



First Street – Block D

Technical Note – Condition 16 – Internal Noise Levels

Prepared by:	Paul Knowles (MIOA)
Checked by:	Warren King (MIOA)

1.0 Introduction

- 1.1 Acoustic and Engineering Consultants Ltd (AEC) has been appointed by Downing Living to undertake noise measurements and prepare a technical note to review whether Condition 16 placed on the scheme by Manchester City Council (MCC), can be discharged.

- 1.2 Condition 16 of MCC's Planning Permission for the scheme states that:

"Prior to the commencement of the superstructure a scheme for acoustically insulating and mechanically ventilating the residential accommodation against noise from adjacent roads shall be submitted to and approved in writing by the City Council as local planning authority.

The approved noise insulation shall be completed before any of the dwelling units are occupied.

The following noise criteria will be required to be achieved:

Bedrooms (night time - 23.00 - 07.00) 30 dB LAeq (individual noise events shall not exceed 45 dB L_{Amax,F} by more than 15 times)

Living Rooms (daytime - 07.00 - 23.00) 35 dB LAeq

Prior to occupation a post completion report to verify that all of the recommended mitigation measures have been installed and effectively mitigate any potential adverse noise impacts in the residential accommodation shall be submitted and agreed in writing by the City Council as local planning authority. Prior to occupation any non-compliance shall be suitably mitigated in accordance with an agreed scheme.

Reason - To secure a reduction in noise in order to protect future residents from noise nuisance, pursuant to policies SP1, H1 and DM1 of the Core Strategy."

- 1.3 As stated in AEC Report: P3921/R8/PJK, there were no entertainment noise sources affecting the habitable rooms in the development, therefore, this has not been considered further.

2.0 External Cladding

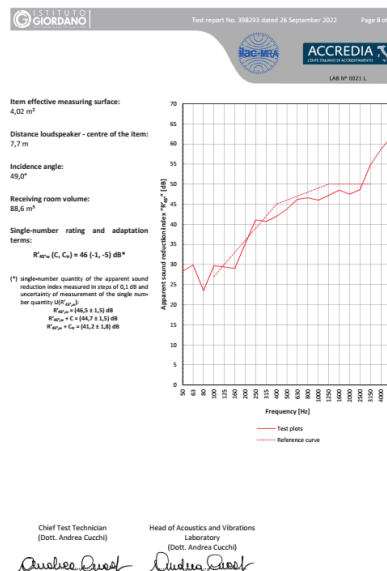
- 2.1 The curtain walling installed in Block D has been designed and constructed by Focchi. The cladding is constructed in Italy in panels, including the doors, and is shipped over to the UK where it is installed onsite by Focchi employees.
- 2.2 A photo of a mock-up tested at the Focchi facility in Italy is provided below.

Photo 2.1 – Mock up of External Cladding



- 2.3 An example of the test data provided by Focchi for an external cladding panel is provided in Figure 2.1.

Figure 2.1 – Data Sheet for Focchi External Cladding Panel



3.0 Noise Measurements and Assessment

General

- 3.1 The measurements were undertaken in general accordance with the Association of Noise Consultants guidance “*Measurement of Sound Levels in Buildings*” issued in June 2020. The calibration certificates for the measurement equipment used by AEC is presented in Appendix A.
- 3.2 The ventilation strategy within the development is a mix of acoustic trickle ventilators and a MVHR system. AEC understands that the MVHR system was operating and balanced in the rooms tested.

Measurement Details

- 3.3 Long term noise levels were measured by AEC between Thursday 24th and Friday 25th April and between Friday 25th and Saturday 26th April 2025 in Studio apartments and Multi-bed Apartments on the eighth and thirtieth floor of Block D.
- 3.4 Short term spot check measurements were also undertaken on six other floors during the daytime of Thursday 24th and Friday 25th April 2025. Please note that there were external works being undertaken during these measurements which may have contributed to measured levels.
- 3.5 The site location showing Block D is presented in Figure B.1 of Appendix B. The floor plans of the eight floors on which the measurements were undertaken are provided in Figures B.2 to B.9.

Ambient Noise Levels

- 3.6 The daytime and night-time internal ambient noise levels measured during the surveys are presented in Tables 3.1 and 3.2, along with the criteria for comparison purposes.

Table 3.1 – Long Term Measured Internal Ambient Noise Levels and Criteria

Test Ref:	Floor / Room	Noise Level, dBL _{Aeq, T}			
		Daytime (0700 – 2300h)		Night-time (2300 – 0700h)	
		Measured Level	Criteria	Measured Level	Criteria
1	605 – Studio Apartment	32	≤ 35	30	≤ 30
2	610 – Studio Apartment	31	≤ 35	30	≤ 30
3	617 – Studio Apartment	32	≤ 35	30	≤ 30
4	619 – Studio Apartment	32	≤ 35	30	≤ 30
5	3002 – Bedroom	34	≤ 35	30	≤ 30
6	3005 – Living Room*	34	≤ 35	30	≤ 30
7	3005 – Bedroom	34	≤ 35	29	≤ 30
8	3007 – Bedroom	32	≤ 35	30	≤ 30

*No bedrooms were available on this elevation at high level as they were the hoist rooms and still to be decorated.

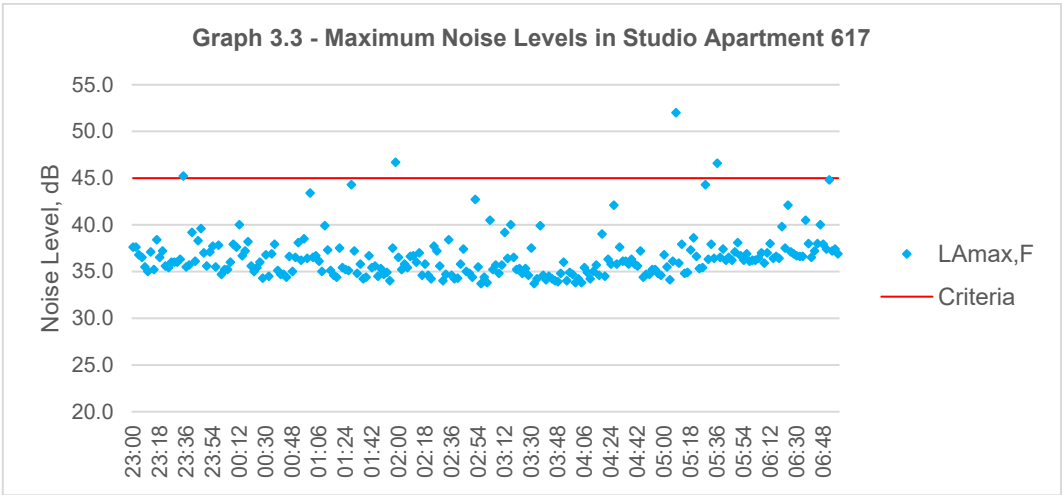
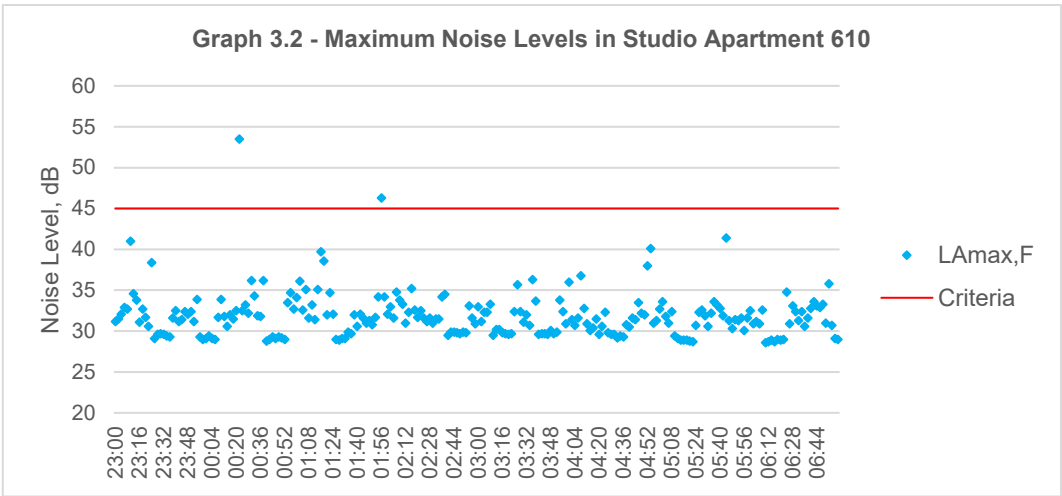
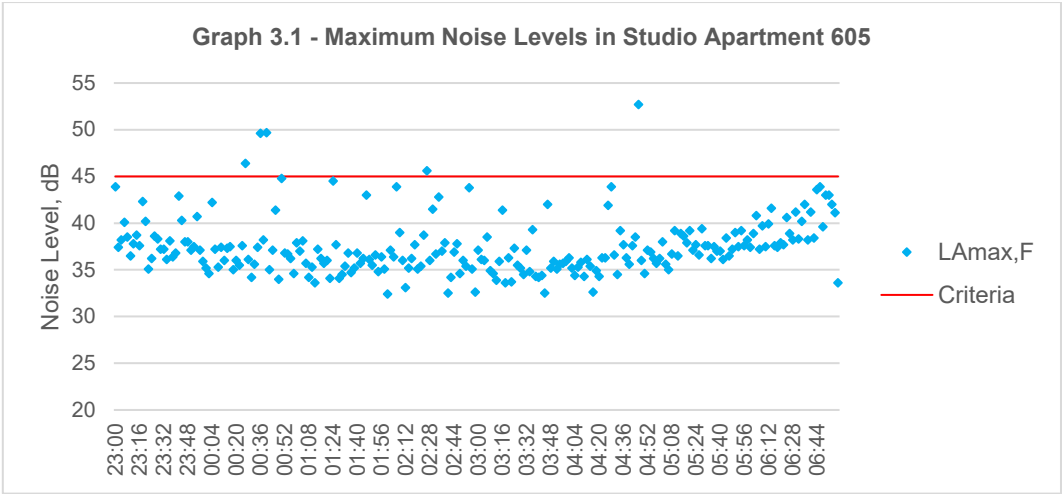
Table 3.2 – Short Term Daytime Measured Internal Ambient Noise Levels and Criteria

