



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

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CALIBRATION

Valid To: March 31, 2025

Certificate Number: 2357.12

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations<sup>1,7</sup>:

I. Dimensional

Parameter / Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
Micrometers <sup>3</sup> –	Up to 4 in	(14 + 1.8L) µin	Grade 2 gage blocks
Flatness <sup>3</sup>	Up to 1 in	5.3 µin	Optical flat
Calipers <sup>3</sup>	Up to 4 in (4 to 6) in	(58 + 0.51L) µin (60 + 2L) µin	Grade 2 gage blocks

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC <sup>2,6</sup> (±)	Comments
DC Voltage – Generate <sup>3</sup>	(0 to 220) mV 220 mV to 2.2 V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1100) V	8.3 µV/V + 0.39 µV 5.3 µV/V + 0.62 µV 3.9 µV/V + 2.3 µV 6.6 µV/V + 3.9 µV 5.2 µV/V + 39 µV 6.7 µV/V + 0.39 mV	Fluke 5730A w/ 5725 amplifier
DC Voltage – Fixed Points – Measure & Generate <sup>3</sup>	100 mV 1 V 1.018 V 10 V 100 V 1000 V	1.5 µV/V 1.4 µV/V 1.2 µV/V 1.2 µV/V 1.4 µV/V 1.5 µV/V	732B 34420A 752A Fluke 57X0A

Parameter/Equipment	Range	CMC <sup>2, 6</sup> (±)	Comments
DC Voltage – Measure <sup>3</sup>	(0 to 200) mV (0.2 to 2) V (2 to 20) V (20 to 200) V (200 to 1050) V	6.4 μV/V + 0.10 μV 3.6 μV/V + 0.40 μV 3.5 μV/V + 4.0 μV 5.8 μV/V + 40 μV 7.4 μV/V + 0.53 mV	Fluke 8508A
DC Current – Generate <sup>3</sup>	(0 to 220) μA (0.22 to 2.2) mA (2.2 to 22) mA (22 to 220) mA (0.22 to 2.2) A (2.2 to 11) A  (3 to 11) A (11 to 20.5) A	39 μA/A + 5.4 nA 31 μA/A + 6.2 nA 32 μA/A + 39 nA 39 μA/A + 0.62 μA 71 μA/A + 12 μA 0.28 mA/A + 0.37 mA  0.39 mA/A + 0.39 mA 0.78 mA/A + 0.58 mA	Fluke 5730A w/5725 amplifier  Fluke 5522A
DC Current – Measure <sup>3</sup>	(0 to 200) μA (0.20 to 2.0) mA (2 to 20) mA (20 to 200) mA (0.2 to 2) A (2 to 20) A  (1 to 20) A (20 to 100) A (100 to 150) A	25 μA/A + 0.40 nA 20 μA/A + 4.0 nA 21 μA/A + 40 nA 48 μA/A + 0.80 μA 0.19 mA/A + 16 μA 0.40 mA/A + 0.40 mA  31 μA/A 75 μA/A + 78 μA 0.011 % + 0.23 mA	Fluke 8508A  Fluke 8508A & shunts
DC Resistance – Generate <sup>3</sup>	(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 3.299 999) 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 0.20 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

Parameter/Equipment	Range	CMC <sup>2, 6</sup> (±)	Comments
DC Resistance – Generate <sup>3</sup> (cont)			
Fixed Points	0 Ω 1 Ω 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 0.16 mΩ 0.22 mΩ 0.43 mΩ 0.99 mΩ 1.9 mΩ 6.9 mΩ 13 mΩ 65 mΩ 0.12 Ω 1.00 Ω 2.2 Ω 15 Ω 58 Ω 0.89 kΩ 1.6 kΩ 21 kΩ	Fluke 5730A
DC Resistance – Measure <sup>3</sup>	(0 to 2) Ω (2 to 20) Ω (20 to 200) Ω (0 to 2) kΩ (2 to 20) kΩ (20 to 200) kΩ (0.2 to 2) MΩ (2 to 20) MΩ	21 μΩ/Ω + 4 μΩ 15 μΩ/Ω + 14 μΩ 12 μΩ/Ω + 50 μΩ 12 μΩ/Ω + 0.50 mΩ 11 μΩ/Ω + 5.0 mΩ 12 μΩ/Ω + 50 mΩ 20 μΩ/Ω + 1.0 Ω 33 μΩ/Ω + 10 Ω	Fluke 8508A
High Voltage Mode	(20 to 200) MΩ (0 to 2) GΩ (2 to 20) GΩ	0.30 mΩ/Ω + 1.0 kΩ 0.24 mΩ/Ω + 0.10 MΩ 1.7 mΩ/Ω + 10 MΩ	

Parameter/Range	Frequency	CMC <sup>2, 6</sup> ( $\pm$ )	Comments
AC Voltage – Generate <sup>3</sup>			
(0.2 to 2.2) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	1.9 mV/V + 3.9 $\mu$ V 0.86 mV/V + 3.9 $\mu$ V 0.86 mV/V + 3.9 $\mu$ V 1.5 mV/V + 3.9 $\mu$ V 2.1 mV/V + 4.7 $\mu$ V 3.5 mV/V + 9.3 $\mu$ V 5.2 mV/V + 19 $\mu$ V 6.6 mV/V + 19 $\mu$ V	Fluke 5730A w/ 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 500 kHz to 1 MHz	0.37 mV/V + 3.9 $\mu$ V 0.17 mV/V + 3.9 $\mu$ V 0.16 mV/V + 3.9 $\mu$ V 0.31 mV/V + 3.9 $\mu$ V 0.58 mV/V + 4.7 $\mu$ V 1.3 mV/V + 9.3 $\mu$ V 1.7 mV/V + 19 $\mu$ V 3.1 mV/V + 19 $\mu$ V	
(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	0.40 mV/V + 12 $\mu$ V 120 $\mu$ V/V + 6.2 $\mu$ V 66 $\mu$ V/V + 6.2 $\mu$ V 0.13 mV/V + 6.2 $\mu$ V 0.34 mV/V + 16 $\mu$ V 0.66 mV/V + 19 $\mu$ V 1.4 mV/V + 23 $\mu$ V 2.7 mV/V + 47 $\mu$ V	
(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 500 kHz to 1 MHz	0.51 mV/V + 39 $\mu$ V 88 $\mu$ V/V + 16 $\mu$ V 42 $\mu$ V/V + 7.8 $\mu$ V 72 $\mu$ V/V + 9.3 $\mu$ V 0.12 mV/V + 31 $\mu$ V 0.34 mV/V + 78 $\mu$ V 0.96 mV/V + 0.19 mV 1.7 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	0.4 mV/V + 0.39 mV 94 $\mu$ V/V + 0.16 mV 44 $\mu$ V/V + 54 $\mu$ V 75 $\mu$ V/V + 93 $\mu$ V 110 $\mu$ V/V + 0.19 mV 0.28 mV/V + 0.62 mV 0.98 mV/V + 1.9 mV 1.7 mV/V + 3.1 mV	

