

#24_WCDMA Band II_RMC 12.2Kbps_Back_15mm_Ch9262

Communication System: UID 0, UMTS (0); Frequency: 1852.4 MHz; Duty Cycle: 1:1
Medium: MSL_1900_161225 Medium parameters used: $f = 1852.4$ MHz; $\sigma = 1.506$ S/m; $\epsilon_r = 52.067$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.4 °C; Liquid Temperature : 22.8 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(8.17, 8.17, 8.17); Calibrated: 2016.09.29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn905; Calibrated: 2016.06.22
- Phantom: SAM (Front) with CRP v5.0; Type: QD000P40CD; Serial: TP:1795
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch9262/Area Scan (71x121x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.714 W/kg

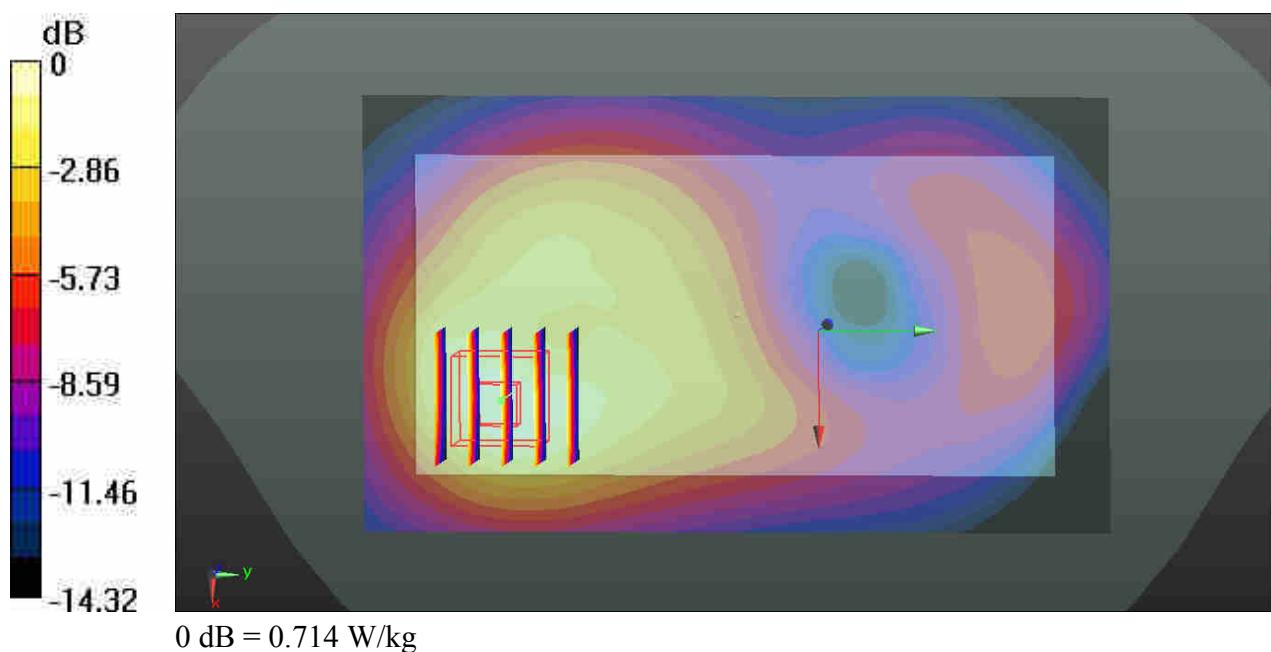
Ch9262/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 3.490 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 0.823 W/kg

SAR(1 g) = 0.525 W/kg; SAR(10 g) = 0.317 W/kg

Maximum value of SAR (measured) = 0.687 W/kg



#25_LTE Band 12_10M_1RB_25Offset_Front_15mm_Ch23095

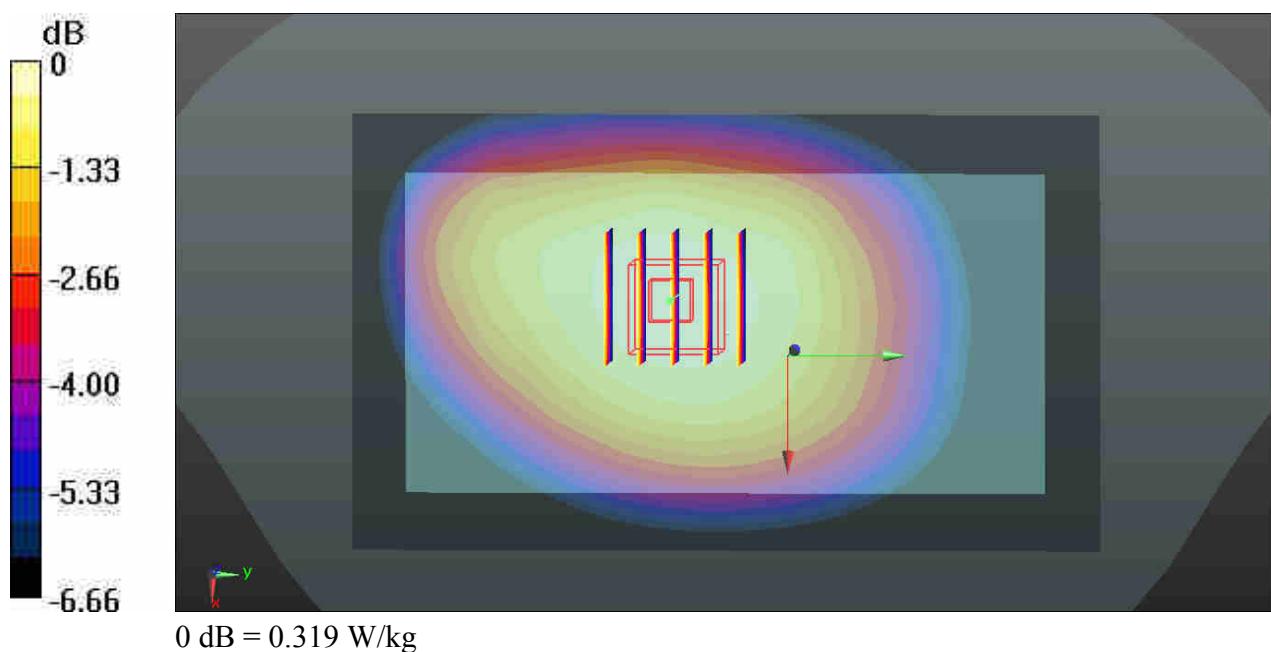
Communication System: UID 0, LTE (0); Frequency: 707.5 MHz; Duty Cycle: 1:1
Medium: MSL_750_161224 Medium parameters used: $f = 707.5$ MHz; $\sigma = 0.93$ S/m; $\epsilon_r = 54.88$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.4 °C; Liquid Temperature : 22.7 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(10.43, 10.43, 10.43); Calibrated: 2016.09.29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn905; Calibrated: 2016.06.22
- Phantom: SAM (Front) with CRP v5.0; Type: QD000P40CD; Serial: TP:1795
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch23095/Area Scan (71x121x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.319 W/kg

Ch23095/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 3.688 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 0.341 W/kg
SAR(1 g) = 0.277 W/kg; SAR(10 g) = 0.220 W/kg
Maximum value of SAR (measured) = 0.314 W/kg



#26_LTE Band 5_10M_1RB_25Offset_Front_15mm_Ch20525

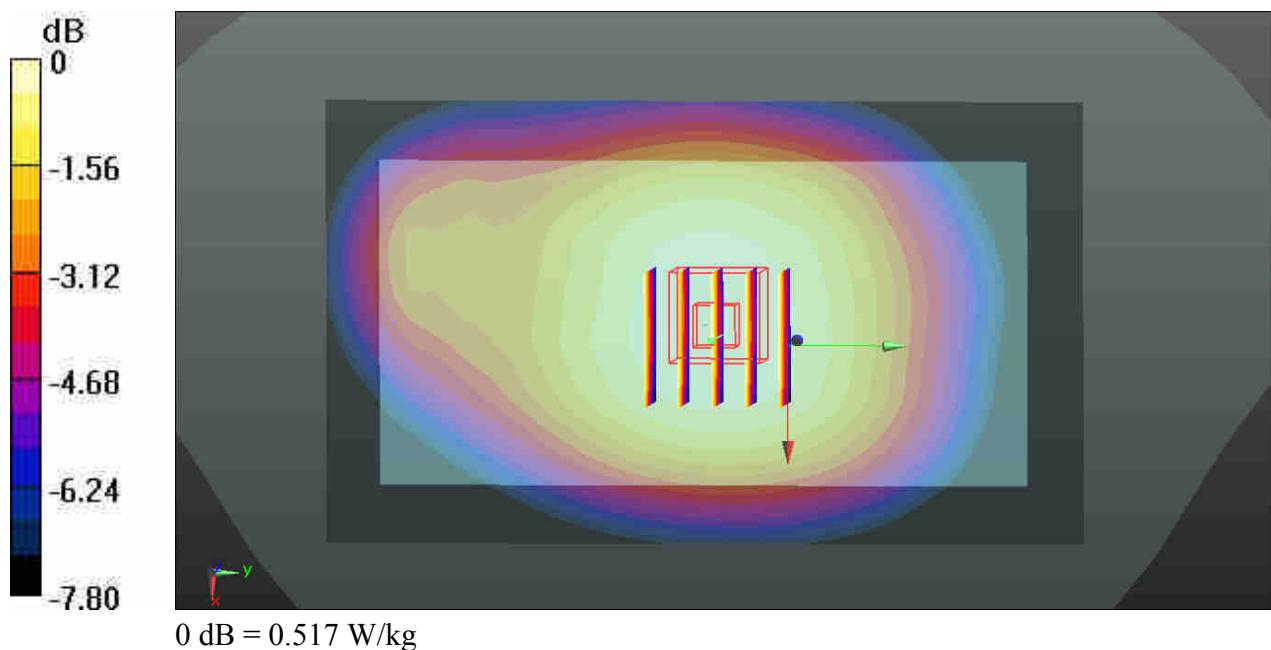
Communication System: UID 0, LTE (0); Frequency: 836.5 MHz; Duty Cycle: 1:1
Medium: MSL_835_161224 Medium parameters used: $f = 836.5$ MHz; $\sigma = 0.983$ S/m; $\epsilon_r = 56.221$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.4 °C; Liquid Temperature : 22.6 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(10.19, 10.19, 10.19); Calibrated: 2016.09.29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn905; Calibrated: 2016.06.22
- Phantom: SAM (Front) with CRP v5.0; Type: QD000P40CD; Serial: TP:1795
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch20525/Area Scan (71x121x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.517 W/kg

Ch20525/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.735 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 0.574 W/kg
SAR(1 g) = 0.456 W/kg; SAR(10 g) = 0.354 W/kg
Maximum value of SAR (measured) = 0.521 W/kg



#27_LTE Band 4_20M_QPSK_1RB_49Offset_Back_15mm_Ch20175

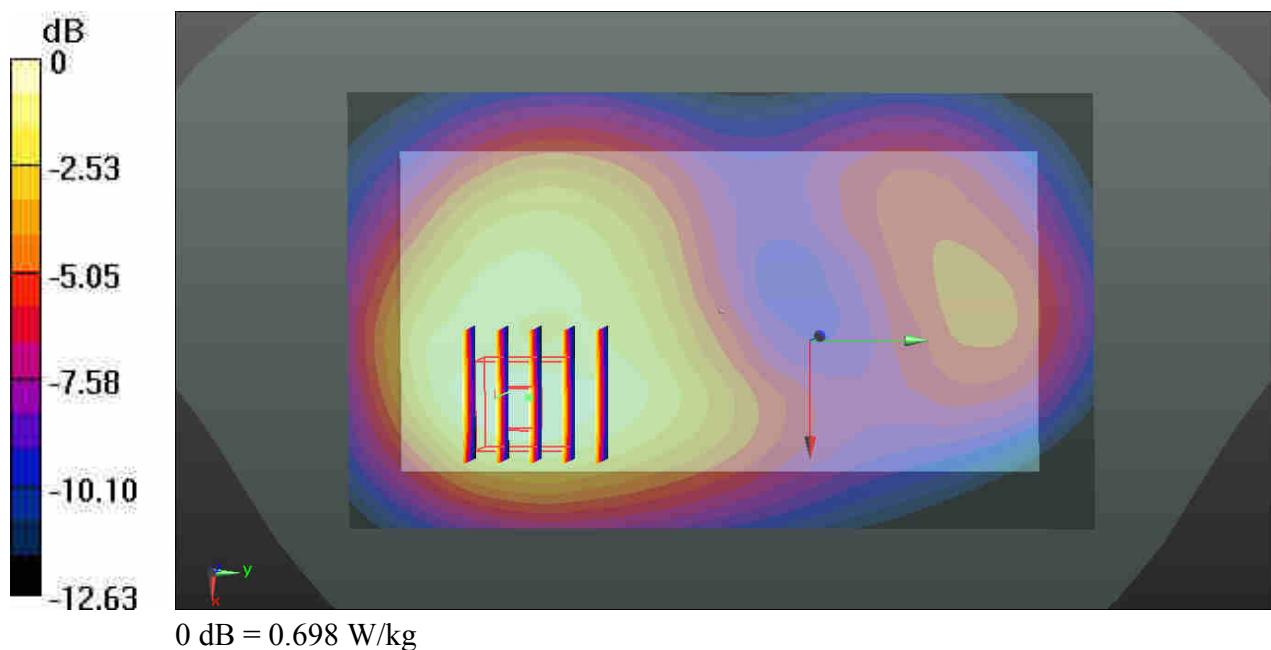
Communication System: UID 0, LTE (0); Frequency: 1732.5 MHz; Duty Cycle: 1:1
Medium: MSL_1800_161225 Medium parameters used: $f = 1732.5$ MHz; $\sigma = 1.494$ S/m; $\epsilon_r = 55.527$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.4 °C; Liquid Temperature : 22.9 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(8.46, 8.46, 8.46); Calibrated: 2016.09.29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn905; Calibrated: 2016.06.22
- Phantom: SAM (Front) with CRP v5.0; Type: QD000P40CD; Serial: TP:1795
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch20175/Area Scan (71x121x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.698 W/kg

Ch20175/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.361 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.819 W/kg
SAR(1 g) = 0.525 W/kg; SAR(10 g) = 0.328 W/kg
Maximum value of SAR (measured) = 0.671 W/kg



