



111 Piccadilly

WELL Performance Verification Acoustic Report

dBx Acoustics Ltd
Beehive Mill, Jersey Street
Manchester M4 6JG

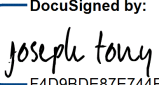
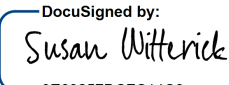
18088 111 Piccadilly Well Performance
Verification Acoustic Report R02

17 November 2020

Client: Bruntwood

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Introduction

dBx Acoustics has been commissioned by Bruntwood to undertake a to undertake a WELL performance verification assessment of the refurbishment and fit-out of the ground floor space at 111 Piccadilly, Manchester in accordance with V2 of WELL Building standard.

For items requiring on-site verification testing, the WELL assessment was undertaken in accordance with the testing protocols presented in *"The Well Performance Verification Guidebook, Q2, 2020"* with measurements made on site on 28th October 2020.

Items requiring design verification are based on a review of the client's drawings and specifications which are listed in Appendix B.

To facilitate this assessment, the following measurements have been undertaken:

- Noise measurements of the external noise intrusion (noise levels originating from outside of the building)
- Background noise levels (noise levels from building services)
- Sound insulation performance of the separating walls
- Reverberation time measurements

A glossary of commonly used acoustic terminology is included within Appendix A.

Features S01 to S05 inclusive are relevant to this project, with a total of 10 points available for compliance.

WELL Building Standard Requirements

This scheme is to be assessed under version V2 of the WELL Building standard. Features S01 to S05 inclusive are applicable to this project. The requirements are summarized as follows;

Feature S01 –Sound Mapping¹

This is a precondition, with no specific points available.

Part 1 – Label Acoustic Zones

An annotated document is required that labels specific zones throughout the project floor plan based on the following:

- Loud zones: includes areas intended for appliances, mechanical equipment or amenities (e.g., kitchens, fitness rooms, social spaces, recreational rooms).
- Quiet zones: includes areas intended for focused work, wellness, rest, study and/or privacy.
- Mixed zones: includes areas intended for learning, collaboration and/or presentation.

Part 2 – Provide Acoustic Design Plan

For All Spaces, the project provides one of the following:

- A plan developed by the project team and/or project owner that outlines acoustical solutions and a timeline for implementation with a focus on managing acoustical comfort, background noise, speech privacy, reverberation time and/or impact noise within the project boundary.
- A detailed report from a professional in acoustics that describes existing conditions, recommended solutions and measurement results with a focus on managing background noise, speech privacy, reverberation time and/or impact noise within the project boundary. These measurements are not required to adhere to the Performance Verification Guidebook requirements for on-site testing.

¹ <https://v2.wellcertified.com/wellv2/en/sound/feature/1>

Feature S02 –Maximum Noise Levels²

A total of three points is available for this feature which is verified by on-site testing.

Part 1: Limit Background Noise Levels (1 or 3 points available)

Either one or three points are available if the Background Noise Levels do not exceed the following limits presented in Table 1 below.

Table 1:Maximum Noise Levels

Sound pressure level (SPL)		Open workspaces, dining areas	Enclosed offices	Conference rooms, classrooms	Points
Average SPL (L_{eq})	dBA	45	40	35	3
	dB(C)	65	60	55	
Max SPL (L_{max})	dBA	55	50	45	
	dB(C)	75	70	65	
Average SPL (L_{eq})	dBA	50	45	40	1
	dB(C)	70	65	60	
Max SPL (L_{max})	dBA	60	55	50	
	dB(C)	80	75	70	

Note: L_{eq} measurements may exceed optimal levels by no more than a 4dB tolerance. L_{max} measurements are slow-weighted and may exceed optimal levels by no more than a 9dB tolerance.

² <https://v2.wellcertified.com/v/en/sound/feature/2>

Feature S03 –Sound Barriers ³

A total of three points is available for this feature, using a combination of technical documents for Part 1 and on-site testing for Part 2.

Part 1 Design for Sound Isolation at Walls and Doors (1 point)

One point is available if the internal walls and door meet the following R_w values.

