



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

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CALIBRATION

Valid To: May 31, 2021

Certificate Number: 2127.03

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following Calibrations^{1,8}:

I. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2, 5, 7, 9} (±)	Comments
DC Voltage ³ – Measure	10 mV to 1000 V	0.008 % of reading + 0.004 % of range	DMM
Series Voltage Drop ³ – LISN or AMN	10 mV to 100 V	0.0099 % of reading + 0.004 % of range	CISPR 16-1-2, DMM
Series Voltage Drop ³ – LISN or AMN	(0 to 300) V	1.2 % + 3 digits	CISPR 16-1-2, clamp-on tester ⁴
DC Voltage ³ – PQT ³	1 mV to 80 V	3.6 %	Oscilloscope
Output Voltage	Up to 260 V DC	3.6 %	IEC/EN 61000-4-11 oscilloscope

Parameter/Equipment	Range	CMC ^{2, 5, 7} (±)	Comments
DC Voltage ³ – (cont)			
ESD Simulator ³	(0.07 to 148) A	3.3 %	IEC/EN 61000-4-2, ISO 10605, ISO 10605(2001), Oscilloscope using IEC ESD target
Current (1 to 30) kV, Contact Discharge			
Voltage Indication	(1 to 30) kV	0.28 %	IEC/EN 61000-4-2, high voltage meter
Voltage Indication, Contact Discharge	(1 to 30) kV	2.5 %	ISO 10605, ISO 10605(2001), Oscilloscope
EFT/Burst Generator ³ (50, 1 000) Ω Load	(0.1 to 5) kV	3.2 %	IEC/EN 61000-4-4, Oscilloscope
Surge Generator ³			
Open and Short Circuit			
Voltage	(0.001 to 8) kV	3.3 %	IEC/EN 61000-4-5, IEC/EN 61000-4-5 (2005), IEC/EN 610004-12 ANSI C62.41.2, ANSI C62.45 Oscilloscope
Current	(0.001 to 4) kA	3.3 %	IEC/EN 61000-4-5, IEC/EN 61000-4-5 (2005), IEC/EN 61000-4- 12, ANSI C62.41.2, ANSI C62.45 Oscilloscope

Parameter/Equipment	Range	CMC ^{2, 5, 7, 9} (±)	Comments
DC Voltage ³ (cont) – PQT ³ Inrush Current Transient Immunity ³ Surge Pulse and Load Dump Pulse Peak Amplitude Burst Pulse Peak Amplitude	(0.001 to 1) kA (1 to 1000) V	3.3 % 3.7 %	IEC/EN 61000-4-11, oscilloscope ISO 7637-2, ISO 7637-2 (2004), ISO 16750-2, oscilloscope
DC Current ³ – Measure	10 mA to 3.0 A (0 to 20) A	0.14 % of reading + 0.023 % of range 3.4 % + 3 digits	DMM Clamp-on tester ⁴
Resistance ³ – Measure	5 mΩ to 100 kΩ	0.017 % of reading + 0.005 % of range	DMM 4-wire measurement

Parameter/Range	Frequency	CMC ^{2, 5, 7, 9} (±)	Comments
AC Current ³ – Measure			
10 mA to 1.0 A	10 Hz to 5 kHz	0.12 % of reading + 0.05 % of range	DMM
(1.0 to 3.9) A	10 Hz to 5 kHz	0.18 % of reading + 0.07 % of range	
10 mA to 100 A	10 Hz to 5 kHz	3.3 %	Oscilloscope, current probe
(0.1 to 600) A	40 Hz to 1 kHz	2.4 % + 6 digit	IEC/EN61000-4-8 clamp-on tester

