RESEARCH DEPARTMENT

RESLO RIBBON MICROPHONE TYPE RBM/T AND VRM/T

Report No. L-044

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PRIVATE AND CONFIDENTIAL

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SUMMARY

The Reslo microphone RBM/T is of the pressure gradient ribbon type and is remarkable for its small size and low price. As originally designed the microphone is not suitable for broadcasting purposes, but with a few simple modifications its performance can be made adequate for certain applications. This report describes tests carried out on the microphone in its original form and on the modified version VRM/T as now supplied to the Corporation.

1. INTRODUCTION

There is a need in television for small microphones of reasonable performance for use in panel games and other programmes where the microphone must appear "in shot". The Reslo microphone type RBM/T held promise of meeting these requirements and accordingly when it appeared on the market a specimen was obtained for test purposes. Two further points in favour of this microphone were the robust construction and low cost.

Fig. 1 shows the external appearance and dimensions of the RBM/T microphone.

Fig. 1 - Microphone type RBM/T or VRM/T. External View

In Figs. 2(a) and 2(b) the outer covers and a protective layer of cloth, originally wound round the magnet assembly, have been removed to show the internal construction as viewed from the front and rear. Damping screens of wire gauze are provided on both sides of the ribbon; in Fig. 2(b) one of these screens has been removed to show the ribbon, which has corrugations of castellated form. Fig. 3 shows a cross-section in a plane at right angles to the length of the ribbon. The interior assembly is asymmetrical with the magnet structure at the front of the pole pieces, thus partially obstructing access of sound to the ribbon. To give a measure of protection against mechanical shock the magnet assembly is mounted on the main frame by means of four soft rubber pads. The ribbon-to-line matching transformer and output plug are housed in a tubular stem to which the microphone is attached by a swivel joint which allows the microphone head to be tilted backwards.

