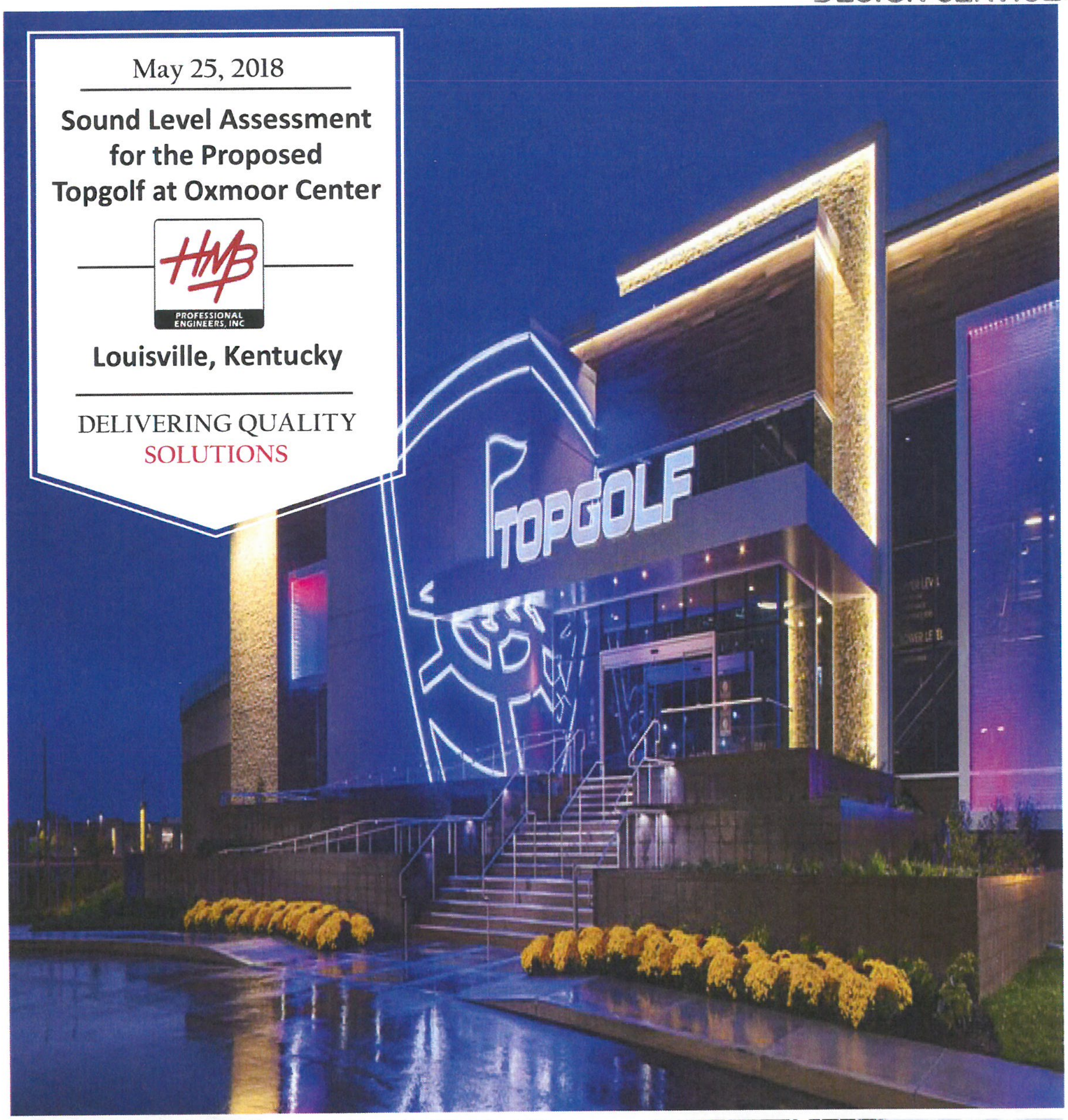
May 25, 2018

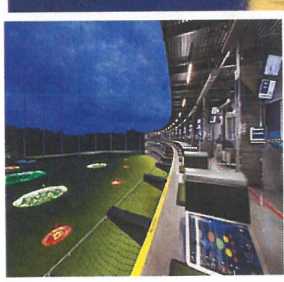
Sound Level Assessment for the Proposed Topgolf at Oxmoor Center

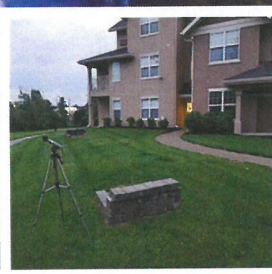
HMB PROFESSIONAL ENGINEERS, INC

Louisville, Kentucky

DELIVERING QUALITY SOLUTIONS







Prepared for: Sabak, Wilson & Lingo, Inc. and Arco Murray on behalf of Topgolf

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CHAPTER 1 – PROJECT INTRODUCTION

1.1 PROJECT DESCRIPTION

Topgolf International Inc. is proposing to redevelop the portion of the Oxmoor Center site containing the former Sears building and parking lot. The Topgolf facility would encompass a multi-level golf and entertainment complex. A project site map of the proposed facility is shown in Figure 1.2-1.

At the request of Sabak, Wilson & Lingo, Inc., Arco Murray and Topgolf International, Inc. HMB Professional Engineers, Inc. conducted a noise evaluation to determine the sound levels at nearby residential properties, including the Oxmoor Lodge assisted living facility, the Oxmoor Apartment Homes and the individual residences to the east of the Oxmoor Center. This report summarizes the survey methodology and results and utilizes the following sources for data to evaluate the potential sound levels for the project and nearby residences:

- Field measurements of the ambient, or existing sound levels;
- The Topgolf Noise Survey conducted on an Existing Topgolf facility in Gilbert, Arizona; and
- A qualitative assessment of noise generated at the proposed location with sound level measurements in both the ambient and noise generating conditions.

1.2 EXISTING NOISE ENVIRONMENT

The noise environment in the vicinity of the proposed Topgolf facility and the closest residences is generally comprised of highway traffic noise (from I-264 and Shelbyville Road), and localized noise sources, including local traffic and residential noise generators (e.g. A/C compressors).

The purpose of this evaluation was to determine if the proposed Topgolf entertainment complex would affect the residences located adjacent to the Oxmoor Center.

The Oxmoor Lodge and adjacent residences along Paddington Drive are over 1,180 feet from the closest point of the residences to the closest point of the proposed Topgolf building (the location the golf driving bays and outdoor entertainment noise generating sources).

The closest point of the Oxmoor Apartment Homes is over 1,600 feet from the closest point of the proposed Topgolf complex.

These locations and distances are shown in Figure 1.2-1.

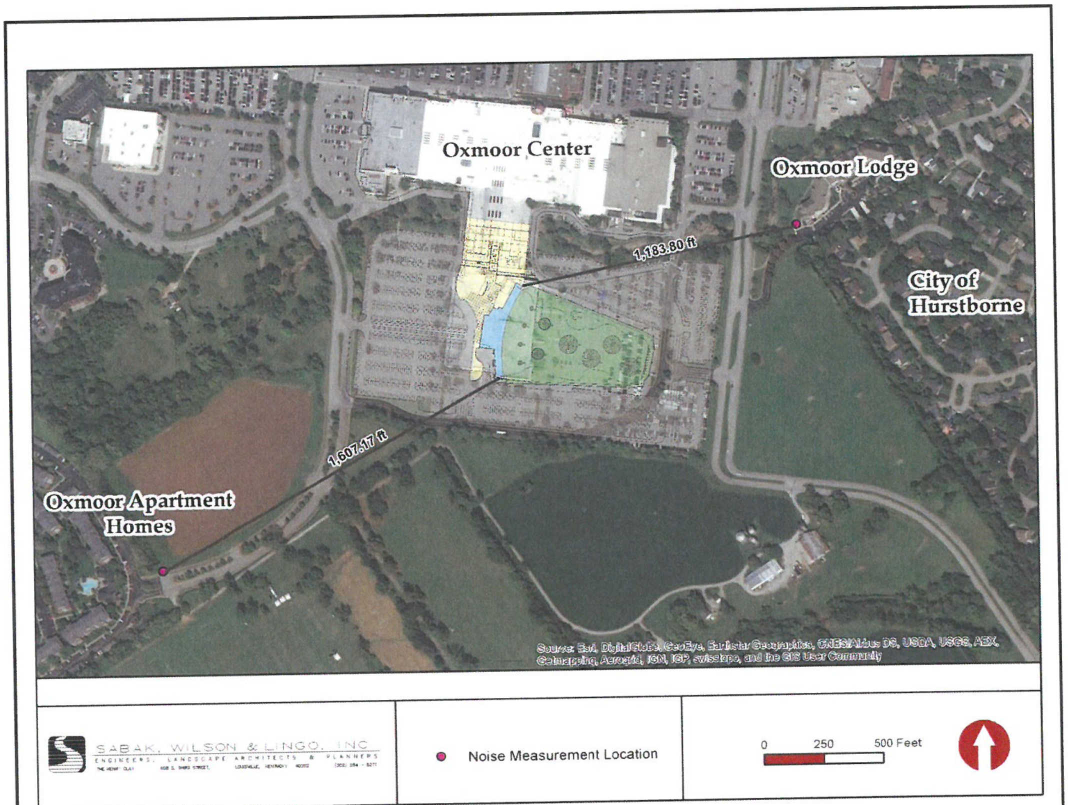


Figure 1.2-1. Proposed Topgolf Layout with Sound Level Measurement Locations

CHAPTER 2 – METHODOLOGY

2.1 NOISE ASSESSMENT METHODOLOGY

To quantify the noise contribution of the Topgolf facility to the noise environment of the residences to the east and west of the Oxmoor Center ambient (existing) sound pressure level measurements were conducted at the locations representing the closest point of the residences to the Topgolf building. These measurements were evaluated with noise levels generated at an existing Topgolf facility in Gilbert, Arizona to quantify a projected level for the residences with an operating Topgolf facility in place at Oxmoor Center.

