Technical Documentation

Microphone Type 4190
for Hand-held Analyzer
Types 2250, 2250-L and 2270

Supplement to Instruction Manual BE 1712

English BE 1805 – 14

Brüel & Kjær

Microphone Type 4190
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

BE 1805 – 14

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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 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 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 marked with that symbol
- Waste electrical and electronic equipment may be returned to your local Brüel & Kjær representative or to Brüel & Kjær Headquarters for disposal

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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 relevent when Hand-held Analyzer Type 2250, 2250 L or 2270 is configured with Free-field ½″ Condenser Microphone Type 4190.

The combination of Free-field ½″ Condenser Microphone Type 4190 and the hand-held analyzer is intended for general purpose use.

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 Microphone Type 4190. The other hardware components can be found in Instruction Manual BE 1712, section 1.2.4.

Table 1.1
Additional hardware components needed for conformance testing of the analyzers configured with Type 4190

Quantity*	Brüel & Kjær Type/Part Number	Description
1 or 2	Type 4190	Free-field ½" Condenser Microphone

*. Quantity depends on which analyzer is to be tested.

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.

No additional information is required in Chapter 2 when using Microphone Type 4190 together with the analyzer.

Chapter 3

Conformance Testing

3.1 Introduction

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

No additional information is required in Chapter 3 when using Microphone Type 4190 together with the analyzer.

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.

4.5 Microphone

Microphone **Type 4190** and Microphone Preamplifier ZC-0032:

Type: Free-field ½″ Condenser Microphone

Polarization Voltage: 200 V

Nominal Open Circuit Sensitivity: 50 mV/Pa, (corresponding to –26 dB re 1 V/Pa) ± 1.5 dB

Capacitance: 16 pF (at 250 Hz)

Nominal Preamplifier Attenuation: 0.22 dB

Extension Cables between Microphone Preamplifier ZC-0032 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 centre of the front surface of the microphone protection grid.

Reference Direction of Sound Incidence: See the small drawings in the lower right corner of the directional response graphs in section 4.7.

4.6.2 Typical Low-frequency Responses

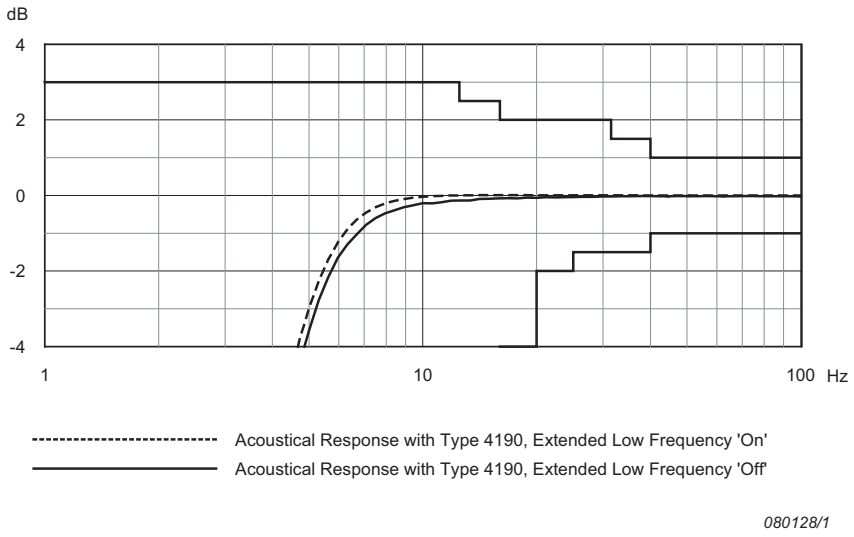
The typical Low-frequency Responses for Z-frequency weighting are given in Fig. 4.2. **For the rear 'Input' socket Electrical Responses refer to section 4.6.2 in the Instruction Manual.** The Acoustical Responses include Microphone Type 4190 and Microphone Preamplifier ZC-0032.

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 in Fig. 4.2 **in the Instruction Manual** because it also includes Microphone Preamplifier ZC-0032.

Fig. 4.2 *Typical low-frequency responses*



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. 4.3 to Fig. 4.8 and Table A.2 to Table A.6. The tables also provide the 'Expanded Uncertainties of Measurement' required by IEC 61672–1, see the start of section 4.6 **in the Instruction Manual**.

Fig. 4.3 *Free-field 0° frequency response for Microphone Type 4190, Microphone Preamplifier ZC-0032 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.2*

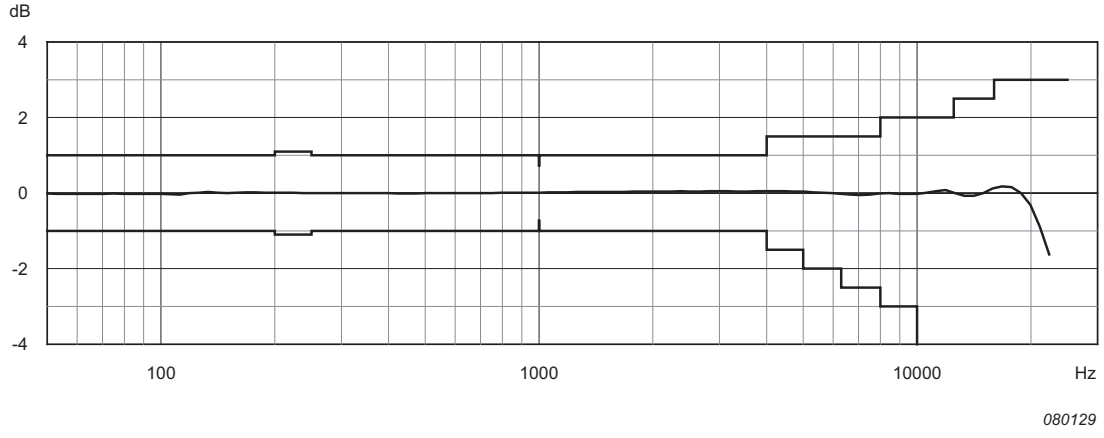


Fig. 4.4 *Influence of the analyzer body on free-field 0° response, corresponds to the "Body Influence" column in Table A.3*

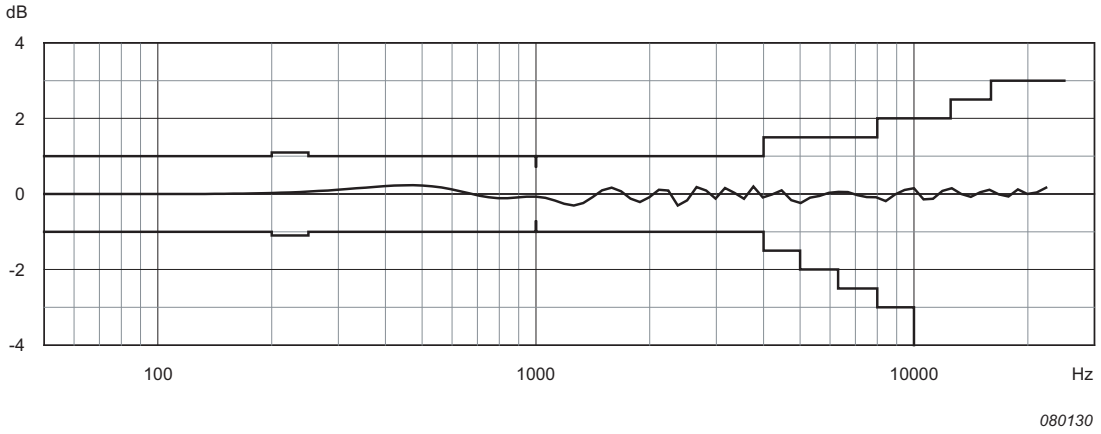


Fig. 4.5 *Free-field 0° frequency response for Microphone Type 4190, Microphone Preamplifier ZC-0032 and the analyzer with the Microphone Preamplifier mounted directly on the analyzer. Corresponds to the "Acoustical Response" column in Table A.3*

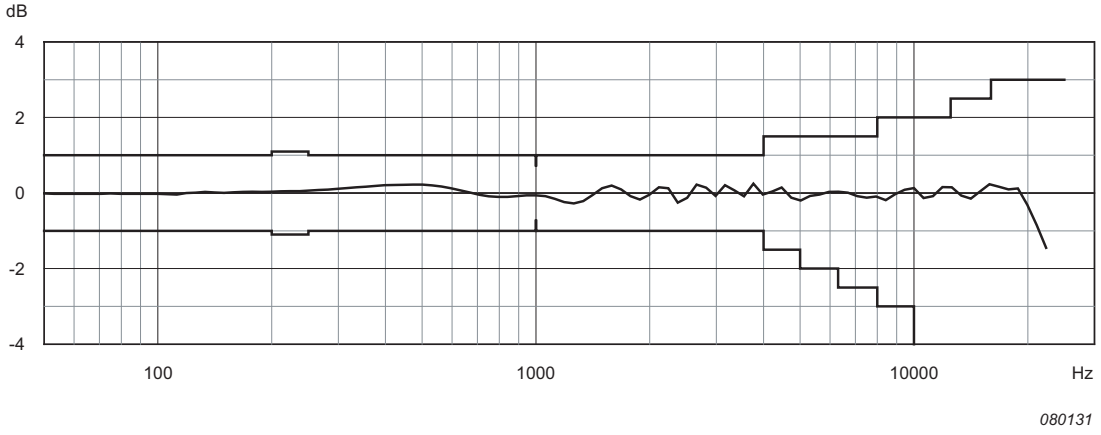


Fig. 4.6 *Free-field 0° frequency response for Windscreen UA-1650, Microphone Type 4190, Microphone Preamplifier ZC-0032 and the analyzer's electrical response, with the Microphone Preamplifier connected to a microphone extension cable. Corresponds to the "Acoustical Response" column in Table A.4*

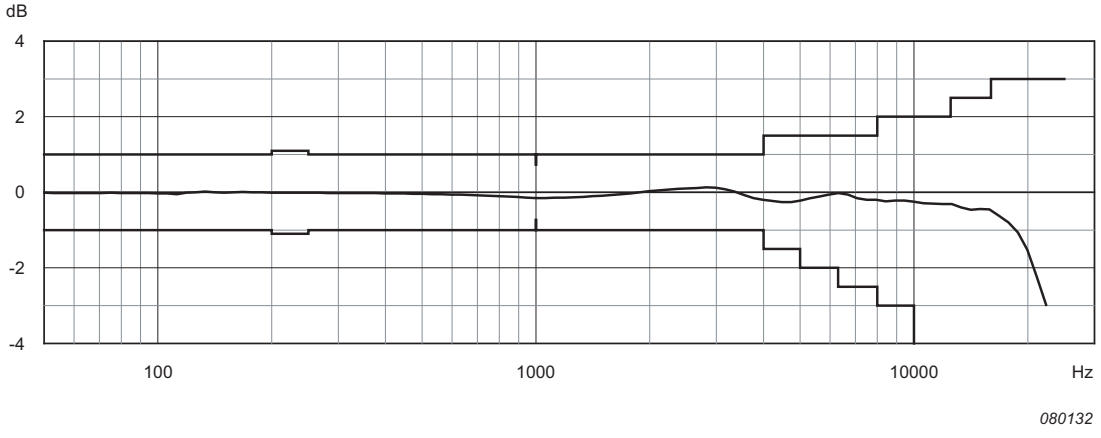


Fig. 4.7 *Free-field 0° frequency response for Windscreen UA-1650, Microphone Type 4190, Microphone Preamplifier ZC-0032 and the analyzer with the Microphone Preamplifier mounted directly on the analyzer. Corresponds to the "Acoustical Response" column in Table A.5*

