



**National Voluntary
Laboratory Accreditation Program**



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

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JAPAN

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CALIBRATION LABORATORIES

NVLAP LAB CODE 200679-0

ELECTROMAGNETICS - DC/LOW FREQUENCY

NVLAP Code: 20/E06

DC Voltage

<i>Range</i>	<i>Best Uncertainty</i> (\pm) ^{note 1}	<i>Remarks</i>
0.01 to 1000 V	0.11 %	DC Voltage Measure, 34401A

NVLAP Code: 20/E09

LF AC Voltage

(e.g. Function Generator)

<i>Range</i>	<i>Best Uncertainty</i> (\pm) ^{note 1}	<i>Remarks</i>
0.1 to 750 V (3 to 5 Hz)	3.13 %	ACV (true RMS) measurement, 34401A
0.1 to 750 V (5 to 10 Hz)	0.46 %	ACV (true RMS) measurement, 34401A
0.1 to 750 V (10 Hz to 20 kHz)	0.12 %	ACV (true RMS) measurement, 34401A
0.1 to 750 V (20 to 50 kHz)	0.18 %	ACV (true RMS) measurement, 34401A
0.1 to 750 V (50 to 100 kHz)	0.79 %	ACV (true RMS) measurement, 34401A
0.1 to 750 V (100 to 300 kHz)	5.20 %	ACV (true RMS) measurement, 34401A

2009-01-01 through 2009-12-31

Effective dates

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NVLAP Code: 20/E13

Magnetics

Range	Best Uncertainty (\pm) ^{note 1}	Remarks
Magnetic Field Meter (IEC 61786)		
1.26 uT to 62.8 uT (at 50 or 60 Hz)	2.11 %	Response to H-field

TIME AND FREQUENCY

NVLAP Code: 20/F01

Frequency Dissemination

CISPR Receiver (CISPR 16-1-1)

Range	Best Uncertainty (\pm) ^{note 1}	Remarks
9 kHz to 6 GHz	0.23 dB	Response to sine - wave voltage – frequency response, E9304A (Type N)
9 kHz to 6 GHz	0.28 dB	Response to sine - wave voltage – frequency response, E9304A H19 (Type N)
10 MHz to 6 GHz	0.28 dB	Response to sine - wave voltage – frequency response, E4412A (Type N)
6 GHz to 18 GHz	0.30 dB	Response to sine - wave voltage – frequency response, E4412A (Type N)
6 GHz to 18 GHz	0.41 dB	Response to sine - wave voltage – frequency response, E9304A H19 (Type N)
50 MHz to 2 GHz	0.25 dB	Response to sine - wave voltage – frequency response, E4413A (Type 3.5 mm)
2 GHz to 10 GHz	0.26 dB	Response to sine - wave voltage – frequency response, E4413A (Type 3.5 mm)
10 GHz to 18 GHz	0.27 dB	Response to sine - wave voltage – frequency response, E4413A (Type 3.5 mm)
18 GHz to 26.5 GHz	0.29 dB	Response to sine - wave voltage – frequency response, E4413A (Type 3.5 mm)
50 MHz to 2 GHz	0.35 dB	Response to sine - wave voltage – frequency response, 8487A (Type 2.4 mm)
2 GHz to 12.4 GHz	0.36 dB	Response to sine - wave voltage – frequency response, 8487A (Type 2.4 mm)
12.4 GHz to 18 GHz	0.37 dB	Response to sine - wave voltage – frequency response, 8487A (Type 2.4 mm)

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18 GHz to 26.5 GHz	0.40 dB	Response to sine - wave voltage – frequency response, 8487A (Type 2.4 mm)
26.5 GHz to 40 GHz	0.43 dB	Response to sine - wave voltage – frequency response, 8487A (Type 2.4 mm)
9 kHz to 18 GHz	0.32 dB	Sine Wave Voltage Accuracy - Linearity
9 kHz to 30 MHz (CISPR Band A/B)	0.83 dB	Response to Pulse - Amplitude Relationship
100 MHz (Band C)	0.94 dB	Response to Pulse - Amplitude Relationship
30 MHz to 100 MHz (CISPR Band C)	1.10 dB	Response to Pulse - Amplitude Relationship
100 MHz to 1000 MHz (CISPR Band C/D)	1.50 dB	Response to Pulse - Amplitude Relationship
9 kHz to 1000 MHz	0.31 dB	Response to Pulse (variation with repetition frequency)
9 kHz to 150 kHz (CISPR Band A)	0.85 %	Overall Selectivity
150 kHz to 30 MHz (CISPR Band B)	1.75 %	Overall Selectivity
30 MHz to 1000 MHz (CISPR Band C/D)	3.47 %	Overall Selectivity
IF < 100 kHz	5.18×10^{-5}	Frequency Measure – Intermediate frequency, 53131A + 910R
IF > 100 kHz	9.35×10^{-6}	Frequency Measure – Intermediate frequency, 53131A + 910R
9 kHz to 1000 MHz	0.19 dB	Random Noise
0.1 Hz to 225 MHz	$1.16 \times 10^{-12} \pm 1$ count	Reference oscillator/generator – frequency 53131A + 910R
10 Hz to 40 GHz	$1.16 \times 10^{-12} \pm 1$ count	Reference oscillator/generator – frequency, MF2414B/53152A + 910R
9 kHz to 6 GHz	0.16 dB	Reference oscillator/generator – level, E9304A (type N)
9 kHz to 6 GHz	0.24 dB	Reference oscillator/generator – level, E9304A H19 (type N)
6 GHz to 18 GHz	0.33 dB	Reference oscillator/generator – level, E9304A H19 (type N)

