Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2017/8/14

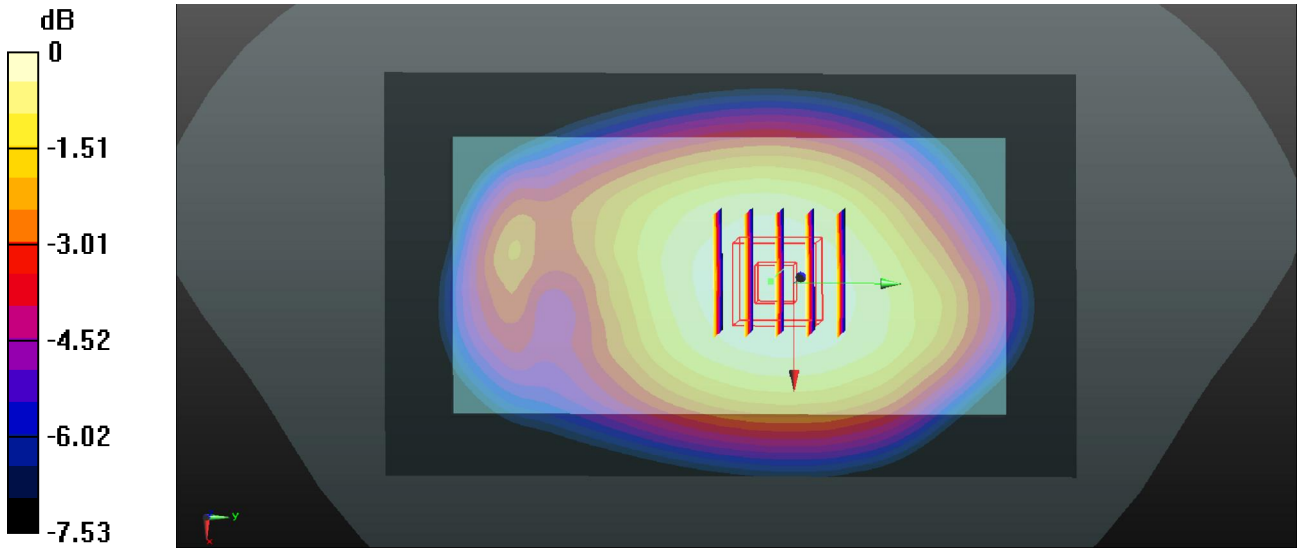
23_WCDMA Band V_RMC 12.2Kbps_Back_15mm_Ch4182

Communication System: UID 0, WCDMA (0); Frequency: 836.4 MHz;Duty Cycle: 1:1
Medium: MSL_835_2017/08/14 Medium parameters used: f = 836.4 MHz; σ = 0.994 S/m; ε_r = 55.74; ρ = 1000 kg/m^3
Ambient Temperature：23.8 ℃; Liquid Temperature ：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3935; ConvF(10.48, 10.48, 10.48); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1754
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch4182/Area Scan (71x121x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.516 W/kg

Ch4182/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 20.47 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.565 W/kg
SAR(1 g) = 0.428 W/kg; SAR(10 g) = 0.330 W/kg
Maximum value of SAR (measured) = 0.515 W/kg



0 dB = 0.515 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2017/8/11

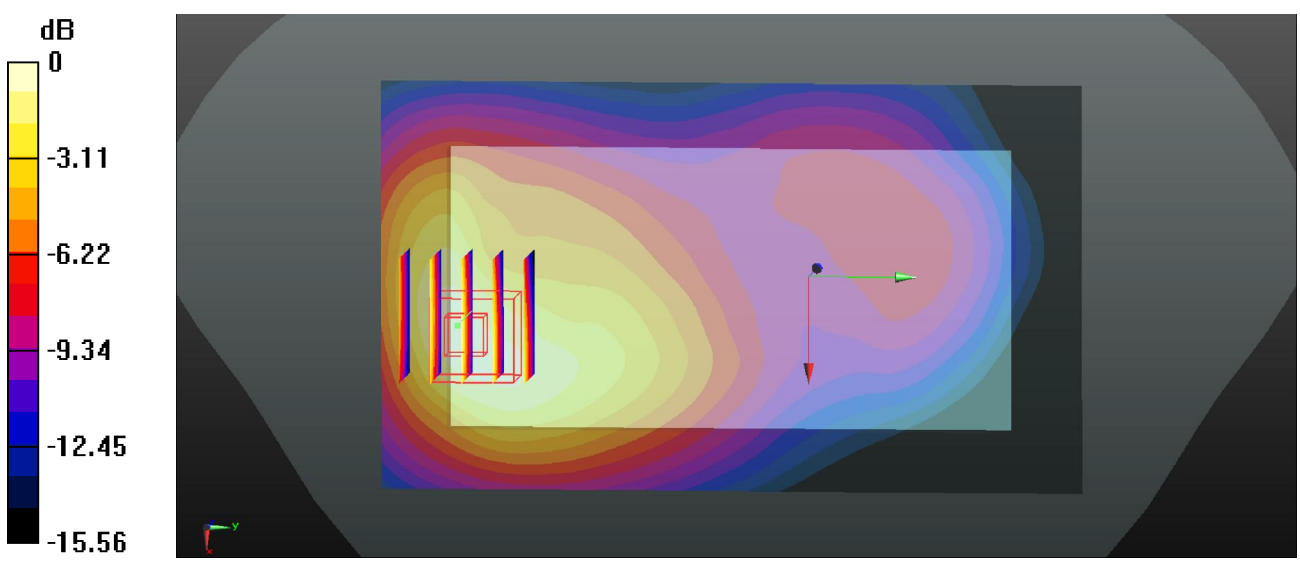
24_WCDMA Band IV_RMC 12.2Kbps_Back_15mm_Ch1312

