



## SCS-Directory

Accreditation number: SCS 0058

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

APTOMET AG  
Worbstrasse 201  
3073 Gümligen

Head: Markus Tschopp  
Responsible for MS: Beat Schär  
Phone: +41 31 934 06 00  
E-Mail: [calibration@aptomet.ch](mailto:calibration@aptomet.ch)  
Internet: <http://www.aptomet.ch>  
Initial accreditation: 06.12.1995  
Current accreditation: 14.03.2021 to 13.03.2026  
Scope of accreditation see: [www.sas.admin.ch](http://www.sas.admin.ch)  
(Accredited bodies)

Additional site under the accreditation:

Luppenstrasse 3  
8320 Fehraltorf

Head: Markus Wampfler  
Phone: +41 31 934 06 02  
E-Mail: [calibration@aptomet.ch](mailto:calibration@aptomet.ch)  
Internet: <http://www.aptomet.ch>

Freiburgstrasse 251  
3018 Bern

Head: Daniel Niedermann  
Phone: +41 31 934 06 01  
E-Mail: [calibration@aptomet.ch](mailto:calibration@aptomet.ch)  
Internet: <http://www.aptomet.ch>

### Scope of accreditation as of 29.11.2023

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

Calibration and Measurement Capability (CMC)



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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ <sup>1)</sup>	Remarks
<b>DC Voltage</b>				
Calibration of voltage measurement instruments	0 mV ... < 220 mV		$7,2 \cdot 10^{-6} U + 0,6 \mu\text{V}$	Also possible in the branches and on site <sup>2)</sup> U = Measurement value
	220 mV ... < 2,2 V		$3,5 \cdot 10^{-6} U + 1,6 \mu\text{V}$	
	2,2 V ... < 22 V		$2,6 \cdot 10^{-6} U + 7 \mu\text{V}$	
	22 V ... < 220 V		$3,5 \cdot 10^{-6} U + 120 \mu\text{V}$	
	220 V ... 1100 V		$4 \cdot 10^{-6} U + 700 \mu\text{V}$	
Calibration of voltage calibrators	0 mV ... < 120 mV		$6,6 \cdot 10^{-6} U + 0,1 \mu\text{V}$	
	120 mV ... < 1,2 V		$2 \cdot 10^{-6} U + 0,2 \mu\text{V}$	
	1,2 V ... < 12 V		$2 \cdot 10^{-6} U + 1 \mu\text{V}$	
	12 V ... < 120 V		$2 \cdot 10^{-6} U + 14 \mu\text{V}$	
	120 V ... 1050 V		$3 \cdot 10^{-6} U + 200 \mu\text{V}$	
Fixed voltages	100 mV		$6,5 \cdot 10^{-6} U$	
	1 V; 10 V; 100 V; 1000V		$2 \cdot 10^{-6} U$	
Calibration of high voltage generators	1 kV ... $\leq$ 10 kV	$R_L \geq 110 \text{ M}\Omega$	0,05 % + 0,11 V	Also possible in Fehraltorf and on site <sup>3)</sup>
	> 10 kV ... 20 kV	$R_L \geq 200 \text{ M}\Omega$	0,06 % + 1,3 V	
	> 20 kV ... 35 kV	$R_L \geq 200 \text{ M}\Omega$	0,1 % + 3,0 V	
	> 35 kV ... 50 kV	$R_L \geq 760 \text{ M}\Omega$	1,2 % + 6,5 V	
Calibration of voltage measurement instruments	1 kV ... $\leq$ 10 kV		0,05 % + 0,11 V	Also possible in Fehraltorf and on site <sup>4)</sup>
	> 10 kV ... 20 kV		0,05 % + 1,3 V	
	> 20 kV ... 35 kV		0,1 % + 3,1 V	
	> 35 kV ... 50 kV		1,2 % + 6,6 V	
<b>DC Current</b>				
Calibration of ammeters	0 $\mu\text{A}$ ... 12 $\mu\text{A}$		$16 \cdot 10^{-6} I + 0,2 \text{ nA}$	Also possible in the branches and on site <sup>2)</sup> I = Measurement value
	> 12 $\mu\text{A}$ ... 120 $\mu\text{A}$		$16 \cdot 10^{-6} I + 0,5 \text{ nA}$	
	> 120 $\mu\text{A}$ ... 1,2 mA		$16 \cdot 10^{-6} I + 4,5 \text{ nA}$	
	> 1,2 mA ... 12 mA		$16 \cdot 10^{-6} I + 41 \text{ nA}$	
	> 12 mA ... 120 mA		$16 \cdot 10^{-6} I + 0,5 \mu\text{A}$	
	> 120 mA ... 2 A		$17 \cdot 10^{-6} I + 4,5 \mu\text{A}$	
	> 2 A ... 20 A		$68 \cdot 10^{-6} I + 43 \mu\text{A}$	
	> 20 A ... 100 A		$73 \cdot 10^{-6} I + 130 \mu\text{A}$	
	> 100 A ... 500 A	With current coil	$5,8 \cdot 10^{-3} I + 26 \text{ mA}$	



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Calibration of current clamps	> 500 A ... 2500 A		$5,8 \cdot 10^{-3} / + 160 \text{ mA}$	
Calibration of current calibrators	0 $\mu\text{A}$ ... 12 $\mu\text{A}$		$16 \cdot 10^{-6} / + 0,11 \text{ nA}$	Also possible in the branches and on site <sup>2)</sup>
	> 12 $\mu\text{A}$ ... 120 $\mu\text{A}$		$16 \cdot 10^{-6} / + 0,4 \text{ nA}$	
	> 120 $\mu\text{A}$ ... 1,2 mA		$16 \cdot 10^{-6} / + 3,6 \text{ nA}$	
	> 1,2 mA ... 12 mA		$16 \cdot 10^{-6} / + 35 \text{ nA}$	
	> 12 mA ... 120 mA		$16 \cdot 10^{-6} / + 350 \text{ nA}$	
	> 120 mA ... 2 A		$17 \cdot 10^{-6} / + 3,7 \mu\text{A}$	
	> 2 A ... 20 A		$68 \cdot 10^{-6} / + 36 \mu\text{A}$	
	> 20 A ... 100 A		$73 \cdot 10^{-6} / + 40 \mu\text{A}$	
<b>DC Resistance</b> Calibration of resistance measurement instruments	100 $\mu\Omega$		$70 \cdot 10^{-6} R$	The measurement uncertainties indicated apply to decadic values
	1 m $\Omega$		$45 \cdot 10^{-6} R$	
	10 m $\Omega$ ; 100 m $\Omega$		$45 \cdot 10^{-6} R$	
With fixed resistors	1 $\Omega$ ; 10 $\Omega$		$10 \cdot 10^{-6} R$	Also possible in the branches and on site <sup>2),5)</sup>
	100 $\Omega$ ; 1 k $\Omega$		$8 \cdot 10^{-6} R$	
	10 k $\Omega$		$5 \cdot 10^{-6} R$	
	19 k $\Omega$ ; 100 k $\Omega$		$8 \cdot 10^{-6} R$	
	1 M $\Omega$		$10 \cdot 10^{-6} R$	
	10 M $\Omega$		$12 \cdot 10^{-6} R$	
	100 M $\Omega$		$40 \cdot 10^{-6} R$	
	1 G $\Omega$		$250 \cdot 10^{-6} R$	
	10 G $\Omega$		$520 \cdot 10^{-6} R$	
	100 G $\Omega$		$750 \cdot 10^{-6} R$	
	1 T $\Omega$		$5 \cdot 10^{-3} R$	
	10 T $\Omega$		$8 \cdot 10^{-3} R$	
	100 T $\Omega$		$16 \cdot 10^{-3} R$	
With precision resistance decades	10 m $\Omega$ ... 10 $\Omega$		$47 \cdot 10^{-6} R + 0,82 \text{ m}\Omega$	Also possible in the branches and on site <sup>2),5)</sup>
	> 10 $\Omega$ ... 1 k $\Omega$		$38 \cdot 10^{-6} R + 1,3 \text{ m}\Omega$	
	> 1 k $\Omega$ ... 10 k $\Omega$		$29 \cdot 10^{-6} R + 6 \text{ m}\Omega$	



