



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

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CALIBRATION

Valid To: December 31, 2021

Certificate Number: 2995.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory at the location above as well as the one satellite laboratory location listed below to perform the following calibrations<sup>1, 7</sup>:

I. Electrical – RF/Microwave

Parameter/Equipment	Frequency	CMC <sup>2</sup> (±)	Comments
Rod Antenna <sup>3</sup> – Antenna Factor	5 Hz to 60 MHz	0.69 dB	Equivalent capacitance substitution method (ECSM): Keysight E5061B, Agilent E5071C, CISPR 16-1-4, ANSI C63.5-2006, SAE ARP958 revision D, IEEE Std 291:1991
Loop Antenna – Antenna Factor	9 kHz to 30 MHz	1.2 dB	SAE ARP958 revision D IEEE 291 1991
	9 kHz to 30 MHz	0.72 dB	
Large Loop Antenna <sup>3</sup> – Validation Factor	9 kHz to 30 MHz	1.6 dB	Agilent E5071C, CISPR 16-1-4

Parameter/Equipment	Frequency	CMC <sup>2, 5</sup> (±)	Comments
Current Probe <sup>3</sup> –  Transfer Impedance & Insertion Loss  VSWR	5 Hz to 9 kHz 9 kHz to 2.1 GHz  5 Hz to 2.1 GHz	0.76 dB 1.2 dB  0.16 %	CISPR 16-1-2, IEC 61000-4-6, Keysight E5061B, Agilent E5071C  Keysight E5061B, Agilent E5071C
Electric Field Probe –  Linearity & Frequency Response (2 to 300) V/m  Rotational Response (Isotropic Deviation) 20 V/m	(0.1 to 200) MHz (200 to 1000) MHz (1 to 2.5) GHz (2.5 to 6) GHz  100 kHz to 6 GHz	0.69 dB 0.63 dB 0.42 dB 0.42 dB  0.69 dB	IEC61000-4-3:2010, GTEM 500, IEEE Std.1309, substitution method: EP600 & HI-6105 type probe
LISN <sup>3</sup> –  Impedance Phase Isolation Voltage Division Factor VSWR Voltage Drop	9 kHz to 1 GHz 9 kHz to 1 GHz 9 kHz to 1 GHz 9 kHz to 1 GHz 9 kHz to 1 GHz 9 kHz to 1 GHz	0.56 % 0.30 % 0.67 dB 0.25 dB 0.30 % 0.56 %	CISPR 16-1-2, CISPR 25, IEC 61000-4-6, with Agilent E5071C & Agilent 85032F type N calibration kit, E5061B  Agilent 34410A, Sanwa 400AD
Pre-Amplifier <sup>3</sup> –  Gain  Linearity	9 kHz to 8.5 GHz (1 to 20) GHz  9 kHz to 8.5 GHz (1 to 20) GHz	1.3 dB 1.9 dB  0.73 dB 1.7 dB	Agilent E5071C, Agilent N5230C, E5061B  Agilent E5071C, Agilent N5230C, E5061B
Coupling/Decoupling Network (CDN) <sup>3</sup> –  Impedance Insertion Loss	150 kHz to 230 MHz 150 kHz to 230 MHz	0.34 % 0.18 dB	IEC61000-4-6;  Agilent E5071C, Agilent 85032F, E5061B

