

United States Department of Commerce  
National Institute of Standards and Technology



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**Certificate of Accreditation to ISO/IEC 17025:2017**

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NVLAP LAB CODE: 200679-0

**IPS Corporation Tokyo Calibration Center**  
Chiba Prefecture  
Japan

*is accredited by the National Voluntary Laboratory Accreditation Program for specific services,  
listed on the Scope of Accreditation, for:*

**Calibration Laboratories**

*This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017.  
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 January 2009).*

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2023-12-13 through 2024-12-31

*Effective Dates*

A handwritten signature in blue ink, reading 'Dana S. Laman', positioned above a horizontal line.

*For the National Voluntary Laboratory Accreditation Program*

CALIBRATION LABORATORIES

NVLAP LAB CODE 200679-0

**SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017**

<p><b>IPS Corporation Tokyo Calibration Center</b> 935, Fusa Abiko-City, Chiba Prefecture 270-1101 JAPAN Mr. Toshio Shiba Phone: 81-4-7187-7311 Fax: 81-4-7187-7312 E-mail: <a href="mailto:tcc@ips-emc.co.jp">tcc@ips-emc.co.jp</a> URL: <a href="http://www.ips-emc.co.jp">http://www.ips-emc.co.jp</a></p>	<p><b>Fields of Calibration</b> Electromagnetics – DC/Low Frequency Time and Frequency Electromagnetics – RF/Microwave</p>
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**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2**

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty Notes 3,5	Remarks
<b>ELECTROMAGNETICS – DC/LOW FREQUENCY</b>			
<b>AC CURRENT and RESISTANCE (20/E02)</b>			
Resistance, Reactance, and Impedance Field calibrations available Note 4  40 Hz to 50 kHz 50 kHz to 200 kHz	100.0 mΩ to 19.999 MΩ	11 % 16 %	ZM2353 + 2325AL
<b>DC VOLTAGE (20/E06)</b>			
DC Voltage Measure Field calibrations available Note 4	0.01 V to 1 V 1 V to 1000 V	0.24 % 0.15 %	34401A
<b>LF AC VOLTAGE (20/E09)</b>			
AC Voltage Measure Field calibrations available Note 4  0.1 V to 750 V	3 Hz to 5 Hz 5 Hz to 10 Hz 10 Hz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz	3.1 % 0.46 % 0.12 % 0.19 % 0.79 % 5.2 %	34401A
0.1 V to 4 V	10 kHz to 30 MHz	8.3 %	E4418B, E4419B, E9304A



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<b>Measured Parameter or Device Calibrated</b>	<b>Range</b>	<b>Expanded Uncertainty</b> Notes 3,5	<b>Remarks</b>
Spectrum Analyzer-- Amplitude and Response Field calibrations available Note 4 5 Hz to 100 kHz 100 kHz to 200 kHz  Reference Level Accuracy Field calibrations available Note 4 9 kHz to 18 GHz	-36 dBm to 4 dBm    10 dB step up to 110 dB	0.14 dB 0.27 dB   0.23 dB	33220A, 33120A
<b>CAPACITANCE (20/E10)</b>			
Capacitance Field calibrations available Note 4 40 Hz to 50 kHz 50 kHz to 200 kHz	1.000 pF to 199.99 mF	11 % 16 %	ZM2353 with 2325AL
<b>INDUCTANCE (20/E11)</b>			
Inductance Field calibrations available Note 4 40 Hz to 50 kHz 50 kHz to 200 kHz	1.00 nH to 19.999 kH	11 % 16 %	ZM2353 with 2325AL
<b>MAGNETICS (20/E13)</b>			
Magnetic Field Meter 50 Hz or 60 Hz Response to H-field	1.26 μT to 62.8 μT	2.1 %	IEC 61786
<b>TIME and FREQUENCY</b>			
<b>FREQUENCY DISSEMINATION (20/F01)</b>			
Sine-Wave Frequency Measure Field calibrations available Note 4	(Aging rate daily) 0.1 Hz to 225 MHz 10 Hz to 40 GHz	1.2 x 10 <sup>-12</sup> + 1 μHz 1.2 x 10 <sup>-12</sup> + 0.6 R	Rubidium Std and Counter



