

P17 WCDMA V_RMC12.2K_Rear Face_1.5cm_Ch4132**DUT: 200701W006**

Communication System: WCDMA; Frequency: 826.4 MHz; Duty Cycle: 1:1

Medium: HSL835_0703 Medium parameters used: $f = 826.4$ MHz; $\sigma = 0.895$ S/m; $\epsilon_r = 40.643$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.4°C; Liquid Temperature : 22.2°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7554; ConvF(9.89, 9.89, 9.89) @ 826.4 MHz; Calibrated: 9/16/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1589; Calibrated: 9/10/2019
- Phantom: Twin-SAM (Right SAM2); Type: QD 000 P41 AA; Serial: 1986
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

- Area Scan (61x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.646 W/kg

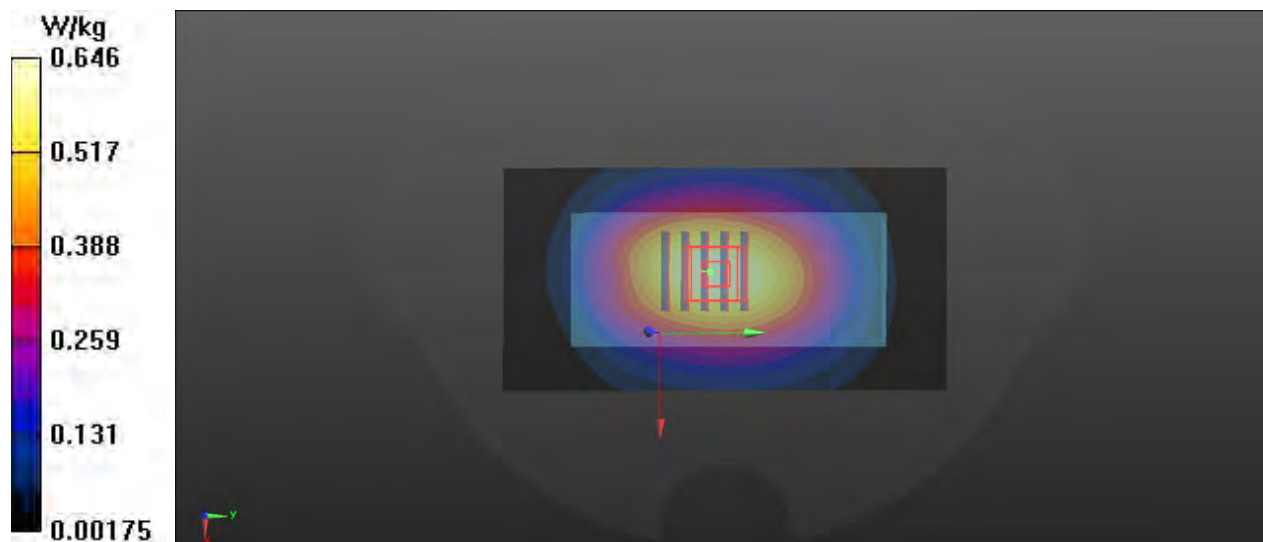
- Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 23.99 V/m; Power Drift = -0.12 dB

Peak SAR (extrapolated) = 0.723 W/kg

SAR(1 g) = 0.489 W/kg; SAR(10 g) = 0.337 W/kg

Maximum value of SAR (measured) = 0.636 W/kg



P18 LTE 2_QPSK20M_Rear Face_1.5cm_Ch18900_1RB_OS50**DUT: 200701W006**

Communication System: LTE; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium: HSL1900_0707 Medium parameters used: $f = 1880$ MHz; $\sigma = 1.421$ S/m; $\epsilon_r = 40.242$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.1°C; Liquid Temperature : 22.4°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7554; ConvF(8.09, 8.09, 8.09) @ 1880 MHz; Calibrated: 9/16/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1589; Calibrated: 9/10/2019
- Phantom: Twin-SAM (Right SAM2); Type: QD 000 P41 AA; Serial: 1986
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

- Area Scan (61x101x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 1.15 W/kg

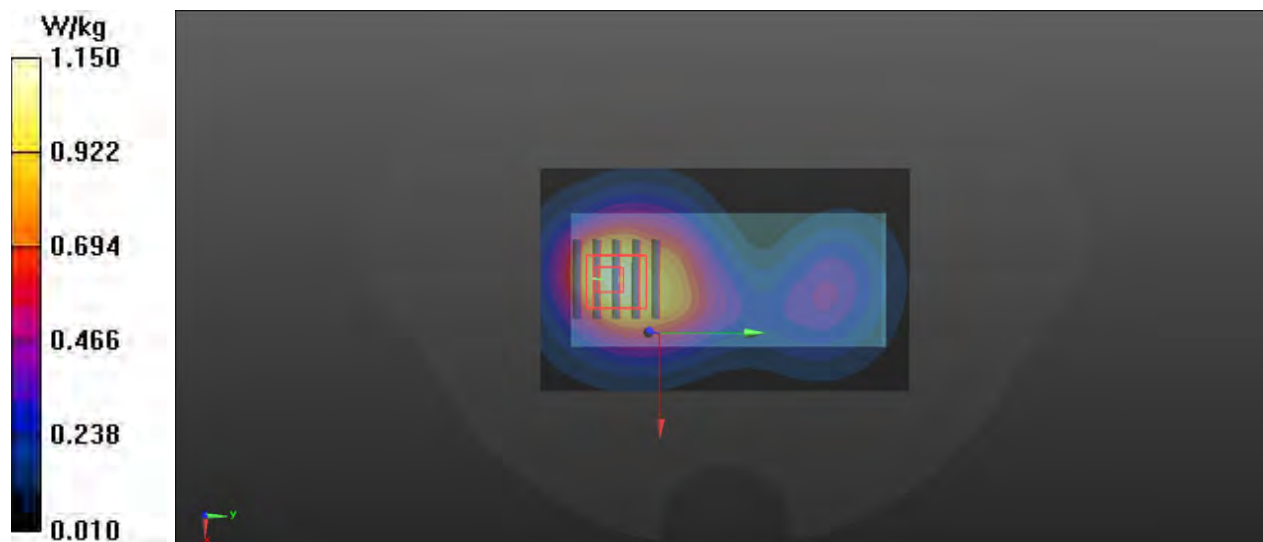
- Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 13.67 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 1.36 W/kg