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10 MHz to 18 GHz	0.30 dB	Reference oscillator/generator – level, E4412A (type N)
50 MHz to 18 GHz	0.20 dB	Reference oscillator/generator – level, E4413A (type 3.5 mm)
18 GHz to 26.5 GHz	0.23 dB	Reference oscillator/generator – level, E4413A (type 3.5 mm)
50 MHz to 18 GHz	0.32 dB	Reference oscillator/generator – level, 8487A (type 2.4 mm)
18 GHz to 40 GHz	0.39 dB	Reference oscillator/generator – level, 8487A (type 2.4 mm)
9 kHz to 40 GHz	0.92 %	Frequency readout accuracy
9 kHz to 40 GHz	0.60 %	Frequency span accuracy
0 dB to –6 dB bandwidth	2.07 %	IF bandwidth accuracy and selectivity
–6 dB to –60 dB bandwidth	2.96 %	IF bandwidth accuracy and selectivity
	0.12 dB	IF bandwidth switching accuracy (relative measurement)
0 dB to 80 dB scale range	0.23 dB	Scale fidelity – LOG scale
0 dB to 20 dB scale range	0.18 dB	Scale fidelity – Linear scale
120 MHz, –40 dBm (for ESIB series only)	0.17 dB	Internal calibration source – level accuracy
9 kHz to 18 GHz	0.18 dB	Input attenuator switching accuracy
9 kHz to 40 GHz	0.63 dB	Noise level
Impulse Bandwidth	8.91 %	Impulse Bandwidth
9 kHz to 30 MHz (CISPR Band A/B)	0.60 dB	CISPR average response to unsteady narrowband disturbances
Spectrum Analyzer & Vector Network Analyzer		
9 kHz to 6 GHz	0.23 dB	Response to sine-wave voltage – frequency response, E9304A (type N)
9 kHz to 6 GHz	0.28 dB	Response to sine-wave voltage – frequency response, E9304A H19 (type N)
6 GHz to 18 GHz	0.41 dB	Response to sine-wave voltage – frequency response, E9304A H19 (type N)
10 MHz to 6 GHz	0.28 dB	Response to sine-wave voltage – frequency response, E4412A (type N)

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6 GHz to 18 GHz	0.30 dB	Response to sine-wave voltage – frequency response, E4412A (type N)
50 MHz to 2 GHz	0.25 dB	Response to sine-wave voltage – frequency response, E4413A (type 3.5 mm)
2 GHz to 10 GHz	0.26 dB	Response to sine-wave voltage – frequency response, E4413A (type 3.5 mm)
10 GHz to 18 GHz	0.27 dB	Response to sine-wave voltage – frequency response, E4413A (type 3.5 mm)
18 GHz to 26.5 GHz	0.29 dB	Response to sine-wave voltage – frequency response, E4413A (type 3.5 mm)
50 MHz to 2 GHz	0.35 dB	Response to sine-wave voltage – frequency response, 8487A (type 2.4 mm)
2 GHz to 12.4 GHz	0.36 dB	Response to sine-wave voltage – frequency response, 8487A (type 2.4 mm)
12.4 GHz to 18 GHz	0.37 dB	Response to sine-wave voltage – frequency response, 8487A (type 2.4 mm)
18 GHz to 26.5 GHz	0.40 dB	Response to sine-wave voltage – frequency response, 8487A (type 2.4 mm)
26.5 GHz to 40 GHz	0.43 dB	Response to sine-wave voltage – frequency response, 8487A (type 2.4 mm)
9 kHz to 18 GHz	0.32 dB	Response to sine – wave voltage – linearity
IF < 100 kHz	5.18×10^{-5}	Frequency measure – Intermediate frequency, 53131A + 910R
IF > 100 kHz	9.35×10^{-6}	Frequency measure – Intermediate frequency, 53131A + 910R
0.1 Hz to 225 MHz	$1.16 \times 10^{-12} \pm 1$ count	Reference oscillator/generator – frequency, 53131A + 910R
10 Hz to 40 GHz	$1.16 \times 10^{-12} \pm 1$ count	Reference oscillator/generator – frequency, MF2414B/53152A + 910R
9 kHz to 6 GHz	0.16 dB	Reference oscillator/generator- level, E9304A (type N)
9 kHz to 6 GHz	0.24 dB	Reference oscillator/generator- level, E9304A H19 (type N)
6 GHz to 18 GHz	0.33 dB	Reference oscillator/generator- level, E9304A H19 (type N)
10 MHz to 18 GHz	0.30 dB	Reference oscillator/generator- level, E4412A (type N)
50 MHz to 18 GHz	0.20 dB	Reference oscillator/generator- level, E4413A (type 3.5 mm)

