HBK HOTTINGER BRÜEL & KJÆR

INSTRUCTION MANUAL

Sound Level Meter
Type 2245

for use with Microphone Type 4966

BE 1910 – 14

Sound Level Meter
Type 2245

with Microphone Type 4966

From Hardware Version 1.0

Firmware Variants:
FW-2245-000
FW-2245-001
FW-2245-002

Instruction Manual

BE 1910−14
September 2023

www.bksv.com

Health and Safety Considerations

This apparatus has been designed and tested in accordance with IEC/EN 61010–1 and ANSI/UL 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.

Safety Symbols and Signal Words Used


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


The manual uses this symbol when a danger or warning statement is applicable


Hazardous Voltage/Electricity. Both the apparatus and manual use this symbol when there is a risk for shock or electrocution


Hot Surface. This manual will use this symbol when there is a risk for burning or scolding


Earth (Ground) Terminal. The apparatus will be marked with this symbol when applicable


Protective Conductor Terminal. The apparatus will be marked with this symbol when applicable

Alternating Current. The apparatus will be marked with this symbol when applicable

Danger Signals an imminent hazardous situation, which, if not avoided, will result in death or serious injury

Warning Signals a possibly hazardous situation, which, if not avoided, will result in death or serious injury

Caution Signals a hazardous situation, which, if not avoided, could result in minor or moderate injury or damage to the apparatus

Notice Signals a situation or practice that requires attention, but does not directly result in personal injury if ignored

Risks and Hazards

Explosion Hazards


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

Electrical Hazards


Warning: 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

Caution: Switch off all power to equipment before connecting or disconnecting their digital interface. Failure to do so could damage the equipment

Mechanical Hazards

Caution: 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

Waste Handling


HBK complies with the EU's Waste Electrical and Electronic Equipment (WEEE) Directive, which issues the following waste handling instructions:

- 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 HBK representative or to Hottinger Brüel & Kjaer A/S for disposal

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Contents

Chapter 1

Introduction

1.1 About This Manual

This instruction manual for Sound Level Meter Type 2245 has been created to fulfil the documentation requirements of the national and international standards that the sound level meter conform to. These standards are listed in section 4.2.

For other microphone configurations, supplements to this manual will be provided.

Other documentation and sales material will also contain specifications for the sound level meter. In the event of any unintended inconsistency between these and those in this instruction manual, the instruction manual takes precedence.

Appendix B of this manual provides cross-references between specific paragraphs in the standards that require topics to be documented and the corresponding sections in this manual that conform to them.

The PC and smart device software contain online help including user help for the sound level meter.

1.1.1 Conventions Used in this Manual

The term "sound level meter" is an abbreviation for "Sound Level Meter Type 2245" throughout this manual.

Selectable Buttons, Values and Pages on the Screen and Command

Indicated by bold type face (for example: select **Enabled**).

Parameters, Text and Variable Fields

Parameters, instructions, descriptions appearing on the screen and variables are indicated by italics (for example: select as *Input*).

Menus and Screen Navigation

Indicated by bold typeface and arrows (for example, go to **Measurement settings** > **Input** > **Sound field**).

Notes and Hints

Please note: Notes contain nice-to-know information that does not convey possible risks to the user or sound level meter.

Hint: Hints are suggestions or tips to help the user avoid typical problems, or to perform tasks easier and/or correctly.

1.2 System Overview

1.2.1 Hardware and Firmware on the Sound Level Meter

To see the currently installed firmware and hardware on the sound level meter, go to the *About* screen (see section 2.3.1).

There are three firmware variants:

- **FW-2245-000:** General type-approved firmware
- **FW-2245-001:** WELMEC type-approved firmware, Germany
- **FW-2245-002:** WELMEC type-approved firmware, Spain

The three firmware variants fulfil the specifications described in this manual.

The FW-2245-000 variant is a superset of the other variants.

The three firmware variants are identical, except for the following restrictions on FW-2245-001 and FW-2245-002 compared to FW-2245-000:

- Installing and updating firmware can only be done by authorized personnel
- Measurements cannot be performed if the Clock has been reset and not automatically set afterwards (FW-2245-000 gives a warning)
- Measurements cannot be opened if a checksum on data fails (FW-2245-000 gives a warning)

In addition, the following restrictions have been made to FW-2245-002:

- Changes to microphone parameters can only be made by authorized personnel (created, modified and deleted)
- Calibration with changes to the sensitivity can only be made by authorized personnel
- The maximum allowed deviation from initial sensitivity of microphone is ± 1.1 dB (instead of ± 1.5 dB)
- Date format can only be dd/mm/YYYY or dd-mm-YYYY
- Time format can only be HH:mm:ss
- Decimal point can only be "," (comma)
- Saved legally relevant data can first be deleted after a 2-year retention period

1.2.2 Basic PC Software

Noise Partner for PC can be used for transferring measurement data from the sound level meter to a standard PC for post-processing and reporting.

Noise Partner for smart devices can be used for controlling the sound level meter and for transferring data from the sound level meter to the smart device for display and post-processing.

Noise Partner can be downloaded from Brüel & Kjær's website. For instructions on using this software, see the software's online help.

1.2.3 Hardware Setup

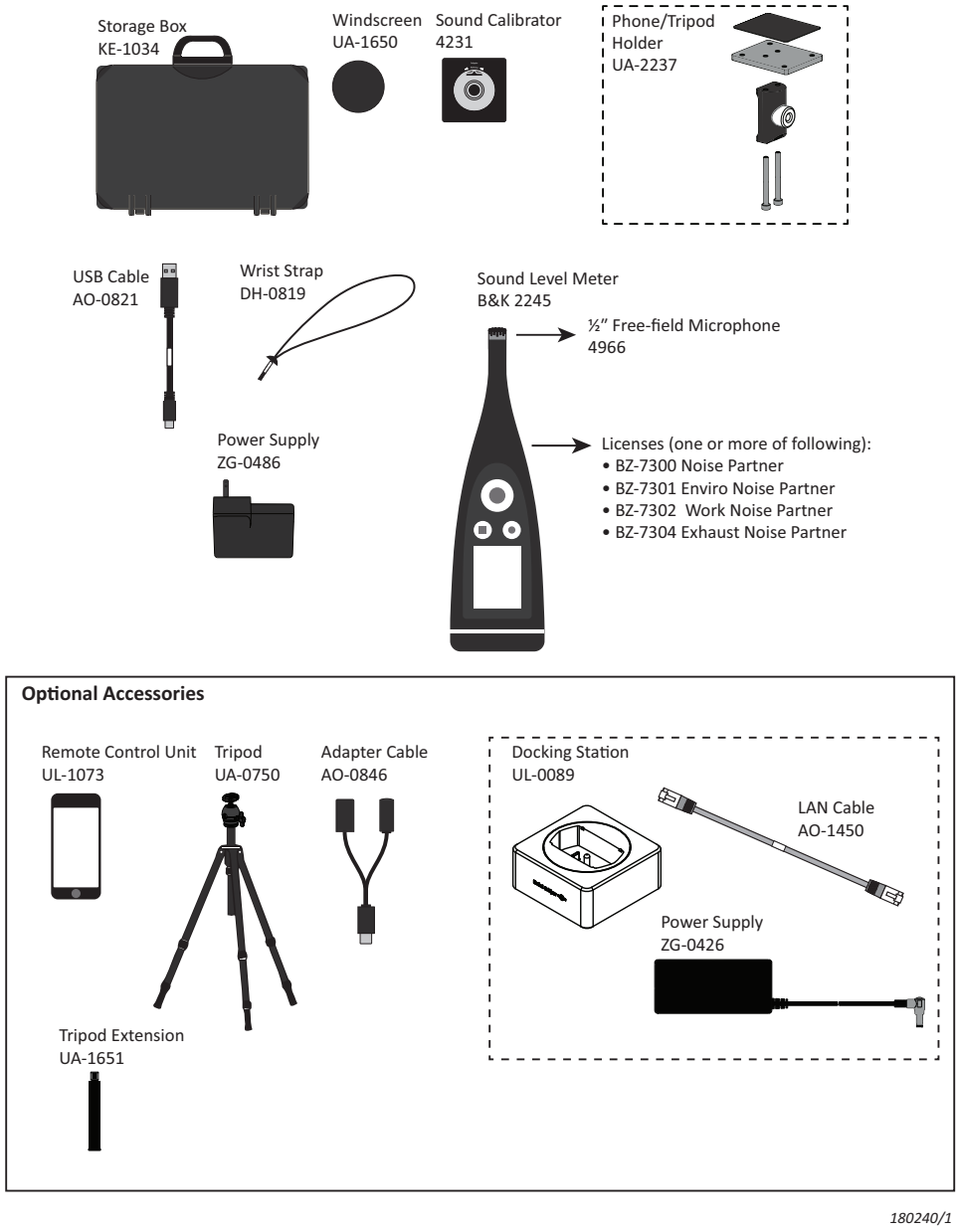
This section provides an overview of the hardware components used with the sound level meter.

A hardware overview is provided in Fig. 1.1; optional accessories are included in the figure.

The components needed for conformance testing of the sound level meter are listed in Table 1.1. The accessories that can be used for an approved measurement with this software version are listed in Table 1.2.

Fig. 1.1
Hardware overview

B&K 2245 Sound Level Meter with Accessories in Hardshell Case



180240/1

Table 1.1
Hardware components needed for conformance testing of Sound Level Meter Type 2245

Quantity	HBK Type/Part Number	Description
1	Type 4966	Prepolarized Free-field ½″ Condenser Microphone
1	WA-0302-B	Electrical Substitute for Microphone Type 4966, 15 pF
1	UA-0245	10–32 UNF to BNC Adapter
1	UA-1650	90 mm dia. Windscreen with auto-detect insert
1	UA-1651	Tripod Extension
1	UA-2238	Tripod Adapter
1	ZG-0486	Power Supply, with integrated USB-A socket
1	AO-0821-D-010	USB Shielded I/O Cable, type A to C, USB 2.0, 1 m
1	Type 4231	Sound Calibrator
1	Type 4226	Multifunction Acoustic Calibrator

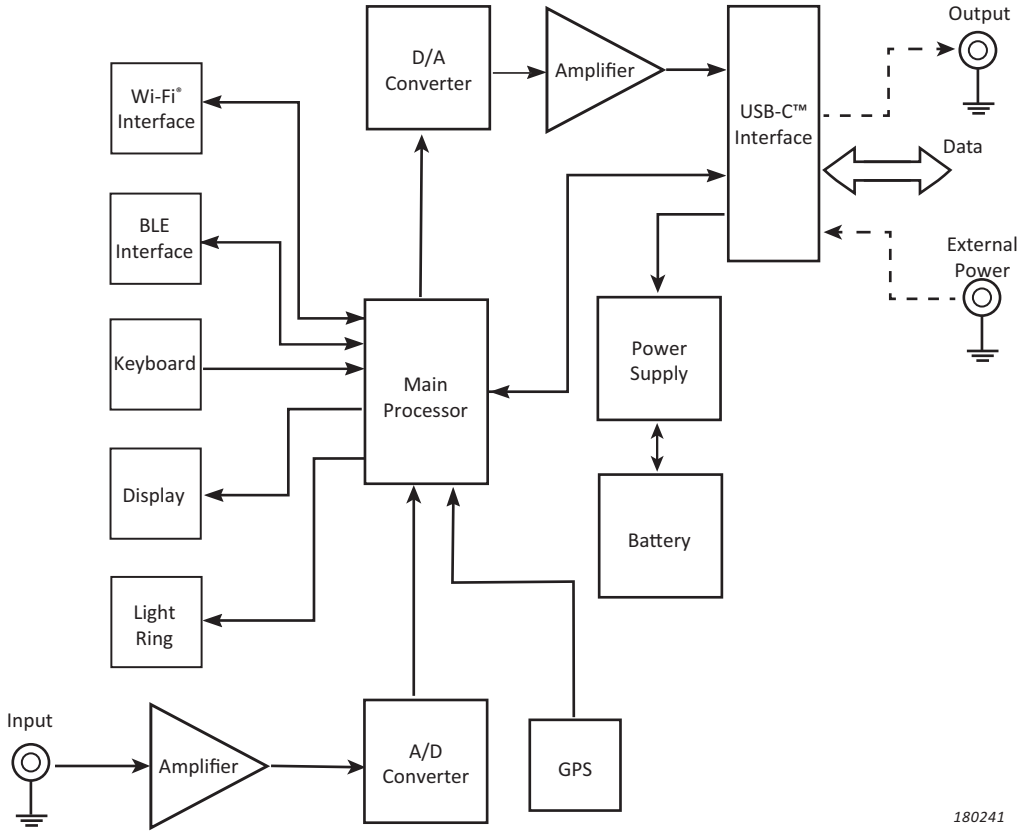
Table 1.2
Accessories that can be used for an approved measurement with this software version

Software Version	HBK Type/Part Number	Description
1.1.3.1653	Type 4966	Prepolarized Free-field ½″ Condenser Microphone
	UA-1650	90 mm dia. Windscreen with auto-detect insert
	UA-1651	Tripod Extension
	UA-2238	Tripod Adapter
	ZG-0486	Power Supply, with integrated USB-A socket
	AO-0821-D-010	USB Shielded I/O Cable, type A to C, USB 2.0, 1 m
	Type 4231	Sound Calibrator

1.2.4 Block Diagram

The block diagram of the sound level meter is shown in Fig. 1.2.

Fig. 1.2
Block diagram of Type 2245



Chapter 2

Short Guide to the Sound Level Meter

2.1 Introduction

This chapter contains a brief guide to the use of the sound level meter.

The user interface of the sound level meter has:

- A screen for displaying settings, results and status
- A keyboard for navigating on the screen, changing settings and controlling the measurement
- A colour-coded light ring to reflect the status of the instrument

2.2 Switching the Sound Level Meter On and Off

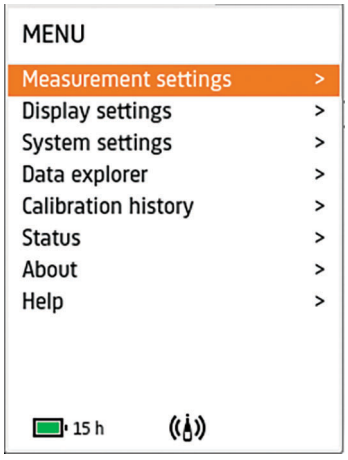
To switch on, press ☰ on the sound level meter for a few seconds. The sound level meter will start-up showing the last used measurement display.

Press and hold ☰ for at least 4 seconds to switch off the sound level meter.

2.3 Setting Up the Sound Level Meter

Please note: Features and their settings will depend on your licence. Not all settings may be available on your sound level meter.

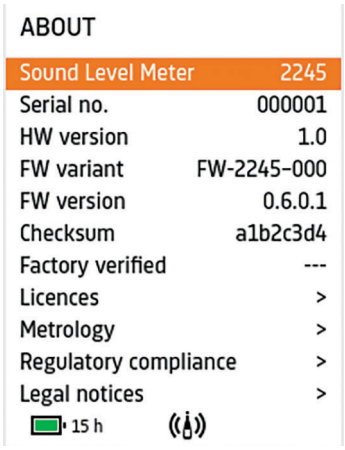
Press ☰ on the sound level meter to enter the menu.



Navigate through the menu using the sound level meter's up/down (▲ / ▼) buttons.

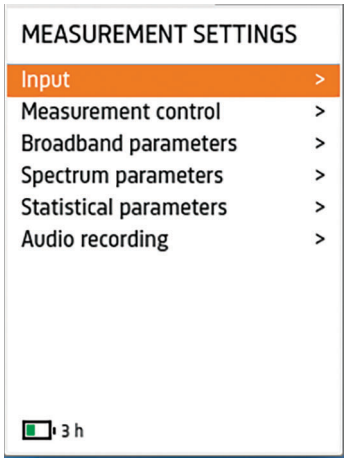
To view specific settings, use the left/right (◄ / ►) buttons.

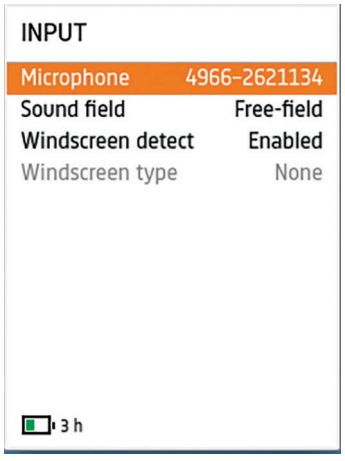
2.3.1 About



Go to **About** to see the sound level meter's serial number, hardware version, firmware variant, and currently installed firmware version.

2.3.2 Measurement Settings





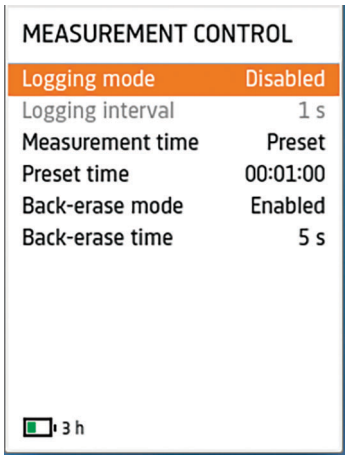
The acoustical frequency response and calibration depends on the sound field, the microphone, the microphone accessories in use, and the electrical frequency response. To improve the quality of the measurement and help the user to measure correctly, the sound level meter compensates for the sound field, the microphone, and the microphone accessories in use by automatically changing the electrical frequency response and calibration.

Hint: To ensure correct and good quality measurements, it is VERY IMPORTANT that parameters in *Measurement settings* are correct.

Go to **Measurement settings** > **Input** to select:

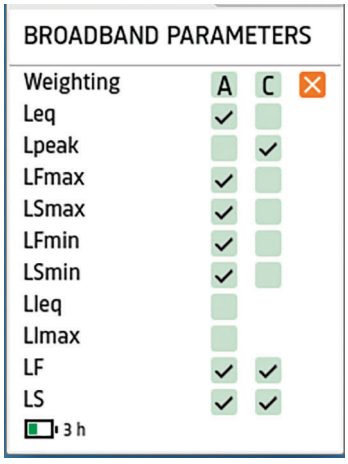
- *Microphone* – to use (if more than one is specified in **System settings** > **Advanced settings** > **Microphones**)
- *Sound field* – Select the sound field correction to apply, based on the type of measurement you will make. The type of microphone is irrelevant. For example, Microphone Type 4966 is a free-field microphone, but if you select **Diffuse-field**, you can make correct measurements in a diffuse field. Selecting **Free-field** will enhance the overall frequency response of the system.

  Please note: Generally, ISO requires free-field conditions and ANSI requires diffuse-field conditions. Check your local standards for the setting you require. No correction is made for an unknown microphone.
- *Windscreen detect* – Toggle **Enabled**/**Disabled** automatic detection of Windscreen UA-1650 when mounted on the microphone preamplifier
- *Windscreen type* – Manually select type of windscreen, when *Windscreen Detect* is **Disabled**



Go to **Measurement settings** > **Measurement control** to set up how to control your measurement:

- *Logging mode* – Select **Enabled** to log measurement data at every *Logging interval*
- *Logging interval* – Define the logging interval when *Logging mode* is **Enabled**. Select **1**, **5**, **10**, **30** or **60** seconds
- *Measurement time* – Select either:
  –**Preset** for the measurement to run for the specified *Preset time*
  –**Free** to run until you press stop
- *Preset time* – Define the measurement time
- *Back-erase mode* – Select **Enabled** to overwrite all data from the specified *Back-erase time* when continuing a paused measurement. Only available when *Logging mode* is **Disabled**. When Back-erase is disabled, measurement continues without overwriting data
- *Back-erase time* – Define the back-erase time, from **1** to **10** seconds



Go to **Measurement settings** > **Broadband parameters** to select the frequency weightings to use and the broadband parameters to measure.

Use the arrow keys on the sound level meter to navigate between the selectable fields, press to select/deselect the parameter.

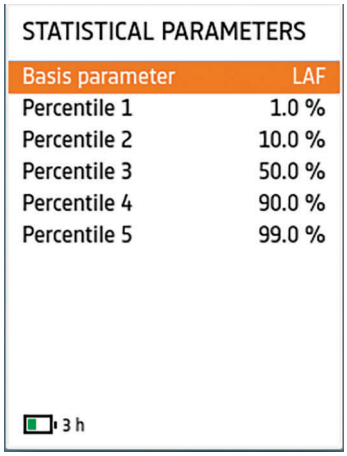
See details on measured broadband parameters in sections 2.13 and 2.14.

Go to **Measurement settings** > **Spectrum parameters** to select the:

- *Bandwidth*: (1/1-octave) or (1/3-octave)
- Frequency *Weighting*: **A**, **B**, **C** or **Z**
- Spectrum parameters: Select from those listed

Use the arrow keys on the sound level meter to navigate between the selectable fields. Press to select/deselect the parameter.

See details on measured broadband parameters in sections 2.13 and 2.14.

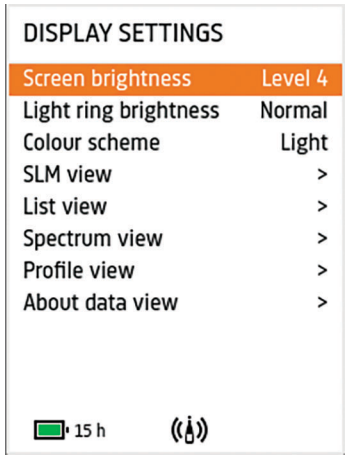


Go to **Measurement settings** > **Statistical parameters** to select the *Basis parameter* for the statistics (**LAeq**, **LAF**, or **LAS**) and up to five percentiles.

See details on statistics in section 2.14.2.

Go to **Measurement settings** > **Audio recording** to enable audio recording in **Listen quality** (MP3 files).

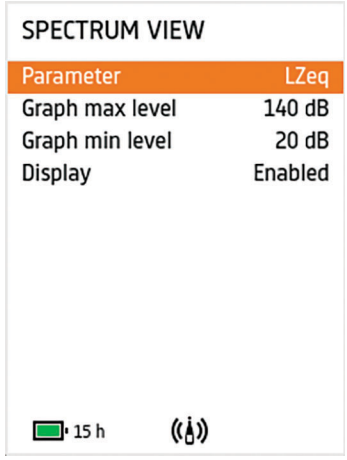
2.3.3 Display Settings



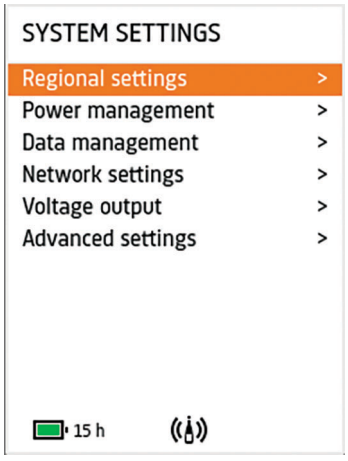
Go to **Display settings** > **Screen brightness** and **Display settings** > **Light ring brightness** to adjust the brightness of the screen and light ring on the sound level meter, respectively.

Go to **Display settings** > **Colour scheme** to select either a **Light** or **Dark** scheme.

Use the rest of the *Display settings* to specify how to display your measurement data. There is a view for each of the five possible displays to specify which parameters to display, the maximum and minimum levels of the graphs, and whether to enable the view for display or not. Here we only show the *Spectrum view*.



2.3.4 System Settings



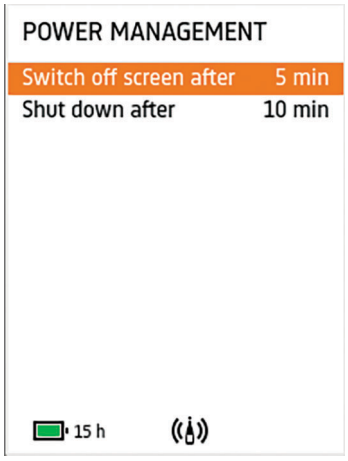
Go to **System settings** to control regional settings, power settings, storage settings, network settings, and advanced service settings.

Go to **System settings** > **Regional settings** > **Language** to select your preferred user interface language.

Define the *Time zone* as a place, and then in the corresponding GMT+/– hours will be shown.

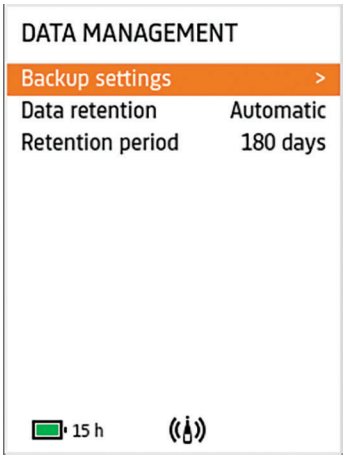
The *Date format* and *Time format* can be defined here together with the type of *Date separator* and *Decimal point*.

Set the *Decimal places* to **1** or **2**. This defines the number of digits after the decimal point for result readings in dB values.



Go to **System settings** > **Power management** to define the duration of inactivity before the display switches off, and the duration before the sound level meter switches off.

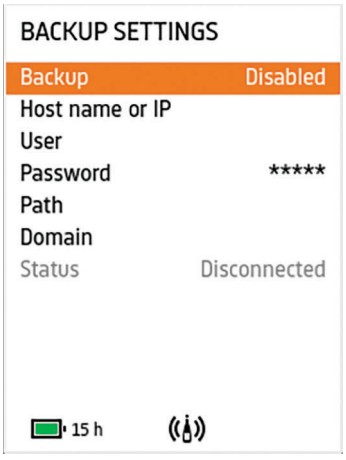
Please note: Connecting the sound level meter to external power will always switch it on and start charging.



Go to **System settings** > **Data management** to set up backup settings for automatic backup and data retention.

Set *Data retention* to **Automatic** or **Manual**: When set to Automatic, data that has been transferred to the PC apps or backed up to a NAS disk/USB memory stick will automatically be moved to the sound level meter's Trash.

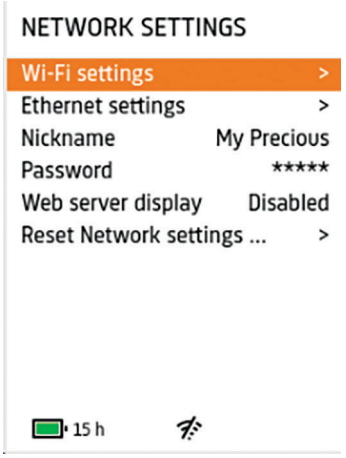
With *Retention period*, define the amount of time data in Trash is retained. Data will be removed from Trash when space is needed (that is, when more than 80% of disk space is used).



Go to **System settings** > **Data management** > **Backup settings** to define how data is automatically backed up. Back up either to:

- a USB memory stick – select the USB stick
- a NAS disk, a folder on a network drive, or on the hard disk on your PC – select **Disabled**, then enter the necessary information

The data transfer will automatically start whenever the sound level meter is connected to the defined backup system.



Go to **System settings** > **Network settings** to set up how to connect to the sound level meter through a network.

The sound level meter has three network interfaces:

- Wi-Fi®
- Ethernet through the USB-C™ connector
- Bluetooth® (Bluetooth Low Energy)

Bluetooth is used for easy pairing of the smart device and sound level meter and will automatically be switched on when *Wi-Fi mode* is set to **Act as hotspot** or **Connect to network**.

Give your sound level meter a *Nickname* as identification (in addition to the serial number) when accessing it from the interface.

You can also define a password for accessing the instrument through Wi-Fi or Ethernet.

By enabling *Web server display*, you can see the display of the sound level meter in an Internet browser by entering: the sound level meter's IP address/display, for example **10.42.0.1/display**.

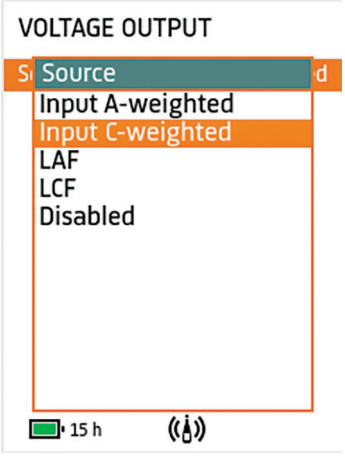
Use *Reset network settings* to clear all network settings. The sound level meter will forget all networks it was connected to.

Go to **System settings** > **Network settings** > **Wi-Fi settings** to connect to the Wi-Fi. Set *Wi-Fi mode* to:

- **Airplane mode** to switch Wi-Fi and Bluetooth off completely
- **Connect to network** to connect to an existing network using a Wi-Fi name and Wi-Fi password
- **Act as hotspot** to create a local hotspot for apps to connect to

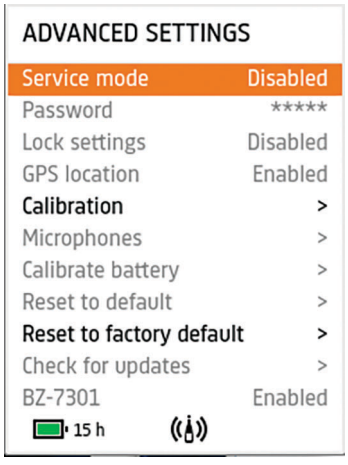
It is recommended to set *Set up IP* to **Automatically**, to let the DNS server manage the IP settings. In special cases, you might need to set up the IP manually.

Go to **System settings** > **Network settings** > **Ethernet settings** to define the interface settings for using a cable – either a USB-C to USB (connected directly to a PC) or a USB-C to Ethernet (connected to LAN).



Go to **System settings** > **Voltage output** to output an analogue signal on the USB-C socket through USB-C to 3.5 mm (Mini) Jack Adapter AO-0846.

Select the input signal to be output for testing purposes, or LXF as a "DC" output.



Go to **System settings** > **Advanced settings** to define a number of settings and functions that require the sound level meter to be set into *Service mode* before they can be accessed to prevent accidental changes to these settings.

You can specify a *Password* for enabling Service mode.

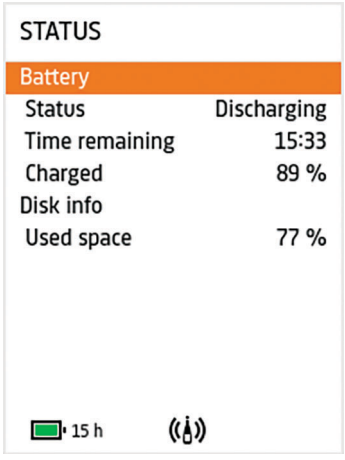
Please note: The only way to reset the password is to use *Reset to factory default*.

Enable *Service mode* to change legally relevant parameters like microphone sensitivity (to perform a calibration with adjustment of sensitivity), to create, change, or delete microphones, to calibrate the battery readings, to reset settings, to update the firmware, or install licences.

You can lock all the settings by enabling *Lock settings*. This can be used, when you have to set up the sound level meter for a specific purpose and want to be sure that nothing is changed during the measurement process. All measurement, display, and system settings are then locked.

By enabling and disabling item numbers like *BZ-7301*, you can open for some of the functionality of the sound level meter (for example, for rental or demonstration purposes).

2.3.5 Status



Go to **Status** to see the *Battery* and *Disk* status.

The small icon at the bottom left corner of the display gives a quick view of the battery status. This icon is on all displays.

2.4 Calibration

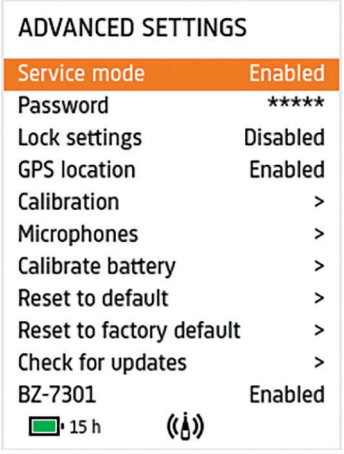
Calibration is an adjustment of your sound level meter to measure and display correct values. The sensitivity of the microphone as well as the response of the electronic circuitry can vary slightly over time or could be affected by environmental conditions such as temperature and humidity. While you are unlikely to ever experience a large drift or change in sensitivity with the sound level meter, it is nevertheless good practice to perform regular checks of the calibration, normally before and after each set of measurements.

It is strongly recommended to use HBK Sound Calibrator Type 4231.

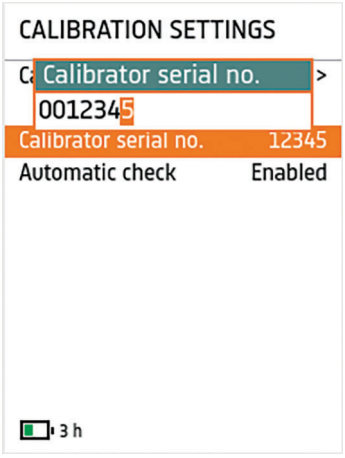
2.4.1 Calibration Procedure

The sound level meter requires a stable 1 kHz signal of either 94 dB or 114 dB. Use Sound Calibrator Type 4231. It provides a stable sound pressure at 1 kHz and has minimal susceptibility to environmental factors. The calibration procedure is semi-automatic: you just need to select calibration mode, and mount and switch on the calibrator, then the sound level meter will calculate the sensitivity.

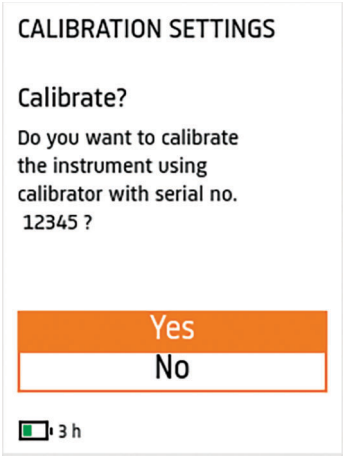
To perform acoustic calibration:



1) Stand away from loud sound sources that may interfere with the calibrator's signal.
2) Switch on the sound level meter.
3) Press ☰ and use the arrow buttons on the sound level meter to navigate to **System settings** > **Advanced settings** and set *Service mode* to **Enabled**.



4) Navigate to **Calibration**, press ► on the sound level meter to enter *Calibration Settings* and insert the *Calibrator serial no.* using the up/down (▲ / ▼) buttons to change the number.



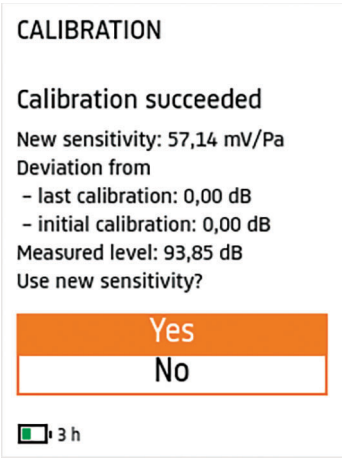
5) Navigate up to **Calibrate** and press ► to start the calibration process.

6) Fit Sound Calibrator Type 4231 carefully onto the microphone of the sound level meter. To avoid handling vibrations that disturb the calibration, rest the assembly in a roughly horizontal position on a table or other flat surface.

   Ensure that the calibrator fits snugly on the microphone.

7) Switch on the calibrator. Wait a few seconds for the level to stabilize.

8) Press ⏻ on the sound level meter to confirm the start of calibration.



9) *Detection signal* appears on the screen as feedback. When the signal has been detected and verified for a while, then the sensitivity is calculated and displayed on the screen together with deviations from the last and initial calibrations.

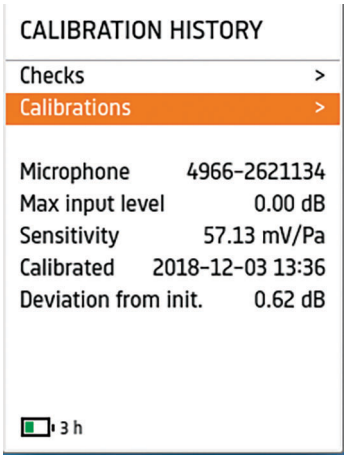
10) Press ☰ to accept the calibration.

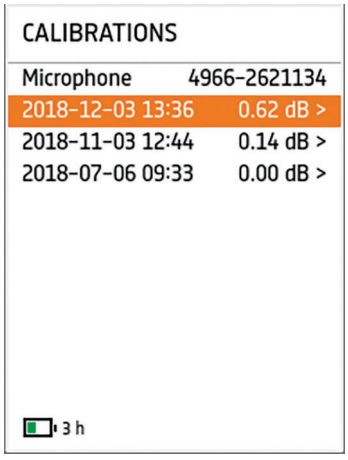
11) Remove the calibrator. It will automatically switch off after a few seconds.

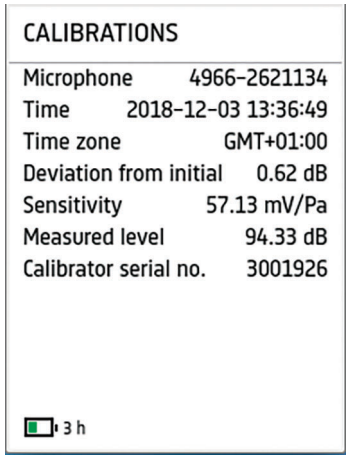
If no calibration signal is detected, you will be informed about an unstable calibration signal and asked to mount the calibrator. Switch the calibrator on and on the sound level meter press ☰ to retry the calibration.

If the calibration deviates more than ±1.5 dB (±1.1 dB for firmware variant FW-2245-002) from the initial calibration, then the calibration is stopped without changing the calibration of the sound level meter.

You can verify calibrations by navigating from the main menu: **Calibration history** > **Calibrations**.







2.4.2 Calibration Check Procedure

It is good practice to perform regular acoustic checks of the calibration, normally before and after each set of measurements. This can easily be done without changing the calibration. The sound level meter keeps a history of all the checks.

Use Sound Calibrator Type 4231. It provides a stable sound pressure at 1 kHz and has minimal susceptibility to environmental factors.

To perform an acoustic check of the calibration:

1) Stand away from loud sound sources that may interfere with the calibrator's signal.

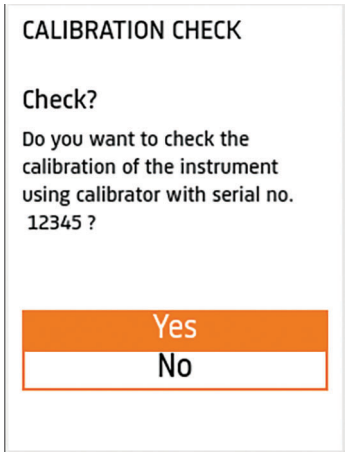
2) Switch on the sound level meter.

3) Stop any measurements (not paused) and display a measurement screen (not in settings). Press ■ to reset the sound level meter.

4) Fit Sound Calibrator Type 4231 carefully onto the microphone of the sound level meter. To avoid handling vibrations that disturb the calibration, rest the assembly in a roughly horizontal position on a table or other flat surface.

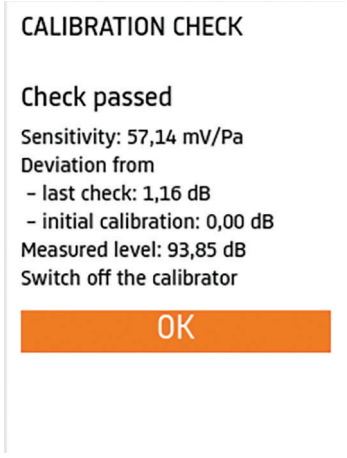
   Ensure that the calibrator fits snugly on the microphone.

5) Switch on the calibrator. Wait a few seconds for the level to stabilize.



6) The sound level meter will detect the signal and verify that you want to perform a calibration check.

7) Press ⏻ on the sound level meter to confirm and start the calibration check.

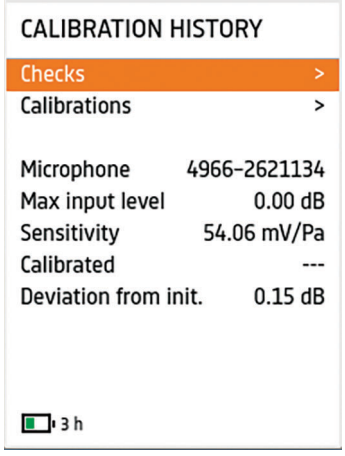


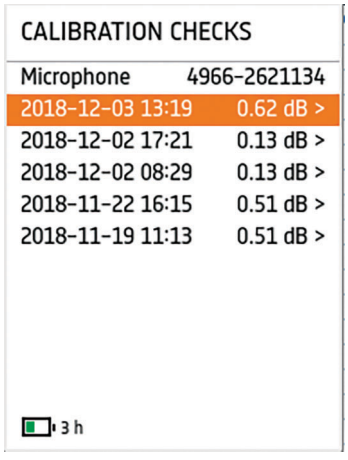
8) *Detection signal* appears on the screen as feedback. When the signal has been detected and verified, then the sensitivity is calculated and displayed on the screen together with deviations from the last and initial calibrations.

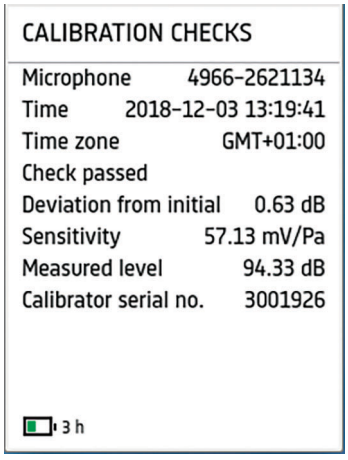
9) Press ⏻ to stop the calibration check.

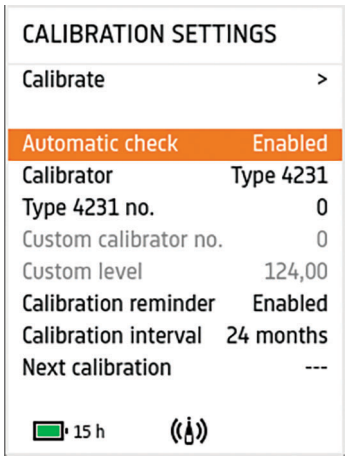
10) Remove the calibrator. It will automatically switch off after a few seconds.

You can verify calibration checks by navigating from the main menu: **Calibration history** > **Checks**.









Please note: You can disable the automatic calibration check in **System settings** > **Advanced settings** > **Calibration**.

2.5 Measuring with the Sound Level Meter

Before a measurement is started and after it is stopped, the sound level meter displays an instantaneous broadband measurement. You can be select which the broadband measurement in the *Display Settings*.

This measurement cannot be saved but it is useful to survey where to measure.

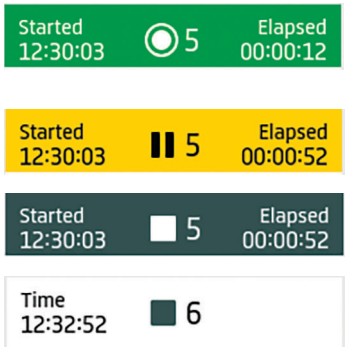
To make a measurement over a time period that can be saved, follow the procedure in the next section.

For more information on instantaneous and timed measurements, see section 2.14.

2.5.1 The Display During Measurement

The upper part of the display shows the measurement information, that is, the current time, measurement status icon (in the display here, it is stopped), and measurement number. This upper part will change colour to advise status.

2.5.2 Start, Pause and Stop the Measurement



Press ● on the sound level meter to start a measurement. The measurement status turns green and the elapsed measurement time is displayed to the right.

Press ● again to pause the measurement, shown as yellow status. You can continue the measurement by pressing the button again.

Press ■ to stop and automatically save the measurement (here, as measurement number 5).

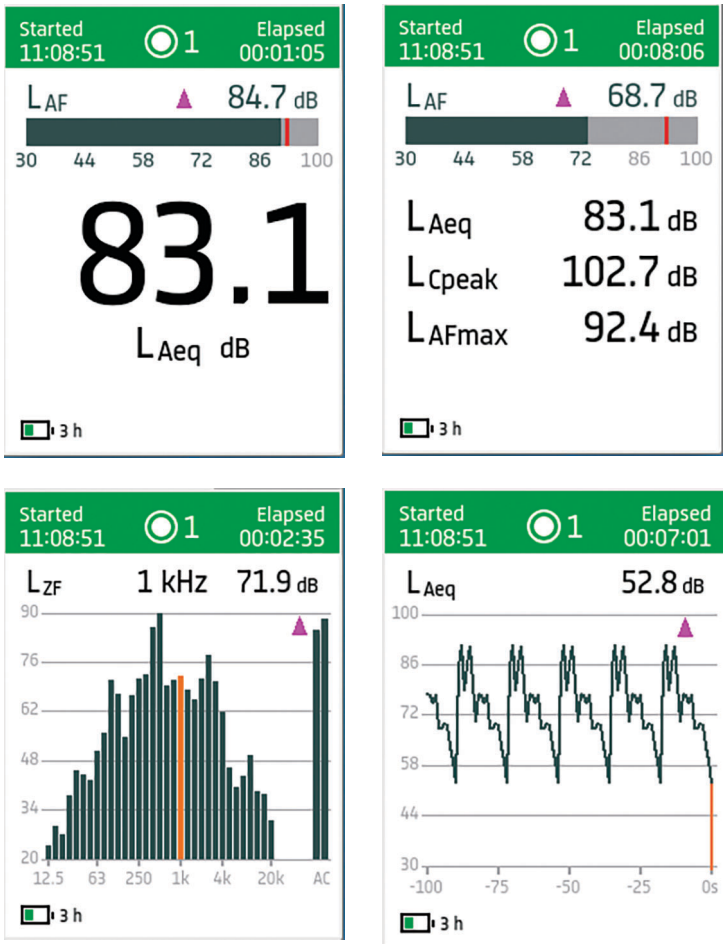
Press ■ again to reset the measurement and display, ready for a new measurement.

2.5.3 Overload and Underrange

The presence of overloads and underrange is shown in the measurement display. See section 2.15.

2.6 Viewing Measurements

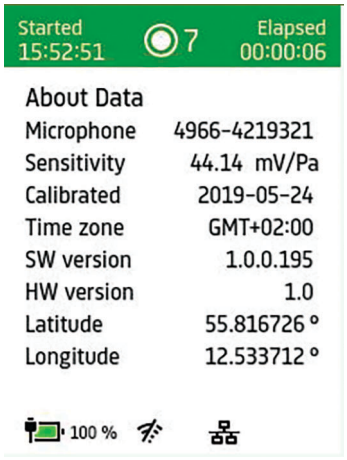
There are several measurement displays (*SLM*, *List*, *Spectrum*, *Profile*, and *About data*). To navigate between them, use the ▲ and ▼ buttons.



Please note: Use ► / ◄ while in the measurement displays to toggle the (main) parameter in the display without going into the *Display settings*.

In the *Spectrum* and *Profile* displays, you can also:

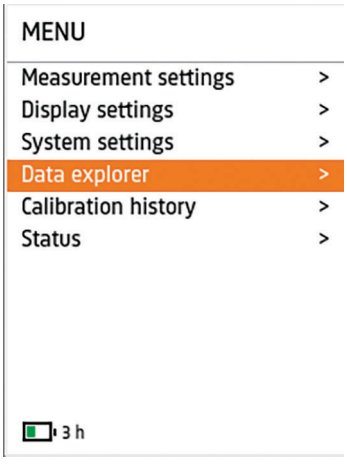
- Press and hold ► or ◄ to move the cursor
- Press and hold ▲ to zoom the y-axis

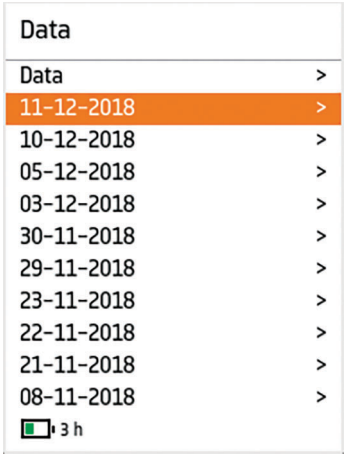


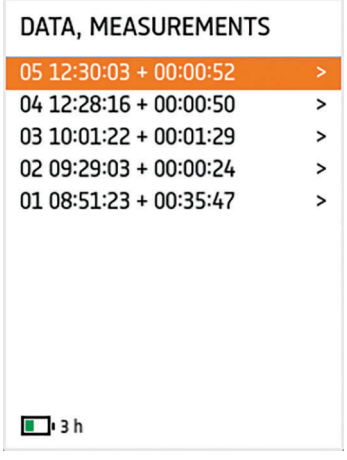
The *About data* display shows the preconditions for the measurement.

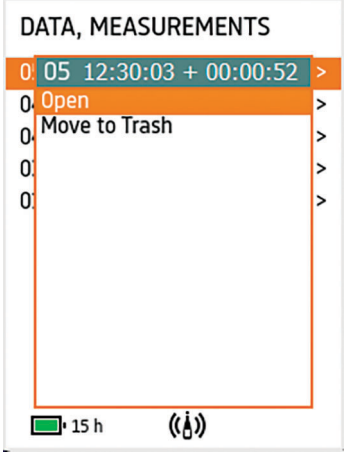
2.7 Viewing Saved Measurements

To view saved measurements, press ☰ and in the main menu go to **Data explorer**.









The internal disk can hold up to 600000 single measurements with just one broadband parameter, or up to 330000 single measurements with all broadband parameters, including statistics and five 1/3-octave spectra.

The internal disk can hold 35 years logging of a single parameter with 1 s intervals, or 300 days logging of all broadband parameters, including statistics and five 1/3-octave spectra with 1 s intervals, or 23 days when audio recording is stored too.

2.8 Positioning the Microphone (Sound Level Meter)

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 sound level meter 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.

For outdoor noise measurements (or indoor measurements exposed to air movement), mount Windscreen UA-1650 onto the microphone and preamplifier combination, ensuring it snaps into place over the windscreen sensor.

It is good practice to measure downwind in dry conditions with a wind speed less than 5 m/s.

It is recommended to place the microphone/sound level meter on a tripod.

2.9 Mounting the Sound Level Meter on a Tripod

To minimise the influence of the operator on measurements, the sound level meter should be mounted on Tripod UA-0750 using Tripod Adapter UA-2238.

For all practical purposes, the sound level meter fulfils the requirements of IEC 61672-1 in this configuration, with or without Windscreen UA-1650 fitted. However, tripod mounting still presents some major difficulties in the measurement of acoustical characteristics of sound level meters and it is, therefore, normally beyond the scope of type approval for sound level meters.

2.10 Measuring Low-level Sounds

If the measured sound level is within the linear operating range or, for C-weighted peak sound levels, within the peak C range given in the specifications (see sections 4.9.7 and 4.9.8), then the self-generated noise and level linearity problems can be ignored.