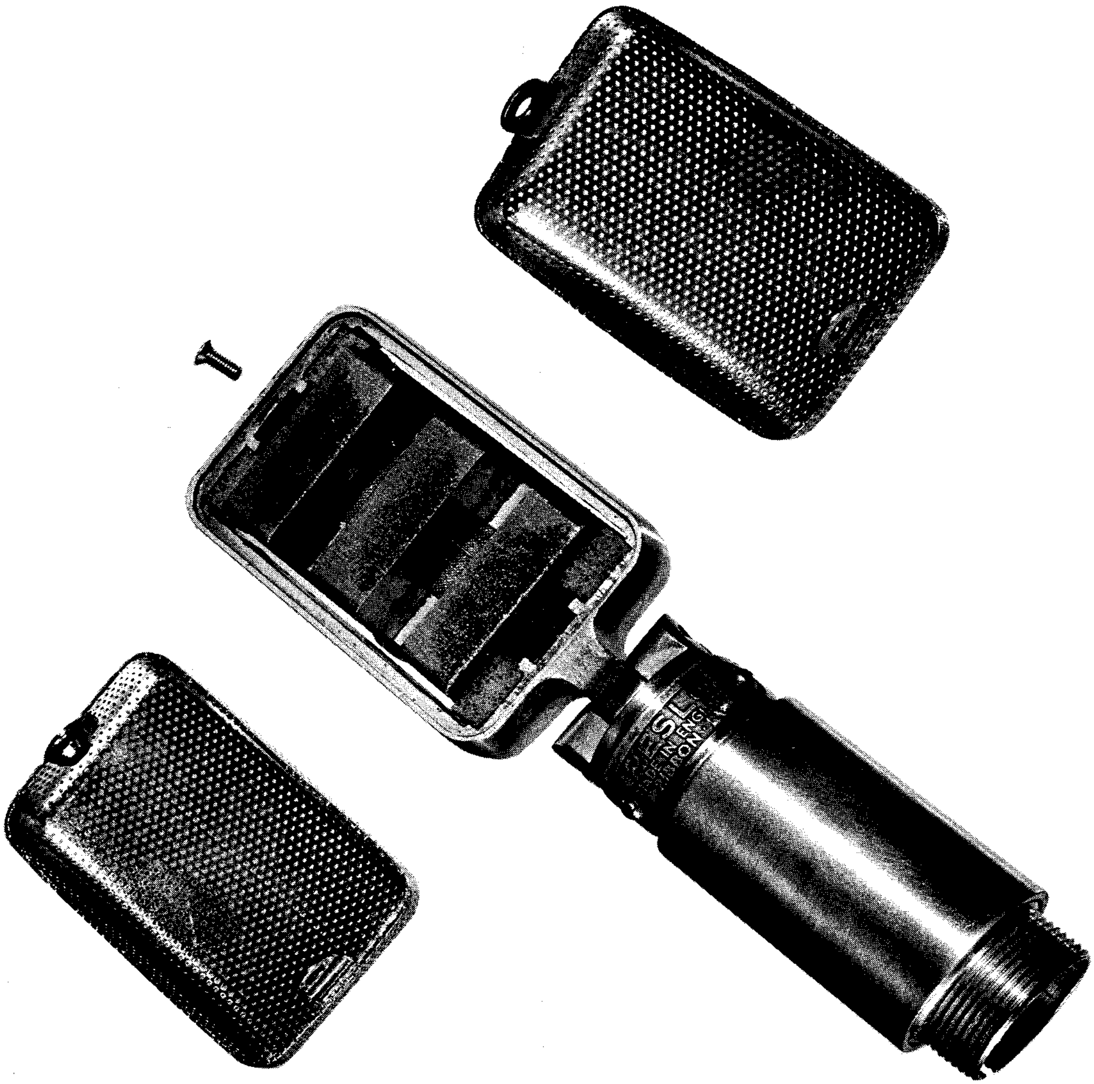

Fig. 2(a) - Microphone type RBM/T. Front view.
Outer covers and protective cloth removed

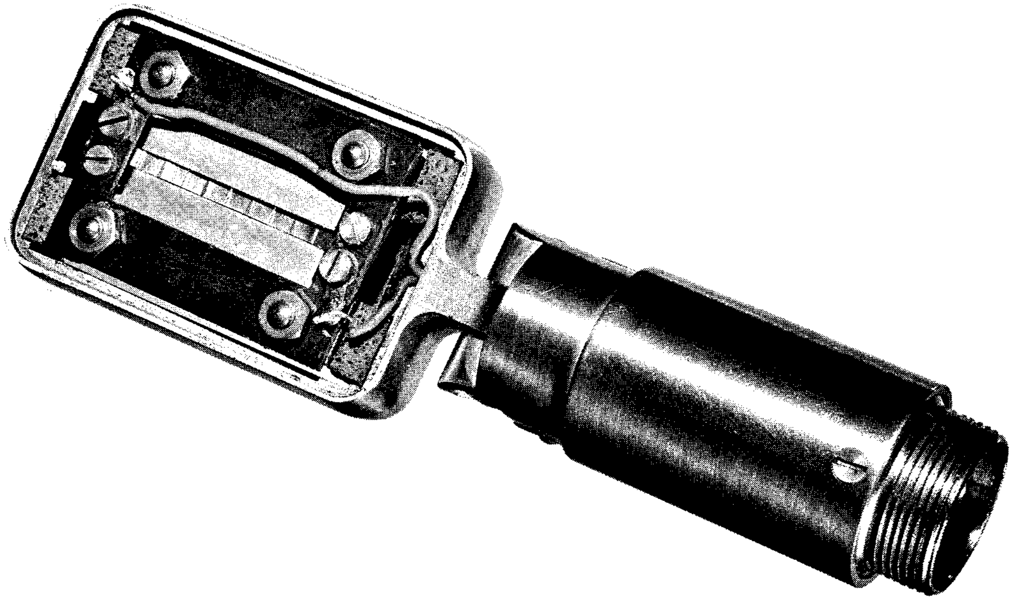

Fig. 2(b) - Microphone type RBM/T.   Rear view.
Outer covers, protective cloth and ribbon damping gauze removed

