Electricity and Magnetism, Hong Kong, China, SCL (Standards and Calibration Laboratory)

Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/ Independent Variable		Expanded Uncertainty						
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?**	**Matrix uncertainty**	**NMI Service Identifier**
DC voltage sources: single values	Solid state voltage standard	Direct comparison with standard	1	1	V			0.088	µV	2	95%	No		1
DC voltage sources: single values	Solid state voltage standard	Direct comparison with standard	1.018	1.018	V			0.090	µV	2	95%	No		2
DC voltage sources: single values	Solid state voltage standard	Direct comparison with standard	10	10	V			0.13	µV	2	95%	No		3
DC voltage sources: single values	Solid state voltage standard	Direct comparison with standard	1	1	V			0.44	µV	2	95%	No		4
DC voltage sources: single values	Solid state voltage standard	Direct comparison with standard	1.018	1.018	V			0.44	µV	2	95%	No		5
DC voltage sources: single values	Solid state voltage standard	Direct comparison with standard	10	10	V			2.4	µV	2	95%	No		6
DC voltage sources: low values (<= 10 V)	DC voltage source, multifunction calibrator	Comparison with standard via DCC potentiometer	0	20	mV			0.12	µV	2	95%	No		7
DC voltage sources: low values (<= 10 V)	DC voltage source, multifunction calibrator	Comparison with standard via DCC potentiometer	20	200	mV			0.13 to 0.18	µV	2	95%	No		8

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/ Independent Variable		Expanded Uncertainty						
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?**	**Matrix uncertainty**	**NMI Service Identifier**
DC voltage sources: low values (<= 10 V)	DC voltage source, multifunction calibrator	Comparison with standard via DCC potentiometer	200	2000	mV			0.26 to 1.3	µV	2	95%	No		9
DC voltage sources: low values (<= 10 V)	DC voltage source, multifunction calibrator	Comparison with standard via resistive divider	2	10	V			1.5 to 7.5	µV	2	95%	No		10
DC voltage sources: intermediate values (>10 V to 1100 V)	DC voltage source, multifunction calibrator	Comparison with standard via resistive divider	10	1000	V			7.6 to 800	µV	2	95%	No		11
DC voltage ratios: up to 1100 V	Resistive dividers	Comparison with reference divider	0.1	1		Input voltage	1 V to 100 V	0.87	µV/V	2	95%	Yes		12
DC voltage ratios: up to 1100 V	Resistive dividers	Comparison with reference divider	0.01	0.1		Input voltage	1 V to 100 V	0.82	µV/V	2	95%	Yes		13
DC voltage ratios: up to 1100 V	Resistive dividers	Comparison with reference divider	0.001	0.01		Input voltage	1 V to 100 V	0.95	µV/V	2	95%	Yes		14
DC voltage ratios: up to 1100 V	Resistive dividers	Comparison with reference divider	1E-04	1E-03		Input voltage	1 V to 100 V	0.9	µV/V	2	95%	Yes		15
DC voltage ratios: up to 1100 V	Resistive dividers	Comparison with reference divider	1E-05	1E-04		Input voltage	1 V to 100 V	0.9	µV/V	2	95%	Yes		16
DC resistance standards and sources: low values (<= 1 Ω)	Fixed resistor	DCC bridge	100	100	mΩ	Maximum current	100 mA	94	nΩ	2	95%	No		17

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/ Independent Variable		Expanded Uncertainty						
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?**	**Matrix uncertainty**	**NMI Service Identifier**
DC resistance standards and sources: low values (<= 1 Ω)	Fixed resistor, resistance box	DCC bridge	0.1	1	Ω	Maximum power dissipation	10 mW	0.14 to 1.4	μΩ	2	95%	No		18
DC resistance standards and sources: low values (<= 1 Ω)	Fixed resistor	DCC bridge	1	1	Ω	Maximum power dissipation	10 mW	0.28	μΩ	2	95%	No		19
DC resistance standards and sources: intermediate values (> 1 Ω to 1 MΩ)	Fixed resistor	DCC bridge	10	10	Ω	Maximum power dissipation	10 mW	2.0	μΩ	2	95%	No		20
DC resistance standards and sources: intermediate values (> 1 Ω to 1 MΩ)	Fixed resistor	DCC bridge	100	100	Ω	Maximum power dissipation	10 mW	30	μΩ	2	95%	No		21
DC resistance standards and sources: intermediate values (> 1 Ω to 1 MΩ)	Fixed resistor	DCC bridge	1	1	kΩ	Maximum power dissipation	10 mW	0.14	mΩ	2	95%	No		22
DC resistance standards and sources: intermediate values (> 1 Ω to 1 MΩ)	Fixed resistor	DCC bridge	10	10	kΩ	Maximum power dissipation	10 mW	1.7	mΩ	2	95%	No		23