Parameter/Equipment	Frequency	CMC <sup>2,5</sup> ( $\pm$ )	Comments
Signal Generator <sup>3</sup> –			
Reference Frequency	10 MHz	0.23 Hz	Keysight E53151A
Frequency Accuracy	1 Hz to 40 GHz	0.43 $\mu$ Hz/Hz	Keysight E5061B, Agilent E53151A & E53152A
Harmonics	9 kHz to 26 GHz	0.86 dB	Keysight E7405A
Level Accuracy	9 kHz to 40 GHz	0.71 dB	Keysight E5061B, Agilent E4417, E9304A & N8487A
Level Linearity	9 kHz to 40 GHz	0.76 dB	Keysight E5061B, Agilent E4417, E9304A & N8487A
AM Depth	20 Hz to 100 kHz	0.60 %	Hewlett Packard 8901A
VSWR	5 Hz to 8.5 GHz	0.08 %	Agilent E5071C, Agilent N5230C, E5061B
FM Depth	(1 to 50) kHz	0.18 %	Lecroy WM8600A &WR 640Zi
Pulse Modulation Pulse	10 Hz to 10 kHz	1.2 %	Lecroy WM8600A &WR 640Zi
Rise/Fall Time	(1 to 20) ns	2.2 %	
Pulse Period	(0 to 10) kHz	1.0 %	
Pulse Mod. Freq	DC to 18 GHz	0.11 %	
Phase Modulation	(0 to 6.28) rad	0.48 %	Hewlett Packard 8901A
EM Clamp <sup>3</sup> –			IEC61000-4-6;
Insertion Loss	9 kHz to 1 GHz	0.23 dB	Agilent E5071C, E5061B
Impedance	9 kHz to 1 GHz	0.3 %	
Power Meter/Sensor <sup>3,6</sup> –			
Calibration Factor	9 kHz to 6 GHz 50 MHz to 40 GHz	3.3 % 5.6 %	Agilent E4417A, E9304A & N8487A
Linearity	9 kHz to 40 GHz	4.0 %	Agilent E4417A, E9304A & N8487A
VSWR	9 kHz to 6 GHz (6 to 20) GHz	0.14 % 0.14 %	Agilent E5071C Agilent N5230C

Parameter/Equipment	Frequency	CMC <sup>2,5</sup> ( $\pm$ )	Comments
Power Amplifier <sup>3,6</sup> –			
Gain	9 kHz to 6 GHz	0.26 dB	R&S SMA100A, Agilent E4417A, E9304A
Maximum Output Power	9 kHz to 6 GHz	0.26 dB	
Linearity	9 kHz to 6 GHz	0.29 dB	
Spectrum Analyzer <sup>3</sup> –			CISPR 16-1-1
10 MHz Reference Frequency	10 MHz	0.23 Hz	Agilent E53151A
Frequency	10 Hz to 40 GHz	0.59 $\mu$ Hz/Hz	Agilent E53151A, E53152A
Input Attenuator	9 kHz to 6 GHz (6 to 22) GHz 9 kHz to 40 GHz	0.46 dB 0.68 dB 0.97 dB	R & S SMA100A, R & S SMF100A, Keysight N5173B
Input Impedance	5 Hz to 9 kHz 9 kHz to 8.5 GHz 10 MHz to 20 GHz	0.16 % 0.37 % 0.45 %	Keysight E5061B Agilent E5071C, Agilent N5230C
Relative Level Accuracy	9 kHz to 6 GHz (6 to 22) GHz 9 kHz to 40 GHz	0.38 dB 0.57 dB 0.44 dB	R & S SMA100A, R & S SMF100A, Keysight N5173B
Bandwidth of Selective Filter	9 kHz to 6 GHz (6 to 22) GHz	3.0 Hz 0.22 Hz	R & S SMA100A, R & S SMF100A
Sine Wave Accuracy	10 Hz to 9 kHz 9 kHz to 40 GHz	0.52 dB 0.44 dB	Anritsu MG443B, Keysight N5173B
Spurious Response	9 kHz to 40 GHz	1.1 dB	Keysight E7405A
Display Linearity	9 kHz to 40 GHz	0.95 dB	Keysight N5173B
Display Scale Fidelity	9 kHz to 26.5 GHz	0.41 dB	Keysight 8494B/8495B
Noise Floor	DC to 40 GHz	0.23 dB	Agilent 85032B, Anritsu 28K50A
Impulse Bandwidth	>1 GHz	0.46 dB	Agilent 33250A
Frequency Span	9 kHz to 6 GHz (6 to 22) GHz	1.2 Hz 0.29 Hz	Agilent 53151A
Center Frequency	9 kHz to 6 GHz (6 to 22) GHz	1.2 Hz 0.31 Hz	R & S SMA100A, R & S SMF100A
Tracking Generator Output Accuracy	9 kHz to 6 GHz	0.31 dB	Agilent E4417 & E9304A

