



財團法人全國認證基金會  
Taiwan Accreditation Foundation

## Certification Accreditation

(Certificate No : LN1001-211207)

**National Measurement Laboratory, R. O. C.**

**National Measurement Laboratory, R. O. C.(Acoustics & Vibration)**

321 Kuang Fu Rd., Sec. 2, Hsinchu, Taiwan, R. O. C.

**is accredited in respect of laboratory**

**Accreditation Criteria** : ISO/IEC 17025:2017 ; CNS 17025:2018

**Accreditation Number** : N1001

**Originally Accredited** : January 01, 2003

**Effective Period** : January 01, 2022 to December 31, 2026

**Accredited Scope** : Calibration Field, see described in the Appendix

**Specific Accreditation Program** : Accreditation Program for National Metrology Institutes



Scan to verify

*Ching-Chang Lien*

Ching-Chang Lien  
President, Taiwan Accreditation Foundation  
December 07, 2021

Accreditation Number : N1001

Laboratory Head : LIN, Tzeng-Yow

## Vibration &amp; Acoustics

| calibration items   | working standard                             | calibration method  | measurand level or range |                         |               |                         | measurement conditions /independent variable   | smallest uncertainty |       |  |     |   |
|---|--|---|--------------------------|-------------------------|---------------|-------------------------|--|----------------------|-------|--|-----|---|
|   |  |   | minimum value            | units                   | maximum value | units                   |  | value                | units |  |     |   |
| KB1001 accelerometer  | B&K 8305 /B&K 2626 /PCB 080A200 /PCB 442A102 | instrument calibration technique for accelerometer comparison method (Document No.: 07-3-83-0038) |                          | V/ (m/s <sup>2</sup> )  |               | V/ (m/s <sup>2</sup> )  | Voltage sensitivity:<br>Frequency 50 Hz to 3 kHz,<br>Frequency/Amplitude:<br>(50 Hz, 100 Hz, 160 Hz, 200 Hz, 300 Hz, 400 Hz, 500 Hz, 600 Hz, 700 Hz, 800 Hz, 900 Hz, 1000 Hz, 1500 Hz, 2000 Hz, 3000 Hz) /100 m/s <sup>2</sup> | 1.4                  | %     |  |     |   |
|   |  |   |                          | V/ (m/s <sup>2</sup> )  |               | V/ (m/s <sup>2</sup> )  |  |                      |       | Voltage sensitivity:<br>Frequency 3 kHz (exclude) to 7 kHz, Frequency/Amplitude:<br>(4000 Hz, 5000 Hz, 6000 Hz, 7000 Hz) /100 m/s <sup>2</sup> | 3.4 | % |
|   |  |   |                          | pC/ (m/s <sup>2</sup> ) |               | pC/ (m/s <sup>2</sup> ) |  |                      |       |  |     |   |
| Approval Signatory: TSUEI, Kuang-Yih; CHEN, Jiun-Kai; TU, Tsung-Hsien |  |   |                          |                         |               |                         |  |                      |       |  |     |   |



| calibration items    | working standard  | calibration method  | measurand level or range |                         |                |                         | measurement conditions /independent variable  | smallest uncertainty |       |
|----------------------|---|---|--------------------------|-------------------------|----------------|-------------------------|---|----------------------|-------|
|                      | brand /model  | document name /no.  | mini mum value           | units                   | maxi mum value | units                   | explanation   | value                | units |
| KB1001 accelerometer | Uniphase 1101 Laser Interferometer Module /RENISHAW /RLU 10 Laser Interferometer Module | instrument calibration technique for accelerometer sine-approximation method (Document No.: 07-3-90-0117) |                          | V/ (m/s <sup>2</sup> )  |                | V/ (m/s <sup>2</sup> )  | Voltage sensitivity:<br>Frequency 50 Hz to 5 kHz,<br>Frequency/Amplitude:<br>(50 Hz/14 m/s <sup>2</sup> ), (100 Hz/22 m/s <sup>2</sup> ),<br>(160 Hz/28 m/s <sup>2</sup> ), (200 Hz/70 m/s <sup>2</sup> ),<br>(300 Hz/70 m/s <sup>2</sup> ), (400 Hz/70 m/s <sup>2</sup> ),<br>(500 Hz/70 m/s <sup>2</sup> ), (600 Hz/70 m/s <sup>2</sup> ),<br>(700 Hz/70 m/s <sup>2</sup> ), (800 Hz/70 m/s <sup>2</sup> ),<br>(900 Hz/70 m/s <sup>2</sup> ), (1000 Hz/70 m/s <sup>2</sup> ),<br>(1500 Hz/70 m/s <sup>2</sup> ), (2000 Hz/70 m/s <sup>2</sup> ),<br>(2500 Hz/70 m/s <sup>2</sup> ), (3000 Hz/99 m/s <sup>2</sup> ),<br>(4000 Hz/99 m/s <sup>2</sup> ), (5000 Hz/99 m/s <sup>2</sup> ) | 0.76                 | %     |
|                      |   |   |                          | V/ (m/s <sup>2</sup> )  |                | V/ (m/s <sup>2</sup> )  | Voltage sensitivity:<br>Frequency 5 kHz (exclude) to 10 kHz,<br>Frequency/Amplitude:<br>(6000 Hz/99 m/s <sup>2</sup> ), (7000 Hz/99 m/s <sup>2</sup> ),<br>(10000 Hz/141 m/s <sup>2</sup> )   | 1.8                  | %     |
|                      |   |   |                          | pC/ (m/s <sup>2</sup> ) |                | pC/ (m/s <sup>2</sup> ) | Charge sensitivity:<br>Frequency 50 Hz to 5 kHz,<br>Frequency/Amplitude: (50 Hz/14 m/s <sup>2</sup> ),<br>(100 Hz/22 m/s <sup>2</sup> ), (160 Hz/28 m/s <sup>2</sup> ),<br>(200 Hz/70 m/s <sup>2</sup> ), (300 Hz/70 m/s <sup>2</sup> ),<br>(400 Hz/70 m/s <sup>2</sup> ), (500 Hz/70 m/s <sup>2</sup> ),<br>(600 Hz/70 m/s <sup>2</sup> ), (700 Hz/70 m/s <sup>2</sup> ),<br>(800 Hz/70 m/s <sup>2</sup> ), (900 Hz/70 m/s <sup>2</sup> ),<br>(1000 Hz/70 m/s <sup>2</sup> ), (1500 Hz/70 m/s <sup>2</sup> ),<br>(2000 Hz/70 m/s <sup>2</sup> ), (2500 Hz/70 m/s <sup>2</sup> ),<br>(3000 Hz/99 m/s <sup>2</sup> ), (4000 Hz/99 m/s <sup>2</sup> ),<br>(5000 Hz/99 m/s <sup>2</sup> )  | 0.8                  | %     |



