



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

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CALIBRATION

Valid To: April 30, 2024

Certificate Number: 2166.01

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

(Table 1 of 2) DC Voltage			
Parameter/Equipment	Range	(±) CMC ^{2, 4, 5, 13}	Comments
DC Voltage Generate (Fixed Points)	± 100 mV	3.0 µV/V	Calibration of reference multimeters w/ Fluke 5720/5725A characterized calibrator For long scale DMM calibrations
	± 200 mV	3.2 µV/V	
	± 2 V	2.4 µV/V	
	± 5 V	0.90 µV/V	
	± 15 V	0.60 µV/V	
	± 19 V	0.70 µV/V	
	± 20 V	2.3 µV/V	
	± 100 V	0.80 µV/V	
	± 200 V	2.3 µV/V	
	± 1 kV	0.90 µV/V	
DC Reference Measure and Generate (Fixed Points)	± 10 V reference	0.30 µV/V	Direct transfer techniques performed utilizing Fluke 732A/732B For 732 transfer calibrations
	± 1.018 V reference	0.70 µV/V	
	± 1.00 V reference	0.70 µV/V	

(Table 2 of 2)
DC Voltage

Parameter/Equipment	Range	(±) CMC ^{2, 4, 5, 13}	Comments
DC Voltage Measure	0.00 V	0.15 µV	Copper short
	± (0 to 10) mV ± (10 to 120) mV ± 120 mV to ± 1.2 V ± (1.2 to 12) V ± (12 to 120) V ± 120 V to ± 1.05 kV	9.0 µV/V + 0.21 µV 3.0 µV/V + 0.10 µV 0.70 µV/V + 0.20 µV 0.50 µV/V + 0.50 µV 0.8 µV/V + 20 µV 1.9 µV/V + 0.15 mV	HP 3458A characterized DMM Utilized in 57XX and 55XX calibrations
	(1.0 to 40) kV	0.10 %	Direct measurements using Ross VD120 voltage divider/Fluke 8846A For calibration of 5320A & 80K high voltage probes
DC Voltage Generate	± (0 to 10) mV ± (10 to 220) mV ± 220 mV to ± 2.2 V ± (2.2 to 11) V ± (11 to 22) V ± (22 to 220) V ± 220 V to ± 1.1 kV	9.0 µV/V + 0.21 µV 3.0 µV/V + 0.30 µV 1.0 µV/V + 1.0 µV 0.60 µV/V + 2.5 µV 0.60 µV/V + 5.0 µV 1.0 µV/V + 50 µV 1.2 µV/V + 0.20 mV	Characterization of Fluke 5720/5725A w/ 732, 752, and 845 for DC voltage sourcing applications
	± 1.1 kV to ± 1.5 kV	16 µV/V + 1.8 mV	Two 5520A/5522As with one sourcing positive voltage, one sourcing negative, and OUT LO terminals connected.

(Table 1 of 2)
DC Current

Parameter/Equipment	Range	(±) CMC ^{2, 4, 5, 13}	Comments
DC Current Measure	± 100 µA	3.0 µA/A	Characterization of Fluke 5720/5725A w/ comparison to DC reference shunts and characterized voltmeter, for calibration of long scale DMMS Char A40B shunt
	± 1 mA	3.0 µA/A	
	± 10 mA	3.0 µA/A	
	± 100 mA	5.0 µA/A	
	± 1 A	10 µA/A	
	± 10 A	30 µA/A	
	± 30 A	29 µA/A	
DC Current Generate ⁶	± 100 µA	5.0 µA/A	Calibration of reference multimeter w/ Fluke 5720/5725A characterized calibrator Char Fluke 52120
	± 1 mA	4.7 µA/A	
	± 10 mA	3.0 µA/A	
	± 100 mA	8.0 µA/A	
	± 1 A	10 µA/A	
	± 10 A	100 µA/A	
	± 30 A	65 µA/A	
DC Current Generate Using a Transconductance Amplifier	± (3.3 to 20) A	78 µA/A + 37 mA	Calibration of clamp meters using a 5522A driving a 52120A into a single wire
	± (20.000 01 to 32.999 99) A	79 µA/A + 38 mA	
	± (33 to 40) A	78 µA/A + 38 mA	
	± (40.0001 to 120) A	78 µA/A + 110 mA	

(Table 2 of 2) DC Current			
Parameter/Equipment	Range	(±) CMC ^{2, 4, 5, 13}	Comments
DC Current Generate Using a Coil	± (10 to 16.49995) A	0.39 % + 40 mA	Calibration of Fluke 39X-series clamps using Fluke 5522A and Fluke 5500A/COIL
	± (16.5 to 80) A	0.39 % + 110 mA	
	± (80.0005 to 149.9995) A	0.39 % + 180 mA	
	± (150 to 549.995) A	0.39 % + 410 mA	
	± (550 to 1025) A	0.40 % + 530 mA	
DC Current Generate Using a Coil and Transconductance Amplifier	± (10 to 40) A	0.54 % + 130 mA	Calibration of Fluke 35X-series clamps using Fluke 5522A with 52120A and 52120A/COIL3KA
	± (40.00025 to 50) A	0.54 % + 140 mA	
	± (50.00025 to 500) A	0.54 % + 180 mA	
	± (500.0025 to 999.9975) A	0.54 % + 670 mA	
	± (1000 to 2000) A	0.54 % + 880 mA	
DC Current Measure and Generate	0.00 A	0.000 060 µA	Open input
	± (1 to 10) µA	6.0 µA/A + 10 pA	Standard reference resistors, shunts and an 8.5-digit DMM 52120A, 55XX and 57XX calibrations
	± (10 to 100) µA	6.0 µA/A + 60 pA	
	± 100 µA to 1 mA	6.0 µA/A + 1.0 nA	
	± (1 to 10) mA	6.0 µA/A + 10 nA	
	± (10 to 100) mA	6.0 µA/A + 0.10 µA	
	± 100 mA to ± 1 A	6.0 µA/A + 1.8 µA	
	± (1 to 10) A	5.0 µA/A + 5.0 µA	
± (10 to 20) A	55 µA/A + 20 µA		
DC Current Measure	± (80 to 120) A	35 µA/A	Fluke 52120A transconductance amplifier calibration
DC Current Generate	± 200.0 µA ± 2 mA ± 20 mA	7.0 µA/A 5.8 µA/A 5.4 µA/A	Calibration of 8588A characterized station using 5720A/5725A

(Table 1 of 2) Resistance			
Parameter/Equipment	Range	(±) CMC ^{2, 4, 5, 13}	Comments
Resistance Measure	0.00 Ω	2.5 µΩ	Copper short
	100 GΩ	0.040 %	Ohms lab reference resistors
	1 TΩ	0.040 %	
	10 TΩ	0.090 %	5320 calibration station characterization

(Table 2 of 2) Resistance			
Parameter/Equipment	Range	(±) CMC ^{2, 4, 5, 13}	Comments
Resistance Measure and Generate	(0.0001 to 0.01) Ω	6.0 μΩ	Calibration of standard resistors with Measurements International 6010 bridge For Fluke 742 standard resistance calibrations and long scale meter calibration station characterization
	(0.01 to 0.1) Ω	5.0 μΩ/Ω	
	(0.1 to 1) Ω	1.0 μΩ/Ω	
	(1 to 10) Ω	0.50 μΩ/Ω	
	(10 to 100) Ω	0.50 μΩ/Ω	
	100 Ω to 1 kΩ	0.50 μΩ/Ω	
	(1 to 10) kΩ	0.70 μΩ/Ω	
	(10 to 100) kΩ	0.70 μΩ/Ω	
	100 kΩ to 1 MΩ	1.6 μΩ/Ω	
	(1 to 10) MΩ	2.2 μΩ/Ω	
	(10 to 100) MΩ	5.1 μΩ/Ω	
	100 MΩ to 1.1 GΩ	26 μΩ/Ω	
	10 GΩ	0.028 %	Fluke 8508A calibration
Resistance Generate	2 GΩ	0.15 %	Calibration of Fluke 5320A using QuadTech 1865 megohmmeter and reference resistors
	4 GΩ	0.15 %	
	8 GΩ	0.15 %	
	10 GΩ	0.15 %	
	100 GΩ	0.20 %	
	1 TΩ	0.50 %	
	9 TΩ	0.90 %	

(Table 1 of 3) AC Voltage Phase Measure (Fixed Points)						
Frequency	AC Voltage (±) CMC ^{2, 4, 13}					
	0.25 V	1.5 V	2.4 V	10 V	23 V	45 V
16 Hz	0.8	1.0	0.7	1.4	1.4	1.4
40 Hz	1.8	1.9	0.7	2.2	2.1	2.1
50 Hz	2.3	2.3	0.8	2.6	2.5	2.5
60 Hz	2.7	2.8	1.1	3.0	2.9	2.9
120 Hz	5.4	5.4	1.3	5.7	5.7	5.7
180 Hz	8.0	8.2	2.1	8.3	8.2	8.2
Comments	Uncertainty applies from (10 to 100) % of range and are in m°.					
	<p>These uncertainties apply when measuring the phase of the Fluke 61XXA voltage channel output with respect to the "master phase reference" signal at the rear of the instrument.</p> <p>The 2.4 V range is only accessible to drive the Fluke 52120A transconductance amplifier, the uncertainties for this range assume a combined Fluke 61XXA & Fluke 52120A calibration system using the same Hewlett Packard 3458A.</p>					

(Table 2 of 3) AC Voltage Phase Measure (Fixed Points)						
Frequency	AC Voltage (\pm) CMC ^{2, 4, 13}					
	0.25 V	1.5 V	2.4 V	10 V	23 V	45 V
450 Hz	20	20	3.6	21	21	21
850 Hz	38	38	6.4	39	38	38
1.2 kHz	54	54	9.2	55	54	54
1.8 kHz	80	80	14	82	81	81
2.4 kHz	110	110	18	110	110	110
3 kHz	140	140	22	140	140	140
3.6 kHz	160	160	26	170	170	170
4.2 kHz	190	190	31	190	190	190
4.8 kHz	220	220	35	220	220	220
5.4 kHz	240	240	40	250	250	250
6 kHz	270	270	44	270	270	270
Comments	Uncertainty applies from (10 to 100) % of range and are in m°					
	<p>These uncertainties apply when measuring the phase of the Fluke 61XXA voltage channel output with respect to the "master phase reference" signal at the rear of the instrument.</p> <p>The 2.4 V range is only accessible to drive the Fluke 52120A Transconductance Amplifier, the uncertainties for this range assume a combined Fluke 61XXA & Fluke 52120A calibration system using the same Hewlett Packard 3458A</p>					

(Table 3 of 3)
AC Voltage Phase Measure (Fixed Points)

Frequency	AC Voltage (\pm) CMC ^{2, 4, 13}				
	90 V Range Linearity		180 V	360 V	1008 V
	7 V	90 V			
16 Hz	3.4	1.4	1.4	1.4	1.5
40 Hz	3.7	2.1	2.1	2.2	2.2
50 Hz	3.9	2.5	2.5	2.6	2.6
60 Hz	4.2	2.9	2.9	3.0	3.0
120 Hz	6.3	5.7	5.7	5.7	5.7
180 Hz	8.7	8.2	8.2	8.3	8.3
450 Hz	21	21	21	21	21
850 Hz	39	38	38	39	39
1.2 kHz	54	54	54	55	54
1.8 kHz	81	81	81	81	81
2.4 kHz	110	110	110	110	110
3 kHz	140	140	140	140	140
3.6 kHz	170	170	170	170	170
4.2 kHz	190	190	190	190	190
4.8 kHz	220	220	220	220	220
5.4 kHz	250	250	250	250	250
6 kHz	270	270	270	270	270
Comments	Uncertainty applies from (10 to 100) % of range and are in m°				
	<p>These uncertainties apply when measuring the phase of the Fluke 61XXA voltage channel output with respect to the "master phase reference" signal at the rear of the instrument</p> <p>The 2.4 V range is only accessible to drive the Fluke 52120A Transconductance Amplifier, the uncertainties for this range assume a combined Fluke 61XXA & Fluke 52120A calibration system using the same Hewlett Packard 3458A</p>				

(Table 1 of 2)
AC Current Phase Measure (Fixed Points)

Frequency	AC Current (\pm) CMC ^{2, 4, 13}				
	0.1 A	0.5 A	1 A	2 A	5 A
16 Hz	1.0	1.0	1.0	1.0	1.0
40 Hz	1.9	1.9	1.9	1.9	1.9
50 Hz	2.4	2.4	2.4	2.4	2.4
60 Hz	2.8	2.8	2.8	2.8	2.8
120 Hz	5.4	5.4	5.4	5.4	5.4
180 Hz	8.1	8.1	8.0	8.0	8.1
450 Hz	20	20	20	20	20
850 Hz	38	38	38	38	38
1.2 kHz	54	54	54	54	54
1.8 kHz	80	80	80	80	80
2.4 kHz	110	110	110	110	110
3 kHz	140	140	140	140	140
3.6 kHz	160	160	160	160	160
4.2 kHz	190	190	190	190	190
4.8 kHz	220	220	220	220	220
5.4 kHz	240	240	240	240	240
6 kHz	270	270	270	270	270
Comments	Uncertainty applies from (10 to 100) % of range and are in m°				
	These uncertainties apply when measuring the phase of the Fluke 61XXA voltage channel output with respect to the "master phase reference" signal at the rear of the instrument				

(Table 2 of 2)
AC Current Phase Measure (Fixed Points)

