ZKXY Technology Co., Ltd.

Sound Level Meter App NoiseLab

Software instruction manual

2025

Core Features

1. Measurement Range: Precise measurements from ambient noise floor to high SPL (requires professional microphones)
2. Hardware Compatibility: Optimized for MicW i-series microphones (i437L/i437C), compliant with IEC 61672 Type 2 standard
3. Calibration: Supports automatic calibration with acoustic calibrators or manual correction value input
4. Platform Support: iOS exclusive (no Android version available)
5. Dual Versions:
   - Lite Edition: Basic sound level meter functions, free download
   - Pro Edition: Advanced features including octave band analysis, FFT, etc. (paid)

Key Measurement Capabilities

1. Basic Mode
   - Real-time SPL display (A/B/C/Z weighting)
   - Time weighting: Fast (0.125s), Slow (1s), Impulse (IEC 61672 compliant)
   - Key parameters: MAX/MIN/PEAK/LEQ/RMS
2. Advanced Analysis
   - Octave Band Analysis: Real-time 1/1 & 1/3 octave spectra with historical data comparison
   - Narrowband FFT: High-resolution frequency analysis with linear/exponential averaging options
   - Multi-Parameter Mode: Simultaneous display of 3 measurement sets with different weightings/detectors
3. Professional Modules
   - Dosimeter: OSHA/NIOSH compliant dose/TWA/LAeq8h calculations
   - Noise Rating Curves: Automatic NR/NC/PNC curve evaluation
   - Loudness Analysis: Steady-state noise analysis per ISO 532-1 (Zwicker method)

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NoiseLab Software Operating Instructions

ZKXY-III-C021 -04-P0008

V1.6

June 2025

1. Installation of the software

This software is currently only available for iOS devices with no Android version supported.

Users can directly search for NoiseLab in the App Store to install the software, and there are currently two versions:

- ✓ NoiseLab-Lite: The streamlined version that fulfills all basic sound level meter and integrating sound level meter requirements. Free to download (professional modules require subscription).
- ✓ NoiseLab: The professional version that adds octave analysis, FFT functions, and multi-parameter sound measurement capabilities. Available as a paid purchase.

Or use WeChat to scan the QR code below to install.

Essential Edition

Professional Edition

After installation, the appropriate icon will appear on the device interface, tap the icon to use it.

NoiseLab must be paired with appropriate hardware in order to perform high-precision testing. Here we recommend the use of MicW portable microphone, including: i437L, i437C, i236C, etc., please choose according to the interface of the cell phone. MicW's i-series microphone dimensions in accordance with the standard measurement microphone design, can be used for the acoustic calibrator. i-series microphone with the use of NoiseLab can meet the requirements of the IEC 61672 Type 2 sound level meter. If users need to perform calibration tests for the sound level meter at a metrology institution themselves, they must use the accessories shown in the figure below.

2. Basic definitions

This application references professional testing equipment, and the parameters and definitions used are as follows:

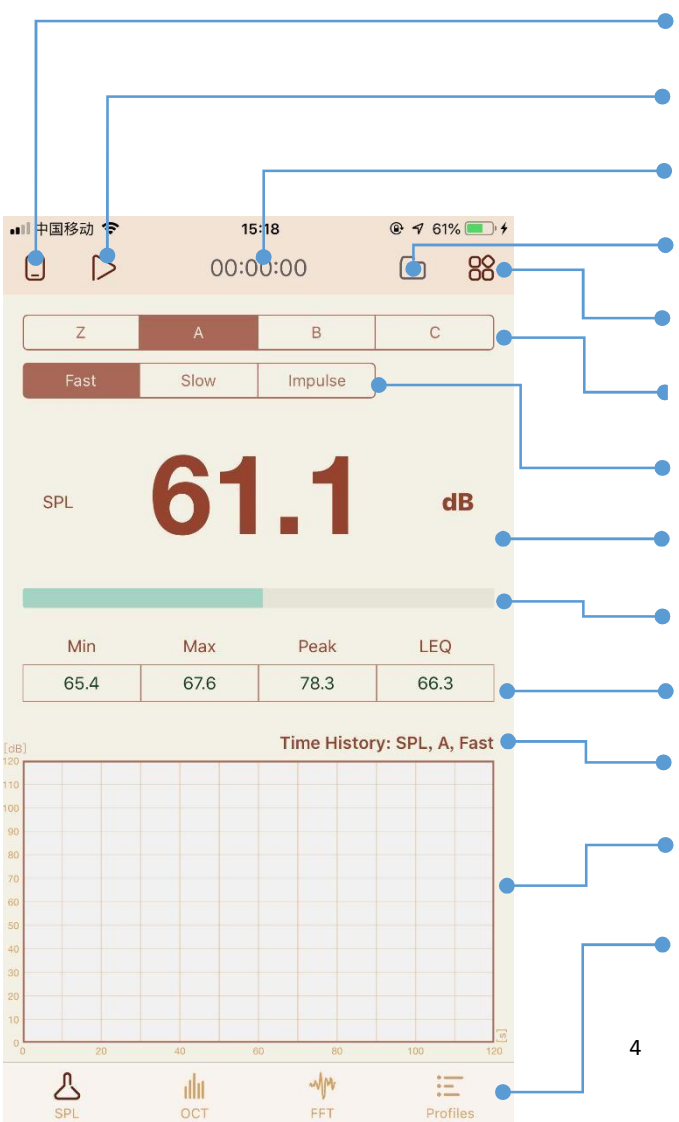
Ks	-	Sampling rate, refers to the number of data acquired by each channel of the data acquisition equipment in 1 second.
Tb	-	Single frame time (s), the length of the cache for each sample analysis, the number of samples per sample is Ks •Tb
T	-	Measurement time (s), the total time from the start of the measurement to the stop of the measurement, an integer multiple of Tb.
τ	-	Time constant, A SLOW time constant is l.0 second. A FAST time constant is 0.125 second. Impulse (I) features a 35 millisecond rise time and a 1.5 second fall time.
D(t)	-	The time-domain signal of the original acquisition, the general processing object is the sampling data of the Tb time period.
Aw (t)	-	The signal of the original time-domain signal after frequency weighting, commonly used frequency weighting include: A, B, C, Z
$P_\tau(t)$	-	The instantaneous value of the frequency-weighted signal after passing through the time weighting detector. $P_\tau(t)=\left(\frac{1}{\tau}\int_{-\infty}^{t} A_w^2(t_x)\exp\left(\frac{t_x-t}{\tau}\right)dt_x\right)^{1/2}$
P_0	-	Reference sound pressure value, 20 μPa
SPL	-	General sound level meter reading, real-time display, obtained directly from time-domain signal, Unit: dB $SPL=20\lg\left(\frac{\max_{Tb}\left(P_\tau(t)\right)}{P_0}\right)$
MAX	-	Maximum value after the time detector during the measurement time, in dB $MAX=20\lg\left(\frac{\max_T\left(P_\tau(t)\right)}{P_0}\right)=max_T(SPL)$
PEAK	-	Maximum value of the time-domain curve after frequency weighting during the measurement time, in dB $PEAK=20\lg\left(\frac{\max_T\lvert(A_W(t)\rvert}{P_0}\right)$

RMS	-	Root-mean-square value of the time-domain curve after frequency weighting during the buffer time, in dB $RMS = 20lg\left(\frac{1}{T_b}\int_0^{T_b}\left(\frac{A_w(t)}{P_0}\right)^2 dt\right)^{1/2}$
LEQ	-	Equivalent Continuous Sound Level. The root mean square (RMS) value of the frequency-weighted time-domain signal over the measurement period, expressed, in dB. $LEQ=20lg\left(\frac{1}{T}\int_0^{T}\left(\frac{A_w(t)}{P_0}\right)^2 dt\right)^{1/2}=10\lg\left(\frac{1}{n}\sum_{i=1}^{n}10^{RMS/10}\right)$
FFT	-	The algorithm for converting time-domain to frequency-domain $A_w(t) \rightarrow A_w(f)$.

