



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

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CALIBRATION

Valid To: August 31, 2019

Certificate Number: 0952.04

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

I. Electrical – DC/Low Frequency

Parameter/Equipment	Frequency	CMC ^{2,5} (±)	Comments
AC Voltage –			
(1.0 to 2.2) mV	50 Hz to 10 kHz	0.62 %	Fluke 5720A
(2.2 to 22) mV	50 Hz to 10 kHz	0.21 %	
(22 to 220) mV	50 Hz to 10 kHz	0.084 %	
(0.22 to 2.2) V	20 Hz to 100 kHz	0.054 %	
(2.2 to 22) V	20 Hz to 100 kHz	0.064 %	
(22 to 220) V	20 Hz to 100 kHz	0.26 %	
(220 to 1000) V	50 Hz to 1 kHz	0.18 %	

Parameter/Equipment	Frequency	CMC ^{2,5} (±)	Comments
AC Current – (100 to 220) uA	(50 Hz to 60Hz)	0.11 %	Fluke 5720A
(0.22 to 220) mA	(50 Hz to 60Hz)	0.065 %	
(0.22 to 2.2) A	(50 Hz to 60Hz)	0.58 %	
1 mA to 60 A	(50, 60, 400, 800) Hz	0.22 %	Yokogawa 255800-1/B

Parameter/Equipment	Range	CMC ^{2,5} (±)	Comments
DC Voltage –	(1 to 220) mV (0.22 to 2.2) V (2.2 to 1000) V	0.0029 % 0.0010 % 0.0053 %	Fluke 5720A
DC Current –	10 µA to 2.2 A 12 µA to 36 A	0.040 % 0.27 %	Fluke 5720A Yokogawa 256042-1/B
Resistance –	(0.1 to 1111.21) Ω 0 Ω 1 kΩ to 111.11 MΩ	0.52 % 100 µΩ 0.23 %	Yokogawa 2793 01 Fluke 5720A Yokogawa 2793 03 Fluke 5720A



Parameter/Equipment	Frequency	CMC ^{2,5} (±)	Comments
Oscilloscope –			
DC Output	DC	0.020 %	Agilent 34401A
AC Output	DC to 2 GHz	0.028 %	Agilent 34401A
Time Interval Accuracy	DC to 2 GHz	0.23 %	Rohde & Schwarz SMY02
Input Impedance	DC to 2 GHz	0.45 %	Agilent 34401A
DC Voltage Measurement Accuracy	DC	1.3 %	Agilent 34401A
Bandwidth	DC to 2 GHz	0.31 dB	Rohde & Schwarz SMY02, power sensor E9304A and power meter E4417A
Trigger Sensitivity	DC to 2 GHz	1.6 %	Rohde & Schwarz SMY02
Zero Error	DC to 2 GHz	7.0 %	Agilent 34401A
Offset Gain	DC to 2 GHz	0.12 %	
DC Gain	DC	0.12 %	

II. Electrical – RF/Microwave

Parameter/Equipment	Frequency	CMC ² (±)	Comments
Antenna Factor –			
Biconical Antennas			
10 Meters	(30 to 300) MHz	0.59 dB	ANSI C63.5:2017 using standard site method w/ HP 4396A and HP 87512A
10 Meters	(30 to 300) MHz	1.1 dB	ANSI C63.5:2017 using reference antenna method w/ R&S SMY02

Parameter/Equipment	Frequency	CMC ² (±)	Comments
Antenna Factor – (cont)			
Biconical Antennas			
(3 and 10) Meters	(30 to 300) MHz (300 to 1000) MHz	1.2 dB 2.5 dB	ANSI C63.5: 1998 using standard site method w/ HP 4396A and Agilent 87512A
10 Meters	(30 to 300) MHz (300 to 1000) MHz	1.2 dB 2.5 dB	ANSI C63.5:2006 using standard site method and reference antenna methods w/ HP 4396A, Agilent 87512A and R&S SMY02
Log Periodic Antennas			
10 Meters	(200 to 1000) MHz	0.88 dB	ANSI C63.5:2017 using standard site method w/ HP 4396A and HP 87512A
10 Meters	(300 to 1000) MHz	1.3 dB	ANSI C63.5:2017 using reference antenna method w/ R&S SMY02
(3 and 10) Meters	(200 to 1000) MHz	3.2 dB	ANSI C63.5: 1998 using standard site method w/ HP 4396A and Agilent 87512A
10 Meters	(200 to 1000) MHz	3.2 dB	ANSI C63.5:2006 using standard site method and Reference antenna method w/ HP 4396A and Agilent 87512A
10 Meters	(300 to 1000) MHz	1.0 dB	ANSI C63.5: 1998, 2006 using reference antenna method w/ R&S SMY02



