EDDYSTONE

HIGH STABILITY COMMUNICATIONS RECEIVER MODEL 880/2

STRATTON & CO. LTD.
EDDYSTONE WORKS
BIRMINGHAM 31

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Sole Manufacturers :

STRATTON & CO. LTD.

ALVECHURCH ROAD : BIRMINGHAM 31 : ENGLAND

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Introduction

The EDDYSTONE Model 880/2 is a high stability communications receiver covering the frequency band 500 kc/s — 30·5 Mc/s (400 kc/s — 30·6 Mc/s with overlaps) in thirty switched ranges. Provision is made for reception of AM, CW and SSB signals with instant sideband selection in the latter mode. The receiver operates directly from all standard AC mains supplies or from any source capable of providing the necessary HT and LT voltages.

High stability is achieved by means of the double conversion technique employed with crystal control of the 1st Local Oscillator. The 1st IF is gang tuned with the RF Section, its coverage being dependent on the RF range in use. The receiver functions as a single conversion superhet when the RF range coincides with the 1st IF.

Each of the thirty tuning ranges has a nominal coverage of one megacycle so that the tuning rate is constant at all frequencies. The dial calibration is linear, accurate to within 1 kilocycle and is presented in such a manner that the ‘ tune frequency ’ is obtained by combining the readings given on separate ‘ Megacycle ’ and ‘ Kilocycle ’ scales. The re-setting accuracy is within 500 c/s at any frequency. A fine tuning control is provided and this will be found invaluable when making precise adjustments during CW and SSB reception. This facility is achieved through use of a reactance control valve across the 2nd Local Oscillator circuit and the same system also allows remote tuning from a distant listening point.

The 2nd IF operates at 500 kc/s and a cathode follower provides output at this frequency for connection to ancillary equipment. Five positions of selectivity are available, two of which employ bandpass crystal filters. An audio filter is fitted for selective CW reception.

The receiver is of robust construction, may be rack or table mounted and is housed in a strong protective cabinet. All panel controls are conveniently positioned for ease of operation and separate audio outputs are available for connection to an external loudspeaker, telephones and remote lines. Two separate audio channels are employed with the line output level adjustable independently of the monitor outputs (speaker and telephones). A small built-in monitor speaker can be used in lieu of an external unit if so desired.

Special provision has been made for diversity working in which two or three 880/2 receivers can be operated with common oscillator control. AGC lines are linked in the normal manner and the common oscillator injection is obtained from the 2nd Oscillator Unit in either receiver.

Great care has been taken to reduce oscillator radiation to an extremely low level and the 880/2 is therefore very suitable for incorporation in installations which employ a number of receivers working in close proximity to one another. This is especially true when the installation includes some receivers operating on channels in the VHF region.

High quality components are employed throughout and the receiver can be operated continuously in all areas under extreme climatic conditions.

A 100 kc/s crystal calibrator is fitted as a standard feature.

TECHNICAL DATA

GENERAL

Frequency Coverage

The nominal coverage is from 500 kc/s — 30·5 Mc/s in thirty switched ranges. Each range has a coverage of 1 Megacycle plus a 100 kc/s overlap at each end so that the total coverage is from 400 kc/s — 30·6 Mc/s.

Range 1 covers 0·5 — 1·5 Mc/s (nominal).
Range 30 covers 29·5 — 30·5 Mc/s (nominal).

Intermediate Frequencies.

"First IF" Tuned over the nominal coverage of 2·5 — 3·5 Mc/s on all 'odd' ranges except Range 1.
Tuned over the nominal coverage of 3·5 — 4·5 Mc/s on Range 1 and all 'even' ranges.

"Second IF" Fixed tuned to 500 kc/s with variable selectivity. The BFO is continuously variable over the range 500 kc/s ± 7 kc/s by means of a panel control. A further control provides two pre-set BFO injection frequencies for sideband selection in SSB reception. The SSB bandwidth is 3 kc/s.

Input and Output Impedances

Aerial Input : 75 ohms (nominal) unbalanced.
IF Output : 250 ohms (nominal) unbalanced. (Suitable for terminating impedances in the range 75–300 ohms).
AF Input : 0·1 Megohm (approx.).
AF Outputs : Two separate audio channels are employed, each having an independent gain control.

Monitor Outputs

(1) Switchable internal loudspeaker.
(2) External loudspeaker : 2·5/3 ohms.
(3) Telephones: Nominally 2,000 ohms but suitable for a wide range of impedances.

Line Output

600 ohms (balanced or unbalanced).

Power Supply

Mains Operation : 100/125V or 200/250V AC (40–60 c/s). (105VA).
External Power Supplies : 225V at 185mA for HT, 6·3V at 6·5A (approx.) for LT.

TABLE I

Valve Complement

Circuit Ref.	*Type*		*Circuit Function*
V1	ECC189	(CV5331)	1st RF Amplifier (Cascode)
V2	6BA6	(CV454)	2nd RF Amplifier
V3	6AK5	(CV850)	1st Mixer
V4	6BA6	(CV454)	Tuned IF Amplifier
V5	6AK5	(CV850)	2nd Mixer
V6	5840	(CV3929)	Crystal Oscillator (EF732)
V7	5840	(CV3929)	Buffer/Multiplier (EF732)
V8	6U8	(CV5065)	Variable Freq. Osc/Reactance Control
V9	6C4	(CV133)	Buffer (VFO Isolation)
V10	6BA6	(CV454)	1st 500 kc/s IF Amplifier
V11	6BA6	(CV454)	2nd 500 kc/s IF Amplifier
V12	6AM6	(CV138)	3rd 500 kc/s IF Amplifier
V13	6AL5	(CV140)	Noise Limiter/AGC Rectifier
V14	6489	(CV469)	AM Detector
V15	12AT7	(CV455)	Cathode Followers. (IF Output and CW/SSB Detector feed)
V16	12AT7	(CV455)	Meter Control/AF Amplifier
V17	6BE6	(CV453)	CW/SSB Detector
V18	12AU7	(CV491)	Line/Monitor AF Amplifiers
V19	6AM5	(CV136)	Monitor Output
V20	6AM5	(CV136)	Line Output
V21	OB2	(CV1833)	Voltage Stabiliser
V22	OB2	(CV1833)	Voltage Stabiliser
D1	100SC2		Variable Capacity Diode (BFO)
D2—D5	DD006		HT Rectifier (silicon diodes)

Accessory Supplies : When running from AC mains, the following supplies are available for powering ancillary equipment.
HT : 260V at 15mA.*
LT : 6·3V at 1·5A.
* unsmoothed.

Fusing : The live side of the mains input is fused at 1·5A.
When operation is from external power supplies, provision should be made for switching and fusing at the supply source.

PERFORMANCE

All figures are typical.

Sensitivity

At all frequencies above 1·5 Mc/s the sensitivity is better than 3uV for a 15dB signal-to-noise ratio. Below 1·5 Mc/s a figure of 5uV obtains for the same conditions.

CW sensitivity is better than 1uV for a 15dB signal-to-noise ratio except on Range 1 (2uV).

Absolute sensitivity is better than 1uV.

All the above figures taken with an IF bandwidth of 3 kc/s.

IF Selectivity

Five degrees of IF selectivity are provided, namely :

'CRYSTAL 1' 'INTERMEDIATE'
'CRYSTAL 2' 'BROAD'
'NARROW'

Selectivity figures for the 'BROAD,' 'INTERMEDIATE' and 'NARROW' positions are as follows :

Position	*Overall Bandwidth (kc/s)*		
	6*dB down*	30*dB down*	60*dB down*
'Broad'	14 kc/s	26 kc/s	36 kc/s
'Intermediate'	7 kc/s	15 kc/s	27 kc/s
'Narrow'	3 kc/s	9 kc/s	15·5 kc/s

Three filter crystals are available for use with the Model 880/2. These are referred to as Crystals 'A,' 'B' and 'C' respectively and any two of these units will be fitted to customers requirements. Selectivity characteristics of the three crystals are as follows :

Crystal	*Overall Bandwidth (kc/s)*		
	6*dB down*	30*dB down*	60*dB down*
'A'	400 c/s	3 kc/s	7·5 kc/s
'B'	1·2 kc/s	4 kc/s	9 kc/s
'C'	3 kc/s	6 kc/s	11·5 kc/s

Crystals 'A' or 'B' can be fitted in the 'CRYSTAL 1' position.

Crystals 'B' or 'C' can be fitted in the 'CRYSTAL 2' position.

Stability

Thermal :

Drift does not exceed 100 c/s in 1 hour at any frequency after a 2-hour warm-up period.

The thermal inertia of the unit is high and short-term drift is not greater than 50 c/s for temperature changes of up to 20°C.

Mains Voltage Variation :

A variation of ±10% in the applied mains voltage does not affect the frequency stability by more than ±100 c/s.

Spurious Response

All spurious signals (including 1st and 2nd images) are at least 90dB down at all frequencies in the range 1·5—15 Mc/s. Above 15 Mc/s the spurious rejection is greater than 60dB.

On Range 1 (0·5—1·5 Mc/s), all spurious signals are greater than 60dB down except near 500 kc/s where the IF rejection figure becomes a function of the 2nd IF selectivity.

Calibration Accuracy

Within one kilocycle at all frequencies (Fine Tuning Control set to centre zero).

The scale can be checked by means of the internal 100 kc/s Crystal Calibrator.

Re-setting Accuracy

Better than 500 c/s at all frequencies.

Noise Factor

Range 1 .. Better than 15.
Ranges 2 — 30 .. 6.

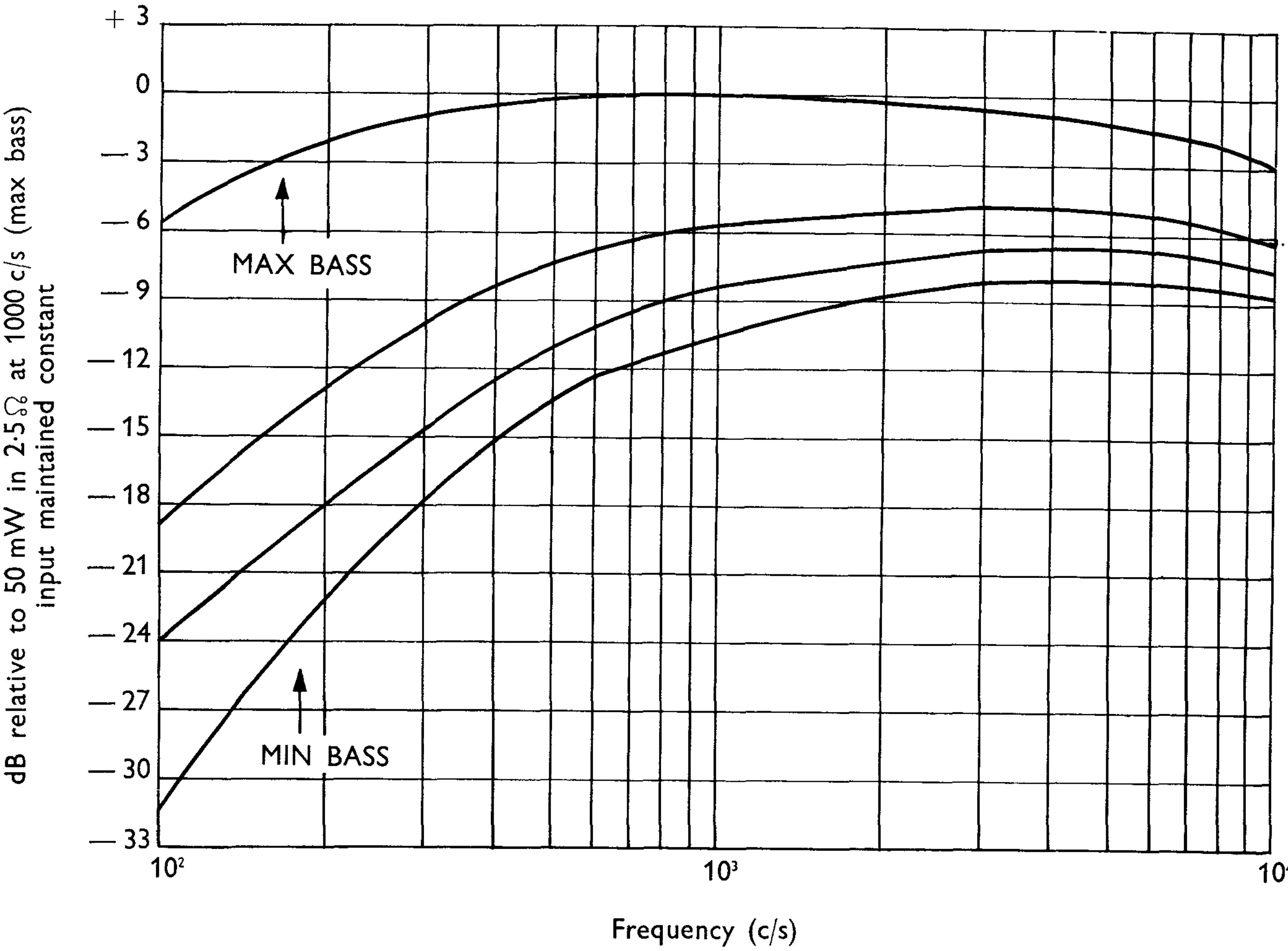


Fig. 1. Audio Response at each position of Bass Switch

Cross Modulation

With a desired signal 60dB above 1uV (AGC ' ON '), the interference produced by a signal 10 kc/s ' off-tune ' and of strength 90dB above 1uV will be greater than 30dB below the output of the desired signal.

With AGC ' OFF ' and by careful adjustment of the RF Gain Control improved cross modulation figures can be obtained.

Intermodulation

Two signals whose sum or difference frequency is equal to either the Intermediate Frequency or the selected Signal Frequency, must each be of a level greater than 90dB above 1uV to produce an output equal to that produced by a normal signal 20dB above 1uV.

Blocking

With a desired signal 60dB above 1uV, an interfering carrier 10 kc/s ' off-tune ' must be of a level exceeding 100dB above 1uV to affect the output by 3dB.

AGC Characteristic

At frequencies above 2 Mc/s, the audio output level does not change by more than 6dB for a carrier variation of 100dB above 3uV. At frequencies below 2 Mc/s, the audio output level is constant within 6dB for a variation of 90dB above 10uV.

Three selectable AGC time constants are provided. The approximate discharge times are as follows :

AGC ' FAST ': 0·05 sec.; AGC ' SLOW ': 0·5 sec.; AGC ' SSB ': 10 secs.

AGC is available for diversity working. (Terminal at rear of set).

Audio Output and Response

The Monitor Output Stage will deliver up to 750mW of audio to a 2·5 ohm loudspeaker. A 100mW line output is available at the 600 ohm terminals.

The audio response is affected by the Bass Switch and Audio Filter Switch settings. Fig. 1 shows the effect of the bass switching with the audio filter out of circuit, while Fig. 2 shows the overall response with the audio filter in circuit and the Bass Switch at 'Max Bass.'

Distortion

10% at 0·5 watt in 2·5 ohms at 1,000 c/s.

Hum Level

Better than 47dB below 0·5 watt.

IF Output

With AGC in use, an output of 50mV across a 75 ohm load is obtained for an input signal of 3uV.

Radiation

Radiation does not exceed 5uV into 75 ohms at any frequency.

Remote Frequency Control

A total swing of 1·5 kc/s is available.

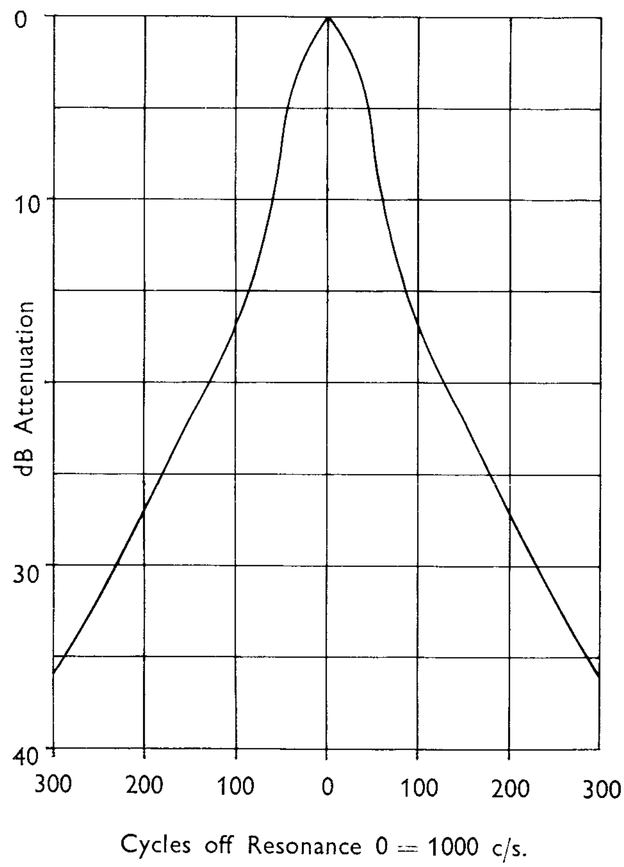


Fig. 2 Overall Selectivity Audio Filter in circuit (Bass Switch at maximum).

CIRCUIT DESCRIPTION

PRINCIPLE OF TUNING EMPLOYED IN THE MODEL '880/2'

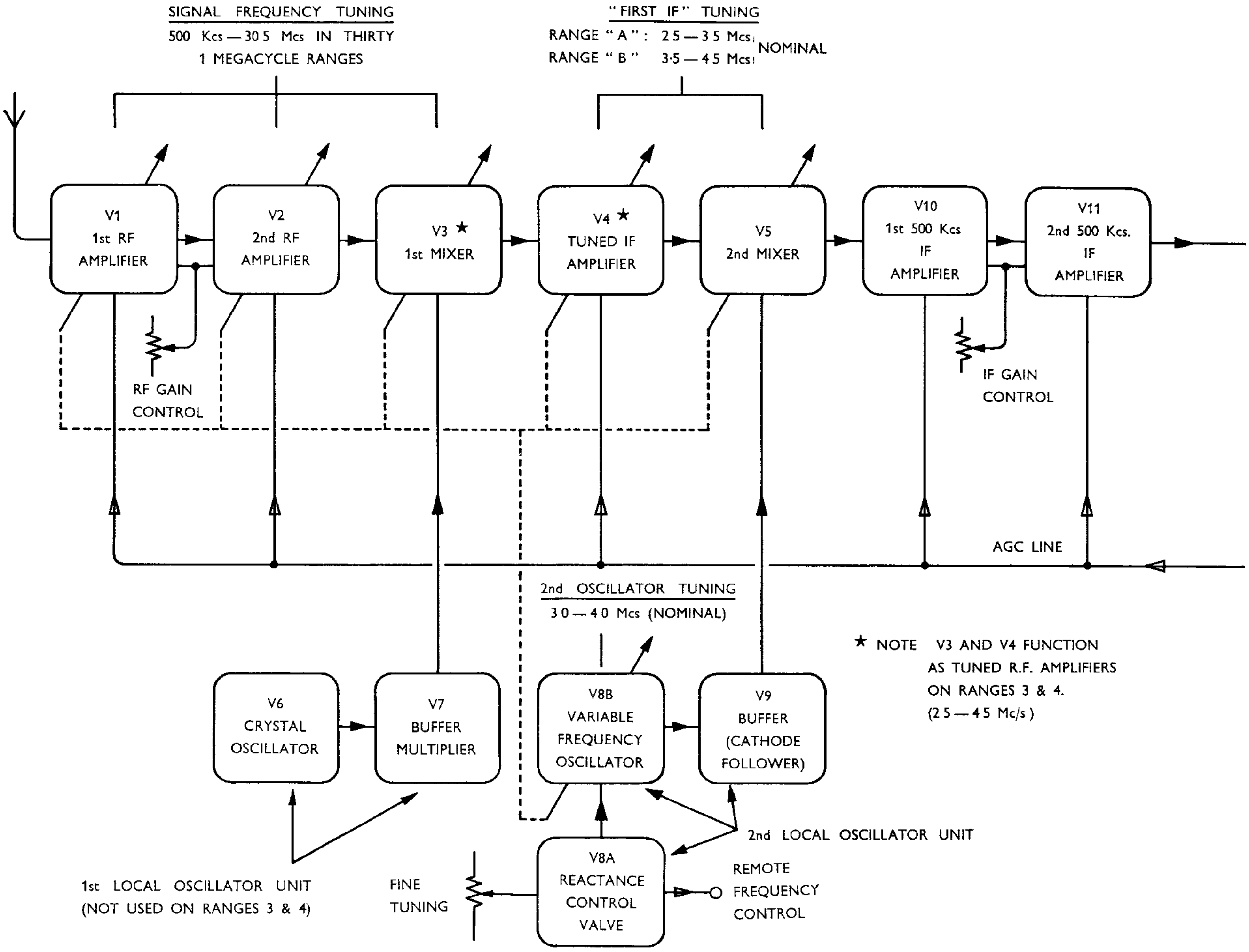
Before considering the complete circuit in detail, it will be advantageous to the user to have a knowledge of the somewhat unusual method of tuning used in the '880/2.' The IF/AF Section will be dealt with first, since, in addition to being the simpler portion of the receiver, a knowledge of its operation is helpful in understanding the more unconventional RF Section.

Reference to Fig. 3 will show that the IF/AF Section (V4, etc.) is in effect, a single conversion superhet having two switched tuning ranges, the range switching and tuning being ganged to the corresponding controls in the RF Section. On all the 'odd' RF ranges except Range 1, the IF Section tunes from 2·5 — 3·5 Mc/s but changes over to 3·5 — 4·5 Mc/s on Range 1 and all the 'even' RF ranges. The two IF ranges will be known as Ranges 'A' and 'B' respectively.

The Local Oscillator associated with the IF Section always tunes the range 3·0 — 4·0 Mc/s, tracking 500 kc/s high on Range 'A' and 500 kc/s low on Range '**B**' resulting in a constant difference frequency of 500 kc/s appearing in the output from the Mixer Stage (V5). This IF output is applied to a conventional three stage IF amplifier feeding the later stages in the receiver.

The tuning of the IF Section is arranged so that regardless of the RF range in use, the 'tuned' IF will be set to its highest frequency when the tuning pointer lies at the **left-hand end** of the tuning scale. This of course, is the reverse of normal practice, where the highest frequency usually occurs at the **right-hand end** of the scale. The reason for arranging the tuning in this way will be made clear later when dealing with the RF Section.

The RF tuning of the '880/2' covers the band 500 kc/s to 30·5 Mc/s in thirty 'one megacycle ranges,'



two of which, Ranges 3 and 4, coincide with the two ranges of the tuned IF. On these ranges the receiver functions as a single conversion superhet, the tuned IF stage becoming an RF stage since it operates at the same frequency as the incoming signal. Fig. 3 shows that the tuned IF Stage is preceded by the 1st Mixer and this also functions as an RF amplifier on Ranges 3 and 4, its Local Oscillator being rendered inoperative by the range switching. The two RF Stages, V1 and V2, operate normally, so that the receiver has a total of four stages of RF amplification when used as a single conversion superhet. All the four stages are gang tuned, the direction of tuning being dictated by that employed in the IF Section, namely frequency increasing from right to left on the tuning scale. On all other ranges the scale calibration follows normal practice with frequency increasing from left to right.

On frequencies other than those in the band 2·5 — 4·5 Mc/s, the receiver becomes a double conversion superhet having two tuned RF Stages, a crystal controlled 1st Local Oscillator and a tuned ' first IF.' The injection frequency from the 1st Local Oscillator is so arranged that when tuning any one of the RF ranges (other than Ranges 3 and 4), the output from the 1st Mixer will lie in one of the ranges covered by the tuned IF Stage.

Taking as an example the RF range covering 10·5 — 11·5 Mc/s. Injection from the 1st Local Oscillator is at 14 Mc/s resulting in an IF output of 3·5 Mc/s for a signal at 10·5 Mc/s and 2·5 Mc/s for an 11·5 Mc/s signal. It will be noted that the **highest frequency in the RF range** produces the **lowest frequency in the IF range,** and it is for this reason that the IF tuning is in the reverse direction to normal. The RF tuning is arranged (as is the scale calibration) to increase in frequency with pointer movement from left to right.

On the next range lower (9·5 — 10·5 Mc/s), the same injection frequency is employed, but since the RF range is removed one megacycle further from the crystal frequency, the IF output will be one megacycle higher, i.e., 3·5 — 4·5 Mc/s.

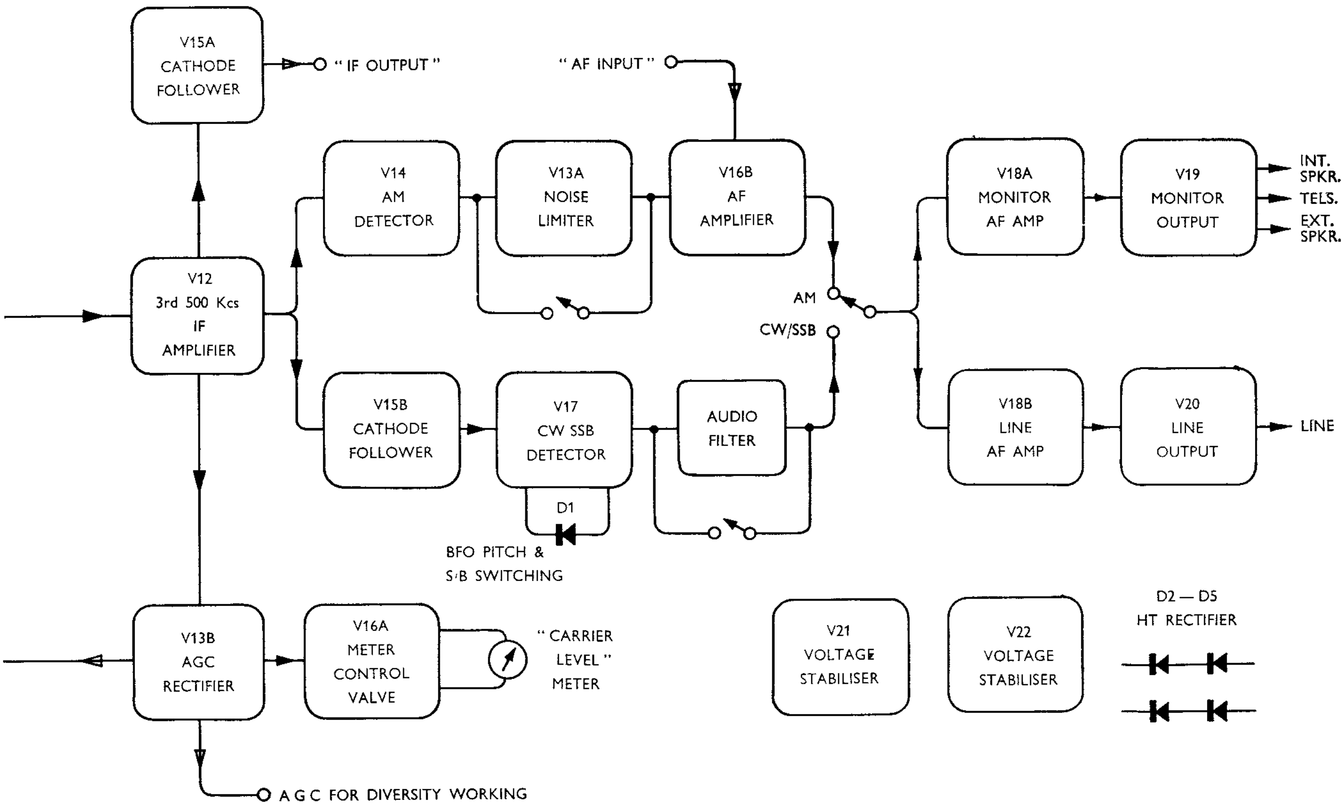


Fig. 3. Block Schematic Diagram — Model 880/2.