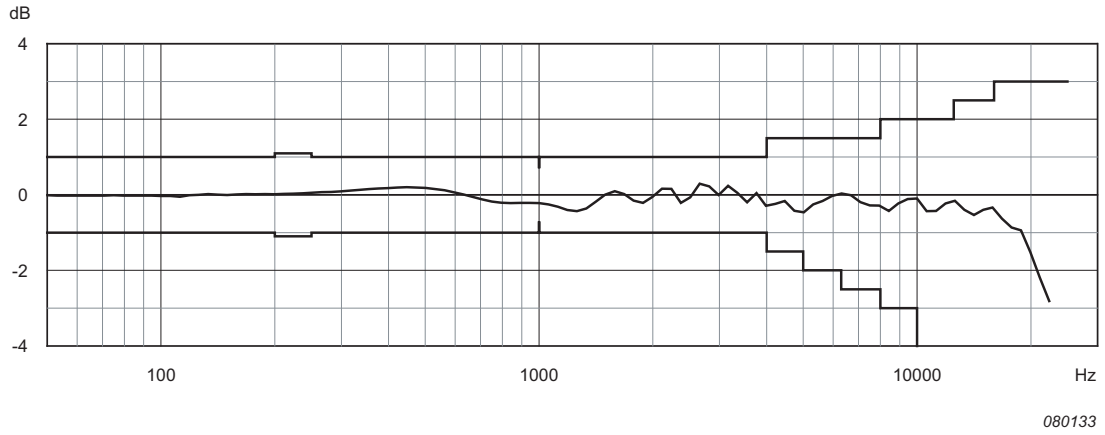
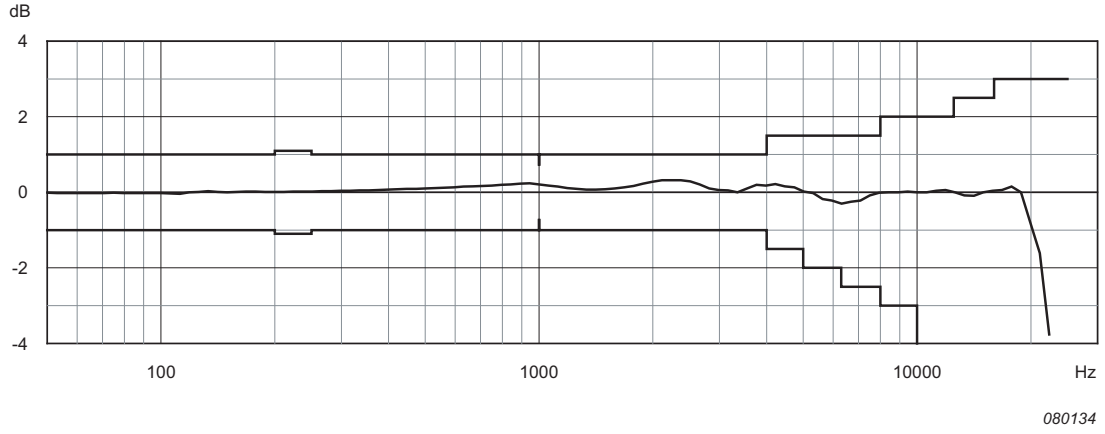


Fig. 4.8 *Free-field 0° frequency response for Outdoor Microphone Kit UA 1404, Microphone Type 4190 Microphone Preamplifier ZC-0032 and the analyzer's electrical response with the Microphone Preamplifier connected to a microphone extension cable. Corresponds to the "Acoustical Response" column in Table A.6*



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. 4.9 and Fig. 4.10, and Table A.7 and Table A.8.

The diffuse-field body influence of the analyzer is so small that the diffuse-field frequency responses are the same with and without the Microphone Preamplifier connected to the microphone extension cable.

Fig. 4.9 *Diffuse-field frequency response for Microphone Type 4190, Microphone Preamplifier ZC-0032 and the analyzer with or without the Microphone Preamplifier connected to a microphone extension cable. Corresponds to the "Acoustical Response" column in Table A.7*

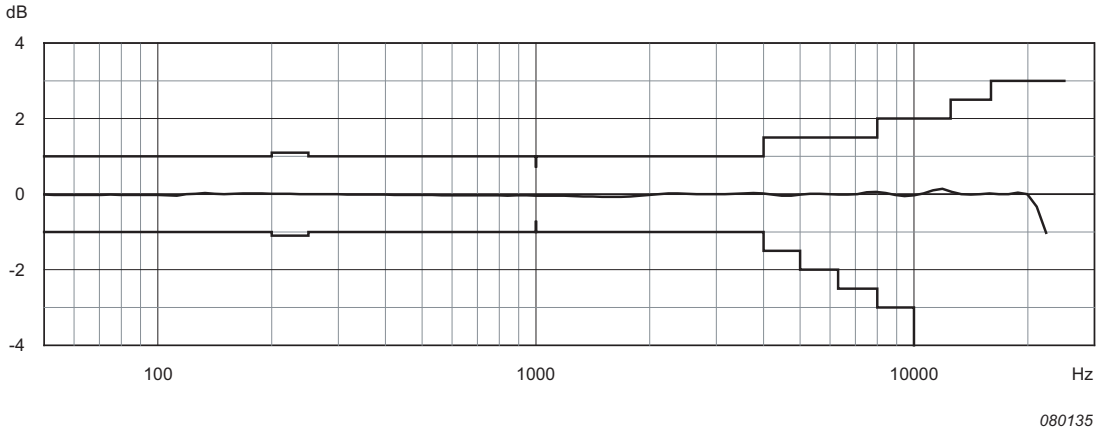


Fig. 4.10 *Diffuse-field frequency response for Windscreen UA-1650, Microphone Type 4190, Microphone Preamplifier ZC-0032 and the analyzer with or without the Microphone Preamplifier connected to a microphone extension cable. Corresponds to the "Acoustical Response" column in Table A.8*

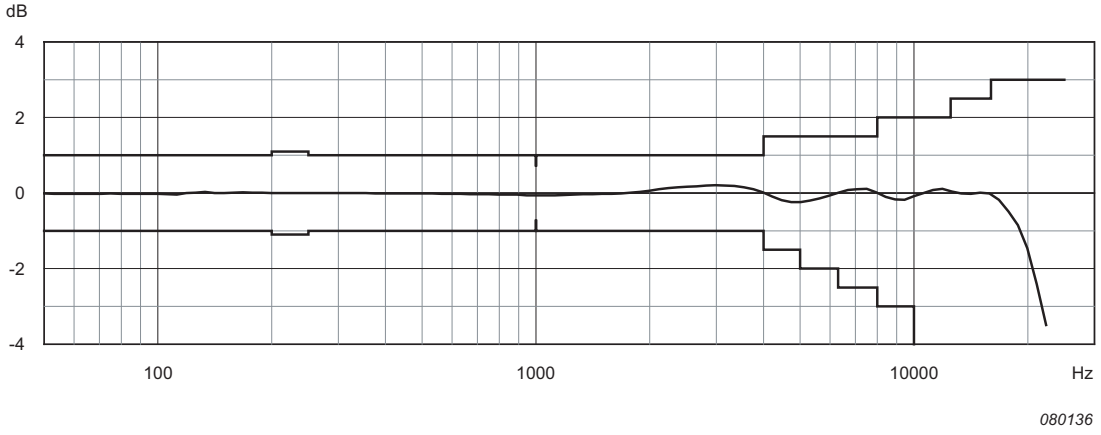
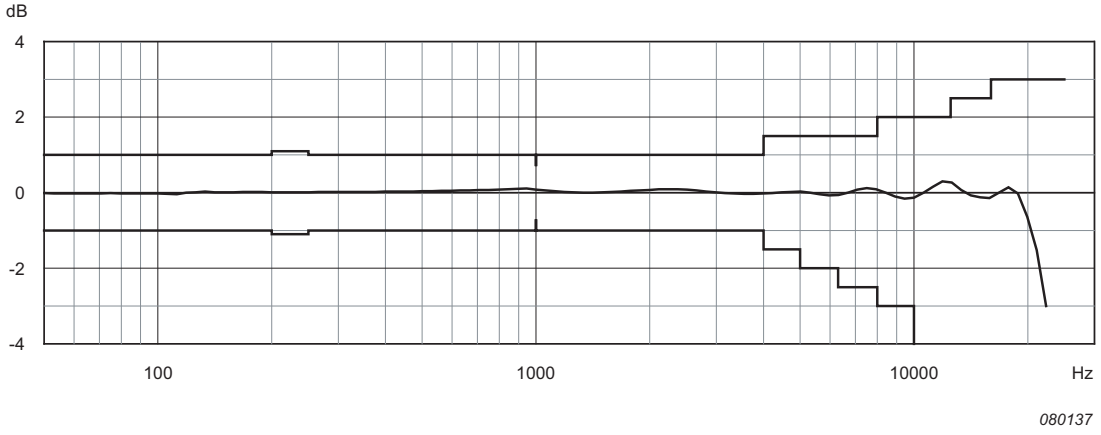


Fig. 4.11 *Diffuse field frequency response for Outdoor Microphone Kit UA-1404, Microphone Type 4190 Microphone Preamplifier ZC-0032 and the analyzer with the Microphone Preamplifier connected to a microphone extension cable. Corresponds to the "Acoustical Response" column in Table A.9*



4.7 Directional Responses

Microphone Type 4190 has the same Directional Response as Microphone Type 4189. For these data see Instruction Manual BE 1712.

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	15.5	14.3	14.4	16.2	16.2
Electrical	13.5	12.7	14.1	19.1	31.2
Total	17.6	16.6	17.3	20.9	31.3
High Range					
Microphone	15.5	14.3	14.4	16.2	16.2
Electrical	31.8	30.4	30.5	34.6	36.2
Total	31.9	30.5	30.6	34.7	36.2
Low Range					
Microphone	15.5	14.3	14.4	16.2	16.2
Electrical	13.5	12.7	14.1	19.1	31.2
Total	17.6	16.6	17.3	20.9	31.3

*. 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	14.5	13.3	13.4	15.2	15.2
Electrical	12.3	11.4	12.7	17.8	26.3
Total	16.5	15.5	16.1	19.7	26.6
High Range					
Microphone	14.5	13.3	13.4	15.2	15.2
Electrical	28.2	26.9	26.9	30.9	32.0
Total	28.4	27.1	27.1	31.0	32.1
Low Range					
Microphone	14.5	13.3	13.4	15.2	15.2
Electrical	12.3	11.4	12.7	17.8	26.3
Total	16.5	15.5	16.1	19.7	26.6

