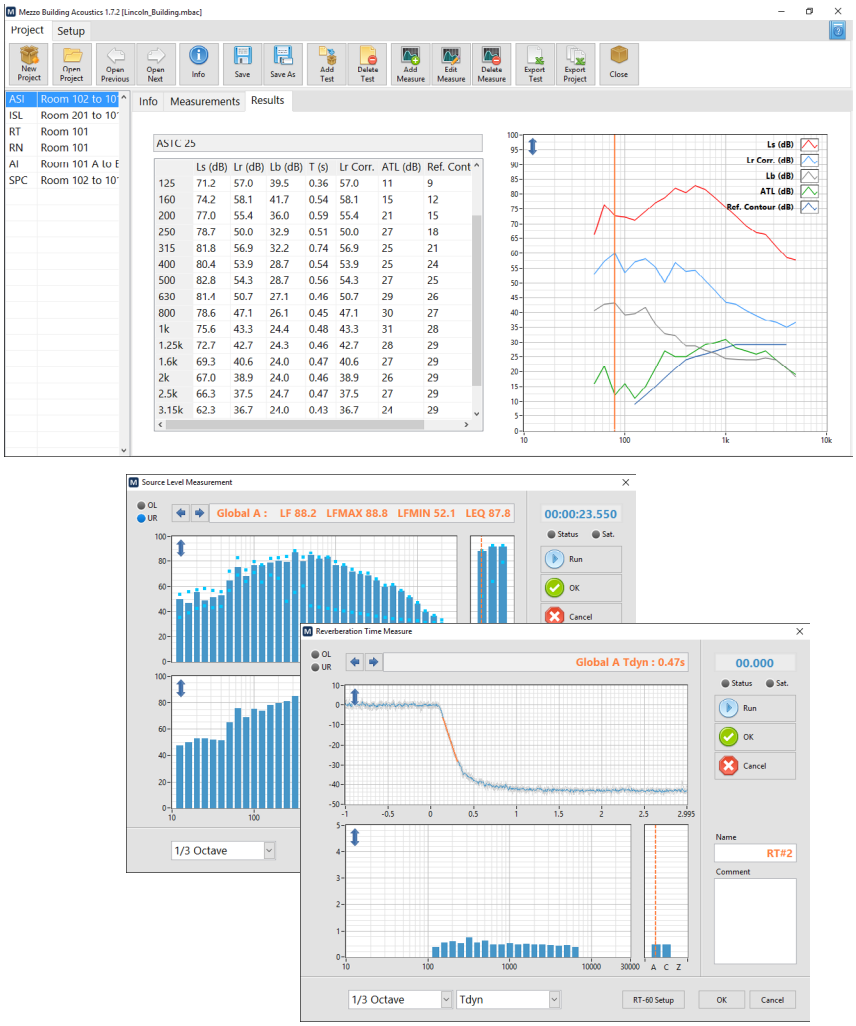
Mezzo Software Suite

Building Acoustics Module

User Guide – v1.7.2

2017-01-05



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1 Introduction

Congratulations on your purchase of the Mezzo Building Acoustics Module.

Intended to be used with the Mezzo Precision Microphone, the Mezzo Building Acoustics Module is the perfect tool for the noise specialist providing an integrated project file with on-site reports:

- Airborne Sound Insulation,
- Impact Sound Level,
- Reverberation Time,
- Room Noise,
- Speech Privacy in Open Offices,
- Speech Privacy provided by a Closed Room.

The Mezzo Building Acoustics uses a project file approach combining measurements and test reports in a single file.

This approach makes it easy to manage a large quantity of measurement and provide on-site reports. The on-site reporting allows not only to view the test result instantly, but also to make sure that no measurement was forgotten.

The current user guide describes the functionalities of the Building Acoustics Module. For more information on the Mezzo Precision Microphone hardware, please refer to the Mezzo Precision Microphone user guide.

2 Standards

Test Type	Standards
Airborne Sound Insulation (ASI)	DW, DNW, DNTW, R'W (ISO 140-4:1998, ISO 717-1:2013) NIC, NNIC, ASTC (ASTM E 0336:2005, ASTM E 0413:2004)
Impact Sound Level (ISL)	L'NW, L'NTW (ISO 140-7:1998 - ISO 717-2:2013) FIIC (ASTM E 0989:2006, ASTM E 1007:2004)
Reverberation Time (RT)	T10, T15, Tdyn T20, T30, EDT (ISO 3382-2:2008) T25 (ASTM E 2235:2004) Interrupted noise method 1/1 Octave and 1/3 Octave
Room Noise (RN)	NC, RNC, RC MkII (ANSI S12.2:2008), RC, NCB (ANSI S12.2:1995) NR (ISO 1996:1971)
Speech Privacy in Open Offices	AI, PI (ASTM E1130:2002)
Speech Privacy provided by a Closed Room	FIIC (ASTM E 2638:2010)

3 Building Acoustics System Description

The following sub-sections describe the three main components of the Building Acoustics system: the computer, the Mezzo unit and the microphone.

3.1 Computer

The PC is at the heart of the monitoring station. Of course, this PC needs to have the Building Acoustics module installed.

Computer Requirements

Item	Minimum Requirements
Operating System	Windows XP SP3, Windows Vista, Windows 7, Windows 8
CPU	Dual-Core at1.2 GHz
Memory	2 GB RAM
Hard drive	300 MB free hard disk space
Port	USB 2.0
Minimal Display resolution	800 x 600

3.2 Mezzo Unit

The Mezzo unit provides the interface for signal measurement. It is connected to the computer using the standard mini-B USB cable (included). The input of the Mezzo Precision Microphone is a SMB connector, which usually hosts a microphone.

3.3 Microphone

The Mezzo unit supports any IEPE compatible microphones. The following table give the recommended microphones. Recommended microphones are BSWA type MPA221 (Class 1) and BSWA type MPA225 (Class 2).

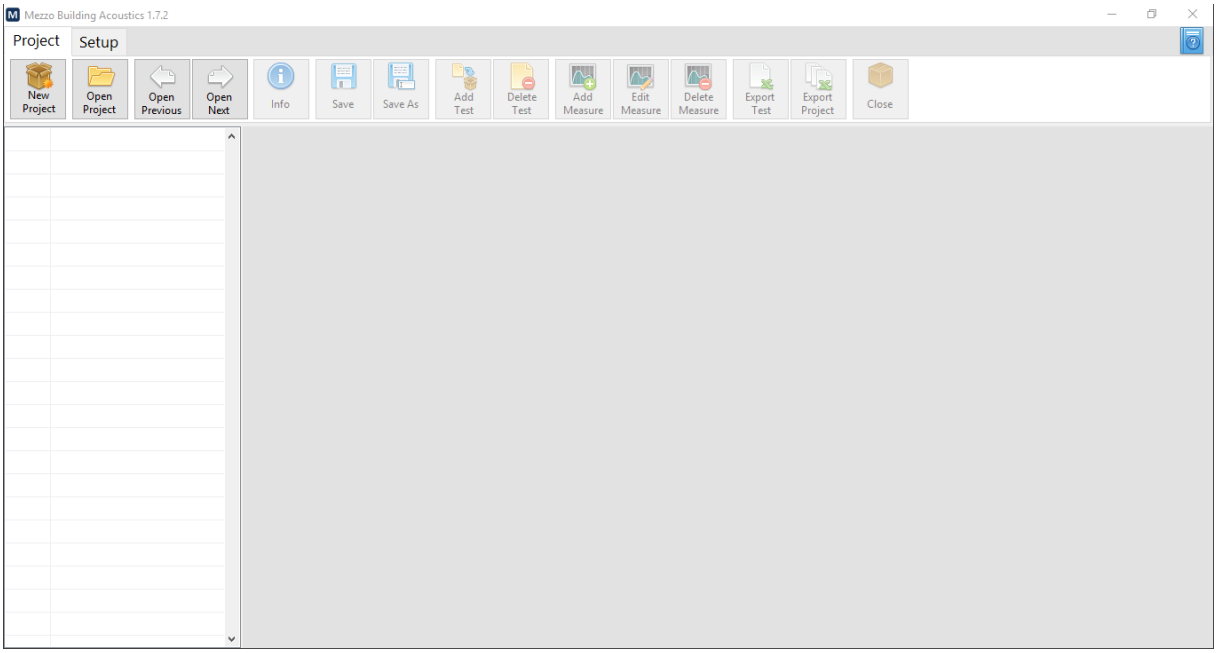
4 Step-by-Step Examples

This section describes how to use the Building Acoustics module through an example project.

4.1 Start the Application

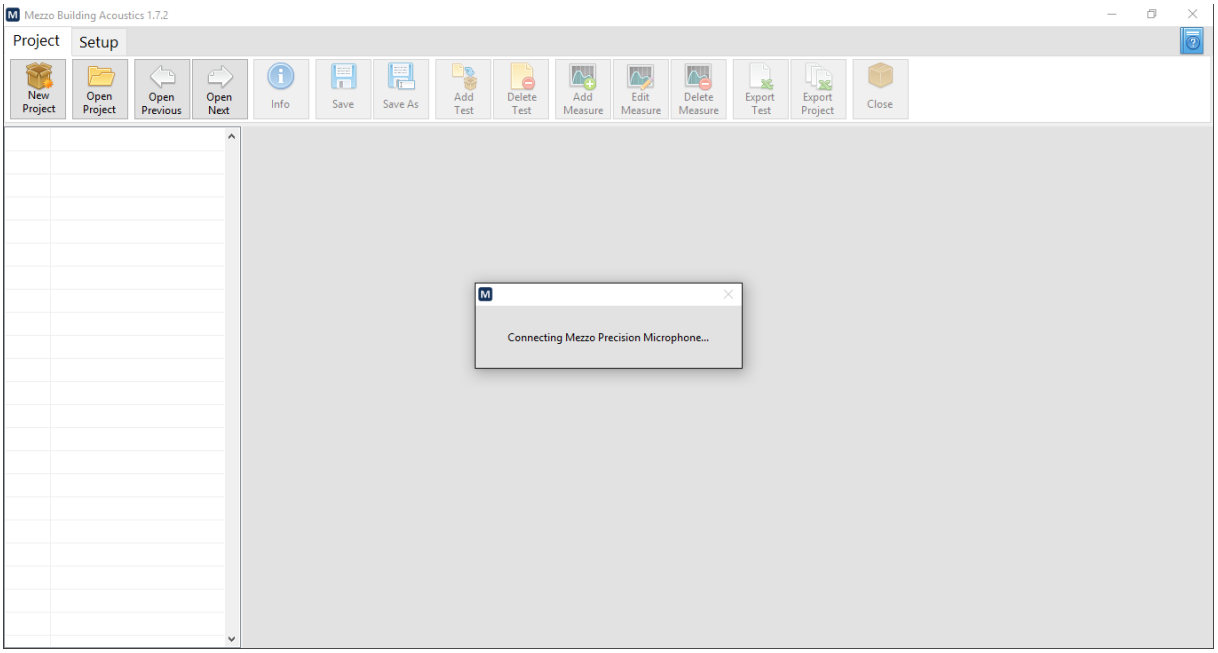
The Mezzo Building Acoustics Module is part the Mezzo Suite installer. The latest release can be downloaded from the Soft dB website (http://www.softdb.com/software.php?mezzo). The installer installs the module and all the necessary drivers.

