SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017,
ANSI/NCSL Z540-1-1994 & ANSI/NCSL Z540.3-2006

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CALIBRATION

Valid To: February 28, 2026 Certificate Number: 2662.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations[1, 7]:

I. Dimensional

Parameter/Equipment	Range	CMC[2] (±)	Comments
Calipers[3] –			
Outside Diameter	Up to 48 in	10 µin + 7.6 µin/in	Gage blocks
Step & Depth	Up to 48 in	16 µin + 7.5 µin/in	Gage blocks, surface plate
Inside Diameter	1.5 in	32 µin	Ring gages
Depth Gages	Up to 48 in	16 µin + 7.5 µin/in	Gage blocks, surface plate
Micrometers[3] –			
Spindle Linearity	Up to 48 in	10 µin + 7.6 µin/in	Gage blocks
Anvil Flatness	50 µin	11 µin	Optical flat
Parallelism	50 µin	9.8 µin	
Dial Indicators[3]	Up to 1 in	57 µin	Indicator calibrator
Height Gages	Up to 48 in	16 µin + 7.5 µin/in	Gage blocks, surface plate

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Parameter/Equipment	Range	CMC[2] (±)	Comments
Rulers[3]	Up to 48 in Up to 24 in	230 µin + 39 µin/in 0.014 in	Micro-rule Standard rule

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2, 4, 5] (±)	Comments
DC Voltage – Generate[3]	(0 to 220) mV (0.22 to 2.2) V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1100) V (0 to 120) mV (0 to 1.2) V (0 to 12) V (0 to 120) V (0 to 1020) V	0.49 µV + 5.7 nV/mV 0.8 µV + 3.5 µV/V 2.9 µV + 2.5 µV/V 4.3 µV + 2.5 µV/V 43 µV + 3.5 µV/V 0.42 mV + 4.5 µV/V 0.8 µV + 9.3 µV/V 1.9 µV + 5.8 µV/V 10 µV + 6.2 µV/V 0.1 mV + 8.5 µV/V 1 mV + 8.5 µV/V	Fluke 5720A Fluke 5560A
DC Voltage[3] – Generate, Fixed Points	1.018 V 10 V	7.1 µV 23 µV	Fluke 732B
DC High Voltage – Generate[3]	(1 to 15) kV	0.13 %	Peschel P20Y-D w/ Ross VD15-50Y-A-LB-AL, Agilent 34401A
DC Voltage –Measure[3]	(0.01 to 1) mV (1 to 10) mV Up to 100 mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1000) V	25 µV + 52 nV/mV 0.41 µV + 53 nV/mV 0.33 µV + 13 nV/mV 0.52 µV + 4 µV/V 1.6 µV + 4 µV/V 35 µV + 6 µV/V 0.2 mV + 8 µV/V	Agilent 34420A Agilent 3458A
DC High Voltage – Measure[3]	(1 to 15) kV (1 to 100) kV	0.13 % 0.12 %	Ross VD15-50Y-A-LB-AL w/ Agilent 34401A Vitrek HVL-100

Parameter/Equipment	Range	CMC[2, 4, 5] (±)	Comments
DC Current –Generate[3]	Up to 220 µA (0.22 to 2.2) mA (2.2 to 22) mA (22 to 220) mA (0.22 to 2.2) A (2.2 to 11) A	6 nA + 35 pA/µA 7.1 nA + 30 nA/mA 41 nA + 30 nA/mA 0.73 µA + 1 µA/mA 12 µA + 0.11 mA/A 0.49 mA + 0.34 mA/A	Fluke 5720A w/ 5725A
	(11 to 20.5) A	9.4 mA + 0.8 mA/A	Fluke 5520A
	(20 to 120) A	0.013 %	Agilent 3458A w/ 6031A, 9211A
	(0 to 120) µA (0 to 1.2) mA (0 to 12) mA (0 to 120) mA (0 to 1.2) A (0 to 3.1) A (0 to 12) A (0 to 30.2) A	6 nA + 97 µA/A 15 nA + 78 µA/A 82 nA + 78 µA/A 0.82 µA + 78 µA/A 10 µA + 0.12 mA/A 0.15 mA + 0.23 mA/A 0.25 mA + 0.23 mA/A 0.5 mA + 0.78 mA/A	Fluke 5560A
Clamp-On Only[3]	(10 to 16.5) A (16.5 to 150) A (150 to 1025) A	50 mA + 6.5 mA/A 0.18 A + 3.4 mA/A 0.83 A + 3.3 mA/A	Fluke 5520A w/ coil
	(2 to 20) A (20 to 120) A	0.08 % 0.023 %	52120A 52120A w/: 3KA coil 6KA coil
	(100 to 2500) A (100 to 5000) A	0.65 % 0.7 %	
DC Current – Measure[3]	Up to 100 nA (0.1 to 1) µA (1 to 10) µA (10 to 100) µA (0.1 to 1) mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A	41 pA + 89 fA/nA 41 pA + 28 pA/µA 0.4 nA + 24 pA/µA 0.82 nA + 22 pA/µA 5.8 nA + 24 nA/mA 53 nA + 21 nA/mA 0.53 µA + 37 nA/mA 10 µA + 0.11 mA/A	Agilent 3458A
	(1 to 10) A (10 to 100) A (1 to 300) A	0.0025 % 0.0052 % 0.0054 %	Guildline 9211A w/ Agilent 3458A

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
DC Resistance – Generate[3]	(0 to 10.9999) Ω	1.2 mΩ + 24 μΩ/Ω	Fluke 5520A, 4-wire
	(11 to 32.9999) Ω	1.5 mΩ + 24 μΩ/Ω	
	(33 to 109.9999) Ω	1.9 mΩ + 22 μΩ/Ω	
	(110 to 329.9999) Ω	4.1 mΩ + 22 μΩ/Ω	
	(330 to 1099.999) Ω	9.1 mΩ + 22 μΩ/Ω	
	(1.1 to 3.299 999) kΩ	41 mΩ + 22 μΩ/Ω	
	(3.3 to 10.999 99) kΩ	92 mΩ + 22 μΩ/Ω	
	(11 to 32.999 99) kΩ	0.41 Ω + 22 μΩ/Ω	
	(33 to 109.9999) kΩ	0.9 Ω + 22 μΩ/Ω	
	(110 to 329.9999) kΩ	8.4 Ω + 26 μΩ/Ω	
	(330 to 1099.999) kΩ	14 Ω + 26 μΩ/Ω	
	(1.1 to 3.299 999) MΩ	93 Ω + 48 μΩ/Ω	
	(3.3 to 10.999 99) MΩ	0.4 kΩ + 0.1 mΩ/Ω	
	(11 to 32.999 99) MΩ	4.4 kΩ + 0.2 mΩ/Ω	
	(33 to 109.9999) MΩ	16 kΩ + 0.4 mΩ/Ω	
	(110 to 329.9999) MΩ	0.35 MΩ + 2.4 mΩ/Ω	
	(330 to 1100) MΩ	4.4 MΩ + 12 mΩ/Ω	
	(1 to 10) MΩ	1.1 kΩ + 1.2 mΩ/Ω	Biddle 72-6346-1
	(10 to 100) MΩ	11 kΩ + 1.2 mΩ/Ω	
	100 MΩ to 1 GΩ	0.23 MΩ + 2.3 mΩ/Ω	
	(1 to 10) GΩ	5.8 MΩ + 6.4 mΩ/Ω	
	(10 to 100) GΩ	0.12 GΩ + 12 mΩ/Ω	
	(0 to 12) Ω	1 mΩ + 19 μΩ/Ω	Fluke 5560A
	(12 to 120) Ω	1.2 mΩ + 19 μΩ/Ω	
	120 Ω to 1.2 kΩ	4.4 mΩ + 19 μΩ/Ω	
	(1.2 to 12) kΩ	44 mΩ + 19 μΩ/Ω	
	(12 to 120) kΩ	0.44 Ω + 19 μΩ/Ω	
	120 kΩ to 1.2 MΩ	4.4 Ω + 19 μΩ/Ω	
	(1.2 to 12) MΩ	63 Ω + 27 μΩ/Ω	
	(12 to 120) MΩ	6.5 kΩ + 0.33 mΩ/Ω	
	(120 to 1200) MΩ	0.47 MΩ + 3.1 mΩ/Ω	

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
DC Resistance – Generate, Fixed Points[3]	0 Ω	50 µΩ	Fluke 5720A
	1 Ω	95 µΩ	
	1.9 Ω	0.18 mΩ	
	10 Ω	0.26 mΩ	
	19 Ω	0.48 mΩ	
	100 Ω	1.1 mΩ	
	190 Ω	2 mΩ	
	1 kΩ	9 mΩ	
	1.9 kΩ	17 mΩ	
	10 kΩ	90 mΩ	
	19 kΩ	0.17 Ω	
	100 kΩ	1.1 Ω	
	190 kΩ	2.1 Ω	
	1 MΩ	18 Ω	
	1.9 MΩ	36 Ω	
	10 MΩ	0.37 kΩ	
	19 MΩ	0.89 kΩ	
	100 MΩ	50 kΩ	
	1 Ω	13 µΩ	Ohm-Labs SmartResistor
	10 Ω	96 µΩ	
	100 Ω	0.14 mΩ	
	1 kΩ	0.63 mΩ	
	10 kΩ	5.7 mΩ	
	100 kΩ	66 mΩ	
	1 MΩ	4.3 Ω	
	10 MΩ	59 Ω	
	1 GΩ	35 kΩ	Fluke 8508A-7000k
	10 GΩ	1.2 MΩ	Keithley 5155-10
	100 GΩ	15 MΩ	Keithley 5155-11
	1 TΩ	0.52 GΩ	Keithley 5155-11
	1 Ω	33 µΩ	L&N 4210-B
	10 Ω	0.34 mΩ	L&N 4025-B
	100 Ω	3.5 mΩ	L&N 4030-B
	1 kΩ	13 mΩ	HP 11103A
	10 kΩ	49 mΩ	Fluke 742A-10k
	10 kΩ	0.25 Ω	L&N 4040-B
	1 MΩ	42 Ω	L&N 4050-B
	19 MΩ	280 Ω	Fluke 742A-19M

