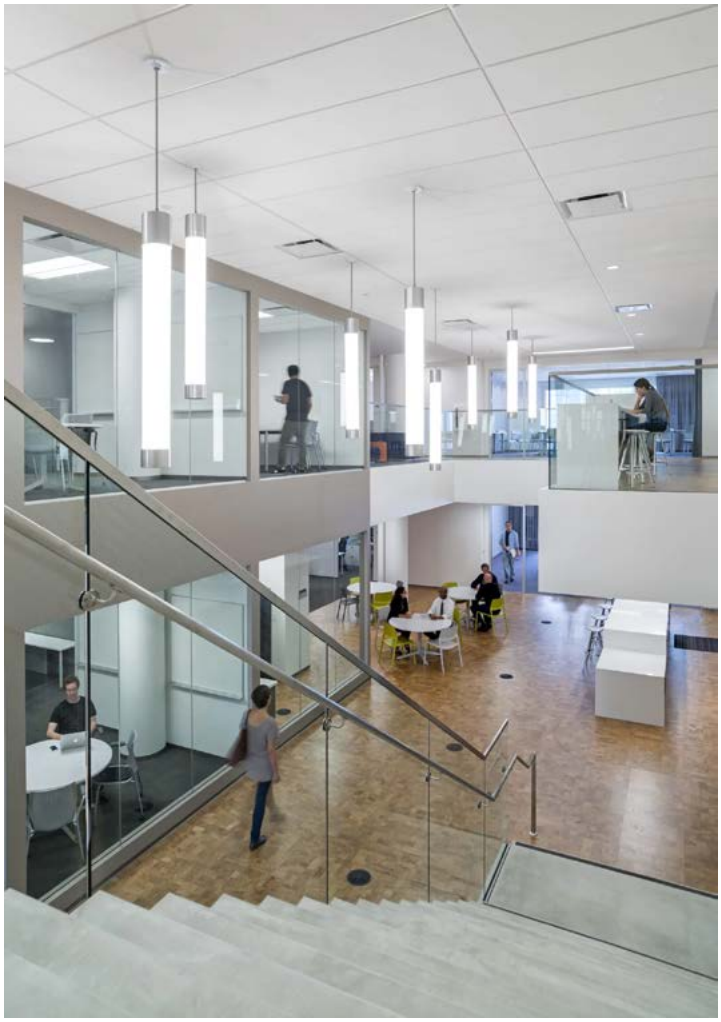
University of California, San Francisco

Acoustics TPC Evaluation

January 29, 2024



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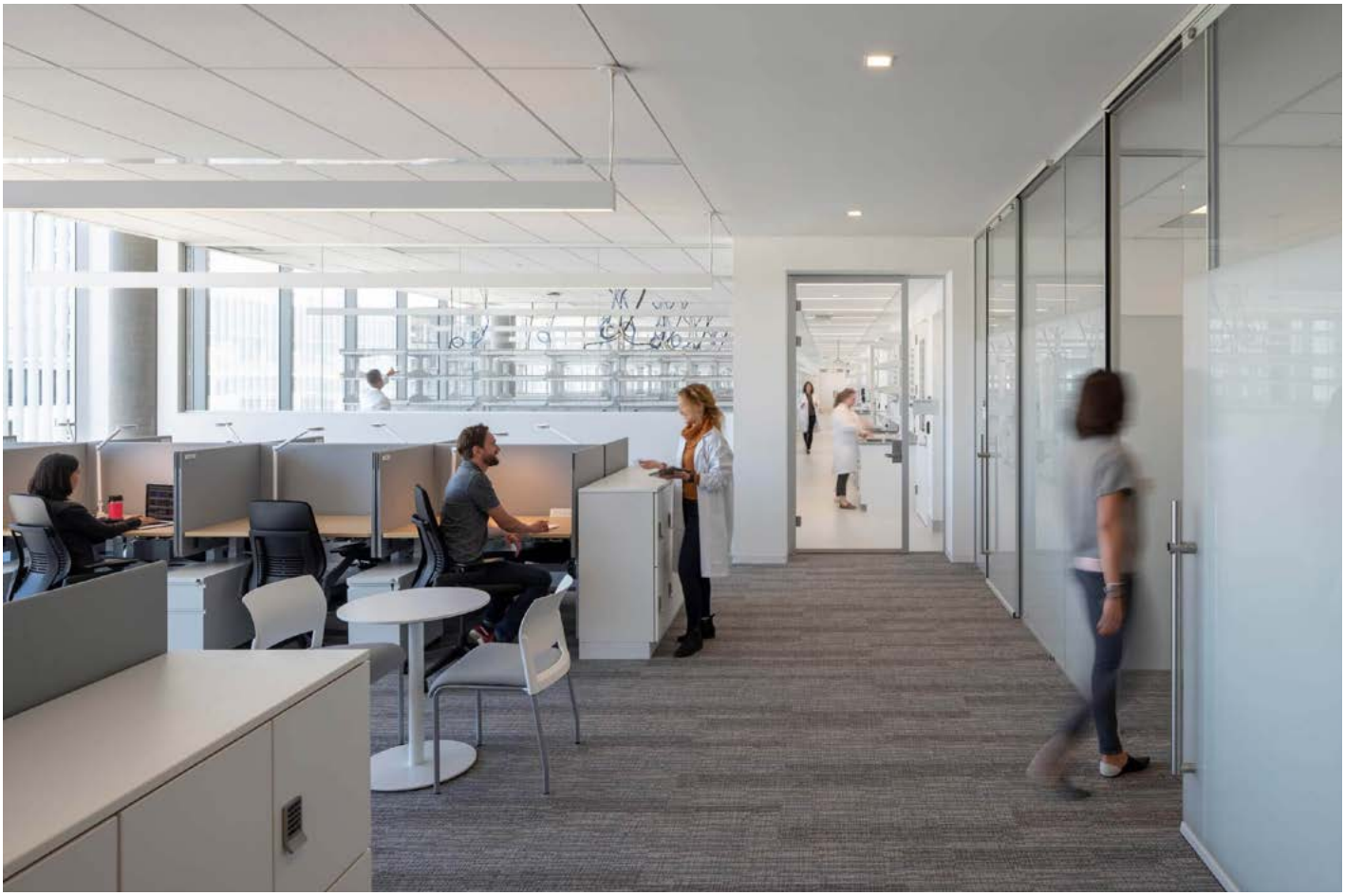
VIBRASURE



VIBRASURE

Acoustics TPC Evaluation

University of California, San Francisco

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Issued: 25 January 2024

Executive Summary

The University of California, San Francisco, (UCSF) uses a Technical Performance Criteria (TPC) document to serve as a guideline for the design of new projects; Section F1030.10 Sound and Vibration Control was created by the Perkins&Will and Vibrasure team to address acoustical and vibration criteria. Since the last revision in 2018, some projects have been completed and occupied, and are currently experiencing negative feedback regarding speech privacy. UCSF would like to evaluate the 2018 TPC document against some of these projects, particularly Block 33, Mission Hall, the Weill Neurosciences Bldg, and the Parnassus Clinical Sciences Bldg (CSB), to determine whether revisions to the TPC may be necessary to help prevent future projects from experiencing similar issues. *This is especially critical as the new PRAB project is in the early stages of design and UCSF would like any revisions to be applied to that project*.

While some acoustical testing had previously been performed by the design teams at three of these buildings (Block 33, Weill, and CSB), the information provided to the Perkins&Will and Vibrasure team was not adequate to fully assess the performance of these buildings against the 2018 TPC. Based on our acoustical test findings in both Mission Hall and Weill, ***the primary cause of speech privacy issues appears to be due to the generally very quiet background noise levels in both buildings***.

Speech privacy between two spaces is determined by the combination of background noise level and the noise reduction provided by the demising partition. Without sound masking, (A) speech privacy is often lower than intended due to lower than expected background noise levels; or (B) the demising partitions need to be overbuilt to guarantee maintaining the desired speech privacy. Overbuilding partitions not only results in increased materials and labor costs but also increases construction schedule and decreases available footprint.

We have reviewed the current PRAB TPC:

- We suggest several changes to Section F1030.14 Sound Masking Systems to both improve the performance of the design and to better standardize the field testing.
- We point out that ASHRAE Table 49 should not be exclusively used to determine equipment vibration isolation, as it is designed for human, and not “high-tech” or animal, sensitivities.
- We suggest modifications to Section F1030.18 Floor Vibration Design to potentially reduce costs while maintaining flexibility for UCSF.
- We suggest relaxing the noise criteria at several locations in Appendix Table F1030.10-C Noise Criteria to both potentially reduce costs and to avoid unnecessarily reducing speech privacy.

The primary recommendation from these findings is that sound masking systems are important tools to reduce partition construction costs as well as to provide a constant level of background noise regardless of the HVAC systems operating point. The constant background noise level will allow design teams to “right size” the partitions and still meet the minimum speech privacy classes required by the TPC. The addition of Section F1030.14 Sound Masking Systems to the current PRAB TPC, assuming our comments are incorporated, directly addresses this recommendation.

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1. PROJECT BACKGROUND

The University of California, San Francisco, (UCSF) uses a Technical Performance Criteria (TPC) document to serve as a guideline for the design of new projects; Section F1030.10 Sound and Vibration Control was created by the Perkins&Will and Vibrasure team to address acoustical and vibration criteria. The original such effort was completed in 2015, with subsequent revisions through 2018.

Since that time, some projects have been completed and occupied, and are currently experiencing negative feedback regarding speech privacy. UCSF would like to evaluate the 2018 TPC document against some of these projects, particularly Block 33, Mission Hall, the Weill Neurosciences Bldg, and the Parnassus Clinical Sciences Bldg (CSB), to determine whether revisions to the TPC may be necessary to help prevent future projects from experiencing similar issues. This is especially critical as the new PRAB project is in the early stages of design and UCSF would like any revisions to be applied to that project.

1.1 Evaluation of Block 33, Mission Hall, Weill, and Clinical Sciences Buildings

While some acoustical testing had previously been performed by the design teams at three of these buildings (Block 33, Weill, and CSB), the information provided to the Perkins&Will and Vibrasure team was not adequate to fully assess the performance of these buildings against the 2018 TPC. While Block 33 had been designed under the 2015 TPC, UCSF has not provided feedback on acoustical issues for that building; testing at CSB was deemed unnecessary at this time, as that project was still undergoing mitigation efforts, and that the CSB was not designed under the TPC. Therefore, it was decided that more in-depth testing was only needed at Mission Hall and Weill. We visited these buildings to perform acoustical testing on 1 April and 25 April 2023.

The team also made an effort to identify and test a UCSF building where no negative acoustical feedback had been received (a reference building); however, no such building was identified to the team.

1.2 Focus on Speech Privacy

While the TPC document covers numerous acoustical and vibration sub-topics, the feedback generated by recently completed and occupied projects was primarily concerned with a lack of speech privacy; therefore, this exercise and report are focused on speech privacy. Prior versions of the TPC did not explicitly address speech privacy; this was introduced in the 2018 revision, partly as result of feedback from the Block 33 team. Speech privacy is objectively defined in the ASTM E2638 standard.

It is our understanding that Block 33, Weill, and CSB were not designed using the 2018 TPC. The ZSFG project was designed using the 2018 TPC but we do not yet have acoustic feedback from that project.

1.3 Evaluation of Current PRAB TPC

During evaluation of the recently completed buildings, the team was provided with the current TPC for the PRAB project. We reviewed this TPC and now provide commentary in Section 4 of this document.

2. TEST PROCEDURES

During our April 2023 site visits, we performed two kinds of tests: (1) background noise measurements at several types of clinical and office spaces; and (2) noise reduction measurements of the demising partitions at these same locations.

The background noise measurements were intended to compare the existing interior noise environment against the TPC, as well as to allow for calculation, in conjunction with the noise reduction results, of the Speech Privacy Class (SPC). These measurements were performed using the manually swept microphone technique for a 60-second duration through the room/space under test. In some cases, the HVAC system was manipulated to document the background noise with the system at minimum vs. maximum operation. We are reporting both the measured overall dBA and 1/3-octave band levels, as well as the calculated Noise Criterion (NC) value.

The noise reduction measurements were intended to identify notable sound leaks, compare against the TPC, and to allow for calculation, in conjunction with the background noise levels, of the SPC. These measurements are performed by playing a standardized test noise signal through a carefully placed loudspeaker and measuring the resultant noise levels within both the “source” room and the “receiver” room. The receive result is adjusted for background noise and then subtracted from the source level to calculate the Noise Reduction (NR) value at each frequency band; these bands are then assessed to derive an overall Noise Isolation Class (NIC). These tests were performed in general accordance with the ASTM E336-20 standard, using the manually swept microphone method for a 60-second duration.

To capture the data, we used our standard test suite. All instruments are annually or bi-annually calibrated to a NIST standard:

Instrument	Make/Model	ID
Sound Analyzer	Norsonic N140	S/N 1407038
Microphone	Norsonic 1225	S/N 271214
Mic Pre-Amp	Norsonic 1209	S/N 21525
Mic Calibrator	LD CAL200	S/N 12542
Loudspeaker Source	Behringer B112D	S/N 220700185AJN

The sound analyzer was calibrated prior to use and checked after to confirm that no significant drift in calibration occurred.

3. RESULTS AND DISCUSSION

3.1 Background Noise Survey

Average background noise levels from open office areas, private offices, conference rooms, and clinical spaces are shown in Figures N.1~N.4, with results from individual locations presented in Appendix B. The Figures include two plots: the upper plot provides the statistical spectra (min/max/average) in 1/3-octave band resolution to provide more detail; the lower plot provides the statistical spectra in 1/1 octave band resolution, allowing direct comparison to NC curves. On all figures, the 2018 TPC NC value/curve is highlighted in red. An overall summary is presented in Table 1 below:

Table 1: Background Noise Level Summary

Area Type	Range	2018 TPC Criterion
Open Plan Office Spaces	NC-25 to NC-40	NC-40
Private Offices/Huddle/Focus	NC-20 to NC-38	NC-35
Conference Rooms	NC-26 to NC-39	NC-30
Clinical Spaces (Weill only)	NC-27 to NC-29	NC-40
Waiting Room (Weill only)	NC-28	NC-35
Animal Imaging (Weill only)	NC-46	NC-45

We make the following comments regarding the background noise levels[1]:

- In general, background noise from the mechanical systems was well controlled and inoffensive throughout both buildings.
- At some locations within Weill, the HVAC systems were able to be manipulated manually during the test between minimum and maximum operating conditions – the summary measurements include the effects of both extremes; comparisons within individual spaces may be seen in Appendix B.
- Figure N.1 shows a summary of the background noise levels in open plan office areas. While the levels range from NC-25 to NC-40, the typical noise levels are well below the target criterion of NC-40, resulting in reduced speech privacy.
- Figure N.2 shows a summary of the background noise levels in private offices and huddle and focus rooms. While the levels range from NC-20 to NC-38, the typical noise levels are well below the target criterion of NC-35, resulting in reduced speech privacy. An airflow device, UFT-520, was particularly noisy at the Mission Hall Fifth Floor.
- Figure N.3 shows a summary of the background noise levels in conference rooms. While the levels range from NC-26 to NC-39, noise levels are well controlled in most conference rooms. Mission Hall 2700 is an exception, which suffers from excessive airflow noise from the floor vents. We note that the mitigations suggested by the Weill design team to address a previously

[1] For reference: each data point is a 60-second, 1/3-octave band L_{EQ}, spanning 6.3 Hz~20 kHz. Octave band data are synthesized from the 1/3-octave band data.

noisy conference room, Weill 675, appear to have resulted in noise levels meeting the TPC criterion.

- Figure N.4 shows a summary of the background noise levels in Weill clinical spaces. The typical noise levels are well below the target criterion of NC-40, resulting in significantly reduced speech privacy.
- In Mission Hall, we understand that sound masking systems had been installed in all of the office areas**.** During our visits, the sound masking system was so low in volume that it was essentially non-functional. What could be heard had a "hissy" and unpleasant character; this could explain the dissatisfaction with this implementation and why the masking system had been turned down so far.
- In Weill, sound masking was not implemented in any of the areas.

3.2 Noise Reduction Survey

Noise reduction test results are summarized in Table 2 below, with results from individual demising partitions presented in Appendix C. The Figures present the NIC, with additional information required per the ASTM E336 standard.

We make the following comments regarding the measured noise reduction:

- In general, the measured NIC ratings are both consistent with past measurements by the design teams and are roughly in compliance with the 2015 TPC or negotiated (lowered) TPC criteria for Weill.
- At some adjacencies, there were sound leaks at various building elements, such as around columns, at return air boots, and penetrations. The raised access floor limited performance at Mission Hall conference rooms, where sound could be clearly heard coming through the bottom of the partition.
- However, noise reduction between enclosed spaces and adjacent corridors or open plan office areas was overall quite poor. At many of these adjacencies, the door was not sealed at the bottom, and this significantly limited the overall performance of the partition.

Table 2: Noise Isolation Class Summary

Tested Adjacency Type	Tested Range of NIC	TPC Allowable NIC[2]
Private Office to Private Office (Misson Hall)	NIC 42	NIC 43
Private Office to Private Office (Weill)	NIC 30 to NIC 39	NIC 38
Conference to Conference/Private	NIC 49 to NIC 52	NIC 43
Private Office to Open Office (w/door)	NIC 26 to NIC 34	NIC 33
Clinical to Clinical/Office (Weill)	NIC 41 to NIC 42	NIC 38
Clinical to Corridor (Weill)	NIC 27 to NIC 36	NIC 28

[2] In Mission Hall, the allowable NIC is based on the 2015 TPC; at Weill, the allowable NIC is based on a negotiated lower performance level – note that this lowered standard does not meet FGI guidelines at clinical spaces.

3.3 Calculated Speech Privacy Class

The SPC can be calculated from field data per the ASTM E2638 standard – in essence, the SPC is determined by adding the background noise level and noise reduction performance together. The calculated results are summarized and compared to the current 2018 TPC targets in Table 3 below:

Table 3: Speech Privacy Class Summary

Tested Adjacency Type	Calculated Range of SPC	2018 TPC Criterion
Private Office to Private Office (Misson Hall)	SPC 65 to SPC 73	SPC 75
Private Office to Private Office (Weill)	SPC 58 to SPC 62	SPC 75
Conference to Conference/Private	SPC 71 to SPC 79	SPC 80
Private Office to Open Office (w/door)	SPC 51 to SPC 61	SPC 75
Clinical to Clinical/Office (Weill)	SPC 65 to SPC 66	SPC 75 / FGI
Clinical to Corridor (Weill)	SPC 53 to SPC 64	SPC 75 / FGI

We make the following comments regarding the calculated speech privacy class:

- In general, the SPC within both buildings is significantly below the SPC targets adopted by the 2018 TPC.
- In particular, the private office-to-private office adjacency at Weill and the private office-to-open office adjacency in both buildings is substantially below the 2018 TPC and results in less than Minimal Speech Privacy (as defined by ASTM E2638).
- In addition, the SPC achieved at clinical spaces in Weill results in less than Minimal Speech Privacy and, therefore, also does not satisfy FGI guidelines.

4. REVIEW OF CURRENT PRAB TPC

We have reviewed the current PRAB TPC, including Section F1030.10 and the associated Appendix Tables. At UCSF's request, another acoustical consulting firm (Wilson Ihrig) performed an independent peer review of the PRAB TPC and our suggested markups; in summary, the peer reviewer suggested some slight revisions to our comments to increase clarity and reduce potential confusion / miscommunication. Based on the peer reviewer feedback, we have revised our TPC markup comments provided previously; our revised comments are presented in full in Appendix D. For completeness, the peer reviewer comments are included in Appendix E.

We summarize the most critical comments below:

- We suggest several changes to Section F1030.14 Sound Masking Systems to both improve the performance of the design and to better standardize the field testing.
- We point out that ASHRAE Table 47 should not be exclusively used to determine equipment vibration isolation, as it is designed for human sensitivities and not "high-tech" or animal sensitivities.
- We suggest modifications to Section F1030.18 Floor Vibration Design to potentially reduce costs while maintaining flexibility for UCSF.
- We suggest relaxing the noise criteria at several locations in Appendix Table F1030.10-C Noise Criteria to both potentially reduce costs and to avoid unnecessarily reducing speech privacy.

5. CONCLUSIONS/RECOMMENDATIONS

Based on the acoustical test findings in both Mission Hall and Weill, the primary cause of speech privacy issues appears to be due to the generally very quiet background noise levels in both buildings. The systemic low noise levels are likely due to two factors: 1) modern ultra efficient HVAC systems can operate over a wide range, resulting in the system potentially operating at a significantly lower noise level than is modeled by the design teams – this is exacerbated at Mission Hall and Weill by the increase in remote working since the COVID-19 pandemic; and 2) systems are typically designed to meet the project noise criteria at the worst-case locations, potentially resulting in noise levels being significantly quieter at large areas further "downstream". We note that issues from CSB also appear to be at least partially due to quiet background noise levels.

As stated in Section 3.3 above, speech privacy between two spaces is determined by the combination of background noise level and the noise reduction provided by the demising partition. Therefore, there are only two "levers to pull" to accomplish the desired level of speech privacy. As stated above, modern efficient HVAC systems cannot be relied upon to generate a consistent background noise level on their own. Without sound masking, the use of these systems typically results in a situation where either: (A) speech privacy is often lower than intended due to lower background noise levels; or (B) the demising partitions need to be overbuilt to guarantee maintaining the desired speech privacy. Overbuilding partitions not only results in increased materials and labor costs but also increases construction schedule and decreases available footprint.

The primary recommendation from these findings is that sound masking systems are important tools to reduce partition construction costs (and to minimize loss of usable footprint) as well as to provide a constant level of background noise regardless of the HVAC systems operating point. The constant background noise level will allow design teams to "right size" the partitions and still meet the minimum speech privacy classes required by the TPC. The addition of Section F1030.14 Sound Masking Systems to the current PRAB TPC, assuming our comments are incorporated, directly addresses this recommendation.

A further argument to the potential usefulness of sound masking systems: if properly designed and installed sound masking systems, meeting the requirements in the marked-up PRAB TPC Section F1030.14, were operating in Mission Hall and Weill, the resultant Speech Privacy Class ratings would at least result in Minimal Speech Privacy and would, in many cases, meet the 2018 TPC SPC criteria – ***without any improvements to the existing partitions***.

Please feel free to call or write with any questions or comments; our contact information is below.

Best regards,

Tyler Rynberg, PE
Vibrasure

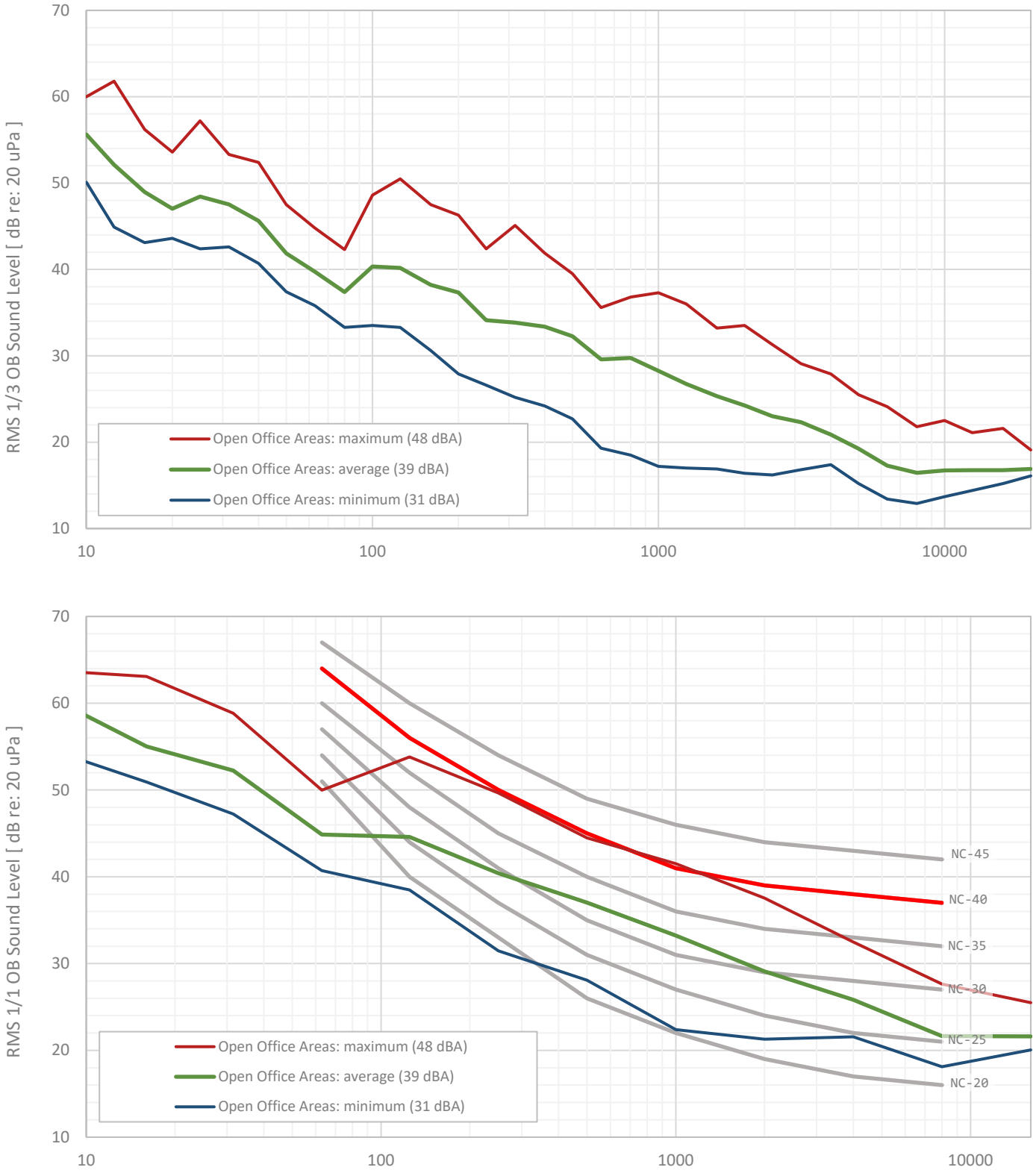


Figure N.1: Results from Open Office Areas under as-built conditions

Average noise levels across the open office areas are NC-32, due to the room HVAC system. In general, open office areas in both Block 33 and Weill had very low background noise levels, resulting in reduced speech privacy.

Data reported on 16 observations at 7 locations between 04/01/23 @ 10:14 and 04/01/23 @ 14:31.

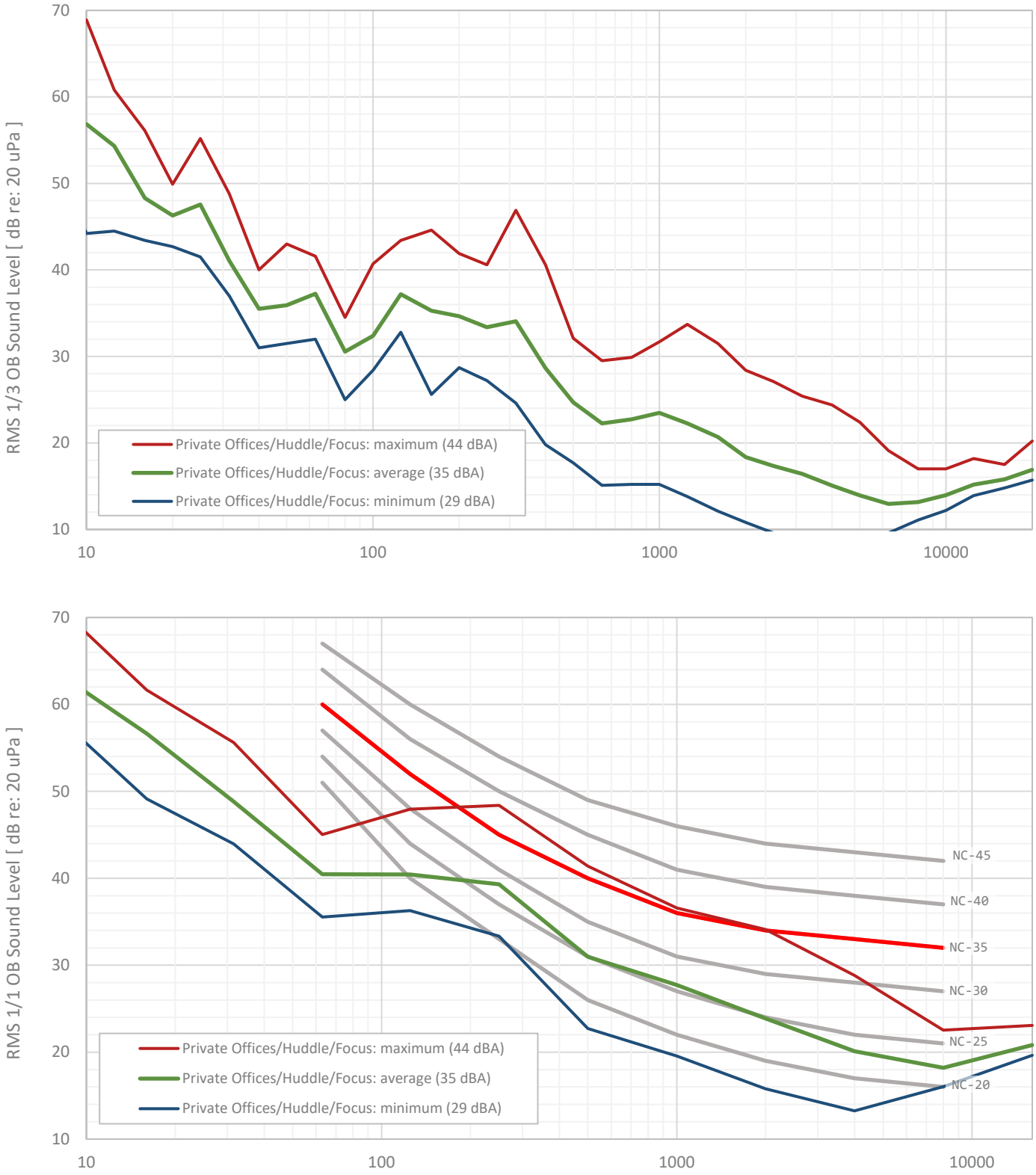


Figure N.2: Results from Private Offices/Huddle/Focus under as-built conditions

Average noise levels are NC-28, due to the room HVAC system; however, noise levels at higher and lower frequencies are far below the NC-35 TPC target. In general, background noise levels in office spaces are too low, resulting in reduced speech privacy.

Data reported on 18 observations at 15 locations between 04/01/23 @ 10:11 and 04/01/23 @ 14:30.

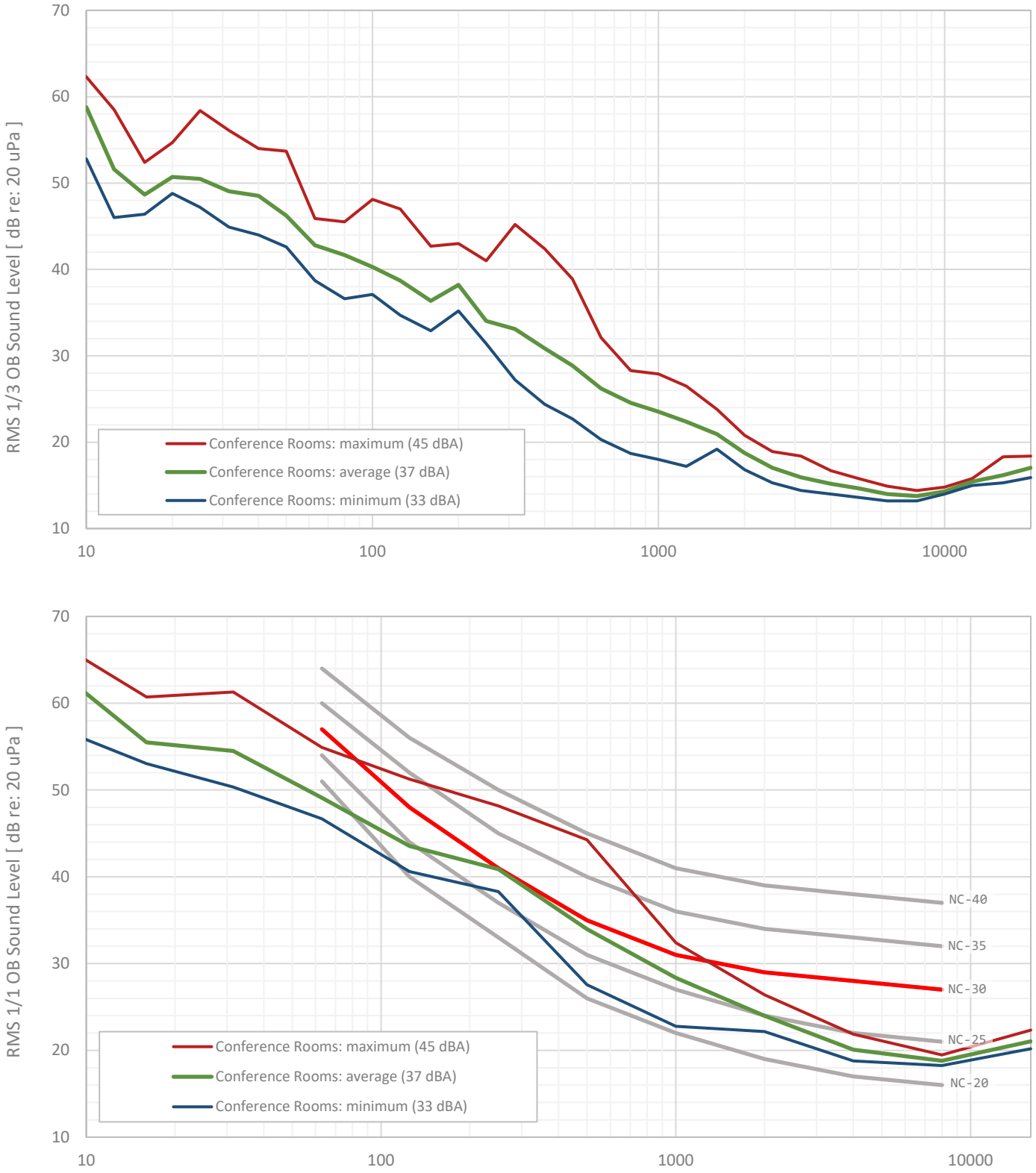


Figure N.3: Results from Conference Rooms under as-built conditions

Average noise levels are NC-30, due to the room HVAC system; higher sound levels in Mission Hall 2700 appear to be caused by a particularly noisy UFT device.

Data reported on 5 observations at 5 locations between 04/01/23 @ 11:01 and 04/01/23 @ 14:46.

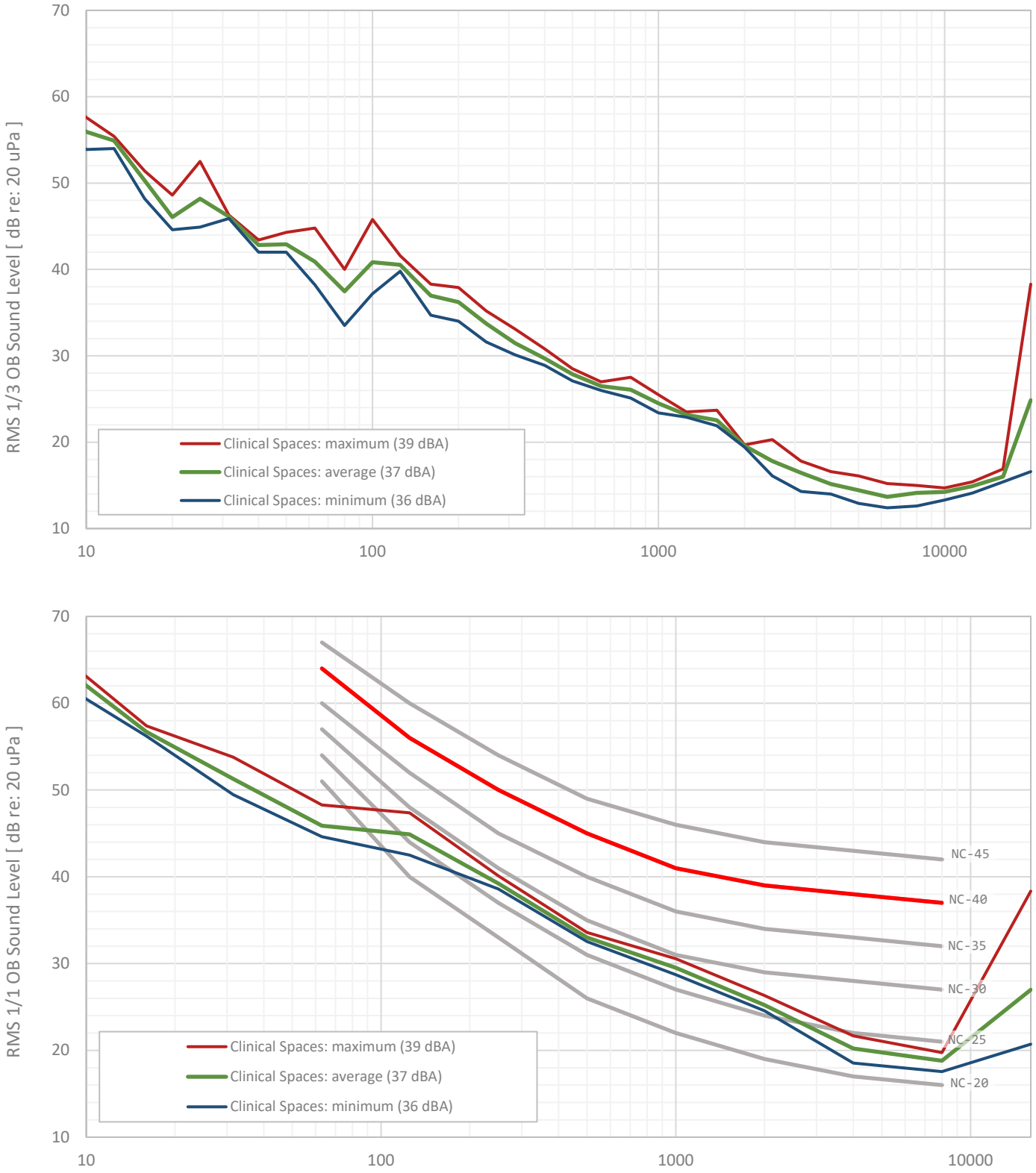


Figure N.4: Results from Clinical Spaces under as-built conditions

Average noise levels are approximately NC-28, due to the room HVAC system. The background noise levels in these rooms are well below the TPC target of NC-40 and result in significantly reduced speech privacy.

Data reported on 3 observations at 3 locations between 04/01/23 @ 13:04 and 04/01/23 @ 13:08.

Appendix A: Acoustical Terms and their Qualitative Meanings

In this document, we use several terms-of-art that have specific meanings in acoustical design. To facilitate the reader's understanding, we discuss these parameters here.

A-weighted sound level (dBA): the dBA level is the overall sound level across the human hearing range, that has been weighted to better account for how humans hear, by penalizing low and high frequency sounds; a higher dBA means a louder sound. Sound levels for typical activities include: a quiet rural area (30 dBA); a conversation at 3-feet (60 dBA); and a motorcycle at 25-feet (90 dBA).

Equivalent sound level (LEQ): because sound levels fluctuate over time, a time-average sound level, the LEQ, is used to characterize the acoustical environment. The LEQ corresponds to a steady-state sound level containing the same total sound energy as a time varying signal over a given time period (usually one hour). For environmental noise studies, the LEQ is almost always A-weighted.

Day-Night Average Sound Level (LDN): the LDN is the overall equivalent sound level across a 24-hour period with the nighttime hours (10 pm to 7 am) penalized by 10 dB to account for the human sensitivity during sleep.

NRC and CAC: both NRC (Noise Reduction Coefficient) and CAC (Ceiling Attenuation Class) are single-number ratings that attempt to describe a spectrum of performance. NRC is applicable to any absorptive system and relates absorption in a few frequency bands important to speech; higher NRC means higher absorption. CAC is applicable specifically to ceiling tiles and relates resistance to sound transmission; higher CAC means that less sound penetrates through the ceiling. For typical acoustical ceiling tile, NRC and CAC are often in conflict, since achieving high CAC requires solid, heavy tiles that do not absorb as much sound.

STC and IIC: both STC (Sound Transmission Class) and IIC (Impact Insulation Class) are single-number ratings that attempt to describe a spectrum of performance. STC is applicable to any demising material and relates the sound isolation provided from speech; higher STC means higher sound isolation. IIC is applicable to floor/ceiling assemblies in particular and relates the impact sound isolation provided from footfalls to the space below; higher IIC means higher impact isolation.

Normal Speech Privacy: the level of isolation that results in conversation being *audible*, but not especially *understandable*. This is typical for routine office spaces, where the goal is to reduce annoyance. A motivated listener could successfully eavesdrop; however, the general experience is to simply be able to hear that people are talking (which might or might not be inappropriate).

Confidential Speech Privacy: the level of isolation that results in conversation being largely beyond understanding. Even a motivated listener would have trouble eavesdropping. Neighbors might be able to hear that someone is talking, but if both parties are relatively quiet, they might not even be aware of each other's presence.

"Inaudible": in the context of isolation between adjacencies, this suggests that it would be difficult to even notice that there is someone next door. This goes beyond speech privacy, in that listeners are probably not even aware that anyone is talking.

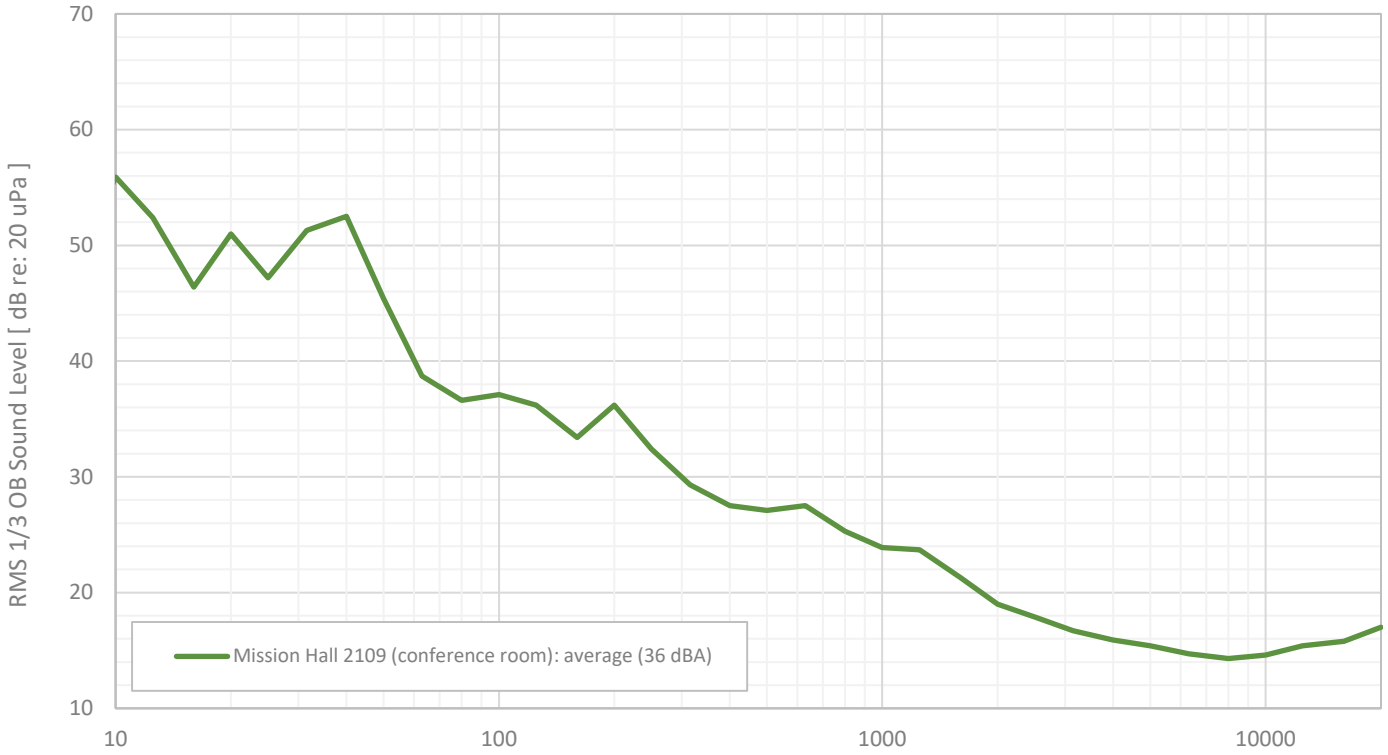
Sound Masking: an “engineered sound” purposefully added to a space so as to raise the background noise level. This makes intruding sounds less prominent, generally increasing isolation and privacy. Up to a point, sound masking can make up for poor physical isolation.

Reverberation: sound bounces around the room in enclosed spaces, losing energy at each reflection (see *Sound Absorption*). The less absorption, the longer the sound will linger. This property is usually expressed as a “reverberation time” called T60: the time (in seconds) required for the sound to decay by 60dB. Depending on the setting, longer or shorter reverberation times are appropriate. When reverberation is inappropriately long, occupants say that the space sounds “echo-y”. When reverberation is too short, occupants might say that the room is “dead”. In truth, T60 is not a single number; instead, it is a spectrum. Rooms with long T60 at low frequencies but short T60 at high frequencies often sound “boom-y” to occupants.

Sound Absorption: in room acoustics, *absorption* is the removal of sound energy from the room. In some cases, what we call “absorption” is actually the combination of physical absorption *plus* the energy that transmits through surfaces and escapes altogether. Lower absorption leads to longer reverberation times, as sounds bounce around longer. This hampers speech intelligibility. Materials do not absorb all frequencies equally, requiring attention to avoid unbalanced rooms that sound unnatural or “boom-y”.

Dispersion: the scattering of sound. Dispersive surfaces are like “matte” finishes for sound. They counter the specular reflections generated by hard, smooth surfaces like glass, which cause the acoustical equivalent of “glare” and other problems. Dispersion helps spread sound around the room evenly. It is desirable in speech-oriented rooms because it helps listeners understand speech even when speaker and listener are not directly facing each other. In general, dispersion reduces the need for absorption; hence, panel systems are available that incorporate both. For small rooms, it can even make the room feel larger and less “stuffy”.

Appendix B: Background Noise Measurement Plots B.1 through B.47



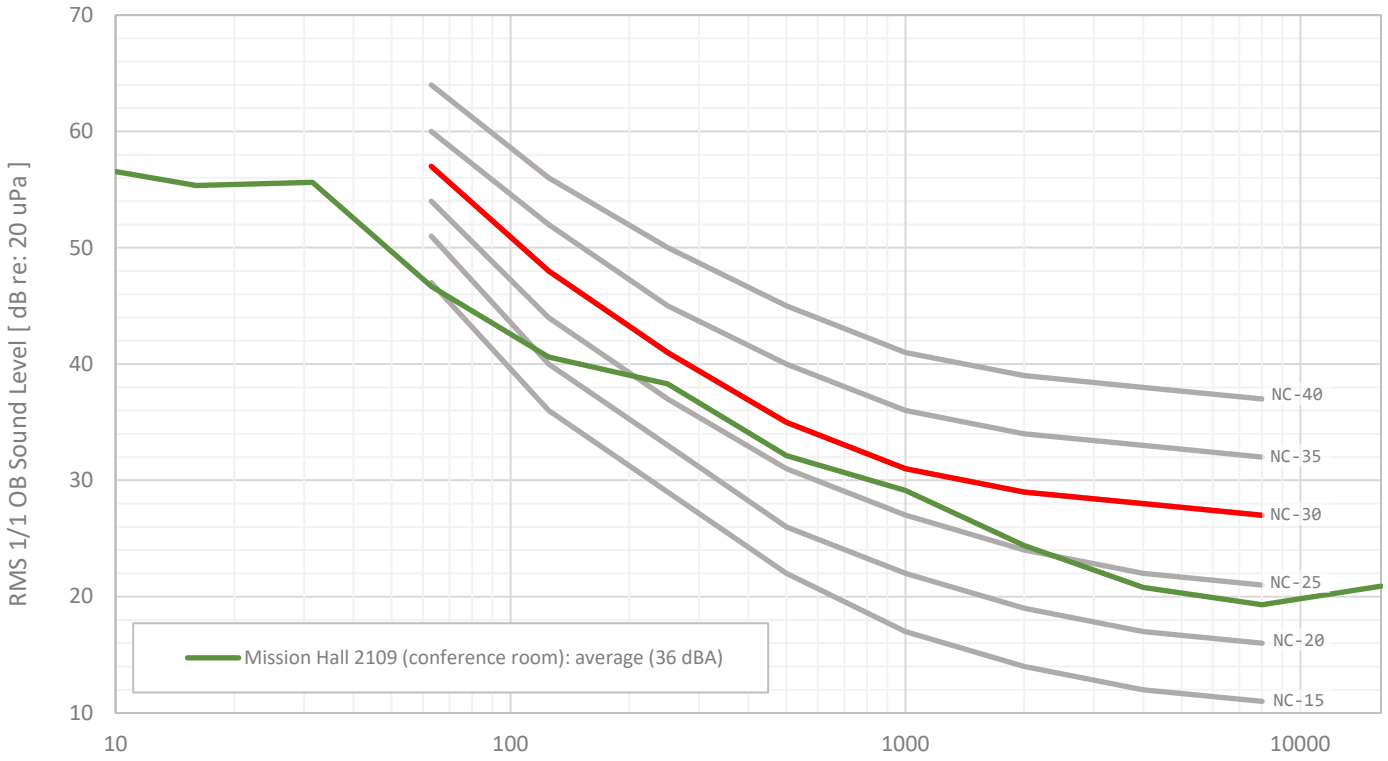
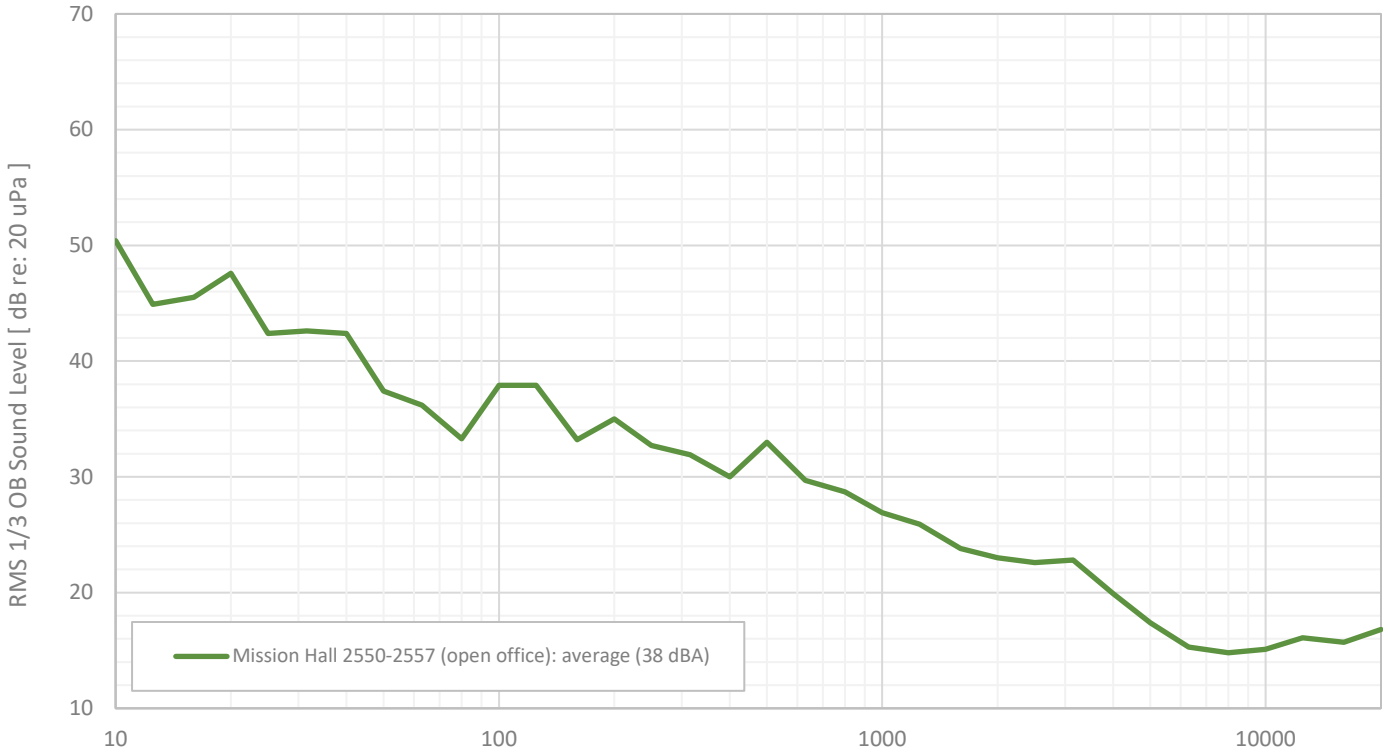


Figure B.1: Results from Mission Hall 2109 (conference room)

Noise levels are NC-28: HVAC ON in normal mode

Data reported on 1 observation at 1 location at 04/01/23 @ 11:54.