Communication System: UID 0, WCDMA (0); Frequency: 1712.4 MHz;Duty Cycle: 1:1
Medium: MSL_1750_2017/08/11 Medium parameters used: f = 1712.4 MHz; σ = 1.487 S/m; ε_r = 52.193; ρ = 1000 kg/m^3
Ambient Temperature：23.7 ℃; Liquid Temperature ：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3935; ConvF(8.46, 8.46, 8.46); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch1312/Area Scan (71x121x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.33 W/kg

Ch1312/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 10.83 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 1.59 W/kg
SAR(1 g) = 1 W/kg; SAR(10 g) = 0.598 W/kg
Maximum value of SAR (measured) = 1.40 W/kg



0 dB = 1.40 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2017/8/8

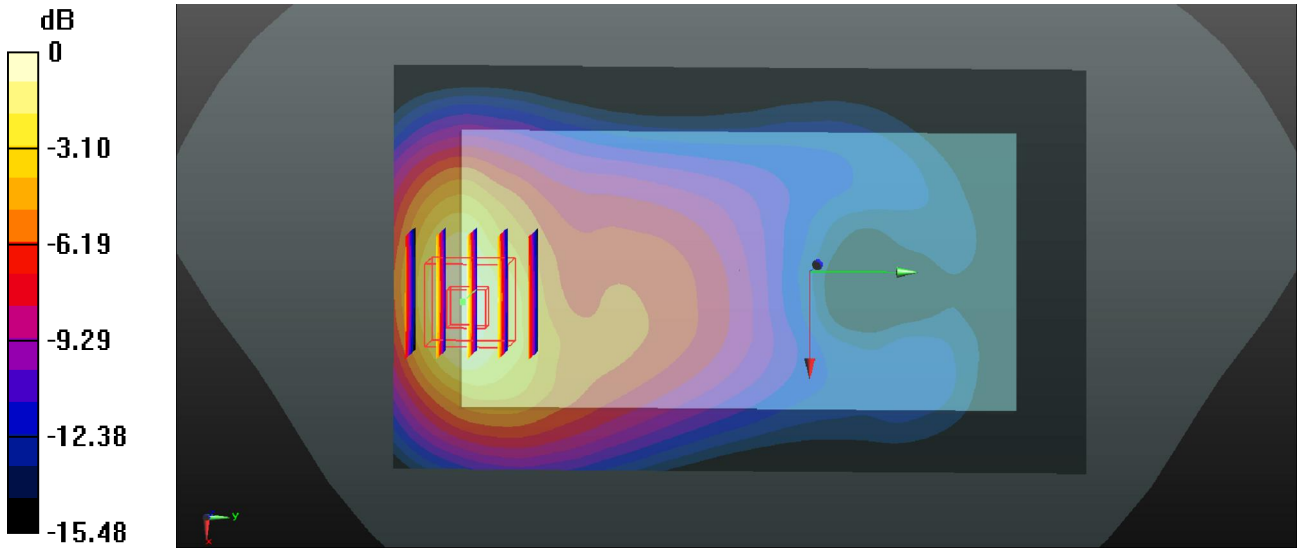
25_WCDMA Band II_RMC 12.2Kbps_Back_15mm_Ch9538

Communication System: UID 0, WCDMA (0); Frequency: 1907.6 MHz;Duty Cycle: 1:1
Medium: MSL_1900_2017/08/08 Medium parameters used: f = 1907.6 MHz; σ = 1.532 S/m; ε_r =54.489; ρ = 1000 kg/m^3
Ambient Temperature：23.6 ℃; Liquid Temperature ：22.3 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3935; ConvF(8.18, 8.18, 8.18); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1754
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch9538/Area Scan (71x121x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.27 W/kg

Ch9538/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 9.378 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 1.50 W/kg
SAR(1 g) = 0.937 W/kg; SAR(10 g) = 0.533 W/kg
Maximum value of SAR (measured) = 1.31 W/kg



0 dB = 1.31 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2017/8/15

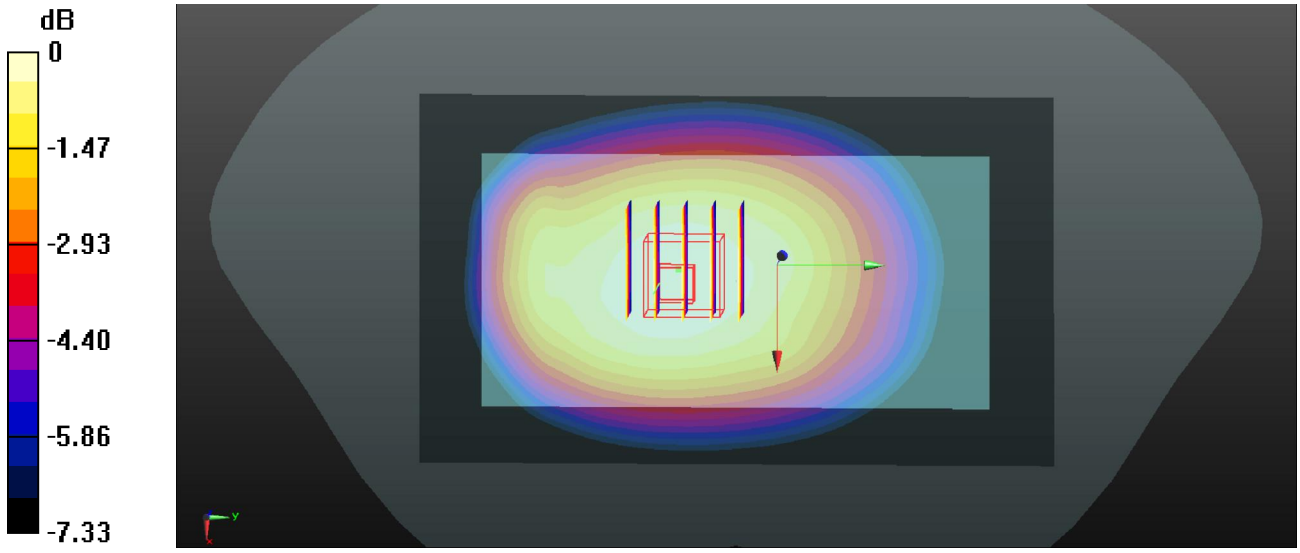
26_LTE Band 12_10M_QPSK_1RB_25offset_Back_15mm_Ch23095

