



In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com http://www.chinattl.cn

## General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.069 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: +86-10-62304633-2512 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com http://www.chinattl.cn

## DASY5 Validation Report for Head TSL

Date: 11.05.2018

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1176**

Communication System: CW; Frequency: 5250 MHz, Frequency: 5600 MHz,  
Frequency: 5750 MHz,

Medium parameters used:  $f = 5250$  MHz;  $\sigma = 4.848$  S/m;  $\epsilon_r = 34.85$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5600$  MHz;  $\sigma = 4.921$  S/m;  $\epsilon_r = 34.47$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5750$  MHz;  $\sigma = 5.067$  S/m;  $\epsilon_r = 34.42$ ;  $\rho = 1000$  kg/m<sup>3</sup>,

Phantom section: Center Section

### DASY5 Configuration:

- Probe: EX3DV4 - SN7514; ConvF(5.02, 5.02, 5.02) @ 5250 MHz; Calibrated: 8/27/2018, ConvF(4.41, 4.41, 4.41) @ 5600 MHz; Calibrated: 8/27/2018, ConvF(4.47, 4.47, 4.47) @ 5750 MHz; Calibrated: 8/27/2018,
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 8/20/2018
- Phantom: MFP\_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

**Dipole Calibration /Pin=100mW, d=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm  
Reference Value = 70.52 V/m; Power Drift = 0.03 dB  
Peak SAR (extrapolated) = 32.2 W/kg  
**SAR(1 g) = 7.93 W/kg; SAR(10 g) = 2.26 W/kg**  
Maximum value of SAR (measured) = 18.5 W/kg

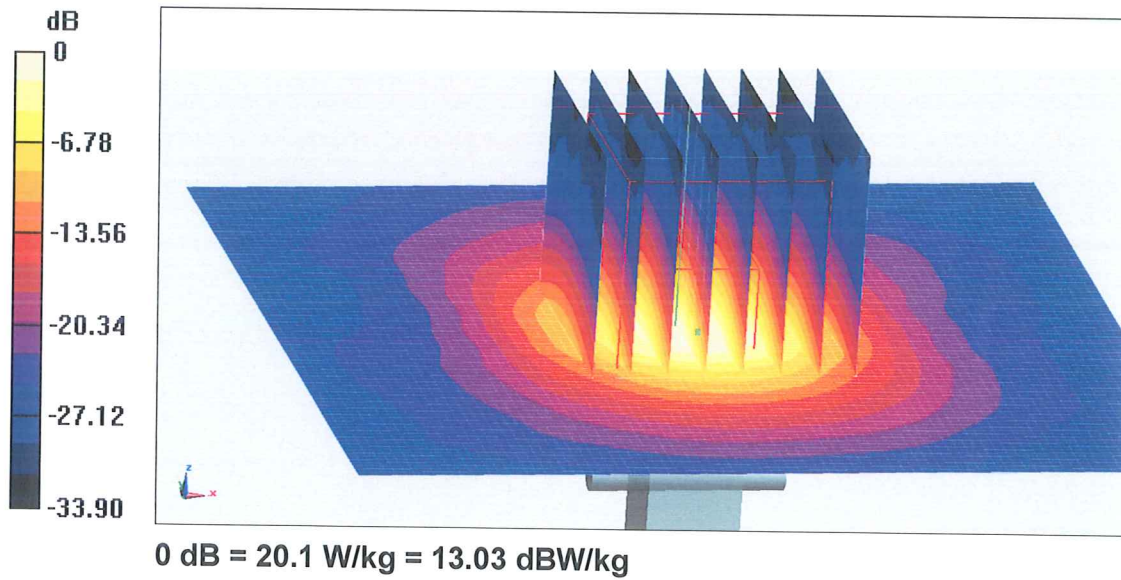
**Dipole Calibration /Pin=100mW, d=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm  
Reference Value = 72.65 V/m; Power Drift = 0.06 dB  
Peak SAR (extrapolated) = 36.4 W/kg  
**SAR(1 g) = 8.15 W/kg; SAR(10 g) = 2.33 W/kg**  
Maximum value of SAR (measured) = 19.3 W/kg

