SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

LAB. SUPPORT LTD.
4165-12 Meisei, Misato
Azumino-shi, Nagano-ken 399-8101 JAPAN
Takashi Maruyama Phone: +81-90-3093-5996
Email: takashi@anc-tv.ne.jp

CALIBRATION

Valid To: May 31, 2025 Certificate Number: 2127.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations[1, 11]:

I. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2, 7, 10, 12] (±)	Comments[8]
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, 7, 10, 12] (±)	Comments[8]
DC Voltage[3] – (cont)			
ESD Simulator[3]			IEC/EN 61000-4-2, ISO 10605, ISO 10605 (2001), oscilloscope using IEC ESD target
Current (1 to 30) kV, Contact Discharge	(0.07 to 148) A	3.3 %	
Voltage Indication Air Discharge	(1 to 30) kV	0.28 %	IEC/EN 61000-4-2, ISO 10605, ISO 10605(2001), high voltage meter
Voltage Indication, Air Discharge	(1 to 30) kV	2.5 %	IEC/EN 61000-4-2, ISO 10605, ISO 10605 (2001), oscilloscope
EFT/Burst Generator[3] (50, 1000) Ω Load	(0.1 to 5) kV	3.2 %	IEC/EN 61000-4-4, oscilloscope
Surge Generator[3]			
Open & Short Circuit			
Voltage	(0.001 to 8) kV	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
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, 7, 10, 12] (±)	Comments[8]
DC Voltage[3] (cont) –			
PQT[3]			
Inrush Current	(0.001 to 1) kA	3.3 %	IEC/EN 61000-4-11, oscilloscope
Transient Immunity[3] (Test Pulse Generator)			
Surge Pulse & Load Dump Pulse Peak Amplitude Burst Pulse Peak Amplitude	(1 to 1000) V	3.7 %	ISO 7637-2, ISO 7637-2 (2004), ISO 7637-3, ISO7637-3(2016) ISO 16750-2, oscilloscope
DC Current[3] – Measure	10 mA to 3.0 A	0.16 % of reading + 0.023 % of range	DMM
	(0 to 20) A	3.4 % + 3 digits	Clamp-on tester[4]
Resistance[3] – Measure	5 mΩ to 100 kΩ	0.017 % of reading + 0.005 % of range	DMM (4-wire measurement)
AC Current[3] – Measure			
10 mA to 1.0 A	10 Hz to 5 kHz	0.17 % of reading + 0.05 % of range	DMM
(1.0 to 3.9) A	10 Hz to 5 kHz	0.25 % of reading + 0.07 % of range	
(0.1 to 600) A	10 Hz to 2 kHz	2.4 % + 6 digit	IEC/EN61000-4-8 clamp-on tester[4]

Parameter/Range	Frequency	CMC[2, 7, 10, 12] (±)	Comments[8]
AC Voltage[3] – Measure			
100.0000 mV	10 Hz to 20 kHz	0.08 % of reading + 0.05 % of range	DMM
(0.000 01 to 1000.000) mV	(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 + 0.03 % of range	
	(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 400 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]

Parameter/Equipment	Range	CMC[2, 7, 10, 12] (±)	Comments
Oscilloscope[3] –			
Amplitude - DC Signal 50 Ω Load 1 MΩ Load	 1 mV to 5 V 1 mV to 25 V	 0.49 % 0.026 %	Signal generator, DMM & power sensor, power meter
Frequency	0.1 Hz to 120 MHz 120 MHz to 6 GHz	1.9 µHz 7 Hz	
Bandwidth	9 kHz to 6 GHz	0.2 dB	
Trigger sensitivity	1 mV to 25 V	8.4 %	

II. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC[2, 9, 10, 12] (±)	Comments
Reflection S_{11}/S_{22}, Magnitude & Phase (VSWR)[3] – Measure			
(0 to 0.2) lin	5 Hz to 9 kHz	(0.0041 to 0.0068) lin	Network analyzer with calibration kit one port device
(0.2 to 0.4) lin		(0.0068 to 0.0098) lin	
(0.4 to 0.6) lin		(0.0098 to 0.013) lin	
(0.6 to 0.8) lin		(0.013 to 0.018) lin	
(0.8 to 1) lin		(0.018 to 0.023) lin	
(0 to 0.03) lin		(180 to 8.7) deg	
(0.03 to 0.04) lin		(8.7 to 6.7) deg	
(0.04 to 0.05) lin		(6.7 to 5.5) deg	
(0.05 to 0.08) lin		(5.5 to 3.7) deg	
(0.08 to 0.09) lin		(3.7 to 3.4) deg	
(0.09 to 0.1) lin		(3.4 to 3.1) deg	
(0.1 to 0.11) lin		(3.1 to 2.9) deg	
(0.11 to 0.12) lin		(2.9 to 2.7) deg	
(0.12 to 0.13) lin		(2.7 to 2.6) deg	
(0.13 to 0.15) lin		(2.6 to 2.5) deg	
(0.14 to 0.15) lin		(2.5 to 2.3) deg	
(0.15 to 0.17) lin		(2.3 to 2.2) deg	
(0.17 to 0.18) lin		(2.2 to 2.1) deg	
(0.18 to 0.19) lin		(2.1 to 2) deg	
(0.19 to 0.2) lin		(2 to 1.9) deg	
(0.2 to 0.3) lin		(1.9 to 1.6) deg	
(0.3 to 0.4) lin		(1.6 to 1.4) deg	
(0.4 to 0.46) lin		(1.4 to 1.3) deg	
(0.46 to 1) lin		1.3 deg	
(0 to 0.2) lin	9 kHz to 10 MHz	(0.0041 to 0.0059) lin	
(0.2 to 0.4) lin		(0.0059 to 0.0081) lin	
(0.4 to 0.6) lin		(0.0081 to 0.011) lin	
(0.6 to 0.8) lin		(0.011 to 0.015) lin	
(0.8 to 1) lin		(0.015 to 0.019) lin	

