

Electricity and Magnetism, South Africa, CSIR-NML (Council for Scientific and Industrial Research - National Metrology Laboratory)



Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty					NMI Service Identifier	Comments
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?		
DC voltage sources: single values	Solid state voltage standard	Direct comparison with standard	1	1	V			0.5	$\mu\text{V}/\text{V}$	2	95%	Yes	DCLF-1.1.1-1	Approved on 18 October 2004
DC voltage sources: single values	Solid state voltage standard, standard cell	Direct comparison with standard	1.018	1.018	V			0.5	$\mu\text{V}/\text{V}$	2	95%	Yes	DCLF-1.1.1-2	Approved on 18 October 2004
DC voltage sources: single values	Solid state voltage standard	Potentiometer and voltage standard	10	10	V			0.5	$\mu\text{V}/\text{V}$	2	95%	Yes	DCLF-1.1.1-3	Approved on 18 October 2004
DC voltage sources: low value ranges ≤ 10 V	DC voltage source, multifunction calibrator	Potentiometer and voltage standard	0	10	V			$(1\text{E-}06U + 0.5)$, U in V	μV	2	95%	No	DCLF-1.1.2-1	Approved on 18 October 2004
DC voltage sources: value ranges > 10 V to 1100 V	DC voltage source, multifunction calibrator	Potentiometer and voltage standard	10	1100	V			2 to 10	$\mu\text{V}/\text{V}$	2	95%	Yes	DCLF-1.1.3-1	Approved on 18 October 2004
DC voltage meters: values > 1 mV to 1100 V	DC voltmeters, multimeters	Multifunction calibrator	0.001	1100	V			4 to 500	$\mu\text{V}/\text{V}$	2	95%	Yes	DCLF-1.2.2-1	Calibrator calibrated in terms of reference standards Approved on 18 October 2004
DC resistance sources: lower than 1Ω	Fixed resistor, resistance box	Current comparator bridge	100E-06	1	Ω	Current	up to 100 A	2 to 10	$\mu\Omega/\Omega$	2	95%	Yes	DCLF-2.1.1-1	Approved on 18 October 2004
DC resistance sources: from 1Ω to $1 \text{ M}\Omega$	Fixed resistor, resistance box	Current comparator bridge, ratio bridge	1	1E+06	Ω	Voltage	up to 5 V	0.5 to 5	$\mu\Omega/\Omega$	2	95%	Yes	DCLF-2.1.2-1	Approved on 18 October 2004
DC resistance sources: higher than $1 \text{ M}\Omega$	Fixed resistor, three terminal resistor, resistance box	Ratio bridge, teraohmmeter	1E+06	100E+12	Ω	Voltage	up to 1000 A	5 to 5000	$\mu\Omega/\Omega$	2	95%	Yes	DCLF-2.1.3-1	Approved on 18 October 2004

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DC resistance sources: standards for high current	DC shunt	Current comparator bridge	100E-06	100E-03	Ω	Current	up to 100 A	2 to 10	$\mu\Omega/\Omega$	2	95%	Yes	DCLF-2.1.4-1	Approved on 18 October 2004
DC resistance sources: multiple ranges	Resistance box, multifunction calibrator	Direct multimeter measurement	0.1	1E+09	Ω			15 to 5000	$\mu\Omega/\Omega$	2	95%	Yes	DCLF-2.1.5-1	Rely on DVM linearity for some cases Approved on 18 October 2004
DC resistance sources: temperature coefficients	Fixed resistor	Current comparator bridge	100E-06	10E+03	Ω	Oil temperature	20 °C to 30 °C	0.5 to 3	$\mu\Omega/\Omega$	2	95%	Yes	DCLF-2.1.6-1	Approved on 18 October 2004
DC resistance meters: low values $\leq 1 \Omega$	Microohmmeter, multimeter, multifunction transfer standard, resistance bridge	Direct measurement of fixed resistor	100E-06	1	Ω			1 to 20	$\mu\Omega/\Omega$	2	95%	Yes	DCLF-2.2.1-1	Will be calibrated according to the manufacturer's specification Approved on 18 October 2004
DC resistance meters: intermediate values, 1 Ω to 1 G Ω	Ohmmeter, multimeter, multifunction transfer standard, resistance bridge	Direct measurement of fixed resistor	1	1E+09	Ω	Voltage	up to 10 V	1 to 50	$\mu\Omega/\Omega$	2	95%	Yes	DCLF-2.2.2-1	Will be calibrated according to the manufacturer's specification Approved on 18 October 2004