Parameter/Range	Frequency	CMC ^{2, 5, 7, 9} (±)	Comments
AC Voltage ³ – Measure			
100.0000 mV (Measure 0.000 01 mV to 1000.000 mV)	10 Hz to 20 kHz	0.08 % of reading + 0.05 % of range	DMM
	(20 to 50) kHz	0.15 % of reading + 0.06 % of range	
	(50 to 100) kHz	0.7 % of reading + 0.09 % of range	
(1.000 000 to 750.000) V	10 Hz to 20 kHz	0.08 % of reading + 0.04 % of range	DMM
	(20 to 50) kHz	0.15 % of reading + 0.06 % of range	
	(50 to 100) kHz	0.7 % of reading + 0.09 % of range	
(1 to 100) V	10 Hz to 100 kHz	3.3 %	Oscilloscope, HV differential probe
PQT ³			
Output Voltage	Up to 260 V (50 to 60) Hz	3.6 %	IEC/EN 61000-4-11, oscilloscope
Series Voltage Drop ³ – LISN or AMN	(0 to 300) V	1.8 % + 6 digits	CISPR 16-1-2, clamp-on tester ⁴

II. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC ^{2, 4, 5, 7, 9} (\pm)	Comments
RF Power ³ – Measure			
(-45 to 40) dBm	9 kHz to 3 GHz	0.6 dB	Power meter
Harmonics ³	9 kHz to 18 GHz	1.1 dB	Spectrum analyzer
Amplitude Modulation ³ – (0 to 100 %)	50 Hz to 100 kHz	1.2 dB	Spectrum analyzer
	50 Hz to 100 kHz	3.5 %	Oscilloscope
RF Insertion Loss ³ –			
Attenuators, RF Cables	5 Hz to 9 kHz 9 kHz to 10 MHz 10 MHz to 2 GHz (2 to 8) GHz (8 to 20) GHz	0.1 dB 0.066 dB 0.058 dB 0.064 dB 0.088 dB	Network analyzer with calibration kit
ESD Target (Insertion Loss)	5 Hz to 6 GHz	0.21 dB	IEC 61000-4-2ISO 10605, Network analyzer with calibration kit
Adapter (Insertion Loss)	5 Hz to 6 GHz	0.22 dB	
Adapter (Return Loss)	5 Hz to 6 GHz	0.22 dB	
Directional Couplers	9 kHz to 10 MHz 10 MHz to 2 GHz (2 to 20) GHz	0.06 dB 0.04 dB 0.09 dB	Network analyzer with calibration kit
CDNs	9 kHz to 300 MHz	0.27 dB + <i>M</i>	CISPR 16-1-2, IEC/EN 61000-4-6, Network analyzer with calibration kit
CDNs (Voltage Division Factor and Isolation)	9 kHz to 300 MHz	0.27 dB + <i>M</i>	Network analyzer with calibration kit
(150 to 50) Ω Adapters 50 Ω Adapters	9 kHz to 300 MHz	0.27 dB + <i>M</i>	IEC/EN 61000-4-6, network analyzer with calibration kit

