National Voluntary Laboratory Accreditation Program

CALIBRATION LABORATORIES

NVLAP LAB CODE 200762-0
Scope Revised: 2012-01-06

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

Boeing Test & Evaluation, Metrology Lab Operations	**Parameter(s) of Accreditation**
MC 2R – 40, PO Box 3707 Seattle, WA 98124-2207 Mr. Derek Porter Phone: 206-544-4885 Fax: 206-544-4923 E-mail: derek.j.porter@boeing.com URL: http://www.boeing.com/commercial/techsvcs/boeingtech	Dimensional Electromagnetics – DC/Low Frequency Time and Frequency Mechanical Electromagnetics – RF/Microwave Thermodynamics

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (k=2) [Note 3]	Remarks
DIMENSIONAL			
NVLAP Code: 20/D01 **Angular**	>20 s to 1000 s 0 s to 20 s 0 ° to 360 ° 0 minutes -10 Minutes 0 minutes -10 Minutes	0.25 Arc Seconds 0.20 Arc Seconds 0.4 Arc Second 0.5 Arc Second or 2 % (whichever is greater) 0.2% + 0.5 Arc Second Per Meter of Separation	Autocollimator Autocollimator Moore Indexing Table Small Angle Generator Laser Angular Optics
NVLAP Code: **20/D11** **Plain Ring Gages**	0.04 to 13.0 in	(7.0 + 0.4*L*) µin (where L is in inches)	Plain Ring Gages
NVLAP Code: **20/D03** **Gage Blocks**	< 0.05 in 0.050 in to 4.0 in 5 in to 20 in	2.5µin (2.2 + 0.3*L*) µin (where L is in inches) (4.3 + 0.35*L*) µin (where L is in inches)	Laser / Mechanical comparison to NIST calibrated masters Mechanical comparison to NIST calibrated masters
NVLAP Code: **20/D05** **Length & Diameter,** **Step Gages**	>0 feet to 25 Feet >0 inch to 5 inches	1.4 µinch / inch +/-0.0001"	Laser Interferometric Bench Coordinate measuring machine

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3]	Remarks
***NVLAP Code:* 20/D09 Roundness**	0.05 in to 3 in >3.0 in to 8.5 in >8.5 in to 11.8 in	3.0 µin 4.0 µin 6.0 µin	Uncertainties increase as height increase above turntable.
***NVLAP Code:* 20/D16 Laser Trackers**	40 meter radius	(0.001" + 10 µinch/inch) (Line of Site)	Scale Bar

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3]									
ELECTROMAGNETICS – DC/LOW FREQUENCY											
		(in µA/A for indicated frequencies)									
	Current Level	***10 Hz***	***20 Hz***	***100 Hz***	***400 Hz***	***1 kHz***	***5 kHz***	***10 kHz***	***20 kHz***	***50 kHz***	***100 kHz***
NVLAP Code: 20/E01 VOLTAGE/ CURRENT CONVERTERS (to 1 MHz)	10 mA	160	55	55	55	55	55	55	55	77	110
	20 mA	160	55	55	55	55	55	55	55	77	110
	30 mA	160	55	55	55	55	55	55	55	77	110
	50 mA	160	55	55	55	55	55	55	55	77	110
	100 mA	160	55	55	55	55	55	55	55	77	110
	200 mA	160	55	55	55	55	55	55	55	77	110
	300 mA	160	55	55	55	55	55	55	55	88	110
AC/DC Difference for Low Frequency Detectors and Shunts	500 mA	160	55	55	55	55	55	55	55	110	220
	1 A	160	55	55	55	55	55	55	59	130	250
	2 A	160	66	55	55	55	55	55	59	130	250
	3 A	160	77	99	66	66	140	140	160	300	550
	5 A	160	88	99	88	88	88	140	190	610	1000
	10 A	160	110	120	110	110	110	88	110	160	
	20 A	180	150	140	110	110	110	110	130	253	

