

January 27, 2021

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3327

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (µV/(V/m) ²) ^A	1.15	1.09	1.03	± 10.1 %
DCP (mV) ^B	103.6	106.2	107.2	

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dBõV	С	D dB	VR mV	Max dev.	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	193.6	± 2.5 %	± 4.7 %
		Y	0.0	0.0	1.0		202.9		
		Z	0.0	0.0	1.0		195.9		

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

^A The uncertainties of Norm X,Y,Z do not affect the E²-field uncertainty inside TSL (see Pages 5 and 6).
 ^B Numerical linearization parameter: uncertainty not required.
 ^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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DASY/EASY - Parameters of Probe: ES3DV3 - SN:3327

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-125.9
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

Note: Measurement distance from surface can be increased to 3-4 mm for an Area Scan job.

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DASY/EASY - Parameters of Probe: ES3DV3 - SN:3327

f (MHz) ^c	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unc (k=2)
750	41.9	0.89	6.49	6.49	6.49	0.80	1.26	± 12.0 %
835	41.5	0.90	6.26	6.26	6.26	0.77	1.23	± 12.0 %
900	41.5	0.97	6.08	6.08	6.08	0.40	1.75	± 12.0 %
1750	40.1	1.37	5.41	5.41	5.41	0.73	1.31	± 12.0 %
1900	40.0	1.40	5.13	5.13	5.13	0.68	1.32	± 12.0 %
2450	39.2	1.80	4.68	4.68	4.68	0.80	1.40	± 12.0 %
2600	39.0	1.96	4.47	4.47	4.47	0.80	1.37	± 12.0 %
3500	37.9	2.91	4.23	4.23	4.23	0.90	1.40	± 13.1 %
3700	37.7	3.12	4.13	4.13	4.13	0.90	1.40	± 13.1 %

Calibration Parameter Determined in Head Tissue Simulating Med	Calibration	Parameter	Determined	in Head	d Tissue	Simulating	Media
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^c Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4-9 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz. ^F At frequencies below 3 GHz, the validity of tissue parameters (s and o) can be relaxed to ± 10% if liquid compensation formula is applied to

⁶ A Industries below 3 GHz, the validity of tissue parameters (c and c) can be relaxed to ± 10% iniquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (c and c) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
 ⁶ Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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DASY/EASY - Parameters of Probe: ES3DV3 - SN:3327

f (MHz) ^c	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unc (k=2)
750	55.5	0.96	6.51	6.51	6.51	0.43	1.58	± 12.0 %
835	55.2	0.97	6.34	6.34	6.34	0.80	1.18	± 12.0 %
900	55.0	1.05	6.23	6.23	6.23	0.57	1.39	± 12.0 %
1750	53.4	1.49	5.26	5.26	5.26	0.48	1.59	± 12.0 %
1900	53.3	1.52	5.01	5.01	5.01	0.48	1.64	± 12.0 %
2450	52.7	1.95	4.49	4.49	4.49	0.80	1.28	± 12.0 %
2600	52.5	2.16	4.34	4.34	4.34	0.80	1.25	± 12.0 %
3500	51.3	3.31	3.81	3.81	3.81	0.80	1.60	± 13.1 %
3700	51.0	3.55	3.71	3.71	3.71	0.80	1.60	± 13.1 %

Calibration Parameter Determined in Body Tissue Simulating Media

^c Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4-9 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz.
^F At frequencies below 3 GHz, the validity of tissue parameters (s and o) can be relaxed to ± 10% if liquid compensation formula is applied to the parameters (below 10 MHz to 10 MHz.

measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to \pm 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters. ^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is

³ Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

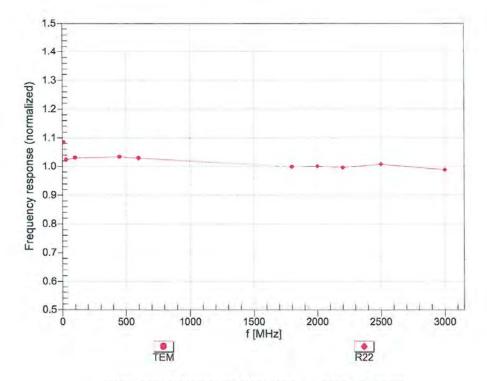
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Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

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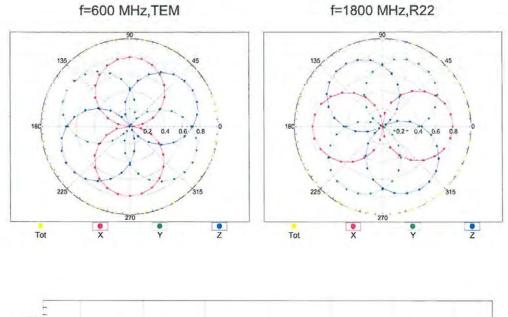
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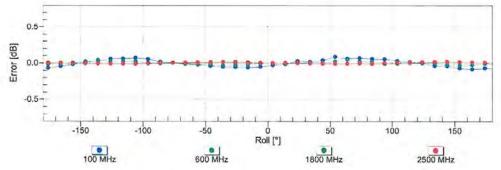
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Receiving Pattern (ϕ), $\vartheta = 0^{\circ}$



Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

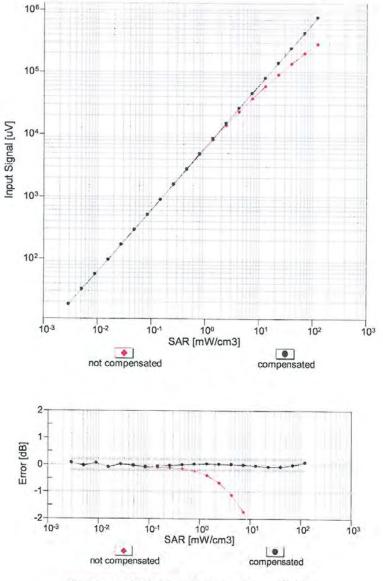
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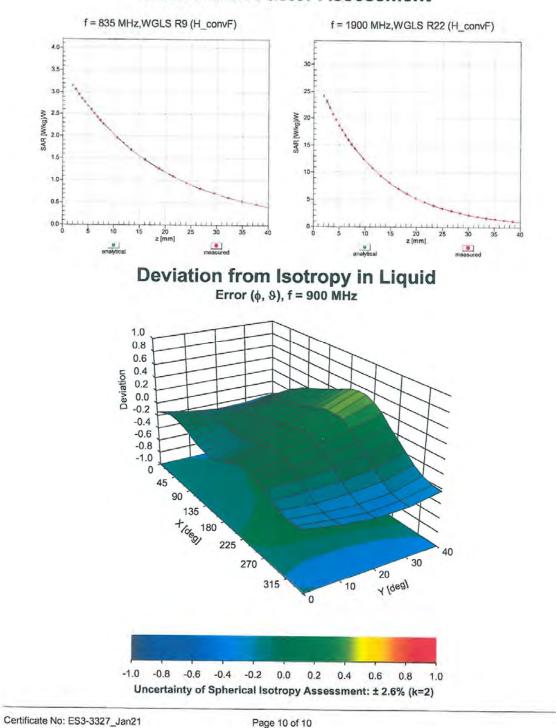


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Conversion Factor Assessment



Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



Schweizerischer Kalibrierdienst Service suisse d'étalonnage Servizio svizzero di taratura Swiss Calibration Service

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Client DT&C (Dymstec)