Parameter/Range	Frequency	CMC ^{2, 4, 7} (\pm)	Comments
RF Insertion Loss ³ (cont) –			
Current / Injection - Clamp (Probes), (Transfer Impedance) Calibration Fixture (Insertion loss)	5 Hz to 3 GHz	0.24 dB	IEC/EN 61000-4-6, ISO11452-4, network analyzer with calibration kit
EM Clamps (Impedance)	9 kHz to 1 GHz	4.4 Ω	Based on: IEC/EN 61000-4-6, network analyzer with calibration kit
(Coupling Factor)	9 kHz to 1 GHz	0.27 dB	
(Decoupling Factor)	9 kHz to 1 GHz	0.27 dB	
Decoupling Clamps (Impedance)	9 kHz to 1 GHz	4.6 Ω	IEC/EN 61000-4-6, network analyzer with calibration kit
(Decoupling Factor)	9 kHz to 1 GHz	0.27 dB	
LISN, AN, AMN (Voltage Division Factor, Insertion Loss)	9 kHz to 1 GHz	0.12 dB + <i>M</i>	Based on: ANSI C63.4, CISPR 16-1-2, network analyzer with calibration kit
LISN, AN, AMN (Isolation)	9 kHz to 1 GHz	0.17 dB + <i>M</i>	Based on: ANSI C63.4, CISPR 16-1-2, network analyzer with calibration kit
CDNE (Voltage Division Factor)	9 kHz to 300 MHz	0.28 dB + <i>M</i>	CISPR 16-1-2, network analyzer with calibration kit
CDNE (Insertion Loss, Isolation)	9 kHz to 300 MHz	0.27 dB + <i>M</i>	CISPR 15 / EN55015, CISPR16-1-2, network analyzer with calibration kit
ISNs (Voltage Division Factor and Isolation)	9 kHz to 250 MHz	0.61 dB + <i>M</i>	CISPR 32 / EN55032, CISPR16-1-2, network analyzer with calibration kit
ISNs (Transmission and Cross Talk)	9 kHz to 250 MHz	0.61 dB + <i>M</i>	CISPR 32 / EN55032, CISPR 16-1-2, network analyzer with calibration kit

Parameter/Range	Frequency	CMC ^{2, 4, 7} (\pm)	Comments
RF Insertion Loss ³ (cont) – ISNs (LCL)	9 kHz to 30 MHz	0.11 dB + <i>M</i>	CISPR 32 / EN55032, CISPR 16-1-2, Network analyzer with calibration kit
Amplifiers (Gain)	9 kHz to 20 GHz	0.06 dB	
Capacitive Voltage Probe	9 kHz to 100 MHz	0.23 dB	
Impedance ³ – LISN, AN, AMN	9 kHz to 1 GHz	0.8 Ω	Based on: ANSI C63.4, CISPR 16-1-2, ISO 7637-2, CISPR 25, ISO 11452-2/-4 network analyzer with calibration kit
CDNs	9 kHz to 300 MHz	0.8 Ω	Based on IEC/EN 61000-4- 6, network analyzer with calibration kit
CDNE (Asymmetrical) (Symmetrical)	9 kHz to 300 MHz	0.8 Ω 3.9 Ω	CISPR 15 / EN55015, CISPR16-1-2, network analyzer with calibration kit
ISN	9 kHz to 230 MHz	1.1 Ω	CISPR 32 / EN55032, CISPR 16-1-2, network analyzer with calibration kit
Terminators	9 kHz to 10 MHz 10 MHz to 20 GHz	0.13 Ω 0.09 Ω	Network analyzer with calibration kit
Impedance Phase Angle ³ – LISN, AN, AMN	9 kHz to 1 GHz	1.1°	Based on: CISPR 16-1-2, network analyzer with calibration kit
ISN	9 kHz to 230 MHz	1.3°	CISPR 32 / EN55032, CISPR 16-1-2, network analyzer with calibration kit
CDNE	9 kHz to 300 MHz	1.3°	CISPR 15 / EN55015, CISPR16-1-2, network analyzer with calibration kit

