



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

TEKTRONIX, INC.
7 Sterling Road
North Billerica, MA 01862
Jodi Maylowski Phone: 800 438 8165

CALIBRATION

Valid To: July 31, 2024

Certificate Number: 2357.28

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, 5} (\pm)	Comments
Calipers ³	Up to 4 in (4 to 12) in (12 to 24) in	(58 + 1.0L) μ in (65 + 4.3L) μ in (99 + 3L) μ in	Gage blocks
Micrometers ³ –	Up to 4 in (4 to 12) in	(9 + 3.4L) μ in (21 + 5.4L) μ in	Gage blocks
Flatness ³	Up to 1 in	8.2 μ in	Optical flat
Height Gages ³	Up to 4 in (4 to 12) in (12 to 24) in	(58 + 1.0L) μ in (65 + 4.3L) μ in (99 + 3L) μ in	Gage blocks
Indicators ³	Up to 4 in	(15 + 1.8L) μ in	Gage blocks

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2,4} (±)	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	6.9 μV/V + 0.39 μV 3.3 μV/V + 0.62 μV 2.8 μV/V + 2.3 μV 3.5 μV/V + 3.9 μV 3.3 μV/V + 39 μV 4.8 μV/V + 0.39 mV	Fluke 5730A
DC Voltage – Measure ³	Up to 100 mV 100 mV to 1 V (1 to 10) V (10 to 100) V 100 V to 1.1 kV Up to 10 kV	11 μV/V + 0.23 μV 5.0 μV/V + 0.23 μV 4.8 μV/V + 0.39 μV 6.8 μV/V + 23 μV 8.5 μV/V + 78 μV 0.027 % + 40 mV	HP 3458A OPT 002 Vitretek 4700
DC Current – Generate ³	(0 to 219.9999) μA (0.22 to 2.199 999) mA (2.2 to 21.999 99) mA (22 to 219.9999) mA (0.22 to 2.2) A (0 to 11) A (11 to 20.5) A	34 μA/A + 5.4 nA 28 μA/A + 6.2 nA 28 μA/A + 39 nA 36 μA/A + 0.62 μA 57 μA/A + 12 μA 0.27 mA/A + 0.37 mA 0.81 mA/A + 0.58 mA	Fluke 5730A Fluke 5730A/5725A Fluke 5522A
w/ Coil	(16.5 to 150) A (150 to 1025) A	4.4 mA/A + 0.11 mA 4.3 mA/A + 0.39 mA	Fluke 5522A/5500A/coil
DC Current – Measure ³	(0 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 (0.1 to 1) A	66 μA/A 32 μA/A 16 μA/A 23 μA/A 20 μA/A 22 μA/A 36 μA/A 96 μA/A	HP 3458A OPT 002
w/ Shunt	(1 to 5) A (5 to 20) A	0.1 mA/A + 0.1 mA 0.1 mA/A + 0.3 mA	CS-20 & CS-50

Parameter/Equipment	Range	CMC ^{2,6} (±)	Comments	
Oscilloscopes ³ –				
Amplitude – DC Signal: Into 50 Ω Load Into 1 MΩ Load	(0 to 6.6) V (0 to 130) V	1.9 mV/V + 31 μV 0.39 mV/V + 31 μV	Fluke 5522A/SC1100	
Amplitude – Square: Wave 50 Ω Load	±1 mV to 6.6 V _{p-p} 10 Hz to 10 kHz	2.0 mV/V + 31 μV		
1 MΩ Load	±1 mV to 130 V _{p-p} 10 Hz to 1 kHz	0.78 mV/V + 31 μV		
Rise Time: Transition Time w/ Rep Rate of ≤ 2 MHz	(200 to 300) ps	15 ps		
Transition Time w/ Rep Rate Between (2 & 10) MHz	(200 to 350) ps	22 ps		
Bandwidth: 5 mV to 5.5 V	50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz 600 MHz to 1.1 GHz	2.9 % + 78 μV 3.1 % + 78 μV 4.1 % + 78 μV 4.7 % + 78 μV		
Time Marker: Into 50 Ω Load	1 ns to 20 ms 50 ms to 5 s	2.1 μs/s (19 + 39t) μs/s		t = time
	Non-Cardinal Points, Any 20 ms or Less	39 μs/s		

Parameter/Equipment	Range	CMC ^{2, 4} (±)	Comments
DC Resistance – Generate ³	(0 to 10.9999) Ω (11 to 32.9999) Ω (33 to 109.9999) Ω (110 to 329.9999) Ω (0.33 to 1.099 999) kΩ (1.1 to 3.299 999) kΩ (3.3 to 10.999 99) kΩ (11 to 32.999 99) kΩ (33 to 109.9999) kΩ (110 to 329.9999) kΩ (0.33 to 1.099 999) MΩ (1.1 to 3.2999 99) MΩ (3.3 to 10.999 99) MΩ (11 to 32.999 99) MΩ (33 to 109.9999) MΩ (110 to 329.9999) MΩ (330 to 1100) MΩ	33 μΩ/Ω + 0.78 mΩ 24 μΩ/Ω + 1.2 mΩ 22 μΩ/Ω + 1.1 mΩ 23 μΩ/Ω + 1.6 mΩ 22 μΩ/Ω + 1.6 mΩ 23 μΩ/Ω + 16 mΩ 23 μΩ/Ω + 16 mΩ 23 μΩ/Ω + 0.16 Ω 23 μΩ/Ω + 0.16 Ω 26 μΩ/Ω + 1.6 Ω 26 μΩ/Ω + 1.6 Ω 48 μΩ/Ω + 23 Ω 0.10 mΩ/Ω + 39 Ω 0.21 mΩ/Ω + 1.9 kΩ 0.40 mΩ/Ω + 2.3 kΩ 2.3 mΩ/Ω + 78 kΩ 12 mΩ/Ω + 0.39 MΩ	Fluke 5522A
	0 Ω 1Ω 1.9 Ω 10 Ω 19 Ω 100 Ω 190 Ω 1 kΩ 1.9 kΩ 10 kΩ 19 kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	49 μΩ 0.12 mΩ 0.14 mΩ 0.20 mΩ 0.39 mΩ 0.9 mΩ 1.7 mΩ 5.8 mΩ 11 mΩ 57 mΩ 0.11 Ω 0.67 Ω 1.6 Ω 12 Ω 55 Ω 0.87 kΩ 1.6 kΩ 20 kΩ	Fluke 5730A
DC Resistance – Measure ³	Up 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 (100 to 1200) MΩ	14 μΩ/Ω + 39 μΩ 12 μΩ/Ω + 0.39 mΩ 10 μΩ/Ω + 0.39 mΩ 10 μΩ/Ω + 3.9 mΩ 11 μΩ/Ω + 39 mΩ 16 μΩ/Ω + 2 Ω 53 μΩ/Ω + 78 Ω 0.40 mΩ/Ω + 0.8 kΩ 4.8 mΩ/Ω + 7.8 kΩ	HP 3458A OPT 002

Parameter/Equipment	Range	CMC ² (±)	Comments
Electrical Simulation of RTDs ³ –			
Pt 385, 100 Ω	(-200 to -80) °C	0.085 °C	Fluke 5522A
	(-80 to 0) °C	0.12 °C	
	(0 to 100) °C	0.12 °C	
	(100 to 300) °C	0.11 °C	
	(300 to 400) °C	0.097 °C	
	(400 to 630) °C	0.11 °C	
	(630 to 800) °C	0.20 °C	
Pt 3926, 100 Ω	(-200 to -80) °C	0.064 °C	
	(-80 to 0) °C	0.076 °C	
	(0 to 100) °C	0.075 °C	
	(100 to 300) °C	0.089 °C	
	(300 to 400) °C	0.095 °C	
	(400 to 630) °C	0.17 °C	
Pt 3916, 100 Ω	(-200 to -190) °C	0.21 °C	
	(-190 to -80) °C	0.060 °C	
	(-80 to 0) °C	0.068 °C	
	(0 to 100) °C	0.070 °C	
	(100 to 260) °C	0.077 °C	
	(260 to 300) °C	0.084 °C	
	(300 to 400) °C	0.090 °C	
	(400 to 600) °C	0.13 °C	
Pt 385, 200 Ω	(-200 to -80) °C	0.041 °C	
	(-80 to 0) °C	0.043 °C	
	(0 to 100) °C	0.044 °C	
	(100 to 260) °C	0.051 °C	
	(260 to 300) °C	0.098 °C	
	(300 to 400) °C	0.11 °C	
	(400 to 600) °C	0.11 °C	
	(600 to 630) °C	0.13 °C	
Pt 385, 500 Ω	(-200 to -80) °C	0.036 °C	
	(-80 to 0) °C	0.043 °C	
	(0 to 100) °C	0.044 °C	
	(100 to 260) °C	0.051 °C	
	(260 to 300) °C	0.066 °C	
	(300 to 400) °C	0.066 °C	
	(400 to 600) °C	0.073 °C	
	(600 to 630) °C	0.088 °C	

