



Celestion Ditton 551



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Introduction

Ditton 551 from Celestion – a three way loudspeaker system capable of the highest standard of reproduction and offering a degree of flexibility enabling it to perform well with a wide range of programme material. The design features a vented box, which provides excellent extension of the low frequencies, while independent controls give the facility to boost or cut the midrange and treble frequencies. The treble unit is fuse protected to prevent damage in overload conditions.

Superbly finished enclosures with specially developed grille fabric will enhance the most elegant decor – should you wish to remove the grille, the front baffle and drive units are fully finished to give an attractive, professional appearance.

When used in pairs, asymmetrical positioning of the mid range and treble drive units on the front baffle of the Ditton 551 improves the directional characteristics of the loudspeakers. The Ditton 551 is capable of exemplary performance – in order to maximise the potential in your system however, we suggest that you read carefully the following paragraphs.

Amplifier Requirements

The basic requirement of an amplifier in any high fidelity system is that sufficient power be available for the loudspeaker to produce the necessary loudness in the listening room with minimal distortion, and without fear of causing loudspeaker damage. The final choice of amplifier power will depend on a number of variables, including the size and shape of the room and also the amount of soft furnishing and decor. As a guide, a recommended range of amplifier powers is given in the specifications.

An understanding of the two major causes of loudspeaker failure will assist in the selection of the most suitable amplifier. The two most common causes of failure due to misuse are described separately below but can occur together.

Mechanical

Each of the individual drive units in the system has been designed with a diaphragm capable of a given excursion, and damage can result if this is exceeded. For example in the bass unit this can occur if the bass and/or volume controls are used to excess, or the loudness control used at high listening levels. In these circumstances there will be a dramatic rise in audible distortion : such overload can be avoided by careful use of the amplifier controls.

In some cases subsonic signals, e.g., from a warped record, can cause excessive excursion of the bass unit and in this case the use of a low frequency (rumble) filter is recommended.

Thermal

Thermal failure is caused by overheating drive unit voice coils beyond their design capability. Such failure can be caused in

treble units by using an amplifier with an inadequate power reserve, which can, if the volume control is used to excess cause the amplifier to 'clip' the output signal. This creates very large amounts of high frequency distortion which will cause overheating and failure. When such a condition occurs the high frequencies will sound distorted – this can be avoided by careful use of the amplifier controls. Bear in mind that it is quite common to reach the maximum output of the amplifier before the volume control is turned to its 'maximum' setting. The loudspeaker power ratings shown in the specifications are given in two forms based on extensive laboratory and field trials.

Continuous Sine Wave Rating

The continuous sine wave input voltage fed to the loudspeaker system at any frequency within the stated band for which no mechanical or thermal degradation occurs, during a period of ten minutes.

Maximum Rated Power

The maximum peak power that is recommended for safe operations with normal programme material (on condition that the amplifier is producing a clean signal – not clipping).

Loudspeaker Positioning

To assist you in choosing a suitable position the next section explains the effect various configurations have on the loudspeaker output.

Ideally the speakers should be placed approximately 8-10 feet (2.5-3.0 metres) apart and because of the interaction of the loudspeakers and the room, it is advisable to experiment with various locations.

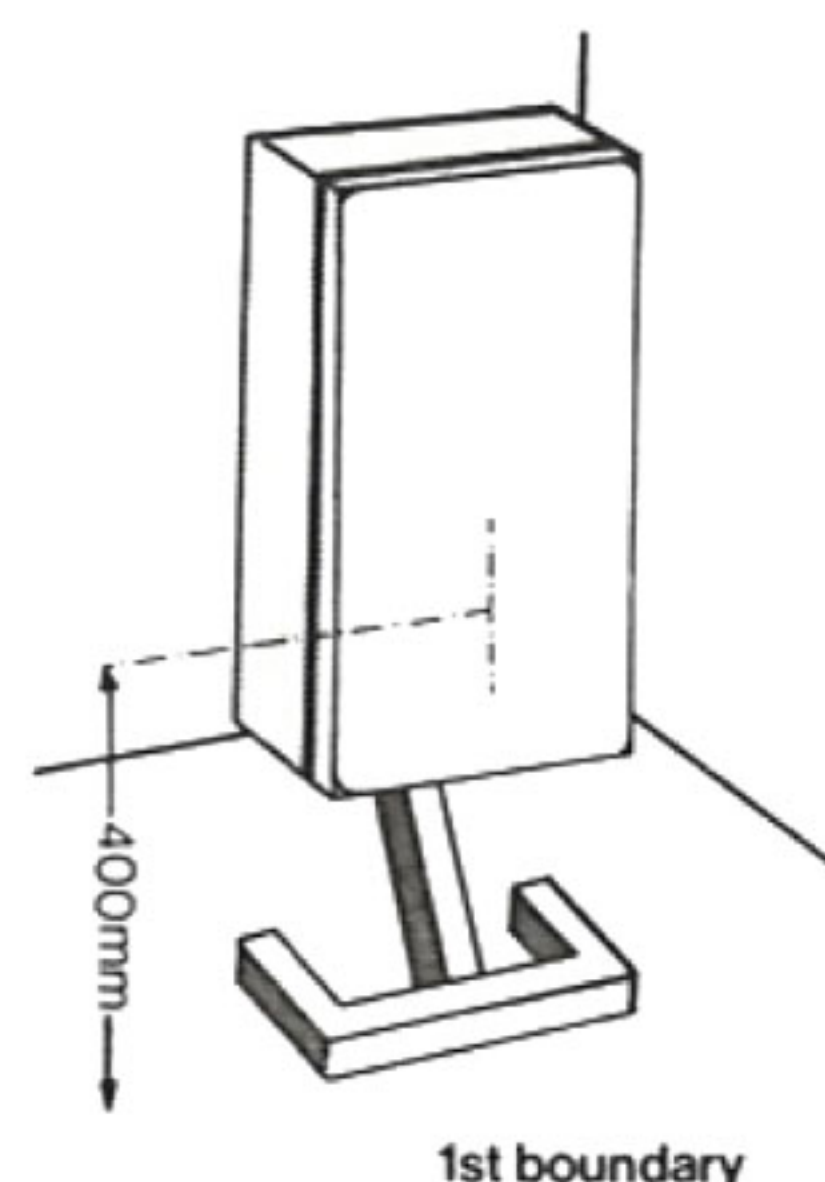
Your Celestion system has been designed to radiate into half space * (2π steradians) and this condition is achieved when the sound source (centre of the bass unit) is approximately 400mm from a single boundary (the floor).