**Dipole Calibration /Pin=100mW, d=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm  
Reference Value = 71.99 V/m; Power Drift = -0.01 dB  
Peak SAR (extrapolated) = 37.6 W/kg  
**SAR(1 g) = 8.05 W/kg; SAR(10 g) = 2.28 W/kg**  
Maximum value of SAR (measured) = 20.1 W/kg



In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com <http://www.chinattl.cn>

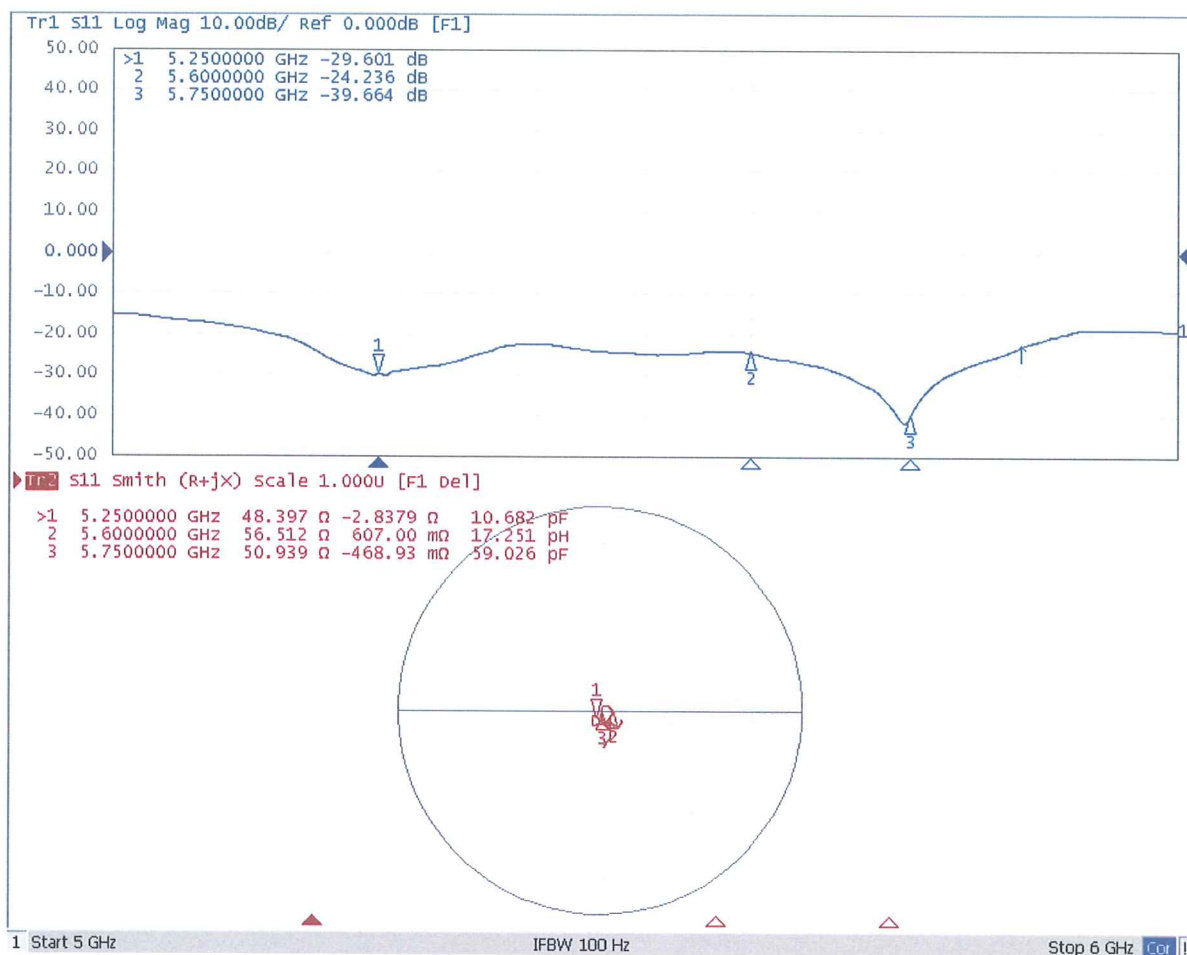




In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2512 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: +86-10-62304633-2512 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com http://www.chinattl.cn

