MARCONI INSTRUMENTS

RTV 3

EB 801B/1
1 - 11/55

OPERATING AND MAINTENANCE

HANDBOOK

for

SIGNAL GENERATOR

TYPE TF 801B/1

MARCONI INSTRUMENTS LTD., ST. ALBANS, HERTS., ENGLAND

CONTENTS

CONTENTS (Continued)

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SCHEDULE OF PARTS SUPPLIED

The complete equipment comprises the following items:-

1. One Signal Generator Type TF 801B/1 complete with attached mains lead, and with valves, etc., as under:-

Valves:	Two:	Type 5861 (DET22), Disc-Seal Triodes.
	One:	Type 6L6 (KT66), Tetrode.
	One:	Type 6AK5 (EF95), Pentode.
	One:	Type 6C4 (L77), Triode.
	One:	Type 12AT7, Double Triode.
	One:	Type 6AS7 (A1834), Double Triode.
	One:	Type 5R4GY, Full-Wave Rectifier.
	One:	Type OB2, Voltage Stabilizer.
Lamp:	One:	6.3-volt, 0.15-amp, M.C.C., Pilot Lamp.
Crystals:	One:	B.T.H. Type CS2A Rectifier.
	Two:	B.T.H. Type CG1E Rectifier.
Fuses:	Two:	2-amp, Glass Cartridge.
	One:	0.15-amp, Glass Cartridge.

2. One 50-ohm Output Lead Type TM 4824.
(Connectors: Type N to Type N.)

3. One 20-dB Attenuator Pad Type TM 4919.
(Connectors: Type N to Type N.)

4. One D.C. Isolating Unit Type TM 4917.
(Connectors: Type N to Crocodile Clips.)

5. One 50-ohm to 75-ohm Matching Unit Type TM 4918.
(Connectors: Type N to Belling Lee Type L734/P.)

6. One 50-ohm to 300-ohm Unbalanced-to-Balanced Matching Unit Type TM 4916.
(Connectors: Type N to Soldering Tags.)

7. One Instruction Book No. EB 801B/1.

1. DESCRIPTION

1.1. GENERAL

The Marconi Signal Generator Type TF 801B/1 covers the frequency range 12 to 470 Mc/s. The output can be continuous wave, sinewave amplitude modulated internally or externally, or pulse amplitude modulated externally. The Generator has an output impedance of 50 ohms.

A NORMAL/HIGH r.f. level switch is fitted. With the switch at NORMAL, the generator provides a calibrated output continuously variable from 0.1 µV to 0.5 volts; also sinewave a.m. can be applied at any depth up to 30%; at most carrier frequencies modulation depths up to 90% can be achieved. With the switch at HIGH, a setting giving the r.f. oscillator valve a reduced life, the maximum output can be increased at most carrier frequencies to 1 volt modulated or 2 volts unmodulated.

For internal modulation there is a 1000 c/s oscillator. External modulation can be applied in either of two ways. One way - the built-in 0-90% modulation monitor is in use, the modulating circuit is a.c. coupled, and sinewave signals between 30 c/s and 20 kc/s can be applied; the other way, particularly useful for video and general pulse modulating signals - the monitor is out of use, the modulating circuit is d.c. coupled, and the r.f. amplifier bandwidth (between 500 kc/s and 3 Mc/s depending on the carrier frequency) is sufficient to accommodate pulse modulation at repetition frequencies up to at least 50 kc/s.

The main dial is hand calibrated directly in frequency, and has a total scale length of approximately 80 inches. An incremental frequency dial driven from the single tuning control allows interpolation between main scale markings to a high degree of accuracy - an extremely useful facility for bandwidth or similar measurements.

The circuit design includes a tuned power amplifier following the master oscillator. Modulation is applied to the carrier at the r.f. amplifier without disturbance to the operating parameters of the master oscillator - low incidental frequency modulation and a good response to pulse modulation have been achieved by this arrangement.

1.2. DESIGN DETAILS

The general arrangement of the electrical circuits is shown on the Functional Diagram, Drawing No. TBB 24165, while the complete Circuit Diagram is given on Drawing No. TC 23093/1; component values are given in the Spares Ordering Schedule No. SOS 801B/1. Both diagrams and the schedule are included at the end of this manual.

Reference to these diagrams should assist the reader in fully understanding the principles described in this section.

R.F. Circuits. The master oscillator (valve V2 on the main circuit diagram) is of the shunt-fed Colpitts type, and its output is applied to a grounded-grid tuned amplifier (valve V6). Each stage employs a planar electrode triode of the disc-seal variety, and has a turret type tuning system. Both the oscillator and the amplifier use capacitance switching to avoid the necessity of passing heavy r.f. circulating currents through metal-to-metal contacts with their inevitably varying contact resistance. The two turrets are ganged together and are rotated to effect band changing.

Tuning within any one band is accomplished by the movement of the two rotors, which are ganged together by means of a wire-drive system. To allow the amplifier to be tuned exactly to the frequency of this master oscillator, there is an independent peaking control which varies the angular position of the amplifier rotor relative to that of the oscillator rotor.

The mechanical arrangement of the r.f. unit assembly is illustrated on MP 801B/1 - TOP VIEW OF R.F. UNIT - at the end of this manual.

The method of coupling the r.f. oscillator to the power amplifier is shown on the circuit diagram, and is dependent upon the frequency band in use. Three types of coupling are used - a capacitive potential divider at the low frequencies, a tapped tuning inductance at the middle frequencies, and a combination of tapped inductance and series capacitance at the high frequencies.

Both modulation and bias are applied to the cathode of the r.f. amplifier valve by means of the d.c. connection between this cathode and the anode of the modulator valve (V9).

1.2. (Continued)

The level of the output from the r.f. amplifier is monitored by a crystal voltmeter comprising the CARRIER LEVEL meter (M1) and the silicon rectifier (X1) inductively coupled to the amplifier tuned circuit. The scale marking of this CARRIER LEVEL meter extends over 6 dB above the SET CARRIER reference mark.

The output from the Signal Generator is drawn via a continuously variable piston attenuator of the mutual inductance type, the launching or input coil of this attenuator being the whole or part of the r.f. amplifier tuning inductor depending on the frequency band in use.

The NORMAL/HIGH switch is included in order that the life of the disc-seal r.f. oscillator valve may be conserved by reducing its anode dissipation when large output levels are not required. With the switch at NORMAL, a resistor in series with the anode circuit reduces the h.t. current and runs the valve well below its permitted rating. With the switch at HIGH, a setting needed only when taking maximum or near maximum output for some application such as energizing an r.f. bridge, the resistor is cut out, and the oscillator gives greater drive to the following amplifier.

Modulation. The internal 1000-c/s modulation oscillator comprises a triode valve (V7) operating in a series-fed Hartley circuit. The output is taken via the SET MODULATION potentiometer (RV3) from a secondary winding on the oscillator transformer (T3) to the grid of the modulation valve (V9), which feeds the signal to the cathode of the r.f. amplifier valve.

For external modulation, the internal oscillator is switched out of circuit, and the input from the external source is introduced via the terminals for sinewave modulation, or the coaxial socket for pulse modulation, and applied to the grid of valve V9.

Modulation depth is monitored on a separate panel meter (M2) which is directly calibrated from 0 to 90%, the indication being produced by amplification and rectification of the a.f. component of the voltage from the carrier level detector (X1). The voltage developed across the load resistor of this detector is applied via a coupling capacitor to the grid of an amplifier valve (V8A), the first section of a double triode. The output from the anode of

1.2. (Continued)

V8A is taken to the grid of the second triode section (V8B), which is connected as a cathode follower. The output at the cathode is rectified by means of a pair of germanium-crystal diodes and applied to the meter. Indication of modulation depth is thus based on a system of absolute measurement, and is independent of any indirect calibration associated with the level of the modulating voltage applied to the modulator stage.

Power Supply Unit. The a.c. mains input is fed, via the ON/OFF switch and fuses, to the primary winding of a single transformer (T1), which is wound with suitable secondary windings to provide all the a.c. voltages required by the instrument, including the filament supplies to the valves. The h.t. supply, derived from a centre-tapped winding, is applied to a full-wave rectifier valve (V1), and thence to a choke-capacitor smoothing circuit. The d.c. voltage is regulated by a conventional series stabilizer circuit, in which the grid voltage of a tetrode cathode-follower valve (V3) is controlled by a high gain pentode amplifier (valve V4), the reference voltage level being provided by means of a gas-filled stabilizer (V5).

The primary connections of the mains transformer can be adjusted so that the instrument can be operated from any 40- to 100-c/s a.c. supply in the voltage ranges 100 to 150 volts and 200 to 250 volts; the instrument can also be operated from a 500-c/s 180-volt supply. Filtering arrangements are provided to supress r.f. leakage via the a.c. supply line.

2. OPERATION

2.1. INSTALLATION

Unless otherwise specified the Signal Generator is normally despatched with its valves in position and with its mains input circuit adjusted for immediate use with 230-volt a.c. mains supplies. The instrument can be adjusted for operation from any supply voltage within the range 180 to 250 and 100 to 150 volts. To check or alter the setting of the mains transformer tappings, the user should refer to MAINTENANCE - Sections 4.4 and 4.4.1 or 4.4.2.

2.1.1. Switching ON and Warming Up

Before switching ON, be quite sure that the instrument is correctly adjusted to suit the particular mains supply to which it is to be connected. Then proceed as follows:-

(1) Connect the mains lead - which is stowed, when not in use, in the left-hand case handle recess - to the mains supply socket.

(2) Check that the NORMAL/HIGH OUTPUT switch is set to NORMAL.

(3) Switch ON by means of the SUPPLY switch; the red pilot lamp should then glow.

(4) Before proceeding further, allow a short time, say 5 minutes, to elapse for the valves to warm up and attain thermal equilibrium. If a particularly high order of stability is required, this time should be increased to, say, 30 minutes.

2.2. TUNING THE INSTRUMENT

The r.f. oscillator tunes from 12 to 470 Mc/s in five bands, which are as follows:-

12	to	24 Mc/s
24	to	48 Mc/s
48	to	110 Mc/s
110	to	260 Mc/s
260	to	470 Mc/s

2.2. (Continued)

To produce the required output frequency:

(1) Select the required frequency band by means of the RANGE switch. To change from one band to another, rotate this control through one and a fifth turns per band until the mechanism locates positively with the knob pointing to the required band. The knob may be turned in either direction as convenient.

(2) Turn the frequency control until the required frequency is indicated on the main tuning dial. Using the central hair-line on the transparent cursor, read the main tuning dial on the calibration arc appropriate to the band selected with the RANGE switch in (1) above.

The frequency control knob is fitted with a small incremental dial which is calibrated linearly from 0 to 100 over its whole circumference and makes approximately 30 revolutions as the main dial is turned through its complete angle of rotation.

After the relationship is determined between (i) movement of the incremental dial through one division and (ii) the corresponding change in frequency, the incremental dial can be used to sub-divide linearly any portion of the frequency cover on any band, a facility which is very useful when making bandwidth or similar measurements.

Tuning through one division of the incremental dial is, at the centre of each band, equivalent to a frequency change of the following order:-

5 kc/s on the 12 to 24 Mc/s band.
10 kc/s on the 24 to 48 Mc/s band.
25 kc/s on the 48 to 110 Mc/s band.
50 kc/s on the 110 to 260 Mc/s band.
100 kc/s on the 260 to 470 Mc/s band.

It will be appreciated that, since the main tuning dial on each Signal Generator is individually calibrated, the above figures can only be regarded as typical. It follows that the relationship between the frequency change and the change in incremental dial reading should be individually determined by the user - in the manner

2.2. (Continued)

outlined below - on the particular TF 801B/1 he is using.

To determine the change in frequency for a one-division change in incremental dial reading, proceed as follows:-

(1) Set the main tuning dial to some convenient whole number of Mc/s at or near the centre of the band to be subsequently used.

(2) Rotate the 0-100 incremental dial relative to the frequency control knob so that its 0 is indicated by the cursor and the reading of the main tuning dial is not altered.

(3) Starting with the main dial indicating the frequency chosen in (1) above, and with the incremental dial reading 0, turn the frequency control until the reading on the main dial changes by a whole number of megacycles.

(4) From: (a) the difference in frequency between the starting point chosen in (1) and the finishing point chosen in (3),
and (b) the total number of incremental divisions traversed in tuning from one point to the other on the main tuning dial,
calculate the frequency change per division of the incremental dial; this change may be conveniently expressed in kilocycles per division.

The following example, obtained by manipulation of the controls on a particular TF 801B/1, illustrates the above method of determining the incremental frequency change per division of the incremental dial.

Example: With the main dial set to 190 Mc/s, the incremental dial was turned relative to the frequency control knob until it read 0. After the frequency control had been set to give a main dial reading of 200 Mc/s, the reading on the incremental dial was 85. The total number of incremental divisions traversed was 185, the incremental dial having rotated through more than one revolution for the frequency change of 10 Mc/s, i.e., 10,000 kc/s.

2.2. (Continued)

In this case, a change of 1 division on the incremental dial corresponded, between 190 and 200 Mc/s, to a nominal frequency change of

$$\frac{10,000}{185} = \text{(Almost exactly) } 54 \text{ kc/s}$$

The law of the main tuning dial of a TF 801B/1 is substantially linear with respect to frequency; where any departure from this law occurs, it will invariably be in the upper quarter of each of the five frequency bands of the Signal Generator. For general working over the lower three-quarters of each of the frequency bands, it will be found that once the relationship between frequency change and change in incremental dial reading has been established at one point near to the centre of each band, the figures can be used over the whole of the lower three-quarters of their respective bands.

When working within the upper quarter of any band, or when the highest accuracy is required at any part of a band, the relationship should be determined separately for the particular section of the frequency band over which the incremental variations are to be made.

2.3. SETTING UP FOR CONTINUOUS WAVE OR MODULATED OUTPUT

The Signal Generator includes facilites for providing the following types of output:-

(1) Continuous wave.

(2) Sinewave modulated,

(a) from the internal 1000-c/s oscillator;
(b) from an external source operating within the frequency range 30 c/s to 20 kc/s.

(3) Pulse modulated from an external source.

2.3. (Continued)

Sections 2.3.1 to 2.3.3, which follow, detail the different setting up procedures required to produce the various types of r.f. output listed above. If, when following these procedures, attempts are made to set up a source e.m.f. greater than 0.5 volt or a sinewave modulation depth greater than 30%, it may be found that, at certain carrier frequencies, there is either (i) insufficient r.f. output to produce a CARRIER-LEVEL-meter deflection to the SET CARRIER mark, or (ii) not sufficient output in reserve to accommodate the required percentage modulation.

In such circumstances, the NORMAL/HIGH switch should be set to HIGH. This action increases the h.t. voltage applied to the master oscillator, and results in a larger amplitude drive to the following tuned amplifier stage, which supplies the input to the attenuator.

With the NORMAL/HIGH switch at NORMAL, the disc-seal oscillator valve operates at only a fraction of its permitted anode dissipation. With the switch at HIGH, the dissipation increases, and the valve operates near its maximum rating. While the HIGH output setting may be used freely when necessary, the practice of operating, whenever possible, with the switch at NORMAL greatly conserves the life of the oscillator valve.

2.3.1. Continuous Wave

(1) Set the MODULATION switch to OFF.

(2) Tune to the required carrier frequency (see Section 2.2. TUNING).

(3) Set the ATTENUATOR dial to indicate the required open-circuit output voltage. (The NORMAL maximum is 0.5 volt or 114 dB above 1 µV.)

(4) Adjust the SET CARRIER control to produce a small deflection on the CARRIER LEVEL meter or, if no reading is obtained on the meter, turn the SET CARRIER control to a point of approximately three-quarters of the way to its maximum clockwise setting.

2.3.1. (Continued)

(5) Carefully tune the PEAK CARRIER control for maximum reading on the CARRIER LEVEL meter; if necessary, readjust the SET CARRIER control to keep the pointer of the CARRIER LEVEL meter on the scale.

(6) Finally, adjust the SET CARRIER control to bring the pointer of the CARRIER LEVEL meter to the red line marked SET CARRIER.

2.3.2. <u>Sinewave Modulation</u>

(a) <u>From the internal 1000-c/s oscillator</u>

(i) Set the MODULATION switch to INT.

(ii) Tune the Signal Generator and peak the output at the required carrier frequency in a manner similar to that described for c.w.

(iii) Adjust the SET MODULATION control to give the required percentage depth as indicated on the MODULATION meter.

(iv) If necessary, readjust the SET CARRIER control to maintain the CARRIER-LEVEL-meter reading at the SET CARRIER mark.

(b) <u>From an external source</u>

(i) Set the MODULATION switch to EXT SINE.

(ii) Couple the external source to the EXTERNAL MOD terminals marked SINE and E.

(iii) Tune the Signal Generator and peak the output at the required carrier frequency in a manner similar to that described for c.w.

(iv) Adjust the level of the input from the external source to give the required modulation depth as indicated on the MODULATION meter.

2.3.2. (Continued)

(v) If necessary, readjust the SET CARRIER control to maintain the CARRIER-LEVEL-meter reading at the SET CARRIER mark.

The impedance presented between the SINE and E terminals to the external modulating source is nominally 1 MΩ resistive shunted by 100 μμF. An input of the order of 1.0 volt r.m.s. is required to produce 30% modulation. With the MODULATOR switch set to EXT SINE, the frequency characteristic of the modulating circuits is flat to within 1 dB with respect to 1 kc/s.

2.3.3. External Pulse Modulation

Introductory Notes

For this type of operation, set the MODULATION switch to EXT PULSE. This action directly couples the grids of the modulator valve to the EXTERNAL MOD. PULSE inlet socket; with this one exception the internal circuits of the Signal Generator are the same as for the c.w. and, with no input applied to the PULSE inlet, the Signal Generator gives a normal c.w. output.

The impedance presented at the PULSE input socket to the external modulating source is nominally 1 MΩ shunted by 50 μμF. An input of not less than 25 volts pulse height is required for pulse modulation; for the best carrier suppression and time of rise, an input of the order of 50 volts should be used.

The r.f. bandwidth of the Signal Generator changes with carrier frequency; it is approximately 500 kc/s when the instrument is tuned to 12 Mc/s, and increases to approximately 3 Mc/s at the 470-Mc/s end of the range. These bandwidths correspond to video-frequency responses of 250 kc/s and 1.5 Mc/s respectively.

Squarewave Modulation. If a squarewave of unity mark-space ratio is applied to the PULSE input socket, the mean level of the carrier, which is "on" during the positive periods, is reduced by half, with corresponding reduction in the CARRIER-LEVEL-meter reading. With the meter deflection set up to the SET CARRIER mark by means of the SET CARRIER control the output level is such that the r.m.s. voltage during the "on" period is equal to twice the voltage indicated on the attenuator dial.

