INTRODUCTION

The Oscillator Test No. 1 provides a r.f. signal of known frequency and amplitude primarily for the alignment and checking of the performance of Service wireless receivers. It operates in the frequency range 85 kc/s to 30 Mc/s, and is complementary to the Oscillator Test No. 2. The signal may be continuous wave (c.w.), amplitude modulated (a.m.) or frequency modulated (f.m.); this latter facility is available only above 2 Mc/s. The output may be varied in steps of 2 dB from 1 μV to 100 mV. For a.m. the depth is fixed at approximately 30% at 1 kc/s and for f.m. the deviation may be varied up to 30 kc/s. The a.m. tone of 1 kc/s is available at separate terminals for checking a.f. circuits. The equipment may be operated from a.c. mains or a 12V battery.

BRIEF DESCRIPTION

2. The block diagram, Fig. 1, shows the principle of operation. The master oscillator V2 is a tuned anode oscillator covering the frequency range as follows:

<table>
<thead>
<tr>
<th>Band</th>
<th>Frequency Range</th>
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<tbody>
<tr>
<td>Band 1</td>
<td>85 kc/s - 250 kc/s</td>
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<tr>
<td>Band 2</td>
<td>250 kc/s - 700 kc/s</td>
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<tr>
<td>Band 3</td>
<td>700 kc/s - 2 Mc/s</td>
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<tr>
<td>Band 4</td>
<td>2 Mc/s - 4 Mc/s</td>
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<tr>
<td>Band 5</td>
<td>4 Mc/s - 8 Mc/s</td>
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<tr>
<td>Band 6</td>
<td>8 Mc/s - 16 Mc/s</td>
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<tr>
<td>Band 7</td>
<td>16 Mc/s - 32 Mc/s</td>
</tr>
</tbody>
</table>
The reactance valve V1 is switched in on bands 4 to 7 inclusive. The valve stages V3 and V4 together comprise a wide-band amplifier. On a.m. the a.f. oscillator V5 is connected to the screen of the second amplifier stage V4, whilst on f.m. the output from V5 is fed to the grid of the reactance valve V1.

Fig. 1 Block diagram

POWER SUPPLIES

3. The equipment is operated either from a.c. mains or a 12V battery. The mains supply may be 110V, 115V, 120V, 220V or 240V, 45–65 c/s. To adjust the transformer tap the equipment must be unsealed and removed from the case. The power consumption is approximately 42 watts for battery operation and 50VA for mains.

NOTE. It is important when using the 12V battery supply that the lead for the a.c. supply is removed and that the cover is replaced on the a.c. input plug F1A'. Similarly, when using a.c. supply the battery lead must be removed and the cover replaced on the battery input plug F1B.

MECHANICAL CONSTRUCTION

4. The test oscillator is a completely self-contained instrument housed in a hermetically sealed case. The equipment consists of a r.f. unit in a screened box, with a number of sub-assemblies arranged around it. The whole of the assembly is mounted on the panel and is withdrawn from the case when the sealing is broken and the panel lifted. Being of the sealed type the instrument should not be opened unless suitable drying and seal testing equipment is available (see paras. 18 and 25).

5. The case is of die-cast aluminium alloy to which the front panel is bolted. All controls and battery and mains sockets are on the front panel. A lid is provided which is held in position during transit by quick-release clips. Connecting leads
and minor spares are carried in a compartment in the lid, and a webbing strap is fitted to the case for carrying the instrument. The overall size of the equipment is 8 3/4 inches by 13 inches by 10 3/4 inches, and the total weight is 30 lb.

TECHNICAL DESCRIPTION

Main Oscillator and Amplifier Circuits

6. The complete circuit diagram is shown in Figs. 2001a and b. The main oscillator is V₂, which is of the tuned anode type. Selection of the appropriate anode inductance, L₁ to L₄ or L₂₅ to L₂₇, for the required frequency band is by switch SW₃b, and of the associated grid coupling coil, L₌a to L₄a or L₂₅a to L₂₇a, by switch SW₃c. Each of the grid coils is inductively coupled to the corresponding anode coil and the grid circuit incorporates a grid capacitor, C₉₂ to C₉₆, suitable for the frequency band selected. The oscillator is tuned on the three lowest bands 1, 2 and 3, 85ko/s to 25ko/s, by capacitors C₃₆a and C₃₆b in parallel. On the higher bands C₃₆b is replaced by V₁, connected as an inductive reactance of fixed value for each band (see para. 10).

