BELFAST CITY AIRPORT

2025 Annual Performance Report

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Executive Summary

Belfast City Airport operates under a Planning Agreement with the Department for Infrastructure dated 22 July 2019 which sets out a series of requirements relating to:

- Aircraft noise, including the numbers and types of aircraft operating at the airport
- The hours within which flights are permitted, and
- The noise exposure resulting from aircraft operations.

This report has been prepared to provide key information demonstrating how the Airport has performed against the requirements of the Planning Agreement.

In 2025, the number of Air Transport Movements (ATMs) was 28,643 with 2,357,940 passengers.

During this period, the Airport maintained full compliance with the requirements of the Planning Agreement.

A summary of the key headlines from 2025 is included below:

- Almost 99% of flights operated within permitted operating hours (06:30-21:30) with the remainder operating within extended hours (21:30-23:59) due to exceptional circumstances
- £99,898 was lodged from fines applied to delayed flights and noise exceedances, to be invested in community projects
- The area of the 57 dB LAeq,16h noise exposure contour area was 3.27 km^2 – well within the contour area limit of 5.2 km^2
- The Quota Count total (a measure relating to the certificated noise levels generated by individual aircraft types) was 1,413 – significantly below the required upper limit of 4,665 and lower than the 1,549 total in 2024
- There was 99.9% adherence by aircraft to departure tracks outperforming the Airport's Environmental Noise Directive Noise Action Plan target of 95%.

Summary of Reporting Requirements

This report has been prepared to meet the following requirement of the Planning Agreement (the Agreement) between Belfast City Airport and the Department for Infrastructure (the Department) dated 22 July 2019:

Covenant 1.1: To submit the Annual Performance Report by 31st March in each calendar year and within the Annual Performance Report to report on the performance and compliance with the covenants in this Agreement in the preceding calendar year in a form which shall include all the annual reporting requirements contained in this Agreement or as agreed with the Department from time to time and which shall be published on the Company's website.

The report addresses each of these reporting requirements either directly within the sections of this report or by reference to further reports (or sections of these) which are provided as appendices.

Table 1 summarises the current reporting requirements within the covenants of the Agreement.

Table 1 – Reporting Requirements

Covenant Reference	Reporting Requirement Summary
2.4.2	Written details of every delayed aircraft outside of permitted hours and circumstances for any aircraft during extended hours
2.4.3	Written report of the payments into and out of the Community Fund
6.7.1.1	Noise exposure contours for year x-1* based on actual ATM (air traffic movements) data
6.7.1.2	Forecast noise contours for years x and x+1 based on predicted ATM data
6.7.1.3	Composite graphic superimposing contours for year, x-1, x and x+1
6.7.2	Comparison of the area within the 57 dB $L_{Aeq,\ 16h}$ contours for the cases described in 6.7.1.1 and 6.7.1.2 with a 5.2 km² area
6.7.3	Total number of ATMs by aircraft type and actual modal split (for year x-1) and assumed modal split (for years x and x+1) for the cases described in 6.7.1.1 and 6.7.1.2
6.7.4	Number of monthly and annual ATMs and a comparison against 48,000 in any period of twelve months
6.7.6	The Quota for year x-1 and a comparison against 4,665
6.7.7	Record of movements by aircraft types not permitted to use the Aerodrome in year x-1 (i.e. to only accept those which meet the requirements of ICAOC Chap 3, Annex 16 and which are not Marginally Compliant Aircraft)
6.7.8	Record of the use by Aircraft of approaches and climb-outs over Belfast Lough in year x-1
6.7.9	Record of ATMs within extended hours and fines administered in year x-1
6.7.10	Log of engine ground runs including time & duration for year x-1
6.7.11	Summary of noise complaints received by the Company, the responses given and the actions taken for year x-1
6.7.12	Review of the degree of adherence to any published noise abatement procedures in operation

6.7.13	Information to verify the accuracy and consistency of the operation of the integrated noise and track keeping system
6.7.14	Evaluation of the data reported including a description of any trends and identification of any relevant features of the Aerodrome operation which may have affected the results
6.7.15	Where the results of the comparison described in 6.7.2 show that the area within the 57 dB $LA_{eq,\ 16h}$ contour of 4.68km² was exceeded in year x-1 or is likely to be exceeded in year x or x+1, submit (and promptly implement) proposed actions to ensure compliance in year x (and report in the subsequent Annual Performance Report)
6.9	In the Annual Performance Report for 2024, provide data showing the percentage of total arrivals in year x-1 that implemented Continuous Descent Approaches and any agreed improvement
6.11	In the Annual Performance Report for 2024, details of the number and type of departing aircraft breaching the departure noise limits (which are to be introduced by 22 July 2020 along with a mechanism to fine breaches of the limits) and a report of payments into and out of the Community Fund in year x-1
6.12.3	Report regarding compliance with the obligation to ensure the availability of fixed electrical ground power (FEGP) (as described in 6.12 and 6.12.1 to 6.12.2.2 in the Agreement) for year x-1 and agreed actions for improvements (if any) in each Annual Performance Report
7	Include a written report on the operation of a noise insulation scheme

Note *In this report 'year x-1', 'year x' and 'year x+1' refer to 2025, 2026 and 2027, respectively

Reports by Requirement

This section provides a report by each requirement within the Agreement.

Details of every delayed aircraft outside of permitted hours and circumstances for any aircraft during extended hours (Reference 2.4.2)

During 2025, 98.9% of flights operated within permitted hours with only a very small proportion utilising extended hours.

Of the 304 flights which operated during extended hours, 278 (91.4%) were arrivals and 26 (8.5%) were departures. There were 12 instances when extension requests were refused by the Airport.

Details of each delayed aircraft are provided at Appendix 1 – 'Extensions Log for 2025'. Details of delayed flights which operated during extended hours, including IATA codes and descriptions, are provided in Appendix 2 – 'Delay Causes'.

Summary of payments into and out of the Community Fund (Reference 2.3.4); Record of ATMs within extended hours and fines administered in year x-1 (Reference 6.7.9)

Belfast City Airport administers a fines mechanism in respect of all delayed aircraft operating during extended hours in accordance with the Agreement, with fines lodged into a Community Fund for investment in local community projects.

In 2025 there were 304 ATMs within extended hours (57.9% before 22:00; 9.5% after 23:00) resulting in a total of £97,226 administered fines.[1] Appendix 3 – 'Extension & Departure Noise Charges for 2025' provides a breakdown of ATMs within extended hours and the associated fines administered.

Table 2 below shows the payments into the Community Fund in 2025 including a summary of the types of projects that received funding (as new projects are identified, further allocations will be made which will meet or exceed the total payments into the Community Fund in 2025).

Table 2 – Community Fund Payments 2025

		£	£
Payments In			
Extensions Jan-Dec			97,226
Extensions over 480			0
Departure Noise Exceedances			2,672
	Subtotal		99,898
Payments Out			
Community & Social Inclusion		11,000	
Sports, Health & Wellbeing		39,118	
Sustainability, Equality & Diversity		15,940	
Education; Employability, Skills & Engagement		12,357	
	Subtotal		78,415
	Balance		21,483

Noise Exposure Contours (Reference 6.7.1.1 to 6.7.1.3)

Under the Planning Agreement, Belfast City Airport is required to produce Noise Contours annually showing the noise exposure on an average summer day (between 16th June and 15th September inclusive) in terms of the LAeq,16h noise indicator at a range of values including 57, 60 and 63 dB. Table 3 shows the area of the 2025, 2026 forecast and 2027 forecast noise contours at values from 54 to 69 dB LAeq,16h in 3 dB steps.

[1] The total number of late flights of 304 excludes an air ambulance flight in August 2025.

Table 3 – 2025, 2026 and 2027 Noise Contour Areas

Contour Level (dB LAeq,16h)	Area of Daytime Air Noise Contours (km2)			Contour Area Limit (km) ^{2}
	2025	2026	2027	
54	6.18	7.07	7.25	
57	3.27	3.75	3.85	5.20
60	1.68	1.93	1.98	
63	0.93	1.07	1.09	
66	0.54	0.62	0.63	
69	0.33	0.38	0.39	

Under the Agreement, the area enclosed by the 57 dB LAeq,16h contour shall not exceed 5.2 km². The area of the 2025 57 dB LAeq, 16hr contour area was 3.27 km² which is 37% smaller than the contour area limit of 5.2 km^2. The contour areas remain smaller than in 2019 prior to the global pandemic, when the 57 dB LAeq, 16h contour area was 3.3 km^2.

Looking ahead, the 57dB LAeq,16h noise contour is forecast to remain below the contour area limit in both 2026 and 2027.

The Noise Contours are discussed in Section 4 and shown in Tables 4 to 8 of the Bickerdike Allen Partners Report 2025, which is provided at Appendix 4.

Comparison of the area within the 57 dB LAeq, 16h contours for the cases described in 6.7.1.1 and 6.7.1.2 with a 5.2km ² area (Reference 6.7.2)

Table 4 shows a comparison of the area within the 57 dB LAeq,16h contour with a 5.2 km^2 area for 2025 with forecasts for 2026 and 2027. Further details are provided in Section 4 of Bickerdike Allen Partners Report 2025 at Appendix 4.

Table 4 – Area of the 57 dB LAeq,16h contour compared with a 5.2 km2 area

Contour Level (dB LAeq,16h)	Area of Daytime Air Noise Contours (km2)			Contour Area Limit $(km)^2$
	2025	2026 (forecast)	2027 (forecast)	
57	3.27	3.75	3.85	5.20

Total number of ATMs by aircraft type and actual modal split (for year x-1) and assumed modal split (for years x and x+1) for the cases described in 6.7.1.1 and 6.7.1.2 (Reference 6.7.3)

Total number of ATMs by aircraft type for the cases described in 6.7.1.1 and 6.7.1.2 is provided below in Table 5.

Table 5 – Total number of ATMs by aircraft type

Aircraft Type	INM Type(s)	Summer Fixed Wing Movements		
		2025 Actual	2026 Forecast	2027 Forecast
Airbus A319ceo	A319-131(1)	962	970	1001
Airbus A320ceo	A320-211(1)	1,014	1,071	1093
Airbus A320neo	A320-211(1)	390	470	477
ATR 42	DO328	102	111	111
ATR 72	DO328/DHC6(1)	3,650	4,389	4,389
Beechcraft Super King Air 200	CNA441	14	n/a	n/a
Bombardier Challenger 350	CL601	20	n/a	n/a
Cessna Citation Jet CJ3	CNA525C	10	n/a	n/a
Cessna Citation Excel CNA560XL	CNA560XL	70	n/a	n/a
Cessna Citation Latitude	CNA680	16	n/a	n/a
Diamond DA-62	BEC58P	16	n/a	n/a
Embraer E145	EMB145	176	153	153
Embraer E175	EMB175/737500(1)	251	n/a	n/a
Embraer E190	EMB190(1)	463	879	934
Embraer Legacy 500	CNA55B	24	n/a	n/a

Embraer Phenom 300	CNA510	16	n/a	n/a
Gulfstream G650	GV	10	n/a	n/a
Pilatus PC-12	CNA208	16	n/a	n/a
Other (less than 10 movements)	Various	94	231	290
Total (2)		**7,314**	**8,274**	**8,448**

(1) INM type modified based on results of a validation exercise.
(2) Forecast totals may not match due to rounding.

The term 'modal split' refers to the split of movements by runway – at Belfast City Airport this is between Runway 04 (c 040º bearing) and Runway 22 (c 220º bearing). This is generally determined by wind direction as aircraft will take off and land into a headwind to maximise lift - so variation is likely each year.

Table 6 shows the actual modal split for 2025 and the long-term average summer modal split for 2021-2025. The actual modal split and the long-term average modal split were used in determining the 2025 contour and the forecast contours respectively, as discussed in Section 3.2 of Bickerdike Allen Partners Report 2025 at Appendix 4.

Table 6 – 2025 and Long-Term Average Summer Modal Split

Runway	% of Summer Movements			
	2025		2021-2025 Average	
	Arrivals	Departures	Arrivals	Departures
04	26%	28%	36%	39%
22	74%	72%	64%	61%

Number of monthly and annual ATMs and a comparison against the current 48,000 limit in any period of twelve months (Reference 6.7.4)

Table 7 shows the monthly ATMs in 2024 and 2025 along with the rolling 12-month total from January 2025 onwards – which remained lower than the upper limit of 48,000 ATMs.

Table 7 – Rolling 12 Month ATM

ATM 2024		ATM 2025		Rolling 12 month ATM
Jan-24	2,116	Jan-25	2,284	30,536
Feb-24	2,245	Feb-25	2,161	30,452
Mar-24	2,619	Mar-25	2,450	30,283
Apr-24	2,519	Apr-25	2,400	30,164
May-24	2,736	May-25	2,538	29,966
Jun-24	2,663	Jun-25	2,447	29,750
Jul-24	2,747	Jul-25	2,592	29,595
Aug-24	2,774	Aug-25	2,421	29,242
Sep-24	2,624	Sep-25	2,220	28,838
Oct-24	2,602	Oct-25	2,262	28,498
Nov-24	2,356	Nov-25	2,391	28,533
Dec-24	2,367	Dec-25	2,477	28,643

The Quota for year x-1 and a comparison against the 4,665 limit (Reference 6.7.6)

The Quota Count total for the Quota Period 2025 was 1,413, which is lower than the upper limit of 4,665. Details of how the Quota Count has been calculated are provided in Table 9: Summer 2025 Quota Count in Section 5 of Bickerdike Allen Partners Report 2025 at Appendix 4.

Record of movements by aircraft types not permitted to use the Aerodrome in year x-1 (Reference 6.7.7)

In 2025 there were no movements of aircraft that did not meet the requirements of ICAO Chapter 3, Annex 16 or are only marginally compliant. Details are provided in Section 6 of Bickerdike Allen Partners Report 2025 at Appendix 4.

Record of the use by Aircraft of approaches and climb-outs over Belfast Lough in year x-1 (Reference 6.7.8)

The Agreement requires Belfast City Airport to maintain a bias in favour of approaches and climb-outs by aircraft over Belfast Lough (the 'Lough Bias'). Whilst direction of approach/climb-out is generally determined by wind direction, Air Traffic Control aims to maximise additional opportunities to direct aircraft over Belfast Lough (for example during light wind conditions, where safe to do so) i.e. departure using runway 04 and arrival using runway 22.

Table 8 shows the number of arrivals and departures over both the City and Belfast Lough throughout 2025. There were 14,707 movements over the Lough from a total of 28,643 movements. On average over the year, 51% of movements were over the Lough, so a bias in favour of arrivals and departures over Belfast Lough was maintained, in compliance with the Agreement.

Table 8 – Arrivals and Departures over the City and Belfast Lough (2025)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Arrivals over City (04*)	187	335	521	463	791	138	548	327	153	250	358	323	**4,394**
Departures over City (22)	914	733	671	684	448	1088	710	830	953	818	813	880	**9,542**
Total over City	1,101	1,068	1,192	1,147	1,239	1,226	1,258	1,157	1,106	1,068	1,171	1,203	**13,936**
Arrivals over Lough (22)	954	747	702	737	478	1086	749	883	957	881	837	915	**9,926**
Departures over Lough (04)	229	346	556	516	821	135	585	381	157	313	383	359	**4,781**
Total over Lough	1,183	1,093	1,258	1,253	1,299	1,221	1,334	1,264	1,114	1,194	1,220	1,274	**14,707**
Total ATMs	2,284	2,161	2,450	2,400	2,538	2,447	2,592	2,421	2,220	2,262	2,391	2,477	**28,643**
Percentage over Lough	52%	51%	51%	52%	51%	50%	51%	52%	50%	53%	51%	51%	**2025 average 51%**

*Runway in use

Log of engine ground runs including time & duration for year x-1 (Reference 6.7.10)

Belfast City Airport operates restrictions on engine ground runs. These are prohibited between 22:30 and 06:00 and require prior approval by Airfield Operations, with further restrictions in place according to location and the power level of runs. All engine ground runs in 2025 complied with these requirements. Details of engine ground run requirements are provided in Appendix 5 – 'AOI-07 Aircraft Engine Ground Running and Use of Auxiliary Power Units and Ground Power Units'. A log of engine ground runs is provided at Appendix 6 – 'Engine Run Log 2025'.

Summary of noise complaints received by the Company, the responses given and the actions taken for year x-1 (Reference 6.7.11)

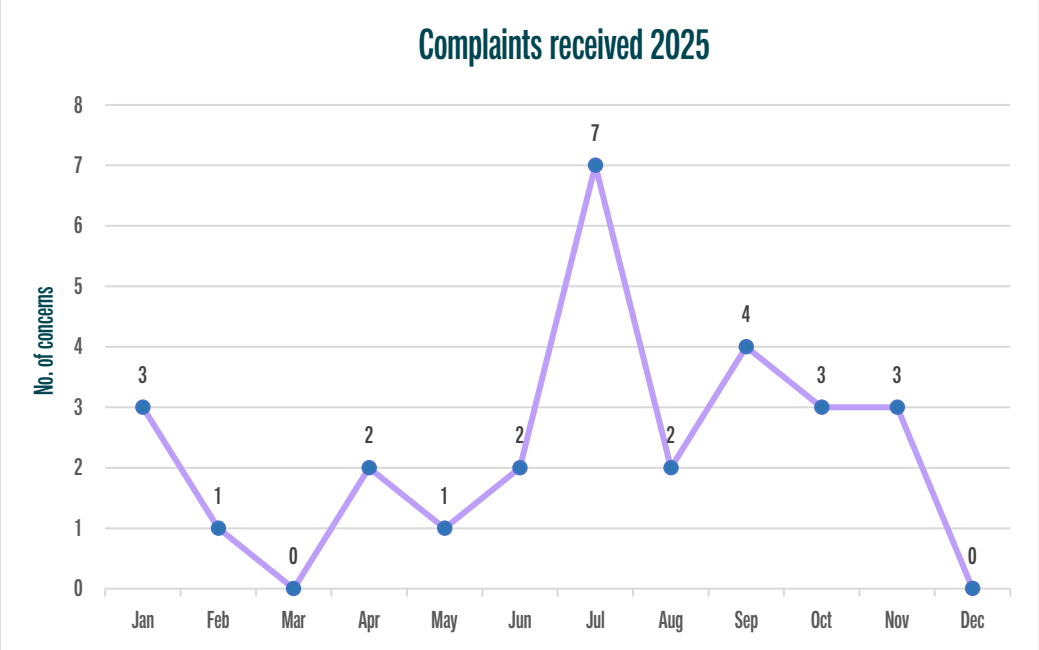
A summary of noise concerns logged in 2025 is provided at Appendix 7 – 'Noise Concerns Summary 2025'. All noise concerns received are responded to by letter, email or telephone, as far as possible within 15 working days. This target was achieved for all noise concerns received in 2025.

Our responses vary depending on the nature of the concerns raised. In the case of general queries, information on the procedures and standards applied at the airport will be provided. In the case of concerns relating to specific noise events, the results of investigation will be provided. In the case of concerns relating to movements during extended hours, our responses typically include reference to the relevant requirements of our Planning Agreement and the guidance issued by the Department relating to extensions.

In 2025, there were a total of 28 complaints made (less than one complaint per 1,000 flights).

- Fifty-seven percent of concerns were received from May to September, and thirty-six percent of the total concerns were associated with track keeping.
- Twenty-five percent of the total concerns throughout the year were associated with flights within extended hours.
- The complaints were made by 21 individuals (with four individuals lodging over half of all complaints).

All track keeping concerns are investigated by the Environment Team and action is taken where necessary including dialogue with airlines to ensure effective implementation of the noise abatement procedures in place at the aerodrome. The chart below shows the monthly distribution of concerns in 2025.



Review of the degree of adherence to any published noise abatement procedures in operation (Reference 6.7.12)

Belfast City Airport's noise abatement procedures are published at https://www.aurora.nats.co.uk/htmlAIP/Publications/2020-01-30-AIRAC/html/eAIP/EG-AD-2.EGAC-en-GB.html#AD-2.EGAC. These determine specific tracks to be flown by aircraft on departure/arrival to minimise the impact of noise on local populations.

There was 99.9% adherence by aircraft to departure tracks outperforming the Airport's Environmental Noise Directive Noise Action Plan target of 95%.

Whilst the incidence of track deviation is very low, in certain situations adherence may prove challenging, for example in poor weather conditions.

The Airport reports track deviations to Airlines each month and maintains dialogue with Airline representatives, to minimise the number of occurrences, investigating the reasons for these and providing guidance on the noise abatement procedures including materials for use by flight crew.

Table 9 summarises the limited number of track deviations in 2025.

Table 9 – Track Deviations in 2025

Runway	A / D	Number Flights	Number Track Deviations	Percentage
04	D	4782	27	0.56%
04	A	4394	0	0.00%
22	D	9541	5	0.05%
22	A	9926	0	0.00%
Total		28643	32	0.11%

Runway	A / D	Number Flights	Number Deviations	Percentage
04	D	4782	27	0.56%
04	A	4394	0	0.00%
22	D	9541	5	0.05%
22	A	9926	0	0.00%
TOTAL		28643	32	0.11%

Information to verify the accuracy and consistency of the operation of the integrated noise and track keeping system (Reference 6.7.13)

The Airport operates a Noise & Flight Track Monitoring System (NTMS) which provides ongoing data on aircraft movements including noise levels and tracks flown. A maintenance and support contract is in place with Topsonic Systemhaus GmbH. This includes a daily preventative maintenance programme incorporating remote system checks on data transmission, completeness, process and storage. Third-party calibration of microphones and monitoring equipment is conducted on a two-yearly basis. A record of equipment calibration status is provided at Appendix 8 – 'Calibration Records 2025'.

Throughout 2025, radar was provided by Belfast International Airport's Crow Hill facility. During which time BCA's local radar underwent upgrade and replacement works.

In May 2025 the NTMS was upgraded, including permanent replacement of the radar feed with ADS-B to avoid any future loss of data during periods of radar maintenance.

Evaluation of the data reported including a description of any trends and identification of any relevant features of the Aerodrome operation which may have affected the results (Reference 6.7.14)

The Airport has fully complied with the requirements of the Agreement during 2025.

It has continued to provide bi-monthly performance reports to the Department since the Agreement came into effect in July 2019, including details of delayed aircraft using the aerodrome in extended hours and the circumstances for use. The following summarises key data and trends:

- In 2025, movements totalled 28,643 compared with 30,368 in 2024
- In 2025, delayed flights after 21:30 constituted 1.1% of all movements i.e. 304 out of 28,643 (compared to 1.2% in 2024 i.e. 354 out of 30,368)
- In 2025, 53% of delays after 21:30 were due to the late arrival of aircraft from another flight or previous sector
- The size of the 57 dB LAeq, 16h noise contour area in 2025 was 3.27 km^2 which is well within the contour area limit of 5.2 km^2.
- The Quota Count total for summer 2025 was 1,413 – a decrease from 1,549 in 2024 and remains lower than the 2019 total of 2,216.
- On average, 84% of arrivals in 2025 implemented Continuous Descent Approach (CDA) compared with 79% in 2024.

Where the results of the comparison described in 6.7.2 show that the area within the 57 dB LAeq, 16h contour of 4.68km² was exceeded in year x-1 or is likely to be exceeded in year x or x+1, submit (and promptly implement) proposed actions to ensure compliance in year x (and report in the subsequent Annual Performance Report) (Reference 6.7.15)

The area within the 57 dB LAeq, 16h contour of 4.68 km^2 was not exceeded in 2025 and is not forecasted to be exceeded in years 2026 or 2027. The areas of the 57 dB LAeq, 16h 2025 contour and forecasted 2026 and 2027 contours are shown in Table 4 (above).

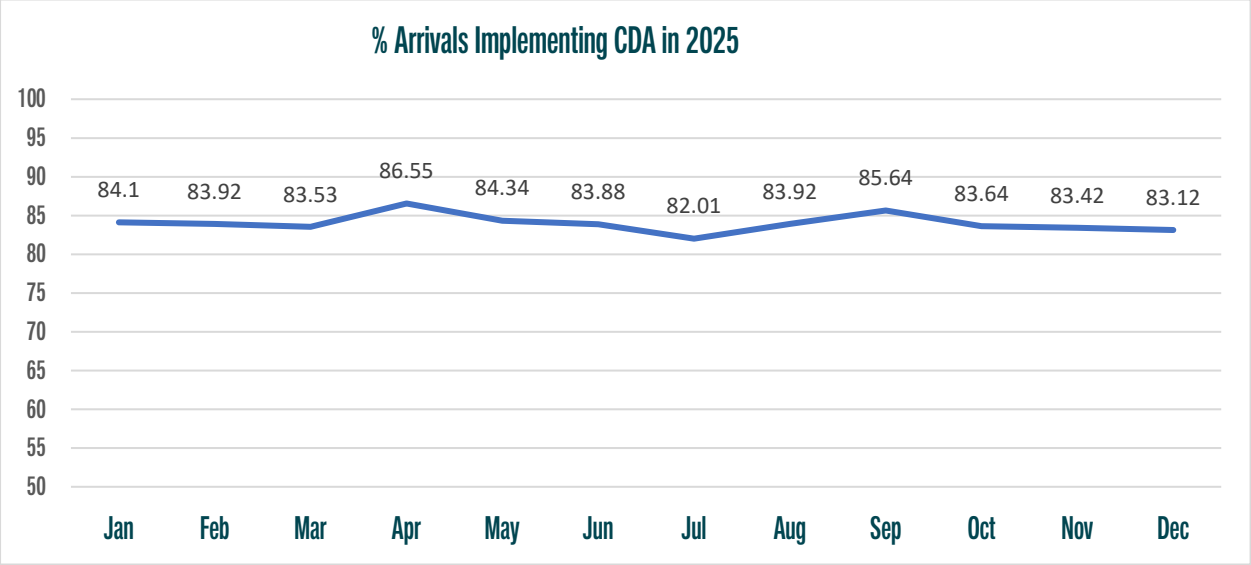
In the Annual Performance Report for 2025, provide data showing the percentage of total arrivals in year x-1

that implemented Continuous Descent Approaches and any agreed improvement (Reference 6.9)

CDA is an operating technique in which arriving aircraft follow a constant-angle descent (rather than a series of steps) to reduce noise and fuel consumption.

The chart below shows the percentage of arrivals implementing CDA by month. On average, 84% of arrivals in 2025 implemented CDA (up from 79% in 2024). Variation in CDA performance is due to a range of factors including weather, air traffic conditions and crew experience.

Subject to safety constraints and the operational requirements of individual aircraft, the Airport will continue to maximise implementation of CDA.



Data provided by NATS (Air Traffic Control provider at Belfast City Airport)

In the Annual Performance Report for 2025, details of the number and type of departing aircraft breaching the departure noise limits and a report of payments into and out of the Community Fund in year x-1 (Reference 6.11)

Departure noise limits are set to encourage improved performance by airlines in how aircraft are flown to minimise noise impact. The following departure noise limits are in place at Belfast City Airport:

83dB LAsmax for aircraft departing towards the city and 87dB LAsmax for aircraft departing towards Belfast Lough (as measured by the Airport's noise monitoring terminals).

Any breaches of these noise limits are identified through the Airport's Noise and Track Monitoring System. During 2025, there were four breaches of the departure noise limit. In September, there was one exceedance of 1.1dB by an A319 on departure from runway 22. In October, there were three exceedances from departures on runway 22. Two were by E190 aircraft with one causing a 0.1dB exceedance and one a 0.2dB exceedance. The other exceedance was a 0.4dB exceedance by an A320 aircraft.

In accordance with Paragraph 6.10 of the Planning Agreement, the Departure Noise Limits were reviewed on the fifth anniversary of the Agreement. The Airport's review concluded that the existing limits remained appropriate and should not be changed. The Department, however, proposed a 1 dB reduction in the Departure Noise Limits at both monitoring terminals. As any amendment would require a formal modification to the Planning Agreement, the Airport intends to reconsider the Departure Noise Limits as part of any future application to modify the Agreement in order to facilitate delivery of its Master Plan 2040 objectives.

Compliance with the obligation to ensure the availability of fixed electrical ground power (FEGP) (as described in 6.12 and 6.12.1 to 6.12.2.2 in the Agreement) for year x-1 and agreed actions for improvements (if any) in each Annual Performance Report (Reference 6.12.3)

All stands at the airport are equipped with FEGP. In 2025, 99% of flights overall used FEGP. Occasions when FEGP was not used were due to the following: aircraft parked in non-standard positions due to weather (whilst operational and available for use at the stand, FEGP equipment in these cases could not reach due to aircraft orientation) and maintenance.

On 3rd October 2025, the FEGP equipment at stand 10 was damaged by an aircraft during a storm while connected to the FEGP. This was repaired on the 11th of December 2025.

FEGP at the airport is subject to an ongoing maintenance regime aimed at achieving maximum serviceability.

Summary of requirement for a noise insulation scheme

At present, no residential dwellings are affected by the level of noise at which a noise insulation scheme must be implemented (ie as defined by the 63 dB LAeq, 16h contour). For this reason, the scheme has not yet been triggered.

Appendix 9 provides a glossary of key terms and further explanation of key points used in this report.

Appendices

Appendix 1 – Extensions Log for 2025

Appendix 2 – Delay Causes

Appendix 3 – Extension & Departure Noise Charges for 2025

Appendix 4 – Bickerdike Allen Partners Report 2025

Appendix 5 – AOI-07 Aircraft Ground Running and Use of Auxiliary Power Units and Ground Power Units

Appendix 6 – Engine Run Log 2025

Appendix 7 – Noise Concerns Summary 2025

Appendix 8 – Calibration Records 2025

Appendix 9 - Explanatory Notes

Appendix 1

Extensions Log for 2025

Date	Airline Code	Sch. Time	Actual Time	Delay Time (mins)	Arr / Dep	Registration	Flight	Airport	Runway	Delay code 1	Description 1	Delay code 2	Description 2
5-Jan-25	EZY	16:30	21:31	301	A	GUJEA	231	BRS		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	96	WX issues in BRS resulting in crew shortage and a/c swap in BRS
5-Jan-25	EZY	17:00	22:13	313	D	GUJEA	232	BRS		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
5-Jan-25	EI	19:55	22:32	157	A	GCMMN	3637	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	46	A/C swap due tech issues
5-Jan-25	EZY	20:35	21:42	67	A	GEZBJ	805	LGW		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	41	Tech issue in LGW
5-Jan-25	EI	20:50	22:05	75	A	GCMMT	3619	MAN		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	46	A/C swap due tech issues
5-Jan-25	EI	21:00	22:58	118	A	GCMJL	3607	SOU		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	19	Delay on previous sector in BHX due late PRM services
6-Jan-25	EI	20:55	23:20	145	A	GCMJM	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	77	WX in LBA
6-Jan-25	KL	21:00	21:54	54	A	PHEZZ	951	AMS		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	46	A/C swap due tech issues
6-Jan-25	BA	17:40	21:38	238	D	GTTNO	1429	LHR		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	77	WX in BHD
7-Jan-25	EI	20:55	21:42	47	A	GCMJL	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	77	wx delays at out stations MAN & LBA closed for a while
7-Jan-25	EI	20:50	21:38	48	A	GCMJN	3619	MAN		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	77	wx delays at out stations MAN & LBA closed for a while
7-Jan-25	EI	20:45	21:33	49	A	GCMJJ	3607	SOU		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to an earlier tech issue at BHD
9-Jan-25	EI	20:55	23:14	139	A	GCMJL	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		wx delays in the UK throughout the day
9-Jan-25	EI	17:20			A	GCMMT	3615	MAN		93	REFUSED AS OVER CURFEW OF 2359. Operated into BFS	71	knock-on effect of snow closure in MAN plus long waiting times for a/c de-icing in MAN
10-Jan-25	EZY	19:35	22:51	196	A	GEZTX	713	MAN		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		more snow disruption in MAN and reduced flow rates
10-Jan-25	EZY	20:05	23:39	214	D	GEZTX	714	MAN		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		more snow disruption in MAN and reduced flow rates
10-Jan-25	EI	20:55	23:07	132	A	GCMJL	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		operational and wx delays in UK
12-Jan-25	EI	21:10	21:52	42	A	GCMJM	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		Aircraft was tech for Slot 1 earlier today
12-Jan-25	EI	20:55	21:56	61	A	EIGZV	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		Late POSN ex DUB earlier today
19-Jan-25	KL	21:00	21:39	39	A	PHEXP	951	AMS		94	Cabin crew rotation		
21-Jan-25	KL	21:00	22:32	92	A	PHEXN	951	AMS		94	Cabin crew rotation		
28-Jan-25	BA	19:25	21:37	132	D	GEUUI	1421	LHR		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	46	A/C swap due tech issues
9-Feb-25	EI	21:10	21:49	39	A	GCMMN	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	89	ATC/Ground control
12-Feb-25	EI	21:10	23:09	119	A	GCMNN	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	46	A/C swap due tech issues
14-Feb-25	EI	20:55	21:38	43	A	GCMJL	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		Earlier tech issues
16-Feb-25	EI	21:10	22:06	56	A	GCMMN	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		Earlier medical emergency on BHD-BHX sector
17-Feb-25	EI	20:55	22:48	113	A	GCMMN	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		a/c tech earlier
17-Feb-25	EI	21:00	22:44	104	A	GCMJN	3607	SOU		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		a/c tech earlier
17-Feb-25	EI	21:10	22:39	89	A	GCMJJ	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		a/c tech earlier
17-Feb-25	EI	17:20	21:40	260	A	GCMMT	3615	MAN		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		Earlier tech issues
19-Feb-25	EI	20:55	22:45	110	A	GCMMN	3679	LBA		72	Wx at BHD		Captain decided to divert to BFS due cross winds, then returned to us when winds dropped
22-Feb-25	EI	21:10	21:47	37	A	GCMMT	3625	CWL		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	15	Boarding and booking discrepencies due to passengers booked on previously cancelled flights on the 21st
23-Feb-25	EI	20:50	21:39	49	A	GCMMN	3619	MAN		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	77	adv wx in MAN delayed boarding
23-Feb-25	EI	20:55	21:48	53	A	GCMJN	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	77	adv wx in LBA delayed boarding/disembarking
23-Feb-25	EI	21:10	23:21	131	A	GCMJL	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	41	bird strike on a previous sector in day
26-Feb-25	EI	21:10	22:15	65	A	GCMMT	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
28-Feb-25	EI	21:10	21:42	32	A	GCMJN	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	19	reduced mobility. a/c also had a laser strike on approach to EDI
1-Mar-25	BA	19:15	22:44	209	A	GEUUO	1420	LHR		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	92	flt crew rotation, caused by earlier wx delays in LHR
7-Mar-25	EI	20:55	21:56	61	A	GCMJM	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		Earlier tech issues
11-Mar-25	EI	21:10	22:19	69	A	GCMJN	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
17-Mar-25	EI	20:55	22:07	72	A	GCMJN	3649	BHX		19	CONNECTING PRM's from EK Flight did not have correct boarding cards issued		
21-Mar-25	KL	21:00	21:32	32	A	PHEXK	951	AMS		95	CREW ROTATION, awaiting crew from another flight (flight deck or entire crew)	41	tech issue in AMS
27-Mar-25	KL	21:00	21:32	32	A	PHEXS	951	AMS		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	41	tech issue in AMS
27-Mar-25	EI	21:10	21:42	32	A	GCMJM	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
30-Mar-25	KL	21:15	21:32	17	A	PHEXS	951	AMS		41	Aircraft tech issue in AMS		
30-Mar-25	EI	21:10	22:19	69	A	GCMJN	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
31-Mar-25	KL	21:15	21:51	36	A	PHEZM	951	AMS		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	46	A/C swap due tech issues
31-Mar-25	EI	20:55	21:55	60	A	GCMMN	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	19	took a delay on the EDI sector awaiting PRM pax
3-Apr-25	BA	20:10	21:52	102	A	GLCAB	8758	LCY		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	41	tech issue with a/c
3-Apr-25	EI	20:55	22:59	124	A	GCMJL	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	46/19	a/c change due tech issues / delay at our station due late prm
3-Apr-25	EI	21:10	21:44	34	A	GCMJM	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	46	a/c swap due multiple tech issues
4-Apr-25	EI	20:55	23:36	161	A	GCMJM	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	63	crew shortage // crew called from standby
4-Apr-25	EI	20:55	23:28	153	A	GCMJN	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	46	a/c swap due multiple tech issues
4-Apr-25	EI	21:10	21:57	47	A	GCMMN	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
7-Apr-25	KL	21:15	21:31	16	A	PHEXK	951	AMS		58	computer issue at AMS		
11-Apr-25	EI	18:50	21:41	171	D	GCMJJ	3658	EDI		46	Aircraft swap		
11-Apr-25	EI	20:50	21:49	59	A	GCMMT	3619	MAN		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
11-Apr-25	EI	21:10	23:41	151	A	GCMJJ	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
15-Apr-25	EI	20:50	22:30	100	A	GCMJM	3619	MAN		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due earlier flight deck shortage
15-Apr-25	EI	21:10	23:20	130	A	GCMMN	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due earlier tech issues at BHD
17-Apr-25	EI	20:50	21:57	67	A	GCMJL	3619	MAN		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due earlier tech issues at BHD
17-Apr-25	EI	21:10	23:35	145	A	GCMJN	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due earlier tech issues at BHD
18-Apr-25	EI	18:40	21:46	186	D	GCMMT	3622	GLA		46	Aircraft change due earlier tech		
18-Apr-25	EI	17:40	23:21	341	A	GCMJL	3657	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due earlier tech issues at BHD. 2 EDI flights combined
19-Apr-25	EI	20:10	21:48	98	A	GCMJM	3653	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due earlier tech issues at BHD
21-Apr-25	EI	20:55	22:08	73	A	GCMJN	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due earlier flight deck shortage
21-Apr-25	EI	21:10	22:32	82	A	GCMJL	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
25-Apr-25	EI	21:10	21:34	24	A	GCMJL	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	87	Ramp congestion in EDI
2-May-25	EI	21:10	21:51	41	A	GCMMT	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	19	REDUCED MOBILITY, boarding / deboarding of passengers with reduced mobility.
3-May-25	KL	21:15	21:39	24	A	PHEXK	951	AMS		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due delay on earlier DUB sector
4-May-25	BA	21:10	21:45	35	A	GLCYT	8758	LCY		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due an ATC delay on a previous sector
5-May-25	KL	21:15	22:05	50	A	PHEXM	951	AMS		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	87/95	single r/w ops in AMS and crew rotation
13-May-25	KL	21:15	22:24	69	A	PHEZA	951	AMS		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	46	A/C swap due tech
14-May-25	EI	20:55	22:10	75	A	GCMMN	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due earlier tech issues at BHD
15-May-25	KL	21:15	21:34	19	A	PHEXG	951	AMS		95	CREW ROTATION, awaiting crew from another flight (flight deck or entire crew)		
18-May-25	EI	20:55	21:35	40	A	GCMJJ	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due a tech delay on the previous sector from BHD
21-May-25	BA	20:45	21:37	52	A	GEUPK	1426	LHR		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		aircraft delayed on previous sector into LHR
21-May-25	KL	21:05	21:48	43	A	PHEXH	951	AMS		16	PAX CONVENIENCE waiting for delayed pax	87	Airport facilities
22-May-25	EZY	20:15	21:49	94	D	GEZGE	804	LGW		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react delay due a PRM (disabled pax) issue on a previous sector
22-May-25	KL	21:15	21:39	24	A	PHEXL	951	AMS		94	CREW ROTATION, awaiting crew from another flight (cabin crew)		operational delay awaiting cabin crew from another sector due to shortage
23-May-25	KL	21:15	21:44	29	A	PHEXO	951	AMS		91	LOAD CONNECTION, awaiting pax from a delayed connecting flight		
27-May-25	EI	20:55	21:42	47	A	GCMJJ	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	46	A/C swap due tech a/c
27-May-25	EI	21:10	23:23	133	A	GCMJM	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	46	A/C swap due tech a/c
28-May-25	EI	20:50	22:22	92	A	GCMMT	3619	MAN		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	46	A/C swap due tech a/c
28-May-25	EI	21:10	22:40	90	A	EIGZV	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	46	A/C swap due tech a/c
29-May-25	EI	18:20	21:45	205	A	GCMMN	3607	SOU		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		Knock on effect to earlier tech issues
29-May-25	EI	20:55	23:15	140	A	GCMMT	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	19	Waiting for PRM