| calibration items   | working standard  | calibration method  | measurand level or range |                         |                |                         | measurement conditions /independent variable  | smallest uncertainty |       |
|---|---|---|--------------------------|-------------------------|----------------|-------------------------|---|----------------------|-------|
|   | brand /model  | document name /no.  | mini mum value           | units                   | maxi mum value | units                   | explanation   | value                | units |
| KB1001 accelerometer  | Uniphase 1101 Laser Interferometer Module /RENISHAW /RLU 10 Laser Interferometer Module | instrument calibration technique for accelerometer sine-approximation method (Document No.: 07-3-90-0117) |                          | pC/ (m/s <sup>2</sup> ) |                | pC/ (m/s <sup>2</sup> ) | Charge sensitivity:<br>Frequency 5 kHz (exclude) to 10 kHz,<br>Frequency/Amplitude:<br>(6000 Hz/99 m/s <sup>2</sup> ) , (7000 Hz/99 m/s <sup>2</sup> ) ,<br>(10000 Hz/141 m/s <sup>2</sup> )  | 1.8                  | %     |
| Approval Signatory: TSUEI, Kuang-Yih; CHEN, Jiun-Kai; TU, Tsung-Hsien |   |   |                          |                         |                |                         |   |                      |       |
| KB1001 accelerometer  | Uniphase 1101 Laser Interferometer Module /RENISHAW /RLU 10 Laser Interferometer Module | instrument calibration technique for accelerometer fringe-counting method (Document No.: 07-3-83-0045)    |                          | V/ (m/s <sup>2</sup> )  |                | V/ (m/s <sup>2</sup> )  | Voltage sensitivity:<br>Frequency 50 Hz to 700 Hz,<br>Frequency/Amplitude: (50 Hz/14 m/s <sup>2</sup> ) ,<br>(100 Hz/22 m/s <sup>2</sup> ) , (160 Hz/28 m/s <sup>2</sup> ) ,<br>(200 Hz/70 m/s <sup>2</sup> ) , (300 Hz/70 m/s <sup>2</sup> ) ,<br>(400 Hz/70 m/s <sup>2</sup> ) , (500 Hz/70 m/s <sup>2</sup> ) ,<br>(600 Hz/70 m/s <sup>2</sup> ) , (700 Hz/70 m/s <sup>2</sup> ) | 0.44                 | %     |
|   |   |   |                          | pC/ (m/s <sup>2</sup> ) |                | pC/ (m/s <sup>2</sup> ) | Charge sensitivity:<br>Frequency 50 Hz to 700 Hz,<br>Frequency/Amplitude: (50 Hz/14 m/s <sup>2</sup> ) ,<br>(100 Hz/22 m/s <sup>2</sup> ) , (160 Hz/28 m/s <sup>2</sup> ) ,<br>(200 Hz/70 m/s <sup>2</sup> ) , (300 Hz/70 m/s <sup>2</sup> ) ,<br>(400 Hz/70 m/s <sup>2</sup> ) , (500 Hz/70 m/s <sup>2</sup> ) ,<br>(600 Hz/70 m/s <sup>2</sup> ) , (700 Hz/70 m/s <sup>2</sup> )  | 0.49                 | %     |
| Approval Signatory: TSUEI, Kuang-Yih; CHEN, Jiun-Kai; TU, Tsung-Hsien |   |   |                          |                         |                |                         |   |                      |       |