2.3.3. (Continued)

Unless the squarewave is completely negative-going with respect to zero, a suitable blocking capacitor must be used, the capacitance being large enough to provide, in conjunction with the 1 MΩ grid leak of the modulator valve, a time constant which is long compared with the periodic time of the square-wave; by this means, the squarewave is restored to the correct mean d.c. level by the diode action of the grid and cathode of the modulator valve.

Positive Pulse Modulation. A positive-going pulse input signal can be used to produce the usual type of pulse-modulated r.f. output, where the "on" period is the duration of the pulse - see figure 1B of drawing No. TBB 24855, which follows page 17. There are two methods of applying the positive-going pulse modulating signal; one requires the use of a battery and external circuit, and is to be used when the absolute r.f. level during the pulse period is important, while the other method, which needs only an input capacitor, does not permit monitoring of the r.f. output.

The mean r.f. level is not sufficient to cause any significant deflection of the CARRIER LEVEL meter; so it is clearly impossible to monitor the output voltage directly. However, by the use of a simple external d.c. restoring circuit, the instrument may be set up to provide a calibrated level of pulse modulated output. The procedure is as follows:-

(1) Connect a germanium crystal diode, a variable d.c. voltage source comprising a battery and 10-kΩ potentiometer, and two 1-μF capacitors into a circuit as shown in figure 2 of drawing No. TBB 24855 following page 17. It is important that the diode is not connected in the reverse direction to that shown; the electrode corresponding to the anode of a thermionic diode should be connected to the PULSE socket inner. A high backward-resistance diode such as the B.T.H. CG1E should be used - with this diode, the "red" electrode should be connected to the slider of the potentiometer.

2.3.3. (Continued)

(2) With no pulse input, turn the SET CARRIER control to maximum, tune to the required frequency, and peak the output as for c.w., then adjust the external potentiometer to bring the CARRIER LEVEL meter pointer to the SET CARRIER mark.

(3) Apply the positive-going input pulse, via the blocking capacitor as shown, to the PULSE input socket of the Signal Generator. The r.m.s. voltage output during the pulse periods will then be indicated by the ATTENUATOR dial.

When the absolute level of the output signal is unimportant, it may be more convenient to apply the second method of injecting the pulse input signal, using only an input capacitor externally. This capacitor, which is connected in series with the input signal, should be of such a value that its time constant in conjunction with the 1-MΩ grid leak of the modulator valve is large compared with the periodic time of the pulse signal. With the pulses applied in this way, the modulator valve, by normal self-bias action, d.c. restores the positive peaks of the pulses to zero as described for squarewave modulation.

The Signal Generator should then be regarded as uncalibrated in respect of absolute output level; the attenuator can, of course, still be used to vary the output level and its decibel scales can be used to make known increments or decrements in the output level.

Negative Pulse Operation. The application of negative-going pulses, which may normally be fed directly into the PULSE input socket, results in the r.f. output being suppressed for the duration of the applied pulses as shown diagrammatically in figure 1A of drawing No. TBB 24855.

Providing the pulse length is not more than 5% of the complete cycle, when the CARRIER LEVEL meter is set to the SET CARRIER mark the amplitude of the r.f. output signal is very nearly equal to the level indicated on the attenuator dial.

FOLD UNDER

PULSE MODULATION DIAGRAMS

MARCONI INSTRUMENTS LIMITED							
DRN	J. F. G.	DATE	13-4-55	TRCD	H. J. F.	CHKD	[signature]
STOCK LIST		TF801 B		DRG Nº		TBB 24855	

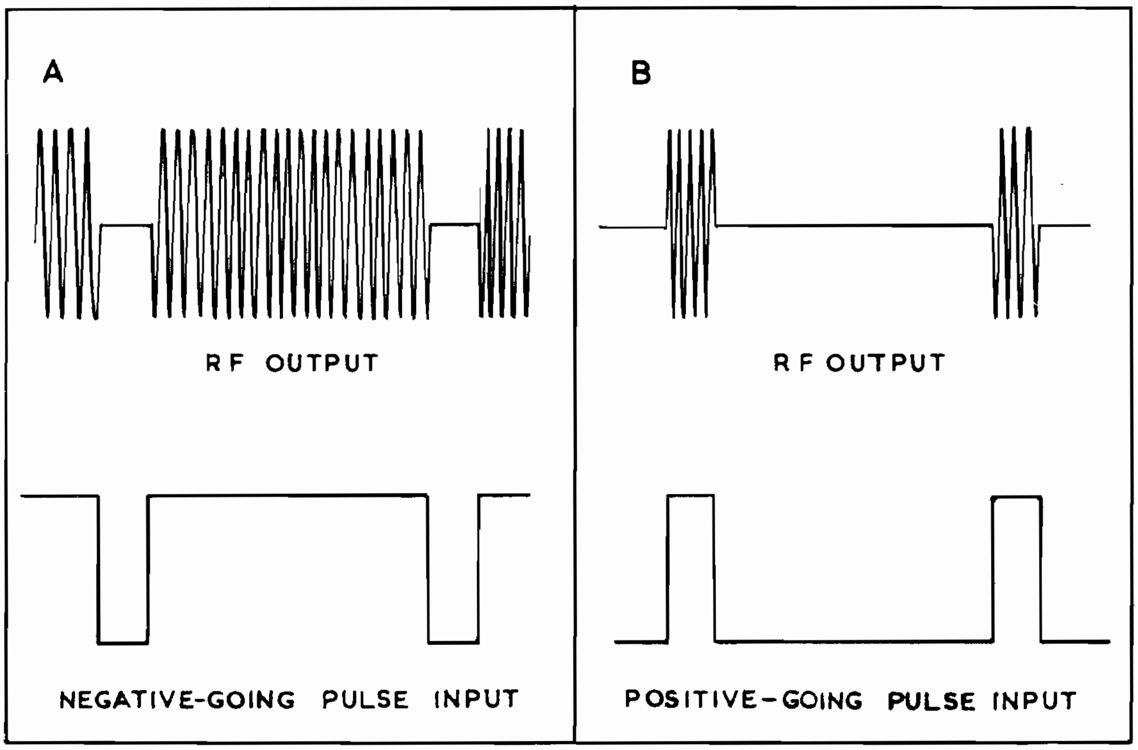


FIGURE 1

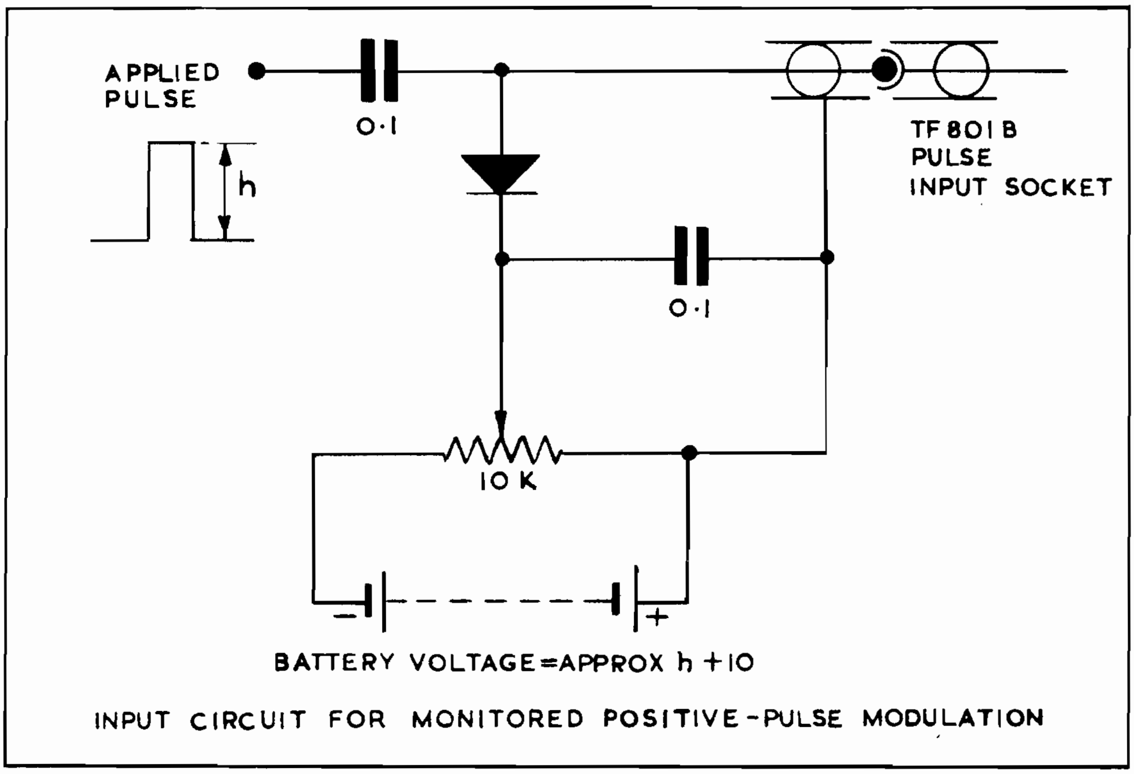


FIGURE 2

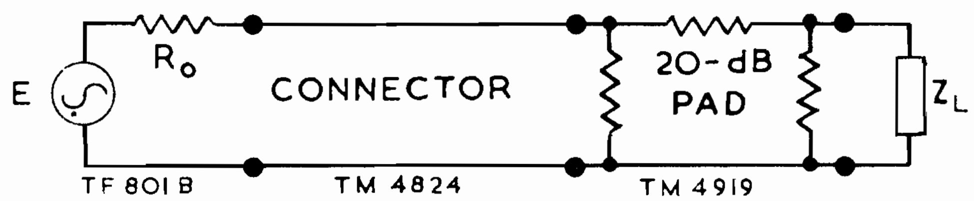
PULSE MODULATION DIAGRAMS

E IS THE E.M.F. INDICATED ON THE ATTENUATOR DIAL

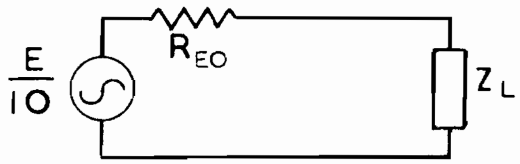
R_O IS THE OUTPUT RESISTANCE OF THE TF 801B = 50 OHMS

Z_L IS THE LOAD IMPEDANCE

FIGURE 3 OUTPUT CONDITIONS FOR DIRECT COUPLING

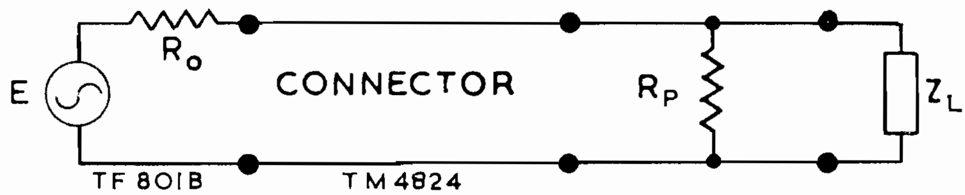


OUTPUT CIRCUIT WITH 20-dB PAD IN USE. THIS IS EQUIVALENT TO:—

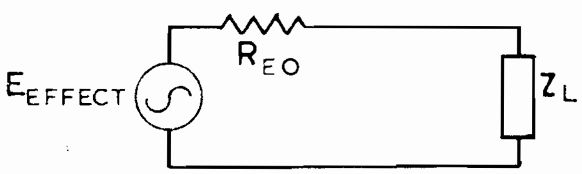


WHERE $R_{EO} = R_O$

FIGURE 4 OUTPUT CONDITIONS FOR COUPLING VIA THE 20-dB PAD



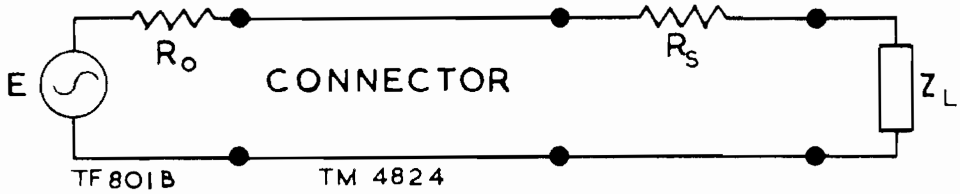
OUTPUT CIRCUIT FOR SOURCE RESISTANCE < 50 OHMS THIS IS EQUIVALENT TO:—



WHERE $E_{EFFECT} = E \dfrac{R_P}{R_P + R_O}$

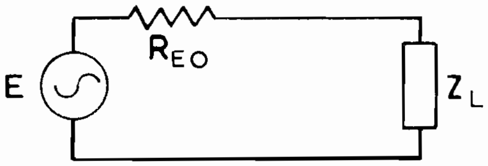
$R_{EO} = \dfrac{R_P R_O}{R_P + R_O}$

FIGURE 5 OUTPUT CONDITIONS USING PARALLEL RESISTOR



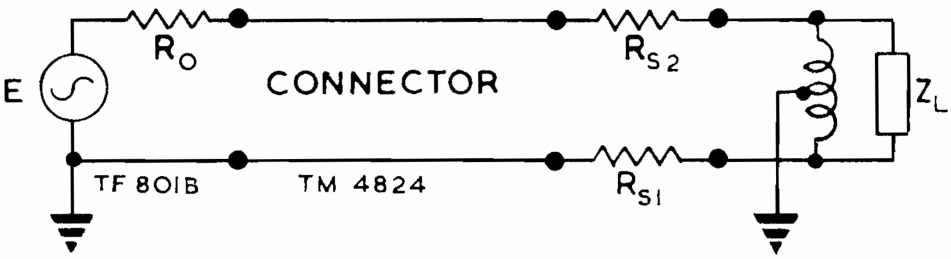
OUTPUT CIRCUIT FOR SOURCE RESISTANCE > 50 OHMS

THIS IS EQUIVALENT TO:–

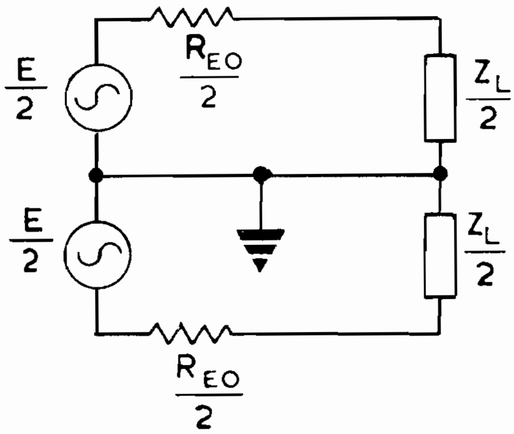


WHERE $R_{EO} = R_O + R_S$

FIGURE 6 OUTPUT CONDITIONS USING SERIES RESISTOR



OUTPUT CIRCUIT FOR BALANCED LINE-TO-LINE SOURCE RESISTANCE > 100 OHMS. WHEN FEEDING INTO BALANCED WINDING THIS IS EQUIVALENT TO:-



WHERE R_{EO} = LINE-TO-LINE RESISTANCE

$$R_O + R_{S2} = \frac{R_{EO}}{2}$$

$$R_{S1} = \frac{R_{EO}}{2}$$

FIGURE 7 OUTPUT CONDITIONS FOR COUPLING TO BALANCED LOAD

D

OUTPUT ARRANGEMENT DIAGRAMS

S

TBB 24856

2.4. R.F. OUTPUT ARRANGEMENTS

For consideration of its output circuit, the TF 801B/1 should be regarded as a zero-impedance voltage generator in series with a resistance of 50 ohms. This condition is shown diagrammatically in figure 3 of drawing No. TBB 24856, where E is the e.m.f. indicated on the ATTENUATOR dial, R_O is the source resistance of the generator, and Z_L is the load impedance.

The ATTENUATOR dial has four scales as follows:-

(i) The dBμV scale, calibrated from -20 to +120 indicates the output e.m.f. in decibels relative to 1 μV.

(ii) The e.m.f. scale, calibrated in units of voltage from 0.1 μV to 1 volt, indicates the e.m.f. directly.

(iii) The dBm scale, calibrated from +7 to -130, indicates the power delivered to an external 50-ohm load in terms of decibels relative to 1 mW.

(iv) The fourth and inner scale, calibrated from 0 to +70, indicates the power output to an external load in decibels relative to thermal noise for a noise-bandwidth of 10 kc/s. (The technique for applying this scale is discussed in Section 2.4.3.)

With the SET CARRIER control adjusted to bring the CARRIER-LEVEL-meter pointer to the SET CARRIER mark, the ATTENUATOR scales are direct reading, each in its particular units as described above.

NOTE: For outputs which require an ATTENUATOR setting corresponding to more than 0.5 volt on the e.m.f. scale, see later Section 2.4.2.

2.4.1. Coupling to the equipment under test (use of the Output Accessories)

The Output CONNECTOR Type TM 4824. This is a 50-ohm coaxial cable 36 inches long and fitted at either end with standard type N free plug (United States, Military No. UG-21B/U; Great Britain Transradio Ltd., type GE.071). These plugs mate with either a standard type N free socket (United States, Military No. UG-23B/U; Great Britain, Transradio Ltd., type 6.043) or a panel mounting type N socket (United States, Military No. UG-22B/U; Great Britain, Transradio Ltd., type DE.071).

Because the Signal Generator has an output impedance which is nominally equal to the characteristic impedance of the CONNECTOR cable, this cable may be regarded as correctly terminated at the input end, so that the possibility of serious errors in the apparent e.m.f. caused by standing waves in the cable can generally be neglected even when the input impedance of the equipment under test is not equal to 50 ohms. However, it is often more important for other reasons that the source impedance is either accurately matched to the load or that it has a particular known value not equal to 50 ohms. Under these circumstances, the effective source resistance at the output end of the system can be altered to the required value by the use of various matching networks, a selection of these being supplied as accessories with the instrument.

The 20-dB Attenuator PAD Type TM 4919. When the equipment under test has an input impedance other than 50 ohms and it is important that the signal is derived from a 50-ohm source, it is advisable, if the insertion loss can be tolerated, to couple the CONNECTOR to the load via the 50-ohm 20-dB attenuator PAD.

With the PAD in circuit, the possibility of error in apparent e.m.f. or effective output impedance due to standing waves is avoided because it is impossible to seriously mismatch the cable - variations in the load impedance from zero to infinity cause the effective line-terminating resistance to depart from its correct value by only 1 ohm approximately.

Figure 4 on drawing No. TBB 24856 shows diagrammatically the effect of connecting the Pad into circuit. The final output conditions are equivalent to those of a zero-impedance

2.4.1. (Continued)

generator producing an e.m.f. equal to E/10 in series with a resistance, R_{EO}, of 50 ohms. The p.d. across the load can, of course, be calculated in the usual way and is equal to

$$\frac{E}{10} \times \frac{Z_L}{R_{EO} + Z_L} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where E is the e.m.f. indicated on the ATTENUATOR dial,

R_{EO} is the effective source resistance of the Signal Generator (50 ohms).