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/ Independent Variable		Expanded Uncertainty						
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?**	**Matrix uncertainty**	**NMI Service Identifier**
DC resistance standards and sources: intermediate values (> 1 Ω to 1 MΩ)	Fixed resistor	DCC bridge	100	100	kΩ	Maximum power dissipation	10 mW	34	mΩ	2	95%	No		24
DC resistance standards and sources: intermediate values (> 1 Ω to 1 MΩ)	Fixed resistor	Kelvin ratio bridge	1	1	MΩ	Maximum power dissipation	10 mW	0.60	Ω	2	95%	No		25
DC resistance standards and sources: intermediate values (> 1 Ω to 1 MΩ)	Fixed resistor, resistance box	DCC bridge	1	10	Ω	Maximum power dissipation	10 mW	0.46 to 4.6	μΩ	2	95%	No		26
DC resistance standards and sources: intermediate values (> 1 Ω to 1 MΩ)	Fixed resistor, resistance box	DCC bridge	10	100	Ω	Maximum power dissipation	10 mW	4.2 to 42	μΩ	2	95%	No		27
DC resistance standards and sources: intermediate values (> 1 Ω to 1 MΩ)	Fixed resistor, resistance box	DCC bridge	100	1000	Ω	Maximum power dissipation	10 mW	46 to 460	μΩ	2	95%	No		28

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/ Independent Variable		Expanded Uncertainty						
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?**	**Matrix uncertainty**	**NMI Service Identifier**
DC resistance standards and sources: intermediate values (> 1 Ω to 1 MΩ)	Fixed resistor, resistance box	Kelvin ratio bridge	0.001	1	MΩ	Maximum power dissipation	10 mW	6.8E-03 to 6.8	Ω	2	95%	No		29
DC resistance standards and sources: higher values (> 1 MΩ)	Fixed resistor	Kelvin ratio bridge	10	10	MΩ	Maximum voltage	100 V	6.6	Ω	2	95%	No		30
DC resistance standards and sources: higher values (> 1 MΩ)	Fixed resistor	Kelvin ratio bridge	100	100	MΩ	Maximum voltage	100 V	0.34	kΩ	2	95%	No		31
DC resistance standards and sources: higher values (> 1 MΩ)	Fixed resistor, resistance box	Kelvin ratio bridge	1	10	MΩ	Maximum voltage	100 V	6.8 to 68	Ω	2	95%	No		32
DC resistance standards and sources: higher values (> 1 MΩ)	Fixed resistor, resistance box	Kelvin ratio bridge	10	100	MΩ	Maximum voltage	100 V	68 to 680	Ω	2	95%	No		33
DC resistance standards and sources: higher values (> 1 MΩ)	Fixed resistor, resistance box	Modified Wheatstone bridge	0.1	10	GΩ	Maximum voltage	1000 V	4.6 to 460	kΩ	2	95%	No		34

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/ Independent Variable		Expanded Uncertainty						
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?**	**Matrix uncertainty**	**NMI Service Identifier**
DC resistance standards and sources: higher values (> 1 MΩ)	Fixed resistor, resistance box	Modified Wheatstone bridge	10	100	GΩ	Maximum voltage	1000 V	0.78 to 7.8	MΩ	2	95%	No		35
DC resistance standards and sources: higher values (> 1 MΩ)	Fixed resistor, resistance box	Modified Wheatstone bridge	100	1000	GΩ	Maximum voltage	1000 V	57 to 570	MΩ	2	95%	No		36
DC resistance standards and sources: standards for high current	DC shunt	DCC bridge	1	1	mΩ	Maximum current	100 A	3.1	nΩ	2	95%	No		37
DC resistance standards and sources: standards for high current	DC shunt	DCC bridge	10	10	mΩ	Maximum current	30 A	19	nΩ	2	95%	No		38
DC resistance standards and sources: standards for high current	DC shunt	DCC bridge	100	100	mΩ	Maximum current	10 A	150	nΩ	2	95%	No		39
DC resistance standards and sources: standards for high current	DC shunt	DCC bridge	0.1	1	mΩ	Maximum current	100 A	0.39 to 3.9	nΩ	2	95%	No		40
DC resistance standards and sources: standards for high current	DC shunt	DCC bridge	1	10	mΩ	Maximum current	100 A at 1 mΩ to 30 A at 10 mΩ	3.9 to 19	nΩ	2	95%	No		41

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/ Independent Variable		Expanded Uncertainty						
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?**	**Matrix uncertainty**	**NMI Service Identifier**
DC resistance standards and sources: standards for high current	DC shunt	DCC bridge	10	100	mΩ	Maximum current	30 A at 10 mΩ to 10 A at 100 mΩ	19 to 150	nΩ	2	95%	No		42
DC current sources: low values (<= 0.1 mA)	Current generator, multifunction calibrator	Volt drop across shunt	0.1	1	µA			0.89 to 3.2	pA	2	95%	No		43
DC current sources: low values (<= 0.1 mA)	Current generator, multifunction calibrator	Volt drop across shunt	1	10	µA			2.2 to 9.8	pA	2	95%	No		44
DC current sources: low values (<= 0.1 mA)	Current generator, multifunction calibrator	Volt drop across shunt	10	100	µA			18 to 90	pA	2	95%	No		45
DC current sources: intermediate values (> 0.1 mA to 20 A)	Current generator, multifunction calibrator	Volt drop across shunt	0.1	1	mA			0.18 to 0.90	nA	2	95%	No		46
DC current sources: intermediate values (> 0.1 mA to 20 A)	Current generator, multifunction calibrator	Volt drop across shunt	1	10	mA			1.8 to 9.0	nA	2	95%	No		47

