acoust IQ

MÜLLER-BBM
INNOVATION LAB

User Manual
(Version 1.2, December 2025)
Portable sound level meter with digital microphone and iPhone

Contents

1 Introduction

This app enables sound levels to be measured using an iPhone (15 and newer) or iPad (with USB-C connection) and a connected Class 1 or Class 2 digital microphone. For simplicity, only the iPhone is mentioned below. The microphone data is stored on the iPhone and can be exported along with other recorded data such as position or measurement documentation.

Furthermore, the most important single values of the calculated sound pressure levels and the 1/3 octave spectrum are shown on the display.

The illustrations in this documentation may vary depending on the device or device configuration (e.g., language, font size, operating system version) or device orientation and should therefore be regarded as a supporting explanation.

Translated with DeepL.com (free version)

2 Product components

The measurement system consists of the following components:

- iPhone (15 or newer) or iPad
- Protective case with microphone mount (Quadlock)
- $\frac{1}{2}$" MKS225 measurement microphone capsule and Microtech Gefell MV240 digital preamplifier with built-in analog/digital converter
- or alternatively UMIK-2 (miniDSP)
- Connection cable between microphone and iPhone (Lemo 4-pin on microphone, USB-C on iPhone) for power supply via iPhone and for digital measurement data transfer from microphone to iPhone (two different lengths: 0.15 m, 2 m, 5 m).
- Windshield (recommended)

Figure 2.1: Product components: connection cable, measuring microphone, microphone capsule, and windshield. Source: www.microtechgefell.de

Figure 2.2: Product components: Microphone in holder, iPhone in protective case, short connection cable.

3 Install and set up the app

- Download the acoust IQ app from the Apple App Store and install it on your smartphone or tablet. Make sure you are connected to the internet.
- Open the app.
- Make sure your smartphone battery is charged. The operating time with the microphone connected is approximately 4 hours when the battery is fully charged.
- Secure the microphone in the holder.
- Connect the external digital microphone (Class 1) to the USB-C port on the iPhone.

3.1 License

To use the full functionality of acoust IQ, a corresponding license is required. You can choose between a monthly license or an annual license. Both options can be easily purchased via the Apple App Store and an in-app purchase or by obtaining a license key. For in-app purchases, a payment method must be stored in your Apple account (e.g., credit card). To obtain a license key, please contact:

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An overview of existing licenses and current subscriptions can be found in the settings (chapter 6) under “License & Subscription” (Figure:3.1). Here you can enter a license key or take out a subscription via the Apple App Store.

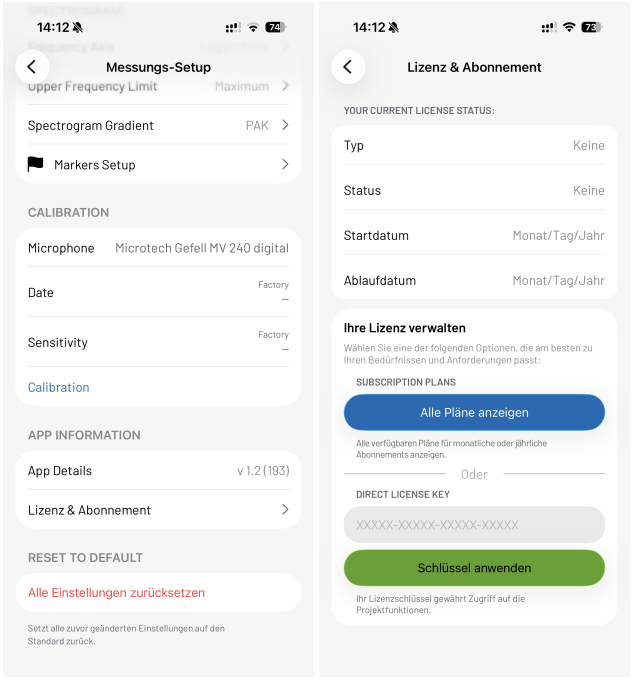


Figure 3.1: Information about licenses and subscription.

3.2 Placement of the measuring microphone

The sound level meter should be positioned away from shielding, reflective, or absorbing objects. In a diffuse sound field, the measured sound pressure levels are reduced by absorbing objects. In a free sound field, the measured sound pressure levels can be increased by reflective objects.

3.3 Mounting the external digital microphone

The following precautions must be observed when mounting the measuring microphone:

- Keep dust and foreign objects away from the microphone diaphragm. Do not touch the diaphragm as it is very sensitive.
- Carefully slide the microphone into the holder on the smartphone.
- Connect the connection cable (4-pin Lemo plug) to the microphone until the plug clicks into place.
- Connect the USB-C to the smartphone until the plug clicks into place.

3.4 Mounting the windshield

When taking measurements outdoors or indoors with air movement, place the windshield on the microphone until it stops.

3.5 Measurement procedure with remote microphone

The measurement microphone can be positioned away from the smartphone by connecting a 2 m or 5 m connection cable and mounting the microphone on a microphone stand.

4 Home screen

After opening acoust IQ, the first thing you see is the home screen. This consists of various tiles and a green button to start a measurement directly.

- Files: Access to saved measurements and creation of a project and folder structure, including management of metadata and reports (chapter 5).
- Documentation: Access this documentation with the option to share or print it if necessary.
- Settings: Relevant settings for measurement, licenses, and calibration options (chapter 7).
- Start new measurement (green button): This is the direct route to measurement or the measurement run. When a measurement is recorded, the project structure is automatically created in the files.

Depending on the license, additional tiles may be available to access additional functions.

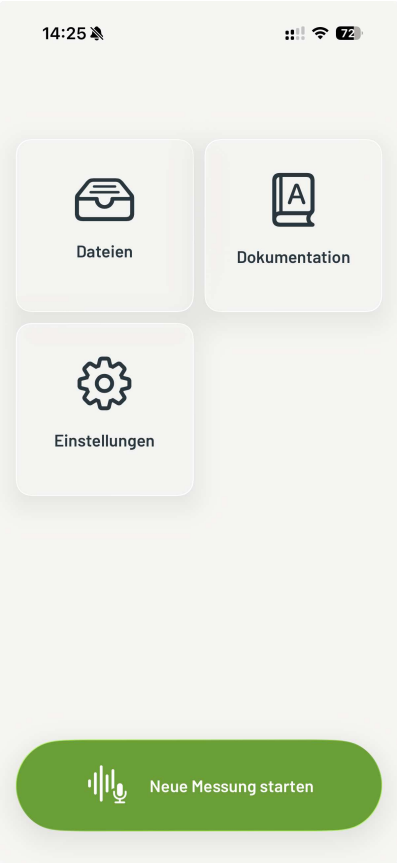
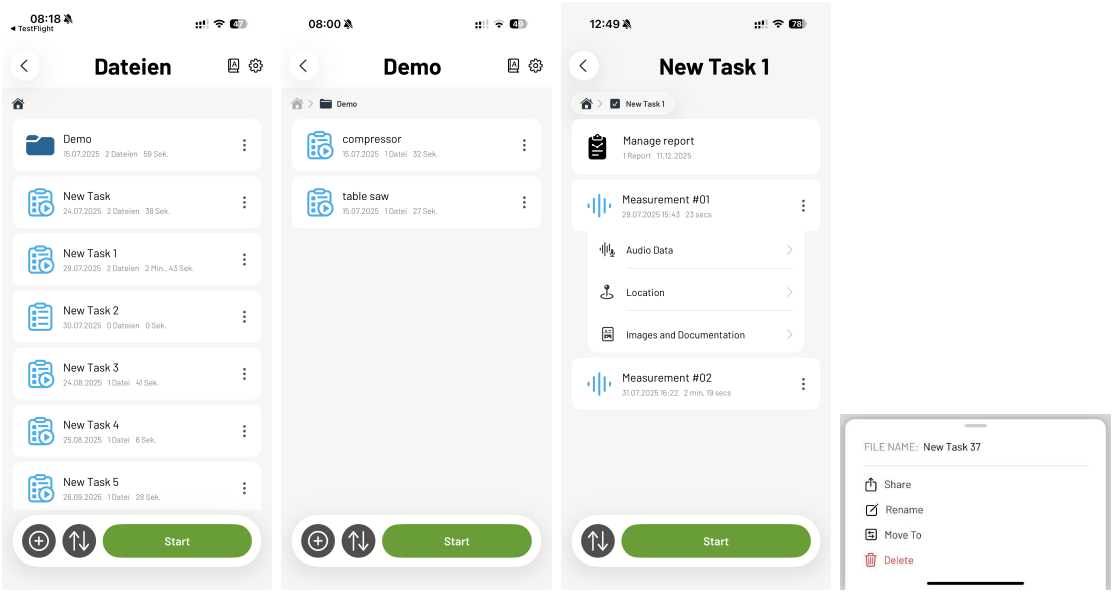


Figure 4.1: The start screen with various tiles.

5 Files and folder structure

The basic directory structure in acoust IQ follows the principle: Project - Task - Measurement.