On the range above 10·5 — 11·5 Mc/s, the crystal is changed by the range switching to produce an injection frequency of 16 Mc/s. At the LF end of the range (11·5 Mc/s), the IF output becomes 4·5 Mc/s, while a signal at 12·5 Mc/s produces output from the 1st Mixer at 3·5 Mc/s.

The same crystal (16 Mc/s) is used on the next range higher, producing an IF output in the lower of the two IF ranges (Range ' A ').

Careful study of Table 2 will provide a complete picture of the technique adopted in covering the entire tuning range of the ' 880/2 '. In general, one crystal serves for two adjacent ranges (one ' odd ' and one ' even '), the 1st IF alternating between Range ' A ' and Range ' B.' The exception to this rule is that Range 1 employs an injection frequency of 5 Mc/s and uses Range ' B ' of the tuned IF.

It should be noted that each range is adjusted and calibrated to cover a little more than the figures given in the table. To provide an overlap between adjacent ranges, each range tunes 100 kc/s outside the limits quoted. The same applies to the tuned IF which covers either 2·4 — 3·6 Mc/s or 3·4 — 4·6 Mc/s depending on the RF range in use. A coverage of exactly one megacycle per range was assumed in order to simplify both the explanation above and the table which appears. on the following page.

THE RF SECTION

This comprises two stages of RF amplification together with the 1st Mixer Stage and its associated crystal controlled Local Oscillator Unit.

The 1st RF Stage (V1) employs an ECC189 high-slope double-triode in a low noise series cascode circuit. This amplifier and the 2nd RF Stage V2 (6BA6) both operate with automatic and/or manual gain control and provide an excellent signal-to-noise ratio at all frequencies throughout the tuning range. A low noise high slope RF pentode (6AK5) functions as the 1st Mixer (V3) with cathode injection from the Local Oscillator. The Mixer operates with fixed cathode bias and without AGC.

Permeability tuning is used in both the RF and Mixer Stages, a total of thirty-five variable inductors together with one pre-set inductor being required to cover the complete tuning range. The inductors are selected by the ' Megacycle ' control (wavechange switch) which also introduces the appropriate pre-set ' tank ' capacitors. It should be noted that some coils are used on more than one range and in this case range selection is by means of the switched capacitors only. (See Detached Circuits Nos. 1, 2 and 3 which give the complete RF and 1st Mixer range switching).

Two image filters are fitted in the aerial input circuit to assist in maintaining the image signals at a low level

TABLE 2

Tuning Ranges

Range	*RF Coverage*	*Injection Frequency*	*IF Range*
1	0·5 — 1·5 Mc/s	5 Mc/s	3·5 — 4·5 Mc/s ('B')
2	1·5 — 2·5 Mc/s	6 Mc/s	3·5 — 4·5 Mc/s ('B')
3	2·5 — 3·5 Mc/s	—	2·5 — 3·5 Mc/s ('A')
4	3·5 — 4·5 Mc/s	—	3·5 — 4·5 Mc/s ('B')
5	4·5 — 5·5 Mc/s	8 Mc/s	2·5 — 3·5 Mc/s ('A')
6	5·5 — 6·5 Mc/s	10 Mc/s	3·5 — 4·5 Mc/s ('B')
7	6·5 — 7·5 Mc/s	10 Mc/s	2·5 — 3·5 Mc/s ('A')
8	7·5 — 8·5 Mc/s	12 Mc/s	3·5 — 4·5 Mc/s ('B')
9	8·5 — 9·5 Mc/s	12 Mc/s	2·5 — 3·5 Mc/s ('A')
10	9·5 — 10·5 Mc/s	14 Mc/s	3·5 — 4·5 Mc/s ('B')
11	10·5 — 11·5 Mc/s	14 Mc/s	2·5 — 3·5 Mc/s ('A')
12	11·5 — 12·5 Mc/s	16 Mc/s	3·5 — 4·5 Mc/s ('B')
13	12·5 — 13·5 Mc/s	16 Mc/s	2·5 — 3·5 Mc/s ('A')
14	13·5 — 14·5 Mc/s	18 Mc/s	3·5 — 4·5 Mc/s ('B')
15	14·5 — 15·5 Mc/s	18 Mc/s	2·5 — 3·5 Mc/s ('A')
16	15·5 — 16·5 Mc/s	20 Mc/s	3·5 — 4·5 Mc/s ('B')
17	16·5 — 17·5 Mc/s	20 Mc/s	2·5 — 3·5 Mc/s ('A')
18	17·5 — 18·5 Mc/s	22 Mc/s	3·5 — 4·5 Mc/s ('B')
19	18·5 — 19·5 Mc/s	22 Mc/s	2·5 — 3·5 Mc/s ('A')
20	19·5 — 20·5 Mc/s	24 Mc/s	3·5 — 4·5 Mc/s ('B')
21	20·5 — 21·5 Mc/s	24 Mc/s	2·5 — 3·5 Mc/s ('A')
22	21·5 — 22·5 Mc/s	26 Mc/s	3·5 — 4·5 Mc/s ('B')
23	22·5 — 23·5 Mc/s	26 Mc/s	2·5 — 3·5 Mc/s ('A')
24	23·5 — 24·5 Mc/s	28 Mc/s	3·5 — 4·5 Mc/s ('B')
25	24·5 — 25·5 Mc/s	28 Mc/s	2·5 — 3·5 Mc/s ('A')
26	25·5 — 26·5 Mc/s	30 Mc/s	3·5 — 4·5 Mc/s ('B')
27	26·5 — 27·5 Mc/s	30 Mc/s	2·5 — 3·5 Mc/s ('A')
28	27·5 — 28·5 Mc/s	32 Mc/s	3·5 — 4·5 Mc/s ('B')
29	28·5 — 29·5 Mc/s	32 Mc/s	2·5 — 3·5 Mc/s ('A')
30	29·5 — 30·5 Mc/s	34 Mc/s	3·5 — 4·5 Mc/s ('B')

on the higher tuning ranges of the receiver. Filter 'A' (see Main Circuit Diagram) is of the low pass type and has a cut-off frequency of about 30·6 Mc/s. It remains in circuit on all ranges but only functions as an image filter at signal frequencies above 23·5 Mc/s. The filter is kept in circuit on all ranges to provide a constant aerial input impedance of approximately 75 ohms on all frequencies to which the receiver may be tuned. Filter 'E' (see Detached Circuit No. 1) is brought into circuit on Ranges 14 — 17 to ensure a spurious response of at least —90dB at all frequencies up to 15 Mc/s. The cut-off frequency of Filter 'E' is approximately 17·6 Mc/s and above 15 Mc/s the spurious response is at least —60dB.

The input circuit of the 1st RF Stage is provided with an 'Aerial Trimmer' control (C172) which allows accurate adjustment of the first tuned circuit when using aerials with impedances differing appreciably from 75 ohms.

AGC bias is shunt fed to the two RF Stages via the feed resistors R1 and R11. The RF AGC feed includes the filter R12/C9 to prevent interaction with the tuned IF Stage.

Manual RF gain control is effected by taking the cathode bias resistors of the RF Stages (R2 and R13) to the junction of R14/R15 via S2b and the common variable cathode resistor RV1. In normal operation, R15 is shorted out by a wire strap or a relay contact across the desensitising terminals. This connects the RF Gain control (RV1) direct to earth and gives normal bias to V1 and V2. The receiver is desensitised by open circuiting the terminals referred to above and under these conditions, the voltage developed across R15 is applied in series with the normal cathode voltage. This increases the bias applied to the RF Stages and so reduces their gain.

When S2b is set to 'C' (CALIBRATE), the cathodes of V1A and V2 are returned direct to chassis via R16.

RV1 is inoperative under these conditions and the additional bias developed across R16 ensures that there is no signal breakthrough whilst calibrating.*

Low value grid stoppers R3, R10 and R20 are fitted in the RF and Mixer Stages to ensure freedom from instability due to parasitic resonances.

The 1st Local Oscillator Unit employs two 'high reliability' sub-miniature RF pentodes (EF732) as Crystal Oscillator (V6) and Buffer/Multiplier (V7). The whole unit is contained in a double screening box to restrict direct radiation and so allow receivers to be operated in close proximity to one another without fear of interaction. A double screened coaxial lead is used to feed the cathode of the 1st Mixer (V3). The inner screen of this lead is connected to the inner screening box which is insulated from the outer box. Earthing of the inner box occurs at the coaxial socket SKT3. The outer screen of the coaxial lead is bonded to the outer box and also to the coaxial plug PL1 which mates with SKT3.

Both the Crystal Oscillator and Buffer/Multiplier Stages operate from a 108V stabilised supply (HT4), extensive filtering being incorporated in the supply feed to prevent radiation from wiring external to the unit. The same precaution is taken in the LT circuit and this, together with the extensive screening referred to above is responsible for the extremely low radiation and low spurious response.

The Crystal Oscillator always works on the fundamental crystal frequency and any multiplication that is required takes place in the following stage. Ten crystals are needed to cover the twenty-eight ranges when the receiver functions with double conversion and Table 3 gives a full summary of the frequencies used for the various ranges, multiplication factors being indicated where applicable.

** See Appendix 'A' for details of Calibrator Unit.*

The appropriate crystal is selected by the 'Megacycles' control which also introduces the correct pre-tuned output circuit for the Buffer/Multiplier Stage. Sixteen separate output circuits are used and these are shown in Detached Circuit No. 5. Each output circuit is provided with a low impedance coupling coil which provides output to the cathode of the 1st Mixer Stage. On Ranges 3 and 4, the 10 Mc/s crystal is switched into circuit to maintain V6 within its ratings. No injection is required on these ranges so S1p is arranged to bypass the output circuit. The lack of oscillator injection allows V3 (1st Mixer) to function as an RF Amplifier in the range 2·5 — 4·5 Mc/s when the receiver operates with single conversion. The output trap L86/C326 is tuned to 12 Mc/s to severely attenuate the 2nd harmonic output on Ranges 14 and 15.

THE IF/AF SECTION

The output from the RF Section is applied to the tuned IF Stage V4 via a low pass filter (Filter 'B') having a cut-off frequency of 4·9 Mc/s. This filter attenuates the higher frequency components in the Mixer output and so maintains the spurious response at a very low level.

The tuned IF Stage (6BA6) feeds the 2nd Mixer which employs a 6AK5 with cathode injection from the 2nd Local Oscillator Unit. Both V4 and V5 input circuits are permeability tuned and ganged to the tuning of the RF and 1st Mixer Stages. (See Detached Circuit No. 4).

No manual gain control is applied to either stage since adequate adjustment of the overall IF gain is provided in the stages operating at the 'second IF.' AGC is applied to V4 via the feed resistor R27.

TABLE 3

Crystal Frequencies and Multiplication Factors

Crystal Frequency	*Multiplication Factor*		
	X1	*X2*	*X3*
5 Mc/s	Range 1	—	—
6 Mc/s	Range 2	—	Ranges 14 and 15
8 Mc/s	Range 5	—	—
10 Mc/s	Ranges 6 and 7	Ranges 16 and 17	Ranges 26 and 27
11 Mc/s	—	Ranges 18 and 19	—
12 Mc/s	Ranges 8 and 9	Ranges 20 and 21	—
13 Mc/s	—	Ranges 22 and 23	—
14 Mc/s	Ranges 10 and 11	Ranges 24 and 25	—
16 Mc/s	Ranges 12 and 13	Ranges 28 and 29	—
17 Mc/s	—	Range 30	—

As in the RF Section, grid stoppers are fitted to both V4 and V5, and these, together with extensive screening ensure stable operation.

The 2nd Local Oscillator Unit employs a 6U8 triode-pentode as a combined electron coupled oscillator (V8B) and reactance control valve (V8A), together with the triode V9 (6C4) which functions as a cathode follower providing a low impedance output to the 2nd Mixer Stage V5.

The total coverage of the e.c.o. is 2·9 — 4·1 Mc/s inclusive of the 100 kc/s band edge overlaps, and whereas all other tuned stages employ permeability tuning, the 2nd Local Oscillator Unit uses a high quality variable capacitor which is ganged to the main tuning control (' Kilocycles ').

All the circuitry associated with V8 is built upon a printed wiring board which is attached directly to the oscillator tuning capacitor in the interest of greater mechanical stability.

To prevent harmonics of the oscillator from reaching the Mixer Stage, two low pass filters (Filters ' C ' and ' D ') are incorporated in the 2nd Local Oscillator Unit. The unit itself is housed in a double screening box to prevent radiation of oscillator harmonics which would otherwise fall within the tuning range of the receiver. Radiation from wiring leaving the unit is avoided by filtering at the point of exit. A coaxial output lead is used for the same reason.

V8B operates from the 108V stabilised line (HT4), while the main HT line (HT1) supplies the Buffer Stage V9. V8A is fed from the other 108V stabilised supply (HT3) via the Fine Tuning control (RV2).

The triode portion of V8 is connected in parallel with the e.c.o. tuned circuit to provide the ' fine tuning ' and ' remote tuning ' facilities. The Fine Tuning control gives a total swing of $\pm$800 c/s and will be found extremely useful when tuning CW and SSB signals. Remote tuning over a range of 1·5 kc/s can be accomplished as explained in the Section dealing with ' Installation.'

Output from the 2nd Mixer is fed to a three stage amplifier operating at the 2nd IF of 500 kc/s. High slope vari-mu pentodes of the 6BA6 type are employed in the first two stages (V10 and V11) while a 6AM6 is used in the final stage (V12).

The amplifier can be switched to provide five degrees of selectivity, two of which involve the use of dual crystal bandpass filters. These are arranged to take any two of three dual crystals which provide 6dB bandwidths as follows :—

Crystal ' A ' : 400 c/s.
Crystal ' B ' : 1·2 kc/s.
Crystal ' C ' : 3 kc/s.

Either Crystal ' A ' or Crystal ' B ' can be fitted in the XL1 position while the XL2 position is designed for Crystals ' B ' or ' C.' Thus an individual receiver could have the following combinations of crystals :—

1. Crystal ' A ' and Crystal ' B.'
2. Crystal ' A ' and Crystal ' C.'
3. Crystal ' B ' and Crystal ' C.'

The crystals employed in the filters are evacuated envelope types with B7G bases (Style ' E '). The phasing capacitors (C87 and C88) are pre-set during initial alignment to give the characteristic steep-sided response associated with crystal filters of the bandpass type. There is no evidence of the rejection notches due to the crystals and side lobes are non-existent.

All crystal units are shorted by the selectivity switching (S3d, f, g and h) except when actually in use. This simple precaution prevents stray excitation of the crystals giving rise to a peaky response when the filters are not in use.

Fig. 4 shows in simplified form, the IF circuit coupling arrangements in each position of the Selectivity Switch. Switched tertiary windings are used to vary the coupling while the gain is maintained sensibly constant by the switched taps on the circuit feeding the first stage.

AGC is applied to the first two stages V10 and V11 via the feed resistors R63 and R68, while manual control of the overall IF gain is provided by RV3 which is in series with the common cathode return of the same two stages. The third stage operates at fixed gain and feeds V13B, V15A, V15B and the miniature diode V14.

V13B ($\frac{1}{2}$ 6AL5) is the AGC Rectifier which controls the RF Amplifiers V1 and V2 and the IF Stages V4, V10 and V11 when AGC is in use. The AGC Switch (S2) provides a choice of three AGC time constants and AGC ' OFF.' A fifth position of the switch applies HT to the internal crystal calibrator. AGC is automatically switched off when calibrating and the two RF Stages desensitised by S2b.

The AGC is delayed by the voltage developed at the potential divider R83/R84. The normal delay voltage is of the order 15V but in the SSB position this delay is decreased by switching R82 in parallel with R84. The lower delay voltage maintains efficient AGC action with the reduced average sideband power available for production of AGC bias when taking SSB signals.

The DC Amplifier V16A is also controlled by the AGC line and serves to actuate the Carrier Level Meter when the AGC is in use. A pre-set control (RV4) in the cathode of V16A allows the meter to be zeroed accurately under no-signal conditions.

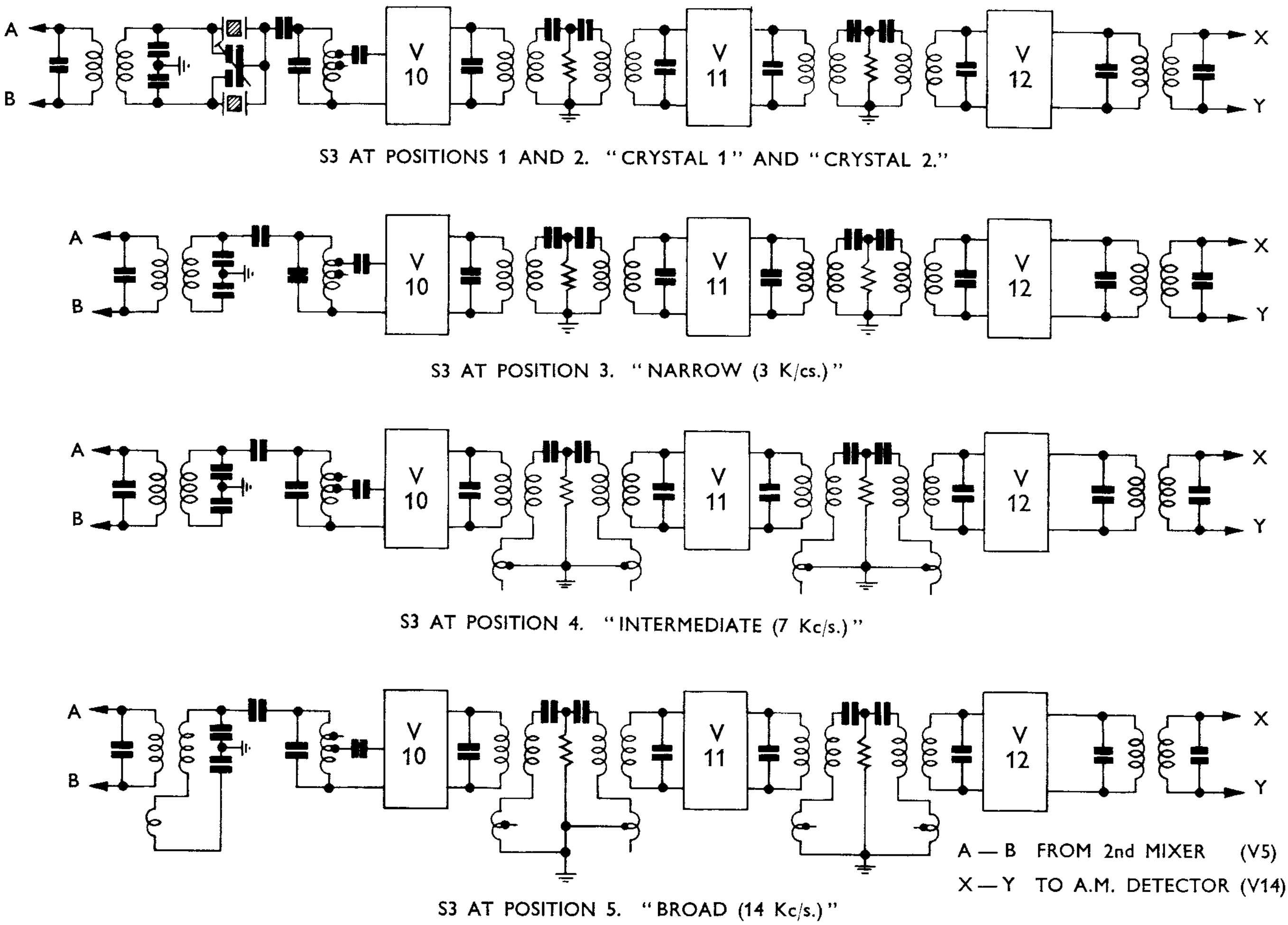


Fig. 4. Coupling arrangements at each position of Selectivity Switch

V15A and V15B are fed in parallel from the secondary of T8, a 12AT7 double-triode being used in this position. Both triodes function as cathode followers, V15A providing a low impedance IF output for external use and V15B feeding the CW/SSB Detector V17. The 6BE6 pentagrid used in this position operates as a product detector and gives superior results to those obtained when using a conventional diode detector for CW and SSB reception. This is especially true under large signal conditions.

The injection frequency from the oscillator section (BFO) is determined by the control voltage applied to the capacity diode (D1) which is connected across the oscillator coil L25. The actual control voltage is dependent on the settings of S1r, S5b, S5c, RV5, RV6 and RV7. RV7, which is adjustable from the panel is brought into circuit by S5b or S5c (dependent on the setting of S1r) to serve as the Pitch control in CW reception.

RV5 and RV6 are pre-set and are the upper and lower sideband selection controls respectively. S1r (part of the Wavechange Switch) is arranged in conjunction with S5b and S5c to reverse the functions of RV5 and RV6 on those ranges when sideband inversion occurs due to the double mixing process where Osc.2 may be above or below the 1st IF. Inversion occurs on Ranges 1, 2 and 3 and on all **even** ranges except Range 4. The operation of S1r ensures that the switch positions for S5 marked on the panel read correctly on all ranges. It should be noted that compensation is not made for sideband inversion in the case of the Pitch control.

All the networks associated with RV5 — RV7 are fed from the HT3 rail (108V stabilised) and the circuit values are such that a pitch swing of ± 7 kc/s is obtainable. The sideband potentiometers are adjusted to give carrier insertion at 498·5 kc/s and 501·5 kc/s as appropriate.

Output from V17 is taken via the coupling capacitor (C139) to the CW/SSB positions of S5d, either direct or via the Audio Filter dependent on the position of S6. Extensive filtering is included in the detector output circuit to prevent radiation of the BFO signal from wiring external to the unit. Direct radiation is restricted by housing the complete detector unit in a small screening can. Harmonics which would otherwise fall within the tuning range of the receiver are therefore adequately suppressed. The screen supply for V17 is obtained from a stabilised source (HT3, 108V) and is applied during CW and SSB reception by one section of the Mode Switch (S5a).

The miniature diode V14 (6489) is used as detector for the reception of AM signals. Incorporated in the detector circuit is a series pulse limiter (V13A) which may be used to reduce impulse noise during AM reception. When not required, the limiter can be taken out of circuit by means of S4.

The detected output across R77 is fed to the grid of V16B ($\frac{1}{2}$ 12AT7) which provides additional audio amplification when receiving AM signals. This compensates for the higher gain of the CW/SSB Detector and obviates the need for adjustment of the gain controls when moving the Mode Switch from the AM to the CW/SSB positions. Output from V16B is taken direct to the AM position of S5d. This section of the Mode Switch feeds the Bass Filter which comprises C146 — C148 and R113 — R115. Bass Filter switching is achieved by S7 which feeds the two independent audio gain controls RV8 and RV9.

The Line Gain (RV8) is pre-set, its slider being taken direct to the grid of V18B ($\frac{1}{2}$ 12AU7) which serves as the driver stage for the Line Output Stage V20. A 6AM5 pentode is employed in this position to provide a 600 ohm line output via T11. An output of 100 mW is available and extensive negative feedback is applied to both stages.

A similar circuit is employed in the audio stages (V18A and V19) which provide the monitor outputs. The circuit is arranged so that the external speaker is ‘cut’ when telephones are plugged in but the internal monitor speaker remains in circuit and can be switched independently by means of S8. It should be noted that when telephones are in use, a loading resistor (R125) is connected across the secondary of T10. An output of 750 mW is available at the 2·5 ohm terminals.

THE POWER SUPPLY SECTION

This portion of the receiver is of fairly conventional design and employs a ‘C’ core mains transformer with one HT and three LT secondary windings. The HT winding is centre-tapped and feeds a full wave rectifier which comprises four miniature silicon rectifiers connected in two pairs. Output from the rectifier is smoothed by a condenser input filter made up of C157, C158 and CH11. The smoothed output across C157 feeds the ‘HT1’ rail at 225V.

Some of the audio stages are supplied from the HT1 rail via R133 (decoupled by C156). This line becomes the HT2 supply and is of the order 195V.

Two voltage stabilisers, V21 and V22 (both type OB2) provide separate 108V supplies (HT3 and HT4) for certain stages in the receiver. The distribution of these supplies is as follows :—

HT3 : Screen of CW/SSB Detector (V17).
Divider network providing control voltage for D1.
Voltage divider in meter circuit.
Fine Tuning Control (RV2 feeding anode of V8A).

HT4 : V6 and V7 (1st Local Oscillator Unit).
V8B (2nd Local Oscillator Unit).

The three separate LT windings are rated as follows :

LT1 : 6·3V @ 6A ; LT2 : 6·3V @ 0·5A ;
LT3 : 6·3V @ 3A (tapped at 5V).

All the valve heaters with the exception of V13 are fed from the LT1 winding, one side of which is earthed. Also fed from this source via the 5 ohm variable resistor RV10 are the two dial lamps ILP1/2. RV10 provides a means of adjusting the brilliancy of the scale illumination and is located at the rear of the receiver.

V13 is fed from the LT2 winding, the centre-tap of which is maintained at a positive potential by the voltage divider R135/R136. This method of supplying V13 eliminates hum in the noise limiter circuit and obviates the need for selection of the 6AL5 for use in this position.

The remaining LT winding is connected to pins 3 and 6 of SKT9 and can be used as a heater supply for a small external unit. Up to 1·5 Amps can be taken from the winding (LT3). An associated HT supply is also available at SKT9 (pins 9 and 12). This supply is unsmoothed and should not be loaded to a greater drain than 15 mA. The unsmoothed voltage is approximately 260V.

The receiver can be operated from external HT and LT supplies when an AC mains supply is not available. Full details are given later in the Section dealing with ‘Installation.’

The AC mains input is switched in both live and neutral poles by the double-pole switch S9. The live pole is fused at 1·5A by the cartridge fuse FS1.

NOTE : Details of the mains transformer primary adjustments are given in the Section on ‘Installation.’

CONSTRUCTIONAL DETAILS

GENERAL

The Model 880/2 can be supplied as a standard rack mounting unit or as a table mounting unit. Either version can be converted to the other by removing certain parts of the existing cover and fitting replacement pieces to suit the desired type of mounting.

OVERALL DIMENSIONS AND WEIGHT

Rack Mounted Version

Width	.. ..	19″ (48·3 cm.).
Height	.. ..	8¾″ (22·2 cm.).
Depth*	.. ..	20½″ (52·1 cm.).
Weight	.. ..	87 lbs. (39·5 kgs.).

*Depth within rack (*i.e.* from rear of panel to projections at rear of cabinet) — 18¾″ (47·6 cm.).

Table Mounted Version

Width	.. ..	19½″ (49·5 cm.).
Height	.. ..	9 7/16″ (23·9 cm.).
Depth	.. ..	20½″ (52·1 cm.).
Weight	.. ..	99 lbs. (44·9 kgs.).

COVER

The cover assemblies used on the two models have much in common. The side-plates, front panel and the separate rear and bottom covers are fitted as standard parts irrespective of the method of mounting. The top covers differ slightly in dimensions and method of fixing but in both cases are made entirely of perforated material. In rack mounted models the top cover is held in place by 10 2BA pan-head screws, while on a table model two quick-release ‘Oddie’ fasteners situated at the rear of the cover provide a convenient method of fixing.

The main difference between the two models lies in the addition of the panel escutcheon and specially shaped side-plates on the table model. (The normal side-plates remain in position). The addition of these two items slightly increases the overall height and width but at the same time gives the cabinet a styled appearance. Polythene mounting feet are fitted to prevent marking of the surface on which the receiver is placed.

Ventilation areas in the main side-plates are duplicated in the shaped plates to avoid obstructing the air circulation. The complete cabinet as a whole is very well ventilated with the top and bottom surfaces both made from perforated material. In addition, further perforated areas are included in the rear cover and internally in the two local oscillator boxes.

One section of the top cover, common to both models but not visible in a table model is the drive cover. This, in addition to preventing the accumulation of dust on the drive mechanism, also serves to carry the two festoon bulbs which are used for dial illumination. The LT supply for the two bulbs is fed via a small two-way connector mounted at the right-hand end of the drive cover. Care should be taken to uncouple this connector before completely removing the cover.

A removable cover is provided in the side-plate at the right-hand side of the receiver to allow access to the 1st Local Oscillator Unit.