*. 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*

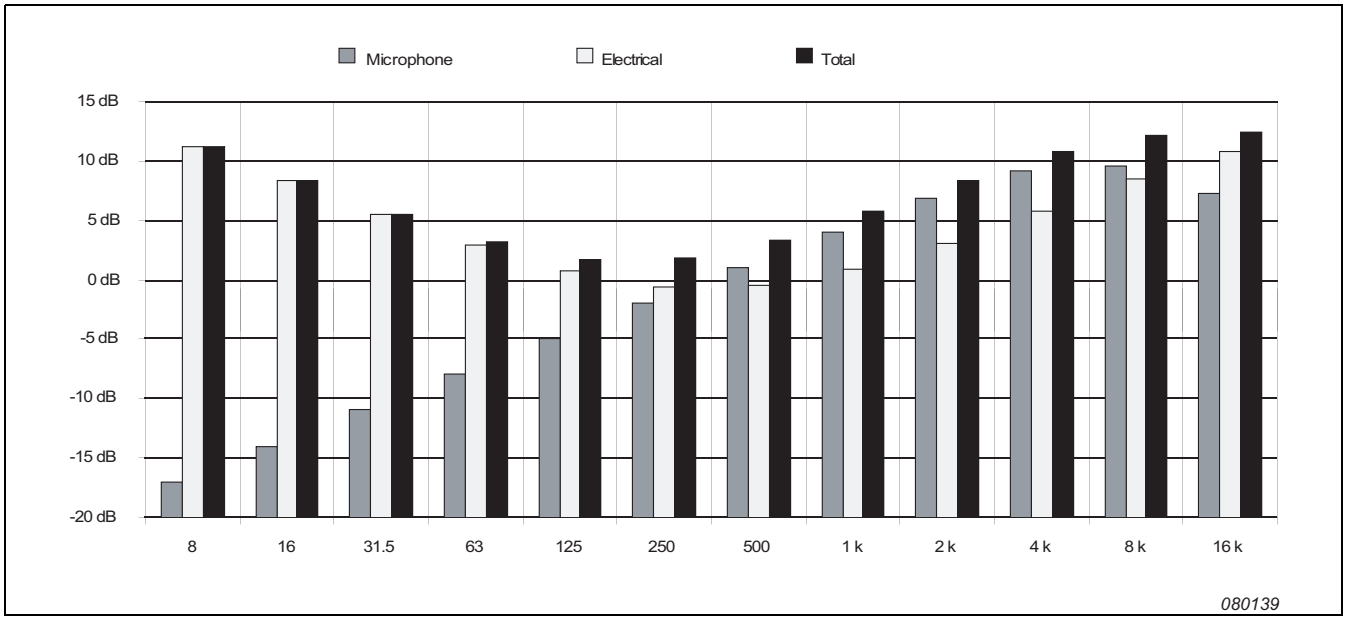


Fig. 4.25 *Typical self-generated noise, 1/1-octave band, High Range*

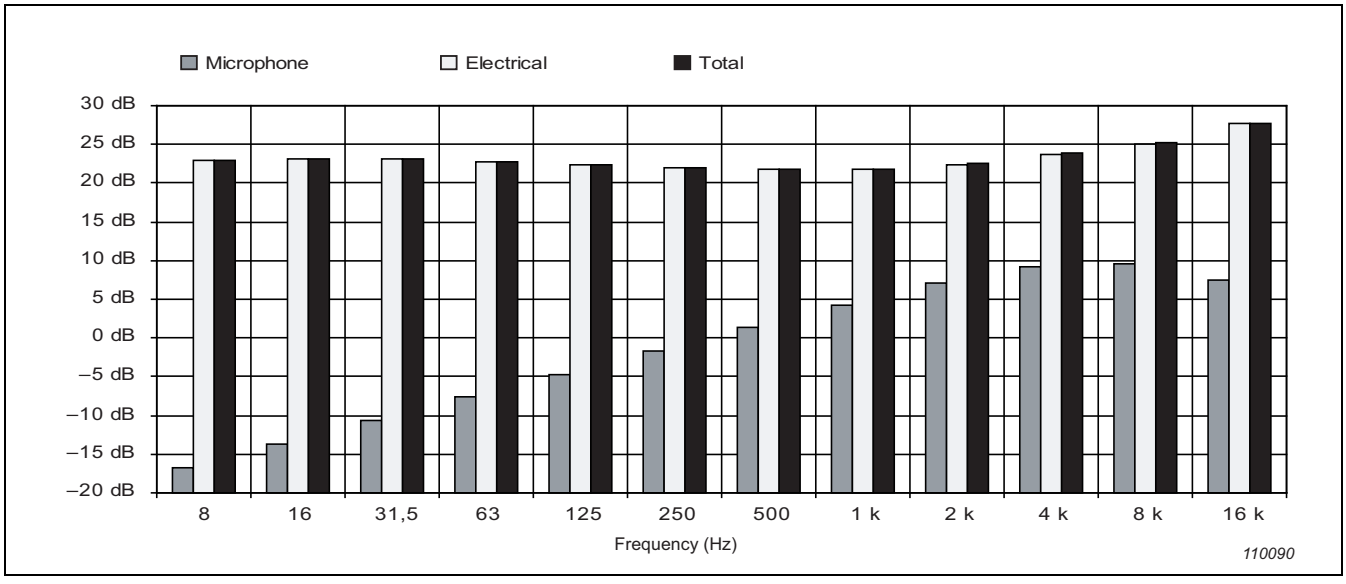


Fig. 4.26 *Typical self-generated noise, 1/1 octave band, Low Range*

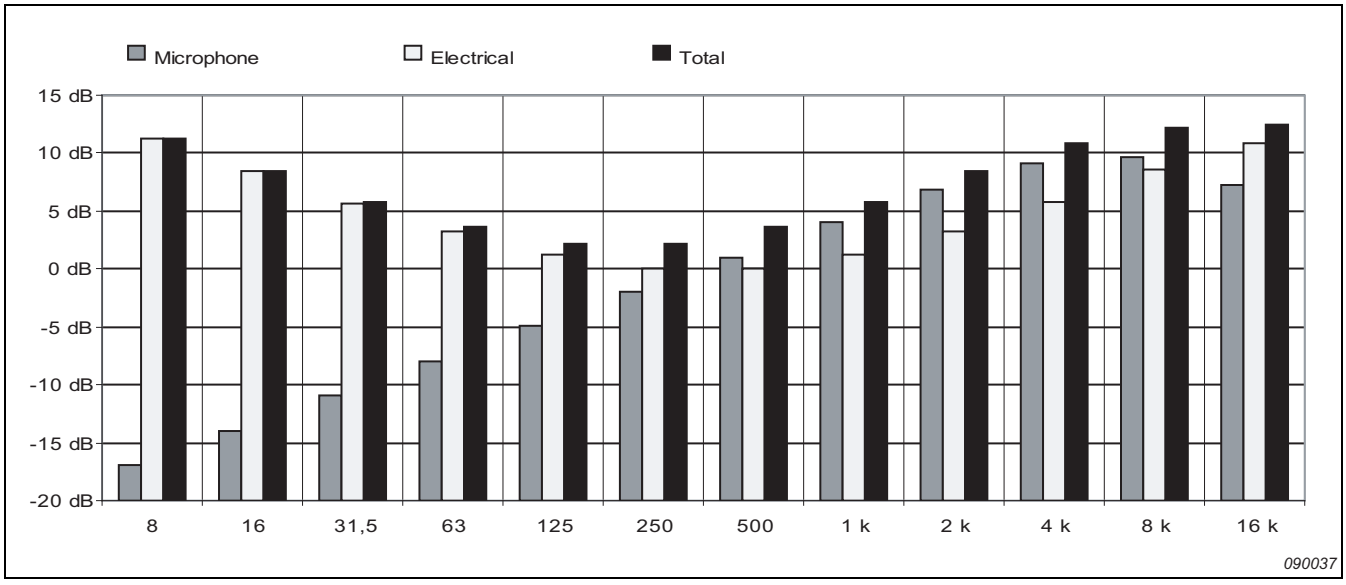


Fig. 4.27 *Typical self-generated noise, 1/3 octave band, Single-range*

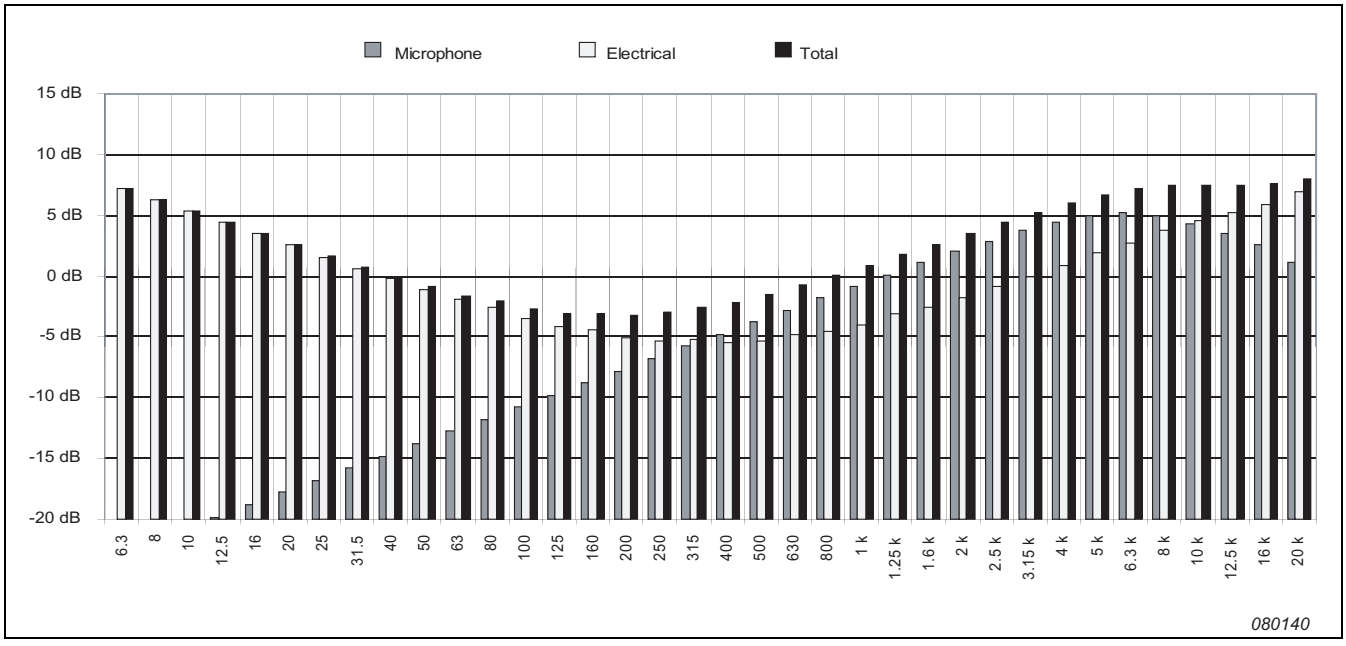


Fig. 4.28 *Typical self-generated noise, 1/3-octave band, High Range*

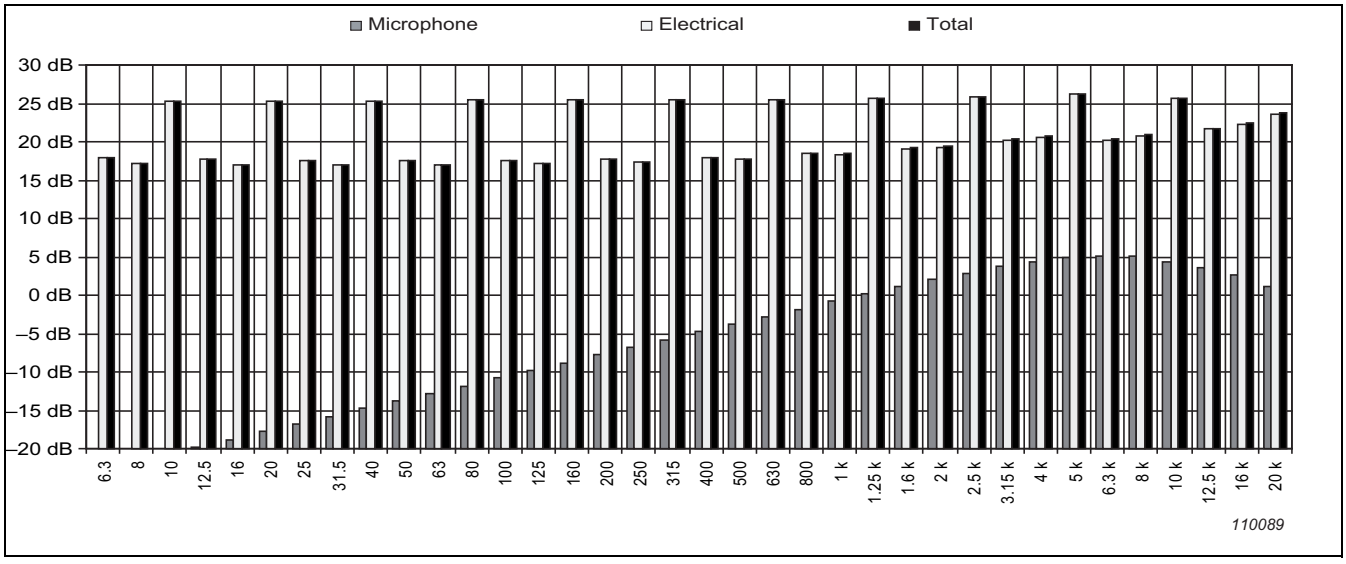
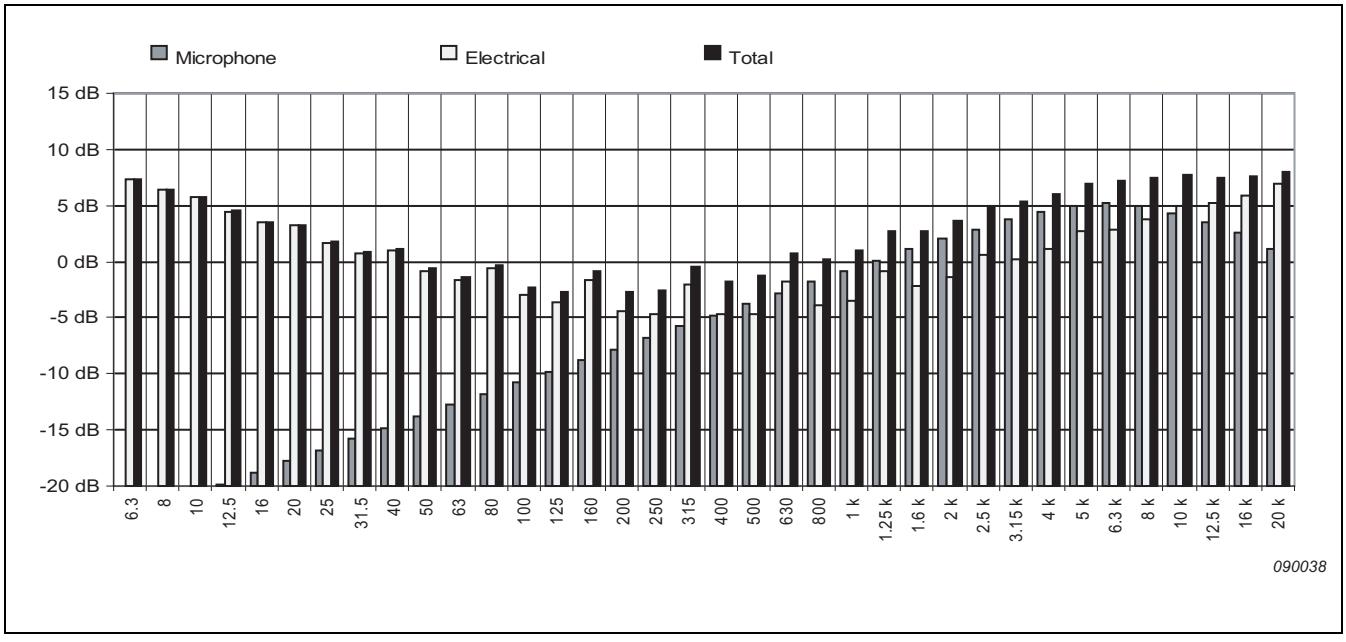


