



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005
& ANSI/NCSL Z540-1-1994

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CALIBRATION

Valid To: June 30, 2013

Certificate Number: 2067.01

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	Range	CMC ^{2, 5, 9} (±)	Comments
DC Voltage ³ – Measure	(0 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V (100 to 1000) V	0.0063 % + 3.5 μV 0.0046 % + 7 μV 0.0040 % + 50 μV 0.0052 % + 0.6 mV 0.0052 % + 10 mV	Agilent 34401A
DC Voltage ³ – Generate	(0 to 320) mV (0.32 to 3.2) V (3.2 to 33) V (33 to 330) V (330 to 1020) V	0.0072 % + 3 μV 0.0058 % + 5 μV 0.0058 % + 50 μV 0.0064 % + 500 μV 0.0064 % + 1.5 mV	Fluke 5500A
DC Current ³ – Measure	(1 to 10) mA (10 to 100) mA 100 mA to 1 A (1 to 3) A (3 to 10) A	0.06 % + 2 μA 0.06 % + 5 μA 0.12 % + 0.1 mA 0.14 % + 0.6 mA 4 %	Agilent 34401A

Parameter/Equipment	Range	CMC ^{2,5} (±)	Comments
DC Current ³ – Generate	(0 to 3.3) mA (3.3 to 33) mA (33 to 330) mA (0.33 to 2.2) A (2.2 to 11) A	0.025 % + 0.05 μA 0.012 % + 0.25 μA 0.012 % + 3.3 μA 0.035 % + 44 μA 0.069 % + 330 μA	Fluke 5500A
Fixed Point	10 A	0.025 % + 1 mA	

Parameter/Range	Frequency	CMC ^{2,5,9} (±)	Comments
AC Voltage ³ – Measure			
(10 to 100) mV	10 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	0.07 % + 40 μV 0.14 % + 50 μV 0.69 % + 80 μV	Agilent 34401A
100 mV to 1.0 V	10 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	0.07 % + 0.3 mV 0.14 % + 0.5 mV 0.69 % + 0.8 mV	
(1 to 10) V	10 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	0.07 % + 3 mV 0.14 % + 5 mV 0.69 % + 8 mV	
(10 to 100) V	10 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	0.07 % + 30 mV 0.14 % + 50 mV 0.69 % + 80 mV	
(100 to 750) V	10 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	0.07 % + 225 mV 0.14 % + 375 mV 0.69 % + 600 mV	
10 mV to 100 V	DC to 1.5 GHz	1.9 %	Tek TDS 7254B
Up to 20 kV _{RMS} Up to 40 kV _{peak}	10 Hz to 50 MHz 10 Hz to 50 MHz	3.7 % 3.7 %	Oscilloscope w/ probe P6015

Parameter/Range	Frequency	CMC ^{2, 5, 9} (±)	Comments
AC Voltage ³ – Generate			
(1.0 to 33) mV	45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz	0.18 % + 20 μV 0.23 % + 20 μV 0.30 % + 20 μV	Fluke 5500A
(33 to 330) mV	45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz	0.06 % + 20 μV 0.12 % + 20 μV 0.19 % + 40 μV	
(0.33 to 3.3) V	45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz	0.03 % + 60 μV 0.09 % + 60 μV 0.16 % + 0.3 mV	
(3.3 to 33) V	45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz	0.05 % + 0.6 mV 0.09 % + 2.6 mV 0.22 % + 5 mV	
(33 to 330) V	45 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz	0.06 % + 6.6 mV 0.09 % + 15 mV 0.09 % + 33 mV	
(330 to 1020) V	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.06 % + 80 mV 0.23 % + 100 mV 0.23 % + 500 mV	
AC Current ³ – Measure			
(0 to 1) A	10 Hz to 5 kHz	0.12 % + 0.4 mA	Agilent 34401A
(1 to 3) A	10 Hz to 5 kHz	0.17 % + 1.8 mA	
(3 to 10) A	10 Hz to 5 kHz	4 %	
Up to 5000 A _{peak}	1 Hz to 20 MHz	1.9 %	Oscilloscope w/ Pearson 110 current monitor coil