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18 GHz to 26.5 GHz	0.23 dB	Reference oscillator/generator- level, E4413A (type 3.5 mm)
50 MHz to 18 GHz	0.32 dB	Reference oscillator/generator- level, 8487A (type 2.4 mm)
18 GHz to 40 GHz	0.39 dB	Reference oscillator/generator- level, 8487A (type 2.4 mm)
9 kHz to 40 GHz	0.92 %	Frequency readout accuracy
9 kHz to 40 GHz	0.60 %	Frequency span accuracy
0 dB to -6 dB bandwidth	2.07 %	IF bandwidth accuracy and selectivity
-6 dB to -60 dB bandwidth	2.96 %	IF bandwidth accuracy and selectivity
	0.12 dB	IF bandwidth switching accuracy (relative measurement)
10 dB step up to 110 dB	0.23 dB	Reference Level Accuracy
0 dB to 80 dB	0.23 dB	Scale fidelity – LOG scale
0 dB to 20 dB scale range	0.18 dB	Scale fidelity – Linear scale
120 MHz, -40 dBm (for ESIB series only)	0.17 dB	Internal calibration source – level accuracy
9 kHz to 18 GHz	0.18 dB	Input attenuator switching accuracy
9 kHz to 40 GHz	0.63 dB	Noise level
-47 dBm to +33 dBm (10 Hz to 20 kHz)	1.21 % (+/- 0.05 dB)	Source level accuracy/ Flatness 34401A + 11048C
10 Hz to VNA Highest Frequency	3.18 dB	VNA Crosstalk
-40 to +20 dBm (10 Hz to 20 kHz)	4.23 %	VNA Absolute Amplitude Accuracy 34401A + 11048C + 11667A
0 to -100 dBm by 10 dB step	0.13 dB	VNA Magnitude Dynamic Accuracy 11667A + 8496B
0 to -100 dBm by 10 dB step	0.425 degrees	VNA Phase Dynamic Accuracy 11667A + 8496B
100 Hz to 18 GHz	0.09 dB + EuC Scale Error	VNA Magnitude Frequency Response 11667A
100 Hz to 18 GHz	0.967 deg + EuC Scale Error	VNA Phase Frequency Response 11667A
-40 to +20 dBm (10 Hz to 20 kHz)	0.18 dB	VNA SA Function, Amplitude Accuracy & Frequency Response, 34401A

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CISPR Pulse Generator (CISPR 16-1-1)

CISPR Band A, B, and C/D

9 kHz to 1000 MHz	5.98 %	Pulse area (integral function)
9 kHz to 1000 MHz	2.55 %	Pulse width (horizontal scale)
9 kHz to 1000 MHz	0.27 dB	Amplitude variation
9 kHz to 1000 MHz	6.12×10^{-6}	Pulse frequency, 53131A + 910R
9 kHz to 1000 MHz	0.25 dB	Flatness of spectrum amplitude
9 kHz to 1000 MHz	0.16 dB	Sine-wave amplitude
1 MHz to 10 MHz	1.16×10^{-12}	Sine-wave frequency, 53131A + 910R

CW Simulator (RF Generator) (Unmodulated Sine-Wave)

100 kHz to 1 GHz (0.1 to 100 W)	4.07 % (+0.17 dB/-0.18 dB)	Absolute power
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Frequency Counter

0.1 Hz to 9 kHz	4.2×10^{-5}	Frequency count accuracy, 33120A
9 kHz to 1 MHz	3.89×10^{-9}	Frequency count accuracy, 910R + SML03
1 MHz to 40 GHz	1.10×10^{-10}	Frequency count accuracy, 910R + SML03 / E8254A
1 MHz to 10 MHz	1.16×10^{-12}	Internal oscillator (time base) accuracy, 53131A + 910R

