

of **D.A.R.E!! Calibrations**

Woerden

Valid from: **08-03-2010** to **1-11-2013**

Replaces annex dated: **03-03-2010**

HCS code	Measured quantity, Instrument, Measure	Range	Best measurement capabilities ($k=2$)	Remarks
LF 0 0	DC/LF Quantities			
LF 1 0	DC Voltage			
	0 - 2 mV		$6 \cdot 10^{-6} \cdot U + 0,9 \mu\text{V}$	Generating
	2 - 20 mV		$7 \cdot 10^{-6} \cdot U + 0,9 \mu\text{V}$	
	20 mV - 200 mV		$9 \cdot 10^{-6} \cdot U + 1,0 \mu\text{V}$	
	200 mV - 2 V		$7 \cdot 10^{-6} \cdot U + 1,2 \mu\text{V}$	
	2 V - 20 V		$5 \cdot 10^{-6} \cdot U + 8 \mu\text{V}$	
	20 V - 200 V		$7 \cdot 10^{-6} \cdot U + 0,08 \text{ mV}$	
	200 V - 1000 V		$9 \cdot 10^{-6} \cdot U + 0,6 \text{ mV}$	
	0- 200 mV		$7 \cdot 10^{-6} \cdot U + 0,8 \mu\text{V}$	Measuring
	200 mV - 2 V		$8 \cdot 10^{-6} \cdot U + 1,0 \mu\text{V}$	
	2 V - 20 V		$7 \cdot 10^{-6} \cdot U + 7 \mu\text{V}$	
	20 V - 200 V		$1,2 \cdot 10^{-5} \cdot U + 0,06 \text{ mV}$	
	200 V - 1000 V		$1,2 \cdot 10^{-5} \cdot U + 0,8 \text{ mV}$	
LF 2 0	DC Current			
	0 - 200 μA		$1,2 \cdot 10^{-4} \cdot I + 5 \text{ nA}$	Generating
	200 μA - 2 mA		$5 \cdot 10^{-5} \cdot I + 12 \text{ nA}$	
	2 - 20 mA		$5 \cdot 10^{-5} \cdot I + 0,12 \mu\text{A}$	
	20 - 200 mA		$5 \cdot 10^{-5} \cdot I + 1,2 \mu\text{A}$	
	200 mA - 2 A		$1,2 \cdot 10^{-4} \cdot I + 23 \mu\text{A}$	

This annex has been approved by:

Ir. J.C. van der Poel
Chief Executive

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	200 μ A - 2 mA		$1,2 \cdot 10^{-4} \cdot I + 0,05 \mu\text{A}$	
	2 - 20 mA		$1,2 \cdot 10^{-4} \cdot I + 0,5 \mu\text{A}$	
	20 - 200 mA		$1,2 \cdot 10^{-4} \cdot I + 5 \mu\text{A}$	
	200 mA - 2 A		$2,4 \cdot 10^{-4} \cdot I + 0,05 \mu\text{A}$	
LF 3 0	AC Voltage			
	0 - 2 mV	30 Hz – 3,3 kHz	$1,1 \cdot 10^{-3} \cdot U + 6 \mu\text{V}$	Generating, 2-wire
		3,3 – 10 kHz	$1,8 \cdot 10^{-3} \cdot U + 6 \mu\text{V}$	
		10 - 33 kHz	$4 \cdot 10^{-3} \cdot U + 6 \mu\text{V}$	
		33 - 100 kHz	$10 \cdot 10^{-3} \cdot U + 6 \mu\text{V}$	
	2 mV - 20 mV	30 Hz - 1 kHz	$3,2 \cdot 10^{-4} \cdot U + 6 \mu\text{V}$	
		1 - 3,3 kHz	$5 \cdot 10^{-4} \cdot U + 6 \mu\text{V}$	
		3,3 – 10 kHz	$1,3 \cdot 10^{-3} \cdot U + 6 \mu\text{V}$	
		10 - 33 kHz	$3,5 \cdot 10^{-3} \cdot U + 6 \mu\text{V}$	
		33 - 100 kHz	$1,2 \cdot 10^{-2} \cdot U + 6 \mu\text{V}$	
	20 mV - 200 mV	30 - 330 Hz	$2,3 \cdot 10^{-4} \cdot U + 6 \mu\text{V}$	
		330 Hz - 1 kHz	$3,1 \cdot 10^{-4} \cdot U + 6 \mu\text{V}$	
		1 – 3,3 kHz	$6 \cdot 10^{-4} \cdot U + 6 \mu\text{V}$	
		3,3 - 10 kHz	$1,3 \cdot 10^{-3} \cdot U + 6 \mu\text{V}$	
		10 - 33 kHz	$3,6 \cdot 10^{-3} \cdot U + 6 \mu\text{V}$	
		33 - 100 kHz	$1,2 \cdot 10^{-2} \cdot U + 6 \mu\text{V}$	
	90 mV - 2V	10 - 32 Hz	$1,3 \cdot 10^{-4} \cdot U + 35 \mu\text{V}$	Generating, 4-wire
		32 - 330 Hz	$9 \cdot 10^{-5} \cdot U + 25 \mu\text{V}$	
		330 Hz – 3,3 kHz	$7 \cdot 10^{-5} \cdot U + 25 \mu\text{V}$	
		3,3 - 33 kHz	$9 \cdot 10^{-5} \cdot U + 11 \mu\text{V}$	
		33 - 100 kHz	$2,2 \cdot 10^{-4} \cdot U + 23 \mu\text{V}$	