Parameter/Range	Frequency	CMC[2, 9, 10, 12] (±)	Comments
Reflection S_{11}/S_{22}, Magnitude & Phase (VSWR)[3] – Measure (cont)			
(0 to 0.01) lin	9 kHz to 10 MHz	(180 to 25) deg	Network analyzer with calibration kit one port device
(0.01 to 0.1) lin		(25 to 2.8) deg	
(0.1 to 0.15) lin		(2.8 to 2.1) deg	
(0.15 to 0.17) lin		(2.1 to 1.9) deg	
(0.17 to 0.18) lin		(1.9 to 1.8) deg	
(0.18 to 0.2) lin		(1.8 to 1.7) deg	
(0.2 to 0.25) lin		(1.7 to 1.5) deg	
(0.25 to 0.3) lin		(1.5 to 1.3) deg	
(0.3 to 0.4) lin		(1.3 to 1.2) deg	
(0.4 to 0.5) lin		(1.2 to 1.1) deg	
(0.5 to 0.6) lin		(1.1 to 1) deg	
(0.6 to 0.9) lin		(1 to 1.1) deg	
(0.9 to 1) lin		1.1 deg	
(0 to 0.2) lin		(0.0052 to 0.0075) lin	
(0.2 to 0.4) lin		(0.0075 to 0.01) lin	
(0.4 to 0.6) lin		(0.01 to 0.014) lin	
(0.6 to 0.8) lin		(0.014 to 0.018) lin	
(0.8 to 1) lin		(0.018 to 0.023) lin	
(0 to 0.01) lin	(10 to 500) MHz	(180 to 32) deg	
(0.01 to 0.1) lin		(32 to 3.6) deg	
(0.1 to 0.15) lin		(3.6 to 2.6) deg	
(0.15 to 0.17) lin		(2.6 to 2.4) deg	
(0.17 to 0.18) lin		(2.4 to 2.3) deg	
(0.18 to 0.2) lin		(2.3 to 2.2) deg	
(0.2 to 0.25) lin		(2.2 to 1.9) deg	
(0.25 to 0.3) lin		(1.9 to 1.7) deg	
(0.3 to 0.4) lin		(1.7 to 1.5) deg	
(0.4 to 0.5) lin		(1.5 to 1.4) deg	
(0.5 to 0.6) lin		(1.4 to 1.3) deg	
(0.6 to 0.9) lin		1.3 deg	
(0.9 to 1) lin		1.3 deg	

Parameter/Range	Frequency	CMC[2, 9, 10, 12] (±)	Comments
Reflection S_{11}/S_{22}, Magnitude & Phase (VSWR)[3] – Measure (cont)			
(0 to 0.2) lin	500 MHz to 2 GHz	(0.0017 to 0.0033) lin	Network analyzer with calibration kit one port device
(0.2 to 0.4) lin		(0.0033 to 0.005) lin	
(0.4 to 0.6) lin		(0.005 to 0.007) lin	
(0.6 to 0.8) lin		(0.007 to 0.0091) lin	
(0.8 to 1) lin		(0.0091 to 0.011) lin	
(0 to 0.01) lin		(180 to 10) deg	
(0.01 to 0.1) lin		(10 to 1.5) deg	
(0.1 to 0.15) lin		(1.5 to 1.2) deg	
(0.15 to 0.17) lin		(1.2 to 1.1) deg	
(0.17 to 0.18) lin		1.1 deg	
(0.18 to 0.2) lin		(1.1 to 1) deg	
(0.2 to 0.25) lin		(1 to 0.9) deg	
(0.25 to 0.3) lin		0.9 deg	
(0.3 to 0.4) lin		(0.9 to 0.8) deg	
(0.4 to 0.5) lin		0.8 deg	
(0.5 to 0.6) lin		(0.8 to 0.7) deg	
(0.6 to 0.9) lin		0.7 deg	
(0.9 to 1) lin		0.7 deg	
(0 to 0.2) lin	(2 to 8) GHz	(0.0023 to 0.0043) lin	
(0.2 to 0.4) lin		(0.0043 to 0.0066) lin	
(0.4 to 0.6) lin		(0.0066 to 0.0091) lin	
(0.6 to 0.8) lin		(0.0091 to 0.012) lin	
(0.8 to 1) lin		(0.012 to 0.015) lin	
(0 to 0.01) lin		(180 to 14) deg	
(0.01 to 0.1) lin		(14 to 2.2) deg	
(0.1 to 0.15) lin		(2.2 to 1.7) deg	
(0.15 to 0.17) lin		(1.7 to 1.6) deg	
(0.17 to 0.18) lin		(1.6 to 1.5) deg	
(0.18 to 0.2) lin		(1.5 to 1.4) deg	
(0.2 to 0.25) lin		(1.4 to 1.3) deg	
(0.25 to 0.3) lin		(1.3 to 1.2) deg	
(0.3 to 0.4) lin		(1.2 to 1.1) deg	
(0.4 to 0.5) lin		(1.1 to 1.0) deg	
(0.5 to 0.6) lin		(1 to 0.9) deg	
(0.6 to 0.9) lin		0.9 deg	
(0.9 to 1) lin		0.9 deg	