#28_LTE Band 2_20M_QPSK_1RB_49Offset_Back_15mm_Ch18700

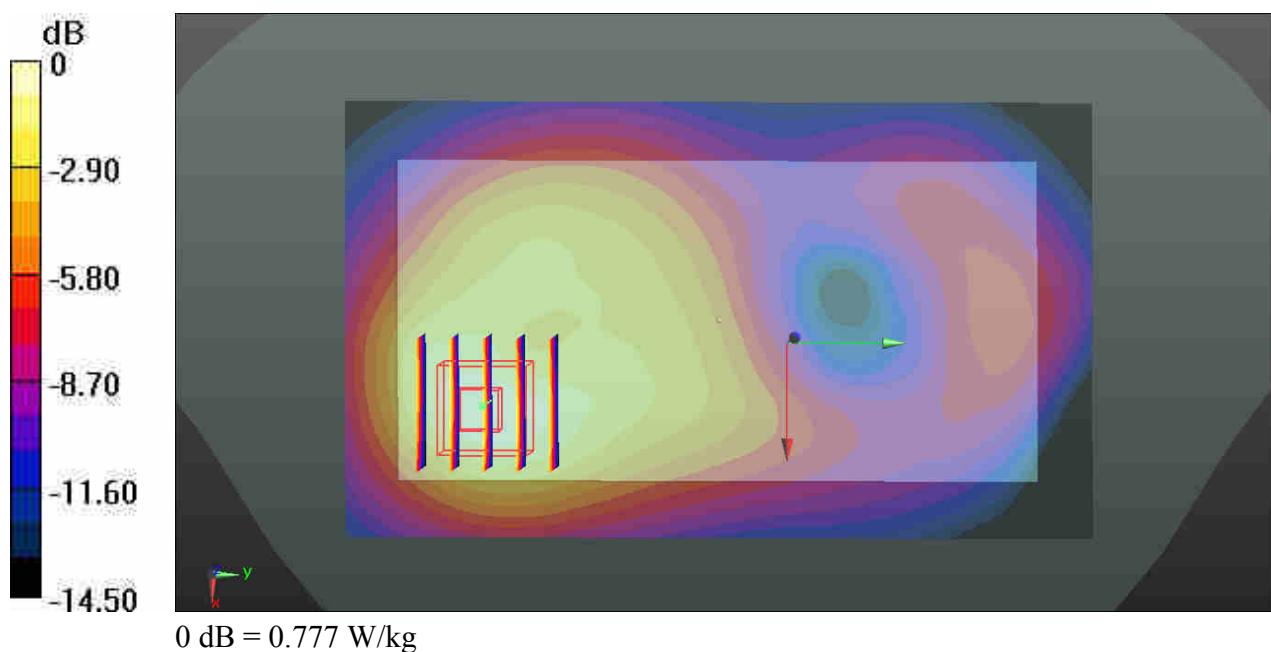
Communication System: UID 0, LTE (0); Frequency: 1860 MHz; Duty Cycle: 1:1
Medium: MSL_1900_161225 Medium parameters used: $f = 1860$ MHz; $\sigma = 1.516$ S/m; $\epsilon_r = 52.01$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.4 °C; Liquid Temperature : 22.8 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(8.17, 8.17, 8.17); Calibrated: 2016.09.29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn905; Calibrated: 2016.06.22
- Phantom: SAM (Front) with CRP v5.0; Type: QD000P40CD; Serial: TP:1795
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch18700/Area Scan (71x121x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.777 W/kg

Ch18700/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 3.774 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 0.911 W/kg
SAR(1 g) = 0.579 W/kg; SAR(10 g) = 0.349 W/kg
Maximum value of SAR (measured) = 0.759 W/kg



#29_LTE Band 30_10M_QPSK_1RB_0Offset_Back_15mm_Ch27710

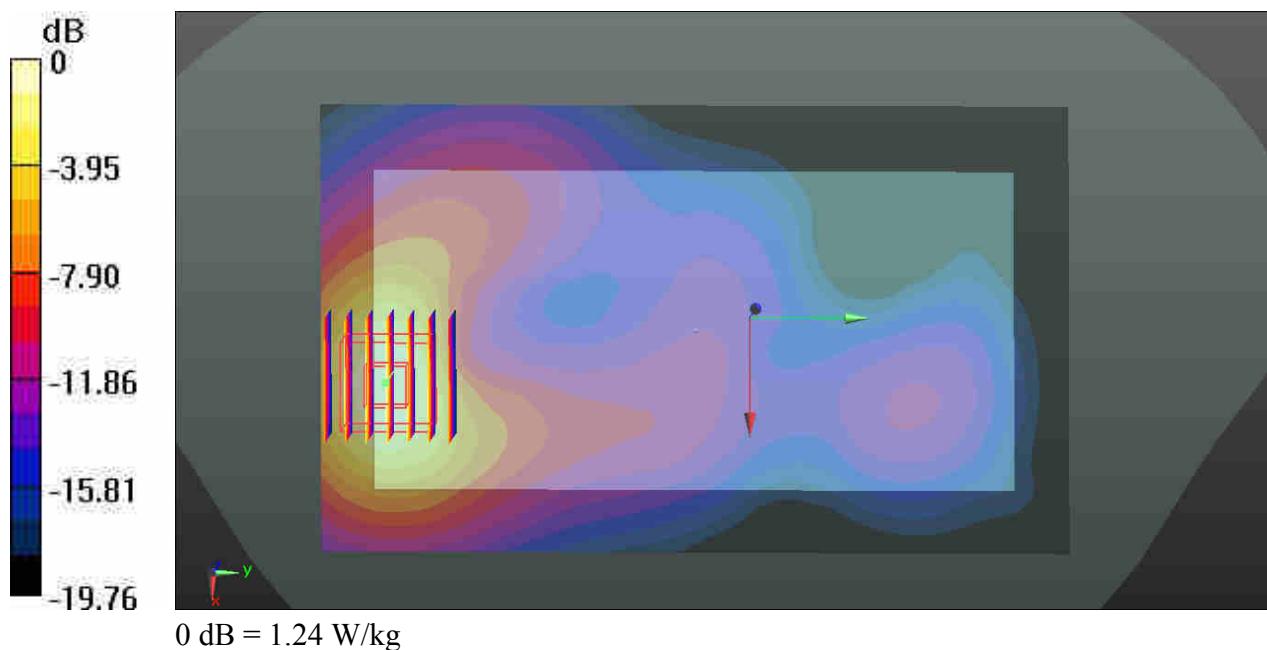
Communication System: UID 0, LTE (0); Frequency: 2310 MHz; Duty Cycle: 1:1
Medium: MSL_2300_161228 Medium parameters used: $f = 2310$ MHz; $\sigma = 1.773$ S/m; $\epsilon_r = 53.718$;
 $\rho = 1000$ kg/m³
Ambient Temperature : 23.4 °C; Liquid Temperature : 22.7 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.93, 7.93, 7.93); Calibrated: 2016.09.29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn905; Calibrated: 2016.06.22
- Phantom: SAM (Front) with CRP v5.0; Type: QD000P40CD; Serial: TP:1795
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch27710/Area Scan (91x151x1): Interpolated grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 1.24 W/kg

Ch27710/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.737 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 1.59 W/kg
SAR(1 g) = 0.886 W/kg; SAR(10 g) = 0.456 W/kg
Maximum value of SAR (measured) = 1.26 W/kg



#30_WLAN2.4GHz_802.11b 1Mbps_Back_15mm_Ch11

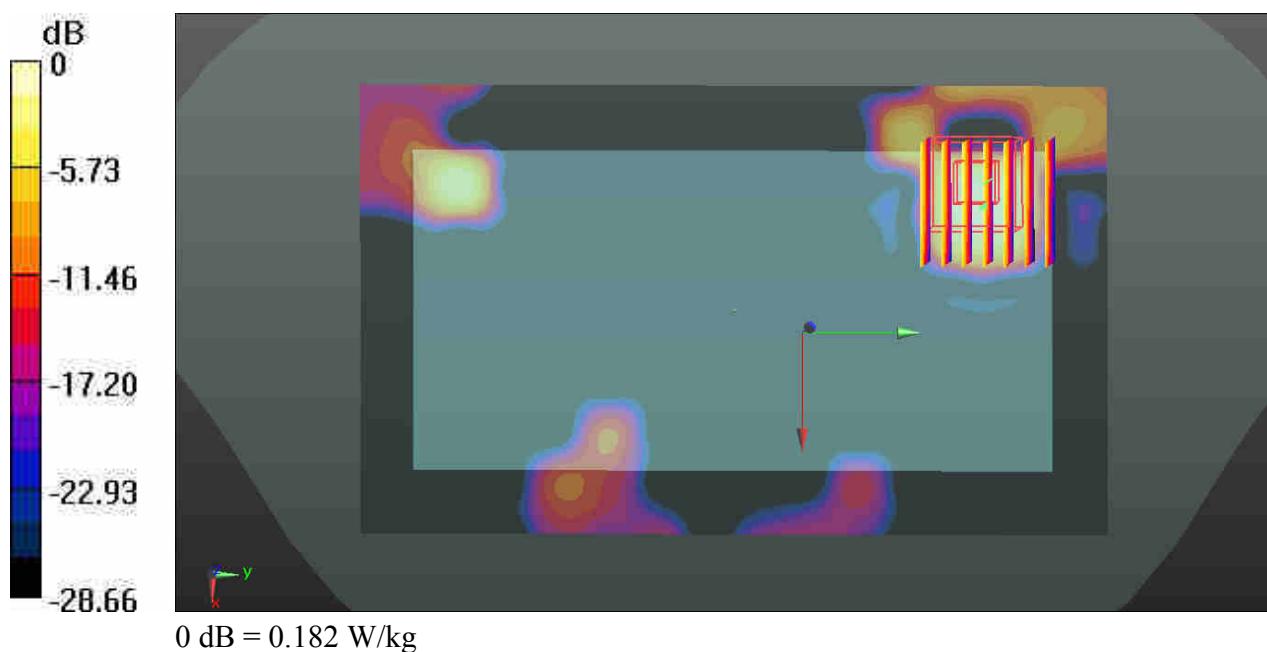
Communication System: UID 0, WIFI (0); Frequency: 2462 MHz; Duty Cycle: 1:1.024
Medium: MSL_2450_161228 Medium parameters used: $f = 2462$ MHz; $\sigma = 1.958$ S/m; $\epsilon_r = 51.184$;
 $\rho = 1000$ kg/m³
Ambient Temperature : 23.5 °C; Liquid Temperature : 22.8 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.66, 7.66, 7.66); Calibrated: 2016.09.29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn905; Calibrated: 2016.06.22
- Phantom: SAM (Front) with CRP v5.0; Type: QD000P40CD; Serial: TP:1795
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch11/Area Scan (91x151x1): Interpolated grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.182 W/kg

Ch11/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0.9890 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 0.181 W/kg
SAR(1 g) = 0.095 W/kg; SAR(10 g) = 0.051 W/kg
Maximum value of SAR (measured) = 0.135 W/kg



#31_LTE Band 4_20M_QPSK_1RB_49Offset_Back_0mm_Ch20175

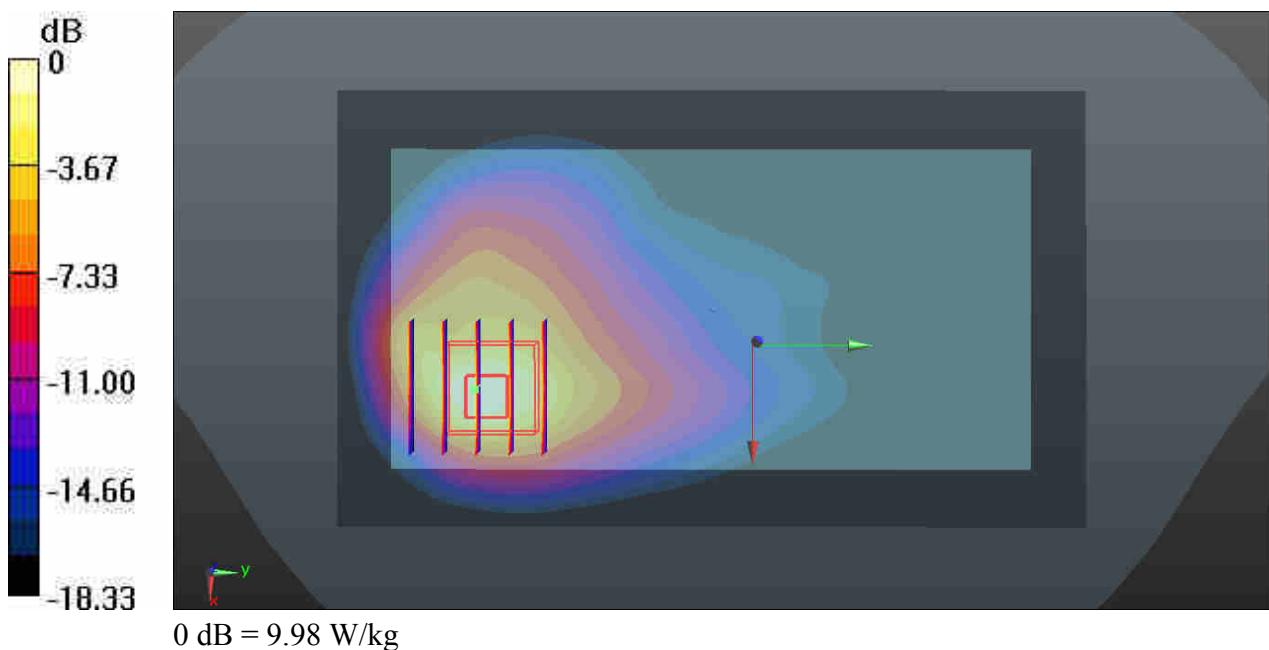
Communication System: UID 0, LTE (0); Frequency: 1732.5 MHz; Duty Cycle: 1:1
Medium: MSL_1800_161225 Medium parameters used: $f = 1732.5$ MHz; $\sigma = 1.494$ S/m; $\epsilon_r = 55.527$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.4 °C; Liquid Temperature : 22.9 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(8.46, 8.46, 8.46); Calibrated: 2016.09.29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn905; Calibrated: 2016.06.22
- Phantom: SAM (Front) with CRP v5.0; Type: QD000P40CD; Serial: TP:1795
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch20175/Area Scan (71x121x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 9.98 W/kg

Ch20175/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 1.842 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 12.1 W/kg
SAR(1 g) = 6.42 W/kg; SAR(10 g) = 3.28 W/kg
Maximum value of SAR (measured) = 9.28 W/kg