Fig. 4.29 *Typical self-generated noise, 1/3 octave band, Low Range*



4.9 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: 159 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)**
139.7 – 24.7	139.7 – 23.9	139.7 – 25.3	139.7 – 30.3	139.7 – 42.4

NOTE: For Sound Exposure Levels, the stated ranges are valid if 10*lg(Δ*t*) is added to the limits. Δ*t* 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	122.3	23.4	22.6	24.0	29.0	41.1
High	122.3	41.7	40.3	40.4	44.5	46.1
Low	92.3	23.4	22.6	24.0	29.0	41.1

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	139.3	23.4	22.6	24.0	29.0	41.1
High	139.3	41.7	40.3	40.4	44.5	46.1
Low	109.3	23.4	22.6	24.0	29.0	41.1

NOTE: For Sound Exposure Levels, the stated ranges are valid if 10*lg(Δ*t*) is added to the limits. Δ*t* 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	140.7	21.3	20.5	21.9	26.9	39.0
High	140.7	39.6	38.2	38.3	42.4	44.0
Low	110.7	21.3	20.5	21.9	26.9	39.0

NOTE: For Sound Exposure Levels, the stated ranges are valid if 10*lg(Δt) 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	143.7	21.3	20.5	21.9	26.9	39.0
High	143.7	39.6	38.2	38.3	42.4	44.0
Low	113.7	21.3	20.5	21.9	26.9	39.0

NOTE: For Sound Exposure Levels, the stated ranges are valid if 10*lg(Δt) 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 tests 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	100.6	139.7	140.7	139.0	135.3	24.7
B-weighting	122.9	139.7	139.0	137.2	133.5	23.9
C-weighting	137.0	139.7	138.9	137.1	133.4	25.3

Table 4.8
Linear Operating Range (Continued)

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)
Z-weighting	140.0	139.7	139.7	140.1	139.6	30.3
Z-weighting Extended Low Frequency	140.0	139.7	139.7	140.1	139.6	42.4
High Range						
A-weighting	100.6	139.7	140.7	139.0	135.3	43.0
B-weighting	122.9	139.7	139.0	137.2	133.5	41.6
C-weighting	137.0	139.7	138.9	137.1	133.4	41.7
Z-weighting	140.0	139.7	139.7	140.1	139.6	45.8
Z-weighting Extended Low Frequency	140.0	139.7	139.7	140.1	139.6	47.4
Low Range						
A-weighting	70.6	109.7	110.7	109.0	105.3	24.7
B-weighting	92.9	109.7	109.0	107.2	103.5	23.9
C-weighting	107.0	109.7	108.9	107.1	103.4	25.3
Z-weighting	110.0	109.7	109.7	110.1	109.6	30.3
Z-weighting Extended Low Frequency	110.0	109.7	109.7	110.1	109.6	42.4

NOTE: For Sound Exposure Levels, the stated ranges are valid if 10*lg(Δt) 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 is:

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	140.0	142.7	141.9	140.1	136.4	42.1
High	140.0	142.7	141.9	140.1	136.4	58.5
Low	110.0	112.7	111.9	110.1	106.4	42.1

4.11 Spectrum Analysis

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	140.0	24.1	20.2
High	140.0	43.0	39.3
Low	110.0	24.1	20.2

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)
140.0 – 24.1	140.0 – 20.2

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 *Free-field 0° frequency response for Microphone Type 4190, Microphone Preamplifier ZC-0032 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 Actuator Response dB	Microphone Free-field Correction dB	Microphone Free-field Response dB	Electrical Response dB	Acoustical Response dB	Expanded Uncertainty dB
63	63.0957	–0.02	0.00	–0.02	0.00	–0.02	0.05
80	79.4328	–0.02	0.00	–0.02	0.00	–0.02	0.05
100	100	–0.03	0.00	–0.03	0.00	–0.03	0.05
125	125.893	0.01	0.00	0.01	0.00	0.01	0.05
160	158.489	0.01	0.00	0.01	0.00	0.01	0.05
200	199.526	0.01	0.00	0.01	0.00	0.01	0.05
250	251.189	0.00	0.00	0.00	0.00	0.00	0.05
315	316.228	–0.01	0.01	0.00	0.00	0.00	0.06
400	398.107	–0.02	0.01	–0.01	0.00	–0.01	0.06
500	501.187	–0.03	0.02	–0.01	0.00	–0.01	0.07
630	630.957	–0.04	0.04	0.00	0.00	0.00	0.07
800	794.328	–0.06	0.07	0.01	0.00	0.01	0.07
1000	1000	–0.09	0.10	0.01	0.00	0.01	0.07
1060	1059.25	–0.10	0.11	0.02	0.00	0.02	0.07
1120	1122.02	–0.11	0.12	0.02	0.00	0.02	0.07
1180	1188.5	–0.12	0.14	0.02	0.00	0.02	0.08
1250	1258.93	–0.13	0.15	0.02	0.00	0.02	0.08
1320	1333.52	–0.14	0.17	0.03	0.00	0.03	0.08
1400	1412.54	–0.16	0.18	0.03	0.00	0.03	0.08
1500	1496.24	–0.17	0.20	0.03	0.00	0.03	0.08
1600	1584.89	–0.19	0.22	0.03	0.00	0.03	0.08
1700	1678.8	–0.21	0.24	0.03	0.00	0.03	0.08
1800	1778.28	–0.23	0.27	0.03	0.00	0.03	0.09
1900	1883.65	–0.26	0.29	0.04	0.00	0.04	0.09
2000	1995.26	–0.29	0.32	0.04	0.00	0.04	0.09
2120	2113.49	–0.32	0.36	0.04	0.00	0.04	0.09
2240	2238.72	–0.35	0.39	0.04	0.00	0.04	0.09
2360	2371.37	–0.39	0.43	0.04	0.01	0.05	0.10
2500	2511.89	–0.44	0.48	0.04	0.01	0.05	0.10
2650	2660.73	–0.49	0.53	0.04	0.01	0.05	0.10
2800	2818.38	–0.54	0.59	0.04	0.01	0.05	0.11
3000	2985.38	–0.60	0.65	0.04	0.01	0.05	0.11
3150	3162.28	–0.67	0.71	0.04	0.01	0.05	0.12
3350	3349.65	–0.75	0.78	0.04	0.01	0.05	0.12
3550	3548.13	–0.83	0.86	0.03	0.01	0.04	0.13

Nominal Frequency	Exact Frequency (6 digits)	Microphone Actuator Response	Microphone Free-field Correction	Microphone Free-field Response	Electrical Response	Acoustical Response	Expanded Uncertainty
Hz	Hz	dB	dB	dB	dB	dB	dB
3750	3758.37	–0.92	0.96	0.04	0.01	0.05	0.13
4000	3981.07	–1.03	1.07	0.04	0.01	0.05	0.14
4250	4216.97	–1.14	1.18	0.04	0.01	0.05	0.14
4500	4466.84	–1.27	1.30	0.03	0.01	0.04	0.14
4750	4731.51	–1.40	1.43	0.03	0.02	0.05	0.14
5000	5011.87	–1.56	1.57	0.02	0.02	0.04	0.15
5300	5308.84	–1.72	1.73	0.01	0.02	0.03	0.15
5600	5623.41	–1.91	1.90	–0.01	0.02	0.01	0.15
6000	5956.62	–2.11	2.09	–0.02	0.02	0.00	0.16
6300	6309.57	–2.32	2.28	–0.04	0.02	–0.02	0.16
6700	6683.44	–2.56	2.49	–0.07	0.03	–0.04	0.17
7100	7079.46	–2.82	2.74	–0.08	0.03	–0.05	0.17
7500	7498.94	–3.11	3.04	–0.07	0.03	–0.04	0.17
8000	7943.28	–3.42	3.38	–0.03	0.03	0.00	0.18
8500	8413.95	–3.77	3.75	–0.02	0.02	0.00	0.19
9000	8912.51	–4.17	4.14	–0.03	0.01	–0.02	0.20
9500	9440.61	–4.62	4.60	–0.02	–0.01	–0.03	0.22
10000	10000	–5.10	5.12	0.02	–0.04	–0.02	0.23
10600	10592.5	–5.59	5.68	0.10	–0.09	0.01	0.24
11200	11220.2	–6.05	6.27	0.22	–0.17	0.05	0.26
11800	11885	–6.46	6.81	0.35	–0.27	0.08	0.28
12500	12589.3	–6.80	7.19	0.40	–0.40	0.00	0.29
13200	13335.2	–7.08	7.54	0.46	–0.52	–0.06	0.31
14000	14125.4	–7.33	7.89	0.56	–0.63	–0.07	0.33
15000	14962.4	–7.54	8.24	0.70	–0.70	0.00	0.35
16000	15848.9	–7.74	8.59	0.85	–0.73	0.12	0.38
17000	16788	–8.01	8.91	0.90	–0.73	0.17	0.40
18000	17782.8	–8.39	9.27	0.87	–0.71	0.16	0.43
19000	18836.5	–8.93	9.62	0.69	–0.70	–0.01	0.45
20000	19952.6	–9.68	10.05	0.37	–0.68	–0.31	0.48
21200	21134.9	–10.66	10.46	–0.21	–0.68	–0.89	0.49
22400	22387.2	–11.77	10.85	–0.92	–0.70	–1.62	0.49

Table A.3 *Free-field 0° frequency response for Microphone Type 4190, Microphone Preamplifier ZC-0032 and the analyzer with the Microphone Preamplifier mounted directly on the analyzer*

Nominal Frequency	Exact Frequency (6 digits)	Acoustical Response (From Table A.2)	Expanded Uncertainty	Body Influence	Expanded Uncertainty	Acoustical Response	Expanded Uncertainty
Hz	Hz	dB	dB	dB	dB	dB	dB
63	63.0957	–0.02	0.05	0.00	0.10	–0.02	0.11
80	79.4328	–0.02	0.05	0.00	0.10	–0.02	0.11
100	100	–0.03	0.05	0.00	0.10	–0.03	0.11
125	125.893	0.01	0.05	0.00	0.10	0.01	0.11
160	158.489	0.01	0.05	0.01	0.10	0.02	0.11
200	199.526	0.01	0.05	0.03	0.10	0.03	0.11
250	251.189	0.00	0.05	0.07	0.10	0.07	0.11
315	316.228	0.00	0.06	0.13	0.10	0.13	0.12
400	398.107	–0.01	0.06	0.21	0.10	0.20	0.12
500	501.187	–0.01	0.07	0.22	0.10	0.22	0.12
630	630.957	0.00	0.07	0.07	0.10	0.07	0.12
800	794.328	0.01	0.07	–0.11	0.10	–0.11	0.12
1000	1000	0.01	0.07	–0.07	0.10	–0.06	0.12
1060	1059.25	0.02	0.07	–0.10	0.10	–0.09	0.12
1120	1122.02	0.02	0.07	–0.18	0.10	–0.16	0.12
1180	1188.5	0.02	0.08	–0.26	0.10	–0.24	0.13
1250	1258.93	0.02	0.08	–0.30	0.10	–0.28	0.13
1320	1333.52	0.03	0.08	–0.24	0.10	–0.22	0.13
1400	1412.54	0.03	0.08	–0.08	0.10	–0.06	0.13

