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: **17-02-2022** to **01-03-2026** Replaces annex dated: **zie T06**

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
On Site	OS

HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
LF 0 0	DC/LF Electricity				
LF 1 0	Direct Voltage				ZTM
	0 µV – 10 µV		$3 \cdot 10^{-6} \cdot U + 0.1$ µV	Measurement	
	10 µV – 100 µV		$5 \cdot 10^{-3} \cdot U$		
	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		$7 \cdot 10^{-6} \cdot U$		

[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

of **TRESCAL Zoetermeer B.V.**
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HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
	2 V – 20 V		$3 \cdot 10^{-6} \cdot U$		
	20 V – 1 kV		$6 \cdot 10^{-6} \cdot U$		
	0 mV – 10 mV		$5.5 \cdot 10^{-5} \cdot U$ + 0.5 µV	Measurement	OS
	10 mV – 100 mV		$4 \cdot 10^{-5} \cdot U$		
	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		$1.2 \cdot 10^{-6} \cdot U$		
	0 mV – 10 mV		$4 \cdot 10^{-6} \cdot U$ + 0.5 µV	Generation	
	10 mV – 100 mV		$6 \cdot 10^{-5} \cdot U$		
	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		$1 \cdot 10^{-5} \cdot U$		
	0 mV – 10 mV		$2 \cdot 10^{-5} \cdot U$ + 1 µV	Generation	OS
	10 mV – 330 mV		$3 \cdot 10^{-5} \cdot U$		
	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	ZTM, OS

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HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
LF 1 3	Direct High Voltage				ZTM
	1 kV – 30 kV		$8 \cdot 10^{-4} \cdot U$	Measurement	ZTM, OS
	1 kV – 30 kV		$1 \cdot 10^{-3} \cdot U$	Generation	ZTM, OS
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	
	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
	0 A – 10 µA		$2 \cdot 10^{-5} \cdot I$ + 0.4 nA		
	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 – 100 A		$1.2 \cdot 10^{-4} \cdot I - 4 \cdot 10^{-5} \cdot I$		
	10 µA – 100 µA		$4 \cdot 10^{-4} \cdot I$	Generation	OS
	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	OS
	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		$1.3 \cdot 10^{-4} \cdot I$		

HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
	100 mA – 20 A		$3.5 \cdot 10^{-3} \cdot I$	Generation, only for current clamps / probes	ZTM, OS
	20 A – 1000 A		$8 \cdot 10^{-3} \cdot I$		
	Conversion factor (0.001 – 1) V/A		$3.5 \cdot 10^{-3} \cdot U/U$		ZTM, OS
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	ZTM, OS
LF 3 0	Alternating Voltage			Measurement and generation	ZTM
	0.7 mV – 2 mV	10 Hz – 20 Hz	$1.4 \cdot 10^{-3} \cdot U$ + 1 µV	Generation > 200V at 50 Hz – 1 kHz	
		20 Hz – 40 Hz	$5.8 \cdot 10^{-4} \cdot U$ + 1 µV		
		40 Hz – 20 kHz	$3.3 \cdot 10^{-4} \cdot U$ + 1 µV		
		20 kHz – 50 kHz	$6.3 \cdot 10^{-4} \cdot U$ + 1.6 µV		
		50 kHz – 100 kHz	$9.4 \cdot 10^{-4} \cdot U$ + 3.1 µV		
		100 kHz – 500 kHz	$1.9 \cdot 10^{-3} \cdot U$ + 6.2 µV		
		500 kHz – 1 MHz	$2.8 \cdot 10^{-3} \cdot U$ + 6.2 µV		
	2 mV – 7 mV	10 Hz – 20 Hz	$6.7 \cdot 10^{-4} \cdot U$ + 1 µV		
		20 Hz – 40 Hz	$2.9 \cdot 10^{-4} \cdot U$ + 1 µV		
		40 Hz – 20 kHz	$1.7 \cdot 10^{-4} \cdot U$ + 1 µV		
		20 kHz – 50 kHz	$3.2 \cdot 10^{-4} \cdot U$ + 1.6 µV		
		50 kHz – 100 kHz	$4.7 \cdot 10^{-4} \cdot U$ + 3.1 µV		
		100 kHz – 500 kHz	$1.1 \cdot 10^{-3} \cdot U$ + 6.2 µV		
		500 kHz – 1 MHz	$2.0 \cdot 10^{-3} \cdot U$ + 6.2 µV		
	7 mV – 20 mV	10 Hz – 20 Hz	$2.0 \cdot 10^{-4} \cdot U$ + 1 µV		
		20 Hz – 40 Hz	$1.0 \cdot 10^{-4} \cdot U$ + 1 µV		
		40 Hz – 20 kHz	$6 \cdot 10^{-5} \cdot U$ + 1 µV		

HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
		20 kHz – 50 kHz	$1.1 \cdot 10^{-4} \cdot U + 1.6$ µV		
		50 kHz – 100 kHz	$2.1 \cdot 10^{-4} \cdot U + 3.1$ µV		
		100 kHz – 500 kHz	$6 \cdot 10^{-4} \cdot U + 6.2$ µV		
		500 kHz – 1 MHz	$1.1 \cdot 10^{-3} \cdot U + 6.2$ µV		
	20 mV – 70 mV	10 Hz – 20 Hz	$2.0 \cdot 10^{-4} \cdot U + 1.2$ µV		
		20 Hz – 40 Hz	$1.0 \cdot 10^{-4} \cdot U + 1.2$ µV		
		40 Hz – 20 kHz	$6.0 \cdot 10^{-5} \cdot U + 1.2$ µV		
		20 kHz – 50 kHz	$1.1 \cdot 10^{-4} \cdot U + 1.6$ µV		
		50 kHz – 100 kHz	$2.1 \cdot 10^{-4} \cdot U + 2.4$ µV		
		100 kHz – 500 kHz	$4.0 \cdot 10^{-4} \cdot U + 6.2$ µV		
		500 kHz – 1 MHz	$1.5 \cdot 10^{-3} \cdot U + 6.2$ µV		
	70 mV – 200 mV	10 Hz – 20 Hz	$1.7 \cdot 10^{-4} \cdot U + 1.2$ µV		
		20 Hz – 40 Hz	$7 \cdot 10^{-5} \cdot U + 1.2$ µV		
		40 Hz – 20 kHz	$4.0 \cdot 10^{-5} \cdot U + 1.2$ µV		
		20 kHz – 50 kHz	$6 \cdot 10^{-5} \cdot U + 1.6$ µV		
		50 kHz – 100 kHz	$1.3 \cdot 10^{-4} \cdot U + 2.4$ µV		
		100 kHz – 500 kHz	$3.0 \cdot 10^{-4} \cdot U + 6.2$ µV		
		500 kHz – 1 MHz	$1.1 \cdot 10^{-3} \cdot U + 6.2$ µV		
	200 mV – 700 mV	10 Hz – 20 Hz	$1.7 \cdot 10^{-4} \cdot U + 1.2$ µV		
		20 Hz – 40 Hz	$6 \cdot 10^{-5} \cdot U + 1.2$ µV		
		40 Hz – 20 kHz	$4.0 \cdot 10^{-5} \cdot U + 1.2$ µV		
		20 kHz – 50 kHz	$5 \cdot 10^{-5} \cdot U + 1.6$ µV		
		50 kHz – 100 kHz	$7 \cdot 10^{-5} \cdot U + 2.4$ µV		
		100 kHz – 500 kHz	$3.0 \cdot 10^{-4} \cdot U + 6.2$ µV		
		500 kHz – 1 MHz	$1.1 \cdot 10^{-3} \cdot U + 6.2$ µV		
	700 mV – 2 V	10 Hz – 20 Hz	$1.6 \cdot 10^{-4} \cdot U$		
		20 Hz – 40 Hz	$6 \cdot 10^{-5} \cdot U$		
		40 Hz – 20 kHz	$3 \cdot 10^{-5} \cdot U$		
		20 kHz – 50 kHz	$5 \cdot 10^{-5} \cdot U$		

HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
		50 kHz – 100 kHz	$7 \cdot 10^{-5} \cdot U$		
		100 kHz – 500 kHz	$3 \cdot 10^{-4} \cdot U$		
		500 kHz – 1 MHz	$1.0 \cdot 10^{-3} \cdot U$		
	2 V – 20 V	10 Hz – 20 Hz	$1.6 \cdot 10^{-4} \cdot U$		
		20 Hz – 40 Hz	$6 \cdot 10^{-5} \cdot U$		
		40 Hz – 20 kHz	$3 \cdot 10^{-5} \cdot U$		
		20 kHz – 50 kHz	$5 \cdot 10^{-5} \cdot U$		
		50 kHz – 100 kHz	$7 \cdot 10^{-5} \cdot U$		
		100 kHz – 500 kHz	$4 \cdot 10^{-4} \cdot U$		
		500 kHz – 1 MHz	$1.2 \cdot 10^{-3} \cdot U$		
	20 V – 200 V	10 Hz – 20 Hz	$1.6 \cdot 10^{-4} \cdot U$		
		20 Hz – 40 Hz	$8 \cdot 10^{-5} \cdot U$		
		40 Hz – 20 kHz	$5 \cdot 10^{-5} \cdot U$		
		20 kHz – 50 kHz	$6 \cdot 10^{-5} \cdot U$		
		50 kHz – 100 kHz	$8 \cdot 10^{-5} \cdot U$		
	200 V – 1000 V	10 Hz – 20 Hz	$1.6 \cdot 10^{-4} \cdot U$	Generation > 200V at 50 Hz – 1 kHz	
		20 Hz – 40 Hz	$8 \cdot 10^{-5} \cdot U$		
		40 Hz – 20 kHz	$5 \cdot 10^{-5} \cdot U$		
		20 kHz – 50 kHz	$1.1 \cdot 10^{-4} \cdot U$		
		50 kHz – 100 kHz	$4 \cdot 10^{-4} \cdot U$		
	1 mV – 10 mV	1 Hz – 40 Hz	$2 \cdot 10^{-3} \cdot U$	Measurement	OS
		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	OS
		20 kHz – 50 kHz	$5 \cdot 10^{-4} \cdot U$		

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		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	OS
		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 – 1000 V	1 Hz – 1 kHz	$5.5 \cdot 10^{-4} \cdot U$	Measurement	OS
		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	OS
		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	OS
		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	OS
		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	$3 \cdot 10^{-3} \cdot U$		

HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
	3.3 V – 33 V	10 Hz – 45 Hz	$5 \cdot 10^{-4} \cdot U$	Generation	OS
		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	OS
		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	OS
	Conversion factor (0.001 – 1) V/V	10 Hz – 100 kHz	$(1 \cdot 10^{-3} - 2 \cdot 10^{-3}) \cdot U/U$		ZTM, OS
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	ZTM, OS
LF 3 3	Alternating High voltage			Measurement and generation	ZTM
	1 – 30 kV	50 Hz	$4.5 \cdot 10^{-3} \cdot U$		ZTM, OS
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	$2.5 \cdot 10^{-4} \cdot I$		

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	20 A – 100 A	20 Hz – 30 kHz	$7 \cdot 10^{-4} \cdot I$	Measurement	
	10 µA – 100 µA	10 Hz – 40 Hz	$3 \cdot 10^{-4} \cdot I$	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	$2.5 \cdot 10^{-4} \cdot I$	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 – 100 A	20 Hz – 30 kHz	$7 \cdot 10^{-4} \cdot I$		
	6 µA – 120 µA	10 – 20 Hz	$5 \cdot 10^{-3} \cdot I$	Measurement	OS
		20 – 45 Hz	$3 \cdot 10^{-3} \cdot I$		
		45 – 5 kHz	$2 \cdot 10^{-3} \cdot I$		
	0.12 mA – 120 mA	10 – 20 Hz	$5 \cdot 10^{-3} \cdot I$	Measurement	OS
		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 A – 1.2 A	10 – 20 Hz	$5 \cdot 10^{-3} \cdot I$	Measurement	OS
		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	$1.5 \cdot 10^{-2} \cdot I$		

HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
	29 µA – 330 µA	10 Hz – 1 kHz	$2 \cdot 10^{-3} \cdot I$	Generation	OS
		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 mA – 3.3 mA	10 Hz – 45 Hz	$2 \cdot 10^{-3} \cdot I$	Generation	OS
		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 mA – 33 mA	10 – 20 Hz	$2 \cdot 10^{-3} \cdot I$	Generation	OS
		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 mA – 330 mA	10 – 20 Hz	$2 \cdot 10^{-3} \cdot I$	Generation	OS
		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 A – 1.1 A	10 – 45 Hz	$2 \cdot 10^{-3} \cdot I$	Generation	OS
		45 Hz – 1 kHz	$6 \cdot 10^{-4} \cdot I$		
		1 – 5 kHz	$6 \cdot 10^{-3} \cdot I$		
		5 – 10 kHz	$2.5 \cdot 10^{-2} \cdot I$		

