

International Accreditation Service
CERTIFICATE OF ACCREDITATION

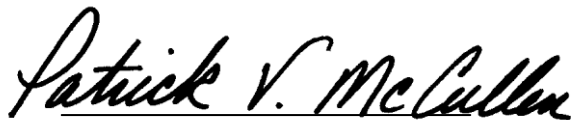
This is to signify that

FIELD CALIBRATIONS, INC.

9831 SOUTH 51ST STREET, SUITE C106
PHOENIX, ARIZONA 85044-5668

Calibration Laboratory CL-112
(Revised March 26, 2012)

has demonstrated compliance with the ANS/ISO/IEC Standard 17025:2005, *General criteria for the competence of testing and calibration laboratories*, and has been accredited commencing August 29, 2011, expiring August 28, 2013, for the calibration discipline(s) listed in the approved scope of accreditation. The laboratory meets requirements in the field of calibration.



Patrick V. McCullen
Vice President



C. P. Ramani, P.E.
President



Print Date: 03/26/2012

(see attached scope of accreditation for fields of testing and accredited test methods)

This accreditation certificate supersedes any IAS accreditation certificate bearing an earlier date. The certificate becomes invalid upon suspension, cancellation or revocation of accreditation.
See the IAS Accreditation Listings on the web at www.iasonline.org for current accreditation information, or contact IAS directly at (562) 364-8201.

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SCOPE OF ACCREDITATION

Field Calibrations, Inc. CL-112
 (Revised March 26, 2012)

Field Calibrations, Inc
 9831 S 51st St, Ste C106
 Phoenix, AZ 85044-5668

Annette Machock
 President
 (480) 756-8828

MEASUREMENT AREA	RANGE & RESOLUTION	CALIBRATION & MEASUREMENT CAPABILITY ¹ (CMC) (±)	TECHNIQUE, REFERENCE STANDARD, EQUIPMENT
<i>Electrical – DC/LF</i>			
DC Voltage – Generate + Measure	0 to 100 mV 100 mV to 1 V (1 to 10) V (10 to 100) V (100 to 1000) V (1000 to 1100) V	(ppm output + μ V) 7 μ V/V + 0.3 μ V 6 μ V/V + 0.3 μ V 6 μ V/V + 0.5 μ V 8 μ V/V + 30 μ V 20 μ V/V + 100 μ V .0009% + 500 μ V	Fluke 5720A w/HP 3458A
	0 to 2 kV 2 to 20kV	0.04% reading + 0.02% range + 0.1 ppm/V	Glassman LG40, Vitrek 4620B
DC Voltage – Measure	20 to 100 kV	0.0035% + 0.1005 kV	Spellman HVD-100-1w/HP 34401A

August 29, 2011
 Commencement Date



C. P. Ramani
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<i>Electrical – DC/LF(cont)</i> DC Current – Generate	(20 to 150) A (150 to 550) A (550 to 1000) A (0 to 100) A	(reading + offset) 0.26% + 0.05 A 0.25% + 0.06 A 0.27% + 0.06 A 0.27% + 150 mA	<i>Fluke 5520A w/50 turn Coil</i> EMS 5.5-150-1-D w/HP3458A & LAB100-100
<i>Electrical – DC/LF</i> DC Current Measure	10 fA to 2 nA (2 to 20) nA (20 to 200) nA 200 nA to 2 μA (2 to 20) μA (20 to 200) μA 200 μA to 2 mA	(% reading + offset) 0.3% + 500 fA 0.2% + 3 pA 0.15% + 20 pA 0.15% + 200 pA 0.1% + 2 nA 0.1% + 20 nA 0.1% + 200 nA	Keithley 487

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<i>Electrical – DC/LF(cont)</i>			
DC Current Measure	0 to 100 nA	(ppm reading + ppm range) 35 + 400	HP 3458A
	0.1 to 1 μA	25 + 40	
	1 to 10 μA	25 + 10	
	10 to 100 μA	25 + 8	
	0.1 to 10 mA	25 + 5	
	(10 to 100) mA	40 + 5	
	(0.1 to 1) A	115 + 10	
	1 to 30 A	(% reading + offset) 0.1307% + 0.3 mA	HP 3458A w/HP 34330A
	(10 to 100) A	0.1007% + 0.3 mA + 0.06 mA/A*	HP 3458A w/LAB 100-100
	(100 to 1000) A	0.1007% + 3 mA + 0.15 mA/A*	HP 3458A w/LAB1000-100
*6mA & 150 mA offset applies at FS only			

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<i>Electrical – DC/LF(cont)</i>			
DC Resistance – Generate	(1, 10, 100) mΩ	0.22%	HP 4203x series
	1 Ω	0.22%	
	(10, 100) Ω	0.12%	
	(1, 10, 100) kΩ	(ppm reading + ppm range) 0.1% + 200 X 10 ⁻⁶	HP 4203x series
	(0 to 10) Ω	15 + 5	Fluke 5500A w/HP3458A
	(10 to 100) Ω	12 + 5	
	190 Ω	(ppm)	Fluke 5720A
	(1, 1.9) kΩ	10	
	(10, 19) kΩ	8.5	
	(100, 190) kΩ	8.5	
	1 MΩ	11	
	1.9 MΩ	20	
10 MΩ	21		
19 MΩ	40		
100 MΩ	47		
		100	

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<i>Electrical – DC/LF(cont)</i> DC Resistance – Generate	11 to 32.99999 MΩ 33 to 109.9999 MΩ 110 to 329.9999MΩ 330 to 1100MΩ 0.1 to 1 GΩ 1 to 10 GΩ 10 to 100 GΩ 1 kΩ (10, 100) kΩ 1 MΩ 10 MΩ 100 MΩ 1 GΩ 10 GΩ 100 GΩ 1TΩ	(ppm output + floor) 250 + 2500 500 + 3000 3000 + 100000 15000 + 500000 (% setting) 0.1% 0.5% 1.0% 0.04% 0.02% 0.025% 0.037% 0.07% 0.1% 0.23% 0.4% 0.5670%	Fluke 5520A PPM R3-1, 110 Biddle 72-6345-1 Megadek Keithley 263 Rohde & Schwarz CR504