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<b>Measured Parameter or Device Calibrated</b>	<b>Range</b>	<b>Expanded Uncertainty <sup>Notes 3,5</sup></b>	<b>Remarks</b>
Signal Generator --			
Pulse Rise and Fall Time Field calibrations available <sup>Note 4</sup>	1 ns to 20 ns	4.7 %	Agilent 54622A Oscilloscope Keysight DSOX3102T
Pulse Period and Width Field calibrations available <sup>Note 4</sup>	10 s to 200 ns	0.81 %	
Function Generator --			
Pulse Rise and Fall Time Field calibrations available <sup>Note 4</sup>	5 ns to 20 ns	0.89 %	Agilent 54622A Oscilloscope and 54845A Oscilloscope Keysight DSOX3102T
Pulse Period and Width Field calibrations available <sup>Note 4</sup>	10 s to 0.5 ms	0.63 %	
Receiver--			
Overall Selectivity Field calibrations available <sup>Note 4</sup>	9 kHz to 18 GHz	6.6 %	CISPR Band A/B/C/D/E
Random Noise Field calibrations available <sup>Note 4</sup>	9 kHz to 1 GHz	0.19 dB	(for 10 dB level variation)
Impulse Bandwidth Field calibrations available <sup>Note 4</sup>	1 MHz IF Filter	8.9 %	CISPR Band E
Spectrum Analyzer-- Field calibrations available <sup>Note 4</sup>			
IF Bandwidth Accuracy and Selectivity	Bandwidth: 0 dB to -6 dB	2.1 %	
	Bandwidth: -6 dB to -60 dB	3.0 %	
Noise Level	5 Hz to 9 kHz 9 kHz to 40 GHz	0.68 dB 0.63 dB	50 Ω termination
Frequency Readout Accuracy	9 kHz to 40 GHz	0.92 %	



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<b>Measured Parameter or Device Calibrated</b>	<b>Range</b>	<b>Expanded Uncertainty <sup>Notes 3,5</sup></b>	<b>Remarks</b>
Frequency Span Accuracy	9 kHz to 40 GHz	0.75 %	
IF BW Switching Accuracy	9 kHz to 40 GHz	0.12 dB	Relative Measurement
<b>OSCILLATOR CHARACTERISTICS (20/F03)</b>			
Signal Generator-- Modulation (at carrier shown) Field calibrations available <sup>Note 4</sup>	at Rate		
AM (5 % to 99 %)			
150 kHz to 10 MHz	50 Hz to 10 kHz	2.3 %	Modulation Analyzer
10 MHz to 1300 MHz	50 Hz to 50 kHz	1.2 %	
9 kHz to 3GHz	2 Hz to 100 kHz	0.82 %	Spectrum Analyzer
3 GHz to 6.5GHz	2 Hz to 100 kHz	2.4 %	
FM			Modulation Analyzer
< 40 kHz peak, 250 kHz to 10 MHz	20 Hz to 10 kHz	2.3 %	
< 400 kHz peak 10 MHz to 1300 MHz	50 Hz to 100 kHz	1.2 %	
PM <sup>Note 7</sup>			
< 40 kHz peak, 150 kHz to 10 MHz	200 Hz to 10 kHz	4.6 %	
< 400 kHz peak 10 MHz to 1300 MHz	200 Hz to 20 kHz	3.5 %	
Harmonics Field calibrations available <sup>Note 4</sup>			
9 kHz to 3 GHz	0 dBc to 80 dBc	0.35 dB	Spectrum Analyzer
3 GHz to 6.5 GHz	0 dBc to 80 dBc	0.63 dB	
6.5 GHz to 18 GHz	0 dBc to 80 dBc	0.96 dB	
18 GHz to 26.5 GHz	0 dBc to 80 dBc	0.92 dB	



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<b>Measured Parameter or Device Calibrated</b>	<b>Range</b>	<b>Expanded Uncertainty <sup>Notes 3,5</sup></b>	<b>Remarks</b>
<b>PULSE WAVEFORM (20/F04)</b>			
CISPR Pulse Generator			
Pulse Area (integral function)	9 kHz to 1 GHz	6.0 %	CISPR 16-1-1 CISPR Band A, B, and C/D
Pulse Width (horizontal scale)		2.6 %	
Amplitude Variation		0.27 dB	
Flatness of Spectrum Amplitude			
Band A		0.37 dB	
Band B		0.30 dB	
Band C/D		0.57 dB	
CISPR Receiver			
Field calibrations available <sup>Note 4</sup>			
Response to Pulse – Amplitude Relationship – RMS Average and Average Detector	10 dB to 60 dB	0.63 dB 0.62 dB	Power Sensor, Power Meter, RF Signal Generator, Power Splitter CISPR Band A/B CISPR Band C/D
9 kHz to 30 MHz			
30 MHz to 1 GHz			
Response to Pulse – Amplitude Relationship – QP Detector	10 dB to 60 dB	0.83 dB 0.94 dB 1.1 dB 1.5 dB 0.73 dB 0.75 dB	CISPR Band A/B CISPR Band C CISPR Band C CISPR Band C/D CISPR Band E CISPR Band E
Response to Pulse – Amplitude Relationship			
9 kHz to 30 MHz			
100 MHz			
30 MHz to 100 MHz			
100 MHz to 1 GHz			
1 GHz to 6 GHz			
6 GHz to 18 GHz			