Parameter/Range	Frequency	CMC ^{2, 5, 9} (±)	Comments
AC Current ³ – Generate			
(0.03 to 0.33) mA	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.27 % + 0.25 μA 0.57 % + 0.15 μA 1.5 % + 0.15 μA	Fluke 5500A
(0.33 to 3.3) mA	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.12 % + 0.3 μA 0.23 % + 0.3 μA 0.69 % + 0.3 μA	
(3.3 to 33) mA	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.10 % + 3 μA 0.23 % + 3 μA 0.69 % + 3 μA	
(33 to 330) mA	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.11 % + 30 μA 0.24 % + 30 μA 0.69 % + 30 μA	
(0.33 to 2.2) A	45 Hz to 1 kHz (1 to 5) kHz	0.12 % + 0.3 mA 0.87 % + 0.3 mA	
(2.2 to 11) A	45 Hz to 65 Hz (65 to 500) Hz (0.5 to 1) kHz	0.08 % + 2 mA 0.12 % + 2 mA 0.39 % + 2 mA	
Distortion ³	20 Hz to 20 kHz	1.4 %	Texio VA2230
Inductance ³ – Measure	(0 to 32) μH (32 to 80) μH (80 to 159) μH (1.59 to 318) mH (318 to 1.59) mH 1.59 mH to 20 H	2.9 % + 0.2 mΩ 1.5 % 0.8 % 0.5 % 0.4 % 0.4 %	NF ZM2353
Resistance ³ – Measure	(0 to 100) Ω 100 Ω to 1 kΩ (1 to 10) kΩ (10 to 100) kΩ 100 kΩ to 1 MΩ (1 to 10) MΩ (10 to 100) MΩ	0.01 % + 4 mΩ 0.01 % + 10 mΩ 0.01 % + 100 mΩ 0.01 % + 1 Ω 0.01 % + 10 Ω 0.05 % + 100 Ω 0.92 % + 10 kΩ	Agilent 34401A NF ZM2353

Parameter/Equipment	Range	CMC ^{2, 5, 9} (±)	Comments
Resistance ³ – Generate	(0 to 11) Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω (0.33 to 1.1) kΩ (1.1 to 3.3) kΩ (3.3 to 11) kΩ (11 to 33) kΩ (33 to 110) kΩ (110 to 330) kΩ (0.33 to 1.1) MΩ (1.1 to 3.3) MΩ (3.3 to 11) MΩ (11 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ	0.027 % + 0.008 Ω 0.016 % + 0.01 Ω 0.011 % + 0.01 Ω 0.011 % + 0.01 Ω 0.010 % + 0.06 Ω 0.010 % + 0.06 Ω 0.010 % + 0.6 Ω 0.011 % + 0.6 Ω 0.013 % + 6 Ω 0.014% + 6 Ω 0.018 % + 55 Ω 0.030 % + 55 Ω 0.07 % + 0.55 kΩ 0.15% + 0.55 kΩ 0.58 % + 5.5 kΩ 0.73 % + 17 kΩ	Fluke 5500A
Capacitance ³ – Measure	(8 to 15.9) pF (15.9 to 31.8) pF (31.8 to 80) pF (80 to 159) pF 159 pF to 1.22 nF 1.22 nF to 15.9 μF (15.9 to 80) μF (80 to 159) μF (159 to 318) μF (318 to 800) μF > 800 μF	1.2 % 0.9 % 0.7 % 0.5 % 0.5 % 0.4 % 0.4 % 0.5 % 0.8 % 1.5 % 2.9 % + 0.2 mΩ	NF ZM2353

II. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC ^{2, 6, 7} (±)	Comments
RF Power, Relative ³ – Measure (VSWR)			
(0 to -50) dB	5 Hz to 500 MHz 500 MHz to 20 GHz (20 to 40) GHz	0.07 dB 0.07 dB 0.74 dB	Network analyzer
(-50 to -70) dB	5 Hz to 500 MHz 500 MHz to 20 GHz	0.13 dB 0.47 dB	