It is possible to correct the measured sound levels, except peak levels, for the typical self-generated noise, found in the specifications, see section 4.8.2. The correction for self-generated noise can be made by subtracting self-generated noise, L_{inh}, from the total sound level, L_{tot}, using the following formula:

$$L_{res} = 10 \lg(10^{L_{tot}/10} - 10^{L_{inh}/10})$$

If $L_{tot} - L_{inh}$ is less than 3 dB, the sound level is too low to be compensated.

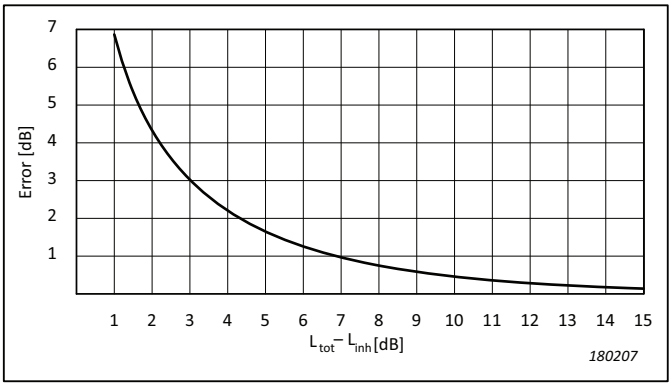


Fig. 2.1
Error from self-generated noise

Fig. 2.1 shows the error on the measured sound levels from the presence of self-generated noise. The curve can also be used for compensation by subtracting the error from the measured sound levels. This is equivalent to using the formula.

2.11 Measuring at Low Static Pressure

The microphone's sensitivity and frequency response depend on the static ambient pressure. This is due to changes in air stiffness in the cavity behind the diaphragm, and changes in air mass in the small gap between the diaphragm and the backplate.

Using a sound level calibrator to adjust the sensitivity of a sound level meter at the calibration check frequency (1 kHz) provides no information on the influence of static pressure on the frequency response. Fig. 2.2 shows the changes in frequency response with changes in static pressure.

Fig. 2.3 shows the typical variation in sensitivity at 250 Hz from that at 101.3 kPa as a function of ambient pressure. The typical pressure coefficient at 250 Hz for Prepolarized Free-field ½″ Microphone Type 4966 is –0.012 dB/kPa, well within the ±0.025 dB/kPa limits required for class 1 sound level meters by IEC 61672.

At the calibration check frequency (1 kHz), the recommended Sound Calibrator Type 4231 is rather insensitive to variations in the static pressure – the static pressure coefficient is below +0.001 dB/kPa.

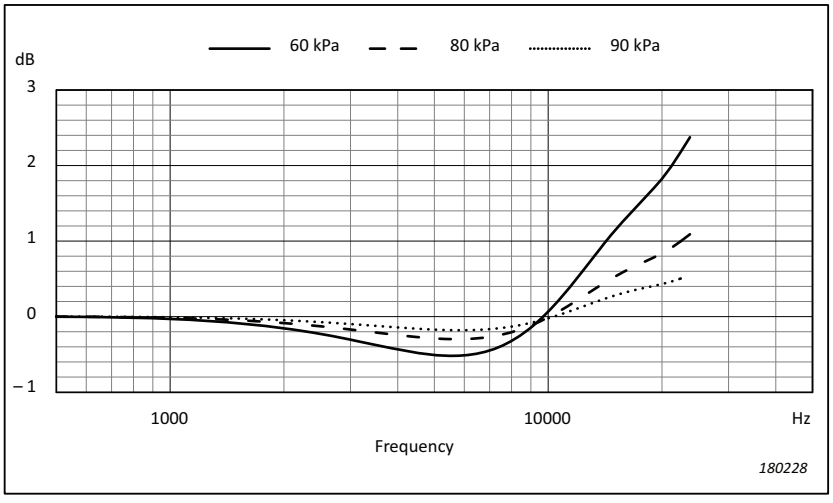
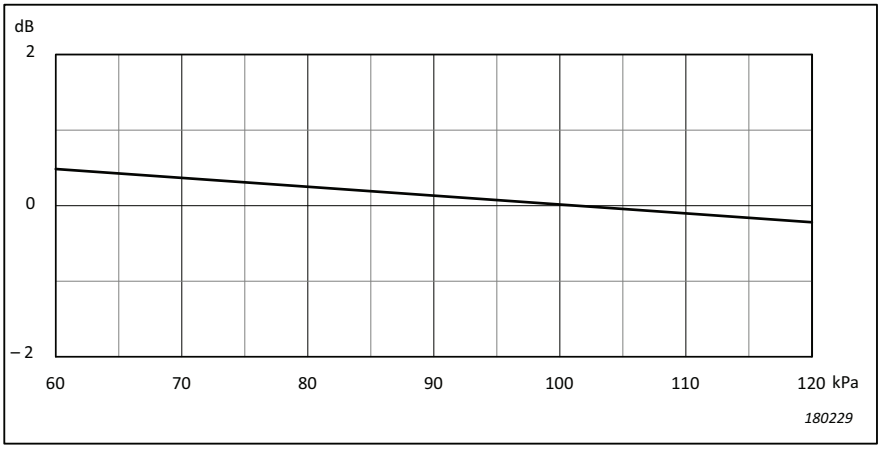


Fig. 2.2
Typical variation in frequency response (normalized at 250 Hz) from that at 101.3 kPa as a function of change in ambient pressure

Fig. 2.3
Typical variation in sensitivity at 250 Hz from that at 101.3 kPa as a function of ambient pressure



2.12 Mechanical Vibration

Mechanical vibration can affect indicated levels at low levels. Section 4.12.4 gives an indication of the level of these errors.

The primary source to the vibration sensitivity is the microphone. It is most sensitive to vibrations coming from a direction perpendicular to the diaphragm.

To reduce this problem, the sound level meter should be mounted isolated from the vibrations if measurements are taken at places where there are strong vibrations.

2.13 Frequency Weightings

Both broadband and spectrum measurements can be frequency weighted with A-, B-, C- or Z-weighting.

The A- and C-weightings conform to the requirements in IEC 61672-1 and IEC 60651. The B-weighting is not defined in IEC 61672-1, but conforms to the requirements in IEC 60651. Although B-weighting is not specified in IEC 61672-1, this realization complies with the same acceptance limits as A- and C-weighting.

The Z-weighting (zero frequency weighting) is a linear, unweighted frequency weighting. It conforms to the Z-weighting defined in IEC 61672-1 and the Lin response defined in IEC 60651.

Table 2.1 states the design goal frequency responses for the frequency weightings. They are stated for the complete sound level meter including the microphone. The corresponding tolerance limits can be found in the standards.

Table 2.1
Frequency weighting design goals

Nominal Frequency (Hz)	Exact Frequency (6 digits) (Hz)	Frequency Weightings (1 decimal) (dB)			
		A	B	C	Z
10	10.0000	–70.4	–38.2	–14.3	0.0
13	12.5893	–63.4	–33.2	–11.2	0.0
16	15.8489	–56.7	–28.5	–8.5	0.0
20	19.9526	–50.5	–24.2	–6.2	0.0
25	25.1189	–44.7	–20.4	–4.4	0.0
32	31.6228	–39.4	–17.1	–3.0	0.0
40	39.8107	–34.6	–14.2	–2.0	0.0
50	50.1187	–30.2	–11.6	–1.3	0.0
63	63.0957	–26.2	–9.3	–0.8	0.0
80	79.4328	–22.5	–7.4	–0.5	0.0
100	100.000	–19.1	–5.6	–0.3	0.0
125	125.893	–16.1	–4.2	–0.2	0.0
160	158.489	–13.4	–3.0	–0.1	0.0
200	199.526	–10.9	–2.0	0.0	0.0
250	251.189	–8.6	–1.3	0.0	0.0
315	316.228	–6.6	–0.8	0.0	0.0
400	398.107	–4.8	–0.5	0.0	0.0
500	501.187	–3.2	–0.3	0.0	0.0
630	630.957	–1.9	–0.1	0.0	0.0
800	794.328	–0.8	–0.0	0.0	0.0
1000	1000.00	0.0	0.0	0.0	0.0
1250	1258.93	0.6	0.0	0.0	0.0
1600	1584.89	1.0	0.0	–0.1	0.0
2000	1995.26	1.2	–0.1	–0.2	0.0
2500	2511.89	1.3	–0.2	–0.3	0.0
3150	3162.28	1.2	–0.4	–0.5	0.0
4000	3981.07	1.0	–0.7	–0.8	0.0
5000	5011.87	0.5	–1.2	–1.3	0.0
6300	6309.57	–0.1	–1.9	–2.0	0.0
8000	7943.28	–1.1	–2.9	–3.0	0.0
10000	10000.0	–2.5	–4.3	–4.4	0.0
12500	12589.3	–4.3	–6.1	–6.2	0.0
16000	15848.9	–6.6	–8.4	–8.5	0.0
20000	19952.6	–9.3	–11.1	–11.2	0.0

2.14 Measured Quantities

This section gives a precise mathematical definition of the measured quantities and defines the abbreviations used in the display.

2.14.1 Instantaneous Broadband Measurements

These measurements are done continuously, independent of measurement start, pause and stop. They cannot be saved and are only displayed.

Overload

For instantaneous measurements, the overload indication is displayed as long as the overload condition exists, or for 1 second, whichever is greater.

Overload is indicated as a flashing ▲ (colour: red) on the screen and by a flashing red light ring. Overload is common to all results of instantaneous measurements.

Underrange

The underrange indication, ▼ (colour: yellow), is displayed as long as the underrange condition exists, or for 1 second, whichever is greater.

The underrange condition is present if any measurement of time-weighted sound level, time average sound level, or sound exposure level is less than the specified lower limit of a linear operating range.

Time-weighted Sound Level, F and S Time-weighted

The time-weighted sound level, $L_{xy}(t)$, is defined as twenty times the logarithm to the base ten of the ratio of a given root-mean-square sound pressure to the reference sound pressure, root-mean-square sound pressure being obtained with a frequency weighting, *x*, and standard time weighting, *y*, where:

- *x* is A for A-weighted, B for B-weighted, C for C-weighted or Z for Z-weighted
- *y* is F for Fast-weighted or S for Slow-weighted

The time-weighted sound level is a continuous function of time and is expressed in decibels (dB). $L_{xy}(t)$ is not displayed, but is the base for $L_{xy}(Tn)$, $L_{xy}(SPL)(Tn)$, $L_{xymax}(T)$ and $L_{xymin}(T)$.

In symbols, frequency-weighted and time-weighted sound level, $L_{xy}(t)$, at any instant of time, *t*, is represented by:

$$L_{xy}(t) = 20 \lg \left[\sqrt{(1/\tau) \int_{-\infty}^{t} p_x^{\,2}(\xi) e^{-(t-\xi)/\tau} d\xi} \Big/ p_0 \right] \quad [\mathrm{dB}]$$

where:

- τ is the exponential time constant in seconds for time-weighting F or S
- ξ is a dummy variable of time integration from some time in the past, as indicated by $-\infty$ for the lower limit of the integral, to the time of observation *t*
- $p_x(\xi)$ is the *x* frequency-weighted instantaneous sound pressure
- p_0 is the reference sound pressure, equal to 20 μPa

The exponential time constants are stated in Table 2.2.

Table 2.2
Exponential time constants and corresponding averaging times

Time Weighting	Time Constant (seconds)	Averaging Time (seconds)
Fast	0.125	0.25
Slow	1	2

Time-weighted Sound Level, I Time-weighted

The I (impulse) time-weighted sound level, $L_{xI}(t)$, is defined as ten times the logarithm to base ten of the ratio of a given mean-square sound pressure to the square of the reference sound pressure, p_0, followed by a peak detector with a decay time constant of 1500 ms. The mean-square sound pressure being obtained with a frequency weighting, *A*, and time weighting with a 35 ms time constant, where:

- p_0 is the reference sound pressure, equal to 20 μPa

The I time-weighted sound level is a continuous function of time and is expressed in decibels (dB). $L_{AI}(t)$ is not displayed but is the base for $L_{AImax}(T)$.

Instantaneous Time-weighted Sound Level

The instantaneous time-weighted sound level, $L_{xy}(Tn)$, is defined as the time-weighted sound level, $L_{xy}(t)$, sampled at $t = T_n$ where:

- *x* is A for A-weighted, B for B-weighted, C for C-weighted or Z for Z-weighted
- *y* is F for Fast-weighted or S for Slow-weighted
- $T_n = t_0 + n \cdot \Delta t$
- t_0 is some starting time
- *n* is an incrementing integer
- Δt is the display update interval

The instantaneous time-weighted sound level is, in other words, updated every Δt second and is expressed in decibels (dB).

The symbols used by the sound level meter for instantaneous time-weighted sound levels are (for A-, B-, C- and Z-frequency weighting and F- and S-time weighting):

LAF, *LAS*, *LBF*, *LBS*, *LCF*, *LCS*, *LZF*, *LZS*

Sound Pressure Level (SPL)

The sound pressure level, $L_{xy}(SPL)(T_n)$, is defined as the greatest time-weighted sound level, $L_{xy}(t)$, within a time interval starting at $t = T_n$ and ending at $t = T_n + \Delta t$ where:

- *x* is A for A-weighted, B for B-weighted, C for C-weighted or Z for Z-weighted
- *y* is F for Fast-weighted, S for Slow-weighted
- $T_n = t_0 + n \cdot \Delta t$
- t_0 is some starting time
- *n* is an incrementing integer
- Δt is the display update interval, equal to 1 second

The sound pressure level is, in other words, updated every 1 second and is expressed in decibels (dB).

The symbols used by the sound level meter for sound pressure levels are (for A-, B-, C- and Z-frequency weighting and F and S-time weighting):

LAF(SPL), *LAS(SPL)*, *LBF(SPL)*, *LBS(SPL)*, *LCF(SPL)*, *LCS(SPL)*, *LZF(SPL)*, *LZS(SPL)*

Taktmaximalpegel

The Taktmaximalpegel, $L_{AF}T(T_n)$, is defined as the greatest time-weighted sound level, $L_{AF}(t)$, within a time interval starting at $t = T_n$ and ending at $t = T_n + \Delta t$ where:

- $T_n = t_0 + n \cdot \Delta t$
- t_0 is some starting time
- n is an incrementing integer
- Δt is the update interval (Taktzeit), equal to 5 seconds

The Taktmaximalpegel is, in other words, updated every 5 seconds and is expressed in decibels (dB).

The Taktmaximalpegel is not displayed by the sound level meter. It is only used for the calculation of Taktmaximal-Mittelungspegel.

2.14.2 Timed Broadband Measurements

These measurements are only executed when ◉ is pressed and are paused when ◉ is pressed again or when ■ has been pressed or when *Preset time* has expired, whichever occurs first. The time interval between start and pause/stop is the elapsed time indicated as *Elapsed*. During the measurement time interval, intermediate results are displayed as if the measurements were paused at the time of display. When the measurements are paused/stopped, the set of results, including latched overload ▲ (colour: magenta) are automatically stored and this is held on the display until either ■ is pressed again, or a new measurement is started.

Press ■ during a stopped measurement to reset the latched overload and to reset all time-weighted sound levels to zero ($-\infty$ dB). From this, the time-weighted sound levels increase to their current values. The timed measurements derived from time-weighted sound levels (for example, the minimum time-weighted sound level, maximum time-weighted sound level, equivalent continuous I-weighted sound level, Taktmaximal-Mittelungspegel, and statistics) are first valid after this has settled. The settling time is less than 1 second for Fast-weighting and less than 2 seconds for Slow-weighting. Therefore, it is recommended to wait a couple of seconds after a reset before starting the measurement. Measurements of equivalent continuous sound level, sound exposure level, and peak sound level are not influenced by this start-up settling after a reset.

Please note: Changing microphone, windscreen, or weightings will also prompt a reset.

Latched Overload

For the timed measurements, a latched overload indication is displayed and included in the set of results if the overload condition exists at any time during the measurement time interval. The latched overload is indicated by a magenta triangle ▲ on the screen. The latched overload is common to all the results of the timed measurements.

Minimum Time-weighted Sound Level

The minimum time-weighted sound level, $L_{xymin}(T)$, is defined as the smallest time-weighted sound level, $L_{xy}(t)$, within a time interval starting at $t = T$ and ending at $t = T + \Delta t$ where:

- x is A for A-weighted, B for B-weighted, C for C-weighted or Z for Z-weighted
- y is F for Fast-weighted or S for Slow-weighted
- T is the start time of the measurement, indicated as *Started*
- Δt is the measuring period, indicated as *Elapsed*

The minimum time-weighted sound level is expressed in decibels (dB).

The symbols used by the sound level meter for minimum time-weighted sound levels are (for A-, B-, C- and Z-frequency weighting and F and S time weighting):

LAFmin, *LASmin*, *LBFmin*, *LBSmin*, *LCFmin*, *LCSmin*, *LZFmin*, *LZSmin*

Maximum Time-weighted Sound Level

The maximum time-weighted sound level, $L_{xymax}(T)$, is defined as the greatest time-weighted sound level, $L_{xy}(t)$, within a time interval starting at $t = T$ and ending at $t = T + \Delta t$ where:

- *x* is A for A-weighted, B for B-weighted, C for C-weighted or Z for Z-weighted
- *y* is F for Fast-weighted or S for Slow-weighted
- *T* is the start time of the measurement, indicated as *Started*
- Δt is the measuring period, indicated as *Elapsed*

The maximum time-weighted sound level is expressed in decibels (dB).

The symbols used by the sound level meter for maximum time-weighted sound levels are (for A-, B-, C- and Z-frequency weighting and F and S time weighting):

LAFmax, *LASmax*, *LBFmax*, *LBSmax*, *LCFmax*, *LCSmax*, *LZFmax*, *LZSmax*

Equivalent Continuous Sound Level

The equivalent continuous sound level (also called time-average sound level), $L_{xeq}(T)$, is defined as twenty times the logarithm to base ten of the ratio of a root-mean-square sound pressure during a time interval to the reference sound pressure – sound pressure being obtained with a frequency weighting, *x*. The time interval is starting at $t = T$ and ending at $t = T + \Delta t$ where:

- *x* is A for A-weighted, B for B-weighted, C for C-weighted or Z for Z-weighted
- *T* is the start time of the measurement, indicated as *Started*
- Δt is the averaging time interval, indicated as *Elapsed*

The equivalent continuous sound level is expressed in decibels (dB).

In symbols, the equivalent continuous sound level, $L_{xeq}(T)$, is given by:

$$L_{xeq}(T) = 20 \lg \left[\sqrt{(1/\Delta t) \int_{T}^{T+\Delta t} p_x^{\,2}(\xi) d\xi} \Big/ p_0 \right] \quad [\mathrm{dB}]$$

where:

- ξ is a dummy variable of time integration over the averaging time interval
- $p_x(\xi)$ is the *x* frequency-weighted instantaneous sound pressure
- p_0 is the reference sound pressure, equal to 20 μPa

The symbols used by the sound level meter for equivalent continuous sound levels are (for A-, B-, C- and Z-frequency weighting):

LAeq, *LBeq*, *LCeq*, *LZeq*

Equivalent Continuous I-weighted Sound Level

The equivalent continuous I-weighted sound level (also called average I-weighted sound level), $L_{xleq}(T)$, is defined as ten times the logarithm to base ten of the mean of ten to the power of the I time-weighted sound level, $L_{xI}(t)$, divided by ten during a time interval. The time interval is starting at $t = T$ and ending at $t = T + \Delta t$ where:

- x is A for A-weighted
- T is the start time of the measurement, indicated as *Started*
- Δt is the averaging time interval, indicated as *Elapsed*

The equivalent continuous I-weighted sound level is expressed in decibels (dB).

In symbols, the equivalent continuous I-weighted sound level, $L_{xleq}(T)$, is given by:

$$L_{xIeq}(T) = 10 \lg \left[(1/\Delta t) \int_{T}^{T+\Delta t} 10^{L_{xI}(\xi)/10} d\xi \right] \quad [\text{dB}]$$

where ξ is a dummy variable of time integration over the averaging time interval.

The symbols used by the sound level meter for A-frequency weighted equivalent continuous I-weighted sound levels is:

LAIeq

Taktmaximal-Mittelungspegel

The Taktmaximal-Mittelungspegel, $L_{AFTeq}(T)$, is defined as ten times the logarithm to base ten of the mean of ten to the power of the Taktmaximalpegel, $L_{AFT}(Tn)$, divided by ten during a time interval. The time interval is starting at $t = T$ and ending at $t = T + N \cdot \Delta t$ where:

- T is the start time of the measurement, indicated as *Started*
- Δt is the Taktzeit, equal to 5 seconds
- $N \cdot \Delta t$ is the averaging time interval, indicated as *Elapsed*

The Taktmaximal-Mittelungspegel is expressed in decibels (dB).

In symbols, Taktmaximal-Mittelungspegel, $L_{AFTeq}(T)$, is given by:

$$L_{AFTeq}(T) = 10 \lg \left[(1/N) \sum_{n=1}^{N} 10^{L_{AFT}(T_n)/10} \right]$$

The symbol used by the sound level meter for Taktmaximal-Mittelungspegel is:

LAFTeq

Sound Exposure Level

The sound exposure level, $L_{xE}(T)$, is defined as ten times the logarithm to base ten of the ratio of integral of the squared sound pressure during a time interval to the reference sound exposure – sound pressure being obtained with a frequency weighting, *x*. The time interval is starting at $t = T$ and ending at $t = T + \Delta t$ where:

- *x* is A for A-weighted, B for B-weighted, C for C-weighted or Z for Z-weighted
- *T* is the start time of the measurement, indicated as *Started*
- Δt is the averaging time interval, indicated as *Elapsed*

The equivalent continuous sound level is expressed in decibels (dB).

In symbols, the equivalent continuous sound level, $L_{xE}(T)$, is given by:

$$L_{xE}(T) = 10 \lg\left[\int_{T}^{T+\Delta t} p_x^2(\xi) d\xi / E_0\right] \quad [\mathrm{dB}]$$

where:

- ξ is a dummy variable of time integration over the averaging time interval
- $p_x(\xi)$ is the *x* frequency-weighted instantaneous sound pressure
- E_0 is the reference sound exposure, equal to $(20\ \mu\mathrm{Pa})^2 \times (1\ \mathrm{s}) = 400 \times 10^{-12}\ \mathrm{Pa}^2\mathrm{s}$

The sound exposure level $L_{xE}(T)$ can also be expressed in terms of the equivalent continuous sound level $L_{xeq}(T)$ and *Elapsed* as:

$$L_{xE}(T) = L_{xeq}(T) + 10 \lg(\Delta t) \quad [dB]$$

where Δt is the averaging time interval, indicated as *Elapsed*, expressed in seconds.

The symbols used by the sound level meter for sound exposure levels are (for A-, B-, C- and Z-frequency weighting):

LAE, *LBE*, *LCE*, *LZE*

Peak Sound Level

The peak sound level, $L_{xpeak}(T)$, is defined as twenty times the logarithm to base ten of the ratio of the greatest absolute instantaneous sound pressure, $p_x(t)$, within a time interval starting at $t = T$ and ending at $t = T + \Delta t$, to the reference sound pressure, p_0, instantaneous sound pressure being obtained with a frequency weighting, *x*, where:

- *x* is A for A-weighted, B for B-weighted, C for C-weighted or Z for Z-weighted
- $p_x(t)$ is the *x* frequency-weighted instantaneous sound pressure
- p_0 is the reference sound pressure, equal to 20 μPa
- *T* is the start time of the measurement, indicated as *Started*
- Δt is the measuring period, indicated as *Elapsed*

The maximum peak sound level is expressed in decibels (dB).

The symbols used by the sound level meter for peak sound levels are (for A-, B-, C- and Z-frequency weighting):

LApeak, *LBpeak*, *LCpeak*, *LZpeak*

Average Sound Level

Average sound level with time weighting S and the exchange rate: $Q = 4$ or 5. The exchange rate is the increase in noise level that corresponds to a doubling of the noise level. This is a widely used occupational health noise parameter in the USA, corresponding to the L_{Aeq} used otherwise.

The symbols used by the sound level meter for average sound levels are (for exchange rates 4 and 5):

LavS4, *LavS5*

Statistics

Statistics can be based on sampling the continuous output of the A-weighted exponential detectors F every 16 ms, S every 125 ms or the 1-second linearly averaged results L_{Aeq}. The samples are divided into 0.2 dB classes in which the frequency of appearance is counted. Based on the counted frequency distribution, the percentile sound levels (also called the exceedance levels), L_{AyN} is calculated.

- *y* is F for Fast-weighted or S for Slow-weighted and nothing for L_{Aeq}
- *N* is a percentage between 0.1 and 99.9. It notes the percentage of time that the indicated noise level was exceeded during the measurement period

2.14.3 Spectrum Measurements

The definition of the measured quantities is the same as for the broadband measurements.

At low frequency bands the exponential time constants for Fast and Slow weighting are modified to get a reasonable B*T product, see section 4.11.5.

2.14.4 Instantaneous Spectrum Measurements

The instantaneous spectrum measurements can measure instantaneous time-weighted sound level L_{xy}, where:

- *x* is A for A-weighted, B for B-weighted, C for C-weighted or Z for Z-weighted
- *y* is F for Fast-weighted or S for Slow-weighted

The symbols used by the sound level meter for instantaneous time-weighted sound level spectra are (for A-, B-, C- and Z-frequency weighting and F and S time weighting):

LAF, *LAS*, *LBF*, *LBS*, *LCF*, *LCS*, *LZF*, *LZS*

Overload is common to the broadband measurements.

2.14.5 Timed Spectrum Measurements

The timed spectrum measurements can measure minimum time-weighted sound level, L_{xymin}, maximum time-weighted sound level, L_{xymax}, and equivalent continuous sound level, L_{xeq}, where:

- *x* is A for A-weighted, B for B-weighted, C for C-weighted or Z for Z-weighted
- *y* is F for Fast-weighted or S for Slow-weighted

The symbols used by the sound level meter for minimum time-weighted sound level spectrum, maximum time-weighted sound level spectrum, and equivalent continuous sound level spectrum are (for A-, B-, C- and Z-frequency weighting and F and S time weighting):

LAFmin, *LASmin*, *LBFmin*, *LBSmin*, *LCFmin*, *LCSmin*, *LZFmin*, *LZSmin*

LAFmax, *LASmax*, *LBFmax*, *LBSmax*, *LCFmax*, *LCSmax*, *LZFmax*, *LZSmax*

LAeq, *LBeq*, *LCeq*, *LZeq*

Latched overload is common to the broadband measurements.

Timed spectrum measurements can be reset in the same way as timed broadband measurements (section 2.14.2). As stated above, the exponential time constant is modified at low frequencies. This leads to longer settling times at low frequencies.

2.15 Overload and Underrange

2.15.1 Overload

Overload indicates that the input signal level exceed the capability of the sound level meter with the current settings.

During measurement, overload is indicated with a flashing red triangle ▲ and a flashing red light ring. The indication is displayed as long as the overload condition exists or for 1 second, whichever is greater.

The final result of the measurement contains an indication with a magenta triangle ▲ if there have been any overloads during the measurement.

If an overload condition exists, some of the input signal is clipped away and thus, will be missing in the broadband results, which becomes too small. In the spectrum measurements, due to the distortion of the signal, some of the missing signal is placed in other bands.

2.15.2 Underrange

Underrange indicates that one or more of the measured quantities time-weighted sound level, time average sound level, or sound exposure level is momentary below the specified lower limit of the linear operating range. The decision on whether there is an underrange condition is made and displayed every 1 second and is based on the results for the last 1 second.

Underrange is indicated with a yellow triangle ▼.

Underrange is only indicated on the screen during measurement. No underrange information is saved with the final result of the measurement.

The underrange indication does not account for the influence of self-generated noise from the microphone because the specifications for the lower limit of the linear operating range apply for measurements of electrical signals inserted into the preamplifier through the applicable input device. This makes the underrange indication a dubious indicator of the quality of the measurement.

Chapter 3

Conformance Testing

3.1 Introduction

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

3.2 Microphone, Accessories and Sound Fields

The acoustical frequency response and calibration depends on the sound field, the microphone, the microphone accessories in use, and the electrical frequency response. To improve the quality of the measurement and help the user to measure correctly, the sound level meter compensates for the sound field, the microphone, and the microphone accessories in use by automatically changing the electrical frequency response and calibration.

This means that a calibration of a microphone is valid for both free field and diffuse field and for all the recommended accessories.

This also means that it is VERY IMPORTANT that parameters on menus reflect the desired configuration. The important menus are:

- **Measurement settings** > **Input**
- **Measurement settings** > **Broadband parameters**
- **Measurement settings** > **Spectrum parameters**

3.2.1 For Acoustical Tests

Microphone Type **4966** shall be used and selected in **Measurement settings** > **Input** > **Microphone**.

3.2.2 For Electrical Tests

The Electrical Substitute for Microphones shall be used.

In **Measurement settings** > **Input**, the following shall be selected:

- An **Unkown** microphone in *Microphone*
- **Free-field** in *Sound field*
- **Disabled** in *Windscreen detect*
- **None** in *Windscreen type*

In this way, an uncompensated electrical frequency response is ensured.

Alternatively, the specified Microphones can be used.

In **Measurement settings** > **Input**, the following shall be selected:

- An **4966** microphone in *Microphone*
- **Free-field** in *Sound field*
- **Disabled** in *Windscreen detect*
- **None** in *Windscreen type*

In this way, an uncompensated electrical frequency response is obtained by subtracting the column Electrical Response (Table A.2 – Table A.5) from the result.

3.3 Calibration During Pattern Evaluation and Periodic Tests

For Pattern Evaluation tests (type approval) and Periodic tests, the sound level meter shall be calibrated.

For Periodic tests performed by a test laboratory, it may be inappropriate to add more temporary calibrations to the customer's *Calibration history*. If this is the case, the laboratory should create new microphones in **System settings** >**Advanced settings** > **Microphones** before the tests. After the tests, these microphones can be deleted. This removes their calibration history.

3.3.1 Acoustic Calibration

The calibration procedure can be found in section 2.4.

For acoustic calibrations, HBK Sound Level Calibrator Type 4231 shall be used and selected in **System settings** >**Advanced settings** > **Calibration** > **Calibrator**.

The adjustment data according to IEC 61672-1 paragraph 5.2.4 for Microphone Type 4966 with Sound Calibrator Type 4231 is 93.92 dB for the 94 dB setting of the calibrator. This value is built into the firmware when *Microphone* is set to **4966** and *Calibrator* to **Type 4231** in the user interface.

3.3.2 Electrical Substitute for Microphones

For electrical tests, the Electrical Substitute for Microphones shall be used and the sound level meter shall be calibrated by keying in the *Sensitivity* using the following procedure:

Please note: Steps 2 – 4 can be skipped if **Service mode** cannot be enabled on the sound level meter.

1) To obtain a BNC type electrical input, replace the microphone with Electrical Substitute WA-0302-B (15 pF) fitted with 10-32 UNF to BNC Adapter UA-0245.
2) In **System settings** >**Advanced settings** > **Service mode** select **Enabled**.
3) In **System settings** >**Advanced settings** > **Microphones** select the microphone used for the tests and select **Edit** > **Sensitivity** > **Yes**.
4) Adjust *Sensitivity* to **43.35 mV/Pa**. This corresponds to the Microphone Type 4966's nominal open circuit sensitivity (50.00 mV/Pa), attenuated by the built-in microphone preamplifier's nominal attenuation (1.24 dB).
5) Connect an electrical sinusoidal signal with a frequency of 1 kHz to the Electrical Substitute for Microphones and adjust the amplitude of this signal until *LZF* (or *LCF*) displays **94.00 dB** in the normal measurement screen. This electrical amplitude is the 94.00 dB reference signal for the electrical tests. The amplitude will typically be 51.9 mV. This is due to the attenuation of the Electrical Substitute for Microphones WA-0302-B together with the preamplifier (nominally 1.54 dB). If the sensitivity was not adjusted using steps 2 – 4, the amplitude will not typically be 51.9 mV. Instead the amplitude will depend on the microphone sensitivity.

This procedure calibrates the sound level meter to a calibration that corresponds to the calibration you would get if the sound level meter were fitted with a microphone with the nominal open circuit sensitivity.

The electrical input obtained in this way has a maximum input level of ± 16.9 V_{Peak} and no damage will occur for signals up to ± 20 V_{Peak}.

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

3.4 Wi-Fi and Bluetooth During Tests

Bluetooth is only used for pairing devices (transferring IP address) for Wi-Fi. Therefore, it is not relevant during tests.

Wi-Fi should be turned on as a hotspot during tests using the following procedure:

Set **System settings** >**Network settings** > **Wi-Fi settings** to **Hotspot**.

3.5 Mounting for Acoustical Tests

For acoustical tests, it is important that the test rig for mounting the sound level meter 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 must be demonstrated with a good, known laboratory microphone.

The sound level meter can be mounted using Tripod Extension UA-1651. The tripod extension stem is screwed into Tripod Adapter UA-2238 and mounted on the sound level meter. The thread on the other end of the stem is used to mount the assembly to the test rig.

3.6 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 one of the following HBK products for acoustic frequency response tests:

- Multifunction Acoustic Calibrator Type 4226
- Electrostatic Actuator UA-0033

If the Multifunction Acoustic Calibrator is used, the calibrator must be set to its Calibration and Pressure sound field modes. The calibrator must be calibrated. Further details can be found in the instruction manual for the Multifunction Acoustic Calibrator.

Acoustical signal test with Electrostatic Actuator UA-0033 should only be made by personnel that are educated in and familiar with the use of the actuator. The actuator should be operated with a DC voltage of approximately 800 V and an rms AC voltage of approximately 100 V.

Correction data, which shall be applied to the 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 in response to plane progressive sinusoidal sound waves incident from the reference direction, are given in Table A.24 and Table A.25.

3.7 Mounting for Mechanical Vibrations Tests

The sound level meter is mounted on a shaker using Tripod Adapter UA-2238.

3.8 Testing 1/1-octave Band and 1/3-octave Band Filters

All tests according to IEC 61260 must be conducted with the following settings:

- Use the Electrical Substitute for Microphones calibrated according to section 3.3.2
- Use the settings for electrical tests according to section 3.2.2
- Set **Measurement settings** > **Spectrum parameters** > **Weighting** to **Z**

3.9 EMC Test Procedures

For Wi-Fi settings, see section 3.4.

3.9.1 Signal Sources for Immunity Test

Acoustical Source for Testing According to IEC 61672

The acoustic signal, which is used during the immunity test according to IEC 61672, is applied to the microphone through a ½″ plastic hose (a normal water hose) – from a source outside the test area, see Fig.3.1. In this way, the acoustic source is not affected by the RF or magnetic field. The source may be a normal entertainment earphone.

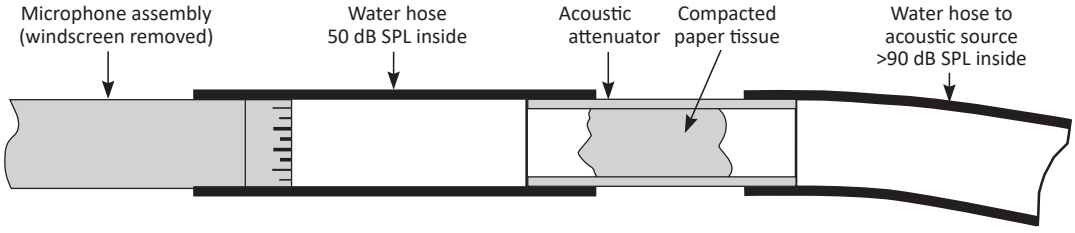


Fig. 3.1
Setting up the signal source for an immunity test

To prevent the acoustic source from being affected by acoustic noise in the surroundings, the following method can be used:

1) Insert an acoustic attenuator in the hose close to the microphone, so that the sound pressure within the greater part of the hose is held far above the surrounding sound level.

Hint: The acoustic attenuator can easily be made from a short piece of metal tubing with an outer diameter of ½″.

2) Squeeze a piece of paper tissue into the tube, and compress it until the desired attenuation is obtained. Up to 40 to 60 dB of acoustic attenuation can be obtained.

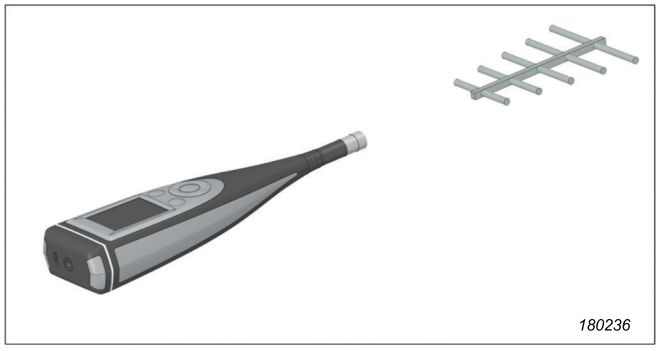
Electrical Source for Testing According to IEC 61260

The short-circuit of the input signal may be achieved by short-circuiting the Electrical Substitute for Microphones mounted on the sound level meter.

3.9.2 Reference Orientation

Fig.3.2 shows the reference orientation of the sound level meter, relative to the RF-emitter/receiver. This is common to both emission and immunity tests.

Fig. 3.2
Reference orientation of the sound level meter relative to the RF-emitter/receiver



3.9.3 Securing of Cables During EMC Test

During test, any excessive cable is folded back on itself in an even number of figure eights. The cable arrangement is common for both the emission and immunity tests.

3.9.4 Accessories Included in EMC Test

The following accessories are connected to the sound level meter during the EMC tests:

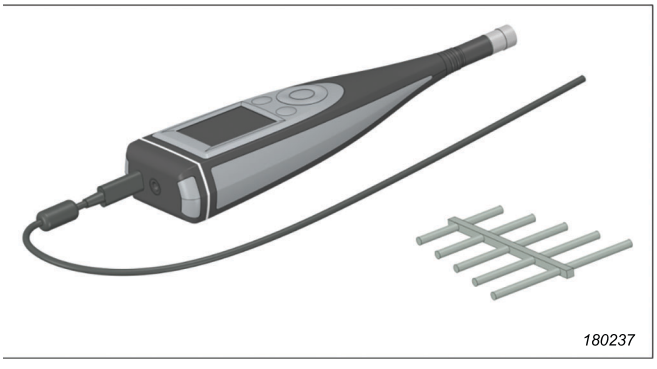
- Power Supply ZG-0486 is connected to the 'USB' socket at the bottom of the sound level meter using USB Cable AO-0821-D-010

Detailed descriptions of the parts are given in Table 1.1.

3.9.5 Normal Mode of Operation During EMC Test

Testing Emission

Fig. 3.3
The direction for the greatest level of radio frequency emission



The greatest level of radio frequency emission is radiated from the sound level meter when set up as follows:

1) Make the connections described in section 3.9.4
2) Arrange orientation as shown in Fig.3.3.
3) Start a measurement and let it run during test.

Fig. 3.4 *The direction for the least immunity to radio frequency fields*

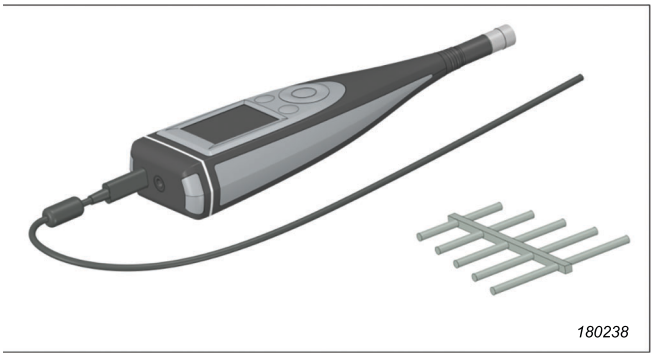
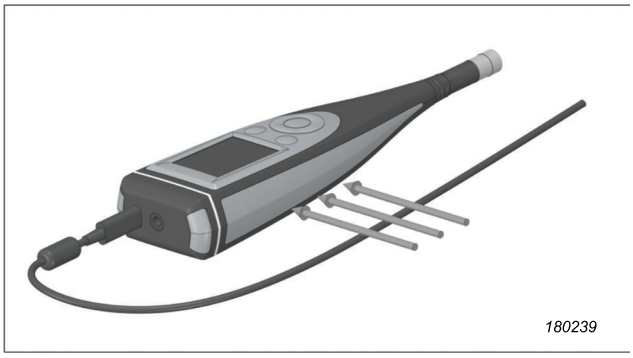


Fig. 3.5 *The direction for the least immunity to magnetic power frequency fields*



Testing Immunity as a Sound Level Meter According to IEC 61672

The highest susceptibility (susceptibility = 1/immunity) is achieved when the sound level meter is set up as follows:

1) Make the connections described in section 3.9.4.
2) In **Measurement settings** > **Input** the following shall be selected:
   - A **4966** microphone in *Microphone*
   - **Free-field** in *Sound field*
   - **Disabled** in *Windscreen detect*
   - **None** in *Windscreen type*
3) Calibrate the microphone according to section 3.3.1.
4) Arrange orientation as shown in Fig.3.4 or Fig.3.5.
5) Excite the microphone with an acoustical signal as described in section 3.9.1.
6) Start a measurement and let it run during test.
7) For radio-frequency tests, observe the *LAF* during test.
8) For power-frequency magnetic field tests, observe *LAF*, *LBF*, *LCF*, and *LZF* during test (only two frequency weightings can be observed simultaneously). Should be tested for both 50 Hz and 60 Hz.

Testing Immunity as a Frequency Analyzer According to IEC 61260

The highest susceptibility (susceptibility = 1/immunity) for the filter sets is achieved when the sound level meter is set up as follows:

1) Make the connections described in section 3.9.4.
2) Mount and calibrate the Electrical Substitute for Microphones (described in section 3.2.2) on the microphone preamplifier and short-circuit it.
3) In **Measurement settings** > **Input** the following shall be selected:
   - A **4966** microphone in *Microphone*
   - **Free-field** in *Sound field*
   - **Disabled** in *Windscreen detect*
   - **None** in *Windscreen type*
4) In **Measurement settings** > **Spectrum parameters** > **Weighting**, **Z** shall be selected.

5) Arrange orientation as shown in Fig.3.4 or Fig.3.5.
6) Start a measurement and let it run during test.
7) For radio frequency tests, observe *LZF* spectrum at 1 kHz during test.
8) For power frequency magnetic field tests, observe *LZF* spectrum during test. Should be tested for both 50 Hz and 60 Hz.

Only 1/3-octave band filters need to be tested. This is because the filters are digital and no disturbance at the filter input will show up to be greater at 1/1-octave bandwidth than at 1/3-octave bandwidth.

Chapter 4

Specifications

4.1 Introduction

Specifications are given for the configuration 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.

4.2 Standards

The sound level meter part of Sound Level Meter Type 2245 conforms to the following national and international standards and classes/types/groups with the accessories and configurations specified in section 1.2.3:

- **IEC 61672-1:2002-05**, Class 1, Group X/Z
- **IEC 61672-1:2013**, Class 1, Group X/Z
- **DIN 45657:1997-07**
- **DIN 45657:2014-07**
- **IEC 60651:1979** (plus Amendment 1 (1993-02) and Amendment 2 (2000-10)), Type 1, Group X/Z
- **IEC 60804:2000-10**, Type 1, Group X/Z
- **ANSI S1.4-1983** (plus ANSI S1.4A-1985 Amendment), Type 1
- **ANSI/ASA S1.4 Part 1-2014**, Class 1, Group X/Z
- **ANSI S1.43-1997**, Type 1

The frequency analysis part of Sound Level Meter Type 2245 conforms to the following additional national and international standards and classes/types/groups:

- **IEC 61260:1995-07** (plus Amendment 1 (2001-09)), 1/1-octave Bands and 1/3-octave Bands, Class 0, Group X/Z, all filters
- **IEC 61260-1:2014**, 1/1-octave Bands and 1/3-octave Bands, Class 1, Group X/Z, all filters
- **ANSI S1.11-2004**, 1/1-octave Bands and 1/3-octave Bands, Class 0, Group X/Z, all filters
- **ANSI/ASA S1.11-2014/Part 1**, 1/1-octave Bands and 1/3-octave Bands, Class 1, Group X/Z, all filters

The firmware is made in accordance with:

- **WELMEC 7.2 Software Guide - 2014**

In the text elsewhere in this manual, references to these standards are shortened to the standards name but are to be understood as the full text above.

The international IEC standards are adopted as European standards by CENELEC. When this happens, the letters IEC are replaced with EN and the number is retained. Type 2245 also conforms to these EN standards.

4.3 Reference Environmental Conditions

- **Air Temperature:** 23 °C
- **Static Pressure:** 101.325 kPa
- **Relative Humidity:** 50%

4.4 Reference Conditions for Acoustic Calibration

- **Reference Level Range:** Only one level range exists and this is the reference level range
- **Reference Sound Pressure Level:** 94.00 dB re 20 μPa
- **Calibration Check Frequency:** 1 kHz

4.5 Microphone

Microphone Type 4966

- **Type:** Prepolarized Free-field ½″ Condenser Microphone
- **Nominal Open Circuit Sensitivity:** 50 mV/Pa, (corresponding to −26 dB re 1 V/Pa) ± 1.5 dB
- **Capacitance:** 14 pF (at 250 Hz)
- **Nominal Preamplifier Attenuation:** 1.24 dB ± 0.1 dB
- **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 Frequency Responses

The frequency responses are given in tabular form in Appendix A and in graphical form in this section.

The specifications for the Lin response defined in IEC 60651 are equivalent to those given here for the Z-weighting.

The acoustical frequency response depends on the sound field, the microphone, the used microphone accessories and the electrical frequency response. To improve the quality of the measurement, the sound level meter compensates for the sound field, the microphone and the used microphone accessories by changing the electrical frequency response.

This means that it is VERY IMPORTANT that parameters in menus reflect the desired configuration. The important parameters are:

- **Measurement settings** > **Input**
- **Measurement settings** > **Broadband parameters**
- **Measurement settings** > **Spectrum parameters**

Limit curves are drawn on some of the frequency response graphs in the following sections. These curves represent the IEC 61672-1:2013 acceptance limits.

The "Expanded Uncertainties of Measurement" in the tables are the two-sigma limits maintained in the HBK production for the specific product. This means that the correct value lies in the range of the measured value plus/minus the expanded uncertainties of measurement with a probability of 95%.

Please note: This range is not related to the production spread. The range is for a specific typical unit. The factory acceptance tests at HBK ensure that the ranges for all units are within the IEC 61672-1 limits.

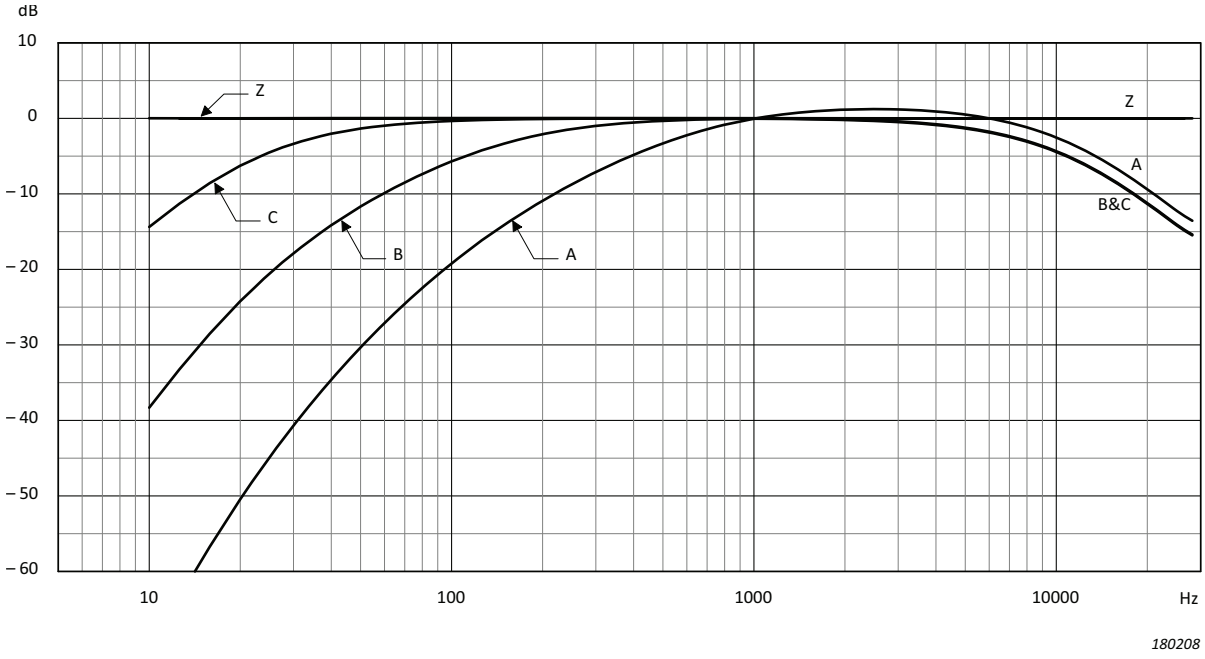
4.6.1 Electrical Frequency Responses

The uncompensated electrical frequency response for the different frequency weightings are given in Fig.4.1 and Table A.1.

The compensated Z-weighted electrical frequency response is given in the "Electrical Response" column of the appropriate tables from Table A.2 to Table A.6 in Appendix A.

The electrical frequency responses in Fig.4.1 and Table A.1 are valid for introduction of the electrical signal through the recommended means to substitute the microphone with an electrical input facility (see section 3.3.2).

Fig. 4.1 *Uncompensated electrical frequency response, corresponds to Table A.1*



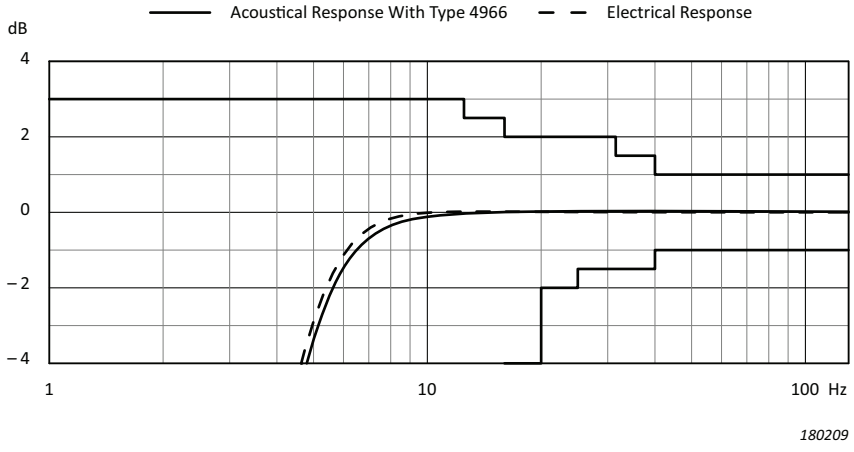
4.6.2 Typical Low-frequency Responses

The typical low-frequency responses for Z-frequency weighting are given in Fig.4.2.