- A project is represented by a folder at the top level (Figure 5.1b). New folders or tasks can be added using the icon in the bottom row of buttons.
- A project can contain any number of tasks (Figure 5.1b).
- The individual measurements are then stored in these tasks (Figure 5.1c). The sub-entries (audio data, location, images, and documentation) can be used to call up the actions described below (see chapter 8.5) for editing the measurement data at any time.
- Above the directory list, there is a breadcrumb navigation to show the position in the directory structure. It can be used to quickly jump back to a location.
- A project or folder is optional; all other structures are necessary and are created automatically when a measurement is started quickly.
- Tasks can also be moved at any time later. To do this, open the context menu via the three dots and select "Move to" (Figure 7.2d).
- In the context menu, tasks or measurements can also be shared, renamed, or deleted (Figure 5.1d).
- Tasks and measurements can be deleted immediately by swiping to the left.
- At the bottom of the screen, there are buttons for creating a new folder or task and the option to change sorting.
- The green "Start" button takes you directly to the measurement preview. A measurement is then saved at the corresponding location in the directory structure. If necessary, a new task is automatically created.
- The measurements can be sorted by name, date, or length using the arrow button .



(a) Top level in the directory tree.

(b) directory structure

(c) Detailed information about a single measurement.

(d) Share, rename, move, or delete measurements.

Figure 5.1: Projects, tasks, and measurements in the directory structure.

5.1 Saving, Sharing, and Deleting a Measurement

- Once the measurement has been completed, a new task is automatically created if it was not created manually beforehand. The date, the number of files, and the total duration of the measurement are displayed in the tab of the new task.
- The context menu is opened via the three-dot icon ⋮. As mentioned above, the available file operations can be found here (Figure 5.1d).

5.1.1 Sharing Measurements and Tasks

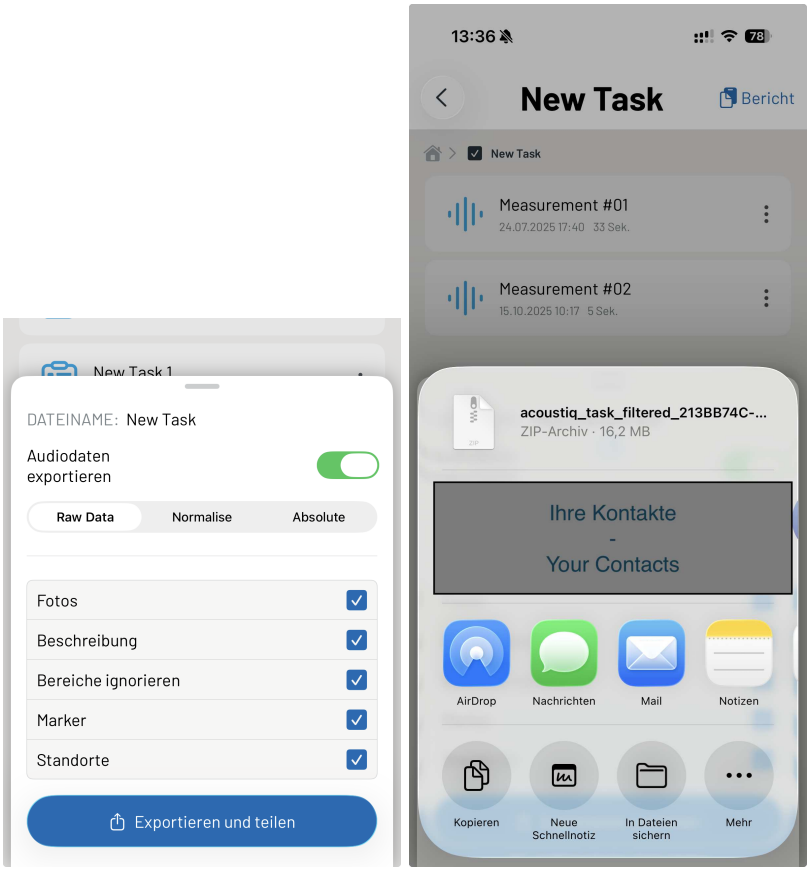
- Tapping the "Share" button opens a selection dialog in which the individual sections can be deselected or selected (Figure 5.2a):
- Export audio: The following options are available: "Raw Data", "Normalise", and "Absolute".
  - Raw Data: Outputs the data exactly as recorded. Due to the high dynamic range of the microphone, a recording may exhibit a very low signal level.
  - Normalise: Increases the level of the recording to allow easy playback of the measurement. The audio data are normalised to a digital peak level of −3 dBFS.

  - Absolute: Exports the recording as an absolute sound pressure waveform in pascals (WAV file with 32-bit floating-point values, sample value 1.0 $\triangleq$ 10 Pa). This ensures that the level is displayed correctly in the Müller-BBM Vibroakustik Systeme GmbH software "PAK".

- Photos: Photos associated with the measurement (maximum of 8)
- Description: Measurement documentation
- Ignore ranges: Excluded sections of the measurement
- Markers: Identification of interfering noise
- Locations: Position data

Using Export and Share, the data are exported as an archive.

- Measurements are compressed as a *.zip file and can, for example, be shared via AirDrop, e-mail, messages, etc. (Figure 5.2b).
- Please note that longer measurements may contain a large amount of data and that some services may be less suitable for this purpose.
- For Apple® users, data export via AirDrop and iCloud is recommended.
- A connection to Microsoft® Windows products can be established, for example, via the OneDrive cloud or Dropbox.



(a) Export measurement. (b) Share measurement.

Figure 5.2: Export and share measurements and tasks.

6 Settings

In the settings, all relevant parameters relating to the measurement, the appearance of figures, and licence management can be configured (Figure 6.1). The microphone calibration can also be checked and performed here. The menu can also be accessed from various locations within the application via the gear icon in the upper right corner (e.g. Files, Measurement Preview).

6.0.1 Time and Frequency Weighting

Time weighting (Figure 6.2a):

- F (FAST, = 125 ms)
- S (SLOW, = 1000 ms)

Frequency weighting (Figure 6.2b):

- A-weighting
- C-weighting
- Linear (no weighting)

6.0.2 Measurement Duration: On/Off

Each measurement is divided into time blocks of a maximum of 30 minutes. This allows meaningful visualisation and editing of the measurement data directly on the device. When switching to a new file, all data continue to be stored without loss.

On: When the limit is exceeded, a new measurement is automatically created in order to continue the measurement.

Off: The measurement stops after 30 minutes.

6.0.3 Spectrogram

Frequency axis (Figure 6.3a):

- Linear
- Logarithmic

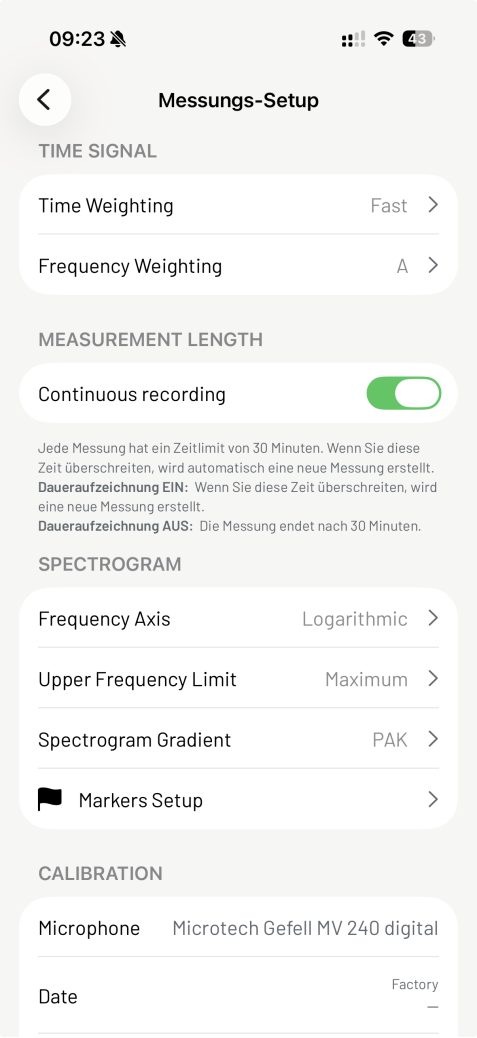
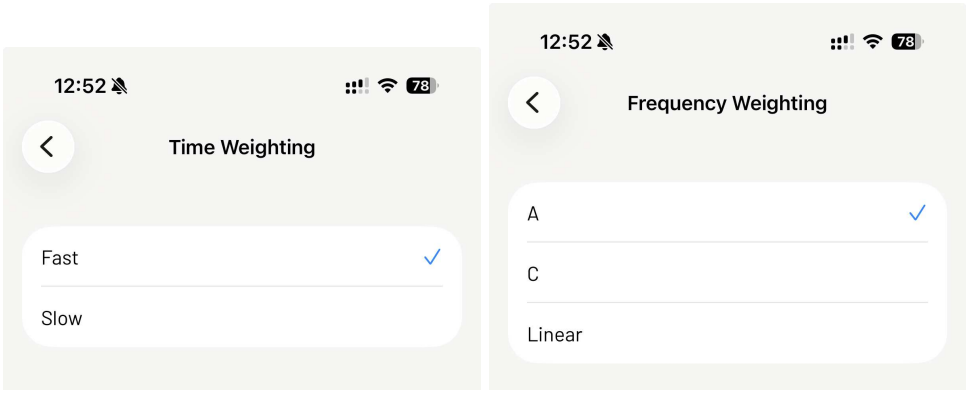


Figure 6.1: Settings menu for display and recording customisation.



