

HOW TO TEST...

# the Acoustics in Meeting Rooms



This document provides a practical guide on how to commission meeting rooms.

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## Introduction

The acoustic characteristics of a meeting room can have a significant impact on the success of meetings. If, for example, the room surfaces create too many reflections of acoustic sound, or even absorb too well, the spoken word is at risk of not being understood.

Also, if there is too much ambient noise in the room (air-conditioners), or too much outside environmental noise entering the room (traffic noise), the full potential of the room may not be realized.

Further, the quality and setup of the audio equipment, such as microphones and loudspeakers, can too have a negative effect.

Fortunately there are objective measurements that can be carried out to quantify that a meeting room is fit-for-purpose.

## Ambient Noise Measurements

Ambient (background) noise should not interfere with the purpose of the room, e.g. the noise of an office air-conditioning system and consistent noise of traffic outside the building should not interfere with video conference calls or conversations.

### INSTRUMENTS YOU NEED

Measure with the XL2 Analyzer.

XL2 Analyzer >>>



### HOW TO MEASURE AMBIENT NOISE

An unoccupied room can be measured to produce a single LAeq broadband value and a 1/1 octave spectrum of the ambient noise.



### 1. Setup XL2

- Choose SLMeter.
- Press the Page key to switch to the spectral display.
- Select LZeq, 1/1 octave resolution, and low Range 20 - 120.

### 2. Verify Background Noise

- Ensure that the level of background noise in the room is typical for the room when it is unoccupied i.e. nobody should be talking and no extraordinary sounds during the measurements



### 3. Measure

- Press the START/STOP button to start.
- Measure for 30 seconds.
- Press the START/STOP button to stop.
- The result is saved in the internal memory.



### 4. View Spectral Results

- The XL2 shows the ambient noise spectrum.



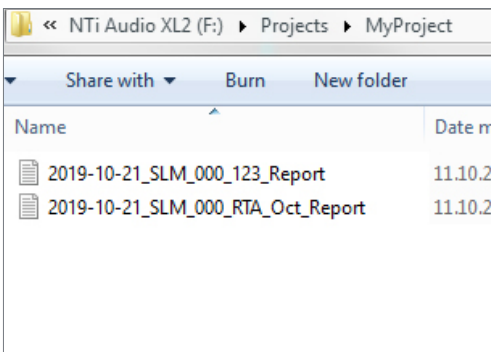
### 5. View Broadband Result

- Switch to SLMeter 123 for the broadband result.
- The LAeq result is the average ambient noise level during the measurement period.



### 6. Connect to a PC

- The results of your measurement are stored on the SD Card of the XL2. To access the data, connect your XL2 via USB cable to a PC, as a Mass Storage Device.



### 7. Access the Files

- The results are stored as tab-delimited, plain text files in the /Projects/MyProject directory.
- Files named “\_123 ..” contain broadband values and files named “\_RTA ..” contain the spectral results.

## Measuring Noise Curves

Noise curves are a common way to specify ambient (background) noise in unoccupied buildings and spaces. They provide a single value that represents the complete spectrum of measured ambient noise.

### INSTRUMENTS YOU NEED

Measure with the XL2 Analyzer.

XL2 Analyzer >>>



### HOW TO MEASURE NOISE CURVES

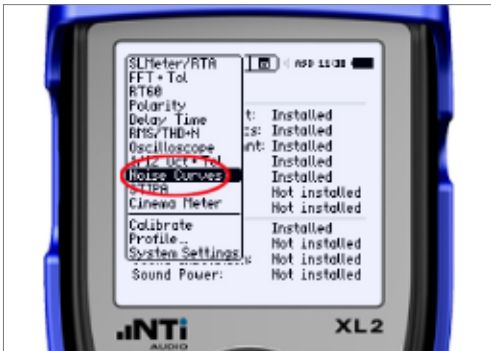
In the XL2 with the “Spectral Limit” Option installed, all standardized methods for measuring Noise Curves are available.