Parameter/Range	Frequency	CMC ^{2, 4, 6, 7, 9} (\pm)	Comments
Reflection S_{11}/S_{22} , Magnitude and Phase – (VSWR) Measure ³ (0 to 0.2) lin (0.2 to 0.4) lin (0.4 to 0.6) lin (0.6 to 0.8) lin (0.8 to 1) lin (0 to 0.03) lin (0.03 to 0.04) lin (0.04 to 0.05) lin (0.05 to 0.08) lin (0.08 to 0.09) lin (0.09 to 0.1) lin (0.1 to 0.11) lin (0.11 to 0.12) lin (0.12 to 0.13) lin (0.13 to 0.15) lin (0.14 to 0.15) lin (0.15 to 0.17) lin (0.17 to 0.18) lin (0.18 to 0.19) lin (0.19 to 0.2) lin (0.2 to 0.3) lin (0.3 to 0.4) lin (0.4 to 0.46) lin (0.46 to 1) lin	5 Hz to 9 kHz	(0.0041 to 0.0068) lin (0.0068 to 0.0098) lin (0.0098 to 0.013) lin (0.013 to 0.018) lin (0.018 to 0.022) lin (180 to 8.7) deg (8.7 to 6.7) deg (6.7 to 5.5) deg (5.5 to 3.7) deg (3.7 to 3.4) deg (3.4 to 3.1) deg (3.1 to 2.9) deg (2.9 to 2.7) deg (2.7 to 2.6) deg (2.6 to 2.5) deg (2.5 to 2.3) deg (2.3 to 2.2) deg (2.2 to 2.1) deg (2.1 to 2.0) deg (2.0 to 1.9) deg (1.9 to 1.6) deg (1.6 to 1.4) deg (1.4 to 1.3) deg 1.3 deg	Network analyzer with calibration kit, one port device

Parameter/Range	Frequency	CMC ^{2, 4, 6, 7, 9} (\pm)	Comments
Reflection S_{11}/S_{22} , Magnitude and Phase – (VSWR) Measure ³ (cont)			
(0 to 0.2) lin (0.2 to 0.4) lin (0.4 to 0.6) lin (0.6 to 0.8) lin (0.8 to 1) lin (0 to 0.01) lin (0.01 to 0.1) lin (0.1 to 0.15) lin (0.15 to 0.17) lin (0.17 to 0.18) lin (0.18 to 0.2) lin (0.2 to 0.25) lin (0.25 to 0.3) lin (0.3 to 0.4) lin (0.4 to 0.5) lin (0.5 to 0.6) lin (0.6 to 0.9) lin (0.9 to 1) lin	9 kHz to 10 MHz	(0.0041 to 0.0059) lin (0.0059 to 0.0081) lin (0.0081 to 0.011) lin (0.011 to 0.015) lin (0.015 to 0.019) lin (180 to 25) deg (25 to 2.8) deg (2.8 to 2.1) deg (2.1 to 1.9) deg (1.9 to 1.8) deg (1.8 to 1.7) deg (1.7 to 1.5) deg (1.5 to 1.3) deg (1.3 to 1.2) deg (1.2 to 1.1) deg (1.1 to 1.0) deg (1.0 to 1.1) deg 1.1 deg	Network analyzer with calibration kit, one port device
(0 to 0.2) lin (0.2 to 0.4) lin (0.4 to 0.6) lin (0.6 to 0.8) lin (0.8 to 1) lin (0 to 0.01) lin (0.01 to 0.1) lin (0.1 to 0.15) lin (0.15 to 0.17) lin (0.17 to 0.18) lin (0.18 to 0.2) lin (0.2 to 0.25) lin (0.25 to 0.3) lin (0.3 to 0.4) lin (0.4 to 0.5) lin (0.5 to 0.6) lin (0.6 to 0.9) lin (0.9 to 1) lin	(10 to 500) MHz	(0.0052 to 0.0075) lin (0.0075 to 0.011) lin (0.011 to 0.014) lin (0.014 to 0.018) lin (0.018 to 0.023) lin (180 to 32) deg (32 to 3.6) deg (3.6 to 2.6) deg (2.6 to 2.4) deg (2.4 to 2.3) deg (2.3 to 2.2) deg (2.2 to 1.9) deg (1.9 to 1.7) deg (1.7 to 1.5) deg (1.5 to 1.4) deg (1.4 to 1.3) deg 1.3 deg 1.3 deg	

