



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

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CALIBRATION

Valid To: September 30, 2019

Certificate Number: 2900.02

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations¹:

I. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ² (±)	Comments
DC Voltage – Generate	(9 to 220) mV (0.22 to 2.2) V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1020) V	2.8 µV 0.017 mV 0.11 mV 0.17 mV 3.9 mV 9.6 mV	Calibrator

Parameter/Equipment	Range	CMC ² (±)	Comments
DC Voltage – Measure	(0.9 to 101) mV (0.1 to 1.01) V (1 to 10.1) V (10 to 101) V (100 to 1020) V	2.1 μV 6.8 μV 54 μV 0.79 mV 7.2 mV	Agilent 3458A digital multimeter
	(1.01 to 2) kV (2.01 to 5) kV (5.01 to 10) kV (10.01 to 30) kV	36 V 53 V 82 V 0.20 kV	High voltage meter
DC Current – Generate	(9 to 220) μA (0.22 to 2.2) mA (2.2 to 22) mA (22 to 220) mA (0.22 to 2.2) A (2 to 10) A (10 to 20) A	15 nA 1.1 μA 1.1 μA 13 μA 0.40 mA 8.4 mA 20 mA	Calibrator
	(20 to 100.2) A	0.27 A	Yokogawa 2215 Shunt resistor
	(100.3 to 200) A (201 to 1000) A	0.65 A 3.3 A	Calibrator & coil
DC Current – Measure	(0.9 to 101) μA (0.1 to 1.01) mA (1 to 10.1) mA (10 to 101) mA (0.1 to 1.01) A	3.3 nA 30 nA 0.32 μA 4.7 μA 0.14 mA	Agilent 3458A Digital multimeter
	(1.01 to 3) A (3.01 to 20) A	5.9 mA 70 mA	Digital multimeter Digital power meter
	(20.1 to 100) A	0.25 A	Yokogawa 2215 Shunt resistor
	(101 to 400) A (401 to 600) A (601 to 1000) A	7.4 A 12 A 39 A	Digital clamp meter

Parameter/Range	Frequency	CMC ² (±)	Comments
AC Voltage – Generate			
(9 to 220) mV	10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.17 mV 63 μV 35 μV 90 μV 0.23 mV 0.28 mV 0.44 mV 0.90 mV	Calibrator
(0.22 to 2.2) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	1.7 mV 1.9 mV 1.4 mV 2.0 mV 1.7 mV 1.4 mV 5.0 mV 17 mV	
(2.2 to 22) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	13 mV 32 mV 1.8 mV 2.9 mV 5.9 mV 13 mV 51 mV 69 mV	
(22 to 220) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.12 V 38 mV 19 mV 83 mV 0.12 V 0.43 V	
(22 to 73) V	(300 to 500) kHz	0.44 V	
(220 to 700) V	(15 to 50) Hz 50 Hz to 1 kHz	0.30 V 60 mV	

Parameter/Range	Frequency	CMC ² (±)	Comments
AC Voltage – Measure			
(10 to 101) mV	(10 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	13 μV 11 μV 19 μV 38 μV 0.15 mV 0.37 mV 1.2 mV	Agilent 3458A Digital multimeter
(0.1 to 1.01) V	(10 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.13 mV 0.11 mV 0.19 mV 0.38 mV 1.0 mV 3.7 mV 12 mV	
(1 to 10.1) V	(10 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	1.3 mV 1.1 mV 1.9 mV 3.8 mV 9.6 mV 37 mV 0.22 V	
(10 to 101) V	(10 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	28 mV 26 mV 26 mV 43 mV 0.15 V 0.48 V 1.8 V	
(100 to 707) V	(10 to 40) Hz 40 Hz to 1KHz (1 to 20) kHz (20 to 50 kHz) (50 to 100) kHz	0.38 V 0.35 V 0.52 V 1.1 V 2.5 V	
(0.71 to 1) kV (1.01 to 2) kV (2.01 to 5) kV (5.01 to 10) kV (10.01 to 20) kV	60 Hz	36 V 47 V 82 V 0.14 kV 0.26 kV	

