**United States Department of Commerce**
**National Institute of Standards and Technology**

# Certificate of Accreditation to ISO/IEC 17025:2017

**NVLAP LAB CODE: 200625-0**

## Scantek, Inc. Calibration Laboratory

Columbia, MD

*is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:*

## Calibration Laboratories

*This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).*

2020-03-18 through 2021-03-31

*Effective Dates*

*For the National Voluntary Laboratory Accreditation Program*

**CALIBRATION LABORATORIES** **NVLAP LAB CODE 200625-0**

# SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

| **Scantek, Inc. Calibration Laboratory** | **Fields of Calibration** |
|---|---|
| 6430 Dobbin Road, Suite C<br>Columbia, MD 21045<br>Steve Marshall<br>Phone: 410-290-7726 Fax: 410-290-9167<br>E-mail: s.marshall@scantekinc.com<br>URL: http://www.scantekinc.com | Electromagnetics – DC/Low Frequency<br>Time and Frequency<br>Mechanical<br><br>This laboratory is compliant to ANSI/NCSL Z540-1-1994; Part 1. ( 20/A01) |

## CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

| **Measured Parameter or Device Calibrated** | **Range** | **Expanded Uncertainty** Note 3,5,8 | **Remarks** |
|---|---|---|---|
| **ELECTROMAGNETICS – DC/LOW FREQUENCY** | | | |
| **DC RESISTANCE AND CURRENT (20/E05)** | | | |
| DC Current | 1 mA to 10 mA<br>10 mA to 100 mA<br>100 mA to 1 A<br>1 A to 3 A | 0.11 % + 0.002 mA<br>0.12 % + 0.005 mA<br>0.25 % + 0.1 mA<br>0.2 % + 0.6 mA | Agilent 34401A |
| DC Resistance (4-wire) | 1 Ω to 100 Ω<br>100 Ω to 1 kΩ<br>1 kΩ to 10 kΩ<br>10 kΩ to 100 kΩ<br>100 kΩ to 1 MΩ | 0.1 % + 0.006 Ω<br>0.1 % + 0.04 Ω<br>0.1 % + 0.4 Ω<br>0.1 % + 4 Ω<br>0.1 % + 40 Ω | Agilent 34401A |
| **DC VOLTAGE (20/E06)** | | | |
| DC Voltage | 1 mV to 100 mV<br>100 mV to 1 V<br>1 V to 10 V<br>10 V to 100 V<br>100 V to 1000 V | 0.0055 % + 0.0036 mV<br>0.0055 % + 0.007 mV<br>0.0055 % + 0.05 mV<br>0.0055 % + 0.6 mV<br>0.0055 % + 0.01 V | Agilent 34401A |

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**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)** [Notes 1,2]

| Measured Parameter or Device Calibrated | Range | Frequency Range | Expanded Uncertainty [Note 3,5,8] | Remarks |
|---|---|---|---|---|
| **LF AC VOLTAGE (20/E09)** | | | | |
| AC Voltage – Generate | | | | Stanford Research |
| Sine, Square, two-tone | 10 $\mu V_{pp}$ to 40 $V_{pp}$ | 0.001 Hz to 200 kHz | 1.1 % | (SR) DS360 |
| Sine or square bursts | 10 $\mu V_{pp}$ to 40 $V_{pp}$ | 0.001 Hz to 200 kHz | 1.1 % | SR DS360 |
| Broadband noise: white | 10 $\mu V_{pp}$ to 40 $V_{pp}$ | 1 Hz to 100 kHz (CF: 11 dB) | 1 dB | |
| Broadband noise: pink | 10 $\mu V_{pp}$ to 40 $V_{pp}$ | 10 Hz – 200 kHz (CF: 12 dB) | 2 dB | measured with 1/3 octave analysis |
| AC Voltage Transfer – Measuring equipment: | | | | |
| Measure | 1 mV to 100 mV | 10 Hz to 50 kHz<br>50 kHz to 200 kHz | 0.001 % + 2 µV<br>0.001 % + 5 µV | Agilent 34401A |
| | 100 mV to 1 V | 10 Hz to 50 kHz<br>50 kHz to 200 kHz | 0.001 % + 20 µV<br>0.001 % + 50 µV | |
| | 1V to 10 V | 10 Hz to 50 kHz<br>50 kHz to 200 kHz | 0.001 % + 0.2 mV<br>0.001 % + 0.5 mV | |
| | 10 V to 100 V | 10 Hz to 50 kHz<br>50 kHz to 200 kHz | 0.001 % + 2 mV<br>0.001 % + 5 mV | |
| | 100 V to 750 V | 10 Hz to 50 kHz<br>50 kHz to 200 kHz | 0.001 % + 15 mV<br>0.001 % + 38 mV | |
| AC Voltage: True RMS | 50 µV to 1 mV | 20 Hz to 20 kHz<br>3 Hz to 100 kHz | 0.24 dB<br>0.40 dB | N-1504A System |
| | 1 mV to 100 mV | 3 Hz to 5 Hz<br>5 Hz to 10 Hz | 1.0 % + 0.04 mV<br>0.36 % + 0.04 mV | Agilent 34401A |