Parameter/Equipment	Range	CMC[2, 4, 5] (±)	Comments
DC Resistance[3] – Generate, Fixed Points, High Voltage			
Up to 20 V	1 kΩ 10 kΩ 100 kΩ 1 MΩ	0.0013 % 0.0013 % 0.0013 % 0.0022 %	IET VRS-100-10-1K-BP-10KV
Up to 100 V	10 MΩ	0.004 %	
Up to 1000 V	100 MΩ 1 GΩ 10 GΩ 100 GΩ 1 TΩ	0.012 % 0.062 % 0.24 % 0.36 % 0.51 %	
Up to 10 kV	10 MΩ 100 MΩ 1 GΩ 10 GΩ 100 GΩ 1 TΩ	0.54 % 0.5 % 0.5 % 0.5 % 0.51 % 0.51 %	
Capacitance – Measure, Time Charge Method	(200 to 329.999) µF (0.33 to 1.099 99) mF (1.1 to 3.2999) mF (3.3 to 10.9999) mF (11 to 32.9999) mF (33 to 110) mF	0.015 % 0.011 % 0.0075 % 0.0059 % 0.0046 % 0.0088 %	5720A, 3458A
DC Resistance – Measure[3]	333 µΩ 1 mΩ 10 mΩ 100 mΩ 1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ (0.01 to 1) Ω (1 to 10) Ω	0.0047 % 0.0046 % 0.002 % 0.002 % 0.0015 % 0.0015 % 0.0015 % 0.0015 % 0.0015 % 3.2 µΩ + 71 µΩ/Ω 86 µΩ + 60 µΩ/Ω	Current transfer using Guildline 9211A & 8508A Agilent 34420A

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
DC Resistance – Measure[3] (cont)	Up to 10 Ω (10 to 100) Ω (100 to 1000) Ω (1 to 10) kΩ (10 to 100) kΩ (100 to 1000) kΩ (1 to 10) MΩ (10 to 100) MΩ (0.1 to 1) GΩ	55 μΩ + 15 μΩ/Ω 0.52 mΩ + 11 μΩ/Ω 0.53 mΩ + 85 μΩ/Ω 5.3 mΩ + 83 μΩ/Ω 0.053 mΩ + 85 μΩ/Ω 2.3 Ω + 14 μΩ/Ω 0.1 kΩ + 55 μΩ/Ω 1 kΩ + 0.52 mΩ/Ω 10 kΩ + 5.1 mΩ/Ω	Agilent 3458A
Electrical Calibration of Thermocouple Indicators[3] –			
Type J	(-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C	0.22 °C 0.13 °C 0.11 °C 0.14 °C 0.18 °C	Fluke 5520A
	(-210 to -100) °C (-100 to 150) °C (150 to 760) °C (760 to 1200) °C	0.22 °C 0.12 °C 0.14 °C 0.19 °C	Fluke 5560A
Type K	(-210 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.27 °C 0.14 °C 0.13 °C 0.21 °C 0.32 °C	Fluke 5520A
	(-210 to -100) °C (-100 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.26 °C 0.12 °C 0.19 °C 0.32 °C	Fluke 5560A
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.51 °C 0.21 °C 0.15 °C 0.13 °C	Fluke 5520A
	(-250 to -150) °C (-150 to 0) °C (0 to 400) °C	0.54 °C 0.19 °C 0.12 °C	Fluke 5560A

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Electrical Calibration of RTDs – Generate[3]			
Pt 385, 100 Ω	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 800) °C	0.042 °C 0.041 °C 0.057 °C 0.073 °C 0.081 °C 0.097 °C 0.19 °C	Fluke 5520A
Pt 3926, 100 Ω	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C	0.041 °C 0.041 °C 0.057 °C 0.073 °C 0.081 °C 0.097 °C	
Pt 3916, 100 Ω	(-200 to -190) °C (-190 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.2 °C 0.033 °C 0.042 °C 0.049 °C 0.057 °C 0.065 °C 0.073 °C 0.081 °C 0.19 °C	
Pt 385, 200 Ω	(-200 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.034 °C 0.034 °C 0.042 °C 0.097 °C 0.11 °C 0.11 °C 0.13 °C	
Pt 385, 500 Ω	(-200 to -80) °C (-80 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.034 °C 0.042 °C 0.041 °C 0.05 °C 0.065 °C 0.073 °C 0.089 °C	
Pt 385, 1000 Ω	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 600) °C (600 to 630) °C	0.026 °C 0.026 °C 0.033 °C 0.042 °C 0.049 °C 0.057 °C 0.19 °C	

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Electrical Calibration of RTDs (ITS-90 to IPTS-68) – Generate[3]			
Pt 100 (385)	(-200 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 800) °C	0.047 °C 0.058 °C 0.081 °C 0.093 °C 0.1 °C 0.21 °C	Fluke 5560A
Pt 100 (3916)	(-200 to -190) °C (-190 to -80) °C (-80 to 0) °C (0 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 630) °C	0.22 °C 0.035 °C 0.047 °C 0.058 °C 0.07 °C 0.081 °C 0.093 °C	
Pt 100 (3926)	(-200 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C	0.047 °C 0.058 °C 0.081 °C 0.093 °C 0.1 °C	
Pt 200 (385)	(-200 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.035 °C 0.047 °C 0.1 °C 0.12 °C 0.13 °C 0.14 °C	
Pt 500 (385)	(-200 to -80) °C (-80 to 100) °C (100 to 260) °C (260 to 400) °C (400 to 600) °C (600 to 630) °C	0.035 °C 0.047 °C 0.058 °C 0.07 °C 0.081 °C 0.1 °C	
Pt 1000 (385)	(-200 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 600) °C (600 to 630) °C	0.024 °C 0.035 °C 0.047 °C 0.058 °C 0.21 °C	

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
AC Voltage – Generate[3]			
Up to 2.2 mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	4 µV + 0.33 µV/mV 4 µV + 85 nV/mV 4 µV + 75 nV/mV 4 µV + 0.18 µV/mV 5 µV + 0.46 µV/mV 10 µV + 0.9 µV/mV 20 µV + 1.2 µV/mV 20 µV + 2.5 µV/mV	Fluke 5720A
(2.2 to 22) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	4.5 µV + 0.22 µV/mV 4.2 µV + 85 nV/mV 4.2 µV + 75 nV/mV 4.4 µV + 0.18 µV/mV 6.1 µV + 0.46 µV/mV 12 µV + 0.9 µV/mV 23 µV + 1.2 µV/mV 26 µV + 2.5 µV/mV	
(22 to 220) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	17 µV + 0.22 µV/mV 9 µV + 85 nV/mV 8.7 µV + 75 nV/mV 11 µV + 0.18 µV/mV 16 µV + 0.46 µV/mV 31 µV + 0.9 µV/mV 48 µV + 1.2 µV/mV 78 µV + 2.5 µV/mV	
220 mV to 2.2 V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	90 µV + 0.22 mV/V 34 µV + 79 µV/V 18 µV + 39 µV/V 26 µV + 70 µV/V 54 µV + 0.11 mV/V 0.16 mV + 0.34 mV/V 0.56 mV + 0.83 mV/V 0.64 mV + 1.5 mV/V	
(2.2 to 22) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.89 mV + 0.22 mV/V 0.34 mV + 80 µV/V 0.15 mV + 40 µV/V 0.26 mV + 70 µV/V 0.41 mV + 0.1 mV/V 1.2 mV + 0.26 mV/V 4 mV + 0.9 mV/V 6.1 mV + 1.3 mV/V	

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
AC Voltage – Generate[3] (cont)			
(22 to 220) V*	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	8.9 mV + 0.22 mV/V 3.4 mV + 80 µV/V 1.7 mV + 47 µV/V 3.5 mV + 72 µV/V 5.9 mV + 0.13 mV/V 34 mV + 0.8 mV/V 0.13 V + 4.2 mV/V 0.24 V + 7 mV/V	Fluke 5720A * 220 V range subject to 2.2E7 V-Hz limitation
(220 to 1100) V	40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz	22 mV + 80 µV/V 34 mV + 0.13 mV/V 93 mV + 0.36 mV/V	Fluke 5720A w/5725A
(220 to 750) V	(30 to 50) kHz (50 to 100) kHz	93 mV + 0.36 mV/V 0.34 V + 1.3 mV/V	
AC Voltage – Generate[3]			
(1 to 12) mV	(0.01 to 3) Hz (3 to 5) Hz (5 to 10) Hz 10 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz	0.11 mV + 50 mV/V 8.9 µV + 1.9 mV/V 7.7 µV + 0.68 mV/V 6.1 µV + 0.12 mV/V 6.3 µV + 0.29 mV/V 16 µV + 1.2 mV/V 36 µV + 6.2 mV/V 36 µV + 6.2 mV/V	Fluke 5560A
(12 to 120) mV	(0.01 to 3) Hz (3 to 5) Hz (5 to 10) Hz 10 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz	1.2 mV + 50 mV/V 30 µV + 1.9 mV/V 15 µV + 0.68 mV/V 7.4 µV + 0.11 mV/V 11 µV + 0.27 mV/V 28 µV + 0.62 mV/V 49 µV + 1.6 mV/V 49 µV + 1.6 mV/V	
(0.12 to 1.2) V	(0.01 to 3) Hz (3 to 5) Hz (5 to 10) Hz (10 to 40) Hz 40.01 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz	12 mV + 50 mV/V 0.3 mV + 1.9 mV/V 0.15 mV + 0.68 mV/V 74 µV + 0.11 mV/V 21 µV + 0.11 mV/V 42 µV + 0.23 mV/V 0.11 mV + 0.54 mV/V 0.26 mV + 1.5 mV/V 0.26 mV + 1.5 mV/V	