Parameter/Range	Frequency	CMC <sup>2,6</sup> (±)	Comments
AC Voltage – Generate <sup>3</sup> (cont)			
(22 to 220) V *Subject to 2.2 x 10 <sup>7</sup> Volt-Hz limitation	(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) kHz	0.45 mV/V + 3.9 mV 110 μV/V + 1.6 mV 57 μV/V + 0.54 mV 95 μV/V + 0.93 mV 0.16 mV/V + 2.3 mV 0.86 mV/V + 16 mV 4.2 mV/V + 39 mV 7.8 mV/V + 78 mV	Fluke 5730A w/ 5725A
(220 to 250) V	(15 to 50) Hz	0.28 mV/V + 16 mV	
(220 to 1000) V	(1 to 20) kHz (20 to 30) kHz	0.13 mV/V + 4.7 mV 0.47 mV/V + 8.5 mV	
(220 to 750) V	(0.03 to 50) kHz (50 to 100) kHz	0.47 mV/V + 8.5 mV 1.8 mV/V + 35 mV	
Absolute:			
(0 to 1.1) mV (1.1 to 3) mV (3 to 11) mV (11 to 33) mV (33 to 110) mV (110 to 330) mV (0.33 to 1.1) V (1.1 to 3.5) V	30 Hz to 500 kHz	6.3 mV/V + 1.6 μV 5.4 mV/V + 2.3 μV 5.4 mV/V + 6.2 μV 4.7 mV/V + 12 μV 4.7 mV/V + 31 μV 3.9 mV/V + 78 μV 3.9 mV/V + 0.31 mV 3.1 mV/V + 0.39 mV	Fluke 5730A Wideband
Flatness:			
Up to 1.1 mV	(10 to 30) Hz 30 Hz to 119.99 kHz (0.12 to 2) MHz (2 to 11.9) MHz (12 to 20) MHz (20 to 30) MHz	2.7 mV/V 0.96 mV/V 2.1 mV/V + 2.3 μV 3.9 mV/V + 2.3 μV 5.9 mV/V + 2.3 μV 14 mV/V + 12 μV	
(> 1.1 to 3) mV	(10 to 30) Hz 30 Hz to 119.99 kHz (0.12 to 2) MHz (2 to 11.9) MHz (12 to 20) MHz (20 to 30) MHz	2.6 mV/V 0.89 mV/V 1.22 mV/V + 2.3 μV 2.7 mV/V + 2.3 μV 4.5 mV/V + 2.3 μV 12 mV/V + 2.3 μV	
(> 3.3 to 11) mV	(10 to 30) Hz 30 Hz to 119.99 kHz (0.12 to 2) MHz (2 to 11.9) MHz (12 to 20) MHz (20 to 30) MHz	2.5 mV/V 0.9 mV/V 1 mV/V + 2.3 μV 1.9 mV/V + 2.3 μV 3.8 mV/V + 2.3 μV 8.5 mV/V + 2.3 μV	

Parameter/Range	Frequency	CMC <sup>2,6</sup> ( $\pm$ )	Comments
AC Voltage – Generate <sup>3</sup> (cont)			
Flatness: (> 11 to 33) mV	(10 to 30) Hz 30 Hz to 119.99 kHz (0.12 to 2) MHz (2 to 11.9) MHz (12 to 20) MHz (20 to 30) MHz	2.5 mV/V 0.89 mV/V 0.98 mV/V + 2.3 $\mu$ V 1.9 mV/V + 2.3 $\mu$ V 3.7 mV/V + 2.3 $\mu$ V 8.4 mV/V + 2.3 $\mu$ V	Fluke 5730A Wideband
(> 33 to 110) mV	(10 to 30) Hz 30 Hz to 119.99 kHz (0.12 to 2) MHz (2 to 11.9) MHz (12 to 20) MHz (20 to 30) MHz	2.5 mV/V 0.85 mV/V 0.99 mV/V + 2.3 $\mu$ V 1.9 mV/V + 2.3 $\mu$ V 3.7 mV/V + 2.3 $\mu$ V 8.4 mV/V + 2.3 $\mu$ V	
(> 110 to 330) mV	(10 to 30) Hz 30 Hz to 119.99 kHz (0.12 to 2) MHz (2 to 11.9) MHz (12 to 20) MHz (20 to 30) MHz	2.5 mV/V 0.84 mV/V 0.98 mV/V + 2.3 $\mu$ V 1.9 mV/V + 2.3 $\mu$ V 3.7 mV/V + 2.3 $\mu$ V 8.4 mV/V + 2.3 $\mu$ V	
> 330 mV to 1.1 V	(10 to 30) Hz 30 Hz to 119.99 kHz (0.12 to 2) MHz (2 to 11.9) MHz (12 to 20) MHz (20 to 30) MHz	2.5 mV/V 0.85 mV/V 0.89 mV/V + 2.3 $\mu$ V 1.9 mV/V + 2.3 $\mu$ V 3.7 mV/V + 2.3 $\mu$ V 8.4 mV/V + 2.3 $\mu$ V	
(1.1 to 3.5) V	(10 to 30) Hz 30 Hz to 119.99 kHz (0.12 to 2) MHz (2 to 11.9) MHz (12 to 20) MHz (20 to 30) MHz	2.5 mV/V 0.83 mV/V 0.98 mV/V + 2.3 $\mu$ V 1.9 mV/V + 2.3 $\mu$ V 3.7 mV/V + 2.3 $\mu$ V 8.4 mV/V + 2.3 $\mu$ V	
AC Voltage – Measure <sup>3</sup>			
Up to 199.99 mV (0.2 to 1.9999) V (2 to 19.999) V (20 to 199.99) V (200 to 1050) V	(1 to 10) Hz (1 to 10) Hz (1 to 10) Hz (1 to 10) Hz (1 to 10) Hz	0.64 mV/V + 14 $\mu$ V 0.93 mV/V + 0.12 mV 0.69 mV/V + 1.2 mV 0.82 mV/V + 12 mV 0.18 mV/V + 10 mV	Fluke 8508A