CHASSIS

Sub-chassis construction is employed throughout, all sub-chassis being built around a central ‘RF frame’ which is securely bolted to the rear of the two drive plates situated behind the front panel.

Six sub-chassis, together with two double screened boxes go to make up the main assembly which is of extremely rugged construction when bolted together. The six sub-chassis are as follows :—

1. 1st RF Amplifier.
2. 2nd RF Amplifier.
3. 1st Mixer Stage.
4. Tuned IF and 2nd Mixer Stages.
5. IF/AF Chassis.
6. Power Unit Chassis.

These, together with the two Oscillator Units, are interconnected by means of a number of cable forms terminated in suitable plugs and sockets which allow units to be removed without resort to a soldering iron.

Both Oscillator Units and all sub-chassis except the Power Unit chassis are of brass, heavily silver plated and lacquered. The Power Unit chassis is of steel, suitably rustproofed and sprayed grey enamel.

PANEL

This is of ⅛″ steel plate with a diecast aluminium escutcheon surrounding the dial aperture. A further escutcheon is fitted in the case of the table model and this fits around and over the edge of the main panel, slightly increasing its dimensions. A double anodised aluminium finger plate covers the whole of the receiver panel and is labelled with all control functions.

Chromium plated panel handles are fitted and these (besides their normal use in lifting the receiver) allow it to be placed ‘face-down’ without damage to the panel controls.

TUNING DIAL AND DRIVE MECHANISM

The tuning dial occupies a central position in the top half of the front panel and has two horizontal scales bearing calibration marks at 100 kc/s. intervals. The top scale is printed in black and is for use on all ranges except 3 and 4. On these two ranges the lower scale is used, the red colouring being used to avoid confusion.

Direct frequency calibration is provided by three calibrated discs which are positioned behind apertures in the scale plate and rotated by the wavechange mechanism (Megacycles). Interpolation between the 100 kc/s. points is achieved by means of the vernier scale located in the lower centre of the main scale.

The main tuning control (Kilocycles) operates a spring-loaded split-gear system which provides two main drive outlets together with a pulley drive for the scale pointer and a gear drive for the vernier scale.

One of the main drive outlets is coupled to the rotor of the tuning capacitor in the 2nd Local Oscillator Unit, while the other drives a helical gear mechanism which raises and lowers the tuning platform carrying the cores for the RF, Mixer and Tuned IF Stages.

The gear ratios are such that it requires twenty-four revolutions of the main tuning control to move the pointer from end to end of its traverse, a total distance of some ten inches. At the same time, the vernier scale makes a total of twelve revolutions, each of which corresponds to a frequency change of 100 kc/s. The resultant tuning rate of 50 kc/s. per revolution will be found adequate for most applications but can be supplemented by adjustment of the Fine Tuning control when necessary.

INTER-UNIT WIRING

As mentioned earlier in this Section, all units are inter-connected by means of cable forms terminated in suitable plugs and sockets to allow easy removal of individual units.

Four miniature 6-way sockets located on the Power Unit chassis distribute the HT and LT supplies to the various sections of the receiver, while a fifth socket allows connection to the dial lamps and mains switch. Six similar sockets are mounted on the rear of the front panel to facilitate connection to the panel controls. The Unit inter-connection drawing at the rear of the Manual gives a complete picture and will be found extremely useful for reference when fault-finding.

NOTE : Inter-unit connectors are omitted from the Main Circuit in the interest of clarity.

INSTALLATION

MOUNTING

The Model 880/2 is supplied complete with all valves, etc., either as a table mounting unit or in a form suitable for rack mounting (880/2/RM). When rack mounted, the receiver occupies a height of 8¾″ in a standard 19″ rack. An area 19½″ ×20½″ is required for table mounting.

Four standard fixing slots are provided when the receiver is intended for use in a rack but no fixing is required in a table mounted installation.

When installing the receiver, due regard should be paid to positioning both for convenience in operation and ease of access to connections at the rear.

When a number of receivers are mounted in a common rack (*e.g.* in a diversity installation), care should be taken to avoid obstructing the ventilation areas at the rear and in the sides of the cabinet.

EXTERNAL CONNECTIONS

Mains

The three-core PVC insulated lead should be terminated in a suitable three-pin plug for connection to the local AC mains supply. The plug should be wired as follows :—

Red lead to live line.
Black lead to neutral line.
Green lead to earth.

NOTE : Before connecting to the local AC mains supply, check that the mains transformer is adjusted for the appropriate voltage. (See ‘Mains Voltage Adjustment’ later in this Section).

External Power Supplies

Provision is made for the receiver to be powered from external HT and LT supplies when an AC mains supply is not available. The HT and LT voltages required are as follows and should be connected to a suitable 12-way female plug (miniature " Jones " type) to mate with SKT9.

HT	.. ..	225V at 185mA.
LT	.. ..	6·3V at 6·5A (approx).

These voltages can be obtained from any convenient source — a motor generator, vibrator pack, transistor convertor, or even direct from suitable accumulators. The HT supply is taken to the input side of the receiver filter circuit so that additional smoothing is available to supplement that provided in the external power supply.

NOTE : The negative sides of both HT and LT supplies are common connections and are earthed at SKT9.

The plug should be wired as shown in the main Circuit Diagram (PL5), taking care not to omit the straps between contacts 4 & 7 and 5 & 8. These links complete the heater supply to V13. Provision should be made to switch and fuse the external supplies at their source.

It should be borne in mind that the current drain of the 880/2 LT circuit is quite high (6·5A with dial lamps and Calibrator). The LT connecting leads should therefore be kept as short as possible using heavy gauge wire to avoid excessive voltage drop.

When operating from AC mains supplies, a similar 12-way plug must be in place at SKT9 to complete the LT circuits to the valve heaters and dial lamps. The plug should be wired with straps between the following contacts :—

1 and 4 2 and 5 7 and 10

If HT and LT supplies are required to power some small item of ancillary equipment, these can be taken from the same plug. Connections are indicated on the Main Circuit Diagram and it should be noted that the HT output is unsmoothed.

The voltages and currents available are as follows and under no circumstances should these values be exceeded.

HT	.. ..	260V* at 15mA.
LT	.. ..	6·3V at 1·5A.

*Actual unsmoothed voltage.

Aerial

Connection is by means of a standard BNC coaxial plug terminating a 75 ohm coaxial line. A suitable plug is provided with the receiver. The input impedance is nominally 75 ohms unbalanced but other impedances can be used satisfactorily since provision is made for tuning the input circuit by means of the Aerial Trimmer, C172.

Earth

This terminal should be taken to a suitable earthing point via a short direct heavy gauge conductor. In installations where the supply source includes an earth leakage trip, a check should be made to see that the operation of the ' trip ' is not affected by the direct earth connection.

Loudspeaker

An external loudspeaker can be connected to the two quick-release terminals marked 2·5 ohms. Any 2·5–3 ohm loudspeaker can be used but the EDDYSTONE Cat. Nos. 688E or 899 are recommended since they match the receiver both electrically and in finish. Details of these speaker units are given in Data Sheet D.S. 123.

Telephones

If loudspeaker reception is not required, telephones can be plugged into the jack socket at the left hand side of the front panel. Although the output impedance is nominally 2,000 ohms, the circuit arrangements are such that higher or lower impedance 'phones can be used quite satisfactorily.

Insertion of the telephone plug disconnects the external loudspeaker and connects a loading resistor (R125) across the secondary of T10.

The internal Monitor Speaker is switched independently of the other outputs.

Line Output

Connection is made to the quick-release terminals marked 600 ohms. If a balanced output is required, the middle terminal (CT) should be connected to earth.

IF Output

Connection should be made by means of a standard BNC coaxial plug terminating a 75 ohm coaxial line. The output available is an un-rectified 500 kc/s. IF signal and may be connected to a suitable FSK adaptor or other ancillary equipment.

AF Input

In certain circumstances it may be desirable to use the audio section of the receiver to amplify audio signals derived from an external source. Such signals can be introduced at JK1 using a standard GPO jack plug, the sleeve of which is the earth connection. Insertion of the plug automatically disconnects the audio output from the AM Detector so that interference from received signals is avoided. The Bass Switch and both AF Gain controls function normally when the receiver is used in this way.*

**The Mode Switch must be at 'AM' when feeding in external audio signals.*

AGC Terminal

See ' Interconnection of receivers for Diversity Operation ' later in this Section.

Oscillator Remote Control

Fine tuning of the receiver can be carried out from a distant listening point if use is made of the Reactance Control Valve (V8A).

The shorting strap which is normally in place between terminals ' G ' and ' E ' (earth) should be removed and a twin cable connected in its place. The remote end of this cable should be connected as shown in Fig. 5.

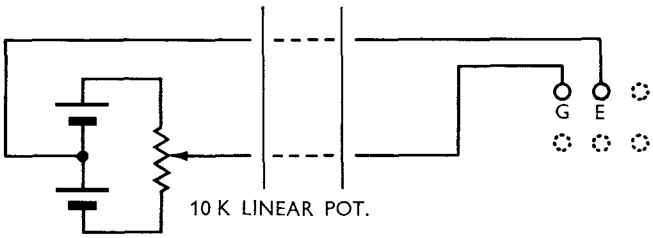


Fig. 5. Connections for Remote Oscillator Control.

With the slider on the 10,000 ohm potentiometer set to mid travel, terminal ' G ' is effectively at earth potential and the receiver ' tune frequency ' will be unchanged from that obtaining when terminals ' G ' and ' E ' are strapped together. Moving the slider in either direction from centre will apply positive or negative bias to the grid of V8A so causing the receiver ' tune frequency ' to change due to the effective capacity of V8A across the 2nd Local Oscillator tuned circuit.

The bias supply can conveniently take the form of two 4·5V or 6V batteries connected in series. The current drain will be of the order 1mA giving a discharge period approximately equal to the shelf life of the batteries. In consequence, no switching is required but batteries should be inspected from time to time in case of electrolyte seepage.

The tuning range is not linear (due to the valve characteristic) but the coverage is adequate to enable the operator to correct for small increments of drift at both receiver and transmitter.

External Relay Terminals

When desensitising facilities are required, an external relay contact or switch can be connected across the two quick-release terminals marked ' D ' and ' E ' (earth). The circuit should be arranged to close when the receiver is required to function normally and open to desensitise the receiver when an associated transmitter is in operation.

If desensitising is not required, the two terminals must be connected together by means of a wire strap.

INTERCONNECTION OF RECEIVERS FOR DIVERSITY OPERATION

880/2 receivers can be used with either independent or common oscillator control to provide an extremely flexible high-stability diversity system.

Fig. 6. shows a pair of 880/2 receivers interconnected with common oscillator control for use as a single channel diversity installation. Audio outputs can be combined as shown (150 ohm loading resistors can be ½ watt rating) or alternatively by means of an ' outboard ' transformer having three separate 600 ohm windings.

AGC terminals should be connected together with screened lead, the braid of which can be conveniently earthed by connection to the terminals ' E ' adjacent to the AGC terminals.

Where desensitising is required, connections to the control switch or relay should be taken as shown. If this facility is not required, the ' D ' and ' E ' terminals must be strapped together with wire links to complete the cathode circuits of the RF Amplifiers.

Interconnection of the two 2nd Mixer cathodes to provide common injection from the 2nd Local Oscillator Unit in the Control Receiver is achieved as follows :—

1. Remove the cover from the RF Section in the Slave Receiver.
2. Take out PL3 and tape it to the adjacent cable (PL2).

   NOTE : This operation disables the 2nd Local Oscillator Unit since its earth return is normally through PL3/SKT5. Care should therefore be taken to ensure that PL3 is properly taped so that intermittent earthing cannot occur. Intermittent earthing would of course give rise to noise in the receiver output.
3. Replace the RF cover.
4. Terminate both ends of a two-foot length of 75 ohm coaxial cable with standard Belling-Lee coaxial plugs (Type L.734).
5. Connect one L.734 plug to SKT6 (Slave Receiver), running the free end of the cable along the left-hand side of the RF cover and through the outlet escutcheon in the rear of the cabinet. Leave the second L.734 plug hanging at the back of the set.

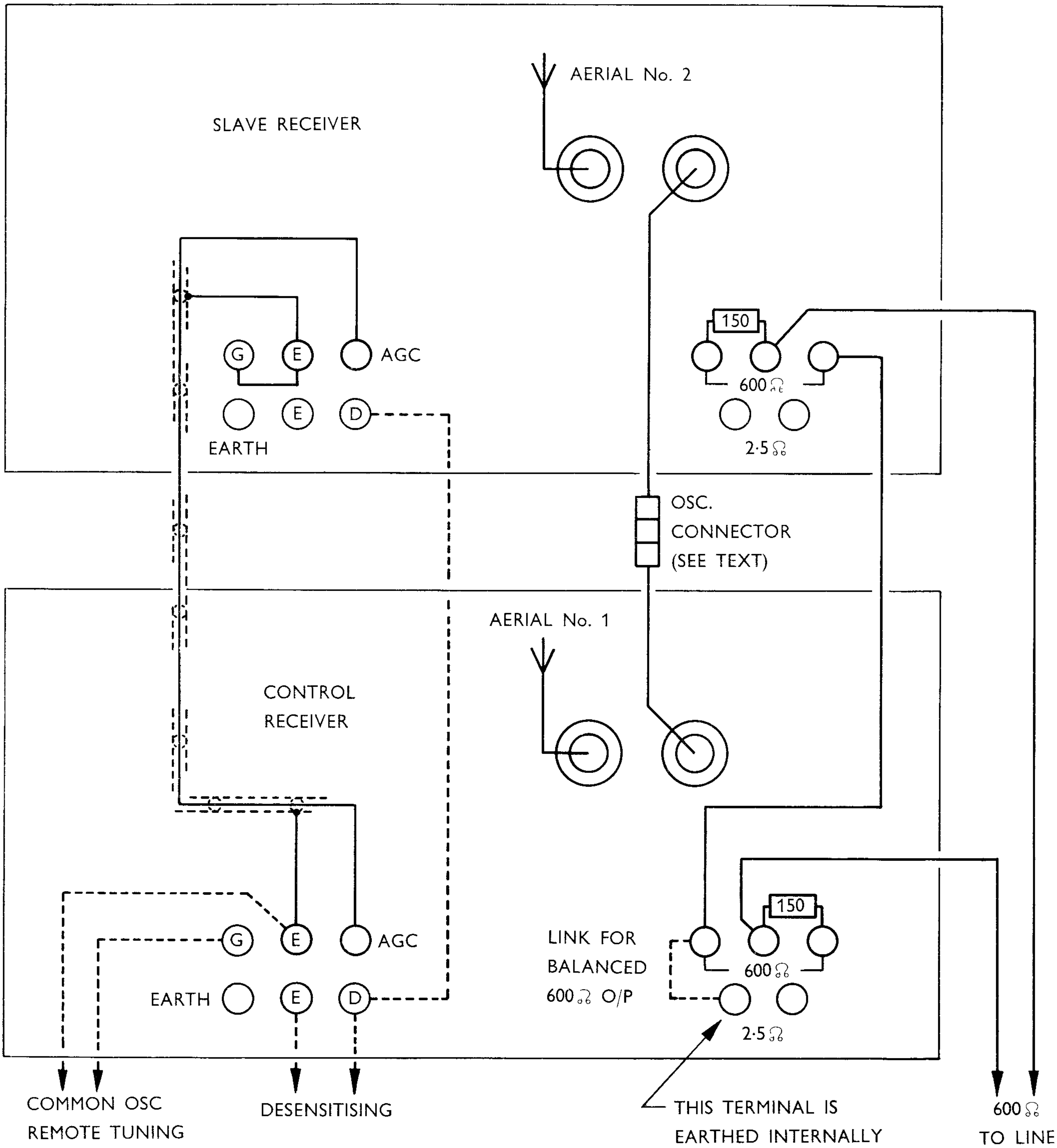


Fig. 6. Interconnection of two 880/2 receivers for dual diversity operation.

6. Make up a further length of 75 ohm coaxial cable with a standard L.734 plug at one end. Connect this end to SKT6 (Control Receiver) and run the free end out through the escutcheon at the rear.

7. Ascertain the length of cable required to reach the L.734 plug at the rear of the Slave Receiver (allowing for looming if required) and cut off the surplus.

8. Terminate the free end of the cable in either of the following two ways so that both cables can be mated at the rear of the equipment.
   (a) Terminate with a standard L.734 plug and use a coaxial line coupler Type L.616 to mate the two L.734 plugs.
   (b) Terminate with a free coaxial socket (Type L.734/J) to mate directly with the L.734 plug at the rear of the Slave Receiver.

NOTE : In a table mounted installation it is possible to make use of a single length of coaxial cable (both ends terminated with standard L.734 plugs) to link SKT6 in each receiver. The use of an external linking connector is essential in the case of rack-mounted assemblies because the appropriate sockets are inaccessible when the units are in position.

Although remote tuning is not possible when independent oscillator control is used, it can be employed in a common oscillator system since any tuning correction will be applied simultaneously to both receivers. The appropriate connections are shown in Fig. 6 but if remote tuning is not needed, then the ' G ' and ' E ' terminals should be connected with a wire strap.

Setting up a diversity installation (with common oscillator control) is carried out as follows :—

1. Check that the receivers are isolated from the remote line system.
2. Set up the control Receiver on the required signal with the Slave monitor speaker switched off.
3. Switch off the Control monitor speaker and tune the Slave Receiver to the same channel. Normal tuning effects will not obtain because neither 1st nor 2nd Oscillator signals are affected by the Tuning control (Kilocycles). The control will function rather as a peaking control and should be set for maximum reading on the carrier meter.

   Check that the Aerial Trimmer is peaked in the normal way.
4. Balance the control settings on each receiver, checking that the switches, etc. are in the same positions.
5. Connect the combined audio output to line and adjust the line level controls by reference to the particular line monitoring system employed.

MAINS VOLTAGE ADJUSTMENT

As despatched, the mains transformer tappings are set for 240V operation. When operation is to be from other mains voltages, the tappings should be set as shown in the table below.

TABLE 4. Mains Transformer Settings.

Voltage	*Strap*	*Input to*
100	C & D E & H	C & H
110	C & D F & G	C & G
115	A & B E & H	B & H
125	A & B F & G	A & G
200	D & E	C & H
210	D & F	C & H
220	D & F	C & G
230	A & E	B & H
240	A & E	B & G
250	A & F	B & G

OPERATION

CONTROL FUNCTIONS

Wavechange and Tuning

These two controls are labelled 'MEGACYCLES' and 'KILOCYCLES' respectively and are operated in conjunction with one another to determine the frequency to which the receiver is tuned. Dial calibration is presented in such a manner that the only figures visible are those applicable to the range in use. This is achieved by means of three calibrated discs rotated by the 'MEGACYCLES' control and appearing behind suitably positioned apertures along the main tuning scale.

Rotation of the tuning control causes a pointer to traverse this scale which has a length of some ten inches and bears calibration marks at 100 kc/s intervals. Interpolation between these points is provided by a vernier scale which is graduated into 100 divisions each representing one kilocycle. The scale is conveniently positioned above and between the main tuning control and wavechange switch.

In point of fact, the vernier carries two scales, one printed in red, the other black. The red scale is calibrated in the reverse direction to the black scale and is intended for use when operating on Ranges 3 and 4 which employ 'reverse tuning' (see 'Circuit Description'). Likewise, the main scale calibration appears in red on these two ranges and is a reminder that the scale must be read in reverse.

Fine Tuning Control

This control is conveniently located at the right-hand edge of the dial aperture and will prove extremely useful when small changes in tuning are necessary (as in SSB reception or when taking CW with the audio filter in circuit). The total swing of the control is $\pm$ 800 c/s, the tuning being sensibly linear. It should be appreciated that the main scale calibration will be slightly in error when the fine control is offset from its central position.

Aerial Trimmer

Provides a means of accurately resonating the aerial input circuit. In operation, this control should always be peaked — either on background hiss or a recieved signal — to give maximum audio output. This control has a 2 : 1 reduction drive.

Gain Controls

Four independent gain controls are provided as follows :—

RF Gain (RV1) :	Controls V1A and V2.
IF Gain (RV3) :	Controls V10 and V11.
AF Gain (RV9) :	Controls audio output on monitor channel.
Line Level (RV8) :	Controls audio output on line channel.

Selectivity Switch

Five degrees of selectivity are provided, two of which involve the use of bandpass crystal filters. 6dB bandwidths of 14, 7 and 3 kc/s are provided as standard but the bandwidths in the two 'CRYSTAL' positions will vary dependent on the users requirements. The bandwidth in the 'CRYSTAL 1' position can be either 400 c/s or 1·2 kc/s, while in the 'CRYSTAL 2' position the bandwidth can be either 1·2 kc/s or 3 kc/s.

A small card should be kept with the receiver detailing the bandwidths available in the two 'CRYSTAL' positions.

CW Pitch

This control, labelled 'BFO,' varies the pitch of the note when receiving CW signals. The control can be set so that the injected frequency from the oscillator lies on either side of the IF passband so providing a means of single signal CW reception with attenuation of either adjacent channel as required.

It should be noted that due to the double conversion system employed, sideband inversion occurs on adjacent ranges (see 'Circuit Description') and care should be taken in tuning CW signals when changing from one range to another.

Mode Switch

Has four positions as follows :—

'AM' .. 'CW' .. 'SSB (UPPER)' .. 'SSB (LOWER).'

This control brings about all necessary circuit changes in selecting the reception mode. These changes include correct routing of audio from the two detectors, application of screen voltage to V17 for CW/SSB reception and, in conjunction with one section of the wavechange switch, selection of the appropriate control voltage for the capacity diode used as the frequency determining element in the beat oscillator circuit.

AGC/Calibrator Switch

Provides a choice of either automatic and/or manual gain control of the pre-detector stages and in one position brings into operation the internal Crystal Calibrator.

Three positions of AGC are provided, namely 'FAST,' 'SLOW' and 'SSB' together with AGC 'OFF.'

In the 'FAST' position, the time constant of the AGC circuit is adjusted to suit the reception of rapidly fading telephony signals or high speed telegraphy. A longer time constant is required for slower speed telegraphy and this is provided in the 'SLOW' position. The AGC delay voltage is reduced in the 'SSB' position to improve the AGC action when dealing with a lower mean carrier level. A discharge time constant of some ten seconds obtains in this position.

When placed at 'C' the AGC is switched off; the calibrator is brought into operation and the two RF Stages desensitised to prevent signal breakthrough whilst calibrating. Calibration markers are provided at 100 kc/s intervals throughout the entire coverage.

Noise Limiter Switch

This control is only operative during the reception of AM signals. Placing the switch in the 'ON' position introduces a series pulse limiter into the detector circuit and this is effective in reducing impulse noises which may be experienced during AM reception.

AF Filter Switch

Introduces a selective audio filter for CW reception under conditions of severe adjacent channel interference.

On AM the audio filter is automatically taken out of circuit by the Mode Switch but on SSB the filter must be switched separately with the AF Filter Switch.

Bass Switch

Provides a means of restoring a balance to the received transmission when sharp selectivity is being used. Cutting the bass to compensate for the loss of the high frequencies will render a signal far more readable than would otherwise be the case. When external audio signals are fed to the receiver, the switch functions as a 'tone' control in the normal way.

Monitor Speaker Switch

Switches the internal monitor speaker on or off as required. This facility is unaffected when telephones are in use.

Mains Switch

Makes or breaks both live and neutral poles of the AC supply to T12.

The Mains Switch performs no function when the receiver is used with external power supplies.

Meter Zero Adjustment

Permits adjustment of the meter needle to zero before comparative checks of carrier level are made.

Dial Lamp Brilliancy

A pre-set control located at the rear of the receiver. Allows the dial illumination to be set to suit the conditions under which the receiver is used.

TUNING INSTRUCTIONS

Preliminary

Check that the AC mains supply or external HT and LT supplies are available. Check all external connections and ascertain that a suitable aerial is in use. Either connect an external speaker or place the internal Monitor Speaker switch to 'On.' If speaker reception is not required, check that the Monitor Speaker switch is set to 'Off' and plug in a pair of telephones at the socket on the front panel. If an external speaker is connected, this will be cut automatically when the 'phone plug is inserted.

Next place the Mains switch to 'On.' (In the case of operation from external power supplies, the Mains switch can be left 'Off' but the external supplies should be switched on at their source). An indication that the receiver is operative is given by the illumination of the tuning dial and the brilliancy of this lighting can be set as required by means of a control at the rear of the receiver.

While the receiver is warming up, set the Fine Tuning control so that the white index mark is at 12 o'clock, set the 'Megacycles' control to the appropriate range and tune with the 'Kilocycles' control to the frequency required.

NOTE: When using Ranges 3 and 4, the scale calibration figures appear in red and this indicates that both the main scale and the 'Kilocycles' vernier must be read in the reverse direction to the other ranges.

A check on scale accuracy can be made if desired by setting first to the 100 kc/s calibration point which is closest to the required frequency. The Mode switch should be set to 'CW' and the BFO ('Pitch') control set so that the white index mark is at 12 o'clock. Bring the Calibrator into action by placing the AGC switch at 'C' (CALIBRATE), set the IF and AF Gain controls to provide a suitable output and adjust the tuning so that the Calibrator signal is at zero-beat. The degree of error can now be read directly from the 'Kilocycles' scale (see Appendix 'A,' page 37).

Once this check has been carried out, any error which may be present can be allowed for when tuning to the required frequency. If the alignment is correct, scale error should not exceed one kilocycle and operators will quickly realise that scale checking is not essential when using the 880/2 except when really precise tuning is required. The Calibrator is switched off by moving the AGC switch to any of the other positions.

Adjust the RF, IF and AF Gain controls for a convenient level of signal or background noise and peak the Aerial Trimmer for maximum output. Set the Selectivity switch to a position appropriate to the mode of reception and interference conditions which prevail.

AM Reception

Place the Mode switch at ' AM ' and, having obtained the desired signal, make any re-adjustments as required. If impulse noise is troublesome the Noise Limiter switch can be placed in the ' On ' position. The Bass switch should be set to provide the desired audio response.

CW Reception

With the Mode switch at ' CW,' set the BFO (' Pitch ') control so that the index mark on the knob is at 12 o'clock and then tune the required signal to zero-beat. Swing the ' Pitch ' control to either side of zero to determine the best setting in relation to the interference present. Adjacent channel interference can now be reduced to a lower level by increasing the IF selectivity and also by bringing in the audio filter if interference is extremely severe.

It is recommended that operators adopt the technique detailed above since this will preclude any possibility of incorrect tuning due to the signal inversion which occurs on certain ranges (see ' Circuit Description '). Setting initially for zero-beat will eliminate the possibility of operators listening to the weaker of two beat signals.

SSB Reception

Unless the incoming signal is of a level greater than about 5uV it will be necessary to make initial tuning adjustments, not by reference to the tuning meter, but by ear with the AGC switched off. This is because the ' Fast ' AGC position (which can be used to provide a meter indication on stronger signals) has too great a delay to give a usable indication on weaker signals. In the ' SSB ' position of the AGC switch the delay is reduced but at the same time the AGC time constant is increased.

The Selectivity switch should be set to ' CRYSTAL 2 ' if Crystal ' C ' (3 kc/s) is fitted in this position but otherwise set to ' NARROW.' The RF and AF Gains are now fully advanced and control of the signal level is by means of the IF Gain. An adequate range of control adjustment will be found on all but the extremely strong signals when the control range of the IF Gain can be supplemented by adjustment of the RF Gain.

Place the Mode switch at ' AM ' and tune on the Main Tuning control for maximum ' garbled ' output. Now move the Mode switch in turn to the UPPER and LOWER ' SSB ' positions : note the position that produces the greatest intelligibility and leave the switch in this position. This check is of course unnecessary if the transmitted sideband is known beforehand.

If the initial tuning adjustment has been made fairly carefully it will be found possible to completely resolve the signal by adjustment of the Fine Tuning control. Inability to achieve this end is an indication that the correct tuning point is outside the range of the Fine control and this will call for a further slight adjustment of the Main Tuning.