*(HALF SPACE can be defined as half of spherical space which is bounded by an infinitely large plane. The loudspeaker faces into either half from the centre of the dividing plane).

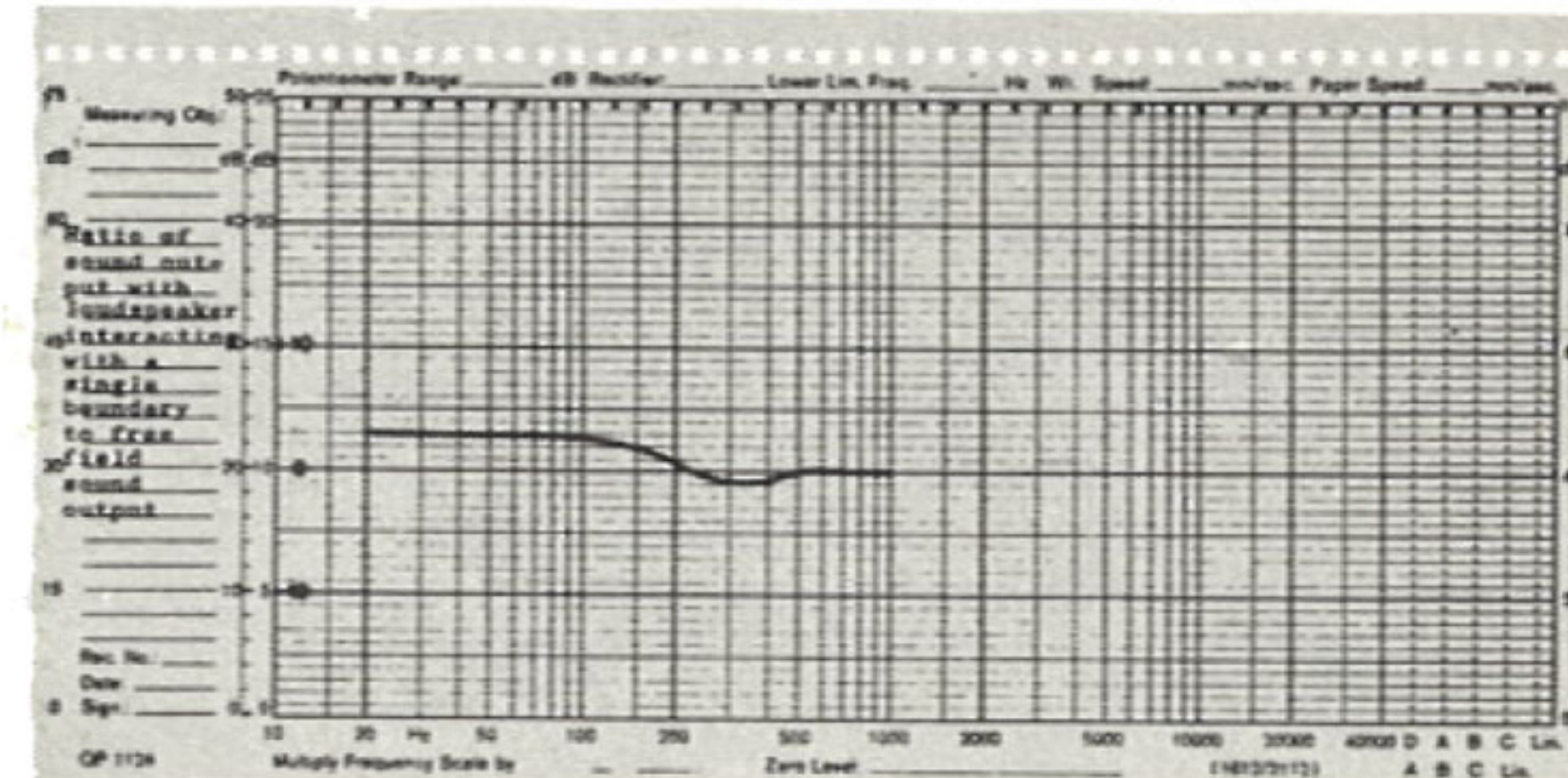
The following three conditions show how the various boundaries affect the power output from a loudspeaker in anechoic conditions. (An anechoic condition being one in which all energy is transmitted and dissipated without reflection.)

The first case has a single boundary below the loudspeaker at 400mm from the sound source.