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		100 - 330 kHz	$1,6 \cdot 10^{-3} \cdot U + 0,12 \text{ mV}$	
		330 kHz - 1 MHz	$1,4 \cdot 10^{-2} \cdot U + 0,9 \text{ mV}$	
	2 V - 20 V	30 - 32 Hz	$1,3 \cdot 10^{-4} \cdot U + 0,35 \text{ mV}$	
		32 - 330 Hz	$9 \cdot 10^{-5} \cdot U + 0,25 \text{ mV}$	
		330 Hz - 33 kHz	$8 \cdot 10^{-5} \cdot U + 0,12 \text{ mV}$	
		33 - 100 kHz	$2,2 \cdot 10^{-4} \cdot U + 0,23 \text{ mV}$	
		100 - 330 kHz	$1,6 \cdot 10^{-3} \cdot U + 1,2 \text{ mV}$	
		330 kHz - 1 MHz	$1,1 \cdot 10^{-2} \cdot U + 5 \text{ mV}$	
	20 V - 200 V	10 - 32 Hz	$1,7 \cdot 10^{-4} \cdot U + 9 \text{ mV}$	
		32 - 330 Hz	$1,2 \cdot 10^{-4} \cdot U + 6 \text{ mV}$	
		330 Hz - 10 kHz	$1,1 \cdot 10^{-4} \cdot U + 1,2 \text{ mV}$	
		10 - 330 kHz	$1,2 \cdot 10^{-4} \cdot U + 2,3 \text{ mV}$	
		330 kHz - 1 MHz	$4 \cdot 10^{-4} \cdot U + 3,5 \text{ mV}$	
	200 V - 1000 V	50 - 330 Hz	$9 \cdot 10^{-4} \cdot U + 50 \text{ mV}$	
		330 Hz - 10 kHz	$7 \cdot 10^{-4} \cdot U + 40 \text{ mV}$	
		10 - 33 kHz	$9 \cdot 10^{-4} \cdot U + 50 \text{ mV}$	
	2 mV - 200 mV	20 - 40 Hz	$3 \cdot 10^{-4} \cdot U + 5 \mu\text{V}$	Measuring
		40 Hz - 2 kHz	$2,8 \cdot 10^{-4} \cdot U + 5 \mu\text{V}$	
		2 - 3 kHz	$2,7 \cdot 10^{-4} \cdot U + 7 \mu\text{V}$	
		3 - 10 kHz	$2,7 \cdot 10^{-4} \cdot U + 5 \mu\text{V}$	
		10 - 30 kHz	$5 \cdot 10^{-4} \cdot U + 5 \mu\text{V}$	
		30 - 100 kHz	$9 \cdot 10^{-4} \cdot U + 5 \mu\text{V}$	
	200 mV - 2 V	20 - 40 Hz	$2,1 \cdot 10^{-4} \cdot U + 23 \mu\text{V}$	
		40 - 100 Hz	$1,9 \cdot 10^{-4} \cdot U + 23 \mu\text{V}$	
		100 - 300 Hz	$1,7 \cdot 10^{-4} \cdot U + 23 \mu\text{V}$	
		300 - 1000 Hz	$1,6 \cdot 10^{-4} \cdot U + 23 \mu\text{V}$	
		1 - 3 kHz	$1,8 \cdot 10^{-4} \cdot U + 23 \mu\text{V}$	