## DASY5 Validation Report for Body TSL

Date: 11.06.2018

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1176**

Communication System: CW; Frequency: 5250 MHz, Frequency: 5600 MHz,  
Frequency: 5750 MHz,

Medium parameters used:  $f = 5250$  MHz;  $\sigma = 5.269$  S/m;  $\epsilon_r = 47.53$ ;  $\rho = 1000$  kg/m<sup>3</sup>,  
Medium parameters used:  $f = 5600$  MHz;  $\sigma = 5.791$  S/m;  $\epsilon_r = 47.12$ ;  $\rho = 1000$  kg/m<sup>3</sup>,  
Medium parameters used:  $f = 5750$  MHz;  $\sigma = 6.018$  S/m;  $\epsilon_r = 46.88$ ;  $\rho = 1000$  kg/m<sup>3</sup>,

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7514; ConvF(4.54, 4.54, 4.54) @ 5250 MHz; Calibrated: 8/27/2018, ConvF(4, 4, 4) @ 5600 MHz; Calibrated: 8/27/2018, ConvF(3.98, 3.98, 3.98) @ 5750 MHz; Calibrated: 8/27/2018,
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 8/20/2018
- Phantom: MFP\_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

**Dipole Calibration /Pin=100mW, d=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm  
Reference Value = 66.47 V/m; Power Drift = -0.02 dB  
Peak SAR (extrapolated) = 29.0 W/kg  
**SAR(1 g) = 7.32 W/kg; SAR(10 g) = 2.08 W/kg**  
Maximum value of SAR (measured) = 16.9 W/kg

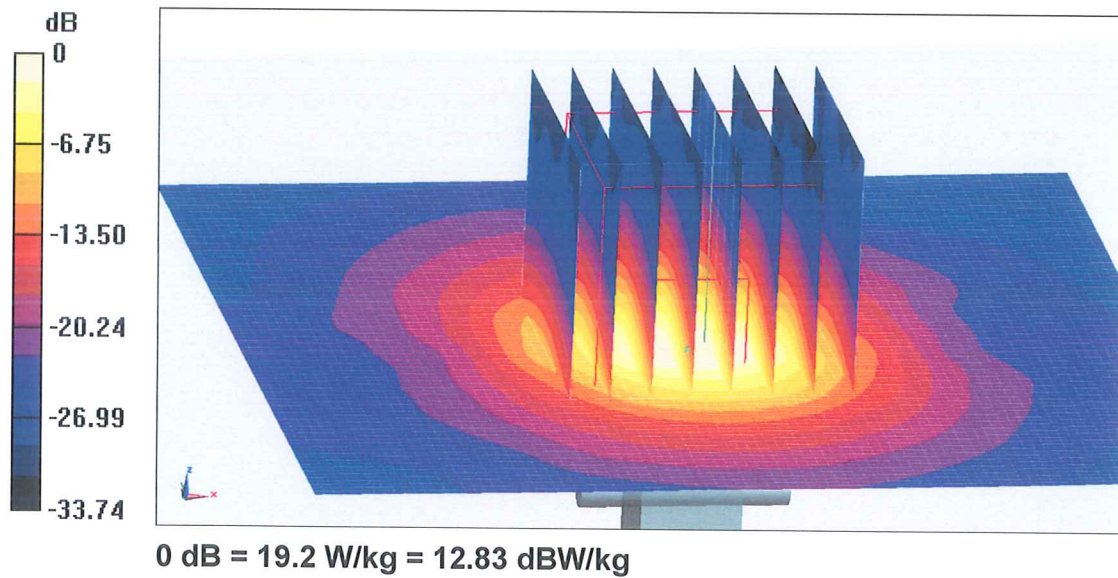
**Dipole Calibration /Pin=100mW, d=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm  
Reference Value = 65.94 V/m; Power Drift = -0.08 dB  
Peak SAR (extrapolated) = 34.6 W/kg  
**SAR(1 g) = 7.77 W/kg; SAR(10 g) = 2.2 W/kg**  
Maximum value of SAR (measured) = 19.1 W/kg

