

ENOSH

SCIENCE CENTER

ACOUSTIC MEASUREMENTS (Al Ghad TV).

According to ASTM-E90 & NRC (ASTM-C423).

Enoshmink Technology

13/9/2023

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Address 135 South investors area 3 New Cairo

.TEL 0226121513 - 0226121368

www.enoshscience.com

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ABSTRACT

This Report presents the results of field measurements that were made using a simplified version of the data collection procedure presented in ASTM E336-96, which is used to determine the sound transmission class (STC). This simplified approach provides a less tedious and more efficient method of estimating the sound insulation of partitions and pathways. Several factors are examined, including the effect of speaker type and location, source signal type, room geometry, type of microphone and placement. All of this influence the collection of the transmission loss measurements used in determining STC ratings. The spatial variation and repeatability of measurements on a particular partition and a comparison of results collected on a similar partition under different field conditions are also included to demonstrate a practical application of the STC method.

Sound transmission class (STC) is a method commonly used in architectural acoustics and noise control problems to provide a single number rating to the speech privacy of common building partitions. The rating is determined by measuring the transmission loss (TL) of the partition of interest and then applying a curve fitting procedure as outlined by ASTM standards. While these standards provide a highly detailed data collection and processing procedure, they give limited insight into the type of response and deviation that may be expected from actual field measurements. Likewise, there is a tremendous amount of discussion in the literature on this topic, with some attempts to relate STC values to human perception and to provide ratings for common partitions. However, what is generally lacking is a detailed discussion involving the collection of field data under real conditions. The focus of this article is to relate the results of field measurements from a simplified version of the data collection procedure presented in ASTM E336-96 to the theoretical STC presented in the literature. This simplified procedure is an attempt to provide a less tedious, more efficient method of estimating the sound insulation of partitions and pathways. In particular, the effect of speaker type and location, source signal type, recording time, room geometry, type of microphone and placement, the spatial variation and repeatability of measurements on a particular partition and a comparison of results collected on a similar partition under different field conditions are analyzed and discussed in detail.

This main purpose of the test is to estimate the Auditoriums Acoustic Behavior before any acoustic treatment. So, After the Acoustic treatments of the Auditoriums another test would be performed with the same way, then final report would be introduced with Deviation table the after-treatment results and the before treatment results and finally the deviation between them.

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PRIVATE ROOMS PROJECTS ACOUSTIC STANDARD.

Recommended ANSI Levels for Room Criteria

<u>Occupancy</u>	<u>RC Curve</u>
Private Residences	25-30 (N)
Apartments	30-35 (N)
Hotels/Motels	
Individual rooms or suites	30-35 (N)
Meeting/banquet rooms	30-35 (N)
Halls, corridors, lobbies	35-40 (N)
Service/support areas	40-45 (N)
Offices	
Executive	25-30 (N)
Conference rooms	25-30 (N)
Private	30-35 (N)
Open-plan areas	35-40 (N)
Business machines/computers	40-45 (N)
Public circulations	40-45 (N)
Hospitals and Clinics	
Private rooms	25-30 (N)
Wards	30-35 (N)
Operating rooms	25-30 (N)
Laboratories	35-40 (N)
Corridors	30-35 (N)
Public areas	35-40 (N)
Churches	30-35 (N)
Schools	
Lecture and classrooms	25-30 (N)
Open-plan classrooms	35-40 (N)
Libraries	35-40 (N)
Courtrooms	35-40 (N)
Legitimate theaters	20-25 (N)
Movie theaters	30-35 (N)
Restaurants	40-45 (N)
Concert and recital halls	15-20 (N)
Recording studios	15-20 (N)
TV studios	20-25 (N)

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EQUIPMENTS

- Phonic PAA3 Handheld Audio Analyzer.
- ANEMOMETER Digital Sound Level Meter (856A).
- TENMARS Sound Level Meter (TM-103).
- Loudspeakers.
- PCs.
- ENOSH Acoustic Camera “For Live Leakage Sources Inspections”:
 1. Metal grid 9U each 1 m².
 2. 10 Line array Microphones.
 3. DSP Unit.
 4. Web Cam.

METHODOLOGY

As the ASTM-E90 standards are not specific for the loudspeaker source, only requiring that it should “radiate sound over a wide angle, a loudspeaker including a Nor-sonic. Placing the loudspeaker in front of the auditorium’s door to help create a more dispersed sound field within the room, assuring that measurements would not be made within the direct field of the speaker. Pink and white noise, at approximately 85 dB (Flat-weighted) as measured at 1 m from the speaker, were used as room excitation sources. The microphones which were free field, were placed in- side the auditorium.

TEST PROCEDURE

In many room acoustics and noise control applications, it is often challenging to determine the directions of arrival (DoAs) of incoming sound sources. This work seeks to solve this problem reliably by beamforming, or spatially filtering, incoming sound data with a spherical microphone array via a probabilistic method. When estimating the DoA, the signal under consideration may contain one or multiple concurrent sound sources originating from different directions. This leads to a two-tiered challenge of first identifying the correct number of sources, followed by determining the directional information of each source. To this end, a probabilistic method of model-based Bayesian analysis is leveraged. This entails generating analytic models of the experimental data, individually defined by a specific number of sound sources and their locations in physical space and evaluating each model to fit the measured data. Through this process, the number of sources is first estimated, and then the DoA information of those sources is extracted from the model that is the most concise to fit the experimental data. This paper will present the analytic models, the Bayesian formulation, and preliminary results to demonstrate the potential usefulness of this model-based Bayesian analysis for complex noise environments with potentially multiple concurrent sources.

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So first, we perform Full acoustic test for the room by measuring the sound pressure level in the room so we can decide if there's a sound leakage or not, then performing a dynamic range analysis to the room to see the frequency band of the noise, after that measuring the reverberation time in the room.