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		3 - 10 kHz	$3 \cdot 10^{-4} \cdot U + 0,05 \text{ mV}$	
		10 - 60 kHz	$6 \cdot 10^{-4} \cdot U + 0,23 \text{ mV}$	
		60 - 100 kHz	$3,5 \cdot 10^{-4} \cdot U + 2,3 \text{ mV}$	
		100 - 300 kHz	$3,7 \cdot 10^{-4} \cdot U + 2,3 \text{ mV}$	
		300 kHz - 1 MHz	$1,2 \cdot 10^{-2} \cdot U + 23 \text{ mV}$	
	2 V - 20 V	20 - 40 Hz	$2,1 \cdot 10^{-4} \cdot U + 0,23 \text{ mV}$	
		40 - 100 Hz	$1,9 \cdot 10^{-4} \cdot U + 0,23 \text{ mV}$	
		100 Hz - 3 kHz	$1,6 \cdot 10^{-4} \cdot U + 0,23 \text{ mV}$	
		3 - 10 kHz	$3,0 \cdot 10^{-4} \cdot U + 0,5 \text{ mV}$	
		10 - 60 kHz	$6 \cdot 10^{-4} \cdot U + 2,3 \text{ mV}$	
		60 - 300 kHz	$3,7 \cdot 10^{-3} \cdot U + 23 \text{ mV}$	
		300 kHz - 1 MHz	$1,2 \cdot 10^{-2} \cdot U + 0,23 \text{ V}$	
	20 V - 200 V	20 - 40 Hz	$2,2 \cdot 10^{-4} \cdot U + 2,3 \text{ mV}$	
		40 - 100 Hz	$1,9 \cdot 10^{-4} \cdot U + 2,3 \text{ mV}$	
		100 - 300 Hz	$1,7 \cdot 10^{-4} \cdot U + 2,3 \text{ mV}$	
		300 Hz - 3 kHz	$1,6 \cdot 10^{-4} \cdot U + 2,3 \text{ mV}$	
		3 - 10 kHz	$1,8 \cdot 10^{-4} \cdot U + 2,3 \text{ mV}$	
		10 - 30 kHz	$3 \cdot 10^{-4} \cdot U + 5 \text{ mV}$	
		30 - 100 kHz	$7 \cdot 10^{-4} \cdot U + 23 \text{ mV}$	
	200 V - 1000 V	40 Hz - 3 kHz	$1,7 \cdot 10^{-3} \cdot U + 23 \text{ mV}$	
		3 - 10 kHz	$2,8 \cdot 10^{-3} \cdot U + 23 \text{ mV}$	
		10 - 30 kHz	$2,8 \cdot 10^{-3} \cdot U + 50 \text{ mV}$	
LF 4 0	AC Current			
	10 - 200 μ A	10 - 32 Hz	$2,3 \cdot 10^{-4} \cdot I + 12 \text{ nA}$	Generating
		32 - 330 Hz	$1,9 \cdot 10^{-3} \cdot I + 11 \text{ nA}$	
		330 - 1000 Hz	$6 \cdot 10^{-3} \cdot I + 5 \text{ nA}$	

