



**SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005  
& ANSI/NCSL Z540-1-1994**

**Tektronix Service Solutions**

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**CALIBRATION**

Valid to: February 7, 2013

Certificate Number: AC-1259

**I. Electromagnetic - DC/Low Frequency**

PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
DC Voltage - Source	Up 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	8 $\mu$ V/V + 600 nV 7 $\mu$ V/V + 1 $\mu$ V 7 $\mu$ V/V + 3.5 $\mu$ V 7 $\mu$ V/V + 6.5 $\mu$ V 8 $\mu$ V/V + 80 $\mu$ V 9 $\mu$ V/V + 500 $\mu$ V	Fluke 5700A	OEM and GIDEP Sourced Calibration Procedures
DC Voltage - Measure	(10 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V 100 V to 1 kV	7 $\mu$ V/V + 300 nV 6 $\mu$ V/V + 300 nV 6 $\mu$ V/V + 500 nV 8 $\mu$ V/V + 30 $\mu$ V 8 $\mu$ V/V + 100 $\mu$ V	HP 3458A Opt 002	
DC Current - Source	Up to 220 $\mu$ A 220 $\mu$ A to 2.2 mA (2.2 to 22) mA (22 to 100) mA (100 to 220) mA  220 mA to 1 A (1 to 2.2) A  (2.2 to 3) A (3 to 11) A (11 to 20.5) A	50 $\mu$ A/A + 8 nA 50 $\mu$ A/A + 8 nA 50 $\mu$ A/A + 80 nA 60 $\mu$ A/A + 800 nA 60 $\mu$ A/A + 800 nA + [(200 x I <sup>2</sup> ) $\mu$ A/A] 80 $\mu$ A/A + 25 $\mu$ A 80 $\mu$ A/A + 25 $\mu$ A + [(10 x I <sup>2</sup> ) $\mu$ A/A] 380 $\mu$ A/A + 40 $\mu$ A 500 $\mu$ A/A + 500 $\mu$ A 1 mA/A + 750 $\mu$ A	Fluke 5700A          Fluke 5520A SC1100	
Clamp-On Ammeters	Up to 550 A	4 mA/A + 500 mA	Fluke 5520A Fluke 50-Turn Coil	



PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
DC Current - Measure	(10 to 100) $\mu$ A 100 $\mu$ A to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A (1 to 300) A	25 $\mu$ A/A + 800 pA 25 $\mu$ A/A + 5 nA 25 $\mu$ A/A + 50 nA 40 $\mu$ A/A + 500 nA 115 $\mu$ A/A + 10 $\mu$ A 100 $\mu$ A/A	HP 3458A Opt 002  Honeywell 1168	
AC Voltage - Source	<b>Up to 2.2 mV</b> (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 <b>(2.2 to 22) mV</b> (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 <b>(22 to 220) mV</b> (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 <b>220 mV to 2.2 V</b> (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	550 $\mu$ V/V + 4.5 $\mu$ V 210 $\mu$ V/V + 4.5 $\mu$ V 105 $\mu$ V/V + 4.5 $\mu$ V 370 $\mu$ V/V + 4.5 $\mu$ V 850 $\mu$ V/V + 7 $\mu$ V 1.1 mV/V + 13 $\mu$ V 1.7 mV/V + 25 $\mu$ V 3.4 mV/V + 25 $\mu$ V  550 $\mu$ V/V + 5 $\mu$ V 210 $\mu$ V/V + 5 $\mu$ V 105 $\mu$ V/V + 5 $\mu$ V 370 $\mu$ V/V + 5 $\mu$ V 850 $\mu$ V/V + 7 $\mu$ V 1.1 mV/V + 12 $\mu$ V 1.7 mV/V + 25 $\mu$ V 3.4 mV/V + 25 $\mu$ V  550 $\mu$ V/V + 13 $\mu$ V 210 $\mu$ V/V + 8 $\mu$ V 105 $\mu$ V/V + 8 $\mu$ V 320 $\mu$ V/V + 8 $\mu$ V 850 $\mu$ V/V + 25 $\mu$ V 1.1 mV/V + 25 $\mu$ V 1.7 mV/V + 35 $\mu$ V 3.4 mV/V + 80 $\mu$ V  500 $\mu$ V/V + 80 $\mu$ V 160 $\mu$ V/V + 25 $\mu$ V 75 $\mu$ V/V + 6 $\mu$ V 120 $\mu$ V/V + 16 $\mu$ V 250 $\mu$ V/V + 70 $\mu$ V 430 $\mu$ V/V + 130 $\mu$ V 1.05 mV/V + 350 $\mu$ V 2.2 mV/V + 850 $\mu$ V	Fluke 5700A	OEM and GIDEP Sourced Calibration Procedures

PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
AC Voltage - Source (cont.)	<b>(2.2 to 22) V</b> (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 <b>(22 to 220) V</b> (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 <b>(220 to 250) V</b> (15 to 50) Hz 50 Hz to 1kHz <b>250 V to 1.1 kV</b> 50 Hz to 1kHz	500 μV/V + 800 μV 160 μV/V + 250 μV 75 μV/V + 60 μV 120 μV/V + 160 μV 250 μV/V + 350 μV 500 μV/V + 1.5 mV 1.25 mV/V + 4.3 mV 2.7 mV/V + 8.5 mV  500 μV/V + 8 mV 160 μV/V + 2.5 mV 80 μV/V + 0.8 mV 220 μV/V + 3.5 mV 500 μV/V + 8 mV 1.5 mV/V + 90 mV 4.7 mV/V + 90 mV 11.5 mV/V + 190 mV  400 μV/V + 16 mV 80 μV/V + 3.5 mV  80 μV/V + 3.5 mV	Fluke 5700A	OEM and GIDEP Sourced Calibration Procedures
	AC Voltage - Measure	<b>Up to 10 mV</b> (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1MHz (1 to 4) MHz (4 to 8) MHz <b>(10 to 100) mV</b> (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz (2 to 4) MHz (4 to 8) MHz (8 to 10) MHz	302 μV/V + 3 μV 202 μV/V + 1.1 μV 302 μV/V + 1.1 μV 1 mV/V + 1.1 μV 5 mV/V + 1.1 μV 40 mV/V + 2 μV 12 mV/V + 5 μV 70 mV/V + 7 μV 200 mV/V + 8 μV  72 μV/V + 4 μV 72 μV/V + 2 μV 142 μV/V + 2 μV 302 μV/V + 2 μV 802 μV/V + 2 μV 3 mV/V + 10 μV 10 mV/V + 10 μV 15 mV/V + 10 μV 40 mV/V + 70 μV 40 mV/V + 80 μV 150 mV/V + 100 μV	

PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
AC Voltage - Measure (cont.)	<b>100 mV to 1 V</b> (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz (2 to 4) MHz (4 to 8) MHz (8 to 10) MHz <b>(1 to 10) V</b> (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz (2 to 4) MHz (4 to 8) MHz (8 to 10) MHz <b>(10 to 100) V</b> (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz <b>100 V to 1 kV</b> (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	72 µV/V + 40 µV 72 µV/V + 20 µV 142 µV/V + 20 µV 302 µV/V + 20 µV 802 µV/V + 20 µV 3 mV/V + 100 µV 10 mV/V + 100 µV 15 mV/V + 100 µV 40 mV/V + 700 µV 40 mV/V + 800 µV 150 mV/V + 1 mV 72 µV/V + 400 µV 72 µV/V + 200 µV 142 µV/V + 200 µV 302 µV/V + 200 µV 802 µV/V + 200 µV 3 mV/V + 1 mV 10 mV/V + 1 mV 15 mV/V + 1 mV 40 mV/V + 7 mV 40 mV/V + 8 mV 150 mV/V + 10 mV 202 µV/V + 4 mV 202 µV/V + 2 mV 202 µV/V + 2 mV 350 µV/V + 2 mV 1.2 mV/V + 2 mV 4 mV/V + 10 mV 15 mV/V + 10 mV 402 µV/V + 40 mV 402 µV/V + 20 mV 602 µV/V + 20 mV 1.2 mV/V + 20 mV 3 mV/V + 20 mV	HP 3458A Opt 002	OEM and GIDEP Sourced Calibration Procedures





