



MS ISO/IEC 17025

Certificate of Accreditation

No: SAMM 088

Valid until: 14 September 2011

This is to certify that

**SIME-SIRIM TECHNOLOGIES SDN BHD
SUBANG JAYA, SELANGOR
MALAYSIA**

(FIELDS OF CALIBRATION: ELECTRICAL, TEMPERATURE, MASS,
DIMENSIONAL, FORCE, PRESSURE,
TORQUE, VOLUMETRIC & HYDROMETER)

has been granted accreditation in respect of the scope of accreditation described in the SCHEDULE attached, subject to the terms and conditions governing the *Skim Akreditasi Makmal Malaysia* (SAMM), the Laboratory Accreditation Scheme of Malaysia.

Laboratories accredited under SAMM meet the requirements of MS ISO/IEC 17025 'General requirements for the competence of testing and calibration laboratories'. This Malaysian Standard is identical with ISO/IEC 17025 published by the International Organization for Standardization (ISO).

"This laboratory is accredited in accordance with recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer joint ISO-ILAC-IAF Communiqué dated 18 June 2005)"



(RIDZWAN KASIM)

for the Director General
Department of Standards Malaysia
Date of issue: 20 October 2008

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LABORATORY LOCATION:
(Permanent laboratory)

**SIME-SIRIM TECHNOLOGIES SDN BHD
KOMPLEKS SIME DARBY
PERSIARAN KEWAJIPAN
47600 SUBANG JAYA, SELANGOR
MALAYSIA**

The standard used for assessment of this laboratory is MS ISO/IEC 17025:2005

FIELD OF CALIBRATION: ELECTRICAL MEASUREMENTS

SCOPE OF ACCREDITATION:

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (\pm) *</u>
1. Measuring Instrument		
DC VOLTAGE	+220 mV Range (0 mV to +220 mV)	9 μ V/V + 0.8 μ V
	-220 mV Range (-220 mV to 0 mV)	9 μ V/V + 0.8 μ V
	+2.2 V Range (0 V to +2.2 V)	8 μ V/V + 1.2 μ V
	-2.2 V Range (-2.2 V to 0 V)	8 μ V/V + 1.2 μ V
	+11 V Range (0 V to +11 V)	8 μ V/V + 4 μ V
	-11 V Range (-11 V to 0 V)	8 μ V/V + 4 μ V
	+22 V Range (0 V to +22 V)	8 μ V/V + 8 μ V
	-22 V Range (-22 V to 0 V)	8 μ V/V + 8 μ V
	+220 V Range (0 V to +220 V)	9 μ V/V + 0.1 mV
	-220 V Range (-220 V to 0 V)	9 μ V/V + 0.1 mV
	+1100 V Range (+100 V to +1100 V)	11 μ V/V + 0.6 mV
	-1100 V Range (-1100 V to -100 V)	11 μ V/V + 0.6 mV
AC VOLTAGE	<u>2.2 mV Range (0.22 mV to 2.2 mV)</u>	
	10 Hz to 20 Hz	0.6 mV/V + 5 μ V
	20 Hz to 40 Hz	0.24 mV/V + 5 μ V
	40 Hz to 20 kHz	0.12 mV/V + 5 μ V
	20 kHz to 50 kHz	0.41 mV/V + 5 μ V
	50 kHz to 100 kHz	0.95 mV/V + 8 μ V
	100 kHz to 300 kHz	1.3 mV/V + 15 μ V
	300 kHz to 500 kHz	1.8 mV/V + 0.03 mV
	500 kHz to 1 MHz	3.6 mV/V + 0.03 mV

* The uncertainties are based on an estimated confidence probability of not less than 95% unless otherwise stated.



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SCOPE OF ACCREDITATION:

Instrument calibrated / Measurement parameters	Range	Best Measurement Capability Expressed as an Uncertainty (\pm) *
1. Measuring Instrument AC VOLTAGE (continued)	<u>22 mV Range (2.2 mV to 22 mV)</u>	
	10 Hz to 20 Hz	0.6 mV/V + 6 μ V
	20 Hz to 40 Hz	0.24 mV/V + 6 μ V
	40 Hz to 20 kHz	0.12 mV/V + 6 μ V
	20 kHz to 50 kHz	0.41 mV/V + 6 μ V
	50 kHz to 100 kHz	0.95 mV/V + 8 μ V
	100 kHz to 300 kHz	1.3 mV/V + 15 μ V
	300 kHz to 500 kHz	1.8 mV/V + 0.03 mV
	500 kHz to 1 MHz	3.6 mV/V + 0.03 mV
	<u>220 mV Range (22 mV to 220 mV)</u>	
	10 Hz to 20 Hz	0.6 mV/V + 16 μ V
	20 Hz to 40 Hz	0.24 mV/V + 0.01 mV
	40 Hz to 20 kHz	0.11 mV/V + 0.01 mV
	20 kHz to 50 kHz	0.36 mV/V + 0.01 mV
	50 kHz to 100 kHz	0.9 mV/V + 0.03 mV
	100 kHz to 300 kHz	1.1 mV/V + 0.03 mV
	300 kHz to 500 kHz	1.8 mV/V + 0.04 mV
	500 kHz to 1 MHz	3.6 mV/V + 0.1 mV
	<u>2.2 V Range (0.22 V to 2.2 V)</u>	
	10 Hz to 20 Hz	0.6 mV/V + 0.1 mV
	20 Hz to 40 Hz	0.18 mV/V + 0.03 mV
	40 Hz to 20 kHz	85 μ V/V + 7 μ V
	20 kHz to 50 kHz	0.14 mV/V + 0.02 mV
	50 kHz to 100 kHz	0.28 mV/V + 0.08 mV
	100 kHz to 300 kHz	0.48 mV/V + 0.15 mV
	300 kHz to 500 kHz	1.2 mV/V + 0.4 mV
	500 kHz to 1 MHz	2.4 mV/V + 1 mV
	<u>22 V Range (2.2 V to 22 V)</u>	
	10 Hz to 20 Hz	0.6 mV/V + 1 mV
	20 Hz to 40 Hz	0.18 mV/V + 0.3 mV
	40 Hz to 20 kHz	85 μ V/V + 0.07 mV
	20 kHz to 50 kHz	0.14 mV/V + 0.2 mV
	50 kHz to 100 kHz	0.28 mV/V + 0.4 mV
	100 kHz to 300 kHz	0.6 mV/V + 1.7 mV
	300 kHz to 500 kHz	1.4 mV/V + 5 mV
	500 kHz to 1 MHz	3 mV/V + 9 mV



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<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
1. Measuring Instrument AC VOLTAGE (continued)	<u>220 V Range (22 V to 220 V)</u>	
	10 Hz to 20 Hz	0.6 mV/V + 0.01 V
	20 Hz to 40 Hz	0.18 mV/V + 3 mV
	40 Hz to 20 kHz	90 μ V/V + 1 mV
	20 kHz to 50 kHz	0.25 mV/V + 4 mV
	50 kHz to 100 kHz	0.6 mV/V + 0.01 V
	100 kHz to 300 kHz	1.6 mV/V + 0.11 V
	300 kHz to 500 kHz	5.4 mV/V + 0.11 V
	500 kHz to 1 MHz	13 mV/V + 0.22 V
	<u>1100 V Range (110 V to 1100 V)</u>	
	50 Hz to 1 kHz	90 μ V/V + 4 mV
	<u>800.01 V to 1050.00 V</u>	
	1 kHz to 3 kHz	0.8 mV/V + 0.13 V
	3 kHz to 10 kHz	0.8 mV/V + 0.21 V
	10 kHz to 20 kHz	1.2 mV/V + 0.32 V
DC CURRENT	0 μ A to +220 μ A	60 μ A/A + 0.01 μ A
	-220 μ A to 0 μ A	60 μ A/A + 0.01 μ A
	0 mA to +2.2 mA	60 μ A/A + 0.01 μ A
	-2.2 mA to 0 mA	60 μ A/A + 0.01 μ A
	0 mA to +22 mA	60 μ A/A + 0.1 μ A
	-22 mA to 0 mA	60 μ A/A + 0.1 μ A
	0 mA to +220 mA	70 μ A/A + 1 μ A
	-220 mA to 0 mA	70 μ A/A + 1 μ A
	0 A to +1A	95 μ A/A + 30 μ A
	-1 A to 0 A	95 μ A/A + 30 μ A
	+0.32001 A to +3.2 A	0.6 mA/A + 0.12 mA
	-3.2 A to -0.32001 A	0.6 mA/A + 0.12 mA
	+3.2001 A to +10.5 A	0.55 mA/A + 0.94 mA
	-10.5 A to -3.2001 A	0.55 mA/A + 0.94 mA
	+10.5001 A to +20 A	0.55 mA/A + 4.5 mA
	-20 A to -10.5001 A	0.55 mA/A + 4.5 mA



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SCOPE OF ACCREDITATION:

<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
1. Measuring Instrument DC CURRENT (continued)	+20 A to +100 A -100 A to -20 A	0.45 mA/A + 20 mA 0.45 mA/A + 20 mA
AC CURRENT	<u>9 μA to 220 μA</u> 10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	0.8 mA/A + 0.03 μ A 0.42 mA/A + 25 nA 0.16 mA/A + 0.02 μ A 0.7 mA/A + 0.05 μ A 1.8 mA/A + 0.1 μ A
	<u>0.22 mA to 2.2 mA</u> 10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	0.8 mA/A + 0.05 μ A 0.42 mA/A + 0.04 μ A 0.16 mA/A + 0.04 μ A 0.7 mA/A + 0.5 μ A 1.8 mA/A + 1 μ A
	<u>2.2 mA to 22 mA</u> 10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	0.8 mA/A + 0.5 μ A 0.42 mA/A + 0.4 μ A 0.16 mA/A + 0.4 μ A 0.7 mA/A + 5 μ A 1.8 mA/A + 0.01 mA
	<u>22 mA to 220 mA</u> 10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	0.8 mA/A + 5 μ A 0.42 mA/A + 4 μ A 0.18 mA/A + 4 μ A 0.7 mA/A + 0.05 mA 1.8 mA/A + 0.1 mA
	<u>0.22 A to 2.2 A</u> 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	0.75 mA/A + 0.04 mA 0.85 mA/A + 0.1 mA 0.01 A/A + 0.2 mA
	<u>0.32001 A to 3.2 A</u> 10 Hz to 3 kHz 3 kHz to 10 kHz	1 mA/A + 0.48 mA 2.5 mA/A + 2.6 mA



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SCOPE OF ACCREDITATION:

<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
1. Measuring Instrument AC CURRENT (continue)	<u>3.2001 A to 10.5 A</u> 10 Hz to 3 kHz 3 kHz to 10 kHz	2 mA/A + 3 mA 5 mA/A + 10 mA
	<u>10.5001 A to 20 A</u> 10 Hz to 3 kHz 3 kHz to 10 kHz	2 mA/A + 6.9 mA 5 mA/A + 23 mA
	<u>20 A to 100 A</u> 10 Hz to 1 kHz 1 kHz to 10 kHz	2.5 mA/A + 0.03 A 5 mA/A + 0.05 A
RESISTANCE	1 m Ω	0.2 m Ω/Ω
Fixed Value	10 m Ω	0.1 m Ω/Ω
	100 m Ω	0.02 m Ω/Ω
	1 Ω	5 $\mu\Omega/\Omega$
	1.9 Ω	0.11 m Ω/Ω
	10 Ω	5 $\mu\Omega/\Omega$
	19 Ω	31 $\mu\Omega/\Omega$
	100 Ω	5 $\mu\Omega/\Omega$
	190 Ω	0.02 m Ω/Ω
	1 k Ω	5 $\mu\Omega/\Omega$
	1.9 k Ω	15 $\mu\Omega/\Omega$
	10 k Ω	5 $\mu\Omega/\Omega$
	19 k Ω	14 $\mu\Omega/\Omega$
	100 k Ω	5 $\mu\Omega/\Omega$
	190 k Ω	15 $\mu\Omega/\Omega$
	1 M Ω	5 $\mu\Omega/\Omega$
	1.9 M Ω	24 $\mu\Omega/\Omega$
	10 M Ω	5 $\mu\Omega/\Omega$
	19 M Ω	0.05 m Ω/Ω
	100 M Ω	0.13 m Ω/Ω
	1 G Ω	5 $\mu\Omega/\Omega$
	10 G Ω	0.02 Ω/Ω
	100 G Ω	0.05 Ω/Ω
	1 T Ω	0.05 Ω/Ω



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<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
1. Measuring Instrument CAPACITANCE Fixed Value	<u>20 Hz to 1 MHz</u>	
	1 pF	1 mF/F
	10 pF	1 mF/F
	100 pF	1 mF/F
	1000 pF	1 mF/F
	0.01 μ F	1 mF/F
	0.1 μ F	1 mF/F
	1.0 μ F	1 mF/F
	<u>≤ 350 Hz</u>	
	0.5000 nF to 4.0000 nF	3 mF/F + 15 pF
	4.0001 nF to 40.000 nF	3 mF/F + 30 pF
	40.001 nF to 400.00 nF	3 mF/F + 0.16 nF
	400.01 nF to 4.0000 μ F	4 mF/F + 1.6 nF
	4.0001 μ F to 40.000 μ F	5 mF/F + 16 nF
	40.001 μ F to 400.00 μ F	5 mF/F + 0.16 μ F
	400.01 μ F to 4.0000 mF	5 mF/F + 1.6 μ F
	4.0001 mF to 40.000 mF	10 mF/F + 0.06 mF
	<u>350 Hz to 1.5 kHz</u>	
	0.5000 nF to 4.0000 nF	6 mF/F + 0.03 nF
	4.0001 nF to 40.000 nF	6 mF/F + 0.06 nF
	40.001 nF to 400.00 nF	6 mF/F + 0.32 nF
	400.01 nF to 4.0000 μ F	8 mF/F + 3.2 nF
	4.0001 μ F to 40.000 μ F	10 mF/F + 32 nF
	40.001 μ F to 400.00 μ F	10 mF/F + 0.32 μ F
	400.01 μ F to 4.0000 mF	10 mF/F + 3.2 μ F
	4.0001 mF to 40.000 mF	20 mF/F + 0.12 mF
INDUCTANCE Fixed Value	100 μ H @ 1 kHz	2.5 mH/H
	1 mH @ 1 kHz	1 mH/H
	10 mH @ 1 kHz	1 mH/H
	100 mH @ 1 kHz	1 mH/H
	1 H @ 1 kHz	1 mH/H
POWER/ ENERGY (DC)	1 kW to 20 kW	0.7 mW/W
	0.1 W to 1 kW	0.22 mW/W