7. The h.t. supply for the anodes and screens of V₁ and V₂ is stabilised at 150 volts obtained from across the terminals of the stabiliser valve V₆. The anode circuit of V₂ is decoupled, according to the frequency band selected, as follows:

<table>
<thead>
<tr>
<th>Band</th>
<th>By R₉ (470 ohms) and C₆₀ (0.1 μF)</th>
<th>By R₇₆ (470 ohms) and C₄₂ (0.01 μF), C₇₆ (0.05 μF)</th>
<th>By R₆₀ (470 ohms) and C₃₈ (0.02 μF)</th>
<th>By R₅ (470 ohms) and C₇₆ (0.1 μF), C₁₁₃ (6,000 pF)</th>
<th>By R₅ (470 ohms) and C₉₉ (0.005 μF), C₁₁₀ (6,000 pF)</th>
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<tbody>
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8. The output from the oscillator is taken from the grid via C₁₀₁l to the grid of V₃, a resistance-capacity buffer stage with an anode load R₆₂ or 390 ohms. The gain of this stage is therefore not much greater than unity, but is maintained reasonably well to the high frequency end of the band. The final stage V₄ incorporates a tuned circuit in its anode on all bands. The anode load comprises L₅ and one of capacitors C₁₁₄ - C₁₁₈, selected by SW₂b for bands 1 to 5, and L₅ and circuit and valve array capacities on bands 6 and 7. The resulting tuned circuits have very flat frequency characteristics and their purpose is to ensure that the output from V₄ is level within prescribed limits for each band. The anode inductance L₅ is shunted by the input resistance of the ladder attenuators in series with R₄₇ (some 300 ohms). It is provided with a pre-set iron slug which allows for adjustment of the tuned circuits and to give compensation for the slight falling off in response exhibited by V₃ in band 7. With SW₁ and SW₂ set at CW and CAR respectively the level of the carrier is monitored by M₁. Adjustment of the carrier level is by means of the SST CAR control RV₁ which controls the screen voltage of V₄. The setting for RV₂ to give correct carrier level corresponding to the attenuator marking is determined by adjusting RV₂ until the meter M₁ reads at the CAL position.

Amplitude Modulation

9. Amplitude modulation is provided by applying an a.f. voltage of suitable value to the screen of the output valve V₄. This a.f. is generated by V₅ operating as a Hartley oscillator in conjunction with the tuned circuit L₇ and C₂₄, resonant at
1,000 c/s. With SWA in the AN position the output from V5 is fed via C26 to the screen of V4. The amplitude of the a.f. output is determined by the standing voltage on the screen grid of V5. This voltage is controlled by the setting of the potentiometer formed by R24, R69, RV3 and R70 across the main h.t. supply and can be varied between pre-determined values by the setting of the SET MOD control RV3. The setting of RV3 thus determines the modulation depth. With the carrier correctly adjusted as in para. 8 and RV3 in about the central position the modulation depth produced in the output is approximately 30%. With SWA at AN and SWB at MOD the a.f. output is monitored on meter ML. The setting for RV3 to give a modulation depth of 30%, with the carrier correctly adjusted, is then determined by varying RV3 until the meter ML reads at the CAL position. The a.f. output is also fed via C33 to the MOD TUNE terminals for direct application when required for a.f. tests.

Frequency Modulation

10. For frequency modulation, the a.f. from V5 is fed via C79 and a network of fixed and variable resistors to the grid of V1. This valve behaves as a reactance valve (see EER TELS A 01) since its grid voltage is approximately in quadrature with its anode voltage. The phase shifting network between anode and grid comprises C35, R33, R27 and C22, C18 or C21, depending on the frequency band selected. On the highest frequency band C27 and the grid/emitter capacitance of V1 together with the switch and wiring capacitance is sufficient to ensure the correct phase shift. The capacitor C34 has a sufficiently low reactance at all frequencies used on 10m to be neglected; it is included to isolate the h.t. from the grid. The phase shifting network is thus R13 and C22 with C27 in parallel on, for example, band 4. This circuit is predominantly resistive over the band (2 kHz - 4 kHz), i.e. the capacitive reactance is small in relation to the resistance of R13 (4.7 kΩ). The current through this circuit therefore leads the voltage by a relatively small angle. The voltage at the grid, however, lags this current by 90° and thus the valve, as a whole, appears as an inductive reactance across the oscillator tuned circuit. The actual value of reactance is determined by the mutual conductance of V1 which is varied by the application to its control grid of the a.f. voltage from V5, thus resulting in frequency modulation of the oscillator. The amplitude of the a.f. fed to the reactor is determined by the settings of the controls RV1, RV4, pre-set resistors RV5 - RV11 and R7, which form a potentiometer network across the output of V5. The correct value of a.f. to produce the deviation indicated by the setting of the DEVIATION control RV4 varies from band to band and also throughout each band. The pre-set resistors RV5 - RV11 are switched in to set up the correct voltage for each band and the potentiometer RV1 is ganged to the main tuning control C36 to adjust the voltage to the correct value throughout the band.