(a) Time weighting (b) Frequency weighting

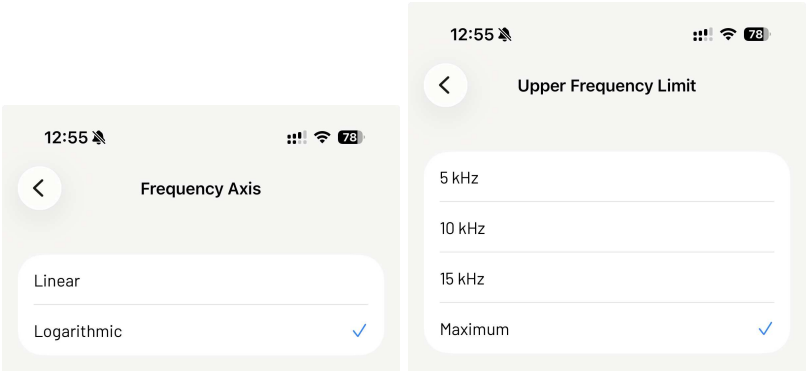
Figure 6.2: Signal settings

Frequency limit (Figure 6.3b):

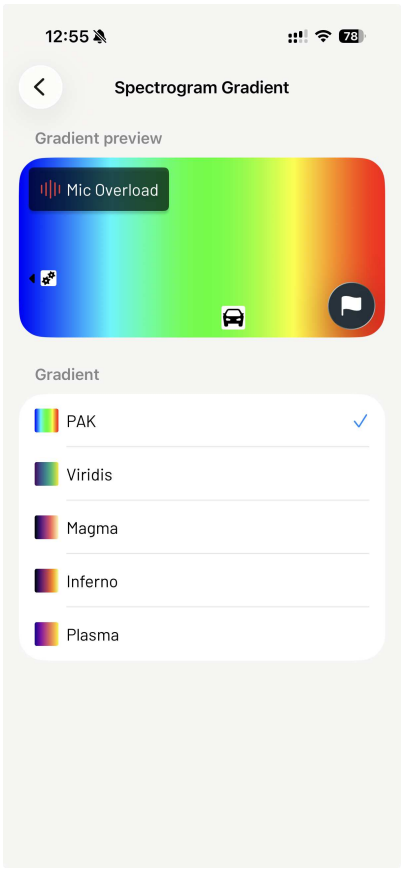
- 5 kHz
- 10 kHz
- 15 kHz
- Maximum 24 kHz

Spectrogram colour scale (Figure 6.3c):

- PAK
- Viridis
- Magma
- Inferno
- Plasma



(a) Frequency axis (b) Frequency limit



(c) Spectrogram colour scale

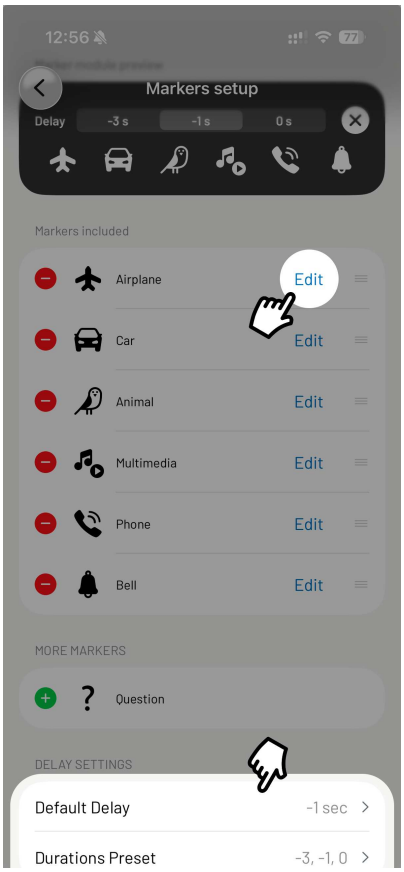
Figure 6.3: Settings

Markers Setup (Figure 6.4):
The Markers Setup provides an overview of multiple markers. Using the edit function, the icons can be individually renamed and replaced (Figure 6.4a).

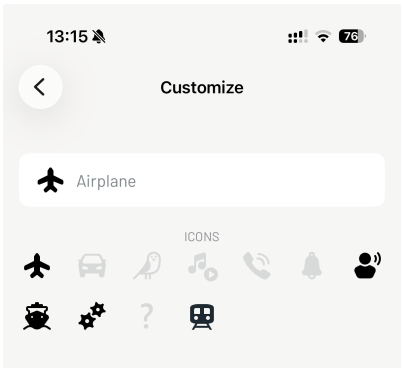
In the lower section, a delay range can be specified under "Delay Settings". This is used to place the marker according to the selected time before pressing the button. This allows the user's individual reaction time to an event to be taken into account.

Default Delay: −3 sec, −1 sec, 0 sec: During a "Live measurement", the marker is set with a delay (Figure 6.4c).

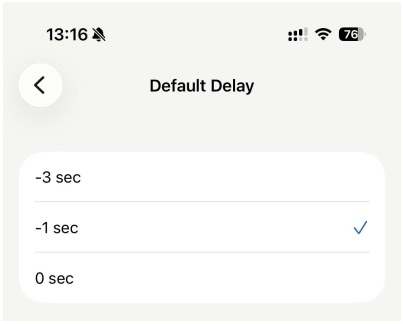
Durations Preset: 0 to −5 sec: Selection of up to three "Default Delay" values (Figure 6.4d).



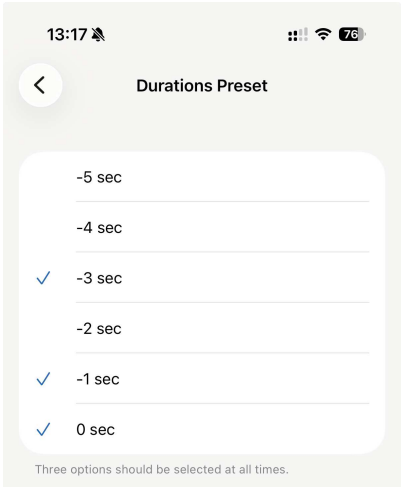
(a) Edit individual markers



(b) Marker icons



(c) Default delay



(d) Available delays

Figure 6.4: Marker setup menu

7 Calibration

To verify functionality and ensure high measurement accuracy for sound level measurements, we recommend performing a check with an acoustic calibrator before carrying out a measurement.

Proceed as follows to perform an acoustic calibration:

1. Keep away from loud sound sources during calibration.
2. Attach the calibrator to the microphone and switch on the test signal on the calibrator.
3. Place the calibrator together with the microphone and smartphone on a stable surface.
4. Open the settings menu via the corresponding tile on the home screen or via the gear icon in the upper right corner, then tap on “Calibration” further down (Figure 7.1).

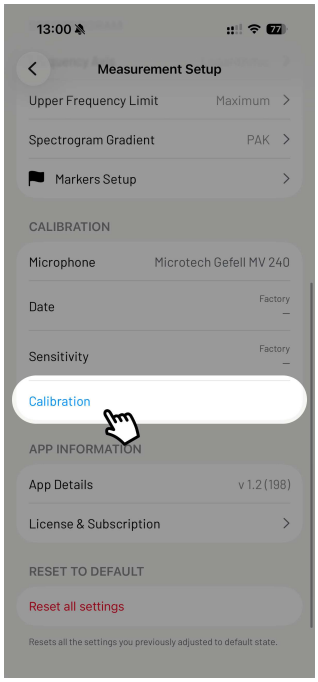


Figure 7.1: Start calibration.

5. If the frequency and level of the calibrator differ from the default values, the values must be entered in the corresponding fields. The frequency can be set between 125 Hz and 4000 Hz, and the level between 90 dB and 130 dB (Figure 7.2a). Note: The frequency and level entry must be confirmed by tapping “Done”.

6. Start the calibration by tapping the green “Start” button (Figure 7.2b).

7. The calibration can be cancelled using Cancel (Figure 7.2c).

8. SComplete the calibration by tapping the green “Save” button (Figure 7.2d).

(a) Enter the frequency and level of the calibrator.

(b) Start calibration.

(c) Ongoing calibration.

(d) Save the calibration.

Figure 7.2: Performing the calibration.

7.1 Displays in the Calibration Menu

1. Microphone: Designation of the connected microphone
2. Date and time: Last calibration
3. Microphone sensitivity: dB

7.2 Plausibility Check

The supported measurement microphone (Microtech Gefell MV240/MKS225) has a sensitivity of approximately −66 dB (0.50119 mV/Pa). After calibration, the sensitivity should not deviate from this value.

8 Sound Level Measurement

The following section describes how to perform a measurement using acoust IQ.

8.1 Performing a Measurement

On the home screen, you can access the measurement preview by pressing the "Start" button (Figure 8.1a). To do so, tap "Start new measurement" in the lower area. After completion of the measurement, a task is automatically created in which the measurement is stored.

Alternatively, you can first create a new folder or task in Files using the " button" and assign a name directly. After the measurement, the new task/folder is labelled with the date, number of files, and total duration of the measurements (Figure 8.1b)). Important: You must be located within a task so that the measurement is assigned correctly. Otherwise, a new task will be created in the corresponding folder.