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<i>Electrical – DC/LF(cont)</i>			
DC Resistance – Measure	(0 to 10) Ω (10 to 100) Ω 100 Ω to 100kΩ 100 kΩ to 1 MΩ (1 to 10) MΩ (10 to 100) MΩ 100 MΩ to 1 GΩ	(ppm reading + ppm range) 15 + 5 12 + 5 10 + 0.5 15 + 2 50 + 10 500 + 10 0.5% + 10	HP3458A
	10 MΩ 100 MΩ 1 GΩ 10GΩ 100GΩ 1TΩ	(% of reading) 0.0050% 0.0064% 0.0149% 0.118% 0.285% 0.567%	HP 3458A; Fluke 5720A Keithley 487; Fluke 5720A

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<i>Electrical – DC/LF(cont)</i>			
DC Power – Generate	330 μ A to 329.99 mA	(% of watts output)	Fluke 5520A
33 mV to 1020 V	330 mA to 2.999 A	0.023%	
	3 to 20.5 A	0.022%	
AC Voltage – Generate			Fluke 5720A
1nV to 2.2 mV	10 to 20 Hz	(ppm output + μ V)	
	(20 to 40) Hz	240 + 4	
	40 Hz to 20 kHz	90 + 4	
	(20 to 50) kHz	80 + 4	
	(50 to 100) kHz	200 + 4	
	(100 to 300) kHz	500 + 5	
	(300 to 500) kHz	1050 + 10	
	500 kHz to 1 MHz	1400 + 20	
		2700 + 20	

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<p><i>Electrical – DC/LF(cont)</i></p> <p>AC Voltage – Generate</p> <p>(2.2 to 22) mV</p>	<p>10 to 20 Hz</p> <p>(20 to 40) Hz</p> <p>40 Hz to 20 kHz</p> <p>(20 to 50) kHz</p> <p>(50 to 100) kHz</p> <p>(100 to 300) kHz</p> <p>(300 to 500) kHz</p> <p>500 kHz to 1 MHz</p>	<p>(ppm output + μV)</p> <p>240 + 4</p> <p>90 + 4</p> <p>80 + 4</p> <p>200 + 4</p> <p>500 + 5</p> <p>1050 + 10</p> <p>1400 + 20</p> <p>2700 + 20</p>	<p>Fluke 5720A</p>

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<i>Electrical – DC/LF(cont)</i> AC Voltage – Generate (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	(ppm output + μ V) 240 + 12 90 + 7 80 + 7 200 + 7 460 + 17 900 + 20 1400 + 25 2700 + 45	Fluke 5720A

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<i>Electrical – DC/LF(cont)</i>			
AC Voltage – Generate (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	(ppm output + μ V) 240 + 40 90 + 15 45 + 8 75 + 10 110 + 30 420 + 8 1000 + 200 1700 + 300	Fluke 5720A
(2.2 to 22) V	10 to 20 Hz (20 to 40) Hz 40 Hz to 20 kHz	240 + 400 90 + 150 45 + 50	

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<p><i>Electrical – DC/LF(cont)</i></p> <p>AC Voltage – Generate (2.2 to 22) V</p> <p>(22 to 220) V</p>	<p>(20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz</p> <p>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</p>	<p>(ppm output + μV) 75 + 100 100 + 200 275 + 600 (0.6mV) 1000 + 2000 (2.0mV) 1500 + 3200 (3.2mV)</p> <p>(ppm output + mV) 240 + 4 90 + 1.5 52 + 0.6 80 + 1 150 + 2.5 900 + 16 4400 + 40 8000 + 80</p>	<p>Fluke 5720A</p>

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<i>Electrical – DC/LF(cont)</i>			
AC Voltage – Generate (220 to 1100) V	15 to 50 Hz 50 Hz to 1 kHz	(ppm output + mV) 300 + 16 70 + 3.5	Fluke 5720A
220 to 750 V	30 to 50 kHz (50 to 500) kHz	600 + 11 2300 + 45	
220 to 1100 V	40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz	90 + 4 165 + 6 600 + 11	Fluke 5720A w/5725A

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<i>Electrical – DC/LF(cont)</i> AC Voltage – Measure 0 to 10 mV	1 to 40 Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	(% reading + % range) 0.03% + 0.03% 0.02% + 0.011% 0.03% + 0.011% 0.1% + 0.011% 0.5% + 0.011% 4% + 0.02%	HP 3458A

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<i>Electrical – DC/LF(cont)</i>			
AC Voltage – Measure (10 mV to 10 V)	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	(% reading + % range) 0.007% + 0.004% 0.007% + 0.002% 0.014% + 0.002% 0.03% + 0.002% 0.08% + 0.002% 0.3% + 0.01% 1% + 0.01%	HP 3458A
(10 to 100) V	(1 to 2) MHz 1 to 40 Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	1.5% + 0.01% 0.02% + 0.004% 0.02% + 0.002% 0.02% + 0.002% 0.035% + 0.002% 0.12% + 0.002% 0.4% + 0.01% 1.5% + 0.01%	HP 3458A

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<i>Electrical – DC/LF(cont)</i>			
AC Voltage Measure (100 to 700) V	1 to 40 Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	(% reading + % range) 0.04% + 0.004% 0.04% + 0.002% 0.06% + 0.002% 0.12% + 0.002% 0.3% + 0.002%	HP 3458A
0 to 2 kV	20 to 100 Hz 100 to 400 Hz	0.07% + 0.1% + 0.2 ppm/V 0.4% + 0.2% + 0.2ppm/V	Virtrek 4620B
(2 to 20) kV	20 to 100Hz	0.2% + 0.1% + 0.2 ppm/V	Virtrek 4620B