| calibration items   | working standard    | calibration method  | measurand level or range |                        |                |                        | measurement conditions /independent variable   | smallest uncertainty |       |
|---|---------------------|---|--------------------------|------------------------|----------------|------------------------|--|----------------------|-------|
|   | brand /model        | document name /no.  | mini mum value           | units                  | maxi mum value | units                  | explanation  | value                | units |
| KB1001<br>low frequency accelerometer                                 | PCB 301M26 /442A102 | instrument calibration technique for low frequency accelerometer comparison method (Document No.: 07-3-86-0085) |                          | V/ (m/s <sup>2</sup> ) |                | V/ (m/s <sup>2</sup> ) | Voltage sensitivity:<br>Frequency 0.5 Hz to 160 Hz,<br>Frequency/Amplitude:<br>(0.5 Hz/0.2 m/s <sup>2</sup> ) , (0.6 Hz/0.5 m/s <sup>2</sup> ) ,<br>(0.63 Hz/0.5 m/s <sup>2</sup> ) , (0.7 Hz/0.5 m/s <sup>2</sup> ) ,<br>(0.8 Hz/0.5 m/s <sup>2</sup> ) , (0.9 Hz/0.5 m/s <sup>2</sup> ) ,<br>(1 Hz/1 m/s <sup>2</sup> ) , (1.25 Hz/1 m/s <sup>2</sup> ) ,<br>(1.6 Hz/1 m/s <sup>2</sup> ) , (2 Hz/1.5 m/s <sup>2</sup> ) ,<br>(2.5 Hz/1.5 m/s <sup>2</sup> ) , (3 Hz/3.5 m/s <sup>2</sup> ) ,<br>(3.15 Hz/3.5 m/s <sup>2</sup> ) , (4 Hz/5 m/s <sup>2</sup> ) ,<br>(5 Hz/5 m/s <sup>2</sup> ) , (6.3 Hz/5 m/s <sup>2</sup> ) ,<br>(7 Hz/5 m/s <sup>2</sup> ) , (8 Hz/5 m/s <sup>2</sup> ) ,<br>(9 Hz/5 m/s <sup>2</sup> ) , (10 Hz/5 m/s <sup>2</sup> ) ,<br>(12.5 Hz/5 m/s <sup>2</sup> ) , (15 Hz/5 m/s <sup>2</sup> ) ,<br>(16 Hz/5 m/s <sup>2</sup> ) , (20 Hz/5 m/s <sup>2</sup> ) ,<br>(30 Hz/5 m/s <sup>2</sup> ) , (31.5 Hz/5 m/s <sup>2</sup> ) ,<br>(40 Hz/5 m/s <sup>2</sup> ) , (50 Hz/5 m/s <sup>2</sup> ) ,<br>(70 Hz/5 m/s <sup>2</sup> ) , (80 Hz/5 m/s <sup>2</sup> ) ,<br>(90 Hz/5 m/s <sup>2</sup> ) , (100 Hz/5 m/s <sup>2</sup> ) ,<br>(160 Hz/2 m/s <sup>2</sup> ) | 1.5                  | %     |
| Approval Signatory: TSUEI, Kuang-Yih; CHEN, Jiun-Kai; TU, Tsung-Hsien |                     |   |                          |                        |                |                        |  |                      |       |



| calibration items   | working standard                                  | calibration method   | measurand level or range |                           |                |                           | measurement conditions /independent variable  | smallest uncertainty |       |
|---|---|--|--------------------------|---------------------------|----------------|---------------------------|---|----------------------|-------|
|   | brand /model                                      | document name /no.   | mini mum value           | units                     | maxi mum value | units                     | explanation   | value                | units |
| KB1001<br>low frequency<br>accelerometer                              | Laser<br>Interferometer<br>Module SIOS<br>SL 02/1 | instrument<br>calibration<br>technique for<br>low frequency<br>accelerometer<br>sine<br>approximation<br>method<br>(Document No.:<br>07-3-87-0004) |                          | V/<br>(m/s <sup>2</sup> ) |                | V/<br>(m/s <sup>2</sup> ) | Voltage sensitivity: Frequency 0.1 Hz,<br>Frequency/Amplitude: (0.1 Hz/0.01 m/s <sup>2</sup> )  | 1.7                  | %     |
|   |   |  |                          | V/<br>(m/s <sup>2</sup> ) |                | V/<br>(m/s <sup>2</sup> ) | Voltage sensitivity: Frequency 0.1 Hz (exclude) to<br>160 Hz (exclude) , Frequency/Amplitude:<br>(0.2 Hz/0.05 m/s <sup>2</sup> ) ,<br>(0.315 Hz, 0.4 Hz, 0.5 Hz, 0.63 Hz) /0.1 m/s <sup>2</sup> ,<br>(0.5 Hz, 0.7 Hz, 0.8 Hz) /0.2 m/s <sup>2</sup> ,<br>(0.6 Hz, 0.63 Hz, 0.7 Hz, 0.8 Hz, 0.9 Hz, 1 Hz) /0.5 m/s <sup>2</sup> ,<br>(1 Hz, 1.25Hz, 1.6 Hz, 2 Hz) /1 m/s <sup>2</sup> ,<br>(2 Hz, 2.5 Hz) /1.5 m/s <sup>2</sup> ,<br>(2.5 Hz, 3.15 Hz) /2 m/s <sup>2</sup> ,<br>(3 Hz, 3.15 Hz) /3.5 m/s <sup>2</sup> ,<br>(4 Hz, 5 Hz, 6.3 Hz, 7 Hz, 8 Hz, 9 Hz, 10 Hz,<br>12 Hz, 12.5 Hz, 15 Hz, 16 Hz, 20 Hz, 30 Hz, 31.5<br>Hz, 40 Hz, 50 Hz, 63 Hz, 70 Hz, 80 Hz, 90 Hz,<br>100 Hz) /5 m/s <sup>2</sup> | 1.3                  | %     |
|   |   |  |                          | V/<br>(m/s <sup>2</sup> ) |                | V/<br>(m/s <sup>2</sup> ) | Voltage sensitivity: Frequency 160 Hz,<br>Frequency/Amplitude:<br>(160 Hz/2 m/s <sup>2</sup> ) (160 Hz/5 m/s <sup>2</sup> )   | 1.6                  | %     |
| Approval Signatory: TSUEI, Kuang-Yih; CHEN, Jiun-Kai; TU, Tsung-Hsien |   |  |                          |                           |                |                           |   |                      |       |