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DC resistance meters: high values > 1 G Ω	Multimeter, multifunction transfer standard, teraohmmeter, resistance bridge	Direct measurement of fixed resistor	1E+09	1E+12	Ω	Voltage	up to 1000 A	50 to 6000	$\mu\Omega/\Omega$	2	95%	Yes	DCLF-2.2.3-1	Will be calibrated according to the manufacturer's specification Approved on 18 October 2004
DC current sources: low values < 0.1 mA	Current generator, multifunction calibrator	Current/voltdrop	10	100	μA			25 to 115	$\mu\text{A}/\text{A}$	2	95%	Yes	DCLF-3.1.1-1	Voltmeter calibrated in terms of reference standards Approved on 18 October 2004
DC current sources: intermediate values 0.1 mA to 20 A	Current generator, multifunction calibrator	Current/voltdrop	0.0001	11	A			15 to 25	$\mu\text{A}/\text{A}$	2	95%	Yes	DCLF-3.1.2-1	Voltmeter calibrated in terms of reference standards Approved on 18 October 2004
DC current meters: low values < 0.1 mA	Picoammeter, nanoammeter, multimeters	Direct measurement	10	100	μA			100 to 1000	$\mu\text{A}/\text{A}$	2	95%	Yes	DCLF-3.2.1-1	Calibrator calibrated in terms of reference standards Approved on 18 October 2004

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DC current meters: intermediate values 0.1 mA to 20 A	Ammeters, multimeters	Direct measurement and current/voltdrop in series with UUT	0.0001	11	A			50 to 100	μA/A	2	95%	Yes	DCLF-3.2.2-1	Approved on 18 October 2004
Self inductance: lower than 1 mH	Fixed inductor, variable inductor, inductance box	Substitution using reference standards/direct measurement	0.1	1	mH	Frequency	1 kHz	0.02 to 0.2	%	2	95%	Yes	DCLF-4.3.1	Approved on 18 October 2004
Self inductance: 1 mH to 1 H	Fixed inductor, variable inductor, inductance box	Substitution using reference standards/direct measurement	0.001	1	H	Frequency	1 kHz	0.2 to 0.03	%	2	95%	Yes	DCLF-4.3.2	Approved on 18 October 2004
Self inductance: higher than 1 H	Fixed inductor, variable inductor, inductance box	Substitution using reference standards/direct measurement	1	10	H	Frequency	120 Hz and 1 kHz	0.05	%	2	95%	Yes	DCLF-4.3.3-1	Approved on 18 October 2004
Self inductance: meters	LCR meter	Substitution using reference standards	0.1	10	H	Frequency	0.012 kHz to 1 kHz	0.03 to 0.3	%	2	95%	Yes	DCLF-4.3.5-1	Approved on 18 October 2004
Capacitance: low loss capacitors	Standard capacitor (sealed, dry-nitrogen or fused silica dielectric)	Substitution using reference standards	1	1000	pF	Frequency	1 kHz	20 to 30	μF/F	2	95%	Yes	DCLF-4.2.1-1	Approved on 18 October 2004
Capacitance: dielectric capacitors	Fixed capacitor, variable capacitor, capacitance box	Substitution using reference standards/direct measurement	0.01	10000	nF	Frequency	1 kHz	20 to 12000	μF/F	2	95%	Yes	DCLF-4.2.2-1	Approved on 18 October 2004
Capacitance: meters	LCR meter	Direct measurement using reference standards	0.01	1000	nF	Frequency	50 Hz to 100 kHz	0.05 to 40	%	2	95%	Yes	DCLF-4.2.5-1	Approved on 18 October 2004
AC/DC voltage transfer difference at low voltages	AC/DC transfer standards	AC/DC direct comparison	70	700	mV	Frequency	20 Hz to 1 MHz	40 to 550	μV/V	2	95%	Yes	DCLF-5.1.1-1	Approved on 18 October 2004