All noise measurements were conducted with a Rion NL-20 precision integrating sound level meter that was factory calibrated and certified to within specifications (see Appendix C) and field calibrated prior to each measurement with a Rion acoustical calibrator to ensure the accuracy of the measurements. All sound level values were measured in and are expressed in terms of A-weighted decibels (dBA). Definitions of terms used in this evaluation are included in Appendix A.

2.2 QUANTITATIVE NOISE LEVEL ASSESSMENT METHODOLOGY

One-hour ambient noise measurements were conducted for each hour between 9:00 PM EDT and 1:00 AM EDT on Friday the 18th of May for the Oxmoor Lodge location and represent the weekend evening operating hours of a typical Topgolf facility and minimize the contribution of highway traffic noise to the existing noise environment.

One-hour ambient noise measurements were conducted for each hour between 9:00 PM EDT and 1:00 AM EDT on Saturday the 19th of May for the Oxmoor Apartment Homes location and represent the weekend evening operating hours of a typical Topgolf facility and minimize the contribution of highway traffic noise from I-264 to the existing noise environment (this yields lower ambient readings and would make any noise contribution from the proposed Topgolf complex more evident).

2.3 QUALITATIVE NOISE ASSESSMENT

A noise source was created in the approximate location of the proposed Topgolf entertainment building and consisted of a stand mounted Electro-Voice ZLX12p 1,000-watt loudspeaker that was used to playback a looped pre-recorded audio track at 85-90dBA measured at 15 feet and a pre-recorded track of crowd noise at 85-90dBA at 15 feet. Five-minute Ambient sound levels (without the generated noise source) and five-minute audio demonstration noise sound levels were measured at the edge of the parking lot (representing a point past the end of the proposed Topgolf driving range net, while still on Oxmoor property), the Oxmoor Lodge and the Oxmoor Apartment Homes. The quantitative noise levels were recorded, and the human perception of the field technician was noted in the project field notes. The playback location and measurement locations are shown in Figure 3.3-1.

CHAPTER 3 – RESULTS

3.1 QUANTITATIVE ASSESSMENT OF THE POTENTIAL NOISE FROM THE PROPOSED TOPGOLF COMPLEX

Bollard Acoustical Consultants, Inc. prepared a comprehensive noise survey of the Gilbert, Arizona Topgolf entertainment complex to assess the noise exposure due to a typical Topgolf operation. Long-term measurements were taken at two locations, identified as Sites A and B in their report. Thirty-minute interval measurements were recorded from 5PM on a Friday to Noon on Sunday and divided into two periods consisting of daytime (from 9AM to 10PM) and nighttime (from 10PM to 1AM) sound levels.

Measurement Site B was located at the end of the driving range field and was affected by noise from Highway 202 (Santan Freeway) in Gilbert, Arizona and therefore is not useful in forecasting noise at other facilities. Site A was located 300 feet from the Topgolf structure and was located approximately half way between the drive bays and the end of the driving field of play and is further removed from Highway 202.

In addition to the long-term measurements, 5-minute short-term measurements were taken on a Saturday night between 9PM and 11PM. These measurements were taken at 17 locations, including Site A, surrounding the Topgolf complex and were selected to quantify typical Topgolf noise generation at a variety of positions around the site. The sound levels measured at Site A were used to forecast the sound level for the Oxmoor Topgolf facility. Sound level measurement results for Site A are provided in Table 3.1–1.

Table 3.1–1. Long-term and Short-term Noise Measurements for Site A at the Topgolf in Gilbert, AZ

LOCATION	LONG-TERM DAYTIME (DBA LEQ)	LONG-TERM NIGHTTIME (DBA LEQ)	SHORT-TERM AT 9:11 P.M. (DBA LEQ)
Site A – 300 feet from the Topgolf structure	59	61	61

The long-term and short-term data demonstrate that at 300 feet from the Topgolf structure the measured sound values range from 59dBA to 61dBA. A value of 61dBA was used to forecast values for the residences in the vicinity of the proposed Oxmoor Topgolf facility. This value is both the highest measured level recorded at Site A and corresponds to nighttime activities.

Site A is located 300 feet from the Topgolf structure and has a recorded value of 61dBA Leq. This value is used, in conjunction with sound pressure level calculations to project the sound pressure level at distances greater than the measurement location. This provides sound pressure levels at both the Oxmoor Lodge and Oxmoor Apartment Homes measurement locations.

The sound pressure Level (L) falls inversely proportional to the distance (1/r) from the noise source. Sound pressure levels decrease by (-)6dBA for each doubling of the distance from the source.

An equation that expresses the sound level (L2) at a projected, evaluative distance based on a known sound level (L1) at a reference distance is as follows:

$$L_2 = L_1 + [20 \times \log (r_1/r_2)]$$

r_1 = reference distance, r_2 = at measured distance

Formula 1

This expression was used to calculate the sound pressure level that would be attributable to the Topgolf structure, where the music and crowd noise are generated, at the Oxmoor measurement sites. This projected value, based on using the 61dBA Leq level at 300 feet (the reference level and distance) from the Gilbert, Arizona Topgolf facility, was then added to the ambient value to predict the total sound level at each Oxmoor measurement site. Since sound level units are logarithmic the equation for adding two sound level values is given by:

$$L_{Total} = 10\log_{10}(10^{\wedge(L1/10)} + 10^{\wedge(L2/10)})$$

L1 and L 2 = ambient and Topgolf projected levels

Formula 2

The Gilbert, Arizona data for Site A and the projected sound pressure level attributable to the Topgolf main structure (calculated based on 61dBA and formula 1) at each Oxmoor measurement site are given in Table 3.1–2.

Table 3.1–2. Gilbert, AZ Topgolf Sound Level for Site A and Associated Sound Pressure Levels Attributable to Topgolf Oxmoor Propagated to Oxmoor Sites

LOCATION	DISTANCE (FT)	NOISE LEVEL (DBA)
Gilbert, AZ – Site A	300	61
Oxmoor Lodge	1,183.8	49.1
Oxmoor Apartment Homes	1,607.2	46.4

The sound pressure level projected for the proposed Topgolf facility show above was then added to the ambient sound level measured each hour between 9:00PM EDT and 1:00AM EDT (using Formula 2) to predict the sound level for each hour at each residential site. The predicted values are given in Table 3.1–3 and both the measurement locations and predicted values are shown in Figure 3.1-1.

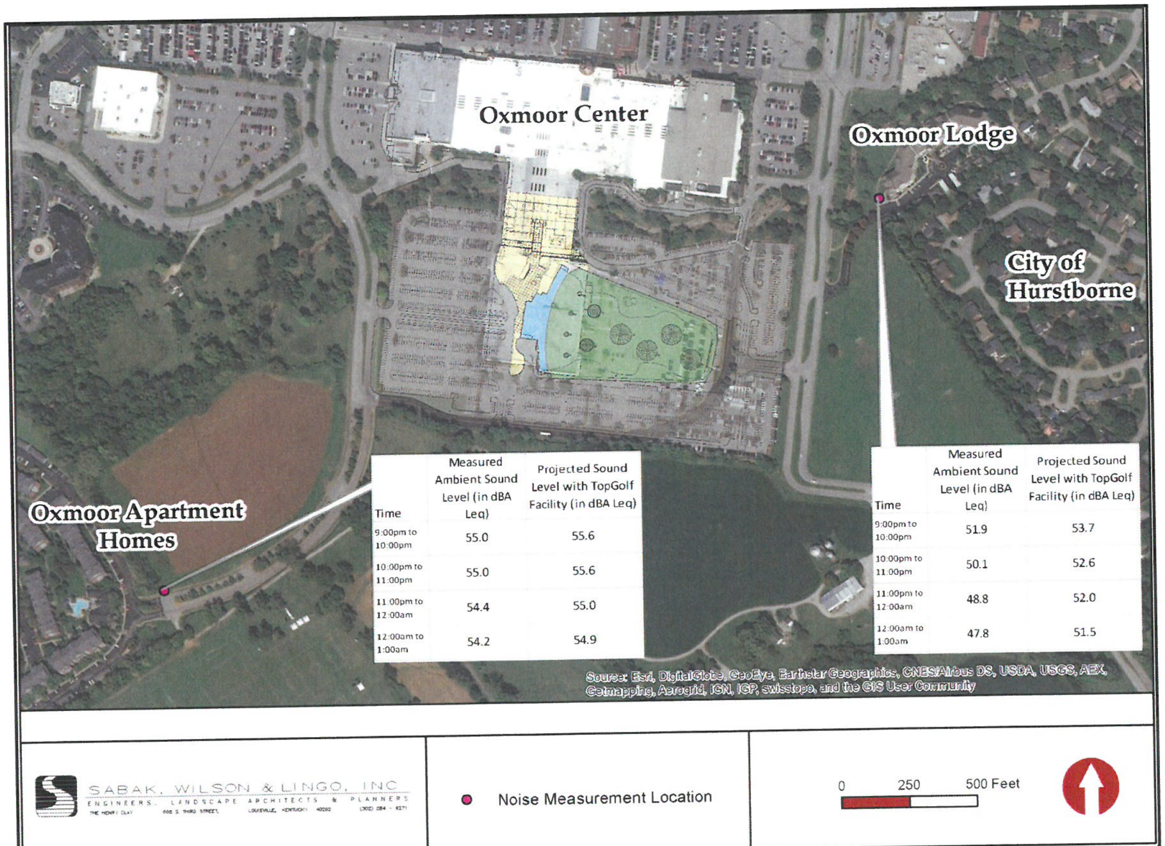
Table 3.1–3. Predicted Sound Levels at Each Measurement Site Based on Acoustic Surveys of the Topgolf Facility in Gilbert, AZ