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NVLAP Code: 20/E05 **DC RESISTANCE and CURRENT**	1 μΩ to 1 mΩ	25 μΩ/Ω	Using MI 6010 Bridge w/ 6011, 6012 Extenders
	>1 mΩ to 10 mΩ	0.60 μΩ/Ω	Using MI 6010 Bridge
	>10 mΩ to 100 mΩ	0.44 μΩ/Ω	w/ 6011 extender
	>0.1 Ω to <1 Ω	0.36 μΩ/Ω	Using MI 6010B Bridge
	1 Ω	0.30 μΩ/Ω	
	>1 Ω to 10 Ω	0.32 μΩ/Ω	
	>10 Ω to 100 Ω	0.33 μΩ/Ω	
	>100 Ω to 1 kΩ	0.35 μΩ/Ω	
	1 kΩ to 10 kΩ	0.37 μΩ/Ω	
	10 kΩ to 100 kΩ	1.1 μΩ/Ω	Using MI 6001A Bridge
	100 kΩ to 1 MΩ	1.5 μΩ/Ω	
	1 MΩ to 10 MΩ	1.8 μΩ/Ω	
	10 MΩ to 100 MΩ	2.1 μΩ/Ω	
	100 MΩ to 1 GΩ	75 μΩ/Ω	Using Guildline 6520 Teraohmmeter
	1 GΩ to 10 GΩ	0.013 %	
	10 GΩ to 100 GΩ	0.015 %	
	100 GΩ to 1 TΩ	0.030 %	
	10 TΩ to 10 TΩ	0.035 %	
NVLAP Code: 20/E06 **DC VOLTAGE**			
Voltage	1.0 V to 1.018 V	0.4 μV/V	Using 3 Zener Intercomparison
	10 V	0.19 μV/V	
	1.0 V to 1.018 V	0.02 μV/V	Using Josephson Junction
	10 V	0.02 μV/V	
High Voltage – Dividers, Meters, & Indicators	100 V to 100 kV	0.013 %	DC Mode

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated		Remark												
NVLAP Code: 20/E09		Direct Comparison Method: AC Source is supplied to both customer unit under test and Fluke 792A Thermal Transfer Standard in parallel.												
LF AC VOLTAGE		**Uncertainty (k=2)** [Note 3] (at indicated frequency, uncertainty values expressed in μV/V)												
Range	***Input***	***10 Hz***	***20 Hz***	***40 Hz***	***100 Hz***	***1 kHz***	***10 kHz***	***20 kHz***	***50 kHz***	***100 kHz***	***300 kHz***	***500 kHz***	***800 kHz***	***1 MHz***
22 mV	2 mV	420	420	420	410	410	410	410	440	540	630	750	880	880
22 mV	6 mV	330	330	290	270	270	270	270	360	420	520	590	730	770
22 mV	10 mV	96	80	80	80	80	80	80	140	200	250	330	423	467
22 mV	20 mV	96	80	80	80	80	80	80	140	200	250	330	423	467
220 mV	20 mV	94	77	77	75	75	75	75	100	170	250	340	424	468
220 mV	60 mV	56	51	45	41	41	35	35	53	95	170	250	381	381
220 mV	100 mV	51	45	39	33	21	21	27	27	50	94	130	291	291
220 mV	200 mV	33	28	17	16	16	16	17	26	44	94	130	274	287
700 mV	200 mV	34	28	18	16	16	16	17	26	44	94	130	273	286
700 mV	600 mV	32	24	23	10	9	9	10	10	14	32	38	62	74
2.2 V	600 mV	32	26	22	10	8	8	9	11	12	28	32	44	54
2.2 V	1.0 V	32	26	22	10	8	8	8	10	11	27	33	45	54
2.2 V	2.0 V	32	26	22	10	8	8	8	8	10	27	33	45	54
7 V	2.0 V	32	26	22	10	8	8	8	9	10	26	32	38	50
7 V	6.0 V	32	26	22	10	8	8	8	9	10	26	32	38	50
22 V	6.0 V	32	27	23	10	8	8	8	10	10	27	33	50	59
22 V	10 V	32	26	22	10	8	8	8	9	11	26	32	50	59
22 V	20 V	32	26	22	10	9	9	9	10	12	26	32	50	59
70 V	20 V	32	26	22	10	9	9	9	10	14	65	69		
70 V	60 V	33	27	26	10	9	9	9	11	14	32	36		
220 V	60 V	32	26	23	10	9	9	9	17	20	34			
220 V	100 V	32	26	23	10	9	9	10	15	17				
220 V	200 V	45	27	24	12	11	11	11	17	22				
1000 V	200 V	50	27	24	15	14	14	14	21	40				
1000 V	600 V	62	27	27	21	15	15	15	21	44				
1000 V	1000 V	62	27	27	24	22	22	23	32	56				

