SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

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CALIBRATION

Valid to: July 25, 2016 Certificate Number: AC-1705

I. Electromagnetic - DC/Low Frequency

PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
DC Voltage - Source[3]	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	7.7 µV/V + 0.86 µV 5.9 µV/V + 0.87 µV 4.2 µV/V + 3.1 µV 3.9 µV/V + 14 µV 5.9 µV/V + 48 µV 7.5 µV/V + 0.76 mV	Fluke 5700A	DOD Midas, OEM, and GIDEP Sourced Procedures
DC Voltage - Measure[3]	Up to 100 mV 100 mV to 1 V (1 to 10) V (10 to 100) V 100 V to 1 kV (1 to 20) kV (20 to 35) kV (35 to 40) kV	7.2 µV/V + 0.55 µV 7 µV/V + 0.42 µV 6.9 µV/V + 0.86 µV 9.2 µV/V + 38 µV 9.3 µV/V + 0.13 µV 20 mV/V 10 mV/V 20 mV/V	HP 3458A Opt 002 with Fluke 80K-40 High Voltage Probe	
DC Current - Source[3] Clamp-On Ammeters[3]	Up to 220 µA 220 µA to 2.2 mA (2.2 to 22) mA (22 to 220) mA 220 mA to 2.2 A (2.2 to 3) A (3 to 11) A (11 to 20.5) A (20 to 1 000) A	48 µA/A + 7.1 nA 41 µA/A + 9.6 nA 42 µA/A + 49 nA 54 µA/A + 0.84 µA 95 µA/A + 15 µA 0.45 mA/A + 66 µA 0.59 mA/A + 0.60 mA 1.2 mA/A + 0.91 mA 2.9 mA/A + 0.08 A	Fluke 5700A Fluke 5520A Fluke 5520A with Fluke Coil	

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DC Current - Measure[3]	Up to 100 nA 100 nA to 1 µA (1 to 10) µA (10 to 100) µA 100 µA to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A Up to 300 A	22 µA/A + 93 pA 18 µA/A + 0.10 nA 28 µA/A + 0.14 nA 30 µA/A + 0.98 nA 30 µA/A + 6.5 nA 30 µA/A + 63 nA 44 µA/A + 1 µA 0.14 mA/A + 12 µA 2.5 mA/A + 1 mA	HP 3458A Opt 002 with Empro HA-300-100	DOD Midas, OEM, and GIDEP Sourced Procedures
AC Voltage - Source[3]	**(1 to 2.2) mV** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz **(2.2 to 22) mV** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz **(22 to 220 mV** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz **220 mV to 2.2 V** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	 0.34 mV/V + 5.8 µV 0.12 mV/V + 5.1 µV 98 µV/V + 4.9 µV 0.25 mV/V + 4.9 µV 0.67 mV/V + 6.7 µV 1.5 mV/V + 13 µV 0.30 mV/V + 4.9 µV 0.11 mV/V + 4.9 µV 96 µV/V + 4.8 µV 24 µV/V + 4.8 µV 0.60 mV/V + 6 µV 1.3 mV/V + 12 µV 1.7 mV/V + 24 µV 3.2 mV/V + 24 µV 0.29 mV/V + 14 µV 0.10 mV/V + 9.4 µV 92 µV/V + 9.2 µV 0.24 mV/V + 88 µV 0.55 mV/V + 20 µV 1.1 mV/V + 24 µV 1.7 mV/V + 30 µV 3.2 mV/V + 53 µV 0.23 mV/V + 54 µV 0.11 mV/V + 19 µV 54 µV/V + 10 µV 88 µV/V + 14 µV 0.13 mV/V + 38 µV 0.50 mV/V + 96 µV 1.2 mV/V + 0.24 mV 2 mV/V + 0.35 mV	Fluke 5700A	