Table 2: Minimum Design Sound Insulation Value

Internal Wall/Door Type	R_w
Walls between circulation zones and other occupiable spaces	40
Walls between rooms for concentration and other regularly occupied spaces.	45
Walls between adjacent quiet zones	50
Walls between areas for conferencing and other regularly occupied spaces.	55
Walls between loud zones and other occupiable spaces	60
Doors connecting private offices and conference rooms to other spaces ¹	30

Note:¹ Doors that connect two occupiable rooms and mechanical equipment rooms have a non-hollow core, minimum STC/R_w of 30 and seals at the head, jamb and base.

³ <https://v2.wellcertified.com/v/en/sound/feature/3>

Part 2 Achieve Sound Isolation at Walls - Option 1: Noise Isolation Class (2 points)

Two points are available when the spaces listed below have interior partition walls that meet the minimum Weighted Difference Level (D_w) listed in Table 3, below.

Table 3: Maximum Noise Levels (2 Points)⁴

Interior Wall Type	Minimum NIC or D_w
Between Loud zones and other occupiable spaces.	55
Between areas for conferencing, learning or sleep and other regularly occupied spaces.	50
Between adjacent Quiet zones.	45
Between rooms for concentration and other regularly occupied spaces.	40
Between Circulation zones and regularly occupied spaces.	35

⁴ <https://v2.wellcertified.com/v/en/sound/feature/3>

Feature S04 – Reverberation Times

A total of two points is available for this feature which can be verified either by technical documentation or on-site testing. For this scheme, on-site testing has been used.

Part 1 – Meet Thresholds for Reverberation Time- Option 2: Reverberation time, performance (2 points) ⁵

All spaces must meet the maximum $RT_{(60)}$ thresholds in the table below when averaged between 500Hz and 1kHz:

Table 4: Maximum Reverberation Time Thresholds (2 Points)

Room Type	Size	$RT_{(60)}$ (seconds)
Areas for Learning and Conferencing	$v < 10,000 \text{ ft}^3$	< 0.6
	$10,000 \text{ ft}^3 \leq v \leq 20,000 \text{ ft}^3$	$0.5 \leq t \leq 0.8$
	$V > 20,000 \text{ ft}^3$	$0.6 \leq t \leq 1.0$

WELL does not set specific RT thresholds for offices or open plan work areas. It is assumed that the criteria above would be applicable to meeting rooms, cellular offices and phone booths at 111 Piccadilly.

⁵ <https://v2.wellcertified.com/wellv2/en/sound/feature/4>

Feature S05 –Sound Reducing Surfaces

The two points available for this feature are verified by technical documentation.

Part 1 – Implement Sound Reducing Surfaces (2 points) ⁶

For all spaces, ceiling finishes should have a minimum absorption performance α_w as described in Table 5 below;

Table 5: Ceiling Absorption Requirements

Space Type	Minimum α_w	
	1 Point	2 Points
Open Workspaces Enclosed Offices	0.70 for at least 75% of available ceiling area, no furniture requirements	0.90 for all available ceiling area, partial height barriers with a minimum 0.70 between all opposing workstations
Meeting Rooms	0.7 for at least 50% of available ceiling area, 0.75 on at least 25% of two walls	0.90 for all available ceiling area, 0.80 on at least 25% of two perpendicular walls
Café	0.75 on at least 50% of available ceiling area	0.90 for all available ceiling area

⁶ <https://v2.wellcertified.com/wellv2/en/sound/feature/5>

Acoustic Feature Verification

Feature S01 –Sound Mapping

Part 1 – Label Acoustic Zones

Acoustic zoning for the scheme is presented on Acoustic design report produced by dBx Acoustics Ltd, Ref: *18088 111 Piccadilly dated 05th October 2018* as well as on the Ground floor plan produced by the project team, Ref: *Ground floor Plan, WELL Quiet Zones, Drawing No. 180048-3DR-00-SK-A-010* dated 20.04.20.

Part 2 – Provide Acoustic Design Plan

dBx Acoustics has issued an acoustic design report for the scheme describing the pre-development conditions and recommended acoustic solutions with a focus on managing background noise, speech privacy, reverberation time. Report Reference: *18088 111 Piccadilly* dated 5th October 2018.

We therefore consider that this pre-condition has been complied with.

Feature S02 – Maximum Noise Levels

Part 1: Limit Background Noise Levels

Noise measurements were taken with all mechanical services fully operational and windows/doors closed to assess the cumulative background sound level arising from both noise intrusion and building services.

The results of the noise measurements are presented in Table 7 below. All figures presented below are rounded to nearest whole decibel.

