## APPENDIX D

# Shell Puget Sound Refinery (PSR) Rail Unloading Facility
# Noise Monitoring Results, Photo Log, and Laboratory Calibration Sheets

Washington State Department of Transportation (WSDOT). 2011.
2011 Traffic Noise Policy and Procedures. October.

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# APPENDIX D: NOISE MONITORING RESULTS, PHOTO LOG, AND LABORATORY CALIBRATION SHEETS

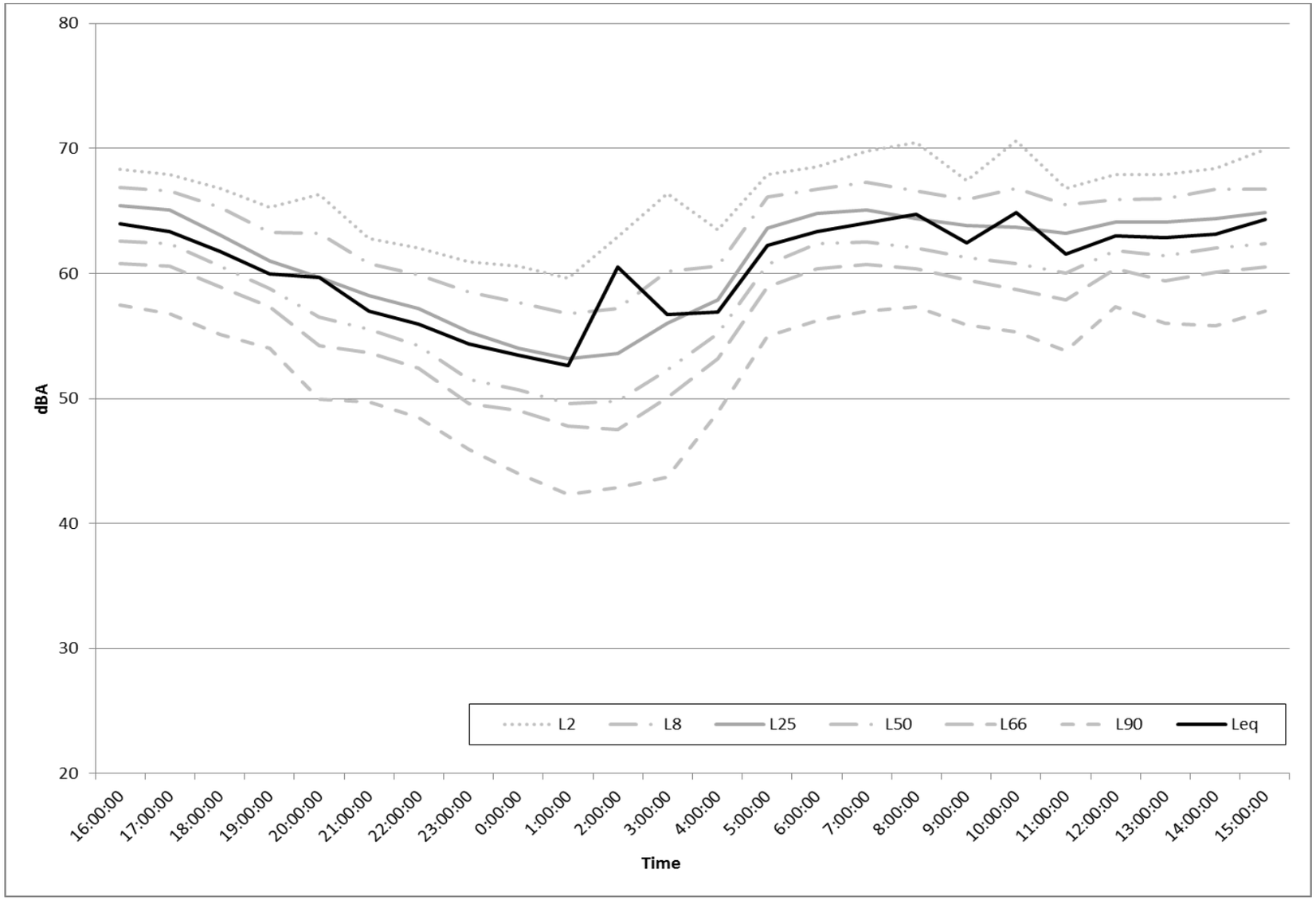
## Part A. Baseline Monitoring Results

| Monitoring Position | AE Area | Longitude | Latitude | Date/Time | | $L_{eq}$ (day) | $L_{eq}$ (night) | $L_{dn}$ | Statistical Sound Levels (Ln) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Start | End | | | | $L_2$ | $L_8$ | $L_{25}$ | $L_{50}$ | $L_{66}$ | $L_{90}$ |
| MP-1 (Near Wetland Mitigation Site) | | -122.4951 | 48.4525 | 4:00 PM 1/4/2016 | 3:00 PM 1/5/2016 | 63 | 59 | 66 | 66 | 64 | 61 | 58 | 56 | 52 |
| MP-2 | | -122.4417 | 48.4455 | 12:00 PM 1/4/2016 | 11:00 AM 1/5/2016 | 67 | 63 | 70 | 71 | 68 | 66 | 62 | 60 | 56 |
| MP-3 | | -122.3861 | 48.4569 | 1:00 PM 1/4/2016 | 12:00 PM 1/5/2016 | 58 | 56 | 63 | 62 | 59 | 56 | 53 | 51 | 47 |
| MP-4 | | -122.3531 | 48.4678 | 1:00 PM 1/4/2016 | 12:00 PM 1/5/2016 | 57 | 54 | 61 | 59 | 56 | 54 | 51 | 50 | 47 |
| MP-5 | | -122.3279 | 48.4714 | 2:00 PM 1/4/2016 | 1:00 PM 1/5/2016 | 64 | 61 | 68 | 64 | 55 | 50 | 48 | 47 | 45 |
| MP-6 | | -122.3258 | 48.4418 | 3:00 PM 1/5/2016 | 2:00 PM 1/6/2016 | 71 | 72 | 79 | 64 | 55 | 47 | 45 | 44 | 43 |
| MP-7 | | -122.3363 | 48.4110 | 3:00 PM 1/5/2016 | 2:00 PM 1/6/2016 | 59 | 60 | 66 | 62 | 58 | 54 | 52 | 51 | 49 |
| MP-8 | | -122.3431 | 48.3416 | 3:00 PM 1/5/2016 | 2:00 PM 1/6/2016 | 63 | 65 | 71 | 65 | 57 | 54 | 52 | 51 | 49 |

| Monitoring Position | AE Area | Longitude | Latitude | Date/Time | | $L_{eq}$ (day) | $L_{eq}$ (night) | $L_{dn}$ | Statistical Sound Levels (Ln) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Start | End | | | | $L_2$ | $L_8$ | $L_{25}$ | $L_{50}$ | $L_{66}$ | $L_{90}$ |
| MP-9 | | -122.3425 | 48.3320 | 3:00 PM 1/5/2016 | 2:00 PM 1/6/2016 | 67 | 65 | 72 | 72 | 67 | 64 | 61 | 60 | 57 |
| MP-10 (Near Heron Rookery) | | -122.5388 | 48.4619 | 4:26 AM 1/6/2016 | 12:00 PM 1/6/2016 | 64 | 60 | 67 | 70 | 66 | 63 | 61 | 58 | 54 |
| MP-11 (Near Bald Eagle Nest) | | -122.5464 | 48.4782 | 5:08 AM 1/6/2016 | 1:19 PM 1/6/2016 | 60 | 59 | 66 | 69 | 56 | 50 | 47 | 46 | 45 |