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AC Voltage - Source[3] (cont.)	**(2.2 to 22) V** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz **(22 to 220) V** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz **220 V to 1.1 kV** (15 to 50) Hz 50 Hz to 1 kHz	 0.30 mV/V + 0.54 mV 0.12 mV/V + 0.20 mV 53 µV/V + 67 µV 91 µV/V + 0.13 mV 0.12 mV/V + 0.26 mV 0.33 mV/V + 0.72 mV 1.2 mV/V + 2.4 mV 1.2 mV/V + 3.8 mV 0.30 mV/V + 5.4 mV 0.12 mV/V + 1.8 mV 59 µV/V + 0.85 mV 99 µV/V + 1.4 mV 0.18 mV/V + 3.1 mV 1.2 m/V + 19 mV 0.36 mV/V + 20 mV 82 µV/V + 5.5 mV	Fluke 5700A	DOD Midas, OEM, and GIDEP Sourced Procedures
AC Voltage - Source[3] Wide Band	**300 µV to 3.5 V** (10 to 30) Hz 30 Hz to 120 kHz **300 µV to 1.1 mV** 120 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz **300 µV to 3 mV** 120 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz **3 mV to 3.5 V** 120 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	 4.9 µV/V + 3.7 µV 4.9 µV/V + 3.7 µV 2.4 µV/V + 3.5 µV 4.7 µV/V + 3.5 µV 7.1 µV/V + 3.5 µV 18 µV/V + 18 µV 1.2 µV/V + 3.5 µV 3.5 µV/V + 3.5 µV 5.9 µV/V + 3.5 µV 18 µV/V + 3.5 µV 1.2 µV/V + 3.5 µV 2.4 µV/V + 3.5 µV 4.7 µV/V + 3.5 µV 12 µV/V + 3.5 µV	Fluke 5700A/03 Wide Band Function	
AC Voltage - Measure[3]	**(1 to 10) mV** (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	 0.36 mV/V + 3.6 µV 0.23 mV/V + 1.4 µV 0.32 V/V + 1.7 µV 1.2 mV/V + 1.6 µV 5.7 mV/V + 2 µV 46 mV/V + 2.6 µV	HP 3458A Opt 002	

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AC Voltage - Measure[3] (cont.)	**100 mV to 10 V**		HP 3458A Opt 002	DOD Midas, OEM, and GIDEP Sourced Procedures
	(1 Hz to 40) Hz	72 µV/V + 0.85 mV		
	40 Hz to 1 kHz	84 µV/V + 0.26 mV		
	(1 to 20) kHz	0.17 mV/V + 0.26 mV		
	(20 to 50) kHz	0.35 mV/V + 0.25 mV		
	(50 to 100) kHz	0.93 mV/V + 0.27 mV		
	(100 to 300) kHz	3.5 mV/V + 1.2 mV		
	300 kHz to 1 MHz	12 mV/V + 1.2 mV		
	(1 to 2) MHz	18 mV/V + 1.2 mV		
	(10 to 100) V			
	(1 to 40) Hz	0.24 mV + 4.7 mV		
	40 Hz to 1 kHz	0.15 mV + 16 mV		
	(1 to 20) kHz	0.15 mV + 17 mV		
	(20 to 50) kHz	0.36 mV + 8.6 mV		
	(50 to 100) kHz	1.4 mV/V + 3.9 mV		
	(100 to 300) kHz	4.8 mV/V + 12 mV		
	300 kHz to 1 MHz	18 mV/V + 12 mV		
	100 V to 1 kV			
	(1 to 40) Hz	0.46 mV/V + 50 mV		
	40 Hz to 1 kHz	0.46 mV/V + 28 mV		
	(1 to 20) kHz	0.69 mV/V + 29 mV		
	(20 to 50) kHz	1.5 mV/V + 24 mV		
	(50 to 100) kHz	3.6 mV/V + 24 mV		
	(1 to 40) kV		with Fluke 80K-40 High Voltage Probe	
	60 Hz	50 mV/V + 0.11 V		
AC Current - Source[3]	**(9 to 220) µA**		Fluke 5700A	
	(10 to 20) Hz	0.36 mA/A + 25 nA		
	(20 to 40) Hz	0.24 mA/A + 16 nA		
	40 Hz to 1 kHz	0.17 mA/A + 12 nA		
	(1 to 5) kHz	0.42 mA/A + 18 nA		
	(5 to 10) kHz	1.6 mA/A + 95 nA		
	220 µA to 2.2 mA			
	(10 to 20) Hz	0.37 mA/A + 73 nA		
	(20 to 40) Hz	0.25 mA/A + 68 nA		
	40 Hz to 1 kHz	0.19 mA/A + 54 nA		
	(1 to 5) kHz	0.32 mA/A+ 0.17 µA		
	(5 to 10) kHz	1.6 mA/A + 0.95 µA		
	(2.2 to 22) mA			
	(10 to 20) Hz	0.32 mA/A + 0.67 µA		
	(20 to 40) Hz	0.20 mA/A + 0.57 µA		
	40 Hz to 1 kHz	0.16 mA/A + 0.46 µA		
	(1 to 5) kHz	0.27 mA/A + 0.73 µA		
	(5 to 10) kHz	1.3 mA/A + 5.9 µA		
	(22 to 220) mA			
	(10 to 20) Hz	0.32 mA/A + 6.1 µA		
	(20 to 40) Hz	0.20 mA/AA + 5 µA		
	40 Hz to 1 kHz	0.16 mA/A + 3.4 µA		
	(1 to 5) kHz	1.4 µA/A + 12 µA		

