

**SCOPE OF COMPETENCY FOR NAVY STANDARDS LABORATORY
SPRINGFIELD, VIRGINIA
(Per SSP CCA conducted 06 – 10 October 2008)**

Electrical/Electronic/Microwave Scope of Competency			
Parameter	Range	Uncertainty	Comments
AC Current, Generated	10 mA to 20 A, DC to 20 kHz	± 0.025 to 0.36%	AC Current Shunts with ACV/DCV Transfer Standard
	10 mA to 20 A, 400 Hz to 5 kHz	± 40 to 150 ppm	NVLAP - AC Current Shunts with ACV/DCV Transfer Standard
AC Current, Measured	10 mA to 20 A, 400 Hz to 5 kHz	± 40 to 150 ppm	NVLAP - AC Current Shunts with ACV/DCV Transfer Standard
AC Ratio	0 to 1.1000000 @ 400 Hz & 1000 Hz	± 0.6 ppm	NVLAP - AC Ratio Comparison
AC Voltage, Generated	1 to 100 mV, 10 Hz to 1 MHz	$\pm (40 \text{ ppm} + 5 \mu\text{V})$ to $(0.1\% + 5 \mu\text{V})$	NVLAP - AC Voltage Calibration System
	1 V, 10 Hz to 1 MHz	$\pm (20 \text{ ppm to } 0.1\%)$	NVLAP - AC Voltage Calibration System
	10 V, 10 Hz to 1 MHz	$\pm (30 \text{ ppm to } 0.1\%)$	NVLAP - AC Voltage Calibration System
	100 V, 10 Hz to 1 MHz	$\pm (40 \text{ ppm to } 0.72\%)$	NVLAP - AC Voltage Calibration System
	1100 V, 10 Hz to 1 MHz	$\pm (50 \text{ ppm} + 9 \text{ mV})$ to $(0.26\% + 9 \text{ mV})$	NVLAP - AC Voltage Calibration System
AC Voltage, Measured	0 to 10 V, 20 Hz	± 65 ppm	NVLAP - Thermal Transfer Standard
	0 to 1000 V, 1 kHz	± 20 to 25 ppm	NVLAP - Thermal Transfer Standard
	0 to 1000 V, 20 kHz	± 30 to 35 ppm	NVLAP - Thermal Transfer Standard
	0 to 1000 V, 50 kHz	± 40 to 45 ppm	NVLAP - Thermal Transfer Standard
	0 to 1000 V, 100 kHz	± 50 to 75 ppm	NVLAP - Thermal Transfer Standard
	0 to 20 V, 1 MHz	± 80 ppm	NVLAP - Thermal Transfer Standard
	0 to 6 V, 20 kHz to 100MHz	± 0.05 to 1.0%	Thermal Voltage Converter
	300 mV to 100 V, 10 to 40 Hz	± 75 ppm	NVLAP - AC Voltage Standard
	300 mV to 100 V, 40 to 20 kHz	± 30 ppm	NVLAP - AC Voltage Standard
	300 mV to 100 V, 20 to 50 kHz	± 70 ppm	NVLAP - AC Voltage Standard

