



NATAcoustic

Acoustic Calibration & Testing Laboratory

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A division of Renzo Tonin & Associates (NSW) Pty Ltd ABN 29 117 462 861

Certificate of Calibration Sound Level Calibrator

Calibration Date 28/10/2014	Job No RB307	Operator SD
Client Name RENZO TONIN & ASSOCIATES (NSW) PTY LTD		
Client Address LEVEL 1 418A ELIZABETH ST SURRY HILLS 2010		

Test Item

Calibrator Make Bruel & Kjaer	Model Type 4321	Serial No 1770974
Accessories N/A		

Class (1 or 2)	1
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Temp deg C	25.6
RH %	40.2
Bar Pressure hPa	1007.3

Applicable Standards:
AS IEC 60942 2004 Australian Standard "Electroacoustics - Sound calibrators"

Applicable Work Instruction:
RWI-08 SLM & Calibrator Verification

Laboratory Equipment :
B&K2636 Measuring Amplifier SN 1135806
B&K4226 Multifunction Acoustic Calibrator SN 2288472
Agilent Function Generator Model 33220A SN MY43004013
Agilent Digital Multimeter Model 34401A SN MY41004386

Traceability:
Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. This document shall not be reproduced, except in full.


Scope:
This certificate is issued on the basis that the instrument complies with the manufacturer's specification. See "Sound Level Meter Verification - Summary of Tests" page for an itemised list of results for each test.

Uncertainty:
The uncertainty is stated at a confidence level of 95% using a k factor of 2.



**NATA Accredited Laboratory
Number 14966**

Authorized Signatory:



Print Name: Renzo Tonin Date: 28 Oct 2014

Template Document Name: RQT-03 (rev 31) Calibrator Verification



NATacoustic
Sound Level Calibrator Verification - Summary of Tests

Calibration Date 28/10/2014	Job No RB307	Operator SD
Client Name RENZO TONIN & ASSOCIATES (NSW) PTY LTD		
Client Address LEVEL 1 418A ELIZABETH ST SURRY HILLS 2010		

1. Instrument Information & Reference Conditions		
Calibrator Make Bruel & Kjaer	Model Type 4321	Serial No 1770974
Accessories N/A		

Class (1 or 2)	1
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Temp deg C	25.6
RH %	40.2
Bar Pressure hPa	1007.3

Test Description

2(a). Absolute Sound Pressure Level	Calibrator Setting	SPL	Uncert (+/-) dB	Pass
	1	94.11	0.11	Yes
	2	113.98	0.11	Yes
	3	N/A	N/A	N/A
	4	N/A	N/A	N/A
	5	N/A	N/A	N/A

2(b). Sound Pressure Level Fluctuation	Calibrator Setting	SPL	Uncert (+/-) dB	Pass
	1	0.04	0.02	Yes
	2	0.06	0.02	Yes
	3	N/A	N/A	N/A
	4	N/A	N/A	N/A
	5	N/A	N/A	N/A

3(a). Frequency Deviation	Calibrator Setting	Freq Hz	Uncert (+/-) %	Pass
	1	999.977	0.01	Yes
	2	999.905	0.01	Yes
	3	N/A	N/A	N/A
	4	N/A	N/A	N/A
	5	N/A	N/A	N/A

3(b). Total Distortion	Calibrator Setting	Distortion %	Uncert (+/-) %	Pass
	1	0.577	0.12	Yes
	2	0.362	0.12	Yes
	3	N/A	N/A	N/A
	4	N/A	N/A	N/A
	5	N/A	N/A	N/A

Unless otherwise stated, the uncertainty of measurement in the SPL is +/-0.12dB. All uncertainties are stated at a confidence level of 95% using a k factor of 2. The calibration of all instruments used in these tests is traceable to Australian Physical Standards held by the National Measurement Institute, Sydney, Australia. This document shall be reproduced only in full unless the express authority of RTA Technology Pty Ltd is obtained.

