Restoration of an Eddystone ‘Classic’ from the 1950’s – an S.680X Re-born into the SPARC Museum Fold, by Gerry O’Hara, G8GUH

Background

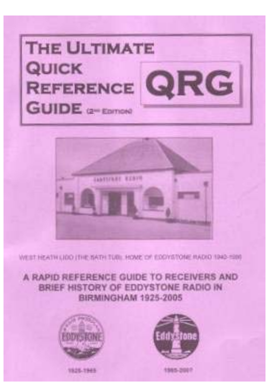
The Eddystone S.680 apparently did not get off to the best of starts. Exhibited at the 1947 Radiolympia Show, it was announced as the successor to the

immediate post-war (and not very successful) S.504. The S.680 used the same sized cabinet and transformer as the contemporary S.640 (a 9 octal valve set aimed at the amateur market), and due to the larger dissipation of the additional valves (total 15), albeit all miniature types except for the rectifier and voltage stabilizer, the set ran a tad on the hot side (see excerpt from the

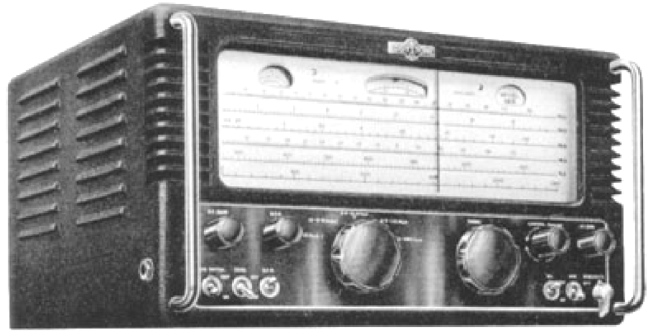
‘Cooke Report’, right). That version of the S.680 therefore did not see the production line proper and it was not until 1949 that it appeared again as the ‘New 680’, aka the S.680/2, though marketed as simply the ‘S.680’ from 1949 to 1951. The shortcomings of the earlier design

> “The company was without a good professional HF receiver, the S.504 having flopped, and Harold Cox was eager to get things moving. He specified that it should use the new B7G miniature valves, be fitted into the 640 cabinet and use the same mains transformer (we had loads in stock!).
>
> “If you look at the Radiolympia report in the Wireless World for October 1947 you’ll see a photo of the new S.680. But it’s smaller than the 680 which was finally released two years later! The problem was heat . . . too much of it.
>
> “The 640 transformer was pushing it to start with and the extra load of the 680 caused it to burst into flames when left permanently operational in high ambient temperatures. Not exactly the sort of reliability which Stratton were seeking to promote.
>
> “After a major re-design the 680 and its slide-rule dial version, the 680X, became one of our best-sellers of the ‘fifties. And this in spite of having a price-tag that was the deposit on a small car!

Above: excerpt from the ‘Cooke Report’ by Bill Cooke, recalling the development problems with Eddystone’s ‘hottest’ post war receiver… Above left: the S.680. Top of next page, the S.680X



had been resolved by a larger power transformer and installing the set in a larger and better-ventilated cabinet – still sporting a ‘half-moon’ dial (photo above) and with 15 valves in a two RF, two IF single conversion circuit with ‘bells and whistles’ such as a crystal filter, variable selectivity, noise limiter, S-meter and a push-pull audio output stage: all-in-all, quite a serious communications receiver. The worthy successor to this model was the S.680X (the ‘X’ suffix reportedly being considered as adding a touch of ‘mystery’ by Harold Cox, Technical Manager and later Technical Director of Eddystone, and not an indication that the set had a crystal filter, which the S.680 had anyway – this was some 40 years before the televising of the X-Files, so far ahead of his time...).



The S.680X had a ten year production life, from 1951 to 1961, during which time some 1,562 sets were produced (EUG QRG, 2005), as well as yours truly (about mid-production run…). The main 'cosmetic' difference between this model and the earlier S.680 was the front panel, which now sported the 'signature' Eddystone 'sliderule' dial (illustration, right) which gave 32 feet of tuning bandspread, compared with only 7.5 feet on the S.680 'half mooner'. Electrically, the sets were almost identical, with the exception of the frequency changer (mixer) valve, this being a 7S7 (X81) in the S.680 and a 6BE6 in the S.680X (though some S.680's were reportedly fitted with a 6BE6 with some circuit modifications to the mixer – Molloy & Poole), the 6AU6 first audio/phase splitter valves in the S.680 replaced by 6BR7's (8D5) in the S.680X, and a few passive component changes, eg. insertion of 12 ohm grid stopper resistors in the RF, mixer and first IF stages to prevent parasitic oscillation, and a revised 'phones circuit. Some other minor modifications found in later models were associated with providing gain compensation with varying selectivity. Copies of circuit diagrams for both models are provided at the end of this article.

Communications Receiver

QUITE a number of improvements have been made to the 15-valve Eddystone 680 communications receiver (reviewed in our September 1949 issue) and in its new guise it is known as the Model 680X. The main change is in the frontal appearance, the small rectangular scale opening now being replaced by one extending right across the cabinet.

A few small changes have been made also in the circuit; for example a small resistor is included in each r.f. grid, presumably for anti-parasitic purposes, although nothing of this nature was met with in the set we tested. There has been a re-arrangement of the headphone circuit and the signal is now taken from the anode of the output valve feeding the phase inverter. A capacitance-resistance network is used and the insertion of the headphone plug in its jack automatically disconnects the loud-speaker.

The makers are Stratton and Co., Ltd., Eddystone Works, Alvechurch Road, West Heath, Birmingham, 31, and the price is £106.

Above: brief review of the S.680X in Wireless World, June, 1952.

The S.680X covers 480KHz to 30MHz in 5 bands:

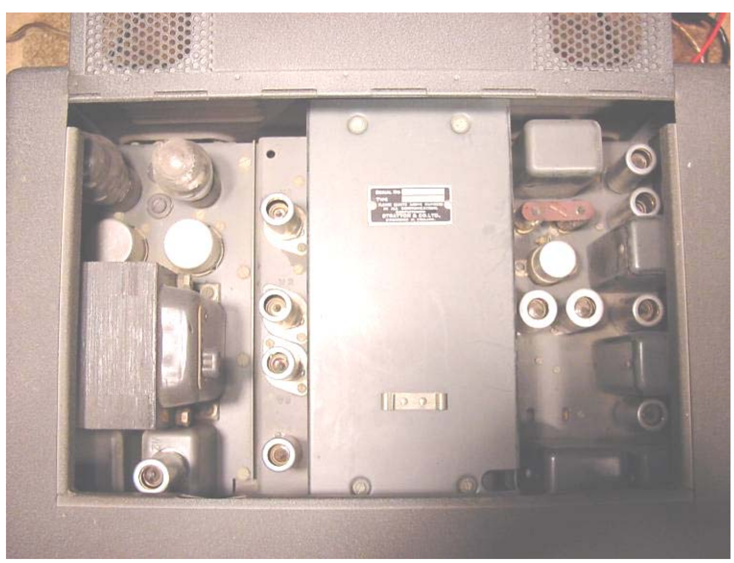
Band 1	..	30 Mc/s. to 12·3 Mc/s.
Band 2	..	12·5 Mc/s. to 5·3 Mc/s.
Band 3	..	5·7 Mc/s. to 2·5 Mc/s.
Band 4	..	2·5 Mc/s. to 1·11 Mc/s.
Band 5	..	1120 kc/s. to 480 kc/s.

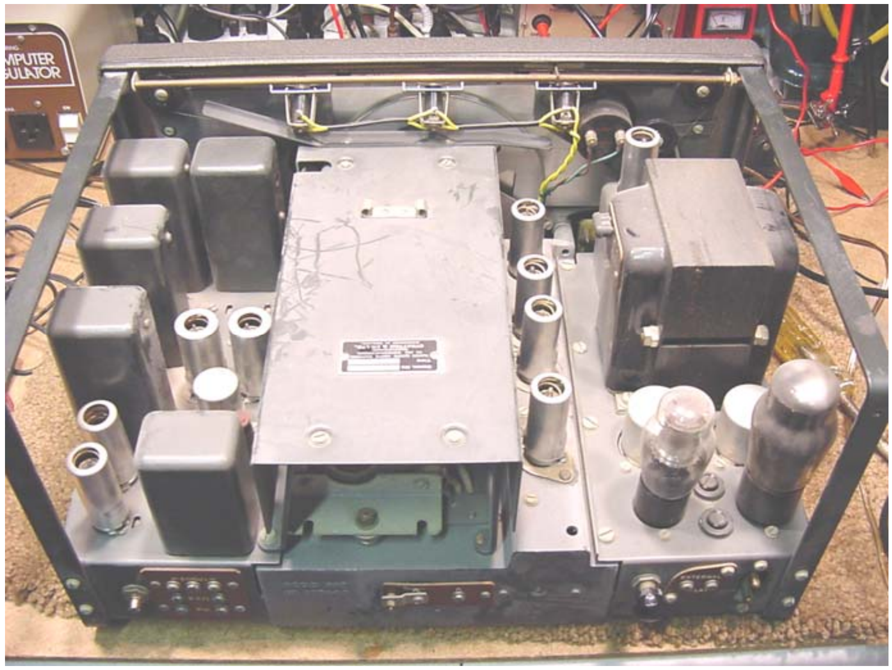
I had been looking out for one of these sets to add to my modest collection for some time, and although one or two had appeared from time to time on EBay, I saw nothing locally (I live in Vancouver, Canada). Then I had a brainwave – the local radio museum, SPARC - *The Society for the Preservation of Antique Radio in Canada* (http://www3.telus.net/radiomuseum/) - had one on display (at least sort of, it being located on the floor in the communications receiver section of the museum display and thus not in a very prominent position) - so I thought 'why not restore the museum's S.680X': I would get to know the receiver, could use it for a while, be able to write an article on it for EUG and give it back to SPARC in a refurbished and working condition and, hopefully, worthy of a better location in the display... a 'win-win' for all…

So, I signed out the museum's S.680X, S/N *GJ1318* (July, 1958 according to Alan Clayton's method, not the QRG method, however I did not confirm this by checking the date on the electrolytic cans as this would have meant dismantling part of the power supply and I decided to leave well alone… see later), carefully loaded it into my Jeep and carted it back to the G8GUH shack for tea and sympathy.

Preliminary Inspection and Safety Checks

Off came the case. Inside was the original 'kettle connector' power lead. It actually looked in pretty good shape (not perished like many I have seen) and tested ok on the meter – so I decided to leave the original power connector in the chassis instead of replacing it with my usual 'Euro-connector' mod. A look above and under the chassis indicated that the set was physically in good shape – all parts appeared to be present and correct and there was no evidence of anything been replaced, overheated/burned out or any physical shorts or damaged wiring. Continuity checks on the power transformer indicated that it was in good shape, the fuses were ok and the mains switch worked.





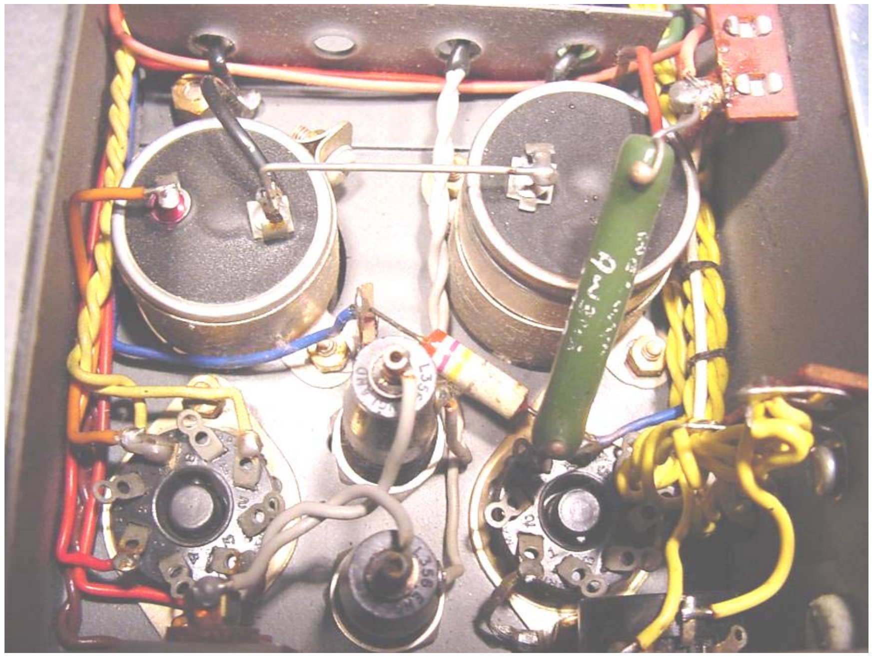
Above: view of the S.680X chassis on arrival – a little dusty. Below: rear view of the case – note the almost 'as-new' condition

The fuses were checked and found to be standard 1 Amp types – as specified for 250v operation (as they had likely been working ok, I left them as-is). The power supply capacitors were inspected closely and there was no sign of bulging or leaking. Looking good so far…

Initial Clean-up and Power-on

The power supply and IF/AF sub-chassis in this set are finished in a grey enamel paint, as are all the IF transformers, crystal filter unit, BFO unit, tuning gang cover, power supply choke and AF output transformer shrouds, making for a very uniform and professional-looking chassis.