ELECTROMAGNETICS - RF MICROWAVE

NVLAP Codes: 20/R05, 20/R06, 20/R07

HF Capacitance, Inductance, and Resistance
(e.g. Reference Impedance Network)

Range	Best Uncertainty (\pm)^{note 1}	Remarks
100.0 m Ω to 19.999 M Ω	10.76 %	Resistance, Reactance, and Impedance ZM2353 + 2325AL
40 Hz to 50 kHz		
100.0 m Ω to 19.999 M Ω	16.45 %	Resistance, Reactance, and Impedance ZM2353 + 2325AL
50 kHz to 200 kHz		
1.000 pF to 199.99 mF	10.76 %	Capacitance
40 Hz to 50 kHz		ZM2353 + 2325AL
1.000 pF to 199.99 mF	16.45 %	Capacitance
50 kHz to 200 kHz		ZM2353 + 2325AL

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1.00 nH to 19.999 kH	10.76 %	Inductance
40 Hz to 50 kHz		ZM2353 + 2325AL
1.00 nH to 19.999 kH	16.45 %	Inductance
50 kHz to 200 kHz		ZM2353 + 2325AL

NVLAP Code: 20/R08
Microwave Antenna Parameters

Range	Best Uncertainty (\pm) ^{note 1}	Remarks
Monopole Antenna (IEEE 291 & ARP958)		
30 Hz to 50 MHz	0.39 dB	Antenna Factor, Gain
LISN ^{note 2}		
9 kHz to 108 MHz	2.01 %	Impedance
9 kHz to 108 MHz	0.2 dB	Insertion Loss
9 kHz to 108 MHz	1.4 dB	Isolation
9 kHz to 108 MHz	2.7 degree	Phase Angle
AC 100 V to 240 V with 50 Hz	0.17 %	Series voltage drop
DC 10 V to 28 V	0.15 %	Series voltage drop
BAN ^{note 2} (ISO 11452-7)		
250 kHz to 500 MHz	3.49 %	Impedance
250 kHz to 500 MHz	2.1 dB	Insertion Loss
CDN ^{note 2}		
100 kHz to 230 MHz	1.35 %	Impedance
100 kHz to 230 MHz	0.2 dB	Insertion Loss
EM Clamp ^{note 2}		
0.1 MHz to 230 MHz	0.4 dB	Insertion Loss
150 ohm to 50 ohm Adaptor ^{note 2}		
0.1 MHz to 230 MHz	0.3 dB	Insertion Loss
Current Probe / Current Injection Probe ^{note 2}		

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10 Hz to 10 kHz	1.1 dB	Insertion Loss
10 Hz to 10 kHz	1.1 dB Ω	Transfer Impedance
10 kHz to 500 MHz	0.5 dB	Insertion Loss
10 kHz to 500 MHz	0.5 dB Ω	Transfer Impedance
500 MHz to 2.1 GHz	0.8 dB	Insertion Loss
500 MHz to 2.1 GHz	0.8 dB Ω	Transfer Impedance
CISPR Current Probe ^{note 2} (e.g. EZ-17 type)		
20 Hz to 1 kHz	0.27 dB	Transducer Factor (using 33120A + 4395A SA function)
1 kHz to 100 MHz	0.25 dB	Transducer Factor (using 4395A + 87512 VNA function)
Hi-Impedance Probe ^{note 2}		
9 kHz to 30 MHz	0.3 dB	Voltage Division Factor
Artificial Hand ^{note 2} (CISPR 16-1-2)		
100 kHz to 30 MHz	2.02 %	Impedance
Capacitive Coupling Clamp (IEC 61000-4-4)		
100 kHz to 30 MHz	16.98 %	Coupling Capacitance
Isotropic Electric Field Probes (such as HI-4422)		
10 kHz to 1 GHz	1.4 dB	Correction factor such as HI- 4422 / FP2000
10 kHz to 1 GHz	0.2 dB	Rotational response such as HI-4422 / FP2000
100 kHz to 1 GHz	1.0 dB	Correction factor such as HI-6005 / FP 6001
1 GHz to 3.5 GHz	2.0 dB	Correction factor such as HI-6005 / FP 6001
100 kHz to 1 GHz	0.2 dB	Rotational response such as HI-6005 / FP6001
1 GHz to 3.5 GHz	0.4 dB	Rotational response such as HI-6005 / FP6001
100 kHz to 1 GHz	1.0 dB	Correction factor such as HI4433 / FP2080 / EMC-20
1 GHz to 3.5 GHz	2.0 dB	Correction factor such as HI4433 / FP2080 / EMC-20