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AC Current - Source[3] (cont.) Clamp-On Ammeters	**220 mA to 2.2 A** 20 Hz to 1kHz (1 to 5) kHz (5 to 10) kHz **(20 to 1 000) A** 45 Hz to 5 kHz	 0.31 mA/A + 44 µA 0.53 mA/A + 0.11 mV 8.3 mA/A + 0.29 mV 2.8 mA/A + 0.14 A	Fluke 5700A Fluke 5520A with Fluke Coil	DOD Midas, OEM, and GIDEP Sourced Procedures
AC Current - Measure[3]	**Up to 100 µA** 10 Hz to 20 Hz 20 Hz to 45 Hz 45 Hz to 100 Hz 100 Hz to 1 kHz **100 µA to 100 mA** 10 Hz to 20 Hz 20 Hz to 45 Hz 45 Hz to 100 Hz 100 Hz to 5 kHz 5 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz **100 mA to 1 A** 10 Hz to 20 Hz 20 Hz to 45 Hz 45 Hz to 100 Hz 100 Hz to 5 kHz 5 kHz to 20 kHz 20 kHz to 50 kHz	 4.7 mA/A + 36 nA 1.8 mA/A + 35 nA 0.71 mA/A + 35 nA 0.70 mA/A + 35 nA 4.7 mA/A + 24 µA 1.8 mA/A + 24 µA 0.71 mA/A + 24 µA 0.36 mA/A + 23 µA 0.71 mA/A + 24 µA 4.7 mA/A + 47 µA 6.5 mA/A + 0.18 mA 4.7 mA/A + 0.24 mA 1.9 mA/A + 0.24 mA 0.95 mA/A + 0.24 mA 1.1 mA/A + 0.26 mA 3.5 mA/A + 0.24 mA 12 mA/A + 0.47 mA	Agilent 3458A Opt 002	
Resistance - Source[3]	Up to 11 Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω 330 Ω to 1.1 kΩ (1.1 to 3.3) kΩ (3.3 to 11) kΩ (11 to 33) kΩ (33 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	5.7 µΩ/Ω + 1.1 mΩ 35 µΩ/Ω + 1.8 mΩ 29 µΩ/Ω + 0.57 mΩ 33 µΩ/Ω + 2.4 mΩ 30 µΩ/Ω + 4.3 mΩ 33 µΩ/Ω + 27 mΩ 4.5 µΩ/Ω + 1.7 Ω 34 µΩ/Ω + 0.23 Ω 33 µΩ/Ω + 0.33 Ω 35 µΩ/Ω + 4 Ω 37 µΩ/Ω + 2.4 Ω 71 µΩ/Ω + 36 Ω 0.15 mΩ/Ω + 67 Ω 0.39 mΩ/Ω + 3 kΩ 0.58 mΩ/Ω + 4.8 kΩ 3.5 mΩ/Ω + 0.12 MΩ 18 mΩ/Ω + 0.59 MΩ	Fluke 5520A	

