

#3

Date: 11/05/2023

**WCDMA II\_RMC 12.2Kbps**

Communication System: UID 0, Generic WCDMA (0); Frequency: 1852.4 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 1852.4$  MHz;  $\sigma = 1.404$  S/m;  $\epsilon_r = 40.843$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

## DASY5 Configuration:

- Probe: EX3DV4 - SN7396; ConvF(8.13, 8.13, 8.13); Calibrated: 05,06.2023;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn428; Calibrated: Aug.30,2023;
- Phantom: SAM 1; Type: SAM;
- Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.5 (6469)

**Area Scan (51x151x1):** Interpolated grid:  $dx=1.500$  mm,  $dy=1.500$  mm

Maximum value of SAR (interpolated) = 1.69 W/kg

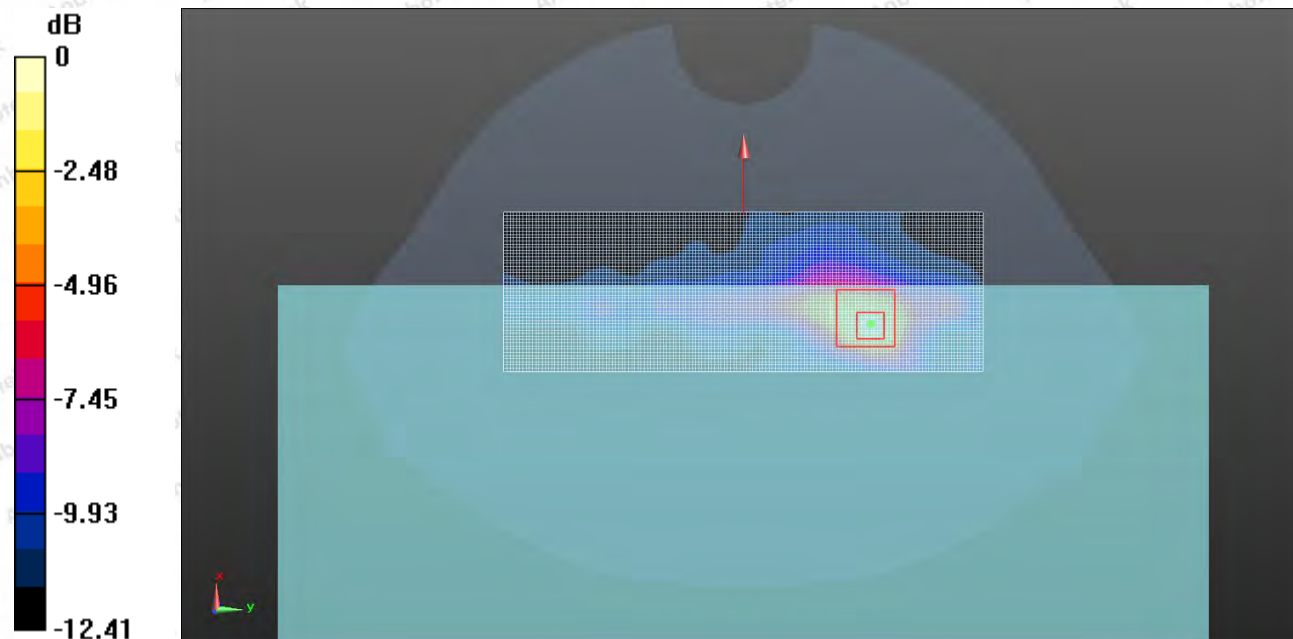
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 17.58 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 1.91 W/kg

**SAR(1 g) = 1.11 W/kg; SAR(10 g) = 0.752 W/kg**

Maximum value of SAR (measured) = 1.53 W/kg



#4

Date: 11/03/2023

**WCDMA V\_RMC 12.2Kbps\_ Rear Side**

Communication System: UID 0, Generic WCDMA (0); Frequency: 826.4 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 826.4$  MHz;  $\sigma = 0.901$  S/m;  $\epsilon_r = 42.194$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

## DASY5 Configuration:

- Probe: EX3DV4 - SN7396; ConvF(9.71, 9.71, 9.71); Calibrated: 05,06.2023;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn428; Calibrated: Aug.30,2023;
- Phantom: SAM 1; Type: SAM;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

**Area Scan (51x151x1):** Interpolated grid:  $dx=1.500$  mm,  $dy=1.500$  mm

Maximum value of SAR (interpolated) = 1.10 W/kg

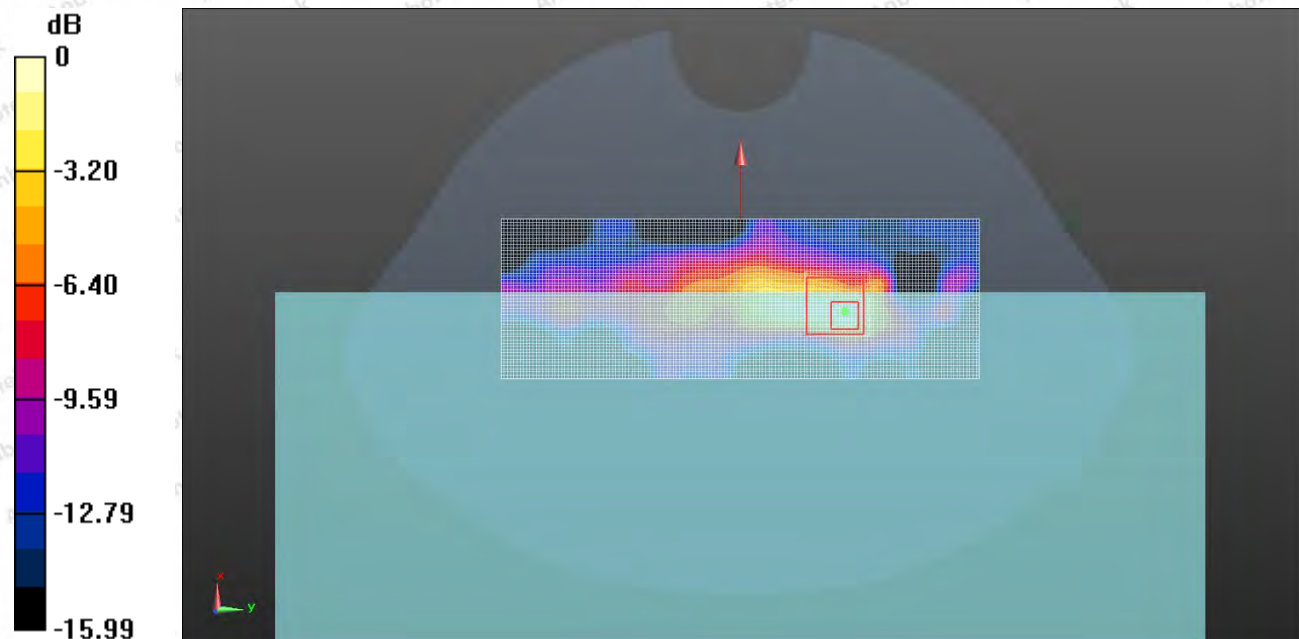
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 16.36 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 1.28 W/kg

**SAR(1 g) = 0.662 W/kg; SAR(10 g) = 0.457 W/kg**

Maximum value of SAR (measured) = 0.841 W/kg



**LTE Band 2 20M QPSK Rear Side**

Communication System: Customer System; Frequency: 1880.0 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 1880.0$  MHz;  $\sigma = 1.41$  mho/m;  $\epsilon = 40.01$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7396; ConvF(8.13, 8.13, 8.13); Calibrated: 05.06.2023;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn428; Calibrated: Aug.30,2023;
- Phantom: SAM 1; Type: SAM;
- Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.5 (6469)

**Area Scan (51x151x1):** Interpolated grid:  $dx = 1.500$  mm,  $dy = 1.500$  mm

Maximum value of SAR (interpolated) = 1.37 W/kg

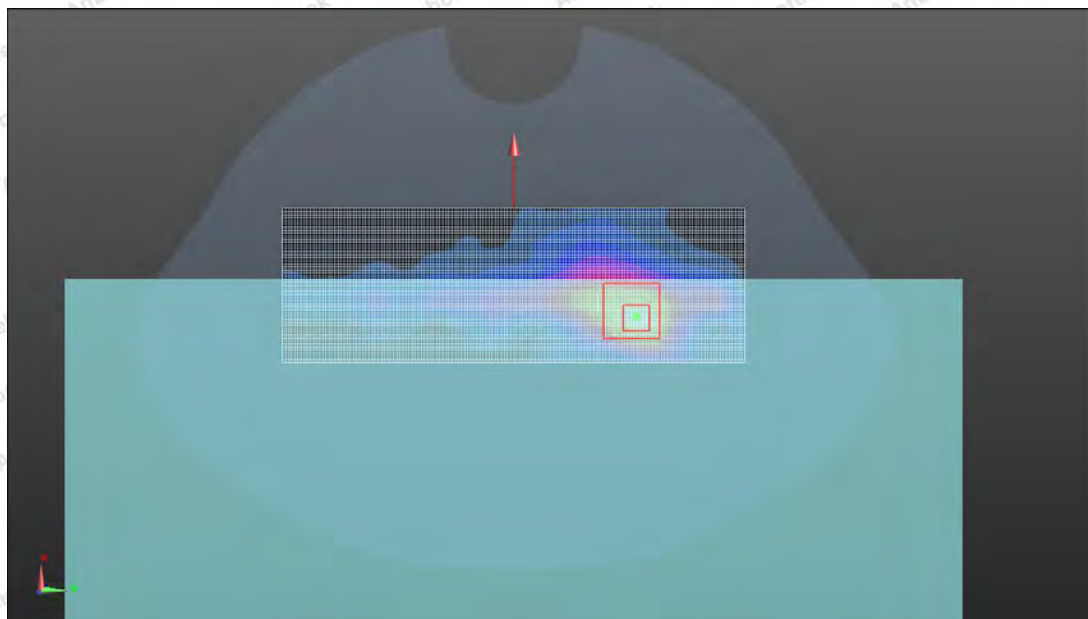
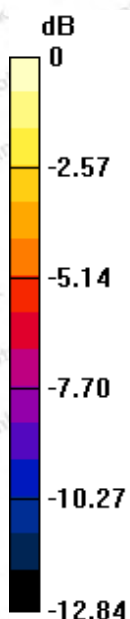
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx = 5$ mm,  $dy = 5$ mm,  $dz = 5$ mm

Reference Value = 16.78 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 1.41 W/kg

**SAR(1 g) = 0.932 W/kg; SAR(10 g) = 0.559 W/kg**

Maximum value of SAR (measured) = 0.997 W/kg



**LTE Band 5 10M QPSK Rear Side**

Communication System: Customer System; Frequency: 836.5 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 836.5$  MHz;  $\sigma = 0.905$  mho/m;  $\epsilon_r = 41.66$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7396; ConvF(9.71, 9.71, 9.71); Calibrated: 05.06.2023;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn428; Calibrated: Aug.30,2023;
- Phantom: SAM 1; Type: SAM;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