Frequency	AC Current (\pm) CMC ^{2, 4, 13}				
	10 A Range Linearity		20 A	50 A	100 A
	0.5 A	10 A			
16 Hz	3.6	1.0	1.0	1.0	1.0
40 Hz	3.9	1.9	1.9	1.9	1.9
50 Hz	4.1	2.4	2.4	2.4	2.4
60 Hz	4.3	2.8	2.8	2.8	2.8
120 Hz	6.9	5.4	5.4	5.4	5.4
180 Hz	9.2	8.1	8.1	8.1	8.1
450 Hz	21	20	21	21	21
850 Hz	38	38	38	38	38
1.2 kHz	54	54	54	54	54
1.8 kHz	81	80	81	81	81
2.4 kHz	110	110	110	110	110
3 kHz	140	140	140	140	140
3.6 kHz	160	160	170	170	170
4.2 kHz	190	190	190	190	190
4.8 kHz	220	220	220	220	220
5.4 kHz	240	240	250	250	250
6 kHz	270	270	270	270	270
Comments	Uncertainty applies from (10 to 100) % of range and are in m°				
	These uncertainties apply when measuring the phase of the Fluke 61XXA voltage channel output with respect to the "master phase reference" signal at the rear of the instrument				

Channel to Channel Phase Difference Measure (<i>Fixed Points</i>)				
Frequency	Voltage channel relative to: (\pm) CMC ^{2, 4, 13}			
	Any other Voltage Channel	Any Current Range (Percent of Range)		Another measurement using the same calibration system voltage range
		10 %	100 %	
16 Hz	1.3	4.3	1.1	1.3
40 Hz	1.4		4.4	
50 Hz				
60 Hz	1.4			
120 Hz	1.9	5.4	1.7	
180 Hz	2.8	5.5	2.3	1.7
450 Hz	5.7	6.3	4.9	
850 Hz	11	10.4	8.9	
1.2 kHz	16	14	14	5.1
1.8 kHz	23	20	20	
2.4 kHz	30	26	26	
3 kHz	37	32	32	
3.6 kHz	45	38	38	
4.2 kHz	52	44	44	6.5
4.8 kHz	60	50	50	9.4
5.4 kHz	67	57	57	
6 kHz	74	63	63	
Comments	Uncertainty applies from (10 to 100) % of range and are in m°			
	Fluke 61XXA calibration station			

Phase Generate			
Range	Frequency	(±) CMC ^{2, 4, 13}	Comments
0°	(200 to 1000) kHz	(Freq [Hz] · 2.0E-08)°	Coupler
(0 to 360)°	1 Hz to 6.25 kHz (6.25 to 200) kHz	10 m° 36 m°	Clarke Hess 5500 phase standard
Comments	For calibration of Fluke internal phase meters		

Phase Measure		
Range	Frequency	(±) CMC ^{2, 13}
(0 to 360)°	5 Hz to 2 kHz	0.02°
	(2 to 5) kHz	0.03°
	(5 to 10) kHz	0.04°
	(10 to 50) kHz	0.05°
Comments	Clarke-Hess 6000A used in calibration of Fluke 55XX calibrators	

(Table 1 of 3) AC Resistance Generate and AC Resistance Measure (±) CMC ^{2, 4, 5, 13}				
AC Resistance	Frequency			Comments
	60 Hz	100 Hz	1 kHz	
(25 to 500) mΩ	0.31 %		69 μΩ/Ω	Calibration of Fluke 5320A (ground bond resistance decade f = 60 Hz)
100 mΩ				
(1 to 180) Ω	0.12 %			
(0.5 to 1.8) kΩ	0.08 %	76 μΩ/Ω	34 μΩ/Ω	Calibration of Hioki IM3533
1 Ω				
5 Ω		0.055 %	0.027 %	General Radio 1689M For calibration of Fluke 55XX station, 63XX transfer resistors, and Hioki IM3533

(Table 2 of 3) AC Resistance Generate and AC Resistance Measure (\pm) CMC ^{2, 4, 5, 13}				
AC Resistance	Frequency			Comments
	60 Hz	100 Hz	1 kHz	
10 Ω		47 $\mu\Omega/\Omega$	24 $\mu\Omega/\Omega$	General Radio 1689M For calibration of Fluke 55XX station, Fluke 63XX transfer resistors, and Hioki IM3533
100 Ω to 100 k Ω		60 $\mu\Omega/\Omega$	16 $\mu\Omega/\Omega$	
2 M Ω		0.20 %	0.070 %	
100 M Ω		8.5 %	3.0 %	
10 k Ω to 5 M Ω	0.20 %			Calibration of Fluke 5320A load

(Table 3 of 3) AC Resistance Generate and AC Resistance Measure (\pm) CMC ^{2, 4, 5, 13}					
AC Resistance	Frequency				Comments
	0.1 Hz	1 Hz	10 Hz	100 Hz to 100 kHz	
1000 Ω	17 $\mu\Omega/\Omega$	16 $\mu\Omega/\Omega$	18 $\mu\Omega/\Omega$	16 $\mu\Omega/\Omega$	Calibration of Hioki IM3533 / Fluke PM6306

(Table 1 of 6)
AC Voltage Generate (Fixed Points)

Frequency	AC Voltage (\pm) CMC ^{2, 4, 5, 6, 13}									
	0.6 mV	2 mV	6 mV	10 mV	20 mV	60 mV	100 mV	120 mV	200 mV	
10 Hz		0.020 %	80 μ V/V		70 μ V/V	0.010 %	55 μ V/V		35 μ V/V	
20 Hz					60 μ V/V	67 μ V/V			23 μ V/V	
40 Hz					50 μ V/V	38 μ V/V			18 μ V/V	
100 Hz					40 μ V/V	47 μ V/V				
1 kHz	0.070 %		67 μ V/V	38 μ V/V		25 μ V/V				
10 kHz		0.022 %	90 μ V/V		40 μ V/V	72 μ V/V	100 mV	120 mV	18 μ V/V	
20 kHz									48 μ V/V	17 μ V/V
50 kHz									53 μ V/V	23 μ V/V
100 kHz									50 μ V/V	85 μ V/V
300 kHz		0.030 %	0.021 %		0.020 %	0.027 %	100 mV	120 mV	80 μ V/V	
500 kHz		0.036 %	0.026 %		0.025 %	0.035 %			0.011 %	
1 MHz		0.13 %	0.055 %		0.04 %	0.041 %			0.018 %	
Comments	Fluke 792 AC/DC transfer standard (with AC divider if needed) to calibrate Fluke 5790A									

(Table 2 of 6)
AC Voltage Generate (Fixed Points)

Frequency	AC Voltage (\pm) CMC ^{2, 4, 5, 13}					
	600 mV	1 V	2 V	6 V	10V	19 V
10 Hz	26 μ V/V	26 μ V/V	25 μ V/V	25 μ V/V	26 μ V/V	
20 Hz	20 μ V/V	23 μ V/V	20 μ V/V	20 μ V/V	22 μ V/V	
30 Hz		20 μ V/V			21 μ V/V	
40 Hz	10 μ V/V	17 μ V/V	8.0 μ V/V	8.0 μ V/V	18 μ V/V	
55 Hz		15 μ V/V			17 μ V/V	
100 Hz	10 μ V/V	7 μ V/V	7 μ V/V	8.0 μ V/V		
300 Hz					9.0 μ V/V	
1 kHz	12 μ V/V		6 μ V/V	8.0 μ V/V	8.0 μ V/V	
3 kHz						
10 kHz	11 μ V/V		6 μ V/V	7.0 μ V/V	9.0 μ V/V	
20 kHz						
30 kHz		8 μ V/V			10 μ V/V	
50 kHz	10 μ V/V		8 μ V/V	7.0 μ V/V		
60 kHz						
100 kHz	12 μ V/V	10 μ V/V	10 μ V/V	8.0 μ V/V	11 μ V/V	
300 kHz	30 μ V/V	25 μ V/V	25 μ V/V	23 μ V/V	23 μ V/V	
500 kHz	32 μ V/V	26 μ V/V	26 μ V/V	28 μ V/V	28 μ V/V	
1 MHz	65 μ V/V	45 μ V/V	45 μ V/V	45 μ V/V	45 μ V/V	
Comments	Fluke 792 AC/DC transfer standard (with AC divider if needed) to calibrate Fluke 5790A and Fluke 8508A					

(Table 3 of 6) AC Voltage Generate (Fixed Points)					
Frequency	AC Voltage (\pm) CMC ^{2, 4, 5, 13}				
	20 V	60 V	100 V	200 V	500 V
10 Hz	25 μ V/V	26 μ V/V	26 μ V/V	36 μ V/V	
20 Hz	30 μ V/V	22 μ V/V	22 μ V/V	23 μ V/V	
40 Hz	8.0 μ V/V	10 μ V/V		18 μ V/V	
50 Hz					24 μ V/V
55 Hz					
100 Hz	8.0 μ V/V	10 μ V/V	10 μ V/V	18 μ V/V	
300 Hz					20 μ V/V
1 kHz	8.0 μ V/V	10 μ V/V	10 μ V/V	13 μ V/V	15 μ V/V
3 kHz					
10 kHz	8.0 μ V/V	10 μ V/V	10 μ V/V	13 μ V/V	
20 kHz				14 μ V/V	
30 kHz					17 μ V/V
50 kHz	8.0 μ V/V	12 μ V/V	12 μ V/V	16 μ V/V	
60 kHz					30 μ V/V
100 kHz	10 μ V/V	15 μ V/V	15 μ V/V	21 μ V/V	41 μ V/V
300 kHz	25 μ V/V	30 μ V/V	30 μ V/V		
500 kHz	30 μ V/V				
1 MHz	45 μ V/V				
Comments	Fluke 792 AC/DC transfer standard (with AC divider if needed) to calibrate Fluke 5790A and Fluke 8508A				

(Table 4 of 6) AC Voltage Generate (Fixed Points)	
Frequency	AC Voltage (\pm) CMC ^{2, 4, 5, 13}
1 kHz	0.040 %
Comments	Calibration of Fluke 8508A

(Table 5 of 6)
AC Voltage Generate (Fixed Points)

Frequency	AC Voltage (\pm) CMC ^{2, 4, 5, 13}							
	10 mV	100 mV	500 mV	50 V	250 V	600 V	700 V	1000 V
10 Hz								50 μ V/V
15 Hz					40 μ V/V			
20 Hz		74 μ V/V						21 μ V/V
40 Hz		32 μ V/V	18 μ V/V			23 μ V/V		
55 Hz		37 μ V/V						
100 Hz						21 μ V/V		
300 Hz		45 μ V/V						
1 kHz	0.027 %	36 μ V/V	12 μ V/V			15 μ V/V		
3 kHz		40 μ V/V						
10 kHz		35 μ V/V				15 μ V/V		
20 kHz		40 μ V/V	11 μ V/V			16 μ V/V		19 μ V/V
30 kHz		50 μ V/V						24 μ V/V
50 kHz		60 μ V/V				20 μ V/V	28 μ V/V	
60 kHz		84 μ V/V						
100 kHz		100 μ V/V	23 μ V/V			40 μ V/V	38 μ V/V	
300 kHz		200 μ V/V	70 μ V/V	40 μ V/V				
1 MHz		0.12 %	0.014 %					
Comments	Calibration of Fluke 5790A or reference multimeters							

(Table 6 of 6) AC Voltage Generate (Fixed Points)		
Frequency	AC Voltage (\pm) CMC ^{2, 4, 5, 13}	
	1 V	3 V
2 MHz	0.60 %	0.50 %
4 MHz		
8 MHz		
10 MHz		
Comments	Calibration of reference multimeters	

(Table 1 of 2) AC Voltage Generate				
Frequency	AC Voltage (\pm) CMC ^{2, 5, 13}			
	(1 to 2.2) mV	(2.2 to 22) mV	(22 to 220) mV	(0.22 to 2.2) V
(10 to 20) Hz	0.33 % + 4 μ V	0.030 % + 4.0 μ V	0.030 % + 12 μ V	0.030 % + 40 μ V
(20 to 40) Hz	0.34 % + 4 μ V	0.020 % + 4.0 μ V	97 μ V/V + 7.0 μ V	95 μ V/V + 7.0 μ V
40 Hz to 20 kHz			82 μ V/V + 7.0 μ V	49 μ V/V + 8.0 μ V
(20 to 50) kHz	0.35 % + 4 μ V	0.030 % + 4.0 μ V	0.030 % + 7.0 μ V	80 μ V/V + 10 μ V
(50 to 100) kHz	0.38 % + 5 μ V	0.060 % + 5.0 μ V	0.050 % + 17 μ V	0.020 % + 30 μ V
(100 to 300) kHz	0.47 % + 20 μ V	0.11 % + 10 μ V	0.090 % + 20 μ V	0.050 % + 80 μ V
(300 to 500) kHz	0.61 % + 10 μ V	0.15 % + 20 μ V	0.14 % + 25 μ V	0.10 % + 0.20 mV
(0.5 to 1) MHz	0.71 % + 20 μ V	0.28 % + 20 μ V	0.27 % + 45 μ V	0.18 % + 0.30 mV
Comments	Fluke 5720A Series II For calibration of long scale and bench DMMs			

(Table 2 of 2)
AC Voltage Generate

Frequency	AC Voltage (\pm) CMC ^{2, 5, 13}		
	(2.2 to 22) V	(22 to 220) V	(220 to 1000) V
(10 to 20) Hz	0.030 % + 0.40 mV	0.030 % + 4.0 μ V	0.030 % + 16 μ V
(20 to 40) Hz	95 μ V/V + 0.15 mV	97 μ V/V + 1.5 μ V	
(40 to 50) Hz	49 μ V/V + 50 μ V	56 μ V/V + 0.60 μ V	94 μ V/V + 4.0 μ V
(50 to 1000) Hz			77 μ V/V + 3.5 μ V
(1 to 20) kHz			0.020 % + 6.0 μ V
(20 to 30) kHz	80 μ V/V + 0.10 mV	90 μ V/V + 1.0 μ V	0.060 % + 11 μ V
(30 to 50) kHz			
(50 to 100) kHz	0.020 % + 0.20 mV	0.020 % + 2.5 μ V	0.23 % + 45 μ V
(100 to 300) kHz	0.030 % + 0.60 mV		
(300 to 500) kHz	0.10 % + 2.0 mV		
(0.5 to 1) MHz	0.16 % + 3.2 mV		
Comments	Fluke 5720A Series II (w/ a Fluke 5725A if needed) For calibration of long scale and bench DMMs		

