

Technical Documentation

Weatherproof Microphone Unit Type 4184-A
for Hand-held Analyzer
Types 2250, 2250-L and 2270

Supplement to Instruction Manual BE 1712

Weatherproof Microphone Unit Type 4184-A for Hand-held Analyzer Types 2250, 2250-L and 2270

Type 2250, from Hardware Version 1.1
Type 2250-L, from Hardware Version 2.0
Type 2270, from Hardware Version 3.0

***Supplement to Instruction Manual
BE 1712***

Safety Considerations

This apparatus has been designed and tested in accordance with IEC 61010–1 and EN 61010–1 *Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use*. This manual contains information and warnings which must be followed to ensure safe operation and to retain the apparatus in safe condition. Special note should be made of the following:

Safety Symbols



The apparatus will be marked with this symbol when it is important that you refer to the associated warning statements given in the manual.



Protective Earth Terminal



Hazardous Voltage

Explosion Hazard

The equipment is not designed to be used in potentially explosive environments. It should not be operated in the presence of flammable liquids or gases.

Warnings

- Switch off all power to equipment before connecting or disconnecting their digital interface. Failure to do so could damage the equipment.
- Whenever it is likely that the correct function or operating safety of the apparatus has been impaired, it must be made inoperative and be secured against unintended operation.
- Any adjustment, maintenance and repair of the open apparatus under voltage must be avoided as far as possible and, if unavoidable, must be carried out only by trained service personnel.



- Do not dispose of electronic equipment or batteries as unsorted municipal waste
- It is your responsibility to contribute to a clean and healthy environment by using the appropriate local return and collection systems
- Hazardous substances in electronic equipment or batteries may have detrimental effects on the environment and human health
- The symbol shown to the left indicates that separate collection systems must be used for any discarded equipment or batteries marked with that symbol
- Waste electrical and electronic equipment or batteries may be returned to your local Brüel & Kjær representative or to Brüel & Kjær Headquarters for disposal

Copyright © 2006 – 2012, Brüel & Kjær Sound & Vibration Measurement A/S

All rights reserved. No part of this publication may be reproduced or distributed in any form, or by any means, without prior written consent from Brüel & Kjær Sound & Vibration Measurement A/S, Nærum, Denmark.

Table of Contents

CHAPTER 1		
Introduction	.....	1
1.1	About This Supplement	1
1.2	System Overview.....	1
CHAPTER 2		
Information Required by the Standards	.....	3
2.1	Introduction.....	3
2.2	Mounting and Placing the Microphone	3
2.4	Calibration	4
2.7	Measuring at Low Static Pressure.....	4
CHAPTER 3		
Conformance Testing	.....	5
3.1	Introduction.....	5
3.2	Mounting for Acoustical Tests	5
3.3	Periodic Testing of Acoustical Frequency Responses	5
3.4	Mounting for Mechanical Vibrations Tests.....	5
3.5	Electrical Substitute for Microphones	6
CHAPTER 4		
Specifications	.....	7
4.1	Specifications	7
4.4	Reference Conditions for Acoustic Calibration	7
4.5	Microphone.....	7
4.7	Directional Responses.....	10
4.8	Self-generated Noise.....	13
4.9	Measuring Ranges	17
APPENDIX A		
Tables	.....	23
A.2	Free-field Frequency Responses	23
A.3	Diffuse-field Frequency Responses.....	26
A.4	Free-field Frequency Responses for Diffuse-field Calibrated Instruments	27
A.5	Directional Responses.....	28
A.6	Periodic Testing of Acoustical Frequency Responses	35
APPENDIX D		
Using Microphone Type 4184-A	.....	37
D.1	Mount Pistonphone Type 4228 onto Type 4184-A	37
D.2	Mount Multifunction Acoustic Calibrator Type 4226 onto Type 4184-A.....	38
D.3	Mount Electrical Substitute for Microphones on the Built-in Microphone Preamplifier	40
INDEX	.....	43

Chapter 1

Introduction

1.1 About This Supplement

This document is a supplement, to Instruction Manual for Hand-held Analyzer Types 2250, 2250-L and 2270 BE 1712. It provides the information relevant when Hand-held Analyzer Type 2250, 2250 L or 2270 is configured with Weatherproof Microphone Unit Type 4184-A.

The combination of Weatherproof Microphone Unit Type 4184-A and the hand-held analyzer is intended for outdoor use where a weatherproof microphone solution is needed.

The numbering of chapters, sections, figures and tables in this supplement corresponds to Instruction Manual BE 1712. This supplement only contains content that is different from the instruction manual and is specific to this microphone configuration. The other chapters, sections, figures and tables should be read in Instruction Manual BE 1712.

Also see section 1.1 of the instruction manual.

1.2 System Overview

1.2.4 Hardware Setup

This section provides an overview of the additional hardware components used when the analyzers are configured with Weatherproof Microphone Unit Type 4184-A. The other hardware components can be found in Instruction Manual BE 1712, section 1.2.4.

NOTE:

- Only one Weatherproof Microphone Unit Type 4184-A can be connected to Type 2270
- Weatherproof Microphone Unit Type 4184-A is calibrated with Brüel & Kjær Pistonphone Type 4228, which has a calibration frequency of 251.2 Hz and a calibration level of approximately 124 dB
- Weatherproof Microphone Unit Type 4184-A includes the Microphone Preamplifier Type ZE-0773
- Weatherproof Microphone Unit Type 4184-A is specified for two reference directions. In the user interface they are selected as two different microphones and are called: 4184-A 0° (Top) and 4184-A 90° (Side)
 - 4184-A 0° (Top)'s reference direction is defined as the inward direction toward the Microphone Reference Point on the microphones rotational axis coming from the opposite direction of the electrical output
 - 4184-A 90° (Side)'s reference direction is defined as the inward direction toward the Microphone Reference Point perpendicular to the microphones rotational axis
- Weatherproof Microphone Unit Type 4184-A has a built-in Windscreen and is therefore not specified without the Windscreen

- Weatherproof Microphone Unit Type 4184-A cannot be mounted directly onto the analyzer. It is always connected through an extension cable
- Weatherproof Microphone Unit Type 4184-A is not specified together with Outdoor Microphone Kit UA-1404

Table 1.1
Additional hardware components needed for conformance testing of the analyzers configured with Type 4184-A

Quantity	Brüel & Kjær Type/Part Number	Description
1	Type 4184-A	Weatherproof Microphone Unit
1	WA-0302-C	Electrical Substitute for Microphone cartridge, 18 pF
1	DB-4237	Fixture for WA-302-C
1	UA-1732	Fixture for calibration assembly
1	DB-4199	Calibration Adaptor
1	210411	Adapter for hose, EMC tests
1	Type 4228	Pistonphone

Chapter 2

Information Required by the Standards

2.1 Introduction

This chapter contains detailed information required by the standards to be described in the Instruction Manual.

2.2 Mounting and Placing the Microphone

Weatherproof Microphone Unit Type 4184-A must be connected to the analyzer with Microphone Cable AO-0697-D-100. The microphone cannot be mounted directly onto the analyzer.

Weatherproof Microphone Unit Type 4184-A is designed to operate mounted vertically with the bird spikes pointing upwards. The microphone should not be mounted outdoors with other orientations.

Weatherproof Microphone Unit Type 4184-A can be mounted on a pipe with Pole Adapter DB-3068. The adapter has a female thread that fits onto the male thread of standard 1.5" opening diameter water pipes (ISO 228-1 G1). The mounting ring of the microphone unit is screwed onto the pole adapter.

The microphone can also be mounted on a tripod with Tripod Adaptor UA-1112. The mounting ring of the microphone unit is screwed onto the tripod adaptor.

The cable must be fed through the pipe or the hole in the tripod adaptor. Connect the cable to the microphone, mount the microphone on the adaptor and secure it with the mounting ring.

The position of the sound opening of the microphone unit (the Microphone Reference Point) is 118 mm above the bottom of the windscreen mounting thread.

The microphone must be placed away from shielding, reflecting, or absorbing objects. In a diffuse sound field, absorbing objects will reduce the measured sound levels. In a free sound field, reflecting objects can change the measured sound levels. Typically, the sound level 0.5 m from a plain reflecting wall is 3 dB higher than if there was no wall.

The operator of the system may be personally shielding, absorbing, and reflecting, and the operator can also be an additional noise source.

The optimum position for the microphone is best found by trying different positions and observing the resulting sound levels.

2.4 Calibration

The procedures for calibrating the analyzer can be found in User Manual for Hand-held Analyzer Types 2250 and 2270 BE 1713, User Manual for Hand-held Analyzer Type 2250-L BE 1766, and in appendix D.1 of this manual.

Weatherproof Microphone Unit Type 4184-A should be calibrated with Brüel & Kjær Pistonphone Type 4228. Type 4228 is a class LS calibrator as specified in International Standard IEC 60942, Electroacoustics Sound Calibrators. The nominal frequency and sound pressure level of Type 4228 are 251.2 Hz and 124 dB re. 20 μ Pa, respectively. The sound pressure level in Type 4228 is proportional to the static pressure; therefore, the procedure in the User Manual for Pistonphone Type 4228 BE 1094 for compensating for the static pressure should be followed.

The procedure for the calibration necessary for the electrical tests during conformance testing can be found in section 3.5.

While performing the calibration procedures, the analyzer is automatically checked for its ability to perform the measurements.

2.7 Measuring at Low Static Pressure

The frequency response of the microphone depends on the static pressure. Using a sound level calibrator to adjust the sensitivity of a Sound Level Meter at the calibration check frequency, 251.2 Hz, provides no information on the influence of static pressure on frequency response.

Conformance to the specified standards ensures that the system measures within the standard's tolerances, in the range from 85 kPa to 108 kPa. In the range of 65 kPa to 108 kPa, the change of frequency response relative to the response at 251.2 Hz will be less than 0.8 dB.

At the calibration check frequency, the microphone is rather insensitive to variations in the static pressure. However, Pistonphone Type 4228 is sensitive to variations in the static pressure. Therefore, the procedure in its manual for compensating for the static pressure should be followed, see section 2.4.

Chapter 3

Conformance Testing

3.1 Introduction

This chapter contains the information needed to conduct conformance testing according to the specified standards.

3.2 Mounting for Acoustical Tests

For acoustical tests, it is important that the test rig for mounting the microphone to be tested is designed to minimise the influence of reflections to a level that is comparatively smaller than the test parameter's maximum Expanded Uncertainties of Measurement. This has to be demonstrated with a good, known laboratory microphone.

For Acoustical tests, Weatherproof Microphone Unit Type 4184-A should be mounted on a standard 1.5" water pipe, see section 2.2. The pipe must be of sufficient length, so as to avoid influence of reflections from the mounting of the pipe in the test rig. The microphone must be connected to the analyzer with Microphone Cable AO-0697-D-100.

3.3 Periodic Testing of Acoustical Frequency Responses

Acoustical signal test of frequency response can be made with plane progressive waves in an anechoic facility. However, this is normally very time-consuming and difficult to do with sufficient accuracy. For the purpose of periodic testing, it is recommended that you use the Brüel & Kjær Multifunction Acoustic Calibrator Type 4226 for acoustic frequency response tests.

For instructions on how to mount the calibrator on the microphone, see appendix D.2.

The Multifunction Acoustic Calibrator must be set to its Calibration and Pressure sound field modes. The calibrator must be calibrated. Further details can be found in the Multifunction Acoustic Calibrator Instruction Manual (BE 1041).

Adjustment data, which must be applied to the sound levels displayed in response to the sound pressure produced by Multifunction Acoustic Calibrator Type 4226 in order to obtain the equivalent sound levels that would be displayed in response to plane progressive sinusoidal sound waves incident from the reference direction, are given in Table A.49.

3.4 Mounting for Mechanical Vibrations Tests

Only Weatherproof Microphone Unit Type 4184-A contributes significantly to the sensitivity to mechanical vibrations and the microphone cannot be mounted directly onto the analyzer. Therefore, only the microphone needs to be tested.

Tripod Adaptor UA-1707 can be used for mounting the microphone on the shaker. Alternatively, the inner M53 × 1.25 thread of the mounting ring of the microphone or pole adaptor DB-3068 can be used.

If, however, you want to test the analyzer, then use the Tripod Mounting Thread situated centrally on the underside of the analyzer.

3.5 Electrical Substitute for Microphones

To obtain a BNC type electrical input, replace the microphone cartridge with a **WA-0302-C, 18 pF**, fitted with a 10-32 UNF-to-BNC adaptor, UA-0245.

The microphone cartridge is an integrated part of the weather protection in Weatherproof Microphone Unit Type 4184-A. For instructions on how to mount **WA-0302-C** on the preamplifier see appendix D.3.

This Electrical Substitute for Microphones has, together with the preamplifier; a nominal attenuation of **0.55 dB**.

The electrical input obtained in this way has a maximum input level of minimum $\pm 10.07 V_{\text{Peak}}$ and no damage will occur for signals up to $\pm 20 V_{\text{Peak}}$.

All electrical inputs can be short-circuited when needed for test.

To calibrate the analyzer for the electrical conformance test with a calibration that corresponds to the calibration you would get if the analyzer were fitted with a microphone with the nominal Open Circuit Sensitivity do the following:

- 1) On the **Setup** display (*Full* tab):
 - Set *Input, Transd. Used* to the microphone that you intend to substitute
 - Set *Input, Input to Top Socket*
- 2) Calibrate the analyzer by typing in the nominal sensitivity as the *Sensitivity* on the **Calibration** display. For Weatherproof Microphone Unit Type 4184-A, the nominal sensitivity is the microphone's Open Circuit Sensitivity (**10.9 mV/Pa**), attenuated by the Microphone Preamplifier ZE-0773's nominal attenuation (**0.20 dB**), which equals **10.66 mV/Pa**. Do not press the **Start Calibration** button.
- 3) Connect an electrical sinusoidal signal with a frequency of 251.2 Hz to the Electrical Substitute for Microphones and adjust the amplitude of this signal until LZP (or LCF) displays 124.00 dB in the **Calibration** display. This electrical amplitude is the 124.00 dB reference for the electrical tests. The amplitude will typically be **359.9 mV**. This is due to the attenuation of the Electrical Substitute for Microphones (nominal **0.55 dB**).

3.7.1 Signal Sources for Immunity Test

Acoustical Source for Testing According to IEC 61672, IEC 60651 and IEC 60804

The acoustic signal, which is used during the Immunity test according to IEC 61672, IEC 60651 and IEC 60804, is applied to the microphone through a ½ " plastic hose (a normal water hose) – from a source outside the test area. In this way, the acoustic source is not affected by the RF or magnetic field. The plastic hose is mounted on Adapter for Hose 210411, which is screwed on the microphone in place of the windscreen. The source may be a normal entertainment earphone.

To prevent the acoustic source from being affected by acoustic noise in the surroundings, a method such as the one listed in Hand-held Analyzer Types 2250, 2250-L and 2270 Instruction Manual BE 1712 can be used.

Electrical Source for Testing According to IEC 61260

The short-circuit of the Input signal may be achieved by short-circuiting the electrical substitute for microphones mounted on the microphone preamplifier.

Chapter 4

Specifications

4.1 Specifications

Specifications are given for the configurations detailed in Chapter 1.

Unless specifically noted, specifications are given as typical data under Reference Environmental Conditions, and with the system calibrated to the nominal microphone open circuit sensitivity.

NOTE: The specifications given here for the Z-weighting, as defined in IEC 61672–1, are also valid for the Lin response, as defined in IEC 60651.

4.4 Reference Conditions for Acoustic Calibration

Reference Level Range: In Single-range applications only one level range exists and this is the reference level range. In Multi-range applications the reference level range is *High Range*.

Reference Sound Pressure Level: 124.00 dB re 20 μ Pa

Reference Frequency: 251.2 Hz

4.5 Microphone

Weatherproof Microphone Unit Type 4184-A which includes Microphone Preamplifier ZE-0773:

Type: Weatherproof Microphone Unit

Nominal Open Circuit Sensitivity: 10.9 mV/Pa, (corresponding to -39.25 dB re 1 V/Pa) ± 1.5 dB

Cartridge Capacitance: 18 pF (at 250 Hz)

Nominal Preamplifier Attenuation: 0.2 dB

Extension Cables between Microphone and the Analyzer: Up to 100 m without degradation of the specifications. **NOTE:** EMC is only tested with a 10 m cable (AO-0697-D-100)

Microphone Reference Point: The point on the microphone's axis at the sound opening of the microphone. The sound opening is 118 mm above the surface at the bottom of the windscreen mounting thread.

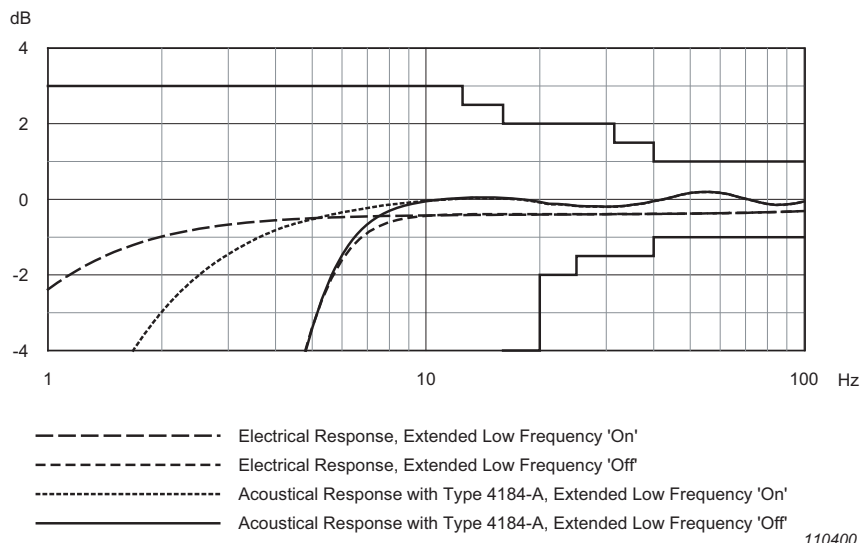
Reference Direction: Two different reference directions of Sound Incidence:

- *4184-A 0° (Top):* This reference direction is defined as the inward direction toward the Microphone Reference Point on the microphones rotational axis, coming from the opposite direction of the electrical output
- *4184-A 90° (Side):* This reference direction is defined as the inward direction toward the Microphone Reference Point perpendicular to the microphones rotational axis

4.6.2 Typical Low-frequency Responses

The typical Low-frequency Responses for Z-frequency weighting are given in Fig.4.2. The Electrical Responses are for the rear (Input) socket. The Acoustical Responses include Weatherproof Microphone Unit Type 4184-A (which again includes Microphone Preamplifier ZE-0773).