Once the signal has been tuned to give natural sounding speech, the AGC switch can be set to ' SSB ' and the IF (and RF) Gain(s) fully advanced to secure maximum AGC action. The Monitor output can be set to the desired level by adjustment of the AF Gain.

It should be noted that it is possible for the audio filter to be in circuit in the ' SSB ' positions of the Mode switch. A check should be made to see that the filter is switched ' Out ' before attempting to tune SSB signals.

Adjustment of Line Level

When the 880/2 is used in a remote installation, adjustment of ' signal-to-line ' should be made in conjunction with the normal line monitoring system. The Line Level control is conveniently located on the front panel and is adjustable with a small screwdriver.

Adjustments made to the Monitor Channel AF Gain do not affect the line level.

Adjustment of the Meter Zero

The Carrier Level Meter is only operative when the AGC is ' On.' To zero the meter, merely take the AGC out of operation and set the meter needle to the ' O ' mark on the meter scale by using the Meter Zero control which is located adjacent to the Line Level control on the front panel.

The meter calibration is arbitrary in equal divisions 0 — 10.

MAINTENANCE

GENERAL

The Model 880/2 is suitable for continuous operation in all areas under extreme climatic conditions and should require very little in the way of maintenance over long periods of use.

As with any piece of electronic equipment, periodic dust removal should be carried out, taking care not to disturb any of the pre-set adjustments.

All switches used in the receiver are of the self-cleaning type and should therefore require no attention. All moving parts are lubricated with a permanent lubricant (molybdenum disulphide) so that regular lubrication is entirely unnecessary. If after the equipment has been in use for a considerable period of time, it is felt that additional lubrication is necessary, this can be carried out with any light mineral oil suitable for the temperature conditions under which the receiver is operated.

External connections, especially telephone leads should be checked from time to time to ensure complete serviceability.

DIAL LAMP REPLACEMENT

The two dial lamps (festoon type) are located on the underside of the drive cover and are readily accessible for ease of replacement.

In the case of a table mounted installation, all that is necessary is to release the two 'Oddie' fasteners at the rear, take off the top cover and then remove the drive cover by taking out the two retaining screws. The drive cover should be lifted carefully to avoid damage to the dial lamp supply connector which must be unplugged to allow complete removal of the cover.

To change a bulb, merely ease back one of the spring contacts, slip out the faulty bulb and fit the replacement.

The procedure is the same in the case of a rack mounted unit except that removal of the top cover is not necessary if the drive cover is tilted whilst being removed.

6V 3W 'Festoon' bulbs should be used as spares.

FUSE REPLACEMENT

The fuse (FS1) fitted in the Model 880/2 lies in the live mains input lead so that failure will result in complete loss of power to the receiver.

A faulty fuse can be changed by unscrewing the fuse holder located at the rear of the receiver (L.H.S.). A 1·5A cartridge type fuse should be used as a replacement and two of these are provided in clips located on the platform cover.

If the replacement fuse blows immediately the receiver is switched on, or fuses burn out regularly over short periods of operation, checks should be made to ascertain the cause.

VALVE REPLACEMENT

Of the valves visible on removing the top cover, all except the two output valves can be removed without using an extraction tool. These two valves (V19 and V20) can be taken out quite easily with a suitable extraction tool.

Replacement of the valves in the two Local Oscillator Units is a little more involved but should present no difficulty if the instructions given below are carefully followed. The wired-in diode (V14), which is located beneath the IF chassis is accessible when the cover is removed.

Replacement of V6 and V7. (1st Local Oscillator Unit)

NOTE : In the case of table models, before proceeding as below, it is necessary to remove the shaped side cover to gain access to the alignment plate. Slacken off the three 2BA screws at the rear of the cover and the two ¼" BSF 'Allen' types situated behind the panel handle. The cover is provided with slots which locate with the fixing points and allow it to be lifted clear without removing the screws completely.

Remove the alignment plate in the right-hand side plate by taking out the single screw and sliding towards the rear of the receiver.

Now take out the seven 6BA screws and remove the outer cover of the double screened box by sliding out from under the flange at the lower edge. This will reveal the inner cover which can be removed in the same way.

Once the inner cover has been removed, the turret lugs to which the valve connections are soldered will be clearly visible. V6 is above V7 when the crystals lie to the left of the valve positions (see Fig. 9).

A faulty valve can easily be removed by unsoldering the connections to the turret lugs and withdrawing the valve from its clip.

When fitting replacement valves of this type (EF732), soldered connections must at be least 5mm from the glass seal and should be made using a thermal shunt. Bends in the lead-out wires must be at least 1·5 mm from the glass seals. Orientation of the lead-out wires should be checked before removing the faulty valve. Valve connections for the EF732 are as follows :—

1. G1	5. A
2. K, G3	6. H
3. H	7. G2
4. K, G3	8. K, G3

When the replacement has been soldered in position, the receiver should be checked before replacing the unit covers, alignment plate, etc.

If V7 is changed it will call for re-alignment of the output coils but V6 can be changed without the need for re-alignment of the crystals.

Replacement of V8 and V9. (2nd Local Oscillator Unit)

Access to V8 and V9 is from the top of the 2nd Local Oscillator Unit, this being the upper of the two double screened boxes at the right-hand side of the receiver.

First remove the four screws which secure the outer cover. Some resistance will be felt in lifting the cover away from the unit and this is due to the sprung earthing strip along the inside edges.

Two inner covers will now be visible, one being hinged at the centre where the two covers meet. This hinged cover can only be lifted by removing the two screws securing the strip carrying the feed-through capacitors and taking off the ' push-fit ' front cover. V8 is located beneath the front cover and V9 beneath the hinged cover. When lifting the rear cover, remove PL3 from SKT5 and feed the coaxial output lead through the hole in the left-hand side of the outer box and the hole in the inner cover so that the cable receives no strain when the cover is lifted.

Both V8 and V9 (see Fig. 8) are secured by means of retaining clips and these should be carefully replaced whenever a valve is changed.

In replacing the covers, do not omit to replace the two screws holding the feed-through strip and ensure that the edges of the outer cover and front inner cover which carry no earthing strip are towards the rear of the receiver.

If V8 is replaced a check should be made of the calibration accuracy. Refer to the Section dealing with ' Re-alignment ' if adjustment should prove necessary.

NOTE : Care should be taken when working on either of the Oscillator Units not to drop screws or other metallic objects into the gaps between the inner and outer boxes. Such items of hardware if left in place would almost certainly short circuit the inner and outer screening boxes and impair their screening properties.

Replacement of V14

This is a sub-miniature wired-in type and is located on the underside of the IF/AF chassis (see Fig. 7).

It is necessary to remove the bottom cover to gain access to V14. Proceed as follows :—

1. Place the receiver with its lower side uppermost and remove the twelve 2BA screws which hold the bottom cover in place.
2. The cover can now be lifted clear and V14 located by reference to Fig. 7.

Replacement of the 6489 used in this position is quite straightforward, connections are as follows and the same precautions mentioned in relation to V6 and V7 apply also to this type of valve.

1. H	4. H
2. A	5. A
3. K	

CHANGING CRYSTALS

The two dual crystals (XL1 and XL2) used in the bandpass filters are standard envelope types on B7G type bases. When replacements are fitted it is most important to replace the screening cans and to ensure that the crystal unit with the closest crystal spacing is inserted in the left-hand socket (receiver viewed from front — see Fig. 7).

Re-alignment of the crystal coil and phasing capacitor will be required when crystal units are changed.

The ten crystals (XL3—XL12) employed in the 1st Local Oscillator Unit are standard Style ' D ' units. They are positioned in two rows of five crystals to the left of V6 and V7 (see Fig. 9). Correct positions for the crystals are as follows :—

Top row, reading from left to right (all frequencies in Mc/s).

17 — 13 — 11 — 16 — 14

Bottom row.

5 — 6 — 8 — 10 — 12

It is most unlikely that these crystals would ever need changing, but should it prove necessary, reference should be made to the ' Section ' dealing with ' Re-alignment.'

REMOVING THE CRYSTAL CALIBRATOR UNIT AND RF COVER

The Calibrator Unit is located on top of the RF cover (left-hand side) and is held in place by four long 4BA cheesehead screws. The B7G connector should be

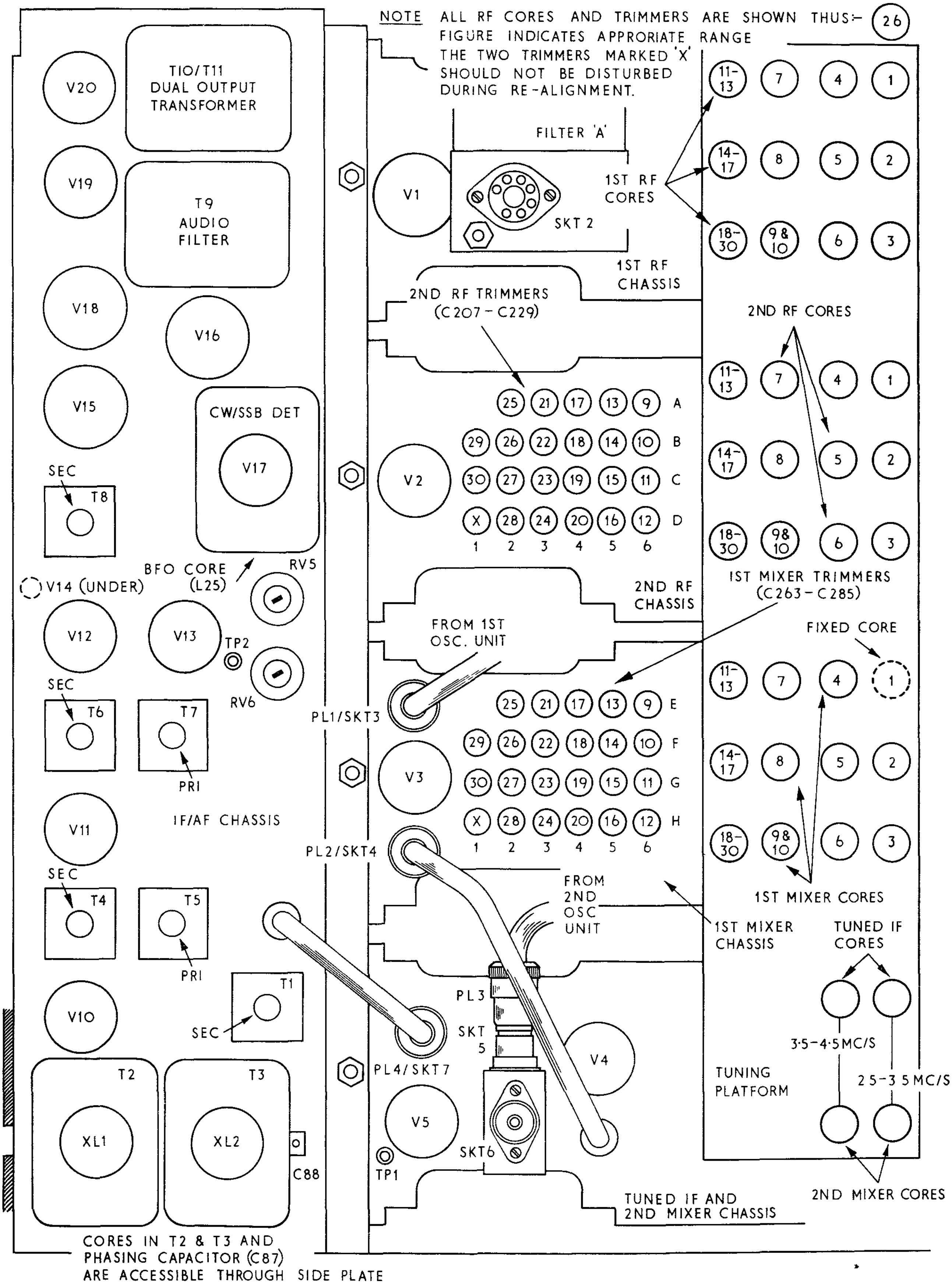


Fig. 7. Part top view showing location of major components and all RF/IF Trimming Adjustments.

unplugged from SKT2 before taking out the retaining screws.

It should be noted that removal of the RF cover can be accomplished without removing the Calibrator Unit. The B7G connector is unplugged and nine 4BA pan head screws removed to allow the RF cover (complete with Calibrator) to be lifted clear. Slots are provided in the sides of the cover to accommodate the various cables which enter the RF Section from the other units.

REMOVING THE TUNING PLATFORM

First remove the RF cover (complete with Calibrator) and disconnect the two oscillator output leads at their sockets on the central chassis assembly.

The tuning platform is attached by means of ' C ' washers to four ' carrier bushes ' which are fitted on the four threaded rods driven by the helical gear mechanism. To release the platform, first set the Main Tuning control to centre scale and then remove the four ' C ' washers. Underneath each will be found a plain washer and a spring washer. These should be carefully removed and stored along with the ' C ' washers in a safe place until required for replacement.

The platform can now be lifted clear, taking care not to exert any lateral strain which could distort the core support rods. It is suggested that the platform be placed on blocks to avoid the possibility of damage to the core assembly while the platform is out of the set.

If the platform is to be out of position for any length of time (as for example in the case of removing one of the central chassis) it is recommended that the ' carrier bushes ' are secured to the threaded rods so that their relative positions are not disturbed. Small pieces of adhesive tape can be used for the purpose but a check should be made that no deposit of foreign matter is left on the threads when the tape is removed. If for any reason, the initial settings are lost, the carrier bushes can be re-positioned by checking the height of the top of the threaded rods above the platform. The measurement should be made from the two small plates on top of the platform and should be $\frac{7}{8}''$ when the tuning is set to centre scale. Great care should be taken to see that all bushes are at the same relative height since any slight error will distort the platform and increase the loading on the tuning control.

Once the relative heights of the ' carrier bushes ' are correct, secure the platform by means of the appropriate washers. In replacing these, remember that the spring washer goes on first, followed by the plain washer and then the ' C ' washer.

A final check should now be made on the depth of penetration of certain cores associated with the permeability tuning system. Actual measurements are given on Page 35 (Table 7) and it will be noted that the cores in question are not used for alignment in the normal way since they are associated with certain coils which are employed on more than one range (i.e. alignment is by means of the appropriate trimmers).

CLEANING THE DIAL GLASS AND SCALE PLATE

The dial glass can be removed by taking out the four ' Phillips ' retaining screws at the corners of the dial escutcheon. The window is best cleaned by using one of the various domestic cleaning products which are specially designed for this purpose. Care should be taken not to ' finger-mark ' the inside of the glass after cleaning.

The scale plate can be cleaned by dusting lightly with a soft lint-free cloth which has been very slightly moistened with warm water. A final rub over with a dry cloth will remove all traces of moisture before the dial glass is replaced.

DRIVE CORD REPLACEMENT

In the unlikely case of the pointer drive cord either breaking or slipping from the pulley grooves, the precedure outlined below should be adopted in ' re-stringing.' If the cord is unbroken it may be possible to replace it correctly without removing the panel. Relevant information can be extracted from the instructions which follow.

1. Remove the top cover, drive cover and bottom cover.

*2. Slacken the four $\frac{1}{4}''$ BSF ' Allen ' screws which are located behind the panel handles. Remove the shaped side covers.

*3. Remove ' Allen ' screws completely and take off the panel escutcheon.

4. Remove the finger plate by proceeding as follows :
   - (i) Remove all control knobs.
   - (ii) Remove all switch rings and any control nuts for which no clearance is provided in the finger plate. Remove the meter after disconnecting the leads at the rear.
   - (iii) Take out the four ' Phillips ' screws at the corners of the dial escutcheon so that this can be removed complete with the glass window.
   - (iv) Remove both panel handles.
   - (v) The finger plate is now free and can be lifted away from the front panel.

* Table Model only.

5. Locate the flexible coupler which joins the two extension spindles for the Aerial Trimmer control. Slacken the two screws which secure the coupler to the shorter of the two spindles.
6. Unplug the six connectors situated at the rear of the lower edge of the panel.
7. Free the Mains switch from its fixing hole and position it clear of the panel.
8. Take out the six panel retaining screws and remove the panel.
9. Remove the scale plate and right-hand wavechange dial to reveal the complete drive cord mechanism.
10. Remove the old drive cord.
11. Turn the Main Tuning control to its fully clockwise position (end of rotation).
12. Secure the new cord to the left-hand drive pulley (8BA screw) ; press cord into pulley slot and wind approximately four turns in an anti-clockwise direction.
13. Take the cord across to the left-hand guide pulley ; pass cord under pulley, clockwise round pulley and across towards jockey pulley at right-hand side.
14. Pass cord over and clockwise round jockey pulley and back across towards right-hand drive pulley.
15. Press cord into pulley groove, wind approximately one turn anti-clockwise, press into slot and secure to 8BA screw.

NOTE : Sufficient tension should be applied to the cord in operations 14 and 15 above to cause the jockey pulley to take up a position slightly to the right of vertical.

16. Operate drive over full traverse and check that cord runs smoothly in pulley grooves.
17. Replace right-hand wavechange dial and scale plate.
18. Turn Main Tuning control to fully clockwise position (end of rotation).
19. Fit pointer at right-hand end of scale in line with last calibration mark. Check for smooth and complete pointer travel.
20. Refit panel, covers, etc. by carrying out operations 1 — 8 in reverse.

FAULT LOCATION

Faults falling in the categories ' loss of output,' ' low sensitivity ' and in some cases ' faults of an intermittent nature ' may be localised by application of straightforward signal tracing techniques. The sectional construction of the 880/2 makes it an ideal subject for this type of fault location.

The Audio Section for example can be checked by introducing an AF signal at JK1. Output can be checked on both Line and Monitor channels and the operation of the Bass switch and Gain controls will be the same as with a normal signal derived from one of the two detectors.

The Mode switch must be set to ' AM ' to carry out this simple test which will give an immediate indication of the serviceability of the audio stages which include V16B. An input of approximately 7mV (1,000 c/s) at JK1 should give an output of 50mW across the 2·5 ohm terminals when the AF Gain is set to maximum and the Bass switch at Max Bass. Under the same conditions and with the same input, the output across the 600 ohm terminals will be of the order 1mW (Line Level at maximum).

Lack of output in any one position of the Mode switch will give an obvious indication of the stage or stages which is/are faulty. If, for example, output is non-existent in the ' AM ' position, suspect the Mode switch wafer S5d and the circuitry associated with V13A, V14 and V16B. The diode (V13A) can be checked by placing the N.L. switch to ' Off.' V16B can be excluded if the audio section is known to be functioning normally with a signal introduced at JK1.

If the receiver functions normally in the ' AM ' and ' CW ' positions but fails to operate in both ' SSB ' positions, the fault will be in the Mode switching or the Range switch wafer S1r or alternatively may be caused by lack of HT3 to the divider networks which feed the capacity diode D1. Failure to operate in just one of the ' SSB ' positions may be due to a fault in the Mode switching (including S1r) or may be due to the appropriate potentiometer providing the wrong control voltage for the diode D1.

When operation is normal in the ' AM ' and ' SSB ' positions but no output is obtained when switched to ' CW,' suspect lack of HT3 to the BFO (pitch) potentiometer RV7 or an open circuit in the Mode switching (including S1r).

The CW/SSB Detector Unit as a whole can be suspected if operation is normal on ' AM ' but no output is obtained in the ' CW ' and ' SSB ' positions.

The complete 2nd IF Section (including the 2nd Mixer, V5) can be checked by introducing a modulated 500 kc/s signal at TP1 (adjacent to V5 — see Fig. 7). The sensitivity should be of the order 1uV for an output of 50mW at the 2·5 ohm terminals (Bass switch and IF/AF Gains at maximum, AGC and NL off).

The Tuned IF Section can be checked in a similar manner with a suitable signal injected at SKT3. The 1st Local Oscillator output is disconnected for this test and it is important to note that the ' live ' generator lead must be isolated by means of a small 0·01 mfd capacitor to prevent DC appearing across the attenuator. The receiver should be tuned to the megacycle point at the centre of both an odd and an even range with the generator tuned to 3 Mc/s and 4 Mc/s respectively. The sensitivity should be of the order 5uV for an output of 50mW (2·5 ohm terminals).

If an output is obtained with a 500 kc/s signal introduced at TP1 but no output is available with a suitable signal introduced at SKT3, the fault may be in the 2nd Local Oscillator Unit. This can be verified by removing PL3 and, with the receiver aerial connected, introducing at either SKT5 or SKT6 a ' substitute ' oscillator signal from a signal generator. Some 100mV will be required and the generator output impedance should be low (75 ohms). Tune the receiver to any frequency and swing the generator tuning over the 3·0 — 4·0 Mc/s range. If normal reception is possible when the generator is tuned in step with the receiver tuning, it is a clear indication that the fault lies in the 2nd Local Oscillator Unit.

NOTE : Remember that the 2nd Local Oscillator tunes in the reverse direction to the RF tuning (except Ranges 3 and 4).

A similar test can be carried out at SKT3 if the 1st Local Oscillator Unit is suspected, but will require a greater level of injection voltage (upwards of 500mV). The generator output should be blocked with a 0·01 mfd capacitor when connecting to SKT3.

Assuming that the Tuned IF Section is functioning normally but that signals are not received with a substitute oscillator signal at SKT3, then the fault will be found in the circuitry associated with V1 and V2. Removing the rear cover on the underside of the RF Section will allow access to the base connections of V1 and V2 so that checks can be made at each grid in turn. Once the point at which the signal is lost has been located, normal servicing techniques — voltage checks, valve substitution, etc. — can be adopted to locate the actual fault. A Table of Voltage Values will be found at the rear of the Manual in Appendix ' C.'

Before anticipating any of the stage faults detailed above, always check that the inter-unit connectors are properly mated and that the various links (including those in PL6) are correctly made. A careful visual check of the wiring will sometimes reveal a broken or shorting lead and save considerable time in fault location. The diagram showing ' Inter-unit Connections ' (at rear of Manual) will prove helpful in tracing specific leads in the various cable forms which link the different units.

RE-ALIGNMENT

General

Although of more complex design than the average general purpose communications receiver, neither the initial factory alignment of the 880/2 nor any subsequent re-alignment can be classed as involved. In point of fact, the RF alignment is made comparatively simple by virtue of the double conversion system employed. Tracking problems are virtually non-existent because once the 2nd Local Oscillator has been set to cover its fixed range of 2·9 — 4·1 Mc/s, it only remains for the 1st Local Oscillator crystals to be zeroed correctly to guarantee accurate calibration on each and every one of the thirty ranges. It should be noted that no specialised equipment is required to re-align the local oscillators. Alignment can be carried out by using the internal Calibrator after this has been standardised against a standard frequency transmission.

IF alignment is quite straightforward and the service engineer or mechanic should not be deterred by the number of tuned circuits which are involved. No complicated stagger tuning sequences are required and although a sweep generator may be useful it is not essential since a complete re-alignment is easily carried out with a standard signal generator.

Valves in most stages can be replaced without the need for re-alignment. Exceptions to this rule are V7 (1st Local Oscillator Unit) and V8 (2nd Local Oscillator Unit). Replacement of V7 may call for slight re-alignment of the output coils (L70 — L85). If V8 is replaced, first check the dial calibration against the internal Calibrator. If the calibration is correct, then no adjustment will be required, but otherwise it will be necessary to re-adjust C55 slightly to compensate for any small change in valve capacity.

Alignment of the low pass Filters ' A ' — ' D ' will not be required and these are sealed to prevent adjustment. Filter ' E ' is unsealed but should not be touched during re-alignment.

Suitably qualified personnel provided with an adequate range of test equipment should experience no difficulty in carrying out re-alignment of this receiver if the instructions given in this Section are followed carefully. The appropriate test equipment is listed below the heading of each sub-section. Three trimming tools are provided with the receiver.

Re-alignment of the 500 kc/s IF Amplifiers

Test equipment required.

Sweep Generator capable of producing a centre sweep frequency of 500 kc/s together with a suitable Oscilloscope.

or : Standard Signal Generator covering 500 kc/s and a Valve Voltmeter (3 — 5V f.s.d.).
Neosid H.S.1. Trimming tool.
Screwdriver Trimming tool.
Small Tommy-bar (5/64″ dia.).

Re-alignment of this Section of the receiver can be carried out either with a standard signal generator or alternatively by using a sweep generator and oscilloscope. Both methods will be described in full on the assumption that the amplifier is not so far out of alignment that it is necessary to apply the generator to each stage in turn. The following information is applicable to either method.

1. In adjusting the IF transformers, it will be found that two points of resonance can be obtained with each core. The correct one to use is that which occurs when the core is furthest from the opposite coil. This is true with the exception of one winding only, namely the secondary (top) core of T8. This core must be set to the inner peak.
2. All cores are provided with hexagonal bores which run completely through their centres. This allows adjustment of the lower core from the top side of the chassis when the special Neosid trimming tool (Type H.S.1.) is used. This tool has a shank of reduced diameter which makes it possible to pass one end of the tool right through the top core for adjustment of the lower core. Reference can be made to Fig. 7 for identification of primary and secondary windings. The lower core in each case is, of course, opposite to the one indicated. All cores are self-locking with rubber string and locking compound.
3. Access to the cores and crystal phasing capacitors in T2 and T3 is as follows :

   Both cores are in line with the lower of the two alignment holes in the left-hand side plate. The cores have the standard hexagonal bore and T3 is adjusted by passing the tool right through the core in T2.

   The phasing capacitor (C87) which is used in the ‘ CRYSTAL 1 ’ position is reached through the upper alignment hole. C88, the ‘ CRYSTAL 2 ’ phasing capacitor, has a small spindle sleeve which protrudes through the right-hand side of the screening can (see Fig. 7). The sleeve is provided with holes so that the capacitor can be adjusted with a small tommy bar.

   In the case of a table-mounting receiver it will be necessary to remove the shaped side cover to gain access to the alignment holes referred to above. This is achieved quite simply ; slacken the two 1/4″ BSF ‘ Allen ’ screws behind the left-hand panel handle and the three 2BA screws at the rear. The screws need not be removed completely because the cover is provided with clearance slots to allow speedy removal.

Sweep Generator Alignment

Switch on the receiver, sweep generator and oscilloscope and allow at least half-an-hour for the equipment to reach operating temperature. Set the receiver controls as follows :

Selectivity Switch	‘ CRYSTAL 1 ’
Mode Switch	‘ AM ’
IF Gain	‘ Maximum ’
Noise Limiter	‘ Off ’
AGC	‘ Off ’

Connect the sweep generator output lead to the Test Point (TP1) which is located close to the 2nd Mixer Stage, V5. It will be necessary to remove the RF cover to make connection to TP1, the location of which is shown in Fig. 7. Reference to the Main Circuit Diagram will show that the generator output is applied direct to the grid of V5 and it is suggested that this stage is operated as a straight amplifier by taking out PL3 to isolate the injection from the 2nd Local Oscillator Unit. Operation of the stage in this manner will prevent spurious beats due to any harmonic content in the generator output mixing with the oscillator and appearing on the display trace.

A further Test Point (TP2) is provided for ease of connection from the diode load (R75) to the Oscilloscope ‘ Y ’ plate amplifier. TP2 is located close to V13 (see Fig. 7) and a screened lead should be used to make connection to it.

With the generator set to the lowest convenient sweep rate and centred on the IF passband, adjust all IF transformers commencing at the primary of T1 and working through to T8 secondary. All cores should be adjusted for greatest height of the display and no attempt should be made to correct for any asymmetry which may be present. A fairly symmetrical response usually indicates that the phasing capacitor (C87) is set correctly, but if this is not the case, then a minor side lobe will be observed on the side of the response. Adjustment of C87 will affect the position at which the side lobe occurs and the clarity with which this can be observed will be dependent entirely on the sweep rate employed. It will be found that one setting of C87 will produce a response which is devoid of all trace of side lobe. This is the correct setting for C87 and under these conditions the response should be reasonably symmetrical.