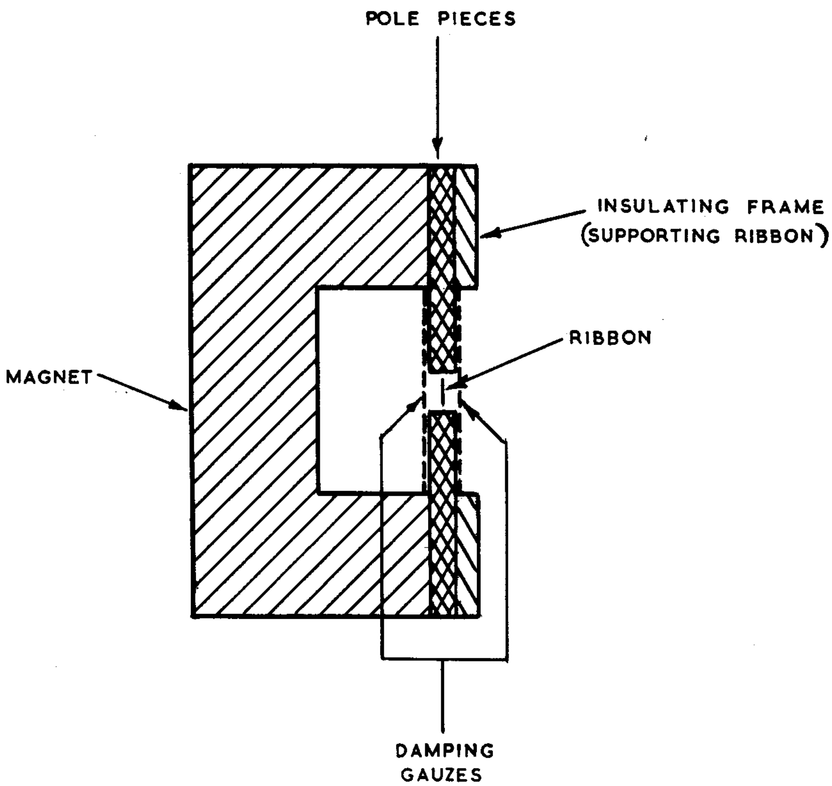

Fig. 3 - Microphone type RBM/T.   Section through magnet assembly
(in plane at right angles to length of ribbon)

The weight of the microphone is 0·55 lb (250 g) and the price to the Corporation, £9.5.0d.

2. PERFORMANCE OF MICROPHONE RBM/T

2.1. Method of Measurement

The frequency characteristics were measured by comparison with a pressure standard in a non-reverberant room, except at frequencies below 200 c/s for which the measurements were made in a plane-wave duct. The accuracy of comparison with the standard was ±½ dB and the characteristics of the standard are known to within ±½ dB.

2.2. Frequency Response

Fig. 4 shows the response of an early model RBM/T microphone for sound incident at various angles in the horizontal plane. It should be noted that 0° refers to the magnet side of the assembly.

It will be seen that at high frequencies the response curves for sound incident at 60° and 120° differ widely from one another and from that for 0° incidence. There is also an appreciable difference at high frequencies between the curves for sound incident at 0° and 180°, the 180° curve being slightly preferable. The response also falls sharply at the bass.