#32_LTE Band 2_20M_QPSK_1RB_49Offset_Back_0mm_Ch19100

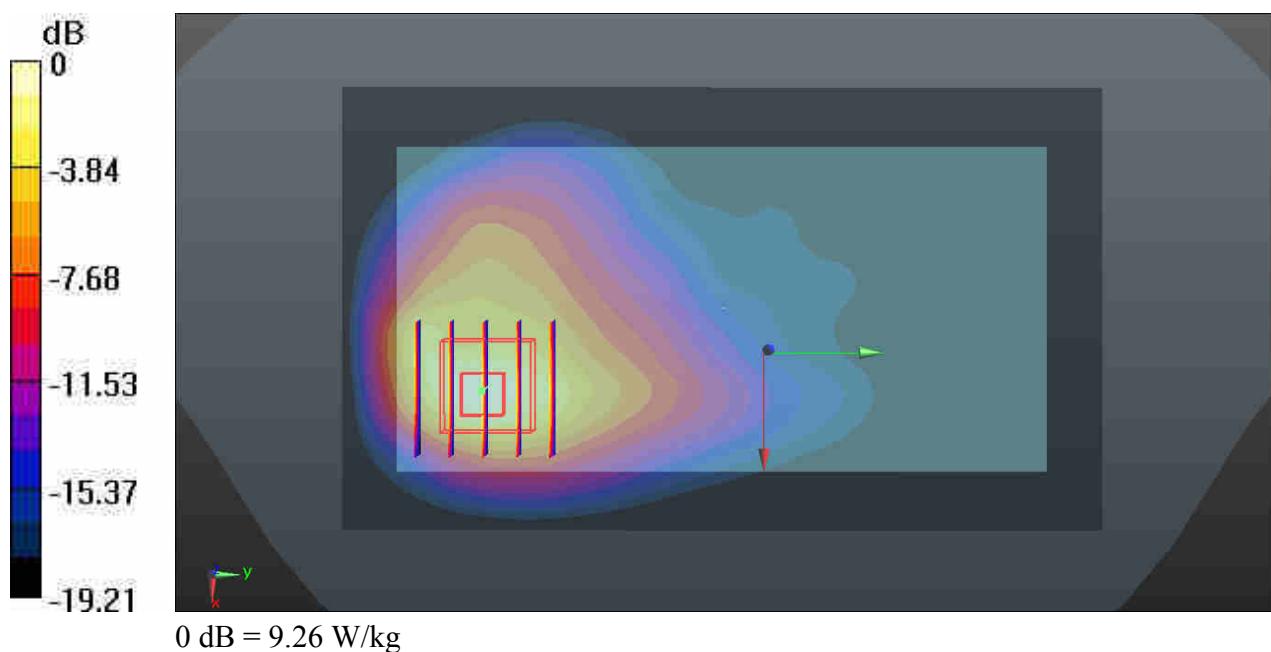
Communication System: UID 0, LTE (0); Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: MSL_1900_161225 Medium parameters used: $f = 1900$ MHz; $\sigma = 1.572$ S/m; $\epsilon_r = 51.809$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.4 °C; Liquid Temperature : 22.8 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(8.17, 8.17, 8.17); Calibrated: 2016.09.29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn905; Calibrated: 2016.06.22
- Phantom: SAM (Front) with CRP v5.0; Type: QD000P40CD; Serial: TP:1795
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch19100/Area Scan (71x121x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 9.26 W/kg

Ch19100/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 1.828 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 11.8 W/kg
SAR(1 g) = 6.03 W/kg; SAR(10 g) = 3.13 W/kg
Maximum value of SAR (measured) = 8.89 W/kg



#33_LTE Band 30_10M_QPSK_1RB_0Offset_Front_0mm_Ch27710

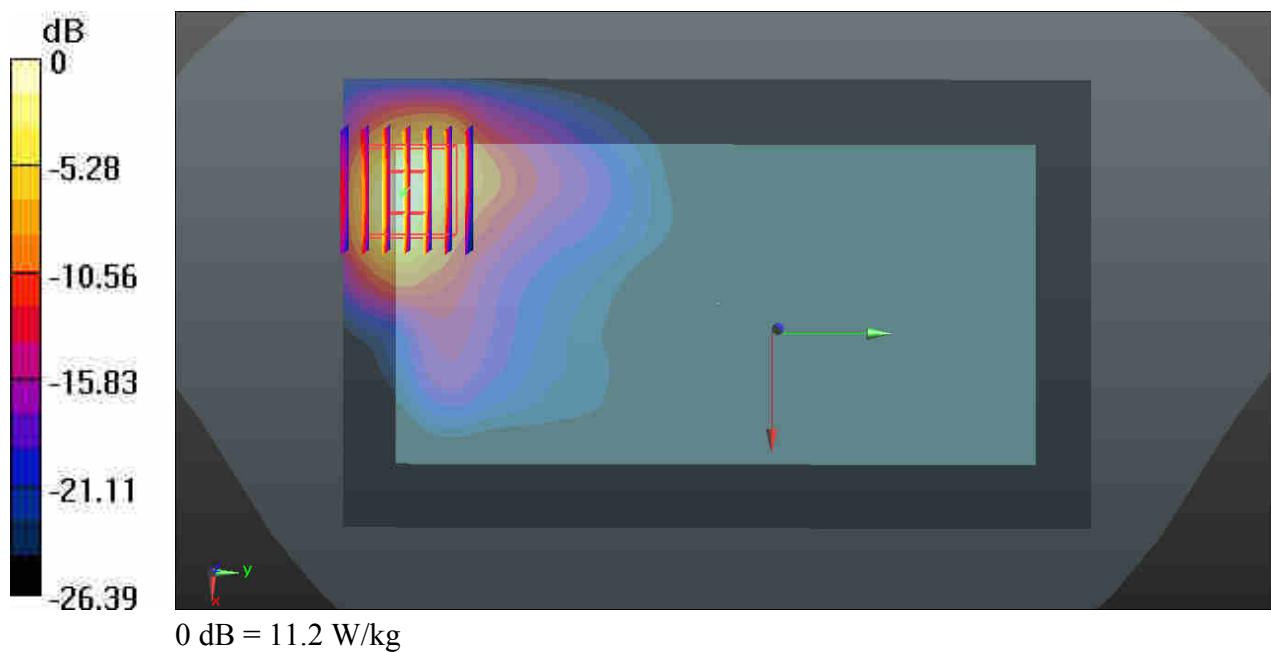
Communication System: UID 0, LTE (0); Frequency: 2310 MHz; Duty Cycle: 1:1
Medium: MSL_2300_161228 Medium parameters used: $f = 2310$ MHz; $\sigma = 1.773$ S/m; $\epsilon_r = 53.718$;
 $\rho = 1000$ kg/m³
Ambient Temperature : 23.4 °C; Liquid Temperature : 22.7 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3911; ConvF(7.93, 7.93, 7.93); Calibrated: 2016.09.29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn905; Calibrated: 2016.06.22
- Phantom: SAM (Front) with CRP v5.0; Type: QD000P40CD; Serial: TP:1795
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch27710/Area Scan (91x151x1): Interpolated grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 11.2 W/kg

Ch27710/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.570 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 20.3 W/kg
SAR(1 g) = 8.23 W/kg; SAR(10 g) = 3.07 W/kg
Maximum value of SAR (measured) = 13.2 W/kg





Appendix C. DASY Calibration Certificate

The DASY calibration certificates are shown as follows.



Client

Sportun-CN

Certificate No: Z16-97222

CALIBRATION CERTIFICATE

Object D750V3 - SN: 1099

Calibration Procedure(s) FD-Z11-003-01
 Calibration Procedures for dipole validation kits

Calibration date: November 21, 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(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	27-Jun-16 (CTTL, No.J16X04771)	Jun-17
Power sensor NRP-Z91	101547	27-Jun-16 (CTTL, No.J16X04771)	Jun-17
Reference Probe EX3DV4	SN 7433	26-Sep-16(SPEAG, No.EX3-7433_Sep16)	Sep-17
DAE4	SN 771	02-Feb-16(CTTL-SPEAG, No.Z16-97011)	Feb-17
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	01-Feb-16 (CTTL, No.J16X00893)	Jan-17
Network Analyzer E5071C	MY46110673	26-Jan-16 (CTTL, No.J16X00894)	Jan-17

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Lu Bingsong	Deputy Director of the laboratory	

Issued: November 26, 2016

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



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORMx,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 300MHz to 3GHz)", February 2005
- c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- d) KDB865664, 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%.



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
 Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
 E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

Measurement Conditions

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

DASY Version	DASY52		52.8.8.1258
Extrapolation	Advanced Extrapolation		
Phantom	Triple Flat Phantom 5.1C		
Distance Dipole Center - TSL	15 mm		with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm		
Frequency	750 MHz \pm 1 MHz		

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 \pm 0.2) °C	41.8 \pm 6 %	0.91 mho/m \pm 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.10 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	8.28 mW /g \pm 20.8 % (k=2)
SAR averaged over 10 cm³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.41 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	5.58 mW /g \pm 20.4 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 \pm 0.2) °C	54.5 \pm 6 %	0.95 mho/m \pm 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.16 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	8.71 mW /g \pm 20.8 % (k=2)
SAR averaged over 10 cm³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.46 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	5.88 mW /g \pm 20.4 % (k=2)



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.2Ω- 3.60jΩ
Return Loss	- 27.7dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.5Ω- 3.23jΩ
Return Loss	- 29.7dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.020 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
-----------------	-------

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

DASY5 Validation Report for Head TSL

Date: 11.21.2016

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1099

Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 750$ MHz; $\sigma = 0.906$ S/m; $\epsilon_r = 41.82$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN7433; ConvF(10.01, 10.01, 10.01); Calibrated: 9/26/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2/2/2016
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

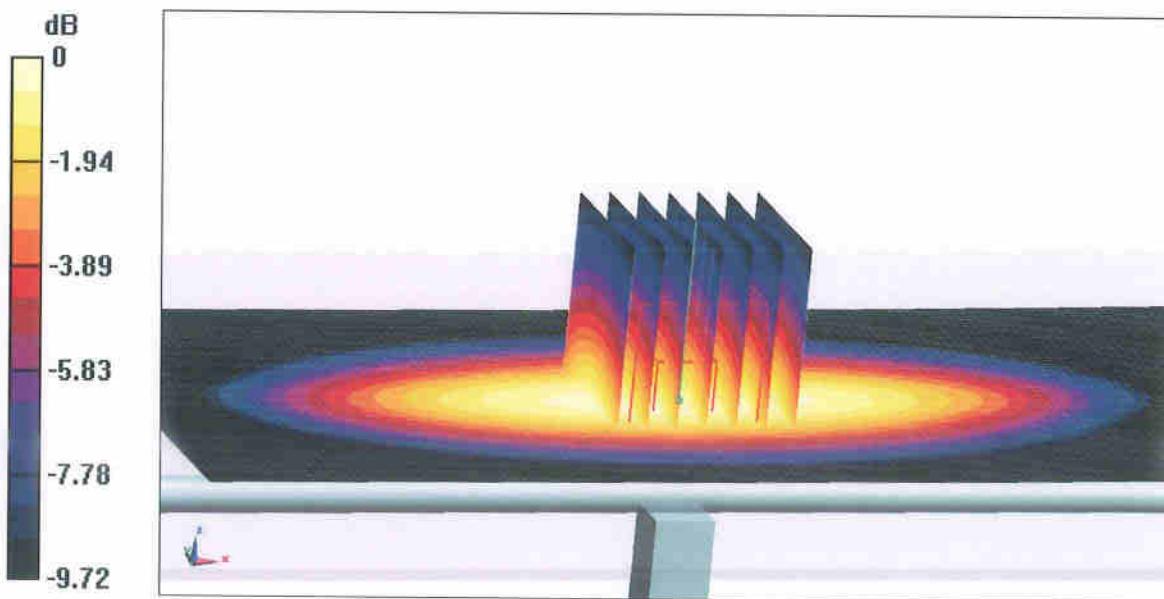
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 54.92 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 3.09 W/kg

SAR(1 g) = 2.1 W/kg; SAR(10 g) = 1.41 W/kg

Maximum value of SAR (measured) = 2.64 W/kg

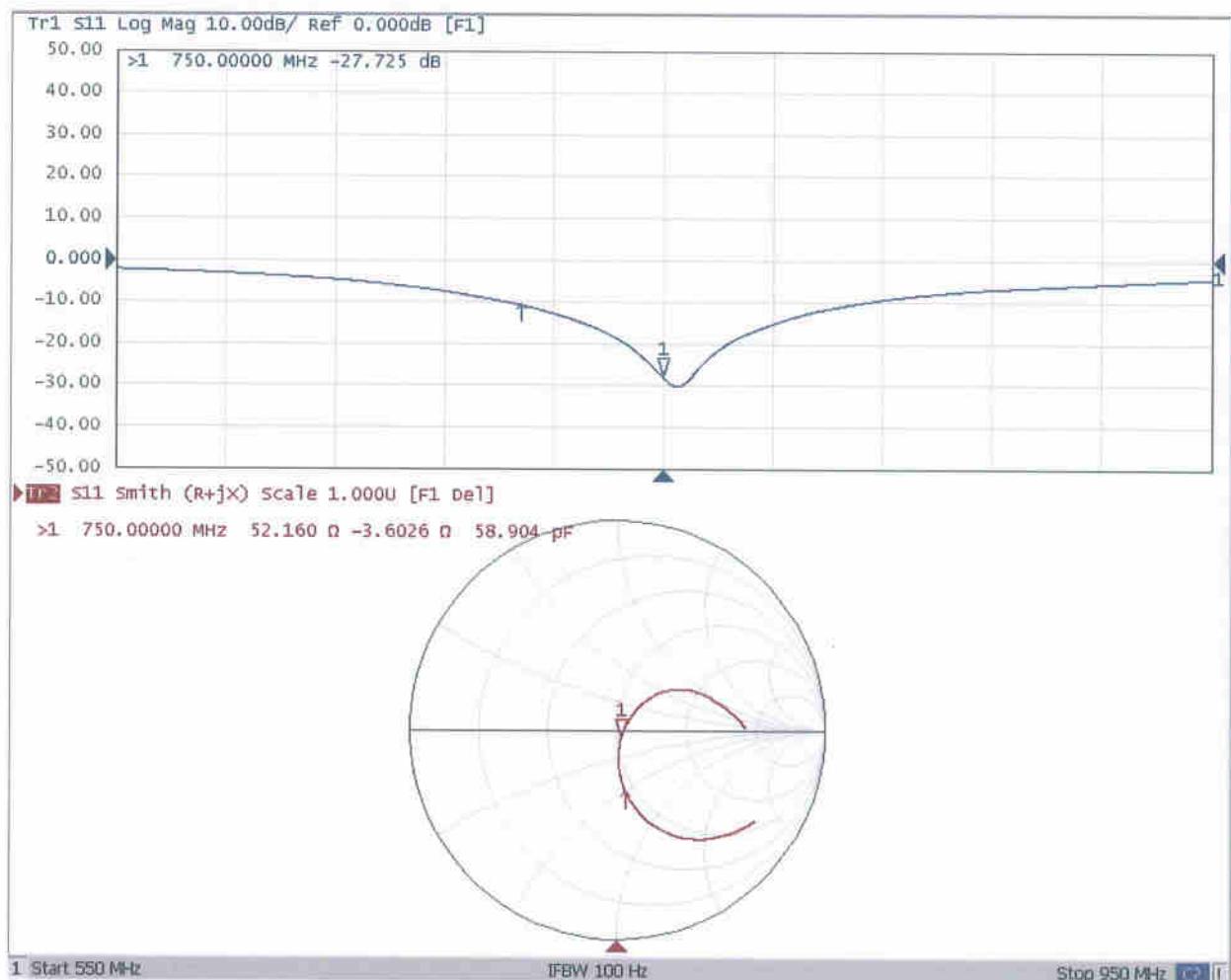




In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: ctl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