Fig.4.2 Typical low-frequency responses



The Low-frequency Responses depends on the state of the *Extended Low Frequency* parameter on the **Setup** display, under *Input*.

The Low-frequency Responses are not influenced by the microphone accessories described in section .1.2.4.

The Low-frequency Responses for introduction of the electrical signal through the recommended means to substitute the microphone with an electrical input facility (see section 3.5) differs from the electrical responses because it also includes Microphone Preamplifier ZE-0773.

4.6.5 Free-field Frequency Responses

The free-field frequency responses for plane progressive sinusoidal sound waves incident from the reference direction with Z-frequency weighting are provided in Fig.4.6a and Fig.4.6b, Table A.4a and Table A.4b. The tables also provides the 'Expanded Uncertainties of Measurement' required by IEC 61672-1, see the start of section 4.6 in the **Instruction Manual**.

Fig.4.3 Weatherproof Microphone Unit Type 4184-A is not specified without windscreen

Fig.4.4 Weatherproof Microphone Unit Type 4184-A cannot be mounted directly on the analyzer

Fig.4.5 Weatherproof Microphone Unit Type 4184-A cannot be mounted directly on the analyzer

Fig. 4.6a 4184-A 0° (Top), Free-field reference direction frequency response for Weatherproof Microphone Unit Type 4184-A and the analyzer's electrical response with the Microphone Preamplifier connected to a microphone extension cable. Corresponds to the "Acoustical Response" column in Table A.4a

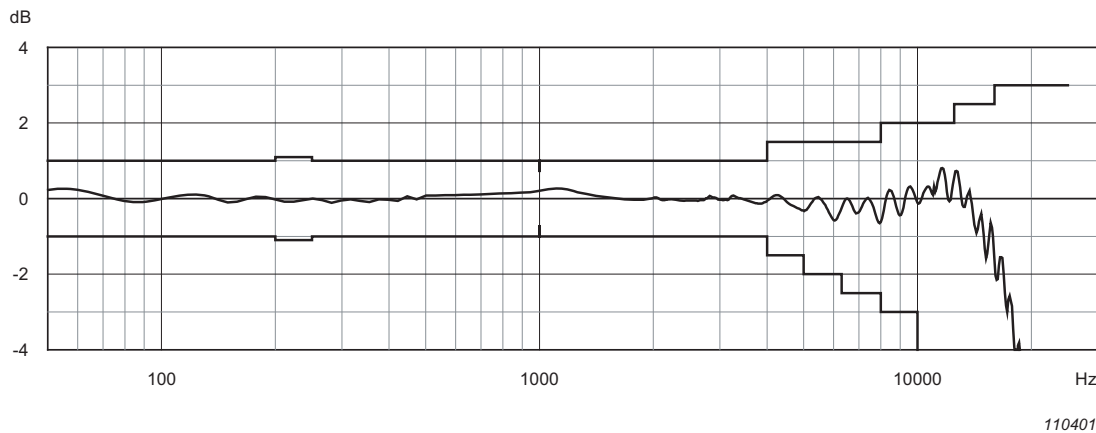


Fig. 4.6b 4184-A 90° (Side), Free-field reference direction frequency response for Weatherproof Microphone Unit Type 4184-A and the analyzer's electrical response with the Microphone Preamplifier connected to a microphone extension cable. Corresponds to the "Acoustical Response" column in Table A.4b

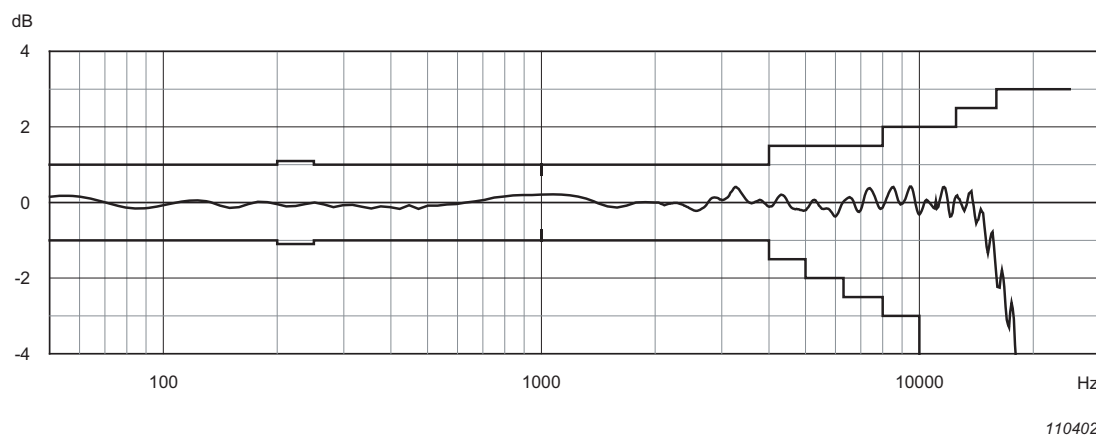


Fig. 4.7 Weatherproof Microphone Unit Type 4184-A cannot be mounted directly on the analyzer

Fig. 4.8 Weatherproof Microphone Unit Type 4184-A is not specified together with Outdoor Microphone Kit UA-1404

4.6.6 Diffuse-field Frequency Responses

The diffuse-field frequency responses (also called random-incidence frequency responses) with Z-frequency weighting are provided in Fig. 4.10 and Table A.8.

Fig. 4.9 Weatherproof Microphone Unit Type 4184-A is not specified without windscreen

Fig. 4.10 Both reference directions, Diffuse-field frequency response for Weatherproof Microphone Unit Type 4184-A and the analyzer's electrical response with the Microphone Preamplifier connected to a microphone extension cable. Corresponds to the "Acoustical Response" column in Table A.8

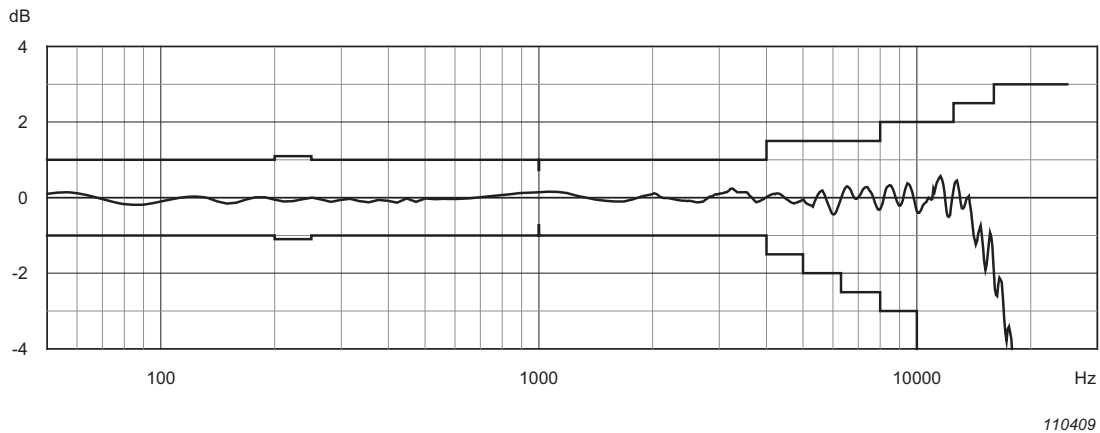


Fig. 4.11 Weatherproof Microphone Unit Type 4184-A is not specified together with Outdoor Microphone Kit UA-1404

4.7 Directional Responses

This section gives directional responses for plane progressive sinusoidal sound waves normalised to the response in the reference direction. The directional responses are given as tables in Appendix A.

The sensitivity variation graphs show the absolute maximum difference between the sensitivities at any two sound incidence angles within the specified interval of angles. For example, at each frequency the value for $\pm 30^\circ$ is the difference between the highest and the lowest sensitivity found in a circular cone with an opening angle of 60° , the top at the Microphone Reference Point and with the reference direction of incidence as the axis. Because the angle interval defines a three-dimensional geometric shape there is only one set of graphs with sensitivity variations, also where the directional response is shown for two planes. The graphs show the maximum variation for the two measurement planes combined. The sensitivity variations are also given as tables in Appendix A.

Limit curves are drawn on the sensitivity variation graphs in the following sections. These curves represent the IEC 61672-1 limits, reduced by the 'Maximum Expanded Uncertainties of Measurement' from Appendix A of IEC 61672-1. The 'Maximum Expanded Uncertainties of Measurement' used here are the maximum uncertainties that a test organisation may have on its measurements when it performs conformance tests according to IEC 61672.

Fig. 4.12 Weatherproof Microphone Unit Type 4184-A is not specified without windscreen

Fig. 4.13 Weatherproof Microphone Unit Type 4184-A is not specified without windscreen

Fig. 4.14 Weatherproof Microphone Unit Type 4184-A cannot be mounted directly on the analyzer

Fig. 4.15 Weatherproof Microphone Unit Type 4184-A cannot be mounted directly on the analyzer

Fig. 4.16 Weatherproof Microphone Unit Type 4184-A cannot be mounted directly on the analyzer

Fig. 4.17 Directional response for Weatherproof Microphone Unit Type 4184-A with the Microphone Preamplifier connected to a microphone extension cable. Corresponds to Table A.31 to Table A.33. The sound incidence angles are for 4184-A 0° (Top)'s reference direction. For 4184-A 90° (Side), subtract 90° from the angles in the plots to get the sound incidence angle

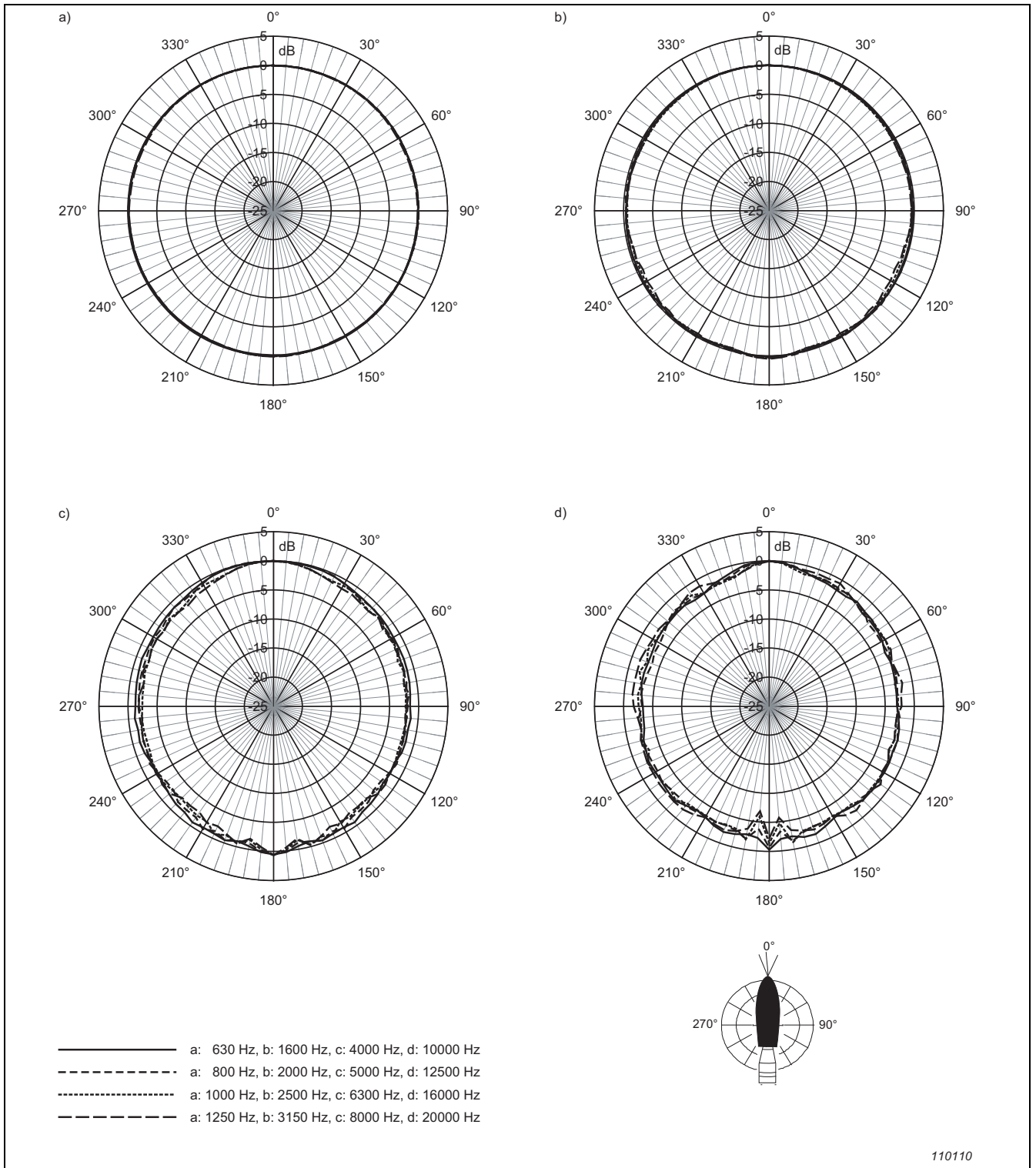


Fig. 4.18a 4184-A 0° (Top), sensitivity variations for Weatherproof Microphone Unit Type 4184-A with the Microphone Preamplifier connected to a microphone extension cable, at sound incidence angles within $\pm\theta^\circ$ from the reference direction. Corresponds to Table A.34a

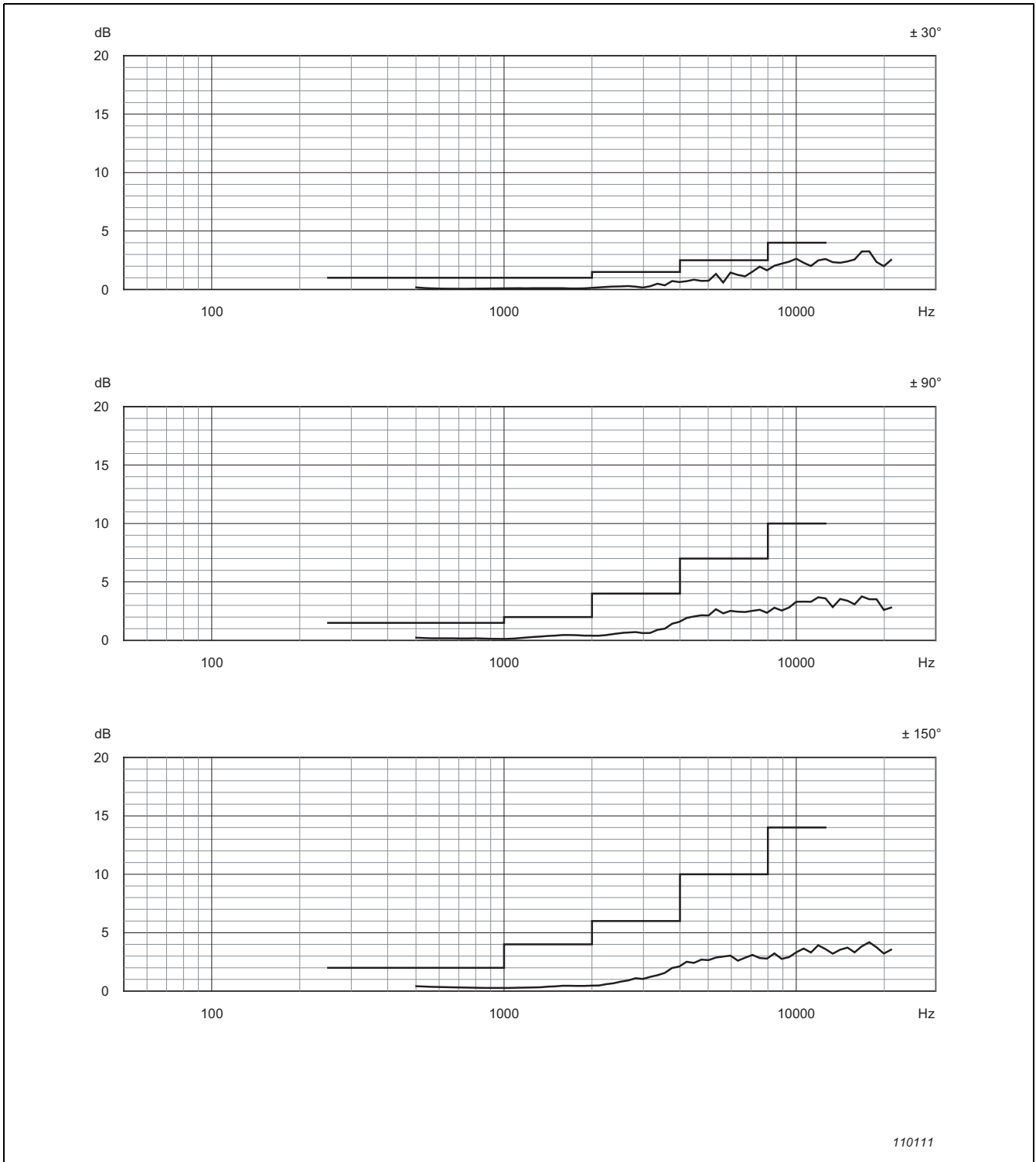


Fig. 4.18b 4184-A 90° (Side), sensitivity variations for Weatherproof Microphone Unit Type 4184-A with the Microphone Preamplifier connected to a microphone extension cable, at sound incidence angles within $\pm\theta^\circ$ from the reference direction. Corresponds to Table A.34b