## Part B. Monitoring Positions

**MP-1**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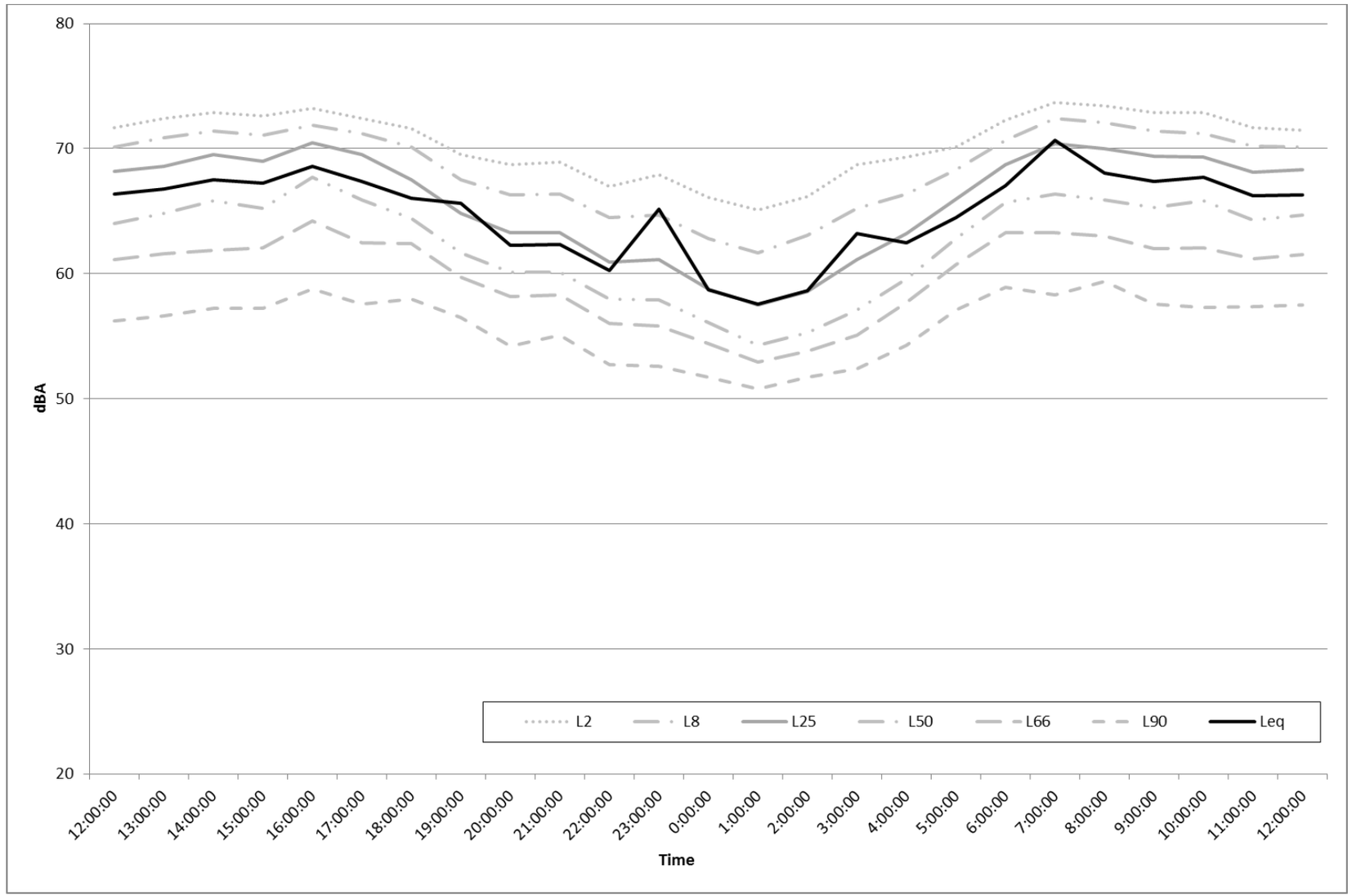
**MP-2**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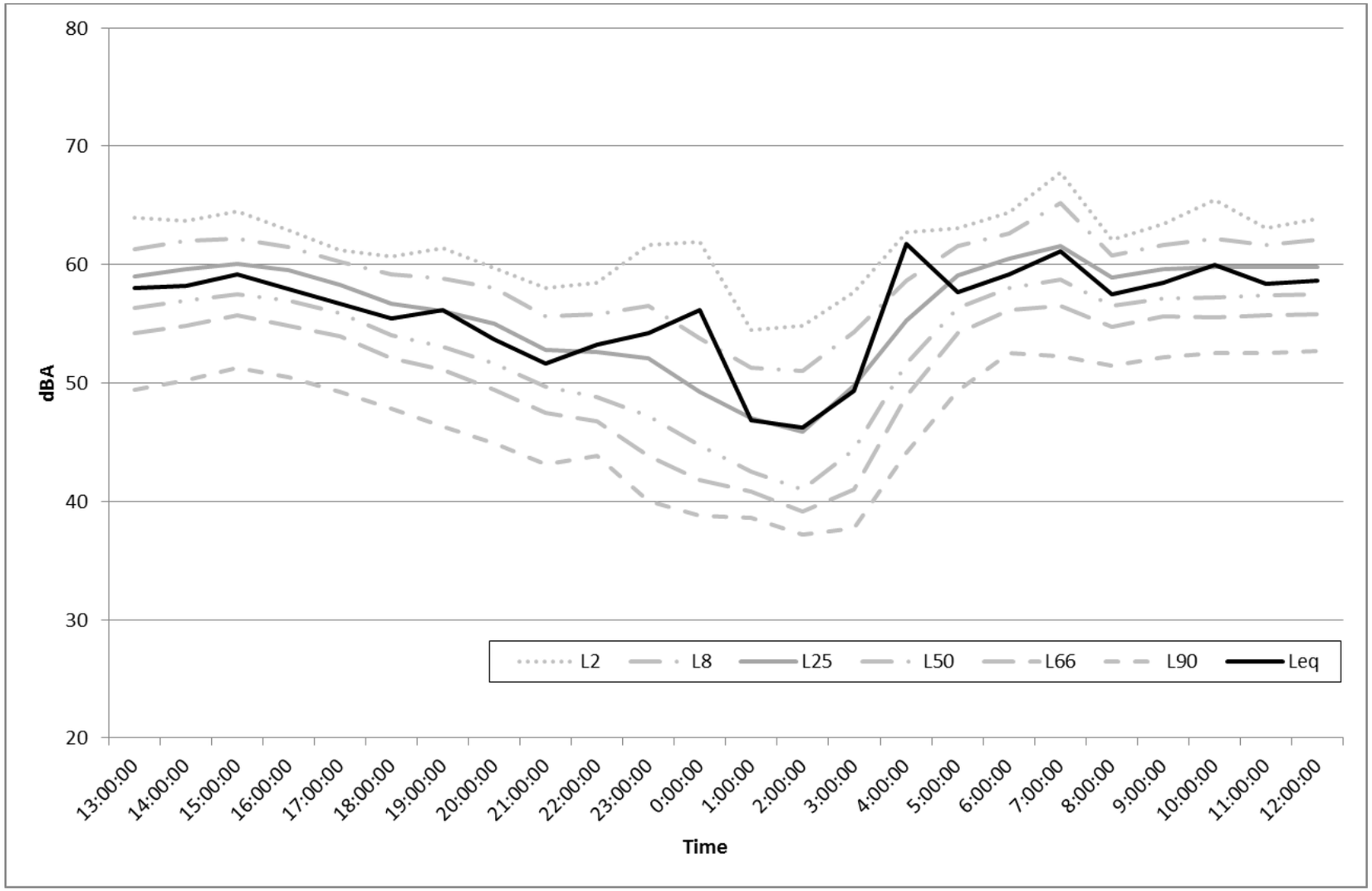
**MP-3**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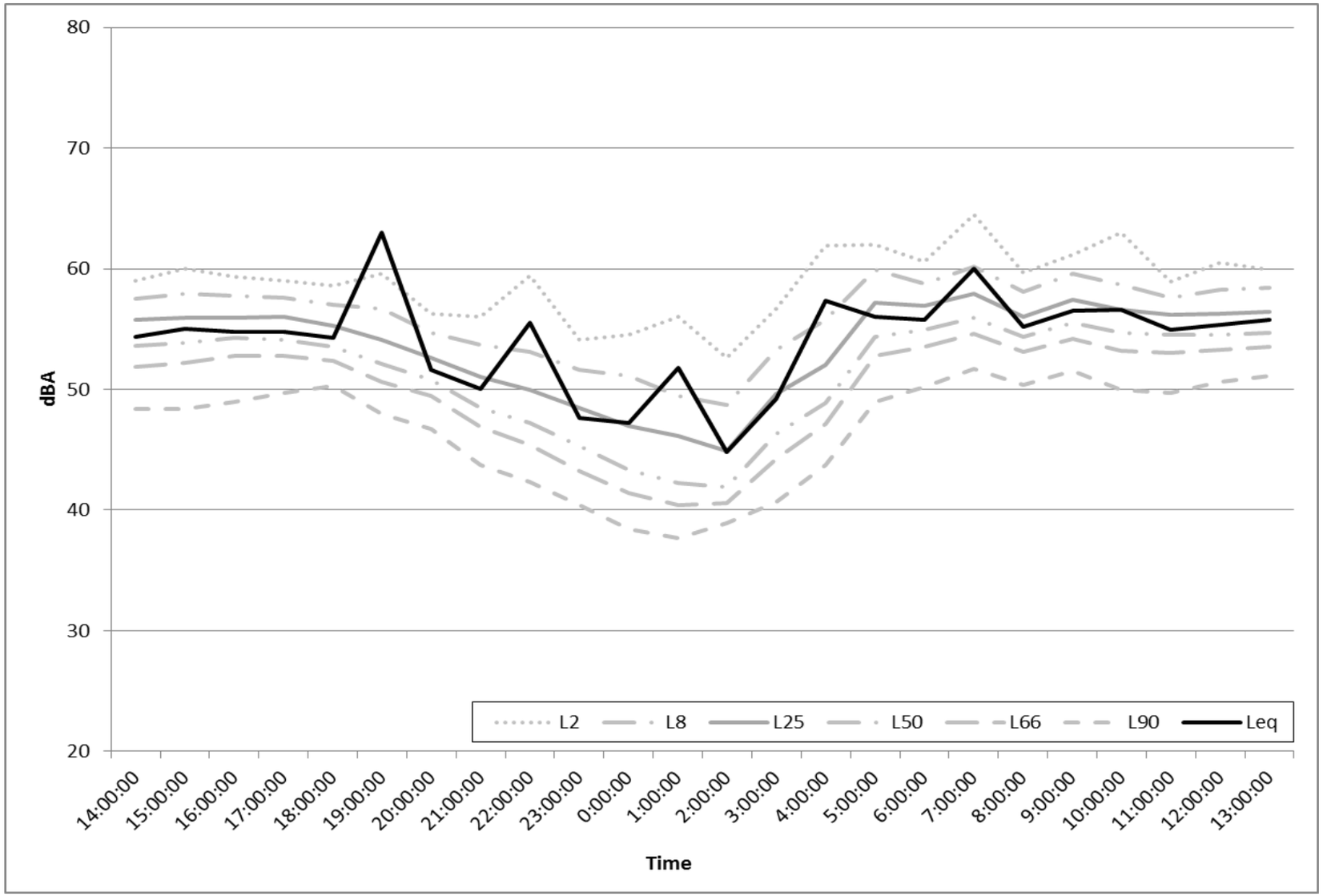
**MP-4**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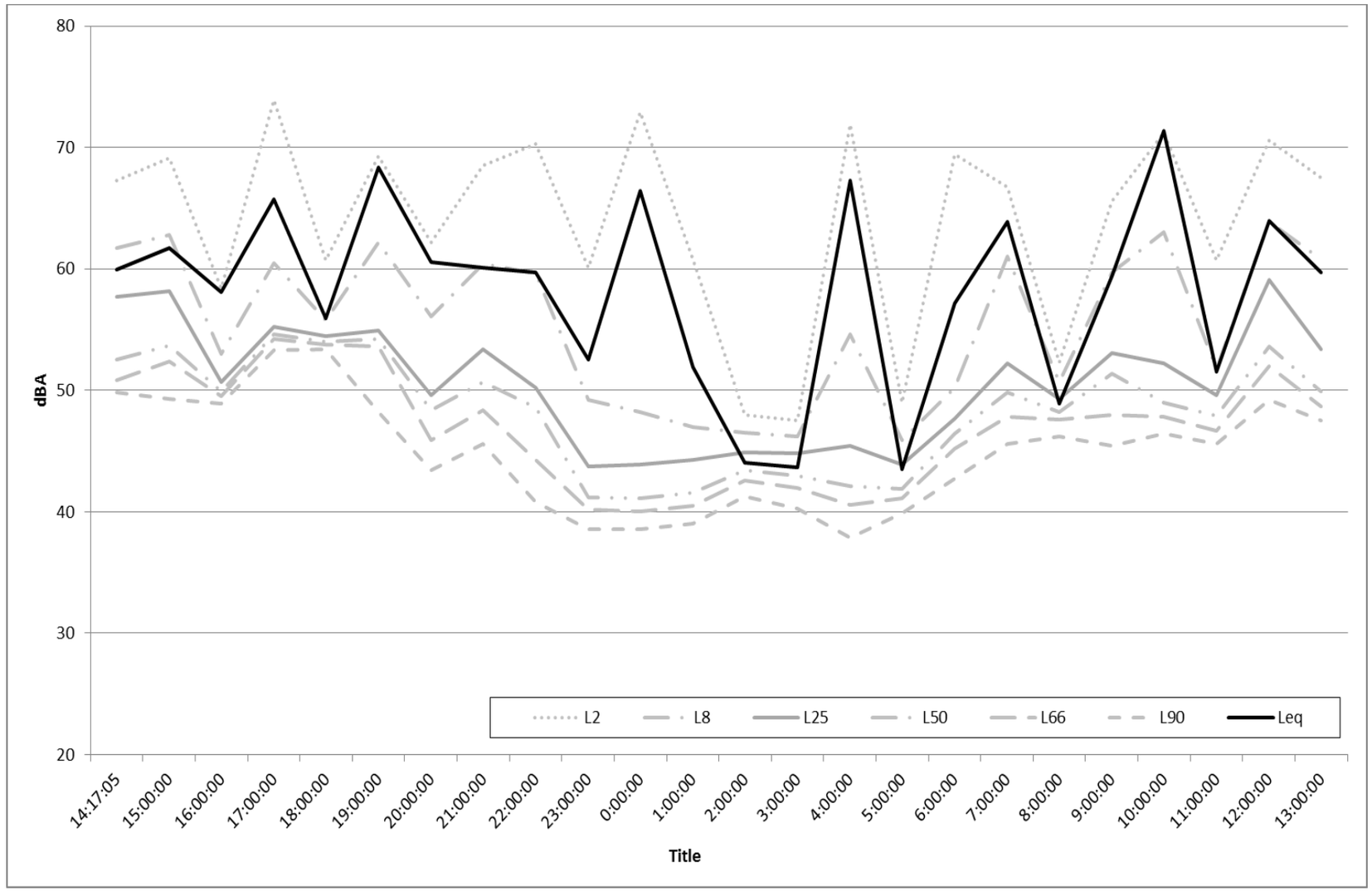