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**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)** [Notes 1,2]

| Measured Parameter or Device Calibrated | Range | Frequency Range | Expanded Uncertainty [Note 3,5,8] | Remarks |
|---|---|---|---|---|
| | | 10 Hz to 20 kHz | 0.06 % + 0.04 mV | |
| | | 20 kHz to 50 kHz | 0.16 % + 0.05 mV | |
| | | 50 kHz to 100 kHz | 0.62 % + 0.08 mV | |
| | | 100 kHz to 300 kHz | 4.0 % + 0.50 mV | |
| | 100 mV to 1 V | 3 Hz to 5 Hz | 1.0 % + 0.2 mV | |
| | | 5 Hz to 10 Hz | 0.36 % + 0.3 mV | |
| | | 10 Hz to 20 kHz | 0.06 % + 0.3 mV | |
| | | 20 kHz to 50 kHz | 0.16 % + 0.5 mV | |
| | | 50 kHz to 100 kHz | 0.62 % + 0.8 mV | |
| | | 100 kHz to 300 kHz | 4.0 % + 5.0 mV | |
| | 1 V to 10 V | 3 Hz to 5 Hz | 1.0 % + 3.0 mV | |
| | | 5 Hz to 10 Hz | 0.36 % + 3.0 mV | |
| | | 10 Hz to 20 kHz | 0.06 % + 3.0 mV | |
| | | 20 kHz to 50 kHz | 0.16 % + 5.0 mV | |
| | | 50 kHz to 100 kHz | 0.62 % + 8.0 mV | |
| | | 100 kHz to 300 kHz | 4.0 % + 50 mV | |
| | 10 V to 100 V | 3 Hz to 5 Hz | 1.0 % + 30 mV | |
| | | 5 Hz to 10 Hz | 0.36 % + 30 mV | |
| | | 10 Hz to 20 kHz | 0.06 % + 30 mV | |
| | | 20 kHz to 50 kHz | 0.16 % + 50 mV | |
| | | 50 kHz to 100 kHz | 0.62 % + 80 mV | |
| | | 100 kHz to 300 kHz | 4.0 % + 0.5 V | |
| | 100 V to 750 V | 3 Hz to 5 Hz | 1.0 % + 0.225 V | |
| | | 5 Hz to 10 Hz | 0.36 % + 0.225 V | |
| | | 10 Hz to 20 kHz | 0.12 % + 0.225 V | |
| | | 20 kHz to 50 kHz | 0.16 % + 0.375 V | |
| | | 50 kHz to 100 kHz | 0.62 % + 0.6 V | |
| | | 100 kHz to 300 kHz | 4.0 % + 3.75 V | |
| Self-Generated Noise | 1 µV to 10 V | 0.1 Hz to 20 kHz | 0.85 dB | 840 RTA |
| | > 30 µV | 20 Hz to 80 kHz | 2 dB | HP 8903A |