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AC Current - Measure	<p><b>(5 to 100) µA</b>  (10 to 20) Hz  (20 to 45) Hz  (45 to 100) Hz  100 Hz to 1 kHz</p> <p><b>100 µA to 1 mA</b>  (10 to 20) Hz  (20 to 45) Hz  (45 to 100) Hz  100 Hz to 5 kHz  (5 to 20) kHz  (20 to 50) kHz  (50 to 100) kHz</p> <p><b>(1 to 10) mA</b>  (10 to 20) Hz  (20 to 45) Hz  (45 to 100) Hz  100 Hz to 5 kHz  (5 to 20) kHz  (20 to 50) kHz  (50 to 100) kHz</p> <p><b>(10 to 100) mA</b>  (10 to 20) Hz  (20 to 45) Hz  (45 to 100) Hz  100 Hz to 5 kHz  (5 to 20) kHz  (20 to 50) kHz  (50 to 100) kHz</p> <p><b>100 mA to 1 A</b>  (10 to 20) Hz  (20 to 45) Hz  (45 to 100) Hz  100 Hz to 5 kHz  (5 to 20) kHz  (20 to 50) kHz</p>	<p>4 mA/A + 30 nA  1.5 mA/A + 30 nA  600 µA/A + 30 nA  600 µA/A + 30 nA</p> <p>4 mA/A + 200 nA  1.5 mA/A + 200 nA  600 µA/A + 200 nA  300 µA/A + 200 nA  600 µA/A + 200 nA  4 mA/A + 400 nA  5.5 mA/A + 1.5 µA</p> <p>4 mA/A + 2 µA  1.5 mA/A + 2 µA  600 µA/A + 2 µA  300 µA/A + 2 µA  600 µA/A + 2 µA  4 mA/A + 4 µA  5.5 mA/A + 15 µA</p> <p>4 mA/A + 20 µA  1.5 mA/A + 20 µA  600 µA/A + 20 µA  300 µA/A + 20 µA  600 µA/A + 20 µA  4 mA/A + 40 µA  5.5 mA/A + 150 µA</p> <p>4 mA/A + 200 µA  1.6 mA/A + 200 µA  800 µA/A + 200 µA  1 mA/A + 200 µA  3 mA/A + 200 µA  10 mA/A + 400 µA</p>	HP 3458A Opt 002	OEM and GIDEP Sourced Calibration Procedures



PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
DC Resistance - Source	Up to 11 Ω (11 to 33) Ω (33 to 110) Ω 110 Ω to 1.1 kΩ (1.1 to 11) kΩ (11 to 110) kΩ (110 to 330) kΩ 330 kΩ to 1.1 MΩ (1.1 to 3.3) MΩ (3.3 to 11) MΩ (11 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ 330 MΩ to 1.1 GΩ	40 μΩ/Ω + 1 mΩ 30 μΩ/Ω + 1.5 mΩ 28 μΩ/Ω + 1.4 mΩ 28 μΩ/Ω + 2 mΩ 28 μΩ/Ω + 20 mΩ 28 μΩ/Ω + 200 mΩ 32 μΩ/Ω + 2 Ω 32 μΩ/Ω + 2 Ω 60 μΩ/Ω + 30 Ω 130 μΩ/Ω + 50 Ω 250 μΩ/Ω + 2.5 kΩ 500 μΩ/Ω + 3 kΩ 3 mΩ/Ω + 100 kΩ 15 mΩ/Ω + 500 kΩ	Fluke 5520A	OEM and GIDEP Sourced Calibration Procedures
Fixed Values	1 Ω 1.9 Ω 10 Ω 19 Ω 100 Ω 190 Ω 1 kΩ 1.9 kΩ 10 kΩ 19 kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	95 μΩ 181 μΩ 280 μΩ 513 μΩ 1.7 mΩ 3.3 mΩ 13 mΩ 25 mΩ 120 mΩ 228 mΩ 1.4 Ω 2.7 Ω 20 Ω 40 Ω 400 Ω 893 Ω 1.1 Ω	Fluke 5700A	
Resistance - Measure	Up to 10 Ω (10 to 100) Ω 100 Ω to 1 kΩ (1 to 10) kΩ (10 to 100) kΩ 100 kΩ to 1 MΩ (1 to 10) MΩ (10 to 100) MΩ 100 MΩ to 1 GΩ	18 μΩ/Ω + 50 μΩ 15 μΩ/Ω + 500 μΩ 13 μΩ/Ω + 500 μΩ 13 μΩ/Ω + 5 mΩ 13 μΩ/Ω + 50 mΩ 18 μΩ/Ω + 2 Ω 53 μΩ/Ω + 100 Ω 503 μΩ/Ω + 1 kΩ 5 mΩ/Ω + 10kΩ	HP 3458A Opt 002	

