



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: April 30, 2024

Certificate Number: 2681.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations^{1, 10}:

I. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2, 7, 8} (±)	Comments
DC Voltage – Measure ³			
Fixed Points	1 V 10 V 100 V	0.69 $\mu\text{V/V}$ 2.3 $\mu\text{V/V}$ 8.5 $\mu\text{V/V}$	Fluke 732C, Fluke 8508A
Variable DC	(0 to 200) mV (0.2 to 2) V (2 to 20) V (20 to 200) V (200 to 1000) V	5.8 $\mu\text{V/V} + 0.10 \mu\text{V}$ 3.7 $\mu\text{V/V} + 0.40 \mu\text{V}$ 3.6 $\mu\text{V/V} + 4.0 \mu\text{V}$ 5.6 $\mu\text{V/V} + 40 \mu\text{V}$ 6.1 $\mu\text{V/V} + 500 \mu\text{V}$	Fluke 8508A
DC Voltage – Generate			
Fixed Points	0.1 V 1 V 10 V 100 V 1000 V	2.6 $\mu\text{V/V}$ 2.4 $\mu\text{V/V}$ 2.2 $\mu\text{V/V}$ 2.1 $\mu\text{V/V}$ 2.1 $\mu\text{V/V}$	Fluke 732C, Guildline 7520
Variable DC	(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	8.5 $\mu\text{V/V} + 0.40 \mu\text{V}$ 5.2 $\mu\text{V/V} + 0.70 \mu\text{V}$ 3.7 $\mu\text{V/V} + 2.5 \mu\text{V}$ 3.7 $\mu\text{V/V} + 4.0 \mu\text{V}$ 5.2 $\mu\text{V/V} + 40 \mu\text{V}$ 6.7 $\mu\text{V/V} + 400 \mu\text{V}$	Fluke 5730A

Parameter/Equipment	Range	CMC ^{2, 6, 7, 8} ($\pm$)	Comments
DC Current – Generate	(0 to 220) μ A (0.22 to 2.2) mA (2.2 to 22) mA (22 to 220) mA (0.22 to 2.2) A (2.2 to 20) A (20 to 100) A (1000 to 5000) A	41 μ A/A + 6.0 nA 36 μ A/A + 7.0 nA 36 μ A/A + 40 nA 46 μ A/A + 0.70 μ A 84 μ A/A + 12 μ A 0.017 % + 1.6 mA 0.013 % + 9.6 mA 0.65 % + 0.54 A	Fluke 5730A Fluke 5730A/52120A Fluke 5730A/52120A, coil 3KA, coil 6KA
DC Current – Measure ³	(1 to 10) μ A (10 to 100) μ A (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 (100 to 300) A (300 to 1000) A	32 μ A/A 30 μ A/A 24 μ A/A 24 μ A/A 25 μ A/A 44 μ A/A 70 μ A/A 0.047 % 0.023 % 0.054 %	Fluke 8508A, Guildline 9211A shunt Fluke 8508A, Ohm- Labs CS-1000

Parameter/Range	Frequency	CMC ^{2, 7, 8} (±)	Comments
AC Voltage – Measure ⁴			
600 µV 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	0.18 % + 1.3 µV 0.076 % + 1.3 µV 0.044 % + 1.3 µV 0.083 % + 2 µV 0.13 % + 2.5 µV 0.24 % + 4.0 µV 0.25 % + 8.0 µV 0.37 % + 8.0 µV	Fluke 5790B
(2.2 to 7) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	0.086 % + 1.3 µV 0.038 % + 1.3 µV 0.022 % + 1.3 µV 0.041 % + 2.0 µV 0.061 % + 2.5 µV	

Parameter/Range	Frequency	CMC ^{2, 6, 7, 8} ($\pm$)	Comments
AC Voltage – Measure ⁴ (cont)			Fluke 5790B
(2.2 to 7) mV	(100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.13 % + 4.0 μ V 0.14 % + 8.0 μ V 0.24 % + 8.0 μ V	
(7 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	0.030 % + 1.3 μ V 0.020 % + 1.3 μ V 0.012 % + 1.3 μ V 0.022 % + 2.0 μ V 0.032 % + 2.5 μ V 0.083 % + 4.0 μ V 0.092 % + 8.0 μ V 0.18 % + 8.0 μ V	
(22 to 70) 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	0.026 % + 1.5 μ V 0.014 % + 1.5 μ V 80 μ V/V + 1.5 μ V 0.015 % + 2.0 μ V 0.030 % + 2.5 μ V 0.058 % + 4.0 μ V 0.075 % + 8.0 μ V 0.12 % + 8.0 μ V	
(70 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	0.022 % + 1.5 μ V 89 μ V/V + 1.5 μ V 42 μ V/V + 1.5 μ V 79 μ V/V + 2.0 μ V 0.018 % + 2.5 μ V 0.028 % + 4.0 μ V 0.040 % + 8.0 μ V 0.11 % + 8.0 μ V	
(220 to 700) 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	0.022 % + 1.5 μ V 84 μ V/V + 1.5 μ V 36 μ V/V + 1.5 μ V 56 μ V/V + 2.0 μ V 83 μ V/V + 2.5 μ V 0.021 % + 4.0 μ V 0.032 % + 8.0 μ V 0.098 % + 8.0 μ V	
(0.7 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	0.021 % 70 μ V/V 26 μ V/V 49 μ V/V 73 μ V/V	

Parameter/Range	Frequency	CMC ^{2, 6, 7, 8} (±)	Comments
AC Voltage – Measure ⁴ (cont)			Fluke 5790B
(0.7 to 2.2) V	(100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.019 % 0.028 % 0.094 %	
(2.2 to 7) 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	0.021 % 71 µV/V 26 µV/V 53 µV/V 84 µV/V 0.021 % 0.041 % 0.13 %	
(7 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 500 kHz to 1 MHz	0.021 % 71 µV/V 30 µV/V 50 µV/V 83 µV/V 0.021 % 0.041 % 0.13 %	
(22 to 70) 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	0.021 % 72 µV/V 36 µV/V 65 µV/V 99 µV/V 0.022 % 0.042 % 0.12 %	
(70 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	0.021 % 72 µV/V 36 µV/V 71 µV/V 0.010 % 0.022 % 0.050 %	
(220 to 700) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	0.020 % 99 µV/V 45 µV/V 0.014 % 0.051 %	

Parameter/Range	Frequency	CMC ^{2, 6, 7, 8} ($\pm$)	Comments
AC Voltage – Measure ⁴ (cont) (700 to 1000) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	0.020 % 99 μ V/V 46 μ V/V 0.014 % 0.051 %	Fluke 5790B
AC Voltage – Generate (0.22 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	0.037 % + 4.0 μ V 0.022 % + 4.0 μ V 0.023 % + 4.0 μ V 0.053 % + 4.0 μ V 0.075 % + 5.0 μ V 0.13 % + 10 μ V 0.17 % + 20 μ V 0.34 % + 20 μ V	Fluke 5730A
(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	0.026 % + 4.0 μ V 0.010 % + 4.0 μ V 98 μ V/V + 4.0 μ V 0.023 % + 4.0 μ V 0.053 % + 5.0 μ V 0.11 % + 10 μ V 0.15 % + 20 μ V 0.30 % + 20 μ 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	0.025 % + 12 μ V 0.010 % + 7.0 μ V 64 μ V/V + 7.0 μ V 0.013 % + 7.0 μ V 0.032 % + 17 μ V 0.067 % + 20 μ V 0.14 % + 25 μ V 0.28 % + 45 μ 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	0.025 % + 40 μ V 99 μ V/V + 15 μ V 51 μ V/V + 8.0 μ V 73 μ V/V + 10 μ V 90 μ V/V + 30 μ V 0.035 % + 80 μ V 0.10 % + 0.20 mV 0.18 % + 0.30 mV	

Parameter/Range	Frequency	CMC ^{2, 7, 8} (±)	Comments
AC Voltage – Generate (cont)			
(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 500 kHz to 1 MHz	0.026 % + 0.40 mV 98 µV/V + 0.15 mV 52 µV/V + 50 µV 73 µV/V + 0.10 mV 88 µV/V + 0.20 mV 0.027 % + 0.60 mV 0.10 % + 2.0 mV 0.16 % + 3.2 mV	Fluke 5730A
(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	0.026 % + 4.0 mV 0.010 % + 1.5 mV 60 µV/V + 0.60 mV 89 µV/V + 1.0 mV 0.016 % + 2.5 mV	Fluke 5730A, 5725A
(220 to 750) V	50 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz (30 to 50) kHz (50 to 100) kHz	82 µV/V + 3.5 mV 0.017 % + 6.0 mV 0.061 % + 11 mV 0.061 % + 11 mV 0.23 % + 45 mV	
(750 to 1100) V	50 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz	82 µV/V + 3.5 mV 0.017 % + 6.0 mV 0.061 % + 11 mV	
AC Voltage – Measure Wideband ⁴			
(0.7 to 2.2) mV	10 Hz to 500 kHz 500 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz (30 to 50) MHz	0.44 % + 1.5 µV 0.35 % + 2.5 µV 0.37 % + 2.5 µV 0.41 % + 2.5 µV 0.56 % + 3.5 µV 0.75 % + 3.5 µV	5790B, option 05 wideband input – 50 Ω
(2.2 to 7) mV	10 Hz to 500 kHz 500 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz (30 to 50) MHz	0.37 % + 7.0 µV 0.35 % + 8.0 µV 0.36 % + 8.0 µV 0.37 % + 8.0 µV 0.44 % + 8.0 µV 0.50 % + 8 µV	
(7 to 22) mV	10 Hz to 500) kHz 500 kHz to 2 MHz (2 to 10) MHz	0.38 % + 13 µV 0.38 % + 13 µV 0.39 % + 13 µV	