Z_L is the input impedance of the equipment under test.

The PAD is fitted with a type N socket at its input end and a type N plug at its output end.

Source Resistance Less than 50 ohms. If the required source resistance is less than 50 ohms, the arrangement shown in figure 5 can be used. A resistor having a value R_p is connected effectively in parallel with the source resistance of the generator so that the output resistance of the system, R_{EO}, is given by the standard expression for resistances in parallel, viz:

$$R_{EO} = \frac{R_p \times R_0}{R_p + R_0}$$

where R_0 is the output resistance of the Signal Generator.

Since the value of the required output resistance is usually the known term, the above expression is more useful when rearranged as follows:-

$$R_p = \frac{R_0 \times R_{EO}}{R_0 - R_{EO}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

2.4.1. (Continued)

Under these conditions, the effective source e.m.f., E_{EFFECT}, presented to the load is given by the expression

$$E_{EFFECT} = E \times \frac{R_p}{R_p + R_0} \quad \text{.................................(3)}$$

where E is the e.m.f. indicated on the ATTENUATOR dial.

Source Resistance Greater than 50 ohms. If the required source resistance is greater than 50 ohms, a resistor having a value R_S can be connected in series with the output as shown in figure 6. With this arrangement, the effective output resistance, R_{EO}, is given by the expression for resistances in series, viz:

$$R_{EO} = R_0 + R_S$$

or, more conveniently

$$R_S = R_{EO} - R_0 \quad \text{..(4)}$$

where R_0 is the output resistance of the Signal Generator.

For the special case where R_{EO} is equal to 75 ohms, the 50-ohm to 75-ohm MATCHING UNIT Type TM 4918 is supplied. This unit contains a 25-ohm resistor which, connected in series with the 50-ohm source resistance of the Signal Generator, gives an effective output resistance of 75 ohms. The MATCHING UNIT is fitted with a type N socket at its input end and a Belling Lee Ltd., type L734/P plug at its output end; this plug mates with a Belling Lee Ltd. free socket type L734/J or panel mounting socket type L604/S.

When the effective output resistance is altered by the above method, the CONNECTOR is mismatched at its output end; it is advisable, therefore, if the insertion loss can be tolerated, to insert the 20-dB PAD between the output end of the CONNECTOR and the correcting resistor, R_S or R_p. The effective source e.m.f. is, of course, then reduced by a factor of 20 dB.

2.4.1. (Continued)

Using the Signal Generator with Balanced Loads. With certain types of equipment, the input circuit is in the form of a balanced winding. Such equipment can be fed from the unbalanced output of the Signal Generator via two correcting resistors as shown in figure 7; this arrangement makes use of the auto-transformer effect of the centre-tapped winding to simulate the behaviour of a balanced source. One resistor, R_{S1}, is connected in series between the earthed screen of the output accessory in use and one side of the balanced winding, and a second resistor, R_{S2}, is connected in series with the "live" output connection and the other side of the balanced winding.

The values of the two resistors, R_{S1} and R_{S2}, can be calculated from the following expressions

$$R_{S1} = \frac{R_{EO}}{2} \quad \text{..............................} (5)$$

$$R_{S2} = \frac{R_{EO}}{2} - R_0 \quad \text{..........................} (5a)$$

where R_{EO} is the required line-to-line output resistance of the Signal Generator.

R_0 is the source resistance of the Signal Generator (50 ohms).

The 50-ohm to 300-ohm UNBALANCED TO BALANCED TRANSFORMER type TM 4916, supplied with the instrument, operates on the principle described above and is fitted with a type N socket at its input end and solder spills at its output end. In this unit, the values of resistors R_{S1} and R_{S2} are 150 ohms and 100 ohms respectively, giving a total line-to-line source resistance of 300 ohms.

When feeding balanced loads by the method described above, it is advisable, if the insertion loss can be tolerated, to use the 20-dB PAD. The effective source e.m.f. is, of course, then reduced by a factor of 20 dB.

OUTPUT ARRANGEMENT DIAGRAMS

FOLD UNDER

MARCONI INSTRUMENTS LIMITED							
DRN.	J. F. G.	DATE	29·4·55	TRCD	H. J. F.	CHKD	
STOCK LIST		TF 801 B		DRG No		TBB 24856	

2.4.1. (Continued)

The D.C. ISOLATING UNIT Type TM 4917. This unit contains a 300-volt working 0.001-µF capacitor connected in series with the output line so that the Signal Generator may be connected to a point of high d.c. potential on the equipment under test. The ISOLATING UNIT is fitted with a type N socket at its input end and two crocodile clips at its output end.

2.4.2. Outputs greater than 0.5 volt

The rated maximum source e.m.f. which the TF 801B/1 is designed to generate is 0.5 volt. This maximum is, of course, more than adequate for all normal applications of a signal generator. However, to cater for specialized uses, such as excitation of an r.f. bridge, the design of the TF 801B/1 includes features which allow e.m.f.'s of greater than 0.5 volt to be obtained at most frequencies. Firstly, as stated earlier, the ATTENUATOR is calibrated up to 1 volt; setting the ATTENUATOR to this point removes the last 6 decibels of attenuation and allows the tuned output stage and the external load to be tightly coupled. Secondly, the CARRIER LEVEL meter is calibrated above its red SET CARRIER mark to a maximum of 2 volts; this additional voltage is for c.w. outputs only and enables the user to realise the further 6 decibels of potential output which the TF 801B/1 valve circuits possess by virtue of being designed to accommodate high-percentage amplitude modulation.

To obtain e.m.f.'s of between 0.5 and 1 volt, the CARRIER LEVEL meter is maintained at the SET CARRIER mark and the ATTENUATOR dial set in the normal manner.

To obtain e.m.f.'s of greater than 1 volt, the ATTENUATOR control must be turned fully anti-clockwise to maximum and the SET CARRIER control advanced to give the required reading on the CARRIER LEVEL meter.

2.4.3. Measurement of Noise Factor using the TF 801B/1

The attenuator dial carries a scale entitled - dB ABOVE THERMAL NOISE FOR 10 kc/s BANDWIDTH. This scale is intended for use in conjunction with the common noise-factor technique involving doubling the power output from the r.f. amplifier system

2.4.3. (Continued)

under test. The scale is direct reading in noise factor when the system under test has a noise bandwidth of 10 kc/s and an input impedance of 50 ohms. The method of using the Signal Generator for noise factor measurement is outlined below.

The noise factor of a receiver is the noise factor of its tuned amplifiers, since the noise produced in the second detector and audio stages is negligible compared with the amplified noise originating in the tuned system. The noise factor measurements are taken, therefore, on the r.f. and i.f. amplifiers only.

Ideally, the second detector should be replaced with a suitable square-law indicator calibrated in terms of power or the square of the output current or voltage. In practice, however, a meter calibrated in r.f. power but which actually measures second detector current is often used with satisfactory results.

(a) Receivers with 50-ohm input impedance

If the receiver has an input impedance of 50 ohms, the following test procedure should be adopted:-

(i) Couple the output of the Signal Generator to the 50-ohm input of the receiver under test by means of the CONNECTOR cable. Do not use the 20-dB PAD.

(ii) Set the Signal Generator output level to zero by turning the RANGE control to a position between the bands.

(iii) Carefully note the reading of the square-law indicator.

(iv) Set the Signal Generator for c.w. output, tune to the centre frequency of the receiver pass-band, and adjust the output level of the Signal Generator to double the previous reading of the square-law indicator.

If the receiver has a noise bandwidth of 10 kc/s, the reading on the "noise factor" scale of the attenuator dial is

2.4.3. (Continued)

equal to the noise factor of the receiver expressed in decibels. If the noise bandwidth of the receiver is different from 10 kc/s, the noise factor of the receiver can be calculated from the expression

$$F_C = F_{ind} - 10 \text{ Log} \frac{B_{eq}}{10^4} \quad \text{.........................(6)}$$

where F_C is the corrected noise factor of the receiver.

F_{ind} is the indicated noise factor.

B_{eq} is the equivalent noise bandwidth of the receiver.

The last term in the above expression, viz. $B_{eq}/10^4$, is really a power ratio, since the effective noise power generated at the input of the receiver is directly proportional to the bandwidth. The TF 801B/1 attenuator scale assumes a 10-kc/s bandwidth, so that the correction figure is simply the ratio, expressed in decibels, of the actual noise bandwidth of the receiver (B_{eq}) to the assumed noise bandwidth (10 kc/s). If B_{eq} is greater than 10 kc/s, the correction in decibels should be subtracted from the indicated noise factor; if it is less than 10 kc/s, the correction should be added.

To compute the equivalent noise bandwidth of a receiver, first plot its frequency response, extending either side of its centre frequency to a point where the sensitivity falls to zero. Next find the mean level of the response curve and draw a horizontal line at this level across the graph. Call the height of this line above the base line - H. By the use of Simpson's rule or some other graphical method of integration, find the area enclosed by the response curve. Call this area - A. Finally construct a rectangle on the base line having an area A and a height H. The bandwidth, A/H, enclosed by the rectangle is the eqivalent noise bandwidth of the receiver.

2.4.3. (Continued)

(b) Receivers with input impedances other than 50 ohms

If the input impedance of the receiver under test is different from 50 ohms, the procedure should be modified as described in the following instructions, and an additional correction must be made. The effective source resistance at the Signal Generator output should be matched to the load by the appropriate method as described in Section 2.4.2. Having fitted the matching resistor and coupled the Signal Generator to the receiver input, carry out operations (ii), (iii), and (iv) as described for receivers with 50-ohm input impedance.

Where the input impedance of the receiver is greater than 50 ohms and matching is accomplished by using a series resistor, the power dissipated in the load is inversely proportional to the input impedance of the receiver. The noise factor is, therefore, given by the expression

$$F = F_C - 10 \text{ Log } \frac{Z_L}{R_0} \quad \text{.........................(7)}$$

where R_0 is the output resistance of the Signal Generator (50 ohms).

Z_L is the input impedance of the receiver under test.

F is the true noise factor.

F_C is the indicated noise factor after the correction is applied for equivalent noise bandwidth.

The last term in the above expression, viz. Z_L/R_0, is again a power ratio, since the assumed power and the actual power are directly proportional to R_0 and Z_L respectively. This ratio is expressed in decibels and subtracted from the figure obtained by applying the correction for noise bandwidth to the indicated noise factor.

Where the input impedance of the receiver is less than 50 ohms and matching is accomplished by means of a parallel

2.4.3. (Continued)

resistor, the power dissipated in the load decreases with the input impedance of receiver, so that the noise factor is given by the expression

$$F = F_C - 10 \text{ Log } \frac{R_0}{Z_L} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(8)$$

This correction figure is the ratio, expressed in decibels, of the assumed impedance to the actual impedance, and is subtracted from the figure that was obtained by applying the correction for noise bandwidth to the indicated noise factor.

The instructions given above apply only when the effective source resistance of the Signal Generator is matched to the input impedance of the receiver. Tests with varying source impedances, e.g., finding the source impedance for minimum noise factor, are very tedious using a single-frequency generator. A suitable standard Noise Generator, such as the Marconi Type TF 1053 (100 to 600 Mc/s) or Type TF 1106 (100 kc/s to 200 Mc/s), is more suitable for these more complicated measurements.

For precise definition of equivalent noise bandwidth and of noise factor, see B.S. 2056 "British Standard Glossary of Terms for Characteristics of Radio Receivers", paragraphs 121 to 123 and 202 to 205.

In order to further elucidate the above instructions, two examples of noise-factor measurement are worked below. The figures quoted are for fictitious receivers and should not be taken as typical of any particular type of receiver operating in the frequency range covered by the Signal Generator Type TF 801B/1.

Example;1. A receiver has an input impedance of 75 ohms. The source resistance of the Signal Generator is matched to the receiver by means of a 25-ohm series resistor as shown in figure 6 of drawing No. TBB 24856.

Carrying out the procedure described in paragraphs (a) (ii) to (a) (iv), a reading of 25 decibels is obtained on the attenuator "noise factor" scale.

2.4.3. (Continued)

The equivalent noise bandwidth is found to be 31.6 kc/s.

Substituting in expression (6):-

$$F_C = 25 - 10 \text{ Log } \frac{31.6 \times 10^3}{10^4}$$

$$= 25 - 10 \text{ Log } 3.16$$
$$= 25 - 5 = 20 \text{ dB}$$

Correcting for input impedance using expression (7):-

$$F = 20 - 10 \text{ Log } \frac{75}{50}$$

$$= 20 - 10 \text{ Log } 1.5$$
$$= 20 - 1.76 = 18.24 \text{ dB}$$

The corrected noise factor is, therefore, 18.24 decibels.

Example 2. A receiver has an input impedance of 30 ohms. The source resistance of the Signal Generator is matched to the receiver by means of a 75-ohm resistor connected in parallel as shown in figure 5 of drawing No. TBB 24856.

By the method described, the indicated noise factor is found to be 16 decibels.

The equivalent noise bandwidth is calculated as 20 kc/s. The ratio of the **true** bandwidth to the assumed bandwidth is 2:1 or, expressed in decibels, 3 dB. Since the true bandwidth is greater than the assumed bandwidth, the correction is subtracted from the indicated noise factor to give a value of F_C equal to 13 dB.

Correcting for impedance in the same way: the ratio of true input impedance to the assumed input impedance is 3:5 or, expressed in decibels, 2.22 dB. Subtracting this figure from F_C gives 10.78 dB.

This example could, of course, be solved by applying expressions (6) and (8) in a manner similar to that in which expressions (6) and (7) were used in the previous example.

3. OPERATIONAL SUMMARY

When the user is familiar with the principles and techniques of operation detailed in the preceding sections of this handbook, the following abridged operation instructions may be found convenient.

ABRIDGED OPERATING INSTRUCTIONS

Frequency Range:
12 to 470 Mc/s.

Source Impedance:
50 ohms.

Output Range:
0.1 μV to 0.5 volt;
higher outputs obtainable at most frequencies.

Modulation:
Internal or external sine a.m.;
external pulse a.m.

Power Supply:
100 to 150 volts, 40 to 100 c/s;
180 to 250 volts, 40 to 100 c/s;
180 volts, 500 c/s.

GENERAL NOTES

(1) Be sure the mains transformer is correctly adjusted before switching on.

(2) The NORMAL/HIGH switch should be set to NORMAL whenever possible. Switch to HIGH only when the required carrier level cannot be obtained by means of the PEAK CARRIER and SET CARRIER controls.

TUNING

Set RANGE switch to band required, then use frequency control to set main dial to required frequency.

C.W. OPERATION

Set MODULATION switch to OFF. Set ATTENUATOR dial to indicate required source e.m.f. Turn PEAK CARRIER control to point which gives maximum deflection on CARRIER LEVEL meter, then, using SET CARRIER control, bring meter pointer to SET CARRIER mark.

3. (Continued)

SINEWAVE MODULATION
INTERNAL: Set MODULATION switch to INT. Adjust ATTENUATOR, PEAK CARRIER and SET CARRIER controls as for C.W. Using SET MODULATION control, bring MODULATION meter to the required reading. If necessary, re-adjust SET CARRIER control to maintain CARRIER LEVEL meter at SET CARRIER mark.

SINEWAVE MODULATION
EXTERNAL: Set MODULATION switch to EXT SINE. Couple modulating source to EXTERNAL MOD terminals. Adjust ATTENUATOR PEAK CARRIER and SET CARRIER control as for C.W. Bring MODULATION meter to required reading by varying level of input from external source. If necessary, readjust SET CARRIER control to maintain CARRIER LEVEL meter at SET CARRIER mark.

EXTERNAL PULSE MODULATION:
Adjust ATTENUATOR, PEAK CARRIER and SET CARRIER controls as for C.W. Couple pulse modulating source to PULSE inlet; use series capacitor if pulses positive-going. Set MODULATION switch to EXT PULSE. Turn SET CARRIER control to maximum.

4. MAINTENANCE

4.1. GENERAL

The following items are included in this handbook (for details see CONTENTS, page 3) to assist in the maintenance of the Signal Generator.

Functional Diagram

Complete Circuit Diagram

Component Layout Illustrations:-

- Front Panel
- General View from Rear
- End View
- Rear View of L.F. and Power Unit Deck
- Front View of L.F. and Power Unit Deck
- Underside View of R.F. Unit
- Top View of R.F. Unit
- Drive-Wire Replacement Diagram

Spares Ordering Schedule with Circuit References

Valve Replacement Data Sheet

Section 1, DESCRIPTION, of this handbook deals with the internal circuits of the Signal Generator and is intended to be read in conjunction with the Functional Diagram. It is strongly recommended that, before commencing the adjustment or replacement of component parts of the instrument, the user should familiarize himself with the principles described in Section 1 and illustrated in the Functional Diagram.

The complete Circuit Diagram shows all the electrical components contained in the instrument. The description of these components - their type, value, rating, etc. - is given in the Spares Ordering Schedule; the Schedule also lists certain selected mechanical components.

4.1. (Continued)

The physical locations of the electrical components are shown on the Component Layout illustrations.

4.2. REMOVAL OF CASE

To remove the instrument from its case, first lay it face downwards on a bench, and remove the four metal domes which serve as feet - each of these domes is held at its centre by a countersunk screw. Next, remove the four similar domes from the back of the case. The case can now be separated from the main body of the instrument. The mains lead passes through to the inside of the instrument via a hole in the bottom of the left-hand case handle recess; feed the cable through this hole as the case is lifted upwards.

4.3. REPLACEMENT OF VALVE AND CRYSTALS

After the removal of the instrument from its case, all valves other than V2 and V6, the disc-seal r.f. valves, are immediately accessible. V2 and V6, together with the r.f. level monitor crystal X1, are contained in the double-screened r.f. unit.

To gain access to the r.f. valves, the instrument should be turned upside down with the front panel vertical. The 22 screws securing the uppermost face of the outer screening box should then be extracted. The removal of the plate held by these screws exposes a second plate secured by a further 25 screws. With this second plate removed, V2, V6, and X1 are immediately accessible.

To remove the oscillator valve, V2, from its mounting, first detach the central filament-supply connector, then slide upwards the two phosphor-bronze clips which hold the black thermal-shunt block to the fixed anode-connecting plate. With the block removed, manipulate the valve forward so that the filament cylinder is detached from its contact and the grid-band is released from its annular spring contact and passes through the hole in the anode-connecting plate.