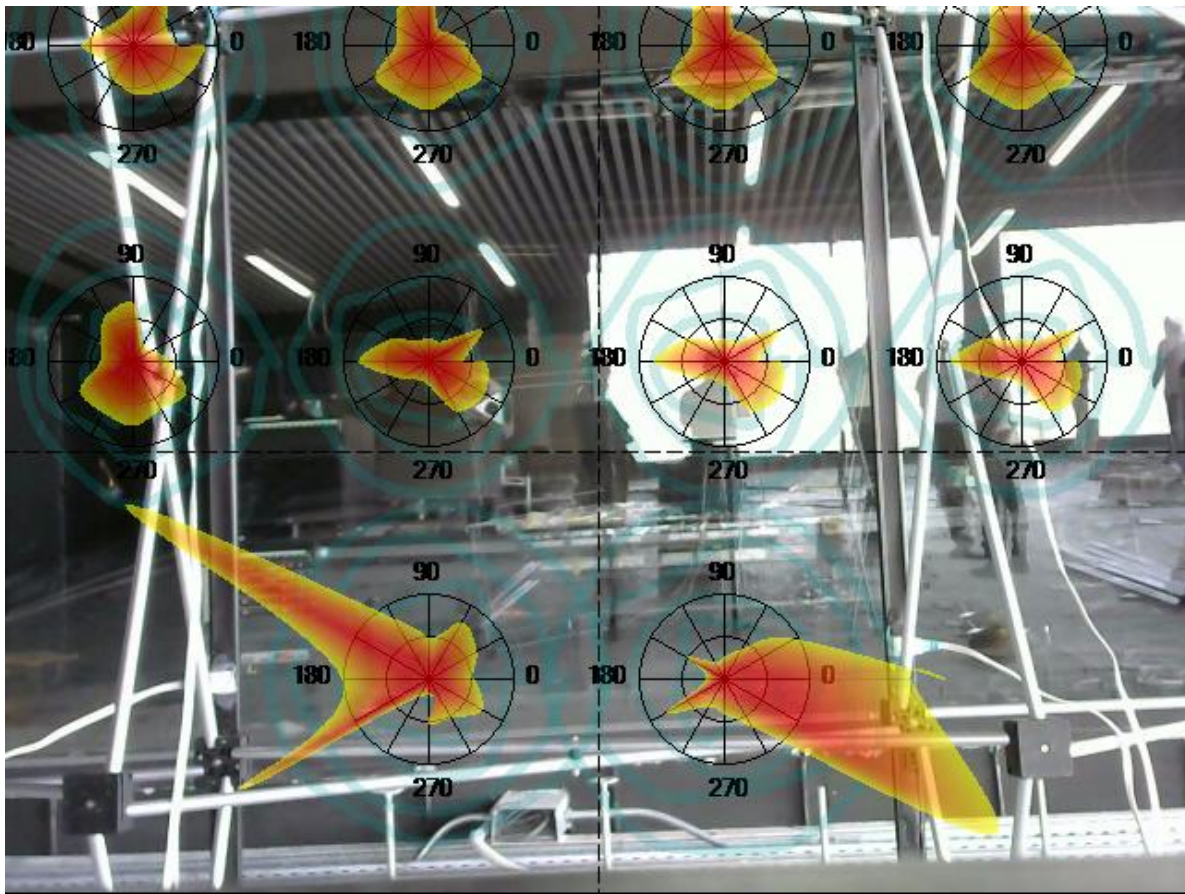
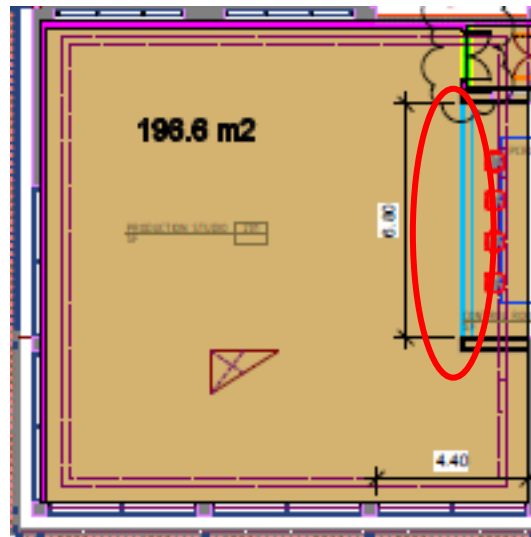
- Positioning the loudspeaker in front of the Rooms' doors.
- Generating Pink Noise 85 db.
- Positioning the Microphone Next to the walls and in the Middle of the Rooms.
- Collecting & processing the data.

Second, inspecting the source of the leakage using the Acoustic Camera, to decide the proper solution for that problem.

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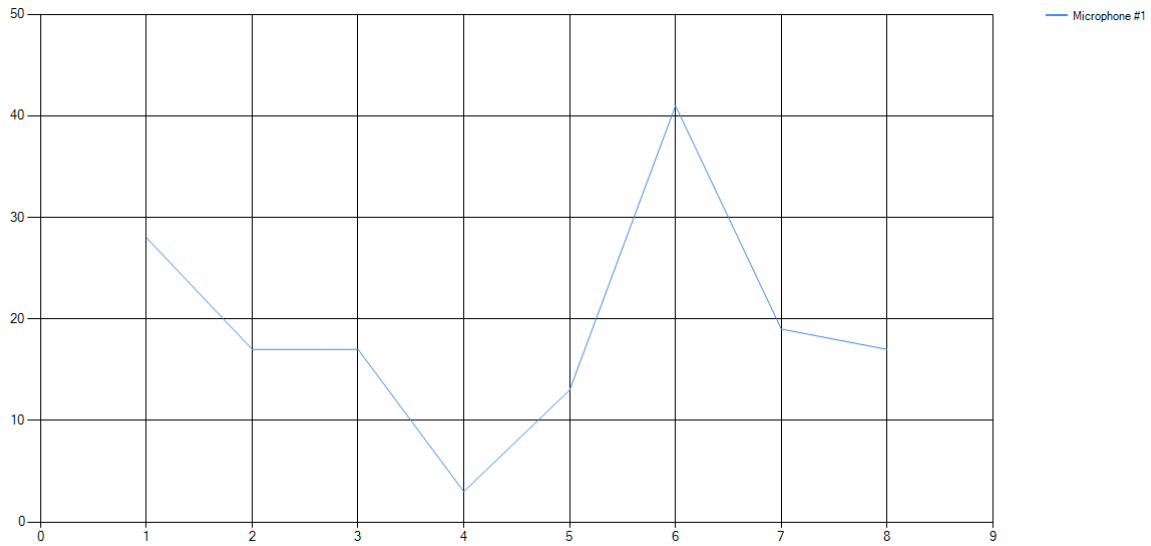
I. TEST RESULTS Adjusting the Window-To-Control Room.