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Template Document Name: RQT-03 (rev 31) Calibrator Verification

1. Calibrator Information & Reference Conditions

Calibration Date	28/10/2014	Job No	RB307	Operator	SD
Client Name	RENZO TONIN & ASSOCIATES (NSW) PTY LTD				
Client Address	LEVEL 1 418A ELIZABETH ST SURRY HILLS 2010				
Calibrator Make	Bruel & Kjaer	Model	Type 4321	Serial No	1770974
Accessories	N/A				

Microphone Type	Bruel & Kjaer 1/2" Type 4189
Adaptor	Nil

Class (1 or 2)	1
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Temp deg C	25.6	OK
RH %	40.2	OK
Bar Pressure hPa	1007	OK

Calibrator Setting No	Nominal Settings		4226 Settings	
	Freq Hz	SPL	SPL	Uncert.
1	1k	94.0	94.03	0.06
2	1k	114.0	114.02	0.06
3				
4				
5				

Colour Legend	
Enter Value	110
Operator Action	110
Difference	1.0
Tolerance	+/-1
Select Toggle	Val
Error/Outside Tolerance	2.0
Informative	110

Checked

2. Sound Pressure Level

Calibrator Setting 1									
SLM & 4226 Settings									
Nominal SPL dB		94.0							
SLM Range		100							
Nominal Frequency Hz		1k							
Reference B&K4226 SPL		94.03							
B&K4226 Setting "Microphone"		b							
B&K4226 Setting "Sound Field"		Pressure							
SPL Deviation from Nominal								Tolerance	
Trial No	Ref mV rms	Test mV rms	dB	Mean	Corr Mean	Uncert	Extended	Class 1	Class 2
#1	509.47	511.88	0.04	0.05	0.08	0.11	0.19	0.40	0.75
#2	508.83	510.65	0.03						
#3	508.49	512.47	0.07						
Fluctuation in SPL								Tolerance	
					Observed	Uncert	Extended	Class 1	Class 2
					0.02	0.02	0.04	0.10	0.20
Pass SPL		Yes	Uncertainty dB		0.11				
Pass Fluctuation in SPL		Yes	Uncertainty dB		0.02				

Calibrator Setting 2									
SLM & 4226 Settings									
Nominal SPL dB		114.0							
SLM Range		120							
Nominal Frequency Hz		1k							
Reference B&K4226 SPL		114.02							
B&K4226 Setting "Microphone"		b							
B&K4226 Setting "Sound Field"		Pressure							
SPL Deviation from Nominal								Tolerance	
Trial No	Ref mV rms	Test mV rms	dB	Mean	Corr Mean	Uncert	Extended	Class 1	Class 2
#1	509.48	508.46	-0.02	-0.06	-0.04	0.11	0.15	0.40	0.75
#2	509.59	505.67	-0.07						
#3	510.38	505.07	-0.09						
Fluctuation in SPL								Tolerance	
					Observed	Uncert	Extended	Class 1	Class 2
					0.04	0.02	0.06	0.10	0.20
Pass SPL		Yes	Uncertainty dB		0.11				
Pass Fluctuation in SPL		Yes	Uncertainty dB		0.02				

Calibrator Setting 3									
SLM & 4226 Settings									
Nominal SPL dB									
SLM Range		100							
Nominal Frequency Hz									
Reference B&K4226 SPL									
B&K4226 Setting "Microphone"		b							
B&K4226 Setting "Sound Field"		Pressure							
SPL Deviation from Nominal								Tolerance	
Trial No	Ref mV rms	Test mV rms	dB	Mean	Corr Mean	Uncert	Extended	Class 1	Class 2
#1								0.40	0.75
#2									
#3									
Fluctuation in SPL								Tolerance	
					Observed	Uncert	Extended	Class 1	Class 2
								0.10	0.20
Pass SPL		N/A	Uncertainty dB		N/A				
Pass Fluctuation in SPL		N/A	Uncertainty dB		N/A				

Calibrator Setting 4									
SLM & 4226 Settings									
Nominal SPL dB									
SLM Range		100							
Nominal Frequency Hz									
Reference B&K4226 SPL									
B&K4226 Setting "Microphone"		b							
B&K4226 Setting "Sound Field"		Pressure							
SPL Deviation from Nominal								Tolerance	

Trial No	Ref mV rms	Test mV rms	dB	Mean	Corr Mean	Uncert	Extended	Class 1	Class 2	
#1								0.40	0.75	
#2										
#3										
Fluctuation in SPL								Tolerance		
						Observed	Uncert	Extended	Class 1	Class 2
									0.10	0.20
Pass SPL			N/A	Uncertainty dB		N/A				
Pass Fluctuation in SPL			N/A	Uncertainty dB		N/A				

