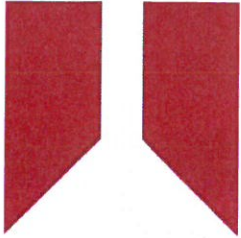


CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **25 May 2022**

CERTIFICATE NUMBER **174917**



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

Page 1 of 2

Approved signatory

J. Johnston

Electronically signed:

Sound Level Meter : BS 7580-2:1997

Instrument information

Manufacturer: Cirrus Research plc Notes:
Model: CR:821A
Serial number: B14856FE
Class: 1
Firmware version: V02.02

Test summary

Date of calibration: 25 May 2022

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.
Periodic tests were performed in accordance with procedures from BS 7580-2:1997.

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of BS 7580-2:1997, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with BS 7580-2:1997, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC BS 7580-2:1997, the sound level meter submitted for testing conforms to the class 1 requirements of BS 7580-2:1997.

Notes

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

Posting Time : **17:51**

CERTIFICATE OF CALIBRATION

Certificate Number:
174917

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Environmental conditions

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

Before Pressure: 99.96 kPa Temperature: 22.2 °C Humidity: 45.0 %
After Pressure: 100.02 kPa Temperature: 21.7 °C Humidity: 44.2 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	TTi	TGA1241	257309
Attenuator	Cirrus Research	ZE:952	78709
Multi-frequency Calibrator	Bruel and Kjaer	4226	2433707

Additional instrument information

Instruction manual: User Manual
Reference level range: 50-110 dB
Pattern approval: Yes
Source of pattern approval: PTB-1.6-40001253

Preamplifier

Manufacturer: Cirrus Research plc
Model: MV:200C
Serial number: 1454

Microphone

Manufacturer: Cirrus Research plc
Model: MK:224
Serial number: 212441D

Test results summary

Test	Result
Linearity	Complies
Linearity (all ranges)	Complies
Electrical frequency weightings	Complies
Weightings at 1 kHz	Complies
R.M.S Accuracy	Complies
Time Averaging	Complies
Overload	Complies
Acoustic frequency weightings	Complies

Acoustic Calibrator

Manufacturer: Cirrus Research plc
Model: CR:513B
Serial number: 028220

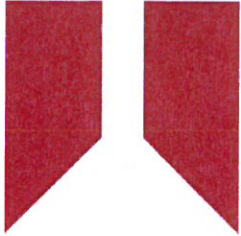
Calibration

Calibration check frequency: 1000 Hz
Calibrator's certificate ref: 174915
Level before adjustment: 94.00 dB(A)
Level after adjustment: 93.70 dB(A)

Posting Time : **17:51**

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**
DATE OF ISSUE **25/05/22** CERTIFICATE NUMBER **174898**



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

Page 1 of 2

Test engineer:
D.Swalwell
Electronically signed:

Microphone

Microphone capsule

Manufacturer: Cirrus Research plc

Model: MK:224

Serial Number: 212441D

Calibration procedure

Date of calibration: 24 May 2022

Open circuit: 54.5 mV/Pa

Sensitivity at 1 kHz: -25.3 dB rel 1 V/Pa

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

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

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

Environmental conditions

Pressure: 99.30 kPa

Temperature: 21.0 °C

Humidity: 48.0 %

Posting Time : **17:51**

CERTIFICATE OF CALIBRATION

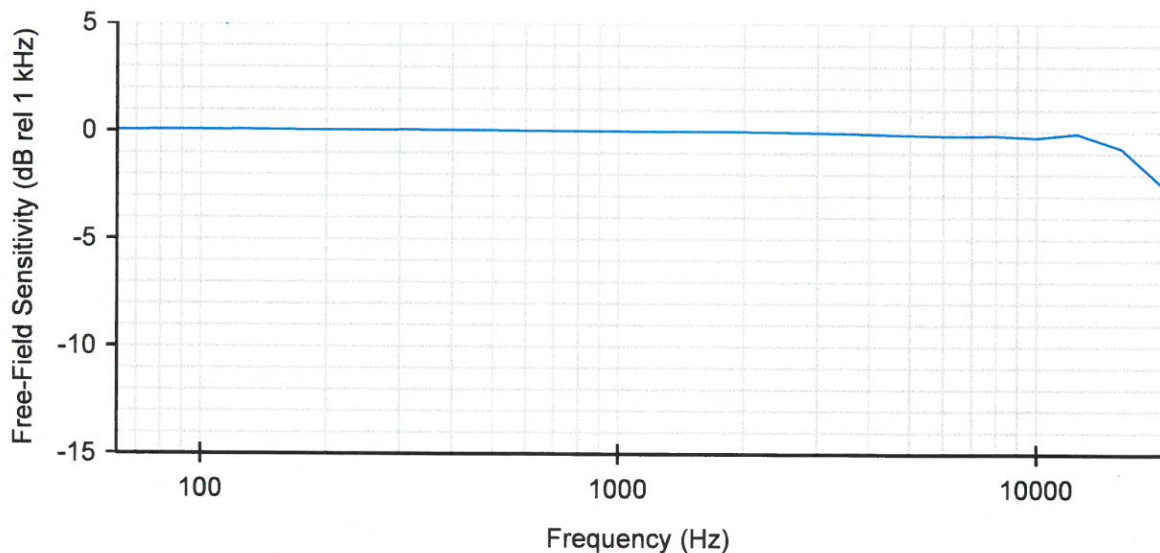
Certificate Number:
174898

Page 2 of 2

Free-Field Frequency Response : Tabular

Frequency (Hz)	Free-Field Sensitivity (dB rel 1 kHz)	Actuator Response (dB)
63	0.04	-0.15
80	0.05	-0.03
100	0.05	0.01
125	0.06	0.06
160	0.05	0.07
200	0.03	0.07
250	0.03	0.07
315	0.06	0.07
400	0.03	0.06
500	0.03	0.05
630	0.00	0.02
800	0.01	0.02
1 000	0.00	0.00
1 250	-0.01	-0.05
1 600	-0.01	-0.12
2 000	-0.01	-0.21
2 500	-0.04	-0.37
3 150	-0.06	-0.62
4 000	-0.11	-0.99
5 000	-0.16	-1.50
6 300	-0.20	-2.25
8 000	-0.18	-3.32
10 000	-0.27	-4.88
12 500	-0.08	-6.58
16 000	-0.78	-8.72
20 000	-2.50	-11.61

Free-Field Frequency Response : Graphical



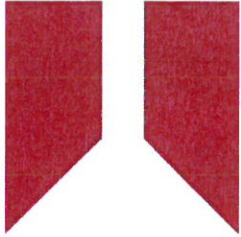
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CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **25 May 2022**

CERTIFICATE NUMBER **174910**



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

Page 1 of 2

Approved signatory

J. Johnston

Electronically signed:

Sound Calibrator : IEC 60942:2003

Instrument information

Manufacturer: Cirrus Research plc

Notes:

Model: CR:513A

Serial number: 031493

Class: 1

Test summary

Date of calibration: 25 May 2022

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

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

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

Notes:

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

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CERTIFICATE OF CALIBRATION

Certificate Number:
174910

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Environmental conditions

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

Pressure: 99.81 kPa
Temperature: 22.0 °C
Humidity: 49.5 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Multimeter	Fluke	8845A	9708001
Distortion Meter	Keithley	2015	1063074
Acoustic Calibrator	Bruel and Kjaer	4231	2610257

Results

	Expected	Sample 1	Sample 2	Sample 3	Average	Deviation	Tolerance	Uncertainty
Level (dB)	94.00	93.94	93.95	93.94	93.94	-0.06	±0.40	0.11 dB
Distortion (%)	< 3.00	0.85	0.85	0.84	0.85	0.85	+3.00	0.13 %
Frequency (Hz)	1000.0	998.1	998.1	998.1	998.1	-1.9	±10.0	0.1 Hz
Level (dB)	104.00	103.90	103.89	103.90	103.90	-0.10	±0.40	0.11 dB
Distortion (%)	< 3.00	0.79	0.79	0.80	0.79	0.79	+3.00	0.13 %
Frequency (Hz)	1000.0	998.1	998.1	998.1	998.1	-1.9	±10.0	0.1 Hz

