

## Electricity and Magnetism, United States, NIST (National Institute of Standards and Technology)



Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
DC resistance	Standard resistor, Thomas type, 4 terminal	Automated 4-terminal Cryogenic Current Comparator bridge	1	1	$\Omega$	Maximum power	10 mW DC	0.018	$\mu\Omega/\Omega$	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51100S
						Oil bath temperature	25.000 °C $\pm$ 0.003 °C									
						Relative humidity	(35 $\pm$ 5) %									
						Ambient pressure	101.66 kPa $\pm$ 4 kPa							Reported as $\pm$ 0.1 kPa		
DC resistance	Standard resistor, Evanohm type, four terminal (oil immersion)	Automated 4-terminal Cryogenic Current Comparator bridge	100	100	$\Omega$	Maximum power	10 mW DC	0.009	$\mu\Omega/\Omega$	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51100S
						Oil bath temperature	25.000 °C $\pm$ 0.010 °C									
						Relative humidity	(35 $\pm$ 5) %									
						Ambient pressure	101.66 kPa $\pm$ 4 kPa							Reported as $\pm$ 0.1 kPa		
DC resistance	Standard resistor, Evanohm type, four terminal (oil immersion)	Automated 4-terminal Cryogenic Current Comparator bridge	10	10	k $\Omega$	Maximum voltage	1 V DC	0.033	$\mu\Omega/\Omega$	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51100S
						Oil bath temperature	25.000 °C $\pm$ 0.01 °C									
						Relative humidity	(35 $\pm$ 5) %									
						Ambient pressure	101.66 kPa $\pm$ 4 kPa							Reported as $\pm$ 0.1 kPa		
DC resistance	Standard resistor, Evanohm type, four-terminal with embedded temperature sensor (air immersion)	Automated 4-terminal Cryogenic Current Comparator bridge	10	10	k $\Omega$	Maximum voltage	1 V DC	0.033	$\mu\Omega/\Omega$	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51100S
						Ambient air temperature	23.00 °C $\pm$ 0.25 °C							Reported as $\pm$ 0.05 °C		
						Relative humidity	(35 $\pm$ 5) %									
						Ambient pressure	101.66 kPa $\pm$ 4 kPa							Reported as $\pm$ 0.1 kPa		

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DC resistance	Standard resistor, Air immersion or oil immersion wire-wound (Rosa and others)	Automated 2-terminal Cryogenic Current Comparator bridge	1	1	MΩ	Maximum voltage	1 V DC	0.2	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51100S
						Ambient air temperature	23.0 °C ± 0.5 °C							Reported as ± 0.1 °C for air immersion resistors		
						Oil bath temperature	25.000 °C ± 0.01 °C									
						Relative humidity	(35 ± 5) %									
						Ambient pressure	101.66 kPa ± 4 kPa							Reported as ± 0.1 kPa		
DC resistance	Standard resistor, Thomas type, 4 terminal	Automated direct current comparator potentiometer	1	1	Ω	Maximum power	10 mW DC	0.04	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51130C
						Oil bath temperature	25.000 °C ± 0.003 °C									
						Relative humidity	(35 ± 5) %									
						Ambient pressure	101.66 kPa ± 4 kPa							Reported as ± 0.1 kPa		
DC resistance	Standard resistor, Evanohm type, four terminal (oil immersion)	Automated Warshawsky bridge	10	10	kΩ	Maximum power	10 mW DC	0.08	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51131C
						Oil bath temperature	25.000 °C ± 0.01 °C									
						Relative humidity	(35 ± 5) %									
						Ambient pressure	101.66 kPa ± 4 kPa							Reported as ± 0.1 kPa		
DC resistance	Standard resistor, Evanohm type, four-terminal with embedded temperature sensor (air immersion)	Automated Warshawsky bridge	10	10	kΩ	Maximum power	10 mW DC	0.08	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51131C
						Ambient air temperature	23.00 °C ± 0.25 °C							Reported as ± 0.05 °C		
						Relative humidity	(35 ± 5) %									
						Ambient pressure	101.66 kPa ± 4 kPa							Reported as ± 0.1 kPa		

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
DC resistance	Standard resistor, 4 terminal, oil immersion (Rosa and others)	Automated DC current comparator bridge	0.1	0.1	mΩ	Maximum power	10 mW DC	4	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51132C
						Oil bath temperature	25.000 °C ± 0.01 °C									
						Relative humidity	≤ 55 %									
DC resistance	Standard resistor, 4 terminal, oil immersion (Rosa and others)	Automated DC current comparator bridge	1	1	mΩ	Maximum power	10 mW DC	1.2	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51133C
						Oil bath temperature	25.000 °C ± 0.01 °C									
						Relative humidity	≤ 55 %									
DC resistance	Standard resistor, 4 terminal, oil immersion (Rosa and others)	Automated DC current comparator bridge	10	10	mΩ	Maximum power	10 mW DC	0.8	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51134C
						Oil bath temperature	25.000 °C ± 0.01 °C									
						Relative humidity	≤ 55 %									
DC resistance	Standard resistor, 4 terminal, oil immersion (Rosa and others)	Automated DC current comparator bridge	100	100	mΩ	Maximum power	10 mW DC	0.5	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51135C
						Oil bath temperature	25.000 °C ± 0.01 °C									
						Relative humidity	≤ 55 %									
DC resistance	Standard resistor, 4 terminal, air immersion or oil immersion (Rosa and others)	Automated DC current comparator bridge	1	1	Ω	Maximum power	10 mW DC	0.3	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51136C
						Ambient air temperature	23.0 °C ± 0.5 °C							Reported as ± 0.1 °C for air immersion resistors		
						Oil bath temperature	25.000 °C ± 0.01 °C									
						Relative humidity	≤ 55 %									

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
DC resistance	Standard resistor, 4 terminal, air immersion or oil immersion (Rosa and others)	Automated DC current comparator bridge	10	10	$\Omega$	Maximum power	10 mW DC	0.3	$\mu\Omega/\Omega$	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51137C
						Ambient air temperature	23.0 °C $\pm$ 0.5 °C							Reported as $\pm$ 0.1 °C for air immersion resistors		
						Oil bath temperature	25.000 °C $\pm$ 0.01 °C									
						Relative humidity	$\leq$ 55 %									
DC resistance	Standard resistor, 4 terminal, air immersion or oil immersion (Rosa and others)	Automated DC current comparator bridge	100	100	$\Omega$	Maximum power	10 mW DC	0.2	$\mu\Omega/\Omega$	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51138C
						Ambient air temperature	23.0 °C $\pm$ 0.5 °C							Reported as $\pm$ 0.1 °C for air immersion resistors		
						Oil bath temperature	25.000 °C $\pm$ 0.01 °C									
						Relative humidity	$\leq$ 55 %									
DC resistance	Standard resistor, 4 terminal, air immersion or oil immersion (Rosa and others)	Automated unbalanced bridge system	1	1	k $\Omega$	Maximum power	10 mW DC	0.2	$\mu\Omega/\Omega$	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51139C
						Ambient air temperature	23.0 °C $\pm$ 0.5 °C							Reported as $\pm$ 0.1 °C for air immersion resistors		
						Oil bath temperature	25.000 °C $\pm$ 0.01 °C									
						Relative humidity	$\leq$ 55 %									
DC resistance	Standard resistor, 4 terminal, air immersion or oil immersion (Rosa and others)	Automated unbalanced bridge system	10	10	k $\Omega$	Maximum power	10 mW DC	0.2	$\mu\Omega/\Omega$	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51140C
						Ambient air temperature	23.0 °C $\pm$ 0.5 °C							Reported as $\pm$ 0.1 °C for air immersion resistors		
						Oil bath temperature	25.000 °C $\pm$ 0.01 °C									
						Relative humidity	$\leq$ 55 %									

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Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
DC resistance	Standard resistor, 4 terminal, air immersion or oil immersion (Rosa and others)	Automated unbalanced bridge system or Automated Warshawsky bridge	100	100	k $\Omega$	Maximum power	10 mW DC	0.8	$\mu\Omega/\Omega$	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51141C
						Ambient air temperature	23.0 °C $\pm$ 0.5 °C							Reported as $\pm$ 0.1 °C for air immersion resistors		
						Oil bath temperature	25.000 °C $\pm$ 0.01 °C									
						Relative humidity	$\leq$ 55 %									
DC resistance	Standard resistor, 4 terminal, air immersion or oil immersion (Rosa and others)	Automated unbalanced bridge system or Automated Warshawsky bridge	1	1	M $\Omega$	Maximum power	10 mW DC	0.8	$\mu\Omega/\Omega$	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51142C
						Ambient air temperature	23.0 °C $\pm$ 0.5 °C							Reported as $\pm$ 0.1 °C for air immersion resistors		
						Oil bath temperature	25.000 °C $\pm$ 0.01 °C									
						Relative humidity	$\leq$ 55 %									
DC resistance	Hermetically sealed or wire-wound standard resistor, 2 terminal, air immersion	Active-arm guarded bridge	10	10	M $\Omega$	Voltage	1 V to 500 V	3	$\mu\Omega/\Omega$	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51143C
						Air bath temperature	(23.0 $\pm$ 0.1) °C							Measured in temperature-controlled air bath		
						Relative humidity	(35 $\pm$ 5) %									
DC resistance	Hermetically sealed or wire-wound standard resistor, 2 terminal, air immersion	Active-arm guarded bridge	100	100	M $\Omega$	Voltage	1 V to 1 kV	5	$\mu\Omega/\Omega$	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51145C
						Air bath temperature	(23.0 $\pm$ 0.1) °C							Measured in temperature-controlled air bath		
						Relative humidity	(35 $\pm$ 5) %									

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Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
DC resistance	Hermetically sealed standard resistor, guard conductors, 2 terminal, air immersion	Active-arm guarded bridge	1	1	GΩ	Voltage	1 V to 1 kV	10	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51147C
						Air bath temperature	(23.0 ± 0.1) °C							Measured in temperature-controlled air bath		
						Relative humidity	(35 ± 5) %									
DC resistance	Hermetically sealed standard resistor, guard conductors, 2 terminal, air immersion	Active-arm guarded bridge	10	10	GΩ	Voltage	1 V to 1 kV	20	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51149C
						Air bath temperature	(23.0 ± 0.1) °C							Measured in temperature-controlled air bath		
						Relative humidity	(35 ± 5) %									
DC resistance	Hermetically sealed standard resistor, guard conductors, 2 terminal, air immersion	Active-arm guarded bridge	100	100	GΩ	Voltage	10 V to 1 kV	50	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51151C
						Air bath temperature	(23.0 ± 0.1) °C							Measured in temperature-controlled air bath		
						Relative humidity	(35 ± 5) %									
DC resistance	Hermetically sealed standard resistor, guard conductors, 2 terminal, air immersion	Active-arm guarded bridge	1	1	TΩ	Voltage	10 V to 1 kV	100	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51153C
						Air bath temperature	(23.0 ± 0.1) °C							Measured in temperature-controlled air bath		
						Relative humidity	(35 ± 5) %									
DC resistance	Standard resistor, 2 terminal, air immersion	Active-arm guarded bridge	10	10	MΩ	Voltage	1 V to 500 V	8	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51143C

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Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
						Air bath temperature	(23.0 ± 0.1) °C							Measured in temperature-controlled air bath		
						Relative humidity	(35 ± 5) %									
DC resistance	Standard resistor, 2 terminal, air immersion	Active-arm guarded bridge	100	100	MΩ	Voltage	1 V to 1 kV	12	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51145C
						Air bath temperature	(23.0 ± 0.1) °C							Measured in temperature-controlled air bath		
						Relative humidity	(35 ± 5) %									
DC resistance	Standard resistor, 2 terminal, air immersion	Active-arm guarded bridge	1	1	GΩ	Voltage	1 V to 1 kV	25	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51147C
						Air bath temperature	(23.0 ± 0.1) °C							Measured in temperature-controlled air bath		
						Relative humidity	(35 ± 5) %									
DC resistance	Standard resistor, 2 terminal, air immersion	Active-arm guarded bridge	10	10	GΩ	Voltage	1 V to 1 kV	50	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51149C
						Air bath temperature	(23.0 ± 0.1) °C							Measured in temperature-controlled air bath		
						Relative humidity	(35 ± 5) %									
DC resistance	Standard resistor, 2 terminal, air immersion	Active-arm guarded bridge	100	100	GΩ	Voltage	10 V to 1 kV	120	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51151C
						Air bath temperature	(23.0 ± 0.1) °C							Measured in temperature-controlled air bath		
						Relative humidity	(35 ± 5) %									
DC resistance	Standard resistor, 2 terminal, air immersion	Active-arm guarded bridge	1	1	TΩ	Voltage	10 V to 1 kV	250	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51153C
						Air bath temperature	(23.0 ± 0.1) °C							Measured in temperature-controlled air bath		
						Relative humidity	(35 ± 5) %									
DC resistance	Standard resistor, 4 terminal, high current, air immersion or oil immersion	Automatic current comparator bridge with range extender	0.01	0.01	mΩ	Current, I	100 A to 2 kA DC	20 to 100	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm, given values only define the minimum and maximum uncertainties	Approved on 29 March 2007	51160C for I ≤ 300 A; 51161 for I > 300 A