Communication System: UID 0, FDD-LTE (0); Frequency: 707.5 MHz;Duty Cycle: 1:1
Medium: MSL_750_2017/08/15 Medium parameters used: f = 707.5 MHz; σ = 0.936 S/m; ε_r = 54.325; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature ：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3935; ConvF(10.68, 10.68, 10.68); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1754
- 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) = 0.478 W/kg

Ch23095/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.93 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.509 W/kg
SAR(1 g) = 0.394 W/kg; SAR(10 g) = 0.306 W/kg
Maximum value of SAR (measured) = 0.469 W/kg



0 dB = 0.469 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2017/8/14

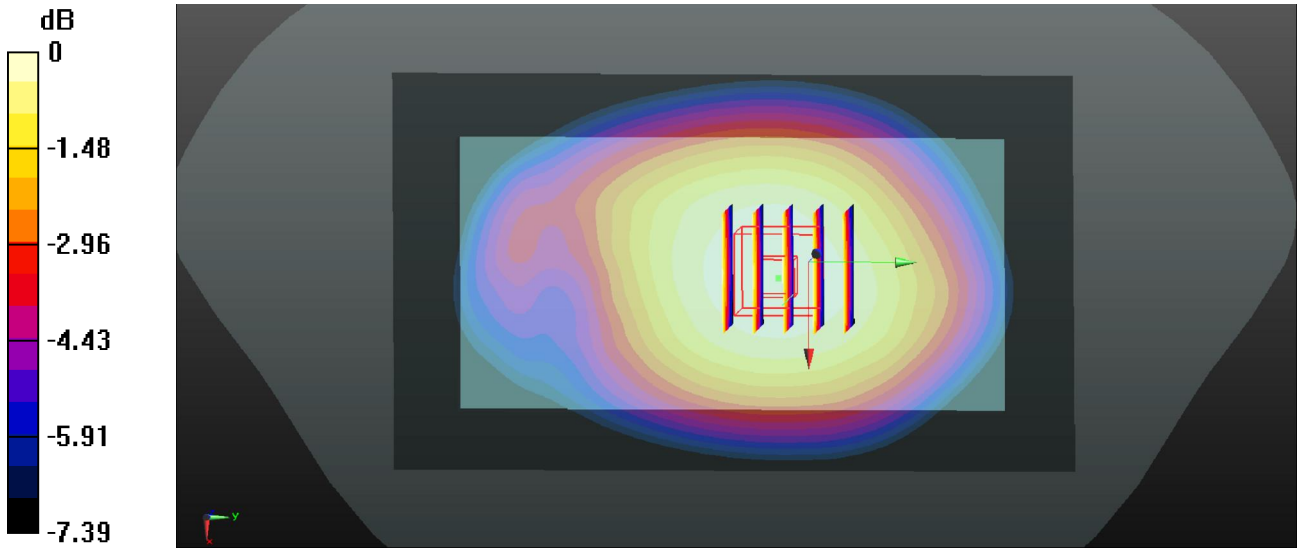
27_LTE Band 5_10M_QPSK_1RB_25offset_Back_15mm_Ch20525

Communication System: UID 0, FDD-LTE (0); Frequency: 836.5 MHz;Duty Cycle: 1:1
Medium: MSL_835_2017/08/14 Medium parameters used: f = 836.5 MHz; σ = 0.994 S/m; ε_r = 55.739; ρ = 1000 kg/m^3
Ambient Temperature：23.8 ℃; Liquid Temperature ：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3935; ConvF(10.48, 10.48, 10.48); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1754
- 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) = 0.584 W/kg

Ch20525/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 21.90 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 0.651 W/kg
SAR(1 g) = 0.484 W/kg; SAR(10 g) = 0.373 W/kg
Maximum value of SAR (measured) = 0.589 W/kg



