A Story about an Eddystone 888A

Introduction

I have a small collection of Eddystone receivers that I have built up over the past four years because I have found them to be better at coping with the high levels of interference at my home location, than any of my modern receivers. My 730/4 was still in Government service as late as 1995/96 and subject to annual maintenance and calibration. It is my first choice for AM reception. My S940 has been thoroughly refurbished and, with its product detector and tuned AGC system, is my first choice for SSB reception. They sit side-by-side on my operating bench, with a choice of tuned-loop receiving antennas and a very good RF earth; and are in use two or three times each week. I wanted an EA12 to go with them but failed to find one. When I was offered the chance to purchase an 888A in good condition, complete with the original 688 Loudspeaker and 669 Signal Strength Meter, I accepted the offer and completed the purchase.

Purpose

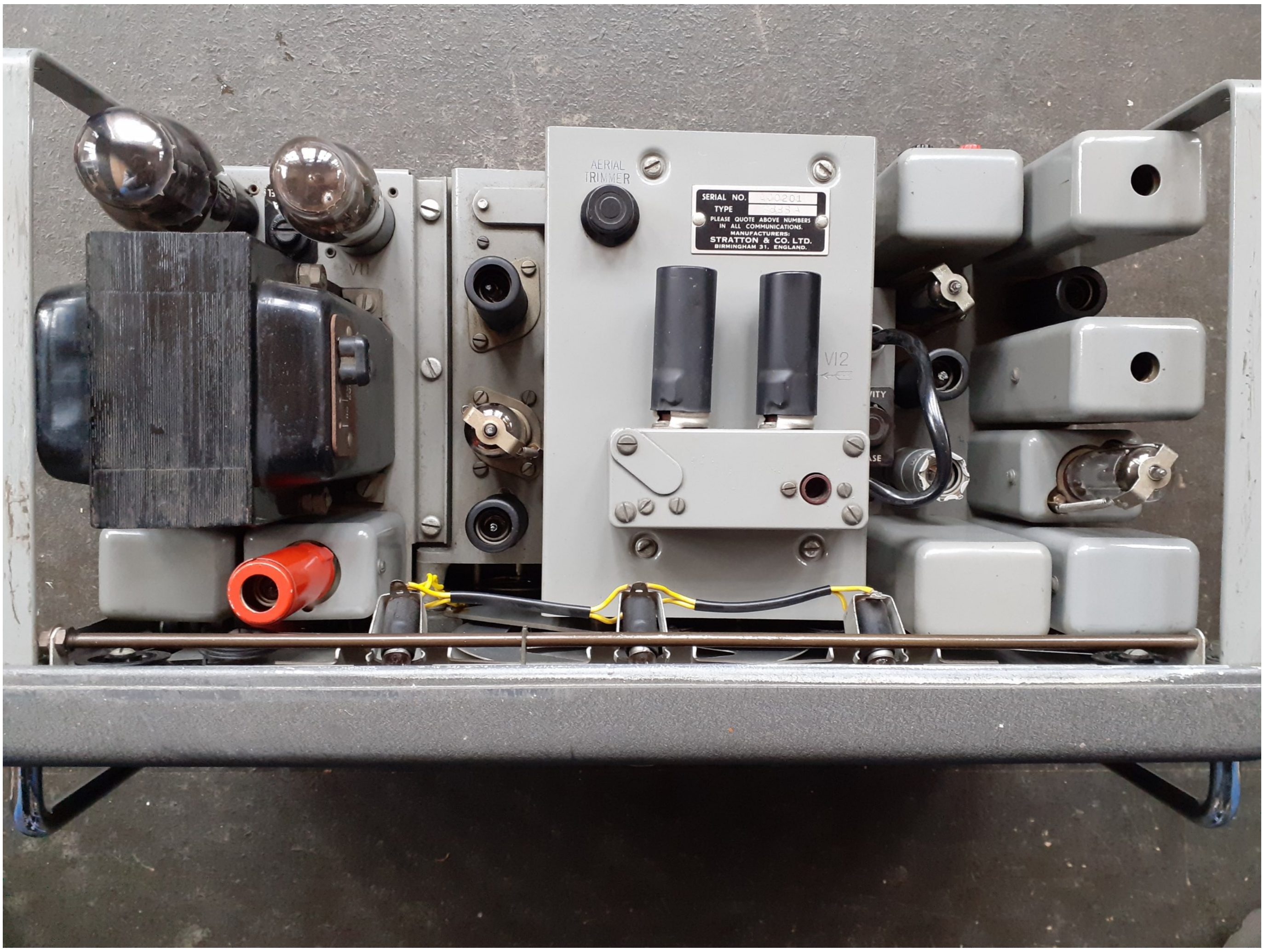
The purpose of this article is not to duplicate any of the other excellent articles, on repairing and/or maintaining Eddystone receivers, available on the Eddystone User Group website. Over the past four years, I have not once found myself short of advice, guidance or detailed instructions on how to do the repair or rebuild task I was about to undertake on any of the receivers in my collection. However, the task of returning my 888A to operational use did not go anything like I had expected. There were times when I wondered what I had done in buying it and whether I ever would succeed and complete the task. However, I did and the 888A is now sitting in the centre of my operating bench doing what it was designed to do; and, it has been doing it for six months without missing a beat.