The Mezzo Building Acoustics Module can be loaded from Windows Start Menu→All Programs→Mezzo→Building Acoustics.



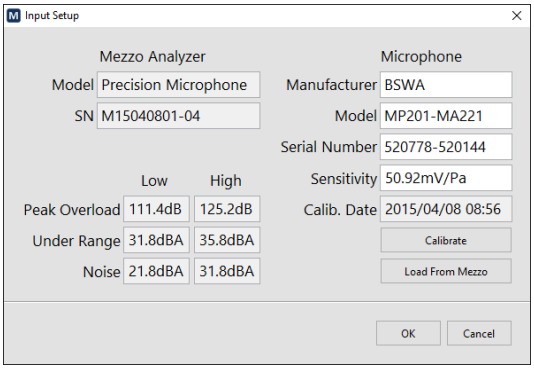
4.2 Configure the Microphone

Connect the Mezzo unit to the computer using the provided standard USB cable (type Mini-B). A small window appears to indicate that the software is connecting to the Mezzo unit.



4.2.1 Set the Microphone Sensitivity

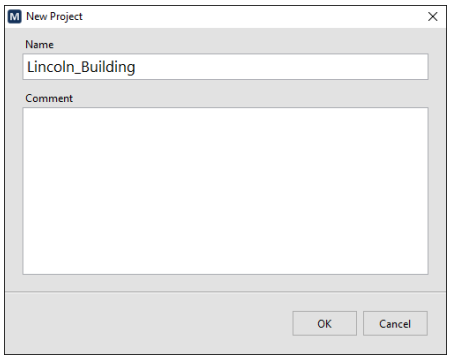
The sensitivity of the Mezzo unit must be set in the software. From the Setup tab of the main panel, press the Input Setup button to open the Input Setup interface. Then, press the Load From Mezzo button to update the microphone sensitivity from the factory calibrated value. It is also possible to perform a new calibration by clicking on the “calibrate” button.



4.3 Create a New Project

A Project File includes all the measurement and test reports from a measurement campaign. It's recommended to use a single project file for a measurement campaign.

To create a new project, click on the "New Project" button from the Project toolbar and enter a project name.



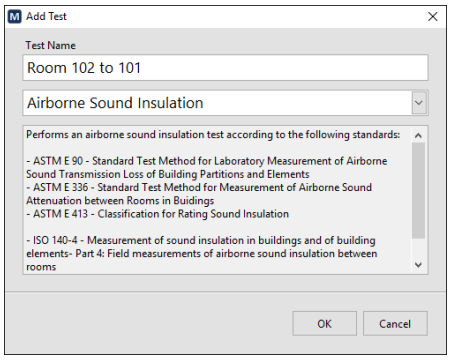
4.4 Add a Test

The measurements are related to tests of a certain type. Available test types are:

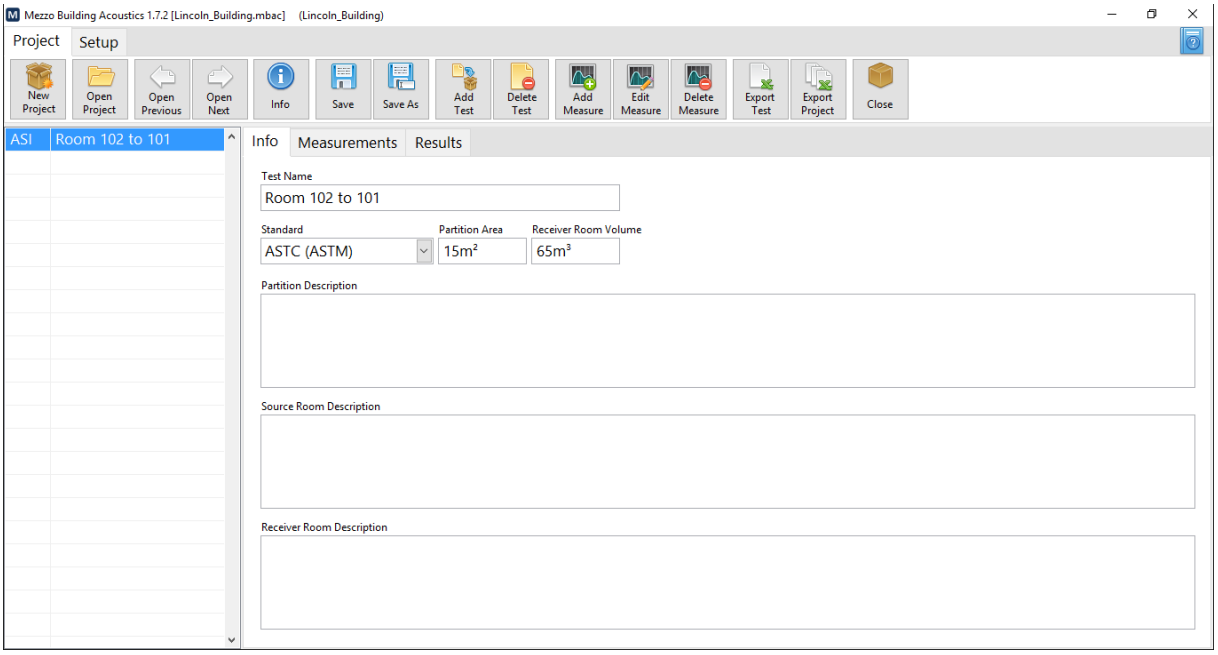
- Airborne Sound Insulation (ASI),
- Impact Sound Level (ISL),
- Reverberation Time (RT),
- Room Noise (RN),
- Speech Privacy in Open Offices (AI),
- Speech Privacy provided by a Closed Room (SPC).

4.4.1 Performing an Airborne Sound Insulation Test

Click on the Add Test button from the Project toolbar. Enter the test name and select "Airborne Sound Insulation" from the test type drop-down menu:



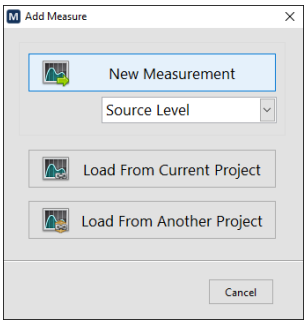
Once the test is created, you can enter the standard, partition area and the receiving room volume:



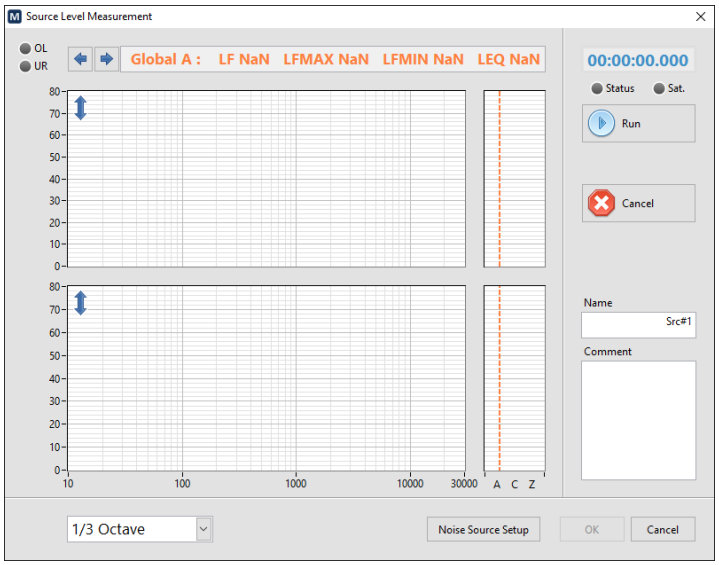
Note that you can change these values afterwards.

Measuring the Source Noise Level

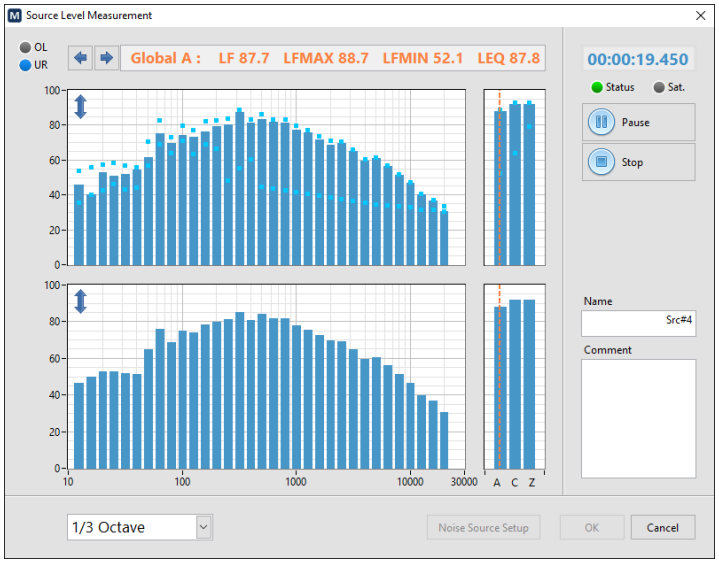
Click on the “Add Measure” button from the project toolbar. Select “Source Level” from the drop-down menu and click on “New Measurement”.



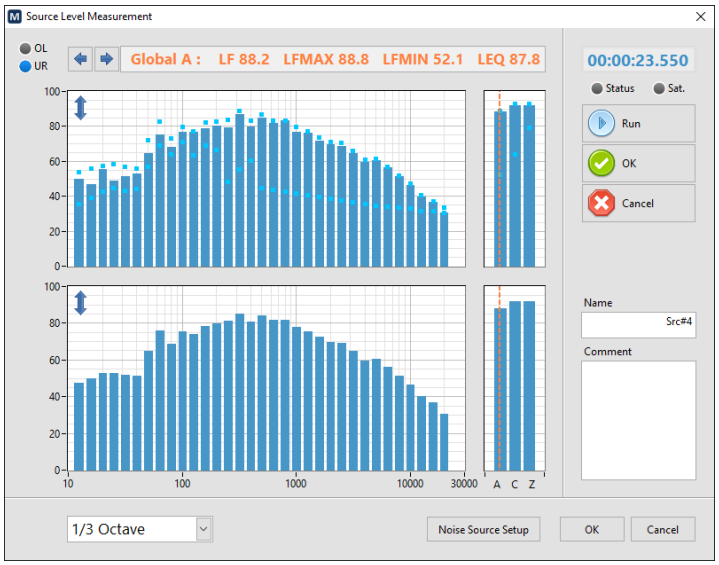
This operation will launch the measurement interface:



Place the noise source in the source room and turn it ON. When you are ready to perform a measurement, click on the "Run" button or press the top button on the microphone wand.