Parameter/Equipment	Frequency	CMC ² (±)	Comments
Antenna Factor – (cont)			
Dipole Antenna			
10 Meters	(30 to 300) MHz (300 to 1000) MHz	0.91 dB 1.0 dB	ANSI C63.5:2017 using reference antenna method with R&S SMY02
10 Meters	(30 to 300) MHz (300 to 1000) MHz	1.3 dB 1.4 dB	ANSI C63.5: 1998, 2006 using reference antenna method w/ R&S SMY02
Horn Antennas	(1 to 18) GHz	1.4 dB	ANSI C63.5:2017 using standard site method w/ Agilent N5230A
	(1 to 18) GHz	2.1 dB	ANSI C63.5: 1998, 2006 using Standard Site method and Reference antenna method w/ Agilent E4446A, Agilent E8257D
	(1 to 18) GHz	2.3 dB	w/ AgilentN5230A
Monopole Antenna	100 kHz to 50 MHz	2.5 dB	CISPR 25:2008, CISPR 16-1-4:2010 and A1:2012, CISPR 16-1- 6:2014 ECSM w/ R&S, ESHS10 and ESVS10 and SMY02
Antenna Balance –			
Biconical Antennas	(30 to 300) MHz	0.50 dB	CISPR 16-1-4:2010 and A1:2012, CISPR 16-1- 6:2014 ANSI C63.5:2006, IEEE291:1991 w/ Agilent 4396A, Agilent 87512A and Agilent 8753D

Parameter/Equipment	Frequency	CMC ² (±)	Comments
Antenna Cross-Polarization – Log.Per. Antennas	(200 to 1000) MHz	0.60 dB	CISPR 16-1-4:2010 and A1:2012, CISPR 16-1-6:2014 ANSI C63.5:2006, IEEE291:1991 w/ Agilent 4396A, Agilent 87512A and Agilent 8753D
Horn Antennas	(1 to 18) GHz	0.80 dB	CISPR 16-1-4 2007, A1 2007 CISPR 16-1-6:2014, ANSI C63.5:2006 IEEE291:1991 w/ Agilent E4446A, Agilent E8257D
	(1 to 18) GHz	2.1 dB	CISPR 16-1-4 2007, A1 2007 CISPR 16-1-6:2014 ANSI C63.5:2006 IEEE291:1991 w/ Agilent N5230A
LISN –			
Impedance	9 kHz to 30 MHz 30 kHz to 1 GHz	3.0 % 0.98 %	CISPR 16-1-2:2014, CISPR 16-4-1:2009, CISPR 16-4-2:2011 and
Phase	9 kHz to 30 MHz	0.51 °	A1:2014, CISPR 16-4-3:2004 and A1:2006, CISPR 16-4-
Decoupling Factor	9 kHz to 1 GHz	1.7 dB	4:2007, ANSI C63.4:2014 using Agilent 4395A, Agilent 87512A and Agilent 85032B
Voltage Division Factor	9 kHz to 30 MHz 30 kHz to 1 GHz	0.12 dB 0.34 dB	
VSWR	9 kHz to 30 MHz	2.1 %	



