HANDBOOK ISSUE 2

D. C. A. IDENT Y5/HB1003

FOR

V.H.F. COMMUNICATION RECEIVER

RACK MOUNTING

D. C. A. TYPE R30

DCA IDENT No. Y5/ 139

AWA TYPE C55917

NOTE:- This Handbook Supersedes Y5/HB35

PP 682

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1. BRIEF SPECIFICATION

1.1 Application

VHF Communication Receiver Type R30 Y5/139 is used for the reception of air-ground transmissions of radio-telephony signals in the frequency range 108-156 Mc. on any one specified crystal - locked frequency.

Power supply circuits, automatic gain control, peak noise limiter and audio limiting are included.

CODAN operation is provided by inbuilt circuits for automatic muting of the receiver under conditions of no carrier input.

Carrier Operated Device Anti-Noise, i.e., a circuit arrangement which mutes the receiver in the absence of a carrier, and allows the receiver to operate normally when a usable carrier is present. This prevents the noise inherent in a high-gain receiver from being disturbing between signals.

1.2 Frequency Coverage

Any spot frequency within the range 108 Mc. to 156 Mc. may be selected provided a crystal of suitable frequency is available.

The one set of R.F. coils covers the whole of the signal frequency range by means of individual variable tuning capacitors.

1.3 Power Requirements

The receiver will operate from a single-phase mains supply of 200-260V., 50-60 cycles A.C., by connecting the supply leads to appropriate taps on mains transformer T10.

Power Factor 0.8

The input required is approximately 170 watts.

1.4 Dimensions, Weights, etc.

Front Panel:	19 in. x 12¼ in. high (7 rack units)
Depth:	11½ in. including dust cover
Unpacked Weight:	Approximately 50 lb. including valves, crystal, dust cover, etc.

1.5 Mechanical Construction

The receiver is of the recessed chassis type of construction with the small components and wiring inside the chassis, and the valves, transformers, and other larger components mounted on top of the chassis. (see figures 1 and 3).

The chassis is fabricated of sheet steel, spot-welded, and is cadmium plated to provide maximum protection against corrosion.

A dust cover fits over the rear of the chassis and is spring-located for ease in removal and replacement. see HR20,000 sheet 3 for repositioning dust cover corner past above CF1.

The front panel is secured by a captive thumb-screw at each end of the cut-out for CODAN and NOISE LIMITER switches, and on removal of these screws hinges forward to provide access to the inside of the chassis. The front panel has spring clip suppressors fitted to prevent local oscillator radiation.

The receiver is designed to mount in a standard 19 inch equipment rack, and is secured by eight 1/4 inch B.S.W. counter-sunk-head screws. These become accessible on opening the front cover panel.

The CODAN THRESHOLD control, CODAN OFF-ON switch, NOISE LIMITER OFF-ON switch, H.T. switch and A.F. level control are all fitted on a panel which may be removed to gain interior access.

Immediately below is another panel bolted to the bottom side of the chassis and holding the REC. MUTED pilot mains fuse (3 Amp), MAINS OFF-ON switch, MAINS pilot and PHONES Jack.

When mounted in a standard 19 inch rack, CODAN OFF-ON and NOISE LIMITER OFF-ON controls are immediately accessible through cut-outs in the front cover panel. The front cover panel must be hinged forward to reach the CODAN THRESHOLD, A.F. LEVEL and H.T. controls.

N/L LEVEL and LIMITER LEVEL controls project through the chassis face, towards the rear of the rack. They are pre-set by means of a screwdriver adjustment and should not require further attention unless operating levels are to be altered or components affecting the operation are changed.

The variable trimmer capacitors for R.F./Mixer, and Oscillator/Tripler stages are accessible through cut-outs in the chassis face, from the rear of the rack. (C1, C8, C9, C23, C24, C37, C38). An insulated screwdriver should be used for all adjustments since H.T. is present on capacitors C8, C23 and C37.

1.5 Circuits

Two stages of inductively-coupled R.F. amplification are provided and the amplified signal is fed into the pentode mixer valve together with the signal from the local oscillator.

The local oscillator comprises a twin-triode crystal oscillator and frequency doubler, followed by a pentode frequency tripler, together giving an output at six times the crystal frequency.

Four stages of intermediate frequency (6165 kc). amplification follow, possessing high selectivity. The transformers are tuned by adjustable iron cores.

The second detector is a diode, and audio voltage developed across its load resistors is fed via a peak-clipping noise limiter to the volume limiting circuits and audio amplifier. The D.C. voltage developed across this load is also used as simple A.G.C. for the first and second R.F. amplifiers.

The noise limiter may be switched in or out of circuit as required.

Volume limiting circuits between the second detector and audio amplifiers consist of a triode amplifier, transformer-coupled to a twin-diode rectifier. The D.C. rectifier output is applied as negative bias to the control grid of a pentode limiting amplifier, thereby varying its gain in inverse proportion to the audio signal amplitude.

Output from the limiting amplifier is fed to a pentode audio-frequency driver valve, with potentiometer control over the volume, and then to a beam-power output tetrode.

The output impedance is 600 ohms.

The amplified automatic gain control system uses an input signal taken from the anode circuit of the fourth I.F. amplifier and amplified by a pentode operating at the intermediate frequency of 6,165 kc. The output from this amplifier is fed simultaneously to the A.G.C. diode and to the first pentode limiter in the codan chain.

The A.G.C. diodes rectify the I.F. signal to produce D.C. voltages proportional to the amplitude of the signal. These A.G.C. voltages are applied as negative bias to the signal grids of both R.F. stages in the form of simple A.G.C. and the first, second and third I.F. amplifiers in the form of delayed A.G.C.

The codan is a device for automatically muting the receiver when no carrier is being received. The carrier signal level to operate the device is automatically set by the amount of noise, both internal and external, existing at the time.

The device consists essentially of a limiting circuit, a detector and a relay valve. In the absence of a carrier, random noise frequencies from the A.G.C. amplifier are limited and detected and the modulation component fed to a relay valve. This valve, designed to respond only to the modulation component of the random noise frequencies, operates a relay.

This relay has two spring sets fitted. When the relay is operated, the receiver is muted, i.e., codan operating, the following functions take place:-

(a) Spring set one (C/O) provides on earth to REC. MUTED indicator lamp.

Note:-In the unoperated condition the earth is supplied as a remote indicator on TSA3 to indicate received signals i.e. codan open.

(b) Spring set two (M) provides an earth to the control grid of the output valve (V22) muting the receiver.

Since the limiting action keeps the total output of the limiter constant, the arrival of a carrier in addition to the random noise frequencies means that the average amplitude of the noise must be reduced. This reduction of noise when the carrier appears results in the dropping out of the relay and the opening of the receiver audio channel. Conversely, an increase in the noise level requires a correspondingly stronger carrier signal to open the receiver.

A full wave rectifier circuit employing silicon diodes and capacitance input filter is used to provide normal H.T. and bias voltages.

1.7 <u>Performance Specification</u> (Typical Figures)

Tests for Signal/Noise Ratio, A.G.C. characteristics, Selectivity, Image and Spurious Responses and Audio Frequency Response, are each conducted with V21 removed from its socket, (i.e., with limiting inoperative).

<u>Input Impedance</u>: 70 to 100 ohms, unbalanced.

<u>Frequency Control:</u> (1[illegible]-156 Mc.)	HC3 Holder, frequency as specified (refer sub-section 3.2.2), within the range 19.027 Mc. to 24.97 Mc. Tolerance ± 0.005%, temperature range 0°C to + 70°C.
<u>I.F. Frequency:</u>	6,165 kc.
<u>Sensitivity:</u> (1[illegible]-156 Mc.)	2 uV., modulated 30% at 400 cycles, for 500 mW. output into 600 ohms.
<u>Signal-to-Noise Ratio:</u> (1[illegible]-156 Mc.)	12 db down on 2 uV. signal modulated 30% at 400 cycles when modulation is removed.
<u>A.G.C. Characteristics:</u>	6 db rise in audio output for R.F. inputs from 10 uV. to 1.0V. with audio limiter off.

Selectivity:

Input	Total Bandwidth
-6 db	60 kc.
-20 db	96 kc.
-60 db	168 kc.

<u>Image Frequency Rejection and Spurious Responses:</u>

1[illegible]-140 Mc.	Better than 75 db down.
140-156 Mc.	Better than 60 db down.

<u>Audio Frequency Response</u>

-3 db at 325 cps
0 db at 1000 "
-3 db at 3200 "

<u>Constancy of Output:</u>	The audio output is constant within 3 db between 325 and 3200 CPS. for all modulation levels from 30% to 100%, when the R.F. input varies between 10 uV and 1.0 V.
<u>Distortion:</u>	The maximum distortion is 8.5% at 400 cycles/sec., without the peak noise limiter in circuit.
<u>Output Impedances:</u>	(i) 600 - ohms (balanced) at 750 mW. (ii) 600 - ohms (balanced) at 40 milliwatts. (iii) 10,000 ohms at 6 milliwatts (monitoring).
<u>Carrier Sensitivity:</u>	With aerial disconnected, 1 uV. input signal will un-mute the receiver.

1.5 Valve and Silicon Diode Complement

V1	1st. R.F. Amplifier	6AK5
V2	Local Crystal Oscillator/Frequency-doubler	6J6
V3	2nd. R.F. Amplifier	6AK5
V4	Mixer	6AU6
V5	Frequency Tripler	6AU6
V6	1st. I.F. Amplifier	6BA6
V7	A.G.C. Amplifier	6AU6
V8	A.G.C. Diode Rectifier	6AL5
V9	2nd. I.F. Amplifier	6BA6
V10	1st. CODAN Limiter	6AU6
V11	3rd. I.F. Amplifier	6BA6
V12	2nd. CODAN Limiter	6BA6
V13	CODAN Noise Amplifier	6AU6
V14	4th. I.F. Amplifier	6AU6
V15	CODAN Relay Valve	6AU6
V16	Diode Detector/Peak Noise Limiter	6AL5
V17	Limiter	6BA6
V18	Limiter Amplifier	6AU6
W1, W2	High-Tension Rectifiers	IN2358
V20	Audio Frequency Driver	6AU6
V21	Limiter Rectifier	6AL5
V22	Audio Output	6AQ5

Total Complement	Qty.
Type 6AK5	2
Type 6AU6	9
Type 6BA6	5
Type 6J6	1
Type 6AL5	3
Type 6AQ5	1
Type IN2358	2

2. TECHNICAL DESCRIPTION

Aerial Section and R.F. Amplifiers (Refer to Figures 1, 2, 3 and 4)

Aerial inductor L1 is tuned by variable capacitor C1 and tapped down for correct matching to the load impedance presented by the receiving aerial. The aerial tap is connected to female coaxial socket CF1, accessible from the rear of the receiver when rack-mounted. (see figure 1)

An incoming signal is fed to the 1st R.F. (radio frequency) amplifier V1 (6AK5) via C2, and undelayed automatic gain control voltage (simple A.G.C.) is applied to the control grid via R1. Minimum operating bias is supplied by R2 (by-passed by C5) in the cathode circuit

R.F. transformer T1 couples the 1st. and 2nd. R.F. amplifiers and is mounted on an insulating strip together with variable trimmers C8 and C9.