Once the alignment is correct in the ‘ CRYSTAL 1 ’ position, move to ‘ CRYSTAL 2 ’ and observe the display on the c.r.t. As before, correct alignment of the phasing capacitor (in this case, C88) will be evident by the absence of the minor lobe. If a side lobe is present, proceed as before and eliminate same by adjustment of C88. The core in T3 should now be peaked to flatten the nose of the response so that the trough is reduced to its lowest proportions.

Adjustment of T3 may call for a slight change in the setting of C88 but the interaction is so slight that once C88 has been re-adjusted, only a minor re-adjustment of the core will be required.

Now check the response in the other positions of the Selectivity switch. It is most unlikely that there will be any serious asymmetry in the 'NARROW' and 'INTERMEDIATE' positions but in the 'BROAD' position it may prove necessary to adjust the secondary core of T8 (and possibly T1) to produce an evenly balanced 'top.' The adjustment calls for a very small change in the core position and can be made without upsetting the response in the other positions.

Alignment with a Standard Signal Generator

NOTE: In the following instructions it is assumed that the receiver is fitted with Crystals 'A' and 'C' in the 'CRYSTAL 1' and 'CRYSTAL 2' positions. When dealing with a receiver which has Crystal 'B' fitted in the 'CRYSTAL 1' position, greater care will be necessary in setting initially to the dead centre of the IF response.

Adjustments are best made with an unmodulated carrier using a valve voltmeter connected to the IF Output socket as an indicating device. If a valve voltmeter is not available, the built-in Carrier Level meter can be used but the indication will not be as clear as with the external meter. The AGC must be in operation when using the internal meter and it should be appreciated that adjustment of T8 secondary will give a dip not a rise in the meter reading since the AGC diode is fed direct from the anode of V12.

The receiver, generator and valve voltmeter should be switched on and allowed at least half-an-hour to reach operating temperature. The generator should be of known stability to avoid confusion due to frequency drift. Receiver controls should be set as follows:

Selectivity Switch ..	'CRYSTAL 1'
Mode Switch ..	'AM'
IF Gain	'Maximum'
Noise Limiter ..	'Off'
AGC	'Off' ('On' if using built-in Carrier Level meter).

The signal generator should be tuned to approximately 500 kc/s with its output lead connected at TP1 (see Fig. 7). Set the valve voltmeter to a suitable range (3 — 5V f.s.d.) and carefully tune the generator (modulation off) across the passband. Observe the output on the valve voltmeter and set the generator to the peak reading. The peak will be extremely sharp and it is doubtful whether the individual crystal peaks will be seen if the alignment is reasonably correct or the generator tuning rate fairly fast.

Now adjust all IF transformer cores, starting at the primary of T1 and working through to T8 secondary. Remember that T8 secondary is set to the inner of the two peaks. All cores should be adjusted for maximum reading on the valve voltmeter, the output being held at about 1·5V by means of the attenuator on the generator.

Once the circuits have been peaked to the centre of the two crystals, detune the generator and again tune very slowly through the IF passband. Careful tuning may reveal a minor lobe on the side of the response and this is an indication that adjustment of the crystal phasing capacitor (C87) is required. If there is no minor lobe, C87 should be left well alone, but if adjustment is required then proceed as follows:

Detune the generator 3 kc/s to either side of the centre frequency and note the increase in generator output required to give the same reading on the valve voltmeter (or Carrier Level meter) as was obtained at the centre frequency. C87 should be adjusted until a point is found where an equal increase is required on either side. Now check the entire response by tuning the generator very slowly through the IF passband. If no trace of side lobe can be found then C87 is set correctly and no further alignment of the filter is required.

Now switch to 'CRYSTAL 2' and carefully set the generator tuning to the centre of the two crystal peaks. Adjust the core in T3 for greatest reading on the valve voltmeter. Detune by equal amounts as before and adjust C88 if necessary in the same manner as C87. T3 may require very slight re-adjustment after adjusting C88.

A check should now be carried out on the symmetry of the response in the other positions of the Selectivity switch. It is most unlikely that there will be any serious asymmetry in the 'NARROW' and 'INTERMEDIATE' positions but in the 'BROAD' position it may prove necessary to adjust the secondary core of T8 (and possibly T1) to produce an evenly balanced 'top.' The adjustment calls for a very small change in the core position and can be made without upsetting the response in the other selectivity positions.

Checking IF Sensitivity

Test equipment required.

Standard Signal Generator covering 500 kc/s and an Output Meter matched to 2·5/3 ohms.

Connect the output of the generator at TP1 and the output meter to the external speaker terminals at the rear of the receiver. Set the receiver controls as follows:

Selectivity Switch	'NARROW'
Mode Switch	'AM'
Noise Limiter and AGC ..	'Off'
IF and AF Gains	'Maximum'
Bass Switch	'Max Bass'

Tune the signal generator to the centre of the IF passband (modulation 30% at 400 c/s) and adjust the attenuator for a reading of 50mW on the output meter. The IF sensitivity is such that an input of approximately 1uV is required for this output. If the sensitivity appears to be low, stage by stage checks can be made with the generator connected direct to the grid of V12 (pin 1) and via the grid capacitors C94 and C102 for V10 and V11 respectively. The following figures are given for guidance and are indicative of the average sensitivities likely to be obtained.

V10	.. ..	4uV for 50mW output.
V11	.. ..	60uV for 50mW output.
V12	.. ..	1·2mV for 50mW output.

Re-alignment of the BFO

Test equipment required: Standard Signal Generator covering 500 kc/s and Screwdriver trimming tool.

Place the Mode Switch at the ' AM ' position, Selectivity Switch at ' CRYSTAL 1 ' and, with the AGC ' On ' inject an unmodulated signal on 500 kc/s at TP1. Observe the Carrier Level meter and adjust the generator tuning for a peak reading on the meter.

Set the BFO (' Pitch ') control so that the white mark on the control knob is at 12 o'clock. Check that this setting occurs with the potentiometer at half-travel.

Now move the Mode Switch to the ' CW ' position and adjust L25 (see Fig. 7) for zero beat.

Once the adjustment is correct in the ' CW ' position, switch to ' SSB UPPER ' and place the Selectivity Switch in the ' NARROW ' position. Detune the generator 1·5 kc/s LF of the centre setting and adjust the pre-set potentiometer RV5 for zero beat.

Now switch to ' SSB LOWER ' and set the generator 1·5 kc/s HF of the centre setting. Adjust RV6 for zero beat.

The two pre-set potentiometers RV5 and RV6 are located on the IF/AF chassis and are marked ' U ' and ' L ' respectively. It should be noted that this marking is correct only when sideband inversion does not take place. Alignment should therefore be carried out with the Range switch at Range 4 or any ' odd ' range except 1 and 3.

Re-alignment of the 2nd Local Oscillator Unit

Test equipment required: Phillips trimming tool and long screwdriver type trimming tool.

This unit can be accurately re-aligned by using the calibration markers provided by the built-in Crystal Calibrator. The Calibrator must be standardised against a standard frequency transmission before commencing the alignment (see Appendix ' A ').

A period of at least half-an-hour (preferably an hour) should be allowed for the equipment to reach full

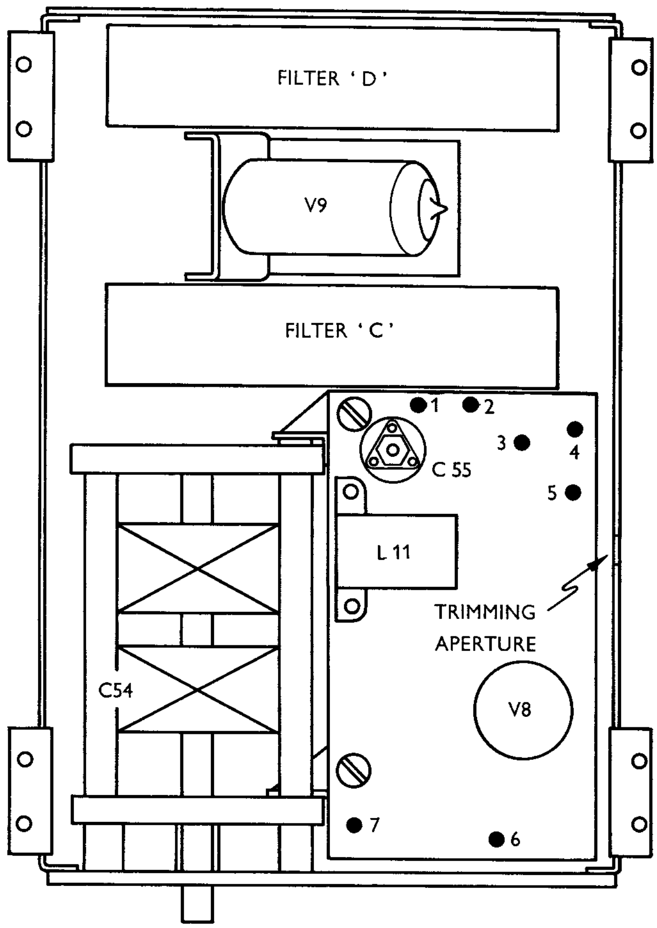


Fig. 8. Location of major components and trimming adjustments in 2nd Local Oscillator Unit.

operating temperature before standardising the Calibrator.

The alignment can be carried out on either Range 3 or Range 4 and though it is immaterial which of these two ranges is employed, it is convenient to place the Range switch at Range 3 so that specific frequencies can be referred to in the text which follows.

The location of the pre-set adjustments, C55 and L11 can be seen from Fig. 8. Access to the capacitor is by removing the outer top cover of the unit (4 screws) when the trimming aperture will be clearly visible in the inner cover. L11 is adjusted through a hole in the side plate and access to this hole will call for removal of the shaped side cover in the case of a table mounting receiver.

The receiver controls should be set as follows :

Fine Tuning	..	White index at 12 o'clock.
Mode Switch	..	' CW.'
BFO (' Pitch ')	..	White index at 12 o'clock.
Selectivity	..	' CRYSTAL 2.'
IF Gain ..	..	Adjust to provide suitable output.
AF Gain ..	..	Maximum.
AGC ..	..	Calibrate position (' C ').
Bass Switch	..	Max Bass.

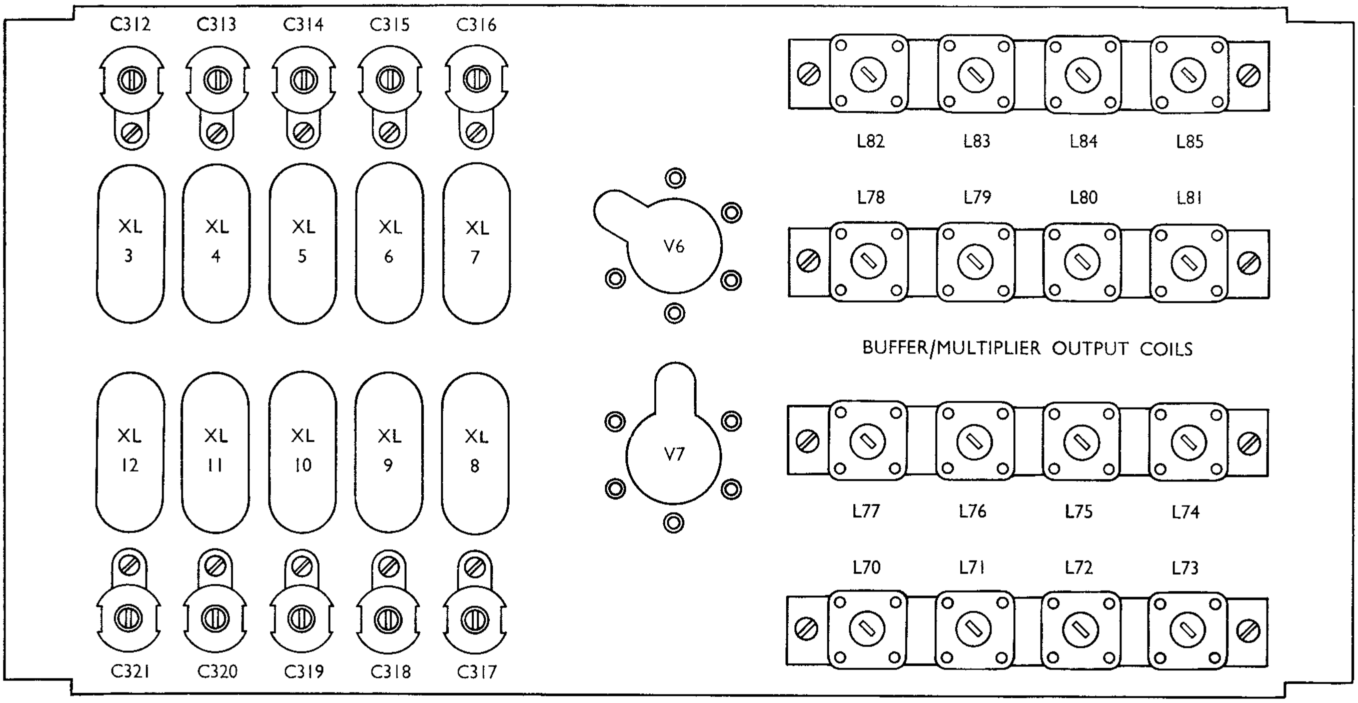


Fig. 9. Location of major components and trimming adjustments in 1st Local Oscillator Unit.

Set the Main Tuning control to precisely 3500 kc/s as indicated by the dial calibration. If the calibration is reasonably correct it should be possible to hear a beat note from the Calibrator signal. C55 should now be adjusted through the trimming aperture in the top cover so that the Calibrator signal falls to zero-beat. (C55 is adjusted with the Phillips type trimming tool).

Now set the Main Tuning at 2500 kc/s as indicated by the dial calibration. Adjust L11 through the trimming aperture in the side cover so that the Calibrator signal is at zero-beat.

Repeat the adjustment at 3500 kc/s and then check the 2500 kc/s point once again. If the re-adjustments have been of a minor nature (which will usually be the case) no further alignment will be called for at the 2500 kc/s point.

Now tune across the range and check that the dial accuracy is within 1 kilocycle at each of the other 100 kc/s points. The tuning capacitor has been carefully adjusted during manufacture to provide a straight-line-frequency characteristic and inability to meet the quoted accuracy (after setting the end points correctly) would indicate a fault in this component. If this should be the case, then it is best that the receiver is returned to the manufacturer so that the capacitor can be accurately re-tracked at the factory.

Re-alignment of the 1st Local Oscillator Unit

Test equipment required.

Signal Generator capable of tuning to 15·3 Mc/s, Valve Voltmeter and screwdriver trimming tools with medium and narrow blades.

Initial alignment of this unit calls for adjustment of all the pre-set capacitors (C312 — C321) which are used to ' zero ' the crystals accurately to their correct frequencies. It is doubtful whether it would be necessary to repeat this procedure in full in any subsequent re-alignment, but a rapid check can be carried out by making use of the internal Crystal Calibrator. This should first be checked against a standard frequency transmission to verify its accuracy (see Appendix ' A ').

NOTE : It is assumed that the 2nd Local Oscillator has been checked as detailed in the previous paragraphs.

Tune to zero-beat with any calibration marker on Range 3 or Range 4 and then (without touching the tuning) move the Range switch to each of the ranges listed in Table 5. If all the crystals are zeroed correctly, all the calibration markers will be at zero-beat. If a crystal is ' off ' frequency it will beat with the marker to produce an audible note, the frequency of which is a measure of the inaccuracy which is present.

Crystals can be zeroed quite easily (if necessary) by adjustment of the appropriate trimmer. Access to the trimmers is as detailed previously in this Section (see ' Replacement of V6 and V7 ').

Refer to Table 5 and note which trimmer requires adjustment. Identify the trimmer on Fig. 9 and then adjust for zero-beat against the Calibrator signal.

Changing the Buffer/Multiplier valve (V7) will probably necessitate readjustment of the cores in the output coils L70 — L85. The procedure is quite straightforward and the only equipment required is a valve voltmeter.

TABLE 5

Range	Trimmer	Range	Trimmer
1	C321	10	C316
2	C320	12	C315
5	C319	18	C314
6	C318	22	C313
8	C317	30	C312

Unplug PL1 from SKT3 and connect PL1 to the valve voltmeter (3V f.s.d.). Select the Ranges indicated in Table 6 and adjust the appropriate coils (see Fig. 9) for maximum reading on the meter.

TABLE 6

Range	Inductance	Range	Inductance
1	L70	16	L78
2	L71	18	L79
5	L72	20	L80
6	L73	22	L81
8	L74	24	L82
10	L75	26	L83
12	L76	28	L84
14	L77	30	L85

Now re-connect PL1 at SKT3 and tune the receiver to 14·7 Mc/s. Inject a modulated signal at the aerial socket on a frequency of 15·3 Mc/s, increasing the generator output until the signal is audible in the speaker. Remove the underside covers of the 1st Local Oscillator Unit to gain access to the rejector coil L86. Adjust this for maximum attenuation of the signal output. L77 will now require slight re-adjustment and it is suggested that alternate adjustment of L77 and L86 is carried out (adjusting both for minimum signal) until no further reduction in output is possible with either coil.

This completes the re-alignment procedure and the 1st Local Oscillator screening covers can now be replaced.

Re-alignment of the ‘Tuned’ IF Section

Test equipment required.

Signal Generator covering 3 Mc/s and 4 Mc/s, Output Meter matched to 2·5/3 ohms and small screwdriver type trimming tool.

Switch on the receiver and signal generator and allow at least half-an-hour for both to reach operating temperature. Remove PL1 from SKT3 and connect the output lead from the generator to SKT3. The live generator lead should be isolated with a 0·01 mfd capacitor.

With the receiver controls set as when checking the sensitivity of the 500 kc/s stages, and with the output meter connected to the 2·5 ohm terminals, select Range 3 and tune the receiver and signal generator to 3·0 Mc/s (generator modulated 30% at 400 c/s). Use a small screwdriver trimming tool to adjust the 2·5 — 3·5 Mc/s ‘Tuned’ IF and 2nd Mixer cores for maximum output. See Fig. 7 for the location of these trimming adjustments which are situated on the tuning platform.

Now alter the generator to 4·0 Mc/s and, without touching the receiver tuning, set the receiver Range switch to Range 4. This puts the receiver on 4 Mc/s and the 3·5 — 4·5 Mc/s cores should now be peaked for maximum output.

A sensitivity check can be carried out and should result in an output of 50mW for an input of the order 5uV (signal introduced at SKT3). Checks should be made at both alignment frequencies.

NOTE : The lower sensitivity at this point compared with that at TP1 is normal and is due mainly to the loss which occurs in Filter ‘B.’

Re-alignment of the RF Section (V1, V2 and V3)

Test equipment required.

Signal Generator covering the range 1 — 30 Mc/s, Output Meter matched to 2·5/3 ohms and a small screwdriver type trimming tool.

Re-alignment of the RF Section will normally be required, only if it has been necessary to change one of the coils associated with the permeability tuning system. If care is taken in replacing the tuning platform after changing a coil then re-alignment can be restricted to the new coil which has been fitted. If however, core positions are inadvertently disturbed while the platform is out of position then it would be advisable to carry out a complete re-alignment of the ‘Tuned’ IF and RF Sections of the receiver.

In this case, certain cores must be adjusted by actual measurement of the depth of penetration into the former. Reference should be made to Table 7. The measurement given is taken at the end of the coil remote from the tuning platform with the tuning control set to centre scale.

Fig. 7 shows the location of all trimming capacitors and cores applicable to alignment of the RF and ‘Tuned’ IF Stages and these are labelled for convenience not with the circuit reference number, but with the range to which they apply. Also shown is a grid reference system which simplifies location of the correct trimmer on the 2nd RF and 1st Mixer sub-chassis. On Fig. 7 locate the desired trimmer — say 2nd RF, Range 21 — and obtain the reference 'A — 3.' This same reference appears on the receiver sub-chassis and enables the correct trimmer to be located without error. On the tuning platform the range is indicated directly, no reference system being required.

The instructions given below are for complete re-alignment. No adjustments are necessary when a valve is replaced but partial alignment must be carried out should it be necessary to change a component associated with one of the tuned circuits. Such alignment calls only for adjustment of the particular circuit concerned and no further trimming should be attempted.

TABLE 7

Inductance	*'X'*
L33, 45 and 57	$1\frac{15}{16}''$
L32, 44 and 56	$1\frac{7}{8}''$
L31, 43 and 55	$2''$
L30, 42 and 54	$1\frac{7}{8}''$

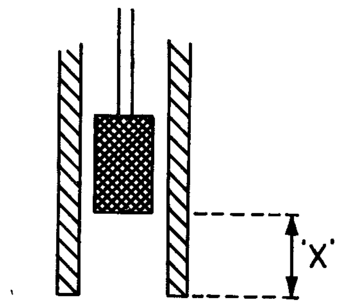


TABLE 8

Range	*Sig. Gen.*	*1st RF Stage*		*2nd RF Stage*		*1st Mixer Stage*	
		Trimmer	*Core*	*Trimmer*	*Core*	*Trimmer*	*Core*
1	1 Mc/s	NIL	L41	NIL	L53	NIL	L65*
2	2 Mc/s	NIL	L40	NIL	L52	NIL	L64
3	3 Mc/s	NIL	L39	NIL	L51	NIL	L63
4	4 Mc/s	NIL	L38	NIL	L50	NIL	L62
5	5 Mc/s	NIL	L37	NIL	L49	NIL	L61
6	6 Mc/s	NIL	L36	NIL	L48	NIL	L60
7	7 Mc/s	NIL	L35	NIL	L47	NIL	L59
8	8 Mc/s	NIL	L34	NIL	L46	NIL	L58
9	9 Mc/s	NIL	L33†	C229 (A6)	L45†	C285 (E6)	L57†
10	10 Mc/s	NIL		C228 (B6)		C284 (F6)	
11	11 Mc/s	NIL		C227 (C6)		C283 (G6)	
12	12 Mc/s	NIL	L32†	C226 (D6)	L44†	C282 (H6)	L56†
13	13 Mc/s	NIL		C225 (A5)		C281 (E5)	
14	14 Mc/s	NIL		C224 (B5)		C280 (F5)	
15	15 Mc/s	NIL	L31†	C223 (C5)	L43†	C279 (G5)	L55†
16	16 Mc/s	NIL		C222 (D5)		C278 (H5)	
17	17 Mc/s	NIL		C221 (A4)		C277 (E4)	
18	18 Mc/s	NIL		C220 (B4)		C276 (F4)	
19	19 Mc/s	NIL		C219 (C4)		C275 (G4)	
20	20 Mc/s	NIL		C218 (D4)		C274 (H4)	
21	21 Mc/s	NIL		C217 (A3)		C273 (E3)	
22	22 Mc/s	NIL		C216 (B3)		C272 (F3)	
23	23 Mc/s	NIL		C215 (C3)		C271 (G3)	
24	24 Mc/s	NIL	L30†	C214 (D3)	L42†	C270 (H3)	L54†
25	25 Mc/s	NIL		C213 (A2)		C269 (E2)	
26	26 Mc/s	NIL		C212 (B2)		C268 (F2)	
27	27 Mc/s	NIL		C211 (C2)		C267 (G2)	
28	28 Mc/s	NIL		C210 (D2)		C266 (H2)	
29	29 Mc/s	NIL		C209 (B1)		C265 (F1)	
30	30 Mc/s	NIL		C208 (C1)		C264 (G1)	

* This core is preset during initial alignment and will not require adjustment.

† These cores are adjusted by measurement of core position (see Table 7).

In carrying out complete re-alignment, first switch on the receiver and generator and allow at least half-an-hour for both to reach operating temperature. Connect a suitable Output Meter to the 2·5 ohm terminals and set the receiver controls as follows :

Selectivity Switch	'NARROW'
Mode Switch	'AM'
RF, IF and AF Gains ..	'Maximum'
AGC	'Off'
Noise Limiter	'Off'
Bass Switch	'Max Bass'

Connect the signal generator output lead to the receiver aerial socket (BNC plug) and set the tuning control so that the pointer lies on the 'megacycle point' at the centre of the scale. Check that the vernier (kilocycles) scale reads zero and once this has been set it should not be touched again throughout the complete alignment.

Set the generator modulation depth at 30% (400 c/s), select the receiver ranges and generator frequencies indicated in Table 8 and adjust the appropriate trimmers or cores for maximum output reading. The Aerial Trimmer (panel control) should be set at half-capacity when aligning Ranges 1 — 8 but on the other ranges its ability to resonate the input circuit indicates correct alignment of L30 — 33.

NOTE : The 2nd RF and 1st Mixer trimmers C207 and C263 (marked 'X' in Fig. 7) should not be touched when carrying out re-alignment. These trimmers are in circuit on all ranges and are used to balance circuit capacities during initial alignment of the receiver.

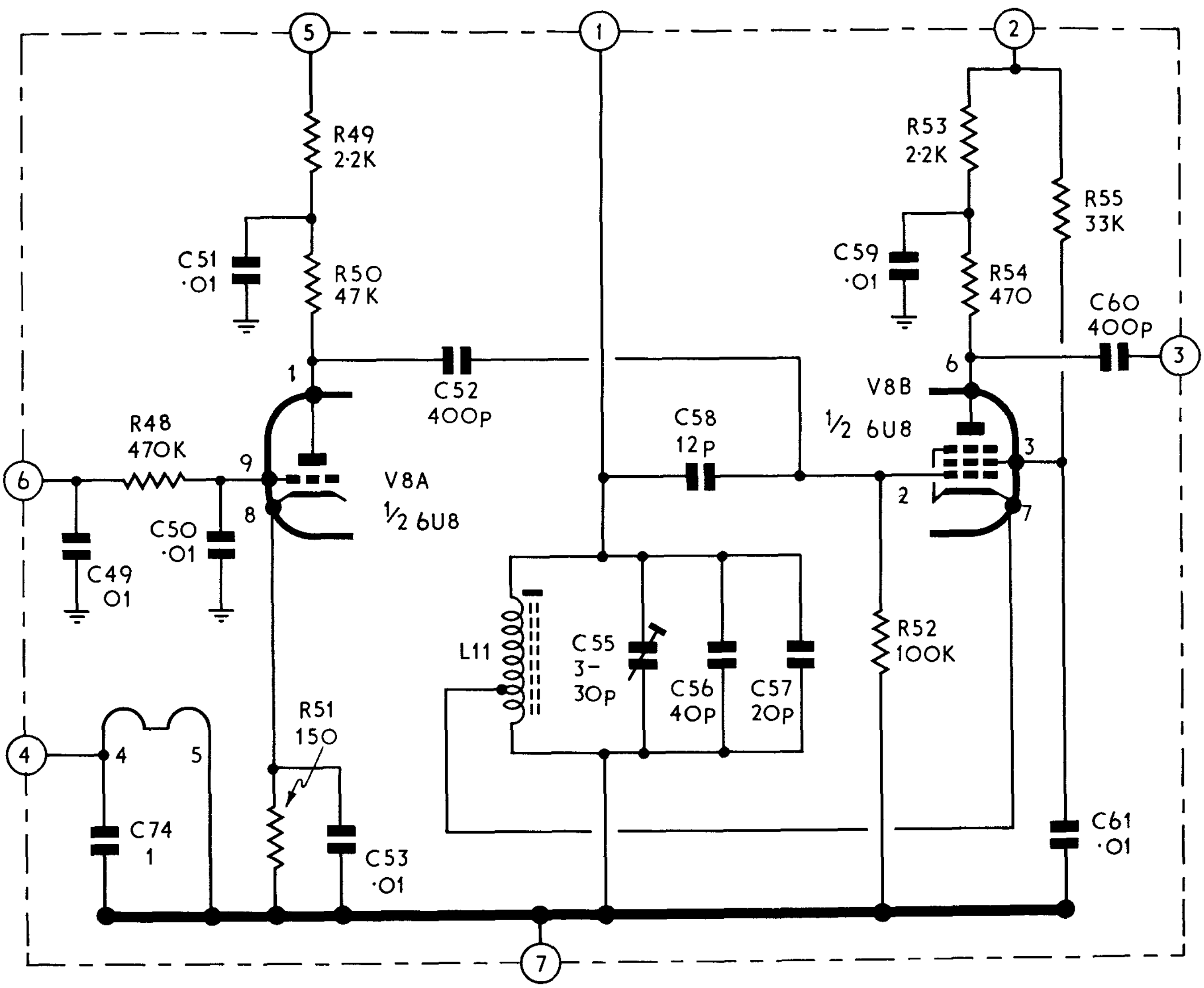


Fig. 10. Theoretical circuit of printed wiring board in 2nd Local Oscillator Unit

APPENDIX "A"

CRYSTAL CALIBRATOR UNIT

The built-in Calibrator Unit provides calibration markers at 100 kc/s intervals throughout the entire coverage of the receiver. The high stability of the 880/2 obviates the need for scale correction each time the receiver is tuned to a new frequency but at the same time it is convenient to have a means of rapidly checking the calibration accuracy so that re-alignment can be carried out immediately if any serious error is noted.

