



SCS-Directory

Accreditation number: SCS 0058

International standard: ISO/IEC 17025:2017
Swiss standard: SN EN ISO/IEC 17025:2018

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Initial accreditation: 06.12.1995
Current accreditation: 14.03.2026 to 13.03.2031
Scope of accreditation see: www.sas.admin.ch
(Accredited bodies)

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Scope of accreditation as of 14.03.2026

Calibration laboratory for electrical quantities, fiber optics, pressure, temperature, humidity, magnetic and electric fields

Calibration and Measurement Capability (CMC)

Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ ¹⁾	Remarks
DC Voltage Calibration of voltage measurement instruments	0 mV ... < 220 mV 220 mV ... < 2,2 V 2,2 V ... < 22 V 22 V ... < 220 V 220 V ... 1100 V		$7,2 \cdot 10^{-6} U + 0,6 \mu V$ $3,5 \cdot 10^{-6} U + 1,6 \mu V$ $2,6 \cdot 10^{-6} U + 7 \mu V$ $3,5 \cdot 10^{-6} U + 120 \mu V$ $4 \cdot 10^{-6} U + 700 \mu V$	Also possible in the branches and on site ²⁾ U = Measurement value



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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ ¹⁾	Remarks
Calibration of voltage calibrators	0 mV ... < 120 mV 120 mV ... < 1,2 V 1,2 V ... < 12 V 12 V ... < 120 V 120 V ... 1050 V		$6,6 \cdot 10^{-6} U + 0,1 \mu V$ $2 \cdot 10^{-6} U + 0,2 \mu V$ $2 \cdot 10^{-6} U + 1 \mu V$ $2 \cdot 10^{-6} U + 14 \mu V$ $3 \cdot 10^{-6} U + 200 \mu V$	Also possible in the branches and on site ²⁾
Fixed voltages	100 mV 1 V; 10 V; 100 V; 1000V		$6,5 \cdot 10^{-6} U$ $2 \cdot 10^{-6} U$	
High voltage				
Calibration of high voltage generators	1 kV ... 10 kV > 10 kV ... 20 kV > 20 kV ... 35 kV > 35 kV ... 50 kV	$R_L \geq 110 M\Omega$ $R_L \geq 200 M\Omega$ $R_L \geq 200 M\Omega$ $R_L \geq 760 M\Omega$	0,05 % + 0,11 V 0,06 % + 1,3 V 0,12 % + 3,0 V 1,2 % + 6,5 V	Procedure KA0022 Also possible in Fehraltendorf and on site ³⁾
Calibration of voltage measurement instruments	1 kV ... 10 kV > 10 kV ... 20 kV > 20 kV ... 35 kV > 35 kV ... 50 kV		0,05 % + 0,13 V 0,06 % + 1,4 V 0,12 % + 3,1 V 1,2 % + 6,6 V	Procedure KA0022 Also possible in Fehraltendorf and on site ⁴⁾
DC Current				
Calibration of ammeters	0 μA ... 12 μA > 12 μA ... 120 μA > 120 μA ... 1,2 mA > 1,2 mA ... 12 mA > 12 mA ... 120 mA > 120 mA ... 2 A > 2 A ... 20 A > 20 A ... 100 A		$16 \cdot 10^{-6} I + 0,2 nA$ $16 \cdot 10^{-6} I + 0,5 nA$ $16 \cdot 10^{-6} I + 4,5 nA$ $16 \cdot 10^{-6} I + 41 nA$ $16 \cdot 10^{-6} I + 0,5 \mu A$ $17 \cdot 10^{-6} I + 4,5 \mu A$ $68 \cdot 10^{-6} I + 43 \mu A$ $73 \cdot 10^{-6} I + 130 \mu A$	Also possible in the branches and on site ²⁾ I = Measurement value
Calibration of current clamps	> 100 A ... 500 A > 500 A ... 2500 A	With current coil	$5,8 \cdot 10^{-3} I + 26 mA$ $5,8 \cdot 10^{-3} I + 160 mA$	
Calibration of current calibrators	0 μA ... 12 μA > 12 μA ... 120 μA > 120 μA ... 1,2 mA > 1,2 mA ... 12 mA		$16 \cdot 10^{-6} I + 0,11 nA$ $16 \cdot 10^{-6} I + 0,4 nA$ $16 \cdot 10^{-6} I + 3,6 nA$ $16 \cdot 10^{-6} I + 35 nA$	Also possible in the branches and on site ²⁾

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	> 12 mA ... 120 mA		16•10 ⁻⁶ / + 350 nA	
	> 120 mA ... 2 A		17•10 ⁻⁶ / + 3,7 µA	
	> 2 A ... 20 A		68•10 ⁻⁶ / + 36 µA	
	> 20 A ... 100 A		73•10 ⁻⁶ / + 40 µA	
DC Resistance				
Calibration of resistance measurement instruments	100 µΩ		70•10 ⁻⁶ R	The measurement uncertainties indicated apply to decadic values
	1 mΩ		45•10 ⁻⁶ R	
	10 mΩ; 100 mΩ		45•10 ⁻⁶ R	
With fixed resistors	1 Ω; 10 Ω		5•10 ⁻⁶ R	Also possible in the branches and on site ^{2),5)}
	100 Ω; 1 kΩ		6•10 ⁻⁶ R	
	10 kΩ		5•10 ⁻⁶ R	
	19 kΩ; 100 kΩ		6•10 ⁻⁶ R	
	1 MΩ		5•10 ⁻⁶ R	
	10 MΩ		10•10 ⁻⁶ R	
	100 MΩ		40•10 ⁻⁶ R	
	1 GΩ		250•10 ⁻⁶ R	
	10 GΩ		520•10 ⁻⁶ R	
	100 GΩ		750•10 ⁻⁶ R	
	1 TΩ		5•10 ⁻³ R	
	10 TΩ		8•10 ⁻³ R	
	100 TΩ		16•10 ⁻³ R	
With precision resistance decades	10 mΩ ... 10 Ω		47•10 ⁻⁶ R + 0,83 mΩ	Also possible in the branches and on site ^{2) 5)}
	> 10 Ω ... 1 kΩ		38•10 ⁻⁶ R + 1,3 mΩ	
	> 1 kΩ ... 10 kΩ		29•10 ⁻⁶ R + 6 mΩ	
	> 10 kΩ ... 100 kΩ		28•10 ⁻⁶ R + 58 mΩ	
	> 100 kΩ ... 1 MΩ		33•10 ⁻⁶ R + 2,4 Ω	
	> 1 MΩ ... 10 MΩ		150•10 ⁻⁶ R + 120 Ω	
	> 10 MΩ ... 100 MΩ		600•10 ⁻⁶ R + 1,2 kΩ	
	> 100 MΩ ... 1 GΩ		1,4•10 ⁻³ R	
	> 1 GΩ ... 10 GΩ		2,6•10 ⁻³ R	

1) The given extended measurement uncertainty is the standard uncertainty of the measurement multiplied by an extension factor $k = 2$, which corresponds to a confidence level of about 95% for a normal distribution.



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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ ¹⁾	Remarks
Calibration of resistances	> 10 G Ω ... 100 G Ω		6,1•10 ⁻³ R	Also possible in the branches and on site ⁵⁾
	> 100 G Ω ... 1 T Ω		9•10 ⁻³ R	
	100 $\mu\Omega$... < 500 $\mu\Omega$		100•10 ⁻⁶ R	
	500 $\mu\Omega$... < 5 m Ω		75•10 ⁻⁶ R	
	5 m Ω ... < 50 m Ω		72•10 ⁻⁶ R	
	50 m Ω ... < 500 m Ω		44•10 ⁻⁶ R	
	500 m Ω ... < 5 Ω		10•10 ⁻⁶ R	
	5 Ω ... < 50 Ω		10•10 ⁻⁶ R	
	50 Ω ... < 500 Ω		10•10 ⁻⁶ R	
	500 Ω ... < 5 k Ω		10•10 ⁻⁶ R	
	5 k Ω ... < 50 k Ω		5,5•10 ⁻⁶ R	
	50 k Ω ... < 500 k Ω		7,5•10 ⁻⁶ R	
	500 k Ω ... < 5 M Ω		15•10 ⁻⁶ R	
	5 M Ω ... < 50 M Ω		60•10 ⁻⁶ R	
	50 M Ω ... < 500 M Ω		480•10 ⁻⁶ R	
	500 M Ω ... < 5 G Ω		600•10 ⁻⁶ R	
	5 G Ω ... < 50 G Ω		850•10 ⁻⁶ R	
	50 G Ω ... < 500 G Ω		1,7•10 ⁻³ R	
	500 G Ω ... < 5 T Ω		6,7•10 ⁻³ R	
	5 T Ω ... < 50 T Ω		9,1•10 ⁻³ R	
	50 T Ω ... 200 T Ω		19•10 ⁻³ R	
DC Power		40 V ... 480 V		
Calibration of power generators	2,4 W ... 96 W	60 mA ... < 200 mA	0,58 %	
	> 8 W ... 240 W	200 mA ... 500 mA	0,35 %	
	> 20 W ... 960 W	> 500 mA ... 2 A	0,12 %	
	> 80 W ... 7,68 kW	> 2 A ... 16 A	0,52 %	
		40 V ... 300 V		
	> 640 W ... 6 kW	> 16 A ... 20 A	0,58 %	
	> 800 W ... 30 kW	20 A ... 100 A	0,14 %	



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Calibration of power analyzers	330 μ W ... 200 W	0,1 V ... 1000 V 3,3 mA ... 200 mA	0,58 %	Also possible in the branches and on site ²⁾
	> 20 mW ... 500 W	> 200 mA ... 500 mA	0,35 %	
	> 50 mW ... 2 kW	> 500 mA ... 2 A	0,12 %	
	> 200 mW ... 20 kW	> 2 A ... 20 A	0,59 %	
Calibration of power meter clamps	> 800 W ... 30 kW	40 V ... 300 V > 20 A ... 100 A	0,14 %	With current coil
	330 μ W ... < 33 mW	0,1 V ... 1000 V 3,3 mA ... 1000 A	0,84 %	
	33 mW ... < 110 mW		0,69 %	
	110 mW ... 100 kW		0,60 %	
	> 100 kW ... 1 MW		0,84 %	
AV Voltage				
Calibration of voltage calibrators	10 mV ... < 22 mV	10 Hz	$1,1 \cdot 10^{-3} U + 0,3 \mu$ V	Also possible in the branches and on site ²⁾ U = Measurement value
		20 Hz; 40 Hz; 500 Hz	$1,1 \cdot 10^{-3} U + 0,1 \mu$ V	
		1 kHz; 10 kHz;	$1,2 \cdot 10^{-3} U + 0,1 \mu$ V	
		20 kHz; 50 kHz; 100 kHz	$1,2 \cdot 10^{-3} U + 0,1 \mu$ V	
		200 kHz; 500 kHz	$1,2 \cdot 10^{-3} U + 0,1 \mu$ V	
		700 kHz; 1 MHz	$1,1 \cdot 10^{-3} U + 0,2 \mu$ V	
	22 mV ... < 70 mV	10 Hz	$370 \cdot 10^{-6} U + 0,8 \mu$ V	
		20 Hz	$370 \cdot 10^{-6} U + 0,3 \mu$ V	
		40 Hz	$370 \cdot 10^{-6} U + 0,1 \mu$ V	
		500 Hz; 1 kHz	$360 \cdot 10^{-6} U + 0,2 \mu$ V	
		10 kHz; 20 kHz; 50 kHz; 100 kHz	$360 \cdot 10^{-6} U + 0,1 \mu$ V	
		200 kHz; 500 kHz	$370 \cdot 10^{-6} U + 0,2 \mu$ V	
		700 kHz	$380 \cdot 10^{-6} U + 0,2 \mu$ V	
		1 MHz	$610 \cdot 10^{-6} U + 0,2 \mu$ V	
	70 mV ... < 220 mV	10 Hz	$53 \cdot 10^{-6} U + 2,1 \mu$ V	
		20 Hz	$53 \cdot 10^{-6} U + 1,1 \mu$ V	
		40 Hz; 500 Hz	$53 \cdot 10^{-6} U + 0,3 \mu$ V	