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (k=2) [Note 3]	Remarks
High Voltage – Dividers, Meters, & Indicators	100 V to 69 kV	0.02 %	AC Mode (60 Hz)

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Measured Parameter or Device Calibrated	**Uncertainty (*k*=2)** [Note 3]					
	(at indicated frequency, uncertainty values expressed in µF/F)					
***NVLAP Code:* 20/E10**	***Range***	***50 Hz***	***100 Hz***	***1 kHz***	***10 kHz***	***20 kHz***
LF Capacitance	1 pF	45	15	6	22	75
	10 pF	12	6	2	5	15
Direct Comparison with	100 pF	12	6	2	5	10
Fused Silica Standards	200 pF	12	6	2	5	10

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	**Range**	**Uncertainty (*k*=2)** [Note 3] **(in µF/F at selected frequencies) ***			
Direct Measurement Using		***50 Hz***	***1 kHz***	***10 kHz***	***20 kHz***
Capacitance Bridge	>0 pF to 1.65 µF	16	6	13	16
		* These are best case and vary depending on test voltage, dissipation, and capacitance being measured. Floor value varies from (5 to 30) aF and will significantly increase stated values as measurement approaches low end of range			
Using AH 2700 Bridge	(50 Hz to 20 kHz)				
		Uncertainty (*k*=2) [Note 3] **(in % at indicated frequency)**			
		100 Hz	***1 kHz***	***10 kHz***	***20 kHz***
NVLAP Code: 20/E11	100 µH	0.15	0.15	0.15	0.15
LF INDUCTANCE	1 mH	0.050	0.050	0.050	0.050
Inductance	10 mH	0.050	0.050	0.050	0.25
	100 mH	0.050	0.050	0.050	
	200 mH	0.050	0.050	0.050	
	1 H	0.050	0.080	0.16	
	2 H	0.050	0.080		
	5 H	0.050	0.050		
	10 H	0.050	0.050		

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Measured Parameter or Device Calibrated	Range	Uncertainty (k=2) [Note 3]	Remarks
TIME and FREQUENCY			
NVLAP Code: 20/F01 **FREQUENCY DISSEMINATION** Frequency Stability	10 MHz	1 part in 10^{11} 1 part in 10^{11} 4 parts in 10^{12} 1 part in 10^{12}	Long Term (per month) Allan Deviation (1 s) Allan Deviation (10 s) Allan Deviation (100 s)
Frequency Measure	1 Hz to 50 GHz	5 parts in 10^{10}	
NVLAP Code: 20/F03 **Oscillator Characterization**	(Rate/Depth)		
AM Measure (carrier F)			
100 kHz to 10 MHz	50 Hz to 10 kHz/ 5% to 99%	0.75 %	
10 MHz to 3000 MHz	50 Hz to 100 kHz/ 20% to 99%	0.5 %	
10 MHz to 3000 MHz	50 Hz to 100 kHz/ 5% to 20%	2.5 %	
3 GHz to 26.5 GHz	50 Hz to 100 kHz/ 20% to 99%	1.5 %	
3 GHz to 26.5 GHz	50 Hz to 100 kHz/ 5% to 20%	4.5 %	
26.5 GHz to 31.15 GHz	50 Hz to 100 kHz/ 20% to 99%	1.9 %	
26.5 GHz to 31.15 GHz	50 Hz to 100 kHz/ 5% to 20%	6.8 %	
31.15 GHz to 50 GHz	50 Hz to 100 kHz/ 20% to 99%	6 %	
31.15 GHz to 50 GHz	50 Hz to 100 kHz/ 5% to 20%	26 %	
FM Measure (Carrier F)	(Rate/Peak Deviation)		
250 kHz to 10 MHz	20 Hz to 10 kHz/ 20 Hz to 10kHz	β >0.2, 1.5 % β >1.2, 1.0 %	β is the ratio of the frequency deviation to modulation rate (deviation/rate)
10 MHz to 6.6 GHz	50 Hz to 200kHz / 250 Hz to 400 kHz	β >0.2, 1.5 % β >0.45, 1.0 %	