The RF section is built on the usual stout Eddystone aluminium alloy casting, the outer surface of which is also painted grey. The chassis was covered in a light coating of fine dust, some fluff and a few dead bugs, but otherwise was in remarkably good shape. The coil box cover was removed to allow access to the tuning gang and I then used a paintbrush and vacuum cleaner to remove the loose dust and debris (above and below the chassis) and then wiped the chassis over with a cloth moistened in warm soapy water – it came up a treat with very little effort. The grey crackle-finish case was also cleaned with warm soapy water, this time using a soft nailbrush: it cleaned up like new apart from a few minor scuff marks. Time for initial power-on checks:

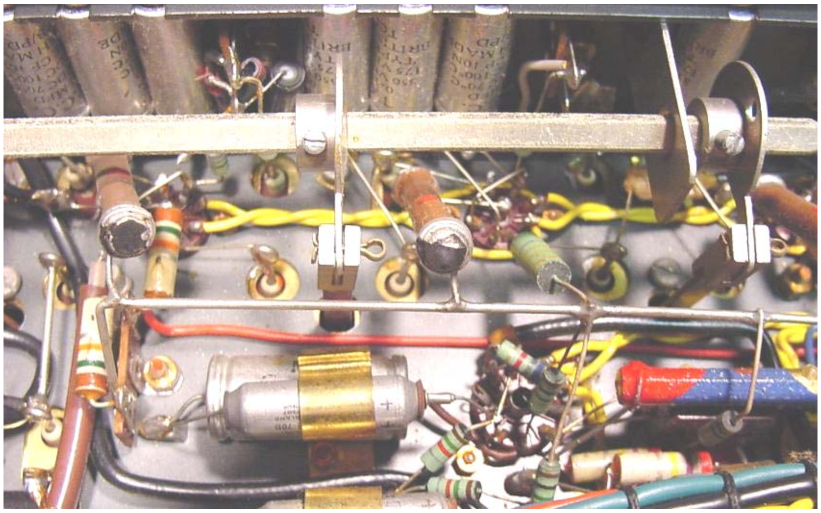


Above: beneath the power supply chassis – all neat and tidy (almost as new!). Below left: above view of the power supply chassis before cleaning – the 5Z4G on the right and VR150/30 on the left

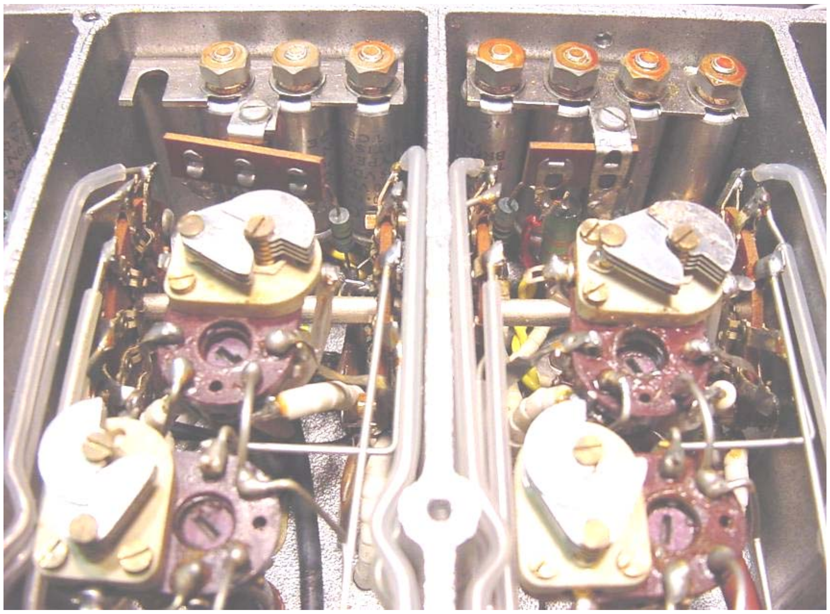
- I removed all the valves, cleaned and checked them on my Precision valve tester – they tested ok;
- Checked the resistance measurement from HT to chassis – rather low, rising to only around 1.8kohms after an initial dip to almost zero on the meter as the smoothing capacitors charged up. I decided that I would re-form the power supply electrolytic capacitors in-situ;

- Attached an AC voltmeter across the power transformer HT secondary, coupled up the power lead to my variac and gradually applied power. The voltmeter indicated that the HT winding was good and so the LT windings were checked – also ok;
- Switched off the power and replaced the rectifier (5Z4G) and voltage stabilizer (VR150/30) valves. Connected a DC voltmeter on its 300v range across the HT line and the chassis. Re-applied power gradually using the variac and at around 60 volts AC applied to the transformer primary, some DC voltage began to appear across the smoothing capacitors (C114 and C115);
- The capacitors were re-formed over a couple of hours by slowly increasing the applied AC voltage from the variac, monitoring the HT current draw (all valves still removed except the 5Z4G rectifier and VR150/30 stabilizer) - increasing the voltage in stages, holding for up to 15 minutes and also switching off/on a couple of times at each stage. I increase the applied voltage in increments of 25v, up to the full HT volts of ~250v DC. At around 160v DC the stabilizer valve started to glow and the stabilized HT line was checked at 150 volts. Leakage current at the end of re-forming exercise was acceptably low on all capacitors – impressive for 49 year old units;

- Undertook leakage checks on a few of the 'TCC' metal-can 0.01uf and 0.1uf paper HT and screen by-pass capacitors, low-voltage electrolytic cathode by-pass capacitors (C98, C99 and C102) and AGC line capacitors (C12, C28, C88, C97) – those tested appeared ok, so I decided to try powering-up the set without replacing any;
- Re-installed the remaining valves and attached a speaker. Slowly brought the set up on the variac over around 15 minutes, checking the HT current draw (transformer HT centre-tap chassis connection temporarily removed and bridged with a milliameter) - about 118mA draw (the manual says 110mA) – seemed ok considering the set was being fed 119 volts on its 110 volt transformer primary tap.



Above: beneath the IF/AF chassis – also all neat and tidy – note the row of tubular paper capacitors at the top. Below: corner of the RF chassis from below – again note the row of 'TCC' tubular paper capacitors at the top (this type seem very reliable)



Electrical Inspection and Voltage Checks

- Checked key voltages using the voltage table in the manual – these were within acceptable ranges (I used a homebrew 1000ohm/volt meter adapter that allows quick switching-in of the correct range shunts – see the sidebar on page 13 of my S.750 restoration article). Audio was heard – though this was only a slight hum/hiss and some annoying intermittent crackling;

- Injecting an audio signal (finger) at the AF gain pot slider resulted in plenty of volume – a few voltage checks around the AF section revealed that all seemed generally in order AF-wise - time to see if the set could receive signals;
- Connected a short aerial and signals were heard on all bands, however, some stations appeared to be spread across large parts of the band indicating that something was not right – an alignment check was needed;
- I left the receiver on 'soak' for a few hours and nothing seemed to be overheating, though the intermittent crackling persisted. Although annoying, this was not 'unbearable', so I decided to check the alignment prior to sorting this out.

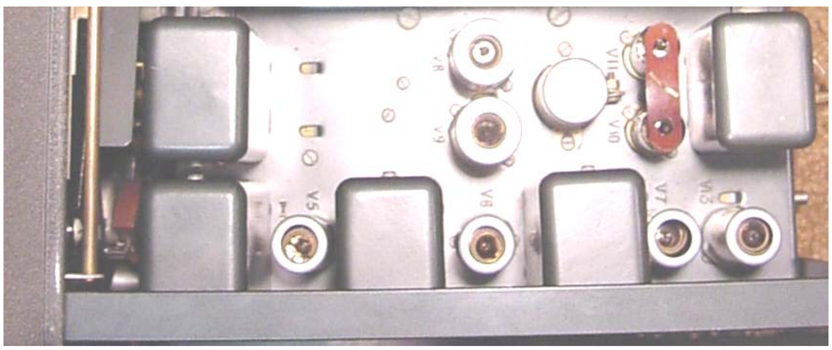
Preliminary Re-Alignment

The S.680X manual contains the alignment procedure – sort of: it provides the rudiments of the RF/Mixer alignment but does not provide IF alignment instructions, instead noting that '*The alignment of a modern variable selectivity IF amplifier as in the "680X" requires the use of a frequency modulated signal generator ("Wobbulator") and an oscilloscope, presenting a visual display to the operator.*' It does provide a series of graphs indicating typical IF response curves at various selectivity settings plus crystal selection and rejection notch responses, and also provides an indication of IF sensitivity (220uV applied to the grid of the first IF valve, V5, for 50mW audio output). Not having my wobbulator handy - its several thousand miles away in my mother-in-law's garage in Burton-on-Trent, UK - and the only sweep generator I have covering down to 4mHz (an old Heathkit model IG-52), I decided to use the 'standard' method using an output meter and a signal generator/digital frequency meter. My Tech Short on Receiver Alignment covers this, so I will not go into great detail here, save to point out that although the nominal IF of the S.680X is 450kHz, the actual IF frequency is determined by the crystal fitted to the particular set being aligned. In summary, the method I used is:

- Switch on the receiver and the signal generator for an hour or so to thoroughly warm up. Set the signal generator to 30% modulation and the attenuator backed off about half way;
- Connect a pair of high impedance 'phones to the receiver, and connect the output meter across the 600 ohm line tap of the output transformer (photo, right) – this allows audio monitoring when needed/wanted while also using the output meter;
- Remove the tuning gang cover and

coilbox cover from the S.680X;

- Short out the local oscillator (LO) gang of the tuning capacitor, C63 (the one nearest the front panel) using a short jumper lead to stop the LO working (see photo at base of previous page – yellow jumper), and connect the signal generator output to the grid of the mixer valve, V3 (couple the signal generator to the stator of the mixer gang of the tuning capacitor, C44 using a 0.01uf capacitor and croc clip – white jumper);
- Set the receiver to maximum selectivity, RF gain high, AF gain to suit preference, noise limiter, AGC and BFO all off (Note: if the receiver is not in the maximum selectivity setting, the primary cores of T3 and T4 and the secondary core of T1 will not be accessible via the lower holes in the IF transformer cans as these cores move upwards to increase mutual coupling between the IF transformer primary and secondary windings for other selectivity settings. Also note that the lower hole in the crystal filter unit can, T2, serves no purpose for alignment and the very restricted access to this is not a concern);
- Switch the crystal into circuit with the phasing control at mid-way,
- Slowly swing the signal generator through the nominal IF, say plus/minus 5kHz. There should be a sharp peak as the signal generator output frequency matches the resonant frequency of the crystal (if there is not, suspect a duff crystal and undertake the remainder of the IF alignment using 450kHz as the receiver IF until a replacement 450kHz crystal can be found and fitted). If you notice multiple peaks, select the strongest one (it should be near the nominal IF of 450kHz). Peak the core of T2;