SAR(1 g) = 0.798 W/kg; SAR(10 g) = 0.476 W/kg

Maximum value of SAR (measured) = 1.13 W/kg



P19 LTE 4_QPSK20M_Rear Face_1.5cm_Ch20050_1RB_OS0**DUT: 200701W006**

Communication System: LTE; Frequency: 1720 MHz; Duty Cycle: 1:1

Medium: HSL1750_0706 Medium parameters used: $f = 1720$ MHz; $\sigma = 1.319$ S/m; $\epsilon_r = 40.805$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6°C; Liquid Temperature : 22.5°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7554; ConvF(8.54, 8.54, 8.54) @ 1720 MHz; Calibrated: 9/16/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1589; Calibrated: 9/10/2019
- Phantom: Twin-SAM (Right SAM2); Type: QD 000 P41 AA; Serial: 1986
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

- Area Scan (61x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 1.20 W/kg

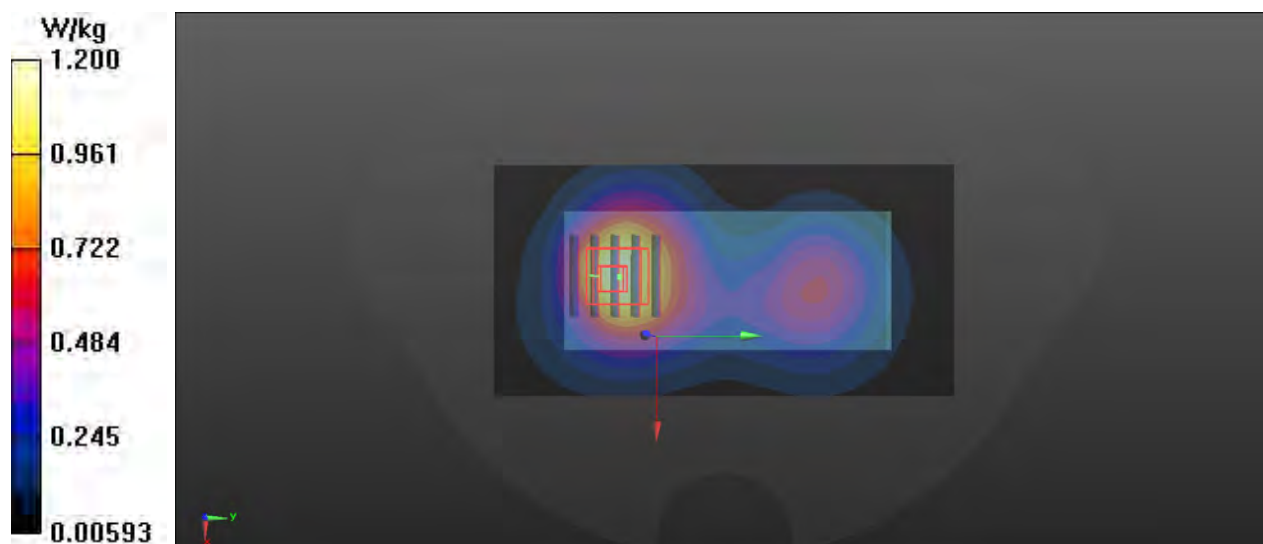
- Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 13.41 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 1.36 W/kg

SAR(1 g) = 0.792 W/kg; SAR(10 g) = 0.480 W/kg

Maximum value of SAR (measured) = 1.11 W/kg



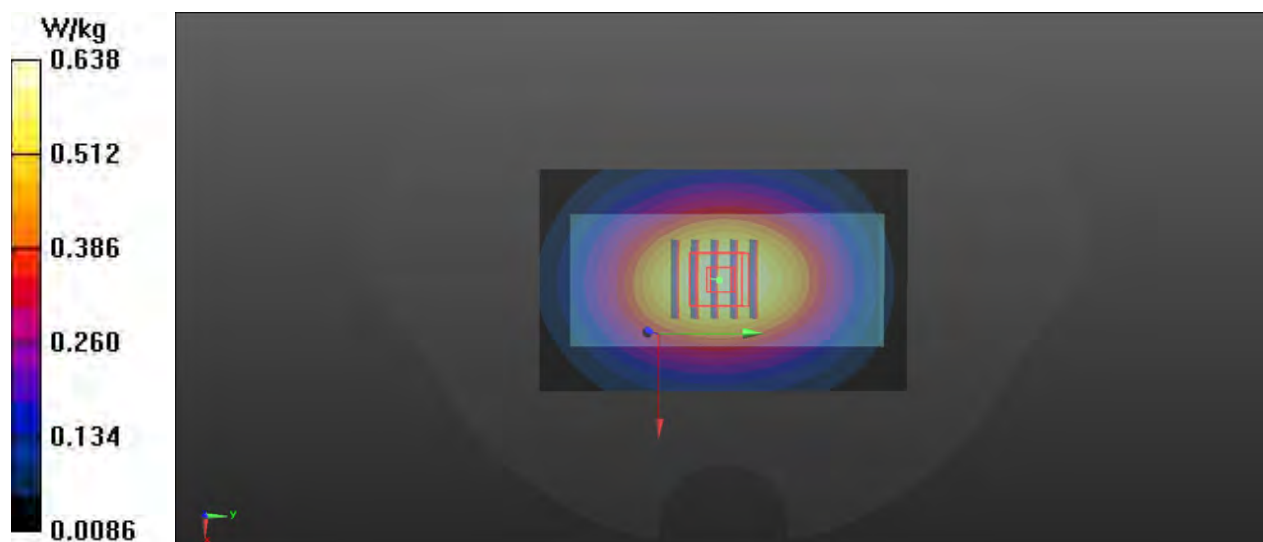
P20 LTE 5_QPSK10M_Front Face_1.5cm_Ch20450_1RB_OS0**DUT: 200701W006**