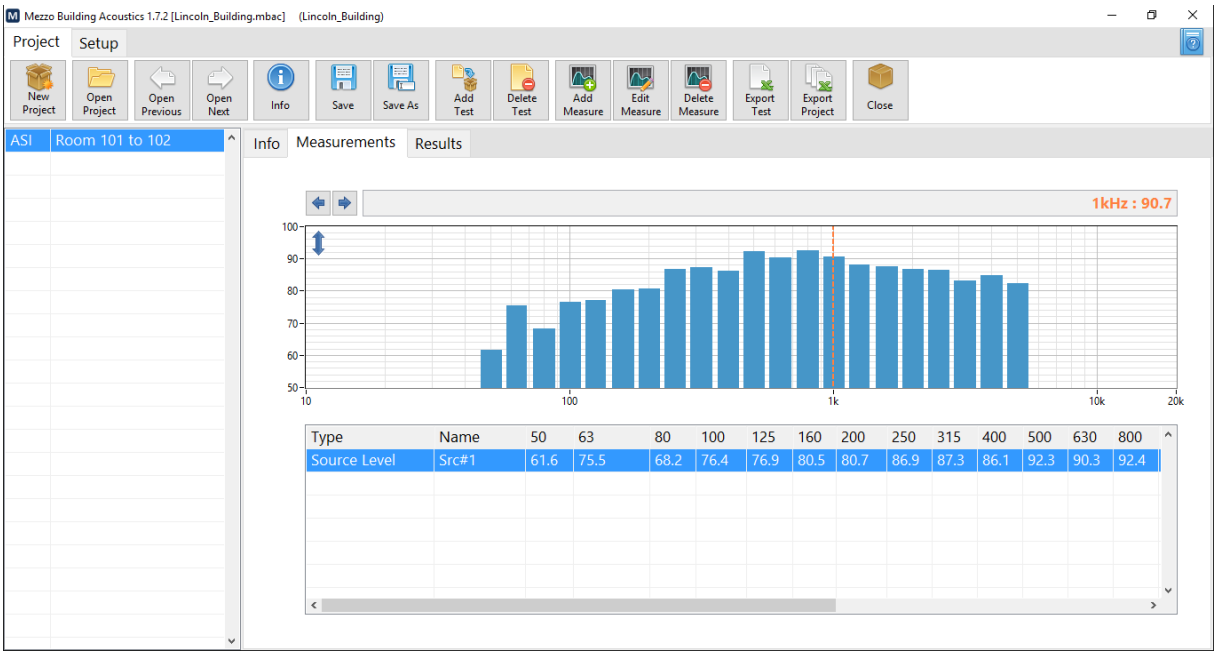


When you are ready to stop the measurement, click on the Stop button or press the middle button on the microphone wand.



If you are satisfied with the result, click on the "OK" button or press the middle button on the microphone wand.

Once accepted, the result will appear in the list in the measurements tab:



It's recommended to perform several source noise measurements. The software will average them automatically.

Measuring the Receiver Noise Level

Leave the noise source ON in the receiving room and go in the receiving room. Click on “Add Measure” from the Project Toolbar, select “Receiver Level” from the drop-down menu and click on “New Measurement”. Perform the measurement in a similar way as for the source level.

It’s recommended to perform several receiver level measurements. The software will average them automatically.

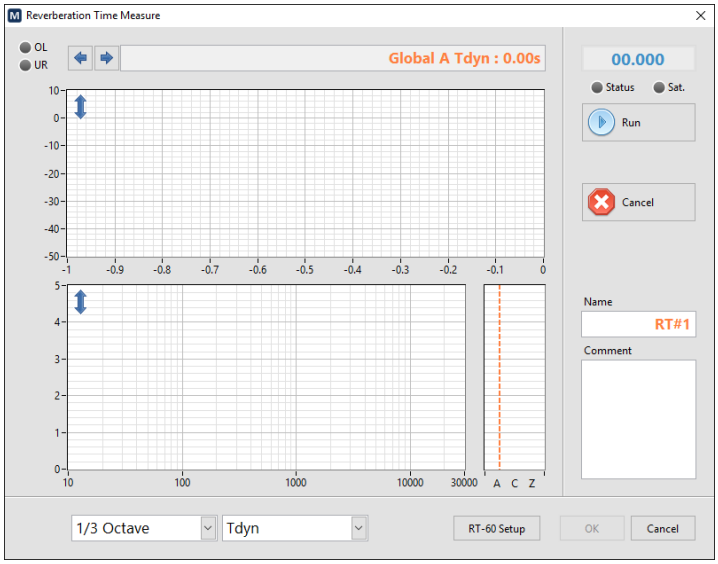
Measuring the Background Noise Level

Turn the noise source OFF in the source room and return in the receiving room. Click on “Add Measure” from the Project Toolbar, select “Background Level” from the drop-down menu and click on “New Measurement”. Perform the measurement in a similar way as for the receiver level.

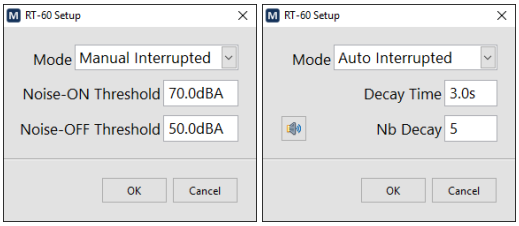
It’s recommended to perform several background level measurements. The software will average them automatically.

Measuring the Reverberation Time

Move the noise source in the receiving room. Click on “Add Measure” from the Project Toolbar, select “Reverberation Time” from the drop-down menu and click on “New Measurement”.



Click on the “RT-60 Setup” button to select how to perform the test and select the measurement mode from the drop-down menu:

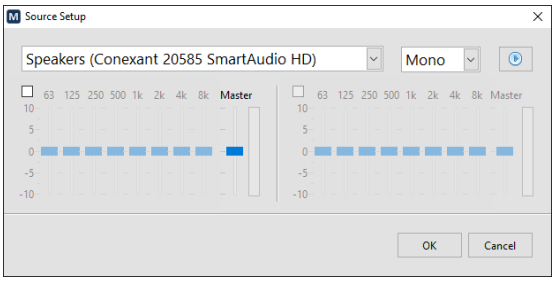


The manual mode uses two threshold levels to detect the Noise source ON and OFF states. The user must manually turn off the noise source to create the interruption.

The automatic mode uses the audio output of the tablet PC to control the source. The decay time indicates the time to leave the noise source ON and OFF and the number of decays indicates how many decay curves will be averaged. For 5 decays at 3s decay time, the measurement duration will be 30s long. This method is faster and more reliable than the manual mode.

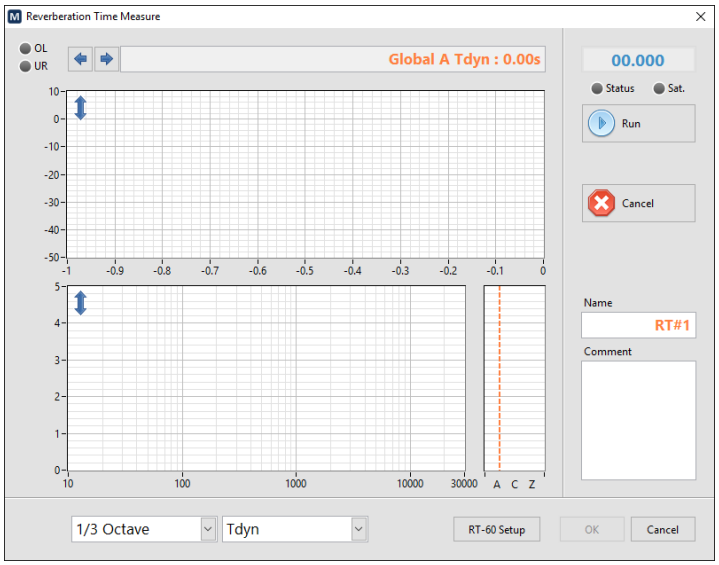
For the purposes of this example, the automatic mode will be used.

Click on the loudspeaker button to adjust and test the sound source:

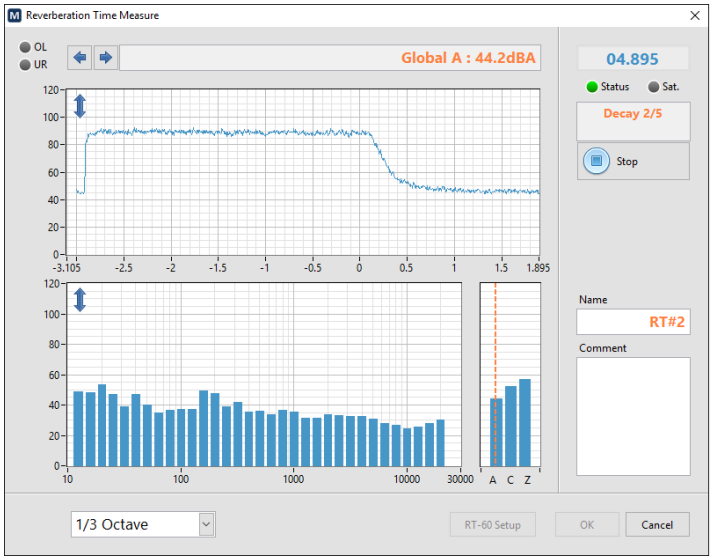


Click on the blue “Play” button to test the volume and adjust the volume accordingly.

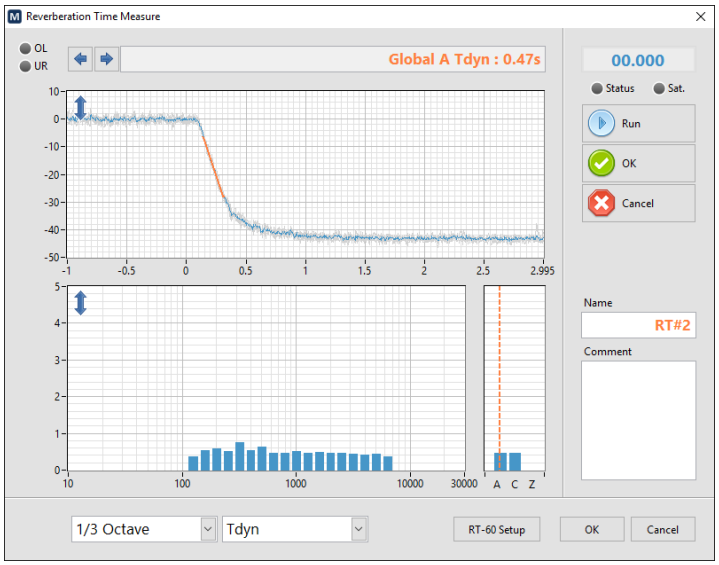
Click on “OK” to go back to the measurement interface.



Click on the “Run” button to start the measurement.