3. Operation Instructions

3.1 Initial interface (SPL)

The initial interface of the software is shown in the figure below, and is in the "wait" state. At this time, frequency weighting and time detection can be freely switched, and the displayed reading is the real- time result of the sound pressure level under the current setting.



Microphone

Start Button

Measurement Time

Save

Menu

Frequency weighting

Time detector

SPL reading

Sound level progress bar with overload indication

Integral acoustic parameter

Parameter description of time history

Graphic display of time history

Measurement mode switching

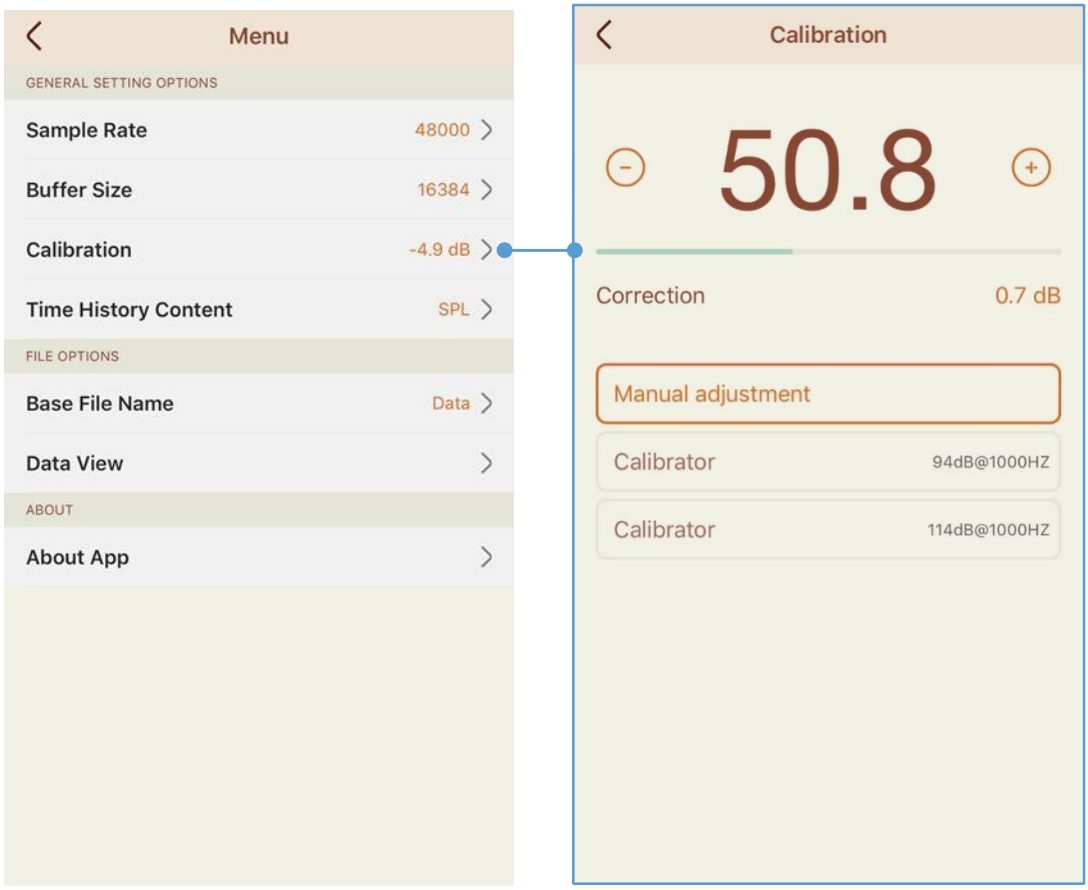
Sound Level Meter Mode "Wait" Status

★ If an external microphone is used, the microphone indicator will show . Make sure this is always the case during the entire test.

★ The integral acoustic parameter is only displayed in the "Test" state, in which case the Start key will be displayed as .

3.2 Calibration

Click on Menu // Calibration to enter the calibration interface:



It is highly recommended to use this function with a professional acoustic calibrator. Please insert the transducer into the calibrator and turn the calibrator on.

Manually click ⊖ ⊕ to adjust the displayed sound pressure level to the sound pressure level indicated by the calibrator. Alternatively, you may select the matching calibration option below for automatic calibration.

★ Make sure that the unit is correctly connected to the external microphone i437L and that the sound calibrator is fully inserted. The acoustic calibrator needs to sound continuously during calibration.

★ When calibration is complete in auto calibration mode, you need to click ✓ to confirm the calibration result.

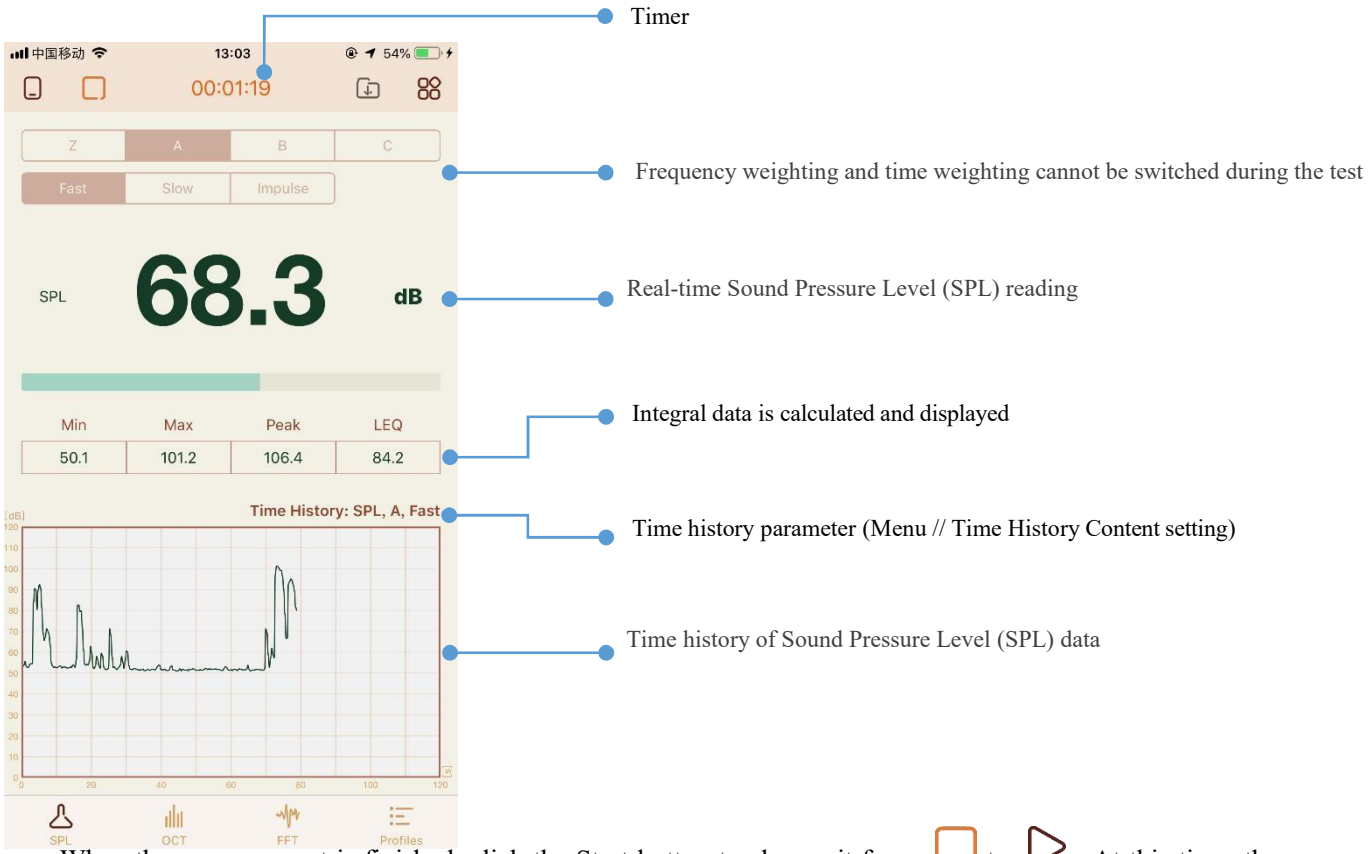
★ If you do not have an acoustic calibrator, please check the factory test certificate of the i437 to find the value of Correction and adjust it by manually clicking ⊖ ⊕ . Please note that in this case, you need to make sure the software's gear setting is Mid.