Impedance Measurement Plot for Head TSL



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

DASY5 Validation Report for Body TSL

Date: 11.21.2016

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1099

Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 750$ MHz; $\sigma = 0.945$ S/m; $\epsilon_r = 54.47$; $\rho = 1000$ kg/m³

Phantom section: Left Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN7433; ConvF(9.83, 9.83, 9.83); Calibrated: 9/26/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2/2/2016
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

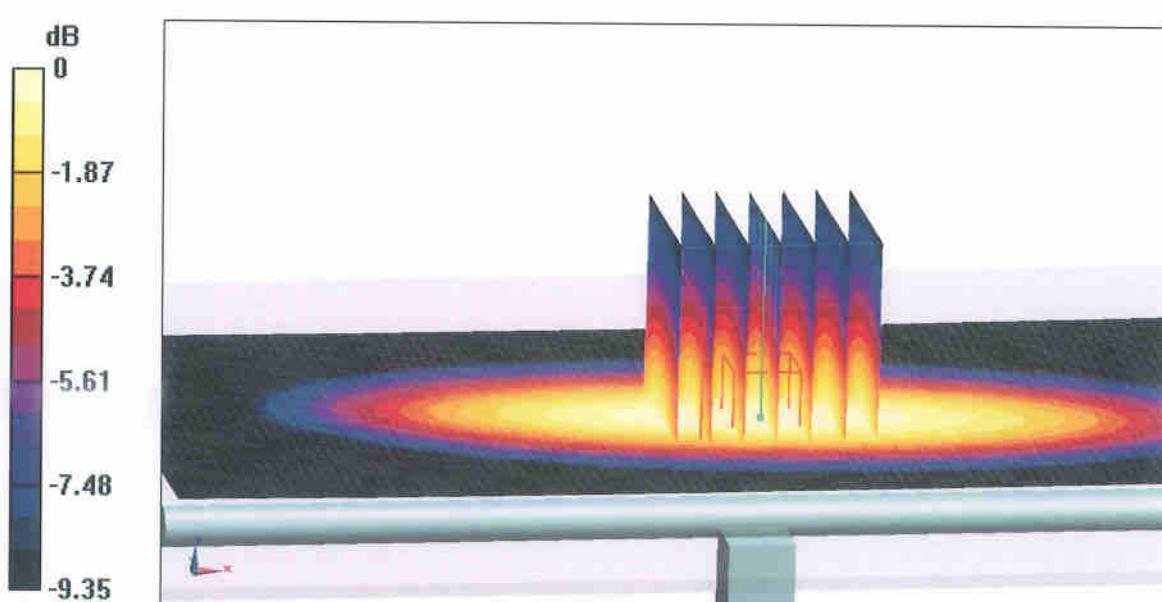
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 53.79 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 3.10 W/kg

SAR(1 g) = 2.16 W/kg; SAR(10 g) = 1.46 W/kg

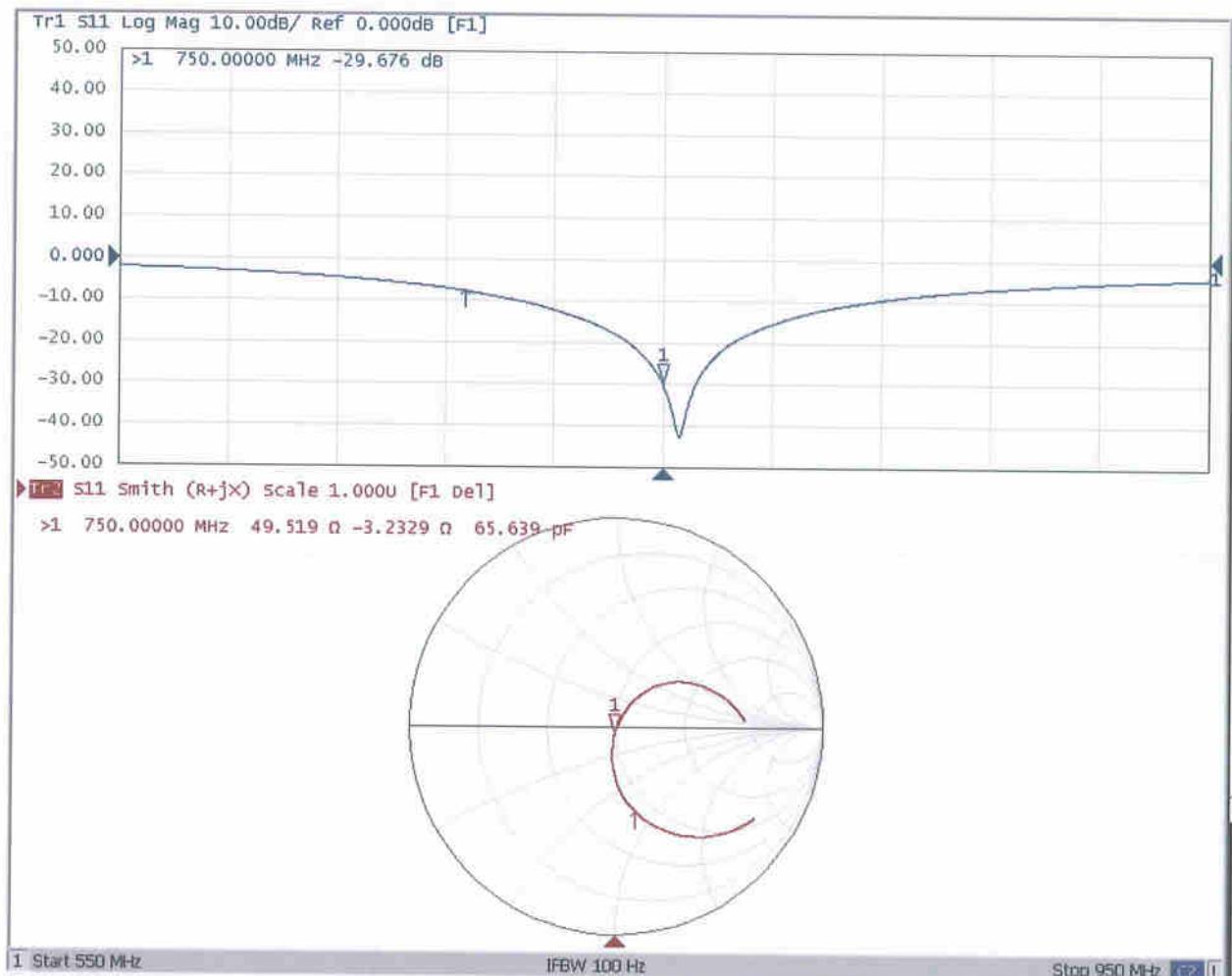
Maximum value of SAR (measured) = 2.69 W/kg



$$0 \text{ dB} = 2.69 \text{ W/kg} = 4.30 \text{ dBW/kg}$$

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: ctl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

Impedance Measurement Plot for Body TSL





Client

Sportun-CN

Certificate No: Z16-97224

CALIBRATION CERTIFICATE

Object D835V2 - SN: 4d162

Calibration Procedure(s) FD-Z11-003-01
 Calibration Procedures for dipole validation kits

Calibration date: November 22, 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(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	27-Jun-16 (CTTL, No.J16X04777)	Jun-17
Power sensor NRP-Z91	101547	27-Jun-16 (CTTL, No.J16X04777)	Jun-17
Reference Probe EX3DV4	SN 7433	26-Sep-16(SPEAG, No.EX3-7433_Sep16)	Sep-17
DAE4	SN 771	02-Feb-16(CTTL-SPEAG, No.Z16-97011)	Feb-17
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	01-Feb-16 (CTTL, No.J16X00893)	Jan-17
Network Analyzer E5071C	MY46110673	26-Jan-16 (CTTL, No.J16X00894)	Jan-17

Calibrated by:	Name	Function	Signature
	Zhao Jing	SAR Test Engineer	
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Lu Bingsong	Deputy Director of the laboratory	

Issued: November 26, 2016

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



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: ctl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

Glossary:

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

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 300MHz to 3GHz)", February 2005
- IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

- 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%.



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
 Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
 E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

Measurement Conditions

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

DASY Version	DASY52	52.8.8.1258
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz \pm 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 \pm 0.2) °C	41.4 \pm 6 %	0.92 mho/m \pm 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.36 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	9.31 mW /g \pm 20.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.55 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	6.13 mW /g \pm 20.4 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 \pm 0.2) °C	54.2 \pm 6 %	0.95 mho/m \pm 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.39 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	9.64 mW /g \pm 20.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.59 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	6.41 mW /g \pm 20.4 % (k=2)



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: ctl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.0Ω- 2.13jΩ
Return Loss	- 32.6dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.0Ω- 3.53jΩ
Return Loss	- 27.7dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.326 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
-----------------	-------

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

DASY5 Validation Report for Head TSL

Date: 11.22.2016

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d162

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 835$ MHz; $\sigma = 0.916$ S/m; $\epsilon_r = 41.41$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN7433; ConvF(9.82, 9.82, 9.82); Calibrated: 9/26/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2/2/2016
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

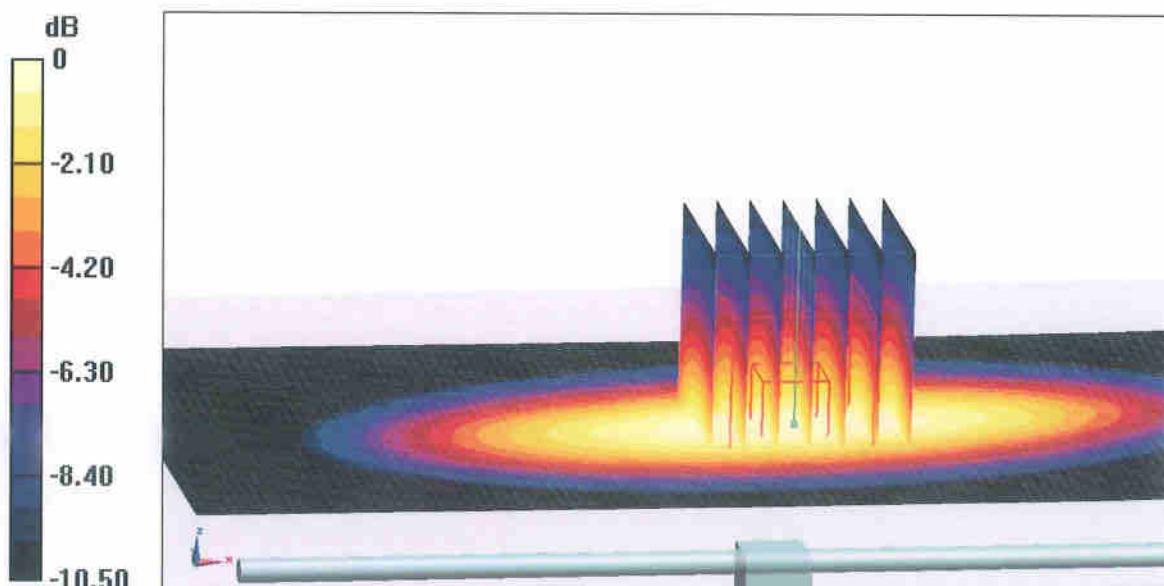
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 58.15V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 3.53 W/kg

SAR(1 g) = 2.36 W/kg; SAR(10 g) = 1.55 W/kg

Maximum value of SAR (measured) = 3.00 W/kg

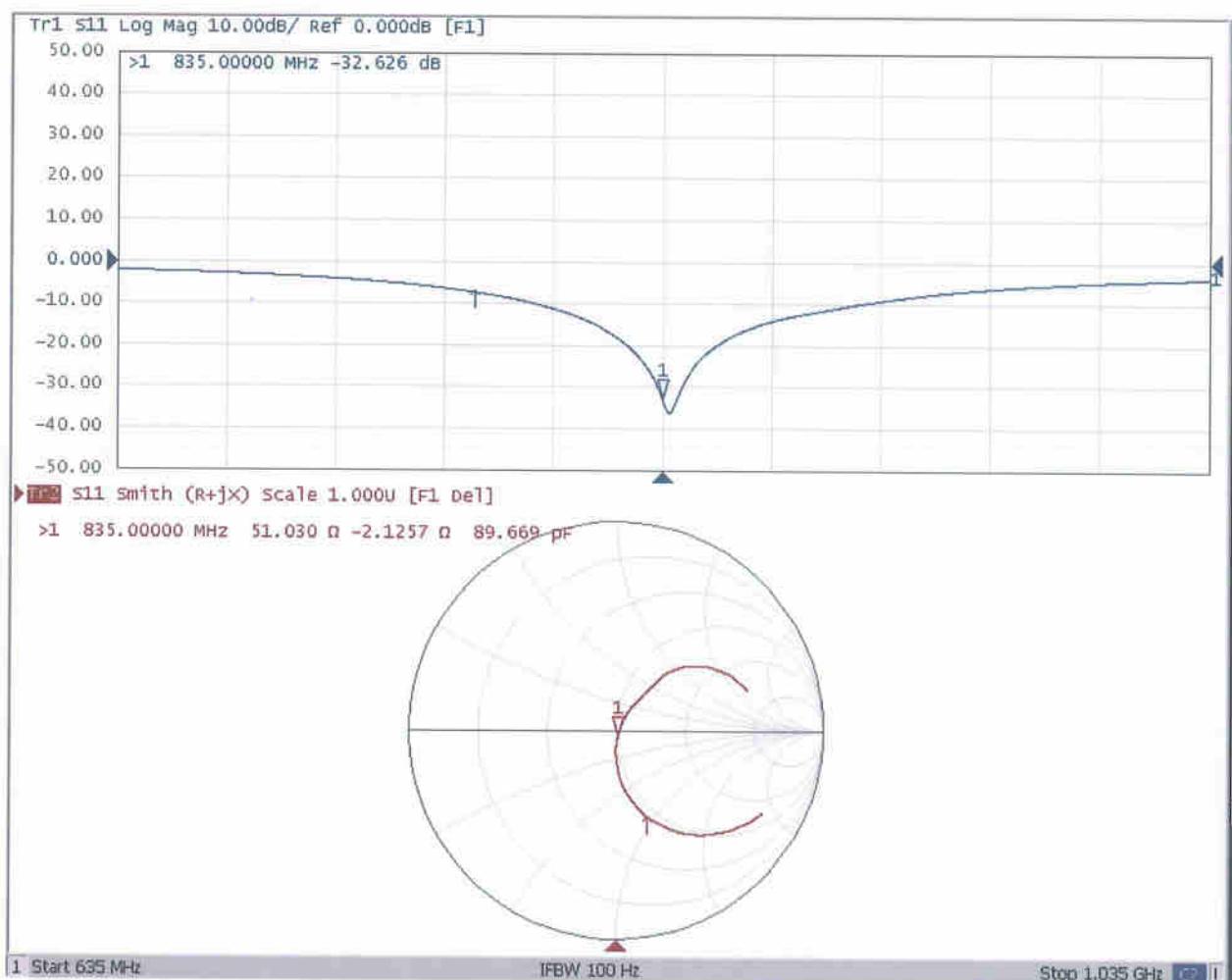




In Collaboration with
S p e a g
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: ctl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

