

DASY5 Validation Report for Body TSL

Date: 19.07.2017

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d069

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used: f = 835 MHz; σ = 1.01 S/m; ϵ_r = 54.8; ρ = 1000 kg/m 3

Phantom section: Flat Section

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

DASY52 Configuration:

• Probe: EX3DV4 - SN7349; ConvF(10.2, 10.2, 10.2); Calibrated: 31.05.2017;

• Sensor-Surface: 1.4mm (Mechanical Surface Detection)

• Electronics: DAE4 Sn601; Calibrated: 28.03.2017

Phantom: Flat Phantom 4.9 (Back); Type: QD 00R P49 AA; Serial: 1005

• DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

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

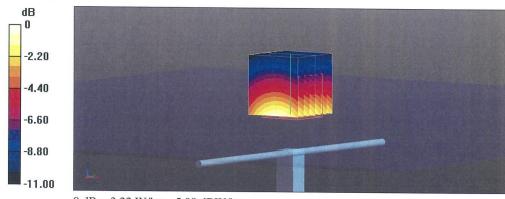
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 59.35 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 3.67 W/kg

SAR(1 g) = 2.43 W/kg; SAR(10 g) = 1.57 W/kg

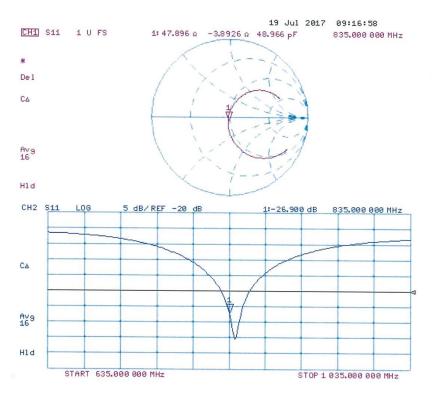
Maximum value of SAR (measured) = 3.22 W/kg



0 dB = 3.22 W/kg = 5.08 dBW/kg



Impedance Measurement Plot for Body TSL





1750 MHz Dipole Calibration Certificate

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





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S 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

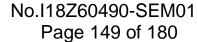
Client

CTTL-BJ (Auden)

Certificate No: D1750V2-1003_Jul17

CALIBRATION (JEHTH ICATI		
Object	D1750V2 - SN:1	003	
Calibration procedure(s)	QA CAL-05.v9		
	Calibration proce	edure for dipole validation kits abo	ove 700 MHz
Calibration date:	July 21, 2017		
his calibration certificate docum	ents the traceability to nat	ional standards, which realize the physical ur	nits of measurements (SI).
ne measurements and the unce	rtainties with confidence p	probability are given on the following pages ar	nd are part of the certificate.
All calibrations have been condu	cted in the closed laborato	ry facility: environment temperature (22 \pm 3) $^{\circ}$	C and humidity < 70%
		, , , , , , , , , , , , , , , , , , , ,	o and namidity < 70%.
Calibration Equipment used (M&	ΓE critical for calibration)		
rimary Standards	ID#	Cal Date (Certificate No.)	Scheduled Calibration
ower meter NRP	SN: 104778	04-Apr-17 (No. 217-02521/02522)	Apr-18
ower sensor NRP-Z91	SN: 103244	04-Apr-17 (No. 217-02521)	Apr-18
ower sensor NRP-Z91	SN: 103245	04-Apr-17 (No. 217-02522)	Apr-18
leference 20 dB Attenuator	SN: 5058 (20k)	07-Apr-17 (No. 217-02528)	Apr-18
ype-N mismatch combination	SN: 5047.2 / 06327	07-Apr-17 (No. 217-02529)	Apr-18
Reference Probe EX3DV4	SN: 7349	31-May-17 (No. EX3-7349_May17)	May-18
AE4	SN: 601	28-Mar-17 (No. DAE4-601_Mar17)	Mar-18
econdary Standards	ID#	Check Date (in house)	Scheduled Check
	SN: GB37480704	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
ower meter EPM-442A			
and the second s	SN: US37292783	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
ower sensor HP 8481A	SN: US37292783 SN: MY41092317	07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16)	
ower sensor HP 8481A ower sensor HP 8481A		The state of the s	In house check: Oct-18
ower meter EPM-442A ower sensor HP 8481A ower sensor HP 8481A F generator R&S SMT-06 letwork Analyzer HP 8753E	SN: MY41092317	07-Oct-15 (in house check Oct-16)	In house check: Oct-18 In house check: Oct-18
ower sensor HP 8481A lower sensor HP 8481A IF generator R&S SMT-06	SN: MY41092317 SN: 100972	07-Oct-15 (in house check Oct-16) 15-Jun-15 (in house check Oct-16)	In house check: Oct-18 In house check: Oct-18 In house check: Oct-17
ower sensor HP 8481A ower sensor HP 8481A F generator R&S SMT-06 etwork Analyzer HP 8753E	SN: MY41092317 SN: 100972 SN: US37390585	07-Oct-15 (in house check Oct-16) 15-Jun-15 (in house check Oct-16) 18-Oct-01 (in house check Oct-16)	In house check: Oct-18 In house check: Oct-18 In house check: Oct-18 In house check: Oct-17 Signature
ower sensor HP 8481A lower sensor HP 8481A IF generator R&S SMT-06	SN: MY41092317 SN: 100972 SN: US37390585	07-Oct-15 (in house check Oct-16) 15-Jun-15 (in house check Oct-16) 18-Oct-01 (in house check Oct-16) Function	In house check: Oct-18 In house check: Oct-18 In house check: Oct-17
ower sensor HP 8481A ower sensor HP 8481A IF generator R&S SMT-06 letwork Analyzer HP 8753E	SN: MY41092317 SN: 100972 SN: US37390585	07-Oct-15 (in house check Oct-16) 15-Jun-15 (in house check Oct-16) 18-Oct-01 (in house check Oct-16) Function	In house check: Oct-18 In house check: Oct-18 In house check: Oct-17
ower sensor HP 8481A lower sensor HP 8481A RF generator R&S SMT-06 letwork Analyzer HP 8753E	SN: MY41092317 SN: 100972 SN: US37390585 Name Michael Weber	07-Oct-15 (in house check Oct-16) 15-Jun-15 (in house check Oct-16) 18-Oct-01 (in house check Oct-16) Function Laboratory Technician	In house check: Oct-18 In house check: Oct-18 In house check: Oct-17