Parameter/Equipment	Range	CMC ² (±)	Comments
Electrical Simulation of RTD's (cont) ³ –			
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 400) °C (400 to 600) °C (600 to 630) °C	0.029 °C 0.029 °C 0.036 °C 0.042 °C 0.050 °C 0.18 °C 0.057 °C 0.18 °C	Fluke 5522A
PtNi 385, 120 Ω (Ni120)	(-80 to 0) °C (0 to 100) °C (100 to 260) °C	0.081 °C 0.11 °C 0.11 °C	
Cu 427, 10 Ω	(-100 to 260) °C	0.69 °C	
Electrical Simulation & Measurement of Thermocouples ³ –			
Type B	(600 to 800) °C (800 to 1000) °C (1000 to 1550) °C (1550 to 1820) °C	0.40 °C 0.29 °C 0.25 °C 0.27 °C	Fluke 5522A
Type C	(0 to 150) °C (150 to 650) °C (650 to 1000) °C (1000 to 1800) °C (1800 to 2316) °C	0.25 °C 0.21 °C 0.25 °C 0.39 °C 0.66 °C	
Type E	(-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C	0.39 °C 0.13 °C 0.11 °C 0.13 °C 0.16 °C	

Parameter/Equipment	Range	CMC ² (±)	Comments
Electrical Simulation & Measurement of Thermocouples ³ – (cont)			
Type J	(-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C	0.25 °C 0.13 °C 0.12 °C 0.14 °C 0.18 °C	Fluke 5522A
Type K	(-200 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 0.20 °C 0.31 °C	
Type L	(-200 to -100) °C (-100 to 800) °C (800 to 900) °C	0.29 °C 0.21 °C 0.15 °C	
Type N	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1300) °C	0.32 °C 0.18 °C 0.15 °C 0.14 °C 0.21 °C	
Type R	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.47 °C 0.29 °C 0.27 °C 0.32 °C	
Type S	(0 to 250) °C (250 to 1000) °C (1000 to 1400) °C (1400 to 1767) °C	0.42 °C 0.29 °C 0.30 °C 0.37 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.50 °C 0.19 °C 0.13 °C 0.11 °C	

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Electrical Simulation & Measurement of Thermocouples ³ – (cont)			
Type U	(-200 to 0) °C (0 to 600) °C	0.45 °C 0.23 °C	Fluke 5522A
DC Power – Generate ³ PF=1	0.01 mW to 3060 W (3060 to 20 910) W	0.18 mW/W 0.57 mW/W	Fluke 5522A

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Current – Generate ³			
(1 to 220) µA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.23 mA/A + 16 nA 0.15 mA/A + 9.3 nA 0.1 mA/A + 7.8 nA 0.25 mA/A + 12 nA 0.9 mA/A + 62 nA	Fluke 5730A w/ Fluke 5725A
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	0.22 mA/A + 39 nA 0.15 mA/A + 31 nA 0.1 mA/A + 31 nA 0.18 mA/A + 0.1 µA 0.9 mA/A + 0.62 µA	
(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	0.22 mA/A + 0.39 µA 0.14 mA/A + 0.31 µA 0.1 mA/A + 0.31 µA 0.18 mA/A + 0.54 µA 0.9 mA/A + 4.7 µA	
(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	0.22 mA/A + 3.9 µA 0.14 mA/A + 3.1 µA 0.1 mA/A + 2.3 µA 0.17 mA/A + 3.1 µA 0.9 mA/A + 9.3 µA	
220 mA to 2.2 A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.22 mA/A + 31 µA 0.37 mA/A + 78 µA 5.4 mA/A + 0.16 mA	

Parameter/Range	Frequency	CMC ^{2, 4, 6} (±)	Comments
AC Current – Generate ³ (cont)			
(2.2 to 11) A	40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.36 mA/A + 0.13 mA 0.69 mA/A + 0.29 mA 2.6 mA/A + 0.58 mA	Fluke 5730A w/ Fluke 5725A
(11 to 20.5) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.95 mA/A + 3.9 mA 1.2 mA/A + 3.9 mA 23 mA/A + 3.9 mA	Fluke 5522A
Clamp-On Ammeters Toroidal:			
(16.5 to 150) A _{AC}	(45 to 65) Hz (65 to 440) Hz	0.41 % 0.85 %	Fluke 5522A w/ 5500A coil
(150 to 1025) A _{AC}	(45 to 65) Hz (65 to 440) Hz	0.39 % 0.85 %	
Clamp-On Ammeters Non-Toroidal:			
(16.5 to 150) A _{AC}	(45 to 65) Hz (65 to 440) Hz	0.78 % 1.2 %	Fluke 5522A w/ 5500A coil
(150 to 1025) A _{AC}	(45 to 65) Hz (65 to 440) Hz	1.2 % 1.6 %	

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Current – Measure ³			
Up to 100 µA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 5 kHz	3.2 mA/A + 23 nA 1.2 mA/A + 23 nA 0.47 mA/A + 23 nA	HP 3458A
100 µA to 1 mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	3.3 mA/A + 0.16 µA 1.2 mA/A + 0.16 µA 0.51 mA/A + 0.16 µA 0.24 mA/A + 0.16 µA	
(1 to 10) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 to 5 kHz	3.2 mA/A + 1.6 µA 1.2 mA/A + 1.6 µA 0.48 mA/A + 1.6 µA 0.24 mA/A + 1.6 µA	
(10 to 100) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	3.2 mA/A + 16 µA 1.2 mA/A + 16 µA 0.47 mA/A + 16 µA 0.24 mA/A + 16 µA	
(100 to 1) A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	3.2 mA/A + 0.16 mA 1.3 mA/A + 0.16 mA 0.65 mA/A + 0.16 mA 0.8 mA/A + 0.16 mA	
(1 to 5) A (5 to 10) A	45 Hz to 1 kHz 45 Hz to 1 kHz	17 mA/A + 2.3 mA 17 mA/A + 5.8 mA	Fluke 187

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 (0.5 to 1) MHz	0.39 mV/V + 3.9 μV 0.34 mV/V + 3.9 μV 0.35 mV/V + 3.9 μV 0.38 mV/V + 3.9 μV 0.6 mV/V + 4.7 μV 1.1 mV/V + 9.3 μV 1.3 mV/V + 19 μV 2.6 mV/V + 19 μV	Fluke 5730A w/ Fluke 5725A
(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 (0.5 to 1) MHz	0.22 mV/V + 3.9 μV 0.1 mV/V + 3.9 μV 0.1 mV/V + 3.9 μV 0.19 mV/V + 3.9 μV 0.43 mV/V + 4.7 μV 0.9 mV/V + 9.3 μV 1.2 mV/V + 19 μV 2.4 mV/V + 19 μV	
(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 (0.5 to 1) MHz	0.35 mV/V + 12 μV 84 μV/V + 6.2 μV 55 μV/V + 6.2 μV 0.11 mV/V + 6.2 μV 0.3 mV/V + 16 μV 0.54 mV/V + 19 μV 1.2 mV/V + 23 μV 2.3 mV/V + 47 μV	
(0.22 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 (0.5 to 1) MHz	0.48 mV/V + 39 μV 80 μV/V + 16 μV 37 μV/V + 7.8 μV 61 μV/V + 9.3 μV 0.11 mV/V + 31 μV 0.3 mV/V + 78 μV 0.86 mV/V + 0.19 mV 1.4 mV/V + 0.31 mV	
(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 (0.5 to 1) MHz	0.36 mV/V + 0.39 mV 85 μV/V + 0.16 mV 38 μV/V + 54 μV 61 μV/V + 93 μV 77 μV/V + 0.19 mV 0.23 mV/V + 0.62 mV 0.86 mV/V + 1.9 mV 1.3 mV/V + 3.1 mV	

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Voltage – Generate (cont) ³			
(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 (0.5 to 1) MHz	0.42 mV/V + 3.9 mV 81 μV/V + 1.6 mV 49 μV/V + 0.54 mV 75 μV/V + 0.93 mV 0.13 mV/V + 2.3 mV 0.78 mV/V + 16 mV 4 mV/V + 39 mV 7 mV/V + 78 mV	Fluke 5730A w/ Fluke 5725A
(220 to 1100) V (5730A)	(15 to 50) Hz 50 Hz to 1 kHz	0.25 mV/V + 16 mV 61 μV/V + 3.1 mV	
(220 to 1100) V (5725A)	40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz	71 μV/V + 3.1 mV 0.1 mV/V + 4.7 mV 0.3 mV/V + 8.5 mV	
(220 to 750) V (5725A)	(30 to 50) kHz (50 to 100) kHz	0.29 mV/V + 8.5 mV 1.1 mV/V + 35 mV	
Up to 10 kV	(15 to 200) Hz (200 to 450) Hz (450 to 600) Hz	0.11 % + 0.12 V 0.43 % + 0.12 V 0.84 % + 0.12 V	Vitrek 4700