Parameter/Range	Frequency	CMC ^{2, 4, 6, 7, 9} (\pm)	Comments
RF Power, Relative ³ – Measure (VSWR) (cont) (-70 to -90) dB (-90 to -100) dB	5 Hz to 20 GHz 300 kHz to 20 GHz	1.2 dB 1.2 dB	Network analyzer
Impedance ³ – 50 Ω Load	1 kHz to 2000 MHz 2 GHz to 18 GHz	0.49 % 1.5 %	Agilent 4294A Agilent 8751A, 87512A, ADVANTEST R3770 & Agilent 8753ES w/ BNC & N calibration standard
VSWR ³ – Γ	1 kHz to 500 MHz 500 MHz to 3 GHz (3 to 18) GHz	2.1 % 3.8 % 6.4 %	Agilent 8751A, 87512A, ADVANTEST R3770 & Agilent 8753ES w/ BNC & N calibration standard
RF Power, Absolute ³ – Measure (+20 to -30) dBm (+20 to -60) dBm (+20 to -70) dBm	50 MHz to 50 GHz 9 kHz to 6 GHz 50 MHz to 26.5 GHz	0.31 dB + <i>M</i> 0.25 dB + <i>M</i> 0.31 dB + <i>M</i>	Agilent E4419 + 8487D E4419 + E9304A E4419 + E4413
RF Power ³ – Generate (-20 to +30) dBm (-140 to +13) dBm (-140 to +8) dBm (-34 to -5) dBm	10 kHz to 15 MHz 15 MHz to 2 GHz (2 to 20) GHz (20 to 40) GHz	0.20 dB 0.27 dB 0.27 dB 0.75 dB	Signal generators and amplifiers

Parameter/Equipment	Frequency	CMC ^{2, 6, 7} (\pm)	Comments
RF Phase ³ – Measure (0 to 90) ^o (0 to 90) ^o (0 to 90) ^o	5 Hz to 500 MHz 500 MHz to 3 GHz (3 to 20) GHz	0.4 ^o 0.6 ^o 4.7 ^o	Network analyzer
Attenuation ³ – Generate (0 to 80) dB, 10 dB Steps	DC to 8 GHz (8 to 12.4) GHz (12.4 to 18) GHz	0.43 dB 0.53 dB 0.85 dB	Step attenuators
Broadband NSA Measurements ³	(30 to 1000) MHz (30 to 300) MHz (300 to 1000) MHz (1 to 40) GHz	0.4 dB 1.4 dB 1.1 dB 1.5 dB	ANSI C63.4 (2003, 2009), CISPR 16-1-4, network analyzer ETSI TS 102 321
Dipole NSA Measurements ³	(30 to 1000) MHz	0.4 dB	ANSI C63.4 (2003, 2009), CISPR 16-1-4, network analyzer
SVSWR Validation ³	(1 to 18) GHz	0.68 dB	CISPR 16-1-4 Ed.3, network analyzer
EM Field Uniformity ³	80 MHz to 6 GHz	0.8 dB	IEC 61000-4-3, Amd 1&2
Shield Effectiveness ³	10 kHz to 1 GHz (1 to 18) GHz	0.8 dB 0.85 dB	EN 50147-1 (1997)
Electric Field Probes ⁸	10 kHz to 1 GHz 100 kHz to 1 GHz (1 to 4) GHz (4 to 18) GHz	0.8 dB 0.7 dB 1.1 dB 1.2 dB	G-TEM using substitution method with transfer standard Anechoic chamber using substitution method with transfer standard

Parameter/Range	Frequency	CMC ^{2, 6, 7} (±)	Comments	
Antenna Factor ⁸ –	Broad Band Antennas, Bi-conical	(30 to 300) MHz	0.89 dB	Substitution method
			0.94 dB	Standard site method, ANSI C63.5 (1988, 1998, 2006)
			1.1 dB	Reference antenna method, ANSI C63.5 (1988, 1998, 2006)
			1.1 dB	SAE ARP 958 rev. D, identical method
	Log Periodic	(200 to 2000) MHz	0.92 dB	Substitution method
			0.72 dB	Standard site method, ANSI C63.5 (1988, 1998, 2006)
		(200 to 1000) MHz	1.1 dB	Reference antenna method, ANSI C63.5 (1988, 1998, 2006)
			1.1 dB	SAE ARP 958 rev. D, identical method
	Bi-Log Antenna	(30 to 300) MHz (300 to 2000) MHz	0.89 dB	Substitution method
			0.92 dB	
		(30 to 300) MHz (300 to 2000) MHz	0.94 dB	Standard site method, ANSI C63.5 (1988, 1998, 2006)
			0.72 dB	
(30 to 300) MHz (300 to 2000) MHz		1.3 dB	Reference antenna method, ANSI C63.5 (1988, 1998, 2006)	
		1.1 dB		
(30 to 2000) MHz	1.1 dB	SAE ARP 958 rev. D, identical method		
Dipole Antennas	(30 to 80) MHz (80 to 1000) MHz	0.9 dB	Reference antenna method, ANSI C63.5 (1988, 1998, 2006)	
		1.0 dB		