Nominal Frequency	Exact Frequency (6 digits)	Acoustical Response (From Table A.2)	Expanded Uncertainty	Body Influence	Expanded Uncertainty	Acoustical Response	Expanded Uncertainty
Hz	Hz	dB	dB	dB	dB	dB	dB
1500	1496.24	0.03	0.08	0.10	0.10	0.12	0.13
1600	1584.89	0.03	0.08	0.17	0.10	0.20	0.13
1700	1678.8	0.03	0.08	0.07	0.10	0.10	0.13
1800	1778.28	0.03	0.09	–0.12	0.10	–0.09	0.13
1900	1883.65	0.04	0.09	–0.21	0.10	–0.18	0.13
2000	1995.26	0.04	0.09	–0.09	0.10	–0.05	0.13
2120	2113.49	0.04	0.09	0.11	0.10	0.15	0.13
2240	2238.72	0.04	0.09	0.09	0.15	0.13	0.13
2360	2371.37	0.05	0.10	–0.30	0.15	–0.25	0.18
2500	2511.89	0.05	0.10	–0.17	0.15	–0.12	0.18
2650	2660.73	0.05	0.10	0.18	0.15	0.23	0.18
2800	2818.38	0.05	0.11	0.09	0.15	0.15	0.19
3000	2985.38	0.05	0.11	–0.12	0.15	–0.07	0.19
3150	3162.28	0.05	0.12	0.16	0.15	0.21	0.19
3350	3349.65	0.05	0.12	0.03	0.15	0.08	0.19
3550	3548.13	0.04	0.13	–0.13	0.15	–0.08	0.19
3750	3758.37	0.05	0.13	0.20	0.15	0.25	0.20
4000	3981.07	0.05	0.14	–0.09	0.15	–0.04	0.20
4250	4216.97	0.05	0.14	–0.01	0.15	0.04	0.21
4500	4466.84	0.04	0.14	0.10	0.15	0.14	0.21
4750	4731.51	0.05	0.14	–0.16	0.15	–0.12	0.21
5000	5011.87	0.04	0.15	–0.24	0.15	–0.20	0.21
5300	5308.84	0.03	0.15	–0.10	0.15	–0.07	0.21
5600	5623.41	0.01	0.15	–0.05	0.15	–0.04	0.21
6000	5956.62	0.00	0.16	0.03	0.15	0.03	0.21
6300	6309.57	–0.02	0.16	0.06	0.15	0.03	0.22
6700	6683.44	–0.04	0.17	0.05	0.15	0.01	0.22
7100	7079.46	–0.05	0.17	–0.03	0.15	–0.08	0.23
7500	7498.94	–0.04	0.17	–0.08	0.20	–0.12	0.23
8000	7943.28	0.00	0.18	–0.08	0.20	–0.09	0.26
8500	8413.95	0.00	0.19	–0.19	0.20	–0.19	0.27
9000	8912.51	–0.02	0.20	–0.01	0.20	–0.02	0.28
9500	9440.61	–0.03	0.22	0.11	0.20	0.08	0.28
10000	10000	–0.02	0.23	0.15	0.20	0.13	0.30
10600	10592.5	0.01	0.24	–0.14	0.20	–0.13	0.30
11200	11220.2	0.05	0.26	–0.13	0.20	–0.08	0.33
11800	11885	0.08	0.28	0.08	0.20	0.16	0.34
12500	12589.3	0.00	0.29	0.15	0.20	0.15	0.35
13200	13335.2	–0.06	0.31	0.00	0.20	–0.06	0.37
14000	14125.4	–0.07	0.33	–0.08	0.20	–0.14	0.39
15000	14962.4	0.00	0.35	0.05	0.20	0.04	0.39
16000	15848.9	0.12	0.38	0.11	0.20	0.23	0.40
17000	16788	0.17	0.40	–0.01	0.20	0.16	0.43
18000	17782.8	0.16	0.43	–0.07	0.20	0.10	0.45
19000	18836.5	–0.01	0.45	0.12	0.20	0.11	0.47
20000	19952.6	–0.31	0.48	0.00	0.20	–0.31	0.49
21200	21134.9	–0.89	0.49	0.04	0.20	–0.85	0.52
22400	22387.2	–1.62	0.49	0.17	0.20	–1.45	0.53

Table A.4 *Free-field 0° frequency response for Windscreen UA-1650, Microphone Type 4190, Microphone Preamplifier ZC-0032 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 (From Table A.2)	Expanded Uncertainty	Influence of Windscreen	Expanded Uncertainty	Electrical Response	Acoustical Response	Expanded Uncertainty
Hz	Hz	dB	dB	dB	dB	dB	dB	dB
63	63.0957	–0.02	0.05	0.00	0.15	0.00	–0.02	0.16
80	79.4328	–0.02	0.05	0.00	0.15	0.00	–0.02	0.16
100	100	–0.03	0.05	0.00	0.15	0.00	–0.03	0.16
125	125.893	0.01	0.05	0.00	0.15	–0.01	0.00	0.16
160	158.489	0.01	0.05	0.00	0.15	–0.01	0.00	0.16
200	199.526	0.01	0.05	0.00	0.15	–0.02	–0.01	0.16
250	251.189	0.00	0.05	0.01	0.15	–0.03	–0.02	0.16
315	316.228	0.00	0.06	0.03	0.15	–0.04	–0.02	0.16
400	398.107	–0.01	0.06	0.05	0.15	–0.07	–0.03	0.16
500	501.187	–0.01	0.07	0.07	0.15	–0.10	–0.04	0.17
630	630.957	0.00	0.07	0.10	0.15	–0.16	–0.06	0.17
800	794.328	0.01	0.07	0.14	0.15	–0.24	–0.10	0.17
1000	1000	0.01	0.07	0.18	0.15	–0.35	–0.15	0.17
1060	1059.25	0.02	0.07	0.21	0.15	–0.38	–0.15	0.17
1120	1122.02	0.02	0.07	0.25	0.15	–0.41	–0.15	0.17
1180	1188.5	0.02	0.08	0.28	0.15	–0.44	–0.14	0.17
1250	1258.93	0.02	0.08	0.32	0.15	–0.47	–0.12	0.17
1320	1333.52	0.03	0.08	0.37	0.15	–0.51	–0.12	0.17
1400	1412.54	0.03	0.08	0.41	0.15	–0.54	–0.10	0.17
1500	1496.24	0.03	0.08	0.45	0.15	–0.57	–0.09	0.17
1600	1584.89	0.03	0.08	0.50	0.15	–0.60	–0.07	0.17
1700	1678.8	0.03	0.08	0.55	0.15	–0.63	–0.05	0.17
1800	1778.28	0.03	0.09	0.59	0.15	–0.65	–0.03	0.17
1900	1883.65	0.04	0.09	0.63	0.15	–0.67	0.00	0.17
2000	1995.26	0.04	0.09	0.67	0.20	–0.68	0.03	0.22
2120	2113.49	0.04	0.09	0.70	0.20	–0.68	0.06	0.22
2240	2238.72	0.04	0.09	0.71	0.20	–0.68	0.07	0.22
2360	2371.37	0.04	0.10	0.72	0.20	–0.67	0.09	0.22
2500	2511.89	0.04	0.10	0.72	0.20	–0.65	0.11	0.22
2650	2660.73	0.04	0.10	0.70	0.20	–0.63	0.11	0.22
2800	2818.38	0.04	0.11	0.68	0.20	–0.60	0.12	0.11
3000	2985.38	0.04	0.11	0.63	0.20	–0.56	0.11	0.23
3150	3162.28	0.04	0.12	0.55	0.20	–0.51	0.08	0.23
3350	3349.65	0.04	0.12	0.44	0.20	–0.46	0.02	0.23
3550	3548.13	0.03	0.13	0.30	0.20	–0.40	–0.07	0.24
3750	3758.37	0.04	0.13	0.16	0.20	–0.35	–0.15	0.24
4000	3981.07	0.04	0.14	0.05	0.20	–0.28	–0.20	0.24
4250	4216.97	0.04	0.14	–0.05	0.20	–0.22	–0.23	0.24
4500	4466.84	0.03	0.14	–0.13	0.20	–0.16	–0.26	0.24
4750	4731.51	0.03	0.14	–0.18	0.20	–0.10	–0.25	0.24
5000	5011.87	0.02	0.15	–0.19	0.20	–0.05	–0.22	0.25
5300	5308.84	0.01	0.15	–0.17	0.25	0.00	–0.17	0.29
5600	5623.41	–0.01	0.15	–0.16	0.25	0.05	–0.11	0.29
6000	5956.62	–0.02	0.16	–0.13	0.25	0.10	–0.06	0.30
6300	6309.57	–0.04	0.16	–0.11	0.25	0.14	–0.01	0.30
6700	6683.44	–0.07	0.17	–0.16	0.25	0.17	–0.06	0.30
7100	7079.46	–0.08	0.17	–0.28	0.25	0.20	–0.16	0.30
7500	7498.94	–0.07	0.17	–0.36	0.25	0.22	–0.21	0.30
8000	7943.28	–0.03	0.18	–0.41	0.25	0.24	–0.21	0.31
8500	8413.95	–0.02	0.19	–0.47	0.25	0.25	–0.24	0.31
9000	8912.51	–0.03	0.20	–0.45	0.25	0.26	–0.21	0.32
9500	9440.61	–0.02	0.22	–0.47	0.25	0.26	–0.22	0.33
10000	10000	0.02	0.23	–0.52	0.25	0.25	–0.24	0.34
10600	10592.5	0.10	0.24	–0.63	0.25	0.24	–0.29	0.35
11200	11220.2	0.22	0.26	–0.74	0.25	0.22	–0.30	0.36

Nominal Frequency	Exact Frequency (6 digits)	Microphone Free–field Response (From Table A.2)	Expanded Uncertainty	Influence of Windscreen	Expanded Uncertainty	Electrical Response	Acoustical Response	Expanded Uncertainty
Hz	Hz	dB	dB	dB	dB	dB	dB	dB
11800	11885	0.35	0.28	–0.86	0.25	0.20	–0.31	0.38
12500	12589.3	0.40	0.29	–0.88	0.25	0.17	–0.32	0.38
13200	13335.2	0.46	0.31	–0.99	0.25	0.14	–0.40	0.40
14000	14125.4	0.56	0.33	–1.13	0.25	0.11	–0.46	0.41
15000	14962.4	0.70	0.35	–1.20	0.30	0.07	–0.44	0.46
16000	15848.9	0.85	0.38	–1.33	0.30	0.03	–0.45	0.48
17000	16788	0.90	0.40	–1.50	0.30	–0.02	–0.62	0.50
18000	17782.8	0.87	0.43	–1.61	0.30	–0.07	–0.81	0.52
19000	18836.5	0.69	0.45	–1.64	0.30	–0.11	–1.06	0.54
20000	19952.6	0.37	0.48	–1.73	0.30	–0.16	–1.52	0.57
21200	21134.9	–0.21	0.49	–1.81	0.30	–0.21	–2.22	0.57
22400	22387.2	–0.92	0.49	–1.79	0.30	–0.27	–2.98	0.57

Table A.5 *Free-field 0° frequency response for Windscreen UA-1650, Microphone Type 4190, Microphone Preamplifier ZC-0032 and the analyzer with the Microphone Preamplifier mounted directly on the analyzer*

Nominal Frequency	Exact Frequency (6 digits)	Acoustical Response (From Table A.4)	Expanded Uncertainty	Body Influence	Expanded Uncertainty	Acoustical Response	Expanded Uncertainty
		dB	dB	dB	dB	dB	dB
63	63.0957	–0.02	0.16	0.00	0.10	–0.02	0.19
80	79.4328	–0.02	0.16	0.00	0.10	–0.02	0.19
100	100	–0.03	0.16	0.00	0.10	–0.03	0.19
125	125.893	0.00	0.16	0.00	0.10	0.00	0.19
160	158.489	0.00	0.16	0.01	0.10	0.01	0.19
200	199.526	–0.01	0.16	0.03	0.10	0.01	0.19
250	251.189	–0.02	0.16	0.07	0.10	0.05	0.19
315	316.228	–0.02	0.16	0.13	0.10	0.11	0.19
400	398.107	–0.03	0.16	0.21	0.10	0.18	0.19
500	501.187	–0.04	0.17	0.22	0.10	0.19	0.19
630	630.957	–0.06	0.17	0.07	0.10	0.01	0.19
800	794.328	–0.10	0.17	–0.11	0.10	–0.21	0.19
1000	1000	–0.15	0.17	–0.07	0.10	–0.23	0.19
1060	1059.25	–0.15	0.17	–0.10	0.10	–0.25	0.19
1120	1122.02	–0.15	0.17	–0.18	0.10	–0.32	0.19
1180	1188.5	–0.14	0.17	–0.26	0.10	–0.39	0.20
1250	1258.93	–0.12	0.17	–0.30	0.10	–0.43	0.20
1320	1333.52	–0.12	0.17	–0.24	0.10	–0.36	0.20
1400	1412.54	–0.10	0.17	–0.08	0.10	–0.19	0.20
1500	1496.24	–0.09	0.17	0.10	0.10	0.01	0.20
1600	1584.89	–0.07	0.17	0.17	0.10	0.10	0.20
1700	1678.8	–0.05	0.17	0.07	0.10	0.02	0.20
1800	1778.28	–0.03	0.17	–0.12	0.10	–0.15	0.20
1900	1883.65	0.00	0.17	–0.21	0.10	–0.22	0.20
2000	1995.26	0.03	0.22	–0.09	0.10	–0.06	0.24
2120	2113.49	0.06	0.22	0.11	0.10	0.17	0.24
2240	2238.72	0.07	0.22	0.09	0.15	0.16	0.27
2360	2371.37	0.09	0.22	–0.30	0.15	–0.21	0.27
2500	2511.89	0.11	0.22	–0.17	0.15	–0.06	0.27
2650	2660.73	0.11	0.22	0.18	0.15	0.30	0.27
2800	2818.38	0.12	0.11	0.09	0.15	0.22	0.19
3000	2985.38	0.11	0.23	–0.12	0.15	–0.01	0.27
3150	3162.28	0.08	0.23	0.16	0.15	0.24	0.28
3350	3349.65	0.02	0.23	0.03	0.15	0.05	0.28
3550	3548.13	–0.07	0.24	–0.13	0.15	–0.19	0.28
3750	3758.37	–0.15	0.24	0.20	0.15	0.05	0.28
4000	3981.07	–0.20	0.24	–0.09	0.15	–0.29	0.29
4250	4216.97	–0.23	0.24	–0.01	0.15	–0.24	0.29
4500	4466.84	–0.26	0.24	0.10	0.15	–0.16	0.29