Parameter/Equipment	Frequency	CMC <sup>2,5</sup> (±)	Comments
EMI Test Receiver <sup>3</sup> –			
Frequency	10 Hz to 40 GHz	0.59 $\mu$ Hz/Hz	CISPR 16-1-1
Input Attenuator	10 Hz to 40 GHz	0.97 dB	Keysight N5173B
Sine Wave Accuracy	10 Hz to 40 GHz	0.32 dB	Keysight N5173B
Input Impedance (SWR – 1.0 to 3.0)	5 Hz to 20 GHz	0.37 %	Agilent E5071C, N5230C E5061B
Display Linearity	9 kHz to 40 GHz	0.95 dB	Keysight N5173B
Bandwidth of Selective Filter	9 kHz to 40 GHz	3.0 Hz	R & S SMA100A, Keysight N5173B
Impulse Bandwidth (RBW: 1 MHz)	>1 GHz	0.46 dB	Agilent 33250A
CISPR Band A of Pulse Response (Amplitude Relationship: 60 dB)	CISPR Band A	0.63 dB	IGUU 2916, main generator: 60 dB
CISPR Band B of Pulse Response (Amplitude Relationship: 60 dB)	CISPR Band B	0.63 dB	IGUU 2916, main generator: 60 dB
CISPR Band C/D of Pulse Response (Amplitude Relationship: 60 dB)	CISPR Band C/D	0.68 dB	IGUU 2916, main generator: 60 dB
CISPR Band E of Pulse Response (Amplitude Relationship: 60 dB)	CISPR Band E	0.96 dB	IGUU 2916, main generator: 60 dB
CISPR Band A of Pulse Response (Variation with Repetition Frequency)	CISPR Band A	0.25 dB	IGUU 2916, main generator: repetition frequency 1 Hz to 200 Hz

Parameter/Equipment	Frequency	CMC <sup>2,5</sup> (±)	Comments
EMI Test Receiver <sup>3</sup> – (cont)			
CISPR Band B of Pulse Response (Variation with Repetition Frequency)	CISPR Band B	0.25 dB	IGUU 2916, main generator: repetition frequency 1 Hz to 10 kHz
CISPR Band C/D of Pulse Response (Variation with Repetition Frequency)	CISPR Band C/D	0.36 dB	IGUU 2916, main generator: repetition frequency ≤ 20 kHz
CISPR Band B of Pulse Response (Variation with Repetition Frequency: Auxiliary Generator)	CISPR Band B	0.78 dB	IGUU 2916, main generator: repetition frequency 1 Hz to 10 kHz
CISPR Band C/D of Pulse Response (Variation with Repetition Frequency: Auxiliary Generator)	CISPR Band C/D	0.96 dB	IGUU 2916, main generator: repetition frequency ≤ 20 kHz
Random Noise (20 to 60) dB/uV	9 kHz to 40 GHz	0.63 dB	Agilent N5173B, Keysight 8495B, CISPR 16-1-1
Noise Floor	DC to 40 GHz	0.23 %	Agilent 85032F
Intermediate Frequency Suppression Ratio	9 kHz to 6 GHz (6 to 22) GHz	0.25 dB 0.50 dB	R & S SMA100A, SMF100A
Image Frequency Suppression Ratio	9 kHz to 6 GHz (6 to 22) GHz	0.25 dB 0.50 dB	R & S SMA100A, SMF100A
Other Spurious Ratio	9 kHz to 6 GHz (6 to 22) GHz	0.25 dB 0.31 dB	Rhode & Schultze SMA100A, SMF100A
CISPR Average Response to Unsteady Narrowband Disturbances	9 kHz to 1 GHz	0.46 dB	R & S SMA100A, Agilent 33250A
Insertion Loss – Directional Coupler, Coaxial Cable, Attenuator <sup>3</sup>	5 Hz to 3 GHz (3 to 8.5) GHz	0.26 dB 0.23 dB	Keysight E5061B, Agilent E5071C
	(8.5 to 20) GHz	0.23 dB	Agilent N5230C
	(20 to 40) GHz	0.96 dB	Keysight N5173B, N8487A