The electrical responses in Fig.4.2 is 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 3.3.2).

The low-frequency responses are not influenced by the microphone accessories described in section 1.2.3.

Fig. 4.2 *Typical low-frequency responses*



4.6.3 Acoustical Frequency Responses

All the acoustical frequency responses are given for Z-frequency weighting.

The A-, B- and C-weighted acoustical frequency responses can be found by adding the appropriate response from the "Add to Acoustical Responses" columns of Table A.1 to the Z-weighted responses.

4.6.4 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 and Fig.4.4 and Table A.2 and Table A.3. The tables also provide the "Expanded Uncertainties of Measurement" required by IEC 61672 - 1, see the start of section 4.6.

Fig.4.3 *Free-field 0° frequency response for the sound level meter. Corresponds to the "Acoustical Response" column in Table A.2*

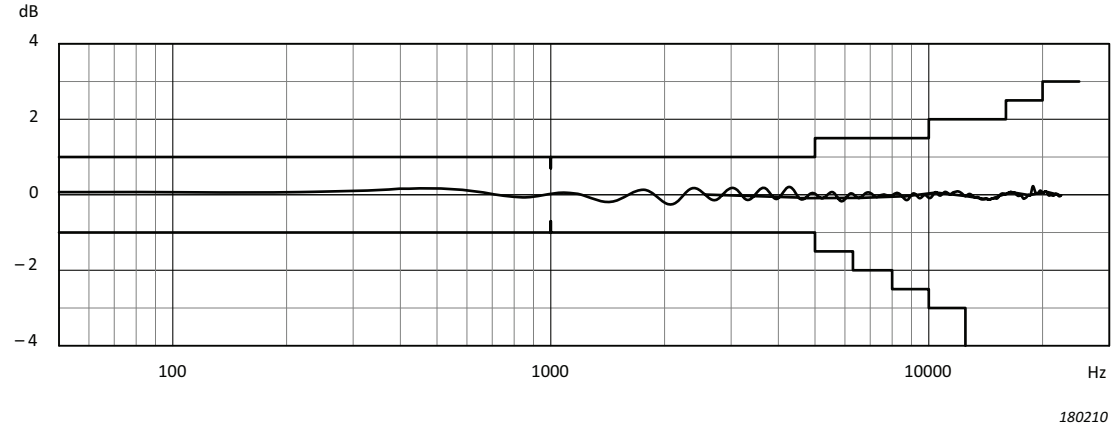
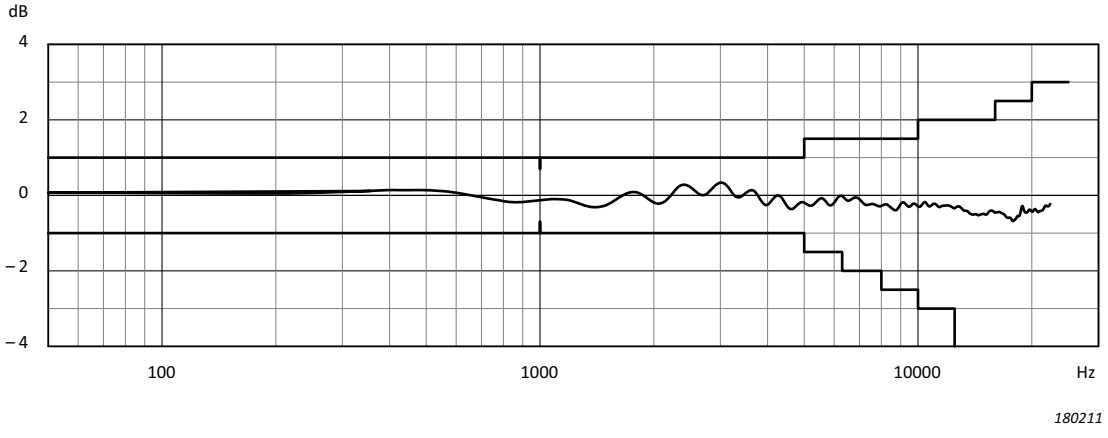


Fig.4.4 *Free-field 0° frequency response for the sound level meter with Windscreen UA-1650. Corresponds to the "Acoustical Response" column in Table A.3*



4.6.5 Diffuse-field Frequency Responses

The diffuse-field frequency responses (also called random-incidence frequency responses) with Z-frequency weighting are provided in Fig.4.5 and Fig.4.6 and Table A.4 to Table A.5.

Fig. 4.5 *Diffuse-field frequency response for the sound level meter. Corresponds to the "Acoustical Response" column in Table A.4*

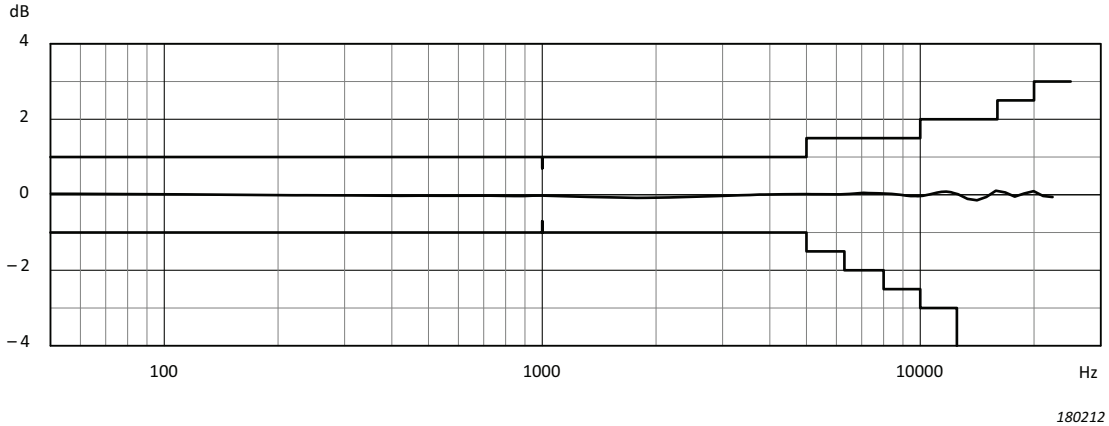
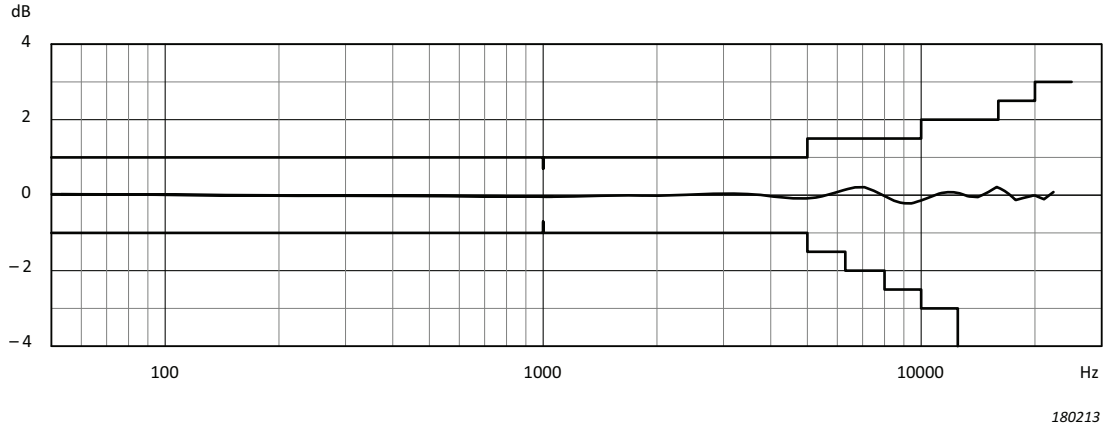


Fig. 4.6 *Diffuse-field frequency response for the sound level meter with Windscreen UA-1650. Corresponds to the "Acoustical Response" column in Table A.5*



4.6.6 Free-field Frequency Responses for Diffuse-field Calibrated Instruments

According to IEC 60651 and IEC 60804, the free-field frequency responses in the reference direction for diffuse-field calibrated instruments must be specified. These responses are given in Table A.6.

4.7 Directional Responses

This section gives directional responses for plane progressive sinusoidal sound waves normalised to the response in the reference direction. Influence of Windscreen UA-1650 is given as tables in Appendix A. Only the resulting directional responses are given here as graphs.

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 ± 30° 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 position of the microphone 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 61672-1:2013 acceptance limits.

IEC 61672-1:2013 defines relative directional response in clause 3.17.

The relative directional response for a reference angle can be derived from the specified directional response by normalisation with the values (in decibels) in the reference direction; that is, for each frequency the value at the reference direction is subtracted from the values at all angles so that the resulting value in the reference direction is 0 dB.

IEC 61672-1:2013 requires information on the directivity index.

The directivity index definition in the standard is not very precise; therefore, we have chosen to use the definition in IEC 61183:1994, Chapter 4, so that the directivity index in decibels equals the difference between the free-field response in the reference direction and the diffuse-field response without the sound level meter's electrical responses.

The directivity index for a specific microphone configuration can, therefore, be found by subtracting the "Acoustical Response" column minus the "Electrical Response" column in the relevant diffuse-field table (Table A.4 to Table A.5), from the "Acoustical Response" column minus the "Electrical Response" column in the relevant free-field table (Table A.2 to Table A.3).

Fig.4.7 *Directional response for the sound level meter measured in a plane parallel to the display and along the microphone axis. Corresponds to Table A.7 to Table A.9*

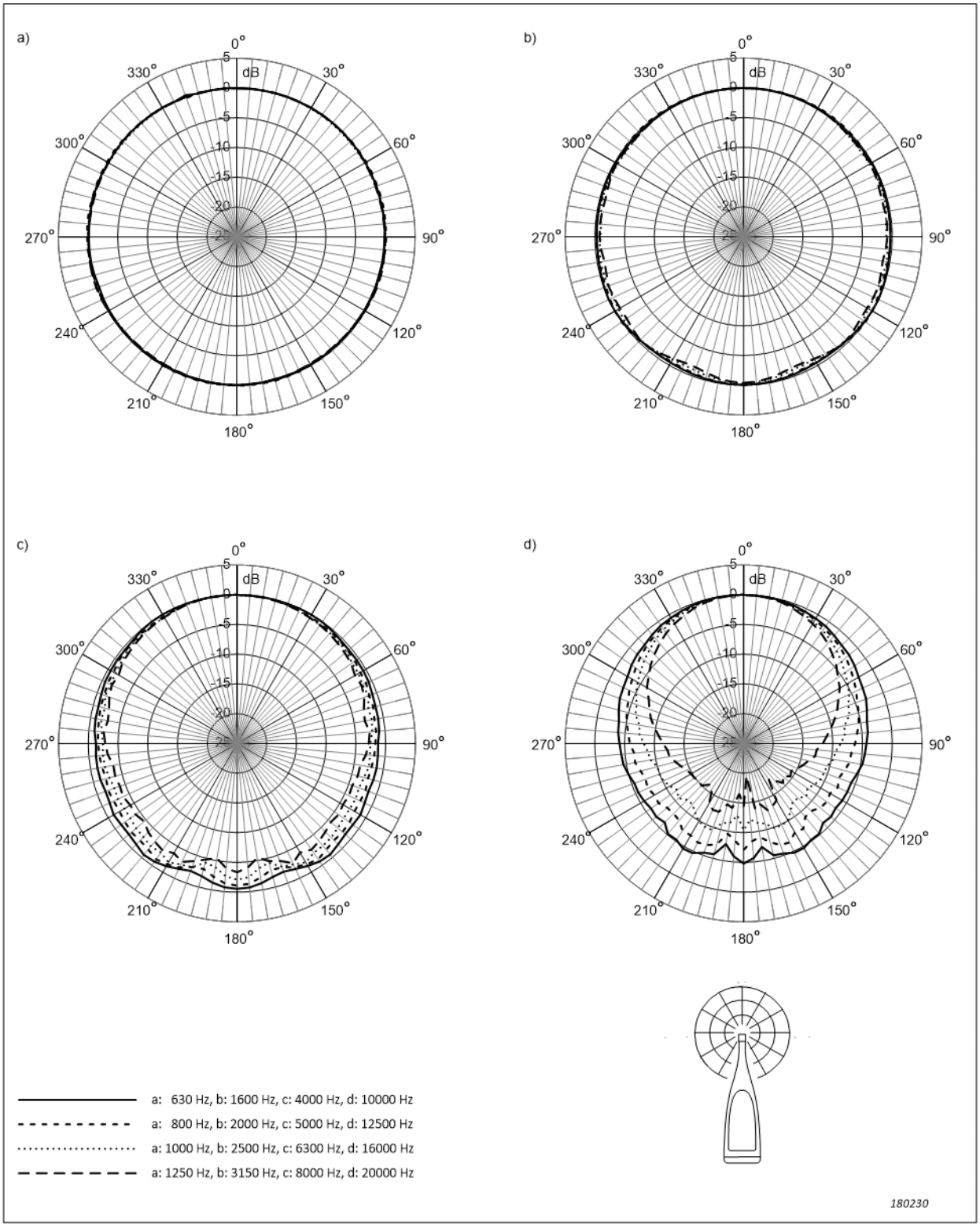


Fig.4.8 *Directional response for the sound level meter measured in a plane perpendicular to the display and along the microphone axis. Corresponds to Table A.10 to Table A.12*

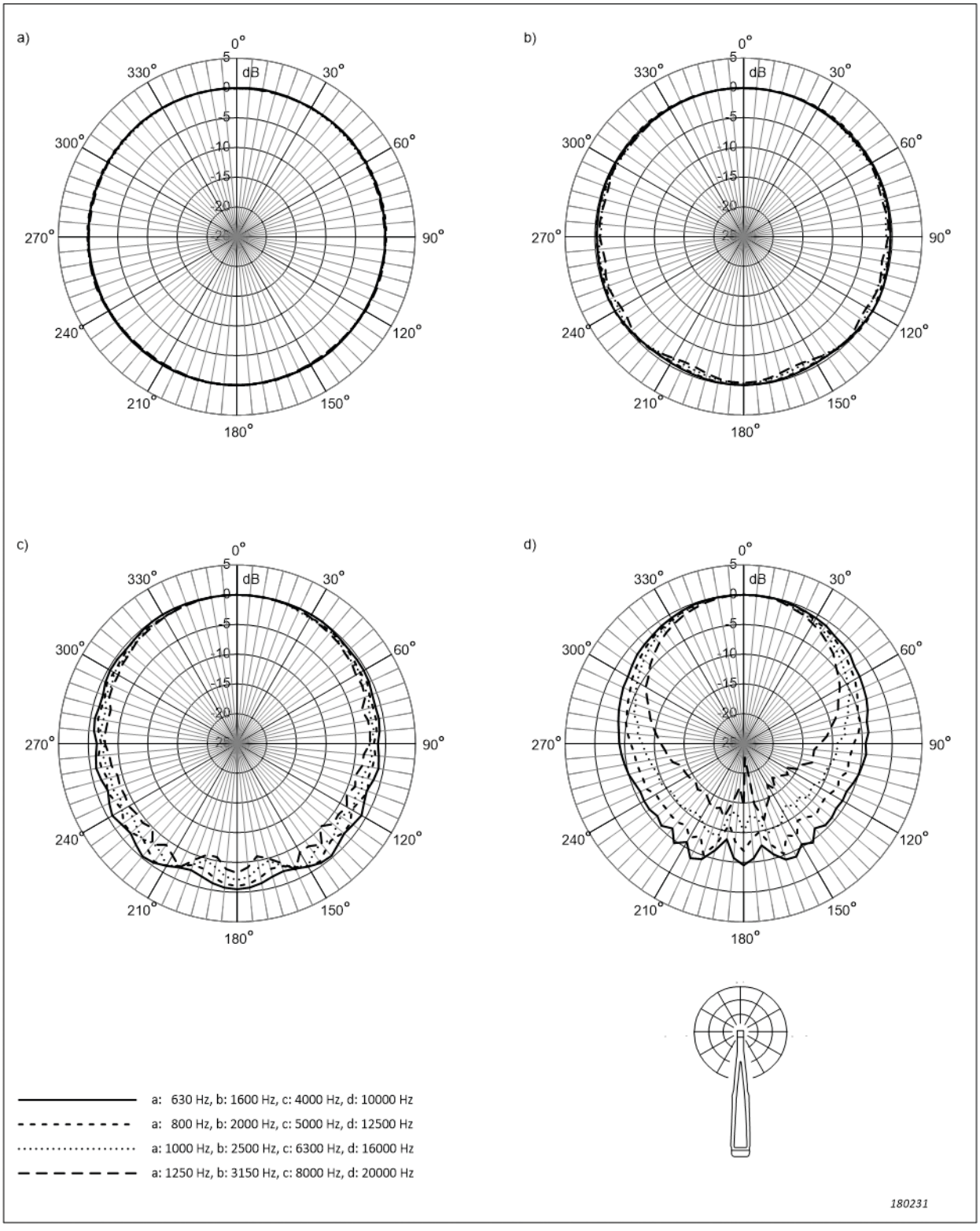


Fig. 4.9 *Sensitivity variations for the sound level meter at sound incidence angles within $\pm\theta°$ from the reference direction. Corresponds to Table A.13*

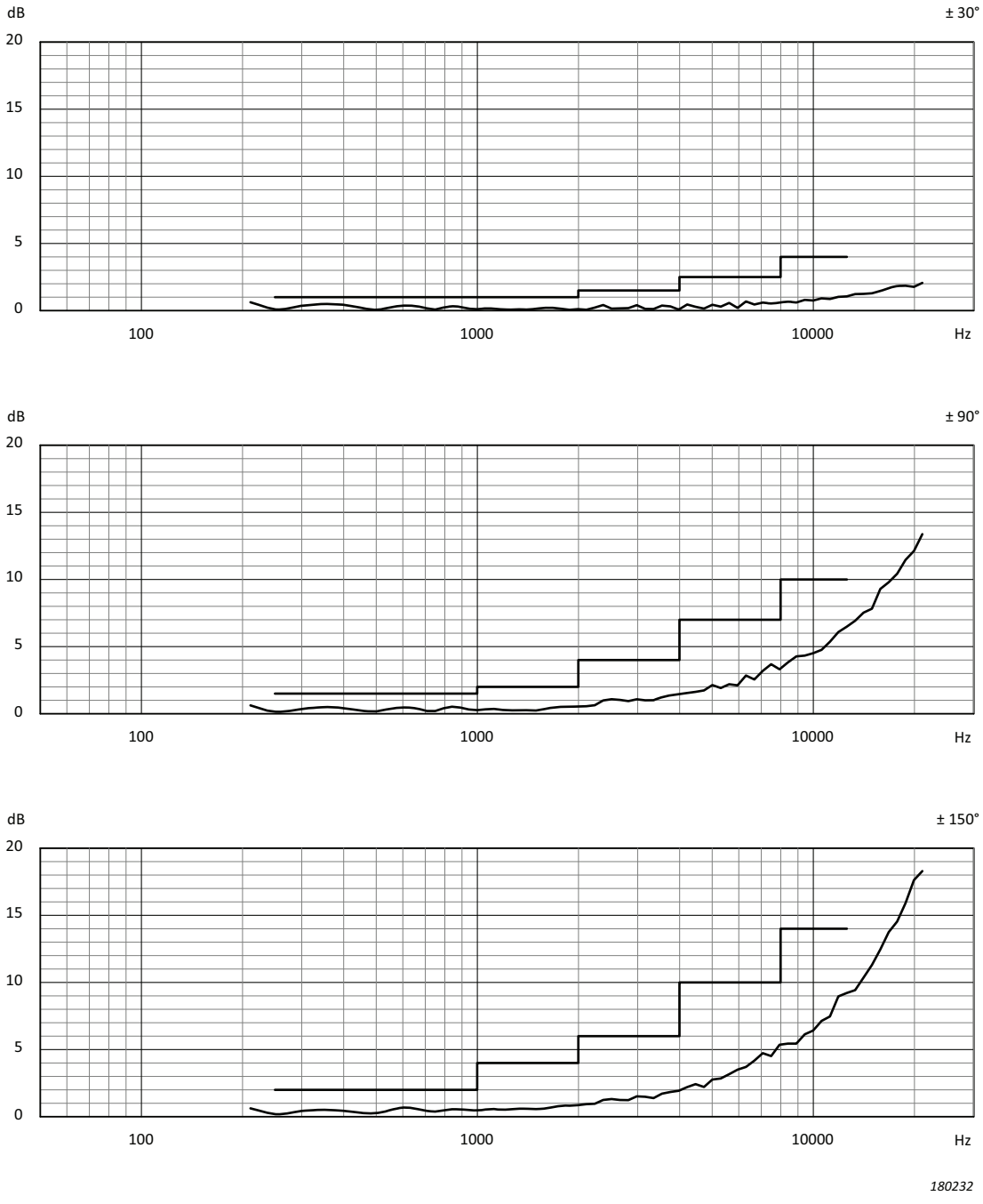


Fig.4.10 *Directional response for the sound level meter with Windscreen UA-1650, measured in a plane parallel to the display and along the microphone axis. Corresponds to Table A.17 to Table A.19*

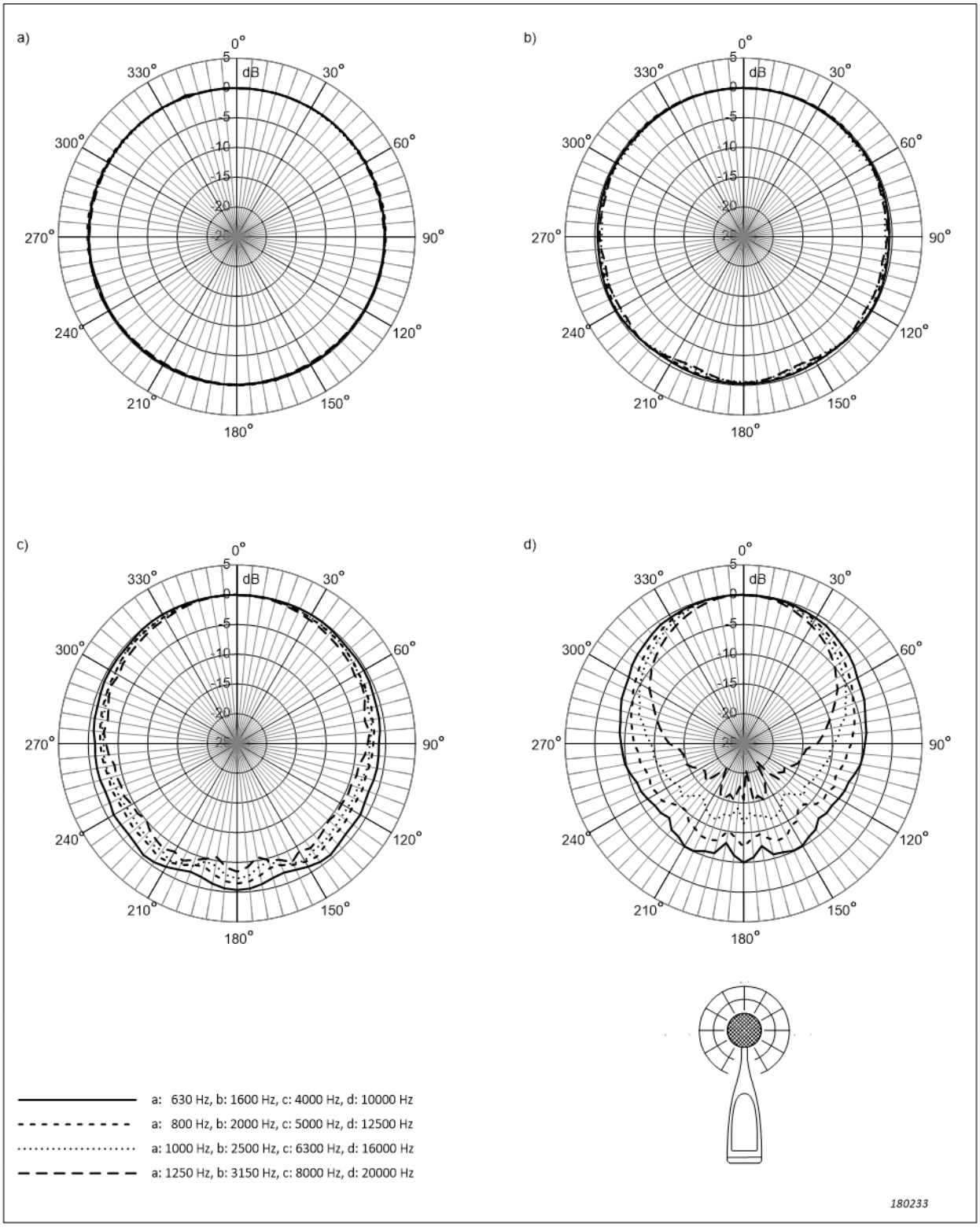


Fig.4.11 *Directional response for the sound level meter with Windscreen UA-1650, measured in a plane perpendicular to the display and along the microphone axis. Corresponds to Table A.20 to Table A.22*

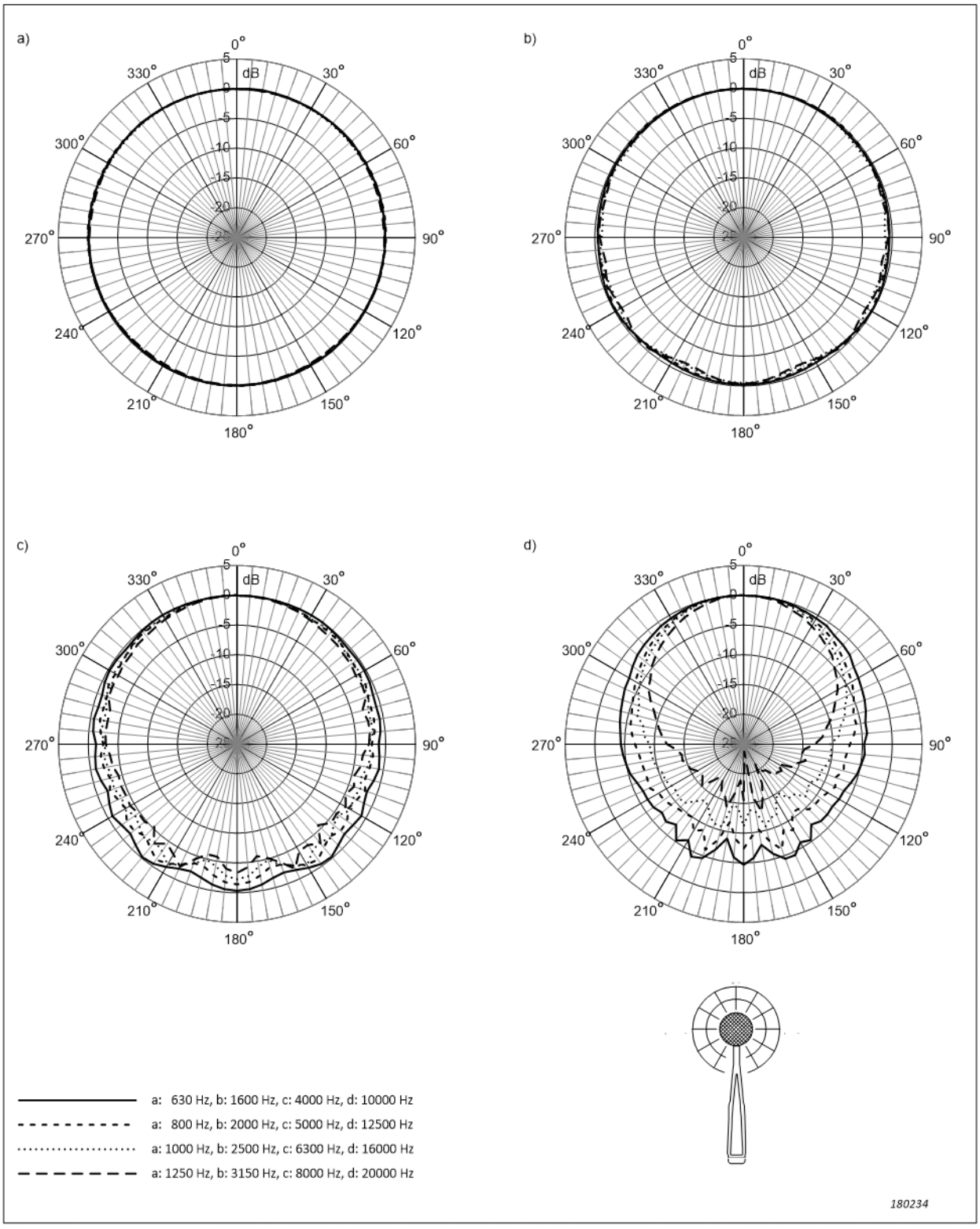
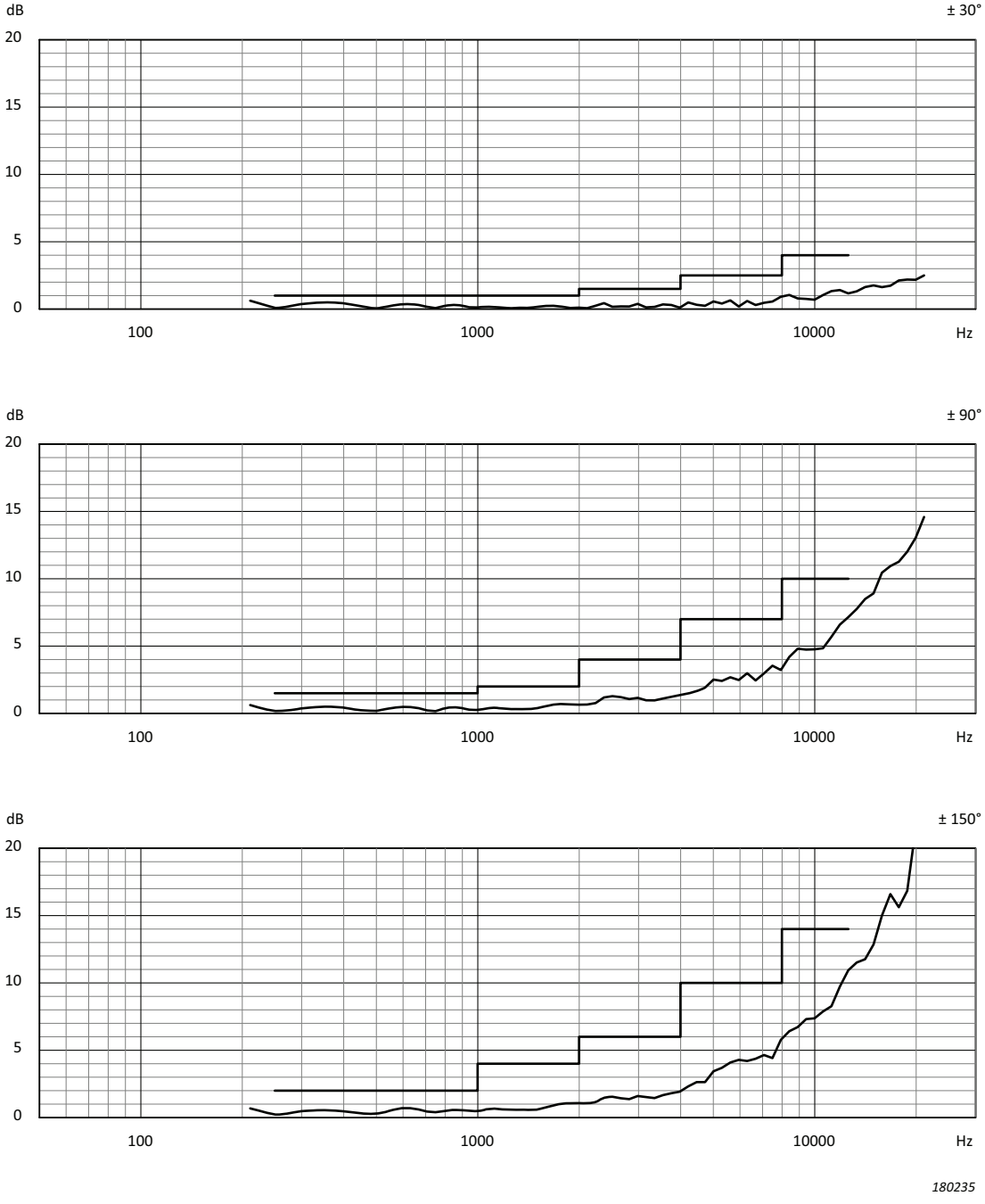


Fig.4.12 *Sensitivity variations of the sound level meter with Windscreen UA-1650, at sound incidence angles within $\pm\theta°$ from the reference direction. Corresponds to Table A.23*



4.8 Self-generated Noise

Self-generated noise is given for nominal microphone open circuit sensitivity, with **Measurement settings** > **Input** >**Sound field** set to **Free-field** and no microphone accessories selected.

Self-generated noise is measured as time-averaged sound level, L_{xeq}, with an averaging time of at least 30 seconds.

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)
Microphone	16.0	14.8	14.8	16.8
Electrical	11.6	12.1	15.1	21.1
Total	17.3	16.7	18.0	22.5

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)
Microphone	14.9	13.7	13.8	15.5
Electrical	8.5	9.2	13.0	19.5
Total	15.8	15.1	16.4	21.0

4.8.3 Typical Self-generated Noise Spectra

Typical spectra for self-generated noise are shown in Fig.4.13 and Fig.4.14.

Fig. 4.13 *Typical self-generated noise, 1/1-octave band*

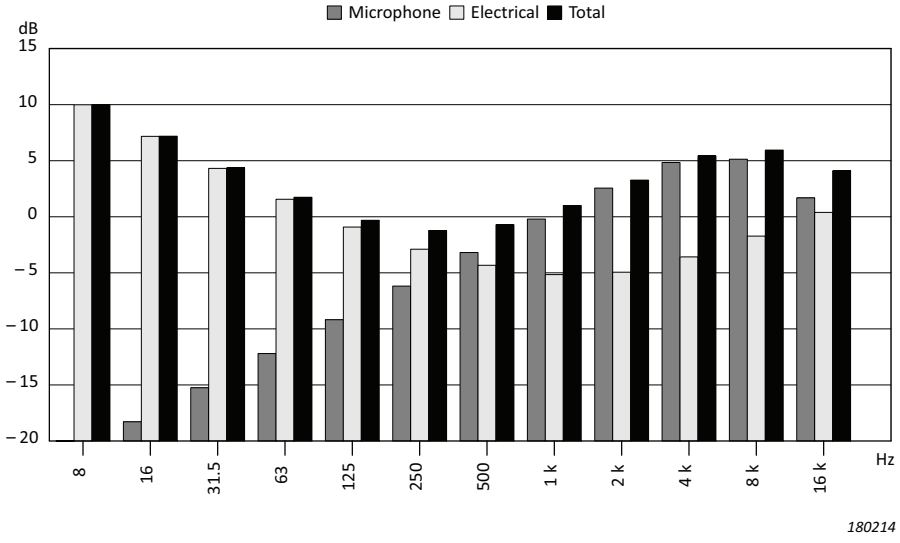
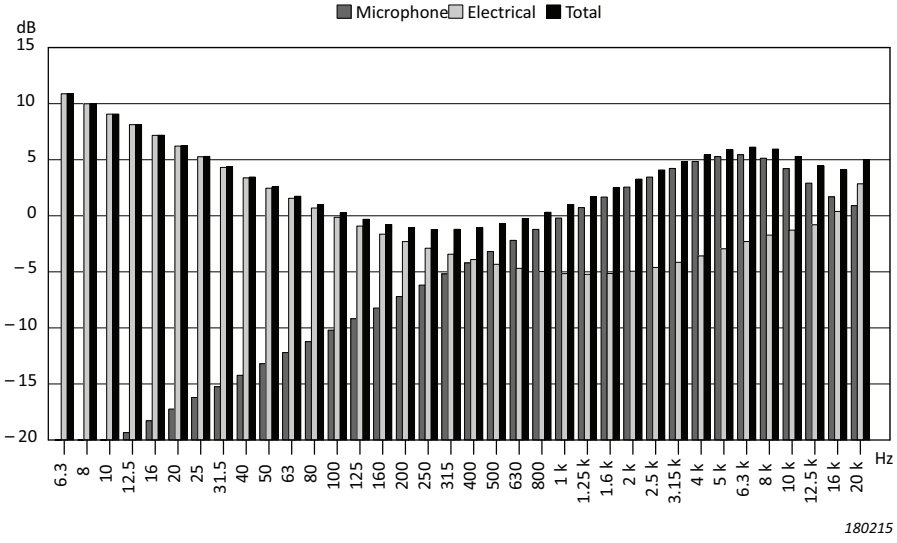


Fig.4.14 *Typical self-generated noise, 1/3 octave band*



4.9 Measuring Ranges

The "Upper Limit" in the following sections is based on the guaranteed worst-case limit for the sound level meter and the nominal open circuit sensitivity of the microphone. The overload limit can, due to tolerances in the sound level meter, be up to 0.6 dB higher than the Upper Limit specified in this manual, 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 sound level meter, the nominal open circuit sensitivity of the microphone under Reference Environmental Conditions, **Measurement settings** > **Input** > **Sound field** 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 be accommodate without causing damage to the sound level meter is 158 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 that 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 (dB)**
140.3 – 23.2	140.3 – 23.6	140.3 – 26.5	140.3 – 32.7	140.3 – 36.5

Please 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*, 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

Upper Limit (dB)	Lower Limit				
	A-weighting (dB)	B-weighting (dB)	C-weighting (dB)	Z-weighting (dB)	Z-weighting Extended (dB)
123.0	21.9	22.3	25.2	31.4	35.2

4.9.4 Indicator Range

Indicator range according to the international standard IEC 60804:

Table 4.5
Indicator range

Upper Limit (dB)	Lower Limit				
	A-weighting (dB)	B-weighting (dB)	C-weighting (dB)	Z-weighting (dB)	Z-weighting Extended (dB)
140.0	21.9	22.3	25.2	31.4	35.2

Please note: For sound exposure levels, the stated ranges are valid if 10*lg(Δt) is added to the limits. Δ*t* being the averaging time interval, indicated as *Elapsed*, 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 Limits in the following table:

Table 4.6
Linearity range

Upper Limit (dB)	Lower Limit				
	A-weighting (dB)	B-weighting (dB)	C-weighting (dB)	Z-weighting (dB)	Z-weighting Extended (dB)
141.5	19.8	20.2	23.1	29.3	33.1

Please note: For sound exposure levels, the stated ranges are valid if 10*lg(Δt) is added to the limits. Δ*t* being the averaging time interval, indicated as *Elapsed*, 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 Limits in the following table:

Table 4.7
Pulse range

Upper Limit (dB)	Lower Limit				
	A-weighting (dB)	B-weighting (dB)	C-weighting (dB)	Z-weighting (dB)	Z-weighting Extended (dB)
142.1	19.8	20.2	23.1	29.3	33.1

Please note: For sound exposure levels, the stated ranges are valid if 10*lg(Δt) is added to the limits. Δ*t* being the averaging time interval, indicated as *Elapsed*, expressed in seconds.

4.9.7 Linear Operating Range

The starting point for all 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)
A-weighting	101.2	140.3	141.5	139.4	135.4	22.8
B-weighting	123.6	140.3	139.8	137.6	133.6	23.6
C-weighting	137.7	140.3	139.7	137.5	133.5	26.3
Z-weighting	140.7	140.3	140.5	140.5	139.8	32.3
Z-weighting extended	140.7	140.3	140.5	140.5	139.8	36.5

Please note: For sound exposure levels, the stated ranges are valid if 10*lg(Δt) is added to the limits. Δ*t* being the averaging time interval, indicated as *Elapsed*, 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

Upper Limit					Lower Limit
31.5 Hz (dB)	1 kHz (dB)	4 kHz (dB)	8 kHz (dB)	12.5 kHz (dB)	All (dB)
140.5	143.3	142.7	140.5	136.5	43.1

4.10 Detectors

Display-update Rates: *Lxy* broadband bars and spectra every 0.25 second; all other spectra and numbers every 1 second

4.10.1 Exponential Averaging

Exponential Averaging Times: Fast (250 ms), Slow (2000 ms), Impulse (70 ms + 1500 ms hold time constant)

Response to Tone Bursts for Exponential Averaging Detectors according to IEC 60651 and DIN 45657:

Table 4.10
Response to tone bursts for exponential averaging detectors

Time Weighting	Duration of Test Tone Burst (ms)	Maximum Response to Test Tone Burst Referred to Response to Continuous Signal (dB)	Standards' Tolerances on Maximum Response (dB)	Analyzer Tolerances on Maximum Response (dB)
	Continuous	0.00		
Fast	200	−0.98	± 1	± 0.1
	100	−2.59	± 2	± 0.1
	50	−4.82	± 2	± 0.1
	20	−8.30	± 2	± 0.1
	10	−11.14	± 2	± 0.1
	5	−14.07	± 2	± 0.1
	2	−17.99	±2	± 0.1
	1	−20.99	± 2	± 0.1
	0.5	−23.99	± 2	± 0.1
	0.25	−26.99	± 2	± 0.1
Slow	2000	−0.63	–	± 0.1
	500	−4.05	± 1	± 0.1
	200	−7.42	–	± 0.1
	50	−13.12	–	± 0.1
Impulse	20	−3.61	± 1.5	± 0.2
	5	−8.76	± 2	± 0.2
	2	−12.55	± 2	± 0.2

Please note: The maximum response to test tone burst referred to response to continuous signal is calculated from the formula in IEC 60651, Appendix C.

4.10.2 Linear Averaging

Linear Averaging Times: 1 second to 32 days, in steps of 1 second

Settling Time according to IEC 60804: < 3 seconds

Nominal Delay Time Between Operation of the Reset Facility and Re-initiation of a Measurement according to IEC 61672-1: < 2 seconds

Time Interval After Completion of a Measurement Before a Reading is Displayed according to IEC 61672-1: < 1 second

Minimum Hold Time according to IEC 60804: Results of a timed measurement are held until a new measurement is initiated or the result is reset

4.10.3 Peak

Peak Onset Time according to IEC 60651: < 100 µs

4.11 Spectrum Analysis

Analytical Filter Design: Optimised Z-transformation of analogue Butterworth filters

Base: 10

Sampling Rate: Octave-based down-sampling from 65.536 kHz

Reference Attenuation: 0 dB, relative to the broadband equivalent continuous Z-weighted sound level L_{Zeq} for a 1 kHz sinusoidal input

4.11.1 1/1-octave Band Centre Frequencies

Nominal: 16 Hz, 31.5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, 8 kHz, 16 kHz

Exact (5 digits): 15.849 Hz, 31.623 Hz, 63.096 Hz, 125.89 Hz, 251.19 Hz, 501.19 Hz, 1.0000 kHz, 1.9953 kHz, 3.9811 kHz, 7.9433 kHz, 15.849 kHz

Real-time Frequency Range (Time-invariant Range): 16 Hz to 16 kHz centre frequencies

Fig. 4.15
The shapes of the 1/1-octave band filters (from 0 to –80 dB). The innermost and outermost curves show IEC 61260 limits

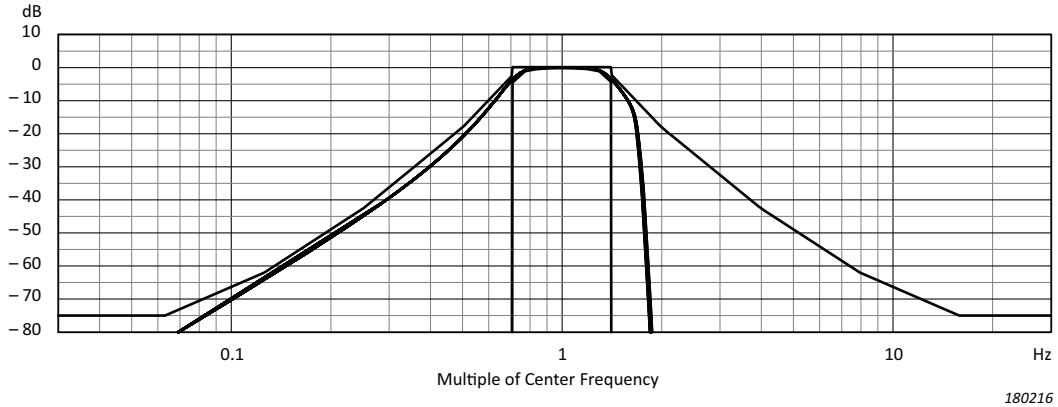
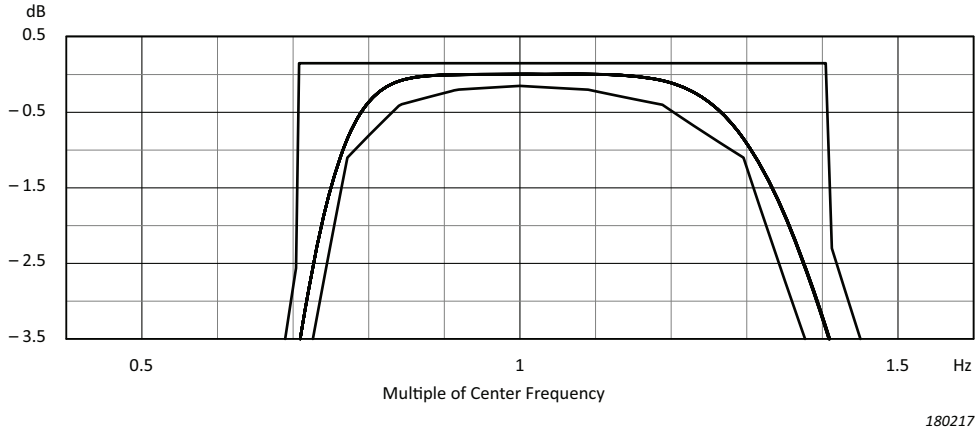


Fig. 4.16
The shapes of the 1/1-octave band filters (from 0 to –3.5 dB). The innermost and outermost curves show IEC 61260 limits



4.11.2 1/3-octave Band Centre Frequencies

Nominal: 12.5 Hz, 16 Hz, 20 Hz, 25 Hz, 31.5 Hz, 40 Hz, 50 Hz, 63 Hz, 80 Hz, 100 Hz, 125 Hz, 160 Hz, 200 Hz, 250 Hz, 315 Hz, 400 Hz, 500 Hz, 630 Hz, 800 Hz, 1 kHz, 1.25 kHz, 1.6 kHz, 2 kHz, 2.5 kHz, 3.15 kHz, 4 kHz, 5 kHz, 6.3 kHz, 8 kHz, 10 kHz, 12.5 kHz, 16 kHz, 20 kHz

Exact (5 digits): 12.589 Hz, 15.849 Hz, 19.953 Hz, 25.119 Hz, 31.623 Hz, 39.811 Hz, 50.119 Hz, 63.096 Hz, 79.433 Hz, 100.00 Hz, 125.89 Hz, 158.49 Hz, 199.53 Hz, 251.19 Hz, 316.23 Hz, 398.11 Hz, 501.19 Hz, 630.96 Hz, 794.33 Hz, 1.0000 kHz, 1.2589 kHz, 1.5849 kHz, 1.9953 kHz, 2.5119 kHz, 3.1623 kHz, 3.9811 kHz, 5.0119 kHz, 6.3096 kHz, 7.9433 kHz, 10.000 kHz, 12.589 kHz, 15.849 kHz, 19.953 kHz

Real-time Frequency Range (Time-invariant Range): 12.5 Hz to 20 kHz, centre frequencies

Fig. 4.17
The shapes of the 1/3-octave band filters (from 0 to –80 dB). The innermost and outermost curves show IEC 61260 limits

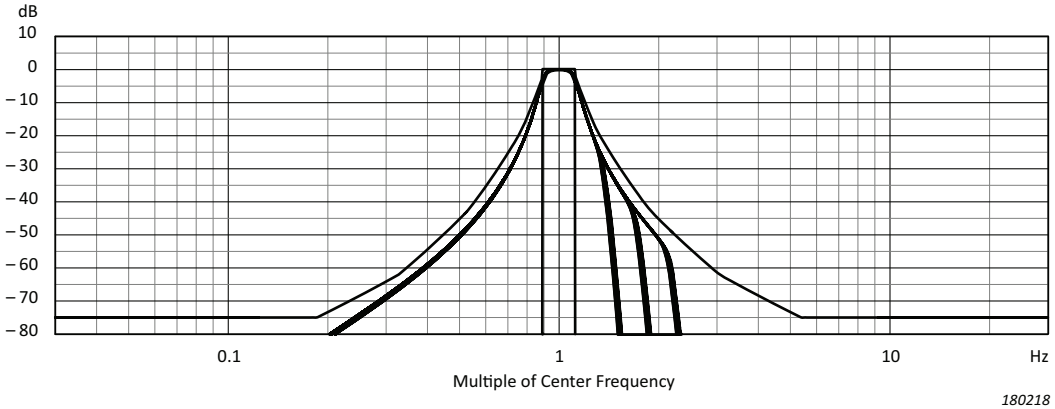
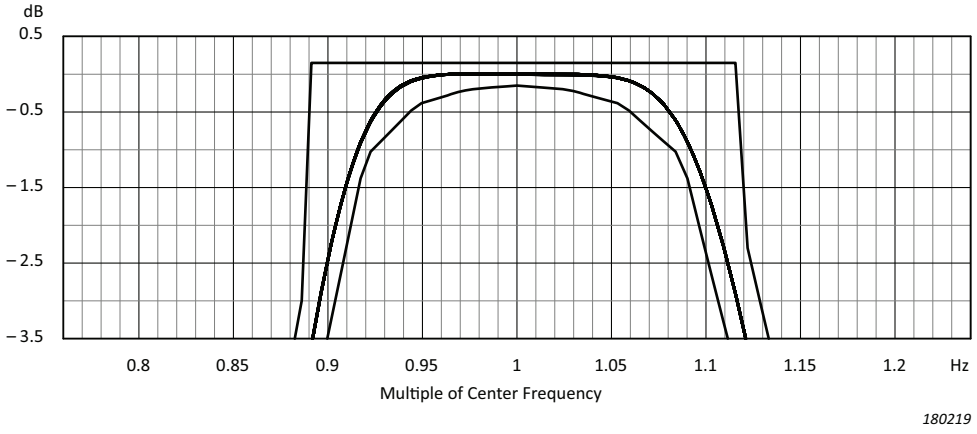


Fig. 4.18
The shapes of the 1/3-octave band filters (from 0 to –3.5 dB). The innermost and outermost curves show IEC 61260 limits



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

Upper Limit (dB)	Lower Limit 1/1-octave (dB)	Lower Limit 1/3-octave (dB)
140.6	22.7	23.5

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)
140.6 – 22.7	140.6 – 23.5

4.11.5 Octave Band Time Constants

At low centre frequencies, the B*T product for time weightings becomes too small to give statistically reliable measurements. To overcome this, the Fast time constant (125 ms) and the Slow time constant (1000 ms) are replaced by progressively longer time constants with decreasing centre frequencies (and corresponding bandwidths). See Table 4.13 and Table 4.14.

