PROBE CALIBRATION CERTIFICATES

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





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

Accreditation No.: SCS 0108

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Client

BACL

Certificate No: EX3-7441_Nov16

CALIBRATION CERTIFICATE

Object

EX3DV4 - SN:7441

Calibration procedure(s)

QA CAL-01.v9, QA CAL-12.v9, QA CAL-14.v4, QA CAL-23.v5,

QA CAL-25.v6

Calibration procedure for dosimetric E-field probes

Calibration date:

November 15, 2016

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: S5277 (20x)	05-Apr-16 (No. 217-02293)	Apr-17
Reference Probe ES3DV2	SN: 3013	31-Dec-15 (No. ES3-3013_Dec15)	Dec-16
DAE4	SN: 660	23-Dec-15 (No. DAE4-660_Dec15)	Dec-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-16)	In house check: Jun-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-16)	In house check: Oct-17

Name Function Signature

Jeton Kastrati Laboratory Technician

Approved by: Katja Pokovic Technical Manager

Issued: November 15, 2016

This calibration certificate shall not be reproduced except in full without written approval of the laboratory

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Glossary:

tissue simulating liquid TSL 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 o 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., 9 = 0 is normal to probe axis

Connector Angle information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

- 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
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- 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
- 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).

EX3DV4 - SN:7441 November 15, 2016

Probe EX3DV4

SN:7441

Manufactured: Calibrated:

May 31, 2016

November 15, 2016

Calibrated for DASY/EASY Systems (Note: non-compatible with DASY2 system!)

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DASY/EASY - Parameters of Probe: EX3DV4 - SN:7441

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k≈2)
Norm (µV/(V/m) ²) ^A	0.40	0.45	0.36	± 10.1 %
DCP (mV) ⁸	100.2	101.2	104.2	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	С	D dB	VR mV	Unc ^t (k=2)
0	CW	×	0.0	0.0	1.0	0.00	188.5	±3.5 %
		Y	0.0	0.0	1.0		177.8	
		Z	0.0	0.0	1.0		182.4	

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.

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:7441

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^C	Relative Permittivity F	Conductivity (S/m) F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unc (k=2)
150	52.3	0.76	13.25	13.25	13.25	0.00	1.00	± 13.3 %
450	43.5	0.87	10.98	10.98	10.98	0.02	1.20	± 13.3 %
750	41.9	0.89	10.73	10.73	10.73	0.53	0.85	± 12.0 %
900	41.5	0.97	10.22	10.22	10.22	0.41	0.96	± 12.0 %
17:50	40.1	1.37	8.92	8.92	8.92	0.35	0.80	± 12.0 %
1900	40.0	1.40	8.48	8.48	8.48	0.33	0.80	± 12.0 %
2450	39.2	1.80	7.85	7.85	7.85	0.35	0.84	± 12.0 %
2600	39.0	1.96	7.53	7.53	7.53	0.36	0.80	± 12.0 %
5250	35.9	4.71	5.67	5.67	5.67	0.35	1.80	± 13.1 %
5600	35.5	5.07	5.00	5.00	5.00	0.40	1.80	± 13.1 %
5800	35.3	5.27	5.11	5.11	5.11	0.40	1.80	± 13.1 %

^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. Above 5 GHz frequency validity can be extended to ± 110 MHz.