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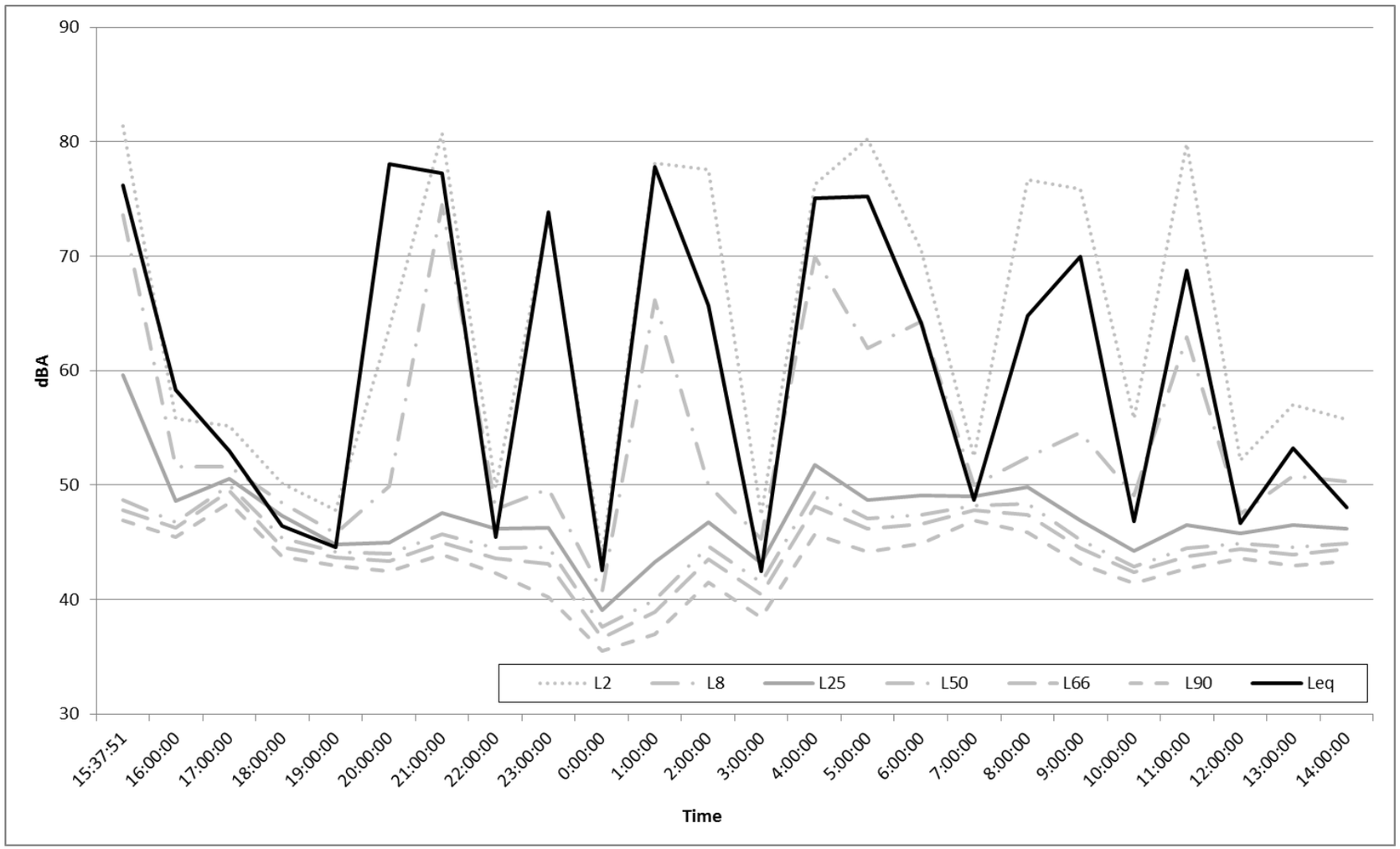
**MP-6**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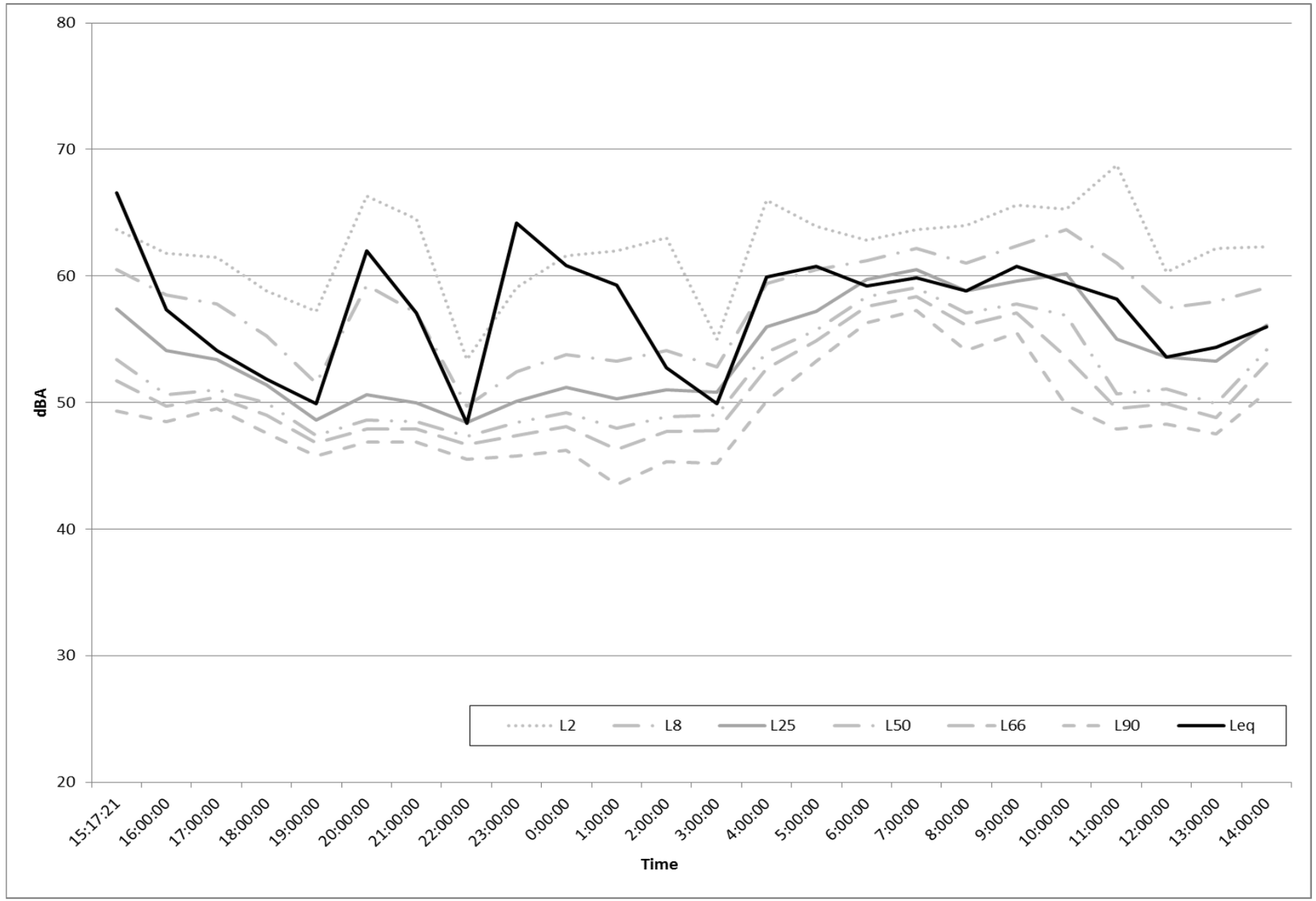
**MP-7**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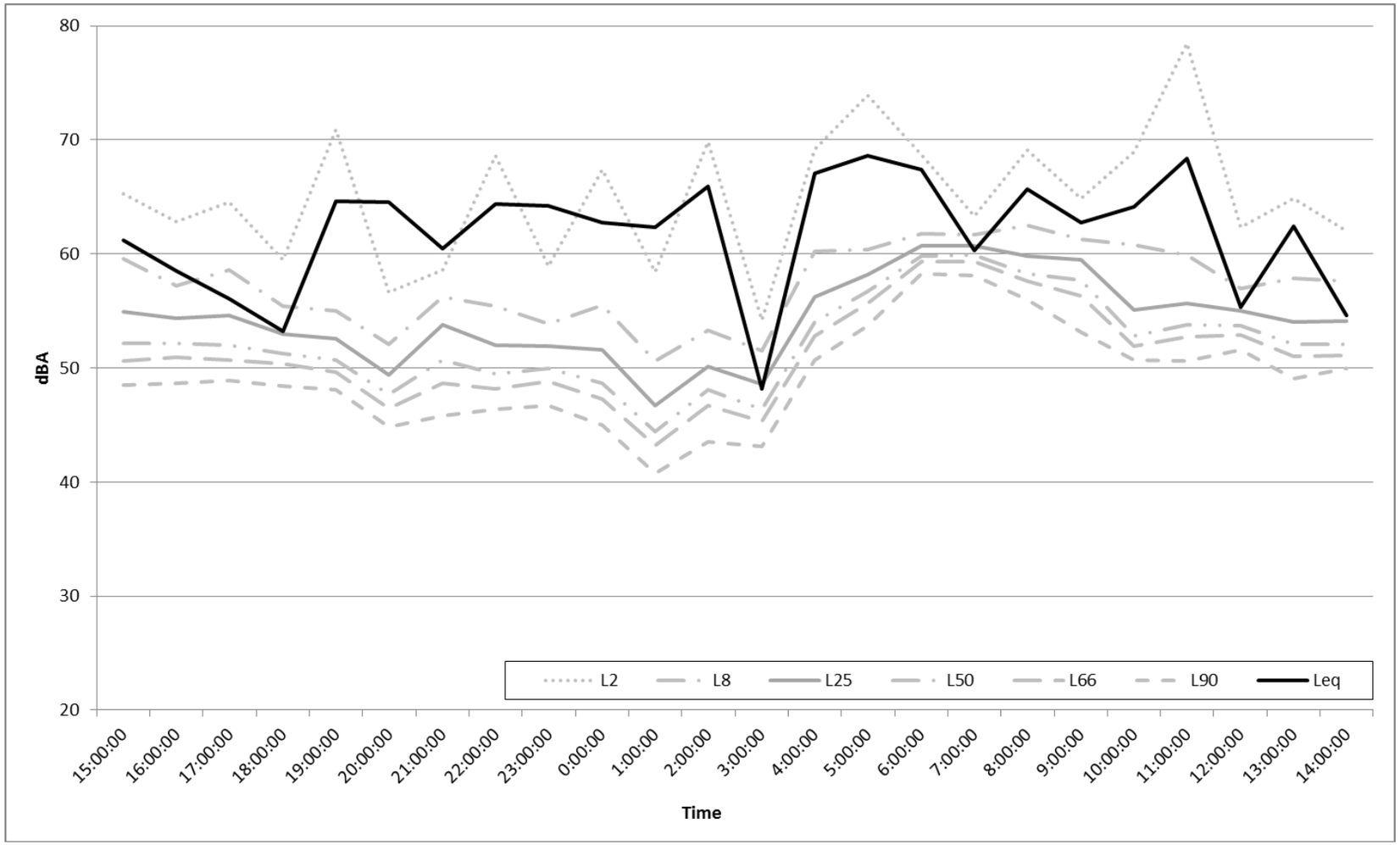
**MP-8**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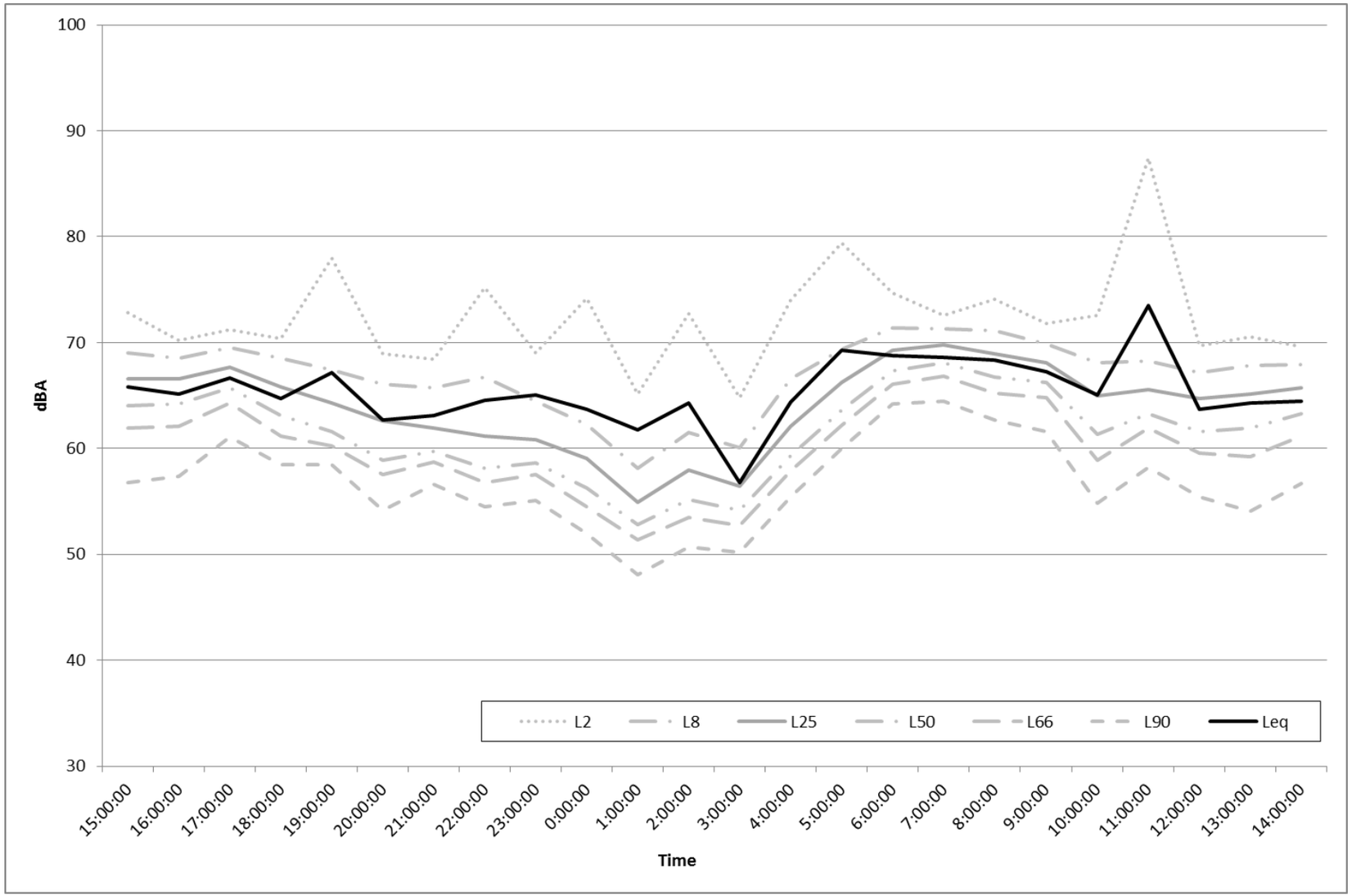
**MP-9**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**MP-10**

