The Eddystone S.830/4 Revisited: Fitting Some New Jewels in the Crown

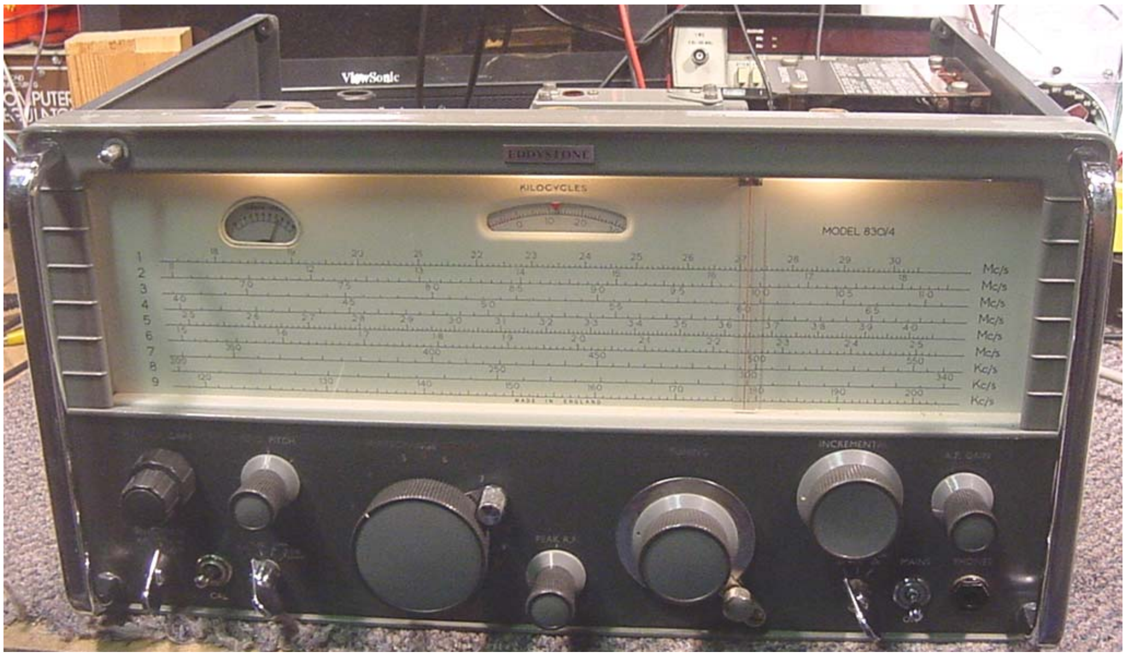
Introduction

Back in March, 2006, I became the proud owner of an Eddystone S.830/4, the version of the high-end 'Jewel in the Crown' set manufactured for government agencies, police and military use in Canada some 40 years previously (my set's Eddystone serial number, LT1507 (photo, below, right) located on the tuning gang cover, suggests a manufacturing date of December1968, but the 'CRC' label on the rear apron indicates 'April 9, 1968') – see Bibliography. My previous work on this set (in 2006) had focused on the power-supply and audio sections, including the replacement of several small electrolytics, rectifier diodes and high-wattage resistors, plus some mechanical repairs/maintenance. After that, the set provided good performance, and so no attempt at re-aligning or checking other capacitors was undertaken. However, in the past couple of years the overall performance of the set and my enjoyment in using it had declined, the set exhibiting the following fault symptoms:

- The appearance of frequent 'birdies' and heterodynes, particularly across ranges 1 and 2 (higher frequencies);
- Reduced sensitivity, especially on the upper ranges;
- Crackling and 'dead spots' when rotating the 'Peak RF' control;
- Poor AGC action on USB and LSB modes;
- Increasingly poor frequency stability (noticeable on all ranges above 1.5MHz); and
- Unable to fully correct frequency error/drift with the curser adjuster;

The birdies had been getting worse particularly over the past year and the set was becoming generally unstable at the higher frequencies, necessitating reducing the RF gain to mitigate this tendency. I particularly noticed this back in January this year while comparing my newly-restored S.840A with the S.830/4: it was so annoying that something had to be done! I suspected that further deterioration of passive components were the root cause of these problems, however, every time I thought about checking the set out, I became distracted by something else (usually a vintage radio restoration project for the SPARC radio museum here in Coquitlam, but sometimes a new Eddystone acquisition). I did get as far as taking the set off its shelf in the workshop/shack (where it was hemmed-in by my S.940 and an HP 'scope), and I even removed its case and placed it on my workbench – where it sat, nude, upended and collecting dust for a couple of months while I dealt with my distractions… I finally completed a run of chassis restorations for SPARC, ending in a particularly nice (Canadian) Philco 3650 from the mid-1930's, and realized that I could finally get on with the S.830/4. No more excuses…

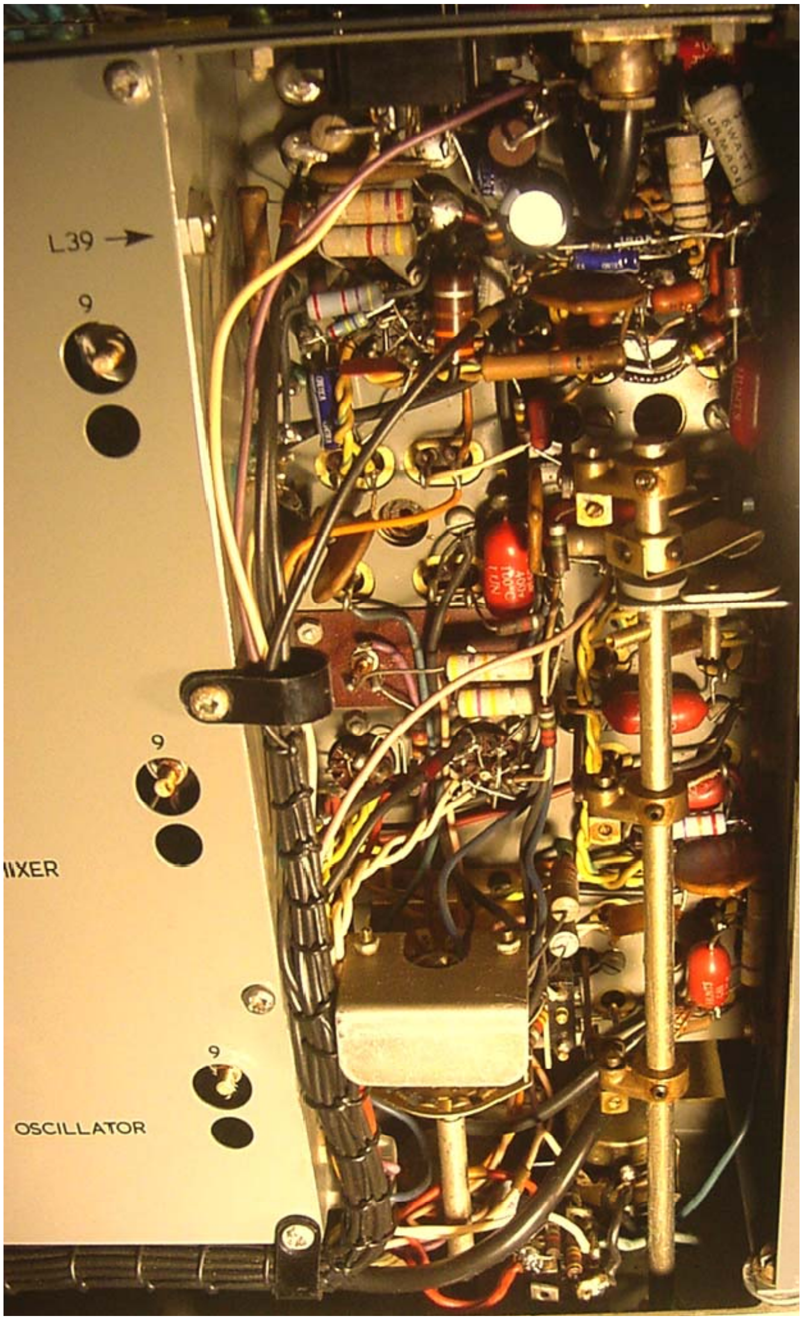
The obvious suspects of course for RF instability are the anode, screen and cathode by-pass capacitors, however, there may also be ageing valves, out-of-tolerance resistors, dry joints,



poorly-executed previous repairs and lead-dress/deteriorating insulation issues to consider in a set of this vintage. While I was at it I thought I may take another look at the power supply section again – I now had some ceramic stand-off insulators that may be suitable for replacing the heat-damaged plastic ones that were repaired in 2006 using epoxy, and I had read a tip that the heat build-up in the power supply could be much-reduced by lifting the power transformer slightly of the chassis using spacers on the mounting bolts.

Many of the RF/IF bypass capacitors in this set are the infamous 'Red-Hunts' variety. I recall that I had checked some of these back in 2006, and they tested ok at that time, however, as a precaution I decided to replace them all, together with any 'rats-dropping' or other suspect capacitor types that may be lurking in the set. Whilst working my way through the set in this way I would also check resistors and for any dry joints. There are some rather inaccessible areas in these sets, in particular the components located around the valve holders in the coilbox, the product detector unit and the 2nd local oscillator. Time to put the kettle on and get cracking….

Approach



I had forgotten what a heavy beast it is – the last Eddystone I had been working on was a diminutive S.870. A look under the chassis brought back memories of 5 years ago - seeing all those dull 'red Hunts' capacitors[1] and tired-looking 1Watt resistors that looked as if they were made from wood dowel (photo, right). Experience has shown that tubular ceramic, disc ceramic, silver mica and polystyrene capacitors rarely fail. So, what to do here? There are several approaches to dealing with this, including:

1. Rebuild the set almost entirely, replacing all paper/suspect type capacitors and all resistors (I have only done this before on two

[1] The component list notes that the 0.05uF 400vw 'red Hunts' (Type G50) have polyester dielectric, whereas the 0.01uF 250vw and 0.01uF 400vw 'red Hunts' (the latter Type G150) are metalized paper. I expected that the polyester capacitors would be very low leakage and have held their capacity well over four decades, and the metalized paper types to be higher-leakage – this was generally true, however four of the polyester dielectric types had leakages of less than 20Mohms when tested on a VTVM and over half of them were out of tolerance (reduced capacitance). The metalized paper types all had higher leakage (some less than 1Mohm) and reduced capacitance, with the Dubilier ones being the worst of the bunch (the 0.003uF one of these was open circuit).