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<i>Electrical – DC/LF(cont)</i>			
AC Voltage – AC Band>2 MHz Measure		(% reading & % range)	
0 to 10 mV	45 Hz to 100 kHz 100 kHz to 1 MHz (1 to 4) MHz (4 to 8) MHz	0.09% + 0.06% 1.2% + 0.05% 7% + 0.07% 20% + 0.08%	HP 3458A
(10 mV to 10 V)	45Hz to 100 kHz 100 kHz to 1 MHz (1 to 4) MHz (4 to 8) MHz (8 to 10)MHz	0.09% + 0.06% 2% + 0.05% 4% + 0.07% 4% + 0.08% 15% + 0.1%	
(10 to 100) V	45 Hz to 100 kHz	0.12% + 0.002%	HP 3458A
(100 to 700) V	45 Hz to 100 kHz	0.3% + 0.01%	

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<i>Electrical – DC/LF(cont)</i> AC Voltage – Amplitude Flatness, Measure, (0 to 1.5) V	10 Hz to 10 MHz (10 to 30) MHz (30 to 50) MHz (50 to 100) MHz	0.08% 0.16% 0.4% 0.8%	HP 3458A w/Fluke A55
<i>Electrical – DC/LF</i> AC Current – Generate 1 nA to 220 μ A	10 to 20 Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	(ppm output + nA) 250 + 16 160 + 10 120 + 8 280 + 12 1100 + 65	Fluke 5720A

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<i>Electrical – DC/LF(cont)</i>			
AC Current – Generate (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	(ppm output + nA) 250 + 40 160 + 35 120 + 35 200 + 110 1100 + 650	Fluke 5720A
(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	250 + 400 160 + 350 120 + 350 200 + 550 1100 + 5000	Fluke 5720A

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<i>Electrical – DC/LF(cont)</i>			
AC Current – Generate (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	ppm output + μ A 250 + 4 160 + 3.5 120 + 2.5 200 + 3.5 1100 + 10	Fluke 5720A
(220 mA to 2.2A)	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	260 + 35 450 + 80 7000 + 160	Fluke 5720A
(2.2 to 11) A	40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	460 + 170 950 + 380 3600 + 750	Fluke 5720A w/5725A

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<i>Electrical – DC/LF(cont)</i>			
AC Current – Generate (1 to 20) A	DC to 5 kHz	(0.025% + 0.012% ^o F) of reading	Shepherd Scientific 100 w/Fluke Y5020; F is frequency in kHz
(20 to 100) A	DC to 1 kHz	0.1% of range	Shepherd Scientific 100 w/Valhalla 2575A
(11 to 20.5) A	45 to 100 Hz 100 Hz to 1 kHz (1 to 5) kHz	(% output + offset) 0.12% + 5 mA 0.15% + 5 mA 3% + 5 mA	Fluke 5520A
(0 to 1000) A	45 to 440 Hz	0.28% + 0.11 A	Fluke 5520A w/50 turn coil
<i>Electrical – DC/LF</i>			
AC Current Measure 0 to 100 μ A	10 to 20 Hz (20 to 45) Hz 45 Hz to 5 kHz	(% reading + % range) 0.4% + 0.03% 0.15% + 0.03% 0.06% + 0.03%	HP 3458A

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<i>Electrical – DC/LF(cont)</i>			
AC Current Measure 100 µA to 100 mA	10 to 20 Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	(% reading + % range) 0.4% + 0.02% 0.15% + 0.02% 0.06% + 0.02% 0.03% + 0.02% 0.06% + 0.02% 0.4% + 0.04% 0.55% + 0.15%	HP 3458A
100 mA to 1 A	10 to 20 Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz	0.4% + 0.02% 0.16% + 0.02% 0.08% + 0.02% 0.1% + 0.02% 0.3% + 0.02% 1% + 0.04%	HP 3458A
(1 to 20) A	DC to 5 kHz	(0.025% + 0.012%*F) of reading	Fluke Y5020; F is frequency in kHz
(20 to 100) A	DC to 1 kHz	0.1% of range	Valhalla 2575A

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<i>Electrical – DC/LF(cont)</i>			
AC Resistance – Generate		% series resistance reactance)	
10Ω	DC to 1 MHz (1 to 2) MHz (2 to 3) MHz (3 to 4) MHz (4 to 5) MHz (5 to 10) MHz (10 to 13) MHz	0.13% (0.014 Ω) 0.14% (0.015 Ω) 0.16% (0.021Ω) 0.17% (0.031 Ω) 0.2% (0.037 Ω) 0.5% (0.10 Ω) 0.7% (0.14 Ω)	HP42030 resistor set
100Ω	DC to 1 MHz (1 to 2) MHz (2 to 3) MHz (3 to 4) MHz (4 to 5) MHz (5 to 10) MHz (10 to 13) MHz	0.13% (0.14 Ω) 0.14% (0.14 Ω) 0.15% (0.19 Ω) 0.15% (0.19 Ω) 0.15% (0.24 Ω) 0.3% (0.58 Ω) 0.4% (0.79 Ω)	HP 42030 resistor set

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<i>Electrical(cont)</i>			
AC Resistance –Generate		Resistance + Stability (Susceptance)	
1 KΩ	DC to 100 kHz 100 kHz to 1 MHz (1 to 2) MHz (2 to 3) MHz (3 to 4) MHz (4 to 5) MHz (5 to 10) MHz (10 to 13) MHz	0.13% + 200 ppm (1.2 μS) 0.13% + 200 ppm (1.4 μS) 0.13% + 200 ppm (1.4 μS) 0.13% + 200 ppm (1.9 μS) 0.14% + 200 ppm (2.4 μS) 0.15% + 200 ppm (3.4 μS) 0.3% + 200 ppm (5.7 μS) 0.4% + 200 ppm (8.7 μS)	HP 42030 resistor set
10 kΩ	DC to 100 kHz 100 kHz to 1 MHz	0.12% + 200 ppm (0.14 μS) 0.13% + 200 ppm (0.24 μS)	HP 42030 resistor set
100 kΩ	DC to 100 kHz 100 kHz to 1 MHz	0.13% + 200 ppm (0.024 μS) 0.13% + 200 ppm (0.154 μS)	

