Appendix 7 – Calibration Records 2022

Type	Model	Serial No.	Calibration Date	Certificate No.	Lab/On-site Calibration	Notes
Meter	NOR-118	32112	26/02/2020	34181	On-site calibration by Sam Death	Not in use
Pre-amp	GRAS-41AM	97213	05/01/2021	36700	Lab calibration (with 32115)	In use at NMT2 Kinnegar (swapped in 4/08/22)
Mic	GRAS-42AS	73645	05/01/2021	36700	Lab calibration (with 32115/97213)	In use at NMT2 Kinnegar (swapped in 4/08/22)
Meter	NOR-118	32115	05/01/2021	36700	Lab calibration	In use at NMT2 Kinnegar (swapped in 4/08/22)
Pre-amp	GRAS-41AM	56262	26/02/2020	34181	On-site calibration by Sam Death (with 32112)	Not in use
Mic	GRAS-42AS	69414	26/02/2020	34181	On-site calibration by Sam Death	Not in use
Meter	NOR-118	32117	28/06/2022	41408	On-site calibration by Sam Death	In use at NMT2 Nettlefield
Pre-amp	GRAS-41AM	95491	28/06/2022	41408	On-site calibration by Sam Death (with 32117)	In use at NMT2 Nettlefield
Mic	GRAS-42AS	73643	28/06/2022	41408	On-site calibration by Sam Death (with 32117/95491)	In use at NMT2 Nettlefield

Campbell Associates Ltd
5b Chelmsford Road Industrial Estate
GREAT DUNMOW, Essex, GB-CM6 1HD
www.campbell-associates.co.uk
Phone 01371 871030 Facsimile 01371879106

CALIBRATION

Certificate of Calibration

Certificate number: 36700

Test object:	**Sound Level Meter, Type 1 (Precision)**
Producer :	**Norsonic**
Type :	**118**
Serial No.:	**32115**
Customer:	**Belfast City Airport**
Address:	**Administration Building, Sydenham Bypass, Belfast. BT3 9JH.**
Contact Person:	**Ian Nuttall**
Order No:	**POR011270**

Method :
Calibration has been performed as set out in CA Technical Procedures TP01 & 02 as appropriate. The following items have been calibrated as set out in BS 7580 Part 1:1997

Tested

	Producer:	Type:	Serial No:	Certificate number
Microphone	GRAS	41AS	73645	36699
Calibrator*	Norsonic	1253_1kHz	21816	U35415
Preamplifier	GRAS	41AM	97213	Included

Additional items that also have been submitted for verification

Wind shield	-
Attenuator	-
Extension cable	-

These items have been taken into account wherever appropriate.

Conditions	Pressure	Temperature	Humidity
Reference conditions:	101.325 kPa	23.0 °C	50 %RH
Measurement conditions:	101.37 ±0.06 kPa	20.5 ±0.3 °C	31.8 ±0.7 %RH

Date received for calibration:	17/12/2020
Date of calibration:	05/01/2021
Date of issue:	05/01/2021
Engineer	
Supervisor	

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

Certificate Cover Sheet

CAMPBELL ASSOCIATES
SOUND, VIBRATION & AIR SOLUTIONS

Belfast City Airport **BEL350**

Equipment	*SOP*	*Tech Log*	*Bin No*	*Group No*	*Cal Number / Period*	*Cover Flag*
NOR-118.32115	**25612**	**21969**	**2118**	**1**	**1 24 Months**	☑

CustomerID: BEL350

EquipmentID: NOR-118.32115

EquipmentType: Slm

CertificateNo: 36700

IssueDate: 05-Jan-21

ExpiryDate: 05-Jan-23

CalComments:

NEW! Calibration Certificate Platform – Coming Soon

You may have noticed this new cover sheet with your certificates; it is in preparation for our exciting calibration project which is now in beta testing. Coming soon for our calibration customers is a free, cloud-based Calibration Certificate Platform. Watch this space for more information on its launch.