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Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
						Ambient air temperature	23.0 °C ± 0.5 °C							Equilibrium device temperature (with attached thermocouple) or air temperature reported as ± 0.5 °C		
						Oil temperature	25.00 °C ± 0.05 °C									
						Relative humidity	≤ 55 %									
DC resistance	Standard resistor, 4 terminal, high current, air immersion or oil immersion	Automatic current comparator bridge with range extender	0.1	0.1	mΩ	Current, I	10 A to 1.2 kA DC	20 to 50	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm, given values only define the minimum and maximum uncertainties	Approved on 29 March 2007	51160C for I ≤ 300 A; 51161 for I > 300 A
						Ambient air temperature	23.0 °C ± 0.5 °C							Equilibrium device temperature (with attached thermocouple) or air temperature reported as ± 0.5 °C		
						Oil temperature	25.00 °C ± 0.05 °C									
						Relative humidity	≤ 55 %									
DC resistance	Standard resistor, 4 terminal, high current, air immersion	Automatic current comparator bridge with range extender	0.333	0.333	mΩ	Current, I	300 A DC	25	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	51160C for I ≤ 300 A; 51161 for I > 300 A
						Ambient air temperature	23.0 °C ± 0.5 °C							Equilibrium device temperature (with attached thermocouple) or air temperature reported as ± 0.5 °C		
						Oil temperature	23.0 °C ± 0.5 °C									
						Relative humidity	≤ 55 %									
DC resistance	Standard resistor, 4 terminal, high current, air immersion or oil immersion	Automatic current comparator bridge with range extender	1	1	mΩ	Current, I	1.0 A to 400 A DC	10 to 50	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm, given values only define the minimum and maximum uncertainties	Approved on 29 March 2007	51160C for I ≤ 300 A; 51161 for I > 300 A
						Ambient air temperature	23.0 °C ± 0.5 °C							Equilibrium device temperature (with attached thermocouple) or air temperature reported as ± 0.5 °C		
						Oil temperature	25.00 °C ± 0.05 °C									
						Relative humidity	≤ 55 %									



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DC resistance	Standard resistor, 4 terminal, high current, air immersion or oil immersion	Automatic current comparator bridge with range extender	10	10	mΩ	Current	0.3 A to 120 A DC	7 to 25	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm, given values only define the minimum and maximum uncertainties	Approved on 29 March 2007	51160C
						Ambient air temperature	23.0 °C ± 0.5 °C							Equilibrium device temperature (with attached thermocouple) or air temperature reported as ± 0.5 °C		
						Oil temperature	25.00 °C ± 0.05 °C									
						Relative humidity	≤ 55 %									
DC resistance	Standard resistor, 4 terminal, high current, air immersion or oil immersion	Automatic current comparator bridge with range extender	100	100	mΩ	Current	0.1 A to 15 A DC	4 to 25	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm, given values only define the minimum and maximum uncertainties	Approved on 29 March 2007	51160C
						Ambient air temperature	23.0 °C ± 0.5 °C							Equilibrium device temperature (with attached thermocouple) or air temperature reported as ± 0.5 °C		
						Oil temperature	25.00 °C ± 0.05 °C									
						Relative humidity	≤ 55 %									
DC voltage	Solid-state (Zener) standards	Comparison with automated resistive scaling system using digital microvoltmeter	1	10	V	Load	open circuit	0.19	μV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53160C
						Ambient temperature	23.0 °C ± 0.5 °C									
						Relative humidity	≤ 55 %									
DC voltage	Saturated (Weston) standard cells	Standard and test voltage differences measured with digital microvoltmeter in redundant design	1.018	1.018	V	Load	open circuit	0.15	μV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53130C
						Ambient temperature	23.0 °C ± 0.5 °C									
						Relative humidity	≤ 55 %									

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Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
Capacitance	Standard capacitor, fused-silica dielectric, three-terminal	Automatic Capacitance Bridge	10	10	pF	Frequency	50 Hz to 20 kHz	< 4 at endpoints to 0.22 at 1592 Hz	μF/F	2	95%	Yes	<a href="#">Matrix 1</a>	Ovenized, temperature monitor readings reported conductance not measured	Approved on 29 March 2007	52130C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23.0 °C ± 0.5 °C									
Capacitance	Standard capacitor, fused-silica dielectric, three-terminal	Automatic Capacitance Bridge	100	100	pF	Frequency	50 Hz to 20 kHz	< 2 at endpoints to 0.19 at 1592 Hz	μF/F	2	95%	Yes	<a href="#">Matrix 1</a>	Ovenized, temperature monitor readings reported conductance not measured	Approved on 29 March 2007	52130C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23.0 °C ± 0.5 °C									
Capacitance	Standard capacitor, nitrogen dielectric, three-terminal	Three-winding transformer bridge (Type 2), 8-digit capacitance meter	10	10	pF	Frequency	100 Hz, 400 Hz, 1000 Hz	6, 5, 4	μF/F	2	95%	Yes		Room temperature, conductance not measured	Approved on 29 March 2007	52140C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									
Capacitance	Standard capacitor, nitrogen dielectric, three-terminal	Three-winding transformer bridge (Type 2), 8-digit capacitance meter	100	100	pF	Frequency	100 Hz, 400 Hz, 1000 Hz	6, 5, 4	μF/F	2	95%	Yes		Room temperature, conductance not measured	Approved on 29 March 2007	52140C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									
Capacitance	Standard capacitor, nitrogen dielectric, three-terminal	Three-winding transformer bridge (Type 2), 8-digit capacitance meter	1000	1000	pF	Frequency	100 Hz, 400 Hz, 1000 Hz	6, 5, 4	μF/F	2	95%	Yes		Room temperature, conductance not measured	Approved on 29 March 2007	52140C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									
Capacitance	Air dielectric, three-terminal	Three-winding transformer bridge (Type 2)	0.001	0.001	pF	Frequency	400 Hz, 1000 Hz	2000	μF/F	2	95%	Yes		Room temperature, conductance not measured	Approved on 29 March 2007	52160C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
Capacitance	Air dielectric, three-terminal	Three-winding transformer bridge (Type 2)	0.01	0.01	pF	Frequency	400 Hz, 1000 Hz	200	μF/F	2	95%	Yes		Room temperature, conductance not measured	Approved on 29 March 2007	52160C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									
Capacitance	Air dielectric, three-terminal	Three-winding transformer bridge (Type 2)	0.1	1000	pF	Frequency	400 Hz, 1000 Hz	100	μF/F	2	95%	Yes		Room temperature, conductance not measured	Approved on 29 March 2007	52160C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									
Capacitance	Air dielectric, three-terminal	Three-winding transformer bridge (Type 2)	10000	10000	pF	Frequency	400 Hz, 1000 Hz	150	μF/F	2	95%	Yes		Room temperature, conductance not measured	Approved on 29 March 2007	52160C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									
Capacitance	Air dielectric, three-terminal	Three-winding transformer bridge (Type 2)	0.01	0.01	pF	Frequency	100 Hz	1300	μF/F	2	95%	Yes		Room temperature, conductance not measured	Approved on 29 March 2007	52160C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									
Capacitance	Air dielectric, three-terminal	Three-winding transformer bridge (Type 2)	0.1	0.1	pF	Frequency	100 Hz	230	μF/F	2	95%	Yes		Room temperature, conductance not measured	Approved on 29 March 2007	52160C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									
Capacitance	Air dielectric, three-terminal	Three-winding transformer bridge (Type 2)	1	1000	pF	Frequency	100 Hz	160	μF/F	2	95%	Yes		Room temperature, conductance not measured	Approved on 29 March 2007	52160C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									
Capacitance	Mica dielectric, three-terminal	Type 12, resistive ratio-arm bridge, digital impedance meter (used as a comparator)	0.001	0.001	μF	Frequency	0.1 kHz, 1 kHz, 10 kHz	120	μF/F	2	95%	Yes		Room temperature	Approved on 29 March 2007	52170C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
Capacitance	Mica dielectric, three-terminal	Type 12, resistive ratio-arm bridge, digital impedance meter (used as a comparator)	0.002	0.02	μF	Frequency	0.1 kHz, 1 kHz, 10 kHz	100	μF/F	2	95%	Yes		Room temperature	Approved on 29 March 2007	52170C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									
Capacitance	Mica dielectric, three-terminal	Type 12, resistive ratio-arm bridge, digital impedance meter (used as a comparator)	0.05	0.05	μF	Frequency	0.1 kHz, 1 kHz, 10 kHz	100, 100, 120	μF/F	2	95%	Yes		Room temperature	Approved on 29 March 2007	52170C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									
Capacitance	Mica dielectric, three-terminal	Type 12, resistive ratio-arm bridge, digital impedance meter (used as a comparator)	0.1	0.1	μF	Frequency	0.1 kHz, 1 kHz, 10 kHz	100, 100, 150	μF/F	2	95%	Yes		Room temperature	Approved on 29 March 2007	52170C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									
Capacitance	Mica dielectric, three-terminal	Type 12, resistive ratio-arm bridge, digital impedance meter (used as a comparator)	0.2	0.2	μF	Frequency	0.1 kHz, 1 kHz, 10 kHz	100, 100, 250	μF/F	2	95%	Yes		Room temperature	Approved on 29 March 2007	52170C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									
Capacitance	Mica dielectric, three-terminal	Type 12, resistive ratio-arm bridge, digital impedance meter (used as a comparator)	0.5	0.5	μF	Frequency	0.1 kHz, 1 kHz, 10 kHz	100, 100, 500	μF/F	2	95%	Yes		Room temperature	Approved on 29 March 2007	52170C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
Capacitance	Mica dielectric, three-terminal	Type 12, resistive ratio-arm bridge, digital impedance meter (used as a comparator)	1	1	μF	Frequency	100 Hz, 1000 Hz	120	μF/F	2	95%	Yes		Room temperature	Approved on 29 March 2007	52170C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									
Capacitance	Air dielectric, four-terminal pair	Network analyzer, capacitance meter (extrapolation)	1	1000	pF	Frequency	1 kHz to 10 MHz	25 to 14000	μF/F	2	95%	Yes	<a href="#">Matrix 2</a>		Approved on 29 March 2007	52110S
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C							Room temperature		
Capacitance: dissipation factor	Air dielectric, four-terminal pair	Network analyzer, capacitance meter (extrapolation)	0	0.1	rad	Frequency	1 kHz to 10 MHz	22 to 5700	μrad	2	95%	Yes	<a href="#">Matrix 3</a>		Approved on 29 March 2007	52110S
						Capacitance	1 pF to 1000 pF									
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C							Room temperature		
Capacitance	Ceramic dielectric, four-terminal pair	Scaling system using a capacitance meter with IVD	0.01	10	μF	Frequency	100 Hz to 100 kHz	20 to 260	μF/F	2	95%	Yes	<a href="#">Matrix 4</a>		Approved on 29 March 2007	52110S
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C							Room temperature		
Capacitance: dissipation factor	Ceramic dielectric, four-terminal pair	Scaling system using a capacitance meter with IVD	0	0.1	rad	Frequency	100 Hz to 100 kHz	16 to 2400	μrad	2	95%	Yes	<a href="#">Matrix 5</a>		Approved on 29 March 2007	52110S
						Capacitance	10 nF to 10 μF									
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C							Room temperature		
Inductance	Standard inductor, air core, six-terminal	Realization with Maxwell-Wien bridge	20	20	μH	Frequency	100 Hz	5000	μH/H	2	95%	Yes		Henry derived from ohm and farad using Maxwell-Wien bridge	Approved on 29 March 2007	52180C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
Inductance	Standard inductor, air core, six-terminal	Realization with Maxwell-Wien bridge	20	20	μH	Frequency	400 Hz, 1 kHz, 10 kHz	2000	μH/H	2	95%	Yes		Henry derived from ohm and farad using Maxwell-Wien bridge	Approved on 29 March 2007	52180C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									
Inductance	Standard inductor, air core, six-terminal	Substitution comparison with working standard of same value	20	50	μH	Frequency	100 Hz, 400 Hz, 1 kHz, 10 kHz	2000	μH/H	2	95%	Yes		Henry derived from ohm and farad using Maxwell-Wien bridge	Approved on 29 March 2007	52180C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									
Inductance	Standard inductor, air core, three-terminal	Substitution comparison with working standard of same value, unknown in 2-terminal configuration	100	100	μH	Frequency	100 Hz, 400 Hz, 1 kHz, 10 kHz	1000	μH/H	2	95%	Yes		Henry derived from ohm and farad using Maxwell-Wien bridge	Approved on 29 March 2007	52180C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									
Inductance	Standard inductor, air core, three-terminal	Substitution comparison with working standard of same value, unknown in 2-terminal configuration	200	200	μH	Frequency	100 Hz, 400 Hz, 1 kHz, 10 kHz	500	μH/H	2	95%	Yes		Henry derived from ohm and farad using Maxwell-Wien bridge	Approved on 29 March 2007	52180C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									
Inductance	Standard inductor, air core, three-terminal	Substitution comparison with working standard of same value, unknown in 2-terminal configuration	500	500	μH	Frequency	100 Hz, 400 Hz, 1000 Hz	200	μH/H	2	95%	Yes		Henry derived from ohm and farad using Maxwell-Wien bridge	Approved on 29 March 2007	52180C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
Inductance	Standard inductor, air core, three-terminal	Substitution comparison with working standard of same value, unknown in 2-terminal configuration	500	500	μH	Frequency	10 kHz	500	μH/H	2	95%	Yes		Henry derived from ohm and farad using Maxwell-Wien bridge	Approved on 29 March 2007	52180C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									
Inductance	Standard inductor, air core, three-terminal	Substitution comparison with working standard of same value, unknown in 2-terminal configuration	1	500	mH	Frequency	100 Hz, 400 Hz, 1000 Hz	200	μH/H	2	95%	Yes		Henry derived from ohm and farad using Maxwell-Wien bridge	Approved on 29 March 2007	52180C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									
Inductance	Standard inductor, air core, three-terminal	Substitution comparison with working standard of same value, unknown in 2-terminal configuration	1	100	mH	Frequency	10 kHz	500	μH/H	2	95%	Yes		Henry derived from ohm and farad using Maxwell-Wien bridge	Approved on 29 March 2007	52180C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									
Inductance	Standard inductor, air core, three-terminal	Substitution comparison with working standard of same value, unknown in 2-terminal configuration	1	2	H	Frequency	1 kHz	500	μH/H	2	95%	Yes		Henry derived from ohm and farad using Maxwell-Wien bridge	Approved on 29 March 2007	52180C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									
Inductance	Standard inductor, air core, three-terminal	Substitution comparison with working standard of same value, unknown in 2-terminal configuration	5	5	H	Frequency	100 Hz	200	μH/H	2	95%	Yes		Henry derived from ohm and farad using Maxwell-Wien bridge	Approved on 29 March 2007	52180C