**Dipole Calibration /Pin=100mW, d=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm  
Reference Value = 61.33 V/m; Power Drift = 0.00 dB  
Peak SAR (extrapolated) = 35.8 W/kg  
**SAR(1 g) = 7.57 W/kg; SAR(10 g) = 2.12 W/kg**  
Maximum value of SAR (measured) = 19.2 W/kg



In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com <http://www.chinattl.cn>

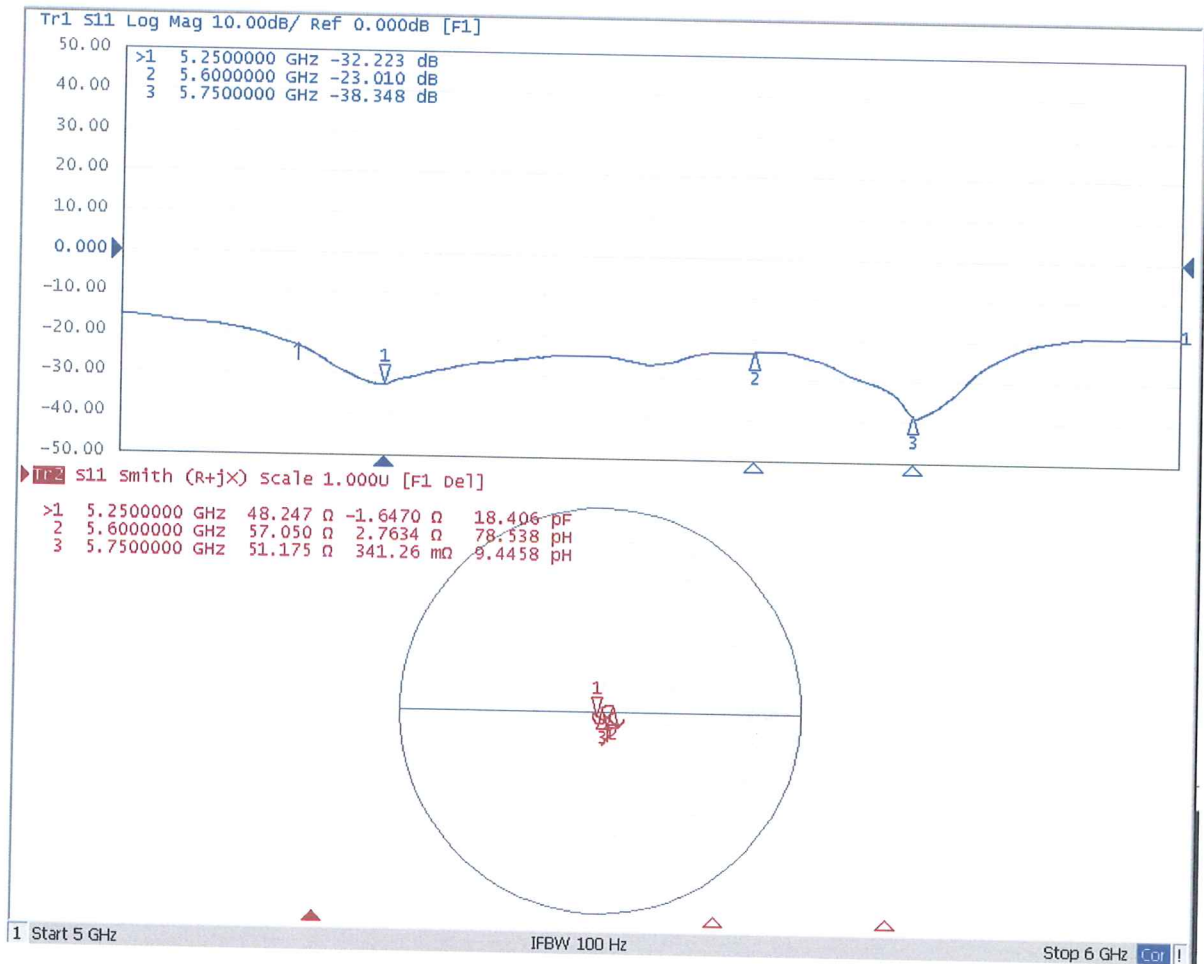




In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com http://www.chinattl.cn