0 dB = 0.589 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2017/8/11

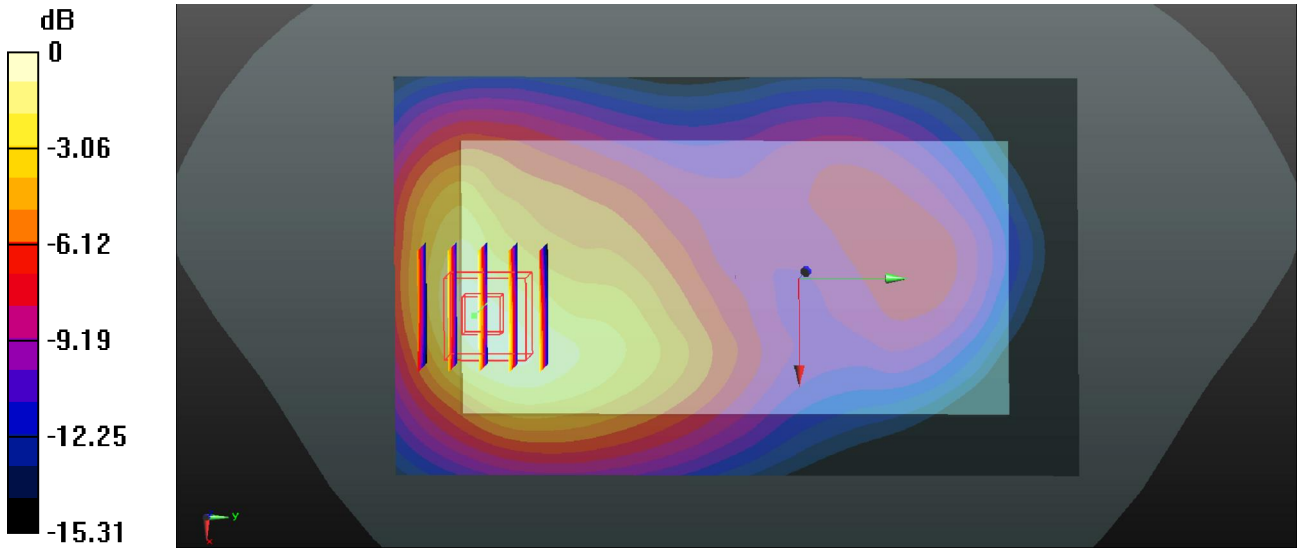
28_LTE Band 66_20M_QPSK_1RB_49offset_Back_15mm_Ch132072

Communication System: UID 0, FDD-LTE (0); Frequency: 1720 MHz;Duty Cycle: 1:1
Medium: MSL_1750_2017/08/11 Medium parameters used: f = 1720 MHz; σ = 1.495 S/m; ε_r = 52.159; ρ = 1000 kg/m^3
Ambient Temperature：23.7 ℃; Liquid Temperature ：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3935; ConvF(8.46, 8.46, 8.46); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch132072/Area Scan (71x121x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.28 W/kg

Ch132072/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 10.54 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 1.62 W/kg
SAR(1 g) = 1.01 W/kg; SAR(10 g) = 0.603 W/kg
Maximum value of SAR (measured) = 1.42 W/kg



0 dB = 1.42 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2017/8/8

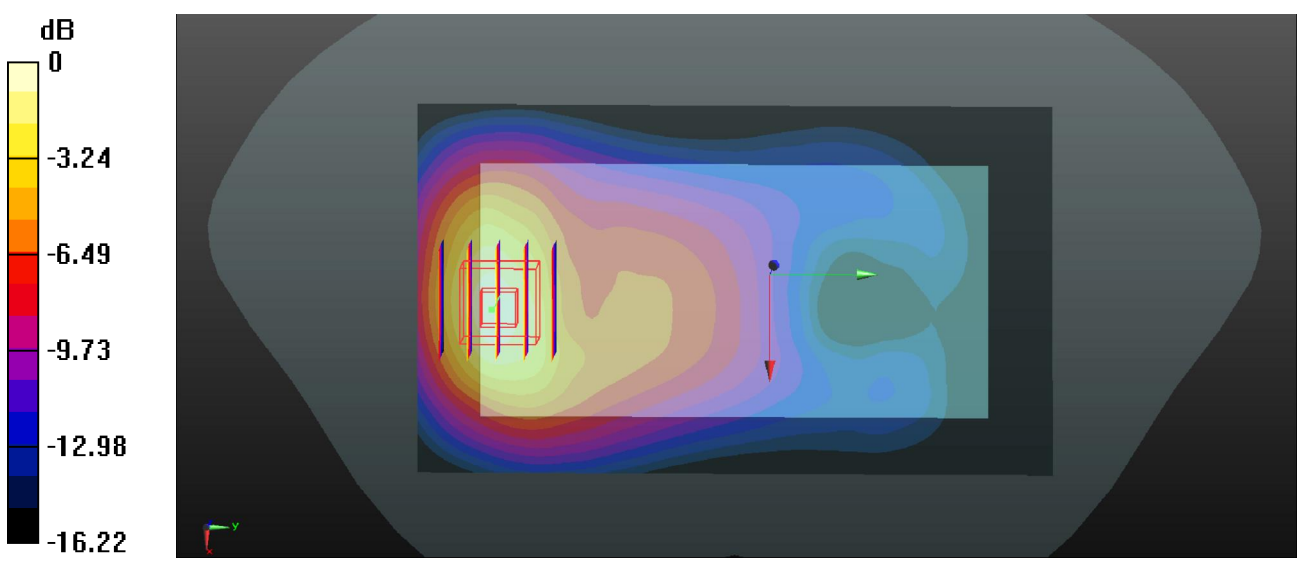
29_LTE Band 2_20M_QPSK_1RB_49offset_Back_15mm_Ch19100

Communication System: UID 0, FDD-LTE (0); Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: MSL_1900_2017/08/08 Medium parameters used: f = 1900 MHz; σ = 1.525 S/m; ε_r = 54.504; ρ = 1000 kg/m^3
Ambient Temperature：23.6 ℃; Liquid Temperature ：22.3 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3935; ConvF(8.18, 8.18, 8.18); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1754
- 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) = 1.24 W/kg

Ch19100/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 9.953 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 1.51 W/kg
SAR(1 g) = 0.936 W/kg; SAR(10 g) = 0.528 W/kg
Maximum value of SAR (measured) = 1.33 W/kg