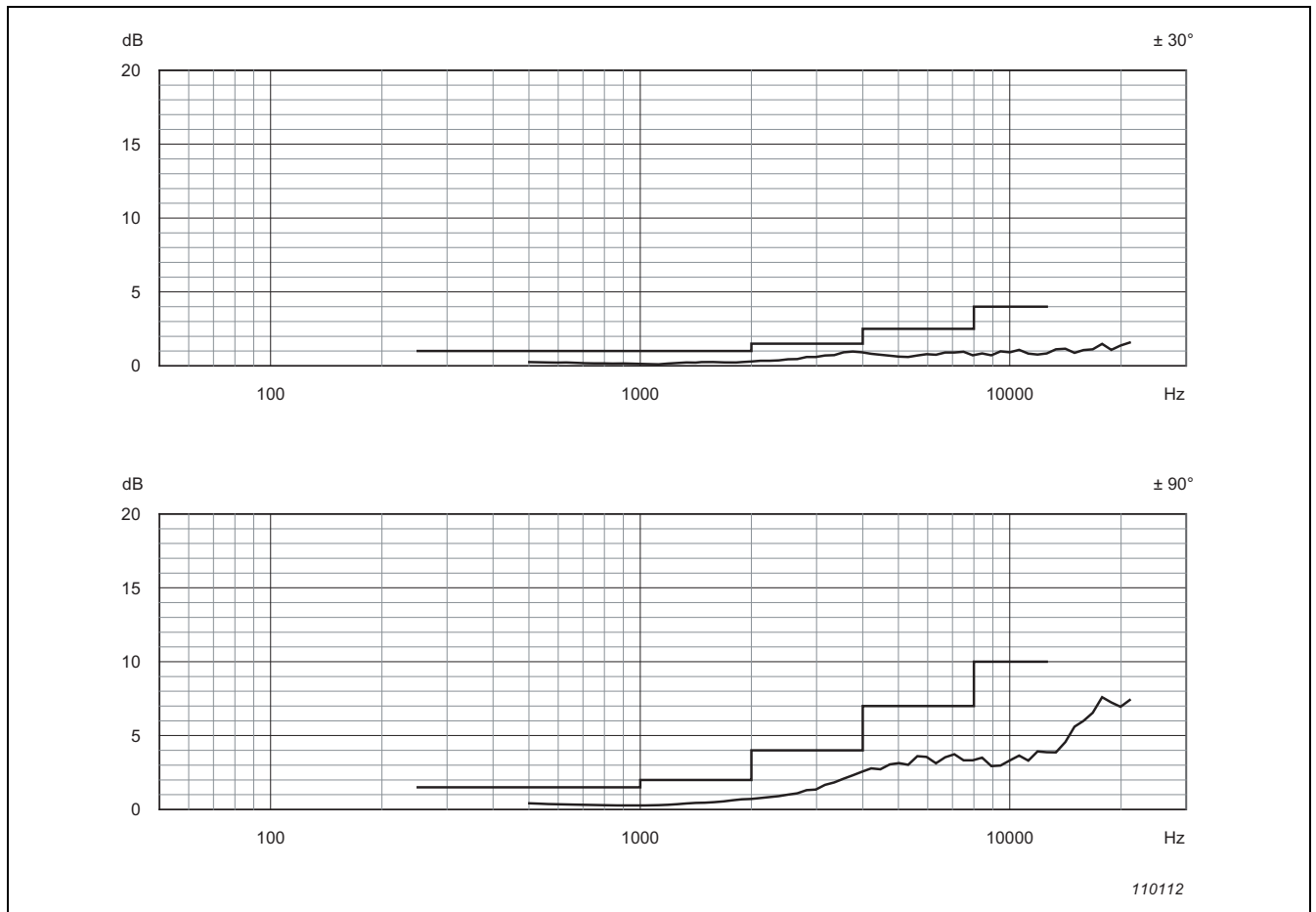


Fig. 4.19 Weatherproof Microphone Unit Type 4184-A cannot be mounted directly on the analyzer

Fig. 4.20 Weatherproof Microphone Unit Type 4184-A cannot be mounted directly on the analyzer

Fig. 4.21 Weatherproof Microphone Unit Type 4184-A cannot be mounted directly on the analyzer

Fig. 4.22 Weatherproof Microphone Unit Type 4184-A is not specified together with Outdoor Microphone Kit UA-1404

Fig. 4.23 Weatherproof Microphone Unit Type 4184-A is not specified together with Outdoor Microphone Kit UA-1404

4.8 Self-generated Noise

Self-generated noise is given for nominal microphone Open Circuit Sensitivity, *Sound Field Correction* set to *Free-field* and no microphone accessories selected.

4.8.1 Maximum Broadband Self-generated Noise

Table 4.1
Maximum broadband
self-generated noise

Maximum Noise	Frequency Weighting				
	A-weighting (dB)	B-weighting (dB)	C-weighting (dB)	Z-weighting* (dB)	Z-weighting* Extended Low Frequency (dB)
Single-range					
Microphone	21.1	19.7	19.7	23.7	23.7
Electrical	29.0	27.6	28.1	33.3	44.3
Total	29.7	28.3	28.7	33.8	44.3
High Range					
Microphone	21.1	19.7	19.7	23.7	23.7
Electrical	47.9	46.3	46.3	51.1	51.9
Total	47.9	46.3	46.3	51.1	51.9
Low Range					
Microphone	21.1	19.7	19.7	23.7	23.7
Electrical	29.0	27.6	28.1	33.3	44.3
Total	29.7	28.3	28.7	33.8	44.3

*. minimum 120 seconds L_{Zeq}

4.8.2 Typical Broadband Self-generated Noise

Table 4.2
Typical broadband
self-generated noise

Typical Noise	Frequency Weighting				
	A-weighting (dB)	B-weighting (dB)	C-weighting (dB)	Z-weighting* (dB)	Z-weighting* Extended Low Frequency (dB)
Single-range					
Microphone	20.1	18.7	18.7	22.7	22.7
Electrical	28.2	26.8	27.3	32.5	39.3
Total	28.8	27.4	27.9	32.9	39.4
High Range					
Microphone	20.1	18.7	18.7	22.7	22.7
Electrical	44.4	42.8	42.8	47.6	48.1
Total	44.4	42.8	42.8	47.6	48.1
Low Range					
Microphone	20.1	18.7	18.7	22.7	22.7
Electrical	28.2	26.8	27.3	32.5	39.3
Total	28.8	27.4	27.9	32.9	39.4

*. minimum 120 seconds L_{Zeq}

4.8.3 Typical Self-generated Noise Spectra

Typical spectra for self-generated noise are shown in Fig. 4.24 to Fig. 4.29.