Parameter/Range	Frequency	CMC[2, 9, 10, 12] (±)	Comments
Reflection S_{11}/S_{22}, Magnitude & Phase (VSWR)[3] – Measure (cont)			
(0 to 0.2) lin	(8 to 20) GHz	(0.0046 to 0.007) lin	Network analyzer with calibration kit one port device
(0.2 to 0.4) lin		(0.007 to 0.0097) lin	
(0.4 to 0.6) lin		(0.0097 to 0.013) lin	
(0.6 to 0.8) lin		(0.013 to 0.016) lin	
(0.8 to 1) lin		(0.016 to 0.02) lin	
(0 to 0.01) lin		(180 to 29) deg	
(0.01 to 0.1) lin		(29 to 4.0) deg	
(0.1 to 0.15) lin		(4.0 to 3.1) deg	
(0.15 to 0.17) lin		(3.1 to 2.9) deg	
(0.17 to 0.18) lin		(2.9 to 2.8) deg	
(0.18 to 0.2) lin		(2.8 to 2.6) deg	
(0.2 to 0.25) lin		(2.6 to 2.2) deg	
(0.25 to 0.3) lin		(2.2 to 1.9) deg	
(0.3 to 0.4) lin		(1.9 to 1.8) deg	
(0.4 to 0.5) lin		(1.1 to 1.0) deg	
(0.5 to 0.6) lin		(1.8 to 1.6) deg	
(0.6 to 0.9) lin		(1.6 to 1.3) deg	
(0.9 to 1) lin		(1.3 to 1.1) deg	
(0 to 0.2) lin	(20 to 40)GHz	(0.011 to 0.014) lin	
(0.2 to 0.4) lin		(0.014 to 0.018) lin	
(0.4 to 0.6) lin		(0.018 to 0.024) lin	
(0.6 to 0.8) lin		(0.024 to 0.031) lin	
(0.8 to 1) lin		(0.031 to 0.39) lin	
(0 to 0.01) lin		180 deg	
(0.01 to 0.1) lin		(180 to 7.0) deg	
(0.1 to 0.15) lin		(7.0 to 4.9) deg	
(0.15 to 0.17) lin		(4.9 to 4.5) deg	
(0.17 to 0.18) lin		(4.5 to 4.3) deg	
(0.18 to 0.2) lin		(4.3 to 4.0) deg	
(0.2 to 0.25) lin		(4.0 to 3.4) deg	
(0.25 to 0.3) lin		(3.4 to 3.1) deg	
(0.3 to 0.4) lin		(3.1 to 2.6) deg	
(0.4 to 0.5) lin		(2.6 to 2.4) deg	
(0.5 to 0.6) lin		(2.4 to 2.3) deg	
(0.6 to 0.9) lin		(2.3 to 2.2) deg	
(0.9 to 1) lin		(2.2 to 2.3) deg	

Parameter/Equipment	Range	CMC[2, 9, 10, 12] (±)	Comments
Transmission S_{12}/S_{21}, Magnitude & Phase[3] – Measure			
5 Hz to 9 kHz	(10 to 0) dB	(0.12 to 0.083) dB (0.77 to 0.55) deg	Network analyzer with calibration kit non-reflecting device
	(0 to -10) dB	(0.083 to 0.099) dB (0.55 to 0.65) deg	
	(-10 to -20) dB	(0.099 to 0.11) dB (0.65 to 0.75) deg	
	(-20 to -30) dB	(0.11 to 0.13) dB (0.75 to 0.85) deg	
	(-30 to -40) dB	(0.13 to 0.15) dB (0.85 to 0.98) deg	
	(-40 to -50) dB	(0.15 to 0.18) dB (0.98 to 1.2) deg	
	(-50 to -60) dB	(0.18 to 0.24) dB (1.2 to 1.6) deg	
	(-60 to -70) dB	(0.24 to 0.4) dB (1.6 to 3.2) deg	
	(-70 to -80) dB	(0.4 to 1.2) dB (3.2 to 8.3) deg	
	(-80 to -90) dB	(1.2 to 3.1) dB (8.3 to 25) deg	

Parameter/Equipment	Range	CMC[2, 9, 10, 12] (±)	Comments
Transmission S_{12}/S_{21}, Magnitude & Phase[3] – Measure (cont)			
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 non-reflecting device
	(0 to -10) dB	(0.047 to 0.057) dB (0.31 to 0.37) deg	
	(-10 to -20) dB	(0.057 to 0.067) dB (0.37 to 0.44) deg	
	(-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 3.2) dB (8.4 to 27) deg	
	(-80 to -90) dB	(3.2 to 7.7) dB (27 to 180) deg	