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<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm)*</u>
1. Measuring Instrument POWER/ ENERGY (AC) (45 Hz to 65 Hz at PF=1)	10 kW to 20 kW 1 W to 10 kW 0.1 W to 1 W	1 mW/W 0.9 mW/W 1 mW/W
FREQUENCY	1 μ Hz to 80 MHz 100 kHz to 4320 MHz	64 nHz/Hz 32 nHz/Hz
Time Base Output	1 kHz to 10 MHz	3.6 nHz/Hz
AMPLITUDE	10 mVp-p to 10 Vp-p (1 μ Hz to 80 MHz, Into 50 Ω) +13 dBm to -140 dBm (100 kHz to 4320 MHz)	10 mVpp/Vpp + 1 mVpp 1 dBm
FLATNESS	Sine Wave Relative to 1 kHz (Auto range On)	0.4 dBm
TIME	1 s to 24 Hrs	0.06 μ s/s + 0.021 s
2. High Voltage Meter DC VOLTAGE	0.5 kV to 10 kV	5 mV/V
AC VOLTAGE	(0.5 kV to 10 kV) @ (50/60) Hz	8 mV/V
3. Clamp Meter DC Current		
10 – Turn Coil	3.2001 A to 32 A 32.001 A to 105 A 105.001 A to 200 A	2.1 mA/A 2.1 mA/A 2.3 mA/A
50 – Turn Coil	16.001 A to 160 A 160.01 A to 525.0 A 525.01 A to 1000.0 A	2.4 mA/A 2.5 mA/A 2.6 mA/A



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<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
3. Clamp Meter AC Current		
10 – Turn Coil	<u>3.2001 A to 32.0 A</u> 10 Hz to 100 Hz 100 Hz to 440 Hz	3 mA/A 8.9 mA/A
	<u>32.001 A to 200.0 A</u> 10 Hz to 100 Hz 100 Hz to 440 Hz	3.3 mA/A 8.2 mA/A
50 – Turn Coil	<u>16.001 A to 160.0 A</u> 10 Hz to 100 Hz	3 mA/A
	<u>160.01 A to 1000.0 A</u> 10 Hz to 100 Hz	3.3 mA/A
4. Insulation Testers		
	(1.0 k Ω to 10.0 k Ω) @ 10.0 V	0.5 m Ω/Ω
	(10.0 k Ω to 100.0 k Ω) @ 50.0 V	0.5 m Ω/Ω
	(0.1 M Ω to 1.0 M Ω) @ 150.0 V	0.5 m Ω/Ω
	(1.0 M Ω to 10.0 M Ω) @ 300.0 V	1 m Ω/Ω
	(10.0 M Ω to 100.0 M Ω) @ 500.0 V	1 m Ω/Ω
	(0.1 G Ω to 1.0 G Ω) @ 1000.0 V	10 m Ω/Ω
	(1.0 G Ω to 10.0 G Ω) @ 5000.0 V	50 m Ω/Ω
	(10.0 G Ω to 100.0 G Ω) @ 5000.0 V	0.1 Ω/Ω
	(100.0 G Ω to 600.0 G Ω) @ 5000.0 V	50 m Ω/Ω
5. Oscilloscope		
Vertical Deflection	0V to ± 6.6 V (50 Ω Load)	2.5 mV/V + 0.04 mV
DC Signal	0V to ± 130 V (1 M Ω Load)	0.5 mV/V + 0.04 mV
Vertical Deflection	± 1 mVp-p to ± 6.6 Vp-p (50 Ω Load)	2.5 mVp-p/Vp-p + 0.04 mVp-p
Square Wave Signal	± 1 mVp-p to ± 130 Vp-p (1 M Ω Load)	1 mVp-p/Vp-p + 0.04 mVp-p
Horizontal Deflection	2 ns/div to 20 ms/div	2.5 μ s/s
Time Markers	50 ms/div to 5 s/div	(25+(Output x 1000)) μ s/s
(50 Ω Load)		



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Instrument calibrated / Measurement parameters	Range	Best Measurement Capability Expressed as an Uncertainty (\pm) *
5. Oscilloscope (continue)		
Bandwidth Amplitude	50 kHz to 600 MHz 600 MHz to 4320 MHz	0.03 Vp-p 0.26 Vp-p
Bandwidth Frequency	50 kHz to 600 MHz 600 MHz to 4320 MHz	2.5 μ Hz/Hz 32 nHz/Hz
Risetime	≤ 300 ps	+0 ns / -0.1 ns
6. Sourcing / Generating Instrument		
DC VOLTAGE	+100 mV Range (+100 μ V to +120 mV) -100 mV Range (-120 mV to -100 μ V)	5 μ V/V + 0.3 μ V 5 μ V/V + 0.3 μ V
	+1 V Range (+100 mV to +1.2 V) -1 V Range (-1.2 V to -100 mV)	4 μ V/V + 0.3 μ V 4 μ V/V + 0.3 μ V
	+10 V Range (+1 V to +12 V) -10 V Range (-12 V to -1 V)	4 μ V/V + 0.5 μ V 4 μ V/V + 0.5 μ V
	+100 V Range (+10 V to +120 V) -100 V Range (-120 V to -10 V)	6 μ V/V + 0.03 mV 6 μ V/V + 0.03 mV
	+1000 V Range (+100 V to +1050 V) -1000 V Range (-1050 V to -100 V)	6 μ V/V + 0.1 mV 6 μ V/V + 0.1 mV
AC VOLTAGE	<u>2.2 mV Range (600 μV to 2.2 mV)</u> 10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 500 kHz 500 kHz to 1 MHz	1.7 mV/V + 1.3 μ V 0.74 mV/V + 1.3 μ V 0.42 mV/V + 1.3 μ V 0.81 mV/V + 2 μ V 1.2 mV/V + 2.5 μ V 2.3 mV/V + 4 μ V 2.4 mV/V + 8 μ V 3.5 mV/V + 8 μ V



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SCOPE OF ACCREDITATION:

<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
6. Sourcing/ Generating Instrument AC VOLTAGE (continue)	<u>7 mV Range (1.9 mV to 7 mV)</u>	
	10 Hz to 20 Hz	0.85 mV/V + 1.3 μ V
	20 Hz to 40 Hz	0.37 mV/V + 1.3 μ V
	40 Hz to 20 kHz	0.21 mV/V + 1.3 μ V
	20 kHz to 50 kHz	0.4 mV/V + 2 μ V
	50 kHz to 100 kHz	0.6 mV/V + 2.5 μ V
	100 kHz to 300 kHz	1.2 mV/V + 4 μ V
	300 kHz to 500 kHz	1.3 mV/V + 8 μ V
	500 kHz to 1 MHz	2.3 mV/V + 8 μ V
	<u>10 mV Range (1 mV to 12 mV)</u>	
	1 Hz to 40 Hz	0.3 mV/V + 3 μ V
	1 MHz to 4 MHz	0.07 V/V + 7 μ V
	4 MHz to 8 MHz	0.2 V/V + 8 μ V
	<u>22 mV Range (6 mV to 22 mV)</u>	
	10 Hz to 20 Hz	0.29 mV/V + 1.3 μ V
	20 Hz to 40 Hz	0.19 mV/V + 1.3 μ V
	40 Hz to 20 kHz	0.11 mV/V + 1.3 μ V
	20 kHz to 50 kHz	0.21 mV/V + 2 μ V
	50 kHz to 100 kHz	0.31 mV/V + 2.5 μ V
	100 kHz to 300 kHz	0.81 mV/V + 4 μ V
	300 kHz to 500 kHz	0.89 mV/V + 8 μ V
	500 kHz to 1 MHz	1.7 mV/V + 8 μ V
	<u>70 mV Range (19 mV to 70 mV)</u>	
	10 Hz to 20 Hz	0.24 mV/V + 1.5 μ V
	20 Hz to 40 Hz	0.12 mV/V + 1.5 μ V
	40 Hz to 20 kHz	65 μ V/V + 1.5 μ V
	20 kHz to 50 kHz	0.13 mV/V + 2 μ V
	50 kHz to 100 kHz	0.26 mV/V + 2.5 μ V
	100 kHz to 300 kHz	0.51 mV/V + 4 μ V
	300 kHz to 500 kHz	0.67 mV/V + 8 μ V
	500 kHz to 1 MHz	1.1 mV/V + 8 μ V
	<u>100 mV range (10 mV to 120 mV)</u>	
	1 Hz to 40 Hz	0.07 mV/V + 4 μ V
	1 MHz to 2 MHz	15 mV/V + 0.01 mV
	2 MHz to 4 MHz	0.04 V/V + 0.07 mV
	4 MHz to 8 MHz	0.04 V/V + 0.08 mV
	8 MHz to 10 MHz	0.15 V/V + 0.1 mV



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<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
6. Sourcing/ Generating Instrument AC VOLTAGE (continue)	<u>220 mV Range (60 mV to 220 mV)</u>	
	10 Hz to 20 Hz	0.21 mV/V + 1.5 μ V
	20 Hz to 40 Hz	85 μ V/V + 1.5 μ V
	40 Hz to 20 kHz	38 μ V/V + 1.5 μ V
	20 kHz to 50 kHz	69 μ V/V + 2 μ V
	50 kHz to 100 kHz	0.16 mV/V + 2.5 μ V
	100 kHz to 300 kHz	0.25 mV/V + 4 μ V
	300 kHz to 500 kHz	0.38 mV/V + 8 μ V
	500 kHz to 1 MHz	1 mV/V + 8 μ V
	<u>700 mV Range (190 mV to 700 mV)</u>	
	10 Hz to 20 Hz	0.21 mV/V + 1.5 μ V
	20 Hz to 40 Hz	76 μ V/V + 1.5 μ V
	40 Hz to 20 kHz	33 μ V/V + 1.5 μ V
	20 kHz to 50 kHz	51 μ V/V + 2 μ V
	50 kHz to 100 kHz	79 μ V/V + 2.5 μ V
	100 kHz to 300 kHz	0.18 mV/V + 4 μ V
	300 kHz to 500 kHz	0.3 mV/V + 8 μ V
	500 kHz to 1 MHz	0.96 mV/V + 8 μ V
	<u>1 V Range (0.1 V to 1.2 V)</u>	
	1 Hz to 40 Hz	0.07 mV/V + 0.04 mV
	1 MHz to 2 MHz	15 mV/V + 0.1 mV
	2 MHz to 4 MHz	0.04 V/V + 0.7 mV
	4 MHz to 8 MHz	0.04 V/V + 0.8 mV
	8 MHz to 10 MHz	0.15 V/V + 1 mV
	<u>2.2 V Range (600 mV to 2.2 V)</u>	
	10 Hz to 20 Hz	0.2 mV/V
	20 Hz to 40 Hz	66 μ V/V
	40 Hz to 20 kHz	24 μ V/V
	20 kHz to 50 kHz	46 μ V/V
	50 kHz to 100 kHz	71 μ V/V
	100 kHz to 300 kHz	0.16 mV/V
	300 kHz to 500 kHz	0.26 mV/V
	500 kHz to 1 MHz	0.9 mV/V



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SCOPE OF ACCREDITATION:

<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
6. Sourcing/ Generating Instrument AC VOLTAGE (continue)	<u>7 V Range (1.9 V to 7 V)</u>	
	10 Hz to 20 Hz	0.2 mV/V
	20 Hz to 40 Hz	67 μ V/V
	40 Hz to 20 kHz	24 μ V/V
	20 kHz to 50 kHz	48 μ V/V
	50 kHz to 100 kHz	81 μ V/V
	100 kHz to 300 kHz	0.19 mV/V
	300 kHz to 500 kHz	0.4 mV/V
	500 kHz to 1 MHz	1.2 mV/V
	<u>10 V Range (1 V to 12 V)</u>	
	1 Hz to 40 Hz	0.07 mV/V + 0.4 mV
	1 MHz to 2 MHz	15 mV/V + 1 mV
	2 MHz to 4 MHz	0.04 V/V + 7 mV
	4 MHz to 8 MHz	0.04 V/V + 8 mV
	8 MHz to 10 MHz	0.15 V/V + 0.01 V
	<u>22 V Range (6 V to 22 V)</u>	
	10 Hz to 20 Hz	0.2 mV/V
	20 Hz to 40 Hz	67 μ V/V
	40 Hz to 20 kHz	27 μ V/V
	20 kHz to 50 kHz	48 μ V/V
	50 kHz to 100 kHz	81 μ V/V
	100 kHz to 300 kHz	0.19 mV/V
	300 kHz to 500 kHz	0.4 mV/V
	500 kHz to 1 MHz	1.2 mV/V
	<u>70 V Range (19 V to 70 V)</u>	
	10 Hz to 20 Hz	0.2 mV/V
	20 Hz to 40 Hz	68 μ V/V
	40 Hz to 20 kHz	32 μ V/V
	20 kHz to 50 kHz	57 μ V/V
	50 kHz to 100 kHz	94 μ V/V
	100 kHz to 300 kHz	0.2 mV/V
	300 kHz to 500 kHz	0.41 mV/V
	500 kHz to 1 MHz	1.2 mV/V