1. Test Snapshot.

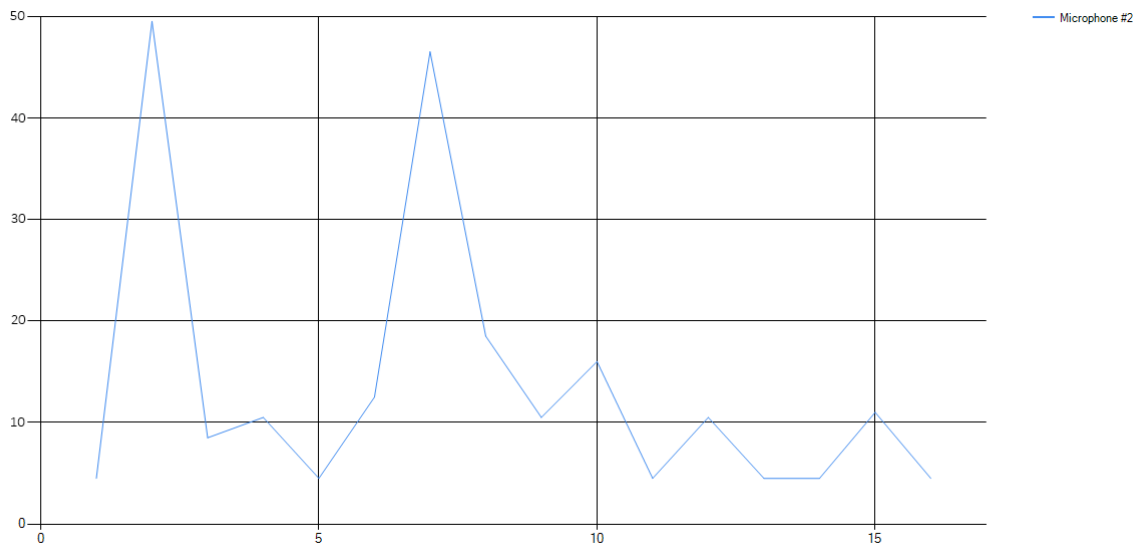


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2. Test Result Using Enosh Acoustic Camera Before Wall Damping Construction.

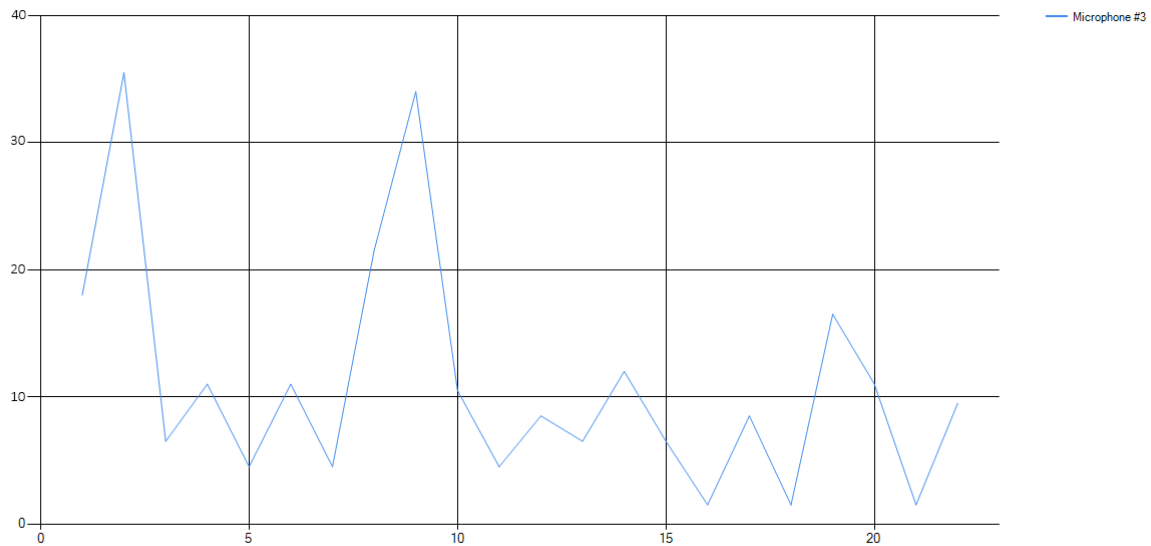


Microphone 1

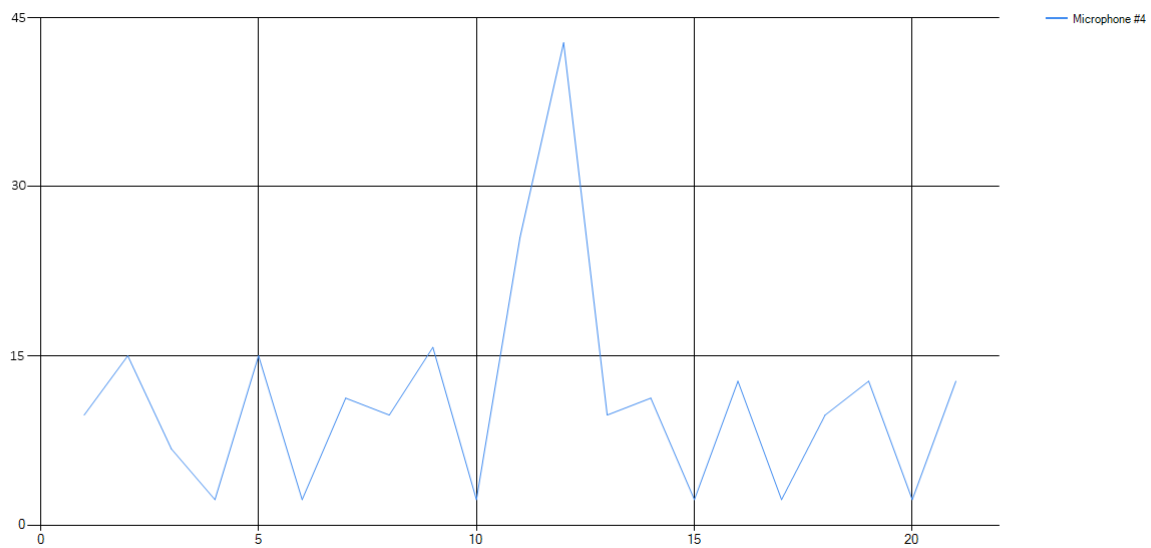


Microphone 2

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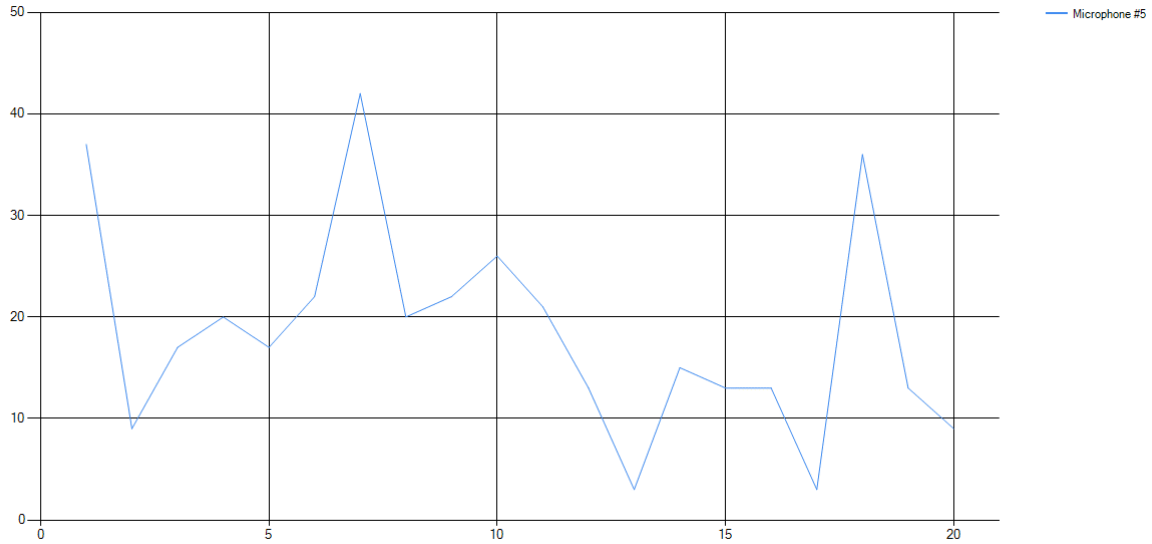