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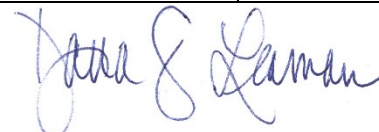
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Measured Parameter or Device Calibrated	Range	Expanded Uncertainty <sup>Notes 3,5</sup>	Remarks
Response to Pulse – Variation with Repetition Frequency 9 kHz to 30 MHz 30 MHz to 1 GHz 1 GHz to 3 GHz 3 GHz to 18 GHz	(10 to 60) dB $\mu$ V	0.69 dB 0.90 dB 0.22 dB 0.52 dB	Pulse Generator IGUU2916  Power Sensor, Power Meter, RF Signal Generator, Power Splitter – Pulse Modulation
9 kHz to 1 GHz	(10 to 80) dB $\mu$ V	0.18 dB	CISPR Band A/B/C/D
<b>ELECTROMAGNETICS – RF/MICROWAVE</b>			
<b>MICROWAVE ANTENNA PARAMETERS (20/R08)</b>			
Monopole Antenna Field calibrations available <sup>Note 4</sup> Antenna Factor, Gain	30 Hz to 50 MHz	0.39 dB	IEEE 291 & SAE ARP958 CISPR 16-1-6
Loop Antenna Field calibrations available <sup>Note 4</sup> Antenna Factor	5 Hz to 200 kHz	0.47 dB	SAE ARP958 Standard Field Method
Isotropic Electric Field Probes Correction Factor	10 kHz to 1 GHz	1.4 dB	HI- 4422 / FP2000
	100 kHz to 1 GHz	1.0 dB	HI-6005 / FP6001 / EP-60x
	1 GHz to 2 GHz	2.0 dB	
	2 GHz to 4 GHz	0.72 dB	
	4 GHz to 6 GHz	0.95 dB	
	100 kHz to 1 GHz	1.0 dB	HI4433 / FP2080 / EMC-20
	1 GHz to 4 GHz	1.7 dB	
	100 kHz to 1 GHz	1.0 dB	OEFS-H-NS, OEFS-H-S1
	1 GHz to 3 GHz	2.0 dB	



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<b>Measured Parameter or Device Calibrated</b>	<b>Range</b>	<b>Expanded Uncertainty <sup>Notes 3,5</sup></b>	<b>Remarks</b>
Rotational Response	10 kHz to 1 GHz	0.14 dB	HI-4422 / FP2000
	100 kHz to 1 GHz	0.14 dB	HI-6005 / FP6001 / EP-60x
	1 GHz to 3.5 GHz	0.12 dB	
	100 kHz to 3.5 GHz	0.15 dB	HI4433 / FP2080/ EMC-20
<b>RF/MICROWAVE POWER (20/R17)</b>			
CISPR Receiver Internal Calibration Source – Level Accuracy Field calibrations available <sup>Note 4</sup>	120 MHz, -40 dBm	0.17 dB	
High Power Sensor/Meters Field calibrations available <sup>Note 4</sup> Amplitude and Linearity	9 kHz to 1 GHz	13 %	Power Sensor, Power Meter, 40 dB attenuator
	1 GHz to 4.2 GHz	19 %	
10 kHz to 1 GHz	100 W to 500 W	13%	
Power Meter & Power Sensor Termination Type Field calibrations available <sup>Note 4</sup> Calibration Factor at 0 dBm	9 kHz to 6 GHz	1.7 %	
	10 MHz to 2 GHz	1.9 %	
	2 GHz to 10 GHz	2.8 %	
	10 GHz to 18 GHz	3.4 %	
	50 MHz to 2 GHz	3.1 %	
	2 GHz to 10 GHz	3.2 %	
	10 GHz to 18 GHz	3.4 %	
18 GHz to 26.5 GHz	4.2 %		
			E4413A & 11667B (type 3.5 mm)