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	220 mV ... < 700 mV	1 kHz; 10 kHz; 20 kHz; 50 kHz; 100 kHz	$53 \cdot 10^{-6} U + 0,2 \mu V$	
		200 kHz; 500 kHz	$69 \cdot 10^{-6} U + 0,2 \mu V$	
		700 kHz	$84 \cdot 10^{-6} U + 0,2 \mu V$	
		1 MHz	$92 \cdot 10^{-6} U + 0,2 \mu V$	
		10 Hz	$58 \cdot 10^{-6} U + 9 \mu V$	
		20 Hz	$50 \cdot 10^{-6} U + 3 \mu V$	
		40 Hz	$47 \cdot 10^{-6} U + 2 \mu V$	
		500 Hz; 1 kHz; 10 kHz; 20 kHz; 50 kHz	$42 \cdot 10^{-6} U + 2 \mu V$	
		100 kHz	$47 \cdot 10^{-6} U + 1 \mu V$	
		200 kHz	$56 \cdot 10^{-6} U + 1 \mu V$	
	700 mV ... < 2,2 V	500 kHz	$76 \cdot 10^{-6} U + 1 \mu V$	
		700 kHz	$190 \cdot 10^{-6} U + 1 \mu V$	
		1 MHz	$120 \cdot 10^{-6} U + 1 \mu V$	
		10 Hz	$52 \cdot 10^{-6} U + 26 \mu V$	
		20 Hz	$42 \cdot 10^{-6} U + 11 \mu V$	
		40 Hz	$41 \cdot 10^{-6} U + 4 \mu V$	
		500 Hz; 1 kHz; 10 kHz; 20 kHz	$41 \cdot 10^{-6} U + 2 \mu V$	
		50 kHz; 100 kHz	$42 \cdot 10^{-6} U + 2 \mu V$	
		200 kHz	$53 \cdot 10^{-6} U + 2 \mu V$	
		500 kHz	$65 \cdot 10^{-6} U + 2 \mu V$	
	2,2 V ... < 7 V	700 kHz	$160 \cdot 10^{-6} U + 2 \mu V$	
		1 MHz	$100 \cdot 10^{-6} U + 2 \mu V$	
		10 Hz	$66 \cdot 10^{-6} U + 44 \mu V$	
		20 Hz	$40 \cdot 10^{-6} U + 30 \mu V$	
		40 Hz	$27 \cdot 10^{-6} U + 13 \mu V$	
		500 Hz	$24 \cdot 10^{-6} U + 15 \mu V$	
		1 kHz	$24 \cdot 10^{-6} U + 13 \mu V$	
		10 kHz	$24 \cdot 10^{-6} U + 8 \mu V$	
		20 kHz	$27 \cdot 10^{-6} U + 10 \mu V$	



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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ ¹⁾	Remarks
	7 V ... < 22 V	50 kHz	$27 \cdot 10^{-6} U + 7 \mu V$	
		100 kHz	$33 \cdot 10^{-6} U + 7 \mu V$	
		200 kHz	$42 \cdot 10^{-6} U + 10 \mu V$	
		500 kHz	$210 \cdot 10^{-6} U + 9 \mu V$	
		700 kHz	$310 \cdot 10^{-6} U + 9 \mu V$	
		1 MHz	$400 \cdot 10^{-6} U + 8 \mu V$	
		10 Hz	$76 \cdot 10^{-6} U + 310 \mu V$	
		20 Hz	$31 \cdot 10^{-6} U + 77 \mu V$	
		40 Hz	$27 \cdot 10^{-6} U + 21 \mu V$	
		500 Hz	$27 \cdot 10^{-6} U + 30 \mu V$	
		1 kHz	$27 \cdot 10^{-6} U + 16 \mu V$	
		10 kHz; 20 kHz	$27 \cdot 10^{-6} U + 9 \mu V$	
		50 kHz	$27 \cdot 10^{-6} U + 18 \mu V$	
		100 kHz	$27 \cdot 10^{-6} U + 13 \mu V$	
	22 V ... < 70 V	200 kHz	$57 \cdot 10^{-6} U + 11 \mu V$	
		500 kHz	$180 \cdot 10^{-6} U + 13 \mu V$	
		700 kHz	$350 \cdot 10^{-6} U + 43 \mu V$	
		1 MHz	$470 \cdot 10^{-6} U + 43 \mu V$	
		10 Hz	$42 \cdot 10^{-6} U + 740 \mu V$	
		20 Hz	$33 \cdot 10^{-6} U + 270 \mu V$	
		40 Hz	$33 \cdot 10^{-6} U + 190 \mu V$	
		500 Hz	$24 \cdot 10^{-6} U + 120 \mu V$	
		1 kHz	$24 \cdot 10^{-6} U + 150 \mu V$	
		10 kHz	$24 \cdot 10^{-6} U + 68 \mu V$	
		20 kHz	$24 \cdot 10^{-6} U + 85 \mu V$	
		50 kHz	$24 \cdot 10^{-6} U + 72 \mu V$	
		100 kHz	$33 \cdot 10^{-6} U + 180 \mu V$	
	70 V ... < 220 V	10 Hz	$52 \cdot 10^{-6} U + 2,2 mV$	
		20 Hz	$42 \cdot 10^{-6} U + 500 \mu V$	
		40 Hz	$42 \cdot 10^{-6} U + 210 \mu V$	



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AC Voltage Calibration of voltage measurement instruments	220 V ... < 700 V	500 Hz	$33 \cdot 10^{-6} U + 240 \mu V$	
		1 kHz	$33 \cdot 10^{-6} U + 210 \mu V$	
		10 kHz	$33 \cdot 10^{-6} U + 190 \mu V$	
		20 kHz	$33 \cdot 10^{-6} U + 120 \mu V$	
		50 kHz	$33 \cdot 10^{-6} U + 170 \mu V$	
		100 kHz	$42 \cdot 10^{-6} U + 640 \mu V$	
		10 Hz	$67 \cdot 10^{-6} U + 900 \mu V$	
		20 Hz	$53 \cdot 10^{-6} U + 900 \mu V$	
		40 Hz	$53 \cdot 10^{-6} U + 900 \mu V$	
		500 Hz	$33 \cdot 10^{-6} U + 890 \mu V$	
	700 V ... 1050 V	1 kHz	$33 \cdot 10^{-6} U + 770 \mu V$	
		10 kHz	$33 \cdot 10^{-6} U + 800 \mu V$	
		20 kHz	$38 \cdot 10^{-6} U + 800 \mu V$	
		50 kHz	$46 \cdot 10^{-6} U + 800 \mu V$	
		100 kHz	$53 \cdot 10^{-6} U + 800 \mu V$	
		10 Hz	$99 \cdot 10^{-6} U + 1 mV$	
		20 Hz	$56 \cdot 10^{-6} U + 1 mV$	
		40 Hz	$53 \cdot 10^{-6} U + 950 \mu V$	
		500 Hz	$33 \cdot 10^{-6} U + 910 \mu V$	
		1 kHz	$33 \cdot 10^{-6} U + 930 \mu V$	
	10 mV ... < 22 mV	10 kHz	$33 \cdot 10^{-6} U + 950 \mu V$	
		20 kHz	$38 \cdot 10^{-6} U + 950 \mu V$	
		50 kHz	$46 \cdot 10^{-6} U + 950 \mu V$	
		100 kHz	$61 \cdot 10^{-6} U + 950 \mu V$	
		10 Hz; 20 Hz	$1,1 \cdot 10^{-3} U + 5,8 \mu V$	
		40 Hz; 500 Hz;	$1,1 \cdot 10^{-3} U + 2,4 \mu V$	
		1 kHz; 10 kHz; 20 kHz; 50 kHz	$1,2 \cdot 10^{-3} U + 2,4 \mu V$	
		100 kHz	$1,2 \cdot 10^{-3} U + 3,5 \mu V$	
		200 kHz	$1,2 \cdot 10^{-3} U + 5,8 \mu V$	



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	22 mV ... < 70 mV	500 kHz	$1,2 \cdot 10^{-3} U + 12 \mu V$	
		700 kHz; 1 MHz	$1,1 \cdot 10^{-3} U + 18 \mu V$	
		10 Hz	$410 \cdot 10^{-6} U + 24 \mu V$	
		20 Hz	$380 \cdot 10^{-6} U + 18 \mu V$	
		40 Hz	$370 \cdot 10^{-6} U + 2,4 \mu V$	
		500 Hz; 1 kHz; 10 kHz; 20 kHz; 50 kHz; 100 kHz	$360 \cdot 10^{-6} U + 2,4 \mu V$	
	70 mV ... < 220 mV	200 kHz	$370 \cdot 10^{-6} U + 4,7 \mu V$	
		500 kHz	$390 \cdot 10^{-6} U + 12 \mu V$	
		700 kHz	$450 \cdot 10^{-6} U + 24 \mu V$	
		1 MHz	$700 \cdot 10^{-6} U + 24 \mu V$	
		10 Hz	$190 \cdot 10^{-6} U + 24 \mu V$	
		20 Hz	$110 \cdot 10^{-6} U + 18 \mu V$	
		40 Hz	$60 \cdot 10^{-6} U + 2,4 \mu V$	
		500 Hz; 1 kHz; 10 kHz; 20 kHz	$55 \cdot 10^{-6} U + 2,4 \mu V$	
		50 kHz; 100 kHz	$60 \cdot 10^{-6} U + 2,4 \mu V$	
		200 kHz	$60 \cdot 10^{-6} U + 4,7 \mu V$	
	220 mV ... < 700 mV	500 kHz	$140 \cdot 10^{-6} U + 12 \mu V$	
		700 kHz; 1 MHz	$250 \cdot 10^{-6} U + 24 \mu V$	
		10 Hz	$190 \cdot 10^{-6} U + 25 \mu V$	
		20 Hz	$110 \cdot 10^{-6} U + 18 \mu V$	
		40 Hz	$49 \cdot 10^{-6} U + 5,1 \mu V$	
		500 Hz; 1 kHz; 10 kHz	$44 \cdot 10^{-6} U + 5,1 \mu V$	
		20 kHz	$49 \cdot 10^{-6} U + 4,8 \mu V$	
		50 kHz; 100 kHz	$50 \cdot 10^{-6} U + 5,9 \mu V$	
		200 kHz	$66 \cdot 10^{-6} U + 12 \mu V$	
		500 kHz	$120 \cdot 10^{-6} U + 24 \mu V$	
		700 kHz	$260 \cdot 10^{-6} U + 58 \mu V$	
		1 MHz	$210 \cdot 10^{-6} U + 58 \mu V$	



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	700 mV ... < 2,2 V	10 Hz	$190 \cdot 10^{-6} U + 35 \mu V$	
		20 Hz	$110 \cdot 10^{-6} U + 21 \mu V$	
		40 Hz	$43 \cdot 10^{-6} U + 6.2 \mu V$	
		500 Hz; 1 kHz; 10 kHz; 20 kHz	$43 \cdot 10^{-6} U + 5.1 \mu V$	
		50 kHz; 100 kHz	$46 \cdot 10^{-6} U + 6,2 \mu V$	
		200 kHz	$64 \cdot 10^{-6} U + 12 \mu V$	
		500 kHz	$110 \cdot 10^{-6} U + 24 \mu V$	
		700 kHz	$230 \cdot 10^{-6} U + 58 \mu V$	
	2,2 V ... < 7 V	1 MHz	$200 \cdot 10^{-6} U + 58 \mu V$	
		10 Hz	$190 \cdot 10^{-6} U + 50 \mu V$	
		20 Hz	$110 \cdot 10^{-6} U + 35 \mu V$	
		40 Hz	$30 \cdot 10^{-6} U + 16 \mu V$	
		500 Hz	$27 \cdot 10^{-6} U + 18 \mu V$	
		1 kHz	$27 \cdot 10^{-6} U + 16 \mu V$	
		10 kHz	$27 \cdot 10^{-6} U + 13 \mu V$	
		20 kHz	$30 \cdot 10^{-6} U + 14 \mu V$	
		50 kHz	$32 \cdot 10^{-6} U + 14 \mu V$	
		100 kHz	$36 \cdot 10^{-6} U + 14 \mu V$	
		200 kHz	$55 \cdot 10^{-6} U + 20 \mu V$	
		500 kHz	$220 \cdot 10^{-6} U + 120 \mu V$	
		700 kHz	$360 \cdot 10^{-6} U + 120 \mu V$	
		1 MHz	$440 \cdot 10^{-6} U + 120 \mu V$	
	7 V ... < 22 V	10 Hz	$190 \cdot 10^{-6} U + 310 \mu V$	
		20 Hz	$100 \cdot 10^{-6} U + 79 \mu V$	
		40 Hz	$30 \cdot 10^{-6} U + 23 \mu V$	
		500 Hz	$30 \cdot 10^{-6} U + 32 \mu V$	
		1 kHz	$30 \cdot 10^{-6} U + 19 \mu V$	
		10 kHz; 20 kHz	$30 \cdot 10^{-6} U + 13 \mu V$	
		50 kHz	$32 \cdot 10^{-6} U + 22 \mu V$	
		100 kHz	$32 \cdot 10^{-6} U + 18 \mu V$	