Microphone 3

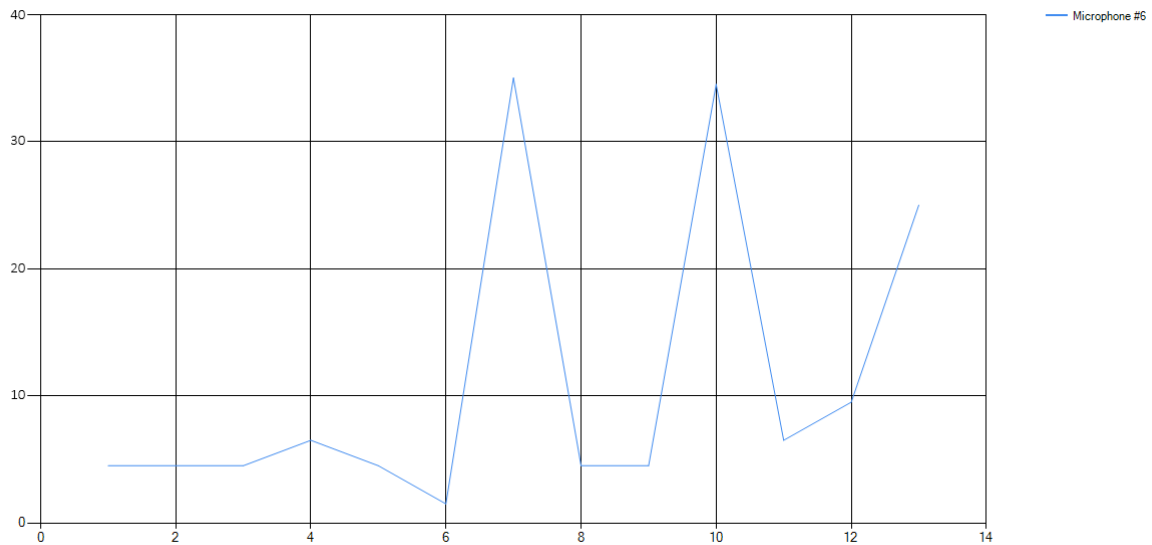


Microphone 4

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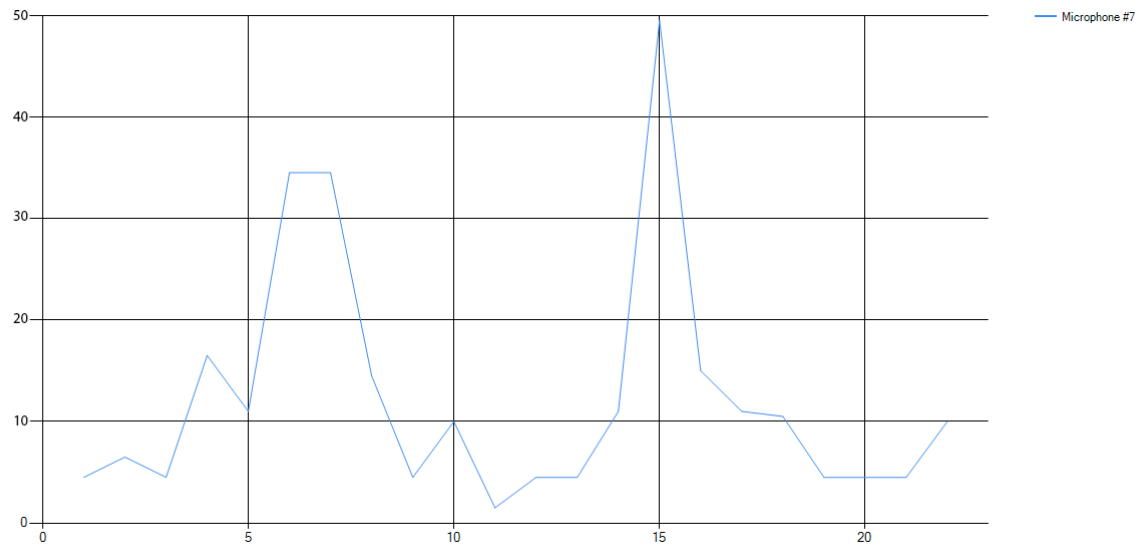