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Voltage – Measure ³			
(Up to 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 kHz to 1 MHz (1 to 4) MHz (4 to 8) MHz	0.27 mV/V + 2.3 μV 0.18 mV/V + 0.85 μV 0.25 mV/V + 0.85 μV 0.78 mV/V + 0.85 μV 3.9 mV/V + 0.85 μV 9.3 mV/V + 3.9 μV 54 mV/V + 5.4 μV 0.16 V/V + 6.2 μV	HP 3458A
(10 to 100) 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 300 kHz to 1 MHz (1 to 4) MHz (4 to 8) MHz (8 to 10) MHz	0.13 mV/V + 3.1 μV 71 μV/V + 1.6 μV 0.11 mV/V + 1.6 μV 0.23 mV/V + 1.6 μV 0.62 mV/V + 1.6 μV 2.3 mV/V + 7.8 μV 7.8 mV/V + 7.8 μV 31 mV/V + 54 μV 31 mV/V + 62 μV 0.12 V/V + 78 μV	
(0.1 to 1) 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 (1 to 4) MHz (4 to 8) MHz (8 to 10) MHz	0.06 mV/V + 31 μV 57 μV/V + 16 μV 0.11 mV/V + 16 μV 0.24 mV/V + 16 μV 0.63 mV/V + 16 μV 2.3 mV/V + 78 μV 7.9 mV/V + 78 μV 31 mV/V + 0.54 mV 31 mV/V + 0.62 mV 0.12 V/V + 0.78 mV	
(1 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 (1 to 4) MHz (4 to 8) MHz (8 to 10) MHz	0.06 mV/V + 0.31 mV 56 μV/V + 0.16 mV 0.11 mV/V + 0.16 mV 0.24 mV/V + 0.16 mV 0.63 mV/V + 0.16 mV 2.3 mV/V + 0.78 mV 7.9 mV/V + 0.78 mV 31 mV/V + 5.4 mV 31 mV/V + 6.2 mV 0.12 V/V + 7.8 mV	

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Voltage – Measure (cont) ³			
(10 to 100) 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	0.16 mV/V + 3.1 mV 0.16 mV/V + 1.6 mV 0.16 mV/V + 1.6 mV 0.28 mV/V + 1.6 mV 0.93 mV/V + 1.6 mV 3.1 mV/V + 7.8 mV 12 mV/V + 7.8 mV	HP 3458A
(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	0.32 mV/V + 31 mV 0.31 mV/V + 16 mV 0.47 mV/V + 16 mV 0.93 mV/V + 16 mV 2.3 mV/V + 16 mV	

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
AC Power – Generate ³ @ (45 to 65) Hz, PF=1	(0.1089 to 2.97) mW (0.297 to 10.89) mW (10.89 to 29.7) mW (2.97 to 108.9) mW (10.89 to 297) mW (29.7 to 726) mW 72.6 mW to 1.485 W 148.5 mW to 6.76 W 1.089 mW to 9.179 W 2.97 mW to 33.6 W 10.89 mW to 91.8 W 29.7 mW to 336.6 W 108.9 mW to 918 W 297 mW to 2244 W 726 mW to 4590 W (1.49 to 20 910) W	2.3 mW/W 1.4 mW/W 1.1 mW/W 1.3 mW/W 1 mW/W 1 mW/W 1.1 mW/W 1 mW/W 3.4 mW/W 0.62 mW/W 0.94 mW/W 0.62 mW/W 0.86 mW/W 0.76 mW/W 0.96 mW/W 0.81 mW/W	Fluke 5522A

Parameter/Range	Frequency	CMC ^{2, 4, 6} (±)	Comments
AC Voltage Flatness – Measure			
0.5 V Thermal Converter	10 Hz to 10 kHz	0.12 %	By comparison to thermal voltage converters w/ HP 3458A, opt 002
	(> 10 to 30) kHz	0.23 %	
	(> 30 to 300) kHz	0.29 %	
	(> 0.3 to 1) MHz	0.58 %	
	(> 1 to 3) MHz	0.70 %	
	(> 3 to 10) MHz	0.71 %	
	(> 10 to 20) MHz	0.76 %	
	(> 20 to 30) MHz	1.8 %	
	(> 30 to 50) MHz	2.8 %	
	(> 50 to 70) MHz	3.6 %	
	(> 70 to 80) MHz	3.9 %	
	(> 80 to 100) MHz	4.8 %	
1, 3 V Thermal Converter	10 Hz to 10 kHz	0.12 %	
	(> 10 to 30) kHz	0.23 %	
	(> 30 to 300) kHz	0.29 %	
	(> 0.3 to 1) MHz	0.58 %	
	(> 1 to 10) MHz	0.70 %	
	(> 10 to 20) MHz	0.72 %	
	(> 20 to 30) MHz	1.7 %	
	(> 30 to 50) MHz	2.6 %	
	(> 50 to 70) MHz	3.5 %	
	(> 70 to 80) MHz	3.9 %	
	(> 80 to 100) MHz	4.7 %	

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Capacitance – Generate ³	(0.19 to 1.1) nF (1.1 to 3.3) nF (3.3 to 11) nF (11 to 110) nF (110 to 330) nF (0.33 to 1.1) μF (1.1 to 3.29) μF (3.3 to 11) μF (11 to 33) μF (33 to 110) μF (110 to 330) μF (0.33 to 1.1) mF (1.1 to 3.3) mF (3.3 to 11) mF (11 to 33) mF (33 to 110) mF	4 mF/F + 7.8 pF 4 mF/F + 7.8 pF 2.1 mF/F + 7.8 pF 2.1 mF/F + 78 pF 2 mF/F + 0.23 nF 2.1 mF/F + 0.78 nF 2.1 mF/F + 2.3 nF 2.1 mF/F + 7.8 nF 3.2 mF/F + 23 nF 3.6 mF/F + 78 nF 3.5 mF/F + 0.23 μF 3.5 mF/F + 0.78 μF 3.5 mF/F + 2.3 μF 3.5 mF/F + 7.8 μF 5.8 mF/F + 23 μF 8.5 mF/F + 78 μF	Fluke 5522A
Capacitance – Measure ³	Up to 1 nF (1 to 10) nF (10 to 100) nF 100 nF to 1 μF (1 to 10) μF (10 to 100) μF (100 to 1000) μF 1000 μF to 10 mF (10 to 50) mF	29 mF/F + 5.8 pF 12 mF/F + 58 pF 12 mF/F + 0.58 nF 12 mF/F + 5.8 nF 13 mF/F + 58 nF 13 mF/F + 0.58 μF 13 mF/F + 5.8 μF 13 mF/F + 58 μF 38 mF/F + 0.12 mF	Fluke 187

Parameter/Range	Frequency	CMC ^{2,6} (±)	Comments
Thermal Voltage Converters –			
	0.45 V	10 Hz 0.013 % 100 Hz 0.0083 % 10 kHz 0.0077 % 30 kHz 0.0081 % 100 kHz 0.0087 % 300 kHz 0.011 % 1 MHz 0.017 % 3 MHz 0.031 % 8 MHz 0.045 % 10 MHz 0.053 % 20 MHz 0.076 % 30 MHz 0.097 % 50 MHz 0.18 % 70 MHz 0.30 % 80 MHz 0.32 % 100 MHz 0.39 %	(0.45, 1 & 3) V thermal converters w/ HP 34420A & AFG3101C
	1.0 V	10 Hz 0.018 % 100 Hz 0.010 % 10 kHz 0.0079 % 30 kHz 0.0078 % 100 kHz 0.0087 % 300 kHz 0.012 % 1 MHz 0.015 % 3 MHz 0.029 % 8 MHz 0.048 % 10 MHz 0.059 % 20 MHz 0.094 % 30 MHz 0.12 % 50 MHz 0.21 % 70 MHz 0.33 % 80 MHz 0.34 % 100 MHz 0.43 %	
3.0 V	10 Hz 0.014 % 100 Hz 0.0076 % 1 kHz 0.0078 % 10 kHz 0.0069 % 30 kHz 0.0069 % 100 kHz 0.0071 % 300 kHz 0.0087 %		

Parameter/Range	Frequency	CMC ^{2, 4, 6} (±)	Comments
Thermal Voltage Converters – (cont) 3.0 V	1 MHz 3 MHz 8 MHz 10 MHz 20 MHz 30 MHz 50 MHz 70 MHz 80 MHz 100 MHz	0.012 % 0.034 % 0.053 % 0.058 % 0.091 % 0.12 % 0.20 % 0.23 % 0.24 % 0.53 %	(0.45, 1 & 3) V thermal converters w/ HP 34420A & AFG3101C
Distortion – Measure ³ (-99.9 to 0) dBm	20 Hz to 20 kHz (20 to 100) kHz	1.3 dB 2.3 dB	Agilent/HP 8903B

III. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC ^{2, 4, 6} (±)	Comments
RF Power – Measure ³			
(-30 to +30) dBm (-70 to -30) dBm	3 Hz to 100 kHz	0.060 dB 0.091 dB	HP 33611A / 3458A
(-10 to +20) dBm (-20 to -10) dBm	100 kHz to 4.2 GHz	0.081 dB 0.080 dB	HP E44XXB & signal generator w/ Keysight power sensor: 8482A
(-10 to +20) dBm (-20 to -10) dBm	(4.2 to 18) GHz	0.078 dB 0.083 dB	8481A
(-20 to +20) dBm	(18 to 26.5) GHz	0.080 dB	8485A
(-20 to +20) dBm	(26.5 to 50) GHz	0.17 dB	N8487A
(-70 to -20) dBm	(18 to 26.5) GHz	0.15 dB	8485D
(+20 to +24) dBm	128 MHz to 18 GHz (18 to 26.5) GHz	0.16 dB 0.17 dB	8481A/8485A
1 mW Power Meter Reference	50 MHz	0.30 %	HP 478A-H75 w/ HP 432A & DMM
RF Power – Generate ³			
(-30 to +30) dBm (-70 to -30) dBm	3 Hz to 100 kHz	0.060 dB 0.091 dB	HP 33611A / 3458A
(-10 to +20) dBm (-20 to -10) dBm	100 kHz to 4.2 GHz	0.081 dB 0.080 dB	HP E44XXB & signal generator w/ Keysight power sensor: 8482A
(-10 to +20) dBm (-20 to -10) dBm	(4.2 to 18) GHz	0.078 dB 0.083 dB	8481A
(-20 to +20) dBm	(18 to 26.5) GHz	0.080 dB	8485A
(-20 to +20) dBm	(26.5 to 50) GHz	0.17 dB	N8487A
(-70 to -20) dBm	(18 to 26.5) GHz	0.15 dB	8485D

Parameter/Range	Frequency	CMC ^{2, 4} (±)	Comments
RF Power – Generate ³ (cont)			HP E44XXB & signal generator w/ Keysight power sensor: 8481A/8485A
(+20 to +24) dBm	128 MHz to 18 GHz (18 to 26.5) GHz	0.16 dB 0.17 dB	
(-56 to 27) dBm	DC to 5 MHz (> 5 to 20) MHz	0.19 dB 0.35 dB	Tektronix AFG3101C
(16 to 24) dBm	(0.2 to 100) kHz (0.1 to 125) MHz	0.023 dB 0.049 dB	Fluke 96270A/LL/FF w/leveling head
(3 to 16) dBm	(0.2 to 100) kHz (0.1 to 150) MHz (0.25 to 1.4) GHz	0.023 dB 0.050 dB 0.20 dB	
(-7 to 3) dBm	(0.2 to 100) kHz (0.1 to 300) MHz (0.3 to 1.4) GHz (1.4 to 4.0) GHz	0.024 dB 0.052 dB 0.17 dB 0.26 dB	
(-47 to -17) dBm	(0.2 to 100) kHz (0.1 to 300) MHz (0.3 to 1.4) GHz (1.4 to 3.5) GHz (3.5 to 4.0) GHz	0.024 dB 0.052 dB 0.17 dB 0.26 dB 0.41 dB	
(-66 to -47) dBm	(0.1 to 10) MHz (10 to 300) MHz (0.3 to 1.4) GHz (1.4 to 4) GHz	0.16 dB 0.089 dB 0.33 dB 0.44 dB	
(-85 to -66) dBm	(0.1 to 10) MHz (10 to 150) MHz (0.15 to 1.5) GHz (1.5 to 4) GHz	0.40 dB 0.10 dB 0.42 dB 0.80 dB	
(-124 to -84) dBm	(10 to 100) MHz (0.1 to 1.4) GHz	0.62 dB 1.5 dB	

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
RF Power – Generate ³ (cont)			
Microwave Output: (-35 to 18) dB	Up to 100 MHz (0.1 to 1) GHz	0.11 dB 0.12 dB	Fluke 96270A/LL/FF w/leveling head
(-35 to 14) dB	(1 to 2.4) GHz (2.4 to 8) GHz (8 to 12) GHz (12 to 18) GHz (18 to 22) GHz	0.14 dB 0.17 dB 0.17 dB 0.23 dB 0.26 dB	
(-35 to 12) dB	(22 to 26.5) GHz	0.34 dB	
RF Attenuation – Tuned RF Power Measure ³			
(0 to -10) dB	100 kHz to 10 MHz	0.018 dB	Rohde & Schwarz FSMR50
(-10 to -20) dB		0.024 dB	
(-20 to -30) dB		0.029 dB	
(-30 to -40) dB		0.035 dB	
(-40 to -50) dB		0.041 dB	
(-50 to -60) dB		0.047 dB	
(-60 to -70) dB		0.052 dB	
(-70 to -80) dB		0.058 dB	
(-80 to -90) dB		0.064 dB	
(-90 to -95) dB		0.071 dB	
(-95 to -100) dB		0.075 dB	
(-100 to -105) dB		0.086 dB	
(-105 to -110) dB		0.094 dB	
(-110 to -115) dB		0.13 dB	
(-115 to -120) dB		0.21 dB	
(-120 to -125) dB	0.27 dB		

Parameter/Range	Frequency	CMC ^{2, 4} (±)	Comments
RF Attenuation – Tuned RF Power Measure ³ (cont)			
(0 to -5) dB	10 MHz to 22 GHz	0.018 dB	Rohde & Schwarz FSMR50
(-5 to -10) dB		0.019 dB	
(-10 to -20) dB		0.024 dB	
(-20 to -30) dB		0.029 dB	
(-30 to -40) dB		0.035 dB	
(-40 to -50) dB		0.041 dB	
(-50 to -60) dB		0.047 dB	
(-60 to -70) dB		0.053 dB	
(-70 to -80) dB		0.059 dB	
(-80 to -85) dB		0.065 dB	
(-85 to -90) dB		0.068 dB	
(-90 to -100) dB		0.074 dB	
(-100 to -105) dB		0.082 dB	
(-105 to -110) dB		0.092 dB	
(-110 to -115) dB		0.094 dB	
(-115 to -120) dB		0.22 dB	
(-120 to -130) dB		0.47 dB	
(-130 to -135) dB		1.3 dB	
(0 to -5) dB	(22 to 26.5) GHz	0.22 dB	
(-5 to -10) dB		0.28 dB	
(-10 to -15) dB		0.35 dB	
(-15 to -20) dB		0.34 dB	
(-20 to -25) dB		0.30 dB	
(-25 to -30) dB		0.21 dB	
(-30 to -35) dB		0.31 dB	
(-35 to -40) dB		0.26 dB	
(-40 to -45) dB		0.35 dB	
(-45 to -50) dB		0.41 dB	
(-50 to -55) dB		0.35 dB	
(-55 to -60) dB		0.32 dB	
(-60 to -65) dB		0.51 dB	
(-65 to -70) dB		0.38 dB	
(-70 to -75) dB		0.23 dB	
(-75 to -80) dB		0.27 dB	
(-80 to -85) dB		0.34 dB	
(-85 to -90) dB		0.31 dB	
(-90 to -95) dB		0.30 dB	
(-95 to -100) dB		0.27 dB	
(-100 to -105) dB		0.27 dB	

Parameter/Range	Frequency	CMC ^{2, 4} (±)	Comments
RF Attenuation – Tuned RF Power Measure ³ (cont)			
(-105 to -110) dB	(22 to 26.5) GHz	0.31 dB	Rohde & Schwarz FSMR50
(-110 to -115) dB		0.45 dB	
(-115 to -120) dB		0.31 dB	
(-120 to -130) dB		2.9 dB	
(-130 to -135) dB		1.3 dB	
(0 to -5) dB	(26.5 to 40) GHz	0.26 dB	
(-5 to -20) dB		0.25 dB	
(-10 to -15) dB		0.25 dB	
(-15 to -20) dB		0.25 dB	
(-20 to -25) dB		0.39 dB	
(-25 to -30) dB		0.29 dB	
(-30 to -35) dB		0.22 dB	
(-35 to -40) dB		0.44 dB	
(-40 to -45) dB		0.31 dB	
(-45 to -50) dB		0.45 dB	
(-50 to -55) dB		0.61 dB	
(-55 to -60) dB		0.41 dB	
(-60 to -65) dB		0.51 dB	
(-65 to -70) dB		0.41 dB	
(-70 to -75) dB		0.29 dB	
(-75 to -80) dB		0.41 dB	
(-80 to -85) dB		0.42 dB	
(-85 to -90) dB		0.41 dB	
(-90 to -95) dB		0.42 dB	
(-95 to -100) dB		0.40 dB	
(-100 to -105) dB	0.38 dB		
(-105 to -110) dB	0.47 dB		
(-110 to -115) dB	0.55 dB		
(-115 to -120) dB	0.18 dB		
(-120 to -125) dB	0.26 dB		
(0 to -5) dB		0.36 dB	
(-5 to -10) dB		0.31 dB	
(-10 to -15) dB		0.45 dB	
(-15 to -20) dB		0.44 dB	
(-20 to -25) dB		0.50 dB	
(-25 to -30) dB		0.52 dB	
(-30 to -35) dB		0.51 dB	
(-35 to -40) dB		0.55 dB	
(-40 to -45) dB		0.43 dB	
(-45 to -50) dB		0.49 dB	
(-50 to -55) dB		0.30 dB	
(-55 to -65) dB		0.36 dB	