RACAL RA-117's - due to a very high proportion of out-of-tolerance resistors and leaky/low-capacitance capacitors found in the examples of that model I have seen);

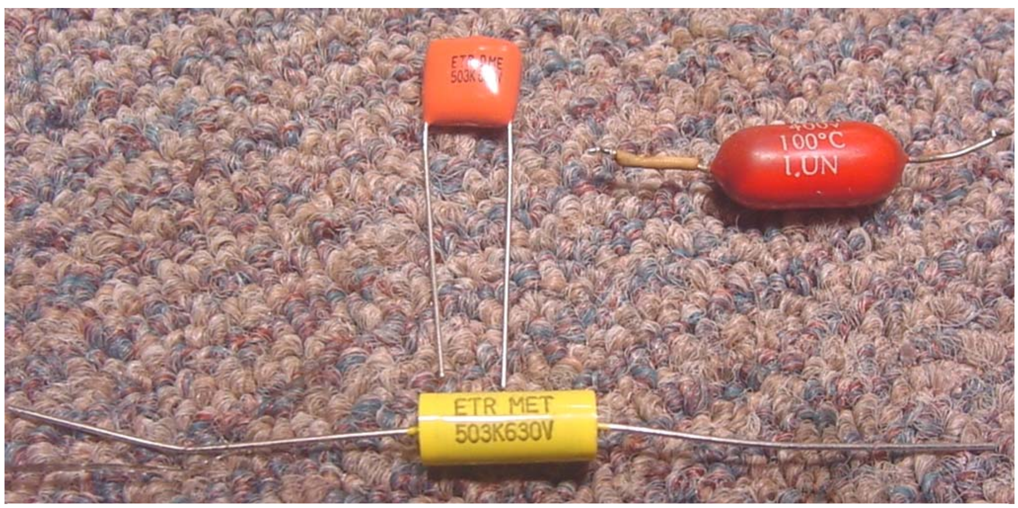
2. Replace all paper/suspect type capacitors and only out-of-tolerance resistors on the main chassis, but replacing all paper/suspect type capacitors and all resistors (whether within tolerance or not) in the less-accessible units as preventative maintenance (BFO/product detector and 2nd local oscillator/mixer units);
3. Replace all paper/suspect type capacitors and only out-of-tolerance resistors;
4. Replace only leaky/low-capacitance capacitors and out-of tolerance resistors.

Undertaking spot checks of resistor values, I found that those that had been less-stressed (cathode, grid stoppers/bias) were generally within tolerance, whereas those in anode and screen circuits tended to be more susceptible to drifting (higher in value), but many were ok. In the interests of preserving as much authenticity/original appearances as much possible[2] commensurate with restoring performance and getting the set back into operational service expediently, I decided on adopting approach 2) above, rationalizing that if (when) components fail in the more accessible areas of the chassis that these can be replaced as necessary quite easily, whereas those in the less-accessible locations are not seen anyway and going into these areas once is preferable to having to re-visit later to fix a fault sometime in the future. Adopting approach 2) still requires the replacement of many components, some of which pose really difficult access issues (discussed later): in total, the 'body count' this time was some 31 capacitors and 18 resistors replaced in this process (I would note that several resistors and capacitors had also been replaced five years ago in addition to the list below):

- 11 x 0.05uF 400vw 'red Hunts' polyester dielectric (C35, 61, 63, 83, 93, 95, 98, 99, 101, 109, 171)
- 6 x 0.01uF 250vw 'red Hunts' metalized paper dielectric (C162, 163, 164, 169, 188, 189)
- 1 x 0.01uF 400vw 'red Hunts' metalized paper dielectric (C124)
- 1 x 0.04uF 250vw Hunts, tubular paper - metal sleeved (C110)
- 4 x 0.01uF 200vw grey plastic bodied 'Type 700' Dubilier metalized paper (C69, 71, 81, 181)
- 1 x 0.003uF 350vw grey plastic bodied 'Type 700' Dubilier metalized paper (C34a)
- 5 x 0.0005uF 600vw grey plastic bodied 'Type 700' Dubilier metalized paper (C104, 111, 165, 175, 176)
- 1 x 25uF 25vw electrolytic, TCC (C174)
- 1 x 10uF 35vw tantalum, STE (C116)
- 2 x 1Watt resistors (R21, 27)
- 16 x ½ Watt resistors (R7, 8, 18, 19, 20, 21, 25, 26, 50, 78, 79, 80, 81, 84, 85, 86)

[2] Eddystone generally took care in their wiring layouts across the board, however, the S.830 series, along with other higher-end Eddystone models, were built to a very high standard – the degree of care that was taken in dressing components and wiring to look 'regimental' is quite astonishing and something that I believe is well-worth preserving as it is an essential part of the set's fabric and 'soul'. I try to replicate of course, but I am an amateur…

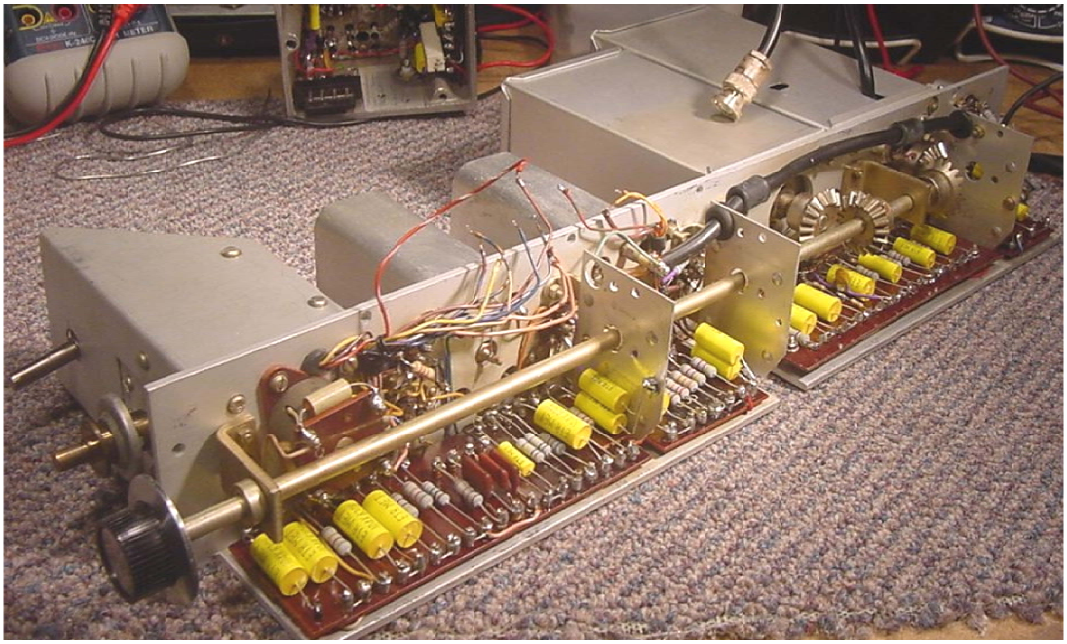
Replacement Component Selection



Above (upper): box of replaced components. The silver-bodied capacitor is a tantalum (at least according to the parts list in the manual). Above (lower): one of the 0.05uF 400vw 'red Hunts' capacitors (right) with the equivalent components in modern metalized polypropylene (radial top, axial below), as supplied by *JustRadios*. These are both 630vw parts

I buy most of my replacement capacitor stock from *JustRadios* in Scarborough, Ontario, Canada (http://www.justradios.com). For replacement of paper capacitors I use metalized polyester or polypropylene film types with 630vw spec (regardless of application). In general, for valve radio repairs, I have a preference for axial lead components (ie. the leads stick out of the ends), but in some applications radial lead components (both leads emerge from one side of the component) can have an advantage, especially where conditions in the chassis are cramped (eg. Zenith Transoceanic sets) or where small rectangular 'block' capacitor bodies need to be re-stuffed (eg. in 1930's Philco sets). To the more fastidious owner, the visual impact of the replacement components may also need some consideration – the axial lead components from JustRadios are bright yellow, whereas the radial lead components are a dull brown/orange. Also, lead length can be a consideration: some chassis have relatively long distances between solder tags/valve bases etc. and many radial lead components will just not stretch between them (axial lead components generally have longer leads than modern radial lead types, plus, of course, the length of the component body – see photo above).

The original metalized paper capacitors in the S.830/4 were all of Hunts manufacture, being a mix of bulbous, red-bodied 250vw and 400vw components (used for bypass applications, but also for some coupling applications) and a few small tubular, grey-bodied Dubilier 200vw components in the lower capacitance values and in some areas of the set where things were rather cramped. The red 0.05uF 400vw capacitors are listed as 'Polyester' – but being of Hunts manufacture I classed them as suspect anyway. For the S.830/4 application I decided on using the radial lead components for most replacements both for ease of access and optics (a sea of yellow would not look right here – whereas in a RACAL RA-117 I think this looks fine – see photo of a refurbished RA-117 100kHz IF strip below). Exceptions to this were the smaller-value (500pf) capacitors, which were replaced with 500vw Aerovox disc ceramics, and the coupling capacitor between the 1st local oscillator and the 1st mixer (C164), where lead length, body shape of the capacitor and the shape of the space available dictated that an axial lead component was needed (this capacitor is all but hidden from view anyway).



JustRadios also sell resistors, and I sometimes buy these also, however, a local supplier in Vancouver (www.leeselectronic.com) sells similar-quality flame-proof metal film resistors and I usually use these parts in my repair work. It should be noted that modern replacement resistors are usually much smaller than those used in the 1960's for the same wattage rating. For appearances, consider using modern 2Watt resistors in place of older 1 Watt types (as they are similar in size) and modern 1 Watt resistors in place of ½ Watt types.