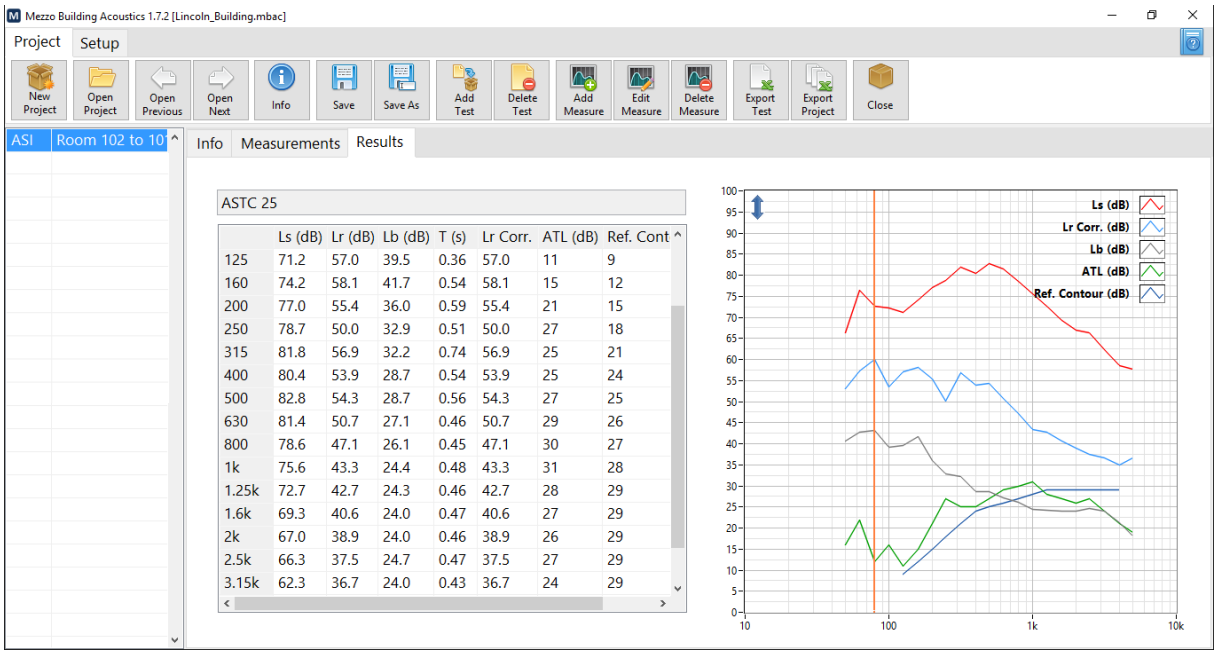


At the end of the measurement, click on the “OK” button to accept the measurement:



Viewing the results

Once all the measurements are taken, the result will appear in the “Results” tab.

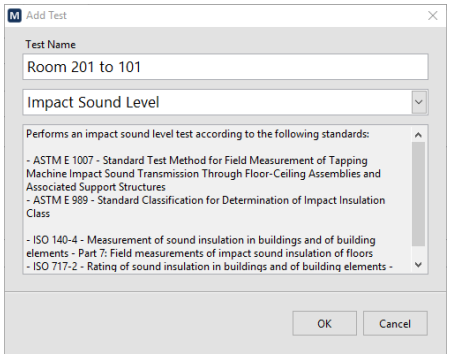


	Ls (dB)	Lr (dB)	Lb (dB)	T (s)	Lr Corr.	ATL (dB)	Ref. Cont
125	71.2	57.0	39.5	0.36	57.0	11	9
160	74.2	58.1	41.7	0.54	58.1	15	12
200	77.0	55.4	36.0	0.59	55.4	21	15
250	78.7	50.0	32.9	0.51	50.0	27	18
315	81.8	56.9	32.2	0.74	56.9	25	21
400	80.4	53.9	28.7	0.54	53.9	25	24
500	82.8	54.3	28.7	0.56	54.3	27	25
630	81.4	50.7	27.1	0.46	50.7	29	26
800	78.6	47.1	26.1	0.45	47.1	30	27
1k	75.6	43.3	24.4	0.48	43.3	31	28
1.25k	72.7	42.7	24.3	0.46	42.7	28	29
1.6k	69.3	40.6	24.0	0.47	40.6	27	29
2k	67.0	38.9	24.0	0.46	38.9	26	29
2.5k	66.3	37.5	24.7	0.47	37.5	27	29
3.15k	62.3	36.7	24.0	0.43	36.7	24	29

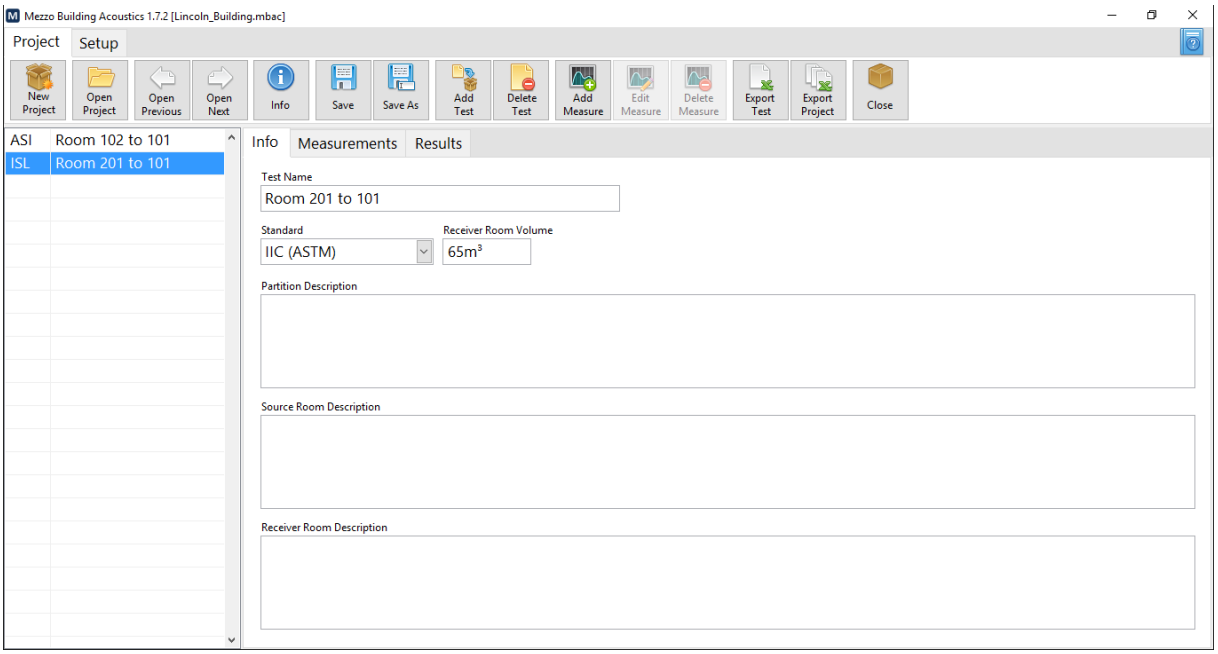
Note that should you want to view the data against other standards, just select a different standard from the “standard” drop-down menu from the Info tab.

4.4.2 Performing an Impact Sound Level Test

Click on the Add Test button from the Project toolbar. Enter the test name and select "Impact Sound Level" from the test type drop-down menu:



Once the test is created, you can select the standard and enter the receiver room volume:



Note that you can change these values afterwards.

Measuring the Receiving Level

Click on the "Add Measure" button from the project toolbar. Select "Receiver Level" from the drop-down menu and click on "New Measurement".

Position the Normalized Tapping Machine[1] at the first position on the source room floor and turn it ON.

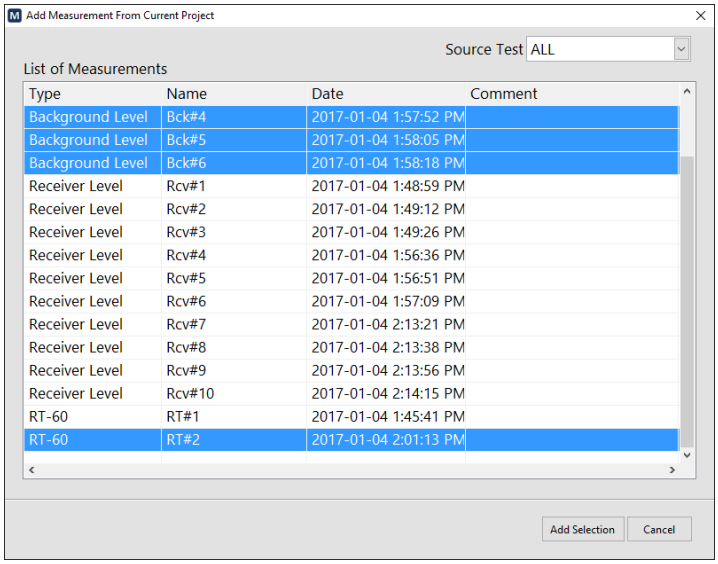
Click on "Run" on the measurement interface and perform the measurement in a similar manner as for the receiver level of the airborne sound insulation test performed previously.

Move the tapping machines for the other positions required by the standard and perform the measurement(s).

Importing the Background Level and Reverberation Time

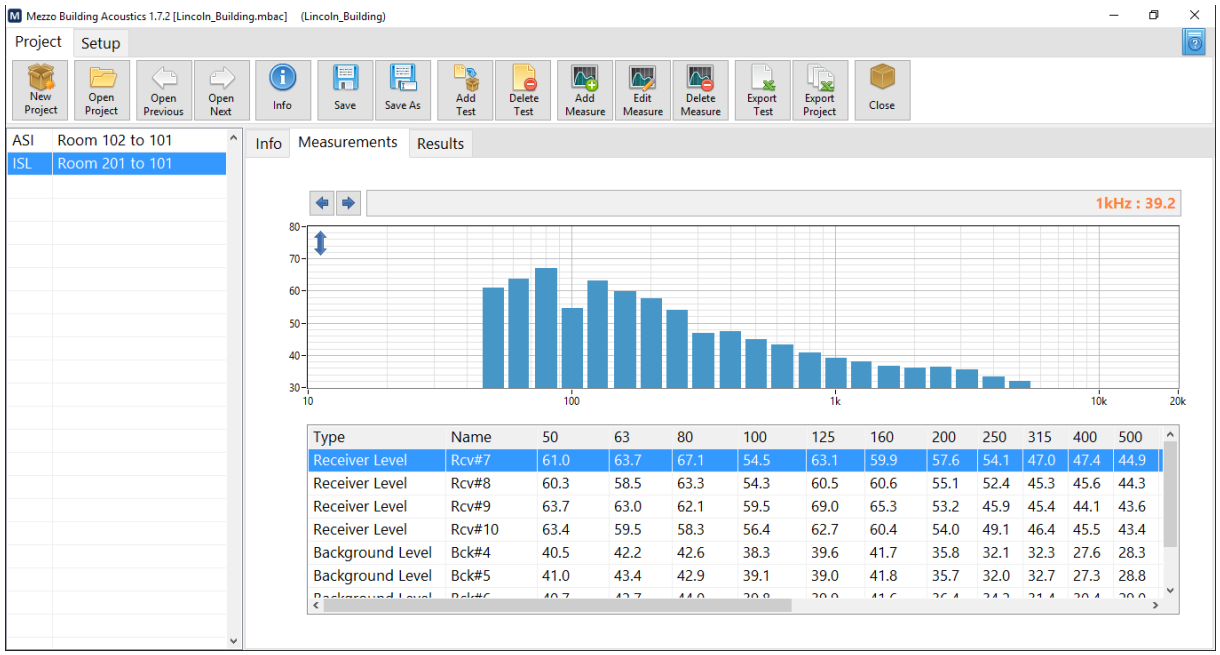
The receiver room being the same as for the airborne sound insulation test, we will use the same background level and reverberation time measurements for this test to save time.