Parameter/Range	Frequency	CMC ^{2, 4, 6} (±)	Comments
RF Attenuation – Tuned RF Power Measure ³ (cont) (-60 to -65) dB (-65 to -70) dB (-70 to -75) dB (-75 to -80) dB (-80 to -85) dB (-85 to -90) dB (-90 to -95) dB (-95 to -100) dB (-100 to -105) dB (-105 to -110) dB (-110 to -115) dB	(40 to 50) GHz	0.36 dB 0.44 dB 0.35 dB 0.42 dB 0.36 dB 0.41 dB 0.37 dB 0.38 dB 0.39 dB 0.37 dB 0.35 dB	Rohde & Schwarz FSMR50
Amplitude Modulation – Generate/Measure ³ Rate: 10 Hz to 10 kHz Depth: (5 to 99) % Rate: 10 Hz to 50 kHz Depth: (5 to 99) % Rate: 50 kHz to 100 kHz Depth: (5 to 99) % Rate: 90 Hz to 150 Hz Depth: (5 to 99) %	(0.1 to 10) MHz (0.01 to 50) GHz (0.01 to 50) GHz (0.01 to 50) GHz	1.5 % 1.0 % 1.5 % 0.42 %	HP 83650B monitored by Rohde & Schwarz FSMR 50
Amplitude Modulation – Generate ³ Rate: 20 Hz to 100 kHz Depths: (0 to 99) % 50 Hz to 50 kHz Rate 20 Hz to 100 kHz Rate	(11 to 13.5) MHz	0.20 % AM 0.33 % AM	HP 11715A

Parameter/Range	Frequency	CMC ^{2, 4, 6} (±)	Comments
Frequency Modulation – Generate/Measure ³ Rate: 10 Hz to 10 kHz Dev: ≤ 50 kHz peak Rate: 10 Hz to 100 kHz Dev: ≤ 500 kHz peak Rate: (100 to 200) kHz Dev: ≤ 500 kHz peak	(0.1 to 10) MHz (0.01 to 50) GHz (0.01 to 50) GHz	1.2 % 1.2 % 3.5 %	Rohde & Schwarz FSMR 50
Frequency Modulation – Generate ³ Rate: DC to 100 kHz Rate: (100 to 200) kHz Dev.: ≤ 12.5 kHz peak Rate: DC to 100 kHz Rate: (100 to 200) kHz Dev.: ≤ 100 kHz peak Rate: DC to 100 kHz Rate: (100 to 200) kHz Dev.: ≤ 400 kHz peak	(11 to 13.5) MHz (88 to 108) MHz (352 to 432) MHz	0.44 % 0.43 % 0.43 % 0.43 % 0.43 % 0.56 %	HP 11715A
Phase Modulation – Measure ³ Rate: 50 Hz to 10 kHz Rate: 50 Hz to 100 kHz	200 kHz to 10 MHz 10 MHz to 50 GHz	1.0 % 1.0 %	Rohde & Schwarz FSMR 50
Phase Noise – Measure ³ 1 Hz Offset 10 Hz Offset 100 Hz Offset 1 kHz Offset 10 kHz Offset 100 kHz Offset 1 MHz Offset	(1 to 10) MHz Carrier	2.7 dBc 2.5 dBc 1.6 dBc 1.6 dBc 1.6 dBc 1.6 dBc 4.0 dBc	Rohde & Schwarz FSWP50

Parameter/Range	Frequency	CMC ^{2, 4} (±)	Comments
Phase Noise – Measure ³			
1 Hz Offset	(10 to 100) MHz	3.7 dBc	Rohde & Schwarz FSWP50
10 Hz Offset		2.8 dBc	
100 Hz Offset		1.6 dBc	
1 kHz Offset		1.6 dBc	
10 kHz Offset		1.6 dBc	
100 kHz Offset		1.6 dBc	
1 MHz Offset		2.7 dBc	
10 MHz Offset		3.3 dBc	
> 30 MHz Offset		4.0 dBc	
1 Hz Offset	100 MHz to 1 GHz	3.2 dBc	
10 Hz Offset		2.4 dBc	
100 Hz Offset		1.7 dBc	
1 kHz Offset		1.6 dBc	
10 kHz Offset		1.6 dBc	
100 kHz Offset		1.6 dBc	
1 MHz Offset		3.9 dBc	
10 MHz Offset		4.0 dBc	
> 30 MHz Offset		4.0 dBc	
1 Hz Offset	(1 to 3) GHz	4.2 dBc	
10 Hz Offset		2.0 dBc	
100 Hz Offset		1.6 dBc	
1 kHz Offset		1.6 dBc	
10 kHz Offset		1.6 dBc	
100 kHz Offset		1.6 dBc	
1 MHz Offset		3.8 dBc	
10 MHz Offset		4.4 dBc	
> 30 MHz Offset		4.1 dBc	
1 Hz Offset	(3 to 7) GHz	4.4 dBc	
10 Hz Offset		2.6 dBc	
100 Hz Offset		1.7 dBc	
1 kHz Offset		1.6 dBc	
10 kHz Offset		1.6 dBc	
100 kHz Offset		1.6 dBc	
1 MHz Offset		3.3 dBc	
10 MHz Offset		3.9 dBc	
> 30 MHz Offset		4.6 dBc	

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Phase Noise – Measure ³ (cont)			
1 Hz Offset	(7 to 10) GHz	4.4 dBc	Rohde & Schwarz FSWP50
10 Hz Offset		2.7 dBc	
100 Hz Offset		1.8 dBc	
1 kHz Offset		1.6 dBc	
10 kHz Offset		1.6 dBc	
100 kHz Offset		1.6 dBc	
1 MHz Offset		3.5 dBc	
10 MHz Offset		3.3 dBc	
> 30 MHz Offset		4.6 dBc	
1 Hz Offset	(10 to 16) GHz	3.2 dBc	
10 Hz Offset		2.7 dBc	
100 Hz Offset		1.7 dBc	
1 kHz Offset		1.6 dBc	
10 kHz Offset		1.6 dBc	
100 kHz Offset		1.6 dBc	
1 MHz Offset		3.3 dBc	
10 MHz Offset		4.1 dBc	
> 30 MHz Offset		4.0 dBc	
1 Hz Offset	(16 to 26.5) GHz	4.1 dBc	
10 Hz Offset		2.7 dBc	
100 Hz Offset		1.7 dBc	
1 kHz Offset		1.6 dBc	
10 kHz Offset		1.6 dBc	
100 kHz Offset		1.6 dBc	
1 MHz Offset		3.6 dBc	
10 MHz Offset		4.2 dBc	
> 30 MHz Offset		4.0 dBc	
1 Hz Offset	(26.5 to 50) GHz	4.1 dBc	
10 Hz Offset		2.0 dBc	
100 Hz Offset		1.8 dBc	
1 kHz Offset		1.6 dBc	
10 kHz Offset		1.6 dBc	
100 kHz Offset		1.6 dBc	
1 MHz Offset		3.7 dBc	
10 MHz Offset		3.6 dBc	
> 30 MHz Offset		4.4 dBc	

Parameter/Range	Frequency	CMC ^{2, 4, 6} (\pm)	Comments
Digital Modulation – Measure ³			Rohde & Schwarz FSMR50
Carrier: 2 MHz to 50 GHz			Types: 2FSK & 4FSK (include GFSK), BPSK, QPSK (3GPP WCDMA, CDMA2000®), OQPSK, DQPSK, $\pi/4$ DQPSK, 8PSK, D8PSK, 3 $\pi/8$ 8PSK (EDGE), 16QAM, 32QAM, 64QAM, 128QAM, 256 QAM, D16QAM, D32QAM, D64QAM, D128QAM, D256QAM, 8VSB, GSM, NADC, PDC, PHS, Bluetooth®, DECT, TETRA
Error Vector Magnitude for Modulation	Symbol Rate: ≤ 100 kHz ≤ 10 MHz ≤ 15 MHz	0.32 % 0.53 % 1.1 %	
Phase Error for Modulation	Mod Freq Span: ≤ 100 kHz ≤ 1 MHz ≤ 10 MHz > 10 MHz	0.32° 0.42° 0.60° 1.3°	