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**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)** [Notes 1,2]

| Measured Parameter or Device Calibrated | Range | Frequency Range | Expanded Uncertainty [Note 3,5,8] | Remarks |
|---|---|---|---|---|
| **TIME AND FREQUENCY** | | | | |
| **FREQUENCY DISSEMINATION (20/F01)** | | | | |
| Frequency Measure | 100 mV to 750 V | 3 Hz to 5 Hz<br>5 Hz to 10 Hz<br>10 Hz to 40 Hz<br>40 Hz to 300 kHz | 0.1 %<br>0.05 %<br>0.03 %<br>0.01 % | Agilent 34401A |
| Frequency Generate | 10 $\mu V_{pp}$ to 40 $V_{pp}$ | 0.001 Hz to 200 kHz | 61 µHz/Hz + 4 mHz | SR DS360 |
| Time intervals | > 8 s | | 1 s | Chronometer |
| **OSCILLATOR CHARACHTERISTICS (20/F03)** | | | | |
| Signal Distortion<br>Signal Level Range:<br>100 mV to 10 V | | | (0.07D + 0.03) THD (where D is % THD) | |
| | > 0.1 % THD | 6 Hz to 20 kHz | | 840 Analyzer |
| 50 mV to 300 V | > 0.01 % THD | 20 kHz to 100 kHz | 2.3 dB | HP 8903A |
| Signal to noise ratio < 80 dB | 50 Hz to 100 kHz | 50 mV to 300 V | 1.5 dB | HP 8903A |
| **MECHANICAL** | | | | |
| **ACOUSTIC (20/M01)** | | | | |
| Sensitivity or Open Circuit Sensitivity: Direct and Comparison Methods | -70 dB to < -50 dB<br>-50 dB to 0 dB<br>-70 dB to < -50 dB<br>-50 dB to 0 dB | 250 Hz<br>250 Hz<br>1 kHz<br>1 kHz | 0.12 dB<br>0.092 dB<br>0.13 dB<br>0.094 dB | dB range values are relative to 1 V/Pa |
| Frequency Response: Electrostatic Excitation [Note 7] | | | Actuator / Free-field and Diffuse Field Response | dB range values are relative to 1 V/Pa |

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**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)** [Notes 1,2]

| Measured Parameter or Device Calibrated | Range | Frequency Range | Expanded Uncertainty [Note 3,5,8] | Remarks |
|---|---|---|---|---|
| (for condenser microphones with removable grid) | | | | |
| | -70 dB to 0 dB | 31.5 Hz to 100 Hz | 0.20 dB / 0.20 dB | |
| | | > 100 Hz to 1.25 kHz | 0.14 dB / 0.18 dB | |
| | | > 1.25 kHz to 4 kHz | 0.14 dB / 0.23 dB | |
| | | > 4 kHz to 8 kHz | 0.17 dB / 0.45 dB | |
| | | > 8 kHz to 10 kHz | 0.38 dB / 0.57 dB | |
| | | > 10 kHz to 16 kHz | 0.38 dB / 0.77 dB | |
| | | > 16 kHz to 20 kHz | 0.59 dB / 0.89 dB | |
| | | > 20 kHz to 50 kHz | 0.8 dB / 2.1 dB | |
| | | > 50 kHz to 100 kHz | 1.1 dB / 4.2 dB | |
| Frequency Response: | | | | |
| Acoustical Method [Note 7] Microphone Sensitivity | | | Pressure / Free-field and Diffuse Field Response | dB range values are relative to 1 V/Pa |
| | -70 dB to 0 dB | 31.5 Hz | 0.14 dB / 0.17 dB | 4226 Calibrator |
| | | 63 Hz | 0.13 dB / 0.20 dB | |
| | | 125 Hz | 0.13 dB / 0.20 dB | |
| | | 250 Hz | 0.09 dB / 0.15 dB | 1253 Calibrator |
| | | 500 Hz | 0.13 dB / 0.16 dB | 4226 Calibrator |
| | | 1 kHz | 0.11 dB / 0.13 dB | 1253 Calibrator |
| | | 2 kHz | 0.13 dB / 0.22 dB | 4226 Calibrator |
| | | 4 kHz | 0.13 dB / 0.32 dB | |
| | | 8 kHz | 0.14 dB / 0.44 dB | |
| | | 12.5 kHz | 0.14 dB / 0.70 dB | |
| | | 16 kHz | 0.23 dB / 0.75 dB | |
| Acoustical Calibrators and Pistonphones | | | | dB range values relative to 20 µPa |
| Sound Pressure Level | 90 dB to 140 dB | 31.5 Hz (± 2 Hz) | 0.11 dB | Direct Method |
| | | 63 Hz to 800 Hz | 0.10 dB | |
| | | 250 Hz (± 10 Hz) | 0.095 dB | reference conditions |
| | | 250 Hz (± 10 Hz) | 0.092 dB | |