Simple A.G.C. voltage is also applied to the control grid of 2nd. R.F. amplifier V3 (6AK5) via R7, and minimum operating bias is supplied by R8 (by-passed by C19) in the cathode circuit.

Transformer T2, similar to T1, couples the 2nd. R.F. amplifier to the mixer V4, and is tuned by variable trimmers C23 and C24.

Mixer

Pentode mixer V4 (6AU6) accepts both the signal frequency fed from the 2nd. R.F. Amplifier via T2 and local oscillator output from frequency-tripler V5 via T4. Both signals are applied to the control grid of V4.

The local oscillator signal combines in the mixer with the incoming signal to produce a difference frequency which is equal to the intermediate frequency of 6, 165 kc.

The 1st. I.F. (intermediate frequency) transformer T3 is tuned to this frequency in both the primary and secondary windings.

In the band 108-132 Mc., the output frequency of the local oscillator chain is designed to be higher than the signal frequency, whilst in the band 132-156 Mc., it is lower than the signal frequency. This expedient is adopted to restrict the tuning range required in the local oscillator chain and also results in limiting the range of crystal frequencies required to cover the tuning range of the receiver.

A.G.C. is not applied to the mixer control grid to avoid affecting the conversion characteristics.

The minimum bias requirements are met by returning grid-leak R16 to the junction of R18/R19 in the grid circuit of frequency-tripler V5 and using the voltage developed in that circuit for the correct mixer bias.

Local Oscillator

One section (V2A) of a type 6J6 twin-triode operates as a conventional crystal oscillator at the third harmonic of the crystal (i.e., 19.027-24.97 Mc) which is connected between grid and cathode. This use of harmonic crystals simplifies the need for multiplying amplifiers and reduces spurious responses.

Section V2B of the valve is used as a frequency-holder and this stage tunes over the range 38.05-49.94 Mc. Doubler output is fed to the frequency tripler V5 (6AU6) via C27.

Frequency tripler V5 tunes over the range 114.16-149.835 Mc., and the double-tuned output transformer, T4, provides added high attenuation of unwanted harmonic content.

The local oscillator signal from T4 is then injected into the control grid of pentode mixer V4 via fixed capacitor C39.

Metering points CF2 and CF3 are used for obtaining resonance (optimum meter deflection) in the crystal oscillator circuit, and maximum grid current in the frequency-tripler stage respectively.

Fixed capacitors C12 (for L3) and C26 (for L4) are normally connected across L3 and L4 respectively, for a frequency coverage from 108-132 Mc. The capacitors are removed from circuit by unsoldering and attaching one end to a blank lug on the base of each can, when a coverage of 132-156 Mc. is required.

2.4 <u>I.F. Amplifiers and Second Detector</u>

Four stages of intermediate frequency amplification are provided by V6, V9, V11, and V14 in conjunction with I.F. transformers T3, T5, T6, T7 and T8 respectively, which are slightly overcoupled to give a satisfactory degree of selectivity.

The valves are type 6BA6 pentodes with the exception of V14 which is a type 6AU6 pentode. The transformers have tuned primaries and secondaries (using adjustable iron cores) with the secondary core adjustments at the top of each transformer can.

A.G.C. is applied to the 1st, 2nd and 3rd I.F. amplifiers.

The 4th I.F. amplifier V14 is coupled via T8 to the 2nd detector V16A which is one section of a type 6AL5 twin-diode. The resistive load for the 2nd detector diode takes the form of voltage-divider R60, R61, R62 and C89 is an R.F. by-pass capacitor.

Minimum bias for the I.F. amplifiers is provided by cathode resistors R24, R37, R44 and R53 respectively. A.G.C. bias to the 1st, 2nd and 3rd I.F. amplifiers is applied through progressive time-constant networks R15/C35, R28/C51 and R38/C65.

2.5 <u>Noise Limiter</u>

Noise Limiter V16B uses the remaining section of the 2nd detector twin-diode in a conventional series arrangement to "clip" sudden pulses of noise greater in amplitude than the required signal. These may be caused by ignition interference, etc.

The rectified current in the diode load R60-R62, due to the presence of a signal, will charge capacitor C93 to a peak potential proportional to the joint effect of the carrier and modulation. The cathode potential of the noise limiter, relative to earth, is then that across C93, and the time-constant of R63/C93 is made so long that this potential does not vary with the audio-frequency (modulation) component of the voltage across the diode load. The anode of the noise limiter diode is connected further down the diode load, at the junction of R61/R62, so that it is positive relative to the cathode.

The diode is therefore conductive, and because C92 is only an R.F. by-pass capacitor, the anode potential follows the audio-frequency voltage, without, however, falling below the cathode potential.

The audio-frequency output from the 2nd detector is therefore transferred to the grid of the limiting amplifier via the noise limiter and the ON position of the NOISE LIMITER switch (S2). (If this switch is OFF, the audio input for the limiting amplifier is taken directly from the 2nd detector diode load.)

When a sudden pulse of noise is superimposed on the carrier, a negative voltage surge appears across the 2nd detector diode load. Since the cathode potential of the noise limiter cannot change quickly, this surge reduces the positive potential of the anode and if it is of sufficient amplitude to drive the anode negative with respect to the cathode, then the valve cuts off and mutes the audio circuit instantaneously. The diode becomes conductive again when the noise voltage falls below the value at which the anode passes through zero potential relative to the cathode.

To prevent distortion of the audio signal the circuit is adjusted by N/L LEVEL control (R60) so that the diode does not cut off below the peak of the normal audio level handled. The N/L LEVEL control adjusts the cut-off point for modulation levels between 60% and 100%.

Volume Limiter

The audio signal from the 2nd detector V16A, developed across load resistors R60, R61, R62, is also fed directly to the bias amplifier-rectifier consisting of V18 (6AU6, triode-connected) and V21 (6AU6, triode-connected) and V21 (6AL5 twin-diode rectifier).

The stages for automatic audio gain control therefore comprise V17, V18 and V21, and combine to produce a constant output for all audio input levels where the modulation depth is greater than 30%.

The audio signal fed to LIMITER LEVEL control (R67) is amplified by V18 (6AU6, triode-connected) and transformer-coupled to twin-diode full-wave rectifier V21 (6AL5).

The resultant negative voltage output from the bias rectifier is applied as D.C. bias to the grid of limiting amplifier V17 thus reducing the stage gain, (i.e., "gm" of the valve), in proportion to the signal amplitude at the input of V17. The amount of limiting is determined by the LIMITER LEVEL control (R67) in the grid of V18.

The A.F. LEVEL control (R75) is adjusted for normal audio output when a satisfactory setting for the LIMITER LEVEL control has been found.

Audio Amplifiers

Conventional resistance-capacitance coupled audio amplifiers follow limiting amplifier V17.

Negative feed back is employed from the anode of output valve (V22) to the cathode of driver valve (V20).

Filter network L9/C117 in output valve (V22) anode prevents hum and noise from the H.T. Supply from being injected in the feed back loop.

A.F. LEVEL control (R75) is provided in the control grid circuit of A.F. driver valve V20 (6AU6) which operates as a pentode amplifier driving output tetrode V22 (6AQ5).

This control is independent of the volume-limiting circuits and is used for adjustment of speaker or headphones output level.

Beam-power tetrode V22 delivers 750 milli-watts audio output from the 600-ohm secondary winding of output transformer T11. Additional outputs of 40 milli-watts in 600-ohms and 6 milli-watts in 10,000 ohms, are also made available via half "H" pads R83, R84, R85 and R86, R87, R88 respectively.

2.8 Circuits

Simple A.G.C. voltage for the 1st and 2nd R.F. amplifiers is provided by the 2nd diode rectifier V16A(6AL5) and is connected to the R.F. section via the decoupling network R103/C113. Amplified A.G.C. voltage for the 1st, 2nd and 3rd I.F. amplifiers is provided by diode rectifier V8A (6AL5).

A signal from the anode of 4th I.F. amplifier V14 is fed via C43 to the input of A.G.C. amplifier V7 (6AU6). Here it is amplified at intermediate frequency and the output from L5 (in the anode of V7) split between A.G.C. diode rectifier V8A and the input of 1st limiter stage V10 (6AU6) in the codan chain, via coupling capacitors C46 and C59 respectively.

Metering point CF4 is connected in series with the 1st. limiter grid resistor and arranged so that a 1600-ohm, 0-100 uA. meter may be used, in tuning L5 to resonance, by obtaining maximum limiter grid current.

In normal operation, diode rectifier V8A is provided with a positive delay bias at its cathode, and the anode swing, provided by A.G.C. amplifier V7 via C46, must be sufficient to overcome this before the diode will conduct and produce A.G.C. voltage across its resistive load (R30). R.F. filtering is provided by R29 and C42.

The decoupling network for the control voltage fed to the three I.F. amplifiers are R15/C35, R28/C51 and R38/C65 respectively.

2.9 CODAN Unit

A portion of the output of the A.G.C. amplifier V7 is fed to the first limiter V10, which is also a frequency doubler. This doubling, though playing no part in the CODAN action, is necessary to avoid instability which may occur due to the excessive overall gain of the I.F. stages at 6,165 kc.

The anode circuit, L6, of V10 is resonant at 12.33 Mc. and the output is fed to the second limiter V12. This limiter also operates as a detector, the output consisting of frequencies extending to about 30 kc., the higher frequencies being effectively by-passed by C75.

The output is fed to a noise amplifier V13, then to relay valve V15 which has the muting relay REL1 in its anode circuit V15 is biased beyond cut-off point by back-bias resistor R72.

The CODAN THRESHOLD control R59 varies the gain of V13 and may be set so that the noise level into V15 (in the absence of a carrier) is just sufficient to operate REL1. The reduction of this noise level by the presence of a carrier will then allow REL1 to open.

Since the effectiveness of the limiters in clipping amplitude modulation varies with the depth of modulation and complete clipping is not possible at modulation depths approaching 100%, a high-pass filter consisting of C85, L7 is included to eliminate any carrier modulation component which could cause REL1 to close even though a carrier is present.

The CODAN ON-OFF switch S1 shorts the relay coil to render the circuit inoperative. Metering point CF6 is used to provide indication for CODAN tuning and adjustment.

<u>Power Supply</u>

Half wave silicon rectifiers W1 and W2 (IN2358) pass their output to a single-section capacitance-input filter C99, L8, C98.

Bias for the relay valve V15 and noise amplifier V13 is provided by cathode-bias resistor R72 connected in the H.T. return of power transformer T11.

Valve heaters are energised from a separate winding on the transformer and this also supplies the REC. MUTED and MAINS pilot lamps.

Power input to the receiver (from the 200-260V., 50 cycle A.C. mains) is controlled by MAINS switch (S3) which, together with the fuse, is mounted on a panel attached to the bottom apron of the chassis so that it is accessible through a cut-out in the front cover panel when the receiver is rack-mounted.

The mains fuse F1, also mounted on the panel, protrudes through the cut-out and may be changed after setting MAINS switch (S3) to OFF, without opening the cover.

A high tension switch (S4) controls the H.T., and is accessible only when the front panel is open. Used during alignment and maintenance.