Fig. 4.24 Typical self-generated noise, 1/1 octave band, Single-range

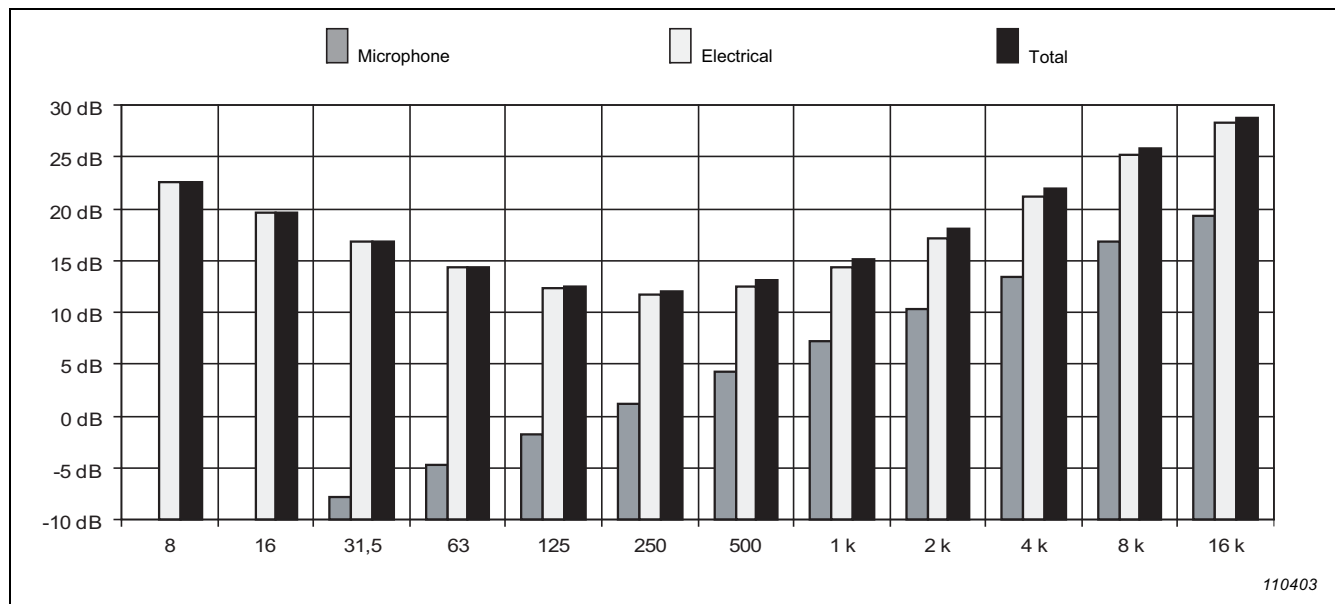


Fig. 4.25 Typical self-generated noise, 1/1-octave band, High Range

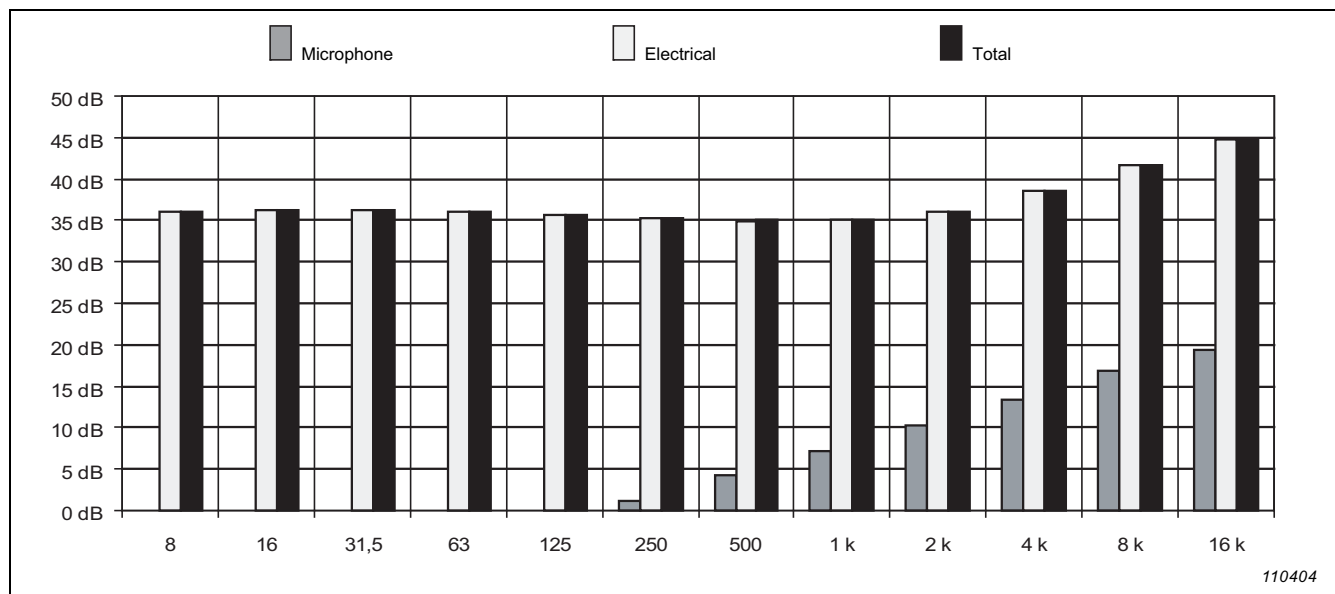


Fig.4.26 Typical self-generated noise, 1/1 octave band, Low Range

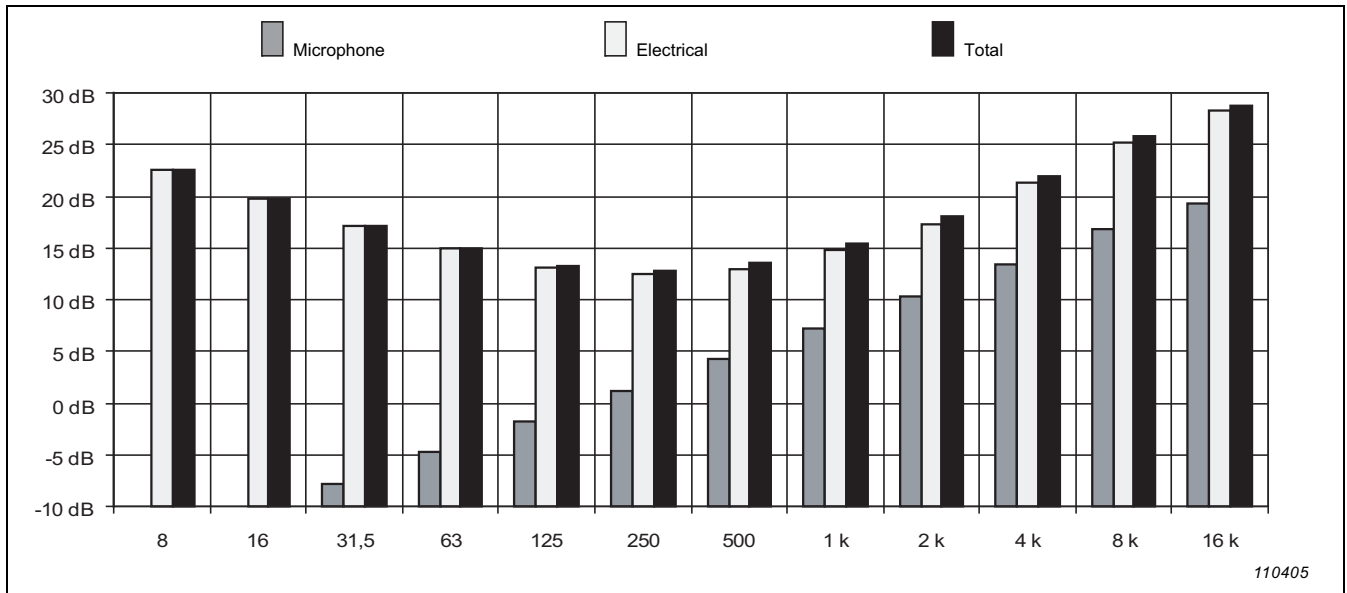


Fig.4.27 Typical self-generated noise, 1/3 octave band, Single-range

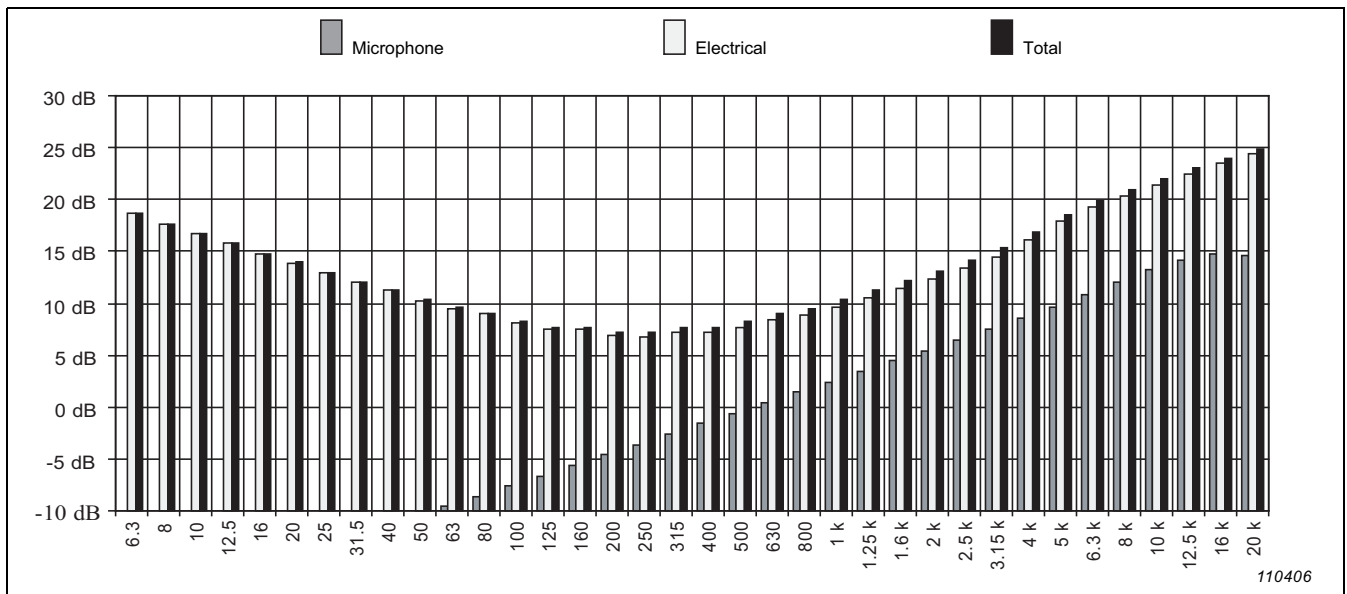


Fig. 4.28 Typical self-generated noise, 1/3 octave band, High range

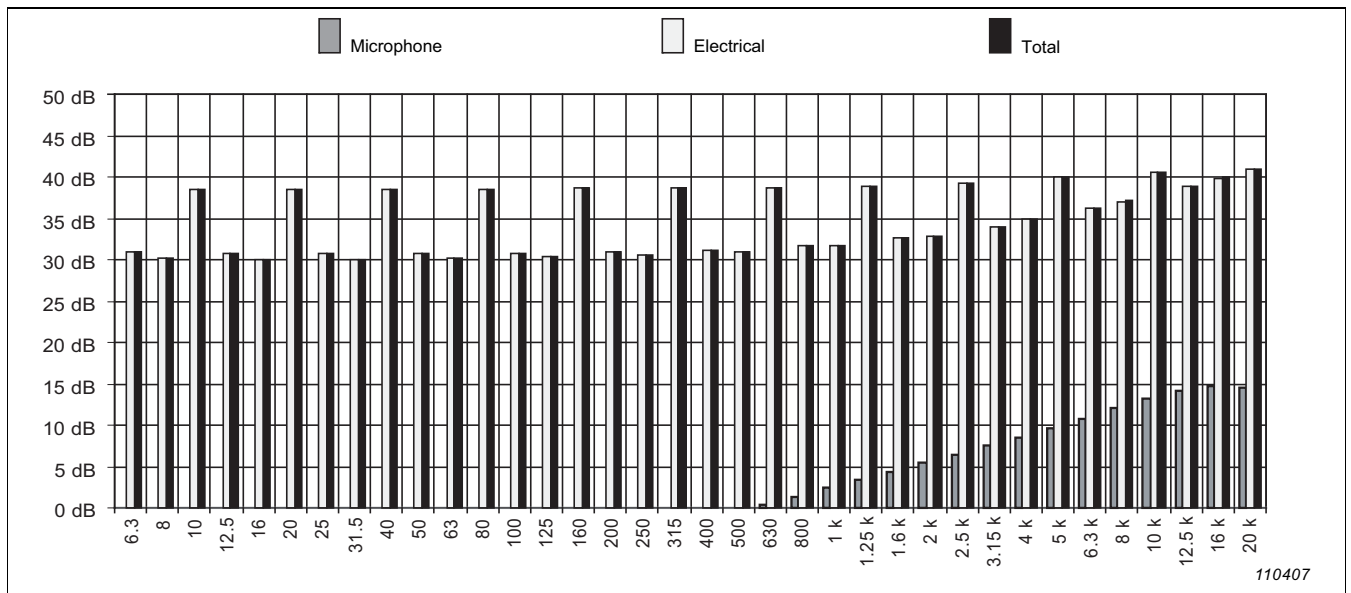
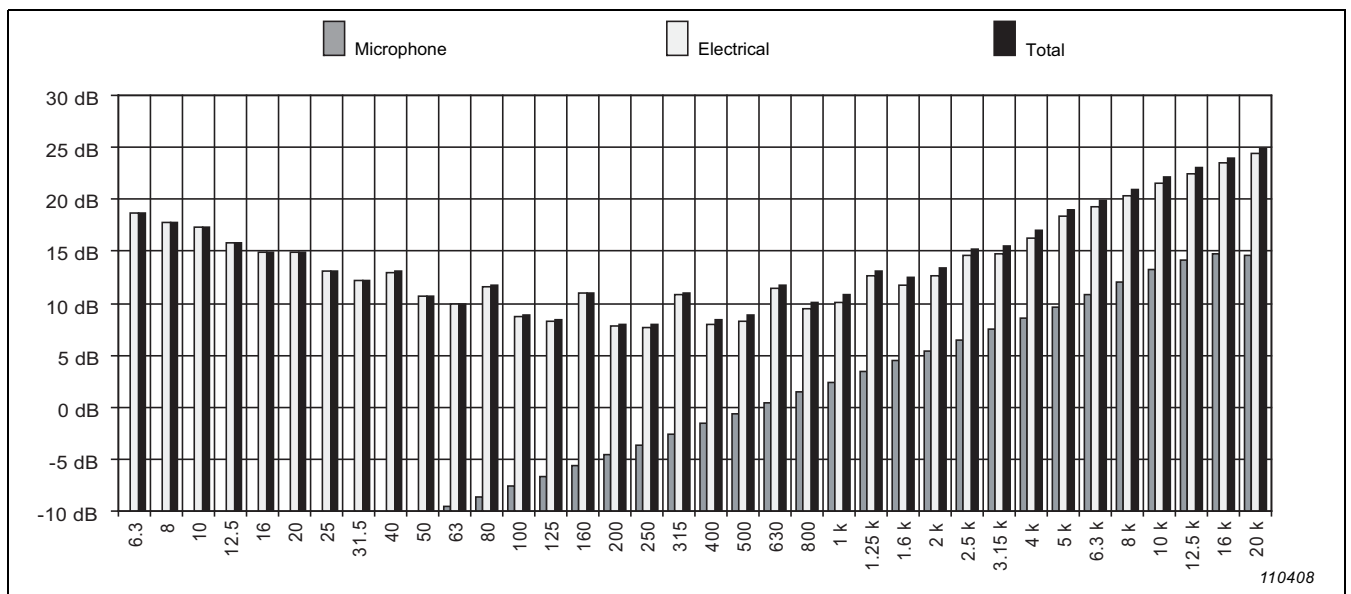


Fig. 4.29 Typical self-generated noise, 1/3 octave band, Low Range



4.8.4 Crosstalk

This only applies to Type 2270.

Not relevant: only one Weatherproof Microphone Unit Type 4184-A can be connected to Type 2270.

4.9 Measuring Ranges

The Upper Limit in the following sections is based on the guaranteed worst-case limit for the analyzer and the nominal Open Circuit Sensitivity of the microphone. The Overload Limit can, due to tolerances in the analyzer, be up to 1.5 dB higher than the worst-case limit, but tolerances specified in the International Standards are maintained as long as no Overload is indicated.

The Lower Limit in the following sections is based on the guaranteed worst-case limit for the analyzer and the nominal Open Circuit Sensitivity of the microphone, under Reference Environmental Conditions, *Sound Field Correction* set to *Free-field* and no microphone accessories selected.

4.9.1 Maximum Sound Level

The maximum Sound Level that the Sound Level Meter can accommodate without causing damage to the Sound Level Meter: 176 dB Peak.

4.9.2 Total Range

Total Range is defined as the difference between the Upper Limit on the least sensitive level range, and the lowest sound pressure level measurable on the most sensitive level range, which can be measured at 1 kHz within the most conservative tolerance limits, specified in the International Standards IEC 61672-1, IEC 60651 and IEC 60804:

Table 4.3
Total range

Frequency Weighting				
A-weighting (dB)	B-weighting (dB)	C-weighting (dB)	Z-weighting (dB)	Z-weighting Extended Low Frequency (dB)
150.3 – 40.2	150.3 – 38.8	150.3 – 39.3	150.3 – 44.5	150.3 – 55.5

NOTE: For Sound Exposure Levels, the stated ranges are valid if $10 \cdot \lg(\Delta t)$ is added to the limits. Δt being the averaging time interval, indicated as *Elapsed Time*, expressed in seconds.

4.9.3 Primary Indicator Range

Primary Indicator Range according to the International Standard IEC 60651:

Table 4.4
Primary Indicator Range

Range	Upper Limit (dB)	Lower Limit				
		A-weighting (dB)	B-weighting (dB)	C-weighting (dB)	Z-weighting (dB)	Z-weighting Extended Low Frequency (dB)
Single	132.3	38.9	37.5	38.0	43.2	54.2
High	132.3	57.8	56.2	56.2	61.0	61.8
Low	105.8	38.9	37.5	38.0	43.2	54.2

4.9.4 Indicator Range

Indicator Range according to the International Standard IEC 60804:

Table 4.5
Indicator Range

Range	Upper Limit (dB)	Lower Limit				
		A-weighting (dB)	B-weighting (dB)	C-weighting (dB)	Z-weighting (dB)	Z-weighting Extended Low Frequency (dB)
Single	149.3	38.9	37.5	38.0	43.2	54.2
High	149.3	57.8	56.2	56.2	61.0	61.8
Low	122.8	38.9	37.5	38.0	43.2	54.2

NOTE: For Sound Exposure Levels, the stated ranges are valid if $10 \cdot \lg(\Delta t)$ is added to the limits. Δt being the averaging time interval, indicated as *Elapsed Time*, expressed in seconds.

4.9.5 Linearity Range

Linearity Range according to the International Standard IEC 60804 is the difference between the Upper and Lower Limit in the following table:

Table 4.6
Linearity Range

Range	Upper Limit (dB)	Lower Limit				
		A-weighting (dB)	B-weighting (dB)	C-weighting (dB)	Z-weighting (dB)	Z-weighting Extended Low Frequency (dB)
Single	151.5	36.8	35.4	35.9	41.1	52.1
High	151.5	55.7	54.1	54.1	58.9	59.7
Low	124.5	36.8	35.4	35.9	41.1	52.1

NOTE: For Sound Exposure Levels, the stated ranges are valid if $10 \cdot \lg(\Delta t)$ is added to the limits. Δt being the averaging time interval, indicated as *Elapsed Time*, expressed in seconds.

4.9.6 Pulse Range

Pulse Range according to the International Standard IEC 60804 is the difference between the Upper and Lower Limit in the following table:

Table 4.7
Pulse Range

Range	Upper Limit (dB)	Lower Limit				
		A-weighting (dB)	B-weighting (dB)	C-weighting (dB)	Z-weighting (dB)	Z-weighting Extended Low Frequency (dB)
Single	154.5	36.8	35.4	35.9	41.1	52.1
High	154.5	55.7	54.1	54.1	58.9	59.7
Low	127.5	36.8	35.4	35.9	41.1	52.1

NOTE: For Sound Exposure Levels, the stated ranges are valid if $10 \cdot \lg(\Delta t)$ is added to the limits. Δt being the averaging time interval, indicated as *Elapsed Time*, expressed in seconds.

4.9.7 Linear Operating Range

The starting point for all the Linear Operating Range test frequencies is 124 dB except at 31.5 Hz, which is 94.0 dB.

Linear Operating Range according to the International Standard IEC 61672-1:

Table 4.8
Linear Operating
Range

Frequency- Weighting	Upper Limit					Lower Limit
	31.5 Hz (dB)	1 kHz (dB)	4 kHz (dB)	8 kHz (dB)	12.5 kHz (dB)	All (dB)
Single-range						
A-weighting	109.8	150.3	151.5	149.4	146.2	40.2
B-weighting	132.2	150.3	149.8	147.6	144.4	38.8
C-weighting	146.3	150.3	149.7	147.5	144.3	39.3
Z-weighting	149.3	150.3	150.5	150.5	150.5	44.5
Z-weighting Extended Low Frequency	149.3	150.3	150.5	150.5	150.5	55.5
High Range						
A-weighting	109.8	150.3	151.5	149.4	146.2	59.1
B-weighting	132.2	150.3	149.8	147.6	144.4	57.5
C-weighting	146.3	150.3	149.7	147.5	144.3	57.5
Z-weighting	149.3	150.3	150.5	150.5	150.5	62.3
Z-weighting Extended Low Frequency	149.3	150.3	150.5	150.5	150.5	63.1
Low Range						
A-weighting	83.3	123.8	124.5	122.9	119.7	40.2
B-weighting	105.7	123.8	122.8	121.1	117.9	38.8
C-weighting	119.8	123.8	122.7	121.0	117.8	39.3
Z-weighting	122.8	123.8	123.5	124.0	124.0	44.5
Z-weighting Extended Low Frequency	122.8	123.8	123.5	124.0	124.0	55.5

NOTE: For Sound Exposure Levels, the stated ranges are valid if $10 \cdot \lg(\Delta t)$ is added to the limits. Δt being the averaging time interval, indicated as *Elapsed Time*, expressed in seconds.

4.9.8 Peak C Range

Peak C Range according to the International Standard IEC 61672-1:

Table 4.9
Peak C Range

Range	Upper Limit					Lower Limit
	31.5 Hz (dB)	1 kHz (dB)	4 kHz (dB)	8 kHz (dB)	12.5 kHz (dB)	All (dB)
Single	149.3	153.3	152.7	150.5	147.3	56.1
High	149.3	153.3	152.7	150.5	147.3	74.3
Low	122.8	126.8	125.7	124.0	120.8	56.1

4.11.3 Linear Operating Range

Linear Operating Range according to the International Standard IEC 61260, for electrical input, for all filters in the filter banks:

Table 4.11
Linear Operating Range

Range	Upper Limit (dB)	Lower Limit 1/1-octave (dB)	Lower Limit 1/3-octave (dB)
Single	149.7	40.8	37.0
High	149.7	59.9	56.1
Low	123.2	40.8	37.0

Below the Lower Limit, the Level Linearity Error is less than or equal to the error found in Fig.2.1 with L_{inh} set to the Lower Limit – 11.5 dB.

4.11.4 Measurement Range

Measurement Range according to the International Standard IEC 61260 is the difference between the Upper Limit of the Linear Operating Range on the least sensitive level range and the Lower Limit of the Linear Operating Range on the most sensitive level range.

Table 4.12
Measurement Range

1/1-octave (dB)	1/3-octave (dB)
149.7 – 40.8	149.7 – 37.0

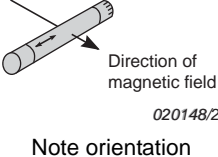
4.12.4 Vibration

Vibration Sensitivity (20 – 1000 Hz) for 1 ms^{-2} : A-weighted max. 86 dB, Z-weighted max. 88 dB.

4.12.5 Immunity to Power Magnetic Fields

Maximum sensitivity to power line (50/60 Hz) magnetic field strength of 80 A/m: is specified as the rise in the self-generated noise coming from the magnetic field. The self-generated noise is stated in section 4.8.

Table 4.15
Magnetic Fields

Configuration	Most Sensitive Direction	Rise in Self-generated Noise				
		A-weighted (dB)	B-weighted (dB)	C-weighted (dB)	Z-weighted (dB)	1/3-octave 50 Hz Band (dB)
The analyzer and Microphone Type 4184-A	Magnetic field perpendicular to the display surface	Not detectable	< 7	< 16	< 12	< 34
Microphone Type 4184-A alone	 Direction of magnetic field 020148/2 Note orientation	Not detectable	< 5	< 13	< 10	< 31

Appendix A

Tables

A.2 Free-field Frequency Responses

Frequency responses with Z-frequency weighting. Measured with plane progressive sinusoidal sound waves incident from the reference direction and the instrument's *Sound Field Correction* parameter set to *Free-field*, see section 4.6.5.