11. To compensate for the valve tolerances should V1 be changed, C27 and R8 have alternative values shown in Fig. 2601 and Table 2601. The most suitable value to give the appropriate specification figures should be fitted during repair and test of the instrument (see EER TELS 2344).

12. As for c.w., the actual deviation is dependent upon the a.f. output from V5 being of the correct amplitude. It is adjusted by the SET MOD control RV3 and monitored by the meter ML. The variable resistor RV5 is used to bring the pointer of the meter coincident with the CAL mark, and the a.f. output is then of the correct amplitude.

Attenuators and Metering

13. The r.f. output from V4 is fed direct to the fine attenuator network R27 - R46.
This provides a range of attenuation in 2dB steps from 0 - 20dB depending on the setting of SWB. The tapping of the fine attenuator is connected to the coarse attenuator network R45 - R55 which provides steps of 20dB up to 80dB. Thus the complete range of the two attenuators is 100dB. The output is taken via a 75 ohm cable to a terminating unit. Terminals on this unit allow for the selection of a source impedance of 75 ohms or 7.5 ohms. In the latter condition, the output signal voltage is one-tenth of the nominal output. The maximum open-circuit output voltage across the 75 ohm terminals is 100mV. If the oscillator is loaded with an impedance of the same order as the source impedance, then the usual calculation must be made to determine the true voltage across the load, e.g. if the load is the input of a wireless set designed to match a coaxial cable with an impedance of 75 ohms resistive, then the voltage delivered to the set will be the indicated voltage as read on the attenuators divided by two.

14. The correct carrier level is monitored by the meter M1 when the switch SWD is switched to OAR. The r.f. output from V4 is rectified by the full-wave rectifier circuit comprising the crystal rectifiers NR2 and NR4, and an r.f. filter consisting of L29, L30, C39, C48, R16, R17, C28, C29, and the feed-through capacitors C14 and C17. When the carrier level is measured as being 100mV at the terminating unit (with the two attenuator switches fully clockwise) the carrier level meter pointer is adjusted to be coincident with the CAL mark by the pre-set potentiometer RV7.

15. The a.m. modulation depth and f.m. deviation are monitored as described in paras. 9 and 12 respectively.

POWER SUPPLIES

Input

16. Two separate sockets are provided on the front panel into which the appropriate supply lead for either a.c. mains or 12V battery is plugged. The mains supply is filtered and feeds the mains transformer TRL at the appropriate tapping point. Mains fuses are provided in each leg. For battery operation the battery supplies a vibrator VBL, which feeds an additional primary winding on TRL. Both the input and the output of the vibrator are filtered and suppressed to reduce "hash" and remove it from the operational frequency band of the instrument. Fuses are provided in each leg of the battery supply. A filter box is provided for use when a common battery is used to supply the oscillator and any other equipment. This box contains two electrolytic capacitors C150, C151, in series across the battery and centre-tapped to earth. It is connected in the battery supply lead and filters out any r.f. introduced via the battery.

Output

17. The mains transformer TRL has two secondaries, one for the h.t. supply, the other, a 5 volt winding, for valve heater supply. The dial lamp LF1 is connected across the 5 volt winding. The h.t. secondary winding output is rectified by the full-wave rectifier V7 and smoothed and filtered by L13, R66, C52 and C51. An h.t. fuse is included in the positive line immediately before the filtering and smoothing. The h.t. supplies to the heater V1 and the master oscillator V2 are stabilised by V6. All supplies fed into the screened r.f. box are filtered at the point of entry.
18. The complete equipment comprises the following main items:

(a) Oscillator, Test, No. 1  
(b) Lid Assembly  
(c) Units, Terminating, r.f. No. 3  
(d) Connector, 3-Point, No. 102, 5 ft.  
(e) Connector, 2-Point 4 ft. 6 in. and Filter Assembly No. 1  
(f) Sundry spare fuses, etc.

Items (c) to (f) inclusive are carried in (b).