The purpose of this article is to help motivate and encourage others who may struggle on those black days when nothing works and everything keeps on dying. It is written as a story or diary of events, in chronological order, so that a reader can appreciate the timescales, the reasons why decisions were made and the way in which success finally emerged from the gloom. However, it is not a ‘blow-by-blow’ account; that would be too long and boring to read. Finally, the story exposes a lovely little bit of history.

The Beginning

On 21st July 2021, my new 888A was put in position on the work bench ready for repair/refurbishment to start. In accordance with ‘best practice’, I made no attempt to apply mains power; I just looked at it and felt the controls. The RF Gain and IF Gain controls both felt a bit rough; all the others felt quite smooth and appeared to operate correctly. The front panel and the rest of the outside of the case were in very good condition. This pleased me because I do not like painting and I do not like to see old equipment painted to look like new. As long as there is no rust/corrosion and no serious chips or scratches, I like to clean the paintwork and let it live on in its original form.

The case was removed – it came off very easily – and I looked inside. Wow, I thought, this is going to be a ‘doddle’; it is all as clean and tidy as the outside, so there is nothing for me to do. I can start looking at the electronics.



Before rolling it upside down, I checked the valves. A complete set of the correct type was in their correct positions. They all looked OK, although the rectifier appeared to have been bought second-hand at some time. Slightly worrying was the sound of something small and metallic rolling around inside the can of the final IF transformer. I made a note to remind me to strip that apart to investigate later.

With the set upside down, I started to examine carefully all the wiring and components that were visible. I started at the captive mains input lead and worked my way around the chassis to the loudspeaker terminals, writing notes on all that I found. I had not gone far before I realised that this set was not going to be a 'doddle' to fix. In that hour of careful examination, I discovered:

- A lot of cracks and splits in the insulation of such critical wires as the mains live lead and the HT line – sufficient in some places to expose the conductor underneath
- The rubber seals of both the HT smoothing capacitors were bulging too much to risk their continued use – they were dated February 1958
- The lubrication on the tuning capacitor and gearbox was a bit dry
- Two brown plastic Hunts capacitors had cases which had split and disintegrated
- The lower coil box cover did not look like an original Eddystone component - being plain aluminium with roughly drilled holes and curious additional covers over the trimmer capacitor access holes
- The main tuning capacitor knob was not adjusted properly and lacked its lubrication pad
- There were two short green wires, connected to terminals on Socket A, which went nowhere

There are several areas of an 888A where access is very limited and even a simple component swap requires major dismantling.

Thus, the first day ended on a low note but with two clear decisions. Firstly, to dismantle most of the set in order to gain access and make the repair work easier and secondly to do no work on the cabinet or chassis – except for some light cleaning – so that it would continue to look original. Also, I was puzzled as to why there were so many obvious areas needing work to be done in a set that looked in such good condition.

The Safety Issue

Much as I like my Eddystone receivers to look original, I own them for the purpose of receiving radio signals and they are in use several times each week; they are not exhibits in a museum. What really matters to me is how well they work and they have to be safe in operation. Therefore, I do modify my receivers in the area of the mains wiring and to suit the use of low-impedance headphones fed from the output of the audio transformer. But I do this in a way that is sympathetic to the original design/construction and which could be reversed at a later date.

My second day working on the 888A was spent satisfying my safety concerns. After an hour or so taking careful measurements and trying different component configurations, I realised that the 888A was being cooperative for a change. First, I removed Socket 'B' and the HT connections to Socket 'A'; taking care to save as much of the wires as I could. Then, I started to rewire the valve heater and HT circuits so that they would operate correctly without the need for Plug 'A' and Plug 'B' to be in place; using the original wires that I had just saved to replace sections that were cracked/split and planning to complete this work once the front panel had been removed and access improved. I was content to do this because I have no intention of ever operating the set from any form of external power supply and I had to do something about all the damaged/faulty insulation; by re-using the wire, as I did, the set still looks like it would have done if Eddystone had not provided the facility to use an external power supply.

They say "every cloud has a silver lining" and, when I removed Socket 'B', I found a broken wire which was completely invisible until the socket was moved out of the way. I investigated and discovered that it was the heater supply to V7. Of course, I have no way of knowing when the wire broke but, without V7, the ANL facility and the Signal Meter would not have worked. Having made this discovery, I repaired the fault while changing the heater wiring and continued my work.

The next task was to install a modern IEC 3-pin filtered mains socket. One of the IEC sockets I had in stock fitted into the hole left by the removal of Socket 'B' with only a little filing and the drilling of two small holes. After a few minutes work, my 888A had its new mains socket fitted to a passable standard and in a manner which could be reversed, if required in the future.

I had an unfortunate experience last year when an electrolytic capacitor exploded in one of my receivers. Fortunately, I was not looking into the set at the time so I was not hurt. But it took me over a week to strip and clean all the debris out of the set; particularly from between the vanes of the tuning capacitor. Therefore, I always renew the electrolytic capacitors in any old Eddystone receiver that I acquire. This time I used a pair of brand new modern capacitors that are the same diameter as the original ones – so fitted the existing clips - but 56 microFarad and 450 Volt continuous working. Additionally, they are a lot shorter and, consequently, provide very useful extra 'finger space'. I replaced the mains wiring from the IEC socket to the transformer, via the On/Off switch, with new, modern flexible cable. Finally, I earthed the centre tap of the transformer secondary winding and re-purposed the Eddystone fuse to interrupt the main HT line. Now, I am content that I have a much safer receiver and the wiring of the power supply still looks reasonably compatible with rest of the receiver.

