



SCS Directory

Accreditation number: SCS 0108

International standard: ISO/IEC 17025:2017
Swiss standard: SN EN ISO/IEC 17025:2018

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Initial accreditation: 17.09.2004
Current accreditation: 17.09.2019 to 16.09.2024
Scope of accreditation see: www.sas.admin.ch
(Accredited bodies)

Scope of accreditation as of 12.05.2023

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
Calibration of E-field probes	2 V/m ... 420 V/m	3 kHz ... 10 MHz	1,06 dB	e.g.,MAGPy-8H3D+E3D
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 H-field probes	10 A/m ... 2200 A/m	3 kHz ... 10 MHz	0,70 dB	e.g., MAGPy-8H3D+E3D



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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 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
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 (typical ²)			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



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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	E* field (typical ²)			e.g. EX3DVx, ET1DVx
	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 ... 700 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
		700 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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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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Calibration Procedure for sources in air above 6 GHz, for H and averaged S	25 mA/m ... 2,5 A/m 2.5 W/m ² ...2,5 kW/m ²	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	homogeneous isotropic material		Open-ended coaxial probes, e.g. DAK-12, DAK-3.5, DAK-1.2 E		
Permittivity	Permittivity, Conductivity or Loss Tangent from 4 MHz ... 67 GHz	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			
35...100	20 GHz ... 40 GHz	4,8 %	Conductivity: > 10 S/m			
	40 GHz ... 67 GHz	6,4 %	Conductivity: > 10 S/m			
	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			
1 ... 10 S/m	3 GHz ... 6 GHz	1,9 %	Conductivity: > 10 S/m			
	6 GHz ... 20 GHz	2,4 %				
	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			
>10 S/m	3 GHz ... 6 GHz	3,0 %	Permittivity:35 – 100			
	6 GHz ... 20 GHz	3,0 %	Permittivity:10 – 40			
	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 20 MHz ... 200 MHz 200 MHz ... 3 GHz 3 GHz ... 6 GHz 6 GHz ... 20 GHz 20 GHz ... 40 GHz 40 GHz ... 67 GHz	0,46 0,28 0,03 0,03 0,03 0,03 0,03	Permittivity: 1 – 15
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 10 MHz ... 20 MHz 20 MHz ... 30 MHz 30 MHz ... 50 MHz 50 MHz ... 5 GHz 5 GHz ... 20 GHz	6,4 % 3,8 % 2,3 % 1,9 % 2,2 % 3,7 %	static conductivity < 0,1 S/m
	1...100	4 MHz ... 10 MHz 10 MHz ... 20 MHz 20 MHz ... 30 MHz 30 MHz ... 50 MHz 50 MHz ... 5 GHz 5 GHz ... 20 GHz 20 GHz ... 40 GHz 40 GHz ... 67 GHz	6,8 % 3,2 % 3,3 % 3,3 % 3,1 % 3,9 % 5,0 % 6,5 %	static conductivity 0,1 – 10 S/m
Conductivity	0.01 ... 0,1 S/m	300 MHz ... 500 MHz 500 MHz ... 5 GHz 5 GHz ... 20 GHz	7,5 % 4,4 % 5,4 %	Permittivity: 1 – 100
Conductivity	0,1 – 10 S/m	4 MHz ... 10 MHz 10 MHz ... 20 MHz 20 MHz ... 30 MHz 30 MHz ... 50 MHz 50 MHz ... 5 GHz 5 GHz ... 20 GHz 20 GHz ... 40 GHz 40 GHz ... 67 GHz	3,9 % 3,9 % 3,8 % 3,4 % 4,8 % 4,8 % 4,8 % 4,9 %	Permittivity: 1 – 100