**MP-11**

## Part C: Noise Mitigation Analyzed but Dismissed

Two mitigation scenarios were analyzed that were dismissed from further consideration due to high costs. Specifically, sound barriers were evaluated throughout the project corridor and a combination of a county-wide quiet zone paired with some sound barriers was also analyzed. The following subsections provide details on these mitigation scenarios that were analyzed but dismissed.

### Sound Barriers at Rail Corridor Right of Way

Sound barriers were evaluated in several locations along the rail corridor to determine if they could effectively reduce sound levels at affected receptors. The acoustic model developed for the impact assessment was adjusted to account for these sound barriers. Sound levels were recalculated to identify barrier insertion loss, or project noise reduction, at the affected residences. The sound barriers modeled for this analysis included the following characteristics:

- 18 feet in height
- Multiple barriers with total length of approximately 15,724 feet

The modeling effort demonstrated that the installation of sound barriers could achieve a reduction of up to 14 dBA. Noise impacts under this mitigated condition were reduced to 24 moderate impacts and one severe impact of the fixed impact limits. Relative to the existing environment, or the relative impact limits, with barriers, the impact conditions would be reduced to 13 moderate impacts and one severe impact.

**FTA impact criteria** are based on a comparison of existing outdoor noise levels with future outdoor noise levels from a project. Impacts are identified via both absolute criteria and relative criteria:

*Absolute criteria*: noise impacts caused by the project alone.

*Relative criteria*: noise impacts caused by a change (increase) in the noise environment as a result of the proposed project.

Because sound barriers were found to effectively reduce noise levels at many of the affected receptors, a preliminary cost evaluation was conducted. The FTA estimated in the year 2006 that the cost per square foot for a sound barrier ranged from $25 to $35. That value is likely to be somewhat low compared to current construction trends. The Washington State Department of Transportation (WSDOT) has identified in its Traffic Noise Guidelines, a cost per square foot of $51.61 to construct a sound barrier. That cost was used in this analysis to achieve a realistic estimate. The sound barriers analyzed for this scenario would have a size of 283,031 square feet and an estimated cost of $14,607,244. These cost estimates do not include fees for design and inspection. The cost to provide mitigation per benefitted residence (of which there are 188) would be $78,114.

To put this value in context, WSDOT criteria for reasonableness of noise mitigation were considered. WSDOT considers sound barriers to mitigate roadway noise, similar to what was modeled in this scenario, and would consider it reasonable to provide mitigation if the cost

were $36,127 or less per benefitted residence (WSDOT 2011). Because the expense for these sound barriers would be much greater than this cost allowance, it is unlikely that sound barriers would be considered a reasonable expenditure using WSDOT guidelines for reasonable noise mitigation.

Because much of the project rail corridor is not owned or operated by Shell, it could be difficult, or impossible, for Shell to implement sound barriers along much of the corridor rights of way. In addition, in some areas sound barriers would not be compatible with existing land uses and would be likely to have impacts on scenic corridors in the Skagit Valley. Considering these factors, sound barriers are not recommended as mitigation for the proposed project.