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Resistance - Source[3] Fixed Points	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 10 mΩ to 1 kΩ (1 to 100) kΩ 100 kΩ to 1 GΩ (1 to 10) GΩ (10 to 100) GΩ	0.12 mΩ 0.22 mΩ 0.28 mΩ 0.58 mΩ 1.3 mΩ 2.4 mΩ 10 mΩ 20 mΩ 90 mΩ 0.19 Ω 1.3 Ω 2.5 Ω 47 47 Ω 0.47 kΩ 1.3 kΩ 12 kΩ 0.1 mΩ/Ω + 2 mΩ 0.1 mΩ/Ω + 0.18 Ω 1 mΩ/Ω + 11 kΩ 2 mΩ/Ω + 0.58 kΩ 5 mΩ/Ω + 23 Ω	Fluke 5700A ESI DB62-11K ESI DB62-111K IET HRRS-Q-3-100M-5KV	DOD Midas, OEM, and GIDEP Sourced Procedures
Resistance - Measure[3] Fixed Points	10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ 1 GΩ	22 μΩ/Ω + 62 μΩ 18 μΩ/Ω + 0.61 mΩ 16 μΩ/Ω + 0.73 mΩ 15 μΩ/Ω + 13 mΩ 15 μΩ/Ω + 67 mΩ 21 μΩ/Ω + 2.7 Ω 46 μΩ/Ω + 0.39 kΩ 0.56 mΩ/Ω + 1.2 kΩ 6 mΩ/Ω + 12 kΩ	HP 3458A Opt 002	
Capacitance - Source[3] 190 pF to 1.1 nF (1.1 to 11) nF (11 to 110) nF (110 to 330) nF 330 nF to 1.1 μF (1.1 to 3.3) μF (3.3 to 11) μF (11 to 33) μF (33 to 110) μF (110 to 330) μF 330 μF to 1.1 mF	10 Hz to 10 kHz 10 Hz to 3 kHz 10 Hz to 10 kHz 10 Hz to 10 kHz (10 to 600) Hz (10 to 300) Hz (10 to 150) Hz (10 to 120) Hz (10 to 80) Hz (10 to 80) Hz (10 to 80) Hz	5 mF/F + 12 pF 5.8 mF/F + 12 pF 2.9 mF/F + 0.12 nF 2.9 mF/F + 0.35 nF 3 mF/F + 1.2 nF 4.1 mF/F + 3.5 nF 4.1 mF/F + 11 nF 4.7 mF/F + 35 nF 5.9 mF/F + 0.11 μF 8.1 mF/F + 0.35 μF 12 mF/F + 0.27 μF	Fluke 5520A	

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Capacitance - Source[3]			Hewlett Packard 16380A set consisting of 16381A, 16382A, 16383A, and 16384A	DOD Midas, OEM, and GIDEP Sourced Procedures
1 pF	1 kHz	1.2 fF		
10 pF	1 kHz	12 fF		
100 pF	1 kHz	0.12 pF		
1 nF	1 kHz	1.2 pF		
Algorithmic Deviation				
1 pF	(1 to 3) MHz	1.2 fF		
	4 MHz	1.3 fF		
	5 MHz	1.5 fF		
	10 MHz	2.8 fF		
	13 MHz	3.9 fF		
10 pF	(1 to 13) MHz	12 fF		
100 pF	(1 to 10) MHz	0.12 pF		
	13 MHz	0.13 pF		
1 nF	(1 to 4) MHz	1.2 pF		
	5 MHz	1.3 pF		
	10 MHz	2.2 pF		
	13 MHz	3 pF		
Inductance - Source	100 µH to 1 mH	24 mH/H + 5 µH	IET 1491-G	
	(1 to 10) mH	24 mH/H + 0.7 mH		
	(10 to 100) mH	19 mH/H + 8.2 µH		
	100 mH to 1 H	9.5 mH/H + 0.13 mH		
	(1 to 10) H	9.5 mH/H + 1.5 mH		
Electrical Simulation of Thermocouple Indicating Devices - Source and Measure[3]			Fluke 5520A	
Type K	(-200 to -50) °C	0.56 °C (1 °F)		
	(-50 to 1 372) °C	0.28 °C (0.5 °F)		
Type T	(-200 to -50) °C	0.56 °C (1 °F)		
	(-50 to 400) °C	0.28 °C (0.5 °F)		
Type J	(-210 to -50) °C	0.56 °C (1 °F)		
	(-50 to 760) °C	0.28 °C (0.5 °F)		
Type E	(-230 to -50) °C	0.56 °C (1 °F)		
	(-50 to 1 000) °C	0.28 °C (0.5 °F)		
Type R	(0 to 1 768) °C	0.95 °C (1.8 °F)		

PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Oscilloscopes[3]				
Square Wave Signal				
10 Hz to 10 kHz 50 Ω 1 M Ω	1 mV to 6.6 V p-p 1 mV to 130 V p-p	0.25 mV/V p-p + 0.11 V 2.5 mV/V p-p + 58 mV	Fluke 5520A	DOD Midas, OEM, and GIDEP Sourced Procedures
	5 mV to 5.5 V	11 mV/V + 0.11 V		
Level Sine Wave				
Amplitude	50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz	25 mV/V + 0.11 V 30 mV/V + 0.11 V 52 mV/V + 0.11 V		
Flatness referenced to 50 kHz reference	50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz	6.3 mV/V + 0.11 V 5.9 mV/V + 0.17 V 23 mV/V + 0.17 V		
Time Markers (5-2-1 sequence) into a 50 Ω load	5 s to 50 ms 20 ms to 100 ns (50 to 20) ns 10 ns (5 to 2) ns	0.30 mHz/Hz + 0.12 Hz 2.5 x 10^{-6} Hz 2.5 x 10^{-6} Hz 2.5 x 10^{-6} Hz 2.5 x 10^{-6} Hz		
Rise Time	≤ 300 ps	0.06 ps/s + 0.03 ps		

II. Electromagnetic - RF/ Microwave

PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
RF Tuned Power-Measure[3]				
(0 to 70) dB (71 to 139) dB	100 kHz to 4.2 GHz	0.02 dB + 0.007 dB/10 dB Step 0.11 dB + 0.01 dB/10 dB Step	Agilent N5531S/OPT518	DOD Midas, OEM, and GIDEP Sourced Procedures
(0 to 70) dB (71 to 139) dB	(4.2 to 18) GHz	0.02 dB + 0.007 dB/10 dB Step 0.11 dB + 0.01 dB/10 dB Step		

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Amplitude Modulation - Source[3] Rate: 6 MHz to 20 GHz, 0 % to 100 %	DC to 100 kHz	1.2 % + 0.07 AM	HP 83620B	DOD Midas, OEM, and GIDEP Sourced Procedures
Amplitude Modulation - Measure[3] Rate: 50 Hz to 10 kHz, 5 % to 99 %	100 kHz to 10 MHz	0.002 % + 0.01 AM	Agilent N5531S	
50 Hz to 100 kHz, 20 % to 99 %	10 MHz to 3 GHz	0.001 % (AM) + 0.01 AM		
50 Hz to 100 kHz, 5 % to 20 %	10 MHz to 3 GHz	0.001 % + 0.03 AM		
(3 to 26.5) GHz, 5 % to 20 %	(3 to 18) GHz	0.001 % (AM) + 0.05 AM		
(3 to 26.5) GHz, 20 % to 99 %	(3 to 18) GHz	0.001 % + 0.02 AM		
Frequency Modulation - Measure[3] Rate: 20 Hz to 10 kHz Dev:20 Hz to 40 kHz peak	250 kHz to 10 MHz	1.7 % + 5.7 Hz 1.1 % + 6.7 Hz	Agilent N5531S	
Rate: 50 Hz to 200 kHz Dev:250 Hz to 400 kHz peak	10 MHz to 6.6 GHz	1.8 % + 5.1 Hz 1.2 % + 6.1 Hz		
Rate: 50 Hz to 200 kHz Dev:250 Hz to 400 kHz peak	(6.6 to 13.2) GHz	2.9 % + 4 Hz 1.2 % + 6.4 Hz		
Rate: 50 Hz to 100 kHz Dev:250 Hz to 400 kHz peak	(13.2 to 18) GHz	4.4 % + 3.8 Hz 1.2 % + 7.6 Hz		
Frequency Modulation - Source[3] Rate: 1 kHz rate Max. Dev. 2 MHz Max. Dev. 4 MHz Max. Dev. 8 MHz Max. Dev. 16 MHz Max. Dev. 32 MHz	250 kHz to 1 GHz (1 to 2) GHz (2 to 3.2) GHz (3.2 to 10) GHz (10 to 20) GHz	4 % + 24 Hz	HP 83620B	

