



**SCOPE OF CALIBRATION TO ISO/IEC 17025:2017 AND  
ANSI/NCSL Z540-3-2006**

**Testmetric**

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Canada

## SCOPE OF CALIBRATION

### I. Dimensional

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
Calipers and Micrometers –	Up to 6 in (6 to 12) in (12 to 24) in (24 to 60) in	(16 + 22L) μin (3 + 14L) μin (20L) μin (110 + 13L) μin	Gage blocks
Universal Measuring Machines	Up to 6 in (6 to 10) in	(4.4 + 13L) μin 14L μin	Gage blocks
Protractors/Angle Meters/Levels	(0 to 360)°	0.0079°	Sine plate, gage blocks
Length Measurements – 1D	Up to 0.1 in (0.1 to 1) in (1 to 4) in (4 to 6) in (6 to 10) in  (10 to 12) in (12 to 24) in	4.9 μin (3.9 + 0.28L) μin (2.8 + 1.5L) μin (5.1 + 0.9L) μin (6 + 0.71L) μin  (8.5 + 1.3L) μin (7.8L) μin	Gage blocks and Supermic      Gage blocks
Rulers/Tape Measures	Up to 6 in (6 to 12) in (12 to 24) in (2 to 100) ft	(180 + 2.9L) μin (160 + 7.4L) μin (61 + 16L) μin 450 μin every 2 ft	Gage blocks

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
Pin/Plug/Thread Wire Gages	Up to 0.1 in (0.1 to 1) in (1 to 3) in (3 to 4) in (4 to 6) in (6 to 10) in	5.1 μin (4 + 0.28L) μin (2.9 + 1.4L) μin (2.7 + 1.5L) μin (5.2 + 0.9L) μin (6 + 0.7L) μin	Gage blocks Gage blocks and Supermic™ (H28 handbook)
Radius Gages	Up to 12 in	0.001 in	Optical comparator
Thread Gages	Up to 0.1 in (0.1 to 1) in (1 to 2) in (2 to 10) in	24 μin (24 + 0.05L) μin (24 + 0.3L) μin (24 + 0.4L) μin	Supermic™, gage blocks, and thread wires
Height/Depth Gages	Up to 12 in (12 to 60) in	(170 + 0.18L) μin (110 + 5.4L) μin	Gage blocks and surface plate
Thickness Gages	Up to 1 in	(0.0021 + 0.03L) in	Step blocks
Squareness	Up to 4 in (4 to 17) in	79 μin 120 μin	Granite angle block, surface plate, gage amplifier and master square
Surface Flatness – Optical Flat	Up to 4 in	3.7 μin	Optical flats and Van Keuren monochromatic light
Surface	Up to 24 in	93 μin	Surface plate with reference standard
Parallelism	Up to 24 in	46 μin	Surface plate with reference standard

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
Gage Blocks	Up to 0.1 in (0.1 to 1) in (1 to 3) in (3 to 4) in (4 to 6) in	4.9 μin (3.8 + 0.35L) μin (2.7 + 1.5L) μin (2.9 + 1.4L) μin (3.3 + 1.3L) μin	Gage blocks CROBLOX/Grade 00 and lab master
Sieves –  Opening Size (X/Y) and Wire Diameter (X/Y)	Up to 5 in	(88 + 15L) μin	ASTM E11  Optical comparator with gage blocks
Durometers –  Types A, B, C, D, O, DO and OO  Indenter Extension and Shape –  Diameter  Radius  Angle  Extension  Indenter Display  Spring Calibration – Force	Up to 0.25 in  Up to 0.5 in  Up to 90°  Up to 0.5 in  Up to 0.1 in  Up to 5 kg	0.001 in  0.001 in  0.097°  830 μin  330 μin  0.26 g	ASTM D2240    Optical comparator    Gage blocks  Mass and balance
Angle Blocks	Up to 180°	0.097°	Optical comparator
V-block –  Parallelism  Squareness  Flatness	Up to 24 in  Up to 4 in (4 to 17) in  Up to 24 in	46 μin  79 μin 120 μin  93 μin	Surface plate, reference standard, and master square