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Calibration of resistances	> 10 k $\Omega$ ... 100 k $\Omega$		$28 \cdot 10^{-6} R + 58 \text{ m}\Omega$	Also possible in the branches and on site <sup>5)</sup>
	> 100 k $\Omega$ ... 1 M $\Omega$		$33 \cdot 10^{-6} R + 2,3 \Omega$	
	> 1 M $\Omega$ ... 10 M $\Omega$		$150 \cdot 10^{-6} R + 116 \Omega$	
	> 10 M $\Omega$ ... 100 M $\Omega$		$600 \cdot 10^{-6} R + 1,2 \text{ k}\Omega$	
	> 100 M $\Omega$ ... 1 G $\Omega$		$1,4 \cdot 10^{-3} R$	
	> 1 G $\Omega$ ... 10 G $\Omega$		$2,6 \cdot 10^{-3} R$	
	> 10 G $\Omega$ ... 100 G $\Omega$		$6 \cdot 10^{-3} R$	
	> 100 G $\Omega$ ... 1 T $\Omega$		$9 \cdot 10^{-3} R$	
	100 $\mu\Omega$ ... < 500 $\mu\Omega$		$100 \cdot 10^{-6} R$	
	500 $\mu\Omega$ ... < 5 m $\Omega$		$75 \cdot 10^{-6} R$	
	5 m $\Omega$ ... < 50 m $\Omega$		$72 \cdot 10^{-6} R$	
	50 m $\Omega$ ... < 500 m $\Omega$		$44 \cdot 10^{-6} R$	
	500 m $\Omega$ ... < 5 $\Omega$		$10 \cdot 10^{-6} R$	
	5 $\Omega$ ... < 50 $\Omega$		$10 \cdot 10^{-6} R$	
	50 $\Omega$ ... < 500 $\Omega$		$10 \cdot 10^{-6} R$	
	500 $\Omega$ ... < 5 k $\Omega$		$10 \cdot 10^{-6} R$	
	5 k $\Omega$ ... < 50 k $\Omega$		$5,5 \cdot 10^{-6} R$	
	50 k $\Omega$ ... < 500 k $\Omega$		$7,5 \cdot 10^{-6} R$	
	500 k $\Omega$ ... < 5 M $\Omega$		$15 \cdot 10^{-6} R$	
	5 M $\Omega$ ... < 50 M $\Omega$		$60 \cdot 10^{-6} R$	
50 M $\Omega$ ... < 500 M $\Omega$		$480 \cdot 10^{-6} R$		
500 M $\Omega$ ... < 5 G $\Omega$		$600 \cdot 10^{-6} R$		
5 G $\Omega$ ... < 50 G $\Omega$		$850 \cdot 10^{-6} R$		
50 G $\Omega$ ... < 500 G $\Omega$		$1,65 \cdot 10^{-3} R$		
500 G $\Omega$ ... < 5 T $\Omega$		$6,8 \cdot 10^{-3} R$		
5 T $\Omega$ ... < 50 T $\Omega$		$9,2 \cdot 10^{-3} R$		
50 T $\Omega$ ... 200 T $\Omega$		$1,85 \cdot 10^{-2} R$		
<b>DC Power</b>		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	0,11 %	



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Calibration of power analyzers	> 80 W ... 7,68 kW	> 2 A ... 16 A 40 V ... 300 V	0,58 %	Also possible in the branches and on site <sup>2)</sup>	
	> 640 W ... 6 kW	> 16 A ... 20 A	0,58 %		
	> 800 W ... 30 kW	20 A ... 100 A 0,1 V ... 1000 V	0,11 %		
	330 $\mu$ W ... 200 W	3,3 mA ... 200 mA	0,58 %		
	> 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 40 V ... 300 V	0,59 %		
Calibration of power meter clamps	> 800 W ... 30 kW	> 20 A ... 100 A 0,1 V ... 1000 V	0,11 %	With current coil	
	330 $\mu$ W ... <33 mW	3,3 mA ... 1000 A	0,91 %		
	33 mW ... <110 mW		0,78 %		
	110 mW ... 100 kW		0,61 %		
	> 100 kW ... 1 MW		0,83 %		
<b>AV Voltage</b> Calibration of voltage calibrators	10 mV ... < 22 mV	10 Hz	$954 \cdot 10^{-6} U + 0,2 \mu\text{V}$	Also possible in the branches and on site <sup>2)</sup> U = Measurement value	
		20 Hz; 40 Hz	$895 \cdot 10^{-6} U + 0,1 \mu\text{V}$		
		500 Hz; 1 kHz; 10 kHz;	$893 \cdot 10^{-6} U + 0,1 \mu\text{V}$		
		20 kHz; 50 kHz; 100 kHz	$470 \cdot 10^{-6} U + 0,1 \mu\text{V}$		
		200 kHz	$951 \cdot 10^{-6} U + 0,1 \mu\text{V}$		
		500 kHz	$1,3 \cdot 10^{-3} U + 0,1 \mu\text{V}$		
		700 kHz	$1,5 \cdot 10^{-3} U + 0,2 \mu\text{V}$		
		1 MHz	$1,5 \cdot 10^{-3} U + 0,2 \mu\text{V}$		
		22 mV ... < 70 mV	10 Hz		$825 \cdot 10^{-6} U + 0,8 \mu\text{V}$
			20 Hz		$696 \cdot 10^{-6} U + 0,3 \mu\text{V}$
	40 Hz; 500 Hz; 1 kHz; 10 kHz		$680 \cdot 10^{-6} U + 0,2 \mu\text{V}$		
	20 kHz; 50 kHz		$702 \cdot 10^{-6} U + 0,1 \mu\text{V}$		
			100 kHz	$754 \cdot 10^{-6} U + 0,1 \mu\text{V}$	



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	70 mV ... < 220 mV	300 kHz	$812 \cdot 10^{-6} U + 0,2 \mu\text{V}$		
		500 kHz	$870 \cdot 10^{-6} U + 0,1 \mu\text{V}$		
		700 kHz	$1,2 \cdot 10^{-3} U + 0,2 \mu\text{V}$		
		1 MHz	$1,8 \cdot 10^{-3} U + 0,2 \mu\text{V}$		
		10 Hz	$150 \cdot 10^{-6} U + 2 \mu\text{V}$		
		20 Hz	$150 \cdot 10^{-6} U + 1 \mu\text{V}$		
		40 Hz	$100 \cdot 10^{-6} U + 0,3 \mu\text{V}$		
		500 Hz; 1 kHz; 10 kHz; 20 kHz	$80 \cdot 10^{-6} U + 0,3 \mu\text{V}$		
		50 kHz	$100 \cdot 10^{-6} U + 0,2 \mu\text{V}$		
		100 kHz	$155 \cdot 10^{-6} U + 0,2 \mu\text{V}$		
		200 kHz	$212 \cdot 10^{-6} U + 0,1 \mu\text{V}$		
		500 kHz; 700 kHz	$295 \cdot 10^{-6} U + 0,2 \mu\text{V}$		
		1 MHz	$443 \cdot 10^{-6} U + 0,2 \mu\text{V}$		
		220 mV ... < 700 mV	10 Hz	$147 \cdot 10^{-6} U + 8 \mu\text{V}$	
			20 Hz	$85 \cdot 10^{-6} U + 3 \mu\text{V}$	
	40 Hz		$63 \cdot 10^{-6} U + 2 \mu\text{V}$		
	500 Hz; 1 kHz; 10 kHz		$38 \cdot 10^{-6} U + 2 \mu\text{V}$		
	20 kHz; 50 kHz; 100 kHz		$51 \cdot 10^{-6} U + 1 \mu\text{V}$		
	200 kHz		$66 \cdot 10^{-6} U + 1 \mu\text{V}$		
	500 kHz		$235 \cdot 10^{-6} U + 1 \mu\text{V}$		
	700 kHz		$442 \cdot 10^{-6} U + 1 \mu\text{V}$		
	1 MHz		$638 \cdot 10^{-6} U + 1 \mu\text{V}$		
	700 mV ... < 2,2 V		10 Hz	$94 \cdot 10^{-6} U + 25 \mu\text{V}$	
			20 Hz	$28 \cdot 10^{-6} U + 10 \mu\text{V}$	
			40 Hz; 500 Hz; 1 kHz; 10 kHz; 20 kHz	$28 \cdot 10^{-6} U + 3 \mu\text{V}$	
			50 kHz	$30 \cdot 10^{-6} U + 1 \mu\text{V}$	
			100 kHz	$40 \cdot 10^{-6} U + 2 \mu\text{V}$	
			200 kHz	$50 \cdot 10^{-6} U + 2 \mu\text{V}$	
		500 kHz	$120 \cdot 10^{-6} U + 1 \mu\text{V}$		



