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Swiss Confederation

Federal Department of Economic Affairs,
Education and Research EAER

State Secretariat for Economic Affairs SECO
Swiss Accreditation Service SAS

SCS Directory

Accreditation number: SCS 0108

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Scope of accreditation see:	www.sas.admin.ch (Accredited bodies)

Scope of accreditation as of 25.06.2020

Calibration Laboratory for Electric Field, Magnetic Field and SAR Sensors and Dielectric Measurement Instrumentation

Calibration and Measurement Capability (CMC)

Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty CMC at (22 ± 3) °C (1)	Remarks
Electric field				
Calibration of E-field probes	0.8 V/m … 800 V/m	4 MHz … 6 GHz	5,1 %	e.g. ER3DV6x, EF3DVx, EU2DVx, EE3DVx, EL3DVx
Calibration of E-field probes	10 V/m … 2000 V/m	750 MHz … 6 GHz 6 GHz … 110 GHz	5,1 % 0,98 dB	e.g. EUmmWVx
Magnetic field				
Calibration of H-field probes	2 mA/m … 2 A/m	4 MHz … 3 GHz	5,1 %	e.g. H2DVx, H3DVx, HL3DVx
Calibration of sensitivity for magnetic field probes in the audio range	0,001 … 0,1 V/(A/m)	1 kHz 0,1 … 1 A/m	2,2 %	e.g. AM1DVx

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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty CMC at (22 ± 3) °C (1)	Remarks
Calibration of magnetic field simulator	-30 … +40 dB A/m	1 kHz	4,1 %	e.g. TMFS (Telephone Magnetic Field Simulator)
Specific absorption rate (SAR)				e.g. ET3Dvx, ES3Dvx, EX3Dvx, ET1Dvx, EU2Dvx
	E* field (typical[2])			
Calibration of dosimetric E-field probes	0,5 V/m … 500 V/m	4 MHz … 450 MHz	6,7 % (13,3 % for SAR)	Temperature transfer calibration *) As example, the indicated range corresponds to 0,2 mW/kg … 200 W/kg for head tissue simulating liquid and f = 450 MHz
	E* field (typical2)			e.g. ET3Dvx, ES3Dvx, EX3Dvx, ET1Dvx, EU2Dvx
Calibration of dosimetric E-field probes	0,45 V/m … 450 V/m	750 MHz … 3 GHz	5,5 % (11 % for SAR)	Waveguide analytical calibration *) As example, the indicated range corresponds to 0,2 mW/kg … 200 W/kg for head tissue simulating liquid and f = 1800 MHz
	0,4 V/m … 450 V/m	3 GHz … 6 GHz	6,5 % (13,1 % for SAR)	Waveguide analytical calibration *) As example, the indicated range corresponds to 0,2 mW/kg … 200 W/kg for head tissue simulating liquid and f = 5200 MHz
	0,4 V/m … 400 V/m	6 GHz … 10 GHz	9,3 % (18,6 % for SAR)	Waveguide analytical calibration *) As example, the indicated range corresponds to 0,2 mW/kg … 200 W/kg for head tissue simulating liquid and f = 7 GHz
	E* field (typical[2])			e.g. EX3DVx, ET1DVx

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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty CMC at (22 ± 3) °C (1)	Remarks
Calibration of temperature SAR probes	0 °C … + 60 °C	Tissue simulating Liquids	0,15 K (5 % temperature gradient for SAR)	As example, the temperature gradient of T1Vx and T1V3LAB probes can be determined to 5 %, which is also contribution to SAR accuracy. (Noise is dominating the lower SAR threshold to typically 0,2 W/kg)
Calibration of test system validation sources	SAR* 1 g and 10 g per 1 W input power	4 MHz … 290 MHz	18,4 % for SAR 1 g 18,0 % for SAR 10 g	e.g. CLA-6, CLA-13, CLA-30, CLA-64, CLA-128, CLA-150, CLA-220
		300 MHz … 450 MHz	18,1 % for SAR 1 g 17,6 % for SAR 10 g	e.g. D835V2 … D3000V2 according to IEEE 1528, IEC 62209-1/2, for 1 g and 10 g SAR
		750 MHz … 3 GHz	17,0 % for SAR 1 g 16,5 % for SAR 10 g	
	SAR* 1 g and 10 g per 1 W input power	3 GHz … 6 GHz	19,9 % for SAR 1 g 19,5 % for SAR 10 g	e.g. D3500V2 … D5GHzV2 according to IEC 62209-2, for 1 g and 10 g SAR
	SAR* 1 g and 10 g per 1 W input power	6 GHz … 10 GHz	24,7 % for SAR 1 g 24,4 % for SAR 10 g	e.g. D6.5GHzV2 … D9GHzV2 according to IEC 62209-U, for 1 g and 10 g SAR *) SAR given (as example) for head tissue simulating liquid
				*) SAR given (as example) for head tissue simulating liquid
Near-Field Calibration of dipoles in air	E* field per 0,1 W input power 30 V/m … 300 V/m	700 MHz … 6 GHz	9,5 % for E field	e.g. CD835V3 … CD5500V3 according to ANSI C 63.19, for E field and H field
	H* field per 0,1 W input power 0,07 A/m … 0,7 A/m	385 MHz – 3 GHz	8,3 % for H field	e.g. AdxxxV5 according to ANSI 14117 for H-field
Calibration of Golden Validation Device	SAR* 1 g and 10 g per GVD input power	900 MHz	15,0 % for SAR 1 g 15,1 % for SAR 10 g	e.g. GVD – SR 004001 AA