| calibration items   | working standard       | calibration method   | measurand level or range |                         |                |                         | measurement conditions /independent variable   | smallest uncertainty |       |
|---|------------------------|--|--------------------------|-------------------------|----------------|-------------------------|--|----------------------|-------|
|   | brand /model           | document name /no.   | mini mum value           | units                   | maxi mum value | units                   | explanation  | value                | units |
| KB1001 shock accelerometer  | PCB 301A12 /PCB 482A21 | instrument calibration technique for shock accelerometer comparison method (Document No.: 07-3-76-0007)      |                          | V/ (m/s <sup>2</sup> )  |                | V/ (m/s <sup>2</sup> )  | Voltage sensitivity:<br>Accerleration: 200 m/s <sup>2</sup> , 2000 m/s <sup>2</sup> , 6000 m/s <sup>2</sup> , 10000 m/s <sup>2</sup> ,<br>Shock duration 0.6 ms to 3.0 ms  | 1.9                  | %     |
| Approval Signatory: TSUEI, Kuang-Yih; CHEN, Jiun-Kai; TU, Tsung-Hsien |                        |  |                          |                         |                |                         |  |                      |       |
| KB1001 shock accelerometer  | REO/32734              | instrument calibration technique for shock accelerometer phase operation method (Document No.: 07-3-98-6157) |                          | V/ (m/s <sup>2</sup> )  |                | V/ (m/s <sup>2</sup> )  | Voltage sensitivity: Accerleration:<br>200 m/s <sup>2</sup> , 1000 m/s <sup>2</sup> , 2000 m/s <sup>2</sup> , 3000 m/s <sup>2</sup> , 4000 m/s <sup>2</sup> , 5000 m/s <sup>2</sup> , 6000 m/s <sup>2</sup> , 8000 m/s <sup>2</sup> , 10000 m/s <sup>2</sup> , Shock duration 0.3 ms to 3.0 ms | 0.8                  | %     |
|   |                        |  |                          | pC/ (m/s <sup>2</sup> ) |                | pC/ (m/s <sup>2</sup> ) | Charge sensitivity: Accerleration:<br>200 m/s <sup>2</sup> , 1000 m/s <sup>2</sup> , 2000 m/s <sup>2</sup> , 3000 m/s <sup>2</sup> , 4000 m/s <sup>2</sup> , 5000 m/s <sup>2</sup> , 6000 m/s <sup>2</sup> , 8000 m/s <sup>2</sup> , 10000 m/s <sup>2</sup> , Shock duration 0.3 ms to 3.0 ms  | 0.8                  | %     |
| Approval Signatory: TSUEI, Kuang-Yih; CHEN, Jiun-Kai; TU, Tsung-Hsien |                        |  |                          |                         |                |                         |  |                      |       |



| calibration items   | working standard   | calibration method  | measurand level or range |                  |                |                  | measurement conditions<br>/independent variable  | smallest uncertainty |       |
|---|--|---|--------------------------|------------------|----------------|------------------|--|----------------------|-------|
|   | brand /model   | document name /no.  | mini mum value           | units            | maxi mum value | units            | explanation  | value                | units |
| KB1002<br>low frequency<br>vibration meter                            | PCB 301M26<br>/442A102<br>/Allied Signal<br>QA-2000<br>/BKM 2601 | instrument<br>calibration<br>technique for<br>low frequency<br>vibration meter<br>comparison<br>method<br>(Document No.:<br>07-3-86-0044) |                          | m                |                | m                | Displacement: Frequency 3.15 Hz to 50 Hz,<br>Frequency/Amplitude: (3.15 Hz/17.87 mm) ,<br>(5 Hz/10.14 mm) , (6.3 Hz/6.38 mm) ,<br>(10 Hz/2.53 mm) , (15 Hz/1.13 mm) ,<br>(16 Hz/0.99 mm) , (20 Hz/0.63 mm) ,<br>(30 Hz/0.28 mm) , (31.5 Hz/0.26 mm) ,<br>(40 Hz/0.16 mm) , (50 Hz/0.1 mm)                                | 2.3                  | %     |
|   |  |   |                          | m/s              |                | m/s              | Velocity: Frequency 3.15 Hz to 50 Hz,<br>Frequency/Amplitude: (3.15 Hz/176.83 mm/s) ,<br>(5 Hz/159.26 mm/s) , (6.3 Hz/126.32 mm/s) ,<br>(10 Hz/79.57 mm/s) , (15 Hz/53.08 mm/s) ,<br>(16 Hz/49.72 mm/s) , (20 Hz/39.82 mm/s) ,<br>(30 Hz/26.54 mm/s) , (31.5 Hz/25.27 mm/s) ,<br>(40 Hz/19.96 mm/s) , (50 Hz/15.94 mm/s) | 1.5                  | %     |
|   |  |   |                          | m/s <sup>2</sup> |                | m/s <sup>2</sup> | Acceleration: Frequency 3.15 Hz to 50 Hz,<br>Frequency/Amplitude: 3.15 Hz/3.5 m/s <sup>2</sup> ,<br>(5 Hz, 6.3 Hz, 10 Hz, 15 Hz, 16 Hz, 20 Hz, 30 Hz,<br>31.5 Hz, 40 Hz, 50 Hz) /5 m/s <sup>2</sup>  | 1.3                  | %     |
| Approval Signatory: TSUEI, Kuang-Yih; CHEN, Jiun-Kai; TU, Tsung-Hsien |  |   |                          |                  |                |                  |  |                      |       |
| KB1002<br>vibration meter   | PCB 080A200<br>/PCB 442A102<br>/B&K 8305<br>/B&K 2626            | instrument<br>calibration<br>technique for<br>vibration meter<br>comparison<br>method<br>(Document No.:<br>07-3-77-0030)                  |                          | m/s <sup>2</sup> |                | m/s <sup>2</sup> | Acceleration: Frequency 50 Hz to 2 kHz,<br>Frequency/Amplitude: (50 Hz, 100 Hz, 160 Hz,<br>200 Hz, 300 Hz, 400 Hz, 500 Hz, 600 Hz, 700 Hz,<br>800 Hz, 900 Hz, 1000 Hz, 1500 Hz, 2000 Hz)<br>/100 m/s <sup>2</sup>  | 1.3                  | %     |
|   |  |   |                          | m/s <sup>2</sup> |                | m/s <sup>2</sup> | Acceleration: Frequency 2 kHz (exclude) to 5 kHz,<br>Frequency/Amplitude:<br>(3000 Hz, 4000 Hz, 5000 Hz) /100 m/s <sup>2</sup>   | 2.6                  | %     |