- Leaving the signal generator tuned to the crystal frequency, switch the crystal out, though keeping the receiver on the maximum selectivity setting;
- Align the IF transformers in the following order: T4 primary, T4 secondary, T3 Secondary, T3 primary, T1 secondary, T1 primary. Repeat at least once as some of the adjustments may interfere with each other, gradually backing off the applied signal using the attenuator on the signal generator as needed to provide a reasonable output meter reading with the receiver RF/IF gain at around $^2/_3$ full and the AF gain at about ¼ full;
- Once no further improvement can be attained, remove the short from the LO capacitor and the signal generator lead from the grid of the mixer valve;
- Replace the tuning gang cover;
- Upend the receiver so it is standing on its power supply end with the coilbox facing you;
- Connect a 330ohm ¼W resistor across the aerial connector (one connection post earthed) and the signal generator to the non-earth end via a 0.0001uf capacitor;
- Follow the alignment procedure for the LO, Mixer and RF stages as per the manual;

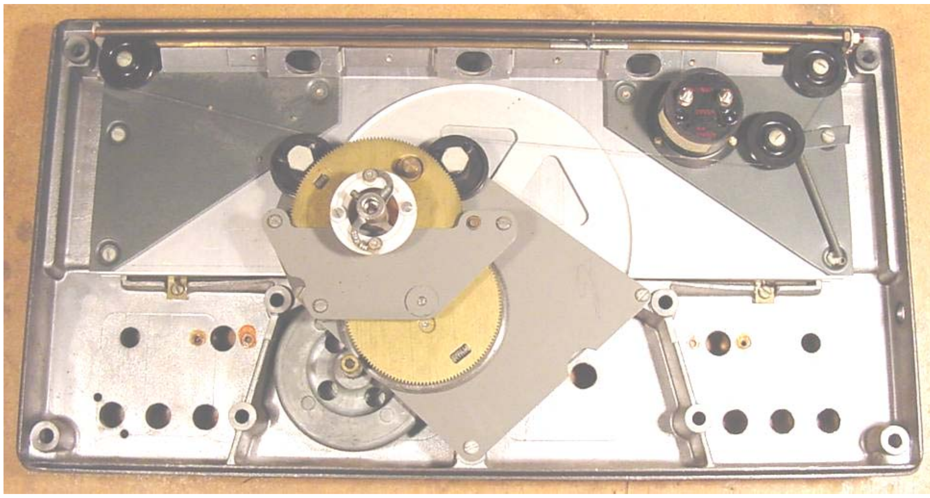
- Adjust the S-meter zero with the aerial connection shorted out (if you cannot obtain a zero reading, suspect resistors R33, R56 and R58);
- Hey presto, your done (for now).

Mechanical Work

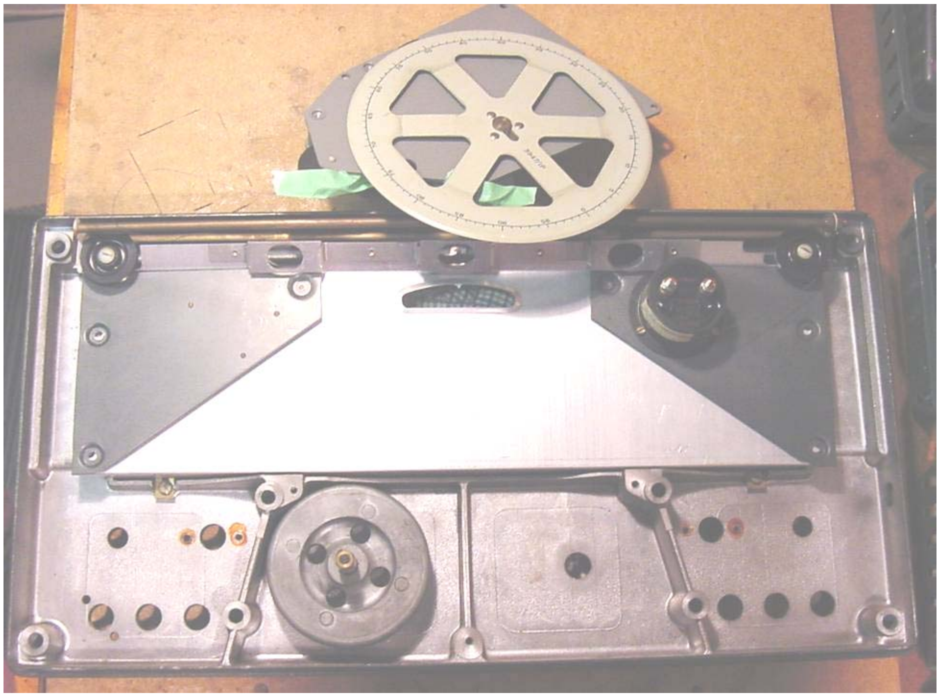
Although the tuning mechanism was running quite smoothly, the dial glass, pointer and scale plate cannot be cleaned properly without dismantling the front of the S.680X, meaning separating the front panel casting from the main chassis had to be undertaken. That was the next job… a bit of a task, but well worth the effort I thought – besides, it allows the tuning mechanism to be inspected and cleaned also – here's how:
- Remove the knobs. Note: take care if the grub screws are 'stubborn' and use a little penetrating oil if necessary. Watch out for a small fibre washer on the tuning shaft. Remove the grub screws entirely, clean threads and apply a minute spot of oil. Wash the knobs in warm soapy water and dry thoroughly;
- Remove the coilbox and tuning capacitor gang covers;
- Remove all valves;
- Carefully remove all the retaining nuts from the controls, using a guard to prevent scoring the finger plate (photo, right) - you will never forgive yourself if you scratch the fingerplate, but any old score marks can be masked reasonably well using a permanent black marker pen - and then prize the fingerplate away from the front panel casting.

- Clean the finger plate with warm soapy water and dry thoroughly. Apply a little 'Armour All' or similar and polish it up (this one looked like new);
Remove the phones socket nut/bushing from the side of the front panel (be careful – there is a washer between the socket and the front panel);

- Disconnect the S-meter wires;
- Loosen the two grub screws holding the flexible coupler to the tuning capacitor gang shaft;
- The drive cord looked in good condition, so I decided to leave it fixed to the spool pulleys at either end and remove them and the cord intact – hoping

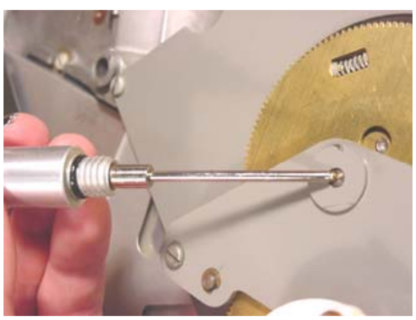


that I would not have to re-string the dial (see EUG Newsletter #25, p17 for tips on this if you have to do it);
- Remove the lower outer front panel retaining bolts – this can be a bit tricky and either a really long or an angle screwdriver is needed. Remove the upper outer front panel retaining bolts and take the chrome handles away. Remove the four brass inner front panel retaining bolts (these are removed from the front and the heads are exposed once the finger plate is off). Pull the front panel casting away, complete with the dial drive mechanism (photo, above) – again be careful as there is a spacing washer between each of the front panel casting mounting points and the coilbox (tip: place a spot of glue on each washer to hold in place when re-fitting the front panel later);

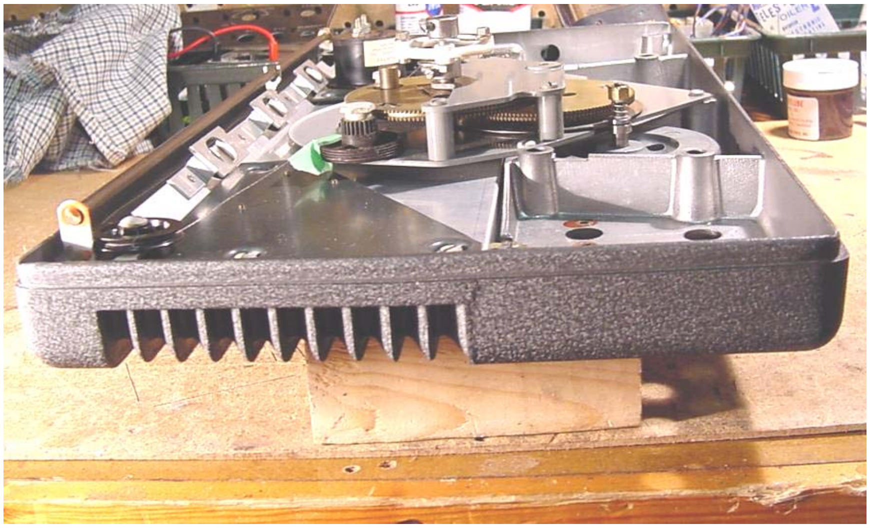


- I prevented the cord from leaving its grooves on the spool pulleys using two small pieces of masking tape. Careful inspection of the gearbox revealed that nothing was binding or blocking movement of the gears and no damage was noted – all of the gears looked in as-new condition in this set;
- Remove the spring-loaded idler (cord tension) pulley by loosening the pivot screw fixing it to the front panel casting, also loosen the three screws holding the gearbox to the front panel casting, tip it forwards and upwards slightly and then ease the drive cord away from the upper two idler pulleys. The gearbox can then be removed with the dial cord intact (photo, above);

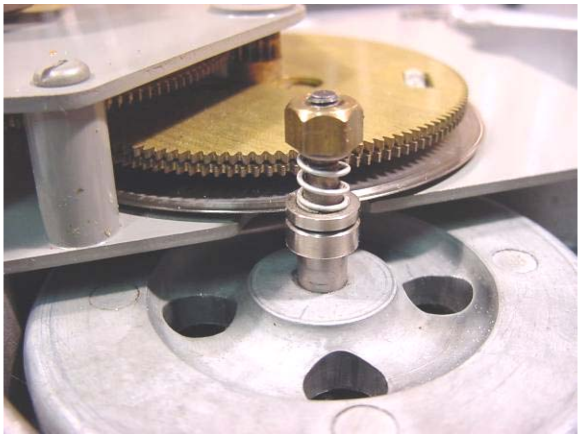
- Remove the dial plate (four screws) and the dial glass (four screws). Pulled the tuning knob spindle out of its bushing (be careful as there are small fibre washers between the flywheel and the brass bushing mounted on the front panel);
- Remove the upper idler pulleys and pointer guide bars by removing their (2) screws from the front panel casting;
- Remove the all-important Eddystone logo – a nice grey enamel one in the case of the S.680X (photo, below right) - by unscrewing its small retaining plate and, finally remove the tuning drive bushing from the front panel casting (3 brass screws). All the component parts are shown in the photo, right.
- I cleaned-up the gearbox and applied a small spot of high quality light machine oil to the bearing points (photo, left) and some moly grease to the spool pulley gears and the pointer shaft and guide bar;

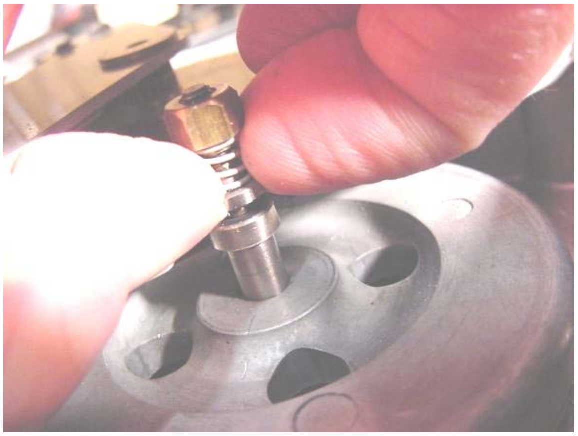


- I cleaned the scale plate and circular vernier dial plate by dusting off the loose fluff and dead bugs and then wiping them using warm soapy water and cotton wool (be very gentle as they are easily damaged);
- While the front panel casting is off the set (photo, base of next page), use the great access this provides to clean up the front panel switches, variable capacitors (BFO and crystal phasing) and Yaxley switch mechanisms – also apply a little De-Oxit (or Servisol/Electrolube cleaner) on contact surfaces and into the AF and RF gain pots. While you are at it, clean the main tuning gang rotor connections, applying a little De-Oxit to the contact points and a dab of moly grease into the roller bearings;