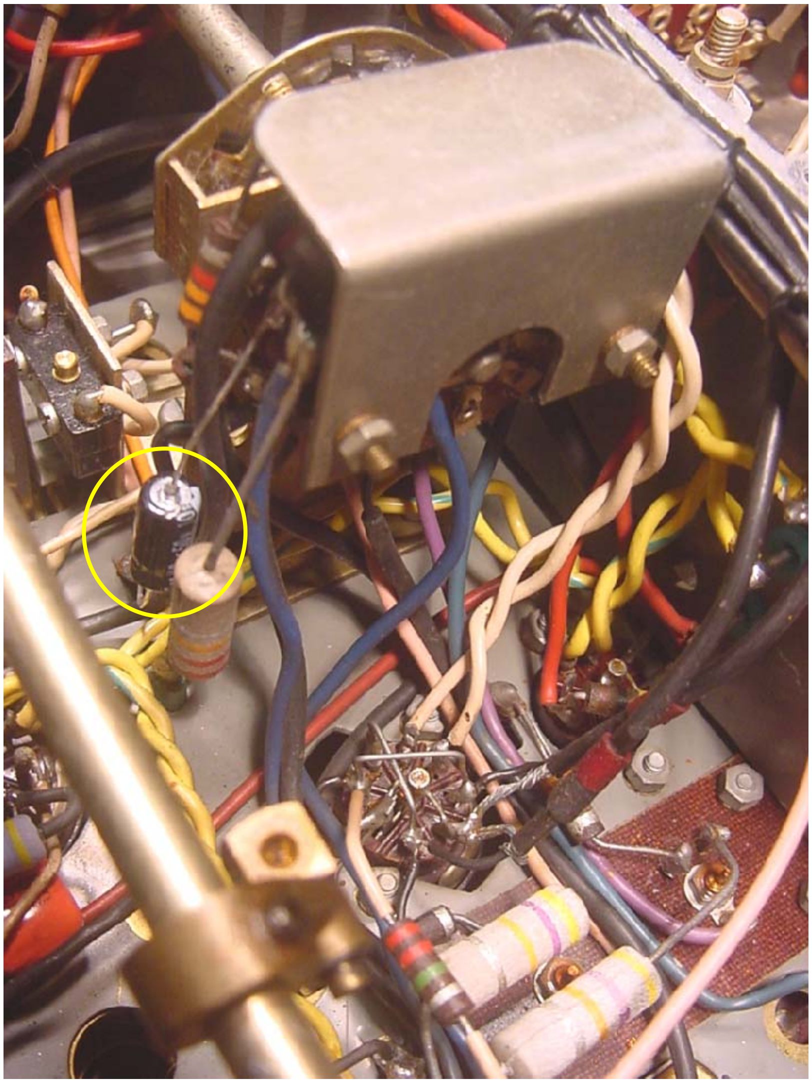
Down to Business…

Having decided on approach and component type (I had all the parts in stock as it happened), and having an otherwise clear workbench, I finally made a start on the S.830/4. The first step on such a project is to closely examine the layout and identify how each replacement component is to be sited and where the leads run/how they have been dressed (take some photos – I find that this always helps – memory fades fast!). Many Eddystone sets have the wiring and component leads simply laid onto solder tags/terminals etc. and then soldered, rather than being wrapped around terminals, valve base pins etc. before soldering – this makes removal of the old part relatively simple compared with sets where the component leads have been wrapped around the terminals several times and run through the hole in the terminal (in such cases, I often simply cut off the old lead at the terminal, though I now own a great vacuum de-soldering gun, (Hakko Model 808, http://www.tequipment.net/Hakko808.html) that makes a good job of removing the solder first, allowing the lead to be pried away – access permitting of course (not always the case, especially in many Eddystone sets where the circuit has been built up progressively from the valve holders in layers).

Having the right tools and knowing appropriate techniques helps enormously in reworking a chassis like this (see my Eddystone S.770U article for more details – pp12 to 15). As a minimum, have a couple of pairs of long, thin but sturdy tweezers (one pair angled), angled and straight locking forceps, small pointed-nose pliers, thin sidecutters and some soldering aids (sharp picks, hooks etc), plus a thin soldering iron (I use a 15 Watt Antex pencil for this).

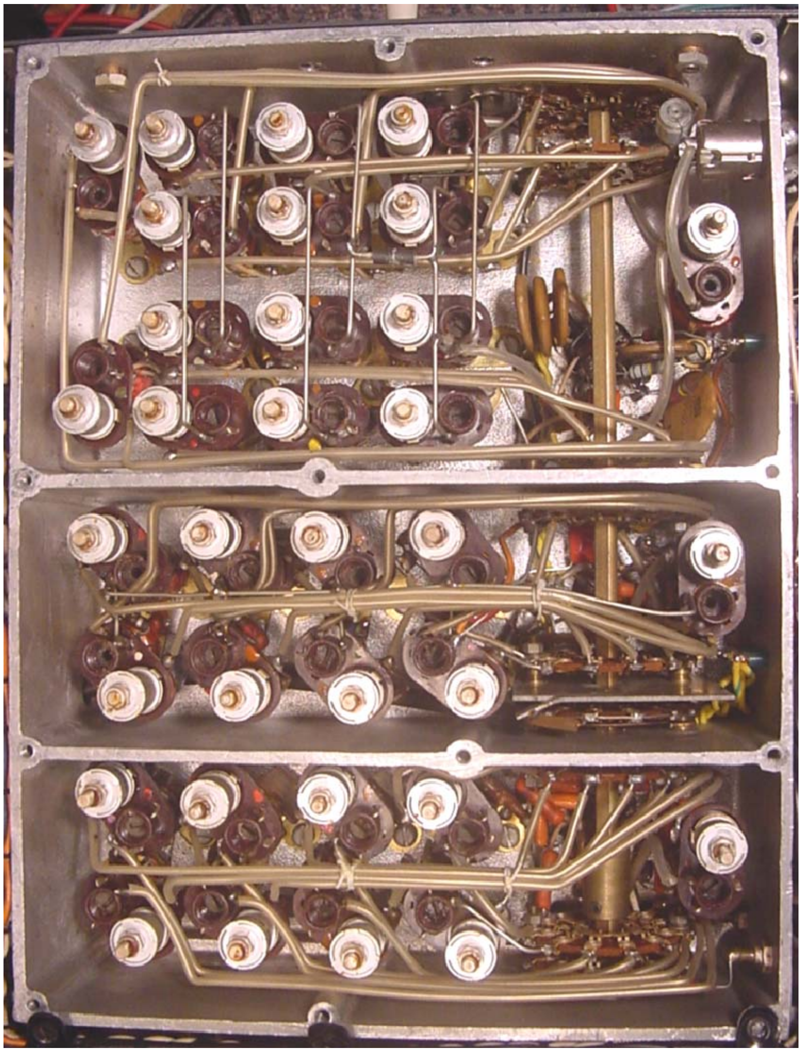
I would also note that it makes sense to test the set at regular intervals during systematic component replacement like this – it gives comfort that all is going well (or identifies when it's not! – see below) as it is surprisingly easy to get mixed-up in 3-D space beneath the chassis.

IF/AF Chassis

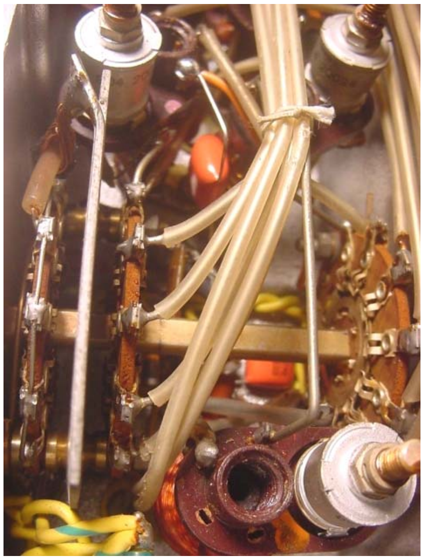


Most of the components on the main (IF/AF) chassis are reasonably accessible (photo on previous page), though some care is needed at the rear of the set where there is a large cluster of parts around the cathode-follower IF output, noise limiter, AM detector, AGC and audio stages. I started with the 'easy stuff', ie. the larger 0.05uF 'red Hunts' bypass capacitors, working through to the smaller (grey) plastic-bodied Dubilier 'Type 700' tubulars, progressing from the front of the set towards the rear. Accessing the capacitors associated with the cathode-follower stage required temporary removal/partial removal of a few components and wires (eg. disconnect one lead and then bend it out of the way, etc). I also replaced the 10uF 25vw tantalum capacitor on the AGC/NL switch (circled yellow in the photo above - inexplicably, I had missed that back in 2006) – the old one measured some 11uF but was very leaky – behaving more like an 80kohm resistor than a capacitor. This would explain the poor AGC action on SSB modes (note that the positive end of this capacitor goes to ground). No real problems were encountered replacing parts in this area of the set, except after being distracted by a phone call I misplaced the anode/screen resistor to the cathode follower stage (V8) onto the adjacent tag on the valve base (cathode) and caused the anode resistor to smoke a bit on switching the set on… but no real harm done. Hey, come on - nobody's perfect!

RF Chassis



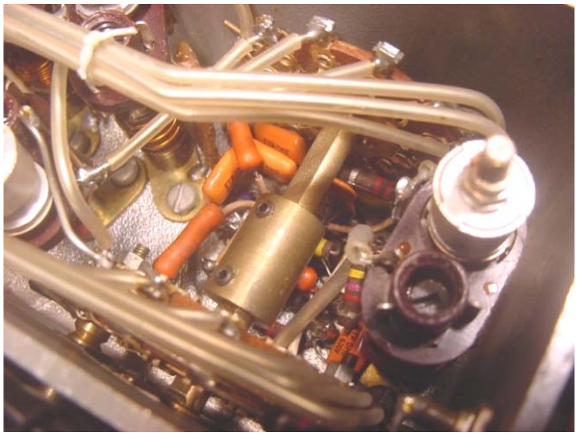
Now we are getting into the real 'nitty gritty' and most fiddly work. The RF/mixer/first local oscillator components are located in the die-cast coilbox. This form of construction is great for screening and stability purposes – but not for ease of servicing as it causes some difficulty in replacing components close to the valve holders (as the circuitry was originally constructed in layers). In order to undertake replacement (or even testing) of some components, the layering has to be undone (or partially undone) and then restored after accessing the original target components.

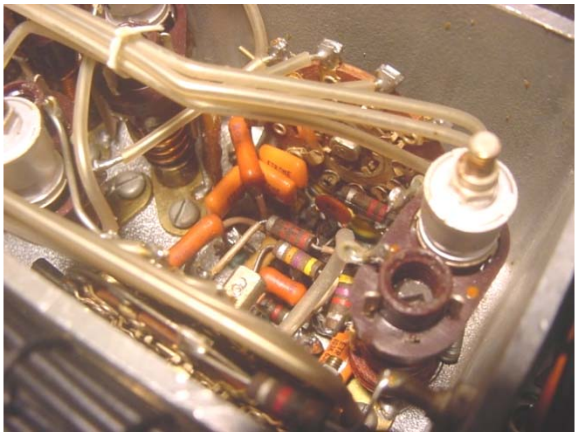


This sounds very off-putting, but in practice (once you have 'got over it') it is fairly straightforward. Again, careful study of component locations, lead dressing etc. plus photos are necessary pre-cursers to picking up soldering iron and other tools.