IV. Mechanical

Parameter/Equipment	Range	CMC ^{2, 5, 6, 8} (\pm)	Comments
Torque Tools ³	(5 to 50) lbf·in (25 to 400) lbf·in (100 to 1000) lbf·in (20 to 250) lbf·ft (250 to 600) lbf·ft (15 to 200) ozf·in	0.30 % 0.31 % 0.29 % 0.29 % 0.65 % 0.29 %	CDI 5000-ST w/ 4 in 1 transducer 2000-400-02 CDI 2000-12-02 CDI 2000-05-02
Force Gauges ³	Up to 1 lbf (1 to 10) lbf (10 to 50) lbf (50 to 100) lbf (100 to 250) lbf	0.061 % 0.031 % 0.038 % 0.055 % 0.044 %	F Class weights
Pressure – Measuring Equipment ³	(0 to 50) psi (> 50 to 300) psi	(0.0008 + 0.000 074 <i>P</i>) psi (0.005 + 0.000 072 <i>P</i>) psi	RPM4

V. Thermodynamics

Parameter/Equipment	Range	CMC ^{2, 5, 8} (±)	Comments
Relative Humidity – Measure ³	(15 to 30) % RH (30 to 45) % RH (45 to 60) % RH (60 to 80) % RH (80 to 90) % RH (90 to 95) % RH	1.3 % RH 1.3 % RH 1.4 % RH 1.4 % RH 1.5 % RH 2.2 % RH	Vaisala HMT335
Temperature – Measure ³	(-200 to -195.7) °C (> -195.7 to -38) °C (> -38 to 0) °C (> 0 to 230) °C (> 230 to 420) °C	0.034 °C 0.058 °C 0.076 °C 0.12 °C 0.16 °C	Fluke 1524 w/ Fluke 5627A probe
Temperature – Measuring Equipment ³	(-45 to 35) °C (35 to 200) °C	0.13 °C (0.083 + 0.0002T) °C	Externally monitored Fluke 9170 Fluke 6102

VI. Time & Frequency

Parameter/Equipment	Range	CMC ^{2, 8} (±)	Comments
Timers & Stopwatches ³	1s to 24 hrs 24 hrs	39 ms 0.039 s/d	Agilent 53132A Helmut Klein 4500
Frequency & RPM – Measuring Equipment ³	(0.001 to 1000) Hz 1000 Hz to 10 MHz (10 to 100 000) RPM 10 MHz to 26.5 GHz	0.58 µHz/Hz 41 pHz/Hz 0.0035 RPM 0.58 nHz/Hz	Rubidium w/ Agilent 33611A Rubidium w/ 83630A
Frequency & RPM – Measure ³	0.001 Hz to 1 kHz 1 kHz to 3 GHz (10 to 100 000) RPM	0.12 mHz/Hz 0.6 nHz/Hz 0.0023 RPM	Agilent 53132A w/Rubidium

SATELLITE FACILITY

TEKTRONIX, INC.
 625 Alpha Dr
 Pittsburgh, PA 15328
 Jodi Maylowski Phone: 800 438 8165

I. Dimensional

Parameter/Equipment	Range	CMC ^{2,5,7} (±)	Comments
Calipers ³	Up to 4 in (4 to 12) in (12 to 48) in	(58 + 0.76L) μin (46 + 4L) μin (59 + 2.9L) μin	Gage block set
Micrometers ³ – Flatness ³ Parallelism ³	Up to 4 in (4 to 12) in Up to 1 in Up to 1 in	(30 + 1.3L) μin (29 + 4.1L) μin 6.1 μin 6.6 μin	Gage block set Optical flat Optical parallel
Indicators ³	Up to 1.0 in (0.05 to 4) in	84 μin (10 + 1.8L) μin	Starrett 716 Gage block set
Tapes/rules ³	Up to 400 ft	0.0025 in	Glass scale
Height Gages ³	(0.05 to 4) in (4 to 12) in (12 to 48) in	(10 + 2.6L) μin (13 + 2.6L) μin (2 + 3.8L) μin	Gage block set

Parameter/Equipment	Range	CMC ^{2, 5, 7} (±)	Comments
Optical Comparators ³			
Angle	15 ° 30 ° 45 °	0.015 ° 0.015 ° 0.015 °	Angle blocks & gage blocks
XY Linearity	Up to 4 in (> 4 to 12) in	78 μin 87 μin	
	0.1 in	21 μin	Pin gauge
Diameter	1.8 in	94 μin	Ring gauge
Depth Gages ³	(0.05 to 4) in (4 to 12) in	(30 + 0.25L) μin (31 + 1.4L) μin	Gage block set
Flatness ³	Up to 4 in	6.2 μin	4" optical flat
Inclinometer ³	(0 to 360)°	0.012°	Sine plate, gage blocks
Hall Effect Thickness Gauge ³	0 in 0.01 in 0.02 in 0.04 in	58 μin 82 μin 160 μin 260 μin	Thickness shims
Laser Micrometer ³	Up to 1 in	(6.1 + 1.2L) μin	Master pin

II. Electrical – DC / Low Frequency

Parameter/Equipment	Range	CMC ^{2, 4} (±)	Comments
DC Voltage – Generate ³	(0 to 329.9999) mV (0 to 3.299 999) V (0 to 32.999 99) V (30 to 329.9999) V (100 to 1000) V	16 μV/V + 0.78 μV 8.5 μV/V + 1.6 μV 9.3 μV/V + 16 μV 14 μV/V + 0.12 mV 14 μV/V + 1.2 mV	Fluke 5520A

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
DC Voltage – Measure ³	(0 to 100) mV 1 V 10 V 100 V 1000 V (1 to 120) kV	10 $\mu\text{V/V} + 0.23 \mu\text{V}$ 7.8 $\mu\text{V/V} + 2.3 \mu\text{V}$ 7.8 $\mu\text{V/V} + 23 \mu\text{V}$ 9.3 $\mu\text{V/V} + 0.23 \text{mV}$ 9.3 $\mu\text{V/V} + 2.3 \text{mV}$ 1.2 mV/V	HP 3458A High voltage divider & DMM
DC Current – Generate ³	(0 to 329.999) μA (0 to 3.299 99) mA (0 to 32.9999) mA (0 to 329.999) mA (0 to 1.099 99) A (1.1 to 2.999 99) A (0 to 10.9999) A (11 to 20.5) A	0.12 mA/A + 16 nA 78 $\mu\text{A/A} + 0.039 \mu\text{A}$ 78 $\mu\text{A/A} + 0.19 \mu\text{A}$ 80 $\mu\text{A/A} + 1.9 \mu\text{A}$ 0.16 mA/A + 31 μA 0.3 mA/A + 31 μA 0.39 mA/A + 0.39 mA 0.78 mA/A + 0.58 mA	Fluke 5520A
DC Current – Measure ³	(0 to 100) nA (0 to 1) μA (0 to 10) μA (0 to 100) μA (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A (1 to 10) A (10 to 100) A	65 $\mu\text{A/A} + 31 \text{pA}$ 32 $\mu\text{A/A} + 31 \text{pA}$ 16 $\mu\text{A/A} + 78 \text{pA}$ 16 $\mu\text{A/A} + 0.62 \text{nA}$ 16 $\mu\text{A/A} + 3.9 \text{nA}$ 17 $\mu\text{A/A} + 39 \text{nA}$ 28 $\mu\text{A/A} + 390 \text{nA}$ 87 $\mu\text{A/A} + 7.8 \mu\text{A}$ 29 $\mu\text{A/A}$ 71 $\mu\text{A/A}$	Agilent 3458A Guildline 9711A & 3458A