| calibration items   | working standard                                      | calibration method  | measurand level or range |       |                |       | measurement conditions /independent variable  | smallest uncertainty |       |
|---|---|---|--------------------------|-------|----------------|-------|---|----------------------|-------|
|   | brand /model  | document name /no.  | mini mum value           | units | maxi mum value | units | explanation   | value                | units |
| KB1002<br>vibration meter   | PCB 080A200<br>/PCB 442A102<br>/B&K 8305<br>/B&K 2626 | instrument calibration technique for vibration meter comparison method (Document No.: 07-3-77-0030) |                          | m/s   |                | m/s   | Velocity: Frequency 50 Hz to 2 kHz, Frequency/Amplitude: (50 Hz/318.12 mm/s) , (100 Hz/159.09 mm/s) , (160 Hz/99.45 mm/s) , (200 Hz/79.50 mm/s) , (300 Hz/52.80 mm/s) , (400 Hz/39.70 mm/s) , (500 Hz/31.70 mm/s) , (600 Hz/26.50 mm/s) , (700 Hz/22.70 mm/s) , (800 Hz/19.90 mm/s) , (900 Hz/17.68 mm/s) , (1000 Hz/15.90 mm/s) , (1500 Hz/10.61 mm/s) , (2000 Hz/7.96 mm/s) | 1.5                  | %     |
|   |   |   |                          | m     |                | m     | Displacement: Frequency 50 Hz to 200 Hz, Frequency/Amplitude: (50 Hz/2.03 mm) , (100 Hz/0.51 mm) , (160 Hz/0.20 mm) , (200 Hz/0.13 mm)  | 2.1                  | %     |
| Approval Signatory: TSUEI, Kuang-Yih; CHEN, Jiun-Kai; TU, Tsung-Hsien |   |   |                          |       |                |       |   |                      |       |
| KB1099<br>charge amplifier  | HP 16383A   | instrument calibration technique for charge amplifier (Document No.: 07-3-96-0230)                  |                          | mV/pC |                | mV/pC | Frequency 10 Hz   | 1.2                  | %     |
|   |   |   |                          | mV/pC |                | mV/pC | Frequency 10 Hz (exclude) to 10 kHz   | 0.10                 | %     |
| Approval Signatory: TSUEI, Kuang-Yih; CHEN, Jiun-Kai; TU, Tsung-Hsien |   |   |                          |       |                |       |   |                      |       |



| calibration items  | working standard   | calibration method  | measurand level or range |                           |                |                           | measurement conditions /independent variable                                    | smallest uncertainty |       |
|--|--------------------|---|--------------------------|---------------------------|----------------|---------------------------|---|----------------------|-------|
|  | brand /model       | document name /no.  | mini mum value           | units                     | maxi mum value | units                     | explanation   | value                | units |
| KB2001 microphone  | B&K 4180           | Instrument Calibration Technique for Pressure Sensitivity of Half-inch Laboratory Standard Microphone-Reciprocity Method (Document No.: 07-3-A8-0201) |                          | dB<br>(reference: 1 V/Pa) |                | dB<br>(reference: 1 V/Pa) | LS2P: Frequency 10 Hz to 10 kHz (fulfilling IEC 61094-1 LS2aP, LS2F)            | 0.06                 | dB    |
|  |                    |   |                          | dB<br>(reference: 1 V/Pa) |                | dB<br>(reference: 1 V/Pa) | LS2P: Frequency 10 kHz (exclude) to 16 kHz (fulfilling IEC 61094-1 LS2aP, LS2F) | 0.08                 | dB    |
|  |                    |   |                          | dB<br>(reference: 1 V/Pa) |                | dB<br>(reference: 1 V/Pa) | LS2P: Frequency 16 kHz (exclude) to 20 kHz (fulfilling IEC 61094-1 LS2aP, LS2F) | 0.12                 | dB    |
|  |                    |   |                          | dB<br>(reference: 1 V/Pa) |                | dB<br>(reference: 1 V/Pa) | LS2P: Frequency 20 kHz (exclude) to 25 kHz (fulfilling IEC 61094-1 LS2aP, LS2F) | 0.20                 | dB    |
| Approval Signatory: KUO, Shu-Fen; LO, Fang-Chun; TU, Tsung-Hsien |                    |   |                          |                           |                |                           |   |                      |       |
| KB2001 microphone  | B&K 4160 /B&K 4180 | instrument calibration technique for microphone free-field sensitivity reciprocity method (Document No.: 07-3-A2-0205)                                |                          | dB<br>(reference: 1 V/Pa) |                | dB<br>(reference: 1 V/Pa) | LS1P: Frequency 1 kHz to 10 kHz (fulfilling IEC 61094-1 LS1P)                   | 0.16                 | dB    |
|  |                    |   |                          | dB<br>(reference: 1 V/Pa) |                | dB<br>(reference: 1 V/Pa) | LS2P: Frequency 1 kHz to 40 kHz (fulfilling IEC 61094-1, LS2aP, LS2F)           | 0.18                 | dB    |
| Approval Signatory: KUO, Shu-Fen; LO, Fang-Chun; TU, Tsung-Hsien |                    |   |                          |                           |                |                           |   |                      |       |