0 dB = 1.33 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2017/8/18

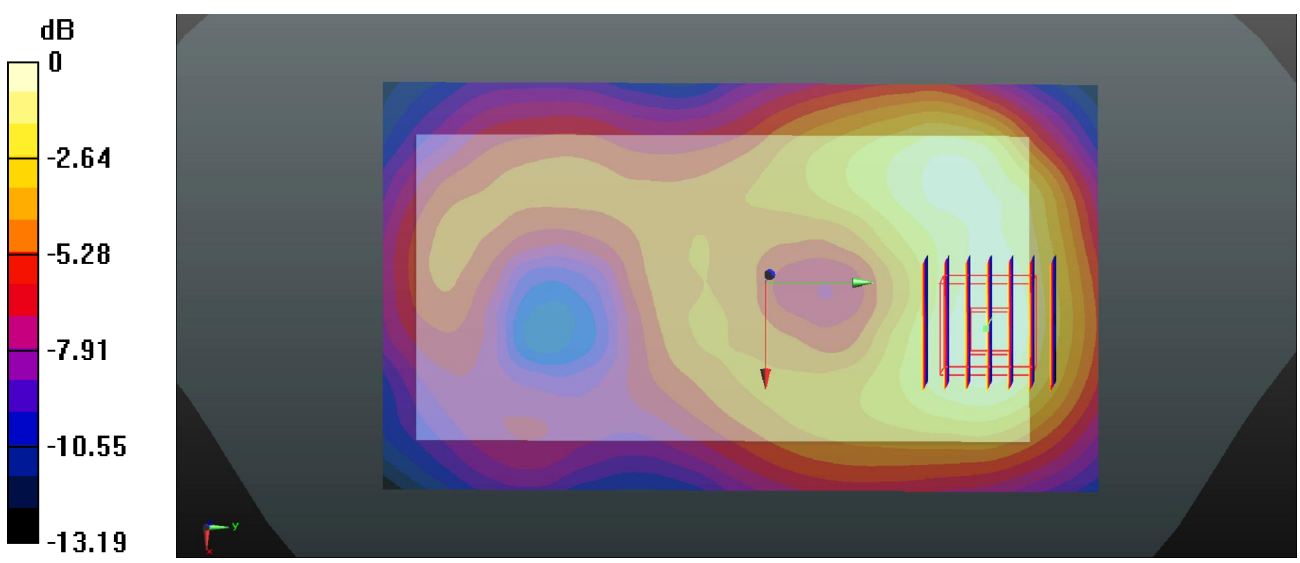
30_WLAN2.4GHz_802.11b 1Mbps_Back_15mm_Ch6

Communication System: UID 0, 802.11b (0); Frequency: 2437 MHz;Duty Cycle: 1:1.025
Medium: MSL_2450_2017/08/18 Medium parameters used: f = 2437 MHz; σ = 1.94 S/m; ε_r = 51.176; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature ：22.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3935; ConvF(7.89, 7.89, 7.89); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1754
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch6/Area Scan (81x141x1): Interpolated grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.0896 W/kg

Ch6/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.533 V/m; Power Drift = -0.14 dB
Peak SAR (extrapolated) = 0.106 W/kg
SAR(1 g) = 0.061 W/kg; SAR(10 g) = 0.037 W/kg
Maximum value of SAR (measured) = 0.0886 W/kg



0 dB = 0.0886 W/kg

Appendix C. DASY Calibration Certificate

The DASY calibration certificates are shown as follows.

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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_XA** **Certificate No: Z17-97037**

CALIBRATION CERTIFICATE

Object	D750V3 - SN: 1087
Calibration Procedure(s)	FD-Z11-003-01 Calibration Procedures for dipole validation kits
Calibration date:	March 20, 2017

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)℃ 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 3617	23-Jan-17(SPEAG,No.EX3-3617_Jan17)	Jan-18
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	13-Jan-17 (CTTL, No.J17X00286)	Jan-18
Network Analyzer E5071C	MY46110673	13-Jan-17 (CTTL, No.J17X00285)	Jan-18

	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: March 24, 2017

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

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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%.

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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 ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.4 ± 6 %	0.91 mho/m ± 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	2.13 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**8.37 mW /g ± 20.8 % (k=2)**
SAR averaged over 10 cm^3 (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	**5.56 mW /g ± 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 ± 0.2) °C	55.2 ± 6 %	0.95 mho/m ± 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	2.17 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**8.73 mW /g ± 20.8 % (k=2)**
SAR averaged over 10 cm^3 (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	**5.87 mW /g ± 20.4 % (k=2)**

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.0Ω- 3.15jΩ
Return Loss	- 29.7dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.7Ω- 2.50jΩ
Return Loss	- 32.0dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.115 ns

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG

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DASY5 Validation Report for Head TSL Date: 03.20.2017

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1087

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

Medium parameters used: f = 750 MHz; σ = 0.908 S/m; ε_r = 41.38; ρ = 1000 kg/m^3

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(10.05, 10.05, 10.05); Calibrated: 1/23/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn777; Calibrated: 8/22/2016
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: xxxx
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