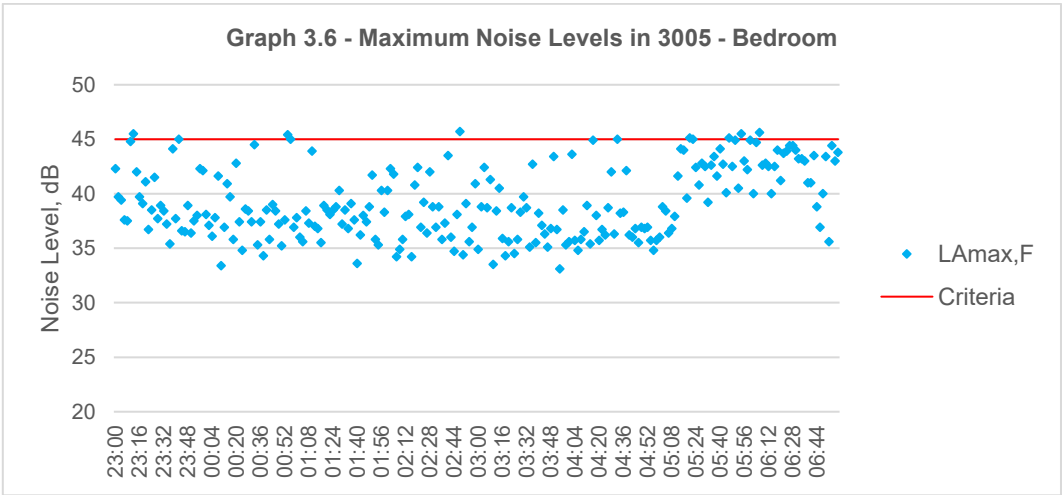
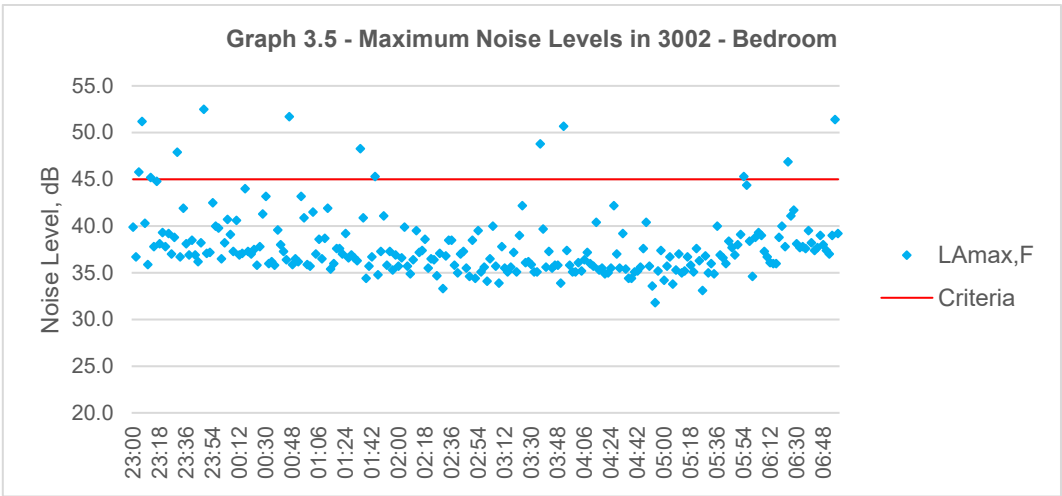
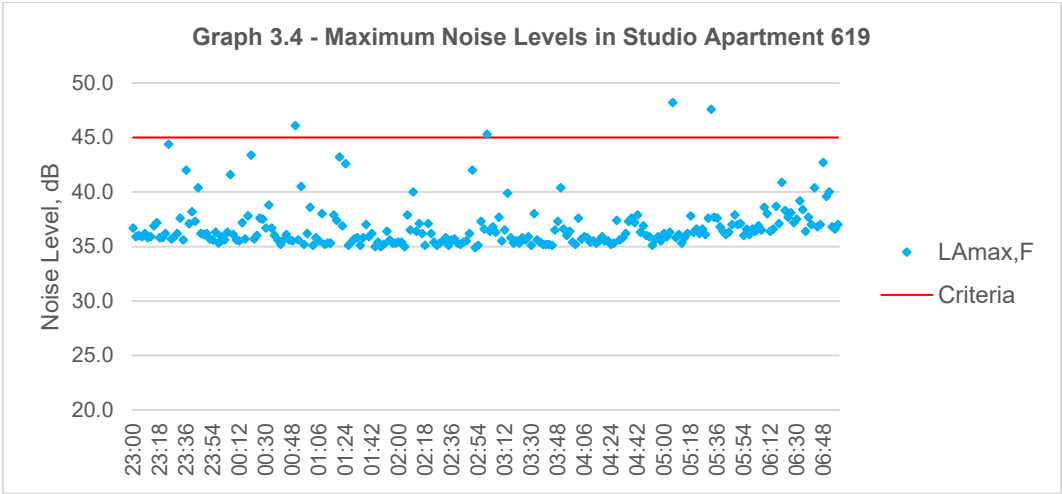
Test Ref:	Room	Noise Level, dBL _{Aeq, T}	
		Measured Level	Criteria
09	202 – Studio Apartment	33	≤ 35
10	204 – Studio Apartment	33	≤ 35
11	210 – Studio Apartment	30	≤ 35
12	213 – Studio Apartment	34	≤ 35
13	1012 – Studio Apartment	33	≤ 35
14	1006 – Studio Apartment	33	≤ 35
15	1009 – Studio Apartment	33	≤ 35
16	1019 – Studio Apartment	33	≤ 35
17	1405 – Studio Apartment	32	≤ 35
18	1402 – Studio Apartment	34	≤ 35
19	1409 – Studio Apartment	33	≤ 35
20	1413 – Living Room	34	≤ 35
21	1801 – Bedroom	30	≤ 35
22	1805 – Bedroom	32	≤ 35
23	1806 – Living Room	30	≤ 35
24	1811 – Living Room	30	≤ 35
25	2204 – Living Room	33	≤ 35
26	2209 – Bedroom	30	≤ 35
27	2211 – Bedroom	30	≤ 35
28	2213 – Bedroom	32	≤ 35
29	2603 – Living Room	30	≤ 35
30	2605 – Living Room	32	≤ 35
31	2608 – Living Room	34	≤ 35
32	2610 – Living Room	34	≤ 35

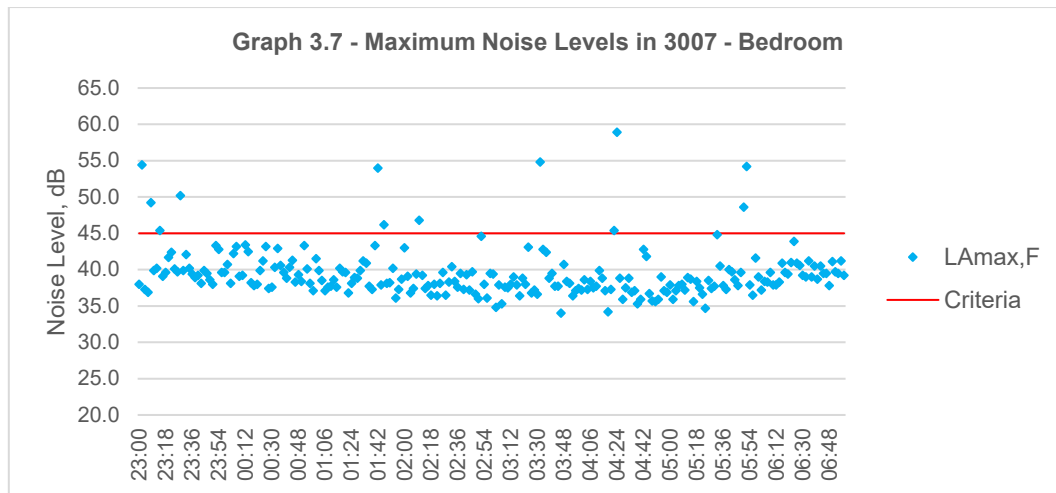
- 3.7 The above demonstrates that the ambient noise level requirements were achieved during both the daytime and night-time periods in all the rooms tested.

Maximum Noise Levels

- 3.8 The maximum noise levels measured over two-minute sampling times in the rooms tested during the night-time periods are presented in Graphs 3.1 to Graph 3.7, below. The night-time maximum noise level criteria of 45dBL_{Amax,F} is also presented on the graphs for reference purposes.







- 3.9 Based on the above dataset, there were fewer than 15 exceedances of $45\text{dB}L_{Amax,F}$, in each room during the night-time assessment period, therefore, the requirements have been met.

Summary and Conclusion

- 3.10 The above assessment demonstrates that internal ambient and maximum noise levels comply with the requirements of Condition 16 in rooms on each elevation of Block D.
- 3.11 As a result, Condition 16 can be discharged.

Appendix A – Calibration Certificates

Certificate of Calibration Issued by University of Salford (Acoustics Calibration Laboratory)	
Page 1 of 3	
APPROVED SIGNATORIES Claire Lomax [] Sean Furlong [] Harry Bulger [x] Daniel Wong-McSweeney []	
acoustic calibration laboratory The University of Salford, Salford, Greater Manchester, M5 4WT, UK http://www.acoustics.salford.ac.uk t 0161 295 3030/0161 295 3319 f 0161 295 4456 e c.lomax1@salford.ac.uk	

Certificate Number: 06527/2

Date of Issue: 15 November 2023

PERIODIC TEST OF A SOUND LEVEL METER to IEC 61672-3:2006

FOR:	Acoustic & Engineering Consultants ltd Suite 316, 3rd Floor Broadstone Mill Broadstone Road Stockport SK5 7DL
FOR THE ATTENTION OF:	Naveen Ramesh Simha
DATE RECEIVED:	13 November 2023
PERIODIC TEST DATE:	15 November 2023
LOCATION OF CALIBRATION:	Acoustic Calibration Laboratory, Newton G31, University of Salford
TEST PROCEDURE:	CTP12 (Laboratory Manual)

Sound Level Meter Details-

Manufacturer	B&K
Model	2250
Serial number	2456390
Class	1
Hardware version: 4.0	Sound Level Meter Software BZ7222 Version 4.7.6

Associated Items:-

Type	Manufacturer	Model	Serial Number	Adaptor
Microphone	B&K	4189	2876807	
Preamplifier	B&K	ZC 0032	25899	
Calibrator	B&K	4231	3018624	UC 0210

Test Engineer (initial): GP / RS Name: Gary Phillips / Rory Stocks

Results in this certificate relate only to instruments tested.