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	2,2 V ... < 7 V	700 kHz	$234 \cdot 10^{-6} U + 2 \mu\text{V}$	
		1 MHz	$453 \cdot 10^{-6} U + 2 \mu\text{V}$	
		10 Hz	$163 \cdot 10^{-6} U + 42 \mu\text{V}$	
		20 Hz	$49 \cdot 10^{-6} U + 28 \mu\text{V}$	
		40 Hz	$28 \cdot 10^{-6} U + 13 \mu\text{V}$	
		500 Hz; 1 kHz; 10 kHz	$22 \cdot 10^{-6} U + 14 \mu\text{V}$	
		20 kHz	$27 \cdot 10^{-6} U + 10 \mu\text{V}$	
		50 kHz; 100 kHz	$33 \cdot 10^{-6} U + 7 \mu\text{V}$	
		200 kHz	$51 \cdot 10^{-6} U + 10 \mu\text{V}$	
		500 kHz	$348 \cdot 10^{-6} U + 9 \mu\text{V}$	
		700 kHz	$407 \cdot 10^{-6} U + 8 \mu\text{V}$	
		1 MHz	$424 \cdot 10^{-6} U + 8 \mu\text{V}$	
	7 V ... < 22 V	10 Hz	$153 \cdot 10^{-6} U + 291 \mu\text{V}$	
		20 Hz	$62 \cdot 10^{-6} U + 73 \mu\text{V}$	
		40 Hz	$40 \cdot 10^{-6} U + 21 \mu\text{V}$	
		500 Hz	$28 \cdot 10^{-6} U + 29 \mu\text{V}$	
		1 kHz; 10 kHz; 20 kHz	$28 \cdot 10^{-6} U + 15 \mu\text{V}$	
		50 kHz	$33 \cdot 10^{-6} U + 17 \mu\text{V}$	
		100 kHz	$47 \cdot 10^{-6} U + 12 \mu\text{V}$	
		200 kHz	$68 \cdot 10^{-6} U + 10 \mu\text{V}$	
		500 kHz	$178 \cdot 10^{-6} U + 12 \mu\text{V}$	
		700 kHz	$345 \cdot 10^{-6} U + 41 \mu\text{V}$	
		1 MHz	$461 \cdot 10^{-6} U + 41 \mu\text{V}$	
		22 V ... < 70 V	10 Hz	$112 \cdot 10^{-6} U + 0,7 \text{ mV}$
	20 Hz		$62 \cdot 10^{-6} U + 257 \mu\text{V}$	
	40 Hz		$56 \cdot 10^{-6} U + 181 \mu\text{V}$	
	500 Hz		$52 \cdot 10^{-6} U + 111 \mu\text{V}$	
	1 kHz		$52 \cdot 10^{-6} U + 138 \mu\text{V}$	
	10 kHz; 20 kHz		$52 \cdot 10^{-6} U + 82 \mu\text{V}$	
	50 kHz		$52 \cdot 10^{-6} U + 71 \mu\text{V}$	



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<b>AC Voltage</b>	70 V ... < 220 V	100 kHz	$66 \cdot 10^{-6} U + 166 \mu\text{V}$	
		10 Hz	$152 \cdot 10^{-6} U + 2,1 \text{ mV}$	
		20 Hz	$68 \cdot 10^{-6} U + 473 \mu\text{V}$	
		40 Hz	$68 \cdot 10^{-6} U + 195 \mu\text{V}$	
		500 Hz; 1 kHz	$53 \cdot 10^{-6} U + 222 \mu\text{V}$	
		10 kHz; 20 kHz; 50 kHz	$53 \cdot 10^{-6} U + 176 \mu\text{V}$	
	220 V ... < 700 V	100 kHz	$68 \cdot 10^{-6} U + 601 \mu\text{V}$	
		10 Hz	$171 \cdot 10^{-6} U + 580 \mu\text{V}$	
		20 Hz	$92 \cdot 10^{-6} U + 580 \mu\text{V}$	
		40 Hz	$72 \cdot 10^{-6} U + 580 \mu\text{V}$	
		500 Hz	$55 \cdot 10^{-6} U + 860 \mu\text{V}$	
		1 kHz	$55 \cdot 10^{-6} U + 750 \mu\text{V}$	
		10 kHz	$55 \cdot 10^{-6} U + 580 \mu\text{V}$	
		20 kHz	$65 \cdot 10^{-6} U + 580 \mu\text{V}$	
		50 kHz	$75 \cdot 10^{-6} U + 580 \mu\text{V}$	
		100 kHz	$235 \cdot 10^{-6} U + 580 \mu\text{V}$	
	700 V ... 1050 V	10 Hz	$172 \cdot 10^{-6} U + 580 \mu\text{V}$	
		20 Hz	$93 \cdot 10^{-6} U + 580 \mu\text{V}$	
		40 Hz	$72 \cdot 10^{-6} U + 580 \mu\text{V}$	
		500 Hz; 1 kHz;	$56 \cdot 10^{-6} U + 900 \mu\text{V}$	
		10 kHz	$56 \cdot 10^{-6} U + 580 \mu\text{V}$	
20 kHz; 50 kHz		$76 \cdot 10^{-6} U + 580 \mu\text{V}$		
100 kHz		$235 \cdot 10^{-6} U + 580 \mu\text{V}$		
Calibration of voltage measurement instruments	10 mV ... < 22 mV	10 Hz; 20 Hz	$842 \cdot 10^{-6} U + 5,8 \mu\text{V}$	Also possible in the branches and on site <sup>2)</sup>
		40 Hz; 500 Hz; 1 kHz; 10 kHz; 20 kHz; 50 kHz	$840 \cdot 10^{-6} U + 2,4 \mu\text{V}$	
		100 kHz	$893 \cdot 10^{-6} U + 3,5 \mu\text{V}$	





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	22 mV ... < 70 mV	200 kHz	$895 \cdot 10^{-6} U + 5,8 \mu V$		
		500 kHz	$895 \cdot 10^{-6} U + 12 \mu V$		
		700 kHz	$900 \cdot 10^{-6} U + 18 \mu V$		
		1 MHz	$956 \cdot 10^{-6} U + 18 \mu V$		
		10 Hz	$217 \cdot 10^{-6} U + 24 \mu V$		
		20 Hz	$136 \cdot 10^{-6} U + 18 \mu V$		
		40 Hz	$101 \cdot 10^{-6} U + 2,4 \mu V$		
		500 Hz; 1 kHz; 10 kHz; 20 kHz	$93 \cdot 10^{-6} U + 2,4 \mu V$		
		50 kHz; 100 kHz	$107 \cdot 10^{-6} U + 2,4 \mu V$		
		200 kHz	$116 \cdot 10^{-6} U + 4,7 \mu V$		
		500 kHz	$172 \cdot 10^{-6} U + 12 \mu V$		
		700 kHz	$280 \cdot 10^{-6} U + 24 \mu V$		
	70 mV ... < 220 mV	1 MHz	$290 \cdot 10^{-6} U + 24 \mu V$		
		10 Hz	$183 \cdot 10^{-6} U + 24 \mu V$		
		20 Hz	$110 \cdot 10^{-6} U + 18 \mu V$		
		40 Hz; 500 Hz; 1 kHz; 10 kHz; 20 kHz; 50 kHz; 100 kHz	$60 \cdot 10^{-6} U + 2,4 \mu V$		
		200 kHz	$63 \cdot 10^{-6} U + 4,7 \mu V$		
		500 kHz	$136 \cdot 10^{-6} U + 12 \mu V$		
		700 kHz; 1 MHz	$250 \cdot 10^{-6} U + 25 \mu V$		
		220 mV ... < 700 mV	10 Hz	$178 \cdot 10^{-6} U + 25 \mu V$	
			20 Hz	$100 \cdot 10^{-6} U + 18 \mu V$	
			40 Hz	$41 \cdot 10^{-6} U + 6 \mu V$	
			500 Hz; 1 kHz; 10 kHz	$27 \cdot 10^{-6} U + 6 \mu V$	
			20 kHz; 50 kHz	$33 \cdot 10^{-6} U + 6 \mu V$	
	100 kHz		$36 \cdot 10^{-6} U + 6 \mu V$		
	200 kHz		$58 \cdot 10^{-6} U + 12 \mu V$		
	500 kHz		$100 \cdot 10^{-6} U + 24 \mu V$		
	700 kHz; 1 MHz		$192 \cdot 10^{-6} U + 58 \mu V$		