Nominal Frequency	Exact Frequency (6 digits)	Acoustical Response (From Table A.4)	Expanded Uncertainty	Body Influence	Expanded Uncertainty	Acoustical Response	Expanded Uncertainty
		dB	dB	dB	dB	dB	dB
4750	4731.51	–0.25	0.24	–0.16	0.15	–0.42	0.29
5000	5011.87	–0.22	0.25	–0.24	0.15	–0.46	0.29
5300	5308.84	–0.17	0.29	–0.10	0.15	–0.26	0.33
5600	5623.41	–0.11	0.29	–0.05	0.15	–0.16	0.33
6000	5956.62	–0.06	0.30	0.03	0.15	–0.02	0.33
6300	6309.57	–0.01	0.30	0.06	0.15	0.04	0.33
6700	6683.44	–0.06	0.30	0.05	0.15	–0.01	0.34
7100	7079.46	–0.16	0.30	–0.03	0.15	–0.19	0.34
7500	7498.94	–0.21	0.30	–0.08	0.20	–0.29	0.36
8000	7943.28	–0.21	0.31	–0.08	0.20	–0.29	0.37
8500	8413.95	–0.24	0.31	–0.19	0.20	–0.43	0.37
9000	8912.51	–0.21	0.32	–0.01	0.20	–0.22	0.38
9500	9440.61	–0.22	0.33	0.11	0.20	–0.11	0.39
10000	10000	–0.24	0.34	0.15	0.20	–0.09	0.39
10600	10592.5	–0.29	0.35	–0.14	0.20	–0.43	0.40
11200	11220.2	–0.30	0.36	–0.13	0.20	–0.43	0.41
11800	11885	–0.31	0.38	0.08	0.20	–0.23	0.43
12500	12589.3	–0.32	0.38	0.15	0.20	–0.17	0.43
13200	13335.2	–0.40	0.40	0.00	0.20	–0.39	0.45
14000	14125.4	–0.46	0.41	–0.08	0.20	–0.53	0.46
15000	14962.4	–0.44	0.46	0.05	0.20	–0.39	0.50
16000	15848.9	–0.45	0.48	0.11	0.20	–0.34	0.52
17000	16788	–0.62	0.50	–0.01	0.20	–0.63	0.54
18000	17782.8	–0.81	0.52	–0.07	0.20	–0.87	0.56
19000	18836.5	–1.06	0.54	0.12	0.20	–0.93	0.58
20000	19952.6	–1.52	0.57	0.00	0.20	–1.52	0.60
21200	21134.9	–2.22	0.57	0.04	0.20	–2.18	0.61
22400	22387.2	–2.98	0.57	0.17	0.20	–2.81	0.61

Table A.6 *Free field 0° frequency response for Outdoor Microphone Kit UA-1404, Microphone Type 4190, Microphone Preamplifier ZC-0032 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 (From Table A.2)	Expanded Uncertainty	Influence of Outdoor Microphone Kit	Expanded Uncertainty	Electrical Response	Acoustical Response	Expanded Uncertainty
		dB	dB	dB	dB	dB	dB	dB
63	63.0957	–0.02	0.05	0.00	0.15	0.00	–0.02	0.16
80	79.4328	–0.02	0.05	0.00	0.15	0.00	–0.02	0.16
100	100	–0.03	0.05	0.00	0.15	0.00	–0.03	0.16
125	125.893	0.01	0.05	0.00	0.15	0.00	0.01	0.16
160	158.489	0.01	0.05	0.00	0.15	0.00	0.01	0.16
200	199.526	0.01	0.05	0.00	0.15	0.00	0.01	0.16
250	251.189	0.00	0.05	0.02	0.15	0.00	0.02	0.16
315	316.228	0.00	0.06	0.04	0.15	0.00	0.04	0.16
400	398.107	–0.01	0.06	0.07	0.15	0.00	0.07	0.16
500	501.187	–0.01	0.07	0.10	0.15	0.00	0.10	0.17
630	630.957	0.00	0.07	0.14	0.15	0.01	0.15	0.17
800	794.328	0.01	0.07	0.18	0.15	0.01	0.20	0.17
1000	1000	0.01	0.07	0.19	0.15	0.01	0.21	0.17
1060	1059.25	0.02	0.07	0.15	0.15	0.01	0.18	0.17
1120	1122.02	0.02	0.07	0.11	0.15	0.01	0.14	0.17
1180	1188.5	0.02	0.08	0.08	0.15	0.02	0.12	0.17
1250	1258.93	0.02	0.08	0.05	0.15	0.02	0.09	0.17
1320	1333.52	0.03	0.08	0.03	0.15	0.02	0.07	0.17
1400	1412.54	0.03	0.08	0.02	0.15	0.02	0.07	0.17
1500	1496.24	0.03	0.08	0.03	0.15	0.02	0.08	0.17
1600	1584.89	0.03	0.08	0.05	0.15	0.03	0.11	0.17
1700	1678.8	0.03	0.08	0.07	0.15	0.03	0.13	0.17
1800	1778.28	0.03	0.09	0.11	0.15	0.03	0.17	0.17

Nominal Frequency	Exact Frequency (6 digits)	Microphone Free-field Response (From Table A.2)	Expanded Uncertainty	Influence of Outdoor Microphone Kit	Expanded Uncertainty	Electrical Response	Acoustical Response	Expanded Uncertainty
		dB	dB	dB	dB	dB	dB	dB
1900	1883.65	0.04	0.09	0.16	0.15	0.04	0.23	0.17
2000	1995.26	0.04	0.09	0.21	0.15	0.04	0.28	0.17
2120	2113.49	0.04	0.09	0.23	0.15	0.04	0.31	0.17
2240	2238.72	0.04	0.09	0.23	0.15	0.05	0.32	0.17
2360	2371.37	0.04	0.10	0.22	0.15	0.06	0.32	0.18
2500	2511.89	0.04	0.10	0.19	0.15	0.06	0.29	0.18
2650	2660.73	0.04	0.10	0.10	0.15	0.07	0.21	0.18
2800	2818.38	0.04	0.11	–0.02	0.15	0.07	0.09	0.19
3000	2985.38	0.04	0.11	–0.07	0.15	0.08	0.06	0.19
3150	3162.28	0.04	0.12	–0.08	0.15	0.09	0.05	0.19
3350	3349.65	0.04	0.12	–0.13	0.15	0.10	0.01	0.19
3550	3548.13	0.03	0.13	–0.04	0.15	0.11	0.10	0.20
3750	3758.37	0.04	0.13	0.05	0.15	0.12	0.21	0.20
4000	3981.07	0.04	0.14	0.01	0.15	0.13	0.18	0.21
4250	4216.97	0.04	0.14	0.04	0.15	0.14	0.22	0.21
4500	4466.84	0.03	0.14	–0.02	0.15	0.15	0.16	0.21
4750	4731.51	0.03	0.14	–0.05	0.15	0.16	0.14	0.21
5000	5011.87	0.02	0.15	–0.17	0.15	0.17	0.02	0.21
5300	5308.84	0.01	0.15	–0.19	0.15	0.17	–0.02	0.21
5600	5623.41	–0.01	0.15	–0.35	0.15	0.18	–0.18	0.21
6000	5956.62	–0.02	0.16	–0.37	0.15	0.18	–0.22	0.22
6300	6309.57	–0.04	0.16	–0.43	0.15	0.17	–0.30	0.22
6700	6683.44	–0.07	0.17	–0.35	0.15	0.16	–0.25	0.23
7100	7079.46	–0.08	0.17	–0.29	0.15	0.15	–0.22	0.23
7500	7498.94	–0.07	0.17	–0.14	0.15	0.12	–0.08	0.23
8000	7943.28	–0.03	0.18	–0.05	0.15	0.08	–0.01	0.23
8500	8413.95	–0.02	0.19	–0.01	0.15	0.03	0.00	0.24
9000	8912.51	–0.03	0.20	0.06	0.15	–0.04	–0.01	0.25
9500	9440.61	–0.02	0.22	0.15	0.15	–0.11	0.02	0.27
10000	10000	0.02	0.23	0.17	0.15	–0.19	0.00	0.27
10600	10592.5	0.10	0.24	0.15	0.15	–0.24	0.00	0.28
11200	11220.2	0.22	0.26	0.06	0.15	–0.24	0.04	0.30
11800	11885	0.35	0.28	–0.14	0.15	–0.14	0.07	0.32
12500	12589.3	0.40	0.29	–0.50	0.15	0.11	0.00	0.33
13200	13335.2	0.46	0.31	–1.08	0.15	0.54	–0.08	0.34
14000	14125.4	0.56	0.33	–1.78	0.15	1.13	–0.09	0.36
15000	14962.4	0.70	0.35	–2.53	0.15	1.83	0.00	0.38
16000	15848.9	0.85	0.38	–3.36	0.15	2.55	0.03	0.41
17000	16788	0.90	0.40	–4.08	0.15	3.24	0.06	0.43
18000	17782.8	0.87	0.43	–4.57	0.15	3.85	0.15	0.46
19000	18836.5	0.69	0.45	–5.06	0.15	4.36	0.00	0.47
20000	19952.6	0.37	0.48	–5.95	0.15	4.77	–0.81	0.50
21200	21134.9	–0.21	0.49	–6.46	0.15	5.06	–1.61	0.51
22400	22387.2	–0.92	0.49	–8.06	0.15	5.23	–3.75	0.51

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 *Diffuse-field frequency response for Microphone Type 4190, Microphone Preamplifier ZC-0032 and the analyzer with or without the Microphone Preamplifier connected to a microphone extension cable*