Impedance Measurement Plot for Head TSL



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

DASY5 Validation Report for Body TSL

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d162

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 835$ MHz; $\sigma = 0.954$ S/m; $\epsilon_r = 54.22$; $\rho = 1000$ kg/m³

Phantom section: Left Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN7433; ConvF(9.5,9.5, 9.5); Calibrated: 9/26/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2/2/2016
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

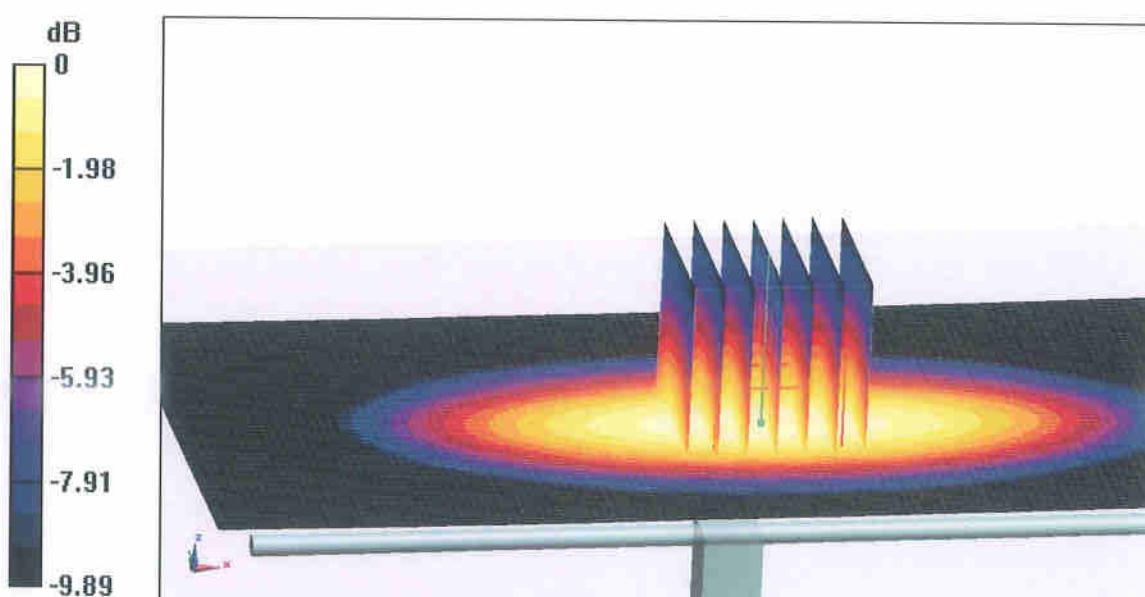
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 56.01 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 3.48 W/kg

SAR(1 g) = 2.39 W/kg; SAR(10 g) = 1.59 W/kg

Maximum value of SAR (measured) = 2.99 W/kg

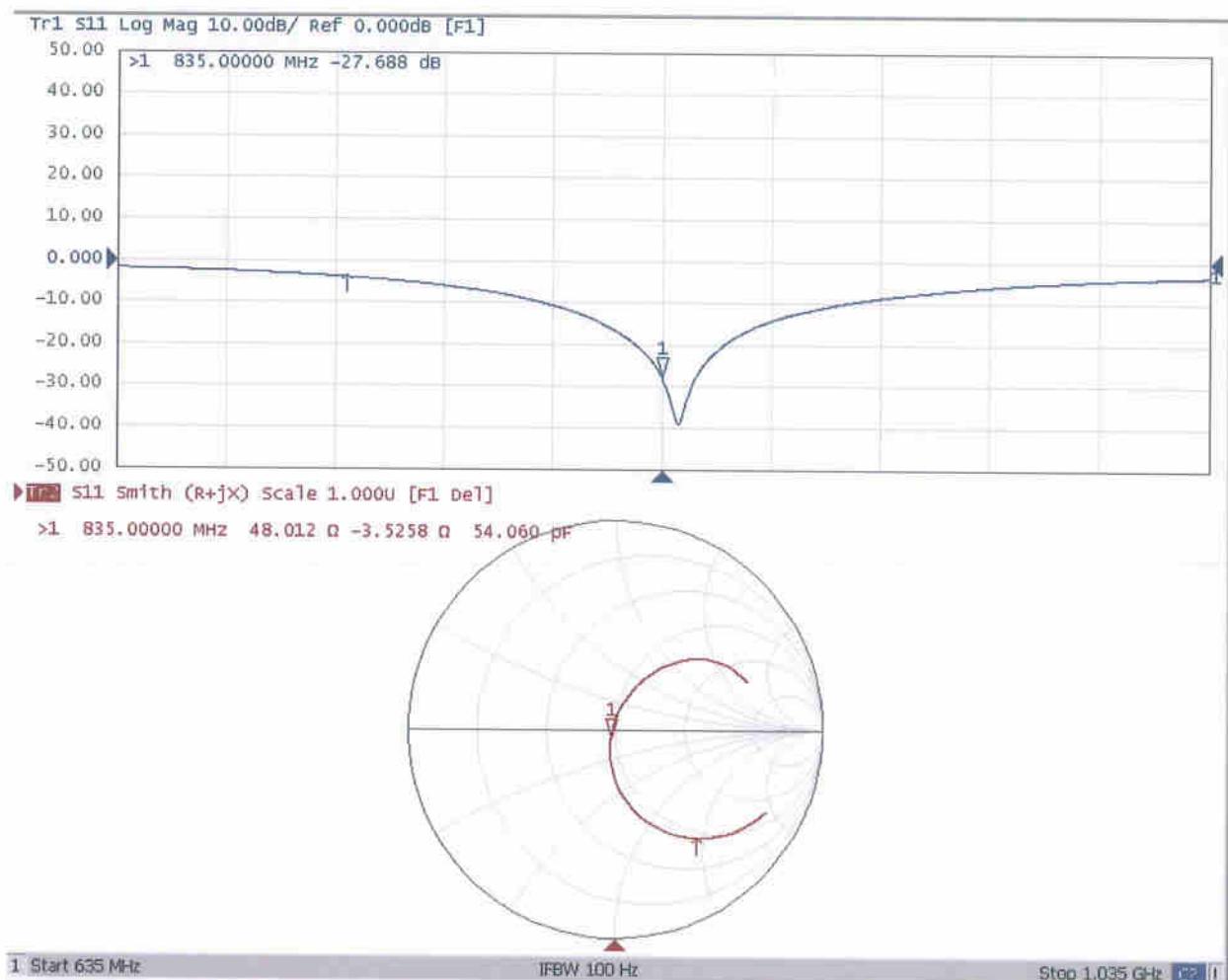


0 dB = 2.99 W/kg = 4.76 dBW/kg



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

Impedance Measurement Plot for Body TSL





In Collaboration with
s p e a g
 CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
 Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
 E-mail: cttl@chinattl.com <http://www.chinattl.cn>



中国认可
 国际互认
 校准
 CALIBRATION
 CNAS L0570

Client

Sporton_CN

Certificate No: Z16-97070

CALIBRATION CERTIFICATE

Object D1750V2 - SN: 1137

Calibration Procedure(s) FD-Z11-2-003-01
 Calibration Procedures for dipole validation kits

Calibration date: May 18, 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(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	01-Jul-15 (CTTL, No.J15X04256)	Jun-16
Power sensor NRP-Z91	101547	01-Jul-15 (CTTL, No.J15X04256)	Jun-16
Reference Probe EX3DV4	SN 7307	19-Feb-16(SPEAG, No.EX3-7307_Feb16)	Feb-17
DAE4	SN 771	02-Feb-16(CTTL-SPEAG, No.Z16-97011)	Feb-17
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	01-Feb-16 (CTTL, No.J16X00893)	Jan-17
Network Analyzer E5071C	MY46110673	26-Jan-16 (CTTL, No.J16X00894)	Jan-17

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Lu Bingsong	Deputy Director of the laboratory	

Issued: May 20, 2016

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



Glossary:

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

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 300MHz to 3GHz)", February 2005
- IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

- 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%.



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
 Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
 E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

Measurement Conditions

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

DASY Version	DASY52	52.8.8.1258
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz \pm 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 \pm 0.2) °C	40.3 \pm 6 %	1.39 mho/m \pm 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.18 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	36.5 mW /g \pm 20.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.04 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	20.1 mW /g \pm 20.4 % (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 \pm 0.2) °C	54.3 \pm 6 %	1.48 mho/m \pm 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.27 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	37.4 mW /g \pm 20.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	4.96 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	20.0 mW /g \pm 20.4 % (k=2)



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$50.3\Omega + 0.73j\Omega$
Return Loss	- 42.0dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$44.9\Omega + 1.29j\Omega$
Return Loss	- 25.2dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.321 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
-----------------	-------



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

DASY5 Validation Report for Head TSL

Date: 05.18.2016

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1137

Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1750$ MHz; $\sigma = 1.388$ S/m; $\epsilon_r = 40.26$; $\rho = 1000$ kg/m³

Phantom section: Right Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN7307; ConvF(8.37, 8.37, 8.37); Calibrated: 2/19/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2/2/2016
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

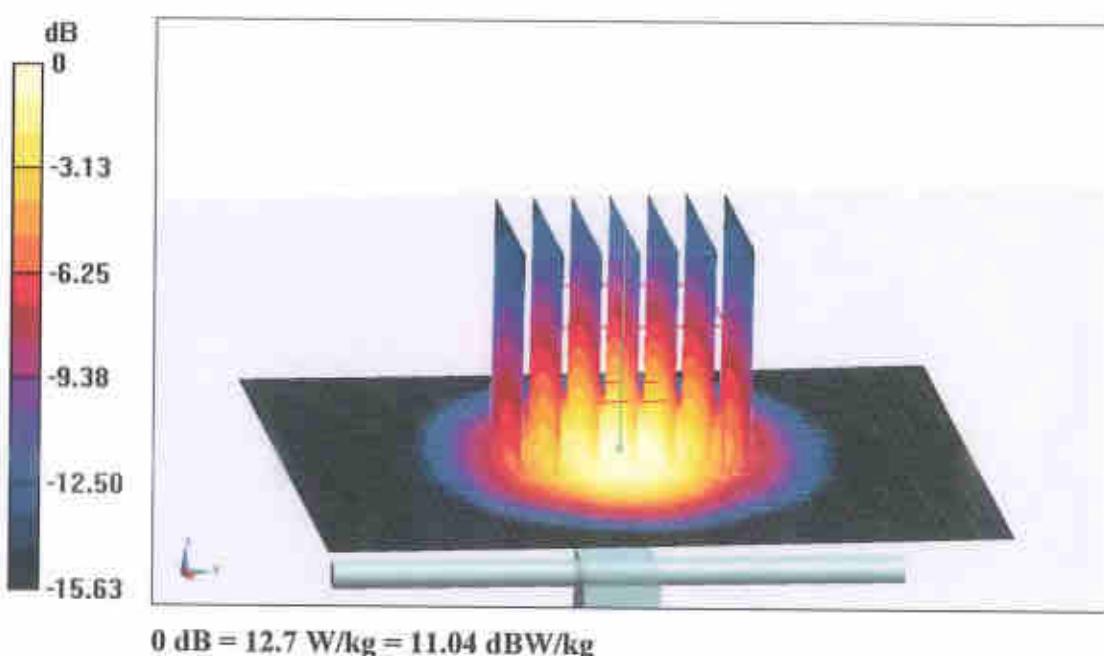
System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 97.87V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 15.9W/kg

SAR(1 g) = 9.18 W/kg; SAR(10 g) = 5.04 W/kg

Maximum value of SAR (measured) = 12.7 W/kg

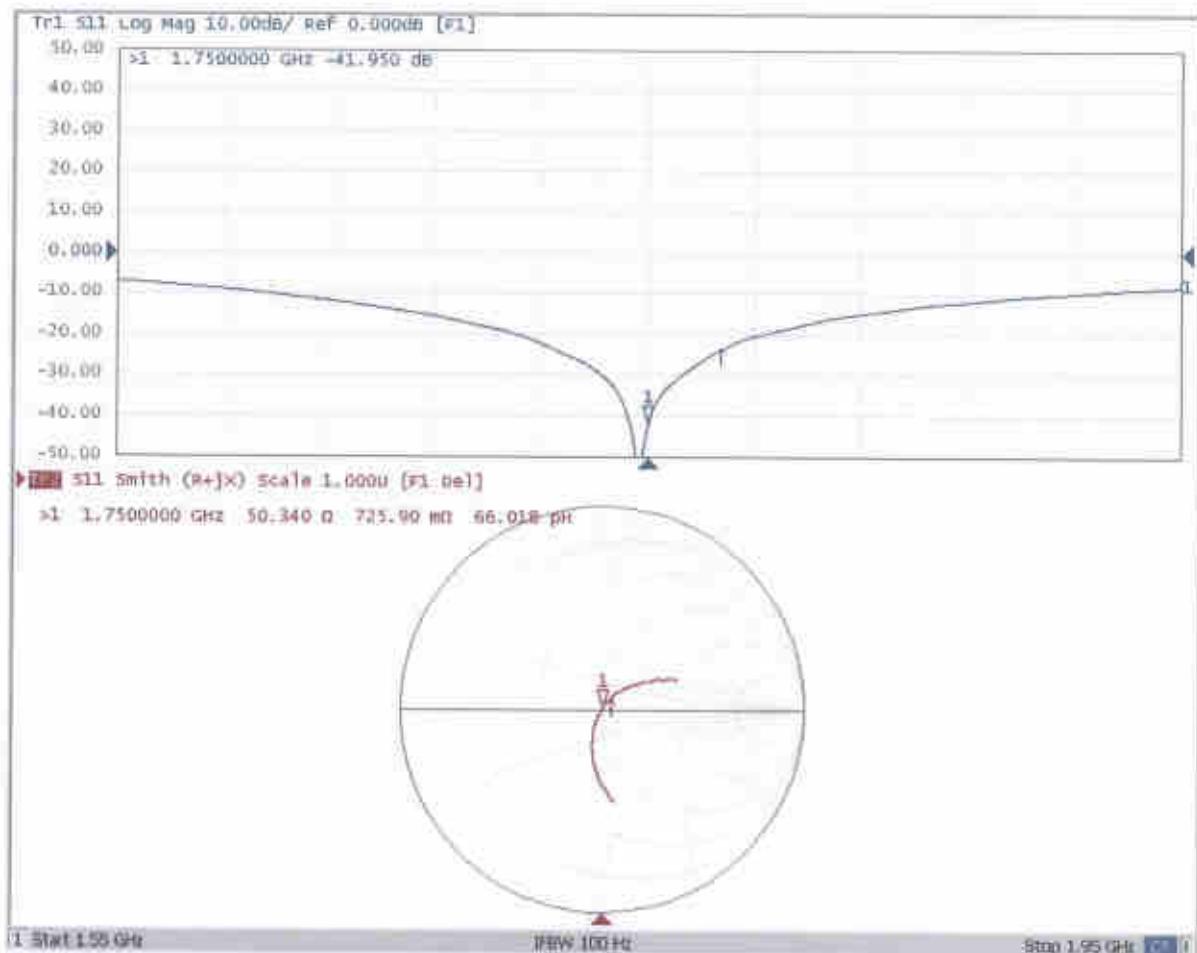




In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

Impedance Measurement Plot for Head TSL





DASY5 Validation Report for Body TSL

Date: 05.18.2016

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1137

Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1750$ MHz; $\sigma = 1.476$ S/m; $\epsilon_r = 54.25$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN7307; ConvF(8.18, 8.18, 8.18); Calibrated: 2/19/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2/2/2016
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