(Table 1 of 4) AC Voltage Measure					
Frequency	AC Voltage (\pm) CMC ^{2, 4, 5, 13}				
	0.6 mV	(1 to 2.2) mV	(2.2 to 7) mV	(7 to 22) mV	
(9.5 to 10) Hz		780 μ V/V + 1.2 μ V	780 μ V/V + 1.2 μ V	780 μ V/V + 1.2 μ V	
(10 to 20) Hz		0.026 % + 1 μ V	0.014 % + 1 μ V	70 μ V/V + 1 μ V	
(20 to 40) Hz					
(40 to 1000) Hz			0.028 % + 1 μ V	0.011 % + 1 μ V	50 μ V/V + 1 μ V
1 kHz	0.20 %				
(1 to 20) kHz			0.029 % + 1.6 μ V	0.011 % + 1.6 μ V	60 μ V/V + 1.6 μ V
(20 to 50) kHz			0.032 % + 1.9 μ V	0.018 % + 1.9 μ V	0.01 % + 1.9 μ V
(50 to 100) kHz			0.053 % + 3.1 μ V	0.048 % + 3.1 μ V	0.024 % + 3.1 μ V
(100 to 300) kHz			0.073 % + 4.7 μ V	0.059 % + 4.7 μ V	0.032 % + 4.7 μ V
(300 to 500) kHz		0.19 % + 4.7 μ V	0.085 % + 4.7 μ V	0.049 % + 4.7 μ V	
(0.5 to 1) MHz					
Comments	Fluke 792A or Fluke 5790A transfer standard for calibration of long scale DMM calibration stations, Fluke 55XX and Fluke 57XX calibrators				

(Table 2 of 4) AC Voltage Measure				
Frequency	AC Voltage (\pm) CMC ^{2, 5, 13}			
	(22 to 70) mV	(70 to 220) mV	(220 to 700) mV	(0.7 to 2.2) V
(9.5 to 10) Hz	780 μ V/V + 1.2 μ V	780 μ V/V + 1.2 μ V	780 μ V/V + 1.2 μ V	780 μ V/V
(10 to 20) Hz	0.012 % + 1.2 μ V	60 μ V/V + 1.2 μ V	50 μ V/V	40 μ V/V
(20 to 40) Hz	93 μ V/V + 1.2 μ V	50 μ V/V + 1.2 μ V		
40 Hz to 20 kHz	50 μ V/V + 1.2 μ V	29 μ V/V + 1.2 μ V	24 μ V/V + 1.2 μ V	17 μ V/V
(20 to 50) kHz	80 μ V/V + 1.6 μ V	50 μ V/V + 1.6 μ V	39 μ V/V + 1.6 μ V	30 μ V/V
(50 to 100) kHz	0.014 % + 1.9 μ V	90 μ V/V + 1.9 μ V	61 μ V/V + 1.9 μ V	
(100 to 300) kHz	0.029 % + 3.1 μ V	0.014 % + 3.1 μ V	120 μ V/V + 3.1 μ V	0.01 %
(300 to 500) kHz	0.038 % + 4.7 μ V	0.013 % + 4.7 μ V	0.017 %	
(0.5 to 1) MHz	0.051 % + 4.7 μ V	0.031 % + 4.7 μ V	0.023 %	0.011 %
Comments	Fluke 792A or Fluke 5790A transfer standard for calibration of long scale DMM calibration stations, Fluke 55XX and Fluke 57XX calibrators			

(Table 3 of 4) AC Voltage Measure			
Frequency	AC Voltage (\pm) CMC ^{2, 5, 13}		
	(2.2 to 7) V	(7 to 22) V	(22 to 70) V
(9.5 to 10) Hz	780 μ V/V	780 μ V/V	780 μ V/V
(10 to 20) Hz	40 μ V/V	90 μ V/V	40 μ V/V
(20 to 40) Hz		40 μ V/V	
40 Hz to 20 kHz	17 μ V/V	19 μ V/V	23 μ V/V
(20 to 50) kHz	30 μ V/V	30 μ V/V	40 μ V/V
(50 to 100) kHz			
(100 to 300) kHz	0.01 %	80 μ V/V	0.01 %
(300 to 500) kHz			310 μ V/V
(0.5 to 1) MHz	0.011 %	0.011 %	850 μ V/V
Comments	Fluke 792A or Fluke 5790A transfer standard for calibration of long scale DMM calibration stations, Fluke 55XX and Fluke 57XX calibrators		

(Table 4 of 4) AC Voltage Measure			
Frequency	AC Voltage (\pm) CMC ^{2, 5, 13}		
	(70 to 220) V	(220 to 700) V	(700 to 1050) V
(10 to 20) Hz	90 μ V/V	0.010 %	
(20 to 40) Hz	50 μ V/V	60 μ V/V	50 μ V/V
40 Hz to 20 kHz	22 μ V/V	30 μ V/V	29 μ V/V
(20 to 50) kHz	40 μ V/V	37 μ V/V	40 μ V/V
(50 to 100) kHz	50 μ V/V	60 μ V/V	60 μ V/V
(100 to 300) kHz	0.011 %		
(300 to 500) kHz	340 μ V/V		
Comments	Fluke 792A or Fluke 5790A transfer standard for calibration of long scale DMM calibration stations, Fluke 55XX and Fluke 57XX calibrators		

AC Voltage Measure (Non-Sinusoidal Waveforms)			
Frequency	AC Voltage _{p-p} (±) CMC ^{2, 5, 13}		
	(1 to 22) mV	(22 to 700) mV	(0.7 to 70) V
(10 to 45) Hz	780 μV/V + 1.0 μV	780 μV/V + 1.2 μV	780 μV/V
45 Hz to 1 kHz	780 μV/V + 1.0 μV	780 μV/V + 1.2 μV	780 μV/V
(1 to 20) kHz	0.13 % + 1.0 μV	0.13 % + 1.2 μV	0.13 %
(20 to 100) kHz	0.39 % + 1.9 μV		0.39 %
Comments	Fluke 5790B AC Measurement Standard for calibration of Fluke 55XX calibrators		

(Table 1 of 2) AC Voltage Measure (Fixed Points)						
Frequency	AC Voltage (±) CMC ^{2, 4, 5, 13}					
	0.25 V	1.5 V	2.4 V	10 V	23 V	45 V
0 Hz	34	34	34	32	34	34
16 Hz	31	25	38	28	31	31
40 Hz	25		27	22	22	20
50 Hz					23	21
60 Hz					25	25
120 Hz						
180 Hz						
450 Hz	25	25	29	24	28	28
850 Hz	27	28				
1.2 kHz	36	36	37	34	36	36
1.8 kHz						
2.4 kHz						
3.0 kHz						
3.6 kHz						
4.2 kHz						
4.8 kHz						
5.4 kHz						
6.0 kHz						
Comments	Note: All uncertainties in μV/V					
	Fluke 61XXA calibration system					

(Table 2 of 2)
AC Voltage Measure (Fixed Points)

Frequency	AC Voltage (\pm) CMC ^{2, 4, 5, 13}				
	90 V Range Linearity		180 V	360V	1008 V
	7 V	90 V			
0 Hz	36	34	34	34	34
16 Hz	56	31	38	38	38
40 Hz		25	27	27	27
50 Hz					
60 Hz					
120 Hz					
180 Hz					
450 Hz					
850 Hz	56	25	28	29	29
1.2 kHz	60	36	37	37	37
1.8 kHz	70				
2.4 kHz					
3.0 kHz	80				
3.6 kHz					
4.2 kHz					
4.8 kHz					
5.4 kHz					
6.0 kHz					
Comments	Note: All uncertainties in μ V/V				
	Fluke 61XXA calibration system				

(Table 1 of 4) AC Current Measure (Fixed Points)								
Frequency	AC Current (\pm) CMC ^{2, 4, 5, 13}							
	20 μ A	200 μ A	300 μ A	2 mA	3 mA	20 mA	200 mA	2 A
10 Hz		80 μ A/A	0.010 %	75 μ A/A	0.010 %	0.012 %	0.012 %	
20 Hz		65 μ A/A		55 μ A/A		65 μ A/A	65 μ A/A	70 μ A/A
40 Hz		55 μ A/A		45 μ A/A		45 μ A/A	45 μ A/A	
45 Hz								
1 kHz	0.015 %	55 μ A/A	75 μ A/A	45 μ A/A	65 μ A/A	45 μ A/A	45 μ A/A	65 μ A/A
5 kHz		0.016 %	0.020 %	75 μ A/A	85 μ A/A	65 μ A/A	65 μ A/A	
10 kHz	0.050 %	0.027 %	0.025 %	0.010 %	0.010 %	0.010 %	0.010 %	0.010 %
30 kHz			0.050 %		0.015 %			
Comments	Multifunction calibrator calibration							

(Table 2 of 4) AC Current Measure (Fixed Points)						
Frequency	AC Current (\pm) CMC ^{2, 4, 5, 13}					
	329 μ A	0.33 mA	1.9 mA	3.29 mA	3.3 mA	19 mA
10 Hz				170 μ A/A		
45 Hz						
1 kHz	99 μ A/A	99 μ A/A	47 μ A/A	42 μ A/A	42 μ A/A	39 μ A/A
5 kHz						
10 kHz	98 μ A/A		46 μ A/A	41 μ A/A		39 μ A/A
30 kHz	160 μ A/A	160 μ A/A	70 μ A/A	53 μ A/A	53 μ A/A	52 μ A/A
Comments	Fluke A40B with Fluke 5790B (calibration of Fluke 55XX calibrators)					

(Table 3 of 4) AC Current Measure (Fixed Points)						
Frequency	AC Current (\pm) CMC ^{2, 4, 5, 13}					
	32.9 mA	33 mA	190 mA	329 mA	0.33 A	1.09 A
10 Hz	170 μ A/A			170 μ A/A		170 μ A/A
45 Hz	37 μ A/A			39 μ A/A		43 μ A/A
1 kHz		37 μ A/A	41 μ A/A			
5 kHz	38 μ A/A	38 μ A/A		38 μ A/A	38 μ A/A	43 μ A/A
10 kHz			41 μ A/A			
30 kHz	50 μ A/A	50 μ A/A	54 μ A/A	51 μ A/A		
Comments	Fluke A40B with Fluke 5790B (calibration of Fluke 55XX calibrators)					

(Table 4 of 4) AC Current Measure (Fixed Points)						
Frequency	AC Current (\pm) CMC ^{2, 4, 5, 13}					
	2.19 A	2.99 A	3.3 A	10.9 A	20 A	
10 Hz	170 μ A/A	170 μ A/A				
45 Hz	51 μ A/A	47 μ A/A		82 μ A/A	48 μ A/A	
65 Hz				83 μ A/A		
500 Hz			52 μ A/A	90 μ A/A	60 μ A/A	
1 kHz	56 μ A/A	52 μ A/A	51 μ A/A	89 μ A/A	59 μ A/A	
5 kHz	56 μ A/A	53 μ A/A	52 μ A/A	97 μ A/A	71 μ A/A	
10 kHz						
Comments	Fluke A40B with Fluke 5790B (calibration of Fluke 55XX calibrators)					

(Table 1 of 2) AC Current Measure & AC Current Generate					
Frequency	AC Current (\pm) CMC ^{2, 4, 5, 13}				
	(10 to 200) μ A	(0.2 to 2) mA	(2 to 20) mA	(20 to 200) mA	(0.2 to 2) A
10 Hz	75 μ A/A + 5.4 nA	86 μ A/A + 21 nA	80 μ A/A + 0.21 μ A	63 μ A/A + 2.1 μ A	70 μ A/A + 21 μ A
(10 to 20) Hz	78 μ A/A + 5.4 nA	50 μ A/A + 21 nA	58 μ A/A + 0.21 μ A	58 μ A/A + 2.1 μ A	61 μ A/A + 21 μ A
(20 to 30) Hz			62 μ A/A + 0.21 μ A	63 μ A/A + 2.1 μ A	68 μ A/A + 21 μ A
(30 to 40) Hz	74 μ A/A + 5.4 nA		53 μ A/A + 0.21 μ A	52 μ A/A + 2.1 μ A	55 μ A/A + 21 μ A
(40 to 55) Hz			57 μ A/A + 0.21 μ A	58 μ A/A + 2.1 μ A	62 μ A/A + 21 μ A
(55 to 300) Hz	87 μ A/A + 5.4 nA		51 μ A/A + 21 nA	58 μ A/A + 0.21 μ A	57 μ A/A + 2.1 μ A
(0.3 to 1) kHz	78 μ A/A + 5.4 nA	53 μ A/A + 0.21 μ A		52 μ A/A + 2.1 μ A	55 μ A/A + 21 μ A
(1 to 5) kHz	0.012 % + 5.4 nA	76 μ A/A + 21 nA	82 μ A/A + 0.21 μ A	78 μ A/A + 2.1 μ A	82 μ A/A + 21 μ A
(5 to 10) kHz	0.031 % + 5.4 nA	0.020 % + 21 nA	0.021 % + 0.21 μ A	0.020 % + 2.1 μ A	0.022 % + 21 μ A
(10 to 20) kHz	0.034 % + 7.1 nA	0.031 % + 51 nA	0.032 % + 0.51 μ A	0.032 % + 5.0 μ A	0.032 % + 50.2 μ A
(20 to 30) kHz	0.053 % + 12 nA	0.051 % + 0.10 μ A	0.051 % + 1.1 μ A	0.051 % + 10 μ A	0.052 % + 100 μ A
Comments	Fluke A40/A40A with a Fluke 792A or Fluke 5790A (calibration of Fluke 55XX & Fluke 57XX calibrators)				