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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty CMC at (22 ± 3) °C (1)	Remarks
DC Voltage				
Calibration of readout units for field and SAR probes	2 mV		1,5 %	e.g. DAE3Vx, DAE4Vx, DAEasyVx
	200 mV		1 %	
	1 mV … 500 mV		1,16 %	e.g. EASY6-DAE, DAE4ICEy
Calibration of SAR for planar array systems	SAR* peak at 4 mm depth per 1 W input power	650 MHz … 3 GHz	25,8 % for iSAR Flat 29,3 % for iSAR Head	e.g. iSAR Flat, iSAR Head
	SAR* peak at 3 mm depth per 1 W input power	650 MHz … 3 GHz	22,4 % for cSAR3D Flat 25,9 % for cSAR3D Left/Right Head	e.g., cSAR3D Flat, cSAR3D Left Head, cSAR3D Right Head
	SAR* peak at 3 mm depth per 1 W input power	3 GHz … 6 GHz	25,1 % for cSAR3D Flat 28,3 % for cSAR3D Left/Right Head	e.g., cSAR3D Flat, cSAR3D Left Head, cSAR3D Right Head
	SAR* peak at 3 mm depth per 1 W input power	6 GHz … 10 GHz	29,8 % for cSAR3D Flat	e.g. cSAR3D Flat, cSAR3D Quad
Calibration of antenna sources for transfer calibration of planar array systems	SAR* peak per 1 W input power	650 MHz … 3 GHz	17,7 % for SAR peak	e.g., SA AAE 083B, SA AAE 190 A, etc.
	SAR* peak per 1 W input power	3 GHz … 6 GHz	19,9 % for SAR peak	
Calibration of thermometers	0 °C … + 60 °C		0.1K	
Calibration of active electro-optical E&H-field probes optimized for close near-field evaluations in air	15 mV/m … 75 V/m	50 MHz … 6000 MHz	3,3 dB	for antenna factor (E-field)
	42 µA/m … 0.5 A/m	50 MHz … 6000 MHz	3,3 dB	for antenna factor (H-field)
Calibration of active electro-optical RF over fiber systems	Gain: -55 … 15dB	10 MHz … 10 GHz	2,0 dB	For transfer function (gain)
Calibration of stabilized RF power sources	- 5 dBm … + 17 dBm	600 MHz … 6 GHz	0,43 dB	e.g. Powersource1
Calibration Procedure for sources in air above 6 GHz	10 V/m …2000 V/m	10 GHz… 110 GHz	1,27 dB 1,47 dB 1,54 dB	e.g. verification source e.g. validation source e.g. general source