Parameter/Equipment	Range	CMC[2, 9, 10, 12] (±)	Comments
Transmission S_{12}/S_{21}, Magnitude & Phase[3] – Measure (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 non-reflecting device
	(0 to -10) dB	(0.037 to 0.046) dB (0.25 to 0.30) deg	
	(-10 to -20) dB	(0.046 to 0.059) dB (0.30 to 0.38) deg	
	(-20 to -30) dB	(0.059 to 0.074) dB (0.38 to 0.49) deg	
	(-30 to -40) dB	(0.074 to 0.13) dB (0.49 to 0.88) deg	
	(-40 to -50) dB	(0.13 to 0.25) dB (0.88 to 1.7) 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 3.2) dB (9.1 to 27) deg	
	(-80 to -90) dB	(3.2 to 7.5) dB (27 to 180) deg	

Parameter/Equipment	Range	CMC[2, 9, 10, 12] (±)	Comments
Transmission S_{12}/S_{21}, Magnitude & Phase[3] – Measure (cont)			
500 MHz to 2 GHz	(10 to 0) dB	(0.12 to 0.03) dB (1.6 to 0.2) deg	Network analyzer with calibration kit non-reflecting device
	(0 to -10) dB	(0.03 to 0.046) dB (0.2 to 0.38) deg	
	(-10 to -20) dB	(0.046 to 0.054) dB (0.38 to 0.46) deg	
	(-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 0.6) deg	
	(-40 to -50) dB	(0.075 to 0.091) dB (0.6 to 0.71) deg	
	(-50 to -60) dB	(0.091 to 0.15) dB (0.71 to 1.1) deg	
	(-60 to -70) dB	(0.15 to 0.26) dB (1.1 to 1.8) deg	
	(-70 to -80) dB	(0.26 to 0.52) dB (1.8 to 3.6) deg	
	(-80 to -90) dB	(0.52 to 1.2) dB (3.6 to 8.8) deg	

Parameter/Equipment	Range	CMC[2, 9, 10, 12] (±)	Comments
Transmission S_{12}/S_{21}, Magnitude & Phase[3] – Measure (cont)			
(2 to 8) GHz	(10 to 0) dB	(0.16 to 0.044) dB (3.5 to 0.29) deg	Network analyzer with calibration kit non-reflecting device
	(0 to -10) dB	(0.044 to 0.059) dB (0.29 to 0.62) deg	
	(-10 to -20) dB	(0.059 to 0.069) dB (0.62 to 0.71) deg	
	(-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	(0.011 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 (1.8 to 3.2) deg	
	(-80 to -90) dB	(0.43 to 0.97) dB (3.2 to 7.0) deg	

Parameter/Equipment	Range	CMC[2, 9, 10, 12] (±)	Comments
Transmission S_{12}/S_{21}, Magnitude & Phase[3] – Measure (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 non-reflecting device
	(0 to -10) dB	(0.065 to 0.083) dB (0.43 to 1.2) deg	
	(-10 to -20) dB	(0.083 to 0.093) dB (1.1 to 1.3) deg	
	(-20 to -30) dB	(0.093 to 0.1) dB (1.3 to 1.3) deg	
	(-30 to -40) dB	(0.1 to 0.11) dB (1.3 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 2.4) deg	
	(-70 to -80) dB	(0.26 to 0.48) dB (2.4 to 3.9) deg	
	(-80 to -90) dB	(0.48 to 1.1) dB (3.9 to 8.0) deg	

Parameter/Equipment	Range	CMC[2, 9, 10, 12] (±)	Comments
Transmission S_{12}/S_{21}, Magnitude and Phase[3] – Measure (cont)			
(20 to 26.5) GHz	(10 to 0) dB	(0.14 to 0.13) dB (0.9 to 0.84) deg	Network analyzer with calibration kit non-reflecting device
	(0 to -10) dB	0.13 dB (0.84 to 0.89) deg	
	(-10 to -20) dB	(0.13 to 0.14) dB (0.89 to 0.95) deg	
	(-20 to -30) dB	(0.14 to 0.15) dB (0.95 to 1.02) deg	
	(-30 to -40) dB	(0.1 to 0.11) dB (1.02 to 1.1) deg	
	(-40 to -50) dB	(0.11 to 0.22) dB (1.1 to 1.5) deg	
	(-50 to -60) dB	(0.22 to 0.27) dB (1.5 to 1.8) deg	
	(-60 to -70) dB	(0.27 to 0.32) dB (1.8 to 2.1) deg	
	(-70 to -80) dB	(0.32 to 0.38) dB (2.1 to 2.6) deg	
	(-80 to -90) dB	(0.38 to 0.49) dB (2.6 to 3.3) deg	

Parameter/Equipment	Range	CMC[2, 9, 10, 12] (±)	Comments
Transmission S12/S21, Magnitude and Phase3 – Measure (cont)			
(26.5 to 40) GHz	(10 to 0) dB	(0.19 to 0.18) dB (1.3 to 1.2) deg	Network analyzer with calibration kit non-reflecting device
	(0 to -10) dB	(0.18 to 0.19) dB 1.2 deg	
	(-10 to -20) dB	(0.19 to 0.2) dB (1.2 to 1.3) deg	
	(-20 to -30) dB	(0.2 to 0.21) dB (1.3 to 1.4) deg	
	(-30 to -40) dB	(0.21 to 0.22) dB (1.4 to 1.5) deg	
	(-40 to -50) dB	(0.22 to 0.27) dB (1.5 to 1.8) deg	
	(-50 to -60) dB	(0.27 to 0.32) dB (1.8 to 2.2) deg	
	(-60 to -70) dB	(0.32 to 0.37) dB (2.2 to 2.5) deg	
	(-70 to -80) dB	(0.37 to 0.43) dB (2.5 to 2.9) deg	
	(-80 to -90) dB	(0.43 to 0.59) dB (2.9 to 4.1) deg	