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/ Independent Variable		Expanded Uncertainty						
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?**	**Matrix uncertainty**	**NMI Service Identifier**
DC current sources: intermediate values (> 0.1 mA to 20 A)	Current generator, multifunction calibrator	Volt drop across shunt	10	100	mA			18 to 200	nA	2	95%	No		48
DC current sources: intermediate values (> 0.1 mA to 20 A)	Current generator, multifunction calibrator	Volt drop across shunt	0.1	1	A			0.59 to 5.9	µA	2	95%	No		49
DC current sources: intermediate values (> 0.1 mA to 20 A)	Current generator	Volt drop across shunt	1	10	A			2.9 to 26	µA	2	95%	No		50
DC current sources: high values (> 20 A to 100 A)	Current generator	Volt drop across shunt	10	30	A			35 to 130	µA	2	95%	No		51
DC current sources: high values (> 20 A to 100 A)	Current generator	Volt drop across shunt	30	100	A			0.60 to 1.7	mA	2	95%	No		52
Capacitance for low loss capacitors	Standard capacitor	Substitution	0.01	1000	nF	Frequency	400 Hz to 10 kHz	5E-05 to 350	pF	2	95%	No	Matrix 1	53
Capacitance for low loss capacitors	Standard capacitor	Direct measurement	0.01	1110	nF	Frequency	50 Hz to 10 kHz	0.001 to 2200	pF	2	95%	No	Matrix 2	54

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/ Independent Variable		Expanded Uncertainty						
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?	Matrix uncertainty	NMI Service Identifier
Self inductance, low values (< 1 mH)	Fixed inductor	Substitution	100	100	µH	Frequency	400 Hz to 10 kHz	0.000014 to 0.000027	mH	2	95%	No	Matrix 3	55
Self inductance, intermediate values (>= 1 mH to 1 H)	Fixed inductor	Substitution	1	1000	mH	Frequency	400 Hz to 10 kHz	0.00018 to 0.14	mH	2	95%	No	Matrix 3	56
Self inductance, low values (< 1 mH)	Fixed inductor	Direct measurement	0.1	< 1	mH	Frequency	400 Hz to 10 kHz	0.00005 to 0.0025	mH	2	95%	No	Matrix 4	57
Self inductance, intermediate values (>=1 mH to 1 H)	Fixed inductor	Direct measurement	1	1000	mH	Frequency	400 Hz to 10 kHz	0.0005 to 2.5	mH	2	95%	No	Matrix 4	58
AC/DC voltage transfer: AC/DC transfer difference at medium voltage	AC/DC transfer standard	Comparison	0.5	5	V	Frequency	20 Hz to 1 MHz	9 to 160	µV/V	2	95%	Yes	Matrix 5	59
AC/DC voltage transfer: AC/DC transfer difference at higher voltage	AC/DC transfer standard	Comparison	10	1000	V	Frequency	20 Hz to 1 MHz	9 to 120	µV/V	2	95%	Yes	Matrix 5	60
AC voltage up to 1000 V: sources	Multifunction calibrator	Comparison with scaled down standard voltage	0.1	200	mV	Frequency	1 kHz to 100 kHz	0.0005 to 0.018	mV	2	95%	No	Matrix 6	61
AC voltage up to 1000 V: sources	Multifunction calibrator	AC/DC transfer	0.5	1000	V	Frequency	20 Hz to 1 MHz	0.008 to 77	mV	2	95%	No	Matrix 6	62

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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?	Matrix uncertainty	NMI Service Identifier
AC voltage up to 1000 V: sources	Multifunction calibrator	AC/DC transfer	0.2	1000	V	Frequency	20 Hz to 50 kHz	0.014 to 200	mV	2	95%	No	Matrix 7	63
AC voltage up to 1000 V: sources	Multifunction calibrator	Comparison with scaled down standard voltage	0.1	250	mV	Frequency	20 Hz to 100 kHz	0.0005 to 0.038	mV	2	95%	No	Matrix 7	64
AC voltage ratio: real component	Inductive voltage divider	Comparison with reference IVD	0	1	V/V	Frequency	400 Hz, 1 kHz	2.6E-07 of input	V/V	2	95%	No		65
AC voltage ratio: imaginary component	Inductive voltage divider	Comparison with reference IVD	0	1	V/V	Frequency	400 Hz, 1 kHz	27E-08 of input	V/V	2	95%	No		66
AC voltage ratio: real component	Inductive voltage divider	Comparison with reference IVD	0	1	V/V	Frequency	10 kHz	2.2E-06 of input	V/V	2	95%	No		67
AC voltage ratio: imaginary component	Inductive voltage divider	Comparison with reference IVD	0	1	V/V	Frequency	10 kHz	300E-08 of input	V/V	2	95%	No		68
AC current up to 100 A: sources	Multifunction calibrator, transconductance amplifier	AC/DC transfer	0.005	20	A	Frequency	40 Hz to 10 kHz	0.00013 to 0.1	mA	2	95%	No	Matrix 8	69
AC current up to 100 A: sources	Multifunction calibrator, transconductance amplifier	AC/DC transfer	0.0025	20	A	Frequency	20 Hz to 10 kHz	0.00002 5 to 6.4	mA	2	95%	No	Matrix 9	70

