



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017
& ANSI/NCSLI Z540-1-1994 & ANSI/NCSLI Z540.3-2006

NORTHROP GRUMMAN SYSTEMS CORPORATION, STRATEGIC SPACE SYSTEMS DIVISION
One Space Park, S/2049
Redondo Beach, CA 90278
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CALIBRATION

Valid To: July 31, 2026

Certificate Number: 3005.01

In recognition of the successful completion of the A2LA evaluation process (including an assessment of the organization's compliance with A2LA's Calibration Program Requirements), accreditation is granted to this laboratory at the location listed above as well as the two satellite laboratory locations listed below to perform the following calibrations^{1, 4}:

I. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2, 6} (±)	Comments		
Resistance – Generate & Measure, Fixed Points	10 μΩ	20 μΩ/Ω	MI-6010B bridge & MI-6011B range extender		
	100 μΩ	10 μΩ/Ω			
	1 mΩ	5.0 μΩ/Ω			
	10 mΩ	2.0 μΩ/Ω			
	100 mΩ	1.0 μΩ/Ω			
	1 Ω	0.30 μΩ/Ω			
	10 Ω	0.50 μΩ/Ω			
	100 Ω	0.50 μΩ/Ω			
	1 kΩ	0.50 μΩ/Ω			
	10 kΩ	0.50 μΩ/Ω			
	10 kΩ	0.50 μΩ/Ω	MI-6000B bridge		
	100 kΩ	1.0 μΩ/Ω			
	1 MΩ	2.0 μΩ/Ω			
	10 MΩ	5.0 μΩ/Ω			
	100 MΩ	10 μΩ/Ω			
	1 GΩ	15 μΩ/Ω			
	DC Voltage – Generate & Measure, Fixed Points	0.1 V		1.1 μV/V	Fluke 734A with Fluke 752A voltage divider & Fluke 8588A
		1 V		0.57 μV/V	
		10 V		0.52 μV/V	
100 V		0.56 μV/V			
1000 V		0.65 μV/V			

Parameter/Range	Frequency	CMC ^{2, 3, 6} (\pm)	Comments
AC Voltage – Measure & Generate			Fluke 792 AC standard & Fluke 8588A
10 mV	10 Hz 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz	97 μ V/V 89 μ V/V 88 μ V/V 88 μ V/V 0.017 % 0.037 %	
100 mV	10 Hz 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz	44 μ V/V 30 μ V/V 22 μ V/V 22 μ V/V 43 μ V/V 0.019 %	
1 V	10 Hz 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz	26 μ V/V 9.5 μ V/V 7.0 μ V/V 7.5 μ V/V 12 μ V/V 47 μ V/V	
10 V	10 Hz 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz	26 μ V/V 7.7 μ V/V 6.8 μ V/V 6.1 μ V/V 8.7 μ V/V 41 μ V/V	
100 V	10 Hz 100 Hz 1 kHz 10 kHz 100 kHz	26 μ V/V 8.5 μ V/V 7.6 μ V/V 8.1 μ V/V 11 μ V/V	
1000 V	40 Hz 100 Hz 1 kHz 10 kHz 20 kHz	22 μ V/V 20 μ V/V 18 μ V/V 18 μ V/V 19 μ V/V	

II. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC ² (±)	Comments
RF Attenuation (Transmission S ₂₁ /S ₁₂) – (0 to 20) dB			
Fixed/Variable Coaxial 2.4 mm	(0.05 to 0.5) GHz (0.5 to 2) GHz (2 to 26.5) GHz (26.5 to 50) GHz	0.040 dB 0.040 dB 0.18 dB 0.31 dB	Keysight PNA-X system network analyzer
3.5 mm	(0.05 to 0.5) GHz (0.5 to 2) GHz (2 to 26.5) GHz	0.050 dB 0.050 dB 0.13 dB	
WR-22	(33 to 50) GHz	0.10 dB	
WR-15	(50 to 75) GHz	0.10 dB	
WR-10	(75 to 110) GHz	0.11 dB	
(20 to 40) dB			
Fixed/Variable Coaxial 2.4 mm	(0.05 to 0.5) GHz (0.5 to 2) GHz (2 to 26.5) GHz (26.5 to 50) GHz	0.030 dB 0.040 dB 0.47 dB 1.9 dB	Keysight PNA-X system network analyzer
3.5 mm	(0.05 to 0.5) GHz (0.5 to 2) GHz (2 to 26.5) GHz	0.29 dB 0.29 dB 0.14 dB	
WR-22	(33 to 50) GHz	0.070 dB	
WR-15	(50 to 75) GHz	0.080 dB	
WR-10	(75 to 110) GHz	0.12 dB	