Parameter/Range	Frequency	CMC <sup>2,6</sup> (±)	Comments
AC Voltage – Measure <sup>3</sup>			
(0 to 2.2) mV	(10 to 20) Hz (20 to 40) Hz (0.04 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz	1.3 mV/V + 1.0 μV 0.58 mV/V + 1.0 μV 0.34 mV/V + 1.0 μV 0.63 mV/V + 1.6 μV 0.94 mV/V + 1.9 μV 1.8 mV/V + 3.1 μV 1.9 mV/V + 6.2 μV 2.7 mV/V + 6.2 μV	Fluke 5790A
(2.2 to 7) mV	(10 to 20) Hz (20 to 40) Hz (0.04 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz	0.66 mV/V + 1.0 μV 0.29 mV/V + 1.0 μV 0.17 mV/V + 1.0 μV 0.32 mV/V + 1.6 μV 0.48 mV/V + 1.9 μV 0.95 mV/V + 3.1 μV 1.0 mV/V + 6.2 μV 1.8 mV/V + 6.2 μV	
(7 to 22) mV	(10 to 20) Hz (20 to 40) Hz (0.04 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz	0.23 mV/V + 1.0 μV 0.16 mV/V + 1.0 μV 95 μV/V + 1.0 μV 0.17 mV/V + 1.6 μV 0.26 mV/V + 1.9 μV 0.65 mV/V + 3.1 μV 0.74 mV/V + 6.2 μV 1.4 mV/V + 6.2 μV	
(22 to 70) mV	(10 to 20) Hz (20 to 40) Hz (0.04 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz	0.19 mV/V + 1.2 μV 0.10 mV/V + 1.2 μV 63 μV/V + 1.2 μV 0.11 mV/V + 1.6 μV 0.22 mV/V + 1.9 μV 0.43 mV/V + 3.1 μV 0.57 mV/V + 6.2 μV 0.91 mV/V + 6.2 μV	

Parameter/Range	Frequency	CMC <sup>2,6</sup> (±)	Comments
AC Voltage – Measure <sup>3</sup>			
(70 to 220) mV	(10 to 20) Hz (20 to 40) Hz (0.04 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz	0.17 mV/V + 1.2 μV 74 μV/V + 1.2 μV 34 μV/V + 1.2 μV 60 μV/V + 1.6 μV 0.13 mV/V + 1.9 μV 0.21 mV/V + 3.1 μV 0.32 mV/V + 6.2 μV 0.80 mV/V + 6.2 μV	Fluke 5790A
(200 to 700) mV	(10 to 20) Hz (20 to 40) Hz (0.04 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz	0.17 mV/V + 1.2 μV 63 μV/V + 1.2 μV 28 μV/V + 1.2 μV 41 μV/V + 1.6 μV 64 μV/V + 1.9 μV 0.14 mV/V + 3.1 μV 0.24 mV/V + 6.2 μV 0.75 mV/V + 6.2 μV	
(0.7 to 2.2) V	(10 to 20) Hz (20 to 40) Hz (0.04 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz	0.16 mV/V 56 μV/V 21 μV/V 37 μV/V 56 μV/V 0.13 mV/V 0.20 mV/V 0.70 mV/V	
(2.2 to 7) V	(10 to 20) Hz (20 to 40) Hz (0.04 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz	0.16 mV/V 58 μV/V 20 μV/V 39 μV/V 65 μV/V 0.15 mV/V 0.31 mV/V 0.93 mV/V	
(7 to 22) V	(10 to 20) Hz (20 to 40) Hz (0.04 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz	0.16 mV/V 57 μV/V 24 μV/V 42 μV/V 67 μV/V 0.15 mV/V 0.31 mV/V 0.93 mV/V	



Parameter/Range	Frequency	CMC <sup>2,6</sup> ( $\pm$ )	Comments
AC Voltage – Measure <sup>3</sup> (cont)			
(22 to 70) V	(10 to 20) Hz (20 to 40) Hz (0.04 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz	0.16 mV/V 58 $\mu$ V/V 27 $\mu$ V/V 46 $\mu$ V/V 74 $\mu$ V/V 0.16 mV/V 0.32 mV/V 0.93 mV/V	Fluke 5790A
(70 to 220) V	(10 to 20) Hz (20 to 40) Hz (0.04 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz	0.16 mV/V 58 $\mu$ V/V 26 $\mu$ V/V 55 $\mu$ V/V 78 $\mu$ V/V 0.17 mV/V 0.39 mV/V	
(220 to 700) V	(10 to 20) Hz (20 to 40) Hz (0.04 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.16 mV/V 79 $\mu$ V/V 37 $\mu$ V/V 0.10 mV/V 0.39 mV/V	
(700 to 1000) V	(10 to 20) Hz (20 to 40) Hz (0.04 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.16 mV/V 80 $\mu$ V/V 37 $\mu$ V/V 0.10 mV/V 0.39 mV/V	
AC Voltage Flatness – Measure <sup>3</sup>			
(0 to 2.2) mV	(120 to 500) kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	4.7 mV/V + 1.9 $\mu$ V 4.7 mV/V + 1.9 $\mu$ V 4.7 mV/V + 1.9 $\mu$ V 4.9 mV/V + 1.9 $\mu$ V 5.5 mV/V + 1.9 $\mu$ V 7.4 mV/V + 2.7 $\mu$ V	Fluke 5790A, opt 003, wideband input (reference to 1 kHz)