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AC/DC voltage transfer difference at medium voltages	Thermal converters (directly connected) and AC/DC transfer standard	AC/DC direct comparison	0.45	10	V	Frequency	10 Hz to 1MHz	10 to 180	μV/V	2	95%	Yes	DCLF-5.1.2-1	Approved on 18 October 2004
AC/DC voltage transfer difference at high voltages	Thermal converters with range extenders and AC/DC transfer standards	AC/DC direct comparison	10	30	V	Frequency	10 Hz to 1MHz	12 to 150	μV/V	2	95%	Yes	DCLF-5.1.3-1	Approved on 18 October 2004
AC/DC voltage transfer difference at high voltages	Thermal converters with range extenders and AC/DC transfer standards	AC/DC direct comparison	30	1000	V	Frequency	10 Hz to 100 kHz	20 to 120	μV/V	2	95%	Yes	DCLF-5.1.3-2	Approved on 18 October 2004
AC voltage up to 1000 V, meters	Digital multimeter	Thermal transfer standard	0.1	1000	V	Frequency	10 Hz to 1 MHz	50 to 200	μV/V	2	95%	Yes	DCLF-5.2.2-1	Approved on 18 October 2004
AC/DC current transfer difference	Thermal converters plus shunts, AC/DC transfer standards plus shunts	Direct comparison	0.01	20	A	Frequency	30 Hz to 5 kHz	100 to 200	μA/A	2	95%	Yes	DCLF-6.1.1-1	Approved on 18 October 2004
AC current up to 100 A: sources	Multifunction calibrator	Thermal transfer standard, plus shunts	0.01	20	A	Frequency	30 Hz to 5 kHz	100 to 200	μA/A	2	95%	Yes	DCLF-6.2.1-1	Approved on 18 October 2004
AC current up to 100 A	Multimeters	Thermal transfer standard, plus shunts	0.01	20	A	Frequency	30 Hz to 5 kHz	100 to 200	μA/A	2	95%	Yes	DCLF-6.2.2-1	Approved on 18 October 2004
RF power: absolute power on coaxials	Power meter, power source	DC substitution in calorimeter	0.001	0.001	W	Frequency	50 MHz	9	mW/W	2	95%	Yes	RF-11.1.1-1	Approved on 18 October 2004
						Impedance	50 Ω							
						Connector	N							

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RF power: absolute power on coaxials	Power meter, power source	DC or 50 MHz substitution	0.0000001	100	W	Frequency	100 kHz to 1 GHz	50	mW/W	2	95%	Yes	RF-11.1.1-2	Approved on 18 October 2004
						Impedance	50 Ω							
						Connector	N, PC-7							
RF power: absolute power on coaxials	Power source	DC or 50 MHz substitution	0.0000001	30	W	Frequency	1 GHz to 18 GHz	60	mW/W	2	95%	Yes	RF-11.1.1-3	Approved on 18 October 2004
						Impedance	50 Ω							
						Connector	N, PC-7							
RF power: absolute power on coaxials	Power meter	50 MHz substitution	0.0000001	0.1	W	Frequency	10 MHz to 26.5 GHz	60	mW/W	2	95%	Yes	RF-11.1.1-4	Approved on 18 October 2004
						Impedance	50 Ω							
						Connector	PC-3.5							
RF power: absolute power on coaxials	Power source	50 MHz substitution	0.00001	0.1	W	Frequency	100 kHz to 2 GHz	40	mW/W	2	95%	Yes	RF-11.1.1-5	Approved on 18 October 2004
						Impedance	75 Ω							
						Connector	N							
RF power: absolute power on coaxials	Power source	DC substitution	0.001	0.001	W	Frequency	100 kHz to 300 MHz	20	mW/W	2	95%	Yes	RF-11.1.1-6	Approved on 18 October 2004
						Impedance	75 Ω							
						Connector	1.6/10, BNC							
RF power: absolute power on waveguides	Power source	DC substitution	0.0001	0.01	W	Frequency	26.5 GHz to 40 GHz	20	mW/W	2	95%	Yes	RF-11.1.2-1	Approved on 18 October 2004
						Waveguide	WG22							
RF power: calibration factor on coaxials	Power Sensor	DC or 50 MHz substitution	0.5	1.5		Frequency	100 kHz to 1 GHz	0.02		2	95%	No	RF-11.1.3-1	Approved on 18 October 2004
						Power	-30 to 10 dBm							
						Impedance	50 Ω							
						Connector	N, PC-7							
RF power: calibration factor on coaxials	Power Sensor	DC or 50 MHz substitution	0.5	1.5		Frequency	1GHz to 6 GHz	0.03		2	95%	No	RF-11.1.3-2	Approved on 18 October 2004