Parameter/Range	Frequency	CMC ^{2, 4, 6, 7, 9} (±)	Comments
Antenna Factor ⁸ – (cont)			
Horn Antennas	(30 to 80) MHz (80 to 1000) MHz	0.9 dB 1.0 dB	Reference antenna method, ANSI C63.5 (1988, 1998, 2006)
	800 MHz to 18 GHz (18 to 40) GHz	1.0 dB 0.8 dB	Standard site method, ANSI C63.5 (1988, 1998, 2006)
	800 MHz to 18 GHz (18 to 40) GHz	1.0 dB 1.1 dB	Substitution method
Horn Antenna Pattern Measurement ³	800 MHz to 18 GHz (18 to 40) GHz	1.1 dB 1.2 dB	SAE ARP 958 rev. D, Identical method
	(1 to 18) GHz (18 to 40) GHz	0.7 dB 0.8 dB	Network analyzer
Loop Antenna / Loop Sensor	10 Hz to 10 MHz (10 to 30) MHz	0.5 dB 0.7 dB	Standard magnetic field method
	10 Hz to 10 MHz	0.7 dB	Center magnetic field method
Rod Antenna ³	10 Hz to 60 MHz	0.5 dB	Equivalent capacitance substitution method (ECSM) HP 8751A, 87512A w/ BNC calibration standards
LISN ³ –			
Insertion Loss	9 kHz to 500 MHz	0.65 dB + <i>M</i>	Agilent 8751A, 87512A with BNC calibration standards
Isolation	9 kHz to 500 MHz	0.66 dB	
Impedance	9 kHz to 500 MHz	1.8 %	
Phase	(0 to +/- 180)°	5.9°	
ISN ³ –			
Voltage Division Factor	150 kHz to 30 MHz	0.3 dB	CISPR 22, CISPR 16-1-2
Decoupling Factor	150 kHz to 30 MHz	0.3 dB	
LCL	LCL 65 dB, 55 dB	0.7 dB	
	LCL 75 dB	1.8 dB	

Parameter/Range	Frequency	CMC ^{2, 4, 6, 7, 9} (\pm)	Comments
CDN's and Adapters – (50 to 150) Ω			
Adapter Insertion Loss	10 kHz to 230 MHz	0.63 dB	IEC 61000-4-6
Coupling Factor	10 kHz to 230 MHz	0.62 dB	Network analyzer & calibration kits
Impedance	10 kHz to 230 MHz	2.7 %	
Absorbing Clamp –			CISPR 16-1-3,
Decoupling Factor	30 MHz to 1 GHz	1.0 dB 2.6 dB	jig method original method
Coupling Factor	30 MHz to 1 GHz	0.3 dB	
Current Probes & Bulk Current Injection Probes ³ –			
Transfer Impedance	5 Hz to 500 MHz 500 MHz to 1 GHz	0.42 dB + <i>M</i> 0.49 dB + <i>M</i>	Agilent 8751A, 87512A with BNC calibration standards, Agilent 8753ES with type N calibration standards
ESD Simulators ³ –			IEC 61000-4-2, ISO 10605, SAE J 1113-13
Contact Voltage (+ and –) Current Rise/Fall Time	(0.15 to 74) A (0.6 to 20) ns	4.1 % 54 ps	Oscilloscope ESD Target and 1.3 m x 1.3 m Plate
Air Discharge (+ and –) Rise/Fall Time RC time Constant	(0.6 to 20) ns (220 to 740) ns	54 ps 2.4 %	
Generated Voltage	(0 to 30) kV	2.6 %	Electro-Static volt meter
ESD Target ³	Transfer Impedance	0.04 %	Fluke 5500A, Agilent 34401A

Parameter/Equipment	Range	CMC ^{2,4,9} (±)	Comments
EFT/Burst Generator ³ – (50 and 1000) Ω			
Voltage (+ and –)	125 V to 6 kV	2.8 % + <i>M</i>	Oscilloscope
Rise Time / Duration	1 ns to 360 ms	1.9 %	
Repetition Rate	Up to 500 kHz	1.9 %	

Parameter/Range	Frequency	CMC ^{2,6,7,9} (±)	Comments
Surge Generator ³ –			
Ring Wave Frequency	Up to 100 kHz	1.9 %	Oscilloscope
Front Time/Duration Time (+ and –)	(0.7 to 840) μs	1.9 %	
Voltage (+ and –)	250 V to 6 kV	3.7 %	
Current (+ and –)	(0.125 to 3) kA	2.2 %	
Voltage Dip/Interruption Generator ³ (PQF) –			
Voltage	(0 to 500) V	1.8 %	Oscilloscope
Current	(0 to 1000) A	1.8 %	
Phase	(0 to 360)°	3.6°	
Time	0.5 μs to 100 ms	0.2 %	
In-Rush Current	(0 to 1000) A	2.9 %	
Frequency Accuracy ³ – Measure	10 Hz to 18 GHz	1.2 x 10 ⁻⁶ %	EIP535B/EIP575B + Rubidium Osc.