Communication System: LTE; Frequency: 829 MHz; Duty Cycle: 1:1

Medium: HSL835_0703 Medium parameters used: $f = 829 \text{ MHz}$; $\sigma = 0.897 \text{ S/m}$; $\epsilon_r = 40.623$; $\rho = 1000 \text{ kg/m}^3$ Ambient Temperature : 23.4°C ; Liquid Temperature : 22.2°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7554; ConvF(9.89, 9.89, 9.89) @ 829 MHz; Calibrated: 9/16/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1589; Calibrated: 9/10/2019
- Phantom: Twin-SAM (Right SAM2); Type: QD 000 P41 AA; Serial: 1986
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

- Area Scan (61x101x1): Interpolated grid: $dx=1.500 \text{ mm}$, $dy=1.500 \text{ mm}$ Maximum value of SAR (interpolated) = 0.638 W/kg **- Zoom Scan (5x5x7)/Cube 0:** Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$ Reference Value = 24.01 V/m ; Power Drift = -0.01 dB Peak SAR (extrapolated) = 0.721 W/kg **SAR(1 g) = 0.498 W/kg ; SAR(10 g) = 0.348 W/kg** Maximum value of SAR (measured) = 0.640 W/kg 

P21 LTE 7_QPSK20M_Rear Face_1.5cm_Ch20850_1RB_OS99**DUT: 200701W006**

Communication System: LTE; Frequency: 2510 MHz; Duty Cycle: 1:1

Medium: HSL2600_0708 Medium parameters used: $f = 2510$ MHz; $\sigma = 1.94$ S/m; $\epsilon_r = 39.277$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.5°C; Liquid Temperature : 22.3°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7554; ConvF(7.17, 7.17, 7.17) @ 2510 MHz; Calibrated: 9/16/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1589; Calibrated: 9/10/2019
- Phantom: Twin-SAM (Right SAM2); Type: QD 000 P41 AA; Serial: 1986
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

- Area Scan (81x151x1): Interpolated grid: $dx=1.200$ mm, $dy=1.200$ mm

Maximum value of SAR (interpolated) = 1.27 W/kg

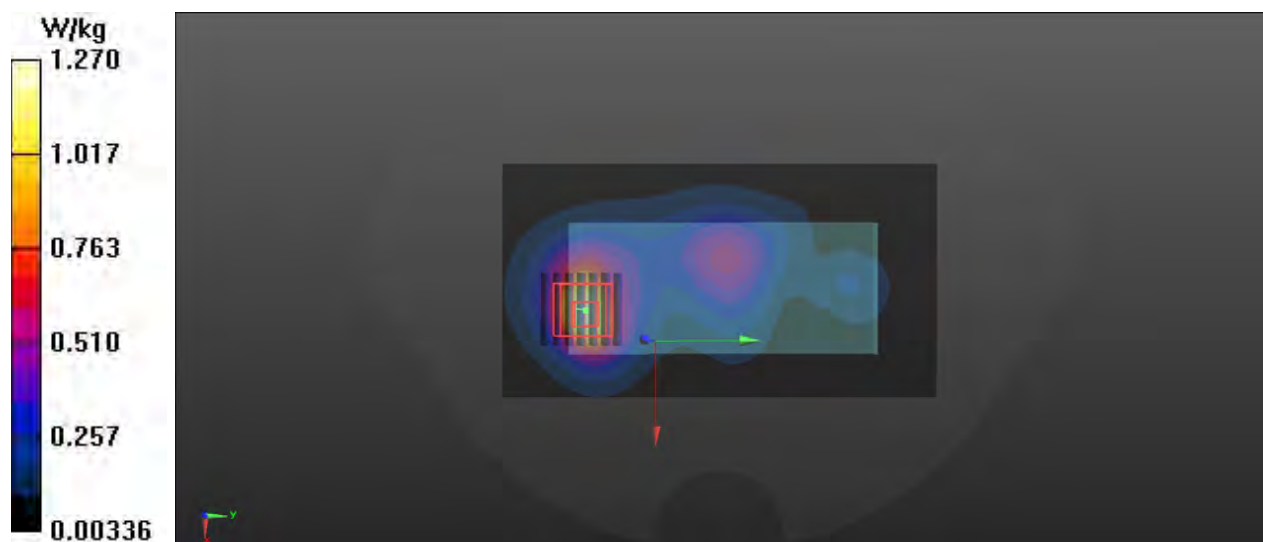
- Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 12.62 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 1.59 W/kg