★ If the gear setting is set to Low, the calibrator's 114 dB gear may be overloaded, then please use the 94 dB gear.

3.3 Test state (SPL)

Click the start key to enter the test state, the key will change from ▷ to □ and the timer will start at the same time.

At this time, the frequency weighting and time detection cannot be modified, while the integration data starts to be calculated and displayed.



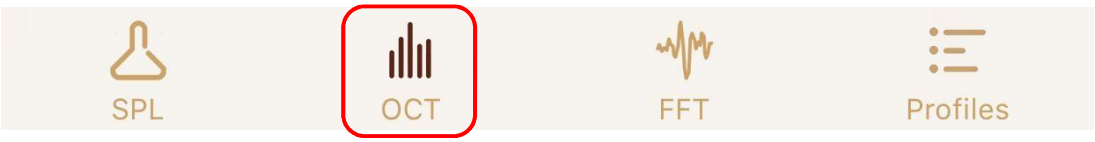
When the measurement is finished, click the Start button to change it from □ to ▷ . At this time, the

Save button will be lit, i.e. will change to . After saving, it will turn gray again, indicating that no data can be saved. Since only the latest data can be stored, the last result file will be lost if the test is re-entered.

★ In addition to following the SPL reading indication, the sound level process bar also has an overload indication function. The color of the instantaneous overload process bar will change to red, and if there is an overload during the measurement time period, the process bar will display a red outer frame.

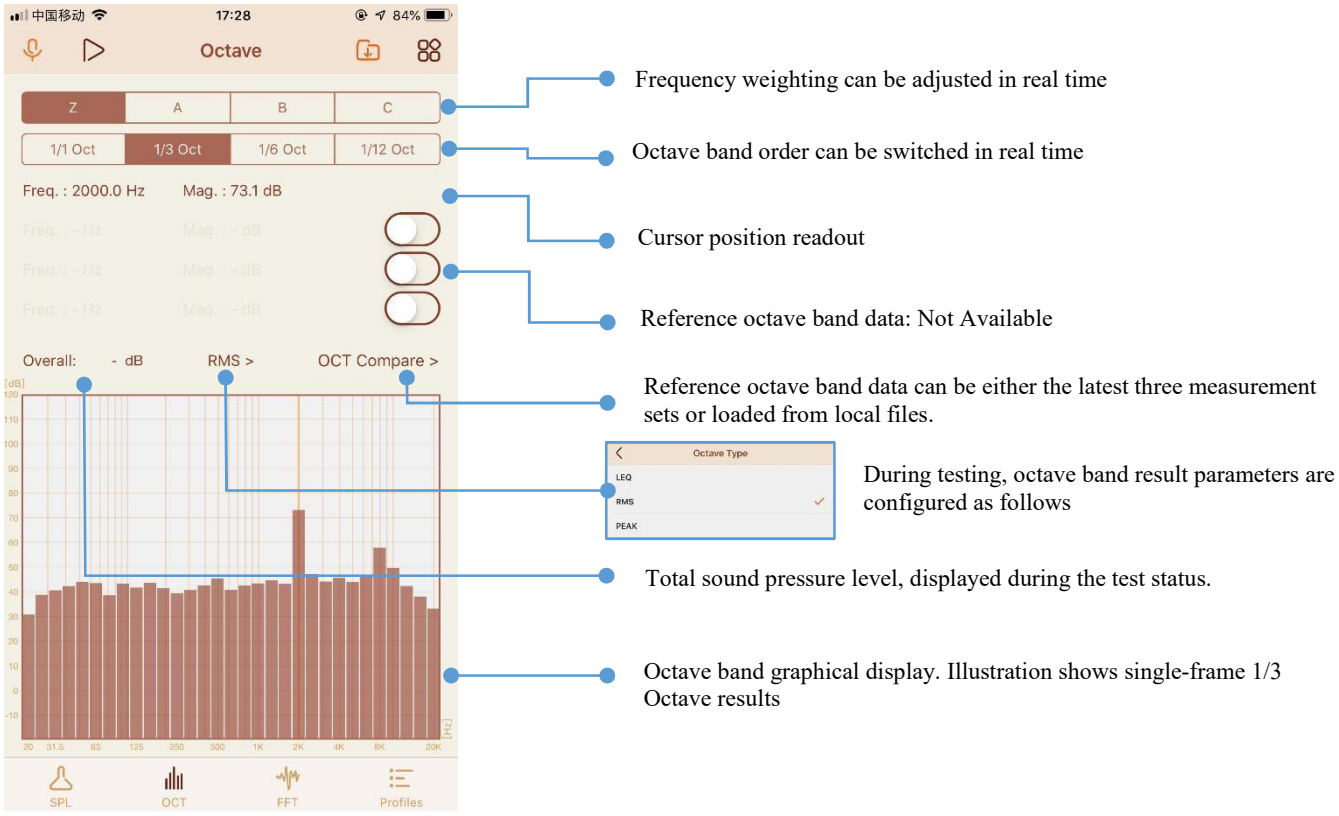
3.4 Octave Mode (OCT)

Click the function below to enter the octave mode.



3.4.1 Initial Waiting State

Octave mode is also divided into waiting state and test state. The first time you open the software octave waiting state is shown in the figure below. The software performs real-time octave band frequency analysis and displays the results.



Octave Band Mode - Standby State (Initial Software Launch)

★ Only when the software is opened for the first time, the interface is as shown above, displaying the real-time

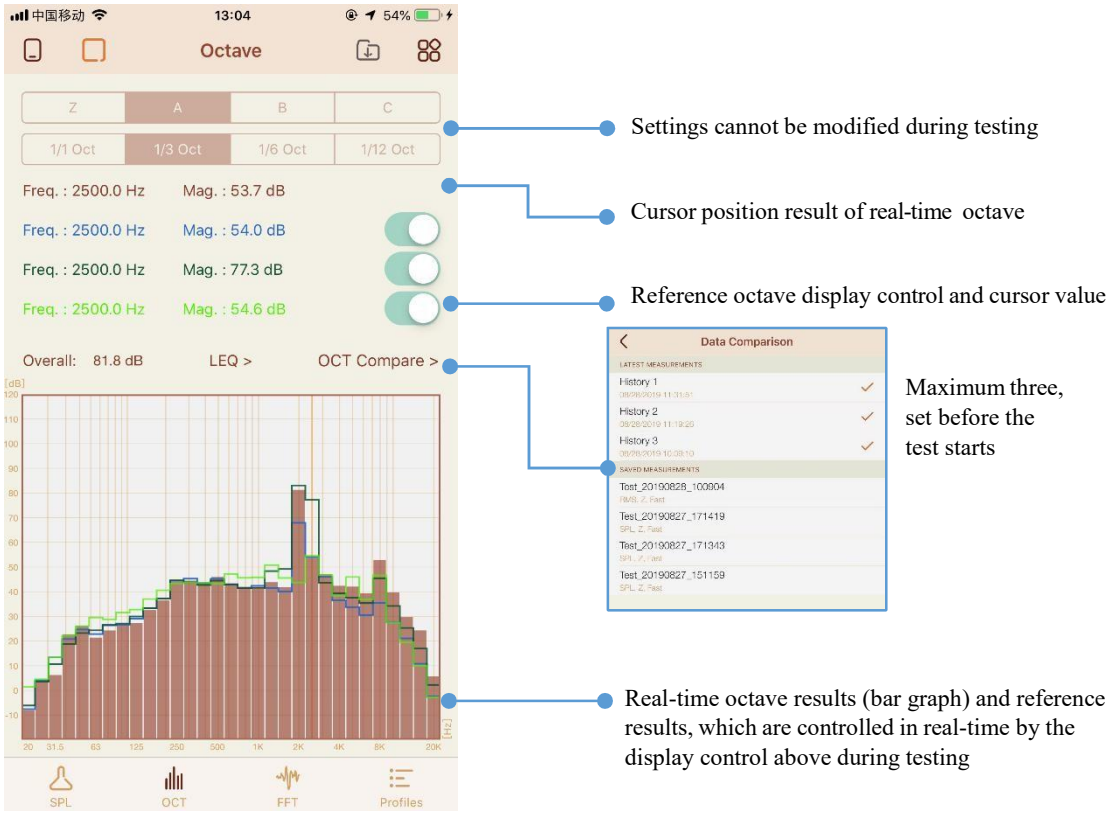
data of octave, i.e., the single-frame result. After clicking , the test will start, and the data displayed will be determined by the setting of the octave result parameter, and will be the integral result of the current test time. By clicking , the test will stop and the real-time octave single-frame results will no longer be displayed until the test is performed again.