Certificate No: D1750V2-1003_Jul17



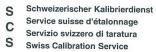


Calibration Laboratory of

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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%.

Certificate No: D1750V2-1003_Jul17 Page 2 of 8



Measurement Conditions

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

DASY Version	DASY5	V52.10.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy , $dz = 5 mm$	S S S S S S S S S S S S S S S S S S S
Frequency	1750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.0 ± 6 %	1.35 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	9.15 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	36.7 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.84 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	19.4 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	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.3 ± 6 %	1.49 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		1

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.29 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	37.1 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	4.94 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	19.8 W/kg ± 16.5 % (k=2)

Certificate No: D1750V2-1003_Jul17



Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.9 Ω + 1.1 jΩ	<u> </u>
Return Loss	- 37.1 dB	2

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.0 Ω + 0.1 jΩ
Return Loss	- 30.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.213 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	July 30, 2008	

Certificate No: D1750V2-1003_Jul17



DASY5 Validation Report for Head TSL

Date: 21.07.2017

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1003

Communication System: UID 0 - CW; Frequency: 1750 MHz

Medium parameters used: f = 1750 MHz; $\sigma = 1.35$ S/m; $\epsilon_r = 39$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

• Probe: EX3DV4 - SN7349; ConvF(8.73, 8.73, 8.73); Calibrated: 31.05.2017;

• Sensor-Surface: 1.4mm (Mechanical Surface Detection)

• Electronics: DAE4 Sn601; Calibrated: 28.03.2017

Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001

• DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

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

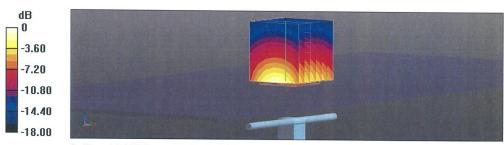
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 104.4 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 17.0 W/kg

SAR(1 g) = 9.15 W/kg; SAR(10 g) = 4.84 W/kg

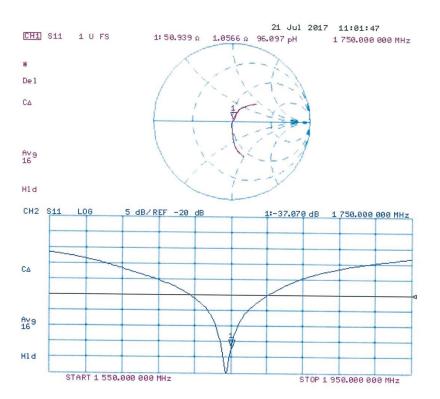
Maximum value of SAR (measured) = 14.0 W/kg