SAR(1 g) = 0.804 W/kg; SAR(10 g) = 0.400 W/kg

Maximum value of SAR (measured) = 1.27 W/kg



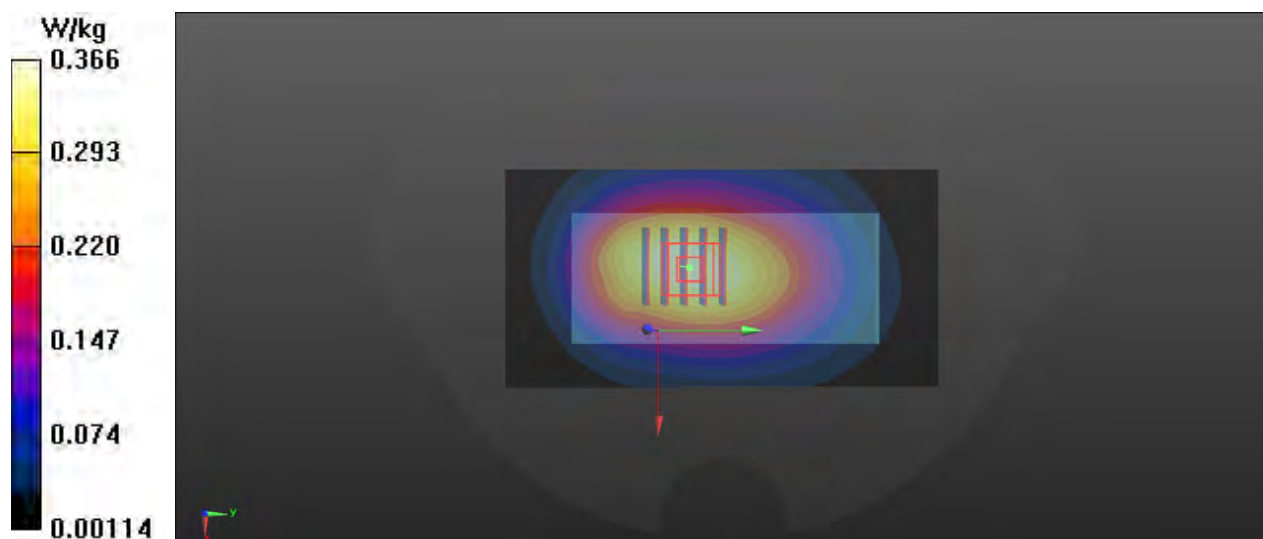
P22 LTE 12_QPSK10M_Rear Face_1.5cm_Ch23130_1RB_OS49**DUT: 200701W006**

Communication System: LTE; Frequency: 711 MHz; Duty Cycle: 1:1

Medium: HSL750_0701 Medium parameters used: $f = 711 \text{ MHz}$; $\sigma = 0.861 \text{ S/m}$; $\epsilon_r = 41.24$; $\rho = 1000 \text{ kg/m}^3$ Ambient Temperature : 23.2°C ; Liquid Temperature : 22.1°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7554; ConvF(10.23, 10.23, 10.23) @ 711 MHz; Calibrated: 9/16/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1589; Calibrated: 9/10/2019
- Phantom: Twin-SAM (Right SAM2); Type: QD 000 P41 AA; Serial: 1986
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

- Area Scan (61x121x1): Interpolated grid: $dx=1.500 \text{ mm}$, $dy=1.500 \text{ mm}$ Maximum value of SAR (interpolated) = 0.366 W/kg **- Zoom Scan (5x5x7)/Cube 0:** Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$ Reference Value = 18.06 V/m ; Power Drift = 0.09 dB Peak SAR (extrapolated) = 0.426 W/kg **SAR(1 g) = 0.290 W/kg ; SAR(10 g) = 0.201 W/kg** Maximum value of SAR (measured) = 0.377 W/kg 

P23 LTE 13_QPSK10M_Rrar Face_1.5cm_Ch23230_1RB_OS49**DUT: 200701W006**

Communication System: LTE; Frequency: 782 MHz; Duty Cycle: 1:1

Medium: HSL750_0701 Medium parameters used: $f = 782 \text{ MHz}$; $\sigma = 0.919 \text{ S/m}$; $\epsilon_r = 40.485$; $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature : 23.2°C; Liquid Temperature : 22.1°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7554; ConvF(10.23, 10.23, 10.23) @ 782 MHz; Calibrated: 9/16/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1589; Calibrated: 9/10/2019
- Phantom: Twin-SAM (Right SAM2); Type: QD 000 P41 AA; Serial: 1986
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

- Area Scan (61x121x1): Interpolated grid: $dx=1.500 \text{ mm}$, $dy=1.500 \text{ mm}$

Maximum value of SAR (interpolated) = 0.826 W/kg

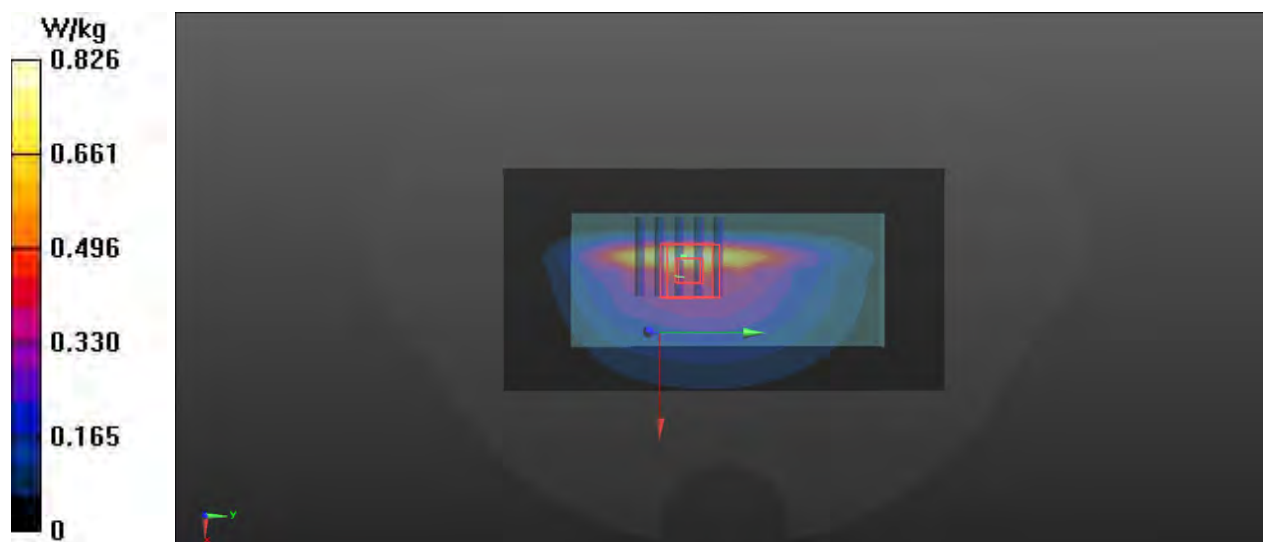
- Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 18.19 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 0.459 W/kg

