SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

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CALIBRATION

Valid To: March 31, 2028 Certificate Number: 2941.01

In recognition of the successful completion of the A2LA evaluation process (including an assessment of the organization's compliance with R205 – A2LA's Calibration Program Requirements) accreditation is granted to this laboratory at the location listed above as well as the satellite laboratory location listed below to perform the following calibrations[1, 8]:

I. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2, 4, 5] (±)	Comments
DC Resistance – Generate[3]	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	25 μΩ/Ω 26 μΩ/Ω 12 μΩ/Ω 25 μΩ/Ω 12 μΩ/Ω 25 μΩ/Ω 12 μΩ/Ω 25 μΩ/Ω 12 μΩ/Ω 25 μΩ/Ω 12 μΩ/Ω 25 μΩ/Ω 24 μΩ/Ω 62 μΩ/Ω 36 μΩ/Ω 0.025 % 0.012 %	Fluke 5700A, 5720A

Parameter/Equipment	Range	CMC[2, 4, 5] (±)	Comments
DC Resistance – Generate[3] (cont)	(0 to 10) Ω (10 to 330) Ω 330 Ω to 3.3 kΩ (3.3 to 33) kΩ (33 to 330) kΩ 330 kΩ to 1 MΩ (1 to 10) MΩ (10 to 100) MΩ	0.024 % + 0.001 Ω 0.020 % + 0.015 Ω 0.013 % + 0.06 Ω 0.013 % + 0.6 Ω 0.020 % + 6 Ω 0.024 % + 55 Ω 0.080 % + 550 Ω 0.60 % + 5.5 kΩ	Fluke 5522A Fluke 5500A, 5522A
DC Resistance – Measure[3]	(0 to 1) Ω (1 to 10) Ω (10 to 100) Ω 100 Ω to 1 kΩ (1 to 10) kΩ (10 to 100) kΩ 100 kΩ to 1 MΩ (1 to 10) MΩ (10 to 100) MΩ	0.11 % + 0.05mΩ 21 μΩ/Ω 19 μΩ/Ω 13 μΩ/Ω 12 μΩ/Ω 13 μΩ/Ω 19 μΩ/Ω 80 μΩ/Ω 0.052 %	HP 3458A
DC Voltage – Generate[3]	(0 to 220) mV 220 mV to 2.2 V (2.2 to 22) V (22 to 220) V 220 V to 1 kV (0 to 330) mV 330 mV to 3.3 V (3.3 to 33) V (33 to 330) V 330 V to 1 kV	9 μV/V + 1 μV 8 μV/V + 1.2 μV 8 μV/V + 8 μV 9 μV/V + 100 μV 11 μV/V + 600 μV 90 μV/V + 3 μV 61 μV/V + 5 μV 61 μV/V + 50 μV 70 μV/V + 500 μV 70 μV/V + 1.5 mV	Fluke 5700A, 5720A Fluke 5500A, 5522A
DC Voltage – Measure[3]	(0 to 0.1) V (0.1 to 1) V (1 to 10) V (10 to 100) V 100 V to 1 kV	9 μV/V + 10 μV 8 μV/V + 1 μV 8 μV/V + 0.5 μV 10 μV/V + 30 μV 10 μV/V + 100 μV	HP3458A

Parameter/Equipment	Range	CMC[2, 4, 5] (±)	Comments
DC Current – Generate[3]	100 µA to 100 mA 100 mA to 1 A (1 to 2.2) A 10 A (2.2 to 10) A (0 to 3.3) mA (3.3 to 33) mA (33 to 330) mA 330 mA to 2.2 A (2.2 to 10) A	55 µA/A 55 µA/A 55 µA/A 55 µA/A 0.048 % 0.020 % + 0.05 µA 0.014 % + 0.25 µA 0.014 % + 3.3 µA 0.040 % + 44 µA 0.074 % + 330 µA	Fluke 5700A & 5725A Fluke 5720A & 5725A Fluke 5500A, 5522A
DC Current – Measure[3]	100 µA to 100 mA 100 mA to 1 A (1 to 10) A 100 µA to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1A	40 µA/A 40 µA/A 40 µA/A 150 µA/A 150 µA/A 200 µA/A 0.050 %	Guildline9211A, HP3458A HP3458A

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
AC Voltage – Generate[3]			
100 mV to 1 kV	1 kHz	0.011 % + 10 µV	Fluke 5700A, 5720A
100 mV to 1 V	40 Hz to 1 kHz	0.022 % + 8 µV	
(1 to 10) V	40 Hz to 1 kHz (1 to 50) kHz (50 to 100) kHz (100 to 500) kHz 500 kHz to 1 MHz	0.012 % + 60 µV 0.018 % + 160 µV 0.033 % + 350 µV 0.19 % + 4.3 mV 0.38 % + 8.5 mV	
(10 to 100) V	40 Hz to 20 kHz	0.010 % + 0.8 mV	
(100 to 1000) V	40 Hz to 20 kHz	0.020 % + 6 mV	Fluke 5720A & 5725A
1 V	(10 to 40) Hz 40 Hz to 100 kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.060 % + 100 µV 0.030 % + 80 µV 0.050 % + 150 µV 0.12 % + 400 µV 0.23 % + 1 mV	Fluke 5700A, 5720A