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						Power	-30 to 10 dBm							
						Impedance	50 Ω							
						Connector	N, PC-7							
RF power: calibration factor on coaxials	Power Sensor	DC or 50 MHz substitution	0.5	1.5		Frequency	6 GHz to 12 GHz	0.04		2	95%	No	RF-11.1.3-3	Approved on 18 October 2004
						Power	-30 to 10 dBm							
						Impedance	50 Ω							
						Connector	N, PC-7							
RF power: calibration factor on coaxials	Power Sensor	DC or 50 MHz substitution	0.5	1.5		Frequency	12 GHz to 18 GHz	0.05		2	95%	No	RF-11.1.3-4	Approved on 18 October 2004
						Power	-30 to 10 dBm							
						Impedance	50 Ω							
						Connector	N, PC-7							
RF power: calibration factor on coaxials	Power Sensor	DC or 50 MHz substitution	0.5	1.5		Frequency	10 MHz to 30 MHz	0.03		2	95%	No	RF-11.1.3-5	Approved on 18 October 2004
						Power	-30 to 10 dBm							
						Impedance	50 Ω							
						Connector	PC-3.5							
RF power: calibration factor on coaxials	Power Sensor	DC or 50 MHz substitution	0.5	1.5		Frequency	30 MHz to 2 GHz	0.02		2	95%	No	RF-11.1.3-6	Approved on 18 October 2004
						Power	-30 to 10 dBm							
						Impedance	50 Ω							
						Connector	PC-3.5							
RF power: calibration factor on coaxials	Power Sensor	DC or 50 MHz substitution	0.5	1.5		Frequency	2 GHz to 10 GHz	0.03		2	95%	No	RF-11.1.3-7	Approved on 18 October 2004
						Power	-30 to 10 dBm							
						Impedance	50 Ω							
						Connector	PC-3.5							
RF power: calibration factor on coaxials	Power Sensor	DC or 50 MHz substitution	0.5	1.5		Frequency	10 GHz to 18 GHz	0.04		2	95%	No	RF-11.1.3-8	Approved on 18 October 2004
						Power	-30 to 10 dBm							
						Impedance	50 Ω							

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RF power: calibration factor on coaxials	Power Sensor	DC or 50 MHz substitution	0.5	1.5		Connector	PC-3.5	0.05		2	95%	No	RF-11.1.3-9	Approved on 18 October 2004
						Frequency	18 GHz to 26.5 GHz							
						Power	-30 to 10 dBm							
RF power: calibration factor on coaxials	Power sensors	50 MHz substitution	0.5	1.5		Connector	PC-3.5	0.03		2	95%	No	RF-11.1.3-10	Approved on 18 October 2004
						Frequency	100 kHz to 300 kHz							
						Power	0 dBm							
RF power: calibration factor on coaxials	Power sensors	50 MHz substitution	0.5	1.5		Impedance	75 Ω	0.02		2	95%	No	RF-11.1.3-11	Approved on 18 October 2004
						Connector	N							
						Frequency	300 kHz to 2 GHz							
RF power: calibration factor on coaxials	Power sensors	DC substitution	0.5	1.5		Power	0 dBm	0.015		2	95%	No	RF-11.1.3-12	Approved on 18 October 2004
						Impedance	75 Ω							
						Connector	1.6/10, BNC							
RF power: measurements in balanced lines	Power source	DC substitution	0.001	0.001	W	Frequency	100 kHz to 5 MHz	10	mW/W	2	95%	Yes	RF-11.1.6-1	Approved on 18 October 2004
						Power	0 dBm							
						Impedance	124 Ω							
RF power: measurements in balanced lines	Power source	DC substitution	0.001	0.001	W	Connector	CF	10	mW/W	2	95%	Yes	RF-11.1.6-2	Approved on 18 October 2004
						Frequency	10 kHz to 2 MHz							
						Power	0 dBm							
						Impedance	150 Ω							
						Connector	CF							