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	200 μ A - 2 mA	10 - 32 Hz	$1,6 \cdot 10^{-4} \cdot I + 0,11 \mu$ A	
		32 - 330 Hz	$1,6 \cdot 10^{-4} \cdot I + 0,12 \mu$ A	
		330 - 1000 Hz	$1,5 \cdot 10^{-4} \cdot I + 0,12 \mu$ A	
		1 - 3,3 kHz	$2,6 \cdot 10^{-4} \cdot I + 0,12 \mu$ A	
		3,3 - 5 kHz	$2,7 \cdot 10^{-4} \cdot I + 0,12 \mu$ A	
	2 mA - 20 mA	10 - 32 Hz	$1,6 \cdot 10^{-4} \cdot I + 1,1 \mu$ A	
		32 - 330 Hz	$1,6 \cdot 10^{-4} \cdot I + 1,2 \mu$ A	
		330 - 1000 Hz	$1,4 \cdot 10^{-4} \cdot I + 1,2 \mu$ A	
		1 - 3,3 kHz	$2,6 \cdot 10^{-4} \cdot I + 1,2 \mu$ A	
		3,3 - 5 kHz	$2,7 \cdot 10^{-4} \cdot I + 1,2 \mu$ A	
	20 mA - 200 mA	10 - 32 Hz	$1,6 \cdot 10^{-4} \cdot I + 11 \mu$ A	
		32 - 330 Hz	$1,6 \cdot 10^{-4} \cdot I + 12 \mu$ A	
		330 - 1000 Hz	$1,4 \cdot 10^{-4} \cdot I + 12 \mu$ A	
		1 - 3,3 kHz	$2,6 \cdot 10^{-4} \cdot I + 12 \mu$ A	
		3,3 - 5 kHz	$2,7 \cdot 10^{-4} \cdot I + 12 \mu$ A	
	200 mA - 2 A	10 - 32 Hz	$4 \cdot 10^{-4} \cdot I + 0,12$ mA	
		32 - 330 Hz	$6 \cdot 10^{-4} \cdot I + 0,12$ mA	
		330 - 1000 Hz	$1,5 \cdot 10^{-5} \cdot I + 0,10$ mA	
		1 - 3,3 kHz	$5 \cdot 10^{-4} \cdot I + 0,09$ mA	
		3,3 - 5 kHz	$8 \cdot 10^{-3} \cdot I + 33 \mu$ A	
	10 μ A - 200 μ A	50 - 1000 Hz	$3,8 \cdot 10^{-4} \cdot I + 23$ nA	Measuring
		1 - 5 kHz	$7 \cdot 10^{-4} \cdot I + 23$ nA	
	200 μ A - 2 mA	50 - 300 Hz	$3,6 \cdot 10^{-4} \cdot I + 0,23 \mu$ A	
		300 - 1000 Hz	$3,7 \cdot 10^{-4} \cdot I + 0,23 \mu$ A	
		1 - 5 kHz	$7 \cdot 10^{-4} \cdot I + 0,23 \mu$ A	

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	2 mA - 20 mA	50 - 300 Hz	$3,6 \cdot 10^{-4} \cdot I + 2,3 \mu\text{A}$	
		300 - 1000 Hz	$3,8 \cdot 10^{-4} \cdot I + 2,3 \mu\text{A}$	
		1 - 5 kHz	$7 \cdot 10^{-4} \cdot I + 2,3 \mu\text{A}$	
	20 mA - 200 mA	50 - 1000 Hz	$3,6 \cdot 10^{-4} \cdot I + 23 \mu\text{A}$	
		1 - 5 kHz	$7 \cdot 10^{-4} \cdot I + 23 \mu\text{A}$	
	200 mA - 2 A	50 - 1000 Hz	$2,3 \cdot 10^{-3} \cdot I + 1,2 \text{ mA}$	
		1 - 5 kHz	$2,3 \cdot 10^{-3} \cdot I + 1,2 \text{ mA}$	
LF 6 1	Resistance			
LF 6 2	DC resistance			
	1 Ω		0,2 m Ω	Generating, 4-wire
	10 Ω		0,5 m Ω	
	100 Ω		1,9 m Ω	
	1 k Ω		21 m Ω	
	10 k Ω		0,2 Ω	
	100 k Ω		2,3 Ω	
	1 M Ω		33 Ω	
	10 M Ω		0,7 k Ω	
	100 M Ω		9 k Ω	
	10 Ω		0,24 Ω	Generating, 2-wire
	100 Ω		0,24 Ω	
	1 k Ω		0,35 Ω	
	10 k Ω		0,5 Ω	
	100 k Ω		2,6 Ω	
	1 M Ω		33 Ω	
	10 M Ω		0,7 k Ω	
	100 M Ω		22 k Ω	