**Area Scan (51x151x1):** Interpolated grid:  $dx = 1.500$  mm,  $dy = 1.500$  mm

Maximum value of SAR (interpolated) = 0.923 W/kg

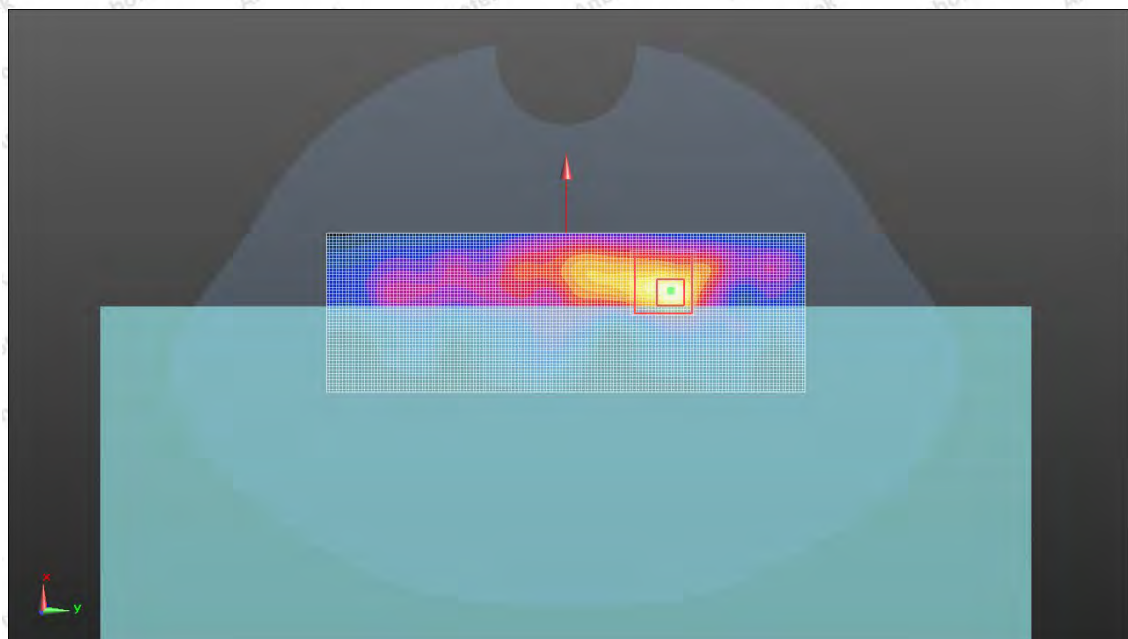
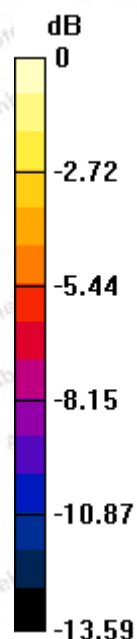
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx = 5$ mm,  $dy = 5$ mm,  $dz = 5$ mm

Reference Value = 8.347 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 1.49 W/kg

**SAR(1 g) = 0.565 W/kg; SAR(10 g) = 0.317 W/kg**

Maximum value of SAR (measured) = 0.608 W/kg



**LTE Band 7\_20M\_QPSK\_Rear Side**

Communication System: UID 0, Generic LTE (0); Frequency: 2535 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 2535$  MHz;  $\sigma = 1.899$  S/m;  $\epsilon_r = 39.788$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

**DASY5 Configuration:**

- Probe: EX3DV4 – SN7396; ConvF(7.38, 7.38, 7.38); Calibrated: 05.06.2023;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn428; Calibrated: Aug.30,2023
- Phantom: SAM; Type: QD000P40CD; Serial: TP:1670
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

**Area Scan (51x151x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm

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

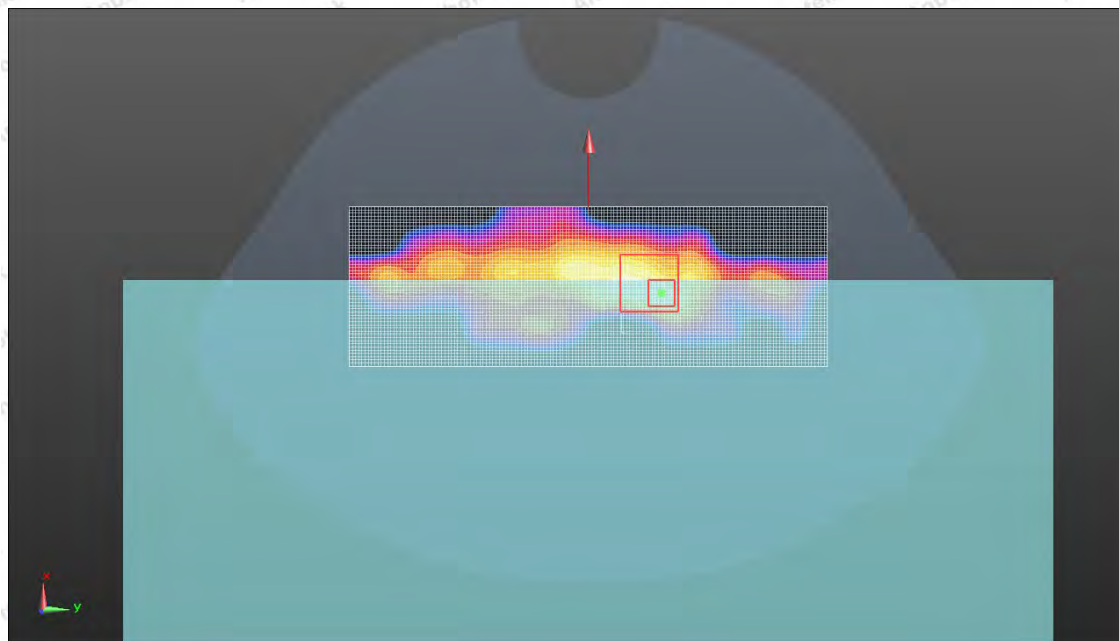
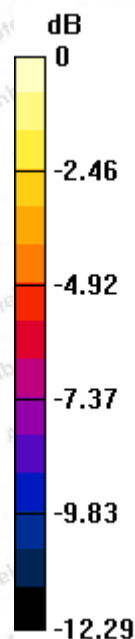
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 12.98 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 1.16 W/kg

**SAR(1 g) = 0.717 W/kg; SAR(10 g) = 0.406 W/kg**

Maximum value of SAR (measured) = 0.796 W/kg



**LTE Band 17\_10M\_QPSK\_ Rear Side**

Communication System: UID 0, Generic LTE (0); Frequency: 710 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 710$  MHz;  $\sigma = 0.873$  S/m;  $\epsilon_r = 42.316$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

**DASY5 Configuration:**

- Probe: EX3DV4 - SN7396; ConvF(9.82, 9.82, 9.82); Calibrated: 05.06.2023;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn428; Calibrated: Aug.30,2023;
- Phantom: SAM 1; Type: SAM;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

**Area Scan (51x151x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.695 W/Kg

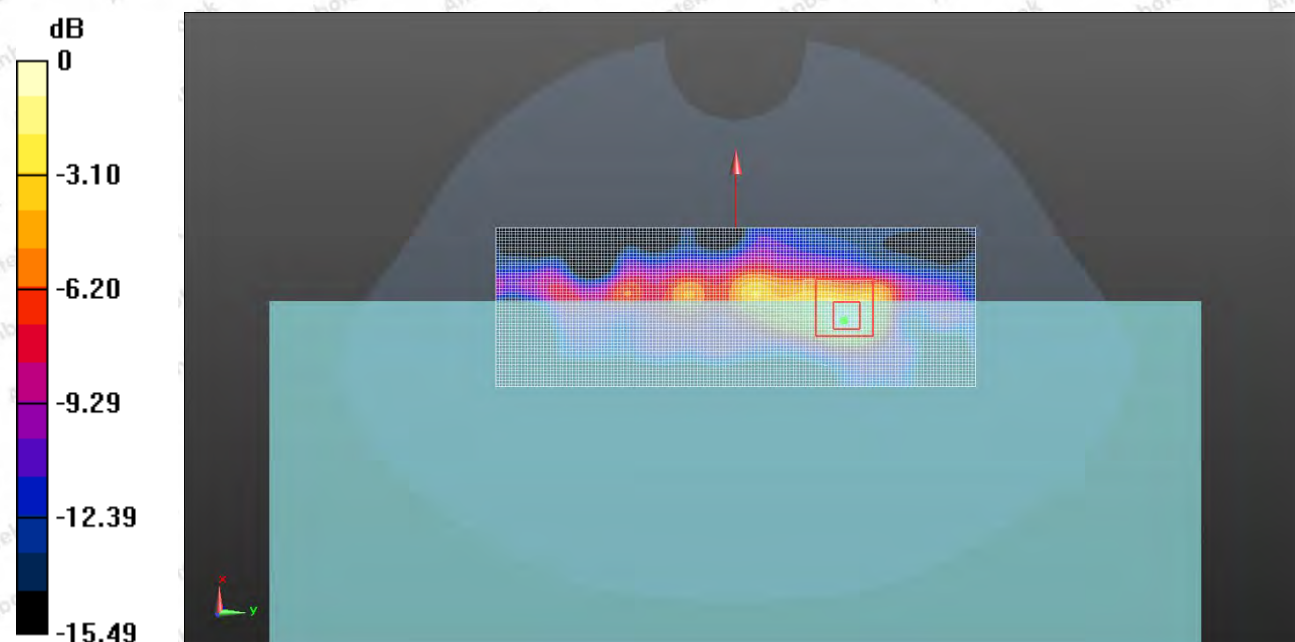
**Zoom Scan (5x6x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 6.97 V/m; Power Drift = 0.10 dB

Peak SAR (extrapolated) = 0.987 W/kg

**SAR(1 g) = 0.428 W/Kg; SAR(10 g) = 0.195 W/Kg**

Maximum value of SAR (measured) = 0.726 W/Kg



**LTE Band 40A\_10M\_QPSK**

Communication System: UID 0, Generic LTE (0); Frequency: 2310 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 2310$  MHz;  $\sigma = 1.301$  S/m;  $\epsilon_r = 38.417$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

**DASY5 Configuration:**

- Probe: EX3DV4 - SN7396; ConvF(7.85, 7.85, 7.85); Calibrated: 05.06.2023;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn428; Calibrated: Aug.30,2023;
- Phantom: SAM 1; Type: SAM;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