Loudspeaker position



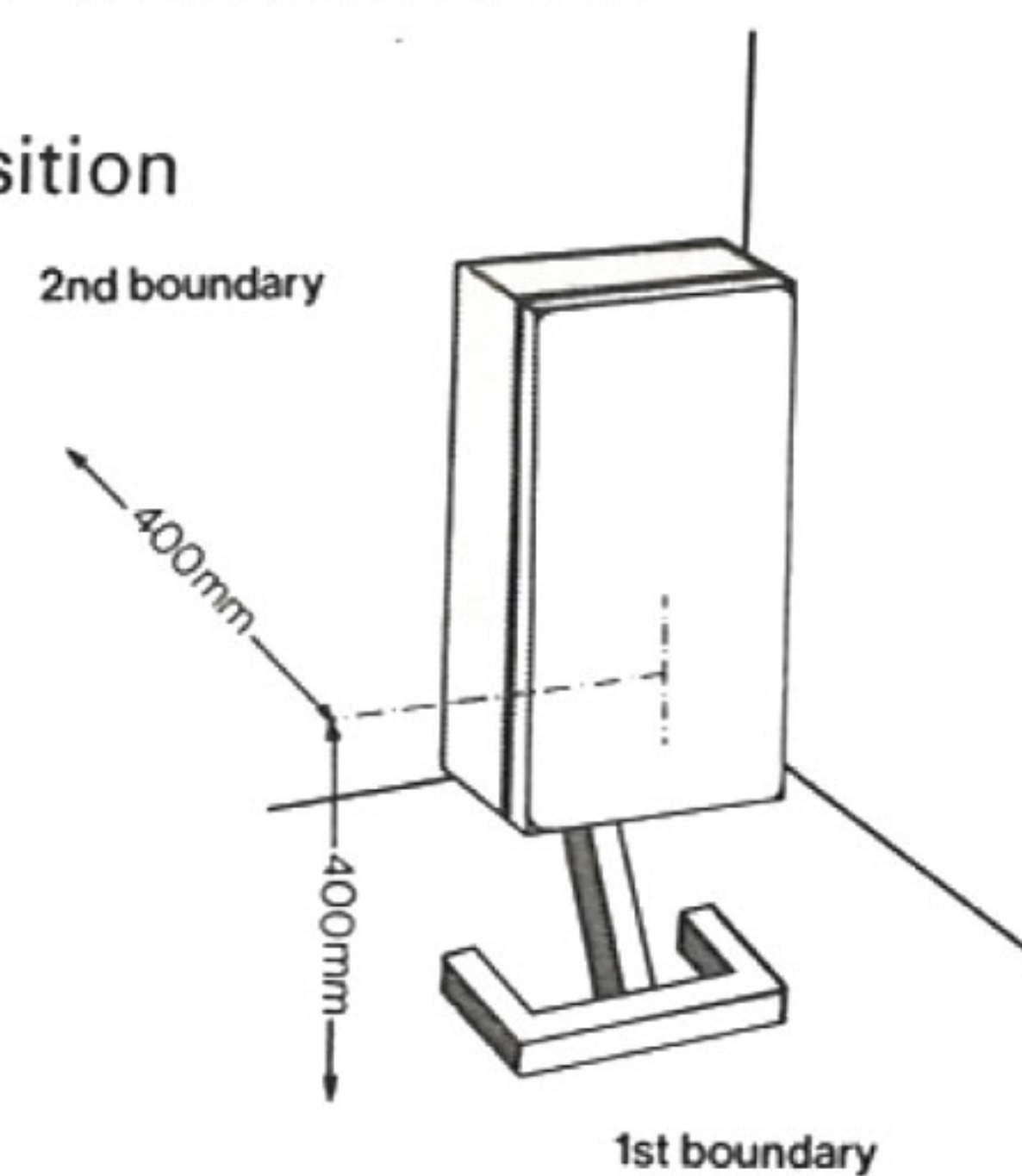
Loudspeaker interaction with one boundary (1) shown as a function of relative power output with frequency.