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	0 - 20 Ω		$2,0 \cdot 10^{-5} \cdot R + 0,12 \text{ m}\Omega$	Measuring, 4-wire
	20 - 200 Ω		$1,5 \cdot 10^{-5} \cdot R + 0,2 \text{ m}\Omega$	
	200 - 2000 Ω		$1,2 \cdot 10^{-5} \cdot R + 1,3 \text{ m}\Omega$	
	2 - 20 k Ω		$1,2 \cdot 10^{-5} \cdot R + 13 \text{ m}\Omega$	
	20 - 200 k Ω		$2,1 \cdot 10^{-5} \cdot R + 110 \text{ m}\Omega$	
	200 k Ω - 2 M Ω		$3,1 \cdot 10^{-5} \cdot R + 1,6 \Omega$	
	2 - 20 M Ω		$3,6 \cdot 10^{-5} \cdot R + 100 \Omega$	Measuring, 2-wire
	20 - 200 M Ω		$1,7 \cdot 10^{-4} \cdot R + 10 \text{ k}\Omega$	
	200 M Ω - 2 G Ω		$3,5 \cdot 10^{-3} \cdot R + 1,1 \text{ M}\Omega$	
RF 0 0	High frequency quantities			
RF 2 1	Reflection coefficient			
	Magnitude 0 to 1,0	30 kHz – 1 MHz	$0,005 + 0,007 \cdot \Gamma + 0,005 \cdot \Gamma^2$	Nom. impedance 50 Ω at nominal -10 dBm RF power
		1 MHz - 2 GHz	$0,005 + 0,003 \cdot \Gamma + 0,005 \cdot \Gamma^2$	
		2 GHz - 8 GHz	$0,02 + 0,004 \cdot \Gamma + 0,02 \cdot \Gamma^2$	
		8 GHz – 18 GHz	$0,03 + 0,004 \cdot \Gamma + 0,04 \cdot \Gamma^2$	
	Phase -180° to $+180^\circ$	30 kHz -18 GHz	$u(\theta) = \arcsin\left(\frac{u(\Gamma)}{ \Gamma }\right)$	If the magnitude is less than its uncertainty, the phase uncertainty is 180°
RF 2 11	Impedance			
	LISN Impedance	30 kHz – 30 MHz	$0,3 \Omega - 1,1 \Omega$ $1,2^\circ - 3,8^\circ$	50 Ω // (50 $\mu\text{H} + 5 \Omega$) and 50 Ω // 50 μH
		100 kHz – 150 MHz	$0,5 \Omega - 0,9 \Omega$ $3,3^\circ - 8^\circ$	50 Ω // (5 $\mu\text{H} + 1 \Omega$) and 50 Ω // 5 μH

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	CDN Impedance	150 kHz – 300 MHz	5 Ω – 6 Ω 2,4 ° – 3,9 °	150 Ω , 0 ° nominal
RF 2 2	Transmission Coefficient			For coaxial 50 Ω devices
	Magnitude 0 to – 40 dB	30 kHz – 1 MHz	0,07 dB	at nom. -10 dBm RF power
		1 MHz - 2 GHz	0,03 dB	
		2 GHz - 8 GHz	0,08 dB	
		8 GHz – 18 GHz	0,10 dB	
	Magn. (–40 to –70)dB	30 kHz – 18 GHz	0,10 dB	at nom. 0 dBm RF power
	Magn. (–70 to –100)dB	30 kHz – 18 GHz	1,0 dB	at nom. +10 dBm RF power
RF 3 0	High Frequency Power			
	Calibration factors of power sensors	30 kHz – 3 MHz	0,10 dB – 0,05 dB	2), 0 dBm nominal
		3 MHz – 300 MHz	0,05 dB	2), 0 dBm nominal
		300 MHz – 4,2 GHz	0,05 dB – 0,07 dB	2), 0 dBm nominal
		10 MHz – 4 GHz	0,07 dB	2), -30 dBm nominal
		4 GHz – 10 GHz	0,07 dB – 0,11 dB	2), -30 dBm nominal
		10 GHz – 18 GHz	0,11 dB	2), -30 dBm nominal
	Linearity of RF power			
	0 to -10 dBm	30 kHz – 4,2 GHz	0,03 dB	
	0 to -20 dBm	30 kHz – 4,2 GHz	0,05 dB	
	0 to -40 dBm	10 MHz – 18 GHz	0,05 dB	
	0 to -50 dBm	10 MHz – 18 GHz	0,07 dB	
	0 to -60 dBm	10 MHz – 18 GHz	0,09 dB	