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Parameter	Range	Uncertainty	Comments
AC Voltage, Measured (continued)	300 mV to 100 V, 50 to 100 kHz	± 150 ppm	NVLAP - AC Voltage Standard
	300 mV to 100 V, 100 to 500 kHz	± 300 ppm	NVLAP - AC Voltage Standard
	300 mV to 100 V, 500 kHz to 1 MHz	± 1000 ppm	NVLAP - AC Voltage Standard
	100 to 1000 V, 10 Hz to 40 Hz	± 80 ppm	NVLAP - AC Voltage Standard
	100 to 1000 V, 40 Hz to 20 kHz	± 35 ppm	NVLAP - AC Voltage Standard
	100 to 1000 V, 20 to 50 kHz	± 75 ppm	NVLAP - AC Voltage Standard
	100 to 1000 V, 50 to 100 kHz	± 150 ppm	NVLAP - AC Voltage Standard
	2 to 20 mV, 10 Hz to 1 MHz	± 80 to 590 ppm	NVLAP - ACV/DCV Transfer Standard
	20 to 200 mV, 10 Hz to 1 MHz	± 30 to 380 ppm	NVLAP - ACV/DCV Transfer Standard
	200 to 600 mV, 10 Hz to 1 MHz	± 12 to 380 ppm	NVLAP - ACV/DCV Transfer Standard
	600 mV to 2 V, 10 Hz to 1 MHz	± 12 to 260 ppm	NVLAP - ACV/DCV Transfer Standard
	2 to 6 V, 10 Hz to 1 MHz	± 12 to 110 ppm	NVLAP - ACV/DCV Transfer Standard
	6 to 20 V, 10 Hz to 1 MHz	± 12 to 120 ppm	NVLAP - ACV/DCV Transfer Standard
	20 to 60 V, 10 Hz to 1 MHz	± 12 to 120 ppm	NVLAP - ACV/DCV Transfer Standard
60 to 200 V, 10 Hz to 100 kHz	± 14 to 55 ppm	NVLAP - ACV/DCV Transfer Standard	
200 to 1000 V, 10 Hz to 100 kHz	± 18 to 90 ppm	NVLAP - ACV/DCV Transfer Standard	
Attenuation, RF, coaxial	0 to 20 dB, 10.0 MHz to 12.4 GHz	± (0.02 dB per 10 db + error of Std)	Attenuator Calibrator/ Std Attenuator
	20 to 80 dB, 10.0 MHz to 12.4 GHz	± (0.01 dB per 10 db + error of Std)	Attenuator Calibrator/ Std Attenuator
	80 to 110 dB, 10.0 MHz to 12.4 GHz	± (0.03 dB per 10 db + error of Std)	Attenuator Calibrator/ Std Attenuator
	0 to 30 dB, 12.4 to 18.0 GHz	± (0.02 dB per 10 db + error of Std)	Attenuator Calibrator/ Std Attenuator
Attenuation, RF, coaxial (continued)	30 to 70 dB, 12.4 to 18.0 GHz	± (0.01 dB per 10 db + error of Std)	Attenuator Calibrator/ Std Attenuator
	70 to 90 dB, 12.4 to 18.0 GHz	± (0.03 dB per 10 db + error of Std)	Attenuator Calibrator/ Std Attenuator
Capacitance, Measured	10 to 1000 pF @ 1 kHz	± 5 to 17 ppm	NVLAP - Capacitance Bridge with Reference Std Capacitors

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Parameter	Range	Uncertainty	Comments
DC Voltage, Generated	1.018 V	± 2.1 ppm	NVLAP - DC Voltage Standard Cell Bank
	1 V	± 1.1 ppm	NVLAP - DC Voltage Standard Cell Bank
	10 V	± 0.7 ppm	NVLAP - DC Voltage Standard Cell Bank
	0 to 1000 V	± 0.7 ppm	NVLAP - DC Voltage Standard Cell Bank & Voltage Divider
DC Voltage, Measured	1.018 V	± 2.1 ppm	NVLAP - Voltage Comparison
	1 V	± 1.1 ppm	NVLAP - Voltage Comparison
	10 V	± 0.7 ppm	NVLAP - Voltage Comparison
	0 to 1000 V	± 0.7 ppm	NVLAP - Voltage Comparison
DC Current, Generated	0 to 2 A	± 0.03% of output	DC Current Supply
	3 to 100 A	± 19 to 33 ppm	NVLAP - DC Current Supply/Shunts/DVM
	100 to 400 A	± (0.03% of output + 20 mA)	DC Current Supply
DC Current, Measured	300 μA to 30 A	± 13 to 46 ppm	DC Current Shunts/DVM
	3 to 100 A	± 19 to 33 ppm	NVLAP - DC Current Shunts/DVM
	100 to 300 A	± 0.01%	DC Current Shunts/DVM
Distortion	0.01 to 100%, 20 Hz to 20 kHz	± 1.0 dB	Distortion Analyzer
	0.01 to 100%, 10 Hz to 50 kHz	+ 1.0 to - 2.0 dB	Distortion Analyzer
	0.01 to 100%, 50 to 110 kHz	+ 1.5 to - 4.0 dB	Distortion Analyzer
	0.001 to 100%, 20 Hz to 20 kHz	± 1.0 dB	Audio Analyzer
	0.001 to 100%, 20 to 100 kHz	± 2.0 dB	Audio Analyzer
Frequency, Generated	10 MHz	± 1 × 10 ⁻¹³ (7 day average)	NVLAP - GPS Receiver
	100 Hz to 500 MHz	± 3 × 10 ⁻¹¹	Rubidium Frequency Standard
	DC to 18 GHz	± 0.01% to 3%	Signal Generators
Frequency, Measured	10 MHz	± 1 × 10 ⁻¹³ (7 day average)	NVLAP - GPS Receiver & Frequency Comparator
	100 Hz to 500 MHz	± 3 × 10 ⁻¹¹	Rubidium Frequency Standard
	DC to 18 GHz	± (1 × 10 ⁻⁹ + 1 count)	Electronic Counter