This certificate provides traceability of measurement to the SI system of units and/or to the units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full except with the prior written approval of the issuing laboratory.

Certificate of Calibration

Issued by University of Salford (Acoustics Calibration Laboratory)

Page 2 of 3

Certificate Number: 06527/2

Date of Issue: 15 November 2023

Procedures from IEC 61672-3: 2006 and TPS 49 Edition 2 June 2009 were used to perform the periodic tests. Manufacturer's instruction manual was marked as follows: B&K 2250 BE 1712-15 April 2007 from hardware version 1.1. Adjustment data used to adjust the sound levels indicated in response to the application of a multi-frequency sound calibrator to sound levels equivalent to those that would be indicated in response to plane, progressive sound waves were obtained from the manufacturer's instruction manual referred to in this certificate.

The sound level meter calibration check frequency is 1000 Hz, the reference sound pressure level is 94 dB, and as this instrument only has a single range, this range is the reference level range.

The environmental conditions in the laboratory at the start of the test were:

Static pressure 100.949 kPa $\pm$ 0.014 kPa; air temperature 23.6 °C $\pm$ 0.3 °C; relative humidity 47.1 % $\pm$ 2.7 %.

The initial response of the instrument to application of the associated sound calibrator was 93.9 dB (C). The instrument was then adjusted to indicate 94.0 dB (C). This indication was obtained from the calibration certificate of the calibrator, 06527/1 and information in the manufacturer's instruction manual specified in this certificate, when the instrument is configured as follows: Input: Top socket, Transducer: 4189(2876807), Sound Field Correction: Free-field, Windscreen Auto Detect: Off, Windscreen Correction: None. The instrument was calibrated without a windshield. Consult manufacturer's instructions if using a windshield.

With the microphone installed the level of self-generated noise was:

A: 17.2 dB*

* Under-range indicated on instrument display

With the microphone replaced by the electrical input device specified in the manufacturer's instruction manual, the levels of self-generated noise were:

A: 13.1 dB*

B: 12.0 dB*

C: 13.3 dB*

Z_{Normal}: 18.3 dB*

Z_{Extended}: 22.7 dB*

* Under-range indicated on instrument display

The environmental conditions in the laboratory at the end of the test were:

Static pressure 101.010 kPa $\pm$ 0.014 kPa; air temperature 23.9 °C $\pm$ 0.3 °C; relative humidity 50.0 % $\pm$ 2.7 %.

This certificate provides traceability of measurement to the SI system of units and/or to the units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full except with the prior written approval of the issuing laboratory.

Certificate of Calibration

Issued by University of Salford (Acoustics Calibration Laboratory)

Page 3 of 3

Certificate Number: 06527/2

Date of Issue: 15 November 2023

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Instruments used in the verification procedure were traceable to *National Standards*. The multi-frequency calibrator method was employed in the acoustical tests of a frequency weighting.

All measurement results are retained at the acoustic calibration laboratory for at least four years.

-----END OF CERTIFICATE-----

This certificate provides traceability of measurement to the SI system of units and/or to the units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full except with the prior written approval of the issuing laboratory.

Certificate of Calibration Issued by University of Salford (Acoustic Calibration Laboratory)		University of Salford MANCHESTER
Page 1 of 2		
APPROVED SIGNATORIES Claire Lomax [] Sean Furlong [] Harry Bulger [x] Daniel Wong-McSweeney []		
acoustic calibration laboratory The University of Salford, Salford, Greater Manchester, M5 4WT, UK http://www.acoustics.salford.ac.uk t 0161 295 3030/0161 295 3319 f 0161 295 4456 e c.lomax1@salford.ac.uk		

Certificate Number: 06527/1

Date of Issue: 15 November 2023

CALIBRATION OF A SOUND CALIBRATOR

FOR: Acoustic & Engineering Consultants Ltd
 Suite 316, 3rd Floor
 Broadstone Mill
 Broadstone Road
 Stockport
 Cheshire
 SK5 7DL

FOR THE ATTENTION OF: Naveen Ramesh Simha

DESCRIPTION: Calibrator with housing for one-inch microphones and adaptor type UC 0210 for half-inch microphones.

MANUFACTURER: B&K

TYPE: 4231

SERIAL NUMBER: 3018624

DATE RECEIVED: 13 November 2023

DATE OF CALIBRATION: 15 November 2023

LOCATION OF CALIBRATION: Acoustic Calibration Laboratory,
 Newton G31, University of Salford.

TEST PROCEDURE: CTP06 (Laboratory Manual)

Test Engineer (initial): GP Name: Gary Phillips

Results in this certificate relate only to instruments tested.

This certificate provides traceability of measurement to the SI system of units and/or to the units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full except with the prior written approval of the issuing laboratory.

Certificate of Calibration

Issued by University of Salford (Acoustic Calibration Laboratory)

Page 2 of 2

Certificate Number: 06527/1

Date of Issue: 15 November 2023

MEASUREMENTS

The sound pressure level generated by the calibrator was measured using a calibrated, WS2P condenser microphone as specified in this certificate. The calibration was carried out with the calibrator in the half-inch configuration.

Five determinations of the sound pressure level, frequency and total distortion were made.

The results have been corrected to the reference pressure of 101.325 kPa using manufacturer's data.

RESULTS

Coupler configuration: Half-inch

Microphone type: B&K 4192

Output level (dB re 20µPa): 94.08 dB ± 0.11 dB

Frequency (Hz): 999.97 Hz ± 0.12 Hz

Total Distortion (%): 0.02 % ± 0.25 %

*Negative values of distortion are not realistic and are not included in the confidence interval.

Average environmental conditions at the time of measurement were:

Pressure: 100.660 kPa ± 0.014 kPa

Temperature: 22.4 °C ± 0.4 °C

Relative humidity: 45.9 % ± 2.7 %

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%.

All measurement results are retained at the acoustic calibration laboratory for at least four years.

-----END OF CERTIFICATE-----

This certificate provides traceability of measurement to the SI system of units and/or to the units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full except with the prior written approval of the issuing laboratory.

Certificate of Calibration Issued by University of Salford (Acoustic Calibration Laboratory)		
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acoustic calibration laboratory The University of Salford, Salford, Greater Manchester, M5 4WT, UK http://www.acoustics.salford.ac.uk t 0161 295 3030/0161 295 3319 f 0161 295 4456 e c.lomax1@salford.ac.uk		

Certificate Number: 06455/2

Date of Issue: 23 October 2023

VERIFICATION OF A TYPE 1 SOUND LEVEL METER to BS7580 Part 1

FOR:	Acoustic & Engineering Consultants Ltd Suite 316, 3rd Floor Broadstone Mill Broadstone Road Stockport Cheshire SK5 7DL
FOR THE ATTENTION OF:	Ross Chamberlain
DATE RECEIVED:	26/09/2023
CALIBRATION DATE:	23/10/2023
LOCATION OF CALIBRATION:	Acoustic Calibration Laboratory, Newton G31, University of Salford
TEST PROCEDURE:	CTP08 (Laboratory Manual)

Equipment details:-

Type	Manufacturer	Model	Serial Number
Sound Level Meter	B&K	2260	2305157
Microphone	B&K	4189	2573885
Preamplifier	B&K	ZC 0026	3630
Calibrator	Cirrus	CR:517	94328

Test Engineer (initial):	GP	Name:	Gary Phillips
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Results in this certificate relate only to instruments tested.

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to the units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full except with the prior written approval of the issuing laboratory.

Certificate of Calibration

Issued by University of Salford (Acoustic Calibration Laboratory)

Page 2 of 2

Certificate Number: 06455/2

Date of Issue: 23 October 2023

SET-UP INFORMATION

The instrument was running software module BZ7202 Version 2.0. The tests were performed with the pre-amplifier directly connected to the instrument. The reference range, reference SPL, primary indicator range, pulse range and linearity range as specified by the manufacturer have been used. The instrument was adjusted to read 94.1 dB (A) in response to the associated calibrator. This reading was obtained from the calibration certificate of the calibrator, 06455/1 and information in the manufacturer's instruction manual, when the instrument is fitted with the supplied UA0237 windscreen.

MEASUREMENTS

The levels of self-generated noise were 14.7 dB (A), 16.5 dB (C), 23.6 dB (Lin).

At the end of the tests the indication of the sound level meter in response to the associated sound calibrator was 94.1 dB (A) which corresponds to the following level at 101.325 kPa:

Sound Pressure Level 94.1 dB (A)

This reading should be used henceforth to set up the sound level meter for field use.

THE SOUND LEVEL METER WAS VERIFIED ACCORDING TO THE PROCEDURE GIVEN IN BS7580: Part 1 1997 WITH THE FOLLOWING EXCEPTIONS:

A stricter test than that specified in 5.5.10 and 5.5.11 of BS 7580 has been used by not applying the low-level signal.

STATEMENT OF RESULT:

THE SOUND LEVEL METER CONFORMS* TO THE TYPE 1 REQUIREMENTS OF BS7580: PART 1 1997.

*Specification: Calibration and tolerances as defined by the requirements defined in BS 7580 Part 1: 1997.

*Decision Rule: Conformance is demonstrated when the instrument conforms with the accuracy requirements defined in BS 7580 Part 1: 1997 AND the expanded measurement uncertainty ($k = 2$ for approximately 95 % coverage probability) is no greater in magnitude than the accuracy requirements in defined in BS 7580 Part 1: 1997.