After pressing "Start", the app displays the current sound pressure levels in the measurement preview (Figure 8.2). Swiping left or right allows switching between level values, spectrogram, third-octave bands (Figures 8.2a, 8.2b, 8.2c), and a freely configurable view (Figure8.2d).

To modify the freely configurable view, press and hold on the screen. Various diagrams and values can then be combined.

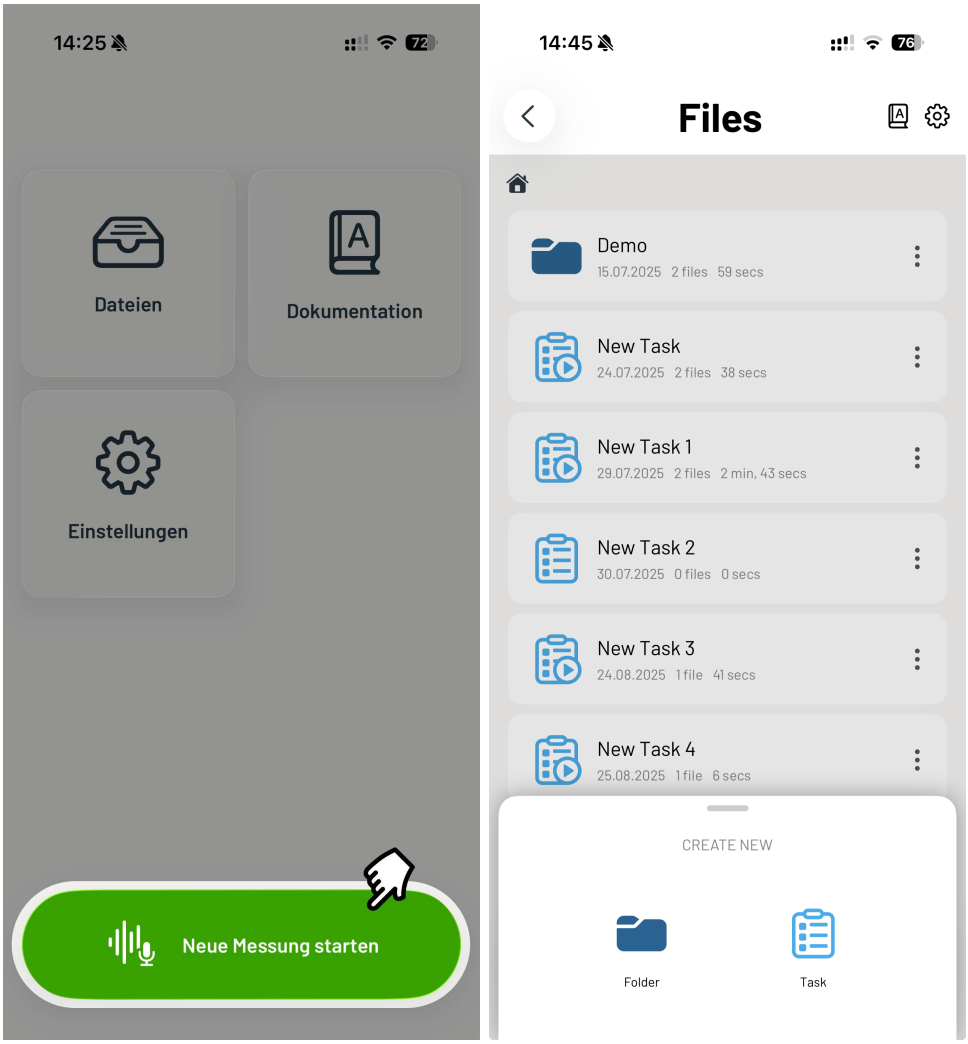
Please note: No measurement (recording) has been started at this point.

• Press the lower green Start button to begin recording. The displayed level values are reset. The app displays the current sound pressure level in decibels (dB).

• After the measurement has started, the red colour in the display indicates that recording is active (Figure 8.4).

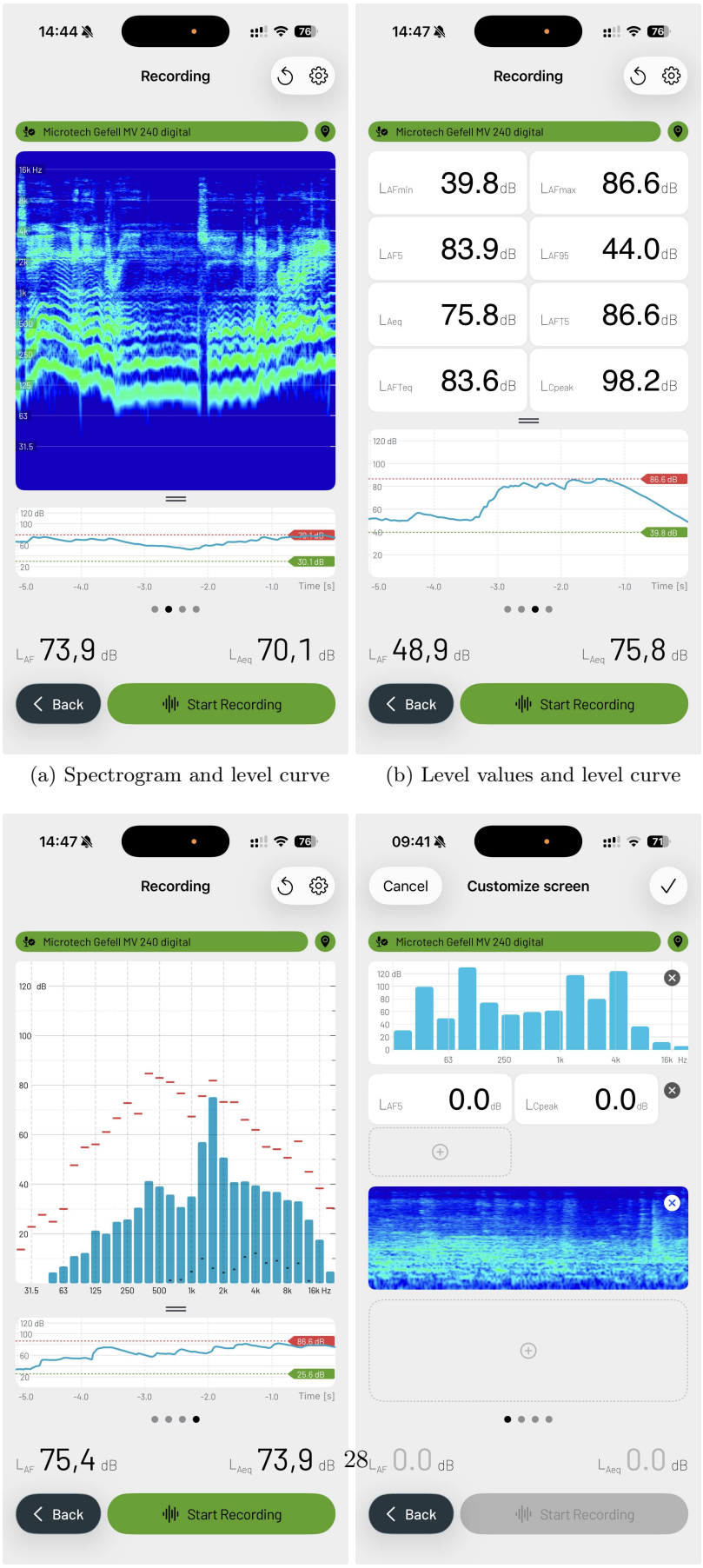
8.2 Markers

Markers can be set to label specific acoustic events. During post-processing, these markers are available as reference points. A total of seven (out of eleven available) different markers can be configured for individual characterisation of noises. The default symbols represent the following noise types: aircraft, bell, telephone, unknown, multimedia, animal, vehicle, train, machine, conversation, ship. Marker configuration is available in the settings (see section 6.0.3).



(a) Start of a measurement (b) Directory structure

Figure 8.1: Create the directory structure and start preparing for measurement.