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RF power: measurements in balanced lines	Power source	DC substitution	0.001	0.001	W	Frequency	200 Hz to 620 kHz	10	mW/W	2	95%	Yes	RF-11.1.6-3	Approved on 18 October 2004
						Power	0 dBm							
						Impedance	600 Ω							
						Connector	CF							
RF power: measurements (calibration factor) in balanced lines	Power sensor	DC substitution	0.5	1.5		Frequency	100 kHz to 5 MHz	0.007		2	95%	No	RF-11.1.6-4	Approved on 18 October 2004
						Power	0 dBm							
						Impedance	124 Ω							
						Connector	CF							
RF power: measurements (calibration factor) in balanced lines	Power sensor	DC substitution	0.5	1.5		Frequency	10 kHz to 2 MHz	0.007		2	95%	No	RF-11.1.6-5	Approved on 18 October 2004
						Power	0 dBm							
						Impedance	150 Ω							
						Connector	CF							
RF power: measurements (calibration factor) in balanced lines	Power sensor	DC substitution	0.5	1.5		Frequency	200 Hz to 620 kHz	0.007		2	95%	No	RF-11.1.6-6	Approved on 18 October 2004
						Power	0 dBm							
						Impedance	600 Ω							
						Connector	CF							

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Scalar RF reflection coefficient and attenuation: reflection measurements (values in linear terms) in balanced lines	Passive devices	Reflectometer	0	0.1		Frequency	100 kHz to 5 MHz	0.007		2	95%	No	RF-11.2.6-1	Approved on 18 October 2004
						Impedance Connector	124 Ω CF							
Scalar RF reflection coefficient and attenuation: reflection measurements (values in linear terms) in balanced lines	Passive devices	Reflectometer	0	0.1		Frequency	10 kHz to 2 MHz	0.005		2	95%	No	RF-11.2.6-2	Approved on 18 October 2004
						Impedance Connector	150 Ω CF							
Scalar RF reflection coefficient and attenuation: reflection measurements (values in linear terms) in balanced lines	Passive devices	Reflectometer	0	0.1		Frequency	200 Hz to 620 kHz	0.005		2	95%	No	RF-11.2.6-3	Approved on 18 October 2004
						Impedance Connector	600 Ω CF							

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Scalar RF reflection coefficient and attenuation: attenuation measurements (values in dB) in balanced lines	Passive devices	RF substitution	0	40	dB	Frequency	6 kHz to 10 MHz	0.07	dB	2	95%	No	RF-11.2.6-4	Approved on 18 October 2004
						Impedance Connector	124 Ω CF							
Scalar RF reflection coefficient and attenuation: attenuation measurements (values in dB) in balanced lines	Passive devices	RF substitution	40	60	dB	Frequency	6 kHz to 10 MHz	0.08	dB	2	95%	No	RF-11.2.6-5	Approved on 18 October 2004
						Impedance Connector	124 Ω CF							
Scalar RF reflection coefficient and attenuation: attenuation measurements (values in dB) in balanced lines	Passive devices	RF substitution	60	80	dB	Frequency	6 kHz to 10 MHz	0.1	dB	2	95%	No	RF-11.2.6-6	Approved on 18 October 2004
						Impedance Connector	124 Ω CF							
Scalar RF reflection coefficient and attenuation: attenuation measurements (values in dB) in balanced lines	Passive devices	RF substitution	0	40	dB	Frequency	80 Hz to 10 MHz	0.07	dB	2	95%	No	RF-11.2.6-7	Approved on 18 October 2004

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						Impedance	150 Ω							
						Connector	CF							
Scalar RF reflection coefficient and attenuation: attenuation measurements (values in dB) in balanced lines	Passive devices	RF substitution	40	60	dB	Frequency	80 Hz to 10 MHz	0.08	dB	2	95%	No	RF-11.2.6-8	Approved on 18 October 2004
						Impedance	150 Ω							
						Connector	CF							
Scalar RF reflection coefficient and attenuation: attenuation measurements (values in dB) in balanced lines	Passive devices	RF substitution	60	80	dB	Frequency	80 Hz to 10 MHz	0.1	dB	2	95%	No	RF-11.2.6-9	Approved on 18 October 2004
						Impedance	150 Ω							
						Connector	CF							
Scalar RF reflection coefficient and attenuation: attenuation measurements (values in dB) in balanced lines	Passive devices	RF substitution	0	40	dB	Frequency	80 Hz to 620 kHz	0.05	dB	2	95%	No	RF-11.2.6-10	Approved on 18 October 2004
						Impedance	600 Ω							
						Connector	CF							