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
AC Voltage – Generate[3] (cont)			
(1.2 to 12) V	(0.01 to 3) Hz (3 to 5) Hz (5 to 10) Hz (10 to 40) Hz 40.01 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz	0.12 V + 50 mV/V 3 mV + 1.9 mV/V 1.6 mV + 0.68 mV/V 0.49 mV + 0.11 mV/V 0.18 mV + 0.11 mV/V 0.33 mV + 0.23 mV/V 0.77 mV + 0.54 mV/V 2.5 mV + 1.6 mV/V 2.5 mV + 1.6 mV/V	Fluke 5560A
(12 to 120) V	(0.01 to 3) Hz (3 to 5) Hz (5 to 10) Hz (10 to 40) Hz 40.01 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz*	1.2 V + 50 mV/V 30 mV + 1.9 mV/V 16 mV + 0.68 mV/V 4.8 mV + 0.11 mV/V 1.8 mV + 0.11 mV/V 3.3 mV + 0.23 mV/V 7.7 mV + 0.54 mV/V 39 mV + 1.6 mV/V	* Max output 70 V
(120 to 330) V	(3 to 5) Hz (5 to 10) Hz 10 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	0.3 V + 1.9 mV/V 0.16 V + 0.68 mV/V 21 mV + 0.11 mV/V 36 mV + 0.23 mV/V 0.16 V + 1.2 mV/V	
(330 to 1020) V	(3 to 5) Hz (5 to 10) Hz 10 Hz to 10 kHz	0.7 V + 1.9 mV/V 0.3 V + 0.68 mV/V 0.12 V + 0.11 mV/V	
AC High Voltage – Generate[3]			
(1 to 10) kV	50/60 Hz	0.59 %	Ross VD15-50Y-A-LB-AL w/ Agilent 34401A, Peschel P20Y-D
AC High Voltage – Measure[3]			
(1 to 42) kV	50/60 Hz	0.59 %	Ross VD60-6.2Y-A-LB-ACD
(1 to 70) kV	50/60/100 Hz	0.17 %	Vitrek HVL-100

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
AC Voltage – Measure[3]			
(0 to 2.2) mV	(10 to 20) Hz	1.3 µV + 1.7 µV/mV	Fluke 5790A
	(20 to 40) Hz	1.3 µV + 0.73 µV/mV	
	40 Hz to 20 kHz	1.3 µV + 0.41 µV/mV	
	(20 to 50) kHz	2 µV + 0.8 µV/mV	
	(50 to 100) kHz	2.5 µV + 1.2 µV/mV	
	(100 to 300) kHz	4 µV + 2 µV/mV	
	(300 to 500) kHz	8 µV + 2.4 µV/mV	
	(0.5 to 1) MHz	8 µV + 3.5 µV/mV	
	(1 to 1.2) MHz	29 µV + 50 nV/mV	
	(1.2 to 2) MHz	29 µV + 50 nV/mV	
	(2 to 10) MHz	29 µV + 0.2 µV/mV	
	(10 to 20) MHz	29 µV + 0.52 µV/mV	
	(20 to 30) MHz	29 µV + 2.5 µV/mV	
(2.2 to 7) mV	(10 to 20) Hz	3 µV + 0.85 µV/mV	
	(20 to 40) Hz	2.1 µV + 0.37 µV/mV	
	40 Hz to 20 kHz	1.7 µV + 0.21 µV/mV	
	(20 to 50) kHz	2.8 µV + 0.4 µV/mV	
	(50 to 100) kHz	3.7 µV + 0.6 µV/mV	
	(100 to 300) kHz	6.4 µV + 1.2 µV/mV	
	(300 to 500) kHz	11 µV + 1.3 µV/mV	
	(0.5 to 1) MHz	13 µV + 2.3 µV/mV	
	(1 to 1.2) MHz	19 µV + 0.15 mV/mV	
	(1.2 to 2) MHz	19 µV + 0.15 mV/mV	
	(2 to 10) MHz	19 µV + 0.28 µV/mV	
	(10 to 20) MHz	19 µV + 0.71 µV/mV	
	(20 to 30) MHz	20 µV + 2.5 µV/mV	
(7 to 22) mV	(10 to 20) Hz	3.1 µV + 0.29 µV/mV	
	(20 to 40) Hz	2.5 µV + 0.19 µV/mV	
	40 Hz to 20 kHz	2 µV + 0.11 µV/mV	
	(20 to 50) kHz	3.3 µV + 0.21 µV/mV	
	(50 to 100) kHz	4.4 µV + 0.31 µV/mV	
	(100 to 300) kHz	8.9 µV + 0.81 µV/mV	
	(300 to 500) kHz	14 µV + 0.89 µV/mV	
	(0.5 to 1) MHz	18 µV + 1.7 µV/mV	
	(1 to 1.2) MHz	19 µV + 0.32 mV/mV	
	(1.2 to 2) MHz	19 µV + 0.32 mV/mV	
	(2 to 10) MHz	20 µV + 0.6 µV/mV	
	(10 to 20) MHz	21 µV + 1.3 µV/mV	
	(20 to 30) MHz	29 µV + 3.5 µV/mV	

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
AC Voltage – Measure[3] (cont)			
(22 to 70) mV	(9.5 to 10) Hz (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz (1 to 1.2) MHz (1.2 to 2) MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	22 µV + 0.29 µV/mV 6.3 µV + 0.19 µV/mV 3.9 µV + 0.11 µV/mV 2.8 µV + 0.21 µV/mV 4.6 µV + 0.31 µV/mV 7.7 µV + 0.82 µV/mV 14 µV + 1 µV/mV 21 µV + 2.6 µV/mV 30 µV + 1.1 µV/mV 32 µV + 0.3 mV/mV 32 µV + 0.3 mV/mV 37 µV + 0.81 µV/mV 43 µV + 1.4 µV/mV 79 µV + 3.5 µV/mV	Fluke 5790A
(70 to 220) mV	(9.5 to 10) Hz (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz (1 to 1.2) MHz (1.2 to 2) MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	63 µV + 1 µV/mV 20 µV + 0.32 µV/mV 8.8 µV + 0.13 µV/mV 4.6 µV + 57 nV/mV 8.7 µV + 0.12 µV/mV 12 µV + 0.16 µV/mV 19 µV + 0.25 µV/mV 31 µV + 0.38 µV/mV 68 µV + 1 µV/mV 34 µV + 0.52 mV/mV 34 µV + 0.52 mV/mV 64 µV + 1 µV/mV 95 µV + 1.6 µV/mV 0.22 mV + 3.6 µV/mV	
(220 to 700) mV	(9.5 to 10) Hz (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz (1 to 1.2) MHz (1.2 to 2) MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	0.21 mV + 1 µV/mV 65 µV + 0.32 µV/mV 24 µV + 0.11 µV/mV 11 µV + 50 nV/mV 16 µV + 80 nV/mV 18 µV + 80 nV/mV 40 µV + 0.18 µV/mV 68 µV + 0.3 µV/mV 0.2 mV + 1 µV/mV 0.11 mV + 0.52 mV/mV 0.11 mV + 0.53 mV/mV 0.21 mV + 1 µV/mV 0.31 mV + 1.6 µV/mV 0.72 mV + 3.6 µV/mV	

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
AC Voltage – Measure[3] (cont)			
700 mV to 2.2 V	(9.5 to 10) Hz (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz (1 to 1.2) MHz (1.2 to 2) MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	0.62 mV + 1 mV/V 0.18 mV + 0.31 mV/V 61 µV + 98 µV/V 23 µV + 31 µV/V 43 µV + 67 µV/V 45 µV + 70 µV/V 97 µV + 0.16 mV/V 0.16 mV + 0.26 mV/V 0.54 mV + 0.9 mV/V 11 µV + 34 nV/mV 11 µV + 34 nV/mV 11 µV + 0.13 µV/mV 11 µV + 0.3 µV/mV 11 µV + 1.5 µV/mV	Fluke 5790A
(2.2 to 7) V	(9.5 to 10) Hz (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz (1 to 1.2) MHz (1.2 to 2) MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	2.1 mV + 1 mV/V 0.61 mV + 0.31 mV/V 0.2 mV + 99 µV/V 67 µV + 33 µV/V 0.14 mV + 70 µV/V 0.16 mV + 81 µV/V 0.38 mV + 0.19 mV/V 0.8 mV + 0.4 mV/V 2.4 mV + 1.2 mV/V 11 µV + 92 nV/mV 11 µV + 96 nV/mV 12 µV + 0.35 µV/mV 12 µV + 0.73 µV/mV 13 µV + 2.8 µV/mV	
(7 to 22) V	(9.5 to 10) Hz (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz	21 mV + 1 mV/V 6.1 mV + 0.31 mV/V 2 mV + 0.1 mV/V 0.89 mV + 44 µV/V 1.7 mV + 86 µV/V 1.9 mV + 94 µV/V 4 mV + 0.2 mV/V 8.2 mV + 0.41 mV/V 24 mV + 1.2 mV/V	
(22 to 70) V	(9.5 to 10) Hz (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz	6.2 mV + 1 mV/V 1.8 mV + 0.31 mV/V 0.6 mV + 99 µV/V 0.22 mV + 37 µV/V 0.42 mV + 70 µV/V 0.49 mV + 81 µV/V 1.1 mV + 0.19 mV/V 2.4 mV + 0.4 mV/V 7.2 mV + 1.2 mV/V	