**Area Scan (51x151x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.437 W/kg

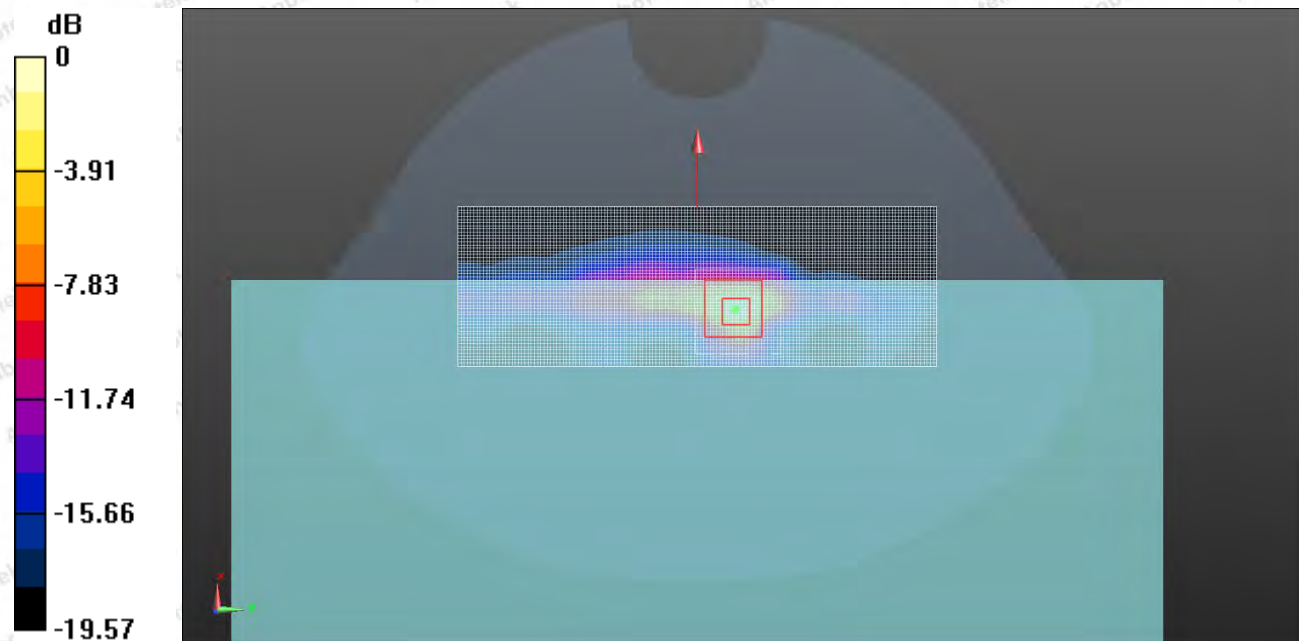
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 5.357 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 0.563 W/kg

**SAR(1 g) = 0.387 W/kg; SAR(10 g) = 0.263 W/kg**

Maximum value of SAR (measured) = 0.456 W/kg



**LTE Band 40B\_10M\_QPSK\_1RB**

Communication System: UID 0, Generic LTE (0); Frequency: 2355 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 2355$  MHz;  $\sigma = 1.635$  S/m;  $\epsilon_r = 38.377$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

**DASY5 Configuration:**

- Probe: EX3DV4 - SN7396; ConvF(7.85, 7.85, 7.85); Calibrated: 05.06.2023;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn428; Calibrated: Aug.30,2023;
- Phantom: SAM 1; Type: SAM;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

**Area Scan (51x151x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.425 W/kg

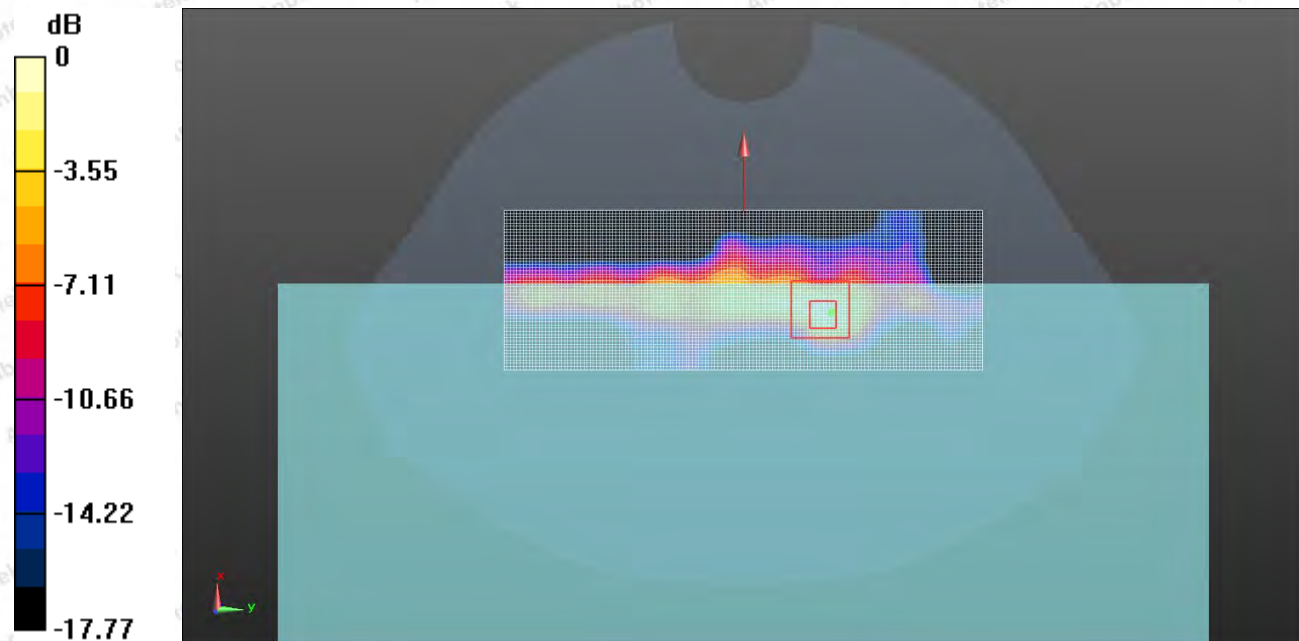
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 5.165 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 0.517 W/kg

**SAR(1 g) = 0.368 W/kg; SAR(10 g) = 0.259 W/kg**

Maximum value of SAR (measured) = 0.419 W/kg



**LTE Band 41\_20M\_QPSK\_Rear Side**

Communication System: UID 0, Generic LTE (0); Frequency: 2593 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 2593$  MHz;  $\sigma = 1.93$  S/m;  $\epsilon_r = 38.839$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

**DASY5 Configuration:**

- Probe: EX3DV4 - SN7396; ConvF(7.38, 7.38, 7.38); Calibrated: 05.06.2023;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn428; Calibrated: Aug.30,2023;
- Phantom: SAM 1; Type: SAM;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

**Area Scan (51x151x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.501 W/kg

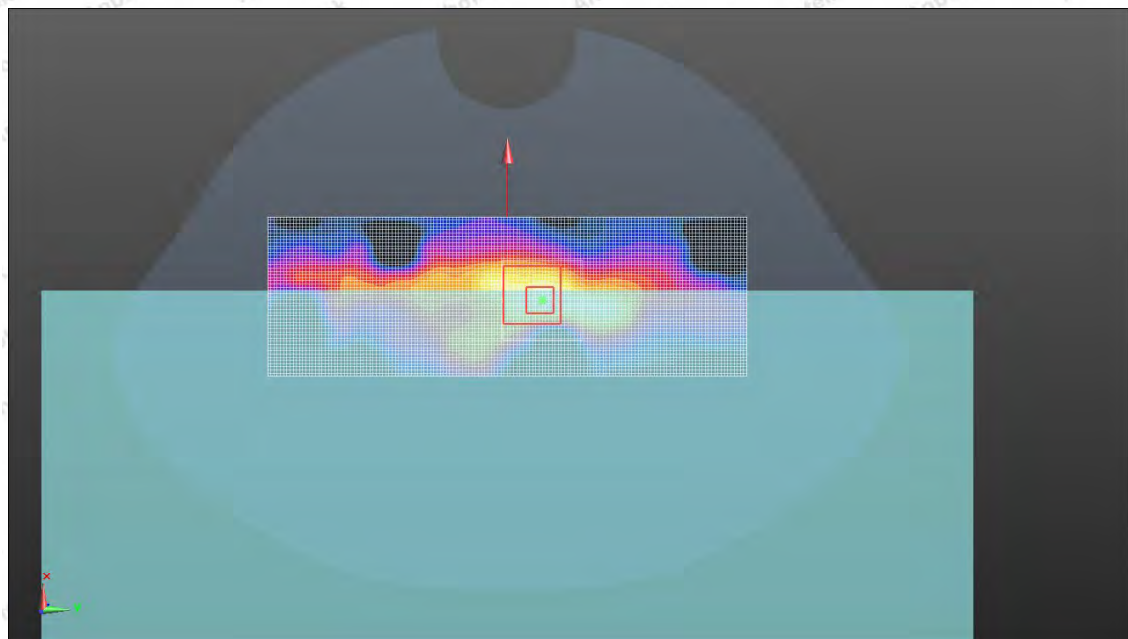
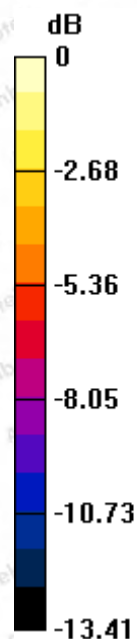
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 7.136 V/m; Power Drift = -0.13 dB

Peak SAR (extrapolated) = 0.550 W/kg

**SAR(1 g) = 0.381 W/kg; SAR(10 g) = 0.279 W/kg**

Maximum value of SAR (measured) = 0.498 W/kg



**WLAN2.4GHz\_802.11b 1Mbps\_Rear Side**

Communication System: UID 0, Generic LTE (0); Frequency: 2472 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 2472$  MHz;  $\sigma = 1.845$  S/m;  $\epsilon_r = 38.157$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

**DASY5 Configuration:**

- Probe: EX3DV4 - SN7396; ConvF(7.57, 7.57, 7.57); Calibrated: 05.06.2023;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn428; Calibrated: Aug.30,2023;
- Phantom: SAM 1; Type: SAM;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