(Table 2 of 2) AC Current Measure & AC Current Generate	
Frequency	AC Current (\pm) CMC ^{2, 5, 13}
	(2 to 20) A
(1 to 5) kHz	0.031 % + 0.21 mA
(5 to 10) kHz	0.061 % + 0.21 mA
(10 to 20) kHz	0.11 % + 0.51 mA
Comments	Fluke A40/A40A with a Fluke 792A or Fluke 5790A (calibration of Fluke 55XX & Fluke 57XX calibrators)

(Table 1 of 3) AC Current Generate (\pm) CMC ^{2, 5, 13}				
	Frequency			
	(10 to 45) Hz	(45 to 1000) Hz	(1 to 5) kHz	(5 to 10) kHz
(2 to 2.999 99) A	0.12 % + 78 μ A	0.039 % + 78 μ A	0.39 % + 780 μ A	1.6 % + 3.9 mA

(Table 2 of 3) AC Current Generate (\pm) CMC ^{2, 5, 13}		
	Frequency	
	(45 to 100) Hz	(100 to 1000) Hz
(3 to 10.9999) A	0.039 % + 1.6 mA	0.062 % + 1.6 mA
(11 to 20.5) A	0.078 % + 3.9 mA	0.10 % + 3.9 mA
Comments	Fluke 5522A calibration of Fluke 280-series multimeters	

(Table 3 of 3) AC Current Generate using Transconductance Amplifier (\pm) CMC ^{2, 5, 13}				
	Frequency			
	(10 to 45) Hz	(45 to 65) Hz	(65 to 300) Hz	(300 to 1000) Hz
(2 to 20) A	0.026 % + 27 mA	0.016 % + 27 mA	0.026 % + 27 mA	0.078 % + 27 mA
(20.0001 to 32.9999) A	0.026 % + 31 mA	0.016 % + 31 mA	0.026 % + 37 mA	0.078 % + 96 mA
(33 to 40) A			0.026 % + 38 mA	
(40.001 to 120) A	0.026 % + 290 mA	0.016 % + 290 mA	0.026 % + 290 mA	0.078 % + 300 mA
Comments	Calibration of clamp meters using a Fluke 5522A driving a Fluke 52120A into a single wire			

Simulation of Flexible AC Current Probe (Rogowski Coil) (Fixed Points)				
Parameter/Equipment	Simulated Current	Frequency	(±) CMC ^{2,13}	Comments
AC Current Generate	50 A	35 Hz	260 mA	Simulation of accessory probe by a Fluke 55XXA into a clamp meter
		100 Hz	100 mA	
		500 Hz	62 mA	
	100 A	50 Hz	180 mA	
	600 A	60 Hz	270 mA	
		500 Hz	110 mA	
	900 A	50 Hz	270 mA	
	950 A	20 Hz	980 mA	
		100 Hz	220 mA	
		500 Hz	140 mA	
	995 A	50 Hz	280 mA	
	1000 A	500 Hz	140 mA	
	2000 A	50 Hz	720 mA	
	2450 A	20 Hz	2.0 A	
		100 Hz	690 mA	
		500 Hz	730 mA	
2500 A	45 Hz	3.4 A		
	50 Hz	1.0 A		
	500 Hz	930 mA		

AC Current Measure			
Frequency	AC Current	(±) CMC ^{2, 4, 5, 13}	Comments
(40 to 1000) Hz	(2 to 11) A	0.040 % + 0.17 mA	Fluke 5725A
(45 to 100) Hz	(11 to 20) A	0.076 % + 5 mA	Fluke 5520A
(100 to 1000) Hz		0.11 % + 5 mA	
(16 to 450) Hz	(80 to 120) A	49 µA/A	Fluke 52120A transconductance amplifier with Fluke 61XX calibration system
850 Hz		51 µA/A	
(1 to 6) kHz		0.011 %	
Comments	Calibration of Fluke 52120A, Fluke 55XX, Fluke 57XX & Fluke 61XX calibrators		

AC Current Generate (<i>Fixed Points</i>)							
Frequency	AC Current (±) CMC ^{2, 4, 5, 6, 13}						
	100 µA	1 mA	10 mA	100 mA	1 A	10 A	30 A
10 Hz						73 µA/A	
55 Hz	60 µA/A	40 µA/A	40 µA/A	40 µA/A	50 µA/A	160 µA/A	
300 Hz			50 µA/A			120 µA/A	
1 kHz		45 µA/A	35 µA/A	30 µA/A	40 µA/A	90 µA/A	79 µA/A
5 kHz	75 µA/A	50 µA/A	40 µA/A	40 µA/A	80 µA/A	0.055 %	
10 kHz	200 µA/A	95 µA/A	120 µA/A	110 µA/A	0.052 %	0.070 %	
Comments	Calibration of reference multimeters						

Table (1 of 2)
AC Current Measure (*Fixed Points*)

Frequency	AC Current (\pm) CMC ^{2, 4, 5, 13}					
	0.1 A	0.5 A	1 A	2 A	5 A	
0 Hz	26	27	27	26	28	
16 Hz	27			27	27	32
40 Hz						
50 Hz						
60 Hz						
120 Hz						
180 Hz						
450 Hz	25	25	25	24	30	
850 Hz	27	27	27	27	32	
1.2 kHz	28	29	29	28	34	
1.8 kHz						
2.4 kHz						
3.0 kHz						
3.6 kHz						
4.2 kHz						
4.8 kHz						
5.4 kHz						
6.0 kHz						
Comments	Note: All uncertainties in $\mu\text{A}/\text{A}$					
	Fluke 61XX calibration system					

(Table 2 of 2)
AC Current Measure (Fixed Points)

Frequency	AC Current (\pm) CMC ^{2, 4, 5, 13}				
	10 A Range Linearity		20 A	50 A	100 A
	0.5 A	10 A			
0 Hz	42	28	28	27	33
16 Hz	45	34	34	34	38
40 Hz					
50 Hz					
60 Hz	78	35	41	50	61
120 Hz					
180 Hz					
450 Hz	46	34	40	48	60
850 Hz	47	35	41	50	61
1.2 kHz	48	37	42		59
1.8 kHz			51	80	
2.4 kHz					
3.0 kHz					
3.6 kHz					
4.2 kHz					
4.8 kHz					
5.4 kHz					
6.0 kHz					
Comments	Note: All uncertainties in $\mu\text{A}/\text{A}$				
	Fluke 61XX calibration system				

(Table 1 of 3) AC Current Measure (<i>Fixed Points</i>)					
Frequency	AC Current (\pm) CMC ^{2, 4, 5, 13}				
	(5 to 10) mA	(10 to 20) mA	(20 to 30) mA	(30 to 50) mA	(50 to 100) mA
10 Hz	0.013 %	0.013 %	0.015 %	0.017 %	0.014 %
20 Hz		75 μ A/A			
40 Hz	75 μ A/A	60 μ A/A	95 μ A/A	0.010 %	85 μ A/A
400 Hz					
1 kHz					
5 kHz					
10 kHz					
20 kHz	75 μ A/A				
30 kHz	90 μ A/A	90 μ A/A	0.012 %	0.011 %	0.01 %
Comments	Fluke 792 AC/DC transfer standard and a Fluke A40 AC/DC current shunt				

(Table 2 of 3) AC Current Measure (<i>Fixed Points</i>)					
Frequency	AC Current (\pm) CMC ^{2, 4, 5, 13}				
	(100 to 200) mA ⁸	(200 to 300) mA	(300 to 500) mA	(0.5 to 1) A	(1 to 2) A
10 Hz	0.013 %	0.015 %	0.016 %	0.015 %	0.012 %
20 Hz					
40 Hz	80 μ A/A	90 μ A/A	0.010 %	90 μ A/A	0.011 %
400 Hz					
1 kHz					
5 kHz					
10 kHz		0.015 %			0.012 %
20 kHz					
30 kHz	95 μ A/A				
Comments	Fluke 792 AC/DC transfer standard and a Fluke A40 AC/DC current shunt				

(Table 3 of 3) AC Current Measure (Fixed Points)				
Frequency	AC Current (\pm) CMC ^{2, 4, 5, 13}			
	(2 to 3) A	(3 to 5) A	(5 to 10) A	(10 to 20 A)
10 Hz	0.015 %	0.018 %	0.015 %	0.017 %
20 Hz				
40 Hz				
400 Hz	0.010 %	0.011 %		0.013 %
1 kHz				
5 kHz				
10 kHz				0.016 %
Comments	Fluke 792 AC/DC transfer standard and a Fluke A40 AC/DC current shunt			

(Table 1 of 3) AC Current Measure (Fixed Points)				
Frequency	2 Amp Range (\pm) CMC ^{2, 4, 5, 13}			
	V in			I in
	0.4 A	1.0 A	2.0 A	2.0 A
DC	51 μ A/A	34 μ A/A	28 μ A/A	30 μ A/A
(10, 16, 40, 50, 60, 120, 180, 450, 850, 1000) Hz	160 μ A/A	110 μ A/A	100 μ A/A	99 μ A/A
(1.2, 1.8, 2.4) kHz	210 μ A/A	470 μ A/A	480 μ A/A	480 μ A/A
(3.0, 3.6, 4.2) kHz	210 μ A/A	480 μ A/A	490 μ A/A	490 μ A/A
4.8 kHz	270 μ A/A	480 μ A/A	490 μ A/A	490 μ A/A
5.4 kHz	270 μ A/A	480 μ A/A	500 μ A/A	500 μ A/A
6.0 kHz	290 μ A/A	830 μ A/A	830 μ A/A	830 μ A/A
8.0 kHz	750 μ A/A	1100 μ A/A	1100 μ A/A	1100 μ A/A
10 kHz	920 μ A/A	1500 μ A/A	1500 μ A/A	1500 μ A/A
Comments	Fluke 61XXA calibration station Fluke 52120A (stand-alone mode) calibration			

(Table 2 of 3) AC Current Measure (Fixed Points)				
Frequency	20 Amp Range (\pm) CMC ^{2, 4, 5, 13}			
	V in			I in
	4 A	10 A	20 A	20 A
DC	73 μ A/A	73 μ A/A	50 μ A/A	51 μ A/A
10 Hz	160 μ A/A	91 μ A/A	82 μ A/A	83 μ A/A
(16, 40, 50, 60, 120, 180, 450, 850, 1000) Hz	160 μ A/A	90 μ A/A	80 μ A/A	81 μ A/A
(1.2, 1.8, 2.4, 3.0) kHz	490 μ A/A	200 μ A/A	190 μ A/A	190 μ A/A
(3.6, 4.2, 4.8, 5.4) kHz	490 μ A/A	200 μ A/A	200 μ A/A	200 μ A/A
6.0 kHz	490 μ A/A	200 μ A/A	210 μ A/A	210 μ A/A
8.0 kHz	500 μ A/A	830 μ A/A	840 μ A/A	840 μ A/A
10 kHz	1500 μ A/A	840 μ A/A	840 μ A/A	840 μ A/A
Comments	Fluke 61XXA calibration station Fluke 52120A (stand-alone mode) calibration			

(Table 3 of 3) AC Current Measure (Fixed Points)				
Frequency	120 Amp Range (\pm) CMC ^{2, 4, 5, 13}			
	V in			I in
	20 A	60 A	120 A	100 A
DC	37 μ A/A	37 μ A/A	33 μ A/A	37 μ A/A
(10, 16, 40, 50, 60, 120, 180, 450, 850, 1000) Hz	160 μ A/A	84 μ A/A	86 μ A/A	73 μ A/A
(1.2, 1.8, 2.4, 3.0) kHz	210 μ A/A	200 μ A/A	210 μ A/A	200 μ A/A
(3.6, 4.2) kHz	210 μ A/A	220 μ A/A	220 μ A/A	210 μ A/A
4.8 kHz	230 μ A/A	220 μ A/A	220 μ A/A	210 μ A/A
5.4 kHz	250 μ A/A	240 μ A/A	240 μ A/A	230 μ A/A
6.0 kHz	290 μ A/A	260 μ A/A	270 μ A/A	260 μ A/A
8.0 kHz	750 μ A/A	740 μ A/A	730 μ A/A	740 μ A/A
10 kHz	770 μ A/A	750 μ A/A	760 μ A/A	760 μ A/A
Comments	Fluke 61XXA calibration station Fluke 52120A (stand-alone mode) calibration			

(Table 1 of 3) AC Current Measure (Fixed Points)			
Frequency	2 Amp Range (\pm) CMC ^{2, 4, 5, 13}		
	0.4 A	1.0 A	2.0 A
DC	60 μ A/A	48 μ A/A	44 μ A/A
(16, 40, 50, 60, 120, 180, 450, 850, 1000) Hz	79 μ A/A	59 μ A/A	49 μ A/A
(1.2, 1.8, 2.4) kHz	79 μ A/A	59 μ A/A	49 μ A/A
3.0 kHz	90 μ A/A	72 μ A/A	64 μ A/A
(3.6, 4.2, 4.8) kHz	92 μ A/A	76 μ A/A	68 μ A/A
(5.4, 6.0) kHz	98 μ A/A	83 μ A/A	76 μ A/A
Comments	Fluke 61XXA calibration station Fluke 52120A calibration (under Fluke 6105A control)		

(Table 2 of 3) AC Current Measure (Fixed Points)			
Frequency	20 Amp Range (\pm) CMC ^{2, 4, 5, 13}		
	4 A	10 A	20 A
DC	78 μ A/A	78 μ A/A	78 μ A/A
(16, 40, 50, 60, 120, 180, 450, 850, 1000) Hz	65 μ A/A	65 μ A/A	56 μ A/A
(1.2, 1.8, 2.4, 3.0) kHz	71 μ A/A	71 μ A/A	63 μ A/A
(3.6, 4.2, 4.8, 5.4) kHz	74 μ A/A	74 μ A/A	67 μ A/A
6.0 kHz	78 μ A/A	78 μ A/A	70 μ A/A
Comments	Fluke 61XXA calibration station Fluke 52120A calibration (under Fluke 6105A control)		