Table 6: Measured Sound Pressure Level

Measurement Location	Target Criteria for 3 points, dB	Target Criteria for 1 point, dB	Measured Sound Pressure Level, dB	Pass/Fail
Reception/Lounge - 19	45 dB L _{Aeq}	50dB L _{Aeq}	55 dB L _{Aeq}	Fail ¹
	65 dB L _{Ceq}	70dB L _{Ceq}	64 dB L _{Ceq}	
	55 dB L _{ASMax}	60dB L _{ASMax}	56 dB L _{ASMax}	
	75 dB L _{CSMax}	80dB L _{CSMax}	66 dB L _{CSMax}	
Servery/café - 37	45 dB L _{Aeq}	50dB L _{Aeq}	53 dB L _{Aeq}	Pass ² (1 pt)
	65 dB L _{Ceq}	70dB L _{Ceq}	63 dB L _{Ceq}	
	55 dB L _{ASMax}	60dB L _{ASMax}	53 dB L _{ASMax}	
	75 dB L _{CSMax}	80dB L _{CSMax}	66 dB L _{CSMax}	
Reception/Lounge -19 (Quiet Zone)	45 dB L _{Aeq}	50dB L _{Aeq}	49 dB L _{Aeq}	Pass (3 pts)
	65 dB L _{Ceq}	70dB L _{Ceq}	50 dB L _{Ceq}	
	55 dB L _{ASMax}	60dB L _{ASMax}	50 dB L _{ASMax}	
	75 dB L _{CSMax}	80dB L _{CSMax}	66 dB L _{CSMax}	
Lounge - 18 ³	45 dB L _{Aeq}	50dB L _{Aeq}	47 dB L _{Aeq}	Pass ² (3 pts)
	65 dB L _{Ceq}	70dB L _{Ceq}	64 dB L _{Ceq}	
	55 dB L _{ASMax}	60dB L _{ASMax}	48 dB L _{ASMax}	
	75 dB L _{CSMax}	80dB L _{CSMax}	71 dB L _{CSMax}	
Office - 14	40 dB L _{Aeq}	45 dB L _{Aeq}	40 dB L _{Aeq}	Pass ² (3 pts)
	60 dB L _{Ceq}	65 dB L _{Ceq}	63 dB L _{Ceq}	
	50 dB L _{ASMax}	55 dB L _{ASMax}	41 dB L _{ASMax}	
	70 dB L _{CSMax}	75 dB L _{CSMax}	69 dB L _{CSMax}	

Measurement Location	Target Criteria for 3 points, dB	Target Criteria for 1 point, dB	Measured Sound Pressure Level, dB	Pass/Fail
Meeting Room 8	35 dB LAeq	40 dB LAeq	41 dB LAeq	Pass ² (1 pt)
	55 dB LCEq	60 dB LCEq	53 dB LCEq	
	45 dB LASMax	50 dB LASMax	42 dB LASMax	
	65 dB LCSMax	70 dB LCSMax	55 dB LCSMax	
Meeting Room 7	35 dB LAeq	40 dB LAeq	43 dB LAeq	Pass ² (1 pt)
	55 dB LCEq	60 dB LCEq	53 dB LCEq	
	45 dB LASMax	50 dB LASMax	43 LASMax	
	65 dB LCSMax	70 dB LCSMax	56 LCSMax	
Co-workspace 9 ³	40 dB LAeq	45 dB LAeq	45 dB LAeq	Pass ² (1 pt)
	60 dB LCEq	65 dB LCEq	60 dB LCEq	
	50 dB LASMax	55 dB LASMax	47 dB LASMax	
	70 dB LCSMax	75 dB LCSMax	65 dB LCSMax	
Video Conference 1	35 dB LAeq	40 dB LAeq	45 dB LAeq	Fail ⁴
	55 dB LCEq	60 dB LCEq	59 dB LCEq	
	45 dB LASMax	50 dB LASMax	47 dB LASMax	
	65 dB LCSMax	70 dB LCSMax	68 dB LCSMax	
Video Conference 2	35 dB LAeq	40 dB LAeq	48 dB LAeq	Fail ⁴
	55 dB LCEq	60 dB LCEq	54 dB LCEq	
	45 dB LASMax	50 dB LASMax	48 LASMax	
	65 dB LCSMax	70 dB LCSMax	55 dB LCSMax	
Video Conference 3	35 dB LAeq	40 dB LAeq	52 dB LAeq	Fail ⁴
	55 dB LCEq	60 dB LCEq	62 dB LCEq	
	45 dB LASMax	50 dB LASMax	52 dB LASMax	
	65 dB LCSMax	70 dB LCSMax	72 dB LCSMax	
Meeting Room 6	35 dB LAeq	40 dB LAeq	47 dB LAeq	Fail ⁴
	55 dB LCEq	60 dB LCEq	55 dB LCEq	