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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						
						1 < Permittivity < 10 Loss tangent < 0,05	4 MHz ... 20 MHz	---	---	0.1 <thickness < 0.2 mm	
							20 MHz ... 30 MHz	---	---		
							30 MHz ... 50 MHz	---	---		
							50 MHz ... 100 MHz	---	---		
							100 MHz ... 600 MHz	32,6 %	0,06		
							600 MHz ... 3 GHz	29,5 %	0,03		
							3 GHz ... 6 GHz	12,6 %	0,03		
							6 GHz ... 20 GHz	10,0 %	0,03		
							20 GHz ... 40 GHz	9,1 %	0,03		
							40 GHz ... 67 GHz	4,5 %	0,03		
							1 < Permittivity < 10 Loss tangent < 0,05	4 MHz ... 20 MHz	34,6 %	0,45	0.2 <thickness < 1 mm
								20 MHz ... 30 MHz	27,0 %	0,27	
								30 MHz ... 50 MHz	25,6 %	0,17	
								50 MHz ... 100 MHz	20,7 %	0,10	
								100 MHz ... 600 MHz	9,1 %	0,06	
								600 MHz ... 3 GHz	6,5 %	0,03	
								3 GHz ... 6 GHz	3,7 %	0,03	
								6 GHz ... 20 GHz	3,3 %	0,03	
								20 GHz ... 40 GHz	3,9 %	0,03	
		40 GHz ... 67 GHz	3,5 %	0,03							
	1 < Permittivity < 10 Loss tangent < 0,05	4 MHz ... 20 MHz	24,3 %	0,45	1 <thickness < 10 mm						
		20 MHz ... 30 MHz	11,2 %	0,27							
		30 MHz ... 50 MHz	7,1 %	0,17							
		50 MHz ... 100 MHz	4,7 %	0,10							
		100 MHz ... 600 MHz	2,7 %	0,06							
		600 MHz ... 3 GHz	2,1 %	0,03							
		3 GHz ... 6 GHz	2,0 %	0,03							
		6 GHz ... 20 GHz	2,2 %	0,03							
		20 GHz ... 40 GHz	3,9 %	0,03							
		40 GHz ... 67 GHz	3,2 %	0,03							
	1 < Permittivity < 10 Loss tangent > 0,05	4 MHz ... 20 MHz	---	---	0.1 <thickness < 0.2 mm						
		20 MHz ... 30 MHz	---	---							
		30 MHz ... 50 MHz	---	---							
		50 MHz ... 100 MHz	---	---							
		100 MHz ... 600 MHz	18,6 %	0,06							
		600 MHz ... 3 GHz	24,6 %	0,03							
		3 GHz ... 6 GHz	14,7 %	0,03							
		6 GHz ... 20 GHz	8,3 %	0,03							
		20 GHz ... 40 GHz	10,4 %	0,03							
		40 GHz ... 67 GHz	4,7 %	0,05							



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1 < Permittivity < 10 Loss tangent > 0,05		4 MHz ... 20 MHz	---	---	0.2 < thickness < 1 mm
		20 MHz ... 30 MHz	---	---	
		30 MHz ... 50 MHz	---	---	
		50 MHz ... 100 MHz	---	---	
		100 MHz ... 600 MHz	29,8 %	0,06	
		600 MHz ... 3 GHz	19,5 %	0,03	
		3 GHz ... 6 GHz	8,0 %	0,03	
		6 GHz ... 20 GHz	4,1 %	0,03	
		20 GHz ... 40 GHz	4,3 %	0,03	
		40 GHz ... 67 GHz	3,8 %	0,03	
1 < Permittivity < 10 Loss tangent > 0,05		4 MHz ... 20 MHz	24,3 %	0,45	1 < thickness < 10 mm
		20 MHz ... 30 MHz	11,2 %	0,27	
		30 MHz ... 50 MHz	7,1 %	0,17	
		50 MHz ... 100 MHz	4,7 %	0,10	
		100 MHz ... 600 MHz	2,6 %	0,06	
		600 MHz ... 3 GHz	2,0 %	0,03	
		3 GHz ... 6 GHz	1,9 %	0,03	
		6 GHz ... 20 GHz	2,0 %	0,03	
		20 GHz ... 40 GHz	3,2 %	0,03	
		40 GHz ... 67 GHz	3,1 %	0,03	
Permittivity > 10 Loss tangent < 0,05		4 MHz ... 20 MHz	28,4 %	0,45	0.1 < thickness < 0.2 mm
		20 MHz ... 30 MHz	18,5 %	0,27	
		30 MHz ... 50 MHz	12,6 %	0,17	
		50 MHz ... 100 MHz	8,6 %	0,10	
		100 MHz ... 600 MHz	5,7 %	0,06	
		600 MHz ... 3 GHz	5,7 %	0,03	
		3 GHz ... 6 GHz	5,7 %	0,03	
		6 GHz ... 20 GHz	4,1 %	0,03	
		20 GHz ... 40 GHz	4,6 %	0,03	
		40 GHz ... 67 GHz	6,2 %	0,03	
Permittivity > 10 Loss tangent < 0,05		4 MHz ... 20 MHz	24,7 %	0,45	0.2 < thickness < 1 mm
		20 MHz ... 30 MHz	12,1 %	0,27	
		30 MHz ... 50 MHz	8,5 %	0,17	
		50 MHz ... 100 MHz	6,6 %	0,10	
		100 MHz ... 600 MHz	3,7 %	0,06	
		600 MHz ... 3 GHz	4,0 %	0,03	
		3 GHz ... 6 GHz	3,0 %	0,03	
		6 GHz ... 20 GHz	3,5 %	0,03	
		20 GHz ... 40 GHz	3,8 %	0,03	
		40 GHz ... 67 GHz	3,9 %	0,03	
Permittivity > 10 Loss tangent < 0,05		4 MHz ... 20 MHz	24,3 %	0,45	1 < thickness < 10 mm
		20 MHz ... 30 MHz	11,2 %	0,27	
		30 MHz ... 50 MHz	7,1 %	0,17	
		50 MHz ... 100 MHz	4,7 %	0,10	
		100 MHz ... 600 MHz	2,6 %	0,06	
		600 MHz ... 3 GHz	1,9 %	0,03	
		3 GHz ... 6 GHz	1,9 %	0,03	
		6 GHz ... 20 GHz	2,0 %	0,03	
		20 GHz ... 40 GHz	4,5 %	0,03	
		40 GHz ... 67 GHz	3,6 %	0,03	