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GREAT DUNMOW, Essex, GB-CM6 1HD
www.campbell-associates.co.uk
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CALIBRATION

Certificate of Calibration

Certificate number: **36700**

Test object:	**Sound Level Meter, Type 1 (Precision)**
Producer :	**Norsonic**
Type :	**118**
Serial No.:	**32115**
Customer:	**Belfast City Airport**
Address:	**Administration Building,** **Sydenham Bypass,** **Belfast. BT3 9JH.**
Contact Person:	**Ian Nuttall**
Order No:	**POR011270**

Method :
Calibration has been performed as set out in CA Technical Procedures TP01 & 02 as appropriate. The following items have been calibrated as set out in BS 7580 Part 1:1997

Tested

	Producer:	Type:	Serial No:	Certificate number
Microphone	GRAS	41AS	73645	36699
Calibrator*	Norsonic	1253_1kHz	21816	U35415
Preamplifier	GRAS	41AM	97213	Included

Additional items that also have been submitted for verification

Wind shield	-
Attenuator	-
Extension cable	-

These items have been taken into account wherever appropriate.

Conditions	Pressure	Temperature	Humidity
Reference conditions:	101.325 kPa	23.0 °C	50 %RH
Measurement conditions:	101.37 ±0.06 kPa	20.5 ±0.3 °C	31.8 ±0.7 %RH

Date received for calibration:	17/12/2020
Date of calibration:	05/01/2021
Date of issue:	05/01/2021
Engineer	[redacted]
Supervisor	[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.
* The calibrator was complete with any required coupler for the microphone specified

Calibration Certificate
UKAS Laboratory Number 0789

Certificate number: 36700

Method

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 BS EN 60651 and or BS EN 60804. 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 sound level meter 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 Section 5 of BS 7580:Part 1:1997. The acoustic calibration at 1 kHz specified in sub-clause 5.6.1 of the standard was performed by application of a reference sound calibrator, whilst the tests at 125 Hz and 8k Hz (sub-clause 5.6.2) 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 below in the statements section.

Traceability :

The following measured values are traceable to the National Physical Laboratory, United Kingdom.
Sound Pressure Level, Voltage, Frequency, Barometric Pressure, Temperature & Relative Humidity

Summary of Measurement Results

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

Statements

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: 11.8 (Below MSD)dB(A), 13.7 (Below MSD)dB(C) and 18.7 (Below MSD)dB(Z).
The following response was finally 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 of measurements is based on a standard uncertainty multiplied by the coverage factor of k=2, providing a level of confidence 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. The uncertainty has been determined in accordance with UKAS requirements.

The sound level meter in the configuration tested was found to comply with BS 7580:1997 part 1 for a type 1 device. The associated calibrator has been corrected for barometric pressure at the time of calibration in accordance with the relevant manufacturer's instructions

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 - Nor1253-24269
Reference calibrator level: 124.01
Before calibration:
Environmental corrections: 0.00
Other corrections: +0.1
Notional level: 124.11
Calibrator level before adjustment: 124.1
After calibration:
Environmental corrections: 0.00
Other corrections: +0.1
Notional level: 124.11
Reference calibrator level after calibration: 124.1
Associated Calibrator: Norsonic - 1253_1kHz - 21816
Associated calibrator level: 124.09
Initial level check:
Environmental corrections: 0.00
Other corrections: 0.10
Notional level: 124.19
Indicated level: 124.2
Final level statement:
Environmental corrections after calibration: 0.00
Other corrections: +0.1
Notional level: 124.19
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	11.8	13.0	P	The value is less than MSD.
C	13.7	15.0	P	The value is less than MSD.
Z	18.7	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	73.9	0.7	-0.1	P
69.0	68.9	0.7	-0.1	P
64.0	63.9	0.7	-0.1	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	73.9	0.7	-0.1	P
69.0	68.9	0.7	-0.1	P
64.0	63.9	0.7	-0.1	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	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	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	113.8	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	113.9	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