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	Absolute power			
	-25 dBm to +10 dBm	30 kHz - 300 kHz	0,5 dB - 0,07 dB	3)
	-25 dBm to +10 dBm	300 kHz - 4,2 GHz	0,07 dB	3)
	-60 dBm to -20 dBm	10 MHz - 18 GHz	0,09 dB	3)
	Frequency response of power measuring devices	30 kHz - 18 GHz	0,06 dB	2), at nom. -20 dBm RF power
	Response of CISPR receivers			
	QP and AV	9 kHz - 1 GHz	0,3 dB	3)
	Bandwidth of RBW filters			
	1 Hz to 10 MHz	30 kHz - 2,4 GHz	$0,8 + 0,02 \cdot BW$	
	1 Hz to 10 MHz	10 MHz - 18 GHz	$0,08 + 0,02 \cdot BW$	
RF 5 0	Electrical /magnetic field quantities /EMC			
	Electrical Field Strength 1 – 200 V/m	100 kHz – 30 MHz	0,5 – 0,6 dB	Temcell
		30 MHz – 75 MHz	0,6 – 1,3 dB	
		75 MHz – 200 MHz	2,4 dB	
	Electrical Field Strength 1 – 100 V/m	200 MHz – 4 GHz	1,2 dB	Anechoic Chamber
		4 GHz – 12GHz	1,3 dB	
		12 GHz – 18 GHz	1,3 - 2,4 dB	
		18 GHz – 40 GHz	2,4 dB	

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	Antenna factor			
	ANSI C63.5	30 MHz – 5 GHz	0,8 dB	OATS, Standard Site method
	ANSI C63.5	30 MHz – 1 GHz	0,8 dB	OATS, Reference antenna method
	Quasi Free Space	20 MHz – 100 MHz	0,9 dB	For use in Full Anechoic Chambers
		100 MHz – 200 MHz	0,8 dB	
		200 MHz – 5 GHz	0,7 dB	
	SAE ARP 958	20 MHz – 100 MHz	0,9 dB	For military or automotive use
		100 MHz – 200 MHz	0,8 dB	
		200 MHz – 5 GHz	0,7 dB	
	Shielding Effectiveness			On Site measurement According to EN50147 and Mil Std 285
	Magnetic Field 100 dB	10 kHz – 30 MHz	± 5 dB	
	Electric Field 120 – 150 dB	10 MHz – 300 MHz	± 5 dB	
	Plane wave 110 – 140 dB	30 MHz – 1 GHz	± 5 dB	
	Plane wave 110 – 140 dB	1 GHz – 18 GHz	± 6 dB	
	Normalized Site Attenuation			On Site measurement According to CISPR 16-1-4 using broadband antennae Horizontal and vertical polarization, distance between 3 m and 30 m
	NSA	30 MHz – 1000 MHz	$\pm 1,6$ dB	

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	Site Voltage Standing Wave Ratio			On Site measurement According to CISPR 16-1-4 using reciprocal method
	S_{VSWR}	1 GHz – 18 GHz	$\pm 2,0$ dB	
	Surge generators and coupling/decoupling networks waveform surge voltage			According to EN 61000-4-5, (November 2005), §6.1.2, §6.2.2 and §6.3.1 10/700 μ s pulse 0,5/700 μ s pulse
	0 V – 550 V		$6,7 V + 0,022 \cdot U$ $6,7 V + 0,025 \cdot U$ (on site)	Coupling/decoupling networks for AC/DC power supply circuits only in combination with appropriate surge generator
	0 V – 1,1 kV		$13,4 V + 0,022 \cdot U$ $13,4 V + 0,025 \cdot U$ (on site)	
	0 V – 2,8 kV		$33,5 V + 0,022 \cdot U$ $33,5 V + 0,025 \cdot U$ (on site)	
	0 V – 5,5 kV		$67 V + 0,022 \cdot U$ $67 V + 0,025 \cdot U$ (on site)	
	Waveform surge current			
	Current amplitude			1,2/50 μ s pulse 10/700 μ s pulse 0,5/700 μ s pulse
	0 – 15 A		$0,18 + 0,022 * I$ $0,18 + 0,029 * I$ (on site)	Measurements at coupling/decoupling network input, output; coupling modes line to neutral, line to earth and neutral to earth
	0 – 30 A		$0,36 + 0,022 * I$ $0,36 + 0,029 * I$ (on site)	
	0 – 60 A		$0,72 + 0,022 * I$ $0,72 + 0,029 * I$ (on site)	
	0 – 150 A		$1,8 + 0,022 * I$ $1,8 + 0,029 * I$ (on site)	
	0 – 300 A		$3,6 + 0,022 * I$ $3,6 + 0,029 * I$ (on site)	
	0 – 600 A		$7,2 + 0,022 * I$ $7,2 + 0,029 * I$ (on site)	