Appendix 1

Extensions Log for 2025

Date	Airline Code	Sch. Time	Actual Time	Delay Time (mins)	Arr / Dep	Registration	Flight #	Airport	Runway	Delay code 1	Description 1	Delay code 2	Description 2
1-Jun-25	BA	20:45	21:39	54	A	GEUPG	1426	LHR		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to earlier tech issue
5-Jun-25	EI	20:50	21:43	53	A	GCMJJ	3619	MAN		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		due to earlier tech issues and aircraft changes
5-Jun-25	EI	21:10	22:19	69	A	GCMJN	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		due to earlier tech issues and aircraft changes
6-Jun-25	EI	N/A	21:36	0	D	EIHDI	3228	GLA		41	tech issue / the aircraft diverted to BHD / orig route was DUB to GLA		there was a deicing issue that caused the diversion
6-Jun-25	EI	21:10	21:39	29	A	GCMJJ	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		due to an earlier tech issue
13-Jun-25	EZY	20:25	21:33	68	A	GEXBX	893	LGW		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		due to an earlier tech issue and a/c change
14-Jun-25	EI	20:50	21:32	42	A	GCMMT	3619	MAN		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	65	late crew procedure
15-Jun-25	BA	21:10	21:32	22	A	GLCYK	8758	LCY		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	65	late crew procedure
16-Jun-25	EI	19:55	22:33	158	A	GCMJJ	3639	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	46	A/C swap due tech a/c
16-Jun-25	EI	21:10	23:09	119	A	GCMJL	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	46	A/C swap due tech a/c
17-Jun-25	EI	21:10	22:02	52	A	GCMMT	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	41	Tech issue before dept from BHD on EI3658
18-Jun-25	EI	19:55	22:01	126	A	GCMJN	3638	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	46	A/C swap due tech issues
19-Jun-25	EI	20:55	21:39	44	A	GCMMN	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	89	ramp congestion in BHX
20-Jun-25	EI	20:55	22:27	92	A	GCMJM	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due earlier ATC slot delays at BHX due to staff shortages
20-Jun-25	EI	21:10	21:40	30	A	GCMJJ	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		due to earlier tech issues
21-Jun-25	EI	20:25	21:38	73	A	GCMJL	3639	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	19	late PRM's
22-Jun-25	EI	21:10	21:46	36	A	GCMJJ	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
22-Jun-25	EI	20:55	22:32	97	A	GCMJM	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	82	ATC slot
22-Jun-25	BA	21:10	22:25	75	A	GLCYN	8758	LCY		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	14	Overbooking
23-Jun-25	EI	20:55	21:33	38	A	GLMMN	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
23-Jun-25	EI	20:55	22:19	84	A	GCMJJ	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
23-Jun-25	EI	21:10	21:33	23	A	GCMMT	3659	EDI		96	OPERATIONS CONTROL,	62	OPERATIONAL REQUIREMENTS, fuel, load alteration
24-Jun-25	BA	20:20	21:33	73	D	GTTNK	1425	LHR		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		Knock on effect to earlier tech issues
24-Jun-25	EI	20:55	21:38	43	A	GCMJM	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	19	late PRM's
25-Jun-25	EI	20:55	22:11	76	A	GCMMT	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	89	
26-Jun-25	EI	18:05	21:33	208	D	GCMJL	3678	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	41	A/c Tech in BHD on previous sector
26-Jun-25	EI	19:55	22:03	128	A	GCMMT	3639	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		A/c Tech in BHD on previous sector
26-Jun-25	EI	20:55			A	GCMJL	3679	LBA			A/C DIV TO BFS AS UNABLE TO MEET CURFEW		
27-Jun-25	EI	20:55	22:29	94	A	GCMMN	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	46	a/c swap due tech issues
27-Jun-25	EI	20:55	21:56	61	A	GCMJL	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		Knock on effect from pos in morning from BFS
28-Jun-25	BA	21:05	21:34	29	A	GLCAD	4520	PMI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	81	ATC slot dept PMI
28-Jun-25	EI	21:15	22:27	72	A	GCMJL	3609	SOU		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	46	A/C swap due tech
30-Jun-25	EI	20:55	21:49	54	A	GCMMN	3649	BHX		16	delayed due to a medical emergency on the inbound flight from BHD to BHX		
2-Jul-25	EI	20:55	21:42	47	A	GCMJN	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to an earlier tech issue
3-Jul-25	EZY	20:35	21:46	71	A	GEZBY	893	LGW		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to earlier ATC delays
3-Jul-25	EI	20:55	22:58	123	A	GCMJL	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to earlier aircraft changes due to tech issues
3-Jul-25	EI	21:10	21:43	33	A	GCMMT	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to earlier aircraft changes due to tech issues
4-Jul-25	EI	20:55	21:51	56	A	GCMMN	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to an earlier aircraft change at BHD due to tech issues
5-Jul-25	EI	20:50	21:44	54	A	GCMJL	3619	MAN		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
5-Jul-25	EI	21:15	21:50	35	A	GCMMN	3609	SOU		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
5-Jul-25	BA	21:05	21:58	53	A	GLCYJ	4520	PMI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		Delays in PMI due to thunderstorms
6-Jul-25	EI	18:15	21:41	206	A	GCMJN	3647	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due earlier tech issues
6-Jul-25	EI	18:50	22:28	218	D	GCMJN	3658	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due earlier tech issues
6-Jul-25	BA	20:05	21:50	105	D	GEUYS	1425	LHR		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to ATC delays at LHR due to thunderstorms
6-Jul-25	EZY	20:25	23:00	155	A	GEZGR	893	LGW		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to ATC delays at LGW due to thunderstorms
6-Jul-25	BA	21:10	21:45	35	A	GLCYP	8758	LCY		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to ATC delays at LCY due to thunderstorms
6-Jul-25	KL	21:15	21:31	16	A	PHEXX	951	AMS		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due ATC delays at AMS due to thunderstorms
6-Jul-25	EI	21:10			A	GCMJN	3659	EDI			Diverted to BFS as wasn't going to meet the curfew		
7-Jul-25	EI	20:55	21:46	51	A	GCMJN	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	62	Ops requirement to change a/c on previous sectors
8-Jul-25	EI	20:55	22:28	93	A	GCMJM	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	41	a/c tech in LBA
8-Jul-25	EI	20:55	21:38	43	A	GCMJJ	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	62	Ops requirement to change a/c on previous sectors
8-Jul-25	EI	21:10	21:48	38	A	GCMMT	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	41	a/c tech on previous sector
9-Jul-25	EI	18:15	22:02	227	A	GCMMT	3647	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	31	lack of dispatcher in BHX due late running of service
9-Jul-25	EI	18:50			D	GCMMT	3658	EDI			sector cancelled as unable to make curfew		
9-Jul-25	EI	21:10			A	GCMMT	3659	EDI			sector cancelled as unable to make curfew		
10-Jul-25	EI	18:10	22:28	258	A	GCMMN	3607	SOU		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		knock on effect from earlier tech issues
10-Jul-25	EI	21:10	22:46	96	A	GCMMT	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		knock on effect from earlier tech issues
12-Jul-25	EI	21:15	21:41	26	A	GCMJM	3609	SOU		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	62	fuel load alteration
12-Jul-25	BA	21:05	22:05	60	A	GLCYN	4520	PMI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	81	ATC Slot
13-Jul-25	BA	21:10	21:39	29	A	GLCYR	8758	LCY		41	AIRCRAFT Tech issue in LCY		
13-Jul-25	EI	21:10	21:43	33	A	GCMJJ	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
14-Jul-25	EI	18:10	21:58	228	A	GCMJJ	3607	SOU		41	tech delay in SOU		
14-Jul-25	EI	20:55	21:43	48	A	GCMJL	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due earlier tech issues
14-Jul-25	EI	21:10	21:47	37	A	GCMMN	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due earlier tech issues
15-Jul-25	EI	18:15	21:48	213	A	GCMJJ	3647	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due earlier tech issues
15-Jul-25	EI	18:50	22:27	217	D	GCMJJ	3658	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due earlier tech issues
15-Jul-25	EI	21:10			A			EDI	'ted to BFS as unable to make curfew				
19-Jul-25	EI	21:15	21:49	34	A	GCMJM	3609	SOU		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	62	fuel load alteration due weight
20-Jul-25	BA	20:05	21:41	96	D	GTTNN	1425	LHR		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	81	atc slot res dept LHR
20-Jul-25	EI	20:50	21:43	53	A	GCMJN	3619	MAN		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	81	atc slot res dept MAN
20-Jul-25	KL	21:15	22:16	61	A	PHEXN	951	AMS		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	55	mass system failure in AMS
21-Jul-25	EI	21:10	21:39	29	A	GCMJL	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		knock on from earlier slot delays
21-Jul-25	EI	20:55	21:45	50	A	GCMJJ	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	89	LIAC and ramp congestion
21-Jul-25	EZY	20:25	22:00	95	A	GEZFT	893	LGW		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	71	LIAC and departure station weather
22-Jul-25	EI	20:55	23:01	126	A	GCMMT	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	16	Return to stand in BHX due pax Medical
23-Jul-25	KL	21:05	21:34	29	A	PHEXU	951	AMS		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	37	Catering issue in AMS
24-Jul-25	EI	20:50	23:54	184	A	GCMJL	3619	MAN		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to tech issues and aircraft changes
24-Jul-25	EI	21:10	23:16	126	A	GCMMN	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to tech issues and aircraft changes
26-Jul-25	EZY	20:25	22:02	97	A	GEZDN	893	LGW		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to an ATC delay on a previous sector
26-Jul-25	EI	21:15	21:33	18	A	GCMJM	3609	SOU		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due a tech issue on the previous sector from BHD
27-Jul-25	EZY	20:25	21:52	87	A	GEZBH	893	LGW		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	35	aircraft cleaning and earlier
27-Jul-25	BA	21:10	21:43	33	A	GLCYT	8758	LCY		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to earlier ATC technical issues that caused a temporary suspension of flights
30-Jul-25	EI	19:55	21:31	96	A	EIFSL	3639	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to earlier ATC technical issues that caused a temporary suspension of flights
30-Jul-25	EI	20:50	22:17	87	A	GCMJN	3619	MAN		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to earlier ATC technical issues that caused a temporary suspension of flights
30-Jul-25	EI	20:50	22:10	80	A	GCMMT	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to earlier ATC technical issues that caused a temporary suspension of flights
30-Jul-25	BA	20:45	22:56	131	A	GEUOF	1426	LHR		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to earlier ATC technical issues that caused a temporary suspension of flights
30-Jul-25	EI	21:10	22:49	99	A	GCMJM	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		

Appendix 1

Extensions Log for 2025

Date	Airline Code	Sch. Time	Actual Time	Delay Time (mins)	Arr / Dep	Registration	Flight #	Airport	Runway	Delay code 1	Description 1	Delay code 2	Description 2
31-Jul-25	EI	20:55	21:56	61	A	GCMJL	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
31-Jul-25	EZY	20:35	22:01	86	A	GEZFI	893	LGW		71	WEATHER DEPARTURE STATION		Thunderstorms over London
4-Aug-25	KL	21:15	21:33	18	A	PHEXF	951	AMS		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
4-Aug-25	EZY	20:25	21:52	87	A	GEZBT	893	LGW		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	72	WEATHER DESTINATION STATION
5-Aug-25	EI	21:10	21:34	24	A	GCMJN	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
5-Aug-25	EI	20:50	21:59	69	A	GCMMT	3619	MAN		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
5-Aug-25	air amb	20.42	21:49		D			Air Amb			Air ambulance arrived with casuality - no road ambulances available - made contact number of times.		
6-Aug-25	EI	20:55	21:31	36	A	GCMJJ	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
7-Aug-25	EI	20:55	22:39	104	A	GCMMN	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	41	A/C tech on prev dept sector
8-Aug-25	EI	19:55	21:43	108	A	GCMMT	3639	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	32	lack of ground staff in BHX
8-Aug-25	EI	20:55	21:54	59	A	GCMJN	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	32	lack of ground staff in BHX
9-Aug-25	KL	21:15	21:34	19	A	PHEXW	951	AMS		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	66	late cabin crew in AMS
9-Aug-25	EI	21:15	22:02	47	A	GCMJJ	3609	SOU		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
10-Aug-25	EI	20:55	21:32	37	A	GCMMT	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	96	a/c swap due on previous sectors
10-Aug-25	EI	20:55	22:02	67	A	GCMMN	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	46	a/c swap due tech issues on previous sectors
10-Aug-25	EI	21:10	21:50	40	A	GCMJJ	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
11-Aug-25	EI	20:55	21:37	42	A	GCMMT	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
11-Aug-25	EI	20:50	21:41	51	A	GCMJM	3619	MAN		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
11-Aug-25	EI	21:10	23:34	144	A	GCMJJ	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		a/c swap on previous sectors
12-Aug-25	EI	21:10	21:54	44	A	GCMJM	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	87	Airport facilities in EDI 7 mins
13-Aug-25	BA	20:10	21:32	82	A	GLCYU	8758	LCY		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
13-Aug-25	EI	21:10	21:40	30	A	GCMMT	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	89	Ramp congestion EDI
14-Aug-25	EI	21:10	23:18	128	A	GCMMT	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	87	a/c swap on previous sectors
15-Aug-25	EI	16:25	21:45	320	A	GCMJN	3645	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to tech issues and aircraft changes
15-Aug-25	EI	16:55	22:21	326	D	GCMJN	3638	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to tech issues and aircraft changes
15-Aug-25	EI	20:55	23:19	144	A	GCMMN	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to tech issues and aircraft changes
15-Aug-25	EI	19:55			A	GCMJN	3639	BHX			DIVERTED TO BFS DUE CURFEW		
16-Aug-25	BA	21:05	21:31	26	A	GLCYJ	4520	PMI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
16-Aug-25	EI	21:15	21:43	28	A	GCMJJ	3609	SOU		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to tech issues and aircraft changes
16-Aug-25	EI	18:15	22:49	274	A	GCMMN	3645	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to tech issues and aircraft changes
17-Aug-25	EI	18:00	21:35	215	D	GCMJN	3618	MAN		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to tech issues and aircraft changes
17-Aug-25	EI	20:50			A	GCMJN	3619	MAN		93	Diverted to BFS as eta was after our curfew time		react due to tech issues and aircraft changes
17-Aug-25	BA	21:20	22:21	61	A	GLCYM	8758	LCY		63	late flight deck crew		
18-Aug-25	EI	20:50	21:47	57	A	GCMJJ	3619	MAN		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to tech issues and aircraft changes
18-Aug-25	EI	20:55	21:59	64	A	GCMJN	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to tech issues and aircraft changes
18-Aug-25	EI	21:10	23:04	114	A	GCMJL	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to tech issues and aircraft changes
20-Aug-25	EI	20:55	21:37	42	A	GCMJN	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to tech issues and aircraft changes
22-Aug-25	EI	19:55	21:38	103	A	GCMJJ	3639	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	89	delay due to earlier tech issue plus 10 mins ramp congestion EDI
27-Aug-25	BA	20:10	22:11	121	A	GLCYR	8758	LCY		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to tech delay on the previous sector
27-Aug-25	BA	20:45	22:04	79	A	GEUPW	1426	LHR		41	tech issues at LHR		
27-Aug-25	EI	20:55	21:39	44	A	GCMJJ	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to earlier handling delays on previous sectors
28-Aug-25	EZY	20:10	21:37	87	D	GEZDV	804	LGW		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		ATC delays at LGW due to bad weather
28-Aug-25	EZY	20:35	22:19	104	A	GEZGE	893	LGW		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	83	slot rest on previous sector due wx
29-Aug-25	BA	20:05	22:19	134	D	GEUYB	1425	LHR		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	41	due tech defect on BA1424
30-Aug-25	EI	21:15	22:37	82	A	GCMJL	3609	SOU		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to an earlier tech issue
31-Aug-25	BA	20:05	22:18	133	D	GTTNX	1425	LHR		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		aircraft change in LHR due to tech reasons
1-Sep-25	BA	20:45	21:53	68	A	GEUYS	1426	LHR		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		knock on delays from earlier weather issues in LHR area
1-Sep-25	EI	20:55	21:34	39	A	GCMJN	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to an ATC delay on a previous sector
1-Sep-25	EI	21:10	22:47	97	A	GCMJM	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to earlier aircraft swap due tech a/c in BHD
4-Sep-25	KL	21:15	22:04	49	A	PHEXM	951	AMS		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		A/C returned to stand in AMS with tech issue
7-Sep-25	EI	17:35	23:19	344	A	GCMFL	3607	SOU		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	41	A/C tech on earlier BHD rotation
7-Sep-25	EI	19:55	23:14	199	A	GCMJN	3639	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	41	A/C tech on earlier BHD rotation due lighting strike
7-Sep-25	EI	21:10	21:45	35	A	GCMJL	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	41	A/C tech on earlier BHD rotation due lighting strike
7-Sep-25	EI	20:55	21:36	41	A	GCMJM	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		A/C tech on earlier BHD rotation due lighting strike
8-Sep-25	EI	21:10	21:33	23	A	GCMJN	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	19	High volume of PRM pax on inbound and out from EDI
11-Sep-25	KL	21:15	22:04	49	A	PHEZX	951	AMS		95	CREW ROTATION, awaiting crew from another flight	32	Loading/unloading
11-Sep-25	EZY	20:15	21:36	81	D	GEZGG	804	LGW		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to earlier ATC delays at LGW
11-Sep-25	EI	20:55	22:09	74	A	GCMMN	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to earlier tech issues and ATC slots
11-Sep-25	EI	20:50	22:46	116	A	GCMJJ	3619	MAN		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to earlier tech issues and ATC slots
12-Sep-25	BA	20:05	21:42	97	D	GEUUB	1425	LHR		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due earlier ATC wx delays at LHR
13-Sep-25	KL	21:15	22:25	70	A	PHEXM	951	AMS		95	CREW ROTATION, awaiting crew from another flight		
14-Sep-25	EZY	20:25	21:43	78	A	GEZBT	893	LGW		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		Earlier ATC delays due WX
14-Sep-25	BA	20:45	21:53	68	A	GEUYE	1426	LHR		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		Earlier ATC delays due WX
14-Sep-25	EI	18:50	21:58	188	D	GCMMN	3658	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	95	Earlier tech issues
14-Sep-25	EI	18:05	22:18	253	D	GCMJL	3678	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		Earlier tech issues
14-Sep-25	BA	21:10	22:54	104	A	GLCYO	8758	LCY		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		Earlier ATC delays due WX
14-Sep-25	EI	19:40	23:19	219	A	GCMJJ	3619	MAN		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		Earlier tech issues
14-Sep-25	EI	21:10			A	GCMMN	3659	EDI		93	Diverted to BFS due BHD curfew		Earlier tech issues
14-Sep-25	EI	20:55			A	GCMJL	3679	LBA		93	Diverted to BFS due BHD curfew		Earlier tech issue
15-Sep-25	KL	21:15	21:36	21	A	PHEZE	951	AMS		87	Airport facilities at Schipol	89	Capacity issues at Schipol
15-Sep-25	EI	21:10	21:58	48	A	GCMJM	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		Earlier tech issues
15-Sep-25	EI	20:55	22:28	93	A	GCMJJ	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	66	Earlier tech issues and late cabin crew
15-Sep-25	EI	19:55	22:57	182	A	GCMJL	3639	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		Earlier tech issues
15-Sep-25	EI	20:50	23:23	153	A	GCMMN	3619	MAN		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		Earlier tech issues
17-Sep-25	EI	20:55	22:05	70	A	GCMJM	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	83	slot delay on earlier sector
20-Sep-25	EI	20:50	21:31	41	A	GCMJJ	3619	MAN		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	34	lack of ground handling staff in MAN
21-Sep-25	EI	20:55	21:58	63	A	GCMFL	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	41	Tech issue on previous sector
21-Sep-25	EI	21:10	22:33	83	A	GCMMN	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	42	Delays from late release from engineers earlier in day
24-Sep-25	EI	20:55	21:34	39	A	GCMJJ	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to earlier tech issues
25-Sep-25	KL	21:15	21:52	37	A	PHEXL	951	AMS		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	39	GT - tech equipment
25-Sep-25	BA	20:45	21:58	73	A	GEUYN	1426	LHR		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	91	Slow loading of 12 wheelchairs
28-Sep-25	BA	20:45	21:32	47	A	GEUUF	1426	LHR		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to earlier weather issues at LHR
28-Sep-25	BA	21:10	21:44	34	A	GLCYM	8758	LCY		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to earlier weather issues at LCY
28-Sep-25	EI	21:10	21:51	41	A	GCMJM	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to earlier tech issues
30-Sep-25	KL	21:15	22:27	72	A	PHEXU	951	AMS		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to awaiting cabin crew from a delayed flight
5-Oct-25	EI	20:55	22:07	72	A	GCMMN	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due earlier tech issues and aircraft changes

Appendix 1

Extensions Log for 2025

Date	Airline Code	Sch. Time	Actual Time	Delay Time (mins)	Arr / Dep	Registration	Flight #	Airport	Runway	Delay code 1	Description 1	Delay code 2	Description 2
5-Oct-25	BA	20:45	22:41	116	A	GEUPZ	1426	LHR		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to earlier weather issues at LHR
6-Oct-25	KL	21:15	21:58	43	A	PHEXW	951	AMS		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to awaiting cabin crew from a delayed flight
7-Oct-25	KL	21:25	22:17	52	A	PHEXF	951	AMS		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to earlier weather issues at AMS
8-Oct-25	EI	20:55	21:35	40	A	GCMJL	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to earlier tech issues
9-Oct-25	EI	20:55	23:21	146	A	GCMFL	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to earlier tech issues
11-Oct-25	KL	21:15	21:36	21	A	PHEZL	951	AMS		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to awaiting cabin crew from a delayed flight
12-Oct-25	EI	19:55	21:34	99	A	GCMJJ	3639	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to earlier tech issues
12-Oct-25	EI	20:55	21:39	44	A	GCMJM	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to earlier tech issues
19-Oct-25	EI	20:55	21:48	53	A	GCMJJ	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to an earlier aircraft change due to tech issues
20-Oct-25	EI	20:55	21:40	45	A	GCMJM	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to earlier tech issues
25-Oct-25	KL	21:15	22:10	55	A	PHEXM	951	AMS		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to earlier ATC delays at AMS
26-Oct-25	EI	21:10	21:48	38	A	GCMJN	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react delay ex EDI + go around on arrival at BHD due to crosswinds
1-Nov-25	EI	20:50	21:50	60	A	GCMJN	3619	MAN		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	41	tech issue in MAN
11-Nov-25	EI	20:35	21:48	73	A	GCMMN	3607	SOU		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	63	Late crew boarding
11-Nov-25	EI	20:55	22:14	79	A	GCMMT	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	41	earlier tech issue
12-Nov-25	EI	21:10	21:34	24	A	GCMJN	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	87	Airport facilities EDI
14-Nov-25	BA	20:10	21:59	109	A	GLCAD	8758	LCY		41	Aircraft tech issue in LCY		
16-Nov-25	EI	21:10	22:43	93	A	GCMMN	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	46	a/c swap due tech aircraft
20-Nov-25	EI	21:10	21:39	29	A	GCMJN	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	61	FLIGHT PLAN, late completion or change of, flight documentation
21-Nov-25	EZY	20:05	21:47	102	D	GEJCK	802	LGW		41	Tech issue at BHD		
23-Nov-25	EI	17:55	21:37	222	D	GCMFL	3648	BHX		41	Tech on earlier sector		
23-Nov-25	EI	21:10	21:41	31	A	GCMJN	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	75	deicing in EDI
23-Nov-25	EI	20:55	div BFS		A	GCMFL	3649	BHX			refused due curfew		
26-Nov-25	EI	21:10	22:14	64	A	GCMMN	3659	EDI		93	AIRCRAFT ROTATION,	41	TECH ISSUE AT BHD ON EARLIER SECTOR
27-Nov-25	EI	21:15	canx		D	EIGPO	302P	DUB			refused due posn and would not make 2130 curfew		
27-Nov-25	EI	20:55	21:34	39	A	GCMMT	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
27-Nov-25	EI	20:35	21:40	65	A	GCMMN	3607	SOU		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
30-Nov-25	EI	20:50	21:40	50	A	GCMJN	3619	MAN		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	89	Ramp congestion MAN
1-Dec-25	EI	20:50	22:39	109	A	GCMJL	3619	MAN		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		due to earlier tech issues
1-Dec-25	EI	21:10	22:44	94	A	GCMMN	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		due to earlier tech issues
3-Dec-25	EI	21:10	21:33	23	A	GCMMN	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		due to earlier tech issues and aircraft changes
5-Dec-25	EI	20:55	21:57	62	A	GCMJJ	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	19/71	PRM PAX & WX
5-Dec-25	EI	19:55	22:11	136	A	GCMJL	3637	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	84	Weather at destination
5-Dec-25	EI	20:50	22:14	84	A	EIFAT	3619	MAN		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	84	Weather at desrtination
5-Dec-25	EZY	17:55	22:22	267	D	GEZOJ	344	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	66	late cabin crew due earlier disruption in EDI
6-Dec-25	EI	21:00	22:45	105	A	GCMMN	3629	GLA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		operational delay / aircraft out of position due to diverting yesterday due to stormy weather at BHD
7-Dec-25	EI	13:25	21:49	504	A	GCMMT	3621	CWL		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		knock on effect from earlier tech issues
8-Dec-25	EI	13:50	22:15	505	A	GCMMT	3613	MAN		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	87	airport facilities in MAN, biometric security issue in MAN
8-Dec-25	EI	20:55	22:29	94	A	GCMMN	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		due to earlier tech issues
8-Dec-25	EI	20:55	22:34	99	A	GCMJL	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		due to earlier tech issues
11-Dec-25	EI	20:55	21:37	42	A	GCMMN	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
11-Dec-25	EI	21:10	21:33	23	A	GCMJN	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	19	Late PRM
13-Dec-25	EI	20:55	21:55	60	A	GCMJJ	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	41	TECH ISSUES ON EARLIER SECTOR
13-Dec-25	EI	20:45	21:48	63	A	GCMJL	3677	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	41	TECH ISSUES ON EARLIER SECTOR
13-Dec-25	EI	21:00	22:47	107	A	GCMMT	3629	GLA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	41	TECH ISSUES ON EARLIER SECTOR
14-Dec-25	EI	21:10	23:04	114	A	GCMJJ	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	87/89	
14-Dec-25	EI	20:50	21:41	51	A	GCMJL	3619	MAN		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
15-Dec-25	EI	20:55	21:51	56	A	GCMJN	3679	LBA		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
15-Dec-25	EI	20:55	22:12	77	A	GCMMN	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
15-Dec-25	EI	21:10	22:28	78	A	GCMJJ	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		
15-Dec-25	EI	20:35	23:07	152	A	GCMMT	3607	SOU		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		knock on delays from earlier MAN runway closure
16-Dec-25	BA	20:15	21:39	84	A	GEUPR	1410	LHR		16	COMMERCIAL PUBLICITY/PASSENGER CONVENIENCE, VIP, press, ground meals and missing personal items		Medical offload of ill pax in LHR
18-Dec-25	EI	20:55	21:59	64	A	GCMMN	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		Ground staff shortage in BHX
19-Dec-25	EI	20:50	22:46	116	A	GCMJN	3619	MAN		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	19	REDUCED MOBILITY, boarding / deboarding of passengers with reduced mobility.on earlier sector
21-Dec-25	EI	20:55	21:37	42	A	GCMMT	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	16	pax convenience on earlier sector
22-Dec-25	EI	20:55	21:48	53	A	GCMJL	3649	BHX		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector	41	EARLIER TECH ISSUE
31-Dec-25	EI	21:10	22:25	75	A	GCMJJ	3659	EDI		93	AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector		react due to an aircraft change on the previous sector due to tech issues

Appendix 2

IATA Code[1]	IATA Description	No. (arr)	No. (dep)
14	Oversales, booking error	1	
15	Boarding, discrepancies and paging, missing checked-in passenger	1	
16	PR/Pax convenience/VIP	4	
19	Reduced mobility, boarding / deboarding of passengers with reduced mobility	12	
31	Aircraft documentation late/inaccurate	1	
32	Loading/unloading, bulky, special load, cabin load, lack of loading staff	3	
34	Servicing equipment, lack of staff	1	
35	Aircraft cleaning	1	
37	Catering, late delivery or loading	1	
39	Technical equipment, lack of or breakdown	1	
41	Aircraft defects	25	5
42	Scheduled maintenance, late release	1	
46	Aircraft change, for technical reasons	20	3
55	Auto equipment failure, departure control	1	
58	Equipment failure, other automated system	1	
61	Flight plan, late completion or change of, flight documentation	1	
62	Operational requirements, fuel, load alteration	5	
63	Late crew boarding or departure procedures, other than connection and standby (flight deck or entire crew)	3	
65	Flight crew special request, not within operational requirements	2	
66	Late cabin crew boarding or departure procedures, other than connection and standby	2	1
71	Weather departure station	2	
72	Weather at destination	2	
75	De-ice/de-snow	1	
77	Ground handling impaired bad weather	5	1
81	ATFM due to demand/capacity problems	3	1
82	ATC Staff/Equipment problem	1	
83	ATFM (air traffic flow management) due to restriction at destination airport, airport and/or runway closed due to obstruction, industrial action, staff shortage, political unrest, noise abatement, night curfew, special flights	2	
84	AFTM due to weather at destination	2	
87	Airport Facilities	8	
89	Restrictions at airport of departure with or without ATFM restrictions, including air traffic services, start-up and	8	

	pushback, airport and/or runway closed due to obstruction or weather, industrial action, staff shortage, political unrest, noise abatement, night curfew, special flights		
91	Load connection, awaiting load from another flight	2	
92	Awaiting flight deck crew	1	
93	Aircraft rotation, late arrival of aircraft from another flight or previous sector	147	14
94	Cabin crew rotation, awaiting cabin crew from another flight	3	
95	Crew rotation, awaiting crew from another flight (flight deck or entire crew)	2	1
96	Operations control	2	
	Totals	**278**	**26**

Whilst Delay Code 1 (as shown in Appendix 1 – Extensions Log for 2023) provides the primary description of each delay, where appropriate Delay Code 2 (as shown in Appendix 1) has been counted in this table, in order to ensure clarity and provide greater detail on delay causes.

Appendix 3

Extension & Departure Noise Charges 1 Jan to 31 Dec 2025

Timeband	Fine rate	No. Extensions	Fines values
21:31 - 21:45	134	112	15,008
21:46 - 22:00	167	64	10,688
22:01 - 22:15	200	33	6,600
22:16 - 22:30	401	31	12,431
22:31 - 22:45	534	19	10,146
22:46 - 23:00	735	16	11,760
23:01 - 23:15	935	10	9,350
23:16 - 23:30	1,069	13	13,897
23:31 - 23:45	1,202	5	6,010
23:46 - 23:59	1,336	1	1,336
	Sub	*304*	*97,226*
	Total £	**97,226**	

Departure Noise Exceedances			
Excess over dBLASmax		**Charge**	**Total**
No greater than 3 dB(A)	4	£668	£2,672
Greater than 3 dB(A)	0	£1,336	£0
Total			£99,898

Bickerdike Allen Partners
Architecture Acoustics Technology

GEORGE BEST BELFAST CITY AIRPORT

2025 ANNUAL REPORT

Report to

George Best Belfast City Airport
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Belfast
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A11298_18_RP012_2.0
30 January 2026

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A11298_18_DR002 Figure 02 Summer Daytime Noise Contours – 2025

A11298_18_DR003 Figure 03 Summer Daytime Noise Contours – 2026 Forecast

A11298_18_DR004 Figure 04 Summer Daytime Noise Contours – 2027 Forecast

A11298_18_DR005 Figure 05 Comparison of 2025, 2026 and 2027 57 dB $L_{Aeq,16h}$ Noise Contours

Appendices

Appendix 1: Glossary of Acoustic Terminology

Appendix 2: George Best Belfast City Airport 2025 Noise Contour Validation

1.0 INTRODUCTION

The planning agreement[1] between Belfast City Airport Limited (BCA) and the Department for Infrastructure dated 22 July 2019 sets out regular reporting that the airport is required to make. The required reporting includes an Annual Performance Report (APR) which is to be submitted annually on 31 March. The content of the APR is detailed in paragraphs 6.7.1 to 6.7.15 of *PART II The Covenants* of the agreement.

Bickerdike Allen Partners LLP (BAP) have been retained by George Best Belfast City Airport (GBBCA) to produce some of the information required for the APR, specifically the information related to the following paragraphs:

- 6.7.1 Noise exposure contours
- 6.7.2 Comparison of noise contour areas
- 6.7.3 Air traffic movements the contours are based on
- 6.7.6 The Quota Count for the previous year
- 6.7.7 A record of movements by aircraft types not permitted to use the airport in the previous year (those only marginally compliant with Chapter 3)
- 6.7.14 (Partial) An evaluation of the data reported, specifically that we are preparing.

Noise contours have been produced for 2025 based on the actual aircraft movements over the 92 day summer period, and for 2026 and 2027 based on forecasts provided by GBBCA. All of the noise contours have been produced using the Federal Aviation Administration's prediction software, the Integrated Noise Model (INM) version 7.0d. This methodology has been validated for the key aircraft types operating at the airport, using results from the Noise Monitoring Terminals (NMTs) installed at GBBCA.

Section 2 of this report gives details of the air traffic movements used to produce the noise contours. Section 3 gives details of the methodology used to produce the noise contours. Section 4 reports the areas of the noise contours and compares them with the 57 dB $L_{Aeq,16h}$ noise contour area limit. Population counts for the key noise exposure contours are also provided. Section 5 reports the results of the quota count assessment for 2025. Section 6 gives details of movements in 2025 by aircraft types that were only marginally compliant with Chapter 3.

[1] Agreement Pursuant to Section 77(1)(a) of the Planning Act (Northern Ireland) 2011

A glossary of acoustic terms can be found in Appendix 1 and Appendix 2 contains details of BAP's noise contour validation exercise.

2.0 AIRCRAFT MOVEMENTS

The basis for the 2025 noise contours are the actual movements during the 92 day summer period, 16 June to 15 September inclusive. Detailed information was provided by GBBCA for all aircraft movements during this period. Although a small proportion of movements occur early in the morning between 6:30 and 7:00 or late in the evening between 23:00 and 00:00 over the 92 day period, for the production of the noise contours all movements have been modelled as taking place within the "daytime period" of 07:00 to 23:00.

The actual movements in 2025 include 26 movements by helicopters. Historically helicopters have not been modelled at GBBCA, as they typically comprise less than 1% of the total movements, and this was also the case in 2025. Their continued omission is not considered significant to the overall contours due to their small number of movements and this maintains consistency with previous contouring.

Compared to 2024, there has been a decrease in fixed-wing movements from 8,204 to 7,314 in 2025. Movements in 2025 are also less than the 9,745 movements that occurred in 2019 before the COVID-19 pandemic.

Forecasts of summer movements have been provided for 2026 and 2027. Total summer movements are forecast to increase to 8,274 in 2026, followed by an increase to 8,448 movements forecast for 2027. The forecasts include an allowance for general aviation (GA) movements, without specifying particular aircraft types. These movements have been modelled based on the GA types which operated in summer 2025.

The INM software includes noise information for many common aircraft types, but as with all noise modelling software, it does not include every aircraft type. This means that substitutions are required, where an alternative aircraft type is used to model the actual type. For larger aircraft this generally does not involve a change but for the smaller types, and in particular the general aviation aircraft, substitutions occur. Where INM has no guidance, an aircraft type has been assigned based on the aircraft size and engine details. Table 1 below shows the aircraft movements by aircraft type in summer 2025 and those forecast for 2026 and 2027. It also includes the INM type used for each aircraft type in the modelling. "n/a" is shown where a type performed fewer than 10 movements or for the forecast movements was not specifically included in the forecast. Movements by these types have been grouped under "other."

Aircraft Type	INM Type(s)	Summer Fixed Wing Movements		
		2025 Actual	2026 Forecast	2027 Forecast
Airbus A319ceo	A319-131[(1)]	962	970	1,001
Airbus A320ceo	A320-211[(1)]	1,014	1,071	1,093
Airbus A320neo	A320-211[(1)]	390	470	477
ATR 42	DO328	102	111	111
ATR 72	DO328/DHC6[(1)]	3,650	4,389	4,389
Beechcraft Super King Air 200	CNA441	14	n/a	n/a
Bombardier Challenger 350	CL601	20	n/a	n/a
Cessna CitationJet CJ3	CNA525C	10	n/a	n/a
Cessna Citation Excel	CNA560XL	70	n/a	n/a
Cessna Citation Latitude	CNA680	16	n/a	n/a
Diamond DA-62	BEC58P	16	n/a	n/a
Embraer E145	EMB145	176	153	153
Embraer E175	EMB175/737500[(1)]	251	n/a	n/a
Embraer E190	EMB190[(1)]	463	879	934
Embraer Legacy 500	CNA55B	24	n/a	n/a
Embraer Phenom 300	CNA510	16	n/a	n/a
Gulfstream G650	GV	10	n/a	n/a
Pilatus PC-12	CNA208	16	n/a	n/a
Other (less than 10 movements)	Various	94	231	290
Total[(2)]		**7,314**	**8,274**	**8,448**

[(1)] INM type modified based on results of a validation exercise.

[(2)] Forecast totals may not match due to rounding.

Table 1: 2025, 2026 and 2027 Summer Fixed Wing Movements

3.0 NOISE CONTOUR METHODOLOGY

3.1 General

The aircraft movement data, provided by GBBCA, has been assessed in relation to aircraft type, departure and arrival route, flight profiles and runway usage to enable input into the noise computation program, the Integrated Noise Model (INM). This section of the report describes how this information has been compiled in a form suitable for analysis purposes.

3.2 Runway Usage

The overall split of movements by runway during the 2025 summer period is given in Table 2, and is compared with the long term average (2021-2025). For the 2025 actual contours, the actual runway usage for each individual movement was used. For the 2026 and 2027 forecast contours the long term average modal split has been used.

Runway	% of Summer Movements			
	2025		2021-2025 Average	
	Arrivals	Departures	Arrivals	Departures
04	26%	28%	36%	39%
22	74%	72%	64%	61%

Table 2: 2025 and Long Term Average Summer Modal Split

The usage of the runways is dependent on the direction of the wind, therefore some variation is to be expected between individual years. Compared to the long term average there was around 10% less usage of runway 04 by arrivals and 11% less by departures in 2025, with corresponding increases in the usage of runway 22.

3.3 Flight Tracks

For each runway there is a single modelled arrival route, which follows the runway centreline. There is one modelled initial departure route on runway 22, but four modelled initial departure routes on runway 04.

A validation exercise was undertaken in 2011 to validate the flight tracks used in the INM software. The details of this exercise are shown in Appendix B of the BAP report Ref: A9443-R01-NW dated November 2011. The resulting main departure tracks are shown in Figure 01 and have been used for the contours as there have been no changes to the published routes since 2011.

The method of determining the split of aircraft between the routes from runway 04 takes into account both aircraft type and destination. Where the destination is in Scotland or in Northern Europe (Iceland, Norway, etc.) the initial route heading in a north easterly direction is used. The remaining traffic is split amongst the three routes which turn south. The particular route depends on the distance at which the aircraft type involved is expected to have achieved one of a set of specific altitudes, as required by the airport's noise abatement procedures. These altitudes are 1,500 ft for small propeller aircraft (maximum takeoff weight of up to 13,000 kg); 2,000 ft for large propeller aircraft; and 3,000 ft for jet aircraft.

For the forecast runway 04 departures, the long-term average (2021-2025) split between the north easterly and southerly routes has been used. This results in 19% of departures using the north easterly route, with the remainder using the southerly routes. Aircraft have been split between the three southerly routes according to weight and type, as was done for the actual contours.

3.4 Dispersion

Aircraft on departure are allocated a departure route to follow. In practice, this route is not followed precisely by all aircraft. To allow for this the INM software was used to generate a mean track for each of the five initially distinct routes, and these mean tracks were then dispersed as described below.

The dispersion model has the common assumption that there are five "dispersed" tracks associated with each departure route; these comprise the mean track of each route and two sub-tracks either side, as the actual pattern of departing aircraft is dispersed about the route's centreline. The degree of dispersion is normally a function of the distance travelled by an aircraft along the route after take-off and also on the form of the route.

When considering many departures, it is commonly found that the spread of aircraft approximates to a "normal distribution" pattern. A simplified mathematical model can be adopted to represent a normal distribution of events, based on standard deviations. The five "dispersed" tracks used to model each departure route comprise the main track of each route and two sub-tracks either side. The resulting allocation of movements to each track is as follows:

- 53.3% departures along the main track;
- 22.2% departures split equally along two inner sub tracks either side of the main track and offset by a distance of 1.355 standard deviations;
- 1.15% departures split equally along two outer sub tracks either side of the main track and offset by a distance of 2.71 standard deviations.

This dispersion model has been used in the INM software, which generates the sub-tracks with distances supplied by the user. The distances and percentages used have been determined by BAP from analysis of similar activity at other airports.

3.5 Flight Profiles

For departure movements the INM software offers a number of standard flight profiles for most aircraft types, particularly for the larger aircraft types. These relate to different departure weights which are greatly affected by the length of the flight, and consequently the fuel load. In the INM software this is referred to as the stage length. The stage length increases in increments of 500 nmi up to 1,500 nmi and then in increments of 1,000 nmi. As the stage length increases, the aircraft has to depart with greater fuel, and so its flight profile is slightly lower than when a shorter stage length is flown.

For the 2025 contours, destination airports were given with the actual movements. Stage lengths have been assigned, where INM offers the option, based on the distance of these airports from GBBCA.

The vast majority (98%) of departures in summer 2025 were to destinations with a stage length of 1 (<500nmi). For the forecast 2026 and 2027 contours, stage lengths for the validated aircraft types have been assigned based on what occurred in summer 2025. All other aircraft movements have been modelled as stage length 1, which in most cases is the only option available in the INM for the aircraft type.