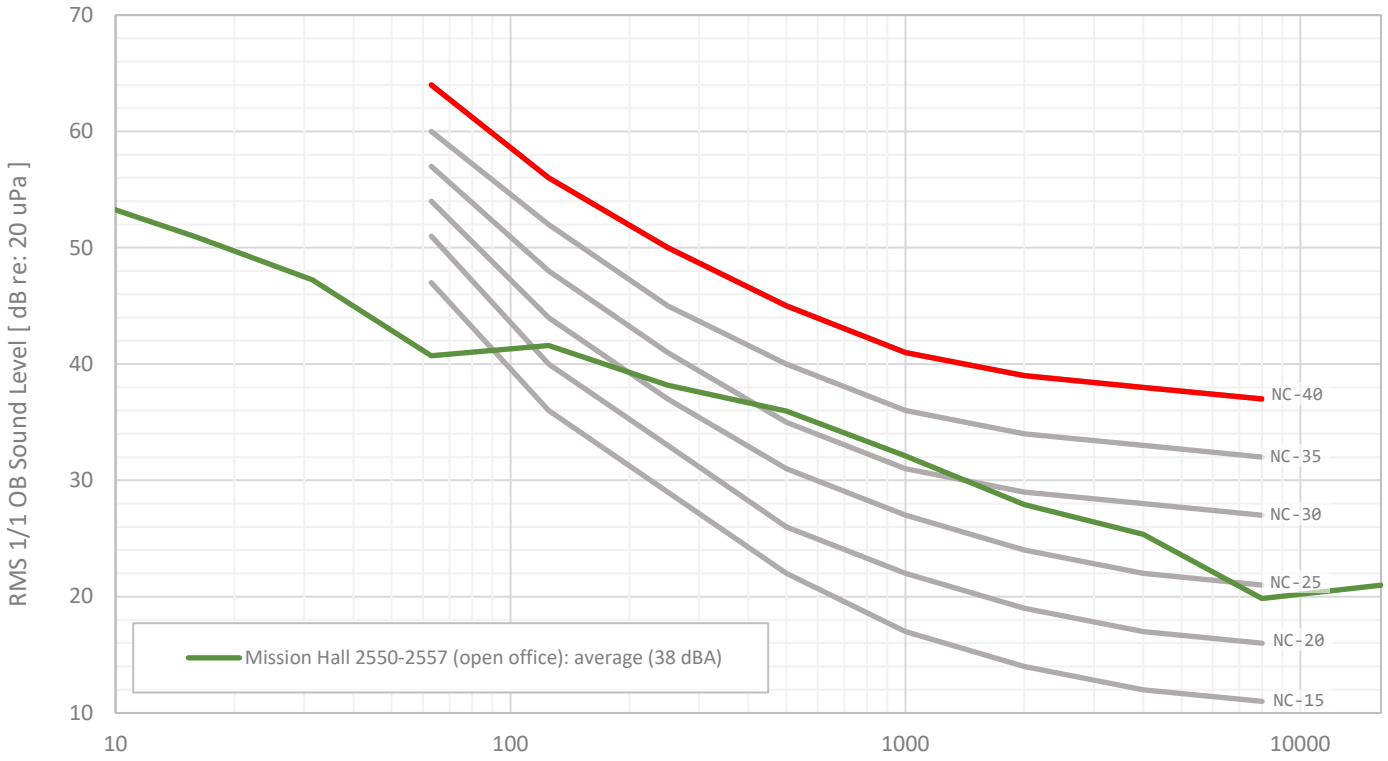
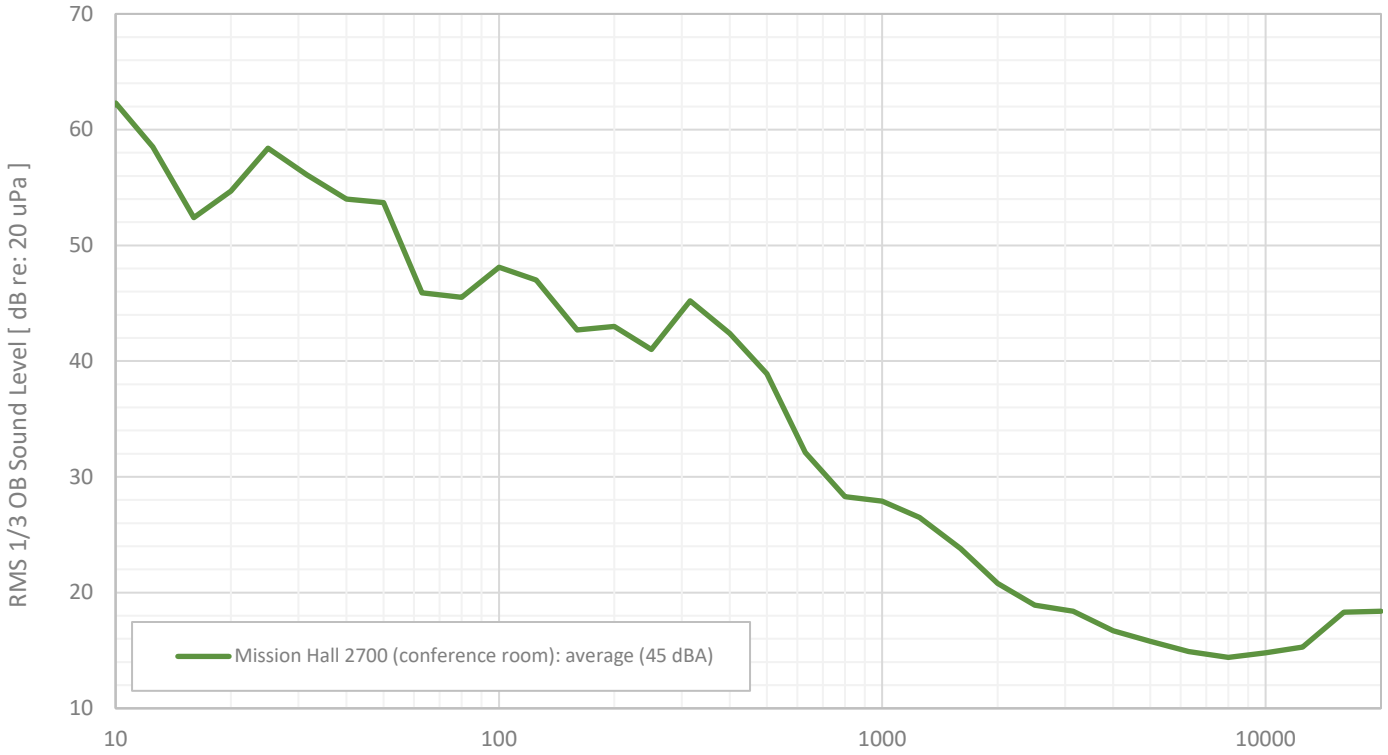


Figure B.2: Results from Mission Hall 2550-2557 (open office)

Noise levels are NC-31: HVAC ON in normal mode

Data reported on 1 observation at 1 location at 04/01/23 @ 11:51.



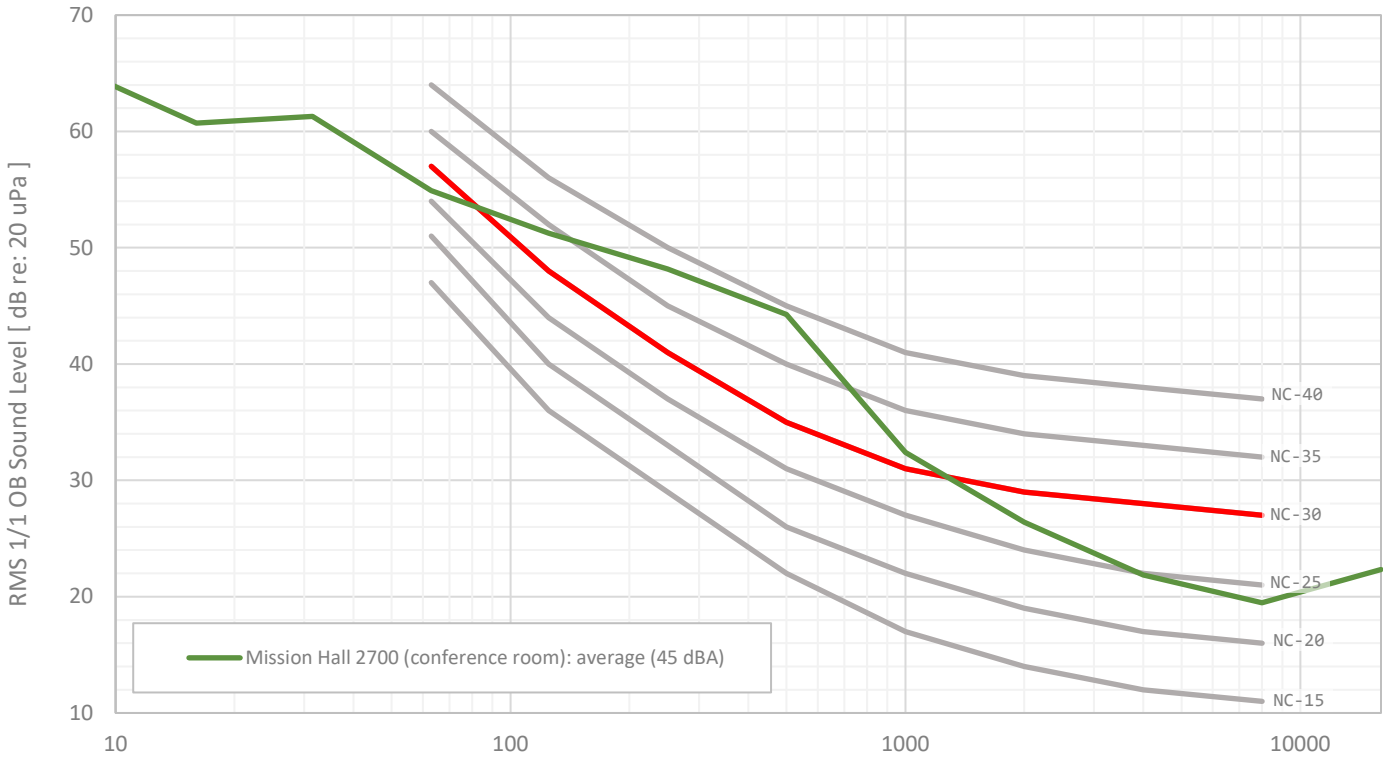
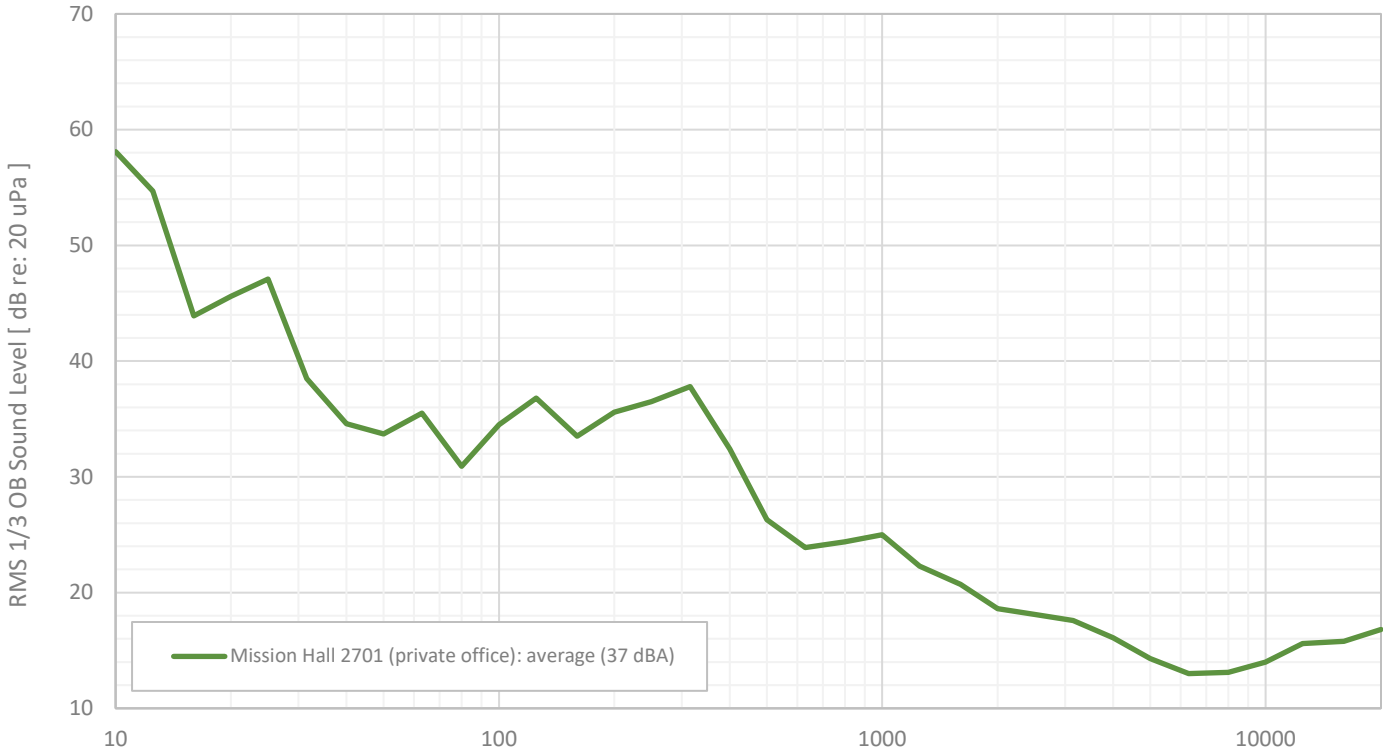


Figure B.3: Results from Mission Hall 2700 (conference room)

Noise levels are NC-39: HVAC ON in normal mode; floor vents at north end of room are dominant

Data reported on 1 observation at 1 location at 04/01/23 @ 11:01.



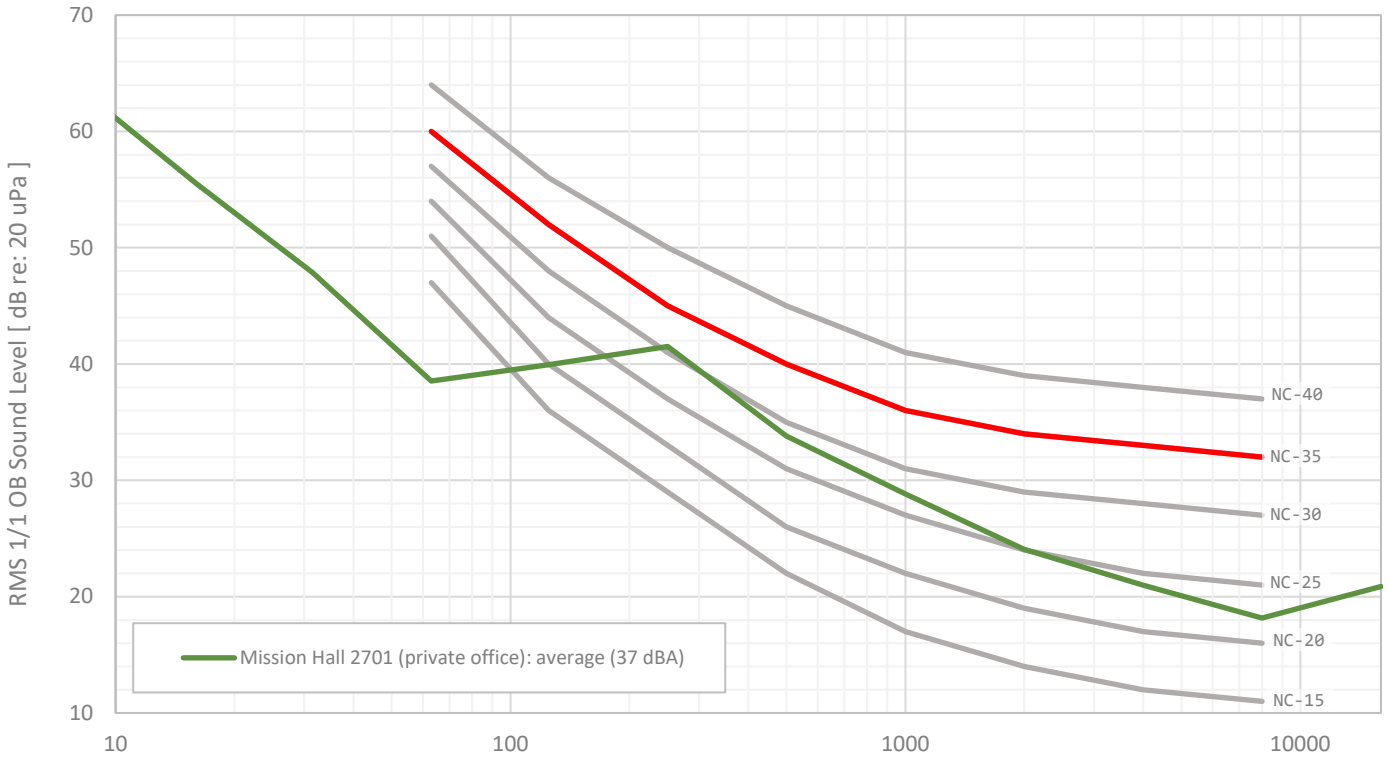
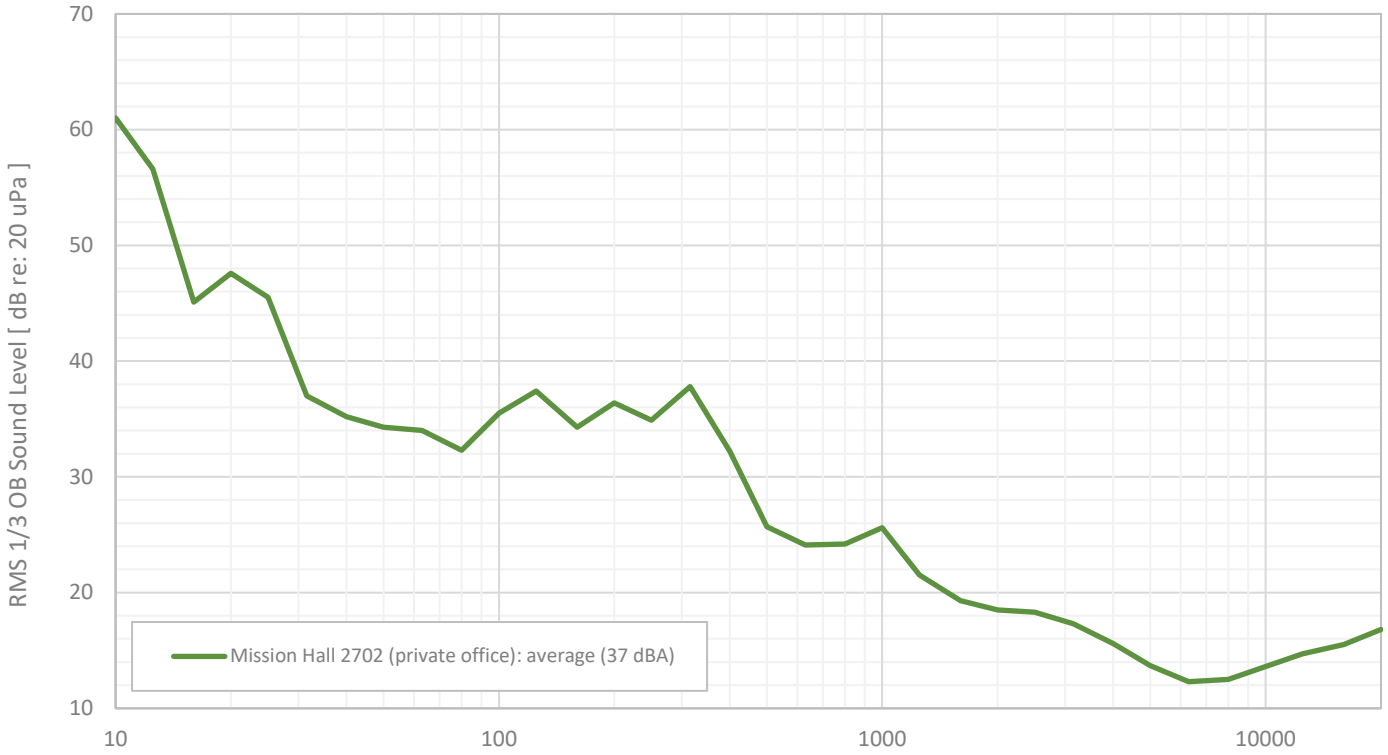


Figure B.4: Results from Mission Hall 2701 (private office)

Noise levels are NC-30: HVAC ON in normal mode

Data reported on 1 observation at 1 location at 04/01/23 @ 11:05.



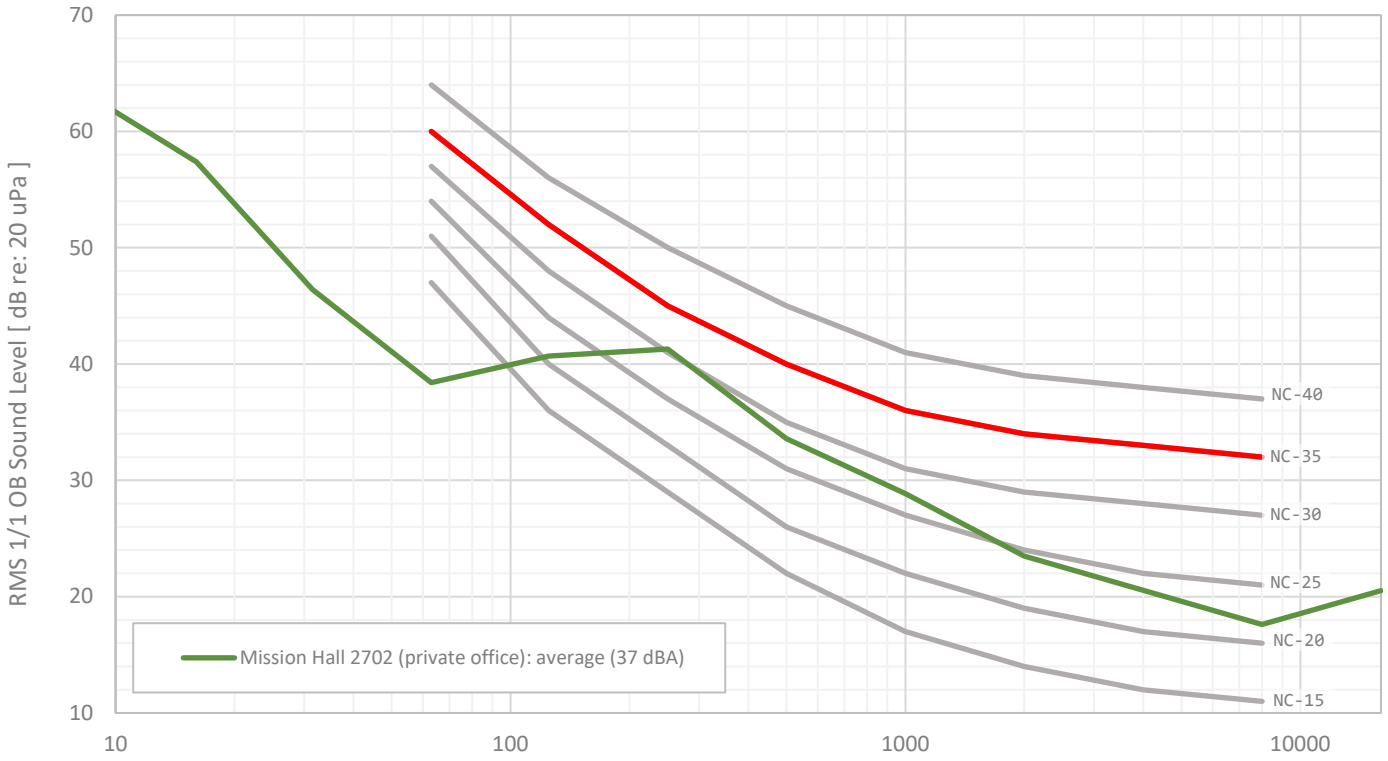


Figure B.5: Results from Mission Hall 2702 (private office)

Noise levels are NC-30: HVAC ON in normal mode

Data reported on 1 observation at 1 location at 04/01/23 @ 11:06.

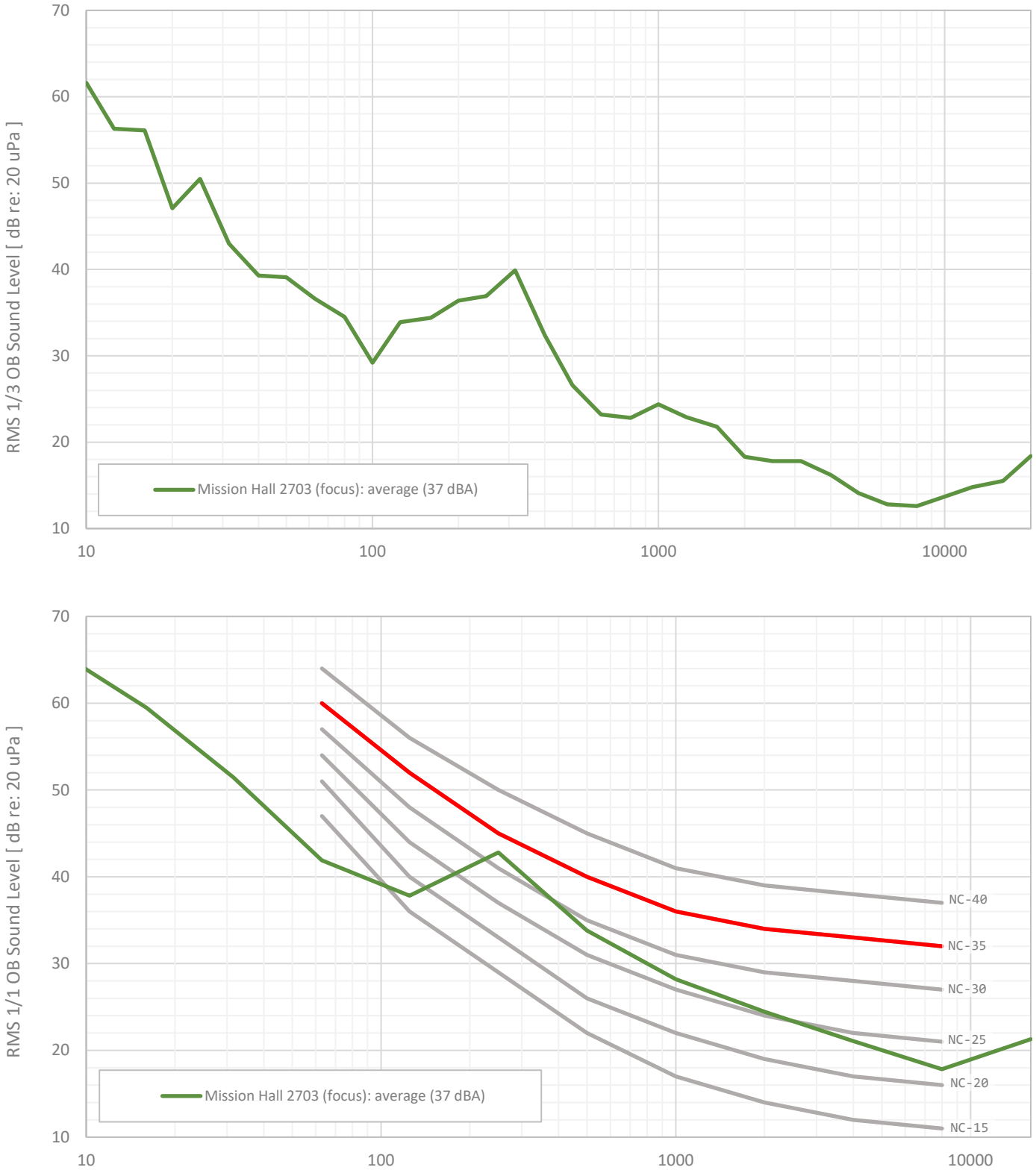
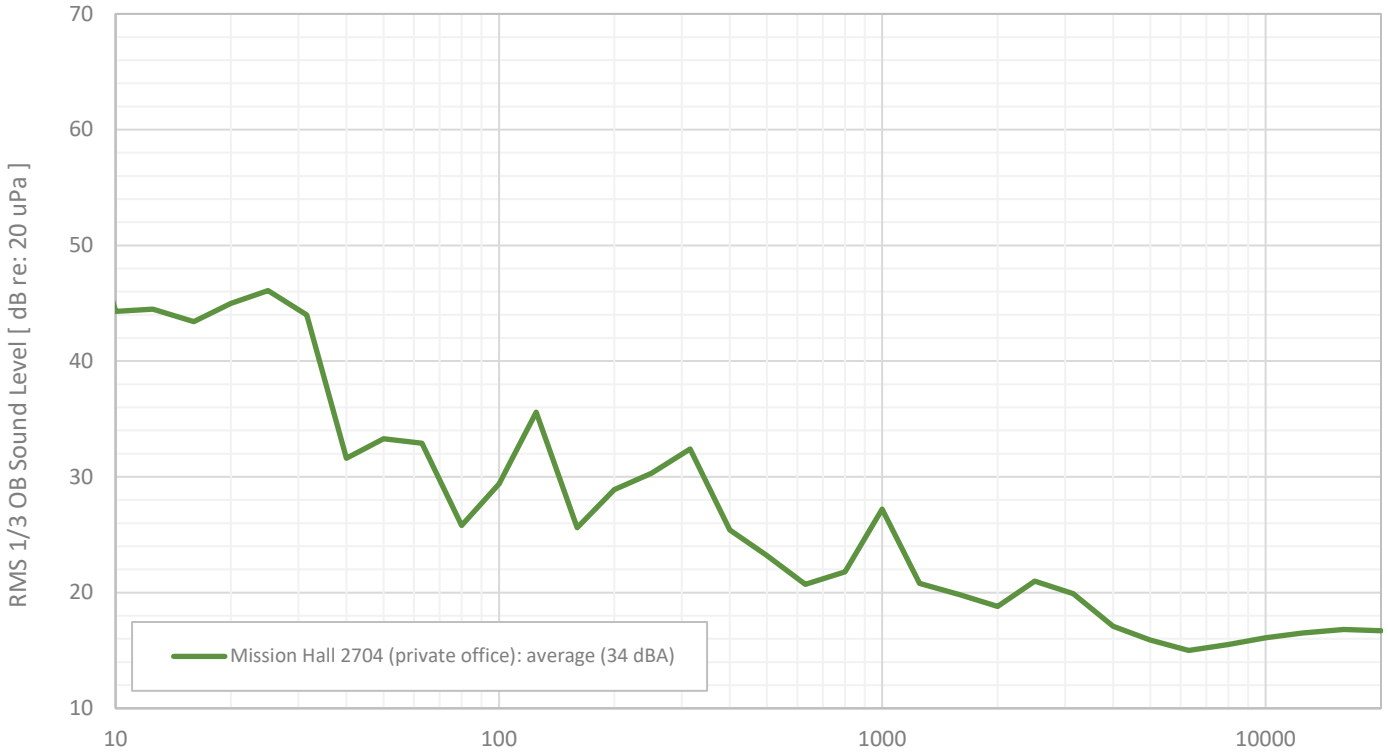


Figure B.6: Results from Mission Hall 2703 (focus)

Noise levels are NC-33: HVAC ON in normal mode

Data reported on 1 observation at 1 location at 04/01/23 @ 11:07.



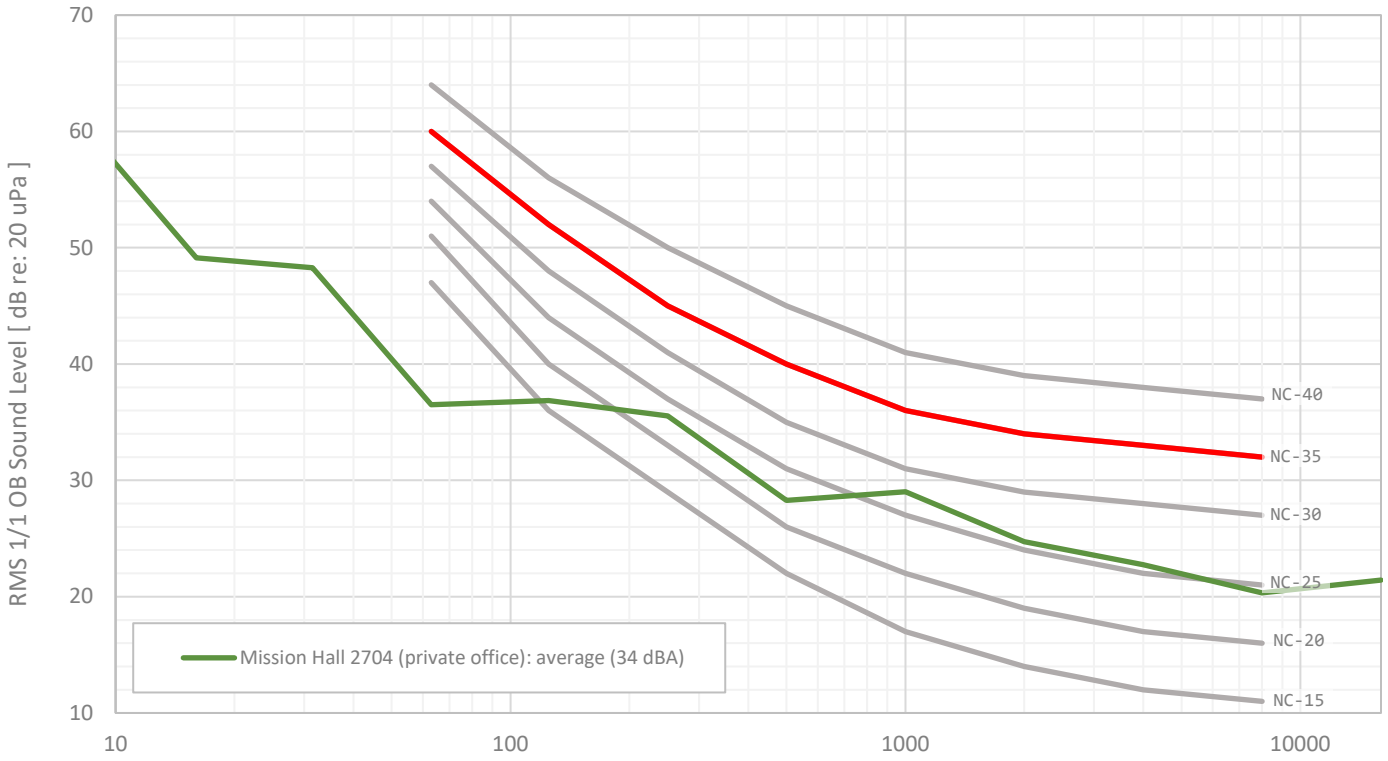


Figure B.7: Results from Mission Hall 2704 (private office)

Noise levels are NC-28: HVAC ON in normal mode

Data reported on 1 observation at 1 location at 04/01/23 @ 11:15.

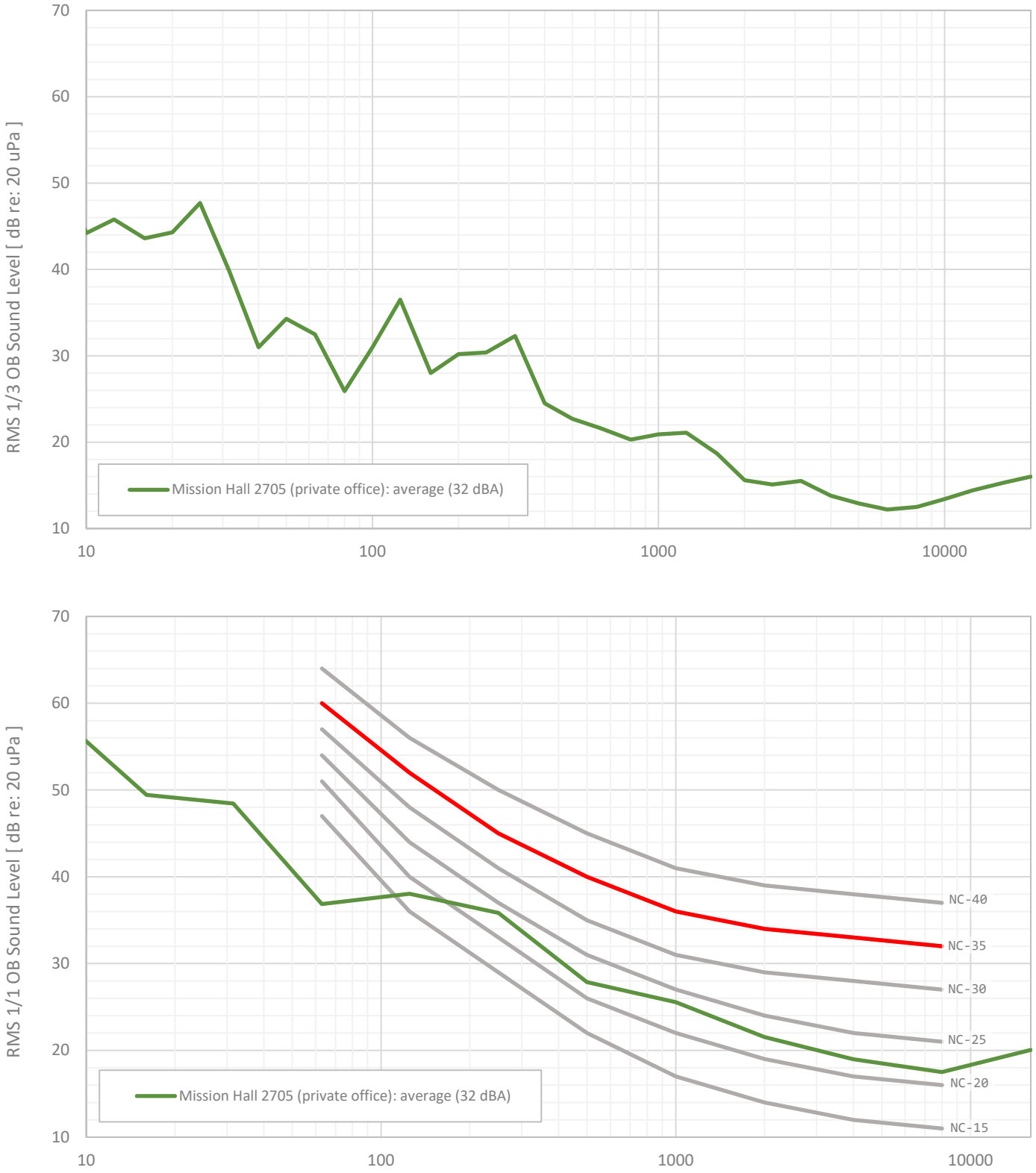
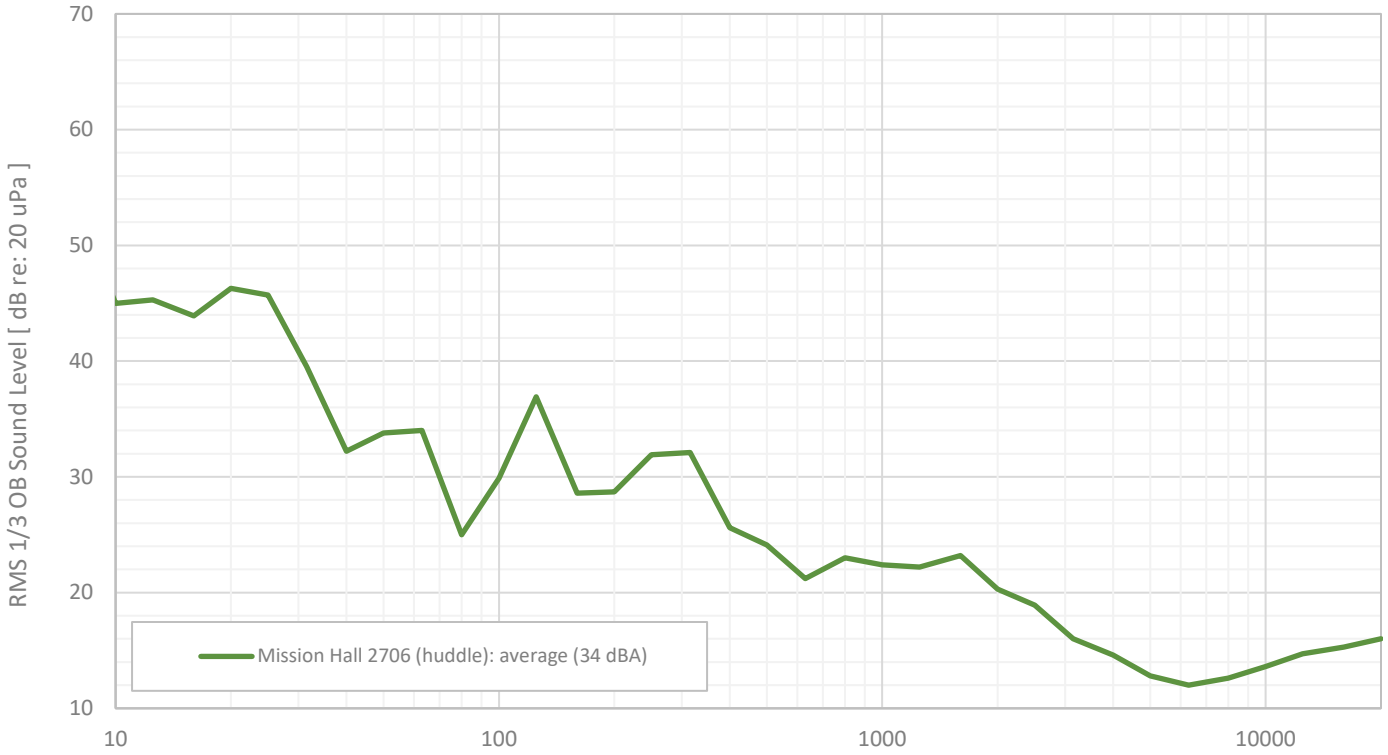


Figure B.8: Results from Mission Hall 2705 (private office)

Noise levels are NC-20: HVAC ON in normal mode

Data reported on 1 observation at 1 location at 04/01/23 @ 11:16.



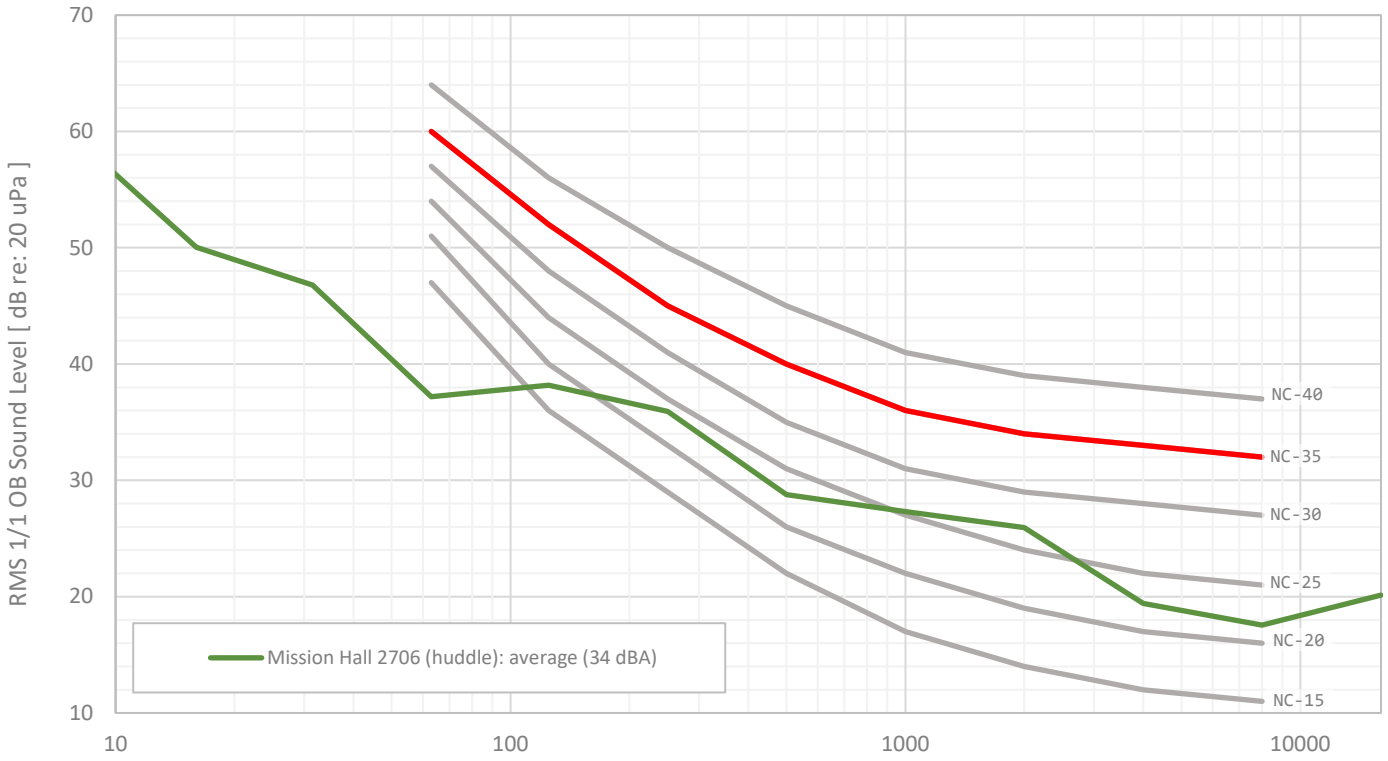
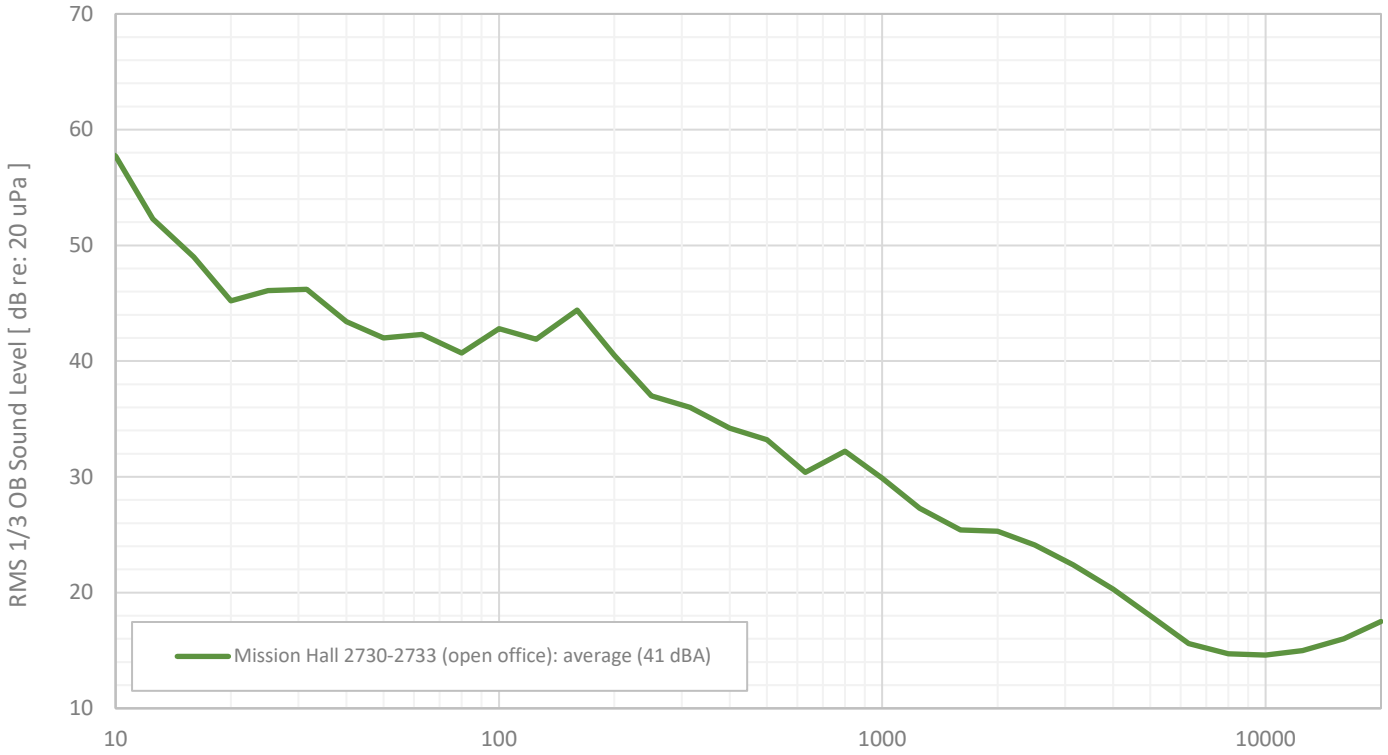


Figure B.9: Results from Mission Hall 2706 (huddle)

Noise levels are NC-27: HVAC ON in normal mode

Data reported on 1 observation at 1 location at 04/01/23 @ 11:17.



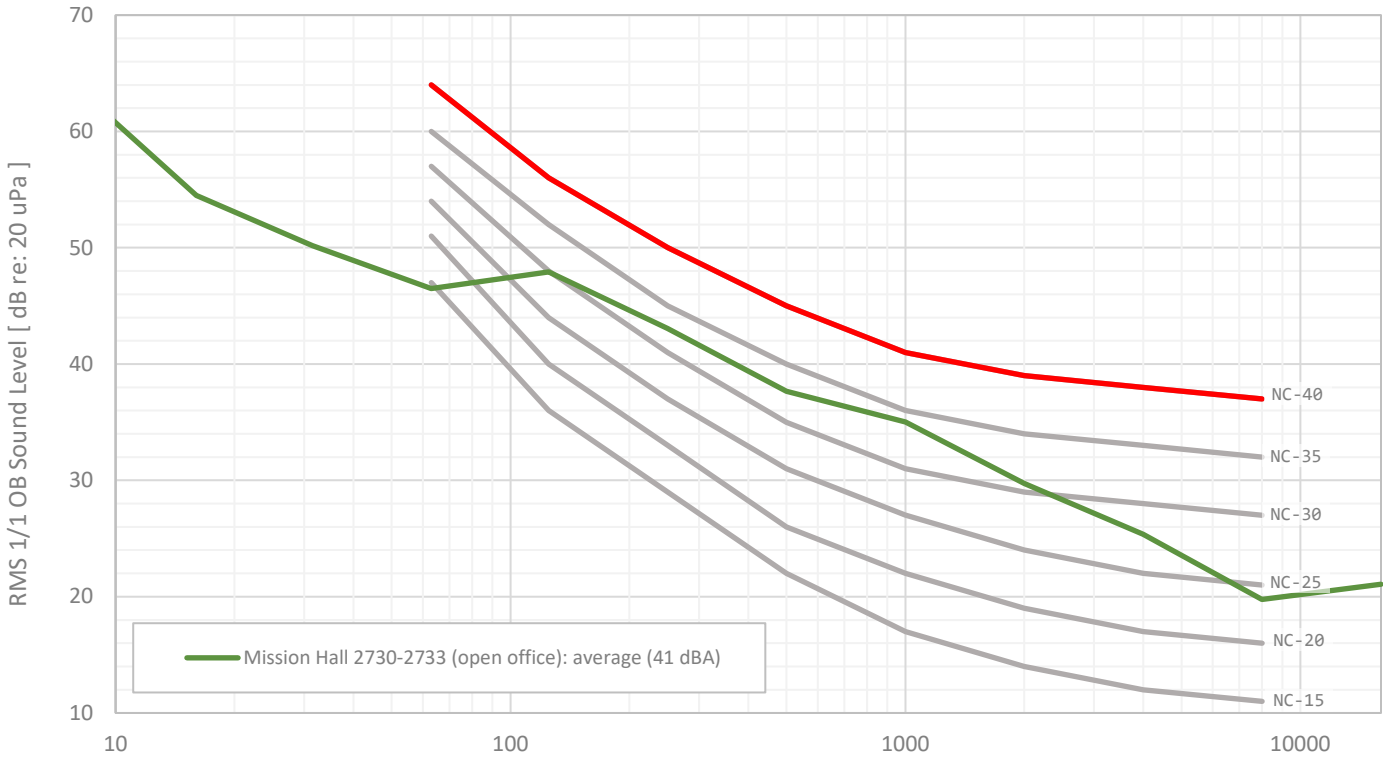


Figure B.10: Results from Mission Hall 2730-2733 (open office)

Noise levels are NC-34: HVAC ON in normal mode

Data reported on 1 observation at 1 location at 04/01/23 @ 11:08.