★ After the test starts, RMS means displaying the octave result obtained from the current frame, i.e. the real-time spectrum; PEAK is the maximum value hold of the each frequency, and the maximum value of each frequency is obtained at the end; LEQ is the average value of the energy of the spectrum.

★ History 1, History 2, and History 3 display the results of the last, second-to-last, and third-to-last tests, respectively.

3.4.2 Test Status

Click the Start button to enter the test state. The octave modes in the test state are as follows:



Test status of octave mode

Tap the Start button again to stop the test, the Start button will change from to . At this time the Save button will be illuminated, i.e. will change to . After saving, it will turn gray again, indicating that there is no data to save.

★ Except for the display control, most of the settings can not be modified in the test state. W hen clicked, it

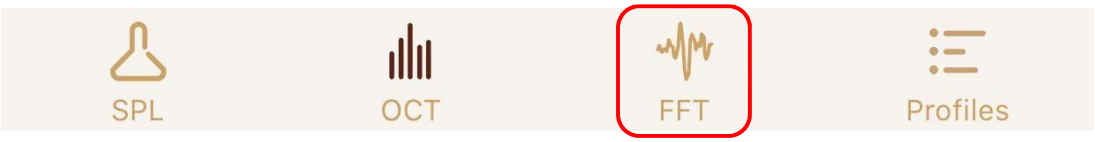
prompts whether to stop the test or not.

★ After stopping the test, it will enter the waiting state again, and except SPL mode, other modes will not be tested in real time, and you can only move the cursor to view the data of other frequency bands after stopping the test.

★ The reference data must be consistent with the current test settings before displaying, for example, if the reference data is the test result in 1/1 Octave mode, and the current test is 1/3 Octave, the reference data will not be displayed on top of the image.

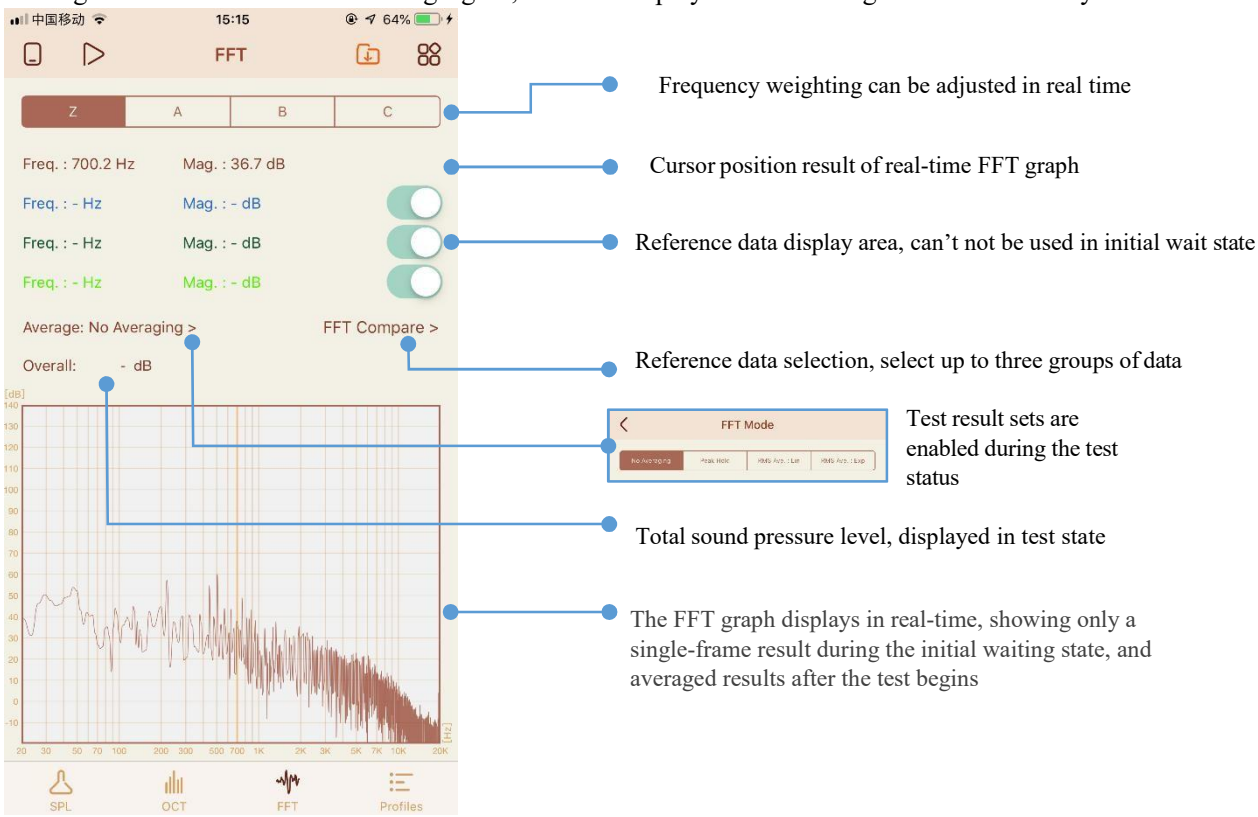
3.5 Narrow Band Analysis Mode (FFT)

Click the function below to enter Octave Mode.



3.5.1 Initial Waiting State

FFT mode is also divided into waiting state and test state. The first time you open the software octave waiting state is shown in the following figure, where it displays real-time single-frame FFT analysis results.