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100 kHz to 3.5 GHz	0.2 dB	Rotational response such as HI4433 / FP2080/ EMC-20
100 kHz to 1 GHz	1.0 dB	Correction factor such as OEFS-H-NS, OEFS-H-S1
1 GHz to 3 GHz	2.0 dB	Correction factor such as OEFS-H-NS, OEFS-H-S1

50 ohm Termination ^{note 2}
Impedance, Reflection Coefficient, and VSWR Measure

10 Hz to 500 MHz	2.02 %	4395A + 87512A + 85032B/F
30 kHz to 1.3 GHz	1.13 %	8753ES + 85032B/F
1.3 GHz to 3 GHz	1.76 %	8753ES + 85032B/F
3 GHz to 6 GHz	3.57 %	8753ES + 85032B/F
9 kHz to 10 MHz	1.20 %	E5071C + 85032F
10 MHz to 3 GHz	1.53 %	E5071C + 85032F
3 GHz to 6 GHz	2.27 %	E5071C + 85032F
6 GHz to 8.5 GHz	2.87 %	E5071C + 85032F
45 MHz to 2GHz	1.24 %	E8563B + 85054B (Type-N)
2 GHz to 8 GHz	2.01 %	E8563B + 85054B (Type-N)
8 GHz to 18 GHz	2.77 %	E8563B + 85054B (Type-N)
45 MHz to 2 GHz	1.18 %	E8563B + 85052B (3.5mm)
2 GHz to 8 GHz	2.23 %	E8563B + 85052B (3.5mm)
8 GHz to 20 GHz	2.69 %	E8563B + 85052B (3.5mm)
20 GHz to 26.5 GHz	2.82 %	E8563B + 85052B (3.5mm)
45 MHz to 2 GHz	1.53 %	E8563B + 85056A (2.4mm)
2 GHz to 8 GHz	1.89 %	E8563B + 85056A (2.4mm)
8 GHz to 20 GHz	1.89 %	E8563B + 85056A (2.4mm)
20 GHz to 40 GHz	2.96 %	E8563B + 85056A (2.4mm)

NVLAP Code: 20/R17
RF Microwave Power Meters
RF Absolute Power Measure (Sine Wave unmodulated)
Signal Generator

Range **Best Uncertainty (\pm)** ^{note 1} **Remarks**

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-30 dBm to +20 dBm (100 kHz to 4.2 GHz)	3.67 %	Sine-wave absolute power measure, 8482A (type N)
-40 dBm to +20 dBm (9 kHz to 6 GHz)	3.68 %	Sine-wave absolute power measure, E9304A (type N)
-30 to +30 dBm (9kHz to 6 GHz)	4.92 %	Sine-wave absolute power measure E9304 H19 (type N)
-30 to +30 dBm (6 GHz to 18 GHz)	7.37 %	Sine-wave absolute power measure E9304 H19 (type N)
-50 dBm to + 20 dBm (10 MHz to 18 GHz)	6.57 %	Sine-wave absolute power measure, E4412A (type N)
-50 dBm to + 20 dBm (50 MHz to 26.5 GHz)	6.2 %	Sine-wave absolute power measure, E4413A (type 3.5 mm)
-30 dBm to +20 dBm (50 MHz to 18 GHz)	7.10 %	Sine-wave absolute power measure, 8487A (type 2.4 mm)
-30 dBm to + 20 dBm (18 GHz to 40 GHz)	8.54 %	Sine-wave absolute power measure, 8487A (type 2.4 mm)
-30 dBm to + 20 dBm (40 GHz to 50 GHz)	10.88 %	Sine-wave absolute power measure, 8487A (type 2.4 mm)
-70 to -20 dBm (50 MHz to 18 GHz)	7.46 %	Sine-Wave absolute power measure, 8487D (type 2.4mm)
-70 to -20 dBm (18 GHz to 40 GHz)	11.87 %	Sine-Wave absolute power measure, 8487D (type 2.4mm)
-70 to -20 dBm (40 GHz to 50 GHz)	14.70 %	Sine-Wave absolute power measure, 8487D (type 2.4mm)
0.1 Hz to 225 MHz	$1.16 \times 10^{-12} \pm 1$ count	Sine-wave frequency measure, HP 53131A + 910R
10 Hz to 40 GHz	$1.16 \times 10^{-12} \pm 1$ count	Sine-wave frequency measure, MF2414B + 910R
9 kHz to 12.4 GHz, 10 dB step	0.31 dB	Switching accuracy of RF output, 8496B
12.4 GHz to 18 GHz, 10 dB step	0.41 dB	Switching accuracy of RF output, 8496B
9 kHz to 12.4 GHz, 1 to 2 dB step	0.29 dB	Switching accuracy of RF output, 8494B
12.4 GHz t 18 GHz, 1 to 2 dB step	0.42 dB	Switching accuracy of RF output, 8494B
Carrier 150 kHz to 10 MHz, Rates 50 Hz to 10 kHz	2.34 % \pm 1 digit	Amplitude modulation (5 % to 99 %)