3. INSTALLATION AND TUNING

3.1 Installation

(a) Initial Check

The receiver should be fitted with the required crystal, valves and valve shield complete with liners (AEI 7.5002) and aligned to the operating frequency. The frequency is to be specified on the designation plate (front cover).

Before mounting the receiver in the rack it must be set up on the bench to check general operation, overall sensitivity, distortion, and alignment frequency. The 600-ohm, 750 mW o/p should be correctly terminated at all times. (Refer to sub-sections 1.7 and 3.2.2.)

A signal generator will need to be connected to the aerial input socket CF1 and note taken of the frequency at which the receiver output "peaks". This will be the required operating frequency for the receiver. If correct, the overall sensitivity for an output of 500 milliwatts can then be determined.

If the receiver does not give maximum response exactly at the required frequency, then the crystal frequency must be verified and tuning of the R.F. circuits checked. (Refer sub-section 3.2.2.)

(b) Monitoring

The receiver should be mounted in a standard 19 inch equipment rack by four 1/4" B.S.W. countersunk-head screws on each side of the front panel.

It occupies seven units of rack space and two units of space must be left above and below it to allow for heat dissipation.

(c) Connections

The coaxial aerial feeder cable must be brought to the rear, when the receiver is rack-mounted, and plugged into the single-point female connector CF1, which is on the chassis in the lower right-hand corner looking at the rear of the rack. (see Figure 1). A right angle coaxial plug is preferable to the straight type.

The earth should be connected to a lug terminal on the mounting screw of block T.S.A. (see Figure 3 grid reference C-5)

Terminal block TSA is approximately on the centre-line of the chassis near the right-hand edge, looking from the rear.

Audio output is available from terminals TSA1/TSA2 (750mW level) TSA4/TSA5 (40mW level) and from phones jack J1 (6mW level) on the front panel. If the 600-ohm 750mW winding of T11 is not used (e.g., to operate a loudspeaker fitted with matching transformer) a 600-ohm 1w resistor MUST be connected between terminals TSA1 and TSA2.

TSA3 is for remote indication of received signal (codan open) at operators console, or a remote earth.

The three-core cable carrying power from the 200-260V. A.C. mains passes through a grommetted hole in the lower lefthand corner of the chassis looking from the rear, Figure 1, and attaches to the MAINS INPUT block which is clamped to the chassis apron on the lower right-hand side of the chassis looking from the front, Figure 3.

E.

Note that the EARTH wire (green) in the cable must be firmly soldered to an earth tag near the power connector block.

A telephone-type jack (J1), mounted on the chassis face and designated PHONES, may be used for monitoring purposes by plugging in a pair of high-impedance headphones.

3.2 Changing Operating Frequency

3.2.1 General

Aerial, R.F. and oscillator circuits will need to be aligned only when a falling off in receiver performance is apparent, a new frequency is required, or replacement of components in the tuned circuits becomes necessary.

Normally, the I.F. stages must not be interefered with unless absolutely necessary. If lack of I.F. sensitivity is apparent, re-alignment may be carried out as indicated in sub-section 4.2.

The method for determining the crystal frequency is covered in sub-section 3.2.2.

3.2.2 Alignment of R.F. Stages and Oscillator

(a) To Determine Oscillator Crystal Frequency

The local oscillator crystal frequency has a direct relationship to the frequency of the incoming signal and is determined in the following manner:-

Let f = Carrier frequency

F_o = Oscillator output frequency

F_x = Crystal frequency

(All expressed in kilocycles)

It will be seen that to obtain F_o, the carrier frequency must be known.

Since the intermediate frequency chosen is 6,165 kc., F_o will require to be f + 6,165 kc., or f - 6,165 kc., depending on the band in which "f" falls.

Therefore, since $F_o = 6F_x$

$$F_x = \frac{f + 6,165 \text{ kc.}}{6}$$ (Where "f" falls in the band 108-132 Mc.)

or $$\frac{f - 6,165 \text{ kc.}}{6}$$ (Where "f" falls in the band 132-156 Mc.)

Where "f" falls in the band 108-132 Mc., F_x will be found in the range 19.027-23.027 Mc.

Should it fall within the band 132-156 Mc., F_x will be found in the range 20.972-24.972 Mc.

This expedient is employed because of the limited tuning range of the local oscillator compared to the wide frequency coverage of the receiver. A reduction in the necessary range of crystal frequencies is also obtained.

Note also that in most cases one crystal can provide two operating frequencies. This may possibly be of advantage in certain circumstances. For example, a 20 Mc. crystal may be used for both 126.164 and 113.835 Mc. reception. It is, of course, necessary to realign the R.F. circuit for the alternative frequency.

(b) Alignment Procedure

(i) Plug crystal of correct frequency into local oscillator crystal socket (CF5) and 0-100 uA. (1600 ohm) test meter into metering point CF2. Connect C12 and C26 as required for the operating frequency band (see last paragraph of sub-section 2.3). Switch on receiver.

Adjust the variable iron core in V2A anode inductor (L3) for the peak of oscillation (maximum reading on the meter of approximately 60 uA.), just before the oscillator drops out.

(ii) Connect the test meter to metering point CF3 and adjust the variable iron core in double anode inductor L4 for a maximum reading on the meter.

Back off the variable iron core in L3 just below the point at which oscillation fails. The reading on the test meter in CF2 should be about 30 uA. and about 40 uA. in CF3.

(iii) Set variable capacitors C37 and C38 in output transformer T4 (for the frequency tripler stage) at mid-position approximately until the R.F. stages are properly aligned.

(iv) Connect the matched 70-ohm output of the signal generator to aerial input socket CF1 on the receiver.

(v) Connect an output meter across the 600-ohm terminals of the output transformer T11 (TSA1 and TSA2). Taking into consideration the impedance of the output meter, ensure that the output is correctly terminated.

Set the generator to the desired operating frequency, apply 30% modulation at 400 cycles and adjust the generator's output control to obtain an indication on the output meter of the receiver. To guard against tuning to an incorrect frequency, tune the generator around the desired frequency to find the strongest signal, which should then be the correct one.

(If the frequency change from any previous setting is large, C1, C8, C9, C23 and C24 should be set roughly to the estimated point of resonance for the R.F. circuits so that adequate output indication is obtained at the new frequency. For example, at 118 Mc. these capacitors should be set approximately two-thirds in mesh.)

Keep the generator output as low as possible at all times to avoid operating the A.G.C. circuits, and to maintain a workable reading on the output meter.

(vi) Adjust trimmer capacitors C24 and C23 in T2 for maximum reading on the output meter, using a non-metallic screwdriver.

Tune trimmer capacitors C37 and C38 in tripler output transformer T4 for peak output meter reading and repeak C24, C23, if necessary.

(vii) Adjust trimmer capacitors C8 and C9 in T1 for maximum output meter indication.

Reduce signal generator output as necessary in order to obtain workable readings on the output meter.

(viii) Aerial trimmer capacitor C1 should now be adjusted for maximum reading on the output meter.

The receiver is now aligned to the operational frequency and a check of the overall sensitivity should give an output of 500 milliwatts for an input of not more than 2 microvolts.

4. MAINTENANCE

4.1 Voltage and Current Analysis

Voltages are measured on an AVO Model 8 type meter set to the highest convenient range.

A.G.C. and volume compression, codan and noise limiter are in operation, with no signal input to aerial connector CF1.

The following figures are typical only and variations within ± 20% may be expected in practice, with the exception of valve heaters where a variation of only ± 5% is permissible.

Input:	200/220/240/260V., A.C., 50 cycles/sec.
H.T.	+280V D.C. to earth (chassis)
Bias	-22V D.C. at centre-tap of T10 to earth (chassis).
Heaters	6.3V A.C. to all valves

Note that all anode voltages in the R.F. circuits are measured at the "cold side", i.e., the H.T. supply side of the anode circuit component, inductor, transformer winding, etc.

4.1.1 Individual Electrodes (Refer Figure 4 Circuit Schematic)

Valve	Electrode	Pin	Voltage
R.F. Amp. 1st. (V1) 6AK5:	Anode	5	190
	Screen	6	70
	Cathode	2	0.6
R.F. Amp. 2nd. (V3) 6AK5:	Anode	5	98
	Screen	6	30-45
	Cathode	2	0.2-0.4
Pentode Mixer (V4) 6AU6:	Anode	5	220
	Screen	6	75
Local Crystal Oscillator comprising (V2) and (V5):			
Crystal Oscillator (V2A) ½-6J6:	Anode	1	75
Frequency Doubler (V2B) ½-6J6:	Anode	2	110
Frequency Tripler (V5) 6AU6:	Anode	5	155
	Screen	6	155
I.F. Amp. 1st. (V6) 6BA6:	Anode	5	225
	Screen	6	45
	Cathode	7	1.55
I.F. Amp. 2nd (V9) 6BA6:	Anode	5	245
	Screen	6	50
	Cathode	7	2.15

I.F. Amp. 3rd. (V11) 6BA6:	Anode	5	265
	Screen	6	60
	Cathode	7	3
I.F. Amp; 4th. (V14) 6AU6:	Anode	5	264
	Screen	6	160
	Cathode	7	3.3
A.G.C. Amp. (V7) 6AU6:	Anode	5	265
	Screen	6	180
	Cathode	7	5
A.G.C. Rectifier (V8A) ½-6AL5:	Cathode	5	22
Limiter 1st. (V10) 6AU6:	Anode	5	30
	Screen	6	30
Limiter 2nd. (V12) 6BA6:	Anode	5	22
Noise Amp. (V13) 6AU6: (CODAN THRESHOLD at max.)	Anode	5	200
	Screen	6	165
	Cathode	7	7.5
Relay Valve (V15) 6AU6: (CODAN Sw. OFF - Signal OFF)	Anode	5	270

4.1.2 Volume Limiting Stages Comprising (V17), (V18), and (V21):

Limiting Amplifier (V17) 6BA6:	Anode	5	125
	Screen	6	35
	Cathode	7	1.1
Bias Amplifier (V18) 6AU6:	Anode	5	255
	Cathode	7	4.5
A.F. Driver (V20) 6AU6:	Anode	5	37
	Screen	6	45
	Cathode	7	1.85
Output Amp. (V22) 6AQ5:	Anode	5	155
	Screen	6	162
	Cathode	2	7.2

4.1.3 Typical Readings at Metering Points (No Signal Input)

Grid and cathode currents are measured on a 0-100 uA. meter (of 1600-ohms internal resistance) plugged into the appropriate metering points CF2, CF3, CF4 and CF6.

Valve	Electrode	Pin	Metering Pt.	Reading uA.
Frequency Doubler (V2B) ½-6J6:	Grid	5	CF2	30
Frequency Tripler (V5) 6AU6:	Grid	1	CF3	40

Limiter 1st. (V10) 6AU6:	Grid	1	CF4	12
Relay Valve (V15) 6AU6:	Cathode	7	CF6	0 - 100

4.2 Complete Alignment Procedure

4.2.1 General

It is essential that adjustments for complete alignment be carried out in a proper sequence as laid down in sub-sections 4.2.2 to 4.2.8.

The procedure for R.F. and local oscillator alignment is detailed in the Installation and Tuning Instructions, sub-section 3.2.2, and is to be carried out after the main alignment is complete.