A Pair of Pleasant Surprises

Having realised on the first day that access is very limited in an 888A – when compared to the S940 or even the 730/4 – the third day was allocated to carefully stripping the receiver. The first thing I discovered was that all the grub screws in the control knobs were intact and had lubrication on their threads. Removing the control knobs took about a minute. The second thing to be discovered was that the nuts and knurled rings which fasten the potentiometers and switches in place were all just nicely, slightly more than finger tight. The rate of progress was awesome. The finger plate lifted off with the use of two finger nails and there was the first of the surprises; a small piece of paper had been folded and hidden behind the finger plate. I carefully unfolded the paper to reveal the printed words:

L.O. SWITCH WAFERS CHANGED JUNE 1964 G3JJZ (see postscript at end)

I have no idea who G3JJZ is/was and my attempts at finding out have failed. However, perhaps a reader of this article will know and perhaps there is someone who would like to know that their 888A is back in operation again.

Having removed the crystal calibrator module and the cover to the tuning capacitor– so as to be able to disconnect the drive to the tuning capacitor – the next task was to remove the eight bolts which fasten the front panel to the receiver chassis. What I discovered completed the second of the pair of surprises. None of the bolts was damaged, nor were any excessively tight or corroded. Interestingly, the four bolts which fasten the front panel to the coil box all had a coating on their threads and tapered heads suggesting that they had been lubricated with general-purpose grease. As a consequence, it took only minutes to undo the bolts.

The discovery of the note from a previous owner and the ease with which disassembly was completed made a pair of very nice surprises and the latter saved a lot of time.

A Stroke of Luck

Whenever I dismantle a receiver for the first time I go very slowly and carefully; taking photographs and writing copious notes. Therefore, when I started to remove the front panel of the 888A, the receiver was firmly supported flat on its back to allow me to remove the four bolts which fasten the front panel to the coil box. I removed the bolts, one at a time and without moving the front panel, but then immediately, put each bolt back into position and screwed it into the coil box by only a couple of turns. When I had done this for all four bolts, I was able to gently slide the front panel up and down on those bolts and have a really good look around to ensure that I had not missed anything. It was my lucky day because this enabled me to spot that, on this particular receiver, in addition to the four thick washers which usually are fitted between the front panel and the coil box, there was a thin one on each of the top two bolts. Had I simply undone the four bolts and lifted off the front panel, these two thin washers would surly have fallen into the receiver and I would not have known where to put them back.

The Work Begins

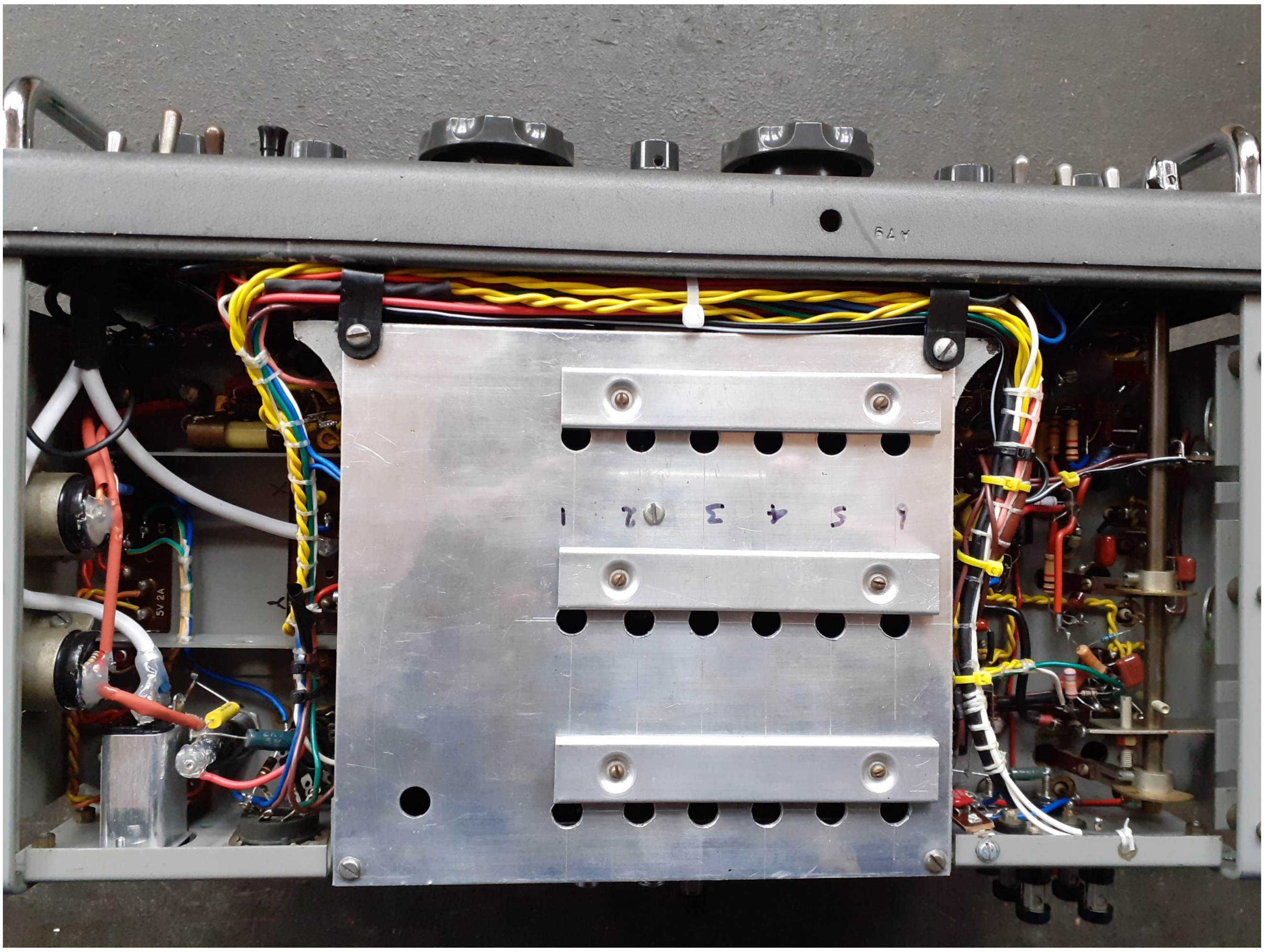
Once the front panel was off the receiver, I completed the work to re-wire the valve heaters and repair the HT wiring. Then I replaced all the components which showed signs of damage or which required the front panel to be removed, in order to gain access. The IF Gain control – R42 – was open circuit between the ends of the track. The AF Gain control – R40 - had a couple of places where the wiper lost contact with the track. The RF Gain control – R7 - just felt very rough, but appeared to be working. Given that changing any of these requires the front panel to be removed, all three were replaced with new potentiometers. Then I extracted and replaced C81 because it is an electrolytic capacitor and fitted a modern new one, with similar dimensions but higher working voltage than employed originally. Then it was time to clean and lubricate the tuning capacitor, drive gearbox and tuning dial assembly before putting the front panel back onto the receiver. Of course, I remembered to refit those two extra washers to the correct two fitting bolts.