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
AC Voltage – Measure[3] (cont)			
(70 to 220) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz	18 mV + 0.31 mV/V 6.1 mV + 0.1 mV/V 2.6 mV + 43 µV/V 6.1 mV + 0.1 mV/V 5.9 mV + 0.1 mV/V 13 mV + 0.21 mV/V 30 mV + 0.5 mV/V	Fluke 5790A
(220 to 700) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	61 mV + 0.31 mV/V 29 mV + 0.15 mV/V 12 mV + 60 µV/V 26 mV + 0.13 mV/V 0.1 V + 0.5 mV/V	
(700 to 1000) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	0.18 V + 0.31 mV/V 88 mV + 0.15 mV/V 34 mV + 60 µV/V 78 mV + 0.13 mV/V 0.3 V + 0.5 mV/V	
AC Current – Generate[3]			
Up to 220 µA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	63 nA + 0.13 nA/µA 12 nA + 0.14 nA/µA 9 nA + 0.11 nA/µA 15 nA + 0.25 nA/µA 75 nA + 0.9 nA/µA	Fluke 5720A w/ 5725A Up to 10 kHz
(29 to 329.99) µA	(10 to 30) kHz	0.69 µA + 0.013 µA/µA	Fluke 5520A from (10 to 30) kHz
220 µA to 2.2 mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	93 nA + 0.23 µA/mA 67 nA + 0.14 µA/mA 60 nA + 0.11 µA/mA 0.15 µA + 0.18 µA/mA 0.85 µA + 0.9 µA/mA	
(0.33 to 3.2999) mA	(10 to 30) kHz	3.3 µA + 7.9 µA/mA	
(2.2 to 22) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.92 µA + 0.23 µA/mA 0.69 µA + 0.14 µA/mA 0.6 µA + 0.11 µA/mA 0.95 µA + 0.18 µA/mA 7 µA + 0.9 µA/mA	
(3.3 to 32.999) mA	(10 to 30) kHz	14 µA + 3.2 µA/mA	

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
AC Current – Generate[3] (cont)			
(22 to 220) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	9.3 µA + 0.23 µA/mA 6.8 µA + 0.14 µA/mA 5 µA + 0.11 µA/mA 7.5 µA + 0.18 µA/mA 30 µA + 0.9 µA/mA	Fluke 5720A w/ 5725A Up to 10 kHz Fluke 5520A from (10 to 30) kHz
(33 to 329.99) mA	(10 to 30) kHz	0.27 mA + 3.2 µA/mA	
220 mA to 2.2 A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	89 µA + 0.24 mA/A 0.17 mA + 0.39 mA/A 1.5 mA + 6 mA/A	Fluke 5720A w/ 5725A
(2.2 to 11) A	40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	1.1 mA + 0.4 mA/A 2.3 mA + 0.85 mA/A 8 mA + 3.3 mA/A	
(11 to 20.5) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	15 mA + 0.96 mA/A 17 mA + 1.2 mA/A 0.27 A + 24 mA/A	Fluke 5520A
Clamp-On Only[3]:			
Toroidal:			Fluke 5520A w/ coil
(10 to 16.5) A	(45 to 65) Hz	26 mA + 2.1 mA/A	
(16.5 to 150) A		50 mA + 1.9 mA/A	
(150 to 1025) A		0.34 A + 1.9 mA/A	
(10 to 16.5) A	(65 to 440) Hz	60 mA + 6 mA/A	
(16.5 to 150) A		0.11 A + 5.3 mA/A	
(150 to 1025) A		0.86 A + 5.3 mA/A	
Non-Toroidal:			
(10 to 16.5) A	(45 to 65) Hz	60 mA + 3.8 mA/A	
(16.5 to 150) A		0.23 A + 3.7 mA/A	
(150 to 1025) A		1.2 A + 3.7 mA/A	
(10 to 16.5) A	(65 to 440) Hz	90 mA + 7.2 mA/A	
(16.5 to 150) A		0.28 A + 6.7 mA/A	
(150 to 1025) A		1.6 A + 6.7 mA/A	

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
AC Current – Generate[3] (cont)			
(2 to 20) A	(10 to 65) Hz (65 to 300) Hz 300 Hz to 1 kHz	0.25 % 0.26 % 0.32 %	52120A
(20 to 120) A	(10 to 65) Hz (65 to 300) Hz 300 Hz to 1 kHz	0.07 % 0.11 % 0.35 %	
(100 to 2500) A (100 to 1000) A	(10 to 300) Hz 300 Hz to 1 kHz	1 A + 4.7 mA/A 0.66 A + 4.7 mA/A	52120A w/: 3KA coil
(100 to 6000) A	10 Hz to 1 kHz	1 A + 4.7 mA/A	6KA coil
AC Current – Generate[3]			
(12 to 120) µA	(3 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	12 nA + 0.19 mA/A 12 nA + 0.19 mA/A 12 nA + 0.19 mA/A 52 nA + 1.2 mA/A 1 µA + 3.9 mA/A	Fluke 5560A
(0.12 to 1.2) mA	(3 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.13 µA + 0.19 mA/A 0.13 µA + 0.19 mA/A 0.13 µA + 0.19 mA/A 0.25 µA + 1.2 mA/A 5.5 µA + 3.9 mA/A	
(1.2 to 12) mA	(3 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	1.3 µA + 0.19 mA/A 1.3 µA + 0.19 mA/A 1.3 µA + 0.19 mA/A 2.5 µA + 1.2 mA/A 15 µA + 3.9 mA/A	
(12 to 120) mA	(3 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	13 µA + 0.19 mA/A 6.5 µA + 0.12 mA/A 10 µA + 0.19 mA/A 25 µA + 1.2 mA/A 0.15 mA + 3.9 mA/A	

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
AC Current – Generate[3] (cont)			
(0.12 to 1.2) A	(3 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.13 mA + 0.18 mA/A 75 µA + 0.19 mA/A 0.1 mA + 0.19 mA/A 0.53 mA + 1.9 mA/A 0.77 mA + 3.9 mA/A	Fluke 5560A
(1.2 to 3.1) A	(3 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.85 mA + 0.29 mA/A 0.58 mA + 0.23 mA/A 0.65 mA + 0.29 mA/A 2.8 mA + 1.9 mA/A	
(3.1 to 12) A	(3 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	1.9 mA + 0.29 mA/A 1.2 mA + 0.23 mA/A 1.7 mA + 0.29 mA/A 6.9 mA + 1.9 mA/A	
(12 to 30) A	(3 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz	19 mA + 0.78 mA/A 15 mA + 0.54 mA/A 55 mA + 3.9 mA/A	
AC Current – Measure[3]			
5 mA to 5 A	(10 to 20) Hz (20 to 40) Hz	0.051 % 0.03 %	Fluke A40, Fluke 5790A
(5 to 100) mA	40 Hz to 20 kHz (20 to 30) kHz	0.025 % 0.034 %	
100 mA to 5A	40 Hz to 10 kHz	0.026 %	
(5 to 10) A	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz	0.056 % 0.038 % 0.034 % 0.022 %	
(10 to 20) A	(10 to 20) Hz (20 to 40) Hz 40 Hz to 10 kHz	0.055 % 0.036 % 0.033 %	
(20 to 300) A	(50 to 60) Hz	0.045 %	L&N shunt, Fluke 5790A
(1 to 2) A (1 to 2) A (2 to 20) A (2 to 20) A (20 to 100) A	Up to 1 kHz (1 to 10) kHz Up to 1 kHz (1 to 10) kHz Up to 1 kHz	0.029 % 0.03 % 0.053 % 0.054 % 0.067 %	Agilent 3458A w/ Valhalla 2575A

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
DC Power[3] – Generate	Up to 1020 V		
Up to 330 µA	Up to 337 mW	0.017 %	Fluke 5520A
Up to 3.3 mA	(0.337 to 3.366) W	0.021 %	
Up to 33 mA	(3.366 to 33.66) W	0.0093 %	
Up to 330 mA	(33.66 to 336.6) W	0.0093 %	
Up to 1.1 A	(0.3366 to 1.122)	0.019 %	
Up to 3 A	kW	0.043 %	
Up to 11 A	(1.122 to 3.06) kW	0.044 %	
Up to 20.5 A	(3.06 to 11.22) kW	0.13 %	
	(11.22 to 20.91) kW		
	Up to 1020 V		
Up to 120 µA	Up to 122 mW	0.015 %	Fluke 5560A
Up to 1.2 mA	(0.12 to 1.224) W	0.0092 %	
Up to 12 mA	(1.225 to 12.24) W	0.0087 %	
Up to 120 mA	(12.24 to 122.4) W	0.0087 %	
Up to 1.2 A	0.1224 to 1.224) kW	0.013 %	
Up to 3.1 A	(1.224 to 3.162) kW	0.028 %	
Up to 12 A	(3.162 to 12.24) kW	0.025 %	
Up to 30.2 A	(12.24 to 30.8) kW	0.08 %	

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
AC Power – Generate[3]	See Table below	See Table below	Fluke 5560A

(45 to 65) Hz	(1.22 to 12.2) W	(12.2 to 122) W	(0.122 to 1.22) kW	(1.22 to 3.16) kW	(3.16 to 12.2) kW	(12.2 to 30.8) kW
Ø 0 ° PF=1.000	0.038 %	0.029 %	0.034 %	0.048 %	0.04 %	0.11 %
Ø 10 ° PF=0.985	0.049 %	0.042 %	0.046 %	0.057 %	0.051 %	0.11 %
Ø 20 ° PF=0.940	0.074 %	0.07 %	0.072 %	0.079 %	0.075 %	0.12 %
Ø 30 ° PF=0.866	0.11 %					0.15 %
Ø 40 ° PF=0.766	0.15 %					
Ø 50 ° PF=0.643	0.21 %					
Ø 60 ° PF=0.500	0.3 %					
Ø 70 ° PF=0.342	0.48 %					
Ø 80 ° PF=0.174	0.99 %					

(65 to 500) Hz	(12.2 to 122) W	(0.122 to 1.22) kW	(1.22 to 3.16) kW	(3.16 to 12.2) kW	(12.2 to 30.8) kW
Ø 0 ° PF=1.000	0.029 %	0.034 %	0.048 %	0.04 %	0.11 %
Ø 10 ° PF=0.985	0.068 %	0.071 %	0.078 %	0.074 %	0.12 %
Ø 20 ° PF=0.940	0.14 %				0.17 %
Ø 30 ° PF=0.866	0.2 %		0.21 %		0.23 %
Ø 40 ° PF=0.766	0.29 %	0.3 %			0.31 %
Ø 50 ° PF=0.643	0.42 %				
Ø 60 ° PF=0.500	0.61 %				
Ø 70 ° PF=0.342	0.96 %				
Ø 80 ° PF=0.174	2 %				