Parameter/Equipment	Frequency	CMC <sup>2,5</sup> ( $\pm$ )	Comments
VSWR <sup>3</sup> – 50 $\Omega$ Termination, Directional Coupler, Attenuator, Antenna	5 Hz to 3 GHz 9 kHz to 8.5 GHz (1 to 20) GHz	1.6 % 1.4 % 1.3 %	Keysight E5061B, Agilent E5071C, Agilent 85032F calibration kit
Impedance <sup>3</sup> – 50 $\Omega$ Termination, Directional Coupler, Attenuator, Antenna	5 Hz to 9 kHz 9 kHz to 8.5 GHz	0.21 % 0.73 %	Keysight E5061B, Agilent E5071C, Agilent 85032F calibration kit
ISN/VSWR <sup>3</sup> , (Impedance Stabilization Network) –			CISPR 16-1-2, CISPR 22
Termination Impedance	150 kHz to 30 MHz	0.15 %	Agilent E5071C, 85032F & TESEQ CAS ISN calibration kits, E5061B
Phase of Basic Network Asymmetric Disturbance	150 kHz to 30 MHz	0.52 %	
Voltage Division Factor of the Asymmetry Between EUT & Measuring Receiver Port	150 kHz to 30 MHz	0.32 dB	
Insertion Loss of the Symmetric Circuit Between EUT & AE Ports	150 kHz to 30 MHz	0.32 dB	
Decoupling Attenuation for Asymmetric Signals Between AE & EUT Ports	150 kHz to 30 MHz	0.26 dB	
Longitudinal Conversion Loss (LCL) at the EUT Port of the Network	150 kHz to 30 MHz	0.61 dB	
Surge Simulator <sup>3,6</sup> –			
Open-Circuit Front Time	(0 to 10) ms	0.09 $\mu$ s	LeCroy WM8600A, WR640Zi
Short-Circuit Front Time	(0 to 10) ms	0.14 $\mu$ s	
Peak Voltage	(-4 to 4) kV	6.2 %	
Peak Current	(-4 to 4) kV	6.2 %	
Voltage Duration	(0 to 1000) ms	0.52 $\mu$ s	
Current Duration	(0 to 500) ms	0.16 $\mu$ s	
Under (Over) Shoot	(-1200 to 1200) V	6.6 %	
Phase	(0 to 20) ms	0.39 $\mu$ s	

Parameter/Equipment	Frequency	CMC <sup>2,5</sup> (±)	Comments
Surge Measurement <sup>3,6</sup> – Burst Tester & High Voltage Unit			
Front Time	Up to 10 µs	0.6 ns	LeCroy WM8600A INA265A, WR640Zi, INA266, Pearson 110
Peak Voltage	(-4 to 4) kV	8.1 %	
Pulse Width	Up to 400 ms	4.5 %	
Residual Test Pulse Voltage	(-400 to 400) V	4.3 %	
Capacitive Coupling Clamp <sup>3,6</sup> – 9 kHz to 30 MHz			
Front Time	(0 to 10) µs	0.6 ns	LeCroy WM8600A, WR640Zi
Peak Voltage	(-4 to 4) kV	8.1 %	
Pulse Width	(0 to 400) ms	4.5 %	
ESD Simulator – 50/60 Hz –			LeCroy WM8600A, 25036 (Target), WR640Zi
Peak Current	(-20 to 20) kV	1.1 %	
30 ns Current	(-20 to 20) kV	1.2 %	
60 ns Current	(-20 to 20) kV	1.2 %	
Rise Time	(0 to 1000) ps	59 ps	
65 ns Current	(-20 to 20) kV	1 %	
130 ns Current	(-20 to 20) kV	1 %	
180 ns Current	(-20 to 20) kV	1 %	
360 ns Current	(-20 to 20) kV	1 %	
400 ns Current	(-20 to 20) kV	1 %	
800 ns Current	(-20 to 20) kV	1 %	



Parameter/Equipment	Frequency	CMC <sup>2,5</sup> (±)	Comments
Absorbing Clamp –			
Clamp Factor	(30 to 300) MHz 300 MHz to 1 GHz	1.4 dB 2.0 dB	CISPR16-1-3, CISPR16-4-1 Agilent E5071C, E5061B
Decoupling Factor DF	(30 to 300) MHz 300 MHz to 1 GHz	1.5 dB 1.6 dB	
Decoupling Factor DR	(30 to 300) MHz 300 MHz to 1 GHz	1.0 dB 1.3 dB	
Click Analyzer <sup>3</sup> –			
Click Duration	0.1 ms to 1.2 s 150 kHz to 30 MHz (20 to 110) dB/μV	1.2 dB	CISPR 16-1-1, TSG-1
High Impedance Probe <sup>3</sup> –			
Voltage Division Factor	9 kHz to 30 MHz	0.24 dB	CISPR 16-1-2, Agilent E5071C, E5061B
Impedance	9 kHz to 30 MHz	0.48 %	Agilent E5071C, E5061B
DC Power Supply <sup>3</sup> –			
Voltage	Up to 1 kV Up to 4 kV	0.005 % 1.4 %	Agilent 34410A Lecroy WM8600A, Lecroy WR 640Zi
Current	Up to 3 A Up to 40 A	2.1 % 3.0 %	Agilent 34410A Sanwa current clamp
Constant Voltage Load Regulation	Up to 1 kV  Up to 4 kV	0.18 %  1.4 %	Agilent 34410A, load resistor  Lecroy WM8600A, Lecroy WR 640Zi, load resistor