	OXMOOR LODGE			OXMOOR APARTMENT HOMES		
TIME	MEASURED AMBIENT SOUND LEVEL (DBA LEQ)	PROJECTED SOUND LEVEL WITH TOPGOLF FACILITY (DBA LEQ)	INCREASE	MEASURED AMBIENT SOUND LEVEL (DBA LEQ)	PROJECTED SOUND LEVEL WITH TOPGOLF FACILITY (DBA LEQ)	INCREASE
9:00 p.m. to 10:00 p.m.	51.9	53.7	1.8	55.0	55.6	0.6
10:00 p.m. to 11:00 p.m.	50.1	52.6	2.5	55.0	55.6	0.6

TIME	OXMOOR LODGE			OXMOOR APARTMENT HOMES		
	MEASURED AMBIENT SOUND LEVEL (DBA LEQ)	PROJECTED SOUND LEVEL WITH TOPGOLF FACILITY (DBA LEQ)	INCREASE	MEASURED AMBIENT SOUND LEVEL (DBA LEQ)	PROJECTED SOUND LEVEL WITH TOPGOLF FACILITY (DBA LEQ)	INCREASE
11:00 p.m. to 12:00 a.m.	48.8	52.0	3.2	54.4	55.0	0.6
12:00 a.m. to 1:00 a.m.	47.8	51.5	3.7	54.2	54.9	0.7

To provide a reference for the measured and calculated sound levels a range of common sounds and their associated levels is included here.

- 40dB equates to an average home living room, library;
- 45dB equates to bird calls, a typical suburban area background;
- 50dB equates to an average office, soft music;
- 60db equates to normal conversational speech;
- 70-80dB equates to a highway at 50 feet;
- 85dB equates to heavy traffic (including large trucks), a noisy restaurant;
- 90dB equates to a passing motorcycle at close range;
- 110-120dB equates to a rock concert.



Time	Measured Ambient Sound Level (in dBA Leq)	Projected Sound Level with TopGolf Facility (in dBA Leq)
9:00pm to 10:00pm	55.0	55.6
10:00pm to 11:00pm	55.0	55.6
11:00pm to 12:00am	54.4	55.0
12:00am to 1:00am	54.2	54.9

Time	Measured Ambient Sound Level (in dBA Leq)	Projected Sound Level with TopGolf Facility (in dBA Leq)
9:00pm to 10:00pm	51.9	53.7
10:00pm to 11:00pm	50.1	52.6
11:00pm to 12:00am	48.8	52.0
12:00am to 1:00am	47.8	51.5

Figure 3.1-1. Ambient (Existing) Sound Levels and Projected Sound Levels for Adjacent Residential Properties with Topgolf

3.2 QUANTITATIVE NOISE ASSESSMENT SUMMARY

The comprehensive noise survey of the Topgolf facility in Gilbert, Arizona provided sound level measurements during nighttime hours that consisted of both long-term and short-term measurements. Both data sets indicated that the Gilbert, Arizona Topgolf, a typical Topgolf facility, would generate 61dBA Leq at 300 feet from the Topgolf structure. That data was used to predict both the sound pressure level attributable to the Topgolf facility and the total projected noise level at residences adjacent to the Oxmoor Center.

While sound pressure level measurements are a quantifiable number utilizing sound pressure level meters and acoustic equations, noise loudness is a perceived or "feeling" measure. Scientific research indicates that a doubling of the loudness feeling is obtained with an increase of about 10dBA. Research has also shown that a sound level increase of 3dBA is "barely perceptible" to the human ear.

Based on the data presented in Table 3.1–3, the change in the sound levels due to the Topgolf facility at the Oxmoor Apartments between 9PM and 1AM would increase less than 1.0dBA and the change in the sound level for the residents' environment would not be perceptible.

Based on the data presented in Table 3.1–3, the change in the sound levels due to the Topgolf facility at the Oxmoor Apartments between 9PM and 11PM would increase between 1.8dBA and 2.5dBA and would not generate a perceptible change in the sound levels for the residents. Between 11PM and 1AM the increase over existing conditions are 3.2dBA and 3.7dBA and would fall into the barely perceptible category for changes in the sound level of the very closest residents noise environment.

From the list of common noises and their associated levels the calculations demonstrate that, based on the noise survey of an operating Topgolf facility, the levels generated by the proposed Oxmoor Topgolf facility would equate to relatively quiet noise environments and would fall below the levels of conversational speech.

It should be noted that these are exterior measurements at the single closest point to the Topgolf facility. All other residences are further from this point and would experience lower levels than those presented here. It should also be noted that interior noise levels would be approximately 15-20dBA lower than these exterior levels based on the construction of the residential structures.

Quantitative analysis of the proposed Topgolf facility has demonstrated that, from an acoustic perspective, the implementation of the project would not have a meaningful impact on any resident adjacent to the Oxmoor Center. For most of the time analyzed during typical weekend operating hours the existing levels combined with the noise generated by Topgolf do not result in even a perceptible change in noise. At the distances that these residents are from the proposed facility, ambient noise near the residential properties is as great as that generated by the typical Topgolf entertainment complex.

3.3 QUALITATIVE NOISE ASSESSMENT FOR GENERATED NOISE

The comprehensive acoustic survey of the Topgolf entertainment complex in Gilbert, Arizona assess both long-term and short-term measurements during operating hours, producing a survey of noise representing a typical and operational Topgolf facility. The report concluded that on the night of the testing that the house music and patron activity were the main sources of noise. Noise generated by parking lot activities was negligible and that no appreciable HVAC system noise was audible at the various monitoring sites.

Some of the conclusions reached following the short-term monitoring that took place between 9PM and 11PM on a Saturday night are:

- The night of the measurements the Gilbert, Arizona Topgolf was operating at, or very near, maximum capacity.
- For noise modeling purposes it can be assumed that sound levels on the drive bays are 85dB Leq. These levels are based on sound level measurements conducted directly within the drive bays.
- The frequency content of the sound measured in the drive bays was relatively broadband, but low frequency components were noted in the 80-100 Hertz (Hz) bands.
- Data at Site A is considered a good benchmark for comparison of noise generation of various Topgolf facilities. It was close enough to the drive bays to ensure that the noise measurement results are representative of Topgolf operations without undue influence from extraneous noise sources.

Based on the conclusions from the Gilbert, Arizona study and to further demonstrate that the facility is not likely to alter the noise environment of the neighboring residents, an acoustic demonstration was conducted to measure sound levels at the Oxmoor Lodge and Oxmoor Apartment Homes with and without generated noise in the approximate location of the Topgolf structure. As noted in the methodology, and consistent with the types of noise generated at the Gilbert, Arizona Topgolf, a music track (with bass frequency components) and a crowd noise track were played individually and set to produce between 85dBA and 90dBA at 15 feet as measured by the Rion NL-20 sound level meter. Five-minute measurements were conducted at the edge of the parking lot, and at the two residential sites. Both ambient (without the music or crowd noise) and noise demonstration levels were recorded at all three locations. The locations and levels are shown in Figure 3.3-1 and the levels are given in Table 3.3–1.

Table 3.3–1. Ambient vs. Music and Crowd Noise Demonstration Measured Sound Levels

SITE	5-MINUTE AMBIENT READINGS (DBA LEQ)	5-MINUTE MUSIC DEMO READINGS (DBA LEQ)	5-MINUTE CROWD NOISE DEMO READINGS (DBA LEQ)
Parking Lot	51.3	51.1	51.5
Oxmoor Lodge	51.7	52.4	52.9
Oxmoor Apartment Homes	55.9	55.3	53.9

This demonstration shows that a single source of noise of sufficient power to produce 85-90dBA Leq at 15 feet would not alter the noise environment from a sound level for the adjacent residences and that localized ambient noise dominates the noise environment at these distances from a noise source.

While sound levels are measurable, sound “loudness” and “volume” are perceived measures that are subjective and are variable between people. While the data shows that the sound levels from the demonstration do not meaningfully alter the sound level at the nearby residences (or even the parking lot at approximately 875 feet from the noise source), field technicians were asked to note any perception of noise and determine if the sound generated was audible. Field observations indicate that the crowd noise tract was inaudible at both residential sites and that only occasionally a barely audible note of the music track was observed, further demonstrating that the residences, at 1,183 feet and 1,607 feet away, are too distantly removed to be affected by the proposed Topgolf facility.