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	700 mV ... < 2,2 V	10 Hz	$175 \cdot 10^{-6} U + 35 \mu\text{V}$	
		20 Hz	$96 \cdot 10^{-6} U + 20 \mu\text{V}$	
		40 Hz; 500 Hz; 1 kHz	$26 \cdot 10^{-6} U + 6 \mu\text{V}$	
		10 kHz; 20 kHz	$27 \cdot 10^{-6} U + 6 \mu\text{V}$	
		50 kHz; 100 kHz	$33 \cdot 10^{-6} U + 7 \mu\text{V}$	
		200 kHz	$45 \cdot 10^{-6} U + 12 \mu\text{V}$	
		500 kHz	$90 \cdot 10^{-6} U + 24 \mu\text{V}$	
		700 kHz; 1 MHz	$187 \cdot 10^{-6} U + 58 \mu\text{V}$	
	2,2 V ... < 7 V	10 Hz	$176 \cdot 10^{-6} U + 48 \mu\text{V}$	
		20 Hz	$96 \cdot 10^{-6} U + 33 \mu\text{V}$	
		40 Hz	$27 \cdot 10^{-6} U + 16 \mu\text{V}$	
		500 Hz; 1 kHz; 10 kHz; 20 kHz	$23 \cdot 10^{-6} U + 17 \mu\text{V}$	
		50 kHz	$26 \cdot 10^{-6} U + 14 \mu\text{V}$	
		100 kHz	$29 \cdot 10^{-6} U + 14 \mu\text{V}$	
		200 kHz	$47 \cdot 10^{-6} U + 20 \mu\text{V}$	
		500 kHz	$93 \cdot 10^{-6} U + 120 \mu\text{V}$	
	7 V ... < 22 V	700 kHz	$186 \cdot 10^{-6} U + 120 \mu\text{V}$	
		1 MHz	$258 \cdot 10^{-6} U + 120 \mu\text{V}$	
		10 Hz	$178 \cdot 10^{-6} U + 300 \mu\text{V}$	
		20 Hz	$98 \cdot 10^{-6} U + 76 \mu\text{V}$	
		40 Hz	$34 \cdot 10^{-6} U + 23 \mu\text{V}$	
		500 Hz	$27 \cdot 10^{-6} U + 31 \mu\text{V}$	
		1 kHz; 10 kHz; 20 kHz	$27 \cdot 10^{-6} U + 20 \mu\text{V}$	
		50 kHz	$29 \cdot 10^{-6} U + 21 \mu\text{V}$	
		100 kHz	$38 \cdot 10^{-6} U + 17 \mu\text{V}$	
		200 kHz	$64 \cdot 10^{-6} U + 20 \mu\text{V}$	
		500 kHz	$222 \cdot 10^{-6} U + 120 \mu\text{V}$	



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## Accreditation number: SCS 0058

Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ <sup>1)</sup>	Remarks
Calibration of high voltage sources	22 V ... < 70 V	700 kHz; 1 MHz	$455 \cdot 10^{-6} U + 125 \mu\text{V}$	
		10 Hz	$184 \cdot 10^{-6} U + 740 \mu\text{V}$	
		20 Hz	$105 \cdot 10^{-6} U + 310 \mu\text{V}$	
		40 Hz	$48 \cdot 10^{-6} U + 204 \mu\text{V}$	
		500 Hz	$37 \cdot 10^{-6} U + 145 \mu\text{V}$	
		1 kHz	$37 \cdot 10^{-6} U + 167 \mu\text{V}$	
		10 kHz; 20 kHz	$37 \cdot 10^{-6} U + 124 \mu\text{V}$	
		50 kHz	$38 \cdot 10^{-6} U + 136 \mu\text{V}$	
	70 V ... < 220 V	100 kHz	$49 \cdot 10^{-6} U + 203 \mu\text{V}$	
		10 Hz	$187 \cdot 10^{-6} U + 2,1 \text{ mV}$	
		20 Hz	$107 \cdot 10^{-6} U + 504 \mu\text{V}$	
		40 Hz	$56 \cdot 10^{-6} U + 216 \mu\text{V}$	
		500 Hz	$41 \cdot 10^{-6} U + 241 \mu\text{V}$	
		1 kHz; 10 kHz; 20 kHz	$41 \cdot 10^{-6} U + 220 \mu\text{V}$	
		50 kHz	$42 \cdot 10^{-6} U + 200 \mu\text{V}$	
		100 kHz	$57 \cdot 10^{-6} U + 612 \mu\text{V}$	
	220 V ... < 700 V	50 Hz	$70 \cdot 10^{-6} U + 0,82 \text{ mV}$	
		500 Hz; 1 kHz	$50 \cdot 10^{-6} U + 1,1 \text{ mV}$	
	700 V ... < 1050 V	50 Hz	$70 \cdot 10^{-6} U + 0,82 \text{ mV}$	
		500 Hz; 1 kHz	$52 \cdot 10^{-6} U + 1,1 \text{ mV}$	
	1 kV ... 10 kV	$R_L \geq 110 \text{ M}\Omega$ ; 50 Hz	0,15 % + 0,2 V	
> 10 kV ... 20 kV		$R_L \geq 200 \text{ M}\Omega$	0,13 % + 0,7 V	
> 20 kV ... 30 kV		$R_L \geq 200 \text{ M}\Omega$	0,13 % + 3,0 V	Also possible in Fehraltorf and on site <sup>6)</sup>
> 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 ... $\leq$ 10 kV		50 Hz	0,15 % + 0,2 V	RMS; $\hat{U}/\sqrt{2}$
> 10 kV ... 20 kV		0,13 % + 1,3 V		



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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ <sup>1)</sup>	Remarks
Calibration of high voltage measurement instruments	> 20 kV ... 30 kV		0,13 % + 3,1 V	Also possible in Fehraltorf and on site <sup>7)</sup>
	> 30 kV ... 50 kV		1,2 % + 22 V	
	> 50 kV ... 100 kV		1,2 % + 29 V	
<b>AC Current</b>				
Calibration of current calibrators	0,1 mA ... < 0,77 mA	40 Hz ... 1 kHz	350•10 <sup>-6</sup> /	Also possible in the branches and on site <sup>2)</sup> I = Measurement value
		> 1 kHz ... 5 kHz	450•10 <sup>-6</sup> /	
	0,77 mA ... < 2 mA	40 Hz ... 1 kHz	250•10 <sup>-6</sup> /	
		> 1 kHz ... 5 kHz	350•10 <sup>-6</sup> /	
	2 mA ... < 10 mA	20 Hz ... < 40 Hz	135•10 <sup>-6</sup> / + 0,5 µA	
		40 Hz ... 10 kHz	105•10 <sup>-6</sup> / + 0,5 µA	
	10 mA ... < 30 mA	20 Hz ... < 40 Hz	140•10 <sup>-6</sup> / + 4,2 µA	
		40 Hz ... 10 kHz	115•10 <sup>-6</sup> / + 4,2 µA	
	30 mA ... < 100 mA	20 Hz ... < 40 Hz	140•10 <sup>-6</sup> / + 4,2 µA	
		40 Hz ... 10 kHz	115•10 <sup>-6</sup> / + 4,2 µA	
	100 mA ... < 300 mA	20 Hz ... < 40 Hz	160•10 <sup>-6</sup> / + 35 µA	
		40 Hz ... 10 kHz	140•10 <sup>-6</sup> / + 35 µA	
			5 kHz ... 10 kHz	
	300 mA ... < 2 A	20 Hz ... < 40 Hz	165•10 <sup>-6</sup> / + 36 µA	
		40 Hz ... < 5 kHz	140•10 <sup>-6</sup> / + 36 µA	
			5 kHz ... 10 kHz	
	2 A ... < 5 A	20 Hz ... < 40 Hz	140•10 <sup>-6</sup> / + 155 µA	
		40 Hz ... < 5 kHz	115•10 <sup>-6</sup> / + 155 µA	
			5 kHz ... 10 kHz	
	5 A ... < 10 A	20 Hz ... < 40 Hz	140•10 <sup>-6</sup> / + 155 µA	
40 Hz ... < 5 kHz		115•10 <sup>-6</sup> / + 160 µA		
		5 kHz ... 10 kHz	115•10 <sup>-6</sup> / + 155 µA	
10 A ... 20 A	20 Hz ... < 40 Hz	145•10 <sup>-6</sup> / + 170 µA		
	40 Hz ... 5 kHz	115•10 <sup>-6</sup> / + 180 µA		
> 20 A ... 120 A	45 Hz ... 55 Hz	210•10 <sup>-6</sup> /		
0,1 mA ... < 0,77 mA	40 Hz ... 1 kHz	350•10 <sup>-6</sup> /		