(Table 3 of 3) AC Current Measure (Fixed Points)			
Frequency	120 Amp Range (\pm) CMC ^{2, 4, 5, 13}		
	20 A	60 A	100 A
DC	51 μ A/A	52 μ A/A	51 μ A/A
(16, 40, 50, 60, 120, 180, 450, 850, 1000) Hz	79 μ A/A	77 μ A/A	72 μ A/A
(1.2, 1.8, 2.4, 3.0) kHz	95 μ A/A	92 μ A/A	89 μ A/A
3.6, 4.2, 4.8, 5.4, 6.0) kHz	97 μ A/A	95 μ A/A	92 μ A/A
Comments	Fluke 61XX calibration station Fluke 52120A calibration (under Fluke 6105A control)		

AC Current Phase Measure (<i>Fixed Points</i>)	
Frequency	All Ranges: 2 A, 20 A & 120 A (\pm) CMC ^{2, 4, 13}
16 Hz	1.3 m $^\circ$
40 Hz	1.8 m $^\circ$
50 Hz	2.2 m $^\circ$
60 Hz	2.5 m $^\circ$
120 Hz	4.3 m $^\circ$
180 Hz	6.4 m $^\circ$
450 Hz	16 m $^\circ$
850 Hz	30 m $^\circ$
1.0 kHz	35 m $^\circ$
1.2 kHz	58 m $^\circ$
1.8 kHz	120 m $^\circ$
2.4 kHz	130 m $^\circ$
3.0 kHz	130 m $^\circ$
3.6 kHz	150 m $^\circ$
4.2 kHz	190 m $^\circ$
4.8 kHz	220 m $^\circ$
5.4 kHz	210 m $^\circ$
6.0 kHz	240 m $^\circ$
Comments	Fluke 61XXA calibration station Fluke 52120A calibration (under Fluke 6105A control)

(Table 1 of 6)
AC Current Phase Measure (Fixed Points)

Frequency	2 Amp Range (\pm) CMC ^{2, 4, 13}		
	0.4 A	1.0 A	2.0 A
16 Hz	1.2	1.2	1.2
40 Hz	1.7	1.7	1.7
50 Hz	2.1	2.1	2.1
60 Hz	2.5	2.5	2.5
120 Hz	4.3	4.3	4.3
180 Hz	6.3	6.3	6.3
450 Hz	16	16	16
850 Hz	30	30	30
1.0 kHz	34	34	34
1.2 kHz	57	57	57
1.8 kHz	120	120	120
2.4 kHz	130	130	130
3.0 kHz	130	130	130
3.6 kHz	150	150	150
4.2 kHz	180	180	180
4.8 kHz	220	220	220
5.4 kHz	210	210	210
6.0 kHz	240	240	240
Comments	All uncertainties are in m°		
	Phase measurement uncertainty assuming a common Fluke 61XXA and Fluke 52120A calibration system. Calibration of 61XXA		

(Table 2 of 6)
AC Current Phase Measure (Fixed Points)

Frequency	20 Amp Range (\pm) CMC ^{2, 4, 13}		
	4 A	10 A	20 A
16 Hz	1.2	1.2	1.2
40 Hz	1.7	1.7	1.7
50 Hz	2.1	2.1	2.1
60 Hz	2.5	2.5	2.5
120 Hz	4.3	4.3	4.3
180 Hz	6.4	6.4	6.4
450 Hz	16	16	16
850 Hz	30	30	30
1.0 kHz	34	34	34
1.2 kHz	57	57	57
1.8 kHz	120	120	120
2.4 kHz	130	130	130
3.0 kHz	130	130	130
3.6 kHz	150	150	150
4.2 kHz	180	180	180
4.8 kHz	220	220	220
5.4 kHz	210	210	210
6.0 kHz	240	240	240
Comments	All uncertainties are in m°		
	Phase measurement uncertainty assuming a common Fluke 61XXA and Fluke 52120A calibration system. Calibration of 61XXA		

(Table 3 of 6)
AC Current Phase Measure (Fixed Points)

Frequency	120 Amp Range (\pm) CMC ^{2, 4, 13}		
	20 A	60 A	120 A
16 Hz	1.3	1.3	1.3
40 Hz	1.8	1.8	1.8
50 Hz	2.2	2.2	2.2
60 Hz	2.5	2.5	2.5
120 Hz	4.3	4.3	4.3
180 Hz	6.4	6.4	6.4
450 Hz	16	16	16
850 Hz	30	30	30
1.0 kHz	34	34	34
1.2 kHz	57	57	57
1.8 kHz	120	120	120
2.4 kHz	130	130	130
3.0 kHz	130	130	130
3.6 kHz	150	150	150
4.2 kHz	180	180	180
4.8 kHz	220	220	220
5.4 kHz	210	210	210
6.0 kHz	240	240	240
Comments	All uncertainties are in m°		
	Phase measurement uncertainty assuming a common Fluke 61XXA and Fluke 52120A calibration system. Calibration of 61XXA		

(Table 4 of 6)
AC Current Phase Measure (Fixed Points)

Frequency	2 Amp Range (\pm) CMC ^{2, 4, 13}		
	0.4 A	1.0 A	2.0 A
16 Hz	1.4	1.4	1.4
40 Hz	2.5	2.5	2.5
50 Hz	3.1	3.1	3.1
60 Hz	3.7	3.7	3.7
120 Hz	6.9	6.9	6.9
180 Hz	11	11	11
450 Hz	26	26	26
850 Hz	49	49	49
1.0 kHz	57	57	57
1.2 kHz	78	78	78
1.8 kHz	140	140	140
2.4 kHz	170	170	170
3.0 kHz	190	190	190
3.6 kHz	230	230	230
4.2 kHz	260	260	260
4.8 kHz	310	310	310
5.4 kHz	330	330	330
6.0 kHz	360	360	360
Comments	All uncertainties are in m ^o		
	Phase measurement uncertainty when the Fluke 6105A is calibrated on a separate system		

(Table 5 of 6)
AC Current Phase Measure (Fixed Points)

Frequency	20 Amp Range (\pm) CMC ^{2, 4, 13}		
	4 A	10 A	20 A
16 Hz	1.4	1.4	1.4
40 Hz	2.5	2.5	2.5
50 Hz	3.1	3.1	3.1
60 Hz	3.7	3.7	3.7
120 Hz	6.9	6.9	6.9
180 Hz	11	11	11
450 Hz	26	26	26
850 Hz	49	49	49
1.0 kHz	57	57	57
1.2 kHz	78	78	78
1.8 kHz	140	140	140
2.4 kHz	170	170	170
3.0 kHz	190	190	190
3.6 kHz	230	230	230
4.2 kHz	260	260	260
4.8 kHz	310	310	310
5.4 kHz	330	330	330
6.0 kHz	360	360	360
Comments	All uncertainties are in m ^o		
	Phase measurement uncertainty when the Fluke 6105A is calibrated on a separate system		

(Table 6 of 6)
AC Current Phase Measure (Fixed Points)

Frequency	120 Amp Range (\pm) CMC ^{2, 4, 13}		
	20 A	60 A	120 A
16 Hz	1.5	1.5	1.5
40 Hz	2.5	2.5	2.5
50 Hz	3.1	3.1	3.1
60 Hz	3.7	3.7	3.7
120 Hz	6.9	6.9	6.9
180 Hz	11	11	11
450 Hz	27	27	27
850 Hz	49	49	49
1.0 kHz	57	57	57
1.2 kHz	78	78	78
1.8 kHz	140	140	140
2.4 kHz	170	170	170
3.0 kHz	190	190	190
3.6 kHz	230	230	230
4.2 kHz	260	260	260
4.8 kHz	310	310	310
5.4 kHz	330	330	330
6.0 kHz	360	360	360
Comments	All uncertainties are in m°		
	Phase measurement uncertainty when the Fluke 6105A is calibrated on a separate system		

Effective Current Transfer Ratio			
Parameter	Frequency	(±) CMC ^{2, 11}	Comments
25 Turn Coils	(50 to 400) Hz	0.085 % of ratio	1000 A max simulated current
50 Turn Coils		0.28 % of ratio	6000 A max simulated current
DC		0.25 % of ratio	Calibration of Fluke 5500/COIL
Comments	Calibration of Fluke 5500A/COIL, Fluke 52120A/COIL 3KA & Fluke 52120A/COIL 6KA current coils		

(Table 1 of 4) AC Current Using a Coil (±) CMC ^{2, 3, 5}			
Clamp Type: Toroidal			
AC Current	Frequency		
	(45 to 64.999) Hz	(65 to 99.999) Hz	(100 to 440) Hz
(10 to 16.4995) A	0.23 % + 52 mA	0.62 % + 52 mA	0.63 % + 52 mA
(16.5 to 99.95) A	0.24 % + 56 mA	0.62 % + 56 mA	0.66 % + 68 mA
(100.00 to 149.95) A	0.24 % + 280 mA	0.62 % + 280 mA	0.66 % + 280 mA
(150 to 1025) A	0.24 % + 300 mA	0.62 % + 300 mA	0.99 % + 350 mA
Comments	Calibration of Fluke 80i-600 using Fluke 5522A, Fluke 5500A/COIL, and Fluke 8846A		

(Table 2 of 4) AC Current Using a Coil (±) CMC ^{2, 3, 5}			
Clamp Type: Non-Toroidal			
AC Current	Frequency		
	(45 to 64.999) Hz	(65 to 99.999) Hz	(100 to 440) Hz
(10 to 16.4995) A	0.44 % + 34 mA	0.78 % + 34 mA	0.79 % + 34 mA
(16.5 to 99.95) A	0.44 % + 200 mA	0.78 % + 200 mA	0.81 % + 200 mA
(100.00 to 149.95) A	0.44 % + 340 mA	0.78 % + 340 mA	0.81 % + 340 mA
(150 to 1025) A	0.45 % + 750 mA	0.78 % + 750 mA	1.1 % + 780 mA
Comments	Calibration of Fluke clamp meters using Fluke 55XXA and Fluke 5500A/COIL		

(Table 3 of 4) AC Current Using a Coil (\pm) CMC ^{2,3,5}		
Clamp Type: Non-Toroidal using Transconductance Amplifier		
AC Current	Frequency	(\pm) CMC ^{2,3,4,11}
(10 to 40) A	(10 to 1000) Hz	0.54 % + 27 mA
(40.000 25 to 50) A	(10 to 1000) Hz	0.54 % + 100 mA
(50.000 25 to 500) A	(10 to 1000) Hz	0.54 % + 220 mA
(500.0025 to 824.9975) A	(10 to 1000) Hz	0.54 % + 510 mA
(825 to 1000) A	(10 to 1000) Hz	0.54 % + 530 mA
(1000.025 to 1400) A	(10 to 1000) Hz	0.54 % + 1.3 A
Comments	Calibration of Fluke 35X-series clamps using Fluke 5522A with Fluke 52120A and Fluke 52120A/COIL3KA	

(Table 4 of 4) AC Current Using a Coil (\pm) CMC ^{2,3,5}			
Clamp Type: Rogowski Coils			
AC Current	Frequency	(\pm) CMC ^{2,3,4,11}	Comments
(5.00025 to 15) A	(10 to 45) Hz	0.55 % + 0.70 A	Fluke 5522A with Fluke 52120A and Fluke 52120A/COIL3KA
	(45 to 500) Hz	0.54 % + 0.70 A	
(15.000 25 to 50) A	(10 to 45) Hz	0.55 % + 0.39 A	
	(45 to 500) Hz	0.54 % + 0.39 A	
(50.000 25 to 150) A	(10 to 45) Hz	0.55 % + 0.73 A	
	(45 to 500) Hz	0.54 % + 0.73 A	
(150.0025 to 500) A	(10 to 45) Hz	0.55 % + 0.45 A	
	(45 to 500) Hz	0.54 % + 0.45 A	
(500.000 25 to 3000) A	(10 to 45) Hz	0.55 % + 2.5 A	
	(45 to 500) Hz	0.54 % + 2.5A	
(3000.05 to 6000) A	(10 to 45) Hz	0.55 % + 4.7 A	Fluke 5522A with Fluke 52120A and Fluke 52120A/COIL6KA
	(45 to 65) Hz	0.54 % + 4.7 A	

(Table 1 of 3) AC Voltage Flatness Measure					
Frequency	AC Voltage Flatness (\pm) CMC ^{2, 4, 5, 13}				
	5 mV	9.9 mV	10 mV	(34, 39, 40) mV	(99, 100, 340, 399, 400) mV
(50 to 400) MHz	1.0 %	0.80 %	0.80 %	0.80 %	0.70 %
(400 to 500) MHz					
(500 to 900) MHz					
(0.9 to 1) GHz	1.1 %	0.90 %	0.90 %	0.90 %	0.80 %
(1 to 1.1) GHz					
(1.1 to 1.2) GHz	1.2 %	1.0 %		1.0 %	0.90 %
(1.2 to 1.5) GHz					
(1.5 to 1.6) GHz					
(1.6 to 2.0) GHz	1.3 %	1.2 %	1.2 %	1.2 %	1.0 %
(2.0 to 2.1) GHz					
	1.4 %	1.2 %	1.3 %	1.3 %	
Comments	Agilent E4418B power meter and power sensors calibration of Fluke 55XX, Fluke 58XX and Fluke 9500 scope calibrators				