Parameter/Range	Frequency	CMC ^{2, 4, 6, 7, 9} (\pm)	Comments
Reflection S_{11}/S_{22} , Magnitude and Phase – (VSWR) Measure ³ (cont)			
(0 to 0.2) lin (0.2 to 0.4) lin (0.4 to 0.6) lin (0.6 to 0.8) lin (0.8 to 1) lin (0 to 0.01) lin (0.01 to 0.1) lin (0.1 to 0.15) lin (0.15 to 0.17) lin (0.17 to 0.18) lin (0.18 to 0.2) lin (0.2 to 0.25) lin (0.25 to 0.3) lin (0.3 to 0.4) lin (0.4 to 0.5) lin (0.5 to 0.6) lin (0.6 to 0.9) lin (0.9 to 1) lin	500 MHz to 2 GHz	(0.0017 to 0.0033) lin (0.0033 to 0.0050) lin (0.0050 to 0.0070) lin (0.0070 to 0.0091) lin (0.0091 to 0.011) lin (180 to 11) deg (11 to 1.5) deg (1.5 to 1.2) deg (1.2 to 1.1) deg 1.1 deg (1.1 to 1.0) deg (1.0 to 0.9) deg 0.9 deg (0.9 to 0.8) deg 0.8 deg (0.8 to 0.7) deg 0.7 deg 0.7 deg	Network analyzer with calibration kit, one port device
(0 to 0.2) lin (0.2 to 0.4) lin (0.4 to 0.6) lin (0.6 to 0.8) lin (0.8 to 1) lin (0 to 0.01) lin (0.01 to 0.1) lin (0.1 to 0.15) lin (0.15 to 0.17) lin (0.17 to 0.18) lin (0.18 to 0.2) lin (0.2 to 0.25) lin (0.25 to 0.3) lin (0.3 to 0.4) lin (0.4 to 0.5) lin (0.5 to 0.6) lin (0.6 to 0.9) lin (0.9 to 1) lin	(2 to 8) GHz	(0.0023 to 0.0043) lin (0.0043 to 0.0066) lin (0.0066 to 0.0091) lin (0.0091 to 0.012) lin (0.012 to 0.015) lin (180 to 14) deg (14 to 2.2) deg (2.2 to 1.7) deg (1.7 to 1.6) deg (1.6 to 1.5) deg (1.5 to 1.4) deg (1.4 to 1.3) deg (1.3 to 1.2) deg (1.2 to 1.1) deg (1.1 to 1.0) deg (1.0 to 0.9) deg 0.9 deg 0.9 deg	
(0 to 0.2) lin (0.2 to 0.4) lin (0.4 to 0.6) lin (0.6 to 0.8) lin (0.8 to 1) lin	(8 to 20) GHz	(0.0046 to 0.0070) lin (0.0070 to 0.0097) lin (0.0097 to 0.013) lin (0.013 to 0.017) lin (0.017 to 0.02) lin	

Parameter/Range	Frequency	CMC ^{2, 4, 6, 7, 9} (\pm)	Comments
Reflection S_{11}/S_{22} , Magnitude and Phase – (VSWR) Measure ³ (cont)	(8 to 20) GHz	(180 to 29) deg (29 to 4.0) deg (4.0 to 3.1) deg (3.1 to 2.9) deg (2.9 to 2.8) deg (2.8 to 2.6) deg (2.6 to 2.2) deg (2.2 to 1.9) deg (1.9 to 1.8) deg (1.1 to 1.0) deg (1.8 to 1.6) deg (1.6 to 1.3) deg (1.3 to 1.1) deg	Network analyzer with calibration kit, one port device
Transmission S_{11}/S_{22} , Magnitude and Phase – Measure ³	5 Hz to 9 kHz (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB (-50 to -60) dB (-60 to -70) dB (-70 to -80) dB	(0.12 to 0.083) dB (0.77 to 0.55) deg (0.083 to 0.099) dB (0.55 to 0.65) deg (0.099 to 0.11) dB (0.65 to 0.75) deg (0.11 to 0.13) dB (0.75 to 0.85) deg (0.13 to 0.15) dB (0.85 to 0.98) deg (0.15 to 0.18) dB (0.98 to 1.2) deg (0.18 to 0.24) dB (1.2 to 1.6) deg (0.24 to 0.40) dB (1.6 to 3.2) deg (0.40 to 1.2) dB (3.2 to 8.3) deg	Network analyzer with calibration kit Non-reflecting device