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									
Inductance	Standard inductor, air core, three-terminal	Substitution comparison with working standard of same value, unknown in 2-terminal configuration	5	5	H	Frequency	400 Hz	500	μH/H	2	95%	Yes		Henry derived from ohm and farad using Maxwell-Wien bridge	Approved on 29 March 2007	52180C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									
Inductance	Standard inductor, air core, three-terminal	Substitution comparison with working standard of same value, unknown in 2-terminal configuration	5	5	H	Frequency	1 kHz	1000	μH/H	2	95%	Yes		Henry derived from ohm and farad using Maxwell-Wien bridge	Approved on 29 March 2007	52180C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									
Inductance	Standard inductor, air core, three-terminal	Substitution comparison with working standard of same value, unknown in 2-terminal configuration	10	10	H	Frequency	100 Hz	200	μH/H	2	95%	Yes		Henry derived from ohm and farad using Maxwell-Wien bridge	Approved on 29 March 2007	52180C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									
Inductance	Standard inductor, air core, three-terminal	Substitution comparison with working standard of same value, unknown in 2-terminal configuration	10	10	H	Frequency	400 Hz	1000	μH/H	2	95%	Yes		Henry derived from ohm and farad using Maxwell-Wien bridge	Approved on 29 March 2007	52180C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									



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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
Inductance	Standard inductor, air core, three-terminal	Substitution comparison with working standard of same value, unknown in 2-terminal configuration	10	10	H	Frequency	1 kHz	2000	μH/H	2	95%	Yes		Henry derived from ohm and farad using Maxwell-Wien bridge	Approved on 29 March 2007	52180C
						Relative humidity	≤ 55 %									
						Laboratory temperature	23 °C ± 1 °C									
AC-DC transfer difference at low voltages	Thermal transfer standard based on single thermocouple junction or solid-state sensor	Measurement of standard signal	2	2	mV	Frequency	10 Hz to 50 kHz	270	μV/V	2	95%	Yes			Approved on 29 March 2007	53350C
						Ambient temperature	21.5 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC-DC transfer difference at low voltages	Thermal transfer standard based on single thermocouple junction or solid-state sensor	Measurement of standard signal	2	2	mV	Frequency	200 kHz	400	μV/V	2	95%	Yes			Approved on 29 March 2007	53350C
						Ambient temperature	21.5 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC-DC transfer difference at low voltages	Thermal transfer standard based on single thermocouple junction or solid-state sensor	Measurement of standard signal	2	2	mV	Frequency	1 MHz	670	μV/V	2	95%	Yes			Approved on 29 March 2007	53350C
						Ambient temperature	21.5 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
AC-DC transfer difference at low voltages	Thermal transfer standard based on single thermocouple junction or solid-state sensor	Measurement of standard signal	10	20	mV	Frequency	10 Hz	70	μV/V	2	95%	Yes			Approved on 29 March 2007	53350C
						Ambient temperature	21.5 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC-DC transfer difference at low voltages	Thermal transfer standard based on single thermocouple junction or solid-state sensor	Measurement of standard signal	10	20	mV	Frequency	50 Hz to 20 kHz	50	μV/V	2	95%	Yes			Approved on 29 March 2007	53350C
						Ambient temperature	21.5 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC-DC transfer difference at low voltages	Thermal transfer standard based on single thermocouple junction or solid-state sensor	Measurement of standard signal	10	20	mV	Frequency	50 kHz	70	μV/V	2	95%	Yes			Approved on 29 March 2007	53350C
						Ambient temperature	21.5 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC-DC transfer difference at low voltages	Thermal transfer standard based on single thermocouple junction or solid-state sensor	Measurement of standard signal	10	20	mV	Frequency	200 kHz	170	μV/V	2	95%	Yes			Approved on 29 March 2007	53350C
						Ambient temperature	21.5 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
AC-DC transfer difference at low voltages	Thermal transfer standard based on single thermocouple junction or solid-state sensor	Measurement of standard signal	10	20	mV	Frequency	1 MHz	335	μV/V	2	95%	Yes			Approved on 29 March 2007	53350C
						Ambient temperature	21.5 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC-DC transfer difference at low voltages	Thermal transfer standard based on single thermocouple junction or solid-state sensor	Measurement of standard signal	50	50	mV	Frequency	10 Hz	40	μV/V	2	95%	Yes			Approved on 29 March 2007	53350C
						Ambient temperature	21.5 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC-DC transfer difference at low voltages	Thermal transfer standard based on single thermocouple junction or solid-state sensor	Measurement of standard signal	50	50	mV	Frequency	50 Hz to 20 kHz	30	μV/V	2	95%	Yes			Approved on 29 March 2007	53350C
						Ambient temperature	21.5 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC-DC transfer difference at low voltages	Thermal transfer standard based on single thermocouple junction or solid-state sensor	Measurement of standard signal	50	50	mV	Frequency	50 kHz	35	μV/V	2	95%	Yes			Approved on 29 March 2007	53350C
						Ambient temperature	21.5 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
AC-DC transfer difference at low voltages	Thermal transfer standard based on single thermocouple junction or solid-state sensor	Measurement of standard signal	50	50	mV	Frequency	200 kHz	100	μV/V	2	95%	Yes			Approved on 29 March 2007	53350C
						Ambient temperature	21.5 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC-DC transfer difference at low voltages	Thermal transfer standard based on single thermocouple junction or solid-state sensor	Measurement of standard signal	50	50	mV	Frequency	1 MHz	270	μV/V	2	95%	Yes			Approved on 29 March 2007	53350C
						Ambient temperature	21.5 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC-DC transfer difference at low voltages	Thermal transfer standard based on single thermocouple junction or solid-state sensor	Measurement of standard signal	100	200	mV	Frequency	10 Hz	30	μV/V	2	95%	Yes			Approved on 29 March 2007	53350C
						Ambient temperature	21.5 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC-DC transfer difference at low voltages	Thermal transfer standard based on single thermocouple junction or solid-state sensor	Measurement of standard signal	100	200	mV	Frequency	50 Hz to 20 kHz	15	μV/V	2	95%	Yes			Approved on 29 March 2007	53350C
						Ambient temperature	21.5 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
AC-DC transfer difference at low voltages	Thermal transfer standard based on single thermocouple junction or solid-state sensor	Measurement of standard signal	100	200	mV	Frequency	50 kHz	20	μV/V	2	95%	Yes			Approved on 29 March 2007	53350C
						Ambient temperature	21.5 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC-DC transfer difference at low voltages	Thermal transfer standard based on single junction thermal converter or solid-state sensor	Measurement of standard signal	100	200	mV	Frequency	200 kHz	55	μV/V	2	95%	Yes			Approved on 29 March 2007	53350C
						Ambient temperature	21.5 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC-DC transfer difference	Multijunction thermal voltage converter	Direct comparison	1	10	V	Frequency	30 Hz to 10 kHz	0.8	μV/V	2	95%	Yes		Standards used are planar MJTC up to 3 V and wire MJTC devices up to 10 V	Approved on 29 March 2007	53350C
						Ambient temperature	21.5 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC-DC transfer difference	Thermal transfer standard based on single junction thermal converter	Direct comparison	0.3	1000	V	Frequency	10 Hz to 100 kHz	3 to 100	μV/V	2	95%	Yes	<a href="#">Matrix 6</a>		Approved on 29 March 2007	53350C
						Ambient temperature	21.5 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC-DC transfer difference	Thermal transfer standard based on solid-state sensor	Direct comparison	0.3	1000	V	Frequency	10 Hz to 100 kHz	3 to 100	μV/V	2	95%	Yes	<a href="#">Matrix 7</a>		Approved on 29 March 2007	53350C
						Ambient temperature	21.5 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
AC-DC transfer difference	Multirange thermal transfer standard based on single junction thermocouple	Direct comparison	1	1000	V	Frequency	10 Hz to 100 kHz	4 to 100	μV/V	2	95%	Yes	<a href="#">Matrix 8</a>		Approved on 29 March 2007	53350C
						Ambient temperature	21.5 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC-DC transfer difference	Thermal transfer standard based on single thermocouple junction	Direct comparison	0.3	100	V	Frequency	200 kHz to 1 MHz	17 to 75	μV/V	2	95%	Yes	<a href="#">Matrix 9</a>		Approved on 29 March 2007	53350C
						Ambient temperature	21.5 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC-DC transfer difference	Thermal transfer standard based on solid-state sensor	Direct comparison	0.3	100	V	Frequency	200 kHz to 1 MHz	17 to 170	μV/V	2	95%	Yes	<a href="#">Matrix 10</a>		Approved on 29 March 2007	53350C
						Ambient temperature	21.5 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC-DC transfer difference	Multirange thermal transfer standard based on single thermocouple junction	Direct comparison	0.3	100	V	Frequency	200 kHz to 1 MHz	17 to 100	μV/V	2	95%	Yes	<a href="#">Matrix 11</a>		Approved on 29 March 2007	53350C
						Ambient temperature	21.5 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC-DC difference (current)	Current converter, or shunt / thermoelement combination	Direct comparison	0.001	20	A	Frequency	10 Hz to 100 kHz	11 to 168	μA/A	2	95%	Yes	<a href="#">Matrix 12</a>		Approved on 29 March 2007	53350C
						Ambient temperature	21.5 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
AC-DC difference (current)	Current converter, or shunt / thermoelement combination	Direct comparison	30	100	A	Frequency	1 kHz to 30 kHz	202 to 499	μA/A	2	95%	Yes	<a href="#">Matrix 13</a>		Approved on 29 March 2007	53350C
						Ambient temperature	21.5 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC power and energy: single phase (frequency ≤ 400 Hz), active power	Watt meters	Comparison	0	60000	W	Frequency	50 Hz to 400 Hz	35	μW/VA	2	95%	Yes			Approved on 29 March 2007	56200C
						Applied voltage	60 V to 600 V									
						Current	0.1 A to 100 A									
						Power factor	any									
						Ambient temperature	23 °C ± 1 °C									
						Relative humidity	≤ 55 %									
AC power and energy: single phase (frequency ≤ 400 Hz), reactive power	VAR meters	Comparison	0	60000	var	Frequency	50 Hz to 400 Hz	45	μvar/VA	2	95%	Yes			Approved on 29 March 2007	56200C
						Applied voltage	60 V to 600 V									
						Current	0.1 A to 100 A									
						Power factor	any									
						Ambient temperature	23 °C ± 1 °C									
						Relative humidity	≤ 55 %									
AC power and energy: single phase (frequency > 400 Hz), active power	Watt meters	Comparison	0	2400	W	Frequency	400 Hz to 3000 Hz	100	μW/VA	2	95%	Yes			Approved on 29 March 2007	56200C
						Applied voltage	60 V to 240 V									
						Current	0.1 A to 10 A									
						Power factor	any									
						Ambient temperature	23 °C ± 1 °C									
						Relative humidity	≤ 55 %									

## Electricity and Magnetism, United States, NIST (National Institute of Standards and Technology)



Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
AC power and energy: single phase (frequency > 400 Hz), reactive power	VAR meters	Comparison	0	2400	var	Frequency	400 Hz to 3000 Hz	110	μvar/VA	2	95%	Yes			Approved on 29 March 2007	56200C
						Applied voltage	60 V to 240 V									
						Current	0.1 A to 10 A									
						Power factor	any									
						Ambient temperature	23 °C ± 1 °C									
AC power and energy: single phase (frequency ≤ 400 Hz), active energy	Watt-hour meters	Comparison	0	3600000	J	Frequency	50 Hz to 400 Hz	35	μJ/VAs	2	95%	Yes			Approved on 29 March 2007	56200C
						Applied voltage	60 V to 600 V									
						Current	0.1 A to 100 A									
						Power factor	any									
						Ambient temperature	23 °C ± 1 °C									
AC power and energy: single phase (frequency ≤ 400 Hz), reactive energy	VAR-hour meters	Comparison	0	3600000	vars	Frequency	50 Hz to 400 Hz	45	μvars/VAs	2	95%	Yes			Approved on 29 March 2007	56200C
						Applied voltage	60 V to 600 V									
						Current	0.1 A to 100 A									
						Power factor	any									
						Ambient temperature	23 °C ± 1 °C									
AC power and energy: single phase (frequency > 400 Hz), active energy	Watt-hour meters	Comparison	0	144000	J	Frequency	400 Hz to 3000 Hz	100	μJ/VAs	2	95%	Yes			Approved on 29 March 2007	56200C
						Applied voltage	60 V to 240 V									
						Current	0.1 A to 10 A									
						Power factor	any									
						Ambient temperature	23 °C ± 1 °C									
						Relative humidity	≤ 55 %									
						Measuring time	60 s									
						Applied voltage	60 V to 240 V									
						Current	0.1 A to 10 A									
						Power factor	any									
						Ambient temperature	23 °C ± 1 °C									
						Relative humidity	≤ 55 %									
						Measuring time	60 s									
						Applied voltage	60 V to 240 V									
						Current	0.1 A to 10 A									
						Power factor	any									
						Ambient temperature	23 °C ± 1 °C									
						Relative humidity	≤ 55 %									
						Measuring time	60 s									
						Applied voltage	60 V to 240 V									
						Current	0.1 A to 10 A									
						Power factor	any									
						Ambient temperature	23 °C ± 1 °C									
						Relative humidity	≤ 55 %									
						Measuring time	60 s									