4.3. (Continued)

To remove the r.f. amplifier valve, V6, slide up the two phosphor-bronze clips to release the black thermal-shunt block; then, having removed the block, draw the valve through the hole in the anode-connecting plate in a manner similar to that described for the oscillator valve, at the same time taking off the central filament connector and the outer filament cylinder, both of which are carried on short fly leads.

The crystal, X1, is held in a spring clip immediately adjacent to the head of the attenuator tube and is easily removed.

All valves and crystals in the TF 801B/1 can be replaced without special selection. If crystal X1 is replaced, the calibration of the SET CARRIER meter must be restandardized as described in Section 4.8.6. If either the modulator valve, V8, or the crystal, X1, is replaced, the accuracy of the MODULATION meter should be checked and, if necessary, the meter sensitivity adjusted as described in Section 4.8.8.

4.4. MAINS INPUT ARRANGEMENTS

The instrument is fitted with a mains transformer with a double wound primary, the two tapped sections of which can be connected in series or series-parallel to allow for operation from any 40- to 100-c/s supply within the voltage ranges 180 to 250 and 100 to 150. The instrument can be operated from a 500-c/s supply when the mains transformer is adjusted for 180-volt operation.

The mains input to the transformer is carried by two fly leads, which are connected by screws to a 6-point tapping panel mounted separately at the side of the transformer. Attached to the tapping panel is a pierced reference plate, which is reversible and marked with a selection of voltages. On one side of the reference plate, the voltages are applicable to the 100- to 150-volt range; on the other side, to the 18C- to 250-volt range. The two main sections of the double wound primary are connected together by one or more links, which are used to join together the appropriate solder-tag terminals mounted directly

4.4. (Continued)

on the transformer coil. To change from one major voltage range to the other, the linking between the transformer tags is altered; to make a small, say 10-volt, change within one of the major ranges, one or both of the screw-secured fly leads on the tapping panel are moved to a fresh position.

In order to examine fully the transformer connections, the instrument must be removed from its case as described in Section 4.2. If it is only required to view or alter the position of the fly leads on the tapping panel, the instrument case need not be removed; the tapping panel is accessible after the removal of the cover-plate in the right-hand case-handle recess.

4.4.1. For supply voltages between 180 and 250 volts, the connection and arrangement of the transformer and tapping panel must be as follows:-

(1) The solder-tag terminals "TAP A" and "TAP B" on the transformer must be linked together.

(2) Other than (1) above, there must be no cross linking between the solder-tag terminals on the transformer.

(3) The pierced and reversible reference plate covering the tapping panel must have its side bearing the 180- to 250-volt marking visible. (The reference plate can be reversed after the screw-secured fly leads are removed and the single screw extracted from between the "0" and "+10" tapping points.)

(4) The lead soldered to the "180" point on the tapping panel must go to the "180" solder-tag terminal on the transformer.

When the above instructions are exactly complied with, the instrument can be adjusted from the tapping panel for operation from any supply voltage between 180 and 250 volts. Make the adjustment by positioning the fly leads on the tapping panel to give a combination suitable to the particular supply.

4.4.1. (Continued)

Example (1) For 180-volt supply mains, one fly lead should be secured in the "180" position, and the other fly lead in the "0" position.

Example (2) For 250-volt supply mains, one fly lead should be secured in the "240" position, and the other fly lead in the "+10" position.

4.4.2. For supply voltages between 100 and 150 volts, the connection and arrangement of the transformer and tapping plate must be as follows:-

(1) The solder tag terminals "TAP A" and "100/200" on the transformer must be linked together.

(2) The solder-tag terminals "TAP B" and "0 V" on the transformer must be linked together.

(3) Other than (1) and (2) above, there must be no other cross linking between the solder-tag terminals and the transformer.

(4) The pierced and reversible reference plate covering the tapping panel must have its side bearing the 100- to 150-volt markings visible. (The reference plate can be reversed after the screw-secured fly leads are removed and the single screw extracted from between the "0" and "+10" tapping points.)

(5) The lead soldered to the rear of the "105" point on the tapping panel must go to the "105" solder-tag terminal on the transformer.

When the above instructions are exactly complied with, the instrument can be adjusted from the tapping panel for operation from any supply voltage between 100 and 150 volts. Make the adjustment by positioning the fly leads on the tapping panel to give a combination suitable for the particular local supply.

4.4.2. (Continued)

Example (1) For use on 100-volt supply mains, one fly lead should be secured in the "100" position and the other fly lead in the "0" position.

Example (2) For use on 115-volt supply mains, one fly lead should be secured in the "105" position and the other fly lead in the "+10" position.

4.5. WORKING VOLTAGES

Measured with a Model 8 AvoMeter set to its highest convenient range, and with the mains transformer tappings set to suit the local supply, the working voltages to be expected are of the following order:-

Mains Transformer, h.t. secondary:	480 - 0 - 480 volts a.c.
l.t. 1:	6.3 volts a.c.
l.t. 2:	6.3 volts a.c.
l.t. 3:	5.0 volts a.c.
H.T. rectified (across C2):	560 volts d.c.
H.T. smoothed (across C3):	560 volts d.c.
H.T. stabilized (V3, pin 8):	300 volts d.c. (adjusted by means of RV1)

The following table shows the anode, screen grid, and cathode voltages with respect to chassis for all valves except the r.f. oscillator valve V2. The voltages listed are subject to a tolerance of 20%, and they should be measured with the panel controls set as follows:-

RANGE:	48 to 110 Mc/s band.
FREQUENCY:	70 Mc/s.
SET CARRIER:	Set to mid travel.
MODULATION selector:	INT SINE.
SET MOD:	Set to Zero.
ATTENUATOR:	200 mV.
NORMAL/HIGH switch:	NORMAL.
PEAK CARRIER:	Adjust for max meter deflection.

4.5. (Continued)

Valve	Va	Vg^2	Vk
V3	560	560	300
V4	300	100	100
V6	320	-	10 approx.
V7	300	-	2
V8a	110	-	23
V8b	320	-	140
V9	14	-	-1.8

The heater voltages of the r.f. valves, V2 and V6, are supplied from a separate booster transformer, and should be within the limits 6.3 volts -0, +10%.

The table below gives the approximate values of anode voltage for the oscillator valve, V2, measured at the centre of each band for both positions of the NORMAL/HIGH OUTPUT switch.

N/H Switch	12 - 24	24 - 48	48 - 110	110 - 260	260 - 470
NORMAL	170	160	250	230	200
HIGH	190	180	300	300	300

4.6. ACCESS TO R.F. UNIT

General tests or some peculiarity in the performance of the Signal Generator may suggest the desirability of inspecting the interior of the R.F. Unit; this unit can be dismantled by following the procedure detailed below.

It must be emphasized that it is most unwise for the user to open this unit unless he is satisfied beyond reasonable doubt that the R.F. Unit does, in fact, contain a fault.

Most of the circuit components in the R.F. Unit are accessible when the two cover plates are removed in the manner

4.6. (Continued)

described in Section 4.3. In order to expose the wire-drive mechanism used on this unit, remove the outer screening cover. To do so, lay the instrument on its face, take out the 23 screws from the periphery of the outer screening cover, and remove it by lifting it vertically. The inner cover can then be removed by extracting the 42 screws holding it in position. This gives access to the heater booster transformer, T2.

4.7. THE WIRE-DRIVE SYSTEMS

Both the main tuning drive and the attenuator drive utilize positive action wire-and-pulley mechanisms. A strong stainless-steel drive wire is used, and the necessity for wire replacement should be infrequent even if the wire receives no attention. However, a certain amount of friction is inevitable, and the life of the wire can be further prolonged if this friction is reduced to a minimum by the periodical application of a small amount of Price's Anti-Freeze grease. The procedure for replacing the drive wire, in the event of a breakage, is outlined in the two sections that follow.

4.7.1. Replacing the main tuning drive-wire

Refer to the illustrations entitled WIRE DRIVE REPLACEMENT DIAGRAM MP 801B/1-8 and TOP VIEW OF R.F. UNIT, MP 801B/1-7.

Replacement drive wires can be obtained in pairs from Marconi Instruments Ltd. They are listed as: Drive-Wires Type TB 25500.

(a) Take the instrument out of its case and remove the outer screening cover from the r.f. unit. Then stand the instrument the right way up on the bench with its back towards you. For improved access to the drive-wire mechanism, remove valve V3 (KT66) from its socket in the power unit chassis.

(b) Remove the spring and the end of wire 1 from drum 'B' by undoing the set screw.

4.7.1. (Continued)

(c) If necessary, push out the wire-securing pin from drum 'A' to release the wire. Take care not to lose the pin; it may have dropped out when the wire snapped.

(d) Remove drum 'C' from its spindle by releasing the grub screws, and remove the spring and the end of wire 2 by taking out the set screw.

(e) Take the shorter of the two new drive-wires; insert the end with the larger loop through the slot in drum 'C'; fit the spring on the set-screw, and secure the spring and the end of the new wire to the drum by means of the screw.

(f) Find the centre of the longer of the two new drive-wires by folding it in half; then facing the rear of the instrument, insert the loop so formed into the slot in drum 'A' in such a way that, when the wire makes a complete turn round the pin as shown in the inset sketch, the end with the larger loop is at the left.

(g) Lead the end of the wire having the smaller loop around drum 'A', and pass it under the rocker drive. Then thread the small loop through the slot in drum 'C' (which is now detached from the r.f. unit), and hook it on the spring.

(h) Arrange the wires on drum 'C' so that wire 1 makes three-quarters of a turn in the counter clockwise direction as viewed from the spring side of the drum, and wire 2 makes three-quarters of a turn in the clockwise direction. Temporarily fix the wires in position with a piece of adhesive tape.

(i) Replace drum 'C' on its spindle, but do not tighten the grub screws.

(j) Bring drum 'A' to the position where the slot is uppermost. Arrange wire 1 so that each side of the securing pin the wire makes a half turn round the drum crossing at the bottom. Then lay the end connected to drum 'C' over the rocker-arm pulley nearer the front panel.

4.7.1. (Continued)

(k) Lead the free end of wire 1 over the inclined pulley nearer the front panel, and pass it round drum 'B' in the counter-clockwise direction; thread the loop through slot 'b', and secure it with the set-screw, fixing the spring in position at the same time.

(l) Bring wire 2 from drum 'C' over the rocker-arm pulley further from the front panel, and then over the appropriate inclined pulley. Lead the wire round drum 'B' in the clockwise direction, thread the loop through slot 'b', and hook it on the spring. To do so, lift the spring with a screwdriver.

(m) Adjust the PEAK CARRIER control to its mid-travel position; remove the inner screening cover from the r.f. unit; rotate the FREQUENCY control to bring the vanes of the oscillator rotor to the same angular position as those of the amplifier rotor; then tighten the grub screws to secure drum 'C' to the spindle.

(n) Turn the FREQUENCY control to its fully counter-clockwise position; slacken off the grub-screws securing drum 'A' to its spindle; then adjust the position of this drum on its spindle so that the 0 on the linear scale on the tuning dial coincides with the cursor hairline. Finally, tighten the grub screws, and replace the covers on the r.f. unit.

4.7.2. <u>Replacing the attenuator drive-wire</u>

Refer to the illustrations entitled WIRE DRIVE REPLACEMENT DIAGRAMS, MP 801B/1-8 and END VIEW MP 801B/1-3.

(a) With the outer case removed, stand the instrument upside down on the bench. Extract the fixing screw from the attenuator dial boss on the front panel, then remove the plastic window and cursor assembly. Take off the attenuator dial by undoing the three counter-sunk fixing screws. Drum 'E' is then exposed.

4.7.2. (Continued)

(b) Make sure that no broken pieces of wire remain attached to the mechanisms. Remove the spring from drum 'E' by extracting the fixing screw. Take care that the wire-securing pin from drum 'D' is not lost; it may have dropped out of the drum when the wire snapped.

(c) By means of the ATTENUATOR control, position the rack so that it is in the centre of its travel, then rotate the control to bring the wire-hole on drum 'D' to the position furthest from drum 'E'.

(d) Find the centre of a 36-inch length of stainless steel drive-wire by folding it in half, and insert the loop so formed into the wire-hole of drum 'D'. Secure the wire with the pin as shown on the diagram.

(e) Wind the wire away from the hole - three and a quarter turns clockwise and four and a quarter turns counter-clockwise round drum 'D' - then lead the ends through the holes in the dial housing to drum 'E'.

(f) Rotate drum 'E' to the position where the slot is nearest to drum 'D', then lay the wire round the drum, each end making one and three quarter turns to the slot.

(g) Pass the two ends of the wire through the slot, pull the wire tight round the system, and knot the ends. Hook on the spring, then secure it at the fixed end by means of the fixing screw.

(h) Reassemble the dial unit in the reverse order to that given in paragraph (a).

(i) Rotate the ATTENUATOR control in the counter-clockwise direction as far as the stop, slacken off the two grub screws fixing drum 'D' to the spindle, and adjust the position of the drum on the spindle to bring the maximum-output end mark of the attenuator dial to the cursor line.

4.8. SCHEDULE OF TESTS

The following information is based on abstracts from the internal Factory Test Schedule TS 801B/1.

4.8.1. Apparatus Required

(a) 750-volt Insulation Tester.

(b) Avometer, Model 8.

(c) Receiver covering the frequency range: 12 to 470 Mc/s, fitted with signal strength meter.

(d) Standardized Signal Generator covering the frequency range: 12 to 470 Mc/s, Marconi Type TF 801B or TF 801B/1.

(e) Valve Millivoltmeter, Marconi Type TF 899.

(f) Audio Frequency Oscillator, Marconi Type TF 195 (series) or TF 894 (series).

(g) Cathode Ray Oscilloscope fitted with calibrated vertical shift.

(h) Carrier Deviation Meter, Marconi Type TF 791 (series).

(i) Crystal Calibrator, Marconi Type TF 723 (series).

(j) Crystal-Diode Detector; time constant of the order of 0.2 μsec.

4.8.2. Insulation (Apparatus required:- Item a)

Test the insulation between each live pin of the supply plug and chassis in both positions of the mains ON/OFF switch. The insulation resistance should not be less than 40 MΩ.

4.8.3. Power Unit Adjustment (Apparatus required:- Item b)

Check that the mains transformer tappings are correctly adjusted as described in Sections 4.4, 4.4.1, and 4.4.2. Measure the mains transformer secondary voltages and note that they are within the limits specified in Section 4.5.

4.8.3. (Continued)

Remove all valves except V1, V3, V4, and V5. By means of the preset voltage control, RV1, set the voltage between the cathode of valve V3 (pin 8) and chassis to 300 volts. Check the regulation of the power supply unit by loading it with a 5000-ohm 20-watt resistor and noting the change of voltage when the load is connected. This change should not exceed 6 volts.

Replace tje valves, and check that the voltages measured at the filament connections of the r.f. valves conform to the limits specified in Section 4.5.

4.8.4. Checking Frequency Calibration (Apparatus required:- Item i)

Switch ON the mains supply, and set the MODULATION switch to OFF. Allow a 20-minute warm up period, then, using the crystal calibrator, check that the frequency calibration is accurate within 1 % of the indicated frequency. Make sure that, by means of the PEAK CARRIER control, it is possible to tune the r.f. amplifier through a peak response as indicated by the CARRIER LEVEL meter.

4.8.5. Setting Up R.F. Circuits (Apparatus required:- Item i)

If the previous test shows the instrument to be unsatisfactory, the r.f. circuits must be set up in the following manner:-

Band A., 12 to 24 Mc/s: Check the oscillator frequency cover, making sure that there is a reasonable 'overlap' at each end of the band. With the PEAK CARRIER control set to its mid-travel position, adjust the amplifier for optimum tracking by means of the trimmer capacitor, C28, at the high frequency end of the band, and the slug in the tuning inductor, L6, at the low frequency end of the band. If necessary, recalibrate the main tuning dial

Band B., 24 to 48 Mc/s: Use the same procedure as for Band A.

Band C., 48 to 110 Mc/s: Check the oscillator frequency cover, making sure that there is a reasonable 'overlap' at each end of the band. With the PEAK CARRIER control set to its mid-travel position, adjust the r.f. amplifier for optimum tracking by means of the

4.8.5. (Continued)

trimmer capacitor, C28, at the high frequency end of the band, and by adjusting the position of the turns of the tuning inductor, L6, at the low frequency end of the band. If necessary, recalibrate the main tuning dial.

Band D., 110 to 260 Mc/s: Use the same procedure as for Band C.

Band E., 260 to 470 Mc/s: Check the oscillator frequency cover, making sure that there is a reasonable 'overlap' at the low frequency end of the band. With the PEAK CARRIER control set to its mid-travel position, adjust the r.f. amplifier for optimum tracking by means of the trimmer capacitor, C28, at the high frequency end of the band, and, at the low frequency end of the band, by adjusting the length of the longer of the two inductor strips - i.e., the one that does not couple with the attenuator and voltmeter pick-up elements. Since, for obvious reasons, this strip can only be shortened and not lengthened, it is generally advisable to fit a new strip if this adjustment appears to be necessary. Recalibrate the main tuning dial if necessary.

Set up the capacitive coupling between the oscillator and the r.f. amplifier on Band E in the following way:-

Make sure that the NORMAL/HIGH OUTPUT switch is at NORMAL; turn the SET CARRIER control fully clockwise; set the attenuator to indicate about 500 mV; and set the RANGE switch to 260 - 470 Mc/s. Adjust the position of the moving electrode of the special capacitor, C8, so that, at the point of lowest output on the frequency band, the reading of the CARRIER LEVEL meter is approximately 1.3 volts.

4.8.6. Setting Up the CARRIER LEVEL Meter (Apparatus required:- Items c, d, and e)

Note: The CARRIER LEVEL monitoring circuit must be set up in the manner described below whenever any adjustment has been made to the r.f. amplifier tuning circuits.

4.8.6. (Continued)

Set the RANGE switch to 12 - 24 Mc/s; connect the output of the TF 801B/1 to the Valve Millivoltmeter; set the frequency to 12 Mc/s, and the ATTENUATOR to 200 mV. Adjust the SET CARRIER control to give a reading on the Millivoltmeter of exactly 200 mV. Adjust the preset control, RV4, to produce a deflection of the CARRIER LEVEL meter pointer to the SET CARRIER mark. This adjustment may be carried out with the instrument out of its case.

With the Signal Generator in its case, use the Receiver to compare its output with that of the Standardized Signal Generator at two frequencies on each band. At the 200-mV setting of the ATTENUATOR the output level should be accurate to within 1 dB. If the output level accuracy varies from band to band, make adjustments to the position of the r.f. amplifier coils near the attenuator on each band until the stated accuracy is attained at all carrier frequencies. (If necessary, readjust RV4 to a compromise setting where the error is increased slightly at 12 Mc/s in order to bring the output level within the specified accuracy on all bands.)