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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty CMC at (22 ± 3) °C (1)	Remarks
Calibration Procedure for sources in air above 6 GHz, for H and averaged S	25 mA/m … 2,5 A/m 2.5 W/m2…2,5 kW/m2	10 GHz… 110 GHz	1,28 dB 1,63 dB 1,70 dB	e.g. verification source e.g. validation source e.g. general source
Measurement capability of the dielectric probe	Permittivity, Conductivity or Loss Tangent from 4 MHz … 67 GHz	homogeneous isotropic material		Open-ended coaxial probes, e.g. DAK-12, DAK-3.5, DAK-1.2 E
Permittivity	1…15			
		4 MHz … 20 MHz	24,3 %	Loss tangent < 0,1
		20 MHz … 200 MHz	11,2 %	
		200 MHz … 3 GHz	2,0 %	
		3 GHz … 6 GHz	2,0 %	
		6 GHz … 20 GHz	2,1 %	
		20 GHz … 40 GHz	3,2 %	
		40 GHz … 67 GHz	3,2 %	
		40 GHz … 67 GHz	4.5%	Conductivity: > 10 S/m
	10…40			
		4 MHz … 10 MHz	6,4 %	Conductivity < 0,1 S/m
		10 MHz … 50 MHz	3,8 %	Conductivity < 0,1 S/m
		50 MHz … 200 MHz	1,8 %	Conductivity: 0,1 – 10 S/m
		200 MHz … 3 GHz	1,8 %	Conductivity: 0,1 – 10 S/m
		3 GHz … 6 GHz	2,3 %	Conductivity: 1 – 10 S/m
		6 GHz … 20 GHz	3,7 %	Conductivity: > 10 S/m
		20 GHz … 40 GHz	4,8 %	Conductivity: > 10 S/m
		40 GHz … 67 GHz	6,4 %	Conductivity: > 10 S/m
	35…100			
		4 MHz … 10 MHz	6,7 %	Conductivity: 0,1 – 1 S/m
		10 MHz … 50 MHz	2,9 %	Conductivity: 0,1 – 1 S/m
		50 MHz … 200 MHz	2,2 %	Conductivity: 1 – 10 S/m
		200 MHz … 3 GHz	1,7 %	Conductivity: 1 – 10 S/m
		3 GHz … 6 GHz	1,9 %	Conductivity: > 10 S/m
		6 GHz … 20 GHz	2,4 %	
Conductivity	1 … 10 S/m			
		4 MHz … 10 MHz	3,1 %	Permittivity: 35 – 100
		10 MHz … 50 MHz	2,9 %	Permittivity: 35 – 100
		50 MHz … 200 MHz	2,5 %	Permittivity:35 – 100
		200 MHz … 3 GHz	3,2 %	Permittivity:35 – 100
		3 GHz … 6 GHz	3,0 %	Permittivity:35 – 100
		6 GHz … 20 GHz	3,0 %	Permittivity:10 – 40
	>10 S/m	20 GHz … 40 GHz	3,8 %	Permittivity:10 – 40
		40 GHz … 67 GHz	4,7 %	Permittivity:1 – 15

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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty CMC at (22 ± 3) °C (1)	Remarks
Loss Tangent	0 … 0,1			
		4 MHz … 20 MHz	0,46	Permittivity: 1 – 15
		20 MHz … 200 MHz	0,28	
		200 MHz … 3 GHz	0,03	
		3 GHz … 6 GHz	0,03	
		6 GHz … 20 GHz	0,03	
		20 GHz … 40 GHz	0,03	
		40 GHz … 67 GHz	0,03	
Measurement capability of the dielectric probe for liquids and gels	Permittivity and Conductivity from 4 MHz … 67GHz	homogeneous isotropic material		Open-ended coaxial probes, e.g. DAK-12, DAK-3.5, DAK-1.2 E
Permittivity	1…100			
		4 MHz … 10 MHz	6,4 %	static conductivity < 0,1 S/m
		10 MHz … 20 MHz	3,8 %	
		20 MHz … 30 MHz	2,3 %	
		30 MHz … 50 MHz	1,9 %	
		50 MHz … 5 GHz	2,2 %	
		5 GHz … 20 GHz	3.7 %	
	1…100			static conductivity 0,1 – 10 S/m
		4 MHz … 10 MHz	6,8 %	
		10 MHz … 20 MHz	3,2 %	
		20 MHz … 30 MHz	3,3 %	
		30 MHz … 50 MHz	3,3 %	
		50 MHz … 5 GHz	3,1 %	
		5 GHz … 20 GHz	3,9 %	
		20 GHz … 40 GHz	5,0 %	
		40 GHz … 67 GHz	6,5 %	
Conductivity	0.01 … 0,1 S/m			Permittivity: 1 – 100
		300 MHz … 500 MHz	7,5 %	
		500 MHz … 5 GHz	4,4 %	
		5 GHz … 20 GHz	5,4 %	
Conductivity	0,1 – 10 S/m			Permittivity: 1 – 100
		4 MHz … 10 MHz	3,9 %	
		10 MHz … 20 MHz	3,9 %	
		20 MHz … 30 MHz	3,8 %	
		30 MHz … 50 MHz	3,4 %	
		50 MHz … 5 GHz	4,8 %	
		5 GHz … 20 GHz	4,8 %	
		20 GHz … 40 GHz	4,8 %	
		40 GHz … 67 GHz	4,9 %	