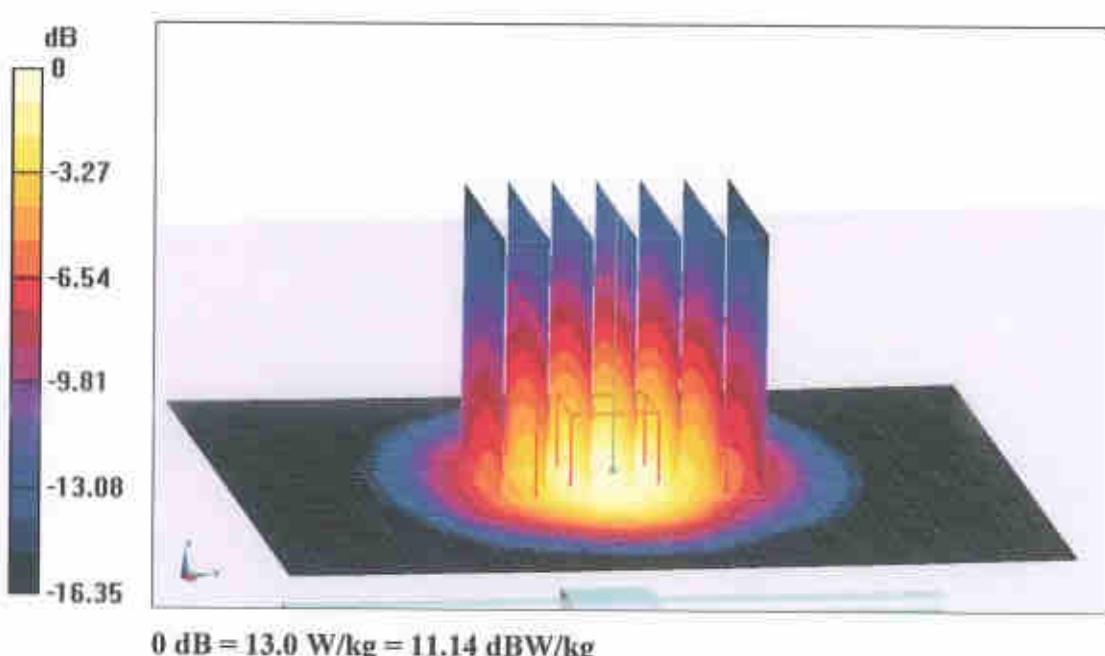
System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:
 $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 96.05 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 16.3 W/kg

SAR(1 g) = 9.27 W/kg; SAR(10 g) = 4.96 W/kg

Maximum value of SAR (measured) = 13.0 W/kg

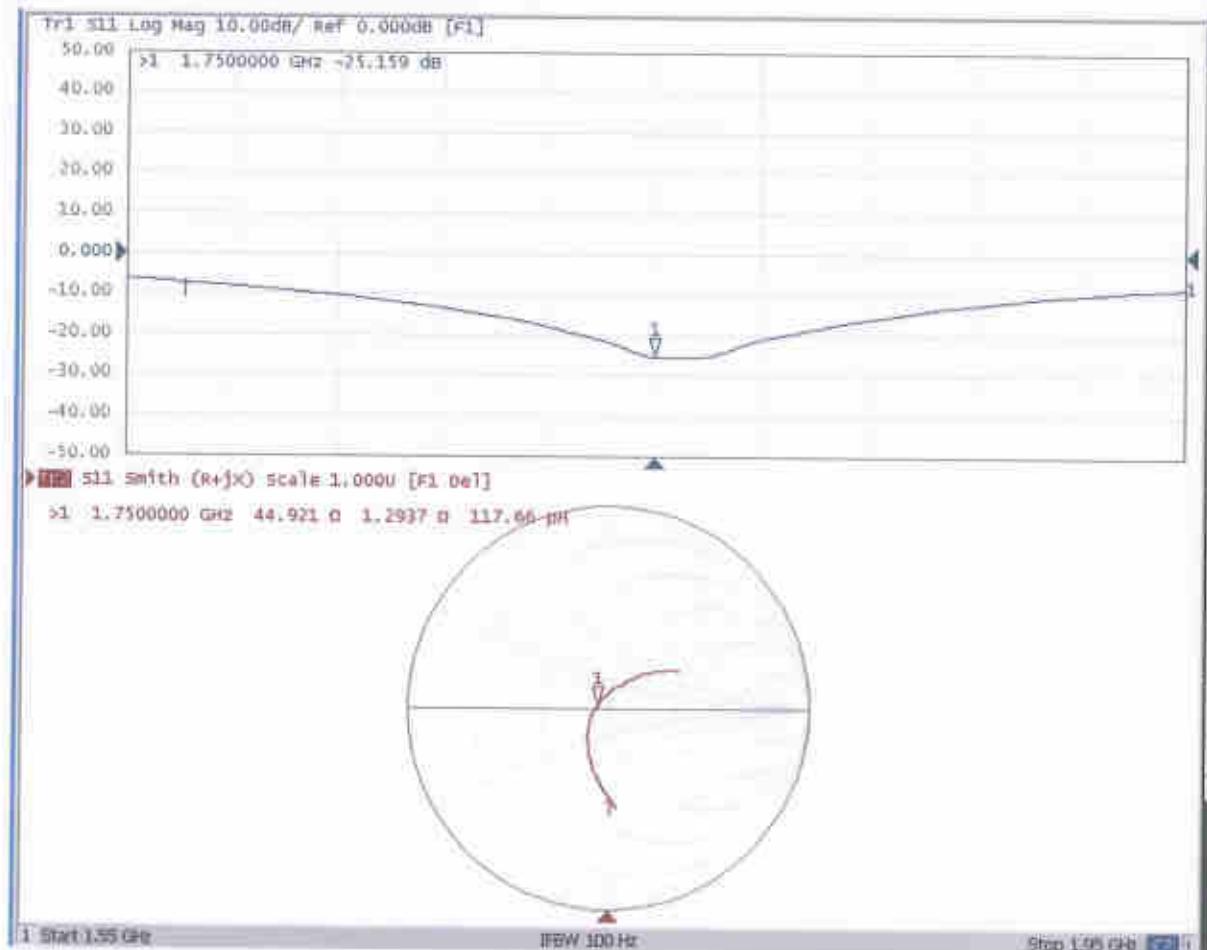




In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

Impedance Measurement Plot for Body TSL





Client

Sporton-CN

Certificate No: Z16-97230

CALIBRATION CERTIFICATE

Object D1900V2 - SN: 5d182

Calibration Procedure(s) FD-Z11-003-01
 Calibration Procedures for dipole validation kits

Calibration date: November 24, 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(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	27-Jun-16 (CTTL, No.J16X04777)	Jun-17
Power sensor NRP-Z91	101547	27-Jun-16 (CTTL, No.J16X04777)	Jun-17
Reference Probe EX3DV4	SN 7433	26-Sep-16(SPEAG, No.EX3-7433_Sep16)	Sep-17
DAE4	SN 771	02-Feb-16(CTTL-SPEAG, No.Z16-97011)	Feb-17
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	01-Feb-16 (CTTL, No.J16X00893)	Jan-17
Network Analyzer E5071C	MY46110673	26-Jan-16 (CTTL, No.J16X00894)	Jan-17

Calibrated by:	Name	Function	Signature
	Zhao Jing	SAR Test Engineer	
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Lu Bingsong	Deputy Director of the laboratory	

Issued: November 27, 2016

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



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: ctl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORMx,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 300MHz to 3GHz)", February 2005
- c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- d) KDB865664, 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%.



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

Measurement Conditions

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

DASY Version	DASY52	52.8.8.1258
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz \pm 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 \pm 0.2) °C	40.4 \pm 6 %	1.43 mho/m \pm 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.1 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	40.0 mW /g \pm 20.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.23 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	20.8 mW /g \pm 20.4 % (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 \pm 0.2) °C	54.6 \pm 6 %	1.53 mho/m \pm 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.2 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	40.8 mW /g \pm 20.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.32 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	21.3 mW /g \pm 20.4 % (k=2)



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: ctl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.6Ω+ 5.15jΩ
Return Loss	- 25.0dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.2Ω+ 6.18jΩ
Return Loss	- 23.7dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.086 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
-----------------	-------

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

DASY5 Validation Report for Head TSL

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d182

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.426$ S/m; $\epsilon_r = 40.35$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN7433; ConvF(7.98, 7.98, 7.98); Calibrated: 9/26/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2/2/2016
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

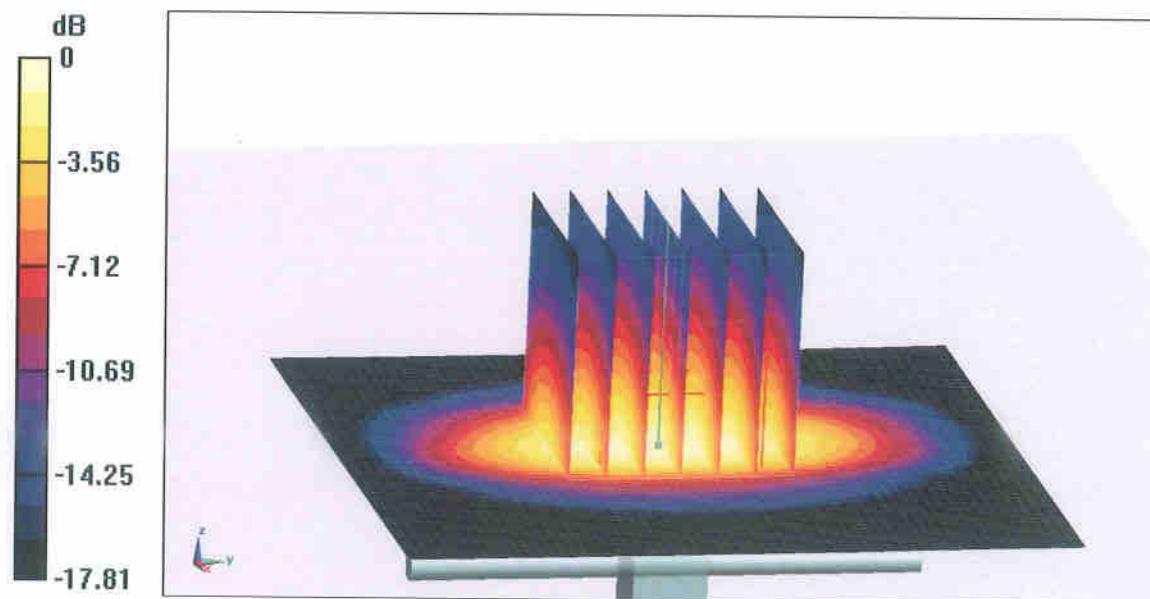
System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 102.8 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 18.7 W/kg

SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.23 W/kg

Maximum value of SAR (measured) = 14.5 W/kg

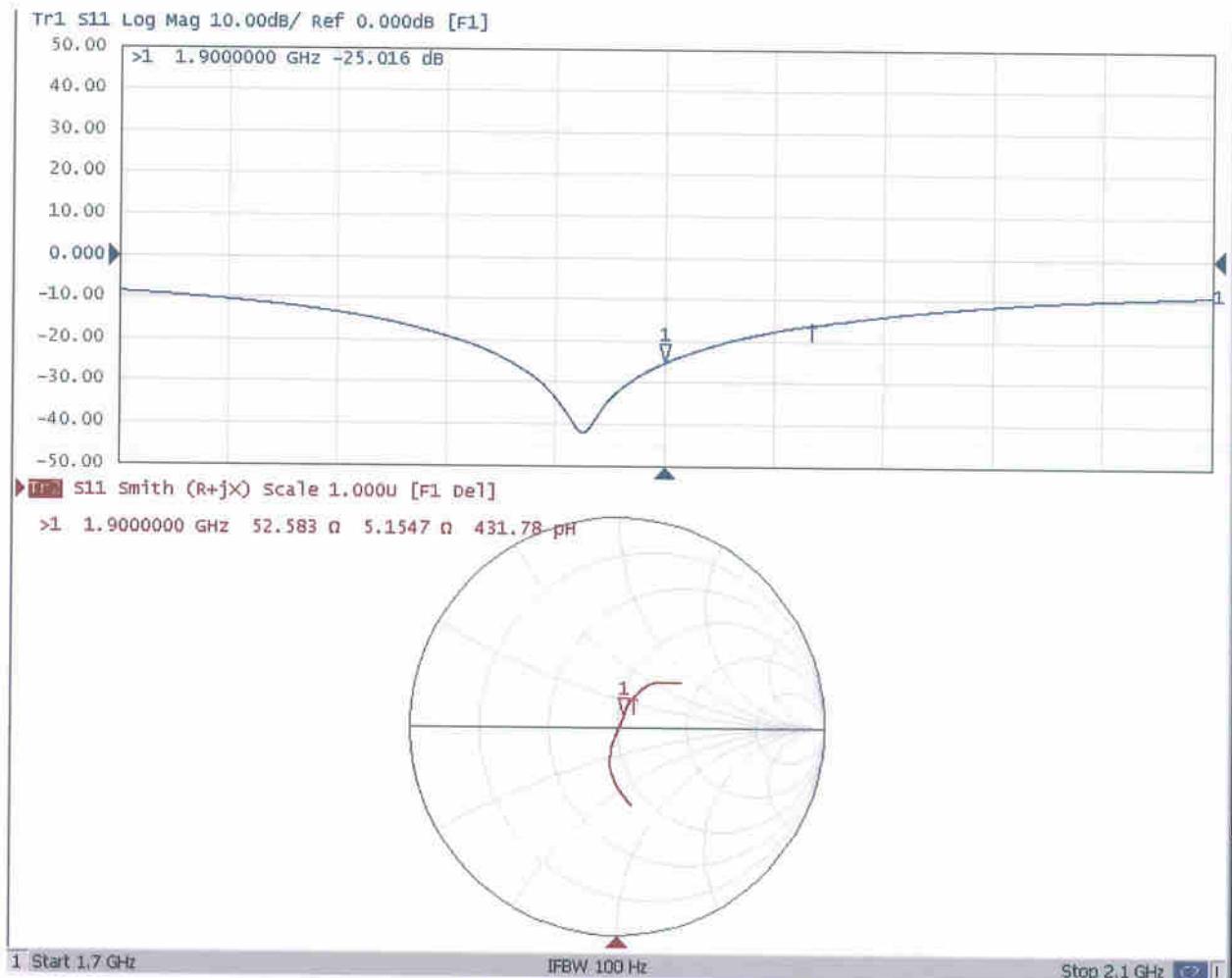




In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: ctl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d182