| calibration items  | working standard | calibration method   | measurand level or range |                           |               |                           | measurement conditions /independent variable   | smallest uncertainty |       |
|--|------------------|--|--------------------------|---------------------------|---------------|---------------------------|--|----------------------|-------|
|  | brand /model     | document name /no.   | minimum value            | units                     | maximum value | units                     | explanation  | value                | units |
| KB2001 microphone  | B&K 4180         | Instrument Calibration Technique for Microphone Free-Field Sensitivity Calibration System-comparison method (Document No.: 07-3-B0-0057) |                          | dB<br>(reference: 1 V/Pa) |               | dB<br>(reference: 1 V/Pa) | LS2/WS2: Frequency 250 Hz to 800 Hz (fulfilling IEC 61094-1, LS2 and IEC 61094-4, WS2)             | 0.40                 | dB    |
|  |                  |  |                          | dB<br>(reference: 1 V/Pa) |               | dB<br>(reference: 1 V/Pa) | LS2/WS2: Frequency 800 Hz (exclude) to 20 kHz (fulfilling IEC 61094-1, LS2 and IEC 61094-4, WS2)   | 0.45                 | dB    |
|  |                  |  |                          | dB<br>(reference: 1 V/Pa) |               | dB<br>(reference: 1 V/Pa) | LS2/WS2: Frequency 20 kHz (exclude) to 31.5 kHz (fulfilling IEC 61094-1, LS2 and IEC 61094-4, WS2) | 0.55                 | dB    |
|  |                  |  |                          | dB<br>(reference: 1 V/Pa) |               | dB<br>(reference: 1 V/Pa) | LS2/WS2: Frequency 31.5 kHz (exclude) to 40 kHz (fulfilling IEC 61094-1, LS2 and IEC 61094-4, WS2) | 0.70                 | dB    |
| Approval Signatory: KUO, Shu-Fen; LO, Fang-Chun; TU, Tsung-Hsien |                  |  |                          |                           |               |                           |  |                      |       |
| KB2001 microphone  | B&K 4160         | instrument calibration technique for microphone sound pressure sensitivity reciprocity method (Document No.: 07-3-83-0046)               |                          | dB<br>(reference: 1 V/Pa) |               | dB<br>(reference: 1 V/Pa) | LS1P: Frequency 20 Hz to 40 Hz (fulfilling IEC 61094-1 LS1P)                                       | 0.06                 | dB    |
|  |                  |  |                          | dB<br>(reference: 1 V/Pa) |               | dB<br>(reference: 1 V/Pa) | LS1P: Frequency 40 Hz (exclude) to 5 kHz (fulfilling IEC 61094-1 LS1P)                             | 0.05                 | dB    |
|  |                  |  |                          | dB<br>(reference: 1 V/Pa) |               | dB<br>(reference: 1 V/Pa) | LS1P: Frequency 5 kHz (exclude) to 10 kHz (fulfilling IEC 61094-1 LS1P)                            | 0.08                 | dB    |
|  |                  |  |                          | dB<br>(reference: 1 V/Pa) |               | dB<br>(reference: 1 V/Pa) | LS1P: Frequency 10 kHz (exclude) to 12.5 kHz (fulfilling IEC 61094-1 LS1P)                         | 0.12                 | dB    |
| Approval Signatory: KUO, Shu-Fen; LO, Fang-Chun; TU, Tsung-Hsien |                  |  |                          |                           |               |                           |  |                      |       |