Click on the "Add Measure" button from the project toolbar and click on "Load From Current Project".



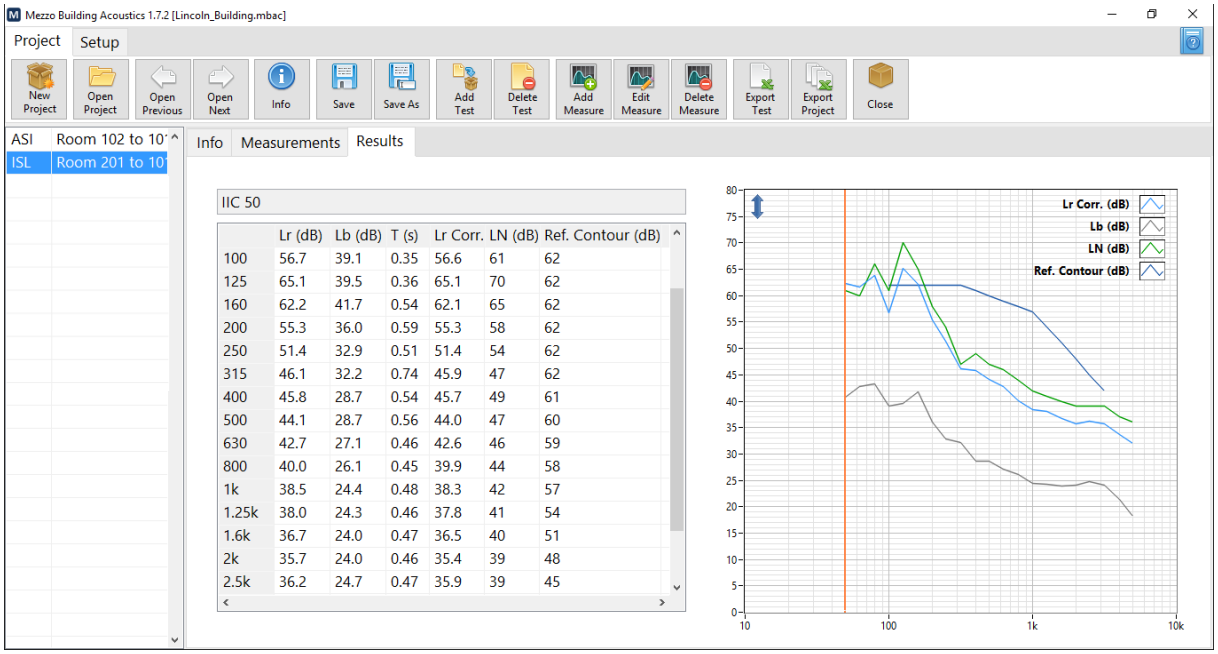
Select the measurements you wish to import and click on "Add Selection". Once imported, the measurements will appear in the list on the Measurements tab.

[1] The tapping machine must conform to specifications given in appendix A of ISO 140-7 (1998) standard.



Viewing the Results

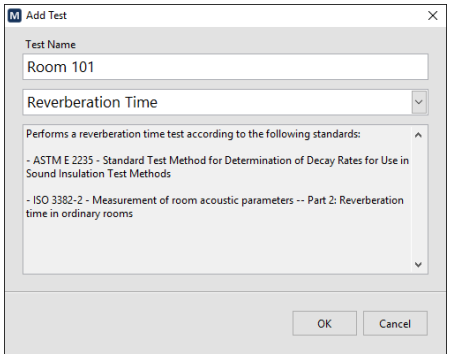
Once all the measurements are taken, the result will appear in the “Results” tab.



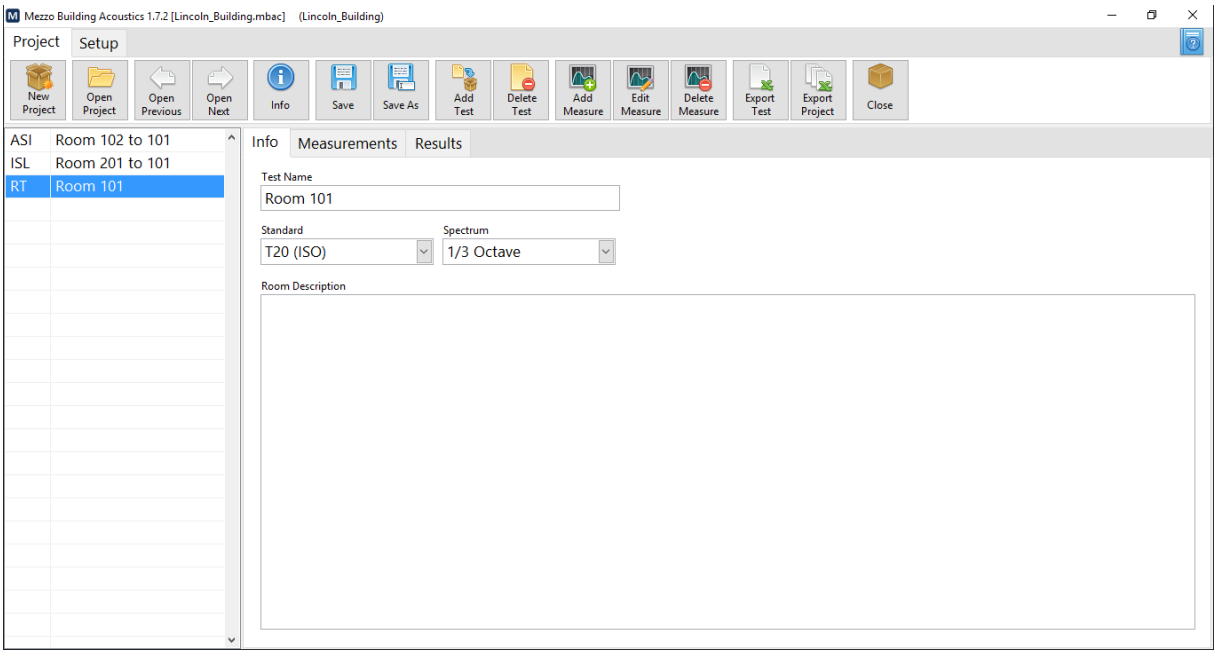
Should you want to view the data against other standards, just select a different standard from the “standard” drop-down menu from the Info tab.

4.4.3 Performing a Reverberation Time Test

Click on the Add Test button from the Project toolbar. Enter the test name and select "Reverberation Time" from the test type drop-down menu:



Once the test is created, you can select the standard and select the spectrum type.



Note that you can change these settings afterwards.

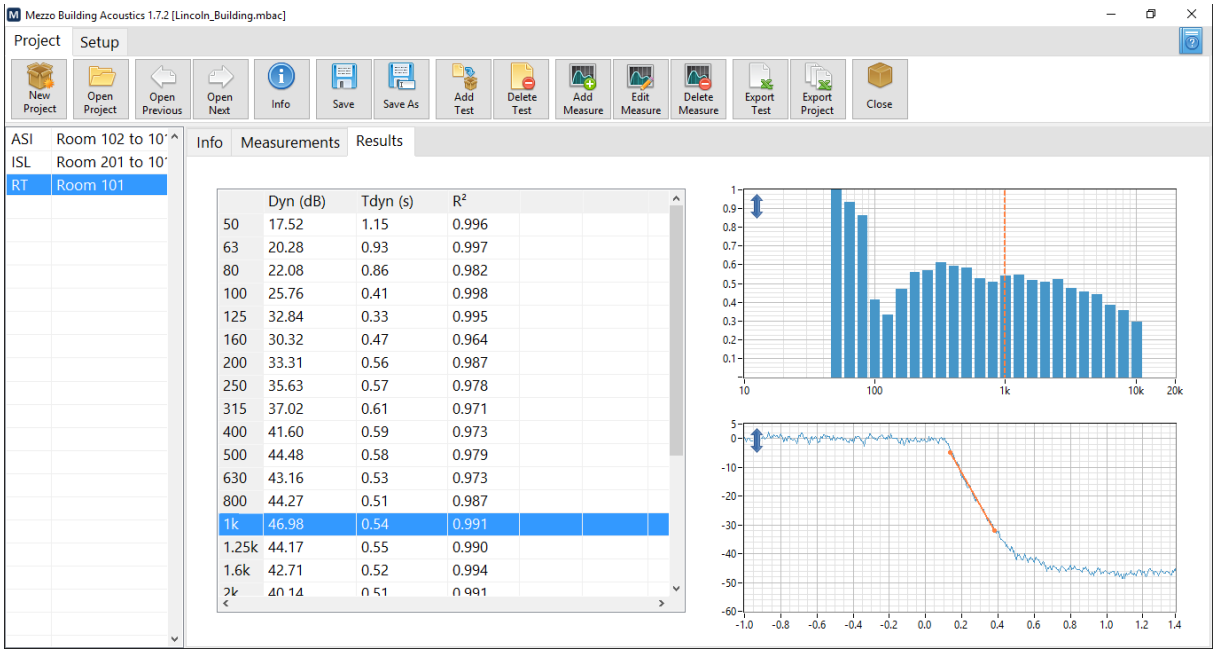
Measuring the Reverberation Time

Since the room under test is the same as the receiving room for the Airborne Sound Insulation test, we will simply import the reverberation time measurements which were already performed. For a detailed process on how to measure the reverberation time, refer to section Measuring the Reverberation Time, p. 9.

Click on the “Add Measure” button from the project toolbar and click on “Import From Current Project”. Select the appropriate measurements from the list and click on “Add Selection”.

Viewing the Results

Go to the “Results” tab to view the resulting Reverberation time for each octave band or fractional octave band.



The “Dyn” column indicates the dynamic which is the difference between the source level and the background level. The TX represents the RT-60 reverberation time in seconds and R^2 indicates the correlation coefficient between the measured decay curve and the linear regression curve.