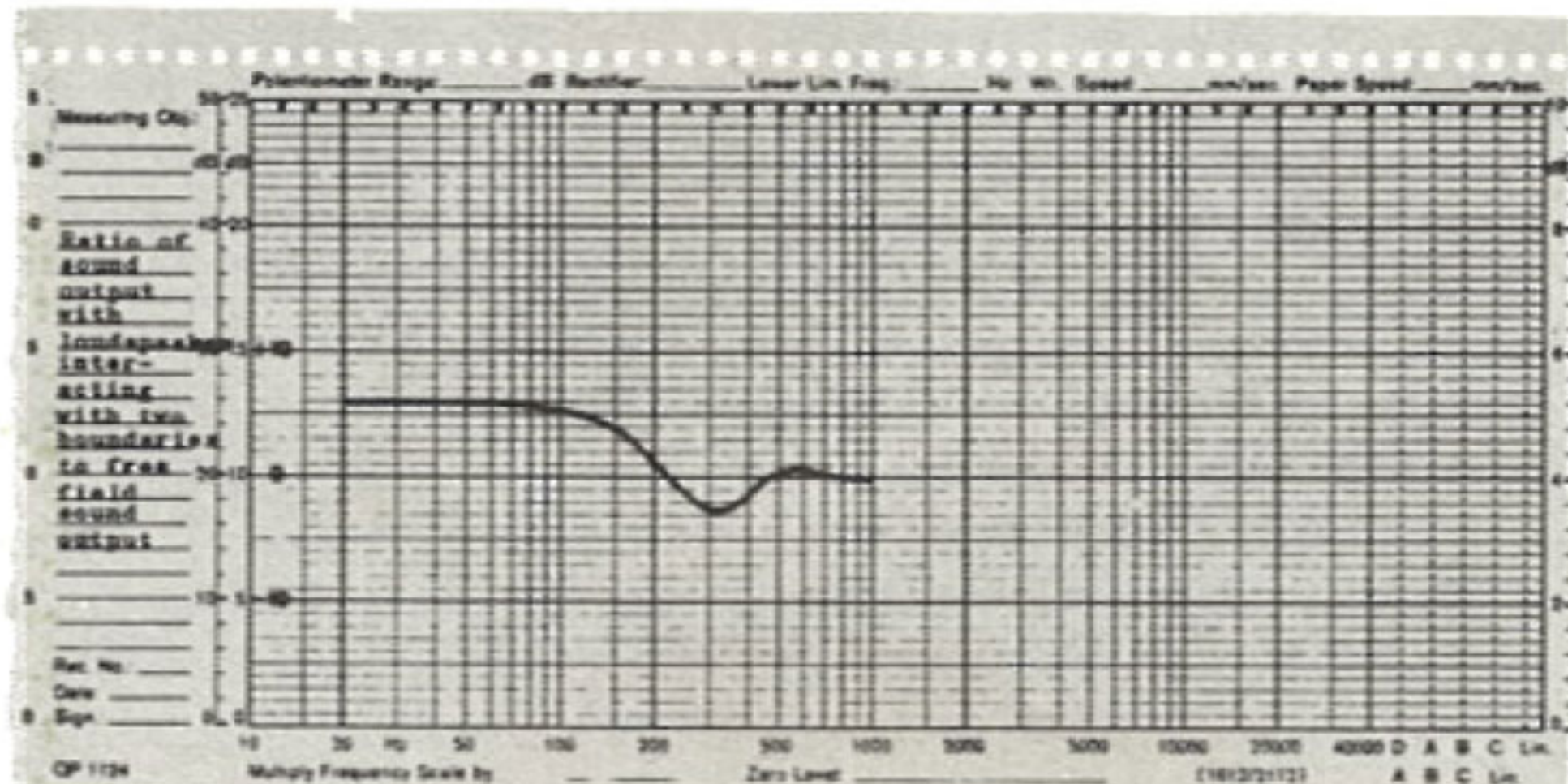
Frequency Hz

In this condition the power output from the loudspeaker is corrected into 2π steradians. Moving the loudspeaker close to a wall, so that the sound source is an equal distance from the floor and wall, will increase the low frequency output as shown below.

Loudspeaker position



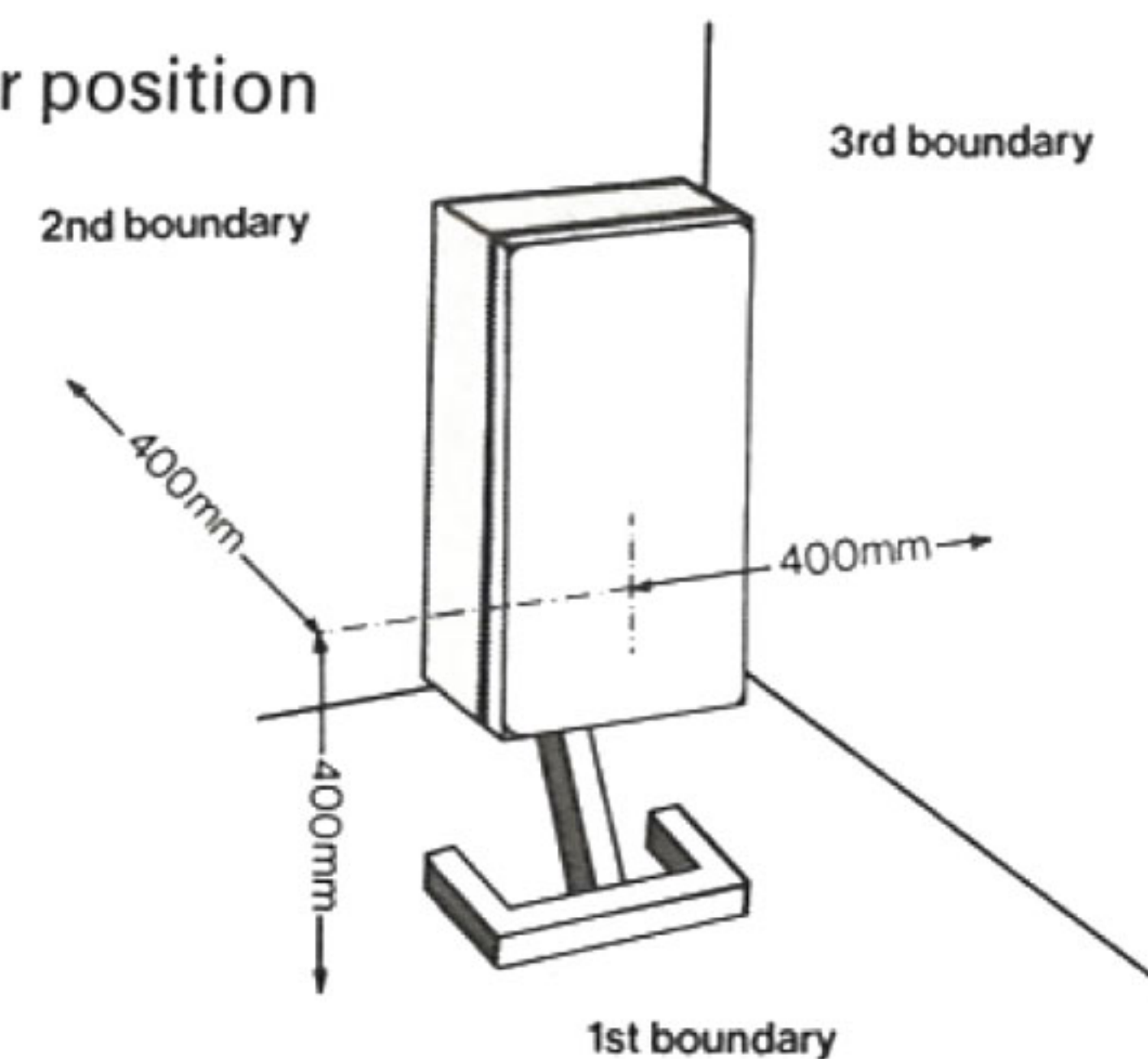
Loudspeaker interaction with two boundaries (2) shown as a function of relative power output with frequency.