Parameter/Equipment	Frequency	CMC ² (±)	Comments	
ISN (Impedance Stabilization Network) –				
Termination Impedance	(0.1 to 80) MHz	0.35 Ω	CISPR 22:2008, EN 55022:2010, HP 4396A w/ Agilent 85046B, 4395A w/ 87512A, 85032B Type N calibration kit	
Phase of Basic Network for Asymmetric Disturbance	(0.1 to 80) MHz	0.74 °		
Voltage Division Factor	(0.1 to 80) MHz	0.76 dB		
Insertion Loss	(0.1 to 80) MHz	0.76 dB		
Decoupling Attenuation	(0.1 to 80) MHz	0.70 dB		CISPR 22:2008, EN 55022:2010 with HP 8753D
Longitudinal Conversion Loss (LCL)	(0.1 to 80) MHz	0.73 dB		
Asymmetric Attenuation	(0.1 to 80) MHz	1.4 dB		
Amplifier –				
Gain	30 kHz to 3 GHz	0.60 dB	HP 8753D	
	(2 to 18) GHz	1.1 dB	Agilent E8257D and Agilent E4418A w/ Agilent E4412A	
Linearity	30 kHz to 3 GHz	2.0 dB	HP 8753D	
	(2 to 18) GHz	1.4 dB	Agilent E8257D and Agilent E4418A w/ Agilent E4412A	
Harmonic Distortion	100 kHz to 1.8 GHz	1.8 dB	Agilent E4446A	
Absorbing Clamp –				
Clamp Factor	(30 to 300) MHz	2.9 dB	Ordinal method CISPR 16-1-3:2004, CISPR 16-1-3, Corrigendum 1:2006	
	(300 to 1000) MHz	3.0 dB		
Clamp Factor	(30 to 300) MHz	1.8 dB	Reference device method CISPR 16-1-3:2004, CISPR 16-1-3, Corrigendum 1:2006	
	(300 to 1000) MHz	2.1 dB		
Decoupling Factor DF	(30 to 300) MHz	0.57 dB		
Decoupling Factor DR	(30 to 300) MHz	0.58 dB		

Parameter/Equipment	Frequency	CMC ^{2,5} (±)	Comments
Capacitive Voltage Probe – Pulse Response	100 kHz to 30 MHz	0.83 dB	CISPR 16-1-2:2014, ANSI C63.4:2014, CISPR 16-1-1:2015 w/ IGUU2916
Relative Pulse Response	100 kHz to 30 MHz	1.1 dB	
CW Response (Voltage Division Factor)	100 kHz to 30 MHz	1.3 dB	Network analyzer 4396A and 85046A
	100 kHz to 30 MHz	0.44 dB	Generator and receiver SMY02 and FCKL1528
Decoupling	100 kHz to 30 MHz	1.9 dB	Network analyzer 8753D
	100 kHz to 30 MHz	1.9 dB	Generator and receiver SMY02 and FCKL1528
CDN – Coupling Factor	100 kHz to 230 MHz	0.87 dB	IEC 61000-4-6: 2013, EN 61000-4-6:2014, HP 4396A and Agilent 85046A and Agilent 85032B Type N calibration kit
Impedance	100 kHz to 230 MHz	1.1 %	
EFT/Burst Generator – Peak Voltage	250 V to 5 kV	2.8 %	IEC 61000-4-4:2012 w/ DSO80204B oscilloscope
Rise Time	5 ns	5.8 %	
Pulse Duration	50 ns	1.2 %	
Pulse Repetition Frequency	(5 to 100) kHz	0.50 %	
Burst Period	300 ms	0.20 %	
Burst Duration	15 ms 0.75 ms	0.80 % 0.80 %	