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Phase Modulation - Measure[3] >0.7 rad Dev. >0.6 rad Dev. >1.2 rad Dev.	 100 kHz to 6.6 GHz (6.6 to 13.2) GHz (13.2 to 18) GHz	 1.2 % + 0.007 rad 1.2 % + 0.007 rad 1.2 % + 0.008 rad	Agilent N5531S	DOD Midas, OEM, and GIDEP Sourced Procedures
Phase Modulation - Measure[3] 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	
Distortion - Measure[3] Rate: 20 Hz to 250 kHz (0.01 to 100) %	250 kHz to 18 GHz 20 Hz to 20 kHz (20 to 100) kHz	0.07 % 1.2 dB 2.3 dB	Agilent N5531S HP 8902B	
Power - Measure[3] 1 mW reference	50 MHz 100 kHz to 4.2 GHz 10 MHz to 18 GHz 50 MHz to 26.5 GHz	0.01 mW 3 % + 0.10 dbm 3.2 % + 0.10 dbm 3 % + 0.10 dbm	HP 478Awith HP 432A HP 8482A, E4419B, HP 8481A, E4419B, HP8485A, E4419B	
Noise Figure - Source[3] 15 dB ENR	10 MHz to 26.5 GHz	0.17 dB	HP 346C	
Noise Figure - Measure[3]	100 kHz to 30 MHz 30 MHz to 3 GHz (3 to 26.5) GHz	0.43 dB 0.42 dB 0.47 dB	HP 346C, Agilent E4448A, HP 8449B	
Transmission S12/S21 Phase and Magnitude - Measure[3]	(0.01 to 2) GHz (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	 0.07 dB and 0.46° 0.06 dB and 0.36° 0.08 dB and 0.5° 0.12 dB and 0.83° 0.29 dB and 1.9° 2.3 dB and 5.5° 5.9 dB and 5.7°	E8362B with various calibration kits	

PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Transmission S12/S21 Phase and Magnitude - Measure[3] (cont.)	**(2 to 8) GHz** (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 (-70 to -80) dB (-80 to -90) dB **(8 to 20) GHz** (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 (-70 to -80) dB (-80 to -90) dB	 0.09 dB and 0.59° 0.07 dB and 0.46° 0.09 dB and 0.57° 0.1 dB and 0.69° 0.12 dB and 0.81° 0.15 dB and 0.98° 0.22 dB and 1.4° 0.45 dB and 3.1° 1.2 dB and 8.7° 3.4 dB and 8.7° 0.19 dB and 1.3° 0.17 dB and 1.1° 0.18 dB and 1.2° 0.2 dB and 1.3° 0.22 dB and 1.4° 0.24 dB and 1.6° 0.32 dB and 2.1° 0.6 dB and 4.1° 1.6 dB and 8.7° 4.2 dB and 11°	E8362B with various calibration kits	DOD Midas, OEM, and GIDEP Sourced Procedures
Reflection S11/S22 Phase and Magnitude - Measure[3]	**(0.01 to 2) GHz** (< 0.03) Γ (< 0.2) Γ (< 0.4) Γ (< 0.6) Γ (< 0.8) Γ (< 1) Γ **(2 to 8) GHz** (< 0.03) Γ (< 0.2) Γ (< 0.4) Γ (< 0.6) Γ (< 0.8) Γ (< 1) Γ **(8 to 20) GHz** (< 0.03) Γ (< 0.2) Γ (< 0.4) Γ (< 0.6) Γ (< 0.8) Γ (< 1) Γ	 0.01 and 3.3 deg 0.01 and 3.3 deg 0.02 and 2 deg 0.02 and 1.6 deg 0.02 and 1.5 deg 0.03 and 1.5 deg 0.01 and 3.5 deg 0.01 and 3.5 deg 0.02 and 2.2 deg 0.02 and 1.8 deg 0.03 and 1.7 deg 0.003 and 1.7 deg 0.03 and 7.8 deg 0.03 and 7.8 deg 0.04 and 4.8 deg 0.04 and 4 deg 0.06 and 3.8 deg 0.07 and 3.9 deg	E8362B with various cal kits	

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III. Time & Frequency

PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Frequency - Source[3]	1 µHz to 80 MHz 10 MHz to 26.5 GHz	5×10^{-12} Hz 5×10^{-12} Hz	HP 33250A with 58503B Agilent 8340B with 58503B	DOD Midas, OEM, and GIDEP Sourced Procedures
Frequency - Measure[3]	1 µHz to 12.4 GHz 1 Hz to 26.5 GHz	5×10^{-12} Hz 5×10^{-12} Hz	HP 53132A Opt 124 with HP 58503B Agilent E4440A with HP 58503A	
Stopwatches/Timers	Up to 3 600 s	0.25 s	HP 53132A	