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Scalar RF reflection coefficient and attenuation: attenuation measurements (values in dB) in balanced lines	Passive devices	RF substitution	40	60	dB	Frequency	80 Hz to 620 kHz	0.08	dB	2	95%	No	RF-11.2.6-11	Approved on 18 October 2004
						Impedance Connector	600 Ω CF							
Scalar RF reflection coefficient and attenuation: attenuation measurements (values in dB) in balanced lines	Passive devices	RF substitution	60	80	dB	Frequency	80 Hz to 620 kHz	0.1	dB	2	95%	No	RF-11.2.6-12	Approved on 18 October 2004
						Impedance Connector	600 Ω CF							
Scattering parameters: reflection coefficient (Sii) on coaxials (values in linear terms: magnitude)	Passive devices	Vector network analyser	0	1		Frequency	30 kHz to 18 GHz	0.005		2	95%	No	RF-11.3.1-1	Approved on 18 October 2004
						Impedance Connector	50 Ω N, PC-7							
Scattering parameters: reflection coefficient (Sii) on coaxials (values in linear terms: magnitude)	Passive devices	Vector network analyser	0	1		Frequency	30 kHz to 26.5 GHz	0.005		2	95%	No	RF-11.3.1-2	Approved on 18 October 2004

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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?		
						Impedance	50 Ω							
						Connector	PC-3.5							
Scattering parameters: reflection coefficient (Sii) on coaxials (values in linear terms: magnitude)	Passive devices	Vector network analyser	0	1		Frequency	30 kHz to 40 GHz	0.03		2	95%	No	RF-11.3.1-3	Approved on 18 October 2004
						Impedance	50 Ω							
						Connector	K							
Scattering parameters: reflection coefficient (Sii) on coaxials (values in linear terms: magnitude)	Passive devices	Vector network analyser	0	1		Frequency	30 kHz to 3 GHz	0.01		2	95%	No	RF-11.3.1-4	Approved on 18 October 2004
						Impedance	75 Ω							
						Connector	N							
Scattering parameters: reflection coefficient (Sii) on coaxials, (values in linear terms: real and imaginary)	Passive devices	Vector network analyser	0	1/-1		Frequency	30 kHz to 18 GHz	0.005		2	95%	No	RF-11.3.1-5	Approved on 18 October 2004
						Impedance	50 Ω							
						Connector	N, PC-7							

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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?		
Scattering parameters: reflection coefficient (Sii) on coaxials, (values in linear terms: real and imaginary)	Passive devices	Vector network analyser	0	1/-1		Frequency	30 kHz to 26.5 GHz	0.005		2	95%	No	RF-11.3.1-6	Approved on 18 October 2004
						Impedance Connector	50 Ω PC-3.5							
Scattering parameters: reflection coefficient (Sii) on coaxials, (values in linear terms: real and imaginary)	Passive devices	Vector network analyser	0	1/-1		Frequency	30 kHz to 40 GHz	0.03		2	95%	No	RF-11.3.1-7	Approved on 18 October 2004
						Impedance Connector	50 Ω K							
RF attenuation, on coaxials (values in dB)	Passive devices	Ratio techniques	0	20	dB	Frequency	DC	0.001	dB	2	95%	No	RF-11.2.3-1	Approved on 18 October 2004
						Impedance Connector	50 Ω and 75 Ω BNC, N, PC-7							
RF attenuation, on coaxials (values in dB)	Passive devices	Ratio techniques	20	40	dB	Frequency	DC	0.002	dB	2	95%	No	RF-11.2.3-2	Approved on 18 October 2004
						Impedance Connector	50 Ω and 75 Ω BNC, N, PC-7							
RF attenuation, on coaxials (values in dB)	Passive devices	Ratio techniques	40	60	dB	Frequency	DC	0.003	dB	2	95%	No	RF-11.2.3-3	Approved on 18 October 2004
						Impedance Connector	50 Ω and 75 Ω BNC, N, PC-7							
RF attenuation, on coaxials (values in dB)	Passive devices	Ratio techniques	60	80	dB	Frequency	DC	0.01	dB	2	95%	No	RF-11.2.3-4	Approved on 18 October 2004