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
DC Resistance – Generate ³	(0 to 11) Ω	38 μΩ/Ω + 0.78 mΩ	Fluke 5520A
	(11 to 33) Ω	23 μΩ/Ω + 1.2 mΩ	
(33 to 110) Ω	22 μΩ/Ω + 1.1 mΩ		
(110 to 330) Ω	22 μΩ/Ω + 1.6 mΩ		
(0.33 to 1.1) kΩ	22 μΩ/Ω + 1.6 mΩ		
(1.1 to 3.3) kΩ	22 μΩ/Ω + 16 mΩ		
(3.3 to 11) kΩ	22 μΩ/Ω + 16 mΩ		
(11 to 33) kΩ	24 μΩ/Ω + 0.16 Ω		
(33 to 110) kΩ	23 μΩ/Ω + 0.16 Ω		
(110 to 330) kΩ	27 μΩ/Ω + 1.6 Ω		
(0.33 to 1.1) MΩ	27 μΩ/Ω + 1.6 Ω		
(1.1 to 3.3) MΩ	59 μΩ/Ω + 23 Ω		
(3.3 to 11) MΩ	0.10 mΩ/Ω + 39 Ω		
(11 to 33) MΩ	0.21 mΩ/Ω + 1.9 kΩ		
(33 to 110) MΩ	0.40 mΩ/Ω + 2.3 kΩ		
(110 to 330) MΩ	2.4 mΩ/Ω + 78 kΩ		
(330 to 1100) MΩ	12 mΩ/Ω + 0.39 MΩ		
Fixed Points	0.33 mΩ	0.44 μΩ	Guildline 9711A
	1.0 mΩ	2.5 μΩ	
	10 mΩ	1.7 μΩ	
	100 mΩ	23 μΩ	
DC Resistance – Measure ³	(0 to 10) Ω	14 μΩ/Ω + 39 μΩ	Fluke 3458A
(10 to 100) Ω	14 μΩ/Ω + 0.39 mΩ		
100 Ω to 1 kΩ	12 μΩ/Ω + 0.39 mΩ		
(1 to 10) kΩ	11 μΩ/Ω + 3.9 mΩ		
(10 to 100) kΩ	12 μΩ/Ω + 39 mΩ		
(0.1 to 1) MΩ	17 μΩ/Ω + 1.6 Ω		
(1 to 10) MΩ	43 μΩ/Ω + 78 Ω		
(10 to 100) MΩ	0.40 mΩ/Ω + 0.78 kΩ		
(100 to 1200) MΩ	4.8 mΩ/Ω + 7.8 kΩ		

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Voltage – Generate ³			
(1 to 32.999) mV	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	0.62 mV/V + 4.7 μV 0.12 mV/V + 4.7 μV 0.16 mV/V + 4.7 μV 0.78 mV/V + 4.7 μV 2.7 mV/V + 9.3 μV 6.2 mV/V + 39 μV	Fluke 5520A
(33 to 329.999) mV	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	0.23 mV/V + 6.2 μV 0.11 mV/V + 6.2 μV 0.12 mV/V + 6.2 μV 0.27 mV/V + 6.2 μV 0.62 mV/V + 25 μV 1.6 mV/V + 54 μV	
(0.33 to 3.29999) V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	0.23 mV/V + 39 μV 0.12 mV/V + 47 μV 0.15 mV/V + 47 μV 0.23 mV/V + 39 μV 0.54 mV/V + 97 μV 1.9 mV/V + 0.47 mV	
(3.3 to 32.9999) V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.23 mV/V + 0.50 mV 0.12 mV/V + 0.47 mV 0.19 mV/V + 0.47 mV 0.27 mV/V + 0.47 mV 0.70 mV/V + 1.2 mV	
(33 to 329.999) V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.15 mV/V + 1.6 mV 0.16 mV/V + 4.7 mV 0.19 mV/V + 4.7 mV 0.23 mV/V + 4.7 mV 1.6 mV/V + 39 mV	
(330 to 1000) V	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.23 mV/V + 7.8 mV 0.20 mV/V + 7.8 mV 0.23 mV/V + 7.8 mV	

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Voltage ³ – 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 kHz to 1 MHz	0.27 μV/V + 2.3 μV 0.19 μV/V + 0.85 μV 0.25 μV/V + 0.85 μV 0.78 μV/V + 0.85 μV 3.9 μV/V + 0.85 μV 3.1 μV/V + 3.9 μV	HP 3458A
(10 to 100) 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 300 kHz to 1 MHz	0.13 μV/V + 3.1 μV 84 μV/V + 1.6 μV 0.11 μV/V + 1.6 μV 0.23 μV/V + 1.6 μV 0.62 μV/V + 1.6 μV 2.5 μV/V + 7.8 μV 7.9 μV/V + 7.8 μV	
(0.1 to 1) 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	90 μV/V + 0.31 mV 55 μV/V + 0.16 mV 0.11 mV/V + 0.16 mV 0.23 mV/V + 0.16 mV 0.62 mV/V + 0.16 mV 2.5 mV/V + 0.78 mV 7.9 mV/V + 0.78 mV	
(1 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	90 μV/V + 0.31 mV 55 μV/V + 0.16 mV 0.11 mV/V + 0.16 mV 0.23 mV/V + 0.16 mV 0.62 mV/V + 0.16 μV 2.5 mV/V + 0.78 mV 7.9 mV/V + 0.78 mV	
(10 to 100) 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	0.17 mV/V + 3.1 mV 0.16 mV/V + 1.6 mV 0.16 mV/V + 1.6 mV 0.27 mV/V + 1.6 mV 0.93 mV/V + 1.6 mV 3.2 mV/V + 7.8 mV 12 mV/V + 7.8 mV	
(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	0.32 mV/V + 31 mV 0.31 mV/V + 16 mV 0.47 mV/V + 16 mV 0.93 mV/V + 16 mV 2.3 mV/V + 16 mV	
700 V to 85 kV	60 Hz	5.9 mV	High voltage divider w/ DMM

Parameter/Range	Frequency	CMC ^{2, 4} (±)	Comments
AC Current – Generate ³			
(29 to 329.99) μA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	1.6 mA/A + 78 nA 1.2 mA/A + 78 nA 0.99 mA/A + 78 nA 2.3 mA/A + 0.12 μA 6.2 mA/A + 0.16 μA 12 mA/A + 0.31 μA	Fluke 5520A
(0.33 to 3.2999) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	1.6 mA/A + 0.12 μA 0.98 mA/A + 0.12 μA 0.79 mA/A + 0.12 μA 1.6 mA/A + 0.16 μA 3.9 mA/A + 0.23 μA 7.8 mA/A + 0.47 μA	
(3.3 to 32.999) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	1.4 mA/A + 1.6 μA 0.71 mA/A + 1.6 μA 0.34 mA/A + 1.6 μA 0.64 mA/A + 1.6 μA 1.6 mA/A + 2.3 μA 3.4 mA/A + 3.1 μA	
(33 to 329.99) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	1.5 mA/A + 16 μA 0.71 mA/A + 16 μA 0.33 mA/A + 16 μA 0.78 mA/A + 39 μA 1.6 mA/A + 78 μA 3.1 mA/A + 0.16 mA	
(0.33 to 1.099 99) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	1.4 mA/A + 78 μA 0.44 mA/A + 78 μA 4.7 mA/A + 0.78 mA 19 mA/A + 3.9 mA	
(1.1 to 2.999 99) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	1.4 mA/A + 78 μA 0.49 mA/A + 78 μA 4.7 mA/A + 0.78 mA 19 mA/A + 3.9 mA	
(3 to 10.9999) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.47 mA/A + 1.6 mA 0.78 mA/A + 1.6 mA 23 mA/A + 1.6 mA	
(11 to 20.5) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.94 mA/A + 3.9 mA 1.2 mA/A + 3.9 mA 23 mA/A + 3.9 mA	

Parameter/Range	Frequency	CMC ^{2, 4} (\pm)	Comments
Capacitance – Generate ³ (0.19 to 1.1) nF (1.1 to 3.3) nF (3.3 to 11) nF (11 to 110) nF (110 to 330) nF (0.33 to 1.1) μ F (1.1 to 3.3) μ F (3.3 to 11) μ F (11 to 33) μ F (33 to 110) μ F (110 to 330) μ F (0.33 to 1.1) mF (1.1 to 3.3) mF (3.3 to 11) mF (11 to 33) mF (33 to 110) mF	10 Hz to 10 kHz 10 Hz to 3 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz (10 to 600) Hz (10 to 300) Hz (10 to 150) Hz (10 to 120) Hz (10 to 80) Hz Up to 80 Hz Up to 50 Hz Up to 20 Hz Up to 2 Hz Up to 0.6 Hz Up to 0.2 Hz	4.1 mF/F + 7.8 pF 3.9 mF/F + 7.8 pF 2 mF/F + 7.8 pF 1.9 mF/F + 77.5 pF 2 mF/F + 0.23 nF 1.9 mF/F + 0.78 nF 2 mF/F + 2.3 nF 1.9 mF/F + 7.8 nF 3.1 mF/F + 23 nF 3.5 mF/F + 78 nF 3.5 mF/F + 0.23 μ F 3.5 mF/F + 0.78 μ F 3.5 mF/F + 2.3 μ F 3.5 mF/F + 7.8 μ F 5.8 mF/F + 23 μ F 8.5 mF/F + 78 μ F	Fluke 5520A
AC Current – Measure ³ Up to 100 μ A (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A	(10 to 20) Hz (20 to 45) Hz 45 Hz to 5 kHz (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz (0.10 to 5) kHz (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz (0.10 to 5) kHz (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz (0.10 to 5) kHz (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz (0.10 to 5) kHz	3.1 mA/A + 23 nA 1.2 mA/A + 23 nA 0.52 mA/A + 23 nA 3.1 mA/A + 0.16 μ A 1.2 mA/A + 0.16 μ A 0.5 mA/A + 0.16 μ A 0.25 mA/A + 0.16 μ A 3.1 mA/A + 1.6 μ A 1.2 mA/A + 1.6 μ A 0.47 mA/A + 1.6 μ A 0.25 mA/A + 1.6 μ A 3.1 mA/A + 16 μ A 1.2 A/A + 16 μ A 0.47 mA/A + 16 μ A 0.25 mA/A + 16 μ A 3.1 mA/A + 0.16 mA 1.2 mA/A + 0.16 mA 0.64 mA/A + 0.16 mA 0.80 mA/A + 0.16 mA	HP 3458A