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
Angle Irons – Parallelism Squareness Flatness	Up to 24 in Up to 4 in (4 to 17) in Up to 24 in	46 μin 79 μin 120 μin 93 μin	Surface plate, reference standard, and master square
Ring Gages	Up to 0.1 in (0.1 to 1) in (1 to 3) in (3 to 4) in (4 to 6) in (6 to 10) in	5.6 μin (4.7 + 0.24L) μin (3.6 + 1.3L) μin (3.2 + 1.5L) μin (5.6 + 0.9L) μin (6.4 + 0.7L) μin	Gage blocks and <i>Supermic</i>

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC <sup>2,5,6</sup> ( $\pm$ )	Comments
DC Voltage <sup>3</sup> – Generate	(0 to 329.9999) mV (0.33 to 3.299999) V (3.3 to 32.9999) V (33 to 329.9999) V (100 to 1000) V	0.0012 % + 2.2 $\mu$ V 0.00030 % + 20 $\mu$ V 0.00080 % + 0.060 mV 0.0011 % + 1.5 mV 0.0012 % + 5.2 mV	Fluke 5520A/SC1100
DC Voltage – Measure	(0 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V (100 to 1000) V	5.6 $\mu$ V/V + 1.1 $\mu$ V 7.0 $\mu$ V/V + 1.7 $\mu$ V 6.9 $\mu$ V/V + 16 $\mu$ V 0.0010 % + 0.18 mV 0.0010 % + 2.3 mV	Fluke 8846A
DC High Voltage <sup>3</sup> – Measure	(1 to 20) kV (20 kV range)  20 kV to 70 kV (70 kV range)	(2.9 + 0.34E) V  (0.30 + 0.48E) V	Precision high voltage meter and probe  <i>E</i> is voltage in kV
DC Current <sup>3</sup> – Generate	(0 to 329.999) $\mu$ A (0.33 to 3.29999) mA (3.3 to 32.9999) mA (33 to 329.999) mA (0 to 1.09999) A (1.1 to 2.99999) A (0 to 10.9999) A (11 to 20.5) A	2.1 $\mu$ A/A + 2.1 $\mu$ A 0.69 $\mu$ A/A + 22 $\mu$ A 0.61 $\mu$ A/A + 0.22 $\mu$ A 0.62 $\mu$ A/A + 2.2 mA 4.1 $\mu$ A/A + 5.8 mA 0.0033 % + 5.8 mA 0.0021 % + 62 mA 0.017 % + 61 mA	Fluke 5520A/SC1100
Clamp meters – Non-Toroidal	(10 to 150) A (150 A to 500) A (500 to 1025) A	1.2 % 0.90 % 0.70 %	Fluke 5520A & coil
DC Current – Measure	(0 to 100) nA 100 nA to 1 $\mu$ A (1 to 10) $\mu$ A (10 to 100) $\mu$ A 100 $\mu$ A to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 10 A  10 $\mu$ A to 200 mA	6.2 $\mu$ A/A + 0.21 nA 0.60 $\mu$ A/A + 2.1 nA 0.30 $\mu$ A/A + 21 nA 0.20 $\mu$ A/A + 0.21 $\mu$ A 0.20 $\mu$ A/A + 2.1 $\mu$ A 0.20 $\mu$ A/A + 21 $\mu$ A 0.40 $\mu$ A/A + 0.21 mA 0.20 $\mu$ A/A + 2.1 mA  0.30 %	Fluke 8846A          w/ digital meter

Parameter/Equipment	Range	CMC <sup>2,5</sup> ( $\pm$ )	Comments
Electrical Calibration of Temperature Indicators RTD simulation <sup>3</sup>	-200 °C to 660 °C	0.0065 % + 0.040 °C	Fluke 5520A/SC1100
AC Power <sup>3</sup> – (0.2 to 20.5) A (45 to 65) Hz	(0.033 to 1020) V	0.080 %	Fluke 5520A/SC1100
DC Power <sup>3</sup> – (0.2 to 20.5) A	(1 to 1020) V	0.035 %	Fluke 5520A/SC1100