A Future Surprise for Someone

After being pleasantly surprised to discover the note from G3JJZ, I took the decision to return it to its hiding place when re-assembling the receiver. In addition, I added a similar note from myself. Who knows when, or even if, someone else will dismantle the receiver in the future; but, if anybody does, they will learn at least something about its history.

The End of the Second Week

By the end of the second week, I was feeling quite cheerful; good progress had been made and my 888A was all back together and looking good.



The mains input wiring had been sorted and made safe; the power supply had been refurbished and was working, ready to power the receiver; the hard-to-access components behind the front panel had been changed; I had changed all the other components that had looked to be damaged or just suspect; and, all the mechanical components had been cleaned and lubricated. I had tested the repaired heater wiring and confirmed that it worked correctly and all the valves had heaters which worked.

Normally, at this stage in the process, I slowly apply increasing mains voltage to be rewarded with signs of life and, maybe, a working Eddystone. But not this time; my 888A was completely and utterly dead. The only things showing any signs of life were the dial lights, the valve heaters and a nice glow from the voltage regulator.

The First Long Slog

I began the task of checking reference voltages and testing components. I realised very quickly that this was no ordinary Eddystone receiver because it had more faulty components than I have ever seen in one piece of electronic equipment. It is quite common in receivers of this vintage to find resistors whose values are 30-50% high – and often the set will still operate. But I was finding open-circuit resistors and near short-circuit capacitors. In the end, it took me over a month of hard work before my 888A was sitting on the bench and working again. There were so many faults that I ended up changing almost all of the passive components, except for the silver mica capacitors inside the coil box and we will return to them later in the story. Once I realised the nature and scale of the task I was facing, I took the decision to make a few small changes to the original construction. I kept to the original circuit diagram but allowed myself the luxury of moving the occasional component or re-routing some wiring to make it easier to repair next time. For example, R33 is now located with C74 and connected directly to the grid of V5, instead of being mounted on the back of Socket 'A' on the other side of the chassis. Similarly, the audio filter comprising C76, R35 and C77 is now mounted on its own little tag strip instead of being buried in an inaccessible corner, under a pile of other components.

Faced with a set that appeared to be completely dead and in which several of the reference voltages were wrong by a large margin, the usual approach of starting with the audio stages and working forward felt a bit feeble. Therefore, I dismantled the HT supply wiring and made a temporary connection only to the audio output valve. This temporary supply was a bit high because of the reduced HT load but nothing went bang or caught fire so I injected an audio signal straight into the grid of V8 and nothing came out of the loudspeaker; nor did the scope show any signal on the anode of V8. Now this came as a surprise, given that I had removed R30, R31 and C87, and renewed R32, R43, C85, C86, C88 and C111, plus I had checked all the voltages on all the pins of the valve were correct. I swapped V8 for a new, tested one without success. Therefore, I made a brew and sat down to study the circuit diagram; asking myself the question, if the signal is not going up through the valve, where is it going? Of course, the answer is that it is going to earth via the piece of coaxial cable that is connected to the grid of the output valve; and it was. I had been so smug spotting all the little cracks and splits in the insulation of the HT and heater supply wiring. Then I had tested and replaced all those faulty passive components. But it had not occurred to me that I needed to treat every bit of wire as suspect and to test it, just like any other component. In this particular case there was a tiny crack in the insulation of the coaxial cable and, probably when I moved it to replace other components, a short circuit had occurred. I fixed that fault and the audio output stage sprang to life and worked well.