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
AC Voltage – Generate[3] (cont)			
(100 to 330) mV	1 kHz	0.070 % + 20 µV	Fluke 5500A, 5522A
(0.33 to 3.3) V	1 kHz	0.040 % + 60 µV	
(3.3 to 33) V	1 kHz	0.052 % + 600 µV	
(33 to 330) V	1 kHz	0.061 % + 6.6 mV	
(330 to 1000) V	1 kHz	0.070 % + 80 mV	
1V	(10 to 45) Hz	0.21 % + 250 µV	
	45 Hz to 10 kHz	0.043 % + 60 µV	
	(10 to 20) kHz	0.10 % + 60 µV	
	(20 to 50) kHz	0.20 % + 300 µV	
	(50 to 100) kHz	0.50 % + 1.7 mV	
	(100 to 500) kHz	1.0 % + 3.3 mV	
AC Voltage – Measure[3]			
(100 to 600) mV	40 Hz to 20 kHz	0.020 % + 2 µV	Fluke 5790A
600 mV to 1 kV	40 Hz to 20 kHz	0.013 % + 2 µV	
(1 to 10) V	(10 to 40) Hz	0.035 %	
	(20 to 100) kHz	0.022 %	
	100 kHz to 1 MHz	0.25 %	
AC Current – Generate[3]			
60 mA to 2.2 A	50 Hz, 60 Hz	0.090 % + 100 nA	Fluke 5700A, 5720A
(2.2 to 10) A	50 Hz, 60 Hz	0.10 % + 200 µA	Fluke 5720A & 5725A
(60 to 330) mA	50 Hz, 60 Hz	0.12 % + 30 µA	Fluke 5500A, 5522A
(0.33 to 2.2) A	50 Hz, 60 Hz	0.14 % + 300 µA	
(2.2 to 10) A	50 Hz, 60 Hz	0.10 % + 2000 µA	

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
AC Current – Measure[3]			
60 mA to 10 A	50 Hz, 60 Hz	0.020 %	Fluke 5790A, L&N 4385
1 mA 10 mA 100 mA 1 A	50 Hz, 60 Hz 50 Hz, 60 Hz 50 Hz, 60 Hz 50 Hz, 60 Hz	0.16 % 0.14 % 0.14 % 0.17 %	HP3458A
(1 to 10) mA (10 to 100) mA 100 mA to 1 A	50 Hz, 60 Hz 50 Hz, 60 Hz 50 Hz, 60 Hz	0.50 % 0.50 % 0.50 %	
AC Power – Generate[3]			
(50 to 2000) W 100 V,75V (0.5 to 20) A PF: 1	50 Hz, 60 Hz Single Phase	0.10 %	Fluke 5500A, 5522A Yokogawa 2885 Agilent 3458A
AC Resistance – Measure[3] Impedance			
100 Ω	1 kHz 10 kHz, 100 kHz 1 MHz	0.06 % 0.09 % 0.19 %	HP 4284A
1 kΩ	1 kHz, 10 kHz 100 kHz 1 MHz	0.06 % 0.09 % 0.19 %	
10 kΩ	1 kHz,10 kHz 100 kHz 1 MHz	0.06 % 0.09 % 0.21 %	
100 kΩ	1 kHz,10 kHz 100 kHz 1 MHz	0.08 % 0.08 % 0.36 %	

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
Capacitance – Measure[3]			
1 pF	1 kHz 10 kHz 100 kHz 1 MHz	28 % 3.0 % 0.65 % 0.67 %	HP 4284A
10 pF	1 kHz 10 kHz 100 kHz 1 MHz	3.0 % 0.50 % 0.41 % 0.42 %	
100 pF	1 kHz 10 kHz 100 kHz 1 MHz	0.49 % 0.18 % 0.16 % 0.19 %	
1000 pF	1 kHz 10 kHz 100 kHz 1 MHz	0.16 % 0.14 % 0.17 % 0.27 %	
0.01 µF	120 Hz 1 kHz 10 kHz	0.16 % 0.14 % 0.14 %	
0.1 µF	120 Hz 1 kHz 10 kHz	0.14 % 0.14 % 0.17 %	
1 µF	120 Hz 1 kHz 10 kHz	0.13 % 0.14 % 0.18 %	
Inductance – Measure[3]			
100 µH	1 kHz	0.53 %	HP 4284A
1 mH	1 kHz	0.25 %	
10 mH	1 kHz	0.14 %	
100 mH	1 kHz	0.14 %	
1000 mH	1 kHz	0.14 %	

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
Distortion – Generate[3]			
-20、-30、-40、-50、-60 dB	1 kHz	0.62 dB	Shibasoku AC12B, Shibasoku H3012 NF WF1946
-50 dB	20, 100, 400 Hz, 10, 20 kHz	0.62 dB	
Distortion – Measure[3]			Panasonic VP-7722A, Panasonic VP-7725A
Up to 31.62 % Up to 3.162 % Up to 0.3162 % Up to 0.03162 % Up to 0.003 162 %	20 Hz to 20 kHz	6.2 % 0.62 % 0.062 % 0.0062 % 0.000 62 %	

II. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC[2, 4, 6] (±)	Comments
EMI Receiver[3] –			CISPR 16-1-1 ANSI C63.2
Frequency	9 kHz to 50 kHz (50 to 500) kHz 500 kHz to 5 MHz 5 MHz to 40 GHz	$(5.7 \times 10^{-7} \cdot F)$ Hz + 0.05 mHz $(9.5 \times 10^{-9} \cdot F)$ Hz + 0.5 mHz $(4.8 \times 10^{-9} \cdot F)$ Hz + 5 mHz $(5.9 \times 10^{-10} \cdot F)$ Hz + 0.05 Hz	Freqtime FT-Rb Agilent 33250A Agilent 83620B Agilent E8267C Agilent N5183A
VSWR	9 kHz to 18 GHz Up to 26.5 GHz Up to 40 GHz	3.1 % 8.3 % 12 %	Agilent E5071C, Agilent E5061B, HP 8720D, HP 85054B, Anritsu 3653 R&S ZNB40 R&S ZN-Z129

Parameter/Range	Frequency	CMC[2, 4, 6] (±)	Comments
EMI Receiver[3] – (cont)			CISPR 16-1-1 ANSI C63.2
Sine-Wave Accuracy	Band A [(9 to 150) kHz] Band B [(0.15 to 30) MHz] Band C [(30 to 300) MHz] Band D [(300 to 1000) MHz] Band E [(1 to 18) GHz]	 0.27 dB 0.27 dB 0.27 dB 0.27 dB 0.27 dB	Agilent N1914A, E9304A, E9300A
	(18 to 40) GHz	1.6 dB	Agilent N1914A, E4413A,N8487A R &S FSMR43, NRP-Z55
Selectivity, 6 dB Bandwidth	Band A [(9 to 150) kHz] Band B [(0.15 to 30) MHz] Band C [(30 to 300) MHz] Band D [(300 to 1000) MHz] Band E [(1 to 18) GHz]	 0.61 % 0.61 % 0.61 % 0.61 % 0.61 %	Advantest R5373P, R5372 Anritsu MF2414B

Parameter/Range	Frequency	CMC[2, 4, 6] (±)	Comments
EMI Receiver[3] – (cont)			
Response to Pulse	Band A [(9 to 150) kHz]	0.64 dB	Schwarzbeck IGUU2916, Schwarzbeck IGUU2918
Quasi-Peak Detector Peak Detector Average Detector	Band B [(0.15 to 30) MHz] Band C [(30 to 300) MHz] Band D [(300 to 1000) MHz]	0.64 dB 0.64 dB 0.64 dB	
Response above 1 GHz to pulses Peak Detector Average Detector	Band E [(1 to 3) GHz]	1.1 dB	R&S SMB100B
Response to Intermittent, Unsteady & Drifting Narrowband Disturbances	Band A [(9 to 150) kHz]	0.62 dB	Agilent 33250A, Agilent E8267C R&S SMA100B
	Band B [(0.15 to 30) MHz]	0.62 dB	
	Band C [(30 to 300) MHz]	0.62 dB	
	Band D [(300 to 1000) MHz]	0.62 dB	
Impulse Bandwidth	Band E [(1 to 3) GHz]	8.8 %	R&S SMB100B

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Electrostatic Discharge Simulator[3] –			
Output Voltage (+/-)	(2 to 30) kV	2.7 %	IEC 61000-4-2, ISO 10605
Discharge Current Waveform –			HV meter DHM-30/2
Rise Time	(0.6 to 1) ns, Up to 15 kV (0.6 to 1) ns, Up to 30 kV	6.8 % 8.3 %	LeCroy WR204Xi-A, LeCroy WR6200A, Noiseken 06-00067A, TESEQ MD103
Peak Current (+/-)	Up to 56.25 A, Up to 15 kV Up to 112.5 A, Up to 30 kV	4.1 % 6.3 %	
2nd Peak Current (+/-)	Up to 33.75 A, Up to 15 kV Up to 67.5 A, Up to 30 kV	6.4 % 7.6 %	
Current, (30 to 800) ns	(0.3 to 30) A, Up to 15 kV (2.25 to 70) A, Up to 30 kV	4.4 % 6.3 %	
Lightning Surge Simulator[3] –			IEC 61000-4-5
Open Circuit Surge Voltage –			
Output Voltage (+/-)	250 V to 15 kV (peak)	3.6 %	LeCroy WR204Xi-A, LeCroy WR6200A Tektronix P6015A, Probe Master 4241A
Front Time/Time to Half Value	(0.8 to 900) µs	3.1 %	
Undershoot Residual Surge Voltage	250 V to 15 kV (peak)	3.6 %	

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Lightning Surge Simulator[3]– (cont)			IEC 61000-4-5
Short Circuit Surge Current –			
Output Current (+/-)	10 A to 7.5 kA (peak)	5.8 %	LeCroy WR204Xi-A, LeCroy WR6200A, Pearson Electric A10, Pearson Electric 110, Pearson Electric 110A
Front Time/Time to Half Value	(0.9 to 400) µs	3.5 %	
Undershoot	10 A to 7.5 kA (peak)	5.8 %	
Phase Shifting	(0 to 360) °	2.4°	LeCroy WR204Xi-A, LeCroy WR6200A, Probe Master 4241A