Parameter/Range	Frequency	CMC ^{2, 7, 8} ($\pm$)	Comments
AC Voltage – Measure Wideband ⁴ (cont)			
(7 to 22) mV	(10 to 20) MHz (20 to 30) MHz (30 to 50) MHz	0.40 % + 13 μ V 0.46 % + 13 μ V 0.58 % + 13 μ V	5790B, option 05 wideband input – 50 Ω
(22 to 70) mV	10 Hz to 500 kHz 500 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz (30 to 50) MHz	0.38 % + 30 μ V 0.38 % + 30 μ V 0.39 % + 30 μ V 0.40 % + 30 μ V 0.46 % + 30 μ V 0.59 % + 30 μ V	
(70 to 220) mV	10 Hz to 500 kHz 500 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz (30 to 50) MHz	0.31 % + 80 μ V 0.31 % + 80 μ V 0.31 % + 80 μ V 0.33 % + 80 μ V 0.40 % + 80 μ V 0.54 % + 80 μ V	
(220 to 700) mV	10 Hz to 500 kHz 500 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz (30 to 50) MHz	0.30 % + 0.30 mV 0.31 % + 0.30 mV 0.31 % + 0.30 mV 0.32 % + 0.30 mV 0.40 % + 0.30 mV 0.54 % + 0.30 mV	
(0.7 to 2.2) V	10 Hz to 500 kHz 500 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz (30 to 50) MHz	0.27 % + 0.40 mV 0.28 % + 0.40 mV 0.29 % + 0.40 mV 0.31 % + 0.40 mV 0.44 % + 0.40 mV 0.65 % + 0.4 mV	
(2.2 to 7) V	10 Hz to 500 kHz 500 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz (30 to 50) MHz	0.27 % + 0.80 mV 0.28 % + 0.80 mV 0.28 % + 0.80 mV 0.30 % + 0.80 mV 0.38 % + 0.80 mV 0.54 % + 0.80 mV	

Parameter/Range	Frequency	CMC ^{2, 7, 8} ($\pm$)	Comments
AC Voltage – Generate Wideband			
(0.3 to 1.1) mV	(10 to 30) Hz 30 Hz to 500 kHz 500 kHz to 2 MHz (2 to 12) MHz (12 to 20) MHz (20 to 30) MHz (30 to 50) MHz	0.62 % + 2.0 μ V 0.58 % + 2.0 μ V 0.37 % + 5.0 μ V 0.45 % + 5.0 μ V 0.55 % + 5.0 μ V 0.76 % + 17 μ V 1.9 % + 17 μ V	Fluke 5730A, option 05 wideband output – 50 Ω
(1.1 to 3) mV	(10 to 30) Hz 30 Hz to 500 kHz 500 kHz to 2 MHz (2 to 12) MHz (12 to 20) MHz (20 to 30) MHz (30 to 50) MHz	0.57 % + 3.0 μ V 0.53 % + 3.0 μ V 0.44 % + 6.0 μ V 0.50 % + 6.0 μ V 0.58 % + 6.0 μ V 1.2 % + 6.0 μ V 2.3 % + 6 μ V	
(3 to 11) mV	(10 to 30) Hz 30 Hz to 500 kHz 500 kHz to 2 MHz (2 to 12) MHz (12 to 20) MHz (20 to 30) MHz (30 to 50) MHz	0.57 % + 8.0 μ V 0.53 % + 8.0 μ V 0.51 % + 11 μ V 0.53 % + 11 μ V 0.59 % + 11 μ V 0.90 % + 11 μ V 1.6 % + 11 μ V	
(11 to 33) mV	(10 to 30) Hz 30 Hz to 500 kHz 500 kHz to 2 MHz (2 to 12) MHz (12 to 20) MHz (20 to 30) MHz (30 to 50) MHz	0.51 % + 16 μ V 0.46 % + 16 μ V 0.46 % + 19 μ V 0.47 % + 19 μ V 0.54 % + 19 μ V 0.88 % + 19 μ V 1.6 % + 19 μ V	
(33 to 110) mV	(10 to 30) Hz 30 Hz to 500 kHz 500 kHz to 2 MHz (2 to 12) MHz (12 to 20) MHz (20 to 30) MHz (30 to 50) MHz	0.51 % + 40 μ V 0.46 % + 40 μ V 0.46 % + 43 μ V 0.48 % + 43 μ V 0.54 % + 43 μ V 0.89 % + 43 μ V 1.6 % + 43 μ V	
(110 to 330) mV	(10 to 30) Hz 30 Hz to 500 kHz 500 kHz to 2 MHz (2 to 12) MHz	0.45 % + 0.10 mV 0.45 % + 0.10 mV 0.45 % + 0.11 mV 0.47 % + 0.11 mV	

Parameter/Range	Frequency	CMC ^{2, 6, 7, 8} ($\pm$)	Comments
AC Voltage – Generate Wideband (cont)			
(110 to 330) mV	(12 to 20) MHz (20 to 30) MHz (30 to 50) MHz	0.54 % + 0.11 mV 0.88 % + 0.11 mV 1.6 % + 0.11 mV	Fluke 5730A, option 05 wideband output – 50 Ω
(0.33 to 1.1) V	(10 to 30) Hz 30 Hz to 500 kHz 500 kHz to 2 MHz (2 to 12) MHz (12 to 20) MHz (20 to 30) MHz (30 to 50) MHz	0.44 % + 0.4 mV 0.38 % + 0.40 mV 0.39 % + 0.41 mV 0.41 % + 0.41 mV 0.49 % + 0.41 mV 0.85 % + 0.41 mV 1.6 % + 0.41 mV	
(1.1 to 3.5) V	(10 to 30) Hz 30 Hz to 500 kHz 500 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz (30 to 50) MHz	0.39 % + 0.50 mV 0.31 % + 0.50 mV 0.32 % + 0.51 mV 0.35 % + 0.51 mV 0.44 % + 0.51 mV 0.83 % + 0.51 mV 1.58 % + 0.51mV	
AC Voltage – Measure Flatness with 1 kHz Reference ⁴			
(0.7 to 2.2) mV	(10 to 30) Hz 30 Hz to 120 kHz 120 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz (30 to 50) MHz	0.54 % 0.53 % 0.54 % 0.57 % 0.61 % 0.65 % 1.1 %	5790B, option 05 wideband input – 50 Ω
(2.2 to 7) mV	(10 to 30) Hz 30 Hz to 120 kHz 120 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz (30 to 50) MHz	0.49 % 0.49 % 0.49 % 0.49 % 0.51 % 0.51 % 0.64 %	
(7 to 22) mV	(10 to 30) Hz 30 Hz to 120 kHz 120 kHz to 2 MHz	0.45 % 0.44 % 0.45 %	

Parameter/Range	Frequency	CMC ^{2, 6, 7, 8} (±)	Comments
AC Voltage – Measure Flatness with 1 kHz Reference ⁴ (cont)			
(7 to 22) mV	(2 to 10) MHz	0.45 %	5790B, option 05 wideband input – 50 Ω
	(10 to 20) MHz	0.45 %	
	(20 to 30) MHz	0.53 %	
	(30 to 50) MHz	0.65 %	
(22 to 70) mV	(10 to 30) Hz	0.44 %	
	30 Hz to 2 MHz	0.43 %	
	(2 to 10) MHz	0.44 %	
	(10 to 20) MHz	0.45 %	
	(20 to 30) MHz	0.51 %	
	(30 to 50) MHz	0.64 %	
(70 to 220) mV	(10 to 30) Hz	0.39 %	
	30 Hz to 500 kHz	0.38 %	
	500 kHz to 2 MHz	0.38 %	
	(2 to 10) MHz	0.39 %	
	(10 to 20) MHz	0.39 %	
	(20 to 30) MHz	0.47 %	
	(30 to 50) MHz	0.60 %	
(220 to 700) mV	(10 to 30) Hz	0.40 %	
	30 Hz to 120 kHz	0.39 %	
	120 kHz to 2 MHz	0.39 %	
	(2 to 10) MHz	0.40 %	
	(10 to 20) MHz	0.41 %	
	(20 to 30) MHz	0.47 %	
	(30 to 50) MHz	0.61 %	
(0.7 to 2.2) V	(10 to 30) Hz	0.30 %	
	30 Hz to 500 kHz	0.29 %	
	500 kHz to 2 MHz	0.29 %	
	(2 to 10) MHz	0.30 %	
	(10 to 20) MHz	0.31 %	
	(20 to 30) MHz	0.40 %	
	(30 to 50) MHz	0.55 %	
(2.2 to 7) V	(10 to 30) Hz	0.31 %	
	30 Hz to 500 kHz	0.30 %	
	500 kHz to 2 MHz	0.30 %	
	(2 to 10) MHz	0.31 %	
	(10 to 20) MHz	0.32 %	
	(20 to 30) MHz	0.40 %	
	(30 to 50) MHz	0.55 %	