Parameter/Range	Frequency	CMC <sup>2,6</sup> ( $\pm$ )	Comments
AC Voltage Flatness – Measure <sup>3</sup> (cont)			
(2.2 to 7) mV	(120 to 500) kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	3.9 mV/V + 6.2 $\mu$ V 3.9 mV/V + 6.2 $\mu$ V 4.0 mV/V + 6.2 $\mu$ V 4.1 mV/V + 6.2 $\mu$ V 4.5 mV/V + 6.2 $\mu$ V 5.2 mV/V + 6.2 $\mu$ V	Fluke 5790A, opt 003, wideband input (reference to 1 kHz)
(22 to 70) mV	(120 to 500) kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	4.0 mV/V + 23 $\mu$ V 4.0 mV/V + 23 $\mu$ V 4.0 mV/V + 23 $\mu$ V 4.1 mV/V + 23 $\mu$ V 4.5 mV/V + 23 $\mu$ V 5.2 mV/V + 23 $\mu$ V	
(70 to 220) mV	(120 to 500) kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	3.2 mV/V + 62 $\mu$ V 3.2 mV/V + 62 $\mu$ V 3.2 mV/V + 62 $\mu$ V 3.4 mV/V + 62 $\mu$ V 3.8 mV/V + 62 $\mu$ V 4.6 mV/V + 62 $\mu$ V	
(220 to 700) mV	(120 to 500) kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	3.2 mV/V + 0.23 mV 3.2 mV/V + 0.23 mV 3.3 mV/V + 0.23 mV 3.4 mV/V + 0.23 mV 3.8 mV/V + 0.23 mV 4.6 mV/V + 0.23 mV	
(0.7 to 2.2) V	(120 to 500) kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	2.8 mV/V + 0.31 mV 2.8 mV/V + 0.31 mV 2.9 mV/V + 0.31 mV 3.1 mV/V + 0.31 mV 3.5 mV/V + 0.31 mV 4.4 mV/V + 0.31 mV	
(2.2 to 7) V	(120 to 500) kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	2.8 mV/V + 0.62 mV 2.9 mV/V + 0.62 mV 2.9 mV/V + 0.62 mV 3.1 mV/V + 0.62 mV 3.6 mV/V + 0.62 mV 4.4 mV/V + 0.62 mV	

Parameter/Range	Frequency	CMC <sup>2,6</sup> (±)	Comments
AC Current – Generate <sup>3</sup>			
(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	0.27 mA/A + 16 nA 0.18 mA/A + 9.3 nA 0.11 mA/A + 7.8 nA 0.29 mA/A + 12 nA 1 mA/A + 62 nA	Fluke 5730A w/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	0.25 mA/A + 39 nA 0.17 mA/A + 31 nA 0.12 mA/A + 31 nA 0.21 mA/A + 0.10 µA 1 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	0.26 mA/A + 0.39 µA 0.17 mA/A + 0.31 µA 0.11 mA/A + 0.31 µA 0.2 mA/A + 0.54 µA 1 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	0.26 mA/A + 3.9 µA 0.17 mA/A + 3.1 µA 0.11 mA/A + 2.3 µA 0.2 mA/A + 3.1 µA 1 mA/A + 9.3 µA	
220 mA to 2.2 A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.26 mA/A + 31 µA 0.41 mA/A + 78 µA 6.2 mA/A + 0.16 mA	
(2.2 to 11) A	40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.4 mA/A + 0.13 mA 0.76 mA/A + 0.29 mA 2.8 mA/A + 0.58 mA	
(11 to 20.5) A	(10 to 100) Hz (0.1 to 1) kHz (1 to 5) kHz	0.96 mA/A + 3.9 mA 1.2 mA/A + 3.9 mA 23 mA/A + 3.9 mA	

Parameter/Range	Frequency	CMC <sup>2, 6</sup> (±)	Comments
AC Current – Measure <sup>3</sup>			
(9 to 199) µA	(10 to 20) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.42 mA/A + 20 nA 0.62 mA/A + 20 nA 0.66 mA/A + 20 nA 1.7 mA/A + 20 nA	Fluke 8508A
(0.2 to 1.9999) mA	(10 to 20) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.32 mA/A + 0.20 µA 0.91 mA/A + 0.20 µA 0.95 mA/A + 0.20 µA 1.9 mA/A + 0.20 µA	
(2 to 19.999) mA	(10 to 20) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.32 mA/A + 2.0 µA 0.80 mA/A + 2.0 µA 0.85 mA/A + 2.0 µA 2.7 mA/A + 2.0 µA	
(20 to 199.99) mA	(10 to 20) Hz 10 Hz to 10 kHz (10 to 30) kHz	0.33 mA/A + 20 µA 0.60 mA/A + 20 µA 2.7 mA/A + 20 µA	
(0.2 to 1.9999) A	(10 to 20) Hz 10 Hz to 10 kHz (10 to 30) kHz	0.34 mA/A + 0.20 mA 3.2 mA/A + 0.20 mA 3.4 mA/A + 0.20 mA	
(20 to 19.999) A	10 Hz to 2 kHz (2 to 10) kHz	0.47 mA/A + 2.0 mA 2.2 mA/A + 2.0 mA	
(2 to 19.999) A	10 Hz to 2 kHz (2 to 10) kHz	0.12 mA/A 0.15 mA/A	Fluke 8508A & Y5020
Capacitance – Generate <sup>3</sup>			
(220 to 399.9) pF	10 Hz to 10 kHz	6.5 fF/pF + 7.8 pF	Fluke 5522A
(0.4 to 1.0999) nF	10 Hz to 10 kHz	4.7 pF/nF + 7.8 pF	
(1.1 to 3.3) nF	10 Hz to 3 kHz	4.0 pF/nF + 7.8 pF	
(3.3 to 11) nF	10 Hz to 1 kHz	2.0 pF/nF + 7.8 pF	
(11 to 110) nF	10 Hz to 1 kHz	2.0 pF/nF + 78 pF	
(110 to 330) nF	10 Hz to 1 kHz	2.1 pF/nF + 230 pF	
(0.33 to 1.1) µF	(10 to 600) Hz	2.0 nF/µF + 0.78 nF	
(1.1 to 3.3) µF	(10 to 300) Hz	2.0 nF/µF + 2.3 nF	
(3.3 to 11) µF	(10 to 150) Hz	2.1 nF/µF + 7.8 nF	
(11 to 33) µF	(10 to 120) Hz	3.2 nF/µF + 23 nF	
(33 to 110) µF	(10 to 80) Hz	3.7 nF/µF + 78 nF	
(110 to 330) µF	(10 to 50) Hz	3.7 nF/µF + 230 nF	
(0.33 to 1.1) mF	(10 to 20) Hz	3.7 µF/mF + 0.78 µF	
(1.1 to 3.3) mF	(0 to 6) Hz	3.5 µF/mF + 2.3 µF	
(3.3 to 11) mF	(0 to 2) Hz	3.5 µF/mF + 7.8 µF	
(11 to 33) mF	(0 to 0.6) Hz	5.8 µF/mF + 23 µF	
(33 to 110) mF	(0 to 0.2) Hz	8.5 µF/mF + 78 µF	