It is recommended to perform a measurement at all typical positions that may be occupied in a room. If a single value is required, extend the total measuring time (10 points need 10 x 30 seconds = 300 seconds), measure each point for 30 seconds, and press the PAUSE button between measuring points.



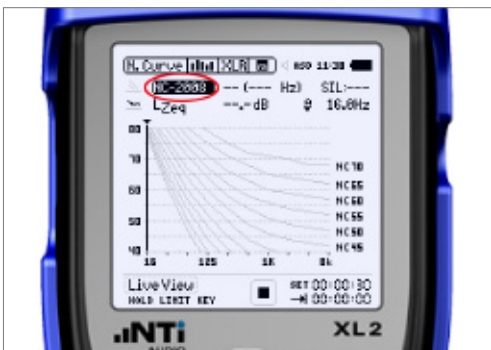
#### 1. Verify Instrument Configuration

- Power up the XL2.
- Check that you have the Spectral Limits option installed



## 2. Select Measurement Function

- Choose Noise Curves from the Main Menu



## 3. Select Noise Curve Type

- Choose the noise curve type



The default is NC-2008. Some projects may require another noise curve type selection; kindly verify your project requirements.

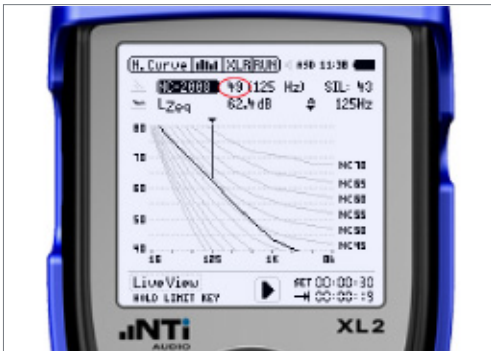
## 4. Verify Background Noise

- Ensure that the level of background noise in the room is typical for the room when it is unoccupied i.e. nobody should be talking and no extraordinary sounds during the measurements.



## 5. Start Measurement

- Press the START button



## 6. Measuring

- The XL2 measures the ambient noise, displays the spectral curve, calculates the NC value, and saves each result in the internal memory.

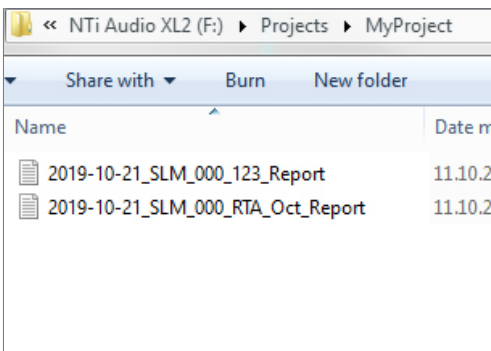


Each measurement takes 30 seconds.



## 7. Connect to a PC

- The results of your measurements are stored on the SD Card of the XL2. To access the data, connect your XL2 via USB cable to a PC, as a Mass Storage Device.



## 8. Access the Files

- The results are stored as tab-delimited, plain text files in the /Projects/MyProject directory

### Further reading:

- Noise curve measurements with the XL2

<https://www.nti-audio.com/Portals/0/data/en/NTi-Audio-AppNote-XL2-Noise-Curves.pdf>

- About noise curve measurements

<https://www.nti-audio.com/noise-curves>



## Reverberation Time RT60 Measurements

Reverberation is one of the most significant acoustic properties of a room.

### INSTRUMENTS YOU NEED

Measure with the XL2 Acoustic Analyzer.

As a sound source, connect the PA3 Power Amplifier (with built-in noise generator) to the DS3 Dodecahedron Speaker.



### HOW TO MEASURE RT60

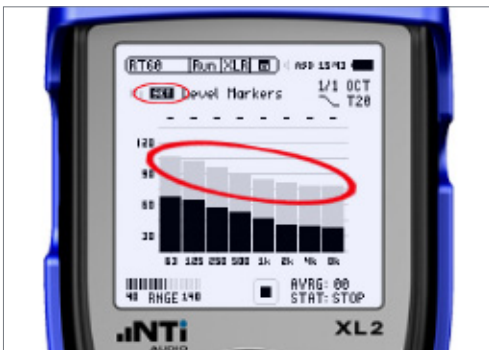
RT60 values vary at different positions within a room. Therefore, the measurement microphone is placed at each measurement position and an average reading taken across the space being measured.