Parameter/Range	Frequency	CMC ² (±)	Comments
AC Current – Generate			
(1 to 220) µA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz	0.19 µA 98 nA 48 nA 0.18 µA	Calibrator
(0.22 to 2.2) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz	1.6 µA 0.80 µA 0.35 µA 1.8 µA	
(2.2 to 22) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz	16 µA 8.1 µA 3.5 µA 18 µA	
(22 to 220) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz	0.16 mA 82 µA 35 µA 0.18 mA	
220 mA to 1 A	20 Hz to 1 kHz (1 to 5) kHz	0.69 mA 0.84 mA	
(1 to 10) A (10.01 to 20) A	(50, 60) Hz	28 mA 55 mA	
(20 to 80) A (80 to 100) A	60 Hz	0.28 A 0.31 A	Tokyo Seiden CTL1-3-0.1, current transformer
(100.1 to 200) A (200.1 to 1000) A	(50, 60) Hz	1.1 A 5.3 A	Calibrator & coil

Parameter/Range	Frequency	CMC ² (±)	Comments
AC Current – Measure			
(0.9 to 101) μA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz	0.51 μA 0.21 μA 0.11 μA	Agilent 3458A Digital multimeter
(0.1 to 1.01) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	4.9 μA 1.0 μA 1.0 μA 0.59 μA	
(1 to 10.1) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	50 μA 20 μA 9.4 μA 0.62 mA	
(10 to 101) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.50 mA 0.20 mA 94 μA 59 μA	
(0.1 to 1.1) A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	4.9 mA 2.1 mA 1.2 mA 1.5 mA	
(1.01 to 3) A	(50, 60) Hz	4.9 mA	Digital multimeter
(3.01 to 20) A		70 mA	Digital power meter
(20.01 to 100) A	60 Hz	0.27 A	Tokyo Seiden CTL1-3-0.1, current transformer, digital power meter
(20.01 to 100) A (100.1 to 400) A (401 to 600) A (601 to 1000) A	50 Hz (50, 60) Hz	2.1 A 7.3 A 12 A 39 A	Digital clamp meter



Parameter/Equipment	Range	CMC ² (±)	Comments
Resistance – Generate	1 Ω 1.9 Ω 10 Ω 19 Ω 100 Ω 190 Ω 1 kΩ 1.9 kΩ 10 kΩ 19 kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	97 μΩ 0.19 mΩ 0.29 mΩ 0.52 mΩ 1.7 mΩ 3.4 mΩ 14 mΩ 26 mΩ 0.13 Ω 0.24 Ω 1.5 Ω 2.7 Ω 21 Ω 41 Ω 0.42 kΩ 0.93 kΩ 12 kΩ	Calibrator
Resistance – Measure	(0.9 to 11) Ω (10 to 110) Ω 100 Ω to 1.1 kΩ (1 to 11) kΩ (10 to 110) kΩ 100 kΩ to 1.1 MΩ (1 to 11) MΩ (10 to 110) MΩ 100 MΩ to 1.1 GΩ	0.63 mΩ 2.2 mΩ 13 mΩ 0.30 Ω 1.3 Ω 20 Ω 0.72 kΩ 62 kΩ 6.2 MΩ	Agilent 3458A digital multimeter



Parameter/Equipment	Range	CMC ^{2,5} (±)	Comments
AC Power – Generate, 50 Hz/60 Hz, Power Factor = 1			
Voltage: 100 V Current: 200 mA	20 W	0.07 %	Calibrator
Voltage: 100 V Current: 100 mA	10 W	0.043 %	
Voltage: 100 V Current: 1 A	100 W	0.041 %	
Voltage: 100 V Current: 10 A	1 kW	0.056 %	
DC Power – Generate, Power Factor = 1			
Voltage: 100 V Current: 100 mA	10 W	0.0088 %	Calibrator
Voltage: 100 V Current: 200 mA	20 W	0.016 %	
Oscilloscope –			
DC Voltage	10 mV to 1000 V	0.028 %	Calibrator
AC Voltage 40 Hz to 20 kHz	10 mV to 220 V	0.64 %	
Frequency Response 10 Hz to 1 MHz	(0.1 to 22) V	1.7 %	
Frequency	10 mHz to 15 MHz	0.16 %	WaveFactory synthesizer