Table 4.13
Octave band Fast time constants

1/1-octave Centre Frequency (Hz)	1/3-octave Centre Frequency (Hz)	Time Constant (ms)	Averaging Time (ms)
≥ 63	≥100	125 (Fast)	250 (Fast)
31.5	80, 63, 50	250	500
16	40, 31.5, 25	500	1000
–	20, 16, 12.5	1000	2000

Table 4.14
Octave band Slow time constants

1/1-octave Centre Frequency (Hz)	1/3-octave Centre Frequency (Hz)	Time Constant (ms)	Averaging Time (ms)
≥16	≥12.5	1000 (Slow)	2000 (Slow)

For a white Gaussian signal and for 1/1-octave centre frequencies from 16 Hz to 63 Hz, these time constants give a maximum relative standard deviation of approximately 1.5 dB. For 1/3-octave centre frequencies from 12.5 Hz to 160 Hz, these time constants give a maximum relative standard deviation of approximately 2 dB.

4.12 Influences from the Operating Environment

The temperature and humidity specifications are given provided that no condensation inside the sound level meter results from the combination.

Excessive condensation may cause permanent damage to the instrumentation.

4.12.1 Environmental Stabilisation Time

Typical stabilisation time after change in environmental conditions is 10 minutes.

When the sound level meter is moved from a warm environment with high humidity, to a colder environment, care should be taken not to produce condensation inside the sound level meter. If condensation is produced, much longer stabilisation periods may be necessary.

4.12.2 Temperature

Operating Temperature Range: –25 to +70 °C (+13 to +158 °F)

Storage Temperature Range: –25 to +70 °C (–13 to +158 °F)

4.12.3 Humidity

Operating Humidity Range: 0% < RH < 90%, providing there is no condensation

4.12.4 Vibration

Vibration Sensitivity (20 to 1000 Hz) for 1 ms^{-2}: A-weighted max. 73 dB, Z-weighted max. 83 dB

4.13 Wireless Interface to the Sound Level Meter

It is not possible to change or corrupt the measured values in any way through these interfaces.

4.13.1 Bluetooth

Bluetooth is only used for pairing devices (transferring IP address) for Wi-Fi.

Standard: Bluetooth 5.0 (BLE)

Frequencies: 2400 – 2483.5 MHz (Channel 0 – 78)

Power: < 10 mW (10 dBm)

4.13.2 Wi-Fi

Wi-Fi can be used for monitoring a measurement, setting up a measurement, controlling a measurement, and transferring data from the sound level meter to another device.

Standard: IEEE 802.11 b/g/n

Frequencies: 2400 – 2483.5 MHz (regional subset of channel 1 – 13)

Power: < 100 mW (20 dBm)

4.13.3 Regulatory Information

European Union Regulatory

Sound Level Meter Type 2245 incorporates a Wi-Fi / Bluetooth radio module, which has been tested to comply with European Radio Equipment directive (RED) 2014/53/EU.

Sound Level Meter Type 2245 has been tested by a qualified test house, and complies with the requirements in the EN 62209-2:2010 specifications for body-worn use and for hand-held use.

USA: FCC (Federal Communication Commission Interference Statement)

ID: 2ASFB-2245-1

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1) This device may not cause harmful interference, and
2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Warning: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Prohibition of co-location. This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

Important Note: The device is designed to operate on the body of users without requiring additional body-worn accessories and has been tested and comply with the Specific Absorption Requirements (SAR) using a test separation distance of 5 mm according to KDB 447498 D01 (sec 4.2.2.c).

Canada: IC/ISED (Industry Canada Statement)

ID: 24805-224501

This device contains license-exempt transmitter/receiver that comply with Innovation, Science and Economic Development Canada's license-exempt RSS(s). Operation is subject to the following two conditions:

1) This device may not cause interference.
2) This device must accept any interference, including interference that may cause undesired operation of the device.

Cet appareil contient un émetteur/récepteur exempt de licence conforme aux exemptions du CNR-Gen d'Innovation, des Sciences et du développement économique Canada.

Le fonctionnement est soumis aux deux conditions suivantes:

1) Cet appareil ne doit pas causer d'interférences.
2) Cet appareil doit accepter toutes les interférences, y compris celles susceptibles de provoquer un fonctionnement indésirable de l'appareil.

4.14 Electrical Interface to the Sound Level Meter

The sound level meter is equipped with a USB-C interface. With available accessories listed in Fig. 1.1, this can be used as a digital interface for transferring data to and from the sound level meter, as a DC input for charging and powering the sound level meter, as well as an analogue voltage output for other equipment.

4.14.1 Voltage Output

3.5 mm Minijack Cable AO-0846 from USB-C

In **System settings** > **Voltage output** set *Source* to the required signal (**Input A-**, **B-**, **C-**, or **Z-weighted** or one of the two **LxF**). The possible weightings will be the two weightings selected in **Measurement settings** > **Broadband parameters** > **Weighting**.

Input A-, B-, C-, or Z-weighted is for test purposes. If one of these are selected, the output will be the input attenuated by 0 dB. This means that the current sensitivity also applies to this output. The sensitivity can be seen in **Calibration history** > **Calibrations** > ***Newest date-time*** > **Sensitivity**. This output is only valid for outputs up to ±2 Vpp. Above this level, the output will start to clip.

If **LAF**, **LBF**, **LCF**, or **LZF** is selected, the output will be the weighted sound level as a voltage between 0 V and 2 V with a resolution of 10 mV/dB, for example, 0 dB equals 0 V output and 100 dB equals 1 V output.

Maximum Peak Output Voltage: ± 2.0 V

Maximum Sinusoidal Output Voltage: 1.41 V_{RMS}

Output Impedance: 50 Ω

Load Impedance: > 15 kΩ || 1 nF for < 0.2 dB attenuation from DC to 20 kHz, short-circuit proof without affecting the measurement results

Max. DC Offset: ± 15 mV

4.14.2 Digital Interfaces

The digital interfaces can be used for monitoring a measurement, setting up a measurement, controlling a measurement, data storage and transferring data from the sound level meter to another device. However, it is not possible to change or influence the measured values in any way through these interfaces.

USB Interface

USB-C interface with support for:

- USB 2.0 High-speed data (480 Mbit/s, host/function)
  - Dual-role data
  - USB function implements Microsoft® Remote NDIS protocol for communication with PC
  - USB host supports hubs, mass storage class and some Ethernet adapters
- USB-C Power Delivery
  - Dual-role power

- USB battery charging, charges the sound level meter with up to 7.5 W from a USB Type A charger and up to 15 W from a USB Type C charger
- Delivers up to 2.5 W

4.14.3 Charge/Power Interface

While measuring, the sound level meter is only intended to be supplied from the built-in battery or mains using the specified external AC main supply adapter(s), see section 4.15.1. Other USB chargers and USB power packs can be used for charging the internal battery.

4.15 Power Supply

4.15.1 External AC Mains Power Supply Adapter

Part No.: Mains Power Supply ZG-0486

Supply Voltage: 100 – 240 V AC, 50/60 Hz

Max. Output Current/Voltage: 2.4 A/5 V

Connector: USB-A socket

4.15.2 Battery

Built-in rechargeable Li-Ion battery

Voltage: 3.6 V (nominal)

Capacity: 6.7 Ah nominal

Typical Operating Time: > 13 hours. However, if the sound level meter is used in low temperatures or there is extensive use of the display backlight, this may reduce the time

Battery Cycle Life: > 500 complete charge/discharge cycles with 80% of initial capacity remaining

Battery Indicator: Remaining battery capacity and expected working time may be read out in *Time remaining* and *Charged %*

Charge Time: With charger ZG-0486, typically 6 hours from empty to full and 3½ hours from empty to 75%. These charging times are for an ambient temperature of 23 °C. At higher ambient temperatures, charging time is prolonged and charging stops if the temperature inside the sound level meter exceeds 60 °C. Charging time is also prolonged at temperatures below 10 °C and charging stops if the temperature inside the sound level meter falls below 0 °C

4.16 Warm-up Time

Warm-up Time: < 30 seconds after reaching equilibrium with the ambient environment and switching on power

4.17 Real-time Clock

Automatically adjusted when the sound level meter is connected to a network with Internet access. No manual adjustment possible

Back-up Powered Clock Drift: < 0.3 seconds over a 24-hour period

4.18 Mark Compliance

	The CE marking is the manufacturer's declaration that the product meets the requirements of the applicable EU directives. For this product it is the Radio Equipment Directive 2014/53/EU. RCM mark indicates compliance with applicable ACMA technical standards – that is, for telecommunications, radio communications, EMC and EME. China RoHS mark indicates all items shipped to China have to be marked as to whether the items are compliant or non-compliant with the Chinese restriction of hazardous substances. WEEE mark indicates compliance with the EU WEEE Directive. FCC mark is a certification mark employed on electronic products manufactured or sold in the United States, which certifies that the electromagnetic interference from the device is under limits approved by the Federal Communications Commission
Electrical Safety	EN/IEC 61010-1, ANSI/UL 61010-1 and CSA C22.2 No.1010.1: Safety requirements for electrical equipment for measurement, control and laboratory use – Part 1: General requirements CB Scheme: • Battery: EN/IEC 62133-2:2017: Secondary cells and batteries containing alkaline or other non-acid electrolytes. Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications – Part 2: Lithium systems
Radio Spectrum	ETSI EN 300 328 V2.1.1: Wideband transmission systems; Data transmission equipment operating in the 2.4 GHz ISM band and using wide band modulation techniques; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU EN 303 413 V1.1.1: Satellite Earth Stations and Systems (SES); Global Navigation Satellite System (GNSS) receivers; Radio equipment operating in the 1164 – 1300 MHz and 1559 – 1610 MHz frequency bands
EMC Emission and Immunity	EN/IEC 61326: Electrical equipment for measurement, control and laboratory use – EMC requirements. EN/IEC 61000-6-2: Generic standard – Immunity for industrial environments. EN/IEC 61000-6-3: Generic emission standard for residential, commercial and light industrial environments, class B. CISPR 32: Radio disturbance characteristics of multimedia equipment. Class B limits. EN 301489-1 V2.2.0: Electromagnetic compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU and the essential requirements of article 6 of Directive 2014/30/EU. EN 301 489-17 V3.2.0: Electromagnetic compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for broadband data transmission systems; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU. EN 301 489-19 V2.1.0: For radio equipment and services; Part 19: Specific conditions for Receive Only Mobile Earth Stations (ROMES) operating in the 1.5 GHz band providing data communications and GNSS Receivers Operating in the RNSS band (ROGNSS) providing positioning, navigation, and timing data. 47 CFR FCC Part 15, subpart B
Product-specific Standards (incl. EMC)	EN/IEC 61672-1:2013: Electroacoustics – Sound level meters – Part 1: Specifications EN/IEC 61260-1:2014: Electroacoustics – Octave-band and fractional-octave-band filters – Part 1: Specifications
Specific Absorption Rate (SAR)	RED (Europe): • 1999/519/EC: Council recommendation of 12 July 1999 on the limitation of exposure of the general public to electro-magnetic fields (0 Hz – 300 GHz) • EN 62311: General RF exposure standard that effectively refers to SAR standards for devices where other assessment methods are not relevant • IEC 62209-2: Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures – Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz) FCC (US): • FCC CFR 2.1093: Radio frequency radiation exposure evaluation: Portable devices • KDB 447498 D01: General RF exposure guidance • KDB 865664 D01: SAR measurement 100 MHz – 6 GHz • KDB 248227 D01: SAR guidance for IEEE 802.11 (Wi-Fi) transmitters • IEEE standard 1528 IEEE: Recommended practice for determining the peak spatial-average Specific Absorption Rate (SAR) in the human head from wireless communications devices: measurement techniques ISED (Canada): • RSS-102: Radio frequency (RF) exposure compliance of radio communication apparatus
Temperature	IEC 60068-2-1 & IEC 60068-2-2: Environmental Testing. Cold and Dry Heat • Storage Temperature: –25 to +70 °C (–13 to +158 °F)
Humidity	IEC 60068-2-78: Damp Heat: 93% RH (non-condensing at +40 °C (104 °F)). Recovery time 2 – 4 hours

Mechanical	Non-operating: • IEC 60068-2-6: Vibration: 0.15 mm, 20 m/s^2, 10 – 500 Hz • IEC 60068-2-27: Bump: 4000 bumps at 400 m/s^2 • IEC 60068-2-27: Shock: 1000 m/s^2, 5 directions • EN 60068-2-32: Free fall: 100 cm, 10 directions
Enclosure	EN/IEC 60529 (1989): Protection provided by enclosures: IP 55

Please note: The above is only guaranteed using accessories listed in this document.

Appendix A

Tables

A.1 Electrical Frequency Responses

Uncompensated electrical frequency responses for the different frequency weightings. Please see the instructions in section 3.2.2 on how to ensure an uncompensated electrical frequency response.

Table A.1 *Uncompensated electrical frequency responses*

Nominal Frequency	Exact Frequency (6 digits)	Electrical Response				Add to Acoustical Responses		
		A-weighting	B-weighting	C-weighting	Z-weighting	A-weighting	B-weighting	C-weighting
Hz	Hz	dB	dB	dB	dB	dB	dB	dB
63	63.0957	−26.24	−9.39	−0.86	0.04	−26.21	−9.36	−0.83
80	79.4328	−22.55	− 7.41	−0.55	0.04	−22.51	−7.37	−0.51
100	100.000	−19.19	−5.69	−0.34	0.04	−19.15	−5.65	−0.30
125	125.893	−16.15	−4.23	−0.21	0.04	−16.10	−4.19	−0.17
160	158.489	−13.40	−3.03	−0.13	0.04	−13.35	−2.99	−0.09
200	199.526	−10.92	−2.09	−0.08	0.04	−10.87	−2.05	−0.03
250	251.189	−8.68	−1.39	−0.04	0.04	−8.63	−1.35	0.00
315	316.228	−6.66	−0.89	−0.03	0.04	−6.62	−0.85	0.02
400	398.107	−4.85	−0.55	−0.02	0.04	−4.81	−0.51	0.02
500	501.187	−3.28	−0.32	−0.01	0.04	−3.24	−0.28	0.03
630	630.957	−1.95	−0.17	−0.02	0.03	−1.91	−0.14	0.02
800	794.328	−0.87	−0.09	−0.03	0.03	−0.84	−0.06	0.01
1000	1000.00	−0.04	−0.04	−0.04	0.03	−0.02	−0.02	−0.02
1060	1059.25	0.12	−0.04	−0.05	0.02	0.15	−0.01	−0.03
1120	1122.02	0.28	−0.04	−0.06	0.02	0.30	−0.01	−0.04
1180	1188.50	0.42	−0.04	−0.07	0.02	0.44	−0.01	−0.05

Table A.1 (Continued) *Uncompensated electrical frequency responses*

Nominal Frequency	Exact Frequency (6 digits)	Electrical Response				Add to Acoustical Responses		
		A-weighting	B-weighting	C-weighting	Z-weighting	A-weighting	B-weighting	C-weighting
Hz	Hz	dB	dB	dB	dB	dB	dB	dB
1250	1258.93	0.55	−0.04	−0.08	0.02	0.57	−0.02	−0.06
1320	1333.52	0.66	−0.04	−0.09	0.02	0.68	−0.02	−0.07
1400	1412.54	0.76	−0.05	−0.10	0.02	0.78	−0.03	−0.08
1500	1496.24	0.86	−0.05	−0.11	0.02	0.87	−0.04	−0.10
1600	1584.89	0.94	−0.07	−0.13	0.02	0.95	−0.05	−0.11
1700	1678.80	1.01	−0.08	−0.15	0.01	1.02	−0.06	−0.13
1800	1778.28	1.07	−0.09	−0.17	0.01	1.08	−0.08	−0.15
1900	1883.65	1.11	−0.11	−0.19	0.01	1.13	−0.10	−0.18
2000	1995.26	1.15	−0.13	−0.21	0.01	1.17	−0.12	−0.20
2120	2113.49	1.19	−0.16	−0.24	0.01	1.20	−0.15	−0.23
2240	2238.72	1.21	−0.19	−0.27	0.01	1.22	−0.18	−0.26
2360	2371.37	1.22	−0.22	−0.31	0.01	1.23	−0.21	−0.30
2500	2511.89	1.23	−0.25	−0.34	0.01	1.23	−0.25	−0.34
2650	2660.73	1.22	−0.30	−0.39	0.01	1.23	−0.29	−0.38
2800	2818.38	1.21	−0.34	−0.44	0.01	1.21	−0.33	−0.43
3000	2985.38	1.19	−0.39	−0.49	0.01	1.19	−0.39	−0.48
3150	3162.28	1.15	−0.45	−0.55	0.01	1.16	−0.45	−0.54
3350	3349.65	1.11	−0.52	−0.62	0.01	1.12	−0.51	−0.61
3550	3548.13	1.06	−0.59	−0.69	0.00	1.06	−0.59	−0.69
3750	3758.37	1.00	−0.67	−0.77	0.00	1.00	−0.67	−0.77
4000	3981.07	0.92	−0.76	−0.86	0.00	0.93	−0.76	−0.86
4250	4216.97	0.84	−0.86	−0.97	0.00	0.84	−0.86	−0.96
4500	4466.84	0.74	−0.98	−1.08	0.00	0.74	−0.97	−1.07
4750	4731.51	0.63	−1.10	−1.20	0.00	0.63	−1.10	−1.20
5000	5011.87	0.50	−1.24	−1.34	0.00	0.51	−1.23	−1.34
5300	5308.84	0.36	−1.39	−1.49	0.00	0.36	−1.39	−1.49
5600	5623.41	0.20	−1.55	−1.66	0.00	0.21	−1.55	−1.66
6000	5956.62	0.03	−1.74	−1.84	0.00	0.03	−1.74	−1.84

Table A.1 (Continued) *Uncompensated electrical frequency responses*

Nominal Frequency	Exact Frequency (6 digits)	Electrical Response				Add to Acoustical Responses		
		A-weighting	B-weighting	C-weighting	Z-weighting	A-weighting	B-weighting	C-weighting
Hz	Hz	dB	dB	dB	dB	dB	dB	dB
6300	6309.57	−0.17	−1.94	−2.04	0.00	−0.17	−1.94	−2.04
6700	6683.44	−0.38	−2.16	−2.27	0.00	−0.38	−2.16	−2.26
7100	7079.46	−0.62	−2.40	−2.51	0.00	−0.62	−2.40	−2.51
7500	7498.94	−0.88	−2.66	−2.77	0.00	−0.87	−2.66	−2.77
8000	7943.28	−1.16	−2.95	−3.06	0.00	−1.16	−2.95	−3.05
8500	8413.95	−1.46	−3.26	−3.37	0.00	−1.46	−3.26	−3.37
9000	8912.51	−1.79	−3.59	−3.70	0.00	−1.79	−3.59	−3.70
9500	9440.61	−2.15	−3.96	−4.06	0.00	−2.15	−3.95	−4.06
10000	10000.0	−2.54	−4.34	−4.45	0.00	−2.54	−4.34	−4.45
10600	10592.5	−2.95	−4.76	−4.87	0.00	−2.95	−4.76	−4.87
11200	11220.2	−3.39	−5.20	−5.31	0.00	−3.39	−5.20	−5.31
11800	11885.0	−3.86	−5.68	−5.78	0.00	−3.86	−5.68	−5.78
12500	12589.3	−4.36	−6.18	−6.29	0.00	−4.36	−6.18	−6.29
13200	13335.2	−4.89	−6.71	−6.82	0.00	−4.89	−6.71	−6.82
14000	14125.4	−5.45	−7.27	−7.38	0.00	−5.45	−7.27	−7.38
15000	14962.4	−6.04	−7.86	−7.97	0.00	−6.04	−7.86	−7.97
16000	15848.9	−6.65	−8.47	−8.58	0.00	−6.65	−8.47	−8.58
17000	16788.0	−7.30	−9.12	−9.23	0.00	−7.30	−9.12	−9.22
18000	17782.8	−7.96	−9.79	−9.89	0.00	−7.96	−9.79	−9.89
19000	18836.5	−8.65	−10.48	−10.59	0.00	−8.65	−10.48	−10.58
20000	19952.6	−9.37	−11.19	−11.30	0.00	−9.37	−11.19	−11.30
21200	21134.9	−10.09	−11.92	−12.03	0.00	−10.09	−11.92	−12.03
22400	22387.2	−10.83	−12.66	−12.76	0.00	−10.83	−12.66	−12.76

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 sound level meter's *Sound Field Correction* parameter set to **Free-field**, see section 4.6.

Table A.2 *Free-field 0° frequency response for the sound level meter*

Nominal Frequency	Exact Frequency (6 digits)	Microphone Free-field Response	Expanded Uncertainty	Body Influence	Expanded Uncertainty	Electrical Response	Acoustical Response	Expanded Uncertainty
Hz	**Hz**	**dB**	**dB**	**dB**	**dB**	**dB**	**dB**	**dB**
63	63.0957	0.03	0.05	0.00	0.10	0.04	0.07	0.11
80	79.4328	0.03	0.05	0.00	0.10	0.04	0.07	0.11
100	100.000	0.02	0.05	0.00	0.10	0.04	0.06	0.11
125	125.893	0.02	0.05	0.00	0.10	0.04	0.06	0.11
160	158.489	0.01	0.05	0.01	0.10	0.04	0.06	0.11
200	199.526	0.00	0.05	0.02	0.10	0.04	0.06	0.11
250	251.189	0.00	0.05	0.03	0.10	0.04	0.07	0.11
315	316.228	0.00	0.05	0.07	0.10	0.04	0.11	0.11
400	398.107	0.00	0.06	0.11	0.10	0.04	0.15	0.11
500	501.187	0.00	0.06	0.13	0.10	0.04	0.17	0.12
630	630.957	−0.01	0.07	0.05	0.10	0.04	0.08	0.12
800	794.328	−0.01	0.08	−0.08	0.10	0.04	−0.05	0.13
1000	1000.00	−0.02	0.08	0.00	0.10	0.04	0.02	0.13
1060	1059.25	−0.02	0.08	0.00	0.10	0.04	0.02	0.13
1120	1122.02	−0.04	0.09	0.00	0.10	0.04	0.00	0.13
1180	1188.50	−0.04	0.09	0.00	0.10	0.04	0.00	0.13
1250	1258.93	−0.05	0.09	0.00	0.10	0.04	−0.01	0.13
1320	1333.52	−0.06	0.09	0.02	0.10	0.04	0.00	0.13
1400	1412.54	−0.06	0.09	0.03	0.10	0.05	0.02	0.13
1500	1496.24	−0.06	0.09	0.02	0.10	0.05	0.01	0.13
1600	1584.89	−0.07	0.10	0.00	0.10	0.05	−0.02	0.14
1700	1678.80	−0.08	0.10	0.02	0.10	0.05	−0.01	0.14
1800	1778.28	−0.09	0.10	0.03	0.10	0.06	0.00	0.14
1900	1883.65	−0.09	0.10	0.00	0.10	0.06	−0.03	0.14
2000	1995.26	−0.08	0.10	0.03	0.10	0.06	0.01	0.14
2120	2113.49	−0.09	0.11	−0.22	0.10	0.07	−0.24	0.15
2240	2238.72	−0.10	0.11	−0.01	0.15	0.07	−0.04	0.18

Table A.2 (Continued) *Free-field 0° frequency response for the sound level meter*

Nominal Frequency	Exact Frequency (6 digits)	Microphone Free-field Response	Expanded Uncertainty	Body Influence	Expanded Uncertainty	Electrical Response	Acoustical Response	Expanded Uncertainty
Hz	Hz	dB	dB	dB	dB	dB	dB	dB
2360	2371.37	−0.09	0.11	0.19	0.15	0.08	0.18	0.18
2500	2511.89	−0.09	0.11	0.08	0.15	0.09	0.08	0.19
2650	2660.73	−0.09	0.11	−0.13	0.15	0.09	−0.13	0.19
2800	2818.38	−0.10	0.11	−0.05	0.15	0.10	−0.05	0.19
3000	2985.38	−0.10	0.12	0.16	0.15	0.11	0.17	0.19
3150	3162.28	−0.10	0.12	0.04	0.15	0.11	0.05	0.19
3350	3349.65	−0.10	0.12	−0.15	0.15	0.12	−0.13	0.19
3550	3548.13	−0.11	0.12	0.09	0.15	0.13	0.11	0.19
3750	3758.37	−0.11	0.12	0.08	0.15	0.14	0.11	0.19
4000	3981.07	−0.12	0.13	−0.13	0.15	0.14	−0.11	0.20
4250	4216.97	−0.13	0.13	0.16	0.15	0.15	0.18	0.20
4500	4466.84	−0.13	0.13	−0.01	0.15	0.15	0.01	0.20
4750	4731.51	−0.14	0.14	−0.08	0.15	0.15	−0.07	0.20
5000	5011.87	−0.14	0.14	0.01	0.15	0.15	0.02	0.21
5300	5308.84	−0.15	0.15	−0.06	0.15	0.15	−0.06	0.21
5600	5623.41	−0.14	0.15	0.04	0.15	0.14	0.04	0.21
6000	5956.62	−0.14	0.16	−0.14	0.15	0.13	−0.15	0.22
6300	6309.57	−0.12	0.16	0.03	0.15	0.10	0.01	0.22
6700	6683.44	−0.07	0.16	−0.02	0.15	0.07	−0.02	0.22
7100	7079.46	−0.01	0.16	0.00	0.15	0.04	0.03	0.22
7500	7498.94	0.03	0.16	−0.01	0.20	−0.01	0.01	0.26
8000	7943.28	0.09	0.16	−0.04	0.20	−0.07	−0.02	0.26
8500	8413.95	0.15	0.17	−0.01	0.20	−0.15	−0.01	0.26
9000	8912.51	0.21	0.17	−0.04	0.20	−0.23	−0.06	0.26
9500	9440.61	0.28	0.21	−0.04	0.20	−0.33	−0.09	0.29
10000	10000.0	0.40	0.30	−0.04	0.20	−0.44	−0.08	0.36
10600	10592.5	0.55	0.31	0.01	0.20	−0.55	0.01	0.37
11200	11220.2	0.74	0.32	−0.03	0.20	−0.66	0.05	0.38
11800	11885.0	0.86	0.34	−0.01	0.20	−0.76	0.09	0.39
12500	12589.3	0.87	0.35	−0.05	0.20	−0.84	−0.02	0.40

Table A.2 ***(Continued)*** *Free-field 0° frequency response for the sound level meter*

Nominal Frequency	Exact Frequency (6 digits)	Microphone Free-field Response	Expanded Uncertainty	Body Influence	Expanded Uncertainty	Electrical Response	Acoustical Response	Expanded Uncertainty
Hz	Hz	dB	dB	dB	dB	dB	dB	dB
13200	13335.2	0.79	0.37	0.01	0.20	−0.87	−0.07	0.42
14000	14125.4	0.73	0.39	0.01	0.20	−0.85	−0.11	0.43
15000	14962.4	0.72	0.40	−0.05	0.20	−0.76	−0.09	0.45
16000	15848.9	0.69	0.42	−0.09	0.20	−0.58	0.02	0.47
17000	16788.0	0.36	0.44	0.01	0.20	−0.30	0.07	0.48
18000	17782.8	−0.13	0.46	−0.03	0.20	0.06	−0.10	0.50
19000	18836.5	−0.50	0.48	0.22	0.20	0.50	0.22	0.52
20000	19952.6	−0.92	0.50	−0.01	0.20	0.99	0.06	0.53
21200	21134.9	−1.54	0.52	0.03	0.20	1.51	0.00	0.55
22400	22387.2	−2.04	0.54	−0.01	0.20	2.03	−0.02	0.57

Table A.3 *Free-field 0° frequency response for the sound level meter with Windscreen UA-1650*

Nominal Frequency	Exact Frequency (6 digits)	Microphone Free-field Response	Expanded Uncertainty	Body Influence	Expanded Uncertainty	Influence of Windscreen	Expanded Uncertainty	Electrical Response	Acoustical Response	Expanded Uncertainty
Hz	Hz	dB	dB	dB	dB	dB	dB	dB	dB	dB
63	63.0957	0.03	0.05	0.00	0.10	0.00	0.15	0.04	0.07	0.19
80	79.4328	0.03	0.05	0.00	0.10	0.00	0.15	0.04	0.07	0.19
100	100.000	0.02	0.05	0.00	0.10	0.00	0.15	0.04	0.06	0.19
125	125.893	0.02	0.05	0.00	0.10	0.00	0.15	0.04	0.06	0.19
160	158.489	0.01	0.05	0.01	0.10	0.00	0.15	0.03	0.05	0.19
200	199.526	0.00	0.05	0.02	0.10	0.00	0.15	0.03	0.05	0.19
250	251.189	0.00	0.05	0.03	0.10	0.01	0.15	0.02	0.06	0.19
315	316.228	0.00	0.05	0.07	0.10	0.03	0.15	0.00	0.10	0.19
400	398.107	0.00	0.06	0.11	0.10	0.05	0.15	−0.02	0.14	0.19
500	501.187	0.00	0.06	0.13	0.10	0.07	0.15	−0.06	0.14	0.19
630	630.957	−0.01	0.07	0.05	0.10	0.10	0.15	−0.11	0.03	0.19
800	794.328	−0.01	0.08	−0.08	0.10	0.14	0.15	−0.19	−0.14	0.20
1000	1000.00	−0.02	0.08	0.00	0.10	0.18	0.15	−0.30	−0.14	0.20
1060	1059.25	−0.02	0.08	0.00	0.10	0.21	0.15	−0.33	−0.14	0.20
1120	1122.02	−0.04	0.09	0.00	0.10	0.25	0.15	−0.36	−0.15	0.20
1180	1188.50	−0.04	0.09	0.00	0.10	0.28	0.15	−0.39	−0.15	0.20
1250	1258.93	−0.05	0.09	0.00	0.10	0.32	0.15	−0.42	−0.15	0.20

Table A.3 (Continued) *Free-field 0° frequency response for the sound level meter with Windscreen UA-1650*

Nominal Frequency	Exact Frequency (6 digits)	Microphone Free-field Response	Expanded Uncertainty	Body Influence	Expanded Uncertainty	Influence of Windscreen	Expanded Uncertainty	Electrical Response	Acoustical Response	Expanded Uncertainty
Hz	Hz	dB	dB	dB	dB	dB	dB	dB	dB	dB
1320	1333.52	−0.06	0.09	0.02	0.10	0.37	0.15	−0.45	−0.12	0.20
1400	1412.54	−0.06	0.09	0.03	0.10	0.41	0.15	−0.48	−0.10	0.20
1500	1496.24	−0.06	0.09	0.02	0.10	0.45	0.15	−0.51	−0.10	0.20
1600	1584.89	−0.07	0.10	0.00	0.10	0.50	0.15	−0.54	−0.11	0.21
1700	1678.80	−0.08	0.10	0.02	0.10	0.55	0.15	−0.56	−0.07	0.21
1800	1778.28	−0.09	0.10	0.03	0.10	0.59	0.15	−0.58	−0.05	0.21
1900	1883.65	−0.09	0.10	0.00	0.10	0.63	0.15	−0.58	−0.04	0.21
2000	1995.26	−0.08	0.10	0.03	0.10	0.67	0.20	−0.59	0.03	0.24
2120	2113.49	−0.09	0.11	−0.22	0.10	0.70	0.20	−0.58	−0.19	0.25
2240	2238.72	−0.10	0.11	−0.01	0.15	0.71	0.20	−0.56	0.04	0.27
2360	2371.37	−0.09	0.11	0.19	0.15	0.72	0.20	−0.54	0.28	0.27
2500	2511.89	−0.09	0.11	0.08	0.15	0.72	0.20	−0.51	0.20	0.27
2650	2660.73	−0.09	0.11	−0.13	0.15	0.70	0.20	−0.46	0.02	0.27
2800	2818.38	−0.10	0.11	−0.05	0.15	0.68	0.20	−0.42	0.11	0.27
3000	2985.38	−0.10	0.12	0.16	0.15	0.63	0.20	−0.36	0.33	0.27
3150	3162.28	−0.10	0.12	0.04	0.15	0.55	0.20	−0.30	0.19	0.27
3350	3349.65	−0.10	0.12	−0.15	0.15	0.44	0.20	−0.24	−0.05	0.27
3550	3548.13	−0.11	0.12	0.09	0.15	0.30	0.20	−0.18	0.10	0.27
3750	3758.37	−0.11	0.12	0.08	0.15	0.16	0.20	−0.12	0.01	0.27
4000	3981.07	−0.12	0.13	−0.13	0.15	0.05	0.20	−0.06	−0.26	0.28
4250	4216.97	−0.13	0.13	0.16	0.15	−0.05	0.20	0.00	−0.02	0.28
4500	4466.84	−0.13	0.13	−0.01	0.15	−0.13	0.20	0.04	−0.23	0.28
4750	4731.51	−0.14	0.14	−0.08	0.15	−0.18	0.20	0.09	−0.31	0.28
5000	5011.87	−0.14	0.14	0.01	0.15	−0.19	0.20	0.12	−0.20	0.28
5300	5308.84	−0.15	0.15	−0.06	0.15	−0.17	0.25	0.15	−0.23	0.33
5600	5623.41	−0.14	0.15	0.04	0.15	−0.16	0.25	0.17	−0.09	0.33
6000	5956.62	−0.14	0.16	−0.14	0.15	−0.13	0.25	0.17	−0.24	0.33
6300	6309.57	−0.12	0.16	0.03	0.15	−0.11	0.25	0.17	−0.03	0.33
6700	6683.44	−0.07	0.16	−0.02	0.15	−0.16	0.25	0.16	−0.09	0.34
7100	7079.46	−0.01	0.16	0.00	0.15	−0.28	0.25	0.14	−0.15	0.34
7500	7498.94	0.03	0.16	−0.01	0.20	−0.36	0.25	0.11	−0.23	0.36
8000	7943.28	0.09	0.16	−0.04	0.20	−0.41	0.25	0.08	−0.28	0.36
8500	8413.95	0.15	0.17	−0.01	0.20	−0.47	0.25	0.03	−0.30	0.36
9000	8912.51	0.21	0.17	−0.04	0.20	−0.45	0.25	−0.02	−0.30	0.36

Table A.3 ***(Continued)*** *Free-field 0° frequency response for the sound level meter with Windscreen UA-1650*

Nominal Frequency	Exact Frequency (6 digits)	Microphone Free-field Response	Expanded Uncertainty	Body Influence	Expanded Uncertainty	Influence of Windscreen	Expanded Uncertainty	Electrical Response	Acoustical Response	Expanded Uncertainty
Hz	**Hz**	**dB**	**dB**	**dB**	**dB**	**dB**	**dB**	**dB**	**dB**	**dB**
9500	9440.61	0.28	0.21	−0.04	0.20	−0.47	0.25	−0.08	−0.31	0.39
10000	10000.0	0.40	0.30	−0.04	0.20	−0.52	0.25	−0.13	−0.29	0.44
10600	10592.5	0.55	0.31	0.01	0.20	−0.63	0.25	−0.19	−0.26	0.45
11200	11220.2	0.74	0.32	−0.03	0.20	−0.74	0.25	−0.23	−0.26	0.46
11800	11885.0	0.86	0.34	−0.01	0.20	−0.86	0.25	−0.26	−0.27	0.47
12500	12589.3	0.87	0.35	−0.05	0.20	−0.88	0.25	−0.26	−0.32	0.47
13200	13335.2	0.79	0.37	0.01	0.20	−0.99	0.25	−0.22	−0.41	0.48
14000	14125.4	0.73	0.39	0.01	0.20	−1.13	0.25	−0.12	−0.51	0.50
15000	14962.4	0.72	0.40	−0.05	0.20	−1.20	0.30	0.05	−0.48	0.54
16000	15848.9	0.69	0.42	−0.09	0.20	−1.33	0.30	0.30	−0.43	0.56
17000	16788.0	0.36	0.44	0.01	0.20	−1.50	0.30	0.64	−0.49	0.57
18000	17782.8	−0.13	0.46	−0.03	0.20	−1.61	0.30	1.09	−0.68	0.59
19000	18836.5	−0.50	0.48	0.22	0.20	−1.64	0.30	1.62	−0.30	0.59
20000	19952.6	−0.92	0.50	−0.01	0.20	−1.73	0.30	2.24	−0.42	0.61
21200	21134.9	−1.54	0.52	0.03	0.20	−1.81	0.30	2.91	−0.41	0.63
22400	22387.2	−2.04	0.54	−0.01	0.20	−1.79	0.30	3.61	−0.23	0.64

A.3 Diffuse-field Frequency Responses

Diffuse-field frequency responses with Z-frequency weighting. Measured with sounds at random incidence and the sound level meter's *Sound Field Correction* parameter set to **Diffuse-field**, see section 4.6.

Table A.4 *Diffuse-field frequency response for the sound level meter*

Nominal Frequency	Exact Frequency (6 digits)	Microphone Diffuse-field Response	Electrical Response	Acoustical Response	Expanded Uncertainty
Hz	**Hz**	**dB**	**dB**	**dB**	**dB**
63	63.0957	0.03	0.04	0.07	0.07
80	79.4328	0.02	0.04	0.06	0.07
100	100.000	0.02	0.04	0.06	0.07
125	125.893	0.01	0.04	0.05	0.07
160	158.489	0.00	0.04	0.04	0.07
200	199.526	−0.01	0.05	0.04	0.07
250	251.189	−0.02	0.05	0.03	0.07
315	316.228	−0.03	0.05	0.02	0.07
400	398.107	−0.03	0.05	0.02	0.07
500	501.187	−0.04	0.06	0.02	0.08
630	630.957	−0.06	0.07	0.01	0.09
800	794.328	−0.07	0.09	0.02	0.10
1000	1000.00	−0.10	0.11	0.01	0.10
1060	1059.25	−0.12	0.12	0.00	0.11
1120	1122.02	−0.14	0.13	−0.01	0.11
1180	1188.50	−0.16	0.14	−0.02	0.11
1250	1258.93	−0.18	0.16	−0.02	0.11
1320	1333.52	−0.21	0.17	−0.04	0.11
1400	1412.54	−0.22	0.19	−0.03	0.11
1500	1496.24	−0.25	0.21	−0.04	0.11
1600	1584.89	−0.28	0.23	−0.05	0.12
1700	1678.80	−0.31	0.25	−0.06	0.12
1800	1778.28	−0.34	0.28	−0.06	0.12
1900	1883.65	−0.37	0.31	−0.06	0.12
2000	1995.26	−0.40	0.34	−0.06	0.12
2120	2113.49	−0.43	0.37	−0.06	0.12
2240	2238.72	−0.48	0.41	−0.07	0.13

Table A.4 ***(Continued)*** *Diffuse-field frequency response for the sound level meter*

Nominal Frequency	Exact Frequency (6 digits)	Microphone Diffuse-field Response	Electrical Response	Acoustical Response	Expanded Uncertainty
Hz	Hz	dB	dB	dB	dB
2360	2371.37	−0.51	0.46	−0.05	0.13
2500	2511.89	−0.55	0.51	−0.04	0.13
2650	2660.73	−0.59	0.56	−0.03	0.13
2800	2818.38	−0.65	0.62	−0.03	0.13
3000	2985.38	−0.71	0.68	−0.03	0.13
3150	3162.28	−0.77	0.75	−0.02	0.13
3350	3349.65	−0.83	0.83	0.00	0.14
3550	3548.13	−0.91	0.91	0.00	0.14
3750	3758.37	−0.99	1.00	0.01	0.14
4000	3981.07	−1.08	1.09	0.01	0.14
4250	4216.97	−1.18	1.19	0.01	0.15
4500	4466.84	−1.28	1.30	0.02	0.15
4750	4731.51	−1.39	1.41	0.02	0.15
5000	5011.87	−1.51	1.53	0.02	0.16
5300	5308.84	−1.64	1.65	0.01	0.17
5600	5623.41	−1.76	1.78	0.02	0.17
6000	5956.62	−1.90	1.91	0.01	0.17
6300	6309.57	−2.03	2.04	0.01	0.17
6700	6683.44	−2.15	2.18	0.03	0.18
7100	7079.46	−2.27	2.32	0.05	0.18
7500	7498.94	−2.41	2.45	0.04	0.18
8000	7943.28	−2.55	2.59	0.04	0.18
8500	8413.95	−2.69	2.72	0.03	0.19
9000	8912.51	−2.86	2.85	−0.01	0.19
9500	9440.61	−3.02	2.98	−0.04	0.23
10000	10000.0	−3.15	3.11	−0.04	0.32
10600	10592.5	−3.25	3.25	0.00	0.33
11200	11220.2	−3.33	3.40	0.07	0.35
11800	11885.0	−3.49	3.57	0.08	0.36
12500	12589.3	−3.76	3.78	0.02	0.38

Table A.4 ***(Continued)*** *Diffuse-field frequency response for the sound level meter*

Nominal Frequency	Exact Frequency (6 digits)	Microphone Diffuse-field Response	Electrical Response	Acoustical Response	Expanded Uncertainty
Hz	**Hz**	**dB**	**dB**	**dB**	**dB**
13200	13335.2	−4.15	4.04	−0.11	0.40
14000	14125.4	−4.52	4.37	−0.15	0.42
15000	14962.4	−4.86	4.80	−0.06	0.44
16000	15848.9	−5.23	5.34	0.11	0.46
17000	16788.0	−5.93	5.99	0.06	0.49
18000	17782.8	−6.79	6.74	−0.05	0.51
19000	18836.5	−7.55	7.59	0.04	0.53
20000	19952.6	−8.39	8.49	0.10	0.56
21200	21134.9	−9.45	9.41	−0.04	0.59
22400	22387.2	−10.39	10.33	−0.06	0.61

Table A.5 *Diffuse-field frequency response for the sound level meter with Windscreen UA-1650*

Nominal Frequency	Exact Frequency (6 digits)	Microphone Diffuse-field Response	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	0.03	0.07	0.00	0.16	0.04	0.07	0.17
80	79.4328	0.02	0.07	0.00	0.16	0.04	0.06	0.17
100	100.000	0.02	0.07	0.00	0.16	0.04	0.06	0.17
125	125.893	0.01	0.07	0.00	0.16	0.04	0.05	0.17
160	158.489	0.00	0.07	0.00	0.16	0.04	0.04	0.17
200	199.526	−0.01	0.07	0.00	0.16	0.04	0.03	0.17
250	251.189	−0.02	0.07	0.01	0.16	0.04	0.03	0.17
315	316.228	−0.03	0.07	0.02	0.16	0.03	0.02	0.17
400	398.107	−0.03	0.07	0.04	0.16	0.02	0.03	0.17
500	501.187	−0.04	0.08	0.06	0.16	0.01	0.03	0.18
630	630.957	−0.06	0.09	0.08	0.16	0.00	0.02	0.18
800	794.328	−0.07	0.10	0.11	0.16	−0.02	0.02	0.19
1000	1000.00	−0.10	0.10	0.15	0.16	−0.05	0.00	0.19
1060	1059.25	−0.12	0.11	0.17	0.17	−0.06	−0.01	0.20
1120	1122.02	−0.14	0.11	0.20	0.17	−0.06	0.00	0.20
1180	1188.50	−0.16	0.11	0.24	0.17	−0.07	0.01	0.20
1250	1258.93	−0.18	0.11	0.28	0.17	−0.08	0.02	0.20

Table A.5 (Continued) *Diffuse-field frequency response for the sound level meter with Windscreen UA-1650*

Nominal Frequency	Exact Frequency (6 digits)	Microphone Diffuse-field Response	Expanded Uncertainty	Influence of Windscreen	Expanded Uncertainty	Electrical Response	Acoustical Response	Expanded Uncertainty
Hz	Hz	dB	dB	dB	dB	dB	dB	dB
1320	1333.52	−0.21	0.11	0.32	0.18	−0.08	0.03	0.21
1400	1412.54	−0.22	0.11	0.36	0.18	−0.09	0.05	0.21
1500	1496.24	−0.25	0.11	0.40	0.18	−0.09	0.06	0.21
1600	1584.89	−0.28	0.12	0.44	0.19	−0.09	0.07	0.22
1700	1678.80	−0.31	0.12	0.48	0.21	−0.09	0.08	0.24
1800	1778.28	−0.34	0.12	0.52	0.21	−0.09	0.09	0.24
1900	1883.65	−0.37	0.12	0.55	0.21	−0.08	0.10	0.24
2000	1995.26	−0.40	0.12	0.58	0.25	−0.06	0.12	0.28
2120	2113.49	−0.43	0.12	0.62	0.25	−0.04	0.15	0.28
2240	2238.72	−0.48	0.13	0.64	0.25	−0.01	0.15	0.28
2360	2371.37	−0.51	0.13	0.67	0.25	0.02	0.18	0.28
2500	2511.89	−0.55	0.13	0.68	0.25	0.07	0.20	0.28
2650	2660.73	−0.59	0.13	0.68	0.25	0.13	0.22	0.28
2800	2818.38	−0.65	0.13	0.66	0.25	0.20	0.21	0.28
3000	2985.38	−0.71	0.13	0.62	0.25	0.29	0.20	0.28
3150	3162.28	−0.77	0.13	0.55	0.25	0.39	0.17	0.28
3350	3349.65	−0.83	0.14	0.45	0.25	0.51	0.13	0.28
3550	3548.13	−0.91	0.14	0.33	0.25	0.63	0.05	0.28
3750	3758.37	−0.99	0.14	0.18	0.25	0.78	−0.03	0.28
4000	3981.07	−1.08	0.14	0.03	0.25	0.93	−0.12	0.29
4250	4216.97	−1.18	0.15	−0.13	0.25	1.10	−0.21	0.29
4500	4466.84	−1.28	0.15	−0.27	0.25	1.27	−0.28	0.29
4750	4731.51	−1.39	0.15	−0.39	0.32	1.45	−0.33	0.35
5000	5011.87	−1.51	0.16	−0.46	0.40	1.64	−0.33	0.43
5300	5308.84	−1.64	0.17	−0.50	0.51	1.83	−0.31	0.54
5600	5623.41	−1.76	0.17	−0.48	0.56	2.02	−0.22	0.58
6000	5956.62	−1.90	0.17	−0.44	0.56	2.20	−0.14	0.59
6300	6309.57	−2.03	0.17	−0.38	0.56	2.39	−0.02	0.59
6700	6683.44	−2.15	0.18	−0.34	0.56	2.57	0.08	0.59
7100	7079.46	−2.27	0.18	−0.36	0.56	2.74	0.11	0.59
7500	7498.94	−2.41	0.18	−0.45	0.56	2.91	0.06	0.59
8000	7943.28	−2.55	0.18	−0.58	0.56	3.08	−0.05	0.59
8500	8413.95	−2.69	0.19	−0.71	0.56	3.25	−0.15	0.59
9000	8912.51	−2.86	0.19	−0.79	0.56	3.43	−0.22	0.59

Table A.5 (Continued) *Diffuse-field frequency response for the sound level meter with Windscreen UA-1650*

Nominal Frequency	Exact Frequency (6 digits)	Microphone Diffuse-field Response	Expanded Uncertainty	Influence of Windscreen	Expanded Uncertainty	Electrical Response	Acoustical Response	Expanded Uncertainty
Hz	**Hz**	**dB**	**dB**	**dB**	**dB**	**dB**	**dB**	**dB**
9500	9440.61	−3.02	0.23	−0.82	0.56	3.61	−0.23	0.60
10000	10000.0	−3.15	0.32	−0.82	0.56	3.80	−0.17	0.64
10600	10592.5	−3.25	0.33	−0.86	0.84	4.02	−0.09	0.90
11200	11220.2	−3.33	0.35	−0.96	0.84	4.28	−0.01	0.91
11800	11885.0	−3.49	0.36	−1.07	0.84	4.57	0.01	0.91
12500	12589.3	−3.76	0.38	−1.19	0.84	4.92	−0.03	0.92
13200	13335.2	−4.15	0.40	−1.31	0.84	5.34	−0.12	0.93
14000	14125.4	−4.52	0.42	−1.43	0.84	5.84	−0.11	0.94
15000	14962.4	−4.86	0.44	−1.53	0.85	6.42	0.03	0.96
16000	15848.9	−5.23	0.46	−1.63	0.85	7.09	0.23	0.97
17000	16788.0	−5.93	0.49	−1.77	0.85	7.85	0.15	0.98
18000	17782.8	−6.79	0.51	−1.92	0.85	8.68	−0.03	0.99
19000	18836.5	−7.55	0.53	−1.98	0.85	9.58	0.05	1.00
20000	19952.6	−8.39	0.56	−2.07	0.85	10.53	0.07	1.02
21200	21134.9	−9.45	0.59	−2.18	0.85	11.51	−0.12	1.03
22400	22387.2	−10.39	0.61	−2.19	0.85	12.49	−0.09	1.05

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 sound level meter's *Sound Field Correction* parameter set to **Diffuse-field**, see section 4.6.