The unit employs a 100 kc/s crystal in a ' tuned-anode ' circuit in which the screen of a 6AU6 pentode is used as an anode. Harmonic output is taken from the anode circuit proper via a 10 pF blocking capacitor to pin 2 of SKT2 and thence via a 3 pF coupling capacitor to the anode of V1B.

Switching of the Calibrator is achieved by means of the AGC switch which has an additional position marked ' C.' In this position of the switch, S2a applies full HT1 to the Calibrator Unit via pin 4 of SKT2. Reduced HT is applied in the other position of the AGC switch to prevent cathode poisoning in the oscillator valve.

At the same time that HT is applied, a further section of the AGC switch (S2b) returns the cathodes of V1A and V2 direct to chassis via the 4,700 ohm resistor R16. This action takes the RF Gain control out of circuit and desensitises the RF Stages to prevent signal break-through whilst calibrating. The AGC is switched off by S2d when the Calibrator is in use.

The 100 kc/s crystal fitted in the Calibrator Unit is a close tolerance type in an evacuated envelope (B7G base). A small air spaced trimmer is connected across the crystal to permit minor adjustment of the crystal frequency when standardising the Calibrator against a standard frequency transmission (MSF, WWV, etc.).

The crystal should always be standardised before using the Calibrator to check scale accuracy. Although a close tolerance crystal is used, frequency change at the fundamental (100 kc/s) is considerably multiplied when calibrating at the higher frequencies in the tuning range.

To standardise the crystal, tune to the most convenient standard transmission, switch to ' CW ' and, with the BFO set to the centre of the IF passband, tune the signal to zero-beat. Now switch to ' calibrate ' (AGC switch to ' C '). If the crystal frequency is correct then the Calibrator signal will be at zero-beat. If not, adjust the small air trimmer (C3) which is accessible through a trimming aperture in the top of the Calibrator Unit (adjacent to the crystal holder). C3 should be set for zero-beat and under this condition the Calibrator is accurately standardised.

List of Calibrator Components

C1	0·01 mfd Tubular Paper ±20% 350V DC wkg.
C2	20 pF Silvered Mica ±10% 350V DC wkg.
C3	3 — 25 pF Air Spaced Trimmer.
C4	10 pF Tubular Ceramic ±10% 350V DC wkg.
R1	22,000 ohms ±10% ½ watt.
R2	0·27 Megohm ±10% ½ watt.
R3	1 Megohm ±10% ½ watt.
V1	6AU6 (CV2524).
XL1	100 kc/s crystal ±·005% (Style ' E ').

APPENDIX "B"

LIST OF COMPONENT VALUES, TOLERANCES AND RATINGS

Capacitors

Ref.	*Value*	*Type*	*Tol.*	*Wkg. Volts*
C1	30 pF	Silvered Mica	5%	350V
C2	140 pF	Silvered Mica	5%	350V
C3	30 pF	Silvered Mica	5%	350V
C4	100 pF	Silvered Mica	10%	350V
C5	0·05 mfd	Tubular Paper	20%	350V
C5a	3 pF	Tubular Ceramic	± ½ pF	350V
C6	0·05 mfd	Tubular Paper	20%	350V
C7	0·003 mfd	Tubular Paper	20%	250V
C8	0·05 mfd	Tubular Paper	20%	350V
C9	0·05 mfd	Tubular Paper	20%	350V
C10	100 pF	Silvered Mica	10%	350V
C11	0·05 mfd	Tubular Paper	20%	350V
C12	0·05 mfd	Tubular Paper	20%	350V
C13	0·05 mfd	Tubular Paper	20%	350V
C14	100 pF	Silvered Mica	10%	350V
C15	0·05 mfd	Tubular Paper	20%	350V
C16	400 pF	Silvered Mica	2%	350V
C17	0·05 mfd	Tubular Paper	20%	350V
C18	40 pF	Silvered Mica	5%	350V
C19	90 pF	Silvered Mica	5%	350V
C20	100 pF	Silvered Mica	5%	350V
C21	40 pF	Silvered Mica	5%	350V
C22	100 pF	Silvered Mica	10%	350V
C23	0·05 mfd	Tubular Paper	20%	350V
C24	0·05 mfd	Tubular Paper	20%	350V
C25	0·05 mfd	Tubular Paper	20%	350V
C26	100 pF	Silvered Mica	10%	350V
C27	0·05 mfd	Tubular Paper	20%	350V
C28	0·01 mfd	Tubular Paper	20%	150V
C29	1500 pF	Tubular Ceramic Feed Thru'	20%	350V
C30	1500 pF	Tubular Ceramic Feed Thru'	20%	350V
C31	0·01 mfd	Tubular Paper	20%	150V
C32	0·01 mfd	Tubular Paper	20%	150V
C33	3 pF	Tubular Ceramic	± ½ pF	350V
C34	800 pF	Silvered Mica	2%	350V
C35	1500 pF	Tubular Ceramic	20%	350V
C36	0·01 mfd	Tubular Paper	20%	150V
C37	100 pF	Silvered Mica	10%	350V
C38	0·01 mfd	Tubular Paper	20%	150V
C39	6 pF	Silvered Mica	± ½ pF	350V
C40	0·01 mfd	Tubular Paper	20%	150V
C41	0·01 mfd	Tubular Paper	20%	150V
C42	1500 pF	Tubular Ceramic	20%	350V
C43	1500 pF	Tubular Ceramic Feed Thru'	20%	350V
C44	1500 pF	Tubular Ceramic Feed Thru'	20%	350V

Capacitors—*continued*

Ref.	*Value*	*Type*	*Tol.*	*Wkg. Volts*
C45	1500 pF	Tubular Ceramic Feed Thru'	20%	350V
C46	1500 pF	Tubular Ceramic Feed Thru'	20%	350V
C47	1500 pF	Tubular Ceramic Feed Thru'	20%	350V
C48	1500 pF	Tubular Ceramic Feed Thru'	20%	350V
C49	0·01 mfd	Tubular Paper	20%	150V
C50	0·01 mfd	Tubular Paper	20%	150V
C51	0·01 mfd	Tubular Paper	20%	150V
C52	400 pF	Silvered Mica	5%	350V
C53	0·01 mfd	Tubular Paper	20%	150V
C54	15–150 pF	Air Spaced Variable	—	—
C55	3–30 pF	Air Spaced Trimmer	—	—
C56	40 pF	Silvered Mica	5%	350V
C57	20 pF	Tubular Ceramic (N.T.C.)	10%	350V
C58	12 pF	Silvered Mica	5%	350V
C59	0·01 mfd	Tubular Paper	20%	150V
C60	400 pF	Silvered Mica	5%	350V
C61	0·01 mfd	Tubular Paper	20%	150V
C62	40 pF	Silvered Mica	5%	350V
C63	100 pF	Silvered Mica	5%	350V
C64	130 pF	Silvered Mica	5%	350V
C65	40 pF	Silvered Mica	5%	350V
C66	1500 pF	Tubular Ceramic	20%	350V
C67	0·01 mfd	Tubular Paper	20%	350V
C68	0·01 mfd	Tubular Paper	20%	150V
C69	100 pF	Silvered Mica	10%	350V
C70	300 pF	Silvered Mica	5%	350V
C71	770 pF	Silvered Mica	5%	200V
C72	970 pF	Silvered Mica	5%	200V
C73	300 pF	Silvered Mica	5%	350V
C74	0·1 mfd	Disc Ceramic	—20% +80%	200V
C75	—	*Reference Not Allocated*	—	—
C76	0·01 mfd	Tubular Paper	20%	150V
C77	1500 pF	Tubular Ceramic Feed Thru'	20%	350V
C78	1500 pF	Tubular Ceramic Feed Thru'	20%	350V
C79	1500 pF	Tubular Ceramic Feed Thru'	20%	350V
C80	1500 pF	Tubular Ceramic Feed Thru'	20%	350V
C81	1500 pF	Tubular Ceramic Feed Thru'	20%	350V
C82	1500 pF	Tubular Ceramic Feed Thru'	20%	350V
C83	390 pF	Polystyrene	5%	125V
C84	0·05 mfd	Tubular Paper	20%	350V
C85	790 pF	Polystyrene	2%	125V
C86	790 pF	Polystyrene	2%	125V
C87	2–10 pF	Air Spaced Trimmer (Differential) ..	—	—
C88	2–10 pF	Air Spaced Trimmer (Differential) ..	—	—
C89	25 pF	Silvered Mica	10%	350V

Capacitors—*continued*

Ref.	*Value*	*Type*	*Tol.*	*Wkg. Volts*
C90	100 pF	Polystyrene	5%	125V
C91	20 pF	Silvered Mica	10%	350V
C92	100 pF	Polystyrene	5%	125V
C93	0·05 mfd	Tubular Paper	20%	350V
C94	100 pF	Silvered Mica	10%	350V
C95	0·05 mfd	Tubular Paper	20%	350V
C96	0·05 mfd	Tubular Paper	20%	350V
C97	390 pF	Polystyrene	5%	125V
C98	390 pF	Polystyrene	5%	125V
C99	390 pF	Polystyrene	5%	125V
C100	390 pF	Polystyrene	5%	125V
C101	0·05 mfd	Tubular Paper	20%	350V
C102	100 pF	Silvered Mica	10%	350V
C103	0·05 mfd	Tubular Paper	20%	350V
C104	0·05 mfd	Tubular Paper	20%	350V
C105	390 pF	Polystyrene	5%	125V
C106	390 pF	Polystyrene	5%	125V
C107	390 pF	Polystyrene	5%	125V
C108	390 pF	Polystyrene	5%	125V
C109	0·05 mfd	Tubular Paper	20%	350V
C110	0·05 mfd	Tubular Paper	20%	350V
C111	0·05 mfd	Tubular Paper	20%	350V
C112	100 pF	Polystyrene	5%	125V
C113	40 pF	Tubular Ceramic	10%	350V
C114	100 pF	Polystyrene	5%	125V
C115	100 pF	Silvered Mica	10%	350V
C116	500 pF	Moulded Mica	20%	350V
C117	0·01 mfd	Moulded Mica	20%	350V
C118	0·05 mfd	Tubular Paper	20%	350V
C119	0·01 mfd	Tubular Paper	20%	150V
C120	0·01 mfd	Tubular Paper	20%	150V
C121	0·05 mfd	Tubular Paper	20%	350V
C122	10 pF	Silvered Mica	10%	350V
C123	0·01 mfd	Tubular Paper	20%	150V
C124	0·05 mfd	Tubular Paper	20%	350V
C125	0·01 mfd	Tubular Paper	20%	150V
C126	0·5 mfd	Tubular Paper	20%	150V
C127	10 mfd	Tantalum Electrolytic	20%	30V
C128	30 mfd	Tubular Electrolytic		15V
C129	0·01 mfd	Moulded Mica	20%	350V
C130	0·01 mfd	Tubular Paper	20%	150V
C131	0·05 mfd	Tubular Paper	20%	350V
C132	0·25 mfd	Metallised Paper	20%	150V
C133	0·01 mfd	Tubular Paper	20%	150V
C134	51 pF	Polystyrene	5%	125V

LIST OF COMPONENT VALUES, TOLERANCES AND RATINGS

Capacitors—*continued*

Ref.	*Value*	*Type*	*Tol.*	*Wkg. Volts*
C135	30 mfd	Tubular Electrolytic		15V
C136*	390 pF	Polystyrene	5%	125V
C137	390 pF	Polystyrene	5%	125V
C138	500 pF	Tubular Paper	20%	350V
C139	0·005 mfd	Tubular Ceramic	20%	350V
C140	40 pF	Silvered Mica	10%	350V
C141	500 pF	Tubular Paper	20%	350V
C142	0·01 mfd	Tubular Paper	20%	150V
C143	0·01 mfd	Tubular Paper	20%	150V
C144†	0·007 mfd	Silvered Mica	1%	350V
C145†	0·007 mfd	Silvered Mica	1%	350V
C146	0·001 mfd	Tubular Ceramic	20%	350V
C147	0·001 mfd	Tubular Ceramic	20%	350V
C148	0·001 mfd	Tubular Ceramic	20%	350V
C149	30 mfd	Tubular Electrolytic		15V
C150	500 pF	Tubular Paper	20%	350V
C151	0·01 mfd	Moulded Mica	20%	350V
C152	30 mfd	Tubular Electrolytic		15V
C153	0·01 mfd	Moulded Mica	20%	350V
C154	0·01 mfd	Moulded Mica	20%	350V
C155	0·25 mfd	Metallised Paper	20%	150V
C156	50 mfd	Tubular Electrolytic		450V
C157	50 mfd	Tubular Electrolytic		450V
C158	50 mfd	Tubular Electrolytic		450V
C159	0·5 mfd	Tubular Paper	20%	150V

C160 etc. — See Detached Circuits 1–5.

* May be 400pF Silvered Mica 2% 350V DC wkg.
† May be 0·007 mfd. Polystyrene 1% 125V DC wkg.

Resistors

Ref.	*Value*	*Tol.*	*Rating*
R1	0·27 Megohm ..	10%	½ watt
R2	100 ohms ..	10%	½ watt
R3	12 ohms ..	10%	½ watt
R4	3·3 Megohms ..	10%	½ watt
R5	0·1 Megohm ..	10%	½ watt
R6	0·1 Megohm ..	10%	½ watt
R7	2,200 ohms ..	10%	1 watt
R8	47,000 ohms ..	10%	1 watt
R9	15,000 ohms ..	10%	1 watt
R10	12 ohms ..	10%	½ watt
R11	0·27 Megohm ..	10%	½ watt
R12	47,000 ohms ..	10%	½ watt
R13	68 ohms ..	10%	½ watt

Ref.	*Value*	*Tol.*	*Rating*
R14	47,000 ohms ..	10%	1 watt
R15	47,000 ohms ..	10%	1 watt
R16	4,700 ohms ..	10%	½ watt
R17	2,200 ohms ..	10%	½ watt
R18	0·27 Megohm ..	10%	½ watt
R19	270 ohms ..	10%	½ watt
R20	12 ohms ..	10%	½ watt
R21	2,200 ohms ..	10%	½ watt
R22	470 ohms ..	10%	½ watt
R23	1 Megohm ..	10%	½ watt
R24	10,000 ohms ..	10%	1 watt
R25	47,000 ohms ..	10%	1 watt
R26	470 ohms ..	10%	½ watt

Resistors—*continued*

Ref.	*Value*	*Tol.*	*Rating*
R27	0·27 Megohm ..	10%	½ watt
R28	68 ohms ..	10%	½ watt
R29	12 ohms ..	10%	½ watt
R30	47,000 ohms ..	10%	1 watt
R31	2,200 ohms ..	10%	½ watt
R32	1 Megohm ..	10%	½ watt
R33	12 ohms ..	10%	½ watt
R34	0·27 Megohm ..	10%	½ watt
R35	270 ohms ..	10%	½ watt
R36	0·1 Megohm ..	10%	½ watt
R37	2,200 ohms ..	10%	½ watt
R38	2,200 ohms ..	10%	½ watt
R39	3,300 ohms ..	10%	½ watt
R40	10,000 ohms ..	10%	½ watt
R41	47,000 ohms ..	10%	½ watt
R42	150 ohms ..	10%	½ watt
R43	68 ohms ..	10%	½ watt
R44	10,000 ohms ..	10%	½ watt
R45	15,000 ohms ..	10%	1 watt
R46	2,200 ohms ..	10%	½ watt
R47	2,200 ohms ..	10%	½ watt
R48	0·47 Megohm ..	10%	½ watt
R49	2,200 ohms ..	10%	½ watt
R50	47,000 ohms ..	10%	½ watt
R51	150 ohms ..	10%	½ watt
R52	0·1 Megohm ..	10%	½ watt
R53	2,200 ohms ..	10%	½ watt
R54	470 ohms ..	10%	½ watt
R55	33,000 ohms ..	10%	½ watt
R56	470 ohms ..	10%	½ watt
R57	2,200 ohms ..	10%	½ watt
R58	680 ohms ..	10%	½ watt
R59	68 ohms ..	10%	½ watt
R60	2,200 ohms ..	10%	½ watt
R61	10,000 ohms ..	10%	1 watt
R62	47,000 ohms ..	10%	1 watt
R63	0·27 Megohm ..	10%	½ watt
R64	100 ohms ..	10%	½ watt
R65	47,000 ohms ..	10%	1 watt
R66	2,200 ohms ..	10%	½ watt
R67	12 ohms ..	10%	½ watt
R68	0·27 Megohm ..	10%	½ watt
R69	100 ohms ..	10%	½ watt
R70	47,000 ohms ..	10%	1 watt
R71	2,200 ohms ..	10%	½ watt
R72	12 ohms ..	10%	½ watt
R73	2,200 ohms ..	10%	½ watt
R74	0·1 Megohm ..	10%	½ watt
R75	0·1 Megohm ..	10%	½ watt
R76	1 Megohm ..	10%	½ watt
R77	2·2 Megohms ..	10%	½ watt
R78	0·1 Megohm ..	10%	½ watt
R79	150 ohms ..	10%	½ watt
R80	0·1 Megohm ..	10%	½ watt
R81	1 Megohm ..	10%	½ watt
R82	4,700 ohms ..	10%	½ watt
R83	0·1 Megohm ..	10%	½ watt
R84	8,200 ohms ..	10%	½ watt
R85	1 Megohm ..	10%	½ watt
R86	2,200 ohms ..	10%	½ watt
R87	10,000 ohms ..	10%	½ watt
R88	470 ohms ..	10%	½ watt
R89	1,000 ohms ..	10%	½ watt
R90	4,700 ohms ..	10%	1 watt
R91	470 ohms ..	10%	½ watt
R92	22,000 ohms ..	10%	1 watt
R93	470 ohms ..	10%	½ watt
R94	0·47 Megohm ..	10%	½ watt
R95	3,300 ohms ..	10%	½ watt
R96	0·1 Megohm ..	10%	½ watt
R97	47 ohms ..	10%	½ watt
R98	0·47 Megohm ..	10%	½ watt
R99	0·1 Megohm ..	10%	½ watt
R100	220 ohms ..	10%	½ watt
R101	0·1 Megohm ..	10%	½ watt
R102	22,000 ohms ..	10%	½ watt
R103	33,000 ohms ..	10%	½ watt
R104	10,000 ohms ..	10%	½ watt
R105	1,000 ohms ..	10%	½ watt
R106	1,000 ohms ..	10%	½ watt
R107	47,000 ohms ..	10%	1 watt
R108	6,800 ohm (nom.)	10%	½ watt
R109	47,000 ohms ..	10%	1 watt
R110	10,000 ohms (nom.)	10%	½ watt
R111	10,000 ohms ..	10%	1 watt
R112	3,300 ohms ..	10%	½ watt

Resistors—*continued*

Ref.	*Value*	*Tol.*	*Rating*
R113	1 Megohm ..	10%	½ watt
R114	1 Megohm ..	10%	½ watt
R115	1 Megohm ..	10%	½ watt
R116	0·47 Megohm ..	10%	½ watt
R117	3,300 ohms ..	10%	½ watt
R118	0·1 Megohm ..	10%	½ watt
R119	2·2 Megohms ..	10%	½ watt
R120	0·47 Megohm ..	10%	½ watt
R121	680 ohms ..	10%	½ watt
R122	4,700 ohms ..	10%	1 watt
R123	47,000 ohms ..	10%	1 watt
R124	4,700 ohms ..	10%	1 watt
R125*	10 ohms ..	5%	3 watt
R126	3,300 ohms ..	10%	½ watt
R127	0·1 Megohm ..	10%	½ watt
R128	2·2 Megohm ..	10%	½ watt
R129	0·47 Megohm ..	10%	½ watt
R130	820 ohms ..	10%	½ watt
R131	4,700 ohms ..	10%	1 watt
R132*	3,300 ohms ..	5%	6 watt
R133	10,000 ohms ..	10%	1 watt
R134*	3,300 ohms ..	5%	6 watt
R135	0·27 Megohm ..	10%	½ watt
R136	10,000 ohms ..	10%	½ watt
R137*	140 ohms ..	5%	4½ watt
R138*	140 ohms ..	5%	4½ watt

R139 etc. — See Detached Circuits 1–5.
* — Wirewound.

Potentiometers

Ref.	*Value*	*Type*
RV1	10,000 ohms	Wirewound
RV2	20,000 ohms	Carbon
RV3	10,000 ohms	Wirewound
RV4	1,000 ohms	Carbon
RV5	1,000 ohms	Carbon
RV6	1,000 ohms	Carbon
RV7	20,000 ohms	Carbon
RV8	0·47 Megohm	Carbon
RV9	0·5 Megohm	Carbon
RV10	5 ohms	Wirewound

APPENDIX "C"

TABLE OF VOLTAGE VALUES

The following ' Table of Voltage Values ' will prove useful in the event of the receiver developing a fault which necessitates carrying out voltage checks.

All readings are typical and were taken with a meter having a sensitivity of 20,000 ohms/volt and an applied mains voltage of 240V. A nominal tolerance of 10% will apply to readings taken with a meter of the sensitivity quoted above and this tolerance should be increased accordingly when using meters of lower sensitivity.

Readings should be taken under ' no-signal ' conditions with controls set as follows. The Remote Tuning and Desensitising links must be in position.

Range switch .. .. .. Range 15.
Mode switch .. .. .. ' AM.'
AGC switch .. .. .. ' Off.'
RF and IF Gains .. .. Maximum.
AF Gain .. .. Minimum.
Fine Tuning and BFO (Pitch) .. Centre scale.

Readings are taken between the point indicated and chassis.

CW/SSB Detector (V17)

This stage is inaccessible for direct voltage checks. Voltages can be checked on leads entering the unit as follows :

(i) **Anode feed** (measured across C131)
190V with Mode switch at ' AM.'
180V with Mode switch at ' CW ' or ' SSB.'

(ii) **Screen feed** (measured across C132)
102V with Mode switch at ' CW ' or ' SSB.'

(iii) **Diode control voltage** (measured at R102)
' CW ' : 11 — 26V for full swing of BFO (Pitch) control. (Nominally 15V at centre setting).
' SSB ' : In the range 12 — 19V depending on the Range in use and the sideband selected.

HT Voltages

HT1 : 225V.
HT2 : 195V.
HT3 : 108V (stabilised).
HT4 : 108V (stabilised).
Unsmoothed HT (measured across C158) : 260V.

Valve	*Anode*	*Screen*	*Cathode*
V1A	95V	—	1·25V[1]
V1B	180V	(g_1 : 93V)	95V
V2	215V	42V[2]	0·27V[3]
V3	174V	19V	0·26V
V4	202V	75V	0·7V
V5	177V	19V	0·23V
V6	64V	97V	0V
V7	94V	88V	1·0V
V8A	26V[4]	—	0·12V
V8B	100V	76V	0V
V9	187V	—	5·2V
V10 & 11	207V	88V[5]	1·35V[6]
V12	195V	195V	1·42V
V13A	—	—	—
V13B	—	—	15V[7]
V14	—	—	—
V15A	168V	—	2·0V
V15B	172V	—	2·0V
V16A	210V	—	3·7V
V16B	115V	—	2·5V
V17	See separate note.		
V18A & B	77V	—	3·5V
V19	215V	208V	9·5V
V20	217V	212V	10·5V
V21 & 22	108V	—	—

1 8·6V with RF Gain at minimum.
2 57V with RF Gain at minimum.
3 8·3V with RF Gain at minimum.
4 20 — 32V for full swing of Fine Tuning control.
5 202V with IF Gain at minimum.
6 30V with IF Gain at minimum.
7 6V with AGC switch in ' SSB ' position.

APPENDIX "D"

LIST OF SPARES

Inductors		Ref. No.
L1 — L4	Not available separately — see Filter ' A.'	
L5 — L10	Not available separately — see Filter ' B.'	
L11	2nd Local Oscillator Coil	D2410A
L12 — L17	Not available separately — see Filter ' C.'	
L18	2nd Local Oscillator Cathode Follower O/P Coil	D2411A
L19 — L24	Not available separately — see Filter ' D.'	
L25	BFO Coil	D2745
L26 — L29	Not available separately — see Filter ' E.'	
L30	1st RF Coil — Ranges 18 — 30 (L)	D2402
L31	1st RF Coil — Ranges 14 — 17 (K)	D2400
L32	1st RF Coil — Ranges 11 — 13 (J)	D2398
L33	1st RF Coil — Ranges 9 & 10 (I)	D2396
L34	1st RF Coil — Range 8 (H)	D2394
L35	1st RF Coil — Range 7 (G)	D2393
L36	1st RF Coil — Range 6 (F)	D2392
L37	1st RF Coil — Range 5 (E)	D2391
L38	1st RF Coil — Range 4 (D)	D2390
L39	1st RF Coil — Range 3 (C)	D2389
L40	1st RF Coil — Range 2 (B)	D2388
L41	1st RF Coil — Range 1 (A)	D2387A
L42	2nd RF Coil — Ranges 18 — 30 (L)	D2401
L43	2nd RF Coil — Ranges 14 — 17 (K)	D2399
L44	2nd RF Coil — Ranges 11 — 13 (J)	D2397
L45	2nd RF Coil — Ranges 9 & 10 (I)	D2395
L46	2nd RF Coil — Range 8 (H)	D2394/1
L47	2nd RF Coil — Range 7 (G)	D2393/1
L48	2nd RF Coil — Range 6 (F)	D2392/1
L49	2nd RF Coil — Range 5 (E)	D2391/1
L50	2nd RF Coil — Range 4 (D)	D2390/1
L51	2nd RF Coil — Range 3 (C)	D2389/1
L52	2nd RF Coil — Range 2 (B)	D2388/1
L53	2nd RF Coil — Range 1 (A)	D2386
L54	1st Mixer Coil — Ranges 18 — 30 (L1)	D2401
L55	1st Mixer Coil — Ranges 14 — 17 (K1)	D2399
L56	1st Mixer Coil — Ranges 11 — 13 (J1)	D2397
L57	1st Mixer Coil — Ranges 9 & 10 (I1)	D2395
L58	1st Mixer Coil — Range 8 (H1)	D2394/1
L59	1st Mixer Coil — Range 7 (G1)	D2393/1
L60	1st Mixer Coil — Range 6 (F1)	D2392/1
L61	1st Mixer Coil — Range 5 (E1)	D2391/1
L62	1st Mixer Coil — Range 4 (D1)	D2390/1
L63	1st Mixer Coil — Range 3 (C1)	D2389/1
L64	1st Mixer Coil — Range 2 (B1)	D2388/1
L65	1st Mixer Coil — Range 1 (A)	D2473A
L66	Tuned IF Coil — Range ' A ' (2·5 — 3·5 Mc/s), (M)	D2403
L67	Tuned IF Coil — Range ' B ' (3·5 — 4·5 Mc/s), (N)	D2404
L68	2nd Mixer Coil — Range ' A ' (2·5 — 3·5 Mc/s), (M)	D2403/1
L69	2nd Mixer Coil — Range ' B ' (3·5 — 4·5 Mc/s), (M)	D2404/1
L70 — L73	Buffer/Multiplier O/P Coils (5, 6, 8 & 10 Mc/s)	D2827
L74 — L77	Buffer/Multiplier O/P Coils (12, 14, 16 & 18 Mc/s)	D2828
L78 — L81	Buffer/Multiplier O/P Coils (20, 22, 24 & 26 Mc/s)	D2829
L82 — L85	Buffer/Multiplier O/P Coils (28, 30, 32 & 34 Mc/s)	D2830
L86	Buffer/Multiplier Rejector Coil	D2592B

Chokes		**Ref. No.**
CH1	LT Choke	D2413
CH2	LT Choke	D2413
CH3	Screen Choke	D2412
CH4	HT Choke	D2414
CH5	HT Choke	D2414
CH6	HT Choke	D2414
CH7	LT Choke	D2413
CH8	HT Choke	D2414
CH9	LT Choke	D2413
CH10	Filter Choke	D2412
CH11	HT Smoothing Choke	D2451
Transformers		
T1	1st 500 kc/s IF Transformer	D2405C
T2	Crystal Filter Unit (500 kc/s). Supplied complete with crystal screening can but less crystal	D2734
T3	Crystal Filter Unit (500 kc/s). Supplied complete with crystal screening can but less crystal	D2734
T4	2nd 500 kc/s IF Transformer	D2406C
T5	3rd 500 kc/s IF Transformer	D2406C
T6	4th 500 kc/s IF Transformer	D2406C
T7	5th 500 kc/s IF Transformer	D2406C
T8	6th 500 kc/s IF Transformer	D2407A
T9	Audio Filter Unit	D2735
T10/T11	Combined 2·5/600 ohms Output Transformer	D2736
T12	Mains Transformer	5339/1P
RF Filters		
Filter 'A'	Aerial Filter	D2738
Filter 'B'	1st IF Filter	D2419
Filter 'C'	2nd L.O. Interstage Filter	D2417A
Filter 'D'	2nd L.O. Output Filter	D2418A
Filter 'E'	Aerial Filter (Ranges 14 — 17)	D2416

NOTE: Filter Units are supplied complete and pre-aligned. Individual filter coils are not available separately.