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	22 V ... < 70 V	200 kHz	$67 \cdot 10^{-6} U + 21 \mu V$	
		500 kHz	$200 \cdot 10^{-6} U + 120 \mu V$	
		700 kHz	$390 \cdot 10^{-6} U + 130 \mu V$	
		1 MHz	$500 \cdot 10^{-6} U + 130 \mu V$	
		10 Hz	$180 \cdot 10^{-6} U + 780 \mu V$	
		20 Hz	$100 \cdot 10^{-6} U + 330 \mu V$	
		40 Hz	$36 \cdot 10^{-6} U + 220 \mu V$	
		500 Hz	$37 \cdot 10^{-6} U + 150 \mu V$	
		1 kHz	$27 \cdot 10^{-6} U + 180 \mu V$	
		10 kHz	$27 \cdot 10^{-6} U + 120 \mu V$	
		20 kHz	$27 \cdot 10^{-6} U + 130 \mu V$	
		50 kHz	$29 \cdot 10^{-6} U + 140 \mu V$	
		100 kHz	$37 \cdot 10^{-6} U + 210 \mu V$	
	70 V ... < 220 V	10 Hz	$190 \cdot 10^{-6} U + 2,3 \text{ mV}$	
		20 Hz	$110 \cdot 10^{-6} U + 530 \mu V$	
		40 Hz	$44 \cdot 10^{-6} U + 230 \mu V$	
		500 Hz	$36 \cdot 10^{-6} U + 260 \mu V$	
		1 kHz	$36 \cdot 10^{-6} U + 230 \mu V$	
		10 kHz	$36 \cdot 10^{-6} U + 210 \mu V$	
		20 kHz	$36 \cdot 10^{-6} U + 160 \mu V$	
		50 kHz	$37 \cdot 10^{-6} U + 210 \mu V$	
		100 kHz	$46 \cdot 10^{-6} U + 650 \mu V$	
	220 V ... < 700 V	50 Hz	$58 \cdot 10^{-6} U + 1,1 \text{ mV}$	
		500 Hz; 1 kHz	$40 \cdot 10^{-6} U + 1,1 \text{ mV}$	
	700 V ... < 1050 V	50 Hz	$58 \cdot 10^{-6} U + 1,2 \text{ mV}$	
		500 Hz; 1 kHz	$40 \cdot 10^{-6} U + 1,1 \text{ mV}$	
High voltage Calibration of high voltage sources	2 kV ... 20 kV	$R_L \geq 760 \text{ M}\Omega$; 16,7 Hz	1,2 % + 6,6 V	Procedure KA0022 RMS; $\hat{U}/\sqrt{2}$
	> 20 kV ... 30 kV		1,2 % + 22 V	
	1 kV ... 10 kV	$R_L \geq 110 \text{ M}\Omega$; 50 Hz	0,15 % + 0,2 V	



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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ ¹⁾	Remarks
Calibration of high voltage measurement instruments	> 10 kV ... 20 kV	$R_L \geq 200 \text{ M}\Omega$	0,13 % + 0,7 V	Also possible in Fehraltorf and on site ⁶⁾
	> 20 kV ... 30 kV	$R_L \geq 200 \text{ M}\Omega$	0,15 % + 3,0 V	
	> 30 kV ... 50 kV	$R_L \geq 760 \text{ M}\Omega$	1,2 % + 22 V	
	> 50 kV ... 100 kV	$R_L \geq 760 \text{ M}\Omega$	1,2 % + 29 V	
	1 kV ... 10 kV	50 Hz	0,15 % + 0,3 V	Procedure KA0022 RMS; $\hat{U}/\sqrt{2}$
	> 10 kV ... 20 kV		0,13 % + 0,8 V	
	> 20 kV ... 30 kV		0,15 % + 3,1 V	Also possible in Fehraltorf and on site ⁷⁾
	> 30 kV ... 50 kV		1,2 % + 23 V	
AC Current Calibration of current calibrators	> 50 kV ... 100 kV		1,2 % + 30 V	
	0,1 mA ... < 0,22 mA	40 Hz ... 5 kHz	$1,2 \cdot 10^{-3} /$	Also possible in the branches and on site ²⁾
	0,22 mA ... < 0,77 mA	40 Hz ... 1 kHz	$400 \cdot 10^{-6} /$	
		> 1 kHz ... 5 kHz	$470 \cdot 10^{-6} /$	I = Measurement value
	0,77 mA ... < 2 mA	40 Hz ... 1 kHz	$180 \cdot 10^{-6} /$	
		> 1 kHz ... 5 kHz	$300 \cdot 10^{-6} /$	
	2 mA ... 10 mA	20 Hz ... < 40 Hz	$100 \cdot 10^{-6} / + 0,44 \mu\text{A}$	
		40 Hz ... 5 kHz	$120 \cdot 10^{-6} / + 0,44 \mu\text{A}$	
		> 5 kHz ... 10 kHz	$200 \cdot 10^{-6} / + 0,44 \mu\text{A}$	
	> 10 mA ... 30 mA	20 Hz ... < 40 Hz	$110 \cdot 10^{-6} / + 4,5 \mu\text{A}$	
		40 Hz ... 10 kHz	$120 \cdot 10^{-6} / + 4,5 \mu\text{A}$	
	> 30 mA ... 100 mA	20 Hz ... < 40 Hz	$120 \cdot 10^{-6} / + 4,5 \mu\text{A}$	
		40 Hz ... 10 kHz	$130 \cdot 10^{-6} / + 4,5 \mu\text{A}$	
	> 100 mA ... 300 mA	20 Hz ... < 40 Hz	$130 \cdot 10^{-6} / + 31 \mu\text{A}$	
		40 Hz ... 10 kHz	$140 \cdot 10^{-6} / + 31 \mu\text{A}$	
	> 300 mA ... 2 A	20 Hz ... < 40 Hz	$130 \cdot 10^{-6} / + 31 \mu\text{A}$	
		40 Hz ... 5 kHz	$140 \cdot 10^{-6} / + 31 \mu\text{A}$	
		> 5 kHz ... 10 kHz	$160 \cdot 10^{-6} / + 31 \mu\text{A}$	
	> 2 A ... 5 A	20 Hz ... < 40 Hz	$120 \cdot 10^{-6} / + 38 \mu\text{A}$	
		40 Hz ... 10 kHz	$140 \cdot 10^{-6} / + 44 \mu\text{A}$	



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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ ¹⁾	Remarks
Calibration of ammeters	> 5 A ... 10 A	20 Hz ... < 40 Hz	$120 \cdot 10^{-6} / + 47 \mu\text{A}$	Also possible in the branches and on site ²⁾
		40 Hz ... 5 kHz	$150 \cdot 10^{-6} / + 57 \mu\text{A}$	
		> 5 kHz ... 10 kHz	$190 \cdot 10^{-6} / + 57 \mu\text{A}$	
	> 10 A ... 20 A	20 Hz ... < 40 Hz	$130 \cdot 10^{-6} / + 89 \mu\text{A}$	
		40 Hz ... 5 kHz	$290 \cdot 10^{-6} / + 120 \mu\text{A}$	
		> 5 kHz ... 10 kHz	$910 \cdot 10^{-6} / + 130 \mu\text{A}$	
	> 20 A ... 120 A	45 Hz ... 55 Hz	$200 \cdot 10^{-6} /$	
	0,1 mA ... < 0,22 mA	40 Hz ... 5 kHz	$1,2 \cdot 10^{-3} /$	
	0,22 mA ... < 0,77 mA	40 Hz ... 1 kHz	$410 \cdot 10^{-6} /$	
		> 1 kHz ... 5 kHz	$480 \cdot 10^{-6} /$	
	0.77 mA ... < 2 mA	40 Hz ... 1 kHz	$190 \cdot 10^{-6} /$	
		> 1 kHz ... 5 kHz	$310 \cdot 10^{-6} /$	
	2 mA ... 10 mA	20 Hz ... < 40 Hz	$140 \cdot 10^{-6} / + 0,46 \mu\text{A}$	
		40 Hz ... 1 kHz	$130 \cdot 10^{-6} / + 0,46 \mu\text{A}$	
		> 1 kHz ... 5 kHz	$140 \cdot 10^{-6} / + 0,74 \mu\text{A}$	
		> 5 kHz ... 10 kHz	$510 \cdot 10^{-6} / + 1,3 \mu\text{A}$	
	> 10 mA ... 30 mA	20 Hz ... < 40 Hz	$150 \cdot 10^{-6} / + 4,6 \mu\text{A}$	
		40 Hz ... 1 kHz	$130 \cdot 10^{-6} / + 4,6 \mu\text{A}$	
		> 1 kHz ... 5 kHz	$140 \cdot 10^{-6} / + 5,7 \mu\text{A}$	
		> 5 kHz ... 10 kHz	$480 \cdot 10^{-6} / + 7,4 \mu\text{A}$	
	> 30 mA ... 100 mA	20 Hz ... < 40 Hz	$160 \cdot 10^{-6} / + 4,6 \mu\text{A}$	
		40 Hz ... 1 kHz	$140 \cdot 10^{-6} / + 4,6 \mu\text{A}$	
		> 1 kHz ... 5 kHz	$150 \cdot 10^{-6} / + 5,7 \mu\text{A}$	
		> 5 kHz ... 10 kHz	$480 \cdot 10^{-6} / + 7,4 \mu\text{A}$	
	> 100 mA ... 300 mA	20 Hz ... 1 kHz	$160 \cdot 10^{-6} / + 32 \mu\text{A}$	
		> 1 kHz ... 5 kHz	$170 \cdot 10^{-6} / + 39 \mu\text{A}$	
		> 5 kHz ... 10 kHz	$940 \cdot 10^{-6} / + 66 \mu\text{A}$	
	> 300 mA ... 2 A	20 Hz ... 1 kHz	$160 \cdot 10^{-6} / + 32 \mu\text{A}$	
		> 1 kHz ... 5 kHz	$170 \cdot 10^{-6} / + 40 \mu\text{A}$	
		> 5 kHz ... 10 kHz	$940 \cdot 10^{-6} / + 66 \mu\text{A}$	