SAR(1 g) = 0.312 W/kg; SAR(10 g) = 0.213 W/kg

Maximum value of SAR (measured) = 0.403 W/kg



P24 LTE 17_QPSK10M_Rear Face_1.5cm_Ch23790_1RB_OS49**DUT: 200701W006**

Communication System: LTE; Frequency: 710 MHz; Duty Cycle: 1:1

Medium: HSL750_0701 Medium parameters used: $f = 710$ MHz; $\sigma = 0.86$ S/m; $\epsilon_r = 41.258$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.2°C; Liquid Temperature : 22.1°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7554; ConvF(10.23, 10.23, 10.23) @ 710 MHz; Calibrated: 9/16/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1589; Calibrated: 9/10/2019
- Phantom: Twin-SAM (Right SAM2); Type: QD 000 P41 AA; Serial: 1986
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

- Area Scan (61x121x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 0.363 W/kg

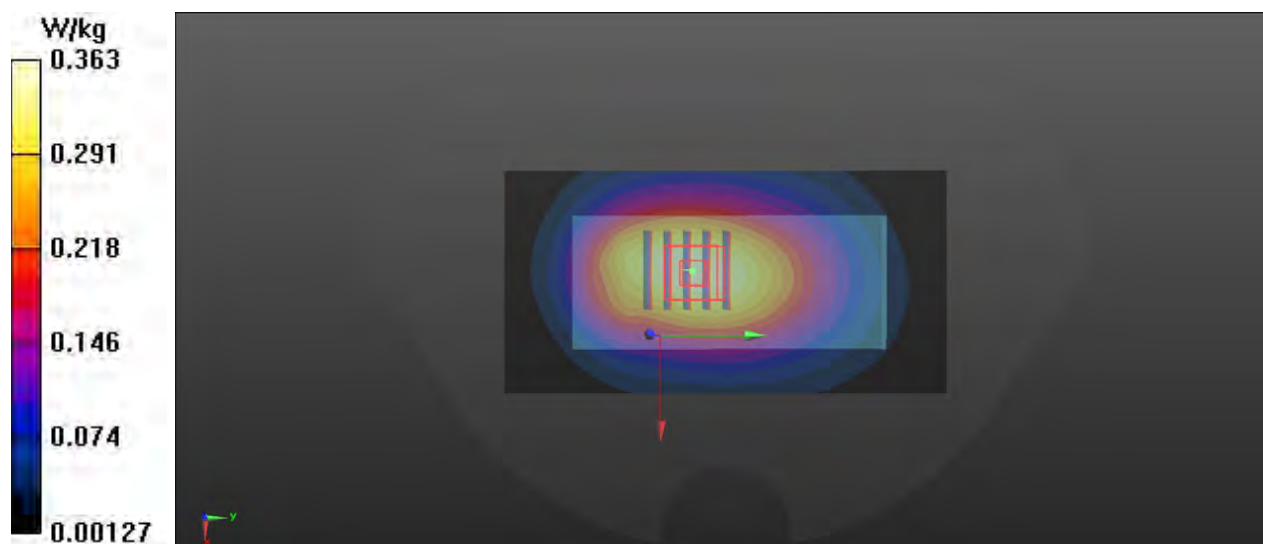
- Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 18.01 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 0.406 W/kg

SAR(1 g) = 0.278 W/kg; SAR(10 g) = 0.193 W/kg

Maximum value of SAR (measured) = 0.359 W/kg



P25 BT_GFSK_Front Face_1.5cm_Ch78**DUT: 200701W006**

Communication System: BT; Frequency: 2480 MHz; Duty Cycle: 1:1.2

Medium: HSL2450_0720 Medium parameters used: $f = 2480$ MHz; $\sigma = 1.877$ S/m; $\epsilon_r = 39.27$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.3°C; Liquid Temperature : 22.2°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7554; ConvF(7.37, 7.37, 7.37) @ 2480 MHz; Calibrated: 9/16/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1589; Calibrated: 9/10/2019
- Phantom: Twin-SAM (Right SAM2); Type: QD 000 P41 AA; Serial: 1986
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

- Area Scan (51x91x1): Interpolated grid: dx=2.000 mm, dy=2.000 mm

Maximum value of SAR (interpolated) = 0.0098 W/kg

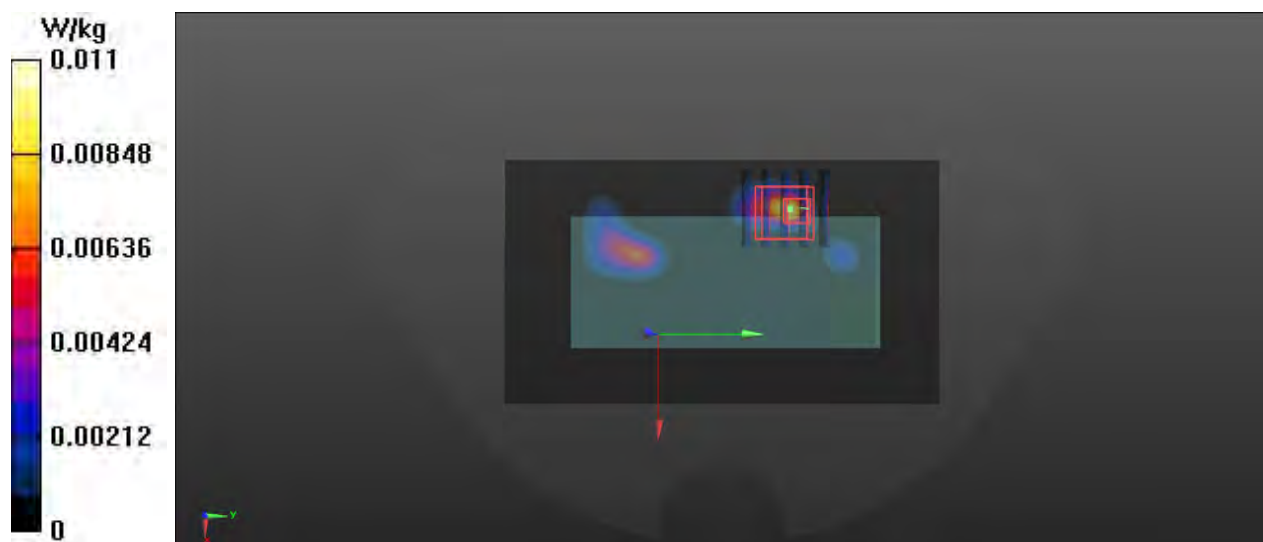
- Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 0 V/m; Power Drift = 0.14 dB