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<i>Electrical</i>			
AC Resistance – Measure	10 mΩ to 100 MΩ	0.05%	HP 4284A
<i>Electrical –DC/LF</i>			
AC Power – Generate			
33 to 329.999 mV 45 to 65 Hz	3.3 to 8.999 mA 9 to 32.999 mA 33 to 89.99 mA 90 to 329.99 mA	0.14% 0.1% 0.14% 0.1%	Fluke 5520A
330mV to 1020 V 45 to 65 Hz	3.3 to 8.999 mA 9 to 32.999 mA 33 to 89.99 mA 90 to 329.99 mA	0.12% 0.08% 0.12% 0.08 %	

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<i>Electrical DC/LF(cont)</i>			
AC Power – Generate	330 mA to 0.8999 A	0.13%	Fluke 5520A
33 to 330 mV	0.9 to 2.1999 A	0.11%	
45 to 65 Hz	2.2 to 4.4999 A	0.13%	
	4.5 to 20.5 A	0.11%	
330 mV to 1020 V	330 mA to 0.8999 A	0.11%	
45 to 65 Hz	0.9 to 2.1999 A	0.09%	
	2.2 to 4.4999 A	0.12%	
	4.5 to 20.5 A	0.1%	

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<p><i>Electrical – DC/LF (cont)</i></p> <p>Capacitance – Generate</p>	<p>0.19 to 3.2999 nF</p> <p>3.3 to 10.9999 nF</p> <p>11 to 109.999 nF</p> <p>110 to 329.999 nF</p> <p>330 nF to 1.09999 μF</p> <p>1.1 to 3.29999 μF</p> <p>3.3 to 10.9999 μF</p> <p>11 to 32.9999 μF</p>	<p>(% output + floor)</p> <p>0.5% + 0.01 nF</p> <p>0.25% + 0.01 nF</p> <p>0.25% + 0.1 nF</p> <p>0.25% + 0.3 nF</p> <p>0.25% + 1 nF</p> <p>0.25% + 3 nF</p> <p>0.25% + 10 nF</p> <p>0.4% + 30 nF</p>	<p>Fluke 5520A</p>

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<i>Electrical – DC/LF (cont)</i>			
Capacitance – Generate	33 to 109.999 μ F 110 to 329.999 μ F 330 μ F to 1.09999 mF 1.1 to 3.2999 mF 3.3 to 10.9999 mF 11 to 32.9999 mF 33 to 110 mF	(% output + floor) 0.45% + 100 nF 0.45% + 300 nF 0.45% + 1 μ F 0.45% + 3 μ F 0.45% + 10 μ F 0.75% + 30 μ F 1.1% + 100 μ F	Fluke 5520A
Fixed Points	(1, 10, 1000) pF 100 pF 100 pF to 1 μ F 1 μ F to 1 F	0.05% 0.0028% 0.05% 0.25%	HP 1638x series GenRad 1404A Arco SS32 set GenRad 1417
<i>Electrical – DC/LF</i>			
Capacitance – Measure	0.1 pF to 10F	0.05%	HP 4284A

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<i>Electrical – DC/LF(cont)</i> Inductance Generate, Fixed Values	100 μ H to 10 H	0.05%	GenRad 1482x series
<i>Electrical – DC/LF</i> Inductance – Measure	0.01 nH to 100 kH	0.05%	HP 4284A
<i>Thermal</i> Electrical Calibration of Thermocouples and Thermocouple Indicators Type B	600 to 800 °C (800 to 1000) °C (1000 to 1550) °C (1550 to 1820) °C	0.44 °C 0.34 °C 0.3 °C 0.33 °C	Fluke 5520A

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<i>Thermal(cont)</i>			
Electrical Calibration of Thermocouples and Thermocouple Indicators			
Type C	0 to 150 °C (150 to 650) °C (650 to 1000) °C (1000 to 1800) °C (1800 to 2316) °C	0.3 °C 0.26 °C 0.31 °C 0.5 °C 0.84 °C	Fluke 5520A
Type E	-250 to -100 °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C	0.5 °C 0.16 °C 0.14 °C 0.16 °C 0.21 °C	Fluke 5520A

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<i>Thermal(cont)</i>			
Electrical Calibration of Thermocouples and Thermocouple Indicators			
Type J	-210 °C to -100 °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C	0.27 °C 0.16 °C 0.14 °C 0.17 °C 0.23 °C	Fluke 5520A
Type K	210 °C to -100 °C (-100 to -25) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.33 °C 0.18 °C 0.16 °C 0.26 °C 0.4 °C	Fluke 5520A

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<i>Thermal(cont)</i>			
Electrical Calibration of Thermocouples and Thermocouple Indicators			
Type L	-200 to -100 °C (-100 to 800) °C (800 to 900) °C	0.37 °C 0.26 °C 0.17 °C	Fluke 5520A
Type N	-200 to -100 °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1300) °C	0.4 °C 0.22 °C 0.19 °C 0.18 °C 0.27 °C	

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<i>Thermal(cont)</i>			
Electrical Calibration of Thermocouples and Thermocouple Indicators			
Type R	0 to 250 °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.57 °C 0.35 °C 0.33 °C 0.4 °C	Fluke 5520A
Type S	0 to 250 °C (250 to 1000) °C (1000 to 1400) °C (1400 to 1767) °C	0.47 °C 0.36 °C 0.37 °C 0.46 °C	

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<i>Thermal(cont)</i>			
Electrical Calibration of Thermocouples and Thermocouple Indicators			
Type T	-250 to -150 °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.63 °C 0.24 °C 0.16 °C 0.14 °C	Fluke 5520A
Type U	-200 to 0 °C (0 to 600) °C	0.56 °C 0.27 °C	

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<i>Thermal(cont)</i>			
Electrical Calibration of RTD – Generate			
Pt 385, 100 Ω	-200 to 0 °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 800) °C	0.05 °C 0.07 °C 0.09 °C 0.1 °C 0.12 °C 0.23 °C	Fluke 5520A
Pt 3926, 100 Ω	-200 to 0 °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C	0.05 °C 0.07 °C 0.09 °C 0.1 °C 0.12 °C	Fluke 5520A