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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ ¹⁾	Remarks
Calibration of current clamps	> 2 A ... 5 A	20 Hz ... < 40 Hz	$120 \cdot 10^{-6} / + 50 \mu\text{A}$	
		40 Hz ... 10 kHz	$140 \cdot 10^{-6} / + 60 \mu\text{A}$	
	> 5 A ... 10 A	20 Hz ... < 40 Hz	$120 \cdot 10^{-6} / + 60 \mu\text{A}$	
		40 Hz ... 5 kHz	$150 \cdot 10^{-6} / + 80 \mu\text{A}$	
		> 5 kHz ... 10 kHz	$190 \cdot 10^{-6} / + 80 \mu\text{A}$	
	> 10 A ... 20 A	20 Hz ... < 40 Hz	$130 \cdot 10^{-6} / + 130 \mu\text{A}$	
		40 Hz ... 5 kHz	$290 \cdot 10^{-6} / + 170 \mu\text{A}$	
		> 5 kHz ... 10 kHz	$910 \cdot 10^{-6} / + 180 \mu\text{A}$	
	> 20 A ... 120 A	45 Hz ... 55 Hz	$200 \cdot 10^{-6} /$	
	50 A ... 500 A	45 Hz ... 55 Hz	$5,8 \cdot 10^{-3} / + 280 \text{ mA}$	
Calibration of Rogowski coils	> 500 A ... 3000 A		$5,8 \cdot 10^{-3} /$	With current coil
	50 A ... 1000 A	45 Hz ... 55 Hz	$5,8 \cdot 10^{-3} / + 550 \text{ mA}$	
Capacitance	1 pF	100 Hz; 1 kHz;	$360 \cdot 10^{-6} \text{ C}$	Decadic values only Also possible in the branches ²⁾ C = Measurement value
		10 kHz	$370 \cdot 10^{-6} \text{ C}$	
	10 pF	100 Hz; 1 kHz; 10 kHz	$360 \cdot 10^{-6} \text{ C}$	
	100 pF	100 Hz; 1 kHz; 10 kHz	$360 \cdot 10^{-6} \text{ C}$	
	1000 pF	100 Hz; 1 kHz; 10 kHz	$360 \cdot 10^{-6} \text{ C}$	
	10 nF	100 Hz	$130 \cdot 10^{-6} \text{ C}$	
		1 kHz	$96 \cdot 10^{-6} \text{ C}$	
	100 nF	100 Hz	$230 \cdot 10^{-6} \text{ C}$	
		1 kHz	$110 \cdot 10^{-6} \text{ C}$	
	1 μF	100 Hz	$440 \cdot 10^{-6} \text{ C}$	
		1 kHz	$130 \cdot 10^{-6} \text{ C}$	
Inductance	100 μH			Decadic values only
		100 Hz	$3,5 \cdot 10^{-3} \text{ L}$	
		1 kHz	$410 \cdot 10^{-6} \text{ L}$	
Calibration of inductance meters				Also possible in the branches ²⁾ L = Measurement value



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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ ¹⁾	Remarks
AC Power	1 mH	100 Hz	$440 \cdot 10^{-6} L$	
		1 kHz	$190 \cdot 10^{-6} L$	
	10 mH	100 Hz; 1 kHz	$140 \cdot 10^{-6} L$	
	100 mH	100 Hz; 1 kHz	$140 \cdot 10^{-6} L$	
	1 H	100 Hz; 1 kHz	$140 \cdot 10^{-6} L$	
	10 H	1 kHz	$190 \cdot 10^{-6} L$	
		48,5 Hz ... 51,5 Hz		
	2,4 W ... 30 kW	40 V ... 480 V		Measuring range referred to $\cos \varphi = 1$
		60 mA ... 100 A		
		$\cos \varphi = 1$	$160 \cdot 10^{-6} P$	Also possible in Fehraltorf and on site ²⁾
Calibration of power sources (effective power)		$\cos \varphi = 0,5 \dots < 1$ (c, i)	$295 \cdot 10^{-6} P$	P = Measurement value
Calibration of power measurement instruments (effective power)		48,5 Hz ... 51,5 Hz		Measuring range referred $\cos \varphi = 1$
	330 μ W ... < 2,4 W	100 mV ... 40 V		
		3,3 mA ... 60 A		
		$\cos \varphi = 1$	0,13 %	
		$\cos \varphi = 0,5 \dots < 1$ (c, i)	0,37 %	Also possible in Fehraltorf and on site ²⁾
	2,4 W ... 30 kW	40 V ... 480 V		Voltages up to 1000 V with greater uncertainty possible
		60 mA ... 100 A		
		$\cos \varphi = 1$	$160 \cdot 10^{-6} P$	
		$\cos \varphi = 0,5 \dots < 1$ (c, i)	$295 \cdot 10^{-6} P$	
		48,5 Hz ... 51,5 Hz		Measuring range referred $\cos \varphi = 1$
Calibration of power meter clamps (effective power)	330 μ W ... < 1 MW	100 mV ... 1000 V		
		3,3 mA ... 1000 A		With current coil
		$\cos \varphi = 1$	0,62 %	Also possible in Fehraltorf and on site ²⁾
		$\cos \varphi = 0,5 \dots < 1$ (c, i)	0,71 %	
		Measurement period:		
	1 mHz ... < 10 mHz	≥ 100 s	$2,0 \cdot 10^{-5} f$	Also possible in the branches and on site ²⁾
	10 mHz ... < 100 mHz		$8,9 \cdot 10^{-6} f$	f = Measurement value
	100 mHz ... < 1 Hz		$1,9 \cdot 10^{-6} f$	
Frequency				
Calibration of frequency counters	1 mHz ... < 10 mHz	≥ 100 s	$2,0 \cdot 10^{-5} f$	Also possible in the branches and on site ²⁾
	10 mHz ... < 100 mHz		$8,9 \cdot 10^{-6} f$	f = Measurement value
	100 mHz ... < 1 Hz		$1,9 \cdot 10^{-6} f$	



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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ ¹⁾	Remarks
Calibration of frequency generators	1 Hz ... < 10 Hz	≥ 10 s	$2,0 \cdot 10^{-7} f$	Also possible in the branches and on site ²⁾
	10 Hz ... < 100 Hz		$2,0 \cdot 10^{-8} f$	
	100 Hz ... < 1 kHz		$1,2 \cdot 10^{-9} f$	
	1 kHz ... < 10 kHz		$1,1 \cdot 10^{-10} f$	
	10 kHz ... < 1 MHz		$1,6 \cdot 10^{-11} f$	
	1 MHz ... < 3 GHz		$9,7 \cdot 10^{-12} f$	
	3 GHz ... 50 GHz		$5,9 \cdot 10^{-11} f$	
		Measurement period:		
	1 mHz ... < 10 mHz	≥ 100 s	$2,0 \cdot 10^{-5} f$	
	10 mHz ... < 100 mHz		$8,9 \cdot 10^{-6} f$	
	100 mHz ... < 1 Hz		$1,9 \cdot 10^{-6} f$	
	1 Hz ... < 10 Hz		$2,0 \cdot 10^{-7} f$	
	10 Hz ... < 100 Hz		$2,0 \cdot 10^{-8} f$	
	100 Hz ... < 1 kHz		$1,2 \cdot 10^{-9} f$	
Period	1 kHz ... < 10 kHz		$1,1 \cdot 10^{-10} f$	
	10 kHz ... < 1 MHz		$1,6 \cdot 10^{-11} f$	
	1 MHz ... < 3 GHz	≥ 10 s	$9,7 \cdot 10^{-12} f$	
	3 GHz ... 50 GHz	≥ 10 s	$5,9 \cdot 10^{-11} f$	
	1 MHz; 5 MHz; 10 MHz	≥ 1 h	$9,6 \cdot 10^{-12} f$	
		Measurement period:		
	10 ns ... < 10 μ s	≥ 10 s	$1,5 \cdot 10^{-16} t$	
	10 μ s ... < 100 μ s		$1,7 \cdot 10^{-15} t$	
	100 μ s ... < 1 ms		$1,1 \cdot 10^{-13} t$	
	1 ms ... < 10 ms		$1,2 \cdot 10^{-11} t$	
	10 ms ... < 100 ms		$2 \cdot 10^{-9} t$	
	100 ms ... < 1 s		$2 \cdot 10^{-7} t$	
	1 s ... 10 s	≥ 100 s	$2 \cdot 10^{-5} t$	
				Phase comparison
				t = Measurement value



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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ ¹⁾	Remarks
Number of revolutions	6 U/min ... < 30 U/min		$5,9 \cdot 10^{-4} \, n$	Optical
	30 U/min ... < 60 U/min		$7,6 \cdot 10^{-4} \, n$	n = Measurement value
	60 U/min ... < 1000 U/min		$6,9 \cdot 10^{-3} \, n$	
	1000 U/min ... < 10000 U/min		$6,7 \cdot 10^{-2} \, n$	
	10000 U/min ... 100000 U/min		$5,8 \cdot 10^{-1} \, n$	
RF- Power				
Calibration of RF power meters	>10 μ W ... 10 mW (-20 dBm ... +10 dBm)	9 kHz ... <2,4 GHz	2,7 % + 73 nW	Analyzer: VSWR $\leq 1,3$
		2,4 GHz ... <12,4 GHz	3,2 % + 73 nW	
		12,4 GHz ... 18 GHz	3,9 % + 73 nW	
	>10 nW ... 10 μ W (-50 dBm ... -20 dBm)	10 MHz ... <2,4 GHz	5,7 % + 155 pW	
		2,4 GHz ... <8 GHz	6,9 % + 155 pW	
		8 GHz ... <18 GHz	11 % + 155 pW	
	100 μ W ... 10 mW (-10 dBm ... +10 dBm)	2,5 MHz ... 1,3 GHz	3,2 % + 0.51 μ W	
	>10 nW ... 100 μ W (-50 dBm ... -10 dBm)	2,5 MHz ... 1,3 GHz	3,9%	
	>0,1 pW ... 10 nW (-100 dBm ... -50 dBm)	2,5 MHz ... 1,3 GHz	4,7%	
	>0,001 pW ... 0,1 pW (-120 dBm ... -100 dBm)	2,5 MHz ... 1,3 GHz	5,7%	
Calibration of signal generators	100 μ W ... 100 mW (-10 dBm ... +20 dBm)	2,5 MHz ... 1,3 GHz	2,7 % + 0,51 μ W	Generator: VSWR $\leq 1,3$
	>10 nW ... 100 μ W (-50 dBm ... -10 dBm)	2,5 MHz ... 1,3 GHz	3,5%	
	>0,1 pW ... 10 nW (-100 dBm ... -50 dBm)	2,5 MHz ... 1,3 GHz	4,3%	
	>0,001 pW ... 0,1 pW (-120 dBm ... -100 dBm)	2,5 MHz ... 1,3 GHz	5,4%	
	>10 μ W ... 100 mW	9 kHz ... <2,4 GHz	2,2 % + 72 nW	



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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ ¹⁾	Remarks
Reflection factor One port (Value and phase)	(-20 dBm ... +20 dBm)	2,4 GHz ... <12,4 GHz	2,9 % + 72 nW	
		12,4 GHz ... 18 GHz	3,5 % + 72 nW	
	>10 nW ... 12,589 μ W	10 MHz ... <2.4 GHz	5,5 % + 156 pW	
	(-50 dBm ... -19 dBm)	2,4 GHz ... <12,4 GHz	6,7 % + 156 pW	
		12,4 GHz ... 18 GHz	10,4 % + 156 pW	
	0 ... 1	9 kHz ... 20 GHz		Z = 50 Ω 3.5mm Connector Also possible on site
			See matrix M.1 & M.2	
	0 ... 1	9 kHz ... 18 GHz		Z = 50 Ω N Connector Also possible on site
			See matrix M.3 & M.4	
	0 ... 1	9 kHz ... 18 GHz		Z = 50 Ω 7mm Connector Also possible on site
Transmission factor Two ports (Value and phase)			See matrix M.5 & M.6	
	0 ... 1	9 kHz ... 3 GHz		Z = 50 Ω BNC Connector Also possible on site
			See matrix M.7 & M.8	
	0 dB ... 80 dB	9 kHz ... 20 GHz		Z = 50 Ω 3.5mm Connector Also possible on site
			See matrix M.9 & M.10	
	0 dB ... 80 dB	9 kHz ... 18 GHz		Z = 50 Ω N Connector Also possible on site
			See matrix M.11 & M.12	
	0 dB ... 80 dB	9 kHz ... 18 GHz		Z = 50 Ω 7mm Connector Also possible on site
			See matrix M.13 & M.14	



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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ ¹⁾	Remarks
	0 dB ... 80 dB	9 kHz ... 3 GHz	See matrix M.15 & M.16	Z = 50 Ω BNC Connector Also possible on site