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Electrical Calibration of Thermocouple Indicators <sup>3</sup> –			
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	0.26 °C 0.14 °C 0.13 °C 0.20 °C 0.31 °C	
Type R	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.45 °C 0.28 °C 0.26 °C 0.32 °C	
Type S	(0 to 250) °C (250 to 1000) °C (1000 to 1400) °C (1400 to 1767) °C	0.38 °C 0.28 °C 0.29 °C 0.36 °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	
Type U	(-200 to 0) °C (0 to 600) °C	0.44 °C 0.21 °C	
Electrical Calibration of RTD Indicators <sup>3</sup> –			
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 0.10 °C 0.11 °C 0.20 °C	Fluke 5522A
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 <sup>2</sup> (±)	Comments
Electrical Calibration of RTD Indicators <sup>3</sup> – (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 0.067 °C 0.070 °C 0.077 °C 0.084 °C 0.090 °C 0.13 °C 0.19 °C	Fluke 5522A
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 0.11 °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 0.88 °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 0.018 °C 0.057 °C 0.018 °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 0.018 °C 0.057 °C 0.018 °C	

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Electrical Calibration of RTD Indicators – (cont)			
Ni 120, 120 Ω	(-80 to 0) °C (0 to 100) °C (100 to 260) °C	0.081 °C 0.11 °C 0.11 °C	Fluke 5522A
Cu 427, 10 Ω	(-100 to 260) °C	0.69 °C	

Parameter/Range	Frequency	CMC <sup>2,6</sup> (±)	Comments
Distortion – Measure <sup>3</sup> (-99.9 to 0) dB	20 Hz to 20 kHz (20 to 100) kHz	1.2 dB 2.3 dB	Agilent/HP 8903B
Oscilloscopes <sup>3</sup> –			
Amplitude - DC Voltage 50 Ω load	1 mV <sub>p-p</sub> to 6.6 V <sub>p-p</sub>	1.9 mV/V + 31 μV	Fluke 5522A/SC 1100
1 MΩ load	1 mV <sub>p-p</sub> to 130 V <sub>p-p</sub>	0.39 mV/V + 31 μV	
Amplitude – Square Wave 50 Ω load	1 mV <sub>p-p</sub> to 6.6 V <sub>p-p</sub> 10 Hz to 10 kHz	1.6 mV/V + 31 μV	
1 MΩ load	1 mV <sub>p-p</sub> to 130 V <sub>p-p</sub> 10 Hz to 10 kHz	0.78 mV/V + 31 μV	
Bandwidth	5 mV to 5.5 V: 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (0.6 to 1.1) GHz	2.8 % 3.0 % 4.1 % 4.7 %	
Resistance	40 Ω to 1.5 MΩ	0.79 mΩ/Ω	
Rise Time – Generate	1 kHz to 2 MHz, (200 to 300) ps	19 ps	
	(2 to 10) MHz, (200 to 350) ps	19 ps	
Time Marker	1 ns to 20 ms 50 ms to 5 s Non-cardinal point	2.1 μs/s (19 + 39 <i>t</i> ) μs/s 39 μs/s	<i>t</i> = time in seconds

III. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC <sup>2,6</sup> (±)	Comments
RF Attenuation – Tuned RF Power Measure <sup>3</sup>			
(0 to -10) dB	100 kHz to 10 MHz	0.037 dB	FSMR3050 w/ NRP-Z37
(-5 to -10) dB		0.037 dB	
(-10 to -20) dB		0.040 dB	
(-15 to -20) dB		0.040 dB	
(-20 to -30) dB		0.043 dB	
(-25 to -30) dB		0.043 dB	
(-30 to -40) dB		0.047 dB	
(-35 to -40) dB		0.047 dB	
(-40 to -50) dB		0.052 dB	
(-45 to -50) dB		0.052 dB	
(-50 to -60) dB		0.056 dB	
(-55 to -60) dB		0.056 dB	
(-60 to -70) dB		0.061 dB	
(-65 to -70) dB		0.061 dB	
(-70 to -80) dB		0.066 dB	
(-75 to -80) dB		0.066 dB	
(-80 to -90) dB		0.073 dB	
(-85 to -90) dB		0.072 dB	
(-90 to -95) dB		0.079 dB	
(-95 to -100) dB		0.094 dB	
(-100 to -105) dB		0.085 dB	
(-105 to -110) dB		0.099 dB	
(-110 to -115) dB		0.19 dB	
(-115 to -120) dB		0.27 dB	
(-120 to -125) dB		0.35 dB	
(0 to -10) dB	10 MHz to 3.1 GHz	0.036 dB	
(-5 to -10) dB		0.036 dB	
(-10 to -20) dB		0.039 dB	
(-15 to -20) dB		0.039 dB	
(-20 to -30) dB		0.043 dB	
(-25 to -30) dB		0.043 dB	
(-30 to -40) dB		0.047 dB	
(-35 to -40) dB		0.047 dB	
(-40 to -50) dB		0.051 dB	
(-45 to -50) dB		0.051 dB	
(-50 to -60) dB		0.056 dB	
(-55 to -60) dB		0.056 dB	
(-60 to -70) dB		0.060 dB	
(-65 to -70) dB		0.060 dB	
(-70 to -80) dB		0.065 dB	
(-75 to -80) dB		0.065 dB	
(-80 to -90) dB		0.070 dB	
(-85 to -90) dB		0.071 dB	
(-90 to -95) dB		0.077 dB	
(-95 to -100) dB		0.078 dB	
(-100 to -105) dB		0.085 dB	
(-105 to -110) dB		0.096 dB	
(-110 to -115) dB		0.097 dB	
(-115 to -120) dB		0.10 dB	
(-120 to -125) dB		0.12 dB	