Parameter/Equipment	Frequency	CMC ^{2,5} (±)	Comments
Surge Generator – Open Circuit: Peak Voltage Front Time Duration Time to Half Value Short Circuit: Peak Current Front Time Duration Time to Half Value CDN Section Phase Shifting	 (0.5, 1, 2, 4) kV (0.5, 1, 2, 4) kV (0.5, 1, 2, 4) kV (0.5, 1, 2, 4) kV 10 A to 2 kA 10 A to 2 kA 10 A to 2 kA 10 A to 2 kA 	 2.4 % 2.3 % 2.3 % 2.3 % 2.5 % 2.3 % 2.3 % 2.3 % 10 μs	 EN 61000-4-5:2014, IEC 61000-4-5:2014 w/ DSO6102A oscilloscope
EM Clamp or Current Injection Probe – Coupling Factor	 100 kHz to 230 MHz	 1.4 dB	IEC 61000-4-6:2013, EN 61000-4-6:2014 HP 4396A w/ 85046A, 4395A w/ 87512A
Impedance – 50 Ω Termination	9 kHz to 1.8 GHz	0.75 %	HP 4396A and HP 85046A HP 4395A and HP 87512A and HP 85032B Type N calibration kit
Magnetic Field Strength Meter –	50 Hz, 60 Hz	0.28 %	IEC 61000-4-8:2009, EN 61000-4-8:2010, IEC 61786:1998 5.2.1.a (JIS C 1910:2004), Yokogawa 2558 and standard coil
Reflection Coefficient ³	30 kHz to 3 GHz (3 to 18) GHz	1.6 % 1.3 %	HP 8753D and Agilent 85032B Type N calibration kit Agilent 11692D and Agilent 773D



Parameter/Equipment	Range	CMC ² (±)	Comments
CISPR Pulse Generator ⁶ –			
Impulse Area	Band A	47 nVs	Agilent 86100C w/ Agilent 86112A (uncertainty based on Schwarzbeck IGUU 2916)
	Band B	1.1 nVs	
	Band C and D	0.18 nVs	
Impulse Bandwidth	Band A	3.7 ns	
	Band B	0.015 ns	
	Band C and D	0.020 ns	
Null Point Frequency	Band A	0.046 MHz	Agilent E4446A (uncertainty based on Schwarzbeck IGUU 2916)
	Band B	3.5 MHz	
	Band C and D	41 MHz	
Flatness of Spectrum Amplitude	Band A	0.45 dB	Agilent E4446A (uncertainty based on Schwarzbeck IGUU 2916)
	Band B	0.45 dB	
	Band C and D	0.57 dB	
Pulse Repetition Frequency	Band A	0.000 50 Hz	Agilent 53132A and Symmetricom 8040C (uncertainty based on Schwarzbeck IGUU 2916)
	Band B	0.000 90 Hz	
	Band C and D	0.000 75 Hz	
Source Errors for Sinewave Output for CISPR Checks (@ 60 dB μ V)	(1, 10, and 100) MHz	0.11 dB	Agilent E4417A w/ Agilent E9304A (uncertainty based on Schwarzbeck IGUU 2916)



Parameter/Equipment	Range	CMC ² (±)	Comments
EMI Receiver ⁴ –			
Input Impedance	Band A Band B Band C Band D Band E	0.75 dB 0.75 dB 1.2 dB 1.2 dB 1.3 dB	CISPR16-1-1:2010 and A1:2010, CISPR16-1-1:2015, CISPR16-4-2:2011 and A1:2014, ANSI C63.2:1996, HP 4396A and HP 85032B HP 4395A and HP 87512A Type N calibration kit, Agilent 11692D and Agilent 773D
Pulse Response	Band A Band B Band C Band D	0.80 dB 0.80 dB 0.77 dB 0.77 dB	Schwarzbeck IGUU2916
Relative Pulse Response	Band A Band B Band C Band D	0.55 dB 0.35 dB 0.61 dB 0.61 dB	
Sine-Wave Accuracy	Band A Band B Band C Band D Band E	0.67 dB 0.67 dB 0.67 dB 0.67 dB 0.72 dB	R&S SMY02 w/ HP 437B and HP 8482A Agilent E8257D
Selectivity, 6 dB Bandwidth	Band A Band B Band C Band D Band E	2.0 Hz 0.11 kHz 0.22 kHz 0.22 kHz 2.9 kHz	R&S SMY02 Agilent E8257D
Intermediate Frequency Rejection Ratio	Band A Band B Band C Band D Band E	0.96 dB 0.96 dB 1.2 dB 1.2 dB 1.9 dB	R&S SMY02 and Agilent E8257D Agilent E8257D
Image Frequency Rejection Ratio	Band A Band B Band C Band D Band E	0.87 dB 0.87 dB 0.87 dB 0.87 dB 1.9 dB	R&S SMY02 Agilent E8257D