### Implementation of FRA Quiet Zones

FRA train horn regulations require that railroad operators sound their horns at all public at-grade crossings. Train horns produce a relatively large noise footprint and, for the proposed project, would be the main cause of impacts along the rail alignment. To mitigate noise impacts, Quiet Zones can be established by which trains can pass through an at-grade crossing without sounding their horns.

The FRA Quiet Zone Calculator was used to evaluate the establishment of Quiet Zones at three at-grade crossings along the Anacortes Subdivision:

- Avon-Allen Road Crossing (Skagit County jurisdiction)
- Pulver Road (Skagit County jurisdiction)
- Garrett Street/SR 20 (City of Burlington jurisdiction)

These three locations were identified for primary consideration because they provide the most efficient amount of train horn noise mitigation. In other words, Quiet Zone treatment at these at-grade crossings would provide the most mitigation at the least amount of intersections.

To establish a Quiet Zone, FRA requires that supplemental safety measures (SSMs) be implemented to negate the need for train operators to use their horns. FRA has predetermined a number of SSMs that fully compensate for lack of a train horn. These SSMs include temporary closure of the at-grade crossing at a predetermined time each day, installation of a four-quadrant gate system, installation of a two-quadrant gate with medians or channelization devices, or creation of one-way streets with gates. Using the FRA Quiet Zone Calculator, it was determined that the “Mountable Medians with Reflective Traffic Channelization Devices” option to provide sufficient safety measures and institute a 24-hour Quiet Zone at each of the crossings would be the most cost-effective option at $13,000 per crossing.

Although the costs to implement a quiet zone may be a reasonable expenditure, Skagit County determined that for safety and reliability reasons quiet zones represent a risk that they are unwilling to take on at this time. Additionally, costs associated with routine maintenance are another reason why these Quiet Zones are not feasible.

### Implementation of FRA Quiet Zones and Sound Barriers

As noted above, a countywide Quiet Zone would effectively mitigate noise impacts to 35 moderate impacts at residences. As described in the previous section, these impacts are localized in two general locations in Burlington and Mount Vernon.

For these residences, seven sound barriers were evaluated to determine if, in combination with the countywide Quiet Zone, they could further mitigate noise impacts. Sound barriers were modeled at heights of 18 feet and varying lengths, depending on the location of each barrier, but in total have a length of 7,984 feet.

Noise impacts under this mitigated condition were reduced to one moderate impact of the fixed impact limits and no impacts compared with the relative noise impact scenario. Using the same cost estimation methods described earlier, these seven barriers would have a square footage of approximately 143,711 and would cost $7,416,909, not including design and inspection fees.

Three of the sound barriers, totaling 59,992 square feet in size, provide mitigation at only one or two residences. The cost of these barriers would total $3,096,204, or $774,051 per benefitted residence, a value that is over 20 times the amount WSDOT considers reasonable for noise mitigation. That means, in this scenario, these three barriers would be dropped from consideration and the number of moderate impacts would increase to five affected residences. Also, the cost to provide noise mitigation in the form of sound barriers would be reduced to $4,320,705, or $144,023 per benefitted residence (of which there are now 30), a value that is approximately four times the amount WSDOT considers reasonable for noise mitigation.

Because the cost of these sound barriers would be much greater than the WSDOT cost allowance, it is unlikely they would be considered a reasonable expenditure. Furthermore, these residences are already experiencing relatively high noise levels associated with railroad traffic. The benefit received solely from the countywide Quiet Zone, even at these moderately affected residential properties, would be between 4 and 7 dBA, which represents a noticeable reduction (i.e., over 3 dBA) in sound levels. Therefore, this mitigation scenario is not recommended as it would provide little improvement compared with the mitigation already achieved via the Quiet Zone.

## Part D: Laboratory Calibration Certificates

# Calibration Certificate

***Certificate Number 2015005712***

***Customer:***
**HDR Engineering Inc**
**Suites 1800 & 1900**
**1001 Southwest 5th Avenue**
**Portland, OR 97204, United States**

| | | | |
|---|---|---|---|
| ***Model Number*** | LxT SE | ***Procedure Number*** | D0001.8378 |
| ***Serial Number*** | 0004202 | ***Technician*** | Ron Harris |
| ***Test Results*** | **Pass** | ***Calibration Date*** | 15 Jun 2015 |
| ***Initial Condition*** | As Manufactured | ***Calibration Due*** | |
| ***Description*** | Sound Expert LxT | ***Temperature*** | 23.28 °C ± 0.01 °C |
| | | ***Humidity*** | 51.1 %RH ± 0.5 %RH |
| | | ***Static Pressure*** | 86.06 kPa ± 0.03 kPa |

***Evaluation Method*** Tested electrically using PRMLxT1L S/N 029354 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 23.6 mV/Pa.

***Compliance Standards*** Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

| | |
|---|---|
| IEC 60651:2001 Type 1 | ANSI S1.4-2014 Class 1 |
| IEC 60804:2000 Type 1 | ANSI S1.4 (R2006) Type 1 |
| IEC 61252:2002 | ANSI S1.11 (R2009) Class 1 |
| IEC 61260:2001 Class 1 | ANSI S1.25 (R2007) |
| IEC 61672:2013 Class 1 | ANSI S1.43 (R2007) Type 1 |

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the SI through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2005.
**Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.**

The quality system is registered to ISO 9001:2008.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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**Standards Used**

| Description | Cal Date | Cal Due | Cal Standard |
|---|---|---|---|
| Hart Scientific 2626-H Temperature Probe | 07/05/2014 | 07/05/2015 | 006767 |
| SRS DS360 Ultra Low Distortion Generator | 11/13/2014 | 11/13/2015 | 007167 |

Larson Davis, a division of PCB Piezotronics, Inc
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

LARSON DAVIS
A PCB PIEZOTRONICS DIV.

5/15/2015 2:45:27PM

Page 1 of 7

# Calibration Certificate

***Certificate Number 2015005714***

***Customer:***
**HDR Engineering Inc**
**Suites 1800 & 1900**
**1001 Southwest 5th Avenue**
**Portland, OR 97204, United States**

| | | | | | |
|---|---|---|---|---|---|
| ***Model Number*** | LxT SE | | ***Procedure Number*** | D0001.8384 | |
| ***Serial Number*** | 0004202 | | ***Technician*** | Ron Harris | |
| ***Test Results*** | **Pass** | | ***Calibration Date*** | 15 Jun 2015 | |
| ***Initial Condition*** | As Manufactured | | ***Calibration Due*** | | |
| ***Description*** | Sound Expert LxT | | ***Temperature*** | 23.13 °C | ± 0.01 °C |
| | | | ***Humidity*** | 48.4 %RH | ± 0.5 %RH |
| | | | ***Static Pressure*** | 86.05 kPa | ± 0.03 kPa |

***Evaluation Method*** ***Tested with:*** ***Data reported in dB re 20 µPa.***
PRMLxT1L, S/N 029354
377B20, S/N 150268

***Compliance Standards*** Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

| | |
|---|---|
| IEC 60651:2001 Type 1 | ANSI S1.4-2014 Class 1 |
| IEC 60804:2000 Type 1 | ANSI S1.4 (R2006) Type 1 |
| IEC 61252:2002 | ANSI S1.11 (R2009) Class 1 |
| IEC 61260:2001 Class 1 | ANSI S1.25 (R2007) |
| IEC 61672:2013 Class 1 | ANSI S1.43 (R2007) Type 1 |

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the SI through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2005.
**Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.**

The quality system is registered to ISO 9001:2008.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

**Standards Used**

| Description | Cal Date | Cal Due | Cal Standard |
|---|---|---|---|
| SRS DS360 Ultra Low Distortion Generator | 07/08/2014 | 07/08/2015 | 006311 |
| Hart Scientific 2626-H Temperature Probe | 07/05/2014 | 07/05/2015 | 006767 |
| Larson Davis CAL200 Acoustic Calibrator | 08/06/2014 | 08/06/2015 | 007027 |
| Larson Davis Model 831 | 03/05/2015 | 03/05/2016 | 007182 |
| 1/2 inch Microphone - P - 0V | 03/11/2015 | 03/11/2016 | 007185 |
| Larson Davis CAL291 Residual Intensity Calibrator | 09/26/2014 | 09/26/2015 | 007287 |

Larson Davis, a division of PCB Piezotronics, Inc
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

ACCREDITED Cert #3027.01

LARSON DAVIS
A PCB PIEZOTRONICS DIV.

6/15/2015 2:48:28PM

Page 1 of 2

# Calibration Certificate

***Certificate Number 2015005714***

***Customer:***
**HDR Engineering Inc**
**Suites 1800 & 1900**
**1001 Southwest 5th Avenue**
**Portland, OR 97204, United States**

| | | | | | |
|---|---|---|---|---|---|
| ***Model Number*** | LxT SE | ***Procedure Number*** | D0001.8384 | | |
| ***Serial Number*** | 0004202 | ***Technician*** | Ron Harris | | |
| ***Test Results*** | **Pass** | ***Calibration Date*** | 15 Jun 2015 | | |
| ***Initial Condition*** | As Manufactured | ***Calibration Due*** | | | |
| ***Description*** | Sound Expert LxT | ***Temperature*** | 23.13 | °C | ± 0.01 °C |
| | | ***Humidity*** | 49.4 | %RH | ± 0.5 %RH |
| | | ***Static Pressure*** | 86.05 | kPa | ± 0.03 kPa |

***Evaluation Method*** ***Tested with:*** ***Data reported in dB re 20 µPa.***
PRMLxT1L, S/N 029354
377B20, S/N 150268

***Compliance Standards*** Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

| | |
|---|---|
| IEC 60651:2001 Type 1 | ANSI S1.4-2014 Class 1 |
| IEC 60804:2000 Type 1 | ANSI S1.4 (R2006) Type 1 |
| IEC 61252:2002 | ANSI S1.11 (R2009) Class 1 |
| IEC 61260:2001 Class 1 | ANSI S1.25 (R2007) |
| IEC 61672:2013 Class 1 | ANSI S1.43 (R2007) Type 1 |

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the SI through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2005.
**Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.**