Parameter/Equipment	Frequency	CMC[2, 7, 10, 12] (±)	Comments[8]
RF Insertion Loss or Gain[3] –			
LISN, AN, AMN (Voltage Division Factor, Insertion Loss)	9 kHz to 1 GHz	0.12 dB + *M*	Based on ANSI C63.4, CISPR 16-1-2, Network analyzer with calibration kit[5]
LISN, AN, AMN (Isolation)	9 kHz to 1 GHz	0.13 dB + *M*	Based on ANSI C63.4, CISPR 16-1-2, Network analyzer with calibration kit[5]
ESD Target (Insertion Loss) Adapter Lines (Insertion Loss) Adapter Lines (Return Loss)	5 Hz to 6 GHz 5 Hz to 6 GHz 5 Hz to 6 GHz	0.3 dB 0.31 dB 0.31 dB	Based on IEC 61000-4-2, ISO 10605, Network analyzer with calibration kit
CDNs (Voltage Division Factor & Isolation)	9 kHz to 300 MHz	0.27 dB + *M*	IEC 61000-4-6, Network analyzer with calibration kit[5]
(150 to 50) Ω Adapters, 50 Ω Adapters	9 kHz to 1 GHz	0.27 dB + *M*	IEC 61000-4-6, Network analyzer with calibration kit[5]
EM Clamps: Impedance Coupling Factor Decoupling Factor	 9 kHz to 1 GHz 9 kHz to 1 GHz 9 kHz to 1 GHz	 4.4 Ω 0.27 dB 0.27 dB	Based on: IEC 61000-4-6 (2013), IEC 61000-4-6, Network analyzer with calibration kit[5]
Decoupling Clamps: Impedance Decoupling Factor	 9 kHz to 1 GHz 9 kHz to 1 GHz	 4.6 Ω 0.27 dB	Based on: IEC 61000-4-6, Network analyzer with calibration kit[5]
Current / Injection – Clamp (Probes), (Transfer Impedance, Transfer Admittance), Calibration Fixture (Insertion Loss)	5 Hz to 3 GHz	0.24 dB	IEC 61000-4-6, ISO11452-4, CISPR 16-1-2, Network analyzer with calibration kit[5]

Parameter/Equipment	Frequency	CMC[2, 7, 10, 12] (±)	Comments[8]
RF Insertion Loss or Gain[3] – (cont)			
ISNs (Voltage Division Factor & Isolation)	9 kHz to 250 MHz	0.61 dB + *M*	CISPR 32 / EN55032, CISPR 16-1-2, network analyzer with calibration kit[5]
ISNs (Transmission & Cross Talk)	9 kHz to 250 MHz	0.61 dB + *M*	CISPR 32 / EN55032, CISPR 16-1-2, network analyzer with calibration kit[5]
ISNs (LCL)	9 kHz to 30 MHz	0.16 dB + *M*	CISPR 32 / EN55032, CISPR 16-1-2, network analyzer with calibration kit[5]
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 (20 to 40) GHz	0.1 dB 0.066 dB 0.058 dB 0.064 dB 0.088 dB 0.69 dB	Network analyzer with calibration kit
Attenuators, RF Cables	9 kHz to 40 GHz	1.1 dB	Spectrum analyzer, power meter
Radiating Loop	5 Hz to 50 MHz	0.43 dB	Network analyzer with calibration kit
Directional Couplers	9 kHz to 10 MHz 10 MHz to 2 GHz (2 to 20) GHz (20 to 40) GHz	0.06 dB 0.04 dB 0.09 dB 0.69 dB	Network analyzer with calibration kit
Directional Couplers	9 kHz to 40 GHz	1.1 dB	Spectrum analyzer, power meter
Amplifiers (Gain)	5 kHz to 20 GHz (20 to 40) GHz	0.06 dB 0.69 dB	Network analyzer with calibration kit
Amplifiers (Gain)	9 kHz to 40 GHz	1.1 dB	Spectrum analyzer, power meter
NSA for Open Area Test Site & Alternative Test Site	30 MHz to 1 GHz	0.94 dB	ANSIC63.4a, CISPR16-1-4, VCCI V-3, network analyzer with calibration kit
ALSE Performance Validation	150 kHz to 1 GHz	0.69 dB	CISPR25, Annex I, network analyzer with calibration kit