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6.6 GHz to 13.2 GHz	50 Hz to 200kHz/	β >0.2, 2.5 %	
	250 Hz to 400 kHz	β >8, 1.0 %	
13.2 GHz to 31.15 GHz	50 Hz to 200kHz/	β >0.2, 3.8 %	
	250 Hz to 400 kHz	β >16, 1.0 %	
31.15 GHz to 50 GHz	50 Hz to 200kHz/	β >0.2, 8.5 %	
	250 Hz to 400 kHz	β >32, 1.0 %	
PM Measure (Carrier F)	(Deviation in Radians)		
10 MHz to 6.6 GHz	>0.7	1.0 %	The upper limit of the deviation range is determined by a combination of carrier frequency and bandwidth settings. The maximum measured value is 24,999 radians.
	>0.3	3.0 %	
6.6 GHz to 13.2 GHz	>2.0	1.0 %	
	>0.6	3.0 %	
13.2 GHz to 26.5 GHz	>4.0	1.0 %	
	>1.2	3.0 %	
26.5 GHz to 31.5 GHz	>4.0	1.0 %	
	>1.3	3.0 %	
31.5 GHz to 50 GHz	>8.0	1.0 %	
	>2.4	3.0 %	
Total Harmonic Distortion 20 Hz to 250 kHz	-80 dB to 0 dB (0.01 % to 100 %)	1 dB	
Spectral Purity 10 MHz to 18 GHz	0 dBc to 138 dBc	1.5 dBc	
MECHANICAL			
NVLAP Code: 20/M06			
FORCE	0.2 lbf to 100 lbf	0.05 %	Deadweight
Force	2 lbf to 1000 lbf	0.05 %	
	1000 lbf to 50 000 lbf	0.05 %	ASTM-E74
	100 000 lbf to 1 000 000 lbf	0.05 %	
NVLAP Code: 20/M08	454 kg	0.71 g	Frazier RU100
MASS	60 kg	59 mg	Mettler-Toledo XP643L
Metric	50 kg	49 mg	
	25 kg	30 mg	
	20 kg	19 mg	

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	10 kg	4 mg	Sartorius CC10000S
	5 kg	1.9 mg	
	3 kg	1.2 mg	
	2 kg	1 mg	
	1 kg	0.082 mg	Mettler Toledo AT1005
	500 g	0.073 mg	
	300 g	0.077 mg	
	200 g	0.065 mg	
	100 g	0.057 mg	Mettler Toledo AX106
	50 g	0.067 mg	
	30 g	0.075 mg	
	20 g	0.0088 mg	
	10 g	0.0088 mg	
	5 g	0.0088 mg	Mettler Toledo XP6U
	3 g	0.0088 mg	
	2 g	0.0011 mg	
	1 g	0.0012 mg	
	500 mg	0.0012 mg	
	300 mg	0.00065 mg	
	200 mg	0.00065 mg	
	100 mg	0.00065 mg	
	50 mg	0.00063 mg	
	30 mg	0.00063 mg	
	20 mg	0.00063 mg	
	10 mg	0.00063 mg	
	5 mg	0.00063 mg	
	3 mg	0.00063 mg	
	2 mg	0.00063 mg	
	1 mg	0.00063 mg	
ELECTROMAGNETICS – RF/MICROWAVE			
NVLAP Code: 20/R04 **ELECTROMAGNETIC FIELD STRENGTH** Field Strength Probe Calibration	10 kHz to 40 GHz	5 %	Uncertainty may increase to 40 % depending on frequency, device under test (DUT), and measurement conditions