Certificate No: EX3-7368_Aug19

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Object	EX3DV4 - SN:736	8	
Calibration procedure(s)		A CAL-14.v5, QA CAL-23.v5, QA ure for dosimetric E-field probes	CAL-25.v7
Calibration date:	August 27, 2019		
The measurements and the un	certainties with confidence pro lucted in the closed laboratory	hal standards, which realize the physical units bability are given on the following pages and facility: environment temperature (22 ± 3) [°] C ε	are part of the certificate.
Primary Standards	10	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	03-Apr-19 (No. 217-02892/02893)	Apr-20
Power sensor NRP-Z91	SN: 103244	03-Apr-19 (No. 217-02892)	Apr-20
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	SN: 103245	03-Apr-19 (No. 217-02893)	Apr-20
Power sensor NRP-Z91		and the second se	
Power sensor NRP-Z91 Reference 20 dB Attenuator	SN: 103245	03-Apr-19 (No. 217-02893)	Apr-20
Power sensor NRP-Z91 Reference 20 dB Attenuator DAE4	SN: 103245 SN: S5277 (20x)	03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894)	Apr-20 Apr-20
Power sensor NRP-Z91 Reference 20 dB Attenuator DAE4 Reference Probe ES3DV2	SN: 103245 SN: S5277 (20x) SN: 660	03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 19-Dec-18 (No. DAE4-660_Dec18)	Apr-20 Apr-20 Dec-19
Power sensor NRP-Z91 Reference 20 dB Attenuator DAE4 Reference Probe ES3DV2 Secondary Standards	SN: 103245 SN: S5277 (20x) SN: 660 SN: 3013	03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 19-Dec-18 (No. DAE4-660_Dec18) 31-Dec-18 (No. ES3-3013_Dec18)	Apr-20 Apr-20 Dec-19 Dec-19
Power sensor NRP-Z91 Reference 20 dB Attenuator DAE4 Reference Probe ES3DV2 Secondary Standards Power meter E4419B	SN: 103245 SN: S5277 (20x) SN: 660 SN: 3013 ID	03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 19-Dec-18 (No. DAE4-660_Dec18) 31-Dec-18 (No. ES3-3013_Dec18) Check Date (in house)	Apr-20 Apr-20 Dec-19 Dec-19 Scheduled Check
Power sensor NRP-Z91 Reference 20 dB Attenuator DAE4 Reference Probe ES3DV2 Secondary Standards Power meter E4419B Power sensor E4412A	SN: 103245 SN: S5277 (20x) SN: 660 SN: 3013 ID SN: GB41293874	03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 19-Dec-18 (No. DAE4-660_Dec18) 31-Dec-18 (No. ES3-3013_Dec18) Check Date (in house) 06-Apr-16 (in house check Jun-18)	Apr-20 Apr-20 Dec-19 Dec-19 Scheduled Check In house check: Jun-20
Power sensor NRP-Z91 Reference 20 dB Attenuator DAE4 Reference Probe ES3DV2 Secondary Standards Power meter E44198 Power sensor E4412A Power sensor E4412A	SN: 103245 SN: S5277 (20x) SN: 660 SN: 3013 ID SN: GB41293874 SN: MY41498087	03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 19-Dec-18 (No. DAE4-660_Dec18) 31-Dec-18 (No. ES3-3013_Dec18) Check Date (in house) 06-Apr-16 (in house check Jun-18) 06-Apr-16 (in house check Jun-18)	Apr-20 Apr-20 Dec-19 Dec-19 Scheduled Check In house check: Jun-20 In house check: Jun-20
Power sensor NRP-Z91 Reference 20 dB Attenuator DAE4 Reference Probe ES3DV2 Secondary Standards Power meter E4419B Power sensor E4412A Power sensor E4412A RF generator HP 8648C	SN: 103245 SN: S5277 (20x) SN: 660 SN: 3013 ID SN: GB41293874 SN: MY41498087 SN: 000110210	03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 19-Dec-18 (No. DAE4-660_Dec18) 31-Dec-18 (No. ES3-3013_Dec18) Check Date (in house) 06-Apr-16 (in house check Jun-18) 06-Apr-16 (in house check Jun-18) 06-Apr-16 (in house check Jun-18)	Apr-20 Apr-20 Dec-19 Dec-19 Scheduled Check In house check: Jun-20 In house check: Jun-20 In house check: Jun-20
Power sensor NRP-Z91 Reference 20 dB Attenuator DAE4 Reference Probe ES3DV2 Secondary Standards Power meter E4419B Power sensor E4412A Power sensor E4412A	SN: 103245 SN: S5277 (20x) SN: 660 SN: 3013 ID SN: GB41293874 SN: MY41498087 SN: 000110210 SN: US3642U01700	03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02893) 19-Dec-18 (No. DAE4-660_Dec18) 31-Dec-18 (No. ES3-3013_Dec18) Check Date (in house) 06-Apr-16 (in house check Jun-18) 06-Apr-16 (in house check Jun-18) 06-Apr-16 (in house check Jun-18) 04-Aug-99 (in house check Jun-18)	Apr-20 Apr-20 Dec-19 Dec-19 Scheduled Check In house check: Jun-20 In house check: Jun-20 In house check: Jun-20 In house check: Jun-20
Power sensor NRP-Z91 Reference 20 dB Attenuator DAE4 Reference Probe ES3DV2 Secondary Standards Power meter E44198 Power sensor E4412A Power sensor E4412A RF generator HP 8648C	SN: 103245 SN: S5277 (20x) SN: 660 SN: 3013 ID SN: GB41293874 SN: MY41498087 SN: 000110210 SN: US3642U01700 SN: US41080477	03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 19-Dec-18 (No. DAE4-660_Dec18) 31-Dec-18 (No. ES3-3013_Dec18) Check Date (in house) 06-Apr-16 (in house check Jun-18) 06-Apr-16 (in house check Jun-18) 06-Apr-16 (in house check Jun-18) 04-Aug-99 (in house check Jun-18) 31-Mar-14 (in house check Oct-18)	Apr-20 Apr-20 Dec-19 Dec-19 Scheduled Check In house check: Jun-20 In house check: Jun-20 In house check: Jun-20 In house check: Jun-20 In house check: Oct-19 Signature
Power sensor NRP-Z91 Reference 20 dB Attenuator DAE4 Reference Probe ES3DV2 Secondary Standards Power meter E44198 Power sensor E4412A Power sensor E4412A RF generator HP 8648C Network Analyzer E8358A	SN: 103245 SN: S5277 (20x) SN: 660 SN: 3013 ID SN: GB41293874 SN: MY41498087 SN: 000110210 SN: US3642U01700 SN: US3642U01700 SN: US41080477 Name	03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 19-Dec-18 (No. DAE4-660_Dec18) 31-Dec-18 (No. ES3-3013_Dec18) Check Date (in house) 06-Apr-16 (in house check Jun-18) 06-Apr-16 (in house check Jun-18) 06-Apr-16 (in house check Jun-18) 04-Aug-99 (in house check Jun-18) 31-Mar-14 (in house check Oct-18) Function	Apr-20 Apr-20 Dec-19 Dec-19 Scheduled Check In house check: Jun-20 In house check: Jun-20 In house check: Jun-20 In house check: Jun-20 In house check: Oct-19

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Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



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Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Glossary:

Glossaly.	
TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization ϕ	φ rotation around probe axis
Polarization 9	9 rotation around an axis that is in the plane normal to probe axis (at measurement center),
	i.e., $\vartheta = 0$ is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system
CF A, B, C, D Polarization φ Polarization θ	crest factor (1/duty_cycle) of the RF signal modulation dependent linearization parameters φ rotation around probe axis θ rotation around an axis that is in the plane normal to probe axis (at measurement center i.e., θ = 0 is normal to probe axis