Parameter/Range	Frequency	CMC ^{2,3} (±)	Comments
VSWR Gamma (Reflection S11/S22) – (0 to 0.5) Reflection Coefficient			
Fixed/Variable Coaxial 2.4 mm	(0.05 to 0.5) GHz (0.5 to 2.0) GHz (2.0 to 26.5) GHz (26.5 to 50.0) GHz	0.97 % 0.97 % 1.6 % 2.0 %	Keysight PNA-X system network analyzer
3.5 mm	(0.05 to 0.5) GHz (0.5 to 2.0) GHz (2.0 to 26.5) GHz	0.49 % 0.49 % 0.75 %	
WR-22	(33 to 50) GHz	0.60 %	
WR-15	(50 to 75) GHz	0.80 %	
WR-10	(75 to 110) GHz	1.0 %	
(0.5 to 0.8) Reflection Coefficient			
Fixed/Variable Coaxial 2.4 mm	(0.05 to 0.5) GHz (0.5 to 2.0) GHz (2.0 to 26.5) GHz (26.5 to 50.0) GHz	1.0 % 1.0 % 1.7 % 2.1 %	Keysight PNA-X system network analyzer
3.5 mm	(0.05 to 0.5) GHz (0.5 to 2.0) GHz (2.0 to 26.5) GHz	0.60 % 0.60 % 1.2 %	
WR-22	(33 to 50) GHz	0.90 %	
WR-15	(50 to 75) GHz	1.5 %	
WR-10	(75 to 110) GHz	1.7 %	

Parameter/Range	Frequency	CMC ^{2,3} (±)	Comments	
VSWR Gamma (Reflection S11/S22) – (cont)				
(0.8 to 1.0) Reflection Coefficient				
Fixed/Variable Coaxial				
2.4 mm	(0.05 to 0.5) GHz	1.2 %	Keysight PNA-X system network analyzer	
	(0.5 to 2.0) GHz	1.2 %		
	(2.0 to 26.5) GHz	2.3 %		
	(26.5 to 50.0) GHz	2.9 %		
3.5 mm	(0.05 to 0.5) GHz	0.90 %		
	(0.5 to 2.0) GHz	0.90 %		
	(2.0 to 26.5) GHz	2.3 %		
WR-22	(33 to 50) GHz	1.1 %		HP 8510C system network analyzer
WR-15	(50 to 75) GHz	2.0 %		
WR-10	(75 to 110) GHz	2.3 %		

Parameter/Range	Frequency	CMC ² (±)	Comments
Noise Figure & Excess Noise Ratio –			Agilent N8975A Noise Figure Analyzer (NFA)
Coaxial			
APC-7	10 MHz to 1 GHz	0.16 dB	
	(1 to 3) GHz	0.16 dB	
	(3 to 5) GHz	0.17 dB	
	(5 to 9) GHz	0.22 dB	
	(9 to 11) GHz	0.21 dB	
	(11 to 13) GHz	0.21 dB	
	(13 to 18) GHz	0.20 dB	
3.5 mm	10 MHz to 6 GHz	0.16 dB	
	(6 to 10) GHz	0.20 dB	
	(10 to 20) GHz	0.20 dB	
	(20 to 26.5) GHz	0.21 dB	
2.4 mm	(1 to 6) GHz	0.19 dB	
	(6 to 10) GHz	0.26 dB	
	(10 to 20) GHz	0.25 dB	
	(20 to 26) GHz	0.34 dB	
	(26 to 33) GHz	0.26 dB	
	(33 to 40) GHz	0.28 dB	
	(40 to 44) GHz	0.44 dB	
	(44 to 50) GHz	0.39 dB	
Waveguide			
WR-42	(18 to 20) GHz	0.23 dB	
	(20 to 22) GHz	0.22 dB	
	(22 to 24) GHz	0.24 dB	
	(24 to 26) GHz	0.21 dB	
WR-28	(26.5 to 28) GHz	0.22 dB	
	(28 to 30) GHz	0.28 dB	
	(30 to 35) GHz	0.27 dB	
	(35 to 40) GHz	0.25 dB	
WR-22	(35 to 40) GHz	0.24 dB	
	(40 to 44) GHz	0.20 dB	
	(44 to 48) GHz	0.25 dB	