4.8.7. Checking the Output Level and Attenuator (Apparatus required:- Items d and e)

Compare the output of the Signal Generator under test with that of the Standardized Signal Generator at the following output levels at the mid-frequency of each band.

Attenuator Setting	Tolerance	
2 volts	2.5 dB	
200 mV	1 dB	
2.0 mV	2 dB	
20 µV	2 dB	14-28 µV

Make sure that the signal strength, as indicated by the signal-strength meter of the receiver, decreases progressively right down to the 1 µV setting of the ATTENUATOR with no tendency, due to stray radiation, to increase again as the ATTENUATOR reading approaches 1 µV.

4.8.8. Making Modulation Adjustments (Apparatus required:- Items f and g)

Using the Audio Frequency Oscillator and the Cathode Ray Oscilloscope, check that, with the MODULATION switch set to INTernal, the frequency of the internal modulation oscillator is within 5% of 1000 c/s. For this test, the a.f. output may be drawn from the slider of the SET MODULATION control.

Set up the modulation monitor in the following way:-

Feed the output of the Signal Generator under test to the receiver; connect the Y amplifier input terminals of the oscilloscope to the output of the i.f. amplifier of the receiver; tune the Signal Generator for maximum deflection of the c.r.o. beam, and adjust the ATTENUATOR to produce a display of convenient dimensions. This test should be made at the low end of the frequency range in order to avoid errors due to f.m. on a.m. Errors can also be caused by an inadequate receiver-bandwidth.

With the Signal Generator internally modulated, adjust the SET MODULATION control for 50% modulation as measured on the c.r.o. screen using the formula:-

$$M(\%) = \frac{D_{max} - D_{min}}{D_{max} + D_{min}} \times 100$$

where D_{max} is the peak-to-peak dimension of the c.r.o. display.

D_{min} is the trough-to-trough dimension of the c.r.o. display.

If necessary, adjust the preset control, RV5, to bring the reading of the %MODULATION meter to exactly 50%. Check the law of the scale up to 90%; an error of 10% of the reading is permitted between 50% and 90% modulation, and an error of 5% modulation at depths below 50%.

Set the MODULATION switch to EXTernal SINE, and, using the Audio Frequency Oscillator as the modulating signal source, check that, at 30% modulation, the frequency response is flat within 1 dB from 30 c/s to 20 kc/s at any carrier frequency. Check that an input signal of 2.5 volts is sufficient to produce 90% modulation at the centre of each frequency band. Set the MODULATION switch to the OFF position and check that the spurious amplitude modulation caused by hum is less than 0.5% on all bands.

4.8.9. Checking Pulse Modulation (Apparatus required:- Items f and j)

Connect the output of the Signal Generator to the Y amplifier input terminals of the Oscilloscope via the crystal-diode detector. Set the MODULATION switch to EXT PULSE, the RANGE switch to 12 - 24 Mc/s, and the frequency to 12 Mc/s; then turn the SET CARRIER control to its fully clockwise position.

Connect the Audio Frequency Oscillator to the PULSE input socket of the Signal Generator via a 10-kΩ resistor, and adjust the a.f. output to 50 volts at a frequency of 5 kc/s.

The Oscilloscope display should then be in the form of a square-wave have a mark-space ratio of unit and a time-of-rise of 2 μsec.

Repeat the test with the Signal Generator output frequency set to 470 Mc/s and the modulation frequency increased to 25 kc/s.

The display should then be in the form of a square-wave having a mark-space ratio of unity and a time-of-rise of 0.3 μsec.

4.8.10. Checking Spurious F.M. (Apparatus required:- Items h and i)

Connect the output of the Signal Generator to the input of the Carrier Deviation Meter.

With the MODULATION switch set to OFF, check that the frequency modulation caused by hum is less than 500 c/s deviation at all carrier frequencies up to 250 Mc/s.

Set the MODULATION switch to INT, and adjust the SET MODULATION control for 30% modulation as indicated on the %MODULATION meter. Check that, at all carrier frequencies up to 250 Mc/s, the f.m. deviation is not greater than 2 kc/s.

Feed the output of the Signal Generator into the Crystal Calibrator, and apply the resulting beat frequency to the input terminal of the Carrier Deviation Meter. Prevent the local oscillator of the Deviation Meter from operating by setting its Frequency Range switch to a position between bands.

With the MODULATION switch in the OFF position, check that deviation of the spurious f.m. due to hum is less than 500 c/s

4.8.10. (Continued)

at all frequencies from 250 Mc/s to 470 Mc/s.

Set the internal amplitude modulation to 30%, and check that the spurious f.m. deviation does not exceed 2 kc/s at all carrier frequencies up to 420 Mc/s.

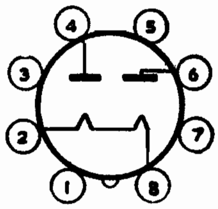
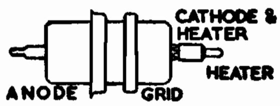
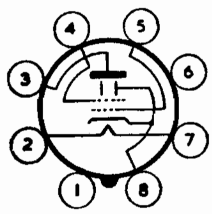
APPENDICES

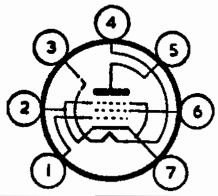
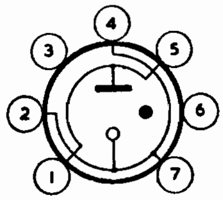
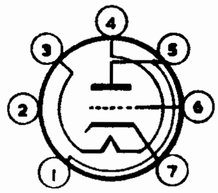
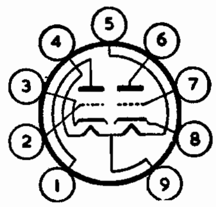
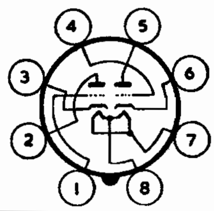
VALVE REPLACEMENT DATA

FOR

SIGNAL GENERATOR Type TF 801B

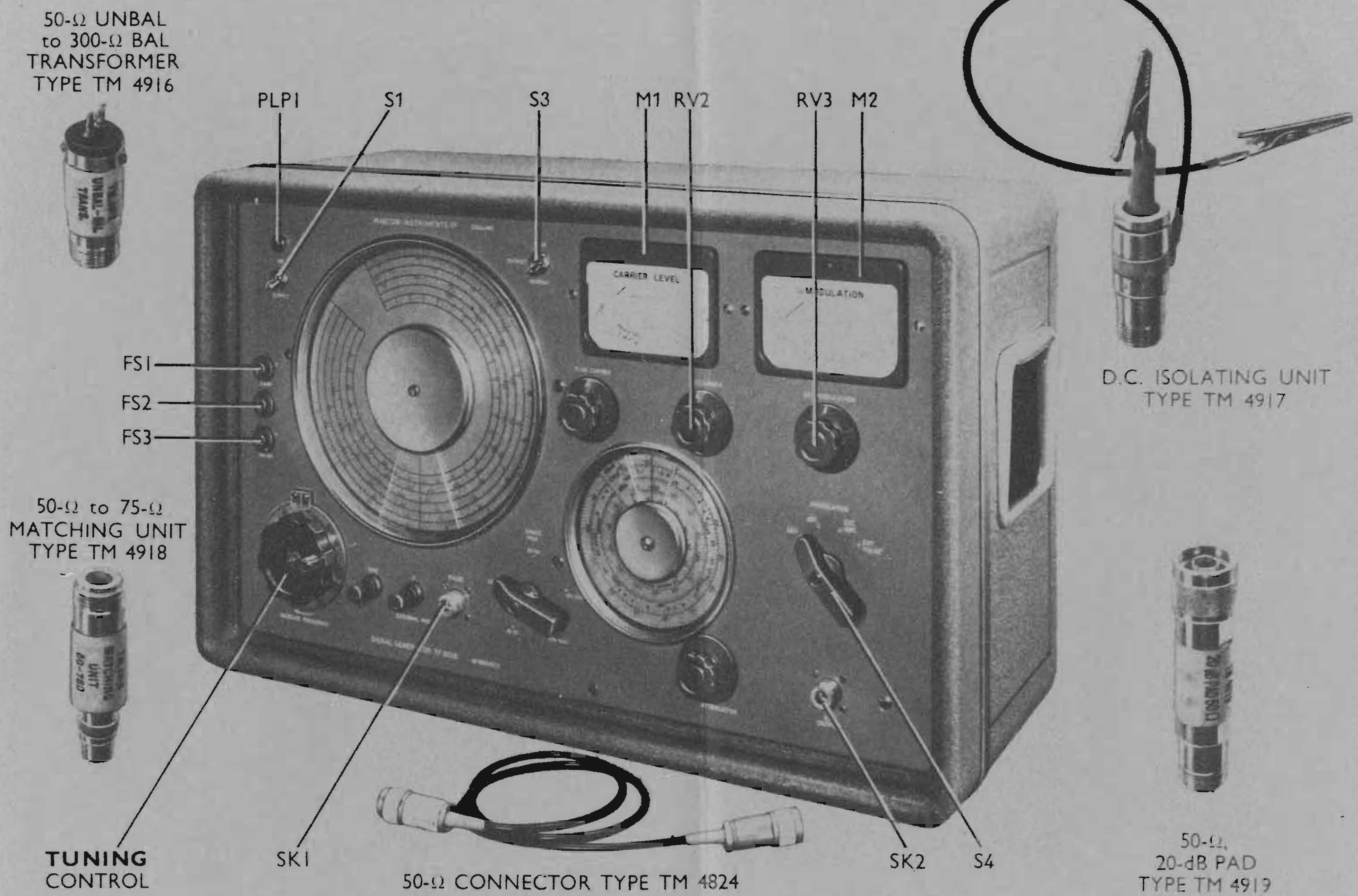
Any valve which becomes faulty should preferably be replaced by a valve of the type originally supplied in the instrument and designated in the following table. If this is not possible, the additional data given by the table may be used as a guide to suitable alternatives.

Valve	*British Commercial Equivalent*	*British Services Equivalent*	*Base*	*U.S. Equivalent*
V1 FULL-WAVE RECTIFIER BRIMAR 5R4GY		CV717	INTERNATIONAL OCTAL 	5R4GY
V2, V6 DISC SEAL TRIODE MARCONI DET22	TDO3–10	CV273	SPECIAL 	5861
V3 TETRODE MARCONI KT66	6L6G	CV1075 CV1947	INTERNATIONAL OCTAL 	6L6G

Valve	*British Commercial Equivalent*	*British Services Equivalent*	*Base*	*U.S. Equivalent*
V4 PENTODE MULLARD EF95	6AK5	CV850	MINIATURE 7-PIN (B7G) 	6AK5
V5 VOLTAGE STABILIZER MULLARD 108C1	QS1208	CV1833	MINIATURE 7-PIN (B7G) 	OB2
V7 TRIODE MARCONI L77	EC90 6C4	CV133	MINIATURE 7-PIN (B7G) 	6C4
V8 DOUBLE TRIODE BRIMAR 12AT7	B309 ECC81	CV455	MINIATURE 9-PIN (B9A) 	12AT7
V9 DOUBLE TRIODE MARCONI A1834		CV2523	INTERNATIONAL OCTAL 	6AS7G

FRONT PANEL

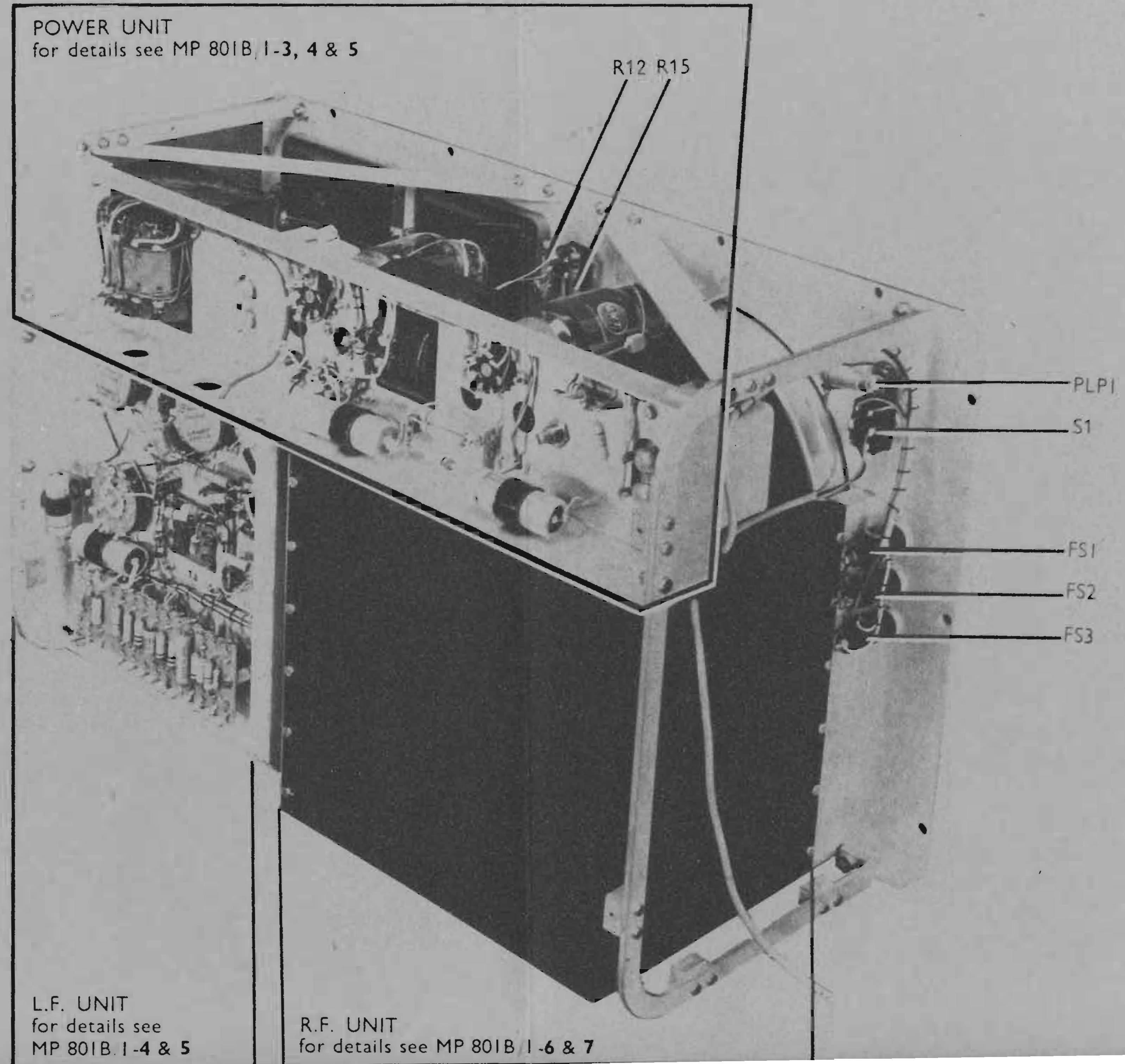
MARCONI INSTRUMENTS LIMITED							
DRN	D.H.	DATE	23.11.55	CHK.D	J.F.G.	ISSUE	1
STOCK LIST		TF 801B/1		DRG No.		MP 801B/1-1	


50-Ω UNBAL
to 300-Ω BAL
TRANSFORMER
TYPE TM 4916
PLP1
S1
S3
M1
RV2
RV3
M2
CARRIER LEVEL
MODULATION
D.C. ISOLATING UNIT
TYPE TM 4917
FS1
FS2
FS3
50-Ω to 75-Ω
MATCHING UNIT
TYPE TM 4918
TUNING
CONTROL
SK1
50-Ω CONNECTOR TYPE TM 4824
SK2
S4
50-Ω,
20-dB PAD
TYPE TM 4919

FRONT PANEL

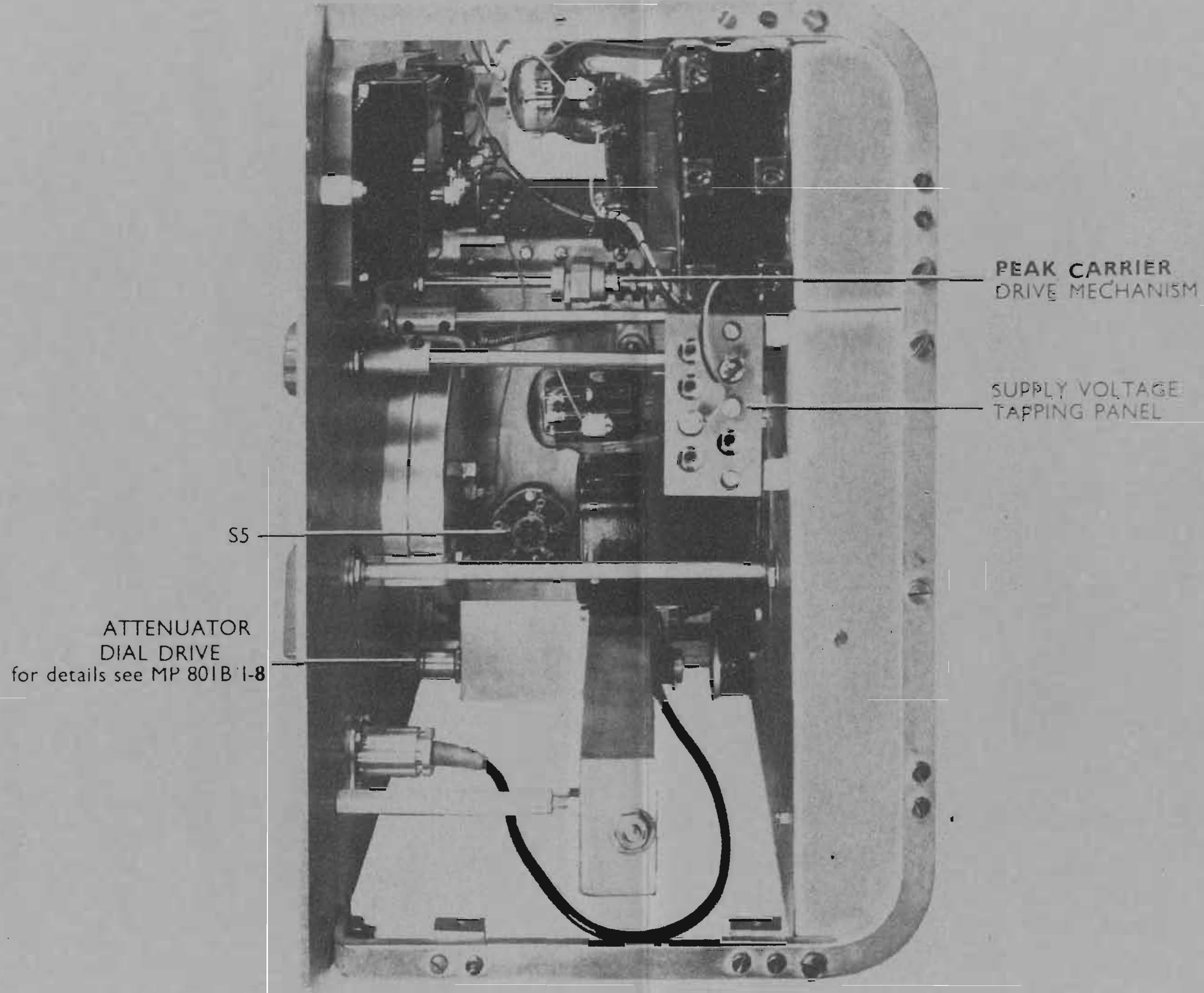
GENERAL VIEW FROM REAR

MARCONI INSTRUMENTS LIMITED							
DRN	D.H.	DATE	23.11.55	CHKD	J.F.G.	ISSUE	1
STOCK LIST		TF 801B/1		DRG No.		MP 801B/1 –2	