Parameter/Range	Frequency	CMC <sup>2,6</sup> (±)	Comments
RF Attenuation – Tuned RF Power Measure <sup>3</sup> (cont)			
(0 to -10) dB	(3.1 to 19.2) GHz	0.041 dB	FSMR3050 w/ NRP-Z37
(-5 to -10) dB		0.046 dB	
(-10 to -20) dB		0.049 dB	
(-15 to -20) dB		0.051 dB	
(-20 to -30) dB		0.054 dB	
(-25 to -30) dB		0.056 dB	
(-30 to -40) dB		0.059 dB	
(-35 to -40) dB		0.062 dB	
(-40 to -50) dB		0.061 dB	
(-45 to -50) dB		0.063 dB	
(-50 to -60) dB		0.067 dB	
(-55 to -60) dB		0.071 dB	
(-60 to -70) dB		0.069 dB	
(-65 to -70) dB		0.067 dB	
(-70 to -80) dB		0.070 dB	
(-75 to -80) dB		0.068 dB	
(-80 to -90) dB	0.076 dB		
(-85 to -90) dB	0.074 dB		
(-90 to -95) dB	0.079 dB		
(-95 to -100) dB	0.081 dB		
(-100 to -105) dB	0.086 dB		
(0 to -10) dB	(19.2 to 26.5) GHz	0.039 dB	
(-5 to -10) dB		0.044 dB	
(-10 to -20) dB		0.051 dB	
(-15 to -20) dB		0.045 dB	
(-20 to -30) dB		0.094 dB	
(-25 to -30) dB		0.085 dB	
(-30 to -40) dB		0.095 dB	
(-35 to -40) dB		0.098 dB	
(-40 to -50) dB		0.092 dB	
(-45 to -50) dB		0.090 dB	
(-50 to -60) dB		0.097 dB	
(-55 to -60) dB		0.095 dB	
(-60 to -70) dB		0.097 dB	
(-65 to -70) dB		0.11 dB	
(-70 to -80) dB		0.097 dB	
(-75 to -80) dB		0.11 dB	
(-80 to -90) dB	0.098 dB		
(-85 to -90) dB	0.097 dB		
(-90 to -95) dB	0.11 dB		
(-95 to -100) dB	0.11 dB		
(-100 to -105) dB	0.15 dB		
(0 to -10) dB	(26.5 to 40) GHz	0.11 dB	FSMR3050
(-5 to -10) dB		0.13 dB	
(-10 to -20) dB		0.14 dB	
(-15 to -20) dB		0.15 dB	
(-20 to -30) dB		0.15 dB	
(-25 to -30) dB		0.15 dB	
(-30 to -40) dB		0.15 dB	
(-35 to -40) dB		0.15 dB	
(-40 to -50) dB		0.17 dB	
(-45 to -50) dB		0.15 dB	
(-50 to -60) dB	0.16 dB		

Parameter/Range	Frequency	CMC <sup>2, 5, 6</sup> (±)	Comments
RF Attenuation – Tuned RF Power Measure <sup>3</sup> (cont) (-55 to -60) dB (-60 to -70) dB (-65 to -70) dB (-70 to -80) dB (-75 to -80) dB (-80 to -90) dB (-85 to -90) dB (-90 to -95) dB (-95 to -100) dB (-100 to -105) dB  (0 to -10) dB (-10 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB (-50 to -60) dB (-60 to -70) dB (-70 to -80) dB (-75 to -80) dB (-90 to -100) dB	(26.5 to 40) GHz  (40 to 50) GHz	0.19 dB 0.13 dB 0.16 dB 0.16 dB 0.17 dB 0.16 dB 0.16 dB 0.17 dB 0.16 dB 0.16 dB  0.62 dB 0.62 dB 0.63 dB 0.62 dB 0.62 dB 0.62 dB 0.62 dB 0.62 dB 0.65 dB 0.66 dB	FSMR3050
RF Power – Measure <sup>3</sup> (-30 to + 20) dBm  (-30 to + 20) dBm  (-70 to -20) dBm  (-20 to + 20) dBm  (-35 to + 20) dBm  1 mW reference	(100 to 500) kHz 500 kHz to 1 MHz 1 MHz to 2 GHz (2 to 4.2) GHz  (4 to 8) GHz (8 to 12) GHz (12 to 18) GHz  (10 to 30) MHz (0.03 to 4) GHz (4 to 6) GHz (6 to 10) GHz (10 to 12) GHz (12 to 14) GHz (14 to 15) GHz (15 to 18) GHz  (18 to 26.5) GHz  (10 to 100) MHz (> 0.10 to 2.4) GHz (> 2.4 to 8) GHz (> 8 to 12) GHz (> 12 to 18) GHz (> 18 to 26.5) GHz  50 MHz	2.5 % 1.5 % 1.3 % 1.8 %  1.9 % 2.0 % 2.1 %  2.5 % 2.7 % 2.7 % 2.9 % 2.8 % 2.7 % 2.8 % 3.5 %  4.1 %  0.034 dB 0.039 dB 0.055 dB 0.068 dB 0.089 dB 0.080 dB  0.59 %	HP 8482A w/ power meter  HP 8481A w/ power meter  HP 8484A w/ power meter  HP 8485A w/ power meter  NRP-Z55 w/ power meter  HP 8487B thermistor, Tegam 1830A

Parameter/Range	Frequency	CMC <sup>2, 5, 8</sup> (±)	Comments
RF Power – Generate <sup>3</sup>			
(20 to 24) dBm (14 to 20) dBm (-17 to +14) dBm (-48 to -17) dBm (-74 to -48) dBm (-84 to -74) dBm (-94 to -84) dBm	(0.01 to 100) kHz	0.023 dB 0.023 dB 0.024 dB 0.025 dB 0.16 dB 0.39 dB 0.45 dB	Fluke 96270A/LL/FF w/ leveling head
(20 to 24) dBm (14 to 20) dBm (-17 to + 14) dBm (-48 to -17) dBm (-74 to -48) dBm (-84 to -74) dBm (-94 to -84) dBm	(0.1 to 10) MHz	0.045 dB 0.042 dB 0.047 dB 0.047 dB 0.16 dB 0.39 dB 0.4 dB	
(20 to 24) dBm (0 to 20) dBm (-48 to 0) dBm (-54 to -48) dBm (-64 to -54) dBm (-74 to -64) dBm (-84 to -74) dBm (-94 to -84) dBm (-104 to -94) dBm (-114 to -104) dBm (-119 to -114) dBm (-129 to -119) dBm (-130 to -129) dBm	(10 to 128) MHz	0.047 dB 0.045 dB 0.047 dB 0.084 dB 0.084 dB 0.086 dB 0.087 dB 0.24 dB 0.55 dB 0.59 dB 0.61 dB 0.61 dB 0.98 dB	
(14 to 20) dBm (+4 to +14) dBm (-48 to +4) dBm (-54 to -48) dBm (-74 to -54) dBm (-84 to -74) dBm (-94 to -84) dBm (-119 to -94) dBm (-129 to -119) dBm (-130 to -129) dBm	(128 to 300) MHz	0.055 dB 0.061 dB 0.063 dB 0.085 dB 0.088 dB 0.24 dB 0.39 dB 1.2 dB 1.4 dB 2.4 dB	
(-48 to 20) dBm (-74 to -48) dBm (-84 to -74) dBm (-94 to -84) dBm (-104 to -94) dBm (-114 to -104) dBm (-119 to -114) dBm (-129 to -119) dBm (-130 to -129) dBm	(0.3 to 1.4) GHz	0.16 dB 0.32 dB 0.39 dB 0.78 dB 1.2 dB 1.3 dB 1.4 dB 1.3 dB 1.9 dB	