3.6 INM Model

All contours and population counts have been determined using the Integrated Noise Model (INM) version 7.0d software. GBBCA data relevant to the INM study is taken from the latest edition of the UK Aeronautical Information Package. A 3.0° approach angle has been used for all aircraft and the ground topography has been assumed to be flat. The INM default headwind of 14.8 km/h has been assumed.

Results from the airport's Noise Monitoring Terminals (NMTs) from the period September 2024 to September 2025 have been used in the 2025 validation exercise to review the INM assumptions for the key aircraft types operating at GBBCA.

The 2025 validation exercise included reviewing six key aircraft types, to best model their operations at GBBCA. The result is that the modelled noise characteristics of these aircraft have been adjusted by modifying the INM aircraft used and/or the noise level of the INM aircraft types as necessary. Where modifications have been made to the noise levels, this has been by applying a factor to the number of movements. These adjustments are detailed in Table 3 below.

Aircraft Type	Default INM Type	Modification to INM Assumptions	
		Arrivals	Departures
Airbus A319ceo	A319-131	A319-131 × 1.0	A319-131 × 1.5
Airbus A320ceo	A320-211	A320-211 × 0.8	A320-211 × 1.0
Airbus A320neo	-	A320-211 × 0.6	A320-211 x 0.4
ATR 72	DO328	DO328 × 0.6	DHC6 × 1.4
Embraer E175	EMB175	EMB175 × 1.1	737500 x 1.4
Embraer E190	EMB190	EMB190 × 1.0	EMB190 × 2.5

Table 3: Modifications to INM Assumptions Used for the Contours

The modelled noise levels have been increased for several aircraft types compared to those used for the 2024 contours, due to an increase in measured noise levels. Full details of the 2025 validation exercise are given in Appendix 2.

4.0 NOISE CONTOURS

Noise contours for 2025, 2026 and 2027 in terms of the $L_{Aeq,16h}$ metric have been produced for the 16 hour daytime period, 07:00 to 23:00; although they also include the movements that occur between 06:30 and 07:00 and the small number that occurred between 23:00 and 00:00. They are based on the actual movements for the 92 day summer period in 2025 and the forecasts provided for 2026 and 2027 as detailed in Section 2. The areas of the noise contours are given in Table 4, where they are compared with the 57 dB $L_{Aeq,16h}$ contour area limit.

The 2025 actual, 2026 forecast and 2027 forecast noise contours are shown in Figures 02, 03 and 04 respectively at values from 54 to 69 dB $L_{Aeq,16h}$ in 3 dB steps. The 57 dB contours for all three years are compared in Figure 05.

Contour Level (dB $L_{Aeq,16h}$)	Area of Daytime Air Noise Contours (km^2)			Contour Area Limit $(km)^2$
	2025	2026	2027	
54	6.18	7.07	7.25	
57	3.27	3.75	3.85	5.20
60	1.68	1.93	1.98	
63	0.93	1.07	1.09	
66	0.54	0.62	0.63	
69	0.33	0.38	0.39	

Table 4: 2024, 2025 and 2026 Noise Contour Areas

The area of the 2025 57 dB $L_{Aeq,16h}$ contour area is 3.27 km^2, which is well below the contour area limit of 5.2 km^2. The areas of the noise contours for 2025 have increased compared to 2024 despite the decrease in movements. This is due to the increase in measured noise levels from individual movements and consequential updates to the validation. The contour areas are similar to 2019, when the 57 dB $L_{Aeq,16h}$ contour area was 3.3 km^2.

The noise contour areas are forecast to increase in 2026 and then again in 2027, this is due to the increase in forecast aircraft movements. The 57 dB contour areas are forecast to remain below the contour area limit in both 2026 and 2027.

4.1 Population and Dwelling Counts

The population and dwelling data has been derived from a 2025 postcode database supplied by CACI Ltd. Population counts for the 2025, 2026, and 2027 $L_{Aeq,16h}$ daytime contours are given in Table 5 and Table 6 below, the corresponding dwelling counts are given in Table 7 and Table 8.

Contour Level (dB $L_{Aeq,16h}$)	2025 Population	2026 Population	2027 Population
54	12,710	14,606	15,028
57	3,586	4,878	5,444
60	0	160	160
63	0	0	0
66	0	0	0
69	0	0	0

Table 5: Comparison of 2025, 2026 and 2027 Population Counts – Cumulative Totals

Year	Population by Contour Band (dB $L_{Aeq,16h}$)						Total
	> 69	69 – 66	66 – 63	63 – 60	60 – 57	57 – 54	
2025	0	0	0	0	3,586	9,124	12,710
2026	0	0	0	160	4,718	9,728	14,606
2027	0	0	0	160	5,284	9,584	15,028

Table 6: Comparison of 2025, 2026 and 2027 Population Counts

Contour Level (dB $L_{Aeq,16h}$)	2025 Dwellings	2026 Dwellings	2027 Dwellings
54	6,087	6,954	7,202
57	1,644	2,251	2,528
60	0	78	78
63	0	0	0
66	0	0	0
69	0	0	0

Table 7: Comparison of 2025, 2026 and 2027 Dwelling Counts – Cumulative Totals

Year	Dwellings by Contour Band (dB $L_{Aeq,16h}$)						Total
	> 69	69 – 66	66 – 63	63 – 60	60 – 57	57 – 54	
2025	0	0	0	0	1,644	4,443	6,087
2026	0	0	0	78	2,173	4,703	6,954
2027	0	0	0	78	2,450	4,674	7,202

Table 8: Comparison of 2025, 2026 and 2027 Dwelling Counts

The number of people and dwellings within the 2025 contours has increased compared to 2024, but remains less than in 2019, when there were 14,033 people and 6,699 dwellings within the 54 dB $L_{Aeq,16h}$ noise contour.

The number of people and dwellings in the 54, 57, and 60 dB contours are forecast to increase in both 2026 and 2027, due to the increase in contour areas. As can be seen on Figure 05, the forecast contours are broadly similar in shape to the 2025 contours.

There were no people or dwellings within the 63 – 60 dB $L_{Aeq,16h}$ contour band in 2025. In 2026 and 2027 there are forecast to be 160 people and 78 dwellings within this contour band due to the forecast increase in aircraft movements resulting in larger noise contours. There are no people or dwellings forecast to be in the 63 dB or higher contour bands for 2026 and 2027.

5.0 QUOTA COUNT

As part of their planning agreement BCA are required to report the quota count for the year just completed. The quota count is based on the aircraft movements in the 92 day summer period and is limited to 4,665.

The quota count production methodology is described in paragraphs 6.4 to 6.6 of *PART II The Covenants* of the agreement. In summary, the method requires the certification data for the aircraft type, which is then processed and compared to a scale to determine the quota count for the aircraft type when arriving, and separately when departing.

For the aircraft that operated, the noise certification data has been obtained either from the noise certificate of the specific aircraft, or for those registered in the UK from the CAA G-INFO database[2] and those registered in Switzerland from the FOCA Swiss Aircraft Register[3]. Where certification data was not available, quota count values have been taken from the Noise Databases published by the CAA[4]. In some cases the tables offer more than one value for an aircraft type, in these cases the expected QC value based on available information has been used, and where only limited information is available the higher QC value has been taken.

The resulting quota count total for summer 2025 was 1,413.000, which is less than the limit of 4,665. Table 9 below gives details of how the quota count for summer 2025 has been calculated, including the specific arrival and departure quota count values used for the key aircraft types. Where more than one quota count value has been used for an aircraft type based on the individual noise certificates, both values are shown.

[2] https://www.caa.co.uk/aircraft-register/g-info/search-g-info/

[3] https://app02.bazl.admin.ch/web/bazl/en/#/lfr/search

[4] https://www.caa.co.uk/commercial-industry/aircraft/airworthiness/certificates-and-permits/noise-certificates/aircraft-noise-certificate/

Aircraft Type	Arrivals	Arr. QC	Departures	Dep. QC	QC Total
Airbus A319ceo	481	0.25	386 95	0.25 0.5	264.250
Airbus A320ceo	507	0.25	500 7	0.5 1	383.750
Airbus A320neo	2 193	0 0.125	195	0.125	48.500
ATR 42	51	0.125	51	0	6.375
ATR 72	1,826	0.125	1,824	0.125	456.250
Beechcraft Super King Air 200	7	0	7	0	0.000
Bombardier Challenger 350	10	0	10	0.125	1.250
Cessna CitationJet CJ3	5	0	5	0.125	0.625
Cessna Citation Excel	35	0.125	35	0	4.375
Cessna Citation Latitude	8	0	8	0	0.000
Diamond DA-62	8	0	8	0	0.000
Embraer E145	88	0.125	88	0.125	22.000
Embraer E175	125	0.25	126	0.25	62.750
Embraer E190	232	0.125	43 188	0.25 0.5	133.750
Embraer Legacy 500	9 3	0 0.125	9 3	0 0.125	0.750
Embraer Phenom 300	8	0	8	0	0.000
Gulfstream G650	5	0	5	0.125	0.625
Pilatus PC-12	8	0	8	0	0.000
Other[1]	60	Various	60	Various	27.750
Total	**3,671**	**-**	**3,669**	**-**	**1,413.000**

[1] Includes 26 movements by helicopters

Table 9: Summer 2025 Quota Count

6.0 MARGINALLY COMPLIANT CHAPTER 3 AIRCRAFT MOVEMENTS

As part of their planning agreement BCA are required to accept in respect of jet aircraft, only those air traffic movements that comply with the certificate limits, as laid down in Chapter 3 of Annex 16, of the standards adopted by the International Civil Aviation Organisation Council and which are not Marginally Compliant Aircraft. In the agreement these are defined as:

> 11. 'Marginally Compliant Aircraft' means civil subsonic jet aeroplanes, that meet the certification limits as laid down in Chapter 3 of Annex 16 by a cumulative margin of not more than 5 EPNdB, whereby the cumulative margin is a figure expressed in EPNdB obtained by adding the individual margins at each of the three reference noise management points as defined in Chapter 3 of Annex 16

BCA are required to report any movements in the year just completed by any aircraft not permitted to use the airport.

For the aircraft that operated in 2025, the noise certification data has been obtained either from the noise certificate of the specific aircraft, or for those registered in the UK from the CAA G-INFO database[2] and those registered in Switzerland from the FOCA Swiss Aircraft Register[3]. Where specific certification data was not available, certification values have been taken from the latest EASA Approved Noise Levels[5].

In some instances, the EASA database offers more than one possible classification for an aircraft type. In these instances a worst case assumption has been made.

There were no movements in 2025 by jet or large propeller aircraft types that do not meet the requirements of Chapter 3 or were only marginally compliant with Chapter 3. There were 8 movements which have been classified as fully compliant with Chapter 3. All of these were based on a worst case assumption, as in each case a noise certificate was unavailable, and the aircraft types could potentially meet Chapter 4 depending on the specific variant. Table 10 below provides a breakdown of the number of movements that fully comply with Chapter 3 or comply with the more stringent Chapter 4 or Chapter 14. The certification of helicopters and light propeller aircraft is to different standards and so these aircraft have been separately recorded.

[5] https://www.easa.europa.eu/easa-and-you/environment/easa-certification-noise-levels

2025 Aircraft Movements					
Not Chapter 3 or Chapter 3 Marginally Compliant	**Chapter 3 Fully Compliant**	**Chapter 4**	**Chapter 14**	**Helicopters and Light Propeller Aircraft**	**Total**
0	8	4,152	24,239	244	28,643

Table 10: 2025 Aircraft Noise Classification

7.0 SUMMARY

$L_{Aeq,16h}$ noise contours and the associated population counts have been produced, based on the actual movements during the 92 day summer period in 2025, and the forecast summer movements for 2026 and 2027. The movements used to produce them have been reported in addition to the contours and the number of people they contain.

The area of the 2025 57 dB $L_{Aeq,16h}$ contour area at 3.27 km^2 is well below the contour area limit of 5.2 km^2. The noise contour areas are forecast to increase in 2026 and 2027. However, the 57 dB contour areas are forecast to remain below the contour area limit in both 2026 and 2027.

The 2025 57 dB $L_{Aeq,16h}$ contour contains 1,644 dwellings and a population of 3,586. There are no dwellings in the 60 dB or higher contours. The number of people and dwellings within the contours is forecast to increase in 2026 and 2027, due to the forecast increase in aircraft movements resulting in larger noise contours. In 2026 and 2027 there are forecast to be 160 people and 78 dwellings within the 60 – 63 dB contour band, due to the increase in contour area. There are forecast to be no people or dwellings within the 63 dB or higher contour bands.

The quota count total for summer 2025 was 1,413.000, which is less than the limit of 4,665.

There were no movements in 2025 by jet or large propeller aircraft types that do not meet the requirements of Chapter 3 or are only marginally compliant with Chapter 3, in compliance with the restriction on the airport.

Ajan Mohanaranjan
for Bickerdike Allen Partners LLP

Duncan Rogers
Senior Acoustic Consultant

David Charles
Partner

Appendix 4



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LEGEND:

Initial Departure Routes

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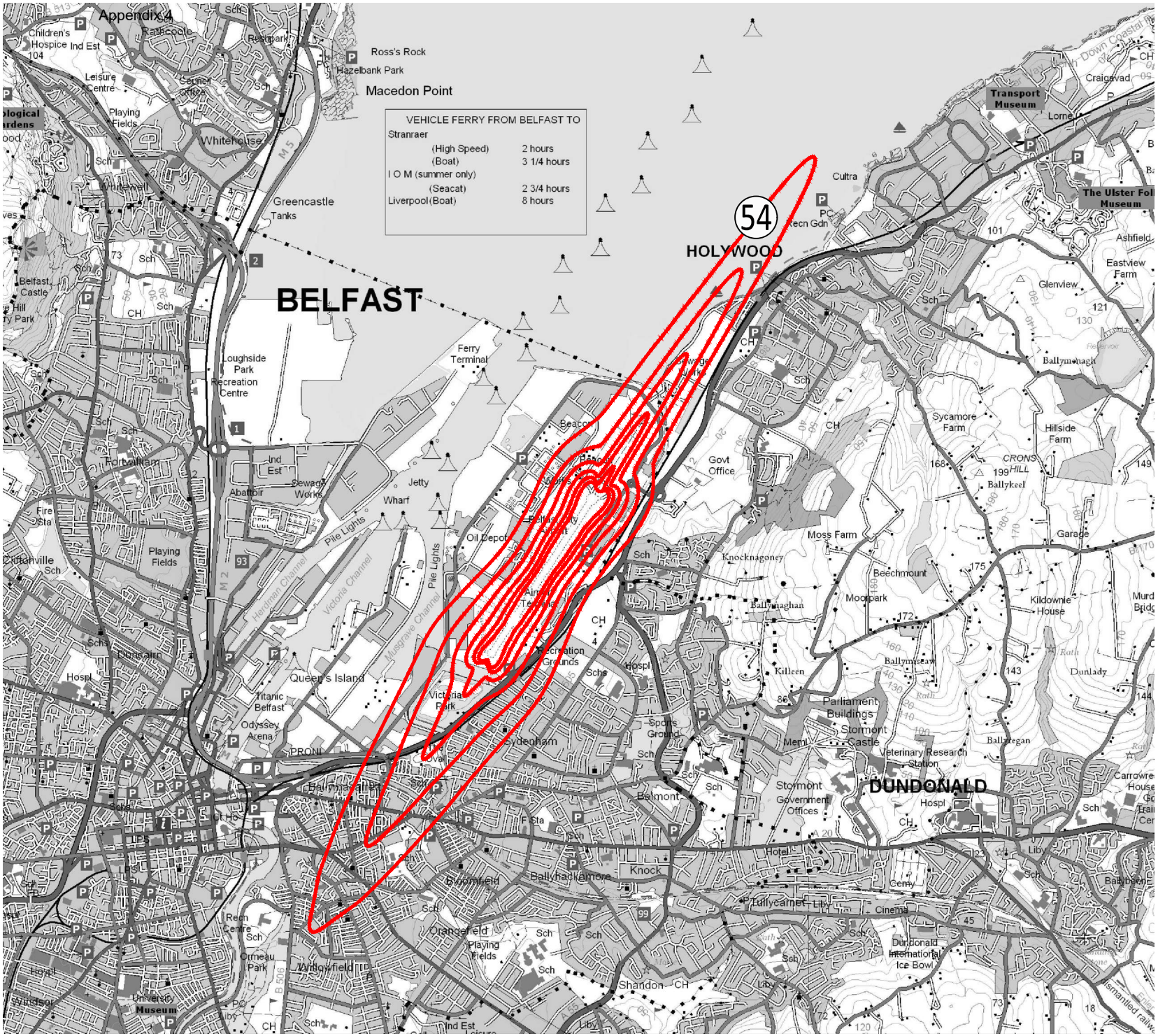
Figure 01
Initial Departure Routes

DRAWN: AM CHECKED: DR

DATE: November 2025 SCALE: 1:125,000@A4

FIGURE No:

A11298_18_DR001_1.0



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LEGEND:

Noise Contours,
54 to 69 dB $L_{Aeq,16h}$ in 3 dB steps

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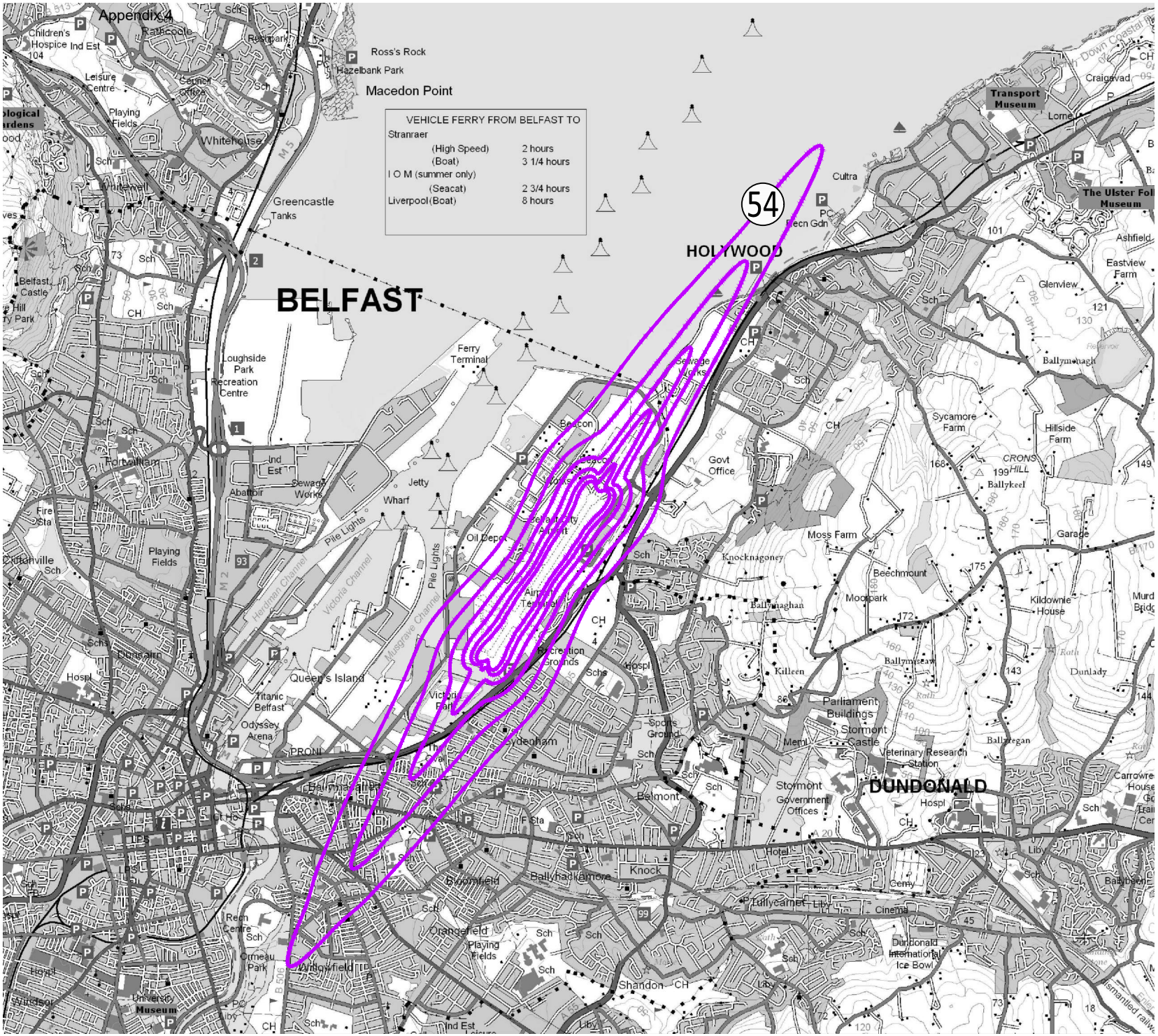
Figure 02
Summer Daytime Noise Contours
2025

DRAWN: AM CHECKED: DR

DATE: November 2025 SCALE: 1:50,000@A4

FIGURE No:

A11298_18_DR002_1.0



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LEGEND:

Noise Contours,
54 to 69 dB $L_{Aeq,16h}$ in 3 dB steps

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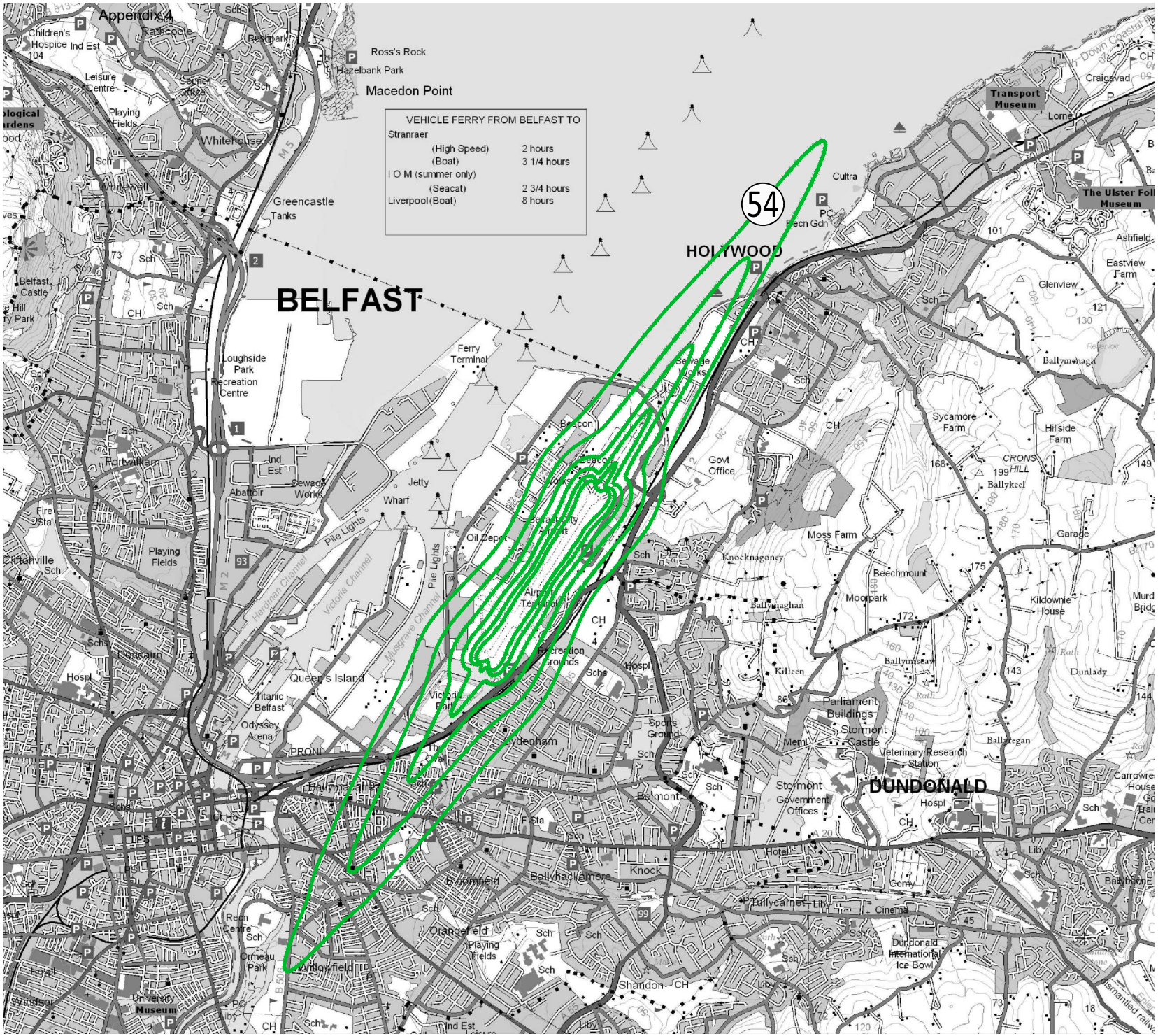
Figure 03
Summer Daytime Noise Contours
2026 Forecast

DRAWN: AM CHECKED: DR

DATE: January 2026 SCALE: 1:50,000@A4

FIGURE No:

A11298_18_DR003_1.0



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LEGEND:

Noise Contours,
54 to 69 dB $L_{Aeq,16h}$ in 3 dB steps

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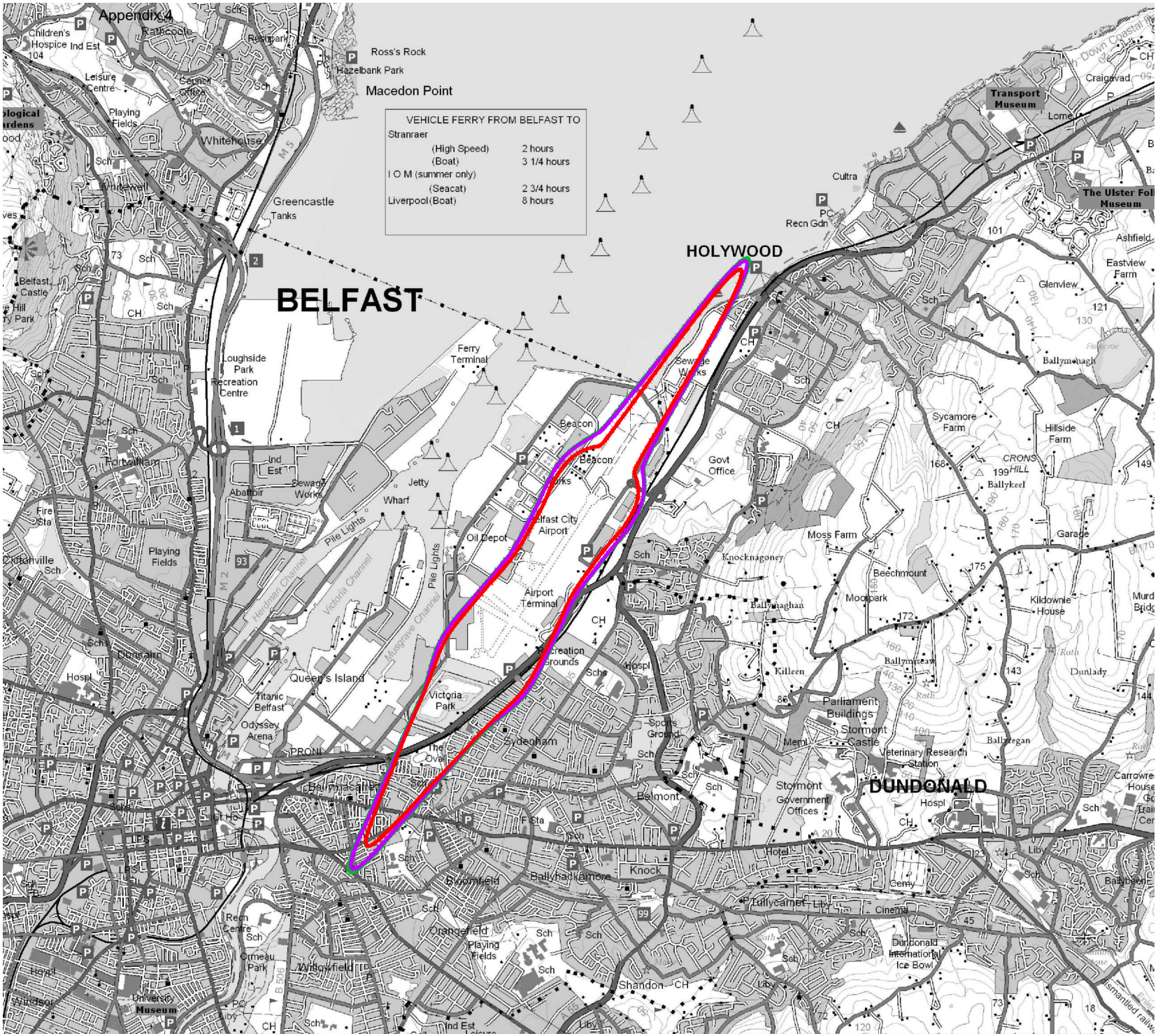
Figure 04
Summer Daytime Noise Contours
2027 Forecast

DRAWN: AM CHECKED: DR

DATE: January 2026 SCALE: 1:50,000@A4

FIGURE No:

A11298_18_DR004_1.0



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LEGEND:

Noise Contours,

- 2025
- 2026
- 2027

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Figure 05
Summer Daytime Noise Contours
2025, 2026 and 2027 57 dB $L_{Aeq,16h}$

DRAWN: AM CHECKED: DR

DATE: January 2026 SCALE: 1:50,000@A4

FIGURE No:

A11298_18_DR005_1.0

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APPENDIX 1
GLOSSARY OF ACOUSTIC TERMINOLOGY

Sound

This is a physical vibration in the air, propagating away from a source, whether heard or not.

The Decibel, dB

The unit used to describe the magnitude of sound is the decibel (dB) and the quantity measured is the sound pressure level. The decibel scale is logarithmic and it ascribes equal values to proportional changes in sound pressure, which is a characteristic of the ear. Use of a logarithmic scale has the added advantage that it compresses the very wide range of sound pressures to which the ear may typically be exposed to a more manageable range of numbers. The threshold of hearing occurs at approximately 0 dB (which corresponds to a reference sound pressure of 2 x 10-5 Pascals) and the threshold of pain is around 120 dB.

The sound energy radiated by a source can also be expressed in decibels. The sound power is a measure of the total sound energy radiated by a source per second, in Watts. The sound power level, L_w is expressed in decibels, referenced to 10-12 Watts.

Frequency, Hz

Frequency is analogous to musical pitch. It depends upon the rate of vibration of the air molecules which transmit the sound and is measure as the number of cycles per second or Hertz (Hz). The human ear is sensitive to sound in the range 20 Hz to 20,000 Hz (20 kHz). For acoustic engineering purposes, the frequency range is normally divided up into discrete bands. The most commonly used bands are octave bands, in which the upper limiting frequency for any band is twice the lower limiting frequency, and one-third octave bands, in which each octave band is divided into three. The bands are described by their centre frequency value and the ranges which are typically used for building acoustics purposes are 63 Hz to 4 kHz (octave bands) and 100 Hz to 3150 Hz (one-third octave bands).

A-Weighting

The sensitivity of the ear is frequency dependent. Sound level meters are fitted with a weighting network which approximates to this response and allows sound levels to be expressed as an overall single figure value, in dB(A).

Effective Perceived Noise Level

Effective Perceived Noise Level (EPNL) is a measure used to express noise levels which analyses the frequency spectra of noise events as well as the duration of sound. The measurement unit for EPNL is EPNdB. This measure is used for the noise certification of aircraft, and the subsequent quota count determination.

Quota Count

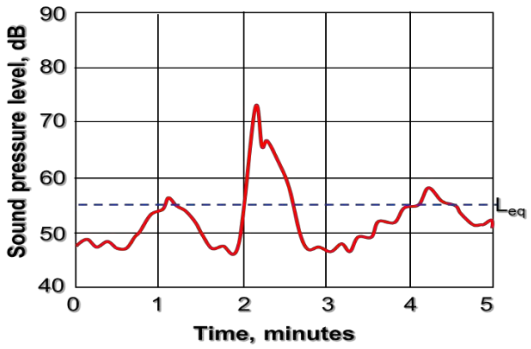
The value assigned to one take-off or to one landing by the aircraft in question, this number being related to its noise classification. The classification is determined from the noise level band in EPNdB, for take-off or landing, as the case may be, for the aircraft in question, as defined in the individual aircraft's noise certificate.

Environmental noise descriptors

Where noise levels vary with time, it is necessary to express the results of a measurement over a period of time in statistical terms. Some commonly used descriptors follow.

$L_{Aeq,T}$ The most widely applicable unit is the equivalent continuous A-weighted sound pressure level (LAeq,T). It is an energy average and is defined as the level of a notional sound which (over a defined period of time, T) would deliver the same A-weighted sound energy as the actual fluctuating sound.

This is shown in the graph below:



Noise Contour

A line which joins points on the ground which receive the same noise exposure from the nearby airborne aircraft; often for daytime studies the exposure is considered over a 16 hour period ($L_{Aeq,16h}$) and for night studies over an 8 hour period (LAeq,8h) with a range of levels used to express the different exposures.

Sound transmission in the open air

Most sources of sound can be characterised as a single point in space. The sound energy radiated is proportional to the surface area of a sphere centred on the point. The area of a sphere is proportional to the square of the radius, so the sound energy is inversely proportional to the square of the radius. This is the inverse square law. In decibel terms, every time the distance from a point source is doubled, the sound pressure level is reduced by 6 dB.

Meteorological effects

Temperature and wind gradients affect noise transmission, especially over large distances. The wind effects range from increasing the level by typically 2 dB downwind, to reducing it by typically 10 dB upwind – or even more in extreme conditions. Temperature and wind gradients are variable and difficult to predict.

Aviation terms

NPR

Noise preferential route – departure flight ground tracks to be followed by aircraft to minimise noise disturbance on the surrounding population.

Dispersion

Due to the effect of the wind, aircraft speed, and pilot choice differing aircraft tracks about the nominal track are flown; this is known as dispersion around a nominal track.

Start of Roll

The position on a runway where aircraft commence their take-off runs.

Threshold

The beginning of that portion of the runway usable for landing.

Radar Vectoring

Aircraft are provided by Air Traffic Control (ATC) with various instructions which result in changes of heading, altitude, and speed. The controller affects safe separation from other traffic by use of radar.

Nominal Tracks

Using recognised international design techniques, tracks across the ground can be delineated for departing and arriving aircraft. These tracks are nominal because they can be influenced by the wind, ATC instructions, the accuracy of navigational systems and the flight characteristics of individual aircraft. In UK it is usual to permit a 1500m swathe to be established about the nominal track for the purposes of assessing whether an aircraft has stayed on track.

Altitude

Height of aircraft above sea level.

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APPENDIX 2
GEORGE BEST BELFAST CITY AIRPORT
2025 NOISE CONTOUR VALIDATION

INTRODUCTION

Summer noise contours have been prepared for George Best Belfast City Airport (GBBCA) for a number of years. This has involved the use of the Federal Aviation Administration (FAA) prediction methodology, the Integrated Noise Model (INM).

The INM software has been used around the world in over 50 countries and consequently is flexible enough to allow local circumstances to be taken into account. This can be achieved by entering specific departure routes, operational profiles, or weather conditions but also by creating or modifying specific noise information for aircraft types.

In order to improve the accuracy of the modelling at GBBCA, validation exercises have been conducted which compare predicted noise levels for individual aircraft movements with noise levels measured at Belfast. This is particularly useful for aircraft types where the INM does not have actual data and so suggests a substitute type.

VALIDATION

The validation exercises use the measured results from the permanent noise monitoring system at GBBCA. Specifically, the results from the Noise Monitoring Terminal (NMT) at Nettlefield Primary School (MP01) and at Kinnegar Army Base (MP02). These NMT locations are approximately 4.5 km from the start of roll location of runway 22 and 3.9 km from the start of roll location of runway 04 respectively. MP02 was relocated on 22nd August 2023 to a new location on the base. A correction factor has therefore been applied to the measured results at this monitor to an allow for the differences between the old and new locations.

Six aircraft types have been selected to be analysed in the validation exercise. These are the Airbus A319ceo, A320ceo and A320neo, the ATR 72, the Embraer E175 and E190. These aircraft types comprised around 92% of the summer period movements in 2025 and were also selected for the 2024 validation exercise. The 2025 validation is based on the results for the period 16th September 2024 to 15th September 2025, which comprise over 15,000 individual aircraft measurements.

The average measured noise levels used for the 2025 validation exercise are given below in Table A2.1 for these aircraft types, where they are compared with the corresponding measured results used for the 2024 validation exercise.

Aircraft Type	Operation	2025 Validation Measured Noise Levels (SEL dB)		2024 Validation Measured Noise Levels (SEL dB)	
		Number	Average[(1)]	Number	Average[(1)]
Airbus A319ceo	Arrival Rwy 04	303	86.5	667	86.3
	Arrival Rwy 22	768	88.6	1,080	87.6
	Departure Rwy 04	286	89.9	505	89.3
	Departure Rwy 22	723	88.5	1,429	88.0
Airbus A320ceo	Arrival Rwy 04	312	86.4	595	86.1
	Arrival Rwy 22	806	88.2	797	87.6
	Departure Rwy 04	325	90.0	395	89.5
	Departure Rwy 22	767	88.1	1,176	87.5
Airbus A320neo	Arrival Rwy 04	123	85.1	231	84.9
	Arrival Rwy 22	326	86.8	322	85.9
	Departure Rwy 04	137	86.1	160	85.2
	Departure Rwy 22	315	84.7	466	84.3
ATR 72	Arrival Rwy 04	1,230	84.3	2,446	84.6
	Arrival Rwy 22	3,095	86.4	3,813	86.2
	Departure Rwy 04	1,244	83.1	1,909	82.1
	Departure Rwy 22	2,690	83.3	5,087	82.7
Embraer E175	Arrival Rwy 04	96	85.7	55	85.6
	Arrival Rwy 22	227	87.3	65	87.3
	Departure Rwy 04	101	90.0	31	89.5
	Departure Rwy 22	210	88.4	100	88.3
Embraer E190	Arrival Rwy 04	156	87.3	373	86.9
	Arrival Rwy 22	402	88.8	568	87.9
	Departure Rwy 04	161	91.4	249	90.4
	Departure Rwy 22	365	89.8	707	89.2

[(1)] Results for Rwy 22 arrivals and Rwy 04 departures include an allowance for the revised location of MP02

Table A2.1: Measured Noise Levels used for Validation in 2025 and 2024

For each aircraft type there are four sets of measured results; arrivals and departures at each of the two monitors. As the monitors are not located symmetrically with regard to the runway the noise levels at each will differ and so they need to be considered separately. For the individual movements within a set there is some variation, so every arrival by an aircraft type does not produce exactly the same noise level. There are a number of factors which contribute to this, in particular the weather conditions.

The spread of results is illustrated in Figures A2.1 to A2.2 below. These show the distribution of measured noise levels from the validation period for the most common operations (Runway 22), arrivals from the north and departures to the south, for the most common aircraft type in the summer period of 2025, the ATR 72.

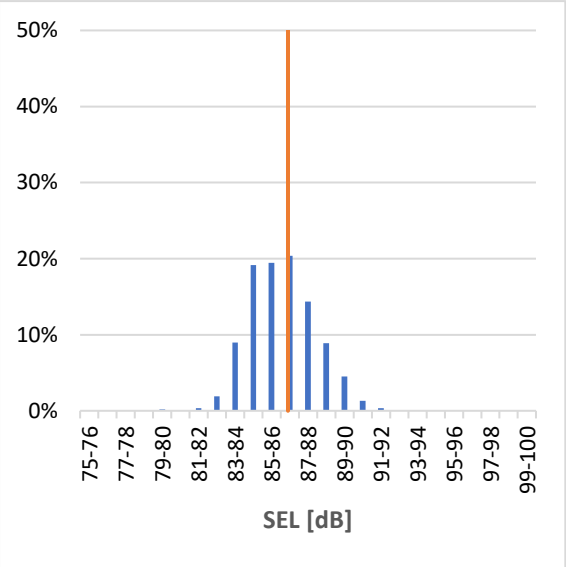


Figure A2.1 – ATR 72 Arrivals

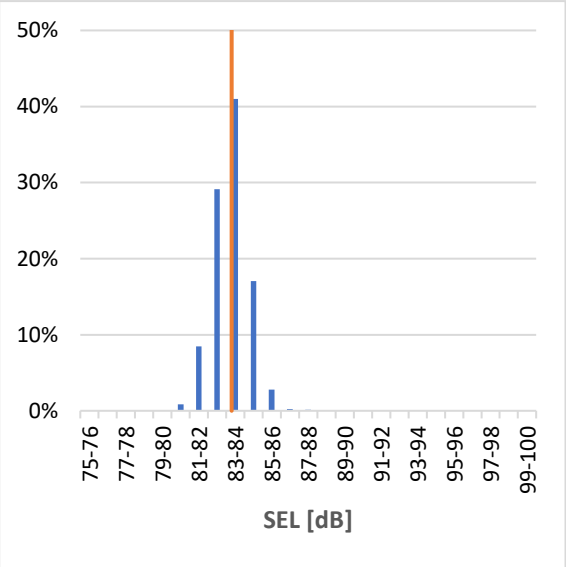


Figure A2.2 – Airbus ATR 72 Departures

The distributions have the large majority of measured noise levels closely grouped together around the averages, shown as a vertical red line on the figures, with a pattern that approximates to a normal distribution with a standard deviation of less than 2 dB. Such distributions of measured noise levels are commonly found at airport fixed noise monitors at a similar distance from the runway. From the distributions of measured noise levels for each of the aircraft types considered, the averages have been determined and compared to INM standard predicted noise levels. Table A2.2 gives the latest measured average noise levels for the six aircraft types considered for validation in 2025.