Parameter/Equipment	Range	CMC ² (±)	Comments
EMI Receiver ⁴ – (cont)			
Spurious Frequency Rejection Ratio	Band A	1.8 dB	R&S SMY02
	Band B	1.8 dB	
	Band C	1.3 dB	Agilent E8257D
	Band D	1.3 dB	
	Band E	1.9 dB	
Peak Detector Verification	Band A	0.74 dB	Schwarzbeck IGUU2916
	Band B	0.74 dB	
	Band C	0.74 dB	
	Band D	0.74 dB	
Average Detector Verification	Band A	0.74 dB	
	Band B	0.74 dB	
	Band C	0.74 dB	
	Band D	0.74 dB	
RMS Detector Verification	Band A	0.74 dB	
	Band B	0.74 dB	
	Band C	0.74 dB	
	Band D	0.74 dB	
Response to Intermittent, Unsteady and Drifting Narrowband Disturbances	Band A	0.64 dB	R&S SMY02
	Band B	0.64 dB	
	Band C	0.72 dB	
	Band D	0.72 dB	
Impulse Bandwidth Measurement (EMI Receiver and Spectrum Analyzer)	< 1 MHz 1 MHz resolution bandwidth	3.1 kHz	Agilent 81101A
Input Impedance on CISPR Band E	(1 to 18) GHz	2.1 dB	Network analyzer N5230A CISPR 16-1-1:2015



Parameter/Range	Frequency	CMC ^{2,5} (±)	Comments
Signal Generator –			
Frequency Accuracy	9 kHz to 1 GHz	0.59 x 10 ⁻⁷ %	Agilent 53132A and Symmetricom 8040C
	(1 to 18) GHz	1.0 x 10 ⁻⁸ %	Agilent 53152A and Symmetricom 8040C
	(18 to 40) GHz	7.8 x 10 ⁻⁹ %	Agilent 53152A and Symmetricom 8040C
Reference Frequency Accuracy	10 MHz	7.9 x 10 ⁻⁹ %	Agilent 53132A and Symmetricom 8040C
Level Accuracy	9 kHz to 1 GHz	0.84 dB	Agilent E4417A w/ E9304A
	(1 to 18) GHz	0.50 dB	HP 437B w/ HP 8481A
(≥-30 dBm)	(18 to 40) GHz	1.1 dB	Agilent E4417A w/ 8487A
(<-30 dBm)	(18 to 40) GHz	1.4 dB	Agilent E4446A
AM Depth	(1 to 100) %	1.9 %	Agilent E4446A
Attenuator Setting Accuracy	9 kHz to 1 GHz	1.9 dB	Agilent E4446A
	(1 to 18) GHz	1.6 dB	
	(18 to 40) GHz	1.9 dB	
Harmonic Distortion	9 kHz to 1 GHz	1.7 dB	Agilent E4446A
	(1 to 18) GHz	1.9 dB	
	(18 to 40) GHz	3.0 dB	
AM Frequency	20 Hz to 100 kHz	0.059 %	Agilent E4446A
Insertion Loss –			
(0 to 80) dB	9 kHz to 500 MHz	0.48 dB	HP 4395A, HP 87512A
(0 to 130) dB	30 kHz to 3 GHz	0.67 dB	HP 8753D, HP 4396A 85032B (assuming no mismatch at input and output of EUT)
	(3 to 18) GHz	0.060 dB	Power sensor E4412A and power meter E4418A
	(18 to 40) GHz	2.3 dB	Power sensor 8487A and power meter E4417A