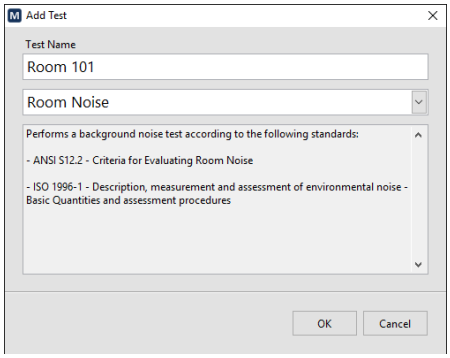
The following table shows the different available RT-60 metrics:

Tag	Linear Regression Range	Minimum Dynamic Range	Standard
Tdyn	-5 to --*	15 dB	---
EDT	0 to -10 dB	25 dB	ISO 3382-2
T10	-5 to -15 dB	30 dB	---
T15	-5 to -20 dB	35 dB	---
T20	-5 to -25 dB	40 dB	ISO 3382-2
T25	-5 to -30 dB	45 dB	ASTM E 2235
T30	-5 to -35 dB	50 dB	ISO 3382-2

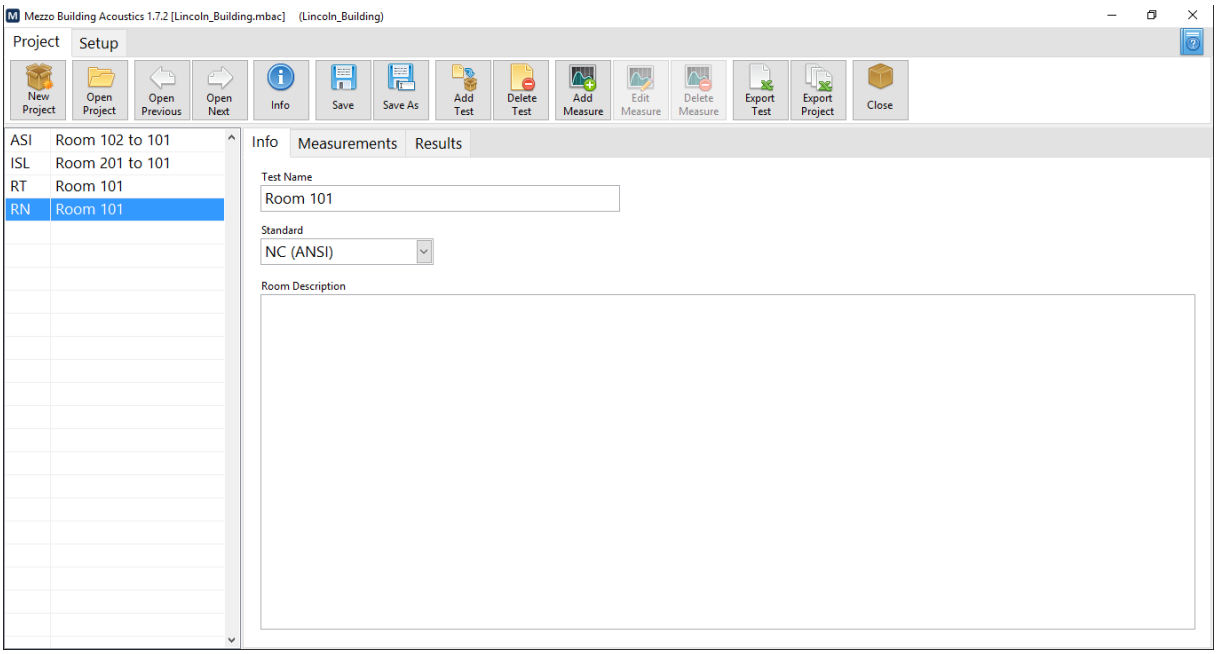
* Tdyn uses all the available dynamic range to evaluate the decay curve.

4.4.4 Performing a Room Noise test

Click on the Add Test button from the Project toolbar. Enter the test name and select “Room Noise” from the test type drop-down menu:



Once the test is created, you can select the standard from the drop-down menu.



Note that you can change this setting afterwards.

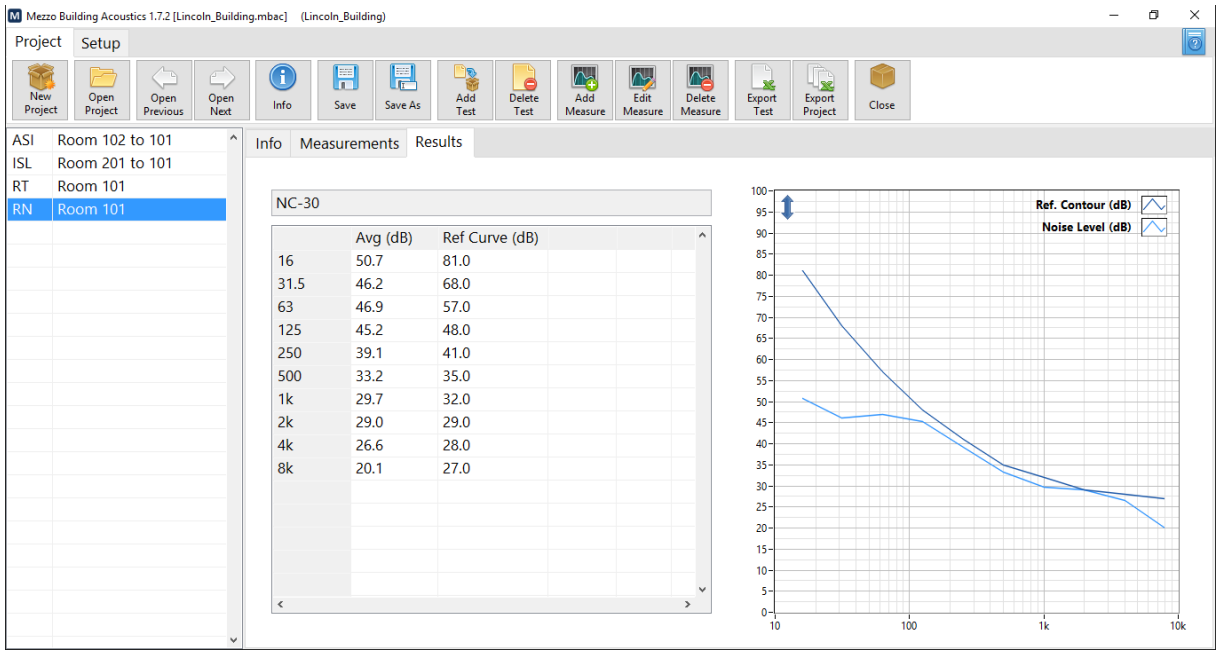
Measuring the Room Noise

Since the room under test is the same as the receiving room for the Airborne Sound Insulation test, we will simply import the background noise measurements which were already performed.

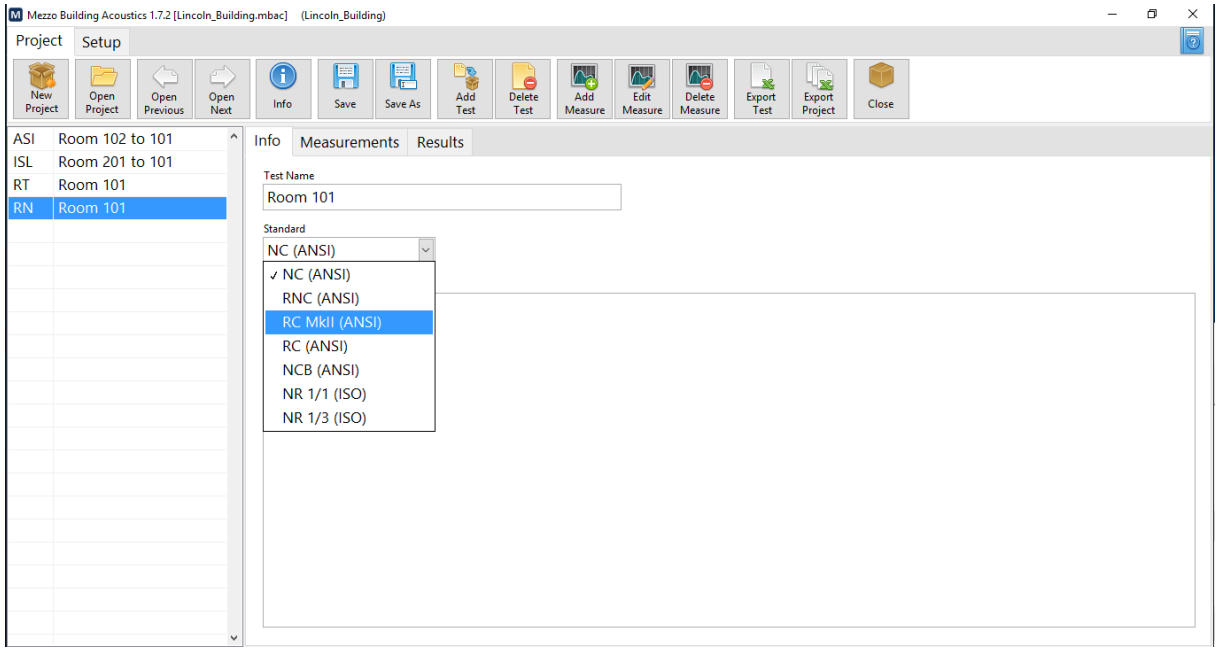
Click on the “Add Measure” button from the project toolbar and click on “Import From Current Project”. Select the appropriate measurements from the list and click on “Add Selection”.

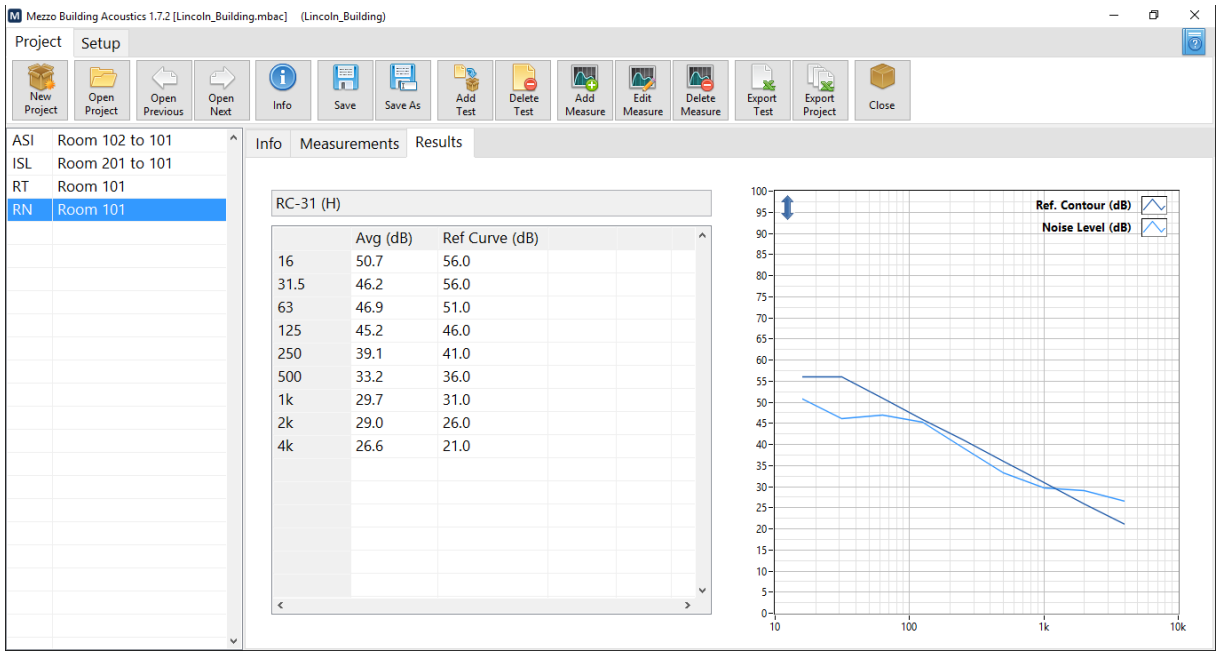
Viewing the Results

Go to the “Results” tab to view the resulting Room Noise criteria.