Aircraft Type	Operation	2025 Validation Measured Noise Levels (SEL dB)		INM Standard Assumptions (SEL dB)	
		Number	Average[1]	Type	Level
Airbus A319ceo	Arrival Rwy 04	303	86.5	A319-131	87.0
	Arrival Rwy 22	768	88.6		88.5
	Departure Rwy 04	286	89.9		87.4
	Departure Rwy 22	723	88.5		87.0
Airbus A320ceo	Arrival Rwy 04	312	86.4	A320-211	87.4
	Arrival Rwy 22	806	88.2		88.8
	Departure Rwy 04	325	90.0		88.9
	Departure Rwy 22	767	88.1		88.2
Airbus A320neo	Arrival Rwy 04	123	85.1	A320-211	87.4
	Arrival Rwy 22	326	86.8		88.8
	Departure Rwy 04	137	86.1		88.9
	Departure Rwy 22	315	84.7		88.2
ATR 72	Arrival Rwy 04	1,230	84.3	DO328	86.3
	Arrival Rwy 22	3,095	86.4		88.2
	Departure Rwy 04	1,244	83.1		81.9
	Departure Rwy 22	2,690	83.3		81.6
Embraer E175	Arrival Rwy 04	96	85.7	EMB175	85.5
	Arrival Rwy 22	227	87.3		86.8
	Departure Rwy 04	101	90.0		87.4
	Departure Rwy 22	210	88.4		87.4
Embraer E190	Arrival Rwy 04	156	87.3	EMB190	86.6
	Arrival Rwy 22	402	88.8		87.8
	Departure Rwy 04	161	91.4		86.6
	Departure Rwy 22	365	89.8		86.0

[1] Results for Rwy 22 arrivals and Rwy 04 departures include an allowance for the revised location of MP02

Table A2.2: Measured and Standard Predicted Noise Levels

Approach to Validation

The general approach to validation modifications has been to only change from the INM standard type when the measured results show clear divergence, i.e. an apparent prediction error in excess of 1.5 dB at a single NMT or an average error of over 1.0 dB across both NMTs. If the type has historically been modified from the standard type, then the approach has been to only change from the previous validation when there is an apparent prediction error or change in measured level in excess of 1.0 dB at a single NMT. Also, the approach seeks to determine any modification by aircraft type and aircraft operation, but not by runway used. This means one modification is adopted for all arrivals by an aircraft type, and one for all departures by an aircraft type.

Comparison of Measured and Predicted Results

The modelled noise levels have been increased for several aircraft types compared to those used for the 2024 contours, due to an increase in measured noise levels. The final validation modifications are summarised below in Table A2.3. These have been used for the 2025, 2026 and 2027 contours.

Aircraft Type	INM Type	Modification to Movements Numbers	
		Arrivals	Departures
Airbus A319ceo	A319-131	A319-131 × 1.0	A319-131 × 1.5
Airbus A320ceo	A320-211	A320-211 × 0.8	A320-211 × 1.0
Airbus A320neo	A320-211	A320-211 × 0.6	A320-211 x 0.4
ATR 72	DO328/DHC6	DO328 × 0.6	DHC6 × 1.4
Embraer E175	EMB175	EMB175 × 1.1	737500 x 1.4
Embraer E190	EMB190	EMB190 × 1.0	EMB190 × 2.5

Table A2.3: 2025 Validation Modifications

The need for modifications for the larger aircraft types in particular is not unexpected as they are available in a range of specifications with different engine types, sometimes from different manufacturers. This means that the actual type operated by the airline may differ to the one in the INM software.

The Airbus A319ceo has been modelled with the standard type but with departures factored up. The Airbus A320ceo, also using the standard type, is factored down on arrival, but unmodified on departure. The Airbus A320neo is a newer quieter version of the A320ceo and is therefore factored down on both arrival and departure.

For the ATR 72, modifications were needed to the INM type as the substitute type it suggests does not agree well with the measured departure results, in addition the movements were factored up. On arrival the substitute type was used, but with movements factored down.

For the Embraer E175, modifications were needed to the INM type as the standard type does not agree well with the measured departure results. On arrival the standard type was used, but with movements factored up.

For the Embraer E190, the standard INM type has been used, but with departures factored up.

Effect of Validation

The effect of the validation exercise on the predicted noise levels for the six aircraft types is detailed in Table A2.4 which gives the differences between the measured noise levels and those predicted after allowing for the validation modifications.

Aircraft Type	Operation	Noise Levels (SEL dB)			
		Measured Average	INM Validated Prediction	Difference Predicted - Measured	Operation Weighted Average Difference
Airbus A319ceo	Arrival Rwy 04	86.5	87.0	+ 0.5	+ 0.1
	Arrival Rwy 22	88.6	88.5	- 0.1	
	Departure Rwy 04	89.9	89.2	- 0.7	0.0
	Departure Rwy 22	88.5	88.8	+ 0.3	
Airbus A320ceo	Arrival Rwy 04	86.4	86.4	0.0	- 0.3
	Arrival Rwy 22	88.2	87.8	- 0.4	
	Departure Rwy 04	90.0	88.9	- 1.1	- 0.2
	Departure Rwy 22	88.1	88.2	+ 0.1	
Airbus A320neo	Arrival Rwy 04	85.1	85.2	+ 0.1	- 0.1
	Arrival Rwy 22	86.8	86.6	- 0.2	
	Departure Rwy 04	86.1	84.9	- 1.2	- 0.7
	Departure Rwy 22	84.7	84.2	- 0.5	
ATR 72	Arrival Rwy 04	84.3	84.1	- 0.2	- 0.3
	Arrival Rwy 22	86.4	86.0	- 0.4	
	Departure Rwy 04	83.1	83.4	+ 0.3	- 0.1
	Departure Rwy 22	83.3	83.1	- 0.2	
Embraer E175	Arrival Rwy 04	85.7	85.9	+ 0.2	0.0
	Arrival Rwy 22	87.3	87.2	- 0.1	
	Departure Rwy 04	90.0	88.9	- 1.1	0.0
	Departure Rwy 22	88.4	88.9	+ 0.5	
Embraer E190	Arrival Rwy 04	87.3	86.6	- 0.7	- 0.9
	Arrival Rwy 22	88.8	87.8	- 1.0	
	Departure Rwy 04	91.4	90.6	- 0.8	- 0.1
	Departure Rwy 22	89.8	90.0	+ 0.2	

Table A2.4: Measured and Validated Predicted Noise Levels

Table A2.4 shows that with the validation modifications there is good correlation between measured and predicted noise levels with differences of less than 1 dB when results from both NMTs are operationally averaged.

The effect of the validation exercises on the contours depends both on the modifications made and the contribution of those aircraft types to the overall noise. Changes to infrequent aircraft types are likely to have very little effect on the contours.

SUMMARY

The validation of noise contours at George Best Belfast City Airport has been continually improved, more recently by checking predictions against the results obtained from GBBCA's noise monitors. This has demonstrated that without validation the standard INM assumptions would be less accurate.

The latest validation has considered six key aircraft types, which were selected based on their number of movements and noise levels. These are the Airbus A319ceo, Airbus A320ceo, Airbus A320neo, ATR 72, Embraer E175 and Embraer E190. The validation exercise has taken into account over 15,000 individual aircraft noise measurements for these types at GBBCA between September 2024 and September 2025.

GBBCA will continue to collect further detailed information from the fixed noise monitors at Nettlefield Primary School and the new location of MP02, which will be used to regularly validate future GBBCA contours. This is in line with the EiP Panel's advice on contour validation.

Appendix 5

AIRPORT OPERATIONAL INSTRUCTION (AOI)

AOI-07

Issue 8.1

Subject:	**Aircraft Engine Ground Running and Use of Auxiliary Power Units and Ground Power Units**
Date of issue:	**05 April 2024**
Authorised by:	DocuSigned by: 14438788A10A4AE... **Michael McDowell, Airfield Operations Manager**

It is the responsibility of all employers to ensure that relevant Airport Operational Instructions (AOIs) and Operational Safety Notices (OSNs) are brought to the attention of their staff. However, individuals remain responsible for their own actions and those who are in doubt should consult their supervisor or manager within their own organisation.

1. Introduction

Belfast City Airport (BCA) is responsible for taking adequate measures to ensure the safety of aircraft, vehicles and persons using the airside environment.

Environmental Policy:
"Through its programme of sustainable development, GBBCA is committed to achieving a balance between the social and economic benefits of the airport's growth and its environmental impacts. We will work with all airport 'stakeholders', including statutory authorities, airlines, business partners and local residents to minimise the impact of our operations on the environment".

2. Distribution and Control

This AOI is published and distributed electronically to organisations involved with the operation of aircraft and supporting services at BCA. The controlled copy is located in the Airport Online Document Library.

Hard copies are not produced by BCA for distribution but may be printed for internal office use. Any hard copies printed by recipients of the electronic distribution are not controlled. Care must be taken to ensure that paper copies are disposed of or fully as required.

Comments or queries relating to the contents of this document should be directed to:

Airfield Operations Manager
Belfast City Airport
Sydenham Bypass
BELFAST
BT3 9JH

Telephone: 028 9093 5006

3. Acronyms

AOI	Airport Operational Instruction
APU	Auxiliary Power Unit
ATC	Air Traffic Control
BCA	Belfast City Airport
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
FEGP	Fixed Electrical Ground Power
FOD	Foreign Object Debris
GPU	Ground Power Unit
OPS	Airfield Operations
OSN	Operational Safety Notice
SMS	Safety Management System

4. Requirements

Aircraft Engine Ground Running

Aircraft engine ground runs are required under certain conditions to enable engineers to certify that an aircraft is "fit for service".

However, engine ground runs cause both significant adverse impact on the environment and create hazards on the apron. They are therefore strictly controlled within the terms of the BCA Environmental Policy, and CAP 642 guidelines.

CAP 642 (Airside Safety Management) advises:
"Engine runs and check starts should be controlled and only carried out with prior approval of the aerodrome operator who should specify the conditions to be applied." This AOI outlines these conditions.

5. Definitions

Engine Ground Run

An engine ground run is defined in **CAP 642 (Airside Safety Management)** as:

"Any engine start-up not followed immediately by the departure of the aircraft concerned."

Person in Charge

The Person in Charge is that ground engineer in contact with the flight deck (usually via headset). This person has full view of the surrounding area and can indicate to the flight deck immediately to cut the engine power in the event of an incident or potential hazard.

Auxiliary Power Units (APU)

Small gas turbines normally mounted in the rear fuselage of most aircraft. They are used to power electrical systems on board, to run air circulation and conditioning systems and to supply bleed air for starting main engines before or during push back.

Mobile Ground Power Units (GPU)

A vehicle capable of supplying power to aircraft parked on the ground usually powered by diesel fuel.

Fixed Electrical Ground Power (FEGP)

Ground based power system which uses grid electricity. An electrical supply cable is plugged into the underside of the aircraft and draws its power from the airport's electricity supply.

6. Hazards

Engine ground runs present an extremely dangerous and complex operation. They carry a high risk of engine ingestion and pose a hazard to ramp personnel and vehicular traffic.

7. General Rules

It must always be ensured that:

- The 'Person in Charge' is in communication with the flight deck (ideally via a headset).
- All the aircraft wheels are chocked (aprons only).
- If on the main apron, the rear of stand roadway has been closed off.

Use of aircraft Auxiliary Power Units (APUs)

Aircraft APUs generate high levels of noise and significant fumes which can cause disturbance to those on nearby aprons, in buildings and in residential areas.

BCA has provided Fixed Electrical Ground Power (FEGP) on Stands 1–10 for the purpose of minimising levels of ambient noise and emissions.

On stands where FEGP is available, it must be used in preference to APUs, where possible.

Airlines and handlers are to ensure that APUs are used for the absolute minimum time necessary to meet operational needs.

APUs are not to be used as a substitute for either FEGP or GPUs.

Use of mobile Ground Power Units (GPUs)

Constantly running mobile GPUs can cause high noise levels on the apron, are an additional obstruction to free movement around a parked aircraft and, if poorly maintained, may deposit oil spillage on the stand.

BCA has provided FEGP on Stands 1–10 for the purpose of minimising levels of ambient noise and emissions.

On stands where FEGP is available, it must be used in preference to GPUs, where possible.

Where there is no alternative to the use of GPUs they should be parked outside the stand (when aircraft parked nose in) and promptly shut down when power is no longer required. The GPU should never be parked over a drain.

When purchasing new GPUs airlines and handling agents are urged to make low working noise levels a prime requirement in the selection process.

8. Approval

Aircraft Engine Ground Running

8.1 Aircraft Parked on Apron Areas (Main Apron & General Aviation Apron)

All engine ground runs shall be subject to the prior approval of Airfield Operations (extension **5027**). Airfield Operations (OPS) will record details electronically for audit purposes.

Requests to carry out engine ground runs must be made no later than 2130 hours' local time.

All engine ground runs are strictly prohibited between 2230 – 0600 hours.

Engine ground runs are permitted on apron areas at "engine idle" setting for short periods of time only. **All other engine runs including high powered runs** require the aircraft to be positioned to the north side of the airfield at "**Sierra"**.

A map illustrating the location of "Sierra" on the north side of the airfield is contained at **Annex A**.

Prior to making a request for permission to carry out an engine ground run the 'Person in Charge' must assess the surrounding area for potential hazards.

The 'Person in Charge' should then seek prior permission to conduct the engine ground run by contacting OPS (extension **5027**) or alternatively by contacting Flight Dispatch on the ground handling frequency. Flight Dispatch staff shall in turn contact OPS.

OPS will advise if the engine ground run is approved.

Once approval has been obtained pilots/engineers must seek permission to start engines from Air Traffic Control (ATC) – Radio contact must be maintained with ATC at all times.

8.2 Aircraft parked on "Sierra" (Airfield north side)

Engine ground runs in this area may be of a higher power.

Engine ground runs in this area are permitted between 0630 – 2130 hours. Pilots/engineers who wish to carry out engine grounds runs on the north side of the airfield between these hours should seek prior permission from OPS (extension **5027**).

Annex B sets out the 'Follow-me' procedure for engineers taxiing aircraft between the apron and Sierra.

8.3 Use of Auxiliary Power Units (APUs)

Use of APUs for aircraft maintenance purposes is strictly prohibited between 2230 – 0600 hours unless there is no alternative power source available (FEGP or GPU).

Should APU use be required outside of permitted hours (0600 hours – 2230 hours), prior approval must be sought from OPS (extension **5027**).

9. Safety

All personnel concerned with engine ground running must be fully conversant with this instruction, which must be complied with at all times.

The 'Person in Charge' of the engine ground run is responsible for ensuring the safety of personnel and equipment in the vicinity of the aircraft.

The use of aircraft strobe lighting is strictly prohibited during engine ground runs.

Consistent with CAA guidance, aircraft strobe lighting should not be displayed for any reason when an aircraft is on the apron or taxiway areas.

Any essential engineering work requiring a strobe light test shall only be carried out when the airport has closed.

9.1 Aircraft Parked on Apron Areas (Main Apron & General Aviation Apron)

The 'Person in Charge' of the engine ground run must ensure that all apron equipment is placed at a safe distance from the aircraft.

The aircraft must be positioned correctly on the stand in such a way that the engine running will not harm persons or cause damage to aircraft, buildings, installations, vehicles or equipment in the vicinity.

On the main apron, the rear of stand road must be closed to safeguard vehicular traffic, before the engine ground run is commenced. This must be undertaken by the airline engineering department or handling agent.

In the event that the closure of the rear of stand road will cause severe disruption to the timely dispatch of other aircraft, OPS may deny approval or request ATC to stop the engine ground run.

If aircraft are parked in a non-standard fashion (e.g. not nose in due to high winds) then all engine ground runs are prohibited on the main apron at this time.

The engine anti-collision beacons must be switched on for the duration of the engine ground run.

The 'Person in Charge' of the engine ground running activities must ensure that all the aircraft wheels are chocked and that the aircraft cannot move under any circumstances.

Engine ground running must not take place and must be ceased when passengers are being embarked/disembarked on any adjacent stands.

The 'Person in Charge' must be in communication with the flight deck at all times during engine ground runs. This will ensure that the engine(s) can be shut down if persons or vehicles move into a dangerous position in front of, behind or in the vicinity of a live engine.

In all instances where aircraft are unserviceable, they should be relocated to a non-contact stand or to the north side of the airfield. Airfield OPS will advise a suitable location.

9.2 Aircraft parked on "Sierra" (Airfield north side)

The aircraft must be positioned in such a way that the engine running will not harm persons or cause damage to aircraft, buildings, installations, vehicles or equipment in the vicinity. The aircraft must also be positioned within the white circle provided.

The "Person in Charge" must ensure that the ground area behind the aircraft is free from loose tarmac, stones and other materials.

The engine anti-collision beacon(s) must be switched on for the duration of the ground run.

The "Person in Charge" must be in communication with the flight deck at all times during engine ground runs. This will ensure that the engine(s) can be shut down if persons or vehicles move into a dangerous position in front of, behind or in the vicinity of a live engine.

NOTE: Where OPS find that the procedures outlined here are not being complied with, or where it is necessary in the interests of safety, they will request ATC, or directly to the 'Person in Charge', to have the engine ground run halted.

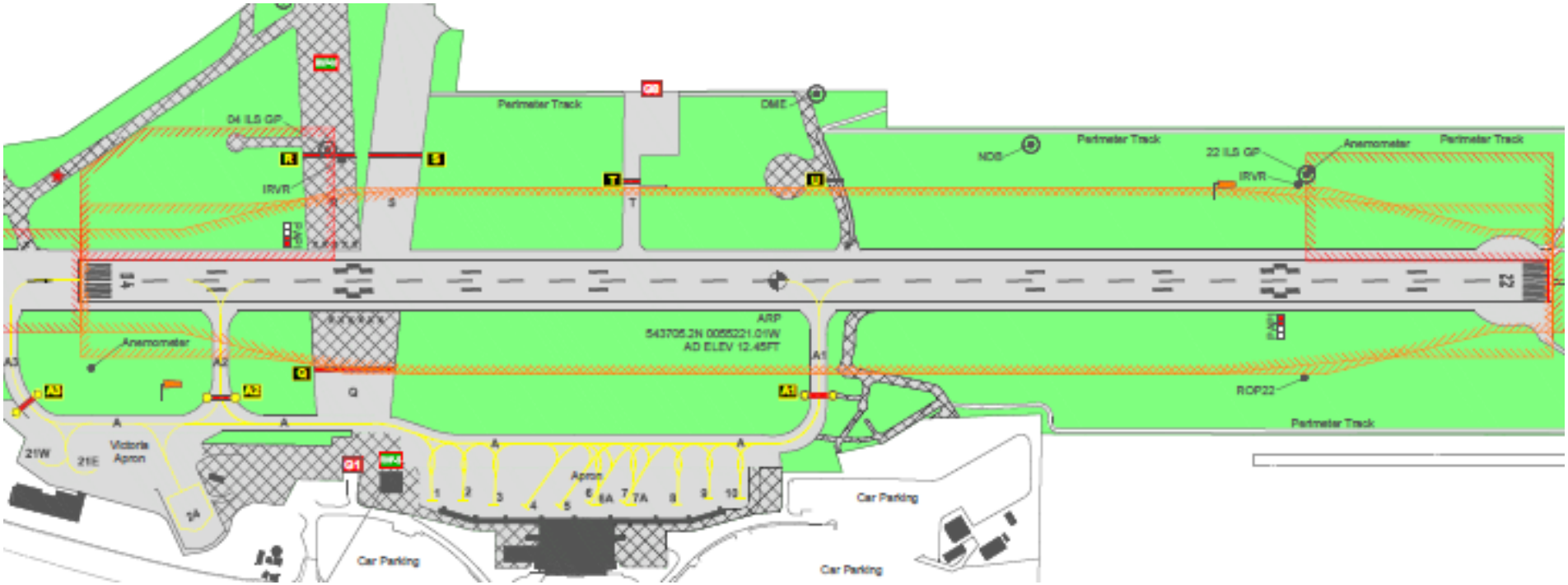
10. Monitoring of Standards

BCA, as the Airport Authority, operates a cautioning mechanism in airside areas.

Where individuals are found to be in breach of regulations, they may be subject to a Written Caution, which shall be formally recorded. This may also involve the issuing of penalty points

Airside Penalty Points will be issued in accordance with **AOI 05 – Airside Safety Regulation Scheme.**

ANNEX A


04 ILS GP
IRVR
Perimeter Track
D/ME
NDB
Perimeter Track
22 ILS GP
Anemometer
Perimeter Track
IRVR
04
22
ARP
543706.2N 0055221.0W
AD ELEV 12.45FT
Anemometer
ROP22
Perimeter Track
21W
21E
Victoria
Apron
Apron
Car Parking
Car Parking
Car Parking

ANNEX B

‘Follow-me’ Procedures	
1.	OPS contact ATC and pass the following information: Aircraft registration, type, current stand, and destination e.g. Sierra.
2.	When pushback clearance is received, OPS pass this on to pushback crew (verbally). OPS then move to the ROSR (to halt vehicle movements) and when in place give ‘thumbs-up’ for the pushback to commence.
3.	When the pushback is complete and all equipment and personnel are clear of the aircraft, the pushback team signal to engineers and OPS. OPS now position their ops vehicle in front of the aircraft (so the vehicle is visible from the cockpit).
4.	When the engineers are ready to taxi they should signal to the ops vehicle with their taxi light.
5.	OPS will now request permission to escort aircraft to destination.
6.	On receiving positive clearance, OPS will illuminate the ‘Follow-me’ sign on top of the Ops vehicle and move off slowly. The aircraft will follow. The engineers must keep a listening watch on the frequency so they are aware of clearance i.e. holding point only, or full clearance to Sierra.
7.	Once both ops vehicle and aircraft are clear of the holding point the ops vehicle will call runway vacated. The airline engineers will self-position the aircraft in the circle provided.
8.	Engineers must follow the safety instructions detailed in AOI-07.
9.	OPS are not required to remain with the engineers during the engine runs.
10.	Engineers should contact OPS by telephone when the engine run is complete.
11.	OPS will position the ops vehicle in front of the aircraft and contact ATC for clearance to cross the runway to the allocated stand.
12.	Once positive clearance has been received the ‘follow-me’ sign will be switched on.
13.	The allocated stand should be checked for FOD and stand guidance activated where appropriate.
14.	Once aircraft is on stand OPS will report taxiway and runway vacated.
Exceptions	
15.	If this procedure is from stand 21 then the aircraft engineer will contact ATC and ask for start-up. Then follow points 4 – 14.
16.	If LVPs are in force, then ATC will refer to AOI-12 and MATS part 2.
17.	Overspeed checks may be carried out on the taxiway at the discretion of ATC.

Appendix 6

Engine runs by Airline for the period: 01-Jan-25 - 31-Dec-2025

	Total	High	Idle
Total	**140**	**20**	**120**
BA	1	0	1
BA CityFlyer	1	0	1
Easyjet	1	0	1
EasyJet	1	0	1
Engineering			
Emerald Airways	135	20	115
Loganair	1	0	1

Date	Registration	Start	Finish	Stand	Power
01-Jan-25	GCMJJ	19:53	19:58	10	Idle
01-Jan-25	GCMJJ	21:00	21:25	Sierra	High
03-Jan-25	GCMMN	06:37	06:41	7a	Idle
05-Jan-25	GCMJJ	14:11	14:17	01	Idle
09-Jan-25	GCMJJ	21:59	22:15	Sierra	Idle
10-Jan-25	GCMJJ	07:02	07:37	Sierra	High
18-Jan-25	GCMJJ	14:40	14:50	Sierra	High
19-Jan-25	GCMMN	07:20	07:30	Sierra	High
25-Jan-25	GCMJM	17:38	17:45	03	Idle
25-Jan-25	GCMJL	19:54	19:59	03	Idle
31-Jan-25	GEUYA	09:20	09:25	04	Idle
12-Feb-25	GCNJJ	21:43	21:47	03	Idle
14-Feb-25	GCMMT	06:33	06:40	01	Idle
19-Feb-25	GCMJL	14:01	14:05	01	Idle
19-Feb-25	GCMJL	14:09	14:13	01	Idle
24-Feb-25	G-CMJL	09:55	10:03	02	Idle
24-Feb-25	G-CMJL	10:13	10:17	02	Idle
24-Feb-25	GCMJL	16:49	16:55	01	Idle
07-Mar-25	GCMJL	14:10	14:17	01	Idle
08-Mar-25	GCMJL	10:55	11:42	21	Idle
08-Mar-25	GCMJL	10:50	11:42	21	Idle
11-Mar-25	GCMJJ	11:35	11:55	Sierra	High
12-Mar-25	GCMMN	07:35	07:40	10	Idle
18-Mar-25	GEJCC	10:59	11:05	05	Idle
20-Mar-25	GCMJM	06:08	06:12	02	Idle
20-Mar-25	GCMJL	11:10	11:15	01	Idle
22-Mar-25	G-CMJJ	14:45	14:57	02	Idle
23-Mar-25	GCMMN	13:53	13:59	10	Idle
23-Mar-25	GCMMN	14:55	15:03	21	Idle
23-Mar-25	GCMMN	15:04	15:18	21	Idle
26-Mar-25	GCMJJ	11:46	11:50	Sierra	High
03-Apr-25	EIGZV	12:10	12:35	Sierra	Idle
03-Apr-25	EIGZV	21:07	21:15	01	Idle
04-Apr-25	EIGZV	08:56	09:33	Sierra	High
04-Apr-25	EI-GZV	11:45	12:19	Sierra	High
05-Apr-25	GCMJM	15:51	16:01	21	Idle
05-Apr-25	GCMJM	17:19	17:34	21	Idle
05-Apr-25	GCMJM	20:40	20:55	21	Idle
08-Apr-25	GCMMN	06:08	06:10	02	Idle

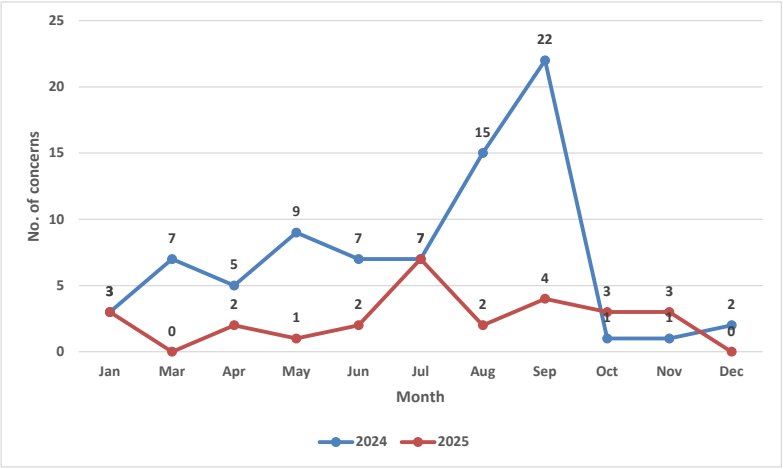
12-Apr-25	GCMJM	20:15	20:20	10	Idle
15-Apr-25	GCMJL	21:27	21:40	03	Idle
15-Apr-25	GCMMN	15:30	15:45	Sierra	High
18-Apr-25	GCMJN	20:55	21:25	Sierra	High
19-Apr-25	GCMJJ	20:20	20:28	Sierra	High
20-Apr-25	GCMJL	06:17	06:22	03	Idle
21-Apr-25	GCMJL	17:46	17:50	10	Idle
21-Apr-25	GCMJL	18:48	18:52	10	Idle
22-Apr-25	GCMJN	13:42	13:54	10	Idle
22-Apr-25	GCMJM	19:04	19:11	09	Idle
22-Apr-25	GCMJM	19:12	19:20	09	Idle
24-Apr-25	GCMJJ	21:10	21:15	02	Idle
03-May-25	GCMJJ	06:40	06:50	Sierra	High
05-May-25	GCMJJ	09:15	09:20	09	Idle
05-May-25	GCMJN	21:25	21:30	02	Idle
09-May-25	GCMJN	22:05	22:10	10	Idle
14-May-25	GCMJJ	07:35	07:40	09	Idle
17-May-25	GCMMT	21:15	21:24	09	Idle
20-May-25	GCMJL	08:24	08:34	24	Idle
20-May-25	GCMJL	08:35	08:45	24	Idle
22-May-25	GCMJM	06:41	06:44	09	Idle
22-May-25	GCMMN	17:29	17:35	09	Idle
25-May-25	GCMJN	06:43	06:45	03	Idle
25-May-25	GCMJJ	21:01	21:05	01	Idle
29-May-25	GCMMT	17:18	17:22	01	Idle
03-Jun-25	GCMMT	13:45	13:55	09	Idle
10-Jun-25	GCMMT	06:50	07:25	7a	Idle
12-Jun-25	GCMJL	14:11	14:20	01	Idle
17-Jun-25	GCMMT	06:10	06:30	Sierra	High
19-Jun-25	GCMMT	21:00	21:05	02	Idle
26-Jun-25	GCMMT	06:30	06:35	09	Idle
27-Jun-25	GCMMN	06:05	06:10	09	Idle
28-Jun-25	GCMJJ	18:51	18:56	09	Idle
03-Jul-25	GCMJM	21:55	22:00	03	Idle
04-Jul-25	GCMJN	20:27	20:30	02	Idle
07-Jul-25	GCMJM	19:41	19:46	10	Idle
09-Jul-25	GCMJJ	17:00	17:05	01	Idle
10-Jul-25	GCMJN	17:51	17:56	Sierra	High
10-Jul-25	GCMJN	21:45	21:55	09	Idle
12-Jul-25	GCMJN	20:37	20:48	21	Idle
23-Jul-25	GCMMN	06:10	06:15	02	Idle
25-Jul-25	GCMJL	13:37	14:00	09	Idle
25-Jul-25	GCMJN	19:36	19:39	02	Idle
25-Jul-25	GCMJN	19:41	19:47	02	Idle
26-Jul-25	GCMJN	19:40	19:48	01	Idle
27-Jul-25	GCMJM	21:24	21:28	02	Idle
29-Jul-25	GCMMN	06:05	06:10	03	Idle
02-Aug-25	GCMJM	07:32	07:35	02	Idle
08-Aug-25	GCMJN	06:30	06:57	Sierra	High
10-Aug-25	GCMJJ	06:15	06:20	03	Idle
11-Aug-25	GCMMN	20:42	20:50	01	Idle
11-Aug-25	GCMMN	20:43	20:51	01	Idle
13-Aug-25	GCMJN	11:15	11:20	10	Idle
15-Aug-25	G-CMJN	16:30	16:35	10	Idle

15-Aug-25	G-CMMN	19:42	20:01	09	Idle
16-Aug-25	GCMMN	12:14	12:30	09	Idle
19-Aug-25	GCMJN	20:22	20:31	09	Idle
19-Aug-25	GCMJN	20:51	20:55	09	Idle
20-Aug-25	G-CMMT	06:15	06:17	02	Idle
20-Aug-25	G-CMJN	07:30	08:30	09	Idle
20-Aug-25	GCMJN	12:40	12:54	Sierra	High
20-Aug-25	GCMJM	19:40	19:55	10	Idle
25-Aug-25	GCMMT	07:00	07:25	01	Idle
30-Aug-25	GCMMN	06:30	06:35	02	Idle
01-Sep-25	GCMMT	12:55	13:00	01	Idle
03-Sep-25	GCMMN	07:57	08:20	Sierra	High
06-Sep-25	GCMJJ	19:59	20:02	10	Idle
06-Sep-25	GCMJM	20:15	20:17	09	Idle
14-Sep-25	GCMFL	21:39	21:45	09	Idle
15-Sep-25	GCMFL	16:35	16:40	09	Idle
18-Sep-25	OE-LKP	12:51	13:02	7a	Idle
20-Sep-25	GCMJN	16:30	16:33	03	Idle
22-Sep-25	GCMFL	16:00	16:10	10	Idle
22-Sep-25	GCMFL	19:53	19:57	10	Idle
23-Sep-25	GCMFL	21:05	21:10	03	Idle
26-Sep-25	GCMJJ	06:20	06:24	10	Idle
27-Sep-25	GCMMN	18:00	18:10	10	Idle
02-Oct-25	GLCYR	14:14	14:16	08	Idle
07-Oct-25	GCMJM	15:49	15:52	09	Idle
11-Oct-25	GCMJJ	13:00	13:05	10	Idle
11-Oct-25	GCMJJ	15:10	15:30	Sierra	High
14-Oct-25	GCMJJ	16:07	16:12	10	Idle
14-Oct-25	GCMJJ	16:06	16:17	10	Idle
18-Oct-25	GCMMN	09:00	09:20	Sierra	High
18-Oct-25	G-CMMN	14:35	14:40	10	Idle
20-Oct-25	GCMMT	15:55	16:18	21	Idle
20-Oct-25	GCMMT	16:39	16:45	21	Idle
21-Oct-25	GCMMT	08:04	08:20	Sierra	High
26-Oct-25	G-CMFL	10:00	10:06	02	Idle
28-Oct-25	GCMJJ	18:35	18:40	09	Idle
01-Nov-25	GCMMT	21:07	21:16	01	Idle
04-Nov-25	GCMMN	08:43	08:50	10	Idle
16-Nov-25	GCMJN	14:35	14:40	03	Idle
18-Nov-25	GCMMN	06:09	06:12	02	Idle
19-Nov-25	GCMMT	15:30	15:36	10	Idle
26-Nov-25	GCMMN	19:25	19:30	01	Idle
26-Nov-25	GCMMN	19:27	19:33	01	Idle
29-Nov-25	EIGPO	20:56	20:59	02	Idle
12-Dec-25	GCMJJ	12:12	12:20	10	Idle
12-Dec-25	GCMJJ	12:47	12:51	10	Idle
15-Dec-25	GLMRE	10:45	10:50	21	Idle

Appendix 7-Noise Concerns Summary 2025

Concerns by Type and Area, 2025																
Area	Bias over City / Flight paths	Low	Noise	Track keeping	After 2130	Disturbed Sleep / Pre-0700 / Early / Weekend	Aircraft Type / Size	Frequency / Too many flights	Ground Noise	Air Quality / Pollution	Specific Aircraft	Other	TOTAL Concerns by Area	% Concerns by Area	TOTAL Individuals logging Concerns By Area	Concern Area by Runway End
Comber / D'adee / Bangor / Dundonald													0	0%	0	Lough
Carnalea / Crawfordsburn													0	0%	0	Lough
Helen's Bay													0	0%	0	Lough
Craigavad													0	0%	0	Lough
Seahill / Cultra / Marino				1									1	4%	1	Lough
Holywood				5									5	18%	2	Lough
Kinnegar													0	0%	0	Lough
Knocknagoney / Old Holywood Road													0	0%	0	Lough
Carrickfergus/Whitehad				1									1	4%	1	Lough
Sydenham / Inverary			1										1	4%	1	City
Ballymacarret													0	0%	0	City
City Centre													0	0%	0	City
Beersbridge / Albertbridge													0	0%	0	City
Newtownards Road / Ballymacarret / Connswater					1								1	4%	1	City
Donegall Road													0	0%	0	City
Ravenhill / Cregagh / Castlereagh													0	0%	0	City
Ormeau / Annadale	1			1									2	7%	2	City
Stranmillis / Malone													0	0%	0	City
Drumbeg / Tullyard													0	0%	0	City
G'wally / C'duff / N'breda / K'breda / Rosetta / Four Winds	3		3										6	21%	4	City
Not Given			3	2	6								11	39%	9	Not given
TOTALS	4	0	7	10	7	0	0	0	0	0	0	0	28	100%	21	
Percent	14%	0%	25%	36%	25%	0%	0%	0%	0%	0%	0%	0%	100%			

Concerns by Month		
	2024	2025
Jan	3	3
Feb	0	1
Mar	7	0
Apr	5	2
May	9	1
Jun	7	2
Jul	7	7
Aug	15	2
Sep	22	4
Oct	1	3
Nov	1	3
Dec	2	0
Total	79	28



Appendix 8 – Calibration Records

Type	Model	Serial No.	Calibration Date	Certificate No.	Lab/On-site Calibration	Notes
Meter	NOR-118	32115	23/01/2024	46524	Lab calibration	In use at NMT1
Pre-amp	GRAS-41AM	97213	23/01/2024	46523	Lab calibration (with 32115)	In use at NMT1
Mic	GRAS-42AS	73645	23/01/2024	46523	Lab calibration (with 32115/97213)	In use at NMT1
Meter	NOR-118	32112	17/01/2023	U42986	Lab calibration	Not in use
Pre-amp	GRAS-41AM	56262	17/01/2023	42985	Lab calibration (with 32112)	Not in use
Mic	GRAS-42AS	69414	17/01/2023	42985	Lab calibration (with 32112/56262)	Not in use
Meter	NOR-118	32117	06/08/2024	48480	Lab calibration	In use at NMT2
Pre-amp	GRAS-41AM	95491	06/08/2024	48479	Lab calibration (with 32117)	In use at NMT2
Mic	GRAS-42AS	73643	06/08/2024	48479	Lab calibration (with 32117/95491)	In use at NMT2
Meter	NOR-118	32059	23/10/2023	U45706	Lab calibration (with 317389/168460	Not in use
Pre-amp	GRAS-41AM	317389	23/10/2023	45705	Lab calibration (with 32059/168460)	Not in use
Mic	GRAS-41AS	168460	23/10/2023	45705	Lab calibration (with 317389/32059	Not in use

Laboratory Location
Campbell Associates Ltd
5b Chelmsford Road Industrial Estate
GREAT DUNMOW, Essex, GB-CM6 1HD
Phone 01371 871030

Certificate of Calibration

Certificate number: **42985**

Test Object: **Measurement Microphone**

Producer: **GRAS**
Type: **41AS**
Serial number: **69414**
Customer: **Belfast City Airport**
Address: **George Best Belfast City Airport, Sydenham Bypass, Belfast. BT3 9JH.**
Contact Person: [redacted]
Order No: **POR013276**

Measurement Results	Sensitivity (dB re 1V/Pa)	Sensitivity (mV/Pa)	Capacitance (pF)
Measurement 1	*-27.69*	*41.24*	*21.75*
Measurement 2	*-27.70*	*41.20*	*21.79*
Measurement 3	*-27.71*	*41.16*	*21.79*
Result (Average):	***-27.70***	***41.20***	***21.78***
Expanded Uncertainty:	0.10		1.00
Degree of Freedom:	>100		>100
Coverage Factor:	2		2

The stated sensitivity is the pressure sensitivity at 250Hz, S_{250}, and is valid at reference conditions. The following correction factors have been applied during the measurement:
Pressure:0 dB/kPa Temperature:0 dB/°C Humidity:0 dB/%RH

Conditions	*Pressure kPa*	*Temperature °C*	*Humidty %RH*
Reference conditions	101.325	23	50
Measurement conditions	98.253 ± 0.042	22.9 ± 0.2	31.6 ± 1.3

The calibration test report shown on the next page gives details of the response at other frequencies relative to this 250 Hz reference sensitivity. Results ≥100 Hz are obtained using an electrostatic actuator as described in BS EN 61094-6 and those below 100 Hz are obtained in a reference pressure chamber. Detailed results are available from the calibration laboratory upon request.

The reported expanded uncertainty of measurements is based on a standard uncertainty multiplied by the coverage factor of k=2, providing a coverage probability of approximately 95%. Where the degrees of freedom are insufficient to maintain this confidence level, the coverage factor is increased to maintain this confidence level.

Calibration Dates:

Received date:	03/01/2023	Reviewed date:	19/01/2023
Calibration date:	17/01/2023	Issued date:	19/01/2023

Technicians: (Electronic certificate)

Calibrated by: [redacted]
Reviewed by: [redacted]

This certificate is issued in accordance with the CA Quality Management system. It provides traceability of measurement to recognized national standards, and to the units of measurement realized at the National Physical Laboratory or other recognized national standards laboratories. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

Certificate of Calibration

Continuation of Certificate number: 42985

Reference Calibrator: WSC1 (A) - Nor1253-24269
Measurement Record: K:\C A\Calibration\Nor-1504\Nor-1017 MicCal\GRAS41AS_69414_M1.nmf

Preconditioning
The equipment was preconditioned for more than 12 hours at the specified calibration temperature and humidity.

Instruments and Program
A complete list of instruments, hardware and software that have been used for this calibration is available from the calibration laboratory

Traceability
The measured values for sound pressure, frequency, voltage, capacitance, temperature, humidity and ambient pressure are traceable to an accredited national physical laboratory.

Observations
The differences between the two results at 100 Hz are within normal limits bearing in mind the different test methods and are taken into account in arriving at the uncertainties of measurement.