Test equipment required for I.F. alignment and codan adjustment comprises a signal generator capable of covering between 5 and 15 Mc., a 0-100 uA. meter of 1600-ohms internal resistance to be used in any one of the metering points CF2, CF3, CF4, CF6, and an output meter for checking receiver audio output. A visual alignment generator may also be used such as a Ratcliffe model 203.

R.F. alignment requires a signal generator covering the frequency range 108-156 Mc., with tone-modulated output for 70-ohm termination.

4.2.2 Setting-up

(i) Set the receiver MAINS switch to ON and wait at least 20 minutes for the equipment to reach a stable operating temperature.

(ii) Connect an output meter across the 600-ohm terminals of output transformer T1 (TSA1 and TSA2). Taking into consideration the output impedance of the meter, ensure that the output is correctly terminated.

(iii) Set up the following controls:-

NOISE LIMITER switch to OFF

Remove limiter rectifier valve V21 from the socket to prevent limiting action

A.F. LEVEL control to maximum

4.2.3 I.F. Alignment

Unsolder the coupling capacitor C25 from the secondary of transformer T2. (Refer Figure 4)

By connecting a 6165 KCS signal generator with an output of 50 micro volts to the control grid of V4 via coupling capacitor C25 and earth lead of signal generator to bottom of T2 secondary, the I.F. sensitivity should be such that an audio output of 500 milliwatts is achieved. If this figure is obtained the I.F. alignment should not be touched.

If I.F. alignment is found necessary, it should be completed in two steps, firstly by peaking the transformers in the normal manner (step 'a') and then by carrying out the damped alignment (step 'b'). With experience the visual alignment technique as described in the Ratcliffe Model 203 handbook, can be used on its own to accurately align the I.F. stages, however the recommended method of alignment is step 'a' and step 'b' with the visual indicator as a monitor.

The addition of a 6165 KCS crystal to the marker generator section of the Ratcliffe model 203 visual alignment generator provides a very effective generator for the alignment procedure described below.

When the crystal marked Ratcliffe model 203 is not used, it will be necessary to calibrate the signal generator to be used by producing a zero beat between the available generator and the associated A.G.A. transmitter or other accurate frequency source.

Having completed the frequency calibration apply 6165 KCS modulated 30% at 400 CPS to the receiver as para one this section.

Note:- It will be generally found that double-humping of the I.F. response curve occurs. This is a normal condition. The response should be fairly symmetrical however.

(a) <u>Preliminary Alignment</u>

(i) Using an insulated screwdriver, first adjust the secondary and then the primary of each I.F. transformer in turn, in the order outlined below, for peak reading on the output meter.

(Secondary iron-core adjustments are made from the top of each can and primary adjustments from the bottom.)

First adjust T8, followed by T7, T6, T5 and T3 in turn.

(ii) Keep generator output to the minimum required for readable working indication on the output meter to avoid operating the A.G.C.

(b) <u>Damped - Alignment</u>

Note:- H.T. switch S4 shall be switched off whilst fitting damping load.

A 1000 ohm resistor is required for damped - alignment of the I.F. channel in addition to the equipment used for the preliminary alignment procedure. This may be made up with two alligator clips.

The loading device is shunted across one winding of the transformer being tuned while the other winding is resonated. Damped-alignment procedure is necessary because of slight over-coupling in the I.F. transformers and is carried out as follows:-

Damping Load Across:	Tune for Peak Output Meter Reading:	Signal Generator Connection Point, etc.
T8/Prim.	T8 secondary	To V14 grid
T8/Sec.	T8 primary	

Damping Load Across	Tune for Peak Output Meter Reading:	Signal Generator Connection Point, etc.
T7/Prim. T7/Sec.	T7 secondary T7 primary	To V11 grid
T6/Prim. T6/Sec.	T6 secondary T6 primary	To V9 grid
T5/Prim. T5/Sec.	T5 secondary T5 primary	To grid V6
T3/Prim. T3/Sec.	T3 secondary T3 primary	To grid V4 via C25 (see 1st and 2nd para, sub-section 4.2.3).

4.2.4 A.G.C. Amplifier Alignment

(i) With the signal generator accurately set to 6,165 kc., and connected directly to V4 as above, adjust its output to approximately 60 uV.

(ii) Connect the 0-100 uA. test meter to metering point CF4.

(iii) Resonate L5, in the anode of V7, by its adjustable iron-core, for a peak reading, normally in the vicinity of 20 uA., on the test meter.

(iv) Reconnect C25 to T2.

4.2.5 Local Oscillator Adjustment

Full details regarding tuning of the local oscillator stages are to be found in the Installation and Tuning Instructions, Sub-section 3.2.2 (a) and (b).

4.2.6 R.F. Alignment

The signal generator required for R.F. alignment must be capable of covering the full receiver range of 108-156 Mc.

Detailed alignment procedure is given in sub-section 3.2.2 of the Installation and Tuning Instructions, parts (a) and (b).

A period of at least 20 minutes must be allowed to elapse before use to ensure stable operation of the generator.

4.2.7 CODAN Adjustment

After the R.F. stages, local oscillator and I.F. stages are accurately aligned, along with the output circuit of A.G.C. amplifier V7, procedure for codan adjustment is as follows:-

(i) Set the CODAN OFF-ON switch to OFF.

Remove the tone-modulated signal from the receiver input (CF1).

(If the codan adjustment is made while the receiver is in the rack, remove the aerial from CF1. High external noise level may result in incorrect adjustment of the CODAN THRESHOLD control).

(ii) Advance CODAN THRESHOLD control (R59) to its maximum anti-clockwise position so that maximum bias is applied to noise amplifier V13.

(iii) Connect the 0-100 uA. test meter to metering point CF6 in the cathode of relay valve V15 and adjust CODAN THRESHOLD control for about half-scale reading on the test meter.

(iv) Adjust the variable iron-core in anode inductor L6 (i.e., after the 1st. limiter V10) for maximum deflection on the meter.

(v) Set the CODAN OFF-ON switch to ON and adjust the CODAN THRESHOLD control for a test meter reading of 60 uA. in CF6 after checking that the codan relay just closes at 30-40 uA., as indicated by the receiver muting and the REC. MUTED pilot showing. If the relay fails to close at the current specified, adjustment of the relay is necessary.

(vi) Connect the signal generator to aerial input connector CF1, since it is already set to the operating frequency of the receiver.

Check that the REC. MUTED pilot extinguishes at an input signal of 1.0 uV.

(vii) If external noise is troublesome when the aerial is re-connected to CF1, the automatic noise-limiter may be brought into operation by setting the NOISE LIMITER switch to ON and adjusting N/L LEVEL control (R60) for most satisfactory suppression of noise peaks, with minimum distortion of telephony signals.

4.2.8 To Check CODAN Operation when Inductor L7 is replaced

With the CODAN THRESHOLD control adjusted for 50 uA. in jack CF6, (R.F., I.F., and CODAN alignment completed), check for correct CODAN operation as follows:-

(i) Apply a 6165 kc. signal of 30 mV., modulated 100% at a minimum audio frequency of 4000 cycles, to the signal grid of V4 (mixer) via C25 (6.8 uuF.)

(ii) Check that the reading at CF6 rises less than 20 uA. for correct CODAN operation.

(iii) If the rise at CF6 is greater than 20 uA., at 4000 cycles modulation frequency, resistor R97 must be shunted across inductor L7, in order to obtain a rise less than 20 uA.

4.2.9 Adjustment of LIMITER LEVEL Control

With all other adjustments complete, replace the bias rectifier V21 in its socket.

To adjust the limiting level in the audio stages of the receiver, proceed as follows:-

(i) Set the NOISE LIMITER switch to OFF.

(ii) Turn the LIMITER LEVEL control to the extreme anti-clockwise position.

(iii) With the signal generator accurately set to 6, 165 kc., modulated 30% at 400 cycles/sec., and connected directly across T2 secondary, adjust its output to 1000 uV.

(iv) Connect an output meter across the 600-ohm terminals of output transformer T11 (TSA1 & TSA2). Taking into consideration the output impedance of the meter, ensure that the output is correctly terminated.

(v) Advance the A.F. LEVEL control (behind the front panel) until the output meter reading is approximately 17V. (500 milliwatts).

(vi) Advance LIMITER LEVEL control until output indication just commences to drop.

(vii) Varying the modulation from 30% - 100% should not vary the output by more than 3 db.

5 - COMPONENT SCHEDULE

V.H.F. COMMUNICATION RECEIVER TYPE R30

CA 170 Ref. No.	Circ. Ref. No.	Description	D.C.A. Ident. No.
	Capacitors		
C1	C1	3.5-21.5 uuF., variable air trimmer, Polar type C31-11, 3 stator and 3 rotor plates	Y1/2289
C2	C2	33 uuF. ± 5%, 500V.W. silvered ceramic	Y1/102
C3	C3	100 uuF. ± 5%, 500V.W., silvered ceramic, non-insulated	Y1/752
C4	C4	100 uuF. ± 5%, 500 V.W., silvered ceramic, non-insulated	Y1/752
C5	C5	100 uuF. ± 5%, 500 V.W., silvered ceramic, non-insulated	Y1/752
C6	C6	100 uuF. ± 5%, 500 V.W., silvered ceramic, non-insulated	Y1/752
C7	C7	330 uuF. -0 + 100%, 500V.W., silvered ceramic	Y1/83
C8	C8	3.5-21.5 uuF., variable air trimmer, Polar type C31-11, 3 stator and 3 rotor plates	Y1/2289
C9	C9	3.5-21.5 uuF., variable air trimmer, Polar type C31-11, 3 stator and 3 rotor plates	Y1/2289
C10	C10	100 uuF. ± 5%, 500V.W., silvered ceramic, non-insulated	Y1/752
C11	C11	1,000 uuF. -0 + 100%, 500V.W., silvered ceramic	Y1/61
C12	C12	5 uuF. ± 5%, 500V.W., silvered ceramic (Refer to text)	Y1/587
C13	C13	33 uuF. ± 5%, 500V.W., silvered ceramic	Y1/102
C14	C14	100 uuF. ± 5%, 500V.W., silvered ceramic, non-insulated	Y1/752
C15	C15	100 uuF., ± 5%, 500V.W., silvered ceramic, non-insulated	Y1/752
C16	* (C16	100 uuF., ± 5%, 500V.W., silvered ceramic, non-insulated	Y1/752
	(	220 pf ± 20% 500V.W., ceramic tubular insulated CTR K1000	Y1/2381