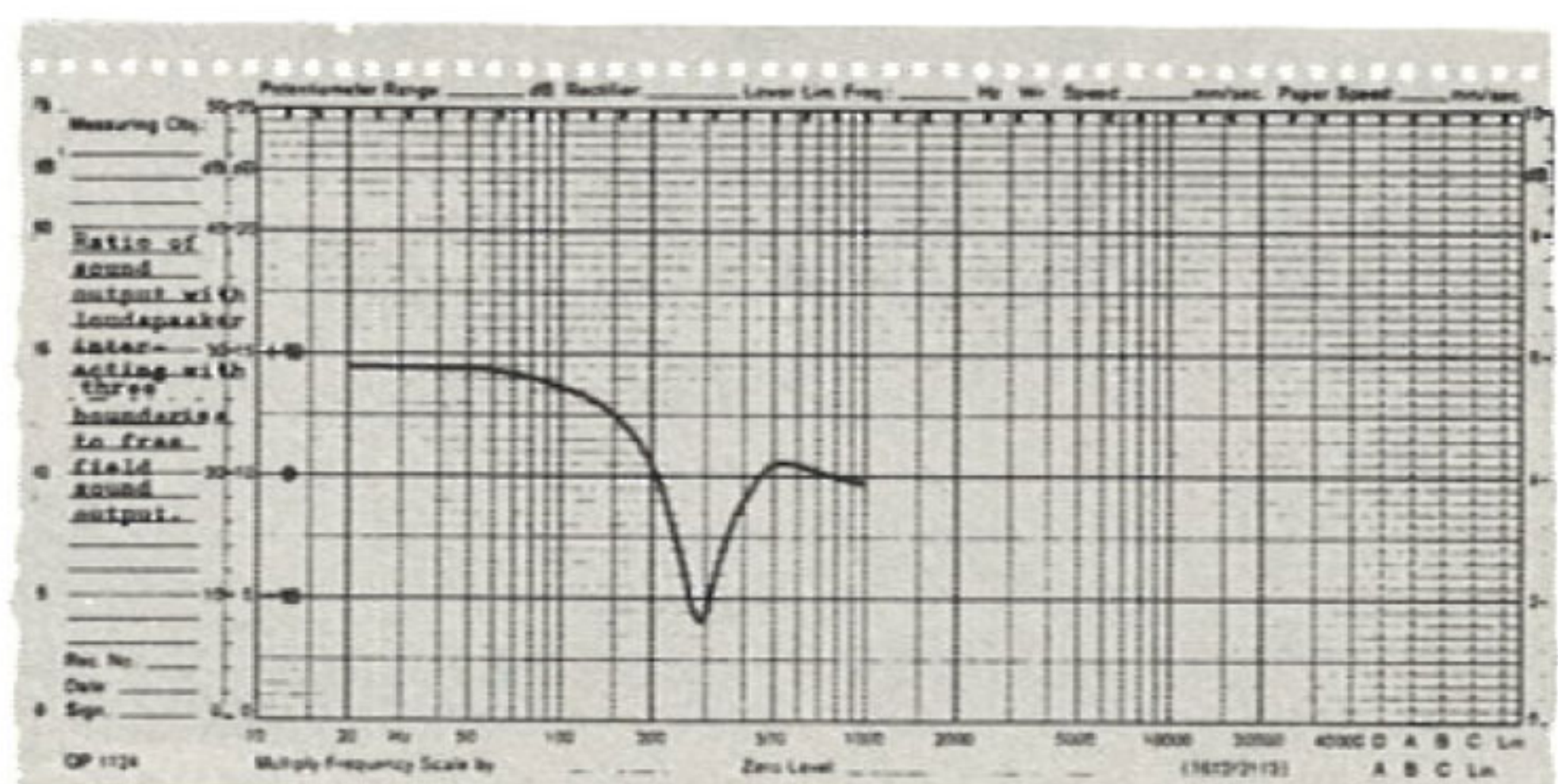
Frequency Hz

However, if we now place the loudspeaker an equal distance from two walls and the floor we will have a situation in which a considerable amount of bass boost is produced but at the expense of a severe loss of information in the lower mid range. It should be explained that this is not a loss in total energy or power output but a subjective effect due to the influence of the boundaries on how the total energy is dispersed.

Loudspeaker position



Loudspeaker interaction with three boundaries (3) shown as a function of relative power output with frequency.



Frequency Hz

These three cases clearly show how important the location of your loudspeaker can be. The loudspeaker has been designed to radiate into 2π steradians (half space) and in the first case this condition has been achieved by positioning the sound source (bass unit) off the floor and away from any walls.

If the loudspeaker is now placed near to a wall, as shown in the second example, there is a 3dB increase in bass output with an accompanying small loss of lower mid-range (200-500Hz) as illustrated in the second curve. This situation is usually quite acceptable in a normal domestic environment.

Placing the loudspeaker in the corner of a room equidistant from all the boundaries, as shown in the third curve, should always be avoided. However, a corner location can be made acceptable by positioning the loudspeaker so that it is an unequal distance (but at least 400mm) from each boundary. Having seen that the near-field anechoic on-axis response has been modified by the presence of the floor and wall boundaries, a few comments about what we hear in the listening room and how to optimize the system follow.

If we assume that the room is totally free of any reflections then we will tend to hear a bass-heavy sound with a loss at the frequency of cancellation (285 Hz in this example), due to interference of the reflecting wall.

Reality is much better than this highly qualified theoretical case. Small reflective surfaces and their random dispersions reduce the effect of the apparent bass of the anechoic case, the null being equally reduced. In short, the undesirable effects of boundary reflections are reduced by random reflections within the confines of a real listening environment.

As for the placement of the speaker, the smoothest response is generally achieved if the speaker is elevated to about 405 mm above the floor. (Centre of bass driver to floor.) The driver should also be about 535 mm forward of the rear wall and 610 mm from the adjacent wall. These dimensions represent a good starting point, but should be modified to suit each users' particular requirements. In summary, the boundaries of a real listening room modify the perceived on-axis response from ideal, but the design of the listening room can and should be made to minimize these effects.

These modifications are achieved by having the walls contribute both random dispersion and absorption. The absorption can be obtained from rugs, curtains and upholstered furniture, while the dispersion results from small randomly placed reflecting surfaces such as picture frames and tables. These random dispersion effects will produce a more uniform sound field within the listening room, and give rise to a more musical environment.

Design and Specification

The physical parameters of the bass unit in conjunction with the enclosure parameters determine the low frequency performance of a loudspeaker system. The Ditton 551 uses a vented design which gives significantly improved low frequency response compared with the sealed box design of the same size. With the vented box design, the design requirements can be met with a reduction in bass unit size, as this form of speaker loading requires less excursion from the bass units. All the cabinet walls are constructed with 18mm high density particle board which has been veneered on both sides for added stability. This design results in a cabinet which is inert and from which little or no radiation takes place.