POWER UNIT
for details see MP 801B. 1-3, 4 & 5
R12 R15
PLP1
S1
FS1
FS2
FS3
L.F. UNIT
for details see
MP 801B. 1-4 & 5
R.F. UNIT
for details see MP 801B 1-6 & 7

END VIEW

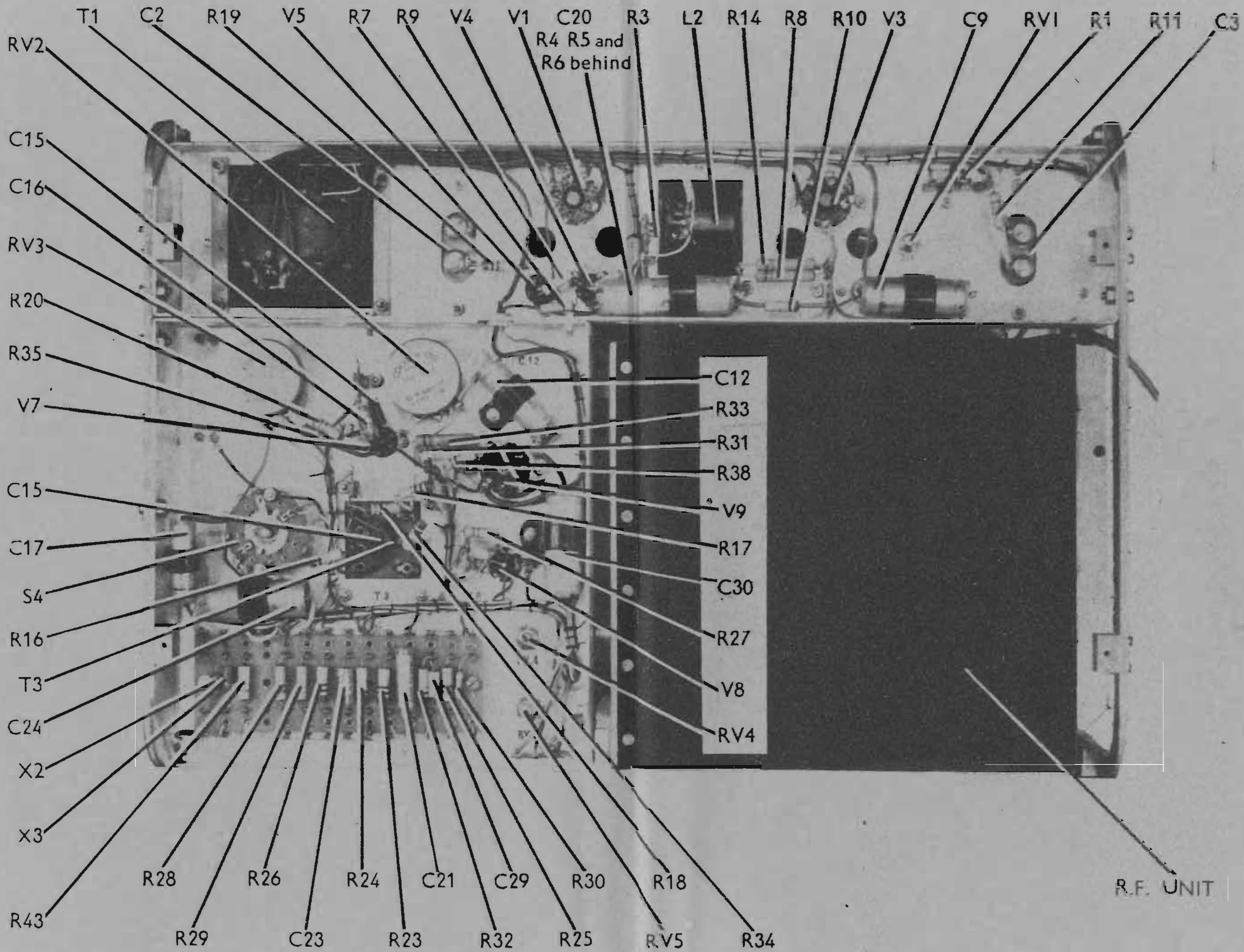
MARCONI INSTRUMENTS LIMITED							
DRN	D.H.	DATE	23.11.55	CHKD	I.F.G.	ISSUE	1
STOCK LIST	TF 801B/1	DRG No.	MP 801B/1-3				


PEAK CARRIER
DRIVE MECHANISM
SUPPLY VOLTAGE
TAPPING PANEL
S5
ATTENUATOR
DIAL DRIVE
for details see MP 801B 1-8

END VIEW

REAR VIEW OF LF AND POWER UNIT DECK

MARCONI INSTRUMENTS LIMITED							
DRN	D.H.	DATE	23.11.55	CHKD		ISSUE	1
STOCK LIST		TF 801B/1		DRG No.		MP 801B/1–4	

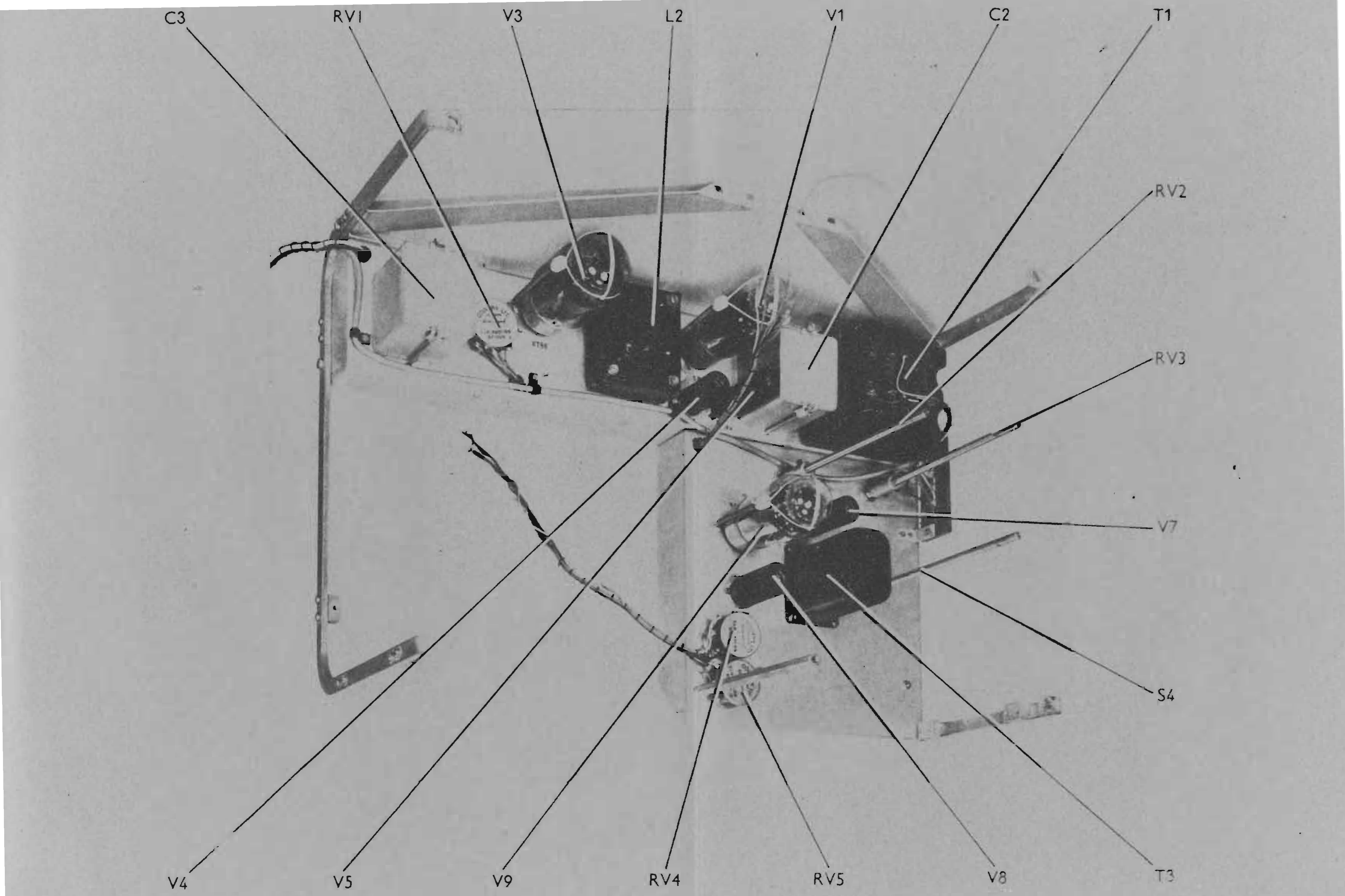


REAR VIEW OF LF AND POWER UNIT DECK

FRONT VIEW OF LF AND POWER UNIT DECK

MARCONI INSTRUMENTS LIMITED							
DRN	D.H.	DATE	23.11.55	CHKD	J.F.G.	ISSUE	1

STOCK LIST	TF 801B/1	DRG No.	MP 801B/1-5

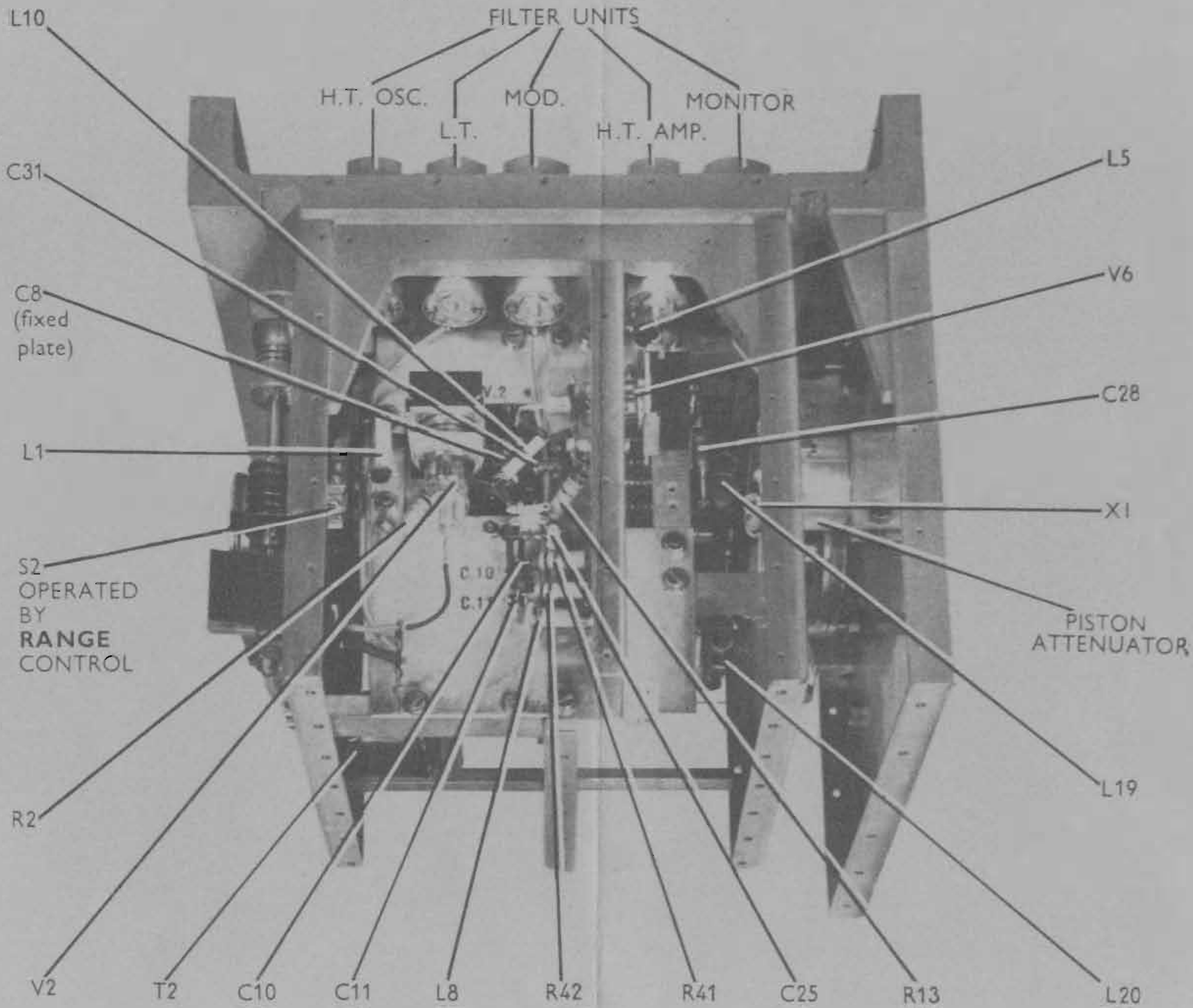


FRONT VIEW OF LF AND POWER UNIT DECK

UNDERSIDE VIEW OF RF UNIT

MARCONI INSTRUMENTS LIMITED							
DRN	D.H.	DATE	2.1.56	CHKD	J.F.G.	ISSUE	1

STOCK LIST	TF 801B/1	DRG No.	MP 801B/1 –6

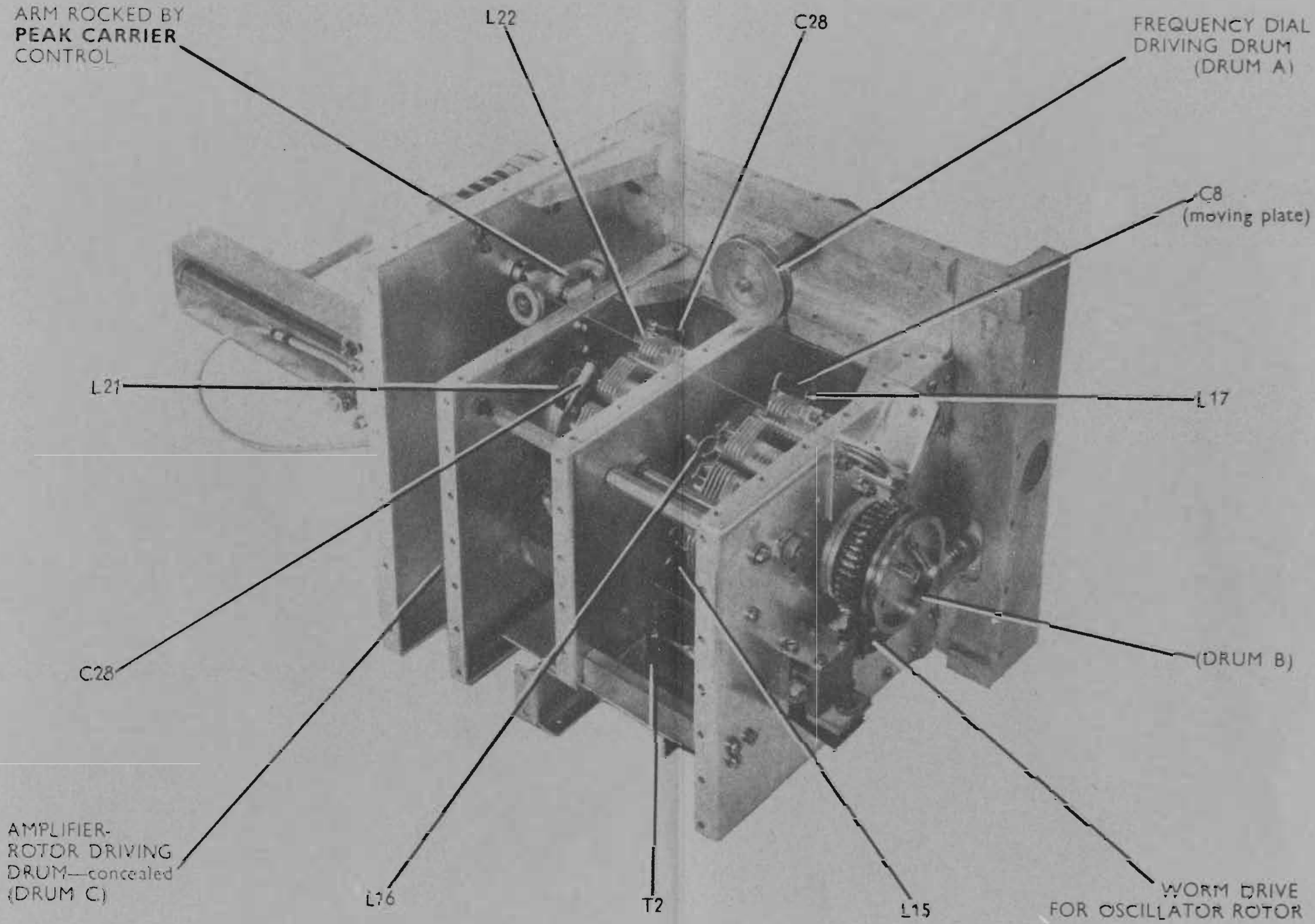


UNDERSIDE VIEW OF RF UNIT

TOP VIEW OF RF UNIT

MARCONI INSTRUMENTS LIMITED							
DRN	D.H.	DATE	4.1.56	CHKD	J.F.G.	ISSUE	1

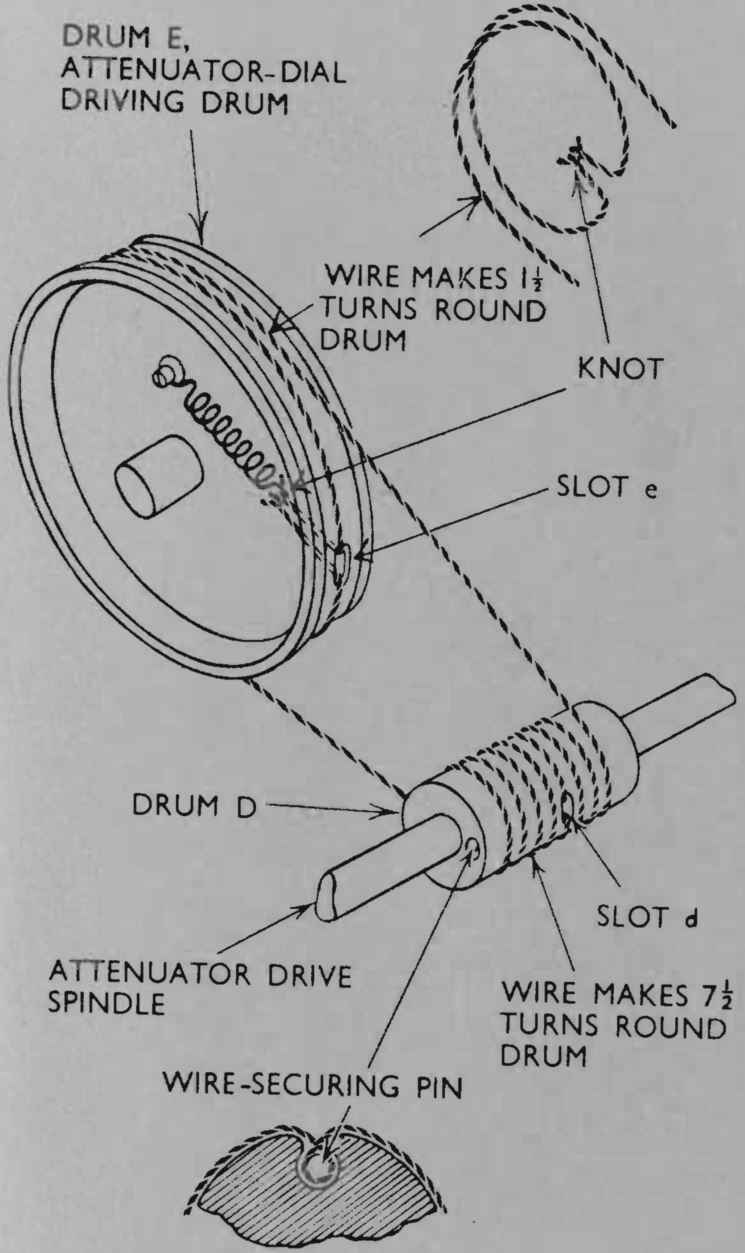
STOCK LIST	TF 801B/1	DRG No.	MP 801B/1 -7