Octave Band Mode - Standby State (Initial Software Launch)

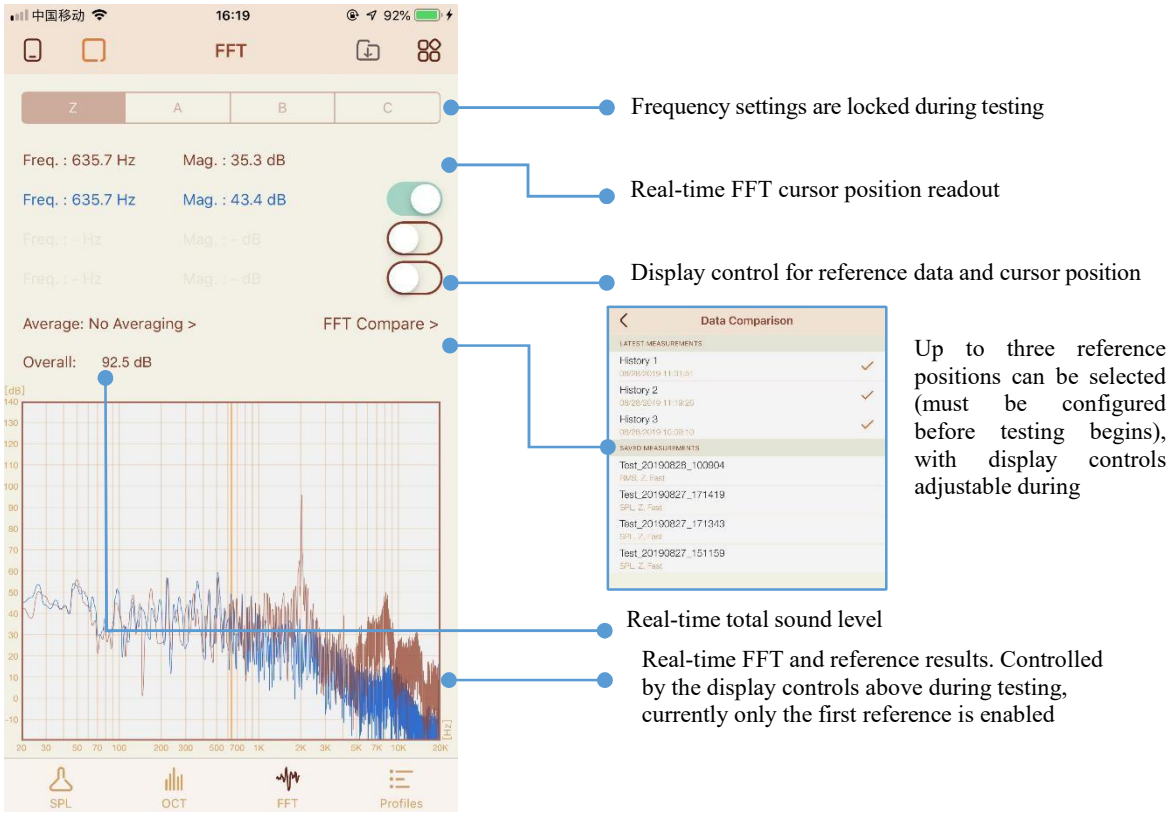
★ Only when the software is opened for the first time, the interface is as shown above, displaying the real-time data of FF analysis, i.e., the single-frame result. After clicking ▷ , the test will start, and the data displayed

will be determined by the setting of the Average parameter. By clicking , the test will stop and the real-time octave single-frame results will no longer be displayed until the test is performed again.

★ After the test starts, No Averaging indicates that the FFT results obtained from the current frame are displayed, i.e., the real-time spectrum; PEAK Hold is the maximum value of the spectrum saved, and finally the maximum value of each frequency is obtained; RMS indicates that the average of the energy, i.e., the square of the sound pressure, is averaged; Lin represents linear averaging - every spectrum within the averaging count has equal weight. Once the specified count is reached, the result remains constant; Exp is exponential averaging, and the weights of the latest data remain unchanged and the data are updated until the test is stopped.

3.5.2 Test Status

Click the Start button to enter the test state, and the FFT modes in the test state are as follows:



Click the Start button again to stop the test, the Start button will change from to , and then the Save button will be lit, i.e. will change to . After saving, it will turn gray again, indicating that there is no data to save.

★ Except for the display control, most of the settings cannot be modified in the test state, and the setting will prompt whether to stop the test or not.

★ After stopping the test, it will enter the waiting state again. Except SPL mode, other modes are no longer real-

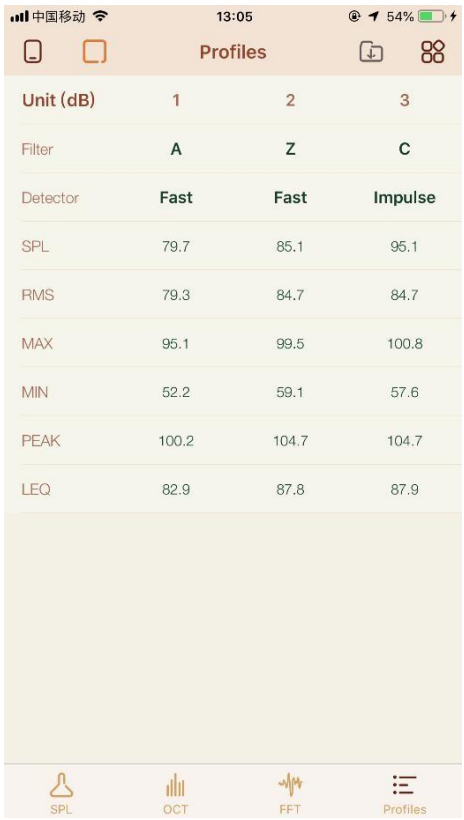
time tested, and FFT mode only allows to move the cursor to view other frequency data above the current graph.

★ The reference data must be consistent with the current test settings before displaying, i.e., FFT data at the same sample rate and size of a single frame can be compared.

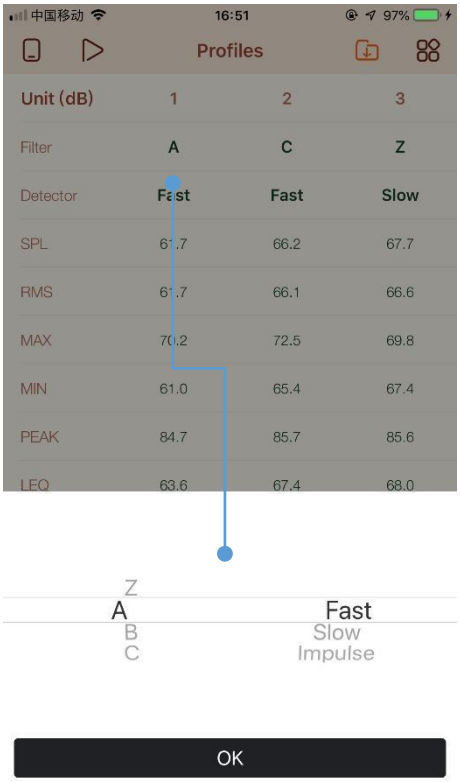
3.6 Other Acoustic Parameters (3Profiles)

Click on the function below to enter the Other Acoustic Parameters mode.

The 3Profiles mode displays sound pressure level data for three different combinations of settings at the same time. Readings are only displayed in the test state, and all data in the waiting state are saved as the original results. The combination of settings can be modified only in the waiting state. Click on the Filter or Detector corresponding to the column that needs to be modified to enter the Edit menu, as shown on the right side of the figure below.