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AC current up to 100 A: sources	Multifunction calibrator, transconductance amplifier	Step down using current transformer	1	100	A	Frequency	45 Hz to 60 Hz	0.077 to 7.7	mA	2	95%	No	Matrix 9	71
AC power: single phase at frequencies <= 400 Hz	Power meter, power converter, wattmeter	Comparison with reference wattmeter	37.5	6000	W	Maximum voltage	300 V	0.0075 to 1.2	W	2	95%	No		72
						Maximum current	20 A							
						Power factor	1							
						Frequency	50 Hz, 60 Hz							
AC power: single phase at frequencies <= 400 Hz	Power meter, power converter, wattmeter	Comparison with reference wattmeter	37.5	6000	W	Maximum voltage	300 V	0.0079 to 1.3	W	2	95%	No		73
						Maximum current	20 A							
						Power factor	0.5 lead or lag							
						Frequency	50 Hz, 60 Hz							
AC power: single phase at frequencies <= 400 Hz	Power meter, power converter, wattmeter	Comparison with reference wattmeter	37.5	6000	W	Maximum voltage	300 V	0.019 to 3	W	2	95%	No		74
						Maximum current	20 A							
						Power factor	from 1 to 0.5 lead or lag							
						Frequency	50 Hz, 60 Hz							
AC power: single phase at frequencies <= 400 Hz	Power meter, power converter, wattmeter	Comparison with reference wattmeter	37.5	6000	W	Maximum voltage	300 V	0.0075 to 1.2	W	2	95%	No		75

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/ Independent Variable		Expanded Uncertainty						
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?**	**Matrix uncertainty**	**NMI Service Identifier**
						Maximum current	20 A							
						Power factor	1							
						Frequency	400 Hz							
AC power: single phase at frequencies <= 400 Hz	Power meter, power converter, wattmeter	Comparison with reference wattmeter	37.5	6000	W	Maximum voltage	300 V	0.014 to 2.2	W	2	95%	No		76
						Maximum current	20 A							
						Power factor	0.5 lead or lag							
						Frequency	400 Hz							
AC power: single phase at frequencies <= 400 Hz	Power meter, power converter, wattmeter	Comparison with reference wattmeter	37.5	6000	W	Maximum voltage	300 V	0.019 to 3	W	2	95%	No		77
						Maximum current	20 A							
						Power factor	from 1 to 0.5 lead or lag							
						Frequency	400 Hz							
High DC voltage: high voltage sources	DC kilovolt source	Direct measurement with reference system	1	30	kV			0.042 to 1.3	V	2	95%	No		78
High DC voltage: high voltage meters	DC kilovolt meter	Comparison with reference system	1	30	kV			0.042 to 1.3	V	2	95%	No		79
Phase angle: meters	Phasemeter	Comparison with standard phase	0	360	°	Voltage	0.1 V to 100 V with equal input levels	0.02	°	2	95%	No		80
						Frequency	40 Hz to 1 kHz							

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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?**	**Matrix uncertainty**	**NMI Service Identifier**
Phase angle: meters	Phasemeter	Comparison with standard phase	0	360	°	Voltage	0.1 V to 100 V with equal input levels	0.04	°	2	95%	No		81
						Frequency	1 kHz to 6.25 kHz							
Phase angle: meters	Phasemeter	Comparison with standard phase	0	360	°	Voltage	0.1 V to 100 V with equal input levels	0.06	°	2	95%	No		82
						Frequency	6.25 kHz to 50 kHz							
Phase angle: meters	Phasemeter	Comparison with standard phase	0	360	°	Voltage	0.1 V to 100 V with equal input levels	0.10	°	2	95%	No		83
						Frequency	50 kHz to 100 kHz							
RF power: absolute power on coaxials	Power meters, 50 Ω, type-N, VRC magnitude < 0.1	Power meter with sensors and resistive splitter	0.01	100	mW	Frequency	0.3 MHz to 30 MHz	40	mW/W	2	95%	Yes		84
RF power: absolute power on coaxials	Power meters, 50 Ω, type-N, VRC magnitude < 0.1	Power meter with sensors and resistive splitter	0.01	100	mW	Frequency	0.03 GHz to 3 GHz	20	mW/W	2	95%	Yes		85
RF power: absolute power on coaxials	Power meters, 50 Ω, type-N, VRC magnitude < 0.1	Power meter with sensors and resistive splitter	0.01	100	mW	Frequency	3 GHz to 18 GHz	43	mW/W	2	95%	Yes		86
RF power: absolute power on coaxials	Power meters, 50 Ω, type-N, VRC magnitude < 0.1	Power meter with sensors and resistive splitter	0.01	10	µW	Frequency	10 MHz to 30 MHz	40	mW/W	2	95%	Yes		87