Microphone 5

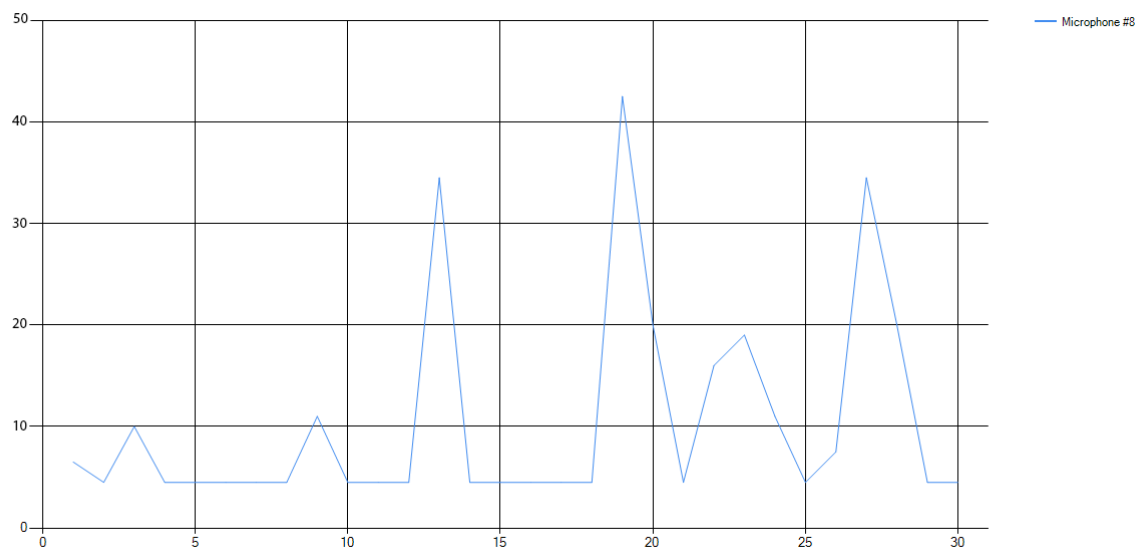


Microphone 6

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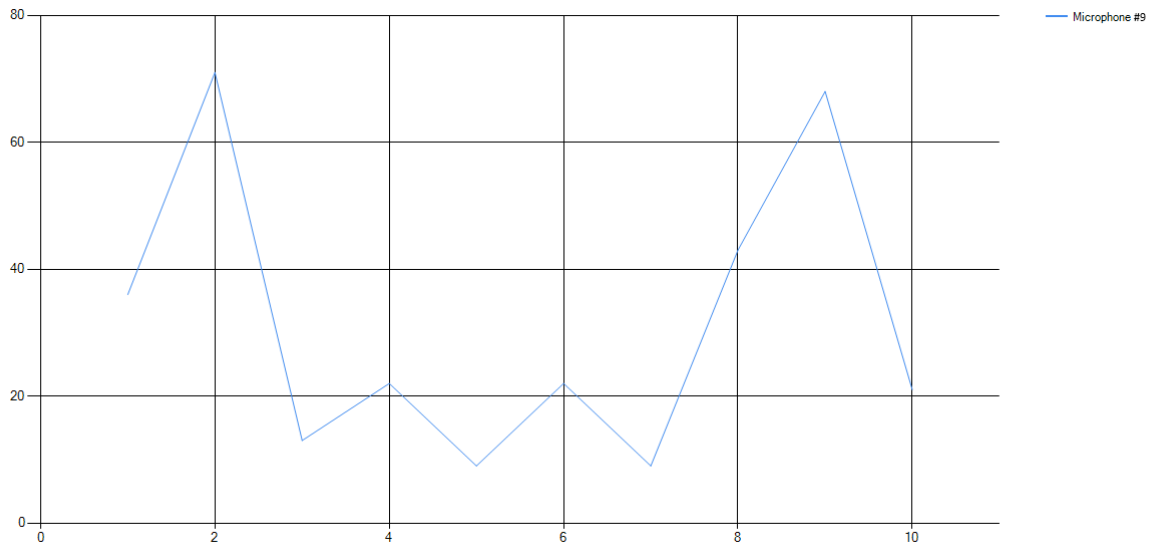