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FIELD OF CALIBRATION: ELECTRICAL MEASUREMENTS

SCOPE OF ACCREDITATION:

<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
6. Sourcing/ Generating Instrument AC VOLTAGE (continue)	<u>100 V Range (10 V to 120 V)</u>	
	1 Hz to 40 Hz	0.2 mV/V + 4 mV
	<u>220 V Range (60 V to 220 V)</u>	
	10 Hz to 20 Hz	0.2 mV/V
	20 Hz to 40 Hz	68 μ V/V
	40 Hz to 20 kHz	31 μ V/V
	20 kHz to 50 kHz	69 μ V/V
	50 kHz to 100 kHz	98 μ V/V
	100 kHz to 300 kHz	0.21 mV/V
	300 kHz to 500 kHz	0.5 mV/V
	<u>700 V Range (190 V to 700 V)</u>	
	10 Hz to 20 Hz	0.2 mV/V
	20 Hz to 40 Hz	99 μ V/V
	40 Hz to 20 kHz	41 μ V/V
	20 kHz to 50 kHz	0.13 mV/V
	50 kHz to 100 kHz	0.5 mV/V
	<u>1000 V Range (100 V to 700 V)</u>	
	1 Hz to 40 Hz	0.4 mV/V + 0.04 V
	<u>1000 V Range (600 V to 1050 V)</u>	
	10 Hz to 20 Hz	0.2 mV/V
	20 Hz to 40 Hz	99 μ V/V
	40 Hz to 20 kHz	38 μ V/V
	20 kHz to 50 kHz	0.13 mV/V
	50 kHz to 100 kHz	0.5 mV/V



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SCOPE OF ACCREDITATION:

<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
6. Sourcing/ Generating Instrument		
DC CURRENT		
	1 pA to +20 pA	0.01 A/A + 3 nA
	-20 pA to -1 pA	0.01 A/A + 3 nA
	20 pA to +200 pA	0.01 A/A + 5 nA
	-200 pA to -20 pA	0.01 A/A + 5 nA
	200 pA to +2 nA	2 mA/A + 0.3 μ A
	-2 nA to -200 pA	2 mA/A + 0.3 μ A
	1 nA to +100 nA	30 μ A/A + 0.04 nA
	-100 nA to -1 nA	30 μ A/A + 0.04 nA
	100 nA to +1 μ A	20 μ A/A + 0.04 nA
	-1 μ A to -100 nA	20 μ A/A + 0.04 nA
	1 μ A to +10 μ A	20 μ A/A + 0.1 nA
	-10 μ A to -1 μ A	20 μ A/A + 0.1 nA
	10 μ A to +100 μ A	20 μ A/A + 0.8 nA
	-100 μ A to -10 μ A	20 μ A/A + 0.8 nA
	100 μ A to +1 mA	20 μ A/A + 5 nA
	-1 mA to -100 μ A	20 μ A/A + 5 nA
	1 mA to +10 mA	20 μ A/A + 0.05 μ A
	-10 mA to -1 mA	20 μ A/A + 0.05 μ A
	10 mA to +100 mA	35 μ A/A + 0.5 μ A
	-100 mA to -10 mA	35 μ A/A + 0.5 μ A
	100 mA to +1 A	0.11 mA/A + 0.01 mA
	-1 A to -100 mA	0.11 mA/A + 0.01 mA
	+1 A to +10 A	5.1 mA
	-10 A to -1 A	5.1 mA
	+10 A to +100 A	0.05 A
	-100 A to -10 A	0.05 A



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<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
6. Sourcing/ Generating Instrument AC CURRENT		
	<u>5 μA to 100 μA</u>	
	10 Hz to 20 Hz	4 mA/A + 0.03 μ A
	20 Hz to 45 Hz	1.5 mA/A + 0.03 μ A
	45 Hz to 100 Hz	0.6 mA/A + 0.03 μ A
	100 Hz to 5 kHz	0.6 mA/A + 0.03 μ A
	<u>0.05 mA to 1 mA</u>	
	10 Hz to 20 Hz	4 mA/A + 0.2 μ A
	20 Hz to 45 Hz	1.5 mA/A + 0.2 μ A
	45 Hz to 100 Hz	0.6 mA/A + 0.2 μ A
	100 Hz to 5 kHz	0.3 mA/A + 0.2 μ A
	5 kHz to 20 kHz	0.6 mA/A + 0.2 μ A
	20 kHz to 50 kHz	4 mA/A + 0.4 μ A
	50 kHz to 100 kHz	5.5 mA/A + 1.5 μ A
	<u>0.5 mA to 10 mA</u>	
	10 Hz to 20 Hz	4 mA/A + 2 μ A
	20 Hz to 45 Hz	1.5 mA/A + 2 μ A
	45 Hz to 100 Hz	0.6 mA/A + 2 μ A
	100 Hz to 5 kHz	0.3 mA/A + 2 μ A
	5 kHz to 20 kHz	0.6 mA/A + 2 μ A
	20 kHz to 50 kHz	4 mA/A + 4 μ A
	50 kHz to 100 kHz	5.5 mA/A + 15 μ A
	<u>5 mA to 100 mA</u>	
	10 Hz to 20 Hz	4 mA/A + 0.02 mA
	20 Hz to 45 Hz	1.5 mA/A + 0.02 mA
	45 Hz to 100 Hz	0.6 mA/A + 0.02 mA
	100 Hz to 5 kHz	0.3 mA/A + 0.02 mA
	5 kHz to 20 kHz	0.6 mA/A + 0.02 mA
	20 kHz to 50 kHz	4 mA/A + 0.04 mA
	50 kHz to 100 kHz	5.5 mA/A + 0.15 mA



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SCOPE OF ACCREDITATION:

<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
6. Sourcing/ Generating Instrument AC CURRENT (continue)	<u>0.05 A to 1 A</u>	
	10 Hz to 20 Hz	4 mA/A + 0.2 mA
	20 Hz to 45 Hz	1.6 mA/A + 0.2 mA
	45 Hz to 100 Hz	0.8 mA/A + 0.2 mA
	100 Hz to 5 kHz	1 mA/A + 0.2 mA
	5 kHz to 20 kHz	3 mA/A + 0.2 mA
	20 kHz to 50 kHz	10 mA/A + 0.4 mA
	<u>1 A to 50 A</u>	
	50 Hz/ 60 Hz	0.5 mA/A
RESISTANCE	0 Ω to 10 Ω	15 $\mu\Omega/\Omega$ + 0.05 m Ω
	10 Ω to 100 Ω	12 $\mu\Omega/\Omega$ + 0.5 m Ω
	0.1 k Ω to 1 k Ω	10 $\mu\Omega/\Omega$ + 0.5 m Ω
	1 k Ω to 10 k Ω	10 $\mu\Omega/\Omega$ + 5 m Ω
	10 k Ω to 100 k Ω	10 $\mu\Omega/\Omega$ + 0.05 Ω
	0.1 M Ω to 1 M Ω	15 $\mu\Omega/\Omega$ + 2 Ω
	1 M Ω to 10 M Ω	50 $\mu\Omega/\Omega$ + 0.1 k Ω
	10 M Ω to 100 M Ω	0.5 m Ω/Ω + 1 k Ω
	100 M Ω to 1 G Ω	5 m Ω/Ω + 0.01 M Ω
	1 G Ω to 2 G Ω	2.3 m Ω/Ω + 0.01 M Ω
	2 G Ω to 20 G Ω	2.3 m Ω/Ω + 0.1 M Ω
	20 G Ω to 200 G Ω	3.5 m Ω/Ω + 1 M Ω
	0.2 T Ω to 2 T Ω	3.5 m Ω/Ω + 0.01 G Ω
	2 T Ω to 20 T Ω	10.3 m Ω/Ω + 0.1 G Ω
	20 T Ω to 200 T Ω	11.5 m Ω/Ω + 1 G Ω
CAPACITANCE	1 pF to 1 mF @ (10 Hz to 1 MHz)	0.5 mF/F
INDUCTANCE	1 μ H to 10 H @ (10 Hz to 1 MHz)	0.5 mH/H
FREQUENCY	1 Hz to 5 GHz	3.6 nHz/Hz



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<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
7. High Voltage Tester DC VOLTAGE	0 kV to 9.999 kV 10 kV to <20 kV 20 kV to 35 kV >35 kV to 40 kV	5 mV/V + 2 V 20 mV/V 10 mV/V 20 mV/V
AC VOLTAGE	(0 kV to 9.999 kV) @ 50/60Hz (10 kV to 20 kV) @ 50/60 Hz (20 kV to 28 kV) @ 50/60 Hz	7 mV/V + 3 V 7 mV/V + 30 V 50 mV/V
8. High Precision Multifunction Calibrators DC VOLTAGE	100 mV @ + 100 % Band Span (+85 mV to +115 mV)	4 μ V/V
	100 mV @ - 100 % Band Span (-115 mV to -85 mV)	4 μ V/V
	1 V @ + 100 % Band Span (+0.9 V to +1.1 V)	2.2 μ V/V
	1 V @ - 100 % Band Span (-1.1 V to -0.9 V)	2.2 μ V/V
	10 V @ + 100 % Band Span (+9 V to +11 V)	1.4 μ V/V
	10 V @ - 100 % Band Span (-11 V to -9 V)	1.4 μ V/V
	10 V @ + 190 % Band Span (+18 V to +19.5 V)	1.8 μ V/V
	10 V @ - 190 % Band Span (-19.5 V to -18 V)	1.8 μ V/V
	100 V @ + 100 % Band Span (+90 V to +110 V)	2 μ V/V



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<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
8. High Precision Multifunction Calibrators DC VOLTAGE (continue)	100 V @ - 100 % Band Span (-110 V to -90 V)	2 μ V/V
	1000 V @ + 100 % Band Span (+900 V to +1100 V)	2 μ V/V
	1000 V @ - 100 % Band Span (-1100 V to -900 V)	2 μ V/V
AC VOLTAGE	<u>1 mV @ 100 % Band Span</u> <u>(0.85 mV to 1.15 mV)</u>	
	10 Hz Frequency Band Span (9 Hz to 11 Hz)	0.28 mV/V
	20 Hz Frequency Band Span (18 Hz to 22 Hz)	0.28 mV/V
	30 Hz Frequency Band Span (27 Hz to 33 Hz)	0.28 mV/V
	40 Hz Frequency Band Span (36 Hz to 44 Hz)	0.28 mV/V
	55 Hz Frequency Band Span (46.25 Hz to 63.75 Hz)	0.28 mV/V
	300 Hz Frequency Band Span (270 Hz to 440 Hz)	0.26 mV/V
	1 kHz Frequency Band Span (0.9 kHz to 1.1 kHz)	0.26 mV/V
	10 kHz Frequency Band Span (9 kHz to 11 kHz)	0.28 mV/V
	20 kHz Frequency Band Span (18 kHz to 22 kHz)	0.3 mV/V
	30 kHz Frequency Band Span (27 kHz to 33 kHz)	0.39 mV/V



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8. High Precision Multifunction Calibrators AC VOLTAGE (continue)	<u>1 mV @ 100 % Band Span</u> <u>(0.85 mV to 1.15 mV)</u>	
	50 kHz Frequency Band Span (45 kHz to 55 kHz)	0.39 mV/V
	100 kHz Frequency Band Span (90 kHz to 110 kHz)	0.62 mV/V
	300 kHz Frequency Band Span (270 kHz to 330 kHz)	0.75 mV/V
	500 kHz Frequency Band Span (450 kHz to 550 kHz)	0.77 mV/V
	1 MHz Frequency Band Span (0.9 MHz to 1.1 MHz)	1.06 mV/V
	<u>10 mV @ 100 % Band Span</u> <u>(8.5 mV to 11.5 mV)</u>	
	10 Hz Frequency Band Span (9 Hz to 11 Hz)	0.16 mV/V
	20 Hz Frequency Band Span (18 Hz to 22 Hz)	0.16 mV/V
	30 Hz Frequency Band Span (27 Hz to 33 Hz)	0.16 mV/V
	40 Hz Frequency Band Span (36 Hz to 44 Hz)	0.16 mV/V
	55 Hz Frequency Band Span (46.25 Hz to 63.75 Hz)	0.16 mV/V
	300 Hz Frequency Band Span (270 Hz to 440 Hz)	0.14 mV/V



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<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
8. High Precision Multifunction Calibrators AC VOLTAGE (continue)	<u>10 mV @ 100 % Band Span</u> <u>(8.5 mV to 11.5 mV)</u>	
	1 kHz Frequency Band Span (0.9 kHz to 1.1 kHz)	0.14 mV/V
	10 kHz Frequency Band Span (9 kHz to 11 kHz)	0.16 mV/V
	20 kHz Frequency Band Span (18 kHz to 22 kHz)	0.16 mV/V
	30 kHz Frequency Band Span (27 kHz to 33 kHz)	0.24 mV/V
	50 kHz Frequency Band Span (45 kHz to 55 kHz)	0.59 mV/V
	100 kHz Frequency Band Span (90 kHz to 110 kHz)	0.59 mV/V
	300 kHz Frequency Band Span (270 kHz to 330 kHz)	0.59 mV/V
	500 kHz Frequency Band Span (450 kHz to 550 kHz)	0.61 mV/V
	1 MHz Frequency Band Span (0.9 MHz to 1.1 MHz)	0.95 mV/V