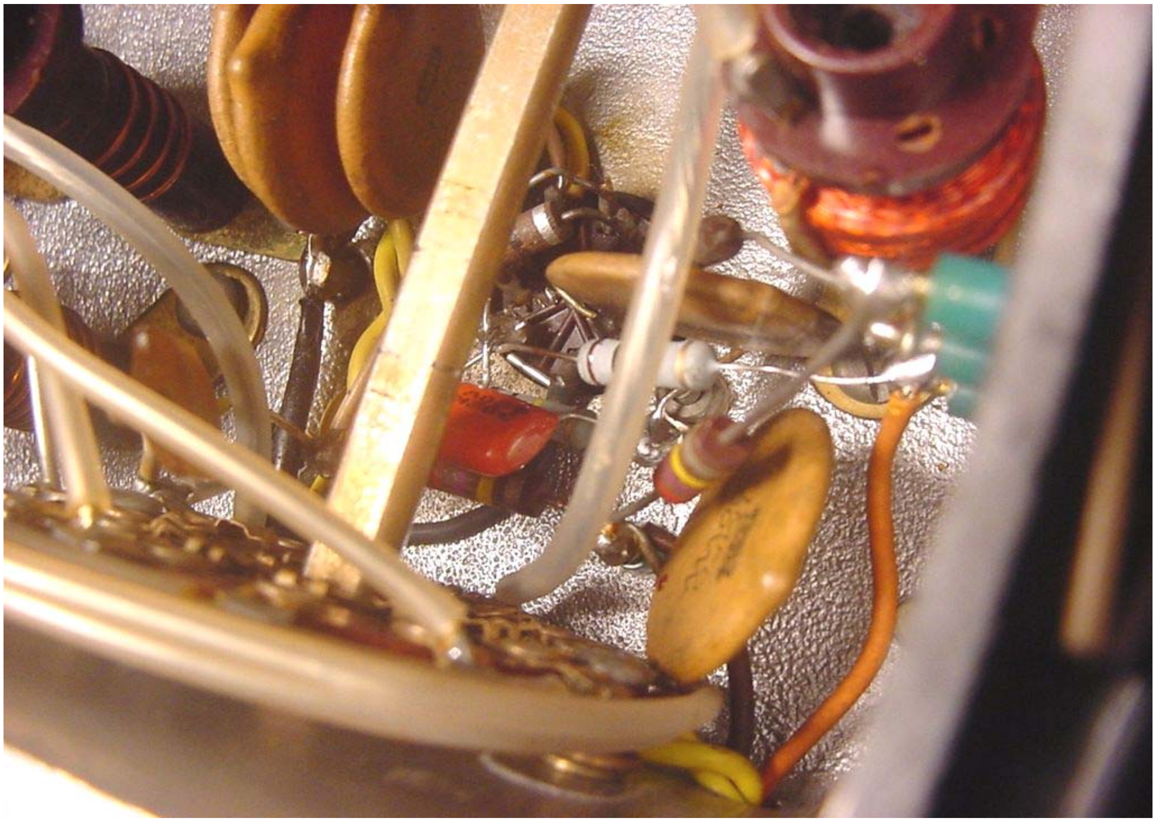
Above: over-view of the coilbox – tighter and more complex than most Eddystone sets due to the 9 wavebands on the S.830 series. Note the LF wavetrap in the aerial section – not present on other variants. Left: many components are hidden deep in a maze or wires, switch wafers and other components – not a job for the ham-fisted…

The coilbox is divided into three compartments: aerial/RF stage, mixer and 1st local oscillator, with the bandchange switch shaft running through all, immediately above the valve holders. Loosening and removal of the brass collar attaching his shaft to the detent

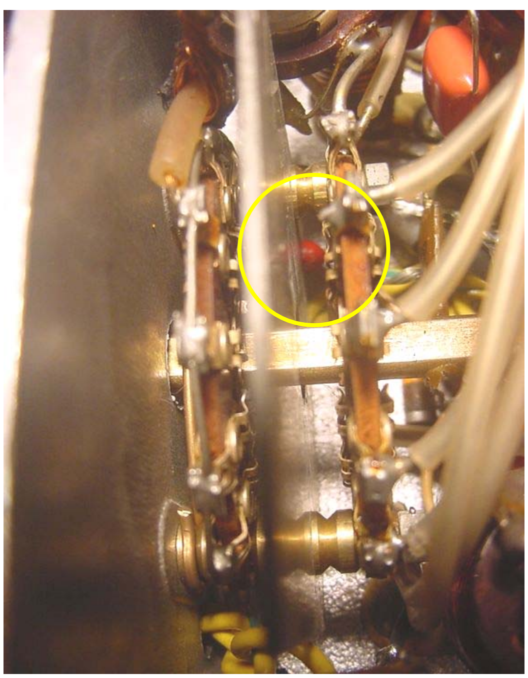


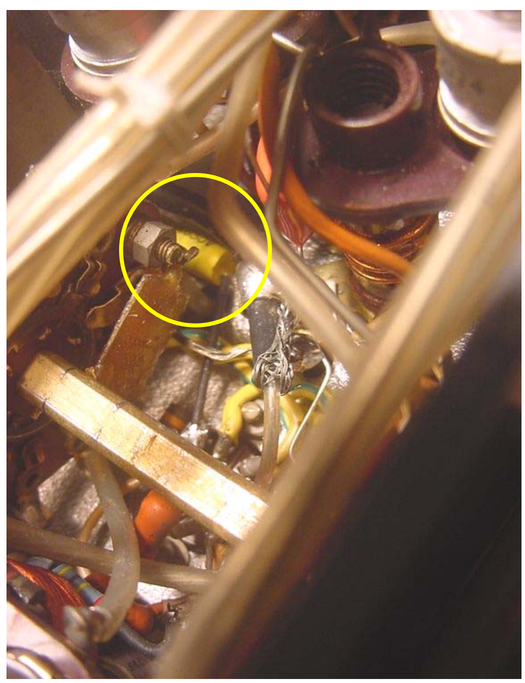


mechanism of the switch allows the shaft to be removed through a hole in the rear of the casting – this is especially useful when working in the 1st local oscillator compartment, and the shaft need only be slid partly out to allow this access (photos, above). However, be careful if you attempt to remove the shaft completely – note the bar springs in each compartment pressing against the shaft will need to be re-installed correctly. I found that there sufficient access to undertake replacement work is available in the RF and 1st mixer compartments without complete removal being necessary (photo below of the RF stage).



The RF stage in the S.830 is a cascode amplifier, and the well-documented problem with the 100kohm bias resistors had been checked-out 5 years ago (by measuring voltages at the time) and all seemed to be ok in this set, however, when tested now (measuring resistance), one of these resistors had almost doubled in value. These were both replaced, along with all metalized paper capacitors. C34a, a 0.003uf Dubilier metalized paper type grounding the second grid of the cascode RF stage at higher frequencies, was found to be open circuit – I suspect this was the cause of some of the instability on Bands 1 and 2. Capacitor replacement work in the 1st mixer stage compartment was straightforward, though that in the local oscillator stage was generally more fiddly as it is more cramped (also, there are more capacitors to replace here). But by far the most difficult component to replace (or even to find!) is the 0.01uF capacitor (C164) coupling the 1st local oscillator to the 1st mixer stage: the original is a 250vw small 'red Hunts' metalized paper capacitor is well-hidden beneath a wafer of the wavechange switch. One lead of this capacitor must be quite long as it feeds through a small hole in the casting wall between the 1sr local oscillator and mixer compartments which is hidden behind the back-to-back switch wafers in these compartments. In my set, this lead was sleeved in black plastic. My original plan was to tack-solder some fusewire to the end of the original capacitor lead in the oscillator compartment and then draw it through the black sleeve as I removed the component from the mixer compartment side, then to attach a lead of the new capacitor to the fusewire and draw back through the plastic sleeve into the oscillator compartment. However, I had considerable difficulty in removing the original capacitor and had to abandon this plan. With the original capacitor finally removed, I then tried to push the fusewire through the plastic sleeve, but the sleeve was kinked and the wire would not penetrate its full length. In the end, I had to remove the plastic sleeve, pass the fusewire through the hole in the coilbox, tack-solder this to the new component lead and





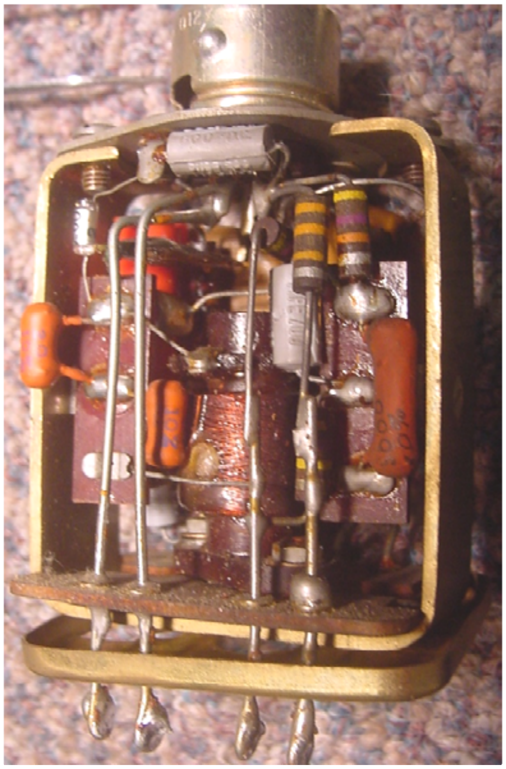
Far left: the original (red) C164 circled – well hidden below the switch wafer, screen plate and wiring. Left: replacement (yellow) C164 circled draw this through the hole in the coilbox with the fusewire, relying only on heatshrink tubing placed over the new component lead for insulation from the coilbox. This process worked, but took almost 1.5 hours to complete! The replaced capacitor was found to be almost an order of magnitude lower in capacitance (0.002uF instead of 0.01uF) - likely resulting in lower than ideal local oscillator injection into the 1st mixer stage. The replacement capacitor was an axial lead type (photos at base of previous page).

While I was checking around in the coilbox, I confirmed that the Amendment Sheet mods had been undertaken on this set (they had):

- C40a and C41a were indeed 500pF, 500vw Polystyrene;
- C63a, a 10pf tubular ceramic, had been fitted from the cathode of V2 (1st mixer) to ground; and
- A ferrite bead had been slipped over the ground connection to the shorting plate of wafer 'Sli' on the bandchange switch.