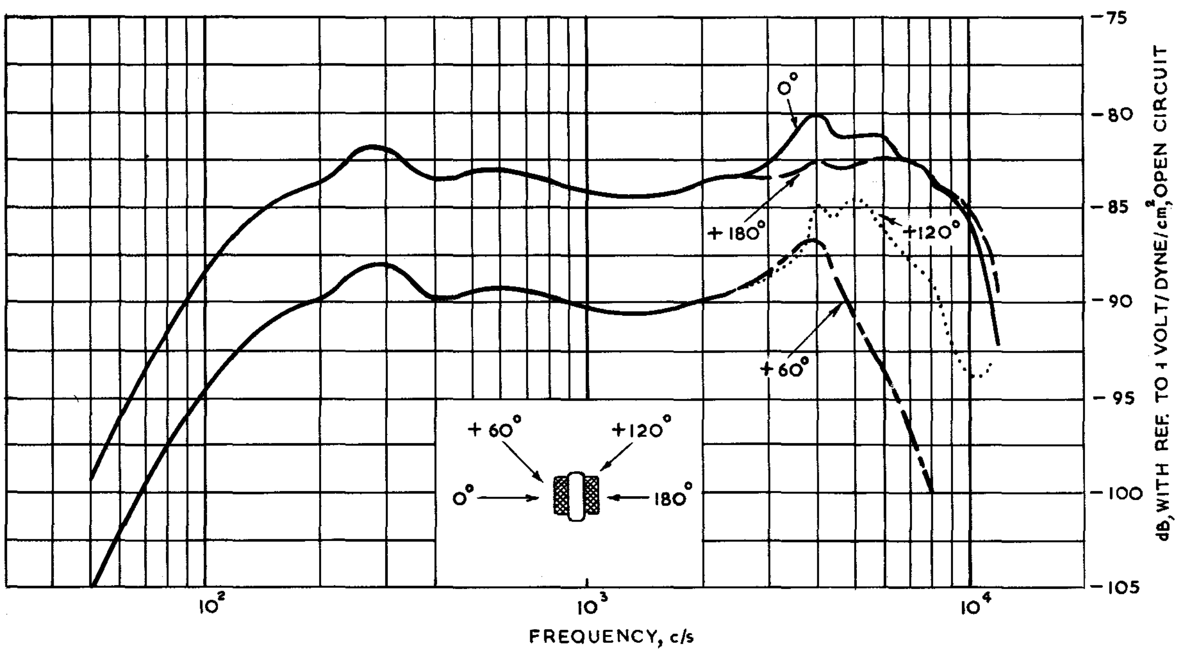

Fig. 4 - Microphone type VRM/T (Specimen A). Frequency characteristics for sound incident at various angles in the horizontal plane

3. MODIFICATIONS

3.1. General

The performance of the microphone fell short of broadcasting standards. It seemed possible, however, that a few simple modifications might result in an appreciable improvement in response, so making the microphone suitable for some broadcasting applications.

3.2. High Frequency Response

Since the 180° curve shown in Fig. 4 is preferable to the 0° curve, it was decided that the magnet assembly should be reversed within the case, thus placing the magnets at the rear of the microphone to obtain a more satisfactory front response at high frequencies.

3.3. Low Frequency Response

The reduction in response at low frequencies was found to be due partly to the presence of the protective layer of cloth, wrapped round the magnet assembly, partly due to the use of ribbon damping of unnecessarily fine mesh, and partly to the use of a transformer having insufficient inductance. The result of modifications affecting these three features is shown in Fig. 5 for a second specimen. The axial response of the microphone as supplied is shown in Fig. 5(a). Fig. 5(b) shows the curve obtained with the cloth removed; the increase in bass response amounts to some 4 dB at 70 c/s. This cloth was presumably included in order to give some protection against wind but can, however, be dispensed with in studio operation with the microphone in a fixed position.

A further slight improvement in bass response was achieved by the use of ribbon damping gauzes of more open mesh than those originally fitted. It was found to be impracticable to change the damping gauze on the magnet side of the assembly without dismantling the microphone, but satisfactory results were obtained by using a damping gauze of 34 S.W.G. 40 meshes/inch on the exposed side in place of 44 S.W.G. 100 meshes/inch (as originally fitted). Fig. 5(c) shows the axial response curve with the damping gauze modification carried out. It can be seen that there is a further rise of about 1 dB at 70 c/s. It is probable that lowering the impedance of the remaining fine mesh damping gauze would result in the effects of ribbon resonance becoming excessive. In order to protect the ribbon assembly against magnetic particles while using such an open mesh, a gauze of Monel metal was employed.

