RAAD VOOR ACCREDITATIE

Dutch Accreditation Council RvA
PO Box 2768 NL-3500 GT Utrecht

The Dutch Accreditation Council RvA, by law appointed as the national accreditation body for The Netherlands, hereby declares that accreditation has been granted to:

Trescal B.V.
Technical Operations
Zoetermeer

The organisation has demonstrated to be able to generate technical valid results in a competent way and work according to a management system.

This accreditation is based on an assessment against the requirements as laid down in EN ISO/IEC 17025:2005.

The accreditation covers the activities as specified in the authorized annex bearing the registration number.

The accreditation is valid provided that the organisation continues to meet the requirements.

The accreditation with registration number:

K 052

is granted on 12 September 1989

This declaration is valid until

30 November 2020

The Chief Executive

Ir. J.C. van der Poel

Annex to declaration of accreditation (scope of accreditation)
Normative document: EN ISO/IEC 17025:2005
Registration number: **K 052**

of **Trescal B.V.**
Technical Operations

This annex is valid from: **16-01-2019** to **30-11-2020** Replaces annex dated: **20-06-2018**

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		$6 \cdot 10^{-6} \cdot U$		
	10 mV – 100 mV		$4 \cdot 10^{-5} \cdot U$	Measurement	On site

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

[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".

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Technical Operations

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HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
	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		$2 \cdot 10^{-5} \cdot U$		
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
	2mV	10 Hz	$1 \cdot 10^{-3} \cdot U$	Generation in 1MOhm	
	2mV	100Hz/1kHz	$5 \cdot 10^{-4} \cdot U$	Generation in 1MOhm	

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HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
	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		$8 \cdot 10^{-3} \cdot I$		
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

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HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
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	$1 \cdot 10^{-4} \cdot U$		
		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	$5 \cdot 10^{-4} \cdot U$		

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HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
		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	$2 \cdot 10^{-4} \cdot U$		
		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
		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	$9 \cdot 10^{-2} \cdot U$		

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		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	$3 \cdot 10^{-3} \cdot U$		
	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	$1 \cdot 10^{-3} \cdot U$		

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HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
	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
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	$2 \cdot 10^{-4} \cdot I$		
		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)	

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Technical Operations

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HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
		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	$3 \cdot 10^{-3} \cdot I$		
		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	$3 \cdot 10^{-3} \cdot I$		

HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
		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	$6 \cdot 10^{-3} \cdot I$		
		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

HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
		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	$8 \cdot 10^{-3} \cdot I$		
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 0,1 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		$1 \cdot 10^{-6} \cdot R$		
	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 – 11) Ω		$1.2 \cdot 10^{-4} \cdot R$	Generation	Also on site
	(11 – 33) Ω		$6 \cdot 10^{-5} \cdot R$		
	(33 – 110) Ω		$3.3 \cdot 10^{-5} \cdot R$		
	110 Ω – 110 k Ω		$2.8 \cdot 10^{-5} \cdot R$		

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This annex is valid from: **16-01-2019** to **30-11-2020** Replaces annex dated: **20-06-2018**

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	(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		$1.5 \cdot 10^{-4} \cdot R$		
	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		$1.5 \cdot 10^{-5} \cdot R$		

HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
	(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	$7 \cdot 10^{-5} \cdot C$		
	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	$5 \cdot 10^{-4} \cdot L$		

Annex to declaration of accreditation (scope of accreditation)
Normative document: EN ISO/IEC 17025:2005
Registration number: **K 052**

of **Trescal B.V.**
Technical Operations

This annex is valid from: **16-01-2019** to **30-11-2020** Replaces annex dated: **20-06-2018**

HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
	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	
		(>2 – 18) GHz	0.034		
		(>18 – 26.5) GHz	0.06		

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of **Trescal B.V.**
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HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
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		
		(>0.05 – 0.5) GHz	0.24 dB		
		(>0.5 – 20) GHz	0.22 dB		
		(>20 – 26.5) GHz	0.24 dB		

HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
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 with power sensor (e.g. generator)	
		>10MHz – 6 GHz	0.12 dB		
		(>6 – 18) GHz	0.15 dB		
		(>18 – 26.5) GHz	0.20 dB		

HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
	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 – 1,300) MHz	0.20 dB		
		(>1.3 - 2.6) GHz	0.25 dB		
	Absolute power -10 to -90 dBm	(10 – 1,300) 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 – 1,300) 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	4) PC 3.5 male connector. Calibration with splitter and power sensor (e.g. spectrum	
		(>6 – 12) GHz	0.16 dB		
		(>12 – 18) GHz	0.19 dB		

HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
		(>18 – 26.5) GHz	0.24 dB	analyser)	
	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		

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HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location

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).