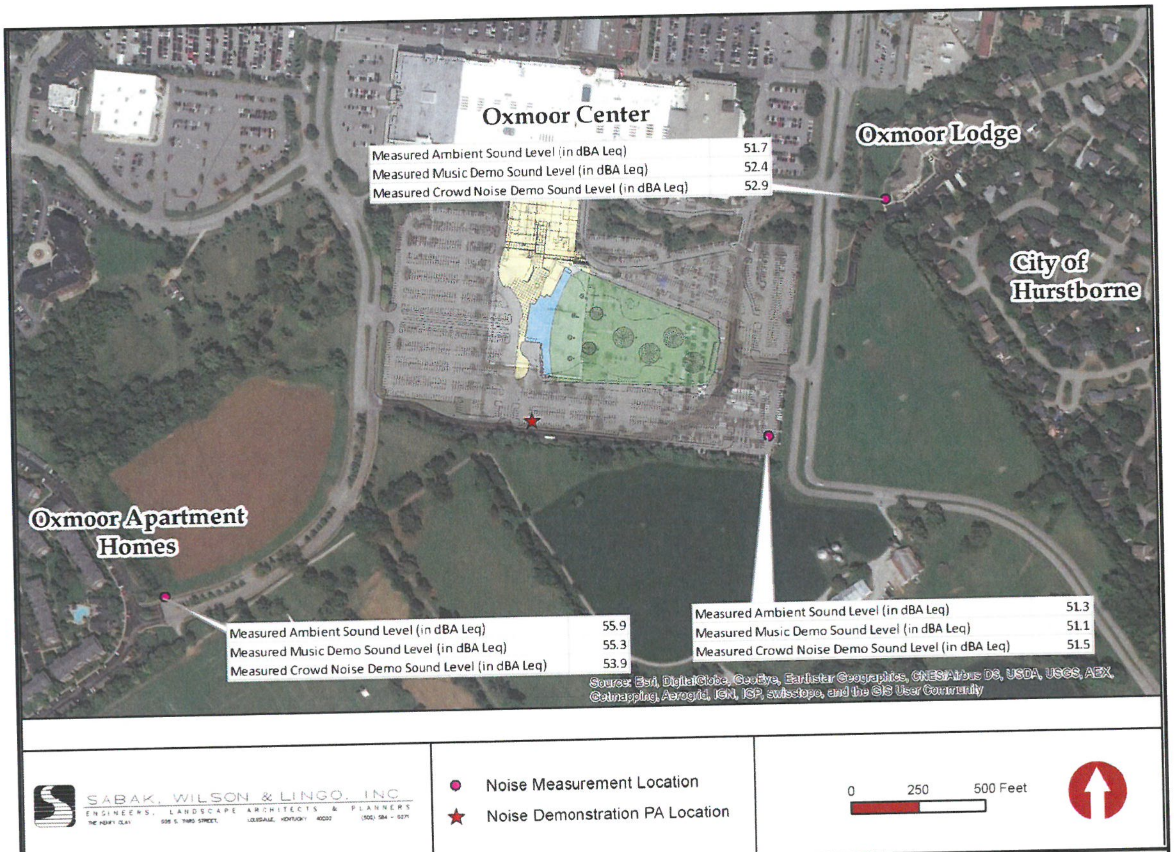


Figure 3.3-1. Acoustic Demo Sound Levels for 85-90 dB Music and Crowd Noise

3.4 SOUND LEVEL RANGES PROPAGATED FROM THE TOPGOLF STRUCTURE

While Sections 3.1 and 3.2 provide a comparison of the projected levels from the Topgolf facility in relation to two ambient measured points, representing the nearby residential areas, a range of noise levels projected over the entire project area was generated to demonstrate the various noise levels associated with the proposed facility and how far out those levels propagate.

The comprehensive noise survey of the Gilbert, Arizona Topgolf facility included three short-term measurements directly inside the driving range bays of the facility approximately 15 feet from the driving areas. These three readings were taken on a Saturday night during a period where the facility was operating at, or very near, maximum capacity. The results indicate that, for noise modeling purposes, it can be assumed that sound levels on the drive bays are 85 dB Leq.

These measurements were used to project a range of sound levels for the proposed Oxmoor Topgolf facility. Distances were calculated using the previously described formula 1 to identify distances that would equate to discreet sound levels based on the 85 dB generated in the drive bays. The ranges chosen to represent common noise environments (as previous described) and their context in relation to the noise environment. The ranges include:

>65dB: Representing noise levels that could make conversational speech more difficult;

60dB to 65dB: Representing noise levels that are above the levels of conversational speech and would be considered intrusive on a residential environment;

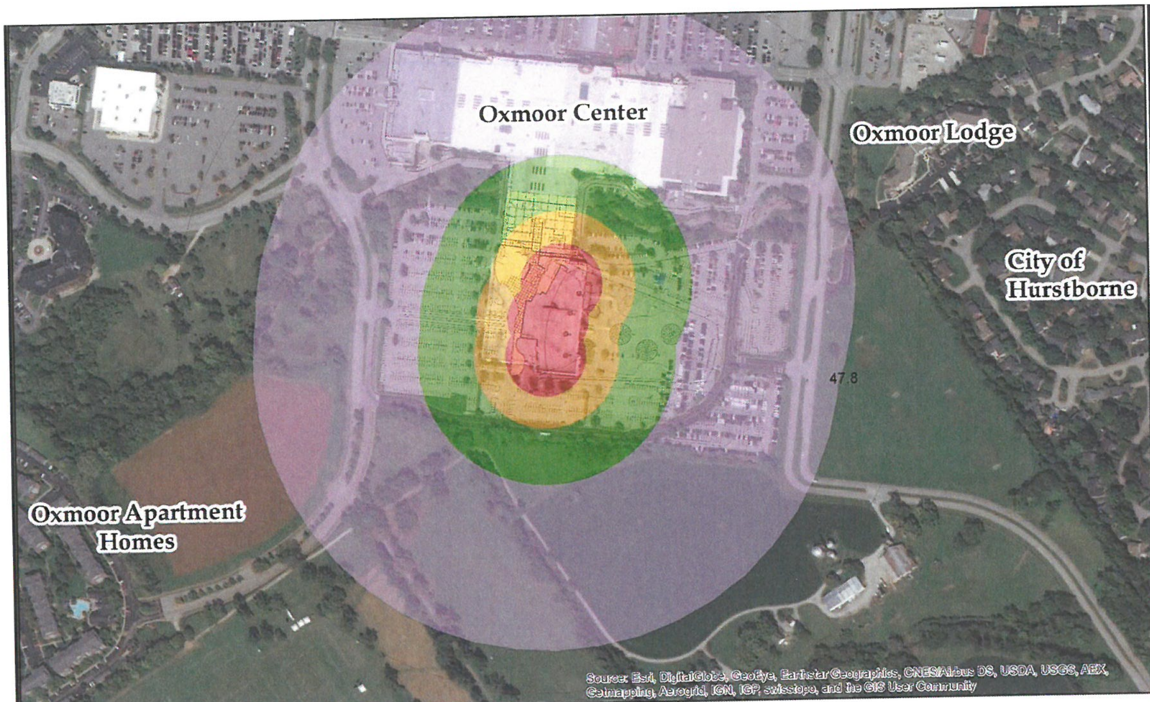
55dB to 60dB: Representing the range of conversational speech;

47.8dB to 55dB: Representing the range of ambient noise levels measured for nearby residents and includes the lowest reading observed at any measured point (Oxmoor Lodge between 12AM and 1AM).

Figure 3.4-1 shows that based on the real-world measured 85dB inside the Topgolf driving bays that the sound levels generated by the proposed facility would be equal to the ambient levels, or less, before reaching the residential areas. It also demonstrates that the loudest, and intrusive, sound levels are contained within the TopGolf property.

While this analysis is based on the 85dB measured in the drive bays in Gilbert, Arizona. A second analysis was performed to see if the Site A data that represents both long-term and short-term measurements correlate with the measurements inside of the facility. The second analysis was done to assess where the levels drop to the lowest real-world field measured levels (47.8dB) based on the Site A data. This analysis shows that 47.8dB is reached just beyond the measurement site at the Oxmoor Lodge and includes the very edge of the Oxmoor Lodge building but does not reach the nearby single-family homes. This analysis is shown in Figure 3.4-2. These two evaluations represents good correlation between the interior and exterior measurements of a Topgolf facility and the projected range of sound levels and their potential to interact with nearby residences.

These evaluations and exhibits demonstrate that the proposed Topgolf facility would not generate sound levels at these distances (distances to the residential developments) that would be different than those that are experienced today in their ambient environment, and as concluded in Section 3.4, adding the sound of the Topgolf facility to the existing sound levels would result in a barely perceptible change in the sound levels for the periods after 11PM to closing and only at the point representing the shortest distance between the facility and the neighborhood.



SABAK, WILSON & LINGO, INC.
ENGINEERS, LANDSCAPE ARCHITECTS & PLANNERS

Projected Noise Level (dBA)
- >65 dB
- 60-65 dB
- 55-60 dB
- 47.8-55 dB

0 250 500 Feet

Figure 3.4-1. Sound Level Ranges Associated with the Proposed Oxmoor Topgolf Facility

Figure 3.4-2. Distance from the Topgolf Facility Where the Sound Level Equals the Lowest Ambient Reading, Based on Site A Data

CHAPTER 4 – SUMMARY

4.1 CONCLUSIONS

Based on the field measured ambient sound level data and calculations of projected sound levels using real-world measurements from an existing Topgolf facility there would be no appreciable change in the sound level of the existing noise environments from the implementation of the proposed project. The field noise demonstration further supports these conclusions.