## Electricity and Magnetism, United States, NIST (National Institute of Standards and Technology)



Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
AC power and energy: single phase (frequency > 400 Hz), reactive energy	VAR-hour meters	Comparison	0	144000	vars	Measuring time	60 s									
						Frequency	400 Hz to 3000 Hz	110	μvars/VAs	2	95%	Yes			Approved on 29 March 2007	56200C
						Applied voltage	60 V to 240 V									
						Current	0.1 A to 10 A									
						Power factor	any									
						Ambient temperature	23 °C ± 1 °C									
						Relative humidity	≤ 55 %									
Phase: sources	Phase generators	Comparison	0	2π	rad	Measuring time	60 s									
						Frequency range	2 Hz to 5 kHz	0.17	mrads	2	95%	No		Uncertainties apply to signals of equal magnitude	Approved on 29 March 2007	55120C
						Ambient temperature	23 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
Phase: meters	Phase meters	Comparison	0	2π	rad	Frequency range	2 Hz to 5 kHz	0.17	mrads	2	95%	No		Uncertainties apply to signals of equal magnitude	Approved on 29 March 2007	55120C
						Ambient temperature	23 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
						Frequency range	5 kHz to 50 kHz	0.7	mrads	2	95%	No		Uncertainties apply to signals of equal magnitude	Approved on 29 March 2007	55120C
Phase: sources	Phase generators	Comparison	0	2π	rad	Ambient temperature	23 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
						Frequency range	5 kHz to 50 kHz	0.7	mrads	2	95%	No		Uncertainties apply to signals of equal magnitude	Approved on 29 March 2007	55120C
						Ambient temperature	23 °C ± 1.5 °C									
Phase: meters	Phase meters	Comparison	0	2π	rad	Relative humidity	≤ 55 %									
						Frequency range	5 kHz to 50 kHz	0.7	mrads	2	95%	No		Uncertainties apply to signals of equal magnitude	Approved on 29 March 2007	55120C
						Ambient temperature	23 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
Phase	VOR meters	Comparison	0	2π	rad	Carrier frequency	9.996 kHz	0.26	mrads	2	95%	No		Phase between two modulation signals measured	Approved on 29 March 2007	55120C
						FM signal frequency	30 Hz									
						AM signal frequency	30 Hz									

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
						Ambient temperature	23 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC voltage ratio relative to input voltage	Inductive voltage dividers: in-phase ratio (decade transformer dividers)	Bridge comparison	0.000	1.000		Frequency	100 Hz, 400 Hz, 1000 Hz	0.5	μV/V	3	99%	Yes		Each step of the 3 most-significant dials, others at zero (32 readings)	Approved on 29 March 2007	54120C
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC voltage ratio relative to input voltage	Inductive voltage dividers: quadrature ratio (decade transformer dividers)	Bridge comparison	0.000	1.000		Frequency	100 Hz, 400 Hz, 1000 Hz	5	μV/V	3	99%	Yes		Each step of the 3 most-significant dials, others at zero (32 readings)	Approved on 29 March 2007	54120C
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC voltage ratio relative to input voltage	Inductive voltage dividers: in-phase ratio (decade transformer dividers)	Bridge comparison	0.000	1.000		Frequency	5 kHz, 10 kHz	1	μV/V	3	99%	Yes		Each step of the 3 most-significant dials, others at zero (32 readings)	Approved on 29 March 2007	54120C
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC voltage ratio relative to input voltage	Inductive voltage dividers: quadrature ratio (decade transformer dividers)	Bridge comparison	0.000	1.000		Frequency	5 kHz, 10 kHz	5	μV/V	3	99%	Yes		Each step of the 3 most-significant dials, others at zero (32 readings)	Approved on 29 March 2007	54120C
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC voltage ratio	AC divider, resistive (ratio)	Comparison with current comparator	1.0E+03	1.0E+07		Frequency	40 Hz to 100 Hz	300	μV/V	2	95%	Yes		Temperature not allowed to vary more than ± 1 °C during test	Approved on 29 March 2007	54212S
						Applied voltage	10 kV to 150 kV									
						Ambient temperature	21 °C ± 2 °C									

## Electricity and Magnetism, United States, NIST (National Institute of Standards and Technology)



Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
AC voltage ratio	AC divider, resistive (phase)	Comparison with current comparator	1.0E-04	1.0E-01	rad	Frequency	40 Hz to 100 Hz	400	μrad	2	95%	No		Temperature not allowed to vary more than ± 1 °C during test	Approved on 29 March 2007	54212S
						Applied voltage	10 kV to 150 kV									
						Ambient temperature	21 ± 2 °C									
AC voltage ratio	AC divider, capacitive (ratio)	Comparison with current comparator	1.0E+03	1.0E+07		Frequency	40 Hz to 100 Hz	300	μV/V	2	95%	Yes		Temperature not allowed to vary more than ± 1 °C during test	Approved on 29 March 2007	54310S
						Applied voltage	10 kV to 150 kV									
						Ambient temperature	21 °C ± 2 °C									
AC voltage ratio	AC divider, capacitive (phase)	Comparison with current comparator	1.0E-04	1.0E-01	rad	Frequency	40 Hz to 100 Hz	400	μrad	2	95%	No		Temperature not allowed to vary more than ± 1 °C during test	Approved on 29 March 2007	54310S
						Applied voltage	10 kV to 150 kV									
						Ambient temperature	21 °C ± 2 °C									
AC voltage ratio	Voltage transformers (ratio)	Bridge comparison with standard	1.0E+00	1.0E+07		Frequency	40 Hz to 100 Hz	30	μV/V	2	95%	Yes		Temperature not allowed to vary more than ± 1 °C during test	Approved on 29 March 2007	54510C
						Applied voltage	≤ 150 kV									
						Ambient temperature	21 °C ± 2 °C									
AC voltage ratio	Voltage transformers (phase)	Bridge comparison with standard	1.0E-06	1.0E-01	rad	Frequency	40 Hz to 100 Hz	10	μrad	2	95%	No		Temperature not allowed to vary more than ± 1 °C during test	Approved on 29 March 2007	54510C
						Applied voltage	≤ 150 kV									
						Ambient temperature	21 °C ± 2 °C									
AC current ratio	Current transformers (ratio)	Bridge comparison with standard	0.25/5	12000/5		Frequency	50 Hz to 400 Hz	10	μA/A	2	95%	Yes		Typical current transformers warrant ± 0.01% to ± 0.03%	Approved on 29 March 2007	54520C
						Current	≤ 18 kA									
						Ambient temperature	23 °C ± 2 °C									
						Relative humidity	≤ 55 %									
AC current ratio	Current transformers (phase)	Bridge comparison with standard	-0.010	0.010	rad	Frequency	50 Hz to 400 Hz	10	μrad	2	95%	No		Typical current transformers warrant ± 0.01% to ± 0.03%	Approved on 29 March 2007	54520C
						Current	≤ 18 kA									
						Ambient temperature	21 °C ± 2 °C									
						Relative humidity	≤ 55 %									

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
DC voltage	Multimeters and calibrators	Comparison with characterized calibrator (for meter), artefact calibration (for calibrator)	0.1	0.1	V	Load	meter input	4	µV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C							Gain and offset - each polarity - every range		
						Relative humidity	≤ 55 %									
DC voltage	Multimeters and calibrators	Comparison with characterized calibrator (for meter), artefact calibration (for calibrator)	1	1	V	Load	meter input	2	µV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C							Gain and offset - each polarity - every range		
						Relative humidity	≤ 55 %									
DC voltage	Multimeters and calibrators	Comparison with characterized calibrator (for meter), artefact calibration (for calibrator)	10	10	V	Load	meter input	1	µV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C							Gain and offset - each polarity - every range		
						Relative humidity	≤ 55 %									
DC voltage	Multimeters and calibrators	Comparison with characterized calibrator (for meter), artefact calibration (for calibrator)	100	100	V	Load	meter input	2	µV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C							Gain and offset - each polarity - every range		
						Relative humidity	≤ 55 %									
DC voltage	Multimeters and calibrators	Comparison with characterized calibrator (for meter), artefact calibration (for calibrator)	1	1	kV	Load	meter input	2	µV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C							Gain and offset - each polarity - every range		
						Relative humidity	≤ 55 %									

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
AC voltage: sources	Calibrators	Comparison with artefact calibration	0.1	0.1	V	Frequency	300 Hz	50	μV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC voltage: meters	Multimeters	Comparison with characterized calibrator	0.1	0.1	V	Frequency	300 Hz	50	μV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC voltage: sources	Calibrators	Comparison with artefact calibration	0.1	0.1	V	Frequency	10 kHz	50	μV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC voltage: meters	Multimeters	Comparison with characterized calibrator	0.1	0.1	V	Frequency	10 kHz	50	μV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC voltage: sources	Calibrators	Comparison with artefact calibration	0.1	0.1	V	Frequency	1 MHz	1000	μV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC voltage: meters	Multimeters	Comparison with characterized calibrator	0.1	0.1	V	Frequency	1 MHz	1000	μV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC voltage: sources	Calibrators	Comparison with artefact calibration	1	1	V	Frequency	300 Hz	20	μV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
AC voltage: meters	Multimeters	Comparison with characterized calibrator	1	1	V	Frequency	300 Hz	20	μV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC voltage: sources	Calibrators	Comparison with artefact calibration	1	1	V	Frequency	10 kHz	20	μV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC voltage: meters	Multimeters	Comparison with characterized calibrator	1	1	V	Frequency	10 kHz	20	μV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC voltage: sources	Calibrators	Comparison with artefact calibration	1	1	V	Frequency	1 MHz	1000	μV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC voltage: meters	Multimeters	Comparison with characterized calibrator	1	1	V	Frequency	1 MHz	1000	μV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC voltage: sources	Calibrators	Comparison with artefact calibration	10	10	V	Frequency	10 Hz	20	μV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC voltage: meters	Multimeters	Comparison with characterized calibrator	10	10	V	Frequency	10 Hz	20	μV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									

## Electricity and Magnetism, United States, NIST (National Institute of Standards and Technology)



Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
AC voltage: sources	Calibrators	Comparison with artefact calibration	10	10	V	Frequency	300 Hz	20	μV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC voltage: meters	Multimeters	Comparison with characterized calibrator	10	10	V	Frequency	300 Hz	20	μV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC voltage: sources	Calibrators	Comparison with artefact calibration	10	10	V	Frequency	10 kHz	20	μV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC voltage: meters	Multimeters	Comparison with characterized calibrator	10	10	V	Frequency	10 kHz	20	μV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC voltage: sources	Calibrators	Comparison with artefact calibration	10	10	V	Frequency	1 MHz	20	μV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC voltage: meters	Multimeters	Comparison with characterized calibrator	10	10	V	Frequency	1 MHz	20	μV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC voltage: sources	Calibrators	Comparison with artefact calibration	100	100	V	Frequency	55 Hz	20	μV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
AC voltage: meters	Multimeters	Comparison with characterized calibrator	100	100	V	Frequency	55 Hz	20	μV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC voltage: sources	Calibrators	Comparison with artefact calibration	100	100	V	Frequency	1 kHz	20	μV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC voltage: meters	Multimeters	Comparison with characterized calibrator	100	100	V	Frequency	1 kHz	20	μV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC voltage: sources	Calibrators	Comparison with artefact calibration	100	100	V	Frequency	100 kHz	500	μV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC voltage: meters	Multimeters	Comparison with characterized calibrator	100	100	V	Frequency	100 kHz	500	μV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC voltage: sources	Calibrators	Comparison with artefact calibration	700	700	V	Frequency	100 kHz	360	μV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC voltage: meters	Multimeters	Comparison with characterized calibrator	700	700	V	Frequency	100 kHz	360	μV/V	2	95%	Yes		Uncertainty expressed relative to the international value of $K_{J-90}$ , not the SI volt	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									