Measurement Location	Target Criteria for 3 points, dB	Target Criteria for 1 point, dB	Measured Sound Pressure Level, dB	Pass/Fail
	45 dB L_{ASMax}	50 dB L_{ASMax}	47 dB L_{ASMax}	
	65 dB L_{CSMax}	70 dB L_{CSMax}	59 dB L_{CSMax}	
Conference Room 5	35 dB L_{Aeq}	40 dB L_{Aeq}	48 dB L_{Aeq}	Fail ¹
	55 dB L_{Ceq}	60 dB L_{Ceq}	62 dB L_{Ceq}	
	45 dB L_{ASMax}	50 dB L_{ASMax}	49 dB L_{ASMax}	
	65 dB L_{CSMax}	70 dB L_{CSMax}	65 dB L_{CSMax}	
Conference Room 4	35 dB L_{Aeq}	40 dB L_{Aeq}	47 dB L_{Aeq}	Fail ¹
	55 dB L_{Ceq}	60 dB L_{Ceq}	63 dB L_{Ceq}	
	45 dB L_{ASMax}	50 dB L_{ASMax}	48 dB L_{ASMax}	
	65 dB L_{CSMax}	70 dB L_{CSMax}	70 dB L_{CSMax}	

Notes:

¹Noise from the mechanical ventilation unit observed.

²As per WELL verification compliance, L_{eq} measurements may exceed optimal levels by no more than a 4dB tolerance.

³Two measurements undertaken within the space. Results presented as per WELL requirements, "All measurements taken in open workspaces should be averaged to a single time-averaged sound pressure level for each criterion (dBA and dBC for both L_{eq} and L_{Max})"⁷

⁴Noise from air terminals/grilles connected to the mechanical ventilation system observed.

Based on the above, the points associated with Feature S02 can not currently be awarded.

In all cases where failure was recorded, this was due to noise from the mechanical services system.

⁷ <https://dev-wellv2.wellcertified.com/wellv2/en/sound/feature/2>

Feature S03 –Sound Barriers

Part 1 Design for Sound Isolation at Walls and Doors - (1 point)

Based on the acoustic design report produced by dBx Acoustics Ltd, Ref: 18088 111 Piccadilly dated 05th October 2018, and supported by the Client's drawings as listed in Appendix B, the separating walls between video conference rooms have been designed to 56 dB R_w and the operable wall between conference rooms at 53 dB R_w . Partitions to meeting rooms have been specified at 50 dB R_w .

As these are plasterboard partitions, a design allowance of 7dB should be made when considering the achievable D_w on site. Therefore, the walls between video conference rooms would be expected to achieve in the order of 50 dB D_w and the walls between the meeting rooms in the order of 43dB D_w .

Based on the above, 1 point can be awarded for 'Feature S03- Sound Barriers -Part-01 Part 1 Design for Sound Isolation at Walls and Doors'.

Part 2 Achieve Sound Isolation at Walls - Option 2: Speech Privacy

Table 8 below presents results of the measurements undertaken on site.

Table 7 – Summary of Tests Undertaken.

Test Element	Source Room	Receiving Room	Measured D_w (dB)	Minimum Required D_w	Pass/Fail
Separating Wall	Conference Room 5	Meeting Room 6	41 ¹	50	Fail
Separating Wall	Conference Room 4	Video Conference Room 3	28 ¹⁺²	50	Fail
Separating Wall	Video Conference Room 3	Video Conference Room 2	30 ¹⁺²	50	Fail
Separating Wall	Meeting Room 7	Meeting Room 8	37 ¹⁺²	43	Fail

Observations and Notes: ¹ Sound leakage observed through cable tray penetrating between separating walls. The sound insulation performance of the separating wall is anticipated to improve if intumescent pillows are used between cable tray penetrations.