C17		C17	1,000 uuF., ± 5%, 500V.W., silvered ceramic, non-insulated	Y1/761
C18		C18	100 uuF., ± 5%, 500V.W., silvered ceramic, non-insulated	Y1/752
C19		C19	100 uuF., ± 5%, 500V.W., silvered ceramic, non-insulated	Y1/752
C20		C20	330 uuF., -0 + 100%, 500V.W., silvered ceramic	Y1/83
C21		C21	100 uuF., ± 5%, 500V.W., silvered ceramic, non-insulated	Y1/752
C22		C22	1,000 uuF., -0 + 100%, 500V.W., silvered ceramic	Y1/61
C23		C23	3.5-21.5 uuF., variable air trimmer, Polar type C31-11, 3 stator and 3 rotor plates	Y1/2289
C24		C24	3.5-21.5 uuF., variable air trimmer, Polar type C31-11, 3 stator and 3 rotor plates	Y1/2289
C25		C25	6.8 uuF., ± 5%, 500V.W., silvered ceramic	Y1/99
C26		C26	5 uuF., ± 5%, 500V.W., silvered ceramic (Refer to text).	Y1/587
C27	* (	C27	100 uuF., ± 5%, 500V.W., silvered ceramic, non-insulated	Y1/752
	(		220 pf ± 20% 500V.W., ceramic tubular CTR K1000 insulated	Y1/2381
C28		C28	1,000 uuF., ± 5%, 500V.W., silvered ceramic	Y1/61
C29		C29	100 uuF., ± 5%, 500V.W., silvered ceramic, non-insulated	Y1/752
C30		C30	0.02 uF., 350V.W., tubular paper, metal case, insulated	Y1/86
C31		C31	3,300 uuF., -0 + 100%, 500V.W., silvered ceramic	Y1/2377
C32		C32	1,000 uuF., -0 + 100%, 500V.W., silvered ceramic	Y1/61
C33		C33	150 uuF. ± 5%, 500V.W., silvered ceramic (Power factor 75 parts in 10-4 at 1 Mc.)	Y1/255
C34		C34	150 uuF. ± 5%, 500V.W., silvered ceramic	Y1/255
C35		C35	1,000 uuF. -0 + 100%, 500V.W., silvered ceramic	Y1/61

C36	100 uuF. ± 5%, 500V.W., silvered ceramic, non-insulated	Y1/752
C37	2-18 uuF., variable air trimmer, Polar type C30-01, 3 stator and 3 rotor plates	Y1/588
C38	3-18 uuF., variable air trimmer, Polar type C30-01, 3 stator and 3 rotor plates	Y1/588
C39	2.2 uuF, ± 0.5%, 500V.W., silvered ceramic	Y1/246
C40	0.02 uF., 250V.W., tubular paper, metal case, insulated	Y1/86
C41	0.01 uF. -0 + 100%, 500V.W., silvered ceramic	Y1/2379
C42	0.1 uF., 350V.W., tubular paper, metal case insulated	Y1/38
C43	2.2 uuF. ± 0.5%, 500V.W., silvered ceramic	Y1/246
C44	0.02 uF., 350V.W., tubular paper, metal case, insulated	Y1/86
C45	3,300 uuF. -0 + 100%, 500V.W., silvered ceramic	Y1/2377
C46	33 uuF. ± 5%, 500V.W., silvered ceramic	Y1/102
C47	Not used	
C48	0.01 uF. -0 + 100%, 500V.W., silvered ceramic	Y1/2379
C49	150 uuF., ± 5%, 500V.W., silvered ceramic	Y1/255
C50	150 uuF., ± 5%, 500V.W., silvered ceramic	Y1/255
C51	1,000 uuF., -0 + 100%, 500V.W., silvered ceramic	Y1/61
C52	0.01 uF. -0 + 100%, 500V.W., silvered ceramic	Y1/2379
* (C53	1,000 uuF., -0 + 100%, 500V.W., silvered ceramic 3,300 pf - 0 _ 100% 500V.W., Hi K ceramic tubular insulated Ducon CTR K6000	Y1/61 Y1/2377
C54	0.02 uF., 350 V.W., tubular paper, metal case, insulated	Y1/86
C55	33 uuF., ± 5%, 500V.W., silvered ceramic (in L5 assembly)	Y1/102

C56		C56	0.01 uF. -0 + 100%, 500V.W., silvered ceramic	Y1/2379
C57		C57	0.01 uF., -0 + 100%, 500V.W., silvered ceramic	Y1/2379
C58		C58	3,300 uuF. -0 + 100%, 500V.W., silvered ceramic	Y1/2377
C59		C59	25 uuF. ± 10%, 500V.W., foil mica	Y1/2380
C60		C60	1,000 uuF. -0 + 100%, 500V.W., silvered ceramic	Y1/61
C61		C61	0.01 uF. -0 + 100%, 500V.W., silvered ceramic	Y1/2379
C62		C62	1,000 uuF. -0 + 100%, 500V.W., silvered ceramic	Y1/61
C63		C63	150 uuF. ± 5%, 500V.W., silvered ceramic	Y1/255
C64		C64	150 uuF. ± 5%, 500V.W., silvered ceramic	Y1/255
C65		C65	1,000 uuF. -0 + 100%, 500V.W., silvered ceramic	Y1/61
C66		C66	0.01 uF. -0 + 100%, 500V.W., silvered ceramic	Y1/2379
C67		C67	33 uuF. ± 5%, 500V.W., silvered ceramic	Y1/102
C68		C68	0.02 uF., 350V.W., tubular paper, metal case, insulated	Y1/86
C69		C69	0.01 uF. -0 + 100%, 500V.W., silvered ceramic	Y1/2379
C70		C70	33 uuF, ± 5%, 500V.W., silvered ceramic	Y1/102
C71		C71	3,300 uuF. -0 + 100%, 500V.W., silvered ceramic	Y1/2377
C72		C72	1,000 uuF. -0 + 100%, 500V.W., silvered ceramic	Y1/61
C73		C73	150 uuF. ± 5%, 500V.W., silvered ceramic	Y1/255
C74		C74	150 uuF. ± 5%, 500V.W., silvered ceramic	Y1/255
C75	*	(C75	100 uuF. ± 5% 500V.W., silvered ceramic	Y1/752
		(	220 ± 20% 500V.W., ceramic tubular Ducon CTR K1000 insulated	Y1/2381
C76		C76	3,300 uuF. -0 + 100%, 500V.W., silvered ceramic	Y1/2377

C77		C77	0.01uF. -0 ± 100%, 500V.W., silvered ceramic	Y1/2379
C78		C78	0.01 uF., 350V.W., tubular paper, metal case, insulated	Y1/452
C79		C79	0.02 uF., 350V.W., tubular paper, metal case, insulated	Y1/86
C80		C80	0.02 uF., 350V.W., tubular paper, metal case, insulated	Y1/86
C81		C81	Not used	
C82		C82	3,300 uuF. -0+ 100%, 500V.W., silvered ceramic	Y1/2377
C83		C83	0.05 uF., 350V.W., tubular paper, metal case, insulated	Y1/37
C84	* (	C84	100 uuF. ± 5%, 500V.W., silvered ceramic, non-insulated	Y1/752
	(		220 pf ± 20%, 500V.W., ceramic tubular insulated	Y1/2381
C85	* (	C85	100 uuF. ± 20%, 500V.W., foil mica	Y1/752
			220 pf ± 20%, 500V.W., ceramic tubular insulated	Y1/2381
C86		C86	0.01 uF. -0 + 100%, 500V.W., silvered ceramic	Y1/2379
C87		C87	150 uuF. ± 5%, 500V.W., silvered ceramic	Y1/255
C88		C88	150 uuF. ± 5%, 500V.W., silvered ceramic	Y1/255
C89		C89	33 uuF., ± 10%, 500V.W., style CMM1G	Y1/270
C90		C90	0.05 uF., 350V.W., tubular paper, metal case, insulated	Y1/37
C91		C91	0.01 uF. -0 + 100%, 500V.W., silvered ceramic	Y1/2379
C92		C92	100 uuF. ± 5%, 500V.W., silvered ceramic, non-insulated	Y1/752
93		C93	0.02 uF., 350V.W., tubular paper, metal case, insulated	Y1/86
4		C94	100 uuF., ± 5%, 500V.W., silvered ceramic, non-insulated	Y1/752
5		C95	0.01 uF. -0 + 100%, 500V.W., silvered ceramic	Y1/2379
6		C96	2,500 uuF., ± 20%, 500V.W., foil mica	Y1/356
7		C97	25 uF., 40 V.P., electrolytic	Y1/1846

C98	C98	16 uF., 525V.P., electrolytic	Y1/1723
C99	C99	8 uF. 525V.P., electrolytic	Y1/703
1C10	C100	0.05 uF., 350V.W., tubular paper, metal case, insulated	Y1/37
1C11	C101	0.002 uF., 500V.W., Style CP31-G	Y1/445
1C12	C102	0.05 uF., 350V.W., tubular paper, metal case, insulated	Y1/37
1C13	C103	0.5 uF., 350V.W., tubular paper, metal case, insulated	Y1/39
1C14	C104	0.01 uF., 350V.W., tubular paper, metal case, insulated	Y1/452
1C15	C105	25uF., 40V.P., electrolytic (mounting feet)	Y1/1744
1C16	C106	16 uF., 525V.P., electrolytic	Y1/1723
1C17	C107	0.05 uF., 350V.W., tubular paper, metal case, insulated	Y1/37
1C18	C108	5000 uuF. ± 5%, 500V.W., silver mica	Y1/366
1C19	C109	Not used	
1C20	C110	0.05 uF., 350V.W., tubular paper, metal case, insulated	Y1/37
1C21	C111	Same as C110	Y1/37
1C22	C112	Not used	
1C23	C113	1000 pfd ceramic	Y1/61
1C24	C114	Capacitor 25mF 500VW Type Ducon ES 2505	Y1/2295
1C25	C115	Capacitor 1000 PF 350VW Style CMM1 - G	Y1/324
1C26	C116	Capacitor 0.47 mF 400VW Philips Polyester Type C296 AC/A470K or Ducon DFH 140.	Y1/2351
1C27	C117	Capacitor 16 mF 450 VW Ducon ET 5 CT	Y1/2235

(b) Resistors

R1	R1	0.1 M. ohm, 1/2W., carbon, insulated	Y8/5492
R2	R2	220 ohm, 1/2W., carbon, insulated	Y8/165
R3	R3	4,700 ohm, 1/2W., carbon, insulated	Y8/263

R4	R4	0.22 M. ohm, 1/2W., carbon, insulated	Y8/5496
R5	R5	33,000 ohm, 3/4W., carbon, insulated	Y8/6494
R6	R6	50,000 ohm, 3/4W., carbon, insulated	Y8/6496
R7	R7	0.1 M. ohm, 1/2W., carbon, insulated	Y8/322
R8	R8	220 ohm, 1/2W., carbon, insulated	Y8/165
R9	R9	0.47 M. ohm, 1/2W., carbon, insulated	Y8/351
R10	R10	155 ohm, 1/2W., wire-wound	Y8/884
R11	R11	33,000 ohm, 1/2W., carbon, insulated	Y8/300
R12	R12	0.22 M. ohm, 1/2W., carbon, insulated	Y8/5496
R13	R13	0.1 M. ohm, 1/2W., carbon, insulated	Y8/322
R14	R14	25,000 ohm, 2W., carbon, insulated	Y8/6493
R15	R15	0.22 M. ohm, 1/2W., carbon insulated	Y8/5496
R16	R16	0.1 M. ohm, 1/2W., carbon, insulated	Y8/322
R17	R17	155 ohm, 1/2W., wire-wound	Y8/884
R18	R18	33,000 ohm, 1/2W., carbon insulated	Y8/300
R19	R19	2200 ohm, 1/2W., carbon, insulated	Y8/248
R20	R20	0.1 M. ohm, 1/2W., carbon, insulated	Y8/322
R21	R21	0.1 M. ohm, 1/2W., carbon, insulated	Y8/322
R22	R22	1000 ohm, 1/2W., carbon, insulated	Y8/5468
R23	R23	10,000 ohm, 3/4W., carbon, insulated	Y8/167
R24	R24	680 ohm, 1/2W., carbon, insulated	Y8/226
R25	R25	0.47 M. ohm, 1/2W., carbon, insulated	Y8/351