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Measured Parameter or Device Calibrated	Range	Expanded Uncertainty <sup>Notes 3,5</sup>	Remarks	
	50 MHz to 18 GHz	5.6 %	8487A & 11667C N8487A & 11667C (type 2.4 mm)	
	18 GHz to 26 GHz	7.0 %		
	26 GHz to 34 GHz	8.2 %		
	34 GHz to 40 GHz	8.9 %		
		50 MHz to 18 GHz	7.3 %	8487D, 11708A, and 11667C (type 2.4 mm)
		18 GHz to 26 GHz	8.9 %	
		26 GHz to 34 GHz	13 %	
		34 GHz to 40 GHz	13 %	
Power Linearity 9 kHz to 6 GHz	-40 dBm to 20 dBm	3.7 %	E9304A	
10 MHz to 18 GHz	-50 dBm to 20 dBm	6.6 %	E4412A	
10 MHz to 26.5 GHz	-50 dBm to 20 dBm	6.2 %	E4413A	
50 MHz to 40 GHz	-30 dBm to 20 dBm	8.5 %	N8487A, 8487A	
50 MHz to 40 GHz	-70 dBm to -20 dBm	12 %	8487D	
RF Absolute Power Measure (Unmodulated Sine-wave) Field calibrations available <sup>Note 4</sup>				
100 kHz to 4.2 GHz	-30 dBm to 20 dBm	3.7 %	8482A (type N)	
9 kHz to 6 GHz	-40 dBm to 20 dBm	3.7 %	E9304A (type N)	
10 MHz to 18 GHz	-50 dBm to 20 dBm	6.6 %	E4412A (type N)	
50 MHz to 26.5 GHz	-50 dBm to 20 dBm	6.2 %	E4413A (type 3.5 mm)	
50 MHz to 18 GHz	-30 dBm to 20 dBm	7.1 %	N8487A (type 2.4 mm)	
18 GHz to 40 GHz		8.5 %	8487A (type 2.4 mm)	
40 GHz to 50 GHz		11 %		



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Measured Parameter or Device Calibrated	Range	Expanded Uncertainty Notes 3,5	Remarks
50 MHz to 18 GHz 18 GHz to 40 GHz 40 GHz to 50 GHz	-70 dBm to -20 dBm	8.0 % 12 % 17 %	8487D (type 2.4mm)
100 kHz to 1 GHz	20 dBm to 50 dBm	4.1 %	E9304, LA250
10 kHz to 1 GHz	50 dBm to 57 dBm	13 %	E9304A, Attenuator
9 kHz to 3 GHz 3 GHz to 6 GHz 6 GHz to 18 GHz	-110 dBm to 10 dBm -110 dBm to 10 dBm -110 dBm to 10 dBm	0.62 dB 1.83 dB 3.0 dB	Spectrum Analyzer
CISPR Receiver Field calibrations available Note 4			CISPR 16-1-1
Frequency Response to Sine Wave Voltage			
-10 dBm to +10 dBm	9 kHz to 6 GHz	0.33 dB	E9304 and 8496B
-47 dBm to -40 dBm	9 kHz to 6 GHz	0.26 dB	E9304 (Type N), 11667A
-40 dBm to +10 dBm	9 kHz to 6 GHz	0.19 dB	E9304 (Type N), 11667A
-50 dBm to +10 dBm	10 MHz to 6 GHz	0.24 dB	E4412A (Type N), 11667A
	6 GHz to 18 GHz	0.32 dB	
0 dBm to +10 dBm	6 GHz to 18 GHz	0.56 dB	E4412A and 8496B
-50 dBm to +10 dBm	50 MHz to 2 GHz	0.25 dB	E4413A (Type 3.5 mm),
	2 GHz to 10 GHz	0.26 dB	11667B
	10 GHz to 18 GHz	0.30 dB	
	18 GHz to 26.5 GHz	0.36 dB	
-20 dBm to +10 dBm	50 MHz to 2 GHz	0.58 dB	N8487A (Type 2.4 mm)
	2 GHz to 12.4 GHz	0.33 dB	8487A (Type 2.4 mm),
	12.4 GHz to 18 GHz	0.35 dB	11667C
	18 GHz to 26.5 GHz	0.40 dB	
	26.5 GHz to 40 GHz	0.66 dB	
CISPR Average Response to Unsteady Narrowband Disturbances			
9 kHz to 30 MHz	60 dB $\mu$ V Reference	0.60 dB	CISPR Band A/B
30 MHz to 999.999 MHz	60 dB $\mu$ V Reference	0.61 dB	CISPR Band C/D
1 GHz to 18 GHz	60 dB $\mu$ V Reference	0.89 dB	CISPR Band E