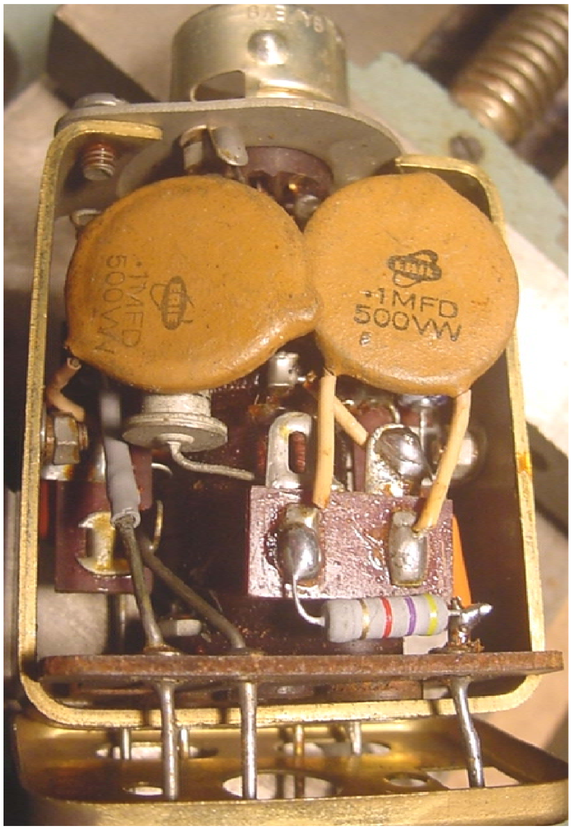
BFO/Product Detector

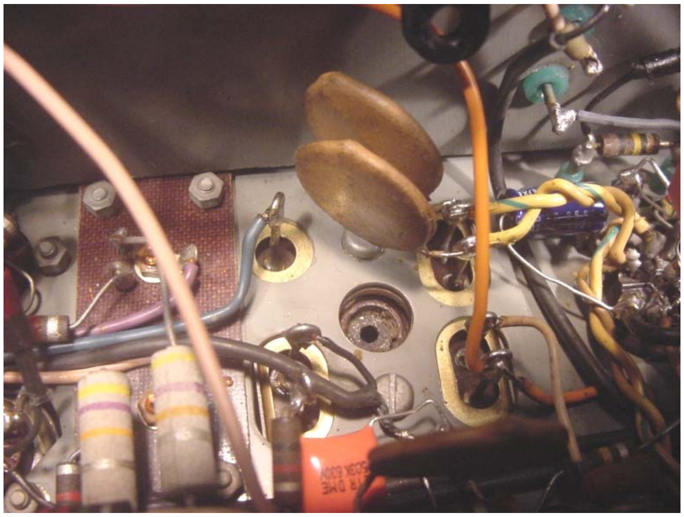
Yes, I know this unit has nothing to do with the RF instability – and the BFO seemed to be working reasonably well - but I thought I may as well tackle this unit anyway as 'preventative maintenance' given my experience of the S.840A BFO unit. Most of the BFO/product detector components are housed in a can similar to the IF transformers, with the valve sitting atop the unit and the mode switching below the chassis – neat, but not the best for ease of maintenance. However, as noted in the EUG Forum discussions,



some passive component checking can be undertaken without removal of the unit (by removing the valve and taking resistance measurements between the pins on the valve base – not entirely satisfactory, especially if there are defective (leaky) capacitors present).

Other recent EUG Forum discussion noted that in the EA12, work on the product detector unit would mean 'major surgery' – the EA12 and S.830 series have some commonality of design and construction, and the product detector is one of those areas, up to a point. However, there is a significant difference between the S.830/1 - 4 variants and the rest of the S.830 range (S.830/5 – 12, and also the EA12), in that the frequency of the BFO (or, more correctly, the carrier insertion oscillator) in the product detector circuit is controlled by a DC voltage applied across a varicap diode (D1, Type 100SC2 – actually a small 'top hat' power rectifier diode) in the S.830/1 - 4 variants, not by the more usual variable capacitor as in the later variants.





Base of previous page: before and after component replacement in the BFO/product detector unit – side 1. Left: after component replacement, side 2. Note the 'top hat' varicap diode. Above: base of the BFO/product detector unit – note seven connections need to be undone to remove the unit from the chassis

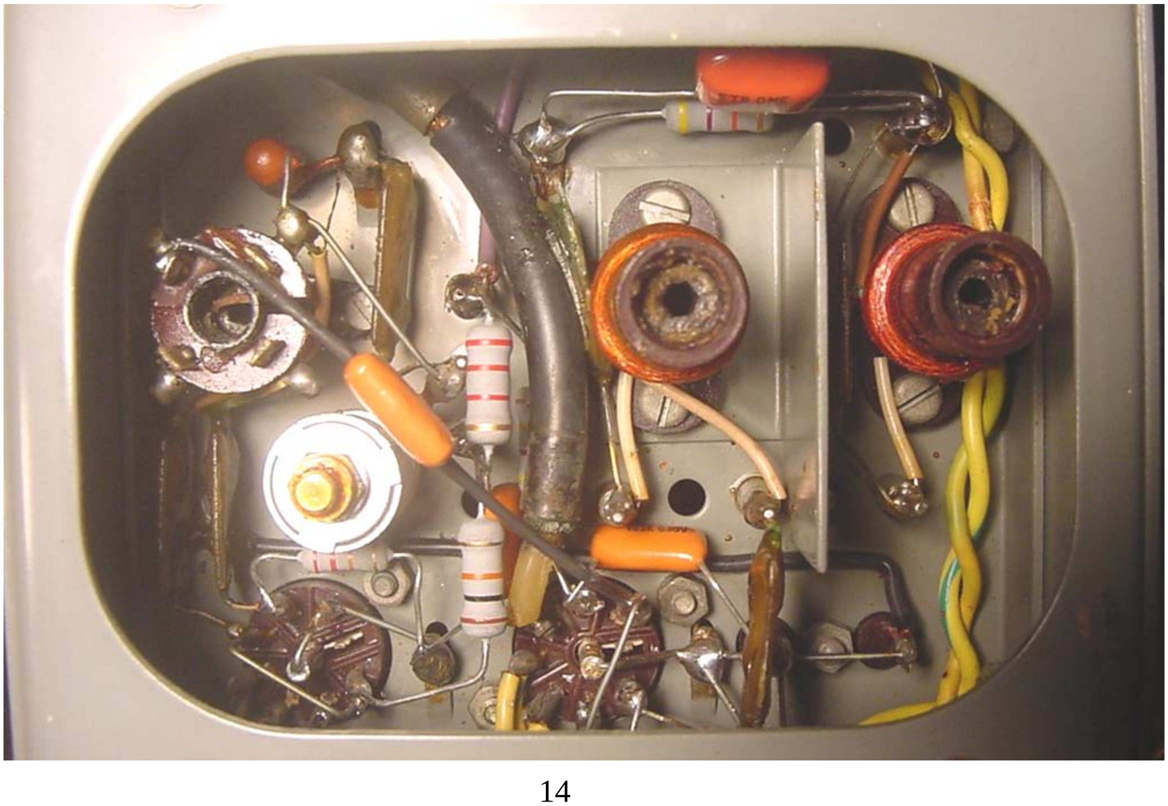
This change also affects the mechanical layout: in the /4 variant, a front panel-mounted pot ('BFO Pitch') varies this voltage in CW mode and pre-set pots set the frequency for USB and LSB modes. In the later S.830 variants (and the EA12), the variable capacitor is controlled by a shaft that extends to the front panel.

Actually, removal of the BFO/product detector unit is fairly straightforward – simply remove the connections from the base of the unit together with the two 4BA screws and its off (just make a note which wire goes where – photo on previous page). Once removed from the chassis, the can is easily removed by taking out two screws, allowing access to the delights within. I replaced all resistors and paper/suspect type capacitors – a little fiddly, but straightforward job. The original 25uF 25vw electrolytic in this unit had effectively zero capacitance and a resistance of around 20kohms.

2nd Local Oscillator/2nd Mixer

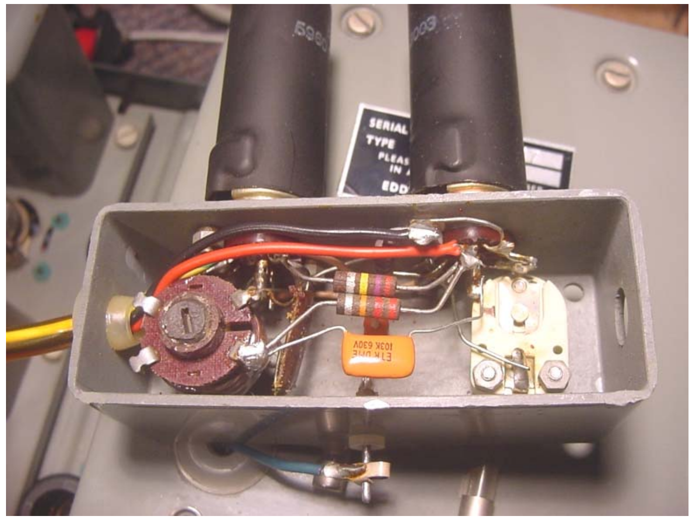
The 2nd local oscillator and 2nd mixer valves and their associated components are located in an enclosed compartment above the power supply chassis. Access to the underside of the valve holders is via a cover plate on the side (actually a double cover plate – one with holes punched to allow access to the trimmers/coils inside, and another, blank, plate that fits over the first when adjustments are complete), with access to the variable ('Incremental Tuning') capacitor gang and valves via another cover plate located on the top of the unit (this one has ventilation holes).

On checking the resistors in this unit, I found that one was open circuit (2nd mixer screen resistor, R21) and one was of incorrect value (a 470kohm resistor had been fitted in place of a 47kohm resistor from the set being new in the anode feed to the 2nd mixer, R27). I replaced all resistors and metalized paper capacitors in this unit (photo, below) and also gave the tuning capacitor a thorough clean and re-lube.



Crystal Calibrator

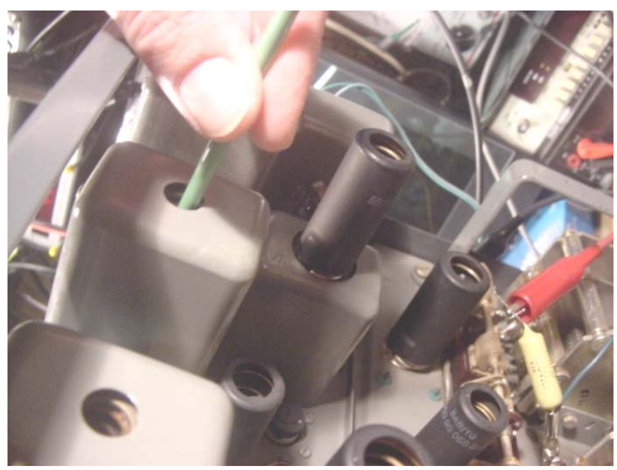
This is easily removed from the tuning gang cover by extracting four screws. Unclipping the 'stray coupling' wire that runs into the tuning gang compartment and unplugging the power supply lead. Only one 'red Hunts' capacitor is present in here (C124) – photo, right, after replacing.



Re-alignment and Performance Testing

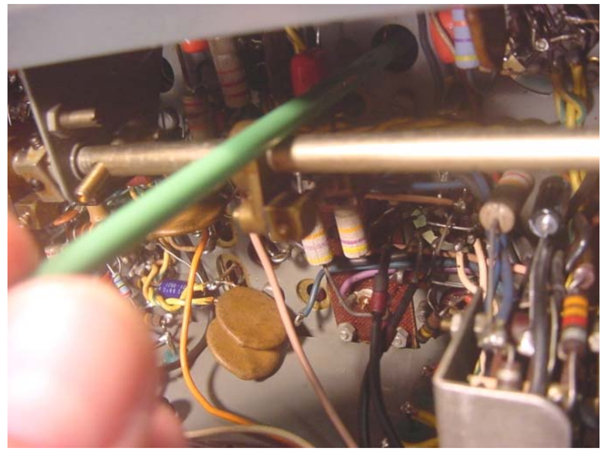
Earlier this year I became the proud 'indefinite loan' recipient of an Agilent (HP) 8935 Cellular network test set – this is an excellent piece of kit hailing from around 2001. It boasts a number of useful test instruments in one case, including an RF spectrum analyzer, AF/RF signal generators, oscilloscope, audio analyser, etc – a very useful piece of kit. I had used this same type of equipment to check and tweak the bandpass filters in one of the RACAL RA-117 sets that I had restored - it made a fairly straightforward job of that once I had the impedance matching pads correct. So, I thought I would try using this to check the set's alignment, sensitivity, selectivity and maybe even measure its signal to noise ratio.