Instruments used in the verification procedure were traceable to National Standards. The method of acoustic calibration employed a standard sound pressure calibrator for the 1 kHz test whilst the tests at 125 Hz and 8 kHz were performed by the electrostatic actuator method. The uncertainty of the Laboratory's 1 kHz calibrator was ± 0.07 dB. The uncertainty of the standard calibrator is not included in the applied tolerances. It is assumed that the sound level meter was manufactured in accordance with BSEN60651: 1994 Type 1, and BSEN60804: 1994 Type 1.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%. All measurement results are retained at the acoustic calibration laboratory for at least four years.

-----END OF CERTIFICATE-----

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to the units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full except with the prior written approval of the issuing laboratory.

Certificate of Calibration Issued by University of Salford (Acoustic Calibration Laboratory)		University of Salford MANCHESTER
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APPROVED SIGNATORIES Claire Lomax [] Sean Furlong [] Harry Bulger [x] Daniel Wong-McSweeney []		
acoustic calibration laboratory The University of Salford, Salford, Greater Manchester, M5 4WT, UK http://www.acoustics.salford.ac.uk t 0161 295 3030/0161 295 3319 f 0161 295 4456 e c.lomax1@salford.ac.uk		



Certificate Number: 06445/1 Date of Issue: 23 October 2023

CALIBRATION OF A SOUND CALIBRATOR

FOR: Acoustic & Engineering Consultants Ltd
 Suite 316, 3rd Floor
 Broadstone Mill
 Broadstone Road
 Stockport
 Cheshire
 SK5 7DL

FOR THE ATTENTION OF: Ross Chamberlain

DESCRIPTION: Calibrator with housing for half-inch microphones.

MANUFACTURER: Cirrus

TYPE: CR:517

SERIAL NUMBER: 94328

DATE RECEIVED: 6 October 2023

DATE OF CALIBRATION: 19 October 2023

LOCATION OF CALIBRATION: Acoustic Calibration Laboratory,
 Newton G31, University of Salford.

TEST PROCEDURE: CTP06 (Laboratory Manual)

Test Engineer (initial): GP Name: Gary Phillips

Results in this certificate relate only to instruments tested.

This certificate provides traceability of measurement to the SI system of units and/or to the units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full except with the prior written approval of the issuing laboratory.

Certificate of Calibration

Issued by University of Salford (Acoustic Calibration Laboratory)

Page 2 of 2

Certificate Number: 06445/1

Date of Issue: 23 October 2023

MEASUREMENTS

The sound pressure level generated by the calibrator was measured using a calibrated, WS2P condenser microphone as specified in this certificate. The calibration was carried out with the calibrator in the half-inch configuration.

Five determinations of the sound pressure level, frequency and total distortion were made.

The reported results are valid at the environmental conditions at the time of calibration. Corrections to the stated level may be required depending on the actual environmental conditions at the time of use. Consult the manufacturer's instruction manual for further information.

RESULTS

Coupler configuration: Half-inch
Microphone type: GRAS 40AG
Output level (dB re 20 μ Pa): 93.99 dB $\pm$ 0.12 dB
Frequency (Hz): 1000.35 Hz $\pm$ 0.12 Hz
Total Distortion (%): 0.38 % $\pm$ 0.26 %

Average environmental conditions at the time of measurement were:

Pressure: 97.576 kPa $\pm$ 0.014 kPa
Temperature: 22.8 $^{\circ}$ C $\pm$ 0.4 $^{\circ}$ C
Relative humidity: 48.4 % $\pm$ 2.7 %

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%.

All measurement results are retained at the acoustic calibration laboratory for at least four years.

-----END OF CERTIFICATE-----

This certificate provides traceability of measurement to the SI system of units and/or to the units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full except with the prior written approval of the issuing laboratory.

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 18 January 2024

CERTIFICATE NUMBER 206751



Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Page 1 of 2

Approved signatory

M.Berry

Electronically signed:

Sound Level Meter : IEC 61672-3:2013

Instrument information

Manufacturer: Cirrus Research plc
Model: CR:171B
Serial number: G078287
Class: 1
Firmware version: 3.2.3254

Notes:

Test summary

Date of calibration: 17 January 2024

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013.

The sound level meter submitted for testing successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full specifications of IEC 61672-1:2013 because (a) evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to determine that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 or correction data for acoustical test of frequency weighting were not provided in the Instruction Manual and (b) because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

Notes

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number:

206751

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Environmental conditions

The following conditions were recorded at the time of the test:

Before Pressure: 98,58 kPa Temperature: 21.7 °C Humidity: 36.6 %
After Pressure: 98,58 kPa Temperature: 21.7 °C Humidity: 38.6 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	SIGLENT	SDG1032X	SDG1XDDQ8R6309
Attenuator	Cirrus Research	ZE-952	93892
Environmental Monitor	Comet	T7510	16986334

Additional instrument information

Instruction manual:

Reference level range: Single range

Pattern approval: No

Source of pattern approval: -

Preamplifier

Model: MV-200F

Serial number: 5719F

Microphone

Model: MK-224

Serial number: 206255A

Test results summary

Test	Result
Toneburst response	Complies
Electrical noise-floor	Complies
Linearity	Complies
Electrical Frequency weightings	Complies
Frequency and time weightings at 1 kHz	Complies
C-weighted peak	Complies
Overload indication	Complies
High level stability	Complies
Long-term stability	Complies
Acoustic Frequency weightings	Complies

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc
DATE OF ISSUE 10 January 2024 CERTIFICATE NUMBER 206756



Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Page 1 of 2

Test engineer:
D. Swahwell
Electronically signed:

Microphone

Microphone capsule

Manufacturer: Cirrus Research plc
Model: MK224
Serial Number: 206255A

Calibration procedure

Date of calibration: 10 January 2024
Open circuit: 32.9 mV/Pa
Sensitivity at 1 kHz: -29.7 dB rel 1 V/Pa

The microphone capsule detailed above has been calibrated to the published data as described in the operating manual of the associated sound level meter (where applicable).

The frequency response was measured using an electrostatic actuator in accordance with BS EN 61094-6:2005 with the free-field response derived via standard correction data traceable to a National Measurement Institute.

The absolute sensitivity at 1 kHz was measured using an acoustic calibrator conforming to IEC 60942:2003 Class 1.

Environmental conditions

Pressure: 102.60 kPa
Temperature: 21.0 °C
Humidity: 39.0 %

CERTIFICATE OF CALIBRATION

Certificate Number:

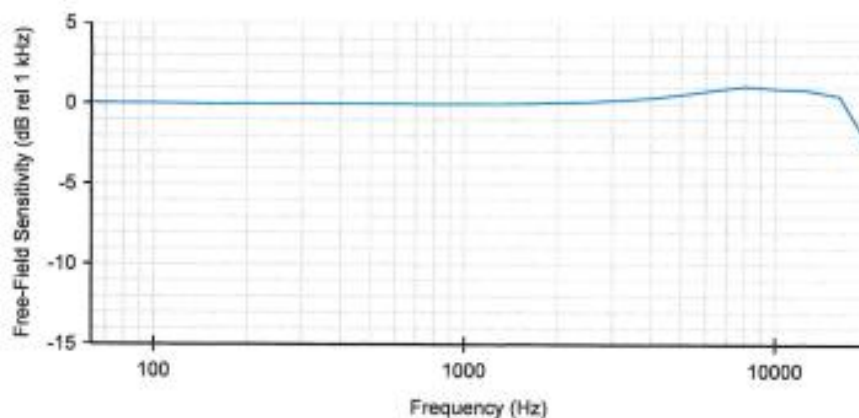
206756

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Free-Field Frequency Response : Tabular

Frequency (Hz)	Free-Field Sensitivity (dB rel 1 kHz)	Actuator Response (dB)
63	0.06	-0.19
80	0.05	-0.09
100	0.05	-0.04
125	0.04	-0.01
160	0.00	-0.02
200	0.02	0.02
250	0.01	0.01
315	0.03	0.01
400	0.00	0.00
500	0.01	-0.00
630	0.00	-0.00
800	-0.00	-0.02
1 000	0.00	-0.02
1 250	0.01	-0.04
1 600	0.04	-0.07
2 000	0.10	-0.09
2 500	0.16	-0.15
3 150	0.25	-0.26
4 000	0.40	-0.43
5 000	0.61	-0.64
6 300	0.88	-1.08
8 000	1.12	-1.96
10 000	0.98	-3.72
12 500	0.91	-5.60
16 000	0.54	-7.41
20 000	-2.39	-11.44

Free-Field Frequency Response : Graphical



CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 18 January 2024

CERTIFICATE NUMBER 206780



Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Page 1 of 2

Approved signatory

M.Berry

Electronically signed:

M.BERRY

Sound Calibrator : IEC 60942:2003

Instrument information

Manufacturer: Brüel & Kjær

Notes:

Model: 4230

Serial number: 1441331

Class: 1

Test summary

Date of calibration: 18 January 2024

The sound calibrator detailed above has been calibrated to the published data as described in the operating manual and in the half-inch configuration. The procedures and techniques used are as described in IEC60942_2003 Annex B – Periodic Tests and three determinations of the sound pressure level, frequency and total distortion were made.

The sound pressure level was measured using a WS2F condenser microphone type MK:224 manufactured by Cirrus Research plc.

The results have been corrected to the reference pressure of 101.33 kPa using the manufacturer's data.

The sound calibrator has been shown to conform to the Class 1 requirements for periodic testing, described in Annex B of IEC 60942:2003 for the sound pressure level(s) and frequency(ies) stated, for the environmental conditions under which the tests were performed.

However, as public evidence was not available, from a testing organisation responsible for pattern approval, to demonstrate that the model of sound calibrator conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2003, no general statement or conclusion can be made about conformance of the sound calibrator to the requirements of IEC 60942:2003.