Parameter/Range	Frequency	CMC ^{2, 7, 8} ($\pm$)	Comments
AC Current – Measure ³			
(20 to 200) μ A	10 Hz to 10 kHz	0.034 % + 0.020 μ A	Fluke 8508A
(0.2 to 2) mA	10 Hz to 10 kHz	0.031 % + 0.20 μ A	
(2 to 20) mA	10 Hz to 10 kHz	0.032 % + 2.0 μ A	
(20 to 200) mA	10 Hz to 10 kHz	0.031 % + 20 μ A	
(0.2 to 2) A	10 Hz to 2 kHz (2 to 10) kHz	0.063 % + 200 μ A 0.087 % + 200 μ A	
(2 to 20) A	10 Hz to 2 kHz (2 to 10) kHz	0.084 % + 2.0 mA 0.26 % + 2.0 mA	
AC Current – Generate			
(9 to 220) μ A	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.026 % + 16 nA 0.017 % + 10 nA 0.012 % + 8.0 nA 0.032 % + 12 nA 0.12 % + 65 nA	Fluke 5730A
(0.22 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	0.027 % + 40 nA 0.017 % + 35 nA 0.011 % + 35 nA 0.021 % + 110 nA 0.11 % + 650 nA	
(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	0.028 % + 400 nA 0.018 % + 350 nA 0.011 % + 350 nA 0.021 % + 550 nA 0.11 % + 5.0 μ A	
(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	0.028 % + 4.0 μ A 0.018 % + 3.5 μ A 0.012 % + 2.5 μ A 0.022 % + 3.5 μ A 0.11 % + 10 μ A	
(0.22 to 2) A	(10 to 850) Hz 850 Hz to 6 kHz (6 to 10) kHz	0.012 % + 40 μ A 0.041 % + 80 μ A 0.71 % + 0.16 mA	
(2 to 20) A	(10 to 850) Hz 850 Hz to 6 kHz	0.011 % + 0.4 mA 0.041 % + 0.8 mA	
(20 to 120) A	(10 to 850) Hz 850 Hz to 6 kHz	0.012 % + 2.4 mA 0.032 % + 4.8 mA	

Parameter/Range	Frequency	CMC ^{2, 6, 7, 8} (±)	Comments
AC Current – Generate (cont) (120 to 6000) A	(1 to 100) Hz	0.54 % + 0.55 A	Fluke 5730A/52120A, coil 3KA, Coil 6KA
AC Current High Frequency – Generate 1 A	DC (1 to ≤10) Hz (10 to ≤40) Hz (40 to ≤55) Hz (55 to ≤100) Hz (100 to ≤ 400) Hz (0.4 to ≤ 1) kHz (1 to ≤ 2) kHz (2 to ≤ 10) kHz (10 to ≤ 30) kHz (30 to ≤ 70) kHz (70 to ≤ 100) kHz	0.015 % 0.22 % 0.075 % 0.072 % 0.072 % 0.044 % 0.044 % 0.045 % 0.075 % 0.15 % 0.37 % 0.37 %	Fluke 8508A, Fluke A40B-100A, Clarke- Hess 8100, single current loop
5 A	DC (1 to ≤ 10) Hz (10 to ≤ 40) Hz (40 to ≤ 55) Hz (55 to ≤ 100) Hz (100 to ≤ 400) Hz (0.4 to ≤ 1) kHz (1 to ≤ 2) kHz (2 to ≤ 10) kHz (10 to ≤ 30) kHz (30 to ≤ 70) kHz (70 to ≤ 100) kHz	0.014 % 0.061 % 0.032 % 0.029 % 0.029 % 0.024 % 0.024 % 0.025 % 0.032 % 0.064 % 0.15 % 0.15 %	
10 A	DC (1 to ≤ 10) Hz (10 to ≤ 40) Hz (40 to ≤ 55) Hz (55 to ≤ 100) Hz (100 to ≤ 400) Hz (0.4 to ≤ 1) kHz (1 to ≤ 2) kHz (2 to ≤ 10) kHz (10 to ≤ 30) kHz (30 to ≤ 70) kHz (70 to ≤ 100) kHz	0.014 % 0.061 % 0.032 % 0.029 % 0.029 % 0.024 % 0.024 % 0.025 % 0.032 % 0.064 % 0.15 % 0.15 %	Fluke 8508A, Fluke A40B-100A, Clarke- Hess 8100, 2x current loop

Parameter/Range	Frequency	CMC ^{2, 6, 7, 8} (±)	Comments
AC Current High Frequency – Generate (cont)			
10 A	DC	0.014 %	Fluke 8508A, Fluke A40B-100A, Clarke- Hess 8100, single current loop
	(1 to ≤ 10) Hz	0.042 %	
	(10 to ≤ 40) Hz	0.027 %	
	(40 to ≤ 55) Hz	0.024 %	
	(55 to ≤ 100) Hz	0.024 %	
	(100 to ≤ 400) Hz	0.022 %	
	(0.4 to ≤ 1) kHz	0.022 %	
	(1 to ≤ 2) kHz	0.023 %	
	(2 to ≤ 10) kHz	0.027 %	
	(10 to ≤ 30) kHz	0.053 %	
	(30 to ≤ 60) kHz	0.12 %	
20 A	DC	0.014 %	
	(1 to ≤ 10) Hz	0.033 %	
	(10 to ≤ 40) Hz	0.024 %	
	(40 to ≤ 55) Hz	0.022 %	
	(55 to ≤ 100) Hz	0.022 %	
	(100 to ≤ 400) Hz	0.021 %	
	(0.4 to ≤ 1) kHz	0.021 %	
	(1 to ≤ 2) kHz	0.021 %	
	(2 to ≤ 10) kHz	0.024 %	
	(10 to ≤ 30) kHz	0.048 %	
30 A	DC	0.013 %	
	(1 to ≤ 10) Hz	0.076 %	
	(10 to ≤ 40) Hz	0.027 %	
	(40 to ≤ 55) Hz	0.024 %	
	(55 to ≤ 100) Hz	0.024 %	
	(100 to ≤ 400) Hz	0.023 %	
	(0.4 to ≤ 1) kHz	0.023 %	
	(1 to ≤ 2) kHz	0.024 %	
	(2 to ≤ 10) kHz	0.027 %	
	(10 to ≤ 25) kHz	0.047 %	
40 A	DC	0.012 %	
	(1 to ≤ 10) Hz	0.061 %	
	(10 to ≤ 40) Hz	0.024 %	
	(40 to ≤ 55) Hz	0.022 %	
	(55 to ≤ 100) Hz	0.022 %	
	(100 to ≤ 400) Hz	0.021 %	
	(0.4 to ≤ 1) kHz	0.021 %	
	(1 to ≤ 2) kHz	0.022 %	
	(2 to ≤ 10) kHz	0.025 %	
	(10 to ≤ 20) kHz	0.042 %	

Parameter/Range	Frequency	CMC ^{2, 6, 7, 8} (±)	Comments
AC Current High Frequency – Generate (cont)			
50 A	DC (1 to ≤ 10) Hz (10 to ≤ 40) Hz (40 to ≤ 55) Hz (55 to ≤ 100) Hz (100 to ≤ 400) Hz (0.4 to ≤ 1) kHz (1 to ≤ 2) kHz (2 to ≤ 10) kHz (10 to ≤ 15) kHz	0.011 % 0.053 % 0.023 % 0.020 % 0.020 % 0.019 % 0.019 % 0.020 % 0.023 % 0.039 %	Fluke 8508A, Fluke A40B-100A, Clarke- Hess 8100, single current loop
60 A	DC (1 to ≤ 10) Hz (10 to ≤ 40) Hz (40 to ≤ 55) Hz (55 to ≤ 100) Hz (100 to ≤ 400) Hz (0.4 to ≤ 1) kHz (1 to ≤ 2) kHz (2 to ≤ 10) kHz	0.0097 % 0.047 % 0.021 % 0.019 % 0.019 % 0.017 % 0.017 % 0.018 % 0.021 %	
70 A	DC (1 to ≤ 10) Hz (10 to ≤ 40) Hz (40 to ≤ 55) Hz (55 to ≤ 100) Hz (100 to ≤ 400) Hz (0.4 to ≤ 1) kHz (1 to ≤ 2) kHz (2 to ≤ 10) kHz	0.0081 % 0.043 % 0.020 % 0.017 % 0.017 % 0.016 % 0.016 % 0.017 % 0.020 %	
80 A	DC (1 to ≤ 10) Hz (10 to ≤ 40) Hz (40 to ≤ 55) Hz (55 to ≤ 100) Hz (100 to ≤ 400) Hz (0.4 to ≤ 1) kHz (1 to ≤ 2) kHz (2 to ≤ 10) kHz	0.0063 % 0.040 % 0.019 % 0.016 % 0.016 % 0.015 % 0.015 % 0.016 % 0.019 %	