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<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
8. High Precision Multifunction Calibrators AC VOLTAGE (continue)	<u>100 mV @ 100 % Band Span</u> <u>(85 mV to 115 mV)</u>	
	10 Hz Frequency Band Span (9 Hz to 11 Hz)	0.12 mV/V
	20 Hz Frequency Band Span (18 Hz to 22 Hz)	0.12 mV/V
	30 Hz Frequency Band Span (27 Hz to 33 Hz)	0.12 mV/V
	40 Hz Frequency Band Span (36 Hz to 44 Hz)	0.12 mV/V
	55 Hz Frequency Band Span (46.25 Hz to 63.75 Hz)	0.12 mV/V
	300 Hz Frequency Band Span (270 Hz to 440 Hz)	89 μ V/V
	1 kHz Frequency Band Span (0.9 kHz to 1.1 kHz)	89 μ V/V
	10 kHz Frequency Band Span (9 kHz to 11 kHz)	0.11 mV/V
	20 kHz Frequency Band Span (18 kHz to 22 kHz)	0.12 mV/V
	30 kHz Frequency Band Span (27 kHz to 33 kHz)	0.19 mV/V
	50 kHz Frequency Band Span (45 kHz to 55 kHz)	0.19 mV/V
	100 kHz Frequency Band Span (90 kHz to 110 kHz)	0.36 mV/V



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<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
8. High Precision Multifunction Calibrators AC VOLTAGE (continue)	<u>100 mV @ 100 % Band Span</u> <u>(85 mV to 115 mV)</u>	
	300 kHz Frequency Band Span (270 kHz to 330 kHz)	96 μ V/V
	500 kHz Frequency Band Span (450 kHz to 550 kHz)	0.61 mV/V
	1 MHz Frequency Band Span (0.9 MHz to 1.1 MHz)	0.95 mV/V
	<u>1 V @ 100 % Band Span</u> <u>(0.9 V to 1.1 V)</u>	
	10 Hz Frequency Band Span (9 Hz to 11 Hz)	36 μ V/V
	20 Hz Frequency Band Span (18 Hz to 22 Hz)	36 μ V/V
	30 Hz Frequency Band Span (27 Hz to 33 Hz)	36 μ V/V
	40 Hz Frequency Band Span (36 Hz to 44 Hz)	24 μ V/V
	55 Hz Frequency Band Span (46.25 Hz to 63.75 Hz)	24 μ V/V
	300 Hz Frequency Band Span (270 Hz to 440 Hz)	24 μ V/V
	1 kHz Frequency Band Span (0.9 kHz to 1.1 kHz)	24 μ V/V
	10 kHz Frequency Band Span (9 kHz to 11 kHz)	24 μ V/V
	20 kHz Frequency Band Span (18 kHz to 22 kHz)	24 μ V/V



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<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
8. High Precision Multifunction Calibrators AC VOLTAGE (continue)	<u>1 V @ 100 % Band Span</u> <u>(0.9 V to 1.1 V)</u>	
	30 kHz Frequency Band Span (27 kHz to 33 kHz)	24 μ V/V
	50 kHz Frequency Band Span (45 kHz to 55 kHz)	31 μ V/V
	100 kHz Frequency Band Span (90 kHz to 110 kHz)	37 μ V/V
	300 kHz Frequency Band Span (270 kHz to 330 kHz)	96 μ V/V
	500 kHz Frequency Band Span (450 kHz to 550 kHz)	0.21 mV/V
	1 MHz Frequency Band Span (0.9 MHz to 1.1 MHz)	0.56 mV/V
	<u>10 V @ 100 % Band Span</u> <u>(9 V to 11 V)</u>	
	10 Hz Frequency Band Span (9 Hz to 11 Hz)	36 μ V/V
	20 Hz Frequency Band Span (18 Hz to 22 Hz)	36 μ V/V
	30 Hz Frequency Band Span (27 Hz to 33 Hz)	36 μ V/V
	40 Hz Frequency Band Span (36 Hz to 44 Hz)	24 μ V/V
	55 Hz Frequency Band Span (46.25 Hz to 63.75 Hz)	24 μ V/V



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<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
8. High Precision Multifunction Calibrators AC VOLTAGE (continue)	<u>10 V @ 100 % Band Span</u> <u>(9 V to 11 V)</u>	
	300 Hz Frequency Band Span (270 Hz to 440 Hz)	24 μ V/V
	1 kHz Frequency Band Span (0.9 kHz to 1.1 kHz)	24 μ V/V
	10 kHz Frequency Band Span (9 kHz to 11 kHz)	24 μ V/V
	20 kHz Frequency Band Span (18 kHz to 22 kHz)	24 μ V/V
	30 kHz Frequency Band Span (27 kHz to 33 kHz)	26 μ V/V
	50 kHz Frequency Band Span (45 kHz to 55 kHz)	26 μ V/V
	100 kHz Frequency Band Span (90 kHz to 110 kHz)	26 μ V/V
	300 kHz Frequency Band Span (270 kHz to 330 kHz)	83 μ V/V
	500 kHz Frequency Band Span (450 kHz to 550 kHz)	0.19 mV/V
	1 MHz Frequency Band Span (0.9 MHz to 1.1 MHz)	0.53 mV/V
	<u>10 V @ 190 % Band Span</u> <u>(18 V to 19.5 V)</u>	
	1 kHz Frequency Band Span (0.9 kHz to 1.1 kHz)	24 μ V/V



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<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
8. High Precision Multifunction Calibrators AC VOLTAGE (continue)	<u>100 V @ 100 % Band Span</u> <u>(90 V to 110V)</u>	
	10 Hz Frequency Band Span (9 Hz to 11 Hz)	41 μ V/V
	20 Hz Frequency Band Span (18 Hz to 22 Hz)	41 μ V/V
	30 Hz Frequency Band Span (27 Hz to 33 Hz)	41 μ V/V
	40 Hz Frequency Band Span (36 Hz to 44 Hz)	36 μ V/V
	55 Hz Frequency Band Span (46.25 Hz to 63.75 Hz)	36 μ V/V
	300 Hz Frequency Band Span (270 Hz to 440 Hz)	26 μ V/V
	1 kHz Frequency Band Span (0.9 kHz to 1.1 kHz)	26 μ V/V
	10 kHz Frequency Band Span (9 kHz to 11 kHz)	26 μ V/V
	20 kHz Frequency Band Span (18 kHz to 22 kHz)	26 μ V/V
	30 kHz Frequency Band Span (27 kHz to 33 kHz)	29 μ V/V
	50 kHz Frequency Band Span (45 kHz to 55 kHz)	35 μ V/V
	100 kHz Frequency Band Span (90 kHz to 110 kHz)	64 μ V/V
	200 kHz Frequency Band Span (180 kHz to 220 kHz)	0.24 mV/V



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<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
8. High Precision Multifunction Calibrators AC VOLTAGE (continue)	<u>1000 V @ 70 % Band Span</u> <u>(600 V to 800V)</u>	
	50 kHz Frequency Band Span (45 kHz to 55 kHz)	0.11 mV/V
	100 kHz Frequency Band Span (90 kHz to 110 kHz)	0.35 mV/V
	<u>1000 V @ 100 % Band Span</u> <u>(900 V to 1100V)</u>	
	55 Hz Frequency Band Span (46.25 Hz to 63.75 Hz)	37 μ V/V
	300 Hz Frequency Band Span (270 Hz to 440 Hz)	37 μ V/V
	1 kHz Frequency Band Span (0.9 kHz to 1.1 kHz)	37 μ V/V
	10 kHz Frequency Band Span (9 kHz to 11 kHz)	42 μ V/V
	20 kHz Frequency Band Span (18 kHz to 22 kHz)	47 μ V/V
	30 kHz Frequency Band Span (27 kHz to 33 kHz)	74 μ V/V



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8. High Precision Multifunction Calibrators RESISTANCE	<u>10 Ω</u> 10 % Band Span (Zero to 2 Ω)	8 $\mu\Omega/\Omega$
	30 % Band Span (2 Ω to 4 Ω)	8 $\mu\Omega/\Omega$
	100 % Band Span (9 Ω to 11 Ω)	8 $\mu\Omega/\Omega$
	190 % Band Span (18.0 Ω to 19.5 Ω)	8 $\mu\Omega/\Omega$
	<u>100 Ω</u> 30 % Band Span (20 Ω to 40 Ω)	6 $\mu\Omega/\Omega$
	100 % Band Span (90 Ω to 110 Ω)	6 $\mu\Omega/\Omega$
	190 % Band Span (180 Ω to 195 Ω)	6 $\mu\Omega/\Omega$
	<u>1 kΩ</u> 30 % Band Span (0.2 k Ω to 0.4 k Ω)	3 $\mu\Omega/\Omega$
	100 % Band Span (0.9 k Ω to 1.1 k Ω)	3 $\mu\Omega/\Omega$
	190 % Band Span (1.8 k Ω to 1.95 k Ω)	3 $\mu\Omega/\Omega$
	<u>10 kΩ</u> 30 % Band Span (2 k Ω to 4 k Ω)	3 $\mu\Omega/\Omega$
	100 % Band Span (9 k Ω to 11 k Ω)	3 $\mu\Omega/\Omega$



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8. High Precision Multifunction Calibrators RESISTANCE (continue)	<u>10 kΩ</u>	
	190 % Band Span (18.0 k Ω to 19.5 k Ω)	3 $\mu\Omega/\Omega$
	<u>100 kΩ</u>	
	30 % Band Span (20 k Ω to 40 k Ω)	6 $\mu\Omega/\Omega$
	100 % Band Span 90 k Ω to 110 k Ω)	6 $\mu\Omega/\Omega$
	190 % Band Span (180 k Ω to 195 k Ω)	6 $\mu\Omega/\Omega$
	<u>1 MΩ</u>	
	30 % Band Span (0.2 M Ω to 0.4 M Ω)	11 $\mu\Omega/\Omega$
	100 % Band Span (0.9 M Ω to 1.1 M Ω)	11 $\mu\Omega/\Omega$
	190 % Band Span (1.80 M Ω to 1.95 M Ω)	11 $\mu\Omega/\Omega$
	<u>10 MΩ</u>	
	30 % Band Span (2 M Ω to 4 M Ω)	21 $\mu\Omega/\Omega$
	100 % Band Span (9 M Ω to 11 M Ω)	21 $\mu\Omega/\Omega$
	190 % Band Span (18.0 M Ω to 19.5 M Ω)	21 $\mu\Omega/\Omega$
	<u>100 MΩ</u>	
	30 % Band Span (20 M Ω to 40 M Ω)	83 $\mu\Omega/\Omega$
	100 % Band Span (90 M Ω to 110 M Ω)	83 $\mu\Omega/\Omega$



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FIELD OF CALIBRATION: ELECTRICAL MEASUREMENTS

SCOPE OF ACCREDITATION:

<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
8. High Precision Multifunction Calibrators DC CURRENT	110 μ A @ +100 % Band Span (+90 μ A to +110 μ A)	21 μ A/A
	110 μ A @ -100 % Band Span (-110 μ A to -90 μ A)	21 μ A/A
	1 mA @ +100 % Band Span (+0.9 mA to +1.1 mA)	11 μ A/A
	1 mA @ -100 % Band Span (-1.1 mA to -0.9 mA)	11 μ A/A
	10 mA @ +100 % Band Span (+9 mA to +11 mA)	11 μ A/A
	10 mA @ -100 % Band Span (-11 mA to -9 mA)	11 μ A/A
	100 mA @ +100 % Band Span (+90 mA to +110 mA)	15 μ A/A
	100 mA @ -100 % Band Span (-110 mA to -90 mA)	15 μ A/A
	1 A @ +100 % Band Span (+0.9 A to +1.1 A)	25 μ A/A
	1 A @ -100 % Band Span (-1.1 A to -0.9 A)	25 μ A/A
	10 A @ +100 % Band Span (+9 A to +11 A)	55 μ A/A
	10 A @ -100 % Band Span (-11 A to -9 A)	55 μ A/A



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FIELD OF CALIBRATION: ELECTRICAL MEASUREMENTS

SCOPE OF ACCREDITATION:

<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
8. High Precision Multifunction Calibrators AC CURRENT	<u>100 μA @ 100 % Band Span (90 μA to 110 μA)</u>	
	10 Hz Frequency Band Span (9 Hz to 11 Hz)	0.13 mA/A
	20 Hz Frequency Band Span (18 Hz to 22 Hz)	0.13 mA/A
	30 Hz Frequency Band Span (27 Hz to 33 Hz)	0.11 mA/A
	40 Hz Frequency Band Span (36 Hz to 44 Hz)	85 μ A/A
	55 Hz Frequency Band Span (46.25 Hz to 63.75 Hz)	85 μ A/A
	300 Hz Frequency Band Span (0.27 kHz to 0.44 kHz)	85 μ A/A
	1 kHz Frequency Band Span (0.9 kHz to 1.1 kHz)	85 μ A/A
	5 kHz Frequency Band Span (4.5 kHz to 5.5 kHz)	0.13 mA/A
	10 kHz Frequency Band Span (9 kHz to 11 kHz)	0.3 mA/A
	20 kHz Frequency Band Span (18 kHz to 22 kHz)	0.33 mA/A
	30 kHz Frequency Band Span (27 kHz to 33 kHz)	0.4 mA/A



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FIELD OF CALIBRATION: ELECTRICAL MEASUREMENTS

SCOPE OF ACCREDITATION:

<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
8. High Precision Multifunction Calibrators AC CURRENT (continue)	<u>1 mA @ 100 % Band Span</u> <u>(0.9 mA to 1.1 mA)</u>	
	10 Hz Frequency Band Span (9 Hz to 11 Hz)	0.12 mA/A
	20 Hz Frequency Band Span (18 Hz to 22 Hz)	0.12 mA/A
	30 Hz Frequency Band Span (27 Hz to 33 Hz)	0.12 mA/A
	40 Hz Frequency Band Span (36 Hz to 44 Hz)	80 μ A/A
	55 Hz Frequency Band Span (46.25 Hz to 63.75 Hz)	80 μ A/A
	300 Hz Frequency Band Span (0.27 kHz to 0.44 kHz)	80 μ A/A
	1 kHz Frequency Band Span (0.9 kHz to 1.1 kHz)	80 μ A/A
	5 kHz Frequency Band Span (4.5 kHz to 5.5 kHz)	0.13 mA/A
	10 kHz Frequency Band Span (9 kHz to 11 kHz)	0.26 mA/A
	20 kHz Frequency Band Span (18 kHz to 22 kHz)	0.29 mA/A
	30 kHz Frequency Band Span (27 kHz to 33 kHz)	0.35 mA/A