For large rooms, measurements are also taken with the loudspeaker in other positions. The loudspeaker and microphone positions should be asymmetrical and more than 1 m from the walls. The microphone should be placed at ear height.



### 1. Select Measurement Function

– On the XL2 select RT60

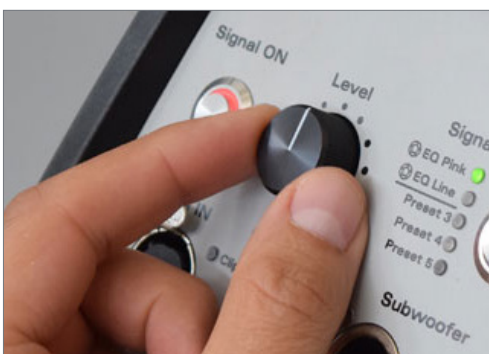


### 2. SET Background Noise Floor

– With a quiet room, press SET to measure the room noise floor

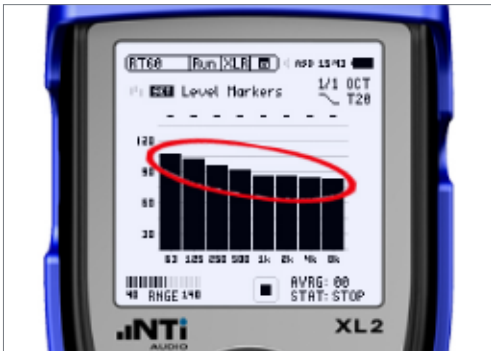


Now wear hearing protection!



### 3. Adjust the Source Level

– On the PA3, play “EQ Pink” noise and adjust the level ...



... until the black bars on the XL2 reach above the level markers indicated by the grey bars.

Turn the PA3 Signal OFF.



#### 4. Measurement

- Press the START button on the XL2.
- Turn the PA3 Signal ON.



#### 5. Toggle Sound Source

- Every 3 seconds, toggle the sound source on and then off.
- Do this 3 times.



#### 6. Trigger Measurement Cycle

- An RT60 measurement is triggered every time the sound source is switched off, as indicated by the tick marks



### 7. How Many Measurements?

- After 3 measurements, the reverberation time and the measurement uncertainty is displayed for each frequency band on the results page (press the Page button). Continue measuring until you have an acceptably-low measurement uncertainty in the lowest frequency band that is relevant for you.



### 8. Stop Measurement

- Press the STOP button.
- To see the results, press the Page button

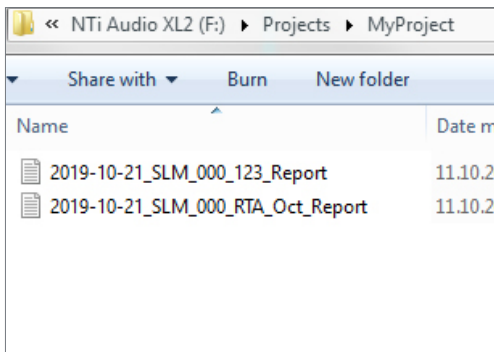
### 9. Repeat

- Move the microphone to the next appropriate position and measure again



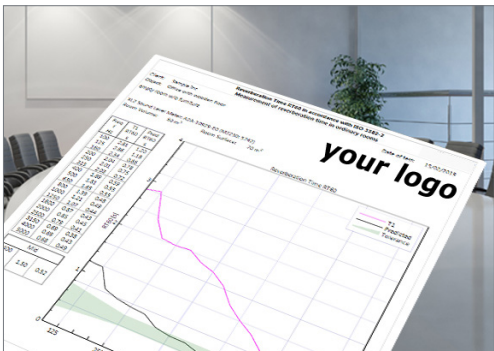
### 10. Connect to a PC

- The results of your measurements are stored on the SD Card of the XL2. To access the data, connect your XL2 via USB cable to a PC, as a Mass Storage Device.