The quality system is registered to ISO 9001:2008.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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**Standards Used**

| Description | Cal Date | Cal Due | Cal Standard |
|---|---|---|---|
| SRS DS360 Ultra Low Distortion Generator | 07/08/2014 | 07/08/2015 | 006311 |
| Hart Scientific 2626-H Temperature Probe | 07/05/2014 | 07/05/2015 | 006767 |
| Larson Davis CAL200 Acoustic Calibrator | 08/06/2014 | 08/06/2015 | 007027 |
| Larson Davis Model 831 | 03/05/2015 | 03/05/2016 | 007182 |
| 1/2 inch Microphone - P - 0V | 03/11/2015 | 03/11/2016 | 007185 |
| Larson Davis CAL291 Residual Intensity Calibrator | 09/26/2014 | 09/26/2015 | 007287 |

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1681 West 820 North
Provo, UT 84601, United States
716-684-0001

ACCREDITED Cert #2927.01

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6/15/2015 2:48:28PM

Page 1 of 2

# Calibration Certificate

***Certificate Number 2015005600***

***Customer:***
**HDR Engineering Inc**
**Suites 1800 & 1900**
**1001 Southwest 5th Avenue**
**Portland, OR 97204, United States**

| | | | | | |
|---|---|---|---|---|---|
| ***Model Number*** | PRMLxT1L | ***Procedure Number*** | D0001.8383 | | |
| ***Serial Number*** | 029354 | ***Technician*** | Whitney Anderson | | |
| ***Test Results*** | **Pass** | ***Calibration Date*** | 11 Jun 2015 | | |
| | | ***Calibration Due*** | | | |
| ***Initial Condition*** | As Manufactured | ***Temperature*** | 23.46 | °C | ± 0.01 °C |
| ***Description*** | Larson Davis 1/2" Preamplifier for LxT Class 1 -1 dB | ***Humidity*** | 49 | %RH | ± 0.5 %RH |
| | | ***Static Pressure*** | 86.01 | kPa | ± 0.03 kPa |

***Evaluation Method*** Tested electrically using a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

***Compliance Standards*** Compliant to Manufacturer Specifications

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the SI through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2005. **Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.**

The quality system is registered to ISO 9001:2008.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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**Standards Used**

| Description | Cal Date | Cal Due | Cal Standard |
|---|---|---|---|
| Sound Level Meter / Real Time Analyzer | 11/05/2014 | 11/05/2015 | 001150 |
| Hart Scientific 2626-H Temperature Probe | 07/05/2014 | 07/05/2015 | 006767 |
| Agilent 34401A DMM | 08/28/2014 | 08/28/2015 | 007165 |
| SRS DS360 Ultra Low Distortion Generator | 11/13/2014 | 11/13/2015 | 007167 |

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Page 1 of 5

# Calibration Certificate

***Certificate Number 2015005710***

***Customer:***
**HDR Engineering Inc**
**Suites 1800 & 1900**
**1001 Southwest 5th Avenue**
**Portland, OR 97204, United States**

| | | | | | |
|---|---|---|---|---|---|
| ***Model Number*** | 377B20 | | ***Procedure Number*** | D0001.8387 | |
| ***Serial Number*** | 150268 | | ***Technician*** | Scott Montgomery | |
| ***Test Results*** | **Pass** | | ***Calibration Date*** | 15 Jun 2015 | |
| ***Initial Condition*** | As Manufactured | | ***Calibration Due*** | | |
| ***Description*** | 1/2 inch Microphone - RI - 0V | | ***Temperature*** | 24.1 °C | ± 0.01 °C |
| | | | ***Humidity*** | 41.0 %RH | ± 0.5 %RH |
| | | | ***Static Pressure*** | 101.56 kPa | ± 0.03 kPa |

***Evaluation Method*** Tested electrically using an electrostatic actuator.

***Compliance Standards*** Compliant to Manufacturer Specifications.

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the SI through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2005.
**Test points marked with a ‡ do not fall within this laboratory's scope of accreditation.**

The quality system is registered to ISO 9001:2008.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.



**Standards Used**

| Description | Cal Date | Cal Due | Cal Standard |
|---|---|---|---|
| Sound Level Meter / Real Time Analyzer | 07/21/2014 | 07/21/2015 | 001230 |
| Microphone Calibration System | 09/03/2014 | 09/03/2015 | 001233 |
| 1/2" Preamplifier | 12/11/2014 | 12/11/2015 | 001274 |
| Agilent 34401A DMM | 12/04/2014 | 12/04/2015 | 001329 |
| Larson Davis CAL250 Acoustic Calibrator | 01/05/2015 | 01/05/2016 | 003030 |
| 1/2" Preamplifier | 12/11/2014 | 12/11/2015 | 006506 |
| Larson Davis 1/2" Preamplifier 7-pin LEMO | 09/11/2014 | 09/11/2015 | 006507 |
| 1/2 inch Microphone - RI - 200V | 07/25/2014 | 07/25/2015 | 006511 |
| 1/2 inch Microphone - RI - 200V | 08/12/2014 | 08/12/2015 | 006519 |
| Larson Davis 1/2" Preamplifier 7-pin LEMO | 09/11/2014 | 09/11/2015 | 006530 |
| Larson Davis 1/2" Preamplifier 7-pin LEMO | 08/14/2014 | 08/14/2015 | 006531 |

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Provo, UT 84601, United States
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6/15/2015 1:51:49PM

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# *Certificate of Calibration and Conformance*

This document certifies that the instrument referenced below meets published specifications per Procedure PRD-P263; ANSI S1.4-1983 (R 2006) Type 1; S1.4A-1985; S1.43-1997 Type 1; S1.11-2004 Octave Band Class 0; S1.25-1991; IEC 61672-2002 Class 1; 60651-2001 Type 1; 60804-2000 Type 1; 61260-2001 Class 0; 61252-2002.

| | | | | |
|---|---|---|---|---|
| Manufacturer: | Larson Davis | Temperature: | 72.6 | °F |
| Model Number: | LxT1-SE | | 22.6 | °C |
| Serial Number: | 3784 | Rel. Humidity: | 19 | % |
| Customer: | TMS Rental | Pressure: | 994.4 | mbars |
| Description: | Sound Level Meter | | 994.4 | hPa |

Note: As Found / As Left: In Tolerance

Upon receipt for testing, this instrument was found to be:

Within the Stated tolerance of the manufacturer's specification

Calibration Date: 23-Apr-15 Calibration Due:

**Calibration Standards Used:**

| Manufacturer | Model | Serial Number | Cal Due | Traceability No. |
|---|---|---|---|---|
| Larson Davis | LDSigGen/2239 | 0760/0109 | 4/7/2016 | 2014-193220 |

This Certificate attests that this instrument has been calibrated under the stated conditions with Measurement and Test Equipment (M&TE) Standards traceable to the National Institute of Standards and Technology (NIST). All of the Measurement Standards have been calibrated to their manufacturers' specified accuracy / uncertainty. Evidence of traceability and accuracy is on file at The Modal Shop and/or Larson Davis Corporate Headquarters. An acceptable accuracy ratio between the Standard(s) and the item calibrated has been maintained. This instrument meets or exceeds the manufacturer's published specification unless noted.

This calibration complies with ISO 17025 and ANSI Z540. The collective uncertainty of the Measurement Standard used does not exceed 25% of the applicable tolerance for each characteristic calibrated unless otherwise noted.

The results documented in this certificate relate only to the item(s) calibrated or tested. Calibration interval assignment and adjustment are the responsibility of the end user. This certificate may not be reproduced, except in full, without the written approval of The Modal Shop.

Technician: Wayne Underwood Signature:

THE MODAL SHOP INC
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The Modal Shop, Inc.
3149 East Kemper Road
Cincinnati, OH 45241
Phone: (513) 351-9919
(800) 860-4867
www.modalshop.com

PRD-F242 revNR December 2, 2008 Page 1 of 1

## *Certificate of Calibration and Conformance*

This document certifies that the instrument referenced below meets published specifications per Procedure PRD-P263; ANSI S1.4-1983 (R 2006) Type 1; S1.4A-1985; S1.43-1997 Type 1; S1.11-2004 Octave Band Class 0; S1.25-1991; IEC 61672-2002 Class 1; 60651-2001 Type 1; 60804-2000 Type 1; 61260-2001 Class 0; 61252-2002.

| | | | | |
|---|---|---|---|---|
| Manufacturer: | Larson Davis | Temperature: | 75.2 | °F |
| Model Number: | LxT | | 24.0 | °C |
| Serial Number: | 3783 | Rel. Humidity: | 24 | % |
| Customer: | TMS Rental | Pressure: | 993 | mbars |
| Description: | Sound Level Meter | | 993 | hPa |

Note: As Found / As Left: In Tolerance

Upon receipt for testing, this instrument was found to be:

Within the Stated tolerance of the manufacturer's specification

Calibration Date: 9-Apr-15 Calibration Due:

**Calibration Standards Used:**

| Manufacturer | Model | Serial Number | Cal Due | Traceability No. |
|---|---|---|---|---|
| Larson Davis | LDSigGen/2239 | 0760/0109 | 4/7/2016 | 2014-193220 |

This Certificate attests that this instrument has been calibrated under the stated conditions with Measurement and Test Equipment (M&TE) Standards traceable to the National Institute of Standards and Technology (NIST). All of the Measurement Standards have been calibrated to their manufacturers' specified accuracy / uncertainty. Evidence of traceability and accuracy is on file at The Modal Shop and/or Larson Davis Corporate Headquarters. An acceptable accuracy ratio between the Standard(s) and the item calibrated has been maintained. This instrument meets or exceeds the manufacturer's published specification unless noted.

This calibration complies with ISO 17025 and ANSI Z540. The collective uncertainty of the Measurement Standard used does not exceed 25% of the applicable tolerance for each characteristic calibrated unless otherwise noted.