Parameter/Range	Frequency	CMC ^{2, 6, 7, 9} (±)	Comments
Displayed Frequency Accuracy ³	10 Hz to 18 GHz	1.2 x 10 ⁻⁶ %	EIP 535B/EIP 575B + Rubidium osc. NF WF1946B R&S SMY02, SMR20
Absolute Amplitude Accuracy ³	9 kHz to 6 GHz (6 to 26.5) GHz (26.5 to 50) GHz	0.25 dB 0.31 dB 0.31 dB	Power meter w/ sensor
Span Readout Accuracy ³	10 Hz to 18 GHz	0.5 %	EIP 535B/EIP 575B NF WF1946B R&S SMY02, SMR20
Amplitude Modulation ³ – Carrier Frequency Modulation Frequency 400 Hz to 10 kHz Modulation Index (10 to 99) %	9 kHz to 1 GHz	2.0 %	Oscilloscope
Frequency Modulation ³ – Carrier Frequency Modulation Frequency (0.3 to 10) kHz FM Deviation (1 to 200) kHz	10 MHz to 2 GHz	1.2 %	Spectrum analyzer
Reference Level ³	9 kHz to 6 GHz (6 to 18) GHz	0.25 dB 0.4 dB	Signal generator Power meter w/ sensor & power divisor
Marker Amplitude Readout Accuracy ³	9 kHz to 6 GHz (6 to 18) GHz	0.25 dB 0.4 dB	Signal generator Power meter w/ sensor & power divisor

Parameter/Range	Frequency	CMC ^{2, 6, 7, 9} (\pm)	Comments
Bandwidth Accuracy	9 kHz to 1 GHz	0.25 dB	Signal generator Power meter w/ sensor & power divisor
Bandwidth Switching Accuracy ³	9 kHz to 18 GHz	0.1 dB	Signal generator Power meter w/ sensor & power divisor
Harmonic Measurement ³	9 kHz to 6 GHz (6 to 50) GHz	0.47 dB 0.55 dB	Spectrum analyzer
Frequency Response	5 Hz to 500 MHz 500 MHz to 20 GHz (20 to 40) GHz	0.07 dB 0.07 dB 0.74 dB	Network analyzer
Oscilloscope ³ –			
Voltage Accuracy	2 mV/div to 10 V/div	0.2 %	Function generator
Frequency Bandwidth	9 kHz to 6 GHz	0.5 dB	Signal generator
Rise Time	DC to 1 GHz (1 to 4) GHz	3.8 % 4.1 %	Pulse generator
CAL Out, Frequency	1 kHz	1.2×10^{-6} %	Function generator
Input Impedance	50 Ω 1 M Ω	0.01 % + 4 m 0.01 % + 10 Ω	Agilent 34401A
Time Accuracy	10 ns to 1 s 200 ps to 1 ns	0.23 % 0.26 %	Function generator Pulse generator
Probe Rise Time	DC to 300 MHz	5.3 %	Pulse generator
Power Analyzer ^{3, 8} –			
AC Voltage	(10 to 1000) V	0.07 %	Fluke 5500A
AC Current	(0.33 to 2.2) A (2.2 to 11) A	0.14 % 0.09 %	