| calibration items | working standard   | calibration method  | measurand level or range |                           |                |                           | measurement conditions /independent variable  | smallest uncertainty |       |
|-------------------|--------------------|---|--------------------------|---------------------------|----------------|---------------------------|---|----------------------|-------|
|                   | brand /model       | document name /no.  | mini mum value           | units                     | maxi mum value | units                     | explanation   | value                | units |
| KB2001 microphone | B&K 4160 /B&K 4180 | instrument calibration technique for microphone sound pressure sensitivity comparison method (Document No.: 07-3-A5-0152) |                          | dB<br>(reference: 1 V/Pa) |                | dB<br>(reference: 1 V/Pa) | Frequency 20 Hz to 40 Hz<br>(fulfilling IEC 61094-1 LS1,<br>IEC 61094-4 WS1)              | 0.12                 | dB    |
|                   |                    |   |                          | dB<br>(reference: 1 V/Pa) |                | dB<br>(reference: 1 V/Pa) | Frequency 40 Hz (exclude) to 4 kHz<br>(fulfilling IEC 61094-1 LS1,<br>IEC 61094-4 WS1)    | 0.08                 | dB    |
|                   |                    |   |                          | dB<br>(reference: 1 V/Pa) |                | dB<br>(reference: 1 V/Pa) | Frequency 4 kHz (exclude) to 8 kHz<br>(fulfilling IEC 61094-1 LS1,<br>IEC 61094-4 WS1)    | 0.12                 | dB    |
|                   |                    |   |                          | dB<br>(reference: 1 V/Pa) |                | dB<br>(reference: 1 V/Pa) | Frequency 8 kHz (exclude) to 12.5 kHz<br>(fulfilling IEC 61094-1 LS1,<br>IEC 61094-4 WS1) | 0.16                 | dB    |
|                   |                    |   |                          | dB<br>(reference: 1 V/Pa) |                | dB<br>(reference: 1 V/Pa) | Frequency 20 Hz to 40 Hz<br>(fulfilling IEC 61094-1LS2,<br>IEC 61094-4 WS2)               | 0.12                 | dB    |
|                   |                    |   |                          | dB<br>(reference: 1 V/Pa) |                | dB<br>(reference: 1 V/Pa) | Frequency 40 Hz (exclude) to 8 kHz<br>(fulfilling IEC 61094-1LS2,<br>IEC 61094-4 WS2)     | 0.08                 | dB    |
|                   |                    |   |                          | dB<br>(reference: 1 V/Pa) |                | dB<br>(reference: 1 V/Pa) | Frequency 8 kHz (exclude) to 20 kHz<br>(fulfilling IEC 61094-1LS2,<br>IEC 61094-4 WS2)    | 0.16                 | dB    |
|                   |                    |   |                          | dB<br>(reference: 1 V/Pa) |                | dB<br>(reference: 1 V/Pa) | Frequency 20 Hz to 40 Hz<br>(fulfilling IEC 61094-4 WS3)                                  | 0.12                 | dB    |
|                   |                    |   |                          | dB<br>(reference: 1 V/Pa) |                | dB<br>(reference: 1 V/Pa) | Frequency 40 Hz (exclude) to 6.3 kHz<br>(fulfilling IEC 61094-4 WS3)                      | 0.08                 | dB    |



| calibration items  | working standard                   | calibration method  | measurand level or range |                             |               |                             | measurement conditions /independent variable                       | smallest uncertainty |       |
|--|------------------------------------|---|--------------------------|-----------------------------|---------------|-----------------------------|--|----------------------|-------|
|  | brand /model                       | document name /no.  | minimum value            | units                       | maximum value | units                       | explanation  | value                | units |
| KB2001 microphone  | B&K 4160 /B&K 4180                 | instrument calibration technique for microphone sound pressure sensitivity comparison method (Document No.: 07-3-A5-0152) |                          | dB (reference: 1 V/Pa)      |               | dB (reference: 1 V/Pa)      | Frequency 6.3 kHz (exclude) to 16 kHz (fulfilling IEC 61094-4 WS3) | 0.16                 | dB    |
|  |                                    |   |                          | dB (reference: 1 V/Pa)      |               | dB (reference: 1 V/Pa)      | Frequency 16 kHz (exclude) to 20 kHz (fulfilling IEC 61094-4 WS3)  | 0.24                 | dB    |
| Approval Signatory: KUO, Shu-Fen; LO, Fang-Chun; TU, Tsung-Hsien |                                    |   |                          |                             |               |                             |  |                      |       |
| KB2002 pistonphone   | B&K 4144 (WS1P) /B&K 4134 (WS2P)   | instrument calibration technique for sound calibrator insert-voltage technique (Document No.: 07-3-83-0050)               | 90                       | dB (reference: 20 $\mu$ Pa) | 130           | dB (reference: 20 $\mu$ Pa) | Frequency 250 Hz   | 0.12                 | dB    |
| Approval Signatory: KUO, Shu-Fen; LO, Fang-Chun; TU, Tsung-Hsien |                                    |   |                          |                             |               |                             |  |                      |       |
| KB2002 pistonphone   | B&K 4160 (LS1P) /B&K 4180 (LS2P) / | instrument calibration technique for sound calibrator insert-voltage technique (Document No.: 07-3-83-0050)               | 90                       | dB (reference: 20 $\mu$ Pa) | 130           | dB (reference: 20 $\mu$ Pa) | Frequency 250 Hz   | 0.09                 | dB    |
| Approval Signatory: KUO, Shu-Fen; LO, Fang-Chun; TU, Tsung-Hsien |                                    |   |                          |                             |               |                             |  |                      |       |



| calibration items  | working standard                 | calibration method  | measurand level or range |                                |               |                                | measurement conditions /independent variable                   | smallest uncertainty |       |
|--|----------------------------------|---|--------------------------|--------------------------------|---------------|--------------------------------|--|----------------------|-------|
|  | brand /model                     | document name /no.  | minimum value            | units                          | maximum value | units                          | explanation  | value                | units |
| KB2002 pistonphone   | B&K 4228                         | instrument calibration technique for sound calibrator comparison method (Document No.: 07-3-80-0027)        | 90                       | dB<br>(reference: 20 $\mu$ Pa) | 130           | dB<br>(reference: 20 $\mu$ Pa) | Frequency 250 Hz   | 0.15                 | dB    |
| Approval Signatory: KUO, Shu-Fen; LO, Fang-Chun; TU, Tsung-Hsien |                                  |   |                          |                                |               |                                |  |                      |       |
| KB2003 sound calibrator  | B&K 4144 (WS1P) /B&K 4134 (WS2P) | instrument calibration technique for sound calibrator insert-voltage technique (Document No.: 07-3-83-0050) | 90                       | dB<br>(reference: 20 $\mu$ Pa) | 120           | dB<br>(reference: 20 $\mu$ Pa) | Sound calibrator: Frequency 1 kHz                              | 0.12                 | dB    |
|  |                                  |   | 90                       | dB<br>(reference: 20 $\mu$ Pa) | 120           | dB<br>(reference: 20 $\mu$ Pa) | Multi-frequency sound calibrator: Frequency 31.5 Hz            | 0.15                 | dB    |
|  |                                  |   | 90                       | dB<br>(reference: 20 $\mu$ Pa) | 120           | dB<br>(reference: 20 $\mu$ Pa) | Multi-frequency sound calibrator: Frequency 63 Hz to 8 kHz     | 0.12                 | dB    |
|  |                                  |   | 90                       | dB<br>(reference: 20 $\mu$ Pa) | 120           | dB<br>(reference: 20 $\mu$ Pa) | Multi-frequency sound calibrator: Frequency 12.5 kHz to 16 kHz | 0.18                 | dB    |
| Approval Signatory: KUO, Shu-Fen; LO, Fang-Chun; TU, Tsung-Hsien |                                  |   |                          |                                |               |                                |  |                      |       |