500 Hz to 1 kHz	(12.2 to 122) W	(0.122 to 1.22) kW	(1.22 to 3.16) kW	(3.16 to 12.2) kW	(12.2 to 30.8) kW
Ø 0 ° PF=1.000	0.029 %	0.034 %	0.048 %	0.04 %	0.11 %
Ø 10 ° PF=0.985	0.13 %				0.16 %

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
AC Power – Generate[3] (cont)	See Table below	See Table below	Fluke 5560A

500 Hz to 1 kHz	(12.2 to 122) W	(0.122 to 1.22) kW	(1.22 to 3.16) kW	(3.16 to 12.2) kW	(12.2 to 30.8) kW
Ø 20 ° PF=0.940	0.26%				0.28 %
Ø 30 ° PF=0.866	0.41%				0.42 %
Ø 40 ° PF=0.766	0.59 %				0.6 %
Ø 50 ° PF=0.643	0.83 %				
Ø 60 ° PF=0.500	1.2 %				
Ø 70 ° PF=0.342	1.9 %				
Ø 80 ° PF=0.174	4 %				
(1 to 5) kHz	(6 to 60) W	(60 to 600) W	(0.6 to 1.55) kW		
Ø 0 ° PF=1.000	0.071 %		0.082 %		
Ø 10 ° PF=0.985	0.64 %				
Ø 20 ° PF=0.940	1.3 %				
Ø 30 ° PF=0.866	2 %				
Ø 40 ° PF=0.766	2.8 %				
Ø 50 ° PF=0.643	4 %				
(5 to 10) kHz	(3 to 30) W	(30 to 300) W			
Ø 0 ° PF=1.000	0.28 %	0.34 %			
Ø 10 ° PF=0.985	1.4 %				
Ø 20 ° PF=0.940	2.7 %				
Ø 30 ° PF=0.866	4.2 %				
(10 to 30) kHz	(3 to 300) W				
Ø 0 ° PF=1.000	1.1 %				
Ø 10 ° PF=0.985	3.4 %				
Ø 20 ° PF=0.940	5.9%				

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
AC Power[3] – Generate (cont)	See Table below	See Table below	Fluke 5520A

(45 to 65) Hz	(3.366 to 33.66) W	(33.66 to 336.6) W	(0.3366 to 1.122) kW	(1.122 to 3.06) kW	(3.06 to 11.22) kW	(11.22 to 20.9) kW
Ø 0 ° PF=1.000	0.052 %		0.068 %	0.076 %	0.083 %	0.17 %
Ø 10 ° PF=0.985	0.06 %		0.075 %	0.082 %	0.088 %	0.18 %
Ø 20 ° PF=0.940	0.082 %		0.093 %	0.099 %	0.1 %	0.18 %
Ø 30 ° PF=0.866	0.11 %		0.12 %	0.13 %		0.2 %
Ø 40 ° PF=0.766	0.16 %			0.17 %		0.23 %
Ø 50 ° PF=0.643	0.21 %		0.22 %			0.27 %
Ø 60 ° PF=0.500	0.31 %					0.35 %
Ø 70 ° PF=0.342	0.48 %			0.49 %		0.51 %
Ø 80 ° PF=0.174	0.99 %					1 %

(65 to 500) Hz	(33.66 to 336.6) W	(0.3366 to 1.122) kW	(1.122 to 3.06) kW	(3.06 to 11.22) kW	(11.22 to 20.9) kW
Ø 0 ° PF=1.000	0.052 %	0.068 %	0.076 %	0.12 %	0.21 %
Ø 10 ° PF=0.985	0.094 %	0.1 %	0.11 %	0.14 %	0.22 %
Ø 20 ° PF=0.940	0.17 %		0.18 %	0.2 %	0.26 %
Ø 30 ° PF=0.866	0.26 %			0.28 %	0.33 %
Ø 40 ° PF=0.766	0.37 %			0.39 %	0.42 %
Ø 50 ° PF=0.643	0.53 %				0.56 %
Ø 60 ° PF=0.500	0.76 %			0.77 %	0.78 %
Ø 70 ° PF=0.342	1.2 %				
Ø 80 ° PF=0.174	2.5 %				

Parameter/Range		Frequency	CMC[2, 4, 5] (±)		Comments
AC Power[3] – Generate (cont)		See Table below	See Table below		Fluke 5520A
500 Hz to 1 kHz	(33.66 to 336.6) W	(0.3366 to 1.122) kW	(1.122 to 3.06) kW	(3.06 to 11.22) kW	(11.22 to 20.9) kW
Ø 0 ° PF=1.000	0.052 %	0.068 %	0.076 %	0.12 %	0.21 %

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
Phase[3] (PF=1) – Measure & Generate	(10 to 65) Hz (65 to 500) Hz 500 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz (3 to 65) Hz (65 to 500) Hz 500 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	Ø 0.1 ° Ø 0.26 ° Ø 0.51 ° Ø 2.6 ° Ø 5.1 ° Ø 10 ° Ø 0.1 ° Ø 0.2 ° Ø 0.4 ° Ø 1.9 ° Ø 3.9 ° Ø 7.8 °	Fluke 5520A Fluke 5560A
AC Ratio, Fixed Points (0.0 to 0.1) (0.1 to 1.111 111)	400 Hz & 1 kHz	$1.2 \times 10^{-6} + 4 \times 10^{-6}$/ 0.000 001 step 1.6×10^{-6}	DT72A
Synchro/Resolver[3] – Indicators (0 to 360) ° Simulators (0 to 360) °	400 Hz 400 Hz	0.000 65° 0.000 91°	DSRS-5DR DCRB-5C-4R

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
Capacitance – Generate[3]			
(0.19 to 0.3999) nF	10 Hz to 10 kHz	8.8 pF + 4 pF/nF	Fluke 5520A
0.4 to 1.0999) nF	10 Hz to 10 kHz	9.7 pF + 4 pF/nF	
(1.1 to 3.299) nF	10 Hz to 3 kHz	13 pF + 4 pF/nF	
(3.3 to 10.999) nF	(10 to 1000) Hz	15 pF + 2 pF/nF	
(11 to 32.9999) nF	(10 to 1000) Hz	0.1 nF + 2 pF/nF	
(33 to 109.999) nF	(10 to 1000) Hz	0.15 nF + 2 pF/nF	
(110 to 329.99) nF	(10 to 1000) Hz	0.46 nF + 2 pF/nF	
(0.33 to 1.0999) µF	(10 to 600) Hz	1.5 nF + 2 nF/µF	
(1.1 to 3.2999) µF	(10 to 300) Hz	4.6 nF + 2 nF/µF	
(3.3 to 10.999) µF	(10 to 150) Hz	15 nF + 2 nF/µF	
(11 to 32.999) µF	(10 to 120) Hz	59 nF + 3.2 nF/µF	
(33 to 109.99) µF	(10 to 80) Hz	0.2 µF + 3.6 nF/µF	
(110 to 329.99) µF	Up to 50 Hz	0.64 µF + 3.6 nF/µF	
(0.33 to 1.0999) mF	Up to 20 Hz	2 µF + 3.6 µF/mF	
(1.1 to 3.2999) mF	Up to 6 Hz	7 µF + 3.5 µF/mF	
(3.3 to 10.999) mF	Up to 2 Hz	38 µF + 2.5 µF/mF	
(11 to 32.999) mF	Up to 0.6 Hz	90 µF + 6 µF/mF	
(33 to 110) mF	Up to 0.2 Hz	0.37 mF + 8.8 µF/mF	
(10 to 100) pF	10 Hz to 1 MHz	14 fF + 0.21 fF/pF	GenRad 1412-BC
(100 to 1000) pF		34 fF + 0.3 fF/pF	
(1 to 10) nF		0.31 pF + 0.3 pF/nF	
(10 to 100) nF		3.1 pF + 0.3 pF/nF	
(100 to 1000) nF		31 pF + 0.3 pF/nF	
(1 to 10) pF	10 Hz to 1 MHz	0.17 fF	GenRad 1413
(10 to 100) pF		1.7 fF	
(100 to 1000) pF		17 fF + 0.17 fF/pF	
(1 to 10) nF		0.17 pF + 0.17 pF/nF	
(10 to 100) nF		1.7 pF + 0.27 pF/nF	
(100 to 1000) nF		17 pF + 0.27 pF/nF	
200 pF to 1.2 nF	100 Hz to 10 kHz	2.4 pF + 0.86 mF/F	Fluke 5560A
(1.2 to 12) nF	150 Hz to 5 kHz	6.2 pF + 0.9 mF/F	
(> 3 to 12) nF	(10 to 150) Hz	7.8 pF + 0.9 mF/F	
(12 to 120) nF	200 Hz to 1.3 kHz	43 pF + 1 mF/F	
(> 30 to 120) nF	(10 to 200) Hz	61 pF + 1 mF/F	
(0.12 to 1.2) µF	(2 to 310) Hz	0.42 nF + 1 mF/F	
(1.2 to 12) µF	(0.5 to 110) Hz	4.2 nF + 1 mF/F	
(12 to 120) µF	(0.5 to 40) Hz	40 nF + 1.2 mF/F	
(0.12 to 1.2) mF	(0.1 to 11) Hz	0.48 µF + 1.9 mF/F	
(1.2 to 12) mF	(0.03 to 4) Hz	5.3 µF + 1.9 mF/F	
(12 to 120) mF	(0.01 to 1.3) Hz	77 µF + 3.9 mF/F	

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
Capacitance – Generate, Fixed Points[3]			
10 nF	120 Hz to 100 kHz	0.75 pF	Keysight 16380C set (4 terminal)
100 nF	120 Hz to 100 kHz	7.6 pF	
1 µF	120 Hz to 1 kHz (1 to 10) kHz (10 to 100) kHz	83 pF 78 pF 95 pF	
1 pF	1 kHz to 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	0.57 fF 0.61 fF 0.69 fF 0.84 fF 1 fF 2.6 fF 3.8 fF	
10 pF	1 kHz to 5 MHz 10 MHz 13 MHz	3.7 fF 3.9 fF 4 fF	
100 pF	1 kHz to 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	35 fF 36 fF 37 fF 48 fF 60 fF	Agilent 16380A set (4 terminal)
1000 pF	1 kHz to 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	0.35 pF 0.38 pF 0.44 pF 0.56 pF 0.71 pF 1.9 pF 2.8 pF	
Capacitance – Measure[3]			
(1 to 10) pF (10 to 100) pF (100 to 1000) pF (1 to 10) nF (10 to 100) nF (100 to 1000) nF (1 to 10) µF (10 to 100) µF (100 to 1000) µF	(0.1 to 10) kHz	41 fF 53 fF 0.26 pF 2.9 pF 31 pF 0.23 nF 2.3 nF 52 nF 4.1 µF	GenRad 1689