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1900 \text{ MHz}$; $\sigma = 1.531 \text{ S/m}$; $\epsilon_r = 54.57$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN7433; ConvF(7.7, 7.7, 7.7); Calibrated: 9/26/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2/2/2016
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:

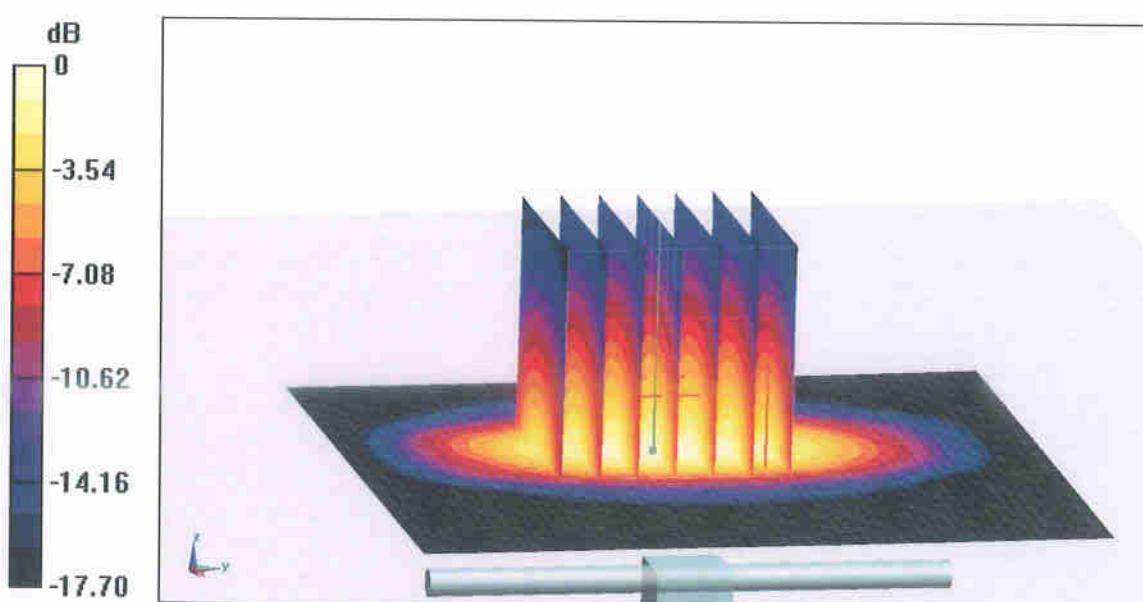
$dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 95.33 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 18.6 W/kg

SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.32 W/kg

Maximum value of SAR (measured) = 14.6 W/kg



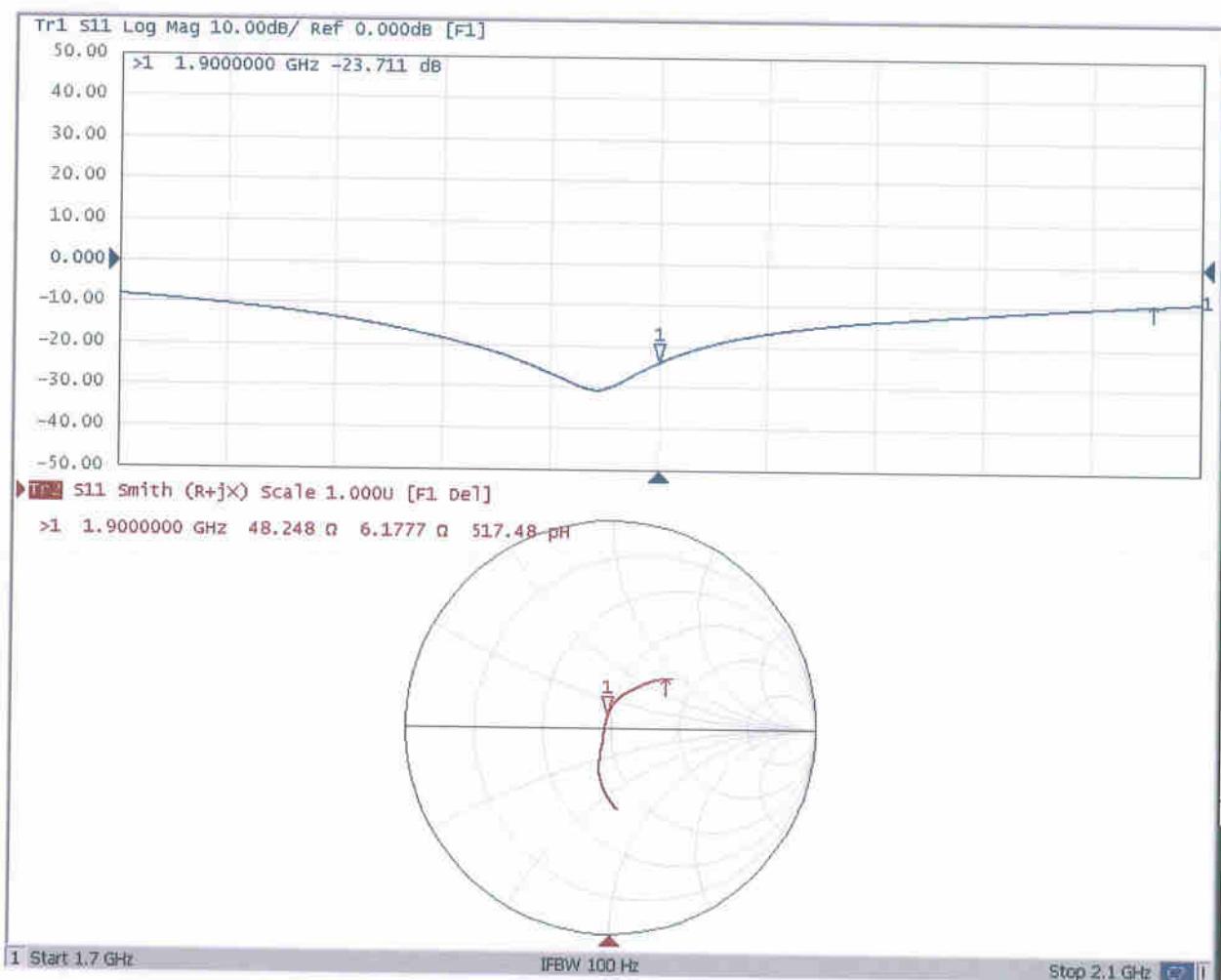
0 dB = 14.6 W/kg = 11.64 dBW/kg



In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: ctl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

Impedance Measurement Plot for Body TSL





In Collaboration with
S p e a g
 CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
 Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
 E-mail: ctll@chinattl.com <http://www.chinattl.com>



中国认可
 国际互认
 校准
 CALIBRATION
 CNAS L0570

Client

Sporton_KS

Certificate No: Z16-97149

CALIBRATION CERTIFICATE

Object D2300V2 - SN: 1056

Calibration Procedure(s) FD-Z11-2-003-01
 Calibration Procedures for dipole validation kits

Calibration date: August 31, 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(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	01-Jul-15 (CTTL, No.J15X04256)	Jun-16
Power sensor NRP-Z91	101547	01-Jul-15 (CTTL, No.J15X04256)	Jun-16
Reference Probe EX3DV4	SN 7307	19-Feb-16(SPEAG, No.EX3-7307_Feb16)	Feb-17
DAE4	SN 777	22-Aug-16(CTTL-SPEAG, No.Z16-97138)	Aug-17
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	01-Feb-16 (CTTL, No.J16X00893)	Jan-17
Network Analyzer E5071C	MY46110673	26-Jan-16 (CTTL, No.J16X00894)	Jan-17

Calibrated by:	Name Zhao Jing	Function SAR Test Engineer	Signature
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Lu Bingsong	Deputy Director of the laboratory	

Issued: September 2, 2016

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



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: tti@chinatti.com [Http://www.chinatti.cn](http://www.chinatti.cn)

Glossary:

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

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 300MHz to 3GHz)", February 2005
- IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

- 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%.



Add: No.31 Xueyuan Road, Haidian District, Beijing, 100191, China
 Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
 E-mail: ctti@chinatti.com [Http://www.chinatti.cn](http://www.chinatti.cn)

Measurement Conditions

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

DASY Version	DASY52	52.8.8.1258
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2300 MHz \pm 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.5	1.67 mho/m
Measured Head TSL parameters	(22.0 \pm 0.2) °C	39.7 \pm 6 %	1.66 mho/m \pm 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	12.0 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	48.2 mW / g \pm 20.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.84 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	23.4 mW / g \pm 20.4 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.9	1.81 mho/m
Measured Body TSL parameters	(22.0 \pm 0.2) °C	53.1 \pm 6 %	1.83 mho/m \pm 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.3 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	49.0 mW / g \pm 20.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	6.02 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	24.0 mW / g \pm 20.4 % (k=2)



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.0Ω- 3.63jΩ
Return Loss	- 27.5dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	44.7Ω- 2.68jΩ
Return Loss	- 24.1dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.060 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
-----------------	-------

DASY5 Validation Report for Head TSL

Date: 08.31.2016

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2300 MHz; Type: D2300V2; Serial: D2300V2 - SN: 1056

Communication System: UID 0, CW; Frequency: 2300 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2300$ MHz; $\sigma = 1.663$ S/m; $\epsilon_r = 39.72$; $\rho = 1000$ kg/m³

Phantom section: Right Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN7307; ConvF(7.65, 7.65, 7.65); Calibrated: 2/19/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn777; Calibrated: 8/22/2016
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

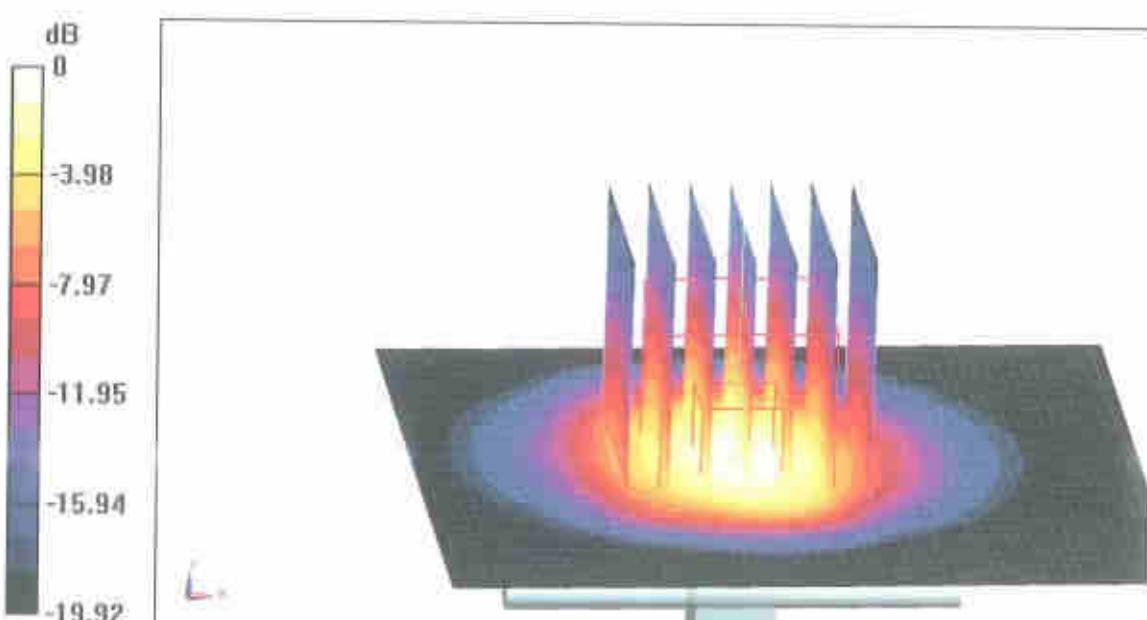
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 103.4 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 23.2 W/kg

SAR(1 g) = 12 W/kg; SAR(10 g) = 5.84 W/kg

Maximum value of SAR (measured) = 17.8 W/kg

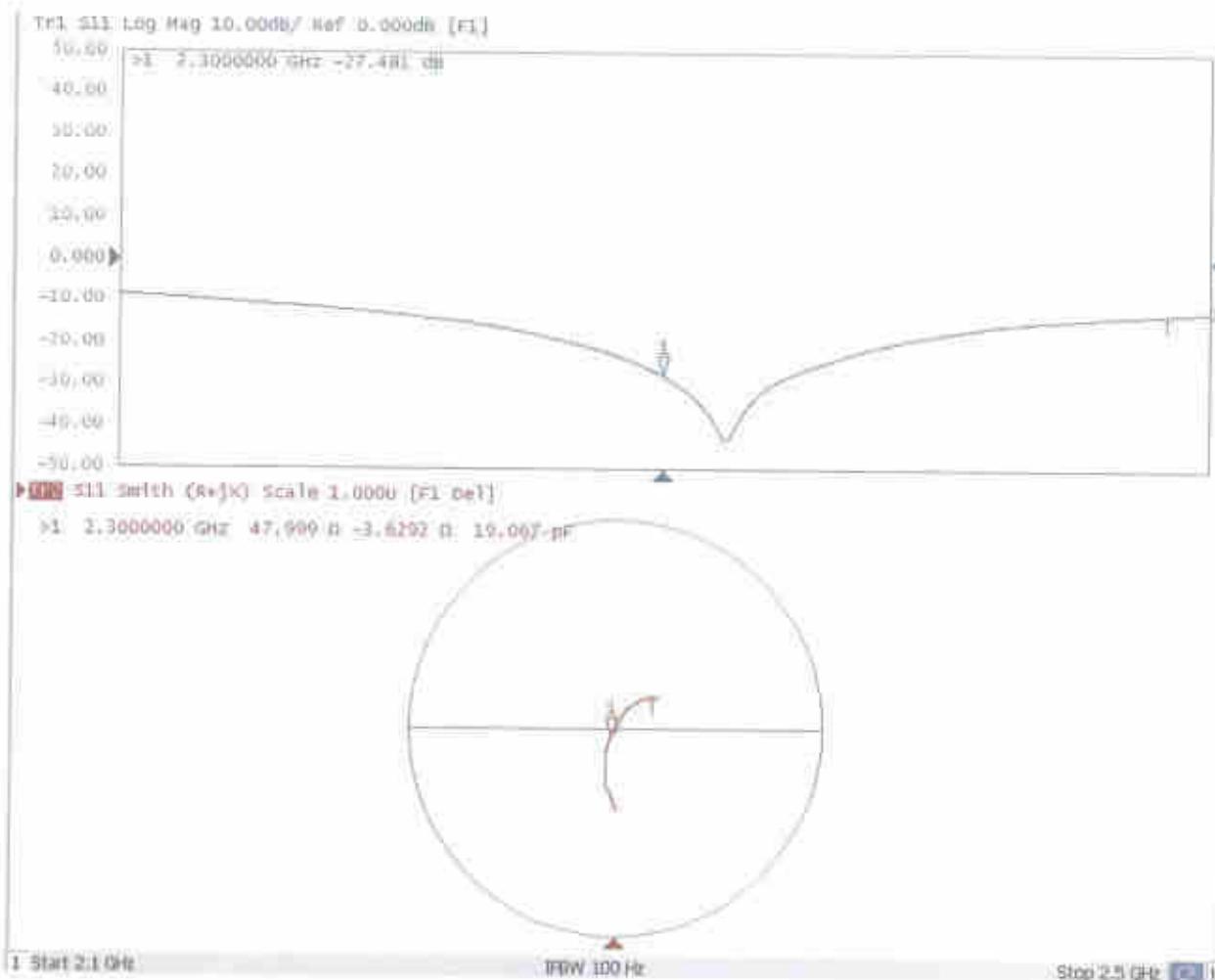




In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

Impedance Measurement Plot for Head TSL



Add: No.51 Xueyuan Roud, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

DASY5 Validation Report for Body TSL

Date: 08.31.2016

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2300 MHz; Type: D2300V2; Serial: D2300V2 - SN: 1056