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Parameter	Range	Uncertainty	Comments
Modulation, Amplitude	0 to 90%	± 2% FS	Signal Generator Calibrator
Modulation, Frequency	30 Hz to 300 kHz	± (2% FS + 15 Hz per 100 MHz)	Signal Generator Calibrator
Phase, Generated	0 to 360°, 60 Hz to 50 kHz, 10 to 100 V	± 6.3 to 10.7 m°	NVLAP - Phase Standard
Phase, Measured	10 to 60 Hz	± 0.10°	Phase Angle Voltmeter
	0 to 360°, 60 Hz to 50 kHz, 10 to 100 V	± 30 m°	NVLAP - Phase Angle Voltmeter
	50 to 100 kHz	± (freq in kHz/100)°	Phase Angle Voltmeter
Resistance, Measured	1 mΩ	± 6.0 ppm	NVLAP - Resistance Bridge
	10 mΩ	± 2.2 ppm	NVLAP - Resistance Bridge
	100 mΩ	± 0.9 ppm	NVLAP - Resistance Bridge
	1 Ω	± 0.25 ppm	NVLAP - Resistance Bridge
	10 Ω	± 0.25 ppm	NVLAP - Resistance Bridge
	100 Ω	± 0.25 ppm	NVLAP - Resistance Bridge
	1 kΩ	± 0.25 ppm	NVLAP - Resistance Bridge
	10 kΩ	± 0.25 ppm	NVLAP - Resistance Bridge
	100 kΩ	± 0.5 ppm	NVLAP - Resistance Bridge
	1 MΩ	± 0.8 ppm	NVLAP - Resistance Bridge
	10 MΩ	± 8.4 ppm	NVLAP - Resistance Bridge
	100 MΩ	± 100 ppm	Resistance Bridge
	Resistance, Generate	1 mΩ	± 6.0 ppm
10 mΩ		± 2.2 ppm	NVLAP - Standard Resistor
100 mΩ		± 0.9 ppm	NVLAP - Standard Resistor
1 Ω		± 0.25 ppm	NVLAP - Standard Resistor
10 Ω		± 0.25 ppm	NVLAP - Standard Resistor
100 Ω		± 0.25 ppm	NVLAP - Standard Resistor
1 kΩ		± 0.25 ppm	NVLAP - Standard Resistor
10 kΩ		± 0.25 ppm	NVLAP - Standard Resistor
100 kΩ		± 0.5 ppm	NVLAP - Standard Resistor
1 MΩ		± 0.8 ppm	NVLAP - Standard Resistor