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
Inductance – Generate, Fixed Points			
100 µH	100 Hz 1 kHz 10 kHz	0.11 µH 0.1 µH 0.12 µH	GenRad 106L
1 mH	100 Hz 1 kHz 10 kHz	1.1 µH 1 µH 1.2 µH	GenRad 106G
100 mH	100 Hz 1 kHz	0.11 mH 0.1 mH	GenRad 106K
Inductance – Generate[3]			
(1 to 10) mH (10 to 100) mH 100 mH to 1 H (1 to 10) H	100 Hz to 1 kHz	3.1 µH + 3.1 µH/mH 31 µH + 2.9 µH/mH 0.34 mH + 2.9 mH/H 2.9 mH + 2.9 mH/H	GenRad 1490-D
Inductance – Generate[3]			
(13 to 120) µH	(490 to 550) Hz (550 to 999) Hz 1 kHz (1.001 to 13) kHz (13 to 17) kHz	1.5 % 0.67 % 0.38 % 0.67 % 1.5 %	Fluke 5560A
(0.120 01 to 1.2) mH	(260 to 330) Hz (330 to 999) Hz 1 kHz (1.001 to 1.6) kHz (1.6 to 2.5) kHz	1.4 % 0.49 % 0.2 % 0.49 % 1.4 %	
(1.2001 to 3.3) mH	(0.5 to 999) Hz 110 Hz (111 to 800) Hz (800 to 980) Hz	0.74 % 0.46 % 0.74 % 1.6 %	
(3.3 to 12) mH	(0.5 to 109) Hz 110 Hz (111 to 1000) Hz (1 to 1.4) kHz	0.49 % 0.2 % 0.49 % 1.4 %	
(12 to 83) mH	(0.1 to 99) Hz 100 Hz (101 to 180) Hz (180 to 230) Hz	0.53 % 0.25 % 0.53 % 1.4 %	

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
Inductance – Generate[3] (cont)			
(83 to 120) mH	(0.1 to 99) Hz 100 Hz (101 to 320) Hz (320 to 1000) Hz	0.49 % 0.2 % 0.49 % 1.4 %	Fluke 5560A
(0.120 01 to 0.65) H	(0.05 to 9.9) Hz 10 Hz (10.1 to 30) Hz (30 to 50) Hz	0.61 % 0.32 % 0.6 % 1.5 %	
(0.65 to 1.2) H	(0.05 to 9.9) Hz 10 Hz (10.1 to 100) Hz (100 to 170) Hz	0.52 % 0.24 % 0.52 % 1.4 %	
(1.2001 to 5.5) H	(0.01 to 2.99) Hz 3 Hz (3.01 to 8) Hz (8 to 16) Hz	0.68 % 0.4 % 0.68 % 1.6 %	
(5.5 to 12) H	(0.01 to 2.99) Hz 3 Hz (3.01 to 19) Hz (19 to 37) Hz	0.57 % 0.28 % 0.57 % 1.4 %	
(12.001 to 30) H	(0.005 to 1.99) Hz 2 Hz (2.01 to 4) Hz (4 to 16) Hz	0.89 % 0.61 % 0.89 % 1.8 %	
(30 to 120) H	(0.005 to 1.99) Hz 2 Hz (2.01 to 7) Hz (7 to 14) Hz	0.61 % 0.32 % 0.6 % 1.5 %	
Inductance – Measure[3]			
Up to 1 mH (1 to 100) mH 100 mH to 1 H (1 to 10) H	(0.1 to 1) kHz	0.19 µH 10 µH 0.31 mH 0.4 mH	GenRad 1689

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
AC Impedance – Generate & Measure[3]			
1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ	(0.1 to 10) kHz	0.74 mΩ 2.2 mΩ 22 mΩ 0.22 Ω 2.3 Ω 22 Ω	Resistance box, GenRad 1689
Oscilloscopes[3] –			
Volt:			
DC Signal into 50 Ω	± (0 to 6.6) V	33 µV + 2 mV/V	Fluke 5520A/SC1100
DC Signal into 1 MΩ	± (0 to 130) V	33 µV + 0.39 mV/V	
Squarewave into 50 Ω	1 mV to 6 V_{p-p}	91 µV + 4.3 mV/V	
Squarewave into 1 MΩ	1 mV to 130 V_{p-p} 10 Hz to 1 kHz (1 to 100) kHz	 0.2 mV + 0.8 mV/V 0.24 mV + 2 mV/V	
Edge into 50 Ω	(200 to 300) ps, (100 kHz to 2 MHz) (200 to 350) ps, (2 to 10) MHz	82 ps 82 ps	
Leveled Sine Wave	5 mV to 5.5 V 50 kHz (reference) 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz 4 mV to 3.5 V (600 to 1100) MHz	 0.33 mV + 17 mV/V 0.4 mV + 31 mV/V 0.43 mV + 36 mV/V 0.53 mV + 57 mV/V 0.58 mV + 67 mV/V	
Time Marker	5 s to 50 ms 50 ms to 1 ns	0.0021 % + (*t* / 1000) % 0.000 36 %	*t* = time in seconds
Wave Generator	1.8 mV to 2.8 V_{p-p} (50 Ω), 10 Hz to 100 kHz 1.8 mV to 55 V_{p-p} (1 MΩ), 10 Hz to 100 kHz	0.12 mV + 23 mV/V 0.12 mV + 23 mV/V	

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
Oscilloscopes[3] –			
Volt			
DC Signal into 1 M Ω	± 1 mV to 200 V	28 µV + 0.25 mV/V	Fluke 9500B w/ active heads
DC Signal into 50 Ω	± 1 mV to 5 V	29 µV + 0.25 mV/V	
Squarewave into 1 MΩ	40 µV to 200 V_{p-p}	12 µV + 1 mV/V	
Squarewave into 50 Ω	40 µV to 5 V_{p-p}	12 µV + 1 mV/V	
Edge, 50 Ω/1 MΩ (Risetime – Generate)	500 ps, 10 Hz to 2 MHz 150 ps, 10 Hz to 2 MHz 70 ps, 10 Hz to 1 MHz	62 ps 28 ps 17 ps	9510 active head 9530 active head 9560 active head
Time Marker	9 ns to 83 µs 83 µs to 55 s	0.000 047 % 0.000 35 %	
Leveled Sine (Bandwidth)	50 kHz to 300 MHz (300 to 550) MHz 550 MHz to 1.1 GHz (1.1 to 3.2) GHz (3.2 to 6) GHz	3.3 % 3.4 % 4 % 4.4 % 5.8 %	
Pulse Characterization – Rise Time & Fall Time – Measure	Up to 6 GHz, 58 ps to 1 ns	70 ps	Tektronix TDS 820
Phase – Measure, Fixed Points[3]			
(0 to 360)° 50 mV to 120 V	101 Hz 1 kHz 101 kHz 1 MHz 13 MHz	0.00 12 ° 0.00 14 ° 0.092 ° 0.64 ° 8.3 °	Agilent 53131A
	20 Hz to 10 kHz (10 to 40) kHz (40 to 100) kHz	0.097 ° 0.12 ° 0.81 °	Krohn-Hite 6500

Parameter/Equipment	Frequency	CMC[2, 4, 5] (±)	Comments
AC Flatness – Measure, Fixed Points[3]	10 Hz 100 Hz to 30 kHz 100 kHz 300 kHz 1 MHz 3 MHz 8 MHz 10 MHz 20 MHz 30 MHz 50 MHz 70 MHz 80 MHz 100 MHz	0.014 % 0.012 % 0.013 % 0.017 % 0.025 % 0.042 % 0.066 % 0.071 % 0.11 % 0.13 % 0.2 % 0.29 % 0.31 % 0.39 %	Precision Measurements EL 1200 (50 Ω)
	10 Hz to 100 kHz 300 kHz to 1 MHz 3 MHz 8 MHz 10 MHz 20 MHz 30 MHz 50 MHz 70 MHz 80 MHz 100 MHz	0.059 % 0.06 % 0.066 % 0.07 % 0.072 % 0.09 % 0.1 % 0.21 % 0.39 % 0.47 % 0.7 %	Ballantine 1395A-3 (50 Ω)

III. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
Power Meter – Power Reference, @ 1 mW[3]	50 MHz	0.43 %	Agilent 432A w/ 478A
Power Meter – Power Accuracy	3 µW to 100 mW	0.29 %	11683A range calibrator

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
Absolute Power – Measure[3]			Power meter w/:
(-70 to -20) dBm	50 MHz to 3 GHz (3 to 13) GHz (13 to 18) GHz (18 to 26.5) GHz (26.5 to 33) GHz (33 to 38) GHz (38 to 41) GHz (41 to 50) GHz	2.9 % 3 % 3.1 % 3.3 % 3.5 % 3.8 % 4.1 % 4.2 %	8487D
(-30 to +10) dBm	100 kHz to 4.2 GHz (4.2 to 18) GHz (18 to 26.5) GHz (26.5 to 33) GHz (33 to 38) GHz (38 to 40) GHz (40 to 49) GHz (49 to 50) GHz	1.2 % 1.8 % 2.6 % 2.2 % 2.6 % 3 % 3.2 % 3.5 %	8482 8481A 8485A 8487A
(+10 to +20) dBm	100 kHz to 4.2 GHz (4.2 to 18) GHz (18 to 26.5) GHz (26.5 to 33) GHz (33 to 38) GHz (38 to 40) GHz (40 to 49) GHz (49 to 50) GHz	3.7 % 3.9 % 4.3 % 4.1 % 4.4 % 4.6 % 4.7 % 4.9 %	8482 8481A 8485A 8487A
Relative Power – Measure[3]			
(0 to -10) dB (-10 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB (-50 to -60) dB (-60 to -70) dB (-70 to -80) dB (-80 to -90) dB (-90 to -100) dB (-100 to -110) dB (-110 to -120) dB (-120 to -127) dB	2.5 MHz to 1.3 GHz	0.047 dB 0.06 dB 0.074 dB 0.087 dB 0.1 dB 0.1 dB 0.11 dB 0.12 dB 0.13 dB 0.15 dB 0.15 dB 0.28 dB 0.29 dB	Agilent 8902A