Notes:

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number:

206780

Page 2 of 2

Environmental conditions

The following conditions were recorded at the time of the test:

Pressure: 99.81 kPa

Temperature: 25.4 °C

Humidity: 39.3 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Distortion Meter	Keithley	2015	0994818
Acoustic Calibrator	Bruel and Kjaer	4231	2610257
Environmental Monitor	Comet	T7510	21962628

Initial Results

	Expected	Sample 1	Sample 2	Sample 3	Average	Deviation	Tolerance	Uncertainty
Level (dB)	94.00	94.04	94.03	94.03	94.03	0.03	±0.40	0.11 dB
Distortion (%)	< 3.00	0.87	0.83	1.03	0.91	0.91	+3.00	0.13 %
Frequency (Hz)	1000.0	1020.4	1020.2	1021.0	1020.5	20.5	±10.0	0.1 Hz

The measured quantities or deviations (as applicable), extended by the expanded combined uncertainty of measurement, must not exceed the corresponding tolerance.

Adjusted Results

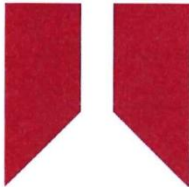
	Expected	Sample 1	Sample 2	Sample 3	Average	Deviation	Tolerance	Uncertainty
Level (dB)	94.00	94.05	94.04	94.05	94.05	0.05	±0.40	0.11 dB
Distortion (%)	< 3.00	0.90	0.93	0.93	0.92	0.92	+3.00	0.13 %
Frequency (Hz)	1000.0	1004.4	1005.0	1004.4	1004.6	4.6	±10.0	0.1 Hz

End of results

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research**

DATE OF ISSUE **06 September 2023** CERTIFICATE NUMBER **198670**



**Cirrus Research
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom**

Page 1 of 2

Approved signatory

R.Thomas

Electronically signed:

Sound Level Meter : IEC 61672-3:2013

Instrument information

Manufacturer:	Cirrus Research plc	Notes:
Model:	CR:171B	
Serial number:	G056597	
Class:	1	
Firmware version:	3.2.3254	

Test summary

Date of calibration: 04 September 2023

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.
Periodic tests were performed in accordance with procedures from IEC 61672-3:2013.

The sound level meter submitted for testing successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full specifications of IEC 61672-1:2013 because (a) evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to determine that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 or correction data for acoustical test of frequency weighting were not provided in the Instruction Manual and (b) because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

Notes

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number:

198670

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Environmental conditions

The following conditions were recorded at the time of the test:

Before Pressure: 101.79 kPa Temperature: 21.6 °C Humidity: 46.6 %
After Pressure: 101.76 kPa Temperature: 21.2 °C Humidity: 43.2 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	KEYSIGHT	33511B	MY58001681
Attenuator	Cirrus Research	ZE:952	64370
Environmental Monitor	Comet	T7510	16966334

Additional instrument information

Instruction manual:

Reference level range: Single range

Pattern approval: No

Source of pattern approval: -

Preamplifier

Model: MV:200F

Serial number: 3277F

Microphone

Model: MK:224

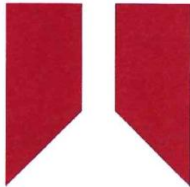
Serial number: 216585D

Test results summary

Test	Result
Toneburst response	Complies
Electrical noise-floor	Complies
Linearity	Complies
Electrical Frequency weightings	Complies
Frequency and time weightings at 1 kHz	Complies
C-weighted peak	Complies
Overload indication	Complies
High level stability	Complies
Long-term stability	Complies
Acoustic Frequency weightings	Complies

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research**
DATE OF ISSUE **24 August 2023** CERTIFICATE NUMBER **198672**



**Cirrus Research
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom**

Page 1 of 2

Test engineer:
D.Swalwell
Electronically signed:

Microphone

Microphone capsule

Manufacturer: Cirrus Research plc
Model: MK:224
Serial Number: 216585D

Calibration procedure

Date of calibration: 24 August 2023
Open circuit: 49.5 mV/Pa
Sensitivity at 1 kHz: -26.1 dB rel 1 V/Pa

The microphone capsule detailed above has been calibrated to the published data as described in the operating manual of the associated sound level meter (where applicable).

The frequency response was measured using an electrostatic actuator in accordance with BS EN 61094-6:2005 with the free-field response derived via standard correction data traceable to a National Measurement Institute.

The absolute sensitivity at 1 kHz was measured using an acoustic calibrator conforming to IEC 60942:2003 Class 1.

Environmental conditions

Pressure: 100.40 kPa
Temperature: 23.0 °C
Humidity: 62.0 %

CERTIFICATE OF CALIBRATION

Certificate Number:

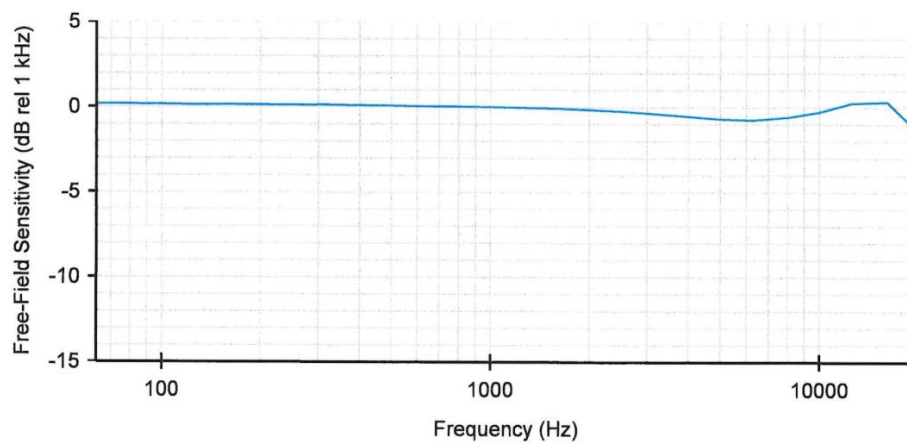
198672

Page 2 of 2

Free-Field Frequency Response : Tabular

Frequency (Hz)	Free-Field Sensitivity (dB rel 1 kHz)	Actuator Response (dB)
63	0.17	-0.06
80	0.17	0.04
100	0.15	0.07
125	0.13	0.10
160	0.13	0.13
200	0.12	0.13
250	0.10	0.12
315	0.12	0.12
400	0.09	0.11
500	0.08	0.09
630	0.03	0.04
800	0.04	0.04
1 000	0.00	-0.01
1 250	-0.04	-0.07
1 600	-0.09	-0.19
2 000	-0.15	-0.34
2 500	-0.24	-0.54
3 150	-0.39	-0.88
4 000	-0.54	-1.35
5 000	-0.70	-1.93
6 300	-0.76	-2.70
8 000	-0.58	-3.64
10 000	-0.28	-4.97
12 500	0.24	-6.26
16 000	0.32	-7.62
20 000	-1.39	-10.43

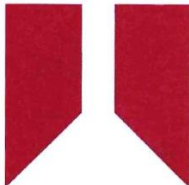
Free-Field Frequency Response : Graphical



CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research**

DATE OF ISSUE **06 September 2023** CERTIFICATE NUMBER **198673**



**Cirrus Research
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom**

Page 1 of 2

Approved signatory

R.Thomas

Electronically signed:

Sound Calibrator : IEC 60942:2003

Instrument information

Manufacturer: Cirrus Research plc

Notes:

Model: CR:515

Serial number: 56719

Class: 1

Test summary

Date of calibration: 05 September 2023

The sound calibrator detailed above has been calibrated to the published data as described in the operating manual and in the half-inch configuration. The procedures and techniques used are as described in IEC60942_2003 Annex B – Periodic Tests and three determinations of the sound pressure level, frequency and total distortion were made.

The sound pressure level was measured using a WS2F condenser microphone type MK:224 manufactured by Cirrus Research plc.

The results have been corrected to the reference pressure of 101.33 kPa using the manufacturer's data.

As public evidence was available, from a testing organisation responsible for approving the results of pattern evaluation tests, to demonstrate that the model of sound calibrator fully conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2003, the sound calibrator tested is considered to conform to all the Class 1 requirements of IEC 60942:2003.

The manufacturer's product information indicates that this model of sound calibrator has been formally pattern approved to IEC60942_2003 Annex A to Class 1. This has been confirmed by Laboratoire National d'Essais (LNE), Physikalisch-Technische Bundesanstalt (PTB) and APPLUS (APPLUS).

Notes:

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number:
198673

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Environmental conditions

The following conditions were recorded at the time of the test:

Pressure: 101.36 kPa
Temperature: 23.6 °C
Humidity: 51.4 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Distortion Meter	Keithley	2015	0994818
Acoustic Calibrator	Brüel and Kjær	4231	2610257
Environmental Monitor	Comet	T7510	21962628

Results

	Expected	Sample 1	Sample 2	Sample 3	Average	Deviation	Tolerance	Uncertainty
Level (dB)	94.00	94.06	94.05	94.04	94.05	0.05	±0.40	0.11 dB
Distortion (%)	< 3.00	0.20	0.35	0.13	0.23	0.23	+3.00	0.13 %
Frequency (Hz)	1000.0	1000.3	1000.3	1000.3	1000.3	0.3	±10.0	0.1 Hz

The measured quantities or deviations (as applicable), extended by the expanded combined uncertainty of measurement, must not exceed the corresponding tolerance.