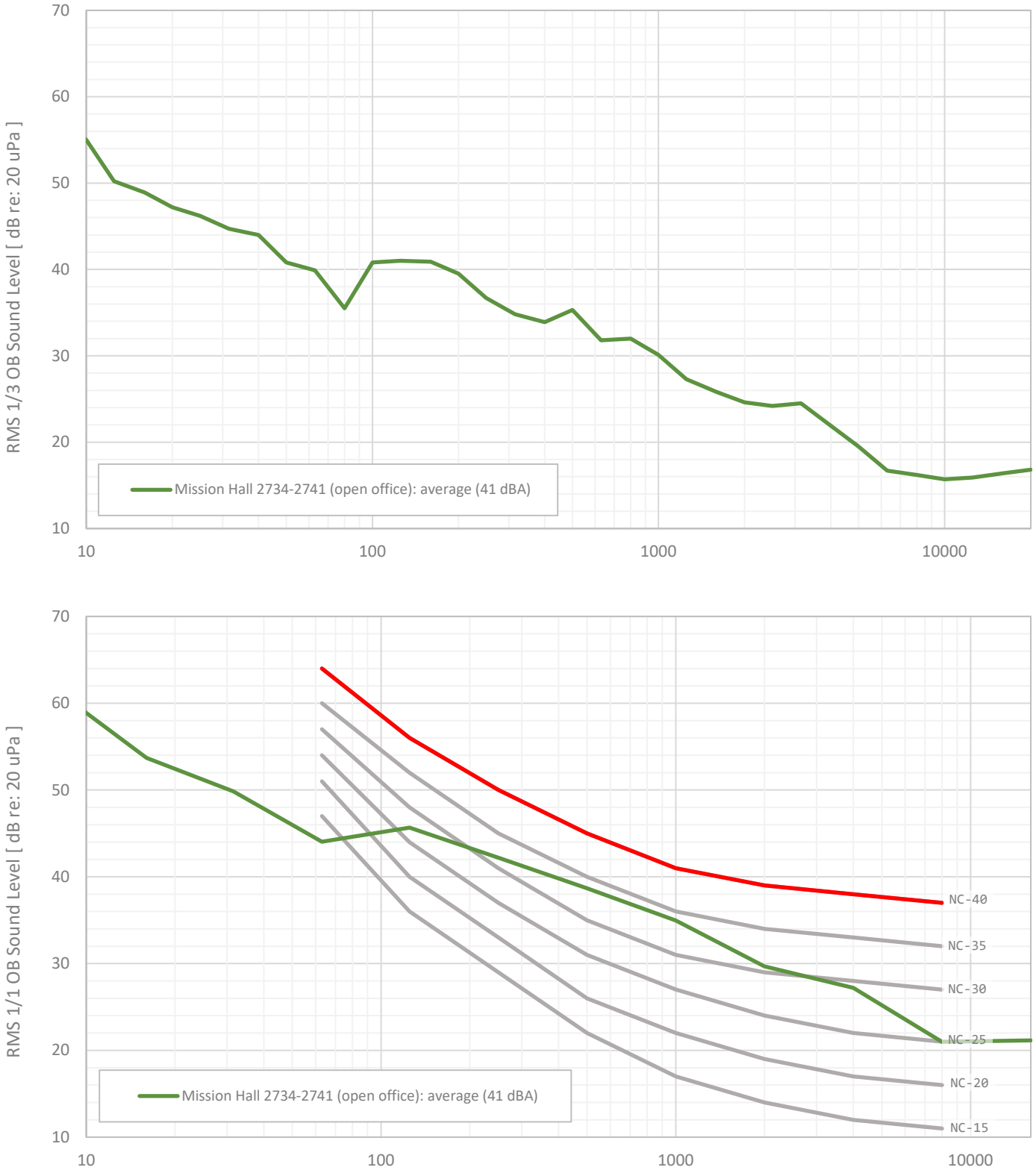
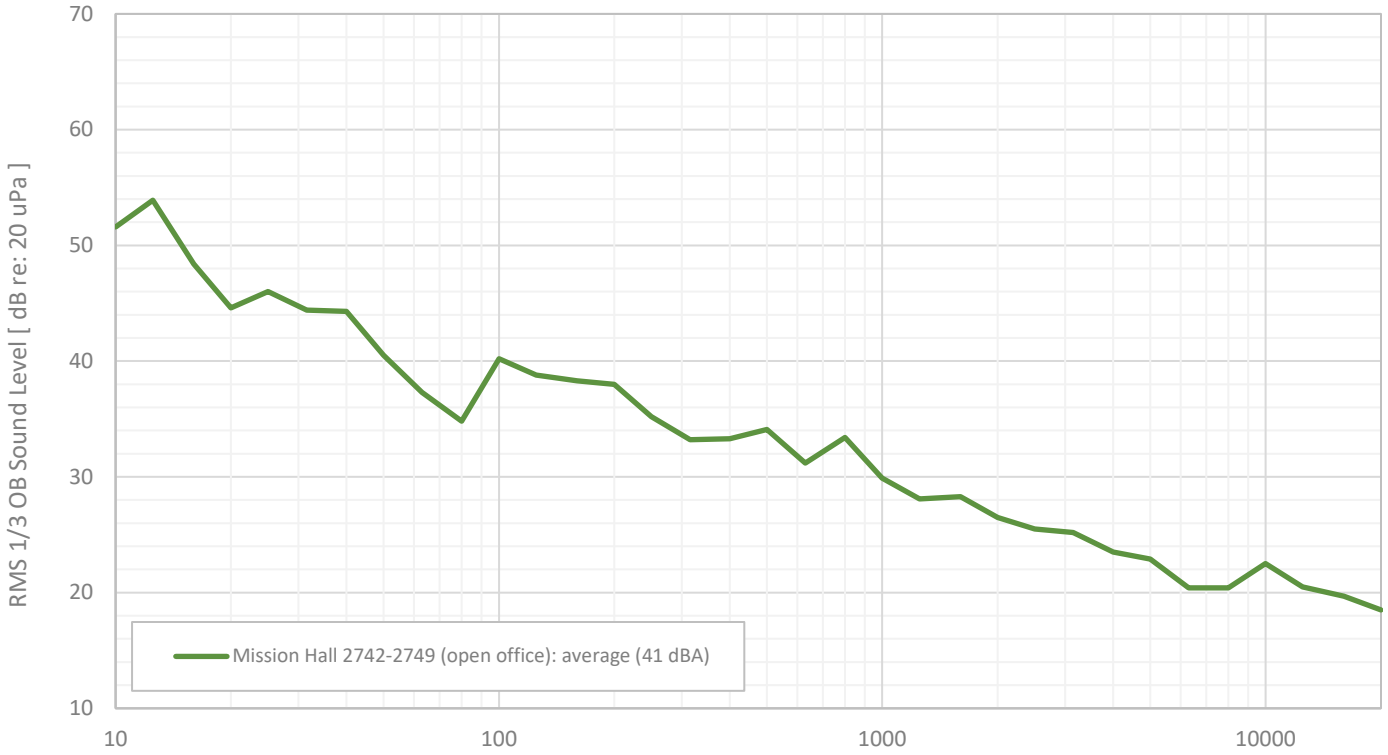


Figure B.11: Results from Mission Hall 2734-2741 (open office)

Noise levels are NC-34: HVAC ON in normal mode

Data reported on 1 observation at 1 location at 04/01/23 @ 11:09.



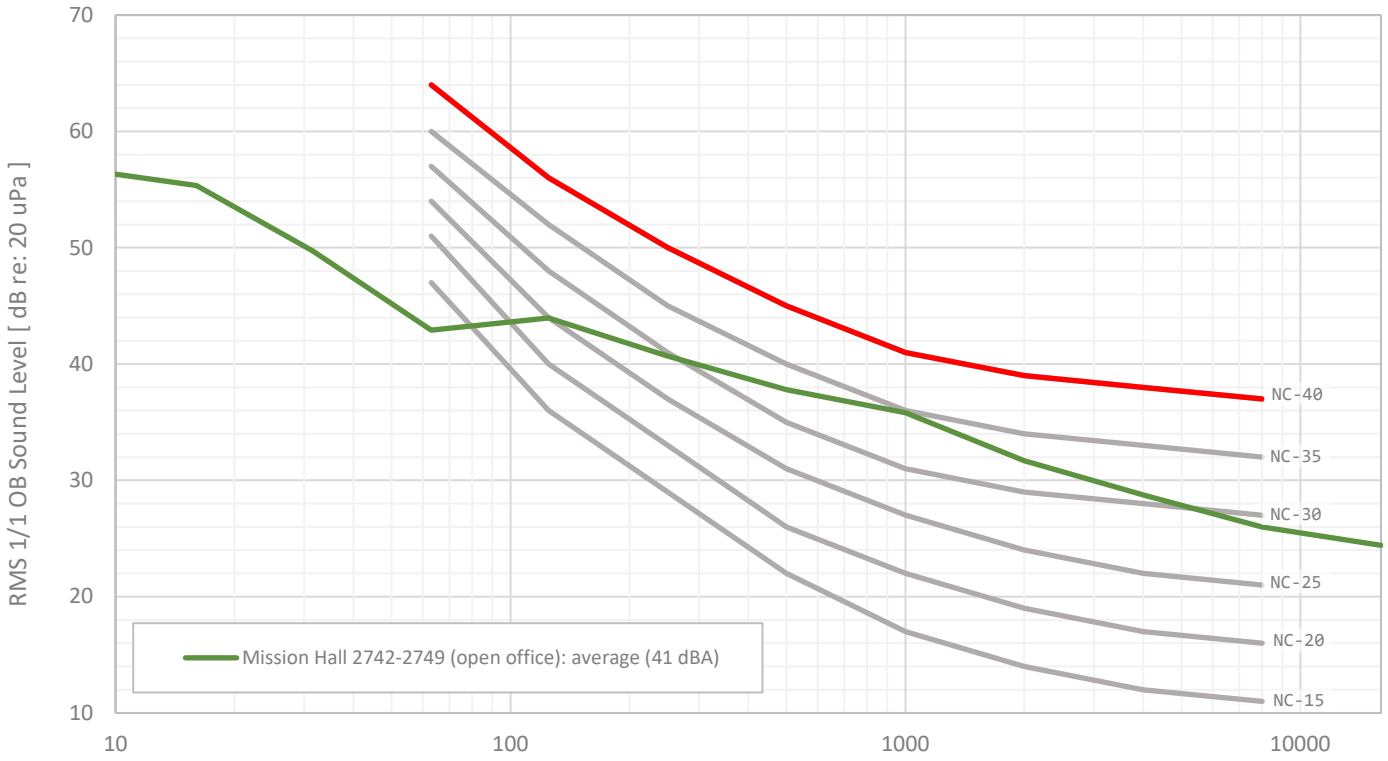
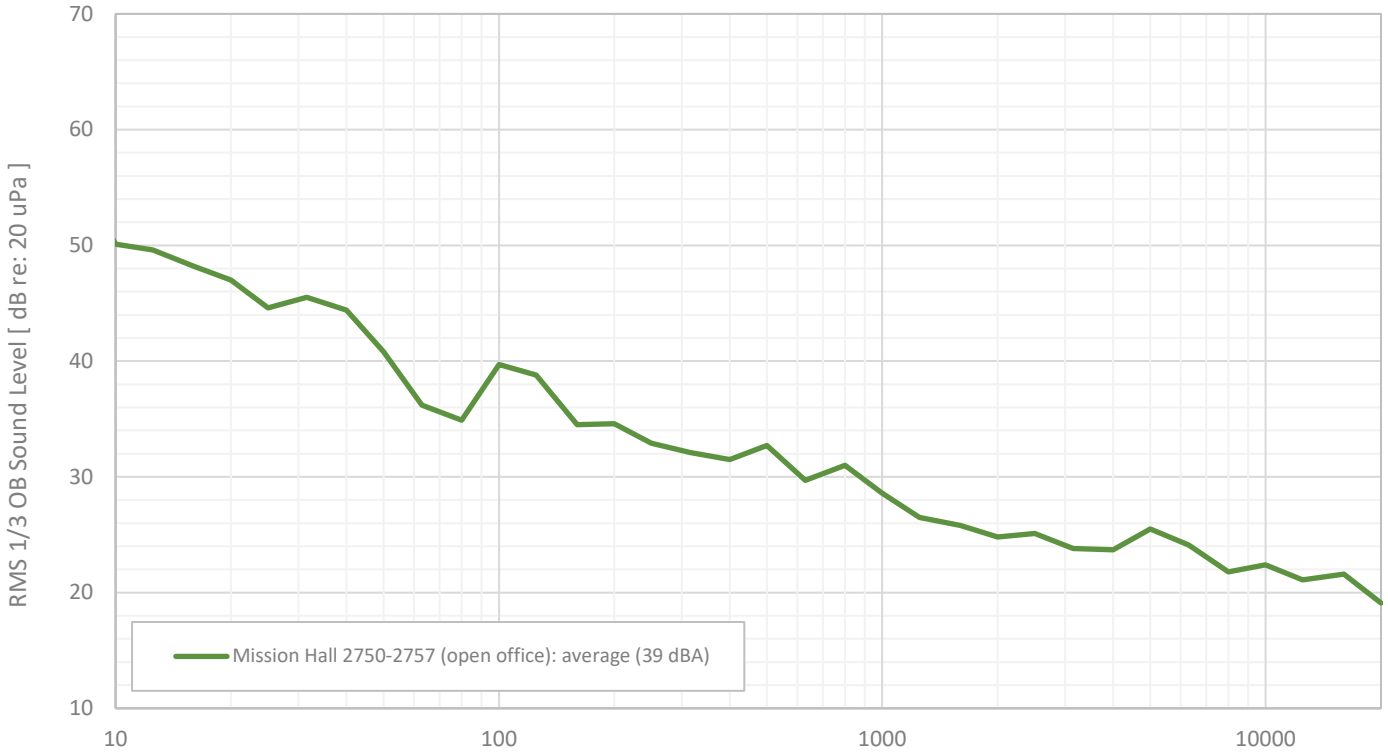


Figure B.12: Results from Mission Hall 2742-2749 (open office)

Noise levels are NC-35: HVAC ON in normal mode

Data reported on 1 observation at 1 location at 04/01/23 @ 11:11.



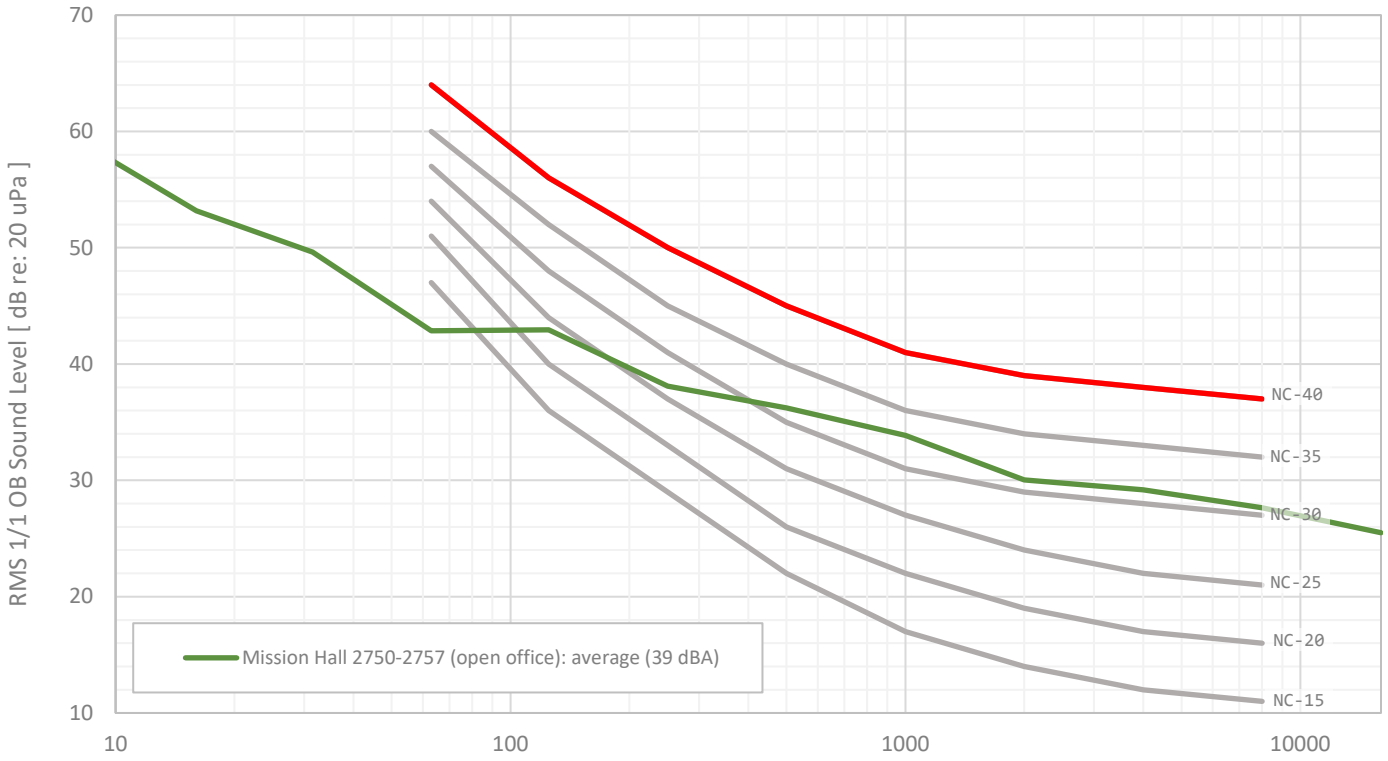


Figure B.13: Results from Mission Hall 2750-2757 (open office)

Noise levels are NC-33: HVAC ON in normal mode

Data reported on 1 observation at 1 location at 04/01/23 @ 11:12.

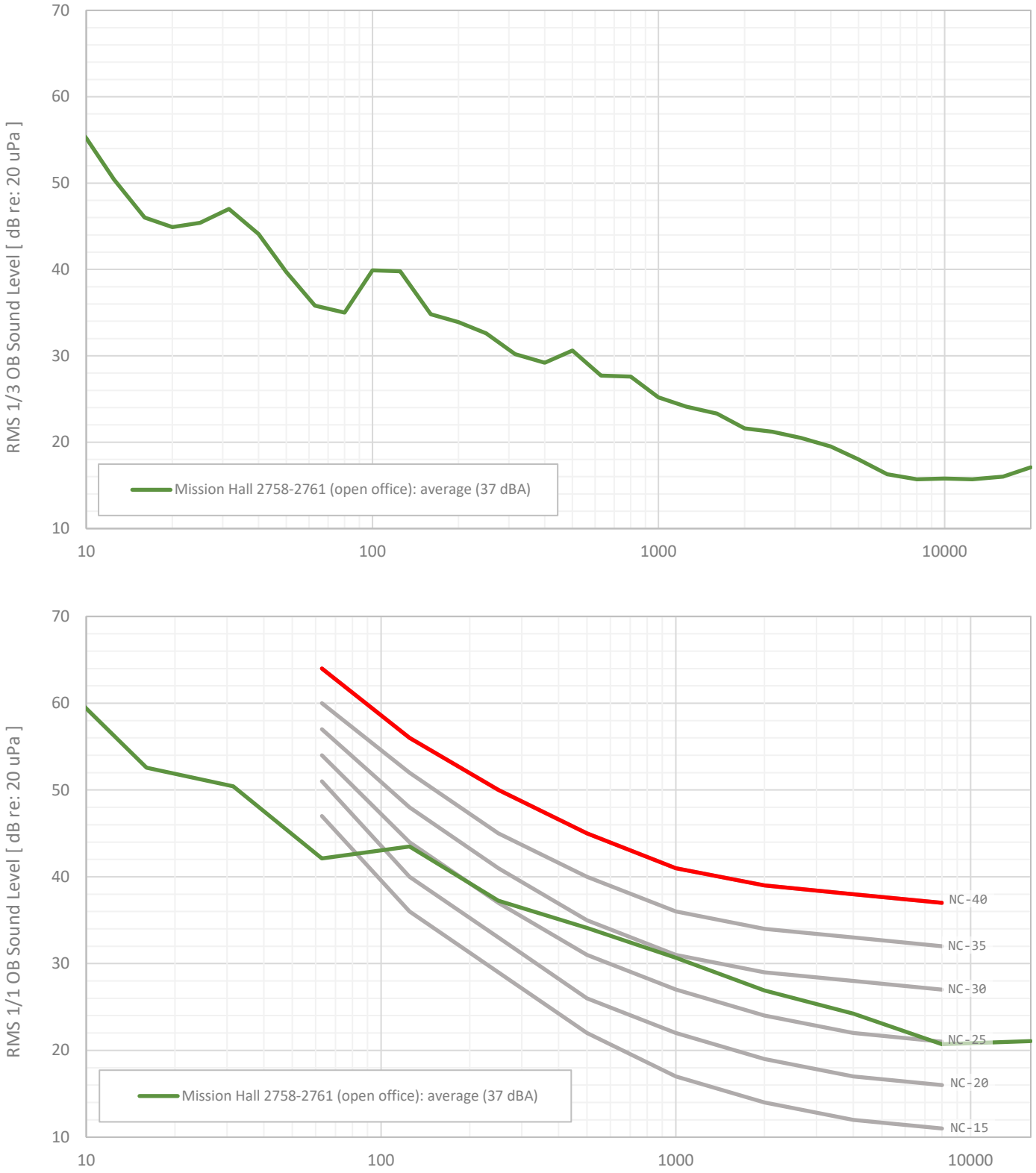
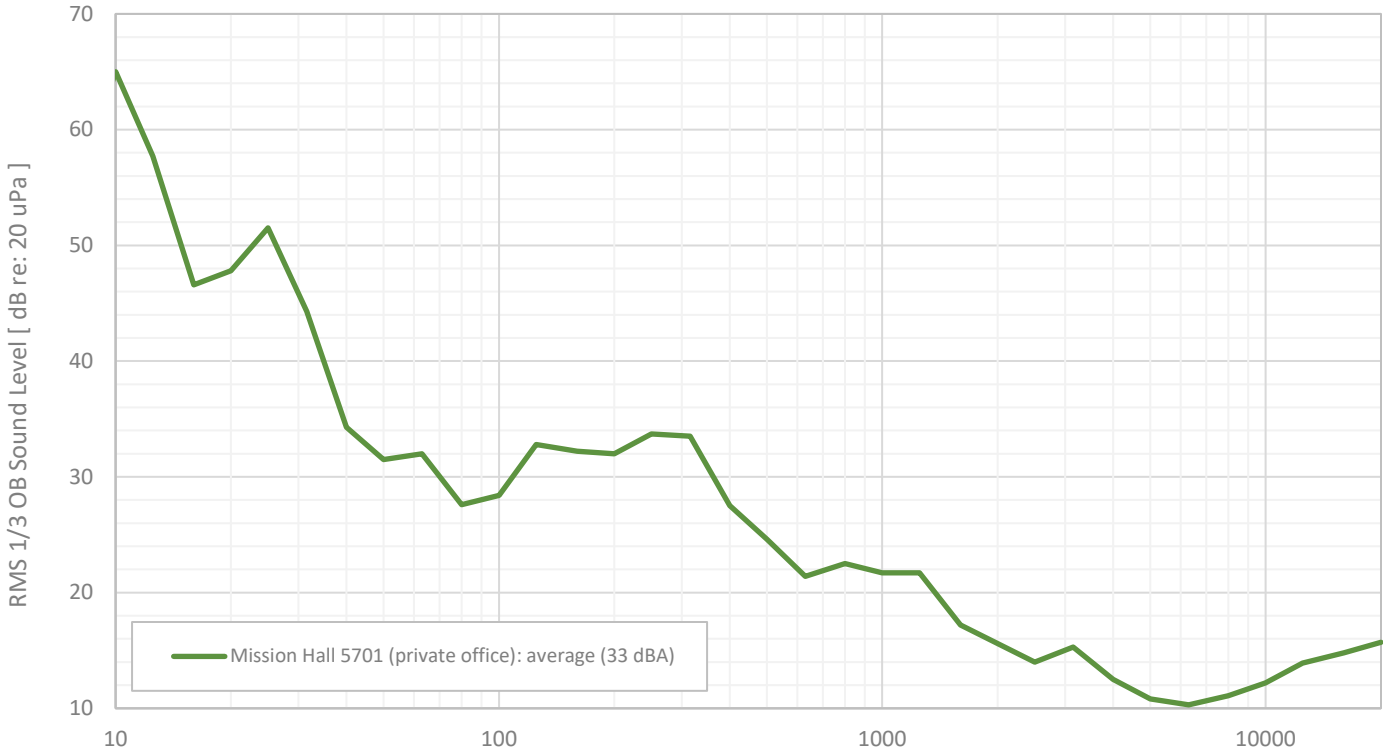


Figure B.14: Results from Mission Hall 2758-2761 (open office)

Noise levels are NC-30: HVAC ON in normal mode

Data reported on 1 observation at 1 location at 04/01/23 @ 11:13.



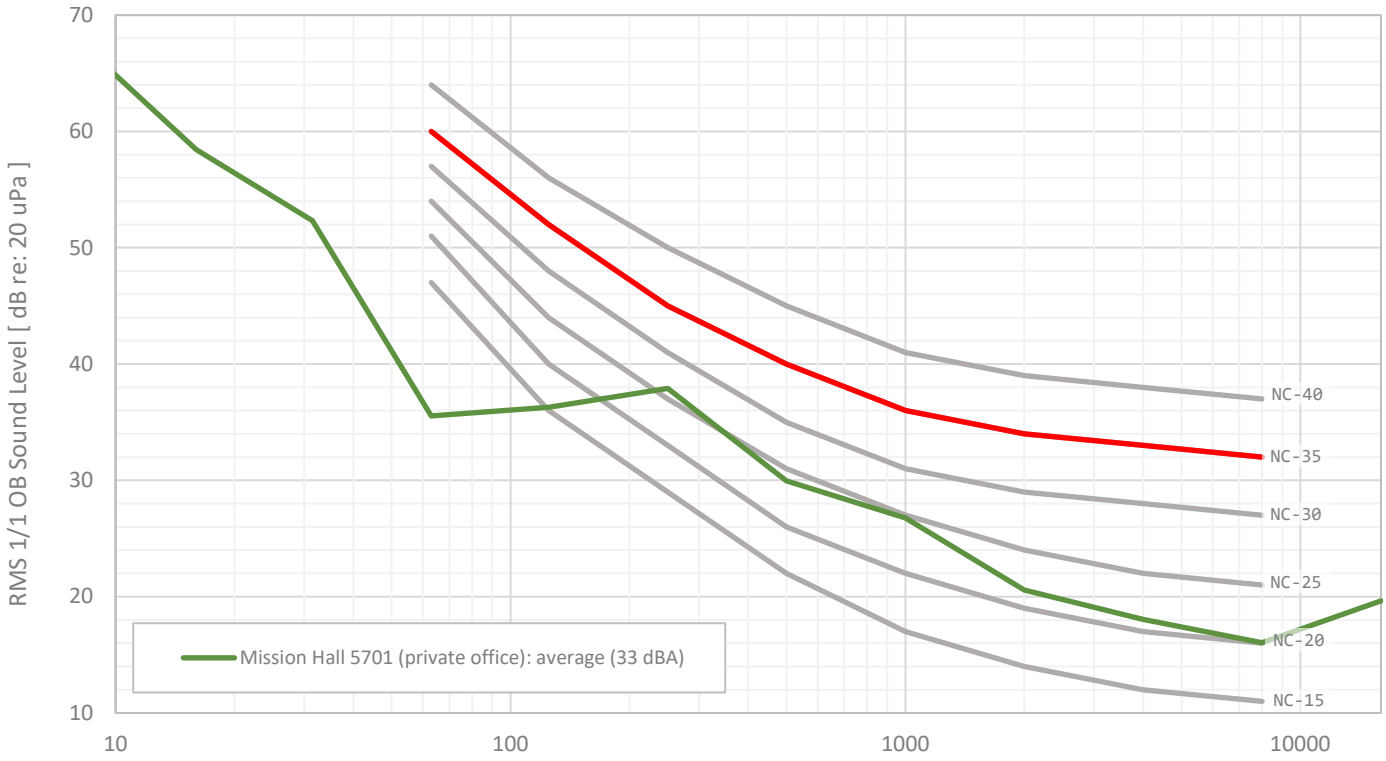
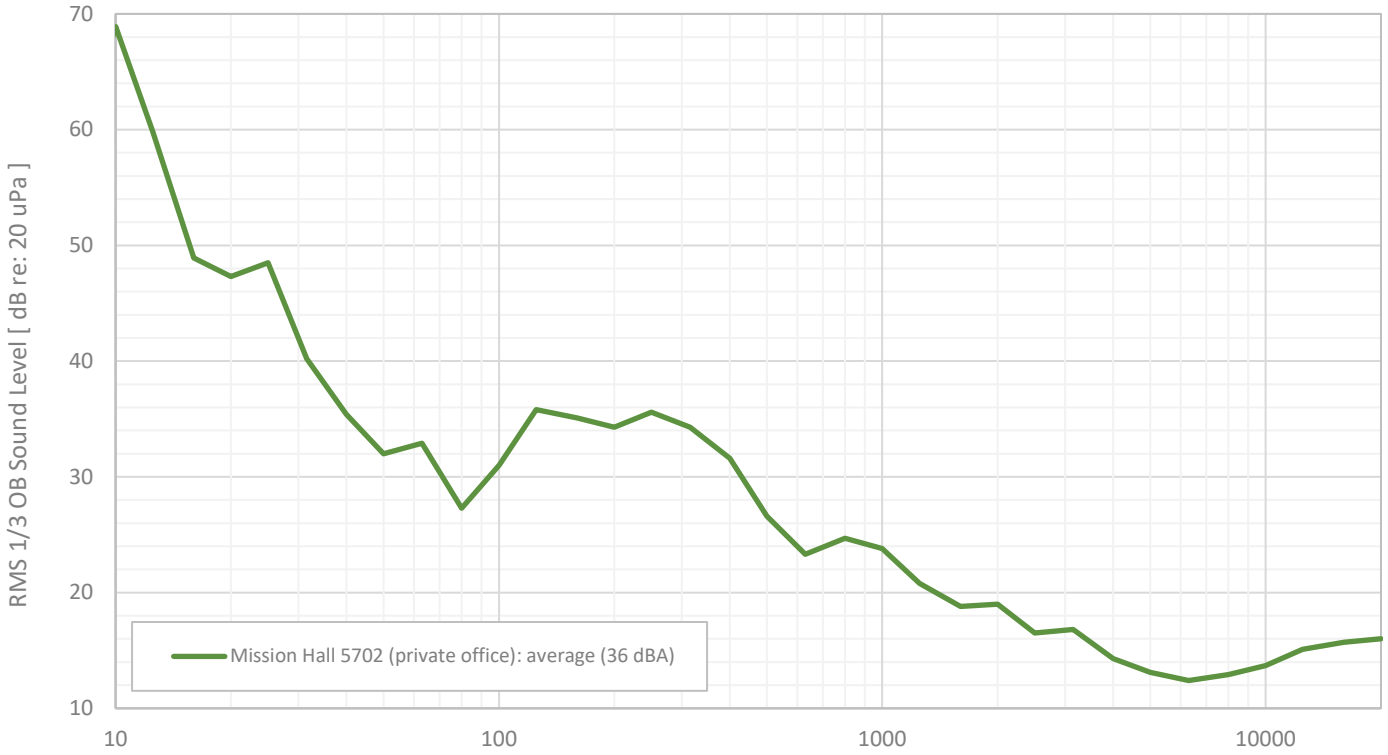


Figure B.15: Results from Mission Hall 5701 (private office)

Noise levels are NC-26: sound masking very quiet and sounds "hissy", HVAC OFF

Data reported on 1 observation at 1 location at 04/01/23 @ 10:11.



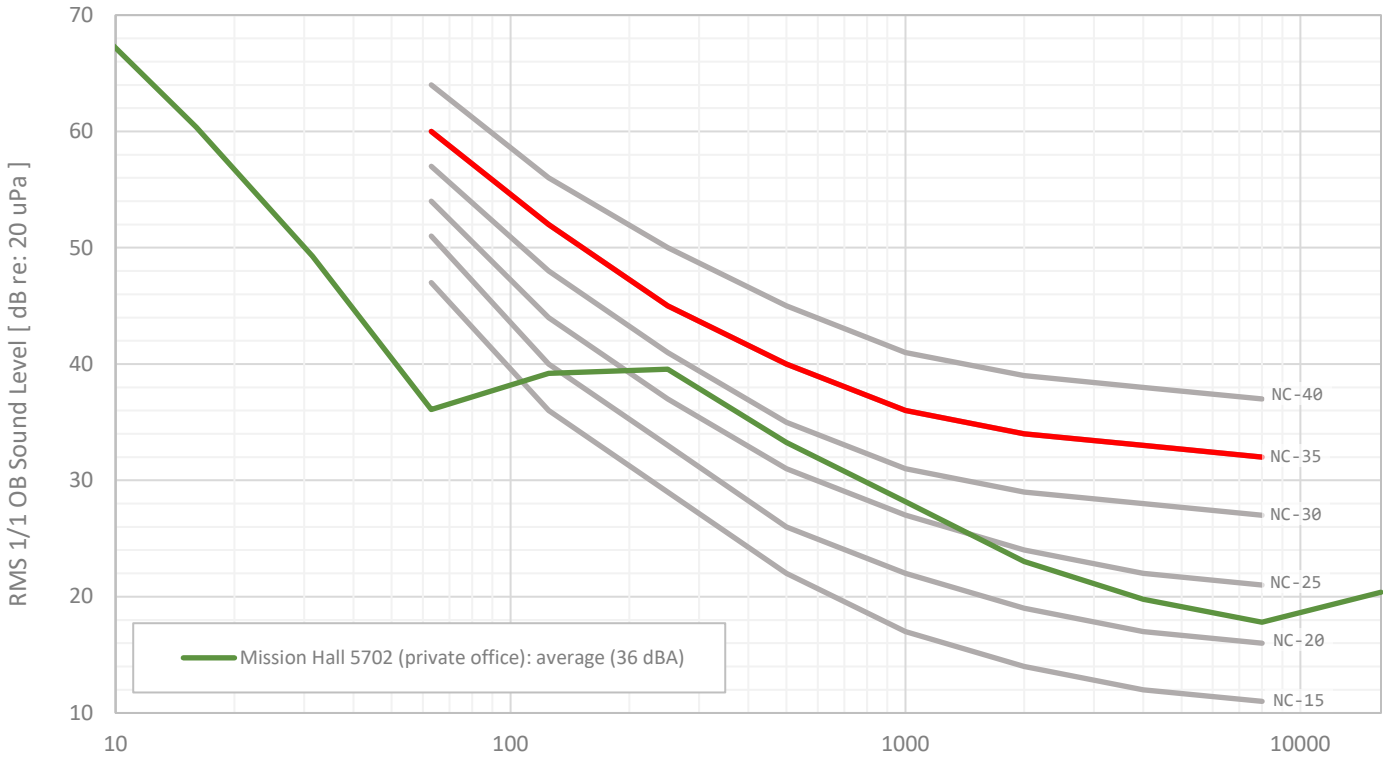
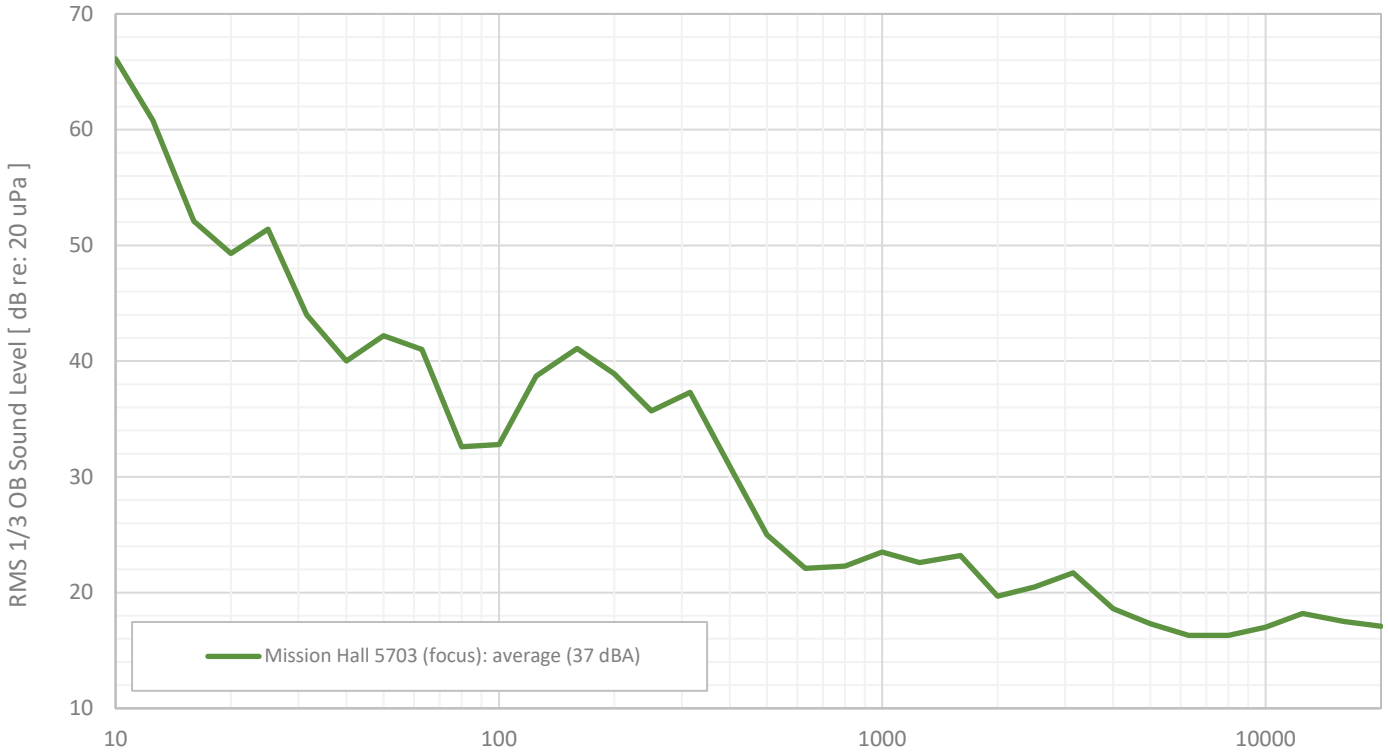


Figure B.16: Results from Mission Hall 5702 (private office)

Noise levels are NC-29: sound masking very quiet and sounds "hissy", HVAC OFF

Data reported on 1 observation at 1 location at 04/01/23 @ 10:12.



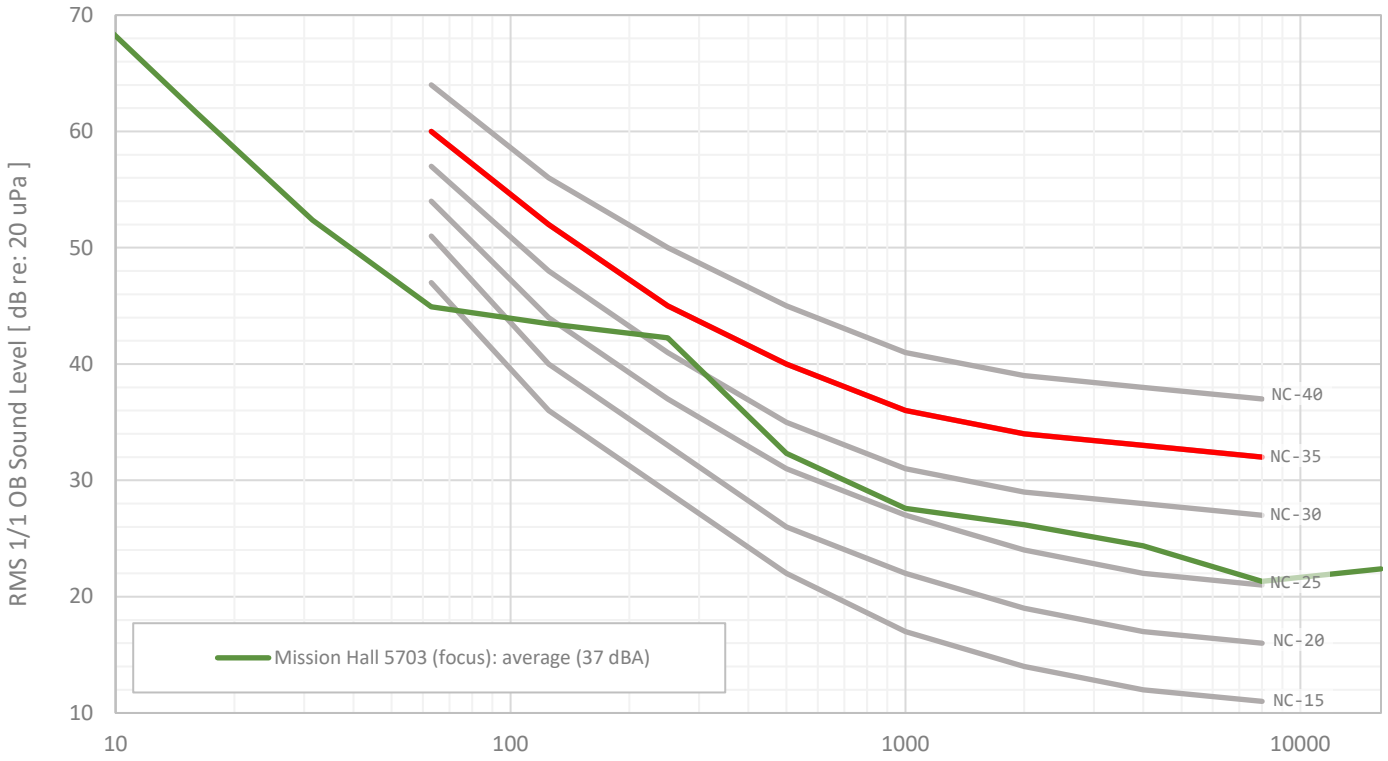
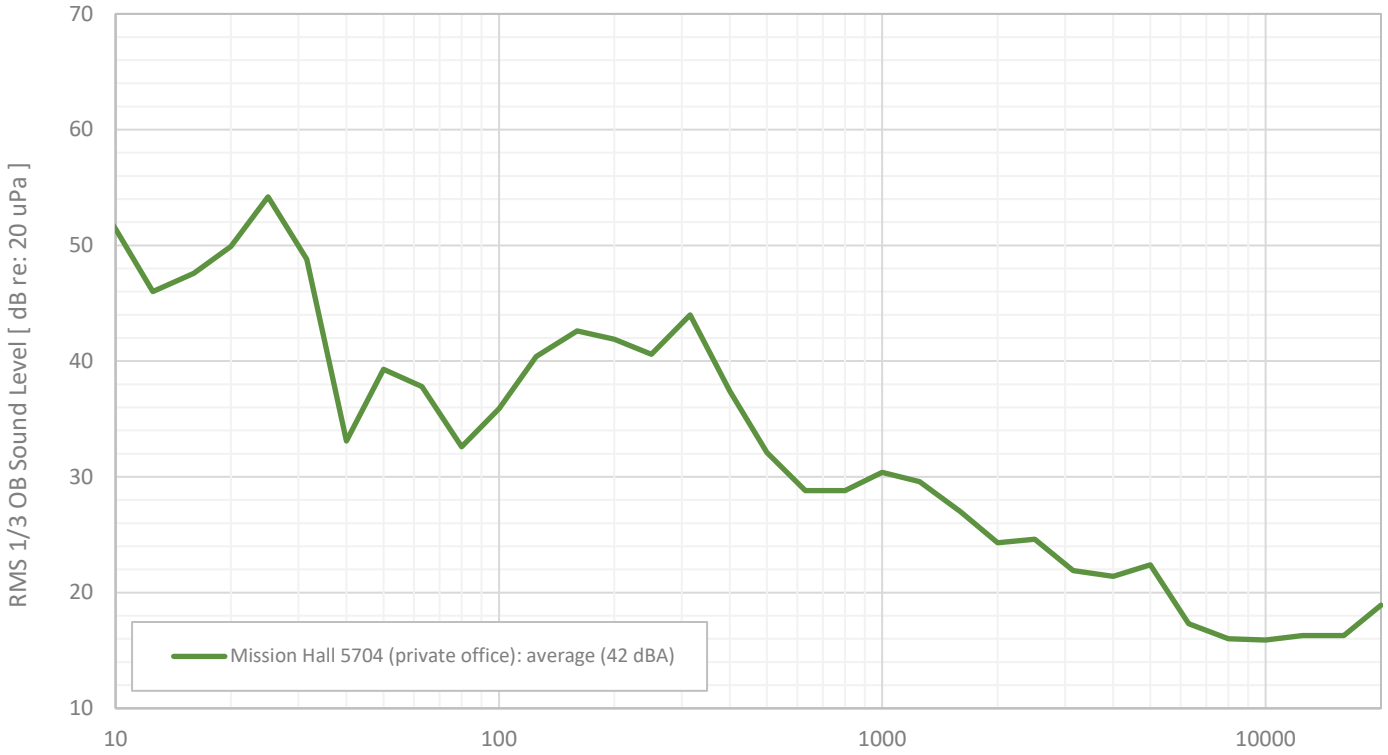


Figure B.17: Results from Mission Hall 5703 (focus)

Noise levels are NC-31: sound masking very quiet and sounds "hissy", HVAC OFF

Data reported on 1 observation at 1 location at 04/01/23 @ 10:13.



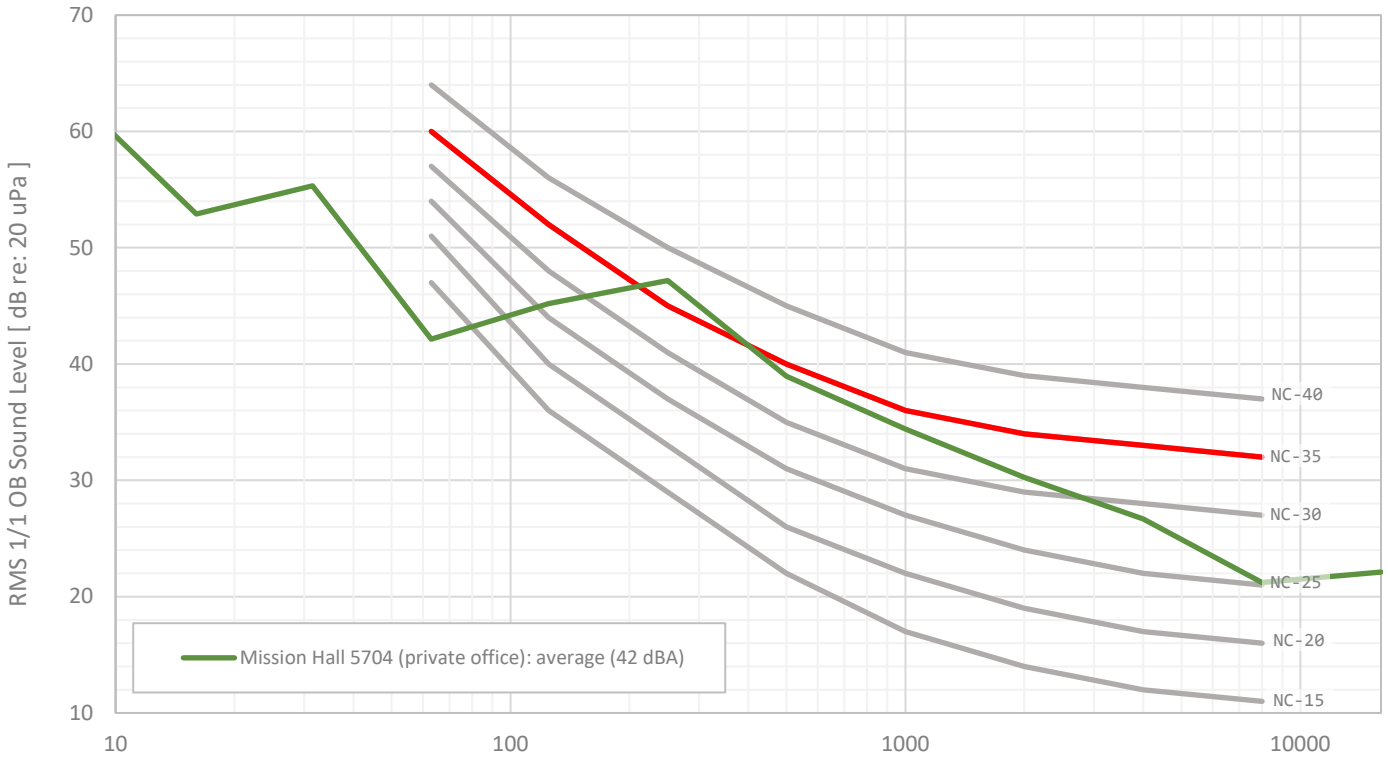


Figure B.18: Results from Mission Hall 5704 (private office)

Noise levels are NC-37: sound masking very quiet, floor vent very dominant

Data reported on 1 observation at 1 location at 04/01/23 @ 10:21.

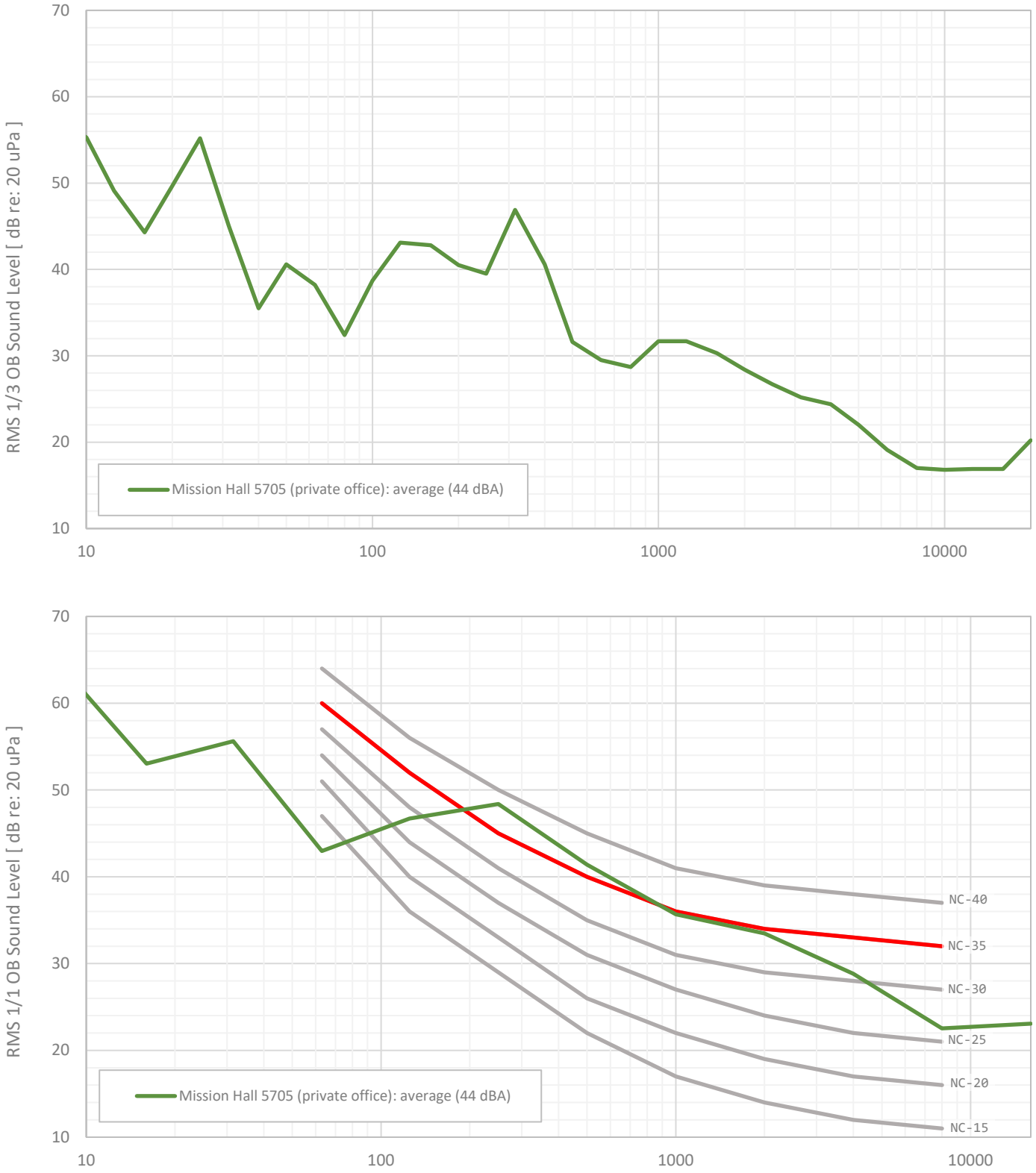
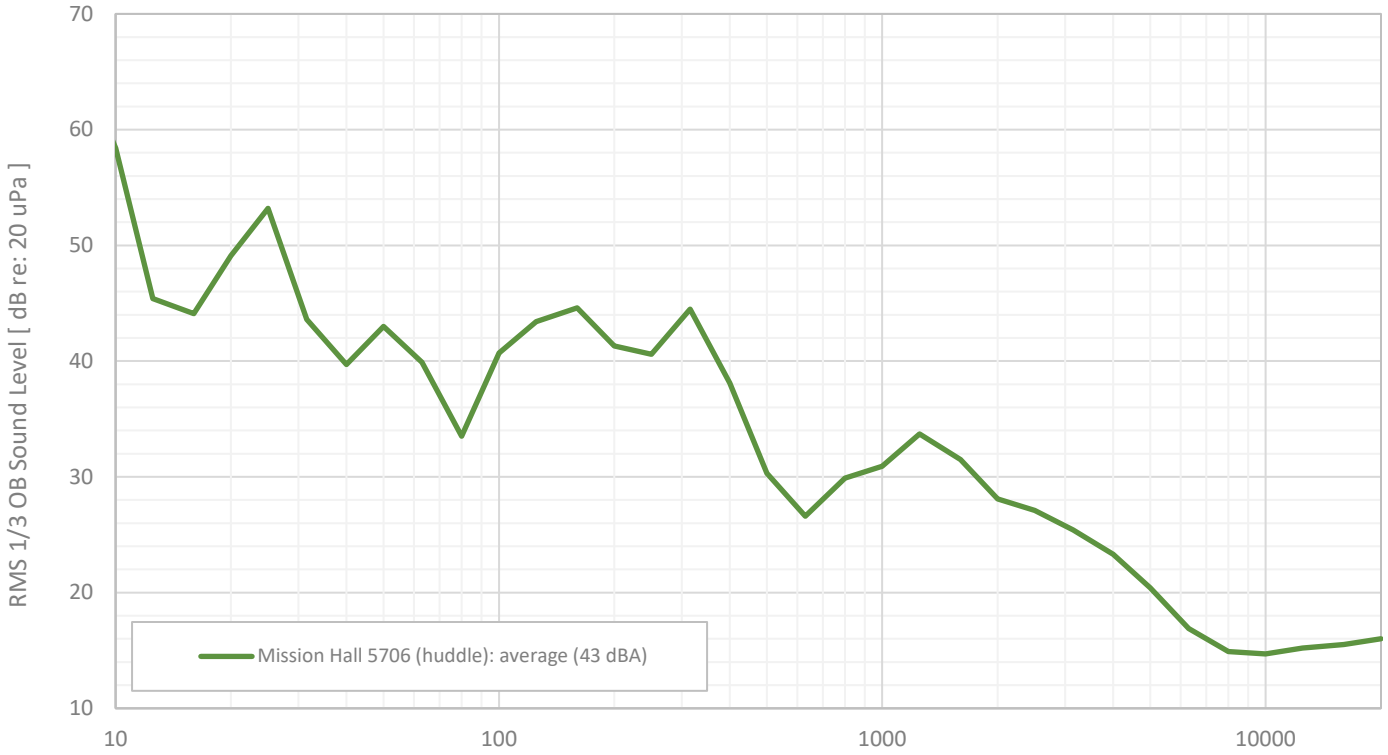


Figure B.19: Results from Mission Hall 5705 (private office)

Noise levels are NC-38: sound masking very quiet, floor vent very dominant

Data reported on 1 observation at 1 location at 04/01/23 @ 10:21.