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
Relative Power – Measure[3] (cont)			
(0 to -10) dB	(1.3 to 26.5) GHz	0.066 dB	Agilent 8902A
(-10 to -20) dB		0.06 dB	
(-20 to -30) dB		0.074 dB	
(-30 to -40) dB		0.087 dB	
(-40 to -50) dB		0.1 dB	
(-50 to -60) dB		0.1 dB	
(-60 to -70) dB		0.11 dB	
(-70 to -80) dB		0.12 dB	
(-80 to -90) dB		0.13 dB	
(-90 to -100) dB		0.15 dB	
(-100 to -110) dB		0.15 dB	
(-110 to -120) dB		0.28 dB	
(-120 to -127) dB		0.29 dB	
Attenuation – Measure[3]			
(0 to -10) dB	2.5 MHz to 1.3 GHz	0.066 dB	HP 8902A w/ 11722A, 11792A
(-10 to -20) dB		0.060 dB	
(-20 to -30) dB		0.074 dB	
(-30 to -40) dB		0.087 dB	
(-40 to -50) dB		0.1 dB	
(-50 to -60) dB		0.1 dB	
(-60 to -70) dB		0.11 dB	
(-70 to -80) dB		0.12 dB	
(-80 to -90) dB		0.13 dB	
(-90 to -100) dB		0.15 dB	
(-100 to -110) dB		0.15 dB	
(-110 to -120) dB		0.2 dB	
(-120 to -127) dB		0.21 dB	
(0 to -10) dB	(1.3 to 18) GHz	0.25 dB	
(-10 to -20) dB		0.25 dB	
(-20 to -30) dB		0.25 dB	
(-30 to -40) dB		0.26 dB	
(-40 to -50) dB		0.26 dB	
(-50 to -60) dB		0.26 dB	
(-60 to -70) dB		0.27 dB	
(-70 to -80) dB		0.27 dB	
(-80 to -90) dB		0.28 dB	
(-90 to -100) dB		0.29 dB	
(-100 to -110) dB		0.29 dB	
(-110 to -120) dB		0.37 dB	
(-120 to -127) dB		0.38 dB	

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
Attenuation – Measure[3] (cont)			
(0 to -10) dB	(18 to 26.5) GHz	0.39 dB	HP 8902A w/ 11722A, 11792A
(-10 to -20) dB		0.39 dB	
(-20 to -30) dB		0.39 dB	
(-30 to -40) dB		0.39 dB	
(-40 to -50) dB		0.4 dB	
(-50 to -60) dB		0.4 dB	
(-60 to -70) dB		0.4 dB	
(-70 to -80) dB		0.4 dB	
(-80 to -90) dB		0.4 dB	
(-90 to -100) dB		0.41 dB	
(-100 to -110) dB		0.41 dB	
(-110 to -120) dB		0.47 dB	
(-120 to -127) dB		0.48 dB	
Attenuation – Generate[3]			
10 dB	30 MHz	0.0062 dB	Weinschel PA-2
20 dB	30 MHz	0.01 dB	
30 dB	30 MHz	0.013 dB	
40 dB	30 MHz	0.017 dB	
50 dB	30 MHz	0.02 dB	
60 dB	30 MHz	0.023 dB	
70 dB	30 MHz	0.025 dB	
80 dB	30 MHz	0.028 dB	
90 dB	30 MHz	0.032 dB	
100 dB	30 MHz	0.035 dB	
10 dB	10 MHz to 12.4 GHz (12.4 to 18) GHz	0.63 dB 0.84 dB	HP 8496B
20 dB	10 MHz to 12.4 GHz (12.4 to 18) GHz	0.85 dB 1 dB	
30 dB	10 MHz to 12.4 GHz (12.4 to 18) GHz	1.1 dB 1.5 dB	
40 dB	10 MHz to 12.4 GHz (12.4 to 18) GHz	1.4 dB 1.9 dB	
50 dB	10 MHz to 12.4 GHz (12.4 to 18) GHz	1.8 dB 2.4 dB	

Parameter/Range	Frequency	CMC[2, 4,] (±)	Comments
Attenuation – Generate[3] (cont)			
60 dB	10 MHz to 12.4 GHz (12.4 to 18) GHz	2.1 dB 2.8 dB	HP 8496B
70 dB	10 MHz to 12.4 GHz (12.4 to 18) GHz	2.4 dB 3.3 dB	
80 dB	10 MHz to 12.4 GHz (12.4 to 18) GHz	2.8 dB 3.7 dB	
90 dB	10 MHz to 12.4 GHz (12.4 to 18) GHz	3.1 dB 4.2 dB	
100 dB	10 MHz to 12.4 GHz (12.4 to 18) GHz	3.5 dB 4.7 dB	
110 dB	10 MHz to 12.4 GHz (12.4 to 18) GHz	4 dB 5.1 dB	
Amplitude Modulation – Measure			
Rate: 50 Hz to 10 kHz Depths: 5 % to 99 %	150 kHz to 10 MHz	0.14 % depth + 0.024 % depth	HP 8902A w/ 11793A
Rate: 20 Hz to 10 kHz Depths: Up to 99 %	150 kHz to 10 MHz	0.11 % depth + 0.023 % depth	
Rate: 50 Hz to 50 kHz Depths: 5 % to 99 %	10 MHz to 1.3 GHz	0.15 % depth + 0.01 % depth	
Rate: 20 Hz to 100 kHz Depths: Up to 99 %	10 MHz to 1.3 GHz	0.11 % depth + 0.023 % depth	
Rate: 50 Hz to 50 kHz Depths: 5 % to 99 %	(1.3 to 26.5) GHz	1.2 % depth + 0.004 % depth	
Rate: 20 Hz to 100 kHz Depths: Up to 99 %	(1.3 to 26.5) GHz	1.2 % depth + 0.015 % depth	

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
Frequency Modulation – Measure			
Rate: 20 Hz to 10 kHz Dev.: ≤ 40 kHz Peak	250 kHz to 10 MHz	3.5 kHz + 16 Hz/kHz	HP 8902A w/ 11793A
Rate: 50 Hz to 100 kHz Dev.: ≤ 400 kHz Peak	10 MHz to 1.3 GHz	3.5 kHz + 7.8 Hz/kHz	
Rate: 20 Hz to 200 kHz Dev.: ≤ 400 kHz Peak	10 MHz to 1.3 GHz	6.8 Hz + 39 Hz/kHz	
Rate: 50 Hz to 100 kHz Dev.: ≤ 400 kHz Peak	(1.3 to 26.5) GHz	6.8 Hz + 7.8 Hz/kHz	
Rate: 20 Hz to 200 kHz Dev.: ≤ 400 kHz Peak	(1.3 to 26.5) GHz	6.8 Hz + 39 Hz/kHz	
Phase Modulation – Measure			
Rate: 200 Hz to 10 kHz (0 to 100) rad	Carrier: 150 kHz ≤ *fc*< 10 MHz	36 mrad + 37 mrad/rad	HP 8902A w/ 11793A
Rate: 200 Hz to 20 kHz (0 to 100) rad	10 MHz ≤ *fc*< 1.3 GHz	36 mrad + 37 mrad/rad	
Rate: 200 Hz to 20 kHz (0 to 100) rad	10 MHz ≤ *fc*< 26.5 GHz	36 mrad + 37 mrad/rad	
Displayed Average Noise Level	45 MHz to 2 GHz (2 to 18) GHz (18.5 to 26.5) GHz (26.5 to 40) GHz (40 to 50) GHz	0.15 dB 0.16 dB 0.34 dB 1.4 dB 1.7 dB	Anritsu 28S50-2 Anritsu 28V50B
Distortion – Measure[3]			
(-60 to 0) dBc	20 Hz to 20 kHz (20 to 100) kHz	1.2 dB 2.3 dB	HP 8903B
(-100 to 0) dBc	100 kHz to 2.5 GHz (2.5 to 22) GHz (22 to 26.5) GHz (26.5 to 31) GHz (31 to 50) GHz	2.1 dB 3.3 dB 4.2 dB 4 dB 4.1 dB	HP 8566A HP 8563E HP 8565E

Parameter/Range	Frequency	CMC[2] (±)	Comments
S-Parameters (Reflection & Transmission)	45 MHz to 26.5 GHz	See tables below (Interpolate CMC's between cardinal points listed)	8510C w/8515, 85053B, 85131D, 85052B
Type N: Reflection S_{11}/S_{22} Linear Magnitude (ρ)			
rho	(0.045 to 2) GHz	(2 to 8) GHz	(8 to 18) GHz
0.01	0.01	0.016	0.02
0.1	0.01	0.016	0.02
0.2	0.01	0.016	0.02
0.3	0.01	0.016	0.02
0.4	0.01	0.016	0.021
0.5	0.011	0.017	0.022
0.6	0.011	0.018	0.024
0.7	0.012	0.02	0.027
0.8	0.013	0.022	0.031
0.9	0.014	0.024	0.036
1.0	0.016	0.028	0.041
Type N: Reflection S_{11}/S_{22} Phase (°)			
rho	(0.045 to 2) GHz	(2 to 8) GHz	(8 to 18) GHz
0.01	180	180	180
0.1	5.9	9.3	12
0.2	3	4.7	6
0.3	2	3.2	4.2
0.4	1.6	2.5	3.3
0.5	1.3	2.2	2.8
0.6	1.1	1.9	2.6
0.7	1.1	1.8	2.5
0.8	1	1.7	2.5
0.9	0.99	1.7	2.6
1.0	1	1.8	2.7
Type N: Transmission S_{12}/S_{21} Linear Magnitude (dB)			
dB	(0.045 to 2) GHz	(2 to 8) GHz	(8 to 18) GHz
10	0.18	0.1	0.11
0	0.02	0.028	0.081
-10	0.027	0.03	0.081
-20	0.028	0.031	0.081
-30	0.03	0.032	0.083
-40	0.038	0.044	0.096
-50	0.073	0.088	0.14
-60	0.21	0.28	0.37
-70	0.94	0.82	1.1