**Area Scan (51x151x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.285 W/kg

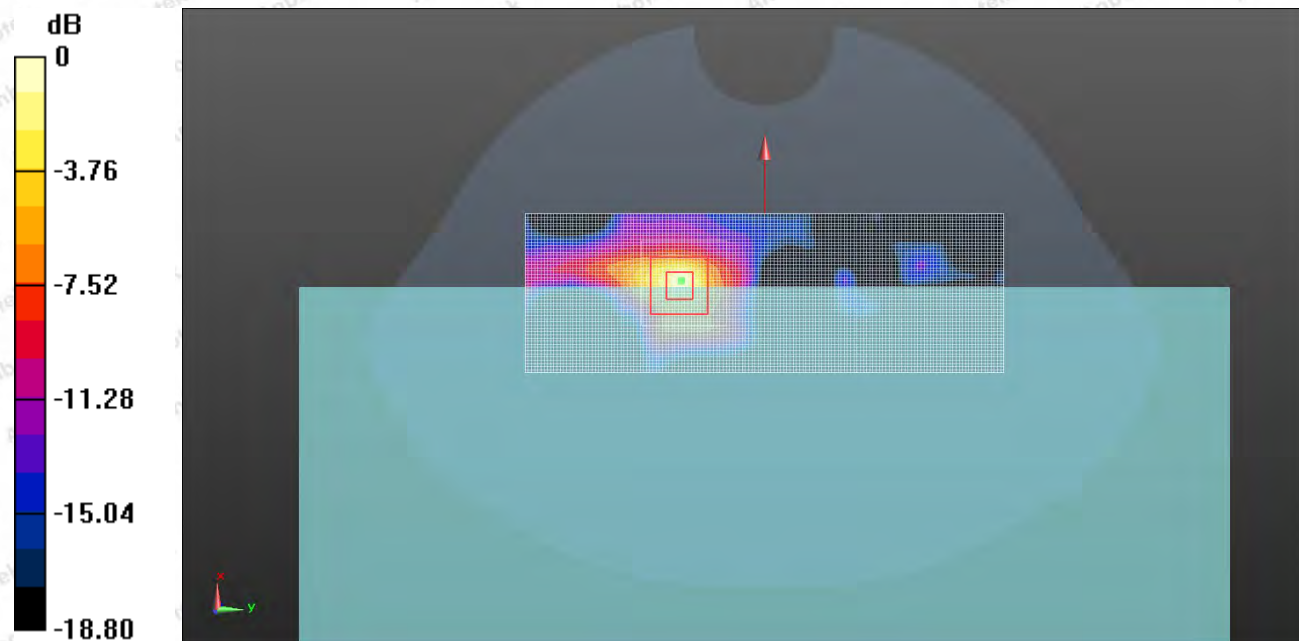
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.046 V/m; Power Drift = -0.12 dB

Peak SAR (extrapolated) = 0.493 W/kg

**SAR(1 g) = 0.263 W/kg; SAR(10 g) = 0.129 W/kg**

Maximum value of SAR (measured) = 0.289 W/kg



## Appendix D. DASY System Calibration Certificate



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中国认可  
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CALIBRATION  
CNAS L0570

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Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209  
E-mail: cttl@chinattl.com Http://www.chinattl.cn

Client

Anbotek (Auden)

Certificate No: Z23-98671

## CALIBRATION CERTIFICATE

Object EX3DV4 - SN:7396

Calibration Procedure(s) FF-Z12-006-08  
Calibration Procedures for Dosimetric E-field Probes

Calibration date: May 06, 2023

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&amp;TE critical for calibration)

| Primary Standards       | ID #        | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
|-------------------------|-------------|------------------------------------------|-----------------------|
| Power Meter NRP2        | 101919      | 20-Jun-22 (CTTL, No.J22 X07447)          | Jun-21                |
| Power sensor NRP-Z91    | 101547      | 20-Jun-22 (CTTL, No.J22 X07447)          | Jun-21                |
| Power sensor NRP-Z91    | 101548      | 20-Jun-22 (CTTL, No.J22 X07447)          | Jun-21                |
| Reference10dBAttenuator | 18N50W-10dB | 13-Mar-23(CTTL,No.J23X01547)             | Mar-22                |
| Reference20dBAttenuator | 18N50W-20dB | 13-Mar-23(CTTL, No.J23X01548)            | Mar-22                |
| Reference Probe EX3DV4  | SN 7433     | 26-Sep-22(SPEAG,No.EX3-7433_Sep22)       | Sep-21                |
| DAE4                    | SN 549      | 13-Dec-22(SPEAG, No.DAE4-549_Dec22)      | Dec -21               |
| Secondary Standards     | ID #        | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
| SignalGeneratorMG3700A  | 6201052605  | 27-Jun-22 (CTTL, No.J22X04776)           | Jun-21                |
| Network Analyzer E5071C | MY46110673  | 13-Jan-23 (CTTL, No.J23X00285)           | Jan -22               |

|                | Name        | Function           |
|----------------|-------------|--------------------|
| Calibrated by: | Yu Zongying | SAR Test Engineer  |
| Reviewed by:   | Lin Hao     | SAR Test Engineer  |
| Approved by:   | Qi Dianyuan | SAR Project Leader |

Signature

Issued: May06, 2023

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

Certificate No: Z23-98671

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 E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

**Glossary:**

|                       |                                                                                                                                             |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| TSL                   | tissue simulating liquid                                                                                                                    |
| NORM <sub>x,y,z</sub> | sensitivity in free space                                                                                                                   |
| ConvF                 | sensitivity in TSL / NORM <sub>x,y,z</sub>                                                                                                  |
| DCP                   | diode compression point                                                                                                                     |
| CF                    | crest factor (1/duty_cycle) of the RF signal                                                                                                |
| A,B,C,D               | modulation dependent linearization parameters                                                                                               |
| Polarization $\Phi$   | $\Phi$ rotation around probe axis                                                                                                           |
| Polarization $\theta$ | $\theta$ rotation around an axis that is in the plane normal to probe axis (at measurement center), i<br>$\theta=0$ is normal to probe axis |

Connector Angle information used in DASY system to align probe sensor X to the robot coordinate system

**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 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"

**Methods Applied and Interpretation of Parameters:**

- NORM<sub>x,y,z</sub>**: Assessed for E-field polarization  $\theta=0$  ( $f \leq 900\text{MHz}$  in TEM-cell;  $f > 1800\text{MHz}$ : waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not effect the  $E^2$ -field uncertainty inside TSL (see below ConvF).
- NORM( $f$ )<sub>x,y,z</sub> = NORM<sub>x,y,z</sub> \* frequency\_response** (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCPx,y,z**: DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics.
- A<sub>x,y,z</sub>; B<sub>x,y,z</sub>; C<sub>x,y,z</sub>; VR<sub>x,y,z</sub>; A,B,C** are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for  $f \leq 800\text{MHz}$ ) and inside waveguide using analytical field distributions based on power measurements for  $f > 800\text{MHz}$ . The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty valued are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM<sub>x,y,z</sub> ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from  $\pm 50\text{MHz}$  to  $\pm 100\text{MHz}$ .
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM<sub>x</sub> (no uncertainty required).





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E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

# Probe EX3DV4

## SN: 7396

Calibrated: May 06, 2023

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)





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**DASY/EASY – Parameters of Probe: EX3DV4 – SN: 7396****Basic Calibration Parameters**

|                                                          | Sensor X | Sensor Y | Sensor Z | Unc (k=2)    |
|----------------------------------------------------------|----------|----------|----------|--------------|
| Norm( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup> | 0.54     | 0.53     | 0.50     | $\pm 10.0\%$ |
| DCP(mV) <sup>B</sup>                                     | 97.8     | 104.5    | 102.5    |              |

**Modulation Calibration Parameters**

| UID | Communication System Name |   | A<br>dB | B<br>dB $\sqrt{\mu\text{V}}$ | C   | D<br>dB | VR<br>mV | Unc <sup>E</sup><br>(k=2) |
|-----|---------------------------|---|---------|------------------------------|-----|---------|----------|---------------------------|
| 0   | CW                        | X | 0.0     | 0.0                          | 1.0 | 0.00    | 199.9    | $\pm 2.4\%$               |
|     |                           | Y | 0.0     | 0.0                          | 1.0 |         | 203.3    |                           |
|     |                           | Z | 0.0     | 0.0                          | 1.0 |         | 195.0    |                           |

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%.

<sup>A</sup> The uncertainties of Norm X, Y, Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Page 5 and Page 6).

<sup>B</sup> Numerical linearization parameter: uncertainty not required.

<sup>E</sup> Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.





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## DASY/EASY – Parameters of Probe: EX3DV4 – SN: 7396

### Calibration Parameter Determined in Head Tissue Simulating Media

| f [MHz] <sup>C</sup> | Relative Permittivity <sup>F</sup> | Conductivity (S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha <sup>G</sup> | Depth <sup>G</sup> (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-------------|
| 750                  | 41.9                               | 0.89                            | 9.82    | 9.82    | 9.82    | 0.30               | 0.85                    | ± 12.1%     |
| 835                  | 41.5                               | 0.90                            | 9.71    | 9.71    | 9.71    | 0.15               | 1.36                    | ± 12.1%     |
| 900                  | 41.5                               | 0.97                            | 9.87    | 9.87    | 9.87    | 0.16               | 1.37                    | ± 12.1%     |
| 1750                 | 40.1                               | 1.37                            | 8.61    | 8.61    | 8.61    | 0.25               | 1.04                    | ± 12.1%     |
| 1900                 | 40.0                               | 1.40                            | 8.13    | 8.13    | 8.13    | 0.24               | 1.01                    | ± 12.1%     |
| 2100                 | 39.8                               | 1.49                            | 8.14    | 8.14    | 8.14    | 0.24               | 1.04                    | ± 12.1%     |
| 2300                 | 39.5                               | 1.67                            | 7.85    | 7.85    | 7.85    | 0.40               | 0.75                    | ± 12.1%     |
| 2450                 | 39.2                               | 1.80                            | 7.57    | 7.57    | 7.57    | 0.50               | 0.75                    | ± 12.1%     |
| 2600                 | 39.0                               | 1.96                            | 7.38    | 7.38    | 7.38    | 0.64               | 0.68                    | ± 12.1%     |
| 5250                 | 35.9                               | 4.71                            | 5.33    | 5.33    | 5.33    | 0.45               | 1.30                    | ± 13.3%     |
| 5600                 | 35.5                               | 5.07                            | 4.89    | 4.89    | 4.89    | 0.45               | 1.35                    | ± 13.3%     |
| 5750                 | 35.4                               | 5.22                            | 4.92    | 4.92    | 4.92    | 0.45               | 1.45                    | ± 13.3%     |

<sup>C</sup> Frequency validity above 300 MHz of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

<sup>F</sup> At frequency below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

<sup>G</sup> Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.





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## DASY/EASY – Parameters of Probe: EX3DV4 – SN: 7396

### Calibration Parameter Determined in Body Tissue Simulating Media

| f [MHz] <sup>C</sup> | Relative Permittivity <sup>F</sup> | Conductivity (S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha <sup>G</sup> | Depth <sup>G</sup> (mm) | Uct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|------------|
| 750                  | 55.5                               | 0.96                            | 10.09   | 10.09   | 10.09   | 0.30               | 0.90                    | ± 12.1%    |
| 835                  | 55.2                               | 0.97                            | 9.88    | 9.88    | 9.88    | 0.19               | 1.32                    | ± 12.1%    |
| 900                  | 55.0                               | 1.05                            | 9.82    | 9.82    | 9.82    | 0.23               | 1.15                    | ± 12.1%    |
| 1750                 | 53.4                               | 1.49                            | 8.24    | 8.24    | 8.24    | 0.24               | 1.06                    | ± 12.1%    |
| 1900                 | 53.3                               | 1.52                            | 7.97    | 7.97    | 7.97    | 0.19               | 1.24                    | ± 12.1%    |
| 2100                 | 53.2                               | 1.62                            | 8.18    | 8.18    | 8.18    | 0.19               | 1.39                    | ± 12.1%    |
| 2300                 | 52.9                               | 1.81                            | 7.88    | 7.88    | 7.88    | 0.55               | 0.80                    | ± 12.1%    |
| 2450                 | 52.7                               | 1.95                            | 7.53    | 7.53    | 7.53    | 0.46               | 0.89                    | ± 12.1%    |
| 2600                 | 52.5                               | 2.16                            | 7.38    | 7.38    | 7.38    | 0.52               | 0.80                    | ± 12.1%    |
| 5250                 | 48.9                               | 5.36                            | 4.93    | 4.93    | 4.93    | 0.45               | 1.80                    | ± 13.3%    |
| 5600                 | 48.5                               | 5.77                            | 4.19    | 4.19    | 4.19    | 0.48               | 1.90                    | ± 13.3%    |
| 5750                 | 48.3                               | 5.94                            | 4.52    | 4.52    | 4.52    | 0.48               | 1.95                    | ± 13.3%    |

<sup>C</sup> Frequency validity above 300 MHz of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

<sup>F</sup> At frequency below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

<sup>G</sup> Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.