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Inductance - Source 100 Hz to 1 kHz	100 µH to 10 mH (10 to 100) mH 100 mH to 10 H	23 mH/H 12 mH/H 8.6 mH/H	GenRad 1490-C	OEM and GIDEP Sourced Calibration Procedures
Fixed Values 100 Hz to 1 kHz	100 µH 1 mH to 1 H	1 mH/H 300 µH/H	GenRad 1482 Series	
DC Power - Source 33 mV to 1 020 V	330 µA to 330 mA 330 mA to 3 A (3 to 20.5) A	0.023 % of Watts Output 0.022 % of Watts Output 0.07 % of Watts Output	Fluke 5520A SC1100	
AC Power - Source PF=1 (45 to 65) Hz	<b>(33 to 330) mV</b> (3.3 to 9) mA (9 to 33) mA (33 to 90) mA (90 to 330) mA (330 to 900) mA 900 mA to 2.2 A (2.2 to 4.5) A (4.5 to 20.5) A <b>330 mV to 1.02 kV</b> (3.3 to 9) mA (9 to 33) mA (33 to 90) mA (90 to 330) mA (330 to 900) mA 900 mA to 2.2 A (2.2 to 4.5) A (4.5 to 20.5) A	0.14 % of Watts Output 0.1 % of Watts Output 0.14 % of Watts Output 0.1 % of Watts Output 0.13 % of Watts Output 0.11 % of Watts Output 0.13 % of Watts Output 0.11 % of Watts Output  0.12 % of Watts Output 0.08 % of Watts Output 0.12 % of Watts Output 0.08 % of Watts Output 0.11 % of Watts Output 0.09 % of Watts Output 0.12 % of Watts Output 0.1 % of Watts Output		

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Electrical Simulation of Thermocouple Indicators	Type B	(600 to 800) °C	0.44 °C	Fluke 5520A SC1100  OEM and GIDEP Sourced Calibration Procedures
		(800 to 1 000) °C	0.34 °C	
		(1 000 to 1 550) °C	0.3 °C	
		(1 550 to 1 820) °C	0.33 °C	
	Type C	(0 to 150) °C	0.3 °C	
		(150 to 650) °C	0.26 °C	
		(650 to 1 000) °C	0.31 °C	
		(1 000 to 1 800) °C	0.5 °C	
		(1 800 to 2 316) °C	0.84 °C	
	Type E	(-250 to -100) °C	0.5 °C	
		(-100 to -25) °C	0.16 °C	
		(-25 to 350) °C	0.14 °C	
		(350 to 650) °C	0.16 °C	
		(650 to 1 000) °C	0.21 °C	
	Type J	(-210 to -100) °C	0.27 °C	
		(-100 to -30) °C	0.16 °C	
		(-30 to 150) °C	0.14 °C	
		(150 to 760) °C	0.17 °C	
		(760 to 1 200) °C	0.23 °C	
	Type K	(-200 to -100) °C	0.33 °C	
		(-100 to -25) °C	0.18 °C	
		(-25 to 120) °C	0.16 °C	
		(120 to 1 000) °C	0.26 °C	
		(1 000 to 1 372) °C	0.4 °C	
	Type L	(-200 to -100) °C	0.37 °C	
		(-100 to 800) °C	0.26 °C	
		(800 to 900) °C	0.17 °C	
	Type N	(-200 to -100) °C	0.4 °C	
(-100 to -25) °C		0.22 °C		
(-25 to 120) °C		0.19 °C		
(120 to 410) °C		0.18 °C		
(410 to 1 300) °C		0.27 °C		

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Electrical Simulation of Thermocouple Indicators (cont.) Type R	(0 to 250) °C (250 to 400) °C (400 to 1 000) °C (1 000 to 1 767) °C	0.57 °C 0.35 °C 0.33 °C 0.4 °C	Fluke 5520A SC1100	OEM and GIDEP Sourced Calibration Procedures
Type S	(0 to 250) °C (250 to 1 000) °C (1 000 to 1 400) °C (1 400 to 1 767) °C	0.47 °C 0.36 °C 0.37 °C 0.46 °C		
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.63 °C 0.24 °C 0.16 °C 0.14 °C		
Type U	(0 to 600) °C	0.27 °C		
Electrical Simulation of RTDs Pt 395, 100 Ω	(-200 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 800) °C	0.05 °C 0.07 °C 0.09 °C 0.1 °C 0.12 °C 0.23 °C		
Pt 3926, 100 Ω	(-200 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C	0.05 °C 0.07 °C 0.09 °C 0.1 °C 0.12 °C		
Pt 3916, 100 Ω	(-200 to -190) °C (-190 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.25 °C 0.04 °C 0.05 °C 0.06 °C 0.07 °C 0.08 °C 0.09 °C 0.1 °C 0.23 °C		