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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
DC current: sources	Calibrators	Comparison with artefact calibration	10	10	mA	Ambient temperature	23.0 °C ± 1.5 °C	10	µA/A	2	95%	Yes		Uncertainty expressed relative to the international values of $K_{J-90}$ and $R_{K-90}$ , not the SI.	Approved on 29 March 2007	53200S
						Relative humidity	≤ 55 %									
DC current: meters	Multimeters	Comparison with characterized calibrator	10	10	mA	Ambient temperature	23.0 °C ± 1.5 °C	10	µA/A	2	95%	Yes		Uncertainty expressed relative to the international values of $K_{J-90}$ and $R_{K-90}$ , not the SI.	Approved on 29 March 2007	53200S
						Relative humidity	≤ 55 %									
DC current: sources	Calibrators	Comparison with artefact calibration	1	1	A	Ambient temperature	23.0 °C ± 1.5 °C	20	µA/A	2	95%	Yes		Uncertainty expressed relative to the international values of $K_{J-90}$ and $R_{K-90}$ , not the SI.	Approved on 29 March 2007	53200S
						Relative humidity	≤ 55 %									
DC current: meters	Multimeters	Comparison with characterized calibrator	1	1	A	Ambient temperature	23.0 °C ± 1.5 °C	20	µA/A	2	95%	Yes		Uncertainty expressed relative to the international values of $K_{J-90}$ and $R_{K-90}$ , not the SI.	Approved on 29 March 2007	53200S
						Relative humidity	≤ 55 %									
DC current: sources	Calibrators	Comparison with artefact calibration	10	10	A	Ambient temperature	23.0 °C ± 1.5 °C	55	µA/A	2	95%	Yes		Uncertainty expressed relative to the international values of $K_{J-90}$ and $R_{K-90}$ , not the SI.	Approved on 29 March 2007	53200S
						Relative humidity	≤ 55 %									
DC current: meters	Multimeters	Comparison with characterized calibrator	10	10	A	Ambient temperature	23.0 °C ± 1.5 °C	55	µA/A	2	95%	Yes		Uncertainty expressed relative to the international values of $K_{J-90}$ and $R_{K-90}$ , not the SI.	Approved on 29 March 2007	53200S
						Relative humidity	≤ 55 %									
AC current: sources	Calibrators	Comparison with artefact calibration	10	10	mA	Frequency	5 kHz	100	µA/A	2	95%	Yes		Uncertainty expressed relative to the international values of $K_{J-90}$ and $R_{K-90}$ , not the SI.	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC current: meters	Multimeters	Comparison with characterized calibrator	10	10	mA	Frequency	5 kHz	100	µA/A	2	95%	Yes		Uncertainty expressed relative to the international values of $K_{J-90}$ and $R_{K-90}$ , not the SI.	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC current: sources	Calibrators	Comparison with artefact calibration	1	1	A	Frequency	55 Hz	100	µA/A	2	95%	Yes		Uncertainty expressed relative to the international values of $K_{J-90}$ and $R_{K-90}$ , not the SI.	Approved on 29 March 2007	53200S

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC current: meters	Multimeters	Comparison with characterized calibrator	1	1	A	Frequency	55 Hz	100	μA/A	2	95%	Yes		Uncertainty expressed relative to the international values of $K_{J-90}$ and $R_{K-90}$ , not the SI.	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC current: sources	Calibrators	Comparison with artefact calibration	1	1	A	Frequency	300 Hz	100	μA/A	2	95%	Yes		Uncertainty expressed relative to the international values of $K_{J-90}$ and $R_{K-90}$ , not the SI.	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC current: meters	Multimeters	Comparison with characterized calibrator	1	1	A	Frequency	300 Hz	100	μA/A	2	95%	Yes		Uncertainty expressed relative to the international values of $K_{J-90}$ and $R_{K-90}$ , not the SI.	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC current: sources	Calibrators	Comparison with artefact calibration	1	1	A	Frequency	5 kHz	200	μA/A	2	95%	Yes		Uncertainty expressed relative to the international values of $K_{J-90}$ and $R_{K-90}$ , not the SI.	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC current: meters	Multimeters	Comparison with characterized calibrator	1	1	A	Frequency	5 kHz	200	μA/A	2	95%	Yes		Uncertainty expressed relative to the international values of $K_{J-90}$ and $R_{K-90}$ , not the SI.	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC current: sources	Calibrators	Comparison with artefact calibration	10	10	A	Frequency	20 kHz	1200	μA/A	2	95%	Yes		Uncertainty expressed relative to the international values of $K_{J-90}$ and $R_{K-90}$ , not the SI.	Approved on 29 March 2007	53200S
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
AC current: meters	Multimeters	Comparison with characterized calibrator	10	10	A	Frequency	20 kHz	1200	μA/A	2	95%	Yes		Uncertainty expressed relative to the international values of $K_{J-90}$ and $R_{K-90}$ , not the SI.	Approved on 29 March 2007	53200S

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
						Ambient temperature	23.0 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
DC resistance: sources	Calibrators	Comparison with artefact calibration	1	1	Ω	Ambient temperature	23.0 °C ± 1.5 °C	20	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	53200S
						Relative humidity	≤ 55 %									
DC resistance: meters	Multimeters	Comparison with characterized calibrator	1	1	Ω	Ambient temperature	23.0 °C ± 1.5 °C	20	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	53200S
						Relative humidity	≤ 55 %									
DC resistance: sources	Calibrators	Comparison with artefact calibration	10	10	Ω	Ambient temperature	23.0 °C ± 1.5 °C	8	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	53200S
						Relative humidity	≤ 55 %									
DC resistance: meters	Multimeters	Comparison with characterized calibrator	10	10	Ω	Ambient temperature	23.0 °C ± 1.5 °C	8	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	53200S
						Relative humidity	≤ 55 %									
DC resistance: sources	Calibrators	Comparison with artefact calibration	1	1	kΩ	Ambient temperature	23.0 °C ± 1.5 °C	3	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	53200S
						Relative humidity	≤ 55 %									
DC resistance: meters	Multimeters	Comparison with characterized calibrator	1	1	kΩ	Ambient temperature	23.0 °C ± 1.5 °C	3	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	53200S
						Relative humidity	≤ 55 %									
DC resistance: sources	Calibrators	Comparison with artefact calibration	100	100	kΩ	Ambient temperature	23.0 °C ± 1.5 °C	5	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	53200S
						Relative humidity	≤ 55 %									
DC resistance: meters	Multimeters	Comparison with characterized calibrator	100	100	kΩ	Ambient temperature	23.0 °C ± 1.5 °C	5	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	53200S
						Relative humidity	≤ 55 %									
DC resistance: sources	Calibrators	Comparison with artefact calibration	1	1	MΩ	Ambient temperature	23.0 °C ± 1.5 °C	30	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	53200S
						Relative humidity	≤ 55 %									

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
DC resistance: meters	Multimeters	Comparison with characterized calibrator	1	1	MΩ	Ambient temperature	23.0 °C ± 1.5 °C	30	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	53200S
						Relative humidity	≤ 55 %									
DC resistance: sources	Calibrators	Comparison with artefact calibration	10	10	MΩ	Ambient temperature	23.0 °C ± 1.5 °C	30	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	53200S
						Relative humidity	≤ 55 %									
DC resistance: meters	Multimeters	Comparison with characterized calibrator	10	10	MΩ	Ambient temperature	23.0 °C ± 1.5 °C	30	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	53200S
						Relative humidity	≤ 55 %									
DC resistance: sources	Calibrators	Comparison with artefact calibration	100	100	MΩ	Ambient temperature	23.0 °C ± 1.5 °C	83	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	53200S
						Relative humidity	≤ 55 %									
DC resistance: meters	Multimeters	Comparison with characterized calibrator	100	100	MΩ	Ambient temperature	23.0 °C ± 1.5 °C	83	μΩ/Ω	2	95%	Yes		Uncertainty expressed relative to the international value of $R_{K-90}$ , not the SI ohm	Approved on 29 March 2007	53200S
						Relative humidity	≤ 55 %									
Impulse spectrum amplitude	Impulse generators. Reference for the unit: 1 μV/MHz	Time domain sampling and Fourier transform	-15	5	dB	Frequency $f$	$f \leq 4$ GHz	0.1	dB	2	95%	No			Approved on 29 March 2007	65200S
						Maximum input voltage	600 mV									
						Frequency spacing	> 10 MHz									
						Impedance	50 W									
						Ambient temperature	23 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
Impulse spectrum amplitude	Impulse generators. Reference for the unit: 1 μV/MHz	Time domain sampling and Fourier transform	-15	5	dB	Frequency $f$	$4 \text{ GHz} < f < 20 \text{ GHz}$	0.5	dB	2	95%	No			Approved on 29 March 2007	65100S
						Maximum input voltage	600 mV									
						Frequency spacing	> 10 MHz									
						Impedance	50 W									
						Ambient temperature	23 °C ± 1.5 °C									

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
						Relative humidity	≤ 55 %									
Pulse amplitude	Pulse generators	Time domain sampling	-0.5	0.5	V	Time	10 ps to 100 ns	1.50E-03	V	2	95%	No			Approved on 29 March 2007	65200S
						Maximum input voltage	600 mV									
						Impedance	50 W									
						Ambient temperature	23 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
Pulse transition duration	Pulse generators	Time domain sampling	1.0E-11	1.0E-07	s	Maximum input voltage	600 mV	1.25	ps	2	95%	No			Approved on 29 March 2007	65200S
						Impedance	50 W									
						Ambient temperature	23 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
Pulse settling	Pulse generators	Time domain sampling	-0.25	0.25	V	Duration from mesial point	1 ns, 10 ns, 100 ns, 1000 ns	10000, 1000, 500, 200	μV/V	2	95%	Yes			Approved on 29 March 2007	65250S
						Maximum input voltage	2 V									
						Impedance	50 W									
						Ambient temperature	23 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
Pulse settling	Pulse generators	Time domain sampling	-2.0	2.0	V	Duration from mesial point	1 ns, 10 ns, 100 ns, 1000 ns	5000, 200, 100, 100	μV/V	2	95%	Yes			Approved on 29 March 2007	65250S
						Maximum input voltage	2 V									
						Impedance	50 W									
						Ambient temperature	23 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									
Time delay interval	Time interval calibrators and coaxial delay lines	Time domain sampling	1.0E-12	1.0E-07	s	Impedance	50 W	(2T + 1), T interval between sampling instances in ps	ps	2	95%	No			Approved on 29 March 2007	65200S
						Maximum input voltage	600 mV									
						Ambient temperature	23 °C ± 1.5 °C									
						Relative humidity	≤ 55 %									

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
HF noise: noise temperature in coaxial	Noise source: Type N, GPC 3.5, GPC 7, and 14 mm	Radiometer	10	15000	K	Frequency	30 MHz and 60 MHz	1.0 to 2.0	%	2	95%	Yes		Uncertainty listed is for a typical high-temperature (5000 K to 12000 K) noise source	Approved on 29 March 2007	61410S
HF noise: noise temperature in coaxial	Noise source: Type N, GPC 7, GPC 3.5, GPC 2.4, and 14 mm	Radiometer	10	15000	K	Frequency	1 GHz to 12.4 GHz	0.8 to 1.0	%	2	95%	Yes		Uncertainty listed is for a typical high-temperature, PC-7 noise source	Approved on 29 March 2007	61420S
HF noise: noise temperature in coaxial	Noise source: Type N, GPC 7, GPC 3.5, GPC 2.4	Radiometer	10	15000	K	Frequency	12.4 GHz to 18 GHz	1.0 to 1.2	%	2	95%	Yes		Uncertainty listed is for a typical high-temperature, PC-7 noise source	Approved on 29 March 2007	61425S
HF noise: noise temperature in coaxial	Noise source: GPC 3.5, GPC 2.4	Radiometer	10	15000	K	Frequency	18 GHz to 26.5 GHz	1.0 to 1.3	%	2	95%	Yes		Uncertainty listed is for a typical high-temperature (5000 K to 12000 K) noise source	Approved on 29 March 2007	61430S
HF noise: noise temperature in coaxial	Noise source: GPC 2.4	Radiometer	30	15000	K	Frequency	26.5 GHz to 40 GHz	1.5 to 1.7	%	2	95%	Yes		Uncertainty listed is for a typical high-temperature (5000 K to 12000 K) noise source	Approved on 29 March 2007	61435S
HF noise: noise temperature in waveguide	Noise source: WR-90	Radiometer	10	15000	K	Frequency	8.2 GHz to 12.4 GHz	1.0 to 1.2	%	2	95%	Yes		Uncertainty listed is for a typical high-temperature (5000 K to 12000 K) noise source	Approved on 29 March 2007	61450S
HF noise: noise temperature in waveguide	Noise source: WR-62	Radiometer	10	15000	K	Frequency	12.4 GHz to 18 GHz	0.7 to 1.0	%	2	95%	Yes		Uncertainty listed is for a typical high-temperature (5000 K to 12000 K) noise source	Approved on 29 March 2007	61455S
HF noise: noise temperature in waveguide	Noise source: WR-42	Radiometer	10	15000	K	Frequency	18 GHz to 26.5 GHz	0.9 to 1.0	%	2	95%	Yes		Uncertainty listed is for a typical high-temperature (5000 K to 12000 K) noise source	Approved on 29 March 2007	61460S
HF noise: noise temperature in waveguide	Noise source: WR-28	Radiometer	30	15000	K	Frequency	26.5 GHz to 40 GHz	1.4 to 1.6	%	2	95%	Yes		Uncertainty listed is for a typical high-temperature (5000 K to 12000 K) noise source	Approved on 29 March 2007	61465S
HF noise: noise temperature in waveguide	Noise source: WR-22	Radiometer	30	15000	K	Frequency	33 GHz to 55 GHz	1.4 to 1.6	%	2	95%	Yes		Uncertainty listed is for a typical high-temperature (5000 K to 12000 K) noise source	Approved on 29 March 2007	61470S
HF noise: noise temperature in waveguide	Noise source: WR-15	Radiometer	30	15000	K	Frequency	50 GHz to 65 GHz	1.7	%	2	95%	Yes		Uncertainty listed is for a typical high-temperature (5000 K to 12000 K) noise source	Approved on 29 March 2007	61475S
HF power: effective efficiency in coaxial	Thermistor or power sensor: N, GPC-7	Direct comparison	0.9	1		Power level	1 mW to 10 mW	0.0028 to 0.005		2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61110S, 61111S