At this stage in the investigation the original design was modified by the makers by fitting damping gauzes of 34 S.W.G. 40 meshes/inch Monel metal on both sides of the ribbon, but the improvement in bass response can be retained by ensuring that one damping gauze is of 34 S.W.G. 40 meshes/inch and the other of 44 S.W.G. 100 meshes/inch. Yet another extension of the low frequency response of the microphone was obtained by fitting a transformer having a higher primary inductance than that fitted originally. The original transformer produced a drop in the open-circuit response of about 3·6 dB at 70 c/s while the replacement transformer fitted, Research Department type AR361, caused a drop of less than 0·2 dB at 70 c/s. With the AR361 transformer the output impedance, originally 50 ohms, is changed to the standard figure of 300 ohms.

The weight of the microphone is 0·55 lb (250 g) and the price to the Corporation, £9.5.0d.

2. PERFORMANCE OF MICROPHONE RBM/T

2.1. Method of Measurement

The frequency characteristics were measured by comparison with a pressure standard in a non-reverberant room, except at frequencies below 200 c/s for which the measurements were made in a plane-wave duct. The accuracy of comparison with the standard was $\pm\frac{1}{2}$ dB and the characteristics of the standard are known to within $\pm\frac{1}{2}$ dB.

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Fig. 4 shows the response of an early model RBM/T microphone for sound incident at various angles in the horizontal plane. It should be noted that 0° refers to the magnet side of the assembly.

It will be seen that at high frequencies the response curves for sound incident at 60° and 120° differ widely from one another and from that for 0° incidence. There is also an appreciable difference at high frequencies between the curves for sound incident at 0° and 180°, the 180° curve being slightly preferable. The response also falls sharply at the bass.