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- Techniques", June 2013
 b) IEC 62209-1, ", "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from handheld and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- NORMx,y,z: Assessed for E-field polarization 9 = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E²-field uncertainty inside TSL (see below ConvF).
- NORM(f)x,y,z = NORMx,y,z * frequency_response (see Frequency Response Chart). This linearization is
 implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included
 in the stated uncertainty of ConvF.
- DCPx,y,z: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters: Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORMx,y,z * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy): in a field of low gradients realized using a flat phantom
 exposed by a patch antenna.
- Sensor Offset: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle: The angle is assessed using the information gained by determining the NORMx (no uncertainty required).

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DASY/EASY - Parameters of Probe: EX3DV4 - SN:7368

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm $(\mu V/(V/m)^2)^A$	0.49	0.42	0.44	± 10.1 %
DCP (mV) ^B	99.8	103.4	99.6	

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dBõV	С	D dB	VR mV	Max dev.	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	183.4	±3.5 %	±4.7 %
		Y	0.0	0.0	1.0		175.0		
		Z	0.0	0.0	1.0		177.6		

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

 ^A The uncertainties of Norm X,Y,Z do not affect the E²-field uncertainty inside TSL (see Page 5).
 ^B Numerical linearization parameter: uncertainty not required.
 ^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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DASY/EASY - Parameters of Probe: EX3DV4 - SN:7368

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	19.3
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

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DASY/EASY - Parameters of Probe: EX3DV4 - SN:7368

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unc (k=2)
750	41.9	0.89	10.12	10.12	10.12	0.50	0.80	± 12.0 %
835	41.5	0.90	9.83	9.83	9.83	0.35	1.02	± 12.0 %
900	41.5	0.97	9.63	9.63	9.63	0.51	0.85	± 12.0 %
1750	40.1	1.37	8.45	8.45	8.45	0.40	0.85	± 12.0 %
1900	40.0	1.40	8.06	8.06	8.06	0.31	0.85	± 12.0 %
2450	39.2	1.80	7.61	7.61	7.61	0.32	0.95	± 12.0 %
2600	39.0	1.96	7.52	7.52	7.52	0.46	0.88	± 12.0 %
3500	37.9	2.91	7.01	7.01	7.01	0.30	1.35	± 13.1 %
3700	37.7	3.12	6.97	6.97	6.97	0.30	1.35	± 13.1 %
5200	36.0	4.66	5.19	5.19	5.19	0.40	1.80	± 13.1 %
5300	35.9	4.76	4.97	4.97	4.97	0.40	1.80	± 13.1 %
5500	35.6	4.96	4.90	4.90	4.90	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.66	4.66	4.66	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.61	4.61	4.61	0.40	1.80	± 13.1 %

Calibration Parameter Determined in Head Tissue Simulating Media

^c Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4-9 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz.

^F At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

the ConvF uncertainty for indicated target tissue parameters. ⁶ Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than \pm 1% for frequencies below 3 GHz and below \pm 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

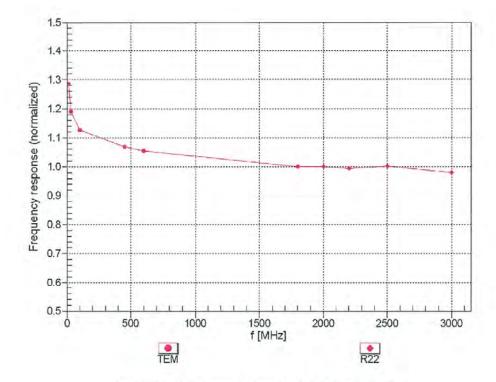
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Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)



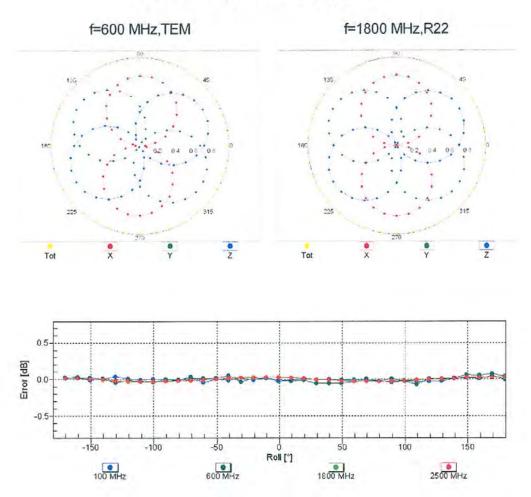
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

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Dt&C

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Receiving Pattern (ϕ), $\vartheta = 0^{\circ}$