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<i>Thermal(cont)</i>			
Electrical Calibration of RTD – Generate			
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	0.25 °C 0.04 °C 0.05 °C 0.06 °C 0.07 °C 0.08 °C 0.09 °C 0.1 °C 0.23 °C	Fluke 5520A
Pt 385, 200 Ω	-200 to 100 °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.04 °C 0.05 °C 0.12 °C 0.13 °C 0.14 °C 0.16 °C	Fluke 5520A

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<p><i>Thermal(cont)</i></p> <p>Electrical Calibration of RTD – Generate</p> <p>Pt 385, 500 Ω</p>	<p>-200 to -80 °C (-80 to 100) °C (100 to 260) °C (260 to 400) °C (400 to 600) °C (600 to 630) °C</p>	<p>0.04 °C 0.05 °C 0.06 °C 0.08 °C 0.09 °C 0.11 °C</p>	<p>Fluke 5520A</p>

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<i>Thermal(cont)</i>			
Electrical Calibration of RTD – Generate			
Pt 385, 1000 Ω	-200 to 0 °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 600) °C (600 to 630) °C	0.03 °C 0.04 °C 0.05 °C 0.06 °C 0.07 °C 0.23 °C	Fluke 5520A
PtNi 385, 120 Ω	-80 to 100 °C (100 to 260) °C	0.08 °C 0.14 °C	
Cu 427, 10 Ω	-100 to 260 °C	0.3 °C	

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<i>Thermal(cont)</i>			
Temperature - Generate	-10°C to 122°C	0.14°C	Hart 9102 w/1502 & 5612
	-10°C to 300°C	0.63°C	
	-30°C to 125°C	0.027°C	Hart 1502A & 5612 w/Hart 7103
	-65 to 200°C	0.027°C	Tenney T6RC w/Hart 1502A + 5612
	35°C to 200°C	0.027°C	Hart 6102 w/Hart 1502A & 5612
	Ambient to 200°C	0.052°C	Hart 9125 w/1502 & 5612
	Ambient to 650°C	0.030°C	Jofra 650SE w/Hart 1502A + 5628(PRT)

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<i>Thermal(cont)</i>			
RTD – Measure, 4-wire	-100 °C to 100 °C -200 °C to 630 °C -148 °F to 212 °F -328 °F to 1166 °F	0.021 °C 0.068 °C 0.036 °F 0.12 °F	Keithley 2002, 4-wire
Temperature – Measure	-200 °C to 660 °C -200°C to 500°C	0.030 °C 0.027°C	Hart 1502A w/5628 Hart 1502A w/5612
Infrared Temperature Measure	Ambient to 125°C	0.83°C	RAYTEK/RAYMX2U

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<i>Thermal(cont)</i>			
Dewpoint - Measure			
10-80% RH	-40°C	1.9 °C @ 10% 0.43 °C @ 80%	Vaisala HMP233/HMP235
	-20°C	2.2 °C @ 10% 0.48 °C @ 80%	
10-100% RH	0 °C	2.5 °C @ 10% 0.48 °C @ 80%	
	20 °C	2.9 °C @ 10% 0.53 °C @ 80%	

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<i>Thermal(cont)</i>			
Dewpoint - Measure	40 °C	3.2 °C @ 10% 0.58 °C @ 80%	Vaisala HMP233/HMP235
	60°C	3.6°C @ 10% 0.64°C @ 80%	
	80°C	4°C @ 10% 0.7°C @ 80%	
	100°C	4.4°C @ 10% 0.76°C @ 80%	
	120°C	4.9°C @ 10% 0.84°C @ 80%	

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<i>Thermal(cont)</i>			
Dewpoint - Measure	140°C	5.3°C @ 10% 0.91°C @ 80%	Vaisala HMP233/HMP235
Relative Humidity - Generate	160°C	5.8°C @ 10% 0.99°C @ 80%	
	0% to 90% 90% to 100%	1% 1.7%	General Eastern C-1 w/Vaisala HMT335
	11.3%, 33.1%, 75.5% 97.6%	1% 2%	Salt solutions

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<i>Thermal(cont)</i>			
Relative Humidity – Measure	10% to 90% 90% to 100%	1% 1.7%	Vaisala HMT335
<i>Time and Frequency</i>			
Timers/Stop Watches	0.001 to 99999.999 sec 5 mHz to 500 MHz	0.001% of rdg 5x10e-12	VWR 62344-880 HP 5345A, Fluke 910R as external time base

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<i>Time and Frequency(cont)</i>			
Oscilloscopes			
Voltage Functions			
DC Signal	0 to ± 6.6 V	(% output + μ V)	Fluke 5820A-2.1G
50 Ω 1 M Ω	0 to ± 130 V	0.25% + 40 μ V 0.025% + 25 μ V	
Square Wave Signal	±1 mV to ± 6.6 Vp-p	0.25% + 40 μ V	
50 Ω	±1 mV to ±130 V p-p	0.05% + 5 μ V	
1 M Ω to 1 kHz > 1 kHz	±1 mV to ±130 V p-p	0.25% + 40 μ V	

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<i>Time and Frequency(cont)</i>			
Squarewave Frequency	10 Hz to 10 kHz	0.33 ppm of setting	Fluke 5820A-2.1G
Edge Functions Amplitude	4 mV to 2.5 Vp-p	(% output + μ V) 2% + 200 μ V	Fluke 5820A-2.1G
Edge Functions Frequency	1 kHz to 10 MHz	.33 ppm of setting	
Leveled Sinewave Amplitude 5 mV to 5 V	50 kHz reference 50 kHz to 100 MHz (100 to 300) MHz (300 to 500) MHz (500 to 600) MHz	(% output + μ V) 2% + 300 μ V 3.5% + 300 μ V 4% + 300 μ V 5.5% + 300 μ V 6% + 300 μ V	Fluke 5820A-2.1G