Parameter/Range	Frequency	CMC ² (±)	Comments
Noise Figure & Excess Noise Ratio – (cont)			Agilent N8975A Noise Figure Analyzer (NFA)
Waveguide			
WR-15	(55 to 60) GHz	0.44 dB	
	(60 to 64) GHz	0.45 dB	
	(64 to 65) GHz	0.59 dB	
WR-10	(75 to 80) GHz	0.53 dB	
	(80 to 85) GHz	0.82 dB	
	(85 to 90) GHz	0.82 dB	
	(90 to 94) GHz	0.67 dB	
	(94 to 100) GHz	0.69 dB	

III. Mechanical

Parameter/Equipment	Range	CMC ^{2, 3, 5} (±)	Comments
Torque Wrench	(20 to 200) ozf-in	1.5 %	CDI torque system
Pressure – Generate	(0 to 15) psig (15 to 1000) psig	0.016 % of FS 0.010 %	Fluke 6270A with PM500 modules

IV. Thermodynamic

Parameter/Equipment	Range	CMC ^{2, 5} (±)	Comments
Temperature – Measure	(-80 to 110) °C	0.010 °C	Fluke SPRT, 7100 temperature bath, & super thermometer

V. Time & Frequency

Parameter/Equipment	Range	CMC ² (±)	Comments
Cesium Frequency Intrinsic Standard – Intrinsic Frequency Reference	(5, 10) MHz	1.0 x 10 ⁻¹² Hz/Hz (over 24 hours)	Agilent 5071A with high performance option 001
GPS Receiver Frequency (Frequency Offset)	10 MHz	2.0 x 10 ⁻¹² Hz/Hz	Symmetricom xli GPS receiver

SATELLITE LOCATION

NORTHROP GRUMMAN SYSTEMS CORPORATION, AEROSPACE SYSTEMS

3520 East Avenue M

Palmdale, CA 93550

Rafael Ojeda Phone: 310 813 7404

I. Mechanical

Parameter/Equipment	Range	CMC ^{2,3} (±)	Comments
Torque Wrench	(20 to 200) ozf-in	1.5 %	CDI torque system

II. Time & Frequency

Parameter/Equipment	Range	CMC ² (±)	Comments
Rubidium Frequency Standard – Frequency Reference	10 MHz	5.0 x 10 ⁻¹¹ Hz/Hz	Stanford research systems FS725

SATELLITE LOCATION

NORTHROP GRUMMAN SYSTEMS CORPORATION, AEROSPACE SYSTEMS
15333 Avenue of Science
San Diego, CA 92128
Rafael Ojeda Phone: 310 813 7404

I. Mechanical

Parameter/Equipment	Range	CMC ^{2,3} (±)	Comments
Torque Wrench	(20 to 200) ozf-in	1.5 %	CDI torque system

II. Time & Frequency

Parameter/Equipment	Range	CMC ² , (±)	Comments
Rubidium Frequency Standard – Frequency Reference	10 MHz	6.0 x 10 ⁻¹¹ Hz/Hz	Stanford research systems FS725

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 In the statement of CMC, percentages are percentage of reading, unless otherwise indicated.

⁴ This scope meets A2LA's *P112 Flexible Scope Policy*.

⁵ 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.

⁶ 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. CMCs 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

NORTHROP GRUMMAN SYSTEMS CORPORATION, STRATEGIC SPACE SYSTEMS DIVISION

Redondo Beach, CA

for technical competence in the field of

Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and the requirements of ANSI/NCSL Z540.3-2006 and R205 – Specific Requirements: Calibration Laboratory Accreditation Program. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).



Presented this 21st day of August 2024.

A blue ink signature of Mr. Trace McInturff, written in a cursive style.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3005.01
Valid to July 31, 2026

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