Feeling more confident, I moved on to the audio pre-amplifier – V6 – and carefully checked all the associated bits of wire, before rigging a temporary HT supply. As soon as the HT supply was applied it sprang to life, the new AF Gain control worked and I was able to check the frequency response of the audio stages; with and without the audio filter switched into circuit. Without the filter, there was a nice smooth response from around 250 Hz to 4500 Hz at the -3 dBs points.

My approach of adding the HT supply to one valve at a time was not really practicable with the IF amplifier. Therefore, I decided to properly rebuild the HT supply to V4, V5, V6 and V8 as a block and then to test the second mixer, IF amplifier and audio stages as one unit. I had stripped and re-built the IF transformers T2 and T3; firstly to fix the rattle referred to above and secondly to lubricate the internal mechanical parts. The rattle turned out to be a sphere of solder about 2 mm in diameter. Probably, it had been there, doing no harm, for the past 60 years. Nonetheless, I am pleased that I heard it when rolling the set onto its back because it could have lodged somewhere different, when being rolled back upright, and caused serious problems. Also, the lubrication inside both transformers had long since gone dry and sticky. Once this had been removed with a little alcohol and new lubricant applied, the moving coils were silky smooth in their movement and would slide down under their own weight. All the passive components associated with V4 and V5 had been replaced and I had gone back and checked every bit of wire. When doing this I discovered that the coaxial cable connecting the output of T3 – via C72 – to the product detector – V9 – was about two inches longer than necessary, so I was able to trim it back and make good safe connections to its ends.

When I applied the HT supply and injected a modulated signal into the grid of V4, I was rewarded with an audio signal out of the loudspeaker. Suddenly, everything was looking much better. Within a matter of minutes, the IF amplifier was roughly aligned to 85 KHz and working, the second mixer was set up and operating so that modulated signals at 85 KHz and 1620 KHz injected into its grid via the test point both gave the expected audio output. Also, the IF Gain control and AGC system were working. Therefore, it was time to let everything warm up properly before starting the IF and second mixer alignment for real. At this point, I heard a distinct sizzling sound, followed by a ‘pop’ and complete silence. Only this time the set was not completely dead. A quick check with the scope showed that the second mixer and IF amplifier were still working; as was the output stage. Only the first audio stage – V6 – was not working because no current was flowing through the valve; even though the cathode was sitting some 10 Volts above earth. That was because C73 was now a resistor of about 1500 Ohms instead of a 20 pF capacitor. That brand spanking new capacitor with its 400 Volt rating had failed; thus proving that the bath-tub curve of failure-probability, probably exists. I replaced it with a new one from a different manufacturer and with a 630 Volt rating; then we were back in business. Except that I now needed another new valve for V6; the one that had been in use when this latest fault occurred had not survived the high current flowing through one of its diodes because of the failed C73.

Once everything was warmed up again, I followed the Eddystone manual to the letter and carefully aligned the IF amplifier and second mixer. Unfortunately, the frequency response of the IF amplifier was rather asymmetric and varied with the Selectivity/Bandwidth Control setting. I was confident that I had rebuilt the mechanical linkages correctly because, before undoing anything, I had carefully marked every joint with a marker pen. However, no matter how many times I re-aligned the IF transformers, nor in what order I did it, the outcome was an asymmetric frequency response. Therefore, I posted a question to members of the EUG, asking if anybody else had experience of this problem. Ian Nutt responded by pointing out that the mechanical linkage – specifically the phasing of the two adjusting arms – was set by experiment in the factory; using a wobbulator to monitor the frequency response of the amplifier. I do not have a wobbulator, so I used a different approach. I carefully took the mechanical linkages apart and then studied the rotary shaft under a bright light and a magnifying glass; looking for the witness marks from the clamping bolts. While doing this, I washed the shaft in alcohol and adjusted the angle of the lighting. This enabled me to see a collection of witness marks and determine the positions of the two original ones. I rebuilt the linkage using these marks and re-assembled everything, before carefully re-aligning the IF amplifier again. The result was magic - thank you Ian – the frequency response is much narrower and beautifully symmetrical. Furthermore, it maintains its symmetry as the Selectivity/Bandwidth Control is varied.

By this time, I really wanted to have a play with my new toy. Therefore, I pressed ahead and completed the tune and re-alignment of the front end of the receiver. Nothing went wrong and a few hours later – without having done any characterisation measurements – the receiver was ready for its first air test and it worked. The tuning was silky smooth, all the controls worked after a fashion and I could hear signals where I expected them to be.

The photograph above shows the receiver with its signal strength meter and loudspeaker connected; working on the 80 metre band that afternoon. However, it was clear that all was not well. When receiving narrow-bandwidth AM signals, it worked reasonably well provided that they were strong signals and maximum RF Gain and IF Gain were not deployed. On SSB though, the product detector appeared to be over-sensitive and prone to producing a lot of distortion. But that was something for another day. That afternoon I enjoyed myself, using my first receiver designed specifically for the amateur bands.