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	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	113.9	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)	Rel. (dB)	Result Code
10ms	+	116.0	116.6		0.6		P
0.1ms	+	116.0	115.5	2.0	-0.5	-1.1	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	114.7	0.5	-0.3	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	107.4	2.0	-0.8	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	51.9	1.7	-0.1	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	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	130.6 -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	97.1	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:	124.09 dB
Ambient corrections:	0.00 dB
Pressure to free field correction:	0.10 dB
Corrected level:	124.19 dB
Indicated level:	124.2 dB

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

Reference level:	89.0 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:	88.83 dB
Indicated level:	88.9 dB
Tolerance:	+/- 1 dB
Error:	0.07 dB

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

Reference level:	89.0 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:	89.00 dB
Indicated level:	88.9 dB
Tolerance:	+/- 1 dB
Error:	-0.10 dB

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

Reference level:	89.0 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:	87.08 dB
Indicated level:	86.7 dB
Tolerance:	+/- 1 dB
Error:	-0.38 dB

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

Reference level:	89.0 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:	82.49 dB
Indicated level:	82.1 dB
Tolerance:	+1.5; -3 dB
Error:	-0.39 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	-0.1	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	-0.4			+-1.0	-0.5
8 k	0.0	-0.6			+1.5,-3	-0.6
12.5 k	0.0	-0.6			+3,-6	-0.6

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	-0.1	-0.4			+-1.0	-0.5
8 k	-0.1	-0.6			+1.5,-3	-0.7
12.5 k	-0.1	-0.6			+3,-6	-0.7

SLM: Z-Weighted results

Freq. (Hz)	SLM (dB)	Mic. (dB)	CR. (dB)	WS. (dB)	Tol. (dB)	Dev. (dB)
31.5	-0.1	0.0			+-1.5	-0.1
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	-0.1	-0.4			+-1.0	-0.5
8 k	-0.1	-0.6			+1.5,-3	-0.7
12.5 k	-0.1	-0.6			+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.

*** End of results ***

Calibration Report

Certificate No.:36699

Manufacturer: **GRAS**
Type: **41AS**
Serial no: **73645**

Customer: **Belfast City Airport**
Address: **Administration Building, Sydenham Bypass, Belfast. BT3 9JH.**
Order No: **POR011270**
Contact Person: **Ian Nuttall**

Measurement Results:

	Sensitivity: (dB re 1V/Pa)	Capacitance: (pF)
1:	-27.76	20.7
2:	-27.75	20.8
3:	-27.75	20.8
Result (Average):	**-27.75**	**20.8**
Expanded Uncertainty:	0.10	2.00
Degree of Freedom:	>100	>100
Coverage Factor:	2.00	2.00

The following correction factors have been applied during the measurement:
Pressure:0.000 dB/kPa Temperature:0.000 dB/°C Relative humidity:0.000 dB/%RH

Reference Calibrator: WSC1 - Nor1253-24269 Volume correction: 0.000 dB
Records:K:\C A\Calibration\Nor-1504\Nor-1017 MicCal\2021\GRAS41AS_73645_M1.nmf
Measurement procedure: TP05
All results quoted are directly traceable to National Physical Laboratory, London

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with EA publication EA-4/02.

Comment:

Environmental conditions:

Pressure:	Temperature:	Relative humidity:
101.403 ± 0.043 kPa	20.8 ± 0.2 °C	31.4 ± 1.1 %RH