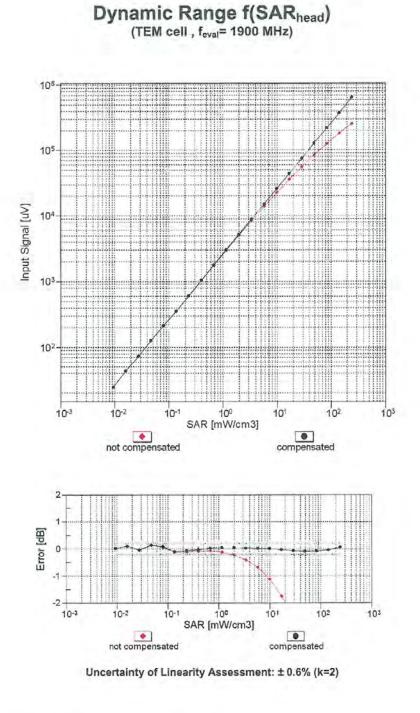
Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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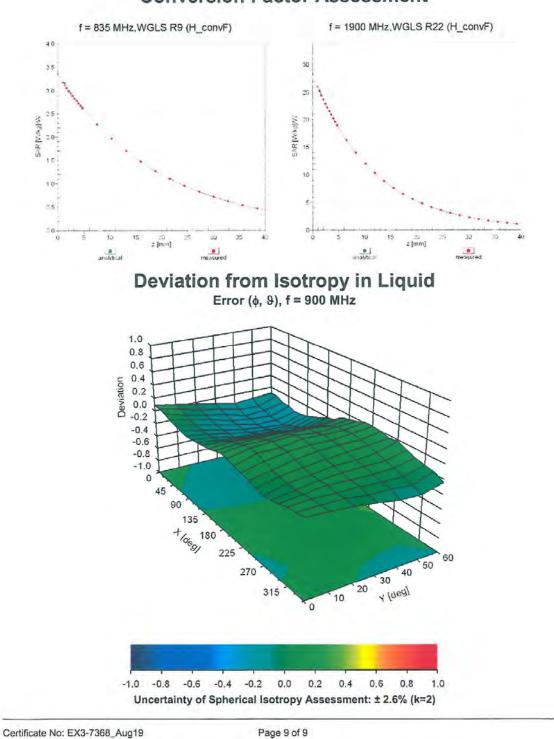


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Conversion Factor Assessment



APPENDIX B. – Dipole Calibration Data





Calibration Laboratory of Schmid & Partner

Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



Schweizerischer Kalibrierdienst Service suisse d'étalonnage Servizio svizzero di taratura Swiss Calibration Service

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

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CALIBRATION C	ERTIFICATI	E	
Object	D750V3 - SN:104	49	
Calibration procedure(s)	QA CAL-05.v11 Calibration Proce	edure for SAR Validation Sources	between 0.7-3 GHz
Calibration date:	January 21, 2021	1	
		onal standards, which realize the physical uni robability are given on the following pages an	
		y facility: environment temperature (22 ± 3)°C	
Calibration Equipment used (M&TE		y racinty, environment temperature (22 ± 3) C	and humidity < 70%.
Primary Standards	ID#	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	01-Apr-20 (No. 217-03100/03101)	Apr-21
ower sensor NRP-Z91	SN: 103244	01-Apr-20 (No. 217-03100)	Apr-21
ower sensor NRP-Z91	SN: 103245	01-Apr-20 (No. 217-03101)	Apr-21
Reference 20 dB Attenuator	SN: BH9394 (20k)	31-Mar-20 (No. 217-03106)	Apr-21
Type-N mismatch combination	SN: 310982 / 06327	31-Mar-20 (No. 217-03104)	Apr-21
Reference Probe EX3DV4	SN: 7349	28-Dec-20 (No. EX3-7349 Dec20)	Dec-21
DAE4	SN: 601	02-Nov-20 (No. DAE4-601_Nov20)	Nov-21
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	ID # SN: GB39512475	Check Date (in house) 30-Oct-14 (in house check Oct-20)	
Power meter E4419B Power sensor HP 8481A			In house check: Oct-22
Power meter E4419B Power sensor HP 8481A	SN: GB39512475	30-Oct-14 (in house check Oct-20)	In house check: Oct-22 In house check: Oct-22
Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	SN: GB39512475 SN: US37292783	30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20)	In house check: Oct-22 In house check: Oct-22 In house check: Oct-22
Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	SN: GB39512475 SN: US37292783 SN: MY41092317	30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 07-Oct-15 (in house check Oct-20)	In house check: Oct-22 In house check: Oct-22 In house check: Oct-22 In house check: Oct-22
Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972	30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 15-Jun-15 (in house check Oct-20)	Scheduled Check In house check: Oct-22 In house check: Oct-22 In house check: Oct-22 In house check: Oct-22 In house check: Oct-21 Signature
Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by:	SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477	30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 15-Jun-15 (in house check Oct-20) 31-Mar-14 (in house check Oct-20)	In house check: Oct-22 In house check: Oct-22 In house check: Oct-22 In house check: Oct-22 In house check: Oct-21
Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477 Name	30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 15-Jun-15 (in house check Oct-20) 31-Mar-14 (in house check Oct-20) Function Laboratory Technician	In house check: Oct-22 In house check: Oct-22 In house check: Oct-22 In house check: Oct-22 In house check: Oct-21
Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by:	SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477 Name Claudio Leubler	30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 15-Jun-15 (in house check Oct-20) 31-Mar-14 (in house check Oct-20) Function	In house check: Oct-22 In house check: Oct-22 In house check: Oct-22 In house check: Oct-22 In house check: Oct-21
Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by:	SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477 Name Claudio Leubler	30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 15-Jun-15 (in house check Oct-20) 31-Mar-14 (in house check Oct-20) Function Laboratory Technician	In house check: Oct-22 In house check: Oct-22 In house check: Oct-22 In house check: Oct-22 In house check: Oct-21