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**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)** [Notes 1,2]

| Measured Parameter or Device Calibrated | Range | Frequency Range | Expanded Uncertainty [Note 3,5,8] | Remarks |
|---|---|---|---|---|
| | | 1 kHz (± 40 Hz) | 0.11 dB | reference conditions |
| | | 1 kHz (± 40 Hz) | 0.10 dB | |
| | | 1250 Hz to 5 kHz | 0.11 dB | |
| | | 6.3 kHz to 8 kHz | 0.14 dB | |
| | | 10 kHz to 12.5 kHz | 0.16 dB | |
| | | 16 kHz | 0.21 dB | |
| Sound Level Stability | 90 dB to 140 dB | 20 Hz to 20 kHz | 0.03 dB | 1504A |
| Sound Level Meters, Dosimeters, Real-time and FFT analyzers, Filter sets [Note 7] | | | Pressure / Free-field and Diffuse Field Response | dB range values relative to 20 µPa |
| Sound Pressure Level: | 94 dB, 104 dB, | | | |
| Fixed points, Tones | 114 dB | 31.5 Hz | 0.15 dB / 0.20 dB | 4226 Calibrator |
| | | 63 Hz | 0.14 dB / 0.20 dB | |
| | | 125 Hz | 0.14 dB / 0.20 dB | |
| | | 250 Hz | 0.14 dB / 0.15 dB | |
| | 124 dB | 250 Hz | 0.09 dB / 0.11 dB | 1253 Calibrator |
| | 94 dB, 104 dB, | | | |
| | 114 dB | 500 Hz | 0.14 dB / 0.15 dB | 4226 Calibrator |
| | | 1 kHz | 0.13 dB / 0.13 dB | |
| | 124 dB | 1 kHz | 0.12 dB / 0.13 dB | 1253 Calibrator |
| | 94 dB, 104 dB, | | | |
| | 114 dB | 2 kHz | 0.14 dB / 0.20 dB | 4226 Calibrator |
| | | 4 kHz | 0.14 dB / 0.25 dB | |
| | | 8 kHz | 0.14 dB / 0.45 dB | |
| | | 12.5 kHz | 0.15 dB / 0.70 dB | |
| | | 16 kHz | 0.25 dB / 0.75 dB | |
| Tone Burst Sounds | 80 dB to 100 dB | 2 kHz | 0.15 dB | dB range values relative to 20 µPa 4226 Calibrator |

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**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)** [Notes 1,2]

| Measured Parameter or Device Calibrated | Range | Frequency Range | Expanded Uncertainty [Note 3,5,8] | Remarks |
|---|---|---|---|---|
| Timed Sounds | | | | |
| Measuring Equipment – | | | | |
| Generate | 94 dB | 1 kHz | 0.01 % dose | |
| | 104 dB | 1 kHz | 0.03 % dose | |
| | 114 dB | 1 kHz | 0.12 % dose | |
| | 124 dB | 1 kHz | 0.26 % dose | |
| PIR Intensity Probe | 0 dB to 60 dB | 40 Hz to 10 kHz | 2.5 dB | Broadband Noise |
| **VIBRATION (20/M11)** | | | | |
| Exciters and Vibration Calibrators | | | | |
| Acceleration – Measure | 0.1 $m/s^2$ to 110 $m/s^2$ | 10 Hz to 100 Hz | 1.1 % | |
| | | > 100 Hz to 160 Hz | 1.0 % | |
| | | > 160 Hz to 1 kHz | 1.1 % | |
| | | > 1 kHz to 5 kHz | 1.1 % | |
| | | > 5 kHz to 10 kHz | 1.3 % | |
| Accelerometers | | | | |
| | 0.03 $mV/(m/s^2)$ to | | | Comparison |
| Sensitivity (Volts) | 5 $V/(m/s^2)$ | 10 Hz to 20 Hz | 1.4 % | Method |
| | | 21 Hz to 99 Hz | 1.3 % | |
| | | 100 Hz to 160 Hz | 1.0 % | |
| | | 161 Hz to 1 kHz | 1.2 % | |
| | | > 1 kHz to < 5 kHz | 1.9 % | |
| | | 5 kHz to < 8 kHz | 2.7 % | |
| | | 8 kHz to 10 kHz | 3.1 % | |
| | 0.03 $pC/(m/s^2)$ to | | | Comparison |
| Sensitivity (Coulombs) | 1 $nC/(m/s^2)$ | 10 Hz to 20 Hz | 1.4% | Method |
| | | 21 Hz to 99 Hz | 1.3 % | |
| | | 100 Hz to 160 Hz | 1.0 % | |
| | | 161 Hz to 1 kHz | 1.2 % | |
| | | > 1 kHz to < 5 kHz | 1.9 % | |
| | | 5 kHz to < 8 kHz | 2.7 % | |
| | | 8 kHz to 10 kHz | 3.1 % | |