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Current – Measure ³ (1 to 100) A	DC to 1 kHz	0.13 %	2575A shunt & DMM

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Electrical Calibration of Thermocouple Indicators & Simulators ³ –			Fluke 5520A
Type J	(-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C	0.25 °C 0.13 °C 0.12 °C 0.14 °C 0.18 °C	
Type K	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.26 °C 0.14 °C 0.13 °C 0.20 °C 0.31 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.50 °C 0.19 °C 0.13 °C 0.11 °C	
Electrical Calibration of RTD Indicators ³ –			Fluke 5520A
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	0.085 °C 0.12 °C 0.12 °C 0.11 °C 0.097 °C 0.11 °C 0.20 °C	
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	0.064 °C 0.076 °C 0.075 °C 0.089 °C 0.095 °C 0.17 °C	

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Electrical Calibration of RTD Indicators ³ – (cont)			
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	0.21 °C 0.060 °C 0.068 °C 0.070 °C 0.077 °C 0.084 °C 0.090 °C 0.13 °C 0.19 °C	Fluke 5520A
Pt 385, 200 Ω	(-200 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	0.041 °C 0.043 °C 0.044 °C 0.051 °C 0.098 °C 0.11 °C 0.11 °C 0.13 °C	
Pt 385, 500 Ω	(-200 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	0.036 °C 0.043 °C 0.044 °C 0.051 °C 0.066 °C 0.066 °C 0.073 °C 0.088 °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 400) °C (400 to 600) °C (600 to 630) °C	0.029 °C 0.029 °C 0.036 °C 0.042 °C 0.050 °C 0.18 °C 0.057 °C 0.18 °C	
PtNi 385, 120 Ω (Ni120)	(-80 to 0) °C (0 to 100) °C (100 to 260) °C	0.081 °C 0.11 °C 0.11 °C	
Cu 427, 10 Ω	(-100 to 260) °C	0.69 °C	

Parameter/Equipment	Range	CMC ^{2, 4, 5} (±)	Comments
Oscilloscope ³ – DC Voltage 50 Ω 1 MΩ	(0 to 6.6) V (0 to 130) V	1.9 mV/V + 24 μV 0.37 mV/V + 24 μV	Fluke 5520A/SC1100
Squarewave 10 Hz to 10 kHz 50 Ω 1 MΩ	1 mV to 6.6 V _{p-p} 1 mV to 130 V _{p-p}	1.9 mV/V + 24 μV 0.78 mV/V + 24 μV	Fluke 5520A / SC1100
Resistance – Measure	(40 to 90) Ω (0.6 to 1.5) MΩ	0.79 mΩ/Ω 0.79 mΩ/Ω	Fluke 5520A / SC1100
Rise Time – Generate	(200 to 300) ps 1 kHz to 2 MHz	19 ps	
	(200 to 350) ps 2 MHz to 10 MHz	19 ps	
Time Marker – Generate	1 ns to 20 ms 50 ms to 5 s Non-cardinal point	6.2 μs/s 7.8 ms/s + 0.0019 % 39 μs/s	

III. Mechanical

Parameter/Equipment	Range	CMC ^{2, 5, 7} (±)	Comments
Scales & Balances ³	(1 to 500) mg (0.5 to 3) g (3 to 10) g (10 to 50) g (50 to 100) g (100 to 300) g (300 to 500) g (0.5 to 1) kg (1 to 2) kg 2 to 3 kg 3 to 8.1 kg	12 μg 49 μg 66 μg 0.15 mg 0.30 mg 0.63 mg 1.4 mg 2.9 mg 6.1 mg 6.8 mg 10 mg	Class 1 weights
	(0.25 to 0.5) lb (0.5 to 10) lb (20 to 25) lb (25 to 50) lb (50 to 100) lb (100 to 250) lb (250 to 350) lb	0.000 019 lb 0.0019 lb 0.0037 lb 0.0059 lb 0.0088 lb 0.014 lb 0.019 lb	Class F weights

Parameter/Equipment	Range	CMC ^{2, 5, 7} (±)	Comments
Torque – Indicating Devices ³	(5 to 50) ozf·in (15 to 200) ozf·in (5 to 50) lbf·in (40 to 400) lbf·in (100 to 1000) lbf·in (20 to 250) lbf·ft	0.60 % 0.32 % 0.30 % 0.31 % 0.46 % 0.43 %	Transducers: CDI 2000-4-02 CDI 2000-5-02 CDI 2000-400-02 (4 in 1) transducer
Speed – Measure ³			
Fixture: Linear Distance – Measure	(0 to 6) in Combined Calculation	200 μin 350 μin	Depth micrometer
Interval: Measure	(5 to 126) s	(0.027 + 0.017 <i>t</i>) ms	Counter
Calculated Speed	(2 to 50) in/min	(100 <i>r</i>) μin/min	Calculation (depth micrometer / counter)
Force – Measuring Equipment ³ –			
Tension	(0 to 10) lbf (10 to 20) lbf	0.0012 lbf 0.0058 lbf	Class 5 weights
Compression	(0 to 70) lbf (70 to 200) lbf	0.24 lbf 0.29 lbf	Force gauge
Pressure – Measuring Equipment ³	(-14 to 15) psi (0 to 2000) psi (0 to 3000) psi	0.0036 psi 0.51 psi 1.7 psi	Fluke 700P04 RPM1-A2000 Fluke 700G29
Pressure – Measuring Equipment ³	Up to 0.5 psig Up to 1.0 psig (0 to 7.5) psia (0 to 15) psia (0 to 150) psia (0 to 300) psia (0 to 750) psig (0 to 1500) psig	0.000 17 psig 0.000 12 psig 0.0009 psia 0.0018 psia 0.018 psia 0.035 psia 0.088 psig 0.18 psig	Mensor CPC 6000 0.5/1.0 PSIG 7.5/15 PSIA 150/300 PSIA 750/1500 PSIA

IV. Thermodynamics

Parameter/Equipment	Range	CMC ^{2,5,7} (±)	Comments
Temperature – Measure ³	(-78 to 300) °C	0.062 °C	Fluke 1552A
Relative Humidity – Measure ³	(20 to 95) % RH	1.3 %	Vaisala HMI 141 w/ HP46 probe

V. Time & Frequency

Parameter/Equipment	Frequency	CMC ^{2,5,7} (±)	Comments
Time Interval ³	(0.1 to 200) s	(18 + 4.7 <i>t</i>) ns	Agilent 53131A
Timers & Stopwatches – Measuring Equipment ³	(0 to 19.99) s/day	0.038 s/day	Helmut Klein timometer
	(1 to 86400) sec	0.039 s/day	Agilent 53131A
Frequency – Measure ³	0.001 Hz to 1 kHz (1 to 1000) kHz (1 to 225) MHz	0.22 mHz/Hz 1.8 μHz/Hz 0.18 μHz/Hz	Agilent 53131A
Frequency – Measuring Equipment ³	(0.01 to 119.99) Hz (120.0 1199.9) Hz	(0.05 + 0.0025 <i>f</i>) mHz (0.0023 + 0.0029 <i>f</i>) mHz	Fluke 5520A

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

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 stated measured values are determined using the indicated instrument (see Comments). This capability is suitable for the calibration of the devices intended to measure or generate the measured value in the ranges indicated. CMC's are expressed as either a specific value that covers the full range or as a percent or fraction of the reading plus a fixed floor specification.

⁵ In the statement of CMC, L is the numerical value of the nominal length of the device measured in inches. In the statement of CMC, % is percent of reading unless otherwise stated. In the statement of CMC, t represents the time in seconds and f represents frequency in units of Hz. In the statement of CMC, r is the numerical value of the nominal rate of speed in inches per minute. In statement of CMC, P is the numerical value of the measured pressure in pounds per square inch (PSI) and T is the value of the measured temperature in degrees Celsius ($^{\circ}\text{C}$).

⁶ This scope meets A2LA's *P112 Flexible Scope Policy*.

⁷ 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.

⁸ This laboratory meets *R205 – Specific Requirements: Calibration Laboratory Accreditation Program* for the types of dimensional tests listed above and is considered equivalent to that of a calibration.



Accredited Laboratory

A2LA has accredited

TEKTRONIX, INC.

N. Billerica, MA

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 1st day of August 2022.

A blue ink signature of the Vice President of Accreditation Services.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 2357.28
Valid to July 31, 2024

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