Certificate No: D750V3-1049_Jan21

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Calibration Laboratory of Schmid & Partner Engineering AG

Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



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Schweizerischer Kalibrierdienst Service suisse d'étalonnage

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Swiss Galibration Service

Accreditation No.: SCS 0108

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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end
 of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed
 point exactly below the center marking of the flat phantom section, with the arms oriented
 parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole
 positioned under the liquid filled phantom. The impedance stated is transformed from the
 measurement at the SMA connector to the feed point. The Return Loss ensures low
 reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

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Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.4 ± 6 %	0.90 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.12 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.39 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.47 W/kg ± 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.5 ± 6 %	0.95 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.17 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	8.75 W/kg ± 17.0 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR averaged over 10 cm ³ (10 g) of Body TSL SAR measured	condition 250 mW input power	1.43 W/kg

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.1 Ω - 1.7 jΩ
Return Loss	- 29.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.1 Ω - 4.6 jΩ
Return Loss	- 26.5 dB

General Antenna Parameters and Design

Floating Delay (and dispeties)		
Electrical Delay (one direction) 1.034 ns	Electrical Delay (one direction)	1.034 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG

Certificate No: D750V3-1049_Jan21

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DASY5 Validation Report for Head TSL

Date: 21.01.2021

Test Laboratory: SPEAG, Zurich, Switzerland

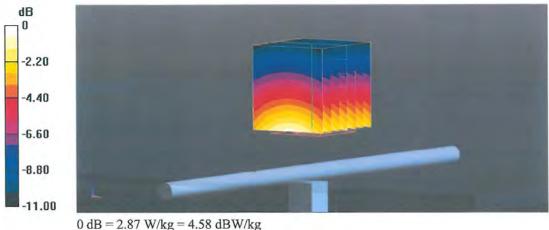
DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1049

Communication System: UID 0 - CW; Frequency: 750 MHz Medium parameters used: f = 750 MHz; $\sigma = 0.9 \text{ S/m}$; $\varepsilon_r = 41.4$; $\rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(10.11, 10.11, 10.11) @ 750 MHz; Calibrated: 28.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection) .
- Electronics: DAE4 Sn601; Calibrated: 02.11.2020
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 59.59 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 3.25 W/kg SAR(1 g) = 2.12 W/kg; SAR(10 g) = 1.38 W/kg Smallest distance from peaks to all points 3 dB below = 18.9 mm Ratio of SAR at M2 to SAR at M1 = 65.1% Maximum value of SAR (measured) = 2.87 W/kg

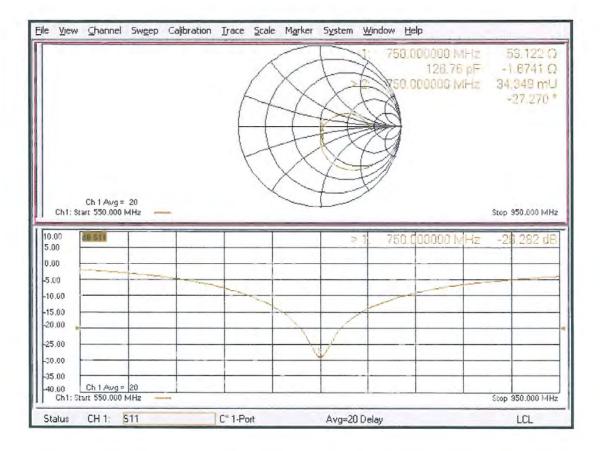


Certificate No: D750V3-1049_Jan21

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Impedance Measurement Plot for Head TSL



Certificate No: D750V3-1049_Jan21

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DASY5 Validation Report for Body TSL

Date: 21.01.2021

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1049

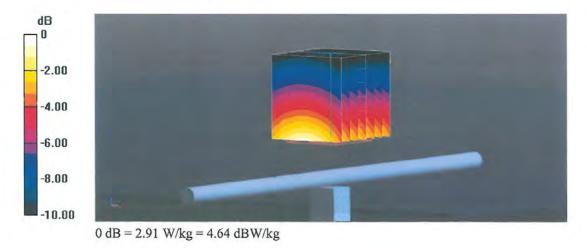
Communication System: UID 0 - CW; Frequency: 750 MHz Medium parameters used: f = 750 MHz; $\sigma = 0.95$ S/m; $\epsilon_r = 55.5$; $\rho = 1000$ kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(10.23, 10.23, 10.23) @ 750 MHz; Calibrated: 28.12.2020
- · Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.11.2020
- Phantom: Flat Phantom 4.9 (Back); Type: QD 00R P49 AA; Serial: 1005
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 55.81 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 3.32 W/kg SAR(1 g) = 2.17 W/kg; SAR(10 g) = 1.43 W/kg Smallest distance from peaks to all points 3 dB below = 16 mm Ratio of SAR at M2 to SAR at M1 = 65.9% Maximum value of SAR (measured) = 2.91 W/kg