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Accreditation number: SCS 0058

Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ <sup>1)</sup>	Remarks
Calibration of ammeters	0.77 mA ... < 2 mA	> 1 kHz ... 5 kHz	450•10 <sup>-6</sup> /	Also possible in the branches and on site <sup>2)</sup>
		40 Hz ... 1 kHz	250•10 <sup>-6</sup> /	
		> 1 kHz ... 5 kHz	350•10 <sup>-6</sup> /	
	2 mA ... < 10 mA	20 Hz ... < 40 Hz	165•10 <sup>-6</sup> / + 0,5 μA	
		40 Hz ... < 1 kHz	110•10 <sup>-6</sup> / + 0,5 μA	
		1 kHz ... < 5 kHz	120•10 <sup>-6</sup> / + 0,8 μA	
		5 kHz ... 10 kHz	480•10 <sup>-6</sup> / + 1,3 μA	
		20 Hz ... < 40 Hz	170•10 <sup>-6</sup> / + 4,5 μA	
	10 mA ... < 30 mA	40 Hz ... < 1 kHz	120•10 <sup>-6</sup> / + 4,5 μA	
		1 kHz ... < 5 kHz	130•10 <sup>-6</sup> / + 5,5 μA	
		5 kHz ... 10 kHz	480•10 <sup>-6</sup> / + 7,5 μA	
		20 Hz ... < 40 Hz	170•10 <sup>-6</sup> / + 4,5 μA	
		40 Hz ... < 1 kHz	120•10 <sup>-6</sup> / + 4,5 μA	
	30 mA ... < 100 mA	1 kHz ... < 5 kHz	130•10 <sup>-6</sup> / + 5,5 μA	
		5 kHz ... 10 kHz	480•10 <sup>-6</sup> / + 7,5 μA	
		20 Hz ... < 40 Hz	170•10 <sup>-6</sup> / + 4,5 μA	
		40 Hz ... < 1 kHz	120•10 <sup>-6</sup> / + 4,5 μA	
		1 kHz ... < 5 kHz	130•10 <sup>-6</sup> / + 5,5 μA	
	100 mA ... < 300 mA	5 kHz ... 10 kHz	480•10 <sup>-6</sup> / + 7,5 μA	
		20 Hz ... < 40 Hz	170•10 <sup>-6</sup> / + 40 μA	
		40 Hz ... < 1 kHz	150•10 <sup>-6</sup> / + 40 μA	
		1 kHz ... < 5 kHz	170•10 <sup>-6</sup> / + 45 μA	
		5 kHz ... 10 kHz	940•10 <sup>-6</sup> / + 70 μA	
	300 mA ... < 2 A	20 Hz ... < 1 kHz	175•10 <sup>-6</sup> / + 40 μA	
1 kHz ... < 5 kHz		165•10 <sup>-6</sup> / + 45 μA		
5 kHz ... 10 kHz		940•10 <sup>-6</sup> / + 70 μA		
2 A ... < 5 A	20 Hz ... < 40 Hz	140•10 <sup>-6</sup> / + 160 μA		
	40 Hz ... < 5 kHz	115•10 <sup>-6</sup> / + 160 μA		
	5 kHz ... 10 kHz	115•10 <sup>-6</sup> / + 160 μA		
5 A ... < 10 A	20 Hz ... < 40 Hz	140•10 <sup>-6</sup> / + 170 μA		
	40 Hz ... < 5 kHz	115•10 <sup>-6</sup> / + 180 μA		
	5 kHz ... 10 kHz	115•10 <sup>-6</sup> / + 170 μA		
10 A ... 20 A	20 Hz ... < 40 Hz	145•10 <sup>-6</sup> / + 230 μA		
	40 Hz ... 5 kHz	120•10 <sup>-6</sup> / + 180 μA		



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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ <sup>1)</sup>	Remarks	
Calibration of current clamps	> 20 A ... 120 A	45 Hz ... 55 Hz	210•10 <sup>-6</sup> I		
	50 A ... 500 A	45 Hz ... 55 Hz	0,58 % + 270 mA	With current coil	
	>500 A ... 3000 A		0,58 %		
Calibration of Rogowski coils	50 A ... 1000 A	45 Hz ... 55 Hz	0,58 % + 540 mA	With current coil	
	1000 A ... 6000 A		0,58 %		
<b>Capacitance</b>				Decadic values only	
Calibration of capacitance measuring devices	1 pF	100 Hz; 1 kHz; 10 kHz	0,37•10 <sup>-3</sup> C	Also possible in the branches <sup>2)</sup>	
	10 pF	100 Hz; 1 kHz; 10 kHz	0,36•10 <sup>-3</sup> C	C = Measurement value	
	100 pF	100 Hz; 1 kHz; 10 kHz	0,36•10 <sup>-3</sup> C		
	1000 pF	100 Hz; 1 kHz; 10 kHz	0,36•10 <sup>-3</sup> C		
	10 nF	100 Hz	0,13•10 <sup>-3</sup> C		
		1 kHz	0,10•10 <sup>-3</sup> C		
	100 nF	100 Hz	0,23•10 <sup>-3</sup> C		
		1 kHz	0,11•10 <sup>-3</sup> C		
	1 μF	100 Hz	0,43•10 <sup>-3</sup> C		
		1 kHz	0,14•10 <sup>-3</sup> C		
<b>Inductance</b>				Decadic values only	
Calibration of inductance meters	100 μH	100 Hz	3,6•10 <sup>-3</sup> L	Also possible in the branches <sup>2)</sup>	
		1 kHz	1,3•10 <sup>-3</sup> L	L = Measurement value	
	1 mH	100 Hz	0,49•10 <sup>-3</sup> L		
		1 kHz	0,39•10 <sup>-3</sup> L		
	10 mH	100 Hz; 1 kHz	0,25•10 <sup>-3</sup> L		
	100 mH	100 Hz; 1 kHz	0,24•10 <sup>-3</sup> L		
	1 H	100 Hz	0,25•10 <sup>-3</sup> L		
		1 kHz	0,24•10 <sup>-3</sup> L		
	<b>AC Power</b>				
	2,4 W ... 30 kW	48,5 Hz ... 51,5 Hz			
40 V ... 480 V					
60 mA ... 100 A					
cos φ = 1			160•10 <sup>-6</sup> P	Measuring range referred to cos φ = 1	



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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ <sup>1)</sup>	Remarks
Calibration of power sources (effective power)		$\cos \varphi = 0,5 \dots < 1$ (c, i)	$295 \cdot 10^{-6} P$	Also possible in Fehraltorf and on site <sup>2)</sup> P = Measurement value
Calibration of power measurement instruments (effective power)	330 $\mu$ W ... < 2,4 W	48,5 Hz ... 51,5 Hz 100 mV ... 40 V 3,3 mA ... 60 A $\cos \varphi = 1$	0,13 %	Measuring range referred $\cos \varphi = 1$
	2,4 W ... 30 kW	$\cos \varphi = 0,5 \dots < 1$ (c, i) 40 V ... 480 V 60 mA ... 100 A $\cos \varphi = 1$	0,37 % $160 \cdot 10^{-6} P$	Also possible in Fehraltorf and on site <sup>2)</sup> Voltages up to 1000 V with greater uncertainty possible
Calibration of power meter clamps (effective power)	330 $\mu$ W ... < 1 MW	48,5 Hz ... 51,5 Hz 100 mV ... 1000 V 3,3 mA ... 1000 A $\cos \varphi = 1$	$295 \cdot 10^{-6} P$	Measuring range referred $\cos \varphi = 1$
		$\cos \varphi = 0,5 \dots < 1$ (c, i)	0,62 % 0,71 %	With current coil Also possible in Fehraltorf and on site <sup>2)</sup>
<b>Frequency</b> Calibration of frequency counters	1 mHz ... < 1 Hz	Measurement period: $\geq 100$ s	$2,0 \cdot 10^{-5} f$	Also possible in the branches and on site <sup>2)</sup> f = Measurement value
	1 Hz ... < 10 Hz		$2,0 \cdot 10^{-7} f$	
	10 Hz ... < 100 Hz		$2,0 \cdot 10^{-8} f$	
	100 Hz ... < 1 kHz		$2,0 \cdot 10^{-9} f$	
	1 kHz ... < 10 kHz		$2,0 \cdot 10^{-10} f$	
	10 kHz ... < 1 MHz		$2,0 \cdot 10^{-11} f$	
	1 MHz ... < 3 GHz	$\geq 10$ s	$1,0 \cdot 10^{-11} f$	
Calibration of frequency generators	3 GHz ... 50 GHz	Measurement period: $\geq 100$ s	$1,0 \cdot 10^{-10} f$	Also possible in the branches and on site <sup>2)</sup>
	1 mHz ... < 1 Hz		$2,0 \cdot 10^{-5} f$	
	1 Hz ... < 10 Hz		$2,0 \cdot 10^{-7} f$	