IV. Optical Radiation

PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Optical Power - Measure[3]	850 nm 1 310 nm 1 550 nm	4.9 % of reading 4.9 % of reading 4.9 % of reading	Agilent 81654, 81655A, 8156A, Newport 1928C, 8181R	DOD Midas, OEM, and GIDEP Sourced Procedures
Optical Wavelength – Measure[3]	(700 to 1 650) nm	3 parts in 10^6	Agilent 86120A	
Light Meters[3] Nominal Irradiance at 25 cm Nominal Radiance with RS-70-2 Diffuser	 300 nm 550 nm 800 nm 1 100 nm 300 nm 550 nm 800 nm 1 100 nm	 8 parts in 10^9 7.5 parts in 10^7 2 parts in 10^6 2.2 parts in 10^6 6.2 parts in 10^9 1 parts in 10^6 9 parts in 10^6 6.5 parts in 10^5	Gamma Scientific RS-10 with RS 70-1	
Laser Power - Measure	Up to 50 W	9.9 mW/W + 18 mW	Gentect Maestro, UP50N-50H-W9-D0	

V. Thermodynamic

PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Temperature - Measure Ovens and Chambers	(-100 to 1 300) °C	1.2 °C	Agilent 34970A	DOD Midas, OEM, and GIDEP Sourced Procedures
Temperature - Measure Dry Well and Liquid Bath	(-40 to 180) °C (-200 to 0) °C (0 to 660) °C	0.24 °C 0.01 °C 0.02 °C	Vaisala HM141/HMP46 Fluke 5626, Agilent 3458A	
IR Temperature	(-18 to 149) °C (100 to 932) °C	1 °C 1.2 °C	Omega BB701 Omega BB-4A	
Relative Humidity - Measure Ovens and Chambers	Up to 90 %RH (90 to 100) %RH	0.2 % of Applied + 1.3 %RH 2.5 %RH	Vaisala HM141/HMP46	
Platinum Resistance Thermometers	(-8 to 100) °C (100 to 350) °C	0.0018 % + 0.006 °C 0.0022 % + 0.006 °C	Fluke 9009, HP 3458A, Fluke 5626	
Thermocouple Sensors	(-8 to 100) °C (100 to 350) °C	0.26 °C 0.66 °C	Fluke 9009, HP 3458A, Fluke 5626	

VI. Mechanical

PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
RPM - Measure	(60 to 6 000) rpm (6 000 to 12 000) rpm (12 000 to 60 000) rpm (60 000 to 100 000) rpm (100 000 to 120 000) rpm	0.03 % of Applied + 0.13 rpm 0.03 % of Applied + 0.16 rpm 0.03 % of Applied + 1.3 rpm 0.03 % of Applied + 1.6 rpm 0.03 % of Applied + 2.4 rpm	Shimpo DT-326	DOD Midas, OEM, and GIDEP Sourced Procedures
Stroboscopes	(0 to 100 000) rpm	0.00007 % of Applied + 0.58 rpm	Fluke 5520A	

PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Sound Level Meters	94 dB 114 dB	0.51 dB 0.23 dB	CEM SC-05 Rion NC-72	DOD Midas, OEM, and GIDEP Sourced Procedures
Force Gages	Up to 20 kgf	23 gf	Class M1 Weights	
Pressure - Source	(-12 to 300) psi (300 to 10 000) psi (0 to 15) psi (0 to 10 000) psi	0.2 psi 0.0001 % of Applied + 9.5 psi 0.21 psi 0.02 % of Applied + 0.21 psi	Fluke 718 300G (Air) Fluke 700P31 (Air) Fluke 700P-24 (Differential) Fluke P324 (Oil)	
Torque Tools	(1 to 10) in lb (10 to 100) in lb (5 to 50) ft lb (25 to 250) ft lb	0.6 % of Applied + 0.008 in lb 0.6 % of Applied + 0.07 in lb 0.6 % of Applied + 0.04 ft lb 0.7 % of Applied + 0.15 ft lb	Mountz LLT10i Mountz BMX100i Mountz BMX50F Mountz BMX250F	
Torque Transducers	Up to 22 cm kg	0.03 % of Applied + 0.0003 cm kg	Mountz 4 in Torque Wheel and Weights	
Balances	1 g 2 g 5 g 10 g 20 g 50 g 100 g 200 g 500 g 1 kg 2 kg 5 kg 10 g 20 g 50 g 100 g 200 g 500 g 1 kg 20 kg	0.15 mg 0.15 mg 0.15 mg 0.23 mg 0.42 mg 1.0 mg 2.0 mg 4.0 mg 7.0 mg 0.01 g 0.02 g 0.05 g 0.7 mg 0.9 mg 1.0 mg 1.7 mg 3.3 mg 8.3 mg 17 mg 0.3 g	Class F Weights (Up to 18.11 kg) Class M1 Weights (Up to 104 kg)	