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Measured Parameter or Device Calibrated	Range	Uncertainty (k=2) [Note 3]	Remarks
NVLAP Code: 20/R08 **MICROWAVE ANTENNA PARAMETERS**			
Antenna Gain Calibrations		Lowest value in range. Actual value dependent on frequency and DUT	Linear/Circular Polarization Ratios, Axial Ratio, Tilt Angle
Log Spiral, Biconic 1 m, 3 m	20 MHz to 200 MHz 200 MHz to 1 GHz 1 GHz to 10 GHz	1.0 dB 0.5 dB 0.5 db	
Log Periodic Antennas 1 m, 3 m, 10 m, Far Field	20 MHz to 6 GHz	0.5 dB	Extrapolation Method
Horn Antennas 1 m, 3 m, 10 m, Far Field	500 MHz to 18 GHz 18 GHz to 26.5 GHz 26.5 GHz to 40 GHz	0.5 dB 0.8 dB 1.0 dB	Gain Extrapolation Method
NVLAP Code: **20/R09** **Noise Temperature**			
Noise Measure (Carrier F) 10 MHz to 18 GHz 18 to 26.5 GHz	(ENR) 4 dB to 30 dB	 0.24 dB 0.26 dB	
Noise Figure Measure 10 MHz to 26.5 GHz	0 dB to 30 dB	0.50 dB	
NVLAP Code: **20/R13** **RF/Microwave Attenuators**	(Lin Mag/Phase)	(Lin Mag/Phase)	
Reflection S_{11}/S_{22} 300 kHz to 1.3 GHz 1.3 GHz to 3 GHz 3GHz to 6 GHz	0 to 1 / -180° to 180°	 0.002 / 0.6° 0.003 / 1.4° 0.005 / 2.3°	VNA & 7 mm Cal Kit

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Measured Parameter or Device Calibrated	Range	Uncertainty (k=2) [Note 3]	Remarks
0.045 GHz to 2 GHz		0.002 / 0.4°	VNA & 7 mm TRL Cal Kit
2 GHz to 8 GHz		0.0015 / 1.1°	
8 GHz to 18 GHz		0.0015 / 4.0°	
0.045 GHz to 2 GHz		0.004 / 0.63°	VNA & 3.5 mm Cal Kit
2 GHz to 8 GHz		0.005 / 2.2°	
8 GHz to 26.5 Hz		0.006 / 3.0°	
0.045 GHz to 2 GHz		0.008 / 0.7°	VNA & 2.4 mm Cal Kit
2 GHz to 20 GHz		0.008 / 4°	
20 GHz to 40 GHz		0.012 / 5.8°	
40 GHz to 50 GHz		0.015 / 11°	
Transmission S_{12}/S_{21}			
300 kHz to 1.3 GHz	0 dB to 20 dB	0.081 dB	VNA & 7 mm Cal Kit
1.3 GHz to 3 GHz		0.089 dB	
3 GHz to 6 GHz		0.12 dB	
300 kHz to 1.3 GHz	20 dB to 50 dB	0.097 dB	
1.3 GHz to 3 GHz		0.097 dB	
3 GHz to 6 GHz		0.13 dB	
300 kHz to 1.3 GHz	50 dB to 60 dB	0.13 dB	
1.3 GHz to 3 GHz		0.15 dB	
3 GHz to 6 GHz		0.23 dB	
45 MHz to 2 GHz	0 dB to 20 dB	0.027 dB	VNA & 7 mm TRL Cal Kit
2 GHz to 8 GHz		0.023 dB	
8 GHz to 18 GHz		0.023 dB	
45 MHz to 2 GHz	20 dB to 40 dB	0.037 dB	
2 GHz to 8 GHz		0.040 dB	
8 GHz to 18 GHz		0.054 dB	
45 MHz to 2 GHz	40 dB to 50 dB	0.075 dB	
2 GHz to 8 GHz		0.10 dB	
8 GHz to 18 GHz		0.14 dB	