However, old habits die hard and after some playing about with the Agilent[3], in the end I used my trusty old Triplett RF generator and my Heathkit AF generator (for the 100kHz IF) – both with a DFM attached to their output, together with a pair of HP precision attenuators. However, I did use the Agilent for that awkward set of frequencies between 110kHz and 155KHz that these two generators do not cover (ie. for the lower end of Range 9 on the S.830/4 and for setting-up the IF trap, L39). The alignment procedure set out in the manual was followed in the main, in summary:



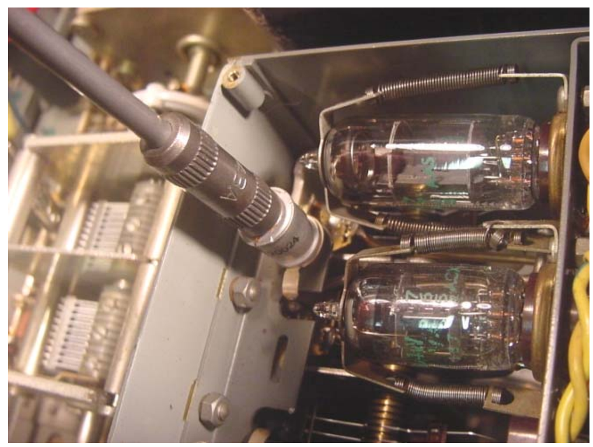
- Set up the 100kHz (2nd) IF, tuning to the actual crystal frequency in the set (in my case, this was 99.978kHz.

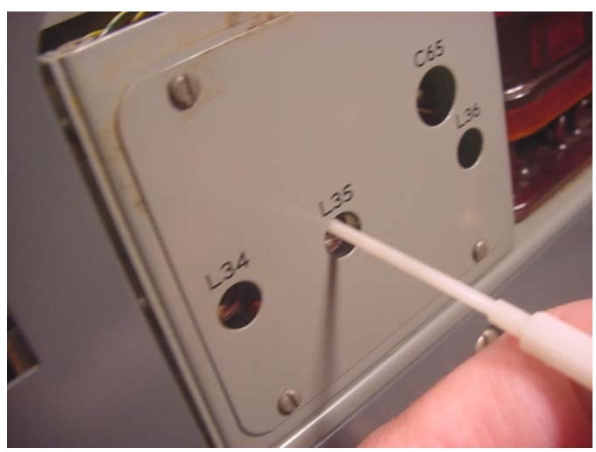
[3] One disadvantage the Agilent has in my small workshop is that it is very noisy – it must have a very large cooling fan in the power supply and it can be somewhat annoying – especially if you want to listen to anything while working and hey, I am a Beatles, 'Zeppelin, Dire Straits, Jethero Tull and Steeleye Span junkie…



No problems with sticking or broken IF transformer slugs – phew! – photo at base of previous page (secondary windings above chassis) and right (primary windings below chassis). Everything peaked as expected – I noted that T1 and T2 were a bit off tune but not by too much;

- Align the BFO for both CW and USB/LSB. Again, very straightforward, except I tuned the USB/LSB by ear (tone) instead of the VTVM voltage method described in the text (because my VTVM developed an intermittent fault during the alignment process that needs investigating - causing the needle to suddenly start wandering about totally unrelated to the voltage being applied to it!). The aural method seems to work ok though;
- Next up for attention is the 2^{nd} local oscillator/mixer and tunable IF transformer unit. The 2^{nd} local oscillator was aligned using my trusty Eton E100 hand-portable digital radio – far easier than the method described in the manual (but they did not have too many digital readout synthesized handheld radios costing $50 back in 1968…) – just punch in 1160kHz on the Eton and then tweak L36 to peak at ‘90’ in the red scale and then with the Eton set at 1340kHz, peak C65 at ‘90’ in the black scale, then iteratively adjust C65 and L36[4] to make it track correctly. Once completed, I

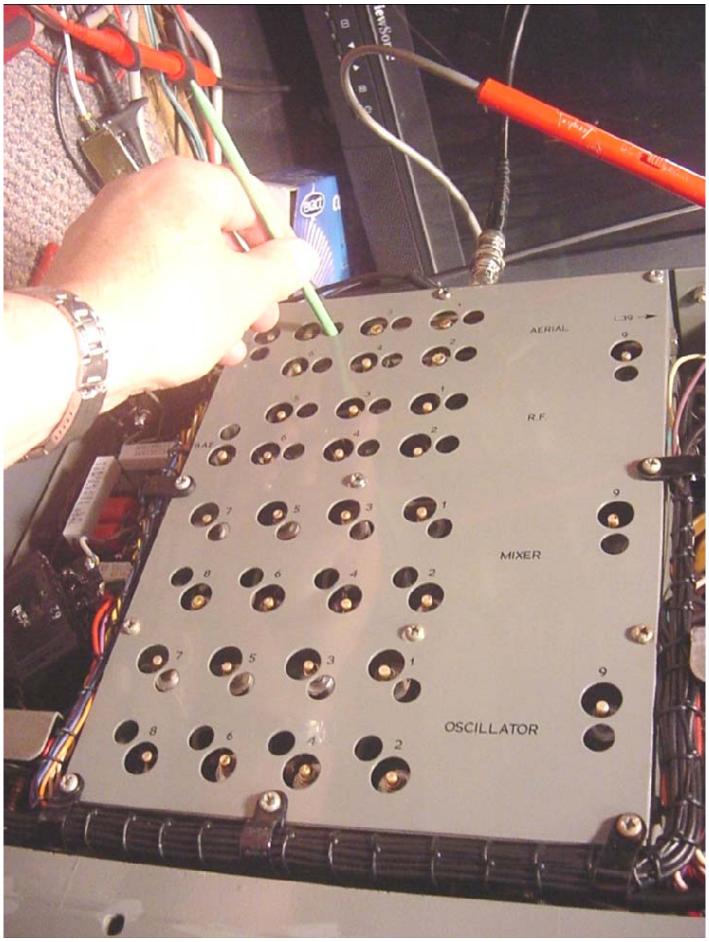




[4] This slug was very loose in its former – the remnants of a rubber thread having fallen out. I removed the slug and coated it with high-viscosity grease (‘Kilopoise’) prior to alignment.

checked each 10kHz increment on the vernier scale for accuracy. Prior to adjusting, my set was quite a way out (30kHz or so) but when I had finished it was spot on. The tunable IF transformer is adjusted for tracking using L34/L35 and C74/C77 with 1260kHz and 1440kHz fed into the 1st mixer stage respectively (photos at base of previous page);

- And finally (almost) the RF section – on checking, my set was surprisingly still fairly accurate regarding frequency setting on all bands considering the number of new components fitted and work completed around the valve bases in the coilbox – though I did not really touch the RF tuned circuits. The alignment work on the coilbox must be completed with the cover in place (photo, right) – this also makes identification of the trimmers and coils very straightforward as they are all numbered in each section.

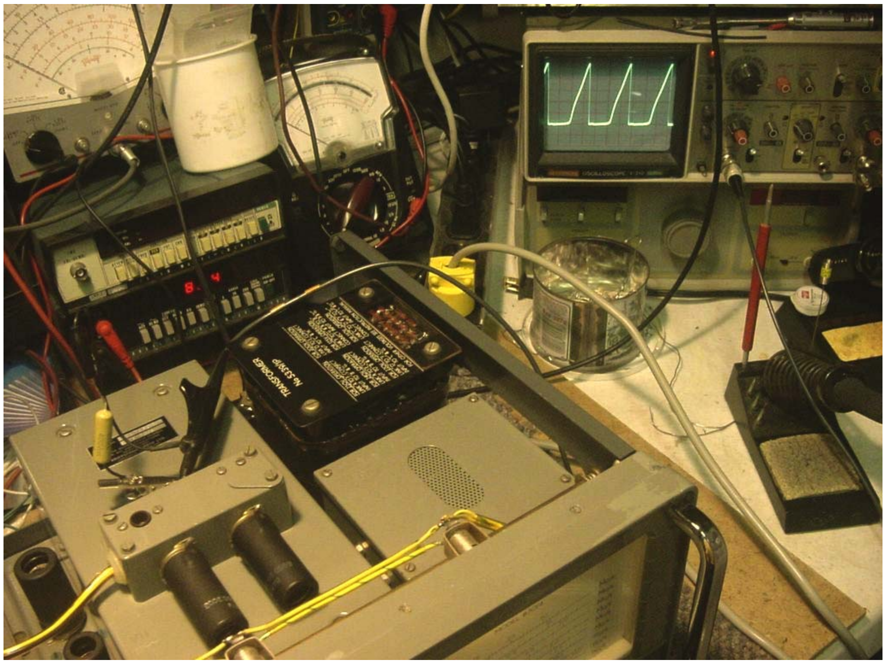


The mixer and RF stages needed tweaking quite a bit though. The trimmers need a 4BA socket trim tool – I found that a 4BA (metal) socket wrench insulated with a wrap of tape worked fine for the most part, though I made a home-made tool from a piece of plastic as some trimmers were affected by the presence of the metal tool (though not many). Also, some of the (LF) slugs require a hexagonal trim tool rather than the flat-head type that most of the other coils take (this is correct as the manual makes a point of it). Again, though, no problems with sticking or broken slugs. Overall, I followed the procedure described in the manual to the letter and it took around 2.5 hours as there are 9 bands - my wrist was sore at the end with continually spinning the tuning know from one end of the scale to the other, but it is now very accurate! (the overall re-alignment process probably took around 5 hours from start to finish);

- The crystal calibrator was checked against a DFM and its trimmer tweaked very slightly to bring the 100kHz markers 'on the nose' (photo, below – checking the calibrator waveform – a bit non-linear, but all the better for generating rich harmonics as required of such a circuit). The slug was also tweaked to peak the output on the higher frequencies.

All done!

Following alignment, the on-air testing was a delight – the set performed far better than ever before. It is quite a revelation to use the incremental tuning mode with confidence that the set is working and aligned correctly – it is very re-settable to a frequency when used with the calibrator and the scale adjuster is hardly needed. Yep, I cannot wait to use the set in some serious listening…



Conclusion

This second-phase of refurbishment has breathed a great big breath of new life back into my S.830/4 – the difference is quite astonishing: the set is now very stable on all bands and on all modes, very sensitive, accurate and, I suspect, performing very much like when it left the Bath Tub in 1968. Changing-out the remaining resistors for modern metal film types would probably lower noise levels a little and further increase stability – and be a 'fit and forget' solution, in my lifetime at least. However, I chose not to go that route for the reasons explained earlier in this article – instead, I will probably check things over every few years just to see if any further drifting in resistor values has occurred and replace as necessary (or sooner of course if a fault arises) – and what a great excuse for cracking open the case and enjoying the 'eye candy' of the sets beautiful, fastidious and delight-to-own 'all-Eddystone' construction. A real Jewel indeed.