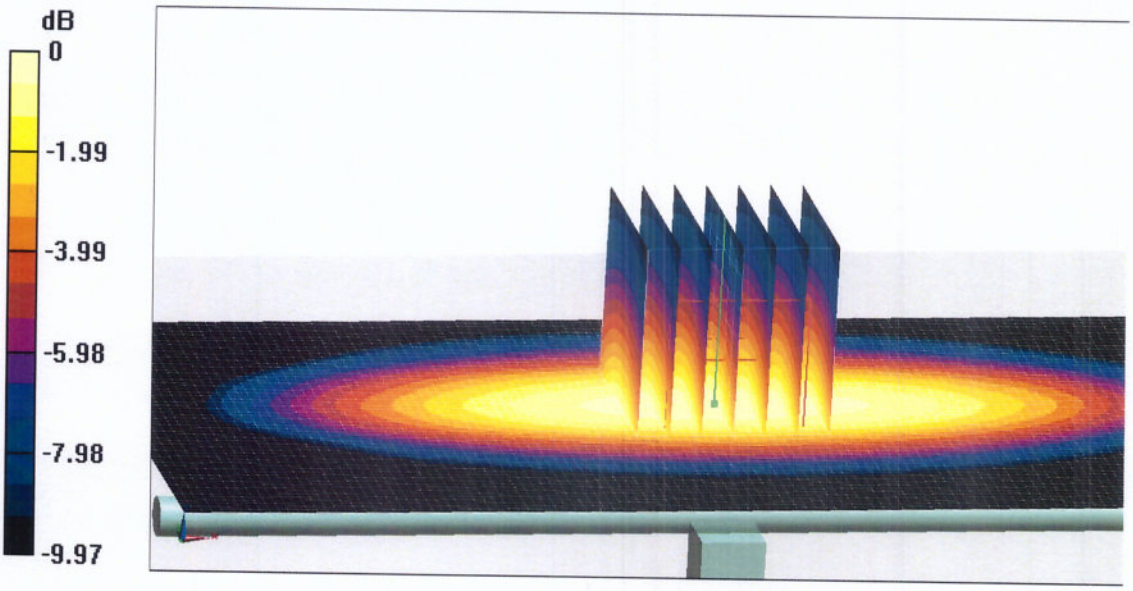
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 52.61 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 3.22 W/kg

SAR(1 g) = 2.13 W/kg; SAR(10 g) = 1.41 W/kg

Maximum value of SAR (measured) = 2.84 W/kg



0 dB = 2.84 W/kg = 4.53 dBW/kg

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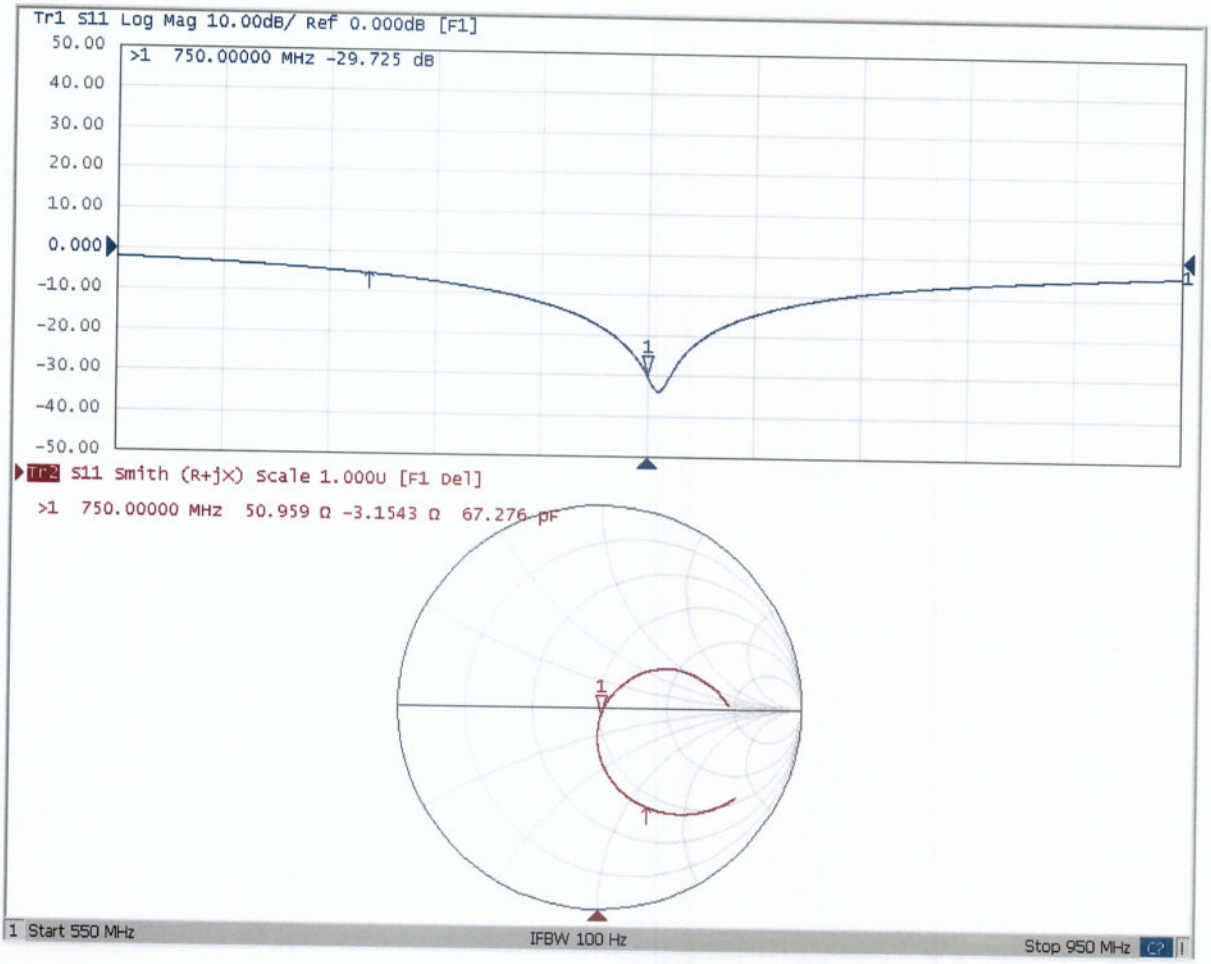
Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL Date: 03.20.2017