Crystals		
XL1	'A' Dual crystal 500 kc/s ±·05%, separation 300 c/s ±50 c/s	6061P
	'B' Dual crystal 500 kc/s ±·05%, separation 1100 c/s ±50 c/s	6062P
XL2	'B' Dual crystal 500 kc/s ±·05%, separation 1100 c/s ±50 c/s	6062P
	'C' Dual crystal 500 kc/s ±·05%, separation 2600 c/s ±50 c/s	6063P
XL3	Inter Services Style 'D' Crystal Unit 17 Mc/s	6064P
XL4	Inter Services Style 'D' Crystal Unit 13 Mc/s	6065P
XL5	Inter Services Style 'D' Crystal Unit 11 Mc/s	6066P
XL6	Inter Services Style 'D' Crystal Unit 16 Mc/s	6067P
XL7	Inter Services Style 'D' Crystal Unit 14 Mc/s	6068P
XL8	Inter Services Style 'D' Crystal Unit 12 Mc/s	6069P
XL9	Inter Services Style 'D' Crystal Unit 10 Mc/s	6070P
XL10	Inter Services Style 'D' Crystal Unit 8 Mc/s	6071P
XL11	Inter Services Style 'D' Crystal Unit 6 Mc/s	6072P
XL12	Inter Services Style 'D' Crystal Unit 5 Mc/s	6073P
Variable Capacitors, Trimmers and Associated Items		
C172	Aerial Trimmer	D1919E
	Spindle for Aerial Trimmer	5608P
	Extension Spindle for Aerial Trimmer	5609P
	Coupler for above	D2469A
C54	2nd L.O. Tuning Capacitor	D2715
	Coupler for 2nd L.O. Tuning Capacitor	D2463A
C55	Concentric Trimmer 3 — 30 *p*F (2nd L.O. Unit)	6074P
	Ceramic Tube Trimmers (RF, Mixer, 1st L.O. Unit)	6075P

Potentiometers

		Ref. No.
RV1	10,000 ohms wirewound	5937P
RV2	20,000 ohms carbon	5938P
RV3	10,000 ohms wirewound	5937P
RV4	1,000 ohms carbon, pre-det	6076P
RV5	1,000 ohms carbon, pre-set	6076P
RV6	1,000 ohms carbon, pre-set	6076P
RV7	20,000 ohms carbon	5938P
RV8	0·47 Megohm carbon, pre-set	6077P
RV9	0·5 Megohm carbon	4103PA
RV10	5 ohms wirewound, pre-set	6078P

Switches

S1	**Wavechange**	
	Wafer (single pole 30 way)	5414P
	Switch rod	5928P
S2	**AGC/Calibrator**	
	4 pole 5 way complete	5935P
S3	**Selectivity**	
	Wafer (2 pole 5 way)	5393P
	Switch rod	5626P
	Clicker Mechanism	5625P
	Coupler	5627P
S4	**Noise Limiter**	
	Toggle type, SPST	4771P
S5	**Mode**	
	4 pole 4 way complete	5935/1P
S6	**AF Filter**	
	Toggle type DPDT	4772P
S7	**Bass**	
	2 pole 4 way complete	5936P
S8	**Monitor Speaker**	
	Toggle type, SPST	4771P
S9	**Mains**	
	Toggle type, DPDT	4772P

Control Knobs

Main Tuning (Kilocycles)	D2831
Wavechange (Megacycles)	5817P
Selectivity, RF Gain, AF Gain, etc.	5816P

Plugs

PL1 — PL4	Coaxial	6079P
PL5/6	12-way (female)	6080P
PL 'a'—'e'	6-way (male). Chassis interconnection	6081P
PL 'f'—'k'	6-way (female). Chassis interconnection	6082P
PL 'l'	2-way (female) Dial lamp connector	6083P
Aerial Plug	Coaxial	6084P

Sockets

SKT1	Coaxial	6085P
SKT2	B7G (Calibrator Socket)	6086P
SKT3 — SKT7	Coaxial	6087P
SKT8	Coaxial	6085P
SKT9	12-way (male)	6088P
SKT 'a'—'e'	6-way (female). Chassis interconnection	6082P
SKT 'f'—'k'	6-way (male). Chassis interconnection	6081P
SKT 'l'	2-way (male). Dial lamp connector	6089P
JK1	Audio Input	6090P
JK2	Telephone Output	6091P

Cores	Ref. No.
RF and 1st IF Coils	
L30 — L37, L42 — L49 & L54 — L61	6092P
L38, L39, L50, L51, L62, L63 & L66 — L69	6093P
L41 & L53	6094P
Remaining coils and 500 kc/s IF Transformers	
L11	6095P
L18	6096P
L25	6097P
L70 — L85	6098P
L86	6095P
T1 — T8	6096P

Drive Assembly

Complete drive assembly	LP2634

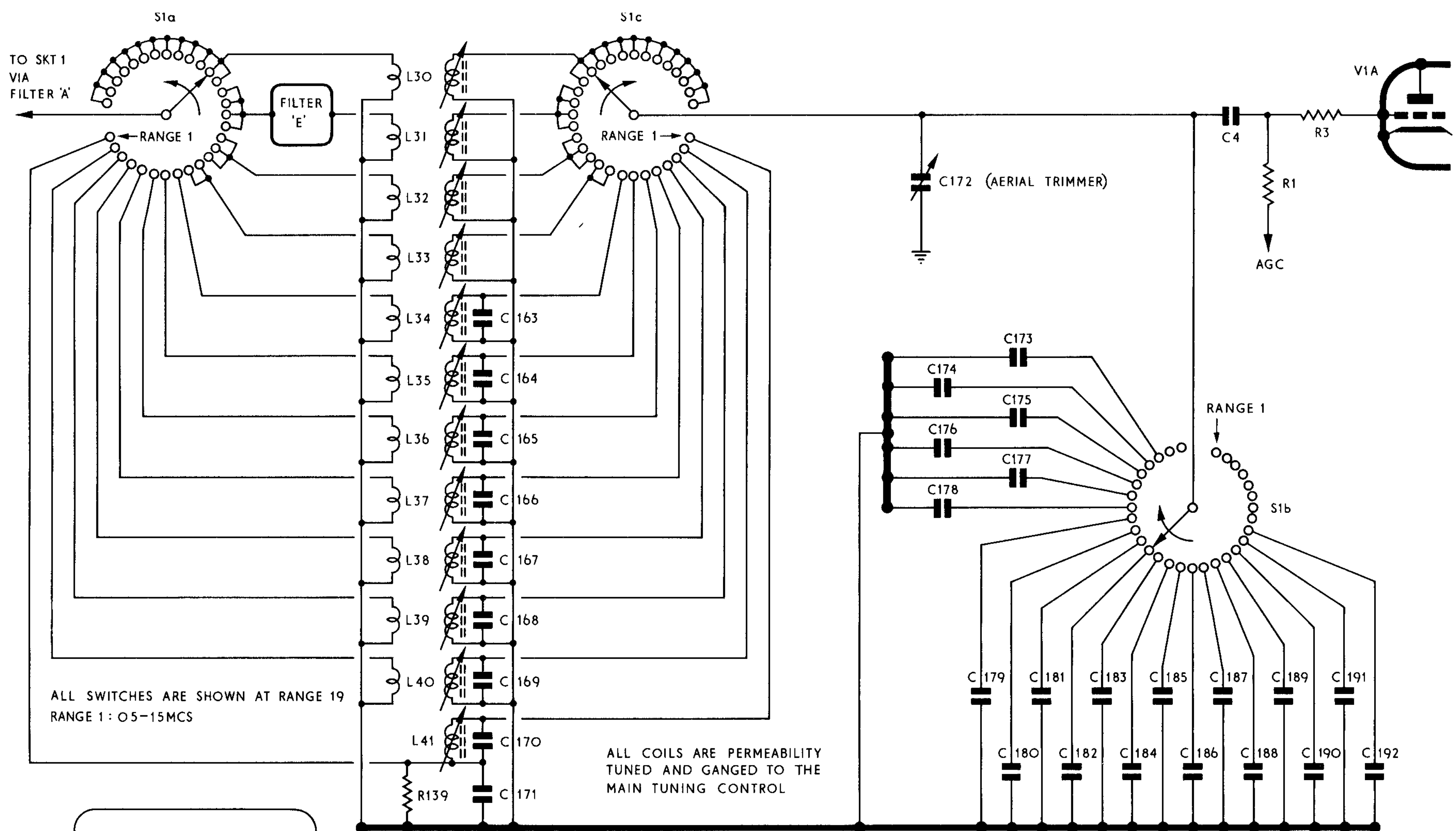
NOTE : This mechanism cannot be assembled without special assembly jigs. Replacement will be on an exchange basis in which a complete drive mechanism will be despatched on receipt of a faulty unit.

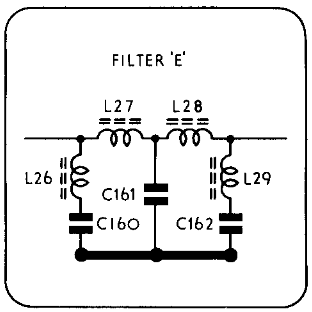
Calibrator Unit

XL1	Crystal, 100 kc/s $\pm 0{\cdot}005\%$	6099P
L1	Coil	D2178
C3	Trimmer	3909PC
PL1	Plug (B7G type)	6100P

Miscellaneous

Protecting handles (panel)	5826P
Protecting handles (small)	5923P
Scale Plate with Pointer Carrier Strip	D2714
Pointer Assembly	D2841
Vernier Dial (Kilocycles)	5563PA
Wavechange Dial (Megacycles) : L.H.	5895P
Wavechange Dial (Megacycles) : Centre	5561PA
Wavechange Dial (Megacycles) : R.H.	5896P
Glass Window	5922P
Scale Escutcheon	5918P
Festoon Bulbs (6V, 3W)	3131P
Panel Escutcheon	5621PA
Rear cover	5924P
Bottom cover	5924/2P
Lid (Table Model)	5925P
Top cover (Rack Model)	5939P
Shaped side cover : L.H.	5622/1P
Shaped side cover : R.H.	5622P
Drive cover	5926P
Loudspeaker (2″, 3 ohms)	6101P
Loudspeaker grille	5933P
Carrier Level Meter	5931P
Clip for meter	5932P
Finger plate (front panel)	5919P
Finger plate (I.F.)	5920P
Finger plate (P.U.)	5921P
Terminal (as used for Diversity AGC, etc.)	6102P
Fuseholder	6103P
Fuses	6104P
Flexible coupler (2nd Local Oscillator Unit)	D2463A
Flexible coupler (Platform drive)	D2469A

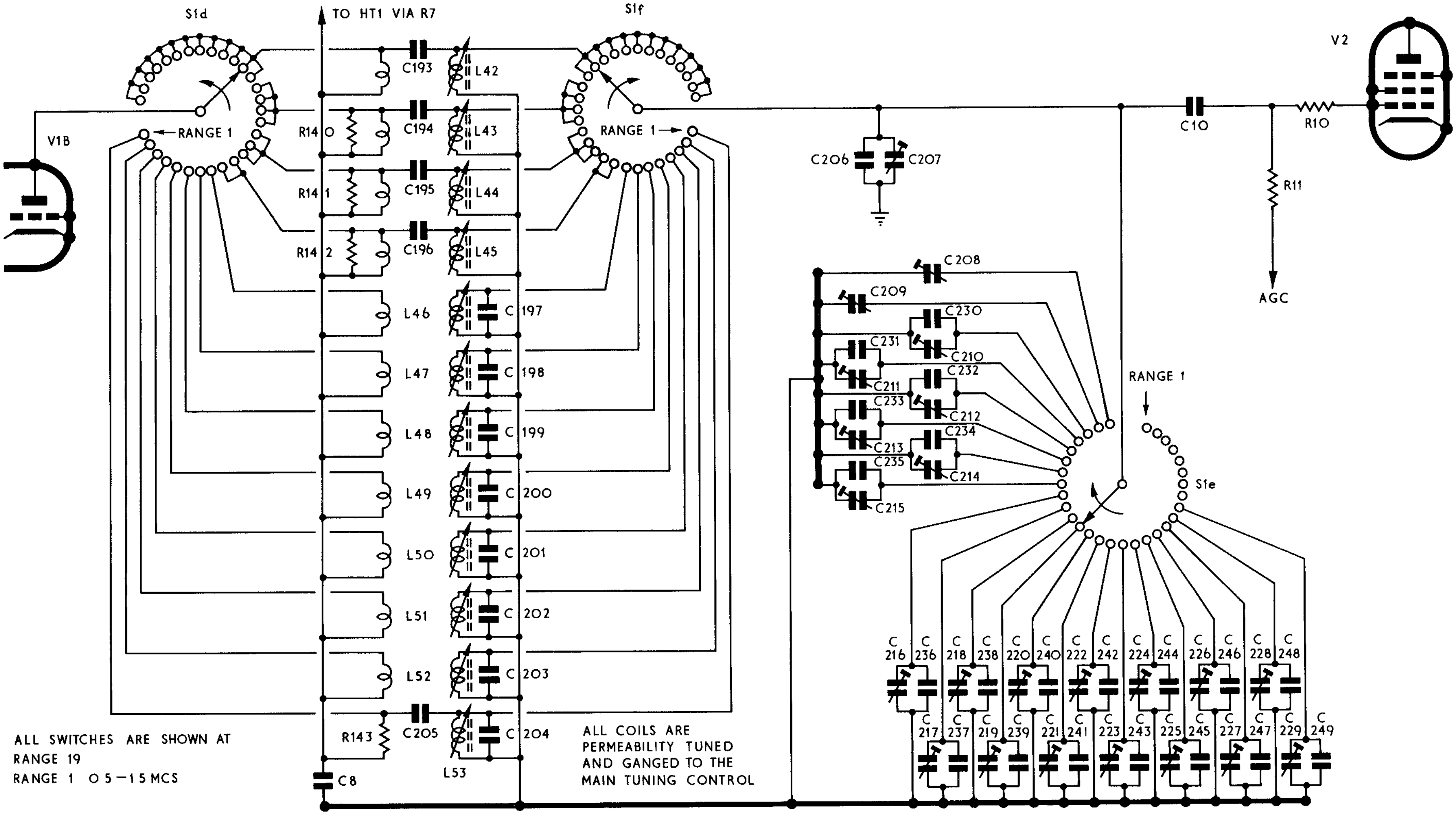




COMPONENT VALUES, TOLERANCES AND RATINGS.

C160	60 pF Silvered Mica ±5% 350V DC wkg.
C161	250 pF Silvered Mica ±5% 350V DC wkg.
C162	60 pF Silvered Mica ±5% 350V DC wkg.
C163	195 pF Silvered Mica ±1% 350V DC wkg.
C164	225 pF Silvered Mica ±1% 350V DC wkg.
C165	275 pF Silvered Mica ±1% 350V DC wkg.
C166	340 pF Silvered Mica ±1% 350V DC wkg.
C167	425 pF Silvered Mica ±1% 350V DC wkg.
C168	540 pF Silvered Mica ±1% 200V DC wkg.
C169	640 pF Silvered Mica ±1% 200V DC wkg.
C170	640 pF Silvered Mica ±1% 200V DC wkg.
C171	0·002 mfd Polystyrene ±5% 125V DC wkg.
C172	3·5–54 pF Air Spaced Variable.
C173	10 pF Silvered Mica ±1 pF 350V DC wkg.
C174	20 pF Silvered Mica ±5% 350V DC wkg.
C175	20 pF Silvered Mica ±5% 350V DC wkg.
C176	30 pF Silvered Mica ±5% 350V DC wkg.
C177	40 pF Silvered Mica ±5% 350V DC wkg.
C178	50 pF Silvered Mica ±5% 350V DC wkg.
C179	60 pF Silvered Mica ±5% 350V DC wkg.
C180	70 pF Silvered Mica ±5% 350V DC wkg.
C181	90 pF Silvered Mica ±5% 350V DC wkg.
C182	100 pF Silvered Mica ±5% 350V DC wkg.
C183	120 pF Silvered Mica ±1% 350V DC wkg.
C184	40 pF Silvered Mica ±5% 350V DC wkg.
C185	50 pF Silvered Mica ±5% 350V DC wkg.
C186	70 pF Silvered Mica ±5% 350V DC wkg.
C187	90 pF Silvered Mica ±5% 350V DC wkg.
C188	70 pF Silvered Mica ±5% 350V DC wkg.
C189	100 pF Silvered Mica ±5% 350V DC wkg.
C190	130 pF Silvered Mica ±1% 350V DC wkg.
C191	110 pF Silvered Mica ±5% 350V DC wkg.
C192	150 pF Silvered Mica ±1% 350V DC wkg.
R139	560 ohms ±10% ½ watt.

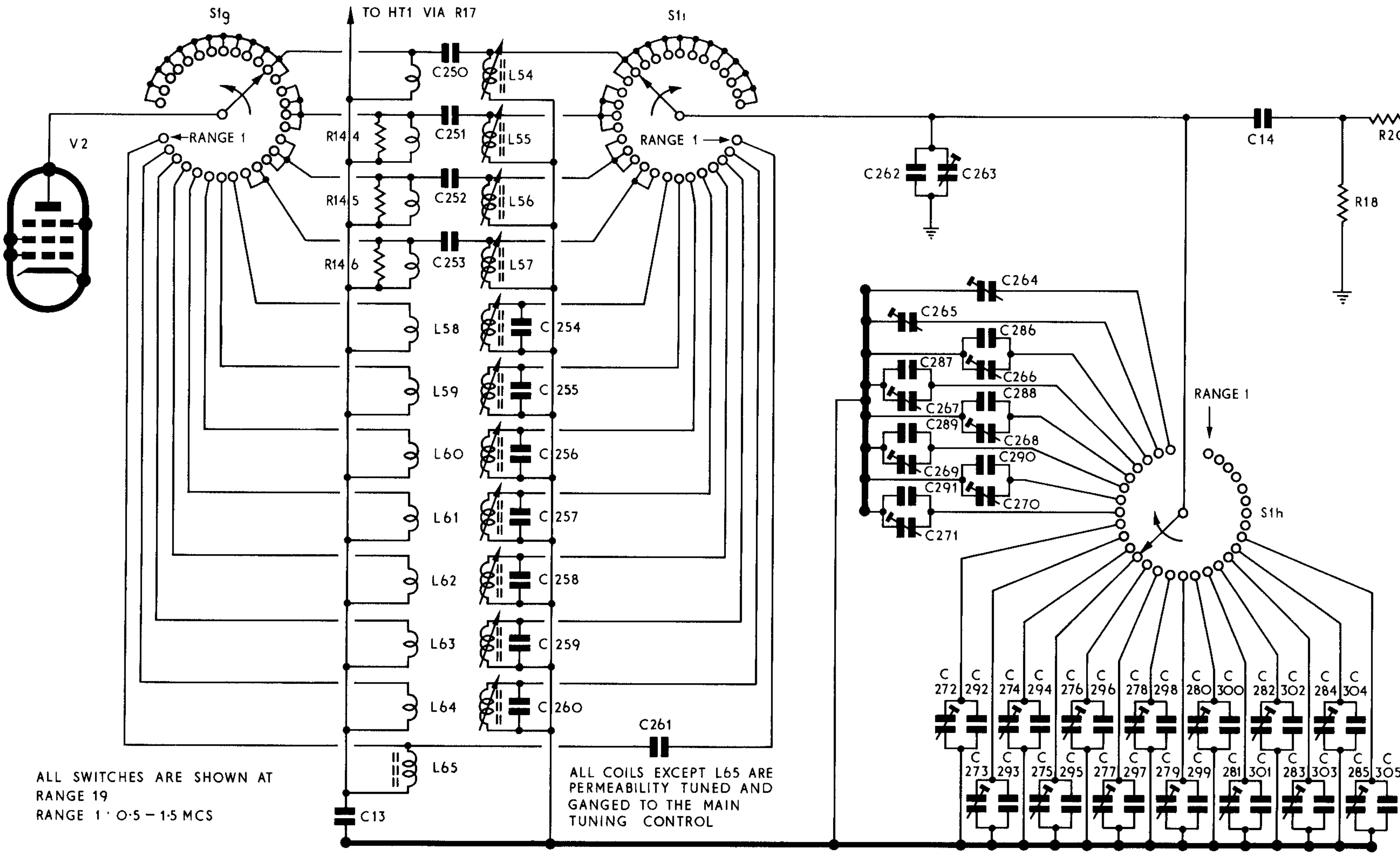
DETACHED CIRCUIT No. 1



COMPONENT VALUES, TOLERANCES AND RATINGS.

C193	25 pF Silvered Mica ±5% 350V DC wkg.
C194	25 pF Silvered Mica ±5% 350V DC wkg.
C195	6 pF Silvered Mica ±1 pF 350V DC wkg.
C196	6 pF Silvered Mica ±1 pF 350V DC wkg.
C197	195 pF Silvered Mica ±1% 350V DC wkg.
C198	225 pF Silvered Mica ±1% 350V DC wkg.
C199	275 pF Silvered Mica ±1% 350V DC wkg.
C200	340 pF Silvered Mica ±1% 350V DC wkg.
C201	425 pF Silvered Mica ±1% 350V DC wkg.
C202	540 pF Silvered Mica ±1% 200V DC wkg.
C203	640 pF Silvered Mica ±1% 200V DC wkg.
C204	640 pF Silvered Mica ±1% 200V DC wkg.
C205	20 pF Silvered Mica ±10% 350V DC wkg.
C206	10 pF Silvered Mica ±1 pF 350V DC wkg.
C207–C229	1–22 pF Ceramic Tube Trimmers.
C230	10 pF Silvered Mica ±1 pF 350V DC wkg.
C231	20 pF Silvered Mica ±5% 350V DC wkg.
C232	20 pF Silvered Mica ±5% 350V DC wkg.
C233	30 pF Silvered Mica ±5% 350V DC wkg.
C234	40 pF Silvered Mica ±5% 350V DC wkg.
C235	50 pF Silvered Mica ±5% 350V DC wkg.
C236	60 pF Silvered Mica ±5% 350V DC wkg.
C237	70 pF Silvered Mica ±5% 350V DC wkg.
C238	90 pF Silvered Mica ±5% 350V DC wkg.
C239	100 pF Silvered Mica ±5% 350V DC wkg.
C240	120 pF Silvered Mica ±1% 350V DC wkg.
C241	40 pF Silvered Mica ±5% 350V DC wkg.
C242	50 pF Silvered Mica ±5% 350V DC wkg.
C243	70 pF Silvered Mica ±5% 350V DC wkg.
C244	90 pF Silvered Mica ±5% 350V DC wkg.
C245	70 pF Silvered Mica ±5% 350V DC wkg.
C246	100 pF Silvered Mica ±5% 350V DC wkg.
C247	130 pF Silvered Mica ±1% 350V DC wkg.
C248	110 pF Silvered Mica ±5% 350V DC wkg.
C249	150 pF Silvered Mica ±1% 350V DC wkg.
R140	6,800 ohms ±10% ½ watt.
R141	6,800 ohms ±10% ½ watt.
R142	6,800 ohms ±10% ½ watt.
R143	4,700 ohms ±10% ½ watt.

DETACHED CIRCUIT No. 2



COMPONENT VALUES, TOLERANCES AND RATINGS.

C250 25 pF Silvered Mica ±5% 350V DC wkg.
C251 25 pF Silvered Mica ±5% 350V DC wkg.
C252 6 pF Silvered Mica ±1 pF 350V DC wkg.
C253 6 pF Silvered Mica ±1 pF 350V DC wkg.
C254 195 pF Silvered Mica ±1% 350V DC wkg.
C255 225 pF Silvered Mica ±1% 350V DC wkg.
C256 275 pF Silvered Mica ±1% 350V DC wkg.
C257 340 pF Silvered Mica ±1% 350V DC wkg.
C258 425 pF Silvered Mica ±1% 350V DC wkg.
C259 540 pF Silvered Mica ±1% 200V DC wkg.
C260 640 pF Silvered Mica ±1% 200V DC wkg.
C261 500 pF Tubular Paper ±20% 350V DC wkg.
C262 10 pF Silvered Mica ±1 pF 350V DC wkg.
C263–C285 1–22 pF Ceramic Tube Trimmers.
C286 10 pF Silvered Mica ±1 pF 350V DC wkg.
C287 20 pF Silvered Mica ±5% 350V DC wkg.
C288 20 pF Silvered Mica ±5% 350V DC wkg.
C289 30 pF Silvered Mica ±5% 350V DC wkg.
C290 40 pF Silvered Mica ±5% 350V DC wkg.
C291 50 pF Silvered Mica ±5% 350V DC wkg.
C292 60 pF Silvered Mica ±5% 350V DC wkg.
C293 70 pF Silvered Mica ±5% 350V DC wkg.
C294 90 pF Silvered Mica ±5% 350V DC wkg.
C295 100 pF Silvered Mica ±5% 350V DC wkg.
C296 120 pF Silvered Mica ±1% 350V DC wkg.
C297 40 pF Silvered Mica ±5% 350V DC wkg.
C298 50 pF Silvered Mica ±5% 350V DC wkg.
C299 70 pF Silvered Mica ±5% 350V DC wkg.
C300 90 pF Silvered Mica ±5% 350V DC wkg.
C301 70 pF Silvered Mica ±5% 350V DC wkg.
C302 100 pF Silvered Mica ±5% 350V DC wkg.
C303 130 pF Silvered Mica ±1% 350V DC wkg.
C304 110 pF Silvered Mica ±5% 350V DC wkg.
C305 150 pF Silvered Mica ±1% 350V DC wkg.
R144 6,800 ohms ±10% ½ watt.
R145 6,800 ohms ±10% ½ watt.
R146 6,800 ohms ±10% ½ watt.