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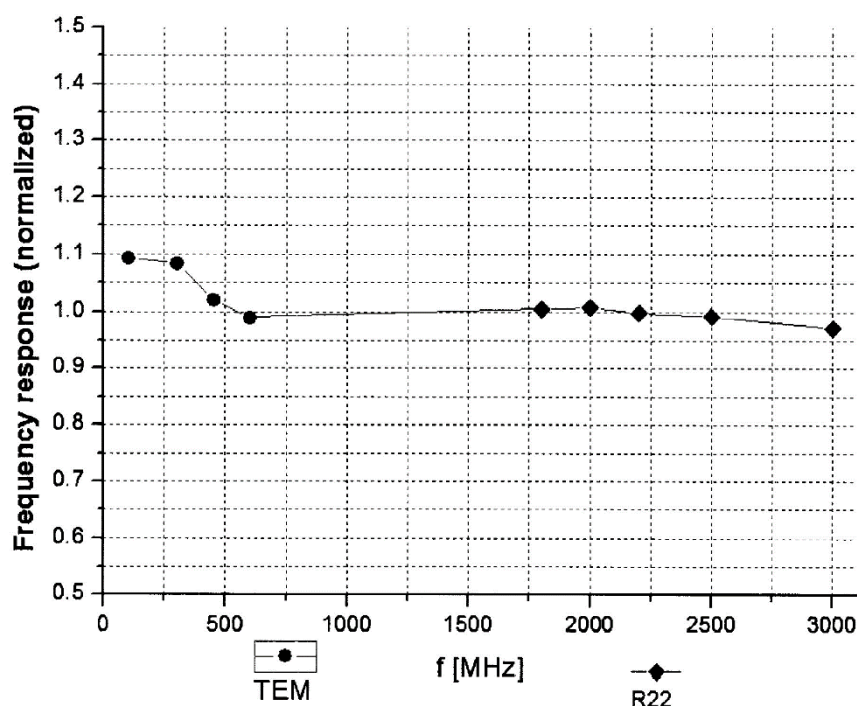
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## Frequency Response of E-Field (TEM-Cell: ifi110 EXX, Waveguide: R22)

Uncertainty of Frequency Response of E-field:  $\pm 7.4\%$  ( $k=2$ )



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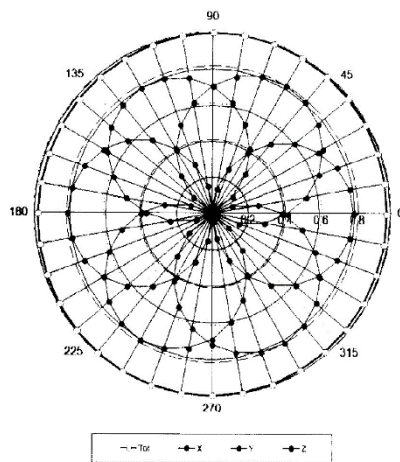
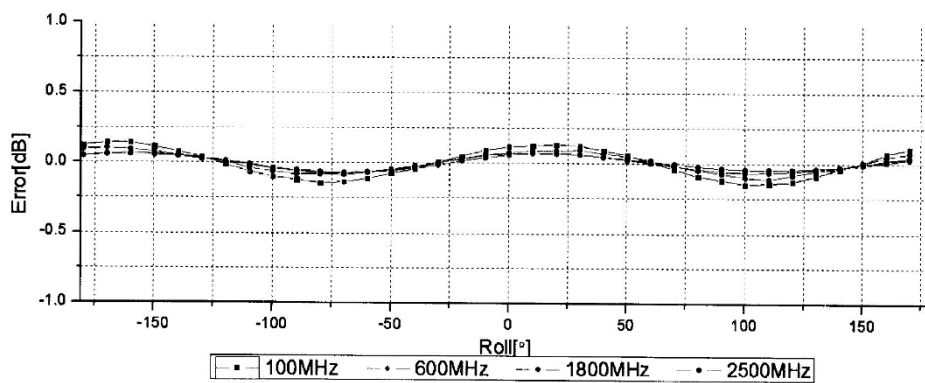
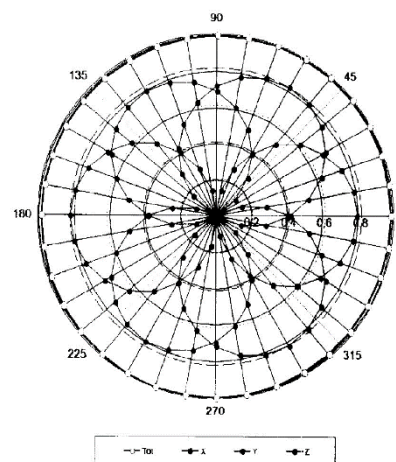
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## Receiving Pattern ( $\Phi$ ), $\theta=0^\circ$

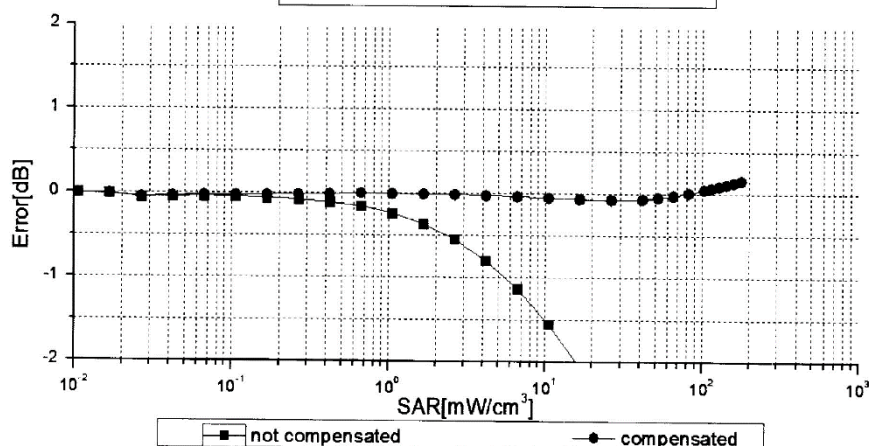
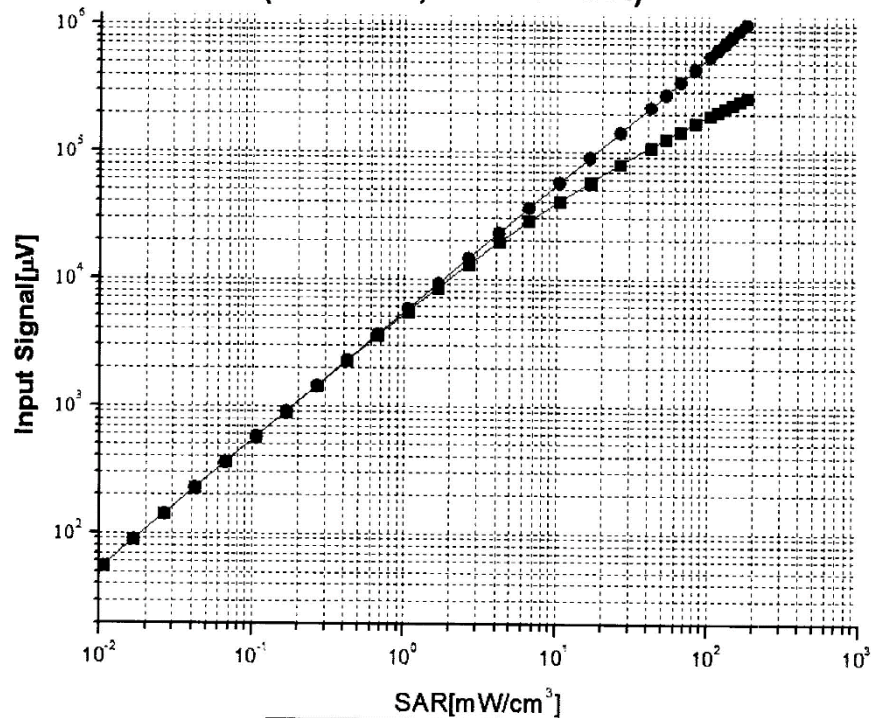
**f=600 MHz, TEM****f=1800 MHz, R22****Uncertainty of Axial Isotropy Assessment:  $\pm 1.2\%$  (k=2)**



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### Dynamic Range f(SAR<sub>head</sub>) (TEM cell, f = 900 MHz)



Uncertainty of Linearity Assessment:  $\pm 0.9\%$  (k=2)

Certificate No: Z23-98671

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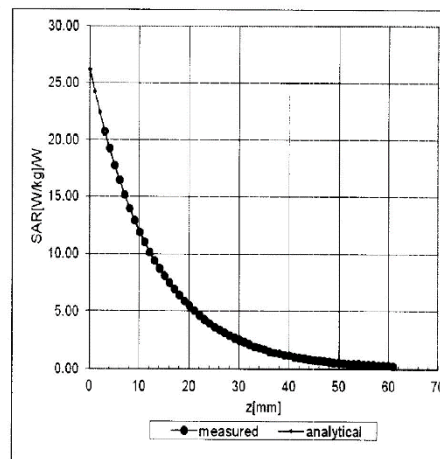
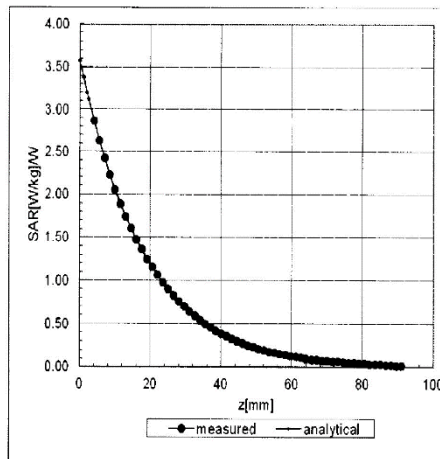