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
RF Power –Measure[3] 1 mW, Type-N, 50 Ω	50 MHz	0.16 dB	Agilent N1914A, E9304A, E9300A
(20 to -10) dBm	9 kHz to 2 GHz	0.20 dB	Agilent N1914A, E4413A, N8487A
(20 to -10) dBm	(2 to 18) GHz	0.23 dB	
(20 to -10) dBm	(18 to 26.5) GHz	0.23 dB	
(20 to -10) dBm	(26.5 to 40) GHz	0.27 dB	
(-10 to -90) dBm	9 kHz to 40 GHz	0.25 dB	Rohde & Schwarz FSMR43, NRP-Z55
VSWR	9 kHz to 18 GHz	2.9 %	Agilent E5071C, Agilent E5061, HP 8720D, HP 85054B, Anritsu 3653

Parameter/Equipment	Range	CMC[2, 4, 5] (±)	Comments
Oscilloscope –			
DC Voltage	(0 to 220) mV 220 mV to 2.2 V (2.2 to 22) V (22 to 220) V 220 V to 1 kV	9 µV/V + 1 µV 8 µV/V + 1.2 µV 8 µV/V + 8 µV 9 µV/V + 100 µV 11 µV/V + 600 µV	Fluke 5700A, 5720A
	(0 to 330) mV 330 mV to 3.3 V (3.3 to 33) V (33 to 330) V 330 V to 1 kV	90 µV/V + 3 µV 61 µV/V + 5 µV 61 µV/V + 50 µV 70 µV/V + 500 µV 70 µV/V + 1.5 mV	Fluke 5500A, 5522A
Time Base	1 MHz	0.05 ns/ms	FT-Rb Advantest R5373P, FSMR43 Anritsu MF2414B
Frequency Response	9 kHz to 2 GHz	0.25 dB	Agilent N1914A, E9304A, E9300A, FSMR, NRP-Z37

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
RF Attenuation[3] –			
(0 to 50) dB (50 to 90) dB	9 kHz to 1 GHz	0.40 dB 0.52 dB	Agilent E5071C, Agilent E5061B, HP 8720D
(0 to 50) dB (50 to 70) dB	(1 to 18) GHz	0.84 dB 1.0 dB	
Artificial Mains Network, Impedance Stabilization Network CDNE [3] –			CISPR 16-1-2, CISPR25 ISO7637-2 ANSI C63.4
Impedance (4 to 300) Ω Phase (0 to 360)° Insertion Loss (0 to -50) dB VSWR Isolation LCL ≤ 55 dB LCL ≤ 65 dB LCL ≤ 75 dB	9 kHz to 400 MHz 9 kHz to 400 MHz 9 kHz to 400 MHz 9 kHz to 200 MHz 9 kHz to 200 MHz 150 kHz to 50 MHz 150 kHz to 50 MHz 150 kHz to 50 MHz	2.9 % 0.85° 0.40 dB 3.0 % 1.0 dB 0.70 dB 0.85 dB 2.1 dB	Agilent E5071C, Agilent E5061B, HP 85054B, HP 85032B HP 85052C Anritsu 3653

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
Reference Impedance Network[3] –			IEC 61000-3-3 IEC 61000-3-11 JIS C 61000-3-2
Impedance (Reactance, Inductance) (0.01 to 1) Ω, (0.1 to 0.5) mH	(50, 60) Hz	1.0 %	HP 4284A
Resistance (0.3 to 3) Ω	DC	0.50 %	HP 3458A, Agilent 34410A, RM3548
RF Pre Amplifier[3] –			
Gain (0 to 60) dB	9 kHz to 10 MHz 10 MHz to 1 GHz (1 to 18) GHz	0.50 dB 0.40 dB 0.84 dB	Agilent E5071C, Agilent E5061C, HP 8720D
Linearity (Input Level)	(-60 to -30) dBm	0.84 dB	

Parameter/Range	Frequency	CMC[2, 4, 6] (±)	Comments
Spectrum Analyzer[3] –			
Amplitude (+20 to -60) dBm	9 kHz to 18 GHz	0.27 dB	Agilent N1914A, E9304A, E9300A
(+10 to -30) dBm	(18 to 40) GHz	0.30 dB	Agilent N1914A, E4413A,N8487A R & S SMR43, NRP- Z55
Frequency	(9 to 50)kHz (50 to 500) kHz 500 kHz to 5 MHz 5 MHz to 40 GHz	$(5.7 \times 10^{-7} \cdot F)$ Hz + 0.05 mHz $(9.5 \times 10^{-9} \cdot F)$ Hz + 0.5 mHz $(4.8 \times 10^{-9} \cdot F)$ Hz + 5 mHz $(5.9 \times 10^{-10} \cdot F)$ Hz + 0.05 Hz	Freqtime FT-Rb Agilent 33250A Agilent 83620B Agilent E8267C Agilent N5183A
Bandwidth	9 kHz to 18 GHz	0.61 %	Advantest R5373P, R5372 Anritsu MF2414B – same as EMI - selectivity
VSWR	9 kHz to 18 GHz Up to 26.5 GHz Up to 40 GHz	3.1 % 8.3 % 12 %	Anritsu MF2414B Agilent E5071C, Agilent E5061B, HP 8720D, HP 85054B, Anritsu 3653 R&S ZNB40 R&S ZN-Z129
Coupling Decoupling Network[3] –			IEC61000-4-6
Impedance (4 to 300) Ω	150 kHz to 400 MHz	2.9 %	Agilent E5071C Agilent E5061B Agilent 85054B
Insertion Loss (0 to -50) dB	150 kHz to 1 GHz	0.50 dB	Agilent 85032B Agilent 85052C Anritsu 3653 R&S ZNB40 R&S ZN-Z129