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PRD-F242 revNR December 2, 2008 Page 1 of 1

## *Certificate of Calibration and Conformance*

This document certifies that the instrument referenced below meets published specifications per Procedure PRD-P263; ANSI S1.4-1983 (R 2006) Type 1; S1.4A-1985; S1.43-1997 Type 1; S1.11-2004 Octave Band Class 0; S1.25-1991; IEC 61672-2002 Class 1; 60651-2001 Type 1; 60804-2000 Type 1; 61260-2001 Class 0; 61252-2002.

| | | | | |
|---|---|---|---|---|
| Manufacturer: | Larson Davis | Temperature: | 71.2 | °F |
| Model Number: | LxT1-SE | | 21.8 | °C |
| Serial Number: | 3742 | Rel. Humidity: | 28.4 | % |
| Customer: | TMS Rental | Pressure: | 992.3 | mbars |
| Description: | Sound Level Meter | | 992.3 | hPa |

Note: As Found / As Left: In Tolerance

Upon receipt for testing, this instrument was found to be:

Within the Stated tolerance of the manufacturer's specification

Calibration Date: 27-Apr-15 Calibration Due:

**Calibration Standards Used:**

| Manufacturer | Model | Serial Number | Cal Due | Traceability No. |
|---|---|---|---|---|
| Larson Davis | LDSigGen/2239 | 0760/0109 | 4/7/2016 | 2014-193220 |

This Certificate attests that this instrument has been calibrated under the stated conditions with Measurement and Test Equipment (M&TE) Standards traceable to the National Institute of Standards and Technology (NIST). All of the Measurement Standards have been calibrated to their manufacturers' specified accuracy / uncertainty. Evidence of traceability and accuracy is on file at The Modal Shop and/or Larson Davis Corporate Headquarters. An acceptable accuracy ratio between the Standard(s) and the item calibrated has been maintained. This instrument meets or exceeds the manufacturer's published specification unless noted.

This calibration complies with ISO 17025 and ANSI Z540. The collective uncertainty of the Measurement Standard used does not exceed 25% of the applicable tolerance for each characteristic calibrated unless otherwise noted.

The results documented in this certificate relate only to the item(s) calibrated or tested. Calibration interval assignment and adjustment are the responsibility of the end user. This certificate may not be reproduced, except in full, without the written approval of The Modal Shop.

Technician: Wayne Underwood Signature:

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PRD-F242 revNR December 2, 2008 Page 1 of 1

# Calibration Certificate

***Certificate Number 2015008651***

***Customer:***
**The Modal Shop**
**3149 East Kemper Road**
**Cincinnati, OH 45241, United States**

| | | | | | |
|---|---|---|---|---|---|
| ***Model Number*** | LxT SE | ***Procedure Number*** | D0001.8384 | | |
| ***Serial Number*** | 0004526 | ***Technician*** | Ron Harris | | |
| ***Test Results*** | **Pass** | ***Calibration Date*** | 8 Sep 2015 | | |
| ***Initial Condition*** | As Manufactured | ***Calibration Due*** | | | |
| ***Description*** | Sound Expert LxT | ***Temperature*** | 22.91 | °C | ± 0.01 °C |
| | | ***Humidity*** | 51.5 | %RH | ± 0.5 %RH |
| | | ***Static Pressure*** | 86.79 | kPa | ± 0.03 kPa |

***Evaluation Method*** ***Tested with:*** ***Data reported in dB re 20 µPa.***
PRMLxT1L. S/N 036012
377B02. S/N 151256

***Compliance Standards*** Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

| | |
|---|---|
| IEC 60651:2001 Type 1 | ANSI S1.4-2014 Class 1 |
| IEC 60804:2000 Type 1 | ANSI S1.4 (R2006) Type 1 |
| IEC 61252:2002 | ANSI S1.11 (R2009) Class 1 |
| IEC 61260:2001 Class 1 | ANSI S1.25 (R2007) |

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the SI through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2005.
**Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.**

The quality system is registered to ISO 9001:2008.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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**Standards Used**

| Description | Cal Date | Cal Due | Cal Standard |
|---|---|---|---|
| SRS DS360 Ultra Low Distortion Generator | 06/24/2015 | 06/24/2016 | 006311 |
| Hart Scientific 2626-H Temperature Probe | 06/17/2015 | 06/17/2016 | 006798 |
| Larson Davis CAL200 Acoustic Calibrator | 08/12/2015 | 08/12/2016 | 007027 |
| Larson Davis Model 831 | 03/05/2015 | 03/05/2016 | 007182 |
| 1/2 inch Microphone - P - 0V | 03/11/2015 | 03/11/2016 | 007185 |
| Larson Davis CAL291 Residual Intensity Calibrator | 09/26/2014 | 09/26/2015 | 007287 |

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9/8/2015 11:09:52AM



***Certificate Number 2015008651***

## Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

| Measurement | Test Result [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|---|---|---|---|---|---|
| 1000 Hz | 114.00 | 113.80 | 114.20 | 0.14 | Pass |

## Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using S-time-weighted sound level

| Frequency [Hz] | Test Result [dB] | Expected [dB] | Lower Limit [dB] | Upper Limit [dB] | Expanded Uncertainty [dB] | Result |
|---|---|---|---|---|---|---|
| 125 | -0.21 | -0.20 | -1.20 | 0.80 | 0.21 | Pass |
| 1000 | 0.10 | 0.00 | -0.70 | 0.70 | 0.21 | Pass |
| 8000 | -2.60 | -3.00 | -5.50 | -1.50 | 0.21 | Pass |

**-- End of measurement results--**

## Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

| Measurement | Test Result [dB] |
|---|---|
| Low Range, 20 dB gain | 64.00 |

**-- End of measurement results--**

**-- End of Report--**

Signatory: *Ron Harris*

Larson Davis, a division of PCB Piezotronics, Inc
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

ACCREDITED Cert. #3822.01

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9/8/2015 11:09:52AM

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3149 East Kemper Rd.
Cincinnati, OH 45241
Ph: 513-351-9919
Fax: 513-458-2172
www.modalshop.com

# ~Certificate of Calibration~

**Manufacturer:** PCB
**Model Number:** 377B02
**Serial Number:** LW135962
**Asset ID:** 48989
**Description:** Free-Field Microphone

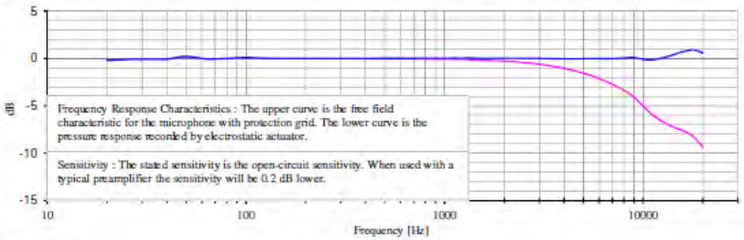
**Customer:** TMS Rental
**Address:**

**Calibration Date:** Mar 30, 2015 13:48:50
**Due Date:**

| Sensitivity: | 250 Hz | 1 kHz | |
|---|---|---|---|
| | -25.92 | -25.99 | dB re. 1V/Pa |
| | 50.59 | 50.17 | mV/Pa |

| | | |
|---|---|---|
| **Temperature:** | 73 (23) | °F (°C) |
| **Humidity:** | 23 | % |
| **Ambient Pressure:** | 997.4 | mbar |
| **Polarization Voltage:** | 0 | VDC |

**Cal Results:** In Tolerance




**Traceability:** The calibration is traceable through 683/281764-12.
**Notes:**
Calibration results relate only to the items calibrated.
This certificate may not be reproduced, except in full, without written permission.
This calibration is performed in compliance with ISO 9001, ISO 17025 and ANSI Z540.
Measurement uncertainty (250 Hz sensitivity calibration) at 95% confidence level: 0.30 dB.
Calibrated per procedure PRD-P204.

**User Note:** As Found: In Tolerance As Left: In Tolerance

**Frequency Response with reference to level at 250 Hz**

| Frequency (Hz) | Upper (dB) | Frequency (Hz) | Upper (dB) | Frequency (Hz) | Upper (dB) | Frequency (Hz) | Upper (dB) |
|---|---|---|---|---|---|---|---|
| 20 | -0.19 | 630 | 0.01 | 4500 | -0.03 | | |
| 25 | -0.09 | 800 | 0.05 | 5000 | -0.02 | | |
| 31.5 | -0.07 | 1000 | 0.05 | 5600 | 0.01 | | |
| 40 | -0.06 | 1120 | 0.05 | 6300 | -0.02 | | |
| 50 | 0.21 | 1250 | 0.05 | 7100 | 0.00 | | |
| 63 | -0.04 | 1400 | 0.05 | 8000 | 0.06 | | |
| 80 | 0.00 | 1600 | 0.04 | 9000 | 0.10 | | |
| 100 | 0.10 | 1800 | 0.03 | 10000 | -0.08 | | |
| 125 | 0.02 | 2000 | 0.04 | 11200 | -0.13 | | |
| 160 | 0.00 | 2240 | 0.03 | 12500 | 0.06 | | |
| 200 | 0.01 | 2500 | 0.03 | 14000 | 0.36 | | |
| 250 | 0.00 | 2800 | 0.03 | 16000 | 0.75 | | |
| 315 | 0.01 | 3150 | 0.01 | 18000 | 0.91 | | |
| 400 | 0.00 | 3550 | -0.01 | 20000 | 0.57 | | |
| 500 | 0.03 | 4000 | -0.03 | | | | |

**Technician:** Michael Malec
**Approval:** _____

**Reference Equipment Used:**

| *Manuf.* | *Model* | *Serial* | *Cal. Date* | *Due Date* |
|---|---|---|---|---|
| GRAS | 40AG | 77606 | 9/15/2014 | 9/15/2015 |

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Page 1 of 1

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# ~Certificate of Calibration~

3149 East Kemper Rd.
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Fax: 513-458-2172
www.modalshop.com

**Manufacturer:** PCB
**Model Number:** 377B02
**Serial Number:** LW138583
**Asset ID:** 49336
**Description:** Free-Field Microphone

**Customer:** TMS Rental
**Address:**

**Calibration Date:** Jun 10, 2015 10:06:16
**Due Date:**

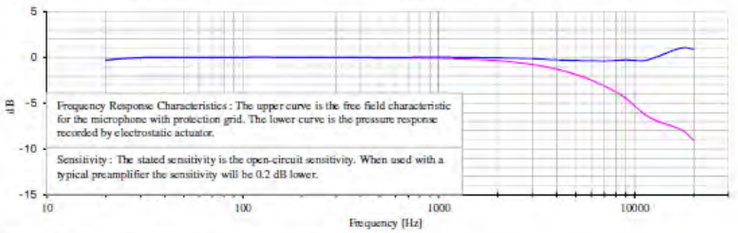
**Sensitivity:**

| 250 Hz | 1 kHz | |
|---|---|---|
| -25.71 | -25.80 | dB re. 1V/Pa |
| 51.80 | 51.28 | mV/Pa |

**Temperature:** 72 (22) °F (°C)
**Humidity:** 46 %
**Ambient Pressure:** 990.4 mbar

**Cal. Results:** In Tolerance

**Polarization Voltage:** 0 VDC




**Traceability:** The calibration is traceable through 683/281764-12.
**Notes:**
Calibration results relate only to the items calibrated.
This certificate may not be reproduced, except in full, without written permission.
This calibration is performed in compliance with ISO 9001, ISO 17025 and ANSI Z540.
Measurement uncertainty (250 Hz sensitivity calibration) at 95% confidence level: 0.30 dB.
Calibrated per procedure PRD-P204.