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<i>Time and Frequency(cont)</i>			
5 mV to 3.5V	10 MHz reference 600 MHz to 1.6 GHz (1.6 to 2.1) GHz	(% output + μV) 2% + 300 μV 7% + 300 μV 8% + 300 μV	Fluke 5820A-2.1G
Leveled Sinewave Amplitude Flatness			
5 mV to 5 V	50 kHz to 100 MHz (100 to 300) MHz (300 to 500) MHz (500 to 600) MHz 600 MHz to 1.6 GHz (1.6 to 2.1) GHz	1.5% + 100 μV 2% + 100 μV 3.5% + 100 μV 4% + 100 μV 5% + 100 μV 6% + 100 μV	Fluke 5820A-2.1G

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<i>Time and Frequency(cont)</i>			
Time Marker	5 s to 50 ms 20 ms to 100 ns 50 ns to 20 ns 10 ns 5 ns to 500 ps	(ppm output) 2.5 + 5 μ Hz 0.33 0.33 0.33 0.33	Fluke 5820A-2.1G spike or square spike, square, 20% pulse spike or square square or sine
Wave Generator – Amplitude Sine/Square Waves			
1.8 mV to 55 Vp-p	10 Hz to 10 kHz	3% p-p output + 100 μ V	
Wave Generator – Frequency Sine/Square Waves	0.01 Hz to 100 kHz	2.5 ppm + 5 μ Hz	

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<i>Time and Frequency(cont)</i>			
Pulse Width Generate	1 to 500 ns	5% + 200 ps	Fluke 5820A-2.1G
Pulse Period Generate	10 μ s to 200 ns	0.33 ppm	
Pulse Skew Generate	+30 ns to -10 ns	500 ps	
Current Output –Squarewave	100 μ A p-p to 100 mA p-p	0.25% + 0.5 μ A	
DC Input Resistance	40-60 Ω /50 Ω 500 K Ω -1.5M Ω / 1M Ω	0.1% 0.1%	
Input Capacitance	1pF – 50 pF @ 1M Ω	5% of input + 0.5 pF	

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<i>Time and Frequency(cont)</i>			
Rise Time – Generate	<14.9 ps	4.447 ps	Tektronix 067-1338-00
	<150 ps	+0/-50 ps	Fluke 5820A-2.1G
	<300 ps	+0/-100 ps	
Rise Time – Measure		≤17.5 ps	Tektronix 11801C w/SD26
<i>Time and Frequency</i>			
Frequency – Generate	0.1, 1, 5, 10 MHz	1 X 10 ⁻¹²	Fluke 910R
	001 Hz to 20 MHz	5 X 10 ⁻¹²	HP 3325B, Fluke 910R as external timebase
	10 MHz to 26.5 GHz	5 X 10 ⁻¹²	HP 8340B, Fluke 910R as external timebase

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<i>Time and Frequency(cont)</i>			
Frequency – Measure	5 mHz to 500 MHz 100 second to 10 second Gate Time	5x10e-12	HP 5345A, Fluke 910R as external time base
	0.4 GHz to 1.5 GHz	5x10e-12	HP 5345A, HP 5355A, Fluke 910R as external time base
	1.5 to 26.5 GHz	5x10e-12	HP 5345A, HP 5355A, HP 5356B, Fluke 910R as external time base

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<i>Electrical – RF/Microwave</i>			
Amplitude Modulation – Measure			
Rate: 50 Hz to 10 kHz Depth: 5% to 99%	150 kHz to 10 MHz	2% + 1 digit	HP 8902A w/HP 11793A (using peak detector)
Rate: 20 Hz to 10 kHz Depth: 5% to 99%		3% + 1 digit	
Rate: 50 Hz to 50 kHz Depth: 5% to 99%	(10 to 1300) MHz	1% + 1 digit	
Rate: 20 Hz to 20 kHz Depth: 5% to 99%		3% + 1 digit	

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<p><i>Electrical – RF/Microwave</i></p> <p>Amplitude Modulation – Measure</p> <p>Rate: 50 Hz to 50 kHz Depth: 5% to 99%</p> <p>Rate: 20 Hz to 100 kHz Depth: 5% to 99%</p>	(1.3 to 26.5) GHz	1.5% + 1 digit	HP 8902A w/HP 11793A (using peak detector)
<p>Frequency Modulation – Measure</p> <p>Rate: 20Hz to 10 kHz Deviation: 40 kHz peak</p>		2% + 1 digit	

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<i>Electrical – RF/Microwave</i>			
Frequency Modulation – Measure			
Rate: 50Hz to 100 kHz Deviation: 400 kHz peak	10 MHz to 1.3 GHz	1% + 1 digit	HP 8902A w/HP 11793A (using peak detector)
Rate: 20 Hz to 200 kHz Deviation: 400 kHz peak	10 MHz to 1.3 GHz	5% + 1 digit	
Rate: 50 Hz to 100 kHz Deviation: 400 kHz peak	1.3 to 26.5 GHz	1% + 1 digit	
Rate: 20 Hz to 200 kHz Deviation: 40 kHz peak	1.3 to 26.5 GHz	5% + 1 digit	

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<i>Electrical – RF/Microwave(cont)</i>			
Amplitude Modulation – Flatness Measure Rate: 90 Hz to 10 kHz Depth: 20% to 80%	10MHz to 1.3GHz Carrier frequency	0.3% + 1 digit	HP 8902A w/HP 11793A (using peak detector)
Modulation Residual AM – Measure 50 Hz to 3 kHz BW	0% to 100% rms	<0.01% rms	HP 8902A

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<i>Electrical – RF/Microwave(cont)</i>			
Modulation Residual FM – Measure	≤100 MHz	<1 Hz _{rms} increasing linearly with frequency to	HP 8902A
50Hz to 3kHz BW	1300 MHz	<8 Hz _{rms}	
<i>RF/Microwave</i>			
Phase Modulation – Measure			
150 kHz to 10 MHz	200 Hz to 10 kHz	4% + 1 digit	HP 8902A w/HP 11793A (using peak detector)
10 MHz to 1.3 GHz	200 Hz to 20 kHz	3% + 1 digit	
(1.3 to 26.5) GHz	200 Hz to 20 kHz	3% + 1 digit	