Parameter/Range	Frequency	CMC[2] (±)	Comments
S-Parameters (Reflection & Transmission) (cont)	45 MHz to 26.5 GHz	See tables below (Interpolate CMC's between cardinal points listed)	8510C w/8515, 85053B, 85131D, 85052B

Type N: Transmission S_{12}/S_{21} Phase (°)			
dB	(0.045 to 2) GHz	(2 to 8) GHz	(8 to 18) GHz
10	1.3	0.84	1
0	0.21	0.36	0.82
-10	0.27	0.37	0.82
-20	0.28	0.38	0.82
-30	0.29	0.38	0.83
-40	0.35	0.45	0.9
-50	0.58	0.75	1.2
-60	1.5	1.9	2.7
-70	4.2	5.3	7.2

3.5 mm: Reflection S_{11}/S_{22} Linear Magnitude (ρ)				
rho	(0.045 to 2) GHz	(2 to 8) GHz	(8 to 20) GHz	(20 to 26.5) GHz
0.01	0.0079	0.013	0.016	0.032
0.1	0.008	0.013	0.016	0.032
0.2	0.008	0.013	0.016	0.032
0.3	0.0081	0.013	0.016	0.032
0.4	0.0083	0.013	0.017	0.033
0.5	0.0088	0.014	0.019	0.034
0.6	0.0095	0.016	0.021	0.037
0.7	0.011	0.019	0.024	0.041
0.8	0.012	0.022	0.029	0.046
0.9	0.014	0.026	0.034	0.053
1.0	0.016	0.031	0.04	0.062

3.5 mm: Reflection S_{11}/S_{22} Phase (°)				
rho	(0.045 to 2) GHz	(2 to 8) GHz	(8 to 20) GHz	(20 to 26.5) GHz
0.01	53	180	180	180
0.1	4.7	7.4	9.4	19
0.2	2.4	3.8	4.9	9.5
0.3	1.6	2.6	3.4	6.5
0.4	1.3	2.1	2.7	5.1
0.5	1.1	1.8	2.4	4.3
0.6	1	1.7	2.3	3.9
0.7	0.97	1.7	2.3	3.7
0.8	0.97	1.8	2.4	3.7
0.9	0.99	1.9	2.5	3.8
1.0	1	2	2.7	3.9

Parameter/Range	Frequency	CMC[2, 5] (±)	Comments
S-Parameters (Reflection & Transmission) (cont)	45 MHz to 26.5 GHz	See tables below (Interpolate CMC's between cardinal points listed)	8510C w/8515, 85053B, 85131D, 85052B

3.5 mm: Transmission S_{12}/S_{21} Linear Magnitude (dB)				
dB	(0.045 to 2) GHz	(2 to 8) GHz	(8 to 20) GHz	(20 to 26.5) GHz
10	0.018	0.028	0.076	0.15
0	0.02	0.028	0.076	0.15
-10	0.026	0.03	0.076	0.15
-20	0.028	0.032	0.077	0.15
-30	0.03	0.033	0.078	0.16
-40	0.038	0.045	0.093	0.21
-50	0.072	0.089	0.14	0.43
-60	0.21	0.28	0.39	1.5
-70	0.64	0.82	1.2	5.2
3.5 mm: Transmission S_{12}/S_{21} Phase (°)				
dB	(0.045 to 2) GHz	(2 to 8) GHz	(8 to 20) GHz	(20 to 26.5) GHz
10	0.21	0.36	0.81	1.4
0	0.21	0.36	0.8	1.4
-10	0.26	0.37	0.81	1.4
-20	0.27	0.38	0.81	1.4
-30	0.28	0.39	0.82	1.4
-40	0.35	0.45	0.89	1.7
-50	0.58	0.75	1.2	3.1
-60	1.5	1.9	2.8	9.9
-70	4.2	5.3	7.6	27

IV. Mechanical

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Balances[3]	Up to 5 kg	Matrix value x *R*	Class 1 weights

Parameter/Equipment	Range		CMC[2, 5, 6] (±)		Comments	
	Unit Under Test Resolution					
Mass	0.0001 g	0.001 g	0.01 g	0.1 g	1 g	10 g
Up to 5 g	0.91					
10 g	1.0					
20 g	1.2					
30 g	1.2					
50 g	1.7					
100 g	3.0	0.87		0.82		
200 g	6.0	1.0				
300 g		1.2				
500 g		1.6				
1 kg		3.0	0.87			
2 kg		6.0	1.0			
3 kg			1.2			
5 kg			1.6			
Scales[3]	(1 to 1200) lb		0.82 x *R*		Class F weights	
Pressure – Measuring Equipment[3]						
Pneumatic (Vacuum & Gage)	(-14.5 to 200) psig		0.17 psi		Fluke 700PD7	
	(0 to 1) psig		0.00082 psi		Fluke 700P22	
	(1 to 2000) psig		0.58 psi + 0.0052 %		Fluke P3031 DWT	
	(> 0 to 15) psig (> 0 to 300) psig (> 0 to 1000) psig		0.018 psi + 0.025 % 0.35 psi + 0.025 % 1.2 psi + 0.025 %		Additel ADT681-RD-GP	
Hydraulic	(> 0 to 10 000) psig		12 psi + 0.025 %			
	(> 0 to 10 000) psig		0.02 %		Ametek T-100 DWT	
Torque – Measuring Equipment[3]					CDI Suretest w/	
	(4 to 50) lbf·in (50 to 400) lbf·in (400 to 1000) lbf·in (83 to 250) lbf·ft		0.29 % 0.29 % 0.3 % 0.29 %		CDI 2000-400-02 4 in 1 transducer	
	(60 to 600) lbf·ft		0.31 %		CDI 2000-12-02 transducer	

Parameter/Equipment	Range	CMC[2, 5, 6] (±)	Comments
Force – Measuring Equipment, Compression & Tension[3]	Up to 1200 lbf	0.0023 %	Class F weights & hangers
Air Velocity – Measuring Equipment, Anemometers	(0.5 to 35) m/s	0.035 m/s + 0.018 m/s / m/s	Direct comparison w/ furnace controls micromanometer, TSI airflow pitot static tube

V. Thermodynamics

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Temperature – Measuring Equipment	-78 °C	0.072 °C	Hart 1502A, 5628, isopropanol/dry ice slurry
Liquid in Glass Thermometers, Digital & Analogue Thermometry Systems	(-5 to 125) °C	0.031 °C + 0.000 11 x $T_{\text{Change from -5 °C}}$	Hart 1502A, 5628, temperature baths/blocks
	(30 to 660) °C	0.13 °C + 0.000 88 x $T_{\text{Change from 30 °C}}$	T = change from indicated temperature
Infrared Thermometers – Measuring Equipment[3] ε = 0.9 to 1.0 λ = (8 to 14) µm	(35 to 500) ºC	0.54 °C + 0.0042 x $T_{\text{Change from 35 °C}}$	Hart 4181 black body T = change from indicated temperature
Temperature – Measure, Hot-Blocks, Chambers, Freezers, Fridges[3]	(-197 to 660) °C	0.013 °C + 0.000 036 x $T_{\text{Change from -197 °C}}$	Hart 1502A, 5628 T = change from indicated temperature

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Relative Humidity – Measuring Equipment[3]	(10 to 90) % RH (20 to 30) ºC	1.4 % RH	Geo Instruments 2000SP
Relative Humidity – Measure[3]	(20 to 90) % RH (90 to 95) % RH	1.4 % RH 2.1 % RH	Vaisala MI70, HMP77

VI. Time & Frequency

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Frequency – Measuring Equipment[3]	10 MHz 1 µHz to 20 MHz 20 MHz to 50 GHz	6.9 µHz 0.58 µHz + 29 pHz/Hz 0.58 mHz + 0.7 pHz/Hz	GPS receiver GPS receiver w/ function or signal generator
Frequency – Measure	 0.01 Hz to 3.0 GHz (3.0 to 26.5) GHz (26.5 to 46) GHz	 5.8 µHz + 2 pH/Hz 2 mHz + 5.2 pHz/Hz 18 mHz + 0.69 pHz/Hz	GPS receiver w/: 53132A-003 5343A 5343A
Tachometers[3]	(1 to 100 000) rpm	0.000 54 rpm + 0.000 038 rpm/rpm	HP 3325B & LED
Stopwatches & Timers[3] Totalize Method Time Base Method	 Up to 86 400 s ± (0 to 19.99) s/day	 32 ms 0.037 s/day	NIST 960-12 Function generator, counter, & GPS receiver Timometer

[1] This laboratory offers commercial calibration service and field calibration services.

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

[3] Field calibration service is available for this calibration. 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] The measurands stated are generated using the indicated instrument (see Comments). This capability is suitable for the calibration of the devices intended to measure the measurand in the ranges indicated. CMC's are expressed as either a specific value that covers the full range or as a fraction or percent/fraction of the reading plus a fixed floor specification.

[5] In the statement of CMC, *R* is the resolution of the unit under test; percentages are to be read as percent of reading, unless noted otherwise.

[6] 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.

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

Accredited Laboratory

A2LA has accredited

TRESCAL, INC.

Alpharetta, GA

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 the requirements of ANSI/NCSL Z540-1-1994 and the requirements of ANSI/NCSL Z540.3-2006 and 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 9th day of April 2024.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 2662.01
Valid to February 28, 2026

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