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PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Mass	Up to 100 g Up to 10 kg	0.1 mg 0.01 g	Class F Weights, Balance	DOD Midas, OEM, and GIDEP Sourced Procedures
Air Velocity	Up to 7 040 fpm	1.2 % of Applied + 1.6 fpm	Interactive Instruments JS500, Omega HHF141A	

VII. Dimensional

PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Ring Gages	Up to 6 in	(3.6 + 10L) µin	Mahr Federal UMM	DOD Midas, OEM, and GIDEP Sourced Procedures
Thread Measuring Wires	Up to 0.09623 in	(3.4 + 10L) µin		
Thread Plug Gages - External Diameter	Up to 2 in (2 to 6) in	85 µin (58 + 10L) µin		
Thread Ring Gages - Internal Diameter	Up to 1.5 in (1 to 8) in	36 µin (15 + 10L) µin		
Gage Blocks	Up to 6 in (6 to 19) in	(3.8 to 10L) µin (-24 + 8.8L) µin		
Pin Gages	Up to 1 in (1 to 6) in	20 µin (5.8 + 10L) µin		
Bore Gages	Up to 1 in	110 µin		

PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Calipers External Diameter	Up to 40 inch (Up to 1 000 mm)	13 µin/in + 590 µin	Grade 2 Gage Blocks, End Rods	DOD Midas, OEM, and GIDEP Sourced Procedures
Inside Diameter (Fixed Points)	(1 and 2) in (25.4 and 50.8) mm	28 µin/in + 660 µin	Ring Gages	
Micrometers and Thickness Gages	Up to 12 in (Up to 300 mm)	30 µin/in + 19 µin	Grade 2 Gage Blocks, End Rods	
Height Gages	Up to 40 in (Up to 1 000 mm)	4.7 µin/in + 750 µin		
Depth Gages	Up to 40 in (Up to 1 000 mm)	21 µin/in + 140 µin	Grade 2 Gage Blocks, End Rods	
Dial Indicators	Up to 4 in (Up to 100 mm)	21 µin/in + 1 800 µin	Grade 2 Gage Blocks	
Dial Test Indicators	Up to 1 mm	0.57 % + 0.0003 mm	Mitutoyo 521-103	
Steel Rules	Up to 72 in (Up to 1 800 mm)	0.04 in	Grade 2 Gage Blocks	
Tape Measure	Up to 600 in (Up to 15 000 mm)	0.04 in		
Feeler (Thickness) Gages	Up to 1 mm	0.00014 mm	Mahr ULM 600	
Holtest	Extension to 25 mm	0.00012 % + 0.0006 mm		

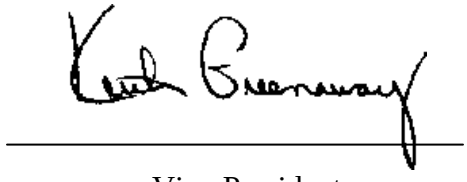
PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Optical Comparators and Visual System	Up to 300 mm	0.01 mm	Grade 2 Gage Blocks, Glass Scale	DOD Midas, OEM, and GIDEP Sourced Procedures
Surface Plates - Flatness	Up to 48 in	240 µin/step	Repeat-O-Meter	

VIII. Chemical Quantities

PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
pH - Source	4.01 pH 7.00 pH 10.00 pH	0.01 pH 0.02 pH 0.02 pH	pH Solutions	DOD Midas, OEM, and GIDEP Sourced Procedures
Conductivity - Source	84 µS/cm 1 413 µS/cm 5 000 µS/cm 12 880 µS/cm 111 800 µS/cm	1.9 µS/cm 7.2 µS/cm 28 µS/cm 71 µS/cm 0.56 mS/cm	Conductivity Solutions	

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. *These parameters are available for on-site calibrations.*
4. *The use of (L) signifies Length in inches.*
5. *This scope is part of and must be included with the Certificate of Accreditation No. AC-1705.*



Vice-President