(Table 2 of 3) AC Voltage Flatness Measure				
Frequency	AC Voltage Flatness (\pm) CMC ^{2, 4, 5, 13}			
	1.2 V	(1.3, 3.4) V	5.5 V	
(50 to 100) MHz	0.60 %	0.85 %	0.85 %	
(100 to 200) MHz		0.75 %	0.75 %	
(200 to 300) MHz			0.70 %	
(300 to 400) MHz	0.65 %		0.75 %	
(400 to 600) MHz	0.70 %	0.70 %	0.70 %	
(0.6 to 1.1) GHz		0.70 %	1.0 %	
(1.1 to 1.2) GHz				
(1.2 to 1.6) GHz	0.95 %			
(1.6 to 2.1) GHz	1.0 %			
Comments	Agilent E4418B power meter and power sensors calibration of Fluke 55XX, Fluke 58XX and Fluke 9500 scope calibrators			

(Table 3 of 3) AC Voltage Flatness Measure		
Frequency	AC Voltage Flatness (\pm) CMC ^{2, 5, 13}	
	(5 to 10) mV	10 mV to 5.5 V
50 kHz to 10 MHz	0.20 %	0.10 %
Comments	Fluke 5790 AC standard calibration of Fluke 55XX and Fluke 57XX calibrators	

(Table 1 of 4) AC Voltage Flatness Generate and AC Voltage Flatness Measure				
Frequency	AC Voltage Flatness (\pm) CMC ^{2, 5, 13}			
	(1 to 2.2) mV	(2.2 to 7) mV	(7 to 22) mV	(22 to 70) mV
(10 to 50) Hz	0.038 %	0.026 %	0.022 %	0.021 %
50 Hz to 100 kHz	0.021 %	0.012 %	0.010 %	0.009 %
(100 to 500) kHz	0.030 %	0.016 %	0.015 %	0.015 %
(500 to 700) kHz		0.020%	0.018 %	
700 kHz to 1 MHz			0.019 %	
(1 to 2) MHz			0.050 %	0.033 %
(2 to 4) MHz	0.035 %	0.029 %		
(4 to 6) MHz		0.035 %		
(6 to 8) MHz	0.040 %			0.035 %
(8 to 9) MHz	0.040 %			
(9 to 10) MHz	0.065 %	0.055 %		0.050 %
(10 to 12) MHz		0.080 %	0.062 %	0.052 %
(12 to 15) MHz	0.070 %		0.060 %	0.055 %
(15 to 17) MHz	0.13 %	0.070 %	0.065 %	0.060 %
(17 to 20) MHz		0.10 %	0.090 %	0.090 %
(20 to 23) MHz	0.15 %	0.11 %	0.11 %	0.11 %
(23 to 26) MHz		0.13 %	0.12 %	0.12 %
(26 to 28) MHz	0.15 %	0.13 %	0.12 %	0.12 %
(28 to 30) MHz		0.14 %	0.13 %	0.13 %
Comments	Fluke 5720A, relative to a reference frequency calibration of Fluke 55XX and Fluke 57XX calibrators			

(Table 2 of 4) AC Voltage Flatness Generate and AC Voltage Flatness Measure				
Frequency	AC Voltage Flatness (\pm) CMC ^{2, 5, 13}			
	(1 to 2.2) mV	(2.2 to 7) mV	(7 to 22) mV	(22 to 70) mV
(30 to 35) MHz	0.17 %	0.16 %	0.16 %	0.15 %
(35 to 40) MHz	0.20 %	0.19 %	0.18 %	0.17 %
(40 to 45) MHz	0.22 %	0.21 %	0.20 %	0.19 %
(45 to 50) MHz	0.25 %	0.23 %	0.22 %	0.21 %
Comments	Fluke 5720A, relative to a reference frequency calibration of Fluke 55XX and Fluke 57XX calibrators			

(Table 3 of 4) AC Voltage Flatness Generate and AC Voltage Flatness Measure				
Frequency	AC Voltage Flatness (\pm) CMC ^{2, 5, 13}			
	(70 to 220) mV	(220 to 700) mV	(0.7 to 2.2) V	(2.2 to 7) V
(10 to 50) Hz	0.020 %	0.016 %	0.016 %	0.015 %
50 Hz to 100 kHz	0.009 %	0.0080 %	0.0075 %	0.0070 %
(100 to 500) kHz	0.014 %	0.014 %	0.013 %	0.013 %
(500 to 700) kHz	0.017 %	0.016 %	0.016 %	0.017 %
700 kHz to 1 MHz		0.017 %	0.017 %	
(1 to 2) MHz			0.017 %	
(2 to 4) MHz	0.025 %	0.024 %	0.023 %	0.025 %
(4 to 6) MHz	0.027 %	0.026 %	0.026 %	
(6 to 8) MHz	0.031 %	0.030 %	0.028 %	0.028 %
(8 to 9) MHz	0.032 %		0.030 %	
(9 to 10) MHz			0.030 %	
(10 to 12) MHz	0.045 %	0.042 %	0.040 %	0.040 %
(12 to 15) MHz	0.046 %	0.045 %	0.045 %	0.045 %
(15 to 17) MHz	0.055 %	0.050 %	0.050 %	0.050 %
(17 to 20) MHz	0.060 %	0.060 %	0.060 %	0.060 %
Comments	Fluke 5720A, relative to a reference frequency calibration of Fluke 55XX and Fluke 57XX calibrators			

(Table 4 of 4) AC Voltage Flatness Generate and AC Voltage Flatness Measure				
Frequency	AC Voltage Flatness (\pm) CMC ^{2, 5, 13}			
	(70 to 220) mV	(220 to 700) mV	(0.7 to 2.2) V	(2.2 to 7) V
(20 to 23) MHz	0.090 %	0.09 %	0.090 %	0.090 %
(23 to 26) MHz	0.10 %	0.10 %	0.10 %	0.10 %
(26 to 28) MHz	0.11 %	0.11 %	0.11 %	0.11 %
(28 to 30) MHz	0.12 %	0.12 %	0.12 %	0.13 %
(30 to 35) MHz	0.15 %	0.14 %	0.13 %	0.13 %
(35 to 40) MHz	0.16 %	0.16 %	0.15 %	0.15 %
(40 to 45) MHz	0.18 %	0.18 %	0.16 %	0.16 %
(45 to 50) MHz	0.20 %	0.20 %	0.18 %	0.18 %
Comments	Fluke 5720A, relative to a reference frequency calibration of Fluke 55XX and Fluke 57XX calibrators			

Capacitance Measure			
Capacitance	Frequency	(\pm) CMC ^{2, 4, 5, 11}	Comments
(1 to 1000) nF	1 kHz	25 μ F/F	Andeen Hagerling 2500A option E

Capacitance Generate			
Capacitance	Frequency	(±) CMC ^{2, 5, 13}	Comments
(0.19 to 0.3999) nF	10 Hz to 10 kHz	0.29 % + 7.8 pF	Fluke 5520A
(0.4 to 1.0999) nF			
(1.1 to 3.2999) nF	10 Hz to 3 kHz		
(3.3 to 10.9999) nF	10 Hz to 1 kHz	0.15 % + 7.8 pF	
(11 to 32.9999) nF		0.15 % + 78 pF	
(33 to 109.999) nF			
(110 to 329.999) nF		0.15 % + 230 pF	
330 nF to 1.09 999 μF	(10 to 600) Hz	0.15 % + 780 pF	
(1.1 to 3.29 999) μF	(10 to 300) Hz		
(3.3 to 10.9999) μF	(10 to 150) Hz		
(11 to 32.9999) μF	(10 to 120) Hz	0.23 % + 23 nF	
(33 to 109.999) μF	(10 to 80) Hz	0.26 % + 78 nF	
(110 to 329.999) μF	(0 to 50) Hz	0.26 % + 0.23 μF	
330 μF to 1.099 99 mF	(0 to 20) Hz	0.26 % + 0.78 μF	
(1.1 to 3.2999) mF	(0 to 6) Hz	0.26 % + 2.3 μF	
(3.3 to 10.9999) mF	(0 to 2) Hz	0.26 % + 7.8 μF	
(11 to 32.9999) mF	(0 to 0.6) Hz	0.54 % + 23 μF	
(33 to 110) mF	(0 to 0.2) Hz	0.78 % + 78 μF	

Capacitance Measure & Generate (DC Charge)			
Capacitance	Equivalent Frequency	(±) CMC ^{2, 3, 4, 5, 13}	Comments
1 nF	(0.08 to 6) Hz Ramp Rate V/Vs	520 μF/F	Fluke 8588A meter calibrations and station calibration
2 nF		670 μF/F	
10 nF		290 μF/F	
20 nF		180 μF/F	
100 nF		180 μF/F	
200 nF		84 μF/F	
1 μF		250 μF/F	
2 μF		230 μF/F	
10 μF		240 μF/F	
20 μF		250 μF/F	
100 μF		250 μF/F	
200 μF		250 μF/F	
1 mF		250 μF/F	
2 mF		250 μF/F	
10 mF		260 μF/F	
20 mF		250 μF/F	
50 mF		250 μF/F	
100 mF		250 μF/F	
Standard capacitors / Andeen 2500 / characterized Fluke 5520A / transfer meter			

Capacitance Measure on Fluke 55XX Series Calibrators (Fixed Points)		
Range	(±) CMC^{2, 4, 5, 13}	Comments
0.33 mF	0.18 %	Charge technique using a DC current source and a long scale voltmeter
0.7 mF	0.08 %	
0.8 mF	0.080 %	
1.0 mF	0.067 %	
1.09 mF	0.067 %	
1.10 mF	0.067 %	
1.2 mF	0.060 %	
2.0 mF	0.060 %	
3 mF	0.035 %	
3.3 mF	0.050 %	
8 mF	0.050 %	
10 mF	0.050 %	
10.9 mF	0.05 %	
12 mF	0.050 %	
20 mF	0.05 %	
30 mF	0.020 %	
33 mF	0.050 %	
80 mF	0.030 %	
100 mF	0.020 %	
110 mF	0.02 %	

(Table 1 of 3) Capacitance Measure on Fluke 55XX Series Calibrators		
Capacitance	(±) CMC^{2, 4, 5, 13}	Frequency
(100 to 300) pF	0.70 %	1 kHz
(300 to 600) pF	0.40 %	
(0.6 to 1.0) nF	0.17 %	
(1 to 3.0) nF	0.11 %	
(3 to 10) nF	0.13 %	
(10 to 30) nF	0.060 %	
(30 to 100) nF		
(100 to 300) nF		
Comments	Fluke PM 6304 RLC meter	

(Table 2 of 3) Capacitance Measure on Fluke 55XX Series Calibrators		
Capacitance	(±) CMC ^{2, 4, 5, 13}	Frequency
(0.3 to 1.0) μF	0.080 %	100 Hz
(1.0 to 3.0) μF	0.060 %	
(3 to 10) μF		
(10 to 30) μF	0.080 %	
(30 to 100) μF	0.11 %	
(100 to 300) μF		
Comments	Fluke PM 6304 RLC meter	

(Table 3 of 3) Capacitance Measure on Fluke 55XX Series Calibrators			
Capacitance	(±) CMC ^{2, 4, 5, 13}	Frequency	
3.3 nF	0.13 %	1 kHz	
7.0 nF			
33 nF	0.080 %		
70 nF			
0.33 μF	0.080 %	100 Hz	
0.70 μF			
3.3 μF			
7.0 μF			
33 μF			
70 μF			0.080 %
109 μF			
200 μF	0.11 %		
300 μF			
330 μF			
1100 μF	0.13 %		
	0.29 %		
Comments	Fluke PM 6304 RLC meter		

Capacitance Generate (<i>Fixed Points</i>)				
Capacitance	Frequency	(±) CMC ^{2, 4, 5, 13}	Comments	
5 pF	10 MHz	0.18 pF	Fluke 55XX/ Fluke 9500/Hioki IM3533/ PM630X Calibrators using artifact capacitors	
20 pF		0.35 pF		
29 pF				
50 pF				
20 pF	1 MHz	0.16 pF		
70 pF		0.50 pF		
90 pF				
1.0 pF	100 Hz to 10 MHz	0.035 %		
10 pF		0.015 %		
100 pF		0.012 %		
1000 pF		0.035 %		
(1, 10, 100, 200, 500, 1000) nF	1 kHz	50 μF/F		Standard capacitors

Capacitance Measure & Generate (DC Charge)			
Capacitance	Equivalent Frequency	(±) CMC ^{2, 3, 4, 5, 13}	Comments
(0.2 to 2) nF	(0.08 to 6) Hz using Ramp Rate V/Vs	380 μF/F	Fluke 8588A meter calibrations and station calibration
(2 to 20) nF		200 μF/F	
(20 to 200) nF		180 μF/F	
(0.2 to 2) μF		72 μF/F	
(2 to 20) μF		160 μF/F	
20 μF to 200 mF		250 μF/F	
Standard capacitors / Andeen 2500 / characterized Fluke 5520A / transfer meter			

Inductance Generate			
Fixed Point	Frequency	(±) CMC ^{2, 4, 5, 13}	Comments
1 mH	(100 to 400) Hz	110 μH/H	General Radio 1482
1 mH	1 kHz	71 μH/H	
100 mH	(100 to 400) Hz	100 μH/H	
100 mH	1 kHz	71 μH/H	
10 H	(100 to 200) Hz	300 μH/H	
10 H	400 Hz	250 μH/H	
10 H	1 kHz	78 μH/H	
Comments	Calibration of Fluke PM63XX and Hioki IM3533 LCR meters		

Electrical Simulation of **Thermocouples** Generate and Measure

Thermocouple Type	Range	(±) CMC ²
Type J	(-210 to -100) °C	0.10 °C
	(-100 to 800) °C	0.05 °C
	(800 to 1200) °C	0.06 °C
Type K	(-200 to -100) °C	0.11 °C
	(-100 to 500) °C	0.06 °C
	(500 to 800) °C	0.07 °C
	(800 to 1372) °C	0.08 °C
Comments	Calibration of handheld Fluke thermometers and process calibrators	