II. Electrical – RF/Microwave

Parameter/Equipment	Range	CMC ^{2, 3, 5} (±)	Comments
RF Power – Measure			
Absolute	9 kHz to 6 GHz 50 MHz to 26.5 GHz	0.16 dB	Agilent E4418B power meter Agilent E9304A power sensor Agilent 8485A power sensor
Relative (RF Insertion Loss/Gain)	9 kHz to 8.5 GHz	0.41 dB	Agilent E5071C network analyzer
RF Power – Generate, Absolute			
9 kHz to 1000 MHz	(-60 to 8) dBm	1.2 dBm	Signal generator
(1 to 18) GHz	(-30 to 10) dBm	1.7 dBm	
Impedance, VSWR – Measure			
One Port Device	9 kHz to 1000 MHz	0.35 %	Agilent E5071C network analyzer
Two Port Device	(1 to 8.5) GHz	0.5 %	
Amplitude Modulation – Measure	150 kHz to 1300 MHz	11 %	Spectrum analyzer



Parameter/Equipment	Range	CMC ^{2, 3, 5} (±)	Comments
Frequency Modulation – Measure	150 kHz to 5 MHz (5 to 1300) MHz	16 % 5.4 %	Spectrum analyzer
Frequency – Measure	10 Hz to 10 MHz 10 MHz to 1 GHz 600 MHz to 40 GHz	0.051 Hz 16 Hz 4.2 kHz	Cosmo GCET frequency standard, Anritsu MF2414B frequency counter
Frequency – Generate	10 MHz GPS common view 9 kHz to 1 GHz (1 to 18) GHz	1.4 x 10 ⁻⁶ Hz 0.0068 Hz 1.2 kHz	Cosmo GCET frequency standard Signal generator
Signal Generator – Output Frequency	10 Hz to 10 MHz 10 MHz to 1 GHz 600 MHz to 40 GHz	0.051 Hz 16 Hz 4.2 kHz	Cosmo GCET frequency standard Anritsu MF2414B frequency counter
Output Level 9 kHz to 6 GHz	(-60 to 10) dBm	0.21 dB	Agilent E4418B power meter
50 MHz to 26.5 GHz	(-60 to 10) dBm	0.24 dB	Agilent E9304A power sensor Agilent 8485A power sensor



Parameter/Equipment	Range	CMC ^{2, 3, 5} (±)	Comments
LISN –			
Insertion Loss	9 kHz to 200 MHz	0.55 dB	CISPR 16-1-2:2006
Impedance (Magnitude)	9 kHz to 200 MHz	7.6 %	Agilent E5071C network analyzer
Impedance (Phase)	9 kHz to 200 MHz	0.22 Degrees	
Isolation	9 kHz to 200 MHz	0.96 dB	
VSWR	9 kHz to 200 MHz	0.35 %	Agilent E5071C network analyzer
EMI Receiver –			
Input Impedance & VSWR	9 kHz to 8.5 GHz	0.35 %	CISPR 16-1-1 (2010) Agilent E5071C network analyzer
Absolute Pulse Response	9 kHz to 1 GHz	2.0 dB	Signal generator Schwarzbeck IGUU2918 CISPR pulse generator
Relative Pulse Response	9 kHz to 1 GHz	1.5 dB	Schwarzbeck IGUU2918 CISPR pulse generator
Intermittent Response	9 kHz to 23.4375 MHz 23.4375 MHz to 1 GHz	2.2 % 6.0 %	Signal generator
Sine-Wave Accuracy	9 kHz to 1 GHz (1 to 3) GHz	1.3 dB 1.3 dB	
Selectivity	CISPR Band A CISPR Band B CISPR Band C CISPR Band D CISPR Band E	15 Hz 0.18 kHz 2.6 kHz 2.7 kHz 49 kHz	