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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	20,9 %	0,35	0.1 <thickness < 0.2 mm		
		20 MHz ... 30 MHz	20,4 %	0,35			
		30 MHz ... 50 MHz	15,3 %	0,35			
		50 MHz ... 100 MHz	11,2 %	0,25			
		100 MHz ... 600 MHz	7,9 %	0,11			
		600 MHz ... 3 GHz	7,2 %	0,02			
		3 GHz ... 6 GHz	5,3 %	0,03			
		6 GHz ... 20 GHz	4,2 %	0,05			
		20 GHz ... 40 GHz	6,4 %	0,06			
	40 GHz ... 67 GHz	8,9 %	0,14				
	Permittivity > 10 Loss tangent > 0,05	4 MHz ... 20 MHz	7,6 %	0,35	0.2 <thickness < 1 mm		
		20 MHz ... 30 MHz	6,1 %	0,35			
		30 MHz ... 50 MHz	6,1 %	0,35			
		50 MHz ... 100 MHz	6,0 %	0,25			
		100 MHz ... 600 MHz	4,8 %	0,11			
		600 MHz ... 3 GHz	5,4 %	0,02			
		3 GHz ... 6 GHz	3,5 %	0,03			
		6 GHz ... 20 GHz	3,8 %	0,05			
		20 GHz ... 40 GHz	5,2 %	0,06			
	40 GHz ... 67 GHz	6,0 %	0,08				
	Permittivity > 10 Loss tangent > 0,05	4 MHz ... 20 MHz	5,2 %	0,35	1 <thickness < 10 mm		
		20 MHz ... 30 MHz	2,6 %	0,35			
		30 MHz ... 50 MHz	2,6 %	0,35			
		50 MHz ... 100 MHz	2,5 %	0,25			
		100 MHz ... 600 MHz	2,5 %	0,11			
		600 MHz ... 3 GHz	2,8 %	0,02			
		3 GHz ... 6 GHz	2,8 %	0,03			
		6 GHz ... 20 GHz	3,6 %	0,05			
20 GHz ... 40 GHz		3,3 %	0,06				
40 GHz ... 67 GHz	4,5 %	0,08					
Permittivity Conductivity	Permittivity > 10 Conductivity > 0,5 S/m	4 MHz ... 20 MHz	6,4 %	3,9 %	1 <thickness < 10 mm		
		20 MHz ... 30 MHz	4,3 %	3,4 %			
		30 MHz ... 50 MHz	4,0 %	3,4 %			
		50 MHz ... 100 MHz	2,5 %	3,4 %			
		100 MHz ... 600 MHz	2,9 %	3,4 %			
		600 MHz ... 3 GHz	2,8 %	5,8 %			
		3 GHz ... 6 GHz	2,8 %	4,0 %			
		6 GHz ... 20 GHz	3,6 %	4,0 %			
		20 GHz ... 40 GHz	3,9 %	4,1 %			
		40 GHz ... 67 GHz	5,1 %	5,0 %			
			Permittivity				
			Conductivity				

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

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