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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?		
						Impedance Connector	50 Ω and 75 Ω BNC, N, PC-7							
RF attenuation, on coaxials (values in dB)	Passive devices	Ratio techniques	80	100	dB	Frequency	DC	0.03	dB	2	95%	No	RF-11.2.3-5	Approved on 18 October 2004
						Impedance Connector	50 Ω and 75 Ω BNC, N, PC-7							
RF attenuation, on coaxials (values in dB)	Passive devices	Ratio techniques	100	110	dB	Frequency	DC	0.1	dB	2	95%	No	RF-11.2.3-6	Approved on 18 October 2004
						Impedance Connector	50 Ω and 75 Ω BNC, N, PC-7							
RF attenuation, on coaxials (values in dB)	Precision measuring receivers	Series substitution	0	10	dB	Frequency	30 MHz	0.003	dB	2	95%	No	RF-11.2.3-7	Approved on 18 October 2004
						Impedance Connector	50 Ω N							
RF attenuation, on coaxials (values in dB)	Precision measuring receivers	Series substitution	10	20	dB	Frequency	30 MHz	0.005	dB	2	95%	No	RF-11.2.3-8	Approved on 18 October 2004
						Impedance Connector	50 Ω N							
RF attenuation, on coaxials (values in dB)	Precision measuring receivers	Series substitution	20	30	dB	Frequency	30 MHz	0.007	dB	2	95%	No	RF-11.2.3-9	Approved on 18 October 2004
						Impedance Connector	50 Ω N							
RF attenuation, on coaxials (values in dB)	Precision measuring receivers	Series substitution	30	40	dB	Frequency	30 MHz	0.009	dB	2	95%	No	RF-11.2.3-10	Approved on 18 October 2004
						Impedance Connector	50 Ω N							
RF attenuation, on coaxials (values in dB)	Precision measuring receivers	Series substitution	40	50	dB	Frequency	30 MHz	0.012	dB	2	95%	No	RF-11.2.3-11	Approved on 18 October 2004
						Impedance Connector	50 Ω N							

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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?		
RF attenuation, on coaxials (values in dB)	Precision measuring receivers	Series substitution	50	60	dB	Frequency	30 MHz	0.013	dB	2	95%	No	RF-11.2.3-12	Approved on 18 October 2004
						Impedance Connector	50 Ω N							
RF attenuation, on coaxials (values in dB)	Precision measuring receivers	Series substitution	60	70	dB	Frequency	30 MHz	0.014	dB	2	95%	No	RF-11.2.3-13	Approved on 18 October 2004
						Impedance Connector	50 Ω N							
RF attenuation, on coaxials (values in dB)	Precision measuring receivers	Series substitution	70	80	dB	Frequency	30 MHz	0.015	dB	2	95%	No	RF-11.2.3-14	Approved on 18 October 2004
						Impedance Connector	50 Ω N							
RF attenuation, on coaxials (values in dB)	Precision measuring receivers	Series substitution	80	90	dB	Frequency	30 MHz	0.02	dB	2	95%	No	RF-11.2.3-15	Approved on 18 October 2004
						Impedance Connector	50 Ω N							
RF attenuation, on coaxials (values in dB)	Precision measuring receivers	Series substitution	90	100	dB	Frequency	30 MHz	0.02	dB	2	95%	No	RF-11.2.3-16	Approved on 18 October 2004
						Impedance Connector	50 Ω N							
RF attenuation, on coaxials (values in dB)	Precision measuring receivers	Series substitution	100	110	dB	Frequency	30 MHz	0.03	dB	2	95%	No	RF-11.2.3-17	Approved on 18 October 2004
						Impedance Connector	50 Ω N							
RF attenuation, on coaxials (values in dB)	Passive devices	Vector network analyser and measuring receiver	0	20	dB	Frequency	30 kHz to 26.5 GHz	0.06	dB	2	95%	No	RF-11.2.3-18	Approved on 18 October 2004
						Impedance Connector	50 Ω N, PC-7, PC-3.5							