Parameter/Frequency	Range	CMC ^{2, 6, 7, 9} (\pm)	Comments
Transmission S_{12}/S_{21} , Magnitude and Phase – Measure ³ (cont)			
5 Hz to 9 kHz	(-80 to -90) dB	(1.2 to 3.0) dB (8.3 to 25) deg	Non-reflecting device
9 kHz to 10 MHz	(10 to 0) dB	(0.064 to 0.047) dB (0.45 to 0.31) deg	Network analyzer with calibration kit
	(0 to -10) dB	(0.047 to 0.057) dB (0.31 to 0.37) deg	Network analyzer with calibration kit
	(-10 to -20) dB	(0.057 to 0.067) dB (0.37 to 0.44) deg	Non-reflecting device
	(-20 to -30) dB	(0.067 to 0.089) dB (0.44 to 0.59) deg	
	(-30 to -40) dB	(0.089 to 0.12) dB (0.59 to 0.79) deg	
	(-40 to -50) dB	(0.12 to 0.19) dB (0.79 to 1.3) deg	
	(-50 to -60) dB	(0.19 to 0.43) dB (1.3 to 2.9) deg	
	(-60 to -70) dB	(0.43 to 1.2) dB (2.9 to 8.4) deg	
	(-70 to -80) dB	(1.2 to 3.3) dB (8.4 to 27) deg	
	(-80 to -90) dB	(3.3 to 7.7) dB (27 to 180) deg	

Parameter/Frequency	Range	CMC ^{2, 6, 7, 9} (\pm)	Comments
Transmission S_{12}/S_{21} Magnitude and Phase – Measure ³ (cont) (10 to 500) MHz	(10 to 0) dB	(0.046 to 0.037) dB (0.31 to 0.25) deg	Network analyzer with calibration kit
	(0 to -10) dB	(0.037 to 0.046) dB (0.25 to 0.30) deg	Network analyzer with calibration kit
	(-10 to -20) dB	(0.046 to 0.059) dB (0.30 to 0.38) deg	Non-reflecting device
	(-20 to -30) dB	(0.059 to 0.074) dB (0.38 to 0.49) deg	
	(-30 to -40) dB	(0.074 to 0.14) dB (0.49 to 0.88) deg	
	(-40 to -50) dB	(0.14 to 0.25) dB (0.88 to 1.67) deg	
	(-50 to -60) dB	(0.25 to 0.52) dB (1.7 to 3.6) deg	
	(-60 to -70) dB	(0.52 to 1.3) dB (3.6 to 9.1) deg	
	(-70 to -80) dB	(1.3 to 3.3) dB (9.1 to 27) deg	
	(-80 to -90) dB	(3.3 to 7.5) dB (27 to 180) deg	

Parameter/Frequency	Range	CMC ^{2, 6, 7, 9} (\pm)	Comments
Transmission S_{12}/S_{21} Magnitude and Phase – Measure ³ (cont)	500 MHz to 2 GHz		
	(10 to 0) dB	(0.13 to 0.030) dB (1.7 to 0.20) deg	Network analyzer with calibration kit
	(0 to -10) dB	(0.030 to 0.046) dB (0.20 to 0.38) deg	Network analyzer with calibration kit
	(-10 to -20) dB	(0.046 to 0.054) dB (0.38 to 0.46) deg	Non-reflecting device
	(-20 to -30) dB	(0.054 to 0.064) dB (0.46 to 0.52) deg	
	(-30 to -40) dB	(0.064 to 0.075) dB (0.52 to 0.60) deg	
	(-40 to -50) dB	(0.075 to 0.091) dB (0.60 to 0.71) deg	
	(-50 to -60) dB	(0.091 to 0.15) dB (0.71 to 1.07) deg	
	(-60 to -70) dB	(0.15 to 0.26) dB (1.1 to 1.9) deg	
	(-70 to -80) dB	(0.26 to 0.52) dB (1.9 to 3.7) deg	
	(-80 to -90) dB	(0.52 to 1.3) dB (3.7 to 8.9) deg	

