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Calibration Laboratory of Schmid & Partner Engineering AG

Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst C Service suisse d'étalonnage

Servizio svizzero di taratura

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

Glossary:

TSLtissue simulating liquidConvFsensitivity in TSL / NORM x,y,zN/Anot 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, "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%.

Certificate No: D1750V2-1023_Jun15



Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
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 %	1.37 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	9.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	37.2 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	5.00 W/kg

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	51.3 ± 6 %	1.49 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	9.48 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	37.6 W/kg ± 17.0 % (k=2)

SAR averaged over 10 \mbox{cm}^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.12 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.4 W/kg ± 16.5 % (k=2)

Certificate No: D1750V2-1023_Jun15



Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.8 Ω + 0.6 jΩ	
Return Loss	- 40.3 dB	

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.9 Ω + 0.6 jΩ
Return Loss	- 29.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.218 ns	
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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	August 20, 2009	1

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DASY5 Validation Report for Head TSL

Date: 23.06.2015

Test Laboratory: SPEAG, Zurich, Switzerland

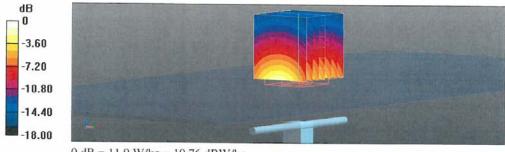
DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1023

Communication System: UID 0 - CW; Frequency: 1750 MHz Medium parameters used: f = 1750 MHz; σ = 1.37 S/m; ε_r = 39; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 SN3205; ConvF(5.2, 5.2, 5.2); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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 = 95.92 V/m; Power Drift = 0.03 dB Peak SAR (extrapolated) = 16.8 W/kg SAR(1 g) = 9.37 W/kg; SAR(10 g) = 5 W/kg Maximum value of SAR (measured) = 11.9 W/kg



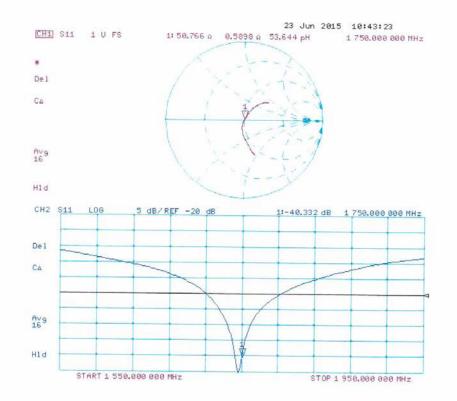
0 dB = 11.9 W/kg = 10.76 dBW/kg

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Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL

Date: 23.06.2015

Test Laboratory: SPEAG, Zurich, Switzerland

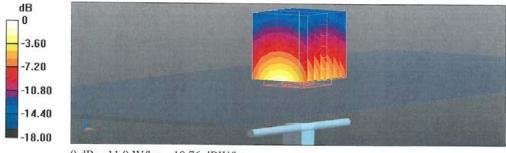
DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1023

Communication System: UID 0 - CW; Frequency: 1750 MHz Medium parameters used: f = 1750 MHz; σ = 1.49 S/m; ϵ_r = 51.3; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 SN3205; ConvF(4.88, 4.88, 4.88); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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 = 93.37 V/m; Power Drift = 0.00 dB Peak SAR (extrapolated) = 16.2 W/kg SAR(1 g) = 9.48 W/kg; SAR(10 g) = 5.12 W/kg Maximum value of SAR (measured) = 11.9 W/kg



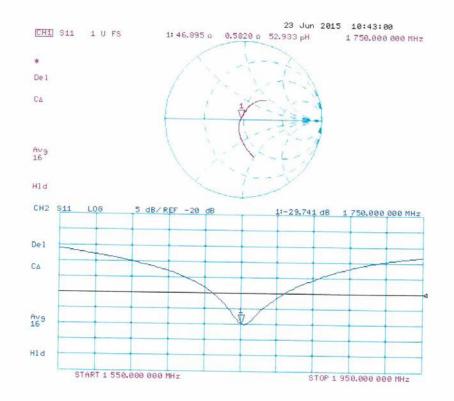
0 dB = 11.9 W/kg = 10.76 dBW/kg

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Impedance Measurement Plot for Body TSL



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1900 MHz Dipole Calibration Certificate