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Carrier 10 MHz to 1300 MHz, Rates 50 Hz to 50 kHz	1.22 % ± 1 digit	Amplitude modulation (5 % to 99 %)
Carrier 250 kHz to 10 MHz, Rates 20 Hz to 10 kHz	2.31 % ± 1 digit	Frequency modulation (deviation <40 kHz peak)
Carrier 10 MHz to 1300 MHz, Rates 50 Hz to 100 kHz	1.16 % ± 1 digit	Frequency modulation (deviation <400 kHz peak)
Carrier 150 kHz to 10 MHz, Rates 200 Hz to 10 kHz	4.62 % ± 1 digit	Phase modulation (deviation < 40 kHz peak)
Carrier 10 MHz to 1300 MHz, Rates 200 Hz to 20 kHz	3.47 % ± 1 digit	Phase modulation (deviation < 400 kHz peak)
9 kHz to 3 GHz	0.35 dB	Harmonics
Power Meter & Power Sensor (Hi-Power & Feedthrough Type)		
9 kHz to 1 GHz, 0.1 to 100 W	12.50 %	Amplitude Freq. Response and Linearity
1 GHz to 4.2 GHz, 0.1 to 20 W	18.86 %	Amplitude Freq. Response and Linearity
Power Meter & Power Sensor (Termination Type)		
9 kHz to 6 GHz (at 0 dBm)	1.71 %	Calibration factor, E9304A & 11667A (type N)
9 kHz to 8 GHz (at 0 dBm)	1.80 %	Calibration factor, E9304A+H19 & 11667A (type N)
8 GHz to 18 GHz (at 0 dBm)	2.41%	Calibration factor, E9304A+H19 & 11667A (type N)
10 MHz to 2 GHz (at 0 dBm)	1.87 %	Calibration factor, E4412A & 11667A (type N)
2 GHz to 10 GHz (at 0 dBm)	2.45 %	Calibration factor, E4412A & 11667A (type N)
10 GHz to 18 GHz (at 0 dBm)	3.06 %	Calibration factor, E4412A & 11667A (type N)
50 MHz to 2 GHz (at 0 dBm)	3.07 %	Calibration factor, E4413A & 11667B (type 3.5 mm)
2 GHz to 10 GHz (at 0 dBm)	3.17 %	Calibration factor, E4413A & 11667B (type 3.5 mm)
10 GHz to 18 GHz (at 0 dBm)	3.41 %	Calibration factor, E4413A & 11667B (type 3.5 mm)
18 GHz to 26.5 GHz (at 0 dBm)	4.13 %	Calibration factor, E4413A & 11667B (type 3.5 mm)
50 MHz to 18 GHz (at 0 dBm)	4.64 %	Calibration factor, 8487A & 11667C (type 2.4 mm)
18 GHz to 26 GHz (at 0 dBm)	5.80 %	Calibration factor, 8487A & 11667C (type 2.4 mm)

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26 GHz to 34 GHz (at 0 dBm)	6.85 %	Calibration factor, 8487A & 11667C (type 2.4 mm)
34 GHz to 40 GHz (at 0 dBm)	7.69 %	Calibration factor, 8487A & 11667C (type 2.4 mm)
50 MHz to 18 GHz (at -20 dBm)	5.78 %	Calibration factor, 8487D & 11667C (type 2.4 mm)
18 GHz to 26 GHz (at -20 dBm)	7.09 %	Calibration factor, 8487D & 11667C (type 2.4 mm)
26 GHz to 34 GHz (at -20 dBm)	9.72 %	Calibration factor, 8487D & 11667C (type 2.4 mm)
34 GHz to 40 GHz (at -20 dBm)	10.27 %	Calibration factor, 8487D & 11667C (type 2.4 mm)
-40 dBm to +20 dBm (9 kHz to 6 GHz)	3.68 %	Power Linearity, E9304A
-30 dBm to +30 dBm (9 kHz to 6 GHz)	4.92 %	Power Linearity, E9304A-H19
-50 dBm to +20 dBm (10 MHz to 18 GHz)	6.57 %	Power Linearity, E4412A
-50 dBm to +20 dBm (10 MHz to 26.5 GHz)	6.20 %	Power Linearity, E4413A
-30 dBm to +20 dBm (50 MHz to 40 GHz)	8.54 %	Power Linearity, 8487A
-70 dBm to -20 dBm (50 MHz to 40 GHz)	11.87 %	Power Linearity, 8487D
Frequency Measure		
0.1 Hz to 225 MHz	$1.16 \times 10^{-12} \pm 1$ count	Sine-wave frequency measures HP 53131A + 910R
10 Hz to 40 GHz	$1.16 \times 10^{-12} \pm 1$ count	Sine-wave frequency measures MF 2414B/53152A + 910R
RF Absolute Power Measure (Unmodulated Sine Wave)		
-30 dBm to +20 dBm (100 kHz to 4.2 GHz)	3.67 %	Sine-wave absolute power measure 8482A (type N)
-40 dBm to +20 dBm (9 kHz to 6 GHz)	3.68 %	Sine-wave absolute power measure E9304A (type N)
-30 dBm to +30 dBm (9 kHz to 6 GHz)	4.92 %	Sine-wave absolute power measure E9304A H19 (type N)