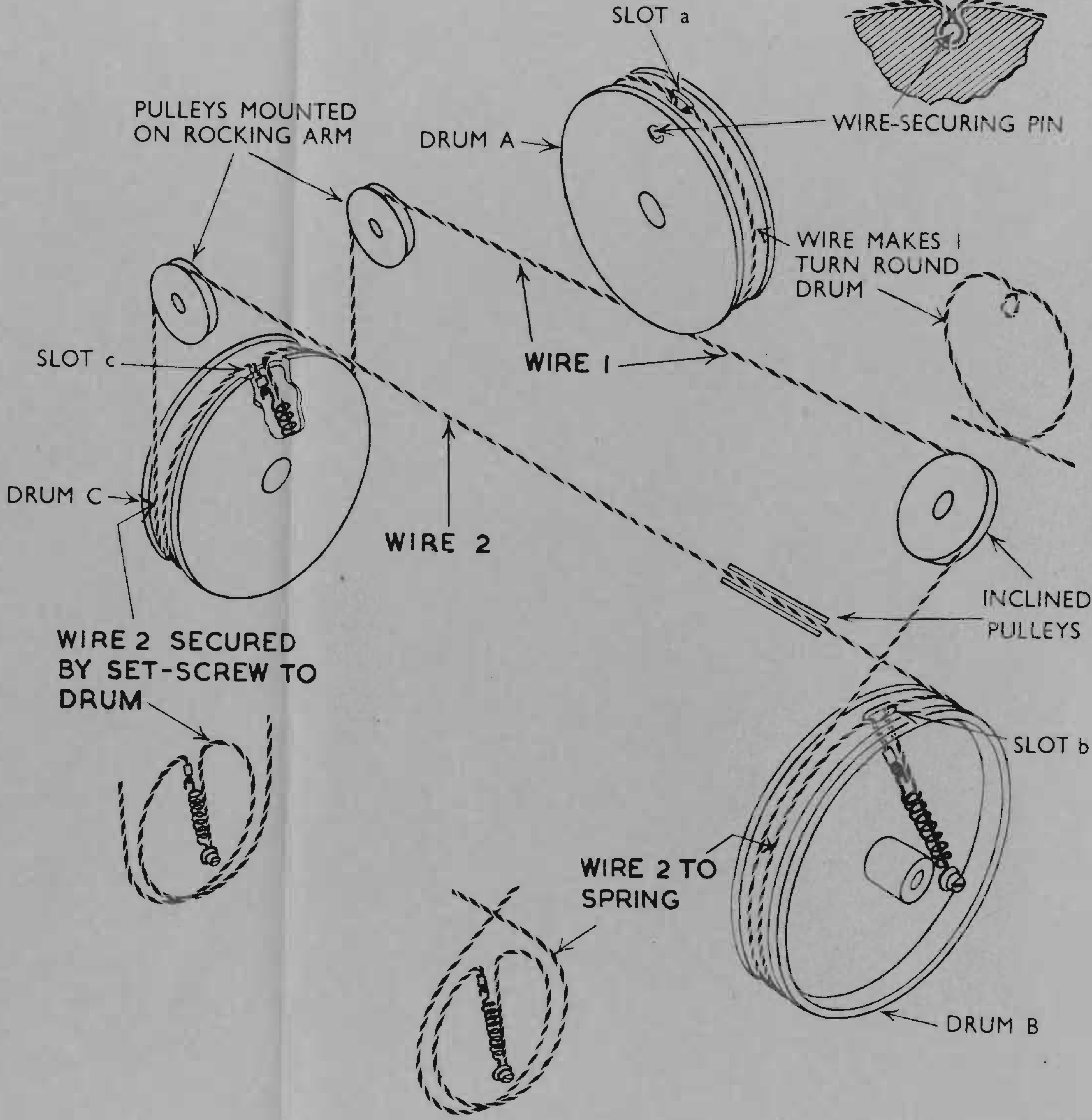
TOP VIEW OF RF UNIT

DRIVE-WIRE REPLACEMENT DIAGRAM

MARCONI INSTRUMENTS LIMITED							
DRN	T.W.	DATE	11.11.55.	CHKD	J.F.G.	ISSUE	1
STOCK LIST	TF 801B/1	DRG No.	MP 801 B/1 - 8				



ATTENUATOR
SEE ALSO MP 801B/1-3



TUNING SYSTEM
SEE ALSO MP 801B/1-7

SPARES ORDERING SCHEDULE NO. SOS/801B/1

WITH CIRCUIT REFERENCES

for

SIGNAL GENERATOR TYPE TF 801B/1

Applicable to Instruments
Serial Nos:-
1850121 to 1850200

When ordering replacement parts, please state: the quantity and type required, the number and issue of this Spares Ordering Schedule, and the SOS item number of the part required.

For example, to order a replacement for the 330-ohm, 3/4 watt resistor, R6, quote:-

1 off, Resistor: SOS/801B/1, Issue 1, Item 6.

SOS Item No.	Circuit Ref.	Description	Works Ref
		RESISTORS	
1	R1	Composition, 10 Ω ±10%, 3/4 W.	PC 66611/1
2	R2	Composition, 15 kΩ ±10%, 3/4 W.	PC 66611/39
3	R3	Composition, 100 Ω ±10%, 3/4 W.	PC 66611/13
4	R4	Composition, 4.7 kΩ ±10%, 3/4 W.	PC 66611/33

SOS Item No.	Circuit Ref.	Description	Works Ref.
		RESISTORS (Continued)	
5	R5	Composition, 680 kΩ ±10%, 3/4 W.	PC 66611/59
6	R6	Composition, 330 kΩ ±10%, 3/4 W.	PC 66611/55
7	R7	Composition, 47 kΩ ±10%, 3/4 W.	PC 66611/45
8	R8	Composition, 68 kΩ ±10%, 1 W.	PC 66612/41
9	R9	Composition, 330 kΩ ±10%, 3/4 W.	PC 66611/55
10	R10	Composition, 100 kΩ ±10%, 3/4 W.	PC 66611/49
11	R11	Composition, 47 kΩ ±10%, 3/4 W.	PC 66611/45
12	R12	Composition, 10 kΩ ±10%, 1 W.	PC 66612/31
13	R13	Composition, 680 Ω ±10%, ½ W.	157-TM4813/1
14	R14	Composition, 68 kΩ ±10%, 1 W.	PC 66612/41
15	R15	Composition, 10 kΩ ±10%, 1 W.	PC 66612/31
16	R16	Composition, 10 kΩ ±10%, 3/4 W.	PC 66611/37
17	R17	Composition, 1 MΩ ±10%, 3/4 W.	PC 66611/61
18	R18	Composition, 68 Ω ±10%, 3/4 W.	PC 66611/11
19	R19	Composition, 150 Ω ±10%, 3/4 W.	PC 66611/15
20	R20	Composition, 2.2 kΩ ±10%, 3/4 W.	PC 66611/29
21	R22	Composition, 47 Ω ±10%, ½ W.	19-TM 4819
22	R23	Composition, 1 MΩ ±10%, 3/4 W.	PC 66611/61
23	R24	Composition, 100 kΩ ±10%, 3/4 W.	PC 66611/49
24	R25	Composition, 470 Ω ±10%, 3/4 W.	PC 66611/21
25	R26	Composition, 1 MΩ ±10%, 3/4 W.	PC 66611/61

SOS Item No.	Circuit Ref.	Description	Works Ref.
		RESISTORS (Continued)	
26	R27	Composition, 4.7 kΩ ±10%, 3/4 W.	PC 66611/33
27	R28	Composition, 470 Ω ±10%, 3/4 W.	PC 66611/21
28	R29	Composition, 33 kΩ ±10%, 3/4 W.	PC 66611/43
29	R30	Composition, 4.7 kΩ ±10%, 1/4 W.	PC 66604/33
30	R31	Composition, 150 kΩ ±10%, 1 W.	PC 66612/49
31	R32	Composition, 10 kΩ ±10%, 3/4 W.	PC 66611/37
32	R33	Composition, 150 kΩ ±10%, 1 W.	PC 66612/49
33	R34	Composition, 10 kΩ ±10%, 3/4 W.	PC 66611/37
34	R35	Composition, 220 kΩ ±10%, 3/4 W.	PC 66611/53
35	R36	Composition, 47 Ω ±10%, ½ W.	19-TM 4819
36	R38	Composition, 47 Ω ±10%, 3/4 W.	PC 66611/9
37	R39	Composition, 33 kΩ ±10%, 1 W.	PC 66612/37
38	R40	Composition, 22 kΩ ±10%, 1 W.	PC 66612/35
39	R41	Composition, 1 kΩ ±10%, 3/4 W.	PC 66611/25
40	R42	Composition, 10 Ω ±10%, 3/4 W.	PC 66611/1
41	R43	Composition, 47 kΩ ±10%, 3/4 W.	PC 66611/45

SOS Item No.	Circuit Ref.	Description	Works Ref.
		VARIABLE RESISTORS	
42	RV1	Wire-Wound, 50 kΩ ±10%, 2 W.	104-TF801B
43	RV2	Wire-Wound, 2 kΩ ±10%, 3 W.	105-TF801B
44	RV3	Wire-Wound, 2 kΩ ±10%, 3 W.	107-TF801B
45	RV4	Wire-Wound, 5 kΩ ±10%, 2 W.	106-TF801B
46	RV5	Wire-Wound, 50 kΩ ±10%, 2 W.	104-TF801B
		CAPACITORS	
47	C1	Ceramic, 100 µµF ±10%, 500 V d.c.	PC 18202/13
48	C2	Paper, 4 µF ±20%, 600 V d.c.	PC 19212/3
49	C3	Paper, 4 µF ±20%, 600 V d.c.	PC 19212/3
50	C5	Special; part of R.F. Oscillator Assembly.	
51	C6	Special; part of R.F. Oscillator Assembly.	
52	C7	Special; part of R.F. Oscillator Assembly.	
53	C8	Special; part of R.F. Oscillator Assembly.	
54	C9	Paper, 0.25 µF ±20%, 350 V d.c.	PC 19202/16
55	C10	Feed-Through, 47 µµF ±20%, 750 V d.c.	147-TM4813
56	C11	Feed-Through, 47 µµF ±20%, 750 V d.c.	147-TM4813
57	C12	Elect., 50 µF -20% +100%, 12 V d.c.	PC 18402/16

SOS Item No.	Circuit Ref.	Description	Works Ref.
		CAPACITORS (Continued)	
58	C15	Paper, 0.01 μF, 400 V d.c. Paper, 0.005 μF, 400 V d.c. Total Tol. ±10%.	8-TM1296D
59	C16	Paper, 0.01 μF ±20%, 350 V d.c.	PC 19202/7
60	C17	Paper, 0.1 μF ±20%, 350 V d.c.	PC 19202/14
61	C18	Special; part of R.F. Amplifier Assembly.	
62	C19	Special; part of R.F. Amplifier Assembly.	
63	C20	Elect., 8 μF -20% +50%, 350 V d.c.	PC 18402/5
64	C21	Paper, 0.05 μF ±20%, 200 V d.c.	9-TM3400GD
65	C22	Ceramic Tubular, 500 μμF, 500 V d.c.	151-TM4813
66	C23	Paper, 0.01 μF ±25%, 350 V d.c.	PC 19202/7
67	C24	Paper, 2 μF ±25%, 150 V d.c.	PC 19301/5
68	C25	Ceramic Tubular, 1500 μμF, 350 V d.c.	152-TM4813
69	C26	Ceramic, 47 μμF ±10%, 500 V d.c.	20-TM4819
70	C27	Ceramic Tubular, 100 μμF ±10%, 500 V d.c.	PC 18202/13
71	C28	Special Variable; part of R.F. Amplifier Assembly.	
72	C29	Ceramic, 220 μμF ±20%, 350 V d.c.	PC 18203/1
73	C30	Paper, 2 μF ±25%, 150 V d.c.	PC 19301/5
74	C31	Ceramic Tubular, 1000 μμF ±20%, 500 V d.c.	153-TM4813/1
75	C33	Ceramic, 2.2 μμF ± 0.5 μμF, 750 V d.c.	19-TM4821/1
76	C34	Ceramic, 36 μμF ±5%, 750 V d.c.	20-TM4821/1

SOS Item No.	Circuit Ref.	Description	Works Ref.
		CAPACITORS (Continued)	
77	C35	Ceramic Tubular, 1000 μμF ±20%, 500 V d.c.	21-TM4821/1
78	C36	Ceramic, 2.2 μμF ±0.5 μμF, 750 V d.c.	19-TM4821/1
79	C37	Ceramic, 24 μμF ±5%, 750 V d.c.	22-TM4821/1
80	C38	Ceramic Tubular, 1000 μμF ±20%, 500 V d.c.	21-TM4821/1
		CHOKES AND INDUCTORS	
81	L1	R.F. Inductor.	TB 16363/11
82	L2	Smoothing Choke.	TM 4499D
83	L5	R.F. Inductor.	TB 16363/11
84	L7	Attenuator Pick Up Coil.	TB 23150/9
85	L8	Inductor.	TB 23173/11
86	L10	Inductor.	TB 23157/2
87	L12	Inductor.	TB 23155/1
88	L13	Oscillator Tuning Coil, Band A.	1-TM4821/1
89	L14	Oscillator Tuning Coil, Band B.	2-TM4821/1

SOS Item No.	Circuit Ref.	Description	Works Ref.
		CHOKES AND INDUCTORS (Continued)	
90	L15	Oscillator Tuning Coil, Band C.	3-TM4821/1
91	L16	Oscillator Tuning Coil, Band D.	4-TM4821/1
92	L17	Oscillator Tuning Coil, Band E.	5-TM4821/1
93	L18	Amplifier Tuning Coil, Band A.	1-TM4820/1
94	L19	Amplifier Tuning Coil, Band B.	2-TM4820/1
95	L20	Amplifier Tuning Coil, Band C.	3-TM4820/1
96	L21	Amplifier Tuning Coil, Band D.	4-TM4820/1
97	L22	Amplifier Tuning Coil, Band E.	5-TM4820/1
		TRANSFORMERS	
98	T1	Mains Transformer.	TM 4501F
99	T2	L.T. Transformer.	TM 4818
100	T3	Modulation Oscillator Transformer.	TM 1296D

SOS Item No.	Circuit Ref.	Description	Works Ref.
		SWITCHES	
101	S1	Toggle.	TB 23903/2
102	S2	Special H.T. Switch.	TB 23147
103	S3	Toggle.	TB 23903/2
104	S4	Rotary, 2-Pole, 4-Way, 4-Position.	TC 4428/368
105	S5	Rotary, 1-Pole, 5-Way, 5-Position.	TC 4428/385
		VALVES, VALVEHOLDERS, AND RETAINERS	
106	V1	5R4G F.W. Rectifier.	73-TF801B
107		Valveholder for V1.	PC 81814/1
108		Retainer for V1.	TC 22744/5
109	V2	DET 22, Disc-Seal Triode.	145-TM4813
110		Thermal Shunt for V2.	TE 23153
111		Retaining Clips for V2, R.H. Clip: L.H. Clip:	TE 23097/6 TE 23097/6A
112		Heater Contact for V2.	TE 23130/6
113		Cathode Connector for V2.	TE 23130/7
114	V3	KT66, Tetrode.	79-TF801B
115		Valveholder for V3.	PC 81814/1
116		Retainer for V3.	TC 22744/57

SOS Item No.	Circuit Ref.	Description	Works Ref.
		VALVES, VALVEHOLDERS, AND RETAINERS (Contd.)	
117	V4	EF95, Pentode.	74-TF801B
118		Valveholder for V4.	PC 81811/1
119		Screening Can for V4.	PC 17501/1
120	V5	OB2, Gas-Filled Stabilizer.	77-TF801B
121		Valveholder for V5.	PC 81811/1
122		Screening Can for V5.	PC 17501/2
123	V6	DET 22, Disc-Seal Triode.	145-TM4813
124		Thermal Shunt for V6.	TE 23153
125		Retaining Clips for V6, R.H. Clip: L.H. Clip:	TE 23097/6 TE 23097/6A
126		Cathode Connector for V6.	TE 23130/7
127	V7	L77, Triode.	75-TF801B
128		Valveholder for V7.	PC 81811/1
129		Screening Can for V7.	PC 17501/1
130	V8	12AT7, Double Triode.	78-TF801B
131		Valveholder for V8.	PC 81816/1
132		Screening Can for V8.	PC 17502/2
133	V9	6AS7, Double Triode.	76-TF801B
134		Valveholder for V9.	PC 81814/1
135		Retainer for V9.	TC 22744/57