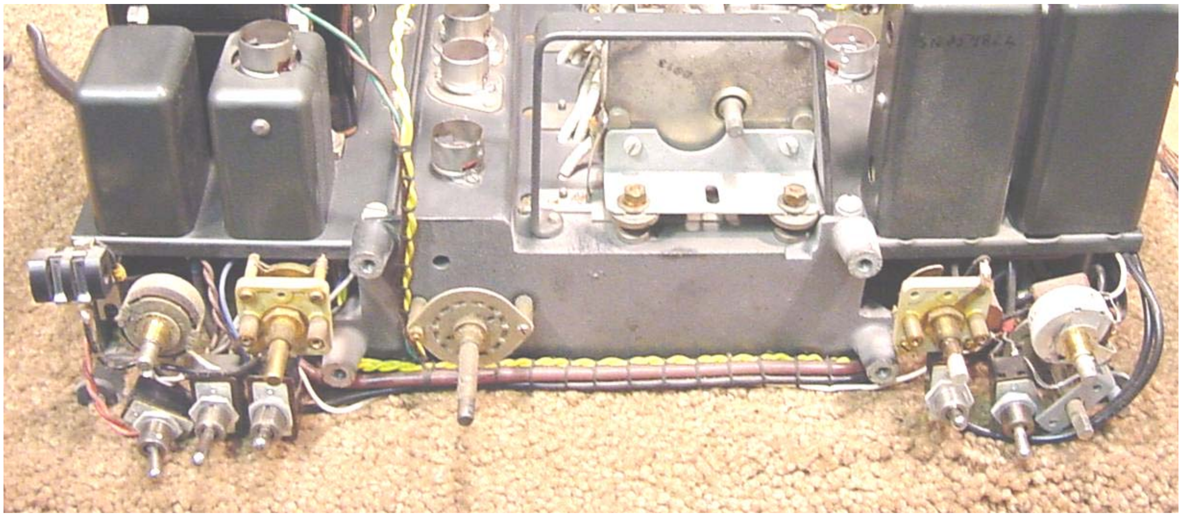


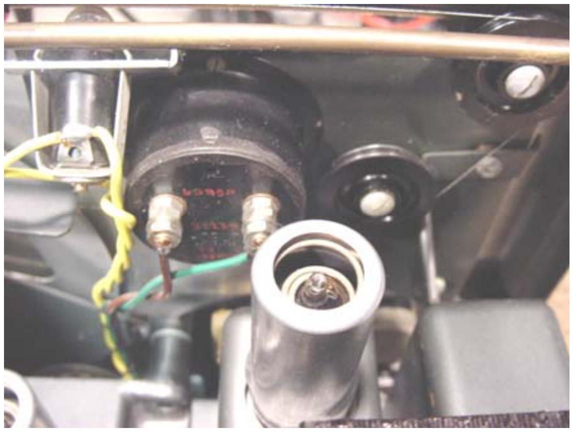
- Clean-up all the remaining drive components (idler pulleys, tuning shaft bushing etc) and re-assemble the drive mechanism to the front panel casting, simply reversing the disassembly order – don't forget to use the guard when tightening the switch and gain control shaft retaining nuts;



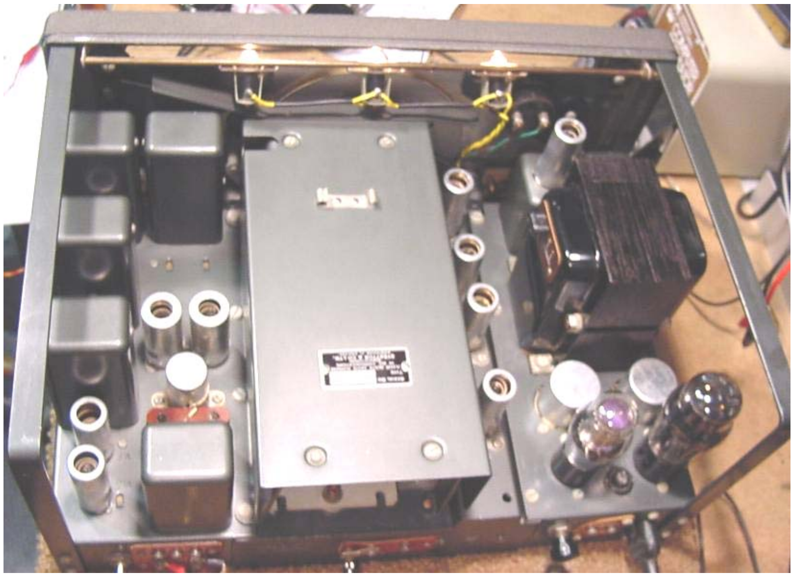


- The tuning knob shaft was coated with moly grease prior to installation in its bushing;
- When re-fitting the gearbox, tuning shaft and friction drive, place the front panel casting on a couple of wooden blocks (photo at top of page) so that the shaft can protrude from the front panel without being forced back through. Close-up views of the flywheel and friction drive mechanism are shown in the photos above (note that the spring exerts





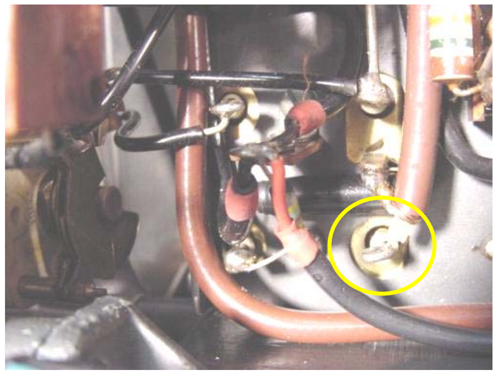
pressure on the two pinch-plates, providing a clutch-like action against the large drive plate it mates with attached to the gearbox;
- The tuning knob was then temporarily fitted and the completed assembly tested for that sensual 'Eddystone smoothness' – yes, it was certainly still there;
- Replace the S-meter connections (green goes to the outer edge, ie right-hand side when viewing the set from the rear) – photo, right;
- Undertook a final clean of the chassis above and below: it now looked 'Bath Tub fresh' – quite an incredible condition for a 50 year old (check out the photos);
- Finally, I replaced all the valves and screens, polishing each before fitting. Hey, this radio looks like its just been unpacked from its delivery case! (photo, left).



Now for a second look at the electronics and alignment…

More Electronic Checks

The receiver was switched on and was now found to be profoundly 'deaf' on all bands… the good news though was that the intermittent cracking had gone. Oh, oh I thought, something has happened while I have been disassembly/re-assembling the set. Mechanical disturbance would seem to be a likely candidate, though careful inspection, especially along the rear of the front panel, did not reveal anything untoward. I measured a few of the 'check point' voltages – they seemed to still be ok…. Hmmm – better do a signal trace.

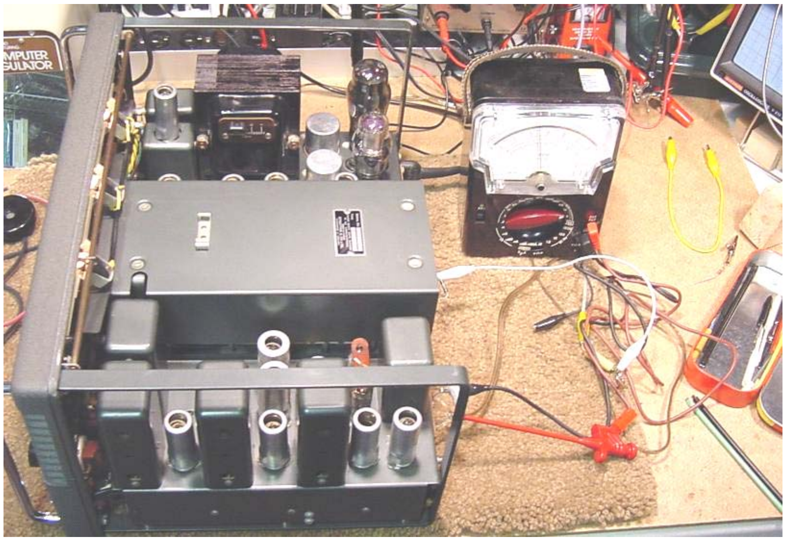


Audio sensitivity seemed ok still (finger on the AF gain slider). I removed the tuning capacitor gang cover, shorted the LO part of the tuning capacitor gang and injected IF into the mixer grid – very weak output from the receiver. Changed the injection point to the grid of the second IF stage (V6) – this time there was good strong output from the receiver. I did the same on the grid of the first IF stage (V5) – very low output noted. I changed out V5 – no difference. It therefore looked like a fault had developed in the crystal filter circuit. I poked an alignment tool into the crystal filter unit coil (T2) and as I did so the receiver sprang back to life and went deaf again when I withdrew it… I found that wobbling the crystal filter unit can a little from side to side had the same effect. I was beginning to think that either I had disturbed some of the wiring when removing/re-installing the front panel (the wiring around the base of the crystal filter unit can is very stout to increase stability and this could have pushed something out of place, causing a short-circuit), or that there was a dry joint within or external to the crystal filter unit can. I upended the receiver and took a very careful look at the connections to the crystal filter unit – no obvious short in the wiring. With the set running, I prodded them a little with an (insulated) alignment tool and after some time found that there was a small piece of loose wire trapped between the Paxolin base of the crystal filter unit and its metal base plate (circled yellow in photo at base of previous page - possibly a component lead clipping from when the set was built) – this small piece of wire was intermittently shorting between the crystal filter unit output connection pin (connecting to the grid of V5) and the earthed metal can base. Each connection pin has a single ceramic insulation bead placed over it that moves up and down freely on the pin – therefore in the normal upright position of the set, the bead drops down the pin and thus the stray piece of wire may form a short as the bead cannot get in the way and prevent it. After finally being able to poke the wire scrap free with fine tweezers, a darning needle and pieces of fine wire (but not succeeding in removing it from the small space between the Paxolin and the metal can base), and not really wishing to remove the crystal filter unit from the chassis to facilitate removal of the wire scrap (perhaps disturbing something else in the process and spoiling the neat, original wiring), I effected the simple remedy of placing a spot of glue on each of the ceramic beads to hold them in place close to the Paxolin base and thus prevent the errant piece of wire being able to short out any of the transformer pins in future.

Final Re-Alignment and Checks

I repeated the alignment procedure again as described above, taking a little more care this time (the RF alignment setup is shown in the photo, right), and afterwards:

- Replaced the coil box cover and undertook a last tweak of the LO, mixer and RF trimmers with this in place (the cores are not accessible with the cover fitted);
- Removed the signal generator and output meter, connected a speaker and aerial and checked out the receiver performance on each band.



I found the set to be extremely sensitive and very selective on all bands, right up to 30mHz – indeed it is one of the best valve receivers from this era that I have ever tried out: very stable and a pleasure to use. Of course I was reticent to hand it back to the Museum…. but hey, it looks and works great and is an icon of the Eddystone marque, so I will now have the pride of knowing that I had a little part in 'flying the (Eddystone) flag' in the SPARC museum in Coquitlam, BC – why not pay us a visit some day!