The mid range and treble units have been located asymmetrically in order to improve the frequency response and directional characteristics of the loudspeaker. The loudspeakers should be positioned in the listening room with the treble units innermost since the off-axis response has been optimised for use in this configuration. The drive units in the Ditton 551 have been specifically designed for use in this system and are refinements of tried and proven Celestion drivers using up-to-the-minute advances in materials technology for even better quality and reliability.

Some of the most interesting technical details of these drive units are detailed as follows:

Bass Unit PC101

1. 290mm diecast aluminium chassis for stability and strength.
2. Fibre cone with a lossy mass at the voice coil in order to damp resonances and a P.V.C. roll surround for low distortion at low frequencies.
3. 50mm voice coil using glass fibre laminated former for exceptional resistance to thermal degradation.
4. Barium ferrite magnet. Motor unit weighing 2.9 kg produced a flux density of 1.1 Tesla (11,000 Gauss).
5. Bass unit operates in a vented enclosure with a quasi-Butterworth third order alignment with a system Q of 0.3 giving a -3dB point of 38 Hz.

Mid Range MD701

1. Diecast aluminium mounting plate for stability and strength.
2. P.V.C. impregnated cellulose fibre woven soft dome diaphragm.
3. 46mm diameter voice coil.
4. Barium ferrite magnet. Motor unit weighing 2.7kg produces a flux density of 1.5 Tesla (15,000 Gauss).

Treble Unit HF2001

1. Hot pressed polyethylene terephthalate polymer diaphragm.
2. Barium ferrite magnet. Motor unit weighing 0.65 kg produces a flux density of 1.3 Tesla (13,000 Gauss).
3. 19mm polyamide impregnated voice coil former with high temperature adhesive system.

Treble Section:

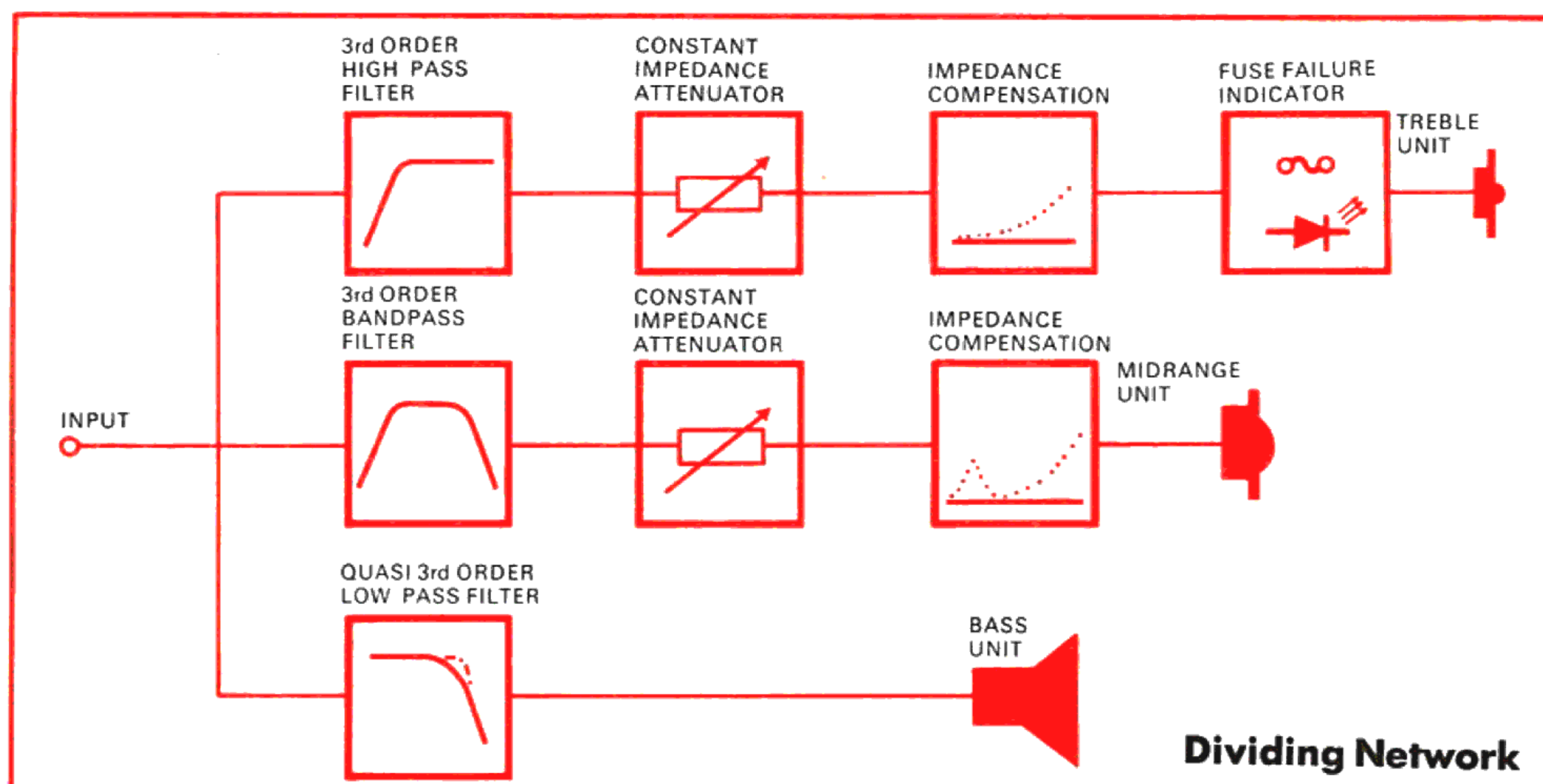
The treble unit is fed from a constant impedance attenuator enabling the level to be adjusted by up to 2dB boost and more than 6dB cut as required, and a compensation network is included to ensure that the Butterworth third order high pass filter feeds into a resistive load. This ensures an accurate control of the treble unit with minimum losses. A 500mA quick acting fuse protects the treble unit from overload and a 6 element circuit is used to indicate a fuse failure. The protection circuit reduces the power to the treble unit and also powers the light emitting diode as a visual indication of overload. Replacing the fuse link restores the system to normal operation. If the fuse fails then a replacement should be fitted as soon as possible; continued use with the LED flashing may cause damage to some other part of the loudspeaker system.