**User Note:** As Found/As Left In Tolerance

**Frequency Response with reference to level at 250 Hz**

| Frequency (Hz) | Upper (dB) | Frequency (Hz) | Upper (dB) | Frequency (Hz) | Upper (dB) | Frequency (Hz) | Upper (dB) |
|---|---|---|---|---|---|---|---|
| 20 | -0.30 | 630 | 0.00 | 4500 | -0.31 | | |
| 25 | -0.11 | 800 | 0.03 | 5000 | -0.34 | | |
| 31.5 | -0.01 | 1000 | 0.03 | 5600 | -0.36 | | |
| 40 | 0.02 | 1120 | 0.02 | 6300 | -0.38 | | |
| 50 | 0.00 | 1250 | 0.01 | 7100 | -0.39 | | |
| 63 | 0.02 | 1400 | 0.01 | 8000 | -0.34 | | |
| 80 | 0.01 | 1600 | -0.02 | 9000 | -0.28 | | |
| 100 | 0.01 | 1800 | -0.03 | 10000 | -0.33 | | |
| 125 | 0.03 | 2000 | -0.04 | 11200 | -0.34 | | |
| 160 | 0.01 | 2240 | -0.08 | 12500 | -0.06 | | |
| 200 | 0.01 | 2500 | -0.09 | 14000 | 0.34 | | |
| 250 | 0.00 | 2800 | -0.12 | 16000 | 0.83 | | |
| 315 | 0.00 | 3150 | -0.16 | 18000 | 1.07 | | |
| 400 | 0.00 | 3550 | -0.21 | 20000 | 0.89 | | |
| 500 | 0.02 | 4000 | -0.27 | | | | |

**Technician:** Wayne Underwood

**Approval:**

**Reference Equipment Used:**

| *Manuf.* | *Model* | *Serial* | *Cal. Date* | *Due Date* |
|---|---|---|---|---|
| GRAS | 40AG | 9542 | 9/15/2014 | 9/15/2015 |

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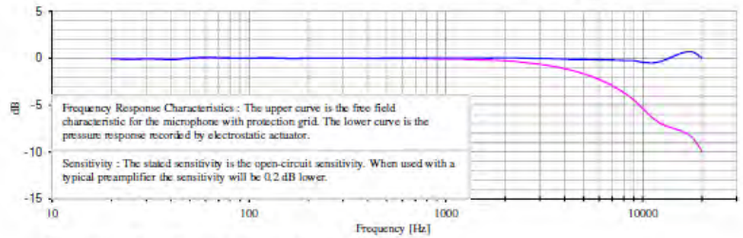
THE MODAL SHOP INC
A PCB GROUP CO.
3149 East Kemper Rd.
Cincinnati, OH 45241
Ph : 513-351-9919
Fax: 513-458-2172
www.modalshop.com

# ~Certificate of Calibration~

| | | | |
|---|---|---|---|
| **Manufacturer:** | PCB | **Asset ID:** | 51415 |
| **Model Number:** | 377B02 | **Customer:** | TMS Rental |
| **Serial Number:** | 141521 | **Calibration Date:** | Feb 02, 2015 14:38:37 |
| **Description:** | Free-Field Microphone | **Due Date:** | |

| **Sensitivity:** | **250 Hz** | **1 kHz** | | **Temperature:** | 74 (23) | °F (°C) |
|---|---|---|---|---|---|---|
| | -26.15 | -26.23 | dB re. 1V/Pa | **Humidity:** | 19 | % |
| | 49.27 | 48.80 | mV/Pa | **Ambient Pressure:** | 998 | mbar |
| **Cal. Results:** | In Tolerance | | | **Polarization Voltage:** | 0 | VDC |




Traceability: The calibration is traceable through 683/281764-12.

Notes:
- Calibration results relate only to the items calibrated.
- This certificate may not be reproduced, except in full, without written permission.
- This calibration is performed in compliance with ISO 9001, ISO 17025 and ANSI Z540.
- Measurement uncertainty (250 Hz sensitivity calibration) at 95% confidence level: 0.30 dB.
- Calibrated per procedure PRD-P204.

User Note : As Found/As Left: In Tolerance

**Frequency Response with reference to level at 250 Hz**

| Frequency (Hz) | Upper (dB) | Frequency (Hz) | Upper (dB) | Frequency (Hz) | Upper (dB) | Frequency (Hz) | Upper (dB) |
|---|---|---|---|---|---|---|---|
| 20 | -0.06 | 630 | 0.02 | 4500 | -0.12 | | |
| 25 | -0.09 | 800 | 0.03 | 5000 | -0.12 | | |
| 31.5 | -0.05 | 1000 | 0.04 | 5600 | -0.14 | | |
| 40 | -0.13 | 1120 | 0.05 | 6300 | -0.16 | | |
| 50 | 0.01 | 1250 | 0.04 | 7100 | -0.19 | | |
| 63 | 0.07 | 1400 | 0.04 | 8000 | -0.23 | | |
| 80 | 0.01 | 1600 | 0.03 | 9000 | -0.25 | | |
| 100 | 0.01 | 1800 | 0.03 | 10000 | -0.43 | | |
| 125 | 0.03 | 2000 | 0.04 | 11200 | -0.49 | | |
| 160 | -0.01 | 2240 | 0.03 | 12500 | -0.31 | | |
| 200 | 0.00 | 2500 | 0.00 | 14000 | 0.12 | | |
| 250 | 0.00 | 2800 | -0.01 | 16000 | 0.60 | | |
| 315 | 0.01 | 3150 | -0.03 | 18000 | 0.65 | | |
| 400 | 0.00 | 3550 | -0.06 | 20000 | 0.01 | | |
| 500 | 0.02 | 4000 | -0.10 | | | | |

**Technician:** Wayne Underwood

**Approval:** _____

**Reference Equipment Used:**

| *Manuf.* | *Model* | *Serial* | *Cal. Date* | *Due Date* |
|---|---|---|---|---|
| GRAS | 40AG | 9542 | 9/15/2014 | 9/15/2015 |

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# ~Certificate of Calibration~

**Manufacturer:** PCB
**Model Number:** 377B02
**Serial Number:** LW137490
**Asset ID:** 52898
**Description:** Free-Field Microphone

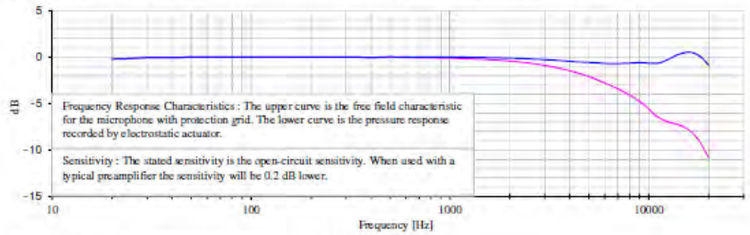
**Customer:** TMS Rental
**Address:**

**Calibration Date:** Jul 20, 2015 14:20:03
**Due Date:**

| Sensitivity: | 250 Hz | 1 kHz | |
|---|---|---|---|
| | -25.01 | -25.14 | dB re. 1V/Pa |
| | 56.17 | 55.37 | mV/Pa |

**Temperature:** 71 (22) °F (°C)
**Humidity:** 53 %
**Ambient Pressure:** 988.6 mbar
**Polarization Voltage:** 0 VDC

**Cal. Results:** In Tolerance




**Traceability:** The calibration is traceable through 683/281764-12.
**Notes:**
Calibration results relate only to the items calibrated.
This certificate may not be reproduced, except in full, without written permission.
This calibration is performed in compliance with ISO 9001, ISO 17025 and ANSI Z540.
Measurement uncertainty (250 Hz sensitivity calibration) at 95% confidence level: 0.30 dB.
Calibrated per procedure PRD-P204.

**User Note:** As Found/As Left In Tolerance

**Frequency Response with reference to level at 250 Hz**

| Frequency (Hz) | Upper (dB) | Frequency (Hz) | Upper (dB) | Frequency (Hz) | Upper (dB) | Frequency (Hz) | Upper (dB) |
|---|---|---|---|---|---|---|---|
| 20 | -0.21 | 630 | -0.01 | 4500 | -0.53 | | |
| 25 | -0.14 | 800 | 0.00 | 5000 | -0.57 | | |
| 31.5 | -0.04 | 1000 | -0.01 | 5600 | -0.63 | | |
| 40 | -0.04 | 1120 | -0.01 | 6300 | -0.68 | | |
| 50 | 0.00 | 1250 | -0.03 | 7100 | -0.69 | | |
| 63 | 0.01 | 1400 | -0.04 | 8000 | -0.65 | | |
| 80 | 0.01 | 1600 | -0.07 | 9000 | -0.59 | | |
| 100 | 0.02 | 1800 | -0.10 | 10000 | -0.64 | | |
| 125 | 0.00 | 2000 | -0.11 | 11200 | -0.65 | | |
| 160 | 0.01 | 2240 | -0.16 | 12500 | -0.26 | | |
| 200 | 0.01 | 2500 | -0.18 | 14000 | 0.27 | | |
| 250 | 0.00 | 2800 | -0.24 | 16000 | 0.54 | | |
| 315 | 0.01 | 3150 | -0.29 | 18000 | 0.13 | | |
| 400 | -0.03 | 3550 | -0.38 | 20000 | -0.85 | | |
| 500 | 0.02 | 4000 | -0.46 | | | | |

**Technician:** Wayne Underwood

**Approval:**

**Reference Equipment Used:**

| *Manuf.* | *Model* | *Serial* | *Cal. Date* | *Due Date* |
|---|---|---|---|---|
| GRAS | 40AG | 9542 | 9/15/2014 | 9/15/2015 |

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