Test Status of the Profiles Mode

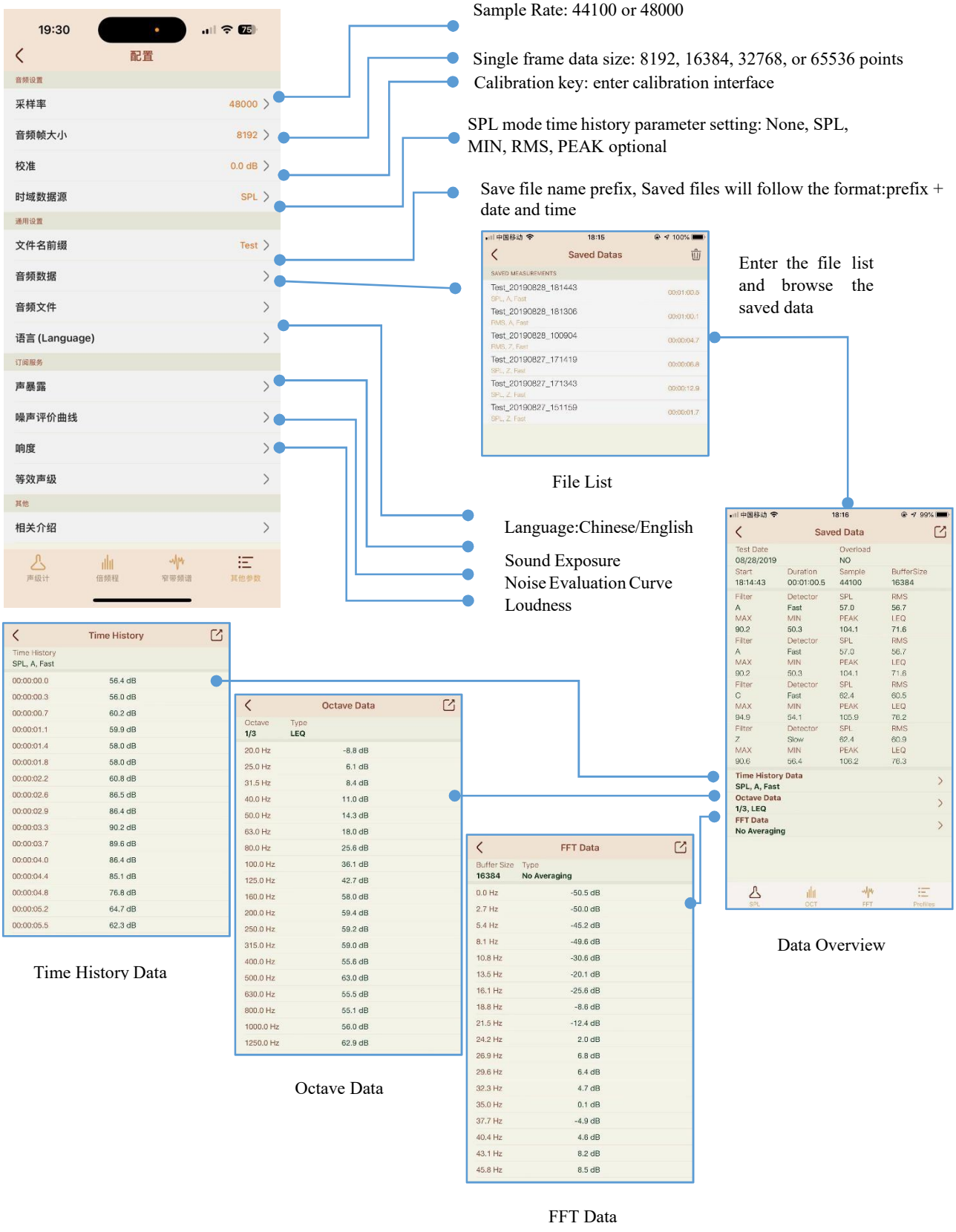


Access to Parameter Settings during Waiting Status of the Profiles Mode

After clicking ▷, the test starts and three sets of results are displayed until the test is stopped by clicking ▢.

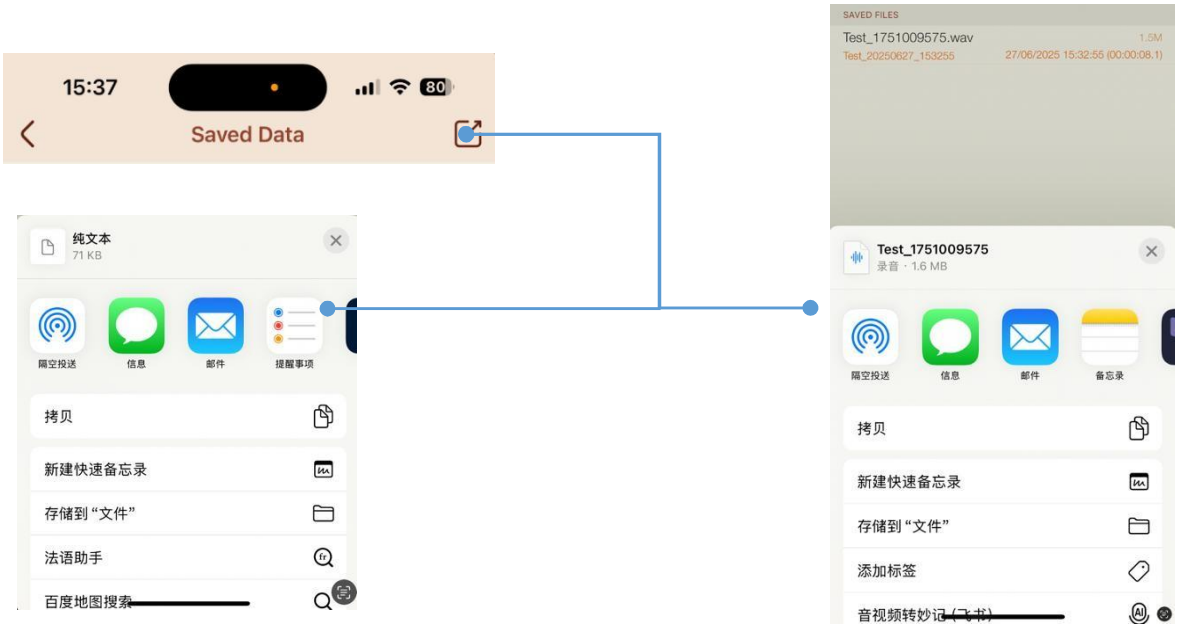
3.7 Menu Setting

Click the menu button to enter the setting menu.



If you need to synchronize the original recording file during the test, you can set it in "Recording Settings and Files", and the recorded file can be viewed here.

Saved files can be viewed locally, or you can click the Share button to send the saved file via email, WeChat, or file:

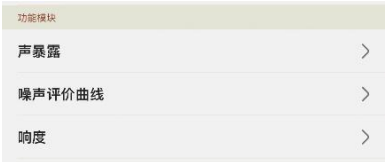


★ The menu will show the gear after inserting the external microphone. If it's not the i-series microphone, if the gear is valid is not sure.

★ If you select WeChat when sharing data, only the data of the current page will be available.

3.8 Other Function Modules

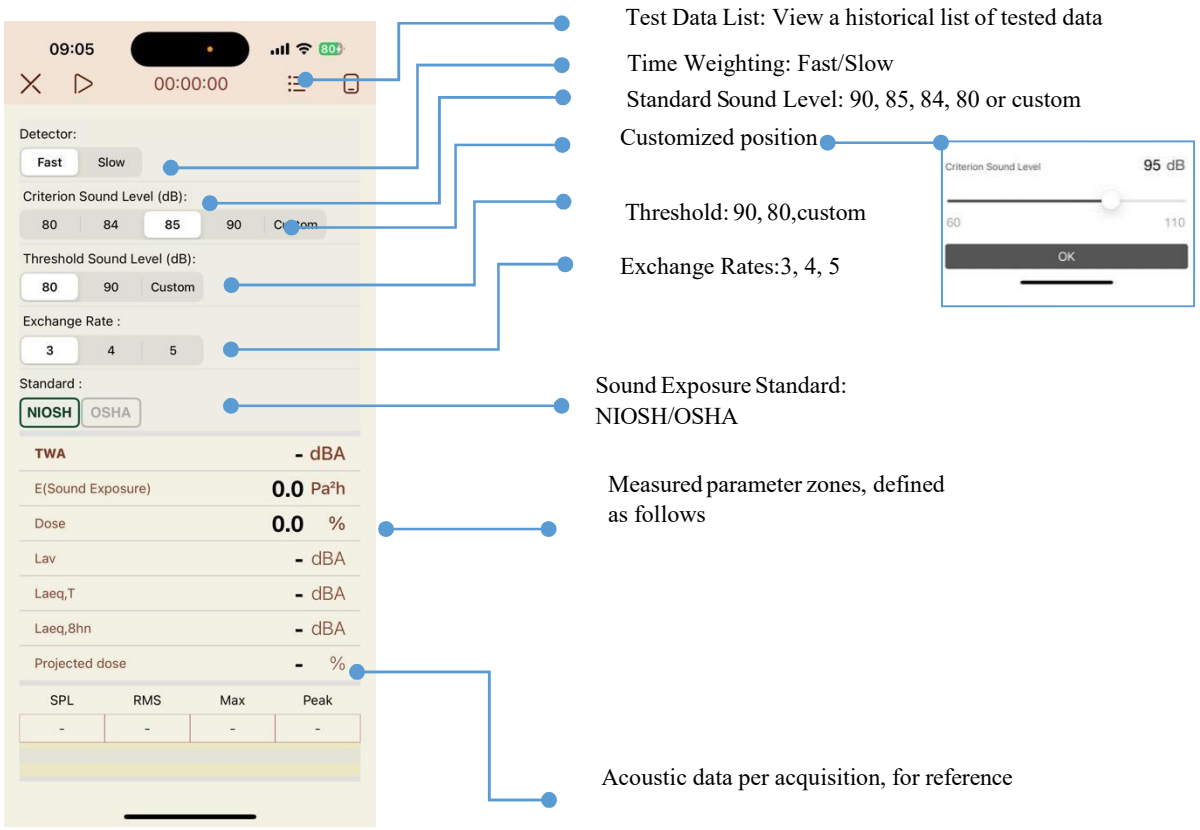
NoiseLab's expansion modules are accessed from the Function Module in the menu, as shown in the figure below. Currently, there are modules for Sound Exposure, Noise Evaluation Curve, Loudness, etc., and new function modules will be added here in the future.