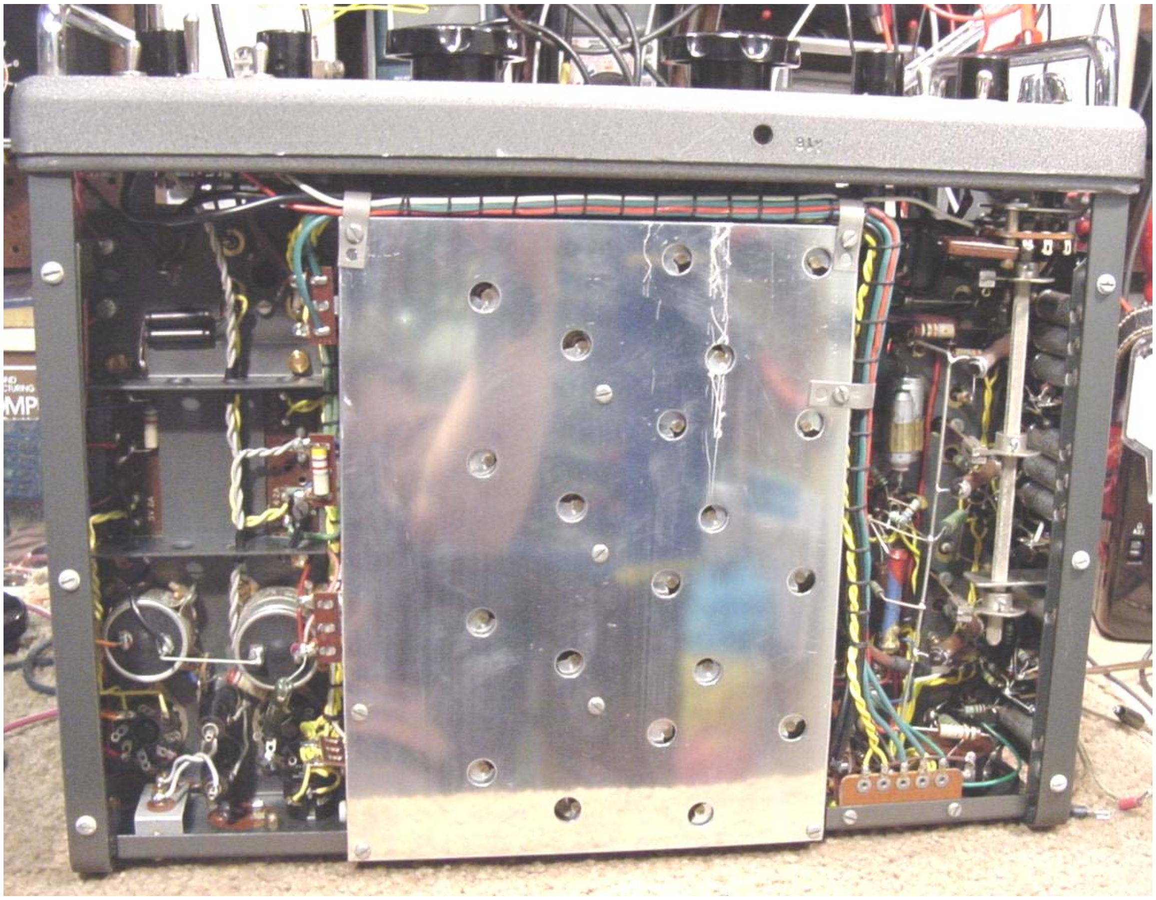
Conclusion

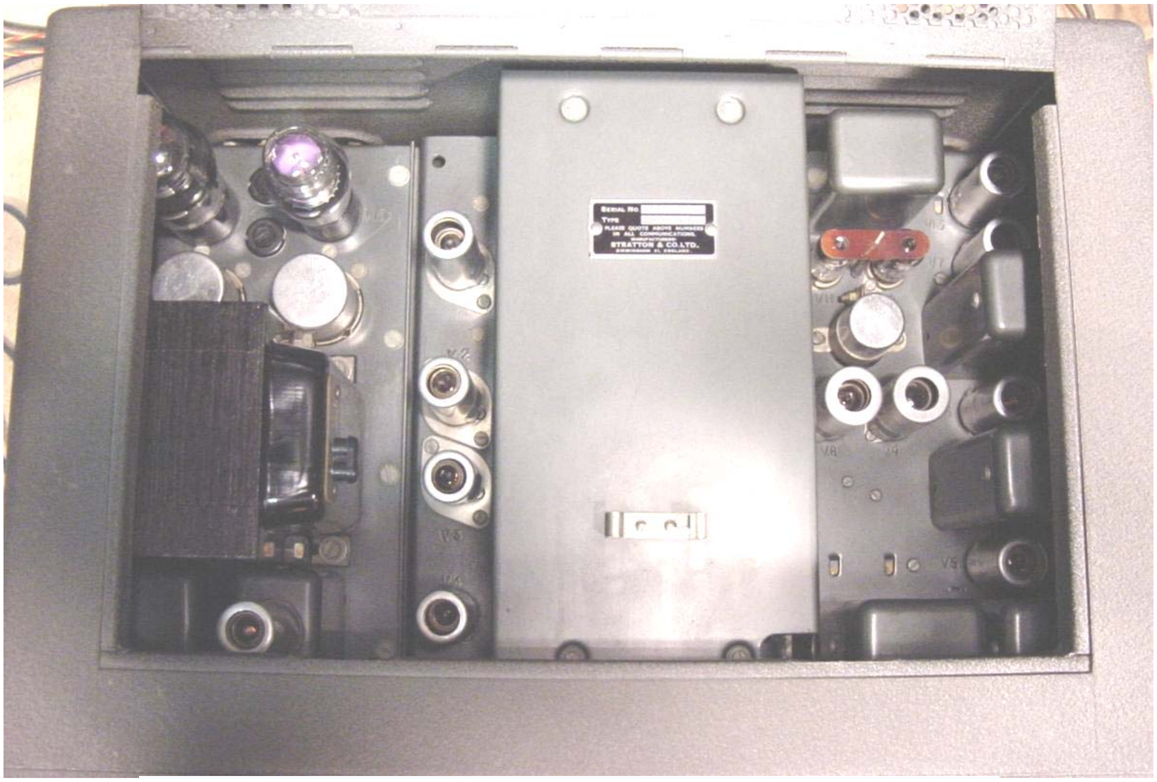
The Eddystone S.680X is an excellent receiver and this one is now (almost) like new. The SPARC museum have a first-class Eddystone exhibit that the folks at the Bath Tub would be proud to know is on display….. and I am still on the look out for one of my own. Oh well… I wonder if SPARC will let me take a look at their S.640 next?

73's

Below: the S.680X on the G8GUH workbench following re-assembly and undergoing soak-testing

Above: time to put the S.680X through its paces before I returned it to the SPARC Museum. It easily held its own against my top performing S.830/4 and S.940 sets – indeed, it is a real pleasure to use

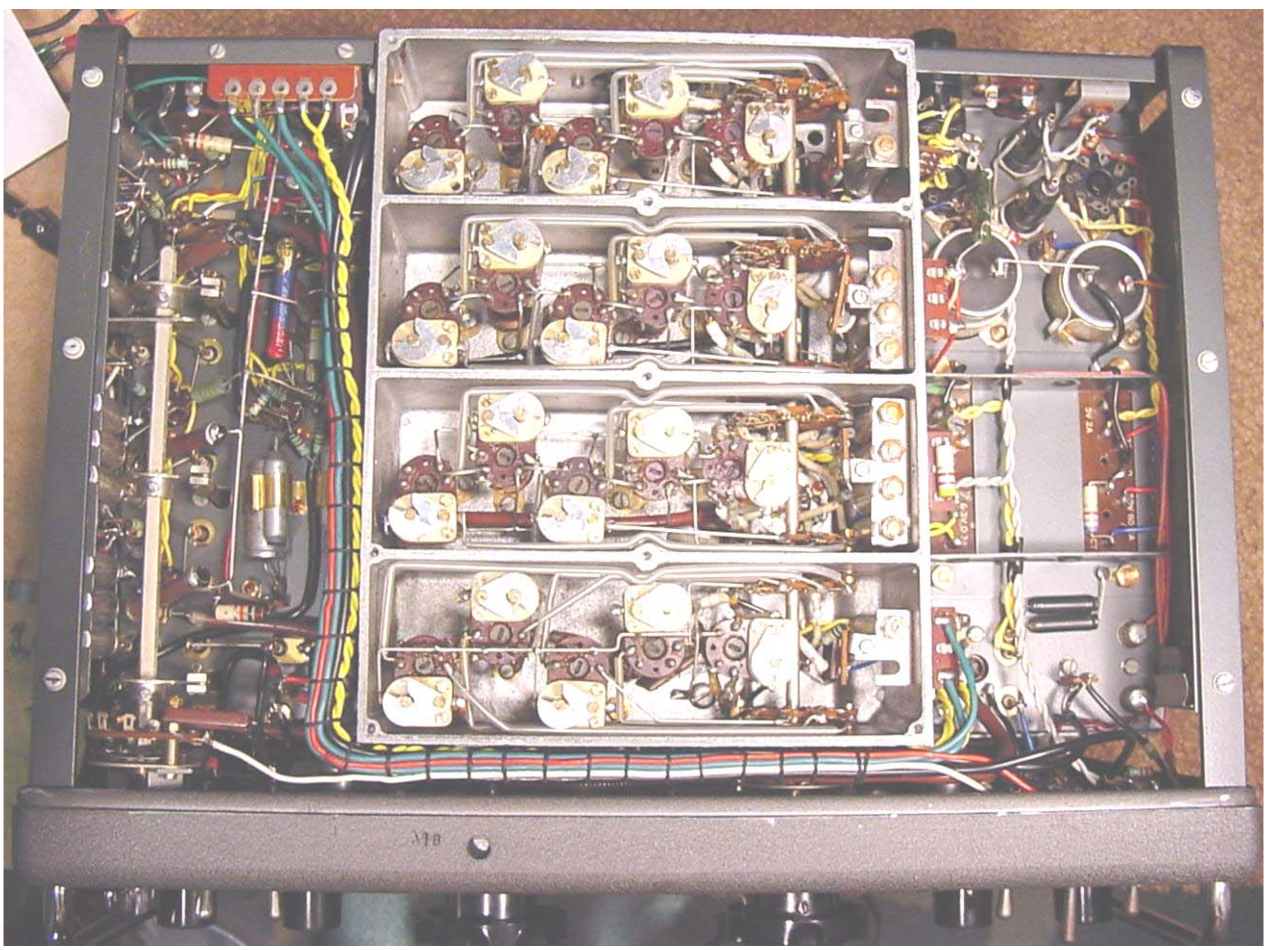




Above: beneath chassis view with coilbox cover in place. Below: above-chassis 'peephole' view trough the access 'lid'

Now, which is my best side….?


600Ω
C.T.
2·5Ω
P.U.
A
EXTERNAL
RELAY




MODEL
680X.
27
28
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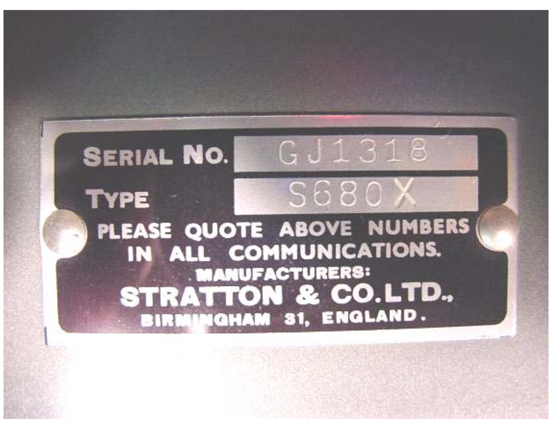
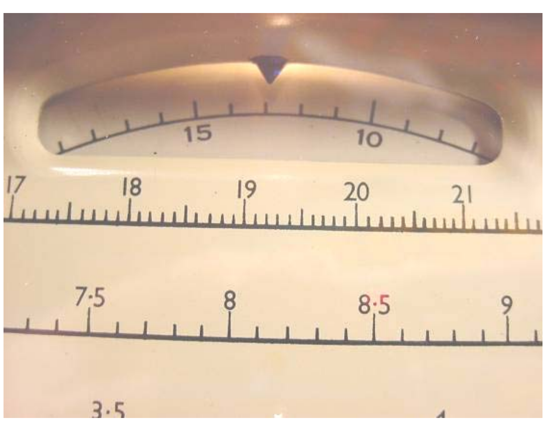

SERIAL No. GJ1318
TYPE S680X
PLEASE QUOTE ABOVE NUMBERS
IN ALL COMMUNICATIONS.
MANUFACTURERS:
STRATTON & CO. LTD.,
BIRMINGHAM 31, ENGLAND.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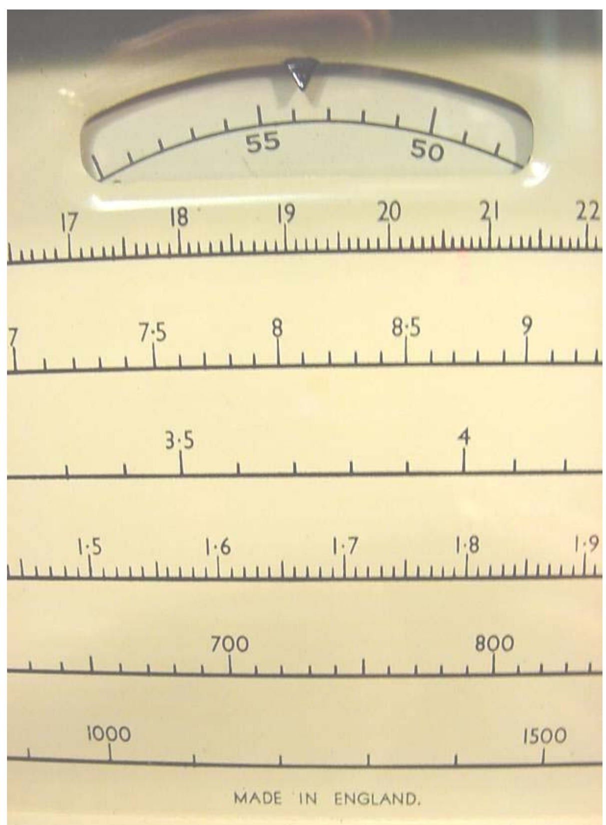
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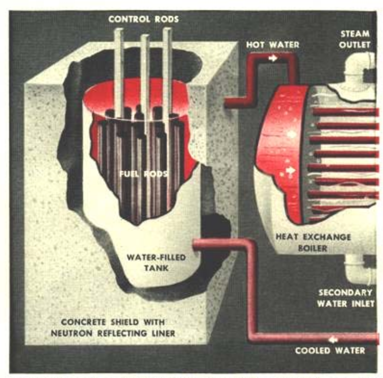
1·8
1·9
700
800
1000
1500
MADE IN ENGLAND.