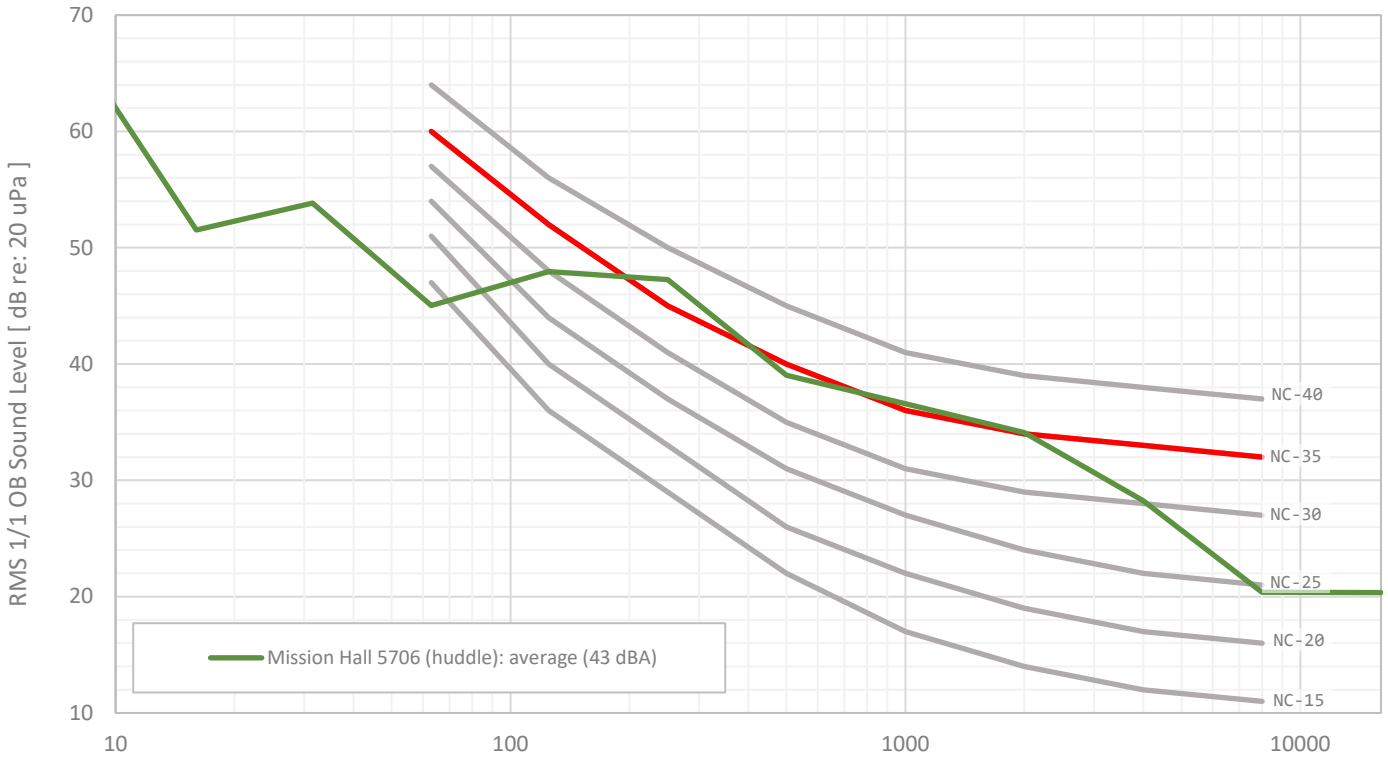
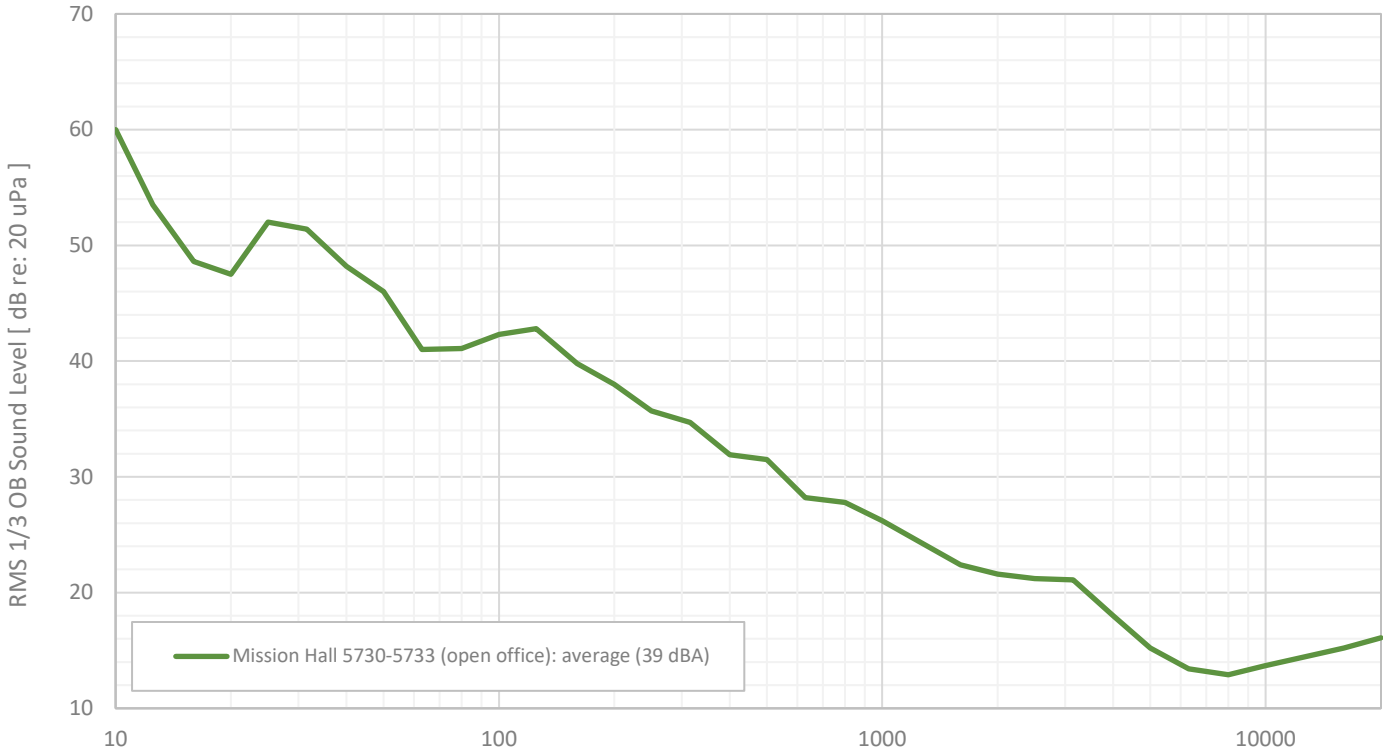


Figure B.20: Results from Mission Hall 5706 (huddle)

Noise levels are NC-37: sound masking very quiet, floor vent very dominant

Data reported on 1 observation at 1 location at 04/01/23 @ 10:22.



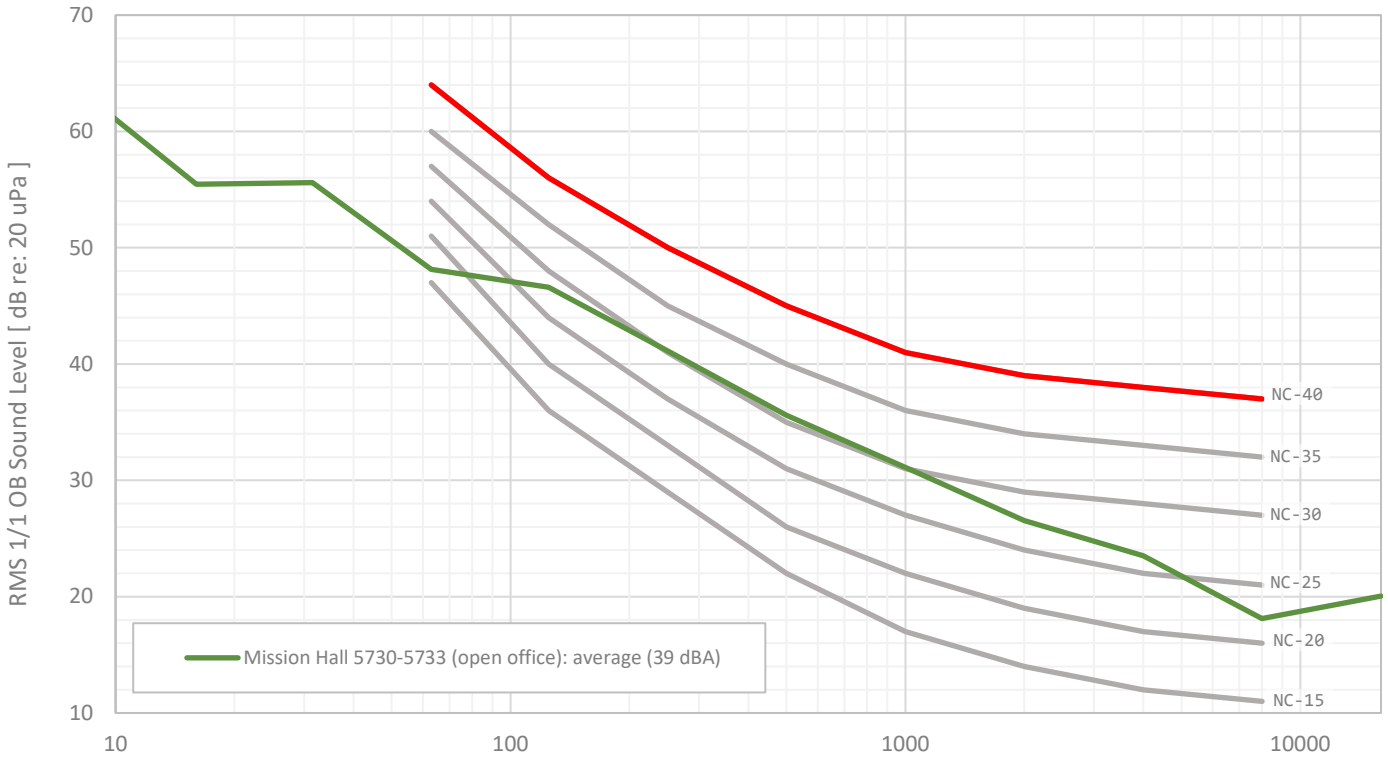
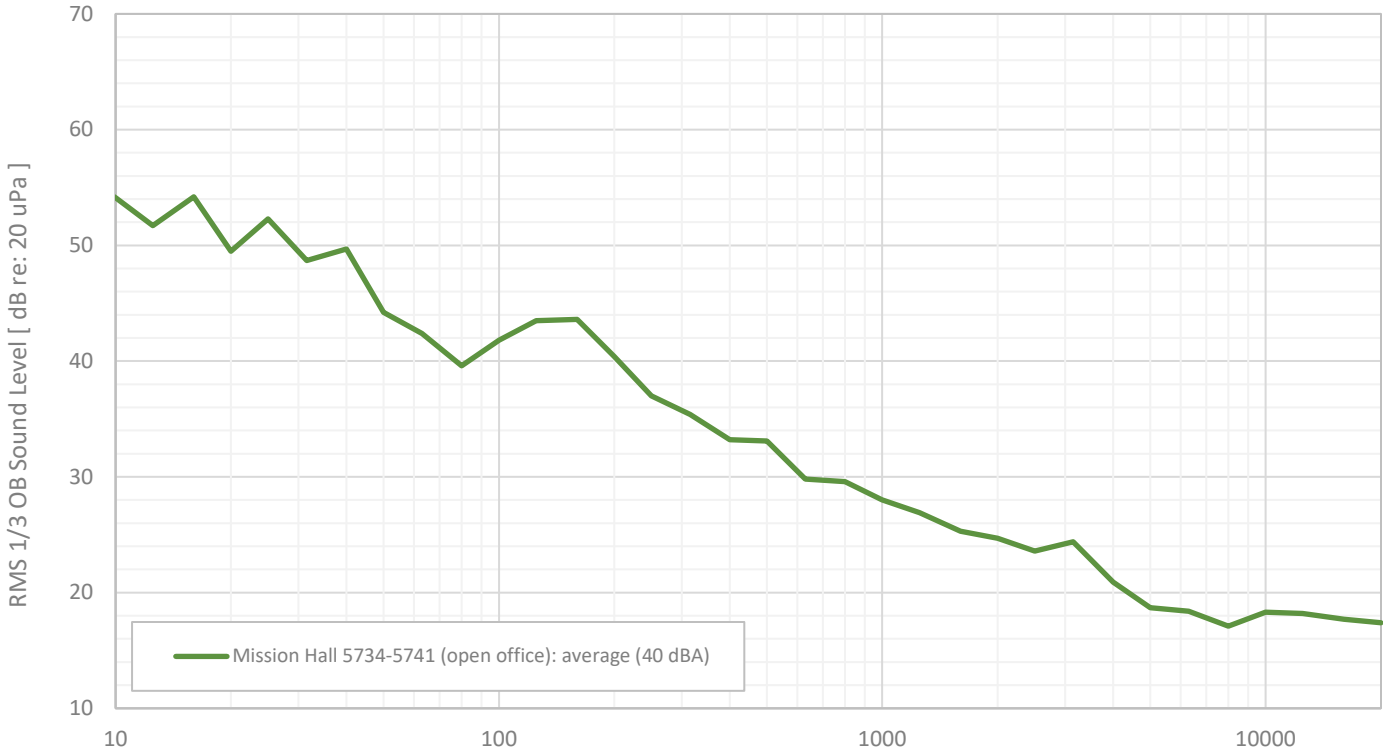


Figure B.21: Results from Mission Hall 5730-5733 (open office)

Noise levels are NC-31: sound masking very quiet and sounds "hissy", HVAC OFF except for UFT-520 by 5761

Data reported on 1 observation at 1 location at 04/01/23 @ 10:14.



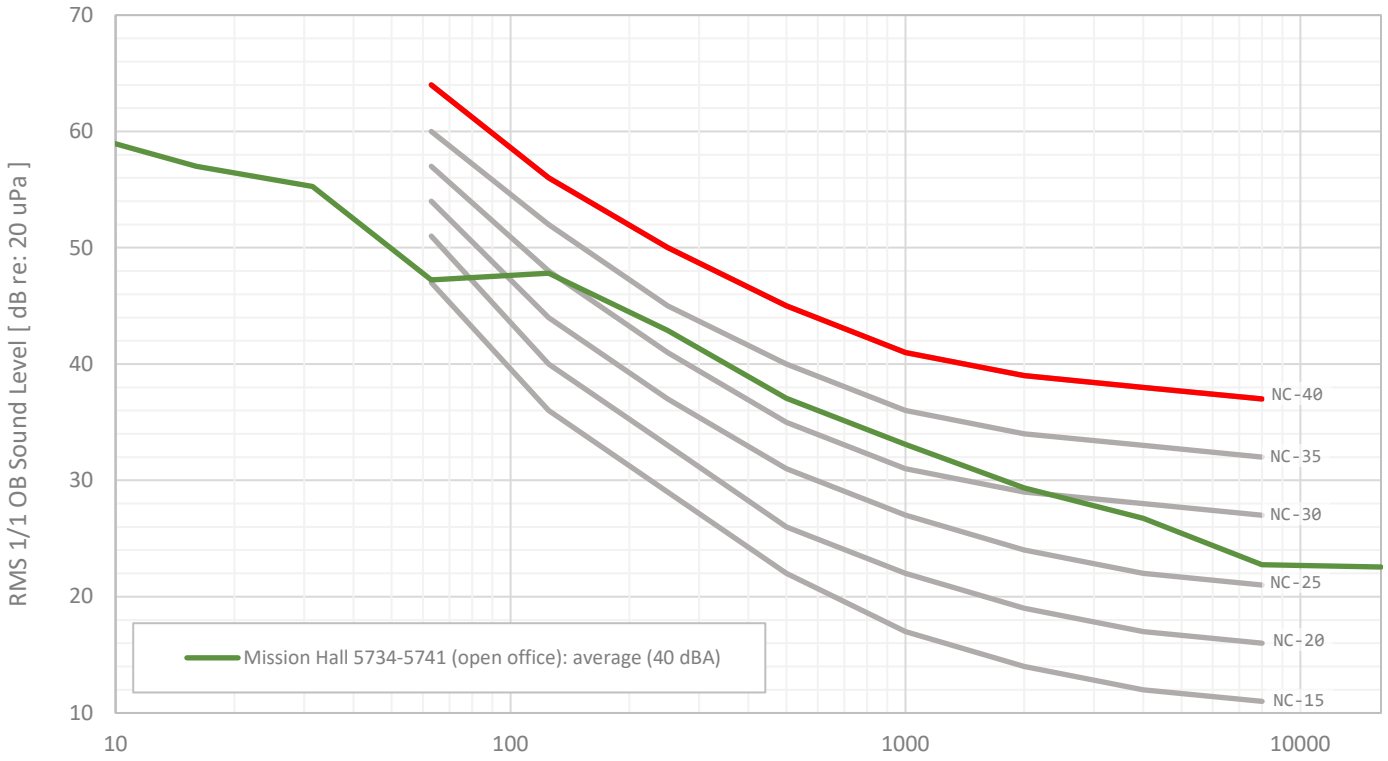
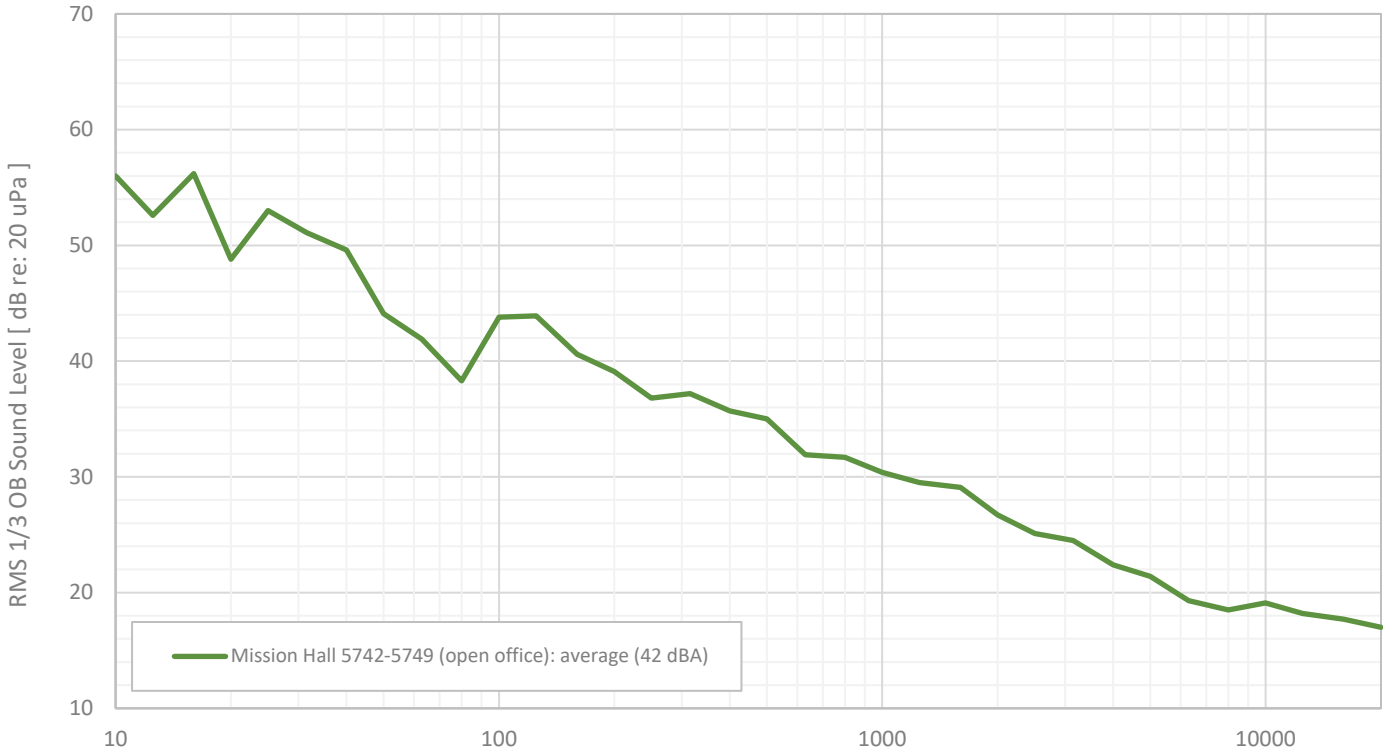


Figure B.22: Results from Mission Hall 5734-5741 (open office)

Noise levels are NC-33: sound masking very quiet and sounds "hissy", HVAC OFF except for UFT-520 by 5761

Data reported on 1 observation at 1 location at 04/01/23 @ 10:16.



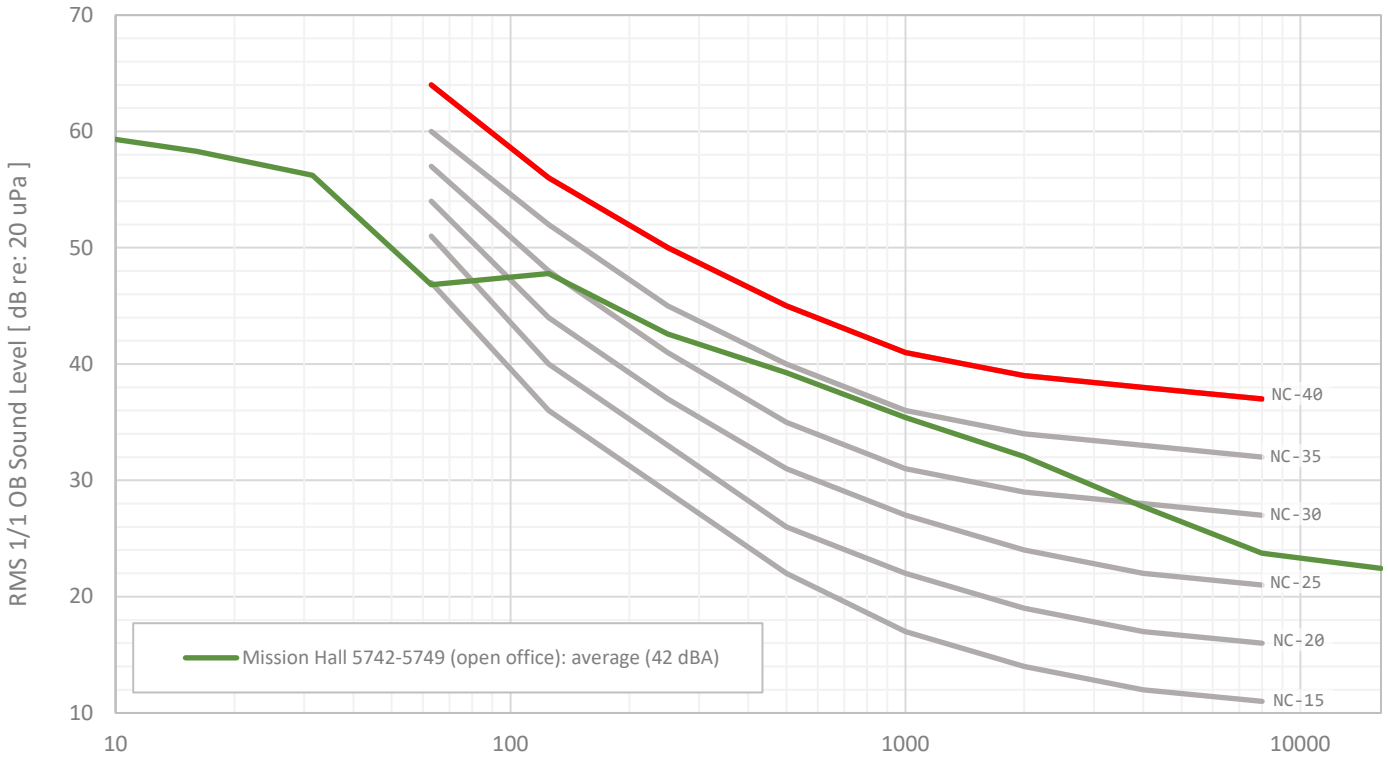
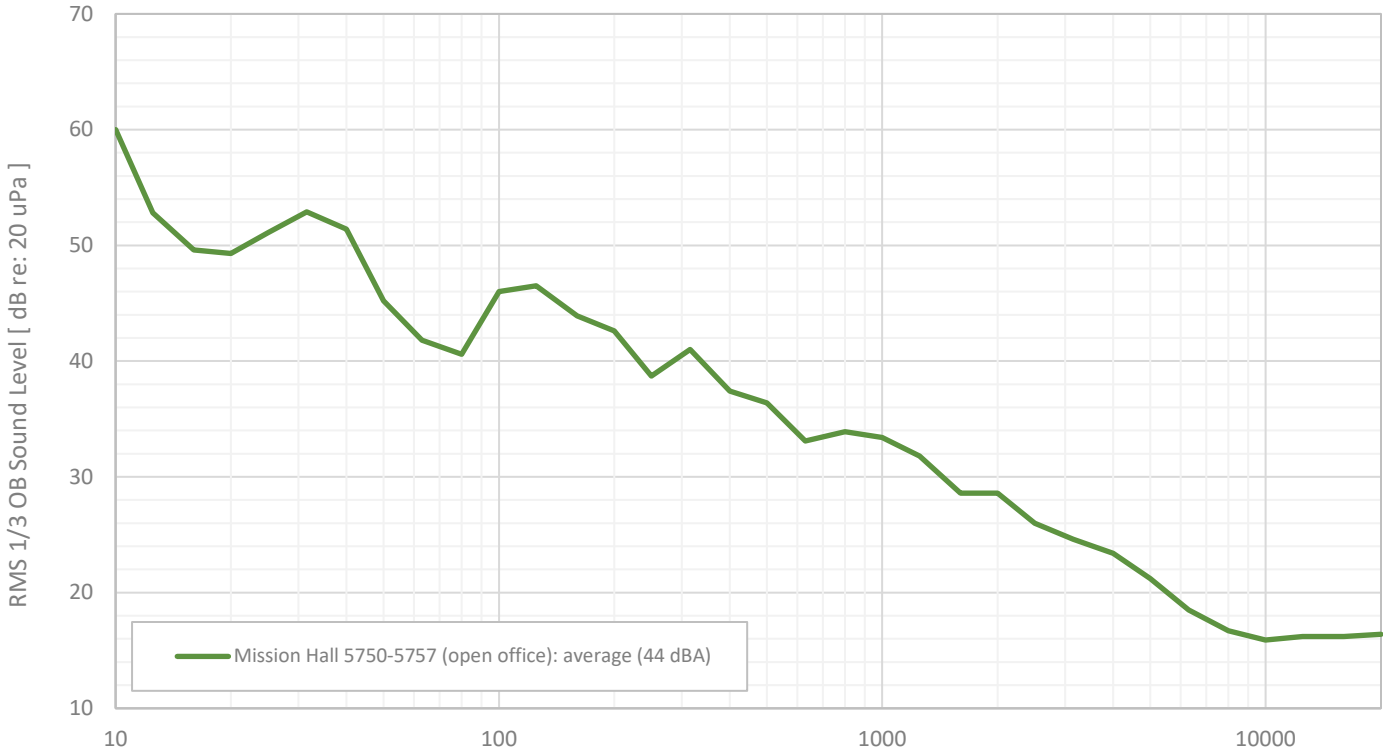


Figure B.23: Results from Mission Hall 5742-5749 (open office)

Noise levels are NC-34: sound masking very quiet and sounds "hissy", HVAC OFF except for UFT-520 by 5761

Data reported on 1 observation at 1 location at 04/01/23 @ 10:17.



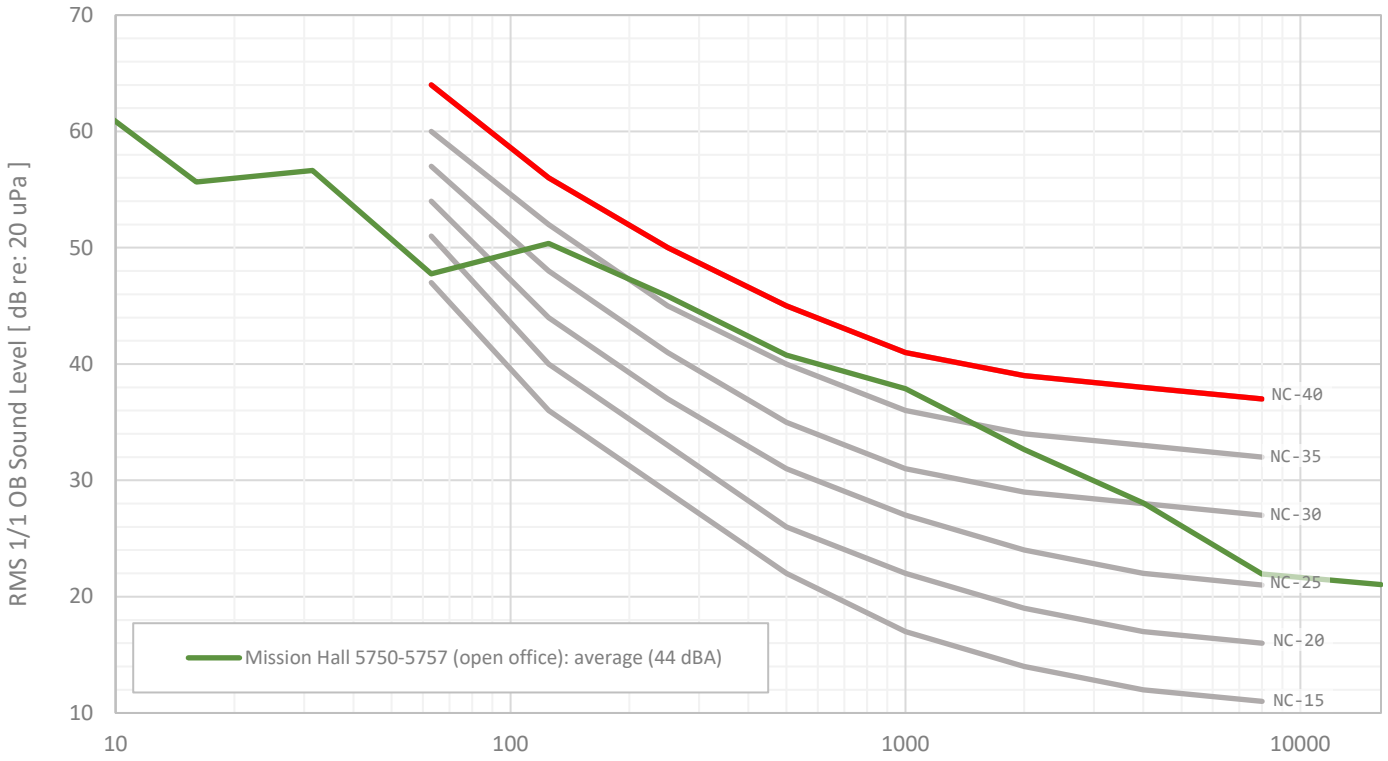


Figure B.24: Results from Mission Hall 5750-5757 (open office)

Noise levels are NC-37: sound masking very quiet and sounds "hissy", HVAC OFF except for UFT-520 by 5761

Data reported on 1 observation at 1 location at 04/01/23 @ 10:18.

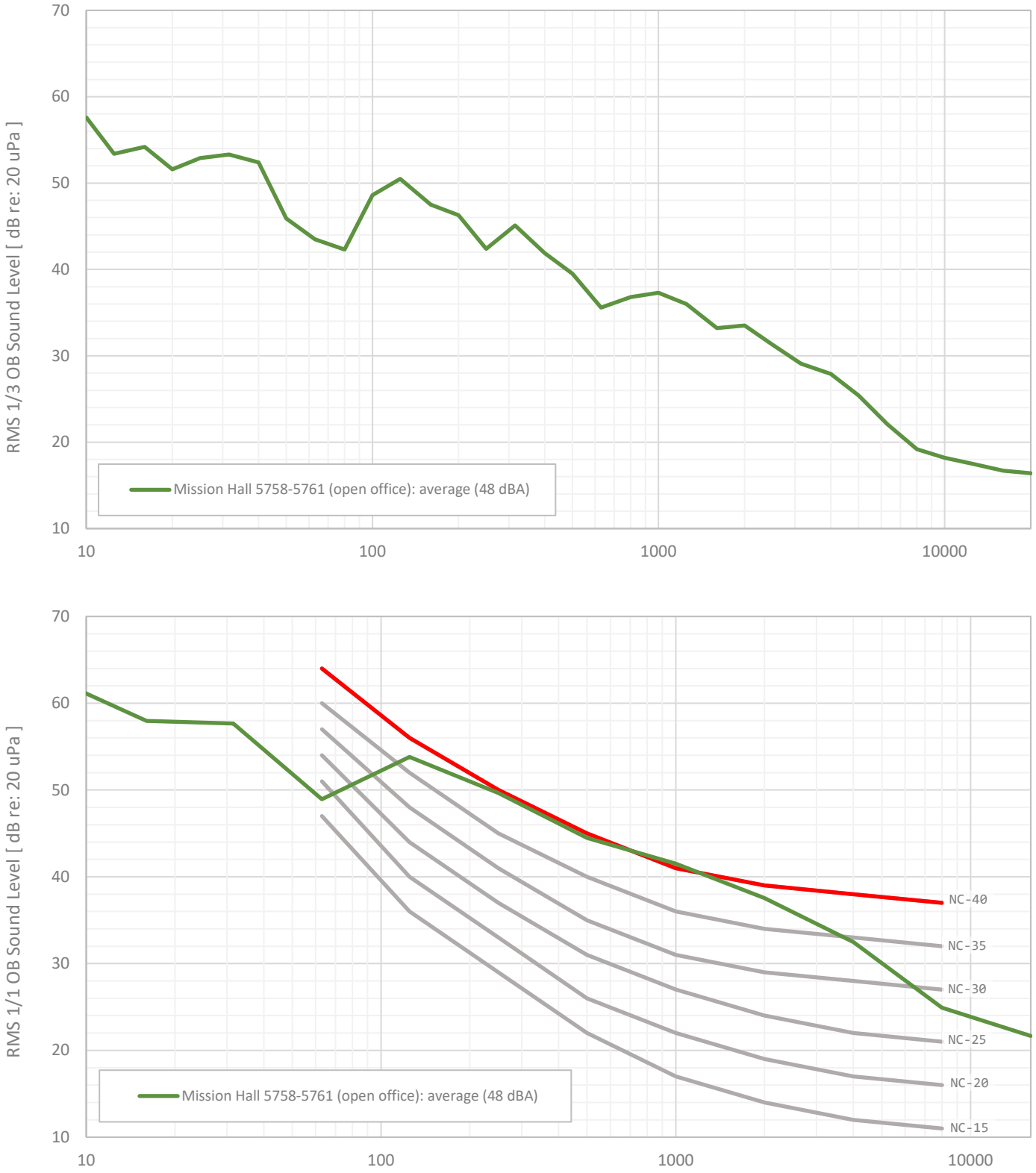


Figure B.25: Results from Mission Hall 5758-5761 (open office)

Noise levels are NC-41: sound masking sounds "hissy"; floor vents very dominant, especially at -61 and -60

Data reported on 1 observation at 1 location at 04/01/23 @ 10:19.

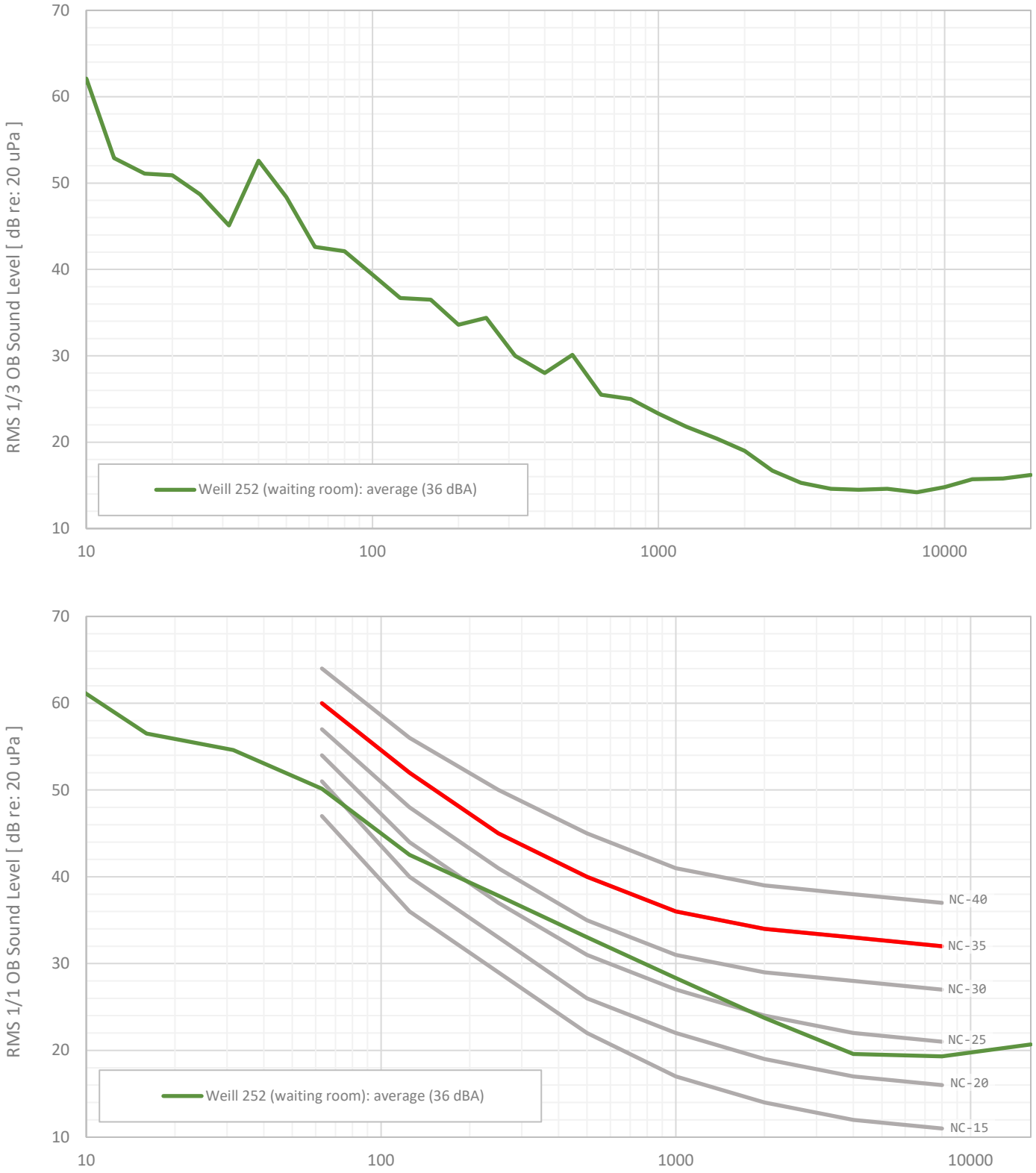


Figure B.26: Results from Weill 252 (waiting room)

Noise levels are NC-28: HVAC Normal; sweep through entire waiting room seating area

Data reported on 1 observation at 1 location at 04/01/23 @ 13:23.

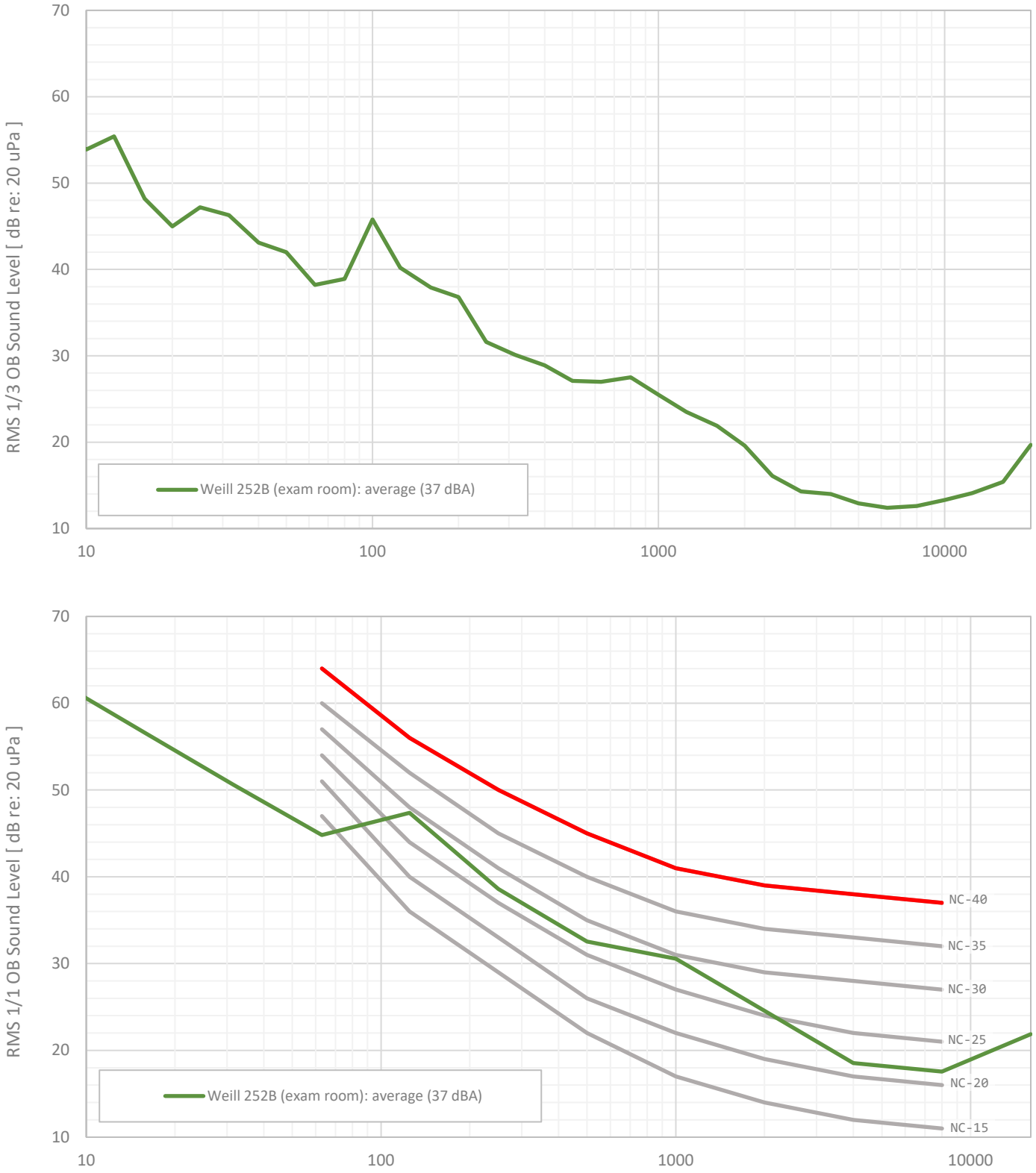


Figure B.27: Results from Weill 252B (exam room)

Noise levels are NC-30: HVAC Normal

Data reported on 1 observation at 1 location at 04/01/23 @ 13:04.

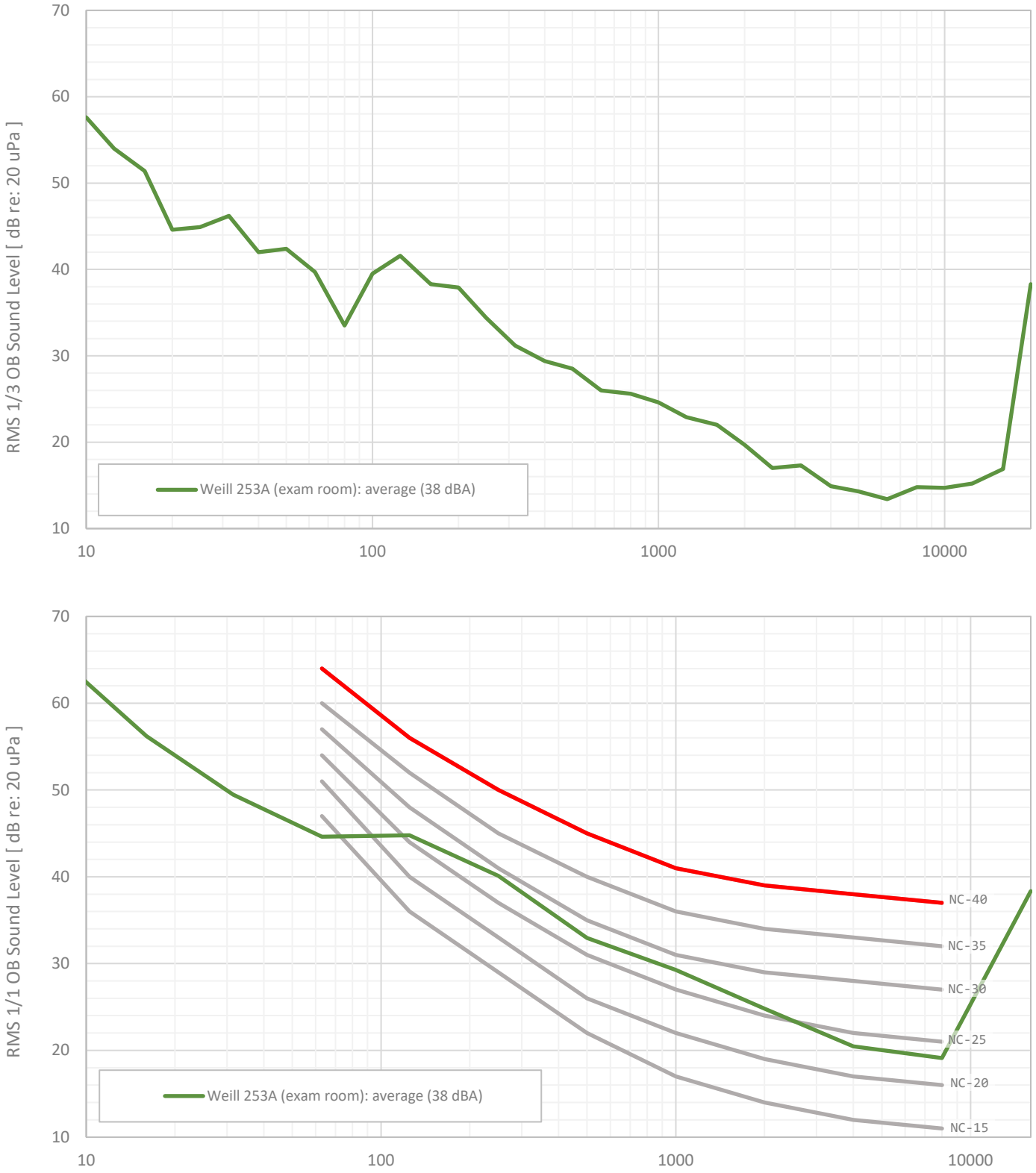
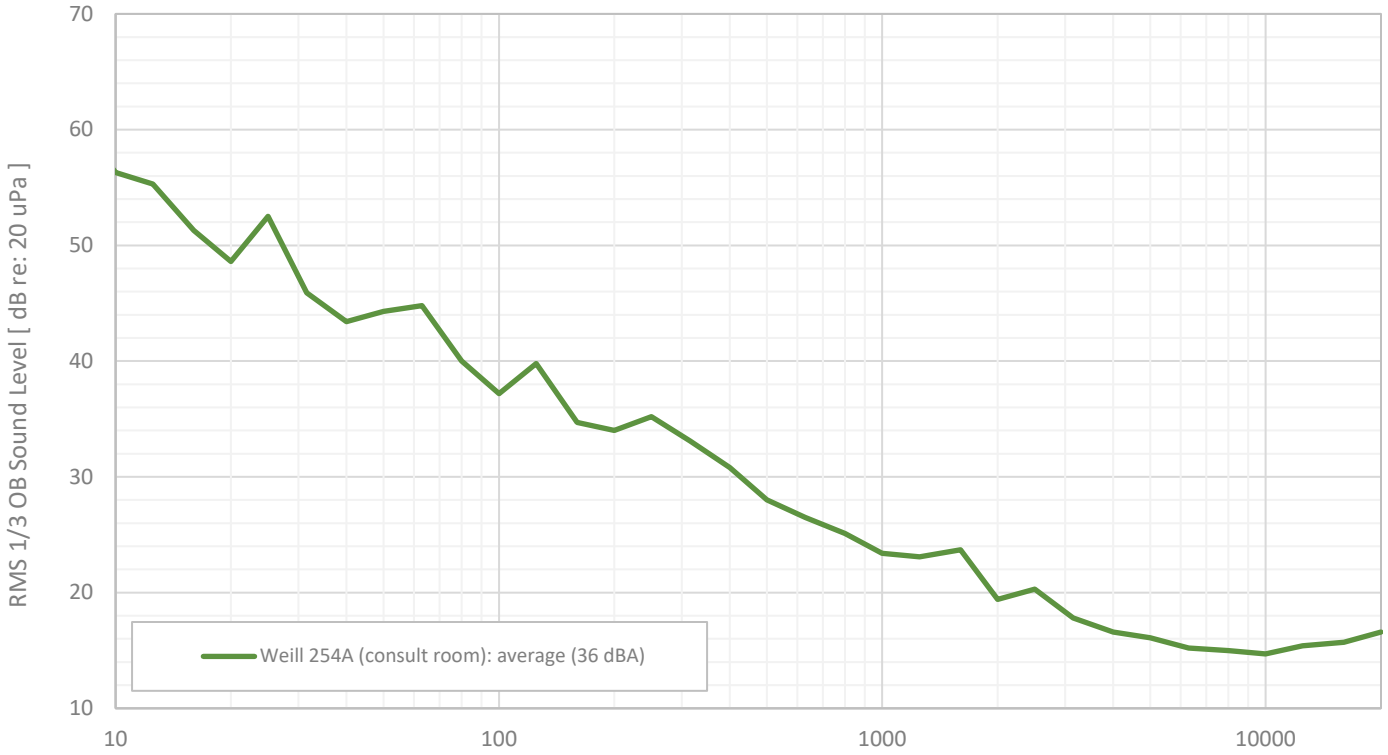


Figure B.28: Results from Weill 253A (exam room)

Noise levels are NC-29: HVAC Normal

Data reported on 1 observation at 1 location at 04/01/23 @ 13:06.



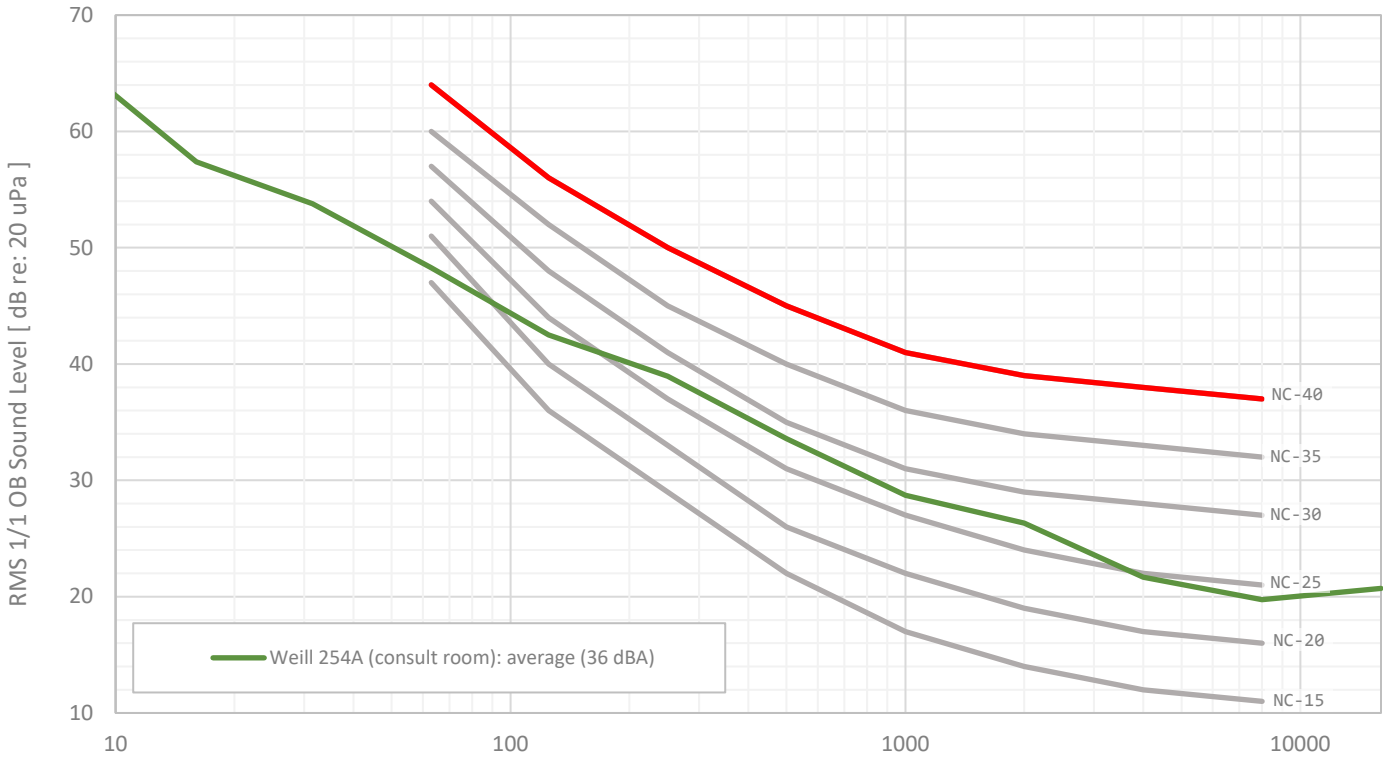


Figure B.29: Results from Weill 254A (consult room)

Noise levels are NC-29: HVAC Normal

Data reported on 1 observation at 1 location at 04/01/23 @ 13:08.