Table A.6 *Free-field 0° frequency response with the Sound field 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.2	Configuration as in Table A.3
Hz	**Hz**	**dB**	**dB**
63	63.0957	0.07	0.07
80	79.4328	0.07	0.07
100	100.000	0.06	0.06
125	125.893	0.06	0.06
160	158.489	0.06	0.06
200	199.526	0.07	0.06
250	251.189	0.08	0.07
315	316.228	0.12	0.10
400	398.107	0.16	0.13
500	501.187	0.19	0.14
630	630.957	0.11	0.04
800	794.328	0.00	−0.11
1000	1000.00	0.09	−0.07
1060	1059.25	0.10	−0.08
1120	1122.02	0.09	−0.10
1180	1188.50	0.10	−0.11
1250	1258.93	0.11	−0.13
1320	1333.52	0.13	−0.12
1400	1412.54	0.16	−0.12
1500	1496.24	0.17	−0.13
1600	1584.89	0.16	−0.16
1700	1678.80	0.19	−0.15
1800	1778.28	0.22	−0.15
1900	1883.65	0.22	−0.17
2000	1995.26	0.29	−0.11
2120	2113.49	0.06	−0.35

Table A.6 ***(Continued)*** *Free-field 0° frequency response with the* Sound field *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.2	Configuration as in Table A.3
Hz	**Hz**	**dB**	**dB**
2240	2238.72	0.30	−0.12
2360	2371.37	0.56	0.12
2500	2511.89	0.50	0.06
2650	2660.73	0.34	−0.09
2800	2818.38	0.47	0.05
3000	2985.38	0.74	0.35
3150	3162.28	0.69	0.33
3350	3349.65	0.58	0.26
3550	3548.13	0.89	0.61
3750	3758.37	0.97	0.75
4000	3981.07	0.84	0.68
4250	4216.97	1.22	1.13
4500	4466.84	1.16	1.13
4750	4731.51	1.19	1.23
5000	5011.87	1.40	1.51
5300	5308.84	1.44	1.62
5600	5623.41	1.68	1.92
6000	5956.62	1.63	1.92
6300	6309.57	1.95	2.30
6700	6683.44	2.09	2.48
7100	7079.46	2.31	2.73
7500	7498.94	2.47	2.93
8000	7943.28	2.64	3.13
8500	8413.95	2.86	3.39
9000	8912.51	3.02	3.60
9500	9440.61	3.22	3.85
10000	10000.0	3.47	4.16
10600	10592.5	3.81	4.58
11200	11220.2	4.11	4.99
11800	11885.0	4.42	5.42

Table A.6 ***(Continued)*** *Free-field 0° frequency response with the Sound field 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.2**	**Configuration as in Table A.3**
Hz	**Hz**	**dB**	**dB**
12500	12589.3	4.60	5.74
13200	13335.2	4.84	6.14
14000	14125.4	5.11	6.58
15000	14962.4	5.47	7.09
16000	15848.9	5.94	7.69
17000	16788.0	6.36	8.22
18000	17782.8	6.58	8.52
19000	18836.5	7.31	9.30
20000	19952.6	7.56	9.60
21200	21134.9	7.90	10.00
22400	22387.2	8.28	10.44

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.7 *Directional response for the sound level meter, measured in a plane parallel to the display and along the microphone's axis, 250 Hz – 2.8 kHz*

Angle	Nominal Frequency												
	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.24 kHz	2.5 kHz	2.8 kHz
0°	0.01	0.03	0.04	−0.01	−0.03	0.02	0.00	0.00	−0.01	−0.01	−0.01	−0.01	−0.01
5°	−0.01	−0.02	0.00	0.01	−0.01	0.00	0.00	0.00	−0.01	0.00	−0.01	0.00	−0.02
10°	−0.01	0.00	0.00	−0.01	−0.02	0.01	−0.01	0.00	−0.03	0.00	−0.04	0.01	−0.05
15°	−0.01	0.01	0.00	−0.01	0.01	−0.01	−0.02	0.00	−0.05	0.01	−0.09	0.01	−0.09
20°	−0.02	−0.02	−0.02	−0.01	0.01	−0.01	−0.04	0.00	−0.08	0.02	−0.14	0.01	−0.14
25°	−0.06	−0.03	0.00	−0.01	−0.01	0.00	−0.06	0.01	−0.12	0.04	−0.18	−0.01	−0.16
30°	−0.03	−0.06	−0.06	−0.02	0.02	−0.01	−0.08	0.02	−0.17	0.06	−0.21	−0.07	−0.17
35°	−0.03	−0.06	−0.07	−0.03	0.04	0.00	−0.11	0.02	−0.20	0.08	−0.21	−0.17	−0.14
40°	−0.05	−0.05	−0.06	−0.04	0.03	0.01	−0.14	0.02	−0.23	0.07	−0.17	−0.32	−0.11
45°	−0.04	−0.09	−0.10	−0.05	0.02	0.03	−0.17	0.01	−0.26	0.02	−0.11	−0.51	−0.11
50°	−0.05	−0.14	−0.10	−0.05	−0.04	0.09	−0.19	−0.01	−0.26	−0.05	−0.05	−0.63	−0.16
55°	−0.06	−0.08	−0.10	−0.06	0.03	0.07	−0.18	−0.06	−0.21	−0.15	−0.02	−0.65	−0.33
60°	−0.07	−0.05	−0.04	−0.07	−0.05	0.13	−0.17	−0.10	−0.17	−0.27	−0.05	−0.58	−0.51
65°	−0.08	−0.04	−0.03	−0.08	−0.05	0.14	−0.16	−0.14	−0.14	−0.38	−0.19	−0.49	−0.60
70°	−0.08	−0.16	−0.15	−0.09	−0.02	0.13	−0.13	−0.17	−0.16	−0.41	−0.38	−0.42	−0.56
75°	−0.10	−0.11	−0.10	−0.10	−0.07	0.17	−0.10	−0.18	−0.20	−0.35	−0.55	−0.48	−0.48
80°	−0.09	−0.11	−0.11	−0.12	−0.08	0.17	−0.06	−0.17	−0.26	−0.25	−0.56	−0.70	−0.48
85°	−0.09	−0.18	−0.21	−0.14	−0.04	0.11	0.01	−0.16	−0.29	−0.22	−0.39	−0.98	−0.55
90°	−0.12	−0.10	−0.10	−0.15	−0.14	0.12	0.04	−0.10	−0.32	−0.27	−0.26	−0.98	−0.80
95°	−0.12	−0.12	−0.13	−0.16	−0.17	0.06	0.05	−0.03	−0.33	−0.33	−0.29	−0.72	−0.95
100°	−0.13	−0.15	−0.16	−0.17	−0.17	−0.01	0.04	0.04	−0.28	−0.38	−0.39	−0.60	−0.74
105°	−0.14	−0.09	−0.09	−0.19	−0.24	−0.03	−0.02	0.09	−0.18	−0.41	−0.46	−0.72	−0.56
110°	−0.15	−0.14	−0.15	−0.20	−0.22	−0.10	−0.10	0.07	−0.07	−0.37	−0.50	−0.82	−0.66
115°	−0.15	−0.14	−0.15	−0.20	−0.24	−0.13	−0.17	0.01	0.00	−0.21	−0.42	−0.81	−0.76
120°	−0.15	−0.21	−0.22	−0.22	−0.24	−0.17	−0.25	−0.10	−0.05	−0.05	−0.23	−0.75	−0.75
125°	−0.16	−0.15	−0.13	−0.22	−0.31	−0.15	−0.31	−0.20	−0.17	0.00	−0.04	−0.52	−0.60
130°	−0.15	−0.15	−0.18	−0.22	−0.24	−0.19	−0.34	−0.29	−0.29	−0.10	−0.04	−0.31	−0.33
135°	−0.13	−0.13	−0.15	−0.23	−0.28	−0.17	−0.38	−0.35	−0.43	−0.30	−0.23	−0.40	−0.24
140°	−0.13	−0.17	−0.17	−0.22	−0.28	−0.15	−0.38	−0.38	−0.52	−0.49	−0.46	−0.68	−0.47
145°	−0.14	−0.20	−0.22	−0.20	−0.20	−0.16	−0.35	−0.39	−0.54	−0.64	−0.66	−0.97	−0.80
150°	−0.14	−0.17	−0.18	−0.20	−0.21	−0.11	−0.32	−0.36	−0.52	−0.70	−0.79	−1.19	−1.10

Table A.7 ***(Continued)*** *Directional response for the sound level meter, measured in a plane parallel to the display and along the microphone's axis, 250 Hz – 2.8 kHz*

Angle	Nominal Frequency												
	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.24 kHz	2.5 kHz	2.8 kHz
155°	−0.14	−0.18	−0.17	−0.19	−0.21	−0.06	−0.28	−0.30	−0.46	−0.66	−0.79	−1.25	−1.26
160°	−0.14	−0.18	−0.20	−0.17	−0.14	−0.06	−0.22	−0.23	−0.35	−0.52	−0.65	−1.10	−1.15
165°	−0.15	−0.06	−0.03	−0.17	−0.25	0.04	−0.19	−0.16	−0.25	−0.36	−0.46	−0.84	−0.85
170°	−0.14	−0.15	−0.16	−0.16	−0.13	0.00	−0.15	−0.12	−0.17	−0.22	−0.28	−0.60	−0.54
175°	−0.13	−0.19	−0.17	−0.15	−0.15	0.04	−0.12	−0.07	−0.12	−0.13	−0.16	−0.44	−0.32
180°	−0.12	−0.27	−0.26	−0.14	−0.08	0.01	−0.11	−0.06	−0.10	−0.10	−0.13	−0.39	−0.25
185°	−0.12	−0.15	−0.17	−0.15	−0.09	0.01	−0.11	−0.08	−0.10	−0.13	−0.17	−0.43	−0.32
190°	−0.12	−0.15	−0.15	−0.16	−0.13	0.01	−0.14	−0.11	−0.16	−0.22	−0.30	−0.59	−0.53
195°	−0.11	−0.15	−0.14	−0.16	−0.18	0.02	−0.18	−0.16	−0.26	−0.37	−0.49	−0.84	−0.86
200°	−0.12	−0.17	−0.17	−0.17	−0.16	−0.03	−0.22	−0.22	−0.35	−0.53	−0.68	−1.09	−1.17
205°	−0.12	−0.09	−0.10	−0.18	−0.20	−0.05	−0.27	−0.29	−0.44	−0.66	−0.81	−1.21	−1.27
210°	−0.11	−0.06	−0.06	−0.19	−0.25	−0.05	−0.32	−0.34	−0.51	−0.71	−0.81	−1.15	−1.10
215°	−0.11	−0.21	−0.24	−0.18	−0.14	−0.16	−0.33	−0.38	−0.52	−0.65	−0.66	−0.94	−0.80
220°	−0.11	−0.16	−0.19	−0.19	−0.20	−0.15	−0.36	−0.37	−0.48	−0.49	−0.44	−0.64	−0.45
225°	−0.12	0.00	−0.05	−0.19	−0.22	−0.14	−0.35	−0.33	−0.37	−0.28	−0.19	−0.37	−0.21
230°	−0.08	−0.31	−0.34	−0.19	−0.14	−0.21	−0.32	−0.26	−0.27	−0.10	0.00	−0.29	−0.26
235°	−0.11	−0.10	−0.14	−0.19	−0.22	−0.14	−0.28	−0.16	−0.11	0.03	0.00	−0.47	−0.57
240°	−0.09	−0.17	−0.18	−0.18	−0.21	−0.11	−0.21	−0.04	0.00	−0.01	−0.18	−0.70	−0.72
245°	−0.09	−0.08	−0.09	−0.17	−0.25	−0.05	−0.14	0.06	0.03	−0.18	−0.39	−0.77	−0.71
250°	−0.10	0.00	0.03	−0.18	−0.35	0.07	−0.07	0.14	−0.05	−0.32	−0.44	−0.74	−0.62
255°	−0.07	−0.05	−0.06	−0.16	−0.22	0.04	0.01	0.14	−0.17	−0.36	−0.40	−0.66	−0.55
260°	−0.08	−0.08	−0.11	−0.14	−0.12	0.05	0.08	0.10	−0.25	−0.31	−0.32	−0.56	−0.71
265°	−0.05	−0.11	−0.13	−0.13	−0.12	0.13	0.09	0.02	−0.31	−0.26	−0.25	−0.68	−0.92
270°	−0.05	0.00	−0.05	−0.12	−0.08	0.16	0.08	−0.07	−0.28	−0.20	−0.25	−0.94	−0.76
275°	−0.04	−0.01	−0.03	−0.11	−0.10	0.24	0.03	−0.11	−0.25	−0.17	−0.37	−0.93	−0.50
280°	−0.03	−0.06	−0.08	−0.09	−0.03	0.23	−0.02	−0.13	−0.20	−0.21	−0.52	−0.64	−0.41
285°	−0.02	−0.11	−0.16	−0.07	0.10	0.17	−0.06	−0.14	−0.13	−0.30	−0.49	−0.42	−0.43
290°	−0.01	−0.03	−0.06	−0.06	0.03	0.20	−0.10	−0.12	−0.10	−0.36	−0.31	−0.37	−0.51
295°	0.00	−0.04	−0.06	−0.05	0.03	0.18	−0.12	−0.09	−0.10	−0.31	−0.12	−0.43	−0.55
300°	0.00	0.01	0.02	−0.04	−0.05	0.21	−0.16	−0.05	−0.15	−0.21	−0.02	−0.53	−0.48
305°	−0.01	0.01	0.01	−0.04	−0.02	0.18	−0.17	0.00	−0.19	−0.08	0.01	−0.58	−0.28
310°	0.01	−0.01	−0.02	−0.02	0.02	0.14	−0.15	0.04	−0.21	0.02	−0.01	−0.56	−0.10
315°	0.01	0.00	−0.02	−0.02	0.05	0.10	−0.14	0.05	−0.22	0.07	−0.09	−0.44	−0.05
320°	−0.01	−0.01	−0.01	−0.01	0.04	0.08	−0.11	0.06	−0.20	0.10	−0.15	−0.26	−0.06

Table A.7 ***(Continued)*** *Directional response for the sound level meter, measured in a plane parallel to the display and along the microphone's axis, 250 Hz – 2.8 kHz*

Angle	Nominal Frequency												
	250 Hz	**315 Hz**	**400 Hz**	**500 Hz**	**630 Hz**	**800 Hz**	**1 kHz**	**1.25 kHz**	**1.6 kHz**	**2 kHz**	**2.24 kHz**	**2.5 kHz**	**2.8 kHz**
325°	0.01	−0.07	−0.07	0.00	0.06	0.04	−0.08	0.06	−0.17	0.10	−0.18	−0.11	−0.09
330°	0.01	−0.03	−0.05	0.00	0.08	0.01	−0.05	0.05	−0.12	0.09	−0.17	−0.01	−0.12
335°	0.01	0.04	0.05	0.00	−0.01	0.05	−0.04	0.04	−0.09	0.06	−0.15	0.03	−0.13
340°	0.01	−0.25	−0.33	0.03	0.31	−0.17	0.01	0.00	−0.03	0.04	−0.09	0.04	−0.10
345°	0.01	−0.02	0.03	0.01	−0.06	0.06	−0.01	0.03	−0.04	0.03	−0.05	0.04	−0.05
350°	0.01	−0.14	−0.11	0.00	0.01	0.01	−0.01	0.01	−0.03	0.01	−0.02	0.01	−0.03
355°	0.01	−0.05	−0.06	0.01	0.04	−0.02	0.01	0.00	0.00	0.00	0.00	0.01	0.00

Table A.8 *Directional response for the sound level meter, measured in a plane parallel to the display and along the microphone's axis, 3.15 kHz – 10 kHz*

Angle	Nominal Frequency												
	3.15 kHz	3.55 kHz	**4 kHz**	4.5 kHz	**5 kHz**	5.6 kHz	**6.3 kHz**	7.1 kHz	**8 kHz**	8.5 kHz	9 kHz	9.5 kHz	**10 kHz**
0°	−0.01	−0.01	−0.01	−0.01	−0.01	−0.02	−0.01	−0.02	−0.02	−0.02	−0.02	−0.02	−0.02
5°	0.00	−0.02	−0.01	−0.01	−0.02	−0.01	−0.02	−0.01	−0.02	−0.03	−0.05	−0.03	−0.03
10°	0.01	−0.06	−0.02	0.01	−0.03	−0.03	−0.05	−0.04	−0.09	−0.09	−0.15	−0.09	−0.09
15°	0.01	−0.14	−0.02	0.01	−0.08	−0.08	−0.13	−0.09	−0.15	−0.16	−0.25	−0.14	−0.16
20°	0.02	−0.22	−0.01	−0.01	−0.16	−0.18	−0.25	−0.18	−0.25	−0.29	−0.35	−0.24	−0.31
25°	−0.01	−0.30	0.00	−0.07	−0.27	−0.30	−0.40	−0.29	−0.39	−0.44	−0.43	−0.45	−0.54
30°	−0.08	−0.36	−0.01	−0.21	−0.41	−0.48	−0.57	−0.47	−0.58	−0.62	−0.58	−0.78	−0.73
35°	−0.19	−0.35	−0.06	−0.36	−0.48	−0.62	−0.67	−0.64	−0.69	−0.83	−0.77	−1.00	−0.93
40°	−0.34	−0.32	−0.21	−0.51	−0.52	−0.76	−0.75	−0.89	−0.87	−1.12	−1.00	−1.17	−1.31
45°	−0.47	−0.31	−0.41	−0.59	−0.57	−0.84	−0.85	−1.08	−1.11	−1.28	−1.31	−1.44	−1.67
50°	−0.51	−0.40	−0.51	−0.61	−0.70	−0.95	−0.98	−1.23	−1.34	−1.53	−1.67	−1.69	−1.85
55°	−0.47	−0.56	−0.48	−0.70	−0.82	−1.04	−1.40	−1.45	−1.58	−1.72	−1.80	−2.10	−2.22
60°	−0.42	−0.75	−0.51	−0.94	−1.10	−1.16	−1.44	−1.64	−2.11	−2.17	−2.23	−2.46	−2.67
65°	−0.57	−0.83	−0.58	−0.93	−1.07	−1.37	−1.72	−1.57	−1.91	−2.43	−2.43	−2.65	−2.91
70°	−0.81	−0.74	−0.80	−1.07	−1.37	−1.49	−1.48	−2.64	−2.25	−2.34	−2.64	−2.84	−3.09
75°	−0.95	−0.84	−0.91	−1.10	−1.29	−1.68	−2.18	−1.95	−2.94	−2.98	−2.88	−3.29	−3.55
80°	−0.87	−1.09	−0.90	−1.31	−1.56	−1.97	−1.99	−2.09	−3.19	−3.53	−3.45	−3.53	−3.94
85°	−0.78	−1.20	−1.03	−1.37	−1.55	−1.78	−2.20	−2.95	−2.61	−3.81	−3.92	−3.91	−4.05
90°	−0.83	−1.08	−1.30	−1.48	−1.74	−2.18	−2.59	−3.15	−2.87	−3.53	−4.25	−4.26	−4.36
95°	−1.02	−1.09	−1.24	−1.72	−1.84	−2.14	−2.58	−2.67	−3.25	−3.67	−4.42	−4.38	−4.55
100°	−1.26	−1.21	−1.18	−1.77	−2.04	−2.31	−2.48	−2.78	−3.97	−3.78	−4.65	−4.57	−4.75
105°	−1.10	−1.46	−1.29	−1.65	−2.22	−2.62	−2.91	−3.36	−3.99	−3.80	−4.92	−4.71	−5.28
110°	−0.85	−1.34	−1.49	−1.77	−2.01	−2.59	−3.19	−3.62	−4.38	−4.13	−4.70	−4.84	−5.76

Table A.8 ***(Continued)*** *Directional response for the sound level meter, measured in a plane parallel to the display and along the microphone's axis, 3.15 kHz – 10 kHz*

Angle	Nominal Frequency												
	3.15 kHz	3.55 kHz	**4 kHz**	4.5 kHz	**5 kHz**	5.6 kHz	**6.3 kHz**	7.1 kHz	**8 kHz**	8.5 kHz	9 kHz	9.5 kHz	**10 kHz**
115°	−0.91	−1.02	−1.34	−1.89	−2.14	−2.54	−3.00	−3.71	−4.26	−4.23	−4.99	−5.05	−5.76
120°	−1.02	−1.14	−1.05	−1.68	−2.21	−2.68	−3.11	−3.49	−4.46	−4.98	−5.09	−5.16	−5.86
125°	−0.99	−1.21	−1.23	−1.50	−1.92	−2.60	−3.11	−3.96	−4.17	−4.75	−5.14	−5.87	−6.10
130°	−0.74	−1.12	−1.26	−1.63	−1.86	−2.27	−2.91	−3.47	−4.45	−5.11	−5.24	−5.62	−5.84
135°	−0.48	−0.77	−1.00	−1.63	−1.96	−2.19	−2.65	−3.00	−4.02	−4.25	−4.81	−5.84	−6.11
140°	−0.59	−0.65	−0.64	−1.14	−1.71	−2.39	−2.57	−3.07	−3.59	−4.00	−4.55	−5.05	−5.23
145°	−0.93	−0.97	−0.80	−1.04	−1.23	−1.72	−2.55	−3.16	−3.21	−3.87	−4.29	−4.74	−5.23
150°	−1.29	−1.37	−1.23	−1.48	−1.59	−1.88	−1.94	−2.30	−3.83	−4.05	−4.13	−4.31	−4.74
155°	−1.56	−1.76	−1.74	−1.94	−2.08	−2.30	−2.58	−2.91	−2.80	−3.41	−3.73	−4.38	−4.76
160°	−1.54	−1.87	−2.08	−2.52	−2.84	−2.90	−2.97	−3.31	−4.02	−4.16	−4.43	−4.71	−5.33
165°	−1.20	−1.54	−1.79	−2.46	−3.00	−3.57	−4.28	−4.71	−4.56	−4.98	−5.12	−5.47	−5.56
170°	−0.81	−1.06	−1.18	−1.76	−2.14	−2.83	−3.73	−4.59	−5.52	−5.91	−6.29	−7.02	−7.34
175°	−0.53	−0.70	−0.71	−1.15	−1.34	−1.88	−2.46	−2.98	−4.09	−4.39	−4.72	−5.27	−5.67
180°	−0.44	−0.59	−0.57	−0.98	−1.11	−1.60	−2.10	−2.49	−3.36	−3.69	−3.98	−4.43	−4.83
185°	−0.53	−0.72	−0.74	−1.20	−1.41	−1.97	−2.62	−3.06	−3.97	−4.39	−4.75	−5.36	−5.96
190°	−0.82	−1.09	−1.24	−1.84	−2.26	−3.01	−3.92	−4.50	−5.44	−6.00	−6.42	−7.36	−7.84
195°	−1.25	−1.62	−1.93	−2.58	−3.18	−3.75	−4.27	−4.58	−4.81	−5.22	−5.45	−5.70	−5.73
200°	−1.61	−1.96	−2.21	−2.59	−2.90	−2.94	−2.88	−3.19	−3.98	−4.26	−4.50	−4.91	−5.48
205°	−1.61	−1.80	−1.76	−1.91	−2.01	−2.24	−2.57	−2.96	−3.05	−3.54	−3.86	−4.33	−4.69
210°	−1.30	−1.35	−1.19	−1.40	−1.55	−1.79	−1.94	−2.41	−3.73	−4.00	−3.97	−4.26	−4.60
215°	−0.94	−0.93	−0.76	−1.00	−1.25	−1.78	−2.63	−3.08	−3.10	−3.75	−4.35	−4.81	−5.27
220°	−0.55	−0.59	−0.58	−1.18	−1.76	−2.39	−2.44	−3.03	−3.48	−4.02	−4.49	−4.78	−5.17
225°	−0.40	−0.74	−1.02	−1.63	−1.94	−2.16	−2.75	−3.02	−3.90	−4.13	−4.73	−5.94	−6.24
230°	−0.70	−1.13	−1.25	−1.58	−1.81	−2.26	−2.84	−3.32	−4.61	−4.99	−5.01	−5.49	−5.83
235°	−1.00	−1.21	−1.21	−1.52	−1.99	−2.68	−3.09	−3.89	−4.19	−4.52	−4.97	−5.93	−5.98
240°	−0.97	−1.12	−1.03	−1.71	−2.16	−2.61	−3.12	−3.48	−4.27	−4.85	−4.78	−5.07	−5.67
245°	−0.89	−1.00	−1.38	−1.86	−2.12	−2.52	−2.88	−3.55	−3.85	−4.15	−4.73	−4.85	−5.46
250°	−0.81	−1.33	−1.46	−1.69	−1.94	−2.53	−3.04	−3.18	−4.02	−4.04	−4.43	−4.74	−5.45
255°	−1.09	−1.43	−1.23	−1.61	−2.18	−2.51	−2.77	−3.23	−3.78	−3.78	−4.67	−4.58	−4.95
260°	−1.24	−1.11	−1.15	−1.74	−1.94	−2.20	−2.45	−2.72	−3.87	−3.64	−4.37	−4.39	−4.48
265°	−0.92	−1.04	−1.18	−1.60	−1.75	−2.02	−2.35	−2.56	−3.19	−3.48	−4.12	−4.21	−4.34
270°	−0.76	−1.04	−1.26	−1.40	−1.63	−2.07	−2.43	−2.78	−2.82	−3.28	−4.02	−4.12	−4.12
275°	−0.76	−1.15	−0.93	−1.32	−1.51	−1.71	−2.17	−2.79	−2.47	−3.57	−3.70	−3.72	−3.82
280°	−0.83	−1.03	−0.84	−1.19	−1.42	−1.81	−1.79	−2.02	−2.94	−3.27	−3.24	−3.30	−3.69

Table A.8 ***(Continued)*** *Directional response for the sound level meter, measured in a plane parallel to the display and along the microphone's axis, 3.15 kHz – 10 kHz*

Angle	Nominal Frequency												
	3.15 kHz	3.55 kHz	**4 kHz**	4.5 kHz	**5 kHz**	5.6 kHz	**6.3 kHz**	7.1 kHz	**8 kHz**	8.5 kHz	9 kHz	9.5 kHz	**10 kHz**
285°	−0.91	−0.75	−0.86	−1.03	−1.23	−1.61	−2.01	−1.80	−2.71	−2.80	−2.69	−3.09	−3.26
290°	−0.75	−0.69	−0.71	−0.97	−1.24	−1.34	−1.40	−2.40	−2.14	−2.20	−2.48	−2.65	−2.83
295°	−0.48	−0.77	−0.50	−0.87	−0.99	−1.28	−1.57	−1.44	−1.75	−2.27	−2.25	−2.44	−2.68
300°	−0.36	−0.70	−0.45	−0.86	−1.02	−1.06	−1.36	−1.50	−2.01	−2.05	−2.11	−2.35	−2.46
305°	−0.41	−0.48	−0.43	−0.60	−0.71	−0.95	−1.23	−1.30	−1.43	−1.58	−1.65	−1.91	−1.98
310°	−0.45	−0.32	−0.45	−0.53	−0.61	−0.85	−0.83	−1.09	−1.24	−1.40	−1.55	−1.56	−1.66
315°	−0.42	−0.25	−0.33	−0.55	−0.49	−0.76	−0.74	−0.95	−1.01	−1.20	−1.19	−1.29	−1.49
320°	−0.29	−0.26	−0.12	−0.45	−0.45	−0.68	−0.66	−0.77	−0.78	−1.02	−0.89	−1.04	−1.10
325°	−0.14	−0.30	0.01	−0.29	−0.41	−0.52	−0.57	−0.50	−0.61	−0.72	−0.64	−0.88	−0.75
330°	−0.02	−0.30	0.05	−0.12	−0.33	−0.37	−0.47	−0.38	−0.50	−0.54	−0.46	−0.64	−0.59
335°	0.03	−0.25	0.03	−0.01	−0.21	−0.21	−0.31	−0.24	−0.32	−0.38	−0.36	−0.34	−0.40
340°	0.05	−0.17	0.01	0.05	−0.11	−0.09	−0.16	−0.11	−0.17	−0.21	−0.29	−0.15	−0.20
345°	0.05	−0.09	0.00	0.05	−0.03	−0.01	−0.04	−0.02	−0.07	−0.08	−0.18	−0.06	−0.08
350°	0.02	−0.04	−0.01	0.02	−0.02	0.00	−0.01	0.00	−0.03	−0.02	−0.08	−0.02	−0.03
355°	0.00	0.00	0.00	0.01	0.01	0.02	0.01	0.01	0.00	0.00	−0.01	0.00	0.00

Table A.9 *Directional response for the sound level meter, measured in a plane parallel to the display and along the microphone's axis, 10.6 kHz – 20 kHz*

Angle	Nominal Frequency											
	10.6 kHz	11.2 kHz	11.8 kHz	**12.5 kHz**	13.2 kHz	14 kHz	15 kHz	**16 kHz**	17 kHz	18 kHz	19 kHz	**20 kHz**
0°	−0.02	−0.02	−0.02	−0.02	−0.02	−0.02	−0.03	−0.04	−0.04	−0.04	−0.03	−0.01
5°	−0.03	−0.04	−0.05	−0.06	−0.06	−0.06	−0.07	−0.07	−0.09	−0.08	−0.09	−0.06
10°	−0.11	−0.12	−0.17	−0.18	−0.18	−0.17	−0.16	−0.16	−0.19	−0.21	−0.19	−0.16
15°	−0.20	−0.22	−0.29	−0.30	−0.32	−0.36	−0.35	−0.38	−0.45	−0.53	−0.49	−0.42
20°	−0.40	−0.41	−0.50	−0.46	−0.53	−0.59	−0.57	−0.67	−0.81	−0.87	−0.86	−0.80
25°	−0.66	−0.62	−0.74	−0.68	−0.82	−0.88	−0.87	−1.01	−1.22	−1.31	−1.29	−1.29
30°	−0.89	−0.84	−0.99	−1.00	−1.21	−1.23	−1.26	−1.43	−1.64	−1.80	−1.82	−1.75
35°	−1.13	−1.15	−1.27	−1.35	−1.53	−1.63	−1.68	−1.81	−2.10	−2.37	−2.42	−2.33
40°	−1.45	−1.50	−1.59	−1.71	−1.89	−2.13	−2.17	−2.30	−2.63	−2.99	−3.07	−3.00
45°	−1.73	−1.87	−2.07	−2.08	−2.38	−2.60	−2.72	−2.92	−3.23	−3.61	−3.85	−3.87
50°	−2.17	−2.28	−2.39	−2.54	−2.80	−3.10	−3.37	−3.54	−3.86	−4.30	−4.71	−4.66
55°	−2.65	−2.73	−2.84	−3.10	−3.21	−3.66	−3.91	−4.24	−4.59	−5.00	−5.39	−5.65
60°	−2.84	−3.01	−3.31	−3.61	−3.74	−4.17	−4.51	−4.78	−5.31	−5.88	−6.23	−6.33
65°	−3.25	−3.32	−3.79	−4.12	−4.18	−4.92	−4.92	−5.44	−6.09	−6.66	−7.08	−7.43
70°	−3.62	−3.86	−4.14	−4.68	−4.76	−5.33	−5.60	−6.26	−6.75	−7.45	−8.17	−8.25

Table A.9 ***(Continued)*** *Directional response for the sound level meter, measured in a plane parallel to the display and along the microphone's axis, 10.6 kHz – 20 kHz*

Angle	Nominal Frequency											
	10.6 kHz	11.2 kHz	11.8 kHz	**12.5 kHz**	13.2 kHz	14 kHz	15 kHz	**16 kHz**	17 kHz	18 kHz	19 kHz	**20 kHz**
75°	−3.92	−4.38	−4.60	−4.98	−5.62	−5.65	−6.55	−6.60	−7.41	−8.30	−8.80	−9.16
80°	−4.44	−4.63	−5.18	−5.35	−5.96	−6.68	−6.72	−7.81	−8.07	−8.86	−9.80	−10.10
85°	−4.62	−5.16	−5.48	−5.85	−6.31	−6.82	−7.74	−7.94	−9.12	−9.58	−10.34	−10.98
90°	−4.71	−5.34	−6.05	−6.26	−6.90	−7.51	−7.79	−8.64	−9.76	−10.36	−11.43	−11.69
95°	−5.42	−5.84	−6.54	−6.83	−7.50	−7.90	−8.62	−9.50	−9.95	−11.03	−11.94	−12.68
100°	−5.85	−6.39	−6.95	−6.91	−7.60	−8.48	−9.05	−9.66	−10.51	−11.77	−13.26	−12.80
105°	−6.12	−6.13	−6.36	−7.45	−8.16	−8.91	−9.49	−10.46	−11.23	−12.13	−12.95	−13.76
110°	−6.20	−6.39	−7.35	−7.99	−8.03	−9.00	−9.75	−10.61	−11.58	−12.81	−14.58	−14.37
115°	−5.91	−7.01	−7.73	−7.53	−8.46	−9.62	−9.62	−10.76	−11.75	−12.94	−14.34	−15.07
120°	−6.19	−6.96	−6.97	−8.23	−8.64	−9.51	−10.58	−11.21	−11.64	−13.06	−13.54	−15.78
125°	−6.76	−6.73	−7.88	−7.94	−8.82	−9.74	−9.86	−11.90	−12.46	−13.36	−14.87	−15.38
130°	−6.99	−7.25	−8.55	−8.20	−9.37	−9.49	−10.46	−11.22	−12.61	−13.15	−14.20	−16.43
135°	−6.94	−7.31	−8.00	−8.97	−9.34	−10.34	−11.11	−12.04	−12.48	−13.65	−14.70	−15.62
140°	−5.92	−6.87	−7.91	−8.89	−9.24	−10.11	−11.26	−12.16	−12.71	−14.44	−15.88	−16.85
145°	−5.84	−6.28	−6.79	−7.50	−8.09	−9.24	−10.33	−11.25	−12.43	−13.82	−14.48	−17.61
150°	−5.14	−5.44	−6.76	−7.77	−8.08	−8.55	−9.20	−10.11	−11.20	−12.28	−13.81	−13.96
155°	−5.34	−5.90	−6.56	−6.67	−7.11	−7.76	−8.61	−9.85	−11.25	−12.10	−13.14	−13.45
160°	−5.90	−6.48	−6.79	−6.87	−7.51	−8.26	−8.98	−9.86	−10.92	−11.82	−11.89	−13.03
165°	−5.85	−6.05	−6.75	−7.81	−8.60	−9.26	−10.07	−11.07	−12.11	−13.20	−14.37	−14.48
170°	−8.22	−8.74	−8.90	−9.04	−9.74	−10.54	−11.01	−11.45	−12.19	−13.14	−13.76	−13.81
175°	−6.30	−7.21	−7.91	−8.53	−9.42	−10.27	−11.12	−12.18	−13.32	−14.20	−15.80	−19.48
180°	−5.35	−5.94	−6.44	−7.14	−8.09	−8.77	−9.51	−10.46	−11.58	−12.54	−13.11	−14.49
185°	−6.66	−7.33	−7.87	−8.57	−9.88	−10.85	−11.75	−12.86	−14.19	−15.75	−15.96	−16.49
190°	−8.39	−8.54	−8.83	−9.61	−10.26	−10.75	−11.04	−11.42	−12.16	−12.81	−12.92	−14.00
195°	−5.83	−6.18	−6.66	−7.46	−8.52	−9.27	−10.10	−11.20	−12.27	−13.30	−13.76	−14.41
200°	−6.04	−6.34	−6.48	−6.82	−7.45	−8.03	−8.63	−9.53	−10.52	−11.35	−12.32	−12.79
205°	−5.01	−5.63	−6.35	−6.67	−7.09	−7.61	−8.29	−9.57	−11.01	−11.90	−12.73	−12.72
210°	−5.14	−5.44	−6.23	−7.19	−7.92	−8.37	−8.83	−9.90	−10.87	−11.98	−13.04	−13.38
215°	−5.67	−5.67	−6.26	−7.11	−7.96	−8.99	−10.04	−10.79	−11.86	−14.00	−14.34	−15.81
220°	−6.03	−6.63	−7.28	−8.13	−9.14	−9.87	−10.85	−11.63	−12.54	−14.16	−15.06	−15.98
225°	−6.58	−6.71	−7.34	−8.34	−9.17	−10.00	−10.91	−11.60	−12.06	−12.79	−13.79	−14.99
230°	−6.81	−6.83	−7.48	−8.20	−9.02	−9.24	−9.85	−10.70	−11.79	−12.40	−14.14	−15.27
235°	−6.45	−6.53	−7.15	−7.53	−8.82	−9.16	−9.49	−11.39	−11.76	−12.77	−13.93	−14.91
240°	−5.85	−6.44	−6.45	−7.70	−8.27	−9.35	−10.16	−10.69	−11.09	−12.60	−13.33	−14.80

Table A.9 ***(Continued)*** *Directional response for the sound level meter, measured in a plane parallel to the display and along the microphone's axis, 10.6 kHz – 20 kHz*

Angle	Nominal Frequency											
	10.6 kHz	11.2 kHz	11.8 kHz	**12.5 kHz**	13.2 kHz	14 kHz	15 kHz	**16 kHz**	17 kHz	18 kHz	19 kHz	**20 kHz**
245°	−5.62	−6.28	−6.93	−7.20	−8.40	−9.18	−9.17	−10.15	−11.24	−12.26	−13.68	−14.42
250°	−5.81	−5.73	−6.68	−7.46	−7.69	−8.59	−9.15	−9.92	−11.07	−12.20	−12.94	−13.81
255°	−5.63	−5.69	−5.80	−7.08	−7.92	−8.53	−9.11	−9.99	−10.66	−11.51	−12.81	−13.11
260°	−5.34	−5.88	−6.08	−6.47	−7.25	−8.07	−8.43	−9.09	−10.05	−11.07	−12.18	−12.33
265°	−4.97	−5.24	−5.82	−6.52	−7.25	−7.54	−8.19	−8.85	−9.41	−10.37	−11.13	−12.15
270°	−4.38	−4.86	−5.43	−5.85	−6.62	−7.14	−7.34	−8.21	−9.11	−9.61	−10.74	−11.43
275°	−4.29	−4.66	−4.83	−5.51	−6.11	−6.50	−7.25	−7.42	−8.48	−8.95	−9.70	−10.70
280°	−4.01	−4.14	−4.55	−5.05	−5.66	−6.26	−6.24	−7.22	−7.55	−8.32	−8.98	−9.77
285°	−3.56	−3.91	−4.07	−4.63	−5.33	−5.30	−6.14	−6.16	−7.02	−7.69	−8.16	−8.86
290°	−3.30	−3.44	−3.66	−4.34	−4.49	−5.05	−5.20	−5.86	−6.29	−6.88	−7.46	−8.13
295°	−2.90	−2.96	−3.29	−3.78	−3.94	−4.66	−4.58	−5.04	−5.64	−6.06	−6.51	−7.39
300°	−2.54	−2.64	−2.86	−3.36	−3.57	−3.98	−4.22	−4.41	−4.88	−5.38	−5.63	−6.22
305°	−2.34	−2.33	−2.42	−2.84	−3.01	−3.41	−3.54	−3.83	−4.19	−4.51	−4.78	−5.48
310°	−1.90	−1.95	−2.01	−2.34	−2.64	−2.86	−3.06	−3.21	−3.54	−3.89	−4.16	−4.56
315°	−1.47	−1.60	−1.71	−1.88	−2.20	−2.35	−2.42	−2.65	−2.95	−3.19	−3.38	−3.79
320°	−1.21	−1.24	−1.30	−1.52	−1.72	−1.93	−1.94	−2.05	−2.35	−2.59	−2.67	−3.03
325°	−0.93	−0.94	−1.02	−1.18	−1.36	−1.42	−1.46	−1.56	−1.80	−1.97	−1.98	−2.31
330°	−0.73	−0.66	−0.78	−0.83	−1.05	−1.06	−1.07	−1.19	−1.34	−1.44	−1.46	−1.75
335°	−0.50	−0.46	−0.54	−0.54	−0.71	−0.76	−0.72	−0.80	−1.00	−1.05	−1.01	−1.25
340°	−0.27	−0.27	−0.34	−0.34	−0.41	−0.49	−0.44	−0.48	−0.59	−0.64	−0.59	−0.75
345°	−0.10	−0.12	−0.16	−0.19	−0.22	−0.28	−0.24	−0.23	−0.29	−0.35	−0.30	−0.43
350°	−0.03	−0.03	−0.05	−0.09	−0.11	−0.13	−0.10	−0.08	−0.12	−0.12	−0.12	−0.16
355°	0.00	0.01	0.01	−0.01	−0.02	−0.02	−0.01	0.00	−0.01	0.00	0.00	−0.05

Table A.10 *Directional response for the sound level meter, measured in a plane perpendicular to the display and along the microphone's axis, 250 Hz – 2.8 kHz*

Angle	Nominal Frequency												
	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.24 kHz	2.5 kHz	2.8 kHz
0°	0.00	0.03	0.04	0.01	−0.01	0.03	−0.01	−0.01	−0.02	−0.02	0.01	0.00	−0.01
5°	0.02	−0.11	−0.12	0.01	0.09	−0.03	−0.01	−0.02	−0.03	−0.02	0.01	−0.01	−0.01
10°	−0.01	−0.14	−0.17	0.01	0.15	−0.07	−0.01	−0.02	−0.02	0.00	−0.01	0.01	−0.03
15°	0.00	−0.06	−0.08	0.01	0.09	−0.03	−0.03	−0.01	−0.05	0.01	−0.06	0.02	−0.06
20°	−0.03	0.09	0.04	0.01	0.08	−0.03	−0.04	−0.02	−0.06	0.03	−0.11	0.01	−0.11
25°	0.00	−0.02	−0.02	−0.01	0.03	0.01	−0.07	0.00	−0.13	0.05	−0.15	−0.02	−0.14
30°	0.00	−0.10	−0.12	−0.01	0.09	−0.02	−0.09	0.00	−0.18	0.06	−0.19	−0.09	−0.16
35°	−0.01	−0.03	−0.03	−0.01	0.03	0.04	−0.11	0.02	−0.21	0.09	−0.17	−0.18	−0.12
40°	−0.02	−0.05	−0.07	−0.02	0.09	0.02	−0.14	0.01	−0.25	0.08	−0.14	−0.34	−0.11
45°	−0.03	−0.12	−0.14	−0.02	0.13	0.03	−0.16	0.01	−0.26	0.06	−0.05	−0.49	−0.10
50°	−0.02	−0.17	−0.22	−0.02	0.18	0.02	−0.17	−0.01	−0.25	−0.01	0.02	−0.60	−0.17
55°	−0.04	−0.04	−0.05	−0.04	0.03	0.13	−0.19	−0.04	−0.23	−0.11	0.05	−0.59	−0.35
60°	−0.06	−0.04	−0.04	−0.04	0.03	0.13	−0.18	−0.09	−0.18	−0.25	0.02	−0.50	−0.53
65°	−0.05	−0.09	−0.09	−0.05	0.04	0.15	−0.16	−0.14	−0.15	−0.38	−0.12	−0.38	−0.58
70°	−0.05	−0.11	−0.13	−0.06	0.07	0.14	−0.12	−0.17	−0.14	−0.43	−0.33	−0.32	−0.47
75°	−0.07	−0.13	−0.17	−0.08	0.08	0.16	−0.09	−0.18	−0.18	−0.38	−0.53	−0.42	−0.33
80°	−0.07	−0.12	−0.14	−0.10	0.00	0.19	−0.05	−0.17	−0.25	−0.28	−0.58	−0.70	−0.34
85°	−0.08	−0.17	−0.20	−0.11	0.00	0.15	0.01	−0.16	−0.29	−0.24	−0.42	−1.02	−0.53
90°	−0.07	−0.09	−0.13	−0.13	−0.07	0.14	0.05	−0.10	−0.32	−0.27	−0.28	−1.00	−0.87
95°	−0.08	−0.15	−0.20	−0.14	−0.03	0.06	0.08	−0.02	−0.31	−0.34	−0.31	−0.68	−1.04
100°	−0.10	−0.14	−0.16	−0.15	−0.12	0.04	0.06	0.06	−0.27	−0.39	−0.43	−0.54	−0.73
105°	−0.10	−0.24	−0.23	−0.16	−0.15	−0.01	0.00	0.11	−0.17	−0.42	−0.52	−0.73	−0.47
110°	−0.10	−0.18	−0.22	−0.17	−0.12	−0.09	−0.06	0.10	−0.02	−0.35	−0.53	−0.92	−0.64
115°	−0.12	−0.13	−0.16	−0.19	−0.18	−0.11	−0.15	0.03	0.05	−0.17	−0.44	−0.94	−0.90
120°	−0.12	−0.08	−0.11	−0.19	−0.21	−0.12	−0.22	−0.06	0.02	0.05	−0.17	−0.76	−0.89
125°	−0.11	−0.20	−0.20	−0.20	−0.22	−0.15	−0.29	−0.17	−0.12	0.11	0.07	−0.42	−0.61
130°	−0.12	−0.14	−0.19	−0.20	−0.18	−0.19	−0.33	−0.27	−0.27	0.00	0.08	−0.17	−0.18
135°	−0.12	−0.11	−0.14	−0.20	−0.21	−0.17	−0.37	−0.34	−0.41	−0.22	−0.12	−0.28	−0.05
140°	−0.11	−0.23	−0.30	−0.19	−0.08	−0.23	−0.36	−0.39	−0.50	−0.44	−0.39	−0.63	−0.31
145°	−0.12	−0.22	−0.26	−0.19	−0.12	−0.17	−0.35	−0.39	−0.55	−0.61	−0.61	−0.98	−0.74
150°	−0.12	−0.05	−0.05	−0.19	−0.28	−0.05	−0.33	−0.34	−0.53	−0.69	−0.76	−1.22	−1.11
155°	−0.12	−0.19	−0.22	−0.17	−0.13	−0.11	−0.26	−0.30	−0.45	−0.66	−0.78	−1.29	−1.31
160°	−0.12	−0.13	−0.15	−0.18	−0.18	−0.06	−0.21	−0.23	−0.35	−0.53	−0.68	−1.13	−1.20
165°	−0.10	−0.10	−0.11	−0.17	−0.19	−0.02	−0.16	−0.15	−0.23	−0.36	−0.50	−0.85	−0.88

Table A.10 (Continued) *Directional response for the sound level meter, measured in a plane perpendicular to the display and along the microphone's axis, 250 Hz – 2.8 kHz*

Angle	Nominal Frequency												
	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.24 kHz	2.5 kHz	2.8 kHz
170°	−0.12	−0.11	−0.13	−0.16	−0.14	−0.02	−0.11	−0.10	−0.14	−0.21	−0.31	−0.59	−0.54
175°	−0.10	−0.21	−0.24	−0.16	−0.08	−0.03	−0.09	−0.07	−0.09	−0.12	−0.19	−0.42	−0.32
180°	−0.11	−0.16	−0.18	−0.15	−0.10	0.01	−0.09	−0.05	−0.07	−0.07	−0.13	−0.35	−0.23
185°	−0.12	−0.18	−0.20	−0.14	−0.06	−0.02	−0.10	−0.07	−0.09	−0.11	−0.18	−0.41	−0.30
190°	−0.14	0.01	−0.07	−0.15	−0.05	−0.03	−0.12	−0.12	−0.12	−0.19	−0.29	−0.56	−0.51
195°	−0.12	−0.09	−0.13	−0.16	−0.11	−0.02	−0.16	−0.16	−0.22	−0.33	−0.46	−0.80	−0.82
200°	−0.12	−0.13	−0.16	−0.16	−0.13	−0.05	−0.21	−0.22	−0.33	−0.51	−0.69	−1.09	−1.19
205°	−0.12	−0.16	−0.20	−0.17	−0.10	−0.10	−0.25	−0.30	−0.44	−0.67	−0.86	−1.28	−1.37
210°	−0.10	−0.19	−0.22	−0.18	−0.14	−0.12	−0.30	−0.36	−0.52	−0.75	−0.89	−1.26	−1.22
215°	−0.11	−0.17	−0.21	−0.19	−0.16	−0.15	−0.34	−0.40	−0.54	−0.71	−0.77	−1.04	−0.88
220°	−0.10	−0.11	−0.15	−0.20	−0.19	−0.16	−0.36	−0.40	−0.50	−0.57	−0.53	−0.70	−0.44
225°	−0.11	−0.19	−0.23	−0.20	−0.18	−0.19	−0.36	−0.37	−0.42	−0.35	−0.22	−0.35	−0.08
230°	−0.10	−0.20	−0.25	−0.20	−0.16	−0.20	−0.34	−0.30	−0.29	−0.11	0.03	−0.18	−0.10
235°	−0.12	−0.12	−0.15	−0.19	−0.22	−0.15	−0.30	−0.19	−0.13	0.05	0.07	−0.37	−0.51
240°	−0.09	−0.19	−0.21	−0.20	−0.20	−0.14	−0.24	−0.07	−0.01	0.03	−0.13	−0.71	−0.87
245°	−0.10	−0.16	−0.23	−0.18	−0.11	−0.15	−0.16	0.03	0.04	−0.14	−0.41	−0.90	−0.91
250°	−0.10	−0.09	−0.12	−0.18	−0.19	−0.06	−0.08	0.11	−0.03	−0.34	−0.54	−0.87	−0.67
255°	−0.10	−0.12	−0.15	−0.16	−0.15	−0.03	0.00	0.13	−0.16	−0.42	−0.51	−0.69	−0.44
260°	−0.08	−0.11	−0.15	−0.15	−0.11	0.02	0.07	0.09	−0.27	−0.39	−0.39	−0.49	−0.60
265°	−0.08	−0.14	−0.17	−0.14	−0.08	0.06	0.09	0.00	−0.33	−0.32	−0.25	−0.58	−0.97
270°	−0.06	−0.09	−0.13	−0.13	−0.07	0.12	0.07	−0.08	−0.33	−0.22	−0.19	−0.90	−0.93
275°	−0.05	−0.11	−0.15	−0.11	−0.03	0.15	0.04	−0.14	−0.28	−0.16	−0.30	−1.02	−0.63
280°	−0.03	−0.11	−0.18	−0.10	0.06	0.13	−0.02	−0.18	−0.22	−0.18	−0.49	−0.80	−0.47
285°	−0.04	−0.10	−0.13	−0.09	0.01	0.17	−0.07	−0.17	−0.17	−0.28	−0.53	−0.55	−0.43
290°	−0.05	−0.04	−0.08	−0.07	0.04	0.15	−0.10	−0.16	−0.10	−0.35	−0.38	−0.45	−0.50
295°	−0.03	−0.03	−0.05	−0.06	−0.01	0.17	−0.13	−0.12	−0.11	−0.33	−0.20	−0.48	−0.56
300°	0.00	−0.04	−0.08	−0.05	0.04	0.13	−0.15	−0.07	−0.13	−0.23	−0.08	−0.54	−0.47
305°	0.01	0.01	−0.03	−0.05	0.01	0.13	−0.17	−0.01	−0.17	−0.11	−0.05	−0.59	−0.28
310°	−0.01	0.03	0.01	−0.03	0.00	0.10	−0.16	0.02	−0.21	−0.01	−0.08	−0.57	−0.11
315°	0.00	−0.03	−0.06	−0.03	0.05	0.06	−0.14	0.04	−0.22	0.05	−0.13	−0.44	−0.05
320°	0.00	−0.12	−0.15	−0.02	0.12	0.01	−0.11	0.05	−0.21	0.08	−0.19	−0.26	−0.07
325°	−0.01	−0.03	−0.04	−0.01	0.05	0.02	−0.09	0.05	−0.17	0.09	−0.22	−0.11	−0.12
330°	0.03	−0.11	−0.11	−0.01	0.04	0.00	−0.06	0.05	−0.15	0.07	−0.21	−0.01	−0.16
335°	−0.01	0.01	0.00	−0.01	0.03	0.00	−0.04	0.03	−0.10	0.05	−0.18	0.04	−0.17