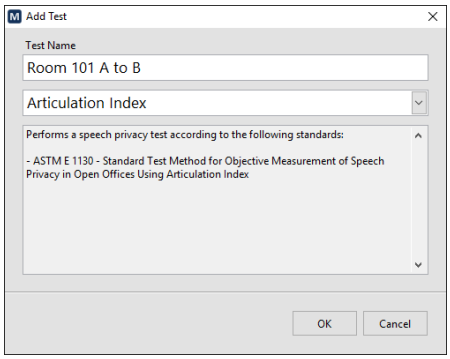
Note that you can view the dataset against another standard curve by selecting another metric from the “Standard” drop-down menu from the Info tab.

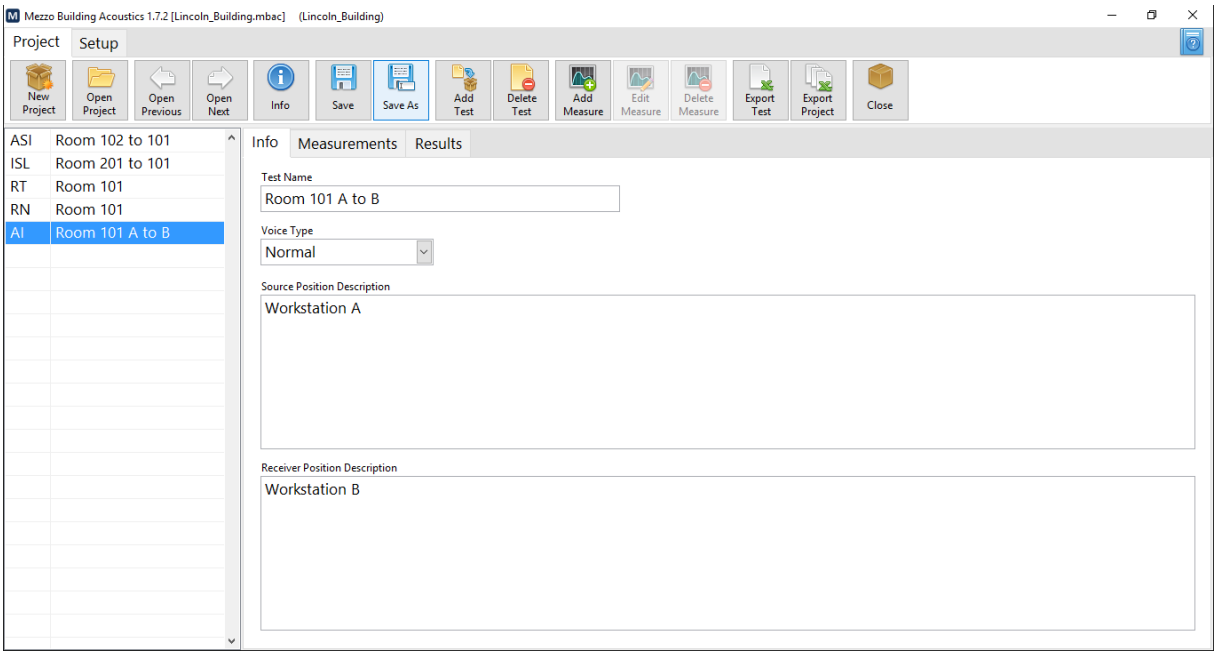




4.4.5 Performing a Speech Privacy for Open Office Test

Click on the Add Test button from the Project toolbar. Enter the test name and select “Articulation Index” from the test type drop-down menu:



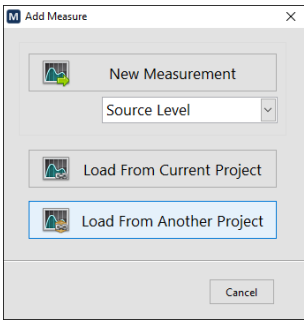


Measuring the Source Level

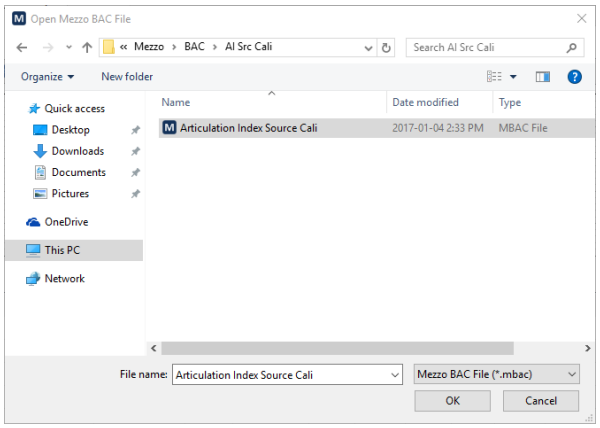
The sound source level must be previously measured in an anechoic room on the loudspeaker axis at 0.6m, 0.9m and 1.2m from the source point. The volume settings must be noted and must be able to be reproduced on the site in a reliable and precise way.

To record the source levels, install the sound source in an anechoic room and set the volume correctly. Create an empty Project and add an Articulation Index test. Measure the source levels by adding 3 measurements at respectively 0.6m, 0.9m and 1.2m from the sound source. This Project will be used later to import these measurements.

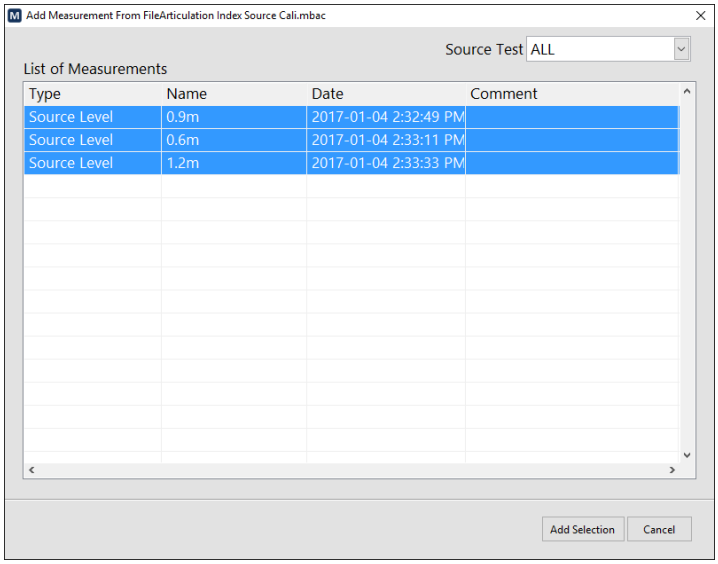
Back to the field measurements, click on “Add Measure” and select “Load from Another Project”:



Browse to the previously created Project file containing the sound source calibration measurements:



Select the 3 source measurements and click on “Add Selection”.



Measuring the Receiver Level

Back to the field, position the sound source at the talker location at a 1.2 m height above the floor. The source shall be oriented towards the listener location and at 25° above horizontal. Set the volume at the same position as it was during the anechoic calibration.

Position the microphone at the listener location at 1.2m above the floor.

Click on “Add Measurement”, select “Receiver Level” from the drop-down menu and click “New Measurement”.

Perform the measurement as described in section Measuring the Source Noise Level, p.6.

Measuring the Background Level

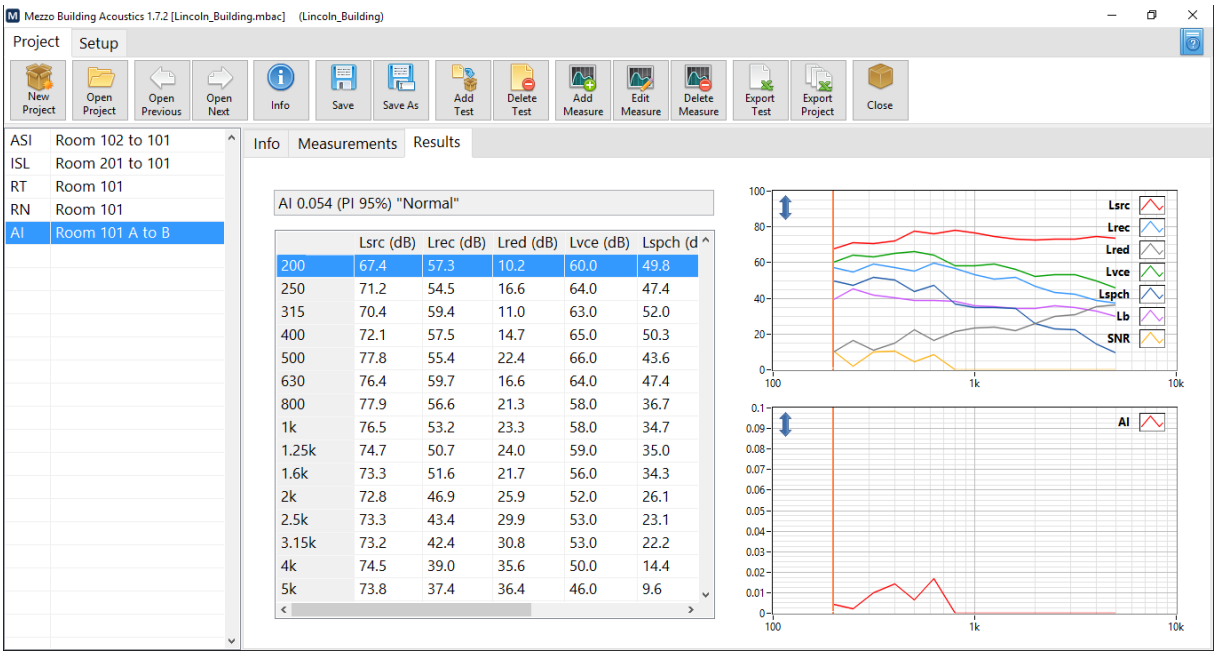
Click on “Add Measurement”, select “Background Level” from the drop-down menu and click “New Measurement”.

Perform the measurement as described in section Measuring the Source Noise Level, p.6.

Alternatively, the background level could be loaded from a previously made measurement if applicable.

Viewing the Results

Go to the “Results” tab to view the resulting Articulation Index and Privacy Index values.