0 dB = 14.0 W/kg = 11.46 dBW/kg



Impedance Measurement Plot for Head TSL





DASY5 Validation Report for Body TSL

Date: 20.07.2017

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1003

Communication System: UID 0 - CW; Frequency: 1750 MHz

Medium parameters used: f = 1750 MHz; $\sigma = 1.49$ S/m; $\epsilon_r = 53.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

• Probe: EX3DV4 - SN7349; ConvF(8.46, 8.46, 8.46); Calibrated: 31.05.2017;

• Sensor-Surface: 1.4mm (Mechanical Surface Detection)

• Electronics: DAE4 Sn601; Calibrated: 28.03.2017

Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002

• DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

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

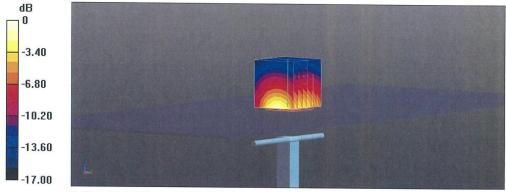
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 99.34 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 16.4 W/kg

SAR(1 g) = 9.29 W/kg; SAR(10 g) = 4.94 W/kg

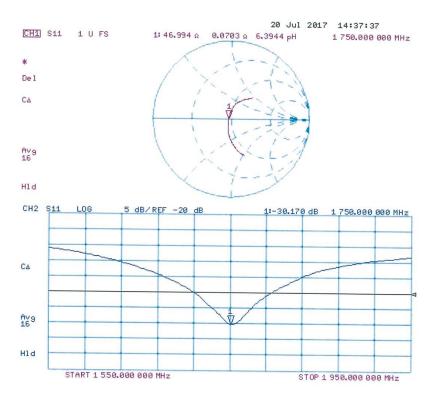
Maximum value of SAR (measured) = 13.4 W/kg



0 dB = 13.4 W/kg = 11.27 dBW/kg



Impedance Measurement Plot for Body TSL





1900 MHz Dipole Calibration Certificate

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





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Client

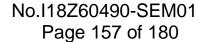
CTTL-BJ (Auden)

Certificate No: D1900V2-5d101_Jul17

CALIBRATION C	ERTIFICATE		
Object	D1900V2 - SN:50	1101	
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz		
Calibration date:	July 26, 2017		
	cted in the closed laborato	robability are given on the following pages an ry facility: environment temperature (22 \pm 3)°C	
Primary Standards	ID#	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-17 (No. 217-02521/02522)	Apr-18
Power sensor NRP-Z91	SN: 103244	04-Apr-17 (No. 217-02521)	Apr-18
Power sensor NRP-Z91	SN: 103245	04-Apr-17 (No. 217-02522)	Apr-18
Reference 20 dB Attenuator	SN: 5058 (20k)	07-Apr-17 (No. 217-02528)	Apr-18
Type-N mismatch combination	SN: 5047.2 / 06327	07-Apr-17 (No. 217-02529)	Apr-18
Reference Probe EX3DV4	SN: 7349	31-May-17 (No. EX3-7349_May17)	May-18
	SN: 601	28-Mar-17 (No. DAE4-601_Mar17)	Mar-18
DAE4			mai 10
DAE4 Secondary Standards	ID#	Check Date (in house)	Scheduled Check
Secondary Standards	ID # SN: GB37480704	Check Date (in house) 07-Oct-15 (in house check Oct-16)	
Secondary Standards Power meter EPM-442A Power sensor HP 8481A	SN: GB37480704 SN: US37292783	07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16)	Scheduled Check In house check: Oct-18 In house check: Oct-18
Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A	SN: GB37480704 SN: US37292783 SN: MY41092317	07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16)	Scheduled Check In house check: Oct-18 In house check: Oct-18 In house check: Oct-18
Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	SN: GB37480704 SN: US37292783 SN: MY41092317 SN: 100972	07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 15-Jun-15 (in house check Oct-16)	Scheduled Check In house check: Oct-18 In house check: Oct-18 In house check: Oct-18 In house check: Oct-18
Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	SN: GB37480704 SN: US37292783 SN: MY41092317	07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16)	Scheduled Check In house check: Oct-18 In house check: Oct-18 In house check: Oct-18
Secondary Standards Power meter EPM-442A Power sensor HP 8481A	SN: GB37480704 SN: US37292783 SN: MY41092317 SN: 100972	07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 15-Jun-15 (in house check Oct-16)	Scheduled Check In house check: Oct-18 In house check: Oct-18 In house check: Oct-18 In house check: Oct-18 In house check: Oct-17 Signature
Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	SN: GB37480704 SN: US37292783 SN: MY41092317 SN: 100972 SN: US37390585	07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 15-Jun-15 (in house check Oct-16) 18-Oct-01 (in house check Oct-16)	Scheduled Check In house check: Oct-18 In house check: Oct-18 In house check: Oct-18 In house check: Oct-18 In house check: Oct-17 Signature
Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer HP 8753E Calibrated by:	SN: GB37480704 SN: US37292783 SN: MY41092317 SN: 100972 SN: US37390585 Name Johannes Kurikka	07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 15-Jun-15 (in house check Oct-16) 18-Oct-01 (in house check Oct-16) Function Laboratory Technician	Scheduled Check In house check: Oct-18 In house check: Oct-18 In house check: Oct-18 In house check: Oct-18 In house check: Oct-17 Signature
Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer HP 8753E	SN: GB37480704 SN: US37292783 SN: MY41092317 SN: 100972 SN: US37390585	07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 15-Jun-15 (in house check Oct-16) 18-Oct-01 (in house check Oct-16) Function	Scheduled Check In house check: Oct-18 In house check: Oct-18 In house check: Oct-18 In house check: Oct-18 In house check: Oct-17