Parameter/Range	Frequency	CMC ^{2, 6, 7, 8} (±)	Comments
AC Current High Frequency – Generate (cont)			
90 A	DC (1 to ≤ 10) Hz (10 to ≤ 40) Hz (40 to ≤ 55) Hz (55 to ≤ 100) Hz (100 to ≤ 400) Hz (0.4 to ≤ 1) kHz (1 to ≤ 2) kHz (2 to ≤ 8) kHz	0.0047 % 0.037 % 0.018 % 0.015 % 0.015 % 0.014 % 0.014 % 0.015 % 0.018 %	Fluke 8508A, Fluke A40B-100A, Clarke-Hess 8100, single current loop
100 A	DC (1 to ≤ 10) Hz (10 to ≤ 40) Hz (40 to ≤ 55) Hz (55 to ≤ 100) Hz (100 to ≤ 400) Hz (0.4 to ≤ 1) kHz (1 to ≤ 2) kHz (2 to ≤ 8) kHz	0.0039 % 0.035 % 0.017 % 0.015 % 0.015 % 0.013 % 0.013 % 0.015 % 0.018 %	
500 A	DC (1 to ≤ 10) Hz (10 to ≤ 40) Hz (40 to ≤ 55) Hz (55 to ≤ 100) Hz (100 to ≤ 400) Hz (0.4 to ≤ 1) kHz (1 to ≤ 2) kHz	0.0039 % 0.035 % 0.017 % 0.015 % 0.015 % 0.013 % 0.013 % 0.015 %	Fluke 8508A, Fluke A40B-100A, Clarke-Hess 8100, 5x current loop
AC Power – Simulated 41.8 Kilowatts (5 to 120) kW	60 Hz (45 to 1000) Hz	39 watts 25 watts + (0.0015 · W)	Fluke 5522A PF = 1
AC Voltage/Current Phase – Generate Voltage vs. Voltage (0 to 90)°	(10 to 65) Hz (65 to 500) Hz (0.5 to 1) kHz	0.095° 0.21° 0.40°	Fluke 5522A

Parameter/Equipment	Range	CMC ^{2, 6, 7, 8} ($\pm$)	Comments
AC Voltage/Current Phase – Generate (cont.)			
Voltage vs. Current (0 to 90)°	(10 to 65) Hz (65 to 500) Hz	0.093° 0.22°	Fluke 5522A
Resistance – Generate			
Variable	(0 to 10.999) Ω (11 to 32.9999) Ω (33 to 109.9999) Ω (110 to 329.999) Ω (0.33 to 1.099 999) k Ω (1.1 to 3.299 999) k Ω (3.3 to 10.999 99) k Ω (11 to 32.999 99) k Ω (33 to 109.9999) k Ω (110 to 329.9999) k Ω (0.33 to 1.099 999) M Ω (1.1 to 3.299 999) M Ω (3.3 to 10.999 99) M Ω (11 to 32.999 99) M Ω (33 to 109.9999) M Ω (110 to 329.9999) M Ω (330 to 1100) M Ω	12 $\mu\Omega/\Omega$ + 0.78 m Ω 13 $\mu\Omega/\Omega$ + 1.2 m Ω 20 $\mu\Omega/\Omega$ + 1.1 m Ω 21 $\mu\Omega/\Omega$ + 1.6 m Ω 22 $\mu\Omega/\Omega$ + 1.6 m Ω 22 $\mu\Omega/\Omega$ + 16 m Ω 23 $\mu\Omega/\Omega$ + 16 m Ω 22 $\mu\Omega/\Omega$ + 0.16 Ω 23 $\mu\Omega/\Omega$ + 0.16 Ω 25 $\mu\Omega/\Omega$ + 1.6 Ω 26 $\mu\Omega/\Omega$ + 1.6 Ω 46 $\mu\Omega/\Omega$ + 24 Ω 0.011 % + 39 Ω 0.018 % + 1.9 k Ω 0.040 % + 2.3 k Ω 0.23 % + 78 k Ω 0.69 % + 0.39 M Ω	Fluke 5522A
Fixed Points	1 m Ω 10 m Ω 100 m Ω	0.042 % 59 $\mu\Omega/\Omega$ 43 $\mu\Omega/\Omega$	Guildline 9211A shunt
	1 Ω 1.9 Ω 10 Ω /19 Ω 100 Ω /190 Ω 1 k Ω /1.9 k Ω 10 k Ω 19 k Ω 100 k Ω 190 k Ω 1 M Ω 1.9 M Ω 10 M Ω 19 M Ω 100 M Ω	97 $\mu\Omega/\Omega$ 96 $\mu\Omega/\Omega$ 25 $\mu\Omega/\Omega$ 11 $\mu\Omega/\Omega$ 6.8 $\mu\Omega/\Omega$ 6.8 $\mu\Omega/\Omega$ 6.9 $\mu\Omega/\Omega$ 8.8 $\mu\Omega/\Omega$ 9.0 $\mu\Omega/\Omega$ 14 $\mu\Omega/\Omega$ 19 $\mu\Omega/\Omega$ 42 $\mu\Omega/\Omega$ 50 $\mu\Omega/\Omega$ 0.011 %	Fluke 5730A

Parameter/Range	Frequency	CMC ^{2, 6, 7, 8} (±)	Comments
Resistance – Generate (cont)			
Fixed Points	1 GΩ 10 GΩ 100 GΩ 1 TΩ	0.81 % 1.0 % 3.1 % 5.4 %	IET VRS-100-10-1K-ROT
Resistance – Measure			
Variable	(0.2 to 2) Ω (2 to 20) Ω (20 to 200) Ω (0.2 to 2) kΩ (2 to 20) kΩ (20 to 200) kΩ (0.2 to 2) MΩ (2 to 20) MΩ (20 to 200) MΩ (0.2 to 2) GΩ (2 to 20) GΩ	19 μΩ/Ω + 4.0 μΩ 10 μΩ/Ω + 14 μΩ 8.4 μΩ/Ω + 50 μΩ 8.2 μΩ/Ω + 0.5 mΩ 8.2 μΩ/Ω + 5.0 mΩ 8.4 μΩ/Ω + 50 mΩ 9.9 μΩ/Ω + 1.0 Ω 21 μΩ/Ω + 10Ω 68 μΩ/Ω + 1.0 kΩ 0.019 % + 0.1 MΩ 0.16 % + 10 MΩ	Fluke 8508A
Fixed Points	0.00033 Ω 0.001 Ω 0.01 Ω 0.1 Ω 1 kΩ 10 kΩ 100 kΩ	0.057 % 0.054 % 0.067 % 43 μΩ/Ω 3.9 μΩ/Ω 1.3 μΩ/Ω 3.9 μΩ/Ω	Fluke 8508A/Guildline 9211A shunt Fluke 8508A/ ESI SR-104
Capacitance – Generate			
(0.19 to 0.3999) nF (0.4 to 1.0999) nF (1.1 to 3.2999) nF (3.3 to 10.999) nF (11 to 32.999) nF (33 to 109.999) nF (110 to 329.999) nF (0.33 to 1.0999) μF (1.1 to 3.2999) μF (3.3 to 10.9999) μF (11 to 32.9999) μF (33 to 109.999) μF (110 to 329.999) μF	(0.01 to 10) kHz (0.01 to 10) kHz (0.01 to 3) kHz (0.01 to 1) kHz (0.01 to 1) kHz (0.01 to 1) kHz (0.01 to 1) kHz (10 to 600) Hz (10 to 300) Hz (10 to 150) Hz (10 to 120) Hz (10 to 80) Hz (0 to 50) Hz	0.42 % + 7.8 pF 0.18 % + 7.8 pF 0.33 % + 7.8 pF 0.18 % + 7.8 pF 0.13 % + 78 pF 0.18 % + 78 pF 0.18 % + 78 pF 0.18 % + 0.24 nF 0.18 % + 0.78 nF 0.18 % + 2.4 nF 0.19 % + 7.8 nF 0.30 % + 24 nF 0.35 % + 78 nF 0.35 % + 0.24 μF	Fluke 5522A