	Accreditation No.: SCS 0108 Certificate No: D1900V2-5d142_Jun15
Client Auden	Certificate No: D1900V2-5d142_Jun15
Object D1900V2 - SN: 5d142	
	Salution in working the
Calibration procedure(s) QA CAL-05.v9 Calibration procedure for dipole valida	ation kits above 700 MHz
Calibration date: June 23, 2015	
	erature (22 \pm 3)°C and humidity < 70%.
Calibration Equipment used (M&TE critical for calibration)	rature (22 ± 3)°C and humidity < 70%.
Calibration Equipment used (M&TE critical for calibration) Primary Standards ID # Cal Date (Certificate No.)	Scheduled Calibration
Calibration Equipment used (M&TE critical for calibration) Primary Standards ID # Cal Date (Certificate No.) Power meter EPM-442A GB37480704 07-Oct-14 (No. 217-02020 UP 07-0ct-14 (No. 217-02020	Scheduled Calibration) Oct-15
Calibration Equipment used (M&TE critical for calibration) Primary Standards ID # Cal Date (Certificate No.) Power meter EPM-442A GB37480704 07-Oct-14 (No. 217-02020 Power sensor HP 8481A US37292783 07-Oct-14 (No. 217-02020	Scheduled Calibration) Oct-15) Oct-15
Calibration Equipment used (M&TE critical for calibration) Primary Standards ID # Cal Date (Certificate No.) Power meter EPM-442A GB37480704 07-Oct-14 (No. 217-02020 Power sensor HP 8481A US37292783 07-Oct-14 (No. 217-02020 Power sensor HP 8481A MY41092317 07-Oct-14 (No. 217-02021	Scheduled Calibration) Oct-15) Oct-15) Oct-15
Calibration Equipment used (M&TE critical for calibration) Primary Standards ID # Cal Date (Certificate No.) Power meter EPM-442A GB37480704 07-Oct-14 (No. 217-02020 Power sensor HP 8481A US37292783 07-Oct-14 (No. 217-02020 Power sensor HP 8481A MY41092317 07-Oct-14 (No. 217-02021 Reference 20 dB Attenuator SN: 5058 (20k) 01-Apr-15 (No. 217-02131	Scheduled Calibration 0 Oct-15 0 Oct-15 0 Oct-15 0 Mar-16
Calibration Equipment used (M&TE critical for calibration) Primary Standards ID # Cal Date (Certificate No.) Power meter EPM-442A GB37480704 07-Oct-14 (No. 217-02020 Power sensor HP 8481A US37292783 07-Oct-14 (No. 217-02020 Power sensor HP 8481A MY41092317 07-Oct-14 (No. 217-02021 Performed 20 dB Attenuator SN: 5058 (20k) 01-Apr-15 (No. 217-02131 Syster N mismatch combination SN: 5047.2 / 06327 01-Apr-15 (No. 217-02134	Scheduled Calibration) Oct-15) Oct-15) Oct-15) Oct-16) Mar-16) Mar-16
Description Cal Date (Certificate No.) Primary Standards ID # Cal Date (Certificate No.) Power meter EPM-442A GB37480704 07-Oct-14 (No. 217-02020 Power sensor HP 8481A US37292783 07-Oct-14 (No. 217-02020 Power sensor HP 8481A MY41092317 07-Oct-14 (No. 217-02021 Power sensor HP 8481A MY41092317 07-Oct-15 (No. 217-02131 Reference 20 dB Attenuator SN: 5056 (20k) 01-Apr-15 (No. 217-02134 Sype-N mismatch combination SN: 5047.2 / 06327 01-Apr-15 (No. 217-02134 Reference Probe ES3DV3 SN: 3205 30-Dec-14 (No. ES3-3205	Scheduled Calibration) Oct-15) Oct-15) Oct-15) Oct-16) Mar-16) Dec-15
Description Cal Date (Certificate No.) Primary Standards ID # Cal Date (Certificate No.) Power meter EPM-442A GB37480704 07-Oct-14 (No. 217-02020 Power sensor HP 8481A US37292783 07-Oct-14 (No. 217-02020 Power sensor HP 8481A MY41092317 07-Oct-14 (No. 217-02021 Power sensor HP 8481A MY41092317 07-Oct-15 (No. 217-02021 Reference 20 dB Attenuator SN: 5056 (20k) 01-Apr-15 (No. 217-02131 Type-N mismatch combination SN: 5047.2 / 06327 01-Apr-15 (No. 217-02134 Reference Probe ES3DV3 SN: 3205 30-Dec-14 (No. ES3-3205 OAE4 SN: 601 18-Aug-14 (No. DAE4-601	Scheduled Calibration) Oct-15) Oct-15) Oct-15) Oct-16) Mar-16) Mar-16 _Dec14) Dec-15 _Aug14) Aug-15