The following conclusions were reached based on this noise assessment of the proposed Oxmoor Topgolf facility:

- At the two ambient measurement sites, the Oxmoor Lodge and the Oxmoor Apartment Homes, the sound level from the proposed Oxmoor Topgolf facility was calculated using data recommended from the comprehensive noise survey of an operating Topgolf facility in Gilbert, AZ. The results indicate that the Topgolf generated sound level would be reduced to 49.1dBA over the 1,183 feet it takes to reach the Oxmoor Lodge and the generated sound level would be reduced to 46.4dBA over the 1,607.2 feet it takes to reach the Oxmoor Apartment Homes. These levels equate to a typical suburban area background level.
- Combining the calculated sound levels generated from Topgolf with the existing sound levels results in changes in sound levels that range from 0.6dBA to 0.7dBA for the Oxmoor Apartment Home measurement location. This change in the sound level of the environment of these residences would not be perceptible and all calculated levels at the residential areas equate to levels that are below the sound levels of typical conversational speech.
- Combining the calculated sound levels from Topgolf with the existing sound levels results in changes in sound levels that range from 1.8dBA to 3.7dBA for the Oxmoor Lodge measurement location. This change in the sound level of the environment of these residences would be considered barely perceptible (a 3dBA change is the first change considered to be barely perceptible) between 11PM and 1AM and not perceptible at other hours. These measurements represent sound levels for the exterior of the residences and at the closest point to the Topgolf facility.
- The calculations of the sound levels, based on real-world Topgolf data and field measurements, indicate that while the sound generated from the proposed facility may be able to be heard (the human ear can hear sound all the way down to zero decibels), the Topgolf facility would only generate barely perceptible changes in the actual sound levels and do so only at a point that represents the very closest area of residential usage (the side lawn of the Oxmoor Lodge).
- Calculations indicate that by the time the sound generated by Topgolf reaches the backyard of the closest single-family residence on Paddington Drive (1,320 feet from Topgolf) the level will have dropped to 48.1dBA (another 1.0dBA lower that the Oxmoor Lodge Point) and by the time it reaches the backyard of the closest single family residence on the other side of Paddington Drive (1,643 feet from Topgolf) the level will have dropped to 46.2dBA, which is lower than the quietest existing ambient reading taken during the study (at the Oxmoor Lodge, at 1AM).
- Sound level ranges were calculated by distance based on the Gilbert, AZ data for interior sound levels when the facility was operating at, or near maximum, capacity and utilizing the data from

Site A of the Gilbert, AZ data. Both real-world observations were recommended as useful for noise modelling purposes. The calculations based on these data sets indicate that at, or before, the sound reaches the residential areas it is at a level that is equal to or less than the existing sound levels at those areas. At distances equating to the closest residential property the sound level will have diminished to a level that it is the same as the ambient level. When using these two evaluations, combined with the range data and heat map (Appendix B) of the Gilbert, AZ Topgolf facility it is evident that intrusive noise levels (greater than 60dBA) are contained to the Topgolf grounds and that beyond approximately 500 feet in all three analyses the sound levels generated are below those that are associated with typical conversational speech.

The Gilbert, Arizona study evaluated both long-term measurements and short-term measurements, at multiple points around an existing Topgolf facility operating at, or near, maximum capacity during weekend evening hours. Data and recommendations from that study were used to assess the potential sound environment for the proposed Oxmoor Topgolf facility. Evaluations of the project generated sound levels, demonstration sound level values, calculated sound ranges and their propagated distances, and a heat map generated from a network of measurement locations at an operating Topgolf, all demonstrate that at the distances the adjacent residents are from the proposed Topgolf that for the generated sound, while it may be audible, it will not meaningfully affect the sound levels of the surrounding residential properties.

Appendix A:
Glossary of Terminology

Glossary of Acoustical Terminology

Ambient Sound Level (or Ambient Noise): The existing acoustical character of a given area that is comprised of all noise sources that contribute to the sound environment. The ambient sound levels are used to demonstrate the existing condition as a baseline of comparison for any potential increases in noise levels.

A-Weighting: A frequency-response adjustment of a sound level meter that approximates the human perception of sound and accounts for the frequencies that the human ear is more sensitive to. It is the most common weighting that is used in noise measurement.

Decibel (dB): The unit of sound, a Bell is defined as the logarithm of the ratio of the sound pressure squared over the reference pressure squared. A Decibel is 1/10 of a Bell.

Field Calibration: A sound level meter calibration check that is carried out in the field using a hand-held calibrator just before making important measurements. It is done to check that the sound level meter is functioning correctly and to make fine adjustments to the instrument.

Instrument Calibration: Sound level meter calibration carried out by a laboratory. A certificate is issued by the laboratory to show conformance with the standards.

Leq: Equivalent sound level. Used when measuring noise that varies over time to average the sound level.

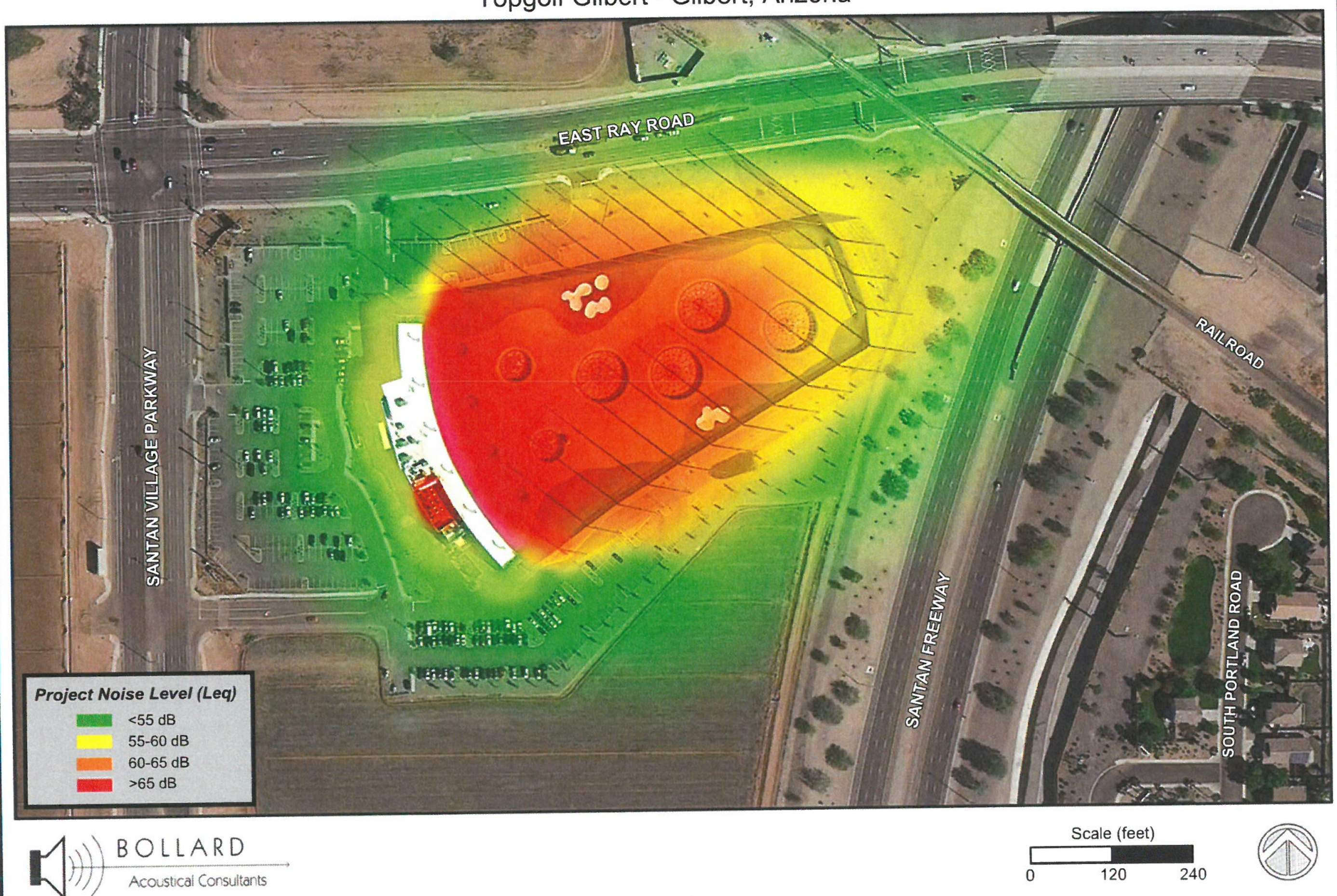
Loudness: A subjective term that is difficult to quantify and may vary from person to person.

Noise: Sound that is undesirable.

Appendix B:

Noise Level Heat Map Generated from the Noise Survey of the Gilbert, AZ Topgolf Facility

Figure 3
Project Noise Generation Heat Map
Topgolf Gilbert - Gilbert, Arizona



Appendix C:

Rion NL-20 and Field Calibrator Laboratory Calibration Certificates

Scantek, Inc.
CALIBRATION LABORATORY

ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.37641

Instrument:	**Sound Level Meter**	*Date Calibrated:* **1/9/2017**	*Cal Due:* **1/9/2019**
Model:	**NL20**		
Manufacturer:	**Rion**		
Serial number:	**00110039**		
Tested with:	**Microphone UC52 s/n 77412** **Preamplifier NH21 s/n 00177**		
Type (class):	**2**		
Customer:	**HMB Professional Engineers, Inc.**		
Tel/Fax:	**502-695-9800 / 502-695-9810**		

Status:	**Received**	**Sent**
In tolerance:	**X**	**X**
Out of tolerance:		
See comments:		

Contains non-accredited tests: __ **Yes** _X_ **No**

Calibration service: __ **Basic** _X_ **Standard**

Address: **3 HMB Circle US 460**
Frankfort, KY 40601

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Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/26/2015
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31052	Oct 26, 2016	Scantek, Inc./ NVLAP	Oct 26, 2017
DS-360-SRS	Function Generator	33584	Oct 20, 2015	ACR Env./ A2LA	Oct 20, 2017
34401A-Agilent Technologies	Digital Voltmeter	US36120731	Oct 12, 2016	ACR Env. / A2LA	Oct 12, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 10, 2016	Scantek, Inc./ NVLAP	Nov 10, 2017
4226-Brüel&Kjær	Multifunction calibrator	2305103	Jul 25, 2016	Scantek, Inc./ NVLAP	Jul 25, 2017

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
23.3	102.34	40.1

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Steven E. Marshall
Signature	[signature]	Signature	Steven E Marshall
Date	1/9/17	Date	1/10/2017

Document stored Z:\Calibration Lab\SLM 2017\RIONL20_00110039_M1.doc

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Results summary: Device complies with following clauses of mentioned specifications:

CLAUSES [1] FROM IEC/ANSI STANDARDS REFERENCED IN PROCEDURES:	RESULT [2,3]	EXPANDED UNCERTAINTY (coverage factor 2) [dB]
INDICATION AT THE CALIBRATION CHECK FREQUENCY - IEC61672-3 ED.2 CLAUSE 10	Passed	0.15
SELF-GENERATED NOISE - IEC 61672-3 ED.2 CLAUSE 11	Passed	0.30
ACOUSTICAL TEST OF A FREQUENCY WEIGHTING - IEC 61672-3 ED.2.0 CLAUSE 12	Passed	0.30
FREQUENCY WEIGHTINGS: A NETWORK - IEC 61672-3 ED.2.0 CLAUSE 13	Passed	0.20
FREQUENCY WEIGHTINGS: C NETWORK - IEC 61672-3 ED.2.0 CLAUSE 13	Passed	0.20
FREQUENCY WEIGHTINGS: Z NETWORK - IEC 61672-3 ED.2.0 CLAUSE 13	Passed	0.20
FREQUENCY AND TIME WEIGHTINGS AT 1 KHZ IEC 61672-3 ED.2.0 CLAUSE 14	Passed	0.20
LEVEL LINEARITY ON THE REFERENCE LEVEL RANGE - IEC 61672-3 ED.2 CLAUSE 16	Passed	0.25
LEVEL LINEARITY INCLUDING THE LEVEL RANGE CONTROL - IEC 61672-3 ED.2.0 CLAUSE 17	Passed	0.25
TONEBURST RESPONSE - IEC 61672-3 ED.2.0 CLAUSE 18	Passed	0.30
OVERLOAD INDICATION - IEC 61672-3 ED.2.0 CLAUSE 20	Passed	0.25
HIGH LEVEL STABILITY TEST - IEC 61672-3 ED.2.0 CLAUSE 21	Passed	0.10
LONG TERM STABILITY TEST - IEC 61672-3 ED.2.0 CLAUSE 15	Passed	0.10

1 The results of this calibration apply only to the instrument type with serial number identified in this report.

2 Parameters are certified at actual environmental conditions.

3 The tests marked with (*) are not covered by the current NVLAP accreditation.

Comments: The sound level meter submitted for testing has successfully completed the class 2 periodic tests of IEC 61672-3, for the environmental conditions under which the tests were performed. However, No general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1 because evidence was not publicly available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter fully conforms to the requirements of IEC 61672-1:2002, and because the periodic tests of IEC 61672-3 cover only a limited subset of the specifications in IEC 61672-1.

Note: The instrument was tested for the parameters listed in the table above, using the test methods described in the listed standards. All tests were performed around the reference conditions. The test results were compared with the manufacturer's or with the standard's specifications, whichever are larger.
Compliance with any standard cannot be claimed based solely on the periodic tests.

Tests made with the following attachments to the instrument:

Microphone:	Rion UC52 s/n 77412 for acoustical test
Preamplifier:	Rion NH21 s/n 00177 for all tests
Other: line adaptor ADP005 (18pF) for electrical tests	
Accompanying acoustical calibrator:	Rion NC-73 s/n 10417585
Windscreen:	Rion WS-10

Measured Data: in Test Report # 37641 of nine pages.

Place of Calibration: Scantek, Inc.
6430 Dobbin Road, Suite C
Columbia, MD 21045 USA

Ph/Fax: 410-290-7726/ -9167
callab@scantekinc.com

Summary of Test Report No.:37641

Rion Type: NL20 Serial no: 00110039

Customer:	**HMB Professional Engineers, Inc.**
Address:	**3 HMB Circle US 460 Frankfort, KY 40601**
Contact Person:	**Mitchell Green**
Phone No.:	**502-695-9800**
Fax No.:	**502-695-9810**

Microphone:	Rion	Type: UC52	Serial no: 77412	Sens:dB
Preamplifier	Rion	Type: NH21	Serial no: 00177	
Calibrator:	Rion	Type: NC-73	Serial no: 10417585	Level:93.97dB
Wind screen	Rion	Type: WS-10		

Measurement Results:

Indication at the calibration check frequency - IEC61672-3 Ed.2 Clause 10	Passed
Self-generated noise - IEC 61672-3 Ed.2 Clause 11	Passed
Acoustical test of a frequency weighting - IEC 61672-3 Ed.2.0 Clause 12	Passed
Frequency weightings: A Network - IEC 61672-3 Ed.2.0 Clause 13	Passed
Frequency weightings: C Network - IEC 61672-3 Ed.2.0 Clause 13	Passed
Frequency weightings: Z Network - IEC 61672-3 Ed.2.0 Clause 13	Passed
Frequency and time weightings at 1 kHz IEC 61672-3 Ed.2.0 Clause 14	Passed
Level linearity on the reference level range - IEC 61672-3 Ed.2 Clause 16	Passed
Level linearity including the level range control - IEC 61672-3 Ed.2.0 Clause 17	Passed
Toneburst response - IEC 61672-3 Ed.2.0 Clause 18	Passed
Overload indication - IEC 61672-3 Ed.2.0 Clause 20	Passed
High level stability test - IEC 61672-3 Ed.2.0 Clause 21	Passed
Long term stability test - IEC 61672-3 Ed.2.0 Clause 15	Passed

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Environmental conditions:

Pressure:	Temperature:	Relative humidity:
102.34	23.3	40.1

Date of calibration: 1/9/2017
Date of issue: 1/9/2017
Supervisor: Steven E. Marshall
Measurements performed by:

Jeremy Gotwalt

Software version: 6.1 T

Scantek, Inc.
6430 Dobbin Rd., Suite C, Columbia, MD 21045
Ph: 410-290-7726 eMail: callab@scantekinc.com

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Test Report No.:37641

Manufacturer:	Rion
Instrument type:	NL20
Serial no:	00110039
Customer:	HMB Professional Engineers, Inc.
Department:	
Order No:	
Contact Person:	Mitchell Green
Address:	3 HMB Circle US 460 Frankfort, KY 40601

Environmental conditions:

Pressure:	102.34
Temperature:	23.3
Relative humidity:	40.1

Supervisor	Steven E. Marshall
Engineer	Jeremy Gotwalt
Date:	1/9/2017

Measurement Results:

Indication at the calibration check frequency - IEC61672-3 Ed.2 Clause 10

Reference Calibrator: WSC4 - NOR1251-30878
Reference calibrator level: 114.00
Before calibration:
  Environmental corrections: 0.00
  Other corrections: -0.2
  Notional level: 113.80
Reference calibrator level before calibration: 113.9
After calibration:
  Environmental corrections: 0.00
  Other corrections: -0.2
  Notional level: 113.80
Reference calibrator level after calibration: 113.8
Associated Calibrator: Rion - NC-73 - 10417585
Associated calibrator level: 93.97
Initial level check:
  Environmental corrections: 0.00
  Other corrections: -0.2
  Notional level: 93.77
Indicated level before calibration: 93.9
Final level statement:
  Environmental corrections after calibration: 0.00
  Other corrections: -0.2
  Notional level: 93.77
Indicated level after calibration: 93.8
This value shall be used for adjusting the sound level meter in the future.
Test Passed

Self-generated noise - IEC 61672-3 Ed.2 Clause 11

Network	Level (dB)	Max (dB)	Uncert. (dB)	Result	Comment
A	12.2	20.0	0.3	P	Equivalent capacity
C	17.7	27.0	0.3	P	Equivalent capacity
Z	24.8	32.0	0.3	P	Equivalent capacity

Test Passed

Acoustical test of a frequency weighting - IEC 61672-3 Ed.2.0 Clause 12

A-Weighted results: free field response

Frequency	Response (dB)	Tol. (dB)	Tol. (dB)	Uncert. (dB)	Result
125 Hz	-0.2	1.5	-1.5	0.2	P
1 kHz	0.0	1.0	-1.0	0.2	P
4 kHz	-1.3	3.0	-3.0	0.3	P
8 kHz	-1.8	5.0	-5.0	0.5	P

Test Passed

Acoustical test of a frequency weighting - IEC 61672-3 Ed.2.0 Clause 12

The overall frequency response of the sound level meter, typical wind screen response and microphone response has shown to conform with the requirements in IEC 61672-3 for a class 2 sound level meter.
Frequency response test using multi frequency calibrator.
Sources for correction data:
Calibrator levels and uncertainty: Scantek - SCL
Microphone field corrections and uncertainty:
Case reflections and uncertainty:
Wind screen corrections and uncertainty:
Tabular information

```
Calibrator =   WSC4 at 94dB
txtMFCL125 =   94.07
txtMFCLU125 =                 0.11
txtSU125 =     0.20
txtM125_1 =    78.1
txtM125_2 =    78.1
txtM125_3 =    78.1
txtMFCL1k =    94.07
txtMFCLU1k =   0.11
txtSU1k =      0.15
txtM1k_1 =     93.9
txtM1k_2 =     93.9
txtM1k_3 =     93.9
txtMFCL4k =    94.02
txtMFCLU4k =   0.11
txtSU4k =      0.40
txtM4k_1 =     93.6
txtM4k_2 =     93.6
txtM4k_3 =     93.6
txtMFCL8k =    93.88
txtMFCLU8k =   0.14
txtSU8k =      0.50
txtM8k_1 =     88.6
txtM8k_2 =     88.6
txtM8k_3 =     88.6
txtSLM125 =    78.1
txtNC125 =     16.1
txtSLMU125 =   0.1
txtMic125 =    0.0
txtMicU125 =   0.05
txtCR125 =
txtCRU125 =
txtWS125 =     0.0
txtWSU125 =    0.1
txtSLM1k =     93.9
txtNC1k =      0
txtSLMU1k =    0.1
txtMFCL1k =    94.07
txtMFCLU1k =   0.11
txtMic1k =     0.4
txtMicU1k =    0.1
txtCR1k =
txtCRU1k =
txtWS1k =      0.1
txtWSU1k =     0.1
txtSLM4k =     93.6
txtNC4k =      -1.0
txtSLMU4k =    0.1
txtMFCL4k =    94.02
```