Nominal Frequency Hz	Exact Frequency (6 digits) Hz	Microphone Actuator Response dB	Microphone Diffuse-field Correction dB	Microphone Diffuse-field Response dB	Electrical Response dB	Acoustical Response dB	Expanded Uncertainty dB
63	63.0957	–0.02	0.00	–0.02	0.00	–0.02	0.05
80	79.4328	–0.02	0.00	–0.02	0.00	–0.02	0.05
100	100	–0.03	0.00	–0.03	0.00	–0.03	0.05
125	125.893	0.01	0.00	0.01	0.00	0.01	0.05
160	158.489	0.01	0.00	0.01	0.00	0.01	0.05
200	199.526	0.01	0.00	0.01	0.00	0.01	0.05
250	251.189	0.00	0.00	0.00	0.01	0.01	0.05
315	316.228	–0.01	–0.01	–0.02	0.01	–0.01	0.06
400	398.107	–0.02	–0.01	–0.03	0.01	–0.02	0.06
500	501.187	–0.03	–0.01	–0.04	0.02	–0.02	0.10
630	630.957	–0.04	–0.02	–0.06	0.03	–0.03	0.10
800	794.328	–0.06	–0.02	–0.08	0.05	–0.03	0.10
1000	1000	–0.09	–0.02	–0.11	0.07	–0.04	0.10
1060	1059.25	–0.10	–0.02	–0.12	0.08	–0.04	0.10
1120	1122.02	–0.11	–0.02	–0.13	0.09	–0.04	0.10
1180	1188.5	–0.12	–0.03	–0.14	0.10	–0.04	0.10
1250	1258.93	–0.13	–0.03	–0.16	0.11	–0.05	0.10
1320	1333.52	–0.14	–0.04	–0.18	0.12	–0.06	0.10
1400	1412.54	–0.16	–0.05	–0.20	0.14	–0.06	0.10
1500	1496.24	–0.17	–0.05	–0.22	0.15	–0.07	0.10
1600	1584.89	–0.19	–0.05	–0.24	0.17	–0.07	0.10
1700	1678.8	–0.21	–0.05	–0.26	0.19	–0.07	0.10
1800	1778.28	–0.23	–0.04	–0.28	0.22	–0.06	0.10
1900	1883.65	–0.26	–0.03	–0.28	0.24	–0.04	0.10
2000	1995.26	–0.29	0.00	–0.29	0.27	–0.02	0.10
2120	2113.49	–0.32	0.02	–0.30	0.30	0.00	0.10
2240	2238.72	–0.35	0.04	–0.32	0.33	0.01	0.11
2360	2371.37	–0.39	0.04	–0.35	0.37	0.02	0.11
2500	2511.89	–0.44	0.04	–0.40	0.42	0.02	0.12
2650	2660.73	–0.49	0.03	–0.46	0.46	0.00	0.12
2800	2818.38	–0.54	0.03	–0.52	0.51	–0.01	0.13
3000	2985.38	–0.60	0.03	–0.58	0.57	–0.01	0.13
3150	3162.28	–0.67	0.04	–0.64	0.64	0.00	0.13
3350	3349.65	–0.75	0.05	–0.70	0.70	0.00	0.14
3550	3548.13	–0.83	0.07	–0.76	0.78	0.02	0.14
3750	3758.37	–0.92	0.09	–0.84	0.86	0.02	0.15
4000	3981.07	–1.03	0.09	–0.94	0.96	0.02	0.15
4250	4216.97	–1.14	0.08	–1.06	1.05	–0.01	0.15
4500	4466.84	–1.27	0.07	–1.20	1.16	–0.04	0.16
4750	4731.51	–1.40	0.09	–1.32	1.28	–0.03	0.16
5000	5011.87	–1.56	0.14	–1.42	1.40	–0.02	0.16
5300	5308.84	–1.72	0.19	–1.53	1.54	0.01	0.17
5600	5623.41	–1.91	0.24	–1.67	1.68	0.01	0.17
6000	5956.62	–2.11	0.28	–1.83	1.83	0.00	0.17
6300	6309.57	–2.32	0.32	–2.01	1.99	–0.02	0.18
6700	6683.44	–2.56	0.39	–2.17	2.16	–0.01	0.18
7100	7079.46	–2.82	0.47	–2.35	2.34	–0.01	0.18
7500	7498.94	–3.11	0.63	–2.48	2.53	0.05	0.19
8000	7943.28	–3.42	0.75	–2.67	2.72	0.05	0.19
8500	8413.95	–3.77	0.87	–2.89	2.92	0.03	0.22
9000	8912.51	–4.17	1.03	–3.14	3.13	–0.01	0.25
9500	9440.61	–4.62	1.23	–3.38	3.33	–0.05	0.28
10000	10000	–5.10	1.53	–3.57	3.54	–0.03	0.31
10600	10592.5	–5.59	1.86	–3.73	3.75	0.02	0.34
11200	11220.2	–6.05	2.20	–3.86	3.95	0.09	0.37

Nominal Frequency	Exact Frequency (6 digits)	Microphone Actuator Response	Microphone Diffuse-field Correction	Microphone Diffuse-field Response	Electrical Response	Acoustical Response	Expanded Uncertainty
Hz	Hz	dB	dB	dB	dB	dB	dB
11800	11885	–6.46	2.44	–4.02	4.15	0.13	0.40
12500	12589.3	–6.80	2.51	–4.29	4.35	0.06	0.43
13200	13335.2	–7.08	2.54	–4.54	4.54	0.00	0.46
14000	14125.4	–7.33	2.59	–4.74	4.73	–0.01	0.49
15000	14962.4	–7.54	2.60	–4.94	4.93	–0.01	0.52
16000	15848.9	–7.74	2.58	–5.16	5.17	0.01	0.55
17000	16788	–8.01	2.52	–5.49	5.49	0.00	0.57
18000	17782.8	–8.39	2.47	–5.92	5.92	0.00	0.59
19000	18836.5	–8.93	2.47	–6.46	6.51	0.05	0.61
20000	19952.6	–9.68	2.48	–7.20	7.20	0.00	0.63
21200	21134.9	–10.66	2.48	–8.19	7.86	–0.33	0.65
22400	22387.2	–11.77	2.42	–9.35	8.33	–1.02	0.67

Table A.8 *Diffuse-field frequency response for Windscreen UA-1650, Microphone Type 4190, Microphone Preamplifier ZC-0032 and the analyzer with or without the Microphone Preamplifier connected to a microphone extension cable*

Nominal Frequency	Exact Frequency (6 digits)	Microphone Diffuse-field Response (From Table A.7)	Expanded Uncertainty	Influence of Windscreen	Expanded Uncertainty	Electrical Response	Acoustical Response	Expanded Uncertainty
Hz	Hz	dB	dB	dB	dB	dB	dB	dB
63	63.0957	–0.02	0.05	0.00	0.05	0.00	–0.02	0.07
80	79.4328	–0.02	0.05	0.00	0.05	0.00	–0.02	0.07
100	100	–0.03	0.05	0.00	0.05	0.00	–0.03	0.07
125	125.893	0.01	0.05	0.00	0.05	0.00	0.01	0.07
160	158.489	0.01	0.05	0.00	0.05	0.00	0.01	0.07
200	199.526	0.01	0.05	0.00	0.05	0.00	0.01	0.07
250	251.189	0.00	0.05	0.01	0.05	–0.01	0.00	0.07
315	316.228	–0.02	0.06	0.02	0.05	–0.01	0.00	0.08
400	398.107	–0.03	0.06	0.04	0.05	–0.02	–0.01	0.08
500	501.187	–0.04	0.10	0.06	0.05	–0.03	–0.02	0.11
630	630.957	–0.06	0.10	0.08	0.05	–0.04	–0.02	0.11
800	794.328	–0.08	0.10	0.11	0.05	–0.07	–0.04	0.11
1000	1000	–0.11	0.10	0.15	0.05	–0.11	–0.07	0.11
1060	1059.25	–0.12	0.10	0.17	0.08	–0.12	–0.06	0.13
1120	1122.02	–0.13	0.10	0.20	0.08	–0.13	–0.06	0.13
1180	1188.5	–0.14	0.10	0.24	0.08	–0.14	–0.05	0.13
1250	1258.93	–0.16	0.10	0.28	0.08	–0.16	–0.04	0.13
1320	1333.52	–0.18	0.10	0.32	0.10	–0.17	–0.03	0.14
1400	1412.54	–0.20	0.10	0.36	0.10	–0.19	–0.03	0.14
1500	1496.24	–0.22	0.10	0.40	0.10	–0.20	–0.02	0.14
1600	1584.89	–0.24	0.10	0.44	0.12	–0.21	–0.02	0.16
1700	1678.8	–0.26	0.10	0.48	0.15	–0.22	0.00	0.18
1800	1778.28	–0.28	0.10	0.52	0.15	–0.23	0.01	0.18
1900	1883.65	–0.28	0.10	0.55	0.15	–0.24	0.03	0.18
2000	1995.26	–0.29	0.10	0.58	0.15	–0.23	0.06	0.18
2120	2113.49	–0.30	0.10	0.62	0.15	–0.22	0.10	0.18
2240	2238.72	–0.32	0.11	0.64	0.15	–0.20	0.13	0.19
2360	2371.37	–0.35	0.11	0.67	0.15	–0.16	0.16	0.19
2500	2511.89	–0.40	0.12	0.68	0.15	–0.11	0.17	0.19
2650	2660.73	–0.46	0.12	0.68	0.15	–0.04	0.18	0.19
2800	2818.38	–0.52	0.13	0.66	0.15	0.05	0.19	0.20
3000	2985.38	–0.58	0.13	0.62	0.15	0.17	0.21	0.20
3150	3162.28	–0.64	0.13	0.55	0.15	0.29	0.20	0.20
3350	3349.65	–0.70	0.14	0.45	0.15	0.44	0.19	0.20
3550	3548.13	–0.76	0.14	0.33	0.15	0.59	0.15	0.21
3750	3758.37	–0.84	0.15	0.18	0.15	0.76	0.11	0.21
4000	3981.07	–0.94	0.15	0.03	0.15	0.93	0.02	0.21
4250	4216.97	–1.06	0.15	–0.13	0.15	1.10	–0.09	0.21
4500	4466.84	–1.20	0.16	–0.27	0.15	1.28	–0.19	0.22

Nominal Frequency	Exact Frequency (6 digits)	Microphone Diffuse-field Response (From Table A.7)	Expanded Uncertainty	Influence of Windscreen	Expanded Uncertainty	Electrical Response	Acoustical Response	Expanded Uncertainty
Hz	Hz	dB	dB	dB	dB	dB	dB	dB
4750	4731.51	–1.32	0.16	–0.39	0.25	1.46	–0.24	0.30
5000	5011.87	–1.42	0.16	–0.46	0.35	1.64	–0.24	0.39
5300	5308.84	–1.53	0.17	–0.50	0.45	1.82	–0.21	0.48
5600	5623.41	–1.67	0.17	–0.48	0.50	2.01	–0.14	0.53
6000	5956.62	–1.83	0.17	–0.44	0.50	2.20	–0.06	0.53
6300	6309.57	–2.01	0.18	–0.38	0.50	2.40	0.02	0.53
6700	6683.44	–2.17	0.18	–0.34	0.50	2.60	0.08	0.53
7100	7079.46	–2.35	0.18	–0.36	0.50	2.81	0.10	0.53
7500	7498.94	–2.48	0.19	–0.45	0.50	3.03	0.11	0.53
8000	7943.28	–2.67	0.19	–0.58	0.50	3.26	0.02	0.53
8500	8413.95	–2.89	0.22	–0.71	0.50	3.51	–0.10	0.55
9000	8912.51	–3.14	0.25	–0.79	0.50	3.76	–0.17	0.56
9500	9440.61	–3.38	0.28	–0.82	0.50	4.03	–0.18	0.57
10000	10000	–3.57	0.31	–0.82	0.50	4.31	–0.08	0.59
10600	10592.5	–3.73	0.34	–0.86	0.80	4.59	0.00	0.87
11200	11220.2	–3.86	0.37	–0.96	0.80	4.89	0.08	0.88
11800	11885	–4.02	0.40	–1.07	0.80	5.20	0.11	0.89
12500	12589.3	–4.29	0.43	–1.19	0.80	5.52	0.04	0.91
13200	13335.2	–4.54	0.46	–1.31	0.80	5.84	–0.01	0.92
14000	14125.4	–4.74	0.49	–1.43	0.80	6.16	–0.02	0.94
15000	14962.4	–4.94	0.52	–1.53	0.80	6.47	0.01	0.95
16000	15848.9	–5.16	0.55	–1.63	0.80	6.78	–0.01	0.97
17000	16788	–5.49	0.57	–1.77	0.80	7.08	–0.18	0.98
18000	17782.8	–5.92	0.59	–1.92	0.80	7.35	–0.49	0.99
19000	18836.5	–6.46	0.61	–1.98	0.80	7.60	–0.85	1.01
20000	19952.6	–7.20	0.63	–2.07	0.80	7.80	–1.46	1.02
21200	21134.9	–8.19	0.65	–2.18	0.80	7.96	–2.41	1.03
22400	22387.2	–9.35	0.67	–2.19	0.80	8.04	–3.50	1.04

Table A.9 *Diffuse field frequency response for Outdoor Microphone Kit UA-1404, Microphone Type 4190, Microphone Preamplifier ZC-0032 and the analyzer with the Microphone Preamplifier connected to a microphone extension cable*