## 11. Access the Files

- The results are stored as tab-delimited, plain text files in the /Projects/MyProject directory



## 12. Make the Report

- Drop the \*.xl2 files (or the contents of the entire folder) into the XL2 Room Acoustics Reporter software

### Further information:

- XL2 Room Acoustics Reporter  
<https://my.nti-audio.com/support/xl2/download/XL2-Room-Acoustics-Reporter.zip>
- VIDEO: How to measure RT60  
<https://youtu.be/D2j4UknWzTc>
- Recommendations during RT60 measurements  
See section “Appendix A: Tips on Measuring RT60”
- About RT60 measurements  
<https://www.nti-audio.com/rt60>

## Speech Intelligibility STI Measurements

STIPA (Speech Transmission Index for Public Address) is the most acknowledged standardized method for measuring the intelligibility of a spoken message. STIPA provides a single STI (Speech Transmission Index) value between 0 (unintelligible) and 1 (excellent intelligibility).

### INSTRUMENTS YOU NEED

Measure with the XL2 Acoustic Analyzer.

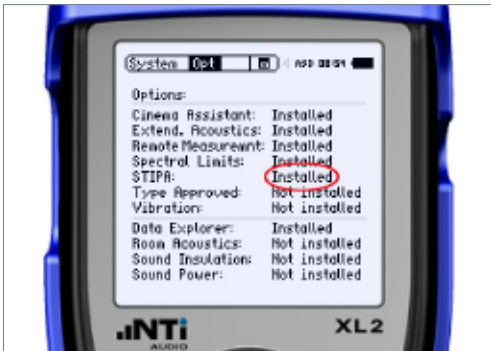
As a sound source, use the TalkBox acoustic signal generator.



### HOW TO MEASURE STI

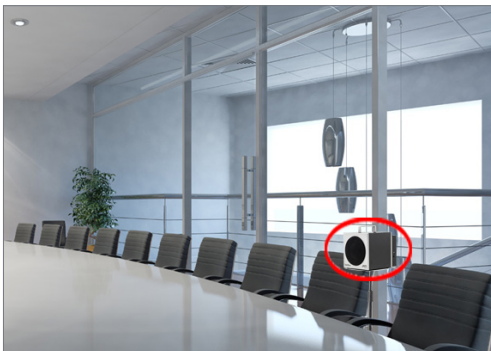
STI values may vary at different listening positions within a room. The values may depend also on the position of the speaker. Therefore, the TalkBox is placed at each appropriate speaking position.

Then the measurement microphone is placed at each appropriate listening position and an average reading taken across the space being measured.



### 1. Verify Instruments Configuration

- Power up the XL2.
- Check that you have the STIPA option installed.



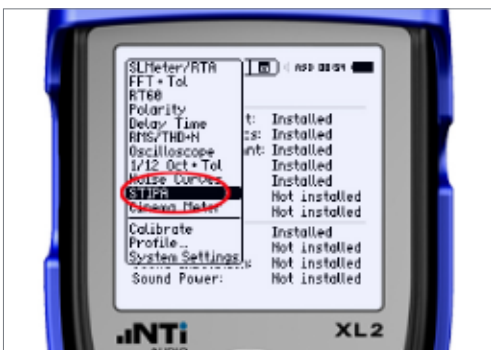
### 2. Position the TalkBox

- Place the TalkBox at a typical speaking position.



### 3. Position the Microphone

- Place the microphone at a typical listening position.



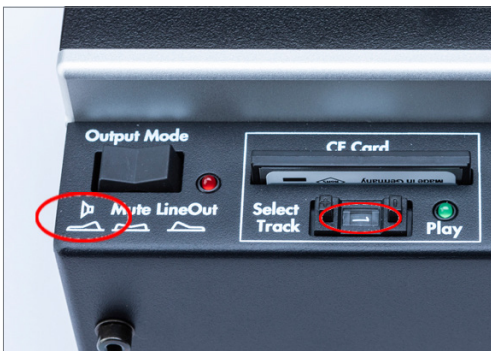
### 4. Select Measurement Function

- On the XL2 select STIPA.