End of results

Appendix B – Figures

Figure B.1 – Site Layout showing Block D

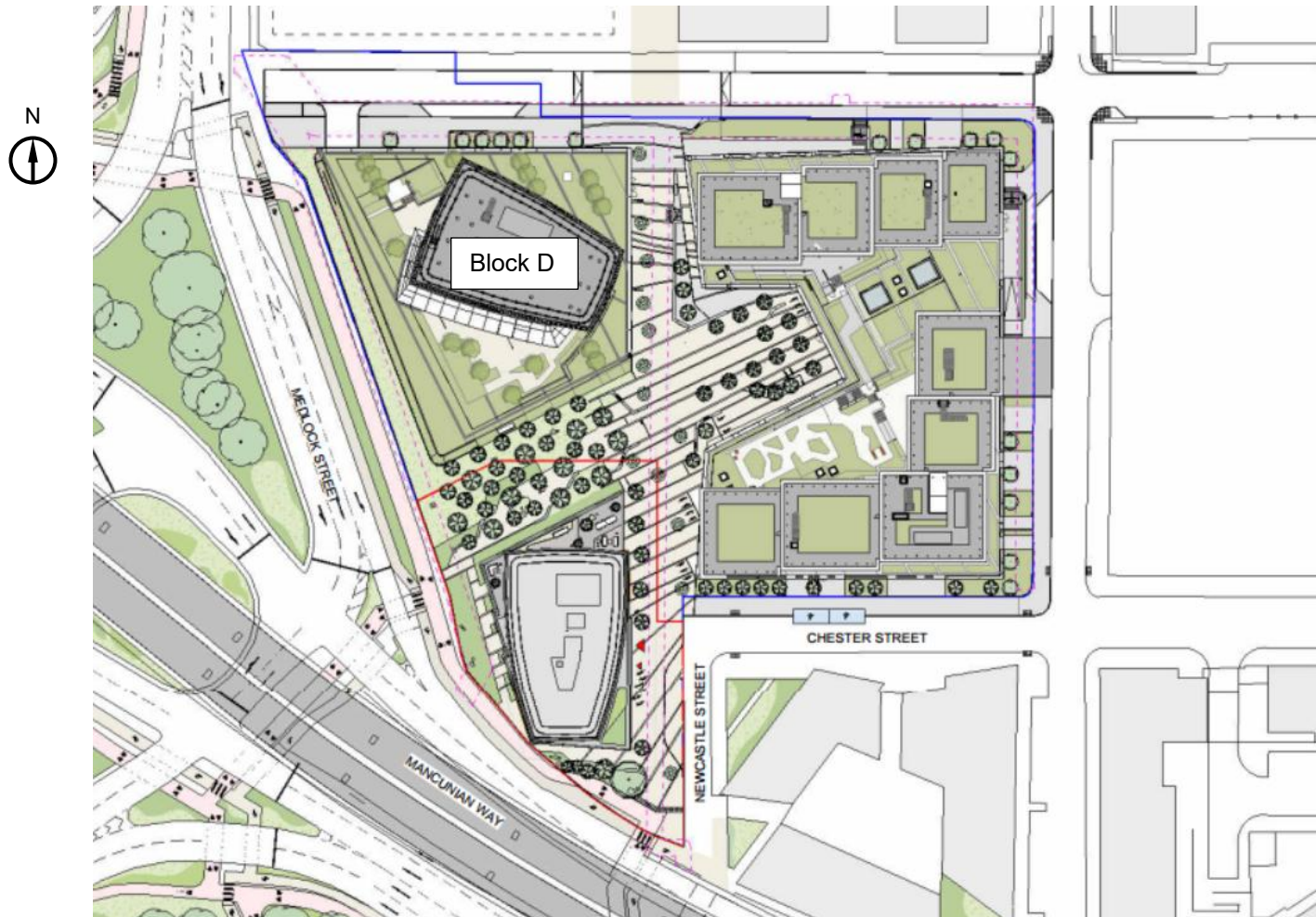


Figure B.2 – Location of Test Rooms on Floor 2 in Block D

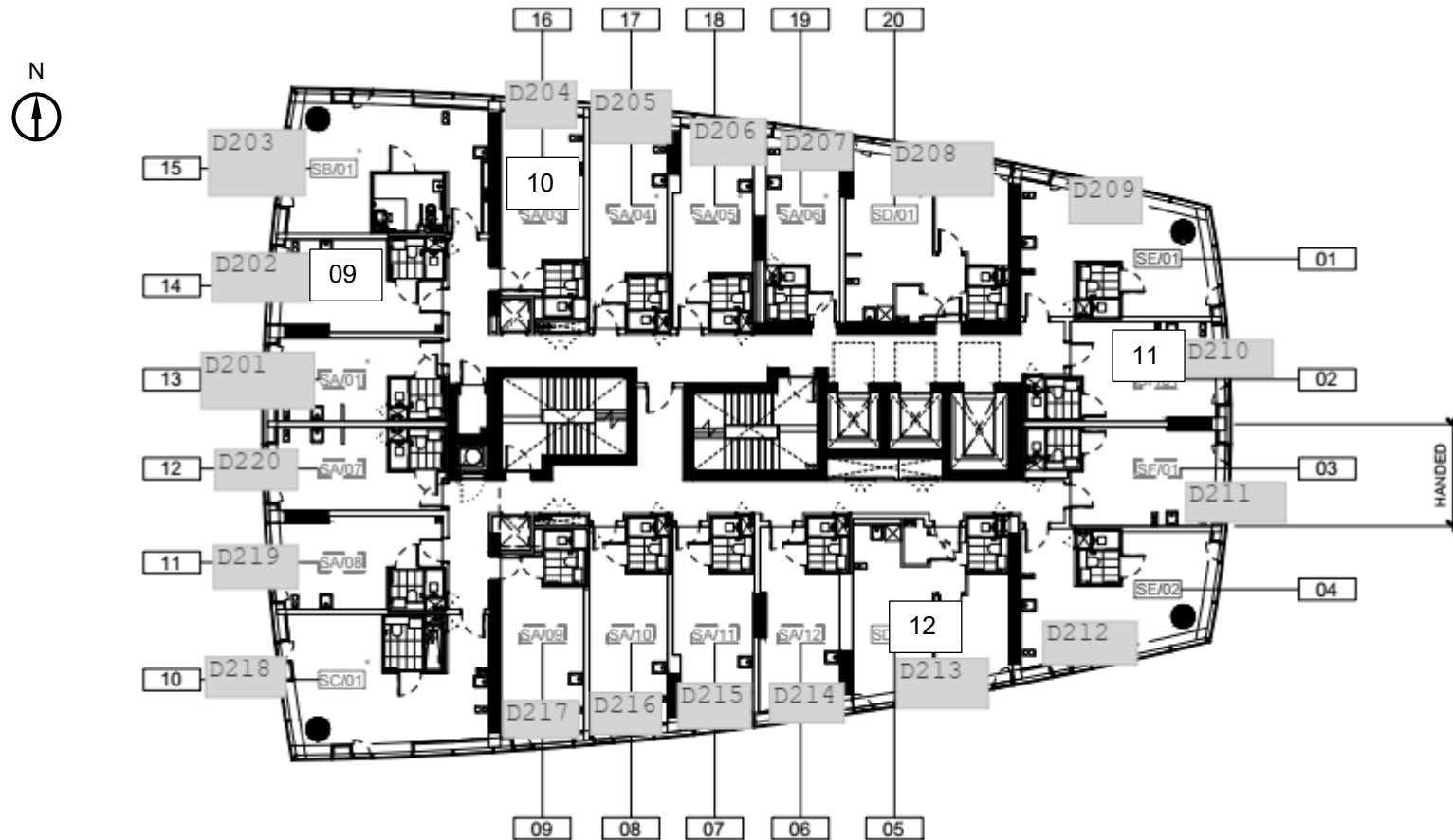


Figure B.3 – Location of Test Rooms on Floor 6 in Block D