Bibliography

There have been many articles, notes, tips and comments written about the S.830 series through the years of the EUG Newsletter/Lighthouse – an extract of the Index covering the S.830 series was provided in my earlier article so I will not repeat it here. However, there are a select few of these articles that I would like to recommend to anyone contemplating restoring or refurbishing an S.830 (in addition to the correct manual – available from the EUG website):

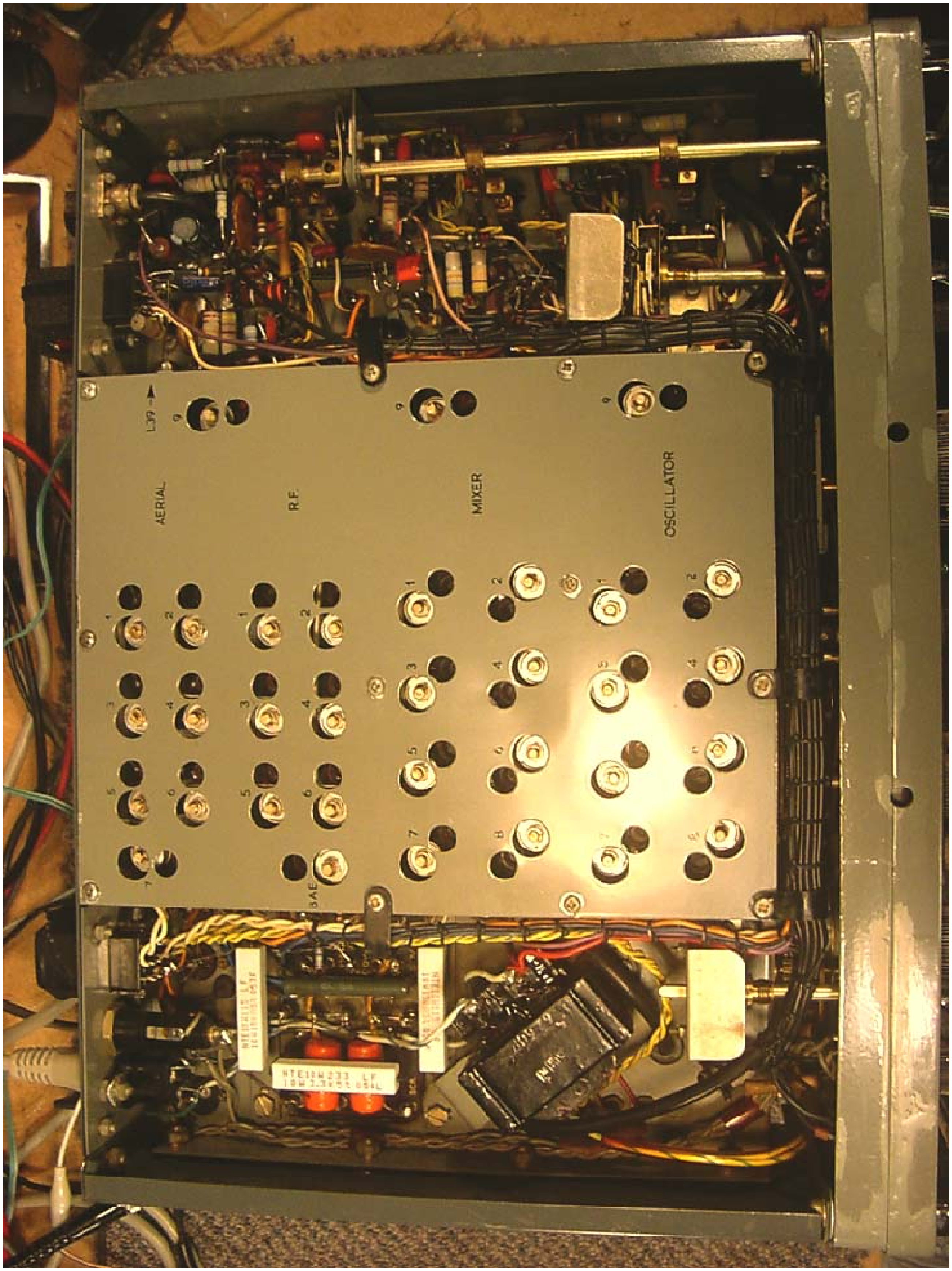
- *Cascode Catastrophe*, Graeme Wormald, Issue 78 p42, April, 2003
- *The Mysterious Disappearing Fault*, Peter Lankshear, Issue 83 p6, February, 2004
- *Serious TLC for the Jewel*, Graham Gosling, Issue 88 p28, Dec 2004 (I had forgot to re-read this one before I worked on my set this time – I wish I had! Talk about re-inventing the wheel – I reckon I could have saved myself a few hours by tapping into Graham's experiences, many identical to my own - note that some component numbers are different on the model he worked on (/7 variant) and the /4 variant featured in the article above. You may find the photos in my article help to illustrate things though…)
- *830 Special Issue*, Issue 77, February, 2003 (various articles)

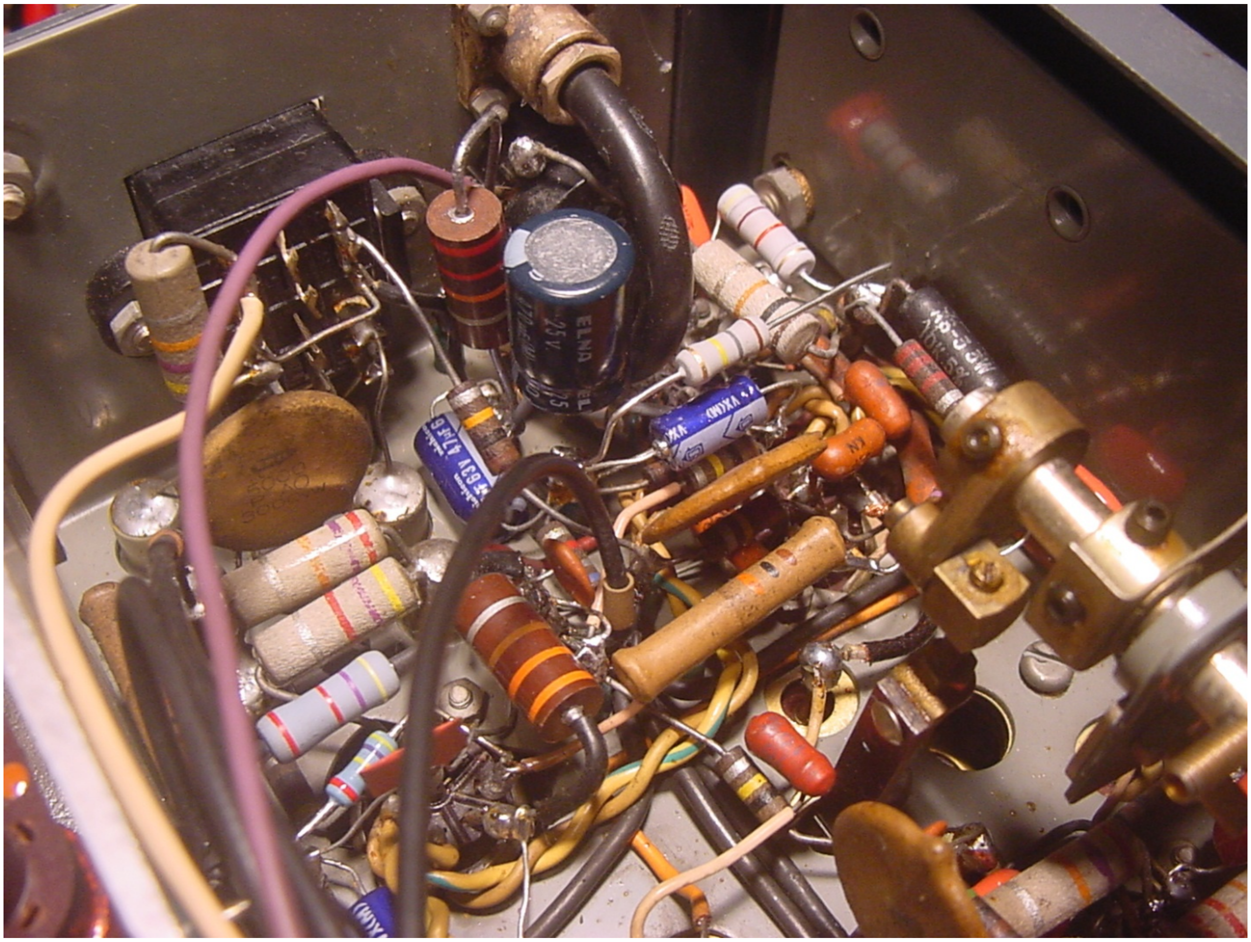
And also, especially for those lucky folks with an S.830/4 variant, you may wish to check out:

- *Notes on the Refurbishing of an Eddystone 830/4 Receiver*, Joel Balogh, Issue 70, p23, December, 2001 (interesting tip on adding a 1000pF capacitor to cure Low-Q on Band 2)
- *The Eddystone 830/4 in Canadian Government Service*, David Whiting, Issue 79 p28, June, 2003
- *Letter From Ontario*, Brian Cauthery, Issue 80 p36, August, 2003
- *Consequence of Good Things coming to an end*, Brian Cauthery, Issue 90 p10, April, 2006 (the receiver featured in this article, S/N 66 has the same 'CRC guarantee' date as my set – April 9, 1968 (same batch of sets? – label from my set in photo, right – S/N 57, 9 prior to Brian's set)