Table A.2 *Weatherproof Microphone Unit Type 4184-A is not specified without windscreen*

Table A.3 *Weatherproof Microphone Unit Type 4184-A cannot be mounted directly on the analyzer*

Table A.4a *4184-A 0° (Top), Free-field reference direction frequency response for Weatherproof Microphone Unit Type 4184-A and the analyzer's electrical response with the Microphone Preamplifier connected to a microphone extension cable*

Nominal Frequency	Exact Frequency	Microphone Free-field Response	Electrical Response	Acoustical Response	Expanded Uncertainty
Hz	Hz (6 digits)	dB	dB	dB	dB
63	63.0957	0.48	-0.29	0.19	0.16
80	79.4328	0.21	-0.27	-0.06	0.16
100	100	0.24	-0.25	-0.01	0.16
125	125.893	0.31	-0.21	0.10	0.16
160	158.489	0.08	-0.16	-0.08	0.16
200	199.526	0.07	-0.09	-0.02	0.16
250	251.189	0.00	0.00	0.00	0.16
315	316.228	-0.13	0.11	-0.02	0.16
400	398.107	-0.27	0.24	-0.03	0.16
500	501.187	-0.28	0.36	0.08	0.17
630	630.957	-0.37	0.47	0.10	0.17
800	794.328	-0.43	0.56	0.13	0.17
1000	1000	-0.43	0.63	0.21	0.17
1060	1059.25	-0.40	0.65	0.25	0.17
1120	1122.02	-0.39	0.66	0.27	0.17
1180	1188.50	-0.43	0.67	0.24	0.17
1250	1258.93	-0.51	0.68	0.17	0.17
1320	1333.52	-0.58	0.69	0.12	0.17
1400	1412.54	-0.64	0.70	0.07	0.17
1500	1496.24	-0.67	0.71	0.04	0.17
1600	1584.89	-0.71	0.72	0.01	0.17
1700	1678.80	-0.74	0.73	-0.02	0.17
1800	1778.28	-0.76	0.73	-0.03	0.17
1900	1883.65	-0.77	0.74	-0.03	0.17
2000	1995.26	-0.73	0.74	0.01	0.22
2120	2113.49	-0.78	0.75	-0.03	0.22
2240	2238.72	-0.77	0.75	-0.02	0.22
2360	2371.37	-0.80	0.75	-0.05	0.22
2500	2511.89	-0.81	0.76	-0.05	0.22
2650	2660.73	-0.81	0.76	-0.05	0.22
2800	2818.38	-0.73	0.76	0.03	0.11

Nominal Frequency	Exact Frequency (6 digits)	Microphone Free-field Response	Electrical Response	Acoustical Response	Expanded Uncertainty
Hz	Hz	dB	dB	dB	dB
3000	2985.38	-0.78	0.76	-0.02	0.23
3150	3162.28	-0.77	0.77	0.00	0.23
3350	3349.65	-0.74	0.77	0.03	0.23
3550	3548.13	-0.82	0.77	-0.05	0.24
3750	3758.37	-0.89	0.77	-0.12	0.24
4000	3981.07	-0.84	0.77	-0.07	0.24
4250	4216.97	-0.70	0.78	0.08	0.24
4500	4466.84	-0.81	0.78	-0.03	0.24
4750	4731.51	-0.99	0.78	-0.21	0.24
5000	5011.87	-1.08	0.78	-0.30	0.25
5300	5308.84	-0.84	0.78	-0.06	0.29
5600	5623.41	-0.87	0.78	-0.09	0.29
6000	5956.62	-1.26	0.78	-0.47	0.30
6300	6309.57	-1.02	0.78	-0.23	0.30
6700	6683.44	-0.97	0.78	-0.18	0.30
7100	7079.46	-1.04	0.78	-0.25	0.30
7500	7498.94	-0.89	0.79	-0.10	0.30
8000	7943.28	-1.29	0.79	-0.50	0.31
8500	8413.95	-0.66	0.79	0.13	0.31
9000	8912.51	-1.10	0.79	-0.31	0.32
9500	9440.61	-0.60	0.80	0.20	0.33
10000	10000	-0.80	0.80	0.00	0.34
10600	10592.5	-0.58	0.80	0.22	0.35
11200	11220.2	-0.44	0.81	0.37	0.36
11800	11885.0	-0.41	0.81	0.40	0.38
12500	12589.3	-0.27	0.82	0.55	0.38
13200	13335.2	-0.84	0.82	-0.01	0.40
14000	14125.4	-1.27	0.83	-0.43	0.41
15000	14962.4	-1.80	0.84	-0.96	0.46
16000	15848.9	-2.09	0.85	-1.24	0.48
17000	16788.0	-2.82	0.86	-1.96	0.50
18000	17782.8	-4.11	0.86	-3.25	0.52
19000	18836.5	-5.45	0.86	-4.59	0.54
20000	19952.6	-6.62	0.86	-5.76	0.57
21200	21134.9	-8.34	0.85	-7.49	0.57
22400	22387.2	-10.13	0.82	-9.31	0.57

Table A.4b 4184-A 90° (Side), Free-field reference direction frequency response for Weatherproof Microphone Unit Type 4184-A and the analyzer's electrical response, with the Microphone Preamplifier connected to a microphone extension cable

Nominal Frequency	Exact Frequency (6 digits)	Microphone Free-field Response	Electrical Response	Acoustical Response	Expanded Uncertainty
Hz	Hz	dB	dB	dB	dB
63	63.0957	0.48	-0.36	0.12	0.16
80	79.4328	0.21	-0.34	-0.13	0.16
100	100	0.24	-0.31	-0.07	0.16
125	125.893	0.31	-0.26	0.05	0.16
160	158.489	0.08	-0.20	-0.12	0.16
200	199.526	0.07	-0.11	-0.04	0.16
250	251.189	0.00	0.00	0.00	0.16
315	316.228	-0.18	0.13	-0.06	0.16
400	398.107	-0.39	0.26	-0.12	0.16
500	501.187	-0.48	0.40	-0.08	0.17
630	630.957	-0.52	0.52	0.00	0.17
800	794.328	-0.48	0.64	0.16	0.17
1000	1000	-0.55	0.76	0.21	0.17
1060	1059.25	-0.58	0.79	0.21	0.17
1120	1122.02	-0.60	0.82	0.22	0.17

Nominal Frequency	Exact Frequency (6 digits)	Microphone Free-field Response	Electrical Response	Acoustical Response	Expanded Uncertainty
Hz	Hz	dB	dB	dB	dB
1180	1188.50	-0.65	0.86	0.20	0.17
1250	1258.93	-0.75	0.89	0.14	0.17
1320	1333.52	-0.84	0.92	0.08	0.17
1400	1412.54	-0.97	0.95	-0.02	0.17
1500	1496.24	-1.08	0.98	-0.10	0.17
1600	1584.89	-1.14	1.02	-0.13	0.17
1700	1678.80	-1.13	1.05	-0.08	0.17
1800	1778.28	-1.08	1.08	0.00	0.17
1900	1883.65	-1.10	1.11	0.01	0.17
2000	1995.26	-1.14	1.14	0.00	0.22
2120	2113.49	-1.21	1.16	-0.05	0.22
2240	2238.72	-1.21	1.19	-0.02	0.22
2360	2371.37	-1.28	1.22	-0.06	0.22
2500	2511.89	-1.43	1.25	-0.19	0.22
2650	2660.73	-1.44	1.28	-0.16	0.22
2800	2818.38	-1.25	1.32	0.08	0.11
3000	2985.38	-1.31	1.39	0.08	0.23
3150	3162.28	-1.24	1.48	0.24	0.23
3350	3349.65	-1.31	1.61	0.30	0.23
3550	3548.13	-1.77	1.77	0.00	0.24
3750	3758.37	-1.94	1.98	0.04	0.24
4000	3981.07	-2.28	2.22	-0.07	0.24
4250	4216.97	-2.35	2.46	0.11	0.24
4500	4466.84	-2.61	2.69	0.08	0.24
4750	4731.51	-3.06	2.89	-0.17	0.24
5000	5011.87	-3.23	3.06	-0.17	0.25
5300	5308.84	-3.19	3.19	0.00	0.29
5600	5623.41	-3.46	3.30	-0.16	0.29
6000	5956.62	-3.67	3.38	-0.29	0.30
6300	6309.57	-3.44	3.44	0.00	0.30
6700	6683.44	-3.52	3.49	-0.03	0.30
7100	7079.46	-3.54	3.53	-0.01	0.30
7500	7498.94	-3.30	3.56	0.26	0.30
8000	7943.28	-3.67	3.59	-0.08	0.31
8500	8413.95	-3.29	3.61	0.32	0.31
9000	8912.51	-3.59	3.62	0.03	0.32
9500	9440.61	-3.31	3.64	0.32	0.33
10000	10000	-3.82	3.65	-0.17	0.34
10600	10592.5	-3.68	3.66	-0.02	0.35
11200	11220.2	-3.66	3.67	0.02	0.36
11800	11885.0	-3.64	3.68	0.04	0.38
12500	12589.3	-3.60	3.69	0.09	0.38
13200	13335.2	-3.70	3.70	0.00	0.40
14000	14125.4	-3.93	3.71	-0.22	0.41
15000	14962.4	-4.51	3.72	-0.80	0.46
16000	15848.9	-5.12	3.73	-1.39	0.48
17000	16788.0	-6.12	3.73	-2.38	0.50
18000	17782.8	-7.25	3.74	-3.51	0.52
19000	18836.5	-8.86	3.74	-5.11	0.54
20000	19952.6	-9.52	3.74	-5.78	0.57
21200	21134.9	-10.51	3.73	-6.78	0.57
22400	22387.2	-12.04	3.69	-8.35	0.57

Table A.5 Weatherproof Microphone Unit Type 4184-A cannot be mounted directly on the analyzer

Table A.6 Weatherproof Microphone Unit Type 4184-A is not specified together with Outdoor Microphone Kit UA-1404

A.3 Diffuse-field Frequency Responses

Diffuse-field frequency responses with Z-frequency weighting. Measured with sounds at random incidence and the instrument's *Sound Field Correction* parameter set to *Diffuse-field*, see section 4.6.6.

Table A.7 *Weatherproof Microphone Unit Type 4184-A is not specified without windscreen*

Table A.8 *Both reference directions, Diffuse-field frequency response for Weatherproof Microphone Unit Type 4184-A and the analyzer's electrical response, with the Microphone Preamplifier connected to a microphone extension cable*

Nominal Frequency Hz	Exact Frequency (6 digits) Hz	Microphone Diffuse-field Response dB	Electrical Response dB	Acoustical Response dB	Expanded Uncertainty dB
63	63.0957	0.48	-0.40	0.08	0.07
80	79.4328	0.21	-0.38	-0.17	0.07
100	100	0.24	-0.34	-0.10	0.07
125	125.893	0.31	-0.29	0.03	0.07
160	158.489	0.08	-0.21	-0.13	0.07
200	199.526	0.07	-0.11	-0.05	0.07
250	251.189	0.00	0.00	0.00	0.07
315	316.228	-0.16	0.13	-0.03	0.08
400	398.107	-0.34	0.25	-0.08	0.08
500	501.187	-0.39	0.37	-0.02	0.11
630	630.957	-0.49	0.47	-0.02	0.11
800	794.328	-0.49	0.56	0.07	0.11
1000	1000	-0.50	0.65	0.14	0.11
1060	1059.25	-0.51	0.67	0.16	0.13
1120	1122.02	-0.54	0.69	0.15	0.13
1180	1188.50	-0.60	0.71	0.12	0.13
1250	1258.93	-0.69	0.74	0.05	0.13
1320	1333.52	-0.76	0.76	0.00	0.14
1400	1412.54	-0.83	0.79	-0.05	0.14
1500	1496.24	-0.89	0.81	-0.08	0.14
1600	1584.89	-0.94	0.84	-0.10	0.16
1700	1678.80	-0.97	0.87	-0.10	0.18
1800	1778.28	-0.94	0.90	-0.04	0.18
1900	1883.65	-0.90	0.93	0.04	0.18
2000	1995.26	-0.88	0.97	0.09	0.18
2120	2113.49	-1.00	1.01	0.01	0.18
2240	2238.72	-1.08	1.05	-0.03	0.19
2360	2371.37	-1.17	1.10	-0.07	0.19
2500	2511.89	-1.24	1.15	-0.09	0.19
2650	2660.73	-1.33	1.22	-0.11	0.19
2800	2818.38	-1.29	1.29	0.00	0.20
3000	2985.38	-1.28	1.37	0.09	0.20
3150	3162.28	-1.30	1.47	0.18	0.20
3350	3349.65	-1.42	1.59	0.17	0.20
3550	3548.13	-1.62	1.72	0.09	0.21
3750	3758.37	-1.94	1.86	-0.08	0.21
4000	3981.07	-2.01	2.01	0.00	0.21
4250	4216.97	-2.07	2.16	0.10	0.21
4500	4466.84	-2.29	2.31	0.03	0.22
4750	4731.51	-2.58	2.45	-0.12	0.30
5000	5011.87	-2.67	2.57	-0.10	0.39
5300	5308.84	-2.81	2.68	-0.13	0.48
5600	5623.41	-2.64	2.76	0.12	0.53
6000	5956.62	-3.14	2.83	-0.32	0.53
6300	6309.57	-2.89	2.88	-0.01	0.53
6700	6683.44	-2.77	2.91	0.15	0.53
7100	7079.46	-2.85	2.94	0.09	0.53
7500	7498.94	-2.80	2.96	0.16	0.53
8000	7943.28	-3.19	2.98	-0.22	0.53
8500	8413.95	-2.72	2.99	0.26	0.55
9000	8912.51	-3.09	2.99	-0.10	0.56

Nominal Frequency	Exact Frequency (6 digits)	Microphone Diffuse-field Response	Electrical Response	Acoustical Response	Expanded Uncertainty
Hz	Hz	dB	dB	dB	dB
9500	9440.61	-2.73	3.00	0.27	0.57
10000	10000	-3.21	3.00	-0.21	0.59
10600	10592.5	-3.12	3.00	-0.11	0.87
11200	11220.2	-2.71	3.01	0.30	0.88
11800	11885.0	-3.01	3.01	0.00	0.89
12500	12589.3	-2.79	3.01	0.23	0.91
13200	13335.2	-3.14	3.02	-0.12	0.92
14000	14125.4	-3.73	3.02	-0.71	0.94
15000	14962.4	-4.32	3.03	-1.30	0.95
16000	15848.9	-4.58	3.03	-1.55	0.97
17000	16788.0	-5.62	3.03	-2.59	0.98
18000	17782.8	-7.09	3.04	-4.06	0.99
19000	18836.5	-8.04	3.04	-5.00	1.01
20000	19952.6	-8.80	3.03	-5.77	1.02
21200	21134.9	-9.76	3.02	-6.74	1.03
22400	22387.2	-11.19	2.98	-8.21	1.04

Table A.9 Weatherproof Microphone Unit Type 4184-A is not specified together with Outdoor Microphone Kit UA-1404

A.4 Free-field Frequency Responses for Diffuse-field Calibrated Instruments

Free-field frequency response in the reference direction for diffuse-field calibrated instruments according to IEC 60651 and IEC 60804. Measured with plane progressive sinusoidal sound waves incident from the reference direction and the instrument's *Sound Field Correction* parameter set to *Diffuse-field*.

Table A.10 Free-field reference direction frequency response with the *Sound Field Correction* parameter set to *Diffuse-field* for the configurations for which there are specified normal Free-field responses

Nominal Frequency	Exact Frequency (6 digits)	Configuration as in Table A.4a	Configuration as in Table A.4b
Hz	Hz	dB	dB
63	63.0957	0.08	0.08
80	79.4328	-0.17	-0.17
100	100	-0.10	-0.10
125	125.893	0.02	0.02
160	158.489	-0.13	-0.13
200	199.526	-0.04	-0.04
250	251.189	0.00	0.00
315	316.228	0.00	-0.06
400	398.107	-0.02	-0.13
500	501.187	0.09	-0.11
630	630.957	0.10	-0.05
800	794.328	0.13	0.08
1000	1000	0.23	0.10
1060	1059.25	0.27	0.09
1120	1122.02	0.30	0.09
1180	1188.50	0.28	0.05
1250	1258.93	0.23	-0.01
1320	1333.52	0.19	-0.08
1400	1412.54	0.16	-0.18
1500	1496.24	0.14	-0.27
1600	1584.89	0.13	-0.31
1700	1678.80	0.12	-0.26
1800	1778.28	0.14	-0.18

Nominal Frequency Hz	Exact Frequency (6 digits) Hz	Configuration as in Table A.4a dB	Configuration as in Table A.4b dB
1900	1883.65	0.16	-0.17
2000	1995.26	0.24	-0.17
2120	2113.49	0.23	-0.20
2240	2238.72	0.28	-0.16
2360	2371.37	0.30	-0.18
2500	2511.89	0.34	-0.29
2650	2660.73	0.41	-0.22
2800	2818.38	0.56	0.05
3000	2985.38	0.59	0.06
3150	3162.28	0.70	0.23
3350	3349.65	0.85	0.28
3550	3548.13	0.90	-0.05
3750	3758.37	0.97	-0.08
4000	3981.07	1.17	-0.28
4250	4216.97	1.46	-0.19
4500	4466.84	1.50	-0.30
4750	4731.51	1.46	-0.61
5000	5011.87	1.49	-0.66
5300	5308.84	1.84	-0.51
5600	5623.41	1.89	-0.70
6000	5956.62	1.58	-0.84
6300	6309.57	1.87	-0.56
6700	6683.44	1.95	-0.61
7100	7079.46	1.91	-0.60
7500	7498.94	2.07	-0.34
8000	7943.28	1.69	-0.69
8500	8413.95	2.33	-0.30
9000	8912.51	1.89	-0.60
9500	9440.61	2.40	-0.32
10000	10000	2.20	-0.82
10600	10592.5	2.42	-0.68
11200	11220.2	2.57	-0.64
11800	11885.0	2.60	-0.63
12500	12589.3	2.74	-0.59
13200	13335.2	2.19	-0.68
14000	14125.4	1.76	-0.91
15000	14962.4	1.23	-1.49
16000	15848.9	0.94	-2.09
17000	16788.0	0.21	-3.08
18000	17782.8	-1.07	-4.21
19000	18836.5	-2.41	-5.81
20000	19952.6	-3.59	-6.49
21200	21134.9	-5.32	-7.49
22400	22387.2	-7.15	-9.06

A.5 Directional Responses

Directional responses for plane progressive sinusoidal sound waves normalised to the response in the reference direction, including sensitivity variations.