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**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)** [Notes 1,2]

| Measured Parameter or Device Calibrated | Range | Frequency Range | Expanded Uncertainty [Note 3,5,8] | Remarks |
|---|---|---|---|---|
| Velocity Sensors | 0.03 mV/(m/s$^2$) to 5 V/(m/s$^2$) | 10 Hz to 20 Hz<br>21 Hz to 99 Hz<br>100 Hz to 160 Hz<br>161 Hz to 1 kHz<br>> 1 kHz to < 5 kHz<br>5 kHz to < 8 kHz<br>8 kHz to 10 kHz | 1.4 %<br>1.3 %<br>1.0 %<br>1.2 %<br>1.9 %<br>2.7 %<br>3.1 % | Comparison Method |
| **END** | | | | |

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| Notes |
|---|

**Note 1:** A Calibration and Measurement Capability (CMC) is a description of the best result of a calibration or measurement (result with the smallest uncertainty of measurement) that is available to the laboratory's customers under normal conditions, when performing more or less routine calibrations of nearly ideal measurement standards or instruments. The CMC is described in the laboratory's scope of accreditation by: the measurement parameter/device being calibrated, the measurement range, the uncertainty associated with that range (see note 3), and remarks on additional parameters, if applicable.

**Note 2:** Calibration and Measurement Capabilities are traceable to the national measurement standards of the U.S. or to the national measurement standards of other countries and are thus traceable to the internationally accepted representation of the appropriate SI (Système International) unit.

**Note 3:** The uncertainty associated with a measurement in a CMC is an expanded uncertainty with a level of confidence of approximately 95 %, typically using a coverage factor of $k = 2$. However, laboratories may report a coverage factor different than $k = 2$ to achieve the 95 % level of confidence. Units for the measurand and its uncertainty are to match. Exceptions to this occur when marketplace practice employs mixed units, such as when the artifact to be measured is labeled in non-SI units and the uncertainty is given in SI units (Example: 5 lb weight with uncertainty given in mg).

**Note 3a:** The uncertainty of a specific calibration by the laboratory may be greater than the uncertainty in the CMC due to the condition and behavior of the customer's device and specific circumstances of the calibration. The uncertainties quoted do not include possible effects on the calibrated device of transportation, long term stability, or intended use.

**Note 3b:** As the CMC represents the best measurement results achievable under normal conditions, the accredited calibration laboratory shall not report smaller uncertainty of measurement than that given in a CMC for calibrations or measurements covered by that CMC.

**Note 3c:** As described in Note 1, CMCs cover calibrations and measurements that are available to the laboratory's customers under *normal conditions.* However, the laboratory may have the capability to offer special tests, employing special conditions, which yield calibration or measurement results with lower uncertainties. Such special tests are not covered by the CMCs and are outside the laboratory's scope of accreditation. In this case, NVLAP requirements for the labeling, on calibration reports, of results outside the laboratory's scope of accreditation apply. These requirements are set out in Annex A.5 of NIST Handbook 150, Procedures and General Requirements.

**Note 4:** Uncertainties associated with field service calibration may be greater as they incorporate on-site environmental contributions, transportation effects, or other factors that affect the measurements. (This note applies only if marked in the body of the scope.)

**Note 5:** Values listed with percent (%) are percent of reading or generated value unless otherwise noted.

**Note 6:** NVLAP accreditation is the formal recognition of specific calibration capabilities. Neither NVLAP nor NIST guarantee the accuracy of individual calibrations made by accredited laboratories.

**Note 7:** The Free-field and Diffuse Field Responses characteristics are calculated using the measured actuator/pressure response and the correction coefficients provided by the manufacturer of the tested device.

**Note 8:** Unless otherwise specified, uncertainties are given at actual conditions.

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