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-30 dBm to +30 dBm (6 GHz to 18 GHz)	7.37 %	Sine-wave absolute power measure E9304A H19 (type N)
-50 dBm to +20 dBm (10 MHz to 18 GHz)	6.57 %	Sine-wave absolute power measure E4412A (type N)
-50 dBm to +20 dBm (50 MHz to 26.5 GHz)	6.20 %	Sine-wave absolute power measure 4413A (type 3.5 mm)
-30 dBm to +20 dBm (50 MHz to 18 GHz)	7.10 %	Sine-wave absolute power measure 8487A (type 2.4 mm)
-30 dBm to +20 dBm (18 GHz to 40 GHz)	8.54 %	Sine-wave absolute power measure 8487A (type 2.4 mm)
-30 dBm to +20 dBm (40 GHz to 50 GHz)	10.88 %	Sine-wave absolute power measure 8487A (type 2.4mm)
-70 dBm to -20 dBm (50 MHz to 18 GHz)	7.46 %	Sine-wave absolute power measure 8487D (type 2.4mm)
-70 dBm to -20 dBm (18 GHz to 26.5 GHz)	9.44 %	Sine-wave absolute power measure 8487D (type 2.4mm)
-70 dBm to -20 dBm (26.5 GHz to 40 GHz)	11.87 %	Sine-wave absolute power measure 8487D (type 2.4mm)
+20 dBm to + 50 dBm (100 kHz to 1000 MHz)	4.07 %	Sine-wave absolute power measure

RF Insertion Loss / Gain Measure

10 Hz to 500 MHz, 0 dB to 60 dB	0.20 dB	4395A + 87512A
10 Hz to 500 MHz, 60 dB to 70 dB	0.44 dB	4395A + 87512A
10 Hz to 500 MHz, 70 dB to 80 dB	0.95 dB	4395A + 87512A
30 kHz to 1.3 GHz, 0 dB to 60 dB	0.09 dB	8753ES
30 kHz to 1.3 GHz, 60 dB to 70 dB	0.20 dB	8753ES
30 kHz to 1.3 GHz, 70 dB to 80 dB	0.54 dB	8753ES
1.3 GHz to 3 GHz, 0 dB to 60 dB	0.10 dB	8753ES
1.3 GHz to 3 GHz, 60 dB to 70 dB	0.23 dB	8753ES
1.3 GHz to 3 GHz, 70 dB to 80 dB	0.60 dB	8753ES
3 GHz to 6 GHz, 0 dB to 60 dB	0.15 dB	8753ES
3 GHz to 6 GHz, 60 dB to 70 dB	0.33 dB	8753ES
3 GHz to 6 GHz, 70 dB to 80 dB	0.93 dB	8753ES
9 kHz to 300 kHz, 0 to 60 dB	0.27 dB	E5071C
9 kHz to 300 kHz, 60 to 70 dB	0.80 dB	E5071C
9 kHz to 300 kHz, 70 to 80 dB	2.13 dB	E5071C