Calibration Equipment used (M&TE critical for calibration) Primary Standards ID # Cal Date (Certificate No.) Power meter EPM-442A GB37480704 07-Oct-14 (No. 217-02020 Power sensor HP 8481A US37292783 07-Oct-14 (No. 217-02020 Power sensor HP 8481A MY41092317 07-Oct-14 (No. 217-02020 Power sensor HP 8481A MY41092317 07-Oct-14 (No. 217-02020 Reference 20 dB Attenuator SN: 5058 (20k) 01-Apr-15 (No. 217-02131 Type-N mismatch combination SN: 50547.2 / 06327 01-Apr-15 (No. 217-02134 Reference Probe ES3DV3 SN: 3205 30-Dec-14 (No. ES3-3205, DAE4 SN: 601 18-Aug-14 (No. DAE4-601	Scheduled Calibration 0 Oct-15 0 Oct-15 0 Oct-15 0 Mar-16 0 Dec-15
Calibration Equipment used (M&TE critical for calibration) Primary Standards ID # Cal Date (Certificate No.) Power meter EPM-442A GB37480704 07-Oct-14 (No. 217-02020 Power sensor HP 8481A US37292783 07-Oct-14 (No. 217-02020 Power sensor HP 8481A MY41092317 07-Oct-14 (No. 217-02021 Reference 20 dB Attenuator SN: 5058 (20k) 01-Apr-15 (No. 217-02131 Type-N mismatch combination SN: 5047.2 / 06327 01-Apr-15 (No. 217-02134 Reference Probe ES3DV3 SN: 3205 30-Dec-14 (No. ES3-3205) DAE4 SN: 601 18-Aug-14 (No. DAE4-601 Secondary Standards ID # Check Date (in house) RF generator R&S SMT-06 100005 04-Aug-99 (in house check	Scheduled Calibration 0 Oct-15 0 Oct-15 0 Oct-15 0 Oct-16 0 Mar-16 0 Dec-15
Calibration Equipment used (M&TE critical for calibration) Primary Standards ID # Cal Date (Certificate No.) Power meter EPM-442A GB37480704 07-Oct-14 (No. 217-02020 Power sensor HP 8481A US37292783 07-Oct-14 (No. 217-02020 Power sensor HP 8481A MY41092317 07-Oct-14 (No. 217-02020 Reference 20 dB Attenuator SN: 5058 (20k) 01-Apr-15 (No. 217-02131 Type-N mismatch combination SN: 5047.2 / 06327 01-Apr-15 (No. 217-02134 Reference Probe ES3DV3 SN: 3025 30-Dec-14 (No. ES3-3205; DAE4 SN: 601 18-Aug-14 (No. DAE4-601 Secondary Standards ID # Check Date (in house) RF generator R&S SMT-06 100005 04-Aug-99 (in house check	Scheduled Calibration 0 Oct-15 0 Oct-15 0 Oct-15 0 Oct-15 0 Oct-15 0 Mar-16
Calibration Equipment used (M&TE critical for calibration) Primary Standards ID # Cal Date (Certificate No.) Power meter EPM-442A GB37480704 07-Oct-14 (No. 217-02020 Power sensor HP 8481A US37292783 07-Oct-14 (No. 217-02020 Power sensor HP 8481A MY41092317 07-Oct-14 (No. 217-02021 Reference 20 dB Attenuator SN: 5058 (20k) 01-Apr-15 (No. 217-02134 Type-N mismatch combination SN: 5047.2 / 06327 01-Apr-15 (No. 217-02134 Reference Probe ES3DV3 SN: 3205 30-Dec-14 (No. DAE4-601 Secondary Standards ID # Check Date (in house) RF generator R&S SMT-06 100005 04-Aug-99 (in house check Network Analyzer HP 8753E US37390585 S4206 18-Oct-01 (in house check	Scheduled Calibration 0) Oct-15 0) Oct-15 0) Oct-15 0) Oct-15 0) Oct-15 0) Mar-16
Calibration Equipment used (M&TE critical for calibration) Primary Standards ID # Cal Date (Certificate No.) Power meter EPM-442A GB37480704 07-Oct-14 (No. 217-02020 Power sensor HP 8481A US37292783 07-Oct-14 (No. 217-02020 Power sensor HP 8481A MY41092317 07-Oct-14 (No. 217-02021 Reference 20 dB Attenuator SN: 5058 (20k) 01-Apr-15 (No. 217-02131 SN: 5047.2 / 06327 01-Apr-15 (No. 217-02134 Reference Probe ES3DV3 SN: 3205 30-Dec-14 (No. ES3-3205) DAE4 SN: 601 18-Aug-14 (No. DAE4-601 Secondary Standards ID # Check Date (in house) RF generator R&S SMT-06 100005 04-Aug-99 (in house check Network Analyzer HP 8753E VS37390585 S4206 18-Oct-01 (in house check	Scheduled Calibration 0 Oct-15 0 Oct-15 0 Oct-15 0 Oct-15 0 Oct-16 0 Mar-16 0 Dec-15 _Aug14) Aug-15 Scheduled Check Cot-13 0 In house check: Oct-16 Oct-14) In house check: Oct-15