## 5. Verify Background Noise

- Ensure that the level of background noise in the room is typical for the room when it is occupied i.e. nobody should be talking and no extraordinary sounds during the measurements.



## 6. Play the STIPA Signal

- On the TalkBox, select the STIPA signal (signal number 1) and switch the Output Mode to loudspeaker to play the signal



## 7. Start

- Press the START button



## 8. Measuring

- The XL2 measures the STI value, and saves the result in its internal memory



Each measurement takes 15 seconds.



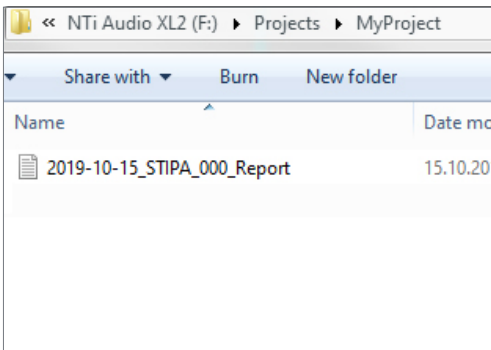
### 9. Repeat

- Move the microphone and/or the TalkBox to the next appropriate position/s and measure again.



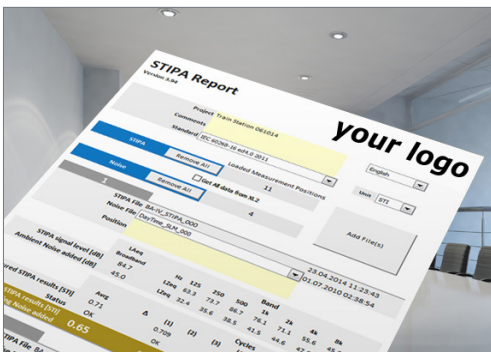
### 10. Connect to a PC

- The results of your measurements are stored on the SD Card of the XL2. To access the data, connect your XL2 via USB cable to a PC, as a Mass Storage Device.



### 11. Access the Files

- The results are stored as tab-delimited, plain text files in the /Projects/MyProject directory



### 12. Make the Report

- Add the \*.txt files to the NTi Audio STI Report

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**Further information:**

- NTi Audio STI Report  
<https://my.nti-audio.com/support/xl2/download/NTi-Audio-STI-Report.zip>
- About STI measurements  
<https://www.nti-audio.com/sti>

## The Instruments You Need

### XL2 MEASUREMENT KIT FOR MEETING ROOM ACOUSTICS

including

- XL2 Acoustic Analyzer
- Spectral Limits Option for XL2
- Speech Intelligibility Option for XL2
- XL2 System Case
- M2230 Measurement Microphone
- ASD Microphone Cable for XL2
- PA3 Power Amplifier with built-in noise generator
- DS3 Dodecahedron Speaker
- Speaker Stand for DS3
- TalkBox Acoustic Generator

Optional as required:

### CLASS 1 SOUND CALIBRATOR

- for microphone calibration to actual environmental conditions

## Appendix A

### Tips on Measuring RT60

Use ear protection during the RT60 measurements.

The pink noise used to generate the signal for the RT60 measurement must be at least 35dB above the noise floor in each frequency band.

Within each cyclic RT60 measurement it is necessary to saturate the room with as much sound energy as possible within each frequency band. This “saturation” occurs when a sound is played for a continuous period and that sound has “had enough time to reflect on all possible surfaces”. The RT60 value for the room is a good indication of the time required for this saturation to occur. Thus for toggling the pink noise we choose a cycle time of at least the RT60 value of the room.

After the pink noise is turned off, the XL2 starts to measure the reverberation time in each frequency band. If the background noise is sporadic, this may interfere with the reading, giving you either an incorrect RT60 value or no value at all.

To overcome this, either reduce the sporadic nature of the background noise (make sure nobody is talking in the room during measurements and measure when there is less traffic noise from outside) or measure many RT60 cycles and delete the outlying cycles.