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300 kHz to 10 MHz, 0 to 60 dB	0.15 dB	E5071C
300 kHz to 10 MHz, 60 to 70 dB	0.31 dB	E5071C
300 kHz to 10 MHz, 70 to 80 dB	0.87 dB	E5071C
10 MHz to 3 GHz, 0 to 60 dB	0.11 dB	E5071C
10 MHz to 3 GHz, 60 to 70 dB	0.16 dB	E5071C
10 MHz to 3 GHz, 70 to 80 dB	0.28 dB	E5071C
3 GHz to 6 GHz, 0 to 60 dB	0.15 dB	E5071C
3 GHz to 6 GHz, 60 to 70 dB	0.20 dB	E5071C
3 GHz to 6 GHz, 70 to 80 dB	0.35 dB	E5071C
6 GHz to 8.5 GHz, 0 to 60 dB	0.18 dB	E5071C
6 GHz to 8.5 GHz, 60 to 70 dB	0.26 dB	E5071C
6 GHz to 8.5 GHz, 70 to 80 dB	0.48 dB	E5071C
45 MHz to 2 GHz, 0 dB to 50 dB	0.23 dB	E8363B, Type N
45 MHz to 2 GHz, 50 dB to 60 dB	0.63 dB	E8363B, Type N
45 MHz to 2 GHz, 60 dB to 70 dB	1.80 dB	E8363B, Type N
2 GHz to 8 GHz, 0 dB to 80 dB	0.33 dB	E8363B, Type N
2 GHz to 8 GHz, 80 dB to 90 dB	0.87 dB	E8363B, Type N
2 GHz to 8 GHz, 90 dB to 100 dB	2.20 dB	E8363B, Type N
8 GHz to 18 GHz, 0 dB to 80 dB	0.32 dB	E8363B, Type N
8 GHz to 18 GHz, 80 dB to 90 dB	0.74 dB	E8363B, Type N
8 GHz to 18 GHz, 90 dB to 100 dB	1.93 dB	E8363B, Type N
45 MHz to 2 GHz, 0 dB to 50 dB	0.21 dB	E8363B, 3.5mm
45 MHz to 2 GHz, 50 dB to 60 dB	0.63 dB	E8363B, 3.5mm
45 MHz to 2 GHz, 60 dB to 70 dB	1.80 dB	E8363B, 3.5mm
2 GHz to 8 GHz, 0 dB to 80 dB	0.33 dB	E8363B, 3.5mm
2 GHz to 8 GHz, 80 dB to 90 dB	0.87 dB	E8363B, 3.5mm
2 GHz to 8 GHz, 90 dB to 100 dB	2.20 dB	E8363B, 3.5mm
8 GHz to 20 GHz, 0 dB to 80 dB	0.32 dB	E8363B, 3.5mm
8 GHz to 20 GHz, 80 dB to 90 dB	0.73 dB	E8363B, 3.5mm
8 GHz to 20 GHz, 90 dB to 100 dB	1.87 dB	E8363B, 3.5mm
20 GHz to 26.5 GHz, 0 dB to 80 dB	0.49 dB	E8363B, 3.5mm
20 GHz to 26.5 GHz, 80 dB to 90 dB	1.20 dB	E8363B, 3.5mm
20 GHz to 26.5 GHz, 90 dB to 100 dB	3.07 dB	E8363B, 3.5mm
45 MHz to 2 GHz, 0 dB to 50 dB	0.22 dB	E8363B, 2.4mm

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45 MHz to 2 GHz, 50 dB to 60 dB	0.61 dB	E8363B, 2.4mm
45 MHz to 2 GHz, 60 dB to 70 dB	1.80 dB	E8363B, 2.4mm
2 GHz to 8 GHz, 0 dB to 80 dB	0.32 dB	E8363B, 2.4mm
2 GHz to 8 GHz, 80 dB to 90 dB	0.87 dB	E8363B, 2.4mm
2 GHz to 8 GHz, 90 dB to 100 dB	2.20 dB	E8363B, 2.4mm
8 GHz to 20 GHz, 0 dB to 80 dB	0.29 dB	E8363B, 2.4mm
8 GHz to 20 GHz, 80 dB to 90 dB	0.73 dB	E8363B, 2.4mm
8 GHz to 20 GHz, 90 dB to 100 dB	1.87 dB	E8363B, 2.4mm
20 GHz to 40.0 GHz, 0 dB to 80 dB	0.50 dB	E8363B, 2.4mm
20 GHz to 40.0 GHz, 80 dB to 90 dB	1.20 dB	E8363B, 2.4mm
20 GHz to 40.0 GHz, 90 dB to 100 dB	3.13 dB	E8363B, 2.4mm

RF Attenuation

0 dB to 110 dB for 9 kHz to 2 GHz	0.08 dB for 10 dB step	8496B-001
0 dB to 110 dB for 2 GHz to 8 GHz	0.10 dB for 10 dB step	8496B-001
0 dB to 110 dB for 8 GHz to 18 GHz	0.17 dB for 10 dB step	8496B-001
0 dB to 11 dB for 9 kHz to 2 GHz	0.09 dB for 1 dB step	8494B-001
0 dB to 11 dB for 2 GHz to 12.4 GHz	0.11 dB for 1 dB step	8494B-001
0 dB to 11 dB for 12.4 GHz to 18 GHz	0.21 dB for 1 dB step	8494B-001

1. Represents an expanded uncertainty using a coverage factor, $k = 2$, at an approximate level of confidence of 95 %.
2. Items available for on-site service.

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