Table A.10 ***(Continued)*** *Directional response for the sound level meter, measured in a plane perpendicular to the display and along the microphone's axis, 250 Hz – 2.8 kHz*

Angle	Nominal Frequency												
	250 Hz	**315 Hz**	**400 Hz**	**500 Hz**	**630 Hz**	**800 Hz**	**1 kHz**	**1.25 kHz**	**1.6 kHz**	**2 kHz**	**2.24 kHz**	**2.5 kHz**	**2.8 kHz**
340°	0.01	−0.01	−0.03	−0.01	0.02	−0.01	−0.02	0.03	−0.06	0.04	−0.12	0.06	−0.12
345°	0.01	0.01	−0.01	0.00	0.02	−0.02	0.00	0.02	−0.02	0.02	−0.09	0.04	−0.09
350°	−0.01	0.16	0.11	−0.01	0.02	−0.02	0.01	0.01	0.02	0.02	−0.05	0.03	−0.05
355°	0.01	−0.03	−0.03	0.00	0.01	−0.02	0.01	0.02	0.01	0.02	−0.01	0.02	0.00

Table A.11 *Directional response for the sound level meter, measured in a plane perpendicular to the display and along the microphones' axis, 3.15 kHz – 10 kHz*

Angle	Nominal Frequency												
	3.15 kHz	3.55 kHz	**4 kHz**	4.5 kHz	**5 kHz**	5.6 kHz	**6.3 kHz**	7.1 kHz	**8 kHz**	8.5 kHz	9 kHz	9.5 kHz	**10 kHz**
0°	0.01	0.00	0.00	−0.01	−0.01	−0.01	0.00	−0.01	0.00	−0.01	−0.01	−0.01	−0.01
5°	0.01	−0.01	0.00	0.00	0.00	0.02	0.01	0.00	−0.01	0.02	−0.04	0.00	0.00
10°	0.02	−0.04	−0.01	0.01	−0.02	0.01	−0.02	0.00	−0.06	−0.02	−0.15	−0.03	−0.04
15°	0.03	−0.10	−0.02	0.03	−0.05	−0.03	−0.10	−0.04	−0.10	−0.09	−0.25	−0.05	−0.09
20°	0.03	−0.18	−0.02	0.01	−0.13	−0.15	−0.26	−0.14	−0.16	−0.27	−0.32	−0.16	−0.26
25°	0.01	−0.26	0.01	−0.03	−0.25	−0.33	−0.48	−0.31	−0.24	−0.47	−0.31	−0.40	−0.47
30°	−0.06	−0.33	0.01	−0.17	−0.41	−0.56	−0.67	−0.58	−0.47	−0.65	−0.47	−0.77	−0.66
35°	−0.15	−0.33	−0.02	−0.34	−0.47	−0.61	−0.58	−0.65	−0.70	−0.74	−0.81	−0.84	−0.83
40°	−0.29	−0.32	−0.17	−0.51	−0.47	−0.60	−0.51	−0.67	−0.84	−0.95	−1.06	−0.93	−1.30
45°	−0.37	−0.30	−0.35	−0.51	−0.43	−0.65	−0.80	−0.96	−0.98	−1.22	−1.23	−1.50	−1.46
50°	−0.40	−0.39	−0.46	−0.47	−0.67	−0.98	−1.28	−1.34	−1.35	−1.41	−1.56	−1.67	−1.67
55°	−0.37	−0.53	−0.40	−0.56	−0.92	−1.10	−1.30	−1.21	−1.49	−1.62	−1.69	−1.94	−2.29
60°	−0.37	−0.71	−0.42	−0.97	−1.09	−0.96	−1.14	−1.48	−1.92	−2.18	−2.15	−2.35	−2.48
65°	−0.56	−0.75	−0.53	−0.98	−0.85	−1.40	−1.77	−1.99	−1.82	−2.18	−2.32	−2.50	−2.78
70°	−0.84	−0.65	−0.83	−0.92	−1.28	−1.58	−1.37	−2.24	−2.06	−2.31	−2.52	−2.72	−3.02
75°	−0.93	−0.79	−0.93	−0.95	−1.36	−1.44	−2.13	−1.86	−3.29	−2.82	−2.87	−3.23	−3.41
80°	−0.73	−1.10	−0.80	−1.40	−1.30	−1.86	−2.10	−1.99	−2.63	−3.77	−3.44	−3.45	−3.97
85°	−0.57	−1.16	−0.95	−1.42	−1.46	−1.82	−1.86	−3.17	−2.58	−3.28	−4.13	−4.05	−3.94
90°	−0.70	−0.87	−1.32	−1.29	−2.00	−1.88	−2.83	−2.93	−2.65	−3.50	−3.99	−4.31	−4.49
95°	−1.06	−0.87	−1.09	−1.65	−1.68	−2.35	−2.22	−2.40	−3.63	−3.29	−4.42	−4.42	−4.32
100°	−1.38	−1.23	−0.85	−1.73	−1.92	−2.33	−2.57	−2.90	−3.64	−3.73	−4.61	−4.58	−4.68
105°	−1.09	−1.66	−1.27	−1.28	−2.25	−2.37	−3.18	−3.30	−4.38	−3.71	−4.59	−4.92	−4.96
110°	−0.70	−1.37	−1.80	−1.71	−1.55	−2.64	−2.73	−4.08	−3.88	−3.91	−4.94	−4.67	−5.43
115°	−0.88	−0.90	−1.45	−2.35	−2.20	−2.07	−3.15	−3.02	−4.68	−4.67	−4.64	−4.90	−5.91
120°	−1.14	−1.12	−0.85	−1.70	−2.75	−2.81	−2.44	−3.73	−3.67	−4.44	−5.42	−5.60	−5.81
125°	−1.09	−1.39	−1.24	−1.23	−1.73	−3.15	−3.69	−3.16	−4.22	−4.82	−4.68	−5.08	−6.00

Table A.11 (Continued) *Directional response for the sound level meter, measured in a plane perpendicular to the display and along the microphones' axis, 3.15 kHz – 10 kHz*

Angle	Nominal Frequency												
	3.15 kHz	3.55 kHz	**4 kHz**	4.5 kHz	**5 kHz**	5.6 kHz	**6.3 kHz**	7.1 kHz	**8 kHz**	8.5 kHz	9 kHz	9.5 kHz	**10 kHz**
130°	−0.65	−1.19	−1.49	−1.79	−1.64	−1.95	−3.28	−4.71	−3.92	−4.20	−4.86	−5.71	−5.66
135°	−0.26	−0.60	−1.00	−1.90	−2.39	−2.33	−2.21	−2.72	−5.34	−5.35	−5.30	−5.40	−5.59
140°	−0.37	−0.37	−0.34	−0.93	−1.77	−2.77	−3.09	−3.09	−2.85	−3.71	−4.90	−6.12	−6.40
145°	−0.83	−0.78	−0.50	−0.61	−0.76	−1.32	−2.59	−4.00	−3.95	−4.17	−4.07	−4.05	−4.67
150°	−1.29	−1.34	−1.12	−1.22	−1.18	−1.24	−1.17	−1.52	−3.89	−4.47	−4.94	−5.30	−5.46
155°	−1.63	−1.82	−1.80	−1.98	−2.08	−2.19	−2.22	−1.98	−1.64	−2.24	−2.67	−3.43	−4.04
160°	−1.61	−1.94	−2.19	−2.68	−3.06	−3.12	−3.17	−3.47	−3.68	−3.60	−3.66	−3.69	−4.25
165°	−1.26	−1.58	−1.87	−2.59	−3.20	−3.79	−4.61	−5.19	−5.02	−5.36	−5.46	−5.63	−5.75
170°	−0.83	−1.05	−1.19	−1.78	−2.19	−2.90	−3.87	−4.82	−5.77	−6.21	−6.60	−7.42	−7.63
175°	−0.53	−0.69	−0.70	−1.15	−1.35	−1.89	−2.51	−3.05	−4.13	−4.45	−4.77	−5.32	−5.64
180°	−0.42	−0.55	−0.52	−0.92	−1.05	−1.53	−2.05	−2.44	−3.25	−3.56	−3.82	−4.22	−4.54
185°	−0.50	−0.67	−0.69	−1.13	−1.32	−1.89	−2.56	−3.01	−3.83	−4.25	−4.59	−5.19	−5.70
190°	−0.77	−1.02	−1.17	−1.75	−2.17	−2.93	−3.94	−4.64	−5.61	−6.30	−6.86	−8.06	−8.67
195°	−1.18	−1.56	−1.88	−2.57	−3.23	−3.92	−4.68	−5.26	−5.67	−6.14	−6.40	−6.53	−6.43
200°	−1.61	−2.04	−2.37	−2.87	−3.31	−3.42	−3.36	−3.67	−4.24	−4.23	−4.07	−4.05	−4.33
205°	−1.72	−1.99	−2.01	−2.20	−2.25	−2.33	−2.40	−2.43	−2.04	−2.29	−2.56	−3.05	−3.75
210°	−1.44	−1.49	−1.27	−1.36	−1.30	−1.31	−1.28	−1.59	−3.28	−4.15	−4.85	−5.65	−5.90
215°	−0.97	−0.87	−0.55	−0.64	−0.72	−1.33	−2.65	−4.02	−4.21	−4.45	−4.46	−4.23	−4.58
220°	−0.43	−0.35	−0.24	−0.88	−1.69	−2.88	−3.14	−3.17	−2.82	−3.38	−4.36	−5.68	−6.39
225°	−0.19	−0.52	−0.94	−1.92	−2.55	−2.42	−2.34	−2.59	−4.91	−5.42	−5.34	−5.40	−5.46
230°	−0.58	−1.22	−1.60	−1.87	−1.73	−1.85	−3.02	−4.45	−4.28	−4.13	−4.56	−5.88	−6.05
235°	−1.14	−1.48	−1.31	−1.22	−1.66	−3.14	−3.60	−3.21	−4.38	−5.11	−4.90	−5.11	−5.67
240°	−1.22	−1.16	−0.77	−1.59	−2.70	−2.79	−2.57	−3.93	−3.97	−4.17	−4.92	−5.54	−5.68
245°	−0.95	−0.79	−1.28	−2.37	−2.28	−2.11	−3.31	−3.18	−4.20	−4.65	−4.76	−5.01	−5.84
250°	−0.64	−1.23	−1.88	−1.79	−1.66	−2.89	−2.73	−3.54	−4.05	−4.01	−4.94	−4.65	−5.49
255°	−0.96	−1.71	−1.36	−1.37	−2.40	−2.28	−2.99	−3.34	−4.19	−3.90	−4.55	−4.67	−4.98
260°	−1.40	−1.31	−0.95	−1.86	−1.82	−2.22	−2.73	−2.90	−3.56	−3.76	−4.59	−4.38	−4.68
265°	−1.17	−0.98	−1.17	−1.68	−1.59	−2.53	−2.32	−2.64	−3.40	−3.58	−4.35	−4.12	−4.37
270°	−0.81	−0.97	−1.41	−1.16	−2.12	−1.92	−2.78	−2.93	−2.77	−3.66	−3.99	−4.11	−4.09
275°	−0.68	−1.23	−0.85	−1.42	−1.61	−1.88	−1.88	−3.04	−2.77	−3.50	−3.84	−3.72	−3.93
280°	−0.79	−1.12	−0.71	−1.58	−1.26	−1.93	−2.16	−1.94	−2.93	−3.49	−3.28	−3.38	−3.61
285°	−0.95	−0.70	−1.02	−1.08	−1.42	−1.40	−2.17	−2.08	−3.00	−2.79	−2.78	−3.02	−3.28
290°	−0.82	−0.61	−1.00	−0.88	−1.38	−1.66	−1.38	−2.24	−2.12	−2.31	−2.47	−2.77	−3.01
295°	−0.50	−0.80	−0.58	−0.96	−0.86	−1.45	−1.78	−1.70	−1.96	−2.26	−2.52	−2.64	−2.66

Table A.11 ***(Continued)*** *Directional response for the sound level meter, measured in a plane perpendicular to the display and along the microphones' axis, 3.15 kHz – 10 kHz*

Angle	Nominal Frequency												
	3.15 kHz	3.55 kHz	**4 kHz**	4.5 kHz	**5 kHz**	5.6 kHz	**6.3 kHz**	7.1 kHz	**8 kHz**	8.5 kHz	9 kHz	9.5 kHz	**10 kHz**
300°	−0.32	−0.84	−0.35	−1.02	−1.08	−0.99	−1.16	−1.67	−1.92	−2.23	−2.19	−2.25	−2.54
305°	−0.40	−0.63	−0.37	−0.59	−0.98	−1.08	−1.25	−1.30	−1.55	−1.67	−1.67	−1.96	−2.11
310°	−0.51	−0.40	−0.52	−0.44	−0.72	−1.05	−1.22	−1.21	−1.43	−1.50	−1.49	−1.69	−1.65
315°	−0.49	−0.26	−0.43	−0.48	−0.40	−0.65	−0.93	−0.88	−1.00	−1.17	−1.29	−1.38	−1.43
320°	−0.37	−0.26	−0.20	−0.52	−0.39	−0.48	−0.60	−0.74	−0.86	−0.96	−1.06	−1.02	−1.21
325°	−0.21	−0.32	−0.02	−0.42	−0.46	−0.48	−0.52	−0.68	−0.69	−0.79	−0.81	−0.81	−0.88
330°	−0.07	−0.33	0.05	−0.23	−0.42	−0.48	−0.48	−0.53	−0.49	−0.59	−0.56	−0.67	−0.65
335°	0.00	−0.29	0.03	−0.08	−0.30	−0.39	−0.37	−0.33	−0.36	−0.41	−0.38	−0.47	−0.41
340°	0.04	−0.19	0.02	0.02	−0.14	−0.22	−0.20	−0.13	−0.22	−0.22	−0.22	−0.25	−0.16
345°	0.03	−0.12	−0.01	0.03	−0.06	−0.11	−0.10	−0.04	−0.14	−0.14	−0.14	−0.14	−0.09
350°	0.01	−0.05	0.00	0.02	−0.02	−0.04	−0.04	−0.01	−0.06	−0.06	−0.06	−0.05	−0.04
355°	0.00	0.00	0.01	0.02	0.00	−0.01	−0.01	0.01	0.00	−0.01	0.01	0.01	0.01

Table A.12 *Directional response for the sound level meter, measured in a plane perpendicular to the display and along the microphone's axis, 10.6 kHz – 20 kHz*

Angle	Nominal Frequency											
	10.6 kHz	11.2 kHz	11.8 kHz	**12.5 kHz**	13.2 kHz	14 kHz	15 kHz	**16 kHz**	17 kHz	18 kHz	19 kHz	**20 kHz**
0°	−0.01	−0.01	0.00	0.00	−0.02	−0.01	−0.02	−0.01	−0.02	−0.03	−0.01	0.01
5°	0.00	−0.02	−0.04	−0.03	−0.03	−0.03	−0.03	−0.02	−0.04	−0.04	−0.06	−0.02
10°	−0.03	−0.06	−0.11	−0.10	−0.10	−0.12	−0.13	−0.11	−0.19	−0.17	−0.20	−0.11
15°	−0.14	−0.21	−0.28	−0.24	−0.27	−0.34	−0.31	−0.32	−0.47	−0.55	−0.48	−0.39
20°	−0.38	−0.43	−0.47	−0.38	−0.46	−0.56	−0.58	−0.67	−0.82	−0.91	−0.90	−0.85
25°	−0.58	−0.56	−0.62	−0.61	−0.75	−0.77	−0.80	−0.96	−1.13	−1.17	−1.24	−1.14
30°	−0.78	−0.77	−0.95	−1.04	−1.16	−1.19	−1.23	−1.32	−1.54	−1.79	−1.79	−1.74
35°	−1.02	−1.14	−1.26	−1.27	−1.36	−1.56	−1.62	−1.78	−2.12	−2.31	−2.35	−2.30
40°	−1.37	−1.40	−1.54	−1.60	−1.89	−2.07	−2.10	−2.29	−2.59	−2.92	−3.22	−3.01
45°	−1.64	−1.75	−2.06	−2.06	−2.26	−2.44	−2.67	−2.89	−3.25	−3.67	−3.78	−3.67
50°	−2.23	−2.23	−2.33	−2.52	−2.78	−3.13	−3.30	−3.56	−3.92	−4.37	−4.73	−4.76
55°	−2.27	−2.64	−2.80	−3.02	−3.12	−3.49	−3.92	−4.17	−4.56	−4.97	−5.33	−5.50
60°	−2.97	−2.71	−3.34	−3.40	−3.68	−4.05	−4.36	−4.76	−5.25	−5.75	−6.10	−6.31
65°	−2.97	−3.48	−3.80	−4.00	−4.04	−4.85	−5.00	−5.28	−6.05	−6.68	−7.15	−7.44
70°	−3.59	−3.52	−4.36	−4.58	−4.58	−5.38	−5.49	−6.35	−6.76	−7.41	−7.98	−8.11
75°	−3.94	−4.38	−4.27	−5.20	−5.31	−5.61	−6.58	−6.78	−7.43	−8.12	−8.89	−9.05
80°	−4.21	−4.79	−5.14	−5.03	−6.24	−6.26	−6.74	−7.82	−8.25	−8.77	−9.42	−10.19
85°	−4.65	−4.85	−5.80	−5.66	−6.03	−7.11	−7.57	−7.88	−9.34	−9.45	−10.30	−10.95

Table A.12 (Continued) *Directional response for the sound level meter, measured in a plane perpendicular to the display and along the microphone's axis, 10.6 kHz – 20 kHz*

Angle	Nominal Frequency											
	10.6 kHz	11.2 kHz	11.8 kHz	**12.5 kHz**	13.2 kHz	14 kHz	15 kHz	**16 kHz**	17 kHz	18 kHz	19 kHz	**20 kHz**
90°	−4.71	−5.12	−5.91	−6.46	−6.61	−7.46	−7.62	−9.26	−9.33	−10.39	−10.99	−12.11
95°	−5.06	−6.08	−6.01	−6.88	−7.14	−8.05	−8.69	−9.25	−9.91	−11.12	−11.89	−13.09
100°	−5.54	−6.23	−7.27	−7.10	−7.42	−8.28	−9.15	−9.61	−10.74	−11.59	−13.25	−13.12
105°	−6.27	−6.28	−6.59	−6.84	−8.46	−8.81	−9.60	−10.19	−11.44	−12.30	−14.13	−12.84
110°	−6.24	−5.98	−7.36	−7.96	−8.29	−8.30	−10.19	−10.50	−11.65	−12.67	−13.37	−14.60
115°	−5.82	−6.94	−7.97	−7.49	−8.58	−9.66	−10.40	−10.21	−12.21	−13.28	−15.00	−14.72
120°	−6.02	−7.44	−6.87	−8.19	−8.63	−8.88	−10.95	−11.30	−12.58	−12.82	−13.12	−17.03
125°	−7.11	−7.03	−7.74	−8.55	−8.52	−9.99	−10.10	−11.30	−13.03	−13.22	−15.07	−15.90
130°	−6.28	−6.42	−8.93	−8.34	−9.41	−9.82	−11.27	−10.82	−13.25	−13.62	−13.62	−16.67
135°	−6.70	−7.12	−7.71	−7.87	−8.64	−10.28	−10.79	−12.21	−13.24	−14.50	−13.70	−16.71
140°	−7.09	−7.24	−7.93	−8.82	−9.36	−10.02	−10.47	−11.20	−12.74	−14.07	−15.24	−17.52
145°	−5.44	−6.38	−8.15	−9.20	−9.32	−10.08	−11.02	−12.42	−13.71	−14.01	−14.23	−15.61
150°	−5.84	−5.83	−6.57	−7.01	−7.47	−8.59	−10.23	−11.87	−12.61	−13.33	−14.61	−17.02
155°	−4.91	−6.18	−7.74	−7.97	−8.19	−8.67	−9.15	−9.97	−11.03	−11.76	−12.90	−14.93
160°	−4.59	−4.59	−4.82	−5.24	−5.98	−7.03	−8.31	−10.09	−11.88	−13.12	−14.41	−13.77
165°	−5.96	−6.36	−7.02	−7.47	−7.95	−8.38	−8.81	−9.34	−10.12	−10.97	−11.49	−11.73
170°	−8.71	−9.33	−9.61	−9.92	−10.41	−11.13	−11.70	−12.31	−13.09	−14.06	−15.13	−14.66
175°	−6.43	−7.35	−8.22	−8.93	−9.70	−10.67	−11.63	−12.80	−14.07	−15.03	−17.02	−22.65
180°	−5.17	−5.74	−6.34	−6.95	−7.74	−8.47	−9.18	−10.08	−11.14	−12.05	−12.82	−14.53
185°	−6.61	−7.26	−7.87	−8.49	−9.70	−10.79	−11.87	−13.09	−14.52	−16.52	−17.77	−17.66
190°	−9.55	−9.83	−10.09	−11.21	−12.17	−12.66	−12.96	−13.33	−13.93	−13.98	−13.40	−15.28
195°	−6.19	−6.59	−7.09	−7.58	−8.18	−8.57	−8.83	−9.13	−9.62	−10.06	−10.79	−12.17
200°	−4.72	−4.87	−4.98	−5.14	−5.71	−6.50	−7.43	−8.87	−10.48	−12.07	−12.90	−13.52
205°	−4.60	−5.62	−6.87	−7.86	−8.70	−8.89	−8.87	−9.46	−10.31	−11.12	−12.71	−13.01
210°	−6.00	−5.90	−6.33	−6.72	−7.27	−7.99	−8.98	−10.61	−11.31	−11.83	−13.36	−13.50
215°	−5.37	−5.88	−6.92	−8.19	−8.89	−9.13	−9.81	−10.88	−12.02	−13.14	−12.51	−14.26
220°	−6.89	−6.76	−6.99	−7.73	−9.00	−9.57	−9.84	−10.47	−12.00	−13.14	−12.59	−14.54
225°	−6.27	−6.95	−7.24	−7.81	−8.66	−9.85	−10.20	−10.11	−11.78	−12.68	−13.92	−14.07
230°	−6.39	−6.40	−7.40	−7.99	−8.39	−9.49	−10.33	−10.27	−11.56	−12.43	−13.92	−14.56
235°	−6.64	−6.30	−7.21	−7.92	−8.78	−8.84	−9.80	−10.47	−10.86	−12.18	−13.39	−14.41
240°	−6.12	−6.92	−6.32	−7.96	−8.20	−8.52	−10.23	−10.05	−10.77	−11.90	−12.67	−14.17
245°	−5.57	−6.71	−6.66	−6.95	−9.01	−8.72	−9.00	−9.47	−10.76	−11.75	−13.65	−14.00
250°	−5.66	−5.62	−7.11	−7.08	−7.68	−8.18	−9.13	−9.77	−10.86	−11.37	−12.26	−14.01
255°	−5.92	−5.51	−5.99	−6.93	−8.02	−8.60	−9.02	−9.31	−10.17	−11.09	−12.32	−12.75
260°	−5.44	−5.97	−5.80	−6.69	−7.18	−7.83	−8.29	−8.90	−9.66	−10.39	−11.98	−12.10

Table A.12 (Continued) *Directional response for the sound level meter, measured in a plane perpendicular to the display and along the microphone's axis, 10.6 kHz – 20 kHz*

Angle	Nominal Frequency											
	10.6 kHz	11.2 kHz	11.8 kHz	**12.5 kHz**	13.2 kHz	14 kHz	15 kHz	**16 kHz**	17 kHz	18 kHz	19 kHz	**20 kHz**
265°	−4.95	−5.68	−5.86	−6.53	−6.95	−7.66	−8.08	−8.40	−9.11	−9.90	−11.10	−11.76
270°	−4.74	−4.86	−5.36	−6.01	−6.58	−7.09	−7.21	−7.95	−8.77	−9.06	−10.39	−11.08
275°	−4.25	−4.51	−5.11	−5.41	−5.95	−6.55	−7.23	−7.10	−8.20	−8.52	−9.56	−10.38
280°	−3.97	−4.46	−4.51	−4.91	−5.77	−6.32	−6.06	−7.11	−7.10	−8.13	−8.62	−9.58
285°	−3.76	−3.88	−4.04	−4.71	−5.42	−5.30	−6.06	−5.86	−6.91	−7.30	−7.99	−8.75
290°	−3.24	−3.45	−3.71	−4.32	−4.67	−4.88	−5.12	−5.72	−5.96	−6.68	−7.22	−8.06
295°	−2.99	−3.16	−3.29	−3.93	−3.92	−4.58	−4.49	−4.90	−5.52	−5.84	−6.23	−7.08
300°	−2.73	−2.65	−2.85	−3.34	−3.45	−4.02	−4.03	−4.34	−4.74	−5.14	−5.45	−6.01
305°	−2.28	−2.42	−2.45	−2.88	−3.11	−3.38	−3.60	−3.70	−4.05	−4.31	−4.71	−5.46
310°	−1.95	−2.11	−1.98	−2.37	−2.53	−2.85	−2.90	−3.10	−3.31	−3.65	−4.03	−4.47
315°	−1.56	−1.54	−1.72	−1.88	−2.22	−2.38	−2.43	−2.50	−2.81	−3.05	−3.30	−3.71
320°	−1.33	−1.29	−1.42	−1.49	−1.83	−1.92	−1.93	−1.98	−2.26	−2.50	−2.58	−2.93
325°	−0.91	−1.01	−1.04	−1.23	−1.38	−1.50	−1.41	−1.51	−1.75	−1.91	−1.98	−2.29
330°	−0.69	−0.71	−0.74	−0.91	−1.04	−1.09	−1.05	−1.11	−1.31	−1.35	−1.40	−1.70
335°	−0.53	−0.48	−0.56	−0.62	−0.75	−0.69	−0.69	−0.73	−0.86	−0.88	−0.86	−1.18
340°	−0.29	−0.22	−0.31	−0.32	−0.44	−0.42	−0.42	−0.49	−0.56	−0.54	−0.61	−0.81
345°	−0.15	−0.09	−0.14	−0.15	−0.24	−0.25	−0.22	−0.26	−0.29	−0.29	−0.31	−0.46
350°	−0.06	−0.03	−0.04	−0.06	−0.09	−0.12	−0.08	−0.09	−0.12	−0.11	−0.12	−0.19
355°	0.01	0.03	0.03	0.02	0.01	0.00	0.02	0.02	0.00	0.02	0.03	−0.02

Table A.13 *Sensitivity variations of the sound level meter, at sound incidence angles within ±θ° from the reference direction*

Nominal Frequency	**Exact Frequency (6 digits)**	**Max Variation ±30°**	**Max Variation ±90°**	**Max Variation ±150°**
Hz	**Hz**	**dB**	**dB**	**dB**
250	251.189	0.09	0.15	0.18
315	316.228	0.41	0.41	0.47
400	398.107	0.44	0.44	0.44
500	501.187	0.05	0.17	0.25
630	630.957	0.37	0.45	0.67
800	794.328	0.23	0.41	0.47
1000	1000.00	0.11	0.27	0.47
1250	1258.93	0.07	0.24	0.55
1600	1584.89	0.20	0.35	0.59
2000	1995.26	0.11	0.53	0.86
2240	2238.72	0.22	0.63	0.96
2500	2511.89	0.15	1.08	1.32
2800	2818.38	0.18	0.94	1.24
3150	3162.28	0.13	1.00	1.48
3550	3548.13	0.37	1.24	1.72
4000	3981.07	0.08	1.47	1.93
4500	4466.84	0.28	1.63	2.43
5000	5011.87	0.44	2.14	2.77
5600	5623.41	0.57	2.20	3.17
6300	6309.57	0.68	2.85	3.71
7100	7079.46	0.60	3.19	4.73
8000	7943.28	0.60	3.31	5.36
8500	8413.95	0.67	3.83	5.44
9000	8912.51	0.60	4.27	5.44
9500	9440.61	0.80	4.33	6.14
10000	10000.0	0.75	4.51	6.42
10600	10592.5	0.91	4.76	7.13
11200	11220.2	0.87	5.36	7.47
11800	11885.0	1.02	6.08	8.96
12500	12589.3	1.06	6.48	9.21

Table A.13 (Continued) *Sensitivity variations of the sound level meter, at sound incidence angles within ±θ° from the reference direction*

Nominal Frequency	Exact Frequency (6 digits)	Max Variation ±30°	Max Variation ±90°	Max Variation ±150°
Hz	**Hz**	**dB**	**dB**	**dB**
13200	13335.2	1.23	6.93	9.43
14000	14125.4	1.25	7.53	10.36
15000	14962.4	1.29	7.82	11.30
16000	15848.9	1.46	9.30	12.46
17000	16788.0	1.68	9.79	13.75
18000	17782.8	1.83	10.42	14.53
19000	18836.5	1.85	11.46	15.91
20000	19952.6	1.77	12.12	17.62

Table A.14 *Influence of Windscreen UA-1650 on directional response, 250 Hz – 2.8 kHz*

Angle	Nominal Frequency												
	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.24 kHz	2.5 kHz	2.8 kHz
0°	−0.02	−0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	−0.01	−0.01	−0.01	−0.01
5°	−0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	−0.01
10°	0.03	0.01	0.00	−0.01	0.00	0.00	−0.01	−0.01	0.00	−0.01	0.00	0.00	0.00
15°	0.01	0.01	0.00	0.00	0.00	0.00	−0.01	−0.01	−0.01	−0.01	−0.01	0.00	−0.01
20°	0.00	0.00	0.00	0.00	0.00	0.00	−0.01	−0.01	−0.01	−0.01	−0.01	0.00	0.00
25°	0.02	0.01	0.00	−0.01	−0.01	0.00	−0.01	−0.01	−0.02	−0.01	−0.02	0.00	0.00
30°	0.02	0.01	0.00	−0.01	−0.01	0.00	−0.01	−0.02	−0.02	−0.02	−0.02	−0.01	0.00
35°	0.02	0.01	0.00	−0.01	−0.02	−0.01	−0.01	−0.03	−0.03	−0.03	−0.03	−0.02	0.01
40°	0.00	0.00	0.00	0.00	−0.01	−0.01	−0.02	−0.04	−0.04	−0.05	−0.03	−0.03	0.02
45°	0.01	0.01	0.00	−0.01	−0.02	−0.02	−0.02	−0.05	−0.05	−0.07	−0.04	−0.04	0.02
50°	−0.01	−0.01	0.00	0.00	−0.01	−0.02	−0.02	−0.06	−0.06	−0.08	−0.06	−0.05	0.01
55°	−0.01	−0.01	0.00	−0.01	−0.01	−0.02	−0.03	−0.07	−0.08	−0.10	−0.08	−0.06	−0.01
60°	−0.01	−0.01	−0.01	−0.01	−0.01	−0.03	−0.04	−0.07	−0.10	−0.11	−0.11	−0.07	−0.01
65°	−0.02	−0.01	−0.01	−0.01	−0.01	−0.03	−0.05	−0.08	−0.12	−0.12	−0.13	−0.10	−0.02
70°	−0.01	−0.01	−0.01	−0.01	−0.01	−0.03	−0.05	−0.09	−0.13	−0.14	−0.14	−0.13	−0.04
75°	−0.01	−0.01	−0.01	−0.02	−0.02	−0.04	−0.06	−0.09	−0.15	−0.16	−0.15	−0.15	−0.06
80°	0.00	−0.01	−0.01	−0.02	−0.02	−0.04	−0.06	−0.10	−0.16	−0.19	−0.17	−0.16	−0.09
85°	0.02	0.00	−0.02	−0.03	−0.03	−0.04	−0.07	−0.11	−0.17	−0.22	−0.19	−0.18	−0.10
90°	−0.01	−0.01	−0.02	−0.02	−0.02	−0.05	−0.07	−0.12	−0.18	−0.23	−0.22	−0.20	−0.11
95°	−0.01	−0.01	−0.02	−0.02	−0.03	−0.05	−0.07	−0.13	−0.18	−0.24	−0.24	−0.23	−0.14
100°	−0.01	−0.01	−0.02	−0.02	−0.03	−0.05	−0.07	−0.12	−0.19	−0.25	−0.25	−0.24	−0.17

Table A.14 (Continued) *Influence of Windscreen UA-1650 on directional response, 250 Hz – 2.8 kHz*

Angle	Nominal Frequency												
	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.24 kHz	2.5 kHz	2.8 kHz
105°	−0.03	−0.02	−0.02	−0.02	−0.02	−0.06	−0.07	−0.12	−0.19	−0.26	−0.26	−0.25	−0.19
110°	−0.01	−0.02	−0.02	−0.03	−0.03	−0.05	−0.08	−0.12	−0.19	−0.26	−0.27	−0.25	−0.19
115°	−0.01	−0.01	−0.02	−0.03	−0.04	−0.05	−0.07	−0.12	−0.19	−0.26	−0.27	−0.26	−0.18
120°	0.01	−0.01	−0.02	−0.04	−0.04	−0.05	−0.07	−0.12	−0.19	−0.26	−0.26	−0.26	−0.18
125°	−0.02	−0.02	−0.02	−0.03	−0.03	−0.05	−0.07	−0.12	−0.18	−0.25	−0.25	−0.26	−0.18
130°	−0.03	−0.02	−0.02	−0.03	−0.04	−0.05	−0.07	−0.13	−0.18	−0.25	−0.24	−0.24	−0.17
135°	−0.02	−0.02	−0.02	−0.03	−0.04	−0.05	−0.07	−0.12	−0.17	−0.24	−0.23	−0.23	−0.15
140°	−0.02	−0.02	−0.02	−0.03	−0.04	−0.05	−0.07	−0.12	−0.16	−0.24	−0.22	−0.22	−0.13
145°	−0.03	−0.03	−0.03	−0.03	−0.04	−0.06	−0.08	−0.13	−0.15	−0.24	−0.22	−0.21	−0.12
150°	−0.03	−0.03	−0.03	−0.03	−0.04	−0.06	−0.08	−0.12	−0.15	−0.24	−0.22	−0.20	−0.12
155°	−0.02	−0.02	−0.03	−0.03	−0.04	−0.06	−0.07	−0.13	−0.15	−0.23	−0.22	−0.20	−0.11
160°	−0.03	−0.03	−0.03	−0.03	−0.04	−0.06	−0.07	−0.13	−0.15	−0.23	−0.21	−0.19	−0.11
165°	−0.03	−0.03	−0.03	−0.03	−0.04	−0.06	−0.07	−0.13	−0.15	−0.23	−0.21	−0.19	−0.10
170°	−0.03	−0.03	−0.03	−0.03	−0.04	−0.06	−0.07	−0.13	−0.15	−0.22	−0.21	−0.19	−0.10
175°	−0.02	−0.02	−0.03	−0.04	−0.04	−0.06	−0.07	−0.13	−0.16	−0.22	−0.21	−0.19	−0.10
180°	0.01	−0.01	−0.03	−0.05	−0.05	−0.05	−0.07	−0.13	−0.16	−0.22	−0.21	−0.19	−0.10
185°	−0.04	−0.03	−0.03	−0.03	−0.03	−0.06	−0.07	−0.12	−0.16	−0.23	−0.21	−0.19	−0.10
190°	−0.02	−0.02	−0.03	−0.04	−0.05	−0.06	−0.07	−0.13	−0.16	−0.23	−0.22	−0.20	−0.11
195°	−0.03	−0.03	−0.03	−0.03	−0.04	−0.06	−0.07	−0.13	−0.16	−0.23	−0.22	−0.20	−0.11
200°	−0.03	−0.03	−0.03	−0.03	−0.04	−0.06	−0.07	−0.13	−0.16	−0.24	−0.22	−0.21	−0.12
205°	−0.04	−0.03	−0.03	−0.03	−0.04	−0.06	−0.07	−0.13	−0.16	−0.24	−0.23	−0.21	−0.12
210°	−0.03	−0.03	−0.03	−0.03	−0.04	−0.06	−0.07	−0.13	−0.16	−0.24	−0.23	−0.22	−0.12
215°	−0.04	−0.03	−0.03	−0.03	−0.04	−0.06	−0.08	−0.13	−0.16	−0.25	−0.23	−0.22	−0.13
220°	−0.01	−0.02	−0.03	−0.04	−0.05	−0.06	−0.08	−0.13	−0.17	−0.25	−0.23	−0.22	−0.14
225°	−0.02	−0.03	−0.03	−0.04	−0.04	−0.06	−0.08	−0.13	−0.18	−0.25	−0.24	−0.23	−0.15
230°	−0.03	−0.03	−0.03	−0.03	−0.04	−0.06	−0.08	−0.13	−0.18	−0.25	−0.25	−0.24	−0.17
235°	−0.03	−0.03	−0.03	−0.03	−0.04	−0.06	−0.08	−0.13	−0.19	−0.26	−0.26	−0.26	−0.19
240°	−0.02	−0.02	−0.03	−0.03	−0.04	−0.06	−0.08	−0.12	−0.20	−0.26	−0.27	−0.26	−0.19
245°	−0.02	−0.02	−0.03	−0.03	−0.04	−0.06	−0.08	−0.13	−0.20	−0.27	−0.27	−0.26	−0.18
250°	−0.02	−0.02	−0.02	−0.03	−0.04	−0.05	−0.08	−0.13	−0.20	−0.26	−0.27	−0.26	−0.19
255°	−0.03	−0.02	−0.02	−0.03	−0.04	−0.06	−0.08	−0.13	−0.20	−0.26	−0.26	−0.25	−0.19
260°	−0.04	−0.03	−0.02	−0.02	−0.03	−0.05	−0.07	−0.13	−0.19	−0.25	−0.25	−0.25	−0.18
265°	−0.02	−0.02	−0.02	−0.03	−0.04	−0.05	−0.07	−0.13	−0.18	−0.24	−0.24	−0.23	−0.14
270°	−0.02	−0.02	−0.02	−0.02	−0.03	−0.05	−0.07	−0.12	−0.17	−0.23	−0.22	−0.21	−0.11
275°	0.01	−0.01	−0.02	−0.04	−0.04	−0.04	−0.07	−0.12	−0.16	−0.21	−0.20	−0.18	−0.10

Table A.14 (Continued) *Influence of Windscreen UA-1650 on directional response, 250 Hz – 2.8 kHz*

Angle	Nominal Frequency												
	250 Hz	**315 Hz**	**400 Hz**	**500 Hz**	**630 Hz**	**800 Hz**	**1 kHz**	**1.25 kHz**	**1.6 kHz**	**2 kHz**	**2.24 kHz**	**2.5 kHz**	**2.8 kHz**
280°	−0.01	−0.02	−0.02	−0.02	−0.02	−0.04	−0.07	−0.10	−0.15	−0.19	−0.17	−0.16	−0.08
285°	−0.01	−0.01	−0.01	−0.02	−0.03	−0.04	−0.06	−0.10	−0.14	−0.16	−0.15	−0.14	−0.05
290°	−0.01	−0.01	−0.01	−0.02	−0.02	−0.04	−0.05	−0.09	−0.13	−0.14	−0.13	−0.12	−0.03
295°	−0.03	−0.02	−0.01	−0.01	−0.01	−0.03	−0.05	−0.08	−0.11	−0.12	−0.12	−0.09	−0.01
300°	0.00	−0.01	−0.01	−0.02	−0.03	−0.03	−0.04	−0.07	−0.09	−0.11	−0.10	−0.06	0.00
305°	−0.02	−0.01	−0.01	−0.01	−0.02	−0.03	−0.03	−0.06	−0.08	−0.09	−0.07	−0.05	0.01
310°	−0.01	−0.01	−0.01	−0.01	−0.02	−0.02	−0.03	−0.05	−0.06	−0.08	−0.05	−0.04	0.02
315°	0.04	0.01	−0.01	−0.02	−0.03	−0.02	−0.02	−0.04	−0.05	−0.06	−0.03	−0.03	0.03
320°	−0.02	−0.01	0.00	0.00	−0.01	−0.01	−0.02	−0.03	−0.03	−0.04	−0.02	−0.02	0.02
325°	0.00	0.00	0.00	−0.01	−0.01	−0.01	−0.01	−0.02	−0.02	−0.02	−0.02	0.00	0.02
330°	0.00	0.00	0.00	−0.01	−0.01	0.00	−0.01	−0.01	−0.02	−0.01	−0.01	0.01	0.02
335°	0.02	0.01	0.00	0.00	−0.01	0.00	0.00	−0.01	−0.01	0.00	−0.01	0.01	0.02
340°	−0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02
345°	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.02
350°	0.03	0.01	0.00	−0.01	−0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.02
355°	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.01	0.01

Table A.15 *Influence of Windscreen UA-1650 on directional response, 3.15 kHz – 10 kHz*

Angle	Nominal Frequency												
	3.15 kHz	3.55 kHz	**4 kHz**	4.5 kHz	**5 kHz**	5.6 kHz	**6.3 kHz**	7.1 kHz	**8 kHz**	8.5 kHz	9 kHz	9.5 kHz	**10 kHz**
0°	−0.01	−0.01	−0.01	−0.01	−0.01	−0.01	−0.01	−0.01	−0.01	−0.02	−0.02	−0.01	−0.01
5°	−0.01	−0.01	−0.01	−0.01	−0.01	−0.01	−0.01	−0.01	−0.02	−0.02	−0.01	0.00	0.00
10°	0.00	0.00	−0.01	−0.01	−0.02	−0.01	0.01	0.00	−0.06	−0.04	−0.02	0.02	0.00
15°	0.01	0.00	−0.01	−0.02	−0.03	−0.01	0.03	0.02	−0.11	−0.10	−0.03	0.06	0.01
20°	0.02	0.01	0.00	−0.03	−0.06	−0.02	0.06	0.05	−0.20	−0.18	−0.05	0.08	0.03
25°	0.03	0.03	0.00	−0.04	−0.09	−0.03	0.09	0.10	−0.27	−0.26	−0.08	0.10	0.05
30°	0.04	0.04	0.01	−0.05	−0.13	−0.06	0.10	0.14	−0.31	−0.36	−0.17	0.06	0.07
35°	0.05	0.06	0.02	−0.06	−0.16	−0.08	0.12	0.19	−0.34	−0.50	−0.28	0.03	0.12
40°	0.06	0.07	0.03	−0.07	−0.19	−0.11	0.15	0.28	−0.37	−0.56	−0.38	−0.04	0.08
45°	0.06	0.09	0.04	−0.07	−0.24	−0.18	0.14	0.34	−0.32	−0.62	−0.54	−0.17	0.06
50°	0.07	0.11	0.06	−0.08	−0.28	−0.24	0.11	0.35	−0.25	−0.65	−0.59	−0.30	−0.03
55°	0.07	0.12	0.09	−0.07	−0.30	−0.27	0.10	0.43	−0.14	−0.58	−0.67	−0.40	−0.11
60°	0.07	0.14	0.11	−0.06	−0.31	−0.34	0.02	0.42	−0.04	−0.51	−0.64	−0.47	−0.25
65°	0.07	0.15	0.12	−0.05	−0.33	−0.40	0.00	0.41	0.05	−0.40	−0.61	−0.48	−0.30
70°	0.06	0.15	0.14	−0.03	−0.33	−0.40	−0.04	0.35	0.11	−0.34	−0.51	−0.47	−0.32

Table A.15 (Continued) *Influence of Windscreen UA-1650 on directional response, 3.15 kHz – 10 kHz*

Angle	Nominal Frequency												
	3.15 kHz	3.55 kHz	**4 kHz**	4.5 kHz	**5 kHz**	5.6 kHz	**6.3 kHz**	7.1 kHz	**8 kHz**	8.5 kHz	9 kHz	9.5 kHz	**10 kHz**
75°	0.06	0.15	0.15	−0.01	−0.32	−0.43	−0.10	0.29	0.10	−0.28	−0.48	−0.40	−0.32
80°	0.04	0.14	0.15	−0.01	−0.32	−0.44	−0.10	0.24	0.01	−0.28	−0.46	−0.39	−0.25
85°	0.01	0.14	0.14	−0.01	−0.33	−0.45	−0.12	0.23	−0.02	−0.35	−0.46	−0.40	−0.24
90°	−0.01	0.12	0.14	−0.02	−0.35	−0.47	−0.12	0.22	−0.17	−0.36	−0.51	−0.39	−0.24
95°	−0.02	0.09	0.12	−0.04	−0.38	−0.50	−0.15	0.26	−0.15	−0.42	−0.53	−0.42	−0.25
100°	−0.04	0.08	0.07	−0.08	−0.42	−0.55	−0.16	0.28	−0.22	−0.46	−0.54	−0.45	−0.27
105°	−0.08	0.06	0.05	−0.13	−0.47	−0.60	−0.20	0.32	−0.21	−0.46	−0.60	−0.49	−0.31
110°	−0.09	0.02	0.03	−0.17	−0.55	−0.68	−0.23	0.33	−0.22	−0.52	−0.63	−0.57	−0.42
115°	−0.08	0.00	−0.01	−0.20	−0.62	−0.77	−0.33	0.32	−0.22	−0.57	−0.76	−0.69	−0.49
120°	−0.07	0.03	−0.01	−0.25	−0.65	−0.84	−0.42	0.25	−0.26	−0.66	−0.86	−0.83	−0.67
125°	−0.07	0.04	0.02	−0.23	−0.68	−0.89	−0.47	0.16	−0.37	−0.82	−1.06	−1.03	−0.76
130°	−0.06	0.04	0.03	−0.20	−0.64	−0.88	−0.52	0.10	−0.43	−0.95	−1.27	−1.25	−0.96
135°	−0.04	0.06	0.05	−0.18	−0.60	−0.79	−0.45	0.09	−0.40	−0.94	−1.31	−1.31	−1.08
140°	−0.03	0.08	0.08	−0.15	−0.57	−0.77	−0.40	0.12	−0.35	−0.85	−1.12	−1.13	−0.93
145°	−0.01	0.11	0.10	−0.11	−0.52	−0.71	−0.36	0.13	−0.32	−0.79	−0.99	−0.86	−0.64
150°	0.00	0.12	0.13	−0.07	−0.46	−0.65	−0.30	0.17	−0.28	−0.73	−0.92	−0.75	−0.47
155°	0.01	0.13	0.15	−0.05	−0.43	−0.60	−0.25	0.20	−0.23	−0.63	−0.76	−0.59	−0.38
160°	0.02	0.13	0.16	−0.03	−0.41	−0.57	−0.21	0.22	−0.19	−0.53	−0.63	−0.45	−0.24
165°	0.02	0.14	0.16	−0.02	−0.39	−0.55	−0.20	0.25	−0.14	−0.48	−0.55	−0.35	−0.17
170°	0.03	0.15	0.17	0.00	−0.38	−0.53	−0.21	0.27	−0.11	−0.44	−0.48	−0.29	−0.17
175°	0.03	0.15	0.18	0.01	−0.36	−0.52	−0.21	0.27	−0.10	−0.41	−0.45	−0.27	−0.15
180°	0.03	0.15	0.18	0.01	−0.37	−0.53	−0.22	0.27	−0.11	−0.41	−0.45	−0.29	−0.16
185°	0.03	0.15	0.17	0.00	−0.37	−0.54	−0.23	0.26	−0.13	−0.44	−0.48	−0.32	−0.19
190°	0.02	0.14	0.16	−0.01	−0.39	−0.56	−0.24	0.25	−0.15	−0.48	−0.52	−0.34	−0.21
195°	0.02	0.13	0.15	−0.03	−0.41	−0.58	−0.23	0.25	−0.15	−0.50	−0.57	−0.37	−0.20
200°	0.01	0.13	0.14	−0.04	−0.43	−0.59	−0.23	0.24	−0.18	−0.55	−0.66	−0.48	−0.27
205°	0.00	0.12	0.13	−0.05	−0.45	−0.61	−0.27	0.20	−0.24	−0.64	−0.77	−0.60	−0.37
210°	0.00	0.11	0.12	−0.08	−0.48	−0.66	−0.32	0.19	−0.29	−0.73	−0.92	−0.75	−0.47
215°	−0.01	0.10	0.10	−0.12	−0.53	−0.73	−0.37	0.16	−0.32	−0.79	−1.01	−0.88	−0.63
220°	−0.03	0.08	0.07	−0.15	−0.58	−0.79	−0.40	0.13	−0.35	−0.85	−1.14	−1.15	−0.93
225°	−0.05	0.05	0.04	−0.18	−0.61	−0.81	−0.46	0.10	−0.39	−0.95	−1.34	−1.34	−1.10
230°	−0.07	0.04	0.03	−0.20	−0.65	−0.89	−0.52	0.10	−0.43	−0.96	−1.30	−1.30	−1.01
235°	−0.07	0.04	0.03	−0.24	−0.70	−0.91	−0.48	0.14	−0.36	−0.85	−1.13	−1.09	−0.81
240°	−0.07	0.03	−0.01	−0.26	−0.67	−0.87	−0.44	0.24	−0.28	−0.68	−0.91	−0.89	−0.70
245°	−0.08	0.00	−0.02	−0.20	−0.63	−0.81	−0.35	0.30	−0.21	−0.57	−0.78	−0.72	−0.50

Table A.15 (Continued) *Influence of Windscreen UA-1650 on directional response, 3.15 kHz – 10 kHz*