Acoustical test of a frequency weighting - IEC 61672-3 Ed.2.0 Clause 12

txtMFCLU4k = 0.11
txtMic4k = 0.2
txtMicU4k = 0.2
txtCR4k =
txtCRU4k =
txtWS4k = 0.3
txtWSU4k = 0.2
txtSLM8k = 88.6
txtNC8k = 1.1
txtSLMU8k = 0.1
txtMFCL8k = 93.88
txtMFCLU8k = 0.14
txtMic8k = 2.7
txtMicU8k = 0.4
txtCR8k =
txtCRU8k =
txtWS8k = 0.0
txtWSU8k = 0.3

Frequency weightings: A Network - IEC 61672-3 Ed.2.0 Clause 13

Freq (Hz)	Ref. (dB)	Meas. (dB)	Tol. (dB)	(dB)	Uncert. (dB)	Dev. (dB)	Result
63.1	83.0	83.0	2.0	-2.0	0.2	0.0	P
125.9	83.0	82.9	1.5	-1.5	0.2	-0.1	P
251.2	83.0	82.9	1.5	-1.5	0.2	-0.1	P
501.2	83.0	82.9	1.5	-1.5	0.2	-0.1	P
1000.0	83.0	83.0	1.0	-1.0	0.2	0.0	P
1995.3	83.0	83.1	2.0	-2.0	0.2	0.1	P
3981.1	83.0	83.1	3.0	-3.0	0.2	0.1	P
7943.3	83.0	83.2	5.0	-5.0	0.2	0.2	P

Test Passed

Frequency weightings: C Network - IEC 61672-3 Ed.2.0 Clause 13

Freq (Hz)	Ref. Level (dB)	Meas. Value (dB)	Tol. (dB)	(dB)	Uncert. (dB)	Dev. (dB)	Result
63.1	83.0	83.0	2.0	-2.0	0.2	0.0	P
125.9	83.0	83.0	1.5	-1.5	0.2	0.0	P
251.2	83.0	83.0	1.5	-1.5	0.2	0.0	P
501.2	83.0	83.0	1.5	-1.5	0.2	0.0	P
1000.0	83.0	83.0	1.0	-1.0	0.2	0.0	P
1995.3	83.0	83.1	2.0	-2.0	0.2	0.1	P
3981.1	83.0	83.1	3.0	-3.0	0.2	0.1	P
7943.3	83.0	83.2	5.0	-5.0	0.2	0.2	P

Test Passed

Frequency weightings: Z Network - IEC 61672-3 Ed.2.0 Clause 13

Freq	Ref. Level	Meas. Value	Tol.		Uncert.	Dev.	Result
(Hz)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	
63.1	83.0	83.0	2.0	-2.0	0.2	0.0	P
125.9	83.0	83.0	1.5	-1.5	0.2	0.0	P
251.2	83.0	83.0	1.5	-1.5	0.2	0.0	P
501.2	83.0	83.0	1.5	-1.5	0.2	0.0	P
1000.0	83.0	83.1	1.0	-1.0	0.2	0.1	P
1995.3	83.0	83.1	2.0	-2.0	0.2	0.1	P
3981.1	83.0	83.1	3.0	-3.0	0.2	0.1	P
7943.3	83.0	83.1	5.0	-5.0	0.2	0.1	P

Test Passed

Frequency and time weightings at 1 kHz IEC 61672-3 Ed.2.0 Clause 14

Weightings Time	Netw	Ref. (dB)	Measured (dB)	Tol. (dB)	(dB)	Uncert. (dB)	Dev. (dB)	Result
Fast	A	94.0	94.0	0.1	-0.1	0.2	0.0	P
Fast	C	94.0	94.1	0.1	-0.1	0.2	0.1	P
Fast	Z	94.0	94.1	0.1	-0.1	0.2	0.1	P
Fast	Flat	94.0	94.1	0.1	-0.1	0.2	0.1	P
Slow	A	94.0	94.0	0.1	-0.1	0.2	0.0	P
Leq	A	94.0	94.0	0.1	-0.1	0.2	0.0	P
SEL	A	104.0	104.0	0.1	-0.1	0.2	0.0	P

Test Passed

Level linearity on the reference level range - IEC 61672-3 Ed.2 Clause 16

Full scale setting: 120dB
The following measurements are SPL measurements
Measured at 31.5 Hz

Ref. (dB)	Measured (dB)	Tol. (dB)	(dB)	Uncert. (dB)	Dev. (dB)	Result
74.0	74.0	1.1	-1.1	0.25	0.0	P
79.0	79.0	1.1	-1.1	0.25	0.0	P
84.6	84.6	1.1	-1.1	0.25	0.0	P
85.6	85.6	1.1	-1.1	0.25	0.0	P
86.6	86.6	1.1	-1.1	0.25	0.0	P
87.6	87.6	1.1	-1.1	0.25	0.0	P
88.6	88.6	1.1	-1.1	0.25	0.0	P
74.0	74.6	1.1	-1.1	0.25	0.6	P
69.0	69.1	1.1	-1.1	0.25	0.1	P
64.0	64.0	1.1	-1.1	0.25	0.0	P
59.0	59.1	1.1	-1.1	0.25	0.1	P
54.0	54.1	1.1	-1.1	0.25	0.1	P
49.0	49.1	1.1	-1.1	0.25	0.1	P
44.0	43.9	1.1	-1.1	0.25	-0.1	P
39.0	38.9	1.1	-1.1	0.25	-0.1	P
37.0	37.0	1.1	-1.1	0.25	0.0	P
36.0	35.9	1.1	-1.1	0.25	-0.1	P
35.0	35.0	1.1	-1.1	0.25	0.0	P

Level linearity on the reference level range - IEC 61672-3 Ed.2 Clause 16

Ref. (dB)	Measured (dB)	Tol. (dB)	(dB)	Uncert. (dB)	Dev. (dB)	Result
34.0	33.9	1.1	-1.1	0.25	-0.1	P
33.0	32.9	1.1	-1.1	0.25	-0.1	P
Measured at 1 kHz						
94.0	94.0	1.1	-1.1	0.25	0.0	P
99.0	99.0	1.1	-1.1	0.25	0.0	P
104.0	104.0	1.1	-1.1	0.25	0.0	P
109.0	109.0	1.1	-1.1	0.25	0.0	P
114.0	114.0	1.1	-1.1	0.25	0.0	P
119.0	119.0	1.1	-1.1	0.25	0.0	P
124.0	124.0	1.1	-1.1	0.25	0.0	P
125.0	125.0	1.1	-1.1	0.25	0.0	P
126.0	126.0	1.1	-1.1	0.25	0.0	P
127.0	127.1	1.1	-1.1	0.25	0.1	P
128.0	128.1	1.1	-1.1	0.25	0.1	P
94.0	94.0	1.1	-1.1	0.25	0.0	P
89.0	89.0	1.1	-1.1	0.25	0.0	P
84.0	84.0	1.1	-1.1	0.25	0.0	P
79.0	79.0	1.1	-1.1	0.25	0.0	P
74.0	74.0	1.1	-1.1	0.25	0.0	P
69.0	69.0	1.1	-1.1	0.25	0.0	P
64.0	64.0	1.1	-1.1	0.25	0.0	P
59.0	59.0	1.1	-1.1	0.25	0.0	P
54.0	54.0	1.1	-1.1	0.25	0.0	P
49.0	49.0	1.1	-1.1	0.25	0.0	P
44.0	44.0	1.1	-1.1	0.25	0.0	P
39.0	38.9	1.1	-1.1	0.25	-0.1	P
37.0	37.0	1.1	-1.1	0.25	0.0	P
36.0	36.0	1.1	-1.1	0.25	0.0	P
35.0	35.0	1.1	-1.1	0.25	0.0	P
34.0	33.9	1.1	-1.1	0.25	-0.1	P
33.0	33.0	1.1	-1.1	0.25	0.0	P
Measured at 8 kHz						
94.0	94.0	1.1	-1.1	0.25	0.0	P
99.0	99.0	1.1	-1.1	0.25	0.0	P
104.0	104.0	1.1	-1.1	0.25	0.0	P
109.0	109.0	1.1	-1.1	0.25	0.0	P
114.0	114.0	1.1	-1.1	0.25	0.0	P
119.0	119.0	1.1	-1.1	0.25	0.0	P
122.9	122.9	1.1	-1.1	0.25	0.0	P
123.9	123.9	1.1	-1.1	0.25	0.0	P
124.9	124.9	1.1	-1.1	0.25	0.0	P
125.9	126.0	1.1	-1.1	0.25	0.1	P
94.0	94.0	1.1	-1.1	0.25	0.0	P
89.0	89.0	1.1	-1.1	0.25	0.0	P
84.0	84.0	1.1	-1.1	0.25	0.0	P
79.0	79.0	1.1	-1.1	0.25	0.0	P
74.0	74.0	1.1	-1.1	0.25	0.0	P
69.0	69.0	1.1	-1.1	0.25	0.0	P
64.0	64.0	1.1	-1.1	0.25	0.0	P
59.0	59.0	1.1	-1.1	0.25	0.0	P
54.0	54.0	1.1	-1.1	0.25	0.0	P
49.0	49.0	1.1	-1.1	0.25	0.0	P
44.0	44.1	1.1	-1.1	0.25	0.1	P
39.0	39.0	1.1	-1.1	0.25	0.0	P
37.0	37.0	1.1	-1.1	0.25	0.0	P
36.0	36.0	1.1	-1.1	0.25	0.0	P
35.0	35.0	1.1	-1.1	0.25	0.0	P

Level linearity on the reference level range - IEC 61672-3 Ed.2 Clause 16

Ref. (dB)	Measured (dB)	Tol. (dB)	(dB)	Uncert. (dB)	Dev. (dB)	Result
34.0	34.0	1.1	-1.1	0.25	0.0	P
33.0	33.0	1.1	-1.1	0.25	0.0	P

Test Passed

Level linearity including the level range control - IEC 61672-3 Ed.2.0 Clause 17

Full Scale (dB)	Ref. Value (dB)	Measured Value (dB)	Tol. Value (dB)	Uncert. (dB)	Dev. (dB)	Result

Measured at 1 kHz
The following measurements are SPL measurements
Measuring the reference level on the available ranges.