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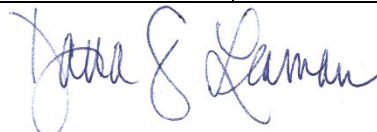
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CW Simulator (RF Generator) Unmodulated Sine Wave Field calibrations available <sup>Note 4</sup> Absolute Power 100 kHz to 1 GHz 10 kHz to 1 GHz	0.1 W to 100 W 100 W to 500 W	4.1 % 13 %	Power Sensor, Power Meter, 40 dB attenuator
<b>SCATTERING PARAMETERS (20/R18)</b>			
VSWR <sup>Note 8</sup> Field calibrations available <sup>Note 4</sup> (0 to 60)	5 Hz to 100 Hz 100 Hz to 150 MHz 150 MHz to 3 GHz  9 kHz to 10 MHz 10 MHz to 3 GHz 3 GHz to 6 GHz 6 GHz to 8.5 GHz 45 MHz to 2 GHz 2 GHz to 8 GHz 8 GHz to 18 GHz  45 MHz to 2 GHz 2 GHz to 8 GHz  8 GHz to 20 GHz 20 GHz to 26.5 GHz 45 MHz to 2 GHz 2 GHz to 8 GHz 8 GHz to 20 GHz 20 GHz to 40 GHz  10 MHz to 2 GHz 2 GHz to 8 GHz 8 GHz to 18 GHz	2.0 % 1.0 % 1.4 %  1.2 % 1.5 % 2.3 % 2.9 % 1.2 % 2.0 % 2.8 %  1.2 % 2.2 %  2.7 % 2.8 % 1.5 % 1.9 % 1.9 % 3.0 %  1.0 % 1.8 % 2.6 %	E5061B + 85032B/85032F   E5071C + 85032F  E8363B + 85054B (Type-N)  E8363B + 85052B (3.5mm)  E8363B + 85056A (2.4mm)  N5234B + 85054B (Type-N)



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CDN Field calibrations available <sup>Note 4</sup>	10 MHz to 2 GHz	1.1 %	N5234B + 85052B (3.5mm)	
	2 GHz to 8 GHz	2.1%		
	8 GHz to 20 GHz	2.6 %		
	20 GHz to 26.5 GHz	2.7 %		
	Impedance	10 MHz to 2 GHz	1.3 %	N5234B + 85056A) (2.4mm)
		2 GHz to 8 GHz	1.7 %	
		8 GHz to 20 GHz	1.7 %	
		20 GHz to 40 GHz	2.8%	
Insertion Loss	100 kHz to 80 MHz	1.4 %	CISPR 16-1-2	
	80 MHz to 230 MHz	2.1 %		
Artificial Hand Field calibrations available <sup>Note 4</sup>	100 kHz to 230 MHz	0.20 dB	CISPR 16-1-2	
	Impedance			
LISN Field calibrations available <sup>Note 4</sup>	100 kHz to 200 kHz	8.3 %	CISPR 16-1-2	
	200 kHz to 30 MHz	3.0 %		
	Impedance			
Impedance	9 kHz to 30 MHz	2.1 %	Network Analyzer, Type N Cal Kit	
	30 MHz to 108 MHz	3.3 %		
	108 MHz to 200 MHz	3.6 %		
Insertion Loss (VDF)	9 kHz to 108 MHz	0.20 dB	Network Analyzer, Type N Cal Kit	
	108 MHz to 150MHz	0.39 dB		
	150 MHz to 200 MHz	0.48 dB		
Isolation	9 kHz to 108 MHz	1.4 dB	Network Analyzer, Type N Cal Kit	
	108 MHz to 200 MHz	0.39 dB		
Phase Angle	9 kHz to 30 MHz	5.4°	Network Analyzer, Type N Cal Kit	
	30 MHz to 108 MHz	6.6°		
	108 MHz to 200 MHz	11°		



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Spectrum Analyzer Field calibrations available <sup>Note 4</sup>			
Scale Fidelity – Log scale	0 dB to 80 dB scale range	0.23 dB	
Scale Fidelity – Linear scale	0 dB to 20 dB scale range	0.18 dB	
Switching Accuracy of RF Output 10 dB Step	9 kHz to 12.4 GHz 12.4 GHz to 18 GHz	0.31 dB 0.41 dB	8496B
1dB to 2 dB Step	9 kHz to 12.4 GHz 12.4 GHz to 18 GHz	0.29 dB 0.42 dB	8494B
Input Attenuator Switching Accuracy	9 kHz to 18 GHz	0.18 dB	
Response to Sine Wave Voltage – Linearity	9 kHz to 6 GHz	0.31 dB	
0 dB to -110 dB step change	6 GHz to 10 GHz 10 GHz to 18 GHz	0.36 dB 0.61 dB	
EM Clamp / Decoupling Clamp Field calibrations available <sup>Note 4</sup>			
Insertion Loss	100 kHz to 230 MHz	0.45 dB	IEC 61000-4-6, Network
Impedance	100 kHz to 100 MHz 100 MHz to 230 MHz	5.8 % 9.0 %	Analyzer, Type N Cal kit
Decoupling Factor	100 kHz to 100 MHz 100 MHz to 230 MHz	0.26 dB 0.64 dB	
Coupling Factor	100 kHz to 100 MHz 100 MHz to 230 MHz	0.57 dB 0.84 dB	
150 Ohm to 50 Ohm Adapter Field calibrations available <sup>Note 4</sup>			
Insertion Loss	100 kHz to 230 MHz	0.24 dB	Vector network analyzer, Type N calibration kit