Postscript

With this being a museum-related article, I thought it would be appropriate to set a little 'historic context' to the launch of such an important and prestigious set as the Eddystone S.680X…

Some Other Events of 1951:

- The 1951 census for British Columbia showed, for the first time, more than a million people in the province
- There was a demonstration at the Hotel Vancouver of the latest weapon in the war against impaired drivers: the "Drunkometer"
- Vancouver enjoyed a visit by Princess Elizabeth and Prince Philip. The Princess would become Queen less than four months later, in February 1952, following the death of her father, King George VI
- North Korean offensive pushes beyond the 38th parallel; truce negotiations fail
- Julius and Ethel Rosenberg convicted of passing U.S. nuclear secrets to the Soviet Union; both are sentenced to death
- General Douglas MacArthur relieved of command in Korea
- Air-to-air refueling of jet aircraft (RF-80) in combat zone accomplished in Korea, believed the first such hookup.
- USAF made first successful recovery of animals from a rocket flight when an instrumented monkey and 11 mice survived an Aerobee flight to an altitude of 236,000 feet from Holloman AFB
- Power steering, Dacron suits, and sugarless chewing gum are introduced
- Mass production of penicillin and streptomycin reaches records



REACTOR'S CORE consists basically of tank in which uranium fuel rods are immersed in water (red). Water slows neutrons emitted by rods, also carries heat of fission out to the boiler where it heats secondary water supply to make steam.

- Electricity generated from nuclear power for the first time
- Cinema: *The African Queen, An American in Paris, Strangers on a Train, A Streetcar Named Desire* . Vivien Leigh wins the Oscar for best actress (in *A Streetcar Named Desire*) and Humphrey Bogart wins the Oscar for best actor (in *The African Queen*)
- Songs: *Hello Young Lovers, Getting to Know You, Cry, Kisses Sweeter than Wine, In the Cool, Cool, Cool of the Evening*

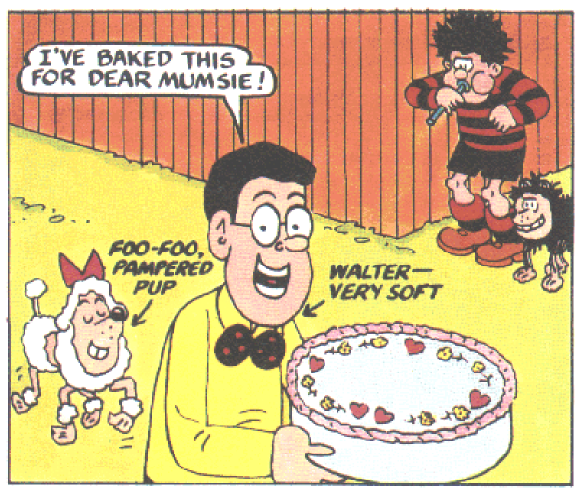
- TV Shows: October 15 – the first episode of *I Love Lucy* airs on US TV, *What's My Line and Bill and Ben, the Flowerpot Men* in the UK
- Books: *A Man Called Peter,* Catherine Marshall; *Lie Down in Darkness,*

William Styron; *Desirée*, Annemarie Selinko; *From Here to Eternity*, James Jones; *The Caine Mutiny*, Herman Woulk; *The Catcher in the Rye*, J.D. Salinger

- Colour television introduced in the US; first color broadcast transmitted from CBS in New York (note: colour TV not available in the UK until 1967)
- *The King and I* opens on Broadway
- Robert Frost and Carl Sandberg both publish collections of poetry titled *Complete Poems*
- Phil Collins (ex-Genesis drummer and vocalist) born on January 30

- In response to the growing popularity of television, movie theatres experiment with a variety of attractions, including wide-screen projection and 3-D effects
- 250,000 US 'G. I.'s' are in Korea
- General Douglas MacArthur says "Old soldiers never die; they just fade away."
- Other new television shows include *The Roy Rogers Show* and *Superman*
- UNIVAC is marketed as the first business computer
- The top song in US is *Cold, Cold, Heart* by Hank Williams, Sr.
- Dennis the Menace is a new comic strip in US and UK

"DON'T SHOUT AT ME! I'M NOT YOUR HUSBAND!"



Watch out, Walter — you're about to be menaced!

Left: the 'syndicated' but popular US 'Menace' introduced in 1951. Right: the 'real' (to me at least) Menace also debuted in the UK *Beano* comic in 1951.

THE BEANO

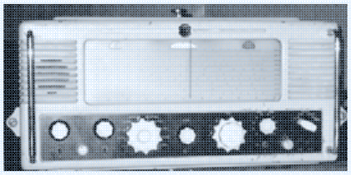
…and into 1952 (other than the launch of the S.680X, altogether a more interesting year in my book, perhaps except in Vancouver):

- Dwight Eisenhower elected President of the USA
- Duke Ellington played a gig at the Palomar Supper Club in Vancouver
- The Lumberman's Arch is installed at Stanley Park, Vancouver
- Korean conflict continues as truce attempts fail
- Princess Elizabeth crowned Queen upon the death of her father, King George VI. – the event is televised
- U.S. begins construction of first nuclear submarine, the *Nautilus*
- U.S. detonates the world's first hydrogen bomb on November 1
- Britain develops an atomic bomb
- First contraceptive pill developed (not available commercially until 1964)

- Drum memory and core memory developed for computers
- Dr. Jonas Salk develops polio vaccine
- Olympics held in Helsinki, Finland
- John Cobb sets a water speed record of 206.89 m.p.h. on Loch Ness, Scotland; is killed in the process
- Cinema: *Limelight, High Noon, The Greatest Show on Earth*
- Songs: *It Takes Two to Tango, Your Cheatin' Heart, Wheel of Fortune*
- TV: More of *I Love Lucy*
- Comedian Robin Williams and actor Patrick Swayze born (maybe it was not such a stellar year after all…)
- 1952 US presidential campaigns are the first to be broadcast on television
- Microwave ovens made available for domestic use in US by *Tappan*; first models are the size of refrigerators and cost over $1,200. They did not become widely available in the UK until the early-1980's

Dr. Percy Spencer, a self-taught engineer with the Raytheon Corporation, invented the microwave oven. He first noticed something very unusual during a radar-related research project around 1946. He was testing a new vacuum tube called a magnetron when he discovered that a chocolate bar in his pocket had melted. This interested Dr. Spencer, leading to another experiment where this time he placed some popcorn kernels near the tube and watched as the kernels exploded. He concluded that the melted chocolate bar and the cooked popcorn were all attributable to exposure to low-density microwave energy. He continued to experiment with other foods on the basis that if these foods can be cooked that quickly, why not other foods? He later created a metal box with an opening, which he fed microwave power. The energy entering the box was unable to escape creating a higher density electromagnetic field. When food was placed in the box and microwave energy fed in, the temperature of the food rose rapidly. Dr. Spencer had now invented what was to become the microwave oven. The first ovens were called 'Radaranges'. The first commercial applications and patents were based in the U.S.A. but there were parallel developments in Britain and Europe. Before long, microwave ovens became a commonly owned kitchen appliance.

- The Great London Smog: the 'pea-souper' that descended on London on the night of 4 December 1952 was a noxious cocktail of chemicals and damp that brought much of the capital to a standstill. Atmospheric conditions conspired to keep the choking haze in place for five days, during which time it claimed the lives of several thousand people. According to the Met Office, on each day during the foggy period, enormous quantities of pollutants were emitted: 1,000 tonnes of smoke particles, 2,000 tonnes of carbon dioxide, 140 tonnes of hydrochloric acid and 14 tonnes of fluorine compounds. Some 370 tonnes of sulphur dioxide were converted into 800 tonnes of sulphuric acid. Most of these chemicals were trapped at low level by the anticyclonic weather that had settled over the capital….

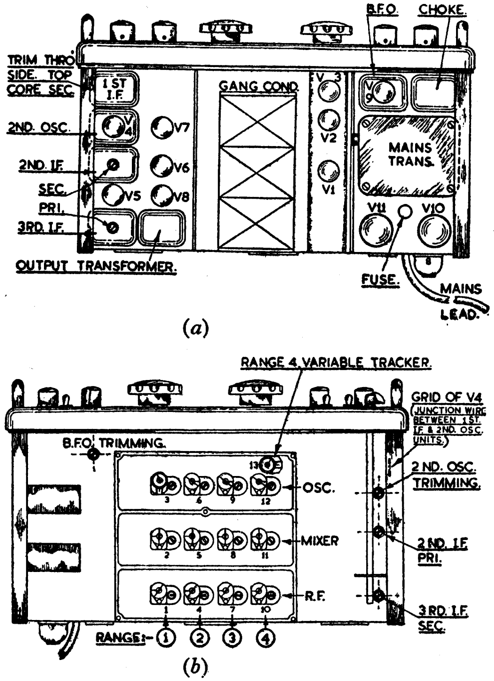


The result of this liaison was recognisably Eddystone, but 50% larger. It had 12 valves, 10 bands, switched IFTs for two frequencies and full coverage from 15Kc/s to 31Mc/s without a gap! 110v AC/DC. Used on RMS 'Queen Mary' etc. Production run 205.

- Oh, and of course the infamous Eddystone S.700 (IMR.54), aka 'Queen Mary' (left) saw light of day – a veritable extravaganza of 1950's communications receiver design. Based on my old favourite the S.750, Harold Cox and Bill Cooke really went to town on this 15kHz to 31MHz coverage dual-conversion set produced for the International Marine Radio Company (IMRC) as a replacement receiver for the Cunard ocean liners. This gigantic set weighed in at 134lbs and cost over £300 – the same price as a family car in those days…
- And I was but a twinkle in my fathers eye.

References

- Radio Bygones, December, 2006 'Eddystone Radio and the Queen Mary', Graham Wormald, G3GGL
- Radio and Television Servicing – Pre-1953 Models, F. Molloy & W.Poole,
- Various documents downloaded from the EUG website, including:
  - The Ultimate Quick Reference Guide (QRG), 2nd Ed., 2005, Graham Wormald, G3GGL
  - S.680X Manual (the circuit in this differs slightly from the version in Molloy & Poole)
- Websites (as well as the EUG site http://www.eddystoneusergroup.org.uk/):
  - http://www3.telus.net/radiomuseum/
  - http://www.babyboomers.com/years/1952.htm
  - http://www.hero.ac.uk/sites/hero/uk/research/archives/2002/the_fog_and_filthy_air3240.cfm
  - http://www2.prestel.co.uk/grayling/beano/infodm.html



Chassis Lay-out—Eddystone Model 750

(*a*) Above chassis view. (*b*) Under chassis view.