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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty CMC at (22 ± 3) °C (1)		Remarks
Capability of the dielectric probe to measure thin layers of solids and liquids in small volume	Permittivity, Conductivity or Loss Tangent from 4 MHz … 67 GHz	Homogeneous isotropic material	Permittivity	Loss tangent	Open-ended coaxial probes, e.g. DAK-TL-12, DAKTL-3.5, DAKTL-1.2 E
Permittivity Loss tangent	1< Permittivity<10 Loss tangent< 0,05	4 MHz … 20 MHz 20 MHz … 30 MHz 30 MHz … 50 MHz 50 MHz … 100 MHz 100 MHz … 600 MHz 600 MHz … 3 GHz 3 GHz … 6 GHz 6 GHz … 20 GHz 20 GHz … 40 GHz 40 GHz … 67 GHz	--- --- --- --- 32,6 % 29,5 % 12,6 % 10,0 % 9,1 % 4,5 %	--- --- --- --- 0.06 0.03 0.03 0.03 0.03 0.03	0.1 <thickness <0.2 mm
	1< Permittivity<10 Loss tangent< 0,05	4 MHz … 20 MHz 20 MHz … 30 MHz 30 MHz … 50 MHz 50 MHz … 100 MHz 100 MHz … 600 MHz 600 MHz … 3 GHz 3 GHz … 6 GHz 6 GHz … 20 GHz 20 GHz … 40 GHz 40 GHz … 67 GHz	34,6 % 27,0 % 25,6 % 20,7 % 9,1 % 6,5 % 3,7 % 3,3 % 3,9 % 3,5 %	0.45 0.27 0.17 0.10 0.06 0.03 0.03 0.03 0.03 0.03	0.2<thickness<1 mm
	1< Permittivity<10 Loss tangent< 0,05	4 MHz … 20 MHz 20 MHz … 30 MHz 30 MHz … 50 MHz 50 MHz … 100 MHz 100 MHz … 600 MHz 600 MHz … 3 GHz 3 GHz … 6 GHz 6 GHz … 20 GHz 20 GHz … 40 GHz 40 GHz … 67 GHz	24,3 % 11,2 % 7,1% 4,7 % 2,7 % 2,1 % 2,0 % 2,2 % 3,9 % 3,2 %	0.45 0.27 0.17 0.10 0.06 0.03 0.03 0.03 0.03 0.03	1 <thickness<10 mm
	1< Permittivity<10 Loss tangent.> 0,05	4 MHz … 20 MHz 20 MHz … 30 MHz 30 MHz … 50 MHz 50 MHz … 100 MHz 100 MHz … 600 MHz 600 MHz … 3 GHz 3 GHz … 6 GHz 6 GHz … 20 GHz 20 GHz … 40 GHz 40 GHz … 67 GHz	--- --- --- --- 18,6 % 24.6 % 14,7 % 8,3 % 10,4 % 4,7 %	--- --- --- --- 0.06 0.03 0.03 0.03 0.03 0.05	0.1 <thickness <0.2 mm

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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty CMC at (22 ± 3) °C (1)		Remarks
	1< Permittivity<10 Loss tangent.> 0,05	4 MHz … 20 MHz 20 MHz … 30 MHz 30 MHz … 50 MHz 50 MHz … 100 MHz 100 MHz … 600 MHz 600 MHz … 3 GHz 3 GHz … 6 GHz 6 GHz … 20 GHz 20 GHz … 40 GHz 40 GHz … 67 GHz	--- --- --- --- 29,8 % 19,5 % 8,0 % 4,1 % 4,3 % 3,8 %	--- --- --- --- 0.06 0.03 0.03 0.03 0.03 0.03	0.2<thickness<1 mm
	1< Permittivity<10 Loss tangent.> 0,05	4 MHz … 20 MHz 20 MHz … 30 MHz 30 MHz … 50 MHz 50 MHz … 100 MHz 100 MHz … 600 MHz 600 MHz … 3 GHz 3 GHz … 6 GHz 6 GHz … 20 GHz 20 GHz … 40 GHz 40 GHz … 67 GHz	24,3 % 11,2 % 7,1% 4,7 % 2,6 % 2,0 % 1,9 % 2,0 % 3,2 % 3,1 %	0.45 0.27 0.17 0.10 0.06 0.03 0.03 0.03 0.03 0.03	1 <thickness<10 mm
	Permittivity>10 Loss tangent< 0,05	4 MHz … 20 MHz 20 MHz … 30 MHz 30 MHz … 50 MHz 50 MHz … 100 MHz 100 MHz … 600 MHz 600 MHz … 3 GHz 3 GHz … 6 GHz 6 GHz … 20 GHz 20 GHz … 40 GHz 40 GHz … 67 GHz	28,4 % 18,5 % 12,6 % 8,6 % 5,7 % 5,7 % 5,7 % 4,1 % 4,6 % 6,2 %	0.45 0.27 0.17 0.10 0.06 0.03 0.03 0.03 0.03 0.03	0.1 <thickness <0.2 mm
	Permittivity>10 Loss tangent< 0,05	4 MHz … 20 MHz 20 MHz … 30 MHz 30 MHz … 50 MHz 50 MHz … 100 MHz 100 MHz … 600 MHz 600 MHz … 3 GHz 3 GHz … 6 GHz 6 GHz … 20 GHz 20 GHz … 40 GHz 40 GHz … 67 GHz	24,7 % 12,1 % 8,5 % 6,6 % 3,7 % 4,0 % 3,0 % 3,5 % 3,8 % 3,9 %	0.45 0.27 0.17 0.10 0.06 0.03 0.03 0.03 0.03 0.03	0.2<thickness<1 mm
	Permittivity>10 Loss tangent< 0,05	4 MHz … 20 MHz 20 MHz … 30 MHz 30 MHz … 50 MHz 50 MHz … 100 MHz 100 MHz … 600 MHz 600 MHz … 3 GHz 3 GHz … 6 GHz 6 GHz … 20 GHz 20 GHz … 40 GHz 40 GHz … 67 GHz	24,3 % 11,2 % 7,1% 4,7 % 2,6 % 1,9 % 1,9 % 2,0 % 4,5 % 3,6 %	0.45 0.27 0.17 0.10 0.06 0.03 0.03 0.03 0.03 0.03	1 <thickness<10 mm