Parameter/Range	Frequency	CMC ^{2, 6, 7, 8} (±)	Comments
Capacitance – Generate (cont)			
(0.33 to 1.099 99) mF	(0 to 20) Hz	0.35 % + 0.78 µF	Fluke 5522A
(1.1 to 3.2999) mF	(0 to 6) Hz	0.33 % + 2.4 µF	
(3.3 to 10.9999) mF	(0 to 2) Hz	0.34 % + 7.8 µF	
(11 to 32.999) mF	(0 to 0.6) Hz	0.57 % + 24 µF	
(33 to 110) mF	(0 to 0.2) Hz	0.84 % + 78 µF	
Fixed Points			
1 pF	1 kHz to 1 MHz	0.017 %	Agilent 16380A capacitor set
	2 MHz	0.027 %	
	3 MHz	0.044 %	
	4 MHz	0.065 %	
	5 MHz	0.089 %	
	10 MHz	0.25 %	
	13 MHz	0.37 %	
10 pF	1 kHz to 1 MHz	0.011 %	
	2 MHz/3 MHz	0.011 %	
	4 MHz/5 MHz	0.012 %	
	10 MHz	0.016 %	
	13 MHz	0.019 %	
100 pF	1 kHz to 1 MHz	0.011 %	
	2 MHz/3 MHz	0.012 %	
	4 MHz	0.014 %	
	5 MHz	0.017 %	
	10 MHz	0.035 %	
	13 MHz	0.050 %	
1000 pF	1 kHz to 1 MHz	0.012 %	
	2 MHz	0.015 %	
	3 MHz	0.030 %	
	4 MHz	0.046 %	
	5 MHz	0.063 %	
	10 MHz	0.19 %	
	13 MHz	0.28 %	
0.01 µF	(100/120) Hz	0.014 %	Agilent 16380C capacitor set
	(1/10/100) kHz	0.014 %	
0.1 µF	(100/120) Hz/1 kHz	0.014 %	
	(1/10/100) kHz	0.014 %	

Parameter/Range	Frequency	CMC ^{2, 6, 7, 8} (±)	Comments
Capacitance – Generate (cont)			
Fixed Points 1 µF	(100/120) Hz (1/10) kHz 100 kHz	0.014 % 0.014 % 0.015 %	Agilent 16380C capacitor set
10 µF	(100/120) Hz/1 kHz 10 kHz 100 kHz	0.014 % 0.021 % 0.70 %	

II. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC ^{2, 6, 7, 8} (±)	Comments
Amplitude Modulation – Measure			
Rate: 10 Hz to 50 Hz Depths: (5 to 99) %	100 kHz to 10 MHz	1.8 %	R&S FSMR
Rate: 50 Hz to 10 kHz Depths: (5 to 99) %		0.87 %	Keysight E444X series opt 233
Rate: 10 Hz to 50 Hz Depths: (5 to 99) %	10 MHz to 3 GHz	1.2 %	R&S FSMR
Rate: 50 Hz to 90 Hz Depths: (5 to 20) %		1.2 %	R&S FSMR
Depths: (20 to 99) %		0.58 %	Keysight E444X series opt 233
Rate: 90 Hz to 150 Hz Depths: (5 to 99) %		0.53 %	R&S FSMR
Rate: 150 Hz to 50 kHz Depths: (5 to 20) %		1.2 %	R&S FSMR
Depths: (20 to 99) %		0.58 %	Keysight E444X series opt 233
Rate: 50 kHz to 100 kHz Depths: (5 to 20) %		1.8 %	R&S FSMR
Depths: (20 to 99) %		0.58 %	Keysight E444X series opt 233

Parameter/Range	Frequency	CMC ^{2, 6, 7, 8} (±)	Comments
Amplitude Modulation – Measure (cont)			
Rate: 10 Hz to 90 Hz Depths: (5 to 99) %	(3 to 50) GHz	1.2 %	R&S FSMR
Rate: 90 Hz to 150 Hz Depths: (5 to 99) %		0.53 %	
Rate: 150 Hz to 50 Hz Depths: (5 to 99) %		1.2 %	
Rate: 50 kHz to 100 kHz Depths: (5 to 99) %		1.8 %	
Bandwidth: ≤ 2 kHz Depths:	3 Hz to 50 GHz		Keysight E444X series N7800 TME Method
(≥1 to 10) %		(0.085 to 0.19) %	
(≥10 to 20) %		(0.19 to 0.31) %	
(≥20 to 30) %		(0.31 to 0.41) %	
(≥30 to 40) %		(0.41 to 0.49) %	
(≥40 to 50) %		(0.49 to 0.55) %	
(≥50 to 60) %		(0.55 to 0.50) %	
(≥60 to 70) %		(0.50 to 0.40) %	
(≥70 to 80) %		(0.40 to 0.28) %	
(≥80 to 90) %		(0.28 to 0.15) %	
(≥90 to 99) %		(0.15 to 0.016) %	
Bandwidth: >2 to < 10 kHz Depths:			
(≥1 to 10) %		(0.081 to 0.15) %	
(≥10 to 20) %		(0.15 to 0.23) %	
(≥20 to 30) %		(0.23 to 0.30) %	
(≥30 to 40) %		(0.30 to 0.35) %	
(≥40 to 50) %		(0.35 to 0.39) %	
(≥50 to 60) %		(0.39 to 0.34) %	
(≥60 to 70) %		(0.34 to 0.27) %	
(≥70 to 80) %		(0.27 to 0.19) %	
(≥80 to 90) %		(0.19 to 0.10) %	
(≥90 to 99) %		(0.10 to 0.011) %	
Bandwidth: ≥2 kHz Depths:			
(≥1 to 10) %		(0.081 to 0.15) %	
(≥10 to 20) %		(0.15 to 0.23) %	
(≥20 to 30) %		(0.23 to 0.29) %	
(≥30 to 40) %		(0.29 to 0.35) %	
(≥40 to 50) %		(0.35 to 0.39) %	

Parameter/Range	Frequency	CMC ^{2, 6, 7, 8} ($\pm$)	Comments
Amplitude Modulation – Measure (cont) Bandwidth: ≥ 2 kHz Depths: $(\geq 40 \text{ to } 50) \%$ $(\geq 50 \text{ to } 60) \%$ $(\geq 60 \text{ to } 70) \%$ $(\geq 70 \text{ to } 80) \%$ $(\geq 80 \text{ to } 90) \%$ $(\geq 90 \text{ to } 99) \%$	3 Hz to 50 GHz	$(0.39 \text{ to } 0.34) \%$ $(0.34 \text{ to } 0.27) \%$ $(0.27 \text{ to } 0.19) \%$ $(0.19 \text{ to } 0.10) \%$ $(0.19 \text{ to } 0.10) \%$ $(0.10 \text{ to } 0.011) \%$	Keysight E444X series N7800 TME Method
Frequency Modulation – Measure Rate: 20 Hz to 10 kHz Dev.: (0.2 to 40) kHz peak	250 kHz to 10 MHz	$\beta > 0.20$ 1.5 % $\beta > 1.2$ 1.0 %	Keysight E444X series opt 233 $\beta = \text{deviation} \div \text{rate}$
Frequency Modulation – Measure (cont.) Rate: 50 Hz to 200 kHz Dev.: (0.25 to 400) kHz peak Rate: 50 Hz to 200 kHz Dev.: (0.25 to 400) kHz peak	10 MHz to 6.6 GHz (6.6 to 13.2) GHz	$\beta > 0.20$ 1.5 % $\beta > 0.45$ 1.0 % $\beta > 0.20$ 2.5 % $\beta > 8.0$ 1.0 %	Keysight E444X series opt 233 $\beta = \text{deviation} \div \text{rate}$
Phase Modulation – Measure Rate: 100 Hz to 100 kHz Dev.: (0.3 to 0.7) Radians peak Dev.: (0.7 to 100) Radians peak	100 kHz to 6.6 GHz	3.0 % 1.0 %	Keysight E444X series option 233
Sine Distortion – Measure (-80 to 0) dB	20 Hz to 250 kHz	1.0 dB	Keysight E444X series option 233