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<i>RF/Microwave(cont)</i>			
Noise Measurement			
Distortion Harmonics <330kHz	20 Hz to 20 kHz 20 kHz to 100 kHz	1 dB 2 dB	HP 8903B
Single Side Band Phase Noise (SSB)	10-1300 MHz	1 dB	HP 8902A-030, 037
<i>RF/Microwave</i>			
Frequency - Generate	10 MHz to 26.5 GHz	5 X 10 ⁻¹²	HP 8340B, Fluke 910R as external time base

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<i>RF/Microwave(cont)</i> Attenuators – Generate DC to 18 GHz	1 dB 2 dB 3 to 6 dB 7 to 8 dB 9 dB 10 dB 11 dB	0.35 dB 0.45 dB 0.55 dB 0.60 dB 0.65 dB 0.70 dB 0.80 dB	Agilent 84904K, APC 3.5 mm connector

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<i>RF/Microwave(cont)</i> Attenuators – Generate >18 to 26.5 GHz	1 dB 2 dB 3 to 6 dB 7 to 8 dB 9 dB 10 dB 11 dB	0.40 dB 0.50 dB 0.70 dB 0.80 dB 0.85 dB 0.90 dB 1.10 dB	Agilent 84904K, APC 3.5 mm connector

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<i>RF/Microwave(cont)</i>			
Attenuators – Generate DC to 6 GHz	10 dB	0.3 dB	HP 8497K, APC 3.5 mm connector
	20 dB	0.5 dB	
	30 dB	0.6 dB	
	40 dB	0.7 dB	
	50 dB	0.8 dB	
	60 dB	1 dB	
	70 to 80 dB	1.1 dB	
>6 to 12.4 GHz	90 dB	1.2 dB	HP 8497K. APC 3.5 mm connector
	10 dB	0.4 dB	
	20 dB	0.5 dB	
	30 dB	0.7 dB	
	40 dB	0.9 dB	
	50 dB	1 dB	

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<i>RF/Microwave(cont)</i>			
Attenuation – Generate			
>6 to 12.4 GHz	60 dB 70 dB 80 dB 90 dB	1.3 dB 1.5 dB 1.6 dB 1.7 dB	HP 8497K. APC 3.5 mm connector
>12.4 to 18 GHz	10 dB 20 dB 30 dB 40 dB 50 dB 60 dB 70 dB 80 dB 90 dB	0.5 dB 0.6 dB 0.8 dB 1.1 dB 1.2 dB 1.4 dB 1.7 dB 1.8 dB 2.1 dB	HP 8497K, APC 3.5 mm connector

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(Revised March 26, 2012)

MEASUREMENT AREA	RANGE & RESOLUTION	CALIBRATION & MEASUREMENT CAPABILITY ¹ (CMC) (±)	TECHNIQUE, REFERENCE STANDARD, EQUIPMENT
<i>RF/Microwave(cont)</i>			
Attenuators - Generate			
>18 to 26.5 GHz	10 dB 20 dB 30 dB 40 dB 50 dB 60 dB 70 dB 80 dB 90 dB	0.7 dB 0.8 dB 1 dB 1.5 dB 1.6 dB 1.9 dB 2.3 dB 2.5 dB 2.8 dB	HP8497, APC 3.5 mm connector
200 Hz to 80 MHz	0-18 dB 20-58 dB 60-98 dB	0.04 dB 0.09 dB 0.20 dB	HP 3335A

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<i>RF/Microwave(cont)</i> RF/Microwave Attenuators – Measure 100 kHz to 26.5 GHz	0 to -20 dB (-20 to -40) dB (-40 to -60) dB (-60 to -80) dB (-80 to -100) dB (-100 to -127) dB	0.05 dB + M 0.18 dB + M 0.2 dB + M 0.24 dB + M 0.28 dB + M 0.35 dB + M	Where: M is the mismatch uncertainty. HP 8902A w/11722A and 11793A

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<i>RF/Microwave(cont)</i>			
Power – Generate			
0.001 Hz to 100 kHz (into 50Ω)	-56.02 to 13.52 dBm 13.52 to 23.98 dBm	0.2 dB 0.1 dB	HP 3325B (sinewave 0 dB attenuation, BNC connector)
100 kHz to 10 MHz (into 50Ω)	-56.02 to +13.52 dBm	0.6 dB	HP3325B (sinewave 0 dB attenuation, BNC connector) HP 8340B, internally leveled type N connector
10 MHz to 20 MHz (into 50Ω)	-56.02 to -16.02 dBm	0.9 dB	
10 MHz to 20 MHz (into 50Ω)	-16.02 to +13.52 dBm	0.6 dB	
100 kHz to 20 MHz (into 50Ω)	13.52 to 23.98 dBm	0.4 dB	
0.01 to 3 GHz	+10 to -9.95 dBm	0.9 dBm	
	-10 to -19.95 dBm	1.2 dBm	
	-20 to -49.95 dBm	1.5 dBm	
	-50 to -79.95 dBm	1.8 dBm	
	-80 to -100 dBm	2.1 dBm	

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<i>RF/Microwave (cont)</i>			
Power – Generate			
2.3 to 20 GHz	+18 to +10 dBm (+10 to -9.95 dBm) -10 to -19.95 dBm -20 to -49.95 dBm -50 to -79.95 dBm -80 to -100 dBm	1.8 dBm 1.5 dBm 2 dBm 2.3 dBm 2.6 dBm 2.9 dBm	HP8340B, internally leveled Type N connector
20 to 26.5 GHz	+18 to +10 dBm (+10 to -9.95 dBm) -10 to -19.95 dBm -20 to -49.95 dBm -50 to -79.95 dBm -80 to -100 dBm	2.3 dBm 2 dBm 2.5 dBm 2.8 dBm 3.1 dBm 3.4 dBm	HP8340B, internally leveled Type N connector

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<i>RF/Microwave(cont)</i>			
Power – Measure			HP 437B, assuming VSWR of calibration item of 1:1
100 kHz to 4.2 GHz	+10 to +20 dBm -30 to +10 dBm	0.02 dB + 0.001 dB/°C 0.02 dB + 0.001 dB/°C	w/8482A
50 MHz to 26.5 GHz	-30 to + 20 dBm	0.02 dB + 0.001 dB/°C	w/8485A
Return loss – Measure (into 50Ω)			
10MHz to 8.4GHz	10 dB 20 dB 30 dB 40 dB	1.2921 dB 1.4467 dB 1.5134 dB 1.5023 dB	HP 85021B w/8755C and 8340B
>8.4 to 12.4GHz	10 dB 20 dB 30 dB 40 dB	1.3009 dB 1.4556 dB 1.5223 dB 1.5112 dB	