Parameter/Equipment	Frequency	CMC ^{2,5} (±)	Comments
Spectrum Analyzer –			
10 MHz Output Frequency Accuracy	10 MHz	0.10 Hz	Rubidium oscillator, counter
10 MHz Reference Frequency Accuracy	10 MHz	0.10 Hz	
Marker Readout Accuracy	DC to 26.5 GHz (>26.5 to 40) GHz	0.20 % 0.50 %	Synthesized generator
Frequency Span Accuracy	DC to 26.5 GHz (>26.5 to 40) GHz	0.47 % 0.70 %	
Frequency Readout Accuracy	DC to 40 GHz	1.2 %	
Noise Sidebands	DC to 26.5 GHz (>26.5 to 40) GHz	0.20 dB/Hz 1.0 dB/Hz	
Spurious Responses	DC to 40 GHz	2.3 dB	
Residual FM	DC to 26.5 GHz (>26.5 to 40) GHz	0.70 dB 0.80 dB	
Display Scale Fidelity	DC to 26.5 GHz (>26.5 to 40) GHz	0.57 dB 0.12 dB	Synthesized generator, step attenuators
Input Attenuation Switching Uncertainty	DC to 26.5 GHz (>26.5 to 40) GHz	0.61 dB 0.41 dB	
Reference Level Accuracy	DC to 26.5 GHz (>26.5 to 40) GHz	0.92 dB 0.10 dB	Synthesized generator, power meter w/sensor, step attenuators
Resolution Bandwidth Switching Uncertainty	DC to 26.5 GHz	0.14 dB	Synthesized generator, attenuator
Absolute Amplitude Accuracy	DC to 26.5 GHz (>26.5 to 40) GHz	1.0 dB 0.31 dB	Power meter w/ sensor, splitter, attenuator
Resolution Bandwidth Accuracy	DC to 26.5 GHz (>26.5 to 40) GHz	0.40 dB 1.0 dB	Synthesized generator, power meter w/sensor, splitter

Parameter/Equipment	Frequency	CMC ^{2,5} (±)	Comments
Spectrum Analyzer – (cont)			
Residual Response	DC to 26.5 GHz (>26.5 to 40) GHz	0.40 dB 0.26 dB	Termination
Displayed Average Noise Level	DC to 26.5 GHz (>26.5 to 40) GHz	0.26 dB 4.4 dB	Terminations
Frequency Response/Flatness	DC to 26.5 GHz (>26.5 to 40) GHz	0.52 dB 1.1 dB	Synthesized generator, power meter with sensor
Tracking Generator Level Flatness	DC to 26.5 GHz (>26.5 to 40) GHz	0.50 dB 0.10 dB	
Overall Absolute Amplitude Accuracy	DC to 26.5 GHz (>26.5 to 40) GHz	1.1 dB 0.31 dB	Synthesized generator, power meter w/ sensor, step attenuators
Click Generator –			
QP Amplitude	150 kHz to 30 MHz	2.1 dB	Agilent DSO80204B
Click Duration	150 kHz to 30 MHz	1.1 %	
Click Analyzer –			
QP Amplitude	150 kHz to 30 MHz	4.5 dB	MEB TSG-1
Click Duration	150 kHz to 30 MHz	2.5 %	
S-Parameter Test Set –			
Directivity	9 kHz to 6 GHz	0.58 dB	
Switch Repeatability	9 kHz to 6 GHz	1.2 dB	
Pre Amplifier –			
Gain	10 MHz to 18 GHz (18 to 40) GHz	1.7 dB 2.9 dB	Network analyzer N5230A
Linearity	10 MHz to 18 GHz (18 to 40) GHz	2.5 dB 2.9 dB	Network analyzer N5230A

Parameter/Equipment	Frequency	CMC ² (±)	Comments
Power Amplifier –			
Gain	10 MHz to 18 GHz	2.3 dB	With N5230A
Linearity	10 MHz to 18 GHz	2.3 dB	
Network Analyzer –			
Frequency Accuracy	9 kHz to 6 GHz (6 to 40) GHz	0.013 x 10 ⁻⁶ 1.7 x 10 ⁻⁸	
Level Accuracy	9 kHz to 6 GHz	0.25 dB	
Level Flatness	9 kHz to 6 GHz	0.25 dB	
Level Accuracy / Level Flatness	(6 to 40) GHz	1.0 dB	
Power Linearity	9 kHz to 6 GHz (6 to 40) GHz	0.56 dB 1.1 dB	
Harmonics	9 kHz to 6 GHz	0.43 dB	
Noise Level / Input Cross Talk	9 kHz to 6 GHz	2.0 dB	
Noise Level	(6 to 40) GHz	3.7 dB	
Input Impedance	9 kHz to 6 GHz (6 to 40) GHz	1.2 dB 2.3 dB	
Absolute Amplitude Accuracy	9 kHz to 6 GHz	0.46 dB	
Dynamic Accuracy			
Magnitude Ratio	9 kHz to 6 GHz	0.50 dB	
Phase	9 kHz to 6 GHz	3.9 °	