Oscilloscopes

Parameter	Range	(±) CMC ^{2, 4, 5, 6}	Comments
Voltage p-p (50 Ω) (10 Hz to 10kHz)	(0.050 to 0.75) V	0.1 % + 20 μV	Fluke 9500 Scope Calibrator
Voltage p-p (1 MΩ)	(0.012 to 60) V	0.078 % + 40 μV	Fluke 5520A/SC1100
Voltage DC	(0.006 to 300) V	0.050 % + 50 μV	Fluke 5520A/SC1100
Timing Accuracy	10 ns to 100 μs	60 μs/s	Fluke 9500 Scope Calibrator
Comments	Calibration of Tektronix DSA8300 & Fluke scope meters		

AC Power Measure					
Frequency	Voltage	Current (A)	Equivalent Power (W)	(\pm) CMC ^{2, 4, 5, 9, 13} (μ W/W)	
				PF 1.0, 0°	PF 0.5, 60°
50 Hz & 60 Hz	115 V	0.250	29	35	51
		0.375	43		
		1.5	173		
		3.0	345	39	54
		15.0	1725	41	55
		30.0	3450		
	50.0	5750			
	230 V	0.250	58	36	51
		0.375	86	35	
		1.5	345	39	
		3.0	690	39	54
		15.0	3450	41	55
		30.0	6900		
		50.0	11 500		
Comments		Fluke 61XXA calibration system calibration of Fluke 61XXA calibrators			

(Table 1 of 2) Dips & Swells Measure				
Frequency	Range	Level	Interval (s)	(\pm) CMC ^{2, 4, 5, 13} (μ V/V)
50 Hz & 60 Hz	90 V	7 V	0.5	190
		70 V		35
		90 V		34
		7 V	60	26
		70 V		26
		90 V		26
	180 V	12 V	0.5	290
		115 V		38
		180 V		38
		12 V	60	42
115 V	22			
Comments		Fluke 61XXA calibration system calibration of Fluke 61XXA calibrators		

(Table 2 of 2) Dips & Swells Measure				
Frequency	Range	Level	Interval (s)	(±) CMC ^{2,4,5,13} (μV/V)
50 Hz & 60 Hz	180 V	180 V	60	22
	360 V	23 V	0.5	290
		230 V		32
		360 V		38
		23 V	60	24
		230 V		340
		360 V		45
	10 A	0.5 A	0.5	38
		5.0 A		220
		10.0 A		35
		0.5 A	60	220
		5.0 A		35
	10.0 A			
Comments	Fluke 61XXA calibration system calibration of Fluke 61XXA calibrators			

II. Electrical – RF/Microwave

RF Power			
Range	Frequency	(±) CMC ^{2,4,5}	Comments
1 mW	50 MHz	0.35 %	Tegam 1830 power meter w/ HP 478H76 power sensor
Comments	Fluke internal calibration of RF power meter reference output		

Voltage Standing Wave Ratio (VSWR)			
Parameter	Frequency	(±) CMC ^{2, 4, 11}	Comments
VSWR of 1:1 to 1:1.4, Source Output up to +13 dBm 50 Ω	(1 to 9.9) MHz	0.037 dB	86205A/FSU26
	10 MHz to 1 GHz	0.028 dB	
	(1 to 1.7) GHz	0.037 dB	
	(1.7 to 2) GHz	0.047 dB	
	(2 to 2.5) GHz	0.064 dB	
	(2.5 to 3) GHz	0.10 dB	
	(3 to 3.6) GHz	0.18 dB	
VSWR of 1:1 to 1:1.4, Source Output up to +7 dBm 75 Ω	(1 to 49.9) MHz	0.043 dB	86207A/FSU26
	50 MHz to 1 GHz	0.036 dB	
	(1 to 1.3) GHz	0.041 dB	
	(1.3 to 2) GHz	0.067 dB	
VSWR of 1:1 to 1:2.4, Source Output up to +13 dBm 2.92 mm	(2.5 to 5) GHz	0.26 dB	SC8233/FSU26
	(5 to 11) GHz	0.42 dB	
	(11 to 20) GHz	0.42 dB	
	(20 to 27) GHz	0.65 dB	
Comments	Calibration station for Fluke 96XXX series RF reference sources		

(Table 1 of 3) RF Flatness Measure, 50 Ω Level Sine (±) CMC ^{2, 4, 8, 11, 12}									
Frequency	(24 to 20) dBm	(20 to 0) dBm	(0 to -10) dBm	(-10 to -20) dBm	(-20 to -30) dBm	(-30 to -40) dBm			
1000 Hz	0.0025 dB	0.0025 dB	0.0025 dB	0.0027 dB	0.0032 dB	0.0042 dB			
20 kHz				0.0032 dB					
75 kHz				0.0032 dB					
100 kHz	0.0026 dB	0.0026 dB	0.0027 dB	0.0033 dB	0.0040 dB	0.0048 dB			
300 kHz	0.026 dB	0.022 dB	0.026 dB	0.026 dB	0.022 dB	0.022 dB			
1 MHz									
10 MHz									
20 MHz									
100 MHz					0.026 dB	0.026 dB			
125 MHz					0.031 dB	0.031 dB	0.031 dB	0.031 dB	0.031 dB
300 MHz									
750 MHz									
1 GHz		0.048 dB	0.035 dB	0.035 dB	0.057 dB	0.057 dB			
1.4 GHz									
2 GHz									
2.5 GHz									
3 GHz									
3.5 GHz									
4 GHz									
4 GHz							0.074 dB	0.12 dB	0.12 dB
4 GHz	0.074 dB	0.13 dB	0.13 dB	0.13 dB	0.13 dB				
Comments	Calibration station for Fluke 96XXX series RF reference sources								

(Table 2 of 3)
RF Flatness Measure, 50 Ω Level Sine (±) CMC^{2, 4, 8, 11, 12}

Frequency	(-40 to -48) dBm	(-48 to -58) dBm	(-58 to -68) dBm	(-68 to -78) dBm	(-78 to -88) dBm
1000 Hz	0.0044 dB				
20 kHz		0.024 dB			
75 kHz					
100 kHz	0.0057 dB	0.019 dB	0.035 dB	0.038 dB	0.099 dB
300 kHz	0.026 dB	0.032 dB	0.044 dB	0.040 dB	0.10 dB
1 MHz			0.037 dB		0.093 dB
10 MHz					0.063 dB
20 MHz					
100 MHz					
125 MHz	0.031 dB	0.036 dB	0.041 dB	0.043 dB	0.065 dB
300 MHz			0.054 dB		
750 MHz					
1 GHz					
1.4 GHz	0.057 dB	0.061 dB	0.10 dB	0.10 dB	0.12 dB
2 GHz	0.061 dB	0.066 dB	0.13 dB	0.13 dB	0.15 dB
2.5 GHz	0.092 dB	0.10 dB	0.15 dB	0.15 dB	0.18 dB
3 GHz			0.18 dB		
3.5 GHz	0.12 dB	0.13 dB	0.20 dB	0.20 dB	0.20 dB
4 GHz	0.13 dB	0.14 dB	0.21 dB	0.21 dB	0.21 dB
Comments	Calibration station for Fluke 96XXX series RF reference sources				

(Table 3 of 3) RF Flatness Measure, 50 Ω Level Sine (±) CMC ^{2, 4, 8, 11, 12}				
Frequency	(-88 to -98) dBm	(-98 to -108) dBm	(-108 to -118) dBm	(-118 to -128) dBm
100 kHz	0.14 dB	0.20 dB	0.18 dB	0.46 dB
300 kHz	0.10 dB	0.13 dB		
1 MHz	0.077 dB			
10 MHz	0.062 dB	0.11 dB	0.16 dB	0.20 dB
20 MHz		0.099 dB	0.15 dB	
100 MHz				
125 MHz	0.064 dB	0.10 dB	0.39 dB	0.25 dB
300 MHz		0.19 dB		0.47 dB
750 MHz				
1 GHz	0.096 dB	0.20 dB	0.40 dB	0.48 dB
1.4 GHz	0.12 dB	0.22 dB	0.42 dB	
2 GHz	0.14 dB	0.24 dB	0.43 dB	
2.5 GHz	0.17 dB	0.26 dB		0.49 dB
3 GHz	0.19 dB		0.45 dB	
3.5 GHz	0.21 dB	0.29 dB	0.49 dB	0.55 dB
4 GHz	0.22 dB			
Comments	Calibration station for Fluke 96XXX series RF reference sources			

(Table 1 of 3) RF Flatness Measure, 75 Ω Level Sine (\pm) CMC ^{2, 4, 8, 11}						
Frequency	(18 to 11) dBm	(11 to 0) dBm	(0 to -10) dBm	(-10 to -20) dBm	(-20 to -30) dBm	(-30 to -40) dBm
1000 Hz	0.0030 dB	0.0030 dB	0.0030 dB	0.0030 dB	0.0030 dB	0.0040 dB
20 kHz						
75 kHz						
100 kHz					0.0040 dB	0.0050 dB
300 kHz	0.064 dB	0.061 dB	0.061 dB	0.061 dB	0.061 dB	0.061 dB
1 MHz	0.055 dB	0.052 dB	0.052 dB	0.052 dB	0.057 dB	0.057 dB
10 MHz						
20 MHz	0.059 dB	0.057 dB	0.057 dB	0.057 dB		
100 MHz						
125 MHz	0.064 dB	0.061 dB	0.061 dB	0.061 dB	0.061 dB	0.061 dB
300 MHz						
750 MHz	0.077 dB	0.074 dB	0.074 dB	0.074 dB	0.074 dB	0.074 dB
1 GHz	0.087 dB	0.083 dB	0.083 dB	0.083 dB	0.083 dB	0.083 dB
1.4 GHz	0.12 dB	0.11 dB	0.11 dB	0.11 dB	0.11 dB	0.11 dB
2 GHz						
2.5 GHz		0.12 dB	0.12 dB	0.12 dB	0.12 dB	0.12 dB
3 GHz						
Comments	Calibration station for Fluke 96XXX series RF reference sources					

(Table 2 of 3)
RF Flatness Measure, 75 Ω Level Sine (\pm) CMC^{2, 4, 8, 11}

Frequency	(-40 to -43) dBm	(-43 to -55) dBm	(-55 to -65) dBm	(-65 to -75) dBm	(-75 to -85) dBm			
1000 Hz	0.0050 dB							
20 kHz								
75 kHz		0.048 dB	0.049 dB					
100 kHz				0.050 dB	0.074 dB			
300 kHz	0.048 dB	0.076 dB	0.077 dB	0.078 dB	0.094 dB			
1 MHz	0.044 dB	0.073 dB	0.074 dB	0.075 dB	0.091 dB			
10 MHz								
20 MHz	0.048 dB							
100 MHz								
125 MHz		0.076 dB	0.077 dB	0.078 dB	0.094 dB			
300 MHz								
750 MHz	0.066 dB	0.088 dB	0.089 dB	0.090 dB	0.10 dB			
1 GHz	0.074 dB	0.096 dB	0.097 dB	0.098 dB	0.11 dB			
1.4 GHz	0.11 dB	0.14 dB	0.14 dB	0.14 dB	0.16 dB			
2 GHz					0.17 dB			
2.5 GHz	0.12 dB							
3 GHz								
Comments	Calibration station for Fluke 96XXX series RF reference sources							

(Table 3 of 3)
RF Flatness Measure, 75 Ω Level Sine (\pm) CMC^{2, 4, 8, 11}

Frequency	(-85 to -95) dBm	(-95 to -105) dBm	(-105 to -115) dBm	(-115 to -125) dBm
100 kHz	0.076 dB	0.13 dB	0.27 dB	0.27 dB
300 kHz	0.096 dB	0.15 dB		
1 MHz	0.094 dB	0.14 dB		
10 MHz				
20 MHz				
100 MHz				
125 MHz	0.096 dB	0.15 dB	0.45 dB	0.45 dB
300 MHz		0.22 dB		
750 MHz	0.11 dB	0.23 dB		
1 GHz				
1.4 GHz	0.17 dB	0.25 dB		
2 GHz				
2.5 GHz				
3 GHz				
Comments	Calibration station for Fluke 96XXX series RF reference sources			

(Table 1 of 4)
**RF Flatness Measure, 50 Ω Level Sine,
 2.92 mm Microwave Output (\pm) CMC^{2, 4, 8, 11}**

Frequency	(24 to 18) dBm	(18 to 0) dBm	(0 to -10) dBm	(-10 to -20) dBm	(-20 to -30) dBm
1 kHz	0.0048 dB	0.0048 dB	0.0048 dB	0.023 dB	0.023 dB
20 kHz					
100 kHz					
300 kHz	0.094 dB	0.087 dB	0.094 dB	0.095 dB	0.096 dB
1 MHz					
10 MHz					
20 MHz					
100 MHz	0.099 dB	0.092 dB	0.098 dB	0.099 dB	0.10 dB
125 MHz					
300 MHz					
750 MHz	0.11 dB	0.095 dB	0.11 dB	0.11 dB	0.11 dB
1 GHz		0.096 dB			
1.4 GHz					
2 GHz	0.12 dB	0.10 dB	0.12 dB	0.12 dB	0.12 dB
2.5 GHz					
3 GHz					
3.5 GHz					
4 GHz					
5 GHz					
6 GHz	0.14 dB	0.12 dB	0.14 dB	0.14 dB	0.14 dB
7 GHz					
8 GHz					
9 GHz					
10 GHz				0.15 dB	0.15 dB
11 GHz					
Comments	Fluke 96270A RF reference source				

(Table 2 of 4)
**RF Flatness Measure, 50 Ω Level Sine,
 2.92 mm Microwave Output (\pm) CMC^{2, 4, 8, 11}**