Table A.11 Weatherproof Microphone Unit Type 4184-A is not specified without windscreen

Table A.12 Weatherproof Microphone Unit Type 4184-A is not specified without windscreen

Table A.13 Weatherproof Microphone Unit Type 4184-A is not specified without windscreen

Table A.14 Weatherproof Microphone Unit Type 4184-A is not specified without windscreen

Table A.15 Weatherproof Microphone Unit Type 4184-A cannot be mounted directly on the analyzer

Table A.16 Weatherproof Microphone Unit Type 4184-A cannot be mounted directly on the analyzer

- Table A.17** *Weatherproof Microphone Unit Type 4184-A cannot be mounted directly on the analyzer*
- Table A.18** *Weatherproof Microphone Unit Type 4184-A cannot be mounted directly on the analyzer*
- Table A.19** *Weatherproof Microphone Unit Type 4184-A cannot be mounted directly on the analyzer*
- Table A.20** *Weatherproof Microphone Unit Type 4184-A cannot be mounted directly on the analyzer*
- Table A.21** *Weatherproof Microphone Unit Type 4184-A cannot be mounted directly on the analyzer*
- Table A.22** *Weatherproof Microphone Unit Type 4184-A cannot be mounted directly on the analyzer*
- Table A.23** *Weatherproof Microphone Unit Type 4184-A cannot be mounted directly on the analyzer*
- Table A.24** *Weatherproof Microphone Unit Type 4184-A cannot be mounted directly on the analyzer*
- Table A.25** *Weatherproof Microphone Unit Type 4184-A cannot be mounted directly on the analyzer*
- Table A.26** *Weatherproof Microphone Unit Type 4184-A cannot be mounted directly on the analyzer*
- Table A.27** *Weatherproof Microphone Unit Type 4184-A cannot be mounted directly on the analyzer*
- Table A.28** *Windscreen is an integral part of Weatherproof Microphone Unit Type 4184-A*
- Table A.29** *Windscreen is an integral part of Weatherproof Microphone Unit Type 4184-A*
- Table A.30** *Windscreen is an integral part of Weatherproof Microphone Unit Type 4184-A*

Table A.31 Directional response for Weatherproof Microphone Unit Type 4184-A with the Microphone Preamplifier connected to a microphone extension cable. The sound incidence angles are for 4184-A 0° (Top)'s reference direction. For 4184-A 90° (Side) subtract 90° degrees from the angles in the table to get the sound incidence angle. 500 Hz – 3550 Hz, in dB

Angle	Frequency											
	500 Hz	630 Hz	800 Hz	1000 Hz	1250 Hz	1600 Hz	2000 Hz	2240 Hz	2500 Hz	2800 Hz	3150 Hz	3550 Hz
0°	-0.03	-0.01	-0.02	-0.01	-0.01	-0.01	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
5°	-0.02	0.00	0.01	-0.02	-0.04	-0.02	-0.03	-0.04	-0.02	-0.03	-0.04	-0.05
10°	-0.01	-0.01	0.03	-0.02	-0.05	-0.03	-0.04	-0.05	-0.05	-0.06	-0.06	-0.08
15°	-0.10	-0.01	0.02	-0.06	-0.05	-0.05	-0.06	-0.08	-0.09	-0.08	-0.12	-0.11
20°	-0.01	-0.03	-0.02	-0.06	-0.07	-0.06	-0.07	-0.12	-0.13	-0.12	-0.19	-0.22
25°	-0.07	-0.01	0.02	-0.08	-0.10	-0.08	-0.10	-0.19	-0.19	-0.18	-0.24	-0.27
30°	0.03	0.01	0.00	-0.07	-0.07	-0.10	-0.10	-0.21	-0.25	-0.22	-0.26	-0.33
35°	-0.07	-0.05	0.01	-0.08	-0.08	-0.12	-0.12	-0.25	-0.31	-0.28	-0.29	-0.48
40°	-0.03	-0.03	0.02	-0.06	-0.11	-0.15	-0.10	-0.30	-0.36	-0.38	-0.29	-0.61
45°	-0.16	-0.09	0.04	-0.08	-0.13	-0.19	-0.09	-0.36	-0.42	-0.50	-0.33	-0.75
50°	0.01	0.00	0.02	-0.06	-0.15	-0.20	-0.05	-0.38	-0.45	-0.55	-0.32	-0.76
55°	-0.06	-0.04	0.03	-0.04	-0.21	-0.20	-0.04	-0.36	-0.48	-0.62	-0.42	-0.72
60°	0.06	0.02	0.02	-0.04	-0.25	-0.23	-0.08	-0.30	-0.53	-0.64	-0.50	-0.64
65°	-0.04	-0.06	-0.03	-0.05	-0.27	-0.27	-0.14	-0.23	-0.56	-0.63	-0.60	-0.72
70°	-0.09	-0.10	-0.03	-0.02	-0.23	-0.31	-0.18	-0.23	-0.46	-0.64	-0.62	-0.75
75°	-0.10	-0.10	0.01	-0.03	-0.23	-0.37	-0.20	-0.31	-0.36	-0.68	-0.53	-0.88
80°	-0.06	-0.06	0.00	0.01	-0.20	-0.37	-0.19	-0.38	-0.34	-0.60	-0.53	-0.98
85°	-0.13	-0.12	-0.03	-0.03	-0.22	-0.36	-0.24	-0.41	-0.47	-0.48	-0.61	-0.82
90°	-0.07	-0.12	0.00	-0.05	-0.18	-0.37	-0.33	-0.40	-0.59	-0.53	-0.50	-0.93
95°	-0.19	-0.16	-0.01	-0.02	-0.17	-0.35	-0.34	-0.52	-0.56	-0.78	-0.51	-0.93
100°	-0.08	-0.11	-0.06	-0.02	-0.21	-0.24	-0.28	-0.57	-0.62	-0.83	-0.70	-0.91
105°	-0.10	-0.20	-0.11	-0.02	-0.17	-0.21	-0.29	-0.47	-0.79	-0.84	-1.00	-1.11
110°	-0.17	-0.17	-0.14	-0.08	-0.12	-0.26	-0.18	-0.50	-0.65	-1.08	-0.94	-1.53
115°	-0.10	-0.16	-0.12	-0.14	-0.08	-0.25	-0.05	-0.36	-0.66	-0.90	-1.20	-1.36
120°	-0.12	-0.15	-0.10	-0.13	-0.15	-0.12	-0.11	-0.23	-0.49	-0.92	-0.92	-1.55
125°	-0.15	-0.16	-0.12	-0.14	-0.24	-0.10	-0.05	-0.33	-0.41	-0.66	-0.97	-1.24
130°	-0.15	-0.13	-0.08	-0.09	-0.21	-0.21	0.09	-0.16	-0.47	-0.63	-0.57	-1.16
135°	-0.32	-0.25	-0.12	-0.08	-0.17	-0.30	-0.07	-0.13	-0.22	-0.64	-0.74	-0.78
140°	-0.24	-0.20	-0.16	-0.10	-0.12	-0.18	-0.15	-0.32	-0.32	-0.34	-0.33	-0.83
145°	-0.23	-0.27	-0.20	-0.16	-0.18	-0.13	-0.03	-0.29	-0.52	-0.71	-0.45	-0.33
150°	-0.19	-0.22	-0.21	-0.20	-0.29	-0.22	0.02	-0.12	-0.28	-0.53	-0.64	-0.82
155°	-0.25	-0.24	-0.17	-0.20	-0.30	-0.34	-0.14	-0.24	-0.29	-0.30	-0.18	-0.33
160°	-0.18	-0.16	-0.13	-0.17	-0.25	-0.36	-0.24	-0.44	-0.56	-0.64	-0.41	-0.35
165°	-0.20	-0.20	-0.12	-0.10	-0.13	-0.24	-0.12	-0.32	-0.50	-0.69	-0.58	-0.72
170°	-0.19	-0.21	-0.09	-0.06	-0.04	-0.08	0.10	-0.06	-0.19	-0.32	-0.20	-0.33
175°	-0.21	-0.17	-0.05	-0.02	0.03	0.01	0.26	0.16	0.10	0.06	0.26	0.28
180°	-0.11	-0.17	-0.09	-0.01	0.05	0.07	0.34	0.26	0.22	0.22	0.46	0.54
185°	-0.29	-0.23	-0.08	0.00	0.02	0.02	0.28	0.17	0.13	0.09	0.29	0.32
190°	-0.20	-0.18	-0.07	-0.05	-0.05	-0.10	0.09	-0.06	-0.16	-0.29	-0.16	-0.25
195°	-0.19	-0.19	-0.11	-0.15	-0.15	-0.25	-0.13	-0.32	-0.49	-0.66	-0.56	-0.72
200°	-0.22	-0.21	-0.15	-0.20	-0.28	-0.37	-0.26	-0.43	-0.54	-0.62	-0.39	-0.36
205°	-0.24	-0.26	-0.20	-0.21	-0.31	-0.36	-0.15	-0.23	-0.30	-0.30	-0.19	-0.34
210°	-0.28	-0.27	-0.21	-0.23	-0.30	-0.21	0.01	-0.11	-0.26	-0.49	-0.58	-0.82
215°	-0.25	-0.29	-0.23	-0.19	-0.21	-0.16	-0.06	-0.30	-0.50	-0.69	-0.42	-0.32
220°	-0.35	-0.29	-0.19	-0.14	-0.17	-0.22	-0.19	-0.34	-0.34	-0.32	-0.28	-0.75
225°	-0.25	-0.21	-0.13	-0.12	-0.19	-0.33	-0.08	-0.10	-0.21	-0.56	-0.66	-0.75
230°	-0.23	-0.21	-0.13	-0.15	-0.27	-0.29	0.05	-0.15	-0.45	-0.62	-0.49	-1.08
235°	-0.16	-0.20	-0.15	-0.17	-0.28	-0.16	-0.09	-0.32	-0.38	-0.58	-0.90	-1.11
240°	-0.16	-0.15	-0.12	-0.18	-0.20	-0.16	-0.16	-0.26	-0.45	-0.87	-0.77	-1.51
245°	-0.15	-0.19	-0.16	-0.17	-0.14	-0.27	-0.10	-0.35	-0.64	-0.80	-1.05	-1.13
250°	-0.18	-0.20	-0.18	-0.13	-0.16	-0.30	-0.20	-0.49	-0.60	-0.99	-0.73	-1.25
255°	-0.08	-0.16	-0.15	-0.07	-0.21	-0.25	-0.32	-0.46	-0.73	-0.76	-0.82	-0.86
260°	-0.17	-0.22	-0.14	-0.08	-0.24	-0.28	-0.30	-0.56	-0.61	-0.73	-0.58	-0.72
265°	-0.22	-0.18	-0.07	-0.08	-0.21	-0.38	-0.35	-0.54	-0.50	-0.74	-0.40	-0.69
270°	-0.07	-0.14	-0.11	-0.08	-0.18	-0.40	-0.38	-0.41	-0.61	-0.50	-0.37	-0.83
275°	-0.09	-0.09	-0.09	-0.09	-0.24	-0.43	-0.27	-0.44	-0.50	-0.46	-0.54	-0.65
280°	-0.09	-0.12	-0.03	-0.06	-0.26	-0.43	-0.22	-0.41	-0.34	-0.56	-0.47	-0.76
285°	-0.14	-0.10	0.00	-0.07	-0.25	-0.39	-0.21	-0.33	-0.33	-0.67	-0.44	-0.75
290°	-0.06	-0.08	0.00	-0.01	-0.25	-0.31	-0.18	-0.22	-0.44	-0.62	-0.51	-0.67
295°	-0.08	-0.07	0.00	-0.05	-0.26	-0.26	-0.15	-0.23	-0.55	-0.58	-0.54	-0.65
300°	-0.01	-0.04	0.02	-0.02	-0.22	-0.22	-0.05	-0.26	-0.52	-0.57	-0.45	-0.57
305°	-0.06	0.00	0.06	-0.04	-0.19	-0.18	-0.02	-0.32	-0.45	-0.54	-0.37	-0.60
310°	0.00	-0.04	0.01	-0.02	-0.15	-0.17	-0.03	-0.34	-0.39	-0.51	-0.28	-0.63
315°	-0.03	-0.01	0.06	-0.04	-0.10	-0.16	-0.03	-0.29	-0.34	-0.41	-0.21	-0.60
320°	-0.08	-0.02	0.07	-0.04	-0.09	-0.13	-0.05	-0.22	-0.30	-0.30	-0.19	-0.49
325°	0.04	0.02	0.02	-0.05	-0.06	-0.09	-0.07	-0.20	-0.23	-0.20	-0.15	-0.35
330°	-0.04	-0.02	0.05	-0.02	-0.04	-0.07	-0.07	-0.15	-0.17	-0.16	-0.14	-0.21
335°	0.08	0.04	0.04	-0.03	-0.02	-0.04	-0.04	-0.11	-0.11	-0.09	-0.13	-0.11
340°	0.03	0.02	0.03	0.01	-0.01	-0.01	-0.01	-0.05	-0.04	-0.02	-0.08	-0.05
345°	-0.02	0.01	0.04	0.01	-0.02	0.00	-0.02	-0.04	-0.03	0.00	-0.05	-0.02
350°	0.01	0.01	0.06	0.02	0.02	0.02	0.03	0.01	0.01	0.03	0.01	0.00
355°	0.05	0.01	0.01	0.00	-0.01	0.00	0.01	-0.01	0.02	0.00	0.01	0.00

Table A.32 Directional response for Weatherproof Microphone Unit Type 4184-A with the Microphone Preamplifier connected to a microphone extension cable. The sound incidence angles are for 4184-A 0° (Top)'s reference direction. For 4184-A 90° (Side) subtract 90° degrees from the angles in the table to get the sound incidence angle. 4000 Hz – 10600 Hz, in dB

