Annex to declaration of accreditation (scope of accreditation)
Normative document: EN ISO/IEC 17025:2017
Registration number: **K 052**

of **TRESCAL Zoetermeer B.V.**
Technical Operations

This annex is valid from: **05-06-2020** to **01-03-2022** Replaces annex dated: **19-02-2020**

Location(s) where activities are performed under accreditation

Head Office

Storkstraat 2 - 4
2722 NN
Zoetermeer
Nederland

Location	Abbreviation/ location code
Storkstraat 2 – 4 2722 NN Zoetermeer The Netherlands	ZTM

HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
LF 0 0	DC/LF Electricity				
LF 1 0	Direct Voltage				ZTM
	10 µV – 100 µV		$5 \cdot 10^{-3} \cdot U$	Measurement	
	100 µV – 1 mV		$5 \cdot 10^{-4} \cdot U$		
	1 mV – 10 mV		$1 \cdot 10^{-4} \cdot U$		
	10 mV – 100 mV		$3 \cdot 10^{-5} \cdot U$		
	100 mV – 2 V		$7 \cdot 10^{-6} \cdot U$		
	2 V – 20 V		$3 \cdot 10^{-6} \cdot U$		
	20 V – 1 kV		$6 \cdot 10^{-6} \cdot U$		

[1] Calibration and Measurement Capability (CMC): Demonstrated measurement uncertainty, with coverage probability of 95%, in a given measurement point or measurement range. Measurement uncertainty, *U*, is calculated according to EA-4/02 "*Evaluation* of the Uncertainty of Measurement in Calibration".

This annex has been approved by the Board of the Dutch Accreditation Council, on its behalf,

J.A.W.M. de Haas
Director of Operations

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HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
	10 mV – 100 mV		$4 \cdot 10^{-5} \cdot U$	Measurement	On site
	100 mV - 1 kV		$1 \cdot 10^{-5} \cdot U$		
	0.1 V		$1 \cdot 10^{-6} \cdot U$	Measurement and generation	
	1 V		$9 \cdot 10^{-7} \cdot U$		
	1.018 V		$9 \cdot 10^{-7} \cdot U$		
	10 V		$7 \cdot 10^{-7} \cdot U$		
	100 V		$7 \cdot 10^{-7} \cdot U$		
	1000 V		$1.2 \cdot 10^{-6} \cdot U$		
	10 mV – 100 mV		$6 \cdot 10^{-5} \cdot U$	Generation	
	100 mV – 2.2 V		$1.5 \cdot 10^{-5} \cdot U$		
	2.2 V – 22 V		$7 \cdot 10^{-6} \cdot U$		
	22 V – 1 kV		$1 \cdot 10^{-5} \cdot U$		
	10 mV – 330 mV		$3 \cdot 10^{-5} \cdot U$	Generation	On site
	330 mV - 1 kV		$2 \cdot 10^{-5} \cdot U$		
	Conversion factor (0.001 – 1) V/V		$1 \cdot 10^{-3} \cdot U/U$	also on site	
LF 1 2	Direct Voltage ratio				ZTM
	(0.001 – 1) V/V		$1 \cdot 10^{-3} \cdot U/U$	primary voltage 100 mV to 1000 V, secondary voltage 0.1 mV to 1000 V	Also on site
LF 1 3	Direct High Voltage				ZTM
	1 kV – 30 kV		$8 \cdot 10^{-4} \cdot U$	Measurement	Also on site
	1 kV – 30 kV		$1 \cdot 10^{-3} \cdot U$	Generation	Also on site
LF 1 4	Pulse Amplitude				ZTM

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HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
	2mV	10 Hz	$1 \cdot 10^{-3} \cdot U$	Generation in 1MOhm	
	2mV	100Hz/1kHz	$5 \cdot 10^{-4} \cdot U$	Generation in 1MOhm	
	5mV – 100V	10Hz/100Hz/1kHz	$5 \cdot 10^{-4} \cdot U$	Generation in 1MOhm	
	2mV – 100V	10 Hz - 1 kHz	$5 \cdot 10^{-4} \cdot U$	Measurement	
LF 2 0	Direct Current			Measurement and generation	ZTM
	10 µA – 1 mA		$1 \cdot 10^{-5} \cdot I$		
	1 mA – 150 mA		$2.5 \cdot 10^{-5} \cdot I$		
	0.15 A – 15 A		$2 \cdot 10^{-5} \cdot I$		
	15 A – 20 A		$5 \cdot 10^{-5} \cdot I$		
	20 A – 30 A		$2 \cdot 10^{-4} \cdot I$		
	10 µA – 100 µA		$4 \cdot 10^{-4} \cdot I$	Generation	On site
	100 µA – 10 mA		$2 \cdot 10^{-4} \cdot I$		
	10 mA – 100 mA		$2 \cdot 10^{-4} \cdot I$		
	0.1 A – 1 A		$3 \cdot 10^{-4} \cdot I$		
	1 A – 10 A		$5 \cdot 10^{-4} \cdot I$		
	10 A – 20 A		$1 \cdot 10^{-3} \cdot I$		
	10 µA – 100 µA		$4 \cdot 10^{-5} \cdot I$	Measurement	On site
	100 µA – 10 mA		$4 \cdot 10^{-5} \cdot I$		
	10 mA – 100 mA		$5 \cdot 10^{-5} \cdot I$		
	0.1 A – 1 A		$1 \cdot 10^{-4} \cdot I$		
	1 A – 20 A		$1.3 \cdot 10^{-4} \cdot I$		
	100 mA – 20 A		$3.5 \cdot 10^{-3} \cdot I$	Generation, only for current clamps / probes	Also on site
	20 A – 1000 A		$8 \cdot 10^{-3} \cdot I$		
	Conversion factor (0.001 – 1) V/A		$3.5 \cdot 10^{-3} \cdot U/U$		Also on site

HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
LF 2 2	Direct Current Ratio				ZTM
	(0.001 – 1) V/A		$3.5 \cdot 10^{-3} \cdot U/I$	primary current 100 mA to 1000 A, secondary voltage 0.1 mV to 1000 V	Also on site
LF 3 0	Alternating Voltage			Measurement and generation	ZTM
	60 mV	10 Hz – 20 Hz	$3 \cdot 10^{-4} \cdot U$	Generation > 200V at 50 Hz – 1 kHz	
		20 Hz – 40 Hz	$1.5 \cdot 10^{-4} \cdot U$		
		40 Hz – 20 kHz	$1 \cdot 10^{-4} \cdot U$		
		20 kHz – 50 kHz	$2 \cdot 10^{-4} \cdot U$		
		50 kHz – 100 kHz	$6 \cdot 10^{-4} \cdot U$		
		100 kHz – 500 kHz	$6 \cdot 10^{-4} \cdot U$		
		500 kHz – 1 MHz	$1.5 \cdot 10^{-3} \cdot U$		
	100 mV – 200 mV	10 Hz – 20 Hz	$2.5 \cdot 10^{-4} \cdot U$		
		20 Hz – 40 Hz	$1 \cdot 10^{-4} \cdot U$		
		40 Hz – 20 kHz	$1 \cdot 10^{-4} \cdot U$		
		20 kHz – 50 kHz	$2.10^{-4} \cdot U$		
		50 kHz – 100 kHz	$2 \cdot 10^{-4} \cdot U$		
		100 kHz – 500 kHz	$5.5 \cdot 10^{-4} \cdot U$		
		500 kHz – 1 MHz	$1.4 \cdot 10^{-3} \cdot U$		
	200 mV – 600 mV	10 Hz – 20 Hz	$2.5 \cdot 10^{-4} \cdot U$		
		20 Hz – 40 Hz	$1 \cdot 10^{-4} \cdot U$		
		40 Hz – 20 kHz	$5 \cdot 10^{-5} \cdot U$		
		20 kHz – 50 kHz	$1 \cdot 10^{-4} \cdot U$		
		50 kHz – 100 kHz	$1 \cdot 10^{-4} \cdot U$		
		100 kHz – 500 kHz	$5 \cdot 10^{-4} \cdot U$		
		500 kHz – 1 MHz	$1.4 \cdot 10^{-3} \cdot U$		
	600 mV – 2 V	10 Hz – 20 Hz	$2 \cdot 10^{-4} \cdot U$		
		20 Hz – 40 Hz	$1 \cdot 10^{-4} \cdot U$		

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HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
		40 Hz – 20 kHz	$5 \cdot 10^{-5} \cdot U$		
		20 kHz – 50 kHz	$1 \cdot 10^{-4} \cdot U$		
		50 kHz – 100 kHz	$1 \cdot 10^{-4} \cdot U$		
		100 kHz – 500 kHz	$5 \cdot 10^{-4} \cdot U$		
		500 kHz – 1 MHz	$1.3 \cdot 10^{-3} \cdot U$		
	2 V – 20 V	10 Hz – 20 Hz	$2 \cdot 10^{-4} \cdot U$		
		20 Hz – 40 Hz	$1 \cdot 10^{-4} \cdot U$		
		40 Hz – 20 kHz	$5 \cdot 10^{-5} \cdot U$		
		20 kHz – 50 kHz	$1 \cdot 10^{-4} \cdot U$		
		50 kHz – 100 kHz	$1 \cdot 10^{-4} \cdot U$		
		100 kHz – 500 kHz	$5 \cdot 10^{-4} \cdot U$		
		500 kHz – 1 MHz	$1.6 \cdot 10^{-3} \cdot U$		
	20 V – 200 V	10 Hz – 20 Hz	$2 \cdot 10^{-4} \cdot U$		
		20 Hz – 40 Hz	$1 \cdot 10^{-4} \cdot U$		
		40 Hz – 20 kHz	$5 \cdot 10^{-5} \cdot U$		
		20 kHz – 50 kHz	$1 \cdot 10^{-4} \cdot U$		
		50 kHz – 100 kHz	$1 \cdot 10^{-4} \cdot U$		
	200 V – 1,000 V	10 Hz – 20 Hz	$2 \cdot 10^{-4} \cdot U$	Generation > 200V at 50 Hz – 1 kHz	
		20 Hz – 40 Hz	$1 \cdot 10^{-4} \cdot U$		
		40 Hz – 20 kHz	$1 \cdot 10^{-4} \cdot U$		
		20 kHz – 50 kHz	$2 \cdot 10^{-4} \cdot U$		
		50 kHz – 100 kHz	$2 \cdot 10^{-4} \cdot U$		
	1 mV – 10 mV	1 Hz – 40 Hz	$2 \cdot 10^{-3} \cdot U$	Measurement	On site
		40 Hz – 1 kHz	$2 \cdot 10^{-3} \cdot U$		
		1 kHz – 20 kHz	$2 \cdot 10^{-3} \cdot U$		
		20 kHz – 50 kHz	$3 \cdot 10^{-3} \cdot U$		
		50 kHz – 100 kHz	$6 \cdot 10^{-3} \cdot U$		
		100 kHz – 300 kHz	$4 \cdot 10^{-2} \cdot U$		
	10 mV – 10 V	1 Hz – 20 kHz	$3 \cdot 10^{-4} \cdot U$	Measurement	On site

HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
		20 kHz – 50 kHz	$5 \cdot 10^{-4} \cdot U$		
		50 kHz – 100 kHz	$9 \cdot 10^{-4} \cdot U$		
		100 kHz – 300 kHz	$3 \cdot 10^{-3} \cdot U$		
		300 kHz – 1 MHz	$9 \cdot 10^{-2} \cdot U$		
		1 MHz – 2 MHz	$1.3 \cdot 10^{-2} \cdot U$		
	10 V – 100 V	1 Hz – 20 kHz	$4 \cdot 10^{-4} \cdot U$	Measurement	On site
		20 kHz – 50 kHz	$5 \cdot 10^{-4} \cdot U$		
		50 kHz – 100 kHz	$1.3 \cdot 10^{-3} \cdot U$		
		100 kHz – 300 kHz	$4 \cdot 10^{-3} \cdot U$		
		300 kHz – 1 MHz	$1.3 \cdot 10^{-2} \cdot U$		
	100 V – 1,000 V	1 Hz – 1 kHz	$5.5 \cdot 10^{-4} \cdot U$	Measurement	On site
		1 kHz – 20 kHz	$7 \cdot 10^{-4} \cdot U$		
		20 kHz – 50 kHz	$1.3 \cdot 10^{-3} \cdot U$		
		50 kHz – 100 kHz	$2.6 \cdot 10^{-2} \cdot U$		
	1 mV – 33 mV	10 Hz – 45 Hz	$1 \cdot 10^{-3} \cdot U$	Generation	On site
		45 Hz – 20 kHz	$5 \cdot 10^{-4} \cdot U$		
		20 kHz – 50 kHz	$1 \cdot 10^{-3} \cdot U$		
		50 kHz – 100 kHz	$4 \cdot 10^{-3} \cdot U$		
		100 kHz – 500 kHz	$8 \cdot 10^{-3} \cdot U$		
	33 mV – 330 mV	10 Hz – 45 Hz	$5 \cdot 10^{-4} \cdot U$	Generation	On site
		45 Hz – 20 kHz	$3 \cdot 10^{-4} \cdot U$		
		20 kHz – 50 kHz	$5 \cdot 10^{-4} \cdot U$		
		50 kHz – 100 kHz	$1 \cdot 10^{-3} \cdot U$		
		100 kHz – 500 kHz	$2 \cdot 10^{-3} \cdot U$		
	330 mV – 3.3 V	10 Hz – 45 Hz	$5 \cdot 10^{-4} \cdot U$	Generation	On site
		45 Hz – 20 kHz	$3 \cdot 10^{-4} \cdot U$		
		20 kHz – 50 kHz	$5 \cdot 10^{-4} \cdot U$		
		50 kHz – 100 kHz	$1 \cdot 10^{-3} \cdot U$		
		100 kHz – 500 kHz	$3 \cdot 10^{-3} \cdot U$		

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	3.3 V – 33 V	10 Hz – 45 Hz	$5 \cdot 10^{-4} \cdot U$	Generation	On site
		45 Hz – 20 kHz	$3 \cdot 10^{-4} \cdot U$		
		20 kHz – 50 kHz	$5 \cdot 10^{-4} \cdot U$		
		50 kHz – 100 kHz	$1 \cdot 10^{-3} \cdot U$		
	33 V – 330 V	45 Hz – 20 kHz	$3 \cdot 10^{-4} \cdot U$	Generation	On site
		20 kHz – 50 kHz	$5 \cdot 10^{-4} \cdot U$		
		50 kHz – 100 kHz	$2 \cdot 10^{-3} \cdot U$		
	330 V – 1,000 V	45 Hz – 10 kHz	$3 \cdot 10^{-4} \cdot U$	Generation	On site
	Conversion factor (0.001 – 1) V/V	10 Hz – 100 kHz	$(1 \cdot 10^{-3} - 2 \cdot 10^{-3}) \cdot U/U$		also on site
LF 3 2	Alternating Voltage Ratio				ZTM
	(0.001 – 1) V/V	10 Hz – 100 kHz	$(1 \cdot 10^{-3} – 2 \cdot 10^{-3}) \cdot U/U$	primary voltage 100 mV to 1000 V, secondary voltage 0.1 mV to 1000 V	Also on site
LF 3 3	Alternating High voltage			Measurement and generation	ZTM
	1 – 30 kV	50 Hz	$4.5 \cdot 10^{-3} \cdot U$		Also on site
LF 4 0	Alternating current				ZTM
	10 µA – 100 µA	10 Hz – 40 Hz	$3 \cdot 10^{-4} \cdot I$	Measurement	
		40 Hz – 1 kHz	$1.5 \cdot 10^{-3} \cdot I$		
		1 kHz – 10 kHz	$4 \cdot 10^{-3} \cdot I$		
		10 kHz – 30 kHz	$1.5 \cdot 10^{-2} \cdot I$		
	100 µA – 1 mA	10 Hz – 1 kHz	$2 \cdot 10^{-4} \cdot I$		
		1 kHz – 10 kHz	$4 \cdot 10^{-4} \cdot I$		
		10 kHz – 30 kHz	$7 \cdot 10^{-4} \cdot I$		
	1 mA – 20 A	20 Hz – 10 kHz	$2 \cdot 10^{-4} \cdot I$		