Calibrator Setting 5										
SLM & 4226 Settings										
Nominal SPL dB										
SLM Range				100						
Nominal Frequency Hz										
Reference B&K4226 SPL										
B&K4226 Setting "Microphone"				b						
B&K4226 Setting "Sound Field"				Pressure						
SPL Deviation from Nominal								Tolerance		
Trial No	Ref mV rms	Test mV rms	dB	Mean	Corr Mean	Uncert	Extended	Class 1	Class 2	
#1								0.40	0.75	
#2										
#3										
Fluctuation in SPL								Tolerance		
						Observed	Uncert	Extended	Class 1	Class 2
									0.10	0.20
Pass SPL			N/A	Uncertainty dB		N/A				
Pass Fluctuation in SPL			N/A	Uncertainty dB		N/A				

Description of Test

2. Sound Pressure Level (Clause B.3.4.3.2 Sound calibrator comparison method and B3.4.4.1 - B3.4.4.3 Measurements)
The sound pressure level generated by the sound calibrator under test shall be measured by comparison with the sound pressure level generated by a calibrated sound calibrator. The measurement of the principal sound pressure level at the principal frequency shall be replicated twice to give a total of three tests. The absolute value of the difference between the mean measured sound pressure level and the specified sound pressure level, extended by the actual expanded uncertainty of measurement, shall not exceed the tolerances given in the tables above for the class of sound calibrator, For multi-frequency sound calibrators, measurements of the principal sound pressure level as described above shall be repeated for the maximum and minimum frequency settings of the sound calibrator for which the instruction manual states that the instrument conforms to the requirements of this standard. Calibrator Readings must be taken as an average over 20 seconds of recording. The amplifier must have 22.4Hz and 22.4kHz filters enabled. The measurement of the sound pressure level shall be repeated (excluding replications) for all other combinations of sound pressure level and frequency settings for which the instruction manual states that the instrument conforms to the requirements of this standard.

Interpretation: The "Mean" is the average value of the three trials (Trial 1,2,3). The "Corr Mean" is the deviation of the sound pressure level from the required value. The "Uncert" is the expanded uncertainty in the measurement and the "Extended" is the deviation of the required sound pressure level extended by the expanded uncertainty in the measurement. The "Extended Fluctuation" is one-half of the maximum observed deviation from the mean extended by the expanded uncertainty in the measurement.

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3(a). Frequency & 3(b). Distortion

3(a). Frequency							
Calibrator Setting	Nominal	Observed	Deviation from Nominal			Tolerance %	
	Hz	Hz	%Diff	Uncert	Extended	Class 1	Class 2
1	1000	999.977	0.00	0.01	0.01	1	2
2	1000	999.905	0.01	0.01	0.02	1	2
3						1	2
4						1	2
5						1	2

Pass
Yes
Yes
N/A
N/A
N/A

3(b). Distortion						
Calibrator Setting	Nominal	Observed	Extended Value		Tolerance %	
	Hz	%THD	Uncert	Extended	Class 1	Class 2
1	1000	0.577	0.12	0.70	3	4
2	1000	0.362	0.12	0.48	3	4
3						
4						
5						

Pass
Yes
Yes
N/A
N/A
N/A

Description of Test

3. Frequency (Clause B3.5 Frequency)

The frequency of the sound generated by the sound calibrator coupled to the microphone shall be measured, at the principal sound pressure level, for each frequency setting of the sound calibrator for which the instruction manual states that the instrument conforms to the requirements of this standard. The absolute value of the difference in per cent between each measured frequency and the corresponding specified frequency, extended by the actual expanded uncertainty of measurement, shall not exceed the tolerance limits given above for the class of sound calibrator.

Interpretation: The "%Diff" column represents the percentage difference of the observed frequency from the nominal frequency. The "Uncert" column is the uncertainty in the measurement and the extended uncertainty is shown in the "Extended" column.

Total Distortion (Clause B3.6 Total distortion)

Total distortion of the sound pressure signal generated by the sound calibrator shall be measured over the frequency range from at least 22.5Hz to 20kHz at the maximum and minimum sound pressure level settings available at each frequency for which the instruction manual states that the instrument conforms to the requirements of this standard. The measured total distortion, extended by the actual expanded uncertainty of measurement, shall not exceed the tolerance limits given above for the class of sound calibrator.

Interpretation: The "%THD" column is the observed Percent Total Harmonic Distortion. The "Uncert" column is the uncertainty in the measurement and the extended uncertainty is shown in the "Extended" column.

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