Method of Calibration
The open circuit sensitivity of the microphone has been determined at 250 Hz against a reference laboratory standard measurement microphone by insert voltage techniques using a laboratory standard sound calibrator as a transfer standard. The electrostatic actuator frequency response was then obtained for frequencies above 100 Hz as described in BS EN IEC 61094-6. In addition, where requested the optional free field frequency response over the range 2 – 100 Hz has been obtained using a pressure chamber; in this case the reference frequency is 100 Hz. All of these results and their associated uncertainties are detailed in the table on page 3 of this certificate. See the observations field below for details of any discrepancies between the 100 Hz results obtained via the electrostatic actuator and pressure chamber.

The overall uncertainty at any frequency σCombined,Fn may be obtained by combining the uncertainty of the open circuit sensitivity σS250 with the uncertainty of the actuator / or LF pressure response at any other frequency σAct,Fn where Fn is the uncertainty at the frequency of interest using the relationship:

$$\sigma_{Combined,Fn} = 2\sqrt{(\sigma^2_{S250} + \sigma^2_{ActFn})}$$

Appendix to this certificate
Where data is available from the microphone manufacturer to correct the actuator / pressure frequency response to obtain the random incidence and / or free field response it is shown in the appendix to this certificate. The uncertainty information relating to these corrections is the responsibility of the microphone manufacturer and when it is available the total uncertainty for the corrected frequency response at each point may then be obtained by including the correction uncertainty in the root-sum-square formula given above. These responses are outside the UKAS accredited scope, but are provided for information.

Observations

Continuation of Certificate number: **42985**

Numerical Results for Relative Frequency Response

Actuator Results					
Freq	Actuator	Uncert.	Freq	Actuator	Uncert.
Hz	dB re 250 Hz	dB	Hz	dB re 250 Hz	dB
100.0	0.02	0.21	5,010.70	-2.26	0.24
112.2	0.02	0.21	5,622.00	-2.66	0.24
125.9	0.02	0.21	6,307.90	-3.11	0.24
141.3	0.02	0.21	7,077.50	-3.71	0.24
158.5	0.01	0.21	7,940.90	-4.29	0.24
177.9	0.01	0.21	8,909.70	-5.01	0.48
199.6	0.01	0.21	9,996.70	-5.82	0.48
223.9	0.00	0.21	11,216	-6.83	0.48
251.2	Ref	0.21	12,585	-7.50	0.48
281.9	-0.01	0.21	14,120	-8.31	0.48
316.3	0.00	0.21	15,843	-8.96	0.48
354.9	-0.01	0.21	17,775	-9.77	0.70
398.2	-0.02	0.21	19,944	-10.90	0.70
446.7	-0.03	0.21	22377		0.90
501.2	-0.04	0.21	25107		0.90
562.4	-0.05	0.21	28170		0.90
631.0	-0.06	0.21	31607		0.90
708.0	-0.07	0.21	35463		0.90
794.4	-0.09	0.21	39790		0.90
891.3	-0.11	0.21	44644		0.90
1000.0	-0.14	0.21	50091		0.90
1122.0	-0.17	0.21	56202		1.20
1258.9	-0.20	0.21	63058		1.20
1412.5	-0.25	0.21	70752		1.20
1584.8	-0.31	0.21	79383		1.20
1778.1	-0.38	0.21	89068		1.20
1995.1	-0.47	0.21	99934		1.20
2238.5	-0.58	0.21	112126		-
2511.6	-0.71	0.21	125806		-
2818.0	-0.87	0.21	141154		-
3161.8	-1.06	0.21	158375		-
3547.5	-1.29	0.21	177696		-
3980.3	-1.56	0.21	199375		-
4465.9	-1.90	0.24	-		-

Low Frequency		
Freq	dB re 100 Hz	Uncert.
Hz		dB
2.0		0.7
2.2		0.7
2.5		0.7
2.8		0.7
3.2		0.7
3.6		0.7
4.0		0.7
4.5		0.7
5.0		0.7
5.6		0.7
6.3		0.7
7.1		0.7
8.0		0.7
8.9		0.7
10.0		0.7
11.2		0.7
12.6		0.7
14.1		0.7
15.9		0.7
17.8		0.7
20.0		0.7
22.4		0.7
25.1		0.7
28.2		0.7
31.6		0.7
35.5		0.7
39.8		0.7
44.7		0.7
50.1		0.7
56.3		0.7
63.1		0.7
70.8		0.7
79.5		0.7
89.2		0.7
100.0	Ref	0.7

Continuation of Certificate number: 42985

Appendix to certificate (not accredited). Random and Free Field Corrected Data

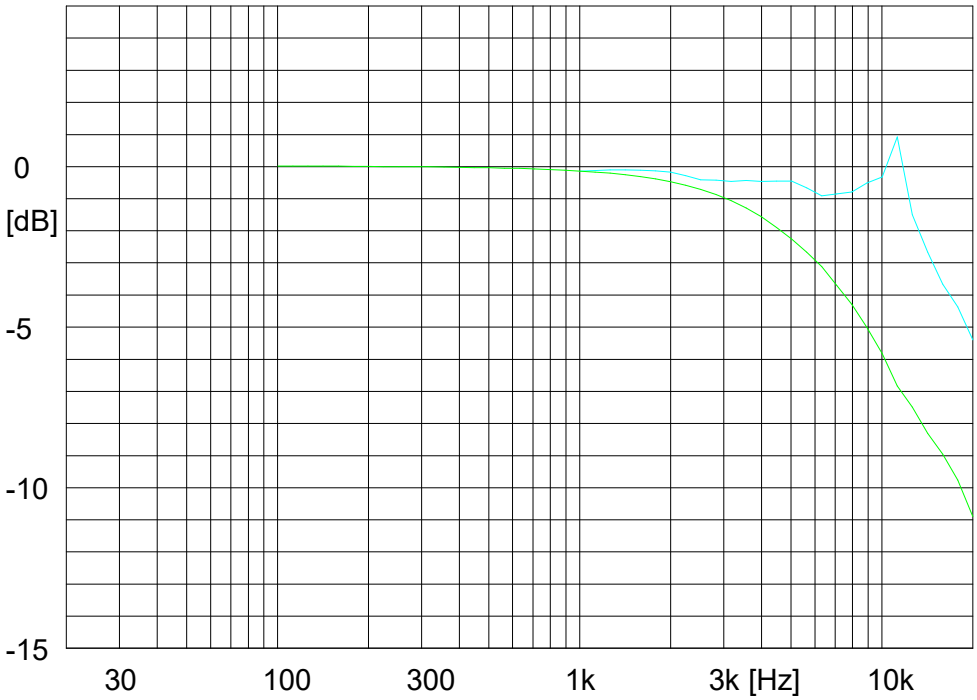
Corrected results, dB re 250 Hz					
Freq Hz	Random incidence corrected	Free field corrected	Freq Hz	Random incidence corrected	Free field corrected
100	0.02	0.02	5,010.70	-2.26	-0.46
112.2	0.02	0.02	5,622.00	-2.66	-0.66
125.9	0.02	0.02	6,307.90	-3.11	-0.91
141.3	0.02	0.02	7,077.50	-3.71	-0.86
158.5	0.01	0.01	7,940.90	-4.29	-0.79
177.9	0.01	0.01	8,909.70	-5.01	-0.51
199.6	0.01	0.01	9,996.70	-5.82	-0.32
223.9	0.00	0.00	11,216	-6.83	0.92
251.2	0.00	0.00	12,585	-7.50	-1.50
281.9	-0.01	-0.01	14,120	-8.31	-2.66
316.3	0.00	0.00	15,843	-8.96	-3.66
354.9	-0.01	-0.01	17,775	-9.77	-4.37
398.2	-0.02	-0.02	19,944	-10.90	-5.40
446.7	-0.03	-0.03	22,377		
501.2	-0.04	-0.04	25,107		
562.4	-0.05	-0.05	28,170		
631	-0.06	-0.06	31,607		
708	-0.07	-0.07	35,463		
794.4	-0.09	-0.09	39,790		
891.3	-0.11	-0.11	44,644		
1,000.00	-0.14	-0.14	50,091		
1,122.00	-0.17	-0.12	56,202		
1,258.90	-0.20	-0.10	63,058		
1,412.50	-0.25	-0.10	70,752		
1,584.80	-0.31	-0.11	79,383		
1,778.10	-0.38	-0.13	89,068		
1,995.10	-0.47	-0.17	99,934		
2,238.50	-0.58	-0.28	112,126		
2,511.60	-0.71	-0.41	125,806		
2,818.00	-0.87	-0.42	141,154		
3,161.80	-1.06	-0.46	158,375		
3,547.50	-1.29	-0.44	177,696		
3,980.30	-1.56	-0.46	199,375		
4,465.90	-1.90	-0.45	-		

The corrections used to produce these random and free field responses are published by the manufacturer and they are responsible for the accuracy of the data and for the associated uncertainties to be applied. Campbell Associates Limited use their best endeavours to ensure the accuracy of this data but are not responsible for any errors, omissions or for ensuring that the data is of the current issue.

If the actuator response was not measured for any frequency, then the corresponding cell in the above table will be blank; similarly, if correction data is not available from the manufacturer the cell will also be blank.
Correction data for frequencies below 100 Hz are not required

** End of Table Section **

Microphone Calibration Certificate



GRAS
Type: 41AS

Serial no: 69414

Sensitivity: 41.20 mV/Pa
-27.70 ±0.10 dB re. 1 V/Pa
Capacitance: 21.8 ±1.0 pF
Date: 17/01/2023

Signature:

Measurement conditions:

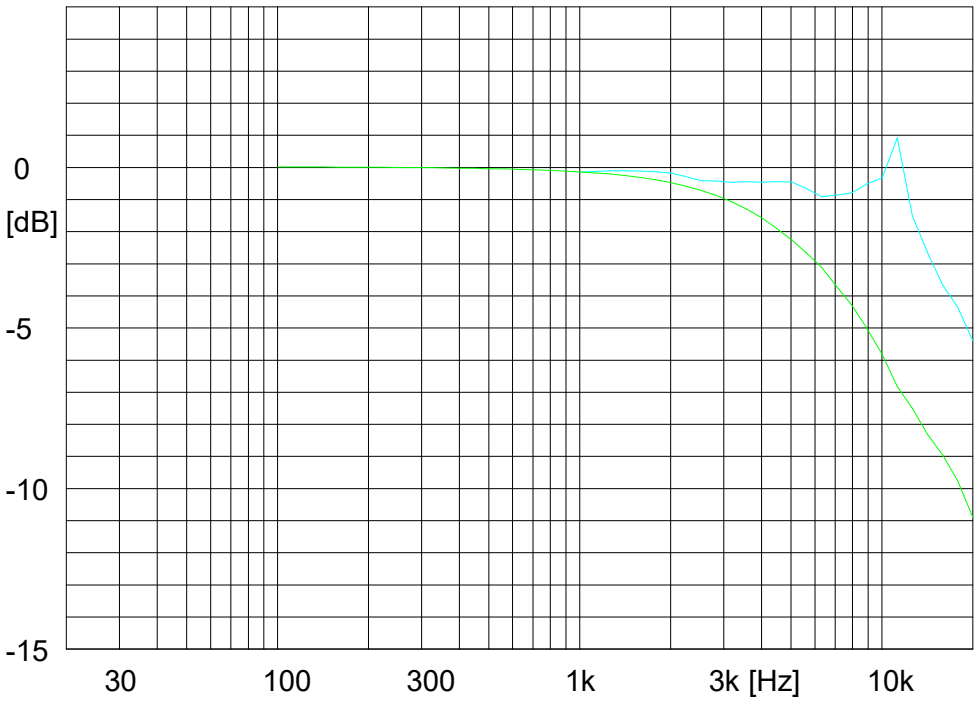
Polarisation voltage:	200.0 V
Pressure:	98.25 ±0.04 kPa
Temperature:	22.9 ±0.2 °C
Relative humidity:	31.6 ±1.3 %RH

Results are normalized to the reference conditions.

Free field response
Pressure (Actuator) response

Campbell Associates
www.campbell-associates.co.uk

Microphone Calibration Certificate



GRAS
Type: 41AS

Serial no: 69414

Sensitivity: 41.20 mV/Pa
-27.70 ±0.10 dB re. 1 V/Pa
Capacitance: 21.8 ±1.0 pF
Date: 17/01/2023

Signature:

Measurement conditions:

Polarisation voltage:	200.0 V
Pressure:	98.25 ±0.04 kPa
Temperature:	22.9 ±0.2 °C
Relative humidity:	31.6 ±1.3 %RH

Results are normalized to the reference conditions.

Free field response
Pressure (Actuator) response

Campbell Associates
www.campbell-associates.co.uk

Comment:

Laboratory Location
Campbell Associates Ltd
5b Chelmsford Road Industrial Estate
GREAT DUNMOW, Essex, GB-CM6 1HD
Phone 01371 871030

Certificate of Calibration

Certificate number: **48479**

Test Object: **Measurement Microphone**

Producer: **GRAS**
Type: **41AS**
Serial number: **73643**
Customer: **Belfast City Airport**
Address: **Airport Road, Belfast,**
Co. Antrim, Northern Ireland. BT3 9JH.
Contact Person: [redacted]
Order No:

Measurement Results	Sensitivity (dB re 1V/Pa)	Sensitivity (mV/Pa)	Capacitance (pF)
Measurement 1	*-27.23*	*43.49*	*21.02*
Measurement 2	*-27.23*	*43.51*	*21.08*
Measurement 3	*-27.23*	*43.49*	*21.08*
Result (Average):	***-27.23***	***43.50***	***21.06***
Expanded Uncertainty:	0.10		2.00
Degree of Freedom:	>100		>100
Coverage Factor:	2		2

The stated sensitivity is the pressure sensitivity at 250Hz, S_{250}, and is valid at reference conditions. The following correction factors have been applied during the measurement:

Pressure:0 dB/kPa Temperature:0 dB/°C Humidity:0 dB/%RH

Conditions	*Pressure kPa*	*Temperature °C*	*Humidty %RH*
Reference conditions	101.325	23	50
Measurement conditions	100.292 ± 0.042	22.0 ± 0.1	61.5 ± 2.2

The calibration test report shown on the next page gives details of the response at other frequencies relative to this 250 Hz reference sensitivity. Results ≥100 Hz are obtained using an electrostatic actuator as described in BS EN 61094-6 and those below 100 Hz are obtained in a reference pressure chamber. Detailed results are available from the calibration laboratory upon request.

The reported expanded uncertainty of measurements is based on a standard uncertainty multiplied by the coverage factor of k=2, providing a coverage probability of approximately 95%. Where the degrees of freedom are insufficient to maintain this confidence level, the coverage factor is increased to maintain this confidence level.

Calibration Dates:

Received date:	02/08/2024	Reviewed date:	06/08/2024
Calibration date:	06/08/2024	Issued date:	06/08/2024

Technicians: (Electronic certificate)

Calibrated by: [redacted]
Reviewed by: [redacted]

This certificate is issued in accordance with the CA Quality Management system. It provides traceability of measurement to recognized national standards, and to the units of measurement realized at the National Physical Laboratory or other recognized national standards laboratories. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

Certificate of Calibration

Continuation of Certificate number: 48479

Reference Calibrator: WSC9 (C) - Nor-1253.21816
Measurement Record: K:\C A\Calibration\Nor-1504\Nor-1017 MicCal\GRAS41AS_73643_M1.nmf

Preconditioning

The equipment was preconditioned for more than 12 hours at the specified calibration temperature and humidity.

Instruments and Program

A complete list of instruments, hardware and software that have been used for this calibration is available from the calibration laboratory

Traceability

The measured values for sound pressure, frequency, voltage, capacitance, temperature, humidity and ambient pressure are traceable to an accredited national physical laboratory.

Observations

The differences between the two results at 100 Hz are within normal limits bearing in mind the different test methods and are taken into account in arriving at the uncertainties of measurement.

Method of Calibration

The open circuit sensitivity of the microphone has been determined at 250 Hz against a reference laboratory standard measurement microphone by insert voltage techniques using a laboratory standard sound calibrator as a transfer standard. The electrostatic actuator frequency response was then obtained for frequencies above 100 Hz as described in BS EN IEC 61094-6. In addition, where requested the optional free field frequency response over the range 2 – 100 Hz has been obtained using a pressure chamber; in this case the reference frequency is 100 Hz. All of these results and their associated uncertainties are detailed in the table on page 3 of this certificate. See the observations field below for details of any discrepancies between the 100 Hz results obtained via the electrostatic actuator and pressure chamber.

The overall uncertainty at any frequency Combined,Fn may be obtained by combining the uncertainty of the open circuit sensitivity S250 with the uncertainty of the actuator / or LF pressure response at any other frequency Act,Fn where Fn is the uncertainty at the frequency of interest using the relationship:

$$\text{Combined,Fn} = 2\sqrt{(2S250 + 2\text{ActFn}}\ )$$

Appendix to this certificate

Where data is available from the microphone manufacturer to correct the actuator / pressure frequency response to obtain the random incidence and / or free field response it is shown in the appendix to this certificate. The uncertainty information relating to these corrections is the responsibility of the microphone manufacturer and when it is available the total uncertainty for the corrected frequency response at each point may then be obtained by including the correction uncertainty in the root-sum-square formula given above. These responses are outside the UKAS accredited scope, but are provided for information.

Observations

Certificate of Calibration

Continuation of Certificate number: 48479

Numerical Results for Relative Frequency Response

Actuator Results					
Freq	Actuator	Uncert.	Freq	Actuator	Uncert.
Hz	dB re 250 Hz	dB	Hz	dB re 250 Hz	dB
100.0	0.01	0.21	5,010.70	-2.24	0.24
112.2	0.01	0.21	5,622.00	-2.63	0.24
125.9	0.01	0.21	6,307.90	-3.06	0.24
141.3	0.00	0.21	7,077.50	-3.54	0.24
158.5	0.00	0.21	7,940.90	-4.08	0.24
177.9	0.00	0.21	8,909.70	-4.71	0.48
199.6	0.00	0.21	9,996.70	-5.45	0.48
223.9	-0.01	0.21	11,216	-6.13	0.48
251.2	Ref	0.21	12,585	-6.70	0.48
281.9	-0.02	0.21	14,120	-7.29	0.48
316.3	-0.02	0.21	15,843	-7.83	0.48
354.9	-0.03	0.21	17,775	-8.47	0.70
398.2	-0.03	0.21	19,944	-9.46	0.70
446.7	-0.04	0.21	22377		0.90
501.2	-0.05	0.21	25107		0.90
562.4	-0.06	0.21	28170		0.90
631.0	-0.07	0.21	31607		0.90
708.0	-0.09	0.21	35463		0.90
794.4	-0.10	0.21	39790		0.90
891.3	-0.13	0.21	44644		0.90
1000.0	-0.15	0.21	50091		0.90
1122.0	-0.19	0.21	56202		1.20
1258.9	-0.23	0.21	63058		1.20
1412.5	-0.27	0.21	70752		1.20
1584.8	-0.33	0.21	79383		1.20
1778.1	-0.41	0.21	89068		1.20
1995.1	-0.49	0.21	99934		1.20
2238.5	-0.61	0.21	112126		-
2511.6	-0.74	0.21	125806		-
2818.0	-0.89	0.21	141154		-
3161.8	-1.08	0.21	158375		-
3547.5	-1.30	0.21	177696		-
3980.3	-1.57	0.21	199375		-
4465.9	-1.87	0.24	-		-

Low Frequency		
Freq	dB re 100 Hz	Uncert.
Hz		dB
2.0		0.7
2.2		0.7
2.5		0.7
2.8		0.7
3.2		0.7
3.6		0.7
4.0		0.7
4.5		0.7
5.0		0.7
5.6		0.7
6.3		0.7
7.1		0.7
8.0		0.7
8.9		0.7
10.0		0.7
11.2		0.7
12.6		0.7
14.1		0.7
15.9		0.7
17.8		0.7
20.0		0.7
22.4		0.7
25.1		0.7
28.2		0.7
31.6		0.7
35.5		0.7
39.8		0.7
44.7		0.7
50.1		0.7
56.3		0.7
63.1		0.7
70.8		0.7
79.5		0.7
89.2		0.7
100.0	Ref	0.7

Certificate of Calibration

Continuation of Certificate number: 48479

Appendix to certificate (not accredited). Random and Free Field Corrected Data

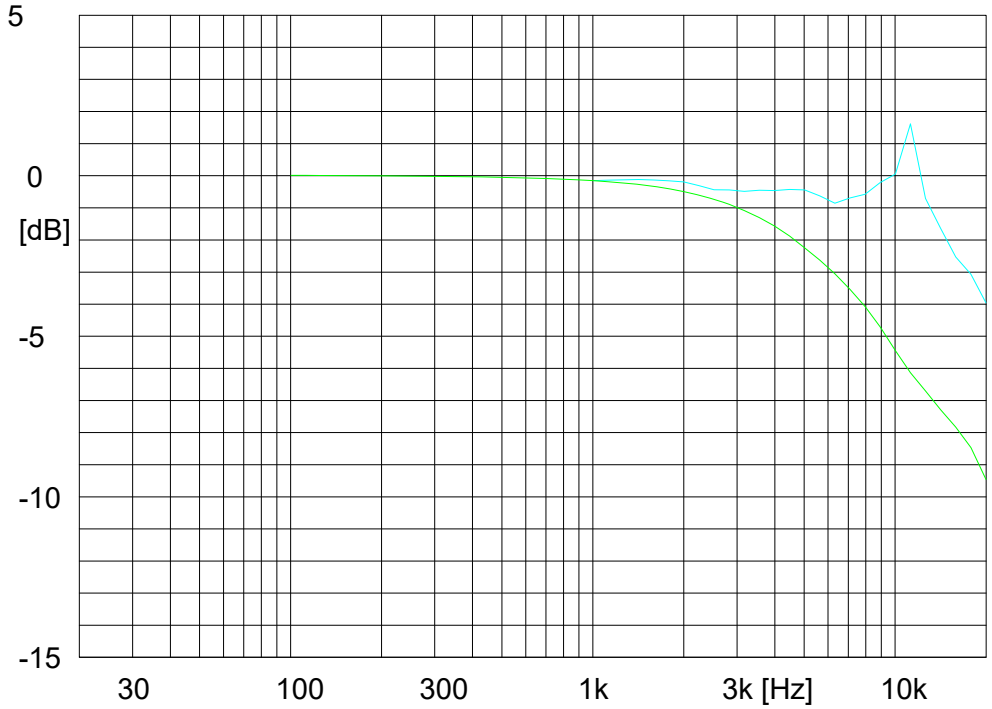
Corrected results, dB re 250 Hz					
Freq Hz	Random incidence corrected	Free field corrected	Freq Hz	Random incidence corrected	Free field corrected
100	0.01	0.01	5,010.70	-2.24	-0.44
112.2	0.01	0.01	5,622.00	-2.63	-0.63
125.9	0.01	0.01	6,307.90	-3.06	-0.86
141.3	0.00	0.00	7,077.50	-3.54	-0.69
158.5	0.00	0.00	7,940.90	-4.08	-0.58
177.9	0.00	0.00	8,909.70	-4.71	-0.21
199.6	0.00	0.00	9,996.70	-5.45	0.05
223.9	-0.01	-0.01	11,216	-6.13	1.62
251.2	-0.01	-0.01	12,585	-6.70	-0.70
281.9	-0.02	-0.02	14,120	-7.29	-1.64
316.3	-0.02	-0.02	15,843	-7.83	-2.53
354.9	-0.03	-0.03	17,775	-8.47	-3.07
398.2	-0.03	-0.03	19,944	-9.46	-3.96
446.7	-0.04	-0.04	22,377		
501.2	-0.05	-0.05	25,107		
562.4	-0.06	-0.06	28,170		
631	-0.07	-0.07	31,607		
708	-0.09	-0.09	35,463		
794.4	-0.10	-0.10	39,790		
891.3	-0.13	-0.13	44,644		
1,000.00	-0.15	-0.15	50,091		
1,122.00	-0.19	-0.14	56,202		
1,258.90	-0.23	-0.13	63,058		
1,412.50	-0.27	-0.12	70,752		
1,584.80	-0.33	-0.13	79,383		
1,778.10	-0.41	-0.16	89,068		
1,995.10	-0.49	-0.19	99,934		
2,238.50	-0.61	-0.31	112,126		
2,511.60	-0.74	-0.44	125,806		
2,818.00	-0.89	-0.44	141,154		
3,161.80	-1.08	-0.48	158,375		
3,547.50	-1.30	-0.45	177,696		
3,980.30	-1.57	-0.47	199,375		
4,465.90	-1.87	-0.42	-		

The corrections used to produce these random and free field responses are published by the manufacturer and they are responsible for the accuracy of the data and for the associated uncertainties to be applied. Campbell Associates Limited use their best endeavours to ensure the accuracy of this data but are not responsible for any errors, omissions or for ensuring that the data is of the current issue.

If the actuator response was not measured for any frequency, then the corresponding cell in the above table will be blank; similarly, if correction data is not available from the manufacturer the cell will also be blank.
Correction data for frequencies below 100 Hz are not required

** End of Table Section **

Microphone Calibration Certificate



GRAS
Type: 41AS

Serial no: 73643

Sensitivity: 43.50 mV/Pa
-27.23 ±0.10 dB re. 1 V/Pa
Capacitance: 21.1 ±2.0 pF
Date: 06/08/2024

Signature:

Measurement conditions:

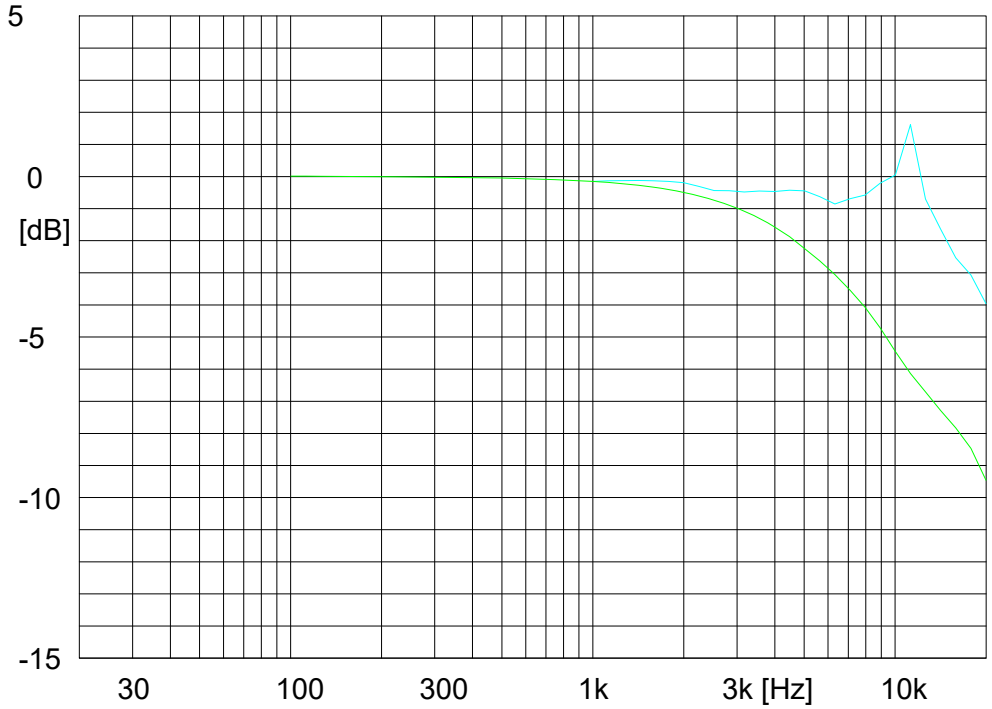
Polarisation voltage:	200.0 V
Pressure:	100.29 ±0.04 kPa
Temperature:	22.0 ±0.1 °C
Relative humidity:	61.5 ±2.2 %RH

Results are normalized to the reference conditions.

Free field response
Pressure (Actuator) response

Campbell Associates
www.campbell-associates.co.uk

Microphone Calibration Certificate



GRAS
Type: 41AS

Serial no: 73643

Sensitivity: 43.50 mV/Pa
-27.23 ±0.10 dB re. 1 V/Pa
Capacitance: 21.1 ±2.0 pF
Date: 06/08/2024

Signature:

Measurement conditions:

Polarisation voltage:	200.0 V
Pressure:	100.29 ±0.04 kPa
Temperature:	22.0 ±0.1 °C
Relative humidity:	61.5 ±2.2 %RH

Results are normalized to the reference conditions.

Free field response
Pressure (Actuator) response

Campbell Associates
www.campbell-associates.co.uk

Comment:

Laboratory Location
Campbell Associates Ltd
5b Chelmsford Road Industrial Estate
GREAT DUNMOW, Essex, GB-CM6 1HD
Phone 01371 871030

Certificate of Calibration

Certificate number: **46523**

Test Object: **Measurement Microphone**

Producer: **GRAS**
Type: **41AS**
Serial number: **73645**
Customer: **Belfast City Airport**
Address: **Airport Road, Belfast,**
Co. Antrim, Northern Ireland. BT3 9JH.
Contact Person: [redacted]
Order No: **POR014410**

Measurement Results	Sensitivity (dB re 1V/Pa)	Sensitivity (mV/Pa)	Capacitance (pF)
Measurement 1	*-27.73*	*41.08*	*20.67*
Measurement 2	*-27.73*	*41.09*	*20.75*
Measurement 3	*-27.73*	*41.09*	*20.78*
Result (Average):	***-27.73***	***41.09***	***20.73***
Expanded Uncertainty:	0.10		2.00
Degree of Freedom:	>100		>100
Coverage Factor:	2		2

The stated sensitivity is the pressure sensitivity at 250Hz, S_{250}, and is valid at reference conditions. The following correction factors have been applied during the measurement:
Pressure:0 dB/kPa Temperature:0 dB/°C Humidity:0 dB/%RH

Conditions	*Pressure kPa*	*Temperature °C*	*Humidty %RH*
Reference conditions	101.325	23	50
Measurement conditions	100.87 ± 0.040	22.6 ± 0.1	39.1 ± 0.7

The calibration test report shown on the next page gives details of the response at other frequencies relative to this 250 Hz reference sensitivity. Results ≥100 Hz are obtained using an electrostatic actuator as described in BS EN 61094-6 and those below 100 Hz are obtained in a reference pressure chamber. Detailed results are available from the calibration laboratory upon request.

The reported expanded uncertainty of measurements is based on a standard uncertainty multiplied by the coverage factor of k=2, providing a coverage probability of approximately 95%. Where the degrees of freedom are insufficient to maintain this confidence level, the coverage factor is increased to maintain this confidence level.

Calibration Dates:

Received date:	11/01/2024	Reviewed date:	25/01/2024
Calibration date:	23/01/2024	Issued date:	25/01/2024

Technicians: (Electronic certificate)

Calibrated by: [redacted]
Reviewed by: [redacted]

This certificate is issued in accordance with the CA Quality Management system. It provides traceability of measurement to recognized national standards, and to the units of measurement realized at the National Physical Laboratory or other recognized national standards laboratories. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

Certificate of Calibration

Continuation of Certificate number: 46523

Reference Calibrator: WSC2 (B) - GRAS42AA-18277
Measurement Record: K:\C A\Calibration\Nor-1504\Nor-1017 MicCal\GRAS41AS_73645_M1.nmf

Preconditioning
The equipment was preconditioned for more than 12 hours at the specified calibration temperature and humidity.

Instruments and Program
A complete list of instruments, hardware and software that have been used for this calibration is available from the calibration laboratory

Traceability
The measured values for sound pressure, frequency, voltage, capacitance, temperature, humidity and ambient pressure are traceable to an accredited national physical laboratory.

Observations
The differences between the two results at 100 Hz are within normal limits bearing in mind the different test methods and are taken into account in arriving at the uncertainties of measurement.

Method of Calibration
The open circuit sensitivity of the microphone has been determined at 250 Hz against a reference laboratory standard measurement microphone by insert voltage techniques using a laboratory standard sound calibrator as a transfer standard. The electrostatic actuator frequency response was then obtained for frequencies above 100 Hz as described in BS EN IEC 61094-6. In addition, where requested the optional free field frequency response over the range 2 – 100 Hz has been obtained using a pressure chamber; in this case the reference frequency is 100 Hz. All of these results and their associated uncertainties are detailed in the table on page 3 of this certificate. See the observations field below for details of any discrepancies between the 100 Hz results obtained via the electrostatic actuator and pressure chamber.

The overall uncertainty at any frequency Combined,Fn may be obtained by combining the uncertainty of the open circuit sensitivity S250 with the uncertainty of the actuator / or LF pressure response at any other frequency Act,Fn where Fn is the uncertainty at the frequency of interest using the relationship:

$$\text{Combined,Fn} = 2\sqrt{(2\text{S250} + 2\text{ActFn})}$$

Appendix to this certificate
Where data is available from the microphone manufacturer to correct the actuator / pressure frequency response to obtain the random incidence and / or free field response it is shown in the appendix to this certificate. The uncertainty information relating to these corrections is the responsibility of the microphone manufacturer and when it is available the total uncertainty for the corrected frequency response at each point may then be obtained by including the correction uncertainty in the root-sum-square formula given above. These responses are outside the UKAS accredited scope, but are provided for information.

Observations

Continuation of Certificate number: **46523**

Numerical Results for Relative Frequency Response

Actuator Results					
Freq	Actuator	Uncert.	Freq	Actuator	Uncert.
Hz	dB re 250 Hz	dB	Hz	dB re 250 Hz	dB
100.0	0.01	0.21	5,010.70	-2.25	0.24
112.2	0.02	0.21	5,622.00	-2.65	0.24
125.9	0.02	0.21	6,307.90	-3.10	0.24
141.3	0.01	0.21	7,077.50	-3.61	0.24
158.5	0.01	0.21	7,940.90	-4.10	0.24
177.9	0.01	0.21	8,909.70	-4.70	0.48
199.6	0.01	0.21	9,996.70	-5.43	0.48
223.9	0.01	0.21	11,216	-6.22	0.48
251.2	Ref	0.21	12,585	-6.87	0.48
281.9	0.00	0.21	14,120	-7.36	0.48
316.3	-0.01	0.21	15,843	-7.89	0.48
354.9	-0.01	0.21	17,775	-8.51	0.70
398.2	-0.02	0.21	19,944	-9.50	0.70
446.7	-0.03	0.21	22377		0.90
501.2	-0.03	0.21	25107		0.90
562.4	-0.04	0.21	28170		0.90
631.0	-0.05	0.21	31607		0.90
708.0	-0.07	0.21	35463		0.90
794.4	-0.09	0.21	39790		0.90
891.3	-0.11	0.21	44644		0.90
1000.0	-0.13	0.21	50091		0.90
1122.0	-0.17	0.21	56202		1.20
1258.9	-0.21	0.21	63058		1.20
1412.5	-0.25	0.21	70752		1.20
1584.8	-0.32	0.21	79383		1.20
1778.1	-0.39	0.21	89068		1.20
1995.1	-0.48	0.21	99934		1.20
2238.5	-0.60	0.21	112126		-
2511.6	-0.73	0.21	125806		-
2818.0	-0.90	0.21	141154		-
3161.8	-1.09	0.21	158375		-
3547.5	-1.32	0.21	177696		-
3980.3	-1.61	0.21	199375		-
4465.9	-1.90	0.24	-		-

Low Frequency		
Freq	dB re 100 Hz	Uncert.
Hz		dB
2.0		0.7
2.2		0.7
2.5		0.7
2.8		0.7
3.2		0.7
3.6		0.7
4.0		0.7
4.5		0.7
5.0		0.7
5.6		0.7
6.3		0.7
7.1		0.7
8.0		0.7
8.9		0.7
10.0		0.7
11.2		0.7
12.6		0.7
14.1		0.7
15.9		0.7
17.8		0.7
20.0		0.7
22.4		0.7
25.1		0.7
28.2		0.7
31.6		0.7
35.5		0.7
39.8		0.7
44.7		0.7
50.1		0.7
56.3		0.7
63.1		0.7
70.8		0.7
79.5		0.7
89.2		0.7
100.0	Ref	0.7

Continuation of Certificate number: 46523

Appendix to certificate (not accredited). Random and Free Field Corrected Data

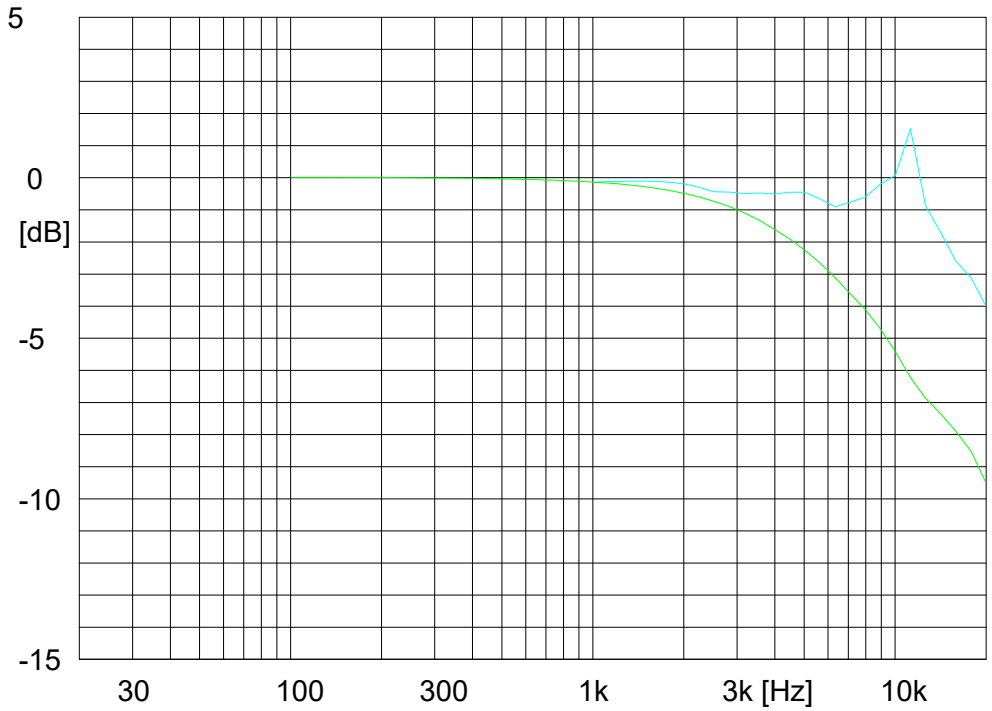
Corrected results, dB re 250 Hz					
Freq Hz	Random incidence corrected	Free field corrected	Freq Hz	Random incidence corrected	Free field corrected
100	0.01	0.01	5,010.70	-2.25	-0.45
112.2	0.02	0.02	5,622.00	-2.65	-0.65
125.9	0.02	0.02	6,307.90	-3.10	-0.90
141.3	0.01	0.01	7,077.50	-3.61	-0.76
158.5	0.01	0.01	7,940.90	-4.10	-0.60
177.9	0.01	0.01	8,909.70	-4.70	-0.20
199.6	0.01	0.01	9,996.70	-5.43	0.08
223.9	0.01	0.01	11,216	-6.22	1.53
251.2	0.00	0.00	12,585	-6.87	-0.87
281.9	0.00	0.00	14,120	-7.36	-1.71
316.3	-0.01	-0.01	15,843	-7.89	-2.59
354.9	-0.01	-0.01	17,775	-8.51	-3.11
398.2	-0.02	-0.02	19,944	-9.50	-4.00
446.7	-0.03	-0.03	22,377		
501.2	-0.03	-0.03	25,107		
562.4	-0.04	-0.04	28,170		
631	-0.05	-0.05	31,607		
708	-0.07	-0.07	35,463		
794.4	-0.09	-0.09	39,790		
891.3	-0.11	-0.11	44,644		
1,000.00	-0.13	-0.13	50,091		
1,122.00	-0.17	-0.12	56,202		
1,258.90	-0.21	-0.11	63,058		
1,412.50	-0.25	-0.10	70,752		
1,584.80	-0.32	-0.12	79,383		
1,778.10	-0.39	-0.14	89,068		
1,995.10	-0.48	-0.18	99,934		
2,238.50	-0.60	-0.30	112,126		
2,511.60	-0.73	-0.43	125,806		
2,818.00	-0.90	-0.45	141,154		
3,161.80	-1.09	-0.49	158,375		
3,547.50	-1.32	-0.47	177,696		
3,980.30	-1.61	-0.51	199,375		
4,465.90	-1.90	-0.45	-		

The corrections used to produce these random and free field responses are published by the manufacturer and they are responsible for the accuracy of the data and for the associated uncertainties to be applied. Campbell Associates Limited use their best endeavours to ensure the accuracy of this data but are not responsible for any errors, omissions or for ensuring that the data is of the current issue.