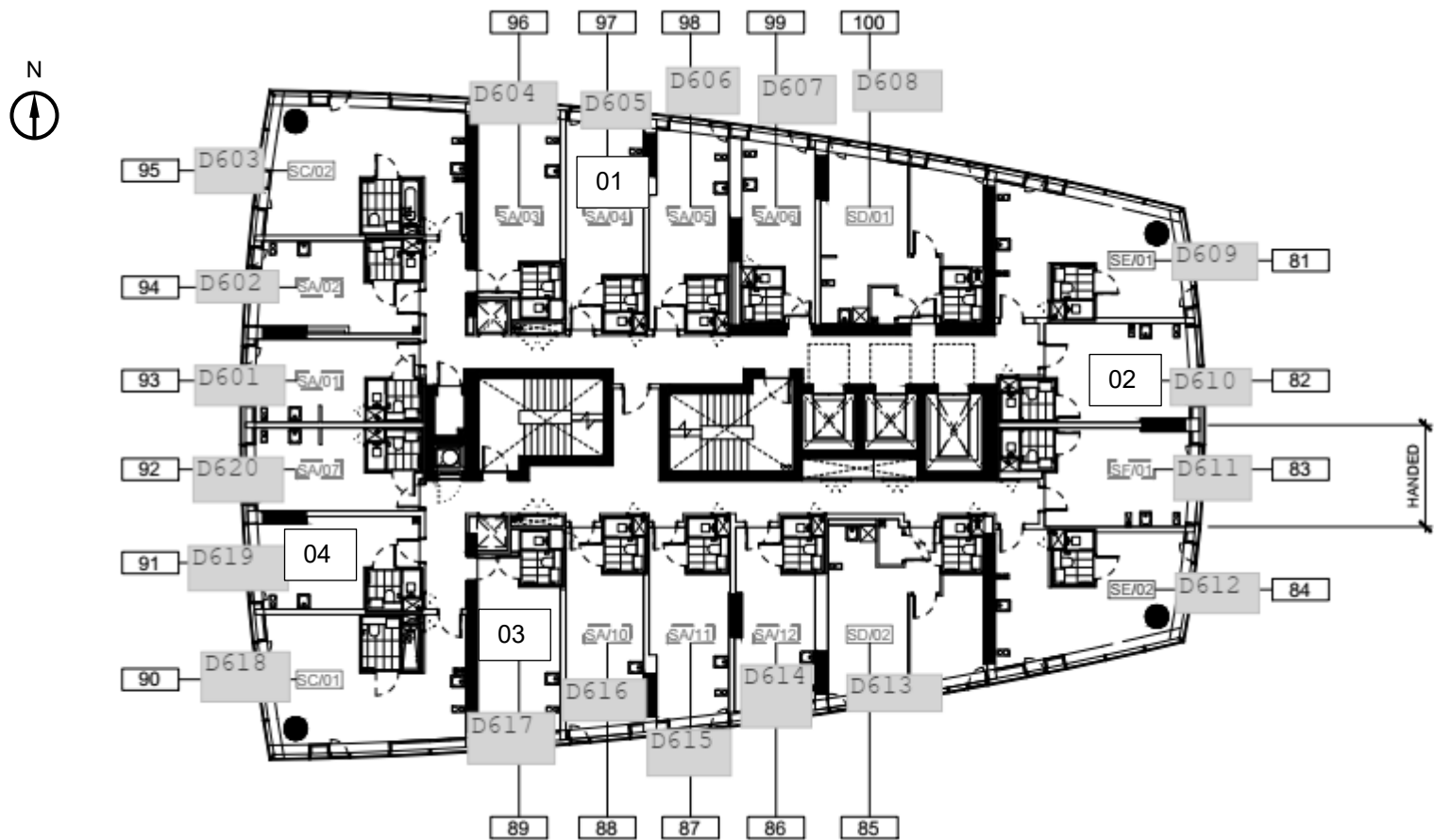


Figure B.4 – Location of Test Rooms on Floor 10 in Block D

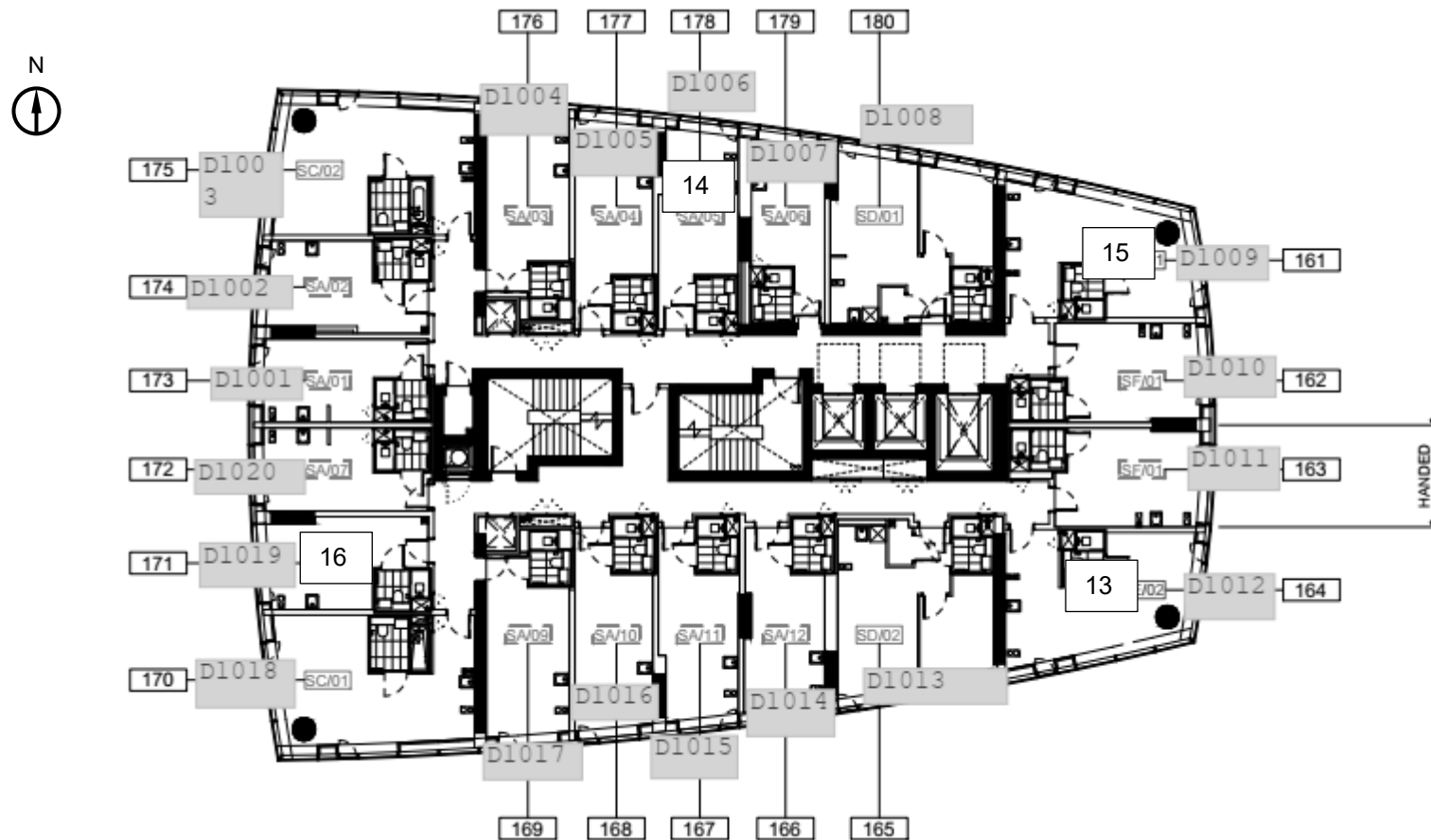


Figure B.5 – Location of Test Rooms on Floor 14 in Block D

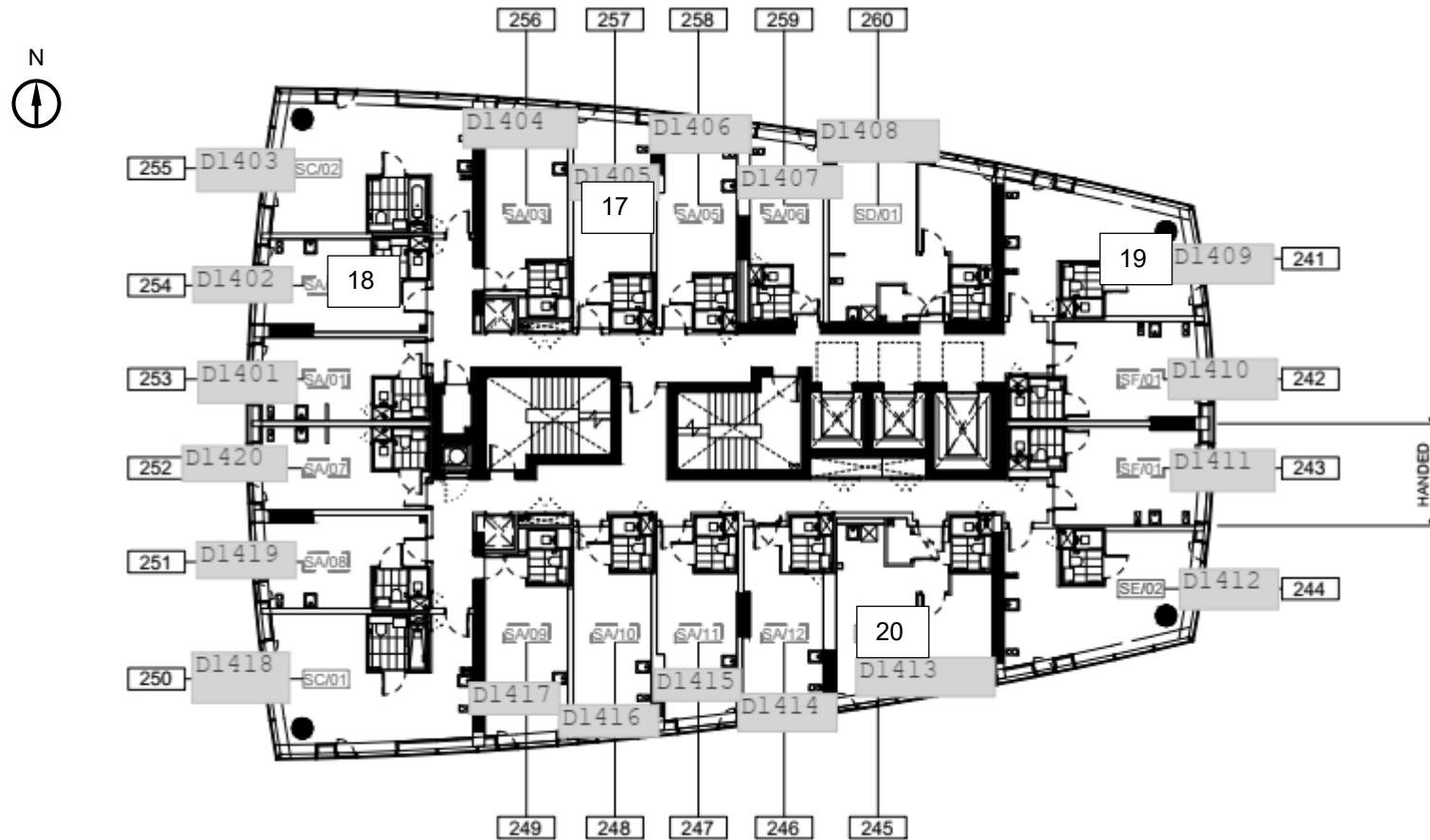


Figure B.6 – Location of Test Rooms on Floor 18 in Block D