3.8.1 Sound Exposure (Dosimeter)

The Dosimeter module is designed for use in the occupational health and safety field to help the user assess the potential hazard of noise to hearing. The module provides key parameters such as sound exposure (Dose), Time Weighted Average (TWA) and Leq to ensure that noise levels in the workplace meet safety standards.

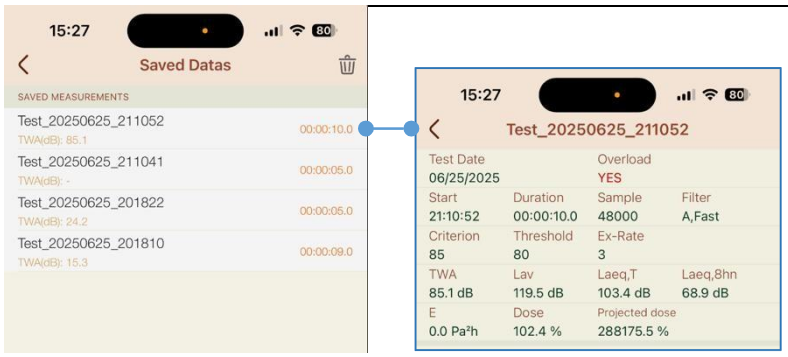
The interface is as follows:



Before the test, select the parameters according to the local test standard, including fast and slow gear, standard sound level, threshold, exchange rate, etc. You can also directly select the standard: NIOSH or OSHA.

Click ▷ to start the test, and the timer starts at the same time. Press ▢ to end the test and get the sound exposure data at the corresponding time, as shown below.

Test data will be automatically saved. The saved file can be viewed by clicking ☰ on the upper right corner. Please click on the corresponding file to display the specific data content.



Parameter Definition

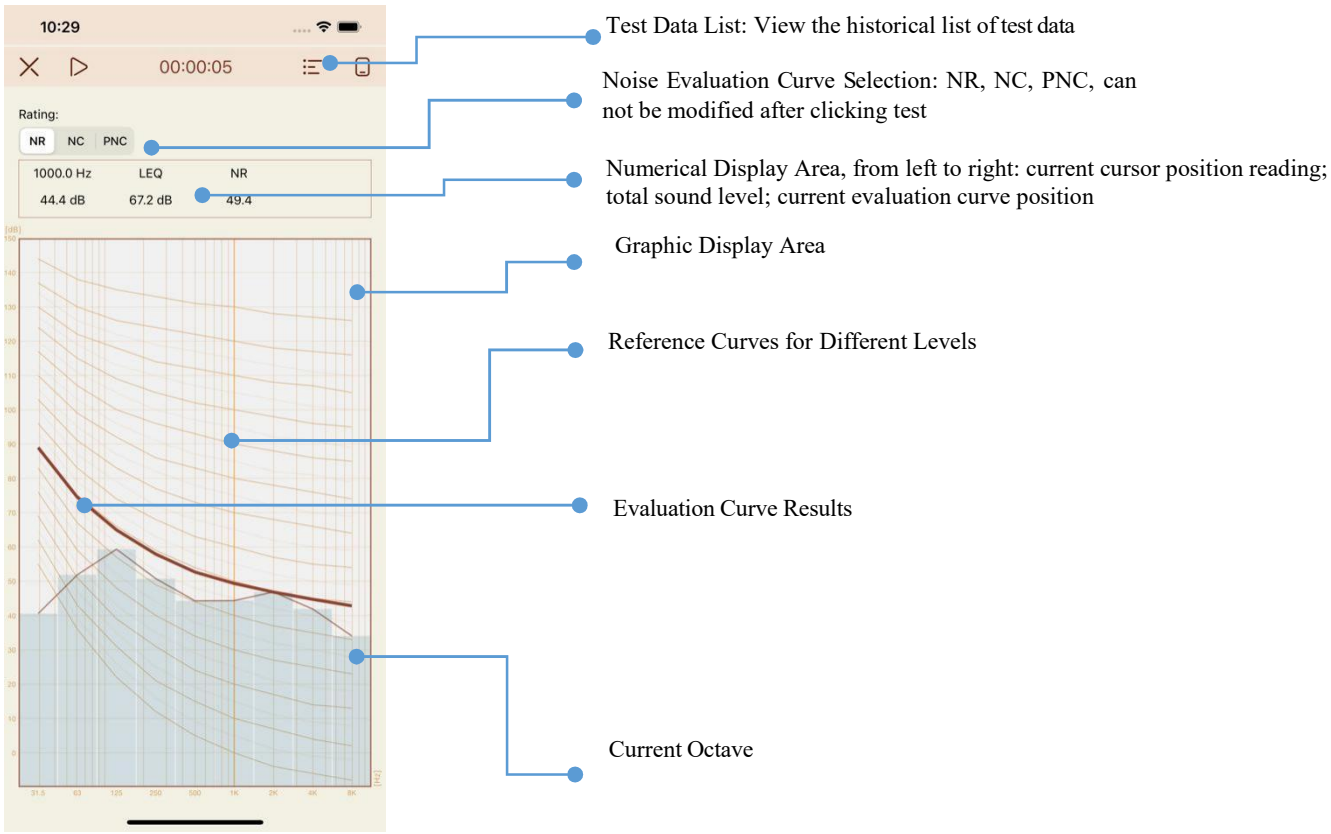
Criterion sound level(Lc)	90, 85, 84, 80 dBA or Variable (V). Definition: Level of a sound which, continuously applied for eight hours,results in a 100% criterion exposure.
Threshold sound level(Lt)	90, 80, V (Variable). Definition: Sound levels below this value are not counted in the dose statistics.
Exchange Rate	5,4,3. Definition: The change in sound level corresponding to a doubling or halving of the duration of sound level while a constant percentage of criterion exposure is maintained.
E	Sound exposure, unit: Pa2h $E=\int_{t1}^{t2} P_A^2\,dt=(p_0^2T)[10^{0.1\times L_{Aeq,T}}]$
D(Q)	Percentage criterion exposure for exchange rate Q, unit: % $D(Q)=(\frac{100}{T_c})\int_0^T 10^{[(L(t)-L_c)/q]}dt$ L(t) is SLOW(or FAST) A-weighted sound level, a function of time, when the sound level is greater than or equal to l, or equals $-\infty$ when the A-weighted sound level is less than Lt; q: exchange rate in decibels，$q=\begin{cases}\frac{3}{lg2}=9.97 & 3dB\\ \frac{5}{lg2}=16.61 & 5dB\\ \frac{4}{lg2}=13.29 & 4dB\end{cases}$
TWA	8-hour time-weighted average sound level，$TWA=L_c+qlg[D(Q)/100]$ dBA
Lav	Average sound pressure，$L_{av}=L_c+qlg[D(Q)\times T_c/100T]$ dBA
$L_{Aeq,T}$	Equivalent continuous A-weighted sound pressure level. The equivalent continuous sound level over measurement duration T (unit: dBA).
$L_{Aeq,8hn}$	Normalized 8-hour Average Sound Level，dBA