Parameter/Range	Frequency	CMC ^{2, 5, 6, 8, 9} (\pm)	Comments
Power Analyzer ³ – (cont)			
AC Power	0.1 W to 11 kW	0.12 %	Fluke 5500A
Power Factor	(0 to 100) %	0.0013 %	Fluke 5500A
Frequency	10 Hz to 2.4 kHz	0.01 Hz	Fluke 5500A
Harmonics Current	50 Hz to 2.4 kHz	0.3 %	Agilent 34401A
Harmonics Distortion	50 Hz to 2.4 kHz	0.1 %	Agilent 34401A
Pst	(0.4 to 3.0)	0.24 %	Agilent 34401A
EMI Receiver ³ –			
Reference Frequency	10 Hz to 6 GHz	1.2 x 10 ⁻⁶ %	Frequency counter & Rubidium oscillator
Input Impedance, SWR	9 kHz to 6 GHz	0.08 dB	Network analyzer w/ calibration kit
Sine-Wave Accuracy (110 to 0) dB μ V	9 kHz to 6 GHz	0.3 dB	Signal generator, power meter/sensor
Pulse Response: QP Pulse Response	Band A and B Band C and D	0.6 dB 1.0 dB	Pulse generator
QP Pulse Rate Response	Band A and B Band C and D	0.6 dB 1.0 dB	Pulse generator
Relative Pulse Response/QP	Band A and B Band C and D	0.6 dB 1.0 dB	Pulse generator
Selectivity, 6 dB Bandwidth	Band A Band B Band C and D Band E	2.4 Hz 130 Hz 1.4 kHz 11 kHz	Pulse generator, frequency counter

Parameter/Range	Frequency	CMC ^{2, 6, 9} (±)	Comments
EMI Receiver ³ – (cont)			
IF Rejection Ratio	9 kHz to 6 GHz	0.3 dB	Signal generator, power meter/sensor
Image Rejection Ratio	9 kHz to 6 GHz	0.3 dB	Signal generator, power meter/sensor
Spurious Responses	9 kHz to 6 GHz	0.3 dB	Signal generator, power meter/sensor
Intermodulation Effects	9 kHz to 6 GHz	0.3 dB	Signal generator, power meter/sensor
Signal Generator ³ –			
Output: Frequency Accuracy	10 Hz to 18 GHz	1.2 x 10 ⁻⁶ %	Frequency counter
Level Accuracy 1 kHz to 26 GHz	(+20 to -50) dBm (-50 to -110) dBm	0.37 dB 0.47 dB	Power meter/sensors Spectrum analyzer
Flatness	1 kHz to 26 GHz	0.37 dB	Power meter/sensors
Impedance, SWR	100 kHz to 18 GHz	0.08 dB	Network analyzer w/ calibration kit
Harmonics	9 kHz to 6 GHz (6 to 26.5) GHz	0.5 dB 0.6 dB	Spectrum analyzer
Amplitude Modulation: Index: (10 to 99) % Modulation Frequency 400 Hz to 10 kHz	500 kHz to 1 GHz	2.0 %	Oscilloscope
Frequency Modulation: Modulation Index (1 to 100) kHz Modulation Frequency 400 Hz to 10 kHz	10 MHz to 1 GHz	1.2 %	Spectrum analyzer
Phase Modulation: Modulation Index (0.01 to 10) rad Modulation Frequency 400 Hz to 10 kHz	10 MHz to 1 GHz	1.2 %	Spectrum analyzer

Parameter/Range	Frequency	CMC ^{2,6,9} (±)	Comments
Spectrum Analyzer ³ –			
Calibration Output: Frequency Level	9 kHz to 18 GHz	1.2 x 10 ⁻⁶ % 0.25 dB	Frequency counter Power meter/sensor
Span Readout Accuracy	9 kHz to 18 GHz	0.5 %	Signal generator, frequency counter
Frequency Readout Accuracy (Including Maker Frequency)	9 kHz to 6 GHz (6 to 18) GHz	1.2 x 10 ⁻⁶ %	Frequency counter
Level Accuracy	9 kHz to 6 GHz (6 to 18) GHz	0.25 dB 0.42 dB	Signal generator, power meter/sensors
Input Attenuator	9 kHz to 6 GHz (6 to 18) GHz	0.25 dB 0.42 dB	Signal generator, power meter/sensor
Reference Level (IF Attenuator)	9 kHz to 18 GHz	0.25 dB 0.42 dB	Signal generator, power meter/sensor
Input Impedance, SWR	9 kHz to 18 GHz	0.08 dB	Network analyzer w/ calibration kit
Resolution Bandwidth	9 kHz to 6 GHz (6 to 18) GHz	2.3 %	Signal generator, power meter/sensor, frequency counter
Tracking Generator: Absolute Output	9 kHz to 6 GHz (6 to 18) GHz	0.25 dB 0.42 dB	Power meter/sensor
Output Level Flatness	9 kHz to 6 GHz (6 to 18) GHz	0.25 dB 0.42 dB	Power meter/sensor