## Impedance Measurement Plot for Body TSL



## Appendix Annual validation for Test Lab.

### General calibration information

|                    |                                                     |
|--------------------|-----------------------------------------------------|
| Date               | 2019.10.09                                          |
| Test Laboratory    | ShenZhen Morlab Communications Technology Co., Ltd. |
| Antenna serial No. | D1750V2-SN:1160                                     |

### Antenna Parameters with Head TSL at 5250 MHz

|                                      |                               |
|--------------------------------------|-------------------------------|
| Impedance, transformed to feed point | $51.35 \Omega + 3.85j \Omega$ |
| Return Loss                          | -27.9dB                       |

### Antenna Parameters Head TSL at 5600 MHz

|                                      |                              |
|--------------------------------------|------------------------------|
| Impedance, transformed to feed point | $44.7 \Omega + 2.96j \Omega$ |
| Return Loss                          | -23.87dB                     |

### Antenna Parameters Head TSL at 5750 MHz

|                                      |                               |
|--------------------------------------|-------------------------------|
| Impedance, transformed to feed point | $46.84 \Omega + 0.95j \Omega$ |
| Return Loss                          | -29.36dB                      |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.276 ns |
|----------------------------------|----------|

After long term use with 100W radiated power, only a slight warming of the dipole near the feed point 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 arm, because they might bend or the soldered connections near the feed point may be damaged.



**System Check\_5250MHz\_Head**

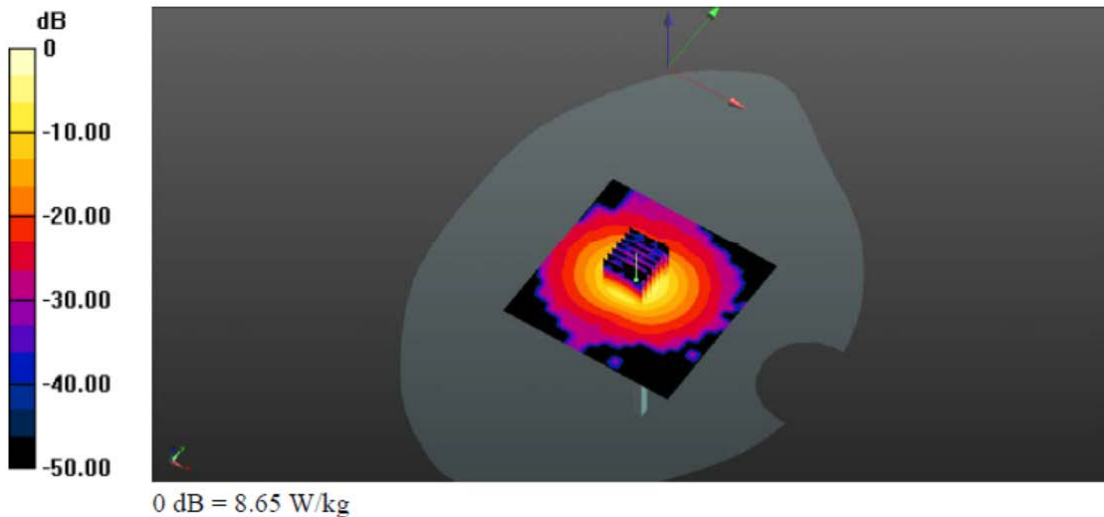
Communication System: UID 0, CW (0); Frequency: 5250 MHz; Duty Cycle: 1:1  
Medium: HSL\_5250 Medium parameters used:  $f = 5250$  MHz;  $\sigma = 4.699$  S/m;  $\epsilon_r = 36.146$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.4 °C; Liquid Temperature : 22.3 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3823; ConvF(4.6, 4.6, 4.6); Calibrated: 2018.11.12;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn480; Calibrated: 2019.04.11
- Phantom: SAM 1; Type: QD000P40CC; Serial: TP:1471
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**CW 5250/Area Scan (201x201x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm  
Maximum value of SAR (interpolated) = 8.65 W/kg