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Current Probe / Current Injection Probe Field calibrations available <sup>Note 4</sup>			
Insertion Loss	10 Hz to 10 kHz 10 kHz to 500 MHz 500 MHz to 2.1 GHz 2.1 GHz to 2.7 GHz 2.7 GHz to 7 GHz	1.1 dB 0.47 dB 0.73 dB 0.86 dB 1.5 dB	Vector network analyzer, Type N calibration kit
Transfer Impedance	10 Hz to 10 kHz 10 kHz to 500 MHz 500 MHz to 2.1 GHz 2.1 GHz to 2.7 GHz 2.7 GHz to 7 GHz	1.1 dB 0.47 dB 0.73 dB 0.86 dB 1.5 dB	
Insertion Impedance	9 kHz to 200 MHz	2.1 %	CISPR 16-1-2
Calibration Jig of Current Injection Probe Field calibrations available <sup>Note 4</sup>			
Transmission Loss	150 kHz to 80 MHz	0.43 dB	IEC 61000-4-6  e.g. EZ-17 type
CISPR Current Probe Field calibrations available <sup>Note 4</sup>			
Transducer Factor	10 Hz to 1 kHz 1 kHz to 100 MHz	0.27 dB 0.25 dB	33120A + 4395A SA function 4395A + 87512 VNA function
Hi-Impedance Probe Field calibrations available <sup>Note 4</sup>			
Voltage Division Factor	9 kHz to 30 MHz	0.23 dB	
RF Insertion Loss / Gain Measure Field calibrations available <sup>Note 4</sup>			
5 Hz to 100 Hz	0 dB to 60 dB 60 dB to 70 dB 70 dB to 80 dB 80 dB to 90 dB	0.15 dB 0.19 dB 0.29 dB 0.60 dB	E5061B



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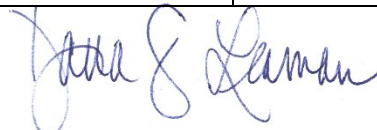
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**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) <sup>Notes 1,2</sup>**

<b>Measured Parameter or Device Calibrated</b>	<b>Range</b>	<b>Expanded Uncertainty <sup>Notes 3,5</sup></b>	<b>Remarks</b>	
100 Hz to 9 kHz	0 dB to 60 dB	0.17 dB		
	60 dB to 70 dB	0.36 dB		
	70 dB to 80 dB	1.0 dB		
	80 dB to 90 dB	2.7 dB		
9 kHz to 150 MHz	0 dB to 60 dB	0.20 dB		
	60 dB to 70 dB	0.47 dB		
	70 dB to 80 dB	1.3 dB		
	80 dB to 90 dB	3.3 dB		
150 MHz to 3 GHz	0 dB to 60 dB	0.13 dB		
	60 dB to 70 dB	0.19 dB		
	70 dB to 80 dB	0.34 dB		
	80 dB to 90 dB	0.82 dB		
9 kHz to 300 kHz	0 dB to 60 dB	0.27 dB		E5071C
	60 dB to 70 dB	0.80 dB		
	70 dB to 80 dB	2.1 dB		
300 kHz to 10 MHz	0 dB to 60 dB	0.15 dB		
	60 dB to 70 dB	0.31 dB		
	70 dB to 80 dB	0.87 dB		
10 MHz to 3 GHz	0 dB to 60 dB	0.11 dB		
	60 dB to 70 dB	0.16 dB		
	70 dB to 80 dB	0.28 dB		
3 GHz to 6 GHz	0 dB to 60 dB	0.15 dB		
	60 dB to 70 dB	0.20 dB		
	70 dB to 80 dB	0.35 dB		
6 GHz to 8.5 GHz	0 dB to 60 dB	0.18 dB		
	60 dB to 70 dB	0.26 dB		
	70 dB to 80 dB	0.48 dB		



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**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) <sup>Notes 1,2</sup>**