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	0 – 1500 A		18 + 0,022 * I 18 + 0,029 * I (<i>on site</i>)	
	0 – 3000 A		36 + 0,022 * I 36 + 0,029 * I (<i>on site</i>)	
	Front time Voltage			
	1,2/50 μ s	0,65 – 1,75 μ s	0,08 μ s	Also applies to On-Site
	10/700 μ s 0,5/700 μ s	5,5 – 15,5 μ s 0,27 – 0,73 μ s	0,5 μ s 0,027 μ s	
	Front time current			
	1,2/50 μ s	6,4 – 9,6 μ s 1,4 – 3,6 μ s	0,18 μ s 0,07 μ s	line - line line - PE
	10/700 μ s 0,5/700 μ s	3,5 – 6,5 μ s 1,0 – 2,2 μ s	0,27 μ s 0,031 μ s	
	Rise time Voltage			Also applies to On-Site
	1,2/50 μ s	0,55 – 1,45 μ s	0,05 μ s	
	10/700 μ s	3,5 – 9,5 μ s	0,27 μ s	
	0,5/700 μ s	0,22 – 0,58 μ s	0,016 μ s	
	Rise time current			Also applies to On-Site
	1,2/50 μ s	4,5 – 8,3 μ s	0,15 μ s	line - line
		1,1 – 2,9 μ s	0,05 μ s	line - PE
	10/700 μ s	2,8 – 5,2 μ s	0,21 μ s	
	0,5/700 μ s	0,6 – 1,8 μ s	0,024 μ s	

of **D.A.R.E!! Calibrations**

Woerden

Valid from: **08-03-2010** to **1-11-2013**

Replaces annex dated: **03-03-2010**

HCS code	Measured quantity, Instrument, Measure	Range	Best measurement capabilities ($k=2$)	Remarks
	Time to half-value Voltage			Also applies to On-Site
	1,2/50 μs	35 μs – 65 μs	1,0 μs	
	10/700 μs		14 μs	
	0,5/700 μs		14 μs	
	Time to half-value Current			Also applies to On-Site
	1,2/50 μs	14 - 26 μs	0,23 μs	line – line
		14 - 36 μs	0,23 μs	line - PE
		220 - 420 μs	6 μs	
		220 - 420 μs	6 μs	
	Pulse duration time Voltage			Also applies to On-Site
	1,2/50 μs	35 μs – 65 μs	1,0 μs	
	10/700 μs	490 - 910 μs	14 μs	
	0,5/700 μs			
	Pulse duration time Current			Also applies to On-Site
	1,2/50 μs	11 - 21 μs	0,23 μs	Current, line to line
		14 - 36 μs	0,23 μs	Current, line to earth
	10/700 μs	210 - 390 μs	6 μs	
	0,5/700 μs	210 - 390 μs	6 μs	

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Woerden

Valid from: **08-03-2010** to **1-11-2013**

Replaces annex dated: **03-03-2010**

HCS code	Measured quantity, Instrument, Measure	Range	Best measurement capabilities ($k=2$)	Remarks
	EFT/burst generators waveform (im)pulse, voltage into 50 ohms			According to EN 61000-4-4 (July 2004)
	0 V – 150V		$2,0\text{ V} + 0,022 \cdot U$ $2,0\text{ V} + 0,025 \cdot U$	On Site
	0 – 300 V		$4,0\text{ V} + 0,022 \cdot U$ $4,0\text{ V} + 0,025 \cdot U$	On Site
	0 – 600 V		$8,0\text{ V} + 0,022 \cdot U$ $8,0\text{ V} + 0,025 \cdot U$	On Site
	0 – 1,5 kV		$20\text{ V} + 0,022 \cdot U$ $20\text{ V} + 0,025 \cdot U$	On Site
	0 – 3 kV		$37\text{ V} + 0,022 \cdot U$ $37\text{ V} + 0,025 \cdot U$	On Site
	EFT/burst generators Waveform pulse voltage into 1 k Ω			
	0 V – 500 V		$6\text{ V} + 0,045 \cdot U$ $6\text{ V} + 0,048 \cdot U$	On Site
	0 V – 1 kV		$12\text{ V} + 0,045 \cdot U$ $12\text{ V} + 0,048 \cdot U$	On Site
	0 V – 2 kV		$24\text{ V} + 0,045 \cdot U$ $24\text{ V} + 0,048 \cdot U$	On Site
	0 V – 5 kV		$60\text{ V} + 0,045 \cdot U$ $60\text{ V} + 0,048 \cdot U$	On Site
	Rise time (10%-90%) 3 ns to 7 ns		0,3 ns	Also applies to On-Site
	Pulse duration time (50%-50%)			Also applies to On-Site
	30 ns to 70 ns		2,0 ns	