Electrical Calibration of Thermocouple Indicating Devices <sup>3</sup> –	Type J	-210 °C to -100 °C	0.27 °C	Fluke 5520A/SC1100
		-100 °C to -30°C	1.16 °C	
		-30 °C to 760 °C	1.17 °C	
		760 °C to 1200 °C	0.23 °C	
	Type K	-200 °C to -100 °C	0.33 °C	
		-100 °C to -25 °C	0.18 °C	
		-25 °C to 120 °C	0.16 °C	
		120 °C to 1000 °C	0.26 °C	
		1000 °C to 1372 °C	0.40 °C	
	Type T	-250 °C to -150 °C	0.63 °C	
		-150 °C to 0 °C	0.24 °C	
		0 °C to 120 °C	0.16 °C	
		120 °C to 400 °C	0.14 °C	
	Type K	-200 to 100 °C	0.5°C	
		-100 to 1000 °C	0.4°C	
		1000 to 1370 °C	0.5°C	
	Type J	-210 to 1130 °C	0.4°C	
	Type T	-250 to -150 °C	0.7°C	
		-150 to 400 °C	0.4°C	

Parameter/Range	Frequency	CMC <sup>2,5,6</sup> ( ± )	Comments
AC Voltage – Generate			
(0.0032 to 32.99) mV	45 Hz to 1 kHz	0.012 % + 5.0 μV	Fluke 5520A/SC1100
(33 to 329.99) mV	45 Hz to 1 kHz	0.011 % + 6.5 μV	
(0.33to 3.299999) V	45 Hz to 1 kHz	0.012 % + 59 μV	
(3.3 to 32.9999) V	45 Hz to 1 kHz	0.012 % + 0.61 mV	
(33 to 329.9999) V	45 Hz to 1 kHz	0.015 % + 3.2 mV	
(100 to 1020) V	45 Hz to 1 kHz	0.022 % + 29 mV	
AC Voltage – Measure			
1 μV to 0.01 V	40 Hz to 20 kHz	0.020 % + 1.5 μV	Fluke 8846A
(0.01 to 0.1) V	40 Hz to 20 kHz	0.0070 % + 5.4 μV	
(0.1 to 1.0) V	40 Hz to 20 kHz	0.0070 % + 41 μV	
(1.0 to 10.0) V	40 Hz to 20 kHz	0.0070 % + 0.48 mV	
(10.0 to 100.0) V	40 Hz to 20 kHz	0.020 % + 4.4 mV	
(100.0 to 1000) V	40 Hz to 20 kHz	0.020 % + 39 mV	



Parameter/Range	Frequency	CMC <sup>2,5,6</sup> ( $\pm$ )	Comments
AC High Voltage – Measure <sup>3</sup>  (1 to 20) kV 20 kV range  (20 to 70) kV 70 kV range	60 Hz  60 Hz	(5.7 + 0.43E) V  (1.5 + 0.65E) V	Precision high voltage meter and probe  E is voltage in kV
AC Current <sup>3</sup> – Generate  (29 to 329.99) $\mu$ A (0.33 to 3.299) mA (3.3 to 32.99) mA (33 to 329.99) mA (0.33 to 1.09999) A (1.1 to 2.99999) A (3 to 10.9999) A (11 to 20.5) A  Clamp Meters – Toroidal  (10 to 150) A (150 to 500) A (500 to 1025) A  Clamp Meters – Non-Toroidal  (10 to 150) A (150 to 500) A (500 to 1025) A	45 Hz to 1 kHz 45 Hz to 1 kHz 45 Hz to 1 kHz 45 Hz to 1 kHz 45 Hz to 1 kHz 45 Hz to 1 kHz 45 Hz to 100 Hz 45 Hz to 100 Hz  (45 to 65) Hz (45 to 65) Hz (45 to 65) Hz  (45 to 65) Hz (45 to 65) Hz (45 to 65) Hz	0.070 % + 0.24 $\mu$ A 0.080 % + 0.68 $\mu$ A 0.030 % + 3.9 $\mu$ A 0.030 % + 33 $\mu$ A 0.040 % + 0.25 mA 0.040 % + 0.43 mA 0.010 % + 22 mA 0.060 % + 26 mA  0.60 % 0.40 % 0.30 %  1.8 % 1.3 % 0.80 %	Fluke 5520A/SC1100       Fluke 5520A & coil
AC Current <sup>3</sup> – Measure  100 pA to 100 $\mu$ A 100 $\mu$ A to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A  10 $\mu$ A to 200 mA	45 Hz to 1 kHz 45 Hz to 5 kHz 45 Hz to 5 kHz 45 Hz to 5 kHz 45 Hz to 5 kHz  60 Hz	0.057 % + 0.045 $\mu$ A 0.056 % + 0.35 $\mu$ A 0.056 % + 3.5 $\mu$ A 0.056 % + 36 $\mu$ A 0.076 % + 0.36 mA  0.36 %	Fluke 8846A     w/ digital meter