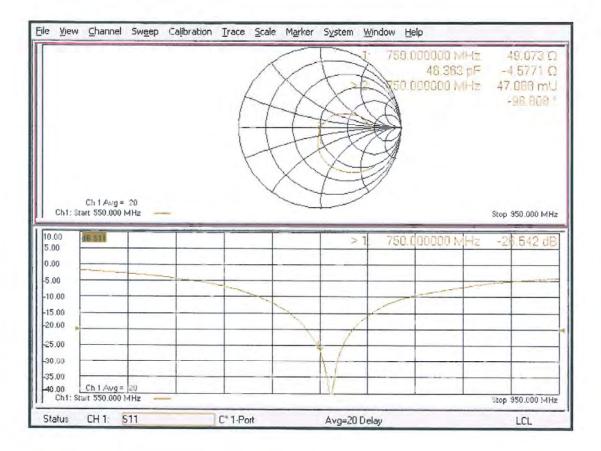


Certificate No: D750V3-1049_Jan21

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Impedance Measurement Plot for Body TSL

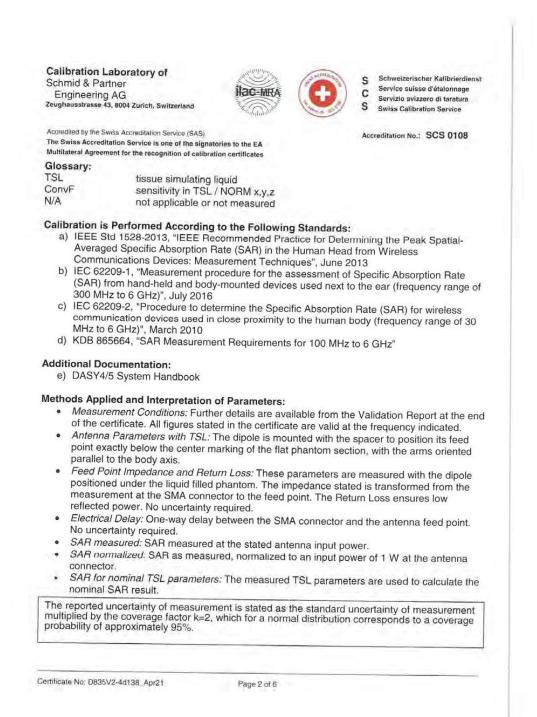


Certificate No: D750V3-1049_Jan21

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Schmid & Partner Engineering AG Leughausstrasse 43, 8004 Zuric	ry of h, Switzerland	Hac-MRA	S Schweizerischer Kalibrierdiens Service suisse d'étalonnage Servizio svizzero di taratura Swiss Calibration Service
Accredited by the Swiss Accredita The Swiss Accreditation Service Multilateral Agreement for the re	e is one of the signator	ies to the EA	Accreditation No.: SCS 0108
Client SGS Korea (Dy	Current Contraction of the Contr		No: D835V2-4d138_Apr21
CALIBRATION C	ERTIFICAT	E	
Object	D835V2 - SN:40	1138	212 11
Calibration procedure(s)	QA CAL-05.v11 Calibration Proc	edure for SAR Validation Source	es between 0.7-3 GHZ ^{2021, 05, 3}
Calibration date:	April 22, 2021		
			and are part of the certificate.
		ry facility: environment temperature (22 \pm 3)	
alibration Equipment used (M&T)			°C and humidity ≼ 70%.
alibration Equipment used (M&T)	E critical for calibration)	ry facility: environment temperature (22 ± 3) Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292)	°C and humidity ≤ 70%. Scheduled Calibration
alibration Equipment used (M&T) rimary Standards ower meter NRP ower sensor NRP-291	E critical for calibration)	Cal Date (Certificate No.)	°C and humidity < 70%.
alibration Equipment used (M&T) rimaty Standards ower meter NRP ower sensor NRP-291 ower sensor NRP-291	E critical for calibration)	Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292)	^o C and humidity < 70%. Scheduled Calibration Apr-22
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Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	42.2 ± 6 %	0.92 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.47 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.75 W/kg ± 17.0 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR averaged over 10 cm ³ (10 g) of Head TSL SAR measured	condition 250 mW input power	1.59 W/kg

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.3 Ω - 2.0 jΩ	
Return Loss	- 33.9 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.398 ns
	1.0001

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG	
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Certificate No: D835V2-4d138_Apr21