<b>Measured Parameter or Device Calibrated</b>	<b>Range</b>	<b>Expanded Uncertainty <sup>Notes 3,5</sup></b>	<b>Remarks</b>
45 MHz to 2 GHz	0 dB to 50 dB	0.23 dB	E8363B, Type N
	50 dB to 60 dB	0.63 dB	
	60 dB to 70 dB	1.8 dB	
2 GHz to 8 GHz	0 dB to 80 dB	0.33 dB	
	80 dB to 90 dB	0.87 dB	
	90 dB to 100 dB	2.2 dB	
8 GHz to 18 GHz	0 dB to 80 dB	0.32 dB	
	80 dB to 90 dB	0.74 dB	
	90 dB to 100 dB	1.9 dB	
45 MHz to 2 GHz	0 dB to 50 dB	0.21 dB	E8363B, 3.5mm
	50 dB to 60 dB	0.63 dB	
	60 dB to 70 dB	1.8 dB	
2 GHz to 8 GHz	0 dB to 80 dB	0.33 dB	
	80 dB to 90 dB	0.87 dB	
	90 dB to 100 dB	2.2 dB	
8 GHz to 20 GHz	0 dB to 80 dB	0.32 dB	
	80 dB to 90 dB	0.73 dB	
	90 dB to 100 dB	1.9 dB	
20 GHz to 26.5 GHz	0 dB to 80 dB	0.49 dB	
	80 dB to 90 dB	1.2 dB	
	90 dB to 100 dB	3.1 dB	
45 MHz to 2 GHz	0 dB to 50 dB	0.22 dB	E8363B, 2.4mm
	50 dB to 60 dB	0.61 dB	
	60 dB to 70 dB	1.8 dB	
2 GHz to 8 GHz	0 dB to 80 dB	0.32 dB	
	80 dB to 90 dB	0.87 dB	
	90 dB to 100 dB	2.2 dB	



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**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) <sup>Notes 1,2</sup>**

<b>Measured Parameter or Device Calibrated</b>	<b>Range</b>	<b>Expanded Uncertainty <sup>Notes 3,5</sup></b>	<b>Remarks</b>	
8 GHz to 20 GHz	0 dB to 80 dB	0.29 dB		
	80 dB to 90 dB	0.73 dB		
	90 dB to 100 dB	1.9 dB		
20 GHz to 40.0 GHz	0 dB to 80 dB	0.50 dB		
	80 dB to 90 dB	1.2 dB		
	90 dB to 100 dB	3.1 dB		
10 MHz to 2 GHz	0 dB to 70 dB	0.20 dB		N5234B, Type-N
	70 dB to 80 dB	0.59 dB		
	80 dB to 90 dB	1.7 dB		
	90 dB to 100 dB	4.1 dB		
2 GHz to 8 GHz	0 dB to 70 dB	0.21 dB		
	70 dB to 80 dB	0.59 dB		
	80 dB to 90 dB	1.7 dB		
	90 dB to 100 dB	4.1 dB		
8 GHz to 18 GHz	0 dB to 60 dB	0.22 dB		
	60 dB to 70 dB	0.59 dB		
	70 dB to 80 dB	1.7 dB		
	80 dB to 90 dB	4.1 dB		
10 MHz to 2 GHz	0 dB to 70 dB	0.19 dB	N5234B, 3.5mm	
	70 dB to 80 dB	0.58 dB		
	80 dB to 90 dB	1.7 dB		
	90 dB to 100 dB	4.1 dB		
2 GHz to 8 GHz	0 dB to 70 dB	0.20 dB		
	70 dB to 80 dB	0.59 dB		
	80 dB to 90 dB	1.7 dB		
	90 dB to 100 dB	4.1 dB		
8 GHz to 20 GHz	0 dB to 60 dB	0.21 dB		
	60 dB to 70 dB	0.59 dB		
	70 dB to 80 dB	1.7 dB		
	80 dB to 90 dB	4.1 dB		



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**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) <sup>Notes 1,2</sup>**

<b>Measured Parameter or Device Calibrated</b>	<b>Range</b>	<b>Expanded Uncertainty <sup>Notes 3,5</sup></b>	<b>Remarks</b>
20 GHz to 26.5 GHz	0 dB to 60 dB	0.21 dB	N5234B, 2.4mm
	60 dB to 70 dB	0.59 dB	
	70 dB to 80 dB	1.7 dB	
	80 dB to 90 dB	4.1 dB	
10 MHz to 2 GHz	0 dB to 70 dB	0.19 dB	
	70 dB to 80 dB	0.59 dB	
	80 dB to 90 dB	1.7 dB	
	90 dB to 100 dB	4.1 dB	
2 GHz to 8 GHz	0 dB to 70 dB	0.20 dB	
	70 dB to 80 dB	0.59 dB	
	80 dB to 90 dB	1.7 dB	
	90 dB to 100 dB	4.1 dB	
8 GHz to 20 GHz	0 dB to 60 dB	0.20 dB	
	60 dB to 70 dB	0.59 dB	
	70 dB to 80 dB	1.7 dB	
	80 dB to 90 dB	4.1 dB	
20 GHz to 40 GHz	0 dB to 60 dB	0.22 dB	
	60 dB to 70 dB	0.59 dB	
	70 dB to 80 dB	1.7 dB	
	80 dB to 90 dB	4.1 dB	
RF Attenuation Field calibrations available <sup>Note 4</sup>			
10 dB Step			
9 kHz to 2 GHz	0 dB to 110 dB	0.08 dB	8496B-001
2 GHz to 8 GHz		0.10 dB	
8 GHz to 18 GHz		0.17 dB	
1 dB Step			
9 kHz to 2 GHz	0 dB to 11 dB	0.09 dB	8494B-001
2 GHz to 12.4 GHz		0.11 dB	
12.4 GHz to 18 GHz		0.21 dB	