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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ <sup>1)</sup>	Remarks
<b>Period</b>	10 Hz ... < 100 Hz		$2,0 \cdot 10^{-8} f$	
	100 Hz ... < 1 kHz		$2,0 \cdot 10^{-9} f$	
	1 kHz ... < 10 kHz		$2,0 \cdot 10^{-10} f$	
	10 kHz ... < 1 MHz		$2,0 \cdot 10^{-11} f$	
	1 MHz ... < 3 GHz	$\geq 10$ s	$1,0 \cdot 10^{-11} f$	
	3 GHz ... 50 GHz	$\geq 10$ s	$1,0 \cdot 10^{-10} f$	
	1 MHz; 5 MHz; 10 MHz	$\geq 1$ h	$1,0 \cdot 10^{-11} f$	Phase comparison
		Measurement period:		
	10 ns ... < 10 $\mu$ s	$\geq 10$ s	$2 \cdot 10^{-16} t$	t = Measurement value
	10 $\mu$ s ... < 100 $\mu$ s		$2 \cdot 10^{-15} t$	
	100 $\mu$ s ... < 1 ms		$1 \cdot 10^{-15} t$	
	1 ms ... < 10 ms		$2 \cdot 10^{-11} t$	
	10 ms ... < 100 ms		$2 \cdot 10^{-9} t$	
100 ms ... < 1 s		$0,2 \cdot 10^{-6} t$		
1 s ... 10 s	$\geq 100$ s	$20 \cdot 10^{-6} t$		
<b>Number of revolutions</b>	6 U/min ... < 30 U/min		$5,8 \cdot 10^{-4} n$	Optical
	30 U/min ... < 60 U/min		$1,2 \cdot 10^{-3} n$	n = Measurement value
	60 U/min ... < 1000 U/min		$6,7 \cdot 10^{-3} n$	
	1000 U/min ... 100000 U/min		$5,6 \cdot 10^{-1} n$	
<b>RF- Power</b> Calibration of RF power meters	10 $\mu$ W ... 5 mW (-20 dBm ... + 7 dBm)	100 kHz ... 2,6 GHz	2,9 % + 0,84 $\mu$ W	Analyzer: VSWR $\leq 1,3$
	0,001 pW ... 1 mW (-120 dBm ... 0 dBm)	2,5 MHz ... 1,3 GHz	3,8 %	
	>1 $\mu$ W ... 2,5 mW (-30 dBm ... +4 dBm)	9 kHz ... < 2,4 GHz	2,7 % + 66 nW	
		2,4 GHz ... < 12,4 GHz	3,4 % + 66 nW	
		12,4 GHz ... 18 GHz	4,7 % + 66 nW	





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## Accreditation number: SCS 0058

Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ <sup>1)</sup>	Remarks
Calibration of signal generators	1 nW ... 1 $\mu$ W (-60 dBm ... -30 dBm)	10 MHz ... < 2,4 GHz	3,8 % + 0,16 nW	Generator: VSWR $\leq$ 1,3
		2,4 GHz ... <12,4 GHz	4,8 % + 0,16 nW	
		12,4 GHz ... 18 GHz	6,6 % + 0,16 nW	
	10 $\mu$ W ... 100 mW (-20 dBm ... +20 dBm)	100 kHz ... 2,6 GHz	2,7 % + 0,84 $\mu$ W	
	>0.1 pW ... 1 mW (-100 dBm ... 0 dBm)	2,5 MHz ... 1,3 GHz	3,2 %	
	0,001pW ... 0,1 pW (-120 dBm ... -100 dBm)	2,5 MHz ... 1,3 GHz	4,9 %	
	>1 $\mu$ W ... 100 mW (-30 dBm ... +20 dBm)	9 kHz ... < 2,4 GHz	2,9 % + 66 nW	
		2,4 GHz ... < 12,4 GHz	3,8 % + 66 nW	
		12,4 GHz ... 18 GHz	4,6 % + 66 nW	
		10 MHz ... < 2,4 GHz	3,4 % + 0,16 nW	
<b>Reflection factor</b> One port (Value and phase)	1 nW ... 1 $\mu$ W (-60 dBm ... -30 dBm)	2,4 GHz ... < 12,4 GHz	4,5 % + 0,16 nW	Z = 50 $\Omega$ 3.5mm Connector Also possible on site
		12,4 GHz ... 18 GHz	5,7 % + 0,16 nW	
	0 ... 1	9 kHz ... 20 GHz	See matrix M.1 & M.2	
	0 ... 1	9 kHz ... 18 GHz	See matrix M.3 & M.4	
	0 ... 1	9 kHz ... 18 GHz	See matrix M.5 & M.6	
	0 ... 1	9 kHz ... 18 GHz	See matrix M.7 & M.8	
	0 ... 1	9 kHz ... 3 GHz		
<b>Transmission factor</b> Two ports	0 dB ... 80 dB	9 kHz ... 20 GHz		Z = 50 $\Omega$



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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ <sup>1)</sup>	Remarks
(Value and phase)	0 dB ... 80 dB	9 kHz ... 18 GHz	See matrix M.9 & M.10	3.5mm Connector Also possible on site Z = 50 $\Omega$ N Connector
	0 dB ... 80 dB	9 kHz ... 18 GHz	See matrix M.11 & M.12	Also possible on site Z = 50 $\Omega$ 7mm Connector
	0 dB ... 80 dB	9 kHz ... 3 GHz	See matrix M.13 & M.14	Also possible on site Z = 50 $\Omega$ BNC Connector
			See matrix M.15 & M.16	Also possible on site

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

Value   $\Gamma$	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  $\varphi$ ; 3.5mm - Connector 50  $\Omega$

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  $|G|$ ; N - Connector 50  $\Omega$

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  $\varphi$ ; N - Connector 50  $\Omega$

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  $\Omega$

Value $ \Gamma $	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  $\varphi$ ; 7mm - Connector 50  $\Omega$

Value $ \Gamma $	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  $\Omega$

Value $ \Gamma $	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  $\varphi$ ; BNC - Connector 50  $\Omega$

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  $\Omega$

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  $\varphi$ ; 3.5mm - Connector 50  $\Omega$

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  $\Omega$

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  $\varphi$ ; N - Connector 50  $\Omega$

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  $\Omega$

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  $\varphi$ ; 7mm - Connector 50  $\Omega$

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  $\Omega$

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  $\varphi$ ; BNC - Connector 50  $\Omega$