(a) Spectrogram and level curve

(b) Level values and level curve

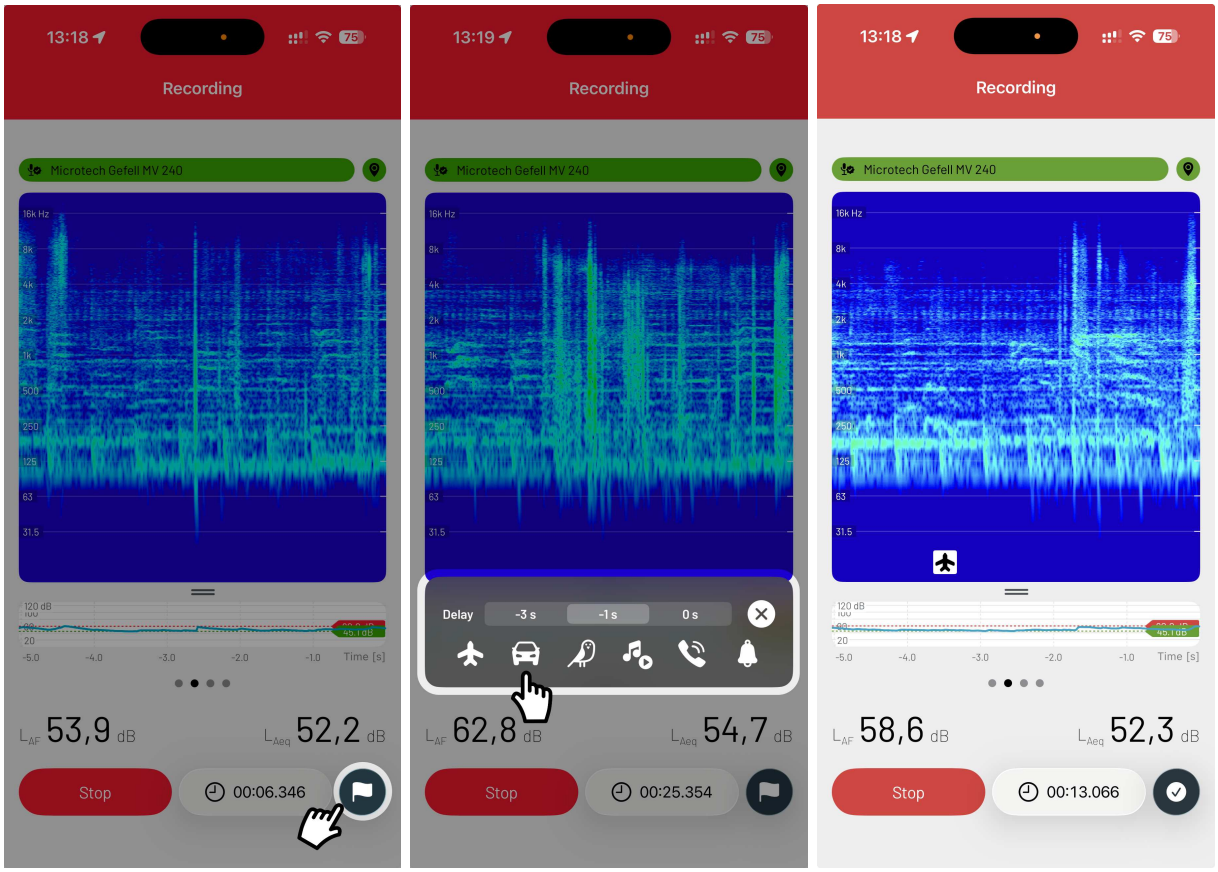
(c) Octave bands

(d) Configurable screen

Figure 8.2: Views of the measurement preparation

8.2.1 Setting Markers During Measurement

During the measurement, various markers can be set manually by pressing the white flag icon . This allows specific acoustic events to be subjectively marked.



(a) Call up marker selection (b) select marker (c) Markers in the spectrogram

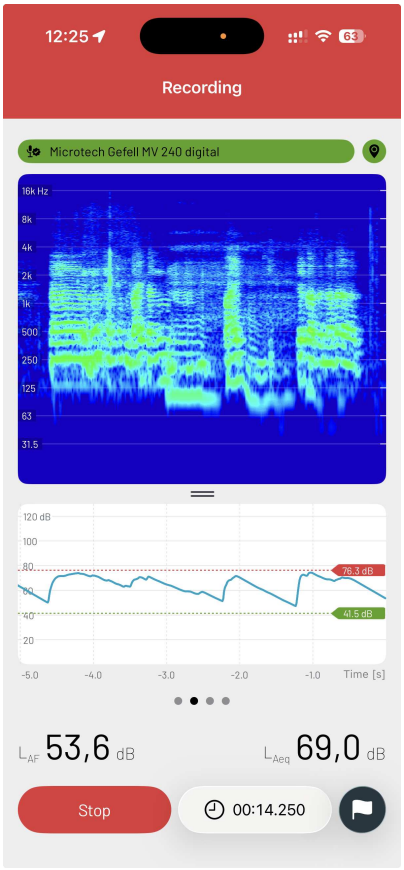
Figure 8.3: Setting markers during recording

8.2.2 Setting Markers After Measurement (Modification)

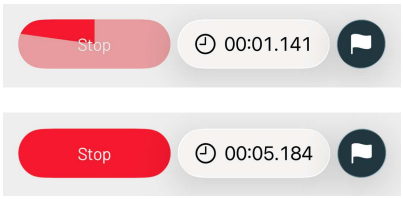
After the measurement, existing markers can be edited or new markers can be added. For details, see section 8.6.2.

8.3 Stopping a Measurement

A measurement can be stopped after a minimum of 5 seconds by pressing the “Stop” button (Figure 8.4b). Pressing “Done” finalises and saves the measurement.



(a) Active measurement recording



(b) Stop measurement after 5 seconds

Figure 8.4: Measurement recording

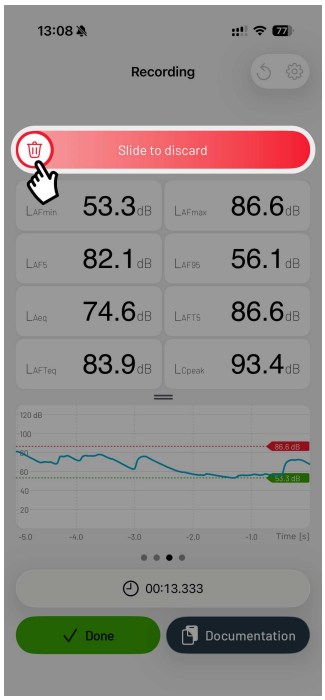


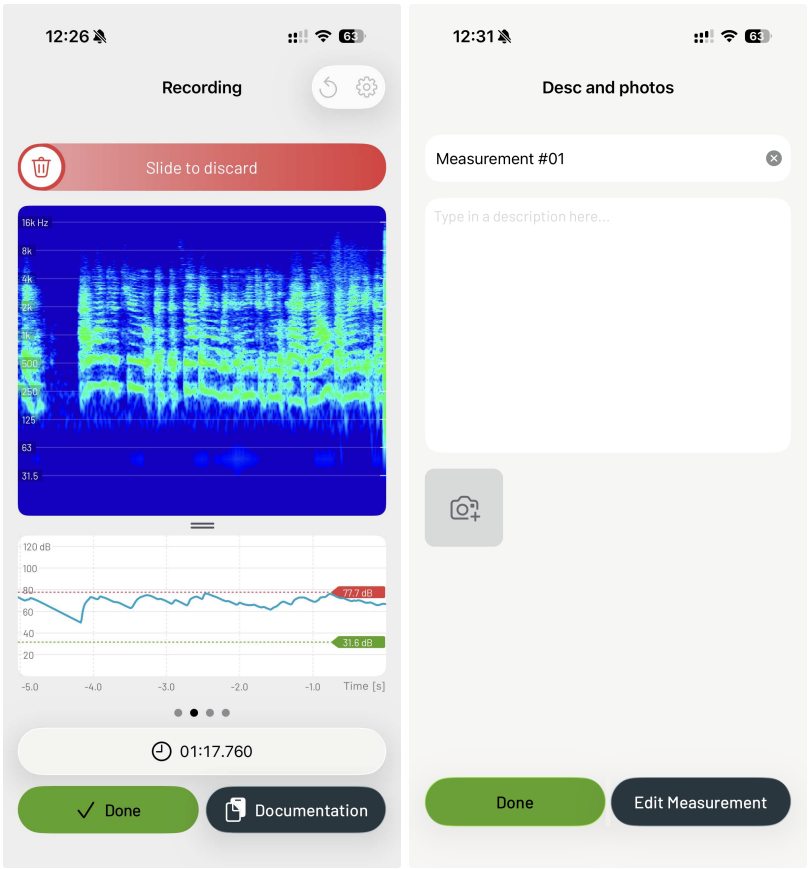
Figure 8.5: Discarding a Measurement

8.4 Discarding a Measurement

If you wish to discard the measurement, swipe from left to right in the red area at the top (Figure 8.5).

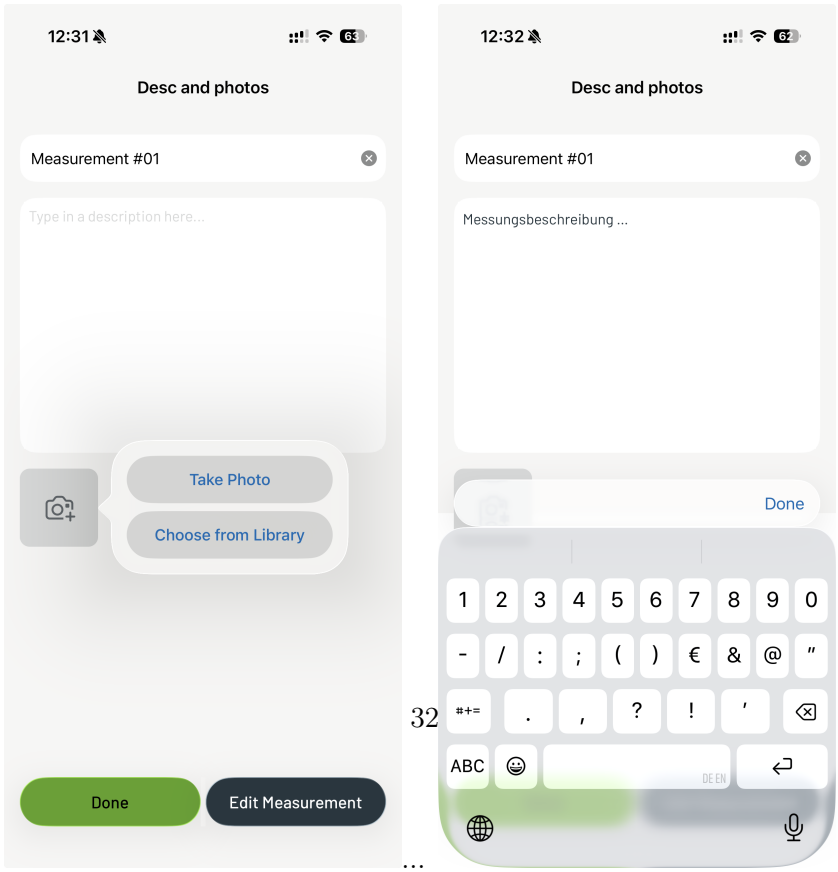
8.5 Measurement Documentation: Photos and Description