Parameter/Range	Frequency	CMC <sup>2,5</sup> (±)	Comments
AC Power Supply/CVCF <sup>3</sup> –			
Voltage –			
Up to 750 V	60 Hz	0.16 %	Agilent 34410A Lecroy WM8600A, Lecroy WR 640Zi
Up to 4 kV	60 Hz	1.4 %	
Current –			
Up to 3 A	60 Hz	0.73 %	Agilent 34410A Lecroy WM8600A, Lecroy WR 640Zi
Up to 40 A	60 Hz	3.0 %	
Voltage Regulation –			
Up to 3 A	60 Hz	0.22 %	Agilent 34410A Lecroy WM8600A, Lecroy WR 640Zi
Up to 40 A	60 Hz	1.4 %	
Frequency	(50, 60, 400) Hz	0.0049 % 0.16 %	Agilent 34410A Lecroy WM8600A, Lecroy WR 640Zi
Phase – Up to 360°	--	0.079 %	Lecroy WM 8600A, Lecroy WR 640Zi
Reference Impedance Network <sup>3</sup> –			
Resistance – (0.1 to 10) Ω	(0.05 to 1) kHz	1.4 %	HIOKI 3522-50, IEC 61000-3-3, IEC 61000-3- 2, IEC 61000-3-11, JIS C 61000-3-2
Reactance – (0.1 to 10) Ω	(0.05 to 1) kHz	1.4 %	
Inductance – (0.1 to 1000) mH	(0.05 to 1) kHz	1.1 %	
Capacitive Voltage Probe <sup>3</sup> –			
Voltage Division Factor	9 kHz to 100 MHz	0.17 dB	CISPR16-1-2, E5061B, E5071C, 85032F, IGUU2916, CAL9222B, ESHS10
RF Output Port VSWR	9 kHz to 100 MHz	0.32 %	
Pulse Response	9 kHz to 100 MHz	1.2 dB	
Pulse Repetition Frequency	9 kHz to 100 MHz	1.2 dB	
Effect of Electric Field	9 kHz to 100 MHz	1.0 dB	

Parameter/Equipment	Frequency	CMC <sup>2,5</sup> (±)	Comments
CMAD (Common Mode Absorption Device) <sup>3</sup> – S11 Magnitude S21 Magnitude	9 kHz to 1 GHz 9 kHz to 1 GHz	0.30 % 0.32 %	CISPR16-1-4 E5071C, 85032F
Directional Coupler <sup>3</sup> – Coupling Factor	5 Hz to 20 GHz	0.8 dB	N5230C, E5071C, E5061B
Attenuator <sup>3</sup> – Attenuation, (0 to 70) dB	5 Hz to 20 GHz	0.8 dB	N5230C, E5071C, E5061B

SATELLITE LABORATORY

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CALIBRATION

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations<sup>1</sup>:

I. Electrical – RF/Microwave

Parameter/Equipment	Frequency	CMC <sup>2</sup> (±)	Comments
Rod Antenna <sup>3</sup> – Antenna factor	5 Hz to 60 MHz	0.69 dB	Equivalent capacitance substitution method (ECSM): Keysight E5061B, Agilent E5071C, CISPR 16-1-4, ANSI C63.5-2006, SAE ARP958 revision D, IEEE Std 291:1991
Antenna Factor – Reference Antenna Method –			ANSI C63.5-2017, ANSI C63.5-2006, CISPR 16-1-6
Dipole Antenna – Horizontal Polarization	(30 to 1000) MHz	1.2 dB	Reference antennas: UHAP, VHAP
Broadband Antenna – Horizontal Polarization	(20 to 300) MHz (200 to 1000) MHz	1.2 dB 1.3 dB	UHAP, VHAP
Double Ridged Guide Horn <sup>4</sup> – Horizontal Polarization	(1 to 18) GHz	1.7 dB	DRG horn
Standard Site Method: Broadband Antenna Types –			
Horizontal & Vertical Polarization	(30 to 300) MHz	1.2 dB	ANSI C63.5-2017, ANSI C63.5-2006, CISPR 16-1-6
Tunable Dipole – Horizontal Polarization	(300 to 1000) MHz	1.2 dB	ANSI C63.5-1998