Angle	Frequency											
	4000 Hz	4500 Hz	5000 Hz	5600 Hz	6300 Hz	7100 Hz	8000 Hz	8500 Hz	9000 Hz	9500 Hz	10000 Hz	10600 Hz
0°	-0.01	-0.01	0.01	-0.01	-0.03	0.00	-0.03	-0.03	-0.03	-0.04	-0.03	-0.02
5°	-0.03	-0.06	-0.03	-0.06	-0.10	-0.12	-0.10	-0.18	-0.12	-0.22	-0.18	-0.15
10°	-0.08	-0.05	-0.02	-0.15	-0.34	-0.25	-0.32	-0.49	-0.40	-0.59	-0.59	-0.59
15°	-0.15	-0.12	-0.04	-0.23	-0.68	-0.42	-0.63	-0.92	-0.70	-0.99	-1.13	-1.19
20°	-0.20	-0.26	-0.11	-0.28	-1.06	-0.64	-1.04	-1.35	-0.94	-1.23	-1.55	-1.89
25°	-0.38	-0.48	-0.30	-0.28	-1.22	-0.93	-1.42	-1.60	-1.19	-1.31	-1.64	-1.84
30°	-0.61	-0.82	-0.68	-0.60	-1.04	-1.52	-1.61	-1.73	-1.60	-1.64	-1.88	-1.52
35°	-0.86	-1.19	-1.16	-1.27	-1.00	-1.93	-1.53	-1.87	-1.82	-1.79	-1.97	-2.00
40°	-1.01	-1.27	-1.22	-1.69	-1.56	-1.52	-1.81	-2.12	-1.63	-1.56	-1.54	-1.70
45°	-1.07	-1.21	-0.99	-1.29	-1.84	-1.70	-1.89	-1.91	-1.51	-1.76	-1.90	-2.06
50°	-1.04	-1.28	-1.14	-1.11	-1.32	-1.75	-1.43	-1.91	-1.86	-1.74	-1.93	-1.96
55°	-1.12	-1.56	-1.63	-1.81	-1.74	-1.26	-2.09	-2.03	-1.71	-1.94	-2.32	-2.53
60°	-1.24	-1.68	-1.51	-1.66	-1.91	-2.00	-1.60	-2.29	-2.26	-2.34	-2.53	-2.87
65°	-1.25	-1.66	-1.52	-1.68	-1.57	-1.43	-1.89	-2.05	-2.07	-2.46	-3.08	-3.02
70°	-1.18	-1.64	-1.84	-2.09	-2.32	-2.23	-1.74	-2.32	-2.20	-2.38	-2.76	-3.19
75°	-1.22	-1.80	-1.87	-1.92	-1.82	-1.42	-1.73	-2.09	-2.40	-2.67	-2.88	-2.77
80°	-1.29	-1.65	-1.81	-2.21	-2.32	-2.33	-2.26	-2.15	-2.28	-2.76	-2.97	-2.82
85°	-1.45	-1.82	-2.07	-2.31	-2.15	-1.77	-1.66	-2.77	-1.99	-2.70	-3.02	-2.78
90°	-1.57	-2.02	-1.95	-2.08	-2.33	-1.92	-2.18	-2.28	-2.47	-2.06	-3.04	-2.73
95°	-1.33	-2.11	-2.05	-2.03	-2.03	-1.98	-2.31	-2.14	-2.50	-2.05	-2.68	-2.77
100°	-1.59	-1.82	-2.14	-2.05	-2.21	-1.84	-1.90	-2.58	-2.00	-2.57	-2.33	-2.95
105°	-1.49	-2.05	-1.93	-2.33	-2.27	-2.02	-2.04	-2.20	-2.04	-2.54	-2.18	-3.15
110°	-1.59	-1.79	-1.99	-1.98	-2.29	-1.95	-1.88	-1.93	-2.01	-2.10	-2.39	-3.06
115°	-2.09	-2.04	-1.65	-2.02	-1.97	-1.93	-1.81	-2.27	-1.79	-1.78	-2.21	-2.45
120°	-1.87	-2.39	-2.07	-1.64	-1.97	-1.64	-2.02	-2.17	-1.96	-1.85	-2.17	-2.12
125°	-2.04	-2.31	-2.51	-2.27	-1.83	-1.70	-1.56	-1.99	-2.04	-1.95	-2.31	-2.42
130°	-1.59	-2.11	-2.60	-2.42	-2.30	-2.18	-1.57	-2.09	-1.46	-1.45	-2.22	-2.37
135°	-1.39	-1.99	-1.88	-2.90	-2.42	-2.51	-2.61	-2.09	-1.57	-1.99	-2.22	-2.32
140°	-1.28	-1.35	-1.76	-2.17	-2.30	-2.87	-2.48	-2.87	-2.39	-2.51	-2.62	-2.50
145°	-0.69	-1.47	-1.69	-1.28	-1.95	-2.11	-2.50	-2.82	-2.56	-2.78	-3.07	-2.95
150°	-0.98	-0.79	-0.73	-1.50	-2.12	-1.37	-1.74	-2.70	-2.55	-2.53	-2.79	-3.16
155°	-0.86	-1.26	-1.29	-1.04	-0.78	-1.07	-2.19	-2.34	-2.02	-2.20	-2.23	-2.28
160°	-0.49	-0.54	-0.43	-0.59	-1.16	-1.41	-1.23	-1.41	-1.20	-1.17	-1.63	-2.25
165°	-0.99	-1.23	-1.00	-0.63	-0.42	-0.20	-0.25	-0.75	-0.94	-1.27	-1.75	-1.85
170°	-0.63	-1.06	-1.18	-1.29	-1.70	-1.79	-1.91	-2.30	-2.06	-2.26	-2.33	-2.23
175°	0.14	-0.09	-0.02	0.01	-0.27	-0.42	-0.64	-1.14	-1.30	-1.53	-2.13	-2.48
180°	0.46	0.33	0.54	0.66	0.55	0.63	0.57	0.31	0.20	0.12	-0.36	-0.59
185°	0.15	-0.05	0.03	0.02	-0.27	-0.44	-0.70	-1.13	-1.29	-1.66	-2.31	-2.72
190°	-0.59	-0.95	-1.11	-1.26	-1.68	-1.85	-1.89	-2.34	-2.34	-2.62	-2.69	-2.64
195°	-1.01	-1.27	-1.09	-0.75	-0.58	-0.48	-0.67	-1.28	-1.47	-1.84	-2.27	-2.29
200°	-0.52	-0.60	-0.53	-0.76	-1.40	-1.76	-1.55	-1.63	-1.41	-1.50	-2.01	-2.41
205°	-0.84	-1.29	-1.36	-1.09	-0.79	-1.15	-2.28	-2.58	-2.26	-2.25	-2.42	-2.58
210°	-0.92	-0.77	-0.64	-1.43	-2.14	-1.56	-1.94	-2.79	-2.70	-2.86	-3.03	-3.21
215°	-0.67	-1.42	-1.70	-1.33	-2.07	-2.26	-2.76	-3.20	-2.73	-2.86	-3.26	-3.02
220°	-1.21	-1.31	-1.73	-2.22	-2.33	-3.10	-2.72	-3.04	-2.42	-2.55	-2.75	-2.57
225°	-1.26	-1.94	-1.75	-2.95	-2.58	-2.58	-2.75	-2.33	-1.61	-1.81	-2.08	-2.30
230°	-1.57	-1.97	-2.55	-2.46	-2.45	-2.34	-1.68	-2.08	-1.68	-1.39	-2.26	-2.59
235°	-1.90	-2.18	-2.46	-2.33	-2.00	-1.79	-1.63	-1.75	-2.00	-2.04	-2.42	-2.89
240°	-1.72	-2.31	-2.03	-1.64	-2.09	-1.80	-1.96	-2.32	-2.05	-2.03	-2.40	-2.46
245°	-1.92	-1.86	-1.55	-2.03	-2.04	-2.03	-1.92	-2.02	-1.88	-1.74	-2.23	-2.82
250°	-1.43	-1.58	-1.91	-2.00	-2.39	-2.19	-1.94	-1.63	-1.72	-2.15	-2.51	-3.62
255°	-1.21	-1.87	-1.90	-2.37	-2.41	-2.08	-1.83	-2.11	-1.84	-2.53	-2.64	-3.50
260°	-1.37	-1.57	-1.99	-2.32	-2.31	-1.94	-1.95	-2.20	-2.28	-2.43	-3.19	-3.06
265°	-1.06	-1.76	-1.92	-2.03	-2.28	-2.23	-2.35	-1.88	-2.48	-2.07	-3.29	-3.11
270°	-1.26	-1.72	-1.76	-2.19	-2.43	-1.95	-1.83	-2.41	-1.86	-2.34	-3.28	-3.29
275°	-1.20	-1.57	-1.78	-2.09	-2.38	-2.33	-1.84	-2.33	-1.86	-2.74	-3.00	-2.97
280°	-1.11	-1.34	-1.64	-2.15	-2.37	-2.53	-2.34	-1.96	-2.34	-2.43	-2.71	-3.20
285°	-1.05	-1.50	-1.58	-1.85	-2.08	-1.77	-1.74	-2.39	-2.13	-2.14	-2.71	-3.25
290°	-0.92	-1.44	-1.61	-1.88	-2.22	-2.33	-2.18	-2.29	-1.88	-2.19	-2.90	-3.17
295°	-1.13	-1.45	-1.44	-1.77	-1.85	-1.65	-1.86	-2.01	-2.17	-2.57	-2.84	-2.98
300°	-1.12	-1.54	-1.33	-1.52	-1.81	-2.19	-1.83	-2.49	-2.30	-2.24	-2.60	-3.06
305°	-1.04	-1.53	-1.59	-1.96	-2.14	-1.63	-2.07	-1.98	-1.91	-2.26	-2.48	-2.59
310°	-0.96	-1.22	-1.22	-1.32	-1.57	-1.92	-1.86	-2.41	-2.18	-2.12	-2.52	-2.43
315°	-0.88	-1.03	-0.88	-1.26	-1.93	-2.01	-2.03	-2.12	-1.99	-2.38	-2.39	-2.32
320°	-0.89	-1.12	-1.11	-1.69	-1.79	-1.60	-2.23	-2.59	-2.23	-2.42	-2.34	-2.34
325°	-0.67	-1.04	-1.07	-1.36	-1.10	-1.89	-1.79	-2.40	-2.52	-2.56	-2.71	-2.83
330°	-0.45	-0.70	-0.61	-0.57	-0.94	-1.35	-1.62	-2.00	-2.18	-2.34	-2.60	-2.27
335°	-0.21	-0.34	-0.15	-0.15	-1.03	-0.67	-1.32	-1.63	-1.39	-1.59	-1.93	-2.10
340°	-0.07	-0.11	0.04	-0.10	-0.85	-0.30	-0.92	-1.30	-0.93	-1.24	-1.54	-1.85
345°	-0.03	-0.03	0.06	-0.12	-0.51	-0.18	-0.50	-0.87	-0.62	-0.91	-1.00	-1.05
350°	0.03	0.02	0.05	-0.05	-0.21	-0.05	-0.16	-0.39	-0.30	-0.44	-0.38	-0.33
355°	-0.03	-0.02	-0.03	-0.06	-0.07	-0.02	-0.06	-0.14	-0.11	-0.14	-0.11	-0.07

Table A.33 Directional response for Weatherproof Microphone Unit Type 4184-A with the Microphone Preamplifier connected to a microphone extension cable. The sound incidence angles are for 4184-A 0° (Top)'s reference direction. For 4184-A 90° (Side) subtract 90° degrees from the angles in the table to get the sound incidence angle. 11200 Hz – 20000 Hz, in dB

Angle	Frequency										
	11200 Hz	11800 Hz	12500 Hz	13200 Hz	14000 Hz	15000 Hz	16000 Hz	17000 Hz	18000 Hz	19000 Hz	20000 Hz
0°	0.00	-0.01	0.00	0.00	0.01	0.02	-0.01	-0.02	0.00	0.01	0.02
5°	-0.09	-0.16	-0.12	-0.07	-0.15	-0.17	-0.26	-0.30	-0.32	-0.22	-0.16
10°	-0.25	-0.52	-0.53	-0.25	-0.58	-0.70	-0.98	-1.08	-1.10	-0.73	-0.67
15°	-0.51	-0.91	-1.04	-0.41	-1.08	-1.29	-1.51	-1.53	-1.36	-0.74	-0.79
20°	-1.14	-1.24	-1.42	-0.72	-1.33	-1.53	-1.28	-1.46	-1.22	-0.58	-0.72
25°	-1.64	-1.61	-1.29	-1.08	-1.23	-1.05	-1.21	-2.04	-1.85	-1.14	-0.80
30°	-1.15	-1.56	-1.41	-0.67	-1.05	-1.02	-1.68	-1.93	-1.76	-0.99	-0.59
35°	-1.26	-1.24	-1.51	-1.04	-1.13	-1.45	-1.33	-2.17	-2.25	-1.81	-1.30
40°	-1.14	-2.06	-1.70	-1.28	-1.87	-1.64	-1.84	-2.87	-3.27	-2.77	-1.88
45°	-1.52	-1.76	-1.85	-2.03	-2.16	-2.23	-2.21	-2.30	-2.82	-2.92	-2.38
50°	-1.62	-2.19	-2.85	-2.27	-2.65	-2.47	-1.94	-2.80	-3.27	-3.28	-2.30
55°	-2.17	-2.95	-2.74	-2.38	-2.56	-2.74	-2.08	-2.29	-3.13	-3.50	-2.33
60°	-2.64	-3.11	-2.78	-2.24	-2.94	-2.79	-2.00	-2.95	-3.25	-2.75	-2.02
65°	-2.38	-3.01	-2.60	-2.32	-2.99	-3.03	-2.22	-2.68	-3.25	-2.48	-1.92
70°	-2.57	-2.81	-2.71	-2.19	-3.53	-2.83	-2.83	-2.95	-2.68	-2.56	-2.59
75°	-2.65	-2.87	-2.53	-2.62	-2.90	-3.37	-2.50	-2.62	-3.17	-2.48	-2.24
80°	-2.30	-2.68	-2.68	-2.35	-3.02	-2.50	-3.07	-2.96	-3.51	-2.52	-1.78
85°	-2.28	-2.84	-2.90	-2.39	-2.38	-2.89	-2.81	-3.74	-3.33	-3.14	-2.24
90°	-2.20	-2.83	-2.99	-2.20	-2.73	-2.66	-2.86	-3.63	-3.33	-3.39	-2.24
95°	-2.28	-2.71	-2.45	-2.10	-2.49	-2.62	-3.00	-3.39	-4.17	-3.32	-3.03
100°	-1.83	-2.82	-2.61	-2.13	-2.55	-2.91	-2.92	-3.33	-3.48	-3.11	-3.04
105°	-1.98	-2.85	-2.16	-2.08	-2.80	-2.51	-2.72	-3.50	-3.55	-3.27	-2.71
110°	-2.05	-2.80	-2.28	-2.29	-2.54	-2.67	-3.03	-2.85	-3.78	-3.26	-3.16
115°	-2.14	-3.16	-2.32	-2.49	-2.55	-2.65	-2.49	-3.35	-3.69	-2.31	-2.43
120°	-1.94	-2.39	-2.40	-3.20	-2.59	-2.71	-2.40	-3.00	-2.82	-3.07	-2.59
125°	-1.83	-2.21	-2.10	-2.39	-2.94	-2.98	-2.45	-3.53	-3.84	-2.53	-1.61
130°	-1.86	-2.63	-2.16	-2.35	-2.21	-2.37	-2.52	-2.99	-3.62	-2.97	-2.44
135°	-1.50	-2.39	-2.68	-2.48	-3.00	-2.64	-2.25	-2.56	-2.69	-3.07	-2.17
140°	-1.94	-2.48	-2.56	-2.21	-2.60	-3.14	-3.04	-2.74	-2.63	-2.27	-1.69
145°	-2.66	-3.16	-2.98	-2.51	-3.12	-3.07	-3.00	-3.49	-3.67	-2.83	-2.15
150°	-2.70	-2.99	-3.09	-3.04	-3.38	-3.29	-3.24	-3.09	-4.13	-3.64	-3.19
155°	-2.34	-3.07	-2.96	-2.86	-3.19	-3.28	-3.07	-3.14	-3.74	-3.18	-2.77
160°	-2.18	-2.88	-3.06	-2.39	-2.48	-2.65	-2.94	-3.63	-3.55	-2.91	-2.47
165°	-1.97	-2.46	-2.58	-2.35	-2.47	-2.60	-2.85	-3.36	-4.11	-3.68	-2.89
170°	-1.59	-1.84	-1.52	-1.02	-1.39	-1.44	-1.28	-2.21	-2.97	-3.15	-3.40
175°	-2.22	-2.75	-3.41	-3.22	-3.94	-4.80	-4.82	-5.37	-6.19	-6.04	-5.80
180°	-0.11	-0.41	-0.74	-0.48	-0.80	-1.28	-1.50	-1.95	-2.69	-2.70	-2.33
185°	-2.54	-3.10	-3.87	-3.86	-4.55	-5.58	-5.98	-6.52	-7.60	-7.23	-6.93
190°	-1.98	-2.22	-1.91	-1.42	-1.73	-1.87	-1.78	-2.76	-3.52	-3.42	-3.65
195°	-2.50	-2.94	-2.89	-2.69	-2.76	-2.83	-3.19	-3.78	-4.31	-3.69	-2.79
200°	-2.47	-3.18	-3.25	-2.77	-2.93	-3.18	-3.38	-3.78	-3.44	-2.72	-2.41
205°	-2.55	-3.29	-3.14	-2.96	-3.44	-3.35	-3.04	-2.97	-3.64	-3.16	-2.67
210°	-2.88	-3.09	-3.29	-3.03	-3.38	-3.26	-3.30	-3.22	-4.06	-3.74	-2.98
215°	-2.52	-3.13	-2.98	-2.68	-2.91	-3.15	-3.30	-3.82	-3.52	-2.84	-2.32
220°	-1.78	-2.23	-2.61	-2.63	-2.79	-3.70	-3.16	-2.87	-2.85	-2.39	-1.89
225°	-1.72	-2.58	-3.00	-2.98	-3.36	-2.85	-2.21	-2.72	-3.01	-2.63	-1.88
230°	-2.40	-3.27	-2.83	-2.71	-2.40	-2.53	-2.88	-2.70	-3.17	-3.07	-1.90
235°	-2.36	-2.69	-2.50	-2.31	-3.06	-2.68	-2.55	-3.16	-3.63	-2.10	-1.90
240°	-2.19	-2.76	-2.83	-3.18	-2.65	-2.54	-2.40	-2.79	-2.93	-3.02	-2.01
245°	-2.41	-3.92	-2.73	-2.65	-2.21	-2.59	-1.92	-3.10	-3.37	-2.21	-1.90
250°	-2.62	-3.77	-2.52	-2.44	-2.11	-2.73	-3.05	-2.80	-3.38	-2.62	-2.11
255°	-2.47	-3.03	-2.15	-2.23	-2.43	-2.10	-2.33	-3.17	-2.83	-2.49	-2.23
260°	-2.68	-3.22	-2.66	-1.86	-2.30	-3.15	-2.68	-3.14	-3.25	-2.72	-2.65
265°	-3.15	-3.07	-2.50	-1.96	-2.29	-2.08	-2.86	-2.81	-2.95	-2.50	-2.33
270°	-2.73	-3.30	-3.13	-2.15	-2.39	-2.61	-2.56	-3.44	-2.76	-2.42	-1.71
275°	-2.99	-3.55	-2.83	-2.28	-2.35	-2.67	-2.34	-3.00	-2.45	-2.44	-1.42
280°	-3.30	-3.61	-3.08	-2.36	-2.68	-1.99	-2.69	-2.41	-2.85	-1.66	-1.46
285°	-3.21	-3.57	-3.34	-2.72	-2.21	-2.72	-1.92	-2.86	-2.60	-1.77	-1.52
290°	-2.78	-3.67	-3.60	-2.51	-3.23	-2.16	-2.67	-2.02	-2.44	-1.97	-1.43
295°	-2.89	-3.58	-3.23	-2.84	-3.01	-3.17	-2.00	-2.04	-2.69	-2.21	-1.70
300°	-2.73	-3.01	-3.29	-2.45	-3.27	-3.06	-2.42	-2.92	-3.13	-2.26	-1.92
305°	-1.91	-2.93	-2.95	-2.74	-2.72	-3.00	-2.50	-2.54	-3.20	-3.06	-1.83
310°	-1.77	-2.13	-2.34	-2.43	-2.67	-2.57	-2.28	-3.06	-3.51	-3.03	-2.16
315°	-1.90	-1.93	-1.84	-1.84	-2.31	-2.25	-2.41	-2.46	-2.99	-2.78	-2.15
320°	-1.55	-2.14	-2.11	-1.46	-2.12	-1.68	-1.82	-2.94	-3.21	-2.78	-1.72
325°	-2.02	-2.05	-2.22	-1.77	-1.84	-1.99	-1.71	-2.29	-2.23	-1.94	-1.16
330°	-1.77	-2.47	-2.60	-2.04	-2.10	-2.18	-2.56	-2.78	-2.71	-1.80	-1.14
335°	-2.01	-2.48	-2.20	-2.34	-2.28	-1.99	-2.30	-3.24	-3.26	-2.33	-1.68
340°	-1.32	-1.66	-2.03	-1.57	-2.16	-2.38	-2.23	-2.59	-2.78	-2.01	-1.97
345°	-0.46	-1.03	-1.43	-0.73	-1.52	-1.75	-2.06	-2.37	-2.45	-1.83	-1.86
350°	-0.08	-0.46	-0.64	-0.27	-0.69	-0.85	-1.12	-1.50	-1.53	-1.16	-1.25
355°	-0.03	-0.14	-0.18	-0.07	-0.18	-0.26	-0.29	-0.43	-0.43	-0.35	-0.46

Table A.34a 4184-A 0° (Top), sensitivity variations for Weatherproof Microphone Unit Type 4184-A with the Microphone Preamplifier connected to a microphone extension cable, at sound incidence angles within $\pm\theta^\circ$ from the reference direction