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Woerden

Valid from: **08-03-2010 to 1-11-2013**

Replaces annex dated: **03-03-2010**

HCS code	Measured quantity, Instrument, Measure	Range	Best measurement capabilities ($k=2$)	Remarks
	Repetition rate			Also applies to On-Site
	5 μ s – 15 μ s		0,15 μ s	
	150 μ s – 600 μ s		2,5 μ s	
	Burst duration			Also applies to On-Site
	10 ms to 20 ms		0,5 μ s + 0,0005 * T	
	Burst period			Also applies to On-Site
	200 ms to 400 ms		500 μ s	
	ESD simulators wave-form discharge current			According to EN 61000-4-2 and ISO 10605
	0 A – 10 A		0,18 A + 0,016·I	
	0 A – 20 A		0,36 A + 0,016·I	
	0 – 50 A		0,91 A + 0,016·I	
	rise time (10% - 90%)			
	0,5 ns to 1,2 ns		0,08 ns	
	i(t) @ t = 30 ns			
	1,7 A – 7 A		0,2 A – 0,3 A	
	3,4 A – 14 A		0,4 A – 0,6 A	
	8,5 A – 35 A		1,0 A – 1,4 A	
	i(t) @ t = 60 ns			
	0,8 A – 3,5 A		0,2 A – 0,22 A	
	1,7 A – 7 A		0,4 A – 0,5 A	
	4,2 A – 18 A		1,0 A – 1,1 A	

of **D.A.R.E!! Calibrations**

Woerden

Valid from: **08-03-2010** to **1-11-2013**

Replaces annex dated: **03-03-2010**

HCS code	Measured quantity, Instrument, Measure	Range	Best measurement capabilities ($k=2$)	Remarks
TF 0 0	TIME AND FREQUENCY			
TF 1 0	Time			
TF 2 1	Frequency			
	10 MHz - 2,7 GHz		$(8 \cdot 10^{-10} / \tau + 1,8 \cdot 10^{-10}) \cdot f$	Measuring, $10 \text{ ms} \leq \tau \leq 400\text{s}$
	10 MHz – 10 Hz		$3 \cdot 10^{-5} \cdot f$	Generating
	10 Hz – 100 kHz		$(1 \cdot 10^{-5} / \tau) \cdot f$	Generating, $10 \text{ ms} \leq \tau \leq 400\text{s}$
	100 kHz – 2,16 GHz		$(1 \cdot 10^{-9} / \tau + 1,8 \cdot 10^{-10}) \cdot f$	Generating, $10 \text{ ms} \leq \tau \leq 400\text{s}$
TF 2 2	Time interval			
	0,5 ns – 10 μs		$(1 \cdot 10^{-9} / \tau + 1,8 \cdot 10^{-10}) \cdot t$	Generating
	10 μs – 100 ms		$(1 \cdot 10^{-5} / \tau) \cdot t$	
	100 ms – 1000 s		$3 \cdot 10^{-5} \cdot t$	

Remarks:

1. The best measurement capability stated in the above table is based on the total measurement uncertainty, not including an uncertainty contribution due to the imperfection of the used IEC target
 2. $|\Gamma_{\text{dut}}| < 0,02$
 3. $|\Gamma_{\text{dut}}| < 0,2$
- 2, 3) All calibrations are based on equipment using N-type connectors. Other connector types are possible (SMA / BNC etc) but this will increase measurement uncertainties

The calibrations are carried out at an ambient temperature of 23°C nominal and a relative humidity of 50% nominal.

The best measurement capability: the highest achievable accuracy for a given measuring point or measuring range, expressed as the total positive and negative measurement uncertainty.

The measurement uncertainty is calculated according to EA-4/02 "Expression of the Uncertainty of Measurement in Calibration".

The measurements are carried out inside the laboratory.