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45 MHz to 2 GHz	50 dB to 60 dB	0.21 dB	
2 GHz to 8 GHz		0.30 dB	
8 GHz to 18 GHz		0.44 dB	
45 MHz to 2 GHz	0 dB to 20 dB	0.044 dB	VNA & 3.5 mm Cal Kit
2 GHz to 8 GHz		0.052 dB	
8 GHz to 20 GHz		0.046 dB	
20 GHz to 26.5 GHz		0.054 dB	
45 MHz to 2 GHz	20 dB to 40 dB	0.142 dB	
2 GHz to 8 GHz		0.058 dB	
8 GHz to 20 GHz		0.057 dB	
20 GHz to 26.5 GHz		0.094 dB	
45 MHz to 2 GHz	40 dB to 50 dB	0.416 dB	
2 GHz to 8 GHz		0.079 dB	
8 GHz to 20 GHz		0.105 dB	
20 GHz to 26.5 GHz		0.22 dB	
45 MHz to 2 GHz	50 dB to 60 dB	1.35 dB	
2 GHz to 8 GHz		0.157 dB	
8 GHz to 20 GHz		0.273 dB	
20 GHz to 26.5 GHz		0.651 dB	
45 MHz to 2 GHz	0 dB to 20 dB	0.038 dB	VNA & 2.4 mm Cal Kit
2 GHz to 8 GHz		0.072 dB	
8 GHz to 20 GHz		0.15 dB	
20 GHz to 26.5 GHz		0.24 dB	
45 MHz to 2 GHz	20 dB to 40 dB	0.14 dB	
2 GHz to 8 GHz		0.086 dB	
8 GHz to 20 GHz		0.31 dB	
20 GHz to 26.5 GHz		1.0 dB	
45 MHz to 2 GHz	40 dB to 50 dB	0.42 dB	
2 GHz to 8 GHz		0.14 dB	

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8 GHz to 20 GHz		0.76 dB	
20 GHz to 26.5 GHz		3.2 dB	
45 MHz to 2 GHz	50 dB to 60 dB	1.3 dB	
2 GHz to 8 GHz		0.33 dB	
8 GHz to 20 GHz		2.3 dB	
Attenuation Measure			
1 kHz	0 dB to 60 dB	0.02 dB	
	60 dB to 110 dB	0.02 dB + 0.02 dB/10 dB step	
1 KHz to 50 GHz	0 dB to 10 dB	0.02 dB	
	10 dB to 30 dB	0.03 dB	
	30 dB to 50 dB	0.04 dB	
	50 dB to 70 dB	0.05 dB	
	70 dB to 90 dB	0.06 dB	
	90 dB to 110 dB	0.07 dB	
	110 dB to 120 dB	0.08 dB	
Relative Tuned Power	10 dB to 0 dB	0.03 dB	
2.5 MHz to 50 GHz	0 dB to -10 dB	0.02 dB	
	-10 dB to -30 dB	0.03 dB	
	-30 dB to -50 dB	0.04 dB	
	-50 dB to -70 dB	0.05 dB	
	-70 dB to -90 dB	0.06 dB	
	-90 dB to -110 dB	0.07 dB	
	-110 dB to -120 dB	0.08 dB	
NVLAP Code: **20/R17 RF/ Microwave Power Meters**			
Absolute Tuned Power	10 dBm to 0 dBm	0.17 dB	
2.5 MHz to 50 GHz	0 dBm to -40 dBm	0.18 dB	
	-40 dBm to -70 dBm	0.22 dB	
	-70 dBm to -90 dBm	0.24 dB	
	-90 dBm to -110 dBm	0.28 dB	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (k=2) [Note 3]	Remarks
	-110 dBm to -120 dBm	0.31 dB	
Power Sensor Cal Factor			
100 kHz to 10 GHz	10 µW to 100 mW	1.6 %	
10 GHz to 18 GHz	10 µW to 100 mW	1.8 %	
18 GHz to 26.5 GHz	10 µW to 100 mW	2.5 %	
26.5 GHz to 40 GHz	10 µW to 100 mW	3.2 %	
40 GHz to 50 GHz	10 µW to 100 mW	3.8 %	
1 GHz to 18 GHz	100 pW to 10 µW	2.2 %	
18 GHz to 26.5 GHz	100 pW to 10 µW	3.7 %	
THERMODYNAMICS			
NVLAP Code: **20/T02** **Humidity**			
Relative Humidity (RH)	8 % RH to 95 % RH	1.0 % RH	-20° C to 60° C
Dew Point	-70° C to -35° C	0.30° C	Sensor at 17 °C to 23 °C
	-35° C to 20° C	0.25° C	
NVLAP Code: **20/T03** **Laboratory Thermometers**	-100° C to 0° C	0.040° C	SPRT using Liquid Bath
	0° C to 30° C	0.02° C	
	30° C to 300° C	0.03° C	
	300° C to 1000° C	1.0° C	Dry Well Furnace with S Type TC
NVLAP Code: **20/T05** **Pressure**	1 psi to 25 psi	0.0035 %	Ruska 2465 Piston Gage
Pneumatic Generate	5 psi to 114 psi	0.0035 %	with Dead Weights
	10 psi to 1000 psi	0.0040 %	
Hydraulic Generate	100 psi to 20 000 psi	0.0060 %	Ruska 2485 & DH Piston
	1 500 to 72 500 psi	0.012 %	Gage with Dead Weights