**CW 5250/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2mm  
Reference Value = 35.37 V/m; Power Drift = 0.04 dB  
Peak SAR (extrapolated) = 46.7 W/kg  
**SAR(1 g) = 7.67 W/kg; SAR(10 g) = 2.23 W/kg**  
Maximum value of SAR (measured) = 8.24 W/kg



Test Laboratory: SAR Lab. of Shenzhen Morlab Communications Technology Co., Ltd.

Date: 2019.10.09

**System Check\_5600MHz\_Head**

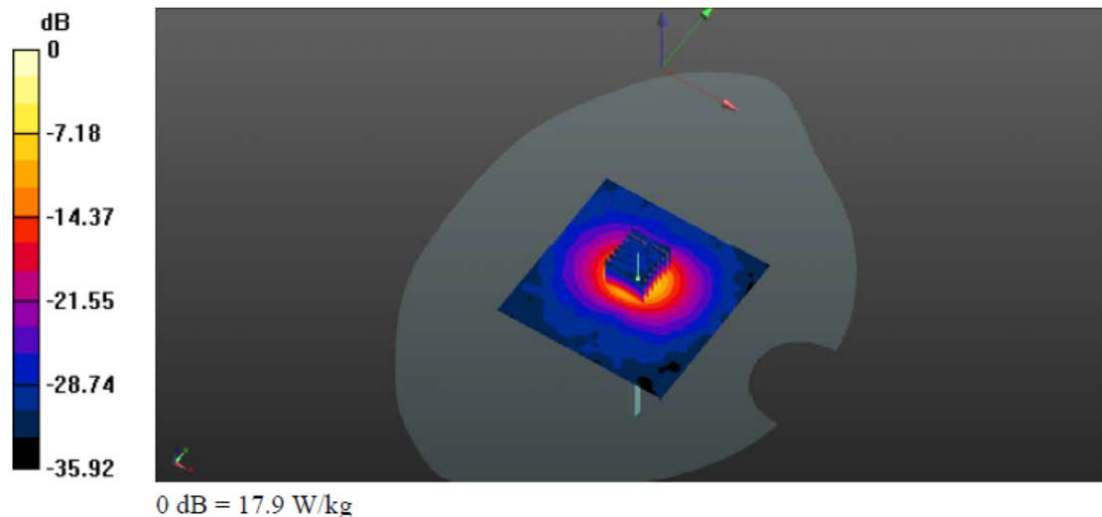
Communication System: UID 0, CW (0); Frequency: 5600 MHz; Duty Cycle: 1:1  
Medium: HSL\_5600 Medium parameters used:  $f = 5600$  MHz;  $\sigma = 5.125$  S/m;  $\epsilon_r = 35.435$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.4 °C; Liquid Temperature : 22.3 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3823; ConvF(4.5, 4.5, 4.5); Calibrated: 2018.11.12;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn480; Calibrated: 2019.04.11
- Phantom: SAM 1; Type: QD000P40CC; Serial: TP:1471
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**CW 5600/Area Scan (201x201x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm  
Maximum value of SAR (interpolated) = 8.96 W/kg

**CW 5600/Zoom Scan (7x7x13)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2mm  
Reference Value = 33.62 V/m; Power Drift = -0.06 dB  
Peak SAR (extrapolated) = 40.3 W/kg  
**SAR(1 g) = 8.31 W/kg; SAR(10 g) = 2.3 W/kg**  
Maximum value of SAR (measured) = 17.9 W/kg



Test Laboratory: SAR Lab. of Shenzhen Morlab Communications Technology Co., Ltd.