- If you wish to document the measurement, tap "Documentation" at the bottom to add photos and notes directly to your measurement (Figure8.6a). The measurement name can be adjusted or accepted. A description of the measurement can be entered in the large text field (Figures 8.6b and 8.6d).
- By tapping the "Photo +" icon, a photo can be taken directly or selected from the photo media library (Figure 8.6c). The description and photos are used later for report generation. A maximum of eight images can be assigned to a measurement. Ensure that the photo description is saved by tapping "Done".



(a) Measurement completed

(b) Documentation of the measurement



(c) Adding photos

(d) measurement description

Figure 8.6: Measurement documentation

- The new measurement can now be saved ("Done") or edited using "Edit measurement". Editing is non-destructive and can be reverted. Switching between different steps is also possible. Detailed information can be found in chapters 8.6 and 9.

8.6 Audio Player and Editing Measurements

When a measurement is selected by tapping it within the directory structure (task), the audio player and "Edit measurement" section appear. Here, markers and ignored areas can be added retrospectively. In addition, the recorded levels and time histories can be viewed. The audio recording can also be played back.

8.6.1 Overview, Original Data, and Modifications

Figure 8.7a provides an overview of the main elements of the audio player.

1. The upper dropdown menu (1) allows switching between the original data and individual modification steps (Figure 8.7b). Individual modifications can be renamed. These names are referenced during report generation.

2. Selection (2) allows switching between different views (spectrogram, level, values, third-octave spectrum).

3. The central cursor (3) serves as a reference line for the displayed level (4) and for placing new markers or ignored areas.

4. Display (4) shows the sound pressure at the time referenced by the cursor (3).

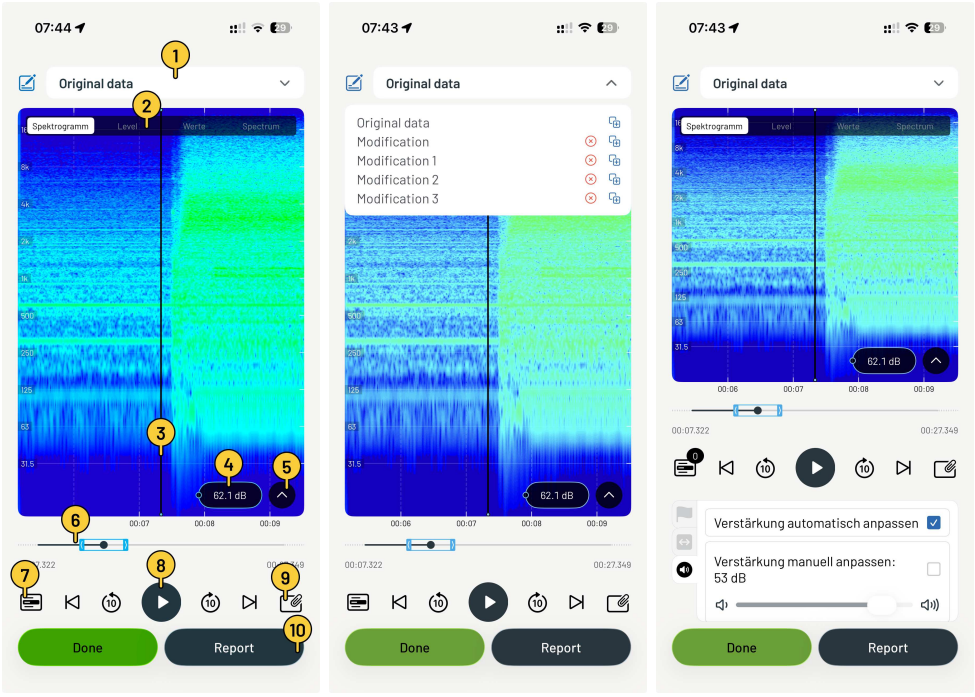
5. The selection menu (5) allows placing a marker or an ignored area. See also section 8.6.2.

6. The time overview (6) shows the current cursor position relative to the total measurement duration. The blue area represents the current screen section. Moving it updates the display accordingly. Adjusting the blue boundaries changes the displayed section. Zooming and navigation can also be performed using gestures directly on the diagram: pinch to zoom, swipe to move.

7. The first icon (7) in the control bar opens the overview menu for markers, ignored areas, and audio normalisation during playback (Figure 8.7c).

8. The five player icons (8) allow playback of the measurement. Please note that playback may be very quiet due to the limited capabilities of smartphone speakers compared to the measurement microphone. The level can be increased automatically or manually using the normalisation function. Normalisation can also be disabled here (Figure 8.7c).

9. The last icon (9) in the control bar provides access to the measurement documentation (section 8.5).



(a) Audio player with central controls.

(b) List of existing modifications

(c) Normalizing the level

Figure 8.7: Overview of the audio player

10. The "Report" button opens the report generator. See also section 8.7.

8.6.2 Setting Ignored Areas and Markers

If disturbing noises occurred during the measurement, the affected area can subsequently be ignored and excluded from the calculation of averaged levels. Markers can also be set for relevant events. The central reference for values or modifications is the central cursor (Figure 8.8c).

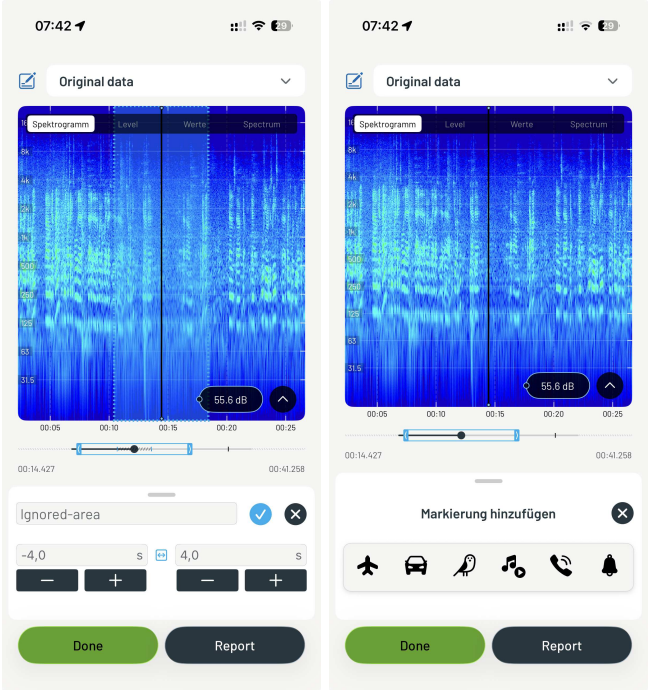
To create a marker or an ignored area, open the selection menu in the measurement to be edited and select the "Ignored-area" icon or "Marker" icon .

A new modification is created automatically. In the "Ignored-area" settings screen, select the start and end of the ignored area relative to the cursor using the "+ / −" buttons. Confirm the selected area by tapping the blue checkmark . The original data remain unchanged and can be accessed at any time via the upper dropdown menu (Figure 8.8a)

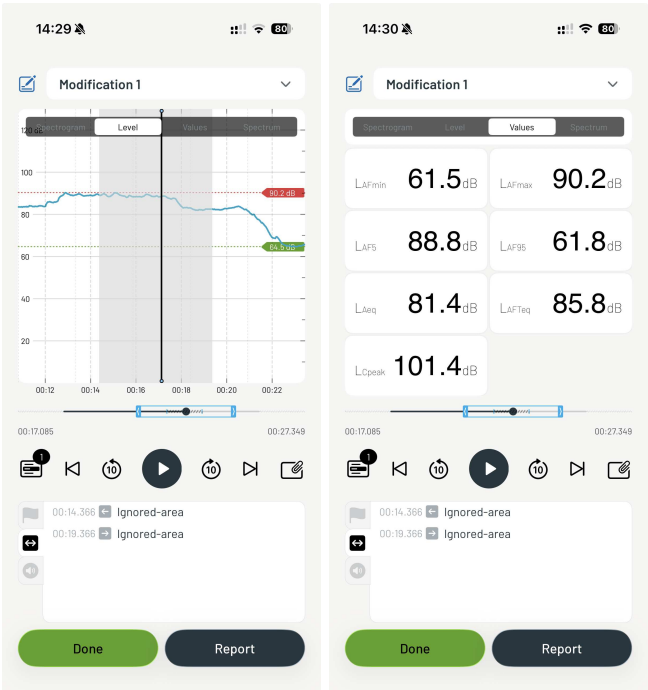
Various markers are available for events (Figure 8.8b). These presets can also be adjusted in the settings (see section 8.2).