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FIELD OF CALIBRATION: ELECTRICAL MEASUREMENTS

SCOPE OF ACCREDITATION:

<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
8. High Precision Multifunction Calibrators AC CURRENT (continue)	<u>10 mA @ 100 % Band Span (9 mA to 11 mA)</u>	
	10 Hz Frequency Band Span (9 Hz to 11 Hz)	0.12 mA/A
	20 Hz Frequency Band Span (18 Hz to 22 Hz)	0.12 mA/A
	30 Hz Frequency Band Span (27 Hz to 33 Hz)	96 μ A/A
	40 Hz Frequency Band Span (36 Hz to 44 Hz)	75 μ A/A
	55 Hz Frequency Band Span (46.25 Hz to 63.75 Hz)	75 μ A/A
	300 Hz Frequency Band Span (0.27 kHz to 0.44 kHz)	75 μ A/A
	1 kHz Frequency Band Span (0.9 kHz to 1.1 kHz)	75 μ A/A
	5 kHz Frequency Band Span (4.5 kHz to 5.5 kHz)	0.12 mA/A
	10 kHz Frequency Band Span (9 kHz to 11 kHz)	0.26 mA/A
	20 kHz Frequency Band Span (18 kHz to 22 kHz)	0.29 mA/A
	30 kHz Frequency Band Span (27 kHz to 33 kHz)	0.35 mA/A



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FIELD OF CALIBRATION: ELECTRICAL MEASUREMENTS

SCOPE OF ACCREDITATION:

<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
8. High Precision Multifunction Calibrators AC CURRENT (continue)	<u>100 mA @ 100 % Band Span</u> <u>(90 mA to 110 mA)</u>	
	10 Hz Frequency Band Span (9 Hz to 11 Hz)	0.12 mA/A
	20 Hz Frequency Band Span (18 Hz to 22 Hz)	0.12 mA/A
	30 Hz Frequency Band Span (27 Hz to 33 Hz)	96 μ A/A
	40 Hz Frequency Band Span (36 Hz to 44 Hz)	75 μ A/A
	55 Hz Frequency Band Span (46.25 Hz to 63.75 Hz)	75 μ A/A
	300 Hz Frequency Band Span (0.27 kHz to 0.44 kHz)	75 μ A/A
	1 kHz Frequency Band Span (0.9 kHz to 1.1 kHz)	75 μ A/A
	5 kHz Frequency Band Span (4.5 kHz to 5.5 kHz)	0.12 mA/A
	10 kHz Frequency Band Span (9 kHz to 11 kHz)	0.26 mA/A
	20 kHz Frequency Band Span (18 kHz to 22 kHz)	0.29 mA/A
	30 kHz Frequency Band Span (27 kHz to 33 kHz)	0.35 mA/A



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FIELD OF CALIBRATION: ELECTRICAL MEASUREMENTS

SCOPE OF ACCREDITATION:

<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
8. High Precision Multifunction Calibrators AC CURRENT (continue)	1 A @ 100 % Band Span (0.9 A to 1.1 A)	
	10 Hz Frequency Band Span (9 Hz to 11 Hz)	0.17 mA/A
	20 Hz Frequency Band Span (18 Hz to 22 Hz)	0.17 mA/A
	30 Hz Frequency Band Span (27 Hz to 33 Hz)	0.16 mA/A
	40 Hz Frequency Band Span (36 Hz to 44 Hz)	0.11 mA/A
	55 Hz Frequency Band Span (46.25 Hz to 63.75 Hz)	0.11 mA/A
	300 Hz Frequency Band Span (0.27 kHz to 0.44 kHz)	0.11 mA/A
	1 kHz Frequency Band Span (0.9 kHz to 1.1 kHz)	0.11 mA/A
	5 kHz Frequency Band Span (4.5 kHz to 5.5 kHz)	0.22 mA/A
	10 kHz Frequency Band Span (9 kHz to 11 kHz)	0.26 mA/A
	20 kHz Frequency Band Span (18 kHz to 22 kHz)	0.29 mA/A
	30 kHz Frequency Band Span (27 kHz to 33 kHz)	0.35 mA/A



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FIELD OF CALIBRATION: ELECTRICAL MEASUREMENTS

SCOPE OF ACCREDITATION:

<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
8. High Precision Multifunction Calibrators AC CURRENT (continue)	10 A @ 100 % Band Span (9 A to 11 A)	
	10 Hz Frequency Band Span (9 Hz to 11 Hz)	0.24 mA/A
	20 Hz Frequency Band Span (18 Hz to 22 Hz)	0.24 mA/A
	30 Hz Frequency Band Span (27 Hz to 33 Hz)	0.24 mA/A
	40 Hz Frequency Band Span (36 Hz to 44 Hz)	0.22 mA/A
	55 Hz Frequency Band Span (46.25 Hz to 63.75 Hz)	0.2 mA/A
	300 Hz Frequency Band Span (0.27 kHz to 0.44 kHz)	0.2 mA/A
	1 kHz Frequency Band Span (0.9 kHz to 1.1 kHz)	0.2 mA/A
	5 kHz Frequency Band Span (4.5 kHz to 5.5 kHz)	0.26 mA/A
	10 kHz Frequency Band Span (9 kHz to 11 kHz)	0.34 mA/A
	20 kHz Frequency Band Span (18 kHz to 22 kHz)	1.2 mA/A

Signatories:

- | | |
|---------------------------------------|-------------------------|
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FIELD OF CALIBRATION : ELECTRICAL MEASUREMENTS

SITE CALIBRATION-CATEGORY 1

SCOPE OF ACCREDITATION :

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (\pm) *</u>
1. Measuring Instrument DC VOLTAGE	+220 mV Range (0 mV to +220 mV)	9 μ V/V + 0.8 μ V
	-220 mV Range (-220 mV to 0 mV)	9 μ V/V + 0.8 μ V
	+2.2 V Range (0 V to +2.2 V)	8 μ V/V + 1.2 μ V
	-2.2 V Range (-2.2 V to 0 V)	8 μ V/V + 1.2 μ V
	+11 V Range (0 V to +11 V)	8 μ V/V + 4 μ V
	-11 V Range (-11 V to 0 V)	8 μ V/V + 4 μ V
	+22 V Range (0 V to +22 V)	8 μ V/V + 8 μ V
	-22 V Range (-22 V to 0 V)	8 μ V/V + 8 μ V
	+220 V Range (0 V to +220 V)	9 μ V/V + 0.1 mV
	-220 V Range (-220 V to 0 V)	9 μ V/V + 0.1 mV
	+1100 V Range (+100 V to +1100 V)	11 μ V/V + 0.6 mV
	-1100 V Range (-1100 V to -100 V)	11 μ V/V + 0.6 mV
	2.2 mV Range (0.22 mV to 2.2 mV)	
	10 Hz to 20 Hz	0.6 mV/V + 5 μ V
AC VOLTAGE	20 Hz to 40 Hz	0.24 mV/V + 5 μ V
	40 Hz to 20 kHz	0.12 mV/V + 5 μ V
	20 kHz to 50 kHz	0.41 mV/V + 5 μ V
	50 kHz to 100 kHz	0.95 mV/V + 8 μ V
	100 kHz to 300 kHz	1.3 mV/V + 15 μ V
	300 kHz to 500 kHz	1.8 mV/V + 0.03 mV
	500 kHz to 1 MHz	3.6 mV/V + 0.03 mV



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FIELD OF CALIBRATION : ELECTRICAL MEASUREMENTS

SITE CALIBRATION-CATEGORY 1

SCOPE OF ACCREDITATION :

<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
1. Measuring Instrument AC VOLTAGE (Continue)	<u>22 mV Range</u>	
	<u>(2.2 mV to 22 mV)</u>	
	10 Hz to 20 Hz	0.6 mV/V + 6 μ V
	20 Hz to 40 Hz	0.24 mV/V + 6 μ V
	40 Hz to 20 kHz	0.12 mV/V + 6 μ V
	20 kHz to 50 kHz	0.41 mV/V + 6 μ V
	50 kHz to 100 kHz	0.95 mV/V + 8 μ V
	100 kHz to 300 kHz	1.3 mV/V + 15 μ V
	300 kHz to 500 kHz	1.8 mV/V + 0.03 mV
	500 kHz to 1 MHz	3.6 mV/V + 0.03 mV
	<u>220 mV Range</u>	
	<u>(22 mV to 220 mV)</u>	
	10 Hz to 20 Hz	0.6 mV/V + 16 μ V
	20 Hz to 40 Hz	0.24 mV/V + 0.01 mV
	40 Hz to 20 kHz	0.11 mV/V + 0.01 mV
	20 kHz to 50 kHz	0.36 mV/V + 0.01 mV
	50 kHz to 100 kHz	0.9 mV/V + 0.03 mV
	100 kHz to 300 kHz	1.1 mV/V + 0.03 mV
	300 kHz to 500 kHz	1.8 mV/V + 0.04 mV
	500 kHz to 1 MHz	3.6 mV/V + 0.1 mV
	<u>2.2 V Range</u>	
	<u>(0.22 V to 2.2 V)</u>	
	10 Hz to 20 Hz	0.6 mV/V + 0.1 mV
	20 Hz to 40 Hz	0.18 mV/V + 0.03 mV
	40 Hz to 20 kHz	85 μ V/V + 7 μ V
	20 kHz to 50 kHz	0.14 mV/V + 0.02 mV
	50 kHz to 100 kHz	0.28 mV/V + 0.08 mV
	100 kHz to 300 kHz	0.48 mV/V + 0.15 mV
	300 kHz to 500 kHz	1.2 mV/V + 0.4 mV
	500 kHz to 1 MHz	2.4 mV/V + 1 mV



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FIELD OF CALIBRATION : ELECTRICAL MEASUREMENTS

SITE CALIBRATION-CATEGORY 1

SCOPE OF ACCREDITATION :

<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
1. Measuring Instrument AC VOLTAGE (continued)	<u>22 V Range (2.2 V to 22 V)</u>	
	10 Hz to 20 Hz	0.6 mV/V + 1 mV
	20 Hz to 40 Hz	0.18 mV/V + 0.3 mV
	40 Hz to 20 kHz	85 μ V/V + 0.07 mV
	20 kHz to 50 kHz	0.14 mV/V + 0.2 mV
	50 kHz to 100 kHz	0.28 mV/V + 0.4 mV
	100 kHz to 300 kHz	0.6 mV/V + 1.7 mV
	300 kHz to 500 kHz	1.4 mV/V + 5 mV
	500 kHz to 1 MHz	3 mV/V + 9 mV
	<u>220 V Range (22 V to 220 V)</u>	
	10 Hz to 20 Hz	0.6 mV/V + 0.01 V
	20 Hz to 40 Hz	0.18 mV/V + 3 mV
	40 Hz to 20 kHz	90 μ V/V + 1 mV
	20 kHz to 50 kHz	0.25 mV/V + 4 mV
	50 kHz to 100 kHz	0.6 mV/V + 0.01 V
	100 kHz to 300 kHz	1.6 mV/V + 0.11 V
	300 kHz to 500 kHz	5.4 mV/V + 0.11 V
	500 kHz to 1 MHz	13 mV/V + 0.22 V
	<u>1100 V Range (110 V to 1100 V)</u>	
	50 Hz to 1 kHz	90 μ V/V + 4 mV
	<u>800.01 V to 1050.00 V</u>	
	1 kHz to 3 kHz	0.8 mV/V + 0.13 V
	3 kHz to 10 kHz	0.8 mV/V + 0.21 V
	10 kHz to 20 kHz	1.2 mV/V + 0.32 V



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FIELD OF CALIBRATION : ELECTRICAL MEASUREMENTS

SITE CALIBRATION-CATEGORY 1

SCOPE OF ACCREDITATION :

<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
1. Measuring Instrument DC CURRENT	0 μ A to +220 μ A	60 μ A/A + 0.01 μ A
	-220 μ A to 0 μ A	60 μ A/A + 0.01 μ A
	0 mA to +2.2 mA	60 μ A/A + 0.01 μ A
	-2.2 mA to 0 mA	60 μ A/A + 0.01 μ A
	0 mA to +22 mA	60 μ A/A + 0.1 μ A
	-22 mA to 0 mA	60 μ A/A + 0.1 μ A
	0 mA to +220 mA	70 μ A/A + 1 μ A
	-220 mA to 0 mA	70 μ A/A + 1 μ A
	0 A to +1A	95 μ A/A + 30 μ A
	-1 A to 0 A	95 μ A/A + 30 μ A
	+0.32001 A to +3.2 A	0.6 mA/A + 0.12 mA
	-3.2 A to -0.32001 A	0.6 mA/A + 0.12 mA
	+3.2001 A to +10.5 A	0.55 mA/A + 0.94 mA
	-10.5 A to -3.2001 A	0.55 mA/A + 0.94 mA
	+10.5001 A to +20 A	0.55 mA/A + 4.5 mA
	-20 A to -10.5001 A	0.55 mA/A + 4.5 mA
	+20 A to +100 A	0.45 mA/A + 20 mA
	-100 A to -20 A	0.45 mA/A + 20 mA
AC CURRENT	<u>9 μA to 220 μA</u>	
	10 Hz to 20 Hz	0.8 mA/A + 0.03 μ A
	20 Hz to 40 Hz	0.42 mA/A + 25 nA
	40 Hz to 1 kHz	0.16 mA/A + 0.02 μ A
	1 kHz to 5 kHz	0.7 mA/A + 0.05 μ A
	5 kHz to 10 kHz	1.8 mA/A + 0.1 μ A
	<u>0.22 mA to 2.2 mA</u>	
	10 Hz to 20 Hz	0.8 mA/A + 0.05 μ A
	20 Hz to 40 Hz	0.42 mA/A + 0.04 μ A
	40 Hz to 1 kHz	0.16 mA/A + 0.04 μ A
	1 kHz to 5 kHz	0.7 mA/A + 0.5 μ A
	5 kHz to 10 kHz	1.8 mA/A + 1 μ A