Matrix M.1: HF- Reflection factor, Value $|G|$; 3.5mm - Connector 50 Ω

Value $ G $	9 kHz ... 300 MHz	300 MHz ... 3 GHz	3 GHz ... 9 GHz	9 GHz ... 20 GHz
0	0.004	0.003 to 0.004	0.004	0.004 to 0.005
0.1	0.005 to 0.003	0.003 to 0.004	0.003 to 0.004	0.004 to 0.005
0.2	0.005 to 0.003	0.003 to 0.004	0.004	0.004 to 0.005
0.3	0.005 to 0.003	0.003 to 0.004	0.004	0.004 to 0.005
0.4	0.004 to 0.006	0.004	0.004 to 0.005	0.004 to 0.005
0.5	0.004 to 0.006	0.004	0.004 to 0.005	0.004 to 0.005
0.6	0.004 to 0.006	0.005 to 0.004	0.004 to 0.006	0.006 to 0.004
0.7	0.005 to 0.007	0.006 to 0.005	0.005 to 0.006	0.006 to 0.004
0.8	0.006 to 0.008	0.006 to 0.005	0.005 to 0.007	0.007 to 0.005
0.9	0.006 to 0.009	0.007 to 0.004	0.005 to 0.008	0.007 to 0.005
1	0.003 to 0.008	0.008 to 0.003	0.007 to 0.004	0.004 to 0.007



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Matrix M.2: HF- Reflection factor, Phase angle φ ; 3.5mm - Connector 50 Ω

Value $ \Gamma $	9 kHz ... 300 MHz	300 MHz ... 3 GHz	3 GHz ... 9 GHz	9 GHz ... 20 GHz
0	-	-	-	-
0.1	2.4 deg to 1.7 deg	1.7 deg to 1.9 deg	1.8 deg to 2.0 deg	2.3 deg to 2.8 deg
0.2	1.4 deg to 0.9 deg	0.9 deg to 1.0 deg	1.0 deg to 1.1 deg	1.2 deg to 1.5 deg
0.3	0.9 deg to 0.6 deg	0.6 deg to 0.7 deg	0.7 deg to 0.8 deg	0.9 deg to 1.2 deg
0.4	0.8 deg to 0.5 deg	0.6 deg to 0.5 deg	0.6 deg to 0.7 deg	0.7 deg to 1.0 deg
0.5	0.7 deg to 0.5 deg	0.5 deg	0.5 deg to 0.7 deg	0.6 deg to 0.9 deg
0.6	0.5 deg to 0.6 deg	0.5 deg to 0.4 deg	0.4 deg to 0.6 deg	0.6 deg to 0.8 deg
0.7	0.4 deg to 0.6 deg	0.5 deg to 0.4 deg	0.4 deg to 0.6 deg	0.6 deg to 0.8 deg
0.8	0.4 deg to 0.6 deg	0.5 deg to 0.4 deg	0.4 deg to 0.6 deg	0.5 deg to 0.7 deg
0.9	0.3 deg to 0.6 deg	0.5 deg to 0.3 deg	0.4 deg to 0.6 deg	0.4 deg to 0.7 deg
1	0.2 deg to 0.4 deg	0.5 deg to 0.2 deg	0.3 deg to 0.4 deg	0.4 deg to 0.7 deg

Matrix M.3: HF- Reflection factor, Value $|\Gamma|$; N - Connector 50 Ω

Value $ \Gamma $	9 kHz ... 300 MHz	300 MHz ... 3 GHz	3 GHz ... 9 GHz	9 GHz ... 18 GHz
0	0.004	0.004	0.005 to 0.004	0.005 to 0.006
0.1	0.005 to 0.004	0.004	0.005 to 0.004	0.005 to 0.006
0.2	0.005 to 0.004	0.004 to 0.005	0.005 to 0.004	0.005 to 0.007
0.3	0.005 to 0.004	0.004 to 0.005	0.004 to 0.005	0.005 to 0.007
0.4	0.006 to 0.004	0.004 to 0.005	0.004 to 0.005	0.005 to 0.007
0.5	0.006 to 0.004	0.004 to 0.005	0.004 to 0.006	0.005 to 0.006
0.6	0.005 to 0.006	0.005 to 0.006	0.005 to 0.006	0.005 to 0.006
0.7	0.005 to 0.007	0.005 to 0.006	0.005 to 0.007	0.005 to 0.007
0.8	0.006 to 0.008	0.006 to 0.007	0.005 to 0.007	0.007 to 0.005
0.9	0.009 to 0.005	0.004 to 0.008	0.004 to 0.008	0.008 to 0.005
1	0.003 to 0.007	0.003 to 0.009	0.008 to 0.004	0.004 to 0.009

Matrix M.4: HF- Reflection factor, Phase angle φ ; N - Connector 50 Ω

Value $ \Gamma $	9 kHz ... 300 MHz	300 MHz ... 3 GHz	3 GHz ... 9 GHz	9 GHz ... 18 GHz
0	-	-	-	-
0.1	2.5 deg to 1.8 deg	1.9 deg to 2.3 deg	2.4 deg to 2.0 deg	2.5 deg to 3.1 deg
0.2	1.5 deg to 0.9 deg	1.0 deg to 1.2 deg	1.0 deg to 1.2 deg	1.3 deg to 2.0 deg
0.3	1.0 deg to 0.7 deg	0.7 deg to 0.8 deg	0.7 deg to 0.9 deg	0.9 deg to 1.3 deg
0.4	0.8 deg to 0.6 deg	0.6 deg to 0.7 deg	0.6 deg to 0.8 deg	0.7 deg to 1.0 deg
0.5	0.7 deg to 0.5 deg	0.5 deg to 0.6 deg	0.5 deg to 0.7 deg	0.6 deg to 0.8 deg
0.6	0.6 deg to 0.5 deg	0.5 deg	0.5 deg to 0.6 deg	0.5 deg to 0.7 deg
0.7	0.4 deg to 0.6 deg	0.4 deg to 0.5 deg	0.4 deg to 0.6 deg	0.5 deg to 0.7 deg
0.8	0.4 deg to 0.6 deg	0.4 deg to 0.5 deg	0.4 deg to 0.6 deg	0.5 deg to 0.6 deg
0.9	0.6 deg to 0.4 deg	0.3 deg to 0.5 deg	0.3 deg to 0.6 deg	0.4 deg to 0.6 deg
1	0.2 deg to 0.4 deg	0.2 deg to 0.5 deg	0.2 deg to 0.5 deg	0.3 deg to 0.6 deg



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Matrix M.5: HF- Reflection factor, Value $|G|$; 7mm - Connector 50 Ω

Value $ G $	9 kHz ... 300 MHz	300 MHz ... 3 GHz	3 GHz ... 9 GHz	9 GHz ... 18 GHz
0	0.004	0.004	0.004 to 0.005	0.005 to 0.007
0.1	0.005 to 0.004	0.004	0.004	0.005 to 0.006
0.2	0.006 to 0.004	0.004	0.004	0.005 to 0.006
0.3	0.006 to 0.004	0.004 to 0.005	0.004 to 0.005	0.005 to 0.007
0.4	0.004 to 0.006	0.005 to 0.004	0.004 to 0.005	0.005 to 0.007
0.5	0.005 to 0.007	0.005 to 0.004	0.005 to 0.006	0.005 to 0.008
0.6	0.005 to 0.007	0.006 to 0.005	0.005 to 0.006	0.006 to 0.009
0.7	0.005 to 0.008	0.006 to 0.005	0.005 to 0.007	0.006 to 0.010
0.8	0.006 to 0.009	0.007 to 0.005	0.006 to 0.008	0.007 to 0.010
0.9	0.007 to 0.010	0.008 to 0.005	0.006 to 0.009	0.008 to 0.013
1	0.004	0.004 to 0.005	0.005 to 0.007	0.006 to 0.009

Matrix M.6: HF- Reflection factor, Phase angle φ ; 7mm - Connector 50 Ω

Value $ G $	9 kHz ... 300 MHz	300 MHz ... 3 GHz	3 GHz ... 9 GHz	9 GHz ... 18 GHz
0	-	-	-	-
0.1	2.8 deg to 2.2 deg	2.2 deg to 2.3 deg	2.3 deg to 2.2 deg	2.6 deg to 3.2 deg
0.2	1.6 deg to 1.1 deg	1.1 deg to 1.2 deg	1.2 deg	1.3 deg to 1.7 deg
0.3	1.1 deg to 0.8 deg	0.8 deg	0.8 deg to 0.9 deg	0.9 deg to 1.3 deg
0.4	0.9 deg to 0.6 deg	0.7 deg to 0.6 deg	0.6 deg to 0.8 deg	0.8 deg to 1.1 deg
0.5	0.7 deg to 0.5 deg	0.6 deg to 0.5 deg	0.5 deg to 0.7 deg	0.7 deg to 0.9 deg
0.6	0.5 deg to 0.7 deg	0.5 deg	0.5 deg to 0.6 deg	0.6 deg to 0.9 deg
0.7	0.5 deg to 0.7 deg	0.5 deg to 0.4 deg	0.5 deg to 0.6 deg	0.6 deg to 0.9 deg
0.8	0.4 deg to 0.7 deg	0.5 deg to 0.4 deg	0.5 deg to 0.6 deg	0.5 deg to 0.7 deg
0.9	0.4 deg to 0.7 deg	0.5 deg to 0.4 deg	0.4 deg to 0.6 deg	0.5 deg to 0.8 deg
1	0.4 deg to 0.3 deg	0.3 deg	0.3 deg to 0.4 deg	0.4 deg to 0.6 deg

Matrix M.7: HF- Reflection factor, Value $|G|$; BNC - Connector 50 Ω

Value $ G $	9 kHz ... 300 MHz	300 MHz ... 3 GHz
0	0.008	0.008 to 0.009
0.1	0.008	0.008 to 0.009
0.2	0.008 to 0.009	0.008 to 0.010
0.3	0.008 to 0.009	0.008 to 0.011
0.4	0.008 to 0.009	0.009 to 0.013
0.5	0.008 to 0.009	0.009 to 0.016
0.6	0.008 to 0.010	0.010 to 0.018
0.7	0.009 to 0.011	0.011 to 0.021
0.8	0.010 to 0.012	0.012 to 0.024
0.9	0.011 to 0.013	0.013 to 0.027
1	0.011 to 0.013	0.013 to 0.030



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Matrix M.8: HF- Reflection factor, Phase angle φ ; BNC - Connector 50 Ω

Value $ \Gamma $	9 kHz ... 300 MHz	300 MHz ... 3 GHz
0	-	-
0.1	4.1 deg to 4.6 deg	4.6 deg to 5.2 deg
0.2	2.1 deg to 2.4 deg	2.4 deg to 3.3 deg
0.3	1.4 deg to 1.6 deg	1.6 deg to 2.8 deg
0.4	1.1 deg to 1.3 deg	1.3 deg to 2.6 deg
0.5	0.9 deg to 1.1 deg	1.1 deg to 2.5 deg
0.6	0.8 deg to 1.0 deg	1.0 deg to 2.4 deg
0.7	0.7 deg to 0.9 deg	0.9 deg to 2.4 deg
0.8	0.7 deg to 0.9 deg	0.9 deg to 2.4 deg
0.9	0.7 deg to 0.9 deg	0.9 deg to 2.4 deg
1	0.6 deg to 0.8 deg	0.8 deg to 2.4 deg