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1087

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

Medium parameters used: f = 750 MHz; σ = 0.952 S/m; ε_r = 55.23; ρ = 1000 kg/m^3

Phantom section: Center Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(9.8, 9.8, 9.8); Calibrated: 1/23/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn777; Calibrated: 8/22/2016
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: xxxx
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

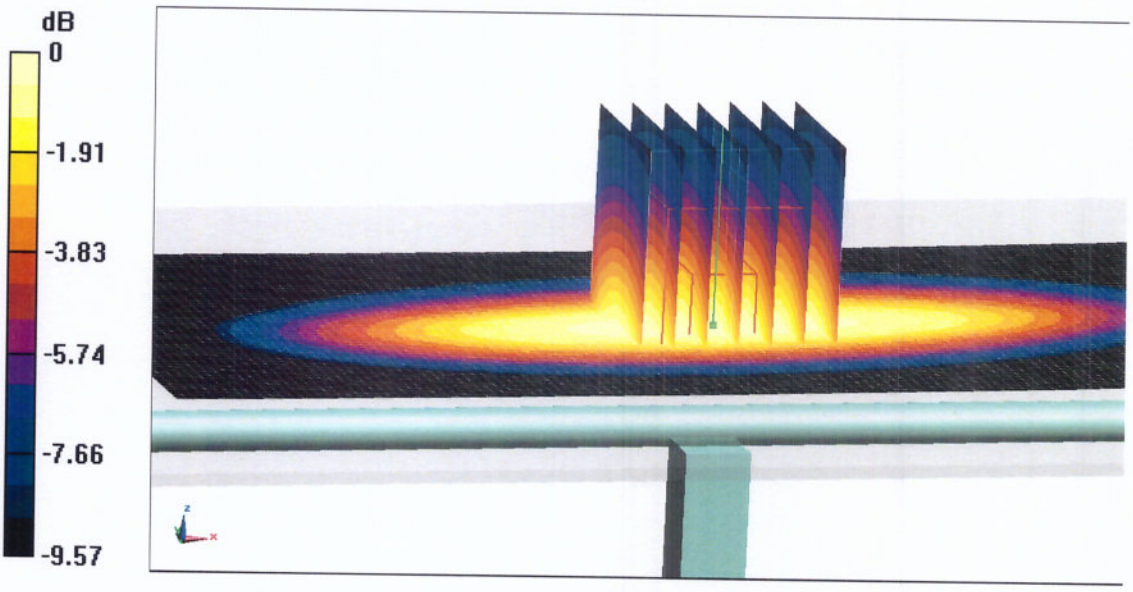
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 54.49 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 3.18 W/kg

SAR(1 g) = 2.17 W/kg; SAR(10 g) = 1.46 W/kg

Maximum value of SAR (measured) = 2.85 W/kg



0 dB = 2.85 W/kg = 4.55 dBW/kg

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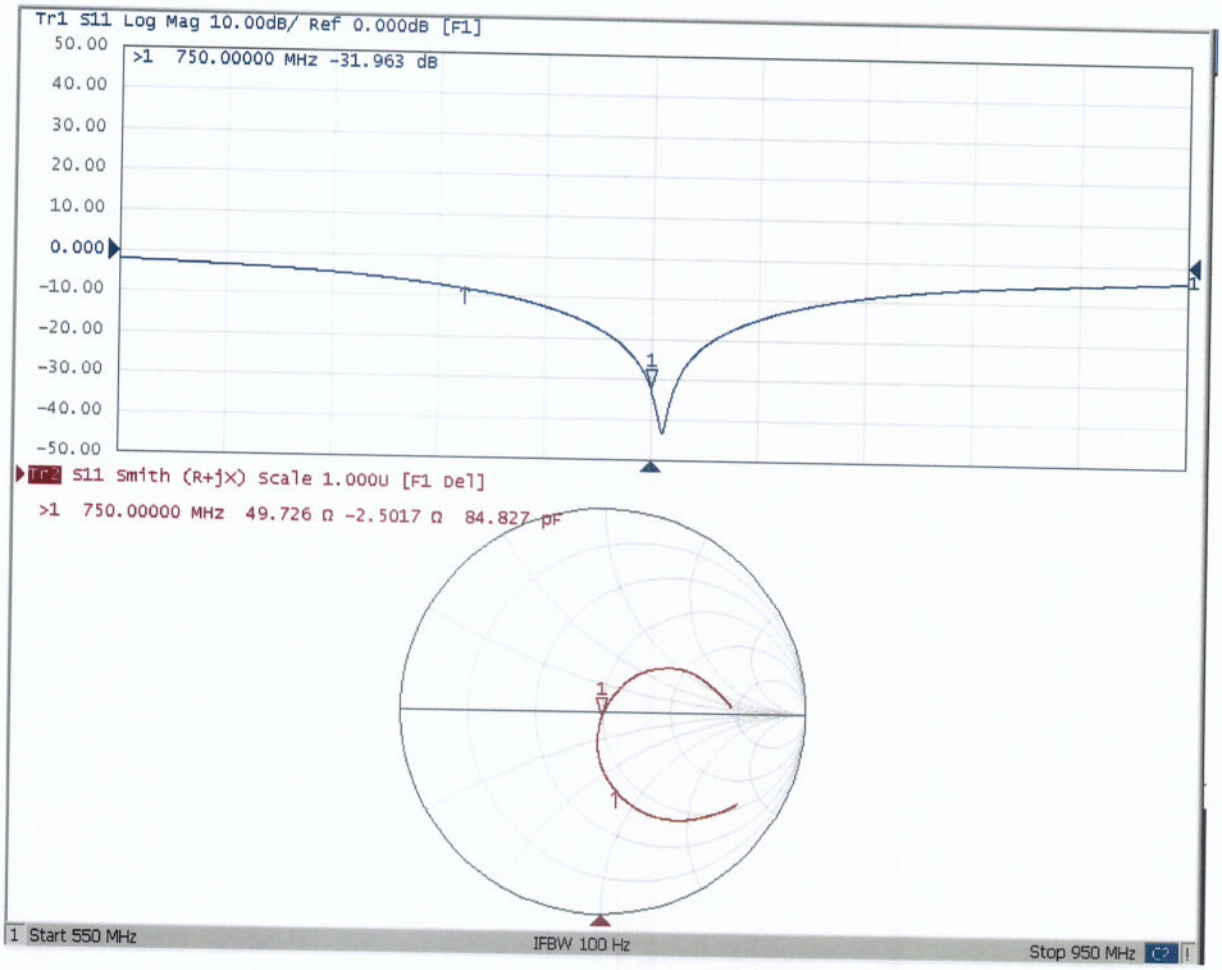
Impedance Measurement Plot for Body TSL