Parameter/Range	Frequency	CMC[2, 4, 6] (±)	Comments
Signal Generator[3] – Output Level			
(20 to -10) dBm (20 to -10) dBm (20 to -10) dBm (20 to -10) dBm (-10 to -90) dBm	9 kHz to 2 GHz (2 to 18) GHz (18 to 26.5) GHz (26.5 to 40) GHz 9 kHz to 40 GHz	0.22 dB 0.25 dB 0.25 dB 0.30 dB 0.29 dB	Agilent N1914A, E4413A, N8487A Rohde & Schwarz FSMR43, NRP-Z55
Frequency Accuracy & Reference Output Frequency	(0.2 to 5) Hz (5 to 500) Hz 500 Hz to 50 kHz (50 to 500) kHz 500 kHz to 5 MHz 5 MHz to 40 GHz	$(8.1 \times 10^{-4} \cdot F)$ Hz + 0.05 mHz $(5.2 \times 10^{-5} \cdot F)$ Hz + 0.05 mHz $(5.7 \times 10^{-7} \cdot F)$ Hz + 0.05 mHz $(9.5 \times 10^{-9} \cdot F)$ Hz + 0.5 mHz $(4.8 \times 10^{-9} \cdot F)$ Hz + 5 mHz $(5.9 \times 10^{-10} \cdot F + 0.05)$ Hz	Freqtime FT-Rb Advantest R5373P, R5372 R&S FSMR43 Anritsu MF2414B
Amplitude Modulation (5 to 99) %	150 kHz to 6 GHz	2.3 %	FSMR
Frequency Modulation Deviation	10 Hz to 200 kHz	2.3 %	FSMR
Pulse Width – Width Cycle	800 ns to 1 s (1 to 2) s	0.3 % 0.3 %	LeCroy WR204Xi-A LeCroy WR6200A
VSWR	9 kHz to 18 GHz	2.9 %	Agilent E5071C, Agilent E5061B, Agilent 8720D, Agilent 85054B Anritsu 3653
High Impedance Probe[3] – Insertion Loss (0 to -50) dB	9 kHz to 30 MHz	0.40 dB	CISPR 16-1-2 Agilent E5071C, Agilent E5061B, Agilent 85054B Agilent 85032B

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
High Impedance Probe[3] – Insertion Loss (0 to -50) dB	 9 kHz to 30 MHz	 0.40 dB	CISPR 16-1-2 Agilent E5071C, Agilent E5061B, Agilent 85054B Agilent 85032B
Current Probe, Injection Probe[3] – Transfer Impedance	 10 Hz to 10 kHz 10 kHz to 1.0 GHz	 1.8 dB 0.80 dB	CISPR 16-1-2 Agilent E5071C, Agilent E5061B, Agilent 85054B Agilent 85032B
Electrical Fast Transient Burst Simulator[3] – Peak Voltage (50 Ω) Peak Voltage (1 kΩ) Pulse Waveform – Pulse Rise Time (50 Ω / 1 kΩ) Pulse Width (50 Ω / 1 kΩ) Burst Duration Burst Period Repetition Frequency Residual Voltage	 125 V to 2 kV 250 V to 4 kV 5 ns 50 ns 15 ms, 0.75 ms 300 ms (5, 100) kHz Up to 500 V	 4.3 % 7.7 % 7.8 % 1.0 % 0.6 % 0.6 % 1.9 % 8.0 %	IEC61000-4-4 LeCroy WR204Xi-A, LeCroy WR6200A, Haefely PAT50A LeCroy WR204Xi-A, LeCroy WR6200A, Haefely PAT1000 LeCroy WR204Xi-A, LeCroy WR6200A, Haefely PAT50A, Haefely PAT1000

Parameter/Range	Frequency	CMC[2, 4, 6] (±)	Comments
Electrical Fast Transient Burst Simulator[3] – (cont)			IEC61000-4-4
Capacitive Coupling Clamp			LeCroy WR204Xi-A, LeCroy WR6200A, Haefely PAT50A
Peak Voltage (50 Ω)	Up to 2 kV	4.2 %	
Pulse Waveform – Pulse Rise Time (50 Ω)	5 ns	8.0 %	
Pulse Width (50 Ω)	50 ns	0.73 %	
Voltage Dip Generator[3] –			IEC 61000-4-11, IEC 61000-4-34
Dip Voltage (50, 60 Hz)	Up to 250 V	0.40 %	HP 3458A, Agilent 34410A
Phase Angle Rise & Fall Time Overshoot & Undershoot Duration Voltage Dips	(0 to 360) ° (0.5 to 50) µs Up to 250 V (5 to 1000) ms	2.4° 1.5 % 3.8 % 1.5 %	LeCroy WR204Xi-A, LeCroy WR6200A, Probe Master 4241A
In-Rush Current	(1 to 1000) A (peak)	4.9 %	LeCroy WR204Xi-A, LeCroy WR6200A, Pearson Electric 110, Pearson Electric 110A