Peak SAR (extrapolated) = 0.0350 W/kg

SAR(1 g) = 0.00733 W/kg; SAR(10 g) = 0.00246 W/kg

Maximum value of SAR (measured) = 0.0116 W/kg



Appendix C. Calibration Certificate for Probe and Dipole

The SPEAG calibration certificates are shown as follows.



In Collaboration with
s p e a g
CALIBRATION LABORATORY



中国认可
国际互认
校准
CALIBRATION
CNAS L0570

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

Client

ADT_CN

Certificate No: Z19-60297

CALIBRATION CERTIFICATE

Object

D750V3 - SN: 1067

Calibration Procedure(s)

FF-Z11-003-01

Calibration Procedures for dipole validation kits

Calibration date:

September 3, 2019

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	106276	11-Apr-19 (CTTL, No.J19X02605)	Apr-20
Power sensor NRP6A	101369	11-Apr-19 (CTTL, No.J19X02605)	Apr-20
Reference Probe EX3DV4	SN 3617	31-Jan-19(SPEAG,No.EX3-3617_Jan19)	Jan-20
DAE4	SN 1555	22-Aug-19(CTTL-SPEAG,No.Z19-60295)	Aug-20
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	23-Jan-19 (CTTL, No.J19X00336)	Jan-20
NetworkAnalyzer E5071C	MY46110673	24-Jan-19 (CTTL, No.J19X00547)	Jan-20

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: September 6, 2019

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



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

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, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- 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%.



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

Measurement Conditions

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

DASY Version	DASY52	V52.10.2
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	41.6 $\pm$ 6 %	0.90 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	2.14 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.45 W/kg $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.43 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.66 W/kg $\pm$ 18.7 % (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	55.9 $\pm$ 6 %	0.94 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	2.15 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	8.74 W/kg $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.43 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	5.79 W/kg $\pm$ 18.7 % (k=2)



Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.4Ω- 4.05jΩ
Return Loss	- 26.8dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.7Ω- 3.29jΩ
Return Loss	- 29.6dB

General Antenna Parameters and Design

Electrical Delay (one direction)	0.901 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

DASY5 Validation Report for Head TSL

Date: 09.03.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1067

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

Medium parameters used: $f = 750 \text{ MHz}$; $\sigma = 0.904 \text{ S/m}$; $\epsilon_r = 41.62$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(10.03, 10.03, 10.03) @ 750 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 8/22/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

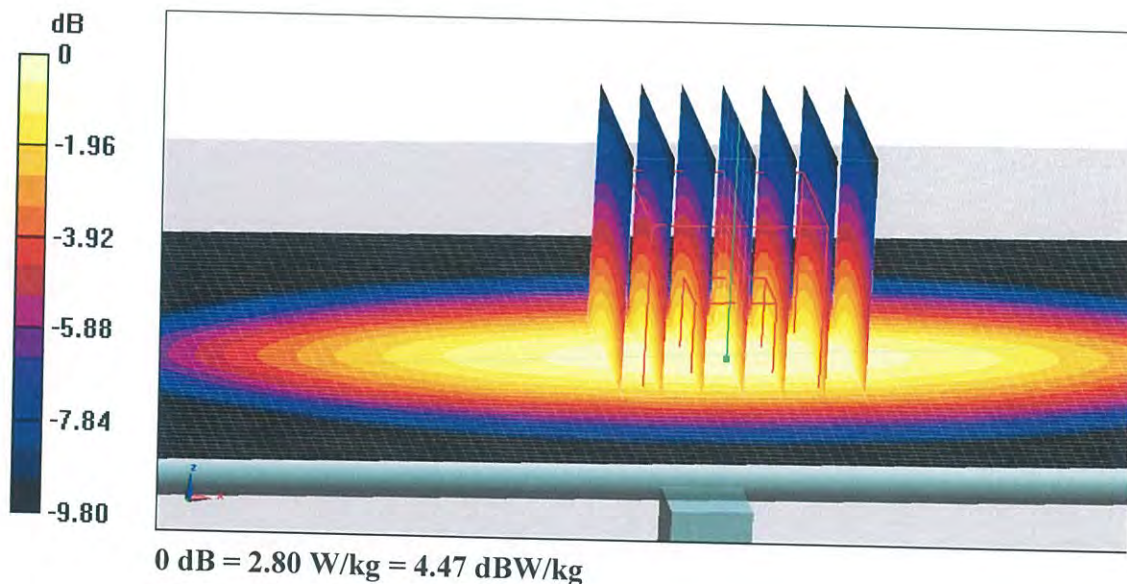
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 55.63 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 3.10 W/kg