| calibration items  | working standard                 | calibration method  | measurand level or range |                                |               |                                | measurement conditions /independent variable                      | smallest uncertainty |       |
|--|----------------------------------|---|--------------------------|--------------------------------|---------------|--------------------------------|---|----------------------|-------|
|  | brand /model                     | document name /no.  | minimum value            | units                          | maximum value | units                          | explanation   | value                | units |
| KB2003 sound calibrator  | B&K 4160 (LS1P) /B&K 4180 (LS2P) | instrument calibration technique for sound calibrator insert-voltage technique (Document No.: 07-3-83-0050) | 90                       | dB<br>(reference: 20 $\mu$ Pa) | 120           | dB<br>(reference: 20 $\mu$ Pa) | Sound calibrator:<br>Frequency 1 kHz                              | 0.09                 | dB    |
|  |                                  |   | 90                       | dB<br>(reference: 20 $\mu$ Pa) | 120           | dB<br>(reference: 20 $\mu$ Pa) | Multi-frequency sound calibrator:<br>Frequency 31.5 Hz            | 0.09                 | dB    |
|  |                                  |   | 90                       | dB<br>(reference: 20 $\mu$ Pa) | 120           | dB<br>(reference: 20 $\mu$ Pa) | Multi-frequency sound calibrator:<br>Frequency 63 Hz to 8 kHz     | 0.09                 | dB    |
|  |                                  |   | 90                       | dB<br>(reference: 20 $\mu$ Pa) | 120           | dB<br>(reference: 20 $\mu$ Pa) | Multi-frequency sound calibrator:<br>Frequency 12.5 kHz to 16 kHz | 0.11                 | dB    |
| Approval Signatory: KUO, Shu-Fen; LO, Fang-Chun; TU, Tsung-Hsien |                                  |   |                          |                                |               |                                |   |                      |       |
| KB2003 sound calibrator  | B&K 4231                         | instrument calibration technique for sound calibrator comparison method (Document No.: 07-3-80-0027)        | 90                       | dB<br>(reference: 20 $\mu$ Pa) | 120           | dB<br>(reference: 20 $\mu$ Pa) | Frequency 1 kHz   | 0.15                 | dB    |
| Approval Signatory: KUO, Shu-Fen; LO, Fang-Chun; TU, Tsung-Hsien |                                  |   |                          |                                |               |                                |   |                      |       |



| calibration items  | working standard                   | calibration method  | measurand level or range |                                |               |                                | measurement conditions /independent variable | smallest uncertainty |       |
|--|------------------------------------|---|--------------------------|--------------------------------|---------------|--------------------------------|--|----------------------|-------|
|  | brand /model                       | document name /no.  | minimum value            | units                          | maximum value | units                          | explanation                                  | value                | units |
| KB2004<br>sound level meter                                      | B&K 4228<br>/B&K 4231<br>/B&K 4226 | instrument calibration technique for sound pressure level of sound level meter (Document No.: 07-3-97-0083) | 124                      | dB<br>(reference: 20 $\mu$ Pa) | 124           | dB<br>(reference: 20 $\mu$ Pa) | Frequency 250 Hz                             | 0.2                  | dB    |
|  |                                    |   | 94                       | dB<br>(reference: 20 $\mu$ Pa) | 114           | dB<br>(reference: 20 $\mu$ Pa) | Frequency 31.5 Hz                            | 0.3                  | dB    |
|  |                                    |   | 94                       | dB<br>(reference: 20 $\mu$ Pa) | 114           | dB<br>(reference: 20 $\mu$ Pa) | Frequency 63 Hz to 1 kHz                     | 0.3                  | dB    |
|  |                                    |   | 94                       | dB<br>(reference: 20 $\mu$ Pa) | 114           | dB<br>(reference: 20 $\mu$ Pa) | Frequency 2 kHz to 4 kHz                     | 0.3                  | dB    |
|  |                                    |   | 94                       | dB<br>(reference: 20 $\mu$ Pa) | 114           | dB<br>(reference: 20 $\mu$ Pa) | Frequency 8 kHz                              | 0.4                  | dB    |
|  |                                    |   | 94                       | dB<br>(reference: 20 $\mu$ Pa) | 114           | dB<br>(reference: 20 $\mu$ Pa) | Frequency 12.5 kHz                           | 0.5                  | dB    |
|  |                                    |   | 94                       | dB<br>(reference: 20 $\mu$ Pa) | 114           | dB<br>(reference: 20 $\mu$ Pa) | Frequency 16 kHz                             | 0.6                  | dB    |
| Approval Signatory: KUO, Shu-Fen; LO, Fang-Chun; TU, Tsung-Hsien |                                    |   |                          |                                |               |                                |  |                      |       |

Note : Smallest uncertainty represents an expanded uncertainty using a coverage factor approximately 95 % level of confidence.  
(Null Below)