Matrix M.9: HF- Transmission factor; 3.5mm - Connector 50 Ω

Attenuation absolute	9 kHz ... 300 MHz	300 MHz ... 3 GHz	3 GHz ... 9 GHz	9 GHz ... 20 GHz
0 dB	0.04 dB to 0.05 dB	0.05 dB to 0.09 dB	0.09 dB to 0.15 dB	0.15 dB
3 dB	0.08 dB to 0.09 dB	0.08 dB to 0.11 dB	0.11 dB to 0.16 dB	0.16 dB
6 dB	0.08 dB to 0.09 dB	0.08 dB to 0.11 dB	0.11 dB to 0.16 dB	0.16 dB
10 dB	0.09 dB to 0.08 dB	0.08 dB to 0.11 dB	0.11 dB to 0.16 dB	0.16 dB
20 dB	0.09 dB to 0.07 dB	0.07 dB to 0.11 dB	0.11 dB to 0.16 dB	0.16 dB to 0.15 dB
30 dB	0.09 dB to 0.07 dB	0.08 dB to 0.11 dB	0.11 dB to 0.16 dB	0.16 dB
40 dB	0.09 dB to 0.08 dB	0.08 dB to 0.11 dB	0.11 dB to 0.16 dB	0.16 dB
50 dB	0.10 dB to 0.08 dB	0.08 dB to 0.12 dB	0.12 dB to 0.17 dB	0.16 dB to 0.17 dB
60 dB	0.14 dB to 0.12 dB	0.12 dB to 0.15 dB	0.15 dB to 0.19 dB	0.19 dB to 0.20 dB
70 dB	0.20 dB to 0.16 dB	0.17 dB to 0.19 dB	0.19 dB to 0.23 dB	0.26 dB to 0.31 dB
80 dB	0.36 dB to 0.21 dB	0.21 dB to 0.24 dB	0.24 dB to 0.27 dB	0.50 dB to 0.71 dB

Matrix M.10: HF- Transmission factor, Phase angle φ ; 3.5mm - Connector 50 Ω

Attenuation absolute	9 kHz to 300 MHz	300 MHz to 3 GHz	3 GHz to 9 GHz	9 GHz to 20 GHz
0 dB	0.4 deg	0.4 deg to 0.8 deg	0.8 deg to 1.3 deg	1.3 deg to 1.8 deg
3 dB	0.6 deg to 0.7 deg	0.6 deg to 0.9 deg	0.9 deg to 1.3 deg	1.3 deg to 1.9 deg
6 dB	0.6 deg to 0.7 deg	0.6 deg to 0.9 deg	0.9 deg to 1.3 deg	1.3 deg to 1.9 deg
10 dB	0.6 deg to 0.7 deg	0.6 deg to 0.9 deg	0.9 deg to 1.3 deg	1.3 deg to 1.9 deg
20 dB	0.6 deg to 0.7 deg	0.6 deg to 0.9 deg	0.9 deg to 1.4 deg	1.3 deg to 1.9 deg
30 dB	0.6 deg to 0.7 deg	0.6 deg to 0.9 deg	0.9 deg to 1.4 deg	1.3 deg to 1.9 deg
40 dB	0.6 deg to 0.7 deg	0.6 deg to 0.9 deg	0.9 deg to 1.4 deg	1.3 deg to 1.9 deg
50 dB	0.6 deg to 0.7 deg	0.6 deg to 0.9 deg	0.9 deg to 1.4 deg	1.4 deg to 1.9 deg
60 dB	0.8 deg to 0.9 deg	0.8 deg to 1.1 deg	1.1 deg to 1.5 deg	1.5 deg to 2.1 deg
70 dB	1.4 deg to 1.1 deg	1.1 deg to 1.3 deg	1.3 deg to 1.7 deg	1.9 deg to 2.6 deg
80 dB	2.4 deg to 1.4 deg	1.5 deg to 1.6 deg	1.6 deg to 2.0 deg	3.4 deg to 4.9 deg



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Matrix M.11: HF- Transmission factor r ; N - Connector 50 Ω

Attenuation absolute	9 kHz to 300 MHz	300 MHz to 3 GHz	3 GHz to 9 GHz	9 GHz to 18 GHz
0 dB	0.04 dB to 0.05 dB	0.05 dB to 0.09 dB	0.09 dB to 0.15 dB	0.15 dB
3 dB	0.08 dB to 0.09 dB	0.08 dB to 0.11 dB	0.11 dB to 0.16 dB	0.16 dB
6 dB	0.08 dB to 0.09 dB	0.08 dB to 0.11 dB	0.11 dB to 0.16 dB	0.16 dB
10 dB	0.08 dB to 0.09 dB	0.08 dB to 0.11 dB	0.11 dB to 0.16 dB	0.16 dB
20 dB	0.09 dB to 0.07 dB	0.07 dB to 0.11 dB	0.11 dB to 0.16 dB	0.16 dB to 0.15 dB
30 dB	0.09 dB to 0.07 dB	0.08 dB to 0.11 dB	0.11 dB to 0.16 dB	0.16 dB
40 dB	0.09 dB to 0.08 dB	0.08 dB to 0.11 dB	0.11 dB to 0.16 dB	0.16 dB
50 dB	0.08 dB to 0.10 dB	0.08 dB to 0.12 dB	0.12 dB to 0.17 dB	0.16 dB to 0.17 dB
60 dB	0.14 dB to 0.12 dB	0.12 dB to 0.15 dB	0.15 dB to 0.19 dB	0.19 dB to 0.20 dB
70 dB	0.20 dB to 0.16 dB	0.17 dB to 0.19 dB	0.19 dB to 0.23 dB	0.26 dB to 0.31 dB
80 dB	0.36 dB to 0.21 dB	0.22 dB to 0.24 dB	0.24 dB to 0.27 dB	0.50 dB to 0.68 dB

Matrix M.12: HF- Transmission factor, Phase angle φ ; N - Connector 50 Ω

Attenuation absolute	9 kHz to 300 MHz	300 MHz to 3 GHz	3 GHz to 9 GHz	9 GHz to 18 GHz
0 dB	0.4 deg	0.4 deg to 0.8 deg	0.8 deg to 1.3 deg	1.3 deg to 1.7 deg
3 dB	0.6 deg to 0.7 deg	0.6 deg to 0.9 deg	0.9 deg to 1.3 deg	1.3 deg to 1.8 deg
6 dB	0.6 deg to 0.7 deg	0.6 deg to 0.9 deg	0.9 deg to 1.3 deg	1.3 deg to 1.8 deg
10 dB	0.6 deg to 0.7 deg	0.6 deg to 0.9 deg	0.9 deg to 1.3 deg	1.3 deg to 1.8 deg
20 dB	0.6 deg to 0.7 deg	0.6 deg to 0.9 deg	0.9 deg to 1.4 deg	1.3 deg to 1.8 deg
30 dB	0.6 deg to 0.7 deg	0.6 deg to 0.9 deg	0.9 deg to 1.4 deg	1.3 deg to 1.8 deg
40 dB	0.6 deg to 0.7 deg	0.6 deg to 0.9 deg	0.9 deg to 1.4 deg	1.3 deg to 1.8 deg
50 dB	0.6 deg to 0.7 deg	0.6 deg to 0.9 deg	0.9 deg to 1.4 deg	1.4 deg to 1.8 deg
60 dB	0.8 deg to 1.0 deg	0.8 deg to 1.1 deg	1.1 deg to 1.5 deg	1.5 deg to 2.0 deg
70 dB	1.4 deg to 1.1 deg	1.1 deg to 1.3 deg	1.3 deg to 1.7 deg	1.9 deg to 2.5 deg
80 dB	2.4 deg to 1.4 deg	1.5 deg to 1.6 deg	1.6 deg to 2.0 deg	3.5 deg to 4.8 deg

Matrix M.13: HF- Transmission factor; 7mm - Connector 50 Ω

Attenuation absolute	9 kHz to 300 MHz	300 MHz to 3 GHz	3 GHz to 9 GHz	9 GHz to 18 GHz
0 dB	0.04 dB to 0.05 dB	0.05 dB to 0.09 dB	0.09 dB to 0.15 dB	0.15 dB
3 dB	0.08 dB to 0.09 dB	0.08 dB to 0.11 dB	0.11 dB to 0.16 dB	0.16 dB
6 dB	0.08 dB to 0.09 dB	0.08 dB to 0.11 dB	0.11 dB to 0.16 dB	0.16 dB
10 dB	0.08 dB to 0.09 dB	0.08 dB to 0.11 dB	0.11 dB to 0.16 dB	0.16 dB
20 dB	0.09 dB to 0.07 dB	0.07 dB to 0.11 dB	0.11 dB to 0.16 dB	0.15 dB to 0.16 dB
30 dB	0.09 dB to 0.07 dB	0.08 dB to 0.11 dB	0.11 dB to 0.16 dB	0.16 dB
40 dB	0.09 dB to 0.08 dB	0.08 dB to 0.11 dB	0.11 dB to 0.16 dB	0.16 dB
50 dB	0.08 dB to 0.10 dB	0.08 dB to 0.12 dB	0.12 dB to 0.17 dB	0.16 dB to 0.17 dB
60 dB	0.14 dB to 0.12 dB	0.12 dB to 0.15 dB	0.15 dB to 0.19 dB	0.19 dB to 0.21 dB
70 dB	0.20 dB to 0.16 dB	0.17 dB to 0.19 dB	0.19 dB to 0.23 dB	0.26 dB to 0.31 dB
80 dB	0.36 dB to 0.21 dB	0.22 dB to 0.24 dB	0.24 dB to 0.27 dB	0.51 dB to 0.70 dB



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Matrix M.14: HF- Transmission factor, Phase angle φ ; 7mm - Connector 50 Ω

Attenuation absolute	9 kHz to 300 MHz	300 MHz to 3 GHz	3 GHz to 9 GHz	9 GHz to 18 GHz
0 dB	0.4 deg	0.4 deg to 0.8 deg	0.8 deg to 1.3 deg	1.3 deg to 1.7 deg
3 dB	0.6 deg to 0.7 deg	0.6 deg to 0.9 deg	0.9 deg to 1.3 deg	1.3 deg to 1.8 deg
6 dB	0.6 deg to 0.7 deg	0.6 deg to 0.9 deg	0.9 deg to 1.3 deg	1.3 deg to 1.8 deg
10 dB	0.6 deg to 0.7 deg	0.6 deg to 0.9 deg	0.9 deg to 1.3 deg	1.3 deg to 1.8 deg
20 dB	0.6 deg to 0.7 deg	0.6 deg to 0.9 deg	0.9 deg to 1.4 deg	1.3 deg to 1.8 deg
30 dB	0.6 deg to 0.7 deg	0.6 deg to 0.9 deg	0.9 deg to 1.4 deg	1.3 deg to 1.8 deg
40 dB	0.6 deg to 0.7 deg	0.6 deg to 0.9 deg	0.9 deg to 1.4 deg	1.3 deg to 1.8 deg
50 dB	0.6 deg to 0.7 deg	0.6 deg to 0.9 deg	0.9 deg to 1.4 deg	1.4 deg to 1.9 deg
60 dB	0.8 deg to 1.0 deg	0.8 deg to 1.1 deg	1.1 deg to 1.5 deg	1.5 deg to 2.0 deg
70 dB	1.4 deg to 1.1 deg	1.1 deg to 1.3 deg	1.3 deg to 1.7 deg	1.9 deg to 2.5 deg
80 dB	2.4 deg to 1.4 deg	1.5 deg to 1.6 deg	1.6 deg to 2.0 deg	3.5 deg to 4.9 deg

Matrix M.15: HF- Transmission factor; BNC - Connector 50 Ω

Attenuation absolute	9 kHz to 300 MHz	300 MHz to 3 GHz
0 dB	0.04 dB to 0.05 dB	0.05 dB to 0.09 dB
3 dB	0.08 dB to 0.09 dB	0.08 dB to 0.11 dB
6 dB	0.10 dB to 0.08 dB	0.08 dB to 0.11 dB
10 dB	0.10 dB to 0.08 dB	0.08 dB to 0.11 dB
20 dB	0.10 dB to 0.07 dB	0.07 dB to 0.11 dB
30 dB	0.10 dB to 0.07 dB	0.08 dB to 0.11 dB
40 dB	0.10 dB to 0.08 dB	0.08 dB to 0.11 dB
50 dB	0.11 dB to 0.08 dB	0.08 dB to 0.12 dB
60 dB	0.15 dB to 0.12 dB	0.12 dB to 0.15 dB
70 dB	0.21 dB to 0.16 dB	0.17 dB to 0.19 dB
80 dB	0.37 dB to 0.21 dB	0.22 dB to 0.24 dB