Parameter/Frequency	Range	CMC ^{2, 6, 7, 9} (\pm)	Comments
Transmission S_{12}/S_{21} Magnitude and Phase – Measure ³ (cont)	(2 to 8) GHz		
	(10 to 0) dB	(0.16 to 0.044) dB (3.6 to 0.29) deg	Network analyzer with calibration kit
	(0 to -10) dB	(0.044 to 0.059) dB (0.29 to 0.62) deg	Network analyzer with calibration kit
	(-10 to -20) dB	(0.059 to 0.069) dB (0.62 to 0.71) deg	Non-reflecting device
	(-20 to -30) dB	(0.069 to 0.078) dB (0.71 to 0.78) deg	
	(-30 to -40) dB	(0.078 to 0.089) dB (0.78 to 0.85) deg	
	(-40 to -50) dB	(0.089 to 0.11) dB (0.85 to 0.71) deg	
	(-50 to -60) dB	(0.11 to 0.15) dB (0.71 to 0.94) deg	
	(-60 to -70) dB	(0.15 to 0.23) dB (0.94 to 1.8) deg	
	(-70 to -80) dB	(0.23 to 0.43) dB (1.9 to 3.2) deg	
	(-80 to -90) dB	(0.43 to 0.97) dB (3.2 to 7.1) deg	

Parameter/Frequency	Range	CMC ^{2, 6, 7, 9} (\pm)	Comments
Transmission S_{12}/S_{21} Magnitude and Phase – Measure ³ (cont)			
(8 to 20) GHz	(10 to 0) dB	(0.24 to 0.065) dB (8.7 to 0.43) deg	Network analyzer with calibration kit
	(0 to -10) dB	(0.065 to 0.083) dB (0.43 to 1.2) deg	Non-reflecting device
	(-10 to -20) dB	(0.083 to 0.093) dB (1.2 to 1.3) deg	
	(-20 to -30) dB	(0.093 to 0.11) dB (1.3 to 1.4) deg	
	(-30 to -40) dB	(0.1 to 0.11) dB (1.4 to 1.4) deg	
	(-40 to -50) dB	(0.11 to 0.13) dB (1.4 to 1.5) deg	
	(-50 to -60) dB	(0.13 to 0.17) dB (1.5 to 1.8) deg	
	(-60 to -70) dB	(0.17 to 0.26) dB (1.8 to 2.5) deg	
	(-70 to -80) dB	(0.26 to 0.48) dB (2.5 to 3.9) deg	
	(-80 to -90) dB	(0.48 to 1.1) dB (3.9 to 8.0) deg	