Parameter/Equipment	Frequency	CMC[2, 7, 10, 12] (±)	Comments[8]
RF Insertion Loss or Gain[3] – (cont)			
Shielding Effectiveness	9 kHz to 18 GHz	1.1 dB	Spectrum Analyzer
Site-VSWR for Open Area Test Site & Alternative Test Site	(1 to 8) GHz (8 to 18) GHz	0.3 dB 0.28 dB	CISPR 16-1-4:2010, CISPR 16-1-4:2012, CISPR 16-1-4, VCCI V-3, network analyzer with calibration kit
Antennas (Antenna Factor):			
Monopole, Rod	5 Hz to 50 MHz	0.51 dB	SAE ARP 958 Rev.D (ECSM), SAE ARP 958 (ECSM), CISPR 25, ANSI C63.5, CISPR16-1-6, network analyzer with calibration kit,
Monopole, Rod	9 kHz to 50 MHz	0.93 dB	SAE ARP 958 Rev.D (ECSM), SAE ARP 958 (ECSM), CISPR 25, ANSI C63.5, CISPR16-1-6, spectrum analyzer
Biconical, Hybrid, Dipole, Log Periodic, Horn	20 MHz to 1 GHz	0.43 dB[6]	SAE ARP 958 Rev.D & E, (two identical antenna method) SAE ARP 958 (two identical antenna method) network analyzer with calibration kit
	20 MHz to 1 GHz	0.43 dB[6]	SAE ARP 958 Rev.D & E (three antenna method), SAE ARP 958 (Three antenna method) network analyzer with calibration kit
	20 MHz to 1 GHz	0.84 dB[6]	SAE ARP 958 Rev.D, & E, (two identical antenna method), SAE ARP 958 (two identical antenna method), spectrum analyzer
	20 MHz to 1 GHz	0.84 dB[6]	SAE ARP 958 Rev.D & E (Three antenna method), SAE ARP 958 (Three antenna method), spectrum analyzer

Parameter/Equipment	Frequency	CMC[2, 7, 10, 12] (±)	Comments[8]
RF Insertion Loss or Gain[3] – (cont)			
Antennas (Antenna Factor):			
Biconical, Hybrid, Dipole, Log Periodic, Horn	(1 to 20) GHz	0.65 dB[6]	SAE ARP 958 Rev.D & E, (two identical antenna method), SAE ARP 958 (two identical antenna method), network analyzer with calibration kit
	(1 to 20) GHz	0.65 dB[6]	SAE ARP 958 Rev.D & E (Three antenna method), SAE ARP 958 (Three antenna method), network analyzer with calibration kit
	(1 to 20) GHz	0.95 dB[6]	SAE ARP 958 Rev.D, SAE ARP 958 (two identical antenna method), SAE ARP 958 (two identical antenna method), spectrum analyzer
	(1 to 20) GHz	0.96 dB[6]	SAE ARP 958 Rev.D & E (Three antenna method), SAE ARP 958 (Three antenna method), spectrum analyzer
	20 MHz to 1 GHz	0.27 dB[6]	ANSI C63.5 (SSM), network analyzer with calibration kit
	20 MHz to 1 GHz	0.87 dB[6]	CISPR16-1-6 (SSM), network analyzer with calibration kit
	20 MHz to 1 GHz	0.43 dB[6]	CISPR16-1-6 (TAM), network analyzer with calibration kit
	20 MHz to 1 GHz	0.69 dB[6]	ANSI C63.5 (SSM), spectrum analyzer
	20 MHz to 1 GHz	0.86 dB[6]	CISPR16-1-6 (SSM), spectrum analyzer
	20 MHz to 1 GHz	0.48 dB[6]	CISPR16-1-6 (TAM), spectrum analyzer

Parameter/Equipment	Frequency	CMC[2, 7, 10, 12] (±)	Comments[8]
RF Insertion Loss or Gain[3] – (cont)			
Antennas (Antenna Factor):			
Horn	(1 to 20) GHz	0.39 dB[6]	ANSI C63.5 (SSM), network analyzer with calibration kit
	(1 to 20) GHz	0.47 dB[6]	CISPR16-1-6 (SSM,TAM), VCCI V-10, network analyzer with calibration kit
	(1 to 20) GHz	0.82 dB[6]	ANSI C63.5 (SSM), spectrum analyzer
	(1 to 20) GHz	0.51 dB[6]	CISPR16-1-6 (SSM,TAM), VCCI V-10, spectrum analyzer
Biconical, Hybrid, Dipole, Log Periodic	(1 to 20) GHz	0.43 dB[6]	ANSI C63.5 (SSM), network analyzer with calibration kit
	(1 to 20) GHz	0.48 dB[6]	CISPR16-1-6 (SSM,TAM), VCCI V-10, network analyzer with calibration kit
	(1 to 20) GHz	0.74 dB[6]	ANSI C63.5 (SSM), spectrum analyzer
	(1 to 20) GHz	0.52 dB[6]	CISPR16-1-6 (SSM,TAM), VCCI V-10, spectrum analyzer
	20 MHz to 1 GHz	0.6 dB[6]	ANSI C63.5 (RAM), network analyzer with calibration kit
	20 MHz to 1 GHz	0.75 dB[6]	CISPR16-1-6 (SAM), VCCI V-10, network analyzer with calibration kit
	20 MHz to 1 GHz	0.96 dB[6]	ANSI C63.5 (RAM), spectrum analyzer
	20 MHz to 1 GHz	0.79 dB[6]	CISPR16-1-6 (SAM), VCCI V-10, spectrum analyzer
Biconical, Hybrid, Log Periodic (GSCF)	30 MHz to 1 GHz	0.3 dB	ANSI C63.5, network analyzer with calibration kit
Antenna Symmetry, Balance	20 MHz to 1GHz	0.3 dB	ANSI C63.5, CISPR16-1-6, network analyzer with calibration kit,