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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?		
RF attenuation, on coaxials (values in dB)	Passive devices	Vector network analyser and measuring receiver	20	40	dB	Frequency	30 kHz to 26.5 GHz	0.13	dB	2	95%	No	RF-11.2.3-19	Approved on 18 October 2004
						Impedance	50 Ω							
						Connector	N, PC-7, PC-3.5							
RF attenuation, on coaxials (values in dB)	Passive devices	Vector network analyser and measuring receiver	40	60	dB	Frequency	30 kHz to 26.5 GHz	0.2	dB	2	95%	No	RF-11.2.3-20	Approved on 18 October 2004
						Impedance	50 Ω							
						Connector	N, PC-7, PC-3.5							
RF attenuation, on coaxials (values in dB)	Passive devices	Measuring receiver	60	80	dB	Frequency	30 kHz to 26.5 GHz	0.3	dB	2	95%	No	RF-11.2.3-21	Approved on 18 October 2004
						Impedance	50 Ω							
						Connector	N, PC-7, PC-3.5							
RF attenuation, on coaxials (values in dB)	Passive devices	Measuring receiver	80	100	dB	Frequency	30 kHz to 26.5 GHz	0.4	dB	2	95%	No	RF-11.2.3-22	Approved on 18 October 2004
						Impedance	50 Ω							
						Connector	N, PC-7, PC-3.5							
RF attenuation, on coaxials (values in dB)	Passive devices	Measuring receiver	100	110	dB	Frequency	30 kHz to 26.5 GHz	0.8	dB	2	95%	No	RF-11.2.3-23	Approved on 18 October 2004
						Impedance	50 Ω							
						Connector	N, PC-7, PC-3.5							
RF attenuation, on coaxials (values in dB)	Passive devices	Vector network analyser and measuring receiver	0	20	dB	Frequency	30 kHz to 2 GHz	0.01	dB	2	95%	No	RF-11.2.3-24	Approved on 18 October 2004
						Impedance	75 Ω							
						Connector	N							

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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?		
RF attenuation, on coaxials (values in dB)	Passive devices	Vector network analyser and measuring receiver	20	40	dB	Frequency	30 kHz to 2 GHz	0.02	dB	2	95%	No	RF-11.2.3-25	Approved on 18 October 2004
						Impedance	75 Ω							
						Connector	N							
RF attenuation, on coaxials (values in dB)	Passive devices	Vector network analyser and measuring receiver	40	60	dB	Frequency	30 kHz to 2 GHz	0.03	dB	2	95%	No	RF-11.2.3-26	Approved on 18 October 2004
						Impedance	75 Ω							
						Connector	N							
RF attenuation, on coaxials (values in dB)	Passive devices	Measuring receiver	60	80	dB	Frequency	30 kHz to 2 GHz	0.04	dB	2	95%	No	RF-11.2.3-27	Approved on 18 October 2004
						Impedance	75 Ω							
						Connector	N							
RF attenuation, on coaxials (values in dB)	Passive devices	Measuring receiver	80	100	dB	Frequency	30 kHz to 2 GHz	0.06	dB	2	95%	No	RF-11.2.3-28	Approved on 18 October 2004
						Impedance	75 Ω							
						Connector	N							
RF attenuation, on coaxials (values in dB)	Passive devices	Measuring receiver	100	110	dB	Frequency	30 kHz to 2 GHz	0.08	dB	2	95%	No	RF-11.2.3-29	Approved on 18 October 2004
						Impedance	75 Ω							
						Connector	N							
RF attenuation, on coaxials (values in dB)	Passive devices	Vector network analyser	0	20	dB	Frequency	45 MHz to 40 GHz	0.5	dB	2	95%	No	RF-11.2.3-30	Approved on 18 October 2004
						Impedance	50 Ω							
						Connector	K							
RF attenuation, on coaxials (values in dB)	Passive devices	Vector network analyser	20	30	dB	Frequency	45 MHz to 40 GHz	0.6	dB	2	95%	No	RF-11.2.3-31	Approved on 18 October 2004
						Impedance	50 Ω							
						Connector	K							

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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?		
RF attenuation, on coaxials (values in dB)	Passive devices	Vector network analyser	30	50	dB	Frequency	45 MHz to 40 GHz	1.4	dB	2	95%	No	RF-11.2.3-32	Approved on 18 October 2004
						Impedance	50 Ω							
						Connector	K							