Later models include a 100,000-ohm resistor from the H.T. line to the junction of R18 and R19 in order to provide improved control of R.F. gain.

Alignment Notes : *Double conversion I.F.:* An 85-kc/s. modulated signal is applied between grid of V4 and chassis while second and third I.F. transformers are adjusted to maximum response. The signal frequency is then changed to 1620 kc/s. and the second oscillator adjusted for maximum output by means of the variable core located in the V4 screening can; two responses may be found, that with core further in (lower frequency) is correct. The signal generator leads are then transferred to the stator of centre section of the gang tuning capacitor and chassis and the first I.F. transformer cores peaked for maximum response. R.F. circuits are adjusted as for single-conversion receivers. Dial calibrations should be checked with the aid of a crystal oscillator. Alignment frequencies are given on page 244.

Voltage Values : Voltages given below are between the points indicated and chassis. Receiver at 28 Mc/s., Range 1, aerial terminals short-circuited, I.F. and R.F. controls at maximum. A.F. gain control at minimum, B.F.O. on. The voltage indicated depends on the internal resistance of the meter employed. A tolerance of plus or minus 5 per cent should be allowed. Total H.T. current 96 mA.

Circuit Reference	1000 *ohms/volt Testmeter*	333 *ohms/volt Testmeter*	*Circuit Reference*	1000 *ohms/volt Testmeter*	333 *ohms/volt Testmeter*
A	225 v.	225 v.	P	0·9 v.	0·9 v.
B	98 v.	90 v.	Q	65 v.	13 v.
C	1·0 v.	0·95 v.	R	1·0 v.	0·7 v.
D	82 v.	80 v.	S	235 v.	235 v.
E	235 v.	236 v.	T	227 v.	225 v.
F	1·6 v.	1·5 v.	U	4·2 v.	4·1 v.
G	98 v.	73 v.	V	150 v.	150 v.
H	78 v.	75 v.	W	235 v.	235 v.
J	232 v.	230 v.	X	275 v.	272 v.
K	1·4 v.	1·2 v.	Y	75 v.	70 v.
L	85 v.	80 v.	Z	2·0 v.	0·9 v.
M	235 v.	235 v.	A–	250 v. (A.C.)	250 v. (A.C.)
N	85 v.	80 v.	B–	250 v. (A.C.)	250 v. (A.C.)

EDDYSTONE Models 680, 680X

General Description : Fifteen-valve (including rectifier and voltage stabiliser), five-waveband communications receiver with two stages of R.F. amplification, crystal filter, " S "-meter and noise limiter. Released 1949.

Power Supplies : A.C. mains, 110 and 200–250 volts.

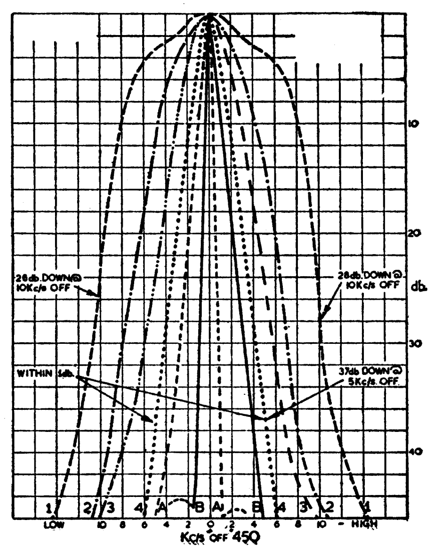
Intermediate Frequency : 450 kc/s. ± 1 kc/s. I.F. circuits should be peaked to exact frequency of crystal. The I.F. transformer cores, however, are sealed, and should not be disturbed unless there is good reason to believe that they require re-alignment.

Valves : (V1) 6BA6; (V2) 6BA6; (V3) 7S7, X81M or 6BE6; (V4) 8D3 (local oscillator); V5) 6BA6; (V6) 6BA6; (V7) 6AL5 or D77; (V8) 6AU6; (V9) 6AU6; (V10) 7D9; (V11) 7D9; (V12) 6BA6 (B.F.O.); (V13) 6AL5 or D77 (noise limiter); (V14) 5Z4G; (V15) VR150/30 (voltage stabiliser). Type 8D3 (V4) is now re-classified as type 6AM6, occasionally type Z77 is used in this position. Type 6BR7 (8D5) replaces type 6AU6 in the 1952 model, known as the 680X.

Modifications : Minor modifications may be found in later models, particularly in arrangement adopted for gain compensation with varying selectivity. Circuit Diagrams for the 680 and 680X are given.

Notes : Aerial input impedance 400 ohms (nominal). Output impedance 2·5 ohms. The pre-set controls at the back of the cabinet are for " S "-meter zero adjustment and for dial-illumination control (R61). The heater circuits are balanced to earth, the noise-limiter valve being supplied by a separate winding on the mains transformer. Fuse rating 1 amp.

Alignment Procedure : Trimmer lay-out and alignment frequencies are given on pages 244–5. Alignment of the I.F. stages should be made with the selectivity control in the position of maximum selectivity (curve 4 in the accompanying illustration). Alignment of the R.F. circuits follows normal procedure: the oscillator circuits are first adjusted to correct any calibration errors, then the F.C., second R.F. and first R.F. stages (in that order) are aligned for maximum response.

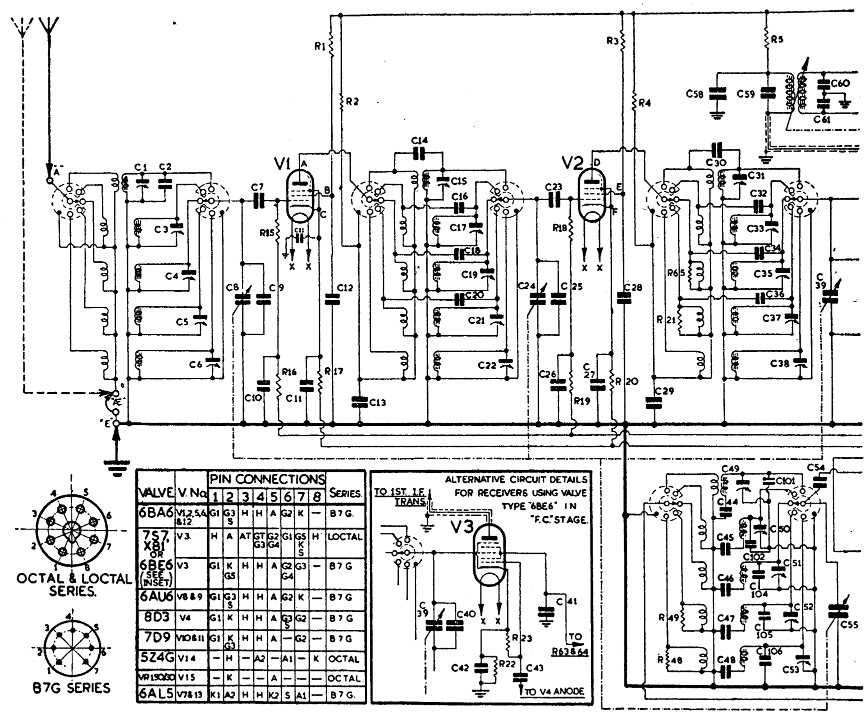


Selectivity Curves for the " 680 " Receiver

(1) — — — — minimum position.
(2) —·—·—· first intermediate position.
(3) —··—··— second intermediate position.
(4) · · · · · · · · maximum selectivity.
(A) — — — — — maximum selectivity, with crystal filter in, and phased to reject signal on one side.
(B) ———— as " A ", but with crystal phased on other side.

Voltage Values : Voltages given below are between the points indicated and chassis. Voltage indicated depends on the internal resistance of the particular meter employed. A tolerance of plus or minus 10 per cent should be allowed. Total H.T. current 115 mA.

Circuit Reference	1000 *ohms/volt Testmeter*	333 *ohms/volt Testmeter*	*Circuit Reference*	1000 *ohms/volt Testmeter*	333 *ohms/volt Testmeter*
A	218 v.	210 v.	Q	1·0 v.	1·0 v.
B	90 v.	82 v.	R	10·2 v.	9·5 v.
C	0·8 v.	0·8 v.	S	60 v.	35 v.
D	210 v.	208 v.	T	40 v.	30 v.
E	90 v.	85 v.	U	0·9 v.	0·7 v.
F	1·2 v.	1 v.	V	62 v.	38 v.
G	218 v.	215 v.	W	0·9 v.	0·7 v.
H	104 v.	100 v.	X	220 v.	220 v.
J	1·3 v.	1·3 v.	Y	222 v.	222 v.
K	104 v.	100 v.	Z	10·2 v.	9·5 v.
L	212 v.	210 v.	A–	85 v.	80 v.
M	90 v.	82 v.	B–	150 v.	150 v.
N	1·0 v.	0·9 v.	C–	260 v.	260 v.
O	200 v.	200 v.	D–	250 v. (A.C.)	250 v. (A.C.)
P	90 v.	82 v.	E–	150 v.	150 v.



Circuit Diagram—

Capacitors.

3/20 pF. (air)	C1, C3, C4, C5, C6, C15, C17, C19, C21, C22, C31, C33, C35, C37, C38, C49, C50, C51, C52, C53
3 pF.	C18, C20, C34, C36
6 pF.	C16, C32, C89
8 pF.	C72
10 pF.	C2, C43, C104, C105, C106
20 pF.	C14, C30, C63
25 pF.	C9, C25, C40
50 pF.	C5 6
100 pF.	C7, C23, C82, C83, C90, C92, C103
200 pF.	C54
2400 pF.	C44
2500 pF.	C45
1625 pF.	C46
900 pF.	C47
400 pF.	C48, C59, C65, C67, C70, C71
500 pF.	C64
800 pF.	C60, C61
0·0005 (mica)	C96, C97, C107
0·002 (mica)	C73
0·01 (mica)	C75, C86, C88, C98
0·01 (paper)	C11,* C26, C68, C76, C84, C93, C99, C100
0·1	C10, C11,* C12, C13, C27, C28, C29, C41, C42, C57, C58, C66, C69, C77, C79, C80, C81
8 (350 v.)	C74
25 (25 v.)	C87
4 (350 v.)	C85
16 (450 v.)	C94
40 (350 v.)	C95

C8, C24, C39, C55 4 Gang capacitor. 10–368 pF. per section.

C62 Crystal phasing capacitor. C91 BFO pitch condenser.

C44, C45, C46, C47, C48 ± 1% tolerance.

C59, C60, C61, C64, C65, C67, C70, C71, C72 ± 2% tolerance.

C9, C25, C40 ± 5% tolerance.

Resistors.

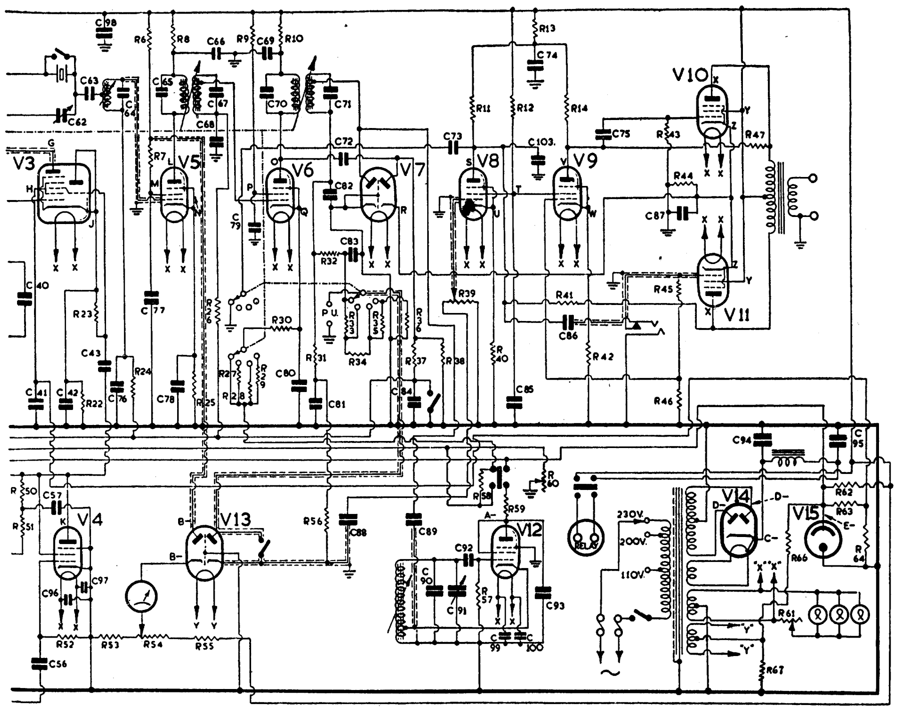
68	R17, R20, R25, R30
150	R21
200	R22
560	R40, R42, R58
620	R44
750	R27
1k	R2, R4, R5, R8, R51
1·5k	R65
2·2k	R48, R49
2·7k	R10, R62
4·7k	R28, R63
6·8k	R67
7·5k	R35, R46
8·2k	R29
10k	R13, R50, R59
12·5k	R55 *
13k	R36
15k	R6, R7, R64
22k	R34, R52
27k	R53
33k	R1, R3, R9
47k	R33, R57
0·1M	R11, R14, R23, R32, R66
0·18M	R12
0·47M	R15, R16, R18, R19, R24, R26 R37, R43, R45
1M	R31, R38
2·2M	R56
3M	R41, R47

R1, R3, R9, R53, R64 1-watt. R62 5-watt. Remainder ½-watt.