Parameter/Range	Frequency	CMC ^{2, 6, 7, 8} ($\pm$)	Comments
RF Power – Generate			
(-36 to 23.98) dBm	1 Hz to 10 MHz (10 to 50) MHz	0.20 dB 0.30 dB	Keysight 33250A
(10 to 14) dBm	(15 to 60) MHz	0.70 dB	Keysight E8257D
(10 to 18) dBm	(60 to 400) MHz	0.92 dB	
(10 to 19) dBm	(0.4 to 3.2) GHz	0.92 dB	
(10 to 17) dBm	(3.2 to 15) GHz	0.92 dB	
(10 to 13) dBm	(15 to 30) GHz	1.2 dB	
(0 to 10) dBm	250 kHz to 2 GHz (2 to 20) GHz (20 to 30) GHz	0.69 dB 0.92 dB 1.0 dB	
(0 to 9) dBm	(30 to 65) GHz	1.2 dB	
(0 to 8) dBm	(65 to 67) GHz	1.5 dB	
(-10 to 0) dBm	250 kHz to 2 GHz (2 to 20) GHz (20 to 65) GHz (65 to 67) GHz	0.69 dB 0.92 dB 1.1 dB 1.2 dB	
(-70 to -10) dBm	250 kHz to 2 GHz (2 to 20) GHz (20 to 40) GHz (40 to 50) GHz	0.81 dB 1.1 dB 1.2 dB 1.7 dB	
Level Sine – Generate			
50 kHz to 10 MHz Reference, V(p-p)			
4.4 mV to 5 V	1 kHz to 300 MHz	2.0 %	Fluke 9500B and 9530
4.4 mV to 5 V	(300 to 550) MHz	2.3 %	active head – 50 Ω
4.4 mV to 3 V	500 MHz to 1.1 GHz	3.0 %	
4.4 mV to 3 V	(>1.1 to 2.5) GHz	3.4 %	
4.4 mV to 2 V	(>2.5 to 3.2) GHz	3.4 %	
(11 to 563) mV	(0.01 to 8.0) GHz	3.0 %	Synthesized Signal
(>0.563 to 6.324) V	(0.01 to 8.0) GHz	3.1 %	Generator, Power
(11 to 563) mV	(>8 to 12.4) GHz	3.2 %	Meter, N8485A,
(>0.563 to 6.324) V	(>8 to 12.4) GHz	3.3 %	11667C
(11 to 563) mV	(>12.4 to 16) GHz	3.2 %	

Parameter/Range	Frequency	CMC ^{2, 6, 7, 8} (±)	Comments
Level Sine – Generate (cont)			
(>0.563 to 6.324) V	(>12.4 to 16) GHz	3.3 %	Synthesized Signal Generator, Power Meter, N8485A, 11667C
(11 to 563) mV	(>16 to 18) GHz	3.3 %	
(>0.563 to 6.324) V	(>16 to 18) GHz	3.4 %	
(11 to 563) mV	(>18 to 20) GHz	3.5 %	
(>0.563 to 6.324) V	(>18 to 20) GHz	3.6 %	
(11 to 563) mV	(>20 to 23) GHz	3.7 %	
(>0.563 to 6.324) V	(>20 to 23) GHz	3.8 %	
(11 to 563) mV	(>23 to 25) GHz	4.4 %	
(>0.563 to 6.324) V	(>23 to 25) GHz	4.5 %	
(11 to 563) mV	(>25 to 33) GHz	5.7 %	
(>0.563 to 6.324) V	(>25 to 33) GHz	5.8 %	
(11 to 563) mV	(0.05 to 8.0) GHz	2.2 %	
(>0.563 to 6.324) V	(0.05 to 8.0) GHz	2.4 %	
(11 to 563) mV	(>8 to 12.4) GHz	2.6 %	
(>0.563 to 6.324) V	(>8 to 12.4) GHz	2.8 %	
(11 to 563) mV	(>12.4 to 16) GHz	2.9 %	
(>0.563 to 6.324) V	(>12.4 to 16) GHz	3.1 %	
(11 to 563) mV	(>16 to 18) GHz	3.1 %	
(>0.563 to 6.324) V	(>16 to 18) GHz	3.2 %	
(11 to 563) mV	(>18 to 20) GHz	3.2 %	
(>0.563 to 6.324) V	(>18 to 20) GHz	3.3 %	
(11 to 563) mV	(>20 to 23) GHz	3.4 %	
(>0.563 to 6.324) V	(>20 to 23) GHz	3.5 %	
(11 to 563) mV	(>23 to 25) GHz	3.6 %	
(>0.563 to 6.324) V	(>23 to 25) GHz	3.7 %	
(11 to 563) mV	(>25 to 33) GHz	4.3 %	
(>0.563 to 6.324) V	(>25 to 33) GHz	4.4 %	
(11 to 563) mV	(>33 to 40) GHz	5.7 %	
(>0.563 to 6.324) V	(>33 to 40) GHz	5.8 %	
(11 to 563) mV	(>40 to 45) GHz	7.2 %	
(>0.563 to 6.324) V	(>40 to 45) GHz	7.3 %	
(11 to 563) mV	(>45 to 50) GHz	8.4 %	
(>0.563 to 6.324) V	(>45 to 50) GHz	8.5 %	
Phase Noise – Measurement			
1 Hz to 1 MHz Offset	50 kHz to 26.5 GHz	2.3 dB	Keysight E5505A
(1 to 100) MHz Offset	50 kHz to 26.5 GHz	4.4 dB	

Parameter/Range	Frequency	CMC ^{2, 7, 8} ($\pm$)	Comments
RF Attenuation – Generate			
1 dB	50 MHz	0.0024 dB	Keysight 8496 series
2 dB		0.0024 dB	
3 dB		0.0024 dB	
4 dB		0.0025 dB	
5 dB		0.0025 dB	
6 dB		0.0025 dB	
7 dB		0.0025 dB	
8 dB		0.0025 dB	
9 dB		0.0025 dB	
10 dB		0.0025 dB	
11 dB		0.0025 dB	
10 dB		0.0036 dB	
20 dB		0.0040 dB	
30 dB		0.0070 dB	
40 dB		0.0070 dB	
50 dB		0.0090 dB	
60 dB		0.010 dB	
70 dB		0.015 dB	
80 dB		0.018 dB	
90 dB		0.021 dB	
100 dB		0.030 dB	
110 dB		0.037 dB	
10 dB	1 MHz	0.0037 dB	Keysight 8496 series
20 dB		0.0041 dB	
30 dB		0.0071 dB	
40 dB		0.0071 dB	
50 dB		0.0091 dB	
60 dB		0.010 dB	
70 dB		0.015 dB	
80 dB		0.018 dB	
90 dB		0.021 dB	
100 dB		0.030 dB	
110 dB		0.037 dB	
Transmission S12/S21 – Measure			
50 Ω Type N: (0 to 20) dB	9 kHz to 3 GHz	Mag (0.029 to 0.061) dB	Keysight E5071C/85032F, Type N connectors
(20 to 40) dB		Phase (0.19 to 0.44) $^{\circ}$	
(40 to 50) dB		Mag (0.049 to 0.39) dB	
		Phase (0.32 to 2.6) $^{\circ}$	
		Mag (0.095 to 1.2) dB	
		Phase (0.63 to 8.2) $^{\circ}$	

Parameter/Range	Frequency	CMC ^{2, 7} ($\pm$)	Comments
Transmission S12/S21 – Measure (cont)			
50 Ω Type N: (0 to 20) dB (20 to 40) dB (40 to 50) dB	(2 to 18) GHz	Mag (0.076 to 0.091) dB Phase (0.50 to 0.61) $^\circ$ Mag (0.091 to 0.12) dB Phase (0.39 to 5.4) $^\circ$ Mag (0.12 to 0.18) dB Phase (0.79 to 1.2) $^\circ$	Keysight N5245A/85054B, Type N connectors
50 Ω with 3.5 mm Connectors: (0 to 20) dB (20 to 40) dB (40 to 50) dB	10 MHz to 26.5 GHz	Mag (0.031 to 0.11) dB Phase (0.21 to 0.72) $^\circ$ Mag (0.059 to 0.78) dB Phase (0.39 to 5.4) $^\circ$ Mag (0.11 to 2.5) dB Phase (0.75 to 19) $^\circ$	Keysight N5245A/85052B, 3.5 mm connectors
50 Ω with 2.4 mm Connectors: (0 to 20) dB (20 to 40) dB (40 to 50) dB	10 MHz to 50 GHz	Mag (0.032 to 0.19) dB Phase (0.21 to 1.3) $^\circ$ Mag (0.062 to 0.78) dB Phase (0.40 to 5.4) $^\circ$ Mag (0.11 to 2.5) dB Phase (0.75 to 19) $^\circ$	Keysight N5245A/85056A, 2.4 mm connectors
Reflection S11/S22 – Measure			
50 Ω with Type N: (0.0001 to 0.25) lin (0.25 to 0.5) lin (0.5 to 0.75) lin (0.75 to 1) lin	9 kHz to 3 GHz	Lin Mag (0.0036 to 0.0052) Phase (0.87 to 180) $^\circ$ Lin Mag (0.0038 to 0.0061) Phase (0.53 to 1.2) $^\circ$ Lin Mag (0.0047 to 0.0082) Phase (0.51 to 0.69) $^\circ$ Lin Mag (0.0067 to 0.012) Phase (0.51 to 0.68) $^\circ$	Keysight E5071C/85032F, Type N connectors
50 Ω with Type N: (0.0001 to 0.25) lin (0.25 to 0.5) lin	(2 to 18) GHz	Lin Mag (0.0040 to 0.0083) Phase (0.97 to 180) $^\circ$ Lin Mag (0.0042 to 0.0061) Phase (0.54 to 1.9) $^\circ$	