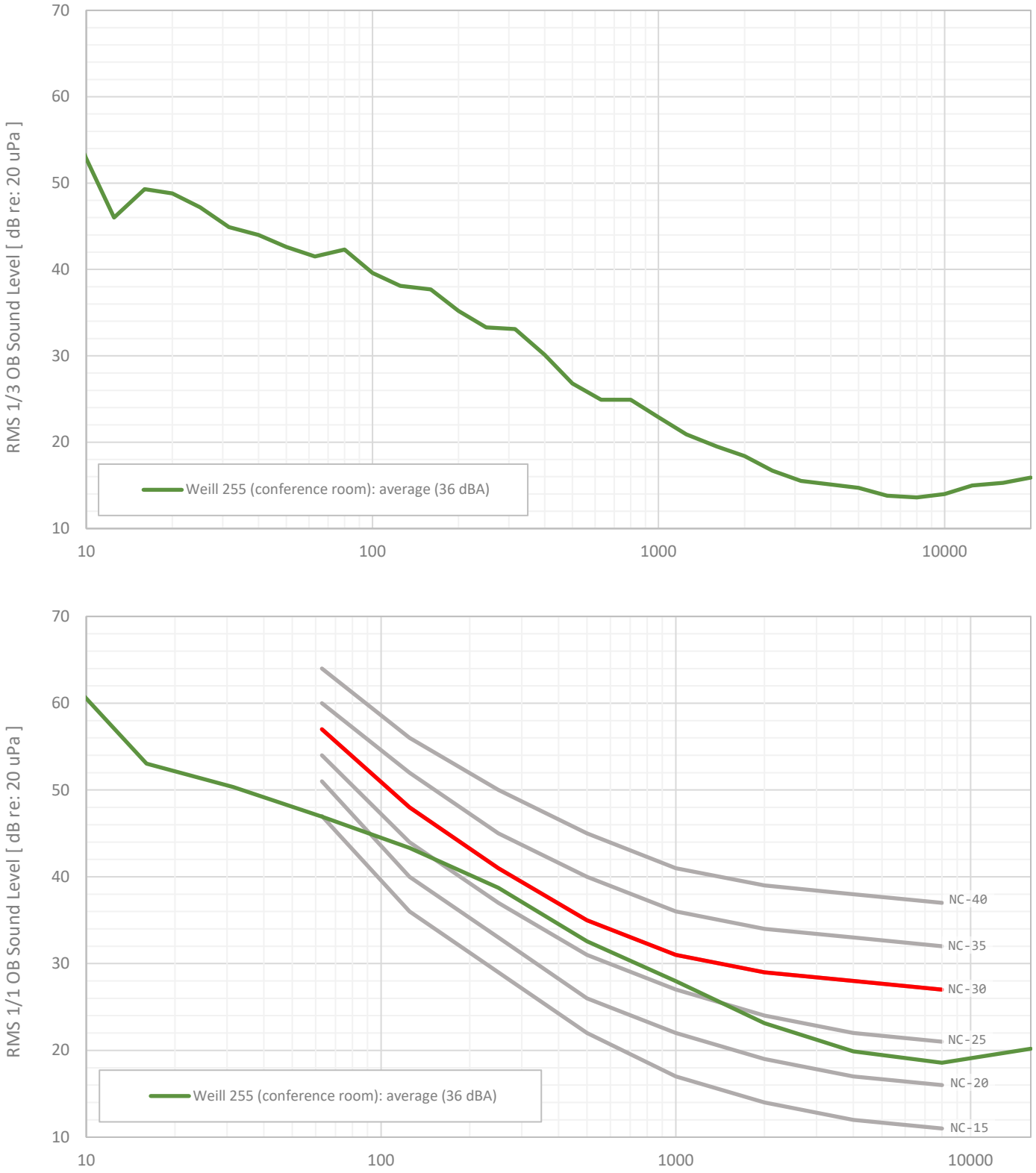
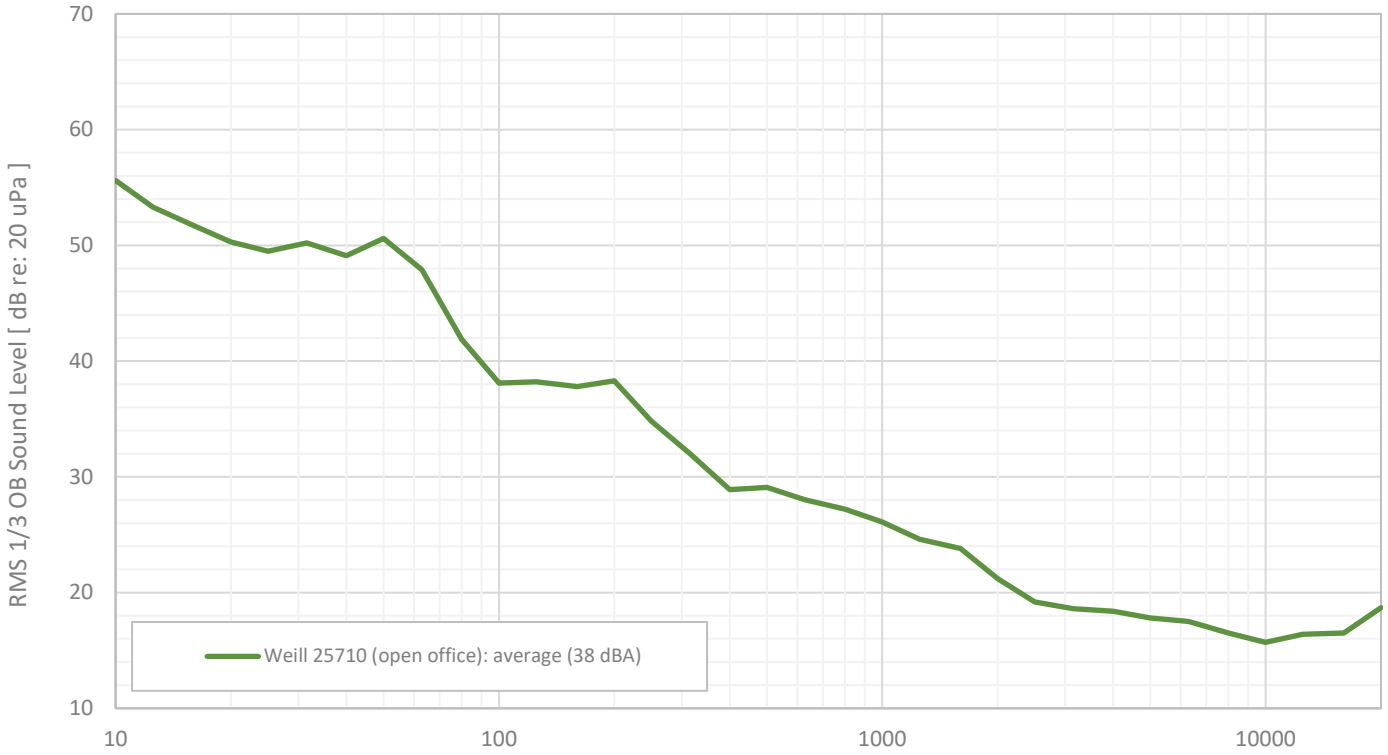


Figure B.30: Results from Weill 255 (conference room)

Noise levels are NC-28: HVAC Normal

Data reported on 1 observation at 1 location at 04/01/23 @ 13:25.



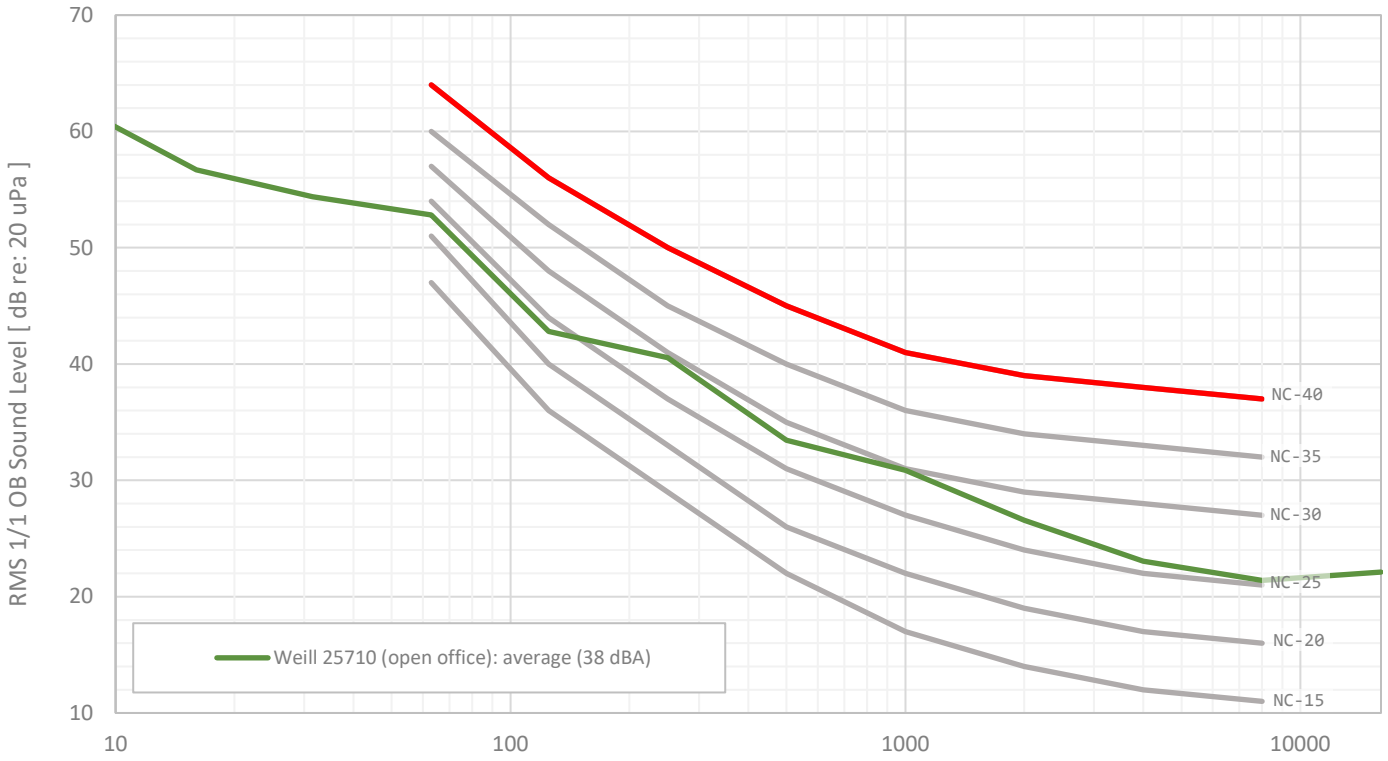
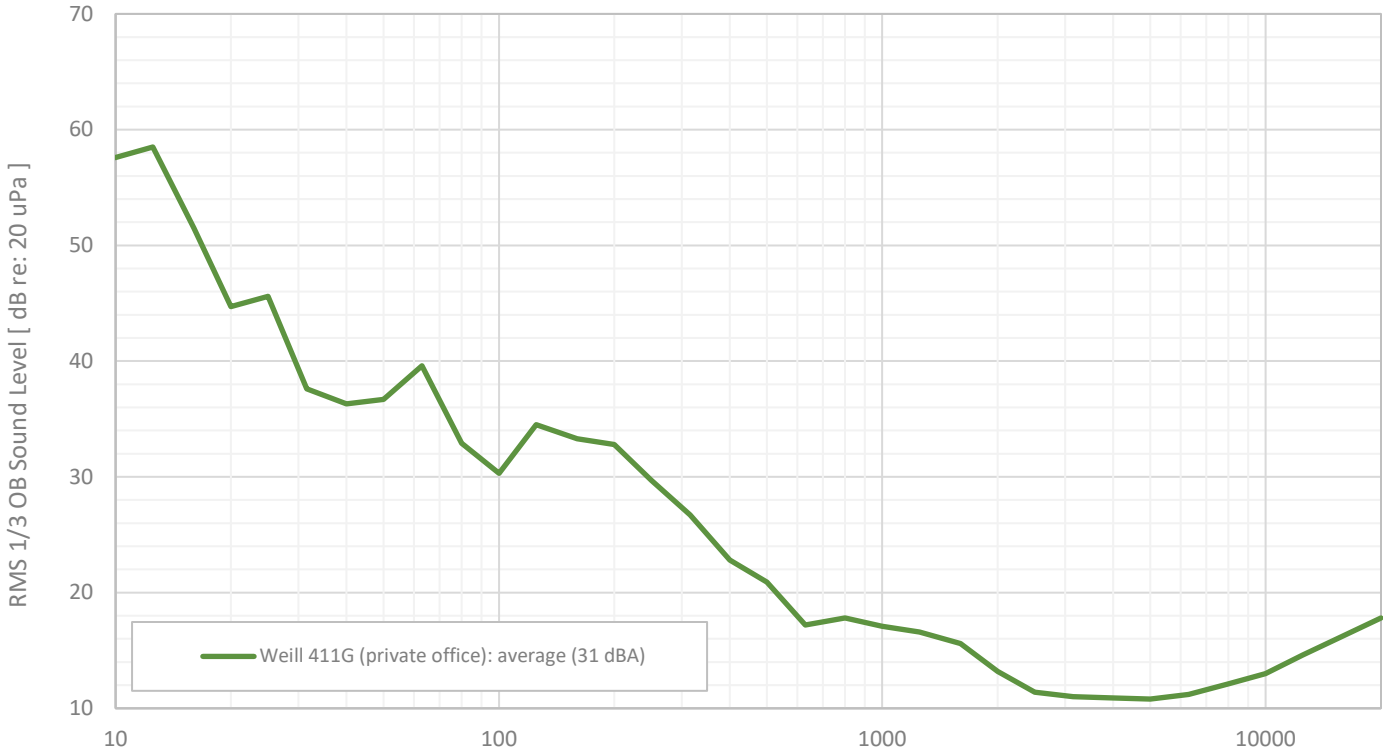


Figure B.31: Results from Weill 25710 (open office)

Noise levels are NC-30: HVAC Normal; sweep through entire open office area

Data reported on 1 observation at 1 location at 04/01/23 @ 13:10.



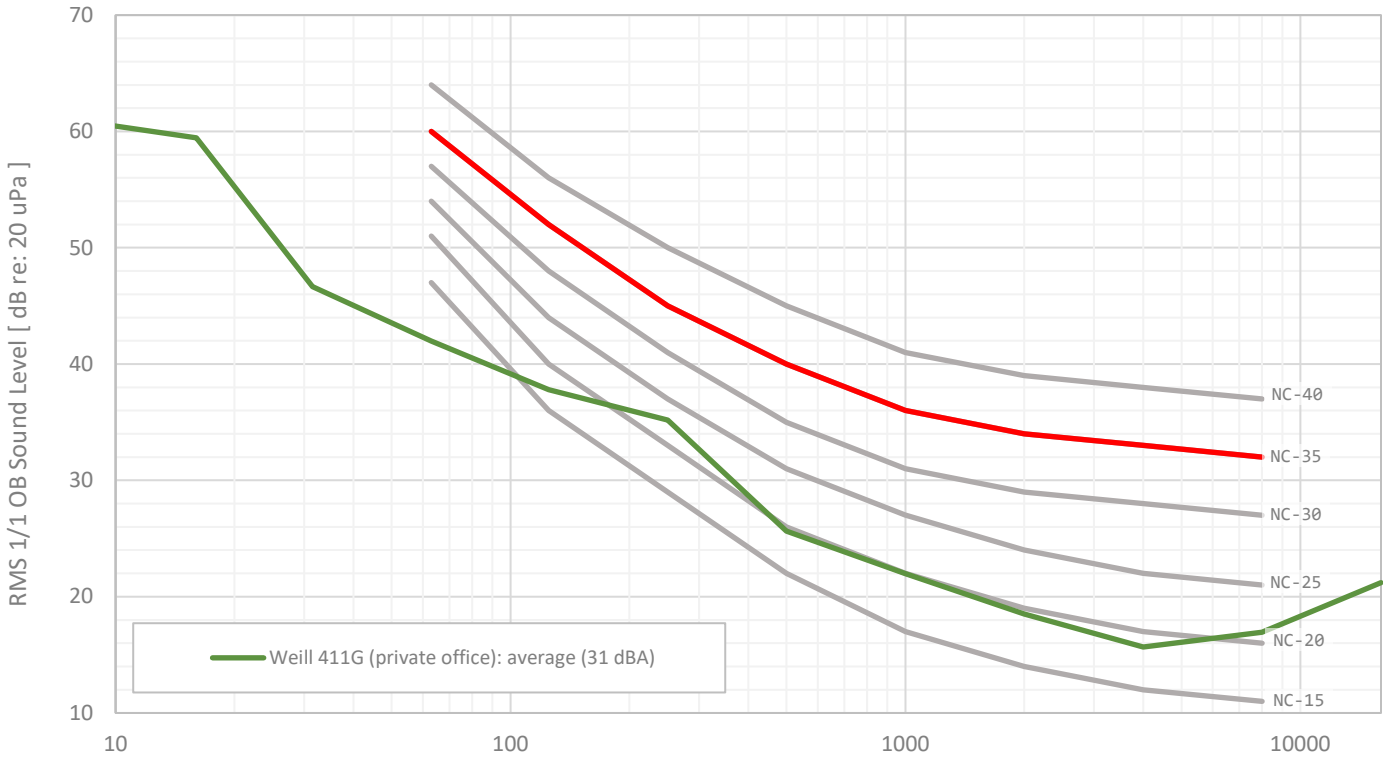
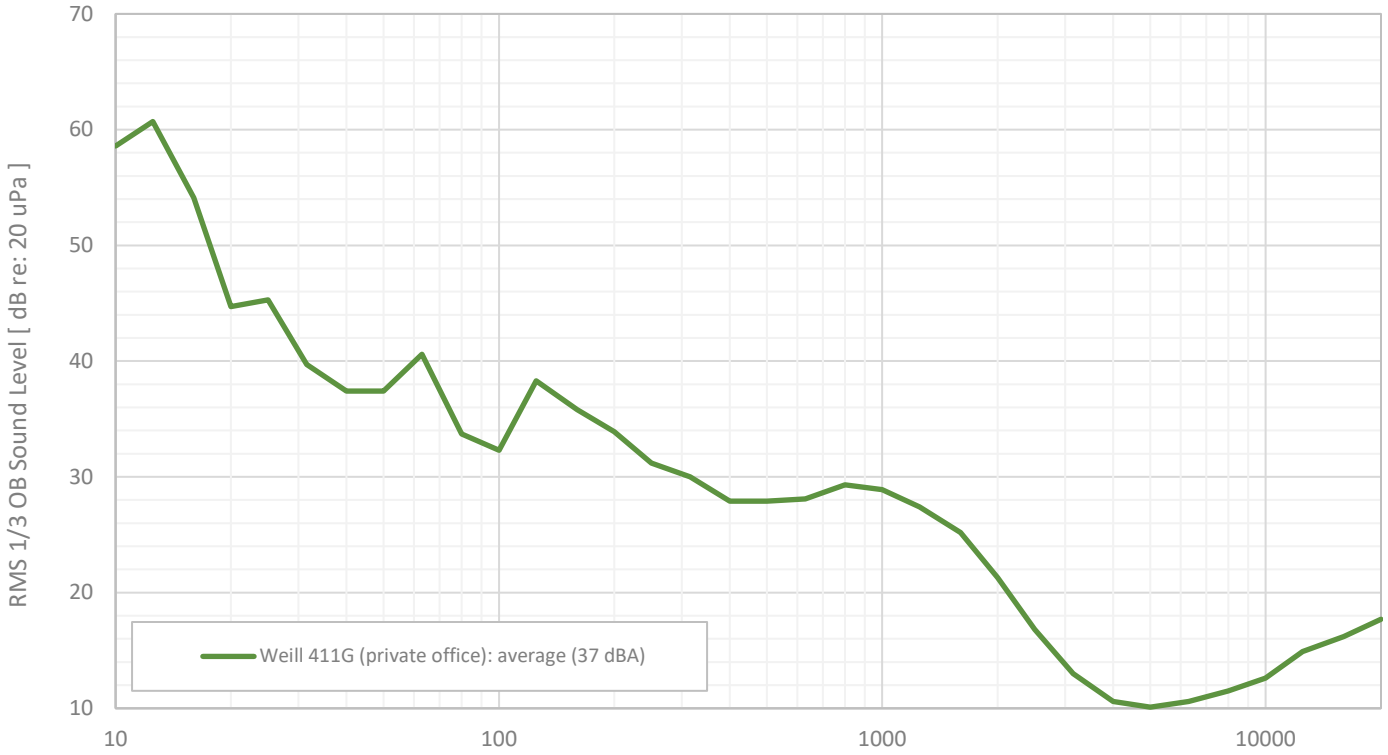


Figure B.32: Results from Weill 411G (private office)

Noise levels are NC-20: HVAC Minimum

Data reported on 1 observation at 1 location at 04/01/23 @ 13:40.



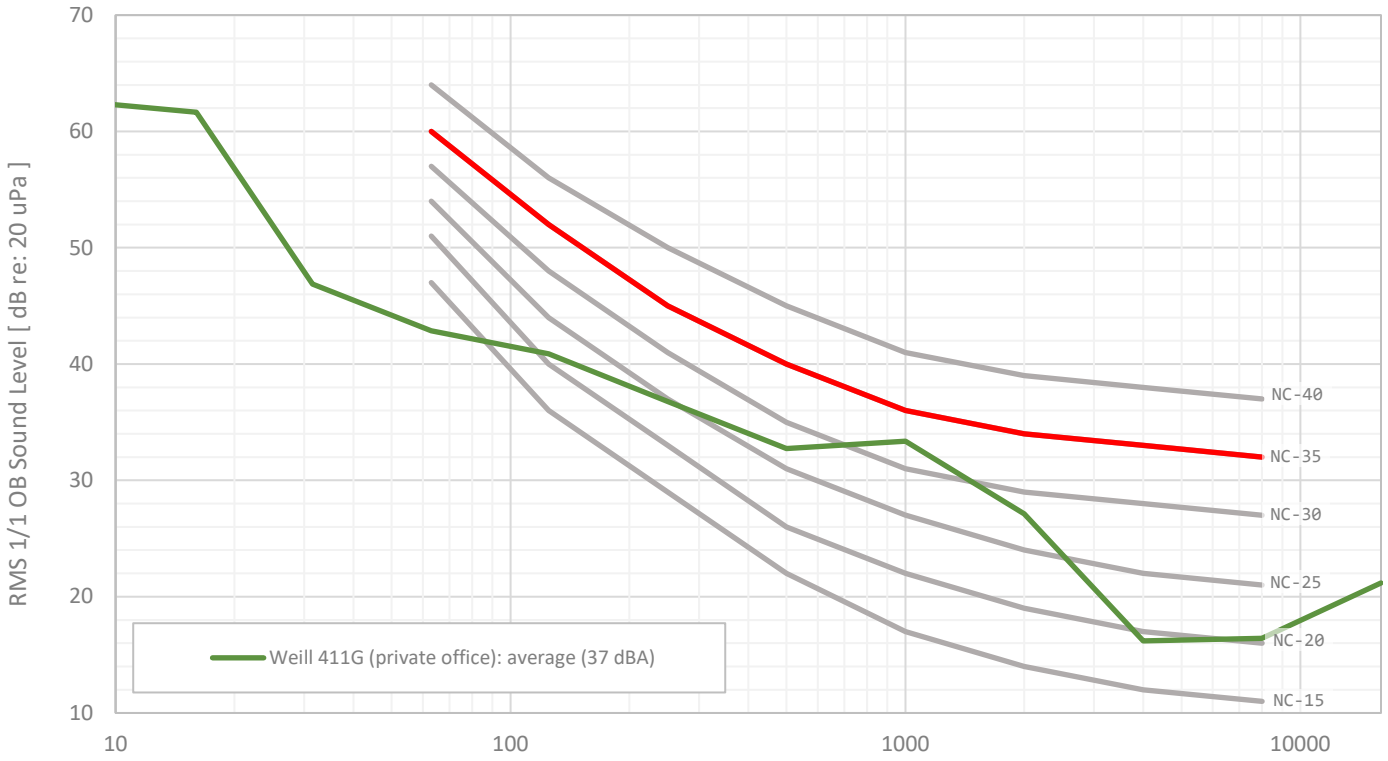
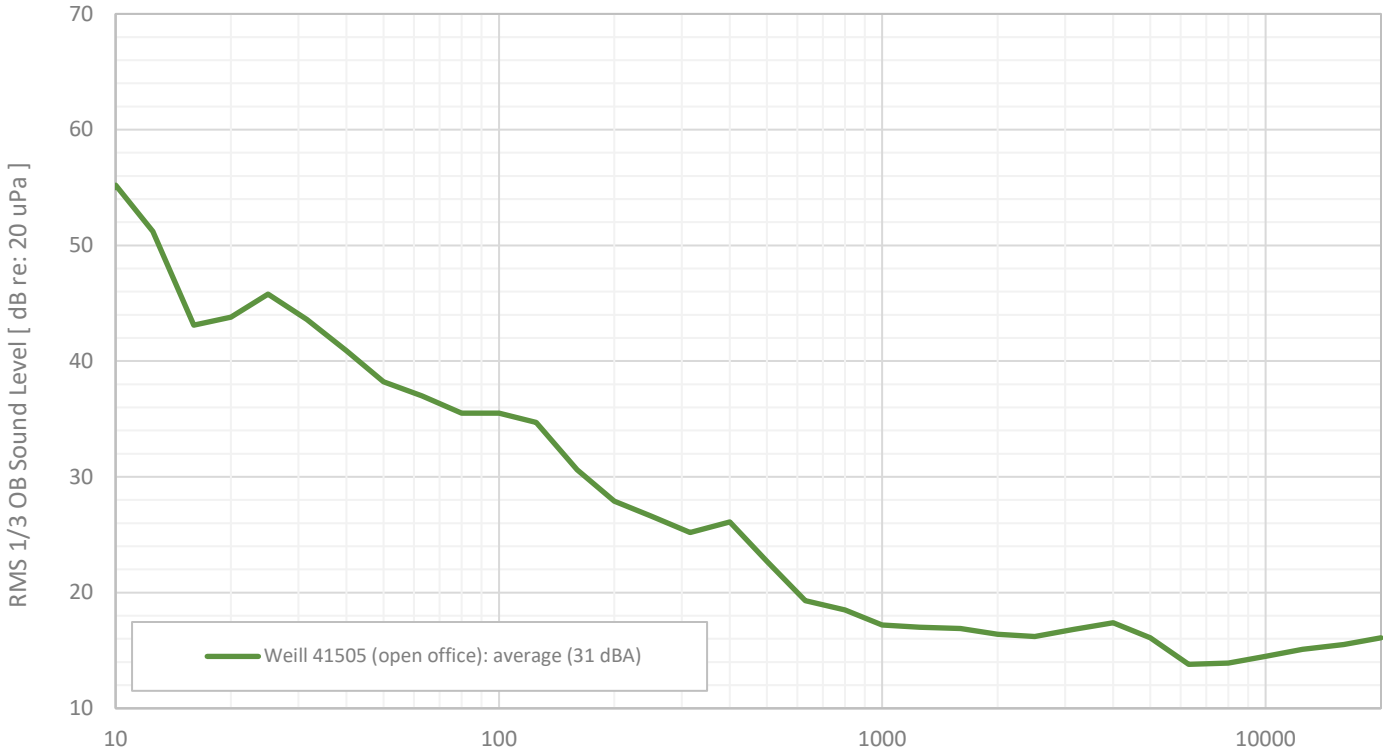


Figure B.33: Results from Weill 411G (private office)

Noise levels are NC-32: HVAC Maximum

Data reported on 1 observation at 1 location at 04/01/23 @ 13:48.



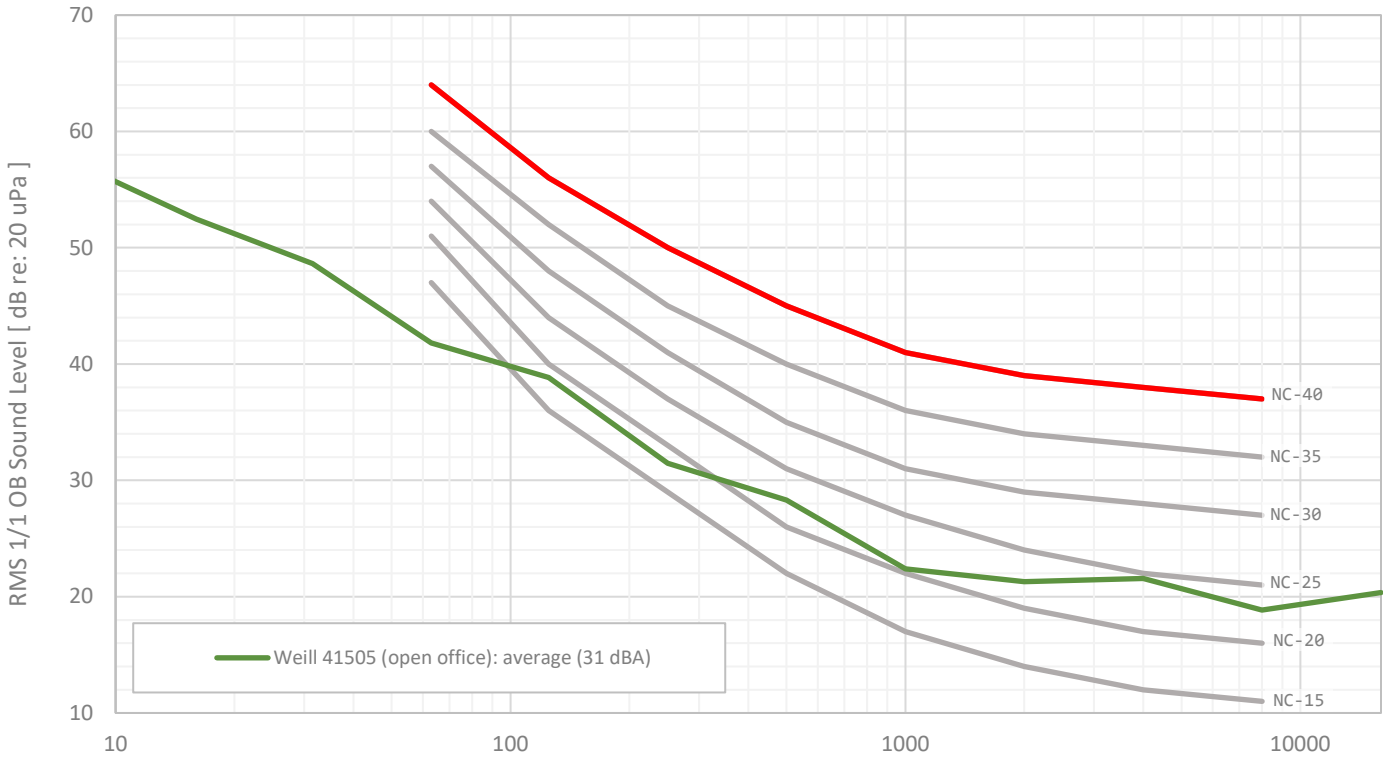


Figure B.34: Results from Weill 41505 (open office)

Noise levels are NC-25: HVAC Minimum

Data reported on 1 observation at 1 location at 04/01/23 @ 13:44.

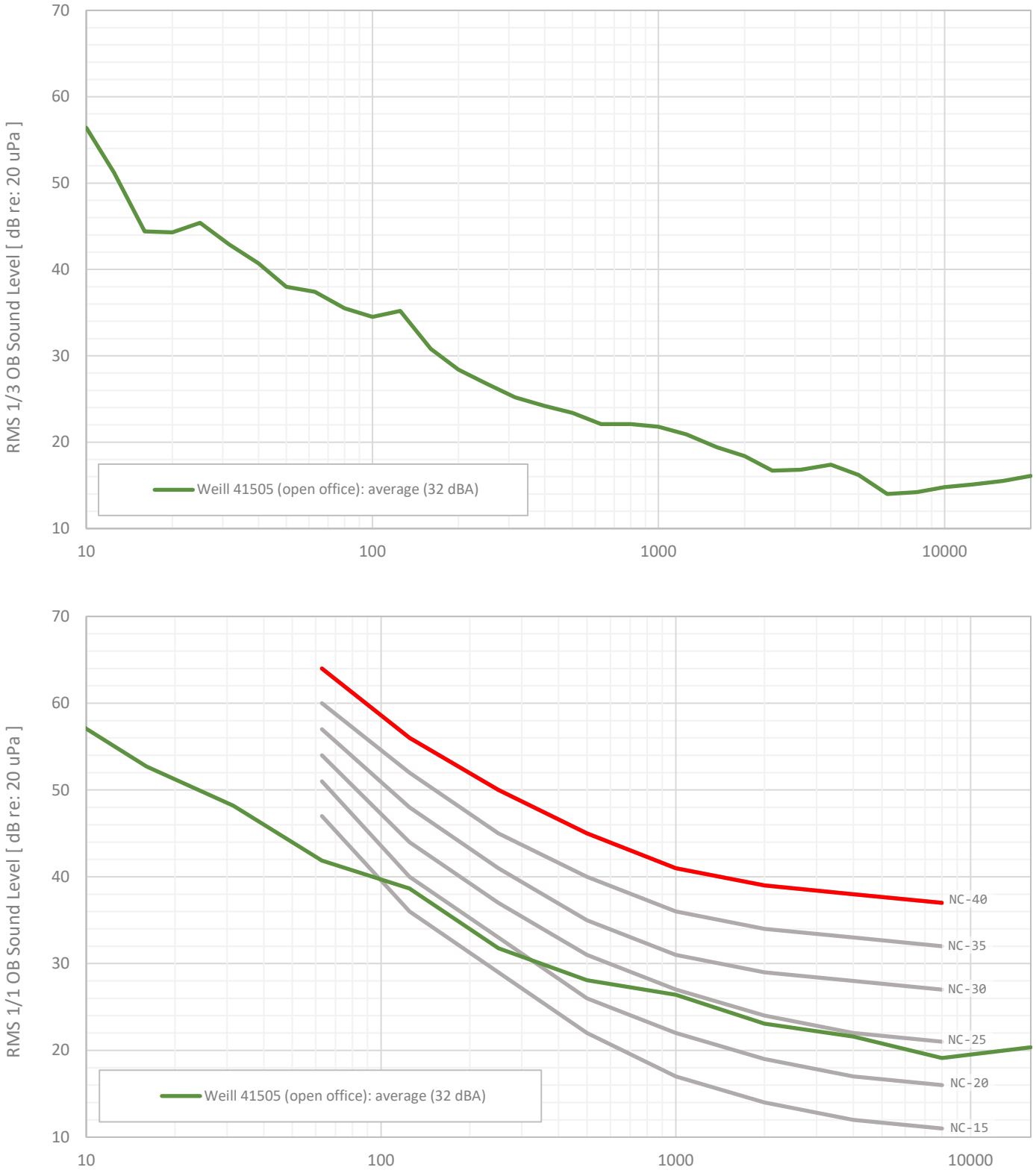
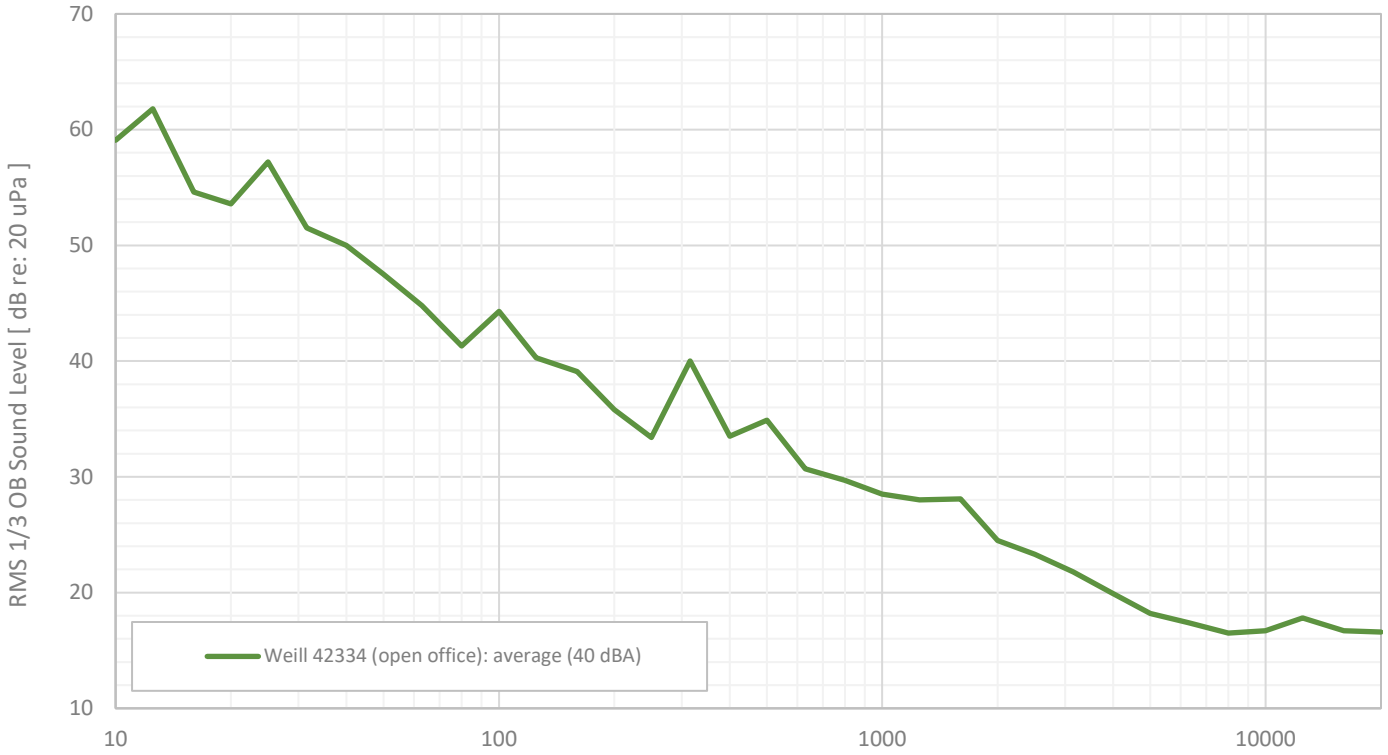


Figure B.35: Results from Weill 41505 (open office)

Noise levels are NC-25: HVAC Maximum

Data reported on 1 observation at 1 location at 04/01/23 @ 13:56.



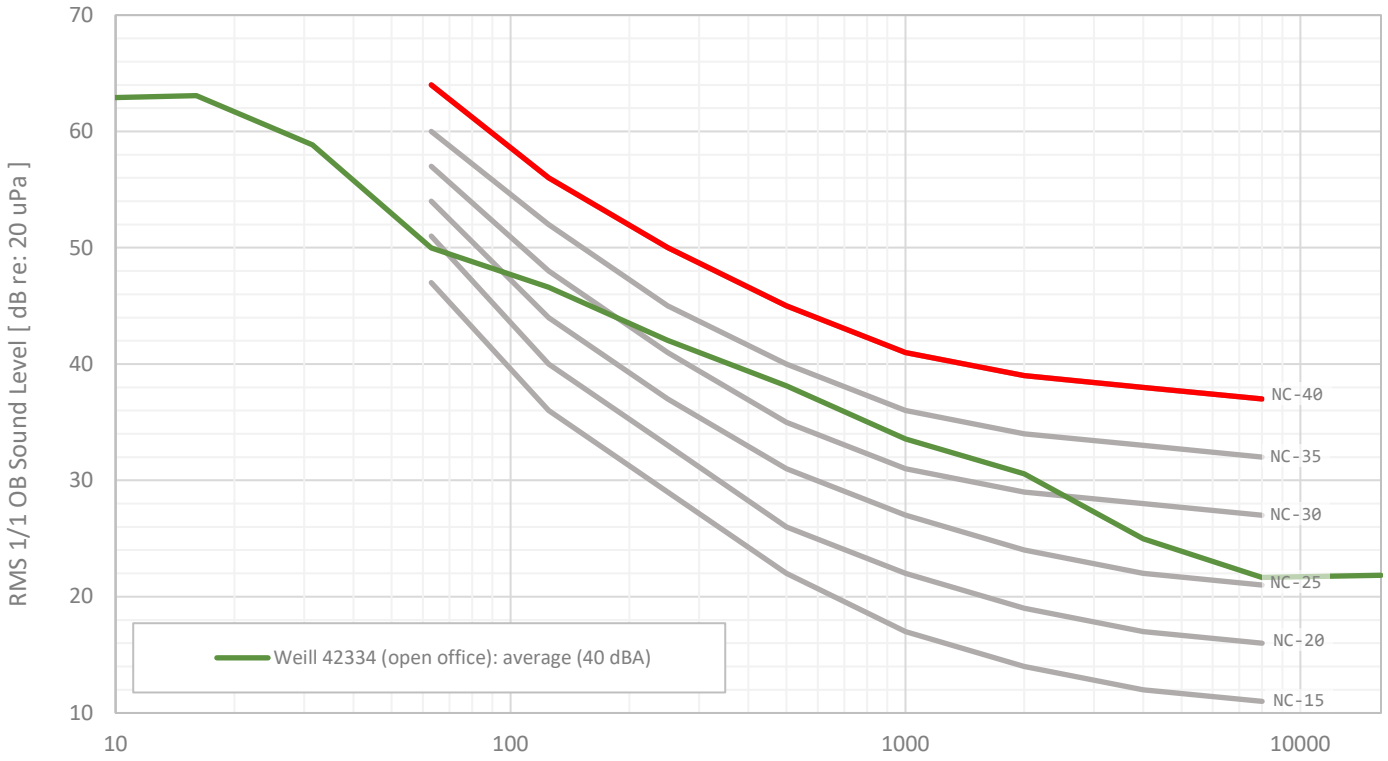
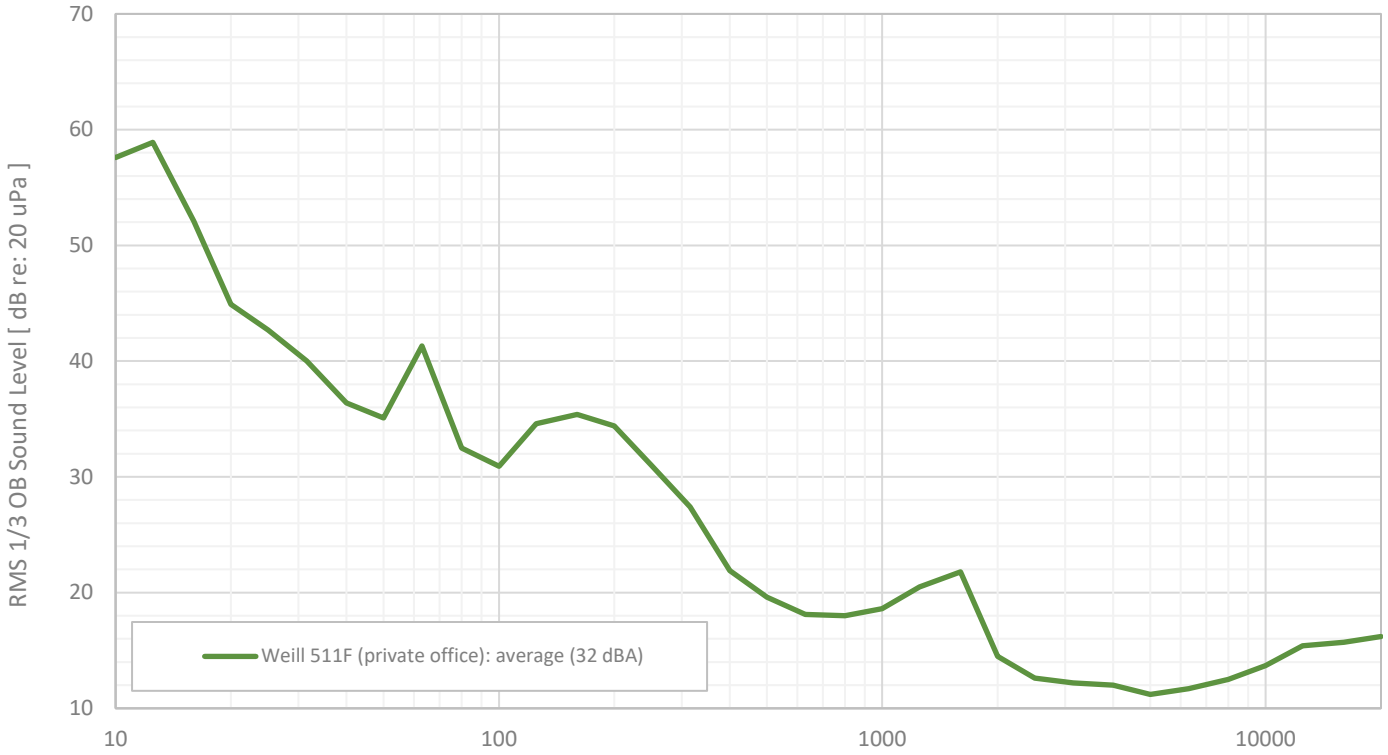


Figure B.36: Results from Weill 42334 (open office)

Noise levels are NC-33: HVAC Normal; sweep through central open lab area

Data reported on 1 observation at 1 location at 04/01/23 @ 13:59.



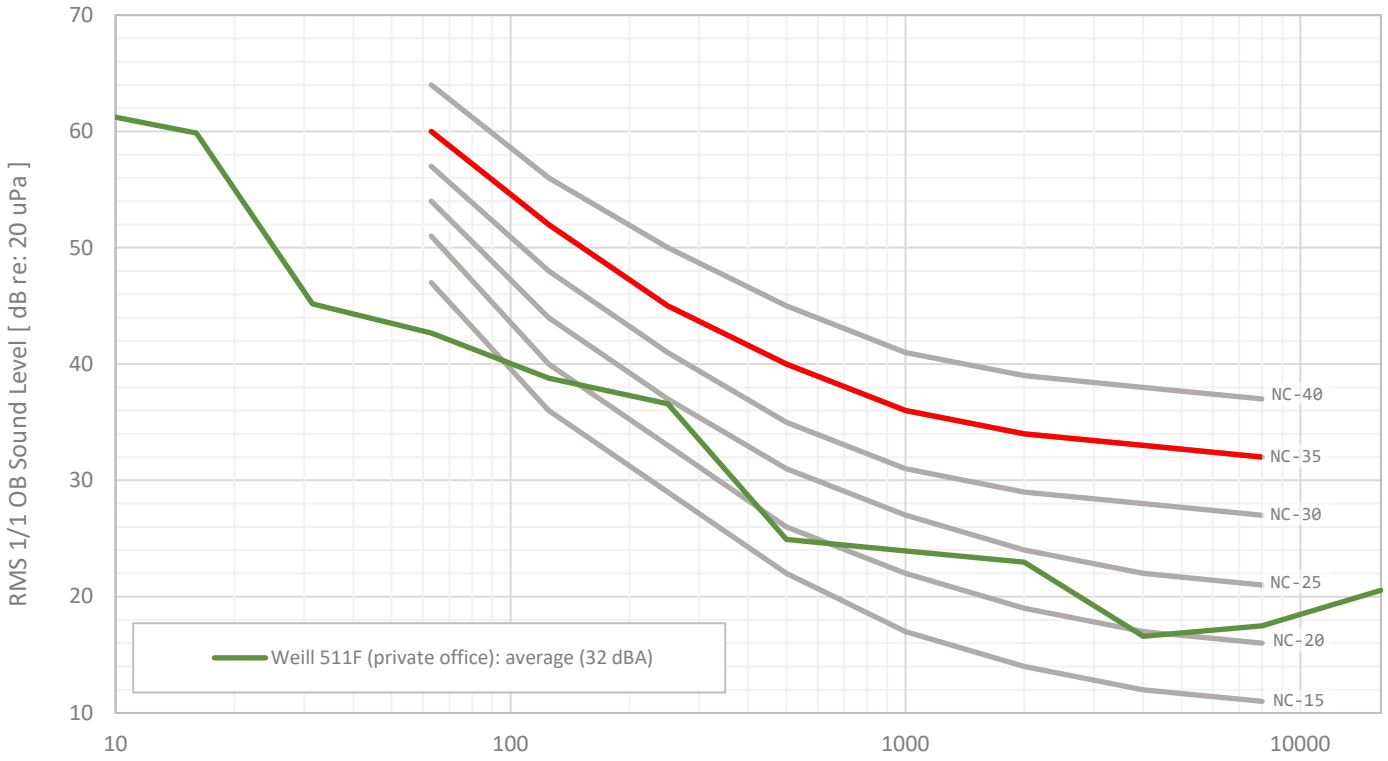
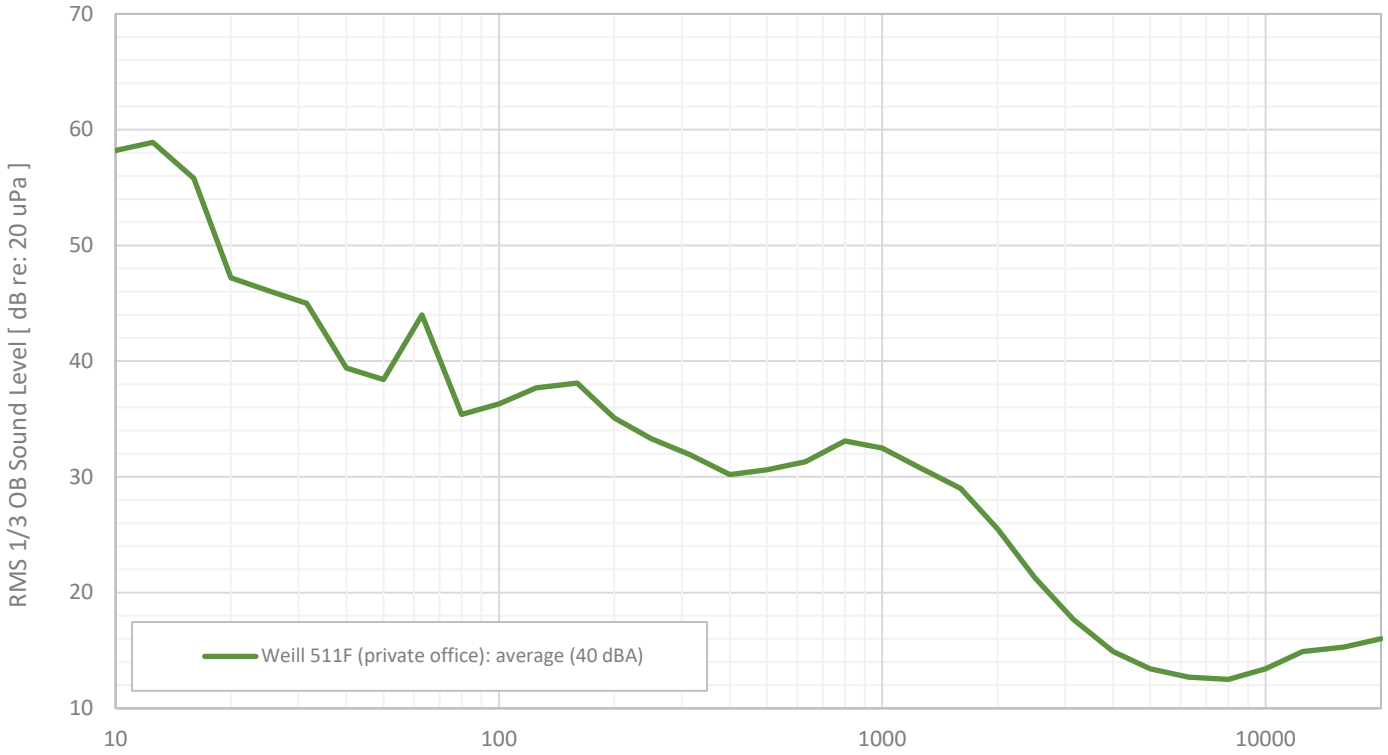


Figure B.37: Results from Weill 511F (private office)

Noise levels are NC-25: HVAC Minimum

Data reported on 1 observation at 1 location at 04/01/23 @ 14:05.



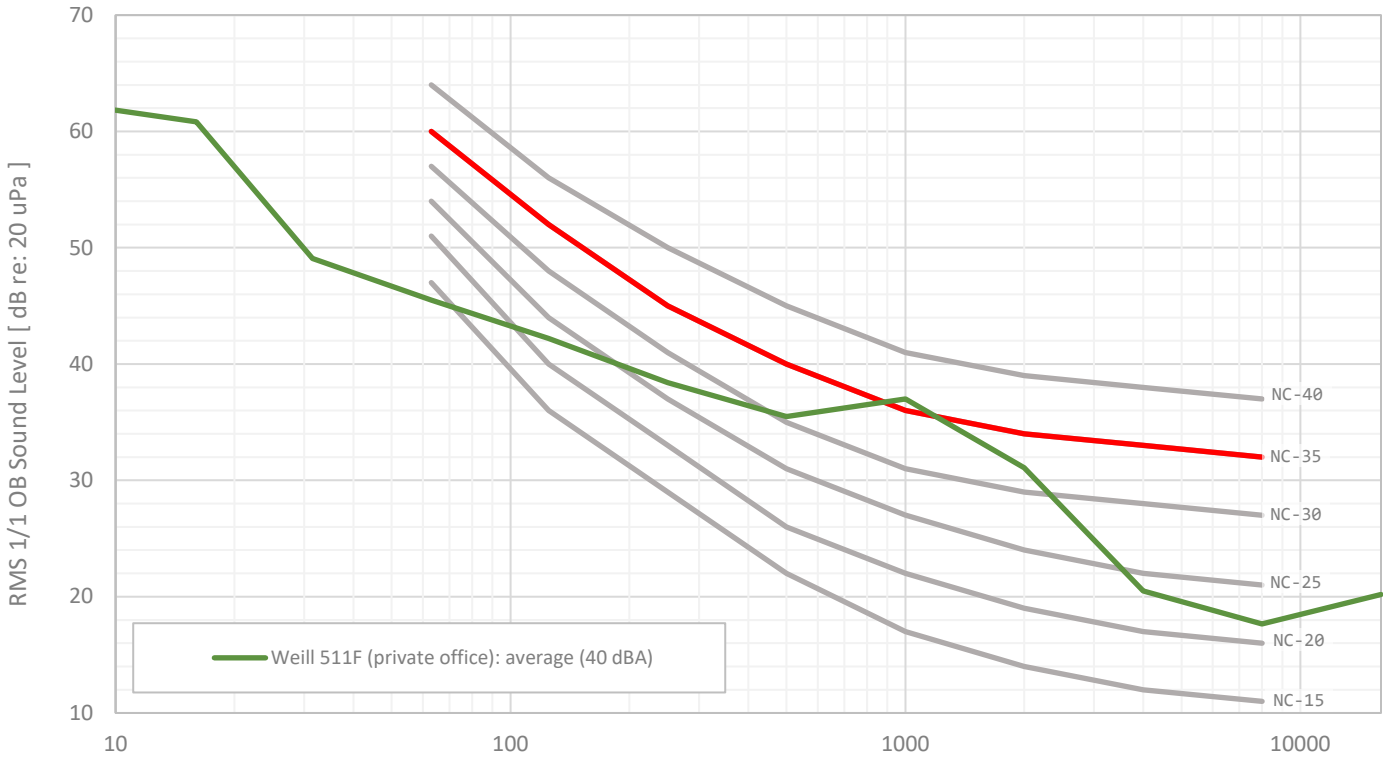


Figure B.38: Results from Weill 511F (private office)

Noise levels are NC-36: HVAC Maximum

Data reported on 1 observation at 1 location at 04/01/23 @ 14:16.