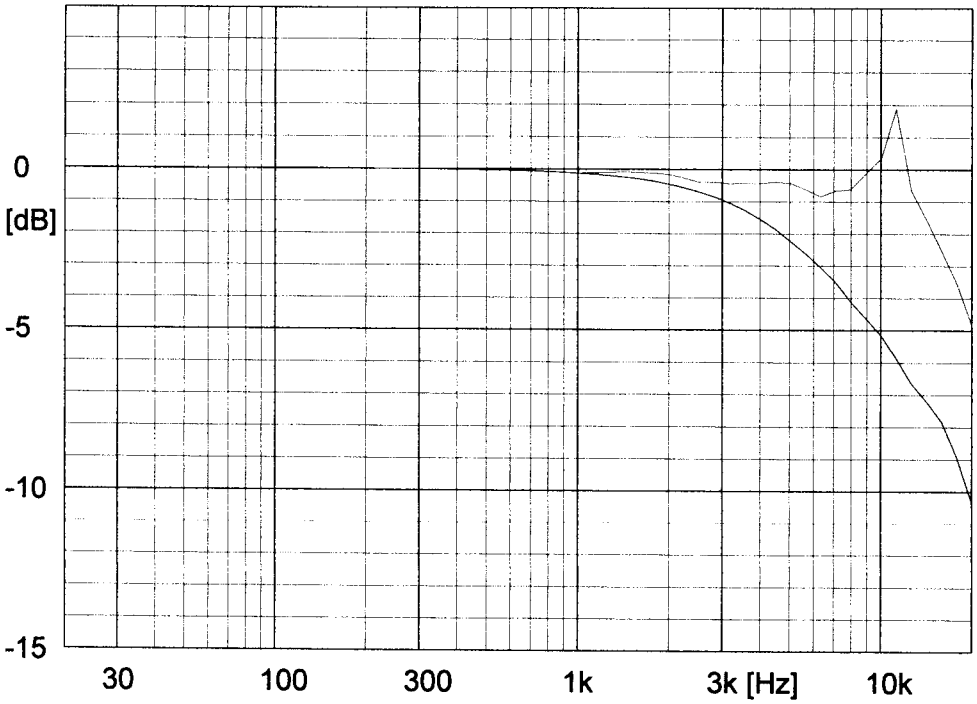
Date of calibration: 05/01/2021
Date of issue: 05/01/2021

Supervisor : Darren Batten TechIOA
Engineer :

Campbell Associates
www.campbell-associates.co.uk

Palanivel Marappan BEng(Hons), MSc
Software version: 6.0h

Microphone Calibration Certificate



GRAS
Type: 41AS

Serial no: 73645

Sensitivity: 40.97 mV/Pa
-27.75 ±0.10 dB re. 1 V/Pa
Capacitance: 20.8 ±2.0 pF
Date: 05/01/2021

Signature: M. Hanivel

Measurement conditions:

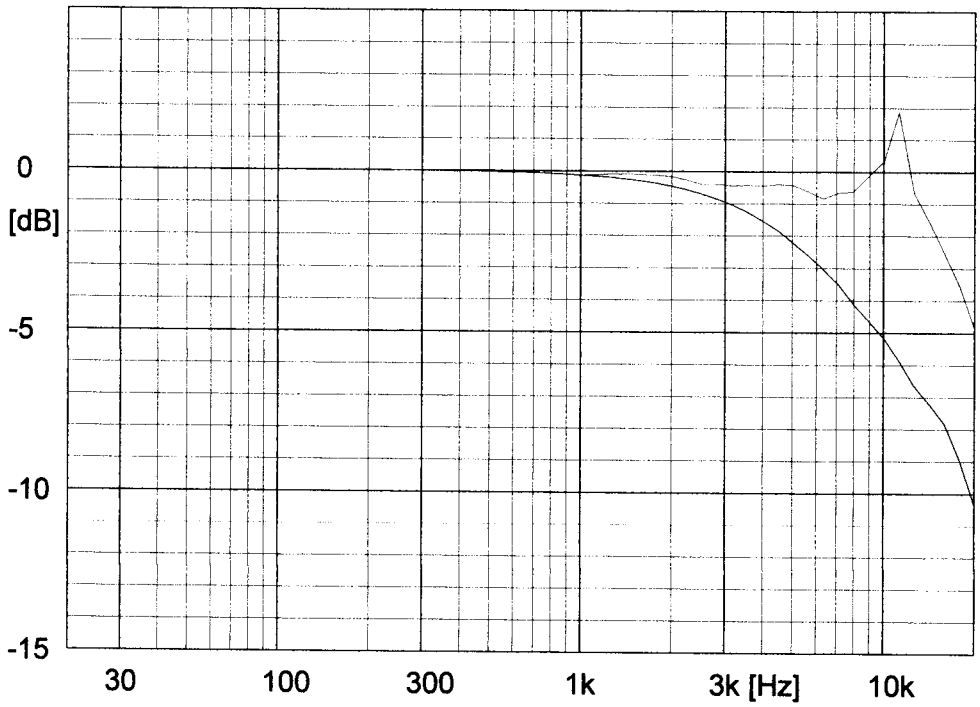
Polarisation voltage:	200.0 V
Pressure:	101.40 ±0.04 kPa
Temperature:	20.8 ±0.2 °C
Relative humidity:	31.4 ±1.1 %RH