Parameter/Range	Frequency	CMC ^{2,5} (±)	Comments
Coaxial Cable – Cable Loss	9 kHz to 10 MHz 10 MHz to 18 GHz (18 to 40) GHz	0.48 dB 1.7 dB 2.9 dB	4395A, 87512A Network analyzer N5230A
Attenuator – Attenuation VSWR	9 kHz to 10 MHz 10 MHz to 18 GHz (18 to 40) GHz 10 MHz to 18 GHz	0.48 dB 1.7 dB 2.9 dB 1.8 dB	4395A, 87512A Network analyzer N5230A
ESD Simulator – Rise Time / Fall Time Peak Current, Current at 30/60 ns	(0.5 to 1.2) ns (1 to 15) kV	0.031 ns 2.4 %	IEC 61000-4-2:2008 ISO 10605
DIP/Interruption Simulator – Output Voltage – (0 to 500) V _(rms) Repetition Time – 10 s Event Time – (0 to 500) ms Phase Shifting – (0 to 360)° Rising Time/Falling Time – (1 to 5) μs Overshoot and Undershoot Voltage – Less than 5 % of Rated Voltage (Ut)	DC to 400 Hz DC to 400 Hz DC to 400 Hz DC to 400 Hz DC to 400 Hz	0.61 % 0.39 % 0.91 % 0.29 ° 2.9 % 3.0 %	IEC 61000-4-11:2004

Parameter/Equipment	Frequency	CMC ^{2,5} (±)	Comments
Capacitive Clamp – Peak Voltage Rise time Pulse Duration	2 kV (set voltage) 5 ns 50 ns	3.9 % 5.8 % 1.2 %	IEC 61000-4-4:2012
AC Power Source – Frequency Accuracy Voltage Accuracy Distortion In-Rush Current Supplying Capacity	DC to 800 Hz (1 to 700) V 20 Hz to 20 kHz 10 kVA (par Phase) 10 kVA	0.26 % 0.47 % 3.6 % 0.83 % 2.1 %	HP 34401A NF E-2001B Agilent DOS6102A
DC Power Source – Output Voltage Accuracy Voltage Drop Noise Level Output Current Accuracy	1 mV to 1000 V DC DC 100 µA to 3A	0.26 % 0.70 % 6.4 % 0.23 %	HP 34401A HP 3458A



Parameter/Equipment	Frequency	CMC ^{2,5} (±)	Comments
Audio Generator / Function Generator –			
Frequency Accuracy Sine Wave	1 Hz to 2 MHz	0.023 %	53152A, 53132A
Amplitude Accuracy Sine Wave	3 Hz to 300 kHz	0.50 %	HP 3458A, E9304A, and E4417A
Distortion Sine Wave	20 Hz to 20 kHz	3.5 %	Levear VP-7727D
Rise/Fall Time Square and Triangle Form Wave	DC to 2 MHz	0.91 ns	DSO6102A
Voltage Accuracy	DC to 2 MHz	3.0 %	HP 3458A
Duty Cycle	DC to 2 MHz	0.30 %	DSO6102A
Open Area Test Site –			
Site Attenuation	(30 to 300) MHz 300 MHz to 1 GHz	1.6 dB 1.5 dB	ANSI C63.5:2006
Site VSWR	(1 to 18) GHz	2.5 dB	CISPR 16-1-4
Current Probe –			
Transfer Impedance	100 kHz to 230 MHz	0.40 dB	CISPR 16-1-2:2014
	0.1 MHz to 1 GHz	1.2 dB	CISPR 16-1-2:2014
	(1.0 to 2.1) GHz	1.9 dB	CISPR 16-1-2:2014
Television Analyzer –			
Field Strength	300 MHz to 1 GHz	1.4 dB	Antennae, power meter w/sensor, spectrum analyzer, signal generator