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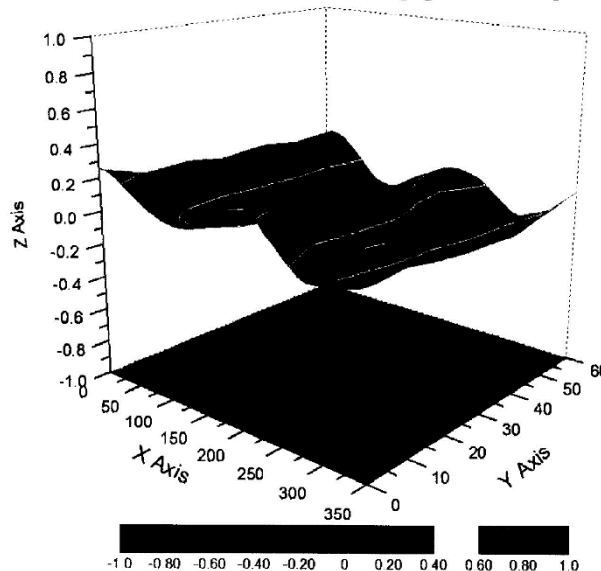
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## Conversion Factor Assessment

**f=900 MHz, WGLS R9(H\_convF)****f=1750 MHz, WGLS R22(H\_convF)**

## Deviation from Isotropy in Liquid

**Uncertainty of Spherical Isotropy Assessment:  $\pm 3.2\%$  (K=2)**



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**DASY/EASY – Parameters of Probe: EX3DV4 – SN: 7396****Other Probe Parameters**

|                                                      |                   |
|------------------------------------------------------|-------------------|
| <b>Sensor Arrangement</b>                            | <b>Triangular</b> |
| <b>Connector Angle (°)</b>                           | <b>156.9</b>      |
| <b>Mechanical Surface Detection Mode</b>             | <b>enabled</b>    |
| <b>Optical Surface Detection Mode</b>                | <b>disable</b>    |
| <b>Probe Overall Length</b>                          | <b>337mm</b>      |
| <b>Probe Body Diameter</b>                           | <b>10mm</b>       |
| <b>Tip Length</b>                                    | <b>9mm</b>        |
| <b>Tip Diameter</b>                                  | <b>2.5mm</b>      |
| <b>Probe Tip to Sensor X Calibration Point</b>       | <b>1mm</b>        |
| <b>Probe Tip to Sensor Y Calibration Point</b>       | <b>1mm</b>        |
| <b>Probe Tip to Sensor Z Calibration Point</b>       | <b>1mm</b>        |
| <b>Recommended Measurement Distance from Surface</b> | <b>1.4mm</b>      |





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Client : CTA

Certificate No: J23Z60391

## CALIBRATION CERTIFICATE

Object DAE3 - SN: 428

Calibration Procedure(s) FF-Z11-002-01  
Calibration Procedure for the Data Acquisition Electronics (DAEx)

Calibration date: August 30, 2023

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&amp;TE critical for calibration)

| Primary Standards      | ID #    | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
|------------------------|---------|------------------------------------------|-----------------------|
| Process Calibrator 753 | 1971018 | 12-Jun-23 (CTTL, No.J23X05436)           | Jun-24                |

|                |             |                    |
|----------------|-------------|--------------------|
| Calibrated by: | Name        | Function           |
|                | Yu Zongying | SAR Test Engineer  |
| Reviewed by:   | Lin Hao     | SAR Test Engineer  |
| Approved by:   | Qi Dianyuan | SAR Project Leader |

Signature

Issued: September 06, 2023

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Certificate No: J23Z60391

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E-mail: [cmf@caict.ac.cn](mailto:cmf@caict.ac.cn)<http://www.caict.ac.cn>**Glossary:**

DAE

data acquisition electronics

Connector angle

information used in DASY system to align probe sensor X to the robot coordinate system.

**Methods Applied and Interpretation of Parameters:**

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle:* The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The report provide only calibration results for DAE, it does not contain other performance test results.





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<http://www.caict.ac.cn>**DC Voltage Measurement**

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 $\mu$ V, full range = -100...+300 mV

Low Range: 1LSB = 61nV, full range = -1.....+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| Calibration Factors | X                         | Y                         | Z                         |
|---------------------|---------------------------|---------------------------|---------------------------|
| High Range          | 404.468 $\pm$ 0.15% (k=2) | 404.804 $\pm$ 0.15% (k=2) | 404.579 $\pm$ 0.15% (k=2) |
| Low Range           | 3.95934 $\pm$ 0.7% (k=2)  | 3.95437 $\pm$ 0.7% (k=2)  | 3.91875 $\pm$ 0.7% (k=2)  |

**Connector Angle**

|                                           |                 |
|-------------------------------------------|-----------------|
| Connector Angle to be used in DASY system | 258.5° $\pm$ 1° |
|-------------------------------------------|-----------------|





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Client **Anbotek (Auden)**Certificate No: **Z18-98076****CALIBRATION CERTIFICATE**Object **D750V3 - SN: 1118**Calibration Procedure(s)  
**FD-Z11-003-01**  
Calibration Procedures for dipole validation kitsCalibration date: **June 08, 2021**

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&amp;TE critical for calibration)

| Primary Standards       | ID #       | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
|-------------------------|------------|------------------------------------------|-----------------------|
| Power Meter NRP2        | 101919     | 01-Jul-20 (CTTL, No.J27X04256)           | Jun-21                |
| Power sensor NRP-Z91    | 101547     | 01-Jul-20 (CTTL, No.J27X04256)           | Jun-21                |
| Reference Probe EX3DV4  | SN 7307    | 19-Feb-21(SPEAG,No.EX3-7307_Feb18)       | Feb-22                |
| DAE4                    | SN 771     | 02-Feb-21(CTTL-SPEAG,No.Z18-97011)       | Feb-22                |
| Secondary Standards     | ID #       | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
| Signal Generator E4438C | MY49071430 | 01-Feb-21 (CTTL, No.J18X00893)           | Jan-22                |
| Network Analyzer E5071C | MY46110673 | 26-Jan-21 (CTTL, No.J18X00894)           | Jan-22                |

|                |             |                    |           |
|----------------|-------------|--------------------|-----------|
|                | 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: June 10, 2021

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#### Glossary:

|       |                                            |
|-------|--------------------------------------------|
| TSL   | tissue simulating liquid                   |
| ConvF | sensitivity in TSL / NORM <sub>x,y,z</sub> |
| 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%.





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### Measurement Conditions

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

|                              |                          |              |
|------------------------------|--------------------------|--------------|
| DASY Version                 | DASY52                   | 52.10.0.1442 |
| 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 | 42.1 $\pm$ 6 % | 0.88 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | <1.0 °C             | —              | —                    |

### SAR result with Head TSL

|                                                         |                    |                                |
|---------------------------------------------------------|--------------------|--------------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL   | Condition          |                                |
| SAR measured                                            | 250 mW input power | 2.06 mW / g                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 8.31 mW / g $\pm$ 18.8 % (k=2) |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | Condition          |                                |
| SAR measured                                            | 250 mW input power | 1.37 mW / g                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 5.52 mW / g $\pm$ 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 | 55.7 $\pm$ 6 % | 0.97 mho/m $\pm$ 6 % |
| Body TSL temperature change during test | <1.0 °C             | —              | —                    |

### SAR result with Body TSL

|                                                         |                    |                                |
|---------------------------------------------------------|--------------------|--------------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL   | Condition          |                                |
| SAR measured                                            | 250 mW input power | 2.21 mW / g                    |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 8.76 mW / g $\pm$ 18.8 % (k=2) |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | Condition          |                                |
| SAR measured                                            | 250 mW input power | 1.48 mW / g                    |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 5.88 mW / g $\pm$ 18.7 % (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 | 53.3Ω- 4.83jΩ |
| Return Loss                          | - 24.9dB      |

##### Antenna Parameters with Body TSL

|                                      |               |
|--------------------------------------|---------------|
| Impedance, transformed to feed point | 48.5Ω- 6.11jΩ |
| Return Loss                          | - 23.9dB      |

##### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.135 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: 06.08.2021

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1118**

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

Medium parameters used:  $f = 750 \text{ MHz}$ ;  $\sigma = 0.882 \text{ S/m}$ ;  $\epsilon_r = 42.14$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7307; ConvF(10.05, 10.05, 10.05); Calibrated: 2/19/2021;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2021-02-02
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7372)

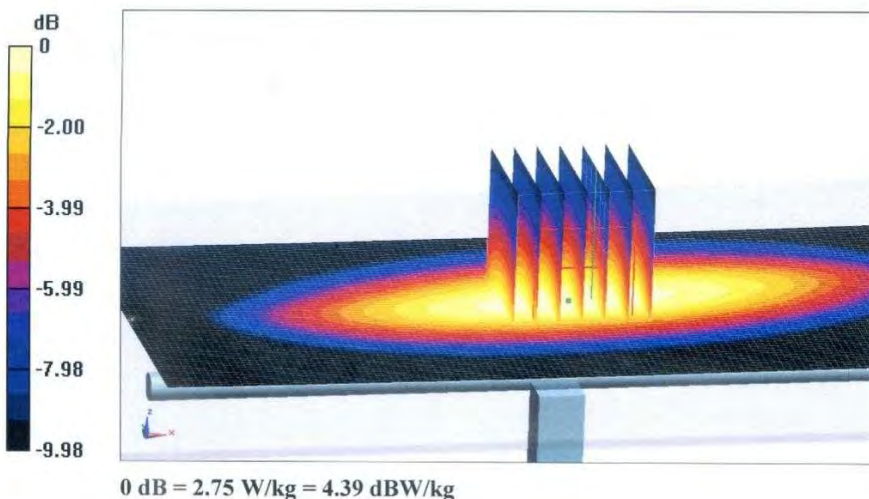
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$ 

Reference Value = 56.45 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 3.14 W/kg

**SAR(1 g) = 2.06 W/kg; SAR(10 g) = 1.37 W/kg**

Maximum value of SAR (measured) = 2.75 W/kg

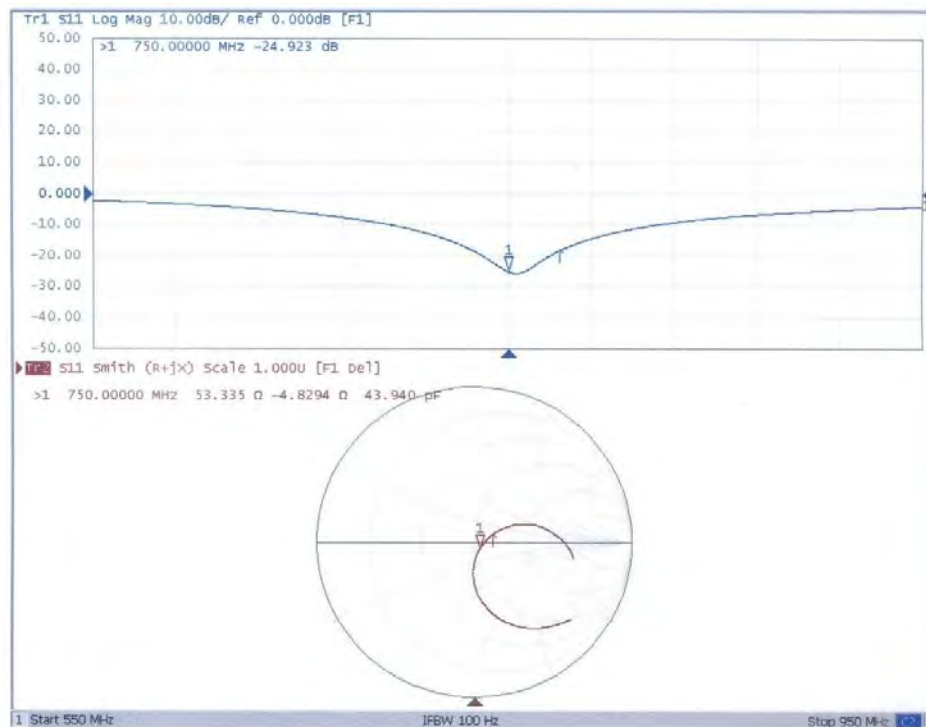




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### Impedance Measurement Plot for Head TSL