Parameter/Equipment	Range	CMC <sup>2,5,6,7</sup> (±)	Comments
Resistance <sup>3</sup> – Generate	(0 to 10.9999) Ω (11 to 32.999) Ω (33 to 109.9999) Ω (110 to 329.9999) Ω 330 Ω to 1.099999 kΩ (1.1 to 3.29999) kΩ (3.3 to 10.99999) kΩ (11 to 32.99999) kΩ (33 to 109.9999) kΩ (110 to 329.9999) kΩ 330 kΩ to 1.099999 MΩ (1.1 to 3.299999) MΩ (3.3 to 10.99999) MΩ (11 to 32.99999) MΩ (33 to 109.9999) MΩ (110 to 329.9999) MΩ (330 to 1100) MΩ	0.0015 % + 0.78 mΩ 0.0025 % + 1.2 mΩ 0.0023 % + 1.1 mΩ 0.0023 % + 1.8 mΩ 0.0088 % + 13 mΩ 0.0017 % + 74 mΩ 0.0021 % + 130 mΩ 0.0022 % + 480 mΩ 0.0022 % + 1.2 Ω 0.0026 % + 5.2 Ω 0.0026 % + 13 Ω 0.0048 % + 91 Ω 0.012 % + 390 Ω 0.020 % + 4.8 kΩ 0.033 % + 24 kΩ 0.24 % + 0.41 MΩ 2.0 % + 0.50 MΩ	Fluke 5520A/SC1100
Fixed Points	10 μΩ 100 μΩ 1 mΩ 10 mΩ 100 mΩ 1 Ω 10 Ω  10 μΩ to 100 μΩ 0.1 mΩ to 1 mΩ 1 mΩ to 10 mΩ 10 mΩ to 100 mΩ 100 mΩ to 1 Ω 1 Ω to 10 Ω	0.27 % 0.027 % 0.017 % 0.015 % 0.014 % 0.013 % 0.013 %  0.0030 % 0.015 % 0.015 % 0.0080 % 0.0090 % 0.0090 %	For the calibration of resistance measurement devices  Measure capability using standard resistors and transfer standard
Resistance <sup>3</sup> – Measure	100 μΩ to 10 Ω (10 to 100) Ω 100 Ω to 1 kΩ (1 to 10) kΩ (10 to 100) kΩ 100 kΩ to 1 MΩ (1 to 10) MΩ (10 to 100) MΩ	0.0010 % + 0.21 mΩ 0.0010 % + 0.62 mΩ 0.0010 % + 3.0 mΩ 0.0010 % + 0.030 mΩ 0.0010 % + 0.32 mΩ 0.0015 % + 5.2 Ω 0.0050 % + 230 Ω 0.050 % + 13 kΩ	Fluke 8846A

Parameter/Range	Frequency	CMC <sup>2,5</sup> (±)	Comments
Capacitance <sup>3</sup>			Fluke 5520A/SC1100
(0.19 to 0.3999) nF	10 Hz to 10 kHz	0.43 % + 0.0080 nF	
(0.4 to 1.099) nF	10 Hz to 10 kHz	0.37 % + 0.0080 nF	
(1.1 to 3.2999) nF	10 Hz to 3 kHz	0.39 % + 0.0080 nF	
(3.3 to 10.9999) nF	10 Hz to 1 kHz	0.12 % + 0.016 nF	
(11 to 32.9999) nF	10 Hz to 1 kHz	0.20 % + 0.077 nF	
(33 to 109.999) nF	10 Hz to 1 kHz	0.19 % + 0.080 nF	
(110 to 329.999) nF	10 Hz to 1 kHz	0.19 % + 0.24 nF	
(0.33 to 1.09999) µF	(10 to 600) Hz	0.19 % + 0.27 nF	
(1.1 to 3.29999) µF	(10 to 300) Hz	0.19 % + 2.4 nF	
(3.3 to 10.9999) µF	(10 to 150) Hz	0.19 % + 8.0 nF	
(11 to 32.9999) µF	(10 to 120) Hz	0.37 % + 5.2 nF	
(33 to 109.999) µF	(10 to 80) Hz	0.35 % + 79 nF	
(110 to 329.999) µF	DC to 50 Hz	0.35 % + 0.24 µF	
0.33 µF to 1.09999 mF	DC to 20 Hz	0.35 % + 0.79 µF	
(1.1 to 3.2999) mF	DC to 6 Hz	0.35 % + 2.4 µF	
(3.3 to 10.9999) mF	DC to 2 Hz	0.41 % + 1.4 µF	
(11 to 32.9999) mF	DC to 0.6 Hz	0.68 % + 11 µF	
(33 to 110) mF	DC to 0.2 Hz	0.82 % + 140 µF	