Markers and ignored areas can be edited or deleted using the corresponding buttons and tabs (bzw.). See also Figure 8.8c).

The ignored area is displayed in grey in the level view for verification. In the values view, levels are calculated without the ignored area (Figure 8.8d).



(a) Create ignored area (b) Create marker



(c) Ignored areas in the level curve (d) Newly calculated values

Figure 8.8: Ignored areas and markers

8.7 Generating a Report

A report can be generated either directly after the measurement or later via file management.

Once all relevant modifications have been created (section 8.6), the report generator is started using the "Report" button (Figure 8.9a).

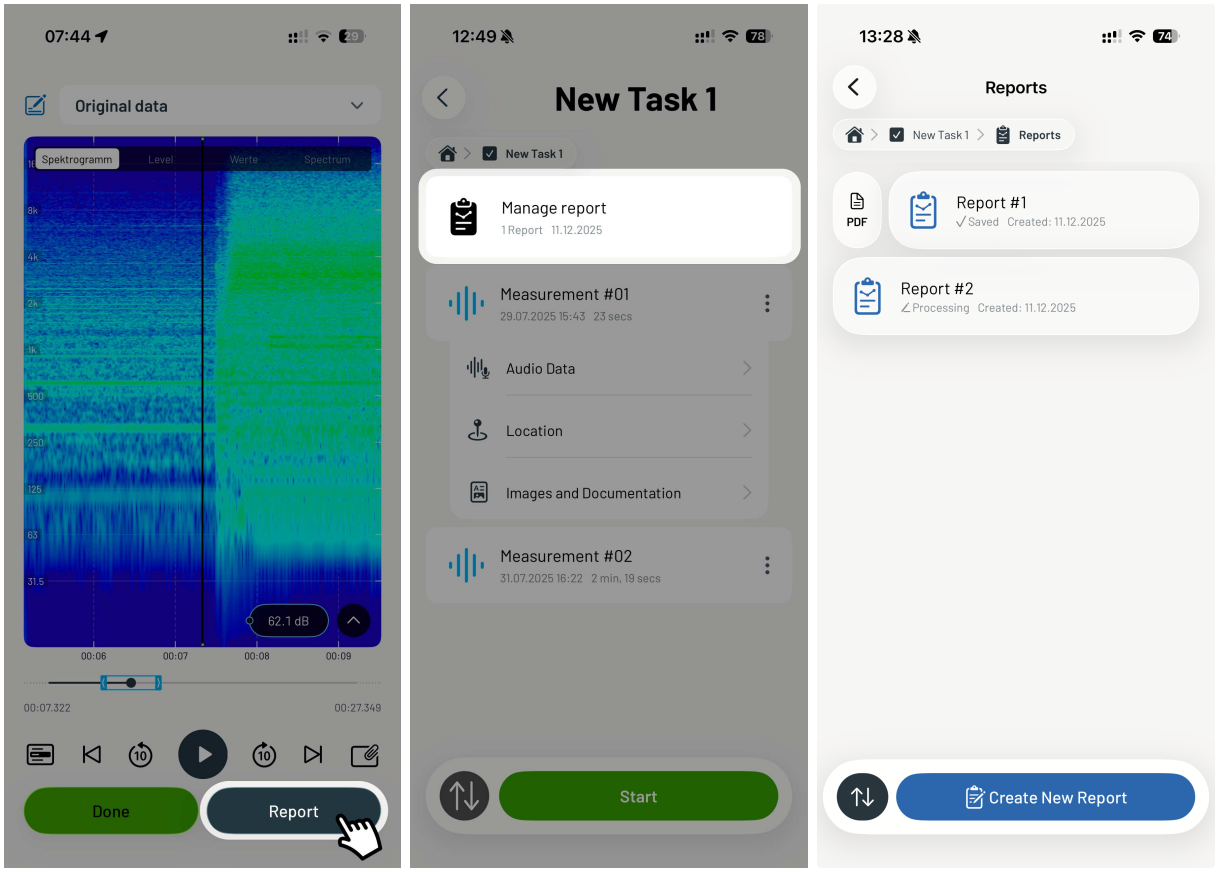
If a report is to be created or modified later, this can be done via the file browser. Within a task, the report management is available (Figure 8.9b). New reports can be created, existing reports edited, and generated PDF documents shared (Figure 8.9c).

Report generation consists of three steps:

1. In the first step, recurring information such as company, editor, or report language is entered.

2. The second step allows various settings related to the measurements and their presentation.

3. In the third step, a PDF is generated for easy sharing of the report.

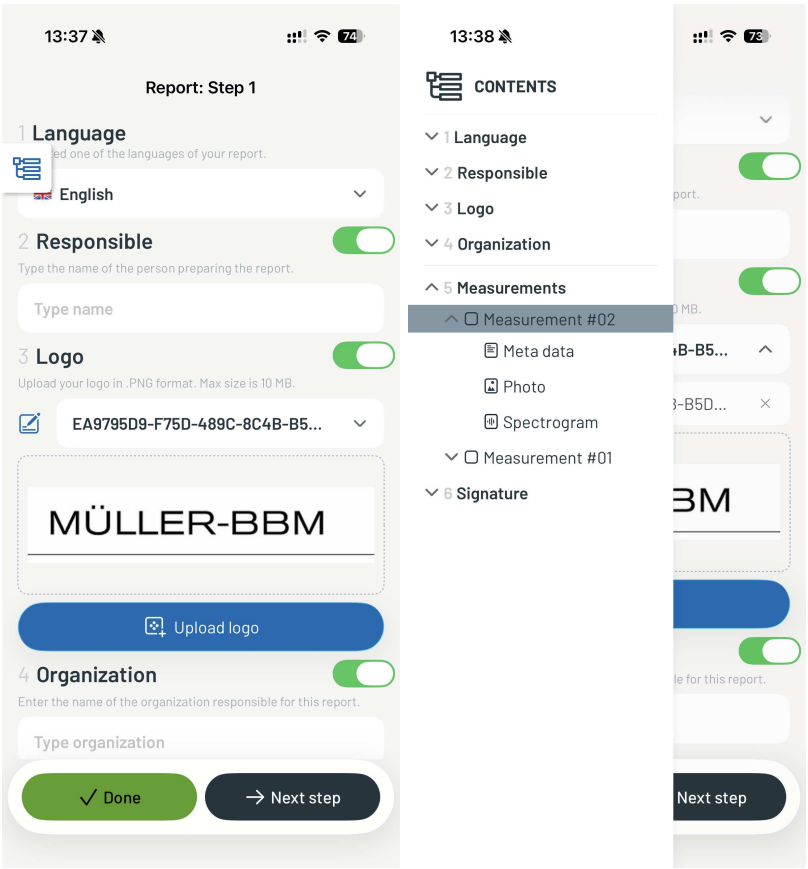


(a) Create report immediately after measurement (b) Report manager in file management (in the task) (c) Reports and related PDF documents

Figure 8.9: Create and manage reports

8.7.1 Report – Step 1

- In this screen (Figure 8.10a), recurring report information is entered. These details are available the next time the generator is opened and do not need to be re-entered. The language in which the report is to be generated can be selected (English, German, Japanese, Portuguese). The person responsible for the measurement can also be specified. Under "Upload Logo", a logo can be selected from the photo media library or captured using the camera. The organisation can then be entered.
- A drop-down menu provides an overview of all relevant items (Figure 8.10b).
- Step 1 is completed by pressing "Next step". "Done" closes the generator and saves the entered data.
- Deactivated blocks are not included in the PDF.



(a) Step 1 of the report generator (b) Overview in the report generator

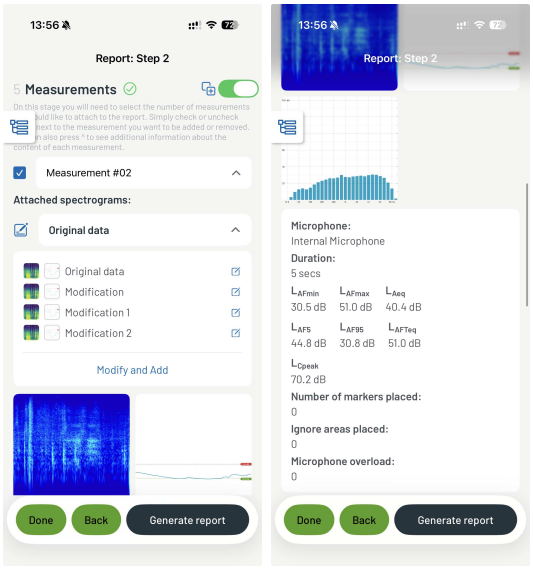
Figure 8.10: The generator for automated creation of measurement reports

8.7.2 Report – Step 2

- Measurement-specific data can now be entered and selected. The structure is divided into measurement data blocks and the signature. Measurement data blocks can be duplicated, deactivated, or deleted using the corresponding icon . Measurements can be removed by first deactivating them using the green slider and then deleting them with the delete icon (Figure 8.11c). This allows, for example, comparison of a measurement with and without modification.
- A measurement block contains the following elements:
  - Measurements, their modifications, and metadata (Figure 8.11a)
  - Diagrams and values (Figure 8.11b)
  - Photos (including image descriptions, Figure 8.11d)
  - Geolocation (as a map); acoust IQ automatically distinguishes between a stationary measurement and a measurement path (Figure 8.11d)