Microphone 7

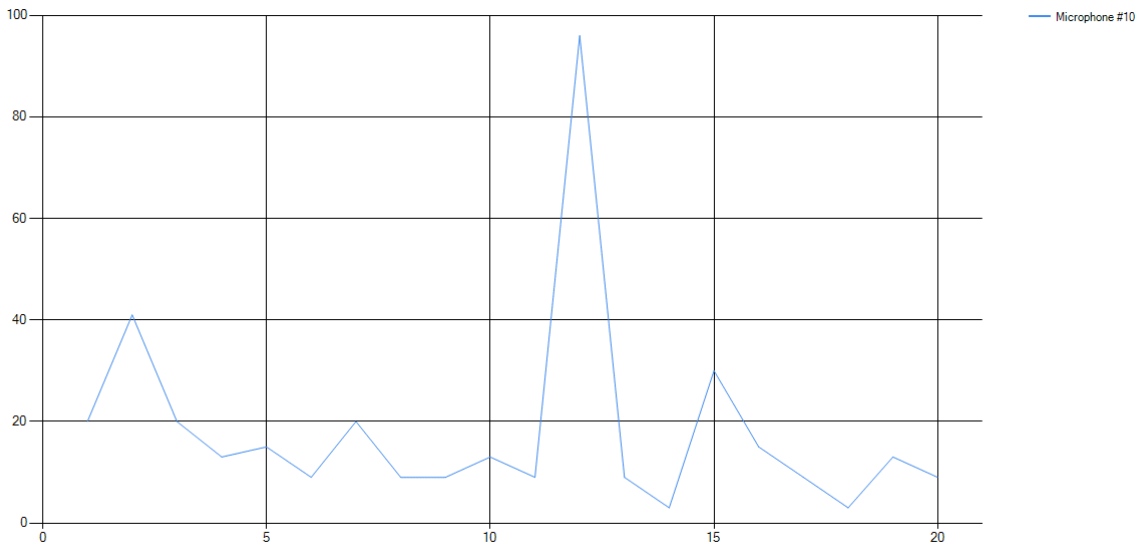


Microphone 8

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Microphone 9

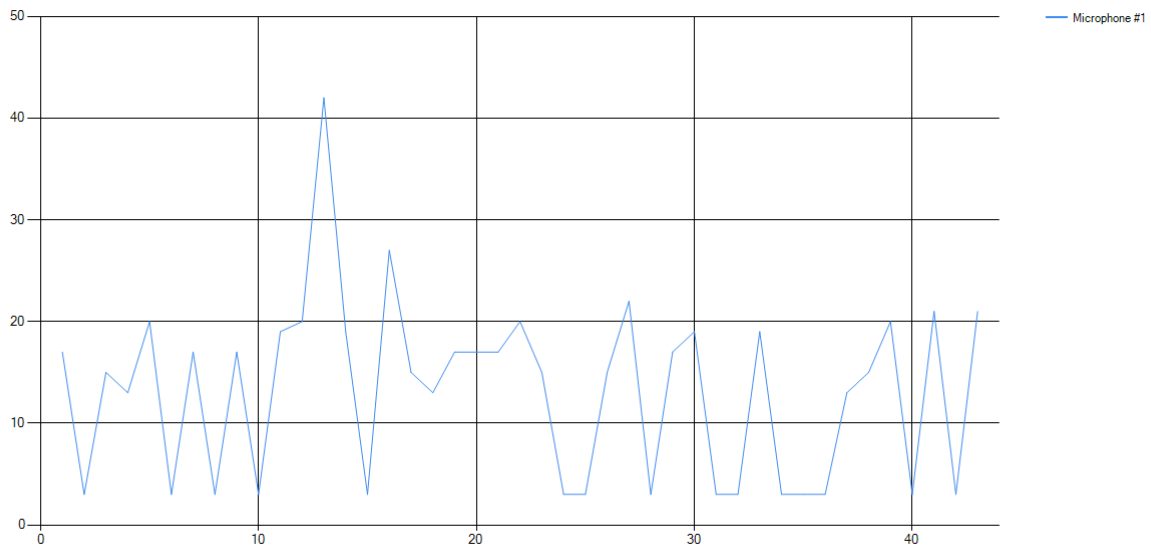


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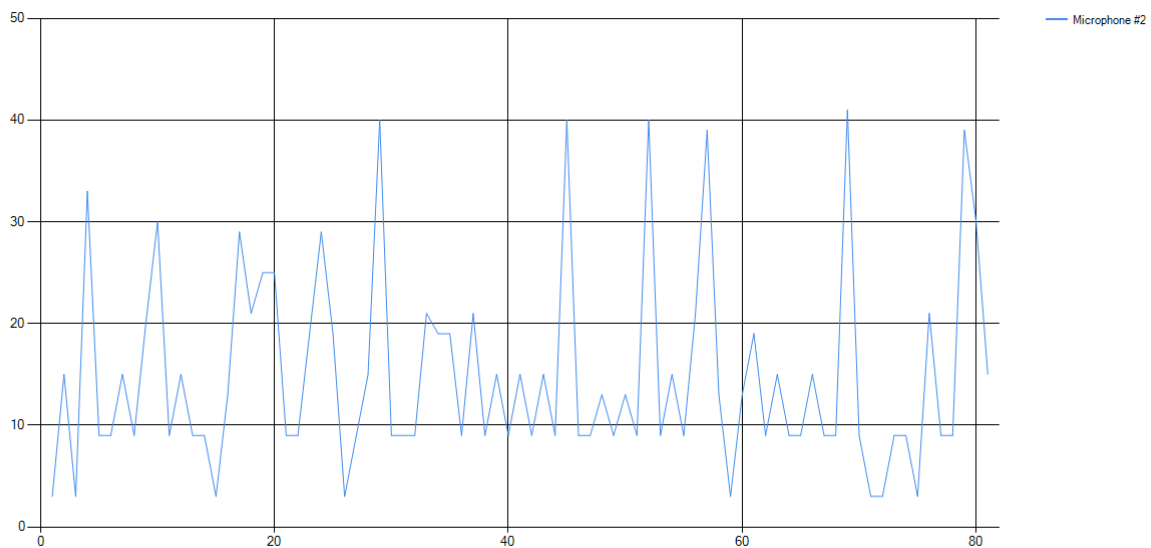
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3. Inspecting Leakage Source Using Enosh Acoustic Camera After Wall Damping Construction.

After Testing the Window, There's no leakage.