Matrix M.16: HF- Transmission factor; Phase angle φ ; BNC - Connector 50 Ω

Attenuation absolute	9 kHz to 300 MHz	300 MHz to 3 GHz
0 dB	0.4 deg	0.4 deg to 0.8 deg
3 dB	0.6 deg to 0.7 deg	0.6 deg to 0.9 deg
6 dB	0.6 deg to 0.7 deg	0.6 deg to 0.9 deg
10 dB	0.7 deg to 0.6 deg	0.6 deg to 0.9 deg
20 dB	0.8 deg to 0.6 deg	0.6 deg to 0.9 deg
30 dB	0.8 deg to 0.6 deg	0.6 deg to 0.9 deg
40 dB	0.8 deg to 0.6 deg	0.6 deg to 0.9 deg
50 dB	0.8 deg to 0.6 deg	0.6 deg to 0.9 deg
60 dB	1.0 deg to 0.8 deg	0.8 deg to 1.1 deg
70 dB	1.4 deg to 1.1 deg	1.1 deg to 1.3 deg
80 dB	2.5 deg to 1.4 deg	1.5 deg to 1.6 deg



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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ ¹⁾	Remarks
Calibration of Oscilloscopes				
Rectangular voltage amplitude	1 mV ... 12 mV	1 kHz/1 M Ω	$1,5 \cdot 10^{-3} U + 12 \mu\text{V}$	Also possible on site ²⁾
	> 12 mV ... 120 mV	1 kHz/1 M Ω	$1,2 \cdot 10^{-3} U + 16 \mu\text{V}$	
	> 120 mV ... 600 mV	1 kHz/1 M Ω	$1,2 \cdot 10^{-3} U + 39 \mu\text{V}$	
	> 600 mV ... 1,2 V	1 kHz/1 M Ω	$1,2 \cdot 10^{-3} U + 62 \mu\text{V}$	
	> 1,2 V ... 5,5 V	1 kHz/1 M Ω	$1,2 \cdot 10^{-3} U + 310 \mu\text{V}$	
	> 5,5 V ... 12 V	1 kHz/1 M Ω	$1,2 \cdot 10^{-3} U + 700 \mu\text{V}$	
	> 12 V ... 30 V	1 kHz/1 M Ω	$1,2 \cdot 10^{-3} U + 2,7 \text{ mV}$	
	> 30 V ... 60 V	1 kHz/1 M Ω	$1,2 \cdot 10^{-3} U + 3,3 \text{ mV}$	
	> 60 V ... 120 V	1 kHz/1 M Ω	$1,2 \cdot 10^{-3} U + 5,9 \text{ mV}$	
	> 120 V ... 200 V	1 kHz/1 M Ω	$1,3 \cdot 10^{-3} U + 27 \text{ mV}$	
	1 mV ... 12 mV	1 kHz/50 Ω	$1,5 \cdot 10^{-3} U + 12 \mu\text{V}$	
	> 12 mV ... 120 mV	1 kHz/50 Ω	$1,2 \cdot 10^{-3} U + 16 \mu\text{V}$	
	> 120 mV ... 600 mV	1 kHz/50 Ω	$1,2 \cdot 10^{-3} U + 39 \mu\text{V}$	
	> 600 mV ... 1,2 V	1 kHz/50 Ω	$1,2 \cdot 10^{-3} U + 62 \mu\text{V}$	
	> 1,2 V ... 5,5 V	1 kHz/50 Ω	$1,2 \cdot 10^{-3} U + 310 \mu\text{V}$	
DC voltage	1 mV ... 300 mV	DC/1 M Ω	$290 \cdot 10^{-6} U + 32 \mu\text{V}$	
	> 300 mV ... 1,5 V	DC/1 M Ω	$290 \cdot 10^{-6} U + 90 \mu\text{V}$	
	> 1,5 V ... 3 V	DC/1 M Ω	$290 \cdot 10^{-6} U + 130 \mu\text{V}$	
	> 3 V ... 6 V	DC/1 M Ω	$290 \cdot 10^{-6} U + 430 \mu\text{V}$	
	> 6 V ... 15 V	DC/1 M Ω	$290 \cdot 10^{-6} U + 630 \mu\text{V}$	
	> 15 V ... 200 V	DC/1 M Ω	$290 \cdot 10^{-6} U + 840 \mu\text{V}$	
	1 mV ... 300 mV	DC/50 Ω	$290 \cdot 10^{-6} U + 32 \mu\text{V}$	
	> 300 mV ... 1.5 V	DC/50 Ω	$290 \cdot 10^{-6} U + 90 \mu\text{V}$	
	> 1,5 V ... 3 V	DC/50 Ω	$290 \cdot 10^{-6} U + 130 \mu\text{V}$	



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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm 1)$	Remarks
Time base	> 3 V ... 5,5 V	DC/50 Ω	$290 \cdot 10^{-6} U + 100 \mu V$	
Sampling rate	0,2 ms	99,5 MHz; 100,5 MHz 30 mVpp ... 1 Vpp 100 MS/s	$50 \cdot 10^{-9} t$	t = Measurement value
Time interval	1 ms	10 MHz / 1 Vpp	$290 \cdot 10^{-9} t$	
Time marker	0,5 ns ... 1 s	100 mV ... 1 V	$1,1 \cdot 10^{-6} t + 12 \text{ ps}$	
Risetime	$\geq 350 \text{ ps}$	4,5 mV ... 3,1 V	39 ps	
Flatness	5 mVpp ... 5 Vpp	$\leq 300 \text{ MHz}$	3,1 %	50 Ω , VSWR $\leq 1,6$
		> 300 MHz ... 550 MHz	4,1 %	Calibrated to U_{inc}
	5 mVpp ... 3 Vpp	> 550 MHz ... 1,1 GHz	5,1 %	
		> 1,1 GHz ... 3,2 GHz	6,2 %	
	5 mVpp ... 5 Vpp	$\leq 10 \text{ MHz}$	3,2 %	1 M Ω , $C_{in} \leq 7 \text{ pF}$
		> 10 MHz ... 100 MHz	5,9 %	Calibrated to U_{Load}
		> 100 MHz ... 150 MHz	11 %	
		> 150 MHz ... 250 MHz	14 %	
Input resistance	50 Ω		0,13 %	
	1 M Ω		0,08 %	
Optical power				
Calibration of fiber optic power measurement instruments	-24 dBm ... -30 dBm	$\lambda = 850 \text{ nm}$	2,0 %	50 μm Multimode
	-22 dBm ... -30 dBm	$\lambda = 1300 \text{ nm}$	2,0 %	
Absolute power	-5 dBm ... -30 dBm	$\lambda = 1310 \text{ nm}$	1,1 %	9 μm Singlemode
	-5 dBm ... -30 dBm	$\lambda = 1550 \text{ nm}$	1,1 %	
Linearity	-24 dBm ... -60 dBm	$\lambda = 850 \text{ nm}$	1,6 %	50 μm Multimode
	-22 dBm ... -60 dBm	$\lambda = 1300 \text{ nm}$	1,5 %	
	-5 dBm ... -60 dBm	$\lambda = 1310 \text{ nm}$	1,5 %	9 μm Singlemode
	-5 dBm ... -60 dBm	$\lambda = 1550 \text{ nm}$	1,6 %	
Calibration of fiber optic sources	0 dBm ... -60 dBm	$\lambda = 800 \dots 900 \text{ nm}$	1,5 %	50 μm Multimode
	-5 dBm ... -60 dBm	$\lambda = 1250 \dots 1350 \text{ nm}$	1,4 %	
Absolute power	-5 dBm ... -60 dBm	$\lambda = 1200 \dots 1600 \text{ nm}$	1,1 %	9 μm Singlemode
	-5 dBm ... -60 dBm	$\lambda = 1600 \dots 1650 \text{ nm}$	1,2 %	



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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ ¹⁾	Remarks
Calibration of fiber optic attenuators	Attenuation range 0 dB ... 40 dB	λ = 850 nm	1,6 %	50 μ m Multimode
	0 dB ... 40 dB	λ = 1300 nm	1,6 %	
	0 dB ... 60 dB	λ = 1310 nm	1,6 %	9 μ m Singlemode
Insertion loss	0 dB ... 60 dB	λ = 1550 nm	1,6 %	
Wavelength of sources	600 nm ... < 1520 nm	P = +10 ... -60 dBm	0,35 nm	
	1520 nm ... 1620 nm		0,07 nm	
	> 1620 nm ... 1750 nm		0,35 nm	
Calibration of OTDR	Distance:	λ :	Deviation of the distance scale:	Also possible on site ²⁾
SM-modules	0 km ... 100 km	1200 nm ... 1650 nm	3,8•10 ⁻⁵ m/m	
			Position offset: 0,72 m	
Scale of attenuation			Deviation of the scale of attenuation:	
	0 dB ... 30 dB	1310 nm	0,013 dB/dB	
		1550 nm	0,022 dB/dB	
		1625 nm	0,026 dB/dB	
		1650 nm	0,023 dB/dB	
Temperature				
Thermal calibration				More units possible: °F; K
Fixed-point for ITS-90	0,01 °C	Triple point of water	0,015 K	
Thermometer with direct display and resistance thermometer	-90 °C ... 125 °C	Comparison with a standard platinum resistance thermometer in air in the bloc calibrator	0,035 K	Also possible in the branches and on site ^{2), 8)}
	> 125 °C ... 165 °C		0,084 K	
	> 165 °C ... 450 °C		0,16 K	
	> 450 °C ... 650 °C		0,21 K	
	> -30 °C ... 165 °C	Comparison with a standard platinum resistance thermometer in liquid in the bath	0,08 K	Also possible in the branches and on site ^{2), 8)}
	-50 °C ... < -40 °C	Comparison with a standard platinum resistance thermometer in air in the climatic chamber	1,22 K	
	-40 °C ... < -20 °C		0,37 K	
	-20 °C ... < -10 °C		0,26 K	
	-10 °C ... < 30 °C		0,25 K	



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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ ¹⁾	Remarks
Thermocouple elements	30 °C ... < 40 °C		0,28 K	
	40 °C ... < 60 °C		0,31 K	
	60 °C ... < 100 °C		1,3 K	
	100 °C ... < 120 °C		1,0 K	
	120 °C ... 150 °C		1,1 K	
Type K; Type N	-90 °C ... 125 °C	Comparison with a standard platinum resistance thermometer in air in the bloc calibrator	0,29 K + 0,002• t	Also possible in the branches and on site ^{2), 8)}
	> 125 °C ... 165 °C		0,30 K + 0,002• t	
	> 165 °C ... 450 °C		0,31 K + 0,002• t	
	> 450 °C ... 650 °C		0,34 K + 0,002• t	
Type J; Type T	-90 °C ... 125 °C		0,23 K + 0,005• t	
	> 125 °C ... 165 °C		0,23 K + 0,005• t	
	> 165 °C ... 450 °C		0,27 K + 0,005• t	
	> 450 °C ... 650 °C		0,30 K + 0,005• t	
Type R; Type S	0 °C ... 650 °C		1,0 K + 0,0004• t	
Type K; Type N	-30 °C ... 165 °C	Comparison with a standard platinum resistance thermometer in liquid in the bath	0,3 K + 0,002• t	Also possible in the branches and on site ^{2), 8)}
Type J; Type T	-30 °C ... 165 °C		0,32 K + 0,005• t	
Type R; Type S	-30 °C ... 165 °C		1,0 K + 0,0004• t	
Type K; Type N	-50 °C ... < -40 °C	Comparison with a standard platinum resistance thermometer in air in the climatic chamber	1,3 K	
	-40 °C ... < -20 °C		0,47 K	
	-20 °C ... < 40 °C		0,4 K	
	40 °C ... < 60 °C		0,42 K	
	60 °C ... 150 °C		1,31 K	
Type J; Type T	-50 °C ... < -40 °C		1,3 K	
	-40 °C ... < -20 °C		0,45 K	
	-20 °C ... < 30 °C		0,35 K	
	30 °C ... < 60 °C		0,41 K	
	60 °C ... < 150 °C		1,32 K	
Type R; Type S	-50 °C ... < -40 °C		1,6 K	
	-40 °C ... < 60 °C		1,1 K	
	60 °C ... 150 °C		1,7 K	