Angle	Nominal Frequency												
	3.15 kHz	3.55 kHz	**4 kHz**	4.5 kHz	**5 kHz**	5.6 kHz	**6.3 kHz**	7.1 kHz	**8 kHz**	8.5 kHz	9 kHz	9.5 kHz	**10 kHz**
250°	−0.09	0.01	0.03	−0.18	−0.57	−0.71	−0.27	0.30	−0.20	−0.51	−0.66	−0.61	−0.45
255°	−0.08	0.06	0.06	−0.15	−0.49	−0.62	−0.22	0.30	−0.19	−0.47	−0.62	−0.52	−0.33
260°	−0.04	0.08	0.07	−0.08	−0.43	−0.57	−0.18	0.27	−0.20	−0.46	−0.56	−0.49	−0.29
265°	−0.01	0.09	0.11	−0.05	−0.39	−0.52	−0.16	0.27	−0.15	−0.43	−0.55	−0.45	−0.26
270°	0.00	0.11	0.14	−0.03	−0.36	−0.48	−0.13	0.23	−0.14	−0.36	−0.54	−0.42	−0.26
275°	0.01	0.15	0.14	−0.01	−0.34	−0.46	−0.12	0.25	−0.01	−0.35	−0.48	−0.42	−0.26
280°	0.04	0.15	0.15	−0.01	−0.32	−0.44	−0.10	0.26	0.04	−0.29	−0.48	−0.42	−0.27
285°	0.06	0.15	0.16	−0.01	−0.32	−0.43	−0.09	0.32	0.11	−0.29	−0.50	−0.43	−0.33
290°	0.07	0.16	0.15	−0.02	−0.33	−0.40	−0.03	0.36	0.12	−0.35	−0.53	−0.49	−0.33
295°	0.07	0.16	0.14	−0.03	−0.33	−0.39	0.02	0.43	0.05	−0.40	−0.63	−0.50	−0.30
300°	0.08	0.15	0.12	−0.05	−0.31	−0.33	0.05	0.43	−0.01	−0.52	−0.66	−0.49	−0.25
305°	0.08	0.14	0.10	−0.06	−0.29	−0.26	0.12	0.45	−0.14	−0.59	−0.69	−0.41	−0.11
310°	0.08	0.12	0.08	−0.07	−0.26	−0.23	0.13	0.39	−0.24	−0.65	−0.61	−0.30	−0.03
315°	0.07	0.11	0.06	−0.06	−0.22	−0.17	0.16	0.37	−0.31	−0.63	−0.54	−0.17	0.06
320°	0.07	0.08	0.05	−0.05	−0.17	−0.10	0.17	0.29	−0.37	−0.56	−0.38	−0.04	0.08
325°	0.07	0.07	0.03	−0.04	−0.14	−0.06	0.14	0.20	−0.34	−0.49	−0.27	0.04	0.13
330°	0.06	0.06	0.02	−0.03	−0.11	−0.03	0.12	0.16	−0.30	−0.35	−0.16	0.07	0.08
335°	0.05	0.05	0.02	−0.02	−0.07	−0.01	0.11	0.12	−0.26	−0.24	−0.07	0.11	0.06
340°	0.03	0.04	0.02	0.00	−0.04	0.01	0.09	0.07	−0.18	−0.16	−0.03	0.11	0.05
345°	0.03	0.03	0.01	0.01	−0.01	0.01	0.06	0.04	−0.09	−0.08	−0.01	0.08	0.03
350°	0.02	0.02	0.01	0.01	0.01	0.02	0.04	0.02	−0.03	−0.03	0.01	0.05	0.02
355°	0.02	0.02	0.01	0.01	0.01	0.02	0.03	0.02	0.00	0.00	0.02	0.03	0.02

Table A.16 *Influence of Windscreen UA-1650 on directional response, 10.6 kHz – 20 kHz*

Angle	Nominal Frequency											
	10.6 kHz	11.2 kHz	11.8 kHz	**12.5 kHz**	13.2 kHz	14 kHz	15 kHz	**16 kHz**	17 kHz	18 kHz	19 kHz	**20 kHz**
0°	−0.01	−0.01	−0.01	−0.01	−0.01	−0.01	−0.01	−0.01	−0.01	−0.01	−0.01	−0.02
5°	−0.02	−0.03	−0.02	0.00	−0.01	−0.03	−0.01	0.00	−0.01	−0.02	−0.01	−0.03
10°	−0.05	−0.08	−0.05	0.00	−0.03	−0.09	−0.02	0.01	−0.02	−0.04	−0.02	−0.08
15°	−0.08	−0.16	−0.11	0.01	−0.05	−0.17	−0.09	0.04	−0.03	−0.11	−0.05	−0.15
20°	−0.10	−0.25	−0.18	0.00	−0.09	−0.26	−0.20	0.04	−0.06	−0.20	−0.12	−0.22
25°	−0.11	−0.35	−0.25	−0.01	−0.08	−0.36	−0.30	−0.07	−0.02	−0.27	−0.25	−0.31
30°	−0.11	−0.46	−0.39	−0.09	−0.07	−0.38	−0.46	−0.16	−0.04	−0.28	−0.33	−0.37
35°	−0.07	−0.49	−0.50	−0.18	−0.09	−0.40	−0.51	−0.33	−0.06	−0.21	−0.36	−0.40
40°	−0.05	−0.52	−0.63	−0.30	−0.11	−0.33	−0.54	−0.40	−0.17	−0.08	−0.25	−0.37
45°	0.03	−0.46	−0.65	−0.41	−0.18	−0.31	−0.49	−0.40	−0.29	−0.02	−0.09	−0.30
50°	0.00	−0.43	−0.68	−0.53	−0.29	−0.29	−0.40	−0.38	−0.40	−0.16	−0.04	−0.29
55°	−0.01	−0.36	−0.64	−0.57	−0.39	−0.32	−0.41	−0.39	−0.47	−0.39	−0.19	−0.36
60°	−0.08	−0.38	−0.61	−0.58	−0.52	−0.43	−0.47	−0.46	−0.52	−0.58	−0.41	−0.44
65°	−0.20	−0.45	−0.66	−0.63	−0.62	−0.55	−0.56	−0.53	−0.54	−0.65	−0.50	−0.53
70°	−0.23	−0.51	−0.71	−0.70	−0.73	−0.66	−0.60	−0.56	−0.58	−0.63	−0.54	−0.81
75°	−0.22	−0.51	−0.74	−0.73	−0.79	−0.80	−0.65	−0.59	−0.66	−0.71	−0.66	−0.90
80°	−0.19	−0.45	−0.69	−0.73	−0.78	−0.90	−0.82	−0.74	−0.82	−0.80	−0.79	−0.85
85°	−0.13	−0.37	−0.58	−0.70	−0.78	−0.94	−1.02	−1.01	−1.04	−0.80	−0.66	−0.77
90°	−0.08	−0.32	−0.51	−0.64	−0.81	−0.95	−1.08	−1.14	−1.13	−0.83	−0.54	−0.91
95°	−0.08	−0.29	−0.54	−0.68	−0.90	−0.91	−1.00	−0.93	−0.94	−0.81	−0.84	−1.70
100°	−0.11	−0.33	−0.57	−0.75	−1.07	−0.94	−0.81	−0.65	−0.66	−0.86	−1.27	−1.98
105°	−0.18	−0.36	−0.57	−0.74	−1.03	−1.05	−0.87	−0.57	−0.61	−0.88	−1.35	−1.35
110°	−0.23	−0.39	−0.54	−0.61	−0.89	−1.09	−0.91	−0.80	−0.99	−0.99	−1.05	−0.90
115°	−0.31	−0.42	−0.49	−0.51	−0.74	−1.10	−0.94	−0.86	−1.05	−1.12	−1.27	−1.01
120°	−0.33	−0.40	−0.44	−0.50	−0.79	−1.10	−0.84	−0.82	−0.88	−1.32	−1.22	−1.30
125°	−0.42	−0.48	−0.55	−0.64	−0.90	−1.04	−0.71	−0.58	−0.76	−1.30	−1.14	−1.29
130°	−0.62	−0.70	−0.76	−0.96	−1.32	−1.09	−0.55	−0.48	−0.79	−0.94	−0.87	−0.95
135°	−0.76	−0.92	−1.18	−1.61	−1.97	−1.32	−0.81	−0.82	−1.58	−0.59	−0.52	−0.82
140°	−0.75	−0.99	−1.42	−1.93	−2.12	−1.62	−1.54	−1.96	−2.68	−1.05	−0.71	−1.78
145°	−0.52	−0.86	−1.33	−1.70	−1.71	−1.58	−1.79	−2.53	−2.83	−1.56	−1.77	−3.84
150°	−0.38	−0.80	−1.21	−1.29	−1.12	−1.14	−1.61	−2.29	−2.00	−1.49	−2.18	−4.05
155°	−0.31	−0.74	−1.17	−1.15	−0.84	−0.84	−1.54	−1.89	−1.21	−0.94	−2.22	−2.77
160°	−0.26	−0.71	−1.02	−0.88	−0.57	−0.77	−1.49	−1.73	−0.86	−0.77	−2.32	−1.91
165°	−0.20	−0.67	−0.89	−0.66	−0.40	−0.68	−1.44	−1.37	−0.53	−0.64	−2.22	−1.47
170°	−0.17	−0.58	−0.79	−0.47	−0.23	−0.59	−1.32	−1.16	−0.33	−0.57	−2.09	−1.28

Table A.16 (Continued) *Influence of Windscreen UA-1650 on directional response, 10.6 kHz – 20 kHz*

Angle	Nominal Frequency											
	10.6 kHz	11.2 kHz	11.8 kHz	**12.5 kHz**	13.2 kHz	14 kHz	15 kHz	**16 kHz**	17 kHz	18 kHz	19 kHz	**20 kHz**
175°	−0.19	−0.57	−0.74	−0.47	−0.21	−0.58	−1.19	−1.07	−0.25	−0.43	−1.93	−1.08
180°	−0.21	−0.60	−0.75	−0.48	−0.25	−0.60	−1.21	−1.08	−0.30	−0.43	−1.95	−1.03
185°	−0.23	−0.62	−0.80	−0.54	−0.29	−0.64	−1.28	−1.22	−0.39	−0.49	−2.08	−1.24
190°	−0.21	−0.61	−0.83	−0.51	−0.24	−0.60	−1.36	−1.25	−0.37	−0.56	−2.18	−1.38
195°	−0.21	−0.67	−0.92	−0.70	−0.43	−0.70	−1.50	−1.54	−0.64	−0.62	−2.39	−1.76
200°	−0.28	−0.73	−1.05	−0.95	−0.59	−0.74	−1.52	−1.88	−0.90	−0.69	−2.49	−2.34
205°	−0.30	−0.73	−1.21	−1.24	−0.88	−0.83	−1.57	−2.09	−1.29	−0.79	−2.26	−3.02
210°	−0.37	−0.80	−1.26	−1.40	−1.15	−1.08	−1.56	−2.44	−2.15	−1.37	−2.11	−4.31
215°	−0.49	−0.82	−1.36	−1.80	−1.80	−1.54	−1.74	−2.59	−3.04	−1.46	−1.56	−4.08
220°	−0.72	−0.96	−1.42	−2.02	−2.24	−1.68	−1.46	−1.99	−3.04	−1.21	−0.72	−2.45
225°	−0.74	−0.89	−1.22	−1.73	−2.11	−1.49	−0.77	−0.94	−1.76	−0.53	−0.53	−1.05
230°	−0.64	−0.68	−0.84	−1.08	−1.40	−1.11	−0.54	−0.56	−0.85	−0.82	−0.94	−1.40
235°	−0.43	−0.47	−0.57	−0.71	−0.96	−1.03	−0.71	−0.71	−0.85	−1.14	−0.98	−2.13
240°	−0.33	−0.39	−0.46	−0.56	−0.87	−1.08	−0.81	−0.99	−1.11	−1.14	−0.86	−1.81
245°	−0.30	−0.41	−0.52	−0.59	−0.81	−1.06	−0.85	−1.00	−1.36	−1.03	−0.95	−1.15
250°	−0.23	−0.37	−0.57	−0.70	−0.97	−1.05	−0.80	−0.82	−1.30	−1.04	−0.75	−0.95
255°	−0.18	−0.33	−0.59	−0.82	−1.15	−1.07	−0.76	−0.55	−0.81	−0.97	−1.25	−1.60
260°	−0.10	−0.29	−0.57	−0.83	−1.19	−0.98	−0.73	−0.65	−0.77	−0.88	−1.16	−2.36
265°	−0.06	−0.26	−0.53	−0.76	−1.02	−0.95	−0.95	−0.95	−1.06	−0.83	−0.71	−1.96
270°	−0.07	−0.29	−0.51	−0.71	−0.90	−0.97	−1.02	−1.19	−1.32	−0.86	−0.41	−1.04
275°	−0.12	−0.35	−0.59	−0.75	−0.86	−0.94	−0.95	−1.07	−1.21	−0.89	−0.59	−0.90
280°	−0.19	−0.43	−0.70	−0.78	−0.86	−0.90	−0.77	−0.77	−0.93	−0.86	−0.76	−1.00
285°	−0.21	−0.50	−0.74	−0.80	−0.87	−0.80	−0.63	−0.61	−0.73	−0.71	−0.60	−1.07
290°	−0.21	−0.50	−0.72	−0.77	−0.80	−0.66	−0.59	−0.60	−0.65	−0.61	−0.54	−0.92
295°	−0.19	−0.44	−0.67	−0.70	−0.66	−0.53	−0.55	−0.57	−0.60	−0.65	−0.53	−0.66
300°	−0.07	−0.37	−0.63	−0.62	−0.52	−0.39	−0.46	−0.50	−0.56	−0.60	−0.46	−0.49
305°	0.00	−0.37	−0.66	−0.59	−0.38	−0.29	−0.41	−0.43	−0.51	−0.42	−0.22	−0.40
310°	0.00	−0.44	−0.70	−0.54	−0.28	−0.27	−0.42	−0.42	−0.44	−0.17	−0.06	−0.32
315°	0.03	−0.48	−0.66	−0.41	−0.17	−0.32	−0.52	−0.45	−0.34	−0.03	−0.12	−0.36
320°	−0.05	−0.52	−0.63	−0.29	−0.10	−0.35	−0.57	−0.45	−0.20	−0.08	−0.29	−0.42
325°	−0.07	−0.48	−0.49	−0.17	−0.09	−0.40	−0.53	−0.37	−0.08	−0.22	−0.40	−0.44
330°	−0.10	−0.45	−0.37	−0.07	−0.07	−0.39	−0.48	−0.19	−0.05	−0.29	−0.36	−0.40
335°	−0.09	−0.34	−0.23	0.01	−0.07	−0.35	−0.32	−0.08	−0.01	−0.28	−0.27	−0.33
340°	−0.08	−0.23	−0.15	0.02	−0.07	−0.25	−0.21	0.04	−0.03	−0.20	−0.13	−0.23
345°	−0.06	−0.14	−0.08	0.03	−0.03	−0.17	−0.10	0.05	−0.02	−0.11	−0.05	−0.14

Table A.16 (Continued) *Influence of Windscreen UA-1650 on directional response, 10.6 kHz – 20 kHz*

Angle	Nominal Frequency											
	10.6 kHz	11.2 kHz	11.8 kHz	**12.5 kHz**	13.2 kHz	14 kHz	15 kHz	**16 kHz**	17 kHz	18 kHz	19 kHz	**20 kHz**
350°	−0.03	−0.06	−0.03	0.03	−0.01	−0.09	−0.02	0.02	−0.01	−0.03	−0.02	−0.06
355°	0.00	−0.01	0.00	0.02	0.01	−0.01	0.01	0.02	0.01	0.00	0.00	0.00

Table A.17 *Directional response for the sound level meter with Windscreen UA-1650, measured in a plane parallel to the display and along the microphone's axis, 250 Hz – 2.8 kHz*

Angle	Nominal Frequency												
	250 Hz	**315 Hz**	**400 Hz**	**500 Hz**	**630 Hz**	**800 Hz**	**1 kHz**	**1.25 kHz**	**1.6 kHz**	**2 kHz**	**2.24 kHz**	**2.5 kHz**	**2.8 kHz**
0°	−0.01	0.02	0.03	0.00	−0.03	0.02	−0.01	0.00	−0.01	−0.01	−0.01	−0.02	−0.02
5°	−0.03	−0.02	0.00	0.01	0.00	0.00	0.00	0.00	−0.02	−0.01	−0.02	−0.01	−0.02
10°	0.02	0.01	0.00	−0.02	−0.02	0.01	−0.01	0.00	−0.03	0.00	−0.05	0.00	−0.05
15°	0.00	0.02	0.00	−0.01	0.01	−0.01	−0.03	−0.01	−0.06	0.00	−0.10	0.01	−0.10
20°	−0.02	−0.02	−0.02	−0.01	0.01	−0.01	−0.05	0.00	−0.10	0.01	−0.15	0.01	−0.14
25°	−0.04	−0.02	0.00	−0.02	−0.02	0.00	−0.06	0.00	−0.14	0.03	−0.20	−0.01	−0.16
30°	−0.01	−0.05	−0.06	−0.03	0.01	−0.01	−0.09	0.00	−0.19	0.04	−0.23	−0.08	−0.17
35°	0.00	−0.05	−0.08	−0.04	0.02	−0.01	−0.12	0.00	−0.23	0.04	−0.23	−0.18	−0.13
40°	−0.05	−0.06	−0.06	−0.04	0.03	0.00	−0.15	−0.02	−0.27	0.02	−0.20	−0.35	−0.10
45°	−0.02	−0.09	−0.10	−0.06	0.00	0.02	−0.19	−0.04	−0.31	−0.05	−0.16	−0.55	−0.09
50°	−0.06	−0.15	−0.11	−0.06	−0.05	0.07	−0.21	−0.06	−0.33	−0.13	−0.11	−0.68	−0.16
55°	−0.06	−0.08	−0.10	−0.07	0.02	0.05	−0.22	−0.12	−0.29	−0.25	−0.11	−0.71	−0.34
60°	−0.08	−0.06	−0.04	−0.07	−0.06	0.10	−0.22	−0.17	−0.27	−0.38	−0.16	−0.65	−0.53
65°	−0.10	−0.05	−0.04	−0.08	−0.07	0.11	−0.20	−0.22	−0.26	−0.50	−0.31	−0.58	−0.63
70°	−0.09	−0.17	−0.16	−0.10	−0.03	0.09	−0.18	−0.26	−0.29	−0.55	−0.52	−0.55	−0.60
75°	−0.11	−0.13	−0.11	−0.12	−0.09	0.13	−0.16	−0.27	−0.35	−0.51	−0.70	−0.63	−0.54
80°	−0.09	−0.12	−0.13	−0.14	−0.10	0.13	−0.12	−0.28	−0.42	−0.44	−0.73	−0.86	−0.56
85°	−0.08	−0.19	−0.23	−0.16	−0.07	0.06	−0.06	−0.27	−0.46	−0.43	−0.58	−1.16	−0.66
90°	−0.13	−0.11	−0.12	−0.17	−0.16	0.07	−0.02	−0.22	−0.50	−0.50	−0.48	−1.19	−0.91
95°	−0.13	−0.13	−0.15	−0.19	−0.20	0.01	−0.01	−0.15	−0.51	−0.57	−0.53	−0.96	−1.09
100°	−0.14	−0.17	−0.18	−0.20	−0.20	−0.06	−0.04	−0.08	−0.47	−0.63	−0.64	−0.85	−0.92
105°	−0.17	−0.11	−0.11	−0.21	−0.27	−0.08	−0.09	−0.03	−0.38	−0.66	−0.72	−0.97	−0.75
110°	−0.15	−0.15	−0.17	−0.23	−0.25	−0.15	−0.17	−0.05	−0.26	−0.63	−0.76	−1.07	−0.85
115°	−0.16	−0.15	−0.17	−0.23	−0.28	−0.18	−0.24	−0.12	−0.19	−0.47	−0.69	−1.07	−0.94
120°	−0.14	−0.21	−0.24	−0.25	−0.28	−0.23	−0.32	−0.22	−0.24	−0.31	−0.49	−1.02	−0.93
125°	−0.18	−0.17	−0.16	−0.24	−0.35	−0.20	−0.38	−0.32	−0.35	−0.25	−0.29	−0.77	−0.78
130°	−0.18	−0.18	−0.20	−0.24	−0.28	−0.24	−0.41	−0.41	−0.47	−0.35	−0.28	−0.56	−0.49
135°	−0.15	−0.15	−0.17	−0.26	−0.31	−0.22	−0.45	−0.48	−0.59	−0.55	−0.46	−0.63	−0.39
140°	−0.15	−0.19	−0.19	−0.25	−0.32	−0.20	−0.45	−0.50	−0.68	−0.73	−0.69	−0.90	−0.60

Table A.17 (Continued) *Directional response for the sound level meter with Windscreen UA-1650, measured in a plane parallel to the display and along the microphone's axis, 250 Hz – 2.8 kHz*

Angle	Nominal Frequency												
	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.24 kHz	2.5 kHz	2.8 kHz
145°	−0.17	−0.23	−0.25	−0.23	−0.24	−0.22	−0.43	−0.51	−0.70	−0.88	−0.89	−1.18	−0.92
150°	−0.17	−0.20	−0.21	−0.23	−0.24	−0.17	−0.40	−0.48	−0.68	−0.94	−1.01	−1.39	−1.21
155°	−0.16	−0.20	−0.19	−0.22	−0.25	−0.12	−0.35	−0.42	−0.61	−0.89	−1.01	−1.45	−1.37
160°	−0.16	−0.21	−0.22	−0.20	−0.18	−0.12	−0.29	−0.36	−0.50	−0.75	−0.86	−1.30	−1.26
165°	−0.17	−0.09	−0.06	−0.20	−0.30	−0.01	−0.26	−0.29	−0.41	−0.59	−0.67	−1.03	−0.96
170°	−0.17	−0.17	−0.18	−0.19	−0.18	−0.06	−0.21	−0.25	−0.32	−0.44	−0.49	−0.79	−0.64
175°	−0.15	−0.21	−0.20	−0.19	−0.20	−0.02	−0.19	−0.20	−0.28	−0.35	−0.37	−0.63	−0.42
180°	−0.11	−0.28	−0.29	−0.19	−0.13	−0.05	−0.17	−0.19	−0.26	−0.32	−0.34	−0.58	−0.35
185°	−0.16	−0.18	−0.20	−0.18	−0.12	−0.05	−0.19	−0.20	−0.26	−0.35	−0.39	−0.63	−0.42
190°	−0.14	−0.17	−0.18	−0.19	−0.17	−0.04	−0.21	−0.24	−0.32	−0.45	−0.51	−0.79	−0.64
195°	−0.14	−0.17	−0.17	−0.19	−0.22	−0.04	−0.25	−0.29	−0.41	−0.60	−0.71	−1.04	−0.97
200°	−0.15	−0.19	−0.20	−0.20	−0.20	−0.08	−0.29	−0.35	−0.51	−0.77	−0.90	−1.29	−1.28
205°	−0.16	−0.12	−0.13	−0.21	−0.24	−0.11	−0.34	−0.42	−0.60	−0.90	−1.04	−1.43	−1.39
210°	−0.14	−0.09	−0.10	−0.22	−0.29	−0.11	−0.39	−0.47	−0.68	−0.95	−1.04	−1.37	−1.22
215°	−0.15	−0.24	−0.27	−0.21	−0.18	−0.22	−0.41	−0.51	−0.69	−0.89	−0.90	−1.16	−0.92
220°	−0.12	−0.19	−0.22	−0.23	−0.24	−0.21	−0.44	−0.50	−0.65	−0.73	−0.67	−0.86	−0.59
225°	−0.14	−0.02	−0.08	−0.23	−0.27	−0.20	−0.43	−0.46	−0.54	−0.53	−0.43	−0.59	−0.36
230°	−0.11	−0.34	−0.37	−0.22	−0.18	−0.27	−0.40	−0.39	−0.46	−0.35	−0.25	−0.53	−0.43
235°	−0.14	−0.13	−0.16	−0.22	−0.25	−0.20	−0.36	−0.29	−0.30	−0.23	−0.25	−0.73	−0.75
240°	−0.11	−0.19	−0.20	−0.21	−0.25	−0.17	−0.29	−0.17	−0.20	−0.27	−0.44	−0.96	−0.91
245°	−0.11	−0.10	−0.11	−0.20	−0.29	−0.11	−0.21	−0.06	−0.17	−0.44	−0.66	−1.03	−0.89
250°	−0.11	−0.02	0.01	−0.21	−0.39	0.01	−0.15	0.02	−0.25	−0.59	−0.70	−1.00	−0.81
255°	−0.09	−0.07	−0.08	−0.19	−0.26	−0.01	−0.07	0.01	−0.36	−0.62	−0.66	−0.91	−0.74
260°	−0.12	−0.11	−0.13	−0.16	−0.15	0.00	0.00	−0.03	−0.44	−0.55	−0.57	−0.81	−0.89
265°	−0.06	−0.13	−0.15	−0.16	−0.16	0.08	0.02	−0.11	−0.49	−0.50	−0.48	−0.91	−1.06
270°	−0.07	−0.01	−0.06	−0.14	−0.11	0.12	0.01	−0.19	−0.45	−0.43	−0.47	−1.14	−0.88
275°	−0.03	−0.02	−0.05	−0.14	−0.14	0.20	−0.04	−0.22	−0.42	−0.38	−0.56	−1.11	−0.59
280°	−0.04	−0.07	−0.09	−0.11	−0.05	0.19	−0.09	−0.24	−0.36	−0.40	−0.69	−0.80	−0.49
285°	−0.03	−0.12	−0.18	−0.09	0.06	0.13	−0.11	−0.24	−0.28	−0.46	−0.64	−0.56	−0.49
290°	−0.03	−0.05	−0.07	−0.07	0.01	0.17	−0.14	−0.21	−0.23	−0.49	−0.45	−0.49	−0.54
295°	−0.02	−0.06	−0.08	−0.06	0.02	0.15	−0.17	−0.17	−0.21	−0.43	−0.24	−0.52	−0.56
300°	0.00	0.01	0.01	−0.06	−0.07	0.18	−0.20	−0.12	−0.24	−0.32	−0.12	−0.60	−0.48
305°	−0.03	0.00	0.01	−0.04	−0.04	0.15	−0.20	−0.06	−0.26	−0.17	−0.06	−0.63	−0.27
310°	−0.01	−0.02	−0.02	−0.03	0.01	0.12	−0.18	−0.01	−0.27	−0.06	−0.07	−0.60	−0.08

Table A.17 ***(Continued)*** *Directional response for the sound level meter with Windscreen UA-1650, measured in a plane parallel to the display and along the microphone's axis, 250 Hz – 2.8 kHz*

Angle	Nominal Frequency												
	250 Hz	**315 Hz**	**400 Hz**	**500 Hz**	**630 Hz**	**800 Hz**	**1 kHz**	**1.25 kHz**	**1.6 kHz**	**2 kHz**	**2.24 kHz**	**2.5 kHz**	**2.8 kHz**
315°	0.05	0.01	−0.03	−0.04	0.02	0.08	−0.16	0.01	−0.26	0.01	−0.13	−0.47	−0.03
320°	−0.03	−0.02	−0.01	−0.01	0.03	0.07	−0.13	0.03	−0.24	0.06	−0.17	−0.27	−0.03
325°	0.01	−0.07	−0.07	−0.01	0.05	0.03	−0.10	0.03	−0.20	0.08	−0.19	−0.12	−0.07
330°	0.01	−0.03	−0.05	0.00	0.07	0.02	−0.06	0.04	−0.14	0.08	−0.18	0.00	−0.10
335°	0.02	0.05	0.05	0.00	−0.02	0.05	−0.04	0.03	−0.10	0.06	−0.15	0.04	−0.11
340°	0.00	−0.25	−0.33	0.02	0.31	−0.17	0.01	0.00	−0.03	0.05	−0.09	0.06	−0.08
345°	0.01	−0.01	0.03	0.01	−0.06	0.06	−0.02	0.03	−0.04	0.04	−0.04	0.06	−0.03
350°	0.05	−0.13	−0.11	0.00	0.00	0.02	−0.01	0.02	−0.03	0.02	−0.01	0.02	−0.01
355°	0.01	−0.05	−0.05	0.01	0.04	−0.02	0.01	0.01	0.00	0.02	0.01	0.02	0.01

Table A.18 *Directional response for the sound level meter with Windscreen UA-1650, measured in a plane parallel to the display and along the microphone's axis, 3.15 kHz – 10kHz*

Angle	Nominal Frequency												
	3.15 kHz	3.55 kHz	**4 kHz**	4.5 kHz	**5 kHz**	5.6 kHz	**6.3 kHz**	7.1 kHz	**8 kHz**	8.5 kHz	9 kHz	9.5 kHz	**10 kHz**
0°	−0.02	−0.02	−0.02	−0.02	−0.03	−0.03	−0.03	−0.03	−0.03	−0.04	−0.04	−0.03	−0.03
5°	−0.01	−0.03	−0.02	−0.02	−0.03	−0.02	−0.02	−0.02	−0.05	−0.04	−0.06	−0.03	−0.03
10°	0.01	−0.07	−0.02	−0.01	−0.05	−0.04	−0.04	−0.04	−0.15	−0.13	−0.17	−0.07	−0.09
15°	0.02	−0.13	−0.03	−0.01	−0.11	−0.09	−0.10	−0.07	−0.26	−0.26	−0.28	−0.08	−0.15
20°	0.03	−0.20	−0.02	−0.04	−0.22	−0.20	−0.20	−0.13	−0.45	−0.47	−0.40	−0.15	−0.29
25°	0.02	−0.28	0.00	−0.11	−0.36	−0.34	−0.31	−0.19	−0.66	−0.69	−0.51	−0.36	−0.49
30°	−0.04	−0.32	0.00	−0.26	−0.54	−0.54	−0.47	−0.33	−0.88	−0.98	−0.75	−0.72	−0.66
35°	−0.14	−0.30	−0.05	−0.42	−0.64	−0.69	−0.55	−0.45	−1.03	−1.33	−1.05	−0.96	−0.81
40°	−0.28	−0.24	−0.18	−0.57	−0.71	−0.87	−0.60	−0.61	−1.25	−1.69	−1.38	−1.22	−1.23
45°	−0.41	−0.22	−0.37	−0.66	−0.81	−1.02	−0.71	−0.73	−1.42	−1.90	−1.85	−1.61	−1.62
50°	−0.44	−0.29	−0.45	−0.69	−0.98	−1.19	−0.86	−0.87	−1.59	−2.17	−2.26	−1.99	−1.88
55°	−0.39	−0.44	−0.39	−0.77	−1.12	−1.31	−1.29	−1.03	−1.73	−2.30	−2.47	−2.50	−2.33
60°	−0.34	−0.62	−0.40	−1.00	−1.41	−1.50	−1.41	−1.22	−2.15	−2.68	−2.86	−2.93	−2.93
65°	−0.50	−0.67	−0.45	−0.98	−1.40	−1.77	−1.72	−1.16	−1.86	−2.83	−3.04	−3.13	−3.21
70°	−0.75	−0.58	−0.66	−1.09	−1.69	−1.89	−1.52	−2.30	−2.14	−2.68	−3.14	−3.30	−3.41
75°	−0.89	−0.69	−0.76	−1.11	−1.61	−2.11	−2.27	−1.65	−2.84	−3.26	−3.37	−3.69	−3.87
80°	−0.83	−0.95	−0.74	−1.32	−1.88	−2.41	−2.09	−1.85	−3.19	−3.82	−3.91	−3.92	−4.19
85°	−0.77	−1.05	−0.89	−1.38	−1.88	−2.23	−2.32	−2.72	−2.64	−4.16	−4.38	−4.31	−4.29
90°	−0.84	−0.96	−1.16	−1.50	−2.10	−2.65	−2.71	−2.93	−3.03	−3.90	−4.76	−4.65	−4.59
95°	−1.03	−1.00	−1.13	−1.76	−2.22	−2.64	−2.73	−2.41	−3.41	−4.10	−4.96	−4.81	−4.81
100°	−1.31	−1.13	−1.11	−1.84	−2.46	−2.86	−2.64	−2.50	−4.19	−4.23	−5.19	−5.02	−5.03

Table A.18 (Continued) *Directional response for the sound level meter with Windscreen UA-1650, measured in a plane parallel to the display and along the microphone's axis, 3.15 kHz – 10kHz*

Angle	Nominal Frequency												
	3.15 kHz	3.55 kHz	**4 kHz**	4.5 kHz	**5 kHz**	5.6 kHz	**6.3 kHz**	7.1 kHz	**8 kHz**	8.5 kHz	9 kHz	9.5 kHz	**10 kHz**
105°	−1.18	−1.40	−1.24	−1.78	−2.68	−3.22	−3.11	−3.05	−4.20	−4.26	−5.52	−5.20	−5.59
110°	−0.94	−1.32	−1.46	−1.94	−2.56	−3.27	−3.43	−3.29	−4.60	−4.65	−5.33	−5.41	−6.17
115°	−0.99	−1.02	−1.35	−2.10	−2.76	−3.31	−3.33	−3.39	−4.48	−4.80	−5.75	−5.73	−6.25
120°	−1.09	−1.11	−1.07	−1.93	−2.86	−3.51	−3.54	−3.24	−4.71	−5.64	−5.96	−5.99	−6.53
125°	−1.06	−1.17	−1.22	−1.74	−2.61	−3.49	−3.58	−3.80	−4.54	−5.57	−6.21	−6.90	−6.87
130°	−0.80	−1.08	−1.23	−1.83	−2.51	−3.15	−3.42	−3.37	−4.88	−6.06	−6.51	−6.87	−6.80
135°	−0.52	−0.71	−0.96	−1.82	−2.56	−2.99	−3.10	−2.91	−4.42	−5.19	−6.12	−7.15	−7.19
140°	−0.62	−0.57	−0.57	−1.29	−2.28	−3.16	−2.97	−2.95	−3.94	−4.85	−5.67	−6.18	−6.16
145°	−0.94	−0.86	−0.70	−1.15	−1.74	−2.42	−2.91	−3.03	−3.53	−4.67	−5.28	−5.60	−5.87
150°	−1.29	−1.25	−1.11	−1.55	−2.05	−2.53	−2.24	−2.12	−4.11	−4.79	−5.06	−5.06	−5.21
155°	−1.55	−1.63	−1.60	−1.99	−2.51	−2.90	−2.83	−2.71	−3.03	−4.04	−4.49	−4.97	−5.14
160°	−1.52	−1.73	−1.92	−2.56	−3.25	−3.46	−3.18	−3.08	−4.21	−4.70	−5.06	−5.16	−5.57
165°	−1.18	−1.40	−1.63	−2.48	−3.39	−4.12	−4.49	−4.46	−4.70	−5.46	−5.66	−5.81	−5.73
170°	−0.79	−0.91	−1.01	−1.76	−2.52	−3.36	−3.94	−4.31	−5.63	−6.35	−6.77	−7.31	−7.51
175°	−0.50	−0.55	−0.53	−1.14	−1.71	−2.40	−2.67	−2.71	−4.19	−4.80	−5.17	−5.54	−5.81
180°	−0.41	−0.44	−0.39	−0.97	−1.48	−2.13	−2.32	−2.23	−3.47	−4.10	−4.43	−4.71	−4.99
185°	−0.51	−0.57	−0.57	−1.20	−1.78	−2.51	−2.85	−2.80	−4.10	−4.83	−5.23	−5.68	−6.15
190°	−0.80	−0.95	−1.08	−1.85	−2.65	−3.57	−4.16	−4.25	−5.59	−6.48	−6.94	−7.70	−8.05
195°	−1.24	−1.48	−1.78	−2.61	−3.59	−4.33	−4.50	−4.32	−4.96	−5.71	−6.01	−6.08	−5.93
200°	−1.60	−1.84	−2.07	−2.63	−3.33	−3.53	−3.11	−2.96	−4.16	−4.81	−5.15	−5.38	−5.76
205°	−1.60	−1.67	−1.63	−1.97	−2.46	−2.85	−2.83	−2.76	−3.29	−4.18	−4.63	−4.93	−5.06
210°	−1.31	−1.24	−1.07	−1.48	−2.03	−2.45	−2.26	−2.21	−4.02	−4.73	−4.89	−5.01	−5.07
215°	−0.95	−0.83	−0.66	−1.11	−1.79	−2.51	−3.00	−2.92	−3.43	−4.54	−5.37	−5.69	−5.90
220°	−0.58	−0.51	−0.51	−1.33	−2.34	−3.18	−2.84	−2.90	−3.83	−4.87	−5.63	−5.92	−6.10
225°	−0.45	−0.69	−0.98	−1.81	−2.54	−2.97	−3.20	−2.93	−4.29	−5.08	−6.07	−7.28	−7.34
230°	−0.77	−1.09	−1.22	−1.78	−2.46	−3.15	−3.36	−3.21	−5.04	−5.95	−6.30	−6.79	−6.84
235°	−1.07	−1.16	−1.18	−1.75	−2.69	−3.59	−3.57	−3.75	−4.55	−5.38	−6.10	−7.02	−6.79
240°	−1.05	−1.09	−1.03	−1.97	−2.83	−3.48	−3.56	−3.24	−4.55	−5.53	−5.69	−5.95	−6.37
245°	−0.97	−1.00	−1.39	−2.07	−2.75	−3.32	−3.23	−3.25	−4.06	−4.72	−5.52	−5.57	−5.96
250°	−0.91	−1.32	−1.43	−1.87	−2.51	−3.24	−3.31	−2.88	−4.23	−4.55	−5.09	−5.34	−5.90
255°	−1.17	−1.37	−1.17	−1.76	−2.68	−3.13	−2.99	−2.93	−3.97	−4.25	−5.29	−5.10	−5.28
260°	−1.28	−1.03	−1.08	−1.82	−2.38	−2.77	−2.63	−2.45	−4.07	−4.10	−4.93	−4.88	−4.77
265°	−0.94	−0.95	−1.07	−1.65	−2.14	−2.54	−2.51	−2.29	−3.34	−3.92	−4.67	−4.65	−4.60
270°	−0.77	−0.93	−1.12	−1.43	−1.99	−2.55	−2.56	−2.55	−2.97	−3.64	−4.56	−4.54	−4.38

Table A.18 ***(Continued)*** *Directional response for the sound level meter with Windscreen UA-1650, measured in a plane parallel to the display and along the microphone's axis, 3.15 kHz – 10kHz*

Angle	Nominal Frequency												
	3.15 kHz	3.55 kHz	**4 kHz**	4.5 kHz	**5 kHz**	5.6 kHz	**6.3 kHz**	7.1 kHz	**8 kHz**	8.5 kHz	9 kHz	9.5 kHz	**10 kHz**
275°	−0.74	−1.01	−0.79	−1.33	−1.85	−2.18	−2.29	−2.55	−2.48	−3.92	−4.17	−4.15	−4.08
280°	−0.79	−0.88	−0.68	−1.20	−1.75	−2.25	−1.89	−1.75	−2.90	−3.57	−3.72	−3.73	−3.96
285°	−0.85	−0.60	−0.70	−1.04	−1.55	−2.05	−2.10	−1.48	−2.60	−3.09	−3.20	−3.52	−3.59
290°	−0.68	−0.52	−0.55	−0.99	−1.56	−1.73	−1.43	−2.04	−2.02	−2.55	−3.01	−3.15	−3.16
295°	−0.40	−0.61	−0.36	−0.90	−1.32	−1.66	−1.55	−1.01	−1.70	−2.67	−2.87	−2.94	−2.98
300°	−0.27	−0.54	−0.33	−0.91	−1.33	−1.40	−1.30	−1.07	−2.02	−2.58	−2.77	−2.83	−2.71
305°	−0.32	−0.34	−0.33	−0.66	−1.00	−1.21	−1.11	−0.85	−1.57	−2.17	−2.34	−2.32	−2.09
310°	−0.37	−0.19	−0.36	−0.60	−0.87	−1.08	−0.70	−0.70	−1.49	−2.05	−2.15	−1.86	−1.68
315°	−0.35	−0.15	−0.27	−0.61	−0.71	−0.93	−0.58	−0.59	−1.32	−1.83	−1.73	−1.46	−1.43
320°	−0.22	−0.18	−0.07	−0.50	−0.62	−0.78	−0.50	−0.48	−1.15	−1.58	−1.28	−1.08	−1.01
325°	−0.08	−0.23	0.05	−0.33	−0.55	−0.58	−0.44	−0.30	−0.95	−1.21	−0.91	−0.84	−0.62
330°	0.03	−0.24	0.07	−0.15	−0.44	−0.40	−0.35	−0.21	−0.80	−0.89	−0.63	−0.58	−0.51
335°	0.08	−0.20	0.05	−0.02	−0.28	−0.22	−0.20	−0.12	−0.58	−0.62	−0.43	−0.23	−0.34
340°	0.08	−0.13	0.03	0.04	−0.15	−0.08	−0.07	−0.04	−0.35	−0.37	−0.32	−0.04	−0.16
345°	0.07	−0.06	0.02	0.06	−0.04	0.00	0.02	0.02	−0.17	−0.17	−0.18	0.02	−0.04
350°	0.04	−0.01	0.01	0.03	−0.01	0.02	0.03	0.02	−0.06	−0.05	−0.07	0.03	0.00
355°	0.02	0.01	0.01	0.02	0.02	0.03	0.04	0.03	0.00	0.00	0.01	0.03	0.02

Table A.19 *Directional response for the sound level meter with Windscreen UA-1650, measured in a plane parallel to the display and along the microphone's axis, 10.6 kHz – 20 kHz*

Angle	Nominal Frequency											
	10.6 kHz	11.2 kHz	11.8 kHz	**12.5 kHz**	13.2 kHz	14 kHz	15 kHz	**16 kHz**	17 kHz	18 kHz	19 kHz	**20 kHz**
0°	−0.03	−0.03	−0.03	−0.03	−0.04	−0.03	−0.04	−0.05	−0.05	−0.05	−0.04	−0.02
5°	−0.05	−0.06	−0.08	−0.07	−0.07	−0.09	−0.07	−0.07	−0.10	−0.10	−0.10	−0.09
10°	−0.16	−0.21	−0.22	−0.18	−0.21	−0.27	−0.19	−0.15	−0.21	−0.25	−0.21	−0.24
15°	−0.28	−0.37	−0.40	−0.29	−0.38	−0.53	−0.44	−0.34	−0.48	−0.64	−0.54	−0.58
20°	−0.50	−0.66	−0.68	−0.46	−0.61	−0.85	−0.77	−0.62	−0.86	−1.06	−0.99	−1.02
25°	−0.76	−0.97	−0.99	−0.69	−0.90	−1.23	−1.17	−1.08	−1.24	−1.58	−1.54	−1.60
30°	−1.00	−1.30	−1.38	−1.09	−1.28	−1.60	−1.72	−1.58	−1.68	−2.08	−2.15	−2.12
35°	−1.21	−1.64	−1.76	−1.54	−1.63	−2.03	−2.19	−2.13	−2.16	−2.58	−2.78	−2.73
40°	−1.50	−2.02	−2.22	−2.00	−2.00	−2.47	−2.71	−2.70	−2.80	−3.07	−3.32	−3.37
45°	−1.70	−2.34	−2.72	−2.49	−2.56	−2.90	−3.21	−3.31	−3.52	−3.63	−3.94	−4.17
50°	−2.18	−2.70	−3.07	−3.07	−3.09	−3.38	−3.77	−3.92	−4.26	−4.46	−4.75	−4.95
55°	−2.66	−3.10	−3.47	−3.66	−3.60	−3.98	−4.31	−4.64	−5.06	−5.40	−5.57	−6.01
60°	−2.92	−3.39	−3.91	−4.19	−4.26	−4.60	−4.98	−5.24	−5.82	−6.46	−6.64	−6.76

Table A.19 (Continued) *Directional response for the sound level meter with Windscreen UA-1650, measured in a plane parallel to the display and along the microphone's axis, 10.6 kHz – 20 kHz*

Angle	Nominal Frequency											
	10.6 kHz	11.2 kHz	11.8 kHz	**12.5 kHz**	13.2 kHz	14 kHz	15 kHz	**16 kHz**	17 kHz	18 kHz	19 kHz	**20 kHz**
65°	−3.45	−3.77	−4.44	−4.76	−4.81	−5.48	−5.48	−5.97	−6.63	−7.31	−7.59	−7.96
70°	−3.85	−4.38	−4.84	−5.38	−5.49	−5.99	−6.20	−6.83	−7.34	−8.08	−8.71	−9.05
75°	−4.13	−4.90	−5.33	−5.70	−6.41	−6.45	−7.19	−7.19	−8.07	−9.01	−9.46	−10.06
80°	−4.63	−5.08	−5.86	−6.08	−6.74	−7.57	−7.55	−8.55	−8.89	−9.66	−10.58	−10.95
85°	−4.75	−5.53	−6.05	−6.55	−7.09	−7.76	−8.76	−8.95	−10.16	−10.39	−11.00	−11.75
90°	−4.79	−5.65	−6.56	−6.91	−7.72	−8.46	−8.87	−9.78	−10.89	−11.19	−11.96	−12.60
95°	−5.50	−6.13	−7.08	−7.51	−8.40	−8.81	−9.62	−10.42	−10.89	−11.85	−12.78	−14.38
100°	−5.96	−6.72	−7.51	−7.66	−8.66	−9.42	−9.85	−10.31	−11.17	−12.63	−14.53	−14.77
105°	−6.30	−6.49	−6.92	−8.19	−9.19	−9.96	−10.36	−11.03	−11.84	−13.02	−14.30	−15.11
110°	−6.43	−6.78	−7.89	−8.60	−8.92	−10.09	−10.66	−11.41	−12.57	−13.80	−15.63	−15.27
115°	−6.22	−7.43	−8.22	−8.04	−9.20	−10.72	−10.56	−11.63	−12.80	−14.06	−15.62	−16.08
120°	−6.53	−7.35	−7.42	−8.73	−9.43	−10.60	−11.42	−12.03	−12.53	−14.37	−14.76	−17.08
125°	−7.18	−7.22	−8.43	−8.58	−9.72	−10.78	−10.57	−12.48	−13.21	−14.66	−16.01	−16.67
130°	−7.61	−7.95	−9.31	−9.16	−10.68	−10.58	−11.01	−11.71	−13.40	−14.08	−15.07	−17.38
135°	−7.70	−8.22	−9.18	−10.58	−11.30	−11.66	−11.92	−12.87	−14.06	−14.24	−15.22	−16.44
140°	−6.67	−7.86	−9.32	−10.82	−11.36	−11.73	−12.80	−14.12	−15.39	−15.48	−16.58	−18.64
145°	−6.36	−7.13	−8.13	−9.20	−9.80	−10.81	−12.12	−13.79	−15.26	−15.38	−16.26	−21.45
150°	−5.52	−6.24	−7.98	−9.06	−9.19	−9.69	−10.81	−12.40	−13.20	−13.78	−15.99	−18.00
155°	−5.66	−6.64	−7.73	−7.83	−7.95	−8.60	−10.15	−11.74	−12.46	−13.05	−15.36	−16.22
160°	−6.16	−7.19	−7.81	−7.75	−8.09	−9.03	−10.47	−11.59	−11.78	−12.58	−14.21	−14.94
165°	−6.05	−6.71	−7.65	−8.47	−9.00	−9.94	−11.52	−12.44	−12.64	−13.84	−16.59	−15.95
170°	−8.39	−9.32	−9.69	−9.51	−9.97	−11.12	−12.33	−12.61	−12.51	−13.71	−15.85	−15.09
175°	−6.48	−7.79	−8.65	−9.00	−9.63	−10.85	−12.31	−13.25	−13.57	−14.63	−17.73	−20.56
180°	−5.57	−6.54	−7.19	−7.62	−8.33	−9.37	−10.72	−11.54	−11.88	−12.97	−15.06	−15.53
185°	−6.89	−7.96	−8.67	−9.11	−10.17	−11.49	−13.04	−14.08	−14.59	−16.24	−18.03	−17.73
190°	−8.60	−9.15	−9.66	−10.13	−10.51	−11.35	−12.40	−12.67	−12.53	−13.37	−15.10	−15.38
195°	−6.05	−6.86	−7.58	−8.16	−8.95	−9.97	−11.60	−12.74	−12.92	−13.92	−16.14	−16.17
200°	−6.32	−7.06	−7.53	−7.76	−8.04	−8.77	−10.15	−11.41	−11.43	−12.04	−14.81	−15.13
205°	−5.31	−6.35	−7.56	−7.91	−7.97	−8.45	−9.86	−11.66	−12.30	−12.69	−15.00	−15.73
210°	−5.50	−6.24	−7.49	−8.59	−9.06	−9.45	−10.40	−12.34	−13.02	−13.34	−15.16	−17.69
215°	−6.16	−6.49	−7.62	−8.91	−9.76	−10.53	−11.78	−13.38	−14.90	−15.46	−15.90	−19.89
220°	−6.75	−7.59	−8.69	−10.15	−11.37	−11.55	−12.31	−13.62	−15.58	−15.37	−15.79	−18.43
225°	−7.32	−7.60	−8.56	−10.07	−11.28	−11.49	−11.68	−12.54	−13.82	−13.32	−14.32	−16.03
230°	−7.45	−7.51	−8.32	−9.29	−10.42	−10.35	−10.39	−11.26	−12.64	−13.21	−15.08	−16.67

Table A.19 (Continued) *Directional response for the sound level meter with Windscreen UA-1650, measured in a plane parallel to the display and along the microphone's axis, 10.6 kHz – 20 kHz*

Angle	Nominal Frequency											
	10.6 kHz	11.2 kHz	11.8 kHz	**12.5 kHz**	13.2 kHz	14 kHz	15 kHz	**16 kHz**	17 kHz	18 kHz	19 kHz	**20 kHz**
235°	−6.89	−7.00	−7.72	−8.24	−9.78	−10.20	−10.21	−12.10	−12.61	−13.91	−14.92	−17.04
240°	−6.18	−6.84	−6.91	−8.25	−9.14	−10.42	−10.97	−11.68	−12.21	−13.74	−14.19	−16.61
245°	−5.92	−6.68	−7.45	−7.79	−9.21	−10.24	−10.02	−11.15	−12.60	−13.29	−14.63	−15.57
250°	−6.04	−6.10	−7.25	−8.16	−8.66	−9.64	−9.95	−10.74	−12.38	−13.24	−13.69	−14.76
255°	−5.80	−6.01	−6.39	−7.90	−9.07	−9.59	−9.88	−10.53	−11.47	−12.48	−14.06	−14.71
260°	−5.44	−6.17	−6.65	−7.30	−8.44	−9.05	−9.16	−9.73	−10.82	−11.94	−13.35	−14.70
265°	−5.03	−5.50	−6.35	−7.28	−8.27	−8.49	−9.14	−9.80	−10.46	−11.20	−11.84	−14.11
270°	−4.45	−5.16	−5.94	−6.56	−7.52	−8.11	−8.36	−9.40	−10.42	−10.47	−11.15	−12.47
275°	−4.41	−5.00	−5.41	−6.25	−6.97	−7.44	−8.20	−8.49	−9.69	−9.84	−10.29	−11.60
280°	−4.20	−4.57	−5.25	−5.83	−6.53	−7.16	−7.01	−7.99	−8.47	−9.18	−9.73	−10.77
285°	−3.77	−4.40	−4.81	−5.43	−6.20	−6.09	−6.77	−6.77	−7.75	−8.40	−8.75	−9.93
290°	−3.52	−3.94	−4.38	−5.11	−5.29	−5.71	−5.79	−6.46	−6.93	−7.50	−8.00	−9.05
295°	−3.09	−3.39	−3.96	−4.48	−4.60	−5.18	−5.12	−5.60	−6.23	−6.71	−7.03	−8.05
300°	−2.61	−3.02	−3.49	−3.98	−4.09	−4.37	−4.68	−4.91	−5.44	−5.98	−6.08	−6.71
305°	−2.34	−2.70	−3.08	−3.44	−3.39	−3.70	−3.94	−4.26	−4.70	−4.92	−5.00	−5.88
310°	−1.90	−2.38	−2.71	−2.88	−2.91	−3.13	−3.48	−3.62	−3.98	−4.05	−4.21	−4.88
315°	−1.45	−2.08	−2.38	−2.29	−2.37	−2.68	−2.94	−3.10	−3.28	−3.22	−3.50	−4.16
320°	−1.26	−1.76	−1.93	−1.81	−1.82	−2.28	−2.51	−2.50	−2.55	−2.68	−2.96	−3.46
325°	−1.00	−1.42	−1.50	−1.34	−1.45	−1.82	−2.00	−1.93	−1.88	−2.19	−2.39	−2.75
330°	−0.83	−1.11	−1.15	−0.90	−1.11	−1.45	−1.56	−1.38	−1.39	−1.74	−1.82	−2.15
335°	−0.59	−0.79	−0.77	−0.53	−0.77	−1.12	−1.04	−0.89	−1.01	−1.32	−1.27	−1.58
340°	−0.35	−0.50	−0.48	−0.32	−0.48	−0.75	−0.65	−0.44	−0.63	−0.85	−0.72	−0.98
345°	−0.16	−0.25	−0.24	−0.15	−0.25	−0.45	−0.34	−0.17	−0.31	−0.46	−0.36	−0.57
350°	−0.06	−0.09	−0.08	−0.06	−0.12	−0.22	−0.12	−0.05	−0.13	−0.15	−0.13	−0.22
355°	0.01	0.00	0.01	0.01	−0.01	−0.04	0.00	0.02	0.00	0.00	0.00	−0.04