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Date: 22.04.2021

DASY5 Validation Report for Head TSL

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d138

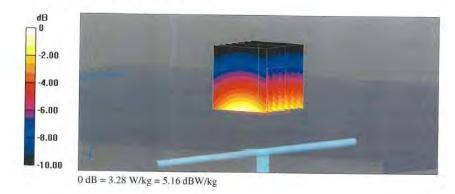
Communication System: UID 0 - CW; Frequency: 835 MHz Medium parameters used: f = 835 MHz; σ = 0.92 S/m; ϵ_r = 42.2; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(9.69, 9.69, 9.69) @ 835 MHz: Calibrated: 28.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.11.2020
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 63.47 V/m; Power Drift = -0.02 dB Peak SAR (extrapolated) = 3.74 W/kg SAR(1 g) = 2.47 W/kg; SAR(10 g) = 1.59 W/kg Smallest distance from peaks to all points 3 dB below = 16.3 mm Ratio of SAR at M2 to SAR at M1 = 66%Maximum value of SAR (measured) = 3.28 W/kg

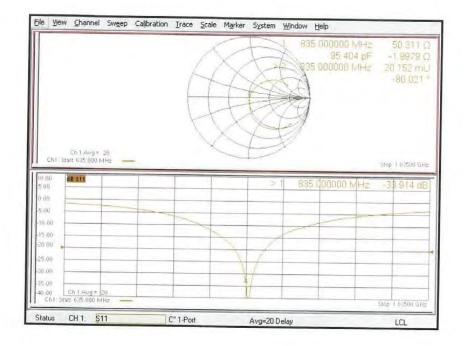


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Dt&C

Impedance Measurement Plot for Head TSL



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Engineering AG eughausstrasse 43, 8004 Zurich	y of h, Switzerland	Hac MRA	S Schweizerischer Kalibrierdienst Service sulsse d'étalonnage Servizio svizzero di taratura Swiss Calibration Service
Accredited by the Swiss Accreditation Service Autiliateral Agreement for the re	is one of the signatori	es to the EA	Accreditation No.: SCS 0108
CALIBRATION C	and the second s		No: D1900V2-5d158_Apr21
ALIBRATION	CHIFICATI		[m. see v.
Object	D1900V2 - SN:5	d158	The stream
Calibration procedure(s)	QA CAL-05.v11 Calibration Proce	edure for SAR Validation Source	es between 0.7-3 GHz
Calibration date:	April 22, 2021		
All calibrations have been conduct	ed in the closed laborato	ry facility: environment temperature (22 ± 3)°C and humidity < 70%.
alibration Equipment used (M&T)			
alibration Equipment used (M&T)	E critical for calibration)	ry facility: environment temperature (22 ± 3) Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292)	°C and humidity < 70%. Scheduled Calibration
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Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the car (frequency range of 300 MHz to 6 GHz)", July 2016
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed
 point exactly below the center marking of the flat phantom section, with the arms oriented
 parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole
 positioned under the liquid filled phantom. The impedance stated is transformed from the
 measurement at the SMA connector to the feed point. The Return Loss ensures low
 reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

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Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.9 ± 6 %	1.40 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.2 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	41.0 W/kg ± 17.0 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR averaged over 10 cm ³ (10 g) of Head TSL SAR measured	condition 250 mW input power	5.30 W/kg

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.3 Ω + 5.9 jΩ	
Return Loss	- 24.2 dB	

General Antenna Parameters and Design

Electrical Deleu (ene direction)	to refer the same
Electrical Delay (one direction)	1.201 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG

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DASY5 Validation Report for Head TSL

Date: 22.04.2021

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d158

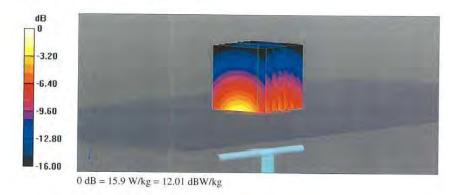
Communication System: UID 0 - CW; Frequency: 1900 MHz Medium parameters used: f = 1900 MHz; σ = 1.40 S/m; ϵ_r = 40.9; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.43, 8.43, 8.43) @ 1900 MHz; Calibrated: 28.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.11.2020
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 111.1 V/m; Power Drift = -0.00 dB Peak SAR (extrapolated) = 18.8 W/kg SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.30 W/kg Smallest distance from peaks to all points 3 dB below = 10 mm Ratio of SAR at M2 to SAR at M1 = 54.5% Maximum value of SAR (measured) = 15.9 W/kg

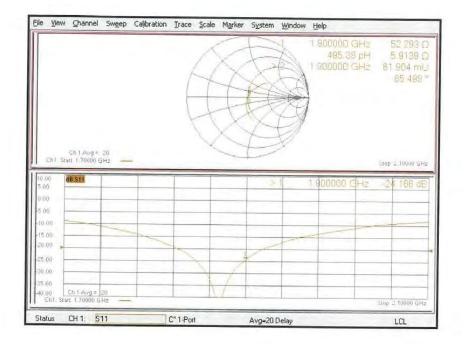


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Dt&C

Impedance Measurement Plot for Head TSL



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