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
						Frequency	0.1 MHz to 10 MHz									
HF power: effective efficiency in coaxial	Thermistor or power sensor: GPC-7	Direct comparison	0.9	1		Power level	1 mW to 10 mW	0.007 to 0.016		2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61120S, 61127S
						Frequency	10 MHz to 18 GHz									
HF Power: effective efficiency in coaxial	Thermistor detector: Type N	Direct comparison	0.9	1		Power level	1 mW to 10 mW	0.003 to 0.0073		2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61120S, 61127S
						Frequency	10 MHz to 18 GHz									
HF Power: effective efficiency in coaxial	Thermocouple power sensor: Type N	Direct comparison	0.9	1		Power level	1 mW to 10 mW	0.013 to 0.016		2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61120S, 61127S
						Frequency	10 MHz to 18 GHz									
HF power: effective efficiency in coaxial	Thermistor detector: 3.5 mm	Direct comparison	0.9	1		Power level	1 mW to 10 mW	0.0067 to 0.017		2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61120S, 61127S
						Frequency	50 MHz to 33 GHz									
HF power: effective efficiency in coaxial	Thermocouple power sensor: 3.5 mm	Direct comparison	0.9	1		Power level	1 mW to 10 mW	0.017 to 0.022		2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61120S, 61127S
						Frequency	50 MHz to 33 GHz									
HF power: effective efficiency in coaxial	Thermistor detector: 2.92 mm	Direct comparison	0.9	1		Power level	1 mW to 10 mW	0.007 to 0.023		2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61120S, 61127S
						Frequency	50 MHz to 40 GHz									
HF power: effective efficiency in coaxial	Thermocouple power sensor: 2.92 mm	Direct comparison	0.9	1		Power level	1 mW to 10 mW	0.018 to 0.023		2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61120S, 61127S
						Frequency	50 MHz to 40 GHz									
HF power: effective efficiency in coaxial	Thermistor detector: 2.4 mm	Direct comparison	0.9	1		Power level	1 mW to 10 mW	0.007 to 0.028		2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61120S, 61127S
						Frequency	50 MHz to 50 GHz									
HF power: effective efficiency in coaxial	Thermocouple power sensor: 2.4 mm	Direct comparison	0.9	1		Power level	1 mW to 10 mW	0.016 to 0.031		2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61120S, 61127S
						Frequency	50 MHz to 50 GHz									
HF power: effective efficiency in coaxial	NIST model CN sensor	DC substitution in microcalorimeter	0.9	1		Power level	10 mW	0.0024 to 0.0045		2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61137C, 61138C

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
						Frequency	50 MHz to 18 GHz									
HF power: effective efficiency in waveguide	Thermistor detector: WR-90	Six-port VNA	0.9	1		Power level	10 mW	0.0108		2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61144S, 61145S
						Frequency	8.2 GHz to 12.4 GHz									
HF power: effective efficiency in waveguide	Thermistor detector: WR-62	Six-port VNA	0.9	1		Power level	10 mW	0.0108		2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61146S, 61147S
						Frequency	12.4 GHz to 18 GHz									
HF power: effective efficiency in waveguide	Thermistor detector: WR-42	Six-port VNA	0.9	1		Power level	10 mW	0.0108		2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61148S, 61149S
						Frequency	18 GHz to 26.5 GHz									
HF Power: effective efficiency in waveguide	Thermistor detector: WR-28	Six-port VNA	0.9	1		Power level	10 mW	0.0108		2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61150S, 61151S
						Frequency	26.5 GHz to 40 GHz									
HF power: effective efficiency in waveguide	Thermistor detector: WR-22	Six-port VNA	0.9	1		Power level	10 mW	0.0128		2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61152S, 61153S
						Frequency	33 GHz to 50 GHz									
HF power: effective efficiency in waveguide	Thermistor detector: WR-15	Six-port VNA	0.9	1		Power level	10 mW	0.017		2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61154S
						Frequency	50 GHz to 75 GHz									
HF power: effective efficiency in waveguide	Thermistor detector: WR-10	Six-port VNA	0.9	1		Power level	10 mW	0.0206		2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61155S
						Frequency	92 GHz to 98 GHz									
Reflection coefficient: on coaxial magnitude	1- or 2-port devices	Six-ports & VANA	0	1		Connector	GR900	0.0035 to 0.0045		2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	10 MHz to 8.5 GHz									
Reflection coefficient: on coaxial magnitude	1- or 2-port devices	Six-ports & VANA	0	1		Connector	GPC 7	0.0070 to 0.0085		2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S



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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
						Frequency	10 MHz to 18 GHz									
Reflection coefficient: on coaxial magnitude	1- or 2-port devices	Six-ports & VANA	0	1		Connector	Type N	0.0035 to 0.0075		2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	10 MHz to 18 GHz									
Reflection coefficient: on coaxial magnitude	1- or 2-port devices	Six-ports & VANA	0	1		Connector	3.5 mm	0.0070 to 0.0135		2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	10 MHz to 33 GHz									
Reflection coefficient: on coaxial magnitude	1- or 2-port devices	Six-ports & VANA	0	1		Connector	2.92 mm	0.0095 to 0.0195		2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	50 MHz to 40 GHz									
Reflection coefficient: on coaxial magnitude	1- or 2-port devices	Six-ports & VANA	0	1		Connector	2.4 mm	0.0125 to 0.0210		2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	50 MHz to 50 GHz									
Reflection coefficient: on coaxial phase (with magnitude of reflection coefficient <= 0.1)	1- or 2-port devices	Six-ports & VANA	0	180	°	Connector	GR900	0.95 to 180	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	10 MHz to 8.5 GHz									
Reflection coefficient: on coaxial phase (with magnitude of reflection coefficient <= 0.1)	1- or 2-port devices	Six-ports & VANA	0	180	°	Connector	GPC 7	3.80 to 180	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	10 MHz to 18 GHz									
Reflection coefficient: on coaxial phase (with magnitude of reflection coefficient <= 0.1)	1- or 2-port devices	Six-ports & VANA	0	180	°	Connector	Type N	1.90 to 180	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	10 MHz to 18 GHz									

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
Reflection coefficient: on coaxial phase (with magnitude of reflection coefficient $\leq 0.1$ )	1- or 2-port devices	Six-ports & VANA	0	180	°	Connector	3.5 mm	3.80 to 180	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	10 MHz to 33 GHz									
Reflection coefficient: on coaxial phase (with magnitude of reflection coefficient $\leq 0.1$ )	1- or 2-port devices	Six-ports & VANA	0	180	°	Connector	2.92 mm	2.30 to 180	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	50 MHz to 40 GHz									
Reflection coefficient: on coaxial phase (with magnitude of reflection coefficient $\leq 0.1$ )	1- or 2-port devices	Six-ports & VANA	0	180	°	Connector	2.4 mm	2.80 to 180	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	50 MHz to 50 GHz									
Reflection coefficient: on coaxial phase (with magnitude of reflection coefficient $> 0.1$ )	1- or 2-port devices	Six-ports & VANA	0	180	°	Connector	GR900	0.10 to 1.00	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	10 MHz to 8.5 GHz									
Reflection coefficient: on coaxial phase (with magnitude of reflection coefficient $> 0.1$ )	1- or 2-port devices	Six-ports & VANA	0	180	°	Connector	GPC 7	0.40 to 4.25	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	10 MHz to 18 GHz									

## Electricity and Magnetism, United States, NIST (National Institute of Standards and Technology)



Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
Reflection coefficient: on coaxial phase (with magnitude of reflection coefficient > 0.1)	1- or 2-port devices	Six-ports & VANA	0	180	°	Connector	Type N	0.20 to 2.15	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	10 MHz to 18 GHz									
Reflection coefficient: on coaxial phase (with magnitude of reflection coefficient > 0.1)	1- or 2-port devices	Six-ports & VANA	0	180	°	Connector	3.5 mm	0.40 to 4.85	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	10 MHz to 33 GHz									
Reflection coefficient: on coaxial phase (with magnitude of reflection coefficient > 0.1)	1- or 2-port devices	Six-ports & VANA	0	180	°	Connector	2.92 mm	0.25 to 3.10	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	50 MHz to 40 GHz									
Reflection coefficient: on coaxial phase (with magnitude of reflection coefficient > 0.1)	1- or 2-port devices	Six-ports & VANA	0	180	°	Connector	2.4 mm	0.30 to 4.1	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	50 MHz to 50 GHz									
Transmission coefficient: on coaxial magnitude	2-port devices	Six-ports & VANA	0	40	dB	Connector	GR900	0.01 to 0.041	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	10 MHz to 8.5 GHz									
Transmission coefficient: on coaxial magnitude	2-port devices	Six-ports & VANA	0	40	dB	Connector	GPC 7	0.009 to 0.047	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	10 MHz to 18 GHz									
Transmission coefficient: on coaxial magnitude	2-port devices	Six-ports & VANA	0	40	dB	Connector	Type N	0.014 to 0.042	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
						Frequency	10 MHz to 18 GHz									
Transmission coefficient: on coaxial magnitude	2-port devices	Six-ports & VANA	0	40	dB	Connector	3.5 mm	0.011 to 0.52	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	10 MHz to 33 GHz									
Transmission coefficient: on coaxial magnitude	2-port devices	Six-ports & VANA	0	40	dB	Connector	2.92 mm	0.011 to 0.059	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	50 MHz to 40 GHz									
Transmission coefficient: on coaxial magnitude	2-port devices	Six-ports & VANA	0	40	dB	Connector	2.4 mm	0.021 to 0.084	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	50 MHz to 50 GHz									
Transmission coefficient: on coaxial magnitude	2-port devices	Six-ports & VANA	40	55	dB	Connector	GR900	0.040 to 0.071	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	10 MHz to 8.5 GHz									
Transmission coefficient: on coaxial magnitude	2-port devices	Six-ports & VANA	40	55	dB	Connector	GPC 7	0.040 to 0.075	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	10 MHz to 18 GHz									
Transmission coefficient: on coaxial magnitude	2-port devices	Six-ports & VANA	40	55	dB	Connector	Type N	0.040 to 0.071	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	10 MHz to 18 GHz									
Transmission coefficient: on coaxial magnitude	2-port devices	Six-ports & VANA	40	55	dB	Connector	3.5 mm	0.040 to 0.078	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	10 MHz to 33 GHz									
Transmission coefficient: on coaxial magnitude	2-port devices	Six-ports & VANA	40	55	dB	Connector	2.92 mm	0.040 to 0.083	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	50 MHz to 40 GHz									
Transmission coefficient: on coaxial magnitude	2-port devices	Six-ports & VANA	40	55	dB	Connector	2.4 mm	0.060 to 0.108	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	50 MHz to 50 GHz									
Transmission coefficient: on coaxial magnitude	2-port devices	Six-ports & VANA	55	70	dB	Connector	GR900	0.070 to 0.300	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
						Frequency	10 MHz to 8.5 GHz									
Transmission coefficient: on coaxial magnitude	2-port devices	Six-ports & VANA	55	70	dB	Connector	GPC 7	0.070 to 0.310	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	10 MHz to 18 GHz									
Transmission coefficient: on coaxial magnitude	2-port devices	Six-ports & VANA	55	70	dB	Connector	Type N	0.070 to 0.310	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	10 MHz to 18 GHz									
Transmission coefficient: on coaxial magnitude	2-port devices	Six-ports & VANA	55	70	dB	Connector	3.5 mm	0.071 to 0.312	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	10 MHz to 33 GHz									
Transmission coefficient: on coaxial magnitude	2-port devices	Six-ports & VANA	55	70	dB	Connector	2.92 mm	0.071 to 0.313	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	50 MHz to 40 GHz									
Transmission coefficient: on coaxial magnitude	2-port devices	Six-ports & VANA	55	70	dB	Connector	2.4 mm	0.091 to 0.335	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	50 MHz to 50 GHz									
Transmission coefficient: on coaxial phase	2-port devices	Six-ports & VANA	0	180	°	Connector	GR900	0.07 to 0.89	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	10 MHz to 8.5 GHz									
Transmission coefficient: on coaxial phase	2-port devices	Six-ports & VANA	0	180	°	Connector	GPC 7	0.12 to 3.57	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	10 MHz to 18 GHz									
Transmission coefficient: on coaxial phase	2-port devices	Six-ports & VANA	0	180	°	Connector	Type N	0.16 to 1.92	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	10 MHz to 18 GHz									
Transmission coefficient: on coaxial phase	2-port devices	Six-ports & VANA	0	180	°	Connector	3.5 mm	0.21 to 3.27	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	10 MHz to 33 GHz									