Parameter/Range	Frequency	CMC <sup>2, 8</sup> (±)	Comments
RF Power – Generate <sup>3</sup> (cont)			
(-48 to +14) dBm (-64 to -48) dBm (-74 to -64) dBm (-94 to -74) dBm	(1.4 to 3) GHz	0.24 dB 0.39 dB 0.41 dB 0.79 dB	Fluke 96270A/LL/FF w/ leveling head
(-17 to +4) dBm (-48 to -17) dBm (-64 to -48) dBm (-74 to -64) dBm (-84 to -74) dBm (-94 to -84) dBm	(3 to 4) GHz	0.24 dB 0.39 dB 0.39 dB 0.41 dB 0.79 dB 0.79 dB	
(-35 to 18) dB	1 kHz to 100 MHz > 100 MHz to 1.4 GHz	0.11 dBm 0.12 dBm	Fluke 96270A & NRP- Z55
(-35 to 14) dB	(1.4 to 2.4) GHz (> 2.4 to 8) GHz (> 8 to 12.4) GHz (> 12.4 to 18) GHz	0.14 dBm 0.17 dBm 0.17 dBm 0.23 dBm	
(-35 to 12) dB	(> 18 to 20) GHz (>20 to 26.5) GHz	0.26 dBm 0.34 dBm	
Thermistor Mount Calibration – Calibration Factor <sup>3</sup>	50 MHz reference  (9 to 50) kHz (50 to 100) kHz (0.1 to 2000) MHz (2.0 to 4.2) GHz (4.2 to 10.0) GHz (10.0 to 11.0) GHz (11.0 to 18.0) GHz	0.85 %  0.68 % 0.92 % 0.86 % 0.88 % 0.92 % 0.96 % 1.00 %	Tegam 2505A/1830A, Agilent EPM 441A
Power Sensor Calibration – Calibration Factor <sup>3</sup>	(10 to 50) MHz (50 to 80) MHz (0.08 to 2.7) GHz (2.7 to 4.6) GHz (4.6 to 5.6) GHz (5.6 to 9.2) GHz (9.2 to 11.4) GHz (11.4 to 12.4) GHz (12.4 to 13.25) GHz (13.25 to 19) GHz (19 to 22) GHz (22 to 29) GHz (29 to 34) GHz (34 to 39) GHz (39 to 43) GHz (43 to 49) GHz 49 GHz 50 GHz	1.5 % 1.0 % 1.1 % 1.2 % 1.3 % 1.4 % 1.5 % 1.6 % 1.7 % 1.8 % 1.9 % 2.4 % 2.7 % 3.0 % 3.5 % 3.9 % 4.4 % 4.7 %	Tegam 2505A/1830A, Agilent EPM 441A

Parameter/Range	Frequency	CMC <sup>2,4,6</sup> (±)	Comments
Reflection Coefficient <sup>3</sup> (Into 50 Ω)			
0 < ρ ≤ 0.2	30 kHz to 1.2 GHz (1.2 to 3) GHz (3 to 6) GHz	0.0019 ρ 0.0028 ρ 0.0053 ρ	Agilent 8753D/ Agilent 85032B
0.2 < ρ ≤ 0.4	30 kHz to 1.2 GHz (1.2 to 3) GHz (3 to 6) GHz	0.0022 ρ 0.0031 ρ 0.0056 ρ	
0.4 < ρ ≤ 0.6	30 kHz to 1.2 GHz (1.2 to 3) GHz (3 to 6) GHz	0.0027 ρ 0.0035 ρ 0.0062 ρ	
0.6 < ρ ≤ 0.8	30 kHz to 1.2 GHz (1.2 to 3) GHz (3 to 6) GHz	0.0033 ρ 0.0042 ρ 0.0078 ρ	
0.8 < ρ ≤ 1	30 kHz to 1.2 GHz (1.2 to 3) GHz (3 to 6) GHz	0.004 ρ 0.005 ρ 0.0091 ρ	
0.000 < ρ ≤ 0.0476	40 MHz to 2 GHz (> 2 to 20) GHz (> 20 to 40) GHz (> 40 to 50) GHz	0.0094 ρ 0.0095 ρ 0.018 ρ 0.021 ρ	Anritsu 37397C/ HP 85056A
0.0476 < ρ ≤ 0.1111	40 MHz to 2 GHz (> 2 to 20) GHz (> 20 to 40) GHz (> 40 to 50) GHz	0.013 ρ 0.013 ρ 0.021 ρ 0.026 ρ	Anritsu 37397C / HP 85054B/85052B/850 56A
0.1111 < ρ ≤ 0.200	40 MHz to 2 GHz (> 2 to 20) GHz (> 20 to 40) GHz (> 40 to 50) GHz	0.014 ρ 0.014 ρ 0.024 ρ 0.031 ρ	
0.200 < ρ ≤ 0.3333	40 MHz to 2 GHz (> 2 to 20) GHz (> 20 to 40) GHz (> 40 to 50) GHz	0.016 ρ 0.017 ρ 0.028 ρ 0.038 ρ	
0.3333 < ρ ≤ 0.500	40 MHz to 2 GHz (> 2 to 20) GHz (> 20 to 40) GHz (> 40 to 50) GHz	0.019 ρ 0.02 ρ 0.034 ρ 0.049 ρ	
Phase Modulation – Measure <sup>3</sup>			FSMR3050
Rate: 10 Hz to 10kHz	100 kHz to < 10 MHz	0.59 % Rdg + 0.0023 rad	
Rate: 10 Hz to 5 MHz	≥ 10 MHz to ≤ 50 GHz	0.59 % Rdg + 0.0023 rad	