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CALIBRATION LABORATORIES

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (k=2) [Note 3]	Remarks
NVLAP Code: **20/T09**	(in inches of Hg)	Absolute/Differential (in inches of Hg)	
Vacuum & Low Pressure Gages	0	NA / 0.00009	Schwien 110 inch Mercury Manometer
	0.1	0.000171 / 0.000091	
	0.5	0.000174 / 0.000091	
	1	0.000178 / 0.000091	
	2	0.000185 / 0.000092	
	5	0.000207 / 0.000095	
	10	0.000245 / 0.0001	
	20	0.00032 / 0.000109	
	30	0.000394 / 0.000118	
	40	0.000469 / 0.000127	
	60	0.000619 / 0.000145	
	90	0.000843 / 0.000172	
	110	0.000993 / 0.00019	
END			

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CALIBRATION LABORATORIES

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Notes

Note 1: A Calibration and Measurement Capability (CMC) is a description of the best result of a calibration or measurement (result with the smallest uncertainty of measurement) that is available to the laboratory's customers under normal conditions, when performing more or less routine calibrations of nearly ideal measurement standards or instruments. The CMC is described in the laboratory's scope of accreditation by: the measurement parameter/device being calibrated, the measurement range, the uncertainty associated with that range (see note 3), and remarks on additional parameters, if applicable.

Note 2: Calibration and Measurement Capabilities are traceable to the national measurement standards of the U.S. or to the national measurement standards of other countries and are thus traceable to the internationally accepted representation of the appropriate SI (Système International) unit.

Note 3: The uncertainty associated with a measurement in a CMC is an expanded uncertainty using a coverage factor, $k = 2$, with a level of confidence of approximately 95 %. Units for the measurand and its uncertainty are to match. Exceptions to this occur when marketplace practice employs mixed units, such as when the artifact to be measured is labeled in non-SI units and the uncertainty is given in SI units (Example: 5 lb weight with uncertainty given in mg).

Note 3a: The uncertainty of a specific calibration by the laboratory may be greater than the uncertainty in the CMC due to the condition and behavior of the customer's device and specific circumstances of the calibration. The uncertainties quoted do not include possible effects on the calibrated device of transportation, long term stability, or intended use.

Note 3b: As the CMC represents the best measurement results achievable under normal conditions, the accredited calibration laboratory shall not report smaller uncertainty of measurement than that given in a CMC for calibrations or measurements covered by that CMC.

Note 3c: As described in Note 1, CMCs cover calibrations and measurements that are available to the laboratory's customers under *normal conditions.* However, the laboratory may have the capability to offer special tests, employing special conditions, which yield calibration or measurement results with lower uncertainties. Such special tests are not covered by the CMCs and are outside the laboratory's scope of accreditation. In this case, NVLAP requirements for the labeling, on calibration reports, of results outside the laboratory's scope of accreditation apply. These requirements are set out in Annex A.1.h. of NIST Handbook 150, Procedures and General Requirements.

Note 4: Uncertainties associated with field service calibration may be greater as they incorporate on-site environmental contributions, transportation effects, or other factors that affect the measurements. (This note applies only if marked in the body of the scope.)

Note 5: Values listed with percent (%) are percent of reading or generated value unless otherwise noted.

Note 6: NVLAP accreditation is the formal recognition of specific calibration capabilities. Neither NVLAP nor NIST guarantee the accuracy of individual calibrations made by accredited laboratories.

Note 7: See NIST Handbook 150 for further explanation of these notes.

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