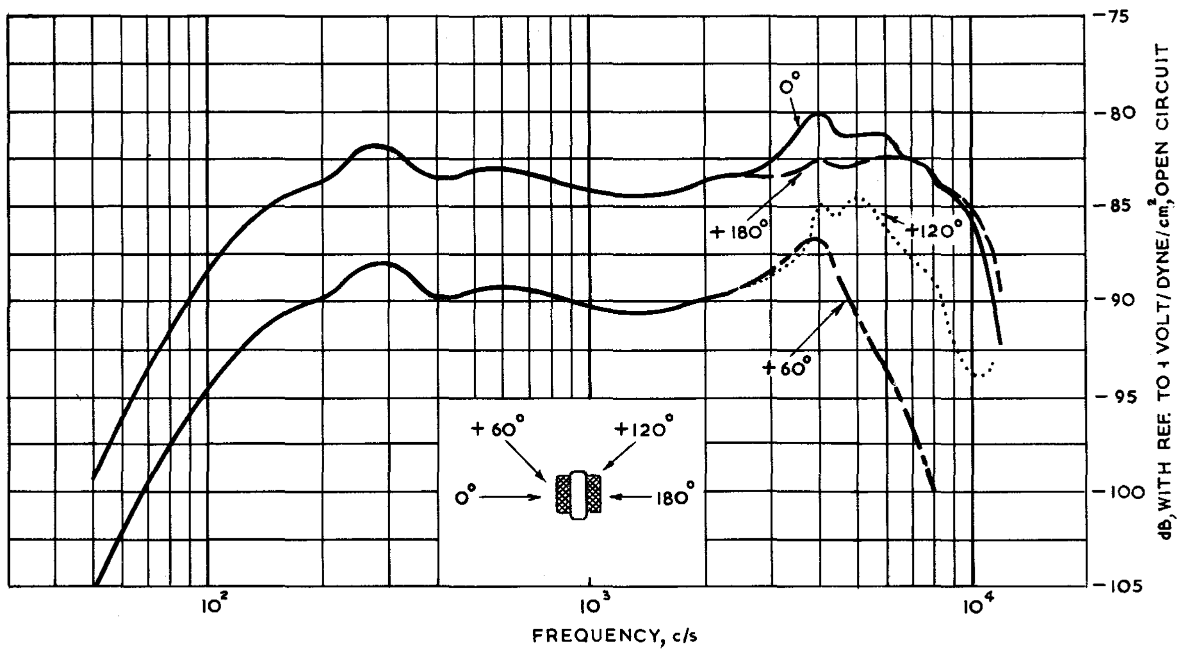

Fig. 4 - Microphone type VRM/T (Specimen A). Frequency characteristics for sound incident at various angles in the horizontal plane

3. MODIFICATIONS

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The performance of the microphone fell short of broadcasting standards. It seemed possible, however, that a few simple modifications might result in an appreciable improvement in response, so making the microphone suitable for some broadcasting applications.

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The reduction in response at low frequencies was found to be due partly to the presence of the protective layer of cloth, wrapped round the magnet assembly, partly due to the use of ribbon damping of unnecessarily fine mesh, and partly to the use of a transformer having insufficient inductance. The result of modifications affecting these three features is shown in Fig. 5 for a second specimen. The axial response of the microphone as supplied is shown in Fig. 5(a). Fig. 5(b) shows the curve obtained with the cloth removed; the increase in bass response amounts to some 4 dB at 70 c/s. This cloth was presumably included in order to give some protection against wind but can, however, be dispensed with in studio operation with the microphone in a fixed position.

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At this stage in the investigation the original design was modified by the makers by fitting damping gauzes of 34 S.W.G. 40 meshes/inch Monel metal on both sides of the ribbon, but the improvement in bass response can be retained by ensuring that one damping gauze is of 34 S.W.G. 40 meshes/inch and the other of 44 S.W.G. 100 meshes/inch. Yet another extension of the low frequency response of the microphone was obtained by fitting a transformer having a higher primary inductance than that fitted originally. The original transformer produced a drop in the open-circuit response of about 3·6 dB at 70 c/s while the replacement transformer fitted, Research Department type AR361, caused a drop of less than 0·2 dB at 70 c/s. With the AR361 transformer the output impedance, originally 50 ohms, is changed to the standard figure of 300 ohms.

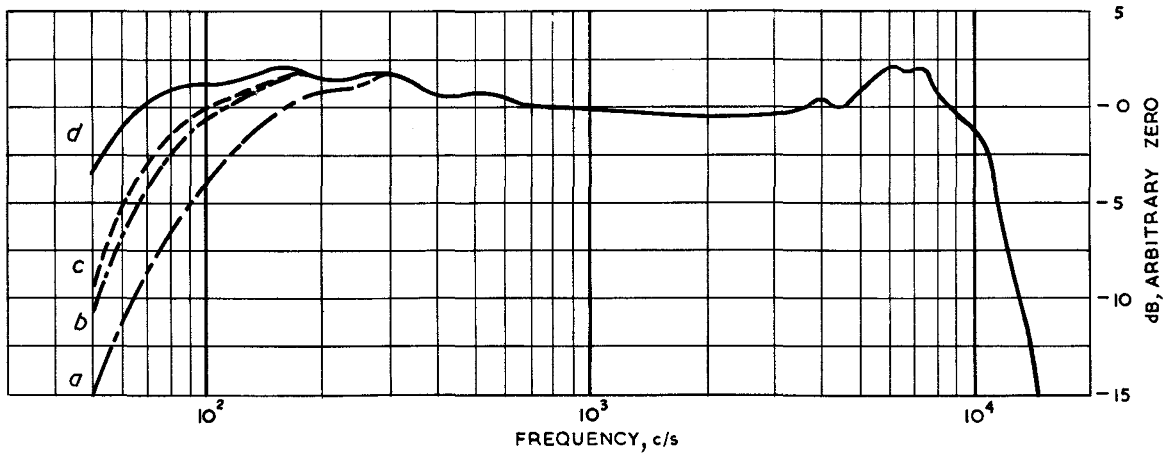

Fig. 5 - Microphone type RBM/T modified (Specimen B). Axial response curves showing effects of modifications affecting low frequency performance