Parameter/Range	Frequency	CMC <sup>2, 5, 6</sup> (±)	Comments
Amplitude Modulation – Measure <sup>3</sup>  Rate: (0.01 to 10) kHz; Depth: ≤ 5% Depth: > 5%  Rate: ≤ 100 kHz; Depth: ≤ 5% Depth: > 5%  Rate: > 100 kHz to ≤ 1 MHz; Depth: ≤ 5% Depth: > 5%	100 kHz to < 10 MHz  ≥ 10 MHz to ≤ 50 GHz	1.3 % 0.20 % + 0.0040 % Rdg  2.2 % 0.21 % + 0.0040 % Rdg  2.6 % 0.30 % + 0.0087 % Rdg	FSMR3050
Frequency Modulation – Measure <sup>3</sup>  Pk Deviation ≤ 50 kHz; Rate: (0.01 to 10) kHz  Pk Deviation ≤ 5 MHz; Rate: 10 Hz to 5 MHz  Pk Deviation ≤ 16 MHz; Rate: 10 Hz to 5 MHz	100 kHz to < 10 MHz  ≥ 10 MHz to < 1GHz  ≥ 1GHz to ≤ 50 GHz	0.68 % + 5.8 Hz  0.88 % + 5.8 Hz  0.59 % + 5.8 Hz	FSMR3050
Single Side-Band Phase Noise Measure <sup>3, 8</sup>  Carrier Frequency: 1 MHz to 8 GHz  (8 to 18) GHz	100 Hz Offset 1 kHz Offset 10 kHz Offset 20 kHz Offset 100 kHz Offset 1 MHz Offset 10 MHz Offset ≥ 30 MHz Offset  100 Hz Offset 1 kHz Offset 10 kHz Offset 20 kHz Offset 100 kHz Offset 1 MHz Offset 10 MHz Offset ≥ 30 MHz Offset	2.0 dB 1.7 dB 1.7 dB 1.6 dB 1.6 dB 2.1 dB 2.1 dB 2.1 dB  2.0 dB 1.7 dB 1.7 dB 1.6 dB 1.6 dB 2.1 dB 2.1 dB 2.2 dB	FSMR3050

Parameter/Range	Frequency	CMC <sup>2, 5, 6</sup> (±)	Comments
Single Side-Band Phase Noise Measure <sup>3, 8</sup>			FSMR3050
(18 to 26.5) GHz	100 Hz Offset	2.2 dB	
	1 kHz Offset	1.7 dB	
	10 kHz Offset	1.7 dB	
	20 kHz Offset	1.6 dB	
	100 kHz Offset	1.6 dB	
	1 MHz Offset	2.2 dB	
	10 MHz Offset	2.1 dB	
≥ 30 MHz Offset	2.1 dB		
(26.5 to 50) GHz	100 Hz Offset	2.2 dB	
	1 kHz Offset	1.7 dB	
	10 kHz Offset	1.7 dB	
	20 kHz Offset	1.6 dB	
	100 kHz Offset	1.6 dB	
	1 MHz Offset	2.1 dB	
	10 MHz Offset	2.1 dB	
≥ 30 MHz Offset	2.2 dB		

#### IV. Mechanical

Parameter / Equipment	Range	CMC <sup>2, 5, 8</sup> (±)	Comments
Torque – Measure Wrenches <sup>3</sup>	(5 to 50) lbf·in	0.30 %	CDI 5000ST w/ 4 in 1 transducer model 2000-400-02  CDI 2000-12-02
	(40 to 400) lbf·in	0.31 %	
	(100 to 1000) lbf·in	0.46 %	
	(20 to 250) lbf·ft	0.43 %	
	(60 to 600) lbf·ft	0.65 %	
Gage Pressure <sup>3</sup> – Pneumatic	(0.2 to 25) psig	0.0015 %	Ruska 2465
	(1.7 to 100) psig	0.0015 %	
	(2 to 1000) psig	0.0030 %	
Absolute Pressure <sup>3</sup> – Pneumatic	(0.2 to 25) psia	0.0015 %	Ruska 2465
	(1.7 to 100) psia	0.0015 %	
	(2 to 1000) psia	0.0030 %	
Scales & Balances <sup>3</sup>	(2 to 5) lb	0.0014 lb	Class F weights
	(5 to 10) lb	0.0017 lb	
	(10 to 25) lb	0.0031 lb	
	(25 to 50) lb	0.0064 lb	
	(50 to 100) lb	0.0088 lb	
	(100 to 350) lb	0.016 lb	
	(350 to 500) lb	0.018 lb	

V. Thermodynamic

Parameter/Equipment	Range	CMC <sup>2, 5, 8</sup> (±)	Comments
Relative Humidity – Measuring Equipment	(20 to 50) % RH (50 to 80) % RH (80 to 95) % RH	0.51 % 0.52 % 0.53 %	Thunder scientific 2500
Temperature – Measuring Equipment	(-190 to -80) °C (-80 to -38) °C (-38 to 0.0) °C (0.0 to 50) °C (50 to 150) °C (150 to 300) °C	27 m°C 17 m°C 17 m°C 17 m°C 8.1 m°C 28 m°C	Fluke 850C w/ Omega PR-11-3-100-1/4-6-E
Temperature – Measure <sup>3</sup>	(-90 to 100) °C (100 to 350) °C	0.034 °C 0.072 °C	PRT w/ Hart 850C
Relative Humidity <sup>3</sup> – Measure	(20 to 90) % RH	1.3 %	Vaisala HMI 141 w/ HP46 probe

VI. Time & Frequency

Parameter/Equipment	Range	CMC <sup>2, 4, 8</sup> (±)	Comments
Frequency <sup>3</sup> – Measure	0.1 Hz to 1 kHz (1 to 1000) kHz (1 to 225) MHz (0.1 to 3) GHz	0.12 mHz/Hz 0.64 nHz/Hz 0.59 nHz/Hz 0.59 nHz/Hz	Datum GPS w/ Agilent 53132A
Frequency – Measuring Equipment	10 MHz  0.001 Hz to 1 kHz 1 kHz to 20 MHz  (0.01 to 50) GHz	20 nHz + 0.6R  0.66 µHz/Hz 0.12 nHz/Hz  28 pHz/Hz	Datum GPS  Datum GPS w/ HP 33250A  Datum GPS w/ HP 83650B

<sup>1</sup> This laboratory offers commercial and field calibration service.



- <sup>2</sup> 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.
- <sup>3</sup> 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.
- <sup>4</sup> In the statement of CMC,  $L$  is the numerical value of the nominal length of the device measured in inches and  $R$  is the resolution of the unit under test. In the statement of CMC,  $D$  is nominal diameter in inches. The symbol  $\rho$  refers to the magnitude of the reflection value being read.
- <sup>5</sup> In the statement of CMC, percentages are to be read as percent of reading, unless noted otherwise.
- <sup>6</sup> 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. CMCs 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.
- <sup>7</sup> This scope meets A2LA's *P112 Flexible Scope Policy*.
- <sup>8</sup> 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.



# Accredited Laboratory

A2LA has accredited

**TEKTRONIX, INC.**

*Phoenix, AZ*

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/NCSLI 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 26<sup>th</sup> day of January 2023.

A blue ink signature of Mr. Trace McInturff, written over a horizontal line.

Mr. Trace McInturff, Vice President, Accreditation Services  
For the Accreditation Council  
Certificate Number 2357.12  
Valid to March 31, 2025

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