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



Schweizerischer Kalibrierdienst Service suisse d'étalonnage

С Servizio svizzero di taratura S

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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 ConvF

tissue simulating liquid 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, "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%.

Certificate No: D1900V2-5d142_Jun15

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Measurement Conditions

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

DASY Version	DASY5	V52.8.8
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	39.0 ± 6 %	1.38 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	40.9 W/kg ± 17.0 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.36 W/kg

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	52.7 ± 6 %	1.53 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	10.3 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	40.9 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.48 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.8 W/kg ± 16.5 % (k=2)

Certificate No: D1900V2-5d142_Jun15



Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.7 Ω + 6.0 jΩ
Return Loss	- 23.9 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.6 Ω + 6.9 jΩ	
Return Loss	- 22.9 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.197 ns
	1.107 113

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 11, 2011



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DASY5 Validation Report for Head TSL

Date: 23.06.2015

Test Laboratory: SPEAG, Zurich, Switzerland

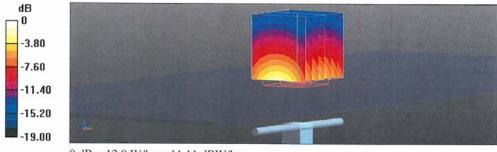
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d142

Communication System: UID 0 - CW; Frequency: 1900 MHz Medium parameters used: f = 1900 MHz; σ = 1.38 S/m; ϵ_r = 39; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 SN3205; ConvF(5, 5, 5); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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 = 99.41 V/m; Power Drift = 0.03 dB Peak SAR (extrapolated) = 18.5 W/kg SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.36 W/kg Maximum value of SAR (measured) = 12.9 W/kg



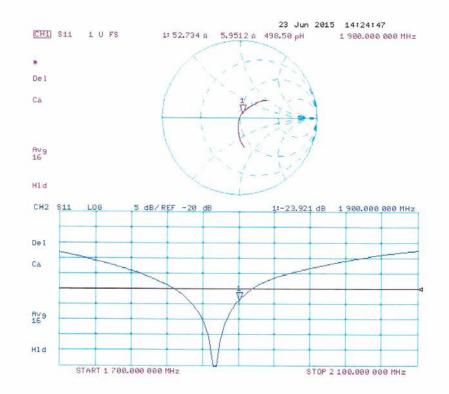
0 dB = 12.9 W/kg = 11.11 dBW/kg

Certificate No: D1900V2-5d142_Jun15

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Impedance Measurement Plot for Head TSL



Certificate No: D1900V2-5d142_Jun15

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DASY5 Validation Report for Body TSL

Date: 23.06.2015

Test Laboratory: SPEAG, Zurich, Switzerland

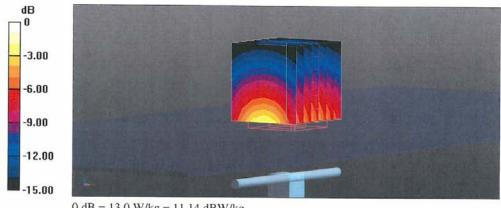
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d142

Communication System: UID 0 - CW; Frequency: 1900 MHz Medium parameters used: f = 1900 MHz; σ = 1.53 S/m; ε_r = 52.7; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 SN3205; ConvF(4.65, 4.65, 4.65); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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 = 96.53 V/m; Power Drift = -0.02 dB Peak SAR (extrapolated) = 17.4 W/kg SAR(1 g) = 10.3 W/kg; SAR(10 g) = 5.48 W/kg Maximum value of SAR (measured) = 13.0 W/kg



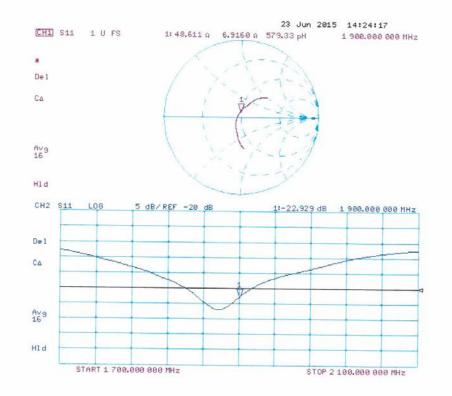
0 dB = 13.0 W/kg = 11.14 dBW/kg

Certificate No: D1900V2-5d142_Jun15

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Impedance Measurement Plot for Body TSL



Certificate No: D1900V2-5d142_Jun15

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2450 MHz Dipole Calibration Certificate

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



S Schweizerischer Kalibrierdienst Service suisse d'étalonnage

- C Service suisse d'étalonnage Servizio svizzero di taratura
- Servizio Svizzero di tarato 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

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, "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%.

Certificate No: D2450V2-869_Jun15

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Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.2 ± 6 %	1.88 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	13.8 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	53.8 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	6.40 W/kg

Body TSL parameters The following parameters and calculations were applied.

<u> </u>	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	50.9 ± 6 %	2.04 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	13.5 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	52.4 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.28 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	24.7 W/kg ± 16.5 % (k=2)

Certificate No: D2450V2-869_Jun15



Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.8 Ω + 4.8 jΩ
Return Loss	- 23.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.3 Ω + 6.8 jΩ
Return Loss	- 23.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.160 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	August 18, 2010



DASY5 Validation Report for Head TSL

Date: 19.06.2015

Test Laboratory: SPEAG, Zurich, Switzerland

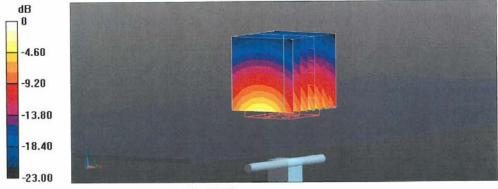
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:869

Communication System: UID 0 - CW; Frequency: 2450 MHz Medium parameters used: f = 2450 MHz; σ = 1.88 S/m; ϵ_r = 38.2; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 SN3205; ConvF(4.54, 4.54, 4.54); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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 = 101.5 V/m; Power Drift = 0.03 dB Peak SAR (extrapolated) = 28.7 W/kg SAR(1 g) = 13.8 W/kg; SAR(10 g) = 6.4 W/kg Maximum value of SAR (measured) = 18.1 W/kg