(a) Microphone as supplied
(b) With protective cloth removed
(c) With protective cloth removed and 34 S.W.G. 40 meshes/inch gauze fitted on one side of ribbon
(d) With protective cloth removed and 34 S.W.G. 40 meshes/inch gauze fitted on one side of ribbon and Research Department transformer type AR361 fitted

Fig. 5(d) shows the response curve obtained with the AR361 transformer. It will be seen that the improvement at 70 c/s is about 3·5 dB.

The modifications discussed above have the effect of extending the bass response of the microphone by more than an octave.

4. RECOMMENDATIONS

In view of the satisfactory performance of the modified microphone the manufacturer was advised of the recommendations listed below.

(a) The ribbon and magnet assembly should be reversed in the case so that the magnet is at the rear.

(b) The protective cloth should be omitted.

(c) The ribbon damping gauzes fitted should be one of 44 S.W.G. 100 meshes/inch and one of 34 S.W.G. 40 meshes/inch, and both should be made of Monel metal.

(d) A transformer to Research Department Specification AR361 should be fitted.

These modifications have been incorporated by the manufacturer in the microphone which in its new form is coded VRM/T and is supplied to the Corporation at a price of £10.

5. PERFORMANCE OF MICROPHONE VRM/T

5.1. Frequency Response

Fig. 6 shows the response curves of a modified microphone for sound incident on the axis and at various angles to the axis in the horizontal plane. It will be noted that while the response curve for sound incident at 0° is acceptable and that for 180° incidence only slightly inferior, the remaining frequency characteristics are not so satisfactory; the curve for sound incident at 60° to the axis has a pronounced peak at about 5 kc/s and that for sound incident at 120° falls off very rapidly above about 4 kc/s.

The corresponding curves for sound incident to the microphone at various angles in the vertical plane are shown in Fig. 7; here again there is a peak in the ± 60° curves at about 5 kc/s and a rapid fall in high frequency response for sound incident at ± 120°.

The axial response curve of a microphone assembled by the manufacturers and incorporating the modifications discussed is shown in Fig. 8. There is good agreement with the corresponding curve in Fig. 6.

The mid-band sensitivity of the microphone measured on a 300 ohms output is −78 dB with reference to 1 volt/dyne/cm².

5.2. Impedance

Fig. 9(a) shows the variation of the microphone impedance with frequency and Fig. 9(b) the relationship between the open-circuit voltage and the voltage developed across a 300-ohm load.

5.3. Noise

5.3.1. General

In the absense of interference the noise output of the microphone is that due to the resistive component of its impedance. The r.m.s. open-circuit noise voltage in the band 0 c/s to 10 kc/s is −133 dB with reference to 1 volt unweighted and −127 dB when weighted with an aural sensitivity network type ASN/3. The sound level in the mid-band region which would produce a microphone output equal to that of the weighted noise is + 25 dB with reference to 0·0002 dyne/cm² (taking the microphone sensitivity as −78 dB with reference to 1 volt/dyne/cm²).

5.3.2. Interference from Magnetic Fields

The open-circuit output of the microphone due to a uniform magnetic field was measured at 50 c/s, 1 kc/s and 10 kc/s, the orientation of the microphone being instrument. The off-axis frequency response is, however, unsatisfactory at the high frequencies and it is therefore important that the microphone should not be used in cases where a wide angle of pick-up is required. The sensitivity is below, and the interference from magnetic fields slightly above, the average for high-quality studio microphones; in spite of these limitations, however, the VRM/T has been found satisfactory in a number of applications in television studios, where its small size and neat appearance are of particular advantage.

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