### III. Mechanical

Parameter/Equipment	Range	CMC (±)	Comments
Torque Wrenches & Screwdrivers – Clockwise	10 in·ozf to 50 in·lbf 50 in·lbf to 1000 in·lbf (50 to 600) ft·lbf	0.80 % 0.70 % 0.40 %	Electronic transducer system
Indirect Verification of Rockwell Hardness Testers <sup>3</sup>	HRBW: (40 to 45) HRBW (70 to 75) HRBW (85 to 90) HRBW  HRC: (20 to 25) HRC (40 to 45) HRC (60 to 65) HRC	1.1 HRBW 0.67 HRBW 0.49 HRBW  0.41 HRC 0.37 HRC 0.35 HRC	ASTM E18 Standardized test blocks per ASTM E18
Pressure – Indicators & Gages	(10 to 300) psi  (20 to 10 000) psi	0.020% fs  0.020% fs	Fluke 2700G

Vacuum	-60inHg	0.025% fs	DPI610
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Parameter/Equipment	Range	CMC ( $\pm$ )	Comments
Balance and Scales 1 mg to 20 kg	(1 to 50) mg 100 mg 200 mg 500 mg 1 g 2 g 5 g 10 g 20 g 50 g 100 g 200 g 500 g 1 kg 2 kg 5 kg 10 kg 20 kg	21 $\mu$ g 33 $\mu$ g 34 $\mu$ g 29 $\mu$ g 40 $\mu$ g 43 $\mu$ g 44 $\mu$ g 64 $\mu$ g 0.10 mg 0.14 mg 0.22 mg 0.43 mg 2.8 mg 11 mg 20 mg 63 mg 110 mg 190 mg	OIML Class E2 mass pieces  ASTM Class 1 mass pieces
Mass 1 mg to 20 kg	(1 to 5) mg 10 mg 20 mg 50 mg 100 mg 200 mg 500 mg 1 g 2 g 5 g 10 g 20 g 50 g 100 g 200 g 300 g 400 g 500 g 1 kg 1.5 kg 2 kg 5 kg 10 kg 20 kg	7.3 $\mu$ g 12 $\mu$ g 12 $\mu$ g 15 $\mu$ g 19 $\mu$ g 24 $\mu$ g 29 $\mu$ g 48 $\mu$ g 57 $\mu$ g 67 $\mu$ g 78 $\mu$ g 0.10 mg 0.12 mg 0.19 mg 0.36 mg 0.53 mg 0.78 mg 0.88 mg 1.8 mg 4.3 mg 4.9 mg 9.1 mg 0.029 g 0.059 g	OIML Class E2 ASTM Class 1  ASTM E617-2013

#### IV Time Frequency

Parameter/Equipment	Range	CMC <sup>2,6</sup> (±)	Comments
10 MHz Source <sup>3</sup>	(Rubidium)	10 MHz 0.03 nHz/Hz Rubidium frequency	Standard referenced to GPS
Frequency – Measuring Equipment	0.01 Hz to 2 MHz	2.5 parts in 10 <sup>6</sup> + 5.0 µHz	Fluke 5520a
	10 Hz to 500 MHz	5 parts in 10 <sup>7</sup> Hz/Hz	HP 5343A
Timers <sup>3</sup>	60 s to 1 hr	1.2 s	Reference stopwatch
Stopwatches	20 s to 24 hr	13 ms/h	NIST Publication 960-12

#### V. Acoustic

Parameter/Equipment	Range	CMC (±)	Comments
Sound Level	Up to 120 dB @ 125 Hz to	1.5 dB	Extech 407736