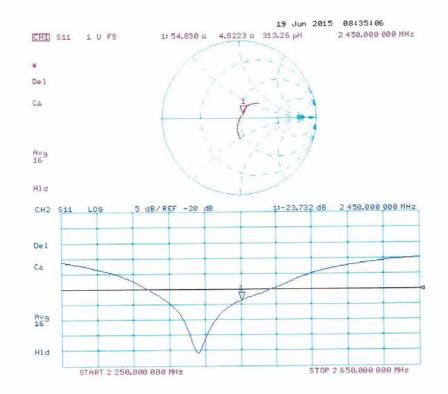
0 dB = 18.1 W/kg = 12.58 dBW/kg

Certificate No: D2450V2-869_Jun15

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Impedance Measurement Plot for Head TSL



Certificate No: D2450V2-869_Jun15

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DASY5 Validation Report for Body TSL

Date: 19.06.2015

Test Laboratory: SPEAG, Zurich, Switzerland

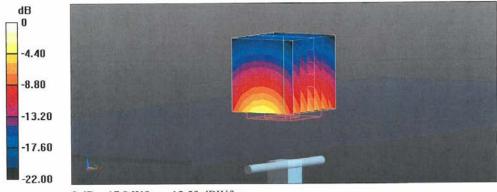
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:869

Communication System: UID 0 - CW; Frequency: 2450 MHz Medium parameters used: f = 2450 MHz; σ = 2.04 S/m; ϵ_r = 50.9; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 SN3205; ConvF(4.32, 4.32, 4.32); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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 = 96.50 V/m; Power Drift = 0.00 dB Peak SAR (extrapolated) = 28.2 W/kg SAR(1 g) = 13.5 W/kg; SAR(10 g) = 6.28 W/kg Maximum value of SAR (measured) = 17.9 W/kg



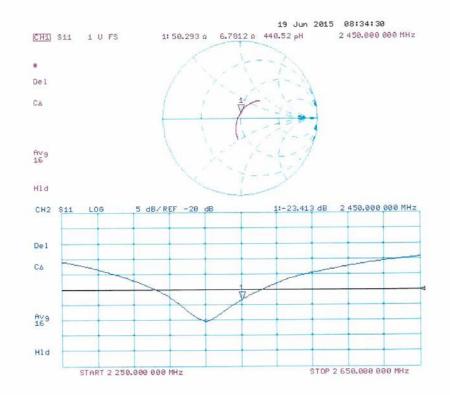
0 dB = 17.9 W/kg = 12.53 dBW/kg

Certificate No: D2450V2-869_Jun15

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Impedance Measurement Plot for Body TSL