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
Transmission coefficient: on coaxial phase	2-port devices	Six-ports & VANA	0	180	°	Connector	2.92 mm	0.21 to 3.95	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	50 MHz to 40 GHz									
Transmission coefficient: on coaxial phase	2-port devices	Six-ports & VANA	0	180	°	Connector	2.4 mm	0.21 to 4.92	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	50 MHz to 50 GHz									
Reflection coefficient: on waveguide magnitude	1- or 2-port devices	Six-ports & VANA	0	1		Connector	WR 90	0.0046 to 0.0075		2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	8.2 GHz to 12.4 GHz									
Reflection coefficient: on waveguide magnitude	1- or 2-port devices	Six-ports & VANA	0	1		Connector	WR 62	0.0046 to 0.0075		2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	12.4 GHz to 18 GHz									
Reflection coefficient: on waveguide magnitude	1- or 2-port devices	Six-ports & VANA	0	1		Connector	WR 42	0.0038 to 0.0055		2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	18 GHz to 26.5 GHz									
Reflection coefficient: on waveguide magnitude	1- or 2-port devices	Six-ports & VANA	0	1		Connector	WR 28	0.0038 to 0.0055		2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	26.5 GHz to 40 GHz									
Reflection coefficient: on waveguide magnitude	1- or 2-port devices	Six-ports & VANA	0	1		Connector	WR 22	0.0076 to 0.0110		2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	33 GHz to 50 GHz									
Reflection coefficient: on waveguide magnitude	1- or 2-port devices	Six-ports & VANA	0	1		Connector	WR 15	0.0076 to 0.0110		2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	50 GHz to 75 GHz									
Reflection coefficient: on waveguide magnitude	1- or 2-port devices	Six-ports & VANA	0	1		Connector	WR 10	0.0140 to 0.0244		2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	75 GHz to 110 GHz									

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
Reflection coefficient: on waveguide phase (with magnitude of reflection coefficient $\leq 0.1$ )	1- or 2-port devices	Six-ports & VANA	0	180	°	Connector	WR 90	1.98 to 180	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	8.2 GHz to 12.4 GHz									
Reflection coefficient: on waveguide phase (with magnitude of reflection coefficient $\leq 0.1$ )	1- or 2-port devices	Six-ports & VANA	0	180	°	Connector	WR 62	2.04 to 180	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	12.4 GHz to 18 GHz									
Reflection coefficient: on waveguide phase (with magnitude of reflection coefficient $\leq 0.1$ )	1- or 2-port devices	Six-ports & VANA	0	180	°	Connector	WR 42	1.64 to 180	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	18 GHz to 26.5 GHz									
Reflection coefficient: on waveguide phase (with magnitude of reflection coefficient $\leq 0.1$ )	1- or 2-port devices	Six-ports & VANA	0	180	°	Connector	WR 28	1.75 to 180	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	26.5 GHz to 40 GHz									
Reflection coefficient: on waveguide phase (with magnitude of reflection coefficient $\leq 0.1$ )	1- or 2-port devices	Six-ports & VANA	0	180	°	Connector	WR 22	3.17 to 180	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	33 GHz to 50 GHz									

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
Reflection coefficient: on waveguide phase (with magnitude of reflection coefficient $\leq 0.1$ )	1- or 2-port devices	Six-ports & VANA	0	180	°	Connector	WR 15	3.73 to 180	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	50 GHz to 75 GHz									
Reflection coefficient: on waveguide phase (with magnitude of reflection coefficient $\leq 0.1$ )	1- or 2-port devices	Six-ports & VANA	0	180	°	Connector	WR 10	7.59 to 180	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	75 GHz to 110 GHz									
Reflection coefficient: on waveguide phase (with magnitude of reflection coefficient $> 0.1$ )	1- or 2-port devices	Six-ports & VANA	0	180	°	Connector	WR 90	0.49 to 1.98	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	8.2 GHz to 12.4 GHz									
Reflection coefficient: on waveguide phase (with magnitude of reflection coefficient $> 0.1$ )	1- or 2-port devices	Six-ports & VANA	0	180	°	Connector	WR 62	0.72 to 2.04	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	12.4 GHz to 18 GHz									
Reflection coefficient: on waveguide phase (with magnitude of reflection coefficient $> 0.1$ )	1- or 2-port devices	Six-ports & VANA	0	180	°	Connector	WR 42	1.03 to 1.64	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	18 GHz to 26.5 GHz									



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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
Reflection coefficient: on waveguide phase (with magnitude of reflection coefficient > 0.1)	1- or 2-port devices	Six-ports & VANA	0	180	°	Connector	WR 28	1.20 to 1.75	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	26.5 GHz to 40 GHz									
Reflection coefficient: on waveguide phase (with magnitude of reflection coefficient > 0.1)	1- or 2-port devices	Six-ports & VANA	0	180	°	Connector	WR 22	1.88 to 3.17	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	33 GHz to 50 GHz									
Reflection coefficient: on waveguide phase (with magnitude of reflection coefficient > 0.1)	1- or 2-port devices	Six-ports & VANA	0	180	°	Connector	WR 15	2.72 to 3.73	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	50 GHz to 75 GHz									
Reflection coefficient: on waveguide phase (with magnitude of reflection coefficient > 0.1)	1- or 2-port devices	Six-ports & VANA	0	180	°	Connector	WR 10	4.12 to 7.59	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	75 GHz to 110 GHz									
Transmission coefficient: on waveguide magnitude	2-port devices	Six-ports & VANA	0	40	dB	Connector	WR 90	0.031 to 0.046	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	8.2 GHz to 12.4 GHz									
Transmission coefficient: on waveguide magnitude	2-port devices	Six-ports & VANA	0	40	dB	Connector	WR 62	0.031 to 0.046	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	12.4 GHz to 18 GHz									

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
Transmission coefficient: on waveguide magnitude	2-port devices	Six-ports & VANA	0	40	dB	Connector	WR 42	0.023 to 0.042	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	18 GHz to 26.5 GHz									
Transmission coefficient: on waveguide magnitude	2-port devices	Six-ports & VANA	0	40	dB	Connector	WR 28	0.023 to 0.042	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	26.5 GHz to 40 GHz									
Transmission coefficient: on waveguide magnitude	2-port devices	Six-ports & VANA	0	40	dB	Connector	WR 22	0.023 to 0.042	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	33 GHz to 50 GHz									
Transmission coefficient: on waveguide magnitude	2-port devices	Six-ports & VANA	0	40	dB	Connector	WR 15	0.042 to 0.081	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	50 GHz to 75 GHz									
Transmission coefficient: on waveguide magnitude	2-port devices	Six-ports & VANA	0	40	dB	Connector	WR 10	0.047 to 0.084	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	75 GHz to 110 GHz									
Transmission coefficient: on waveguide magnitude	2-port devices	Six-ports & VANA	40	50	dB	Connector	WR 90	0.046 to 0.072	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	8.2 GHz to 12.4 GHz									
Transmission coefficient: on waveguide magnitude	2-port devices	Six-ports & VANA	40	50	dB	Connector	WR 62	0.046 to 0.072	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	12.4 GHz to 18 GHz									
Transmission coefficient: on waveguide magnitude	2-port devices	Six-ports & VANA	40	50	dB	Connector	WR 42	0.042 to 0.070	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	18 GHz to 26.5 GHz									
Transmission coefficient: on waveguide magnitude	2-port devices	Six-ports & VANA	40	50	dB	Connector	WR 28	0.042 to 0.070	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	26.5 GHz to 40 GHz									

## Electricity and Magnetism, United States, NIST (National Institute of Standards and Technology)



Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
Transmission coefficient: on waveguide magnitude	2-port devices	Six-ports & VANA	40	50	dB	Connector	WR 22	0.042 to 0.070	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	33 GHz to 50 GHz									
Transmission coefficient: on waveguide magnitude	2-port devices	Six-ports & VANA	40	50	dB	Connector	WR 15	0.081 to 0.138	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	50 GHz to 75 GHz									
Transmission coefficient: on waveguide magnitude	2-port devices	Six-ports & VANA	40	50	dB	Connector	WR 10	0.084 to 0.140	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	75 GHz to 110 GHz									
Transmission coefficient: on waveguide phase	2-port devices	Six-ports & VANA	50	70	dB	Connector	WR 90	0.072 to 0.310	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	8.2 GHz to 12.4 GHz									
Transmission coefficient: on waveguide phase	2-port devices	Six-ports & VANA	50	70	dB	Connector	WR 62	0.072 to 0.311	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	12.4 GHz to 18 GHz									
Transmission coefficient: on waveguide phase	2-port devices	Six-ports & VANA	50	70	dB	Connector	WR 42	0.070 to 0.310	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	18 GHz to 26.5 GHz									
Transmission coefficient: on waveguide phase	2-port devices	Six-ports & VANA	50	70	dB	Connector	WR 28	0.070 to 0.310	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	26.5 GHz to 40 GHz									
Transmission coefficient: on waveguide phase	2-port devices	Six-ports & VANA	50	70	dB	Connector	WR 22	0.070 to 0.310	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	33 GHz to 50 GHz									
Transmission coefficient: on waveguide phase	2-port devices	Six-ports & VANA	50	70	dB	Connector	WR 15	0.138 to 0.620	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	50 GHz to 75 GHz									

## Electricity and Magnetism, United States, NIST (National Institute of Standards and Technology)



Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
Transmission coefficient: on waveguide phase	2-port devices	Six-ports & VANA	50	70	dB	Connector	WR 10	0.140 to 0.621	dB	2	95%	Yes		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	75 GHz to 110 GHz									
Transmission coefficient: on waveguide phase	2-port devices	Six-ports & VANA	0	180	°	Connector	WR 90	0.38	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	8.2 GHz to 12.4 GHz									
Transmission coefficient: on waveguide phase	2-port devices	Six-ports & VANA	0	180	°	Connector	WR 62	0.65	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	12.4 GHz to 18 GHz									
Transmission coefficient: on waveguide phase	2-port devices	Six-ports & VANA	0	180	°	Connector	WR 42	1.03	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	18 GHz to 26.5 GHz									
Transmission coefficient: on waveguide phase	2-port devices	Six-ports & VANA	0	180	°	Connector	WR 28	1.19	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	26.5 GHz to 40 GHz									
Transmission coefficient: on waveguide phase	2-port devices	Six-ports & VANA	0	180	°	Connector	WR 22	1.79	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	33 GHz to 50 GHz									
Transmission coefficient: on waveguide phase	2-port devices	Six-ports & VANA	0	180	°	Connector	WR 15	2.71	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	50 GHz to 75 GHz									
Transmission coefficient: on waveguide phase	2-port devices	Six-ports & VANA	0	180	°	Connector	WR 10	3.93	°	2	95%	No		Uncertainty listed is for a typical device	Approved on 29 March 2007	61290S
						Frequency	75 GHz to 110 GHz									
HF antenna parameter: antenna gain	Directive antennas	Extrapolation range	0	35	dB	Frequency	2 GHz to 30 GHz	0.07	dB	2	95%	No		Uncertainty listed is nominal	Approved on 29 March 2007	63100S

## Electricity and Magnetism, United States, NIST (National Institute of Standards and Technology)



Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty						Comments	Approval date	NMI Service Identifier
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Uncertainty Matrix			
HF antenna parameter: antenna gain	Directive antennas	Extrapolation range	0	35	dB	Frequency	30 GHz to 75 GHz	0.1	dB	2	95%	No		Uncertainty listed is nominal	Approved on 29 March 2007	63100S
HF antenna parameter: polarization	Directive antennas	Extrapolation range	-60	0	dB	Frequency	2 GHz to 75 GHz	0.03	dB/dB	2	95%	Yes		Uncertainty listed is nominal	Approved on 29 March 2007	63100S
HF antenna parameter: antenna gain	Directive antennas	Near-field range	20	60	dB	Frequency	2 GHz to 75 GHz	0.13	dB	2	95%	No		Uncertainty listed is nominal	Approved on 29 March 2007	63200S
HF antenna parameter: antenna polarization	Directive antennas	Near-field range	-60	0	dB	Frequency	2 GHz to 75 GHz	0.07	dB/dB	2	95%	Yes		Uncertainty listed is nominal	Approved on 29 March 2007	63200S
HF antenna parameter: antenna pattern	Directive antennas	Far-field range	-60	0	dB	Frequency	2 GHz to 75 GHz	0.03	dB/dB	2	95%	Yes		Uncertainty listed is nominal	Approved on 29 March 2007	63400S
HF field strength: electric and magnetic field strength	TEM cell	TEM cell	1	200	V/m	Frequency	10 kHz to 300 MHz	0.59	dB	2	95%	Yes		Uncertainty listed is nominal	Approved on 29 March 2007	64100S
HF field strength: electric and magnetic field strength	TEM cell	TEM cell	1	200	V/m	Frequency	10 kHz to 300 MHz	0.59	dB	2	95%	Yes		Uncertainty listed is nominal	Approved on 29 March 2007	64100S
HF field strength: electric and magnetic field strength	Directive waveguide	Anechoic chamber	1	150	V/m	Frequency	200 MHz to 450 MHz (open-ended waveguide)	0.61	dB	2	95%	Yes		Uncertainty listed is nominal	Approved on 29 March 2007	64300S
HF field strength: electric and magnetic field strength	Directive antennas	Anechoic chamber	1	200	V/m	Frequency	450 MHz to 40 GHz (pyramidal horn)	0.61	dB	2	95%	Yes		Uncertainty listed is nominal	Approved on 29 March 2007	64300S

**Electricity and Magnetism, United States, NIST (National Institute of Standards and Technology)****Uncertainty table: Matrix 1**

Capacitance, NIST Internal Identifier: 52130C

	50 Hz	80 Hz	100 Hz	160 Hz	200 Hz	300 Hz	400 Hz	600 Hz	800 Hz	1 kHz	1.6 kHz	2 kHz	3 kHz	4 kHz	6 kHz	8 kHz	10 kHz	12 kHz	16 kHz	20 kHz
10 pF	3.8	2.1	1.4	0.9	0.7	0.50	0.41	0.32	0.27	0.24	0.22	0.23	0.28	0.34	0.50	0.7	1.0	1.6	2.3	3.5
100 pF	1.6	1.0	0.8	0.6	0.51	0.41	0.35	0.28	0.24	0.21	0.19	0.20	0.24	0.29	0.40	0.54	0.7	1.1	1.5	2.4

The expanded uncertainties are expressed in  $\mu\text{F}/\text{F}$ .