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FIELD OF CALIBRATION : ELECTRICAL MEASUREMENTS

SITE CALIBRATION-CATEGORY 1

SCOPE OF ACCREDITATION :

<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
1. Measuring Instrument AC CURRENT (Continue)	<u>2.2 mA to 22 mA</u>	
	10 Hz to 20 Hz	0.8 mA/A + 0.5 μ A
	20 Hz to 40 Hz	0.42 mA/A + 0.4 μ A
	40 Hz to 1 kHz	0.16 mA/A + 0.4 μ A
	1 kHz to 5 kHz	0.7 mA/A + 5 μ A
	5 kHz to 10 kHz	1.8 mA/A + 0.01 mA
	<u>22 mA to 220 mA</u>	
	10 Hz to 20 Hz	0.8 mA/A + 5 μ A
	20 Hz to 40 Hz	0.42 mA/A + 4 μ A
	40 Hz to 1 kHz	0.18 mA/A + 4 μ A
	1 kHz to 5 kHz	0.7 mA/A + 0.05 mA
	5 kHz to 10 kHz	1.8 mA/A + 0.1 mA
	<u>0.22 A to 2.2 A</u>	
	40 Hz to 1 kHz	0.75 mA/A + 0.04 mA
	1 kHz to 5 kHz	0.85 mA/A + 0.1 mA
	5 kHz to 10 kHz	0.01 A/A + 0.2 mA
	<u>0.32001 A to 3.2 A</u>	
	10 Hz to 3 kHz	1 mA/A + 0.48 mA
	3 kHz to 10 kHz	2.5 mA/A + 2.6 mA
	<u>3.2001 A to 10.5 A</u>	
	10 Hz to 3 kHz	2 mA/A + 3 mA
	3 kHz to 10 kHz	5 mA/A + 10 mA
	<u>10.5001 A to 20 A</u>	
	10 Hz to 3 kHz	2 mA/A + 6.9 mA
	3 kHz to 10 kHz	5 mA/A + 23 mA
	<u>20 A to 100 A</u>	
	10 Hz to 1 kHz	2.5 mA/A + 0.03 A
	1 kHz to 10 kHz	5 mA/A + 0.05 A



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SITE CALIBRATION-CATEGORY 1

SCOPE OF ACCREDITATION :

<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
1. Measuring Instrument RESISTANCE Fixed Value		
	10 m Ω	0.1 m Ω/Ω
	100 m Ω	0.02 m Ω/Ω
	1 Ω	5 $\mu\Omega/\Omega$
	1.9 Ω	0.11 m Ω/Ω
	10 Ω	5 $\mu\Omega/\Omega$
	19 Ω	31 $\mu\Omega/\Omega$
	100 Ω	5 $\mu\Omega/\Omega$
	190 Ω	0.02 m Ω/Ω
	1 k Ω	5 $\mu\Omega/\Omega$
	1.9 k Ω	15 $\mu\Omega/\Omega$
	10 k Ω	5 $\mu\Omega/\Omega$
	19 k Ω	14 $\mu\Omega/\Omega$
	100 k Ω	5 $\mu\Omega/\Omega$
	190 k Ω	15 $\mu\Omega/\Omega$
	1 M Ω	5 $\mu\Omega/\Omega$
	1.9 M Ω	24 $\mu\Omega/\Omega$
	10 M Ω	5 $\mu\Omega/\Omega$
	19 M Ω	0.05 m Ω/Ω
	100 M Ω	0.13 m Ω/Ω
	1 G Ω	5 $\mu\Omega/\Omega$
	10 G Ω	0.02 Ω/Ω
CAPACITANCE Fixed Value	<u>20 Hz to 1 MHz</u>	
	1 pF	1 mF/F
	10 pF	1 mF/F
	100 pF	1 mF/F
	1000 pF	1 mF/F
	0.01 μ F	1 mF/F
	0.1 μ F	1 mF/F
	1.0 μ F	1 mF/F



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SITE CALIBRATION-CATEGORY 1

SCOPE OF ACCREDITATION :

<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
1. Measuring Instrument CAPACITANCE (Continue)	<u>≤ 350 Hz</u>	
	0.5 nF to 4.0 nF	3 mF/F + 15 pF
	4.0001 nF to 40.0 nF	3 mF/F + 30 pF
	40.001 nF to 400.0 nF	3 mF/F + 0.16 nF
	400.01 nF to 4.0 μ F	4 mF/F + 1.6 nF
	4.0001 μ F to 40.0 μ F	5 mF/F + 16 nF
	40.001 μ F to 400.0 μ F	5 mF/F + 0.16 μ F
	400.01 μ F to 4.0 mF	5 mF/F + 1.6 μ F
	4.0001 mF to 40.0 mF	10 mF/F + 0.06 mF
	<u>350 Hz to 1.5 kHz</u>	
	0.5 nF to 4.0 nF	6 mF/F + 0.03 nF
	4.0001 nF to 40.0 nF	6 mF/F + 0.06 nF
	40.001 nF to 400.0 nF	6 mF/F + 0.32 nF
	400.01 nF to 4.0 μ F	8 mF/F + 3.2 nF
	4.0001 μ F to 40.0 μ F	10 mF/F + 32 nF
	40.001 μ F to 400.0 μ F	10 mF/F + 0.32 μ F
	400.01 μ F to 4.0 mF	10 mF/F + 3.2 μ F
	4.0001 mF to 40.0 mF	20 mF/F + 0.12 mF
INDUCTANCE	100 μ H @ 1 kHz	2.5 mH/H
Fixed Value	1 mH @ 1 kHz	1 mH/H
	10 mH @ 1 kHz	1 mH/H
	100 mH @ 1 kHz	1 mH/H
	1 H @ 1 kHz	1 mH/H
POWER/ ENERGY (DC)	1 kW to 20 kW	0.7 mW/W
	0.1 W to 1 kW	0.22 mW/W
POWER/ ENERGY (AC)	10 kW to 20 kW	1 mW/W
(45 Hz to 65 Hz at PF=1)	1 W to 10 kW	0.9 mW/W
	0.1 W to 1 W	1 mW/W
FREQUENCY	1 μ Hz to 80 MHz	64 nHz/Hz
	100 kHz to 4320 MHz	32 nHz/Hz
Time Base Output	1 kHz to 10 MHz	3.6 nHz/Hz



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SITE CALIBRATION-CATEGORY 1

SCOPE OF ACCREDITATION :

<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
1. Measuring Instrument		
AMPLITUDE	10 mVp-p to 10 Vp-p (1 μ Hz to 80 MHz, Into 50 Ω) +13 dBm to -140 dBm (100 kHz to 4320 MHz)	10 mVp-p/ Vp-p + 1 mVp-p 1 dBm
FLATNESS	Sine Wave Relative to 1 kHz (Auto range On)	0.4 dBm
TIME	1 s to 24 Hrs	0.06 μ s/s + 0.021 s
2. High Voltage Meter		
DC VOLTAGE	0.5 kV to 10 kV	5 mV/V
AC VOLTAGE	(0.5 kV to 10 kV) @ (50/60) Hz	8 mV/V
3. Clamp Meter		
DC Current		
<u>10 – Turn Coil</u>	3.2001 A to 32 A 32.001 A to 105 A 105.001 A to 200 A	2.1 mA/A 2.1 mA/A 2.3 mA/A
<u>50 – Turn Coil</u>	16.001 A to 160 A 160.01 A to 525.0 A 525.01 A to 1000.0 A	2.4 mA/A 2.5 mA/A 2.6 mA/A
AC Current		
<u>10 – Turn Coil</u>	<u>3.2001 A to 32.0 A</u> 10 Hz to 100 Hz 100 Hz to 440 Hz	3 mA/A 8.9 mA/A
	<u>32.001 A to 200.0 A</u> 10 Hz to 100 Hz 100 Hz to 440 Hz	3.3 mA/A 8.2 mA/A
<u>50 – Turn Coil</u>	<u>16.001 A to 160.0 A</u> 10 Hz to 100 Hz	3 mA/A
	<u>160.01 A to 1000.0 A</u> 10 Hz to 100 Hz	3.3 mA/A



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FIELD OF CALIBRATION : ELECTRICAL MEASUREMENTS

SITE CALIBRATION-CATEGORY 1

SCOPE OF ACCREDITATION :

<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
4. Insulation Testers		
	(1.0 k Ω to 10.0 k Ω) @ 10.0 V	0.5 m Ω/Ω
	(10.0 k Ω to 100.0 k Ω) @ 50.0 V	0.5 m Ω/Ω
	(0.1 M Ω to 1.0 M Ω) @ 150.0 V	0.5 m Ω/Ω
	(1.0 M Ω to 10.0 M Ω) @ 300.0 V	1 m Ω/Ω
	(10.0 M Ω to 100.0 M Ω) @ 500.0 V	1 m Ω/Ω
	(0.1 G Ω to 1.0 G Ω) @ 1000.0 V	10 m Ω/Ω
	(1.0 G Ω to 10.0 G Ω) @ 5000.0 V	50 m Ω/Ω
	(10.0 G Ω to 100.0 G Ω) @ 5000.0 V	0.1 Ω/Ω
	(100.0 G Ω to 600.0 G Ω) @ 5000.0 V	50 m Ω/Ω
5. Oscilloscope		
Vertical Deflection		
DC Signal	0V to ± 6.6 V (50 Ω Load)	2.5 mV/V + 0.04 mV
	0V to ± 130 V (1 M Ω Load)	0.5 mV/V + 0.04 mV
Vertical Deflection		
Square Wave Signal	± 1 mVp-p to ± 6.6 Vp-p (50 Ω Load)	2.5 mVp-p/Vp-p + 0.04 mVp-p
	± 1 mVp-p to ± 130 Vp-p (1 M Ω Load)	1 mVp-p/Vp-p + 0.04 mVp-p
Horizontal Deflection		
Time Markers	2 ns/div to 20 ms/div	2.5 μ s/s
(50 Ω Load)	50 ms/div to 5 s/div	(25+(Output x 1000)) μ s/s
Bandwidth Amplitude	50 kHz to 600 MHz	0.03 Vp-p
	600 MHz to 4320 MHz	0.26 Vp-p
Bandwidth Frequency	50 kHz to 600 MHz	2.5 μ Hz/Hz
	600 MHz to 4320 MHz	32 nHz/Hz
Risetime	≤ 300 ps	+ 0 ns / -0.1 ns



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FIELD OF CALIBRATION : ELECTRICAL MEASUREMENTS

SITE CALIBRATION-CATEGORY 1

SCOPE OF ACCREDITATION :

<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
6. Sourcing/ Generating Instrument		
DC VOLTAGE	+100 mV Range (+100 μ V to +120 mV)	5 μ V/V + 0.3 μ V
	-100 mV Range (-120 mV to -100 μ V)	5 μ V/V + 0.3 μ V
	+1 V Range (+100 mV to +1.2 V)	4 μ V/V + 0.3 μ V
	-1 V Range (-1.2 V to -100 mV)	4 μ V/V + 0.3 μ V
	+10 V Range (+1 V to +12 V)	4 μ V/V + 0.5 μ V
	-10 V Range (-12 V to -1 V)	4 μ V/V + 0.5 μ V
	+100 V Range (+10 V to +120 V)	6 μ V/V + 0.03 mV
	-100 V Range (-120 V to -10 V)	6 μ V/V + 0.03 mV
	+1000 V Range (+100 V to +1050 V)	6 μ V/V + 0.1 mV
	-1000 V Range (-1050 V to -100 V)	6 μ V/V + 0.1 mV
AC VOLTAGE	<u>10 mV Range (1 mV to 12 mV)</u>	
	1 Hz to 40 Hz	0.3 mV/V + 3 μ V
	40 Hz to 1 kHz	0.2 mV/V + 1.1 μ V
	1 kHz to 20 kHz	0.3 mV/V + 1.1 μ V
	20 kHz to 50 kHz	1 mV/V + 1.1 μ V
	50 kHz to 100 kHz	5 mV/V + 1.1 μ V
	100 kHz to 1 MHz	12 mV/V + 5 μ V
	1 MHz to 4 MHz	0.07 V/V + 7 μ V
	4 MHz to 8 MHz	0.2 V/V + 8 μ V



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FIELD OF CALIBRATION : ELECTRICAL MEASUREMENTS

SITE CALIBRATION-CATEGORY 1

SCOPE OF ACCREDITATION :