² The sound insulation performance of the separating wall is undermined by the flanking transmission through junction of separating wall and external wall/glazing.

Based on the above, the points associated with S03 cannot currently be awarded.

Remedial works are required to the partitions in order to control sound flanking both at services penetrations, and at junctions with the external walls/glazing. We also recommend that the as-built specification of these partitions is confirmed.

Feature S04 – Reverberation Time

Part 1 – Meet Thresholds for Reverberation Time- Option 2: Reverberation time, performance (2 points)

The results of the noise measurements are presented in Table 9 below.

Table 8 – Summary of Reverberation Tests Undertaken in Video Conference Room.

Measurement Location	Room Volume (ft ³)	Target Criteria, RT ₍₆₀₎ (seconds)	Measured RT ₍₆₀₎ (seconds) ¹	Pass/Fail
Video Conference - 03	1271	≤0.60	0.39	Pass
Conference room - 04	2860	≤0.60	0.48	Pass
Conference room - 05	2540	≤0.60	0.52	Pass
Meeting room - 07	2540	≤0.60	0.51	Pass
Co-workspace 9	6886	0.80≤t≤1.0	1.00	Pass

Note: ¹The average RT60 value from 500 Hz - 1 kHz of the three measurements per measurement location is used to determine compliance with the WELL threshold.

RT measurements were not undertaken in Video Conference Rooms 01 and 02 as no power supply was available. However, we anticipate that the reverberation time in these rooms would be similar to Video Conference Room 03 due to similar room finishes and room volumes.

Based on the above, 2 points can be awarded for Feature S04.

Feature S05 –Sound Reducing Surfaces

Part 1 – Implement Sound Reducing Surfaces (2 points)

The drawings received from the Client do not show the area or specification of acoustic finishes included. However, based on the recommendation for such surfaces in the acoustic design report and the successful achievement of points associated with S04 (above), ***we anticipate that these points can be awarded/***

Conclusion

Based on the on-site verification testing, and assessment of the as-built drawings and specifications, the ground floor space at 111 Piccadilly currently achieves 5 of a maximum 10 possible points under WELL features S01-S05.

The specific issues identified on site requiring remediation in order to achieve further points are;

- Building services noise levels are too high in a number of spaces (Feature S02)
- Building services penetrations in acoustically critical walls are not sealed (Feature S03)
- Junctions between internal partitions and the external wall/glazing are not fully sealed (Feature S03). The as-built specification of the walls on site should be confirmed.

Appendix A – Glossary of Acoustic Terminology

Decibel, dB	A unit of level derived from the logarithm of the ratio between the value of a quantity and a reference value. For sound pressure level (L_p) the reference quantity is 2×10^{-5} N/m ² . The sound pressure level existing when microphone measured pressure is 2×10^{-5} N/m ² is 0 dB, the threshold of hearing.
L	Instantaneous value of Sound Pressure Level (L_p) or Sound Power Level (L_w).
Frequency	Number of cycles per second, measured in hertz (Hz), related to sound pitch.
A weighting	Arithmetic corrections applied to values of L_p according to frequency. When logarithmically summed for all frequencies, the resulting single "A weighted value" becomes comparable with other such values from which a comparative loudness judgement can be made, then, without knowledge of frequency content of the source.
$L_{eq,T}$	Equivalent continuous level of sound pressure which, if it actually existed for the integration time period T of the measurement, would possess the same energy as the constantly varying values of L_p actually measured.
$L_{Aeq,T}$	Equivalent continuous level of A weighted sound pressure which, if it actually existed for the integration time period, T, of the measurement would possess the same energy as the constantly varying values of L_p actually measured.
$L_{n,T}$	L_p which was exceeded for n% of time, T.
$L_{An,T}$	Level in dBA which was exceeded for n% of time, T.
$L_{max,T}$	The instantaneous maximum sound pressure level which occurred during time, T.
$L_{Amax,T}$	The instantaneous maximum A weighted sound pressure level which occurred during time, T.

Appendix B – Design Information Used In Assessment

The following drawings supplied by Bruntwood have been referred to within this assessment.

180048-3DR-DE-22101 Wall Types Reference Plan, Ground Floor

180048-3DR-DE-40100 Wall Finishes – Ground Floor

180048-3DR-DE-22103 Wall Details

180048-3DR-DE-22106 Folding Wall Details