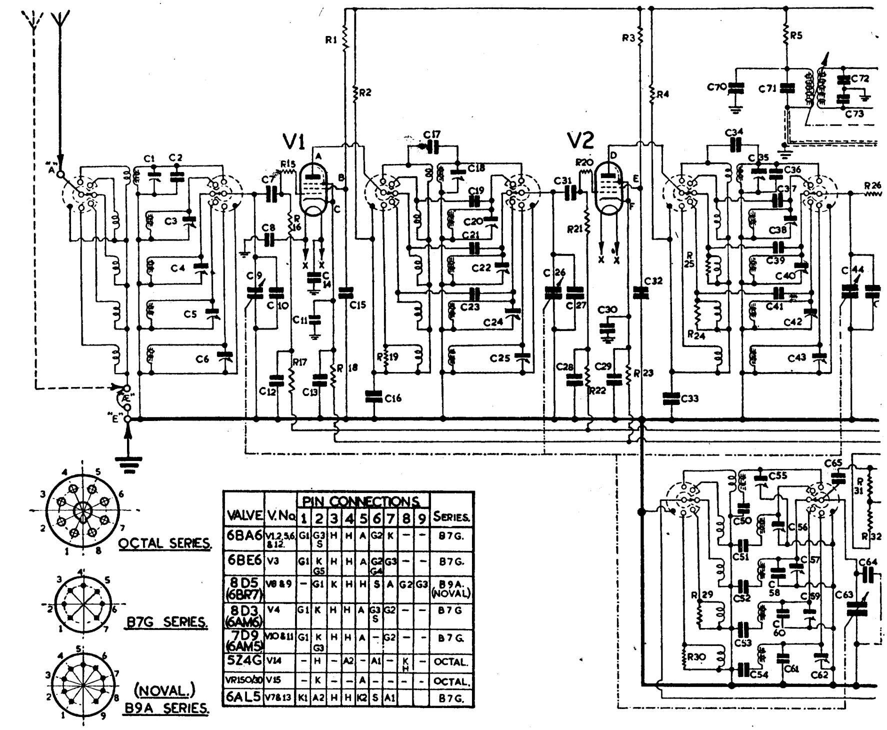
Potentiometers: R60 10,000 ohms; R61 5 ohms; R39 0·5M; R54 5,000 ohms.

* One each, 0·01 and 0·1 in parallel.

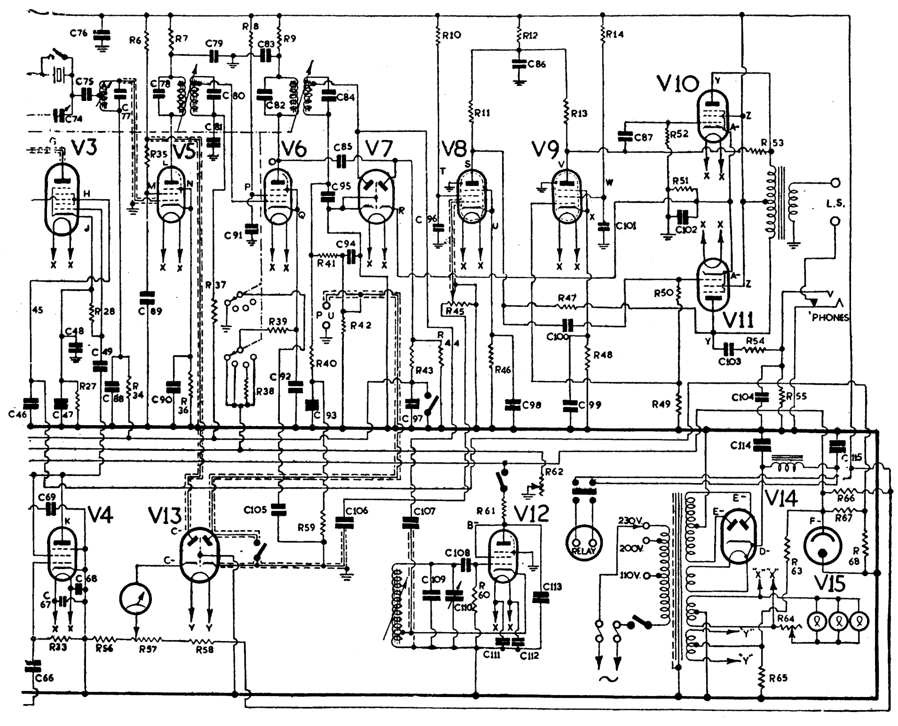
* Two 25,000-ohm resistors in parallel.



Eddystone Model 680



VALVE	V. No.	PIN CONNECTIONS 1	2	3	4	5	6	7	8	9	SERIES.
6BA6	V1,2,5,6, & 12.	G1	G3 S	H	H	A	G2	K	—	—	B7G.
6BE6	V3	G1	K G5	H	H	A	G2 G4	G3	—	—	B7G.
8D5 (6BR7)	V8 & 9	—	G1	K	H	H	S	A	G2	G3	B9A. (NOVAL)
8D3 (6AM6)	V4	G1	K	H	H	A	G3 S	G2	—	—	B7G
7D9 (6AM5)	V10 & 11	G1	K G3	H	H	A	—	G2	—	—	B7G.
5Z4G	V14	—	H	—	A2	—	A1	—	K H	—	OCTAL.
VR150/30	V15	—	K	—	—	A	—	—	—	—	OCTAL.
6AL5	V7 & 13	K1	A2	H	H	K2	S	A1			B7G.



CIRCUIT DIAGRAM—EDDYSTONE MODEL 680X

Capacitors.

C1	3–23 pF.
C2	10 pF.
C3	3–23 pF.
C4	3–23 pF.
C5	3–23 pF.
C6	3–23 pF.
C7	100 pF.
C8	0·0005
C9	10–367·75 pF.
C10	25 pF.
C11	0·01
C12	0·01
C13	0·1
C14	0·0005
C15	0·1
C16	0·1
C17	20 pF.
C18	3–23 pF.
C19	6 pF.
C20	3–23 pF.
C21	3 pF.
C22	3–23 pF.
C23	3 pF.
C24	3–23 pF.
C25	3–23 pF.
C26	10–367·75 pF.
C27	25 pF.
C28	0·01
C29	0·1
C30	0·01
C31	100 pF.
C32	0·1
C33	0·1
C34	20 pF.
C35	3–23 pF.
C36	3 pF.
C37	6 pF.
C38	3–23 pF.
C39	3 pF.
C40	3–23 pF.
C41	3 pF.
C42	3–23 pF.
C43	3–23 pF.
C44	10–367·75 pF.
C45	25 pF.
C46	0·1
C47	0·1
C48	0·01
C49	10 pF.
C50	7000 pF.
C51	3625 pF.
C52	1625 pF.
C53	900 pF.
C54	440 pF.
C55	3–23 pF.
C56	3–23 pF.
C57	3–23 pF.
C58	10 pF.
C59	3–23 pF.
C60	20 pF.
C61	20 pF.
C62	3–23 pF.
C63	10–367·75 pF.
C64	12 pF.
C65	200 pF.
C66	50 pF.
C67	0·0005
C68	0·0005
C69	0·1
C70	0·1
C71	400 pF.
C72	800 pF.
C73	800 pF.
C74	
C75	20 pF.
C76	0·01
C77	500 pF.
C78	400 pF.
C79	0·1
C80	400 pF.
C81	0·01
C82	400 pF.
C83	0·1
C84	400 pF.
C85	10 pF.
C86	8
C87	0·01
C88	0·01
C89	0·1
C90	0·1
C91	0·1
C92	0·1
C93	0·1
C94	100 pF
C95	100 pF.
C96	0·5
C97	0·01
C98	30
C99	30
C100	0·01
C101	0·5
C102	30
C103	0·002
C104	0·01
C105	0·002
C106	0·01
C107	8 pF.
C108	100 pF.
C109	100 pF.
C110	
C111	0·01
C112	0·01
C113	0·01
C114	16
C115	40

Resistors.

R1	33,000 (1 W.)
R2	1,000
R3	33,000 (1 W.)
R4	1,000
R5	1,000
R6	15,000
R7	1,000
R8	33,000
R9	1,000
R10	1M
R11	0·27M
R12	10,000
R13	0·27M
R14	1M
R15	12
R16	0·47M
R17	0·47M
R18	68
R19	150
R20	12
R21	0·47M
R22	0·47M
R23	68
R24	150
R25	1,500
R26	12
R27	150
R28	100,000
R29	2,200
R30	2,200
R31	10,000
R32	1,000
R33	22,000
R34	0·47M
R35	15,000
R36	68
R37	0·47M
R38	560
R39	68
R40	1M
R41	100,000
R42	100,000
R43	0·47M
R44	1M
R45	0·5M (Pot.)
R46	1,500
R47	3M
R48	1,500
R49	6,800
R50	0·47M
R51	620
R52	0·47M
R53	3M
R54	100,000
R55	2,200
R56	27,000
R57	5,000 (Pot.)
R58	10,000
R59	2M
R60	47,000
R61	10,000
R62	10,000 (Pot.)
R63	0·27M
R64	5 (Pot.)
R65	6,800
R66	2,700 (W.W.)
R67	4,700
R68	22,000 (1 W.)

VOLTAGE VALUES.

The voltages are between the point indicated and the chassis. Set the receiver at 1000 kc/s on Range 5 with the aerial shorted out, R.F. control set at maximum. A.F. gain control set at minimum with B.F.O. on. Two sets of values are given using different meters as shown. It will be evident that the actual voltage indicated depends on the meter employed. A tolerance of plus or minus 5 per cent should be allowed on the values given.

Point	333 *o.p.v.*	1000 *o.p.v.*	*Point*	333 *o.p.v.*	1000 *o.p.v.*
A	205 v.	218 v.	R	11·5 v.	11·5 v.
B	80 v.	84 v.	S	20 v.	25 v.
C	0·8 v.	1 v.	T	18 v.	25 v.
D	210 v.	218 v.	U	0·7 v.	0·8 v.
E	80 v.	83 v.	V	18 v.	22 v.
F	1 v.	1·9 v.	W	15 v.	22 v.
G	212 v.	220 v.	X	0·8 v.	0·8 v.
H	100 v.	100 v.	Y	218 v.	220 v.
J	1·1 v.	1·2 v.	Z	220 v.	225 v.
K	85 v.	100 v.	A—	11·5 v.	11·5 v.
L	206 v.	210 v.	B—	85 v.	85 v.
M	88 v.	93 v.	C—	142 v.	150 v.
N	1 v.	1 v.	D—	252 v.	260 v.
O	206 v.	210 v.	E—	240 v. (A.C.)	245 v. (A.C.)
P	75 v.	80 v.	F—	150 v.	150 v.
Q	1 v.	1 v.			

Total H.T. current: 110 mA. Heater-to-heater voltage: 6·3 A.C.