130	94.0	94.0	1.1	0.25	0.0	P
120	94.0	94.0	1.1	0.25	0.0	P
110	94.0	94.0	1.1	0.25	0.0	P
100	94.0	94.0	1.1	0.25	0.0	P

Measuring 5 dB below full scale on all available ranges.

130	125.0	125.0	1.1	0.25	0.0	P
120	115.0	115.0	1.1	0.25	0.0	P
110	105.0	105.0	1.1	0.25	0.0	P
100	95.0	95.0	1.1	0.25	0.0	P
90	85.0	85.0	1.1	0.25	0.0	P
80	75.0	75.0	1.1	0.25	0.0	P

Test Passed

Toneburst response - IEC 61672-3 Ed.2.0 Clause 18

Burst type	Ref. (dB)	Measured (dB)	Tol. (dB)	(dB)	Uncert. (dB)	Dev. (dB)	Result
Fast 200 mSec	125.0	125.0	1.0	-1.0	0.3	0.0	P
Fast 2.0 mSec	108.0	108.0	1.0	-2.5	0.3	0.0	P
Fast 0.25 mSec	99.0	98.9	1.5	-5.0	0.3	-0.1	P
Slow 200 mSec	118.6	118.6	1.0	-1.0	0.3	0.0	P
Slow 2.0 mSec	99.0	99.0	1.0	-5.0	0.3	0.0	P
SEL 200 mSec	119.0	119.0	1.0	-1.0	0.3	0.0	P
SEL 2.0 mSec	99.0	99.0	1.0	-2.5	0.3	0.0	P
SEL 0.25 mSec	90.0	89.9	1.8	-5.0	0.3	-0.1	P

Test Passed

Overload indication - IEC 61672-3 Ed.2.0 Clause 20

	Measured (dB)	Tol. (+/-dB)	Uncert. (dB)	Result
Level difference of positive and negative pulses:	0.1	1.5	0.25	P
Positive 1/2 cycle 4 kHz. Overload occurred at:	139.3			
Negative 1/2 cycle 4 kHz. Overload occurred at:	139.2			

Test Passed

High level stability test - IEC 61672-3 Ed.2.0 Clause 21

Test signal: Sine wave at 1 kHz

Initial level (dB)	Final level (dB)	Diff. (dB)	Tol. value (dB)	Uncert. (dB)	Result
137.0	137.1	0.1	0.3	0.10	P

Test Passed

Long term stability test - IEC 61672-3 Ed.2.0 Clause 15

Test signal: Sine wave at 1 kHz

Time inteval (mm:SS)	StartLevel (dB)	StopLevel (dB)	Difference (dB)	Tolerence (dB)	Result
26:24	94.0	94.0	0.0	0.3	P

Test Passed

JDG

Scantek, Inc.
CALIBRATION LABORATORY

ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.37640

Instrument:	**Acoustical Calibrator**	*Date Calibrated:* **1/9/2017**	*Cal Due:* **1/9/2019**	
Model:	**NC-73**	*Status:*	**Received**	**Sent**
Manufacturer:	**Rion**	*In tolerance:*	X	X
Serial number:	**10417585**	*Out of tolerance:*		
Class (IEC 60942):	**2**	*See comments:*		
Barometer type:		*Contains non-accredited tests:* __Yes _X_ No		
Barometer s/n:				

Customer: **HMB Professional Engineers, Inc.**
Tel/Fax: **502-695-9800 / 502-695-9810**
Address: **3 HMB Circle US 460**
Frankfort, KY 40601

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Tested in accordance with the following procedures and standards:
Calibration of Acoustical Calibrators, Scantek Inc., Rev. 10/1/2010

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31052	Oct 26, 2016	Scantek, Inc./ NVLAP	Oct 26, 2017
DS-360-SRS	Function Generator	33584	Oct 20, 2015	ACR Env./ A2LA	Oct 20, 2017
34401A-Agilent Technologies	Digital Voltmeter	US36120731	Oct 12, 2016	ACR Env. / A2LA	Oct 12, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
140-Norsonic	Real Time Analyzer	1406423	Oct 29, 2016	Scantek / NVLAP	Oct 29, 2017
PC Program 1018 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
4134-Brüel&Kjær	Microphone	173368	Nov 10, 2016	Scantek, Inc. / NVLAP	Nov 10, 2017
1203-Norsonic	Preamplifier	14052	Aug 24, 2016	Scantek, Inc./ NVLAP	Aug 24, 2017

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK)

Calibrated by:	Jeremy Gotwalt	Authorized signatory:	Steven E. Marshall
Signature	[signature]	Signature	Steven E Marshall
Date	1/9/17	Date	1/10/2017

Document stored as: Z:\Calibration Lab\Cal 2017\RIONNC73_10417585_M1.doc

18 ZONE 1014

Results summary: Device was tested and complies with following clauses of mentioned specifications:

CLAUSES[1] FROM STANDARDS REFERENCED IN PROCEDURES:	MET[2]	NOT MET	COMMENTS
Manufacturer specifications			
Manufacturer specifications: Sound pressure level	X		
Manufacturer specifications: Frequency	X		
Manufacturer specifications: Total harmonic distortion	X		
Current standards			
ANSI S1.40:2006 B.3 / IEC 60942: 2003 B.2 - Preliminary inspection	X		
ANSI S1.40:2006 B.4.4 / IEC 60942: 2003 B.3.4 - Sound pressure level	X		
ANSI S1.40:2006 A.5.4 / IEC 60942: 2003 A.4.4 - Sound pressure level stability	X		
ANSI S1.40:2006 B.4.5 / IEC 60942: 2003 B.3.5 - Frequency	X		
ANSI S1.40:2006 B.4.6 / IEC 60942: 2003 B.3.6 - Total harmonic distortion	X		

1 The results of this calibration apply only to the instrument type with serial number identified in this report.

2 The tests marked with (*) are not covered by the current NVLAP accreditation.

Main measured parameters [3]:

Measured[4]/Acceptable[5] Tone frequency (Hz):	Measured[4]/Acceptable[5] Total Harmonic Distortion (%):	Measured [4]/Acceptable Level[5] (dB):
995.32 ± 1.0/1000.0 ± 20.0	0.18 ± 0.10/ < 4	93.97 ± 0.12/94.0 ± 0.75

3 The stated level is valid at measurement conditions.

4 The above expanded uncertainties for frequency and distortion are calculated with a coverage factor k=2; for level k=2.00

5 Acceptable parameters values are from the current standards

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
23.2 ± 1.1	102.51 ± 0.000	38.2 ± 2.7

Tests made with following attachments to instrument:

Calibrator ½" Adaptor Type: Rion NC-71-S02
Other:

Adjustments: Unit was not adjusted.
Comments: The instrument was tested and met all specifications found in the referenced procedures.

Note: The instrument was tested for the parameters listed in the table above, using the test methods described in the listed standards. All tests were performed around the reference conditions. The test results were compared with the manufacturer's or with the standard's specifications, whichever are larger.
Compliance with any standard cannot be claimed based solely on the periodic tests.

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Measured Data: in Acoustical Calibrator Test Report # 37640 of one page.

Place of Calibration: Scantek, Inc.
6430 Dobbin Road, Suite C
Columbia, MD 21045 USA

Ph/Fax: 410-290-7726/ -9167
callab@scantekinc.com

Test Report No.:37640

Manufacturer:	**Rion**
Type:	**NC-73**
Serial no:	**10417585**

Customer:	HMB Professional Engineers, Inc.
Department:	
Address:	3 HMB Circle US 460 Frankfort, KY 40601
Order No:	
Contact Person:	Mitchell Green
Phone No.:	502-695-9800
Fax No.:	502-695-9810

Measurement Results:

	Level: (dB)	P. Stab : (dB)	Frequency: (Hz)	F. Stab : (%)	Distortion: (% TD)
1:	93.97	0.02	995.30	0.01	0.18
2:	93.97	0.01	995.33	0.01	0.18
3:	93.97	0.01	995.34	0.01	0.18
Result (Average):	**93.97**	**0.01**	**995.32**	**0.01**	**0.18**
Expanded Uncertainty:	0.12	0.02	1.00	0.01	0.10
Degree of Freedom:	>100	>100	>100	7	>100
Coverage Factor:	2.00	2.00	2.00	2.43	2.00

The stated levels are relative to 20μPa.

The stated level is valid at measurement conditions.
Reference microphone: 4134-173368. Volume correction: 0.000 dB
Records:Z:\Calibration Lab\Cal 2017\RIONNC73_10417585_M1.nmf

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with EA publication EA-4/02.

Environmental conditions:

Pressure:	Temperature:	Relative humidity:
102.510 ± 0.020 kPa	23.2 ± 1.1 °C	38.2 ± 2.7 %RH

Date of calibration: 1/9/2017
Date of issue: 1/9/2017

Supervisor : Steven E. Marshall
Measurements performed by:

Jeremy Gotwalt
Software version: 6.1T

Scantek, Inc.
6430 Dobbin Rd., Suite C, Columbia, MD 21045
Ph: 410-290-7726 eMail: callab@scantekinc.com