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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?**	**Matrix uncertainty**	**NMI Service Identifier**
RF power: absolute power on coaxials	Power meters, 50 Ω, type-N, VRC magnitude < 0.1	Power meter with sensors and resistive splitter	0.01	10	µW	Frequency	0.03 GHz to 3 GHz	25	mW/W	2	95%	Yes		88
RF power: absolute power on coaxials	Power meters, 50 Ω, type-N, VRC magnitude < 0.1	Power meter with sensors and resistive splitter	0.01	10	µW	Frequency	3 GHz to 18 GHz	54	mW/W	2	95%	Yes		89
RF power: absolute power on coaxials	Power meters, 50 Ω, type-N, VRC magnitude < 0.1. The absolute power in dB makes reference to 1 mW	Signal analyser and resistive splitter	-100	20	dB (reference: 1 mW)	Frequency	100 Hz to 2.65 GHz	1	dB	2	95%	No		90
RF power: absolute power on coaxials	Power sources, 50 Ω, type-N, VRC magnitude < 0.2	Power meter with sensors	0.01	100	mW	Frequency	0.3 MHz to 30 MHz	40	mW/W	2	95%	Yes		91
RF power: absolute power on coaxials	Power sources, 50 Ω, type-N, VRC magnitude < 0.2	Power meter with sensors	0.01	100	mW	Frequency	0.03 GHz to 3 GHz	25	mW/W	2	95%	Yes		92
RF power: absolute power on coaxials	Power sources, 50 Ω, type-N, VRC magnitude < 0.2	Power meter with sensors	0.01	100	mW	Frequency	3 GHz to 18 GHz	50	mW/W	2	95%	Yes		93

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/ Independent Variable		Expanded Uncertainty						
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?**	**Matrix uncertainty**	**NMI Service Identifier**
RF power: absolute power on coaxials	Power sources, 50 Ω, type-N, VRC magnitude < 0.2	Power meter with sensors	0.01	10	µW	Frequency	10 MHz to 30 MHz	77	mW/W	2	95%	Yes		94
RF power: absolute power on coaxials	Power sources, 50 Ω, type-N, VRC magnitude < 0.2	Power meter with sensors	0.01	10	µW	Frequency	0.03 GHz to 3 GHz	35	mW/W	2	95%	Yes		95
RF power: absolute power on coaxials	Power sources, 50 Ω, type-N, VRC magnitude < 0.2	Power meter with sensors	0.01	10	µW	Frequency	3 GHz to 18 GHz	77	mW/W	2	95%	Yes		96
RF power: absolute power on coaxials	Power sources, 50 Ω, type-N, VRC magnitude < 0.2. The absolute power in dB makes reference to 1 mW	Signal analyser	-100	20	dB	Frequency	100 Hz to 2.65 GHz	1	dB	2	95%	No		97
RF power: effective efficiency on coaxials	Thermistor sensors: 50 Ω, type-N and PC7	DC substitution in microcalorimeter	0.9	1		Frequency	10 MHz to 30 MHz	0.009		2	95%	No		98
						Power level	10 mW							
RF power: effective efficiency on coaxials	Thermistor sensors: 50 Ω, type-N and PC7	DC substitution in microcalorimeter	0.9	1		Frequency	0.03 GHz to 3 GHz	0.004		2	95%	No		99

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/ Independent Variable		Expanded Uncertainty						
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?**	**Matrix uncertainty**	**NMI Service Identifier**
						Power level	10 mW							
RF power: effective efficiency on coaxials	Thermistor sensors: 50 Ω, type-N and PC7	DC substitution in microcalorimeter	0.9	1		Frequency	3 GHz to 18 GHz	0.019		2	95%	No		100
						Power level	10 mW							
RF power: calibration factor on coaxials	Power sensors, 50 Ω, type-N, VRC magnitude < 0.1	Power comparison using resistive splitter	0.8	1		Frequency	0.3 MHz to 30 MHz	0.03		2	95%	No		101
						Power level	10 mW							
RF power: calibration factor on coaxials	Power sensors, 50 Ω, type-N, VRC magnitude < 0.1	Power comparison using resistive splitter	0.8	1		Frequency	0.03 GHz to 3 GHz	0.01		2	95%	No		102
						Power level	10 mW							
RF power: calibration factor on coaxials	Power sensors, 50 Ω, type-N, VRC magnitude < 0.1	Power comparison using resistive splitter	0.8	1		Frequency	3 GHz to 18 GHz	0.033		2	95%	No		103
						Power level	10 mW							
RF power: calibration factor on coaxials	Power sensors, 50 Ω, type-N, VRC magnitude < 0.1	Power comparison using resistive splitter	0.8	1		Frequency	10 MHz to 30 MHz	0.02		2	95%	No		104
						Power level	10 µW							