If the actuator response was not measured for any frequency, then the corresponding cell in the above table will be blank; similarly, if correction data is not available from the manufacturer the cell will also be blank.
Correction data for frequencies below 100 Hz are not required

** End of Table Section **

Microphone Calibration Certificate



GRAS
Type: 41AS

Serial no: 73645

Sensitivity: 41.09 mV/Pa
-27.73 ±0.10 dB re. 1 V/Pa
Capacitance: 20.7 ±2.0 pF
Date: 23/01/2024

Signature:

Measurement conditions:

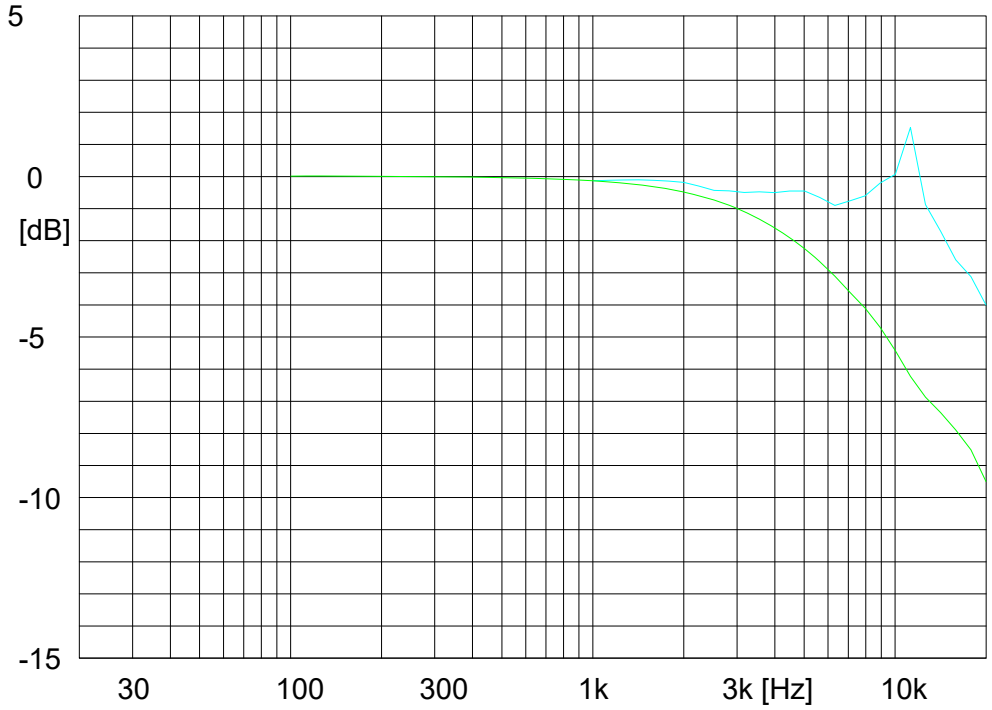
Polarisation voltage:	200.0 V
Pressure:	100.87 ±0.04 kPa
Temperature:	22.6 ±0.1 °C
Relative humidity:	39.1 ±0.7 %RH

Results are normalized to the reference conditions.

Free field response
Pressure (Actuator) response

Campbell Associates
www.campbell-associates.co.uk

Microphone Calibration Certificate



GRAS
Type: 41AS

Serial no: 73645

Sensitivity: 41.09 mV/Pa
-27.73 ±0.10 dB re. 1 V/Pa
Capacitance: 20.7 ±2.0 pF
Date: 23/01/2024

Signature:

Measurement conditions:

Polarisation voltage:	200.0 V
Pressure:	100.87 ±0.04 kPa
Temperature:	22.6 ±0.1 °C
Relative humidity:	39.1 ±0.7 %RH

Results are normalized to the reference conditions.

Free field response
Pressure (Actuator) response

Campbell Associates
www.campbell-associates.co.uk

Comment:

Laboratory Location
Campbell Associates Ltd
5b Chelmsford Road Industrial Estate
GREAT DUNMOW, Essex, GB-CM6 1HD
Phone 01371 871030

Certificate of Calibration

Certificate number: **45705**

Test Object: **Measurement Microphone**

Producer: **GRAS**
Type: **41AS**
Serial number: **168460**
Customer: **Belfast City Airport**
Address: **Airport Road, Belfast,**
Co. Antrim, Northern Ireland. BT3 9JH.
Contact Person: [redacted]
Order No: **291001**

Measurement Results	Sensitivity (dB re 1V/Pa)	Sensitivity (mV/Pa)	Capacitance (pF)
Measurement 1	*-27.27*	*43.29*	*21.68*
Measurement 2	*-27.27*	*43.29*	*21.79*
Measurement 3	*-27.27*	*43.31*	*21.80*
Result (Average):	***-27.27***	***43.30***	***21.76***
Expanded Uncertainty:	0.10		2.00
Degree of Freedom:	>100		>100
Coverage Factor:	2		2

The stated sensitivity is the pressure sensitivity at 250Hz, S_{250}, and is valid at reference conditions. The following correction factors have been applied during the measurement:
Pressure:0 dB/kPa Temperature:0 dB/°C Humidity:0 dB/%RH

Conditions	*Pressure kPa*	*Temperature °C*	*Humidty %RH*
Reference conditions	101.325	23	50
Measurement conditions	100.27 ± 0.040	21.8 ± 0.1	51.4 ± 0.7

The calibration test report shown on the next page gives details of the response at other frequencies relative to this 250 Hz reference sensitivity. Results ≥100 Hz are obtained using an electrostatic actuator as described in BS EN 61094-6 and those below 100 Hz are obtained in a reference pressure chamber. Detailed results are available from the calibration laboratory upon request.

The reported expanded uncertainty of measurements is based on a standard uncertainty multiplied by the coverage factor of k=2, providing a coverage probability of approximately 95%. Where the degrees of freedom are insufficient to maintain this confidence level, the coverage factor is increased to maintain this confidence level.

Calibration Dates:

Received date:	06/10/2023	Reviewed date:	23/10/2023
Calibration date:	23/10/2023	Issued date:	23/10/2023

Technicians: (Electronic certificate)

Calibrated by: [redacted]
Reviewed by: [redacted]

This certificate is issued in accordance with the CA Quality Management system. It provides traceability of measurement to recognized national standards, and to the units of measurement realized at the National Physical Laboratory or other recognized national standards laboratories. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

Certificate of Calibration

Continuation of Certificate number: 45705

Reference Calibrator: WSC9 (C) - Nor-1253.21816
Measurement Record: K:\C A\Calibration\Nor-1504\Nor-1017 MicCal\GRAS41AS_168460_M1.nmf

Preconditioning
The equipment was preconditioned for more than 12 hours at the specified calibration temperature and humidity.

Instruments and Program
A complete list of instruments, hardware and software that have been used for this calibration is available from the calibration laboratory

Traceability
The measured values for sound pressure, frequency, voltage, capacitance, temperature, humidity and ambient pressure are traceable to an accredited national physical laboratory.

Observations
The differences between the two results at 100 Hz are within normal limits bearing in mind the different test methods and are taken into account in arriving at the uncertainties of measurement.

Method of Calibration
The open circuit sensitivity of the microphone has been determined at 250 Hz against a reference laboratory standard measurement microphone by insert voltage techniques using a laboratory standard sound calibrator as a transfer standard. The electrostatic actuator frequency response was then obtained for frequencies above 100 Hz as described in BS EN IEC 61094-6. In addition, where requested the optional free field frequency response over the range 2 – 100 Hz has been obtained using a pressure chamber; in this case the reference frequency is 100 Hz. All of these results and their associated uncertainties are detailed in the table on page 3 of this certificate. See the observations field below for details of any discrepancies between the 100 Hz results obtained via the electrostatic actuator and pressure chamber.

The overall uncertainty at any frequency Combined,Fn may be obtained by combining the uncertainty of the open circuit sensitivity S250 with the uncertainty of the actuator / or LF pressure response at any other frequency Act,Fn where Fn is the uncertainty at the frequency of interest using the relationship:

$$\text{Combined,Fn} = 2\sqrt{(2\text{S250} + 2\text{ActFn})}$$

Appendix to this certificate
Where data is available from the microphone manufacturer to correct the actuator / pressure frequency response to obtain the random incidence and / or free field response it is shown in the appendix to this certificate. The uncertainty information relating to these corrections is the responsibility of the microphone manufacturer and when it is available the total uncertainty for the corrected frequency response at each point may then be obtained by including the correction uncertainty in the root-sum-square formula given above. These responses are outside the UKAS accredited scope, but are provided for information.

Observations

Continuation of Certificate number: **45705**

Numerical Results for Relative Frequency Response

Actuator Results					
Freq	Actuator	Uncert.	Freq	Actuator	Uncert.
Hz	dB re 250 Hz	dB	Hz	dB re 250 Hz	dB
100.0	0.02	0.21	5,010.70	-1.79	0.24
112.2	0.02	0.21	5,622.00	-2.18	0.24
125.9	0.02	0.21	6,307.90	-2.60	0.24
141.3	0.02	0.21	7,077.50	-3.10	0.24
158.5	0.02	0.21	7,940.90	-3.69	0.24
177.9	0.02	0.21	8,909.70	-4.42	0.48
199.6	0.03	0.21	9,996.70	-5.29	0.48
223.9	0.03	0.21	11,216	-6.21	0.48
251.2	Ref	0.21	12,585	-6.98	0.48
281.9	0.03	0.21	14,120	-7.80	0.48
316.3	0.02	0.21	15,843	-8.60	0.48
354.9	0.02	0.21	17,775	-9.49	0.70
398.2	0.02	0.21	19,944	-10.58	0.70
446.7	0.02	0.21	22377		0.90
501.2	0.01	0.21	25107		0.90
562.4	0.00	0.21	28170		0.90
631.0	0.01	0.21	31607		0.90
708.0	-0.01	0.21	35463		0.90
794.4	-0.02	0.21	39790		0.90
891.3	-0.04	0.21	44644		0.90
1000.0	-0.05	0.21	50091		0.90
1122.0	-0.08	0.21	56202		1.20
1258.9	-0.11	0.21	63058		1.20
1412.5	-0.14	0.21	70752		1.20
1584.8	-0.19	0.21	79383		1.20
1778.1	-0.24	0.21	89068		1.20
1995.1	-0.31	0.21	99934		1.20
2238.5	-0.40	0.21	112126		-
2511.6	-0.50	0.21	125806		-
2818.0	-0.62	0.21	141154		-
3161.8	-0.78	0.21	158375		-
3547.5	-0.97	0.21	177696		-
3980.3	-1.20	0.21	199375		-
4465.9	-1.47	0.24	-		-

Low Frequency		
Freq	dB re 100 Hz	Uncert.
Hz		dB
2.0		0.7
2.2		0.7
2.5		0.7
2.8		0.7
3.2		0.7
3.6		0.7
4.0		0.7
4.5		0.7
5.0		0.7
5.6		0.7
6.3		0.7
7.1		0.7
8.0		0.7
8.9		0.7
10.0		0.7
11.2		0.7
12.6		0.7
14.1		0.7
15.9		0.7
17.8		0.7
20.0		0.7
22.4		0.7
25.1		0.7
28.2		0.7
31.6		0.7
35.5		0.7
39.8		0.7
44.7		0.7
50.1		0.7
56.3		0.7
63.1		0.7
70.8		0.7
79.5		0.7
89.2		0.7
100.0	Ref	0.7

Continuation of Certificate number: 45705

Appendix to certificate (not accredited). Random and Free Field Corrected Data

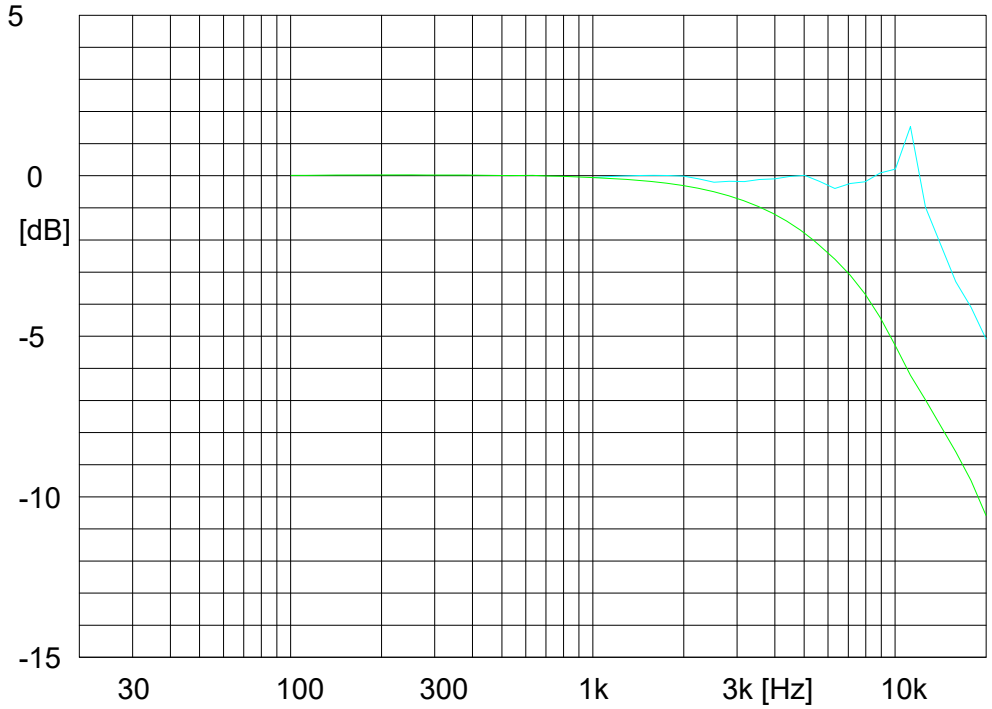
Corrected results, dB re 250 Hz					
Freq Hz	Random incidence corrected	Free field corrected	Freq Hz	Random incidence corrected	Free field corrected
100	0.02	0.02	5,010.70	-1.79	0.01
112.2	0.02	0.02	5,622.00	-2.18	-0.18
125.9	0.02	0.02	6,307.90	-2.60	-0.40
141.3	0.02	0.02	7,077.50	-3.10	-0.25
158.5	0.02	0.02	7,940.90	-3.69	-0.19
177.9	0.02	0.02	8,909.70	-4.42	0.08
199.6	0.03	0.03	9,996.70	-5.29	0.21
223.9	0.03	0.03	11,216	-6.21	1.54
251.2	0.03	0.03	12,585	-6.98	-0.98
281.9	0.03	0.03	14,120	-7.80	-2.15
316.3	0.02	0.02	15,843	-8.60	-3.30
354.9	0.02	0.02	17,775	-9.49	-4.09
398.2	0.02	0.02	19,944	-10.58	-5.08
446.7	0.02	0.02	22,377		
501.2	0.01	0.01	25,107		
562.4	0.00	0.00	28,170		
631	0.01	0.01	31,607		
708	-0.01	-0.01	35,463		
794.4	-0.02	-0.02	39,790		
891.3	-0.04	-0.04	44,644		
1,000.00	-0.05	-0.05	50,091		
1,122.00	-0.08	-0.03	56,202		
1,258.90	-0.11	-0.01	63,058		
1,412.50	-0.14	0.01	70,752		
1,584.80	-0.19	0.01	79,383		
1,778.10	-0.24	0.01	89,068		
1,995.10	-0.31	-0.01	99,934		
2,238.50	-0.40	-0.10	112,126		
2,511.60	-0.50	-0.20	125,806		
2,818.00	-0.62	-0.17	141,154		
3,161.80	-0.78	-0.18	158,375		
3,547.50	-0.97	-0.12	177,696		
3,980.30	-1.20	-0.10	199,375		
4,465.90	-1.47	-0.02	-		

The corrections used to produce these random and free field responses are published by the manufacturer and they are responsible for the accuracy of the data and for the associated uncertainties to be applied. Campbell Associates Limited use their best endeavours to ensure the accuracy of this data but are not responsible for any errors, omissions or for ensuring that the data is of the current issue.

If the actuator response was not measured for any frequency, then the corresponding cell in the above table will be blank; similarly, if correction data is not available from the manufacturer the cell will also be blank.
Correction data for frequencies below 100 Hz are not required

** End of Table Section **

Microphone Calibration Certificate



GRAS
Type: 41AS

Serial no: 168460

Sensitivity: 43.30 mV/Pa
-27.27 ±0.10 dB re. 1 V/Pa
Capacitance: 21.8 ±2.0 pF
Date: 23/10/2023

Signature:

Measurement conditions:

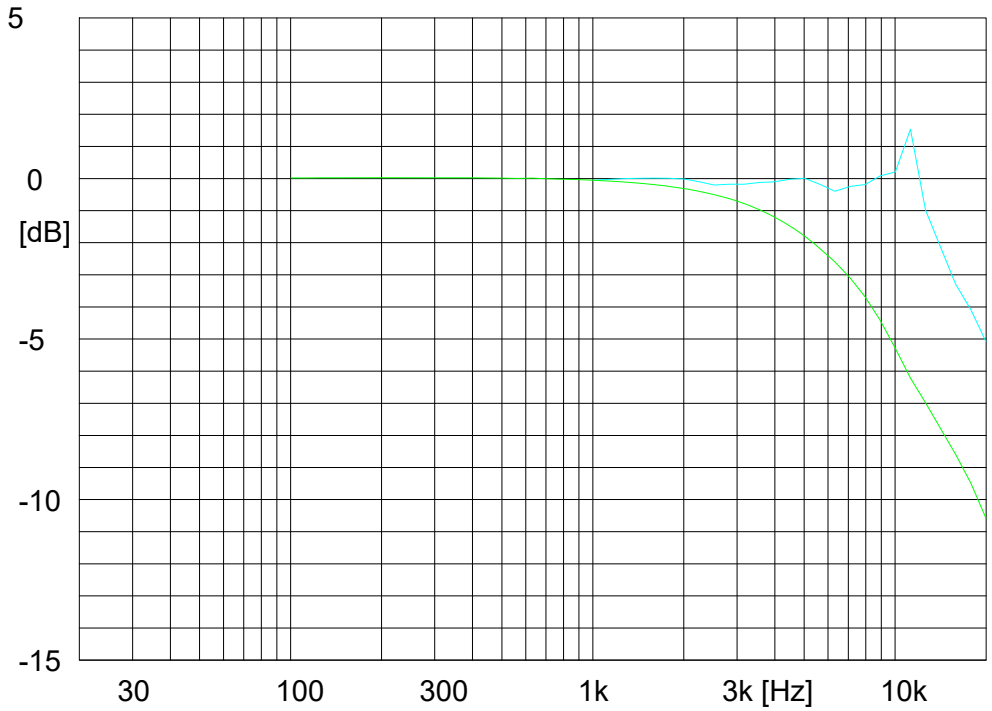
Polarisation voltage:	200.0 V
Pressure:	100.27 ±0.04 kPa
Temperature:	21.8 ±0.1 °C
Relative humidity:	51.4 ±0.7 %RH

Results are normalized to the reference conditions.

Free field response
Pressure (Actuator) response

Campbell Associates
www.campbell-associates.co.uk

Microphone Calibration Certificate



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Results are normalized to the reference conditions.

Free field response
Pressure (Actuator) response

Campbell Associates
www.campbell-associates.co.uk

Comment:

Laboratory Location
Campbell Associates Ltd
5b Chelmsford Road Industrial Estate
GREAT DUNMOW, Essex, GB-CM6 1HD
Phone 01371 871030

Certificate of Calibration and Conformance

Certificate number: **U45706**

Test Object: **Sound Level Meter, BS EN 60651 and or BS EN 60804 Class 1**

Producer: **Norsonic AS.**
Type: **118**
Serial number: **32059**
Customer: **Belfast City Airport**
Address: **Airport Road, Belfast,**
Co. Antrim, Northern Ireland. BT3 9JH.
Contact Person: [redacted]
Order No: **291001**

Introduction:
Calibration has been performed as set out in CA Technical Procedures which are based on the procedures for periodic verification of sound level meters as per the **Test Object** listed above. Results and conformance statement are overleaf and detailed results, where appropriate, are provided in the attached Measurement Report.

Tested:	*Producer*	*Type*	*Serial No*	*Certificate No*
Microphone	GRAS	41AS	168460	45705
Calibrator*	Norsonic	1256	125626986	Cal022-2023-17966
Preamplifier	GRAS	41AM	317389	Included

* The calibrator was complete with any required coupler for the microphone specified.

Additional items that have also been submitted for verification:

Wind shield	N/A
Attenuator	N/A
Extension cable	N/A

These items have been taken into account wherever appropriate.

Conditions	*Pressure kPa*	*Temperature °C*	*Humidity %RH*
Reference conditions	101.325	23	50
Measurement conditions	100.22 ±0.04	22.48 ±0.5	48.30 ±2.6

Calibration Dates:

Received date:	06/10/2023	Reviewed date:	23/10/2023
Calibration date:	23/10/2023	Issued date:	23/10/2023

Technicians: (Electronic certificate)

Calibrated by: [redacted]

Reviewed by: [redacted]

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 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 and Conformance

Continuation of Certificate number: **U45706**

The statements of conformance and observation notes detailed in this certificate are made with reference to the following standards in respect of the calibration of the test object.

Manufactured:	**BS EN 60651 and or BS EN 60804**
Periodic Tests:	**BS 7580 Part 1:1997**
Pattern Evaluation:	**Not Applicable**

Conformance:
From markings on the sound level meter or by reference to the manufacturer's published literature it has been determined that the instrument submitted for verification was originally manufactured to the listed standard and similarly that the associated sound calibrator conforms to the BS EN IEC 60942 standard.

Measurement Summary:

Indication at the calibration check frequency - BS7580 #5.4	Passed
Noise test - BS 7580 #5.5.2	Passed
Level Linearity Test - BS 7580, #5.5.3	Passed
Frequency weightings: A Network - BS 7580 #5.5.4	Passed
Frequency weightings: C Network - BS 7580 #5.5.4	Passed
Frequency weightings: Z Network - BS 7580 #5.5.4	Passed
Time weightings F and S - BS 7580 #5.5.5	Passed
Peak response - BS 7580 #5.5.6	Passed
RMS accuracy - BS 7580 #5.5.7	Passed
Time weighting I - BS 7580 #5.5.8	Passed
Integrating Test : Time averaging - BS 7580 #5.5.9	Passed
Integrating Test : Pulse range - BS 7580 #5.5.10	Passed
Integrating Test : Sound exposure level - BS 7580 #5.5.11	Passed
Overload SPL Test - BS 7580 #5.5.12	Passed
Overload Leq Test - BS 7580 #5.5.12	Passed
Acoustic tests - BS 7580 #5.4 and 5.6	Passed
Summation of acoustic tests - BS 7580 #5.5.4	Passed

Calibration Method
The reference range, reference sound pressure level, primary indicator range, secondary indicator range, pulse range, linearity range and display range as specified by the manufacturer were used for the verification. The test object was set to A weighting and adjusted to read correctly in response to the associated sound calibrator the reading was derived from the calibrator calibration certificate and manufacturer's instruction manuals.
A measurement of the self noise of the sound level meter was then made using a dummy microphone having a capacitance of ±20% of the associated microphones self capacitance. The sound level meter was then tested, and its overall sensitivity adjusted, in accordance with the requirements of the listed standard . The acoustic calibration at 1 kHz was performed by application of a reference sound calibrator, whilst the tests at 125 Hz and 8k Hz were performed by the electrostatic actuator method. At the end of the test, the associated sound calibrator was reapplied to the sound level meter and the meter reading was recorded and is noted.

Statement of Conformance
The sound level meter in the configuration tested was found to comply with the requirements of the listed standard. The associated calibrator has been corrected for barometric pressure at the time of calibration in accordance with the relevant manufacturer's instructions

Observations
The sound level meter in the configuration tested conforms to the requirements of BS 7580 Part 1.

Certificate of Calibration and Conformance

Continuation of Certificate number: U45706

The final response obtained using the associated calibrator.(§5.6.3): 113.8dB(C) with GRAS-RA0009 s/n 1156 calibration adaptor with corrections of -0.2dB at 250Hz. This reading should be used henceforth to set up the sound level meter for field use.

The self-generated noise recorded in the test specified in § 5.5.2 was: (Below MSD)11.2dB(A), (Below MSD) 12.1dB(C) and (Below MSD) 17.1dB(Z) .

A stricter test than that specified in paragraphs 5.5.6 of BS7580:1997 has been used by verifying that the 10 ms reference pulse is also correct. The level uncertainty of the Laboratory's 1 kHz sound calibrator used during this verification is ± 0.1 dB.
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%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

Decision Rule

Basic Meter Function - A PASS or PASSED statement indicates that the instrument conforms with the relevant accuracy requirements of the testing standard AND the expanded measurement uncertainty (k = 2 for approximately 95 % coverage probability) is no greater in magnitude than the accuracy requirements defined in BS-7580 Part 1:1997 standard

This certificate relates only to the items tested above.

** End of Certificate **

Measurement Results:

Indication at the calibration check frequency - BS7580 Clause 5.4

```
Reference level: 114.0 dB
Reference Range: 130 dB FS
Reference Frequency: 1000 Hz
Reference Calibrator: WSC9  (C) - Nor-1253.21816
Reference calibrator level: 124.04
Before calibration:
Environmental corrections: 0.00
Other corrections: -0.2
Notional level: 123.84
Calibrator level before adjustment: 123.8
After calibration:
Environmental corrections: 0.00
Other corrections: -0.2
Notional level: 123.84
Reference calibrator level after calibration: 123.8
Associated Calibrator: Norsonic - 1256 - 125626986
Associated calibrator level: 114.01
Initial level check:
Environmental corrections: 0.00
Other corrections: -0.20
Notional level: 113.81
Indicated level: 113.8
Final level statement:
Environmental corrections after calibration: 0.00
Other corrections: -0.2
Notional level: 113.81
Calibrator level after adjustment: 113.8
This value shall be used for adjusting the sound level meter in the future.
Test Passed
```

Noise test - BS 7580 Clause 5.5.2

The SLM is set to A-weighted and the most sensitive range setting. A dummy microphone is fitted, and the self-noise is measured on all available weighting networks over a 20 second period.

Network	Noise Level (dB)	Max allowed (dB)	Result code	
A	11.2	13.0	P	The value is less than MSD.
C	12.1	15.0	P	The value is less than MSD.
Z	17.1	25.0	P	The value is less than MSD.

Test Passed

Level Linearity Test - BS 7580, Clause 5.5.3

The LEQ linearity of the detector of the SLM is tested in 5 dB steps on the reference range. Additionally, the reference level and a level 2 dB above the bottom and 2 dB below the top of the other available measurement ranges are also measured.
The measurements on the reference range is repeated with SPL results, if possible
Test signal: 4 kHz sine wave.

Reference Value (dB)	Measured Value (dB)	Tol. Value (dB)	Error Value (dB)	Error Code
Measured at 4 kHz				
Full scale setting: 130dB				
The following measurements are LEQ measurements				
114.0	114.0	0.7	0.0	P
119.0	119.0	0.7	0.0	P
124.0	124.0	0.7	0.0	P
129.0	129.0	0.7	0.0	P
131.0	131.0	0.7	0.0	P
132.0	132.0	0.7	0.0	P
133.0	133.0	0.7	0.0	P
134.0	134.0	0.7	0.0	P
135.0	135.0	0.7	0.0	P
136.0	136.0	0.7	0.0	P
137.0	137.0	0.7	0.0	P
114.0	114.0	0.7	0.0	P
109.0	109.0	0.7	0.0	P
104.0	104.0	0.7	0.0	P
99.0	99.0	0.7	0.0	P
94.0	94.0	0.7	0.0	P
89.0	89.0	0.7	0.0	P
84.0	84.0	0.7	0.0	P
79.0	79.0	0.7	0.0	P
74.0	74.0	0.7	0.0	P
69.0	69.0	0.7	0.0	P
64.0	64.0	0.7	0.0	P
59.0	59.0	0.7	0.0	P
54.0	54.0	0.7	0.0	P
49.0	49.0	0.7	0.0	P
46.0	46.0	0.7	0.0	P
45.0	45.0	0.7	0.0	P
44.0	44.0	0.7	0.0	P
43.0	43.0	0.7	0.0	P
42.0	42.0	0.7	0.0	P
41.0	41.0	0.7	0.0	P
40.0	40.0	0.7	0.0	P
Full scale setting: 130dB				
114.0	114.0	0.7	0.0	P
135.0	135.0	0.7	0.0	P
40.0	40.0	0.7	0.0	P
Full scale setting: 130dB				
The following measurements are SPL measurements				
114.0	114.0	0.7	0.0	P
119.0	119.0	1.0	0.0	P
124.0	124.0	1.0	0.0	P
129.0	129.0	1.0	0.0	P
131.0	131.0	1.0	0.0	P
132.0	132.0	1.0	0.0	P

Level Linearity Test - BS 7580, Clause 5.5.3

Reference Value (dB)	Measured Value (dB)	Tol. Value (dB)	Error Value (dB)	Error Code
133.0	133.0	1.0	0.0	P
134.0	134.0	1.0	0.0	P
135.0	135.0	1.0	0.0	P
136.0	136.0	1.0	0.0	P
137.0	137.0	1.0	0.0	P
114.0	114.0	0.7	0.0	P
109.0	109.0	0.7	0.0	P
104.0	104.0	0.7	0.0	P
99.0	99.0	0.7	0.0	P
94.0	94.0	0.7	0.0	P
89.0	89.0	0.7	0.0	P
84.0	84.0	0.7	0.0	P
79.0	79.0	0.7	0.0	P
74.0	74.0	0.7	0.0	P
69.0	69.0	0.7	0.0	P
64.0	64.0	0.7	0.0	P
59.0	59.0	0.7	0.0	P
54.0	54.0	0.7	0.0	P
49.0	49.0	0.7	0.0	P
46.0	46.0	0.7	0.0	P
45.0	45.0	0.7	0.0	P
44.0	44.0	0.7	0.0	P
43.0	43.0	0.7	0.0	P
42.0	42.0	0.7	0.0	P
41.0	41.0	0.7	0.0	P
40.0	40.0	0.7	0.0	P

Test Passed

Frequency weightings: A Network - BS 7580 Clause 5.5.4

The SLM is set to its reference range and tested relative to 1k Hz at the reference SPL. All available networks are tested. Tolerances given here are for information only and relate to complete instrument, see test §5.5.4. for complete instrument data to which these tolerances relate.

Freq (Hz)	Ref (dB)	Meas. Value (dB)	Tolerance HiLim (dB)	Tolerance LoLim (dB)	Result Value (dB)	Code	
31.6	114.0	113.9	1.5	-1.5	-0.1	P	Adjusted 25.4dB **
63.1	114.0	114.0	1.5	-1.5	0.0	P	Adjusted 12.2dB **
125.9	114.0	113.9	1.0	-1.0	-0.1	P	
251.2	114.0	113.9	1.0	-1.0	-0.1	P	
501.2	114.0	113.9	1.0	-1.0	-0.1	P	
1000.0	114.0	113.9	1.0	-1.0	-0.1	P	
1995.3	114.0	113.9	1.0	-1.0	-0.1	P	
3981.1	114.0	113.9	1.0	-1.0	-0.1	P	
7943.3	114.0	114.0	1.5	-3.0	0.0	P	
12589.3	114.0	114.0	3.0	-6.0	0.0	P	

** indicates that level is adjusted because of limited dynamic range.

Test Passed

Frequency weightings: C Network - BS 7580 Clause 5.5.4

The SLM is set to its reference range and tested relative to 1k Hz at the reference SPL. All available networks are tested. Tolerances given here are for information only and relate to complete instrument, see test §5.5.4. for complete instrument data to which these tolerances relate.

Freq (Hz)	Ref (dB)	Meas. Value (dB)	Tolerance HiLim (dB)	Tolerance LoLim (dB)	Result Value (dB)	Code
31.6	114.0	114.0	1.5	-1.5	0.0	P
63.1	114.0	113.9	1.5	-1.5	-0.1	P
125.9	114.0	114.0	1.0	-1.0	0.0	P
251.2	114.0	113.9	1.0	-1.0	-0.1	P
501.2	114.0	114.0	1.0	-1.0	0.0	P
1000.0	114.0	113.9	1.0	-1.0	-0.1	P
1995.3	114.0	113.9	1.0	-1.0	-0.1	P
3981.1	114.0	113.9	1.0	-1.0	-0.1	P
7943.3	114.0	114.0	1.5	-3.0	0.0	P
12589.3	114.0	113.9	3.0	-6.0	-0.1	P

Test Passed

Frequency weightings: Z Network - BS 7580 Clause 5.5.4

The SLM is set to its reference range and tested relative to 1k Hz at the reference SPL. All available networks are tested. Tolerances given here are for information only and relate to complete instrument, see test §5.5.4. for complete instrument data to which these tolerances relate.

Freq (Hz)	Ref (dB)	Meas. Value (dB)	Tolerance HiLim (dB)	Tolerance LoLim (dB)	Result Value (dB)	Code
31.6	114.0	113.8	1.5	-1.5	-0.2	P
63.1	114.0	113.9	1.5	-1.5	-0.1	P
125.9	114.0	113.9	1.0	-1.0	-0.1	P
251.2	114.0	113.9	1.0	-1.0	-0.1	P
501.2	114.0	113.9	1.0	-1.0	-0.1	P
1000.0	114.0	113.9	1.0	-1.0	-0.1	P
1995.3	114.0	113.9	1.0	-1.0	-0.1	P
3981.1	114.0	113.9	1.0	-1.0	-0.1	P
7943.3	114.0	113.9	1.5	-3.0	-0.1	P
12589.3	114.0	113.9	3.0	-6.0	-0.1	P

Test Passed

Time weightings F and S - BS 7580 Clause 5.5.5

A continuous sine wave is applied to the SLM and adjusted to give an indication 4 dB below upper limit of the primary indicator range. Then onset transient characteristics are tested using a single sine wave burst with an amplitude equal to the continuous signal and a duration of T(ms).
Test signal: Single Sine Wave Burst of 2 kHz.

Time Constant	Burst Duration (ms)	Ref. Value (dB)	Measured Value (dB)	Tolerance Value (dB)	Result Value (dB)	
Fast	200	112.0	112.0	1.0	0.0	P
Slow	500	108.9	109.0	1.0	0.1	P

Test Passed

Peak response - BS 7580 Clause 5.5.6

Rectangular wave pulses are used to test the peak response. The response of a 100 micro second pulse shall not differ from the response of a 10 milliseconds pulse by more than 2dB.

Pulse Duration	Pulse Polarity	Ref. Value (dB)	Meas. Value (dB)	Tolerance Value (dB)	Error values Abs. (dB)	Error values Rel. (dB)	Result Code
10ms	+	116.0	116.6		0.6		P
0.1ms	+	116.0	115.6	2.0	-0.4	-1.0	P
10ms	-	116.0	116.6		0.6		P
0.1ms	-	116.0	115.7	2.0	-0.3	-0.9	P

The results have been compensated for the impulse response of
the C-weighting network.
Test Passed

RMS accuracy - BS 7580 Clause 5.5.7

The instrument is set to time constant Slow. A continuous sine wave (2kHz) is applied to the SLM and adjusted to give an indication 2 dB below upper limit of the primary indicator range The signal is replaced by a sequence of tone bursts (CF=3) with a repetition rate of 40Hz.

	Crest Factor	Ref. Value (dB)	Meas. Value (dB)	Tolerance norm (dB)	Result Value (dB)	
F	3	115.0	115.1	0.5	0.1	P
F	3	115.0	114.8	0.5	-0.2	P
S	3	115.0	114.7	0.5	-0.3	P

Test Passed

Time weighting I - BS 7580 Clause 5.5.8

A continuous sine wave (2 kHz) is applied to the SLM and adjusted to give an indication at the upper limit of the primary indicator range. The onset transient characteristics are tested. First, a single sine wave burst with the amplitude equal to the continuous signal and the duration of 5 ms is used. Then, the same burst is repeated with a frequency of 100 Hz.

Burst type	Reference Value (dB)	Measured Value (dB)	Tolerance norm (dB)	Result Value (dB)	
5 ms single burst	108.2	106.9	2.0	-1.3	P
100Hz repeated	114.3	113.9	1.0	-0.4	P

Test Passed

Integrating Test : Time averaging - BS 7580 Clause 5.5.9

The SLM is set to the reference range. The signal generator is adjusted to give a 4 kHz sine wave with an rms level 30dB below the top of the Linearity range. The sine wave is replaced by a sequence of tone burst with the same frequency and the same rms level. For type 1 and 0 instruments, the burst duty factor (the distance between each burst) is increased, while the amplitude is increased to keep the same equivalent rms level. 1 minute, 6 minutes and 1 hour respectively.
Test signal: Continuous sine wave burst of 4kHz

Burst Duration (ms)	Ref. Value (dB)	Tolerance norm (dB)	Meas. Value (dB)	Error (LeqA) (dB)	
1/10^3	107.0	1.0	106.9	-0.1	P
1/10^4	97.0	1.0	96.7	-0.3	P

Test Passed

Integrating Test : Pulse range - BS 7580 Clause 5.5.10

Pulse handling is tested on the reference range using a 10 ms tone burst (of 4 kHz) during an integration period of 10 seconds superimposed on a low level background signal. The resulting A-weighted Leq shall correspond to table II of BS EN IEC 60804. The test is repeated on the upper end of the linearity range.

Burst Duration (ms)	Ref. Value (dB)	Measured Value (dB)	Tolerance Norm (dB)	Result Value (dB)	
10	52.0	51.7	1.7	-0.3	P
10	102.0	102.0	1.7	0.0	P

Test Passed

Integrating Test : Sound exposure level - BS 7580 Clause 5.5.11

Pulse handling is tested on the reference range using a 10 ms tone burst (of 4 kHz) during an integration period of 10 seconds. The A-weighted SEL of the burst shall correspond to table II of BS EN 60804. The test is repeated on the lower end of the pulse range.

Burst Duration (ms)	Ref. Value (dB)	Measured Value (dB)	Tolerance Norm (dB)	Result Value (dB)	
10	62.0	62.0	1.7	0.0	P
10	112.0	112.0	1.7	0.0	P

Test Passed

Overload SPL Test - BS 7580 Clause 5.5.12

The SLM is set to reference range. A continuous tone burst is applied and adjusted until overload occurs. Then signal is reduced to give an on-scale indication. The level is further reduced 3 dB and the SLM shall indicate correctly within the tolerances given in table XIII of BS EN 60651.

	Ref. Value (dB)		Measured Value (dB)	Tolerance Norm (dB)	Result Value (dB)	
SPL CF3	130.7	-3	127.8	1.0	0.1	P

Overload occurred at: 131.7dB RMS

```
Overload SPL Test - BS 7580 Clause 5.5.12
              Ref.   Measured   Tolerance   Result
             Value     Value      Norm      Value
              (dB)      (dB)      (dB)      (dB)

Test Passed
```

Overload Leq Test - BS 7580 Clause 5.5.12

The SLM is set to Leq. A 1 ms pulse of 4 kHz on a low level background is applied and adjusted until overload occurs. Then the level is reduced 1 dB. A single tone burst is then applied and the Leq,10s measured. The result shall be within the tolerances given in table II of BS EN IEC 60804.

```
              Ref.   Measured   Tolerance   Result
             Value     Value      Norm      Value
              (dB)      (dB)      (dB)      (dB)
LEQ 1ms       97.1      97.0       2.2      -0.1   P
Overload occurred approximately at: 141.1 dB (peak level)
Test Passed
```

Acoustic tests - BS 7580 Clause 5.4 and 5.6

```
The sound level meter was initially calibrated with the associated calibrator.(§5.4)
Reference level:                        114.01 dB
Ambient corrections:                      0.00 dB
Pressure to free field correction:       -0.20 dB
Corrected level:                        113.81 dB
Indicated level:                         113.8 dB
The sound level meter was tested at 125 Hz. (§5.6.2)
Reference level:                          91.3 dB
Ambient corrections:                           dB
Pressure to free field correction:        0.00 dB
Case reflections:                              dB
Linearity error:                               dB
Weighting correction:                     0.17 dB
Windscreen corrections:                        dB
Notional level:                          91.13 dB
Indicated level:                          91.2 dB
Tolerance:                               +/- 1 dB
Error:                                    0.07 dB
The sound level meter was tested at 1k Hz. (§5.6.2)
Reference level:                          91.3 dB
Ambient corrections:                           dB
Pressure to free field correction:        0.00 dB
Case reflections:                              dB
Linearity error:                               dB
Weighting correction:                     0.00 dB
Windscreen corrections:                        dB
Notional level:                          91.30 dB
Indicated level:                          91.3 dB
Tolerance:                               +/- 1 dB
Error:                                    0.00 dB
The sound level meter was tested at 4k Hz. (§5.6.2)
Reference level:                          91.3 dB
Ambient corrections:                           dB
Pressure to free field correction:        1.10 dB
```

Acoustic tests - BS 7580 Clause 5.4 and 5.6

Case reflections:		dB
Linearity error:		dB
Weighting correction:	0.82	dB
Windscreen corrections:		dB
Notional level:	89.38	dB
Indicated level:	89.2	dB
Tolerance:	+/- 1	dB
Error:	-0.18	dB

The sound level meter was tested at 8k Hz. (§5.6.2)

Reference level:	91.3	dB
Ambient corrections:		dB
Pressure to free field correction:	3.50	dB
Case reflections:		dB
Linearity error:		dB
Weighting correction:	3.01	dB
Windscreen corrections:		dB
Notional level:	84.79	dB
Indicated level:	84.6	dB
Tolerance:	+1.5; -3	dB
Error:	-0.19	dB

The measurement was performed using an electrostatic actuator method.
Response: Free field
Test Passed

Summation of acoustic tests - BS 7580 Clause 5.5.4

The microphone data are measured using electrostatic actuator.