Mid Range Section:

The 50mm soft dome midrange unit is fed from a constant impedance attenuator, with the same range of adjustment as the treble unit. In addition a compensating network equalises both the rise in impedance due to the inductance of the voice coil and fundamental resonance, to give a resistive load for the Butterworth third order bandpass filter.

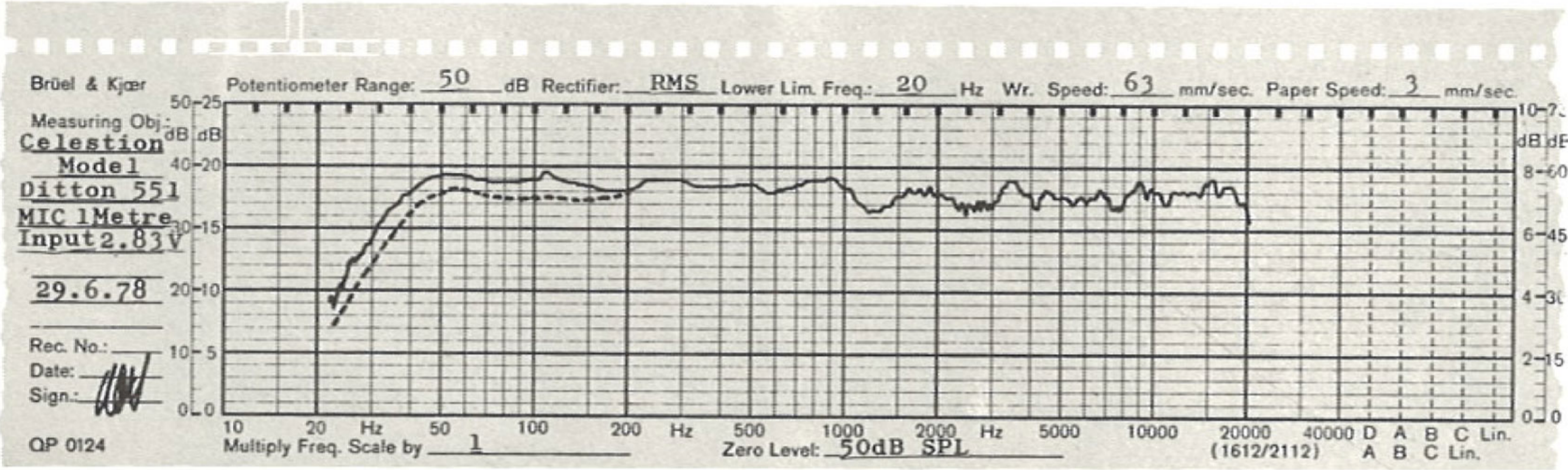
Bass Section:

The bass unit is fed via a quasi-Butterworth third order low pass filter to correct for the directivity of the unit and hence maintain a flat on-axis amplitude response.



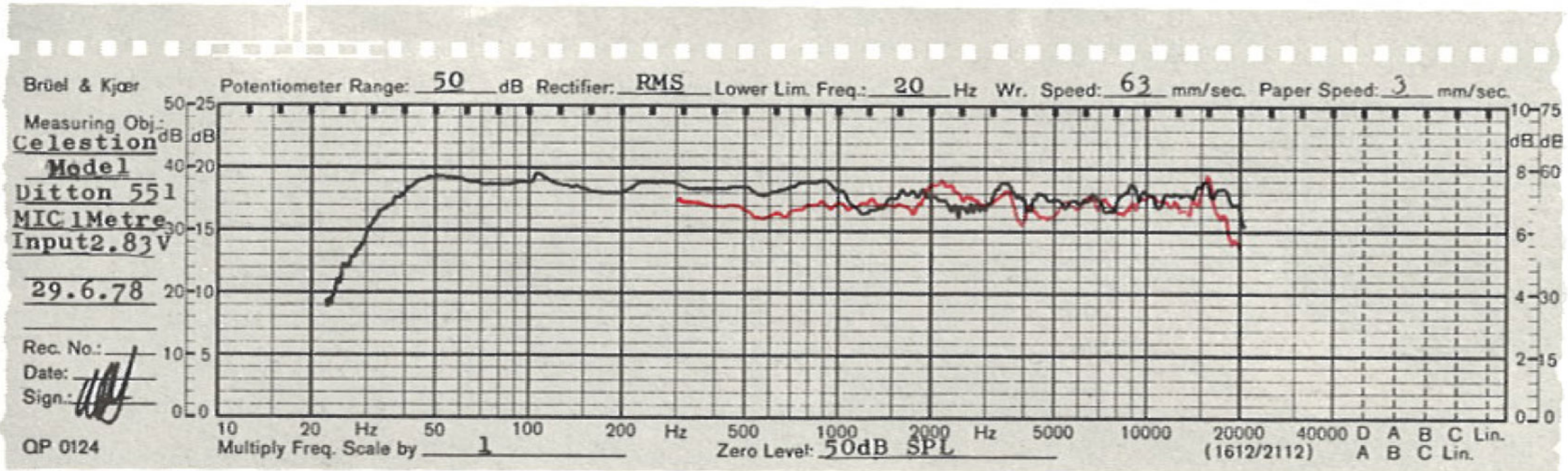
Performance Curves

On-axis amplitude response:



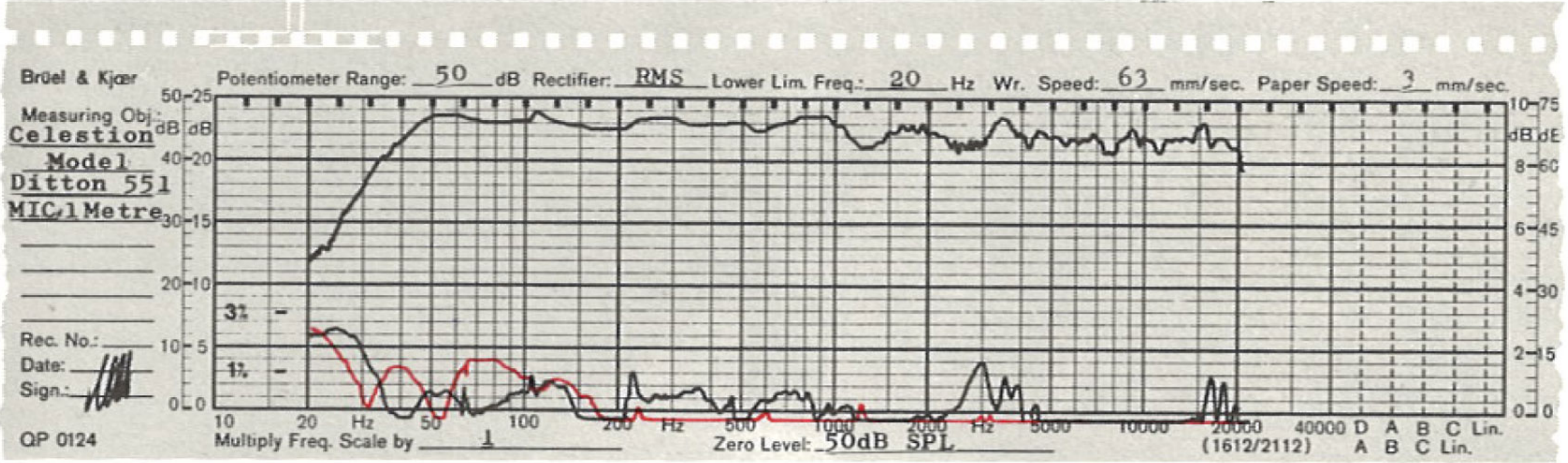
The on-axis response is taken in anechoic conditions down to 200Hz and then into 2π steradians (half space) down to 20Hz. The dotted curve shows the correction for the loudspeaker radiating into 4π steradians (full space).

Off-axis amplitude response:



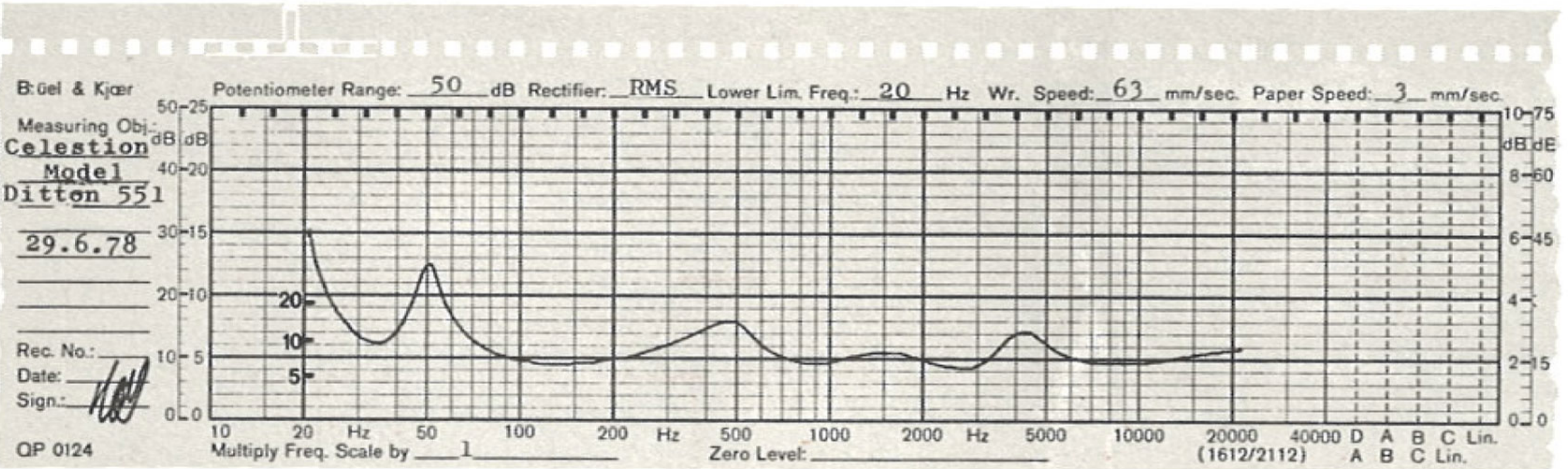
Taken at 30° off-axis (preferred direction). *Off-axis shown in red*
On-axis response is shown for reference.

Harmonic distortion:



Second and third order harmonic distortion taken with loudspeaker producing 96dB SPL fundamental at 1 metre on axis. *Third order harmonic distortion shown in red*

Impedance



Curve shows variation of impedance with frequency on logarithmic scales.

Dividing Network

The 15 element dividing network and fuse fail indicator block diagram :



Specification

Overall dimension

H 720mm 28½ ins.
W 395mm 15½ ins.
D 328mm 13 ins.

Internal volume

65 litres

Net weight

25kg

Packed weight pair

62kg

Impedance

8 ohms

Amplifier requirements

(Continuous rated sine wave output)
20 watts to 140 watts

Frequency response

38Hz to 20kHz ± 3 dB into 2π steradians
(half space)

Crossover frequencies

600Hz, 4.5kHz

Power ratings

- (1) Maximum rated power 140 watts programme
- (2) Continuous sine wave rating
22 volts 20Hz to 600Hz
14 volts 600Hz to 4.5kHz
11 volts 4.5kHz to 20kHz

Sensitivity

3.25 watts of pink noise input produce
90dB SPL at one metre on axis in an
anechoic environment

Controls

Midrange and treble levels independently
adjustable from 2dB lift to greater than
6dB cut

Finish

Available in : Oiled American Walnut, Elm,
Black Ash

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