#### VI. Electrical – RF/Microwave

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Attenuation <sup>3</sup> –  (1 to 2) dB (3 to 4) dB (5 to 6) dB (7 to 10) dB 11 dB  (1 to 6) dB (6 to 9) dB (10 to 11) dB	DC to 12.4 GHz       (12.4 to 18) GHz	0.77 dB 0.83 dB 0.90 dB 0.98 dB 1.1 dB  1.3 dB 1.4 dB 1.5 dB	HP 8494B 1 dB step attenuator

Attenuation <sup>3</sup> – (cont)			
10 dB 20 dB 30 dB 40 dB 50 dB 60 dB 70 dB 80 dB 90 dB 100 dB 110 dB	DC to 12.4 GHz	0.91 dB 1.1 dB 1.3 dB 1.6 dB 1.9 dB 2.2 dB 2.6 dB 2.9 dB 3.2 dB 3.6 dB 3.9 dB	HP 8496B 10 dB step attenuator
10 dB 20 dB 30 dB 40 dB 50 dB 60 dB 70 dB 80 dB 90 dB 100 dB 110 dB	(12.4 to 18) GHz	1.2 dB 1.4 dB 1.7 dB 2.1 dB 2.5 dB 3.0 dB 3.4 dB 3.9 dB 4.3 dB 4.8 dB 5.2 dB	

Parameter/Equipment	Range	CMC <sup>2</sup> ( ±)	Comments
RF Power (Tuned)– Measure3			
(10 to -100) dBm (-100 to -120) dBm (-120 to -127) dBm	(0.1 to 1.3) GHz	0.18 dB 0.22 dB 0.37 dB	HP 8902A w/ opt 050 and HP 11722A power sensor
(10 to -100) dBm (-100 to -120) dBm	(1.3 to 26.5) GHz	0.29 dB 0.31dB	HP 8902A w/ 11793A down converter and HP 11792A power sensor
RF Absolute Power – Measure			
100 MHz to 26.5 GHz 100 kHz to 26.5 GHz	(-70 to -20) dB (-20 to 10) dB	0.16 dB 0.16 dB	HP E4416A w/8481A/8482A/8485A/D

RF Power – Generate <sup>3</sup>			
(+13 to -56) dBm	0.001 Hz to 10 MHz	0.24 dB	HP 3325A
(-13 to -16) dBm	10Mhz to 20 MHz	0.69 dB	
(-16 to -56) dBm		1.0 dB	
(0 to -18) dBm	200 Hz to 81 MHz	0.05 dB	
(-20 to -58) dBm	200 Hz to 81 MHz	0.11 dB	
(-60 to -98) dBm	200 Hz to 81 MHz	0.23 dB	
(+10 to -9.95) dBm	(0.05 to 2.3) GHz	1.0 dB	HP 8340B
(-10 to -19.95) dBm		1.4 dB	
(-20 to -49.95) dBm		1.7 dB	
(-50 to -79.95) dBm		2.1 dB	
(-80 to -100) dbm		2.4 dB	
(-100 to -110) dBm		3.4 dB	

Parameter/Equipment	Range	CMC <sup>2</sup> ( $\pm$ )	Comments
RF Power – Generate <sup>3</sup> (cont)			
(+18 to +10) dBm	(2.3 to 20) GHz	2.1 dB	HP 8340B
(+10 to -9.95) dBm		1.8 dB	
(-10 to -19.95) dBm		2.3 dB	
(-20 to -49.95) dBm		2.7 dB	
(-50 to -79.95) dBm		3.0 dB	
(-80 to -100) dbm		3.4 dB	
(-100 to -110) dBm		4.3 dB	
(+18 to +10) dBm	(20 to 26.5) GHz	2.7 dB	
(+10 to -9.95) dBm		2.3 dB	
(-10 to -19.95) dBm		2.9 dB	
(-20 to -49.95) dBm		3.2 dB	
(-50 to -79.95) dBm		3.6 dB	
(-80 to -100) dbm		4.0 dB	
(-100 to -110) dBm		4.3 dB	