Parameter/Range	Frequency	CMC ^{2, 6, 8, 9} (\pm)	Comments
Network Analyzer ³ –			
Frequency	1 kHz to 40 GHz	$1.2 \times 10^{-6} \%$	Frequency counter
VSWR	1 kHz to 0.5 GHz (0.5 to 3) GHz (3 to 40) GHz	2.1 % 3.8 % 6.4 %	Network analyzer
Output Level Accuracy	1 kHz to 6 GHz (6 to 40) GHz	0.25 dB 0.31 dB	Power meter/sensor
Output Level Flatness	1 kHz to 6 GHz (6 to 40) GHz	0.25 dB 0.31 dB	Power meter/sensor
S ₂₁ , S ₁₂ – Attenuation:			
(0 to -50) dB	1 kHz to 18 GHz (18 to 40) GHz	0.15 dB 0.39 dB	Precision attenuators
(-60 to -100) dB	1 kHz to 18 GHz (18 to 40) GHz	0.62 dB 0.71 dB	
S ₁₁ , S ₂₂ – Return Loss:	1 kHz to 40 GHz	0.9 dB for 12 dB 2.1 dB for 24 dB	Precision attenuators & calibration kit
Phase	DC to 4 GHz	0.16°	Precision BNC cable

III. Time & Frequency

Parameter/Equipment	Frequency	CMC ^{2, 9} (\pm)	Comments
Frequency ³ – Measuring Equipment	0.01 μ Hz to 100 Hz 100 Hz to 1 MHz 1 MHz to 1 GHz (1 to 18) GHz	0.024 % 0.0052 % 0.00026 % 0.00016 %	NF WF1946B Rhode & Schwarz SMY 02 Rhode & Schwarz SMR 20
Frequency ³ – Measure	10 Hz to 18 GHz	$1.2 \times 10^{-6} \%$	EIP 535B & Rubidium oscillator
Time Interval ³ – Measure	330 ps to 1 s	1.6 % + 30 ps	Oscilloscope

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- ¹ This laboratory offers commercial and field calibration service.
- ² Calibration and Measurement Capability (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. Calibration and Measurement Capabilities 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 source of the mismatch uncertainty due to connections of the device to other devices in actual use.
- ⁵ Agilent 34401A or Fluke 5500A CMCs are to be read as percent of reading plus a floor value when % is used as part of the CMC.
- ⁶ Instruments are calibrated against manufacturer's specifications. These calibrations may also, at customer request, be based on conformance to the calibration requirements of various standards such as CISPR 16-1-1, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-11, EN 61000-4-5, IEC 61000-4-2, IEC 61000-3-2, IEC 61000-3-3, IEC 61000-4-7, IEC 61000-4-8, IEC 61000-4-9, IEC 61000-4-10, IEC 61000-4-11, IEC 61000-4-12, IEC 61000-4-13, IEC 61000-4-14, IEC 61000-4-15, ANSI 62.41:1991, ANSI C63.16, ANSI C62-41, UL 864, UL 1449, ISO 7637-2, ISO 17069, ITU Rec K.17, ITU Rec K.20, ITU Rec K.21, SBC-TP-76200, GR1089CORE and SAE J1113-13. Other standards may apply and the customer should contact the lab for further information.
- ⁷ Some of the types of instruments calibrated under these parameters are: EMI Receivers, EFT/Burst Generators, ESD Guns and Targets, Surge Generators, Generators for Voltage Dips, Short Interrupts and Variations, Ring Wave Generators, Network Analyzers, Click Analyzers, Impulse Generators, Power Meters, Power Sensors, Signal Generators, Spectrum Analyzers, Attenuators, Terminations, Power Analyzers, Reference Impedance Network (RIN) and CVCF power supply.
- ⁸ These calibrations are performed only at the Fujitsu General EMC Laboratory, located at 1116 Suenaga, Takatsu-ku, Kawasaki, 213-8502, JAPAN. Calibrations with no location identifier are performed either at LIBERTY LABS ASIA, Inc. facility or the Fujitsu General EMC Laboratory.
- ⁹ In the statement of CMC, percentages are to be read as percent of reading unless otherwise noted.



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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 the requirements of ANSI/NCSL Z540-1-1994 and 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 12th day of December 2011.





Peter Meyer

President & CEO
For the Accreditation Council
Certificate Number 2067.01
Valid to June 30, 2013

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