SLM: A-Weighted results

Freq. (Hz)	SLM (dB)	Mic. (dB)	CR. (dB)	WS. (dB)	Tol. (dB)	Dev. (dB)
31.5	0.0	0.0			+-1.5	0.0
63	0.1	0.0			+-1.5	0.1
125	0.0	0.0			+-1.0	0.0
250	0.0	0.0			+-1.0	0.0
500	0.0	0.0			+-1.0	0.0
1 k	0.0	-0.1			+-1.0	-0.1
2 k	0.0	0.0			+-1.0	0.0
4 k	0.0	-0.1			+-1.0	-0.1
8 k	0.1	-0.2			+1.5,-3	-0.1
12.5 k	0.1	-1.0			+3,-6	-0.9

SLM: C-Weighted results

Freq. (Hz)	SLM (dB)	Mic. (dB)	CR. (dB)	WS. (dB)	Tol. (dB)	Dev. (dB)
31.5	0.1	0.0			+-1.5	0.1
63	0.0	0.0			+-1.5	0.0
125	0.1	0.0			+-1.0	0.1
250	0.0	0.0			+-1.0	0.0
500	0.1	0.0			+-1.0	0.1
1 k	0.0	-0.1			+-1.0	-0.1
2 k	0.0	0.0			+-1.0	0.0
4 k	0.0	-0.1			+-1.0	-0.1
8 k	0.1	-0.2			+1.5,-3	-0.1
12.5 k	0.0	-1.0			+3,-6	-1.0

SLM: Z-Weighted results

Freq. (Hz)	SLM (dB)	Mic. (dB)	CR. (dB)	WS. (dB)	Tol. (dB)	Dev. (dB)

Summation of acoustic tests - BS 7580 Clause 5.5.4

31.5	-0.1	0.0	+-1.5	-0.1
63	0.0	0.0	+-1.5	0.0
125	0.0	0.0	+-1.0	0.0
250	0.0	0.0	+-1.0	0.0
500	0.0	0.0	+-1.0	0.0
1 k	0.0	-0.1	+-1.0	-0.1
2 k	0.0	0.0	+-1.0	0.0
4 k	0.0	-0.1	+-1.0	-0.1
8 k	0.0	-0.2	+1.5,-3	-0.2
12.5 k	0.0	-1.0	+3,-6	-1.0

Test Passed
The overall frequency response of the sound level meter and microphone response has shown to conform with the requirements in §6 of the BSEN 60651 and §5.5.4 in BS 7580 Part 1.

*** End of results ***

Laboratory Location
Campbell Associates Ltd
5b Chelmsford Road Industrial Estate
GREAT DUNMOW, Essex, GB-CM6 1HD
Phone 01371 871030

Certificate of Calibration

Certificate number: **U42986**

Test Object: **Sound Level Meter, BS EN 60651 and or BS EN 60804 Class 1**

Producer: **Norsonic AS.**
Type: **118**
Serial number: **32112**
Customer: **Belfast City Airport**
Address: **George Best Belfast City Airport, Sydenham Bypass, Belfast. BT3 9JH.**
Contact Person: [redacted].
Order No: **POR013276**

Introduction:
Calibration has been performed as set out in CA Technical Procedures which are based on the procedures for periodic verification of sound level meters as per the **Test Object** listed above. Results and conformance statement are overleaf and detailed results, where appropriate, are provided in the attached Measurement Report.

Tested:	*Producer*	*Type*	*Serial No*	*Certificate No*
Microphone	GRAS	41AS	69414	42985
Calibrator*	Norsonic	1253_250Hz	21816	U42378
Preamplifier	GRAS	41AM	56262	Included

* The calibrator was complete with any required coupler for the microphone specified.

Additional items that have also been submitted for verification:

Wind shield	N/A
Attenuator	N/A
Extension cable	N/A

These items have been taken into account wherever appropriate.

0

Conditions	*Pressure kPa*	*Temperature °C*	*Humidity %RH*
Reference conditions	101.325	23	50
Measurement conditions	98.31 ±0.04	23.18 ±0.2	31.80 ±0.75

Calibration Dates:

Received date:	03/01/2023	Reviewed date:	19/01/2023
Calibration date:	17/01/2023	Issued date:	19/01/2023

Technicians: (Electronic certificate)

Calibrated by: [redacted]

Reviewed by: [redacted]

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 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

Continuation of Certificate number: **U42986**

The statements of conformance and observation notes detailed in this certificate are made with reference to the following standards in respect of the calibration of the test object.

Manufactured:	**BS EN 60651 and or BS EN 60804**
Periodic Tests:	**BS 7580 Part 1:1997**
Pattern Evaluation:	**Not Applicable**

Conformance:
From markings on the sound level meter or by reference to the manufacturer's published literature it has been determined that the instrument submitted for verification was originally manufactured to the listed standard and similarly that the associated sound calibrator conforms to the BS EN IEC 60942 standard.

Measurement Summary:

Indication at the calibration check frequency - BS7580 #5.4	Passed
Noise test - BS 7580 #5.5.2	Passed
Level Linearity Test - BS 7580, #5.5.3	Passed
Frequency weightings: A Network - BS 7580 #5.5.4	Passed
Frequency weightings: C Network - BS 7580 #5.5.4	Passed
Frequency weightings: Z Network - BS 7580 #5.5.4	Passed
Time weightings F and S - BS 7580 #5.5.5	Passed
Peak response - BS 7580 #5.5.6	Passed
RMS accuracy - BS 7580 #5.5.7	Passed
Time weighting I - BS 7580 #5.5.8	Passed
Integrating Test : Time averaging - BS 7580 #5.5.9	Passed
Integrating Test : Pulse range - BS 7580 #5.5.10	Passed
Integrating Test : Sound exposure level - BS 7580 #5.5.11	Passed
Overload SPL Test - BS 7580 #5.5.12	Passed
Overload Leq Test - BS 7580 #5.5.12	Passed
Acoustic tests - BS 7580 #5.4 and 5.6	Passed
Summation of acoustic tests - BS 7580 #5.5.4	Passed

Comments
Correct level with associated calibrator is 124.2dB(C).

Calibration Method
The reference range, reference sound pressure level, primary indicator range, secondary indicator range, pulse range, linearity range and display range as specified by the manufacturer were used for the verification. The test object was set to A weighting and adjusted to read correctly in response to the associated sound calibrator the reading was derived from the calibrator calibration certificate and manufacturer's instruction manuals.
A measurement of the self noise of the sound level meter was then made using a dummy microphone having a capacitance of ±20% of the associated microphones self capacitance. The sound level meter was then tested, and its overall sensitivity adjusted, in accordance with the requirements of the listed standard . The acoustic calibration at 1 kHz was performed by application of a reference sound calibrator, whilst the tests at 125 Hz and 8k Hz were performed by the electrostatic actuator method. At the end of the test, the associated sound calibrator was reapplied to the sound level meter and the meter reading was recorded and is noted.

Statement of Conformance
The sound level meter in the configuration tested was found to comply with the requirements of the listed standard. The associated calibrator has been corrected for barometric pressure at the time of calibration in accordance with the relevant manufacturer's instructions

Observations
The final response obtained using the associated calibrator.(§5.6.3): 124.2dB(C) with GRAS-RA0041 s/n 546 calibration adaptor with corrections of +0.0dB at 250Hz. This reading should be used henceforth to set up the sound level meter for field use.

Certificate of Calibration

Continuation of Certificate number: U42986

The self-generated noise recorded in the test specified in § 5.5.2 was: 12.3 (Below MSD)dB(A), 13.7 (Below MSD)dB(C) and 18.4dB(Lin).

The final response obtained using the associated calibrator.(§5.6.3): 124.2dB(C).

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

A stricter test than that specified in paragraphs 5.5.6 of BS7580:1997 has been used by verifying that the 10 ms reference pulse is also correct. The level uncertainty of the Laboratory's 1 kHz sound calibrator used during this verification is ± 0.1 dB.
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%. The uncertainty evaluation has been carried out in accordance with UKAS

Decision Rule
Basic Meter Function - A PASS or PASSED statement indicates that the instrument conforms with the relevant accuracy requirements of the testing standard AND the expanded measurement uncertainty (k = 2 for approximately 95 % coverage probability) is no greater in magnitude than the accuracy requirements defined in BS-7580 Part 1:1997 standard

This certificate relates only to the items tested above.

** End of Certificate **

Measurement Results:

Indication at the calibration check frequency - BS7580 Clause 5.4

```
Reference level: 114.0 dB
Reference Range: 130 dB FS
Reference Frequency: 1000 Hz
Reference Calibrator: WSC1   (A) - Nor1253-24269
Reference calibrator level: 123.98
Before calibration:
Environmental corrections: 0.00
Other corrections: 0.00
Notional level: 123.98
Calibrator level before adjustment: 124.1
After calibration:
Environmental corrections: 0.00
Other corrections: 0.00
Notional level: 123.98
Reference calibrator level after calibration: 124.1
Associated Calibrator: Norsonic - 1253_250Hz - 21816
Associated calibrator level: 124.00
Initial level check:
Environmental corrections: 0.00
Other corrections: 0.00
Notional level: 124.00
Indicated level: 124.2
Final level statement:
Environmental corrections after calibration: 0.00
Other corrections: 0.00
Notional level: 124.00
Calibrator level after adjustment: 124.2
This value shall be used for adjusting the sound level meter in the future.
Test Passed
```

Noise test - BS 7580 Clause 5.5.2

The SLM is set to A-weighted and the most sensitive range setting. A dummy microphone is fitted, and the self-noise is measured on all available weighting networks over a 20 second period.

Network	Noise Level (dB)	Max allowed (dB)	Result code	
A	12.3	13.0	P	The value is less than MSD.
C	13.7	15.0	P	The value is less than MSD.
Z	18.4	25.0	P	The value is less than MSD.

Test Passed

Level Linearity Test - BS 7580, Clause 5.5.3

The LEQ linearity of the detector of the SLM is tested in 5 dB steps on the reference range. Additionally, the reference level and a level 2 dB above the bottom and 2 dB below the top of the other available measurement ranges are also measured.
The measurements on the reference range is repeated with SPL results, if possible
Test signal: 4 kHz sine wave.

Reference Value (dB)	Measured Value (dB)	Tol. Value (dB)	Error Value (dB)	Error Code
Measured at 4 kHz				
Full scale setting: 130dB				
The following measurements are LEQ measurements				
114.0	114.0	0.7	0.0	P
119.0	119.0	0.7	0.0	P
124.0	124.0	0.7	0.0	P
129.0	129.0	0.7	0.0	P
131.0	131.0	0.7	0.0	P
132.0	132.0	0.7	0.0	P
133.0	133.0	0.7	0.0	P
134.0	134.0	0.7	0.0	P
135.0	135.0	0.7	0.0	P
136.0	136.0	0.7	0.0	P
137.0	137.0	0.7	0.0	P
114.0	114.0	0.7	0.0	P
109.0	109.0	0.7	0.0	P
104.0	104.0	0.7	0.0	P
99.0	99.0	0.7	0.0	P
94.0	94.0	0.7	0.0	P
89.0	89.0	0.7	0.0	P
84.0	84.0	0.7	0.0	P
79.0	79.0	0.7	0.0	P
74.0	74.0	0.7	0.0	P
69.0	69.0	0.7	0.0	P
64.0	64.0	0.7	0.0	P
59.0	59.0	0.7	0.0	P
54.0	54.0	0.7	0.0	P
49.0	49.0	0.7	0.0	P
46.0	46.0	0.7	0.0	P
45.0	45.0	0.7	0.0	P
44.0	44.0	0.7	0.0	P
43.0	43.0	0.7	0.0	P
42.0	42.1	0.7	0.1	P
41.0	41.0	0.7	0.0	P
40.0	40.0	0.7	0.0	P
Full scale setting: 130dB				
114.0	114.0	0.7	0.0	P
135.0	135.0	0.7	0.0	P
40.0	40.0	0.7	0.0	P
Full scale setting: 130dB				
The following measurements are SPL measurements				
114.0	114.0	0.7	0.0	P
119.0	119.0	1.0	0.0	P
124.0	124.0	1.0	0.0	P
129.0	129.0	1.0	0.0	P
131.0	131.0	1.0	0.0	P
132.0	132.0	1.0	0.0	P

Level Linearity Test - BS 7580, Clause 5.5.3

Reference Value (dB)	Measured Value (dB)	Tol. Value (dB)	Error Value (dB)	Error Code
133.0	133.0	1.0	0.0	P
134.0	134.0	1.0	0.0	P
135.0	135.0	1.0	0.0	P
136.0	136.0	1.0	0.0	P
137.0	137.0	1.0	0.0	P
114.0	114.0	0.7	0.0	P
109.0	109.0	0.7	0.0	P
104.0	104.0	0.7	0.0	P
99.0	99.0	0.7	0.0	P
94.0	94.0	0.7	0.0	P
89.0	89.0	0.7	0.0	P
84.0	84.0	0.7	0.0	P
79.0	79.0	0.7	0.0	P
74.0	74.0	0.7	0.0	P
69.0	69.0	0.7	0.0	P
64.0	64.0	0.7	0.0	P
59.0	59.0	0.7	0.0	P
54.0	54.0	0.7	0.0	P
49.0	49.0	0.7	0.0	P
46.0	46.0	0.7	0.0	P
45.0	45.0	0.7	0.0	P
44.0	44.0	0.7	0.0	P
43.0	43.0	0.7	0.0	P
42.0	42.0	0.7	0.0	P
41.0	41.0	0.7	0.0	P
40.0	40.0	0.7	0.0	P

Test Passed

Frequency weightings: A Network - BS 7580 Clause 5.5.4

The SLM is set to its reference range and tested relative to 1k Hz at the reference SPL. All available networks are tested. Tolerances given here are for information only and relate to complete instrument, see test §5.5.4. for complete instrument data to which these tolerances relate.

Freq (Hz)	Ref (dB)	Meas. Value (dB)	Tolerance HiLim (dB)	Tolerance LoLim (dB)	Result Value (dB)	Code	
31.6	114.0	113.8	1.5	-1.5	-0.2	P	Adjusted 25.4dB **
63.1	114.0	113.9	1.5	-1.5	-0.1	P	Adjusted 12.2dB **
125.9	114.0	113.9	1.0	-1.0	-0.1	P	
251.2	114.0	113.9	1.0	-1.0	-0.1	P	
501.2	114.0	113.9	1.0	-1.0	-0.1	P	
1000.0	114.0	114.0	1.0	-1.0	0.0	P	
1995.3	114.0	113.9	1.0	-1.0	-0.1	P	
3981.1	114.0	113.8	1.0	-1.0	-0.2	P	
7943.3	114.0	113.9	1.5	-3.0	-0.1	P	
12589.3	114.0	113.9	3.0	-6.0	-0.1	P	

** indicates that level is adjusted because of limited dynamic range.

Test Passed

Frequency weightings: C Network - BS 7580 Clause 5.5.4

The SLM is set to its reference range and tested relative to 1k Hz at the reference SPL. All available networks are tested. Tolerances given here are for information only and relate to complete instrument, see test §5.5.4. for complete instrument data to which these tolerances relate.

Freq (Hz)	Ref (dB)	Meas. Value (dB)	Tolerance HiLim (dB)	Tolerance LoLim (dB)	Result Value (dB)	Code
31.6	114.0	113.9	1.5	-1.5	-0.1	P
63.1	114.0	113.9	1.5	-1.5	-0.1	P
125.9	114.0	113.9	1.0	-1.0	-0.1	P
251.2	114.0	113.9	1.0	-1.0	-0.1	P
501.2	114.0	114.0	1.0	-1.0	0.0	P
1000.0	114.0	114.0	1.0	-1.0	0.0	P
1995.3	114.0	113.9	1.0	-1.0	-0.1	P
3981.1	114.0	113.8	1.0	-1.0	-0.2	P
7943.3	114.0	113.9	1.5	-3.0	-0.1	P
12589.3	114.0	113.9	3.0	-6.0	-0.1	P

Test Passed

Frequency weightings: Z Network - BS 7580 Clause 5.5.4

The SLM is set to its reference range and tested relative to 1k Hz at the reference SPL. All available networks are tested. Tolerances given here are for information only and relate to complete instrument, see test §5.5.4. for complete instrument data to which these tolerances relate.

Freq (Hz)	Ref (dB)	Meas. Value (dB)	Tolerance HiLim (dB)	Tolerance LoLim (dB)	Result Value (dB)	Code
31.6	114.0	113.9	1.5	-1.5	-0.1	P
63.1	114.0	113.9	1.5	-1.5	-0.1	P
125.9	114.0	113.9	1.0	-1.0	-0.1	P
251.2	114.0	113.9	1.0	-1.0	-0.1	P
501.2	114.0	113.9	1.0	-1.0	-0.1	P
1000.0	114.0	114.0	1.0	-1.0	0.0	P
1995.3	114.0	113.9	1.0	-1.0	-0.1	P
3981.1	114.0	113.9	1.0	-1.0	-0.1	P
7943.3	114.0	113.9	1.5	-3.0	-0.1	P
12589.3	114.0	113.9	3.0	-6.0	-0.1	P

Test Passed

Time weightings F and S - BS 7580 Clause 5.5.5

A continuous sine wave is applied to the SLM and adjusted to give an indication 4 dB below upper limit of the primary indicator range. Then onset transient characteristics are tested using a single sine wave burst with an amplitude equal to the continuous signal and a duration of T(ms).
Test signal: Single Sine Wave Burst of 2 kHz.

Time Constant	Burst Duration (ms)	Ref. Value (dB)	Measured Value (dB)	Tolerance Value (dB)	Result Value (dB)	
Fast	200	112.0	112.0	1.0	0.0	P
Slow	500	108.9	108.9	1.0	0.0	P

Test Passed

Peak response - BS 7580 Clause 5.5.6

Rectangular wave pulses are used to test the peak response. The response of a 100 micro second pulse shall not differ from the response of a 10 milliseconds pulse by more than 2dB.

Pulse Duration	Pulse Polarity	Ref. Value (dB)	Meas. Value (dB)	Tolerance Value (dB)	Error values Abs. (dB)	Error values Rel. (dB)	Result Code
10ms	+	116.0	116.6		0.6		P
0.1ms	+	116.0	115.7	2.0	-0.3	-0.9	P
10ms	-	116.0	116.6		0.6		P
0.1ms	-	116.0	115.6	2.0	-0.4	-1.0	P

The results have been compensated for the impulse response of
the C-weighting network.
Test Passed

RMS accuracy - BS 7580 Clause 5.5.7

The instrument is set to time constant Slow. A continuous sine wave (2kHz) is applied to the SLM and adjusted to give an indication 2 dB below upper limit of the primary indicator range
The signal is replaced by a sequence of tone bursts (CF=3) with a repetition rate of 40Hz.

	Crest Factor	Ref. Value (dB)	Meas. Value (dB)	Tolerance norm (dB)	Result Value (dB)	
F	3	115.0	115.2	0.5	0.2	P
S	3	115.0	115.0	0.5	0.0	P

Test Passed

Time weighting I - BS 7580 Clause 5.5.8

A continuous sine wave (2 kHz) is applied to the SLM and adjusted to give an indication at the upper limit of the primary indicator range. The onset transient characteristics are tested. First, a single sine wave burst with the amplitude equal to the continuous signal and the duration of 5 ms is used. Then, the same burst is repeated with a frequency of 100 Hz.

Burst type	Reference Value (dB)	Measured Value (dB)	Tolerance norm (dB)	Result Value (dB)	
5 ms single burst	108.2	107.9	2.0	-0.3	P
100Hz repeated	114.3	113.9	1.0	-0.4	P

Test Passed

Integrating Test : Time averaging - BS 7580 Clause 5.5.9

The SLM is set to the reference range. The signal generator is adjusted to give a 4 kHz sine wave with an rms level 30dB below the top of the Linearity range. The sine wave is replaced by a sequence of tone burst with the same frequency and the same rms level. For type 1 and 0 instruments, the burst duty factor (the distance between each burst) is increased, while the amplitude is increased to keep the same equivalent rms level. 1 minute, 6 minutes and 1 hour respectively.
Test signal: Continuous sine wave burst of 4kHz

Burst Duration (ms)	Ref. Value (dB)	Tolerance norm (dB)	Meas. Value (dB)	Error (LeqA) (dB)	
1/10^3	107.0	1.0	107.0	0.0	P
1/10^4	97.0	1.0	97.0	0.0	P

Test Passed

Integrating Test : Pulse range - BS 7580 Clause 5.5.10

Pulse handling is tested on the reference range using a 10 ms tone burst (of 4 kHz) during an integration period of 10 seconds superimposed on a low level background signal. The resulting A-weighted Leq shall correspond to table II of BS EN IEC 60804. The test is repeated on the upper end of the linearity range.

Burst Duration (ms)	Ref. Value (dB)	Measured Value (dB)	Tolerance Norm (dB)	Result Value (dB)	
10	52.0	52.0	1.7	0.0	P
10	102.0	102.0	1.7	0.0	P

Test Passed

Integrating Test : Sound exposure level - BS 7580 Clause 5.5.11

Pulse handling is tested on the reference range using a 10 ms tone burst (of 4 kHz) during an integration period of 10 seconds. The A-weighted SEL of the burst shall correspond to table II of BS EN 60804. The test is repeated on the lower end of the pulse range.

Burst Duration (ms)	Ref. Value (dB)	Measured Value (dB)	Tolerance Norm (dB)	Result Value (dB)	
10	62.0	62.0	1.7	0.0	P
10	112.0	112.0	1.7	0.0	P

Test Passed

Overload SPL Test - BS 7580 Clause 5.5.12

The SLM is set to reference range. A continuous tone burst is applied and adjusted until overload occurs. Then signal is reduced to give an on-scale indication. The level is further reduced 3 dB and the SLM shall indicate correctly within the tolerances given in table XIII of BS EN 60651.

	Ref. Value (dB)	Measured Value (dB)	Tolerance Norm (dB)	Result Value (dB)	
SPL CF3	130.6 -3	127.6	1.0	0.0	P

Overload occurred at: 131.6dB RMS

Test Passed

Overload Leq Test - BS 7580 Clause 5.5.12

The SLM is set to Leq. A 1 ms pulse of 4 kHz on a low level background is applied and adjusted until overload occurs. Then the level is reduced 1 dB. A single tone burst is then applied and the Leq,10s measured. The result shall be within the tolerances given in table II of BS EN IEC 60804.

	Ref. Value (dB)	Measured Value (dB)	Tolerance Norm (dB)	Result Value (dB)	
LEQ 1ms	96.9	96.9	2.2	0.0	P

Overload occurred approximately at: 140.9 dB (peak level)

Test Passed

Acoustic tests - BS 7580 Clause 5.4 and 5.6

```
The sound level meter was tested at 125 Hz. (§5.6.2)
Reference level:                          90.1 dB
Ambient corrections:                           dB
Pressure to free field correction:        0.00 dB
Case reflections:                              dB
Linearity error:                               dB
Weighting correction:                     0.17 dB
Windscreen corrections:                        dB
Notional level:                          89.93 dB
Indicated level:                          90.0 dB
Tolerance:                               +/- 1 dB
Error:                                    0.07 dB
The sound level meter was tested at 1k Hz. (§5.6.2)
Reference level:                          90.1 dB
Ambient corrections:                           dB
Pressure to free field correction:        0.00 dB
Case reflections:                              dB
Linearity error:                               dB
Weighting correction:                     0.00 dB
Windscreen corrections:                        dB
Notional level:                          90.10 dB
Indicated level:                          90.0 dB
Tolerance:                               +/- 1 dB
Error:                                   -0.10 dB
The sound level meter was tested at 4k Hz. (§5.6.2)
Reference level:                          90.1 dB
Ambient corrections:                           dB
Pressure to free field correction:        1.10 dB
Case reflections:                              dB
Linearity error:                               dB
Weighting correction:                     0.82 dB
Windscreen corrections:                        dB
Notional level:                          88.18 dB
Indicated level:                          87.6 dB
Tolerance:                               +/- 1 dB
Error:                                   -0.58 dB
The sound level meter was tested at 8k Hz. (§5.6.2)
Reference level:                          90.1 dB
Ambient corrections:                           dB
Pressure to free field correction:        3.50 dB
Case reflections:                              dB
Linearity error:                               dB
Weighting correction:                     3.01 dB
Windscreen corrections:                        dB
Notional level:                          83.59 dB
Indicated level:                          82.8 dB
Tolerance:                          +1.5; -3 dB
Error:                                   -0.79 dB
The measurement was performed using an electrostatic actuator method.
Response: Free field
Test Passed
```

Summation of acoustic tests - BS 7580 Clause 5.5.4

The microphone data are measured using electrostatic actuator.

SLM: A-Weighted results

Freq. (Hz)	SLM (dB)	Mic. (dB)	CR. (dB)	WS. (dB)	Tol. (dB)	Dev. (dB)
31.5	-0.2	0.0			+-1.5	-0.2
63	-0.1	0.0			+-1.5	-0.1
125	-0.1	0.0			+-1.0	-0.1
250	-0.1	0.0			+-1.0	-0.1
500	-0.1	0.0			+-1.0	-0.1
1 k	0.0	-0.1			+-1.0	-0.1
2 k	-0.1	-0.2			+-1.0	-0.3
4 k	-0.2	-0.5			+-1.0	-0.7
8 k	-0.1	-0.8			+1.5,-3	-0.9
12.5 k	-0.1	-1.5			+3,-6	-1.6

SLM: C-Weighted results

Freq. (Hz)	SLM (dB)	Mic. (dB)	CR. (dB)	WS. (dB)	Tol. (dB)	Dev. (dB)
31.5	-0.1	0.0			+-1.5	-0.1
63	-0.1	0.0			+-1.5	-0.1
125	-0.1	0.0			+-1.0	-0.1
250	-0.1	0.0			+-1.0	-0.1
500	0.0	0.0			+-1.0	0.0
1 k	0.0	-0.1			+-1.0	-0.1
2 k	-0.1	-0.2			+-1.0	-0.3
4 k	-0.2	-0.5			+-1.0	-0.7
8 k	-0.1	-0.8			+1.5,-3	-0.9
12.5 k	-0.1	-1.5			+3,-6	-1.6

SLM: Z-Weighted results

Freq. (Hz)	SLM (dB)	Mic. (dB)	CR. (dB)	WS. (dB)	Tol. (dB)	Dev. (dB)
31.5	-0.1	0.0			+-1.5	-0.1
63	-0.1	0.0			+-1.5	-0.1
125	-0.1	0.0			+-1.0	-0.1
250	-0.1	0.0			+-1.0	-0.1
500	-0.1	0.0			+-1.0	-0.1
1 k	0.0	-0.1			+-1.0	-0.1
2 k	-0.1	-0.2			+-1.0	-0.3
4 k	-0.1	-0.5			+-1.0	-0.6
8 k	-0.1	-0.8			+1.5,-3	-0.9
12.5 k	-0.1	-1.5			+3,-6	-1.6

Test Passed

The overall frequency response of the sound level meter and microphone response has shown to conform with the requirements in §6 of the BSEN 60651 and §5.5.4 in BS 7580 Part 1.

*** End of results ***

Laboratory Location
Campbell Associates Ltd
5b Chelmsford Road Industrial Estate
GREAT DUNMOW, Essex, GB-CM6 1HD
Phone 01371 871030

Certificate of Calibration

Certificate number: **46524**

Test Object: **Sound Level Meter, BS EN 60651 and or BS EN 60804 Class 1**

Producer: **Norsonic AS.**
Type: **118**
Serial number: **32115**
Customer: **Belfast City Airport**
Address: **Airport Road, Belfast,**
Co. Antrim, Northern Ireland. BT3 9JH.
Contact Person: [redacted]
Order No: **POR014410**

Introduction:
Calibration has been performed as set out in CA Technical Procedures which are based on the procedures for periodic verification of sound level meters as per the **Test Object** listed above. Results and conformance statement are overleaf and detailed results, where appropriate, are provided in the attached Measurement Report.

Tested:	*Producer*	*Type*	*Serial No*	*Certificate No*
Microphone	GRAS	41AS	73645	46523
Calibrator*	Norsonic	1253_250Hz	26672	U44593
Preamplifier	GRAS	41AM	97213	Included

* The calibrator was complete with any required coupler for the microphone specified.

Additional items that have also been submitted for verification:
Wind shield N/A
Attenuator N/A
Extension cable N/A
These items have been taken into account wherever appropriate.

Conditions	*Pressure kPa*	*Temperature °C*	*Humidity %RH*
Reference conditions	101.325	23	50
Measurement conditions	100.82 ±0.07	22.08 ±0.55	41.85 ±2.75

Calibration Dates:

Received date:	11/01/2024	Reviewed date:	25/01/2024
Calibration date:	23/01/2024	Issued date:	25/01/2024

Technicians: (Electronic certificate)

Calibrated by: [redacted]

Reviewed by: [redacted]

This certificate is issued in accordance with the CA Quality Management system. It provides traceability of measurement to recognized national standards, and to the units of measurement realized at the National Physical Laboratory or other recognized national standards laboratories. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

Certificate of Calibration

Continuation of Certificate number: **46524**

The statements of conformance and observation notes detailed in this certificate are made with reference to the following standards in respect of the calibration of the test object.

Manufactured:	**BS EN 60651 and or BS EN 60804**
Periodic Tests:	**BS 7580 Part 1:1997**
Pattern Evaluation:	**Not Applicable**

Conformance:
From markings on the sound level meter or by reference to the manufacturer's published literature it has been determined that the instrument submitted for verification was originally manufactured to the listed standard and similarly that the associated sound calibrator conforms to the BS EN IEC 60942 standard.

Measurement Summary:

Indication at the calibration check frequency - BS7580 #5.4	Passed
Noise test - BS 7580 #5.5.2	Passed
Level Linearity Test - BS 7580, #5.5.3	Passed
Frequency weightings: A Network - BS 7580 #5.5.4	Passed
Frequency weightings: C Network - BS 7580 #5.5.4	Passed
Frequency weightings: Z Network - BS 7580 #5.5.4	Passed
Time weightings F and S - BS 7580 #5.5.5	Passed
Peak response - BS 7580 #5.5.6	Passed
RMS accuracy - BS 7580 #5.5.7	Passed
Time weighting I - BS 7580 #5.5.8	Passed
Integrating Test : Time averaging - BS 7580 #5.5.9	Passed
Integrating Test : Pulse range - BS 7580 #5.5.10	Passed
Integrating Test : Sound exposure level - BS 7580 #5.5.11	Passed
Overload SPL Test - BS 7580 #5.5.12	Passed
Overload Leq Test - BS 7580 #5.5.12	Passed
Acoustic tests - BS 7580 #5.4 and 5.6	Passed
Summation of acoustic tests - BS 7580 #5.5.4	Passed

Calibration Method
The reference range, reference sound pressure level, primary indicator range, secondary indicator range, pulse range, linearity range and display range as specified by the manufacturer were used for the verification. The test object was set to A weighting and adjusted to read correctly in response to the associated sound calibrator the reading was derived from the calibrator calibration certificate and manufacturer's instruction manuals.
A measurement of the self noise of the sound level meter was then made using a dummy microphone having a capacitance of ±20% of the associated microphones self capacitance. The sound level meter was then tested, and its overall sensitivity adjusted, in accordance with the requirements of the listed standard . The acoustic calibration at 1 kHz was performed by application of a reference sound calibrator, whilst the tests at 125 Hz and 8k Hz were performed by the electrostatic actuator method. At the end of the test, the associated sound calibrator was reapplied to the sound level meter and the meter reading was recorded and is noted.

Statement of Conformance
The sound level meter in the configuration tested was found to comply with the requirements of the listed standard. The associated calibrator has been corrected for barometric pressure at the time of calibration in accordance with the relevant manufacturer's instructions

Observations
The sound level meter in the configuration tested conforms to the requirements of BS 7580 Part 1.

Certificate of Calibration

Continuation of Certificate number: 46524

The final response obtained using the associated calibrator.(§5.6.3): 123.9dB(C) with GRAS-RA0009 s/n 1142 calibration adaptor with corrections of -0.1dB at 250Hz. This reading should be used henceforth to set up the sound level meter for field use.

The self-generated noise recorded in the test specified in § 5.5.2 was: (Below MSD) 11.8dB(A), (Below MSD) 13.6dB(C) and (Below MSD) 18.5dB(Z).

A stricter test than that specified in paragraphs 5.5.6 of BS7580:1997 has been used by verifying that the 10 ms reference pulse is also correct. The level uncertainty of the Laboratory's 1 kHz sound calibrator used during this verification is ± 0.1 dB.
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%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

This certificate relates only to the items tested above.

** End of Certificate **

Measurement Results:

Indication at the calibration check frequency - BS7580 Clause 5.4

```
Reference level: 114.0 dB
Reference Range: 130 dB FS
Reference Frequency: 1000 Hz
Reference Calibrator: WSC1  (A) - Nor1253-24269
Reference calibrator level: 123.98
Before calibration:
Environmental corrections: 0.00
Other corrections: -0.1
Notional level: 123.88
Calibrator level before adjustment: 123.9
After calibration:
Environmental corrections: 0.00
Other corrections: -0.1
Notional level: 123.88
Reference calibrator level after calibration: 123.9
Associated Calibrator: Norsonic - 1253_250Hz - 26672
Associated calibrator level: 123.98
Initial level check:
Environmental corrections: 0.00
Other corrections: -0.10
Notional level: 123.88
Indicated level: 123.9
Final level statement:
Environmental corrections after calibration: 0.00
Other corrections: -0.10
Notional level: 123.88
Calibrator level after adjustment: 123.9
This value shall be used for adjusting the sound level meter in the future.
Test Passed
```

Noise test - BS 7580 Clause 5.5.2

The SLM is set to A-weighted and the most sensitive range setting. A dummy microphone is fitted, and the self-noise is measured on all available weighting networks over a 20 second period.

```
Network  Noise Level Max allowed Result
            (dB)        (dB)     code
   A        11.8        13.0       P   The value is less than MSD.
   C        13.6        15.0       P   The value is less than MSD.
   Z        18.5        25.0       P   The value is less than MSD.
Test Passed
```

Level Linearity Test - BS 7580, Clause 5.5.3

The LEQ linearity of the detector of the SLM is tested in 5 dB steps on the reference range. Additionally, the reference level and a level 2 dB above the bottom and 2 dB below the top of the other available measurement ranges are also measured.
The measurements on the reference range is repeated with SPL results, if possible
Test signal: 4 kHz sine wave.

Reference Value (dB)	Measured Value (dB)	Tol. Value (dB)	Error Value (dB)	Error Code
Measured at 4 kHz				
Full scale setting: 130dB				
The following measurements are LEQ measurements				
114.0	114.0	0.7	0.0	P
119.0	119.0	0.7	0.0	P
124.0	124.0	0.7	0.0	P
129.0	129.0	0.7	0.0	P
131.0	131.0	0.7	0.0	P
132.0	132.0	0.7	0.0	P
133.0	133.0	0.7	0.0	P
134.0	134.0	0.7	0.0	P
135.0	135.0	0.7	0.0	P
136.0	136.0	0.7	0.0	P
137.0	137.0	0.7	0.0	P
114.0	114.0	0.7	0.0	P
109.0	109.0	0.7	0.0	P
104.0	104.1	0.7	0.1	P
99.0	99.1	0.7	0.1	P
94.0	94.1	0.7	0.1	P
89.0	89.1	0.7	0.1	P
84.0	84.1	0.7	0.1	P
79.0	79.0	0.7	0.0	P
74.0	74.0	0.7	0.0	P
69.0	69.0	0.7	0.0	P
64.0	64.0	0.7	0.0	P
59.0	59.0	0.7	0.0	P
54.0	54.1	0.7	0.1	P
49.0	49.1	0.7	0.1	P
46.0	46.1	0.7	0.1	P
45.0	45.1	0.7	0.1	P
44.0	44.1	0.7	0.1	P
43.0	43.1	0.7	0.1	P
42.0	42.1	0.7	0.1	P
41.0	41.1	0.7	0.1	P
40.0	40.1	0.7	0.1	P
Full scale setting: 130dB				
114.0	114.0	0.7	0.0	P
135.0	135.0	0.7	0.0	P
40.0	40.1	0.7	0.1	P
Full scale setting: 130dB				
The following measurements are SPL measurements				
114.0	114.0	0.7	0.0	P
119.0	119.0	1.0	0.0	P
124.0	124.0	1.0	0.0	P
129.0	129.0	1.0	0.0	P
131.0	131.0	1.0	0.0	P
132.0	132.0	1.0	0.0	P

Level Linearity Test - BS 7580, Clause 5.5.3

Reference Value (dB)	Measured Value (dB)	Tol. Value (dB)	Error Value (dB)	Error Code
133.0	133.0	1.0	0.0	P
134.0	134.0	1.0	0.0	P
135.0	135.0	1.0	0.0	P
136.0	136.0	1.0	0.0	P
137.0	137.0	1.0	0.0	P
114.0	114.1	0.7	0.1	P
109.0	109.0	0.7	0.0	P
104.0	104.1	0.7	0.1	P
99.0	99.1	0.7	0.1	P
94.0	94.1	0.7	0.1	P
89.0	89.1	0.7	0.1	P
84.0	84.1	0.7	0.1	P
79.0	79.0	0.7	0.0	P
74.0	74.0	0.7	0.0	P
69.0	69.0	0.7	0.0	P
64.0	64.0	0.7	0.0	P
59.0	59.0	0.7	0.0	P
54.0	54.1	0.7	0.1	P
49.0	49.1	0.7	0.1	P
46.0	46.0	0.7	0.0	P
45.0	45.1	0.7	0.1	P
44.0	44.1	0.7	0.1	P
43.0	43.1	0.7	0.1	P
42.0	42.1	0.7	0.1	P
41.0	41.1	0.7	0.1	P
40.0	40.1	0.7	0.1	P

Test Passed

Frequency weightings: A Network - BS 7580 Clause 5.5.4

The SLM is set to its reference range and tested relative to 1k Hz at the reference SPL. All available networks are tested. Tolerances given here are for information only and relate to complete instrument, see test §5.5.4. for complete instrument data to which these tolerances relate.

Freq (Hz)	Ref (dB)	Meas. Value (dB)	Tolerance HiLim (dB)	Tolerance LoLim (dB)	Result Value (dB)	Code	
31.6	114.0	113.9	1.5	-1.5	-0.1	P	Adjusted 25.4dB **
63.1	114.0	113.9	1.5	-1.5	-0.1	P	Adjusted 12.2dB **
125.9	114.0	113.9	1.0	-1.0	-0.1	P	
251.2	114.0	113.9	1.0	-1.0	-0.1	P	
501.2	114.0	113.9	1.0	-1.0	-0.1	P	
1000.0	114.0	114.0	1.0	-1.0	0.0	P	
1995.3	114.0	113.9	1.0	-1.0	-0.1	P	
3981.1	114.0	113.9	1.0	-1.0	-0.1	P	
7943.3	114.0	113.9	1.5	-3.0	-0.1	P	
12589.3	114.0	113.9	3.0	-6.0	-0.1	P	

** indicates that level is adjusted because of limited dynamic range.

Test Passed

Frequency weightings: C Network - BS 7580 Clause 5.5.4

The SLM is set to its reference range and tested relative to 1k Hz at the reference SPL. All available networks are tested. Tolerances given here are for information only and relate to complete instrument, see test §5.5.4. for complete instrument data to which these tolerances relate.

Freq (Hz)	Ref (dB)	Meas. Value (dB)	Tolerance HiLim (dB)	Tolerance LoLim (dB)	Result Value (dB)	Code
31.6	114.0	113.8	1.5	-1.5	-0.2	P
63.1	114.0	113.9	1.5	-1.5	-0.1	P
125.9	114.0	114.0	1.0	-1.0	0.0	P
251.2	114.0	113.9	1.0	-1.0	-0.1	P
501.2	114.0	114.0	1.0	-1.0	0.0	P
1000.0	114.0	114.0	1.0	-1.0	0.0	P
1995.3	114.0	113.9	1.0	-1.0	-0.1	P
3981.1	114.0	113.8	1.0	-1.0	-0.2	P
7943.3	114.0	113.9	1.5	-3.0	-0.1	P
12589.3	114.0	113.9	3.0	-6.0	-0.1	P

Test Passed

Frequency weightings: Z Network - BS 7580 Clause 5.5.4

The SLM is set to its reference range and tested relative to 1k Hz at the reference SPL. All available networks are tested. Tolerances given here are for information only and relate to complete instrument, see test §5.5.4. for complete instrument data to which these tolerances relate.

Freq (Hz)	Ref (dB)	Meas. Value (dB)	Tolerance HiLim (dB)	Tolerance LoLim (dB)	Result Value (dB)	Code
31.6	114.0	113.8	1.5	-1.5	-0.2	P
63.1	114.0	113.9	1.5	-1.5	-0.1	P
125.9	114.0	113.9	1.0	-1.0	-0.1	P
251.2	114.0	113.9	1.0	-1.0	-0.1	P
501.2	114.0	113.9	1.0	-1.0	-0.1	P
1000.0	114.0	114.0	1.0	-1.0	0.0	P
1995.3	114.0	113.9	1.0	-1.0	-0.1	P
3981.1	114.0	113.9	1.0	-1.0	-0.1	P
7943.3	114.0	114.0	1.5	-3.0	0.0	P
12589.3	114.0	113.9	3.0	-6.0	-0.1	P

Test Passed

Time weightings F and S - BS 7580 Clause 5.5.5

A continuous sine wave is applied to the SLM and adjusted to give an indication 4 dB below upper limit of the primary indicator range. Then onset transient characteristics are tested using a single sine wave burst with an amplitude equal to the continuous signal and a duration of T(ms).
Test signal: Single Sine Wave Burst of 2 kHz.