Parameter/Range	Frequency	CMC[2, 4, 6] (±)	Comments
CVCF Power Source[3] – AC Voltage (50, 60 Hz)	Up to 400 V	0.07 %	IEC 61000-3-2 HP 3458 A, Agilent 34410A
AC Current (50, 60 Hz)	Up to 100 A	2.3 %	HP 3458 A, Agilent 34410A, Pearson Electric A10, Pearson Electric 110, Pearson Electric 110A
Frequency	(5 to 500) Hz	$(5.2 \times 10^{-5} \cdot F)$ Hz + 0.05 mHz	Freqtime FT-Rb Advantest R5373P
Distortion (50, 60, 400 Hz)	Up to 31.62 % Up to 3.162 % Up to 0.3162 % Up to 0.031 62 % Up to 0.003 162 %	6.2 % 0.62 % 0.062 % 0.0062 % 0.000 62 %	Panasonic VP-7722A Panasonic VP-7725A

III. Time & Frequency

Parameter/Equipment	Range	CMC[2, 6, 7] (±)	Comments
Frequency – Measure & Measuring Equipment [3]	(0.2 to 5) Hz (5 to 500) Hz 500 Hz to 50 kHz (50 to 500) kHz 500 kHz to 5 MHz 5 MHz to 40 GHz	$(8.1 \times 10^{-4} \cdot F)$ Hz + 0.05 mHz $(5.2 \times 10^{-5} \cdot F)$ Hz + 0.05 mHz $(5.7 \times 10^{-7} \cdot F)$ Hz + 0.05 mHz $(9.5 \times 10^{-9} \cdot F)$ Hz + 0.5 mHz $(4.8 \times 10^{-9} \cdot F)$ Hz + 5 mHz $(5.9 \times 10^{-10} \cdot F + 0.05)$ Hz	Freqtime FT-Rb Advantest R5373P, R5372 R&S FSMR43 Anritsu MF2414B Agilent 33250A Agilent 83620B Agilent E8267C Agilent N5183A

SATELLITE LABORATORY

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CALIBRATION

I. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2, 4, 5] (±)	Comments
DC Resistance – Generate[3]	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	25 µΩ/Ω 26 µΩ/Ω 12 µΩ/Ω 25 µΩ/Ω 12 µΩ/Ω 25 µΩ/Ω 12 µΩ/Ω 25 µΩ/Ω 12 µΩ/Ω 25 µΩ/Ω 12 µΩ/Ω 25 µΩ/Ω 24 µΩ/Ω 62 µΩ/Ω 36 µΩ/Ω 0.025 % 0.012 %	Fluke 5700A
	(0 to 10) Ω (10 to 330) Ω 330 Ω to 3.3 kΩ (3.3 to 33) kΩ (33 to 330) kΩ 330 kΩ to 1 MΩ (1 to 10) MΩ (10 to 100) MΩ	0.024 % + 0.001 Ω 0.020 % + 0.015 Ω 0.013 % + 0.06 Ω 0.013 % + 0.6 Ω 0.020 % + 6 Ω 0.024 % + 55 Ω 0.080 % + 550 Ω 0.60 % + 5.5 kΩ	Fluke 5522A

Parameter/Equipment	Range	CMC[2, 4, 5] (±)	Comments
DC Resistance – Measure[3]	(0 to 1) Ω (1 to 10) Ω (10 to 100) Ω 100 Ω to 1 kΩ (1 to 10) kΩ (10 to 100) kΩ 100 kΩ to 1 MΩ (1 to 10) MΩ (10 to 100) MΩ	0.11 % + 0.05mΩ 21 μΩ/Ω 19 μΩ/Ω 13 μΩ/Ω 12 μΩ/Ω 13 μΩ/Ω 19 μΩ/Ω 80 μΩ/Ω 0.052 %	HP 3458A, Fluke 8508A
DC Voltage – Generate[3]	(0 to 220) mV 220 mV to 2.2 V (2.2 to 22) V (22 to 220) V 220 V to 1 kV (0 to 330) mV 330 mV to 3.3 V (3.3 to 33) V (33 to 330) V 330 V to 1 kV	9 μV/V + 1 μV 8 μV/V + 1.2 μV 8 μV/V + 8 μV 9 μV/V + 100 μV 11 μV/V + 600 μV 90 μV/V + 3 μV 61 μV/V + 5 μV 61 μV/V + 50 μV 70 μV/V + 500 μV 70 μV/V + 1.5 mV	Fluke 5700A Fluke 5522A
DC Voltage – Measure[3]	(0 to 0.1) V (0.1 to 1) V (1 to 10) V (10 to 100) V 100 V to 1 kV	9 μV/V + 10 μV 8 μV/V + 1 μV 8 μV/V + 0.5 μV 10 μV/V + 30 μV 10 μV/V + 100 μV	HP3458A Fluke 8508A
DC Current – Generate[3]	100 μA to 100 mA 100 mA to 1 A (1 to 2.2) A 10 A (2.2 to 10) A (0 to 3.3) mA (3.3 to 33) mA (33 to 330) mA 330 mA to 2.2 A (2.2 to 10) A	55 μA/A 55 μA/A 55 μA/A 55 μA/A 0.048 % 0.020 % + 0.05 μA 0.014 % + 0.25 μA 0.014 % + 3.3 μA 0.040 % + 44 μA 0.074 % + 330 μA	Fluke 5700A & 5725A Fluke 5522A