*All frequencies below 3 GHz, the validity of tissue parameters (s and o) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (s and o) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

*AlphaDepth 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: EX3DV4 - SN:7441

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ⁶ (mm)	Unc (k=2)
150	61.9	0.80	12.58	12.58	12.58	0.00	1.00	± 13.3 %
450	56.7	0.94	12.08	12.08	12.08	0.06	1.20	± 13.3 %
750	55.5	0.96	10.12	10.12	10.12	0.53	0.80	± 12.0 %
900	55.0	1.05	9.85	9.85	9.85	0.44	0.80	± 12.0 %
1750	53.4	1.49	8.25	8.25	8.25	0.37	0.80	± 12.0 %
1900	53.3	1.52	7.95	7.95	7.95	0.31	1.00	± 12.0 %
2450	52.7	1.95	7.67	7.67	7.67	0.36	0.80	± 12.0 %
2600	52.5	2.16	7.39	7.39	7.39	0.29	0.80	± 12.0 %
5250	48.9	5.36	5.24	5.24	5.24	0.40	1.90	± 13.1 %
5600	48.5	5.77	4.33	4.33	4.33	0.50	1.90	± 13.1 %
5800	48.2	6.00	4.48	4.48	4.48	0.50	1.90	± 13.1 %

^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. Above 5 GHz frequency validity can be extended to ± 110 MHz.

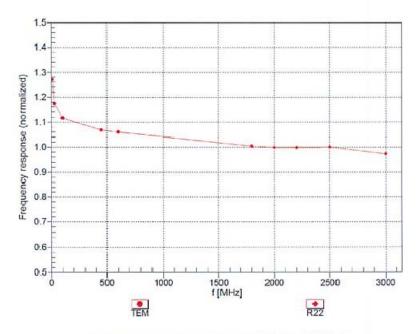
**A frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

**Apha/Deph 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 claimeter from the boundary.

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November 15, 2016

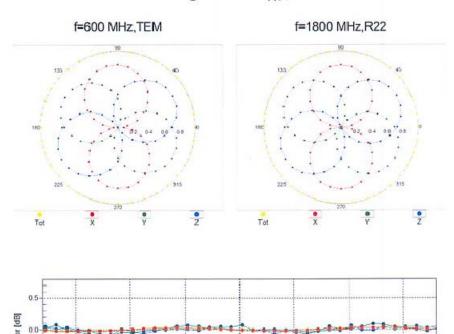
Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)



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

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



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

1800 MHz

2500 MHz

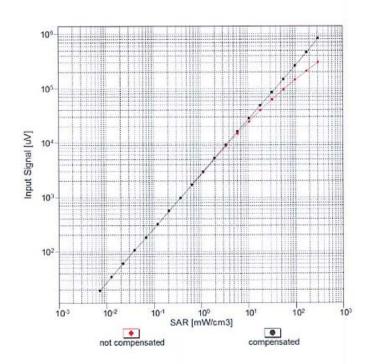
600 MHz

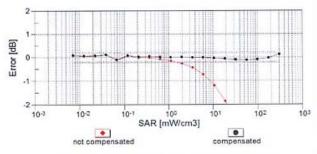
100 MHz

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Dynamic Range f(SAR_{head}) (TEM cell , f_{eval}= 1900 MHz)

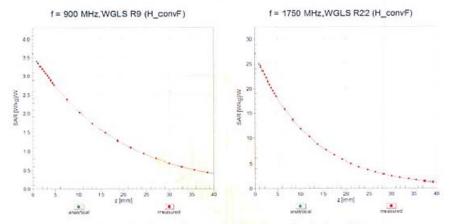




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

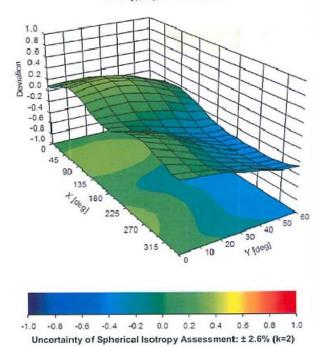
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Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (¢, 9), f = 900 MHz



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DASY/EASY - Parameters of Probe: EX3DV4 - SN:7441

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	102.1
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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DIPOLE CALIBRATION CERTIFICATES