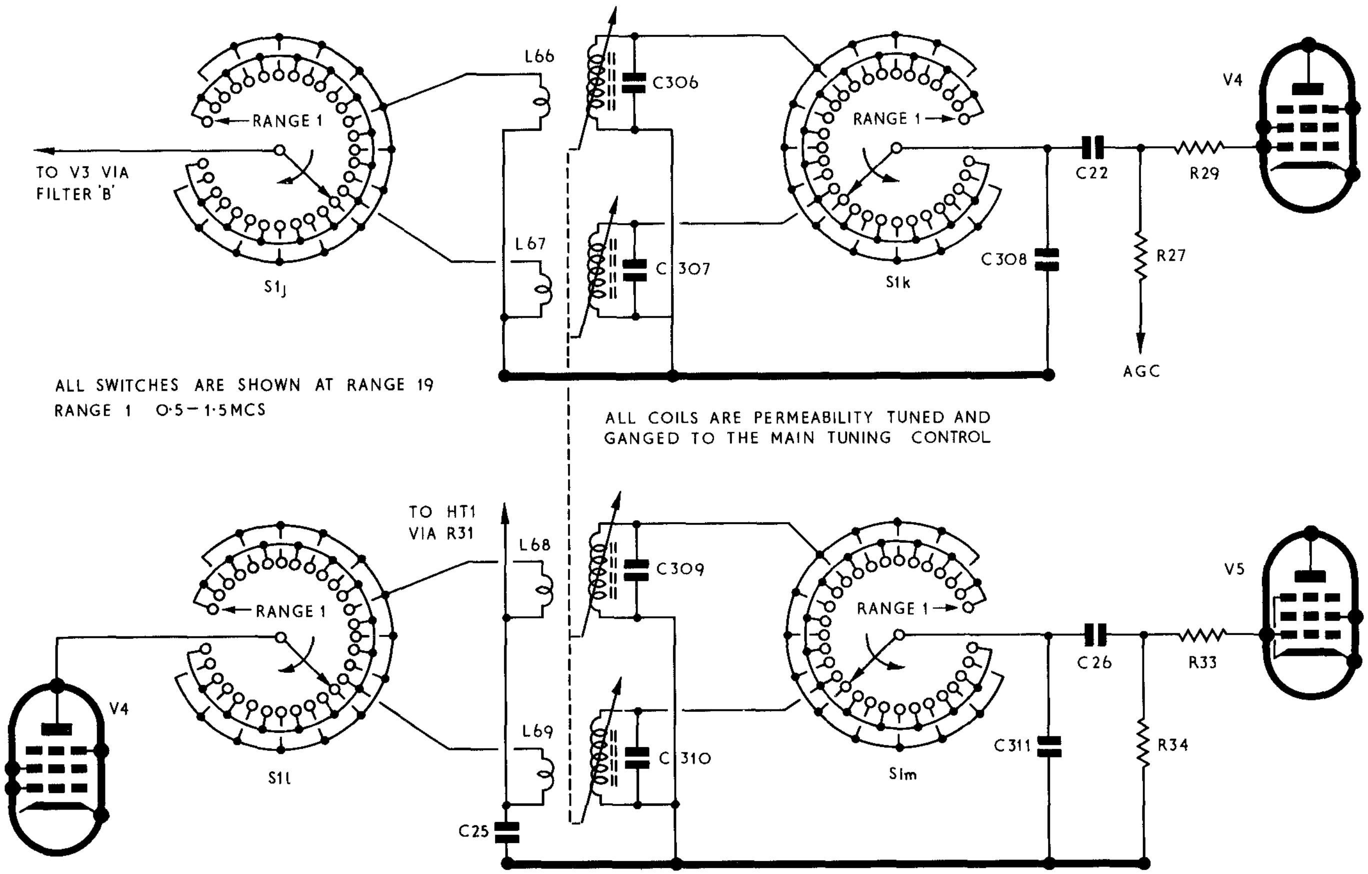
DETACHED CIRCUIT No. 3

DETACHED CIRCUIT No. 4

COMPONENT VALUES, TOLERANCES AND RATINGS.

C306 275 pF Silvered Mica ±1% 350V DC wkg.
C307 225 pF Silvered Mica ±1% 350V DC wkg.
C308 25 pF Silvered Mica ±10% 350V DC wkg.

C309 275 pF Silvered Mica ±1% 350V DC wkg.
C310 225 pF Silvered Mica ±1% 350V DC wkg.
C311 25 pF Silvered Mica ±10% 350V DC wkg.



DETACHED CIRCUIT No. 5 (SEE BELOW)

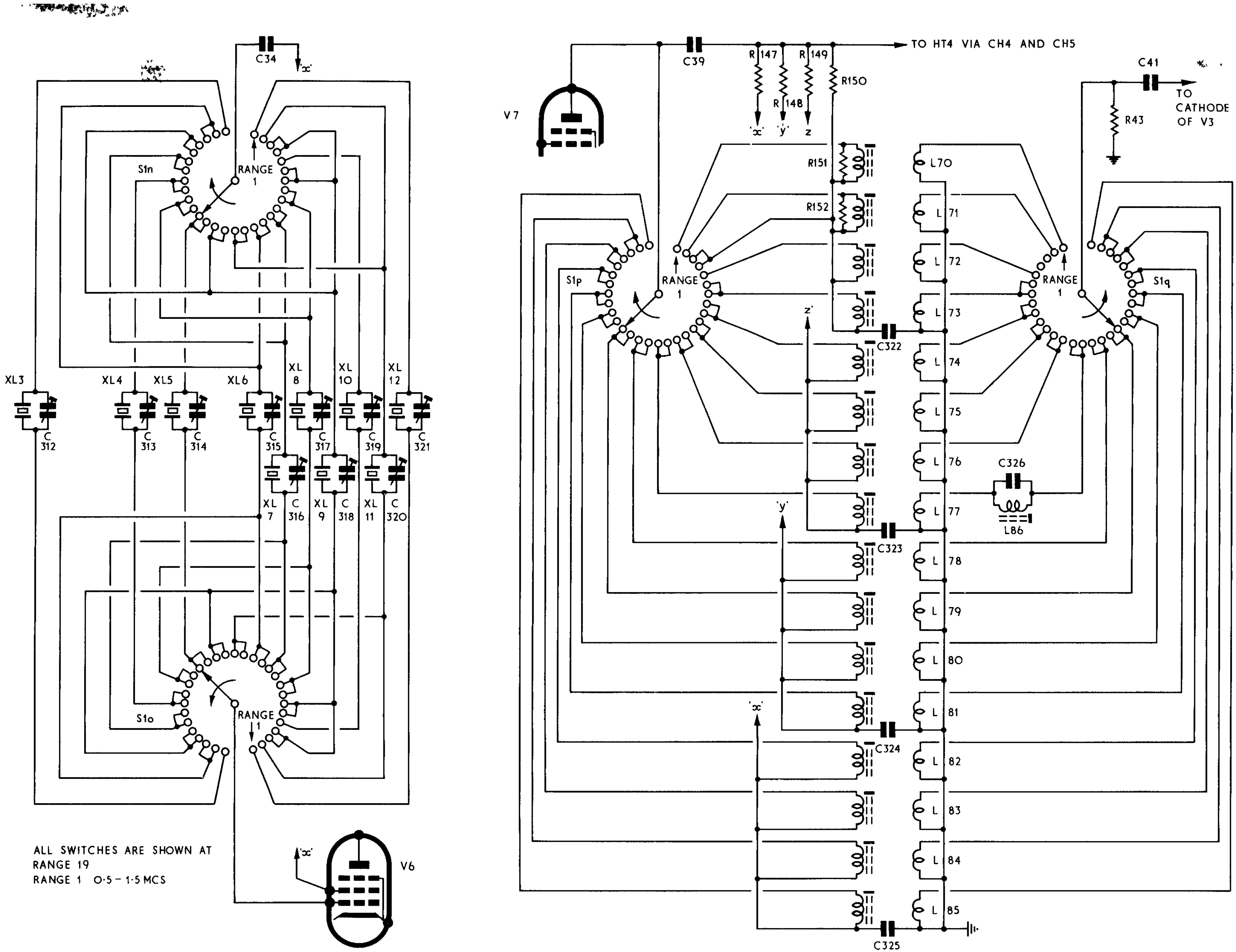
COMPONENT VALUES, TOLERANCES AND RATINGS.

C312 1–22 pF Ceramic Tube Trimmer.
C313 1–22 pF Ceramic Tube Trimmer.
C314 1–22 pF Ceramic Tube Trimmer.
C315 1–22 pF Ceramic Tube Trimmer.
C316 1–22 pF Ceramic Tube Trimmer.
C317 1–22 pF Ceramic Tube Trimmer.
C318 1–22 pF Ceramic Tube Trimmer.
C319 1–22 pF Ceramic Tube Trimmer.
C320 1–22 pF Ceramic Tube Trimmer.
C321 1–22 pF Ceramic Tube Trimmer.

C322 0·01 mfd Tubular Paper ±20% 150V DC wkg.
C323 0·01 mfd Tubular Paper ±20% 150V DC wkg.
C324 0·01 mfd Tubular Paper ±20% 150V DC wkg.
C325 0·01 mfd Tubular Paper ±20% 150V DC wkg.
C326 40 pF Silvered Mica ±10% 350V DC wkg.

R147 2,200 ohms ±10% ½ watt.
R148 2,200 ohms ±10% ½ watt.
R149 2,200 ohms ±10% ½ watt.
R150 2,200 ohms ±10% ½ watt.
R151 10,000 ohms ±10% ½ watt.
R152 10,000 ohms ±10% ½ watt.

XL3 17 Mc/s Inter-Services Style 'D' Crystal Unit.
XL4 13 Mc/s Inter-Services Style 'D' Crystal Unit.
XL5 11 Mc/s Inter-Services Style 'D' Crystal Unit.
XL6 16 Mc/s Inter-Services Style 'D' Crystal Unit.
XL7 14 Mc/s Inter-Services Style 'D' Crystal Unit.
XL8 12 Mc/s Inter-Services Style 'D' Crystal Unit.
XL9 10 Mc/s Inter-Services Style 'D' Crystal Unit.
XL10 8 Mc/s Inter-Services Style 'D' Crystal Unit.
XL11 6 Mc/s Inter-Services Style 'D' Crystal Unit.
XL12 5 Mc/s Inter-Services Style 'D' Crystal Unit.



C34
'x'
S1n
RANGE 1
XL3
XL4
XL5
XL6
XL 8
XL 10
XL 12
C 312
C 313
C 314
C 315
C 317
C 319
C 321
XL 7
C 316
XL 9
C 318
XL 11
C 320
S1o
RANGE 1
'x'
V6
ALL SWITCHES ARE SHOWN AT
RANGE 19
RANGE 1 0·5 – 1·5 MCS
TO HT4 VIA CH4 AND CH5
C39
V7
R 147
R 148
R 149
R150
'x'
'y'
z
C41
TO CATHODE OF V3
R43
R151
R152
S1p
RANGE 1
RANGE 1
S1q
L70
L 71
L 72
L 73
L 74
L 75
L 76
L 77
L 78
L 79
L 80
L 81
L 82
L 83
L 84
L 85
C322
C323
C324
C325
C326
L86
z'
'y'
'x'

1. CIRCUIT CHANGES.

Crystal Calibrator.

The injection capacitor C5a (between SKT2/2 and the anode of V1B) should be de both on the Circuit Diagram and in the list on page 38. Injection is now at the a V2 by proximity coupling and is effected by an injection probe which protrudes fron underside of the Calibrator Unit. The probe is fed directly from C4 and no connec made to PL1/2. (References "C4" and "PL1/2" refer to the Calibrator Unit.)

Care should be taken when removing the Calibrator Unit not to foul the inject: probe protruding from it.

Selectivity Switching.

The "Broad", "Intermediate" and "Narrow" positions of S3c should be shown stra together and connected to earth through an 80pF capacitor. This component is all the reference C86a and should be added to the list on page 39.

"C86a 80pF Silvered Mica ±5% 350V DC wkg."

The switch wafer S3k should be shown wired exactly as S3m, i.e. the full tert: T5 is in circuit in the "Broad" position.

CW/SSB Detector.

A 100K resistor should be shown between earth and the junction of R101 and R1 This component is external to the screening can and is allocated the reference R10 should be added to the list on page 42: "R102a 0.1MΩ ±10% ½ watt."

Line Output Channel.

The cathodes of V18B and V20 should be shown decoupled by C153a (0.01μF) and (0.1μF) respectively. These components should be added to the list on page 41.

"C153a 0.01μF Tubular Paper ±20% 150V DC wkg."
"C154a 0.1μF Plate Ceramic +80% -20% 200V DC wkg."

HT1 Decoupling.

A 0.05μF capacitor should be shown connected directly between the main HT rai and chassis. (A convenient place to add this component is below PL6 on the Main Diagram). The reference C155a applies and the component should be entered in the on page 41: "C155a 0.05μF Tubular Paper ±20% 350V DC wkg."

2. CHANGE OF COMPONENT VALUE.

Main Circuit Diagram.

R16 should read "10K". In the list on page 41, R16 should be amended to rea "10,000Ω ±10% 1 watt."

Detached Circuit Diagrams.

C181, C238 and C294 which appear in Detached Circuits 1, 2 and 3 respectively be amended to read "80pF."

In Detached Circuit No. 2., R143 should read "2,200Ω."

3. CHANGE OF COMPONENT TYPE.

In the list on page 39, C58 should read "12pF Tubular Ceramic ±1pF 750V DC wk

4. SPARES.

The Ref. Nos. of the coils listed below should be amended by adding the suffi "A" (e.g. D2393A).

L35-L40, L47-L53, L59-L64, L66-L69. (all numbers are inclusive).

Model 880/2 July 1963

AMENDMENT SHEET NO. 2

Fuse. A thermal-storage delay fuse is now specified for use with this receiver. The type employed is a Bulgin F283/1.5A and can be obtained from S & Co. by quoting Spares Ref. 6471P.

Page 40. Delete C109 and amend C113 to read 15pF.

Page 42. Amend R78 to read 0.27MΩ.

Main Circuit. Amend C113 to read 15pF and R78 to read 270K.

Delete C109 and return the earthy side of C111 to the cathode of V12 instead of to chassis.

Model 880/2 November 1963

AMENDMENT SHEET NO. 3

Page 40. Amend C117 and C129 to read:- "0.01μF Moulded Mica ± 20% 400V."

Page 41. Amend C151, C153 and C154 to read:- "0.01μF Moulded Mica ± 20% 400V."

Page 42. Amend R108 to read:- "4,700Ω (nom) ± 10% 1 watt."

Amend R110 to read:- "6,800Ω (nom) ± 10% 1 watt."

Page 43. Amend RV5 and RV6 to read:- "5,600Ω carbon."

Page 47. Amend RV5 and RV6 to read:- "5,600Ω carbon, pre-set . . 6366P."

Page 50. Detached Circuit No. 2. Delete:- "C206."

Add:- "CH12."

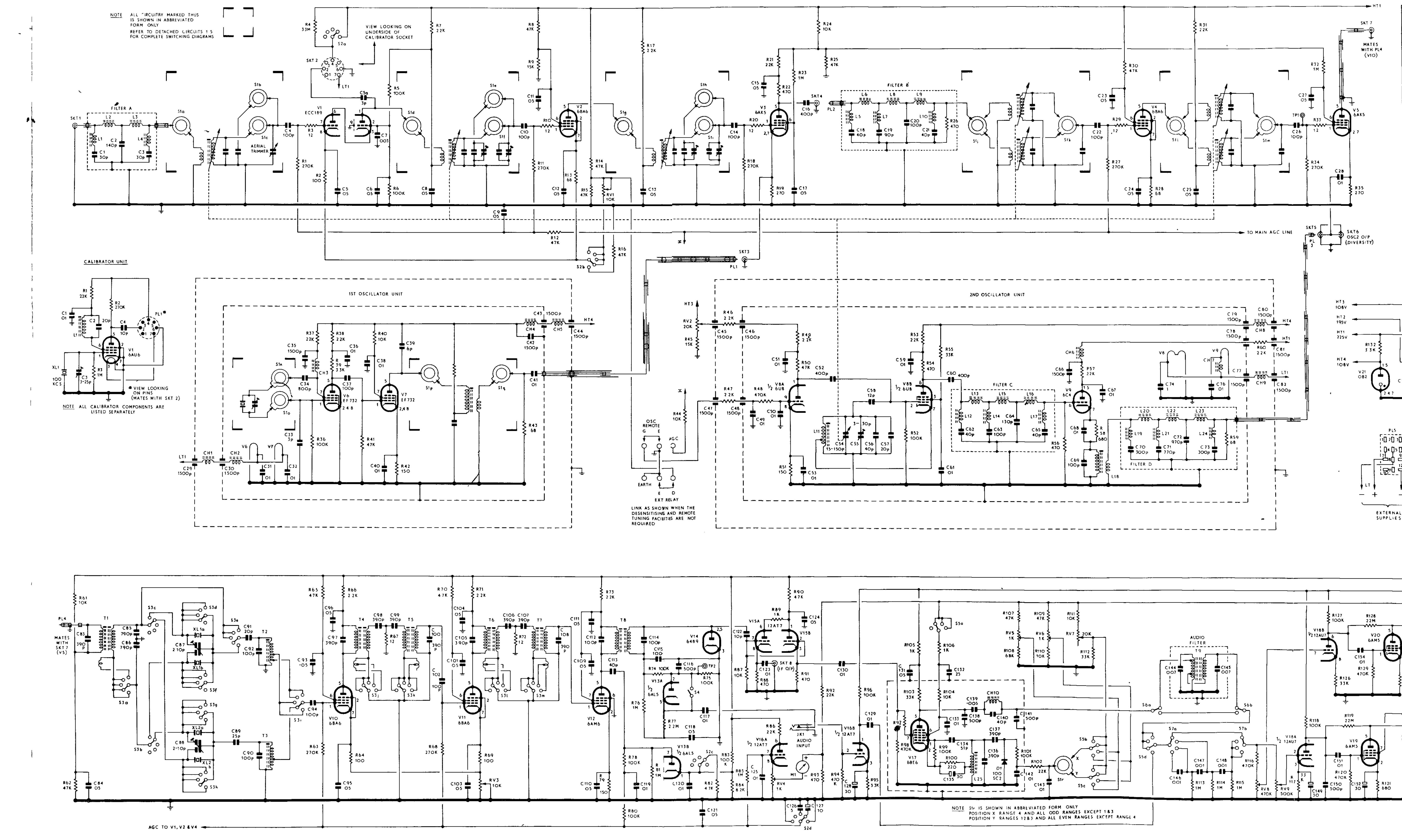
(CH12 comprises two ferroxcube beads on the lead between the primary of L42 and the Range Switch Sld. CH12 should be shown thus:- ———===———)
CH12

Page 51. Detached Circuit No. 3. Delete:- "C262."

Main Circuit. Amend R108 to read:- "4.7K."

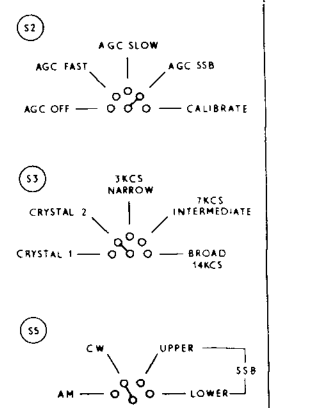
Amend R110 to read:- "6.8K."

Amend RV5 and RV6 to read:- "5.6K."

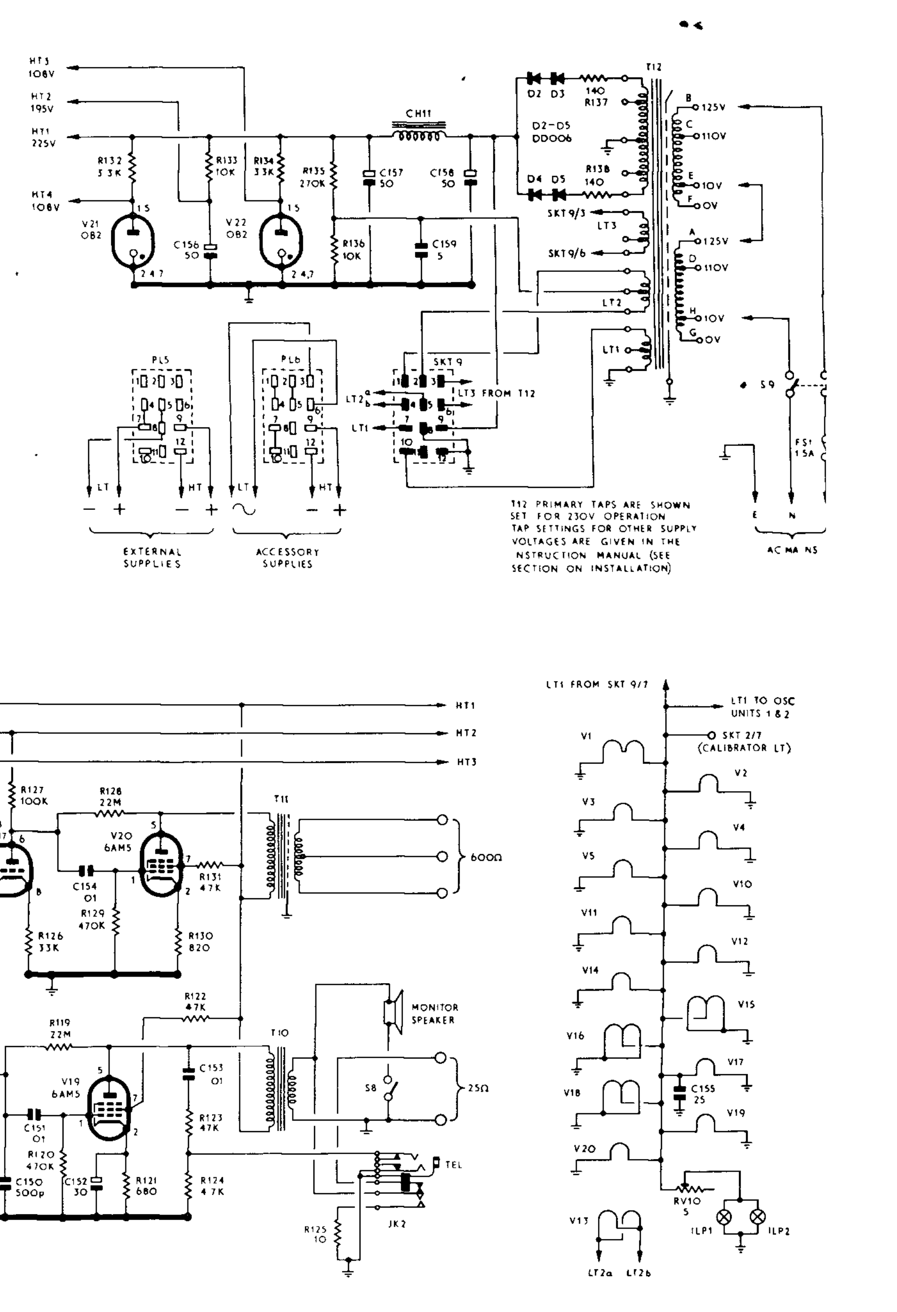


	CONTROL FUNCTIONS
S1	WAVECHANGE
S2	AGC/CALIBRATOR
S3	SELECTIVITY
S4	NOISE LIMITER
S5	SIGNAL MODE
S6	AUDIO FILTER
S7	BASS FILTER
S8	MONITOR SPEAKER
S9	MAINS
RV1	RF GAIN
RV2	FINE TUNING
RV3	IF GAIN
RV4	METER ZERO
RV5	CARRIER INSERTION (USB)
RV6	CARRIER INSERTION (LSB)
RV7	BFO PITCH
RV8	AF GAIN (LINE)
RV9	AF GAIN (MONITOR)
RV10	DIAL LAMP BRILLIANCY

SWITCH POSITIONS



S4 IS SHOWN AT ON, S6 AT IN AND S7 AT MAXIMUM BASS
S8 AND S9 ARE SHOWN AT OFF



SERVICING AND ALIGNMENT OF EDDYSTONE 880 / 2 RECEIVERS.

Introduction

1. Some difficulty has been experienced with 880/2 receivers due to a number of factors, some being

a. the seemingly complex nature of the receiver,
b. The need for precision in aligning the 500 kc. I.F. strip,
c. lack of suitable test equipment.

2. The method of alignment described here is designed to overcome at least part of these problems by;

a. using readily available test equipment in a way that does not require high accuracy measurements or frequency stability in the instruments themselves.
b. presenting a visual display of the I.F. response curve of the receiver, and using the inbuilt filter Xtals to provide frequency markers.

3. The receiver is not difficult to work on if each stage is taken one at a time. There are numerous check points provided to isolate each stage and to take time off to consider the operation of each stage in turn is time well spent. It is necessary to have a clear picture of the overall operation of the receiver to find faults quickly.

4. Some of the more common faults found in the 880/2 are;

a. Open circuit power supply resistors especially R 137, R 138.
b. 500kc. I.F. amplifier out of alignment of faulty.
c. V 14 faulty, usually corroded leads which appears to be caused by P.V.C. sleeving used on the leads attacking them.
d. V 6. faulty causing intermittent operation on some bands (due to Xtal oscillator dropping out.) of oscillation
e. Dirty band switches or dry and broken joints between the band switch and the associated coils.

ALIGNMENT

1. Switch receiver on to warm up for half hour or more before commencing any alignment. In the meantime check for the following;

a. Power supply resistors,
b. Both V.R. tubes alight.
c. Diode V 14 leads
d. Smooth operation of tuning mechanism and band switches. Clean and lubricate if necessary.
e. S meter zero adjustment. (if faulty possibly due to V16a or R92 , R93.

2. ASSEMBLE necessary test equipment required (listed below)

a. Marconi AM / FM Signal generator TF 995A or equivalent.
b. Philips GM 5655 C.R.O. or equivalent. (See note below)
c. Power meter (A.F.) calibrated in DBM e.g. A.P.O. TMS, Marconi 1065A etc. suitable for measuring 600 ohms TERMINATED.
d. Connection leads
e. Eddystone/ Neosid alignment tools as supplied with Rx.
f. Receiver handbook.

3. The C.R.O. should have a timebase output available that has an amplitude of at least 15 to 20 volts. With the GM 5655 use BU6 at rear of instrument but also note that with GM 5655 that R 63 should be reduced from 4.7 megs to 200K ohms.

Interconnect equipment as per fig 1.

a. BU 6 on Oscilloscope goes to EXT. MOD terminal of F.M. Gen.
b. Test point TP 2 in receiver connected to Vertical Input of C.R.O. (BU 5 on GM 5655 1 : 10) TP 2 is near V 13
c. R.F. output from TF 995A to aerial input of Rx.
d. A.F. power meter to 600 ohm line terminals of RX.
e. Earth terminals of C.R.O., SIG GEN and REC to be connected together.

13. SIGNAL to NOISE RATIO [illegible] to noise ratio) is measured by first measuring noise output when the receiver is tuned to CARRIER ONLY and then SUBTRACTING this from the output reading when the carrier is MODULATED. The result is the S/N ratio. e.g. Carrier only + 6 dbm., and Mod., + 18 dbm would give S/N ratio of 12 db.

14. If the 880 is in good condition it should have a S/N ratio of not less than 12 db. at 1 uv input mod 30 %. It should have an overall sensitivity that gives an OUTPUT from the 600 ohm line of not less than + 18 dbm (approx 60 mw). for the above input condition.

15. Finally check the calibration of the Rx dial against the Xtal Calibrator, after it has been standardised as per Page 37 of the handbook. (It is suggested that WWV on 10 or 15 mcs. be used as a standard.) and adjust the tracking if necessary.

16. B.F.O. should also be checked as per handbook. BN.

17. It has been noticed that in certain receivers in the serial group esp. that there has been a tendancy for the I.F. cores to jam and this is due to the rubber locking strip hardening and it is almost impossible to adjust the cores of the I.F.T.s without breaking the cores. Various solvents have been tried to release or disolve the rubber strip but without success and the only remedy it to replace the complete I.F. transformer.

18. It will be noted that the above method of aligement is almost identical to that given in the handbook except that all aligements are carried out at the SIGNAL frequency instead of the I.F. freq as in the handbook. This method does not have any effect on the accuracy of the align ment and allows readily available signal generator to be used.

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