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Parameter	Range	Uncertainty	Comments
Resistance, Generate (continued)	10 MΩ	± 8.4 ppm	NVLAP - Standard Resistor
	100 MΩ	± 100 ppm	Standard Resistor
RF Power (continuous wave)	1 μW to 10 mW, 10 MHz to 18 GHz	± (0.2% + error of Standard Mount)	RF Power Calibration System
Synchro Standards	0 to 360°	± 1.5 seconds of arc	Ratio Transformer with Phase Angle Voltmeter
Voltage Standing Wave Ratio (VSWR)	1.01 to 1.20, 30 MHz to 18 GHz	± 0.008 to 0.07 VSWR	Standard Mismatch Comparison
Waveform: Oscilloscope:			
Time Mark	2 ns to 5 s	± 0.01%	Time Mark Generator
Calibration	10 mV to 20 V p-p	± 0.75%	Calibration Generator
Frequency Response	0 to 250 MHz	± 1 to 3%	Leveled Sinewave Generator
Rise Time	<125 ps	< 125 ps	Tunnel Diode Pulse Generator
Amplitude	10 mV to 50 V p-p	± 0.3%	Amplitude Generator

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Physical/Mechanical Scope of Competency			
Parameter	Range	Uncertainty	Comments
Flatness	4 inch diameter or less	$\pm 2 \mu$ inch	Master Optical Flat/Plano-Interferometer
	4 to 10 inch diameter	$\pm 3 \mu$ inch	Master Optical Flat/Plano-Interferometer
Force	0 to 500 lbf	$\pm 0.02\%$	NVLAP - Force Machine/Deadweight, Indicator
	0 to 100,000 lbf	± 0.04 to 0.05%	NVLAP - Force Machine/Load Cell, Indicator
Mercury Vapor	0 to 0.3 mg/m^3	$\pm 15\%$	Mercury Vapor Calibration Kit
Pressure, Absolute, Gas Pressure, Differential, Gas Pressure, Differential, Liquid	0.5 to 100 inHg	± 0.0005 to 0.0035 inHg	NVLAP - Mercury Manometer
	2 to 700 psia	± 50 ppm	NVLAP - Air Deadweight Tester
	2 to 700 psig	± 50 ppm	NVLAP - Air Deadweight Tester
	400 to 1,600 psig	± 50 ppm	NVLAP - Oil Deadweight Tester
	1,600 to 16,000 psig	± 55 ppm	NVLAP - Oil Deadweight Tester
Relative Humidity, Generated	20 to 90% RH	$\pm 2\%$ RH	Humidity Test Chamber
	11.3% RH	$\pm 0.3\%$ RH	Saturated Aqueous Salt Solutions
	32.8% RH	$\pm 0.2\%$ RH	Saturated Aqueous Salt Solutions
	52.9% RH	$\pm 0.2\%$ RH	Saturated Aqueous Salt Solutions
	75.3% RH	$\pm 0.1\%$ RH	Saturated Aqueous Salt Solutions
	93.6% RH	$\pm 0.6\%$ RH	Saturated Aqueous Salt Solutions
Relative Humidity, Measured	5 to 95% RH	$\pm 0.6\%$ Dew Point	Dew Point Analyzer
Temperature	-196 to +500°C	± 19 mK	NVLAP - SPRT/Bridge/Baths
	+0.01°C	± 1 mK	NVLAP - Triple Point of Water
	-195.8020°C	± 5 mK	Nitrogen Boiling Point
	-189.2442°C	± 5 mK	NVLAP - Argon Boiling Point
	-38.8344°C	± 3 mK	NVLAP - Triple Point of Mercury

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Parameter	Range	Uncertainty	Comments
Temperature (continued)	+29.7646°C	± 3 mK	NVLAP - Gallium Freeze Point
	+156.5985°C	± 3 mK	NVLAP - Indium Freeze Point
	+231.9280°C	± 3 mK	NVLAP - Tin Freeze Point
	+419.5270°C	± 4 mK	NVLAP - Zinc Freeze Point
	+660.3230°C	± 10 mK	Aluminum Freeze Point
Torque, Generated	0 to 24 lbin	± 0.1% (at Standard Gravity)	Weight Set & Holder, Calibration Lever
	10 to 100 lbft	± 0.1% (at Standard Gravity)	Weight Set & Holder, Calibration Lever
	0 to 1,000 lbft	± 0.1% (at Standard Gravity)	Weight Set & Holder, Calibration Lever
Torque, Measured	2.5 to 1,000 lbft	± 0.1% FS	Torque Tester

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