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Niam DACI

Object	D450V3 - SN: 10	096	Report Horses
Calibration procedure(s)	QA CAL-15.v8 Calibration proce	edure for dipole validation kits bel	low 700 MHz
Calibration date:	November 07, 20	016	
The measurements and the unce	ertainties with confidence p	ional standards, which realize the physical ur probability are given on the following pages ar ry facility: environment temperature $(22 \pm 3)^6$	nd are part of the certificate.
Primary Standards	ID#	Cal Date (Certificate No.)	Scheduled Calibration
A CONTRACTOR OF THE PROPERTY O	SN: 104778	06-Apr-16 (No. 217-02288/02289)	An- 17
Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ET3DV6	SN: 103244 SN: 103245 SN: 5277 (20x) SN: 5047.2 / 06327 SN: 1507 SN: 654	06-Apr-16 (No. 217-02288) 06-Apr-16 (No. 217-02289) 05-Apr-16 (No. 217-02293) 05-Apr-16 (No. 217-02293) 05-Apr-16 (No. 217-02295) 31-Dec-15 (No. ET3-1507_Dec15) 12-Aug-16 (No. DAE4-654_Aug16)	Apr-17 Apr-17 Apr-17 Apr-17 Apr-17 Dec-16 Aug-17
Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ET3DV6 DAE4 Secondary Standards	SN: 103244 SN: 103245 SN: 5277 (20x) SN: 5047.2 / 06327 SN: 1507	06-Apr-16 (No. 217-02288) 06-Apr-16 (No. 217-02289) 05-Apr-16 (No. 217-02293) 05-Apr-16 (No. 217-02295) 31-Dec-15 (No. ET3-1507_Dec15) 12-Aug-16 (No. DAE4-654_Aug16)	Apr-17 Apr-17 Apr-17 Apr-17 Dec-16 Aug-17
Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ET3DV6 DAE4	SN: 103244 SN: 103245 SN: 5277 (20x) SN: 5047.2 / 06327 SN: 1507 SN: 654	06-Apr-16 (No. 217-02288) 06-Apr-16 (No. 217-02289) 05-Apr-16 (No. 217-02293) 05-Apr-16 (No. 217-02295) 31-Dec-15 (No. ET3-1507_Dec15)	Apr-17 Apr-17 Apr-17 Apr-17 Dec-16
Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ET3DV6 DAE4 Secondary Standards Power meter E4419B Power sensor E4412A RF generator HP 8648C	SN: 103244 SN: 103245 SN: 5277 (20x) SN: 5047.2 / 06327 SN: 1507 SN: 654 ID # SN: GB41293874 SN: MY41498087 SN: 000110210 SN: US3642U01700	06-Apr-16 (No. 217-02288) 06-Apr-16 (No. 217-02289) 05-Apr-16 (No. 217-02293) 05-Apr-16 (No. 217-02295) 31-Dec-15 (No. ET3-1507_Dec15) 12-Aug-16 (No. DAE4-654_Aug16) Check Date (in house) 06-Apr-16 (No. 217-02285/02284) 06-Apr-16 (No. 217-02285) 06-Apr-16 (No. 217-02284) 04-Aug-99 (in house check Jun-16)	Apr-17 Apr-17 Apr-17 Apr-17 Dec-16 Aug-17 Scheduled Check In house check: Jun-18
Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ET3DV6 DAE4 Secondary Standards Power meter E4419B Power sensor E4412A RF generator HP 8648C	SN: 103244 SN: 103245 SN: 5277 (20x) SN: 5047.2 / 06327 SN: 1507 SN: 654 ID # SN: GB41293874 SN: MY41498087 SN: 000110210 SN: US37390585	06-Apr-16 (No. 217-02288) 06-Apr-16 (No. 217-02289) 05-Apr-16 (No. 217-02293) 05-Apr-16 (No. 217-02295) 31-Dec-15 (No. ET3-1507_Dec15) 12-Aug-16 (No. DAE4-654_Aug16) Check Date (in house) 06-Apr-16 (No. 217-02285/02284) 06-Apr-16 (No. 217-02285) 06-Apr-16 (No. 217-02284) 04-Aug-99 (in house check Jun-16) 18-Oct-01 (in house check Oct-16)	Apr-17 Apr-17 Apr-17 Apr-17 Apr-17 Dec-16 Aug-17 Scheduled Check In house check: Jun-18 In house check: Jun-18 In house check: Jun-18

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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
- EC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- 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%.