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Measured Quantity / Instrument or Gauge	Measurement Range	Measurement Conditions	Best Measurement Uncertainty CMC at (22 ± 3) °C (1)		Remarks
	Permittivity>10 Loss tangent> 0,05	4 MHz … 20 MHz 20 MHz … 30 MHz 30 MHz … 50 MHz 50 MHz … 100 MHz 100 MHz … 600 MHz 600 MHz … 3 GHz 3 GHz … 6 GHz 6 GHz … 20 GHz 20 GHz … 40 GHz 40 GHz … 67 GHz	20,9 % 20,4 % 15,3 % 11,2 % 7,9 % 7,2 % 5,3 % 4,2 % 6,4 % 8,9 %	0.35 0.35 0.35 0.25 0.11 0.02 0.03 0.05 0.06 0.14	0.1 <thickness <0.2 mm
	Permittivity>10 Loss tangent> 0,05	4 MHz … 20 MHz 20 MHz … 30 MHz 30 MHz … 50 MHz 50 MHz … 100 MHz 100 MHz … 600 MHz 600 MHz … 3 GHz 3 GHz … 6 GHz 6 GHz … 20 GHz 20 GHz … 40 GHz 40 GHz … 67 GHz	7,6 % 6,1 % 6,1 % 6,0 % 4,8 % 5,4 % 3,5 % 3,8 % 5,2 % 6,0 %	0.35 0.35 0.35 0.25 0.11 0.02 0.03 0.05 0.06 0.08	0.2<thickness<1 mm
	Permittivity>10 Loss tangent> 0,05	4 MHz … 20 MHz 20 MHz … 30 MHz 30 MHz … 50 MHz 50 MHz … 100 MHz 100 MHz … 600 MHz 600 MHz … 3 GHz 3 GHz … 6 GHz 6 GHz … 20 GHz 20 GHz … 40 GHz 40 GHz … 67 GHz	5,2 % 2,6 % 2,6 % 2,5 % 2,5 % 2,8 % 2,8 % 3,6 % 3,3 % 4,5 %	0.35 0.35 0.35 0.25 0.11 0.02 0.03 0.05 0.06 0.08	1 <thickness<10 mm
			Permittivity	Conduc-tivity	
Permittivity Conductivity	Permittivity >10 Conductivity> 0,5 S/m	4 MHz … 20 MHz 20 MHz … 30 MHz 30 MHz … 50 MHz 50 MHz … 100 MHz 100 MHz … 600 MHz 600 MHz … 3 GHz 3 GHz … 6 GHz 6 GHz … 20 GHz 20 GHz … 40 GHz 40 GHz … 67 GHz	6.4 % 4.3 % 4.0 % 2,5 % 2,9 % 2,8 % 2,8 % 3,6 % 3,9 % 5,1 %	3.9 % 3.4 % 3.4 % 3.4 % 3.4 % 5,8 % 4,0 % 4,0 % 4,1 % 5,0 %	1 <thickness<10 mm

(2) Slightly depending on the frequency and probe type.

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