SAR(1 g) = 2.14 W/kg; SAR(10 g) = 1.43 W/kg

Maximum value of SAR (measured) = 2.80 W/kg

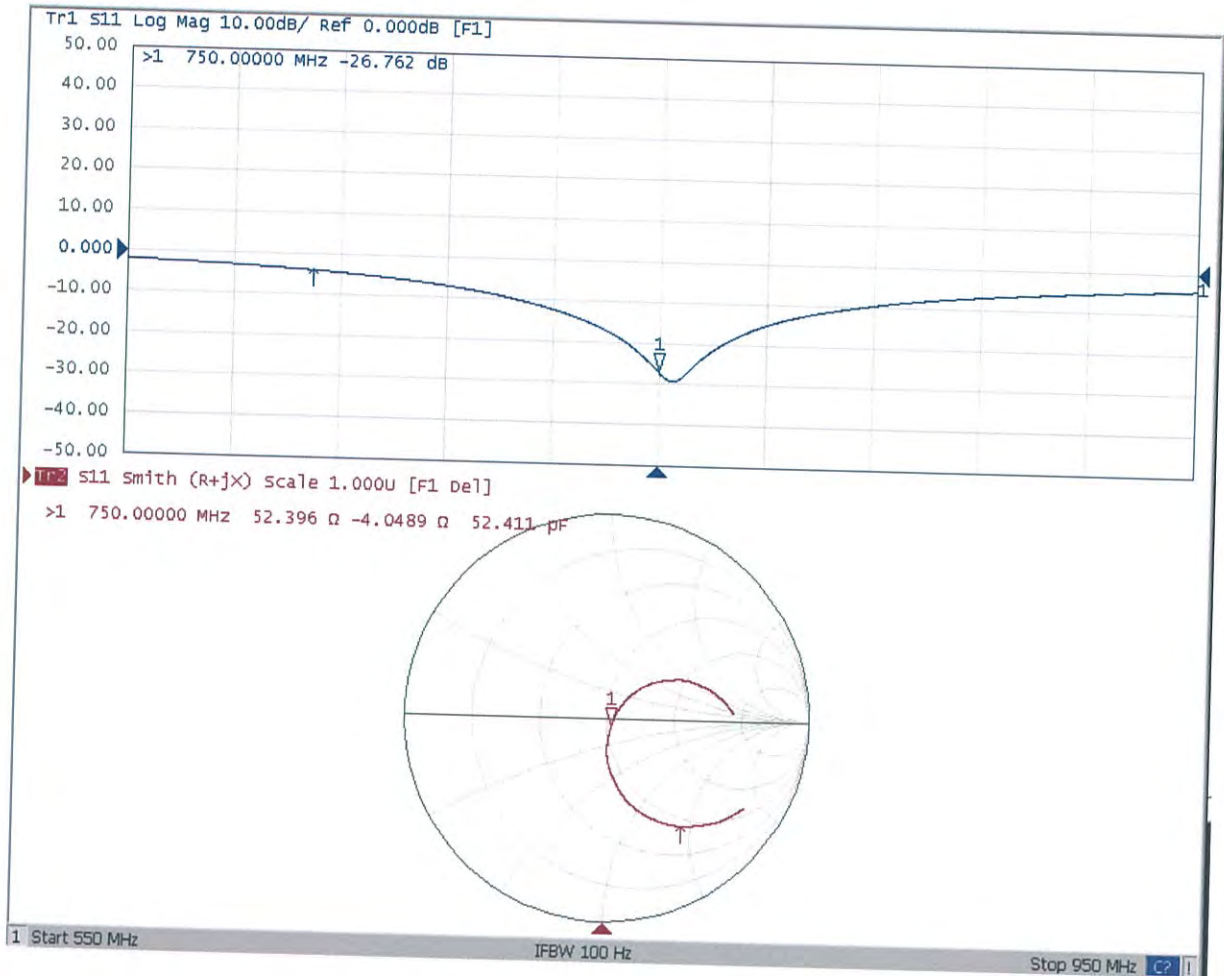




In Collaboration with
s p e a g
CALIBRATION LABORATORY

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

Impedance Measurement Plot for Head 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

DASY5 Validation Report for Body TSL

Date: 09.03.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1067

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

Medium parameters used: $f = 750 \text{ MHz}$; $\sigma = 0.942 \text{ S/m}$; $\epsilon_r = 55.87$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(9.85, 9.85, 9.85) @ 750 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 8/22/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

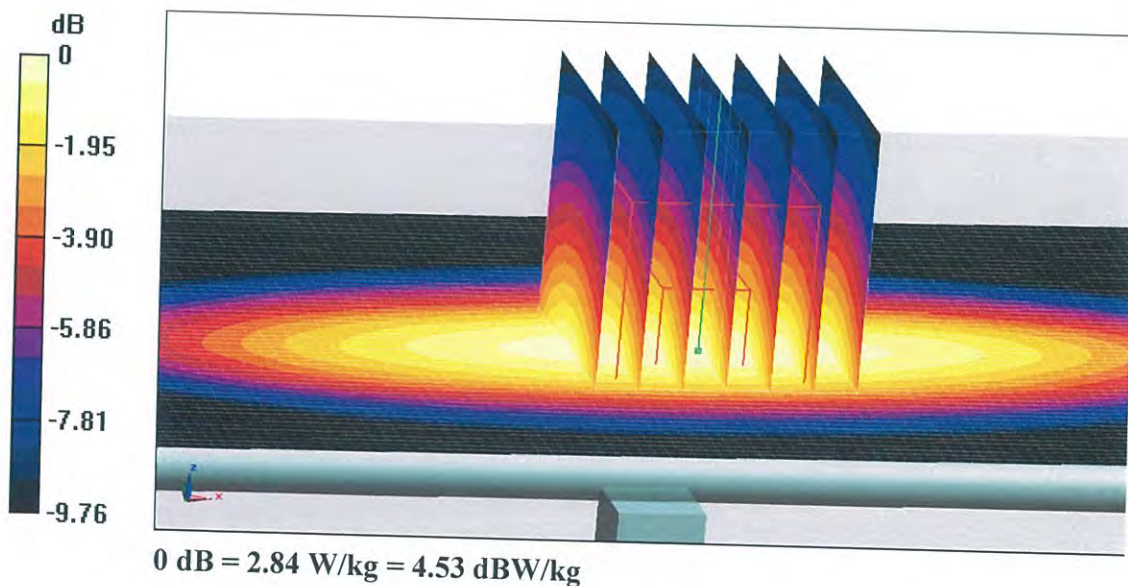
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 53.19 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 3.18 W/kg