Parameter/Equipment	Frequency	CMC <sup>2</sup> (±)	Comments
Antenna Factor – (cont)			
Broadband Hybrid – Horizontal & Vertical Polarization	(20 to 30) MHz (30 to 300) MHz (30 to 3000) MHz	1.8 dB 1.2 dB 1.2 dB	ANSI C63.5 – 2017, CISPR 16-1-6, ANSI C63.5-2006, ANSI C63.5-1998, ARP 958 rev. D gain method
Biconical Dipole – Horizontal & Vertical Polarization	(20 to 30) MHz (30 to 300) MHz	1.8 dB 1.2 dB	ANSI C63.5 - 2017 CISPR 16-1-6, CA-QP-020
Log Periodic Array – Horizontal & Vertical Polarization	(200 to 3000) MHz	1.2 dB	ANSI C63.5-1998, SAE ARP958 rev. D gain method
Double Ridged Guide Horn – Horizontal & Vertical Polarization	(1 to 18) GHz	1.1 dB	ANSI C63.5 – 2017, CISPR 16-1-6, ANSI C63.5-2006, SAE ARP958 rev. D gain method
Standard Gain Horn – Horizontal & Vertical Polarization	(1 to 18) GHz	1.1 dB	ANSI C63.5 – 2017, CISPR 16-1-6, ANSI C63.5-2006
For NSA –			
Biconical Dipole – Horizontal & Vertical Polarization	(30 to 300) MHz	1.2 dB	ANSI C63.5 – 2017, ANSI C63.5-2006, ANSI C63.5-1998
Log Periodic Array – Horizontal & Vertical Polarization	(200 to 1000) MHz	1.2 dB	
Biconical, Log Periodic, Hybrid Antenna – Horizontal & Vertical Polarization			
Antenna Symmetry – Vertical Polarization	30 MHz to 1 GHz (1 to 18) GHz	0.58 dB 0.52 dB	ANSI C63.5-2017, C63.5-2006, CISPR 16-1-4
Cross-Polar Response – Horizontal/Vertical Polarization	30 MHz to 1 GHz (1 to 18) GHz	0.61 dB 0.52 dB	ANSI C63.5 – 2017, CISPR 16-1-4

Parameter/Equipment	Frequency	CMC <sup>2,5</sup> (±)	Comments
Large Loop Antenna <sup>3</sup> – Validation Factor	9 kHz to 30 MHz	1.6 dB	Agilent E5071C, CISPR 16-1-4
VSWR – Antennas	30 MHz to 20 GHz	0.68 %	Keysight N5230C, calibration kit

<sup>1</sup> This laboratory offers commercial calibration service.

<sup>2</sup> 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.

<sup>3</sup> 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.

<sup>4</sup> Distance between horn or double ridge guide antennas being calibrated are at a distance equal to or greater than  $R = 2D^2/\text{wavelength}$ ; with calibrated distance is not less than  $R = 0.5D^2/\text{wavelength}$ .  $D$  is the largest linear dimension (e.g., width or height) of the aperture of the antenna and the wavelength is for the frequency being considered, both in meters. (Derived from ANSI C63.5-2006, clause 5.2).  
No calibration shall be performed at  $R < 0.62(D^3/\lambda)^{-0.5}$ . Antenna Factor measured at distances of  $0.62(D^3/\lambda)^{-0.5} \leq R \leq 2 D^2/\lambda$  shall be deemed acceptable at the calibrated distance. Antenna Factor measured at distances of  $R \geq 2 D^2/\lambda$  shall be deemed acceptable at the calibrated distance and greater. (Derived from ANSI C63.5-2017, clause 5.1.3.1). Separation distance of 3 meters is normally used between the front face of the antennas.

<sup>5</sup> In the statement of CMC, percentages are to be read as percentage of reading, unless otherwise noted.

<sup>6</sup> In the statement of CMC, 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. All other uncertainties include the mismatch error.

<sup>7</sup> This scope meets A2LA's *P112 Flexible Scope Policy*.



## *Accredited Laboratory*

A2LA has accredited

**TOKIN EMC ENGINEERING CO., LTD.**

*Tsukuba-City, Ibaraki, 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 15<sup>th</sup> day of January 2020.

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

Vice President, Accreditation Services  
For the Accreditation Council  
Certificate Number 2995.01  
Valid to December 31, 2021

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