Parameter/Equipment	Frequency	CMC[2, 7, 10, 12] (±)	Comments[8]
Impedance[3] –			
LISN, AN, AMN	9 kHz to 1 GHz	0.83 Ω	Based on ANSIC63.4, CISPR16-1-2, CISPR25, ISO 7637-2, ISO11452-1, network analyzer with calibration kit
CDNs	9 kHz to 300 MHz	0.8 Ω	Based on IEC 61000-4-6, network analyzer with calibration kit
ISNs	9 kHz to 230 MHz	1.1 Ω	CISPR 32 / EN55032, CISPR 16-1-2, network analyzer with calibration kit
Terminators	5 Hz to 10 MHz 10 MHz to 20 GHz	0.13 Ω 0.09 Ω	Network analyzer with calibration kit
Impedance Phase[3] –			
LISN, AN, AMN	9 kHz to 1 GHz	1.1 deg	CISPR 16-1-2, Network analyzer with calibration kit
ISNs	9 kHz to 230 MHz	1.3 deg	CISPR 32 / EN55032, CISPR 16-1-2, Network analyzer with calibration kit
RF Power[3] – Measure			
(-120 to 40) dBm	9 kHz to 40 GHz	0.6 dB	Power meter, signal analyzer
Harmonics[3]	9 kHz to 18 GHz	1.1 dB	Spectrum analyzer
Power Sensor Correction Factor (0 dBm)	9 kHz to 50 MHz 50 MHz to 6 GHz (6 to 8) GHz (8 to 18) GHz (18 to 40) GHz	3.4 % 3.5 % 5.3 % 5.5 % 5.6 %	Power meter & power sensor
Power Sensor Linearity (-20 to 20) dBm	50 MHz	3.6 %	
Power Meter Ref. Out 0 dBm	50 MHz	3.4 %	

Parameter/Equipment	Frequency	CMC[2, 7, 10, 12] (±)	Comments[8]
RF Power[3] – Measure (cont.)			
Amplitude Modulation[3] – (0 to 100 %)	50 Hz to 100 kHz	1.5 dB	Signal analyzer
	50 Hz to 100 kHz	3.5 %	Oscilloscope
Carrier Frequency	9 kHz to 26.5 GHz	0.72 %	Signal Analyzer
Modulation Frequency 10 Hz to 100 kHz			
Modulation Depth (5 to 99) %			
Frequency Modulation[3] –			
Carrier Frequency	9 kHz to 26.5 GHz	2.4 %	Signal analyzer
Modulation Frequency 10 Hz to 100 kHz			
Frequency Deviation (1 to 500) kHz			
Pulse Modulation [3] –			
Carrier Frequency	9 kHz to 40 GHz		Oscilloscope
Rise & Fall Time (0 to 90) %		3.5 %	
Pulse Width 200 ns to 30ms		3.5 %	
Span Accuracy[3] –	1 kHz to 40 GHz	0.0022 %	Signal generator
Reference Level Accuracy, Absolute Amplitude Accuracy Frequency Response, Marker Display Level Accuracy[3] –	9 kHz to 6 GHz (6 to 40) GHz	0.27 dB 0.33 dB	Power meter, power sensor & signal generator
Attenuator Accuracy[3] – (0 to 115) dB	9 kHz to 40 GHz	0.79 dB	Signal generator

Parameter/Range	Frequency	CMC[2, 7, 10, 12] (±)	Comments[8]
RF Power[3] – Measure (cont.)			
Log Fidelity[3] –	9 kHz to 18 GHz (0 to 10) dB (11 to 40) dB (41 to 60) dB (61 to 80) dB (81 to 101) dB 18 GHz to 40 GHz (0 to 10) dB (11 to 40) dB (41 to 60) dB (61 to 80) dB (81 to 101) dB	1.2 dB 1.8 dB 2.3 dB 3 dB 4.7 dB 1.7 dB 2.4 dB 3.3 dB 3.5 dB 4.9 dB	Step attenuator
Bandwidth Accuracy Overall Selectivity[3, 13] –	10 Hz to 50 MHz	2.3 %	Signal generator CISPR 16-1-1
Bandwidth Switching Accuracy[3] –	9 kHz to 40 GHz	2.3 dB	Signal generator
VSWR, Input Impedance[3] –	9 kHz to 20 GHz (20 to 40) GHz	0.023 lin 1.2 lin	Network analyzer with calibration kit, signal generator, power meter, power sensor, directional couplers
Pulse Repetition Response[3, 13] –	CISPR Bands A/B CISPR Bands C/D CISPR Band E	0.9 dB 1.2 dB 1.1 dB	CISPR 16-1-1 Pulse generator, signal generator, power meter, power sensor, function generator
CW - Pulse Amplitude Comparison[3, 13] –	CISPR Bands A/B CISPR Bands C/D CISPR Band E	0.95 dB 1.2 dB 1.1 dB	CISPR 16-1-1 Pulse generator, signal generator, power meter, power sensor, function generator