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/ Independent Variable		Expanded Uncertainty						
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?**	**Matrix uncertainty**	**NMI Service Identifier**
RF power: calibration factor on coaxials	Power sensors, 50 Ω, type-N, VRC magnitude < 0.1	Power comparison using resistive splitter	0.8	1		Frequency	0.03 GHz to 3 GHz	0.018		2	95%	No		105
						Power level	10 µW							
RF power: calibration factor on coaxials	Power sensors, 50 Ω, type-N, VRC magnitude < 0.1	Power comparison using resistive splitter	0.8	1		Frequency	3 GHz to 18 GHz	0.039		2	95%	No		106
						Power level	10 µW							
Scalar RF attenuation on coaxials: magnitude, *A*	Passive device, step attenuator, 50 Ω, type-N, VRC magnitude < 0.02	IF substitution at 30 MHz	0	50	dB	Frequency	30 MHz	(0.009 + 0.0006 *A*), *A* in dB	dB	2	95%	No		107
Scalar RF attenuation on coaxials: magnitude, *A*	Passive device, step attenuator, 50 Ω, type-N, VRC magnitude < 0.02	IF substitution at 30 MHz	0	50	dB	Frequency	30 MHz to 16 GHz	0.05	dB	2	95%	No		108
Scalar RF attenuation on coaxials: magnitude, *A*	Passive device, fixed and step attenuator, 50 Ω, type-N and PC7	Network analyser	0	20	dB	Frequency	0.3 MHz to 18 GHz	(0.039 + 0.0028 *A*), *A* in dB	dB	2	95%	No		109
Scalar RF attenuation on coaxials: magnitude, *A*	Passive device, fixed and step attenuator, 50 Ω, type-N and PC7	Network analyser	20	40	dB	Frequency	0.3 MHz to 18 GHz	(0.0049 *A* - 0.055), *A* in dB	dB	2	95%	No		110

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/ Independent Variable		Expanded Uncertainty						
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?**	**Matrix uncertainty**	**NMI Service Identifier**
Scalar RF attenuation on coaxials: magnitude, *A*	Passive device, fixed and step attenuator, 50 Ω, type-N and PC7	Network analyser	40	60	dB	Frequency	0.3 MHz to 18 GHz	(0.026*A* - 0.955), *A* in dB	dB	2	95%	No		111
Scalar RF attenuation on coaxials: magnitude, *A*	Passive device, fixed and step attenuator, 50 Ω, type-N and PC7	Network analyser	60	80	dB	Frequency	0.3 MHz to 18 GHz	(0.33*A* - 19.3), *A* in dB	dB	2	95%	No		112
Reflection coefficient on coaxials: magnitude, Γ	Passive device, one-port and two-port, 50 Ω, type-N	Network analyser	0	1		Frequency	0.3 MHz to 45 MHz	(0.008 + 0.038Γ)		2	95%	No		113
Reflection coefficient on coaxials: magnitude, Γ	Passive device, one-port and two-port, 50 Ω, type-N	Network analyser	0	1		Frequency	0.045 GHz to 2 GHz	(0.0066 + 0.0104Γ)		2	95%	No		114
Reflection coefficient on coaxials: magnitude, Γ	Passive device, one-port and two-port, 50 Ω, type-N	Network analyser	0	1		Frequency	2 GHz to 8 GHz	(0.011 + 0.021Γ)		2	95%	No		115
Reflection coefficient on coaxials: magnitude, Γ	Passive device, one-port and two-port, 50 Ω, type-N	Network analyser	0	1		Frequency	8 GHz to 18 GHz	(0.020 + 0.034Γ)		2	95%	No		116

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/ Independent Variable		Expanded Uncertainty						
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?**	**Matrix uncertainty**	**NMI Service Identifier**
Reflection coefficient on coaxials: magnitude, Γ	Passive device, one-port and two-port, 50 Ω, PC7	Network analyser	0	1		Frequency	0.045 GHz to 2 GHz	$(0.004 + 0.008\Gamma)$		2	95%	No		117
Reflection coefficient on coaxials: magnitude, Γ	Passive device, one-port and two-port, 50 Ω, PC7	Network analyser	0	1		Frequency	2 GHz to 8 GHz	$(0.004 + 0.004\Gamma)$		2	95%	No		118
Reflection coefficient on coaxials: magnitude, Γ	Passive device, one-port and two-port, 50 W, PC7	Network analyser	0	1		Frequency	8 GHz to 18 GHz	$(0.008 + 0.004\Gamma)$		2	95%	No		119
Pulse amplitude, *a*	Oscilloscope	Oscilloscope calibrator	4.0E+01	4.0E+07	μV	Waveform	Square wave	$(3 + 0.0032a)$, *a* in	μV	2	95%	No		120
						Frequency	1 kHz							
Pulse time parameters: period, *T*	Oscilloscope	Oscilloscope calibrator	5.0E-10	5	s	Waveform	triangular pulse	$0.0006T$, *T* in s	s	2	95%	No		121
						Pulse amplitude	0.1 V to 1 V							
Pulse time parameters: risetime, τ	Pulse generator, 50 Ω	Calibrated oscilloscope	3	10	ns	Pulse amplitude	0.1 V to 1 V	0.023τ, τ in ns	ns	2	95%	No		122
HF signal: modulation, AM depth *M*	Signal generator and modulation meter, 50 Ω	Signal analyser or modulation meter	0.01	0.99		Carrier frequency	150 kHz to 1.3 GHz	$M \cdot Q[0.013, 1.16h]$		2	95%	No		123