Parameter/Range	Frequency	CMC ^{2,5} (±)	Comments
ESD Target –			
Flatness of Measurement Chain	30 kHz to 3 GHz	1.2 dB	IEC 61000-4-2:2008, ISO 10605:2008, 8753D
	10 MHz to 4 GHz	1.7 dB	N5230A
Input Resistance	DC	1.9 %	
Directional Couplers –			
Coupling Factor	9 kHz to 1 GHz	1.4 dB	4395A, 8753D,
	(1 to 18) GHz	1.8 dB	N5230A
	(18 to 40) GHz	3.0 dB	
Insertion loss	9 kHz to 1 GHz	1.3 dB	
	(1 to 18) GHz	1.7 dB	
	(18 to 40) GHz	2.9 dB	
VSWR	9 kHz to 1 GHz	0.55 dB	
	(1 to 18) GHz	1.8 dB	
Directivity	9 kHz to 1 GHz	1.3 dB	
	(1 to 18) GHz	1.9 dB	
	(18 to 40) GHz	3.2 dB	
Coil –			
Magnetic Field Level	(40 to 800) Hz	0.41 %	Yokogawa 2558 EMCO HI-3624A
Power Sensor –			
VSWR	DC to 3 GHz	0.85 %	HP 8753D,
	(3 to 18) GHz	1.3 %	Agilent E8257D, Agilent E4418A, Agilent E4412A, Agilent 11692D
Insertion Loss on Passage Typed Power Sensor	9 kHz to 1 GHz	0.47 dB	
	(1 to 18) GHz	1.7 dB	

Parameter/Range	Frequency	CMC ^{2,5} (±)	Comments
Power Sensor – (cont)			
Level Accuracy			
-60 dBm to 0 dBm	9 kHz to 10 MHz	4.7 %	HP 8753D, Agilent E8257D, Agilent E4418A, Agilent E4412A, Agilent 11692D
-70 dBm to 0 dBm	10 MHz to 4 GHz (4 to 6) GHz (6 to 18) GHz	5.1 % 5.7 % 6.8 %	
-30 dBm to 0 dBm	(18 to 26.5) GHz (26.5 to 40) GHz	6.3 % 12 %	
-70 dBm to -30 dBm	(18 to 26.5) GHz (26.5 to 40) GHz	6.6 % 18 %	
Calibration Factor	9 kHz to 4 GHz (4 to 6) GHz (6 to 18) GHz (18 to 26.5) GHz (26.5 to 40) GHz	3.7 % 5.0 % 5.8 % 8.9 % 11 %	
Power Meter –			
Zero Carryover	50 MHz	0.34 %	Keysight 11683A
Instrument Accuracy	50 MHz	0.34 %	
Reference Power	50 MHz	0.59 %	Keysight 478A option H76

III. Time & Frequency

Parameter/Equipment	Range	CMC ^{2,5} (±)	Comments
Frequency	0.1 Hz to 2 MHz	0.023 %	NF 1915

¹ This laboratory offers commercial calibration service.



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

³ For Reflection Coefficient calibrations, CMCs are based on a 1 port device measurement.

⁴ For the calibrations noted, CMCs are based on R&S ESHS10 and R&S ESVS10.

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

⁶ For CISPR Pulse Generator calibrations, CMCs are based on Schwarzbeck IGUU 2916.



Accredited Laboratory

A2LA has accredited

JEL LIMITED

Abiko-City, Chiba-Prefecture, Japan

for technical competence in the field of

Calibration

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



Presented this 25th day of August 2017.

A handwritten signature in black ink, written over a horizontal line.

President and CEO
For the Accreditation Council
Certificate Number 0952.04
Valid to August 31, 2019
Revised July 16, 2018

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



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