Frequency	(24 to 18) dBm	(18 to 0) dBm	(0 to -10) dBm	(-10 to -20) dBm	(-20 to -30) dBm
12 GHz	0.14 dB	0.12 dB	0.14 dB	0.16 dB	0.16 dB
13 GHz	0.19 dB	0.17 dB	0.20 dB	0.21 dB	0.21 dB
14 GHz					
15 GHz					
16 GHz	0.20 dB	0.18 dB	0.21 dB	0.22 dB	0.22 dB
17 GHz					
18 GHz					
19 GHz				0.23 dB	
20 GHz					
21 GHz					
22 GHz	0.25 dB	0.25 dB			
23 GHz			0.22 dB	0.26 dB	
24 GHz					0.27 dB
25 GHz	0.19 dB	0.23 dB	0.28 dB	0.28 dB	
26 GHz	0.22 dB	0.20 dB			0.24 dB
26.5 GHz					
Comments	Fluke 96270A RF reference source				

(Table 3 of 4)
**RF Flatness Measure, 50 Ω Level Sine,
 2.92 mm Microwave Output (±) CMC^{2, 4, 8, 11}**

Frequency	(-30 to -40) dBm	(-40 to -50) dBm	(-50 to -60) dBm	(-60 to -70) dBm	(-70 to -80) dBm	(-80 to -90) dBm
1 kHz	0.023 dB	0.047 dB				
20 kHz			0.11 dB	0.13 dB	0.15 dB	0.15 dB
100 kHz			0.080 dB	0.082 dB		
300 kHz	0.097 dB	0.10 dB	0.11 dB	0.12 dB	0.13 dB	0.13 dB
1 MHz						
10 MHz						
20 MHz						
100 MHz	0.10 dB	0.12 dB	0.12 dB	0.13 dB	0.13 dB	0.14 dB
125 MHz						
300 MHz						
750 MHz	0.11 dB	0.12 dB	0.12 dB	0.13 dB	0.13 dB	0.14 dB
1 GHz						
1.4 GHz	0.12 dB	0.13 dB	0.13 dB	0.13 dB	0.14 dB	0.15 dB
2 GHz						
2.5 GHz						
3 GHz						
3.5 GHz						
4 GHz						
5 GHz						
6 GHz	0.13 dB	0.15 dB	0.15 dB	0.14 dB	0.15 dB	0.19 dB
7 GHz	0.14 dB	0.16 dB	0.16 dB	0.16 dB	0.20 dB	
8 GHz			0.17 dB	0.17 dB		
9 GHz						
Comments	Fluke 96270A RF reference source					

(Table 4 of 4)
**RF Flatness Measure, 50 Ω Level Sine,
 2.92 mm Microwave Output (\pm) CMC^{2, 4, 8, 11}**

Frequency	(-30 to -40) dBm	(-40 to -50) dBm	(-50 to -60) dBm	(-60 to -70) dBm	(-70 to -80) dBm	(-80 to -90) dBm
10 GHz	0.15 dB	0.17 dB	0.17 dB	0.17 dB	0.20 dB	0.20 dB
11 GHz		0.21 dB	0.21 dB			
12 GHz	0.16 dB			0.18 dB		
13 GHz	0.21 dB	0.25 dB	0.25 dB	0.22 dB	0.24 dB	0.24 dB
14 GHz				0.28 dB		
15 GHz			0.22 dB	0.28 dB	0.28 dB	0.30 dB
16 GHz						
17 GHz	0.23 dB	0.46 dB	0.32 dB	0.31 dB	0.30 dB	0.30 dB
18 GHz					0.31 dB	
19 GHz			0.25 dB	0.33 dB	0.54 dB	0.37 dB
20 GHz						
21 GHz	0.26 dB	0.73 dB	0.44 dB	0.62 dB	0.54 dB	0.54 dB
22 GHz	0.27 dB					
23 GHz	0.28 dB		0.62 dB	0.70 dB	0.91 dB	0.91 dB
24 GHz						
25 GHz	0.28 dB	0.73 dB	0.49 dB	0.70 dB	0.91 dB	0.91 dB
26 GHz						
26.5 GHz	0.26 dB	0.44 dB	0.62 dB	0.54 dB	0.54 dB	
Comments	Fluke 96270A RF reference source					

III. Mechanical

Parameter	Range	(±) CMC ^{2,5}	Comments
Gauge Pressure (Pneumatic) Nitrogen	(-100 to 0) kPa	0.0024 % + 5.2 Pa	Ruska 7250i
	(0 to 1875) Pa (1875 to 2833) Pa (2833 to 7500) Pa	0.0075 % + 100 mPa 0.0090 % + 37 mPa 0.0091 % + 14 mPa	Fluke 7250LP Differential ⁷
	(7.5 to 27.5) kPa (27.5 to 55) kPa	0.0077 % + 1.4 Pa 0.0091 % + 0.41 Pa	Ruska 7250xi
	(55 to 82.7) kPa (82.7 to 206.9) kPa	0.0024 % + 4.1 Pa 0.0056 % + 20 mPa	Ruska 7250i
	(206.8 to 248.2) kPa	25 Pa	Fluke PM500- BG250k
	(248.2 to 344.7) kPa	34 Pa	Fluke PM500-G700k
	(344.7 to 689.4) kPa	0.01 %	Fluke PM500-G700k
	(689.4 to 3500) kPa	0.0092 % + 0.55 Pa	Ruska 7250xi
	(3.5 to 7) MPa	0.01 %	Fluke PM500-BG7M
	(7 to 10.3) MPa	0.01 %	Fluke PM500- BG10M
	(10.3 to 13.8) MPa	0.0093 % + 0.13 kPa	Ruska 7250i
	(13.8 to 20) MPa	0.01 %	Fluke PM500- BG20M
	(20 to 70) MPa	0.01 %	Fluke PM630-A70M
Absolute Pressure (Pneumatic) Nitrogen	(0.7 to 82.7) kPa (82.7 to 206.8) kPa	0.0025 % + 4.3 Pa 0.0056 % + 1.3 Pa	Ruska 7250i
	(206.8 to 344.7) kPa	0.027 kPa	Fluke PM500- BG250k
	(344.7 to 441.3) kPa	0.036 kPa	Fluke PM500-G700k
	(441.3 to 786) kPa	0.01 % + 0.01 kPa	Fluke PM500-G700k
	(786 to 3500) kPa	0.0092 % + 14 Pa	Ruska 7250xi
	(3.5 to 7) MPa	0.01 % + 0.01 kPa	Fluke PM500-BG7M
	(7 to 10.3) MPa	0.01 % + 0.01 kPa	Fluke PM500- BG10M

IV. Thermodynamics

Parameter	Range	(±) CMC ^{2, 11}	Comments
Temperature Measure and Temperature Measuring Equipment (PRT Calibration)	-50 °C 0.010 °C TPW 29.7646 °C MpGa	0.010 °C	Super-thermometer (1595A)/PRT reference thermometer, TPW cell, Ga cell, In cell, dry wells
	100 °C 156.5985 °C MpIn	0.012 °C	
	(100 to 500) °C	0.050 °C	
Temperature Measuring Equipment (Calibration of Thermistors)	(0 to 100) °C	0.008 °C	Super-thermometer (1595A)/PRT reference thermometer, TPW cell, liquid baths
Temperature Measuring Equipment Fixed Points	0.0100 °C TPW	0.004 °C	TPW cell, Ga cell, In cell
	29.7646 °C MpGa	0.005 °C	
	156.5985 °C MpIn	0.006 °C	
Temperature Measuring Equipment Set Points	-60 °C	0.016 °C	Super-thermometer (1595A) /PRT reference thermometer, liquid baths and dry wells
	-50 °C, -40 °C	0.010 °C	
	-20 °C	0.018 °C	
	50 °C	0.014 °C	
	100 °C	0.012 °C	
	200 °C, 300 °C, 400 °C	0.042 °C	
500 °C	0.046 °C		
Temperature Measuring Equipment Thermocouples (Type E, J, K, T)	(20 to 30) °C	0.035 °C	Super-thermometer, SPRT, liquid baths
Comments	Calibration station for Fluke temperature probes and meters		

Infrared Radiation Measure			
Wavelength [λ]	Range	(\pm) CMC^{2, 11}	Comments
(8 to 14) μm	(253 to 303) K	$-0.80 \times 10^{-3} T_m + 0.44 \text{ K}$	Heitronics TRT IV
	(303 to 1233) K	$1.1 \times 10^{-3} T_m - 0.14 \text{ K}$	
	(1233 to 1773) K	$2.1 \times 10^{-3} T_m - 1.4 \text{ K}$	
3.9 μm	(428 to 1233) K	$0.20 \times 10^{-3} T_m + 0.65 \text{ K}$	Heitronics TRT II
1.6 μm	(573 to 1073) K	$1.9 \times 10^{-3} T_m$	Endurance E2MH
1.0 μm	(1033 to 2973) K	$1.9 \times 10^{-3} T_m$	Endurance E1MH
where T_m represents the measurement temperature [K] Fluke IR calibration station			

Infrared Radiation Measuring Equipment			
Wavelength [λ]	Range	(\pm) CMC^{2, 11}	Comments
(8 to 14) μm	(253 to 303) K	$-2.2 \times 10^{-3} T_m + 0.84 \text{ K}$	IR cavity, Heitronics TRT IV
	(303 to 1233) K	$0.99 \times 10^{-3} T_m - 0.13 \text{ K}$	
	(1233 to 1773) K	$2.2 \times 10^{-3} T_m - 1.6 \text{ K}$	
3.9 μm	(428 to 1233) K	$0.80 \times 10^{-3} T_m + 0.19 \text{ K}$	IR cavity, TRT II
1.6 μm	(573 to 1073) K	$1.9 \times 10^{-3} T_m$	IR cavity, endurance E2MH
1.0 μm	(1033 to 2973) K	$1.9 \times 10^{-3} T_m$	IR cavity, endurance E1MH
where T_m represents the measurement temperature [K] Fluke IR calibration station			

V. Rise Time

Parameter	Range	(±) CMC ^{2,11}	Comments
Rise Time Measure (4 mV to 4 V)	23 ps to 2 ns	4 ps	Fluke 55XX and Fluke 95XX head calibration stations
Rise Time Generate (4 mV to 4 V)	10 ps to 25 ps	7.3 ps	Tektronix fast step generator
Comments	Calibration of Tektronix 11801 or Tektronix DSA8300 digital sampling oscilloscope		

VI. Time & Frequency

Parameter	Range	(±) CMC ^{2,11}	Comments
Frequency Generate and Measure	(1, 5, 10) MHz	0.9 parts in 10 ¹² Hz/Hz	GPS through FMAS system from NIST and HP5071 & Fluke 910R
Frequency Generate	1 MHz to 10 MHz	1.0 parts in 10 ¹⁰ Hz/Hz + 1 µHz	GPS based 10 MHz distributed signal and Fluke 9640/HP 33265B signal generators
	10 MHz to 4.0 GHz	5.5 parts in 10 ⁹ Hz/Hz	
Frequency Measure	1 MHz to 1.3 GHz	6.0 parts in 10 ¹² Hz/Hz + 2.4 µHz	GPS based 10 MHz distributed signal and Fluke 6680B counter
	(1.3 to 2.7) GHz	14 µHz	
	(3 to 26.5) GHz	110 parts in 10 ¹² Hz/Hz	Spectrum analyzer
Comments	Calibration station for Fluke Frequency counters and Fluke 96XXX		

VII. Laser Power

Fiber Optic Laser Power Measuring Equipment			
Wavelength [λ]	Range	(\pm) CMC^{2, 5, 11}	Comments
(635 to 650) nm	Absolute Power: (700 to 1000 μ W)	6.8 %	EXFO FPM-820 with FHM-8705 special
850 nm	Absolute Power: 100 μ W	2.3 %	
	Linearity: (0 to -58) dBm	1.8 %	
1310 nm	Absolute Power: 100 μ W	2.2 %	
	Linearity: (0 to -58) dBm	2.0 %	
Comments	Special calibration of Fluke Networks calibration station		

VIII. Dimensional Quantities

Inclination Angle Measuring Equipment		
Range	(\pm) CMC^{2, 11}	Comments
(-75 to 75) °	$1.1 \times 10^{-3} \cdot \theta + 0.14$ °	Relative angle using a sine plate and gage blocks

IX. Optical Quantities

Solar Irradiance Measuring Equipment			
Solar Spectrum	Range	(\pm) CMC^{2, 5, 11}	Comments
AM1.5 (ASTM G-173)	(0 to 1000) W/m ²	0.81 % + 0.67 W/m ²	Comparison to reference solar cell with a solar simulator

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 Consensus Traceability based on extrapolation of measured values.
- ⁴ The uncertainties shown relate to voltages and frequencies that lie within ± 10 % of the specified values. For intermediate points between the discrete unit pairs, the uncertainty will be the greatest of the 4 adjacent unit pairs, plus 10 %.
- ⁵ In the statement of CMC, ratios such as percent or part-per-million values are of reading, unless otherwise indicated in the table.
- ⁶ The contributions from the "best existing device" are not included in the CMC claim for this parameter.
- ⁷ CMCs apply to negative equivalent pressure.
- ⁸ For intermediate Frequency points, the larger CMC from the adjacent Frequency points applies.
- ⁹ The laboratory does not offer commercial calibration service for this measurement parameter.
- ¹⁰ This scope meets A2LA's *P112 Flexible Scope Policy*.
- ¹¹ 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.
- ¹² The uncertainties are applicable to the source amplitude measurement of the Fluke 96270A for the fundamental, specified harmonic frequencies and RF Reference Source using a dedicated measurement system. Uncertainties may also be reported for differences in level reported as Attenuation, the attenuation uncertainty will be the combined uncertainties of the reference level and the uncertainty of the final level.
- ¹³ 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.



Accredited Laboratory

A2LA has accredited

FLUKE CORPORATION

Everett, WA

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 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 16th day of June 2022.

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

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 2166.01
Valid to April 30, 2024

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