<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
6. Sourcing/ Generating Instrument AC VOLTAGE (Continue)	<u>100 mV range (10 mV to 120 mV)</u>	
	1 Hz to 40 Hz	0.07 mV/V + 4 μ V
	40 Hz to 1 kHz	0.07 mV/V + 2 μ V
	1 kHz to 20 kHz	0.14 mV/V + 2 μ V
	20 kHz to 50 kHz	0.3 mV/V + 2 μ V
	50 kHz to 100 kHz	0.8 mV/V + 2 μ V
	100 kHz to 300 kHz	3 mV/V + 0.01 mV
	300 kHz to 1 MHz	0.01 V/V + 0.01 mV
	1 MHz to 2 MHz	15 mV/V + 0.01 mV
	2 MHz to 4 MHz	0.04 V/V + 0.07 mV
	4 MHz to 8 MHz	0.04 V/V + 0.08 mV
	8 MHz to 10 MHz	0.15 V/V + 0.1 mV
	<u>1 V Range (0.1 V to 1.2 V)</u>	
	1 Hz to 40 Hz	0.07 mV/V + 0.04 mV
	40 Hz to 1 kHz	0.07 mV/V + 0.02 mV
	1 kHz to 20 kHz	0.14 mV/V + 0.02 mV
	20 kHz to 50 kHz	0.3 mV/V + 0.02 mV
	50 kHz to 100 kHz	0.8 mV/V + 0.02 mV
	100 kHz to 300 kHz	3 mV/V + 0.1 mV
	300 kHz to 1 MHz	0.01 V/V + 0.1 mV
	1 MHz to 2 MHz	15 mV/V + 0.1 mV
	2 MHz to 4 MHz	0.04 V/V + 0.7 mV
	4 MHz to 8 MHz	0.04 V/V + 0.8 mV
	8 MHz to 10 MHz	0.15 V/V + 1 mV
	<u>10 V Range (1 V to 12 V)</u>	
	1 Hz to 40 Hz	0.07 mV/V + 0.4 mV
	40 Hz to 1 kHz	0.07 mV/V + 0.2 mV
	1 kHz to 20 kHz	0.14 mV/V + 0.2 mV
	20 kHz to 50 kHz	0.3 mV/V + 0.2 mV
	50 kHz to 100 kHz	0.8 mV/V + 0.2 mV
	100 kHz to 300 kHz	3 mV/V + 1 mV
	300 kHz to 1 MHz	0.01 V/V + 1 mV
	1 MHz to 2 MHz	15 mV/V + 1 mV
	2 MHz to 4 MHz	0.04 V/V + 7 mV
	4 MHz to 8 MHz	0.04 V/V + 8 mV
	8 MHz to 10 MHz	0.15 V/V + 0.01 V



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FIELD OF CALIBRATION : ELECTRICAL MEASUREMENTS

SITE CALIBRATION-CATEGORY 1

SCOPE OF ACCREDITATION :

<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
6. Sourcing/ Generating Instrument AC VOLTAGE (continue)	<u>100 V Range (10 V to 120 V)</u> 1 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz	0.2 mV/V + 4 mV 0.2 mV/V + 2 mV 0.2 mV/V + 2 mV 0.35 mV/V + 2 mV 1.2 mV/V + 2 mV 4 mV/V + 0.01 V 15 mV/V + 0.01 V
	<u>1000 V Range (100 V to 700 V)</u> 1 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz	0.4 mV/V + 0.04 V 0.4 mV/V + 0.02 V 0.6 mV/V + 0.02 V 1.2 mV/V + 0.02 V 3 mV/V + 0.02 V
DC CURRENT	1 nA to +100 nA -100 nA to -1 nA 100 nA to +1 μ A -1 μ A to -100 nA 1 μ A to +10 μ A -10 μ A to -1 μ A 10 μ A to +100 μ A -100 μ A to -10 μ A 100 μ A to +1 mA -1 mA to -100 μ A 1 mA to +10 mA -10 mA to -1 mA 10 mA to +100 mA -100 mA to -10 mA	30 μ A/A + 0.04 nA 30 μ A/A + 0.04 nA 20 μ A/A + 0.04 nA 20 μ A/A + 0.04 nA 20 μ A/A + 0.1 nA 20 μ A/A + 0.1 nA 20 μ A/A + 0.8 nA 20 μ A/A + 0.8 nA 20 μ A/A + 5 nA 20 μ A/A + 5 nA 20 μ A/A + 0.05 μ A 20 μ A/A + 0.05 μ A 35 μ A/A + 0.5 μ A 35 μ A/A + 0.5 μ A



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FIELD OF CALIBRATION : ELECTRICAL MEASUREMENTS

SITE CALIBRATION-CATEGORY 1

SCOPE OF ACCREDITATION :

<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
6. Sourcing/ Generating Instrument		
DC CURRENT (continue)	100 mA to +1 A	0.11 mA/A + 0.01 mA
	-1 A to -100 mA	0.11 mA/A + 0.01 mA
	+1 A to +10 A	5.1 mA
	-10 A to -1 A	5.1 mA
	+10 A to +100 A	0.05 A
	-100 A to -10 A	0.05 A
	+100 A to +1000 A	15 mA/A + 2A
	-1000 A to -100 A	15 mA/A - 2A
AC CURRENT	<u>5 μA to 100 μA</u>	
	10 Hz to 20 Hz	4 mA/A + 0.03 μ A
	20 Hz to 45 Hz	1.5 mA/A + 0.03 μ A
	45 Hz to 100 Hz	0.6 mA/A + 0.03 μ A
	100 Hz to 5 kHz	0.6 mA/A + 0.03 μ A
	<u>0.05 mA to 1 mA</u>	
	10 Hz to 20 Hz	4 mA/A + 0.2 μ A
	20 Hz to 45 Hz	1.5 mA/A + 0.2 μ A
	45 Hz to 100 Hz	0.6 mA/A + 0.2 μ A
	100 Hz to 5 kHz	0.3 mA/A + 0.2 μ A
	5 kHz to 20 kHz	0.6 mA/A + 0.2 μ A
	20 kHz to 50 kHz	4 mA/A + 0.4 μ A
	50 kHz to 100 kHz	5.5 mA/A + 1.5 μ A
	<u>0.5 mA to 10 mA</u>	
	10 Hz to 20 Hz	4 mA/A + 2 μ A
	20 Hz to 45 Hz	1.5 mA/A + 2 μ A
	45 Hz to 100 Hz	0.6 mA/A + 2 μ A
	100 Hz to 5 kHz	0.3 mA/A + 2 μ A
	5 kHz to 20 kHz	0.6 mA/A + 2 μ A
	20 kHz to 50 kHz	4 mA/A + 4 μ A
	50 kHz to 100 kHz	5.5 mA/A + 15 μ A



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FIELD OF CALIBRATION : ELECTRICAL MEASUREMENTS

SITE CALIBRATION-CATEGORY 1

SCOPE OF ACCREDITATION :

<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
6. Sourcing/ Generating Instrument AC CURRENT (continue)		
	<u>5 mA to 100 mA</u>	
	10 Hz to 20 Hz	4 mA/A + 0.02 mA
	20 Hz to 45 Hz	1.5 mA/A + 0.02 mA
	45 Hz to 100 Hz	0.6 mA/A + 0.02 mA
	100 Hz to 5 kHz	0.3 mA/A + 0.02 mA
	5 kHz to 20 kHz	0.6 mA/A + 0.02 mA
	20 kHz to 50 kHz	4 mA/A + 0.04 mA
	50 kHz to 100 kHz	5.5 mA/A + 0.15 mA
	<u>0.05 A to 1 A</u>	
	10 Hz to 20 Hz	4 mA/A + 0.2 mA
	20 Hz to 45 Hz	1.6 mA/A + 0.2 mA
	45 Hz to 100 Hz	0.8 mA/A + 0.2 mA
	100 Hz to 5 kHz	1 mA/A + 0.2 mA
	5 kHz to 20 kHz	3 mA/A + 0.2 mA
	20 kHz to 50 kHz	10 mA/A + 0.4 mA
	<u>1 A to 50 A</u>	
	50 Hz/ 60 Hz	0.5 mA/A
	<u>50 A to 1000 A</u>	
	50 Hz/ 60 Hz	15 mA/A + 2 A
	40 Hz to 1 kHz	0.03 A/A + 4 A
RESISTANCE		
	0 Ω to 10 Ω	15 $\mu\Omega/\Omega$ + 0.05 m Ω
	10 Ω to 100 Ω	12 $\mu\Omega/\Omega$ + 0.05 m Ω
	0.1 k Ω to 1 k Ω	10 $\mu\Omega/\Omega$ + 0.05 m Ω
	1 k Ω to 10 k Ω	10 $\mu\Omega/\Omega$ + 5 m Ω
	10 k Ω to 100 k Ω	10 $\mu\Omega/\Omega$ + 0.05 Ω
	0.1 M Ω to 1 M Ω	15 $\mu\Omega/\Omega$ + 2 Ω
	1 M Ω to 10 M Ω	50 $\mu\Omega/\Omega$ + 0.1 k Ω
	10 M Ω to 100 M Ω	0.5 m Ω/Ω + 1 k Ω
	100 M Ω to 1 G Ω	5 m Ω/Ω + 0.01 M Ω



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FIELD OF CALIBRATION : ELECTRICAL MEASUREMENTS

SITE CALIBRATION-CATEGORY 1

SCOPE OF ACCREDITATION :

<u>Instrument calibrated / Measurement parameters</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
6. Sourcing/ Generating Instrument		
CAPACITANCE	1 pF to 1 mF @ (10 Hz to 1 MHz)	0.5 mF/F
INDUCTANCE	1 μ H to 10 H @ (10 Hz to 1 MHz)	0.5 mH/H
FREQUENCY	1 Hz to 5 GHz	3.6 nHz/Hz
7. High Voltage Tester		
DC VOLTAGE	0 kV to 9.999 kV 10 kV to <20 kV 20 kV to 35 kV >35 kV to 40 kV	5 mV/V + 2 V 20 mV/V 10 mV/V 20 mV/V
AC VOLTAGE	(0 kV to 9.999 kV) @ 50/60Hz (10 kV to 20 kV) @ 50/60 Hz (20 kV to 28 kV) @ 50/60 Hz	7 mV/V + 3 V 7 mV/V + 30 V 50 mV/V

Signatories:

- | | |
|---------------------------------------|-------------------------|
| 1. Mr. Mohd. Fahimy Bin Ahmad Ta'adin | I/C No.: 610322-08-6029 |
| 2. Mr. Mohd. Fikri Bin Mohd Nor | I/C No.: 660219-03-5499 |
| 3. Mr. Syahrel Bin Shari | I/C No.: 721216-01-6029 |



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FIELD OF CALIBRATION : TEMPERATURE MEASUREMENT

SCOPE OF ACCREDITATION :

<u>Instrument Calibrated / Measurement Parameter</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
Liquid In-glass Thermometer (Partial Immersion)	0 °C to 200 °C	2 °C

Signatory:

1. Mr. Mohd Dali Bin Silam

I/C No. : 580306-01-5541



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FIELD OF CALIBRATION : TEMPERATURE MEASUREMENT

SCOPE OF ACCREDITATION :

<u>Instrument Calibrated / Measurement Parameter</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
Liquid-in-glass thermometer (Total Immersion)	- 80 °C to 0 °C	0.05 °C
	0 °C to 80 °C	0.03 °C
	80 °C to 250 °C	0.05 °C
	250 °C to 500 °C	0.10 °C
Platinum Resistance Thermometer	- 80 °C to 250 °C	0.05 °C
	250 °C to 600 °C	0.1 °C
	600 °C to 950 °C	0.5 °C
Thermocouple	- 80 °C to 250 °C	0.5 °C
	250 °C to 950 °C	0.6 °C
Psychrometer		
Thermohygrograph	0 °C to 50 °C	0.5 °C
Thermohygrometer	35 % to 95 % RH	3.0 % RH
Temperature switch	- 50 °C to 10 °C	1 °C
	10 °C to 100 °C	2 °C
	100 °C to 600 °C	3 °C
Mechanical thermometer	- 80 °C to 50 °C	0.1 °C
	50 °C to 600 °C	1.5 °C
Temperature Controlled Enclosure	- 60 °C to 200 °C	0.8 °C
	200 °C to 400 °C	1.2 °C
Temperature Calibrator (Dry block)	- 30 °C to 400 °C	0.1 °C
	400 °C to 950 °C	1.2 °C



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FIELD OF CALIBRATION : TEMPERATURE MEASUREMENT

SCOPE OF ACCREDITATION :

<u>Instrument Calibrated / Measurement Parameter</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
Temperature Indicating Instruments (by electrical simulation):-		
K - type	- 200 °C to 0 °C	0.4 °C
	0 °C to 1300 °C	0.4 °C
J - type	- 200 °C to 0 °C	0.3 °C
	0 °C to 1100 °C	0.3 °C
T - type	- 200 °C to 0 °C	0.5 °C
	0 °C to 400 °C	0.4 °C
E - type	- 200 °C to 0 °C	0.4 °C
	0 °C to 900 °C	0.3 °C
R - type	0 °C to 1000 °C	1.3 °C
	1000 °C to 1700 °C	1.1 °C
S - type	- 50 °C to 1000 °C	1.3 °C
	1000 °C to 1700 °C	1.2 °C
Pt 100	- 200 °C to 0 °C	0.2 °C
	0 °C to 800 °C	0.5 °C

Signatories:

- | | |
|------------------------------|--------------------------|
| 1. Mr. Mohd Dali Bin Silam | I/C No. : 580306-01-5541 |
| 2. Mr. Abdul Jalil Baharudin | I/C No. : 591113-10-5595 |
| 3. Mr. Zulkifli Ahmad | I/C No. : 701129-08-5183 |



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FIELD OF CALIBRATION : TEMPERATURE MEASUREMENT

SITE CALIBRATION - CATEGORY I

SCOPE OF ACCREDITATION :

<u>Instrument Calibrated / Measurement Parameter</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
Humidity Chamber	20 % to 95 % RH	2.0 % of RH
Temperature Controlled Enclosure	- 60 °C to 200 °C 200 °C to 400 °C 400 °C to 950 °C	0.8 °C 1.2 °C 2 °C
Temperature Indicating Instruments (by electrical simulation) :-		
K - type	- 200 °C to 0 °C 0 °C to 1300 °C	0.4 °C 0.4 °C
J - type	- 200 °C to 0 °C 0 °C to 1100 °C	0.3 °C 0.3 °C
T - type	- 200 °C to 0 °C 0 °C to 400 °C	0.5 °C 0.4 °C
E - type	- 200 °C to 0 °C 0 °C to 900 °C	0.4 °C 0.3 °C
R - type	0 °C to 1000 °C 1000 °C to 1700 °C	1.3 °C 1.1 °C
S - type	- 50 °C to 1000 °C 1000 °C to 1700 °C	1.3 °C 1.2 °C
Pt 100	- 200 °C to 0 °C 0 °C to 800 °C	0.2 °C 0.5 °C

