlands as the sea ducting from the South usually dissipates when it meets the UK land mass. I also completed with the Market Reef Expedition, OJ0DX (JP90) via MS on 27/7."

At GW4VXE, although my 2m beam is down, I managed to work EA8JK (IL18) on FT8 by tropo using my vertical on 20 July. There was an Es opening to the EA5/EA7 areas on 22 July and I was pleased to a good number of stations using the same vertical.

The 70cm Band

During the RSGB 70cm activity contest on 12 July, Jef ON8NT worked M0LMK (JO01), G4CLA (IO92), G4FEV (IO92), G4RUL/P (JO00), G6VOV (JO02), G7LRQ (IO91) and G0XDI (IO91). Next day during the FT8 Activity session, Jef worked M0LMK (JO01), G4NBS (JO02), G0BIX (JO01), 2E0DUE (JO01), G4BRK (IO91) and M0IEP (IO91).

The 23cm Band

Jef ON8NT uses 10W from an IC-9700 into a Wimo Flat Panel antenna and worked G3XDY (JO02) during the RSGB Activity contest on 19 July followed next day on FT8 with contacts with G4BAO (JO02) and G4DDK (JO02).

Satellites

Many thanks to **Patrick Stoddard WD9EWK** (Phoenix) who as ever, has plenty of interesting news from the satellite scene in the USA. He writes, *"On 11 August, the new Kenwood radio in the Russian segment of the ISS was activated as a packet/APRS digipeater on 145.825MHz. This means that the ISS is supporting both voice and packet communications. The two stations don't appear to be interfering with each other. I have been using my Kenwood TH-D74 handheld radio to work the digipeater on 145.825MHz from one VFO, while using the other VFO to hear the crossband repeater's downlink around 437.800MHz. The crossband repeater IDs as NA1SS, and the packet digipeater as RS0ISS.*

*"A little while back, I was asked to test a prototype 2W 2m/70cm FM transceiver designed for satellite operating. The radio is called SOAR (Satellite Optimized Amateur Radio, **Fig. 3**), made by Halibut Electronics. Halibut Electronics is the new company founded by **Mark N6MTS** in California. SOAR is intended to make satellite operating easier, by automating functions that are usually done manually by satellite operators, and reducing the amount of kit required to get on the satellites. SOAR can also be used like a handheld radio, working FM repeaters and simplex, complete with CTCSS tones. SOAR is not large; about 125 x 100 x 28mm (about 5 x 4 x 1.2in), excluding items like connectors and knobs sticking out of the SOAR.*

"SOAR has a GPS module, which is used to set the clock and determine your location. With updated Keplerian elements, it is capable of showing a satellite's track in real time, adjust the uplink and downlink frequencies to compensate for the Doppler effect, and start an audio recording. It has separate 2m and 70cm antenna ports – perfect for those using 2m/70cm Yagis like the Arrow, or other two-antenna solutions. SOAR will also record audio during satellite passes automatically, or the recorder can be manually activated. More information about SOAR is available at:

http://electronics.halibut.com/soar

"Testing so far has been promising. I have used the SOAR prototype on different FM satellites, and even made a contact with NA1SS through the ISS crossband repeater. N6MTS mentioned he never tried working the satellites, in part due to the amount of equipment required. With the SOAR, Mark has made his first satellite contacts. Mark and I worked each other through the ISS crossband repeater on 3 August. Both of us used SOARs.

"In the next few weeks, Halibut Electronics plans to ship the first 100 SOARs in its early adopter program, before the radio goes into full production."

At GW4VXE, as well as the NA1SS QSO, I was interested to make my first transatlantic QSOs using the ISS crossband repeater, including VO1NC (GN38) and VE1CWJ (FN85). For the first time in several months, I tried out RS-44 and was pleased to work KE9AJ (EN50), W2GDJ (FN32), NA1ME (FN54), WA2FHJ (FN13), W8LR (EM79), VE6WQ (DO33), GM4ILS (IO87) and SM/LA9XGA/P (JP62).

That's it for this month! Thanks to everyone who has been in touch. Please keep your news coming, on any aspect of VHF/UHF and microwave operation. See you next month. **PW**

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composition resistors used may well have changed value a long way, and perhaps checking and replacing with modern intrinsically low-noise types would have an effect. The trouble with that is that in transistor circuits you cannot just measure them in-situ, both because there are potential dividers which mean there are two paths for current, not just across the R under test, but also because of turning on transistor junctions. I could even try a newer RF amplifier transistor, but I think leaving it alone is more sensible. If it were in poor condition, I may have thought differently. Digging about on PCBs is likely to lead to lifted tracks on these older sets. I find modern PCBs on fibreglass remarkably forgiving.

So, the PSU was the only thing I did. It is fairly conventional, but I used the positive regulator IC, 7809, 'upside down': I regulated the positive then connected that to the ground, as being all PNP transistors, the supply is negative rail. I also made provision for external low voltage AC or DC input using a bridge rectifier, which also acts to prevent reversal of the supply.

There is only one interesting point about my PSU. As I pushed it into the back of the set there was an awful hum. At first I thought I had messed it up by putting the transformer at the wrong end so it could induce hum into the audio transformer. Wrong, nothing to do with it. I had heard of modulation hum, but not previously encountered it. I tried a small capacitor I had replaced in a valve set across the mains transformer secondary and like magic the hum went. The capacitor leaked but at the low volts here it is fine. The transformer was a little too deep. There was a danger of a short to the radio, so a piece of Perspex was added over it, and under each of the PSU's retaining screws, an aluminium washer a couple of mm thick was placed, held in position by double-sided tape.

Conclusion

Compared to the valve Eddystones, this set has a poor specification, electrically. It lacks the selectable bandwidths in the IF, its signal-to-noise ratio is poor, and the audio output is small. Also, its AGC effectiveness is poor. However, it may also be said, try picking up any valved set with one or two fingers around the handles, or running them off six D-cells! And it is small and light. While modern semiconductor sets can proverbially wipe the floor with it, for its time it was probably a very good performer in its class. It also takes up little space, and is elegant enough to be allowed in the lounge where there are non-radio enthusiasts to be negotiated with. As such while I prefer my valve sets, including some very nice broadcast receivers, I am glad to have acquired this one, and would have been prepared to pay a few quid for it. For Eddystone enthusiasts, it is needed to complete the vintage range. **PW**