	Lsrc (dB)	Lrec (dB)	Lred (dB)	Lvce (dB)	Lspch (d
200	67.4	57.3	10.2	60.0	49.8
250	71.2	54.5	16.6	64.0	47.4
315	70.4	59.4	11.0	63.0	52.0
400	72.1	57.5	14.7	65.0	50.3
500	77.8	55.4	22.4	66.0	43.6
630	76.4	59.7	16.6	64.0	47.4
800	77.9	56.6	21.3	58.0	36.7
1k	76.5	53.2	23.3	58.0	34.7
1.25k	74.7	50.7	24.0	59.0	35.0
1.6k	73.3	51.6	21.7	56.0	34.3
2k	72.8	46.9	25.9	52.0	26.1
2.5k	73.3	43.4	29.9	53.0	23.1
3.15k	73.2	42.4	30.8	53.0	22.2
4k	74.5	39.0	35.6	50.0	14.4
5k	73.8	37.4	36.4	46.0	9.6

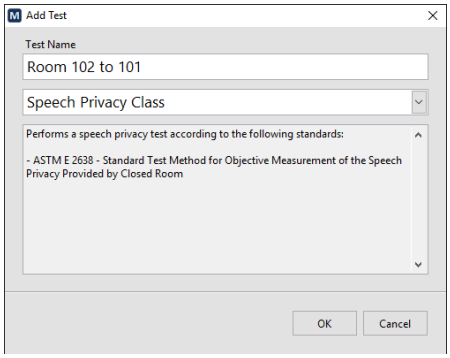
The following table lists the criteria against subjective ratings of speech privacy:

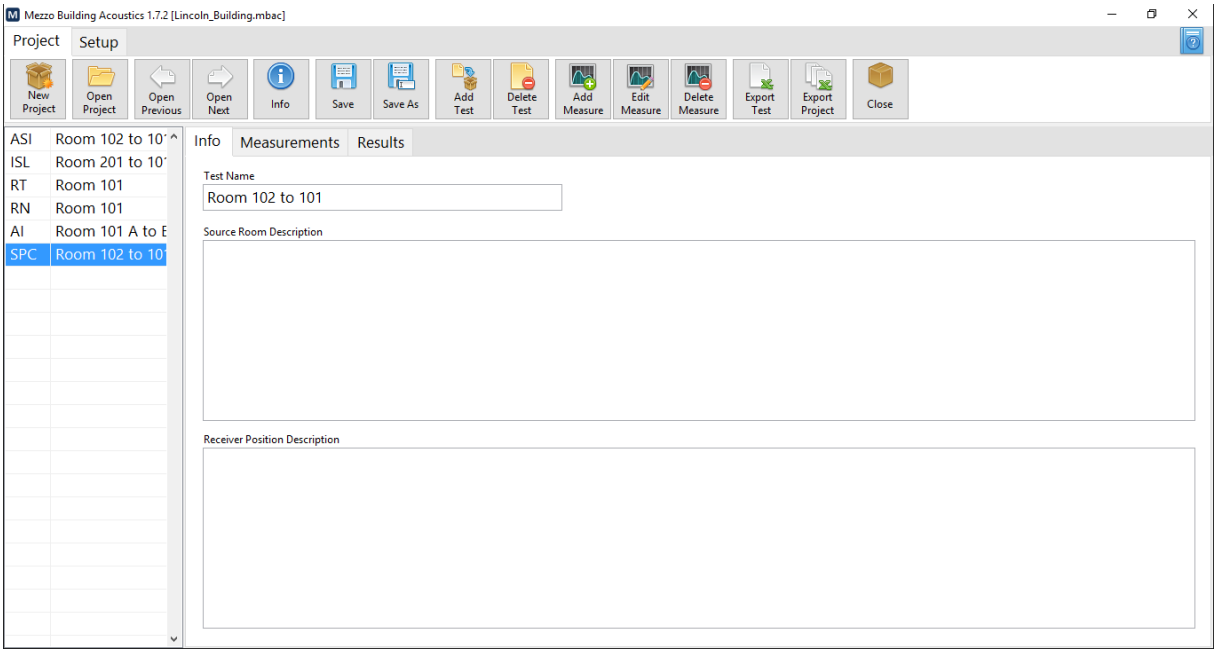
AI	PI	Subjective Rating
AI ≤ 0.05	PI ≥ 95	Confidential
0.05 < AI ≤ 0.2	95 > PI ≥ 80	Normal
0.2 < AI ≤ 0.3	80 > PI ≥ 70	Poor
0.3 < AI ≤ 0.4	70 > PI ≥ 60	Bad
0.4 < AI	60 > PI	No Privacy

Should you want to evaluate the privacy level for another type of speech, simply select the appropriate speech type from the “Speech” drop-down menu from the Info Tab.

4.4.6 Performing a Speech Privacy Provided by a Closed Room Test

Click on the Add Test button from the Project toolbar. Enter the test name and select "Speech Privacy Class" from the test type drop-down menu:





Measuring the Source Level

Position the sound source in the source room and turn it ON.

Click on "Add Measurement", select "Source Level" from the drop-down menu and click "New Measurement".

Perform the measurement as described in section Measuring the Source Noise Level, p.6.

Measuring the Receiver Level

With the source still ON in the source room, go to the receiving room and position the microphone at the listener location.

Click on “Add Measurement”, select “Receiver Level” from the drop-down menu and click “New Measurement”.

Perform the measurement as described in section Measuring the Source Noise Level, p.6.

Measuring the Background Level

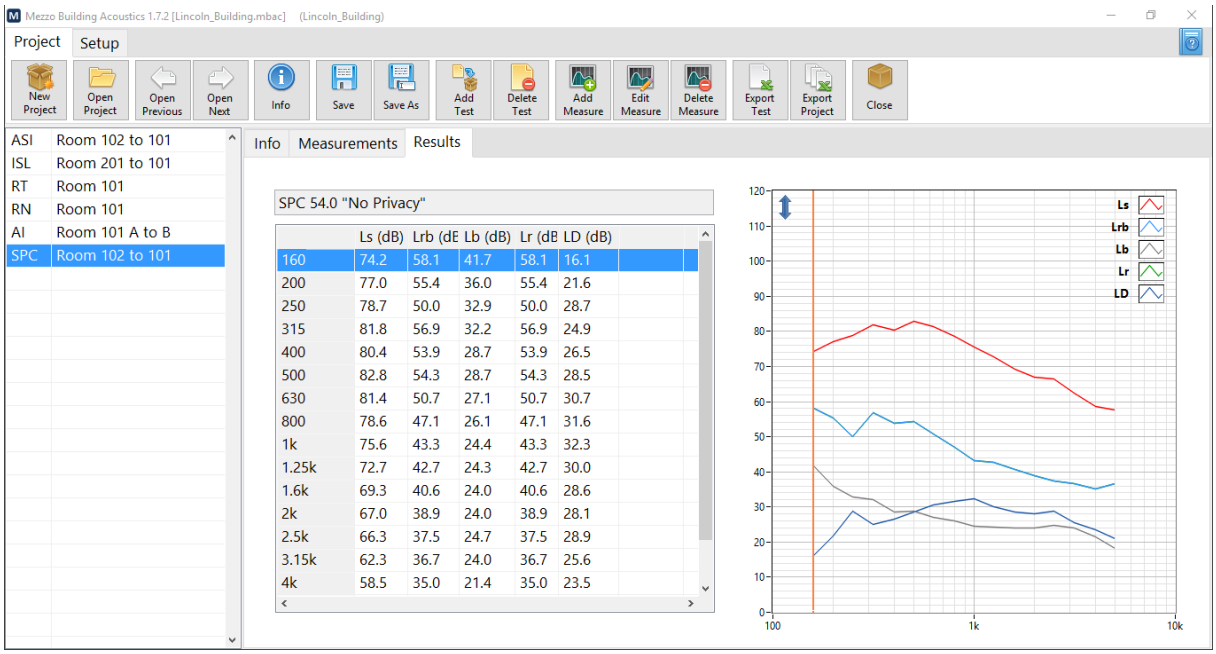
Click on “Add Measurement”, select “Background Level” from the drop-down menu and click “New Measurement”.

Perform the measurement as described in section Measuring the Source Noise Level, p.6.

Alternatively, the background level could be loaded from a previously made measurement if applicable.

Viewing the Results

Go to the “Results” tab to view the resulting Speech Privacy Class value.



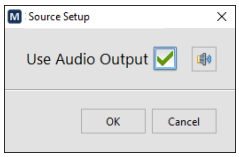
The following table lists the Speech Privacy Class criteria against subjective ratings of speech privacy:

SPC	Subjective Rating
70	Minimal Privacy
75	Standard Privacy
80	Standard Security
85	High Security
90	Very High Security

5 Additional Information

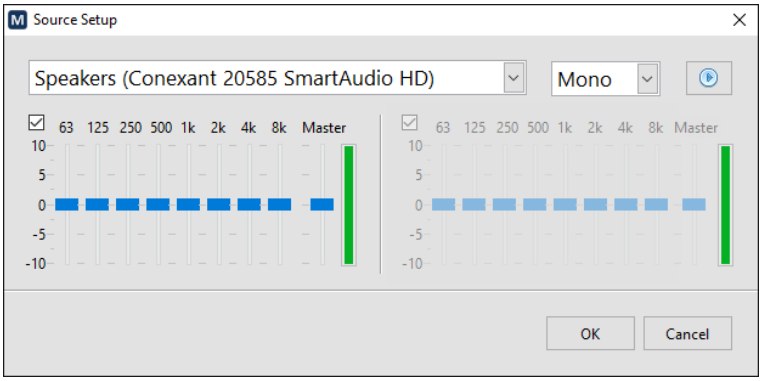
5.1 Noise Source Setup

It is possible to use the audio output of the tablet PC to feed the noise source not only for the RT-60 but also for the source and receiver levels. To use the audio output, click on the "Noise Source Setup" button in the measurement interface and check "Use Audio Output".



Using this option, the noise source will turn ON and OFF automatically when performing the measurement.

5.1.1 Output Setup



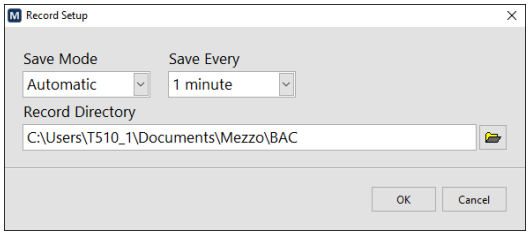
The output setup allows to configure the audio output of the tablet PC to be used as a noise source for the STC tests and RT-60 tests. The generator outputs a pink noise for both audio channels. Two equalizers can be added to customize the sound on each channel. As an example, one channel can be connected to an omni-directional speaker (dodecahedron) while the other can be used with a low-frequency speaker. Hence, two different equalizers can be used for better performance.

5.2 Exporting Data

The data can be exported to a text file (tab delimited) for a single test or the complete project. Click on the "Export Test" button to export a single test or "Export Project" to export all the tests from the project.

5.3 Record Setup

Click on the “Record Setup” button from the “Setup” tab to access the record parameters.



The automatic save mode will automatically create a project file in the record directory upon creating a project and will automatically save the file every X minutes.

In manual mode, the user must manually save the project to a file.

The automatic mode is recommended to avoid losing any data.