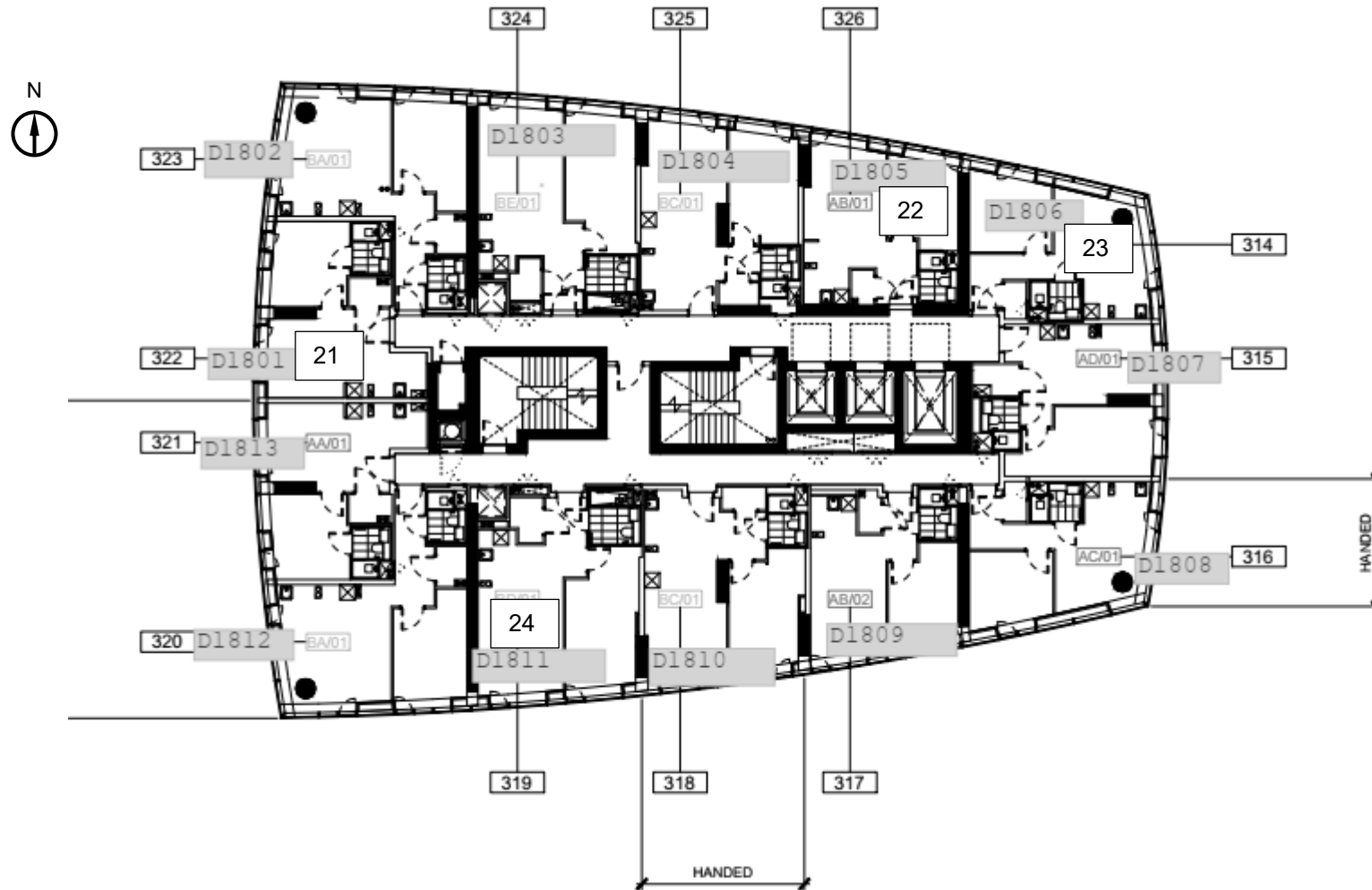


Figure B.7 – Location of Test Rooms on Floor 22 in Block D

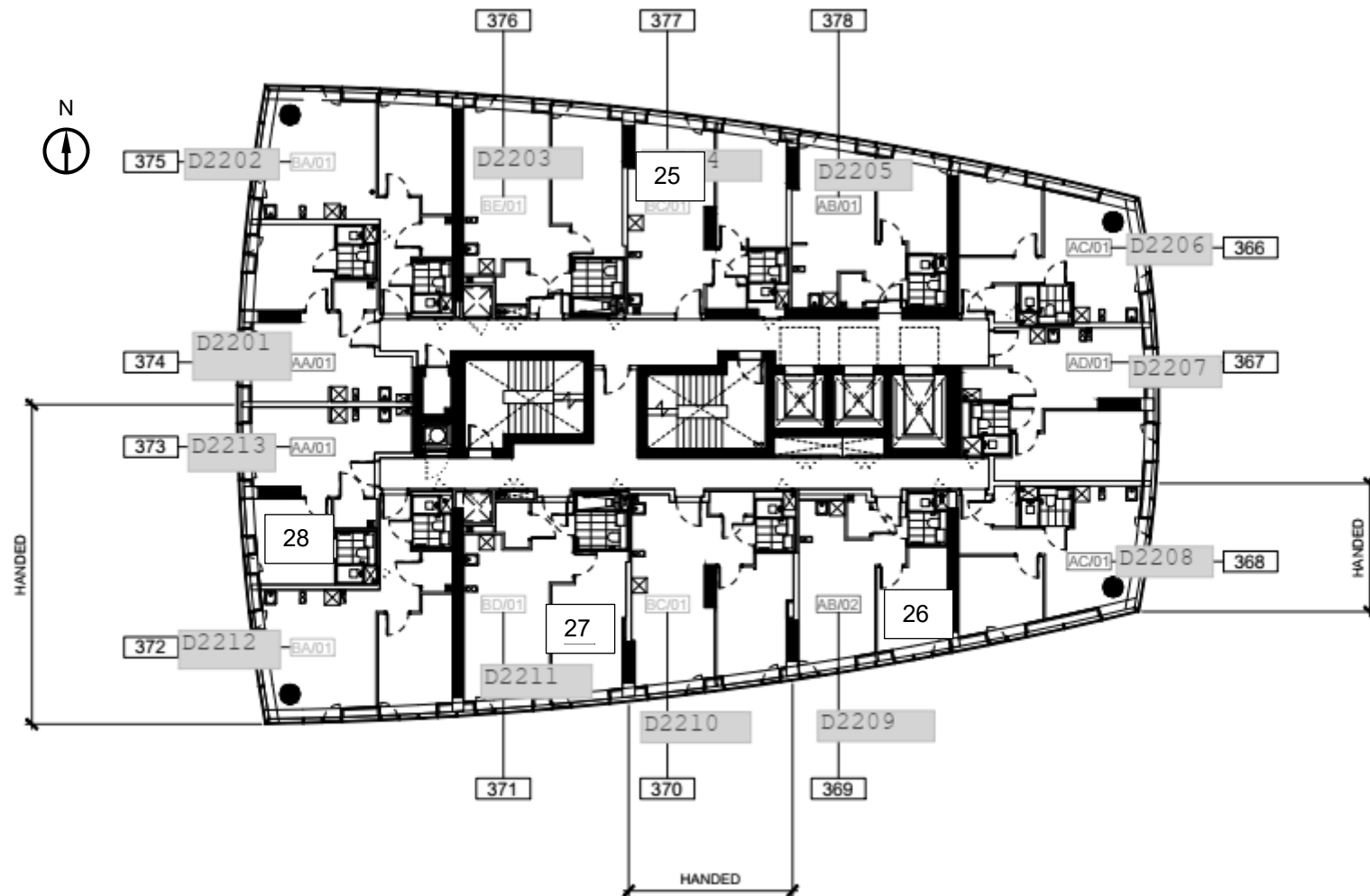


Figure B.8 – Location of Test Rooms on Floor 26 in Block D

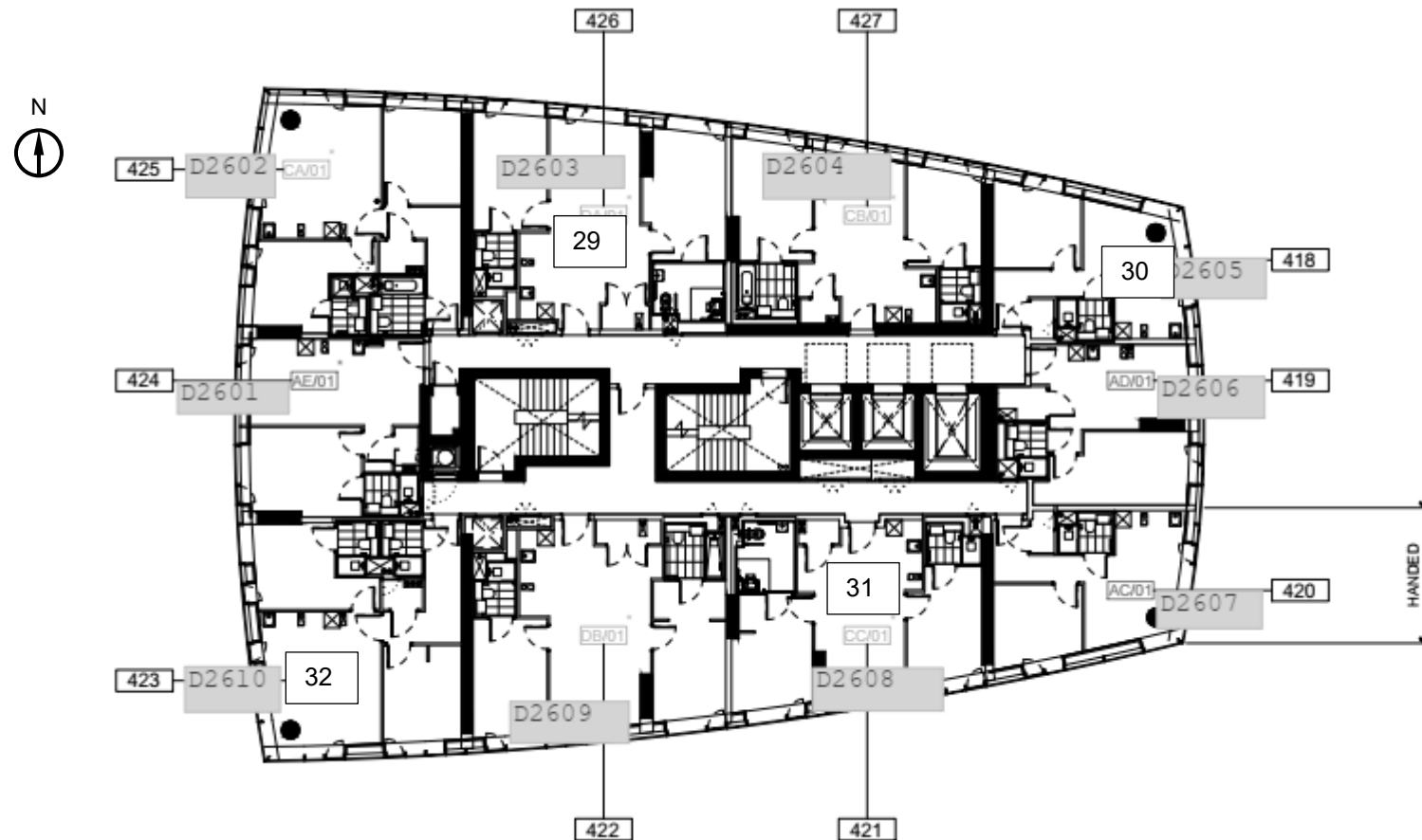


Figure B.9 – Location of Test Rooms on Floor 30 in Block D