SOS Item No.	Circuit Ref.	Description	Works Ref.
		CRYSTALS	
136	X1	CS2A, Silicon Rectifier.	6-TM4823
137	X2	CG1E, Germanium Rectifier.	21-TM3400GD
138	X3	CG1E, Germanium Rectifier.	21-TM3400GD
		LAMPS	
139	PLP1	6.3-volt, 0.15-amp.	148-TF801B
		METERS	
140	M1	100-μA F.S.D.	TM 3970/28
141	M2	100-μA F.S.D.	TM 3970/50
		FUSES	
142	FS1	2-amp, Glass Cartridge.	145-TF801B
143	FS2	2-amp, Glass Cartridge.	145-TF801B
144	FS3	0.15-amp, Glass Cartridge.	144-TF801B
		PLUGS, SOCKETS, AND CONNECTING LEADS	
145	SKT1	Coaxial 50-ohm, Type N Socket.	159-TF801B
146	SKT2	Coaxial, 50-ohm, Type N Socket.	15-TM4819
147	PL1	3-Pin, 5-amp, Mains Plug.	1-TM2560AQ
148		Connector, 50-ohm Coaxial.	TM 4824
149		Mains Lead.	TM 2560AQ

SOS Item No.	Circuit Ref.	Description	Works Ref.
		KNOBS, DRIVES AND DIALS	
150		Knob for Frequency Control.	TD 23123/2B
151		Screw and Handle for Item 150.	TD 23123/5 and TB 23172/2
152		Incremental Frequency Dial.	TD 23123/6
153		Dome Nut for fixing Item 150.	TB 24145/17
154		Spring Washer.	11-TM4817
155		Cursor.	TD 23123/3
156		Cursor Block.	TB 13803/1F
157		Complete Knob and Dial Assembly.	TM 4817
158		Frequency Dial.	TC 23146
159		Cursor for Frequency Dial.	TE 23099/7A
160		Window for Frequency Dial.	TC 18378/1
161		Centre Mask for Frequency Dial.	TC 23983/1
162		Spinning to carry Frequency Dial.	TD 23113
163		Washer for Frequency Dial Assembly.	TB 3696/3
164		Centre Screw for Frequency Dial Assembly.	TA 4008/3
165		Mounting Bush for Frequency Dial.	TE 23099/8
166		Cursor Centre-Retainer (for Item 159).	TE 23099/9
167		Stainless-Steel Drive Wire.	TB 18892
168		Bar Type Knobs.	TB 3969/3
169		Skirted Knobs.	TB 17848/3

SOS Item No.	Circuit Ref.	Description	Works Ref.
		KNOBS, DRIVES AND DIALS (Continued)	
170		Attenuator Dial.	25-TF801B
171		Cursor for Attenuator Dial.	TE 23099/7
172		Window for Attenuator Dial.	TE 23106/6
173		Centre Mask for Attenuator Dial.	TC 23983/2
174		Spinning to carry Attenuator Dial.	TC 23121
175		Centre Screw for Attenuator Dial Assembly.	TA 4008/3
176		Spacer for Attenuator Dial Assembly.	TB 4970/607
177		Stiffening Plate for Item 174.	TE 23106/9
178		Fixed Spindle for Attenuator Dial.	TE 23099/14
179		Mounting Boss for Attenuator Dial.	TE 23099/5
180		Wire Drive Drum for Attenuator Dial.	TE 23106/7
181		Mounting Brackets for Item 174.	TE 17645/15A
		MISCELLANEOUS	
182		Complete Case Assembly.	TE 23102
183		Front Panel.	TE 23108
184		Handle Escutcheon.	TB 18258/2
185		Mains Lead Cable Support.	53-TF801B
186		Case Foot.	TA 11420

SOS Item No.	Cir-cuit Ref.	Description	Works Ref.
		MISCELLANEOUS (Continued)	
187		Terminal (EXTERNAL MOD. SINE and E).	TB 24330/5
188		R.F. Unit Outer Screening Cover.	TE 23101
189		R.F. Unit Inner Screening Cover.	TE 23100/1
190		Translucent Plastic Cover.	173-TF801B
191		20-dB Attenuator Pad.	TM 4919
192		D.C. Isolating Unit.	TM 4917
193		50-ohm to 75-ohm Matching Unit.	TM 4918
194		50-ohm to 300-ohm Unbalance-to-Balance Transformer.	TM 4916
195		Operating and Maintenance Handbook.	EB 801B/1

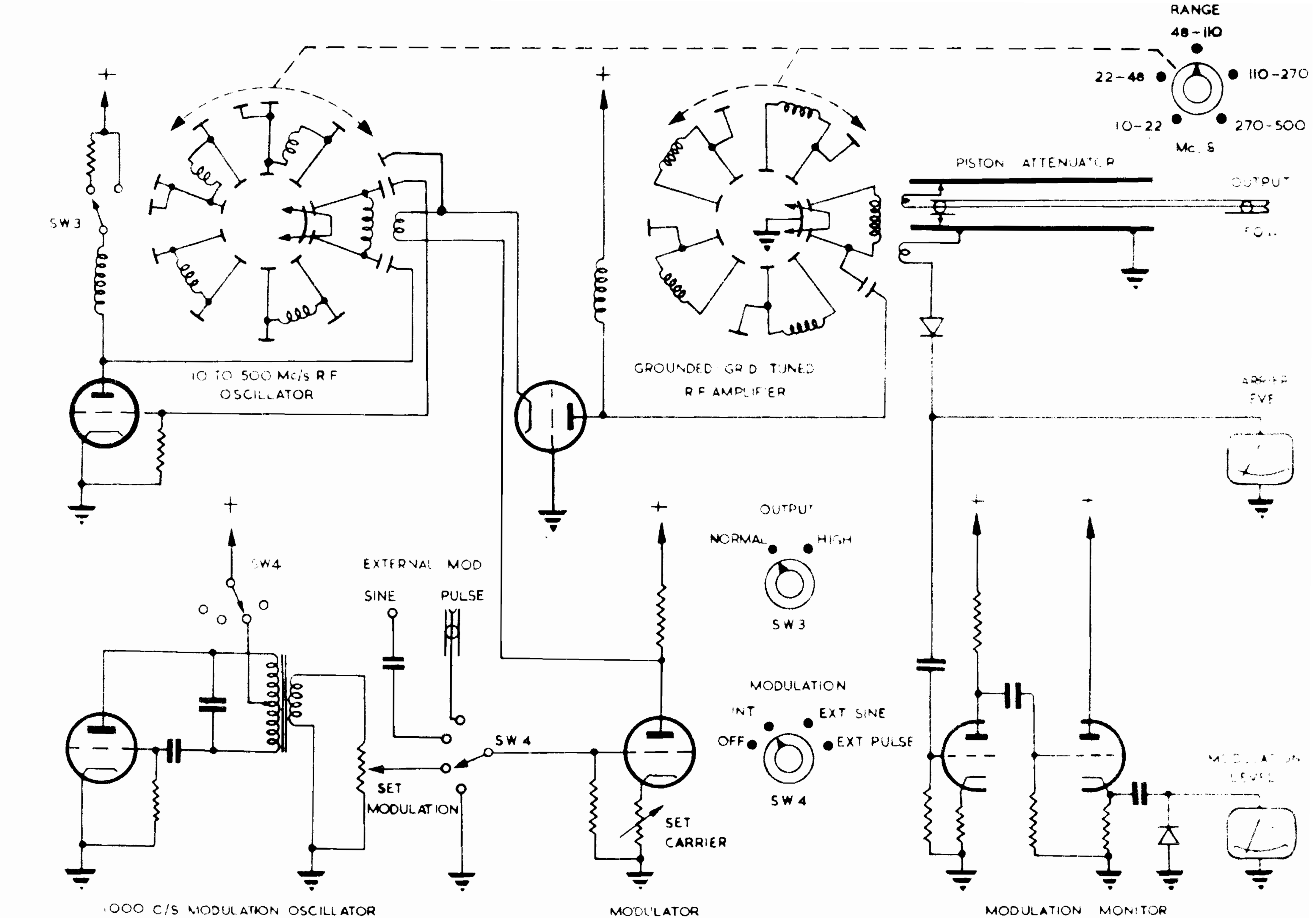
FUNCTIONAL DIAGRAM

OF

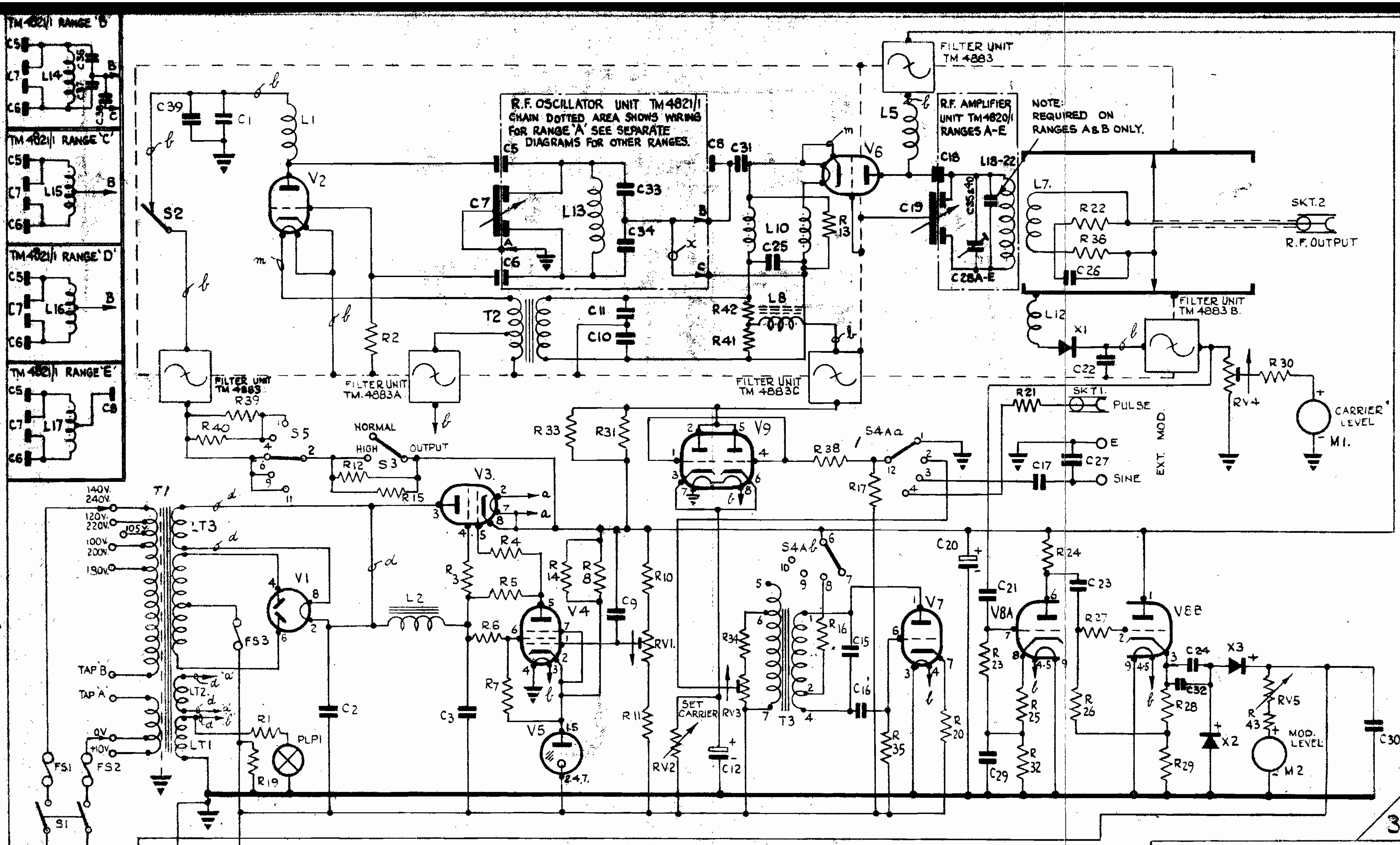
SIGNAL GENERATOR

TYPE TF 801 B

MARCONI INSTRUMENTS LIMITED							
DRAWN	W.R.T.	DATE	24-9-54	CH'KD	W.K.C.	ISSUE	1
STOCK LIST	TF 801 B	DRG No	TBB 24165				



RANGE
48-110
22-48
110-270
10-22
270-500
Mc/S
PISTON ATTENUATOR
SW3
10 TO 500 Mc/s R.F.
OSCILLATOR
GROUNDED-GRID TUNED
R.F. AMPLIFIER
OUTPUT
NORMAL
HIGH
SW3
SW4
EXTERNAL MOD
SINE
PULSE
SW4
SET
MODULATION
SET
CARRIER
MODULATION
INT
EXT SINE
OFF
EXT PULSE
SW4
1000 C/S MODULATION OSCILLATOR
MODULATOR
MODULATION MONITOR



NOTE:-

1. LEADS MARKED THUS σ^{d} TO BE WIRED IN TC. 20700/5
2. FOR COMPONENT LIST SEE SHEET 2.
3. LEADS MARKED THUS σ^{b} TO BE WIRED IN TC. 20700/3.
4. LEADS MARKED THUS σ^{m} TO BE WIRED IN COPPER LINEAR THREAD 16/3/·0028.
5. LEAD MARKED THUS σ^{x} TO BE WIRED IN 24 SWG TINNED CU WIRE.

MODULATION

OFF · INT. · EXT. SINE · EXT. PULSE

S 4

PANEL · A B

S 4

TITLE. CIRCUIT DIAGRAM FOR 12-470 Mc/s SIG. GEN. TYPE TF 801B/1	
DRN. R. HILL	ASSY. TE. 23091
DATE 29-7-55	S. LIST TF 801B/1
CHKD.	SCALE -
APPD.	DRG. No TC. 23093 / 1 SHT. 1. OF 2 SHTS
TRACED.	

MARCONI INSTRUMENTS LTD.

DECIBEL CONVERSION TABLE

Ratio Down			*Ratio Up*	
VOLTAGE	*POWER*	*DECIBELS*	*VOLTAGE*	*POWER*
1·0	1·0	**0**	1·0	1·0
·9886	·9772	**·1**	1·012	1·023
·9772	·9550	**·2**	1·023	1·047
·9661	·9333	**·3**	1·035	1·072
·9550	·9120	**·4**	1·047	1·096
·9441	·8913	**·5**	1·059	1·122
·9333	·8710	**·6**	1·072	1·148
·9226	·8511	**·7**	1·084	1·175
·9120	·8318	**·8**	1·096	1·202
·9016	·8128	**·9**	1·109	1·230
·8913	·7943	**1·0**	1·122	1·259
·8710	·7586	**1·2**	1·148	1·318
·8511	·7244	**1·4**	1·175	1·380
·8318	·6918	**1·6**	1·202	1·445
·8128	·6607	**1·8**	1·230	1·514
·7943	·6310	**2·0**	1·259	1·585
·7762	·6026	**2·2**	1·288	1·660
·7586	·5754	**2·4**	1·318	1·738
·7413	·5495	**2·6**	1·349	1·820
·7244	·5248	**2·8**	1·380	1·905
·7079	·5012	**3·0**	1·413	1·995
·6683	·4467	**3·5**	1·496	2·239
·6310	·3981	**4·0**	1·585	2·512
·5957	·3548	**4·5**	1·679	2·818
·5623	·3162	**5·0**	1·778	3·162
·5309	·2818	**5·5**	1·884	3·548
·5012	·2512	**6**	1·995	3·981
·4467	·1995	**7**	2·239	5·012
·3981	·1585	**8**	2·512	6·310
·3548	·1259	**9**	2·818	7·943
·3162	·1000	**10**	3·162	10·000
·2818	·07943	**11**	3·548	12·59
·2512	·06310	**12**	3·981	15·85
·2239	·05012	**13**	4·467	19·95
·1995	·03981	**14**	5·012	25·12
·1778	·03162	**15**	5·623	31·62

DECIBEL CONVERSION TABLE

Ratio Down			*Ratio Up*	
VOLTAGE	*POWER*	*DECIBELS*	*VOLTAGE*	*POWER*
·1585	·02512	**16**	6·310	39·81
·1413	·01995	**17**	7·079	50·12
·1259	·01585	**18**	7·943	63·10
·1122	·01259	**19**	8·913	79·43
·1000	·01000	**20**	10·000	100·00
·07943	·006310	**22**	12·59	158·5
·06310	·003981	**24**	15·85	251·2
·05012	·002512	**26**	19·95	398·1
·03981	·001585	**28**	25·12	631·0
·03162	·001000	**30**	31·62	1,000
·02512	·0006310	**32**	39·81	1,585
·01995	·0003981	**34**	50·12	2,512
·01585	·0002512	**36**	63·10	3,981
·01259	·0001585	**38**	79·43	6,310
·01000	·0001000	**40**	100·00	10,000
·007943	·00006310	**42**	125·9	15,850
·006310	·00003981	**44**	158·5	25,120
·005012	·00002512	**46**	199·5	39,810
·003981	·00001585	**48**	251·2	63,100
·003162	·00001000	**50**	316·2	100,000
·002512	$6·310 \times 10^{-6}$	**52**	398·1	158,500
·001995	$3·981 \times 10^{-6}$	**54**	501·2	251,200
·001585	$2·512 \times 10^{-6}$	**56**	631·0	398,100
·001259	$1·585 \times 10^{-6}$	**58**	794·3	631,000
·001000	10^{-6}	**60**	1,000	10^{6}
·0005623	$3·162 \times 10^{-7}$	**65**	1,778	$3·162 \times 10^{6}$
·0003162	10^{-7}	**70**	3,162	10^{7}
·0001778	$3·162 \times 10^{-8}$	**75**	5,623	$3·162 \times 10^{7}$
·0001000	10^{-8}	**80**	10,000	10^{8}
·00005623	$3·162 \times 10^{-9}$	**85**	17,780	$3·162 \times 10^{8}$
·00003162	10^{-9}	**90**	31,620	10^{9}
·00001000	10^{-10}	**100**	100,000	10^{10}
$3·162 \times 10^{-6}$	10^{-11}	**110**	316,200	10^{11}
10^{-6}	10^{-12}	**120**	10^{6}	10^{12}
$3·162 \times 10^{-7}$	10^{-13}	**130**	$3·162 \times 10^{6}$	10^{13}
10^{-7}	10^{-14}	**140**	10^{7}	10^{14}