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HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
	1.1 A – 3 A	40 – 45 Hz	$2 \cdot 10^{-3} \cdot I$	Generation	OS
		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 A – 11 A	45 Hz – 5 kHz	$1 \cdot 10^{-3} \cdot I$	Generation	OS
		5 kHz – 10 kHz	$2.5 \cdot 10^{-2} \cdot I$		
	11 A – 20.5 A	45 Hz – 5 kHz	$2 \cdot 10^{-3} \cdot I$	Generation	OS
		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	ZTM, OS
	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	$4 \cdot 10^{-3} \cdot U/I$		ZTM, OS
LF 4 2	Alternating Current Ratio				ZTM, OS
	(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 – 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 Ω; 10 Ω; 100 Ω; 1000 Ω		$3 \cdot 10^{-6} \cdot R$		
	10 kΩ		$1 \cdot 10^{-6} \cdot R$		
	100 kΩ		$4 \cdot 10^{-6} \cdot R$		

HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
	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	ZTM, OS
	0.1 mΩ – 11 Ω		$3.2 \cdot 10^{-5} \cdot R + 1 \cdot 10^{-3}$ Ω		
	11 Ω – 33 Ω		$6 \cdot 10^{-5} \cdot R$		
	33 Ω – 110 Ω		$3.3 \cdot 10^{-5} \cdot R$		
	110 Ω – 110 kΩ		$2.8 \cdot 10^{-5} \cdot R$		
	0.1 MΩ – 1.1 MΩ		$3 \cdot 10^{-5} \cdot R$		
	1.1 MΩ – 3.3 MΩ		$6 \cdot 10^{-5} \cdot R$		
	3.3 MΩ – 11 MΩ		$1.2 \cdot 10^{-4} \cdot R$		
	11 MΩ – 33 MΩ		$3 \cdot 10^{-4} \cdot R$		
	33 MΩ – 110 MΩ		$5 \cdot 10^{-4} \cdot R$		
	110 MΩ – 330 MΩ		$3 \cdot 10^{-3} \cdot R$		
	0.33 GΩ – 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 Ω; 100 Ω; 1 kΩ		$3 \cdot 10^{-6} \cdot R$		
	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		$3.5 \cdot 10^{-5} \cdot R$		

HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
	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 Ω – 10 Ω		$2 \cdot 10^{-5} \cdot R$	Measurement	OS
	10 Ω – 100 Ω		$1.5 \cdot 10^{-5} \cdot R$		
	0.1 kΩ – 1 kΩ		$1 \cdot 10^{-5} \cdot R$		
	1 kΩ – 10 kΩ		$1 \cdot 10^{-5} \cdot R$		
	10 kΩ – 100 kΩ		$1 \cdot 10^{-5} \cdot R$		
	0.1 MΩ – 1 MΩ		$1.5 \cdot 10^{-5} \cdot R$		
	1 MΩ – 10 MΩ		$5 \cdot 10^{-5} \cdot R$		
	10 MΩ – 100 MΩ		$4 \cdot 10^{-4} \cdot R$		
	100 MΩ – 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 nF	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	$1.5 \cdot 10^{-4} \cdot C$		

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HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
	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, OS
	linear magnitude |Γ|	0.05 GHz – 2 GHz	$0.005 + 0.004 \cdot \lvert\Gamma\rvert$	Measurement N connector. Best accuracy for a test object VSWR of maximum 1.04	
		>2 GHz – 18 GHz	$0.012 + 0.020 \cdot \lvert\Gamma\rvert$		
		0.05 GHz – 2 GHz	$0.006 + 0.007 \cdot \lvert\Gamma\rvert$	Measurement PC 3.5 connector. Best accuracy for a test object VSWR of maximum 1.06	
		>2 GHz – 18 GHz	$0.017 + 0.022 \cdot \lvert\Gamma\rvert$		
		>18 GHz – 26.5 GHz	$0.029 + 0.021 \cdot \lvert\Gamma\rvert$		
	VSWR				
		0.05 GHz – 2 GHz	0.011	Measurement N connector. Best accuracy for a test object VSWR of maximum 1.04	
		>2 GHz – 18 GHz	0.024		

HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
		0.05 GHz – 2 GHz	0.011	Measurement PC 3.5 connector. Best accuracy for a test object VSWR of maximum 1.06	
		>2 GHz – 18 GHz	0.034		
		>18 GHz – 26.5 GHz	0.06		
RF 2 2	Attenuation				ZTM, OS
	10 dB – 30 dB	0.05 GHz – <1 GHz	0.05 dB	3) Measurement with measuring receiver, N or PC 7 connector	
		1 GHz – 14GHz	0.10 dB		
		>14 GHz – 18 GHz	0.15 dB		
	> 30 dB – 60 dB	0.05 GHz – <1 GHz	0.07 dB		
		1 GHz – 16 GHz	0.10 dB		
		>16 GHz – 18 GHz	0.15 dB		
	3 dB – 10 dB	0.05 GHz – <1 GHz	0.07dB	4) Measurement with VNA, N connector	
		1 GHz – 18 GHz	0.14 dB		
	>10 dB – 20 dB	0.05 GHz – <1 GHz	0.09 dB		
		1 GHz – 18 GHz	0.15 dB		
	>20 dB – 40 dB	0.05 GHz – <1 GHz	0.12 dB		
		1 GHz – 18 GHz	0.17 dB		
	>40 dB – 50 dB	(0.05 – 18) GHz	0.22 dB		
	>50 dB – 60 dB	0.05 GHz	0.32 dB		
		>0.05 GHz – 18 GHz	0.26 dB		
	3 dB – 20 dB	0.05 GHz – <1 GHz	0.08 dB	4) Measurement with VNA, PC 3.5 connector	
		1 GHz – 20 GHz	0.15 dB		
		>20 GHz – 26.5 GHz	0.17 dB		

HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
	>20 dB – 40 dB	0.05 GHz – 20 GHz	0.17 dB		
		>20 GHz – 26.5 GHz	0.19 dB		
	>40 dB – 50 dB	0.05 GHz – 20 GHz	0.19 dB		
		>20 GHz – 26.5 GHz	0.21 dB		
	>50 dB– 60 dB	0.05 GHz	0.32 dB		
		>0.05 GHz – 0.5 GHz	0.24 dB		
		>0.5 GHz – 20 GHz	0.22 dB		
		>20 GHz – 26.5 GHz	0.24 dB		
	10 dB – 50 dB	0.05 GHz – 1 GHz	0.04 dB	Generation with a step attenuator, relative to 0 dB (e.g. netwerk analyzer)	
	>50 dB – 60 dB	0.05 GHz – 1 GHz	0.05 dB		
	>60 dB – 70 dB	0.05 GHz – 1 GHz	0.10 dB		
	>70 dB – 80 dB	0.05 GHz – 1 GHz	0.20 dB		
RF 3 0	High frequency Power				ZTM, OS
	Calibration factor	100 kHz – 500 kHz	1.3 % – 1.0 %	1), 2), N connector. Nominal 1 mW, Calibration of a power sensor	
		500 kHz – 18 GHz	1.0 % – 2.0 %		
		10 MHz – 50 MHz	2.7 % – 2.1 %	1), 2), N connector. Nominal 1 µW, Calibration of a power sensor	
		50 MHz – 18 GHz	2.1 % – 3.6 %		
		10 MHz – 33 GHz	1.5 % – 3.0 %	1), 2). PC 3.5 connector. Nominal 1 mW, Calibration of a power sensor	
		10 MHz – 40 GHz	1.6 % – 5.0 %	1), 2). PC 2.92 connector. Nominal 1 mW, Calibration of a power sensor	

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HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
	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 – 1 GHz	0.10 dB	4) BNC connector. Measurement with power sensor (e.g. generator)	
		100 kHz – 8 GHz	0.07 dB	4) N female or PC 7 connector. Measurement with power sensor (e.g. generator)	
		>8 GHz – 18 GHz	0.10 dB		
		10 MHz – 8 GHz	0.08 dB	4) PC 3.5 male or female connector. Measurement with power sensor (e.g. generator)	
		>8 GHz – 18 GHz	0.12 dB		
		>18 GHz – 26.5 GHz	0.15 dB		
		> 26.5 GHz – 33 GHz	0.22 dB		
	Absolute power -10 to -90 dBm	2.5 MHz – 1000 MHz	0.20 dB	4) BNC connector. Measurement with measuring receiver (e.g. generator)	
	Absolute power -90 to -110 dBm	2.5 MHz – 1000 MHz	0.20 dB		
	Absolute power -10 to -90 dBm	2.5 MHz – 1300 MHz	0.20 dB	4) N female or PC 7 connector. Measurement with measuring receiver (e.g. generator)	
		>1.3 GHz – 2.6 GHz	0.25 dB		
	Absolute power -90 to -110 dBm	2.5 MHz – 1300 MHz	0.20 dB		
		>1.3 GHz – 2.6 GHz	0.25 dB		
	Absolute power -10 to -90 dBm	10 MHz – 1300 MHz	0.20 dB	4) PC 3.5 male or female connector. Measurement with measuring receiver (e.g. generator)	
		>1.3 GHz – 10 GHz	0.25 dB		
		>10 GHz – 21 GHz	0.35 dB		
		>21 GHz – 24 GHz	0.40 dB		
		>24 GHz – 26 GHz	0.60 dB		

HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
	Absolute power -90 to -110 dBm	10 MHz – 1300 MHz	0.25 dB		
		>1.3 GHz – 10 GHz	0.30 dB		
		>10 GHz – 21 GHz	0.35 dB		
		>21 GHz – 24 GHz	0.40 dB		
		>24 GHz – 26 GHz	0.60 dB		
	Absolute power 0 to -10 dBm	100 kHz – 1 GHz	0.10 dB	4) BNC connector. Generation with splitter and power sensor (e.g. spectrum analyser)	
		100 kHz – 8 GHz	0.08 dB	4) N male or female or PC 7 connector. Generation with splitter and power sensor (e.g. spectrum analyser)	
		>8 GHz – 18 GHz	0.12 dB		
		10 MHz – 8 GHz	0.10 dB	4) PC 3.5 male connector. Generation with splitter and power sensor (e.g. spectrum analyser)	
		>8 GHz – 18 GHz	0.16 dB		
		>18 GHz – 26.5 GHz	0.20 dB		
		>26.5 GHz – 30 GHz	0.24 dB		
		>30 GHz – 33 GHz	0.30 dB		
	Absolute power -10 to -90 dBm	50 MHz	0.25 dB	4) BNC connector. Generation 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. Generation 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. Generation 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
TF 0 0	Time and Frequency				
TF 2 1	Frequency				ZTM
	100 kHz		$1 \cdot 10^{-11} \cdot f$	Measurement measuring time τ ≥1000 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 τ ≥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		
	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		$1.2 \cdot 10^{-9} \cdot T$		

HCS code	Measured quantity, Range	Frequency	CMC[1]	Remarks	Location
	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		$1.2 \cdot 10^{-5} \cdot T$ – $1.2 \cdot 10^{-4} \cdot T$		
TF 2 2	Time interval			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		

HCS code	Measured quantity, Instrument, Measure	Range	CMC[2]	Remarks	Location
OQ 0 0	Optical quantities				
OQ 1 3	Optical system properties				ZTM
	Optical wavelength	1511 – 1542 nm	0.2 pm	Generation of wavelength with a wavelength reference cell, fixed wavelengths	
		840 – 860 nm	0.4 pm	Generation of wavelength in combination with a reference wavelength meter	
		1270 – 1650 nm	0.4 pm		
		840 – 860 nm	0.4 pm	Measurement of wavelength with a reference wavelength meter	
		1270 – 1650 nm	0.4 pm		
		600 – 1530 nm	300 pm	Measurement of wavelength with an optical spectrum analyser	
		1530 – 1570 nm	50 pm		
		1570 – 1750 nm	300 pm		

[2] 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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HCS code	Measured quantity, Instrument, Measure	Range	CMC[2]	Remarks	Location
OQ 1 5	Optical Power				ZTM
	-5 dBm to -55 dBm (316 μW – 3.16 nW)	850 nm	0.09 dB	Measurement with a power meter (e.g. optical source) and generation with a source and reference power meter (e.g. optical power meter)	
	-5 dBm to -55 dBm (316 μW – 3.16 nW)	1300 nm	0.13 dB		
	+3 dBm to -55 dBm (2 mW – 3.16 nW)	1310 nm	0.09 dB		
	+3 dBm to -55 dBm (2 mW – 3.16 nW)	1550 nm	0.09 dB		
	-5 dBm to -55 dBm (316 μW – 3.16 nW)	1625 nm	0.10 dB		
OQ 1 5	Linearity of optical power meters				ZTM
	-5 dBm to -55 dBm (316 µW – 3.16 nW)	850 nm	0.05 dB	Linearity calibration relative to -10 dBm (e.g. optical power meter)	
	-5 dBm to -55 dBm (316 µW – 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, Instrument, Measure	Range	CMC[2]	Remarks	Location
OQ 1 5	Optical attenuator				ZTM
	0 dB to 45 dB	850 nm	0.06 dB	Measurement of incremental loss (e.g. optical step attenuator)	
	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		
TE 0 0	Temperature				
TE 15 0	Cold junction compensation				ZTM
TE 15 1	Compensation wires for reference junction	0 ºC	0.25 ºC	Cold junction compensation, thermocouple J and K	

Electrical and optical calibrations are performed at nominal 23 ºC.

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;