Amplitude Modulation – Measure <sup>3</sup>			
Rate: 50 Hz to 10 kHz Depths: 5 % to 99 %	150 kHz to 10 MHz	2.8 % + 1 digit	HP 8902A w/ HP 11722A power sensor
Rate: 20 Hz to 10 kHz Depths: to 99 %	150 kHz to 10 MHz	3.8 % + 1 digit	
Rate: 50 Hz to 50 kHz Depths: 5 % to 99 %	10 MHz to 1.3 GHz	1.7 % + 1 digit	
Rate: 20 Hz to 100 kHz Depths: to 99 %	10 MHz to 1.3 GHz	3.7 % + 1 digit	
Rate: 50 Hz to 50 kHz Depths: 5 % to 99 %	(1.3 to 18) GHz	3.2 % + 1 digit	HP 8902A w/ HP 11792A power sensor
Rate: 20 Hz to 100 kHz Depths: to 99 %	10 MHz to 26.5 GHz	4.7 % + 1 digit	
Frequency Modulation – Measure <sup>3</sup>			
Rate: 20 Hz to 10 kHz Dev: ≤ 40 kHz pk	250 kHz to 10 MHz	2.9 % + 1 digit	HP 8902A w/ HP 11722A power sensor

Parameter/Equipment	Range	CMC <sup>2</sup> ( ± )	Comments
Frequency Modulation – Measure <sup>3</sup> (cont)			
Rate: 50 Hz to 100 kHz Dev: ≤ 400 kHz pk	10 MHz to 1.3 GHz	1.9 % + 1 digit	HP 8902A w/ HP 11792A power sensor
Rate: 20 Hz to 200 kHz Dev: ≤ 400 kHz pk	10 MHz to 1.3 GHz	6.0 % + 1 digit	
Rate: 50 Hz to 100 kHz Dev: ≤ 400 kHz pk	10 MHz to 26.5 GHz	3.5 % + 1 digit	
Rate: 20 Hz to 200 kHz Dev: ≤ 400 kHz pk	10 MHz to 1.3 GHz	6.6 % + 1 digit	

Phase Modulation – Measure <sup>3</sup>			
Rate: 200 Hz to 10 kHz	$150 \text{ kHz} \leq f_c < 10 \text{ MHz}$	5.3 % + 1 digit	HP 8902A w/ HP 11722A power sensor
Rate: 200 Hz to 20 kHz	$10 \text{ MHz} \leq f_c \leq 1.3 \text{ GHz}$	4.3 % + 1 digit	
Rate: 200 Hz to 20 kHz	$10 \text{ MHz} \leq f_c \leq 26.5 \text{ GHz}$	5.2 % + 1 digit	HP 8902A w/ HP 11792A power sensor
			$f_c$ represents the frequency carrier
Power Reference, Fixed Point – @ 1 mW	50 MHz	0.18 dBm	HP 8902A
Power Meters, Fixed Points <sup>3</sup> –			
Instrument Accuracy	(3, 10, 30, 100, 300) $\mu\text{W}$ (1, 3, 10, 30, 100) mW	0.32 % 0.32 %	Range calibrator, Agilent 11683A

## VII Chemical

Parameter/Equipment	Range	CMC <sup>2</sup> ( $\pm$ )	Comments
pH – Buffer	4 pH 7 pH 10 pH	0.014 pH 0.016 pH 0.016 pH	Standard reference buffer
Conductivity – Buffer	(5 to 30) $\mu\text{S}$ (>30 to 84) $\mu\text{S}$ (>84 to 300) $\mu\text{S}$ (>300 to 1413) $\mu\text{S}$ (>1413 to 3000) $\mu\text{S}$ (>3000 to 13 000) $\mu\text{S}$	0.011 $\mu\text{S}$ + 1 % 0.0025 $\mu\text{S}$ + 1 % 0.33 $\mu\text{S}$ + 0.64 % 1.4 $\mu\text{S}$ + 0.3 % 15 $\mu\text{S}$ 0.27 mS	Standard reference buffer

1 This laboratory offers commercial calibration service and field calibration service.

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

3 Field calibration service is available for this calibration and this laboratory for these calibrations. Please note the actual measurement uncertainties achievable on a customer's site can normally be expected to be larger than the CMC found on the Scope. Allowance must be made for aspects such as the environment at the place of calibration and for other possible adverse effects such as those caused by transportation of the calibration equipment. The usual allowance for the actual uncertainty introduced by the item being calibrated, (e.g. resolution) must also be considered and this, on its own, could result in the actual measurement uncertainty achievable on a customer's site being larger than the CMC.

4 In the statement of CMC,  $L$  is the numerical value of the nominal length of the device measured in inches or meters and  $D$  is the numerical value of the nominal diameter of the device measured in inches or meters.