R26	R26	10,000 ohm, 3/4W., carbon insulated	Y8/6488
R27	R27	33,000 ohm, 2 W., carbon, insulated (2 x 68,000 ohm, 1W., in parallel)	Y8/6498
R28	R28	0.1 M. ohm, 1/2W., carbon, insulated	Y8/322
R29	R29	1.0 M. ohm, 1/2W., carbon, insulated	Y8/367
R30	R30	0.22 M. ohm, 1/2W., carbon, insulated	Y8/5496
R31	R31	2,200 ohm, 1/2W., carbon, insulated	Y8/248
R32	R32	0.22 M. ohm, 1/2W., carbon, insulated	Y8/5496
R33	R33	25,000 ohm, 1/2W., carbon, insulated	Y8/5485
R34	R34	0.1 M. ohm, 1/2W., carbon, insulated	Y8/322
R35	R35	1,000 ohm, 1/2W., carbon, insulated	Y8/5468
R36	R36	1,000 ohm, 1/2W., carbon insulated	Y8/5468
R37	R37	1,000 ohm, 1/2W., carbon insulated	Y8/5468
R38	R38	0.1 M. ohm, 1/2W., carbon, insulated	Y8/322
R39	R39	10,000 ohm, 1W., carbon, insulated	Y8/6488
R40	R40	33,000 ohm, 2 W., carbon, insulated (2 x 68,000 ohm, 1W., in parallel)	Y8/6498
R41	R41	0.1 M. ohm, 1/2W., carbon, insulated	Y8/322
R42	R42	1,000 ohm, 1/2W., carbon, insulated	Y8/5468
R43	R43	0.22 M. ohm, $\pm$ 20%, 0.75W., carbon, insulated	Y8/338
R44	R44	1,000 ohm, 1/2W., carbon, insulated	Y8/5468
R45	R45	1,000 ohm, 3/4W., carbon, insulated	Y8/159
R46	R46	0.25 M. ohm, 1/2W., carbon, insulated	Y8/5497

R47	R47	10,000 ohm, 1W., carbon, insulated	Y8/6488
R48	R48	33,000 ohm, 2 W., carbon, insulated (2 x 68,000 ohm, 1W., in parallel)	Y8/6498
R49	R49	0.15 M. ohm, ± 20%, 0.75W., carbon insulated	Y8/330
R50	R50	0.1 M. ohm, 1/2W., carbon, insulated	Y8/322
R51	R51	4,700 ohm, 1/2W., carbon, insulated	Y8/263
R52	R52	150 ohm, 3/4W., carbon, insulated	Y8/203
R53	R53	1,000 ohm, 1/2W., carbon, insulated	Y8/5468
R54	R54	47,000 ohm, 1/2W., carbon, insulated	Y8/308
R55	R55	0.22 M. ohm, 1/2W., carbon, insulated	Y8/5496
R56	R56	47,000 ohm, 3/4W., carbon, insulated	Y8/168
R57	R57	0.1 M. ohm, 1/2W., carbon, insulated	Y8/322
R58	R58	150 ohm, 3/4W., carbon, insulated	Y8/203
R59	R59	0.1 M. ohm variable carbon potentiometer, Morganite LHNAR10450/LESF32, linear, spindle 1.3/16" long with ½" flat	Y8/1856
R60	R60	50,000 ohm, variable carbon potentiometer, Morganite LHNAR50350/LESD24, spindle 15/16" long with screwdriver slot 3/64" wide and 1/16" deep, linear	Y8/1846
R61	R61	47,000 ohm 1/2W., carbon, insulated	Y8/308
R62	R62	33,000 ohm, 1/2W., carbon, insulated	Y8/300
R63	R63	0.47 M. ohm, 1/2W., carbon, insulated	Y8/351
R64	R64	22.4 ohm, 1/2W., wire-wound	Y8/4556
R65	R65	1.0 M. ohm, 1/2W., carbon, insulated	Y8/367
R66	R66	0.1 M. ohm, 1/2W., carbon, insulated	Y8/322
R67	R67	0.5 M. ohm, variable carbon potentiometer, Morganite LHNAR50410/LESD24, Log. lar, spindle 15/16" long with ~~screwdriver slot 3/64" wide~~ and 1/16" deep	Y8/1875

R68	R68	0.22 M ohm 1/2W., carbon insulated	Y8/338
R69	R69	0.22 M. ohm, 1/2W., carbon, insulated	Y8/338
R70	R70	630 ohm, 1/2W., carbon, insulated	Y8/5466
R71	R71	330 ohm, 1/2W., carbon, insulated	Y8/212
R72	R72	~~200~~ ohm, 8W., wire-wound, ctg. C, mtg. ft. 350Ω ADJ	Y8/4271 Y9/1064
R73	R73	0.22 M. ohm, 1/2W., carbon, insulated	Y8/5496
R74	R74	22,000 ohm 1/2W., carbon, insulated	Y8/161
R75	R75	0.5 M. ohm, variable carbon potentiometer, Log. law, spindle 15/16" long with screwdriver slot 3/64" wide and 1/16" deep, Morganite LHNAR50410/LESD24	Y8/1875
R76	R76	2,200 ohm, 1/2W., carbon, insulated	Y8/248
R77	R77	0.47 M. ohm, 1/2W., carbon, insulated	Y8/351
R78	R78	0.47 M. ohm, 1/2W., carbon, insulated	Y8/351
R79	R79	0.22 M. ohm, 1/2W., carbon, insulated	Y8/5496
R80	R80	0.47 M. ohm, 1/2W., carbon, insulated	Y8/351
R81	R81	330, M. ½W., carbon, insulated	Y8/113
R82	R82	47,000 ohm 3/4W., carbon, insulated	Y8/168
R83	R83	470 M, 1/2W., carbon insulated	Y8/351
R84	R84	680 ohm ± 10% 1/2W., carbon, insulated	Y8/5466
R85	R85	470 M, 1/2W., carbon, insulated	Y8/351
R86	R86	6,800 ohm ± 10%, 1/4W., carbon, insulated	Y8/270
R87	R87	33,000 ohm ± 10%, 1/2W., carbon, insulated	Y8/5486

R88	R88	6,800 ohm ± 10%, 1/4W., carbon insulated	Y8/270
R89	R89	0.47 M. ohm, 1/2W., carbon insulated	Y8/351
R90	R90	4,700 ohm, 4.5W., wire-wound VIT Enamel	Y8/943
R91	R91	Not used	
R92	R92	220 ohm, 6W., wire-wound, VIT. Enamel	Y8/920
R93	R93	220 ohm, 6W., wire-wound, VIT. ENAMEL	Y8/920
R94	R94	1.0 M. ohm, 3/4W., carbon, insulated	Y8/170
R95	R95	0,22M., ± 10% ½ W., Fitted only if required	Y8/338
R96	R96	100 ohm, 1/2W., carbon, insulated	Y8/158
R97	R97	470 ohm, ½W., carbon, insulated	Y8/351
R98	R98	15 ohm ¼ watt carbon, insulated	Y8/175
R99	R99	470 ohm, ¼ watt carbon, insulated	Y8/5464
R10	R100	470 ohm ¼ watt carbon, insulated	Y8/5464
R11	R101	470 ohm ¼ watt carbon, insulated	Y8/5464
R12	R102	470 ohm ¼ watt carbon, insulated	Y8/5464
R13	R103	1 Meg ¼ watt carbon, insulated	Y8/367
R14	R104	220 ohm 0.5W	Y8/208
R15	R105	47K ohm 0.5W	Y8/168
( )	Connectors		
SK1	CF1	Coaxial, single-point, female	V8/419
SK2	CF2,)		
SK3	CF3,)	Socket assembly, 2 point, female	V8/302
SK4	CF4,)	Socket assembly, 2 point, female	
SK6	CF6,)	Socket assembly, 2 point, female	
SK5	CF5	Socket assembly, 2 point, female	V8/303
( )	Crystal		
X1	X1	Crystal HC3 Holder	Y2/3
( )	Fuse		
F1	F1	Fuse, glass cartridge, loaded 3A	Y12/9
FH1	-	Fuse holder, panel MTG	V12/41

(e) Jack

JK1	J1	Single-circuit	V8/18

(g) Lamps

LP1	P1	6.3V., 0.25A., M.E.S. base	V1/130
LP2	P2	6.3V., 0.25A., M.E.S. base	V1/130
LH1	-	Lamp Holder	V15/-

(h) Relay comprising:-

RL1	REL1	3000-type, 2 x 1000 ohm coil, double-polarized, 20/SCO/444;	V13/195
		Yoke assembly c/w armature 12 mil stud, spring sets, 1/SSP/803 and 7/SSP/803	V13/979

(j) Valve Sockets

VS1	V1	7-pin miniature, ceramic, fitted with screen registor	Y11/646
		Screen for above socket	Y11/661
VS2	V2	7-pin miniature, ceramic, fitted with screen register	Y11/646
		Screen for above socket	Y11/661
VS3	V3	7-pin, miniature, ceramic, fitted with screen register	Y11/646
		Screen for above socket	Y11/661
VS4	V4	7-pin miniature, ceramic, fitted with screen register	Y11/646
		Screen for above socket	Y11/661
VS5	V5	7-pin miniature, ceramic, fitted with screen register	Y11/646
		Screen for above socket	Y11/661
VS6	V6	7-pin miniature, ceramic, fitted with screen register.	Y11/646
		Screen for above socket	Y11/661
VS7	V7	7-pin miniature, ceramic, fitted with screen register	Y11/646
		Screen for above socket	Y11/661
VS8	V8	7-pin miniature, ceramic, fitted with screen register	Y11/646
		Screen for above socket	Y11/661

VS9	V9	7-pin miniature, ceramic, fitted with screen register	Y11/646
		Screen for above socket	Y11/661
VS10	V10	7-pin miniature, ceramic, fitted with screen register	Y11/646
		Screen for above socket	Y11/661
VS11	V11	7-pin miniature, ceramic, fitted with screen register	Y11/646
		Screen for above socket	Y11/661
VS12	V12	7-pin miniature, ceramic, fitted with screen register	Y11/646
		Screen for above socket	Y11/661
VS13	V13	7-pin, miniature, ceramic, fitted with screen register	Y11/646
		Screen for above socket	Y11/661
VS14	V14	7-pin, miniature, ceramic, fitted with screen register	Y11/646
		Screen for above socket	Y11/661
VS15	V15	7-pin, miniature, ceramic, fitted with screen register	Y11/646
		Screen for above socket	Y11/661
VS16	V16	7-pin, miniature, ceramic, fitted with screen register	Y11/646
		Screen for above socket	Y11/661
VS17	V17	7-pin, miniature, ceramic, fitted with screen register	Y11/646
		Screen for above socket	Y11/661
VS18	V18	7-pin, miniature, ceramic, fitted with screen register	Y11/646
		Screen for above socket	Y11/661
VS20	V20	7-pin, miniature, ceramic, fitted with screen register	Y11/646
		Screen for above socket	Y11/661
VS21	V21	7-pin, miniature, ceramic, fitted with screen register	Y11/646
		Screen for above socket	Y11/661
VS22	V22	7-pin, miniature, ceramic, fitted with screen register	Y11/646