Nominal Frequency	Exact Frequency (6 digits)	Microphone Diffuse-field Response (From Table A.7)	Expanded Uncertainty	Influence of Outdoor Microphone Kit	Expanded Uncertainty	Electrical Response	Acoustical Response	Expanded Uncertainty
Hz	Hz	dB	dB	dB	dB	dB	dB	dB
63	63.0957	–0.02	0.05	0.00	0.05	0.00	–0.02	0.07
80	79.4328	–0.02	0.05	0.00	0.05	0.00	–0.02	0.07
100	100	–0.03	0.05	0.00	0.05	0.00	–0.03	0.07
125	125.893	0.01	0.05	0.00	0.05	0.00	0.01	0.07
160	158.489	0.01	0.05	0.00	0.05	0.00	0.01	0.07
200	199.526	0.01	0.05	0.00	0.05	0.01	0.02	0.07
250	251.189	0.00	0.05	0.01	0.05	0.01	0.02	0.07
315	316.228	–0.02	0.06	0.02	0.05	0.01	0.02	0.08
400	398.107	–0.03	0.06	0.04	0.05	0.02	0.03	0.08
500	501.187	–0.04	0.10	0.06	0.05	0.02	0.03	0.11
630	630.957	–0.06	0.10	0.08	0.05	0.04	0.06	0.11
800	794.328	–0.08	0.10	0.10	0.05	0.06	0.08	0.11
1000	1000	–0.11	0.10	0.09	0.05	0.09	0.08	0.11
1060	1059.25	–0.12	0.10	0.07	0.08	0.11	0.06	0.13
1120	1122.02	–0.13	0.10	0.05	0.08	0.12	0.04	0.13
1180	1188.5	–0.14	0.10	0.03	0.08	0.13	0.02	0.13
1250	1258.93	–0.16	0.10	0.02	0.08	0.15	0.01	0.13
1320	1333.52	–0.18	0.10	0.02	0.10	0.17	0.01	0.14
1400	1412.54	–0.20	0.10	0.02	0.10	0.19	0.01	0.14
1500	1496.24	–0.22	0.10	0.03	0.10	0.21	0.01	0.14
1600	1584.89	–0.24	0.10	0.03	0.12	0.23	0.02	0.16
1700	1678.8	–0.26	0.10	0.03	0.15	0.26	0.03	0.18
1800	1778.28	–0.28	0.10	0.03	0.15	0.29	0.04	0.18

Nominal Frequency	Exact Frequency (6 digits)	Microphone Diffuse-field Response (From Table A.7)	Expanded Uncertainty	Influence of Outdoor Microphone Kit	Expanded Uncertainty	Electrical Response	Acoustical Response	Expanded Uncertainty
Hz	Hz	dB	dB	dB	dB	dB	dB	dB
1900	1883.65	–0.28	0.10	0.02	0.15	0.33	0.06	0.18
2000	1995.26	–0.29	0.10	–0.01	0.15	0.37	0.07	0.18
2120	2113.49	–0.30	0.10	–0.03	0.15	0.41	0.08	0.18
2240	2238.72	–0.32	0.11	–0.05	0.15	0.46	0.09	0.19
2360	2371.37	–0.35	0.11	–0.08	0.15	0.52	0.09	0.19
2500	2511.89	–0.40	0.12	–0.10	0.15	0.58	0.08	0.19
2650	2660.73	–0.46	0.12	–0.13	0.15	0.65	0.06	0.19
2800	2818.38	–0.52	0.13	–0.18	0.15	0.73	0.03	0.20
3000	2985.38	–0.58	0.13	–0.23	0.15	0.81	0.00	0.20
3150	3162.28	–0.64	0.13	–0.29	0.15	0.91	–0.01	0.20
3350	3349.65	–0.70	0.14	–0.35	0.15	1.02	–0.02	0.20
3550	3548.13	–0.76	0.14	–0.40	0.15	1.14	–0.03	0.21
3750	3758.37	–0.84	0.15	–0.46	0.15	1.27	–0.03	0.21
4000	3981.07	–0.94	0.15	–0.50	0.15	1.42	–0.02	0.21
4250	4216.97	–1.06	0.15	–0.52	0.15	1.58	0.00	0.21
4500	4466.84	–1.20	0.16	–0.55	0.15	1.75	0.01	0.22
4750	4731.51	–1.32	0.16	–0.60	0.25	1.94	0.02	0.30
5000	5011.87	–1.42	0.16	–0.70	0.35	2.14	0.02	0.39
5300	5308.84	–1.53	0.17	–0.83	0.45	2.36	0.00	0.48
5600	5623.41	–1.67	0.17	–0.94	0.50	2.57	–0.04	0.53
6000	5956.62	–1.83	0.17	–1.01	0.50	2.77	–0.07	0.53
6300	6309.57	–2.01	0.18	–1.00	0.50	2.95	–0.06	0.53
6700	6683.44	–2.17	0.18	–0.89	0.50	3.07	0.00	0.53
7100	7079.46	–2.35	0.18	–0.67	0.50	3.10	0.09	0.53
7500	7498.94	–2.48	0.19	–0.42	0.50	3.02	0.12	0.53
8000	7943.28	–2.67	0.19	–0.08	0.50	2.84	0.10	0.53
8500	8413.95	–2.89	0.22	0.30	0.50	2.60	0.00	0.55
9000	8912.51	–3.14	0.25	0.67	0.50	2.37	–0.10	0.56
9500	9440.61	–3.38	0.28	1.00	0.50	2.23	–0.15	0.57
10000	10000	–3.57	0.31	1.23	0.50	2.21	–0.13	0.59
10600	10592.5	–3.73	0.34	1.40	0.80	2.33	0.00	0.87
11200	11220.2	–3.86	0.37	1.47	0.80	2.55	0.16	0.88
11800	11885	–4.02	0.40	1.47	0.80	2.85	0.31	0.89
12500	12589.3	–4.29	0.43	1.36	0.80	3.20	0.27	0.91
13200	13335.2	–4.54	0.46	1.02	0.80	3.58	0.06	0.92
14000	14125.4	–4.74	0.49	0.69	0.80	3.98	–0.07	0.94
15000	14962.4	–4.94	0.52	0.43	0.80	4.38	–0.13	0.95
16000	15848.9	–5.16	0.55	0.25	0.80	4.78	–0.13	0.97
17000	16788	–5.49	0.57	0.34	0.80	5.15	0.00	0.98
18000	17782.8	–5.92	0.59	0.56	0.80	5.50	0.14	0.99
19000	18836.5	–6.46	0.61	0.63	0.80	5.81	–0.02	1.01
20000	19952.6	–7.20	0.63	0.49	0.80	6.07	–0.64	1.02
21200	21134.9	–8.19	0.65	0.40	0.80	6.26	–1.52	1.03
22400	22387.2	–9.35	0.67	–0.02	0.80	6.37	–3.00	1.04

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 0° 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 Hz	Exact Frequency (6 digits) Hz	Configuration as in Table A.2 dB	Configuration as in Table A.3 dB	Configuration as in Table A.4 dB	Configuration as in Table A.5 dB	Configuration as in Table A.6 dB
63	63.0957	–0.02	–0.02	–0.02	–0.02	–0.02
80	79.4328	–0.02	–0.02	–0.02	–0.02	–0.02
100	100	–0.03	–0.03	–0.03	–0.03	–0.03
125	125.893	0.01	0.01	0.01	0.01	0.01
160	158.489	0.01	0.02	0.01	0.02	0.01
200	199.526	0.01	0.03	0.01	0.03	0.02
250	251.189	0.01	0.08	0.00	0.07	0.03
315	316.228	0.01	0.14	0.01	0.14	0.05
400	398.107	0.00	0.21	0.02	0.23	0.09
500	501.187	0.01	0.24	0.03	0.26	0.12
630	630.957	0.03	0.10	0.06	0.13	0.18
800	794.328	0.06	–0.06	0.07	–0.04	0.25
1000	1000	0.08	0.01	0.09	0.02	0.29
1060	1059.25	0.10	–0.01	0.11	0.01	0.28
1120	1122.02	0.11	–0.07	0.14	–0.04	0.25
1180	1188.5	0.12	–0.14	0.17	–0.09	0.23
1250	1258.93	0.13	–0.17	0.19	–0.12	0.22
1320	1333.52	0.15	–0.10	0.22	–0.02	0.22
1400	1412.54	0.17	0.09	0.25	0.17	0.24
1500	1496.24	0.18	0.27	0.28	0.38	0.27
1600	1584.89	0.20	0.37	0.32	0.49	0.31
1700	1678.8	0.22	0.29	0.36	0.43	0.36
1800	1778.28	0.25	0.13	0.39	0.27	0.43
1900	1883.65	0.28	0.06	0.43	0.22	0.52
2000	1995.26	0.31	0.22	0.48	0.39	0.61
2120	2113.49	0.34	0.45	0.52	0.63	0.68
2240	2238.72	0.37	0.46	0.55	0.64	0.73
2360	2371.37	0.41	0.11	0.60	0.30	0.78
2500	2511.89	0.46	0.29	0.65	0.48	0.81
2650	2660.73	0.50	0.68	0.70	0.89	0.79
2800	2818.38	0.55	0.65	0.77	0.87	0.75
3000	2985.38	0.61	0.49	0.84	0.72	0.79
3150	3162.28	0.68	0.84	0.88	1.04	0.87
3350	3349.65	0.74	0.77	0.92	0.95	0.93
3550	3548.13	0.81	0.69	0.93	0.80	1.13
3750	3758.37	0.90	1.10	0.96	1.16	1.36
4000	3981.07	1.00	0.91	1.02	0.92	1.47
4250	4216.97	1.09	1.08	1.09	1.08	1.66
4500	4466.84	1.19	1.29	1.18	1.28	1.76
4750	4731.51	1.31	1.14	1.31	1.14	1.92
5000	5011.87	1.42	1.18	1.47	1.23	1.99
5300	5308.84	1.55	1.45	1.66	1.56	2.17
5600	5623.41	1.67	1.62	1.85	1.80	2.22
6000	5956.62	1.81	1.84	2.05	2.08	2.38
6300	6309.57	1.95	2.00	2.25	2.30	2.48
6700	6683.44	2.09	2.14	2.37	2.42	2.66
7100	7079.46	2.26	2.23	2.45	2.42	2.73
7500	7498.94	2.46	2.38	2.60	2.52	2.82
8000	7943.28	2.69	2.60	2.82	2.73	2.75
8500	8413.95	2.90	2.71	3.02	2.83	2.57
9000	8912.51	3.10	3.10	3.29	3.28	2.40
9500	9440.61	3.31	3.42	3.55	3.66	2.36
10000	10000	3.56	3.71	3.82	3.97	2.40
10600	10592.5	3.85	3.71	4.06	3.92	2.57
11200	11220.2	4.17	4.04	4.37	4.24	2.83

Nominal Frequency	Exact Frequency (6 digits)	Configuration as in Table A.2	Configuration as in Table A.3	Configuration as in Table A.4	Configuration as in Table A.5	Configuration as in Table A.6
Hz	Hz	dB	dB	dB	dB	dB
11800	11885	4.50	4.58	4.69	4.77	3.06
12500	12589.3	4.75	4.90	5.04	5.19	3.09
13200	13335.2	5.00	5.00	5.30	5.31	2.96
14000	14125.4	5.29	5.22	5.60	5.52	2.76
15000	14962.4	5.63	5.67	5.96	6.01	2.55
16000	15848.9	6.02	6.13	6.30	6.42	2.26
17000	16788	6.39	6.38	6.48	6.47	1.97
18000	17782.8	6.79	6.73	6.62	6.55	1.80
19000	18836.5	7.20	7.32	6.65	6.78	1.45
20000	19952.6	7.57	7.57	6.45	6.44	0.49
21200	21134.9	7.65	7.69	5.95	5.99	–0.41
22400	22387.2	7.41	7.58	5.33	5.50	–2.61

A.5 Directional Responses

Microphone 4190 has the same Directional Response as Microphone Type 4189. For these data see Instruction Manual BE 1712.

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, or in response to simulation of sound pressure by Electrostatic Actuator UA-0033, 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 and Table A.50 to view the data.

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	Correction Data For Preamplifier Connected to an Extension Cable	Expanded Uncertainty	Correction Data For Preamplifier Mounted Directly on the Analyzer	Expanded Uncertainty
Hz	dB	dB	dB	dB
31.5	0.00	0.30	0.00	0.32
63	0.00	0.06	0.00	0.12
125	0.00	0.05	0.00	0.11
250	0.00	0.05	0.07	0.11
500	0.01	0.05	0.23	0.11
1000	0.08	0.05	0.01	0.11
2000	0.27	0.09	0.18	0.14
4000	0.89	0.11	0.80	0.19
8000	2.80	0.22	2.72	0.30
12500	5.43	0.27	5.58	0.34
16000	6.50	0.32	6.61	0.38

Table A.50 *Acoustical test with Electrostatic Actuator UA-0033. 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 For Preamplifier Connected to an Extension Cable	Expanded Uncertainty	Correction Data For Preamplifier Mounted Directly on the Analyzer	Expanded Uncertainty
Hz	Hz	dB	dB	dB	dB
31.5	31.6228	0.00	0.02	0.00	0.10
63	63.0957	0.00	0.02	0.00	0.10
125	125.893	0.00	0.02	0.00	0.10
250	251.189	0.00	0.02	0.07	0.10
500	501.187	0.02	0.02	0.25	0.10
1000	1000	0.10	0.02	0.03	0.10
2000	1995.26	0.32	0.05	0.24	0.11
4000	3981.07	1.07	0.08	0.97	0.17
8000	7943.28	3.38	0.09	3.30	0.22
12500	12589.3	7.19	0.11	7.34	0.23
16000	15848.9	8.59	0.12	8.70	0.23

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