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CNAS L0570

Client Sporton_XA Certificate No: Z17-97038

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 4d151
Calibration Procedure(s)	FD-Z11-003-01 Calibration Procedures for dipole validation kits
Calibration date:	March 20, 2017

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)℃ 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 3617	23-Jan-17(SPEAG,No.EX3-3617_Jan17)	Jan-18
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	13-Jan-17 (CTTL, No.J17X00286)	Jan-18
Network Analyzer E5071C	MY46110673	13-Jan-17 (CTTL, No.J17X00285)	Jan-18

	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: March 24, 2017

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

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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%.

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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 ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.0 ± 6 %	0.89 mho/m ± 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	2.41 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**9.73 mW /g ± 20.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.57 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**6.33 mW /g ± 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 ± 0.2) °C	55.6 ± 6 %	0.96 mho/m ± 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	2.41 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**9.72 mW /g ± 20.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.60 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**6.44 mW /g ± 20.4 % (k=2)**

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.2Ω- 3.30jΩ
Return Loss	- 28.3dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.0Ω- 3.06jΩ
Return Loss	- 25.6dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.474 ns

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG

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DASY5 Validation Report for Head TSL

Test Laboratory: CTTL, Beijing, China Date: 03.20.2017

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d151

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

Medium parameters used: f = 835 MHz; σ = 0.886 S/m; ε_r = 40.96; ρ = 1000 kg/m^3

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(9.73, 9.73, 9.73); Calibrated: 1/23/2017;
- Sensor-Surface: 1.4mm (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)

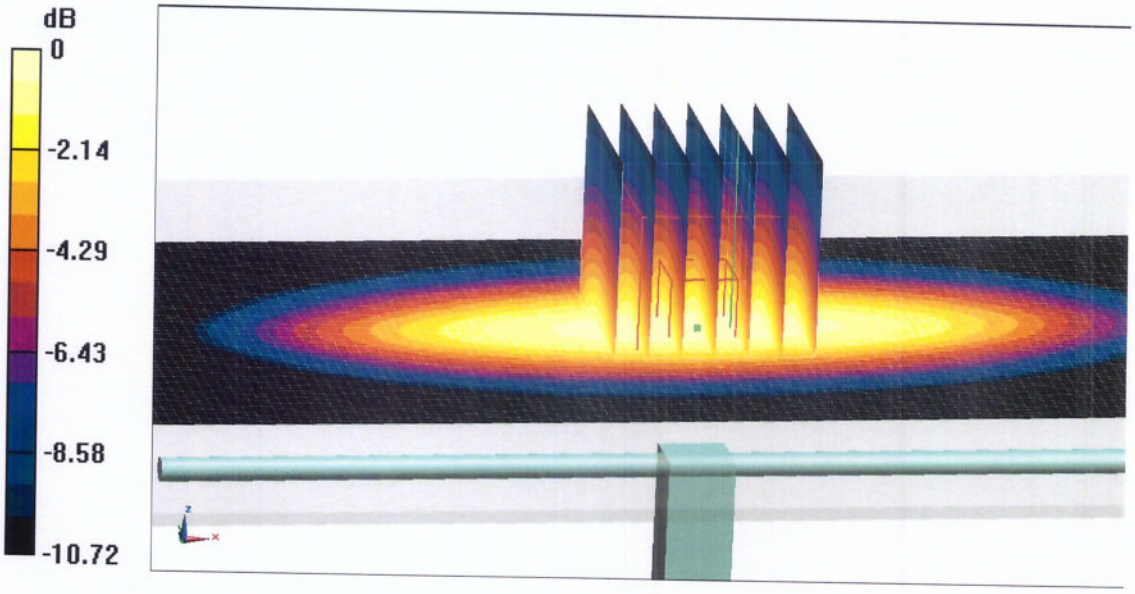
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 59.22V/m; Power Drift =- 0.03 dB

Peak SAR (extrapolated) = 3.68 W/kg

SAR(1 g) = 2.41 W/kg; SAR(10 g) = 1.57 W/kg

Maximum value of SAR (measured) = 3.24 W/kg



0 dB = 3.24 W/kg = 5.11 dBW/kg