Signatories:

- | | |
|------------------------------|--------------------------|
| 1. Mr. Mohd Dali Bin Silam | I/C No. : 580306-01-5541 |
| 2. Mr. Abdul Jalil Baharudin | I/C No. : 591113-10-5595 |
| 3. Mr. Zulkifli Ahmad | I/C No. : 701129-08-5183 |



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FIELD OF CALIBRATION : DIMENSIONAL MEASUREMENTS

SCOPE OF ACCREDITATION :

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (\pm) *</u>
Angle Gauge Block	0.5 mm to 100 mm 100 mm to 250 mm	(0.1 + 1.0 L) μ m L in m
Angle Gauge Block (Imperial units)	0.05 inch to 4 inch	(0.004 + 1.0 L) μ inch L in inch
Angle Bevel Protractor	0 – 360 degrees : Graduation 5 min. Graduation 1 deg.	6 minute 1 degree
Snap Gauge / Caliper Gauge	Up to 200 mm	5 μ m
Micrometer	0.001 mm to 100 mm	2 μ m
Caliper	0.01 mm to 1000 mm	0.02 mm
Height Gauge	0.01 mm to 600 mm	6 μ m
Caliper Checker	20 mm to 600 mm	6 μ m
Calibration Tester	0 mm to 25 mm	2 μ m
Dial / Digital Test Indicator	0.001 mm to 100 mm	2 μ m
Dial / Digital Gauge	0.001 mm to 100 mm	2 μ m
Dial / Digital Thickness Gauge	0.001 mm to 50 mm	5 μ m
Depth Micro-Checker	0 mm to 300 mm	6 μ m



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FIELD OF CALIBRATION : DIMENSIONAL MEASUREMENT

SCOPE OF ACCREDITATION :

<u>Instrument Calibrated / Measurement Parameter</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
Feeler Gauge	0.005 mm to 2.0 mm	3 μ m
Glass Scale	up to 200 mm 200 mm to 300 mm	3.8 μ m 5.6 μ m
Grind Gauge/Fine Gauge	0.001 mm to 0.15 mm	0.5 μ m
Height master	0.001 mm to 600 mm	6 μ m
Ruler	0.1 mm to 2000 mm	0.1 mm
Ring Gauge	1.0 mm to 300 mm	2 μ m
Mu-checker	0.1 mm to 2000 μ m	2 μ m
Precision Height Gauge	0.001 mm to 600 mm	4 μ m
Straight Edge	0 mm to 600 mm	1.5 μ m
Tape	1 mm to 100 m	0.5 mm
Thickness Foil	0.001 mm to 2.0 mm	3 μ m
Standard Rod	5 mm to 600 mm	6 μ m
Pin Gauge (Diameter Only)	0.1 mm to 50 mm	2 μ m
Plain Plug Gauge (Diameter Only)	0.1 mm to 50 mm	2 μ m

Signatories:

- | | |
|------------------------------|--------------------------|
| 1. Ms. Hasnah Bt Hassan | I/C No. : 630418-02-5624 |
| 2. Mr. Abdul Jalil Baharudin | I/C No. : 591113-10-5595 |
| 3. Mr. Mohd Hashim Effandi | I/C No. : 671201-01-5405 |



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FIELD OF CALIBRATION : DIMENSIONAL

SITE CALIBRATION - CATEGORY I

SCOPE OF ACCREDITATION :

<u>Instrument Calibrated / Measurement Parameter</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
Profile Projector (X and Y axis only)	1 mm to 300 mm	4 μ m
Surface Table/Plate	2500 mm x 1600 mm	5 μ m

Signatories:

- | | |
|------------------------------|--------------------------|
| 1. Ms. Hasnah Bt Hassan | I/C No. : 630418-02-5624 |
| 2. Mr. Abdul Jalil Baharudin | I/C No. : 591113-10-5595 |
| 3. Mr. Mohd Hashim Effandi | I/C No. : 671201-10-5405 |



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FIELD OF CALIBRATION : MASS MEASUREMENTS

SCOPE OF ACCREDITATION :

<u>Instrument Calibrated / Measurement Parameter</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
Standard Weights - Class E2 , F1, F2, M1, M2 & M3	1 mg	0.002 mg
	2 mg	0.002 mg
	5 mg	0.002 mg
	10 mg	0.002 mg
	20 mg	0.003 mg
	50 mg	0.004 mg
	100 mg	0.005 mg
	200 mg	0.006 mg
	500 mg	0.008 mg
	1 g	0.010 mg
	2 g	0.012 mg
	5 g	0.016 mg
	10 g	0.020 mg
	20 g	0.025 mg
	50 g	0.03 mg
	100 g	0.05 mg
	200 g	0.10 mg
	500 g	0.23 mg
	1 kg	0.5 mg
	2 kg	1.0 mg
	5 kg	3.0 mg
Standard Weights - Class F1, F2, M1, M2 & M3	10 kg	15 mg
	20 kg	36 mg
	50 kg	75 mg
Weight Blocks	1 mg to 100 g	6 mg
	100 g to 1 kg	2 mg
	1 kg to 10 kg	20 mg
	10 kg to 30 kg	40 mg
	30 kg to 60 kg	90 mg
Spring /Hanging Scale	1 g to 5 kg	16 g
	5 kg to 20 kg	31 g
	20 kg to 50 kg	62 g
	50 kg to 100 kg	124 g

Signatories:

1. Mr. Abdul Jalil Baharudin

I/C No. : 591113-10-5595

2. Mr. Mohammad Najib Kamaruddin

I/C No. : 740507-08-5239



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FIELD OF CALIBRATION : MASS MEASUREMENTS

SITE CALIBRATION - CATEGORY I

SCOPE OF ACCREDITATION :

<u>Instrument Calibrated / Measurement Parameter</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
Analytical Balance	0.1 mg to 1 kg	0.2 mg
Balance / Scale (Tri-beam, Single beam, Spring, Mechanical & Electronic)	10 g to 1000 kg	1.0 mg
Electrical and Mechanical Balances	1 mg to 200 kg	1 mg
	1000 kg to 2000 kg	1 kg

Signatories:

1. Mr. Abdul Jalil Baharudin

I/C No. : 591113-10-5595

2. Mr. Mohammad Najib Kamaruddin

I/C No. : 740507-08-5239



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FIELDS OF CALIBRATION : FORCE & TORQUE MEASUREMENT

SCOPE OF ACCREDITATION :

<u>Instrument Calibrated / Measurement Parameter</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
Force Measurement		
Proving Rings/Load Cells	0 kgf to 100 kgf	0.01 kgf
	101 kgf to 500 kgf	0.1 kgf
	501 kgf to 1000 kgf	0.6 kgf
	1001 kgf to 5000 kgf	2 kgf
	5001 kgf to 10000 kgf	20 kgf
	10001 kgf to 30000 kgf	60 kgf
Push-pull/ Force Gauge	1 gf to 5 kgf	16 gf
	5 kgf to 20 kgf	31 gf
	20 kgf to 50 kgf	62 gf
	50 kgf to 100 kgf	124 gf
Gramme/ Dial Tension Gauge	1 gf to 50 gf	1 gf
	50 gf to 500 gf	6 gf
	500 gf to 2000 gf	30 gf
Torque Measurement		
Torque wrench	0 Nm to 1 Nm	0.07 Nm
	1 Nm to 50 Nm	0.04 Nm
	51 Nm to 100 Nm	0.3 Nm
	101 Nm to 500 Nm	1 Nm
Torque meter and analyser	0 Nm to 1 Nm	0.005 Nm
	1 Nm to 50 Nm	0.045 Nm
	51 Nm to 100 Nm	0.3 Nm
	101 Nm to 500 Nm	0.4 Nm

Signatories:

- | | |
|------------------------------|--------------------------|
| 1. Mr. Abdul Jalil Baharudin | I/C No. : 591113-10-5595 |
| 2. Mr. Noor Azam Ismail | I/C No. : 730629-14-5579 |
| 3. Mr. Ahmad Borhan Sa'aba | I/C No. : 730128-06-5757 |



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FIELD OF CALIBRATION : FORCE

SITE CALIBRATION - CATEGORY I

SCOPE OF ACCREDITATION :

<u>Instrument Calibrated / Measurement Parameter</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
Universal Testing Machine / Compression mode (tension mode up to 5000kgf)	0 kgf to 100 kgf	0.01 kgf
	101 kgf to 500 kgf	0.1 kgf
	501 kgf to 1000 kgf	0.6 kgf
	1001 kgf to 5000 kgf	2 kgf
	5001 kgf to 10000 kgf	20 kgf
	10001 kgf to 60000 kgf	60 kgf
	60001 kgf to 200000 kgf	400 kgf
Charpy / Izod Impact Tester	1 Joule to 300 Joules	1 % of reading

Signatories:

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|------------------------------|--------------------------|
| 1. Mr. Abdul Jalil Baharudin | I/C No. : 591113-10-5595 |
| 2. Mr. Noor Azam Ismail | I/C No. : 730629-14-5579 |
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FIELD OF CALIBRATION : PRESSURE MEASUREMENT

SCOPE OF ACCREDITATION :

<u>Instrument Calibrated / Measurement Parameter</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
Pressure measuring device (Gas medium)	1 psi to 100 psi 101 psi to 1600 psi	0.01 % of pressure 0.01 % of pressure
Pressure measuring device (Oil medium)	10 psi to 800 psi 801 psi to 16000 psi	0.04 % of pressure 0.01 % of pressure
Vacuum gauge	Ambient to 67 cm Hg	0.1 % of pressure
Low Pressure Measuring Devices		
Mercury Manometer	0 psi to 1500 mm Hg	2 mm Hg
Water Manometer	0 psi to 1500 mm H ₂ O	3 mm H ₂ O
Cross Floatation of Deadweight Tester	0 psi to 16 000 psi	0.02% of pressure

Signatories:

- | | |
|------------------------------|--------------------------|
| 1. Mr. Abdul Jalil Baharudin | I/C No. : 591113-10-5595 |
| 2. Mr. Noor Azam Ismail | I/C No. : 730629-14-5579 |
| 3. Ms. Norihan Zainal | I/C No. : 700801-01-6318 |
| 4. Mr. Ahmad Borhan Sa'aba | I/C No. : 730128-06-5757 |



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FIELD OF CALIBRATION : PRESSURE MEASUREMENT

SITE CALIBRATION - CATEGORY I

SCOPE OF ACCREDITATION :

<u>Instrument Calibrated / Measurement Parameter</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
Pressure measuring device (Oil medium)	0 psi to 500 psi	0.7 % of pressure
	0 psi to 1000 psi	0.7 % of pressure
	0 psi to 3000 psi	0.6 % of pressure
	0 psi to 4500 psi	0.4 % of pressure
	0 psi to 7500 psi	0.4 % of pressure
	0 psi to 10 000 psi	0.7 % of pressure
	0 psi to 12 000 psi	0.6 % of pressure
	0 psi to 16 000 psi	0.6 % of pressure
Vacuum Measuring Devices	Ambient to -70 cm Hg	1.0 % of pressure
Pressure Gauge	0 bar to 20 bar	0.5 % of pressure

Signatories:

- | | |
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| 3. Ms. Norihan Zainal | I/C No. : 700801-01-6318 |
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FIELD OF CALIBRATION : VOLUMETRIC

SCOPE OF ACCREDITATION :

<u>Instrument Calibrated / Measurement Parameter</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
Bulb Pipette	1 ml to 5 ml	0.008 ml
	5 ml to 100 ml	0.03 ml
Graduated Pipette	1 ml to 5 ml	0.008 ml
	5 ml to 100 ml	0.03 ml
Measuring Cylinder (5ml to 2000ml)	5 ml to 100 ml	0.05 ml
	100 ml to 500 ml	0.5 ml
	500 ml to 1000 ml	2.0 ml
	1000 ml to 2000 ml	3.0 ml
Burette	1 ml to 50 ml	0.05 ml
Beaker & Flasks (5ml to 2000ml)	5 ml to 100 ml	1.0 ml
	100 ml to 1000 ml	3.0 ml
	1000 ml to 2000 ml	5.0 ml

Signatory:

1. Mr. Mohd Dali Bin Silam

I/C No. : 580306-01-5541



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FIELD OF CALIBRATION : HYDROMETER

SCOPE OF ACCREDITATION :

<u>Instrument Calibrated / Measurement Parameter</u>	<u>Range</u>	<u>Best Measurement Capability Expressed as an Uncertainty (\pm) *</u>
Density Hydrometer	0.600 g/ml to 0.650 g/ml 0.650 g/ml to 0.700 g/ml 0.700 g/ml to 0.750 g/ml 0.750 g/ml to 0.800 g/ml 0.800 g/ml to 0.850 g/ml 0.850 g/ml to 0.900 g/ml 0.900 g/ml to 0.950 g/ml 0.950 g/ml to 1.000 g/ml 1.000 g/ml to 1.050 g/ml 1.050 g/ml to 1.100 g/ml 1.100 g/ml to 1.150 g/ml 1.150 g/ml to 1.200 g/ml 1.200 g/ml to 1.250 g/ml 1.250 g/ml to 1.300 g/ml 1.300 g/ml to 1.350 g/ml 1.350 g/ml to 1.400 g/ml 1.400 g/ml to 1.450 g/ml 1.450g/ml to 1.500g/ml	0.0006 g/ml (graduation 0.0005g/ml)

Signatory:

1. Mr. Mohd Dali Bin Silam

I/C No. : 580306-01-5541