$$L_{Aeq,8hn}=L_{Aeq,T}+10lg\ (\frac{T}{T_c})$$

3.8.2 Noise evaluation curve (Noise Curve)

The Noise Curve module is designed for the evaluation of background noise from buildings, equipment and the environment, and supports a variety of international standard noise evaluation curves, including NR, NC and PNC curves. Through these curves, users can quickly assess whether the noise complies with the relevant standards and optimize the acoustic design.

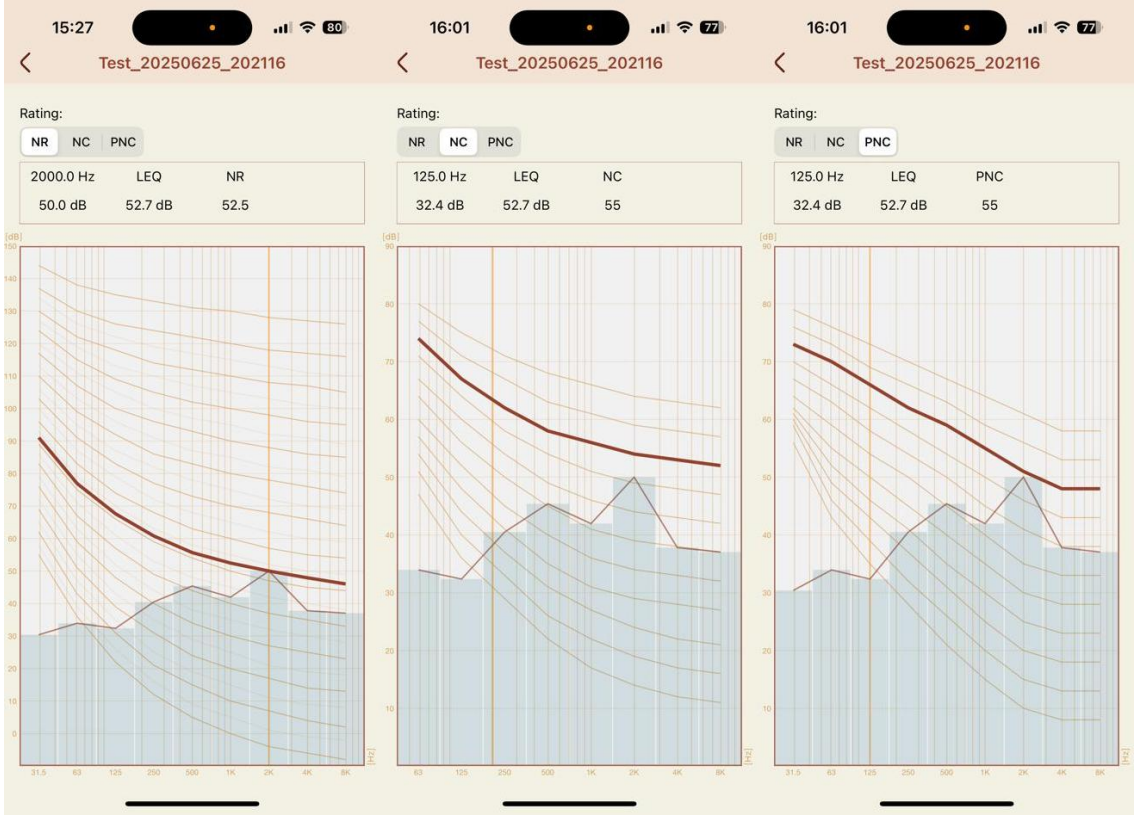
The test interface is shown below:



Before the test, select the desired noise evaluation curve: NR, NC or PNC. Click to start the test while the timer starts. The program starts the 1/1-octave test and averages the energy simultaneously until the test ends by pressing . The software will calculate and display the noise evaluation curve according to the final averaged spectrum. During the test, you can move the cursor to check the noise value of the corresponding frequency at any time.

The test data will be saved automatically, the saved file can be viewed by clicking at the upper right corner, and the corresponding file will be displayed by clicking the corresponding data.

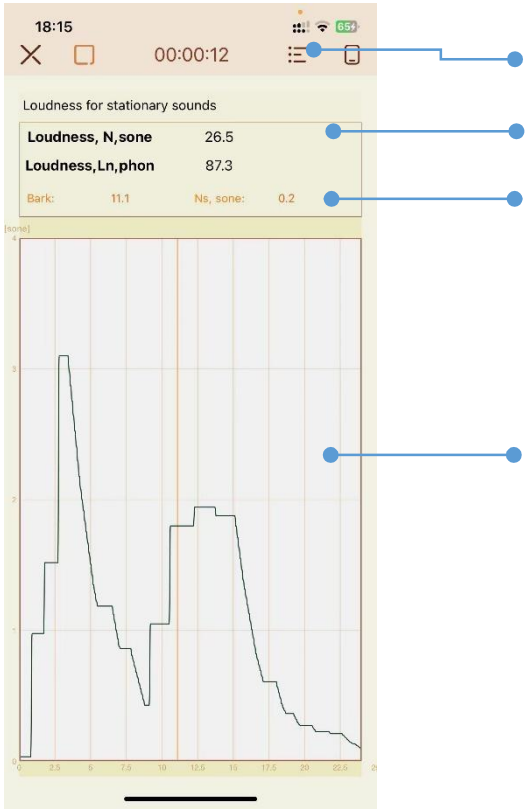
Clicking on the corresponding data will display the page of test data content, in which you can switch NR, NC or PNC to view the curve of the corresponding standard, and at the same time, you can also view the corresponding data according to the spectrum.



3.8.3 Loudness

Loudness is an important parameter to measure the impact of sound on the human ear, especially in the field of audio engineering, product noise evaluation, etc. NoiseLab's loudness analysis module is based on the standard of ISO 532-1 2017 Acoustics - Methods for calculating loudness Part 1: Zwicker method. 1: Zwicker method, which currently only supports the measurement and calculation of loudness and loudness level of steady state noise.

The test interface is shown below:



Test Data List: view the historical list of test data

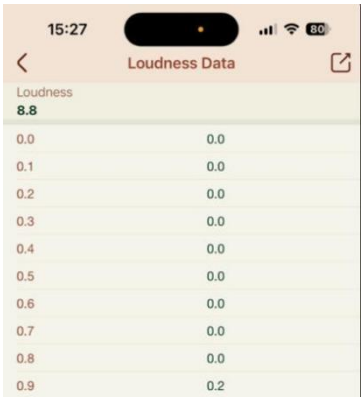
Total loudness results, including loudness (unit: sone) and loudness level (unit: phon)

Cursor position, displaying the specific loudness corresponding to the critical band

Specific Loudness Spectrogram Area

Directly click to start the loudness test, the software gives the current loudness spectrum and total loudness in real time, as shown in the above figure. When you press to end the test, the displayed result is the last set of 1/3 octave calculated loudness.

The test data will be saved automatically, the saved file is viewed by clicking at the upper right corner and clicking the file name to view the saved content:



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