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	ELI4 Flat Phantom	Shell thickness: 2 ± 0.2 mm
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	43.5	0.87 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	43.9 ± 6 %	0.87 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	1.13 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	4.53 W/kg ± 18.1 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	0.759 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	3.04 W/kg ± 17.6 % (k=2)

Body TSL parameters
The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	56.7	0.94 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	58.0 ± 6 %	0.96 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	1.15 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	4.55 W/kg ± 18.1 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	0.766 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	3.03 W/kg ± 17.6 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	57.7 Ω - 5.6 jΩ
Return Loss	- 21.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	54.2 Ω - 9.5 jΩ
Return Loss	- 20.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.346 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
Manufactured on	September 15, 2015

DASY5 Validation Report for Head TSL

Date: 07.11.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 450 MHz; Type: D450V3; Serial: D450V3 - SN: 1096

Communication System: UID 0 - CW; Frequency: 450 MHz

Medium parameters used: f = 450 MHz; $\sigma = 0.87 \text{ S/m}$; $\varepsilon_r = 43.9$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

Probe: ET3DV6 - SN1507; ConvF(6.58, 6.58, 6.58); Calibrated: 31.12.2015;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn654; Calibrated: 12.08.2016

Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1003

DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

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

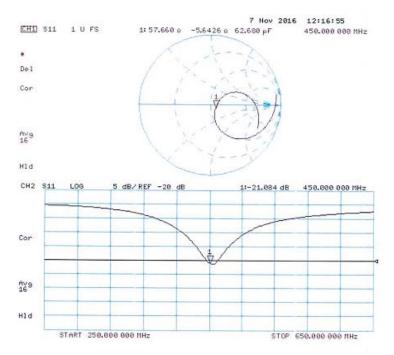
Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 39.51 V/m; Power Drift = -0.03 dB Peak SAR (extrapolated) = 1.61 W/kg SAR(1 g) = 1.13 W/kg; SAR(10 g) = 0.759 W/kg

Maximum value of SAR (measured) = 1.21 W/kg

-2.00 -4.00 -6.00 -8.00 -10.00

0 dB = 1.21 W/kg = 0.83 dBW/kg

Impedance Measurement Plot for Head TSL



Certificate No: D450V3-1096_Nov16

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DASY5 Validation Report for Body TSL

Date: 07.11.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 450 MHz D450V3; Type: D450V3; Serial: D450V3 - SN:1096

Communication System: UID 0 - CW; Frequency: 450 MHz

Medium parameters used: f = 450 MHz; $\sigma = 0.96 \text{ S/m}$; $\varepsilon_r = 58$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

Probe: ET3DV6 - SN1507; ConvF(6.99, 6.99, 6.99); Calibrated: 31.12.2015;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn654; Calibrated: 12.08.2016

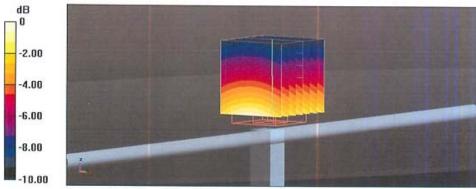
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1003

DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

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

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 36.76 V/m; Power Drift = -0.00 dB Peak SAR (extrapolated) = 1.80 W/kg SAR(1 g) = 1.15 W/kg; SAR(10 g) = 0.766 W/kg

Maximum value of SAR (measured) = 1.23 W/kg



0 dB = 1.23 W/kg = 0.90 dBW/kg

Impedance Measurement Plot for Body TSL