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
DC Current – Measure[3]	100 µA to 100 mA 100 mA to 1 A (1 to 10)	40 µA/A 40 µA/A 40 µA/A	Guildline 9211A, HP3458A
	100 µA to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1A	150 µA/A 150 µA/A 200 µA/A 0.050 %	 HP3458A Fluke 8508A
	(1 to 2) A (2 to 10) A 10 A	0.038 % 0.12 % 0.085 %	Fluke 8508A
AC Voltage – Generate[3]			
100 mV to 1 kV	1 kHz	0.011 % + 10 µV	Fluke 5700A & 5725A
100 mV to 1 V	40 Hz to 1 kHz	0.022 % + 8 µV	
(1 to 10) V	40 Hz to 1 kHz (1 to 50) kHz (50 to 100) kHz (100 to 500) kHz 500 kHz to 1 MHz	0.012 % + 60 µV 0.018 % + 160 µV 0.033 % + 350 µV 0.19 % + 4.3 mV 0.38 % + 8.5 mV	
(10 to 100) V	40 Hz to 20 kHz	0.010 % + 0.8 mV	
(100 to 1000) V	40 Hz to 20 kHz	0.020 % + 6 mV	
1 V	(10 to 40) Hz 40 Hz to 100 kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.060 % + 100 µV 0.030 % + 80 µV 0.050 % + 150 µV 0.12 % + 400 µV 0.23 % + 1 mV	

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
AC Voltage – Generate[3] (cont)			
(100 to 330) mV	1 kHz	0.070 % + 20 µV	Fluke 5522A
(0.33 to 3.3) V	1 kHz	0.040 % + 60 µV	
(3.3 to 33) V	1 kHz	0.052 % + 600 µV	
(33 to 330) V	1 kHz	0.061 % + 6.6 mV	
(330 to 1000) V	1 kHz	0.070 % + 80 mV	
1 V	(10 to 45) Hz	0.21 % + 250 µV	
	45 Hz to 10 kHz	0.043 % + 60 µV	
	(10 to 20) kHz	0.10 % + 60 µV	
	(20 to 50) kHz	0.20 % + 300 µV	
	(50 to 100) kHz	0.50 % + 1.7 mV	
	(100 to 500) kHz	1.0 % + 3.3 mV	
AC Voltage – Measure[3]			
(100 to 600) mV	40 Hz to 20 kHz	0.020 % + 2 µV	Fluke 5790A
600 mV to 1 kV	40 Hz to 20 kHz	0.013 % + 2 µV	Rohde & Schwarz URE3
(1 to 10) V	(10 to 40) Hz	0.035 %	
	(20 to 100) kHz	0.022 %	
	100 kHz to 1 MHz	0.25 %	
AC Current – Generate[3]			
60 mA to 2.2 A	50 Hz, 60 Hz	0.090 % + 100 nA	Fluke 5700A & 5725A
(2.2 to 10) A	50 Hz, 60 Hz	0.10 % + 200 µA	
(60 to 330) mA	50 Hz, 60 Hz	0.12 % + 30 µA	Fluke 5522A
(0.33 to 2.2) A	50 Hz, 60 Hz	0.14 % + 300 µA	
(2.2 to 10) A	50 Hz, 60 Hz	0.10 % + 2000 µA	

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
AC Current – Measure[3]			
60 mA to 10 A	50 Hz, 60 Hz	0.020 %	Fluke5790A, L&N 4385
1 mA	50 Hz, 60 Hz	0.16 %	HP3458A
10 mA	50 Hz, 60 Hz	0.14 %	Fluke 8508A
100 mA	50 Hz, 60 Hz	0.14 %	
1 A	50 Hz, 60 Hz	0.17 %	
(1 to 10) mA	50 Hz, 60 Hz	0.50 %	
(10 to 100) mA	50 Hz, 60 Hz	0.50 %	
100 mA to 1 A	50 Hz, 60 Hz	0.50 %	
(1 to 2) A	50 Hz, 60 Hz	0.17 %	Fluke 8508A
10 A	50 Hz, 60 Hz	0.21 %	
(2 to 10) A	50 Hz, 60 Hz	0.37 %	
AC Power – Generate[3]			
(50 to 2000) W 100 V,75V (0.5 to 20) A PF: 1	50 Hz, 60 Hz Single Phase	0.10 %	Fluke 5522A Yokogawa 2885 Agilent 3458A