**Electricity and Magnetism, United States, NIST (National Institute of Standards and Technology)****Uncertainty table: Matrix 2**

Capacitance, NIST Internal Identifier: 52110S

	1 kHz	10 kHz	50 kHz	100 kHz	500 kHz	1 MHz	2 MHz	3 MHz	4 MHz	5 MHz	6 MHz	7 MHz	8 MHz	9 MHz	10 MHz
1 pF	25	25	50	80	350	710	1600	2600	3800	5100	6600	8200	10000	12000	14000
10 pF	25	25	25	25	25	25	50	100	170	270	390	530	700	900	1100
100 pF	25	25	25	25	25	30	55	100	180	270	390	540	700	900	1100
1000 pF	25	25	25	25	25	25	55	100	180	270	390	530	700	900	1100

The expanded uncertainties are expressed in  $\mu\text{F}/\text{F}$ .

**Electricity and Magnetism, United States, NIST (National Institute of Standards and Technology)****Uncertainty table: Matrix 3**

Capacitance: dissipation factor, NIST Internal Identifier: 52110S

	1 kHz	10 kHz	50 kHz	100 kHz	500 kHz	1 MHz	2 MHz	3 MHz	4 MHz	5 MHz	6 MHz	7 MHz	8 MHz	9 MHz	10 MHz
1 pF	25	25	35	50	160	300	650	1100	1600	2100	2700	3400	4100	4900	5700
10 pF	22	22	22	23	24	28	46	76	120	170	240	310	400	500	610
100 pF	24	24	24	24	24	24	26	30	35	42	51	62	75	90	105
1000 pF	23	23	24	25	34	50	110	180	280	410	560	730	930	1200	1400

The expanded uncertainties are expressed in  $\mu\text{rad}$ .



**Electricity and Magnetism, United States, NIST (National Institute of Standards and Technology)****Uncertainty table: Matrix 4**

Capacitance, NIST Internal Identifier: 52110S

	100 Hz	1 kHz	10 kHz	100 kHz
10 nF	160	20	26	70
100 nF	220	40	160	80
1 $\mu$ F	260	50	220	180
10 $\mu$ F	260	60	230	200

The expanded uncertainties are expressed in  $\mu$ F/F.

**Electricity and Magnetism, United States, NIST (National Institute of Standards and Technology)****Uncertainty table: Matrix 5**

Capacitance: dissipation factor, NIST Internal Identifier: 52110S

	100 Hz	1 kHz	10 kHz	100 kHz
10 nF	200	16	20	50
100 nF	240	50	170	160
1 $\mu$ F	260	60	230	2000
10 $\mu$ F	260	180	270	2400

The expanded uncertainties are expressed in  $\mu$ rad.

**Electricity and Magnetism, United States, NIST (National Institute of Standards and Technology)****Uncertainty table: Matrix 6**

AC-DC transfer difference, NIST Internal Identifier: 53350C

	10 Hz	20 Hz	40 Hz	100 Hz	400 Hz	1 kHz	10 kHz	20 kHz	50 kHz	100 kHz
0.3 V	25	20	15	12	10	8	8	10	13	22
0.5 V	13	11	9	5	5	5	5	5	6	8
1 V	14	11	9	5	5	4	4	5	6	7
2 V	14	11	9	5	5	3	3	3	4	6
3 V	14	12	10	5	5	3	4	4	5	6
4 V	14	12	10	5	5	4	4	4	5	7
5 V	15	12	10	5	5	4	4	4	5	7
6 V	15	12	10	5	5	4	4	4	5	7
10 V	15	12	10	5	5	4	4	4	5	7
12 V	15	12	10	5	5	5	5	5	6	8
20 V	16	12	10	5	5	5	5	5	6	8
30 V	16	13	10	6	5	5	5	5	6	9
40 V	16	13	10	6	5	5	5	5	7	9
50 V	17	13	11	6	5	5	5	5	7	9
60 V	17	13	11	6	6	5	5	5	7	9
100 V	17	13	11	6	6	6	6	6	7	9
120 V	100	20	20	20	20	7	7	7	8	12
200 V	100	20	20	20	20	7	7	7	9	14
300 V	100	20	20	20	20	7	7	8	10	15
400 V	100	20	20	20	20	9	9	10	13	20
500 V	100	20	20	20	20	10	10	10	14	22
600 V	100	20	20	20	20	11	11	12	15	24
1000 V	100	20	20	20	20	16	17	17	22	35

The expanded uncertainties are expressed in  $\mu\text{V/V}$ .

**Electricity and Magnetism, United States, NIST (National Institute of Standards and Technology)****Uncertainty table: Matrix 7**

AC-DC transfer difference, NIST Internal Identifier: 53350C

	10 Hz	20 Hz	40 Hz	100 Hz	400 Hz	1 kHz	10 kHz	20 kHz	50 kHz	100 kHz
<b>0.3 V</b>	25	20	11	11	11	11	11	12	18	30
<b>0.5 V</b>	21	17	16	6	5	5	5	5	6	8
<b>1 V</b>	21	18	16	6	5	4	4	5	6	7
<b>2 V</b>	21	18	16	6	5	3	3	3	4	6
<b>3 V</b>	22	18	16	6	5	3	3	4	5	6
<b>4 V</b>	22	18	16	6	5	4	4	4	5	6
<b>5 V</b>	22	18	16	6	5	4	4	4	5	6
<b>6 V</b>	22	18	16	6	6	4	4	4	5	6
<b>10 V</b>	22	18	16	6	6	4	4	4	5	7
<b>12 V</b>	22	18	16	6	6	5	5	5	6	8
<b>20 V</b>	22	19	16	6	6	5	5	5	6	8
<b>30 V</b>	23	19	17	6	6	5	5	5	6	8
<b>40 V</b>	23	19	17	6	6	5	5	5	7	9
<b>50 V</b>	23	19	17	6	6	5	5	5	7	9
<b>60 V</b>	23	19	17	6	6	5	5	5	7	9
<b>100 V</b>	23	19	17	6	6	5	5	6	7	9
<b>120 V</b>	100	20	20	20	20	6	6	7	8	12
<b>200 V</b>	100	20	20	20	20	7	7	7	9	13
<b>300 V</b>	100	20	20	20	20	8	8	8	10	14
<b>400 V</b>	100	20	20	20	20	9	9	9	12	18
<b>500 V</b>	100	20	20	20	20	10	10	10	14	21
<b>600 V</b>	100	20	20	20	20	10	10	10	15	23
<b>1000 V</b>	100	20	20	20	20	16	16	17	23	34

The expanded uncertainties are expressed in  $\mu\text{V/V}$ .

**Electricity and Magnetism, United States, NIST (National Institute of Standards and Technology)****Uncertainty table: Matrix 8**

AC-DC transfer difference, NIST Internal Identifier: 53350C

	10 Hz	20 Hz	40 Hz	100 Hz	400 Hz	1 kHz	10 kHz	20 kHz	50 kHz	100 kHz
<b>0.3 V</b>	25	20	15	15	15	15	15	18	22	33
<b>0.5 V</b>	14	12	11	10	10	6	6	5	7	10
<b>1 V</b>	14	13	12	10	10	4	4	5	7	10
<b>2 V</b>	15	13	12	10	10	4	4	4	5	9
<b>3 V</b>	15	14	13	10	10	4	4	4	6	9
<b>4 V</b>	15	14	13	10	10	4	4	4	6	9
<b>5 V</b>	15	14	13	10	10	4	4	4	6	9
<b>6 V</b>	16	14	13	10	10	4	4	4	6	9
<b>10 V</b>	16	15	14	11	10	4	4	4	6	9
<b>12 V</b>	16	15	14	11	10	5	5	5	7	10
<b>20 V</b>	16	15	14	11	10	5	5	5	7	10
<b>30 V</b>	17	15	15	11	10	5	5	5	7	10
<b>40 V</b>	17	15	15	11	10	5	6	5	7	11
<b>50 V</b>	17	15	15	11	10	5	6	5	7	11
<b>60 V</b>	17	16	15	11	10	5	6	5	7	11
<b>100 V</b>	18	16	15	11	10	6	6	6	8	11
<b>120 V</b>	100	20	20	20	20	7	7	7	9	13
<b>200 V</b>	100	20	20	20	20	7	7	8	10	14
<b>300 V</b>	100	20	20	20	20	9	9	9	11	16
<b>400 V</b>	100	20	20	20	20	12	12	13	15	22
<b>500 V</b>	100	20	20	20	20	12	12	13	15	24
<b>600 V</b>	100	20	20	20	20	18	18	18	22	34
<b>1000 V</b>	100	20	20	20	20	23	23	24	31	46

The expanded uncertainties are expressed in  $\mu\text{V/V}$ .

**Electricity and Magnetism, United States, NIST (National Institute of Standards and Technology)****Uncertainty table: Matrix 9**

AC-DC transfer difference, NIST Internal Identifier: 53350C

	200 kHz	500 kHz	700 kHz	1 MHz
0.3 V	30	45	60	75
0.5 V	20	22	26	33
1 V	19	22	25	32
2 V	19	21	24	31
3 V	18	20	23	30
4 V	18	20	23	30
5 V	17	19	22	29
6 V	17	19	22	29
10 V	17	19	22	29
12 V	17	19	22	29
20 V	17	19	22	29
30 V	20	22	22	31
40 V	20	22	25	31
50 V	20	22	25	31
60 V	20	22	25	31
100 V	21	23	27	33

The expanded uncertainties are expressed in  $\mu\text{V/V}$ .

**Electricity and Magnetism, United States, NIST (National Institute of Standards and Technology)****Uncertainty table: Matrix 10**

AC-DC transfer difference, NIST Internal Identifier: 53350C

	200 kHz	500 kHz	700 kHz	1 MHz
0.3 V	70	100	150	170
0.5 V	20	22	26	33
1 V	19	22	25	32
2 V	19	21	24	31
3 V	18	20	23	30
4 V	18	20	23	30
5 V	17	19	22	29
6 V	17	19	22	29
10 V	17	19	22	29
12 V	17	19	22	29
20 V	17	19	22	29
30 V	20	22	22	31
40 V	20	22	25	31
50 V	20	22	25	31
60 V	20	22	25	31
100 V	21	23	27	33

The expanded uncertainties are expressed in  $\mu\text{V/V}$ .

**Electricity and Magnetism, United States, NIST (National Institute of Standards and Technology)****Uncertainty table: Matrix 11**

AC-DC transfer difference, NIST Internal Identifier: 53350C

	200 kHz	500 kHz	700 kHz	1 MHz
0.3 V	50	65	80	100
0.5 V	20	22	26	33
1 V	19	22	25	32
2 V	19	21	24	31
3 V	18	20	23	30
4 V	18	20	23	30
5 V	17	19	22	29
6 V	17	19	22	29
10 V	17	19	22	29
12 V	17	19	22	29
20 V	17	19	22	29
30 V	20	22	22	31
40 V	20	22	25	31
50 V	20	22	25	31
60 V	20	22	25	31
100 V	21	23	27	33

The expanded uncertainties are expressed in  $\mu\text{V/V}$ .



**Electricity and Magnetism, United States, NIST (National Institute of Standards and Technology)****Uncertainty table: Matrix 12**

AC-DC difference (current), NIST Internal Identifier: 53350C

	10 Hz	20 Hz	40 Hz	100 Hz	400 Hz	1 kHz	10 kHz	20 kHz	30 kHz	50 kHz	100 kHz
<b>1 mA</b>	40	30	25	25	25	25	25	25	25	30	35
<b>2.5 mA</b>	30	25	18	18	18	18	18	18	20	25	29
<b>5 mA</b>	22	18	11	11	11	11	11	11	15	27	38
<b>10 mA</b>	22	18	11	11	11	11	11	11	15	27	38
<b>15 mA</b>	22	18	11	11	11	11	11	11	15	27	38
<b>20 mA</b>	22	18	11	11	11	11	11	11	15	29	42
<b>30 mA</b>	22	18	11	11	11	11	11	11	15	30	45
<b>50 mA</b>	22	18	11	11	11	11	11	11	15	33	51
<b>100 mA</b>	24	20	12	12	12	12	12	12	17	39	60
<b>250 A</b>	28	23	14	14	14	14	14	14	19	43	67
<b>500 A</b>	30	25	15	15	15	15	15	15	20	47	74
<b>1 A</b>	34	28	17	17	17	17	17	17	24	54	83
<b>2 A</b>	40	33	20	20	20	20	20	20	26	59	92
<b>3 A</b>	48	40	24	24	24	24	24	24	31	69	106
<b>5 A</b>	58	48	29	29	29	29	29	29	38	78	117
<b>10 A</b>	74	62	37	37	37	37	37	37	54	99	144
<b>20 A</b>	110	92	55	55	55	55	55	55	79	124	168

The expanded uncertainties are expressed in  $\mu\text{A/A}$ .

**Electricity and Magnetism, United States, NIST (National Institute of Standards and Technology)****Uncertainty table: Matrix 13**

AC-DC difference (current), NIST Internal Identifier: 53350C

	1 kHz	10 kHz	20 kHz	30 kHz
30 A	202	251	266	314
50 A	251	329	361	442
80 A	310	428	488	-
100 A	373	499	-	-

The expanded uncertainties are expressed in  $\mu\text{A/A}$ .