Parameter/Equipment	Range	CMC ^{2,3,5} (±)	Comments
Antenna Factor – 1 m			SAE ARP958 Rev.D
Log Periodic Antenna	(200 to 1000) MHz	1.4 dB	Agilent E5071C network analyzer
Biconical Antenna	(25 to 300) MHz	1.2 dB	
Rod Antenna	9 kHz to 30 MHz	1.1 dB	Signal generator EMI test receiver
Horn Antenna	(1 to 18) GHz	1.6 dB	
	(1 to 8.5) GHz	1.3 dB	Network Analyzer
Antenna Factor – 10 m			ANSI C63.5 (1998) standard site method
Log Periodic Antenna	(200 to 1000) MHz	1.4 dB	Agilent E5071C network analyzer
Biconical Antenna	(25 to 300) MHz	1.2 dB	
CDN & Adapters –			
Insertion Loss (50 to 150) Ω	10 kHz to 230 MHz	0.082 dB	IEC 61000-4-6 (2008) Agilent E5071C network analyzer
Impedance	9 kHz to 230 MHz	7.9 %	IEC 61000-4-6 (2008) Agilent E5071C network analyzer
Bulk Current Injection Probe & Fixture –			
Insertion Loss	10 kHz to 400 MHz	0.090 dB	Agilent E5071C network analyzer
VSWR	10 kHz to 400 MHz	3.0 %	



Parameter/Equipment	Range	CMC ^{2, 3, 5} (±)	Comments
Spectrum Analyzer –			
Calibration Output Frequency	(10 to 50) MHz	1.8 Hz	Cosmo GCET frequency standard Anritsu MF2414B frequency counter
Calibration Output Level	(10 to 50) MHz	0.16 dB	Agilent E4418B power meter Agilent E9304A power sensor Agilent 8485A power sensor
Frequency Readout Accuracy, Counter Accuracy	9 kHz to 1 GHz (1 to 3) GHz	0.012 Hz 1.2 kHz	Signal generator
Frequency Response	9 kHz to 1 GHz (1 to 3) GHz	0.8 dB 1.3 dB	
Resolution Bandwidth Accuracy	1 kHz to 3 MHz	4.8 %	
Resolution Bandwidth Selectivity	300 Hz to 20 MHz	4.8 %	
Resolution Bandwidth Switching Accuracy	(0 to -60) dBm	0.60 dB	
Reference Level Switching Accuracy	(0 to -60) dBm	0.61 dB	Agilent E4418B power meter Agilent E9304A power sensor Agilent 8485A power sensor
VSWR	10 kHz to 3 GHz	0.41 dB	Agilent E5071C network analyzer
Absorbing Clamp	30 MHz to 1 GHz	0.41 dB	CISPR 16-1-3 (2004) Agilent E5071C network analyzer



¹ This laboratory offers commercial calibration service.

² Calibration and Measurement Capability Uncertainty (CMC) is the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation when performing more or less routine calibrations of nearly ideal measurement standards or nearly ideal measuring equipment. CMCs represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of $k = 2$. The actual measurement uncertainty of a specific calibration performed by the laboratory may be greater than the CMC due to the behavior of the customer's device and to influences from the circumstances of the specific calibration.

³ Uncertainty does not include mismatch error due to connections of the device to other devices in actual use. Mismatch uncertainties, due to the reflection coefficient of the device to be calibrated, are to be included in the overall measurement uncertainty, the approach of determining expanded uncertainties at approximately the 95% level of confidence, (using a coverage factor of $k = 2$) is to be applied for this calculation as well.

⁴ For standards or methods listed in this scope without a revision date, laboratories are expected to be competent in the use of the current version within one year of the date of publication of the standard calibration method or upon the date specified by the standard calibration method originator when the originator has implementation authority. When a superseded standard or method is required for an accredited calibration, the scope will include the superseded date/version.

⁵ In the statement of CMC, the value is defined as the percentage of reading.



Accredited Laboratory

A2LA has accredited

COSMOS CORPORATION

Matsusaka-shi, Japan

for technical competence in the field of

Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets R205 – Specific Requirements: Calibration Laboratory Accreditation Program. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).



Presented this 19th day of October 2017.

A blue ink signature of the Senior Director of Accreditation Services.

Senior Director, Accreditation Services
For the Accreditation Council
Certificate Number 2900.02
Valid to September 30, 2019
Revised January 24, 2019

For the calibrations to which this accreditation applies, please refer to the laboratory's Calibration Scope of Accreditation.