(k) Switches

S1	S1	Toggle type, S.P.S.T.	V14/248
S2	S2	Toggle type, D.P.D.T.	V14/713
S3	S3	Toggle type, D.P.S.T.	V14/85
S4	S4	Toggle type, S.P.S.T.	V14/674

(l) Terminal Blocks

TL1	TSA	Block, 5-way	V8/154
TL2	TSB	Connector, 2-way	V8/185

(m) Inductors

L1	L1	Aerial inductor assembly, comprising:- Mounting panel 55917T147, Capacitor 2U52838, Inductor 55917T147 - 6 turns 18 S.W.G. tinned copper wire wound clockwise at 16 t.p.i., inside diameter 3/16", $1\frac{1}{4}$" long, winding 6/16", aerial tap $1\frac{1}{2}$ turns from end, $1\frac{1}{2}$" long of 22 S.W.G. tinned copper wire	Y3/179
L2	L2	Oscillator grid choke, 14 turns 28 mil. enamel copper wire, and colour blue, varnish dip	Y3/182
L3	L3	Oscillator anode assembly, $12\frac{1}{2}$ turns 18 mil enamel copper wire close-wound on .406" outside diameter former, tuning slug at top of can. Connections: Start to tag 5, Finish tag 4, Identification V95 printed near can top and blue dot near tag 1 on base. Can size 2.9/16" high by 1.5/16" square	Y3/181
L4	L4	Doubler anode assembly, single winding, $5\frac{1}{2}$ turns close-wound on .406" outside diameter former, 22.4 mil enamel copper wire, tuning slug at top of can. Connections: Start to tag 5, Finish to tag 4, Identification Red dot near tag 1 on base. Can size 2.9/16" high by 1.5/16" square.	Y3/180

L5	L5	A.G.C. I.F. assembly, 6,165 kc., 40 turns enamel copper wire close-wound on .406" outside diameter former; Connections: Start tag 5, Finish tag 4, tuning slug as base of can, capacitors 33 uuF. between tag 4 & 5, 25 uuF. between 5 & 2. Identification V96 printed near can top, white dot near tag 1 on base. Can size 2.9/16" high by 1.5/16"	Y3/423
L6	L6	Limiter I.F. assembly, 12.33 Mc., 15 turns 18 mil enamel copper wire close-wound on .406" outside diameter former, Start tag 4, Finish tag 5, capacitors 33 uuF. between tag 4 & 5, tuning slug in base of can. Identification V97 printed near can top, green dot near tag 1 on base. Can size 2.9/16" high by 1.5/16" square	Y3/424
L7	L7	Audio choke, impedance 28,000 ohms, Inductance 5.8H at 100-cycles, double-wound, D.C. resistance 754-ohms; insulation 500V. R.M.S. between windings and to frame. Telcovin flexible leads. Approximate can size 1 3/8" x 2" high Bitumen impregnated	Y3/177
L8	L8	Filter choke, 125 mA., C.C., resistance 87 ohms; inductance 5.45H. at 50 cycles; insulation 2.5 kV. between windings and to frame; dry air filled. Approximate can size, 3.7/16" x 4" x 4.3/16" high. Corundite seal-type terminals.	Y3/178
L9	L9	Choke filter 10H 100mA Special type TZ805 (size to HR 22281, sheet 2)	Y3/1662
(n)	<u>Transformers.</u>		
T1	T1	R.F. inductor and capacitor assembly comprising:- Mounting panel 55917T146, two variable trimmer capacitors type 2U52838, and two inductors type 55917T148, each 6 turns 18 S.W.G. enamel copper wire, 3/16" inside dia., wound anti-clockwise at 16 t.p.i., 1¼" long, winding 3/8".	Y3/307
T2	T2	R.F. Inductor and capacitor assembly, comprising:- Mounting panel 55917T146, two variable trimmer capacitors type 2U52838, and two inductors type 55917T148, each 6 turns 18 S.W.G. enamel copper wire, wound anti-clockwise at 16 t.p.i., 3/16" inside dia., 1¼" long, winding 3/8"	Y3/307

T3	T3	1st. I.F. assembly, 6,165 kc., comprising:- primary and secondary windings each 20 turns 18 mil enamel copper wire, space-wound at approx. 33 t.p.i., on 9/16" dia. former, and each shunted by 150 uuF. ± 5%, 500V.W., silvered ceramic capacitor, T.C.C. type SCT13, with two tuning cores. Identification, white dot near tag 1 on base, V88 printed near can top, Approx. can size 1.5/16" x 3 1/8" high	Y9/162
T4	T4	Tripler output transformer comprising:- Mounting panel 55917T146, two variable trimmer capacitors type 2U52838 and two inductors type 55917T147, each 6 turns 18 S.W.G. tinned copper wire wound clockwise at 16 t.p.i., inside dia. 3/16", 1¼" long, winding 3/8"	Y3/308
T5	T5	2nd. I.F. assembly, 6,165 kc., comprising:- primary and secondary windings each 20 turns 18 mil enamel copper wire, space-wound at approx. 33 t.p.i. on 9/16" dia. former, and each shunted by 150 uuF., 500V.W., silvered ceramic capacitor, T.C.C. type SCT13, with two tuning cores. Identification, white dot near tag 1 on base, V88 printed near can top. Approx. can size, 1.5/16" x 3 1/8" high	Y9/162
T6	T6	3rd I.F. assembly, 6,165 kc., comprising:- primary and secondary windings each 20 turns 18 mil enamel copper wire, space-wound at approx. 33 t.p.i. on 9/16" dia. former, and each shunted by 150 uuF., 500V.W., silvered ceramic capacitor, T.C.C. type SCT13, with two tuning cores. Identification, white dot near tag 1 on base, V88 printed near can top. Approx. can size, 1.5/16" x 3 1/8 high	Y9/162
T7	T7	4th I.F. assembly, 6,165 kc., comprising:- primary and secondary windings each 20 turns 18 mil enamel copper wire, space-wound at approx. 33 t.p.i. on 9/16" dia. former, and each shunted by a 150 uuF., 500V.W., silvered ceramic capacitor, T.C.C. type SCT13, with two tuning cores. Identification, white dot near tag 1 on base, V88 printed near can top. Approx. can size, 1.5/16" x 3 1/8" high	Y9/162
T8	T8	5th I.F. assembly, 6,165 kc., comprising:- primary and secondary windings, each 20 turns 18 mil enamel copper wire, space-wound at approx. 33 t.p.i. on 9/16" dia. former, and each shunted by 150 uuF., 500V.W., silvered ceramic capacitor, T.C.C. type SCT13, with two tuning cores, Identification, white dot near tag 1 on base, V88 printed near can top. Approx. can size, 1.5/16" x 3 1/8" high	Y9/162

T9	T9	Compressor rectifier coupling, impedance ratio 7500/7500 ohms C.T., Ip - 8 mA., Primary D.C. resistance 905 ohms, dry-air filled, Corundite seal-type terminals; insulation 2 kV. between windings and to frame. Approx. can size 2½" x 1 3/4" x 2½" high	Y9/160
T10	T10	Rectifier, Primary: 200-260V. in 20V. steps, 50-60 cycles. Secondary: 276V./C.T./276V., 125mA.; 6.3V., 6.6A.; 5V., 3A. Oil-filled, hermetically sealed with Corundite seal-type terminals. Insulation 2kV. between windings and to frame. Approx. can size 5¼" x 4½" x 6.7/8" high	Y9/165
T11	T11	Audio output, impedance ratio 5400/600 ohms, Ip - 40 mA. D.C., Lp., 17.5H. at 50 cycles. Dry-air filled with Corundite seal-type terminals. Primary D.C. resistance 370 ohms. Secondary 71 ohms. Insulation 2 kV. between windings and to frame. Approx. can size 3¼" x 2.5/8" x 2.7/16" high	Y9/61

(o) Valves

V1	V1	6AK5	Y11/374
V2	V2	6J6	Y11/398
V3	V3	6AK5	Y11/374
V4	V4	6AU6	Y11/376
V5	V5	6AU6	Y11/376
V6	V6	6BA6	Y11/382
V7	V7	6AU6	Y11/376
V8	V8	6AL5	Y11/375
V9	V9	6BA6	Y11/382
V10	V10	6AU6	Y11/376
V11	V11	6BA6	Y11/382
V12	V12	6BA6	Y11/382
V13	V13	6AU6	Y11/376
V14	V14	6AU6	Y11/376
V15	V15	6AU6	Y11/376
V16	V16	6AL5	Y11/375

V17	V17	6BA6	Y11/382
V18	V18	6AU6	Y11/376
V20	V20	6AU6	Y11/376
V21	V21	6AL5	Y11/375
V22	V22	6AQ5	Y11/3
(p)	Silicon Diodes		
D1	W1	1N2358	Y11/112
D2	W2	1N2358	Y11/112