III. Time & Frequency

Parameter/Equipment	Range	CMC ^{2, 5, 7} (\pm)	Comments
Time Interval & Frequency ³ –	0.5 ns to 60 s	3.5 %	Oscilloscope
ESD Simulator ³ , Contact Discharge, Rise Time, RC Time Constant	0.5 ns to 60 s	3.5 %	IEC/EN 61000-4-2, ISO 10605, ISO 10605 (2001), oscilloscope using IEC ESD target
EFT/Burst Generator ³ (50, 1000) Ω Load			
Rise Time	(2 to 7) ns	3.5 %	IEC/EN 61000-4-4, oscilloscope
Impulse Duration	(30 to 170) ns	3.6 %	IEC/EN 61000-4-4, oscilloscope
Burst Duration	(0.5 to 20) ms	3.5 %	IEC/EN 61000-4-4, oscilloscope
Burst Period	(200 to 400) ms	3.5 %	IEC/EN 61000-4-4, oscilloscope
Repetition Frequency	1 kHz to 1 MHz	3.5 %	IEC/EN 61000-4-4, oscilloscope
Surge Generator ³ Open and Short Circuit			
Front Time, Rise Time	(0.3 to 13) μ s	3.5 %	IEC/EN 61000-4-5, IEC/EN 61000-4-5 (2005), IEC/EN 610004-12 oscilloscope
Time to Half Value, Duration	(10 to 900) μ s	3.6 %	IEC/EN 61000-4-5, IEC/EN 61000-4-5 (2005), oscilloscope
Open Circuit Phase Shifting	(0 to 20) ms	3.6 %	IEC/EN 61000-4-5, IEC/EN 61000-4-5 (2005), IEC/EN 610004-12 oscilloscope

Parameter/Equipment	Range	CMC ^{2, 5, 7} (±)	Comments
Time Interval and Frequency ³ (cont) –			
Oscillation Frequency	(100 to 1000) kHz	3.5 %	IEC/EN 61000-4-12, oscilloscope
Voltage Transient Emission ³			
Switching Time	(200 to 400) ns	3.5 %	ISO 7637-2, ISO 7637-2 (2004), oscilloscope
Transient Immunity ³ Surge Pulse and Load Dump Pulse			
Rise Time	0.4 µs to 15 ms	3.5 %	ISO 7637-2, ISO 7637-2 (2004), ISO 16750-2, oscilloscope
Duration	0.1 µs to 700 ms	4 %	ISO 7637-2, ISO 7637-2 (2004), ISO 16750-2, oscilloscope
Transient Immunity ³ Burst Pulse			
Rise Time	(3 to 7) ns	3.7 %	ISO 7637-2, ISO 7637-2 (2004), oscilloscope
Duration	(30 to 200) ns	3.9 %	ISO 7637-2, ISO 7637-2 (2004), oscilloscope

Parameter/Equipment	Range	CMC ^{2, 5, 7, 9} (\pm)	Comments
Time Interval and Frequency ³ (cont) – PQT ³			
Phase Angle	(0 to 359)°	3.6 %	IEC/EN 61000-4-11, oscilloscope
Pulse Rise/Fall Time	(1 to 5) μ s	3.5 %	IEC/EN 61000-4-11, oscilloscope
Voltage Dropout Time	20 μ s to 200 ms	3.5 %	Oscilloscope
Repetition Time	1 ms to 5 s	3.5 %	Oscilloscope
Frequency ³ – Measure	(40 to 300) kHz	0.017 %	DMM
	40 Hz to 1 MHz	3.5 %	Oscilloscope, HV differential probe
	10 Hz to 3 GHz	0.9 Hz	Frequency counter
	9 kHz to 26.5 GHz	0.3 %	Spectrum analyzer

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 and this laboratory meets A2LA R104 – *General Requirements: Accreditation of Field Testing and Field Calibration Laboratories* for these Calibrations. 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, M is the Mismatch error. CMC does not include mismatch error due to connections of the device to other devices in actual use. Mismatch CMCs, due to the reflection coefficient of the device to be calibrated, are to be included in the overall CMC; the approach of determining expanded CMCs at approximately the 95% level of confidence, (using a coverage factor of $k = 2$) is to be applied for this calculation as well.

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

⁶ CMC for intermediate values of measurand can be found by interpolation.

⁷ The contributions from the existing device are not include in the CMC claim.

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

⁹ 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.

WITHDRAWN



Accredited Laboratory

A2LA has accredited

AMETEK CO., LTD. NAGOYA OFFICE

Nagoya-shi, Aichi-ken, 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 28th day of May 2019.

A blue ink signature of the Vice President of Accreditation Services.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 2127.03
Valid to May 31, 2021

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