Nominal Frequency Hz	Exact Frequency (6 digits) Hz	Max Variation $\pm 30^\circ$ dB	Max Variation $\pm 90^\circ$ dB	Max Variation $\pm 150^\circ$ dB
500 Hz	501.187 Hz	0.17	0.23	0.42
630 Hz	630.958 Hz	0.07	0.18	0.33
800 Hz	794.328 Hz	0.08	0.18	0.30
1000 Hz	1000 Hz	0.10	0.12	0.25
1250 Hz	1258.93 Hz	0.12	0.29	0.32
1600 Hz	1584.89 Hz	0.12	0.46	0.46
2000 Hz	1995.26 Hz	0.13	0.41	0.46
2240 Hz	2238.72 Hz	0.22	0.45	0.59
2500 Hz	2511.89 Hz	0.27	0.63	0.81
2800 Hz	2818.38 Hz	0.25	0.71	1.11
3150 Hz	3162.28 Hz	0.28	0.64	1.22
3550 Hz	3548.13 Hz	0.35	1.00	1.57
4000 Hz	3981.07 Hz	0.64	1.59	2.11
4500 Hz	4466.84 Hz	0.84	2.04	2.41
5000 Hz	5011.87 Hz	0.75	2.13	2.66
5600 Hz	5623.41 Hz	0.60	2.31	2.96
6300 Hz	6309.58 Hz	1.24	2.46	2.61
7100 Hz	7079.46 Hz	1.52	2.53	3.10
8000 Hz	7943.28 Hz	1.64	2.37	2.79
8500 Hz	8413.95 Hz	2.03	2.80	3.23
9000 Hz	8912.51 Hz	2.21	2.55	2.76
9500 Hz	9440.61 Hz	2.38	2.80	2.91
10000 Hz	10000 Hz	2.63	3.30	3.32
10600 Hz	10592.5 Hz	2.29	3.31	3.64
11200 Hz	11220.2 Hz	2.01	3.31	3.31
11800 Hz	11885.0 Hz	2.49	3.68	3.93
12500 Hz	12589.2 Hz	2.60	3.60	3.60
13200 Hz	13335.2 Hz	2.34	2.84	3.21
14000 Hz	14125.4 Hz	2.29	3.54	3.54
15000 Hz	14962.4 Hz	2.40	3.39	3.73
16000 Hz	15848.9 Hz	2.57	3.08	3.31
17000 Hz	16788.0 Hz	3.26	3.76	3.84
18000 Hz	17782.8 Hz	3.26	3.51	4.18
19000 Hz	18836.5 Hz	2.35	3.52	3.75
20000 Hz	19952.6 Hz	2.00	2.61	3.21

Table A.34b 4184-A 90° (Side), sensitivity variations for Weatherproof Microphone Unit Type 4184-A with the Microphone Preamplifier connected to a microphone extension cable, at sound incidence angles within $\pm\theta^\circ$ from the reference direction

Nominal Frequency Hz	Exact Frequency (6 digits) Hz	Max Variation $\pm 30^\circ$ dB	Max Variation $\pm 90^\circ$ dB	Max Variation $\pm 150^\circ$ dB
500 Hz	501.187 Hz	0.26	0.42	0.42
630 Hz	630.958 Hz	0.22	0.33	0.33
800 Hz	794.328 Hz	0.16	0.30	0.30
1000 Hz	1000 Hz	0.14	0.25	0.25
1250 Hz	1258.93 Hz	0.20	0.35	0.35
1600 Hz	1584.89 Hz	0.25	0.50	0.50
2000 Hz	1995.26 Hz	0.29	0.72	0.72
2240 Hz	2238.72 Hz	0.34	0.83	0.83
2500 Hz	2511.89 Hz	0.45	1.01	1.01
2800 Hz	2818.38 Hz	0.60	1.31	1.31
3150 Hz	3162.28 Hz	0.70	1.66	1.66
3550 Hz	3548.13 Hz	0.91	2.08	2.08
4000 Hz	3981.07 Hz	0.91	2.55	2.55
4500 Hz	4466.84 Hz	0.75	2.72	2.72
5000 Hz	5011.87 Hz	0.62	3.14	3.14
5600 Hz	5623.41 Hz	0.69	3.61	3.61
6300 Hz	6309.58 Hz	0.75	3.13	3.13
7100 Hz	7079.46 Hz	0.91	3.73	3.73
8000 Hz	7943.28 Hz	0.71	3.33	3.33
8500 Hz	8413.95 Hz	0.84	3.51	3.51
9000 Hz	8912.51 Hz	0.72	2.93	2.93
9500 Hz	9440.61 Hz	0.98	2.98	2.98
10000 Hz	10000 Hz	0.91	3.32	3.32
10600 Hz	10592.5 Hz	1.08	3.64	3.64
11200 Hz	11220.2 Hz	0.82	3.31	3.31
11800 Hz	11885.0 Hz	0.77	3.93	3.93
12500 Hz	12589.2 Hz	0.84	3.88	3.88
13200 Hz	13335.2 Hz	1.12	3.86	3.86
14000 Hz	14125.4 Hz	1.15	4.56	4.56
15000 Hz	14962.4 Hz	0.87	5.60	5.60
16000 Hz	15848.9 Hz	1.07	5.99	5.99
17000 Hz	16788.0 Hz	1.12	6.55	6.55
18000 Hz	17782.8 Hz	1.49	7.60	7.60
19000 Hz	18836.5 Hz	1.07	7.24	7.24
20000 Hz	19952.6 Hz	1.37	6.95	6.95

Table A.35 Weatherproof Microphone Unit Type 4184-A cannot be mounted directly on the analyzer

Table A.36 Weatherproof Microphone Unit Type 4184-A cannot be mounted directly on the analyzer

Table A.37 Weatherproof Microphone Unit Type 4184-A cannot be mounted directly on the analyzer

Table A.38 Weatherproof Microphone Unit Type 4184-A cannot be mounted directly on the analyzer

Table A.39 Weatherproof Microphone Unit Type 4184-A cannot be mounted directly on the analyzer

Table A.40 Weatherproof Microphone Unit Type 4184-A cannot be mounted directly on the analyzer

Table A.41 Weatherproof Microphone Unit Type 4184-A cannot be mounted directly on the analyzer

Table A.42 Weatherproof Microphone Unit Type 4184-A is not specified together with Outdoor Microphone Kit UA-1404

Table A.43 Weatherproof Microphone Unit Type 4184-A is not specified together with Outdoor Microphone Kit UA-1404

Table A.44 *Weatherproof Microphone Unit Type 4184-A is not specified together with Outdoor Microphone Kit UA-1404*

Table A.45 *Weatherproof Microphone Unit Type 4184-A is not specified together with Outdoor Microphone Kit UA-1404*

Table A.46 *Weatherproof Microphone Unit Type 4184-A is not specified together with Outdoor Microphone Kit UA-1404*

Table A.47 *Weatherproof Microphone Unit Type 4184-A is not specified together with Outdoor Microphone Kit UA-1404*

Table A.48 *Weatherproof Microphone Unit Type 4184-A is not specified together with Outdoor Microphone Kit UA-1404*

A.6 Periodic Testing of Acoustical Frequency Responses

This section gives the adjustment data that must be applied to sound levels displayed in response to the sound pressure produced by Multifunction Acoustic Calibrator Type 4226, in order to obtain the equivalent sound levels that would be displayed under reference environmental conditions in response to plane progressive sinusoidal sound waves incident from the reference direction. See Table A.49 to view the data.

The uncertainty of the corrections in Table A.49 includes a component for inter-sample variability of Weatherproof Microphone Unit Type 4184-A. Due to the construction of the microphone, the inter-sample variability cannot be separated from the adjustment data. The uncertainty is allowed for in the adjustment of Weatherproof Microphone Unit Type 4184-A.

NOTE: that the data in Table A.49 are only valid at the frequencies stated in the table. The data values can **not** be interpolated for other frequency values.

Table A.49 *Acoustical test with Multifunction Acoustic Calibrator Type 4226. Adjustment data that must be applied to the readings of the analyzer in order to obtain equivalent sound levels that would be displayed in response to plane progressive sinusoidal sound waves incident from the reference direction*

Nominal Frequency	Exact Frequency	Correction Data	Expanded	Correction Data	Expanded	Correction Data	Expanded
Hz	(6 digits) Hz	For 4184-A 0° (Top) dB	Uncertainty dB	For 4184-A 90° (Side) dB	Uncertainty dB	for Diffuse Field dB	Uncertainty
31.5	31.6228	0.00	0.05	0.00	0.05	0.00	0.05
63	63.0957	0.00	0.05	0.00	0.05	0.00	0.05
125	125.893	0.00	0.05	0.00	0.05	0.00	0.05
250	251.189	0.00	0.05	0.00	0.05	0.00	0.05
500	501.187	0.10	0.16	-0.09	0.16	-0.01	0.16
1000	1000.00	0.19	0.14	0.07	0.14	0.12	0.15
2000	1995.26	0.36	0.19	-0.06	0.19	0.22	0.21
4000	3981.07	0.75	0.32	-0.71	0.32	-0.40	0.36
8000	7943.28	0.52	0.53	-1.81	0.53	-1.32	0.56
12500	12589.3	1.46	0.76	-1.85	0.76	-1.07	0.78
16000	15848.9	0.80	1.30	-2.38	1.30	-1.65	1.32

Table A.50 *No data are given for Acoustical Test with Electrostatic Actuator UA-0033*

Appendix D

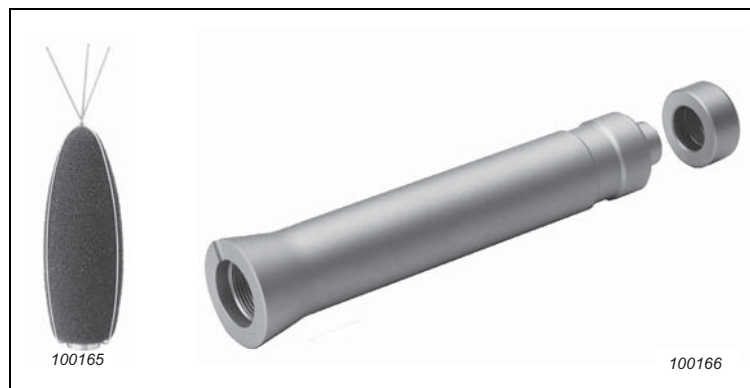
Using Microphone Type 4184-A

D.1 Mount Pistonphone Type 4228 onto Type 4184-A

Weatherproof Microphone Unit Type 4184-A should be calibrated with Brüel & Kjær Pistonphone Type 4228, which has a calibration frequency of 251.2 Hz and a calibration level of approximately 124 dB.

Fig. D.1

Left:
Windscreen
UA-1070 and
Windscreen Holder
UA-1071
Right:
Protection Tube
(Sound Calibrator
Adaptor) UA-1072
and Protection Cap
UA-1073



To mount Pistonphone Type 4228 onto Type 4184-A:

- 1) Unscrew the windscreen and windscreen holder (Fig.D.1 Left).
- 2) Screw on Sound Calibrator Adaptor UA-1072 (protection tube without protection cap; Fig.D.1 Right).
- 3) Insert the sound calibrator adaptor into the pistonphone Type 4228.

NOTE: UA-1072 and the pistonphone must be connected directly without the use of any of the pistonphone's adaptors.

In the Calibration setup of the analyzer's software, select the *Details* tab and set *Calibrator* to *Custom*, insert the Sound Pressure Level obtained from the Calibration Chart of Type 4228 and add the ambient pressure correction in dB, obtained from the barometer supplied with Type 4228.

D.2 Mount Multifunction Acoustic Calibrator Type 4226 onto Type 4184-A

Periodic acoustical frequency response testing using Brüel & Kjær Multifunction Acoustic Calibrator Type 4226 is recommended.

To mount Acoustic Calibrator Type 4226 onto Weatherproof Microphone Unit Type 4184-A using Calibration Adaptor DB-4199:

NOTE:

- Because the Microphone Type 4184-A is partly disassembled during this test, the test should only be performed in a clean environment
- Avoid excessive torque when screwing the tip on to or off of the microphone. Approximately 2.5 cm below the probe termination there are venting holes. These holes weaken the area
- Never place the microphone upside down on equilibrium on the pressure coupler or hold by the coupler

1) Unscrew the windshield and remove it from the microphone unit.

2) Stand the microphone vertically on the tripod (Fig.D.2).

Fig.D.2

*Left:
Attach base to
tripod and run cable
through base, then
screw microphone
to base*

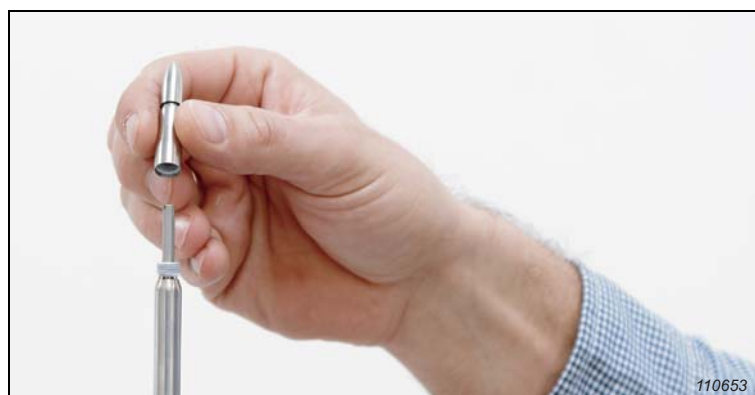
*Right:
Type 4184-A
mounted on tripod*



3) Unscrew the nose tip and remove it (Fig.D.3).

Fig.D.3

*Close-up of
removing the
microphone tip*



- 4) Mount Calibration Adaptor DB-4199:
 - a) Loosen the Acoustic Coupler UA-1231 tightening ring by turning it counter clockwise.
 - b) Place Calibration Adaptor DB-4199 into the coupler.
 - c) Re-tighten the coupler tightening ring by turning it clockwise.
- 5) Insert the microphone probe into the calibration adaptor until the probe tip passes through the adaptor and contacts the stop at the base of the coupler.

NOTE: Do not use excessive force: It is important that the probe is properly seated against the stop at the base. It should be a firm, snug fit.

Fig. D.4
*Weatherproof
Microphone Unit
Type 4184-A and
Calibrator Type 4226
with*
1. Acoustic Coupler
UA-1231
and
2. Calibration
Adaptor DB-4199



NOTE: When reassembling the microphone, the nose tip should be aligned with the rest of the microphone. If the tip is not in line, the microphone should be sent to Brüel & Kjær for repair.

D.3 Mount Electrical Substitute for Microphones on the Built-in Microphone Pre-amplifier

NOTE: Because the Microphone Type 4184-A is partly disassembled during this test, the test should only be performed in a clean environment.

To mount Electrical Substitute for Microphone Cartridge WA-0302:

- 1) Unscrew the base of the Type 4184-A microphone housing using Pin Wrench QA-0178 (Fig.D.5).

Fig.D.5
Base of
Type 4184-A
and pin wrench:
Unscrew counter-
clockwise



- 2) Remove the electronics assembly (consisting of actuator amplifier and pre-amplifier) from the microphone housing by sliding it out (Fig.D.6).

Fig.D.6
Slide the electronics
assembly out of the
microphone housing



- 3) Gently place the electronics assembly (Fig.D.7) on a clean work surface.

Fig.D.7
Electronics
assembly



- 4) Connect Electrical Substitute for Microphone cartridge WA-0302-C to the electrical assembly using Dummy Microphone Holder DB-4237 (Fig.D.8).

Fig. D.8

Left:
Microphone
cartridge
WA-0302.-C,
dummy holder
DB-4237 and
electronics assembly
Right:
Optional UNF-to-
BNC Adaptor
UA-0245



- 5) Place assembly onto the assembly holder, UA-1743 (Fig.D.9).

NOTE: The base of the microphone electronics assembly should be positioned on the side of the holder labelled UA-1743.

Fig. D.9

Left:
Assembly, adapter
and cartridge in
holder UA-1743
Right:
In holder while using
optional UNF-to-
BNC adapter



Index

A		
About This Manual	1	
C		
Calibration	4	
Cartridge Capacitance	7	
Components Included with Type 2250/2270	2	
Conformance Testing	5	
D		
Diffuse-field Frequency Responses	9	
Directional Responses	10	
E		
Expanded Uncertainties of Measurement	10	
Extension Cables	7	
F		
Free-field Frequency Responses	8, 23, 38	
for Diffuse-field Calibrated Instruments	27	
Frequency Responses		
Free-field	23, 38	
Free-field for Diffuse-field Calibrated Instruments	27	
I		
Immunity to Power Magnetic Fields	22	
Indicator Range	19	
Instruction Manual	1	
Introduction	1	
L		
Linear Operating Range	20, 21	
Linearity Range	19	
Lower Limit	18	
M		
Maximum Broadband Self-generated Noise	14	
Maximum Expanded Uncertainties		
of Measurement	10	
Maximum Sound Level	18	
Measurement Range	21	
Measuring at Low Static Pressure	4	
Measuring Ranges	17	
Microphone	7	
Mounting and Placing	3	
Microphone Reference Point	7	
Mounting and Placing the Microphone	3	
Mounting for Acoustical Tests	5	
Mounting for Mechanical Vibration Tests	5	
N		
Nominal Open Circuit Sensitivity	7	
Nominal Preamplifier Attenuation	7	
O		
Open Circuit Sensitivity	17	
Overload Limit	17	
P		
Peak C Range	21	
Primary Indicator Range	18	
Pulse Range	19	
R		
Random-incidence Frequency Responses	9	
Reference Conditions for Acoustic Calibration	7	
Reference Directions of Sound Incidence	7	
Reference Environmental Conditions	7	
Reference Frequency	7	
Reference Sound Pressure Level	7	
S		
Self-generated Noise	13	
Specifications	7	
Standards Requirements	3	
T		
Test Rig	5	
Total Range	18	
Typical Broadband Self-generated Noise	14	
Typical Self-generated Noise Spectrums	15	
U		
Upper Limit	17	
User Manual BE 1713	1	
V		
Vibration	21	
Vibration Sensitivity	21	

HEADQUARTERS: Brüel & Kjær Sound & Vibration Measurement A/S · DK-2850 Nærum · Denmark
Telephone: +45 7741 2000 · Fax: +45 4580 1405 · www.bksv.com · info@bksv.com

Local representatives and service organisations worldwide