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<i>RF/Microwave(cont)</i>			
Return loss – Measure (into 50Ω)			
>12.4 to 20GHz	10 dB 20 dB 30 dB. 40 dB	1.3383 dB 1.4934 dB 1.5602 dB 1.5491 dB	HP 85021B w/8755C and 8340B
>20 to 26.5GHz	10 dB 20 dB 30 dB 40 dB	1.4822 dB 1.6385 dB 1.7058 dB 1.6945 dB	

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<p><i>RF/Microwave(cont)</i></p> <p>Harmonic and Non-Harmonic Amplitude Measure</p> <p>0.02 Hz to 25.5 kHz</p> <p>9 kHz to 25 GHz</p>	<p>+30 to -120 dBV</p> <p>0-60 dB Reference level</p> <p><-60 to -70 dB Reference level</p>	<p>0.6 dB Log</p> <p>0.2 dB/2 dB Log; 0.75 dB maximum cumulative 3% linear</p> <p>0.2/2 dB log; 1 dB maximum cumulative 3% linear</p>	<p>HP 3582A</p> <p>HP 8592B</p>
<p><i>Dimensional</i></p> <p>Micrometer</p> <p>Calipers</p>	<p>0.0625 to 60 in</p> <p>Up to 60 in</p>	<p>(20 + 7L) μin</p> <p>(35 + 10L) μin</p>	<p>Gage blocks, and micrometer standards Where: L is the length in inches</p>

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<i>Dimensional(cont)</i>			
Calipers	1 in (internal diameter)	80 μin	Ring Gage
<i>Mechanical</i>			
Totalizers	0.01 to 100 000 ft 0.02 to 100 000 m 1 to 100 000 in	.03%	Electromatic CDT2000
Speed – Generate	55-5000 rpm 5000-7000 rpm 7000-46000 rpm Contact	0.001 rpm 0.0012 rpm 0.000018%	Quantum N-11-ECS/3A w/HP 53132A
	0 to 100 000 rpm Non-contact	1 X 10 ⁻¹²	HP 3325A w/Fluke 910R

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<i>Mechanical(cont)</i>			
Speed – Measure	0 to 100 000 rpm 0.3 to 6500 fpm 4 to 78 000 ipm 0.1 to 2000 mpm	.03%	Electromatic CDT2000
Acceleration/Vibration – Measure (at 1 g)	5 to 50 Hz 100 Hz to 2 kHz 2.5 kHz to 10 kHz 10 Hz to 50 Hz (50 to 100) Hz 100 Hz to 10 kHz	2% 1% 2% .04% + .015% .025% + .015% .02% + .01%	Dytran 3120AK Keithley 2002

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<i>Mechanical(cont)</i>			
Scales and Balances	1 to 100 g 10g to 10 kg	See Note	Class 5 weights Class 1 weights
	5 oz to 100 lb 50 to 400 lb	See Note	Class F weights
Pressure – Generate and Measure	0 to 10 inH ₂ O 0 to 12 inH ₂ O -12 to 100 psi 0 to 30 psia -12 to 300 psi 0 to 500 psi 0 to 1000 psi	0.03 inH ₂ O 0.0025 inH ₂ O 0.05 psi 0.021 psi 0.15 psi 0.25 psi 0.5 psi	Fluke 700P01 w/718 Dwyer 1425-12 Fluke 718-100G Fluke 700PA5 w/718 Fluke 718-300G Fluke 700P07 w/718 Fluke 700P08

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<i>Mechanical (cont)</i>			
Pressure – Generate and Measure	0 to 3000 psi	1.5 psi	Druck DPI104 3k
	0 to 5000 psi	2.5 psi	Druck DPI104 5k
	0 to 7000 psi	4 psi	Ashcroft 7000
Force – Measure	0 to 10000 psi	8 psi	Fluke 700P31
	0 to 10 000 psi (oil)	0.1%	Ashcroft 1305D
	0 to 300 psi	0.15 psi	Fluke 700P27 with 718
	0 to 10000 lbf	0.1% fs + 0.03% rdg	Interface 1211NE w/Newport Infinity C
	0 to 50000 lbf	100 lbf	Transcell TI-500E w/VMC VLC-120
	50000 to 100000 lbf	200 lbf	Transcell TI-500E w/VMC VLC-120
	0 to 300000 lbf	0.5% rdg + 0.05% rdg	Omega PX105 w/Analogic AN2559

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<i>Mechanical (cont)</i>			
Vacuum – Generate and Measure	-30 to 203.6 inHg	0.1 inHg	Fluke 718
	-12 to 0 psi	0.05 psi	Fluke 718 w/hand pump
<i>Chemical/Gas</i>			
pH Generate	(4, 7) units 10 units	0.002 units 0.005 units	Solutions

¹ "Calibration Measurement Capability" 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 of nearly ideal measuring instruments. Calibration Measurement Capabilities are expressed as uncertainties at approximately the 95% level of confidence, usually using a coverage factor of $k=2$. The measurement uncertainty of a specific calibration performed by the laboratory may be greater than the least uncertainty due to the behavior of the customer's device, to the environment (if the calibration is performed in the field), and to influences from the circumstances of the specific calibration.

NOTE: Calibration parameters are performed primarily on-site at customer locations. The uncertainty of scale/balance calibration is highly dependent on local conditions, such as scale resolution and sensitivity, scale cleanliness, local gravity, temperature and humidity, dust, vibration, etc.; therefore, any statement of uncertainty is misleading. The class of the best weights used by the laboratory is shown in the Technique column. Use of weights in combination, whether in the same class or different classes, will increase measurement uncertainty resulting from the additive effect of weight tolerances, as defined in ASTM E 617.

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