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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ ¹⁾	Remarks
Thermal installations				
Bloc calibrator with dry bloc insert	-90 °C ... < 125 °C 125 °C ... 165 °C > 165 °C ... 250 °C > 250 °C ... 450 °C > 450 °C ... 650 °C	With PRT Pt 100	0,033 K 0,083 K 0,1 K 0,16 K 0,21 K	Also possible in the branches and on site ²⁾
Bloc calibrator with micro bath insert	- 30 °C ... 165 °C		0,11 K	
(Ovens, climate chambers)	-90 °C ... -50 °C	With PRT Pt 100	0,2 K	
Display deviation from the (reference-) measuring point	> -50 °C ... 125 °C > 125 °C ... 250 °C > 250 °C ... 350 °C		0,2 K 0,21 K	
		With TC type J	1,1 K + 0.003• t	
measuring point in the thermal installations (Baths, Ovens, climate chambers)	-90 °C ... 150 °C > 150 °C ... 350 °C	With PRT Pt 100 With TC Type J	0,2 K 1,0 K + 0.003• t	Also possible on site ²⁾
Relative humidity	20 %rH ... < 45 %rH 45 %rH ... 80 %rH	Measuring point in climate chamber at 23 °C	1,43 %rH 1,5 %rH	
Electric calibration				
Measurement of RTD- temperature calibrator	-200 °C ... 300 °C > 300 °C ... 800 °C	Pt 100 (Pt 385)	0,01 K 0,02 K	Also possible in the branches and on site ²⁾
Simulations of RTD- temperature measuring instruments	-200 °C ... 0 °C > 0 °C ... 100 °C > 100 °C ... 630 °C > 630 °C ... 800 °C	Pt 100 (Pt 385)	0,06 K 0,08 K 0,12 K 0,27 K	
	-200 °C ... 100 °C > 100 °C ... 300 °C > 300 °C ... 400 °C > 400 °C ... 600 °C > 600 °C ... 630 °C	Pt 200 (Pt 385)	0,05 K 0,06 K 0,14 K 0,16 K 0,19 K	
	-200 °C ... -80 °C > -80 °C ... 100 °C > 100 °C ... 260 °C > 260 °C ... 400 °C	Pt 500 (Pt 385)	0,05 K 0,06 K 0,07 K 0,10 K	



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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ ¹⁾	Remarks
Measurement and simulations of thermocouple measuring instruments and -calibrators	> 400 °C ... 600 °C	Pt 1000 (Pt 385)	0,11 K	Also possible in the branches and on site ²⁾
	> 600 °C ... 630 °C		0,13 K	
	-200 °C ... 0 °C		0,04 K	
	> 0 °C ... 100 °C		0,05 K	
	> 100 °C ... 260 °C		0,06 K	
	> 260 °C ... 300 °C		0,07 K	
	> 300 °C ... 400 °C		0,08 K	
	> 400 °C ... 600 °C		0,09 K	
	> 600 °C ... 630 °C		0,27 K	
	600 °C ... 800 °C	Typ B	0,51 K	
	> 800 °C ... 1820 °C	Typ C	0,39 K	
	0 °C ... 1000 °C		0,36 K	
	> 1000 °C ... 1800 °C		0,58 K	
	> 1800 °C ... 2316 °C	Typ E	0,97 K	
	-250 °C ... < -100 °C		0,58 K	
	-100 °C ... 650 °C		0,19 K	
	> 650 °C ... 2100 °C	Typ J	0,24 K	
	-210 °C ... < -100 °C		0,31 K	
	-100 °C ... < -30 °C		0,19 K	
	-30 °C ... < 150 °C	Typ K	0,16 K	
	150 °C ... 760 °C		0,20 K	
	> 760 °C ... 1200 °C		0,27 K	
	-210 °C ... < -100 °C		0,38 K	
	-100 °C ... < -25 °C		0,21 K	
	-25 °C ... 120 °C	Typ L	0,19 K	
	> 120 °C ... 1000 °C		0,30 K	
	> 1000 °C ... 1372 °C		0,46 K	
	-210 °C ... < -100 °C		0,43 K	
	-100 °C ... 800 °C	Typ N	0,30 K	
	> 800 ... 900 °C		0,20 K	
	-210 °C ... < -100 °C		0,46 K	
	-100 °C ... < -25 °C		0,25 K	
	-25 °C ... 410 °C		0,22 K	



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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ ¹⁾	Remarks
Pressure	> 410 °C ... 1300 °C	Typ R	0,31 K	
	0 °C ... < 250 °C		0,66 K	
	250 °C ... 1000 °C		0,40 K	
	> 1000 °C ... 1767 °C		0,46 K	
	0 °C ... < 250 °C	Typ S	0,54 K	
	250 °C ... 1400 °C		0,43 K	
	> 1400 °C ... 1767 °C		0,53 K	
	-250 °C ... < -150 °C	Typ T	0,73 K	
	-150 °C ... < 0 °C		0,28 K	
	0 °C ... 400 °C	Typ U	0,19 K	
	-200 °C ... < 0 °C		0,65 K	
	0 °C ... 600 °C		0,31 K	
	Absolute pressure in fluids			
	0.01 mbar ... 13,8 mbar		0,094 mbar	
	> 13,8 mbar ... 14 bar		$35 \cdot 10^{-6} p + 0,004 \text{ mbar}$	
	> 14 bar ... 70 bar		$50 \cdot 10^{-6} p$	
	> 70 bar ... 210 bar		$50 \cdot 10^{-6} p$	
	> 210 bar ... 1000 bar		$250 \cdot 10^{-6} p$	
	Positive and negative gauge pressure in fluids			
	-900 mbar ... 14 bar		$35 \cdot 10^{-6} p$	
	> 14 bar ... 70 bar		$50 \cdot 10^{-6} p$	
	> 70 bar ... 210 bar		$50 \cdot 10^{-6} p$	
	> 210 bar ... 1000 bar		$25 \cdot 10^{-6} p$	
	Differential pressure in fluids			
	-160 mbar ... -77 mbar		0,015 mbar	
	> -77 mbar ... -10 mbar		$120 \cdot 10^{-6} p + 0,006 \text{ mbar}$	
	> -10 mbar ... < 10 mbar		$100 \cdot 10^{-6} p + 0,006 \text{ mbar}$	
	10 mbar ... < 77 mbar		$120 \cdot 10^{-6} p + 0,006 \text{ mbar}$	
	77 mbar ... 160 mbar		0,015 mbar	
	0 ... 46,7 kPa	20 °C ... 25 °C	0,08 kPa	



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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ ¹⁾	Remarks
Manometer of blood pressure monitor	0 ... 350 mmHg		0,6 mmHg	According to Standard: SN EN ISO 81060-1
Magnetic flux density				
Calibration of magnetic field analyzers	0,1 μ T ... 200 μ T	10 Hz ... 1 kHz	1,9 % + 0,12 μ T	Also other units possible: A/m; A/cm, Gauss
	0,1 μ T ... 25 μ T	> 1 kHz ... 2 kHz		
	> 200 μ T ... 250 μ T	10 Hz ... 1 kHz	1,9 % + 0,12 μ T	
Electric field strength				
Calibration of electric field analyzers	0 V/m ... 1330 V/m	10 Hz ... 1 kHz	1,6 % + 0,12 V/m	
	0 V/m ... 293 V/m	> 1 kHz ... 100 kHz		
	1,3 kV/m ... 20 kV/m	50 Hz		
CDN				
Impedance	0 Ω ... 250 Ω	9 kHz ... 230 MHz	4,0 Ω	According to SN EN 61000-4-6
Voltage Division Factor	0 dB ... 60 dB	9 kHz ... 230 MHz	0,4 dB	Also possible on site
LISN				
Impedance	0 Ω ... 250 Ω	9 kHz ... 100 kHz	0,35 Ω	According to CISPR 16-1-2
		>100 kHz ... 5 MHz	0,8 Ω	Also possible on site
		>5 MHz ... 30 MHz	0,8 Ω	
Phase	-180 ° ... 180 °	9 kHz ... 100 kHz	2,0 °	
		>100 kHz ... 5 MHz	1,0 °	
		>5 MHz ... 30 MHz	4,0 °	
Voltage Division Factor		9 kHz ... 30 MHz	0,4 dB	
Isolation	40 dB	9 kHz ... 20 MHz	1,2 dB	
		>20 MHz ... 30 MHz	2,8 dB	
	50 dB	9 kHz ... 20 MHz	2,4 dB	
		>20 MHz ... 30 MHz	2,8 dB	
	60 dB	25 kHz ... 20 MHz	2,2 dB	
		>20 MHz ... 30 MHz	2,8 dB	



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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ ¹⁾	Remarks
Surge	70 dB	100 kHz ... 3 MHz >3 MHz ... 30 MHz	1,6 dB 3,6 dB	According to SN EN 61000-4-5 Also possible on site
Peak Voltage	0,4 kV ... 5 kV		5,3 %	
Peak Current	1 A ... 4 kA		7,1 %	
Rise Time Voltage	0,4 μ s ... 10 μ s		21 ns	
Rise Time Current	0,4 μ s ... 10 μ s		100 ns	
Pulse duration Voltage	10 μ s ... 100 μ s		800 ns	
Pulse duration Current	10 μ s ... 100 μ s		100 ns	
Burst				According to SN EN 61000-4-4 Also possible on site
Peak Voltage	0,1 kV ... 4,2 kV		4,9 %	
Rise Time	2 ns ... 1 μ s		0,34 ns	
Pulse duration	5 ns ... 1 μ s		1,1 ns	
Burst duration	2 ms ... 20 ms	5 kHz Puls	2 ms	
	0,2 ... 20 ms	100 kHz Puls	0,2 ms	
Burst period	10 ms ... 500 ms		20 ms	
NSA Of semi-anechoic chambers				According to CISPR 16-1-4: 2020
	30 MHz ... < 59 MHz		3,3 dB	Only possible on site.
	59 MHz ... < 85 MHz		2,8 dB	
	85 MHz ... < 200 MHz		2,2 dB	
	200 MHz ... 1000 MHz		2,1 dB	
Site VSWR Of semi-anechoic chambers				According to CISPR 16-1-4: 2020
	1 GHz ... 6 GHz		1,2 dB	Only possible on site.
	> 6 GHz ... 12 GHz		1,5 dB	
	> 12 GHz ... 18 GHz		1,6 dB	



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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ ¹⁾	Remarks
Calibration of instrument transformers				
Inductive voltage transformer	2 kV $\leq$ U _p $\leq$ 60 kV Usr: 100 V; 100/ $\sqrt{3}$ V 110 V; 110/ $\sqrt{3}$ V	50 Hz	0,018 % / 0,27 min	IEC 61869-1 IEC 61869-3 EN 61869-1 EN 61869-3
Inductive current transformer	5 A $\leq$ I _p $\leq$ 2 kA > 2 kA $\leq$ I _p $\leq$ 6 kA Isr: 1 A; 5 A	50 Hz 50 Hz	0,023 % / 1,0 min 0,022 % / 1,4 min	IEC 61869-1 IEC 61869-2 EN 61869-1 EN 61869-2

The dimensionless parts of the measurement uncertainty are relative values, referred to the measured value.

Notes and limitations:

- 2) Calibration on site with larger measurement uncertainties
- 3) in Gümligen up to 35 kV, in Fehraltorf and on site up to 50 kV
- 4) in Gümligen up to 12 kV, in Fehraltorf and on site up to 50 kV
- 5) in the branch and on site up to 5 T Ω possible
- 6) in Gümligen up to 30 kV, in Fehraltorf and on site up to 100 kV
- 7) in Gümligen up to 20 kV, in Fehraltorf and on site up to 100 kV (Generator should be available on site)
- 8) in the branch and on site: -30 °C ... 165 °C

In case of contradictions in the language versions of the directories, the German version shall apply.

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