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**DASY5 Validation Report for Body TSL**

Date: 06.08.2021

Test Laboratory: CTTT, Beijing, China

**DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1118**

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

Medium parameters used:  $f = 750 \text{ MHz}$ ;  $\sigma = 0.972 \text{ S/m}$ ;  $\epsilon_r = 55.73$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Center Section

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

**DASY5 Configuration:**

- Probe: EX3DV4 - SN7307; ConvF(9.8, 9.8, 9.8); Calibrated: 2/19/2021;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2021-02-02
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7372)

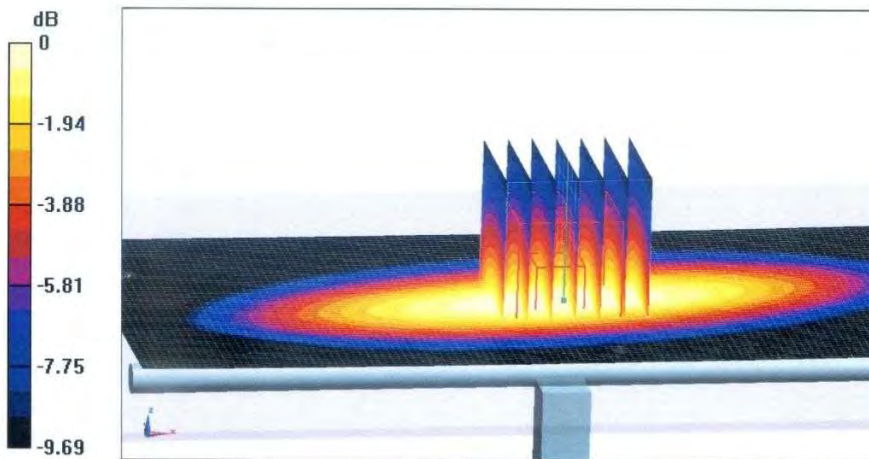
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$ 

Reference Value = 54.05 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 3.37 W/kg

**SAR(1 g) = 2.21 W/kg; SAR(10 g) = 1.48 W/kg**

Maximum value of SAR (measured) = 2.95 W/kg

**0 dB = 2.95 W/kg = 4.70 dBW/kg**

Certificate No: Z18-97076

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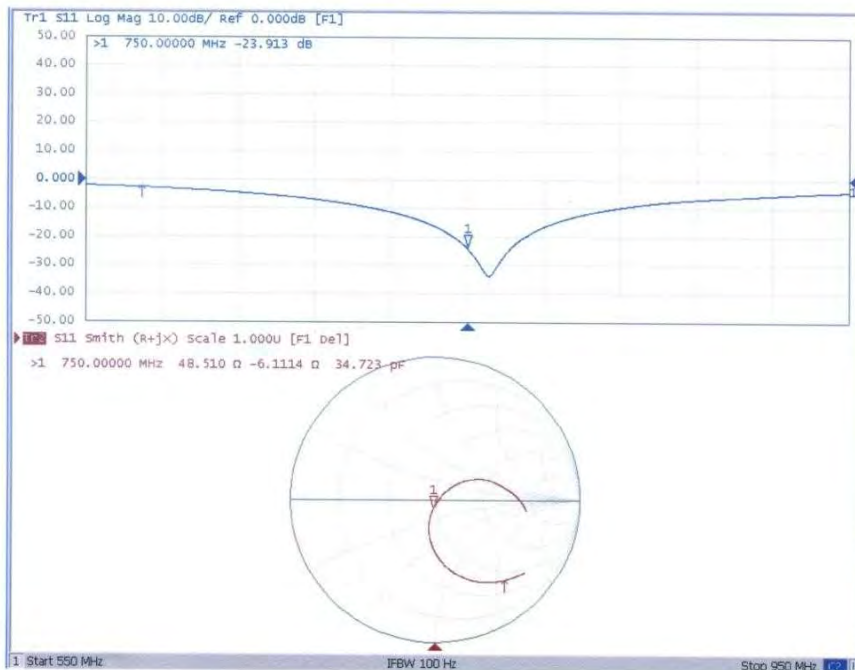


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## Impedance Measurement Plot for Body TSL





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Client

Anbotek (Auden)

Certificate No: Z18-97089

**CALIBRATION CERTIFICATE**

Object D835V2 - SN: 4d154

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

Calibration date: Jun 16, 2021

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&amp;TE critical for calibration)

| Primary Standards      | ID #    | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
|------------------------|---------|------------------------------------------|-----------------------|
| Power Meter NRP2       | 101919  | 1-Jul-20 (CTTL, No.J17X04256)            | Jun-21                |
| Power sensor NRP-Z91   | 101547  | 1-Jul-20 (CTTL, No.J17X04256)            | Jun-21                |
| Reference Probe EX3DV4 | SN 7307 | 19-Feb-21(SPEAG,No.EX3-7307_Feb18)       | Feb-22                |
| DAE4                   | SN 771  | 02-Feb-21(CTTL-SPEAG,No.Z18-97011)       | Feb-22                |

| Secondary Standards     | ID #       | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
|-------------------------|------------|------------------------------------------|-----------------------|
| Signal Generator E4438C | MY49071430 | 01-Feb-21 (CTTL, No.J18X00893)           | Jan-22                |
| Network Analyzer E5071C | MY46110673 | 26-Jan-21 (CTTL, No.J18X00894)           | Jan-22                |

|                | 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: Jun 17, 2021

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**Glossary:**

|       |                                            |
|-------|--------------------------------------------|
| TSL   | tissue simulating liquid                   |
| ConvF | sensitivity in TSL / NORM <sub>x,y,z</sub> |
| 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%.





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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 $\pm$ 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 | 41.0 $\pm$ 6 % | 0.89 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | <1.0 °C             | ---            | ---                  |

### SAR result with Head TSL

|                                                         |                    |                                |
|---------------------------------------------------------|--------------------|--------------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL   | Condition          |                                |
| SAR measured                                            | 250 mW input power | 2.30 mW / g                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 9.24 mW / g $\pm$ 20.8 % (k=2) |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | Condition          |                                |
| SAR measured                                            | 250 mW input power | 1.50 mW / g                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 6.02 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 | 55.4 $\pm$ 6 % | 0.99 mho/m $\pm$ 6 % |
| Body TSL temperature change during test | <1.0 °C             | ---            | ---                  |

### SAR result with Body TSL

|                                                         |                    |                                |
|---------------------------------------------------------|--------------------|--------------------------------|
| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL   | Condition          |                                |
| SAR measured                                            | 250 mW input power | 2.43 mW / g                    |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 9.57 mW / g $\pm$ 20.8 % (k=2) |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | Condition          |                                |
| SAR measured                                            | 250 mW input power | 1.61 mW / g                    |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 6.36 mW / g $\pm$ 20.4 % (k=2) |

Certificate No: Z18-97089

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## Appendix

### Antenna Parameters with Head TSL

|                                      |               |
|--------------------------------------|---------------|
| Impedance, transformed to feed point | 49.2Ω- 3.11jΩ |
| Return Loss                          | - 29.8dB      |

### Antenna Parameters with Body TSL

|                                      |               |
|--------------------------------------|---------------|
| Impedance, transformed to feed point | 46.6Ω- 2.33jΩ |
| Return Loss                          | - 27.4dB      |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.508 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: 06.16.2021

Test Laboratory: CTTT, Beijing, China

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d154**

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

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.891 \text{ S/m}$ ;  $\epsilon_r = 40.97$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7307; ConvF(10.01, 10.01, 10.01); Calibrated: 2/19/2021;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2021-02-02
- 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)

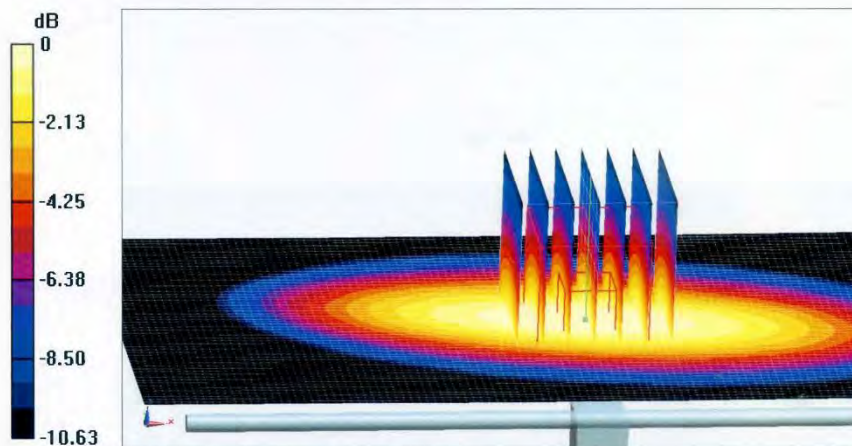
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  
 $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 58.14 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 3.41 W/kg