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Electrical Simulation of RTDs (cont.) Pt 385, 200 Ω	(- 200 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.04 °C 0.05 °C 0.12 °C 0.13 °C 0.14 °C 0.16 °C	Fluke 5520A SC1100	OEM and GIDEP Sourced Calibration Procedures	
Pt 385, 500 Ω	(-200 to -80) °C (-80 to 100) °C (100 to 260) °C (260 to 400) °C (400 to 600) °C (600 to 630) °C	0.04 °C 0.05 °C 0.06 °C 0.08 °C 0.09 °C 0.11 °C			
Pt 385, 1 kΩ	(-200 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 600) °C (600 to 630) °C	0.03 °C 0.04 °C 0.05 °C 0.06 °C 0.07 °C 0.23 °C			
PtNi 385, 120 Ω	(-80 to 100) °C (100 to 260) °C	0.08 °C 0.14 °C			
Capacitance - Source					Fluke 5520A SC1100
10 Hz to 10 kHz	190 pF to 1.1 nF	5 mF/F + 10 pF			
10 Hz to 3 kHz	(1.1 to 3.3) nF	5 mF/F + 10 pF			
10 Hz to 1 kHz	(3.3 to 11) nF	2.5 mF/F + 10 pF			
10 Hz to 1 kHz	(11 to 110) nF	2.5 mF/F + 100 pF			
10 Hz to 1 kHz	(110 to 330) nF	2.5 mF/F + 300 pF			
(10 to 600) Hz	330 nF to 1.1 μF	2.5 mF/F + 1 nF			
(10 to 300) Hz	(1.1 to 3.3) μF	2.5 mF/F + 3 nF			
(10 to 150) Hz	(3.3 to 11) μF	2.5 mF/F + 10 nF			
(10 to 120) Hz	(11 to 33) μF	4 mF/F + 30 nF			
(10 to 80) Hz	(33 to 110) μF	4.5 mF/F + 100 nF			
(0 to 50) Hz	(110 to 330) μF	4.5 mF/F + 300 nF			
(0 to 20) Hz	330 μF to 1.1 mF	4.5 mF/F + 1 μF			
(0 to 6) Hz	(1.1 to 3.3) mF	4.5 mF/F + 3 μF			
(0 to 2) Hz	(3.3 to 11) mF	4.5 mF/F + 10 μF			
(0 to 0.6) Hz	(11 to 33) mF	7.5 mF/F + 30 μF			
(0 to 0.2) Hz	(33 to 110) mF	11 mF/F + 100 μF			



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Capacitance - Source Fixed Values	<b>(1 to 10) µF</b> 10 Hz to 1 kHz	27 mF/F	GenRad 1424A	OEM and GIDEP Sourced Calibration Procedures
	<b>0.1 pF</b>		HP 16380C and HP 16380A Standard Capacitor Sets	
	190 pF to 1.1 nF	54 mF/F		
	(1.1 to 3.3) nF	54 mF/F		
	(3.3 to 11) nF	32 mF/F		
	(11 to 33) nF	27 mF/F		
	33 nF to 3.3 µF	27 mF/F		
	(3.3 to 11) µF	29 mF/F		
	(11 to 33) µF	46 mF/F		
	(33 to 110) µF	51 mF/F		
	(110 to 330) µF	54 mF/F		
	330 µF to 1.1 mF	62 mF/F		
	<b>1 pF</b>			
	100 Hz to 1 kHz	620 µF/F		
	1 kHz to 1 MHz	720 µF/F		
	(1 to 2) MHz	830 µF/F		
	(2 to 3) MHz	990 µF/F		
	(3 to 4) MHz	1.6 mF/F		
	(4 to 5) MHz	2.2 mF/F		
	(5 to 10) MHz	6.8 mF/F		
	(10 to 13) MHz	10 mF/F		
	<b>10 pF</b>			
	100 Hz to 1 kHz	620 µF/F		
	1 kHz to 1 MHz	660 µF/F		
(1 to 2) MHz	750 µF/F			
(2 to 3) MHz	760 µF/F			
(3 to 4) MHz	830 µF/F			
(4 to 5) MHz	950 µF/F			
(5 to 10) MHz	1.6 mF/F			
(10 to 13) MHz	1.8 mF/F			
<b>100 pF</b>				
100 Hz to 1 kHz	730 µF/F			
1 kHz to 1 MHz	660 µF/F			
(1 to 2) MHz	750 µF/F			
(2 to 3) MHz	760 µF/F			
(3 to 4) MHz	830 µF/F			
(4 to 5) MHz	950 µF/F			
(5 to 10) MHz	1.6 mF/F			
(10 to 13) MHz	1.8 mF/F			



PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Capacitance - Source Fixed Values (cont.)	<b>1 nF</b> 100 Hz to 1 kHz 1 kHz to 1 MHz (1 to 2) MHz (2 to 3) MHz (3 to 4) MHz (4 to 5) MHz (5 to 10) MHz (10 to 13) MHz <b>10 nF</b> (100 to 120) Hz 120 Hz to 1 kHz (1 to 10) kHz (10 to 100) kHz <b>100 nF</b> (100 to 120) Hz 120 Hz to 1 kHz (1 to 10) kHz (10 to 100) kHz <b>1 μF</b> (100 to 120) Hz 120 Hz to 1 kHz (1 to 10) kHz (10 to 100) kHz	620 μF/F 720 μF/F 830 μF/F 990 μF/F 1.3 mF/F 1.6 mF/F 3.6 mF/F 4.9 mF/F 630 μF/F 620 μF/F 640 μF/F 710 μF/F 630 μF/F 620 μF/F 640 μF/F 710 μF/F 670 μF/F 620 μF/F 670 μF/F 910 μF/F	HP 16380C and HP 16380A Standard Capacitor Sets	OEM and GIDEP Sourced Calibration Procedures
<b>Oscilloscopes</b> DC Signal into 50 Ω Load into 1 MΩ Load Amplitude Square Wave 50 Ω Load 1 MΩ Load Leveled Sine Wave - Flatness Relative to 50 kHz Time Marker into 50 Ω Load Edge Specs into 50 Ω Load Rise Time Amplitude (Peak to Peak)	0 V to ± 6.6 V 0 V to ± 130 V 1 mV to 6.6 V p-p (10 Hz to 10 kHz) 1 mV to 130 V p-p (10 Hz to 10 kHz) <b>5 mV to 5.5 V</b> 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz <b>5 mV to 3.5 V</b> (600 to 1 100) MHz 5 s to 50 ms 20 ms to 100 ns (50 to 20) ns 10 ns (5 to 1) ns ≤350 ps 5 mV to 2.5 V	2.5 mV/V + 40 μV 500 μV/V + 40 μV 2.5 mV/V + 40 μV 1 mV/V + 40 μV 15 mV/V + 100 μV 20 mV/V + 100 μV 40 mV/V + 100 μV 50 mV/V + 100 μV (25 + 1000t) μs/s 2.5 μs/s 2.5 μs/s 2.5 μs/s 2.5 μs/s +0 ps/-100 ps 20 mV/V + 200 μV	Fluke 5520A/SC1100	



PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
<b>Oscilloscopes</b> (cont.) Frequency Wave Generator - Source: Amplitude (10 Hz to 10 kHz) Square,Sine,Triangle into 1 MΩ into 50 MΩ  Frequency	1 kHz to 10 MHz   1.8 mV to 55 V p-p 1.8 mV to 2.5 V p-p  10 Hz to 100 kHz	2.5 μs/s of setting   30 mV/V + 100 μV 30 mV/V + 100 μV  25 μs/s + 15 mHz	Fluke 5520A/SC1100	OEM and GIDEP Sourced Calibration Procedures

## II. Electromagnetic - RF/Microwave

PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
RF Power - Source (-56 to +24) dBm  (-127 to +13) dBm	DC to 20 MHz  20 MHz to 26.5 GHz	0.52 dB  3 %	HP 3325B  HP 83630B, 8902A w/ 11722A, 11793A	OEM and GIDEP Sourced Calibration Procedures
RF Power - Measure (-20 to +30) dBm  (-30 to +20) dBm	100 kHz to 2.6 GHz  (2.6 to 26.5) GHz	2.9 %  2.9 %	HP 8902A w/ 11722A  HP 4419B w/ HP 8485A sensor	
Phase Modulation - Measure Rate: 200 Hz to 10 kHz Rate: 200 Hz to 20 kHz	150 kHz to 10 MHz 10 MHz to 1.3 GHz	4.6 % + 1 digit 3.5 % + 1 digit	HP 8902A w/ 11722A	

PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
VSWR - Measure Into 50 Ω (P = Rho)				
0.00 < P < 0.09910	300 kHz to 3 GHz	0.013 P	8753C	OEM and GIDEP Sourced Calibration Procedures
0.09910 < P < 0.25094	300 kHz to 3 GHz	0.018 P		
0.25094 < P < 0.500	300 kHz to 3 GHz	0.038 P		
0.500 < P < 7.00	300 kHz to 3 GHz	0.069 P		
0.00 < P < 0.0476	(45MHz. to 8.4) GHz	0.026 P	8510C	
	(8.4 to 12.4) GHz	0.041 P		
	(12.4 to 18) GHz	0.036 P		
0.0476 < P < 0.1111	(0.01 to 8.4) GHz	0.031 P		
	(8.4 to 12.4) GHz	0.051 P		
	(12.4 to 18) GHz	0.046 P		
0.1111 < P < 0.200	(0.01 to 8.4) GHz	0.045 P		
	(8.4 to 12.4) GHz	0.079 P		
	(12.4 to 18) GHz	0.072 P		
0.200 < P < 0.3333	(0.01 to 8.4) GHz	0.09 P		
	(8.4 to 12.4) GHz	0.17 P		
	(12.4 to 18) GHz	0.16 P		
0.3333 < P < 0.500	(0.01 to 8.4) GHz	0.24 P		
	(8.4 to 12.4) GHz	0.49 P		
	(12.4 to 18) GHz	0.47 P		
Amplitude Modulation - Source				
Rate: 50 Hz to 100 kHz Depths: (5 to 95) %	10 kHz to 13.5 MHz	0.1 %	HP 11715A	
Rate: 50 Hz to 100 kHz Depths: (95 to 99) %	10 kHz to 13.5 MHz	0.1 %		
Rate: 1 kHz; Depth: 30 %	10 MHz to 26.5 GHz	5.82 %		
Rate: DC to 100 kHz Depth: (0 to 90) %	10 MHz to 26.5 GHz	5.85 %		

PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Amplitude Modulation - Measure Rate: 50 Hz to 10 kHz Depths: 5 % to 99 %	150 kHz to 10 MHz	2 % + 1 digit	HP 8902A	OEM and GIDEP Sourced Calibration Procedures
Rate: 20 Hz to 10 kHz Depths: to 99 %	150 kHz to 10 MHz	3 % + 1 digit		
Rate: 50 Hz to 50 kHz Depths: 5 % to 99 %	10 MHz to 1.3 GHz	1 % + 1 digit		
Rate: 20 Hz to 100 kHz Depths: to 99 %	10 MHz to 1.3 GHz	3 % + 1 digit		
Rate: 50 Hz to 50 kHz Depths: to 99 %	(1.3 to 26.5) GHz	1.5 % + 1 digit	HP 8902A w/ 11793A	
Rate: 20 Hz to 100 kHz Depths: to 99 %	(1.3 to 26.5) GHz	3 % + 1 digit		
Transmission Phase - Into 50 Ω, ( 0 to 360) ° (+10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB (-50 to -60) dB (-60 to 70) dB	300 kHz to 3 GHz	5.8 ° 1.4 ° 1.4 ° 1.4 ° 1.8 ° 2.4 ° 4.9 ° 12 °	HP 8753C with 85046A and N-type connector	
(+10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB (-50 to -60) dB (-60 to 70) dB	45 MHz to 18 GHz	(0.3 to 1.9) ° (0.3 to 1.1) ° (0.3 to 1.1) ° (0.3 to 1.1) ° (0.5 to 1.1) ° (0.75 to 1.2) ° (0.8 to 3) ° (1.3 to 8.7) °	HP 8510C, 8515A and 83630B, w/ 85054B	

PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Transmission Phase (cont.) – Into 75 Ω, (0 to 360) ° (+10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB (-50 to -60) dB (-60 to 70) dB	300 kHz to 2 GHz	5.8 ° 1.4 ° 1.4 ° 1.7 ° 2.1 ° 4.1 ° 10 ° 33 °	HP 8753C with 85046A and N-type connector	OEM and GIDEP Sourced Calibration Procedures
Frequency Modulation - Source Rate: 20 Hz to 10 kHz Dev.: 40 kHz peak	10 kHz to 432 MHz	0.1 %	HP 11715A	
Frequency Modulation – Measure Rate: 20 Hz to 10 kHz Dev.: ≤ 40 kHz peak	250 kHz to 10 MHz	2 % + 1 digit	HP 8902A w/ 11793A	
Rate: 50 Hz to 100 kHz Dev.: ≤ 400 kHz peak	10 MHz to 1.3 GHz	1 % + 1 digit		
Rate: 20 Hz to 200 kHz Dev.: ≤ 400 kHz peak	10 MHz to 1.3 GHz	5 % + 1 digit		
Rate: 50 Hz to 100 kHz Dev.: ≤ 400 kHz peak	(1.3 to 26.5) GHz	1 % + 1 digit		
Rate: 20 Hz to 200 kHz Dev.: ≤ 400 kHz peak	(1.3 to 26.5) GHz	5 % + 1 digit		
<b>RF Attenuation</b> (0 to -1) dBm  (-1 to -10) dBm  (-10 to -20) dBm  (-20 to -30) dBm  (-30 to -40) dBm  (-40 to -50) dBm	2.5 MHz to 1.3 GHz (1.3 to 26.5) GHz 2.5 MHz to 1.3 GHz (1.3 to 26.5) GHz 2.5 MHz to 1.3 GHz (1.3 to 26.5) GHz 2.5 MHz to 1.3 GHz (1.3 to 26.5) GHz 2.5 MHz to 1.3 GHz (1.3 to 26.5) GHz	0.1 dB 0.05 dB 0.03 dB 0.06 dB 0.05 dB 0.07 dB 0.08 dB 0.09 dB 0.11 dB 0.12 dB 0.13 dB 0.14 dB	HP 8902A HP 11793A HP 11722A	

PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
<b>RF Attenuation (cont.)</b>				
(-50 to -60) dBm	2.5 MHz to 1.3 GHz	0.16 dB		
	(1.3 to 26.5) GHz	0.16 dB		
(-60 to -70) dBm	2.5 MHz to 1.3 GHz	0.19 dB		
	(1.3 to 26.5) GHz	0.2 dB		
(-70 to -80) dBm	2.5 MHz to 1.3 GHz	0.22 dB		
	(1.3 to 26.5) GHz	0.23 dB	HP 8902A	OEM and GIDEP
(-80 to -90) dBm	2.5 MHz to 1.3 GHz	0.24 dB	HP 11793A	Sourced Calibration
	(1.3 to 26.5) GHz	0.25 dB	HP 11722A	Procedures
(-90 to -100) dBm	2.5 MHz to 1.3 GHz	0.26 dB		
	(1.3 to 26.5) GHz	0.26 dB		
(-100 to -110) dBm	2.5 MHz to 1.3 GHz	0.31 dB		
	(1.3 to 26.5) GHz	0.32 dB		
(-110 to -120) dBm	2.5 MHz to 1.3 GHz	0.37 dB		
	(1.3 to 26.5) GHz	0.37 dB		

### III. Time & Frequency

PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Time Interval	1 s to 3 hrs	0.5 s	HP 53131A	
Frequency - Source	DC to 20 MHz	5 parts in 10 <sup>12</sup>	HP 3325B	OEM and GIDEP Sourced Calibration Procedures
	20 MHz to 26.5 GHz	5 parts in 10 <sup>12</sup>	HP 83630B	
Frequency - Measure	DC to 500 MHz	3 parts in 10 <sup>12</sup>	HP 5343A	
	500 MHz to 26.5 GHz	3 parts in 10 <sup>12</sup>		

### IV. Mechanical

PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Torque	4 in-lbs to 250 ft-lbs	0.41 %	CDI and AKO Torque Systems	OEM and GIDEP Sourced Calibration Procedures

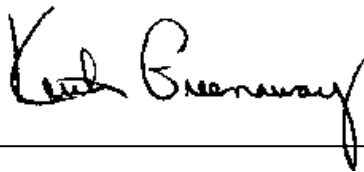


## V. Dimensional

PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Single Axis Dimensional Gaging* (Outside)	Up to 10 in	(19 + 6.4L) μin	P&W Model C with Grade 3 Gage Blocks	OEM and GIDEP Sourced Calibration Procedures
Thread Plug Gages*	Up to 4 in	(42 + 4.3L) μin	P&W Model C with Thread Wires	
Micrometers	Up to 4 in (4 to 20) in	(86 + 2L) μin (118 + 4L) μin	Grade 3 Gage Blocks, Ungraded Long Gage Blocks, Optical Flats	
Calipers	Up to 4 in (4 to 20) in	(153 + 1.2L) μin (760 + 0.9L) μin	Grade 3 Gage Blocks, Ungraded Long Gage Blocks	
Height Gages	Up to 4 in (4 to 20) in	(76 + 2.2L) μin (61 + 5.4L) μin	Grade 3 Gage Blocks, Ungraded Long Gage Blocks, Surface Plate	
Indicators	Up to 4 in	(86 + 2L) μin	Grade 3 Gage Blocks	

**Notes:**

1. Calibration and Measurement Capabilities (CMC) (Expanded Uncertainties) are based on approximately a 95% confidence interval, using a coverage of  $k=2$ .
2. This laboratory offers calibration services in its laboratory and on-site at customer-designated locations. Since on-site conditions are typically more variable than those in the laboratory, larger measurement uncertainties are expected on-site than what is reported on the accredited scope.
3. Capabilities denoted by an asterisk (\*) are available in the laboratory only (not available for on-site calibration activity).
4. CMC listed for Electromagnetic - DC/Low Frequency do not include possible contributions from a "best available" unit under test.
5. The use of (L) signifies an expression of Length in inches.
6. The use of (t) signifies Time in seconds.
7. This scope also applies to the satellite site at 4607 SE International Way, Milwaukie, OR 97222. Contact: Suzanne Wootten Phone: 503-627-4023. These parameters have been verified and authorized for accredited calibration at the Milwaukie satellite site.
8. This scope is part of and must be included with the Certificate of Accreditation No. AC-1259.



Vice President