Communication System: UID 0, CW; Frequency: 2300 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2300$ MHz; $\sigma = 1.829$ S/m; $\epsilon_r = 53.14$; $\rho = 1000$ kg/m 3

Phantom section: Center Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN7307; ConvF(7.41, 7.41, 7.41); Calibrated: 2/19/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn777; Calibrated: 8/22/2016
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

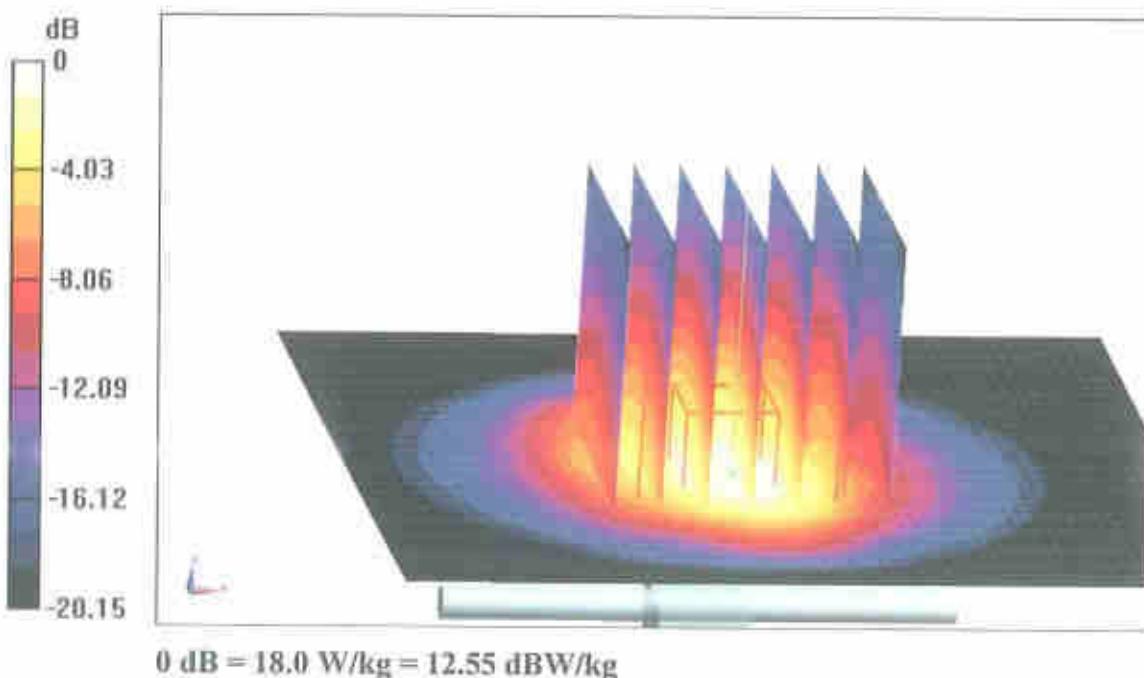
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 99.90 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 23.7 W/kg

SAR(1 g) = 12.3 W/kg; SAR(10 g) = 6.02 W/kg

Maximum value of SAR (measured) = 18.0 W/kg

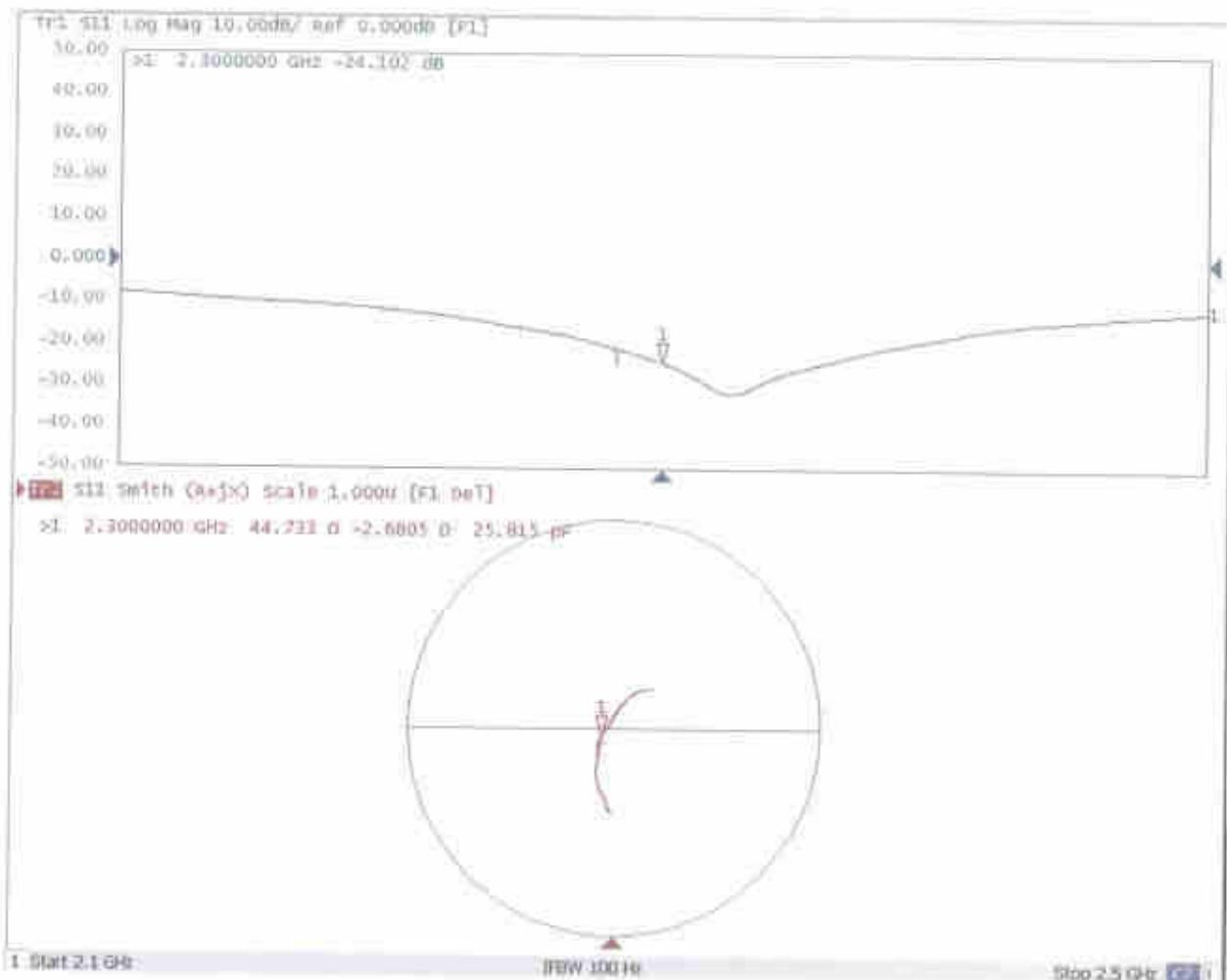




In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.51 Xucyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

Impedance Measurement Plot for Body TSL





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

Accreditation No.: SCS 0108

Client Sporton-SZ (Auden)

Certificate No: D2450V2-924_Feb16

CALIBRATION CERTIFICATE

Object D2450V2 - SN: 924

Calibration procedure(s) QA CAL-05.v9
 Calibration procedure for dipole validation kits above 700 MHz

Calibration date: February 24, 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 $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	US37292783	07-Oct-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	MY41092317	07-Oct-15 (No. 217-02223)	Oct-16
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe EX3DV4	SN: 7349	31-Dec-15 (No. EX3-7349_Dec15)	Dec-16
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100972	15-Jun-15 (in house check Jun-15)	In house check: Jun-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

Calibrated by:	Name	Function	Signature
	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: February 24, 2016

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



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:

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

Additional Documentation:

- 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	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	38.7 ± 6 %	1.84 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	52.5 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.19 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.6 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	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.9 ± 6 %	2.00 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.0 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	51.4 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.07 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	24.1 W/kg ± 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$52.7 \Omega + 4.0 \text{ j} \Omega$
Return Loss	- 26.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$48.7 \Omega + 6.1 \text{ j} \Omega$
Return Loss	- 24.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.155 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 26, 2013

DASY5 Validation Report for Head TSL

Date: 24.02.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 924

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.84$ S/m; $\epsilon_r = 38.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.76, 7.76, 7.76); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

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 = 114.9 V/m; Power Drift = 0.01 dB

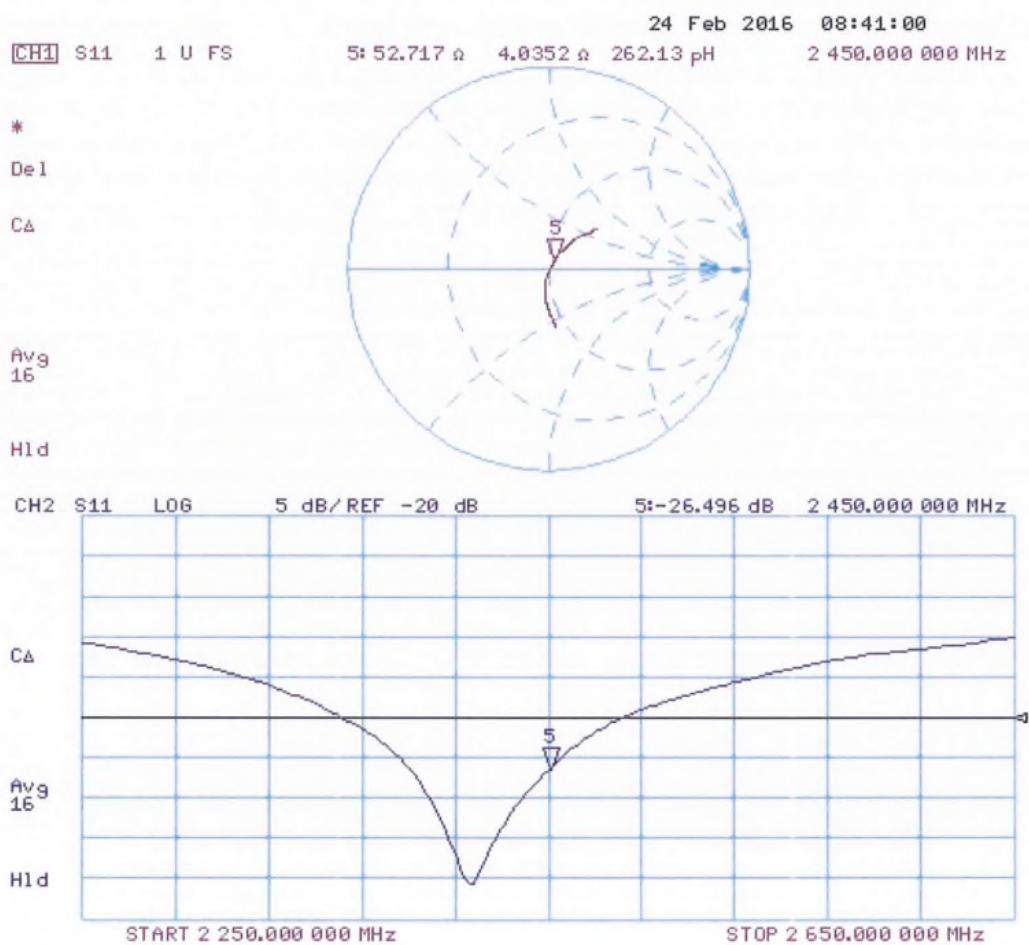
Peak SAR (extrapolated) = 27.0 W/kg

SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.19 W/kg

Maximum value of SAR (measured) = 21.9 W/kg



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 24.02.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 924

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 2$ S/m; $\epsilon_r = 52.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.79, 7.79, 7.79); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

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

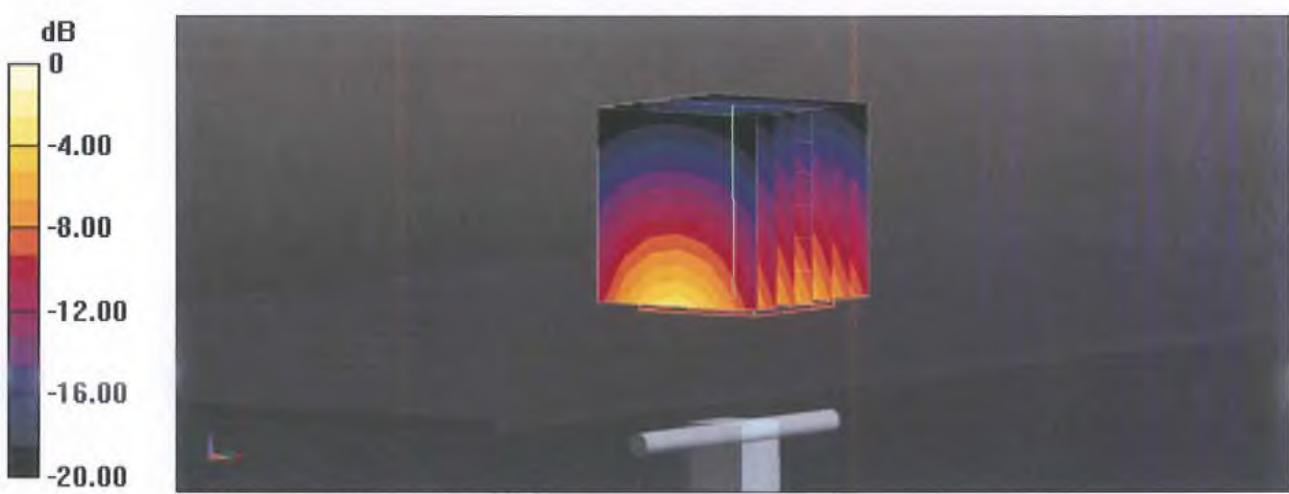
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 107.5 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 26.0 W/kg

SAR(1 g) = 13 W/kg; SAR(10 g) = 6.07 W/kg

Maximum value of SAR (measured) = 21.4 W/kg



Impedance Measurement Plot for Body TSL