The Problem with the Product Detector

As soon as I tried to receive SSB signals, I hit what I regarded as a problem. Moving the mode switch from AM to SSB caused an immediate and large increase in audio output, coupled with high levels of audio distortion. It was possible to overcome this by turning Off the AGC and relying on manual gain control; with the IF Gain control. I am fully aware that some people see manual control of receiver gain as part of SSB reception. I am afraid that I take the view that, if I have a Carrier Insertion Oscillator, Product Detector and AGC system in my receiver, then I should not have to do any work. I should be able to switch between AM and SSB reception with little fuss; just like when using my Eddystone S940 or the Racal 1772 I used to use at work. I moved the 888A back onto the workbench and connected up the test gear. A quick test soon confirmed that the audio output of the product detector was starting to distort at input RF signal levels way below the point at which the AGC system was starting to act. This is not the case with the S940 which happily demodulates SSB signals over a wide range of amplitudes, under the control of the AGC system. Therefore, I compared the circuit diagrams of four Eddystone receivers – 888A, S940, EA12 and 830 – which use the 6BE6 valve as a BFO/CIO and Product Detector. Generally speaking, they all use the same circuit and have a capacitive attenuator to reduce the amplitude of the IF signal fed to the input of the Product Detector. In the case of the EA12 and S940 this is made from a capacitor of 5 or 6 pF and the capacitance of about 12 inches of coaxial cable. In the case of the 830, it is made up from a 10 pF capacitor and a 50 pF capacitor. However, in the case of the 888A – both the published circuit diagram and my receiver – it is made up from a 500 pF capacitor and the capacitance of that 12 inch-long piece of coaxial cable. Therefore, I tried an experiment by changing the input coupling capacitor – C72 – from 500 pf to 5 pF. The impact was an immediate and obvious improvement; SSB signals could now be demodulated over an increased range of input signal levels, under the control of the AGC system, and the receiver was easier to use. But, the RF Gain and IF Gain controls both had to be reduced a little below their maximum settings before the AGC system would start to operate properly. Also, I noted that the AGC response times were a bit too fast for good SSB reception. However, much more worryingly, I noted that the CIO/BFO pitch appeared to be varying with signal amplitude and causing audio distortion; that was something I had not seen before and I had no idea of what might cause it.

A Month of Highs and Lows

At the start of October 2021, I thought that the Long Slog had come to an end, my 888A was working – albeit there were a few issues with the Product Detector and the AGC response time was too short – and it was a nice day. However, after a couple of hours of fun, the receiver was fully warmed through and it was time to complete the task of very carefully tuning and aligning everything according to the Eddystone manual. This work was completed without any problems; it was nice to work on a set where all the ferrite cores were intact and lubricated, and all the trimmer capacitors were functioning properly. Unfortunately, when the work was completed and I characterised the receiver's performance, there was some bad news waiting for me. I discovered that there was a wide variation in 'sensitivity' from band to band. It did not matter whether I measured the RF input signal required to generate a defined audio output or just checked the RF input required to produce a reading of S9 on the signal meter, the results were the same. The 'sensitivity' was relatively constant across each tuning band, but there were big variations between the six bands. For example, the listing below records the RF input signal required to produce a reading of S9 on the signal meter at the centre of each of the six tuning bands:

1.9 MHz	-88 dBm	14.2 MHz	-63 dBm
3.8 MHz	-81 dBm	21.3 MHz	-60 dBm
7.2 MHz	-76 dBm	29.0 MHz	-70 dBm

A check of my other Eddystone receivers confirmed that they do not show anything like this degree of variation in performance. Therefore, I spent two days testing and measuring my 888A and could not find an explanation. This included more cleaning of the contacts in the waveband selection switch, swapping ferrite cores between bands and re-checking all the earth connections and mounting bolts inside the coil box. All this did was tend to confirm that the variation in 'sensitivity' was due to gain variation in the RF tuning/amplification stages. Consequently, I took the decision to do something I had never done before; to strip out and re-build the RF components in the coil box; re-making all the soldered joints, checking the DC resistance of all the windings of all the coils, replacing all the silver mica capacitors and cleaning and re-bolting all the mechanical joints. On 31st October, I was able to repeat all my previous 'sensitivity' measurements and the results below are directly comparable with those given above:

1.9 MHz	-80 dBm	14.2 MHz	-63 dBm
3.8 MHz	-80 dBm	21.3 MHz	-56 dBm
7.2 MHz	-73 dBm	29.0 MHz	-68 dBm

Readers of this story will not be surprised to learn that I was not particularly happy at the end of October. I had never expected so much work inside the coil box to deliver so little obvious benefit. In one sense, that is disappointing; on the other hand, it does suggest that there is nothing wrong with this aspect of receiver performance. The reduction in sensitivity at 1.9 MHz was a surprise and could be viewed as a significant loss but, on the other hand, it means the overall performance of the receiver across the six operating bands is more consistent. Thus, the only real disappointment is that, after doing all the work, Band 2 remains the least sensitive and is even less sensitive than it was before.

While I had been working on my 888A in the UK, KF6C had been taking some measurements on his in the USA and had sent me some numbers – thank you Brian – to compare with mine. Brian's numbers are not comparable directly with those above. However, his measurements show a similar degree of variation in sensitivity across the six operating bands, except that Band 2 is a little more sensitive than either of Band 3 or Band 1; rather than significantly less sensitive. Thus, it became clear that there was something wrong with the Band 2 performance of my receiver; its sensitivity was low by about 15 dBs. All I had to do was find out the reason for this and resolve the issue causing it.