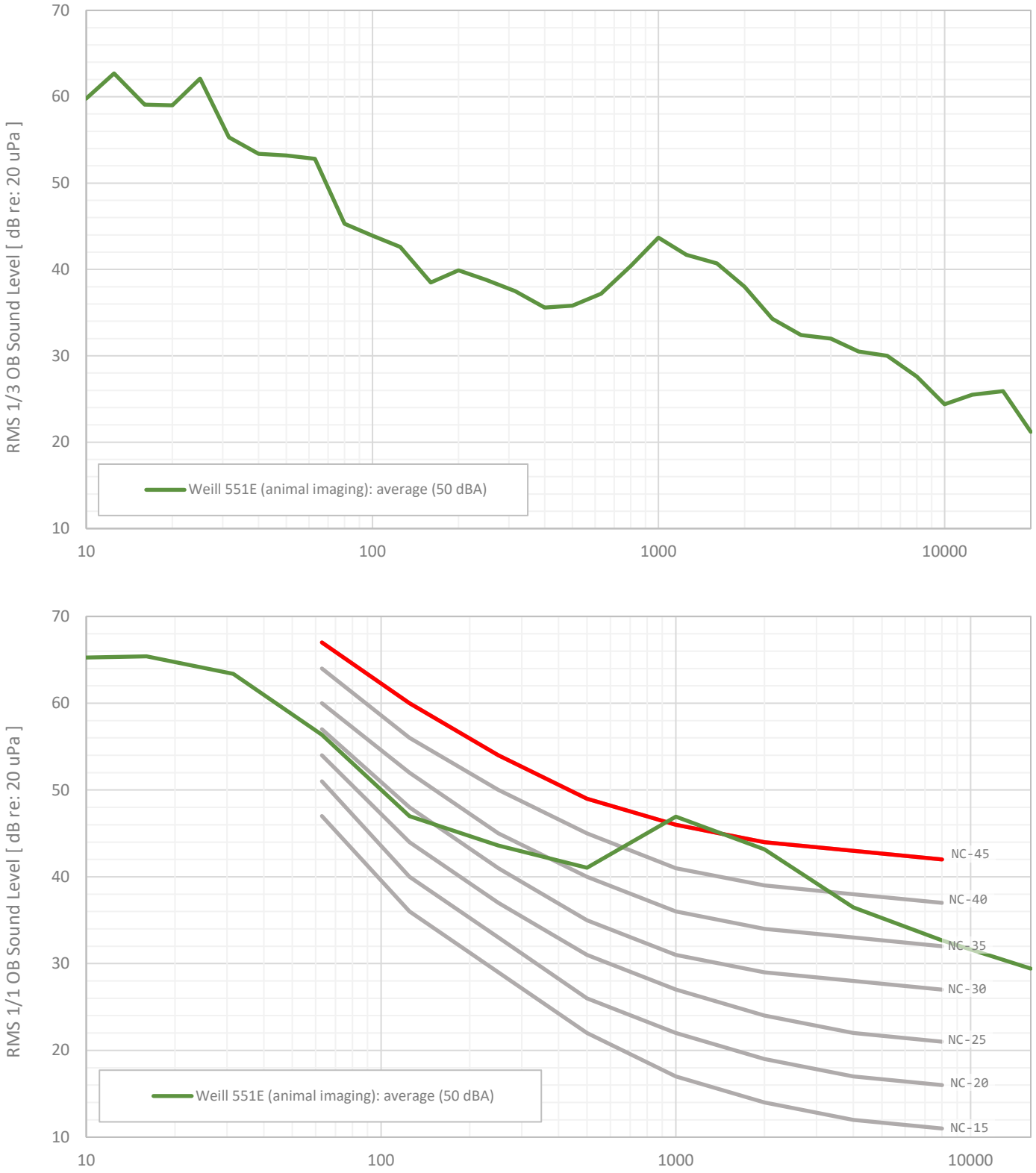
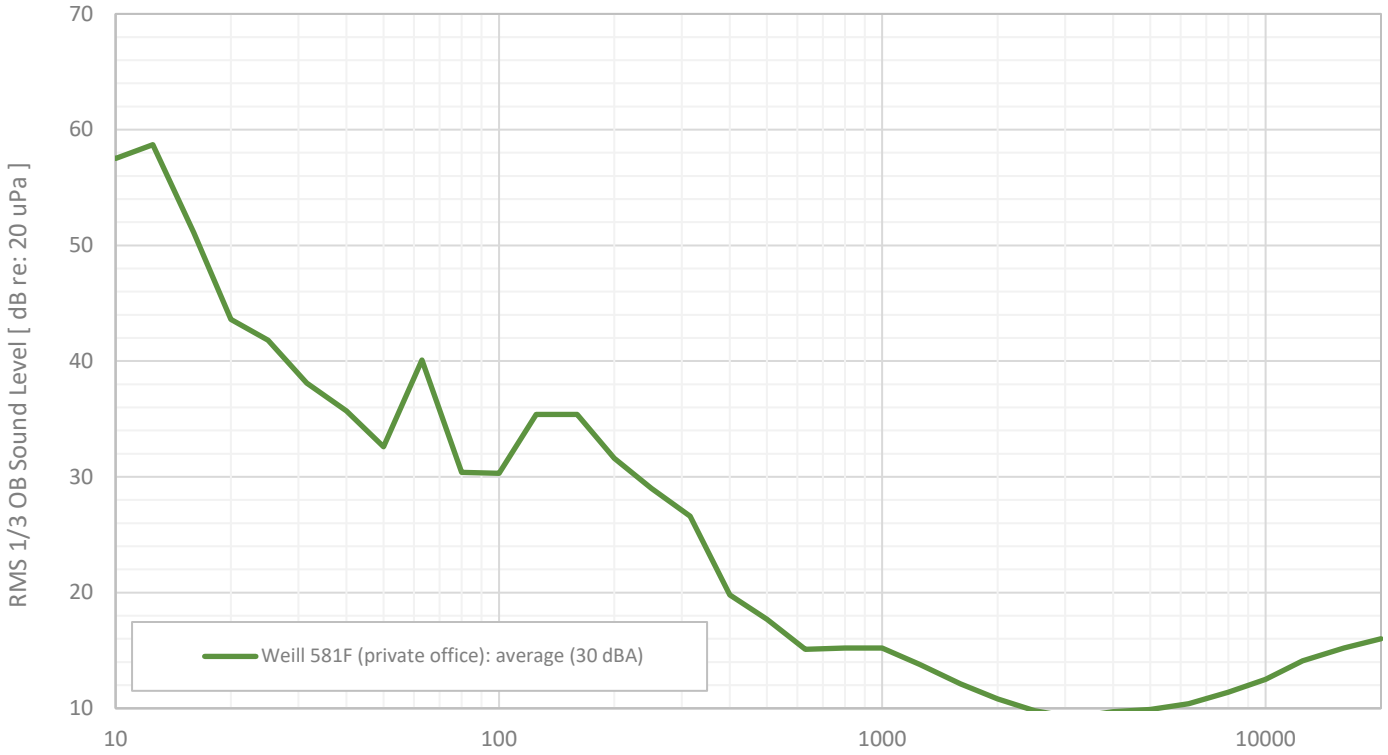


Figure B.39: Results from Weill 551E (animal imaging)

Noise levels are NC-46: HVAC Normal?; door shuts forcefully

Data reported on 1 observation at 1 location at 04/01/23 @ 14:12.



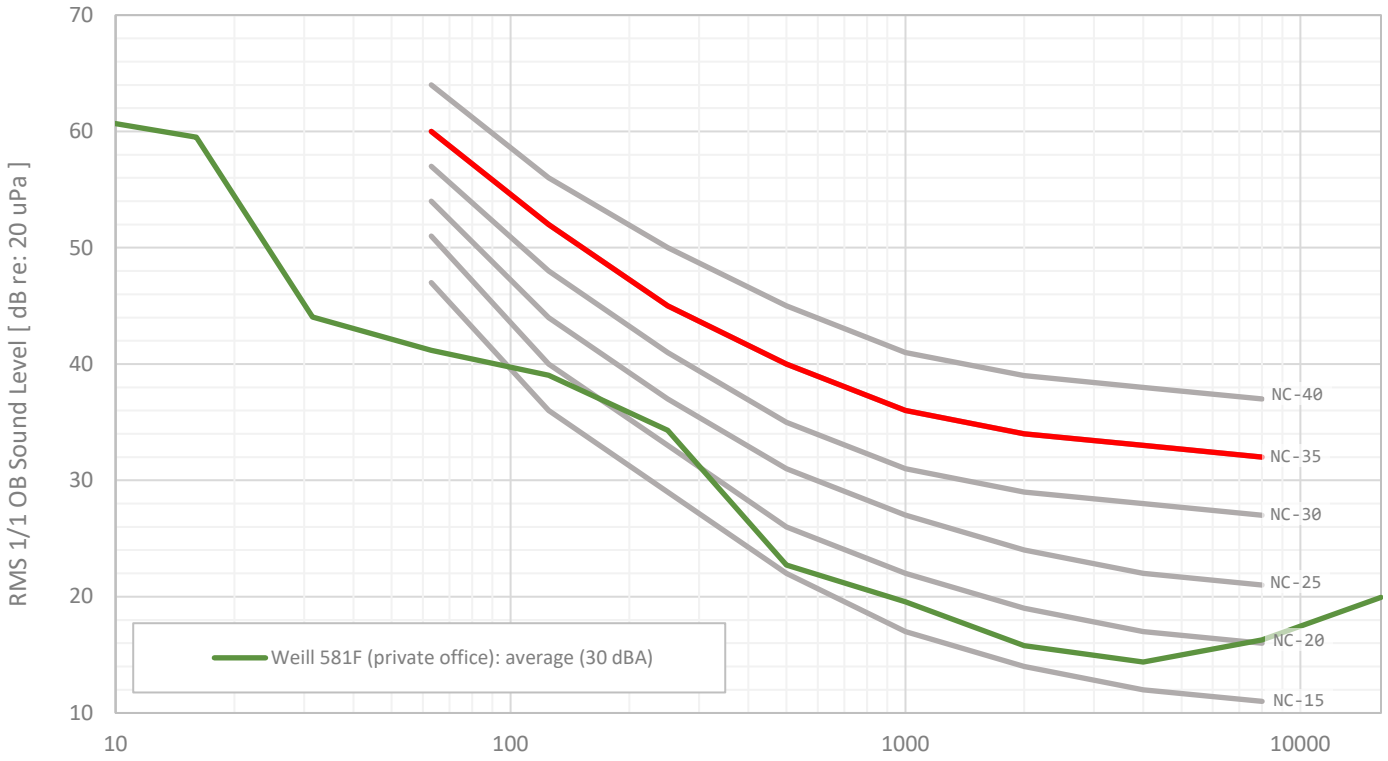
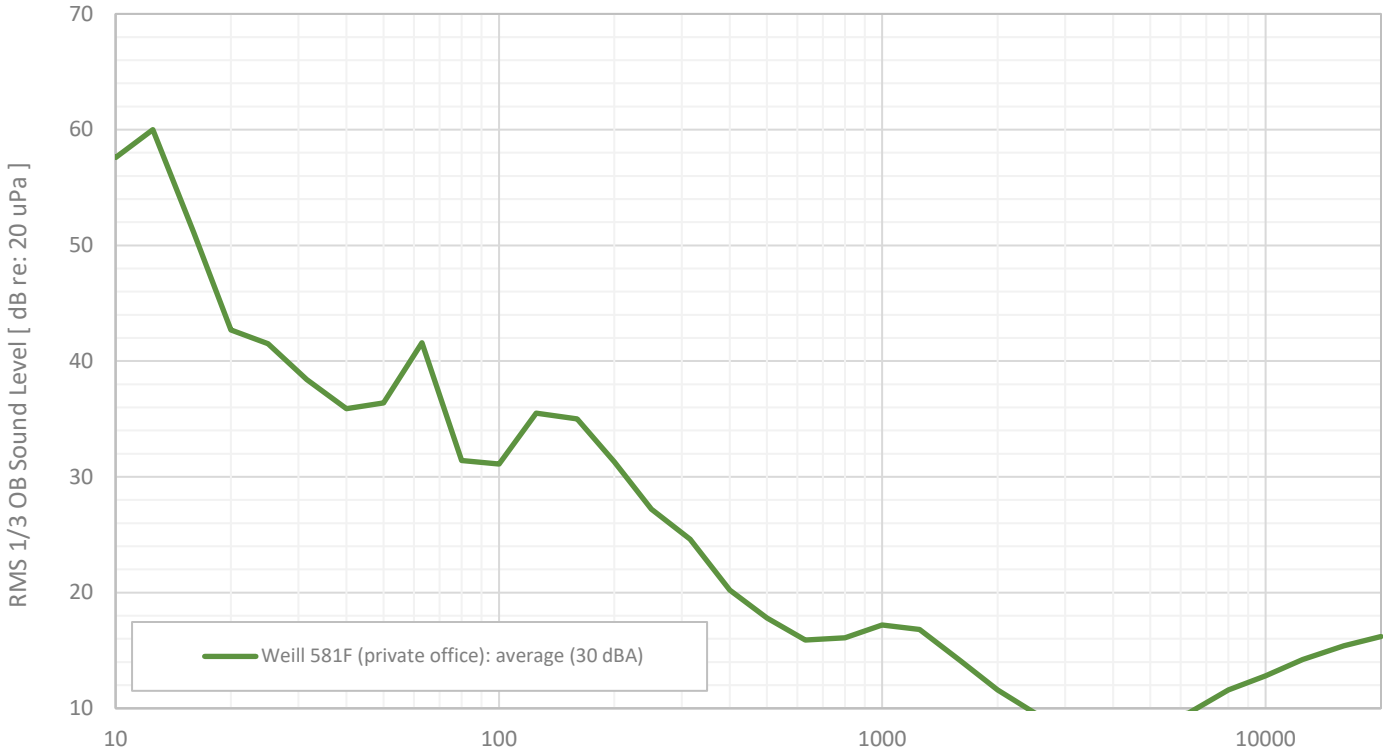


Figure B.40: Results from Weill 581F (private office)

Noise levels are NC-20: HVAC Minimum

Data reported on 1 observation at 1 location at 04/01/23 @ 14:21.



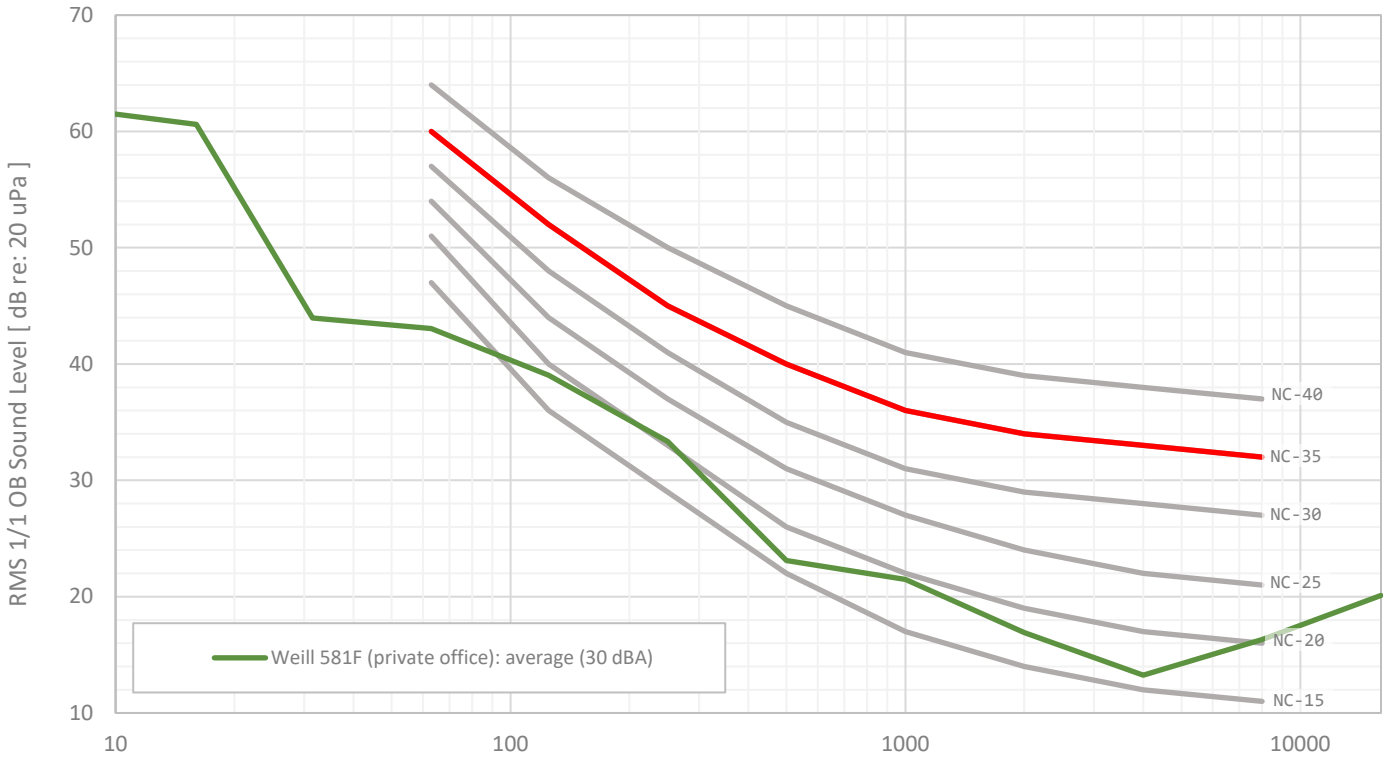


Figure B.41: Results from Weill 581F (private office)

Noise levels are NC-20: HVAC Maximum

Data reported on 1 observation at 1 location at 04/01/23 @ 14:28.

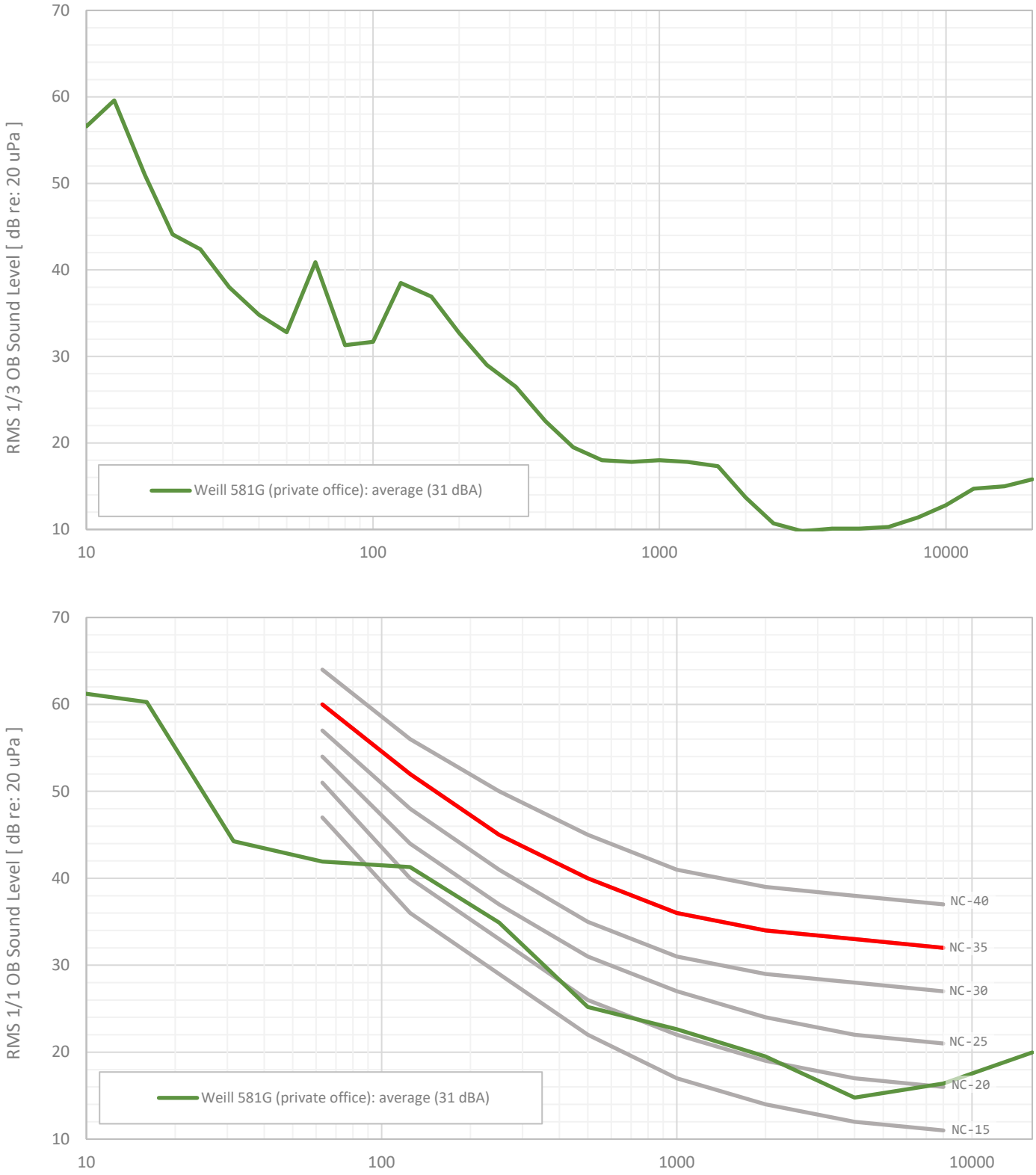
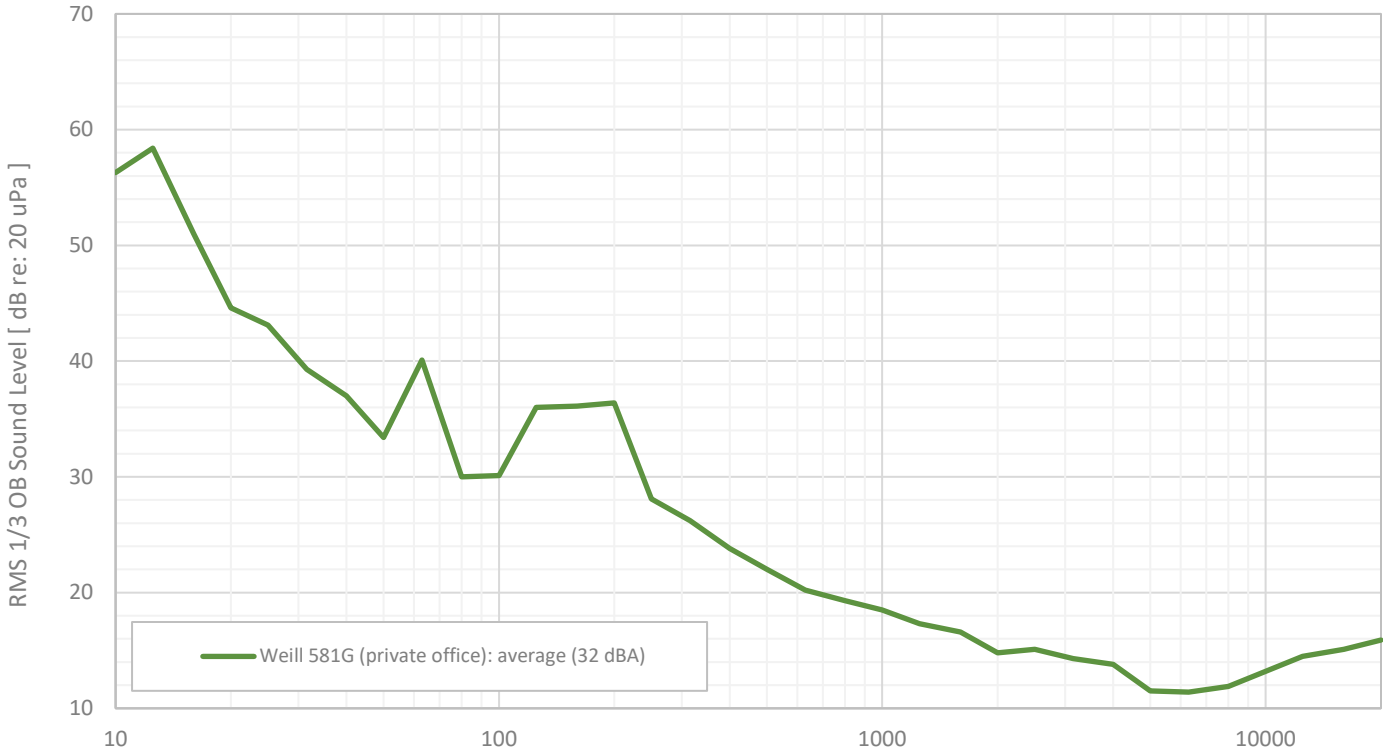


Figure B.42: Results from Weill 581G (private office)

Noise levels are NC-20: HVAC Minimum

Data reported on 1 observation at 1 location at 04/01/23 @ 14:22.



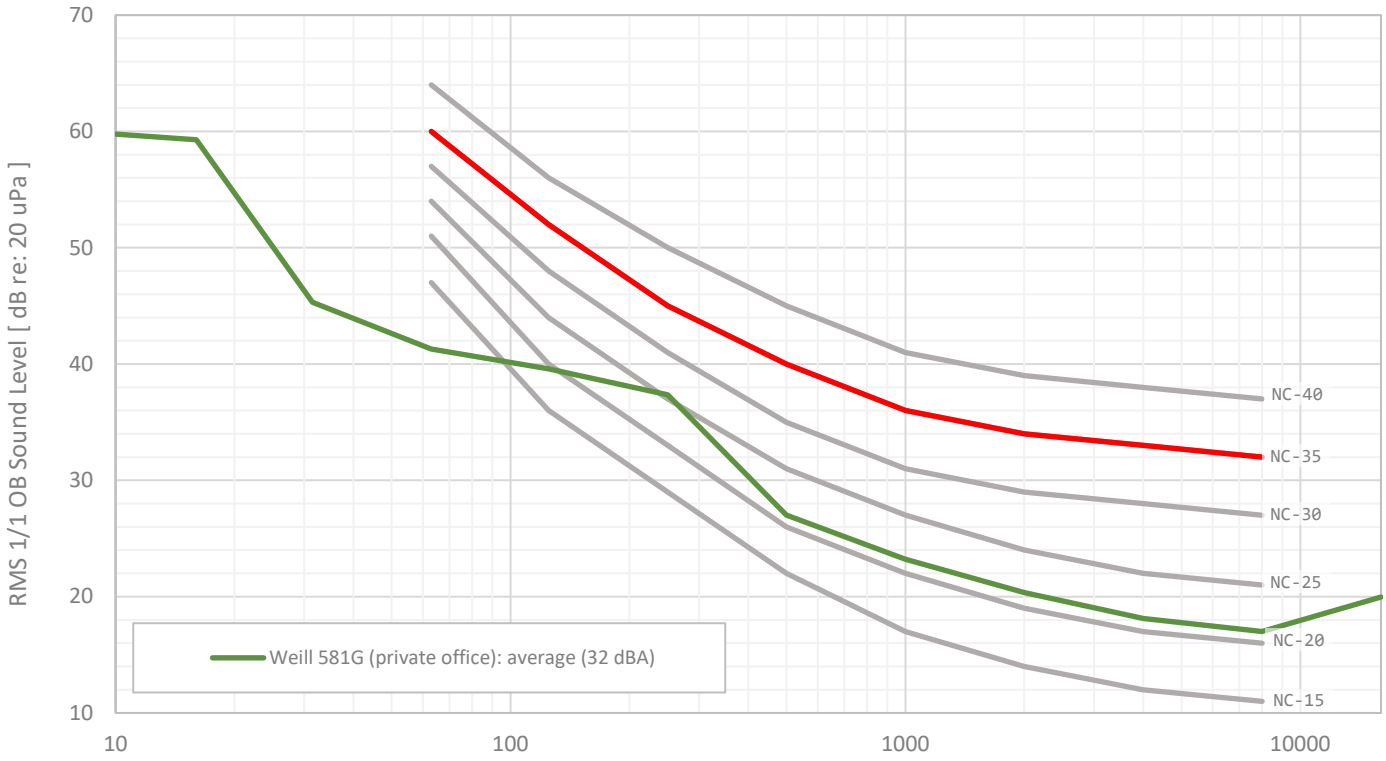
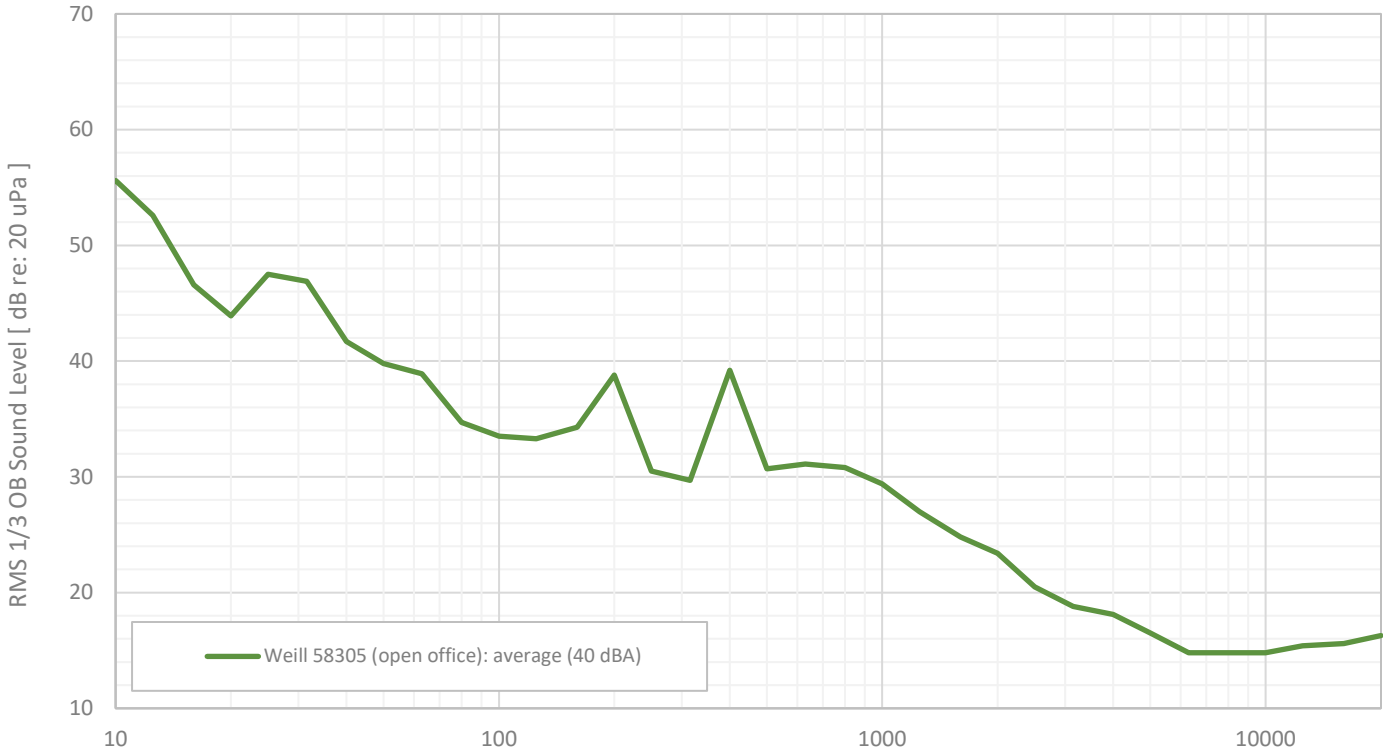


Figure B.43: Results from Weill 581G (private office)

Noise levels are NC-25: HVAC Maximum

Data reported on 1 observation at 1 location at 04/01/23 @ 14:30.



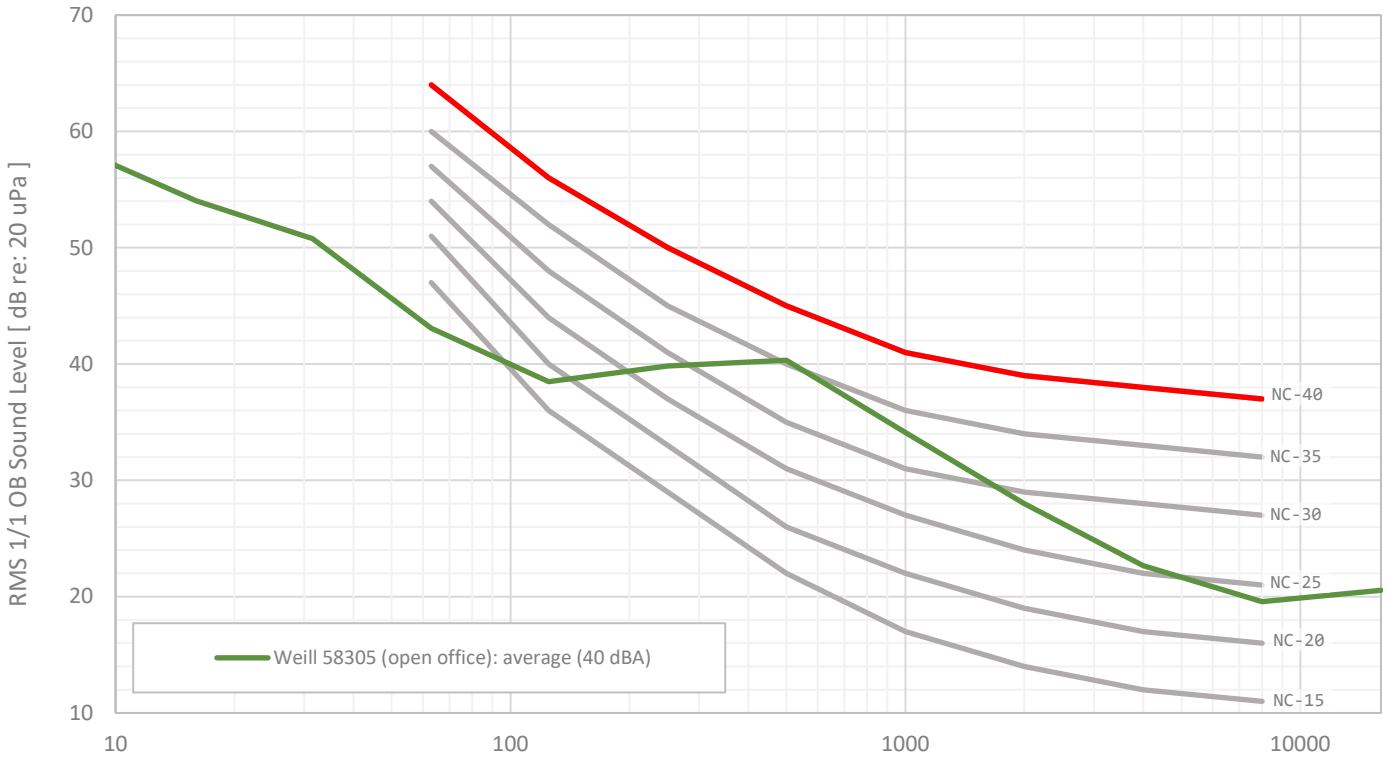


Figure B.44: Results from Weill 58305 (open office)

Noise levels are NC-35: HVAC Minimum; very quiet, dominated by a computer running with a very loud fan

Data reported on 1 observation at 1 location at 04/01/23 @ 14:24.

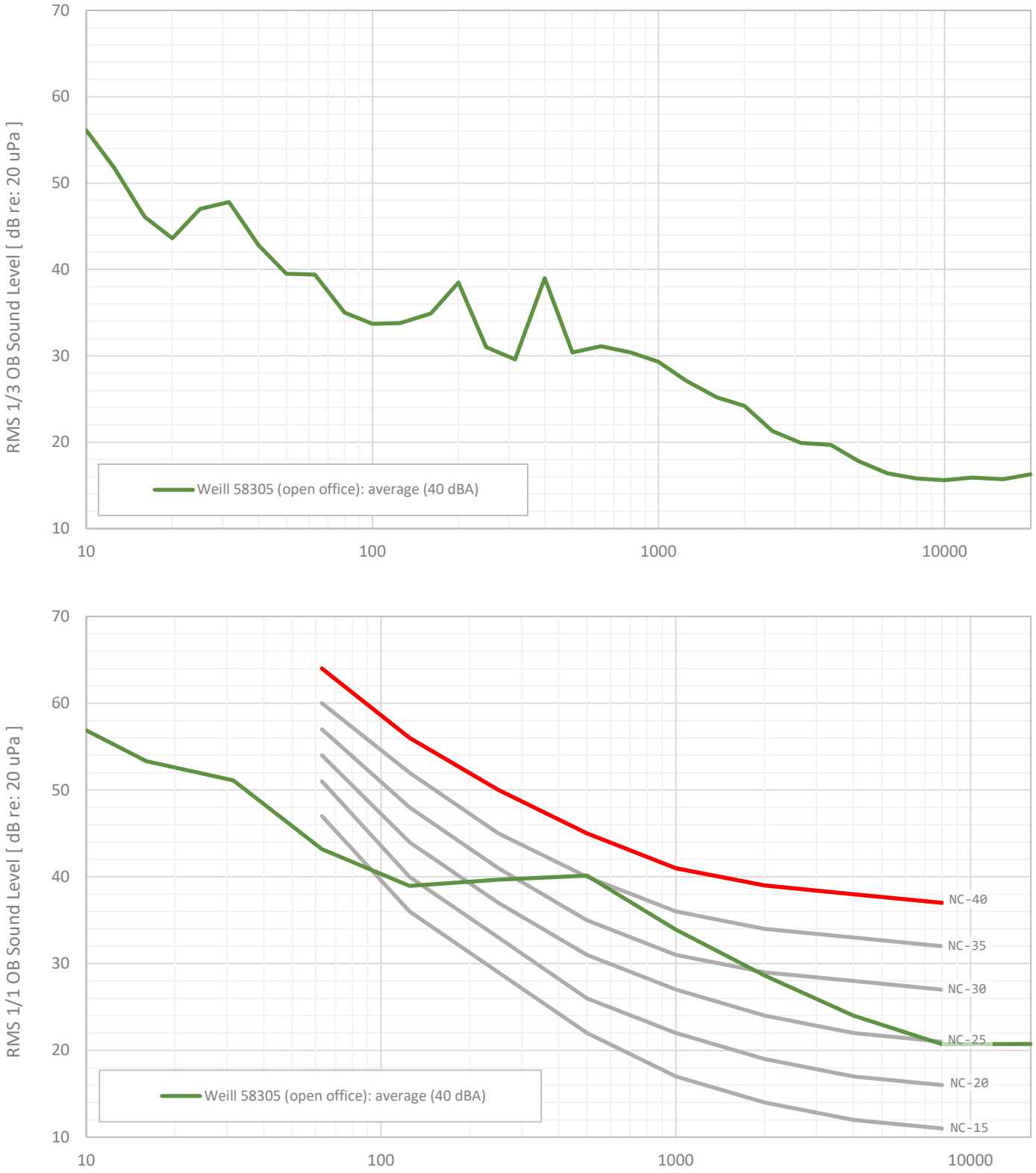


Figure B.45: Results from Weill 58305 (open office)

Noise levels are NC-35: HVAC Maximum; very quiet, dominated by a computer running with a very loud fan

Data reported on 1 observation at 1 location at 04/01/23 @ 14:31.

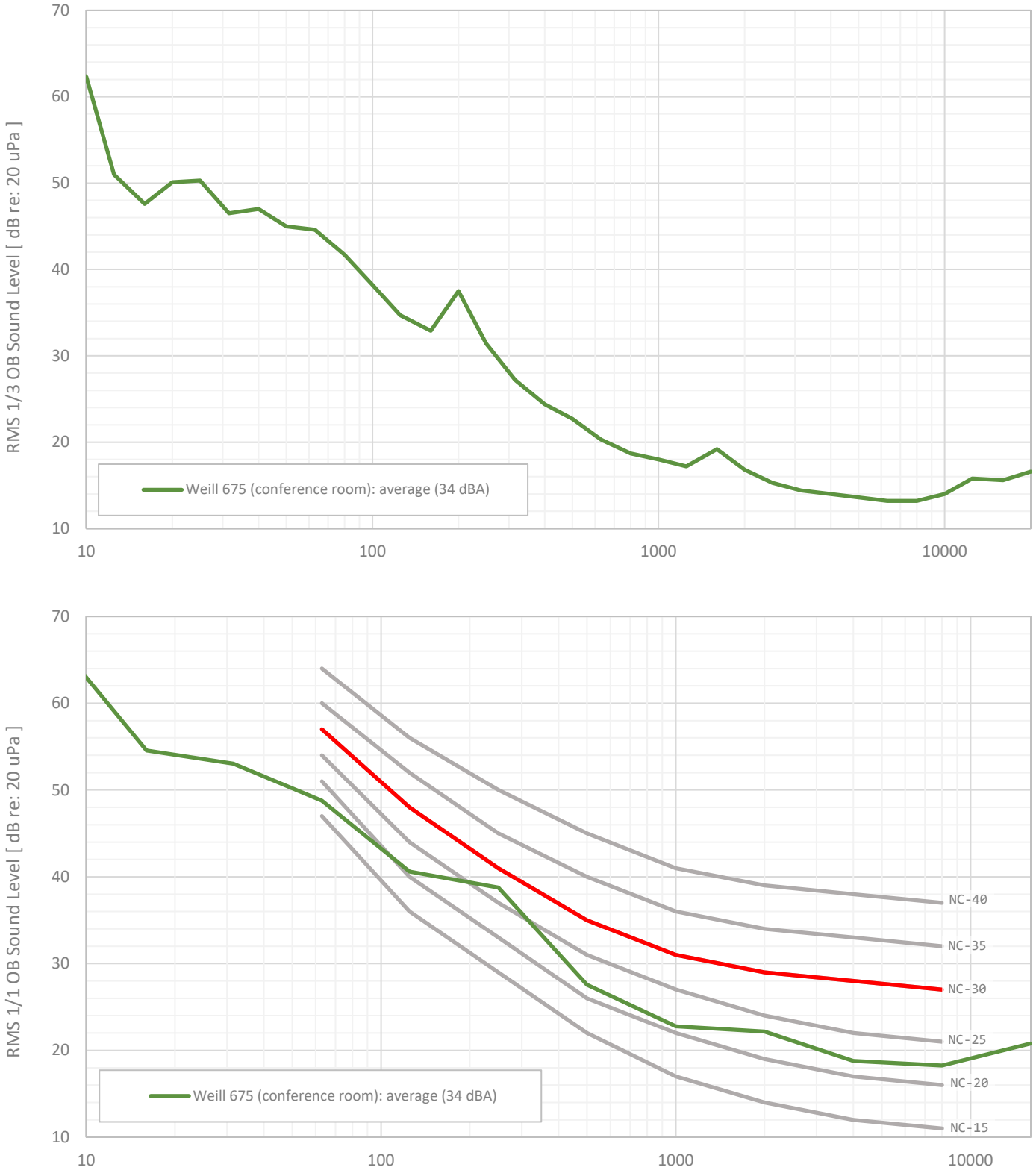


Figure B.46: Results from Weill 675 (conference room)

Noise levels are NC-28: HVAC Minimum - light contamination from exterior noise

Data reported on 1 observation at 1 location at 04/01/23 @ 14:37.

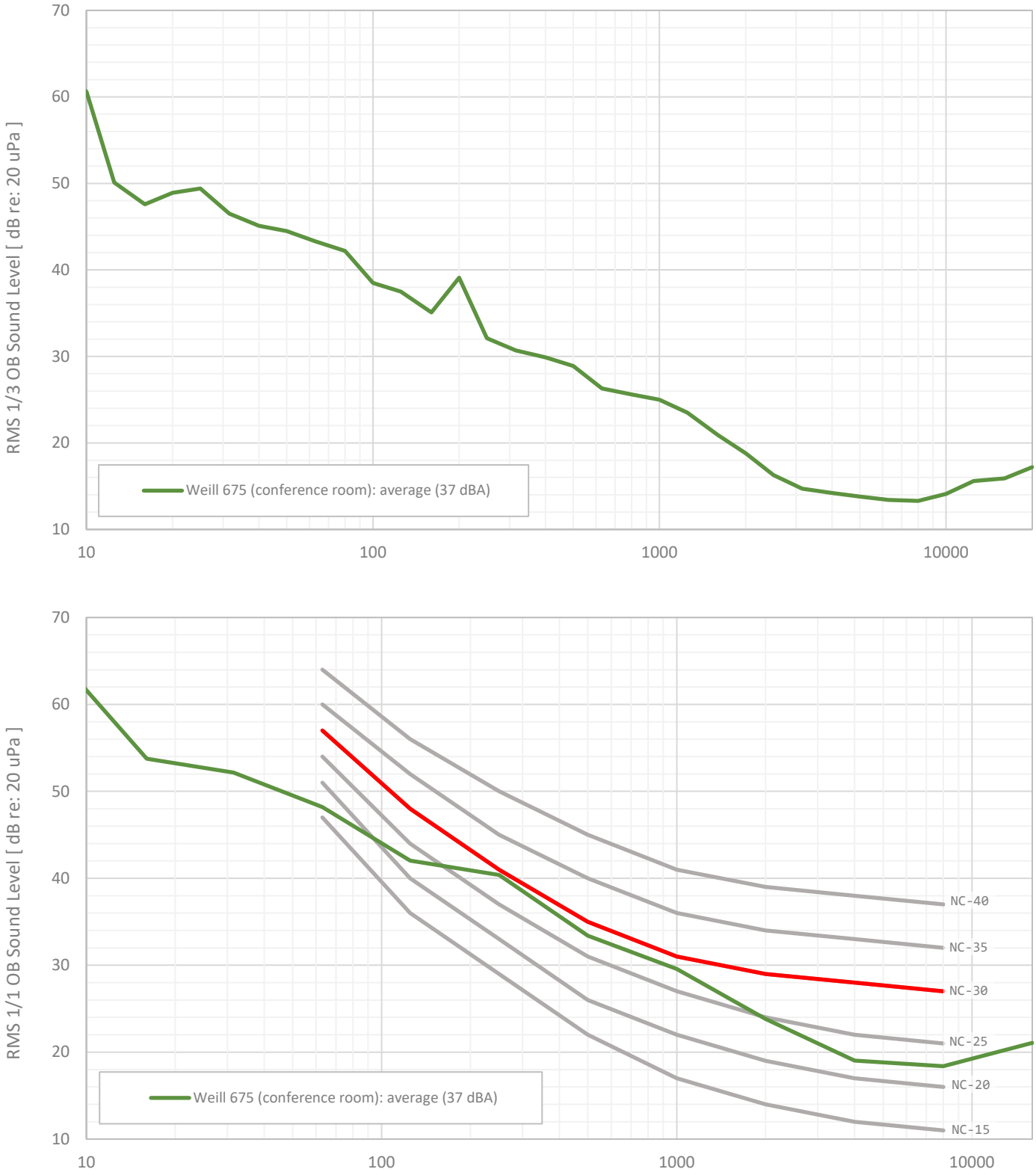


Figure B.47: Results from Weill 675 (conference room)

Noise levels are NC-29: HVAC Maximum - light contamination from exterior noise

Data reported on 1 observation at 1 location at 04/01/23 @ 14:46.