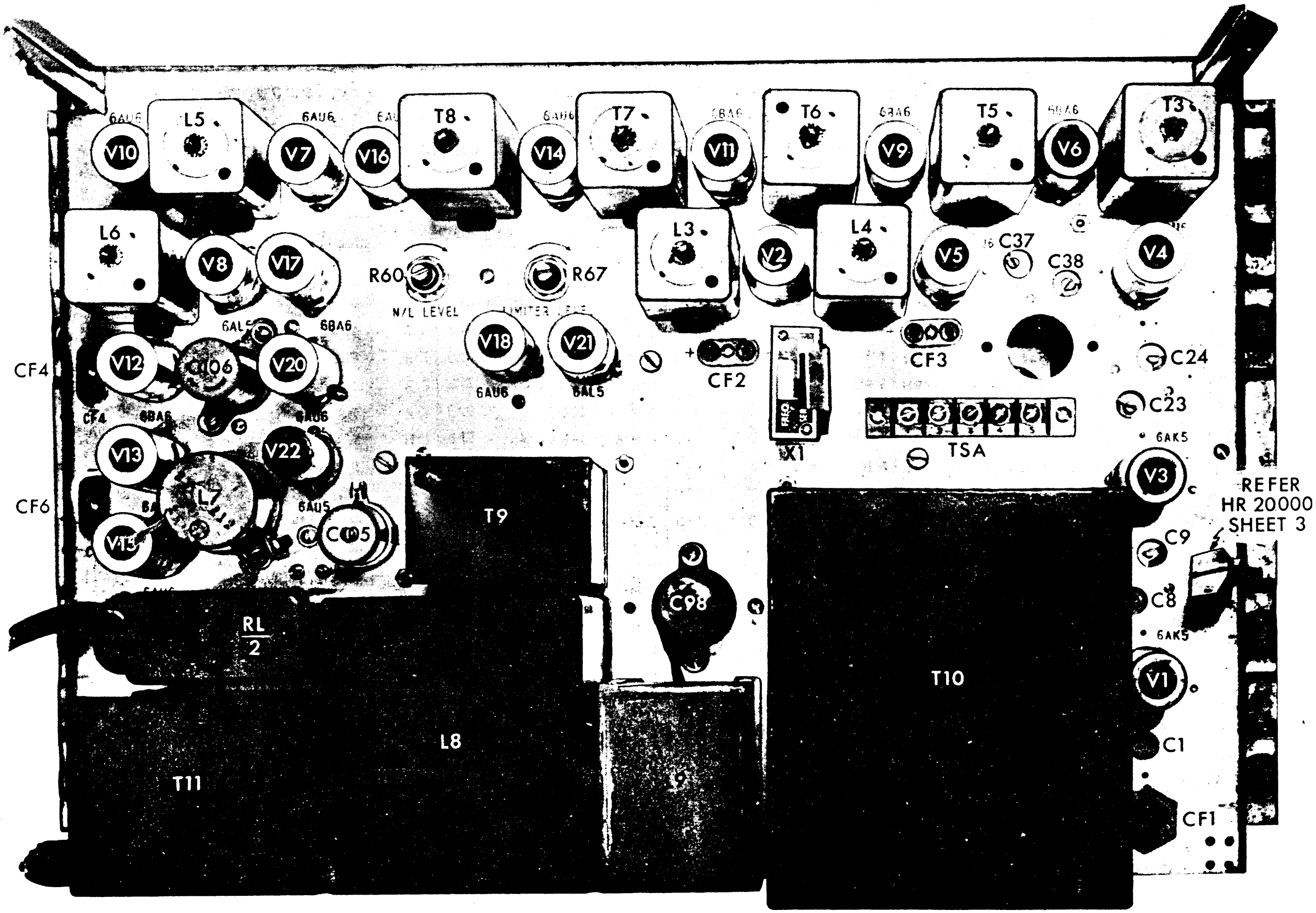

FIG 1. REAR VIEW, VHF RECEIVER R30

COMPONENT LOCATION

CAPACITORS

C1	B-9	C11	G-4	C21	G-3	C31	B-3	C41	C-D-2	C51	D-2	C61	P-2	C71	G-3	C81		C91	R-6	C101	L-4	C111
C2	C-9-B-8	C12	G-3	C22	E-4	C32	B-3	C42	R-3	C52	N-4	C62	F-3	C72	H-3	C82	J-3	C92	L-2	C102	M-5-6	C112
C3	B-9	C13	C-6	C23	B-5	C33	B-2	C43	K-2	C53	M-3	C63	F-2	C73	H-2	C83	H-3	C93	K-3	C103	H-6	C113
C4	A-8	C14	B-6	C24	B-4	C34	B-2	C44	M-2	C54	E-2	C64	F-2	C74	H-2	C84	P-6	C94	L-2	C104	M-5	C114
C5	C-8	C15	B-5	C25	B-4	C35	B-2	C45	C-3	C55	N-2	C65	F-2	C75	P-5	C85	P-6	C95	K-3	C105	L-M-6	C115
C6	C-8	C16	G-4	C26	E-3	C36	D-3	C46	M-N-3	C56	M-2	C66	P-2	C76	P-5	C86	J-3	C96	L-5	C106	N-5	C116
C7	C-7	C17	G-4	C27	E-3	C37	D-3	C47		C57	E-2	C67	P-4	C77	N-5	C87	K-2	C97	K-6	C107	L-9	C117
C8	B-7	C18	C-6	C28	F-4	C38	C-3	C48	B-3	C58	E-3	C68	G-2	C78	N-5	C88	K-2	C98	G-H-7	C108	N-9	
C9	B-7	C19	C-6	C29	D-E-4	C39	C-3	C49	D-2	C59	N-2	C69	H-2	C79	N-6-7	C89	K-2	C99	F-G-6	C109		
C10	B-6	C20	C-5	C30	A-4	C40	C-2	C50	D-2	C60	R-5	C70	P-4	C80	J-2	C90	L-8	C100	N-4	C110	J-6	

RESISTORS

R1	B-8	R11	G-4	R21	B-3	R31	M-3	R41	N-P-2	R51	P-6	R61	L-3	R71	J-4	R81	M-6	R91		R101	H-2
R2	C-8	R12	B-6	R22	B-3	R32	N-3	R42	R-5	R52	H-2-3	R62	L-3	R72	C-D-10	R82	N-5	R92	E-7	R102	J-K-2
R3	F-5	R13	C-5	R23	D-2-3	R33	N-4	R43	P-3	R53	J-2	R63	L-3	R73	M-4	R83	N-10	R93	E-8	R103	K-2
R4	B-7-8	R14	F-4	R24	C-2	R34	M-2	R44	G-2	R54	N-6	R64	R-6	R74	N-4	R84	N-9	R94	B-8	R104	M-4
R5	C-7	R15	B-2	R25	M-3	R35	N-2	R45	F-3	R55	P-N-6	R65	K-L-3	R75	M-N-7	R85	N-10	R95	N-6	R105	M-5
R6	H-4	R16	C-3	R26	C-2	R36	F-3	R46	P-4	R56	N-6	R66	L-3	R76	L-4	R86	N-10	R96	J-4		
R7	B-6	R17	E-4	R27	C-3	R37	E-2	R47	G-2	R57	J-K-3	R67	J-3	R77	M-5	R87	M-10	R97	B-10		
R8	C-6	R18	E-3	R28	D-2	R38	F-2	R48	G-3	R58	N-2	R68	K-5	R78	H-4	R88	N-10	R98	D-4		
R9	A-6	R19	E-4	R29	N-3	R39	E-2	R49	N-5	R59	C-7	R69	K-5	R79	M-N-4	R89	J-5	R99	D-2		
R10	G-5	R20	B-4	R30	N-4	R40	E-3	R50	N-6-P-5	R60	L-3	R70	M-4	R80	M-6	R90	M-8	R100	F-2		

MISCELLANEOUS

VALVES AND DIODES

V1	B-8	V10	P-2	V20	M-5
V2	F-G-4	V11	G-2	V21	J-4
V3	B-6	V12	P-5	V22	M-6
V4	B-4	V13	P-6	W1	G-7
V5	E-4	V14	J-2	W2	F-G-7-8
V6	C-2	V15	P-7		
V7	M-2	V16	L-2		
V8	N-4	V17	M-4		
V9	E-2	V18	K-4		

TRANSFORMERS

T1	B-7	T10	E-8
T2	B-5	T11	N-9
T3	B-2		
T4	C-D-3		
T5	D-2		
T6	F-2		
T7	H-2		
T8	K-2		
T9	K-6		

INDUCTORS

L1	B-9
L2	F-4
L3	H-4
L4	F-4
L5	N-2
L6	P-4
L7	N-6
L8	K-9
L9 TOPSIDE	

SOCKETS

CF1	B-10
CF2	G-4
CF3	E-4
CF4	R-5
CF5	F-5
CF6	R-6

SWITCHES

S1	G-8
S2	J-8
S3	H-J-10
S4	E-8

LAMPS

P1	G-10
P2	K-10

VARIOUS

TERMINAL STRIPS		JACK	
TSA	D-5	J1	K-10
TSB	L-10	**FUSE**	
		F1	G-10
RELAY		**CRYSTAL**	
RL 2	M-N-8	X1	F-5

FIG. 2.

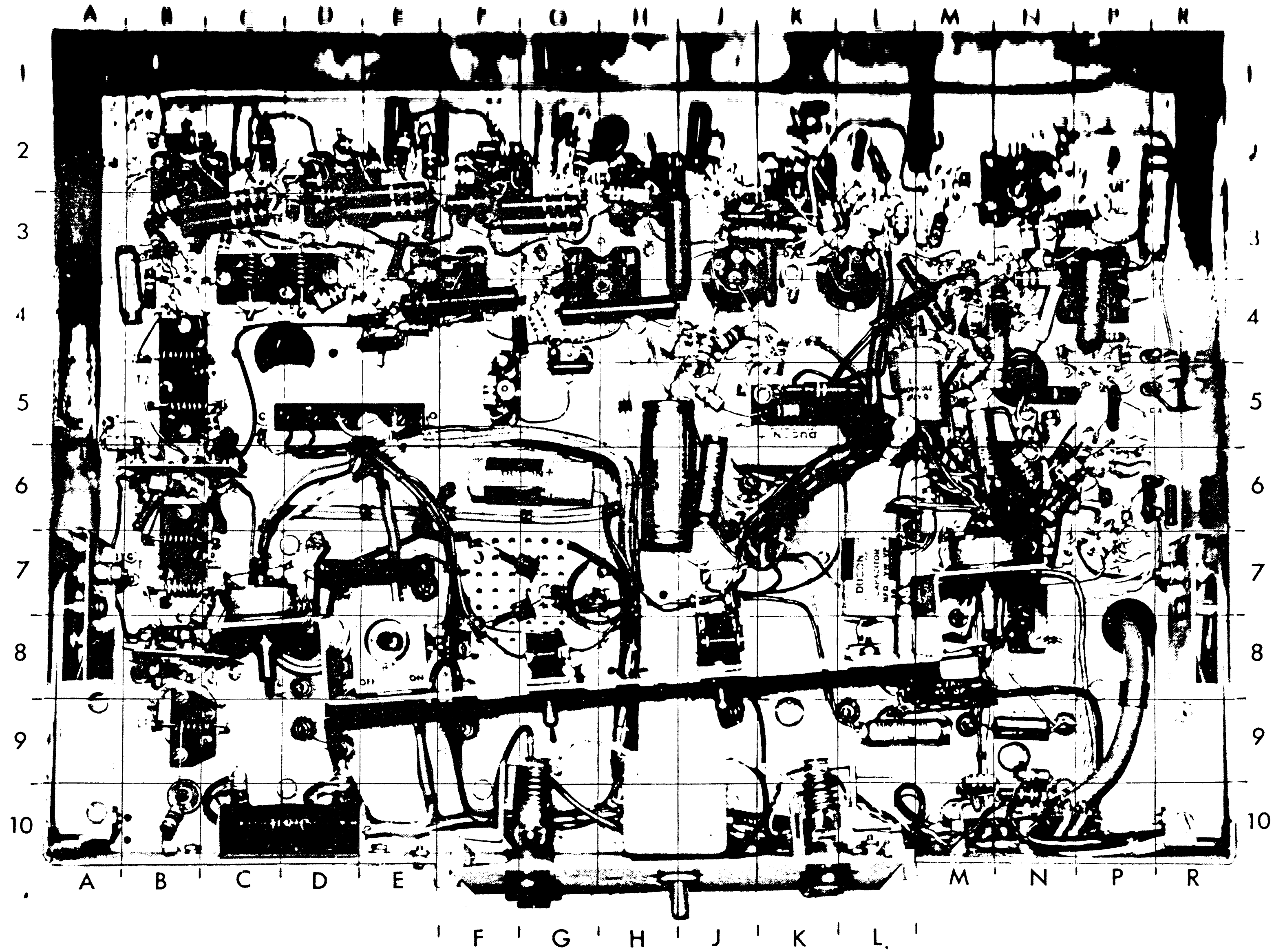

FIG. 3 FRONT VIEW, VHF RECEIVER R30