Certificate No: D2450V2-869_Jun15

Page 8 of 8



2600 MHz Dipole Calibration Certificate

chmid & Partner Engineering AG ughausstrasse 43, 8004 Zurich	, Switzerland	C C C C C C C C C C C C C C C C C C C	Schweizerischer Kalibrierdienst Service suisse d'étalonnage Servizio svizzero di taratura Swiss Calibration Service
ccredited by the Swiss Accreditation Service			No.: SCS 108
ultilateral Agreement for the re-		certificates	: D2600V2-1012_Jul14
CTTL (Auden)	EDTIEICATE		. 0200072-1012_00114
ALIBRATION			
Dbject	D2600V2 - SN: 10	012	
Calibration procedure(s)	QA CAL-05.v9 Calibration proces	dure for dipole validation kits abo	ove 700 MHz
Calibration date:	July 16, 2014		
The measurements and the unce	rtainties with confidence p	onal standards, which realize the physical ur robability are given on the following pages ar y facility: environment temperature $(22 \pm 3)^{\circ}$	nd are part of the certificate.
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The measurements and the uncert All calibrations have been conduct Calibration Equipment used (M&T Primary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination	tainties with confidence provided in the closed laborator (E critical for calibration) ID # GB37480704 US37292783 MY41092317 SN: 5058 (20k) SN: 5047.2 / 06327	Cal Date (Certificate No.) 09-Oct-13 (No. 217-01827) 09-Oct-13 (No. 217-01828) 03-Apr-14 (No. 217-01921)	nd are part of the certificate. C and humidity < 70%. Scheduled Calibration Oct-14 Oct-14 Oct-14 Apr-15 Apr-15
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The measurements and the uncer All calibrations have been conduct Calibration Equipment used (M&T Primary Standards Power sensor HP 8481A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ES3DV3 DAE4	tainties with confidence provided in the closed laborator (E critical for calibration) ID # GB37480704 US37292783 MY41092317 SN: 5058 (20k) SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3205	Cal Date (Certificate No.) 09-Oct-13 (No. 217-01827) 09-Oct-13 (No. 217-01828) 03-Apr-14 (No. 217-01918) 03-Apr-14 (No. ES3-3205_Dec13) 30-Apr-14 (No. DAE4-601_Apr14) Check Date (in house)	nd are part of the certificate. C and humidity < 70%. Scheduled Calibration Oct-14 Oct-14 Oct-14 Oct-14 Apr-15 Dec-14 Apr-15 Dec-14 Apr-15 Scheduled Check
The measurements and the uncer All calibrations have been conduc Calibration Equipment used (M&T Primary Standards Power sensor HP 8481A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ES3DV3 DAE4 Secondary Standards RF generator R&S SMT-06	tainties with confidence pr ted in the closed laborator (E critical for calibration) (D # (B37480704 US37292783 MY41092317 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 5047.2 / 06327 SN: 3205 SN: 601 (D # 100005	Cal Date (Certificate No.) 09-Oct-13 (No. 217-01827) 09-Oct-13 (No. 217-01828) 03-Apr-14 (No. 217-01918) 03-Apr-14 (No. 217-01921) 30-Dec-13 (No. ES3-3205_Dec13) 30-Apr-14 (No. DAE4-601_Apr14)	nd are part of the certificate. C and humidity < 70%. Scheduled Calibration Oct-14 Oct-14 Oct-14 Oct-14 Apr-15 Dec-14 Apr-15
The measurements and the uncer All calibrations have been conduc Calibration Equipment used (M&T Primary Standards Power sensor HP 8481A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ES3DV3 DAE4 Secondary Standards RF generator R&S SMT-06	tainties with confidence pr ted in the closed laborator (E critical for calibration) (D # (B37480704 US37292783 MY41092317 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 5047.2 / 06327 SN: 3205 SN: 601 (D # 100005	Cal Date (Certificate No.) 09-Oct-13 (No. 217-01827) 09-Oct-13 (No. 217-01921) 03-Apr-14 (No. 217-01918) 03-Apr-14 (No. 217-01921) 30-Dec-13 (No. ES3-3205_Dec13) 30-Apr-14 (No. DAE4-601_Apr14) Check Date (in house) 04-Aug-99 (in house check Oct-13) 18-Oct-01 (in house check Oct-13)	nd are part of the certificate. C and humidity < 70%. Scheduled Calibration Oct-14 Oct-14 Oct-14 Apr-15 Apr-15 Dec-14 Apr-15 Scheduled Check In house check: Oct-16 In house check: Oct-14
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The measurements and the uncer All calibrations have been conduc Calibration Equipment used (M&T Primary Standards Power meter EPM-442A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ES3DV3 DAE4 Secondary Standards RF generator R&S SMT-06 Network Analyzer HP 8753E Calibrated by: Approved by:	tainties with confidence provided in the closed laborator (E critical for calibration) ID # GB37480704 US37292783 MY41092317 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3205 SN: 601 ID # 100005 US37390585 S4206 Name Michael Weber Katja Pokovic	Cal Date (Certificate No.) 09-Oct-13 (No. 217-01827) 09-Oct-13 (No. 217-01827) 09-Oct-13 (No. 217-01827) 09-Oct-13 (No. 217-01827) 09-Oct-13 (No. 217-01828) 03-Apr-14 (No. 217-01918) 03-Apr-14 (No. 217-01921) 30-Dec-13 (No. ES3-3205_Dec13) 30-Apr-14 (No. DAE4-601_Apr14) Check Date (in house) 04-Aug-99 (in house check Oct-13) 18-Oct-01 (in house check Oct-13) Function Laboratory Technician	nd are part of the certificate. C and humidity < 70%. Scheduled Calibration Oct-14 Oct-14 Oct-14 Apr-15 Apr-15 Dec-14 Apr-15 Scheduled Check In house check: Oct-16 In house check: Oct-16 In house check: Oct-14 Signature Milliogo Scheduled Signature Milliogo Scheduled Scheduled Signature Milliogo Scheduled Scheduled Scheduled Signature Milliogo Scheduled Scheduled Scheduled Signature Milliogo Scheduled Schedule



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



SWISS BRD

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Schweizerischer Kalibrierdienst Service suisse d'étalonnage С Servizio svizzero di taratura

S Swiss Calibration Service

Accreditation No.: SCS 108

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, "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) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

d) 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: D2600V2-1012_Jul14

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Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2600 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.3 ± 6 %	2.02 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	14.8 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	57.8 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	condition 250 mW input power	6.58 W/kg

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	50.1 ± 6 %	2.21 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	14.6 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	57.2 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	6.43 W/kg

Certificate No: D2600V2-1012_Jul14



Appendix (Additional assessments outside the scope of SCS108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.7 Ω - 5.0 jΩ	
Return Loss	- 25.6 dB	

Antenna Parameters with Body TSL

Impedance, transformed to feed point	44.9 Ω - 3.8 jΩ	
Return Loss	- 23.6 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.152 ns
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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	October 30, 2007

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DASY5 Validation Report for Head TSL

Date: 16.07.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1012

 $\begin{array}{l} \mbox{Communication System: UID 0 - CW; Frequency: 2600 MHz} \\ \mbox{Medium parameters used: } f = 2600 MHz; \mbox{σ} = 2.02 \mbox{ S/m; ϵ_r} = 37.3; \mbox{ρ} = 1000 \mbox{kg/m^3} \\ \mbox{Phantom section: Flat Section} \\ \mbox{Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)} \\ \end{array}$

DASY52 Configuration:

- Probe: ES3DV3 SN3205; ConvF(4.46, 4.46, 4.46); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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 = 101.5 V/m; Power Drift = 0.07 dB Peak SAR (extrapolated) = 31.9 W/kg SAR(1 g) = 14.8 W/kg; SAR(10 g) = 6.58 W/kg Maximum value of SAR (measured) = 19.5 W/kg



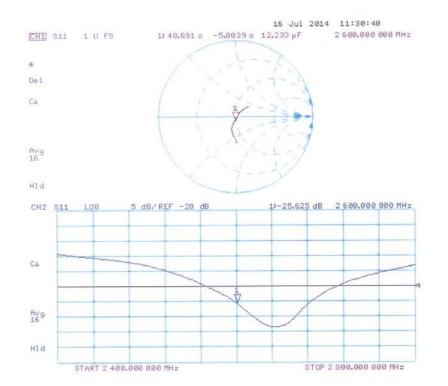
0 dB = 19.5 W/kg = 12.90 dBW/kg

Certificate No: D2600V2-1012_Jul14

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Impedance Measurement Plot for Head TSL



Certificate No: D2600V2-1012_Jul14

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DASY5 Validation Report for Body TSL

Date: 16.07.2014

Test Laboratory: SPEAG, Zurich, Switzerland

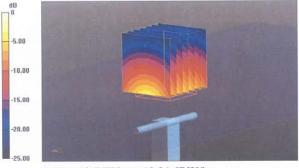
DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1012

Communication System: UID 0 - CW; Frequency: 2600 MHz Medium parameters used: f = 2600 MHz; σ = 2.21 S/m; ϵ_r = 50.1; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 SN3205; ConvF(4.24, 4.24, 4.24); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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 = 97.59 V/m; Power Drift = 0.00 dB Peak SAR (extrapolated) = 31.9 W/kg SAR(1 g) = 14.6 W/kg; SAR(10 g) = 6.43 W/kg Maximum value of SAR (measured) = 19.7 W/kg



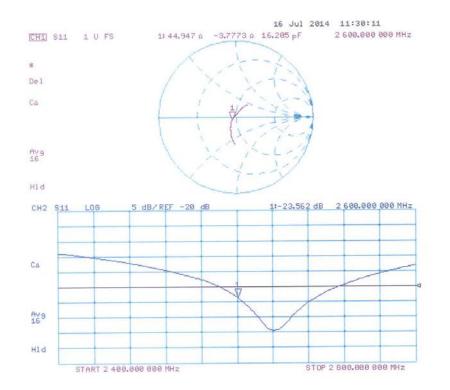
0 dB = 19.7 W/kg = 12.94 dBW/kg

Certificate No: D2600V2-1012_Jul14

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Impedance Measurement Plot for Body TSL



Certificate No: D2600V2-1012_Jul14

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750 MHz Dipole Calibration Certificate

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



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

Accreditation No.: SCS 0108

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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