Certificate No: D1900V2-5d101_Jul17

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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

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%.

Certificate No: D1900V2-5d101 Jul17 Page 2 of 8



Measurement Conditions

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

DASY Version	DASY5	V52.10.0
Extrapolation	Advanced Extrapolation	No.
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	40.7 ± 6 %	1.39 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	9.93 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	40.0 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	W 300.0
SAR measured	250 mW input power	5.23 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	21.0 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	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.1 ± 6 %	1.50 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	10.0 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	40.5 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.33 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.5 W/kg ± 16.5 % (k=2)

Certificate No: D1900V2-5d101_Jul17



Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.7 Ω + 5.8 jΩ
Return Loss	- 24.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$46.2 \Omega + 6.6 jΩ$
Return Loss	- 22.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.203 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	March 28, 2008

Certificate No: D1900V2-5d101_Jul17



DASY5 Validation Report for Head TSL

Date: 26.07.2017

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d101

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used: f = 1900 MHz; $\sigma = 1.39 \text{ S/m}$; $\varepsilon_r = 40.7$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.43, 8.43, 8.43); Calibrated: 31.05.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 28.03.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

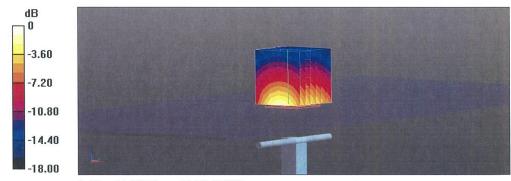
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 106.3 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 18.4 W/kg

SAR(1 g) = 9.93 W/kg; SAR(10 g) = 5.23 W/kg

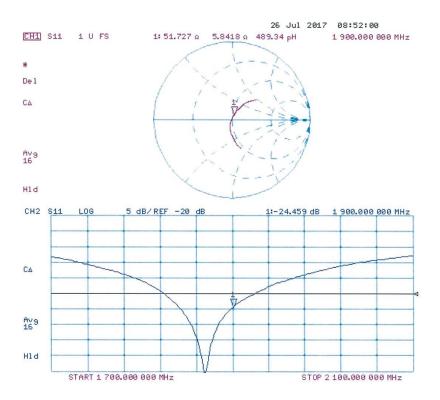
Maximum value of SAR (measured) = 14.9 W/kg



0 dB = 14.9 W/kg = 11.73 dBW/kg



Impedance Measurement Plot for Head TSL





DASY5 Validation Report for Body TSL

Date: 26.07.2017

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d101

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used: f = 1900 MHz; $\sigma = 1.5 \text{ S/m}$; $\varepsilon_r = 54.1$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

• Probe: EX3DV4 - SN7349; ConvF(8.2, 8.2, 8.2); Calibrated: 31.05.2017;

• Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn601; Calibrated: 28.03.2017

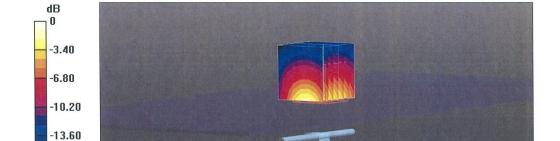
Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002

• DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

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

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 101.8 V/m; Power Drift = -0.09 dB Peak SAR (extrapolated) = 17.6 W/kg SAR(1 g) = 10 W/kg; SAR(10 g) = 5.33 W/kg

Maximum value of SAR (measured) = 14.4 W/kg



0 dB = 14.4 W/kg = 11.58 dBW/kg

-17.00



Impedance Measurement Plot for Body TSL