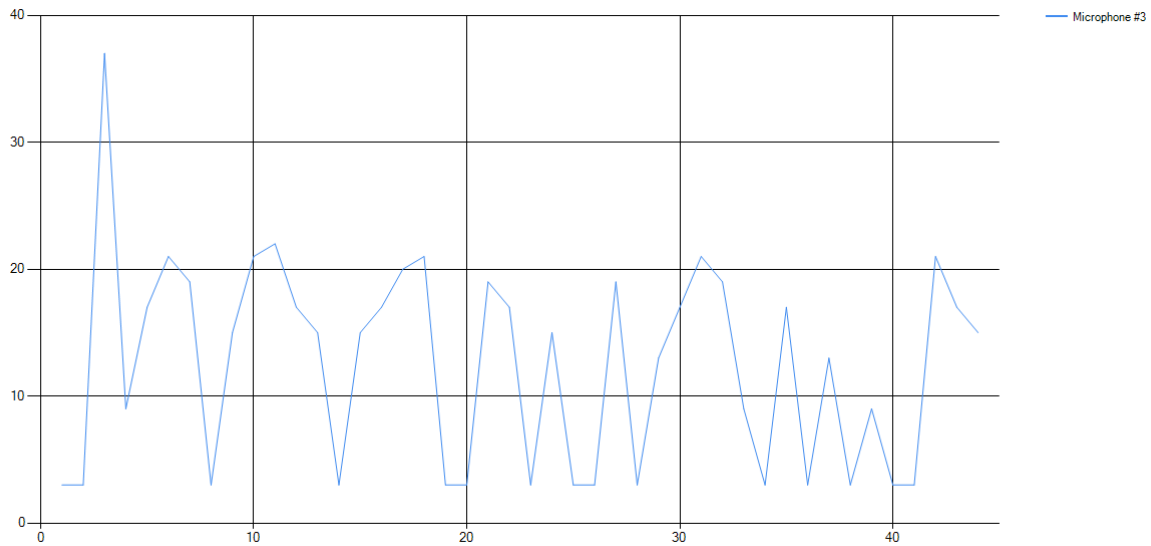


Microphone 1

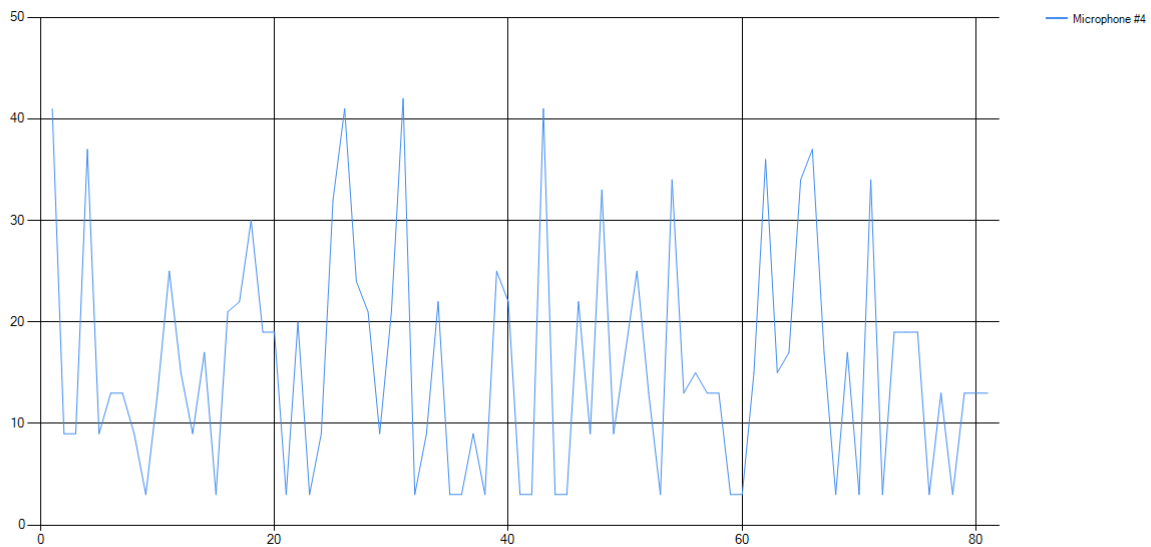


Microphone 2

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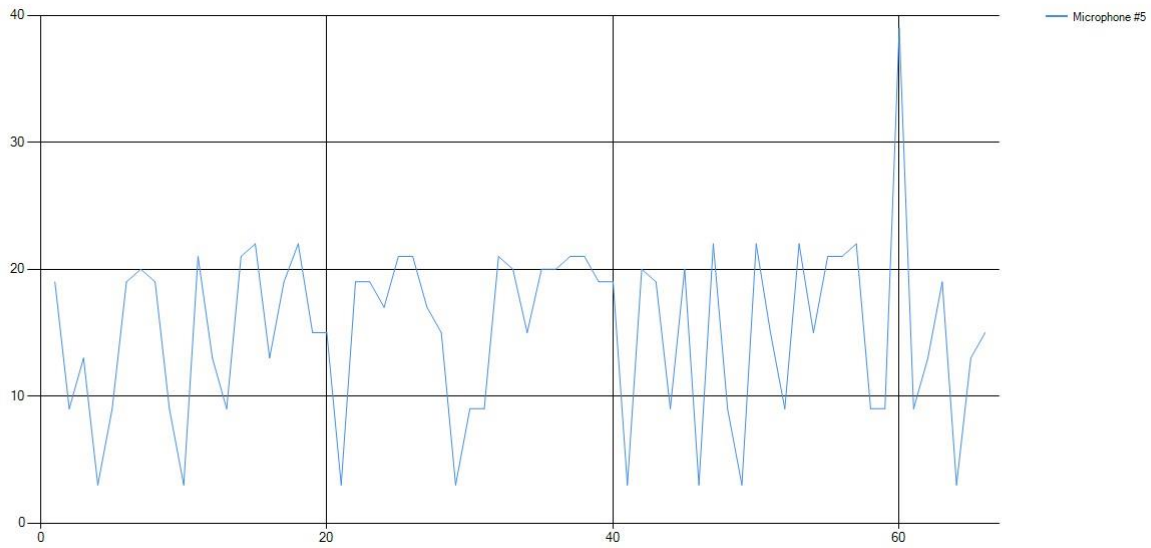


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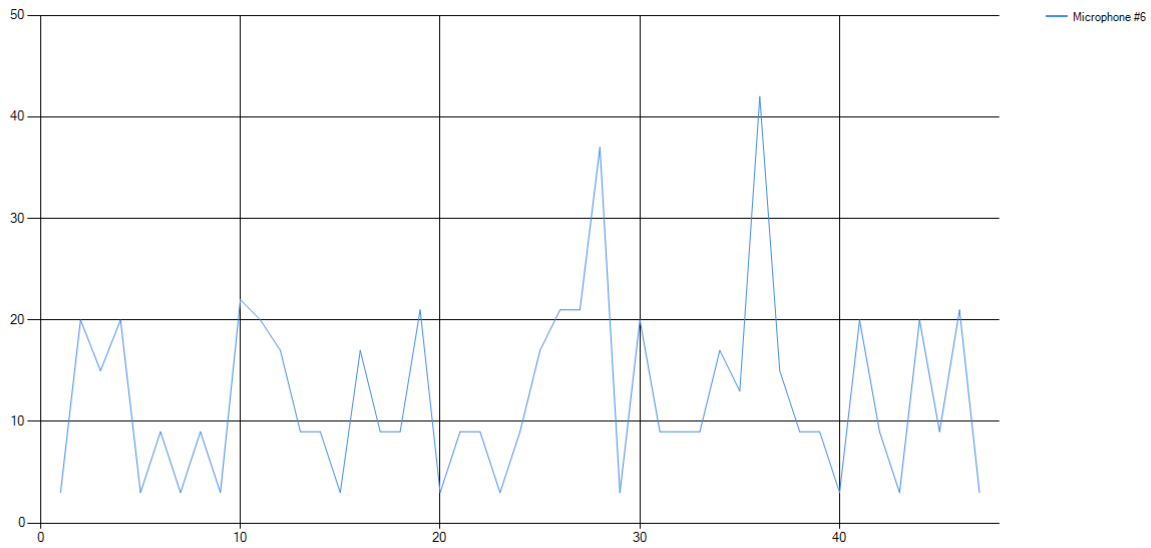


Microphone 4

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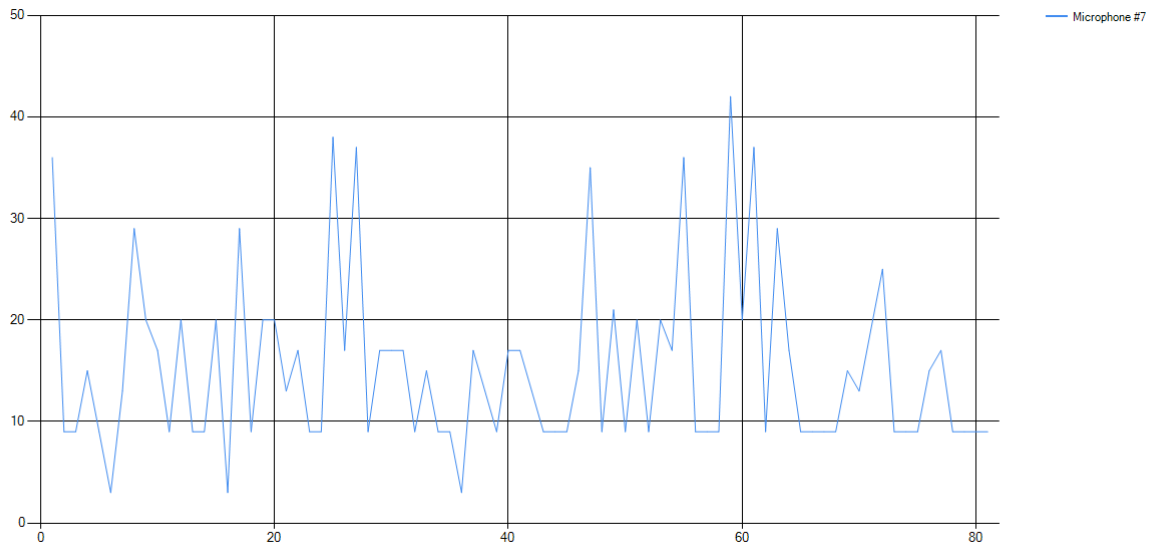