Date: 2019.10.09

**System Check\_5750MHz\_Head**

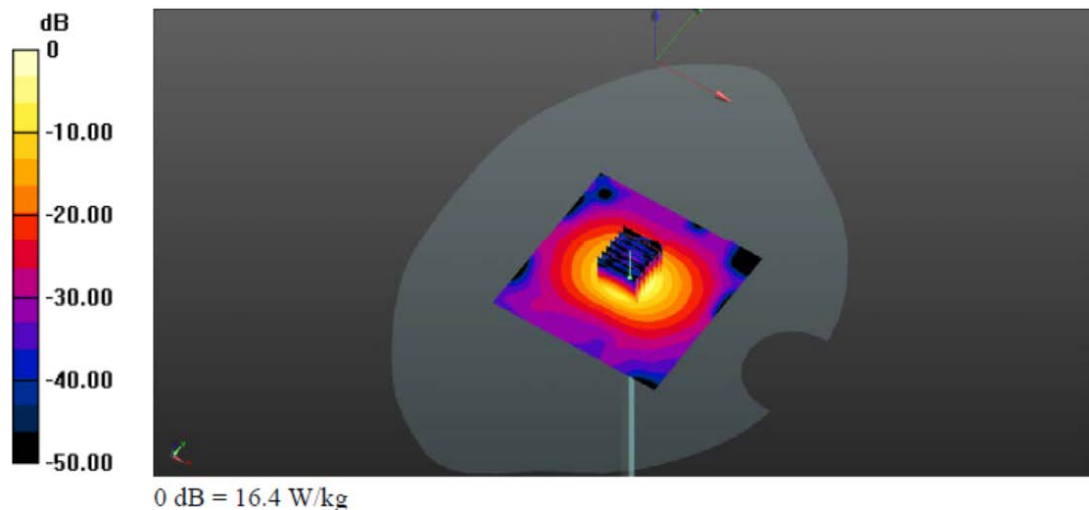
Communication System: UID 0, CW (0); Frequency: 5750 MHz; Duty Cycle: 1:1  
Medium: HSL\_5750 Medium parameters used:  $f = 5750$  MHz;  $\sigma = 5.298$  S/m;  $\epsilon_r = 35.158$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.4 °C; Liquid Temperature : 22.3 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3823; ConvF(4.6, 4.6, 4.6); Calibrated: 2018.11.12;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn480; Calibrated: 2019.04.11
- Phantom: SAM 1; Type: QD000P40CC; Serial: TP:1471
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**CW5750/Area Scan (101x101x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm  
Maximum value of SAR (interpolated) = 16.4 W/kg

**CW5750/Zoom Scan (7x7x13)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2mm  
Reference Value = 37.87 V/m; Power Drift = 0.10 dB  
Peak SAR (extrapolated) = 39.3 W/kg  
**SAR(1 g) = 7.96 W/kg; SAR(10 g) = 2.31 W/kg**  
Maximum value of SAR (measured) = 16.4 W/kg



1 Active Ch/Trace 2 Response 3 Stimulus 4 Mkr/Analysis 5 Instr State

Tr1 S11 Log Mag 10.00dB/ Ref 0.000dB [F1]

50.00  
40.00  
30.00  
20.00  
10.00  
0.000  
-10.00  
-20.00  
-30.00  
-40.00  
-50.00

>1 5.2500000 GHz -27.902 dB  
2 5.6000000 GHz -23.868 dB  
3 5.7500000 GHz -29.356 dB

1  
2  
3

Tr2 S11 Smith (R+jX) Scale 1.000U [F1]

>1 5.2500000 GHz 51.350  $\Omega$  3.8537  $\Omega$  116.83  $^{\circ}$   
2 5.6000000 GHz 44.702  $\Omega$  2.9617  $\Omega$  84.172  $^{\circ}$   
3 5.7500000 GHz 46.842  $\Omega$  952.65 m $\Omega$  26.368  $^{\circ}$

1  
2  
3