Unfortunately, life became more complicated; while searching for the cause of the variation in sensitivity between bands, I discovered a very wide variation in sensitivity/gain of the receiver as the Selectivity/Bandwidth Control was varied. I had been conducting my sensitivity tests with the RF Gain and IF Gain both set on Maximum and the Selectivity/Bandwidth Control set for Maximum Selectivity/Minimum Bandwidth. I discovered that the apparent sensitivity/gain of the receiver would increase by over 40 dBs if the Selectivity/Bandwidth Control was moved through its operating range –

while the RF Gain and IF Gain controls both remained on Maximum. If this was not bad enough, I discovered that the IF amplifier bandwidth on Minimum Selectivity/Maximum Bandwidth – corresponding to maximum gain – was much less than it should have been. Then, while thinking about why this might be, the receiver caught fire. Specifically, R9 had produced quite a display of smoke and flames before I could remove the mains power; C33 had failed to a short circuit.

The Second Long Slog

The failure of C33 was a surprise to me because it was the first time I had encountered a failure in one of the chassis-bolted decoupling capacitors used by Eddystone. My 730 and 940 both have all their original chassis-bolted capacitors in place and working fine. Therefore, I started checking the others in the receiver and found two more that were seriously lossy. Consequently, I decided it was time to fix my reliability problems once and for all. It was quite a task but, by the time that 2022 dawned, I had an 888A containing all new components and which had been under power for a couple of weeks without anything failing. In hindsight, I should have recognised much sooner that there was something strange about this receiver and rebuilt it completely, the first time around. It would have saved me a lot of time and effort.

However, I now had an 888A that was working – after a fashion – and appeared to be reliable; nothing had failed or caught fire for a couple of weeks. Therefore, I set out to check and/or measure everything that I could. The sensitivity/gain variation between bands – as described above – was real and not part of my imagination. With the RF Gain and IF Gain both set on Maximum, the Selectivity/Bandwidth Control was varying the sensitivity of the receiver by about 40 dBs. The Selectivity/Bandwidth Control was not varying the bandwidth as it should have and the maximum bandwidth was much narrower than it should have been. Curiously, I had not seen this problem when I was testing the IF amplifier on its own. Finally, the frequency of the audio signal at the output of the product detector was varying with the amplitude of the received input signal; as though the BFO/CIO was being 'pulled'. It was while I was exploring this last strange phenomenon that I made a discovery.

The Big Discovery

I do not have a source of SSB signals for testing a receiver, such as the 888A, but I do have a modern high-performance RF signal generator, a Digital Frequency Meter and an accurate RMS voltmeter. Therefore, I use an un-modulated RF input signal and step the frequency in increments of 100 Hz across the frequency range of an SSB signal; for the selected test carrier frequency – with the receiver correctly tuned and the BFO/CIO pitch set appropriately. This process takes a lot of time and patience, but it can yield very good results. When I tried to do it with my 888A, I hit a problem. If the RF and IF amplifiers were producing maximum gain, the product detector would produce all sorts of spurious output signals. This was difficult to understand on the test bench, when signals could be held constant. In the real world, when the received signal would be controlling the gain of the amplifiers – via the AGC system – the situation was far more complex because the spurious signals were being modulated by the very signals that the receiver was trying to receive. I spent several days trying to work out what was causing the problem before realising that I still had an 85KHz signal coming out of the IF amplifier, even though I had just turned Off the RF signal generator. Of course, I assumed that it was the IF amplifier oscillating; only it was not. It was the first mixer oscillating at the frequency to which its input was tuned; which may or may not quite be the same as the frequency which the receiver is receiving.

Once I had made this discovery, solving the problem was relatively straightforward. It is interesting that Eddystone put grid-stopper resistors in the RF amplifier – R4 – and second mixer –R21 – but not the first mixer – V2 – so I added one. I tried various values and these helped the situation but were not sufficient. Therefore, I left a 15 Ohm resistor in place and continued looking. I experimented with an anode stopper – on V2 – and, again, this helped but was not enough. I left a 150 Ohm resistor in place and did some more thinking. I realised that I had replaced both R7 and R42 with modern wire-wound components. Therefore, I experimented by adding low-value resistors in series with both controls. I found that 150 Ohm resistors were just about enough to stop V2 oscillating so I settled on resistors of 270 Ohm to be on the safe side. These additional resistors had a big positive impact. The Selectivity/ Bandwidth Control now worked properly – causing only a small variation in gain – and the receiver bandwidth measured at the RF input to the receiver was the same as when measured at the input to the IF amplifier. All the spurious outputs from the product detector had vanished.

March 2022 – A Memorable Month

As soon as I was satisfied that the first mixer was not going to break into oscillation – regardless of what I did with the controls – I conducted a quick air test; what a pleasant surprise that was. The receiver worked like I had expected it to; way back in November 2021. With RF Gain and IF Gain set on Maximum and AGC turned On, I could tune up and down the bands, receiving signals to my heart's content. No more fiddling with the BFO/CIO Pitch control; just leave it on plus or minus 1 as appropriate. The Selectivity/Bandwidth Control worked as advertised; producing a smooth variation in received bandwidth, with little variation in sensitivity/gain. When a very strong signal was encountered, the RF Gain control could be used to smoothly reduce the gain of the RF amplifier – without any strange and unexpected effects – acting as though it were linked to the pointer on the Signal Strength Meter. Most of the time this last action was not required because the product detector worked like the one in my S940 and produced good clean audio from any input SSB signal up to S9 on the meter.