Time Constant	Burst Duration (ms)	Ref. Value (dB)	Measured Value (dB)	Tolerance Value (dB)	Result Value (dB)	
Fast	200	112.0	112.0	1.0	0.0	P
Slow	500	108.9	108.9	1.0	0.0	P

Test Passed

Peak response - BS 7580 Clause 5.5.6

Rectangular wave pulses are used to test the peak response. The response of a 100 micro second pulse shall not differ from the response of a 10 milliseconds pulse by more than 2dB.

Pulse Duration	Pulse Polarity	Ref. Value (dB)	Meas. Value (dB)	Tolerance Value (dB)	Error values Abs. (dB)	Error values Rel. (dB)	Result Code
10ms	+	116.0	116.6		0.6		P
0.1ms	+	116.0	115.6	2.0	-0.4	-1.0	P
10ms	-	116.0	116.5		0.5		P
0.1ms	-	116.0	115.5	2.0	-0.5	-1.0	P

The results have been compensated for the impulse response of
the C-weighting network.
Test Passed

RMS accuracy - BS 7580 Clause 5.5.7

The instrument is set to time constant Slow. A continuous sine wave (2kHz) is applied to the SLM and adjusted to give an indication 2 dB below upper limit of the primary indicator range
The signal is replaced by a sequence of tone bursts (CF=3) with a repetition rate of 40Hz.

	Crest Factor	Ref. Value (dB)	Meas. Value (dB)	Tolerance norm (dB)	Result Value (dB)	
F	3	115.0	115.0	0.5	0.0	P
S	3	115.0	114.9	0.5	-0.1	P

Test Passed

Time weighting I - BS 7580 Clause 5.5.8

A continuous sine wave (2 kHz) is applied to the SLM and adjusted to give an indication at the upper limit of the primary indicator range. The onset transient characteristics are tested. First, a single sine wave burst with the amplitude equal to the continuous signal and the duration of 5 ms is used. Then, the same burst is repeated with a frequency of 100 Hz.

Burst type	Reference Value (dB)	Measured Value (dB)	Tolerance norm (dB)	Result Value (dB)	
5 ms single burst	108.2	107.9	2.0	-0.3	P
100Hz repeated	114.3	113.9	1.0	-0.4	P

Test Passed

Integrating Test : Time averaging - BS 7580 Clause 5.5.9

The SLM is set to the reference range. The signal generator is adjusted to give a 4 kHz sine wave with an rms level 30dB below the top of the Linearity range. The sine wave is replaced by a sequence of tone burst with the same frequency and the same rms level. For type 1 and 0 instruments, the burst duty factor (the distance between each burst) is increased, while the amplitude is increased to keep the same equivalent rms level. 1 minute, 6 minutes and 1 hour respectively.
Test signal: Continuous sine wave burst of 4kHz

Burst Duration (ms)	Ref. Value (dB)	Tolerance norm (dB)	Meas. Value (dB)	Error (LeqA) (dB)	
1/10^3	107.0	1.0	106.9	-0.1	P
1/10^4	97.0	1.0	96.9	-0.1	P

Test Passed

Integrating Test : Pulse range - BS 7580 Clause 5.5.10

Pulse handling is tested on the reference range using a 10 ms tone burst (of 4 kHz) during an integration period of 10 seconds superimposed on a low level background signal. The resulting A-weighted Leq shall correspond to table II of BS EN IEC 60804. The test is repeated on the upper end of the linearity range.

Burst Duration (ms)	Ref. Value (dB)	Measured Value (dB)	Tolerance Norm (dB)	Result Value (dB)	
10	52.0	52.0	1.7	0.0	P
10	102.0	101.9	1.7	-0.1	P

Test Passed

Integrating Test : Sound exposure level - BS 7580 Clause 5.5.11

Pulse handling is tested on the reference range using a 10 ms tone burst (of 4 kHz) during an integration period of 10 seconds. The A-weighted SEL of the burst shall correspond to table II of BS EN 60804. The test is repeated on the lower end of the pulse range.

Burst Duration (ms)	Ref. Value (dB)	Measured Value (dB)	Tolerance Norm (dB)	Result Value (dB)	
10	62.0	62.0	1.7	0.0	P
10	112.0	111.9	1.7	-0.1	P

Test Passed

Overload SPL Test - BS 7580 Clause 5.5.12

The SLM is set to reference range. A continuous tone burst is applied and adjusted until overload occurs. Then signal is reduced to give an on-scale indication. The level is further reduced 3 dB and the SLM shall indicate correctly within the tolerances given in table XIII of BS EN 60651.

	Ref. Value (dB)	Measured Value (dB)	Tolerance Norm (dB)	Result Value (dB)	
SPL CF3	130.7 -3	127.7	1.0	0.0	P

Overload occurred at: 131.7dB RMS

Test Passed

Overload Leq Test - BS 7580 Clause 5.5.12

The SLM is set to Leq. A 1 ms pulse of 4 kHz on a low level background is applied and adjusted until overload occurs. Then the level is reduced 1 dB. A single tone burst is then applied and the Leq,10s measured. The result shall be within the tolerances given in table II of BS EN IEC 60804.

	Ref. Value (dB)	Measured Value (dB)	Tolerance Norm (dB)	Result Value (dB)	
LEQ 1ms	97.0	97.0	2.2	0.0	P

Overload occurred approximately at: 141.0 dB (peak level)

Test Passed

Acoustic tests - BS 7580 Clause 5.4 and 5.6

The sound level meter was initially calibrated with the associated calibrator.(§5.4)

Reference level:	123.98 dB
Ambient corrections:	0.00 dB
Pressure to free field correction:	-0.10 dB
Corrected level:	123.88 dB
Indicated level:	123.9 dB

The sound level meter was tested at 125 Hz. (§5.6.2)

Reference level:	87.0 dB
Ambient corrections:	dB
Pressure to free field correction:	0.00 dB
Case reflections:	dB
Linearity error:	dB
Weighting correction:	0.17 dB
Windscreen corrections:	dB
Notional level:	86.83 dB
Indicated level:	86.9 dB
Tolerance:	+/- 1 dB
Error:	0.07 dB

The sound level meter was tested at 1k Hz. (§5.6.2)

Reference level:	87.0 dB
Ambient corrections:	dB
Pressure to free field correction:	0.00 dB
Case reflections:	dB
Linearity error:	dB
Weighting correction:	0.00 dB
Windscreen corrections:	dB
Notional level:	87.00 dB
Indicated level:	87.0 dB
Tolerance:	+/- 1 dB
Error:	0.00 dB

The sound level meter was tested at 4k Hz. (§5.6.2)

Reference level:	87.0 dB
Ambient corrections:	dB
Pressure to free field correction:	1.10 dB
Case reflections:	dB
Linearity error:	dB
Weighting correction:	0.82 dB
Windscreen corrections:	dB
Notional level:	85.08 dB
Indicated level:	84.7 dB
Tolerance:	+/- 1 dB
Error:	-0.38 dB

The sound level meter was tested at 8k Hz. (§5.6.2)

Reference level:	87.0 dB
Ambient corrections:	dB
Pressure to free field correction:	3.50 dB
Case reflections:	dB
Linearity error:	dB
Weighting correction:	3.01 dB
Windscreen corrections:	dB
Notional level:	80.49 dB
Indicated level:	80.1 dB
Tolerance:	+1.5; -3 dB
Error:	-0.39 dB

The measurement was performed using an electrostatic actuator method.
Response: Free field
The following response was finally obtained using the associated calibrator.(§5.6.3)

Acoustic tests - BS 7580 Clause 5.4 and 5.6

Calibrator level: 123.98 dB
Ambient corrections: 0.00 dB
Other corrections: -0.10 dB
Notional level: 123.88 dB
The sound level meter reading obtained at the end of the measurements in response to the associated sound calibrator was: 123.9 dB.
This reading should be used henceforth to set up the sound level meter for field use.
Test Passed

Summation of acoustic tests - BS 7580 Clause 5.5.4

The microphone data are measured using electrostatic actuator.
SLM: A-Weighted results

Freq. (Hz)	SLM (dB)	Mic. (dB)	CR. (dB)	WS. (dB)	Tol. (dB)	Dev. (dB)
31.5	-0.1	0.0			+-1.5	-0.1
63	-0.1	0.0			+-1.5	-0.1
125	-0.1	0.0			+-1.0	-0.1
250	-0.1	0.0			+-1.0	-0.1
500	-0.1	0.0			+-1.0	-0.1
1 k	0.0	-0.1			+-1.0	-0.1
2 k	-0.1	-0.2			+-1.0	-0.3
4 k	-0.1	-0.5			+-1.0	-0.6
8 k	-0.1	-0.6			+1.5,-3	-0.7
12.5 k	-0.1	-0.9			+3,-6	-1.0

SLM: C-Weighted results

Freq. (Hz)	SLM (dB)	Mic. (dB)	CR. (dB)	WS. (dB)	Tol. (dB)	Dev. (dB)
31.5	-0.2	0.0			+-1.5	-0.2
63	-0.1	0.0			+-1.5	-0.1
125	0.0	0.0			+-1.0	0.0
250	-0.1	0.0			+-1.0	-0.1
500	0.0	0.0			+-1.0	0.0
1 k	0.0	-0.1			+-1.0	-0.1
2 k	-0.1	-0.2			+-1.0	-0.3
4 k	-0.2	-0.5			+-1.0	-0.7
8 k	-0.1	-0.6			+1.5,-3	-0.7
12.5 k	-0.1	-0.9			+3,-6	-1.0

SLM: Z-Weighted results

Freq. (Hz)	SLM (dB)	Mic. (dB)	CR. (dB)	WS. (dB)	Tol. (dB)	Dev. (dB)
31.5	-0.2	0.0			+-1.5	-0.2
63	-0.1	0.0			+-1.5	-0.1
125	-0.1	0.0			+-1.0	-0.1
250	-0.1	0.0			+-1.0	-0.1
500	-0.1	0.0			+-1.0	-0.1
1 k	0.0	-0.1			+-1.0	-0.1
2 k	-0.1	-0.2			+-1.0	-0.3
4 k	-0.1	-0.5			+-1.0	-0.6
8 k	0.0	-0.6			+1.5,-3	-0.6
12.5 k	-0.1	-0.9			+3,-6	-1.0

Test Passed
The overall frequency response of the sound level meter and microphone response has shown to conform with the requirements in §6 of the BSEN 60651 and §5.5.4 in BS 7580 Part 1.

Summation of acoustic tests - BS 7580 Clause 5.5.4

*** End of results ***

Laboratory Location
Campbell Associates Ltd
5b Chelmsford Road Industrial Estate
GREAT DUNMOW, Essex, GB-CM6 1HD
Phone 01371 871030

Certificate of Calibration

Certificate number: **48480**

Test Object: **Sound Level Meter, BS EN 60651 and or BS EN 60804 Class 1**

Producer: **Norsonic AS.**
Type: **118**
Serial number: **32117**
Customer: **Belfast City Airport**
Address: **Airport Road, Belfast,**
Co. Antrim, Northern Ireland. BT3 9JH.
Contact Person: [redacted]
Order No: **POR014136**

Introduction:
Calibration has been performed as set out in CA Technical Procedures which are based on the procedures for periodic verification of sound level meters as per the **Test Object** listed above. Results and conformance statement are overleaf and detailed results, where appropriate, are provided in the attached Measurement Report.

Tested:	*Producer*	*Type*	*Serial No*	*Certificate No*
Microphone	GRAS	41AS	73643	48479
Calibrator*	Norsonic	1253_250Hz	26672	U48274
Preamplifier	GRAS	41AM	95491	Included

* The calibrator was complete with any required coupler for the microphone specified.

Additional items that have also been submitted for verification:
Wind shield N/A
Attenuator N/A
Extension cable N/A
These items have been taken into account wherever appropriate.

Conditions	*Pressure kPa*	*Temperature °C*	*Humidity %RH*
Reference conditions	101.325	23	50
Measurement conditions	100.27 ±0.01	22.03 ±0.1	59.53 ±1.95

Calibration Dates:

Received date:	02/08/2024	Reviewed date:	06/08/2024
Calibration date:	06/08/2024	Issued date:	06/08/2024

Technicians: (Electronic certificate)

Calibrated by: [redacted]

Reviewed by: [redacted]

This certificate is issued in accordance with the CA Quality Management system. It provides traceability of measurement to recognized national standards, and to the units of measurement realized at the National Physical Laboratory or other recognized national standards laboratories. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

Certificate of Calibration

Continuation of Certificate number: **48480**

The statements of conformance and observation notes detailed in this certificate are made with reference to the following standards in respect of the calibration of the test object.

Manufactured:	**BS EN 60651 and or BS EN 60804**
Periodic Tests:	**BS 7580 Part 1:1997**
Pattern Evaluation:	**Not Applicable**

Conformance:
From markings on the sound level meter or by reference to the manufacturer's published literature it has been determined that the instrument submitted for verification was originally manufactured to the listed standard and similarly that the associated sound calibrator conforms to the BS EN IEC 60942 standard.

Measurement Summary:

Indication at the calibration check frequency - BS7580 #5.4	Passed
Noise test - BS 7580 #5.5.2	Passed
Level Linearity Test - BS 7580, #5.5.3	Passed
Frequency weightings: A Network - BS 7580 #5.5.4	Passed
Frequency weightings: C Network - BS 7580 #5.5.4	Passed
Frequency weightings: Z Network - BS 7580 #5.5.4	Passed
Time weightings F and S - BS 7580 #5.5.5	Passed
Peak response - BS 7580 #5.5.6	Passed
RMS accuracy - BS 7580 #5.5.7	Passed
Time weighting I - BS 7580 #5.5.8	Passed
Integrating Test : Time averaging - BS 7580 #5.5.9	Passed
Integrating Test : Pulse range - BS 7580 #5.5.10	Passed
Integrating Test : Sound exposure level - BS 7580 #5.5.11	Passed
Overload SPL Test - BS 7580 #5.5.12	Passed
Overload Leq Test - BS 7580 #5.5.12	Passed
Acoustic tests - BS 7580 #5.4 and 5.6	Passed
Summation of acoustic tests - BS 7580 #5.5.4	Passed

Calibration Method
The reference range, reference sound pressure level, primary indicator range, secondary indicator range, pulse range, linearity range and display range as specified by the manufacturer were used for the verification. The test object was set to A weighting and adjusted to read correctly in response to the associated sound calibrator the reading was derived from the calibrator calibration certificate and manufacturer's instruction manuals.
A measurement of the self noise of the sound level meter was then made using a dummy microphone having a capacitance of ±20% of the associated microphones self capacitance. The sound level meter was then tested, and its overall sensitivity adjusted, in accordance with the requirements of the listed standard . The acoustic calibration at 1 kHz was performed by application of a reference sound calibrator, whilst the tests at 125 Hz and 8k Hz were performed by the electrostatic actuator method. At the end of the test, the associated sound calibrator was reapplied to the sound level meter and the meter reading was recorded and is noted.

Statement of Conformance
The sound level meter in the configuration tested was found to comply with the requirements of the listed standard. The associated calibrator has been corrected for barometric pressure at the time of calibration in accordance with the relevant manufacturer's instructions

Observations
The sound level meter in the configuration tested conforms to the requirements of BS 7580 Part 1.

The self-generated noise recorded in the test specified in § 5.5.2 was: (Below MSD) 11.7dB(A), (Below MSD) 13.1dB(C) and (Below MSD) 18.1dB(Z)

Certificate of Calibration

Continuation of Certificate number: 48480

The final response obtained using the associated calibrator.(§5.6.3): 123.9dB(C).

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

A stricter test than that specified in paragraphs 5.5.6 of BS7580:1997 has been used by verifying that the 10 ms reference pulse is also correct. The level uncertainty of the Laboratory's 1 kHz sound calibrator used during this verification is ± 0.1 dB.
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%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

This certificate relates only to the items tested above.

** End of Certificate **

Measurement Results:

Indication at the calibration check frequency - BS7580 Clause 5.4

```
Reference level: 114.0 dB
Reference Range: 130 dB FS
Reference Frequency: 1000 Hz
Reference Calibrator: WSC9  (C) - Nor-1253.21816
Reference calibrator level: 124.00
Before calibration:
Environmental corrections: 0.00
Other corrections: -0.1
Notional level: 123.90
Calibrator level before adjustment: 123.9
After calibration:
Environmental corrections: 0.00
Other corrections: -0.1
Notional level: 123.90
Reference calibrator level after calibration: 123.9
Associated Calibrator: Norsonic - 1253_250Hz - 26672
Associated calibrator level: 124.00
Initial level check:
Environmental corrections: 0.00
Other corrections: -0.10
Notional level: 123.90
Indicated level: 123.9
Final level statement:
Environmental corrections after calibration: 0.00
Other corrections: -0.10
Notional level: 123.90
Calibrator level after adjustment: 123.9
This value shall be used for adjusting the sound level meter in the future.
Test Passed
```

Noise test - BS 7580 Clause 5.5.2

The SLM is set to A-weighted and the most sensitive range setting. A dummy microphone is fitted, and the self-noise is measured on all available weighting networks over a 20 second period.

```
Network  Noise Level Max allowed Result
            (dB)        (dB)     code
   A        11.7        13.0       P   The value is less than MSD.
   C        13.1        15.0       P   The value is less than MSD.
   Z        18.1        25.0       P   The value is less than MSD.
Test Passed
```

Level Linearity Test - BS 7580, Clause 5.5.3

The LEQ linearity of the detector of the SLM is tested in 5 dB steps on the reference range. Additionally, the reference level and a level 2 dB above the bottom and 2 dB below the top of the other available measurement ranges are also measured.
The measurements on the reference range is repeated with SPL results, if possible
Test signal: 4 kHz sine wave.

Reference Value (dB)	Measured Value (dB)	Tol. Value (dB)	Error Value (dB)	Error Code
Measured at 4 kHz				
Full scale setting: 130dB				
The following measurements are LEQ measurements				
114.0	114.1	0.7	0.1	P
119.0	119.1	0.7	0.1	P
124.0	124.1	0.7	0.1	P
129.0	129.1	0.7	0.1	P
131.0	131.1	0.7	0.1	P
132.0	132.1	0.7	0.1	P
133.0	133.0	0.7	0.0	P
134.0	134.0	0.7	0.0	P
135.0	135.0	0.7	0.0	P
136.0	136.0	0.7	0.0	P
137.0	137.0	0.7	0.0	P
114.0	114.0	0.7	0.0	P
109.0	109.0	0.7	0.0	P
104.0	104.0	0.7	0.0	P
99.0	99.1	0.7	0.1	P
94.0	94.0	0.7	0.0	P
89.0	89.1	0.7	0.1	P
84.0	84.0	0.7	0.0	P
79.0	79.0	0.7	0.0	P
74.0	74.0	0.7	0.0	P
69.0	69.0	0.7	0.0	P
64.0	64.0	0.7	0.0	P
59.0	59.0	0.7	0.0	P
54.0	54.0	0.7	0.0	P
49.0	49.0	0.7	0.0	P
46.0	46.0	0.7	0.0	P
45.0	45.0	0.7	0.0	P
44.0	44.0	0.7	0.0	P
43.0	43.0	0.7	0.0	P
42.0	42.0	0.7	0.0	P
41.0	41.0	0.7	0.0	P
40.0	40.0	0.7	0.0	P
Full scale setting: 130dB				
114.0	114.1	0.7	0.1	P
135.0	135.1	0.7	0.1	P
40.0	40.0	0.7	0.0	P
Full scale setting: 130dB				
The following measurements are SPL measurements				
114.0	114.0	0.7	0.0	P
119.0	119.1	1.0	0.1	P
124.0	124.0	1.0	0.0	P
129.0	129.1	1.0	0.1	P
131.0	131.0	1.0	0.0	P
132.0	132.0	1.0	0.0	P

Level Linearity Test - BS 7580, Clause 5.5.3

Reference Value (dB)	Measured Value (dB)	Tol. Value (dB)	Error Value (dB)	Error Code
133.0	133.0	1.0	0.0	P
134.0	134.0	1.0	0.0	P
135.0	135.0	1.0	0.0	P
136.0	136.0	1.0	0.0	P
137.0	137.0	1.0	0.0	P
114.0	114.1	0.7	0.1	P
109.0	109.1	0.7	0.1	P
104.0	104.0	0.7	0.0	P
99.0	99.1	0.7	0.1	P
94.0	94.0	0.7	0.0	P
89.0	89.1	0.7	0.1	P
84.0	84.0	0.7	0.0	P
79.0	79.0	0.7	0.0	P
74.0	74.0	0.7	0.0	P
69.0	69.0	0.7	0.0	P
64.0	64.0	0.7	0.0	P
59.0	59.0	0.7	0.0	P
54.0	54.0	0.7	0.0	P
49.0	49.0	0.7	0.0	P
46.0	46.0	0.7	0.0	P
45.0	45.0	0.7	0.0	P
44.0	44.0	0.7	0.0	P
43.0	43.0	0.7	0.0	P
42.0	42.1	0.7	0.1	P
41.0	41.0	0.7	0.0	P
40.0	40.0	0.7	0.0	P

Test Passed

Frequency weightings: A Network - BS 7580 Clause 5.5.4

The SLM is set to its reference range and tested relative to 1k Hz at the reference SPL. All available networks are tested. Tolerances given here are for information only and relate to complete instrument, see test §5.5.4. for complete instrument data to which these tolerances relate.

Freq (Hz)	Ref (dB)	Meas. Value (dB)	Tolerance HiLim (dB)	Tolerance LoLim (dB)	Result Value (dB)	Code	
31.6	114.0	113.9	1.5	-1.5	-0.1	P	Adjusted 25.4dB **
63.1	114.0	114.0	1.5	-1.5	0.0	P	Adjusted 12.2dB **
125.9	114.0	114.0	1.0	-1.0	0.0	P	
251.2	114.0	114.0	1.0	-1.0	0.0	P	
501.2	114.0	114.0	1.0	-1.0	0.0	P	
1000.0	114.0	114.0	1.0	-1.0	0.0	P	
1995.3	114.0	114.0	1.0	-1.0	0.0	P	
3981.1	114.0	114.0	1.0	-1.0	0.0	P	
7943.3	114.0	114.0	1.5	-3.0	0.0	P	
12589.3	114.0	114.0	3.0	-6.0	0.0	P	

** indicates that level is adjusted because of limited dynamic range.

Test Passed

Frequency weightings: C Network - BS 7580 Clause 5.5.4

The SLM is set to its reference range and tested relative to 1k Hz at the reference SPL. All available networks are tested. Tolerances given here are for information only and relate to complete instrument, see test §5.5.4. for complete instrument data to which these tolerances relate.

Freq (Hz)	Ref (dB)	Meas. Value (dB)	Tolerance HiLim (dB)	Tolerance LoLim (dB)	Result Value (dB)	Code
31.6	114.0	113.9	1.5	-1.5	-0.1	P
63.1	114.0	114.0	1.5	-1.5	0.0	P
125.9	114.0	114.1	1.0	-1.0	0.1	P
251.2	114.0	114.0	1.0	-1.0	0.0	P
501.2	114.0	114.1	1.0	-1.0	0.1	P
1000.0	114.0	114.0	1.0	-1.0	0.0	P
1995.3	114.0	114.0	1.0	-1.0	0.0	P
3981.1	114.0	114.0	1.0	-1.0	0.0	P
7943.3	114.0	114.0	1.5	-3.0	0.0	P
12589.3	114.0	114.0	3.0	-6.0	0.0	P

Test Passed

Frequency weightings: Z Network - BS 7580 Clause 5.5.4

The SLM is set to its reference range and tested relative to 1k Hz at the reference SPL. All available networks are tested. Tolerances given here are for information only and relate to complete instrument, see test §5.5.4. for complete instrument data to which these tolerances relate.

Freq (Hz)	Ref (dB)	Meas. Value (dB)	Tolerance HiLim (dB)	Tolerance LoLim (dB)	Result Value (dB)	Code
31.6	114.0	114.0	1.5	-1.5	0.0	P
63.1	114.0	113.9	1.5	-1.5	-0.1	P
125.9	114.0	114.0	1.0	-1.0	0.0	P
251.2	114.0	114.0	1.0	-1.0	0.0	P
501.2	114.0	114.0	1.0	-1.0	0.0	P
1000.0	114.0	114.0	1.0	-1.0	0.0	P
1995.3	114.0	114.0	1.0	-1.0	0.0	P
3981.1	114.0	114.0	1.0	-1.0	0.0	P
7943.3	114.0	114.0	1.5	-3.0	0.0	P
12589.3	114.0	114.0	3.0	-6.0	0.0	P

Test Passed

Time weightings F and S - BS 7580 Clause 5.5.5

A continuous sine wave is applied to the SLM and adjusted to give an indication 4 dB below upper limit of the primary indicator range. Then onset transient characteristics are tested using a single sine wave burst with an amplitude equal to the continuous signal and a duration of T(ms).
Test signal: Single Sine Wave Burst of 2 kHz.

Time Constant	Burst Duration (ms)	Ref. Value (dB)	Measured Value (dB)	Tolerance Value (dB)	Result Value (dB)	
Fast	200	112.0	111.9	1.0	-0.1	P
Slow	500	108.9	108.9	1.0	0.0	P

Test Passed

Peak response - BS 7580 Clause 5.5.6

Rectangular wave pulses are used to test the peak response. The response of a 100 micro second pulse shall not differ from the response of a 10 milliseconds pulse by more than 2dB.

Pulse Duration	Pulse Polarity	Ref. Value (dB)	Meas. Value (dB)	Tolerance Value (dB)	Error values Abs. (dB)	Error values Rel. (dB)	Result Code
10ms	+	116.0	116.7		0.7		P
0.1ms	+	116.0	115.7	2.0	-0.3	-1.0	P
10ms	-	116.0	116.7		0.7		P
0.1ms	-	116.0	115.7	2.0	-0.3	-1.0	P

The results have been compensated for the impulse response of
the C-weighting network.
Test Passed

RMS accuracy - BS 7580 Clause 5.5.7

The instrument is set to time constant Slow. A continuous sine wave (2kHz) is applied to the SLM and adjusted to give an indication 2 dB below upper limit of the primary indicator range
The signal is replaced by a sequence of tone bursts (CF=3) with a repetition rate of 40Hz.

	Crest Factor	Ref. Value (dB)	Meas. Value (dB)	Tolerance norm (dB)	Result Value (dB)	
F	3	115.0	115.1	0.5	0.1	P
S	3	115.0	115.0	0.5	0.0	P

Test Passed

Time weighting I - BS 7580 Clause 5.5.8

A continuous sine wave (2 kHz) is applied to the SLM and adjusted to give an indication at the upper limit of the primary indicator range. The onset transient characteristics are tested. First, a single sine wave burst with the amplitude equal to the continuous signal and the duration of 5 ms is used. Then, the same burst is repeated with a frequency of 100 Hz.

Burst type	Reference Value (dB)	Measured Value (dB)	Tolerance norm (dB)	Result Value (dB)	
5 ms single burst	108.2	107.9	2.0	-0.3	P
100Hz repeated	114.3	113.9	1.0	-0.4	P

Test Passed

Integrating Test : Time averaging - BS 7580 Clause 5.5.9

The SLM is set to the reference range. The signal generator is adjusted to give a 4 kHz sine wave with an rms level 30dB below the top of the Linearity range. The sine wave is replaced by a sequence of tone burst with the same frequency and the same rms level. For type 1 and 0 instruments, the burst duty factor (the distance between each burst) is increased, while the amplitude is increased to keep the same equivalent rms level. 1 minute, 6 minutes and 1 hour respectively.
Test signal: Continuous sine wave burst of 4kHz

Burst Duration (ms)	Ref. Value (dB)	Tolerance norm (dB)	Meas. Value (dB)	Error (LeqA) (dB)	
1/10^3	107.0	1.0	106.9	-0.1	P
1/10^4	97.0	1.0	96.9	-0.1	P

Test Passed

Integrating Test : Pulse range - BS 7580 Clause 5.5.10

Pulse handling is tested on the reference range using a 10 ms tone burst (of 4 kHz) during an integration period of 10 seconds superimposed on a low level background signal. The resulting A-weighted Leq shall correspond to table II of BS EN IEC 60804. The test is repeated on the upper end of the linearity range.

Burst Duration (ms)	Ref. Value (dB)	Measured Value (dB)	Tolerance Norm (dB)	Result Value (dB)	
10	52.0	52.0	1.7	0.0	P
10	102.0	102.0	1.7	0.0	P

Test Passed

Integrating Test : Sound exposure level - BS 7580 Clause 5.5.11

Pulse handling is tested on the reference range using a 10 ms tone burst (of 4 kHz) during an integration period of 10 seconds. The A-weighted SEL of the burst shall correspond to table II of BS EN 60804. The test is repeated on the lower end of the pulse range.

Burst Duration (ms)	Ref. Value (dB)	Measured Value (dB)	Tolerance Norm (dB)	Result Value (dB)	
10	62.0	61.9	1.7	-0.1	P
10	112.0	112.0	1.7	0.0	P

Test Passed

Overload SPL Test - BS 7580 Clause 5.5.12

The SLM is set to reference range. A continuous tone burst is applied and adjusted until overload occurs. Then signal is reduced to give an on-scale indication. The level is further reduced 3 dB and the SLM shall indicate correctly within the tolerances given in table XIII of BS EN 60651.

	Ref. Value (dB)	Measured Value (dB)	Tolerance Norm (dB)	Result Value (dB)	
SPL CF3	130.6 -3	127.6	1.0	0.0	P

Overload occurred at: 131.6dB RMS

Test Passed

Overload Leq Test - BS 7580 Clause 5.5.12

The SLM is set to Leq. A 1 ms pulse of 4 kHz on a low level background is applied and adjusted until overload occurs. Then the level is reduced 1 dB. A single tone burst is then applied and the Leq,10s measured. The result shall be within the tolerances given in table II of BS EN IEC 60804.

	Ref. Value (dB)	Measured Value (dB)	Tolerance Norm (dB)	Result Value (dB)	
LEQ 1ms	97.0	97.0	2.2	0.0	P

Overload occurred approximately at: 141.0 dB (peak level)

Test Passed

Acoustic tests - BS 7580 Clause 5.4 and 5.6

The sound level meter was initially calibrated with the associated calibrator.(§5.4)

Reference level:	124.00 dB
Ambient corrections:	0.00 dB
Pressure to free field correction:	-0.10 dB
Corrected level:	123.90 dB
Indicated level:	123.9 dB

The sound level meter was tested at 125 Hz. (§5.6.2)

Reference level:	89.9 dB
Ambient corrections:	dB
Pressure to free field correction:	0.00 dB
Case reflections:	dB
Linearity error:	dB
Weighting correction:	0.00 dB
Windscreen corrections:	dB
Notional level:	89.90 dB
Indicated level:	89.9 dB
Tolerance:	+/- 1 dB
Error:	0.00 dB

The sound level meter was tested at 1k Hz. (§5.6.2)

Reference level:	89.9 dB
Ambient corrections:	dB
Pressure to free field correction:	0.00 dB
Case reflections:	dB
Linearity error:	dB
Weighting correction:	0.00 dB
Windscreen corrections:	dB
Notional level:	89.90 dB
Indicated level:	89.8 dB
Tolerance:	+/- 1 dB
Error:	-0.10 dB

The sound level meter was tested at 4k Hz. (§5.6.2)

Reference level:	89.9 dB
Ambient corrections:	dB
Pressure to free field correction:	1.10 dB
Case reflections:	dB
Linearity error:	dB
Weighting correction:	0.00 dB
Windscreen corrections:	dB
Notional level:	88.80 dB
Indicated level:	88.4 dB
Tolerance:	+/- 1 dB
Error:	-0.40 dB

The sound level meter was tested at 8k Hz. (§5.6.2)

Reference level:	89.9 dB
Ambient corrections:	dB
Pressure to free field correction:	3.50 dB
Case reflections:	dB
Linearity error:	dB
Weighting correction:	0.00 dB
Windscreen corrections:	dB
Notional level:	86.40 dB
Indicated level:	85.8 dB
Tolerance:	+1.5; -3 dB
Error:	-0.60 dB

The measurement was performed using an electrostatic actuator method.
Response: Free field
The following response was finally obtained using the associated calibrator.(§5.6.3)

Acoustic tests - BS 7580 Clause 5.4 and 5.6

Calibrator level: 124.00 dB
Ambient corrections: 0.00 dB
Other corrections: -0.10 dB
Notional level: 123.90 dB
The sound level meter reading obtained at the end of the measurements in response to the associated sound calibrator was: 123.9 dB.
This reading should be used henceforth to set up the sound level meter for field use.
Test Passed

Summation of acoustic tests - BS 7580 Clause 5.5.4

The microphone data are measured using electrostatic actuator.
SLM: A-Weighted results

Freq. (Hz)	SLM (dB)	Mic. (dB)	CR. (dB)	WS. (dB)	Tol. (dB)	Dev. (dB)
31.5	-0.1	0.0			+-1.5	-0.1
63	0.0	0.0			+-1.5	0.0
125	0.0	0.0			+-1.0	0.0
250	0.0	0.0			+-1.0	0.0
500	0.0	0.0			+-1.0	0.0
1 k	0.0	-0.2			+-1.0	-0.2
2 k	0.0	-0.2			+-1.0	-0.2
4 k	0.0	-0.5			+-1.0	-0.5
8 k	0.0	-0.6			+1.5,-3	-0.6
12.5 k	0.0	-0.7			+3,-6	-0.7

SLM: C-Weighted results

Freq. (Hz)	SLM (dB)	Mic. (dB)	CR. (dB)	WS. (dB)	Tol. (dB)	Dev. (dB)
31.5	-0.1	0.0			+-1.5	-0.1
63	0.0	0.0			+-1.5	0.0
125	0.1	0.0			+-1.0	0.1
250	0.0	0.0			+-1.0	0.0
500	0.1	0.0			+-1.0	0.1
1 k	0.0	-0.2			+-1.0	-0.2
2 k	0.0	-0.2			+-1.0	-0.2
4 k	0.0	-0.5			+-1.0	-0.5
8 k	0.0	-0.6			+1.5,-3	-0.6
12.5 k	0.0	-0.7			+3,-6	-0.7

SLM: Z-Weighted results

Freq. (Hz)	SLM (dB)	Mic. (dB)	CR. (dB)	WS. (dB)	Tol. (dB)	Dev. (dB)
31.5	0.0	0.0			+-1.5	0.0
63	-0.1	0.0			+-1.5	-0.1
125	0.0	0.0			+-1.0	0.0
250	0.0	0.0			+-1.0	0.0
500	0.0	0.0			+-1.0	0.0
1 k	0.0	-0.2			+-1.0	-0.2
2 k	0.0	-0.2			+-1.0	-0.2
4 k	0.0	-0.5			+-1.0	-0.5
8 k	0.0	-0.6			+1.5,-3	-0.6
12.5 k	0.0	-0.7			+3,-6	-0.7

Test Passed
The overall frequency response of the sound level meter and microphone response has shown to conform with the requirements in §6 of the BSEN 60651 and §5.5.4 in BS 7580 Part 1.

Summation of acoustic tests - BS 7580 Clause 5.5.4

*** End of results ***

Appendix 9

Glossary

Term	Explanation
ATM	Air Traffic Movements ie individual instances of departure and arrival
Community Fund	The fund into which fines imposed as penalties for delays and departure noise exceedances are paid. The money is used to fund local community-based projects
Continuous Descent Approach (CDA)	An operating technique in which arriving aircraft follow a constant-angle descent (rather than a series of steps) in order to reduce noise and fuel consumption
Extended Hours/Extension	The period from 21:31 to 23:59 during which extensions may be granted under exceptional circumstances
FEGP	Fixed Electrical Ground Power – a system into which aircraft can directly connect for power whilst parked. Eliminates noise and emissions arising from the use of traditional diesel-powered GPUs (mobile Ground Power Units) and on-board APUs (Auxiliary Power Units)
ICAO Chapter 3, Annex 16	Noise standards set out in the Convention on International Civil Aviation (which jet aircraft must meet if operating at Belfast City Airport)
Lough Bias	Bias in favour of movements over Belfast Lough (as opposed to over the city) in order to minimise community noise impact
Modal Split	The split of movements by runway – this is between Runway 04 (c 040° bearing) and Runway 22 (c 220° bearing)
Noise Abatement Procedure (NAP)	Instructions followed by departing/arriving aircraft requiring specified tracks to be flown in order to minimise noise nuisance
Noise and Track Monitoring System	A system combining information from recorded noise events, radar tracks, and flight schedules to provide data used in generating noise contours and reporting on noise exceedances and track deviations
Noise Contour	Line drawn on a map which represents an area inside which noise levels exceed a given threshold. Under the Planning Agreement, the area enclosed by the 57 dB LAeq 16h contour must not exceed 5.2 square kilometres. This contour is determined from data relating to ATM during the period from 16th June to 15th September each year

Appendix 9

Permitted Hours	The period between the hours of 06:30 and 09:30 pm local time
Quota/Quota Count	Each aircraft type is assigned a quota count - a numerical value based on the level of noise it produces during take-off and landing. The Quota is the totalled quota count values for all ATMs during a given period. At Belfast City Airport the Quota is limited to 4,665 during the period from 16th June to 15th September

Further explanatory notes

Lough Bias

Under the 2019 Planning Agreement, Belfast City Airport is required to maintain a bias in favour of approaches and climb-outs by aircraft over Belfast Lough and to use all reasonable endeavours to maximise the use by aircraft of approaches and climb-outs over Belfast Lough… The intended purpose of the Lough Bias is to reduce the impact of noise from arriving and departing aircraft in populated areas.

For safety, aircraft must land and take off into the wind. When winds are southerly to westerly, departing flights will climb out over the city whilst inbound flights will approach from the Lough - and vice versa in northerly to easterly winds. Departures and arrivals must therefore travel in the same direction and not towards each other. So, assuming there is a similar number of departures as arrivals, nominally half of all flights will be over the Lough and half over the city.

However, to achieve the Lough Bias air traffic control will take the opportunity to direct more flights over the Lough than over the city when conditions allow, subject to safety limitations. It should be noted that because these opportunities are limited, the Lough Bias will always be a relatively small percentage in favour of movements (whether arrivals or departures) over Belfast Lough.

Noise Abatement Procedures

Belfast City Airport operates Noise Abatement Procedures (NAP) which flight crew are required to follow with the aim of mitigating the impact of noise from departing and arriving aircraft. The NAP include, in summary, the following requirements:

Aircraft departing 04 runway (ie towards Belfast Lough), on passing 500 feet are to turn left onto 033°M then reach the required altitude before turning again (1,500 feet for turboprop aircraft less than 13,000kg, 2,000 feet for turboprop aircraft greater than 13,000kg and 3,000 feet for jet aircraft)

Aircraft departing 22 runway (over the city) must climb straight ahead until reaching the altitudes set out above before turning

Aircraft arriving over Belfast Lough are to cross the coast not below 2,500 feet before establishing on the final approach track five nautical miles from the runway threshold

Aircraft arriving over Belfast City are to establish on the final approach track no later than five nautical miles from the threshold at an altitude of not below 1,500 feet

All arriving aircraft are to descend to the runway threshold at an angle of three degrees.

Whilst the NAP provide parameters within which flights are expected to operate, the tracks flown will vary within these parameters according to a range of factors including aircraft type, load and performance, onward route etc. This results in the dispersal of air traffic, avoiding concentration of noise impact on particular areas. On occasion, factors such as weather conditions and the need to ensure aircraft stabilisation may affect flight crews' ability to adhere to the NAP. In all cases, the need to ensure safety will have priority over noise abatement.

It should be noted that there has been no change to the required routing of aircraft in recent years. Whilst the Airport reports all non-adherence to airlines to prevent further occurrence, the incidence of non-adherence to the NAP remains very low (0.11% of all movements in 2025).

Belfast City Airport's Noise Abatement Procedures are contained within Airline Information Publication (AIP) AD 2.EGAC-1 available at: https://www.aurora.nats.co.uk/htmlAIP/Publications/2025-11-27-AIRAC/html/index-enrGB.html.

Extensions

The term extension refers to the permission granted by Belfast City Airport for a delayed aircraft to arrive or depart beyond 2130hrs. Under the Planning Agreement, extensions may be granted for flights to operate during the period 2131hrs to 2359hrs in 'exceptional circumstances' as defined by the Department. Every two months, the Airport submits a report detailing the circumstances of each extension for the Department to determine compliance with the Planning Agreement requirements.

The reasons for extensions are wide-ranging – from adverse weather conditions to technical problems with aircraft. Often an extension is requested due to an issue arising at another airport earlier in the day leading to a 'knock-on' delay at Belfast City Airport. It should be noted that most extensions are for delayed arrivals (92% in 2025).

Belfast City Airport makes every effort to avoid delays where possible. Extensions represent only a small proportion of flights (1.1% in 2025), the majority of which are 30 minutes or less. In recent years Belfast City Airport has consistently been recognised by the Civil Aviation Authority as the UK's most punctual airport.