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/ Independent Variable		Expanded Uncertainty						
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?**	**Matrix uncertainty**	**NMI Service Identifier**
						Modulating frequency	100 Hz to 200 kHz							
						Voltage ratio of harmonic against modulating signal, *h*	0 to 0.1							
Signal: modulation, FM deviation *d*	Signal generator and modulation meter, 50 Ω	Signal analyser or modulation meter	0.1	400	kHz	Carrier frequency	150 kHz to 1.3 GHz	0.008*d*, *d* in kHz	kHz	2	95%	No		124
						Modulating frequency	100 Hz to 200 kHz							
RF voltage sources	RF generator, 50 Ω, type-N	Power meter with sensors	0.023	2.2	V	Frequency	0.3 MHz to 1 GHz	32	mV/V	2	95%	Yes		125
RF voltage meter	RF voltmeter, 50 Ω, type-N	Power meter with sensors	0.023	2.2	V	Frequency	0.3 MHz to 1 GHz	32	mV/V	2	95%	Yes		126

Hong Kong, China, SCL (Standards and Calibration Laboratory)

Uncertainty matrix: Matrix 1

Capacitance for low loss capacitor. Internal identifier: 53

	400 Hz	1 kHz	10 kHz
10 pF	0.00005	0.00005	0.00008
100 pF	0.0005	0.0005	0.00053
1000 pF	0.005	0.005	0.0053
0.01 µF	0.77	0.66	2.3
0.1 µF	7.7	6.6	23
1 µF	99	84	350

The expanded uncertainties given in this table are expressed in pF.

Hong Kong, China, SCL (Standards and Calibration Laboratory)

Uncertainty matrix: Matrix 2
Capacitance for low loss capacitor. Internal identifier: 54

	50 Hz to 100 Hz	100 Hz to 1 kHz	1 kHz to 10 kHz
10 pF to 100 pF	0.01 to 0.1	0.001 to 0.01	0.002 to 0.02
100 pF to 50 nF	0.01 to 5	0.01 to 5	0.025 to 13
50 nF to 1110 nF	5 to 110	5 to 110	100 to 2200

The expanded uncertainties given in this table are expressed in pF.

Hong Kong, China, SCL (Standards and Calibration Laboratory)

Uncertainty matrix: Matrix 3
Self inductance. Internal identifier: 55 and 56

	400 Hz	1 kHz	10 kHz
100 µH	0.00002	0.000014	0.000027
1 mH	0.00020	0.00018	0.00027
10 mH	0.0014	0.0014	0.0027
100 mH	0.014	0.014	0.12
1 H	0.14	0.14	-

The expanded uncertainties given in this table are expressed in mH.

Hong Kong, China, SCL (Standards and Calibration Laboratory)

Uncertainty matrix: Matrix 4
Self inductance. Internal identifier: 57 and 58

	400 Hz	1 kHz	10 kHz
0.1 mH to < 1 mH	0.0001 to 0.001	0.00005 to 0.0005	0.00025 to 0.0025
1 mH to 1000 mH	0.0005 to 0.5	0.0005 to 0.5	0.0025 to 2.5

The expanded uncertainties given in this table are expressed in mH.

Hong Kong, China, SCL (Standards and Calibration Laboratory)

Uncertainty matrix: Matrix 5

AC/DC voltage transfer. Internal identifier: 59 and 60

	20 Hz	40 Hz	1 kHz	10 kHz	20 kHz	30 kHz	50 kHz	100 kHz	200 kHz	300 kHz	500 kHz	1 MHz
0.5 V	12	11	11	10	13	-	12	27	-	56	69	160
1 V	10	9	9	9	10	-	11	17	-	39	56	160
2 V	10	9	9	9	9	-	9	14	-	28	34	120
4 V	-	-	-	-	-	-	-	-	-	-	-	-
5 V	11	10	10	10	10	-	10	14	-	25	29	120
10 V	11	9	9	9	9	-	9	14	-	24	29	120
20 V	12	10	9	10	10	-	10	14	-	25	29	120
40 V	-	-	-	-	-	-	-	-	-	-	-	-
50 V	11	11	11	11	11	-	11	16	-	-	-	-
100 V	11	11	10	10	10	10	10	16	27	-	-	-
200 V	13	12	11	12	15	17	20	36	-	-	-	-
400 V	-	-	-	-	-	-	-	-	-	-	-	-
500 V	17	16	15	16	23	28	45	73	-	-	-	-
700 V	-	16	15	18	30	42	61	110	-	-	-	-
1000 V	-	18	15	18	30	42	-	-	-	-	-	-

The expanded uncertainties given in this table are expressed in μV/V.

Hong Kong, China, SCL (Standards and Calibration Laboratory)

Uncertainty matrix: Matrix 6
AC voltage up to 1000 V, sources. Internal identifier: 61 and 62