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
AC Resistance – Measure[3] Impedance			
100 Ω	1 kHz 10 kHz, 100 kHz 1 MHz	0.06 % 0.09 % 0.19 %	HP 4284A
1 kΩ	1 kHz, 10 kHz 100 kHz 1 MHz	0.06 % 0.09 % 0.19 %	
10 kΩ	1 kHz,10 kHz 100 kHz 1 MHz	0.06 % 0.09 % 0.21 %	
100 kΩ	1 kHz,10 kHz 100 kHz 1 MHz	0.08 % 0.08 % 0.36 %	
Capacitance – Measure[3]			
1 pF	1 kHz 10 kHz 100 kHz 1 MHz	28 % 3.0 % 0.65 % 0.67 %	HP 4284A
10 pF	1 kHz 10 kHz 100 kHz 1 MHz	3.0 % 0.50 % 0.41 % 0.42 %	
100 pF	1 kHz 10 kHz 100 kHz 1 MHz	0.49 % 0.18 % 0.16 % 0.19 %	
1000 pF	1 kHz 10 kHz 100 kHz 1 MHz	0.16 % 0.14 % 0.17 % 0.27 %	
0.01 µF	120 Hz 1 kHz 10 kHz	0.16 % 0.14 % 0.14 %	

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
Capacitance – Measure[3] (cont)			
0.1 µF	120 Hz 1 kHz 10 kHz	0.14 % 0.14 % 0.17 %	HP 4284A
1 µF	120 Hz 1 kHz 10 kHz	0.13 % 0.14 % 0.18 %	
Inductance – Measure[3]			
100 µH	1 kHz	0.53 %	HP 4284A
1 mH	1 kHz	0.25 %	
10 mH	1 kHz	0.14 %	
100 mH	1 kHz	0.14 %	
1000 mH	1 kHz	0.14 %	
Distortion – Generate[3]			
-20、-30、-40、-50、-60 dB	1 kHz	0.62 dB	Shibasoku AC12B Shibasoku H3012 NF WF1946
-50 dB	20, 100, 400 Hz, 10, 20 kHz	0.62 dB	
Distortion – Measure[3]			
Up to 31.62 % Up to 3.162 % Up to 0.3162 % Up to 0.031 62 % Up to 0.003 162 %	20 Hz to 20 kHz	6.2 % 0.62 % 0.062 % 0.0062 % 0.000 62 %	Panasonic VP-7722A Panasonic VP-7725A

II. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
RF Power –Measure[3] (20 to -30) dBm	9 kHz to 18 GHz	0.20 dB + 0.08 dB	R&S URV55/NRV-Z51 R&S SMF100A Agilent 33250A

III. Time & Frequency

Parameter/Equipment	Range	CMC[2, 6, 7] (±)	Comments
Frequency – Measure & Measuring Equipment [3]	(0.2 to 5) Hz (5 to 500) Hz 500 Hz to 50 kHz (50 to 500) kHz 500 kHz to 5 MHz 5 MHz to 40 GHz	$(8.1 \times 10^{-4} \cdot F)$ Hz + 0.05 mHz $(5.2 \times 10^{-5} \cdot F)$ Hz + 0.05 mHz $(5.7 \times 10^{-7} \cdot F)$ Hz + 0.05 mHz $(9.5 \times 10^{-9} \cdot F)$ Hz + 0.5 mHz $(4.8 \times 10^{-9} \cdot F)$ Hz + 5 mHz $(5.9 \times 10^{-10} \cdot F + 0.05)$ Hz	Freqtime FT-Rb Quartzlock A10-B Agilent 53132A R&S SMF100A Agilent 33250A

[1] This laboratory offers commercial calibration service and field 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] Field calibration service is available for this calibration. Please note the actual measurement uncertainties achievable on a customer's site can normally be expected to be larger than the CMC found on the A2LA Scope. Allowance must be made for aspects such as the environment at the place of calibration and for other possible adverse effects such as those caused by transportation of the calibration equipment. The usual allowance for the actual uncertainty introduced by the item being calibrated, (e.g. resolution) must also be considered and this, on its own, could result in the actual measurement uncertainty achievable on a customer's site being larger than the CMC.

[4] In the statement of CMC, percentage represents a percent of reading unless otherwise noted.

[5] The measurands stated are generated using the indicated instrument (see Comments). This capability is suitable for the calibration of the devices intended to measure the measurand in the ranges indicated. CMCs are expressed as either a specific value that covers the full range or as a fraction of the reading plus a fixed floor specification.

[6] In the statement of CMC, F represents the frequency in Hz.

[7] The type of instrument or material being calibrated is defined by the parameter. This indicates the laboratory is capable of calibrating instruments that measure or generate the values in the ranges indicated for the listed measurement parameter.

[8] This scope meets A2LA's P112 *Flexible Scope Policy.*

Accredited Laboratory

A2LA has accredited

PANASONIC SNET CALIBRATION LABORATORY

Yokohama, Kanagawa, JAPAN

for technical competence in the field of

Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *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 April 2017*).

Presented this 16th day of March 2026.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 2941.01
Valid to March 31, 2028

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