Parameter/Range	Frequency	CMC ^{2, 6, 7} ($\pm$)	Comments
Reflection S11/S22 – Measure (cont)			
50 Ω with Type N: (0.5 to 0.75) lin (0.75 to 1) lin	(2 to 18) GHz	Lin Mag (0.0047 to 0.010) Phase (0.44 to 1.2) $^{\circ}$ Lin Mag (0.0047 to 0.016) Phase (0.44 to 1.5) $^{\circ}$	Keysight N5245A/85054B, type N connectors
50 Ω with 3.5 mm Connectors: (0.0001 to 0.25) lin (0.25 to 0.5) lin (0.5 to 0.75) lin (0.75 to 1) lin	10 MHz to 26.5 GHz	Lin Mag (0.0040 to 0.0068) Phase (0.96 to 180) $^{\circ}$ Lin Mag (0.0042 to 0.0098) Phase (0.58 to 1.6) $^{\circ}$ Lin Mag (0.0051 to 0.017) Phase (0.55 to 1.3) $^{\circ}$ Lin Mag (0.0075 to 0.029) Phase (0.55 to 1.7) $^{\circ}$	
50 Ω with 2.4 mm Connectors: (0.0001 to 0.25) lin (0.25 to 0.5) lin (0.5 to 0.75) lin (0.75 to 1) lin	10 MHz to 50 GHz	Lin Mag (0.0080 to 0.016) Phase (1.9 to 180) $^{\circ}$ Lin Mag (0.0081 to 0.018) Phase (0.98 to 3.7) $^{\circ}$ Lin Mag (0.0085 to 0.021) Phase (0.74 to 1.7) $^{\circ}$ Lin Mag (0.0093 to 0.033) Phase (0.69 to 2.0) $^{\circ}$	
Absolute RF Power – Measure			
1 mW	50 MHz	3.1 μ W	Keysight 432A/478A/Fluke 8508A
(20 to 30) dBm	9 kHz to 7 GHz (7 to 18) GHz (18 to 24) GHz	3.3 % 3.4 % 3.6 %	Keysight EPM power meter / E9300

Parameter/Range	Frequency	CMC ^{2, 6, 7, 8} (±)	Comments
Absolute RF Power – Measure (cont)			
(10 to 20) dBm	(9 to 100) kHz (100 to 300) kHz 300 kHz to 7 GHz (7 to 18) GHz (18 to 26) GHz (26 to 33) GHz (33 to 34) GHz (34 to 38) GHz (38 to 43) GHz (43 to 48) GHz (48 to 50) GHz (50 to 70) GHz	2.4 % 1.5 % 1.4 % 1.6 % 2.0 % 2.2 % 2.3 % 2.5 % 2.9 % 3.0 % 3.3 % 4.0 %	Keysight EPM power meter / 8480/N8480 and E9300
(0 to 10) dBm	(9 to 100) kHz (100 to 300) kHz 300 kHz to 4 MHz 4 MHz to 8 GHz (8 to 16) GHz (16 to 18) GHz (18 to 26) GHz (26 to 33) GHz (33 to 38) GHz (38 to 43) GHz (43 to 48) GHz (48 to 49) GHz (49 to 50) GHz (50 to 70) GHz	2.4 % 1.2 % 1.1 % 1.2 % 1.3 % 1.5 % 1.9 % 2.1 % 2.4 % 2.8 % 2.9 % 3.0 % 3.3 % 3.9 %	Keysight EPM power meter / 8480/N8480 and E9300 series power sensors
(-10 to 0) dBm	(9 to 100) kHz (100 to 300) kHz 300 kHz to 4 GHz (4 to 16) GHz (16 to 18) GHz (18 to 26) GHz (26 to 33) GHz (33 to 38) GHz (38 to 43) GHz	2.9 % 1.2 % 1.1 % 1.3 % 1.5 % 1.9 % 2.1 % 2.4 % 2.8 %	
(-10 to 0) dBm	(43 to 48) GHz (48 to 49) GHz (49 to 50) GHz (50 to 70) GHz	2.9 % 3.0 % 3.3 % 3.9 %	

Parameter/Range	Frequency	CMC ^{2, 6, 7, 8} (±)	Comments
Absolute RF Power – Measure (cont.)			
(-20 to -10) dBm	(9 to 100) kHz	3.3 %	Keysight EPM power meter / 8480/N8480 and E9300 series power sensors
	(100 to 300) kHz	1.3 %	
	300 kHz to 6 GHz	1.2 %	
	(6 to 15) GHz	1.3 %	
	(15 to 18) GHz	1.5 %	
	(18 to 26) GHz	1.8 %	
	(26 to 33) GHz	2.0 %	
	(33 to 35) GHz	2.3 %	
	(35 to 38) GHz	2.4 %	
	(38 to 40) GHz	2.7 %	
	(40 to 43) GHz	2.8 %	
	(43 to 48) GHz	2.9 %	
	(48 to 49) GHz	3.0 %	
	(49 to 50) GHz	3.3 %	
	(50 to 70) GHz	3.9 %	
(-30 to -20) dBm	9 kHz to 5 GHz	1.6 %	
	(5 to 15) GHz	1.7 %	
	(15 to 18) GHz	1.8 %	
	(18 to 26) GHz	2.5 %	
	(26 to 33) GHz	2.7 %	
	(33 to 35) GHz	2.9 %	
	(35 to 38) GHz	3.0 %	
	(38 to 40) GHz	3.2 %	
	(40 to 43) GHz	3.3 %	
	(43 to 48) GHz	3.4 %	
(-40 to -30) dBm	(48 to 49) GHz	3.5 %	
	(49 to 50) GHz	3.7 %	
	9 kHz to 10 MHz	3.3 %	
	(10 to 300) MHz	1.6 %	
	300 MHz to 15 GHz	1.7 %	
	(15 to 17) GHz	1.8 %	
	(17 to 18) GHz	1.9 %	
	(18 to 26) GHz	2.2 %	
	(26 to 31) GHz	2.4 %	
	(31 to 34) GHz	2.5 %	
	(34 to 38) GHz	2.7 %	Keysight EPM power meter / 8480/N8480 and E9300 series power sensors
	(38 to 40) GHz	2.9 %	
	(40 to 49) GHz	3.0 %	
	(49 to 50) GHz	3.2 %	

Parameter/Range	Frequency	CMC ^{2, 6, 7, 8} (±)	Comments
Absolute RF Power – Measure (cont)			
(-50 to -40) dBm	(9 to 100) kHz	4.6 %	Keysight EPM power meter / 8480/N8480 and E9300 series power sensors / E444X series spectrum analyzer
	100 kHz to 5 MHz	3.3 %	
	5 MHz to 3 GHz	1.7 %	
	(3 to 8) GHz	2.4 %	
	(8 to 16) GHz	2.5 %	
	(16 to 18) GHz	2.6 %	
	(18 to 26) GHz	2.8 %	
	(26 to 33) GHz	2.9 %	
	(33 to 34) GHz	3.0 %	
	(34 to 38) GHz	3.2 %	
	(38 to 44) GHz	3.5 %	
	(44 to 48) GHz	3.6 %	
	(48 to 49) GHz	3.7 %	
	(49 to 50) GHz	3.8 %	
(-60 to -50) dBm	100 kHz to 10 MHz	3.3 %	
	10 MHz to 3 GHz	1.7 %	
	(3 to 7) GHz	2.6 %	
	(7 to 18) GHz	2.7 %	
	(18 to 26) GHz	3.0 %	
	(26 to 33) GHz	3.1 %	
	(33 to 38) GHz	3.3 %	
	(38 to 43) GHz	3.6 %	
	(43 to 48) GHz	3.7 %	
	(48 to 49) GHz	3.8 %	
(-70 to -60) dBm	(49 to 50) GHz	4.0 %	
	100 kHz to 10 MHz	3.4 %	
	10 MHz to 3 GHz	1.9 %	
	(3 to 6) GHz	2.7 %	
	(6 to 16) GHz	2.9 %	
	(16 to 18) GHz	3.0 %	
	(18 to 26) GHz	3.2 %	
	(26 to 33) GHz	3.3 %	
	(33 to 34) GHz	3.4 %	
	(34 to 38) GHz	3.5 %	
(-80 to -70) dBm	(38 to 43) GHz	3.8 %	
	(43 to 48) GHz	3.9 %	
	(48 to 49) GHz	4.0 %	
	(49 to 50) GHz	4.1 %	
	100 kHz to 10 MHz	3.5 %	
	10 MHz to 3 GHz	2.0 %	
	(3 to 6) GHz	2.9 %	