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**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) <sup>Notes 1,2</sup>**

<b>Measured Parameter or Device Calibrated</b>	<b>Range</b>	<b>Expanded Uncertainty <sup>Notes 3,5</sup></b>	<b>Remarks</b>
Digital Oscilloscope Field calibrations available <sup>Note 4</sup>			
Vertical scale accuracy – DC Voltage	10 mV to 25 V	0.46 %	Agilent 34401A
Vertical scale accuracy – AC Voltage	10 mV to 25 V 100 Hz to 100 kHz	0.88 %	Agilent 34401A
Horizontal scale accuracy - Frequency	0.1 Hz to 6 GHz	0.35 %	R&S SMA 100A, Agilent 33X20A
Bandwidth (-3 dB)	9 kHz to 6 GHz	14 %	R&S SMA 100A
Input resistance	50 Ω, 1 MΩ	0.012 %	Agilent 34401A
Frequency Response	9 kHz to 150 MHz	3.6 %	R&S SMA 100A, Power Sensor, Power Meter
RF Power Amplifier Field calibrations available <sup>Note 4</sup>			
Gain	9 kHz to 300 kHz 300 kHz to 8.5 GHz	0.39 dB 0.38 dB	
Power linearity	9 kHz to 10 MHz 10 MHz to 1 GHz 1 GHz to 4 GHz	12 % 9.7 % 11 %	
Harmonics 0 dBc to -80 dBc	9 kHz to 6.5 GHz 6.5 GHz to 26.5 GHz	1.6 dB 1.3 dB	
<b>END</b>			

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Notes

**Note 1:** A Calibration and Measurement Capability (CMC) is a description of the best result of a calibration or measurement (result with the smallest uncertainty of measurement) that is available to the laboratory's customers under normal conditions, when performing more or less routine calibrations of nearly ideal measurement standards or instruments. The CMC is described in the laboratory's scope of accreditation by: the measurement parameter/device being calibrated, the measurement range, the uncertainty associated with that range (see note 3), and remarks on additional parameters, if applicable.

**Note 2:** Calibration and Measurement Capabilities are traceable to the national measurement standards of the U.S. or to the national measurement standards of other countries and are thus traceable to the internationally accepted representation of the appropriate SI (Système International) unit.

**Note 3:** The uncertainty associated with a measurement in a CMC is an expanded uncertainty with a level of confidence of approximately 95 %, typically using a coverage factor of  $k = 2$ . However, laboratories may report a coverage factor different than  $k = 2$  to achieve the 95 % level of confidence. Units for the measurand and its uncertainty are to match. Exceptions to this occur when marketplace practice employs mixed units, such as when the artifact to be measured is labeled in non-SI units and the uncertainty is given in SI units (Example: 5 lb weight with uncertainty given in mg).

**Note 3a:** The uncertainty of a specific calibration by the laboratory may be greater than the uncertainty in the CMC due to the condition and behavior of the customer's device and specific circumstances of the calibration. The uncertainties quoted do not include possible effects on the calibrated device of transportation, long term stability, or intended use.

**Note 3b:** As the CMC represents the best measurement results achievable under normal conditions, the accredited calibration laboratory shall not report smaller uncertainty of measurement than that given in a CMC for calibrations or measurements covered by that CMC.

**Note 3c:** As described in Note 1, CMCs cover calibrations and measurements that are available to the laboratory's customers under *normal conditions*. However, the laboratory may have the capability to offer special tests, employing special conditions, which yield calibration or measurement results with lower uncertainties. Such special tests are not covered by the CMCs and are outside the laboratory's scope of accreditation. In this case, NVLAP requirements for the labeling, on calibration reports, of results outside the laboratory's scope of accreditation apply. These requirements are set out in Annex A.5. of NIST Handbook 150, Procedures and General Requirements.

**Note 4:** Uncertainties associated with field service calibration may be greater as they incorporate on-site environmental contributions, transportation effects, or other factors that affect the measurements. (This note applies only if marked in the body of the scope.)


**Note 5:** Values listed with percent (%) are percent of reading or generated value unless otherwise noted.

**Note 6:** NVLAP accreditation is the formal recognition of specific calibration capabilities. Neither NVLAP nor NIST guarantee the accuracy of individual calibrations made by accredited laboratories.

**Note 7:** Measured value in Radians. Range is dependent on rate, carrier, and peak deviation.

**Note 8:** Reflection Coefficient, Impedance or Return Loss measurements are available.

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