Appendix C: Noise Reduction Measurement Plots C.1 through C.18

Partition Under Test: A - Exam Room to Exam Room
Source Room: Weill 252B
Receive Room: Weill 252C
NIC Rating: **42**
SPC Rating: **66**

sound leak at door(s); partition meets NIC-42

Frequency	NR	Source, L_1	Receive, L_2	Background Noise, L_B	Adjusted Receive, L_2'	Deficiency, NIC 42 Contour
100 Hz	22	96.2	74.2	42.6	74.2	
125 Hz	20	96.2	76.4	44.1	76.4	6
160 Hz	23	95.4	72.5	37.9	72.5	6
200 Hz	29	93.1	64.4	35.1	64.4	3
250 Hz	31	86.5	55.3	32.6	55.3	4
315 Hz	36	89.1	53.2	29.5	53.2	2
400 Hz	38	90.4	52.7	28.2	52.7	3
500 Hz	39	87.2	48.2	29.6	48.2	3
630 Hz	42	88.7	46.8	26.6	46.8	1
800 Hz	45	87	42.3	25.2	42.3	0
1000 Hz	47	87.8	40.8	24	40.8	0
1250 Hz	48	87.2	39.1	23.2	39.1	0
1600 Hz	48	86	37.6	22.7	37.6	0
2000 Hz	46	83.5	37.8	19.5	37.8	0
2500 Hz	44	86.6	42.2	16.8	42.2	2
3150 Hz	47	86.1	39.6	15.6	39.6	0
4000 Hz	50	87.4	37.1	15.8	37.1	0
5000 Hz	52	84	31.7	16.1	31.7	
					Total Deficiencies:	31

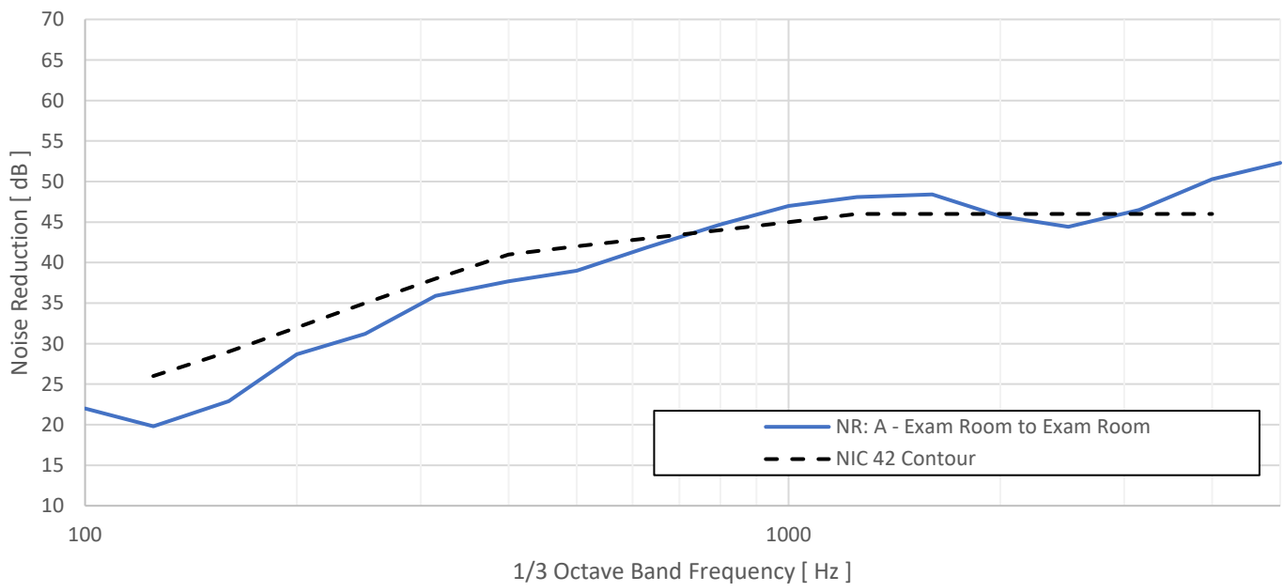


Figure C.1: Noise reduction of partition between Weill 252B and Weill 252C

Partition Under Test: B - Exam Room to Corridor w/door
Source Room: Weill 252B
Receive Room: Weill Corridor
NIC Rating: **27**
SPC Rating: **53**

sound leak at door; partition meets NIC-27

Frequency	NR	Source, L_1	Receive, L_2	Background Noise, L_B	Adjusted Receive, L_2'	Deficiency, NIC 27 Contour
100 Hz	22	93.6	71.3	42.1	71.3	
125 Hz	19	90.2	71.7	39.5	71.7	0
160 Hz	20	91.2	71.2	37.4	71.2	0
200 Hz	23	91.1	67.9	38.5	67.9	0
250 Hz	26	90.9	64.9	34.7	64.9	0
315 Hz	26	89.8	63.7	32.5	63.7	0
400 Hz	27	88.6	61.6	30.9	61.6	0
500 Hz	26	87.1	61.5	30.3	61.5	1
630 Hz	27	87.4	60.7	27.5	60.7	1
800 Hz	29	86.6	57.9	25.7	57.9	0
1000 Hz	28	86.6	58.6	23.8	58.6	2
1250 Hz	29	86.1	57.4	23.8	57.4	2
1600 Hz	28	84.9	56.9	23.6	56.9	3
2000 Hz	27	81.8	55.0	22.4	55.0	4
2500 Hz	26	85.2	58.8	20.1	58.8	5
3150 Hz	27	84.9	58.2	17	58.2	4
4000 Hz	28	86	57.8	15.7	57.8	3
5000 Hz	28	82.7	54.6	14.8	54.6	
					Total Deficiencies:	26

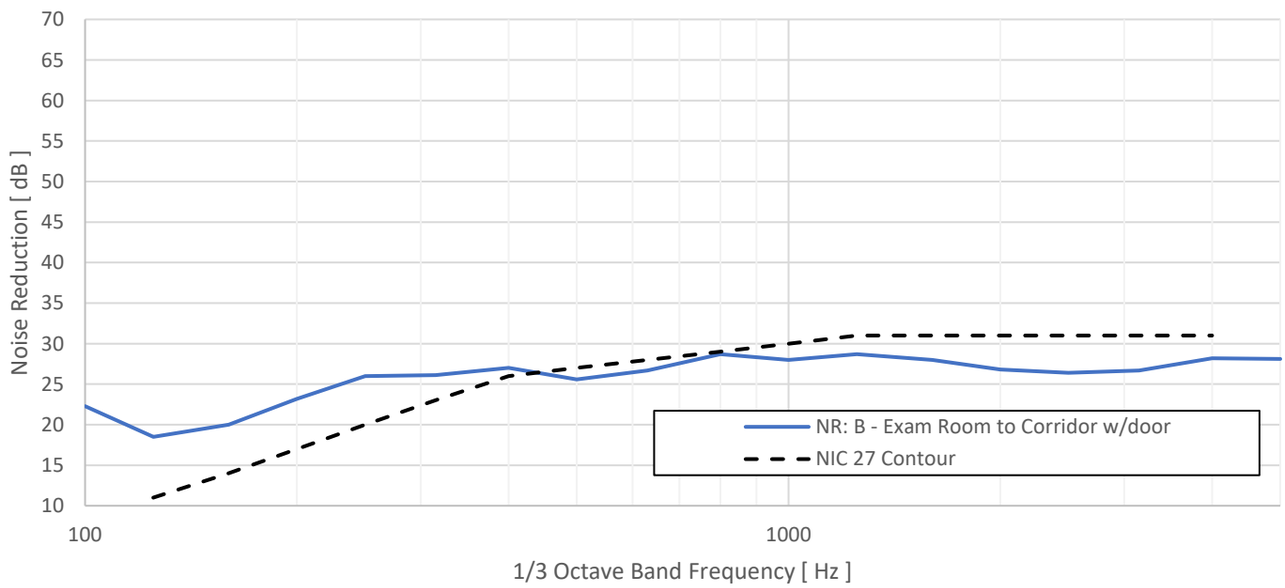


Figure C.2: Noise reduction of partition between Weill 252B and Weill Corridor

Partition Under Test: C - Consult Room to Corridor w/o door
Source Room: Weill 254A
Receive Room: Weill Corridor
NIC Rating: **36**
SPC Rating: **64**

corridor to plan north, minor sound leak at extinguisher cabinet; partition meets NIC-36

Frequency	NR	Source, L_1	Receive, L_2	Background Noise, L_B	Adjusted Receive, L_2'	Deficiency, NIC 36 Contour
100 Hz	21	97.3	76.5	42	76.5	
125 Hz	18	96.1	78.2	42.4	78.2	2
160 Hz	21	94.8	73.8	41.5	73.8	2
200 Hz	28	92.4	64.5	47.3	64.5	0
250 Hz	33	90.1	57.6	42	57.6	0
315 Hz	32	91.3	59.4	39.9	59.4	0
400 Hz	35	91.1	56.6	33.7	56.6	1
500 Hz	35	90.9	56.2	30.7	56.2	1
630 Hz	35	90.6	55.2	28.7	55.2	2
800 Hz	37	89.2	52.6	27.8	52.6	1
1000 Hz	37	89.1	52.2	25.2	52.2	2
1250 Hz	38	89	51.3	23.5	51.3	2
1600 Hz	37	87.7	50.8	22.5	50.8	3
2000 Hz	36	84.6	48.7	22.5	48.7	4
2500 Hz	35	87.6	52.2	24.2	52.2	5
3150 Hz	37	87.4	50.9	21.1	50.9	3
4000 Hz	37	88.3	51.2	18.9	51.2	3
5000 Hz	37	85	48.2	18.8	48.2	
					Total Deficiencies:	32

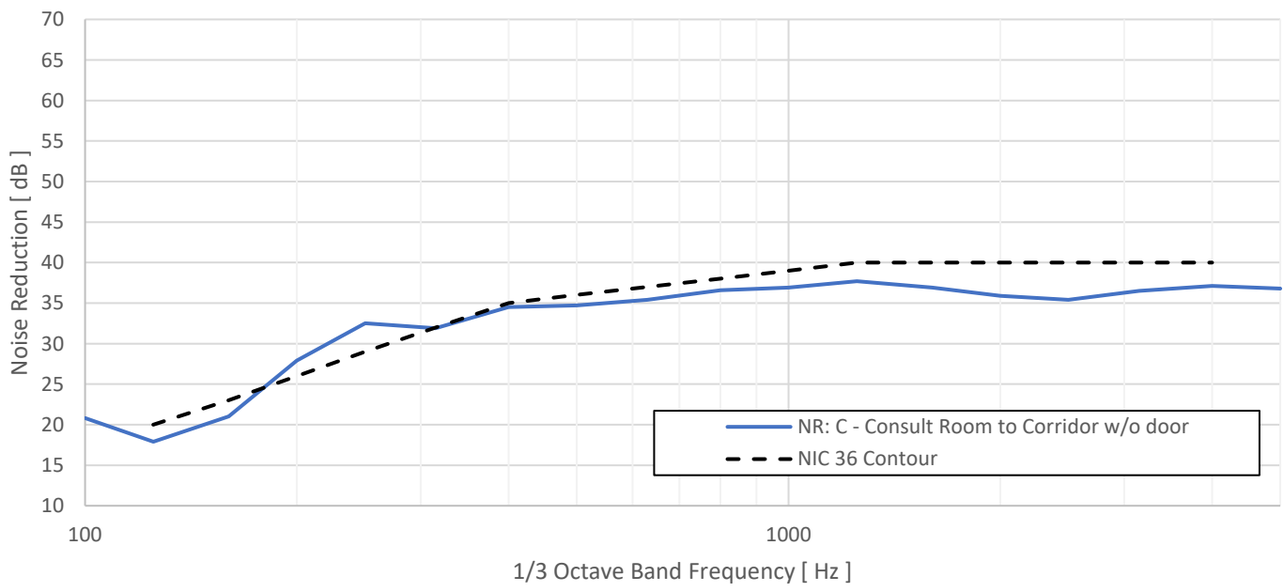


Figure C.3: Noise reduction of partition between Weill 254A and Weill Corridor

Partition Under Test: D - Exam Room to Team Workroom
Source Room: Weill 253B
Receive Room: Weill 253C
NIC Rating: **41**
SPC Rating: **65**

door closed, sound leak at penetration at shelf mounting; partition meets NIC-41

Frequency	NR	Source, L_1	Receive, L_2	Background Noise, L_B	Adjusted Receive, L_2'	Deficiency, NIC 41 Contour
100 Hz	25	88.7	63.5	39.2	63.5	
125 Hz	20	92	72.5	40.2	72.5	6
160 Hz	28	99.3	71.2	37.6	71.2	0
200 Hz	29	92.8	64.3	36.1	64.3	3
250 Hz	32	87.4	55.8	33.1	55.8	2
315 Hz	33	87.2	54.2	30.9	54.2	4
400 Hz	36	87.1	50.9	27.5	50.9	4
500 Hz	38	88.3	50.4	26.5	50.4	3
630 Hz	41	86.5	45.9	24.7	45.9	1
800 Hz	44	86.7	42.6	23	42.6	0
1000 Hz	46	87.1	40.8	21.3	40.8	0
1250 Hz	46	86.8	40.5	19.4	40.5	0
1600 Hz	45	85.9	40.6	20.8	40.6	0
2000 Hz	44	82.8	38.7	17.9	38.7	1
2500 Hz	45	85.6	40.2	15.6	40.2	0
3150 Hz	49	85.7	37.0	15	37.0	0
4000 Hz	52	86.6	34.3	14.3	34.3	0
5000 Hz	54	83.4	29.1	14.1	29.1	
					Total Deficiencies:	24

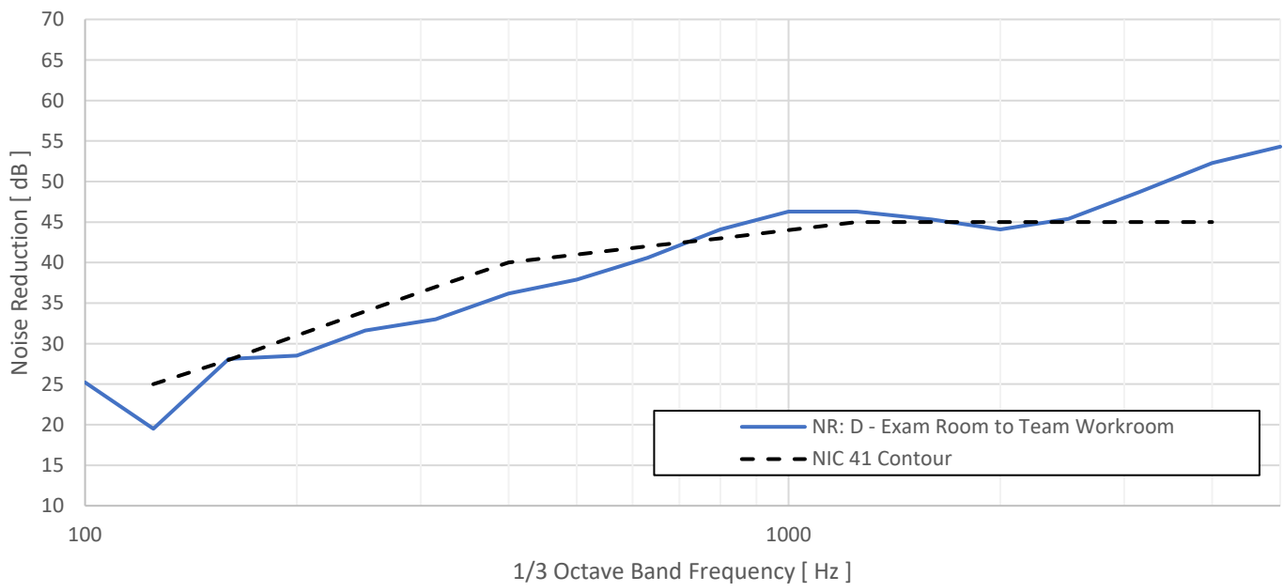


Figure C.4: Noise reduction of partition between Weill 253B and Weill 253C

Partition Under Test: E - Exam Room to Team Workroom
Source Room: Weill 253B
Receive Room: Weill 253C
NIC Rating: **38**
SPC Rating: **61**

door open, sound leak at penetration at shelf mounting; partition meets NIC-38

Frequency	NR	Source, L_1	Receive, L_2	Background Noise, L_B	Adjusted Receive, L_2'	Deficiency, NIC 38 Contour
100 Hz	26	88.7	62.7	39.2	62.7	
125 Hz	20	92	72.3	40.2	72.3	2
160 Hz	29	99.3	70.6	37.6	70.6	0
200 Hz	28	92.8	65.0	36.1	65.0	0
250 Hz	31	87.4	56.0	33.1	56.0	0
315 Hz	32	87.2	55.3	30.9	55.3	2
400 Hz	34	87.1	53.0	27.5	53.0	3
500 Hz	35	88.3	53.8	26.5	53.8	4
630 Hz	38	86.5	48.7	24.7	48.7	1
800 Hz	40	86.7	47.0	23	47.0	0
1000 Hz	42	87.1	45.6	21.3	45.6	0
1250 Hz	42	86.8	44.6	19.4	44.6	0
1600 Hz	40	85.9	45.7	20.8	45.7	2
2000 Hz	40	82.8	43.3	17.9	43.3	3
2500 Hz	39	85.6	46.2	15.6	46.2	3
3150 Hz	41	85.7	44.4	15	44.4	1
4000 Hz	42	86.6	44.7	14.3	44.7	0
5000 Hz	42	83.4	41.8	14.1	41.8	
					Total Deficiencies:	20

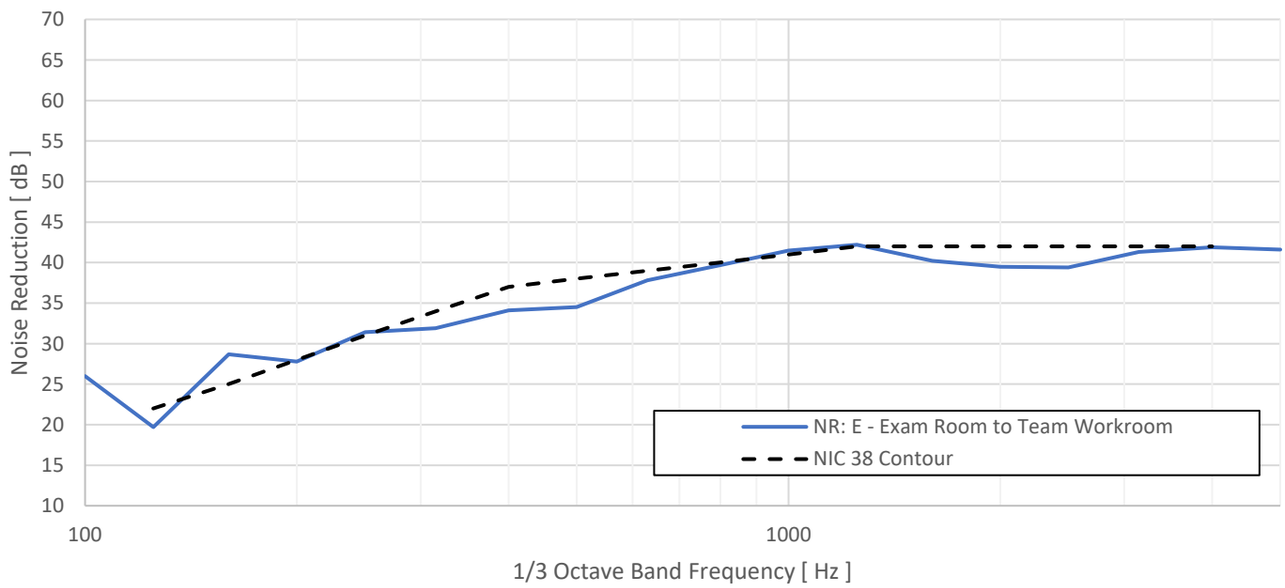


Figure C.5: Noise reduction of partition between Weill 253B and Weill 253C

Partition Under Test: F - Private Office to Private Office
Source Room: Weill 581H
Receive Room: Weill 581G
NIC Rating: **30**
SPC Rating: **58**

partition is well sealed, with minor sound leak at mullion; partition meets NIC-30

Frequency	NR	Source, L_1	Receive, L_2	Background Noise, L_B	Adjusted Receive, L_2'	Deficiency, NIC 30 Contour
100 Hz	17	97.2	80.0	29.7	80.0	
125 Hz	6	96.1	89.7	34	89.7	8
160 Hz	13	94.7	82.2	32.9	82.2	5
200 Hz	22	94.5	72.7	31.4	72.7	0
250 Hz	31	93	62.4	27.2	62.4	0
315 Hz	31	91.7	61.0	24.8	61.0	0
400 Hz	35	86.4	51.7	21.4	51.7	0
500 Hz	38	87.9	50.4	18.3	50.4	0
630 Hz	39	86.8	47.6	18.9	47.6	0
800 Hz	43	87.5	45.0	20.2	45.0	0
1000 Hz	43	87.7	44.5	18.3	44.5	0
1250 Hz	45	87.8	42.9	18.8	42.9	0
1600 Hz	45	86.8	42.2	18.7	42.2	0
2000 Hz	42	83.6	42.1	13.9	42.1	0
2500 Hz	43	86.1	43.1	13.5	43.1	0
3150 Hz	47	85.8	39.3	12.9	39.3	0
4000 Hz	51	86.9	36.0	12.7	36.0	0
5000 Hz	54	83.7	29.8	13.1	29.8	
					Total Deficiencies:	12

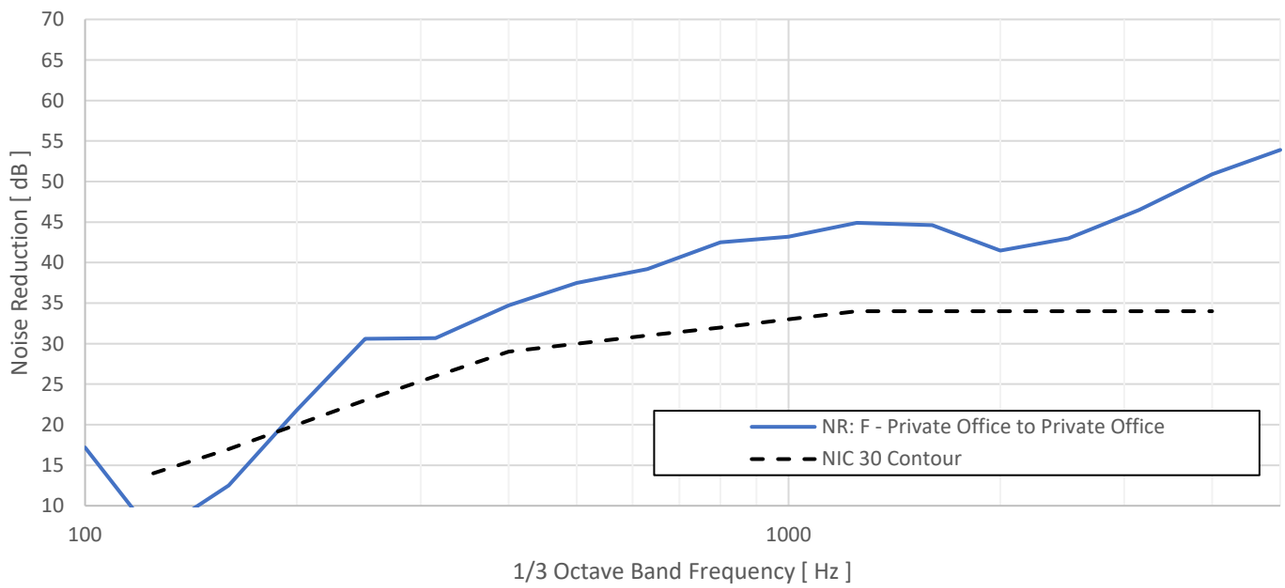


Figure C.6: Noise reduction of partition between Weill 581H and Weill 581G

Partition Under Test: G - Private Office to Private Office
Source Room: Weill 581H
Receive Room: Weill 581J
NIC Rating: **37**
SPC Rating: **62**

partition is well sealed, with minor sound leak at mullion; partition meets NIC-37

Frequency	NR	Source, L_1	Receive, L_2	Background Noise, L_B	Adjusted Receive, L_2'	Deficiency, NIC 37 Contour
100 Hz	21	94.8	73.6	32.7	73.6	
125 Hz	15	100.6	85.7	36.6	85.7	6
160 Hz	16	91.9	75.6	38.1	75.6	8
200 Hz	23	95.1	72.1	34.6	72.1	4
250 Hz	28	89.3	60.9	32.1	60.9	2
315 Hz	31	89.5	58.7	29.6	58.7	2
400 Hz	37	84.6	48.1	23.2	48.1	0
500 Hz	40	88.2	47.9	19.4	47.9	0
630 Hz	41	88.4	47.7	18.2	47.7	0
800 Hz	43	86.6	43.5	18.4	43.5	0
1000 Hz	46	88.4	42.9	18.1	42.9	0
1250 Hz	46	88.1	41.7	19	41.7	0
1600 Hz	46	87.7	41.9	19.4	41.9	0
2000 Hz	43	84.3	40.9	17	40.9	0
2500 Hz	45	87.4	42.1	15.3	42.1	0
3150 Hz	49	87.2	38.3	14.1	38.3	0
4000 Hz	52	88.4	36.4	13.9	36.4	0
5000 Hz	54	85.3	31.0	14	31.0	
					Total Deficiencies:	22

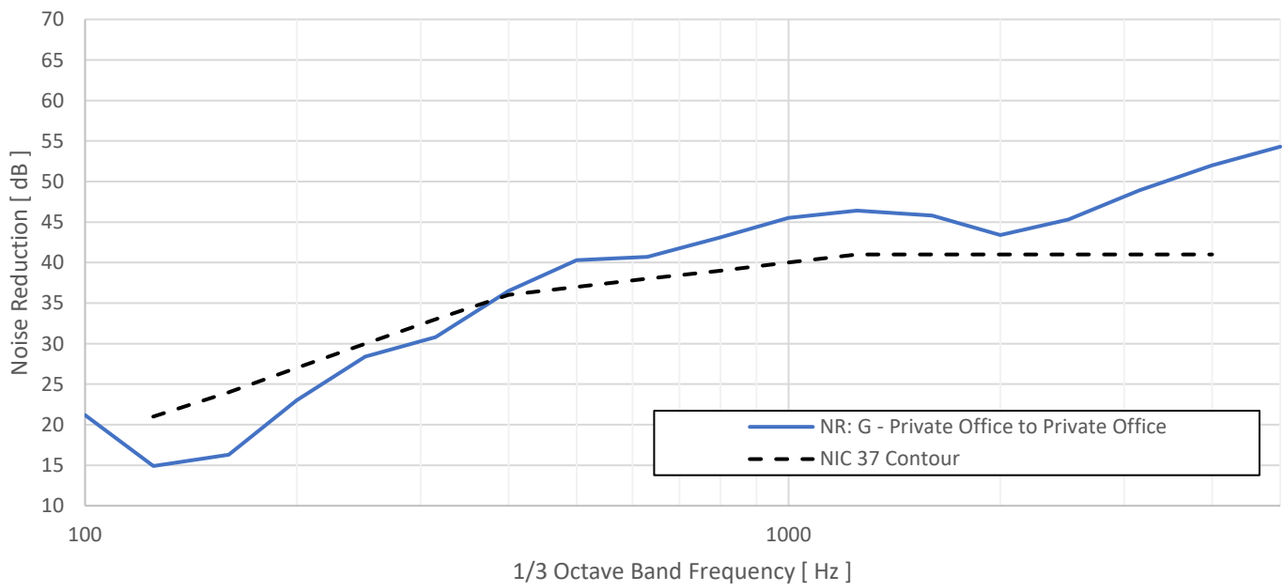


Figure C.7: Noise reduction of partition between Weill 581H and Weill 581J

Partition Under Test: H - Private Office to Open Office
Source Room: Weill 581H
Receive Room: Weill 58505
NIC Rating: **34**
SPC Rating: **61**

sound leak at sliding door and top of wall; partition meets NIC-34

Frequency	NR	Source, L_1	Receive, L_2	Background Noise, L_B	Adjusted Receive, L_2'	Deficiency, NIC 34 Contour
100 Hz	24	94.8	71.1	34.2	71.1	
125 Hz	26	100.6	74.8	33.5	74.8	0
160 Hz	24	91.9	68.3	34.3	68.3	0
200 Hz	28	95.1	67.1	37.6	67.1	0
250 Hz	29	89.3	60.1	30.8	60.1	0
315 Hz	33	89.5	57.0	29.3	57.0	0
400 Hz	30	84.6	54.5	36.8	54.5	3
500 Hz	32	88.2	55.9	30.3	55.9	2
630 Hz	32	88.4	56.3	30.6	56.3	3
800 Hz	32	86.6	54.3	30.4	54.3	4
1000 Hz	33	88.4	55.1	29.4	55.1	4
1250 Hz	33	88.1	55.4	26.9	55.4	5
1600 Hz	34	87.7	53.5	24.9	53.5	4
2000 Hz	36	84.3	48.6	23.3	48.6	2
2500 Hz	36	87.4	51.6	20.7	51.6	2
3150 Hz	38	87.2	49.0	19	49.0	0
4000 Hz	41	88.4	47.8	17.9	47.8	0
5000 Hz	42	85.3	43.0	16.3	43.0	
					Total Deficiencies:	29

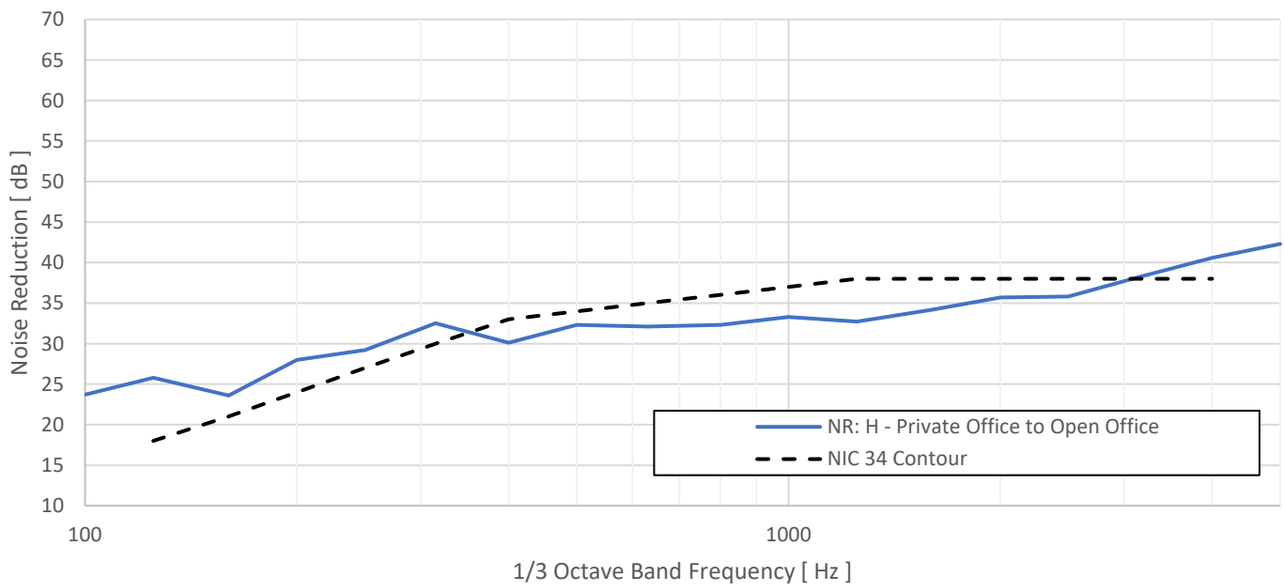


Figure C.8: Noise reduction of partition between Weill 581H and Weill 58505

Partition Under Test: I - Private Office to Private Office
Source Room: Weill 511F
Receive Room: Weill 511G
NIC Rating: **39**
SPC Rating: **59**

partition is well sealed, with minor sound leak at mullion; partition meets NIC-39

Frequency	NR	Source, L_1	Receive, L_2	Background Noise, L_B	Adjusted Receive, L_2'	Deficiency, NIC 39 Contour
100 Hz	22	99.2	77.1	31.2	77.1	
125 Hz	17	96.8	80.2	32.7	80.2	6
160 Hz	21	96.8	75.8	33.9	75.8	5
200 Hz	24	93.2	69.3	31.6	69.3	5
250 Hz	31	90.1	59.6	29	59.6	2
315 Hz	30	91	61.2	26.1	61.2	5
400 Hz	35	86.1	50.8	21.3	50.8	3
500 Hz	40	90	50.0	19.1	50.0	0
630 Hz	41	88.9	48.3	17.8	48.3	0
800 Hz	44	88.4	44.7	17.7	44.7	0
1000 Hz	45	88.6	43.9	18.2	43.9	0
1250 Hz	43	88.7	45.8	18.3	45.8	0
1600 Hz	43	87.6	45.0	16.5	45.0	0
2000 Hz	42	84.1	42.0	13.3	42.0	1
2500 Hz	44	87.2	43.0	10.8	43.0	0
3150 Hz	48	87.2	39.2	10	39.2	0
4000 Hz	52	88.4	36.4	10.4	36.4	0
5000 Hz	53	85.2	31.8	10.5	31.8	
					Total Deficiencies:	27

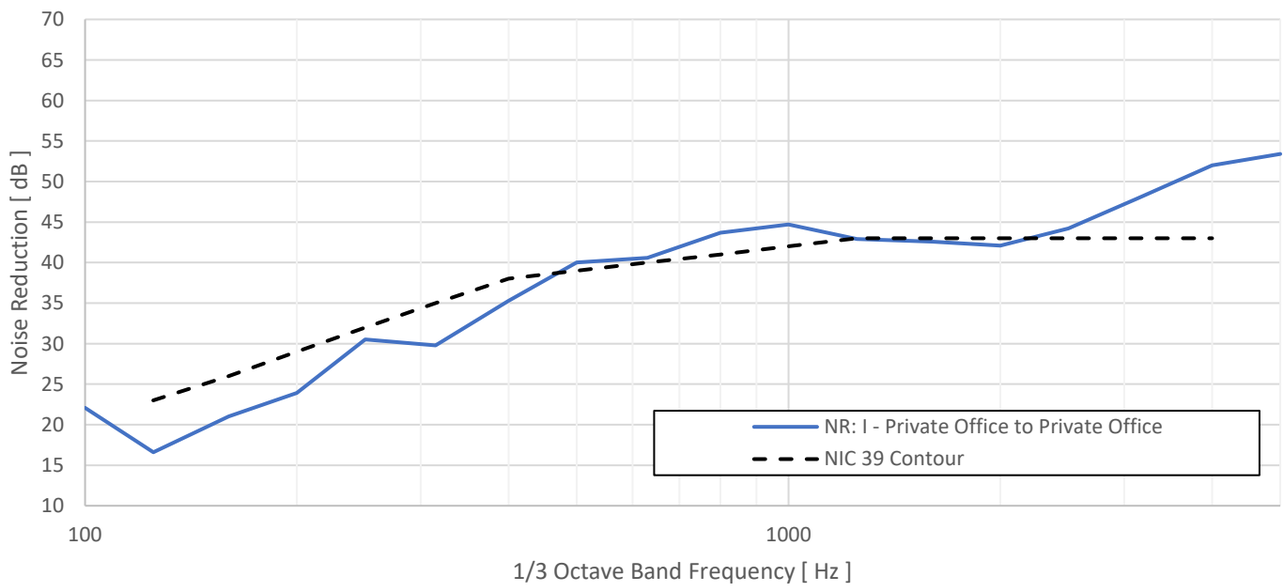


Figure C.9: Noise reduction of partition between Weill 511F and Weill 511G

Partition Under Test: J - Private Office to Private Office
Source Room: Weill 511F
Receive Room: Weill 511E
NIC Rating: **39**
SPC Rating: **59**

partition is well sealed, with minor sound leak at mullion; partition meets NIC-39

Frequency	NR	Source, L_1	Receive, L_2	Background Noise, L_B	Adjusted Receive, L_2'	Deficiency, NIC 39 Contour
100 Hz	25	92	67.5	30.7	67.5	
125 Hz	18	94.1	76.2	35.3	76.2	5
160 Hz	21	91.7	70.9	35.8	70.9	5
200 Hz	21	92.6	71.3	33	71.3	8
250 Hz	27	88.5	61.6	29.4	61.6	5
315 Hz	30	90.1	59.9	26.5	59.9	5
400 Hz	37	90	53.5	21.3	53.5	2
500 Hz	38	88.3	50.4	17.9	50.4	1
630 Hz	40	87.5	47.1	16.4	47.1	0
800 Hz	44	86.6	43.0	16.5	43.0	0
1000 Hz	45	87.4	42.8	15.8	42.8	0
1250 Hz	46	88.1	42.6	16.5	42.6	0
1600 Hz	46	87.5	41.8	17.4	41.8	0
2000 Hz	43	84.3	41.1	13	41.1	0
2500 Hz	45	87.1	42.0	11.5	42.0	0
3150 Hz	48	86.4	38.6	10.8	38.6	0
4000 Hz	51	87.6	36.3	10.8	36.3	0
5000 Hz	54	84.2	29.9	11.1	29.9	
					Total Deficiencies:	31

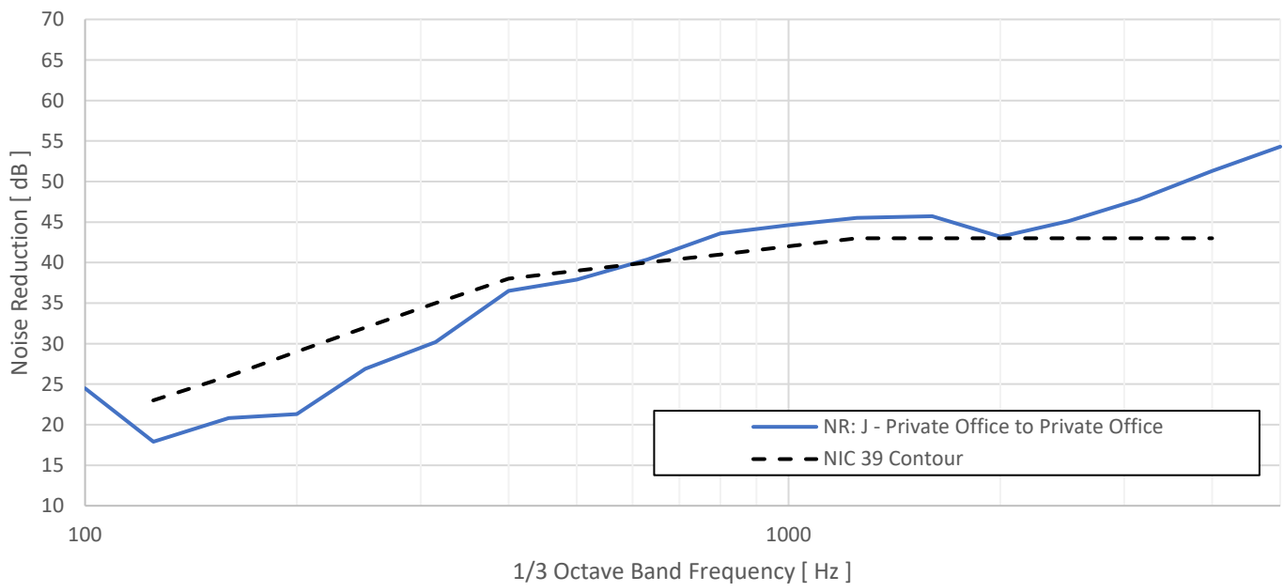


Figure C.10: Noise reduction of partition between Weill 511F and Weill 511E

Partition Under Test: K - Private Office to Open Office
Source Room: Weill 511F
Receive Room: Weill 51306
NIC Rating: **29**
SPC Rating: **51**

sound leak at top of concrete column (not sealed) and door; partition meets NIC-29

Frequency	NR	Source, L_1	Receive, L_2	Background Noise, L_B	Adjusted Receive, L_2'	Deficiency, NIC 29 Contour
100 Hz	26	92	65.8	35.3	65.8	
125 Hz	20	94.1	74.2	35.8	74.2	0
160 Hz	22	91.7	69.4	33.7	69.4	0
200 Hz	28	92.6	64.7	29.7	64.7	0
250 Hz	30	88.5	58.4	26.4	58.4	0
315 Hz	29	90.1	61.5	25.9	61.5	0
400 Hz	29	90	61.4	23.3	61.4	0
500 Hz	28	88.3	60.3	22.7	60.3	1
630 Hz	28	87.5	59.6	23.3	59.6	2
800 Hz	28	86.6	59.0	21.7	59.0	3
1000 Hz	27	87.4	60.3	22.2	60.3	5
1250 Hz	27	88.1	61.3	22.8	61.3	6
1600 Hz	27	87.5	60.9	21.5	60.9	6
2000 Hz	29	84.3	55.6	18	55.6	4
2500 Hz	32	87.1	55.5	15.6	55.5	1
3150 Hz	34	86.4	52.7	14.2	52.7	0
4000 Hz	37	87.6	50.5	13.9	50.5	0
5000 Hz	39	84.2	45.3	13.2	45.3	
					Total Deficiencies:	30

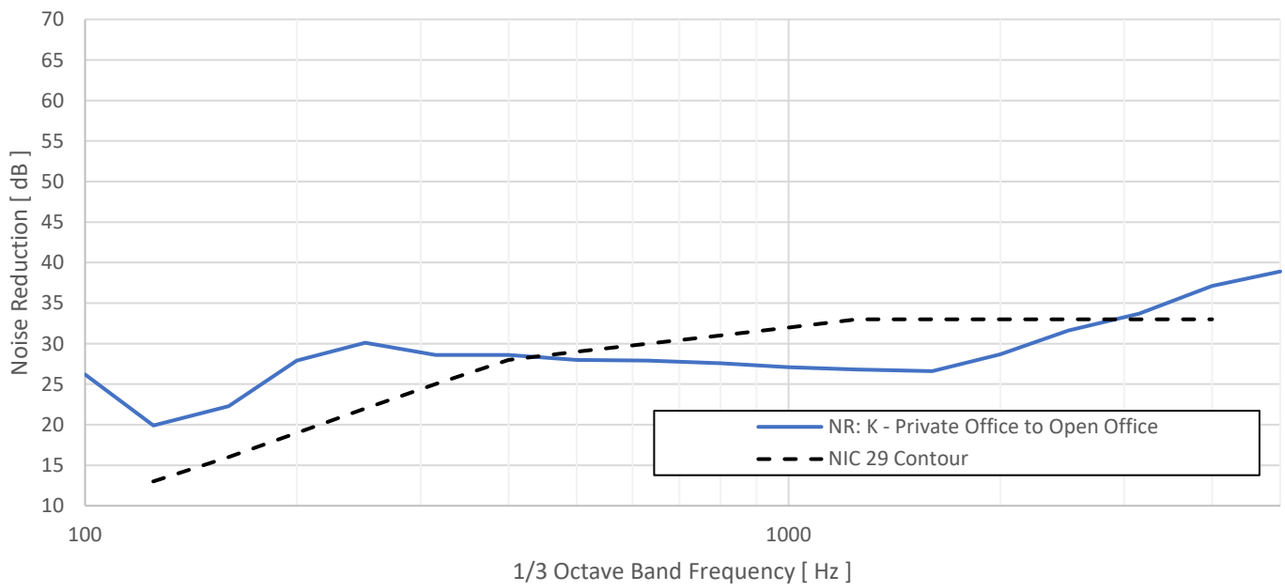


Figure C.11: Noise reduction of partition between Weill 511F and Weill 51306

Partition Under Test: L - Conference Room (large) to Conference Room (medium)
Source Room: Mission Hall 2109
Receive Room: Mission Hall 2110
NIC Rating: **49**
SPC Rating: **71**

partition is well sealed, sound leak at door; partition meets NIC-49

Frequency	NR	Source, L_1	Receive, L_2	Background Noise, L_B	Adjusted Receive, L_2'	Deficiency, NIC 49 Contour
100 Hz	22	92.8	71.0	32.8	71.0	
125 Hz	25	91.3	65.9	33.1	65.9	8
160 Hz	31	88.5	57.5	30.4	57.5	5
200 Hz	33	84.6	52.0	33.5	52.0	6
250 Hz	40	86.6	46.9	32.7	46.9	2
315 Hz	45	90.4	45.6	28.6	45.6	0
400 Hz	47	87.4	40.7	25.1	40.7	1
500 Hz	48	85.9	37.8	26.6	37.8	1
630 Hz	49	84.5	35.5	25.7	35.0	1
800 Hz	52	84.9	33.2	20.9	33.2	0
1000 Hz	52	86.7	35.1	21.2	35.1	0
1250 Hz	55	85.9	30.9	21.2	30.4	0
1600 Hz	57	85.4	28.8	18.3	28.8	0
2000 Hz	55	83.7	28.9	17.2	28.9	0
2500 Hz	53	87.2	34.2	15.8	34.2	0
3150 Hz	49	86.8	37.7	14.8	37.7	4
4000 Hz	52	87.4	35.5	14.2	35.5	1
5000 Hz	55	84.2	29.6	13.7	29.6	
					Total Deficiencies:	30

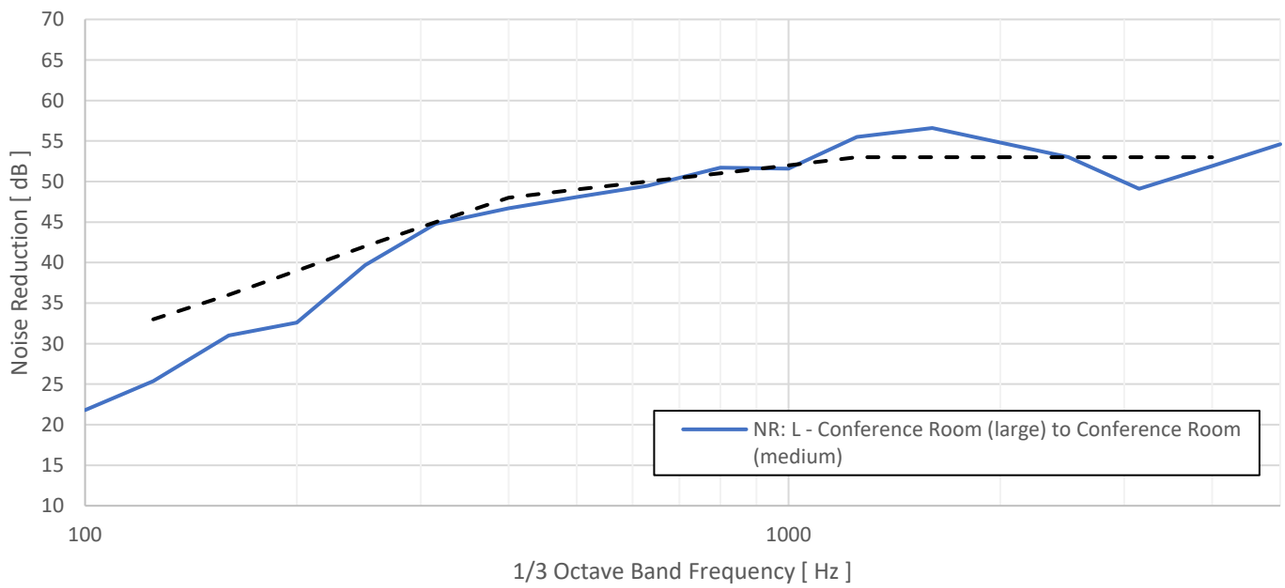


Figure C.12: Noise reduction of partition between Mission Hall 2109 and Mission Hall 2110

Partition Under Test: M - Private Office to Focus Room
Source Room: Mission Hall 2702
Receive Room: Mission Hall 2703
NIC Rating: **42**
SPC Rating: **66**

partition is well sealed, with minor sound leak at top of wall; partition meets NIC-42

Frequency	NR	Source, L_1	Receive, L_2	Background Noise, L_B	Adjusted Receive, L_2'	Deficiency, NIC 42 Contour
100 Hz	21	96.2	75.7	33.2	75.7	
125 Hz	27	93.7	67.2	34.2	67.2	0
160 Hz	28	94.8	66.9	32.4	66.9	1
200 Hz	29	97.3	68.1	37.7	68.1	3
250 Hz	35	93.3	58.8	37.1	58.8	1
315 Hz	32	93.7	62.2	39	62.2	7
400 Hz	37	90.9	53.8	32.4	53.8	4
500 Hz	42	88.5	46.2	26.4	46.2	0
630 Hz	45	88.6	43.5	23.3	43.5	0
800 Hz	47	88.6	42.1	23	42.1	0
1000 Hz	47	89	41.8	23.8	41.8	0
1250 Hz	46	89.4	43.3	21.6	43.3	0
1600 Hz	42	88.3	46.0	20.8	46.0	4
2000 Hz	42	84.8	42.4	17.5	42.4	4
2500 Hz	42	88.6	46.8	16.8	46.8	4
3150 Hz	45	88.2	43.0	17.3	43.0	1
4000 Hz	49	89.4	40.9	16	40.9	0
5000 Hz	51	86.3	35.6	13.3	35.6	
					Total Deficiencies:	27

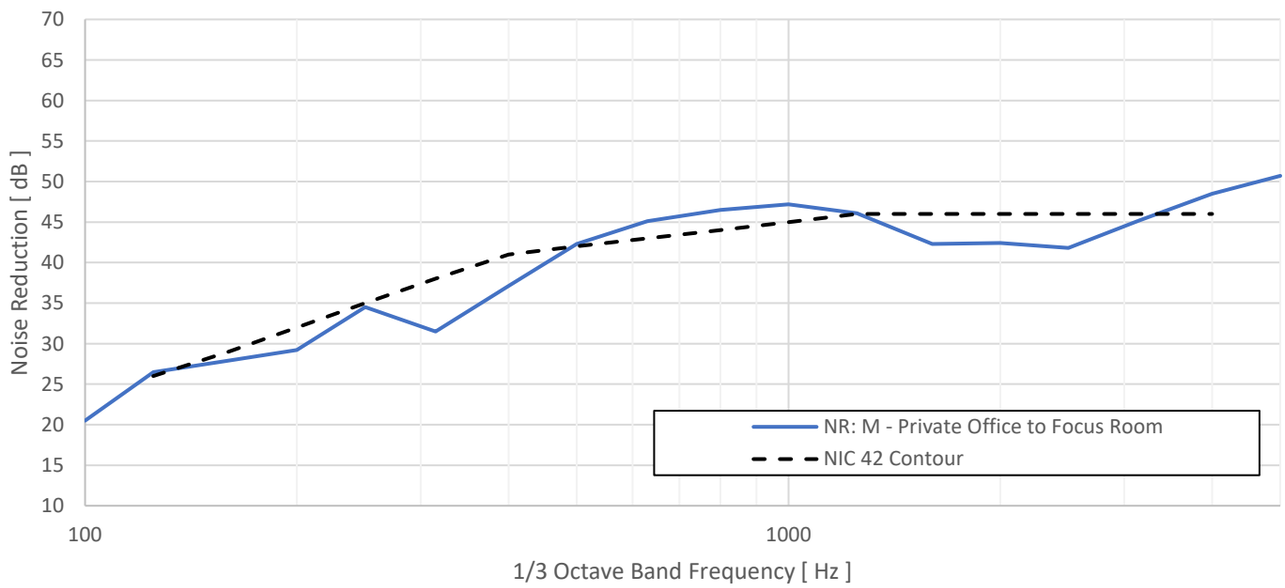


Figure C.13: Noise reduction of partition between Mission Hall 2702 and Mission Hall 2703

Partition Under Test: N - Private Office to Open Office
Source Room: Mission Hall 2702
Receive Room: Mission Hall 2731-32
NIC Rating: **31**
SPC Rating: **60**

sound leak at return air grille and door; partition meets NIC-31

Frequency	NR	Source, L_1	Receive, L_2	Background Noise, L_B	Adjusted Receive, L_2'	Deficiency, NIC 31 Contour
100 Hz	20	96.2	76.1	37.6	76.1	
125 Hz	20	93.7	73.8	38.2	73.8	0
160 Hz	27	94.8	67.4	35.6	67.4	0
200 Hz	29	97.3	68.3	35.6	68.3	0
250 Hz	29	93.3	64.1	36.1	64.1	0
315 Hz	32	93.7	61.7	34.7	61.7	0
400 Hz	29	90.9	62.0	33.3	62.0	1
500 Hz	26	88.5	62.2	32.6	62.2	5
630 Hz	28	88.6	61.1	30.7	61.1	5
800 Hz	31	88.6	57.3	30.8	57.3	2
1000 Hz	32	89	57.1	28.3	57.1	2
1250 Hz	31	89.4	58.0	26	58.0	4
1600 Hz	30	88.3	58.6	25.5	58.6	5
2000 Hz	33	84.8	52.1	23.2	52.1	2
2500 Hz	35	88.6	53.2	22.7	53.2	0
3150 Hz	36	88.2	51.9	22.3	51.9	0
4000 Hz	37	89.4	52.2	19.9	52.2	0
5000 Hz	38	86.3	48.2	16.9	48.2	
					Total Deficiencies:	25

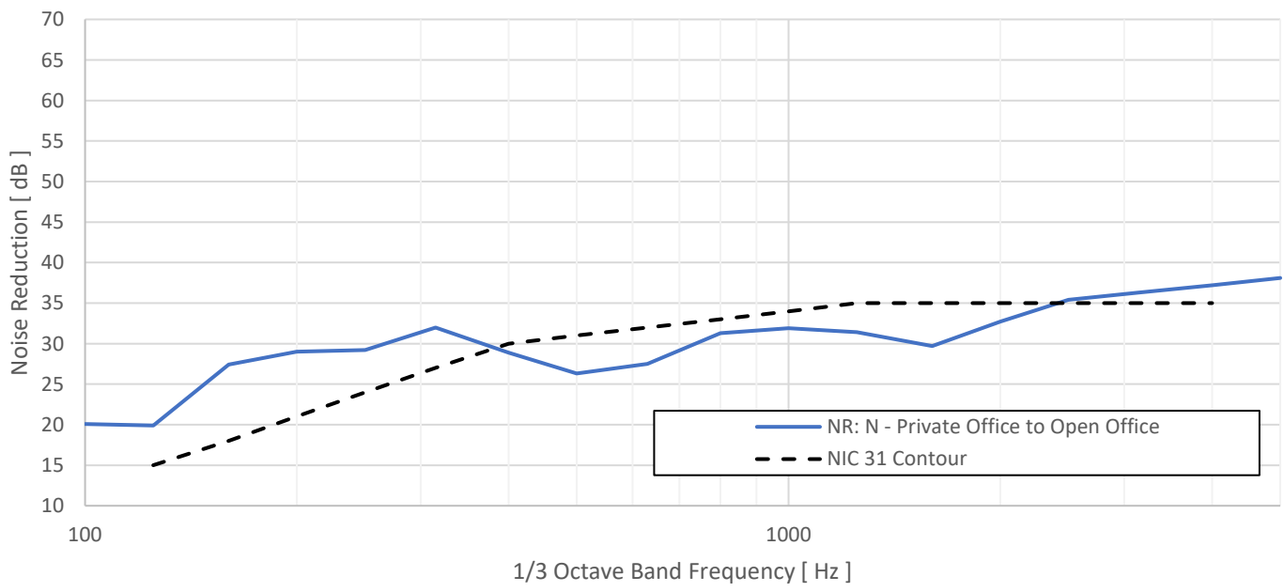


Figure C.14: Noise reduction of partition between Mission Hall 2702 and Mission Hall 2731-32

Partition Under Test: O - Private Office to Private Office
Source Room: Mission Hall 2702
Receive Room: Mission Hall 2701
NIC Rating: **42**
SPC Rating: **65**

partition is well sealed, with minor sound leak at top of wall; partition meets NIC-42

Frequency	NR	Source, L_1	Receive, L_2	Background Noise, L_B	Adjusted Receive, L_2'	Deficiency, NIC 42 Contour
100 Hz	14	94.4	80.2	35.4	80.2	
125 Hz	19	100	81.3	33.3	81.3	7
160 Hz	29	98.5	69.2	32.2	69.2	0
200 Hz	30	98	68.2	35.2	68.2	2
250 Hz	34	94.5	60.1	36.4	60.1	1
315 Hz	35	92.2	57.2	38.5	57.2	3
400 Hz	37	90	53.5	31.7	53.5	5
500 Hz	40	88.1	48.4	24.7	48.4	2
630 Hz	42	88.4	46.0	23.2	46.0	1
800 Hz	46	88.8	43.0	24.4	43.0	0
1000 Hz	47	90	43.1	25.1	43.1	0
1250 Hz	46	88.7	42.7	21	42.7	0
1600 Hz	46	88.5	42.5	18.6	42.5	0
2000 Hz	42	85.1	43.2	15.4	43.2	4
2500 Hz	42	88.8	47.0	15.2	47.0	4
3150 Hz	45	88.6	43.2	15.4	43.2	1
4000 Hz	50	89.8	40.3	14.4	40.3	0
5000 Hz	51	86.5	35.2	12.9	35.2	
					Total Deficiencies:	29

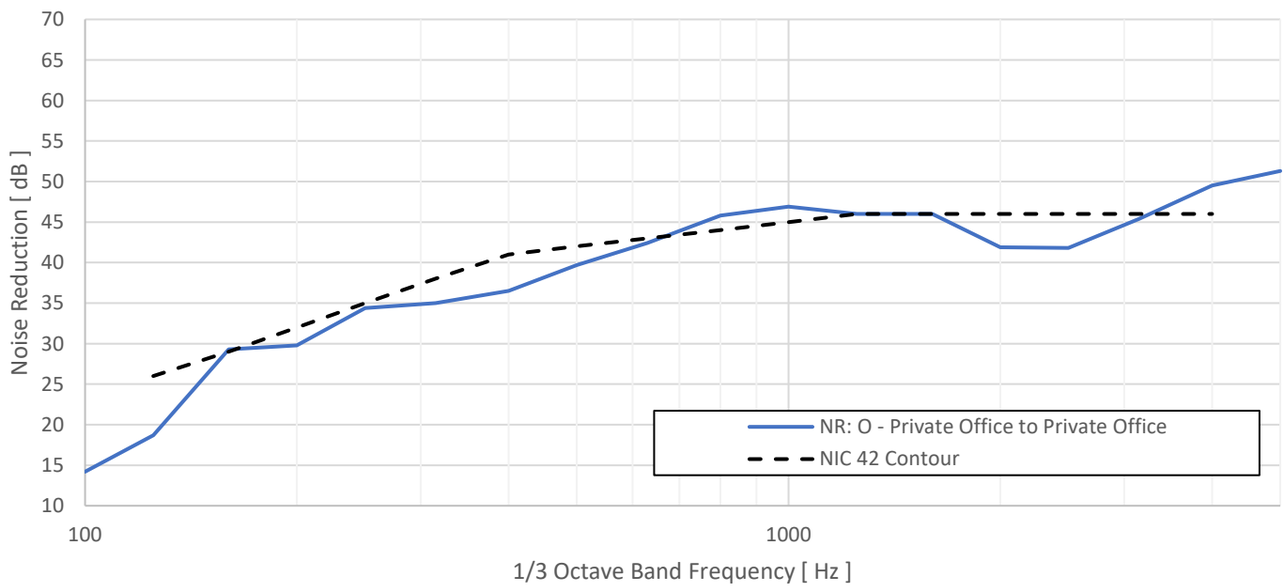


Figure C.15: Noise reduction of partition between Mission Hall 2702 and Mission Hall 2701

Partition Under Test: P - Private Office to Conference Room (large)
Source Room: Mission Hall 2702
Receive Room: Mission Hall 2700
NIC Rating: **52**
SPC Rating: **79**

sound leak at bottom of partition; partition meets NIC-52

Frequency	NR	Source, L_1	Receive, L_2	Background Noise, L_B	Adjusted Receive, L_2'	Deficiency, NIC 52 Contour
100 Hz	21	94.4	73.2	47.4	73.2	
125 Hz	36	100	64.4	45.1	64.4	0
160 Hz	36	98.5	62.9	41.4	62.9	3
200 Hz	42	98	56.2	39.1	56.2	0
250 Hz	46	94.5	48.6	38.3	48.6	0
315 Hz	46	92.2	47.9	42.1	46.6	2
400 Hz	47	90	44.5	38.5	43.2	4
500 Hz	50	88.1	39.3	35.7	38.0	2
630 Hz	53	88.4	36.4	28.2	35.7	0
800 Hz	55	88.8	34.8	25.3	34.3	0
1000 Hz	52	90	38.2	25	38.2	3
1250 Hz	53	88.7	36.0	22.2	36.0	3
1600 Hz	53	88.5	35.2	19.2	35.2	3
2000 Hz	55	85.1	30.6	16.7	30.6	2
2500 Hz	60	88.8	28.9	14.7	28.9	0
3150 Hz	61	88.6	27.5	13.5	27.5	0
4000 Hz	64	89.8	26.1	12.6	26.1	0
5000 Hz	67	86.5	19.9	12	19.1	
					Total Deficiencies:	24

**The difference between the background noise level in the receiving room and the total receiving room sound level at this frequency was less than 6 dB. This information shall only be used as an estimate of the lower limit of this result at this frequency.*

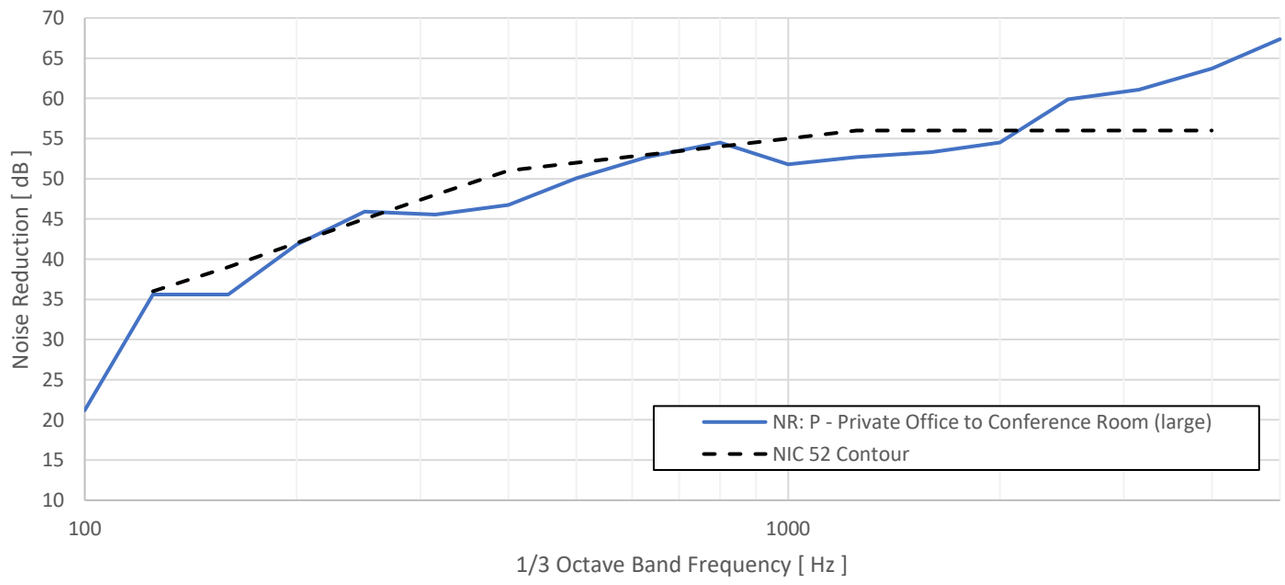


Figure C.16: Noise reduction of partition between Mission Hall 2702 and Mission Hall 2700