	20 Hz	40 Hz	1 kHz	10 kHz	20 kHz	30 kHz	50 kHz	100 kHz	300 kHz	500 kHz	1 MHz
0.1 mV	-	-	0.0005	0.0005	0.0005	-	0.0005	0.0006	-	-	-
0.2 mV	-	-	0.0005	0.0005	0.0005	-	0.0006	0.0008	-	-	-
1 mV	-	-	0.0005	0.0005	0.0005	-	0.0006	0.0007	-	-	-
2 mV	-	-	0.0006	0.0006	0.0006	-	0.0006	0.0008	-	-	-
10 mV	-	-	0.0007	0.0007	0.0007	-	0.001	0.0022	-	-	-
20 mV	-	-	0.0008	0.0008	0.001	-	0.0016	0.0044	-	-	-
100 mV	-	-	0.003	0.003	0.003	-	0.006	0.009	-	-	-
200 mV	-	-	0.006	0.006	0.006	-	0.01	0.018	-	-	-
0.5 V	0.008	0.008	0.008	0.008	0.008	-	0.0085	0.015	0.029	0.035	0.080
1 V	0.016	0.015	0.015	0.015	0.016	-	0.016	0.021	0.041	0.057	0.16
2 V	0.032	0.030	0.030	0.030	0.030	-	0.030	0.036	0.060	0.072	0.24
4 V	-	-	-	-	-	-	-	-	-	-	-
5 V	0.080	0.080	0.080	0.080	0.080	-	0.080	0.090	0.14	0.16	0.6
10 V	0.16	0.15	0.15	0.15	0.15	-	0.15	0.18	0.27	0.32	1.2
20 V	0.32	0.30	0.30	0.30	0.30	-	0.30	0.36	0.56	0.62	2.4
40 V	-	-	-	-	-	-	-	-	-	-	-
50 V	0.8	0.8	0.8	0.8	0.8	-	0.8	1	-	-	-
100 V	1.6	1.6	1.6	1.6	1.6	1.6	1.6	2	-	-	-
200 V	3.6	3.2	3.2	3.2	3.8	4.2	4.8	8.8	-	-	-
400 V	-	-	-	-	-	-	-	-	-	-	-
500 V	11	9.5	9.5	10	13	15	24	37	-	-	-
700 V	-	13	13	15	22	31	43	77	-	-	-
1000 V	-	19	19	22	32	44	-	-	-	-	-

The expanded uncertainties given in this table are expressed in mV.

Hong Kong, China, SCL (Standards and Calibration Laboratory)

Uncertainty matrix: Matrix 7
AC voltage up to 1000 V, sources. Internal identifier: 63 and 64

	20 Hz	20 Hz to 40 Hz	40 Hz to 100 Hz	100 Hz to 1 kHz	1 kHz to 10 kHz	10 kHz to 20 kHz	20 kHz to 50 kHz	50 kHz to 100 kHz	100 kHz to 300 kHz	300 kHz to 500 kHz	500 kHz to 1 MHz
0.1 mV to 100 mV	0.0038 to 0.038	-	0.0005 to 0.007	0.0005 to 0.007	0.0005 to 0.007	0.0005 to 0.008	0.0005 to 0.01	0.0006 to 0.025	-	-	-
100 mV to 250 mV	0.0049 to 0.013	-	0.004 to 0.01	0.004 to 0.01	0.004 to 0.01	0.009 to 0.023	0.006 to 0.015	0.015 to 0.038	-	-	-
0.2 V to 20 V	-	0.015 to 4	0.014 to 1.4	0.014 to 0.74	0.014 to 1.3	0.014 to 1.3	0.026 to 1.7	0.06 to 3.1	0.15 to 4	0.3 to 9	0.5 to 12
20 V to 30 V	-	4 to 6	1.4 to 2.1	0.74 to 1.8	1.3 to 2.0	1.3 to 2.0	1.7 to 2.6	3.1 to 4.7	7.5 to 30	7.5 to 30	-
30 V to 700 V	-	6 to 140	2.1 to 63	1.1 to 63	2.0 to 63	2.0 to 63	2.6 to 61	4.7 to 110	-	-	-
700 V to 1000 V	-	140 to 200	49 to 90	26 to 90	46 to 90	46 to 90	61 to 87	-	-	-	-

The expanded uncertainties given in this table are expressed in mV.

Hong Kong, China, SCL (Standards and Calibration Laboratory)

Uncertainty matrix: Matrix 8
AC current up to 100 A, sources. Internal identifier: 69

	40 Hz	1 kHz	5 kHz	10 kHz
5 mA	0.00013	0.00013	0.00013	0.00013
10 mA	0.00026	0.00026	0.00026	0.00026
15 mA	-	-	-	-
20 mA	0.00052	0.00052	0.00052	0.00052
30 mA	0.00078	0.00078	0.00078	0.00078
50 mA	0.0013	0.0013	0.0013	0.0013
100 mA	0.0026	0.0026	0.0026	0.0026
200 mA	0.0052	0.0052	0.0052	0.0052
300 mA	0.0078	0.0078	0.017	0.017
500 mA	0.013	0.013	0.028	0.028
1 A	0.026	0.026	0.055	0.06
2 A	0.054	0.054	0.11	0.11
3 A	0.087	0.090	0.090	0.1
5 A	0.15	0.15	0.17	0.26
10 A	0.31	0.31	0.31	0.38
15 A	0.54	0.51	0.51	0.57
20 A	0.72	0.66	0.76	-

The expanded uncertainties given in this table are expressed in mA.

Hong Kong, China, SCL (Standards and Calibration Laboratory)

Uncertainty matrix: Matrix 9
AC current up to 100 A. Internal identifier: 70 and 71

	20 Hz to 10 kHz	45 Hz to 60 Hz
2.5 mA to 5 mA	0.00025 to 0.0005	-
0.005 A to 5 A	0.0015 to 1.5	-
5 A to 20 A	1.6 to 6.4	-
1 A to 100 A	-	0.077 to 7.7

The expanded uncertainties given in this table are expressed in mA.