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:

Campbell Associates Ltd

Sonitus House
5B Chelmsford Road Industrial Estate
GREAT DUNMOW, Essex, CM6 1HD
www.campbell-associates.co.uk
Phone 01371 871030 Facsimilie 01371879106

Certificate of Field Calibration

Certificate Number:- 41408

Test Object:	**Sound Level Meter Class 1 (Precision)**
Manufacturer:	**Norsonic**
Type:	**118**
Serial no:	**32117 NMT1 - Nettlefield**
Customer:	Belfast City Airport
Address:	Sydenham Bypass Belfast
Contact Person	Ian Nuttall

Method:

The unit's absolute acoustic sensitivity has been set in accordance with the manufacturer's recommendations using an associated calibrator. A series of acoustic tests have then been performed to verify the performance of the unit over its operating range. The units self noise has also be verified. The results of these tests are detailed overleaf.

	Producer:	Type:	Serial No:	Certificate number:
Microphone:	GRAS	41AM	95491	Included
Calibrator:	Norsonic	1251	31313	U40631

Additional items that have been used for verification:

Multi-frequency calibrator	Nor-1253	Serial No:	27765
Calibrator	Nor-1257	Serial No:	125725145
Calibrator	Nor-1253	Serial No:	21816
Calibration coupler for GRAS-41AM	GRAS-RA0009	Serial No:	429
Dummy microphone	GRAS-RA0041		

These items have been taken into account wherever possible.

Date of calibration	28/06/2022
Date of issue	05/07/2022

Technicians: (Electronic certificate)

Calibrated by: [redacted]

Certificate of Field Calibration

On completion of these tests the absolute acoustic sensitivity of the unit was re-checked with the associated

Measurement results:

Acoustic Tests						
Frequency Response						
Device	Freq, Hz	dB(A)	A wtg	dB(C)	Error	Result
Nor-1257	125	94.10	-0.13	94.30	-0.03	PASS
	250	94.25	0.01	94.45	0.11	PASS
	500	94.23	-0.01	94.43	0.09	PASS
	1000	94.23		94.33	-	Ref
	2000	95.22	0.99	95.02	0.69	PASS
	4000	93.75	-0.48	93.05	-1.28	PASS
Amplitude Linearity						
Device	Freq, Hz	Level dB	Reading	Error, dB	Limit, dB	Result
WSM3	1000	123.99	123.92	-0.16	0.6	PASS
WSM5	1000	114.03	114.12	Ref		Ref
Nor-1257	1000	94	94.23	0.14	0.6	PASS

Observations:

The associated calibrator has been provided by the Laboratory and the results are considered valid for other sound calibrators of the same model.

Comments:

If a different model of calibrator is used it may be necessary to apply a correction to the level quoted for field use. Next verification is recommeded within two years of the date of this certificate. This calibration is valid for the environmental conditions at the time of calibration and any observations detailed over leaf.

Final level with associated calibrator and coupler is **115.1 dB(A)**

Final level measured by electrostatic actuator is **89.6 dB(C)**