I felt that the standard AGC response times were too fast for typical amateur SSB signals. Therefore, I set about developing a simple little modification to provide slower response times when receiving SSB signals. Firstly, I re-purposed the Send/Receive switch – Sw12 – to act as an On/Off switch for the modification. I did this by disconnecting and joining together the two original wires which connect Sw12 across R 41. Once this was done and these wires were insulated and tucked away safely, I had the On/Off switch which I needed. The circuit diagram of the modification is shown in **Figure 1**. On the left – annotated as Original – is part of the standard AGC circuit. On the right – annotated as Addition – are the three new/additional components and the re-purposed Sw12. After some experimentation using off-air signals, I settled on the component values shown. Other operators may well

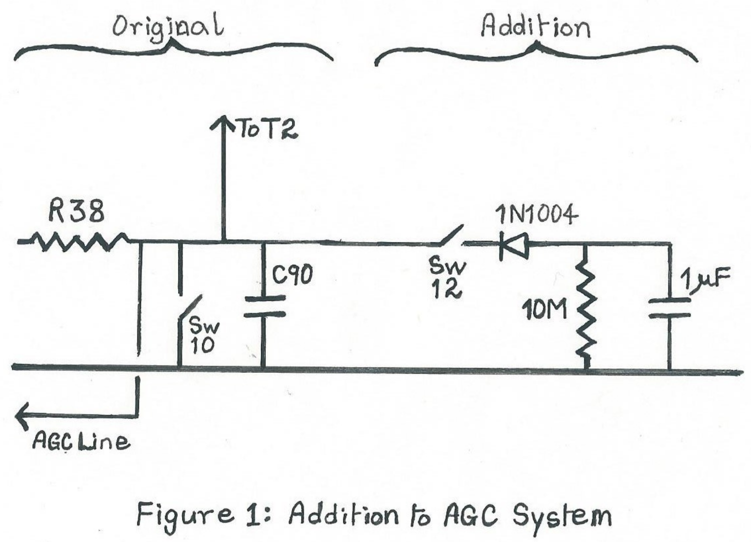


Figure 1: Addition to AGC System

prefer different values.

At the end of the month, the receiver was still working each time I turned it On. Therefore, I did a final check of its alignment, recorded the final measurements of sensitivity and moved it across to the operating bench. Job done; at last I had an 888A that worked well and was a pleasure to operate.

Final Measurements

Firstly, I checked the 'sensitivity' of the receiver by measuring the RF input signal required to produce an S9 reading on the signal strength meter – as I had done previously – and the results are given below:-

1.9 MHz	-76 dBm	14.2 MHz	-58 dBm
3.8 MHz	-75 dBm	21.3 MHz	-53 dBm
7.2 MHz	-68 dBm	29.0 MHz	-62 dBm

These figures can be compared directly with those given above. They show a similar variation in 'sensitivity' between the bands; in spite of all the work done re-furbishing the receiver and looking for causes of this variation. It may be that this is just a strange characteristic of the Model 888A. The absolute 'sensitivity' has been reduced by about 5 dBs by the work done to prevent the first mixer from oscillating. This is unfortunate but to be expected, given what was done. I believe that it is a price worth paying to have a receiver that is easy and pleasant to operate.

I checked the calibration of the meter and the results are as follows:

S9 + 8 dBs	-55dBm
S9 + 4 dBs	-62dBm
S9	-68dBm
S8	-73dBm
S7	-79dBm
S6	-85dBm
S5	-91dBm
S4	-96dBm
S3	-101dBm

These results were obtained using an RF input frequency of 7.2 MHz, so that S9 corresponds to – 68dBm – rather than the correct -73dBm - and shows a reasonably respectable five or six dBs per increment.

Finally, I measured the variation in gain caused by the use of the Selectivity/Bandwidth Control. Now, with all the modifications in place, the variation was insignificant. I measured the RF input signal required to produce an S9 meter indication at 29.0 MHz, as follows:

Maximum Selectivity	-57 dBm
Mid-range	-62 dBm
Minimum Selectivity	-59 dBm

In most practical situations, this variation is of no consequence; especially now that the control produces a nice smooth variation in bandwidth and does not trigger strange, un-wanted effects.

A Final Question

I asked myself the question: why did my first mixer start oscillating? Consequently, I went digging in my scrap box and found the old potentiometers that had been the RF Gain Control and the IF Gain Control. They both were a carbon-composition type and their minimum resistance was not zero; it was a bit variable – because of the wear that had occurred – but in the range 200 to 300 Ohms. The wire-wound replacements that I had used both produced zero Ohms on their minimum setting. I could have saved myself a lot of time and effort, if only I had used my brain and checked before making that substitution. In my defence, it is worth noting that all my other Eddystone receivers were fitted originally with wire-wound potentiometers for RF/IF Gain control. So, why did Eddystone use carbon-composition potentiometers in my 888A?

The Last Word

The 888A has been sitting in the centre of my operating bench for the past six months and it has not missed a beat. Every time I turned it On, it worked and was a pleasure to use. It was well worth the long slog of finding and sorting all the problems; and that taught me some more about Eddystone receivers.

In my opinion, the 888A is a bit short of gain but, most of the time, this is not an issue because of the high levels of man-made interference at my location. On those occasions when it is, my S940 comes to the rescue.

Victor Jenkins

Postscript Dave Newton G3JJZ

Dave was a member of FISTS CW society and went SK in 2014. He lived in Bromley Kent but at time of the note he probably lived in Catford. His wife Pat G0BRV died in 2017. Both were members of Crystal Palace Radio and Electronics Club. Dave was involved with M2000A which was a Millenium special event station in 2000.