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 $\pm$ <sup>1)</sup>	Remarks
<b>Calibration of Oscilloscopes</b>				
Rectangular voltage amplitude	1 mV ... 120 mV	1 kHz/1 M $\Omega$	$1,3 \cdot 10^{-3} U + 16 \mu\text{V}$	Also possible on site <sup>2)</sup>
	> 120 mV ... 1,2 V	1 kHz/1 M $\Omega$	$1,3 \cdot 10^{-3} U + 62 \mu\text{V}$	
	> 1,2 V ... 12 V	1 kHz/1 M $\Omega$	$1,2 \cdot 10^{-3} U + 698 \mu\text{V}$	
	> 12 V ... 60 V	1 kHz/1 M $\Omega$	$1,2 \cdot 10^{-3} U + 3,3 \text{ mV}$	
	> 60 V ... 120 V	1 kHz/1 M $\Omega$	$1,2 \cdot 10^{-3} U + 5,9 \text{ mV}$	
	> 120 V ... 200 V	1 kHz/1 M $\Omega$	$1,2 \cdot 10^{-3} U + 27 \text{ mV}$	
	1 mV ... 120 mV	1 kHz/50 $\Omega$	$1,3 \cdot 10^{-3} U + 16 \mu\text{V}$	
	> 120 mV ... 1,2 mV	1 kHz/50 $\Omega$	$1,3 \cdot 10^{-3} U + 62 \mu\text{V}$	
	> 1,2 mV ... 3 V	1 kHz/50 $\Omega$	$1,2 \cdot 10^{-3} U + 307 \mu\text{V}$	
	> 3 V ... 5,5 V	1 kHz/50 $\Omega$	$1,2 \cdot 10^{-3} U + 305 \mu\text{V}$	
DC voltage	1 mV ... 300 mV	DC/1 M $\Omega$	$290 \cdot 10^{-6} U + 32 \mu\text{V}$	
	> 300 mV ... 3 V	DC/1 M $\Omega$	$290 \cdot 10^{-6} U + 122 \mu\text{V}$	
	> 3 V ... 15 V	DC/1 M $\Omega$	$290 \cdot 10^{-6} U + 623 \mu\text{V}$	
	> 15 V ... 120 V	DC/1 M $\Omega$	$290 \cdot 10^{-6} U + 801 \mu\text{V}$	
	> 120 V ... 200 V	DC/1 M $\Omega$	$290 \cdot 10^{-6} U + 1,1 \text{ mV}$	
	1 mV ... 300 mV	DC/50 $\Omega$	$290 \cdot 10^{-6} U + 32 \mu\text{V}$	
	> 300 mV ... 3 V	DC/50 $\Omega$	$290 \cdot 10^{-6} U + 122 \mu\text{V}$	
> 3 V ... 5,5 V	DC/50 $\Omega$	$290 \cdot 10^{-6} U + 100 \mu\text{V}$		
<b>Time base</b>				
Sampling rate	0,2 ms	99,5 MHz; 100,5 MHz 30 mVpp ... 1 Vpp 100 MS/s	$0,05 \cdot 10^{-6} t$	t = Measurement value
Time interval	1 ms	10 MHz / 1 Vpp	$0,4 \cdot 10^{-6} t$	
Time marker	0,5 ns ... 20 s	100 mV ... 1 V	$1,2 \cdot 10^{-6} t + 12 \text{ ps}$	





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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ <sup>1)</sup>	Remarks
Risetime	$\geq 350$ ps	4,4 mV ... 3,1 V	37 ps	
Flatness	5 mVpp ... 5 Vpp	$\leq 300$ MHz	3,10 %	50 $\Omega$ , VSWR $\leq 1,6$ Calibrated to $U_{inc}$
		$> 300$ MHz ... 550 MHz	4,00 %	
	5 mVpp ... 3 Vpp	$> 550$ MHz ... 1,1 GHz	5,10 %	
	5 mVpp ... 5 Vpp	$\leq 10$ MHz	3,10 %	1 M $\Omega$ , $C_{in} \leq 7$ pF Calibrated to $U_{Load}$
		$> 10$ MHz ... 100 MHz	5,90 %	
		$> 100$ MHz ... 150 MHz	10,40 %	
		$> 150$ MHz ... 250 MHz	13,60 %	
Input resistance	50 $\Omega$		0,09 %	
	1 M $\Omega$		0,07 %	
<b>Optical power</b>				
Calibration of fiber optic power measurement instruments	-24 dBm ... -30 dBm	$\lambda = 850$ nm	2,0 %	50 $\mu$ m Multimode
		$\lambda = 1300$ nm	1,8 %	
Absolute power	-5 dBm ... -30 dBm	$\lambda = 1310$ nm	1,2 %	9 $\mu$ m Singlemode
	-5 dBm ... -30 dBm	$\lambda = 1550$ nm	1,2 %	
	-5 dBm ... -30 dBm	$\lambda = 1550$ nm	1,2 %	
Linearity	-24 dBm ... -60 dBm	$\lambda = 850$ nm	1,5 %	50 $\mu$ m Multimode
		$\lambda = 1300$ nm	1,5 %	
	-5 dBm ... -60 dBm	$\lambda = 1310$ nm	1,5 %	9 $\mu$ m Singlemode
		$\lambda = 1550$ nm	1,6 %	
Calibration of fiber optic sources	0 dBm ... -60 dBm	$\lambda = 800$ ... 900 nm	1,5 %	50 $\mu$ m Multimode
	-5 dBm ... -60 dBm	$\lambda = 1250$ ... 1350 nm	1,2 %	
Absolute power	-5 dBm ... -60 dBm	$\lambda = 1200$ ... 1650 nm	1,2 %	9 $\mu$ m Singlemode
Attenuation range				
Calibration of fiber optic attenuators	0 dB ... 40 dB	$\lambda = 850$ nm	1,6 %	50 $\mu$ m Multimode
		$\lambda = 1300$ nm	1,6 %	
		$\lambda = 1310$ nm	1,6 %	
Insertion loss	0 dB ... 60 dB	$\lambda = 1550$ nm	1,6 %	9 $\mu$ m Singlemode
<b>Wavelength of sources</b>				
	600 nm ... < 1530 nm	P = +10 ... -60 dBm	0,35 nm	
	1530 nm ... 1570 nm		0,08 nm	
	> 1570 nm ... 1750 nm		0,35 nm	



## SCS-Directory

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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ <sup>1)</sup>	Remarks
<b>Calibration of OTDR</b>	Distance:	$\lambda$ :	Deviation of the distance scale:	Also possible on site <sup>2)</sup>
SM-modules	0 km ... 100 km	1200 nm ... 1650 nm	3,7•10 <sup>-5</sup> m/m	
Scale of attenuation	0 dB ... 30 dB	1310 nm	Position offset: 0,70 m	
		1550 nm	Deviation of the scale of attenuation:	
		1625 nm	0,012 dB/dB	
		1650 nm	0,017 dB/dB	
			0,016 dB/dB	
			0,015 dB/dB	
<b>Temperature</b>				
Thermal calibration				More units possible: °F; K
Fixed-point for ITS-90	0,01 °C	Triple point of water	0,015 °C	
Thermometer with direct display and resistance thermometer	-90 °C ... 125 °C	Comparison with a standard platinum resistance thermometer in air in the bloc calibrator	0,026 °C	Also possible in the branches and on site <sup>2), 8)</sup>
	> 125 °C ... 165 °C		0,09 °C	
	> 165 °C ... 300 °C		0,21 °C	
	> 300 °C ... 450 °C		0,24 °C	
Thermocouple elements	> -30 °C ... 165 °C	Comparison with a standard platinum resistance thermometer in liquid in the bath	0,11 °C	Also possible in the branches and on site <sup>2), 8)</sup>
	-35 °C ... <5 °C	Comparison with a standard platinum resistance thermometer in air in the climatic chamber	0,37 °C	
	5 °C ... 30 °C		0,25 °C	
	> 30 °C ... 45 °C		0,27 °C	
Type K; Type N	-90 °C ... 125 °C	Comparison with a standard platinum resistance thermometer in air in the bloc calibrator	0,28 °C + 0,001• t	Also possible in the branches and on site <sup>2), 8)</sup>
	> 125 °C ... 300 °C		0,26 °C + 0,0017• t	
	> 300 °C ... 450 °C		0,2 °C + 0,002• t	
Type J; Type T	-90 °C ... 125 °C		0,25 °C + 0,004• t	
	> 125 °C ... 300 °C		0,25 °C + 0,005• t	
	> 300 °C ... 450 °C		0,3 °C + 0,0053• t	
Type R; Type S	0 °C ... 450 °C		1,0 °C	



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## Accreditation number: SCS 0058

Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ <sup>1)</sup>	Remarks
Type K; Type N	-30 °C ... 165 °C	Comparison with a standard platinum resistance thermometer in liquid in the bath	0,3 °C + 0,0012• t	Also possible in the branches and on site <sup>2), 8)</sup>
Type J; Type T	-30 °C ... 165 °C		0,3 °C + 0,0042• t	
Type R; Type S	-30 °C ... 165 °C		1,0 °C	
Type K; Type N	-35 °C ... <5 °C	Comparison with a standard platinum resistance thermometer in air in the climatic chamber	0,5 °C	
	5 °C ... 30 °C		0,4 °C	
	> 30 °C ... 45 °C		0,4 °C	
Type J; Type T	-35 °C ... <5 °C		0,5 °C	
	5 °C ... 45 °C		0,4 °C	
Type R; Type S	-35 °C ... < 5 °C		0,4 °C	
	5 °C ... 45 °C		1.1 °C	
Thermal installations (Bloc calibrator, bath)	-90 °C ... <-50 °C	With PRT Pt 100	0,065 °C	Also possible in the branches and on site <sup>2)</sup>
	-50 °C ... 125 °C		0,055 °C	
	> 125 °C ... 300 °C		0,21 °C	
	> 300 °C ... 450 °C		0,24 °C	
(Ovens, climate chambers) Display deviation from the (reference-) measuring point	-90 °C ... -50 °C	With PRT Pt 100	0,31 °C	Also possible on site <sup>2)</sup>
	> -50 °C ... 125 °C		0,30 °C	
	> 125 °C ... 250 °C	With TC type J	0,45 °C	
	> 250 °C ... 350 °C		1,22 °C + 0.003• t	
Electric calibration				
Measurement of RTD- temperature calibrator	-200 °C ... 300 °C	Pt 100	0,01 °C	Also possible in the branches and on site <sup>2)</sup>
	300 °C ... 800 °C		0,01 °C	
Simulations of RTD- temperature measuring instruments	-200 °C ... 0 °C	Pt 100	0,06 °C	
	>0 °C ... 100 °C		0,08 °C	
	>100 °C ... 630 °C		0,12 °C	
	>630 °C ... 800 °C		0,27 °C	
Measurement and simulations of thermocouple measuring instruments and -calibrators	600 °C ... 800 °C	Typ B	0,51 °C	Also possible in the branches and on site <sup>2)</sup>
	>800 °C ... 1820 °C		0,39 °C	
	0 °C ... 1000 °C	Typ C	0,36 °C	
	>1000 °C ... 1800 °C		0,58 °C	
	>1800 °C ... 2316 °C		0,97 °C	



## SCS-Directory

## Accreditation number: SCS 0058

Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ <sup>1)</sup>	Remarks
	-250 °C ... <-100 °C	Typ E	0,58 °C	
	-100 °C ... 650 °C		0,19 °C	
	>650 °C ... 2100 °C		0,24 °C	
	-210 °C ... <-100 °C	Typ J	0,31 °C	
	-100 °C ... <-30 °C		0,19 °C	
	-30 °C ... <150 °C		0,16 °C	
	150 °C ... 760 °C		0,20 °C	
	>760 °C ... 1200 °C		0,27 °C	
	-210 °C ... <-100 °C	Typ K	0,38 °C	
	-100 °C ... <-25 °C		0,21 °C	
	-25 °C ... 120 °C		0,19 °C	
	>120 °C ... 1000 °C		0,30 °C	
	>1000 °C ... 1372 °C		0,46 °C	
	-210 °C ... <-100 °C	Typ L	0,43 °C	
	-100 °C ... 800 °C		0,30 °C	
	>800 ... 900 °C		0,20 °C	
	-210 °C ... <-100 °C	Typ N	0,46 °C	
	-100 °C ... <-25 °C		0,25 °C	
	-25 °C ... 410 °C		0,22 °C	
	>410 °C ... 1300 °C		0,31 °C	
	0 °C ... <250 °C	Typ R	0,66 °C	
	250 °C ... 1000 °C		0,40 °C	
	>1000 °C ... 1767 °C		0,46 °C	
	0 °C ... <250 °C	Typ S	0,54 °C	
	250 °C ... 1400 °C		0,43 °C	
	>1400 °C ... 1767 °C		0,53 °C	
	-250 °C ... <-150 °C	Typ T	0,73 °C	
	-150 °C ... <0 °C		0,28 °C	
	0 °C ... 400 °C		0,19 °C	
	-200 °C ... <0 °C	Typ U	0,65 °C	
	0 °C ... 600 °C		0,31 °C	



## SCS-Directory

Accreditation number: SCS 0058

Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ <sup>1)</sup>	Remarks
<b>Pressure</b>				
Absolute pressure in fluids	13,8 mbar ... 14 bar		0,0035 % + 0,004 mbar	Also other units possible: Pa; psi; mmHg; mmH2O  Also possible on site <sup>2)</sup>
	> 14 bar ... 70 bar		0,005 %	
	> 70 bar ... 210 bar		0,005 %	
	> 210 bar ... 1000 bar		0,025 %	
Positive and negative gauge pressure in fluids	-900 mbar ... 14 bar		0,0035 %	
	> 14 bar ... 70 bar		0,005 %	
	> 70 bar ... 210 bar		0,005 %	
	> 210 bar ... 1000 bar		0,025 %	
Differential pressure in fluids	-160 mbar ... -10 mbar		0,008 % + 0,006 mbar	
	> -10 mbar ... < 10 mbar		0,01 % + 0,002 mbar	
	10 mbar ... 160 mbar		0,008 % + 0,006 mbar	
Manometer of blood pressure monitor	0 ... 46,7 kPa	20 °C ... 25 °C	0,08 kPa	According to Standards:  SN EN 1060-1 SN EN 1060-2 SN EN 1060-3 EN ISO 81060-1 OMIL R16-1 OMIL R16-2
	0 ... 350 mmHg		0,6 mmHg	
<b>Magnetic flux density</b>				
Calibration of magnetic field analyzers	0,1 $\mu$ T ... 200 $\mu$ T	10 Hz ... 1 kHz	1,80 % + 0,12 $\mu$ T	Also other units possible: A/m; A/cm, Gauss
	0,1 $\mu$ T ... 25 $\mu$ T	1 kHz ... 2 kHz		
	>200 $\mu$ T ... 250 $\mu$ T	10 Hz ... 1 kHz	1,85 % + 0,12 $\mu$ T	
<b>Electric field strength</b>				
Calibration of electric field analyzers	0 V/m ... 1330 V/m	10 Hz ... 1 kHz	1,60 % + 0,12 V/m	
	0 V/m ... 293 V/m	1 kHz ... 100 kHz		
	1,3 kV/m ... 20 kV/m	50 Hz		
<b>CDN</b>				
Impedance	0 $\Omega$ ... 250 $\Omega$	9 kHz ... 230 MHz	4,0 $\Omega$	According to SN EN 61000-4-6



## SCS-Directory

Accreditation number: SCS 0058

Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ <sup>1)</sup>	Remarks
Voltage Division Factor	0 dB ... 60 dB	9 kHz ... 230 MHz	0,4 dB	Also possible on site
<b>LISN</b>				
Impedance	0 $\Omega$ ... 250 $\Omega$	9 kHz ... 100 kHz	0,35 $\Omega$	According to CISPR 16-1-2
		>100 kHz ... 5 MHz	0,8 $\Omega$	Also possible on site
		>5 MHz ... 30 MHz	0,8 $\Omega$	
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	
	70 dB	100 kHz ... 3 MHz	1,6 dB	
		>3 MHz ... 30 MHz	3,6 dB	
<b>Surge</b>				
Peak Voltage	0,4 kV ... 5 kV		5,4 %	According to SN EN 61000-4-5 Also possible on site
Peak Current	1 A ... 4 kA		5,2 %	
Rise Time Voltage	0,4 $\mu$ s ... 10 $\mu$ s		22 ns	
Rise Time Current	0,4 $\mu$ s ... 10 $\mu$ s		100 ns	
Pulse duration Voltage	10 $\mu$ s ... 100 $\mu$ s		800 ns	
Pulse duration Current	10 $\mu$ s ... 100 $\mu$ s		100 ns	
<b>Burst</b>				
Peak Voltage	0,1 kV ... 4,2 kV		4,5 %	According to SN EN 61000-4-4 Also possible on site
Rise Time	2 ns ... 1 $\mu$ s		0,32 ns	
Pulse duration	5 ns ... 1 $\mu$ s		1,1 ns	
Burst duration	2 ms ... 20 ms	5 kHz Pulse	2 ms	
	0,2 ... 20 ms	100 kHz Pulse	0,2 ms	



## SCS-Directory

**Accreditation number: SCS 0058**

Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty $\pm$ <sup>1)</sup>	Remarks
Burst period	10 ms ... 500 ms		20 ms	

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 branches and on site up to 5 TΩ 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 branches 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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