SAR(1 g) = 2.15 W/kg; SAR(10 g) = 1.43 W/kg

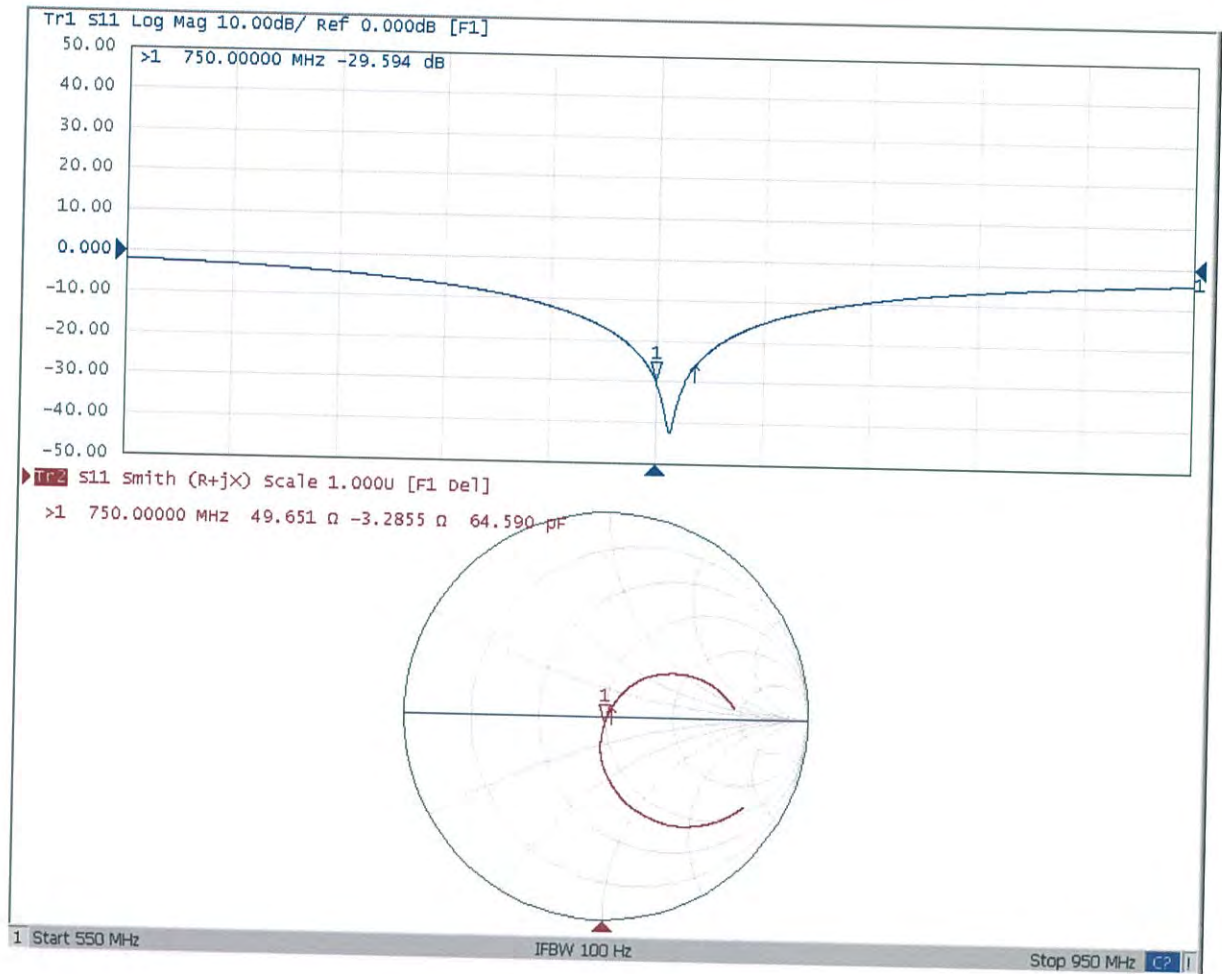
Maximum value of SAR (measured) = 2.84 W/kg





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

Impedance Measurement Plot for Body TSL





In Collaboration with
s p e a g
CALIBRATION LABORATORY



中国认可
国际互认
校准
CALIBRATION
CNAS L0570

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

Client **ADT_CN**

Certificate No: **Z19-60298**

CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d139**

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

Calibration date: **September 3, 2019**

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	106276	11-Apr-19 (CTTL, No.J19X02605)	Apr-20
Power sensor NRP6A	101369	11-Apr-19 (CTTL, No.J19X02605)	Apr-20
Reference Probe EX3DV4	SN 3617	31-Jan-19(SPEAG,No.EX3-3617_Jan19)	Jan-20
DAE4	SN 1555	22-Aug-19(CTTL-SPEAG,No.Z19-60295)	Aug-20
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	23-Jan-19 (CTTL, No.J19X00336)	Jan-20
NetworkAnalyzer E5071C	MY46110673	24-Jan-19 (CTTL, No.J19X00547)	Jan-20

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: September 6, 2019

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



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

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, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- 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%.



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

Measurement Conditions

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

DASY Version	DASY52	V52.10.2
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	41.9 $\pm$ 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 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.53 W/kg $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.58 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.28 W/kg $\pm$ 18.7 % (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	55.6 $\pm$ 6 %	0.96 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 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	9.63 W/kg $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.58 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	6.35 W/kg $\pm$ 18.7 % (k=2)



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

Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.8Ω- 2.97jΩ
Return Loss	- 30.3dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.1Ω- 4.52jΩ
Return Loss	- 25.2dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.256 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
-----------------	-------