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HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
		10 kHz – 30 kHz	$2.5 \cdot 10^{-4} \cdot I$		
	20 A – 50 A	20 Hz – 5 kHz	$8 \cdot 10^{-4} \cdot I$		
	10 µA – 100 µA	10 Hz – 40 Hz	$3 \cdot 10^{-4} \cdot I$	Calibration (Generation)	
		40 Hz – 1 kHz	$1.5 \cdot 10^{-3} \cdot I$		
		1 kHz – 10 kHz	$4 \cdot 10^{-3} \cdot I$		
		10 kHz – 30 kHz	$1.5 \cdot 10^{-2} \cdot I$		
	100 µA – 1 mA	10 Hz – 1 kHz	$2.5 \cdot 10^{-4} \cdot I$	Calibration (Generation)	
		1 kHz – 10 kHz	$4 \cdot 10^{-4} \cdot I$		
		10 kHz – 30 kHz	$7 \cdot 10^{-4} \cdot I$		
	1 mA – 100 mA	20 Hz – 30 kHz	$2.5 \cdot 10^{-4} \cdot I$		
	100 mA – 11 A	20 Hz – 10 kHz	$2.5 \cdot 10^{-4} \cdot I$		
	11 A – 20 A	20 Hz – 5 kHz	$2.5 \cdot 10^{-4} \cdot I$		
	20 A – 50 A	20 Hz – 1 kHz	$8 \cdot 10^{-4} \cdot I$		
	6 – 120 µA	10 – 20 Hz	$5 \cdot 10^{-3} \cdot I$	Measurement	On site
		20 – 45 Hz	$3 \cdot 10^{-3} \cdot I$		
		45 – 5 kHz	$2 \cdot 10^{-3} \cdot I$		
	0.12 – 120 mA	10 – 20 Hz	$5 \cdot 10^{-3} \cdot I$	Measurement	On site
		20 – 45 Hz	$3 \cdot 10^{-3} \cdot I$		
		45 – 100 Hz	$2 \cdot 10^{-3} \cdot I$		
		100 Hz – 5 kHz	$1 \cdot 10^{-3} \cdot I$		
		5 kHz – 20 kHz	$2 \cdot 10^{-3} \cdot I$		
		20 kHz – 50 kHz	$5 \cdot 10^{-3} \cdot I$		
		50 kHz – 100 kHz	$8 \cdot 10^{-3} \cdot I$		
	0.12 – 1.2 A	10 – 20 Hz	$5 \cdot 10^{-3} \cdot I$	Measurement	On site
		20 – 45 Hz	$3 \cdot 10^{-3} \cdot I$		

HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
		45 Hz – 5 kHz	$2 \cdot 10^{-3} \cdot I$		
		5 kHz – 20 kHz	$4 \cdot 10^{-3} \cdot I$		
		20 kHz – 50 kHz	$1.5 \cdot 10^{-2} \cdot I$		
	29 – 330 µA	10 Hz – 1 kHz	$2 \cdot 10^{-3} \cdot I$	Generation	On site
		1 kHz – 5 kHz	$3 \cdot 10^{-3} \cdot I$		
		5 kHz – 10 kHz	$8 \cdot 10^{-4} \cdot I$		
		10 kHz – 30 kHz	$1.5 \cdot 10^{-2} \cdot I$		
	0.33 – 3.3 mA	10 Hz – 45 Hz	$2 \cdot 10^{-3} \cdot I$	Generation	On site
		45 Hz – 1 kHz	$1 \cdot 10^{-3} \cdot I$		
		1 – 5 kHz	$2 \cdot 10^{-3} \cdot I$		
		5 – 10 kHz	$5 \cdot 10^{-3} \cdot I$		
		10 – 30 kHz	$9 \cdot 10^{-3} \cdot I$		
	3.3 – 33 mA	10 – 20 Hz	$2 \cdot 10^{-3} \cdot I$	Generation	On site
		20 – 45 Hz	$1 \cdot 10^{-3} \cdot I$		
		45 Hz – 1 kHz	$5 \cdot 10^{-4} \cdot I$		
		1 kHz – 5 kHz	$8 \cdot 10^{-4} \cdot I$		
		5 kHz – 10 kHz	$2 \cdot 10^{-3} \cdot I$		
		10 kHz – 30 kHz	$4 \cdot 10^{-3} \cdot I$		
	33 – 330 mA	10 – 20 Hz	$2 \cdot 10^{-3} \cdot I$	Generation	On site
		20 – 45 Hz	$1 \cdot 10^{-3} \cdot I$		
		45 Hz – 1 kHz	$5 \cdot 10^{-4} \cdot I$		
		1 – 5 kHz	$1 \cdot 10^{-3} \cdot I$		
		5 – 10 kHz	$2 \cdot 10^{-3} \cdot I$		
		10 – 30 kHz	$4 \cdot 10^{-3} \cdot I$		
	0.33 – 1.1 A	10 – 45 Hz	$2 \cdot 10^{-3} \cdot I$	Generation	On site
		45 Hz – 1 kHz	$6 \cdot 10^{-4} \cdot I$		
		1 – 5 kHz	$6 \cdot 10^{-3} \cdot I$		

HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
		5 – 10 kHz	$2.5 \cdot 10^{-2} \cdot I$		
	1.1 – 3 A	40 – 45 Hz	$2 \cdot 10^{-3} \cdot I$		
		45 Hz – 1 kHz	$6 \cdot 10^{-4} \cdot I$		
		1 kHz – 5 kHz	$6 \cdot 10^{-3} \cdot I$		
		5 kHz – 10 kHz	$2.2 \cdot 10^{-2} \cdot I$		
	3 – 11 A	45 Hz – 5 kHz	$1 \cdot 10^{-3} \cdot I$	Generation	On site
		5 kHz – 10 kHz	$2.5 \cdot 10^{-2} \cdot I$		
	11 – 20.5 A	45 Hz – 5 kHz	$2 \cdot 10^{-3} \cdot I$	Generation	On site
		5 kHz – 10 kHz	$2.5 \cdot 10^{-2} \cdot I$		
	100 mA – 20 A	20 Hz – 1000 Hz	$4 \cdot 10^{-3} \cdot I$	Generation, only for current clamps / probes	Also on site
	20 A – 1000 A	30 Hz – 60 Hz	$8 \cdot 10^{-3} \cdot I$		
	Conversion factor (0.001 – 1) V/A	20 Hz – 1000 Hz	$4 \cdot 10^{-3} \cdot U/I$		also on site
LF 4 2	Alternating Current Ratio				Also on site
	(0.001 – 1) V/A	20 Hz – 1000 Hz,	$4 \cdot 10^{-3} \cdot U/I$	primary current 100 mA to 1000 A, secondary voltage 0.1 mV to 1000 V, >20 A 30 to 60 Hz	
LF 6 1	Resistance				ZTM
	0.08 mΩ		$1.5 \cdot 10^{-4} \cdot R$	Generation	
	0.2 mΩ; 0.4 mΩ; 0.8 mΩ		$1 \cdot 10^{-4} \cdot R$		
	1 mΩ		$3.5 \cdot 10^{-5} \cdot R$		
	10 mΩ		$1.5 \cdot 10^{-5} \cdot R$		
	100 mΩ		$5 \cdot 10^{-6} \cdot R$		
	1; 10; 100; 1,000 Ω		$3 \cdot 10^{-6} \cdot R$		
	10 kΩ		$1 \cdot 10^{-6} \cdot R$		

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	100 kΩ		$4 \cdot 10^{-6} \cdot R$		
	1 MΩ		$6 \cdot 10^{-6} \cdot R$		
	10 MΩ		$8 \cdot 10^{-6} \cdot R$		
	100 MΩ		$5.5 \cdot 10^{-5} \cdot R$		
	0 Ω		$1 \cdot 10^{-3}$ Ω	Generation	Also on site
	(0.0001 – 11) Ω		$3.2 \cdot 10^{-5} \cdot R + 1 \cdot 10^{-3}$ Ω		
	(11 – 33) Ω		$6 \cdot 10^{-5} \cdot R$		
	(33 – 110) Ω		$3.3 \cdot 10^{-5} \cdot R$		
	110 Ω – 110 kΩ		$2.8 \cdot 10^{-5} \cdot R$		
	(0.1 – 1.1) MΩ		$3 \cdot 10^{-5} \cdot R$		
	(1.1 – 3.3) MΩ		$6 \cdot 10^{-5} \cdot R$		
	(3.3 – 11) MΩ		$1.2 \cdot 10^{-4} \cdot R$		
	(11 – 33) MΩ		$3 \cdot 10^{-4} \cdot R$		
	(33– 110) MΩ		$5 \cdot 10^{-4} \cdot R$		
	(110 – 330) MΩ		$3 \cdot 10^{-3} \cdot R$		
	(0.33 – 1.1) GΩ		$1.2 \cdot 10^{-2} \cdot R$		
	0.08 mΩ		$1.5 \cdot 10^{-4} \cdot R$	Measurement	
	1 mΩ		$6 \cdot 10^{-5} \cdot R$		
	10 mΩ		$5 \cdot 10^{-5} \cdot R$		
	100 mΩ		$3 \cdot 10^{-5} \cdot R$		
	1 Ω		$6 \cdot 10^{-6} \cdot R$		
	10; 100; 1,000 Ω		$3 \cdot 10^{-6} \cdot R$		
	10 kΩ		$1 \cdot 10^{-6} \cdot R$		
	100 kΩ		$4 \cdot 10^{-6} \cdot R$		
	1 MΩ		$6 \cdot 10^{-6} \cdot R$		
	10 MΩ		$1 \cdot 10^{-5} \cdot R$		
	100 MΩ		$6 \cdot 10^{-5} \cdot R$		
	0.08 mΩ – 1 mΩ		$1.5 \cdot 10^{-4} \cdot R$		

HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
	1 mΩ – 1 Ω		$3.5 \cdot 10^{-5} \cdot R$		
	1 Ω – 2 Ω		$3 \cdot 10^{-5} \cdot R$		
	2 Ω – 20 Ω		$2 \cdot 10^{-5} \cdot R$		
	20 Ω – 200 kΩ		$5 \cdot 10^{-6} \cdot R$		
	200 kΩ – 2 MΩ		$1 \cdot 10^{-5} \, R$		
	2 MΩ – 20 MΩ		$5 \cdot 10^{-5} \cdot R$		
	20 MΩ – 200 MΩ		$5 \cdot 10^{-4} \cdot R$		
	(0.1 – 10) Ω		$2 \cdot 10^{-5} \cdot R$	Measurement	on site
	(10 – 100) Ω		$1.5 \cdot 10^{-5} \cdot R$		
	(0.1 – 1) kΩ		$1 \cdot 10^{-5} \cdot R$		
	(1 – 10) kΩ		$1 \cdot 10^{-5} \cdot R$		
	(10 – 100) kΩ		$1 \cdot 10^{-5} \cdot R$		
	(0.1 – 1) MΩ		$1.5 \cdot 10^{-5} \cdot R$		
	(1 – 10) MΩ		$5 \cdot 10^{-5} \cdot R$		
	(10 – 100) MΩ		$4 \cdot 10^{-4} \cdot R$		
	(100 – 200) MΩ		$4 \cdot 10^{-3} \cdot R$		
LF 6 4	Capacitance				ZTM
	1 pF	1 kHz	$1.5 \cdot 10^{-4} \cdot C$	Generation	
	10 pF	1 kHz	$4.10^{-5} \cdot C$		
	100 pF; 1,000 pF	1 kHz	$1.5 \cdot 10^{-5} \cdot C$		
	10 nF	1 kHz	$1 \cdot 10^{-4} \cdot C$		
	100 nF	1 kHz	$1 \cdot 10^{-4} \cdot C$		
	1 µF	1 kHz	$2.5 \cdot 10^{-4} \cdot C$		
	1 pF – 10 pF	1 kHz	$1.2 \cdot 10^{-5} \cdot C$	Measurement, D <0.01	
	10 pF – 1 nF	1 kHz	$4 \cdot 10^{-5} \cdot C$		
	1 nF – 10 nF	1 kHz	$7 \cdot 10^{-5} \cdot C$		

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HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
	10 nF – 100 nF	1 kHz	$1.5 \cdot 10^{-4} \cdot C$		
	100 nF – 1 µF	1 kHz	$3.3 \cdot 10^{-4} \cdot C$		
LF 6 7	Inductance			Measurement and generation	ZTM
	100 µH	1 kHz	$1.5 \cdot 10^{-3} \cdot L$		
	1 mH	1 kHz	$5 \cdot 10^{-4} \cdot L$		
	10 mH	1 kHz	$5 \cdot 10^{-4} \cdot L$		
	100 mH	1 kHz	$5 \cdot 10^{-4} \cdot L$		
	1 H	1 kHz	$5 \cdot 10^{-4} \cdot L$		
	1 H	400 Hz	$5 \cdot 10^{-4} \cdot L$		
RF 0 0	High Frequency electricity				
RF 2 1	Reflection coefficient				ZTM
	linear magnitude |Γ|	(0.05 – 2) GHz	0.005 + 0.004*|Γ|	N connector. Best accuracy for a test object VSWR of maximum 1.04	
		(>2 – 18) GHz	0.012 + 0.020*|Γ|		
		(0.05 – 2) GHz	0.006 + 0.007*|Γ|	PC 3.5 connector. Best accuracy for a test object VSWR of maximum 1.06	
		(>2 – 18) GHz	0.017 + 0.022*|Γ|		
		(>18 – 26.5) GHz	0.029 + 0.021*|Γ|		
	VSWR				
		(0.05 – 2) GHz	0.011	N connector. Best accuracy for a test object VSWR of maximum 1.04	
		(>2 – 18) GHz	0.024		
		(0.05 – 2) GHz	0.011	PC 3.5 connector. Best accuracy for a test object VSWR of maximum 1.06	

HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
		(>2 – 18) GHz	0.034		
		(>18 – 26.5) GHz	0.06		
RF 2 2	Attenuation				
	(10 – 30) dB	(0.05 – < 1) GHz	0.05 dB	3) measured with measuring receiver, N or PC 7 connector	
		(1 – 14) GHz	0.10 dB		
		(> 14 – 18) GHz	0.15 dB		
	(> 30 – 60) dB	(0.05 – < 1) GHz	0.07 dB		
		(1 – 16) GHz	0.10 dB		
		(> 16 – 18) GHz	0.15 dB		
	(3 – 10) dB	(0.05 – <1) GHz	0.07dB	4) Measured with VNA, N connector	
		(1 – 18) GHz	0.14 dB		
	(>10 – 20) dB	(0.05 – <1) GHz	0.09 dB		
		(1 – 18) GHz	0.15 dB		
	(>20 – 40) dB	(0.05 – <1) GHz	0.12 dB		
		(1 – 18) GHz	0.17 dB		
	(>40 – 50) dB	(0.05 – 18) GHz	0.22 dB		
	(>50 – 60) dB	0.05 GHz	0.32 dB		
		(>0.05 – 18) GHz	0.26 dB		
	(3 – 20) dB	(0.05 – <1) GHz	0.08 dB	4) Measured with VNA, PC 3.5 connector	
		(1 – 20) GHz	0.15 dB		
		(>20 – 26.5) GHz	0.17 dB		
	(>20 – 40) dB	(0.05 – 20) GHz	0.17 dB		
		(>20 – 26.5) GHz	0.19 dB		
	(>40 – 50) dB	(0.05 – 20) GHz	0.19 dB		
		(>20 – 26.5) GHz	0.21 dB		
	(>50 – 60) dB	0.05 GHz	0.32 dB		

HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
		(>0.05 – 0.5) GHz	0.24 dB		
		(>0.5 – 20) GHz	0.22 dB		
		(>20 – 26.5) GHz	0.24 dB		
	(10 – 50) dB	(0.05 – 1) GHz	0.04 dB	Calibration with a step attenuator, relative to 0 dB	
	(>50 – 60) dB	(0.05 – 1) GHz	0.05 dB		
	(>60 – 70) dB	(0.05 – 1) GHz	0.10 dB		
	(>70 – 80) dB	(0.05 – 1) GHz	0.20 dB		
RF 3 0	High frequency Power				ZTM
	Calibration factor	(100 – 500) kHz	(2.0 – 1.2) %	1), 2), N connector. Nominal 1 mW	
		500 kHz – 18 GHz	(1.2 – 3.0) %		
		(10 – 50) MHz	(2.7 – 2.1) %	1), 2), N connector. Nominal 1 µW	
		50 MHz – 18 GHz	(2.1 – 3.6) %		
		(10 – 50) MHz	(2.8 – 2.1) %	1), 2). PC 3.5 connector. Nominal 1 mW	
		50 MHz – 26.5 GHz	(2.1 – 3.0) %		
	Absolute power 1 mW	50 MHz	0.004 mW	N connector, measurement and generation	
	Absolute power 0 dBm	50 MHz	0.018 dB		
	Absolute power 0 to -10 dBm	100 kHz	0.13 dB	4) BNC connector. Measurement with power sensor (e.g. generator)	
		>100 kHz - 1 GHz	0.10 dB		
		100 kHz	0.13 dB	4) N female or PC 7 connector. Measurement with power sensor (e.g. generator)	
		>100 kHz – 6 GHz	0.10 dB		
		(>6 – 14) GHz	0.13 dB		
		(>14 – 18) GHz	0.15 dB		
		10 MHz	0.20 dB	4) PC 3.5 male or female connector. Measurement	
		>10MHz – 6 GHz	0.12 dB		

HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
		(>6 – 18) GHz	0.15 dB	with power sensor (e.g. generator)	
		(>18 – 26.5) GHz	0.20 dB		
	Absolute power -10 to -90 dBm	(2.5 – 1000) MHz	0.20 dB	4) BNC connector. Measurement with measuring receiver (e.g. generator)	
	Absolute power -90 to -110 dBm	(2.5 – 1000) MHz	0.20 dB		
	Absolute power -10 to -90 dBm	(2.5 – 1300) MHz	0.20 dB	4) N female or PC 7 connector. Measurement with measuring receiver (e.g. generator)	
		(>1.3 – 2.6) GHz	0.25 dB		
	Absolute power -90 to -110 dBm	(2.5 – 1300) MHz	0.20 dB		
		(>1.3 - 2.6) GHz	0.25 dB		
	Absolute power -10 to -90 dBm	(10 – 1300) MHz	0.20 dB	4) PC 3.5 male or female connector. Measurement with measuring receiver (e.g. generator)	
		(>1.3 – 10) GHz	0.25 dB		
		(>10 – 21) GHz	0.35 dB		
		(>21 – 24) GHz	0.40 dB		
		(>24 – 26) GHz	0.60 dB		
	Absolute power -90 to -110 dBm	(10 – 1300) Mhz	0.25 dB		
		(>1.3 – 10) GHz	0.30 dB		
		(>10 – 21) GHz	0.35 dB		
		(>21 – 24) GHz	0.40 dB		
		(>24 – 26) GHz	0.60 dB		
	Absolute power 0 to -10 dBm	100 kHz	0.16 dB	4) BNC connector. Calibration with splitter and power sensor (e.g. spectrum analyser)	
		>100 kHz – 6 GHz	0.13 dB		
		100 kHz	0.16 dB	4) N male or female or PC 7 connector. Calibration with splitter and power sensor (e.g. spectrum analyser)	
		>100 kHz – 6 GHz	0.13 dB		
		(>6 – 12) GHz	0.16 dB		
		(>12 – 18) GHz	0.19 dB		
		10 MHz – 6 GHz	0.13 dB		

HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
		(>6 – 12) GHz	0.16 dB	4) PC 3.5 male connector. Calibration with splitter and power sensor (e.g. spectrum analyser)	
		(>12 – 18) GHz	0.19 dB		
		(>18 – 26.5) GHz	0.24 dB		
	Absolute power -10 to -90 dBm	50 MHz	0.25 dB	4) BNC connector. Calibration with splitter and measuring receiver (e.g. spectrum analyser)	
	Absolute power -90 to -100 dBm	50 MHz	0.30 dB		
	Absolute power -10 to -90 dBm	50 MHz	0.25 dB	4) N male or female or PC 7 connector. Calibration with splitter and measuring receiver (e.g. spectrum analyser)	
	Absolute power -90 to -100 dBm	50 MHz	0.30 dB		
	Absolute power -10 to -90 dBm	50 MHz	0.25 dB	4) PC 3.5 male connector. Measurement with splitter and measuring receiver (e.g. spectrum analyser)	
	Absolute power -90 to -100 dBm	50 MHz	0.30 dB		
TF 0 0	Time and Frequency				
TF 2 1	Frequency				ZTM
	100 kHz		$1 \cdot 10^{-11} \cdot f$	Measurement measuring time $\tau \geq 1{,}000$ s	
	1 MHz		$1 \cdot 10^{-11} \cdot f$		
	5 MHz		$1 \cdot 10^{-11} \cdot f$		
	10 MHz		$1 \cdot 10^{-11} \cdot f$		
	0.1 Hz – 1 Hz		12 µHz	Measurement. Generation measuring time $\tau \geq 20$ s	
	1 Hz – 10 Hz		12 µHz		
	10 Hz – 100 Hz		12 µHz – 1.2 µHz		
	100 Hz – 1 kHz		1.2 µHz		
	1 kHz – 10 kHz		1.2 µHz		
	10 kHz – 100 kHz		1.2 µHz		
	100 kHz – 1 MHz		1.2 µHz – 12 µHz		
	1 MHz – 10 MHz		12 µHz – 0.12 mHz		

HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
	10 MHz – 100 MHz		0.12 mHz – 1.2 mHz		
	100 MHz – 1 GHz		1.2 mHz – 12 mHz		
	1 GHz – 3 GHz		12 mHz – 14 mHz		
	3 GHz – 27.5 GHz		1.2 Hz		
TF 2 2	Time interval			Measurement	ZTM
	100 ps – 1 ns		$1.2 \cdot 10^{-9} \cdot T$		
	1 ns – 10 ns		$1.2 \cdot 10^{-9} \cdot T$		
	10 ns – 100 ns		$1.2 \cdot 10^{-9} \cdot T$		
	100 ns – 1µs		$1.2 \cdot 10^{-9} \cdot T$		
	1 µs – 10 µs		$1.2 \cdot 10^{-9} \cdot T$		
	10 µs – 100 µs		$1.2 \cdot 10^{-9} \cdot T$		
	100 µs – 1 ms		$1.2 \cdot 10^{-9} \cdot T$		
	1 ms – 10 ms		$1.2 \cdot 10^{-9} \cdot T$		
	10 ms – 100 ms		$1.2 \cdot 10^{-8} \cdot T$ – $1.2 \cdot 10^{-6} \cdot T$		
	100 ms – 1 s		$1.2 \cdot 10^{-6} \cdot T$ – $1.2 \cdot 10^{-5} \cdot T$		
	1 s – 10 s		$1.2 \cdot 10^{-5} \cdot T$ – $1.2 \cdot 10^{-4} \cdot T$		
				Measurement	
	0.1 µs – 100 ms		$1 \cdot 10^{-6} \cdot T$ + 10 ns	Equipment with separated electrical start and stop inputs.	
	100 ms – 1 s		$1 \cdot 10^{-5} \cdot T$ + 10 ns		
	1 s – 10 s		$1 \cdot 10^{-4} \cdot T$ + 10 ns		
OQ 1 0	Optical quantities				
OQ 13	Optical wavelength	1511 – 1542 nm	0.2 pm	Calibration of wavelength with a wavelength reference cell, fixed wavelengths	

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HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
		840 – 860 nm 1270 – 1650 nm	0.4 pm 0.4 pm	Calibration of wavelength in combination with a reference wavelength meter	
		840 – 860 nm 1270 – 1650 nm	0.4 pm 0.4 pm	Measurement of wavelength with a reference wavelength meter	
		600 – 1530 nm	300 ppm	Measurement of wavelength with an optical spectrum analyser	
OQ 1 5	Optical Power				ZTM
	-5 dBm to -55 dBm (316 μW to 3.16 nW)	850 nm	0.09 dB (≈2.0 %)	Measurement and Calibration	
	-5 dBm to -55 dBm (316 μW to 3.16 nW)	1300 nm	0.13 dB (≈3.0 %)		
	+3 dBm to -55 dBm (2 mW – 3.16 nW)	1310 nm	0.09 dB (≈2.0 %)		
	+3 dBm to -55 dBm (2 mW – 3.16 nW)	1550 nm	0.09 dB (≈2.0 %)		
	-5 dBm to -55 dBm (316 μW – 3.16 nW)	1625 nm	0.10 dB (≈2.3 %)		
	-5 dBm to -55 dBm (316 μW to 3.16 nW)	850 nm	0.05 dB	Linearity calibration relative to -10 dBm	
	-5 dBm to -55 dBm (316 μW to 3.16 nW)	1300 nm	0.05 dB		
	+3 dBm to -55 dBm (2 mW- 3.16 nW)	1310 nm	0.05 dB		
	+3 dBm to -55 dBm (2 mW- 3.16 nW)	1550 nm	0.05 dB		
	-5 dBm to -55 dBm ((316 μW – 3.16 nW)	1625 nm	0.05 dB		

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HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
	0 dB to 45 dB	850 nm	0.06 dB	Measurement of incremental loss	
	0 dB to 45 dB	1300 nm	0.06 dB		
	0 dB to 55 dB	1310 nm	0.05 dB		
	0 dB to 55 dB	1550 nm	0.05 dB		
	0 dB to 50 dB	1625 nm	0.05 dB		

Electrical and optical calibrations are performed at nominal 23 °C.

The CMC in RF and Microwave measurements are applicable to instruments with a characteristic impedance of nominal 50 Ohm
1) Measurements are performed at a fixed set of measurement frequencies;
2) Calibration factor is applicable to measurements relative to 50 MHz;
3) CMC is calculated for a test object VSWR of 1.01 and the maximal VSWR for the uncertainty calculation is 1.35;
4) CMC is calculated for a test object with a typical VSWR of 1 to 1.27;

The measurements are carried out inside Trescal BV 's laboratory or in another location (on site).