Parameter/Range	Frequency	CMC ^{2, 6, 7, 8} (±)	Comments
Absolute RF Power – Measure (cont)			
(-80 to -70) dBm	(6 to 18) GHz	3.2 %	Keysight EPM power meter / 8480/N8480 and E9300 Series power sensors / E444X series spectrum analyzer
	(18 to 26) GHz	3.4 %	
	(26 to 33) GHz	3.5 %	
	(33 to 34) GHz	3.6 %	
	(34 to 38) GHz	3.7 %	
	(38 to 43) GHz	4.0 %	
	(43 to 48) GHz	4.1 %	
	(48 to 49) GHz	4.2 %	
	(49 to 50) GHz	4.4 %	
(-90 to -80) dBm	100 kHz to 10 MHz	3.6 %	
	10 MHz to 3 GHz	2.2 %	
	(3 to 6) GHz	3.1 %	
	(6 to 15) GHz	3.4 %	
	(15 to 18) GHz	3.5 %	
	(18 to 28) GHz	3.7 %	
	(28 to 34) GHz	3.8 %	
	(34 to 35) GHz	3.9 %	
	(35 to 38) GHz	4.0 %	
	(38 to 43) GHz	4.2 %	
	(43 to 48) GHz	4.3 %	
	(48 to 49) GHz	4.4 %	
	(49 to 50) GHz	4.6 %	
(-100 to -90) dBm	100 kHz to 10 MHz	3.7 %	
	10 MHz to 3 GHz	2.4 %	
	(3 to 6) GHz	3.3 %	
	(6 to 16) GHz	3.7 %	
	(16 to 18) GHz	3.8 %	
(-110 to -100) dBm	100 kHz to 10 MHz	3.8 %	
	10 MHz to 3 GHz	2.6 %	
	(3 to 6) GHz	3.6 %	
	(6 to 16) GHz	4.0 %	
	(16 to 18) GHz	4.1 %	
(-120 to -110) dBm	100 kHz to 10 MHz	4.0 %	
	10 MHz to 3 GHz	2.8 %	
	(3 to 6) GHz	3.9 %	
(-127 to -120) dBm	100 kHz to 10 MHz	4.1 %	
	10 MHz to 3 GHz	3.0 %	
	(3 to 6) GHz	4.2 %	

Parameter/Range	Frequency	CMC ^{2, 6, 7, 8} (±)	Comments
Relative RF Peak Power Comparison – (-15 to 15) dBm	1 MHz to 26.5 GHz (26.5 to 50) GHz	0.024 dB 0.040 dB	Keysight 86100A/83484A
RF Power Sensor – Calibration Factor	(6 to 300) kHz (>0.3 to 100) MHz (>0.100 to 5) GHz (>5 to 15) GHz (>15 to 18) GHz (>18 to 26.5) GHz (>26.5 to 34) GHz (>34 to 38) GHz (>38 to 43) GHz (>43 to 48) GHz (>48 to 49) GHz (>49 to 50) GHz	0.86 % 0.81 % 0.87 % 1.0 % 0.99 % 2.5 % 2.7 % 3.0 % 3.3 % 3.8 % 4.2 % 4.6 %	TEGAM 2505A TEGAM 2510A TEGAM 1830A
Linearity (16 to 20) dBm (10 to 16) dBm (-39 to 10) dBm (-48 to -39) dBm	(10 to 128) MHz	1.8 % 1.2 % 0.96 % 1.4 %	Fluke 96270A
(10 to 20) dBm (0 to 10) dBm (-10 to 0) dBm (-30 to -10) dBm	9 kHz to 50 GHz	0.17 % 0.10 % 0.11 % 0.17 %	Keysight 8494H / 8496H / E4412A/E4413A
(-40 to -30) dBm (-45 to -40) dBm (-47 to -45) dBm -47 dBm -48 dBm -49 dBm -50 dBm -51 dBm -52 dBm -53 dBm -54 dBm -55 dBm -56 dBm -57 dBm -58 dBm		0.22 % 0.24 % 0.25 % 0.26 % 0.28 % 0.30 % 0.41 % 0.44 % 0.49 % 0.56 % 0.65 % 0.77 % 0.94 % 1.2 % 1.5 %	Keysight 8494H / 8496H / 8481D/8485D/8487D

Parameter/Range	Frequency	CMC ^{2, 6, 7, 8} (±)	Comments
RF Power Sensor – (cont) Linearity -59 dBm -60 dBm -61 dBm -62 dBm -63 dBm -64 dBm -65 dBm -66 dBm -67 dBm -68 dBm -69 dBm -70 dBm	9 kHz to 50 GHz	1.8 % 2.3 % 2.8 % 3.5 % 4.4 % 5.5 % 6.9 % 8.7 % 11 % 14 % 18 % 22 %	Keysight 8494H / 8496H / 8481D/ 8485D/8487D
Network Analyzer Dynamic Accuracy (-60 to 5) dBm Reference -20 dBm	(-19 to 5) dBm (-21 to -60) dBm	0.020 % + 0.0034 % /dB step up from reference 0.020 % + 0.0034 % /dB step down from reference	Keysight E8257D/ EPM power Meter/8480/N8480 series sensor and U3020AD01 test set
Pulse and Pulse Modulation – Measure ⁵ Rise/Fall Width/Time Interval	10 % to 90 % Pulse or Pulse Envelope (0.1 to 1) ns (1 to 100) µs	0.14 % + 9.0 ps 0.18 % + 9.0 ps 0.12 % + 9.0 ps	Keysight 86100A, 83484A

Parameter/Equipment	Range	CMC ^{2, 6, 8} ($\pm$)	Comments
Digital Modulation – Measure			Keysight N9030A
GSM EDGE Residual EVM	(0 to 15) % (0.8 to 1.9) GHz	0.015 %	
Residual Phase Error	(0 to 1) ° (0 to 3) °	0.015 ° 0.12 °	
CDMA 2000 IS95, 1xEV-DO Residual EVM	(0 to 2) % (0.8 to 2.1) GHz	0.023 %	
W-CDMA Residual EVM	(0 to 1.5) % (1.8 to 2.2) GHz	0.025 %	
QPSK Residual EVM	(0 to 2.5) % (1 to 6) GHz (6 to 32) GHz (32 to 44) GHz	0.01 % 0.05 % 0.065 %	
$\pi/4$ DQPSK Residual EVM	(0 to 2.5) % (1 to 6) GHz	0.025 %	
16, 64, 256 QAM Residual EVM	(0 to 2.5) % (1 to 6) GHz (6 to 32) GHz (32 to 44) GHz	0.015 % 0.03 % 0.045 %	
2FSK (including DECT) Shift Error or Frequency Deviation	(0 to 2) % (1 to 6) GHz	0.048 % of deviation	
NADC Residual EVM	(0 to 2) % (750 to 950) MHz	0.042 %	
PDC Residual EVM	(0 to 2) % (810 to 1501) MHz	0.055 %	
PHS Residual EVM	(0 to 2) % (1 to 2) GHz	0.035 %	
TETRA Residual EVM	(0 to 2) % 350 MHz to 1 GHz	0.044 %	

III. Time & Frequency

Parameter/Equipment	Range	CMC ^{2,9} ($\pm$)	Comments
Frequency – Generate Equipment	10 Hz to 15 MHz	2.7 pHz/Hz	Keysight 33120A phase locked to Fluke 910
	250 kHz to 67 GHz	2.7 pHz/Hz	Keysight E8257D phase locked to Fluke 910
Frequency – Measure	10 Hz to 12.4 GHz	120 pHz/Hz	Fluke 910, Agilent 53132A phase locked
	(12.4 to 26.5) GHz	1.6 Hz	Keysight 53151A phase locked
	(26.5 to 46) GHz	2.0 Hz	Keysight 53152A phase locked

¹ This laboratory offers commercial 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 Based on using the Fluke 8508A at the temperature (TCal) it was calibrated $\pm 5^\circ\text{C}$, 4 Hr. warm up, maximum resolution and an input zero or offset null performed if temp moves more than $\pm 1^\circ\text{C}$ from temperature at which previous input zero or null was performed. Calibration and Measurement Capability is based upon 1-year specifications and is read as parts in 106 or percent of reading plus parts in 106 or percent of range. TCal = $23^\circ\text{C} \pm 5^\circ\text{C}$ ($73.4^\circ\text{F} \pm 9^\circ\text{F}$).

⁴ Based on using the Fluke 5790A/B at the temperature (TCal) it was calibrated $\pm 5^\circ\text{C}$ with 30 minutes warm up. Calibration and Measurement Capability is based upon 1-year specifications and is read as parts in 106 or percent of reading plus fixed amount. TCal = $23^\circ\text{C} \pm 5^\circ\text{C}$ ($73.4^\circ\text{F} \pm 9^\circ\text{F}$).

⁵ Transition time characteristic calculated from $T = 0.35 / \text{Bandwidth}$ (26.5 GHz).

⁶ In a statement of CMC, percentage refers to percent of reading, unless otherwise noted. In the statement of CMC, W is defined as the watt reading, "rms" refers to root mean square.

⁷ The contributions from the "best existing device" are not included in the CMC claim.

- ⁸ The measurands stated are generated using the indicated instrument (see Comments). This capability is suitable for the calibration of the devices intended to measure the measurand in the ranges indicated. CMCs are expressed as either a specific value that covers the full range or as a fraction of the reading plus a fixed floor specification.
- ⁹ 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. 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.
- ¹⁰ This scope meets A2LA's *P112 Flexible Scope Policy*.



Accredited Laboratory

A2LA has accredited

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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 24th day of May 2022.

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

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 2681.01
Valid to April 30, 2024

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