Table A.20 *Directional response for the sound level meter with Windscreen UA-1650, measured in a plane perpendicular to the display and along the microphone's axis, 250 Hz – 2.8 kHz*

Angle	Nominal Frequency												
	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.24 kHz	2.5 kHz	2.8 kHz
0°	−0.02	0.02	0.04	0.01	0.00	0.03	−0.02	−0.01	−0.02	−0.02	0.00	−0.01	−0.02
5°	0.01	−0.11	−0.11	0.01	0.10	−0.02	−0.01	−0.01	−0.03	−0.02	0.00	−0.01	−0.02
10°	0.02	−0.13	−0.17	0.00	0.15	−0.07	−0.02	−0.03	−0.03	0.00	−0.01	0.01	−0.03
15°	0.01	−0.06	−0.08	0.01	0.09	−0.03	−0.04	−0.02	−0.06	0.00	−0.07	0.01	−0.07
20°	−0.03	0.09	0.04	0.00	0.08	−0.03	−0.05	−0.02	−0.08	0.02	−0.12	0.00	−0.11
25°	0.02	−0.01	−0.02	−0.02	0.02	0.01	−0.08	−0.01	−0.16	0.03	−0.17	−0.02	−0.14
30°	0.02	−0.10	−0.12	−0.01	0.08	−0.02	−0.10	−0.02	−0.21	0.04	−0.20	−0.10	−0.15
35°	0.01	−0.02	−0.03	−0.02	0.01	0.03	−0.13	0.00	−0.24	0.06	−0.20	−0.19	−0.11
40°	−0.02	−0.05	−0.07	−0.02	0.08	0.01	−0.16	−0.03	−0.28	0.03	−0.17	−0.36	−0.10
45°	−0.02	−0.11	−0.14	−0.03	0.11	0.01	−0.18	−0.04	−0.31	−0.01	−0.09	−0.53	−0.08
50°	−0.03	−0.18	−0.22	−0.03	0.17	0.00	−0.19	−0.07	−0.31	−0.09	−0.04	−0.65	−0.16
55°	−0.05	−0.05	−0.05	−0.05	0.02	0.10	−0.23	−0.11	−0.31	−0.21	−0.03	−0.65	−0.35
60°	−0.07	−0.05	−0.05	−0.05	0.02	0.11	−0.22	−0.17	−0.28	−0.36	−0.09	−0.57	−0.55
65°	−0.07	−0.10	−0.10	−0.06	0.02	0.12	−0.21	−0.22	−0.27	−0.50	−0.24	−0.48	−0.60
70°	−0.07	−0.12	−0.14	−0.07	0.06	0.11	−0.18	−0.26	−0.27	−0.57	−0.46	−0.45	−0.51
75°	−0.08	−0.15	−0.18	−0.10	0.06	0.12	−0.15	−0.27	−0.33	−0.55	−0.68	−0.57	−0.39
80°	−0.07	−0.12	−0.15	−0.12	−0.02	0.15	−0.12	−0.28	−0.41	−0.47	−0.75	−0.86	−0.43
85°	−0.06	−0.18	−0.22	−0.14	−0.03	0.11	−0.06	−0.27	−0.46	−0.45	−0.61	−1.20	−0.63
90°	−0.09	−0.11	−0.14	−0.15	−0.09	0.10	−0.02	−0.22	−0.49	−0.51	−0.50	−1.21	−0.98
95°	−0.08	−0.16	−0.22	−0.17	−0.06	0.01	0.01	−0.15	−0.49	−0.58	−0.55	−0.91	−1.17
100°	−0.10	−0.15	−0.18	−0.17	−0.14	−0.01	−0.02	−0.06	−0.46	−0.64	−0.68	−0.78	−0.90
105°	−0.14	−0.26	−0.25	−0.18	−0.17	−0.07	−0.07	−0.01	−0.37	−0.68	−0.78	−0.98	−0.67
110°	−0.11	−0.19	−0.24	−0.20	−0.16	−0.14	−0.14	−0.03	−0.22	−0.61	−0.80	−1.17	−0.82
115°	−0.13	−0.15	−0.18	−0.21	−0.22	−0.16	−0.22	−0.09	−0.15	−0.43	−0.70	−1.19	−1.08
120°	−0.11	−0.08	−0.13	−0.23	−0.26	−0.17	−0.30	−0.18	−0.17	−0.21	−0.43	−1.02	−1.07
125°	−0.13	−0.22	−0.23	−0.22	−0.26	−0.20	−0.36	−0.30	−0.31	−0.14	−0.18	−0.67	−0.79
130°	−0.15	−0.17	−0.21	−0.23	−0.22	−0.24	−0.41	−0.40	−0.45	−0.25	−0.16	−0.41	−0.35
135°	−0.14	−0.13	−0.17	−0.23	−0.25	−0.22	−0.44	−0.47	−0.58	−0.46	−0.35	−0.50	−0.19
140°	−0.13	−0.25	−0.32	−0.22	−0.12	−0.28	−0.43	−0.51	−0.66	−0.68	−0.61	−0.84	−0.45
145°	−0.15	−0.24	−0.28	−0.22	−0.16	−0.23	−0.43	−0.51	−0.70	−0.85	−0.83	−1.19	−0.86
150°	−0.15	−0.08	−0.08	−0.22	−0.31	−0.11	−0.41	−0.47	−0.69	−0.93	−0.98	−1.42	−1.23
155°	−0.13	−0.21	−0.25	−0.20	−0.17	−0.17	−0.33	−0.42	−0.60	−0.89	−1.00	−1.48	−1.42
160°	−0.14	−0.15	−0.17	−0.21	−0.22	−0.11	−0.28	−0.35	−0.50	−0.76	−0.89	−1.32	−1.31
165°	−0.13	−0.12	−0.14	−0.20	−0.23	−0.08	−0.22	−0.28	−0.39	−0.59	−0.71	−1.04	−0.98

Table A.20 ***(Continued)*** *Directional response for the sound level meter with Windscreen UA-1650, measured in a plane perpendicular to the display and along the microphone's axis, 250 Hz – 2.8 kHz*

Angle	Nominal Frequency												
	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.24 kHz	2.5 kHz	2.8 kHz
170°	−0.15	−0.13	−0.16	−0.19	−0.18	−0.08	−0.18	−0.23	−0.29	−0.43	−0.52	−0.77	−0.64
175°	−0.12	−0.23	−0.27	−0.19	−0.12	−0.08	−0.16	−0.19	−0.25	−0.34	−0.40	−0.61	−0.42
180°	−0.10	−0.17	−0.21	−0.20	−0.16	−0.05	−0.16	−0.18	−0.23	−0.29	−0.34	−0.54	−0.33
185°	−0.16	−0.21	−0.23	−0.17	−0.09	−0.08	−0.17	−0.20	−0.25	−0.34	−0.39	−0.61	−0.40
190°	−0.16	−0.01	−0.10	−0.19	−0.09	−0.09	−0.19	−0.25	−0.28	−0.42	−0.51	−0.76	−0.62
195°	−0.15	−0.12	−0.16	−0.19	−0.15	−0.08	−0.23	−0.29	−0.38	−0.56	−0.68	−1.00	−0.93
200°	−0.15	−0.16	−0.19	−0.19	−0.17	−0.11	−0.28	−0.36	−0.49	−0.75	−0.91	−1.30	−1.30
205°	−0.16	−0.19	−0.23	−0.20	−0.14	−0.16	−0.33	−0.43	−0.59	−0.92	−1.09	−1.50	−1.49
210°	−0.13	−0.21	−0.25	−0.21	−0.18	−0.18	−0.38	−0.49	−0.68	−0.99	−1.12	−1.47	−1.35
215°	−0.14	−0.20	−0.24	−0.22	−0.20	−0.21	−0.42	−0.53	−0.71	−0.96	−1.00	−1.26	−1.01
220°	−0.11	−0.13	−0.19	−0.24	−0.24	−0.22	−0.44	−0.53	−0.67	−0.82	−0.76	−0.92	−0.58
225°	−0.13	−0.22	−0.26	−0.24	−0.22	−0.24	−0.44	−0.50	−0.60	−0.60	−0.46	−0.57	−0.23
230°	−0.13	−0.23	−0.28	−0.23	−0.21	−0.26	−0.41	−0.43	−0.47	−0.36	−0.21	−0.42	−0.27
235°	−0.15	−0.15	−0.18	−0.22	−0.25	−0.21	−0.38	−0.32	−0.32	−0.21	−0.19	−0.63	−0.70
240°	−0.12	−0.21	−0.24	−0.23	−0.24	−0.19	−0.32	−0.20	−0.21	−0.23	−0.40	−0.98	−1.06
245°	−0.11	−0.18	−0.25	−0.22	−0.15	−0.21	−0.23	−0.10	−0.15	−0.41	−0.68	−1.16	−1.09
250°	−0.12	−0.11	−0.14	−0.21	−0.23	−0.11	−0.16	−0.01	−0.23	−0.60	−0.81	−1.13	−0.86
255°	−0.12	−0.14	−0.17	−0.19	−0.18	−0.09	−0.07	0.00	−0.35	−0.68	−0.77	−0.94	−0.63
260°	−0.12	−0.14	−0.17	−0.16	−0.14	−0.03	−0.01	−0.04	−0.46	−0.64	−0.64	−0.74	−0.77
265°	−0.09	−0.16	−0.19	−0.17	−0.12	0.01	0.02	−0.13	−0.52	−0.56	−0.49	−0.81	−1.11
270°	−0.07	−0.11	−0.15	−0.15	−0.10	0.07	0.01	−0.20	−0.50	−0.45	−0.41	−1.11	−1.04
275°	−0.04	−0.12	−0.17	−0.15	−0.07	0.11	−0.03	−0.25	−0.45	−0.37	−0.50	−1.20	−0.73
280°	−0.05	−0.13	−0.20	−0.12	0.03	0.09	−0.09	−0.28	−0.38	−0.37	−0.66	−0.96	−0.55
285°	−0.05	−0.11	−0.14	−0.11	−0.02	0.13	−0.13	−0.27	−0.31	−0.44	−0.68	−0.69	−0.48
290°	−0.07	−0.06	−0.09	−0.08	0.02	0.11	−0.15	−0.25	−0.23	−0.49	−0.52	−0.57	−0.53
295°	−0.06	−0.05	−0.06	−0.07	−0.03	0.14	−0.18	−0.19	−0.22	−0.45	−0.32	−0.57	−0.57
300°	−0.01	−0.05	−0.09	−0.07	0.01	0.10	−0.19	−0.14	−0.22	−0.34	−0.18	−0.60	−0.47
305°	−0.01	0.00	−0.03	−0.06	−0.01	0.11	−0.20	−0.08	−0.25	−0.20	−0.12	−0.64	−0.28
310°	−0.02	0.02	0.00	−0.04	−0.01	0.08	−0.19	−0.04	−0.27	−0.09	−0.13	−0.61	−0.09
315°	0.04	−0.02	−0.07	−0.05	0.03	0.04	−0.17	0.00	−0.27	−0.01	−0.17	−0.47	−0.02
320°	−0.01	−0.13	−0.15	−0.02	0.11	−0.01	−0.13	0.02	−0.24	0.04	−0.21	−0.27	−0.05
325°	−0.01	−0.03	−0.05	−0.02	0.04	0.01	−0.10	0.03	−0.20	0.06	−0.24	−0.11	−0.10
330°	0.02	−0.11	−0.12	−0.02	0.03	0.00	−0.07	0.04	−0.16	0.06	−0.22	0.00	−0.14
335°	0.01	0.02	0.00	−0.02	0.01	0.00	−0.04	0.03	−0.11	0.05	−0.19	0.05	−0.15

Table A.20 ***(Continued)*** *Directional response for the sound level meter with Windscreen UA-1650, measured in a plane perpendicular to the display and along the microphone's axis, 250 Hz – 2.8 kHz*

Angle	Nominal Frequency												
	250 Hz	**315 Hz**	**400 Hz**	**500 Hz**	**630 Hz**	**800 Hz**	**1 kHz**	**1.25 kHz**	**1.6 kHz**	**2 kHz**	**2.24 kHz**	**2.5 kHz**	**2.8 kHz**
340°	0.01	−0.01	−0.03	−0.01	0.02	−0.01	−0.03	0.03	−0.06	0.05	−0.12	0.07	−0.10
345°	0.02	0.01	−0.01	0.00	0.02	−0.02	−0.01	0.02	−0.03	0.03	−0.08	0.06	−0.07
350°	0.03	0.17	0.10	−0.02	0.01	−0.01	0.00	0.02	0.03	0.03	−0.04	0.04	−0.03
355°	0.01	−0.03	−0.03	0.00	0.01	−0.02	0.02	0.03	0.02	0.03	0.00	0.03	0.01

Table A.21 *Directional response for the sound level meter with Windscreen UA-1650, measured in a plane perpendicular to the display and along the microphone's axis, 3.15 kHz – 10 kHz*

Angle	Nominal Frequency												
	3.15 kHz	3.55 kHz	**4 kHz**	4.5 kHz	**5 kHz**	5.6 kHz	**6.3 kHz**	7.1 kHz	**8 kHz**	8.5 kHz	9 kHz	9.5 kHz	**10 kHz**
0°	0.00	−0.01	−0.01	−0.02	−0.02	−0.02	−0.02	−0.02	−0.02	−0.02	−0.03	−0.02	−0.02
5°	0.00	−0.02	−0.01	−0.01	−0.02	0.00	0.00	0.00	−0.03	0.00	−0.05	0.00	0.00
10°	0.02	−0.05	−0.02	0.00	−0.04	−0.01	−0.01	0.00	−0.12	−0.07	−0.17	−0.01	−0.04
15°	0.04	−0.09	−0.02	0.01	−0.08	−0.05	−0.07	−0.02	−0.21	−0.19	−0.28	0.01	−0.08
20°	0.04	−0.16	−0.02	−0.01	−0.19	−0.17	−0.20	−0.10	−0.36	−0.45	−0.37	−0.07	−0.24
25°	0.03	−0.23	0.01	−0.07	−0.34	−0.37	−0.39	−0.21	−0.51	−0.72	−0.38	−0.30	−0.43
30°	−0.02	−0.29	0.01	−0.22	−0.54	−0.62	−0.57	−0.44	−0.77	−1.01	−0.64	−0.71	−0.59
35°	−0.10	−0.27	0.00	−0.40	−0.63	−0.68	−0.46	−0.46	−1.04	−1.24	−1.09	−0.81	−0.71
40°	−0.23	−0.25	−0.14	−0.58	−0.66	−0.71	−0.36	−0.40	−1.22	−1.52	−1.44	−0.97	−1.22
45°	−0.31	−0.21	−0.30	−0.58	−0.67	−0.83	−0.66	−0.62	−1.30	−1.84	−1.76	−1.67	−1.41
50°	−0.34	−0.28	−0.40	−0.54	−0.96	−1.22	−1.17	−0.99	−1.60	−2.06	−2.15	−1.97	−1.70
55°	−0.30	−0.41	−0.32	−0.63	−1.22	−1.36	−1.20	−0.79	−1.63	−2.21	−2.36	−2.34	−2.41
60°	−0.29	−0.58	−0.30	−1.03	−1.41	−1.30	−1.11	−1.06	−1.96	−2.69	−2.79	−2.82	−2.73
65°	−0.50	−0.60	−0.41	−1.03	−1.19	−1.79	−1.77	−1.58	−1.77	−2.57	−2.93	−2.97	−3.08
70°	−0.78	−0.50	−0.70	−0.94	−1.61	−1.98	−1.41	−1.89	−1.95	−2.64	−3.03	−3.19	−3.34
75°	−0.88	−0.64	−0.78	−0.96	−1.69	−1.88	−2.22	−1.56	−3.19	−3.11	−3.35	−3.63	−3.73
80°	−0.69	−0.96	−0.64	−1.41	−1.62	−2.29	−2.20	−1.75	−2.63	−4.06	−3.90	−3.84	−4.22
85°	−0.56	−1.02	−0.81	−1.43	−1.79	−2.27	−1.98	−2.94	−2.60	−3.63	−4.58	−4.44	−4.17
90°	−0.71	−0.76	−1.18	−1.31	−2.35	−2.34	−2.95	−2.70	−2.82	−3.86	−4.50	−4.70	−4.73
95°	−1.07	−0.79	−0.97	−1.69	−2.06	−2.85	−2.37	−2.14	−3.78	−3.72	−4.95	−4.85	−4.57
100°	−1.42	−1.16	−0.78	−1.81	−2.34	−2.88	−2.73	−2.62	−3.86	−4.18	−5.15	−5.03	−4.95
105°	−1.17	−1.60	−1.22	−1.42	−2.71	−2.97	−3.38	−2.99	−4.59	−4.18	−5.18	−5.41	−5.27
110°	−0.79	−1.36	−1.77	−1.88	−2.10	−3.32	−2.96	−3.75	−4.09	−4.43	−5.58	−5.24	−5.85
115°	−0.96	−0.90	−1.46	−2.55	−2.82	−2.85	−3.48	−2.71	−4.89	−5.25	−5.39	−5.58	−6.40
120°	−1.21	−1.09	−0.86	−1.94	−3.41	−3.65	−2.86	−3.48	−3.93	−5.10	−6.28	−6.43	−6.48
125°	−1.16	−1.35	−1.22	−1.46	−2.41	−4.04	−4.17	−3.00	−4.59	−5.64	−5.74	−6.11	−6.76

Table A.21 (Continued) *Directional response for the sound level meter with Windscreen UA-1650, measured in a plane perpendicular to the display and along the microphone's axis, 3.15 kHz – 10 kHz*

Angle	Nominal Frequency												
	3.15 kHz	3.55 kHz	**4 kHz**	4.5 kHz	**5 kHz**	5.6 kHz	**6.3 kHz**	7.1 kHz	**8 kHz**	8.5 kHz	9 kHz	9.5 kHz	**10 kHz**
130°	−0.72	−1.15	−1.46	−1.99	−2.28	−2.83	−3.80	−4.62	−4.35	−5.15	−6.13	−6.95	−6.62
135°	−0.30	−0.55	−0.95	−2.08	−2.99	−3.13	−2.66	−2.63	−5.74	−6.29	−6.61	−6.71	−6.67
140°	−0.40	−0.29	−0.27	−1.09	−2.34	−3.54	−3.49	−2.97	−3.19	−4.55	−6.02	−7.25	−7.33
145°	−0.84	−0.67	−0.40	−0.72	−1.27	−2.03	−2.95	−3.87	−4.28	−4.96	−5.06	−4.91	−5.31
150°	−1.29	−1.22	−0.99	−1.29	−1.64	−1.89	−1.47	−1.35	−4.16	−5.20	−5.87	−6.05	−5.93
155°	−1.62	−1.69	−1.66	−2.03	−2.50	−2.78	−2.46	−1.78	−1.87	−2.88	−3.43	−4.01	−4.42
160°	−1.60	−1.80	−2.03	−2.72	−3.47	−3.69	−3.38	−3.25	−3.87	−4.13	−4.29	−4.14	−4.49
165°	−1.24	−1.44	−1.70	−2.60	−3.59	−4.34	−4.81	−4.95	−5.16	−5.83	−6.00	−5.97	−5.92
170°	−0.80	−0.90	−1.02	−1.79	−2.56	−3.42	−4.08	−4.55	−5.88	−6.65	−7.08	−7.71	−7.80
175°	−0.50	−0.54	−0.52	−1.14	−1.71	−2.41	−2.73	−2.78	−4.23	−4.86	−5.22	−5.60	−5.79
180°	−0.39	−0.40	−0.34	−0.91	−1.41	−2.06	−2.27	−2.17	−3.36	−3.97	−4.27	−4.50	−4.70
185°	−0.48	−0.52	−0.52	−1.13	−1.69	−2.43	−2.79	−2.76	−3.96	−4.69	−5.07	−5.51	−5.90
190°	−0.75	−0.88	−1.01	−1.76	−2.55	−3.49	−4.18	−4.39	−5.76	−6.78	−7.39	−8.40	−8.88
195°	−1.16	−1.42	−1.73	−2.59	−3.64	−4.51	−4.91	−5.01	−5.82	−6.64	−6.97	−6.91	−6.63
200°	−1.60	−1.91	−2.24	−2.91	−3.73	−4.01	−3.59	−3.43	−4.42	−4.77	−4.73	−4.53	−4.60
205°	−1.72	−1.87	−1.89	−2.26	−2.70	−2.94	−2.66	−2.22	−2.28	−2.92	−3.32	−3.65	−4.12
210°	−1.44	−1.38	−1.16	−1.44	−1.78	−1.97	−1.60	−1.40	−3.57	−4.87	−5.77	−6.40	−6.37
215°	−0.98	−0.77	−0.45	−0.75	−1.26	−2.06	−3.01	−3.86	−4.54	−5.24	−5.48	−5.11	−5.21
220°	−0.46	−0.28	−0.18	−1.04	−2.27	−3.67	−3.54	−3.03	−3.17	−4.22	−5.51	−6.83	−7.32
225°	−0.24	−0.47	−0.91	−2.10	−3.16	−3.24	−2.80	−2.49	−5.30	−6.37	−6.68	−6.74	−6.56
230°	−0.65	−1.18	−1.56	−2.07	−2.38	−2.74	−3.54	−4.35	−4.71	−5.09	−5.85	−7.18	−7.06
235°	−1.21	−1.44	−1.28	−1.46	−2.36	−4.06	−4.08	−3.07	−4.74	−5.96	−6.03	−6.20	−6.48
240°	−1.29	−1.13	−0.78	−1.84	−3.37	−3.66	−3.02	−3.69	−4.25	−4.85	−5.83	−6.43	−6.37
245°	−1.03	−0.78	−1.30	−2.57	−2.91	−2.92	−3.66	−2.88	−4.41	−5.23	−5.54	−5.73	−6.34
250°	−0.73	−1.22	−1.85	−1.97	−2.23	−3.60	−3.00	−3.23	−4.25	−4.53	−5.59	−5.26	−5.94
255°	−1.04	−1.64	−1.31	−1.52	−2.89	−2.90	−3.21	−3.03	−4.38	−4.37	−5.17	−5.19	−5.31
260°	−1.44	−1.23	−0.88	−1.94	−2.26	−2.78	−2.91	−2.63	−3.76	−4.22	−5.15	−4.86	−4.97
265°	−1.18	−0.89	−1.06	−1.73	−1.98	−3.05	−2.48	−2.38	−3.55	−4.02	−4.90	−4.57	−4.63
270°	−0.82	−0.85	−1.27	−1.19	−2.48	−2.40	−2.92	−2.69	−2.91	−4.02	−4.53	−4.53	−4.35
275°	−0.67	−1.08	−0.71	−1.43	−1.95	−2.34	−2.00	−2.79	−2.78	−3.86	−4.31	−4.14	−4.19
280°	−0.74	−0.97	−0.56	−1.58	−1.58	−2.36	−2.26	−1.68	−2.89	−3.78	−3.76	−3.81	−3.88
285°	−0.89	−0.55	−0.85	−1.09	−1.74	−1.83	−2.27	−1.76	−2.89	−3.08	−3.28	−3.46	−3.61
290°	−0.75	−0.45	−0.85	−0.89	−1.71	−2.06	−1.41	−1.88	−2.01	−2.65	−3.00	−3.27	−3.34
295°	−0.42	−0.64	−0.44	−1.00	−1.18	−1.84	−1.77	−1.27	−1.91	−2.66	−3.14	−3.14	−2.96

Table A.21 ***(Continued)*** *Directional response for the sound level meter with Windscreen UA-1650, measured in a plane perpendicular to the display and along the microphone's axis, 3.15 kHz – 10 kHz*

Angle	Nominal Frequency												
	3.15 kHz	3.55 kHz	**4 kHz**	4.5 kHz	**5 kHz**	5.6 kHz	**6.3 kHz**	7.1 kHz	**8 kHz**	8.5 kHz	9 kHz	9.5 kHz	**10 kHz**
300°	−0.24	−0.68	−0.23	−1.06	−1.39	−1.33	−1.11	−1.23	−1.94	−2.75	−2.85	−2.74	−2.79
305°	−0.32	−0.48	−0.27	−0.66	−1.27	−1.34	−1.14	−0.85	−1.70	−2.26	−2.36	−2.37	−2.22
310°	−0.43	−0.28	−0.44	−0.51	−0.98	−1.28	−1.09	−0.83	−1.68	−2.15	−2.09	−2.00	−1.68
315°	−0.41	−0.15	−0.37	−0.54	−0.62	−0.82	−0.77	−0.52	−1.31	−1.79	−1.83	−1.54	−1.36
320°	−0.30	−0.17	−0.15	−0.57	−0.56	−0.58	−0.43	−0.46	−1.23	−1.52	−1.45	−1.06	−1.12
325°	−0.14	−0.25	0.01	−0.46	−0.60	−0.54	−0.39	−0.48	−1.04	−1.28	−1.08	−0.77	−0.75
330°	−0.02	−0.27	0.07	−0.26	−0.53	−0.51	−0.35	−0.36	−0.79	−0.94	−0.72	−0.60	−0.57
335°	0.04	−0.24	0.05	−0.10	−0.38	−0.40	−0.26	−0.21	−0.62	−0.64	−0.45	−0.36	−0.35
340°	0.08	−0.15	0.04	0.02	−0.18	−0.21	−0.11	−0.06	−0.40	−0.38	−0.25	−0.14	−0.12
345°	0.06	−0.09	0.01	0.04	−0.07	−0.10	−0.03	0.00	−0.23	−0.22	−0.15	−0.06	−0.06
350°	0.03	−0.03	0.01	0.03	−0.01	−0.03	0.00	0.01	−0.09	−0.09	−0.05	0.00	−0.01
355°	0.02	0.01	0.02	0.03	0.02	0.01	0.02	0.03	0.00	−0.01	0.03	0.03	0.03

Table A.22 *Directional response for the sound level meter with Windscreen UA-1650, measured in a plane perpendicular to the display and along the microphone's axis, 10.6 kHz – 20 kHz*

Angle	Nominal Frequency											
	10.6 kHz	11.2 kHz	11.8 kHz	**12.5 kHz**	13.2 kHz	14 kHz	15 kHz	**16 kHz**	17 kHz	18 kHz	19 kHz	**20 kHz**
0°	−0.02	−0.03	−0.02	−0.01	−0.03	−0.02	−0.03	−0.03	−0.03	−0.04	−0.02	0.00
5°	−0.02	−0.04	−0.06	−0.04	−0.05	−0.05	−0.03	−0.02	−0.05	−0.05	−0.07	−0.05
10°	−0.08	−0.14	−0.16	−0.10	−0.13	−0.22	−0.15	−0.09	−0.21	−0.21	−0.23	−0.19
15°	−0.22	−0.37	−0.39	−0.23	−0.32	−0.51	−0.40	−0.27	−0.50	−0.66	−0.53	−0.54
20°	−0.48	−0.68	−0.65	−0.38	−0.55	−0.82	−0.78	−0.63	−0.87	−1.10	−1.02	−1.08
25°	−0.69	−0.91	−0.87	−0.61	−0.83	−1.13	−1.09	−1.02	−1.14	−1.44	−1.49	−1.45
30°	−0.89	−1.24	−1.34	−1.13	−1.23	−1.56	−1.69	−1.48	−1.58	−2.07	−2.12	−2.11
35°	−1.10	−1.62	−1.76	−1.45	−1.45	−1.95	−2.12	−2.11	−2.18	−2.52	−2.70	−2.70
40°	−1.42	−1.91	−2.17	−1.90	−1.99	−2.40	−2.64	−2.69	−2.76	−3.00	−3.47	−3.38
45°	−1.61	−2.21	−2.71	−2.46	−2.44	−2.75	−3.16	−3.29	−3.55	−3.68	−3.87	−3.97
50°	−2.23	−2.66	−3.00	−3.04	−3.07	−3.41	−3.70	−3.93	−4.32	−4.53	−4.78	−5.05
55°	−2.28	−3.01	−3.43	−3.59	−3.51	−3.81	−4.32	−4.56	−5.03	−5.36	−5.52	−5.86
60°	−3.06	−3.09	−3.94	−3.98	−4.20	−4.48	−4.83	−5.22	−5.76	−6.32	−6.50	−6.74
65°	−3.18	−3.93	−4.45	−4.63	−4.66	−5.40	−5.56	−5.81	−6.60	−7.33	−7.66	−7.98
70°	−3.82	−4.03	−5.06	−5.27	−5.31	−6.04	−6.10	−6.92	−7.35	−8.04	−8.52	−8.92
75°	−4.16	−4.89	−5.01	−5.93	−6.09	−6.41	−7.22	−7.38	−8.08	−8.83	−9.55	−9.95
80°	−4.40	−5.24	−5.83	−5.76	−7.02	−7.16	−7.57	−8.56	−9.07	−9.57	−10.20	−11.04
85°	−4.78	−5.22	−6.37	−6.36	−6.81	−8.05	−8.59	−8.89	−10.38	−10.25	−10.96	−11.72

Table A.22 (Continued) *Directional response for the sound level meter with Windscreen UA-1650, measured in a plane perpendicular to the display and along the microphone's axis, 10.6 kHz – 20 kHz*

Angle	Nominal Frequency											
	10.6 kHz	11.2 kHz	11.8 kHz	**12.5 kHz**	13.2 kHz	14 kHz	15 kHz	**16 kHz**	17 kHz	18 kHz	19 kHz	**20 kHz**
90°	−4.79	−5.43	−6.41	−7.11	−7.42	−8.41	−8.70	−10.40	−10.46	−11.22	−11.52	−13.01
95°	−5.14	−6.37	−6.54	−7.57	−8.04	−8.96	−9.69	−10.17	−10.85	−11.93	−12.73	−14.79
100°	−5.65	−6.56	−7.84	−7.86	−8.49	−9.23	−9.96	−10.26	−11.41	−12.45	−14.51	−15.10
105°	−6.45	−6.64	−7.16	−7.58	−9.49	−9.86	−10.47	−10.76	−12.04	−13.19	−15.47	−14.20
110°	−6.47	−6.37	−7.90	−8.57	−9.18	−9.38	−11.10	−11.30	−12.64	−13.67	−14.42	−15.50
115°	−6.13	−7.36	−8.46	−8.00	−9.32	−10.76	−11.34	−11.07	−13.26	−14.40	−16.27	−15.73
120°	−6.35	−7.84	−7.31	−8.69	−9.42	−9.98	−11.79	−12.12	−13.47	−14.13	−14.33	−18.33
125°	−7.53	−7.51	−8.28	−9.19	−9.41	−11.03	−10.81	−11.88	−13.79	−14.52	−16.21	−17.19
130°	−6.90	−7.12	−9.69	−9.29	−10.72	−10.91	−11.82	−11.30	−14.04	−14.56	−14.49	−17.62
135°	−7.46	−8.03	−8.89	−9.48	−10.61	−11.60	−11.60	−13.04	−14.82	−15.09	−14.22	−17.53
140°	−7.84	−8.23	−9.34	−10.75	−11.48	−11.63	−12.02	−13.16	−15.41	−15.12	−15.95	−19.30
145°	−5.96	−7.23	−9.49	−10.90	−11.03	−11.66	−12.81	−14.96	−16.54	−15.57	−16.01	−19.45
150°	−6.22	−6.63	−7.79	−8.30	−8.59	−9.74	−11.83	−14.16	−14.62	−14.82	−16.79	−21.06
155°	−5.22	−6.91	−8.91	−9.13	−9.03	−9.51	−10.70	−11.86	−12.24	−12.71	−15.12	−17.70
160°	−4.85	−5.30	−5.84	−6.12	−6.55	−7.80	−9.80	−11.82	−12.74	−13.89	−16.73	−15.68
165°	−6.16	−7.02	−7.91	−8.13	−8.35	−9.06	−10.26	−10.71	−10.66	−11.61	−13.71	−13.20
170°	−8.88	−9.91	−10.40	−10.39	−10.64	−11.72	−13.02	−13.47	−13.41	−14.63	−17.22	−15.93
175°	−6.61	−7.93	−8.96	−9.40	−9.91	−11.24	−12.82	−13.87	−14.33	−15.46	−18.96	−23.73
180°	−5.38	−6.34	−7.09	−7.43	−7.99	−9.07	−10.39	−11.16	−11.44	−12.48	−14.78	−15.56
185°	−6.85	−7.89	−8.67	−9.03	−9.99	−11.43	−13.15	−14.30	−14.92	−17.01	−19.84	−18.90
190°	−9.75	−10.44	−10.93	−11.73	−12.42	−13.26	−14.32	−14.58	−14.30	−14.54	−15.59	−16.66
195°	−6.40	−7.27	−8.01	−8.29	−8.61	−9.27	−10.33	−10.67	−10.26	−10.69	−13.18	−13.92
200°	−5.00	−5.60	−6.04	−6.09	−6.30	−7.24	−8.95	−10.75	−11.39	−12.76	−15.39	−15.86
205°	−4.90	−6.34	−8.08	−9.10	−9.58	−9.72	−10.44	−11.54	−11.60	−11.91	−14.97	−16.03
210°	−6.37	−6.70	−7.60	−8.12	−8.41	−9.07	−10.55	−13.05	−13.46	−13.20	−15.48	−17.82
215°	−5.86	−6.70	−8.28	−9.99	−10.70	−10.67	−11.55	−13.47	−15.06	−14.59	−14.07	−18.34
220°	−7.61	−7.72	−8.40	−9.75	−11.23	−11.25	−11.30	−12.46	−15.04	−14.36	−13.31	−16.99
225°	−7.01	−7.84	−8.46	−9.54	−10.77	−11.35	−10.97	−11.05	−13.54	−13.21	−14.45	−15.12
230°	−7.03	−7.08	−8.23	−9.08	−9.78	−10.59	−10.88	−10.83	−12.41	−13.25	−14.86	−15.96
235°	−7.08	−6.77	−7.78	−8.64	−9.74	−9.87	−10.51	−11.18	−11.71	−13.32	−14.38	−16.54
240°	−6.45	−7.32	−6.78	−8.52	−9.07	−9.60	−11.04	−11.04	−11.88	−13.04	−13.53	−15.98
245°	−5.86	−7.12	−7.18	−7.54	−9.82	−9.78	−9.86	−10.48	−12.11	−12.78	−14.60	−15.14
250°	−5.89	−5.99	−7.68	−7.78	−8.65	−9.23	−9.93	−10.59	−12.16	−12.41	−13.01	−14.96
255°	−6.10	−5.83	−6.58	−7.75	−9.17	−9.67	−9.78	−9.85	−10.98	−12.07	−13.57	−14.35
260°	−5.54	−6.26	−6.37	−7.52	−8.38	−8.80	−9.02	−9.55	−10.42	−11.27	−13.15	−14.46

Table A.22 ***(Continued)*** *Directional response for the sound level meter with Windscreen UA-1650, measured in a plane perpendicular to the display and along the microphone's axis, 10.6 kHz – 20 kHz*

Angle	Nominal Frequency											
	10.6 kHz	11.2 kHz	11.8 kHz	**12.5 kHz**	13.2 kHz	14 kHz	15 kHz	**16 kHz**	17 kHz	18 kHz	19 kHz	**20 kHz**
265°	−5.01	−5.94	−6.39	−7.29	−7.97	−8.60	−9.03	−9.36	−10.16	−10.72	−11.81	−13.72
270°	−4.80	−5.16	−5.87	−6.72	−7.47	−8.06	−8.23	−9.15	−10.08	−9.92	−10.80	−12.11
275°	−4.37	−4.86	−5.70	−6.15	−6.81	−7.50	−8.18	−8.17	−9.41	−9.41	−10.16	−11.28
280°	−4.15	−4.88	−5.20	−5.69	−6.63	−7.22	−6.83	−7.88	−8.03	−8.98	−9.37	−10.58
285°	−3.97	−4.38	−4.78	−5.50	−6.29	−6.10	−6.69	−6.47	−7.64	−8.01	−8.59	−9.82
290°	−3.45	−3.95	−4.43	−5.09	−5.47	−5.54	−5.71	−6.31	−6.61	−7.29	−7.76	−8.98
295°	−3.18	−3.60	−3.96	−4.63	−4.57	−5.11	−5.03	−5.47	−6.12	−6.48	−6.76	−7.75
300°	−2.80	−3.02	−3.48	−3.96	−3.98	−4.42	−4.49	−4.84	−5.30	−5.74	−5.90	−6.50
305°	−2.28	−2.79	−3.11	−3.47	−3.49	−3.67	−4.00	−4.13	−4.56	−4.72	−4.93	−5.86
310°	−1.96	−2.54	−2.68	−2.90	−2.81	−3.12	−3.32	−3.52	−3.75	−3.81	−4.08	−4.80
315°	−1.54	−2.01	−2.39	−2.29	−2.39	−2.71	−2.94	−2.94	−3.14	−3.08	−3.42	−4.07
320°	−1.37	−1.81	−2.06	−1.78	−1.93	−2.27	−2.50	−2.43	−2.46	−2.58	−2.88	−3.35
325°	−0.98	−1.50	−1.52	−1.39	−1.47	−1.91	−1.94	−1.88	−1.83	−2.13	−2.39	−2.73
330°	−0.79	−1.16	−1.11	−0.98	−1.11	−1.47	−1.54	−1.30	−1.35	−1.65	−1.76	−2.10
335°	−0.62	−0.82	−0.78	−0.61	−0.82	−1.05	−1.01	−0.82	−0.86	−1.15	−1.12	−1.51
340°	−0.37	−0.44	−0.45	−0.30	−0.50	−0.67	−0.64	−0.45	−0.59	−0.74	−0.73	−1.04
345°	−0.21	−0.23	−0.22	−0.12	−0.27	−0.42	−0.31	−0.20	−0.31	−0.40	−0.36	−0.60
350°	−0.08	−0.08	−0.07	−0.03	−0.11	−0.20	−0.10	−0.06	−0.12	−0.14	−0.13	−0.25
355°	0.01	0.02	0.03	0.04	0.02	−0.01	0.03	0.03	0.01	0.02	0.03	−0.02

Table A.23 *Sensitivity variations of the sound level meter with Windscreen UA-1650, at sound incidence angles within ±θ° from the reference direction*

Nominal Frequency	**Exact Frequency (6 digits)**	**Max Variation ±30°**	**Max Variation ±90°**	**Max Variation ±150°**
Hz	**Hz**	**dB**	**dB**	**dB**
250	251.189	0.08	0.18	0.22
315	316.228	0.43	0.43	0.51
400	398.107	0.44	0.44	0.47
500	501.187	0.05	0.19	0.28
630	630.957	0.37	0.47	0.70
800	794.328	0.23	0.36	0.48
1000	1000.00	0.12	0.25	0.48
1250	1258.93	0.07	0.32	0.57

Table A.23 (Continued) *Sensitivity variations of the sound level meter with Windscreen UA-1650, at sound incidence angles within ±θ° from the reference direction*

Nominal Frequency	**Exact Frequency (6 digits)**	**Max Variation ±30°**	**Max Variation ±90°**	**Max Variation ±150°**
Hz	**Hz**	**dB**	**dB**	**dB**
1600	1584.89	0.23	0.52	0.73
2000	1995.26	0.11	0.65	1.07
2240	2238.72	0.25	0.77	1.14
2500	2511.89	0.17	1.28	1.55
2800	2818.38	0.19	1.07	1.37
3150	3162.28	0.13	0.98	1.52
3550	3548.13	0.35	1.10	1.67
4000	3981.07	0.10	1.35	1.93
4500	4466.84	0.32	1.64	2.63
5000	5011.87	0.57	2.51	3.44
5600	5623.41	0.65	2.68	4.09
6300	6309.57	0.60	2.98	4.20
7100	7079.46	0.47	2.97	4.65
8000	7943.28	0.92	3.22	5.78
8500	8413.95	1.05	4.20	6.41
9000	8912.51	0.79	4.81	6.72
9500	9440.61	0.76	4.74	7.31
10000	10000.0	0.70	4.76	7.37
10600	10592.5	1.04	4.84	7.88
11200	11220.2	1.34	5.69	8.27
11800	11885.0	1.42	6.59	9.72
12500	12589.3	1.16	7.15	10.94
13200	13335.2	1.32	7.75	11.51
14000	14125.4	1.64	8.50	11.76
15000	14962.4	1.76	8.91	12.85
16000	15848.9	1.63	10.45	15.01
17000	16788.0	1.73	10.94	16.60
18000	17782.8	2.13	11.26	15.62
19000	18836.5	2.19	12.01	16.84
20000	19952.6	2.18	13.04	21.47

A.6 Periodic Testing of Acoustical Frequency Responses

This section gives the correction data that shall 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.24 and Table A.25 to view the data.

Table A.24 *Acoustical test with Multifunction Acoustic Calibrator Type 4226. Correction data that must be applied to the readings of the sound level meter in order to obtain equivalent sound levels that would be displayed in response to plane progressive sinusoidal sound waves incident from the reference direction or from random directions*

Calibrator Frequency	**Correction Data for Sound Level Meter Free-field 0° without Windscreen**	**Expanded Uncertainty**	**Correction Data for Sound Level Meter Free-field 0° with Windscreen UA-1650**	**Expanded Uncertainty**
Hz	**dB**	**dB**	**dB**	**dB**
32	0.0027	0.15	0.00	0.21
63	0.0514	0.13	0.05	0.20
125	0.061	0.12	0.06	0.20
250	0.075	0.12	0.07	0.20
500	0.185	0.14	0.15	0.20
1000	0.080	0.16	–0.08	0.22
2000	0.257	0.18	0.28	0.27
4000	0.829	0.24	0.67	0.31
8000	2.862	0.31	2.60	0.40
12500	5.153	0.48	4.85	0.54
16000	6.377	0.59	5.93	0.66

Table A.25 *Acoustical test with Electrostatic Actuator UA-0033. Correction data that must be applied to the readings of the sound level meter in order to obtain equivalent sound levels that would be displayed in response to plane progressive sinusoidal sound waves incident from the reference direction or from random directions*

Nominal Frequency	Exact Frequency (6 digits)	Correction Data for Sound Level Meter Free-field 0° without Windscreen	Expanded Uncertainty	Correction Data for Sound Level Meter Free-field 0° with Windscreen UA-1650	Expanded Uncertainty
Hz	**Hz**	**dB**	**dB**	**dB**	**dB**
63	63.0957	0.02	0.11	0.02	0.19
80	79.4328	0.03	0.11	0.03	0.19
100	100.000	0.03	0.11	0.03	0.19
125	125.893	0.04	0.11	0.04	0.19
160	158.489	0.05	0.11	0.04	0.19
200	199.526	0.06	0.11	0.05	0.19
250	251.189	0.07	0.11	0.06	0.19
315	316.228	0.12	0.11	0.11	0.19
400	398.107	0.16	0.11	0.15	0.19
500	501.187	0.19	0.12	0.16	0.19
630	630.957	0.12	0.12	0.07	0.19
800	794.328	0.01	0.13	−0.08	0.20
1000	1000.00	0.12	0.13	−0.04	0.20
1060	1059.25	0.13	0.13	−0.03	0.20
1120	1122.02	0.13	0.13	−0.02	0.20
1180	1188.50	0.14	0.13	−0.01	0.20
1250	1258.93	0.15	0.13	0.01	0.20
1320	1333.52	0.18	0.13	0.06	0.20
1400	1412.54	0.21	0.13	0.09	0.20
1500	1496.24	0.22	0.13	0.11	0.20
1600	1584.89	0.22	0.14	0.13	0.21
1700	1678.80	0.26	0.14	0.20	0.21
1800	1778.28	0.30	0.14	0.25	0.21
1900	1883.65	0.30	0.14	0.29	0.21
2000	1995.26	0.37	0.14	0.39	0.24
2120	2113.49	0.16	0.15	0.21	0.25
2240	2238.72	0.41	0.18	0.49	0.27
2360	2371.37	0.67	0.18	0.77	0.27

Table A.25 ***(Continued)*** *Acoustical test with Electrostatic Actuator UA-0033. Correction data that must be applied to the readings of the sound level meter in order to obtain equivalent sound levels that would be displayed in response to plane progressive sinusoidal sound waves incident from the reference direction or from random directions*

Nominal Frequency	Exact Frequency (6 digits)	Correction Data for Sound Level Meter Free-field 0° without Windscreen	Expanded Uncertainty	Correction Data for Sound Level Meter Free-field 0° with Windscreen UA-1650	Expanded Uncertainty
Hz	Hz	dB	dB	dB	dB
2500	2511.89	0.62	0.19	0.74	0.27
2650	2660.73	0.46	0.19	0.61	0.27
2800	2818.38	0.61	0.19	0.77	0.27
3000	2985.38	0.90	0.19	1.06	0.27
3150	3162.28	0.85	0.19	0.99	0.27
3350	3349.65	0.75	0.19	0.83	0.27
3550	3548.13	1.08	0.19	1.07	0.27
3750	3758.37	1.17	0.19	1.07	0.27
4000	3981.07	1.06	0.20	0.91	0.28
4250	4216.97	1.46	0.20	1.26	0.28
4500	4466.84	1.41	0.20	1.17	0.28
4750	4731.51	1.46	0.20	1.22	0.28
5000	5011.87	1.69	0.21	1.47	0.28
5300	5308.84	1.77	0.21	1.60	0.33
5600	5623.41	2.04	0.21	1.91	0.33
6000	5956.62	2.02	0.22	1.93	0.33
6300	6309.57	2.36	0.22	2.32	0.33
6700	6683.44	2.52	0.22	2.45	0.34
7100	7079.46	2.77	0.22	2.59	0.34
7500	7498.94	2.98	0.26	2.74	0.36
8000	7943.28	3.20	0.26	2.94	0.36
8500	8413.95	3.49	0.26	3.20	0.36
9000	8912.51	3.78	0.26	3.54	0.36
9500	9440.61	4.13	0.29	3.92	0.39
10000	10000.0	4.56	0.36	4.35	0.44
10600	10592.5	5.11	0.37	4.84	0.45
11200	11220.2	5.59	0.38	5.28	0.46
11800	11885.0	6.07	0.39	5.71	0.47
12500	12589.3	6.32	0.40	6.02	0.47

Table A.25 ***(Continued)*** *Acoustical test with Electrostatic Actuator UA-0033. Correction data that must be applied to the readings of the sound level meter in order to obtain equivalent sound levels that would be displayed in response to plane progressive sinusoidal sound waves incident from the reference direction or from random directions*

Nominal Frequency	Exact Frequency (6 digits)	Correction Data for Sound Level Meter Free-field 0° without Windscreen	Expanded Uncertainty	Correction Data for Sound Level Meter Free-field 0° with Windscreen UA-1650	Expanded Uncertainty
Hz	**Hz**	**dB**	**dB**	**dB**	**dB**
13200	13335.2	6.60	0.42	6.26	0.48
14000	14125.4	6.88	0.43	6.48	0.50
15000	14962.4	7.30	0.45	6.91	0.54
16000	15848.9	7.85	0.47	7.41	0.56
17000	16788.0	8.40	0.48	7.84	0.57
18000	17782.8	8.87	0.50	8.29	0.59
19000	18836.5	10.00	0.52	9.48	0.59
20000	19952.6	10.77	0.53	10.29	0.61
21200	21134.9	11.74	0.55	11.33	0.63
22400	22387.2	12.90	0.57	12.69	0.64

Appendix B

Cross-references to Standards

B.1 Introduction

This appendix provides cross-references between specific paragraphs in the standards that require topics to be documented in an instruction manual, and the corresponding sections in this manual that conform to those paragraphs.

Section B.2 contains the cross-reference tables to the following relevant standards: IEC 61672-1 and IEC 61260.

Section B.3 provides a list of cross-references to topics that are not provided in, or are irrelevant to this product. For example, the cross-reference "B.3a)" in a cross-reference table refers to section B.3, item a.

A normal index can be found at the end of this manual.

B.2 Cross-references to Standards

IEC 61672–1:2013	
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IEC 61260:2014	
Standard's Paragraph	**This Manual's Section**
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B.3 Irrelevant Topics

This section provides a list of the cross-references to topics that are not provided in or are irrelevant to this product. References are made to the following texts:

a) "No microphone extension device or cable can be used. The microphone is mounted directly on the sound level meter's built-in preamplifier."

b) "The sound level meter has only one level range."

c) "The sound level meter has only one channel."

d) "No user-selectable thresholds are provided."

e) "Only one display, in regards to IEC 61672, is provided."

f) "No components of the sound level meter are intended to be operated only in an environmentally controlled enclosure."

g) "No performance degradation or loss of function specified."

h) "No greater field strengths specified."

i) "No sound level less than 74 dB is specified."

j) "No adjustment procedures needed. Reference attenuation is specified relative to the sound level meter calibration."

k) "The band-pass filters are not an integral part of the sound level meter for the measurement of reverberation time."

l) "Not applicable."

m)"The filter is an integral part of the sound level meter."

n) "While measuring, the sound level meter is only intended to be supplied from the built-in battery or mains using the specified external AC main supply adapter(s). As long as the supply voltage to the external AC main supply adapter is within the specified tolerances, the sound level meter fulfils the requirements of the specified standards. See section 4.15.1."

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