Partition Under Test: Q - Huddle Room to Open Office
Source Room: Mission Hall 5706
Receive Room: Mission Hall 5763-64
NIC Rating: **26**
SPC Rating: **61**

sound leak at top of wall and at door; partition meets NIC-26

Frequency	NR	Source, L_1	Receive, L_2	Background Noise, L_B	Adjusted Receive, L_2'	Deficiency, NIC 26 Contour
100 Hz	18	95.2	77.6	45.3	77.6	
125 Hz	19	96.1	76.9	46.8	76.9	0
160 Hz	24	93.2	69.5	47.7	69.5	0
200 Hz	23	90.1	67.3	45	67.3	0
250 Hz	25	88.1	63.4	42.2	63.4	0
315 Hz	27	90.3	63.4	45.1	63.4	0
400 Hz	28	88.7	60.5	41.6	60.5	0
500 Hz	28	89.4	61.0	39.7	61.0	0
630 Hz	28	87.8	59.6	35.4	59.6	0
800 Hz	29	88.5	59.1	34	59.1	0
1000 Hz	29	88.6	60.0	32.7	60.0	0
1250 Hz	26	89.1	63.2	30.7	63.2	4
1600 Hz	27	88.6	61.9	28.8	61.9	3
2000 Hz	24	84.5	60.2	27.7	60.2	6
2500 Hz	25	88.9	63.5	26.4	63.5	5
3150 Hz	28	88.9	61.2	25.8	61.2	2
4000 Hz	25	89.5	64.2	23.9	64.2	5
5000 Hz	26	86.4	60.0	22.9	60.0	
					Total Deficiencies:	25

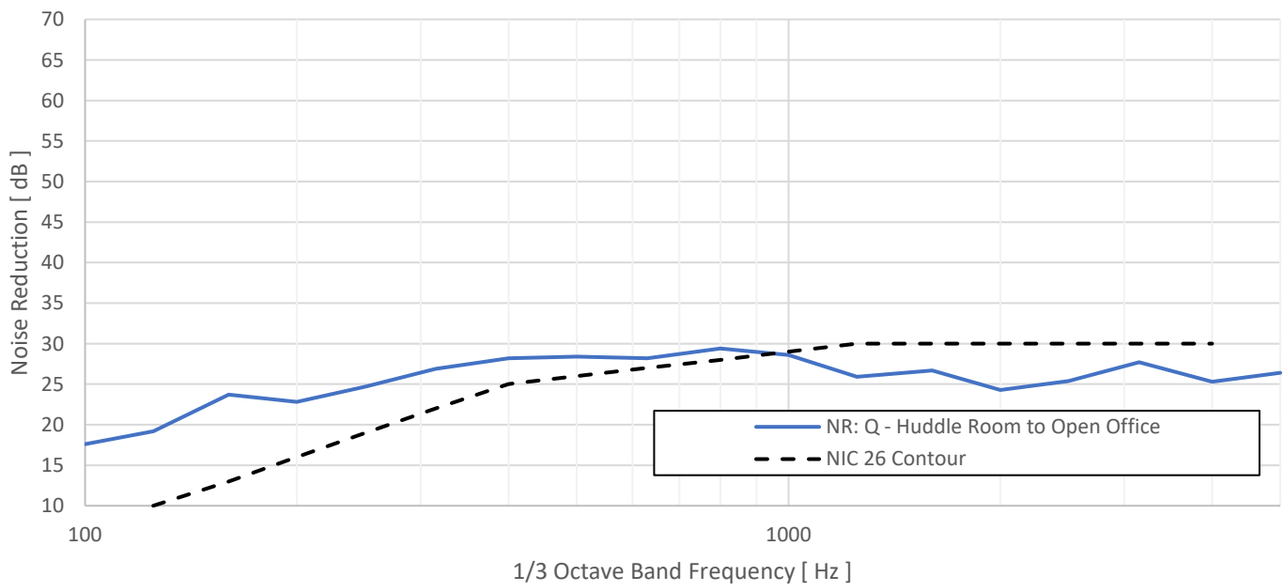


Figure C.17: Noise reduction of partition between Mission Hall 5706 and Mission Hall 5763-64

Partition Under Test: R - Huddle Room to Private Office
Source Room: Mission Hall 5706
Receive Room: Mission Hall 5705
NIC Rating: **42**
SPC Rating: **73**

some rattling in the room slightly contaminated results; partition meets NIC-42

Frequency	NR	Source, L_1	Receive, L_2	Background Noise, L_B	Adjusted Receive, L_2'	Deficiency, NIC 42 Contour
100 Hz	10	95.2	85.6	37.9	85.6	
125 Hz	20	96.1	75.7	41.7	75.7	6
160 Hz	30	93.2	63.4	42.8	63.4	0
200 Hz	32	90.1	58.5	40.3	58.5	0
250 Hz	34	88.1	54.2	38.1	54.2	1
315 Hz	38	90.3	53.5	45.4	52.8	0
400 Hz	37	88.7	52.2	39.9	52.2	5
500 Hz	41	89.4	48.3	30.5	48.3	1
630 Hz	40	87.8	47.8	28.5	47.8	3
800 Hz	45	88.5	43.2	28.4	43.2	0
1000 Hz	45	88.6	43.6	31.2	43.6	0
1250 Hz	45	89.1	44.1	31	44.1	1
1600 Hz	44	88.6	44.9	29.3	44.9	2
2000 Hz	41	84.5	43.5	27.8	43.5	5
2500 Hz	41	88.9	48.1	26	48.1	5
3150 Hz	44	88.9	44.6	24.6	44.6	2
4000 Hz	48	89.5	41.7	23.9	41.7	0
5000 Hz	50	86.4	36.9	21.3	36.9	
					Total Deficiencies:	31

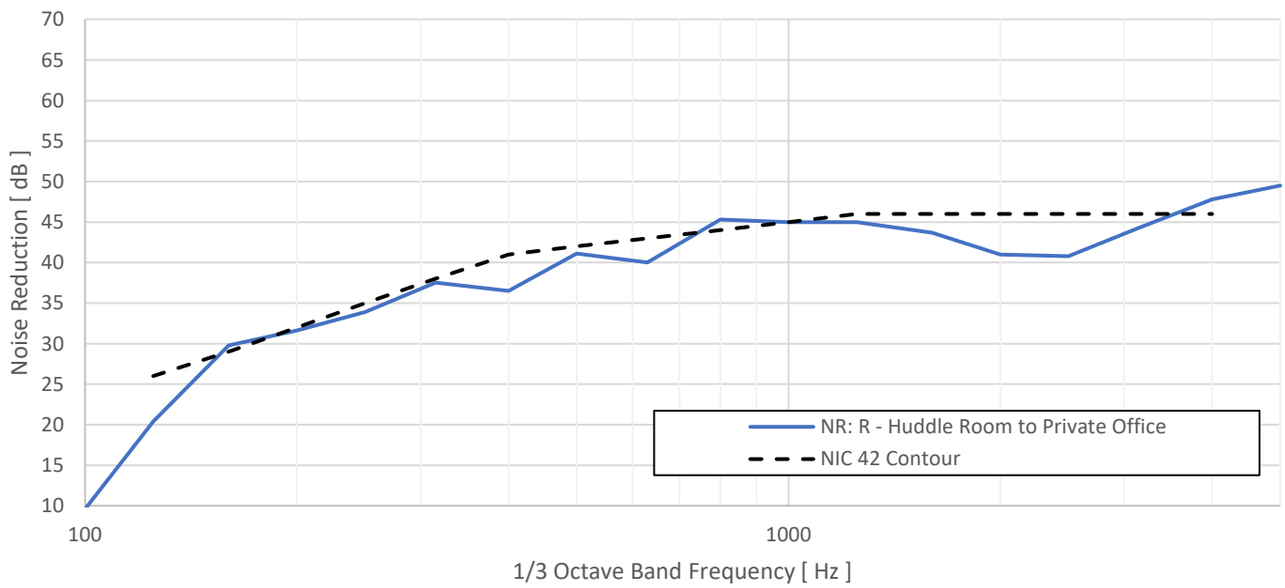


Figure C.18: Noise reduction of partition between Mission Hall 5706 and Mission Hall 5705

Appendix D: Suggested Revisions to the Current PRAB TPC

F 1030.10 Sound and Vibration Control

A. Intent

Appropriate control of sound and vibration is critical for occupant comfort and communication, and for a research environment free from significant environmental interference. Note that due to the special requirements imposed by research and clinical functions, in some cases the required controls can be considerably more demanding than in typical commercial construction. The overall goal of sound and vibration control is to deliver spaces that are safe, comfortable, and productive for the human, animal, and/or instrument occupants.

From the vibration and acoustical perspective, the PRAB project is expected to include five notable uses: (1) vibration-sensitive laboratory functions; (2) a “low-touch” clinic in which greater-than-typical acoustical isolation is desired; (3) a vivarium with special requirements; (4) testing facilities potentially housing both sources as well as sensitive receivers of vibrations; (5) research areas containing laser microscopes requiring vibration control as well as laser safety installations. Not only are these uses more sensitive than typical constructions, these sensitivities are expected to occur at frequencies not often encountered in routine projects. In particular, is high-frequency sound (ultrasound) in animal areas should be considered.

The Integrated Delivery Team (IDT) shall consider acoustical and vibration issues starting with the conceptual phase and provide designs, hardware, and systems that, over their expected lifetimes:

1. Provide noise and vibration environments that do not interfere with instrument / equipment performance; animal welfare or research activities; patient privacy; or human comfort and concentration.
2. Provide configurations and visual cues that nudge occupants to naturally limit their own sound and vibration emissions.
3. Resist sound intrusion from exterior sources in the current condition as well as in the face of future development.
4. Maximize use of passive sound and vibration isolation via space planning and physical separation of sources from sensitive receivers.
5. Resist sound intrusion from congregation and activated areas into high-privacy private and open plan workspaces; and provide normal speech privacy for enclosed rooms against open areas and confidential speech privacy between enclosed rooms.
6. Strategically organize interior plan so as to interrupt line of sight between occupants in open work areas and congregation spaces (break areas, collaboration areas, conference rooms and classrooms, auditorium pre-function spaces, and similar areas where congregation is likely to occur). Orient entrances to congregation spaces so that they do not directly face open work areas.
7. Accommodate the ways that occupants realistically use and misuse spaces, including behaviors adjacent to intended activities (such as entering / leaving conference rooms). Seek to plan and design spaces in order to ameliorate the misuse of spaces (such as encouraging staff to eat in break areas rather than in labs).
8. Provide enhanced speech intelligibility in conference and presentation settings.
9. Provide reduced speech intelligibility across open-plan areas to improve privacy.
10. Provide base-building noise levels consistent with the functional uses of spaces.
11. Achieve HVAC sound requirements with quieter fans so as to minimize the use of duct-based sound attenuators that contribute to pressure drop.
12. Provide machine isolation sufficient to generally prevent tones from mechanical systems from dominating building vibration environments.
13. Utilize isolation and attenuation hardware consistent with the University’s lifecycle and maintainability goals.
14. Deliver structural and foundation systems that meet project vibration criteria as required by programmatic and equipment requirements.
15. Seek to preserve the ambient vibration environment, regardless of vibration criterion.
16. Maximize utilization of vibrationally quieter locations across the site and within the building itself and consider potential impacts from future development when locating sensitive equipment.
17. In animal settings, minimize “acoustical contact” between incompatible species (such as those with predator / prey relationships) and between animals and humans in routine non-animal spaces.
18. The use of sound masking systems is not a typical practice for UCSF and should be used only as required to meet Speech Privacy criteria requirements with permission from UCSF.

Environmental noise and vibration issues extend beyond impacts to the project under bid. The IDT shall also consider impacts generated by the project upon adjacent structure and properties, including:

1. Exterior noise emissions.
2. Construction noise and vibration.
3. Location and vibration isolation of exterior sources like emergency generators and loading docks.

F 1030.12 Exterior Façade Noise Design

a. Description: Façade design to control exterior noise intrusion to occupied interior spaces.
b. Performance Requirements:

1. Exterior noise intrusion into interior spaces shall meet the following limits in any single hour of operation:
   a. For uses without special acoustic considerations, such as General Laboratories; Laboratory Support; Storage; General Circulation; Breakout; and Retail: refer to the requirements listed in Section 5.507 "Environmental Comfort" in the 2019 California Green Building Standards Code. The prescriptive method (Section 5.507.4.1) or the performance method (Section 5.507.4.2) may be used to determine compliance.
   b. Classrooms and Conference Rooms: refer to the requirements listed in Section 5.4.1 "Outdoor-to-indoor attenuation of airborne sound" in ANSI/ASA S12.60-2010. Use Classroom requirements for Conference Rooms.
   c. Open Plan Offices; Reception; Waiting Rooms; and Multi-Occupant Patient Care Areas: 45dBA
   d. Private Offices; Libraries; Exam Rooms: 40dBA
   e. Operating Rooms; Procedure Rooms; Testing Rooms; Patient Consultation Rooms: 35dBA
   f. Spaces with sensitive equipment: refer to vendor criteria; pay particular attention to restrictive low-frequency criteria if present. Utilize the average hourly measured outdoor daytime L1 spectrum as the basis for design.
   g. Spaces with sensitive environments, including but not limited to audio/video production: create appropriate criteria for use.
2. Design shall be based on measurement data from the site, at project-relevant elevations, with modifications provided for future development of the neighborhood as well as anticipated outdoor noise sources serving the building itself.
3. Onsite measurements shall be conducted for a minimum two (2)-day period to determine ambient noise levels. The measurements shall include noise levels during the hours of operation of the building. The noise data collected shall be 1-hour Leq spectra as well as overall levels in dBA. If noise-sensitive equipment will be located on exterior walls, additionally collect daytime (as well as evening and overnight, if relevant) Ln statistical spectra.
4. The design shall be executed using spectral data; however, exterior systems may be specified using the OITC method if desired.

c. Project-specific requirements, allowable exterior noise intrusion into interior spaces in any single hour of operation:
1. Mass Spectroscopy Lab: refer to vendor criteria and utilize the average hourly measured outdoor daytime L1 spectrum as the basis for design.
2. Vivariums: create appropriate criteria for types of animals and research being conducted, not to exceed 45dBA. Refer to Table F1030.10-D for information regarding frequency ranges of laboratory animal hearing.

F 1030.13 Interior Adjacencies Noise Control

a. Description: Interior construction to control noise intrusion between adjacencies.
b. Provide mock-ups as required for this project (see CR Z 1040.40).
c. Partition Performance Requirements:

1. General interior separations shall meet adjacency-specific SPC (Speech Privacy Criteria) or STC (Sound Transmission Class) requirements as per Table F1030.10-A.
2. SPC categories are defined below, please also refer to the ASTM E-2638-10 standard, available via https://www.astm.org/Standards/E2638.htm:

Table F 1030.13-A Speech Privacy Criterion Categories

PRAB Project Category	ASTM Privacy Category	Description
Minimal	Minimal Speech Privacy	Frequently intelligible
Normal	Standard Speech Privacy	Occasionally intelligible and frequently audible
Confidential	Standard Speech Security	Very rarely intelligible and occasionally audible
Essentially free from intrusion	High Speech Security	Essentially not intelligible and very rarely audible

Note: ASTM E-2638-10 – Objective Measurement of the Speech Privacy Provided by a Closed Room

3. The SPC requirements assume a normal conversational level of 60 dBA at a distance of three (3) feet. For adjacencies where speech is expected to be at a “raised” or “loud” level, conversational levels of 65 dBA and 70 dBA, respectively, should be assumed. This may apply to Conference Rooms, Classrooms, and Auditoriums.
4. The adjacency isolation requirements presume that the program can avoid awkward door placements, and that all doors open to corridors and other routine circulation areas. Refer to Table F1030.10-B for STC requirements for partitions with doors. Special circumstances in which other door placement is necessary will require special consideration.
5. For any given adjacency, the requirement shall be met in totality, exclusive of doors, but inclusive of sidelights, clerestories, and above-ceiling and below-floor flanking paths.
6. For partitions with SPC requirements, the field tested SPC as per ASTM E-2638-10 must meet the requirements in Table F 1030.13-A. Since SPC does not have reciprocity, the test is directional and should be performed with the source located in the room requiring the higher level of speech privacy with receptor(s) located in the adjacent area (e.g., source in a conference room and receptor in adjacent corridor).
    a. When selecting partition performance to meet target SPC, assume an average NC level of 10 points below target criteria due to variability in occupancy and HVAC load.
    b. Where partial-height partitions or other reductions in partition performance are accepted during design for cost savings, compliance to SPC will be challenging. This risk should be considered and discussed with UCSF during design to reach an agreement about compliance requirements.
7. For partitions with STC requirements, the field-tested NIC as per ASTM E336-20 must be within 7 points of the STC from Table F1030.10-A, or from F1030.10-B if the partition contains a door.
    a. Document special circumstances in which alternative door placement is necessary. Refer to (Table F 1030.10-A: STC/SPC Criteria: Partitions without Doors) for adjacencies in which doorways are discouraged.
    b. Glass partition systems, used where visibility and daylighting are desirable, will deliver limited sound isolation performance (typically, only Minimal Speech Privacy). These locations shall be identified by the IDT and approved by the University.
8. Use a plumbing wall incorporating isolation features for restroom and shower room walls with significant plumbing. Do not locate toilets on walls shared with enclosed occupied rooms.
9. For rooms adjacent to Mechanical Rooms and Elevator Shafts, specify partitions, doors, windows, penetrations, opening and other elements of the partition system as needed to control noise to meet the room background HVAC noise requirements (CR F1030.16 HVAC Noise Control) minus 10dB.
10. Tier 2: Consider the future adaptation of unoccupied spaces adjacent to mechanical rooms, restrooms, and other noise generating spaces into occupied spaces and apply interior adjacencies noise control criteria to these spaces.

d. Floor/Ceiling Isolation Performance Requirements:

1. Adjacency-specific SPC and STC ratings apply to both vertical as well as horizontal adjacencies.
2. Limit impact noise intrusion between vertical adjacencies with the minimum IIC (Impact Isolation Class)
    a. Open Plan Offices and similar areas: IIC-45.
    b. Waiting Rooms; Multi-Occupant Patient Care Areas; Private Offices; Libraries; Focus Rooms; Huddle Rooms: IIC-50.
    c. Conference Rooms; Classrooms; Auditoriums: IIC-60.

e. Door Performance Requirements in acoustically rated partitions:

1. Generally, locate doorways so as to minimize the impact of noise intrusion through doors, and pay particular attention to the configuration of spaces and doors where sliding doors are used.
2. Swinging doors in acoustically-rated partitions must be solid-core with perimeter seals and with anticipated STC ratings no more than 10 points below the main partition rating. Do not rely on door undercuts for return air pathways except in locations where speech privacy to the corridor is not required and glass partitions are used.
3. Sliding doors should not be used where “Normal Speech Privacy” (or better) is indicated . If sliding doors are used, the sliding mechanism cannot adequately control sound transmission; therefore, where speech privacy is a concern only use glass panels as these deter occupants outside the room from loitering and generating noise or inadvertently overhearing conversations from the room.
4. The STC rating of a swinging door shall be met in totality, including any vision panels, accommodations for hardware and technology, and the door frame inclusive of seals and interface with partition.
5. Where doors in high-sensitivity areas (such as Lecture Halls or Executive Conference Rooms) open into high-noise areas, use acoustically-rated doors to preserve the partition performance, as well as strategies to control noise when doors are open (vestibule, jogs, acoustical panels, etc.).

f. Project-specific partition requirements:

1. Operable Partitions:

a. Operable partitions must meet the requirements in Table F1030.10-A. Refer to CR C1010.50 for additional details on construction.
b. Acoustical consultant to provide details for overhead track and floor interface so as to maintain field-measured NIC to within 7 points of the requirements. Refer to ASTM E557 for recommended practices.

2. Scientific and Medical Equipment Rooms:

a. Confirm appropriateness of constructions for acoustical isolation for noise-sensitive equipment. Sensitivities may be biased toward low frequencies; SPC and STC requirements in Tables F1030.10-A/B are minimums intended to address human comfort only.
b. For spaces in which equipment are significant noise generators, consider high-isolation partitions or parent-room construction to achieve sufficient sound isolation to adjacencies. Consider the actual frequency content of equipment noise during design. Provide high protection for office and public adjacencies so that equipment noise is unintrusive to occupants not involved with these activities.

3. Linear Equipment Rooms and Support Spaces:

a. Specify partitions as needed to control noise (in adjacent enclosed rooms) to meet the room background HVAC noise requirements (CR F1030.16 HVAC Noise Control) minus 10dB.
b. Do not locate Linear Equipment Rooms such that they open to non-laboratory open-plan spaces.

4. Vivariums:

a. Confirm appropriateness of constructions for acoustical isolation in animal areas. SPC and STC ratings in Tables F1030.10-A/B are geared toward human (rather than animal) hearing. Refer to Table F1030.10-D for information regarding frequency ranges of laboratory animal hearing.
b. Stud partitions may include acoustical batts in animal areas. Where no thermal or fire rating is required, batts may be held up from the sill plate by 6” if desired for biological contamination control.
c. Provide high protection for office and public adjacencies so that animal sounds are inaudible to occupants not involved with vivarium activities.

5. Low-Touch Clinic:

a. Specify partitions at exam and interview rooms to meet SPC and STC ratings in Tables F1030.10-A/B, per the more restrictive of FGI 2018 Table 1.2-6 or Type “C” Confidential Speech Privacy. Patients using these spaces may speak at a higher sound level and/or be more sensitive to hearing other patients; the IDT should seek input from UCSF on whether the SPC rating should be calculated using the “raised” or “loud” conversational level, rather than the “normal” conversational level.

F 1030.14 Sound Masking Systems

a. Description: A sound masking system provides an evenly distributed spectrum of broad band noise designed to reduce speech intelligibility and thereby improve speech privacy and reduce distraction. The principles of the system involve feeding a shaped sound signal, very similar to ventilation air movement sound, through a distributed loudspeaker system, usually in the ceiling. An electronic sound masking system consists of:

1. A central equipment rack (containing a masking sound generator producing a non-repetitive noise signal, a set of signal shaping filters and a power amplifier or amplifiers)
2. A zone controller
3. A distributed system of loudspeakers located above the ceiling

b. Performance Requirements:

1. Sound masking should only be considered in design as a tool to meet the speech privacy requirements in Tables **F1030.10-A** and **F1030.10-B,** in conjunction with HVAC noise and sound isolating partition assemblies. It should be implemented based on the following Tiered strategies:

Tier	Strategy
TIER 1	The use of sound masking at NC-35 and NC-40 spaces may be considered as part of a joint strategy with partition assembly isolation to meet speech privacy, allowing flexibility in partition assembly design for potential cost savings.
TIER 2	Minimize use of sound masking in design. When selecting partition performance to meet target SPC during design, assume an average NC level of 10 points below target criteria due to variability in occupancy and HVAC load. This will likely result in higher-performing partitions, with associated cost.

2. The sound should be evenly distributed throughout the floor areas and must be capable of being adjusted to the individual privacy requirements in any given area, as well as overall adjustment post-occupancy.
3. Proper masking sound level is very important - if the masking level is too low, it won't do its job of increasing speech privacy and if the level is too high, it may be disturbing and people in the space will subconsciously raise their voices, negating any improvements in speech privacy. The level of the sound masking shall not exceed the NC criteria for that space as dictated in Table **F1030.10-C.**
4. The masking system should be zoned with separate control for each channel so that the masking sound in different areas can be controlled independently. Zones should be approved by UCSF during design. Typical zoning may include:
   a. One zone for each enclosed space for spaces >220 sf such as meeting rooms and wellness spaces.
   b. Combined zones for spaces <220 sf such as private office, huddle and phone rooms.
   c. Zones by program for open areas: i.e. reception, lounge, open collaboration, and open office.
5. Open offices and private office/exam rooms are best for sound masking implementation. Meeting and classrooms may benefit from sound masking but should be lower priority.
6. Consider the impact of levels and system layouts in design on hard-of-hearing individuals and assistive listening devices.
7. The system must include a timer to adjust sound masking volume according to a programmed schedule coordinated with UCSF and the Acoustic Consultant during design. Each zone shall have independent schedules, which will include a "ramp up" and "ramp down" at the beginning and end of the workday, respectively, and allow for unique programming each day of the week/year.
8. Distortion, hum and residual noise produced by the system shall be totally inaudible in any normally-accessible area. All switching artefacts shall be inaudible.
9. The system shall be set up initially so the Leq sound pressure levels in the table below are present at any position in the measurement plane (around ear height of a seated person, typically within the range of 42.5"-51.2" above the floor) to within ±2 decibels in each third-octave band:

Table 1 Sound Masking Spectrum (Sound pressure level in dB re 20µPa)

	1/3 Octave Band Center Frequency, Hz																
	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k
NC-30: Classroom, Conference Room	Sound Masking is not typically used at levels below NC-35. If it is determined in design that these spaces should have Sound Masking, UCSF approval is required.																
NC-35: Private Office, Huddle, Exam	40	39	37	36	34	33	32	31	30	29	28	26	24	22	19	16	11
NC-40: Study Area, Open Office	47	46	44	43	41	40	39	38	37	36	35	33	31	29	26	23	18

10. The system shall have a crest factor of at least 10 dB at each third-octave band frequency above the maximum levels specified in Table 1 (peak sound level = Leq + crest factor).
11. Levels measured across each floor must not vary by more than 2.5 dB in any octave band center frequency and +/- 3 dB overall.

4. Use flexible connection for services to isolated machinery, including piping, ducting, and electrical conduits.
5. Piping and ducting on isolated systems shall be resiliently mounted for the first 50 linear feet. Additionally, isolate large piping and ducting supported below vibration-sensitive floors as needed to meet vibration and acoustical criteria.
6. Use resilient penetration sleeves or seals where piping and ducting pass through structural elements.
7. The following apply to steel spring isolators:
    a. In general, use single-spring (rather than ganged multi-spring) isolators. For very heavy machinery, such as plant-sized chillers, multiple parallel springs may be used when suitable single-coil springs do not exist. Do not use nested springs.
    b. Do not specify any steel spring system with less than 1” minimum actual static deflection in operation.
    c. Springs shall be laterally stable without housing; with lateral stiffness at least 80% of axial stiffness; diameter not less than 80% of the compressed height; and additional travel-to-solid of at least 50% of actual deflection.
    d. The spring element shall be seated in a neoprene cup or incorporate a permanently-adhered double neoprene pad to control high frequency transmissibility.
    e. For spring hangers, provide sufficient frame diameter to allow a minimum of 30-degree arc swing in the hanger rod.
8. The following apply to neoprene isolators:
    a. Specify double neoprene pad unless the supported system is too lightweight to fully engage a multi-layer neoprene isolator.
    b. If specifying neoprene mounts, use double-deflection systems.
    c. Do not specify neoprene systems in any instance where machine operational speeds (including VFD range) fall below 1,500 RPM.
    d. Detail independent restraints; do not bolt through neoprene pad systems for seismic control.
9. The following apply to machine bases:
    a. When isolating machinery, size machine bases to also support heavy piping, suction/discharge elbows, and similar items.
    b. Do not employ structural rail isolation.
    c. Size concrete inertia bases so that the base thickness is 1/12 of the longest base dimension, not to exceed 12”.
10. Specify and install independent isolation for all rotating machinery 1HP or greater in power. For fractional horsepower equipment, utilize neoprene pad or neoprene-in-shear mounts as provided by the machine vendor.
11. For machinery greater than 5HP, use steel springs unless specifically disallowed by the manufacturer.
12. Select springs with static deflection appropriate to machine power and RPM.
13. All metal parts shall be hot-dip galvanized as per ASTM A-123 or protected by powder or neoprene coating, or meet or exceed the corrosive-resistant criteria of the equipment it supports, whichever is more stringent.
14. Elastomeric components, including neoprene, must be oil- and water-resistant.
15. All isolation hardware must allow visual access to the isolating element. Consequently, telescoping mounts, housed springs, and other systems in which the isolating element is hidden are not allowed.
16. Seismic controls must be achieved by snubbers and cabling as appropriate, separate from spring systems.
    a. Isolator selection for specific equipment types should follow ASHRAE Chapter 48

F 1030.18 Floor Vibration Design

a. Description: Floor vibration limits for occupant comfort and equipment performance. These excitations may come from building utilities, equipment, and/or occupant movement.

1. Unless noted otherwise, the limits of items b and c apply to footfall-induced vibrations from walkers for both resonant and transient response.
2. Unless noted otherwise, limit vibrations from building mechanical / electrical / plumbing systems and from vibration-producing equipment to 2,000 micro-inches/sec or 50% of the allowed walker-induced value applicable to the use area impacted, whichever is lower. Spac ith criteria equivalent or more stringent than VC-C (as per IEST RP-CC012.3) are excluded from this criterion.
3. All references to response limits are taken as upper bounds, that is, not to be exceeded as supported by a peer-reviewed engineering analysis of the vibration response of the structural system under the specified loading conditions.
4. Where the vibrational response of a floor is substantially in compliance with the design criteria, but with limited zones of exceedance in non-critical locations not more than 20% higher than the criteria, the condition shall be presented to the University for consideration and may be judged acceptable by the University.

b. Footfall vibration impact parameters:

1. Meet the appropriate floor vibration requirement (see Item c below, or as per vendor criteria) considering footfall vibration impacts of a 168 lb walker with the following maximum considered walking speeds in the different areas for general cases and shall be adjusted based on the expected traffic and clear walking paths based on AISC DG 11.

Space	Enclosed rooms	Open-plan setting	Other general areas with fairly clear walking paths	Major corridors with significant foot traffic
Maximum walking speed	1.25 – 1.60 Hz depending on room size*	1.25 - 1.60 Hz depending on foot traffic*	1.85 Hz*	2.1 Hz*

* *As per AISC DG11, 1.25 Hz walking applies to areas with one or two walkers and limited walking paths; examples are laboratories with fewer than three workers and medical imaging rooms. 1.60 Hz walking applies to areas with three or four potential walkers and limited walking paths. 1.85 Hz walking applies to busy areas with fairly clear walking paths. 2.1 Hz walking applies to areas with clear walking paths, such as corridors.*

2. Calculate and test walker impacts.

c. Performance requirements:

1. **Community and retail spaces and other occupied spaces not requiring special vibration criteria**: 32,000 micro-inches/sec (ISO-Workshop).
2. **Office spaces**: as presented in the table below.

Tier	Criteria	Comment
TIER 1	16,000 mips	ISO-Office
TIER 2	12,000 mips for focus rooms and closed study rooms 16,000 mips for open offices	Between ISO-Residential and ISO-Office
TIER 3	2,000 mips for 40-60% of spaces All other spaces to TIER 2.	Allowing conversion to lab spaces in the future.

3. **Education spaces**: as presented in the table below.

Tier	Criteria	Comment
TIER 1	16,000 mips	ISO-Office
TIER 2	12,000 mips for closed offices 16,000 mips for open education spaces	Between ISO-Residential and ISO-Office
TIER 3	2,000 mips for 40-60% of spaces All other spaces to TIER 2.	Allowing conversion to lab spaces in the future.

1. **Generic patient and clinical research spaces**, not including Testing Rooms, Procedure Rooms, Operating Rooms, and similar working spaces: 8,000 micro-inches/sec (ISO-Residential/Daytime) and 0.5%G (AISC DG-11).
2. **Inpatient and residential sleeping spaces**: 6,000 micro-inches/sec (modified ISO-Residential/Daytime).
3. **Clinical research working spaces** like Testing Rooms, Procedure Rooms and Operating Rooms, with no special vibration requirements due to equipment or procedures: 4,000 micro-inches/sec (ISO-Operating Theater, as per IEST RP-CC012.3)
4. **Routine laboratory spaces** with no special vibration requirements and optical microscopy at 100x or less: 4,000 micro-inches/sec (ISO-Operating Theater, as per IEST RP-CC012.3).

5. **Research laboratories with intermediate vibration requirements**, such as optical microscopy between 100x and 400x; micro-balances; optical balances; conventional spectrophotometry; typical mass spectroscopy: 2,000 micro-inches/sec (VC-A, as per IEST RP-CC012.3). Criteria at specific equipment may be adjusted based on vendor-supplied criteria and/or equipment vibration isolation specifications with UCSF approval.
6. For item (7) and (8) above, the following tier system shall be considered for future flexibility:

Tier	Routine laboratory spaces	Research laboratories with intermediate vibration requirements	Comment
TIER 1	4,000 mips (ISO-OR)	2,000 mips (VC-A)	As needed
TIER 2	2,000 mips (VC-A)	2,000 mips (VC-A)	Allowing extensive future flexibility

7. **Vivarium**: 2,000 micro-inches/sec (VC-A, as per IEST RP-CC012.3, and National Institute of Health
8. **Medical imaging suites with modest vibration requirements, including x-ray, ultrasound, fluoroscopy:** refer to vendor-supplied criteria. If vendor supplied criteria does not exist or in the absence of specific instrument identification by the University, deliver performance no worse than 4,000 micro-inches/sec (ISO-Operating Theater, as per IEST RP-CC012.3).
9. **Medical imaging suites with moderate vibration requirements, including CT, PET:** refer to vendor-supplied criteria. If vendor supplied criteria does not exist or in the absence of specific instrument identification by the University, deliver performance no worse than 1,000 micro-inches/sec (VC-B, as per IEST RP-CC012.3).
10. **Medical imaging suites with stringent vibration requirements, including MRI, MEG**: refer to vendor-supplied criteria. If vendor supplied criteria does not exist or in the absence of specific instrument identification by the University, deliver performance no worse than 500 micro-inches/sec (VC-C, as per IEST RP-CC012.3) in response to both mechanical system and walker impacts. Note that VC-C criteria is difficult to meet on a suspended slab. Any related equipment should be considered to be located on groundslab.
11. **High-end imaging suites, including electron microscopy, NMR, and scanning probe techniques**: refer to vendor-supplied criteria. If vendor supplied criteria does not exist or in the absence of specific instrument identification by the University, deliver performance no worse than 125 micro-inches/sec (VC-E, as per IEST RP-CC012.3) in response to both mechanical system and walker impacts. VC-E criterion is extremely difficult to meet on a suspended slab. Any related equipment should be located on groundslab. Traffic-induced groundborne vibration levels may exceed this criterion at some location.
12. **Research, development, and medical spaces housing techniques not mentioned here**: refer to IEST RP-CC012.3, Section 5.12.5, unless vendor-supplied criteria exist.
13. Where equipment vendor-supplied vibration criteria are more stringent than the criteria listed in this section, provide a design solution to satisfy vendor-supplied vibration criteria. Solutions may include local stiffening of the structure, strategically locating equipment, providing vibration isolation tables (if allowed by the equipment vendor), and/or other measures.
14. In cases where sensitive equipment is suspended from the structural floor above, meet the appropriate requirement (see Item c below, or as per vendor criteria) on the supporting upper floor, whichever is more restrictive.

F 1030.19 Environmental Noise and Vibration

a. Description: Outdoor noise and vibration impacts due to the project's routine operations.
b. Performance Requirements:

1. Coordinate locations of exterior noise sources with façade design. Interior noise level requirements in F1030.12 apply to the project's noise sources whether indoors or outdoors.
2. Outdoor equipment shall not create noise levels exceeding 65dBA at the building façade, except where special consideration is given to façade noise isolation and interior occupancy.
3. Consider the effect of emergency generators as an exterior noise source.
4. Noise levels from building noise sources at outdoor assembly or patient sitting areas at the building shall be limited to 50dBA.
5. The project, as a whole, must comply with applicable noise ordinances, including Article 29 of the San Francisco Police Code (SFPC 29, Section 2909, 2014 or later).
6. For other UCSF outdoor areas, apply Article 29 of the SF Police Code at the property line, if one exists, otherwise midway between buildings.
7. The new project shall not generate noise or vibration levels that create exceedances at sensitive equipment in adjacent buildings.
8. Animal sounds shall be completely inaudible to humans outside of the building.

4. Door schedule, including notes regarding acoustical seals where used.
5. Machine-specific schedule of vibration isolation requirements for M/E/P systems.
6. Cut sheets for proposed vibration isolation hardware.
7. If raised access floors are used: designs for floor pedestals supporting vibration-sensitive equipment.
8. If special building foundations are utilized for sensitive instruments: design details and supporting calculations.
9. Data or other documentation confirming appropriate control of ultrasound emissions by facilities systems in animal areas.

Construction

1. Laboratory test data for façade OITC performance.
2. Submittals for vibration isolation hardware.
3. Submittals for wall acoustical panels and ceiling systems.
4. Submittals for HVAC noise control silencers and ductwork.
5. Results of mock-up testing described in Z1040.41.
6. If special building foundations are utilized for sensitive instruments, provide vibration test data at foundation completion. Collect data using methodologies consistent with instrument vendor criteria, and demonstrate compliance with respect to random/broadband components as well as transportation-induced transients.

Startup

1. Acoustical testing by IDT to demonstrate compliance; prepare a test plan (including representative sample sizes and statistical methodologies) for review and acceptance by the SRC and execute testing as follows:
   a. Perform testing of representative sampling (at least five examples of each type) of spaces for HVAC noise (NC) limits; test after system balancing is complete.
   b. For spaces along the exterior of the building, perform testing of exterior noise intrusion. Include testing of each type of space in the proposed test protocol. Test without HVAC unless room HVAC NC levels are sufficiently low to allow demonstration of compliance.
   c. Perform testing of representative sampling of acoustical partitions, plus areas using glazed partitions, for conformance with SPC/NIC requirements. For SPC testing, test with balanced HVAC and sound masking (if present), with source located in space requiring the higher level of speech privacy. NIC should be shown as compliant with partition performance criteria set during design and approved by UCSF. SPC compliance is not strictly required if NIC is met, but should be noted for record in the case of future post-occupancy privacy issues.
   d. Perform testing at property line(s) and at outdoor gathering areas.
2. Vibration testing and inspection by IDT to demonstrate compliance with project vibration criteria:
   a. Test in the “As-Built” condition with substantially all building M/E/P online. Use instrumentation consistent with Section 5 and report data consistent with Section 6.4 of IEST RP-CC024.1. Provide data in narrowband in addition to 1/3 octave band formats.
   b. For highly-sensitive equipment requiring VC-C environments (or quieter), provide sufficient data to demonstrate compliance under both random/broadband components as well as transportation-induced transients.
   c. On suspended floors, execute walker tests using the design walking speeds three type of structural bays per each vibration zone. Include the structural bay expected to have the most onerous response. For walker tests, report the peak-hold velocity spectrum in 1/3 octave bands for 1-100 Hz.
3. Perform walk-through of machine rooms and inspect rotating equipment vibration isolation; identify shorted or misaligned systems to be remedied.

r. BSL-3: Wall section showing proper seals for containment, to include electrical outlets, joints, finishes, ceiling transition, floor transition, etc.

3. Testing:

a. Perform acoustical testing of two partitions enveloping the room; these must include the partition with the entry door and the wall with the most penetrations. Test both partitions in accordance with ASTM E336-15. For the partition with the entry door, report the measured ASTC and laboratory STC ratings (or estimated rating when laboratory is not available) for the partition and door to the Owner for review. It is assumed that the ASTC will form the basis of comparison against the requirements, as only realistic flanking paths should be included in the mock-up. For the partition without the entry door, use the measured noise reduction (NR) and appropriate background noise levels to verify SPC requirements will be met with final background noise levels.

b. Perform acoustical testing of the interior reverberation time, defined as the time required for a signal to decay by 60dB. Test in accordance with ISO 3382-2:2008, using “engineering” accuracy and either the 20dB or the 30dB evaluation range as needed. Report the calculated reverberation time for direct comparison against requirements.

e. Intermediate Distribution Frame (IDF) Room:

1. Completely finished in-place construction including:

a. Completion of all partitions to structural decks above and below.
b. Door(s) (CR C1030)
c. Raised floor and acoustical baffles, if applicable.
d. All utility systems, penetrations, and closure.
e. All equipment included in (CR D6090.20 Data Communications Support Spaces).
f. All interior finishes. (CR C20)

f. Exterior and Interior Signage:

1. Content Mockup: See (CR G2060.30 and C1090.22 for signage types requiring content mockups):

a. All content mockups shall include University-provided content (text) for University and Donor review and approval.

1. Option 1: superimpose rendered mockup of signage into exterior or interior building renderings at a content-legible scale. Significantly-oblique-angle views are not acceptable.
2. Option 2: if the schedule permits adequate time for University and Donor review and revision, the mockup may be provided full-scale, in-place, and made from alternative materials (cardboard, paper, etc.) in order to convey the sign’s visual intent.

2. Construction Mockup:

a. Provide one mockup of each sign type for University approval. (CR
b. In place mockups are acceptable. (CR D6090.20, C1090.22))

C. Verification & Validation (All Tiers) (See systems for additional verification)

Design	1. Identify In-Place construction locations. 2. DD drawings of mockup locations NOT In-Place. 3. CD drawings of mockup locations NOT In-Place. 4. Mockup drawings showing representatives of all assemblies as well as applicable enclosure details. 5. Samples of any finishes proposed to be excluded (with University approval) in the mockup. 6. Review of manufacturer(s) quality assurance and quality control during production of mock-up components, and compliance with approved and stamped shop drawings or submittals.
Construction	1. Construct Mockups with enough lead time AFTER testing to modify construction detailing as necessary to modify design to ensure performance criteria. 2. Retain and protect mockups and first-in-place installations until punch list for that installed scope has been closed or owner has provided written release of said mockup. 3. Physical mockups and first-in-place installations to be tracked as submittals. This would get mockups on the project schedule (in case reviews require travel) and consolidates review comments to be found later if needed).

APPENDIX

Table F 1030.10-A: STC/SPC Criteria: Partitions without Doors

Table F 1030.10-A: STC/SPC Criteria: Partitions without Doors

Minimum STC/SPC Requirements, Partitions Without Doors	Office Corridors and Reception	Commons, Open Collab, Social Hub	Open-Plan Office, Hotel Stations	Libraries	Huddle Rooms, Focus Rooms	Private Offices	Conference Rooms, Classrooms	File Rooms, Storage Rooms	Mail & Copy Rooms	Telecom & Server Rooms	Waiting Rooms	Operating Rooms, Treatment Rooms, Procedure Rooms	Exam Rooms, Testing Rooms, Pre/Post Op	Low-Touch Interview/Exam Rooms	Laboratories, Lab Support	Vivarium General Occupancies and Animal Holding	Animal Behavioral testing	Vivarium Cagewash	Retail, Pantry/Kitchenette	Restrooms, Locker/Shower Rooms
Office Corridors and Reception	NR	NR	NR	A	B	B	B/C	NR	NR	40	NR	FGI	FGI	FGI/C	40	55	55	55	NR	40
Commons, Open Collab, Social Hub		NR	A	A	B	B	C	NR	NR	45	A	NA	NA	NA	45	55	NA	NA	NR	45
Open-Plan Office, Hotel Stations			NR	A	B	B	C	NR	NR	45	A	FGI	FGI	FGI/C	45	55	NA	NA	45	45
Libraries				NR	B	B	C	NR	45	50	A	FGI	FGI	FGI/C	45	NA	NA	NA	50	45
Huddle Rooms, Focus Rooms					B	B	C	B	B	50	B	FGI	FGI	FGI/C	50	NA	NA	NA	50	50
Private Offices						B	C	B	B	50	B	FGI	FGI	FGI/C	45	NA	NA	NA	50	50
Conference Rooms, Classrooms							C	C	C	55	C	NA	NA	FGI/C	50	NA	NA	NA	55	55
File Rooms, Storage Rooms								NR	NR	NR	NR	FGI	FGI	FGI/C	NR	NR	NR	NR	NR	NR
Mail & Copy Rooms									NR	40	40	FGI	FGI	FGI/C	40	NA	NA	NA	NR	NR
Telecom & Server Rooms										NR	40	FGI	FGI	FGI/C	45	55	55	45	NR	NR
Waiting Rooms											NR	FGI	FGI	FGI/C	45	NA	NA	NA	50	45
Operating Rooms, Treatment Rooms, Procedure Rooms												FGI	FGI	FGI/C	FGI	NA	NA	NA	FGI	FGI
Exam Rooms, Testing Rooms, Pre/Post Op													FGI	FGI/C	FGI	NA	NA	NA	FGI	FGI
Low-Touch Interview/Exam Rooms														FGI/C	FGI/C	45	45	45	45	45
Laboratories, Lab Support															45	45	45	45	45	45
Vivarium General Occupancies and Animal Holding																40	45	45	NA	NR
Animal Behavioral testing																	45	50	NA	NA
Vivarium Cagewash																		NR	NA	45
Retail, Pantry/Kitchenette																			NR	45
Restrooms, Locker/Shower Rooms																				NR

For Mechanical Rooms, Building and Elevator Shafts, MRI Magnet Rooms: refer to main text (CR F1030.13 Interior Adjacencies Noise Control)

Number values indicate the minimum STC requirement; letter values indicate Speech Privacy Criterion categories.

"NR" means no rating

"NA" means adjacency discouraged; if proposed, confirm STC with University

"FGI" means refer to FGI 2018 Table 1.2-6 for minimum requirements

"A" means "Minimal Speech Privacy", refer to ASTM E-2638-10

"B" means "Standard Speech Privacy", refer to ASTM E-2638-10

"C" means "Confidential Speech Privacy", refer to ASTM E-2638-10 ("Standard Speech Security" Category)

"D" means "Essentially free from intrusion", refer to ASTM E-2638-10 ("High Speech Security" Category)

Note [1]: use FGI or Confidential Speech Privacy, whichever is more restrictive. UCSF to inform of "normal", "raised", or "loud" conversational level for these rooms.

APPENDIX

Table F1030.10-C: Noise Criteria

Table F1030.10-C: Noise Criteria

Office & Educational Spaces	NC	Note
Rooms Dedicated to Videoconference Technology	NC-25	
Classrooms & Conference Rooms (> 400 sf)	NC-25	
Classrooms & Conference Rooms (< 400 sf)	NC-30	
Focus Rooms, Huddle Rooms, & Private Offices	NC-30	
Libraries, Quiet Study Rooms, Computer Lab, & Computer Stations	NC-30	
Wellness Rooms, Mother's Rooms, Meditation Rooms	NC-35	
Open Plan Offices, Workstations, Hotel Stations, Study Carrels, & Breakout Rooms	NC-40	
Retail, Pantry / Kitchenette	NC-40	
Commons, Reception, Circulation, Locker Rooms	NC-40	
File Rooms, Storage Rooms, Mail & Copy Rooms	NC-50	
Telecom & Server Rooms	NC-50	
Unoccupied Areas		
Mechanical & Electrical Rooms	NC-65	[4]
Other Unoccupied Areas	NC-65	
Medical & Clinical Spaces		
Procedure Rooms, Pre-Op & Post-Op Rooms	NC-35	
Waiting Rooms	NC-35	
Multi-Occupant Patient Care Areas	NC-35	
Exam Rooms, Consultation Rooms, & Interview Rooms	NC-40	
Medical Laboratories	NC-45	
Medical Equipment Support Rooms	NC-45	
Laboratories and Imaging Facilities		
Imaging Support Rooms, Sample Preparation Rooms, Equipment Support Rooms	NC-45	[1], [2]
Laboratories with Typical Air-Flow Requirements	NC-45	
Laboratories with High Air-Flow Requirements and Modest Speech Intelligibility Requirements	NC-50	
Animal Facilities		
Behavioral Study Rooms	NC-40	[3]
Animal Holding Rooms	NC-45	[3]
General Occupancies in Vivarium	NC-45	
Notes		
Note [1]: some equipment exhibit extraordinary sensitivities at low frequencies; confirm that room noise criteria are compatible with equipment requirements.		
Note [2]: regardless of room noise criterion, ensure that noise from Imaging Support and Sample Preparation Rooms does not interfere with proper operation of imaging equipment.		
Note [3]: NC levels shown here address human comfort and are assumed acceptable for animals; refer to Table F1030.10-D for animal hearing ranges and ensure that ultrasound levels are compatible with animal welfare.		
Note [4]: Noise levels in spaces without regular occupancy should be evaluated during design based on expected OSHA daily noise dose		

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Appendix E: Wilson Ihrig Peer Review Comments of Vibrasure PRAB TPC Review

Project:	UCSF TPC Acoustics Peer Review	Client:	Perkins & Will
WIA Project #:	23-134	Contact:	John Long
From:	Leisa Nalls	Reference:	UCSF TPC documents + Vibrasure Acoustics TPC Evaluation draft
Date:	9 January 2024	Subject:	Peer review comments

Following is a list of comments and recommendations related to acoustic items in the UCSF PRAB TPC documents and the draft comments presented by Vibrasure in their review of the TPC documents. Unless stated below, we take no exception to the comments and suggested edits proposed by Vibrasure for the TPC documents.

PRAB DPB TPC + Appendices & Quality Assurance Documents			
ITEM	**Section**	**ISSUE**	**COMMENT / RECOMMENDATION**
1	F1030.13.c.7	From TPC: "*For partitions with STC requirements, the field-tested NIC as per ASTM E336-20 must be within 7 points of the STC from Table F1030.10-A, or from F1030.10-B if the partition contains a door.*"	The allowance of a 7 point differential between design STC and field tested NIC is higher than industry standards and would seem to warrant a comment. We recommend that this is limited to a maximum 5 point differential. This is consistent with the CBC field testing allowance. We did not see a comment on this in the Vibrasure documentation/comments.
2	F1030.13.f.2	Scientific and Medical Equipment Rooms – reference to structure-borne noise and vibration control not explicitly addressed	This section appears to only address airborne noise control concerns for the Scientific and Medical Equipment Rooms. There are other sections specifically for MEP vibration and Floor Vibration Design, but those sections do not fully address the structure-borne noise concerns. We recommend that a statement regarding control of structure-borne noise and vibration is also included as a third subitem. Comment could include reference to concrete housekeeping pads and vibration isolation measures to isolate noise generating equipment from the building structure. We did not see a comment on this in the Vibrasure documentation/comments.

Project:	UCSF TPC Acoustics Peer Review	Client:	Perkins & Will
WIA Project #:	23-134	Contact:	John Long
From:	Leisa Nalls	Reference:	UCSF TPC documents + Vibrasure Acoustics TPC Evaluation draft
Date:	9 January 2024	Subject:	Peer review comments

PRAB DPB TPC + Appendices & Quality Assurance Documents			
ITEM	**Section**	**ISSUE**	**COMMENT / RECOMMENDATION**
3	F1030.14.a.3	Sound Masking System – loudspeakers noted to only be located above the ceiling	There are systems that function as both a PA system and sound masking system, using the same speakers for both. These systems are typically in-ceiling speakers, not above ceiling speakers. For versatility, this section could be revised to indicate both above and in-ceiling speakers could be used for the sound masking system, with a comment that the in-ceiling option is only for when the speakers are dual use with the PA system. We did not see a comment on this in the Vibrasure documentation/comments.
4	F1030.14.b	Vibrasure note by section heading – recommend modifying location of note to 14.b.4	The comment/note directly after the section F 1030.14.b heading seems relevant to the statement made in section 14.b.4. We recommend that this comment/note is relocated so that it is associated with item 14.b.4.
5	F1030.14.b.1	Vibrasure note by Tier heading in table – recommend removing comment	The comment/note directly adjacent to the Tier heading in the table does not seem to account for the statement in 14.b.1 directly above the table. That statement indicates that the baseline condition is no sound masking unless required, and in that case the tiered strategies indicated in the table should be implemented. We recommend removing this comment.
6	F1030.14.b.9	Vibrasure note by item 14.b.9 – recommend modifying location of note to 14.b.3	The comment/note at section F 1030.14.b.9 heading seems relevant to the statement made in section 14.b.3. We recommend that this comment/note is relocated so that it is associated with item 14.b.3.

Project:	UCSF TPC Acoustics Peer Review	Client:	Perkins & Will
WIA Project #:	23-134	Contact:	John Long
From:	Leisa Nalls	Reference:	UCSF TPC documents + Vibrasure Acoustics TPC Evaluation draft
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PRAB DPB TPC + Appendices & Quality Assurance Documents			
ITEM	**Section**	**ISSUE**	**COMMENT / RECOMMENDATION**
7	F1030.17.b.16.a	ASHRAE vibration isolation guidelines reference – recommend updating to current version	The Noise and Vibration Control chapter in the current (starting in 2019) version of ASHRAE is now Chapter 49, not Chapter 48 as referenced in the TPC. We recommend that the Vibrasure comment on this item is expanded to correct the ASHRAE Chapter reference or that the chapter title is clearly stated to minimize confusion with future ASHRAE versions.
8	F1030.19.b.2&4	Outdoor equipment noise limits – no time duration or metric indicated	The two noise limits for outdoor equipment or building noise sources provided in F 1030.19.b.2 & 19.b.4 do not include a time limitation or other defining metric. We recommend that a note is included to clarify that these are hourly Leq or similar time constrained metrics. It is not recommended that these limits are based on a 24-hour average such as Ldn. We did not see a comment on this in the Vibrasure documentation/comments.
9	Z1040.42.d.3.a	ASTC referenced here where NIC is referenced in F 1030.13.c.7 for field testing	The reporting metric for field tested partitions is not consistent between the Technical Criteria and Quality Assurance documents. Recommend that the NIC rating/metric is referenced in the Z 1040.42.d.3.a section as it may not always be possible to meet the ASTM standards of measurement in mockup conditions. We did not see a comment on this in the Vibrasure documentation/comments.