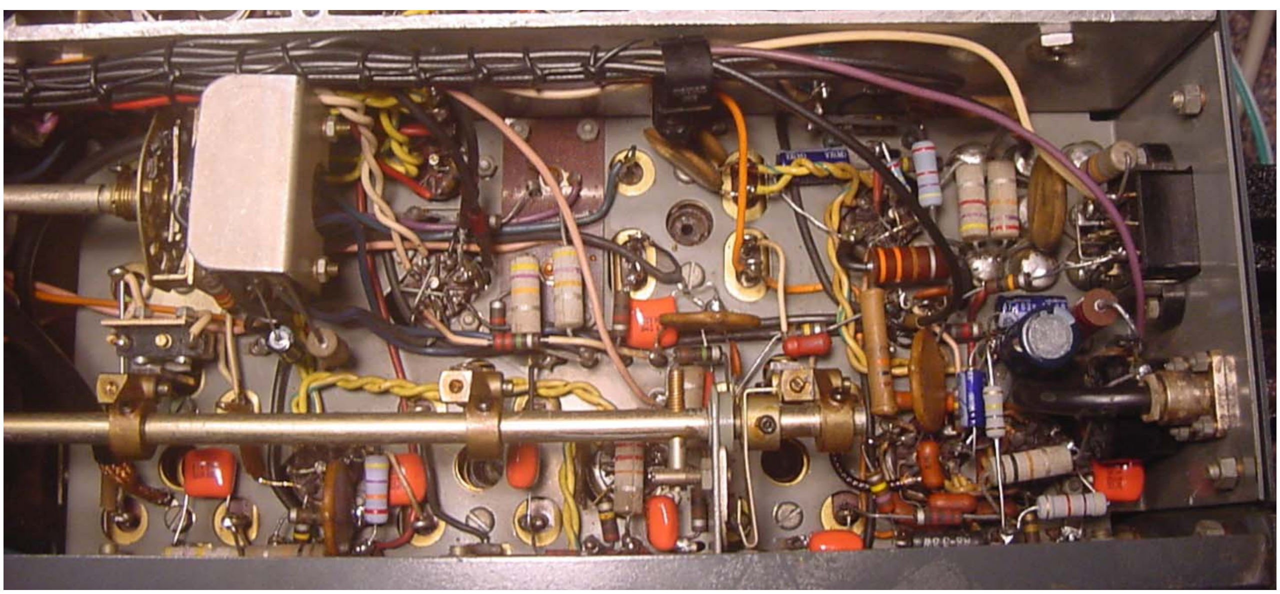
Postscript: having read Graham Gosling's article listed above, I thought I may as well check-out the response of the 100kHz IF in my S.830/4 with the Agilent 8935 spectrum analyser – but I soon realized that the Agilent only goes down to 400kHz in this mode. Then I thought – Ah, but there is the wobbulator I constructed some time ago (the design by Raymond Haigh published in Radio Bygones No. 82, April/May 2003) - but that only goes down to around 350kHz! So, I guess checking/tweaking my S.830/4's 2nd IF response curves will just have to wait – I think a modification to the wobbulator should be possible to give a lower frequency range - that is for another day though…. Besides, the response from the method given in the manual seems to be fine (both in listening tests and checking signal strength at fixed frequency offsets) if some care is taken to avoid a humpy response during the alignment process.

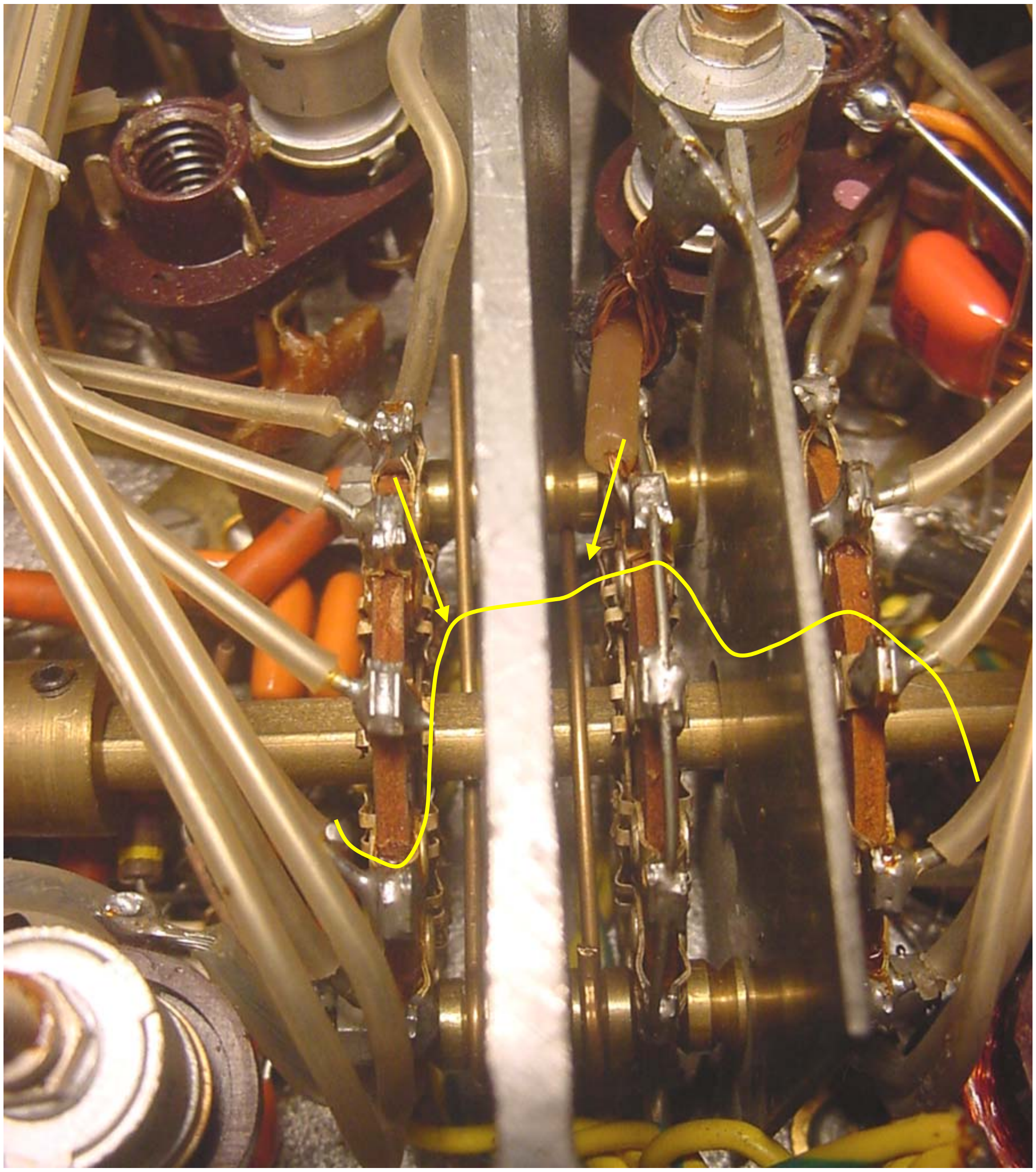
Above: the all-singing, all-dancing Agilent 8935 (Cellular) 'Base Station Test Set' – an excellent piece of kit, but with an annoying frequency gap below 400kHz in the Spectrum Analyser mode. Below: the homebrew wobbulator unit based on the design published in Radio Bygones in 2003. I added a DFM and a few other enhancements – including an extra switch position for an external coil: handy when I get around to modifying this unit to include a 100kHz band…


AERIAL
R.F.
MIXER
OSCILLATOR

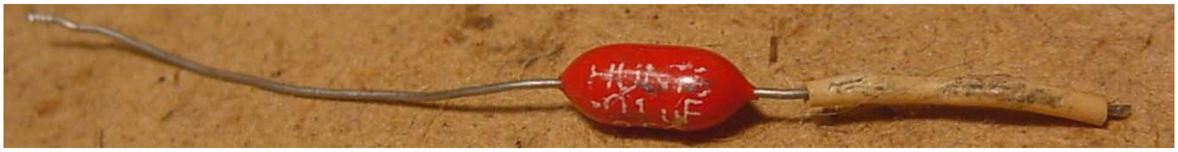


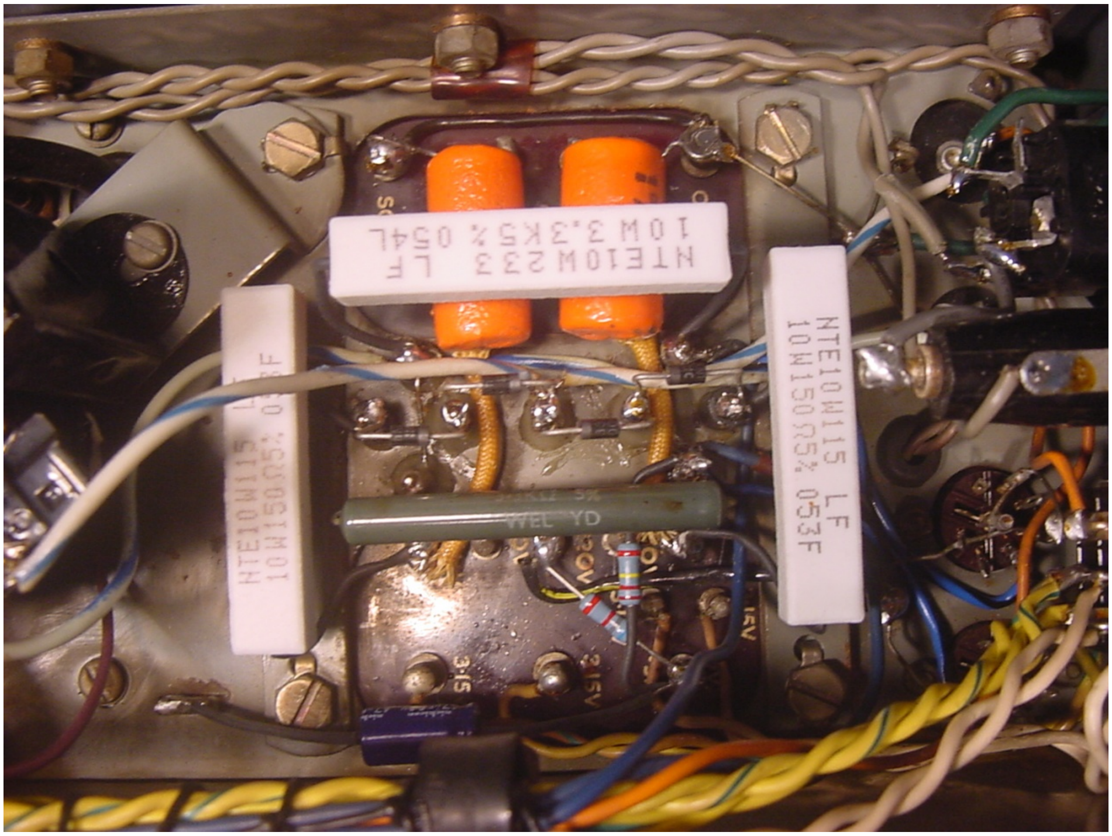
Above: refurbished limiter, AGC/AM detector, audio and 100kHz IF cathode-follower stages – the most cramped bit of the chassis (but easier to work on than it looks – honestly!).
Below: the entire IF/AF chassis after refurbishment.





Above: the tortuous route of C164 between the local oscillator and 1st mixer compartments traced in yellow (the black-sleeved lead can just be seen where the arrows point) . It wends its way from the mixer cathode past the switch wafer and screening plate, through a hole in the side wall, past the second switch wafer and connects to a tag on the local oscillator valve base – all but hidden from view. Below: the original part (it tested almost an order of magnitude lower in capacitance than its indicated 0.01uF)





Above: work on the power supply was going to include replacing the repaired stand-off insulators with new ceramic ones, however, the type I had in stock were unsuitable so I left well-alone for the time being at least. The 'temporary' repairs I made 5 years ago seem to be holding up well anyway. Below: an S.830/4 component graveyard…