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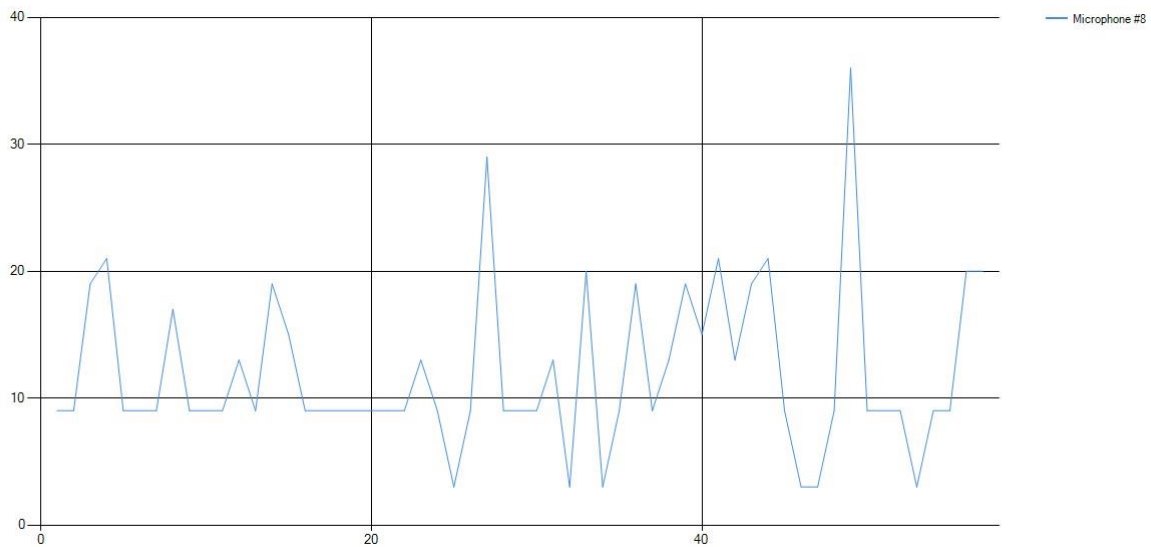


Microphone 6

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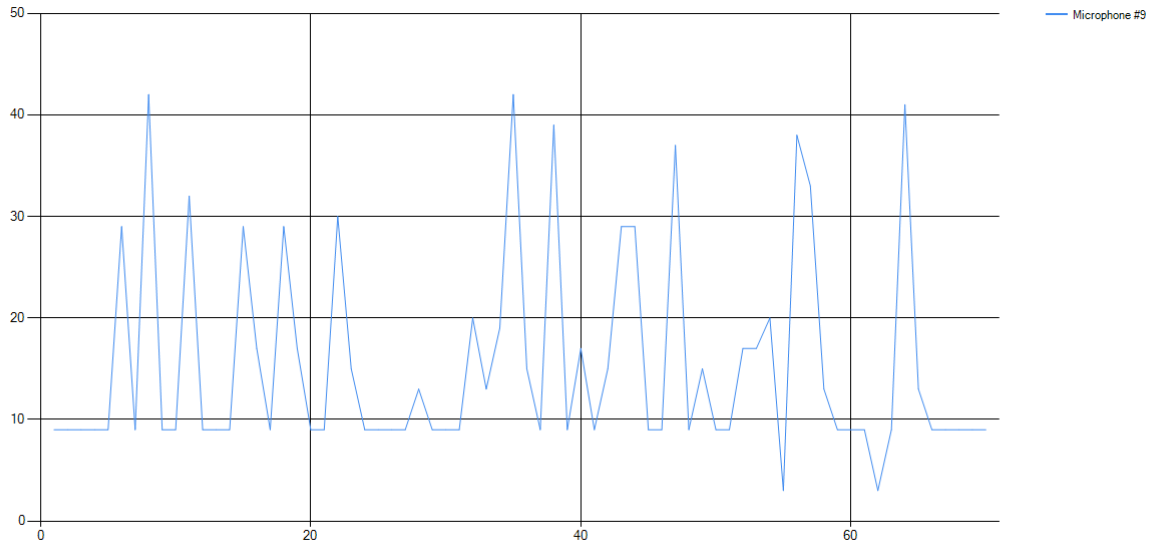


Microphone 7

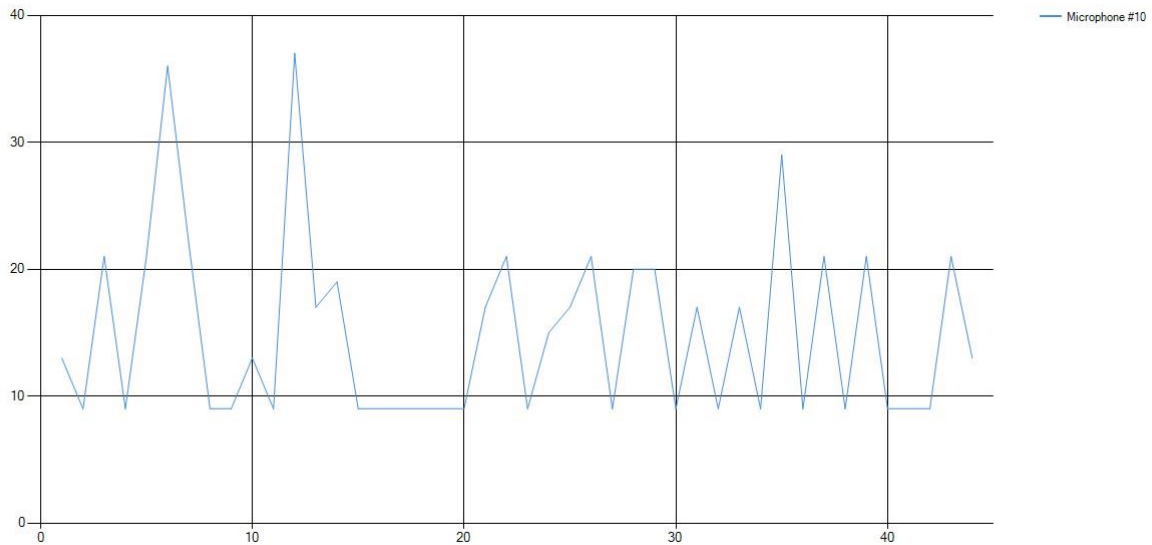


Microphone 8

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Microphone 9



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Conclusion.

- We have tested SPL level before wall damping construction and we have found leakage on the ground level in range of (70-90) dB.
- The SPL value range in the room after adjusting the window on average equals (30 -35) dB.
- The sound leakage on the ground level has been solved after Wall Damping Construction and SPL value reduced by 30-35) dB.

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TEST RESULTS USING AUDIO ANALYZER AFTER ADDING INSULATING GLASS

TEST PROCEDURE

We have tested SPL value using the audio analyzer in the center of each room of Al Ghad TV studios.

TEST RESULTS ACCORDING TO AUDIO ANALYZER

Room	SPL(dB)
PCR	Inside: 32 Outside: 35
Montage Room	35
ACR	34
TX	31
MCI	Inside: 32 Outside: 35
Broadcast	33

Conclusion.

- The SPL value range in all rooms on average equals (30-35) dB.
- The SPL value reduced by (30-35) dB as it was around (60-65) dB before adding the insulating glass.

R&D Electro-Acoustic Engineers: Muhammed Ashraf, Samir Helmy

Approved By:

Prof./ Ibrahim El-Noshokaty.

CEO Enoshmink Technology.

CTO Technical Committee ASA.

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