Parameter/Frequency	Range	CMC[2, 7, 10, 12] (±)	Comments[8]
RF Power[3] – Measure (cont.)			
Noise Floor[3] –	1 Hz to 40 GHz	1.7 dB	50 Ω termination
Harmonics[3] –			
9 kHz to 10 MHz	(0 to -90) dBc	0.97 dB	Signal analyzer
10 MHz to 3.6 GHz	(0 to -90) dBc	0.73 dB	
(3.5 to 7) GHz	(0 to -90) dBc	2.9 dB	
(7 to 13.6) GHz	(0 to -90) dBc	3.4 dB	
(13.5 to 36) GHz	(0 to -90) dBc	4 dB	
Sub Harmonic[3] –			
9 kHz to 10 MHz	(0 to -90) dBc	1.1 dB	Signal analyzer
10 MHz to 3.6 GHz	(0 to -90) dBc	1.2 dB	
(3.5 to 7) GHz	(0 to -90) dBc	2.9 dB	
(7 to 22) GHz	(0 to -90) dBc	4.6 dB	

III. Time & Frequency

Parameter/Equipment	Range	CMC [2, 7, 10, 12] (±)	Comments[8]
Time Interval & Frequency[3] –	0.5 ns to 60 s 16 mHz to 2 GHz	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

Parameter/Equipment	Range	CMC [2, 7, 10, 12] (±)	Comments[8]
Time Interval & Frequency[3] (cont.) –			
Surge Generator[3] Open & Short Circuit			
Front Time, Rise Time	(0.3 to 13) µs	3.5 %	IEC/EN 61000-4-5, IEC/EN 61000-4-5 (2005), IEC/EN 61000-4-12, oscilloscope
Time to Half Value, Duration	(10 to 900) µs	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 61000-4-12 oscilloscope
Oscillation Frequency[3]	(100 to 2000) kHz	3.5 %	IEC/EN 61000-4-12, oscilloscope
Voltage Transient Emission[3] (Switch S)			
Switching Time	(200 to 400) ns	3.5 %	ISO 7637-2, ISO 7637-2 (2004), oscilloscope
Transient Immunity[3] (Test Pulse Generator) Surge Pulse & Load Dump Pulse			
Pulse Rise/Fall Time	0.4 µs to 15 ms	3.5 %	ISO 7637-2, ISO 7637-2 (2004), ISO 7637-3, ISO 7637-3(2016), ISO 16750-2, oscilloscope
Pulse Duration / Pulse Repetition Time	0.1 µs to 700 ms	4 %	ISO 7637-2, ISO 7637-2 (2004), ISO 7637-3, ISO 7637-3(2016), ISO 16750-2 (clause 4.6.4), oscilloscope

Parameter/Equipment	Range	CMC[2, 7, 9, 10, 12] (±)	Comments[8]
Time Interval & Frequency[3] (cont) –			
Transient Immunity[3] (Test Pulse Generator)Burst Pulse			
Rise/Fall Time	(3 to 7) ns	3.7 %	ISO 7637-2, ISO 7637-2 (2004), ISO 7637-3, ISO 7637-3(2016), oscilloscope
Pulse Duration/ Pulse Repletion Time/Time Between Bursts/ Burst Cycle Time	(30 to 200) ns	3.9 %	ISO 7637-2, ISO 7637-2 (2004), ISO 7637-3, ISO 7637-3(2016), oscilloscope
PQT[3]			
Phase Angle	(0 to 359) °	3.6 %	IEC/EN 61000-4-11, oscilloscope
Pulse Rise/Fall Time	(1 to 5) µs	3.5 %	IEC/EN 61000-4-11, oscilloscope
Voltage Dropout Time	20 µs to 200 ms	3.5 %	Oscilloscope
Repetition Time	1 ms to 5 s	3.5 %	Oscilloscope
Frequency[3] – Measure	10 MHz	0.58 Hz	Frequency counter
	(5 to 10) Hz (10 to 40) Hz 40 Hz to 300 kHz	0.059 % 0.037 % 0.017 %	DMM
	40 Hz to 1 MHz	3.5 %	Oscilloscope, HV differential probe
	10 Hz to 10 MHz 10 MHz to 1 GHz 600 MHz to 40 GHz	(0.007 to 0.58) Hz[14] (0.58 to 58) Hz[14] 35 Hz to 1.5 kHz[14]	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. CMC's 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 Calibration and Measurement Capability Uncertainty (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 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] AC/DC Volt Meters may be used instead of clamp tester.

[5] In the statement of CMC, M is the Mismatch error. 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.

[6] CMC does not include DUT error due to connections of the device to other devices in actual use. 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 DUT error as well.

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

[8] When the date, revision or edition of a test method standard is not identified in the scope of accreditation, the laboratories is required to be using the current version within one year of the date of publication, per part C., Section 1 of the *R101 – General Requirements – Accreditation of ISO-IEC17025 Laboratories* . If a specifier/regulator imposes a different transition period, this will supersede the A2LA one year implementation period.

[9] CMC for intermediate values of measurand can be found by interpolation.

[10] The contributions from the existing device are not include in the CMC claim.

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

[12] 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.

[13] Instruments may be calibrated in accordance with various editions of applicable standards like CISPR 16-1-1 or ANSI C63.2

[14] Intermediate uncertainty values within the stated range can be determined using the following equation: ±1count ±Standard Frequency Accuracy x Measurement Frequency (Hz) ±Trigger Error (Measurement Frequency GHz / 2 Count)

Accredited Laboratory

A2LA has accredited

LAB SUPPORT LTD.

Azumino-shi, Nagano-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 29th day of August 2023.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 2127.01
Valid to May 31, 2025
Revised December 7, 2023

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