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

End of results

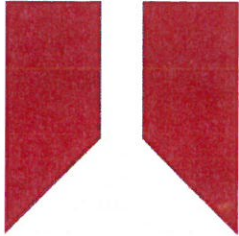
Posting Time : **17:51**

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 25 May 2022

CERTIFICATE NUMBER 174916



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

Page 1 of 2

Approved signatory

R.Woodall

Electronically signed:

Sound Level Meter : BS 7580-2:1997

Instrument information

Manufacturer:	Cirrus Research plc	Notes:
Model:	CR:252B	
Serial number:	B11603F	
Class:	2	
Firmware version:	N/A	

Test summary

Date of calibration: 25 May 2022

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

Periodic tests were performed in accordance with procedures from BS 7580-2:1997.

The sound level meter submitted for testing has successfully completed the class 2 periodic tests of BS 7580-2:1997, for the environmental conditions under which the tests were performed. However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of BS 7580-2:1997 because evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in BS 7580-2:1997 and because the periodic tests of BS 7580-2:1997 cover only a limited subset of the specifications in BS 7580-2:1997.

Notes

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

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CERTIFICATE OF CALIBRATION

Certificate Number:
174916

Page 2 of 2

Environmental conditions

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

Before Pressure: 99.97 kPa Temperature: 22.2 °C Humidity: 45.0 %
After Pressure: 100.00 kPa Temperature: 22.0 °C Humidity: 44.5 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	TTi	TGA1241	307449
Attenuator	Cirrus Research	ZE:952	93892
Multi-frequency Calibrator	Bruel and Kjaer	4226	2433707

Additional instrument information

Instruction manual: Manual
Reference level range: 50-110 dB
Pattern approval: No
Source of pattern approval: -

Preamplifier

Manufacturer: -
Model: -
Serial number: -

Microphone

Manufacturer: -
Model: -
Serial number: -

Test results summary

Test	Result
Linearity	Complies
Linearity (all ranges)	Complies
Electrical frequency weightings	Complies
Weightings at 1 kHz	Complies
R.M.S Accuracy	Complies
Overload	Complies
Acoustic frequency weightings	Complies

Acoustic Calibrator

Manufacturer: B&K
Model: Type 4231
Serial number: 2579252

Calibration

Calibration check frequency: 1000 Hz
Calibrator's certificate ref: 001
Level before adjustment: 94.80 dB(A)
Level after adjustment: 94.80 dB(A)

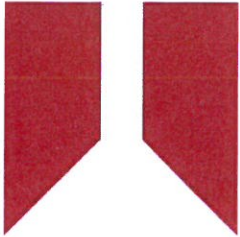
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CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **25 May 2022**

CERTIFICATE NUMBER **174915**



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

Page 1 of 2

Approved signatory

J. Johnston

Electronically signed:

Sound Calibrator : IEC 60942:2003

Instrument information

Manufacturer: Cirrus Research plc

Notes:

Model: CR:513A

Serial number: 028220

Class: 1

Test summary

Date of calibration: 25 May 2022

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

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

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

Notes:

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

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CERTIFICATE OF CALIBRATION

Certificate Number:
174915

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Environmental conditions

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

Pressure: 99.83 kPa
Temperature: 22.0 °C
Humidity: 48.5 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Multimeter	Fluke	8845A	9708001
Distortion Meter	Keithley	2015	1063074
Acoustic Calibrator	Bruel and Kjaer	4231	2610257

Results

	Expected	Sample 1	Sample 2	Sample 3	Average	Deviation	Tolerance	Uncertainty
Level (dB)	94.00	93.95	93.94	93.95	93.95	-0.05	±0.40	0.11 dB
Distortion (%)	< 3.00	0.74	0.75	0.72	0.74	0.74	+3.00	0.13 %
Frequency (Hz)	1000.0	1000.1	1000.1	1000.1	1000.1	0.1	±10.0	0.1 Hz
Level (dB)	104.00	103.87	103.86	103.87	103.87	-0.13	±0.40	0.11 dB
Distortion (%)	< 3.00	0.78	0.78	0.77	0.78	0.78	+3.00	0.13 %
Frequency (Hz)	1000.0	1000.1	1000.1	1000.1	1000.1	0.1	±10.0	0.1 Hz

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

End of results

Posting Time : **17:51**