AL IDDATION O		Certificate No	: D750V3-1017_Jul15
ALIBRATION C	ERTIFICATE		
Dbject	D750V3 - SN: 10	17	
Calibration procedure(s)	QA CAL-05.v9 Calibration proce	dure for dipole validation kits abo	ove 700 MHz
Calibration date:	July 23, 2015		
		onal standards, which realize the physical uni	
The measurements and the uncer	rtainties with confidence p	robability are given on the following pages an	d are part of the certificate.
All calibrations have been conduc	ted in the closed laborator	ry facility: environment temperature (22 \pm 3)°C	C and humidity < 70%.
Calibration Equipment used (M&T	E critical for calibration)		
Primary Standards	ID #	Cal Date (Certificate No.)	
		our bute (continente riter)	Scheduled Calibration
	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power meter EPM-442A	GB37480704 US37292783		
Power meter EPM-442A Power sensor HP 8481A		07-Oct-14 (No. 217-02020)	Oct-15
Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020) 07-Oct-14 (No. 217-02020) 07-Oct-14 (No. 217-02021) 01-Apr-15 (No. 217-02131)	Oct-15 Oct-15 Oct-15 Mar-16
Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A Reference 20 dB Attenuator	US37292783 MY41092317 SN: 5058 (20k) SN: 5047.2 / 06327	07-Oct-14 (No. 217-02020) 07-Oct-14 (No. 217-02020) 07-Oct-14 (No. 217-02021) 01-Apr-15 (No. 217-02131) 01-Apr-15 (No. 217-02134)	Oct-15 Oct-15 Oct-15 Mar-16 Mar-16
Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ES3DV3	US37292783 MY41092317 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3205	07-Oct-14 (No. 217-02020) 07-Oct-14 (No. 217-02020) 07-Oct-14 (No. 217-02021) 01-Apr-15 (No. 217-02131) 01-Apr-15 (No. 217-02134) 30-Dec-14 (No. ES3-3205_Dec14)	Oct-15 Oct-15 Oct-15 Mar-16 Mar-16 Dec-15
Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ES3DV3	US37292783 MY41092317 SN: 5058 (20k) SN: 5047.2 / 06327	07-Oct-14 (No. 217-02020) 07-Oct-14 (No. 217-02020) 07-Oct-14 (No. 217-02021) 01-Apr-15 (No. 217-02131) 01-Apr-15 (No. 217-02134)	Oct-15 Oct-15 Oct-15 Mar-16 Mar-16
Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ES3DV3 DAE4	US37292783 MY41092317 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3205	07-Oct-14 (No. 217-02020) 07-Oct-14 (No. 217-02020) 07-Oct-14 (No. 217-02021) 01-Apr-15 (No. 217-02131) 01-Apr-15 (No. 217-02134) 30-Dec-14 (No. ES3-3205_Dec14)	Oct-15 Oct-15 Oct-15 Mar-16 Mar-16 Dec-15
Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ES3DV3 DAE4 Secondary Standards	US37292783 MY41092317 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3205 SN: 601	07-Oct-14 (No. 217-02020) 07-Oct-14 (No. 217-02020) 07-Oct-14 (No. 217-02021) 01-Apr-15 (No. 217-02131) 01-Apr-15 (No. 217-02134) 30-Dec-14 (No. ES3-3205_Dec14) 18-Aug-14 (No. DAE4-601_Aug14)	Oct-15 Oct-15 Oct-15 Mar-16 Mar-16 Dec-15 Aug-15
Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ES3DV3	US37292783 MY41092317 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3205 SN: 601 ID #	07-Oct-14 (No. 217-02020) 07-Oct-14 (No. 217-02020) 07-Oct-14 (No. 217-02021) 01-Apr-15 (No. 217-02131) 01-Apr-15 (No. 217-02134) 30-Dec-14 (No. ES3-3205_Dec14) 18-Aug-14 (No. DAE4-601_Aug14) Check Date (in house)	Oct-15 Oct-15 Oct-15 Mar-16 Mar-16 Dec-15 Aug-15 Scheduled Check
Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ES3DV3 DAE4 Secondary Standards RF generator R&S SMT-06	US37292783 MY41092317 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3205 SN: 601 ID # 100005 US37390585 S4206	07-Oct-14 (No. 217-02020) 07-Oct-14 (No. 217-02020) 07-Oct-14 (No. 217-02021) 01-Apr-15 (No. 217-02131) 01-Apr-15 (No. 217-02134) 30-Dec-14 (No. 217-02134) 30-Dec-14 (No. ES3-3205_Dec14) 18-Aug-14 (No. DAE4-601_Aug14) Check Date (in house) 04-Aug-99 (in house check Oct-13) 18-Oct-01 (in house check Oct-14)	Oct-15 Oct-15 Oct-15 Mar-16 Dec-15 Aug-15 Scheduled Check In house check: Oct-16 In house check: Oct-15
Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ES3DV3 DAE4 Secondary Standards RF generator R&S SMT-06 Network Analyzer HP 8753E	US37292783 MY41092317 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3205 SN: 601 ID # 100005 US37390585 S4206 Name	07-Oct-14 (No. 217-02020) 07-Oct-14 (No. 217-02020) 07-Oct-14 (No. 217-02021) 01-Apr-15 (No. 217-02131) 01-Apr-15 (No. 217-02134) 30-Dec-14 (No. ES3-3205_Dec14) 18-Aug-14 (No. DAE4-601_Aug14) Check Date (in house) 04-Aug-99 (in house check Oct-13) 18-Oct-01 (in house check Oct-14) Function	Oct-15 Oct-15 Oct-15 Mar-16 Mar-16 Dec-15 Aug-15 Scheduled Check In house check: Oct-16
Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ES3DV3 DAE4 Secondary Standards RF generator R&S SMT-06	US37292783 MY41092317 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3205 SN: 601 ID # 100005 US37390585 S4206	07-Oct-14 (No. 217-02020) 07-Oct-14 (No. 217-02020) 07-Oct-14 (No. 217-02021) 01-Apr-15 (No. 217-02131) 01-Apr-15 (No. 217-02134) 30-Dec-14 (No. 217-02134) 30-Dec-14 (No. ES3-3205_Dec14) 18-Aug-14 (No. DAE4-601_Aug14) Check Date (in house) 04-Aug-99 (in house check Oct-13) 18-Oct-01 (in house check Oct-14)	Oct-15 Oct-15 Oct-15 Mar-16 Mar-16 Dec-15 Aug-15 Scheduled Check In house check: Oct-16 In house check: Oct-15
Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ES3DV3 DAE4 <u>Secondary Standards</u> RF generator R&S SMT-06 Network Analyzer HP 8753E	US37292783 MY41092317 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3205 SN: 601 ID # 100005 US37390585 S4206 Name	07-Oct-14 (No. 217-02020) 07-Oct-14 (No. 217-02020) 07-Oct-14 (No. 217-02021) 01-Apr-15 (No. 217-02131) 01-Apr-15 (No. 217-02134) 30-Dec-14 (No. ES3-3205_Dec14) 18-Aug-14 (No. DAE4-601_Aug14) Check Date (in house) 04-Aug-99 (in house check Oct-13) 18-Oct-01 (in house check Oct-14) Function	Oct-15 Oct-15 Oct-15 Mar-16 Dec-15 Aug-15 Scheduled Check In house check: Oct-16 In house check: Oct-15

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