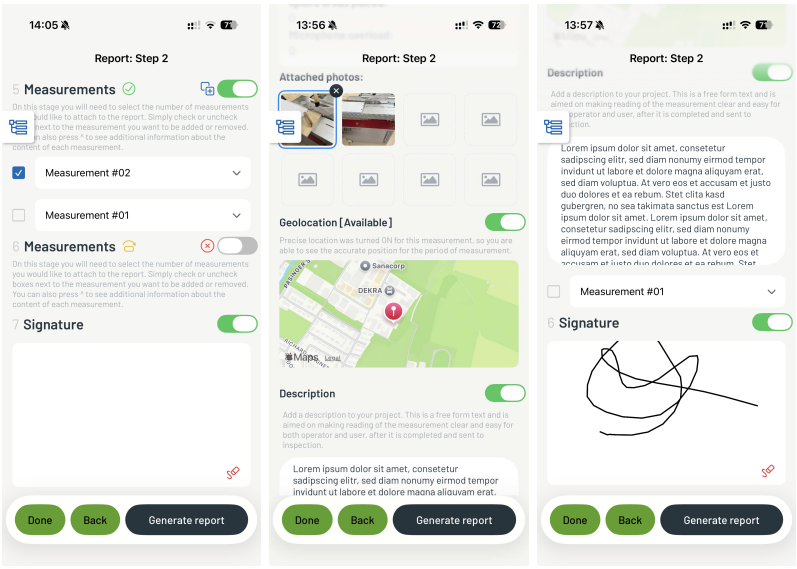
  - Project description (Figure 8.11e)

- Pressing “Create report” generates the report preview. The report can then be shared as a PDF. If a PDF already exists, it will be overwritten by the newly generated report.



(a) Select measurement and modification

(b) Diagrams and values of the measurement



(c) Add and delete additional measurements

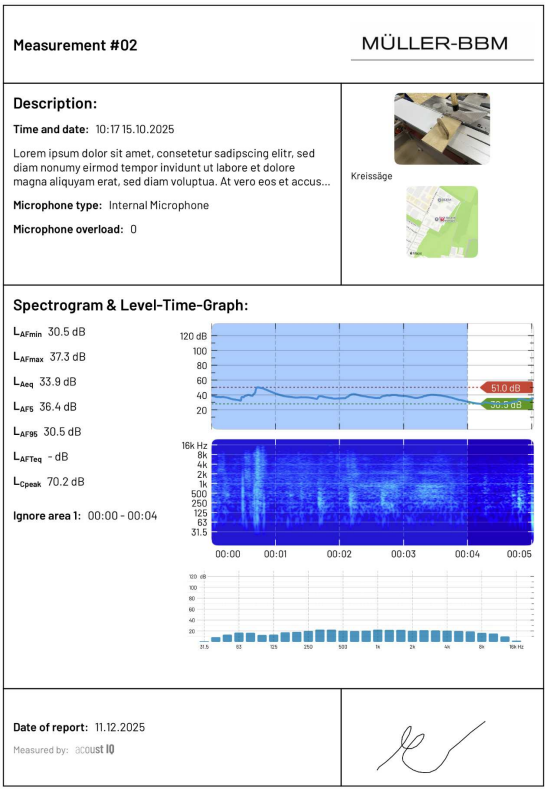
(d) Photos and geolocation

(e) Measurement description and signature

Figure 8.11: Second step in the report generator

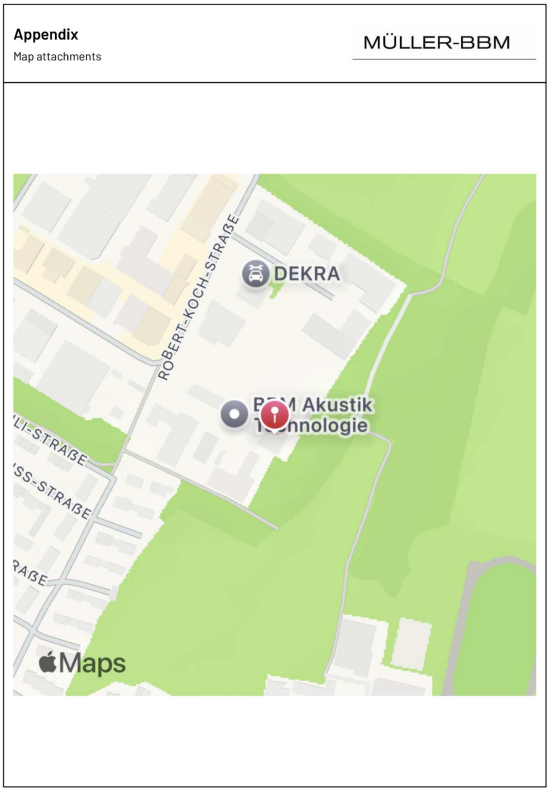
8.8 Generated Report

In the output, one page of the report is used per measurement (Figures 8.12a). This allows individual report pages to be easily integrated into other documents. Diagrams, photos, and geoinformation are additionally included as separate pages in the appendix (Figures 8.12b, 8.12c).



(a) Main page of the report

(b) Photo attachment



(c) Map appendix

Figure 8.12: Generated report

9 Measurement Parameters

The acoust IQ app, in combination with the measurement microphone (Microtech Gefell MV240/MKS225), forms a precise Class 1 handheld sound level meter that meets the requirements of the following standards for sound measurement and frequency analysis:

- DIN 45 641
- DIN EN 61672-1
- DIN EN 61260-1

The following calculated level values are available simultaneously (reference sound pressure p_0 = 20 µPa, Figure 9.1):

L_{AF} current A-weighted sound pressure level with time constant F (Fast)

L_{Aeq} equivalent A-weighted continuous sound level

L_{AFmin} minimum A-weighted sound pressure level

L_{AFmax} maximum A-weighted sound pressure level

L_{AF5} 5% percentile level

L_{AF95} 95% percentile level

L_{AFT5} A-weighted maximum cycle level with 5-second cycle time

L_{AFTeq} energy-averaged A-weighted peak level

L_{Cpeak} C-weighted peak sound pressure level

frequency ratings: A, C, linear (Z)

time ratings: F (fast) und S (slow) The time limit for each measurement is preset to 30 minutes. When this time is reached, a new measurement is recorded in the task until the 'Stop' button is pressed.

The measurement time is determined by 'Start' and 'Stop'.

The spectrogram and the level-time curve with the sound level LAF (instantaneous value and third octave level) are continuously updated.

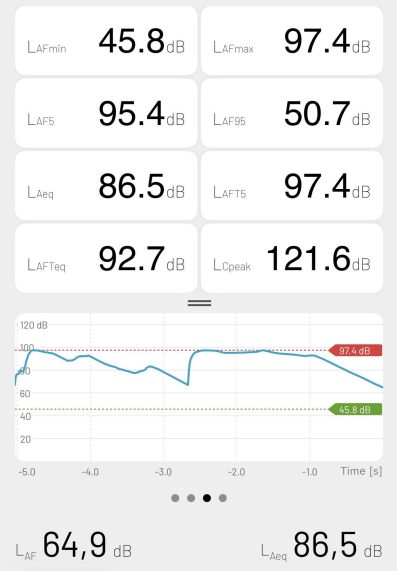


Figure 9.1: Available level values

9.1 Overview Symbols

Marker

Ignored-area

Photos & description

Display of the number of markers, Ignored-areas

Number of markers, Ignored-area

Add Ignore-area

Add Markers

10 Technical data

10.1 Microtech Gefell MV240/MKS225

Frequency range 1 Hz bis 80 kHz

Intrinsic noise with MKS225 7 dB(A)

Limiting sound pressure level 160 dB

Digital connection USB 2.0 (Audio Class 2.0) via USB-C

Further technical details can be found at the following link: `https://www.microtechgefell.de/mikrofonverstaerker?wl=1118-MV240USB#start`

10.2 UMIK-2 (miniDSP)

Intrinsic noise ca. 18 dB(A)

Limiting sound pressure level 125 dB

Digital connection USB 2.0 (Audio Class 2.0) via USB-C

When using the UMIK-2, the classification of the sound level measurement system is reduced to Class 2. For more details on the alternative microphone UMIK-2 (miniDSP), please refer to the manufacturer's website: `https://www.minidsp.com/products/acoustic-measurement/umik-2`

11 Important Notes

- Ensure that the sound level meter is correctly calibrated in order to obtain accurate measurement results.
- Familiarise yourself with the applicable regulations and guidelines for sound level measurement to ensure that measurements are carried out correctly and in compliance with legal requirements.
- Hold the sound level meter steady in your hand during the measurement and do not place it on mechanically vibrating surfaces.
- Individual figures in this document may differ in detail, language, or format.

12 Tips

- Practise using the app and the sound level meter before carrying out the actual measurement.
- The app is easy to use and does not require any prior technical knowledge.
- If you have any questions, please contact the app's support team.

Enjoy performing your sound level measurements!