**SAR(1 g) = 2.3 W/kg; SAR(10 g) = 1.5 W/kg**

Maximum value of SAR (measured) = 2.91 W/kg

**0 dB = 2.91 W/kg = 4.64 dBW/kg**

Certificate No: Z18-97089

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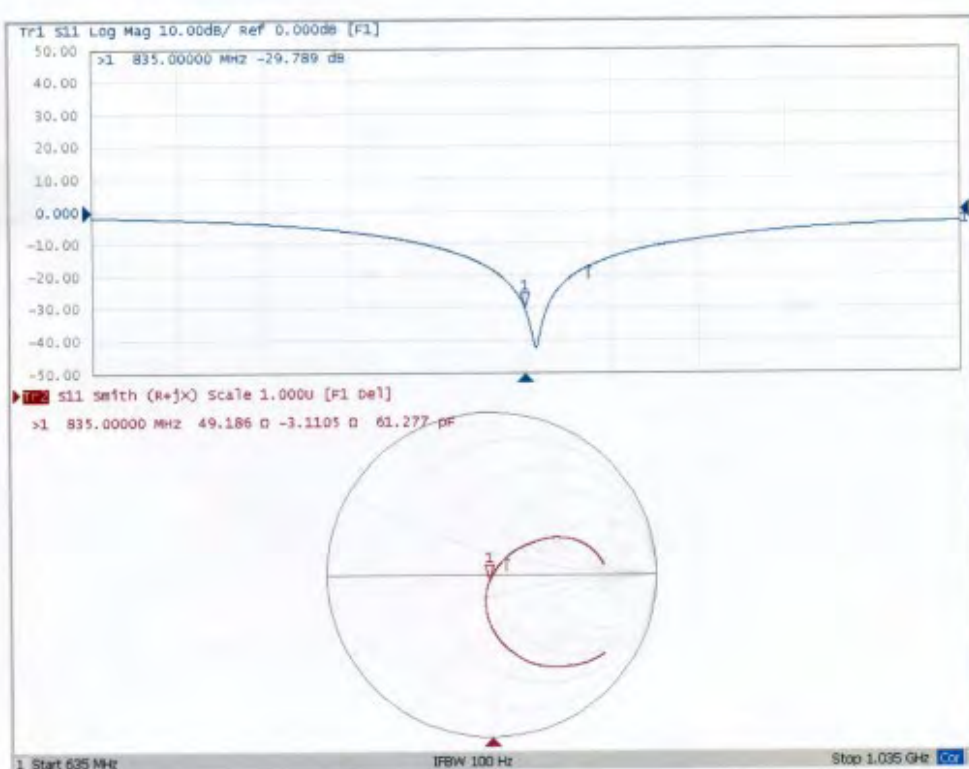




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### Impedance Measurement Plot for Head TSL



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**DASY5 Validation Report for Body TSL**

Date: 06.16.2021

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d154**

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

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.991 \text{ S/m}$ ;  $\epsilon_r = 55.41$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Center Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7307; ConvF(9.83,9.83, 9.83); Calibrated: 2/19/2021;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2021-02-02
- 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)

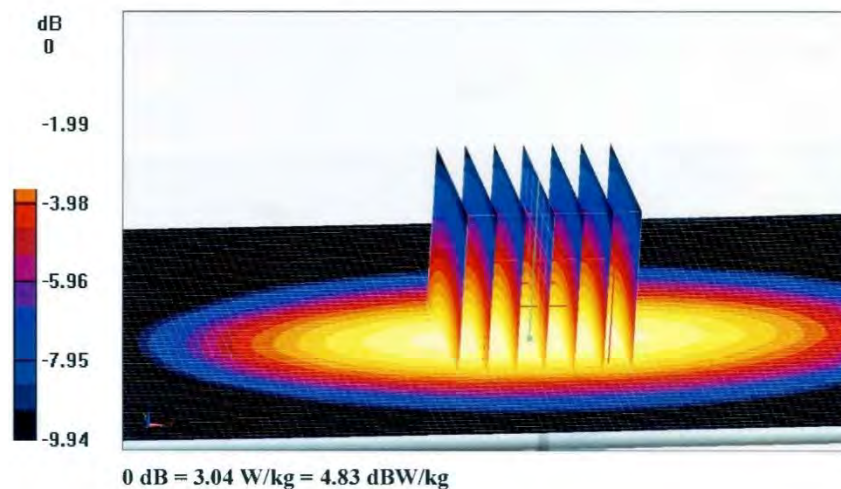
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  
 $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 54.01 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.53 W/kg

**SAR(1 g) = 2.43 W/kg; SAR(10 g) = 1.61 W/kg**

Maximum value of SAR (measured) = 3.04 W/kg



Certificate No: Z18-97089

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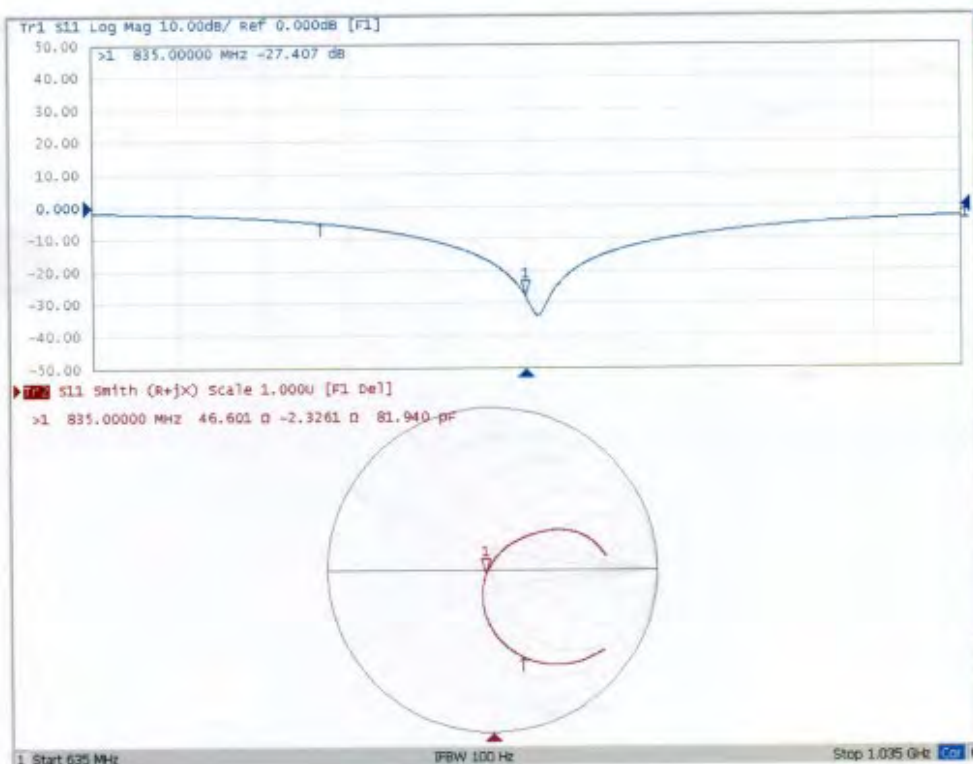




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## Impedance Measurement Plot for Body TSL





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Client Anbotek (Auden)

Certificate No: 222-97090

## CALIBRATION CERTIFICATE

Object D1900V2 - SN: 5d175

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

Calibration date: Jun 15, 2022

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&E critical for calibration)

| Primary Standards       | ID #       | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
|-------------------------|------------|------------------------------------------|-----------------------|
| Power Meter NRP2        | 101919     | 01-Jul-22 (CTTL, No.J22X04256)           | Jun-22                |
| Power sensor NRP-Z91    | 101547     | 01-Jul-22 (CTTL, No.J22X04256)           | Jun-22                |
| Reference Probe EX3DV4  | SN 7307    | 19-Feb-22 (SPEAG, No.EX3-7307_Feb19)     | Feb-22                |
| DAE4                    | SN 771     | 02-Feb-22 (CTTL-SPEAG, No.222-97011)     | Feb-22                |
| Secondary Standards     | ID #       | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
| Signal Generator E4438C | MY49071430 | 01-Feb-22 (CTTL, No.J19X00893)           | Jan-22                |
| Network Analyzer E5071C | MY46110673 | 26-Jan-22 (CTTL, No.J19X00894)           | Jan-22                |

|                |             |                                   |           |
|----------------|-------------|-----------------------------------|-----------|
|                | 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: Jun 17, 2022

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**Glossary:**

|       |                                            |
|-------|--------------------------------------------|
| TSL   | tissue simulating liquid                   |
| ConvF | sensitivity in TSL / NORM <sub>x,y,z</sub> |
| 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%.





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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 | 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 | 40.3 $\pm$ 6 % | 1.38 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | <1.0 °C             | ----           | ----                 |

### SAR result with Head TSL

| SAR averaged over 1 $\text{cm}^3$ (1 g) of Head TSL   | Condition          |                                |
|-------------------------------------------------------|--------------------|--------------------------------|
| SAR measured                                          | 250 mW input power | 9.99 mW / g                    |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 40.4 mW / g $\pm$ 20.8 % (k=2) |
| SAR averaged over 10 $\text{cm}^3$ (10 g) of Head TSL | Condition          |                                |
| SAR measured                                          | 250 mW input power | 5.28 mW / g                    |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 21.3 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 | 53.3 $\pm$ 6 % | 1.54 mho/m $\pm$ 6 % |
| Body TSL temperature change during test | <1.0 °C             | ----           | ----                 |

### SAR result with Body TSL

| SAR averaged over 1 $\text{cm}^3$ (1 g) of Body TSL   | Condition          |                                |
|-------------------------------------------------------|--------------------|--------------------------------|
| SAR measured                                          | 250 mW input power | 10.1 mW / g                    |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 40.1 mW / g $\pm$ 20.8 % (k=2) |
| SAR averaged over 10 $\text{cm}^3$ (10 g) of Body TSL | Condition          |                                |
| SAR measured                                          | 250 mW input power | 5.39 mW / g                    |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 21.5 mW / g $\pm$ 20.4 % (k=2) |

Certificate No: Z22-97090

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## Appendix

### Antenna Parameters with Head TSL

|                                      |               |
|--------------------------------------|---------------|
| Impedance, transformed to feed point | 53.2Ω+ 5.44jΩ |
| Return Loss                          | - 24.3dB      |

### Antenna Parameters with Body TSL

|                                      |               |
|--------------------------------------|---------------|
| Impedance, transformed to feed point | 48.9Ω+ 5.75jΩ |
| Return Loss                          | - 24.6dB      |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.304 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: 06.15.2022

Test Laboratory: CCTL, Beijing, China

**DUT:** Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d175

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

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.381$  S/m;  $\epsilon_r = 40.33$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Right Section

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

#### DASY5 Configuration:

- Probe: EX3DV4 - SN7307; ConvF(8.1, 8.1, 8.1); Calibrated: 2/19/2022;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2/2/2022
- 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:

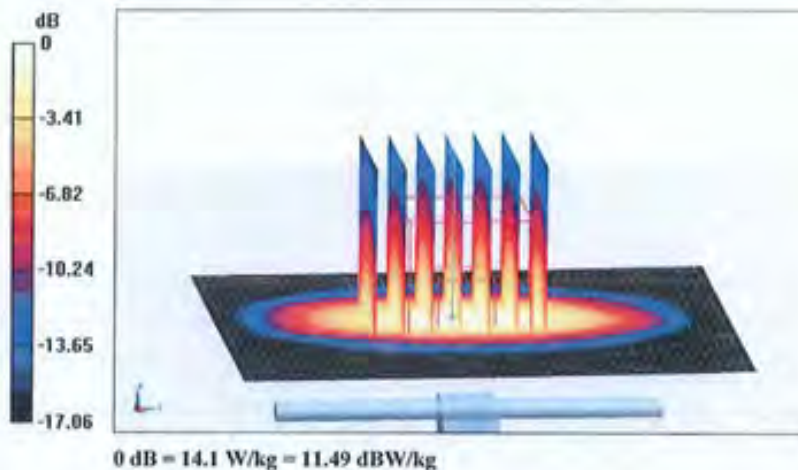
$dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 103.5V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 18.0W/kg

SAR(1 g) = 9.99 W/kg; SAR(10 g) = 5.28 W/kg

Maximum value of SAR (measured) = 14.1 W/kg



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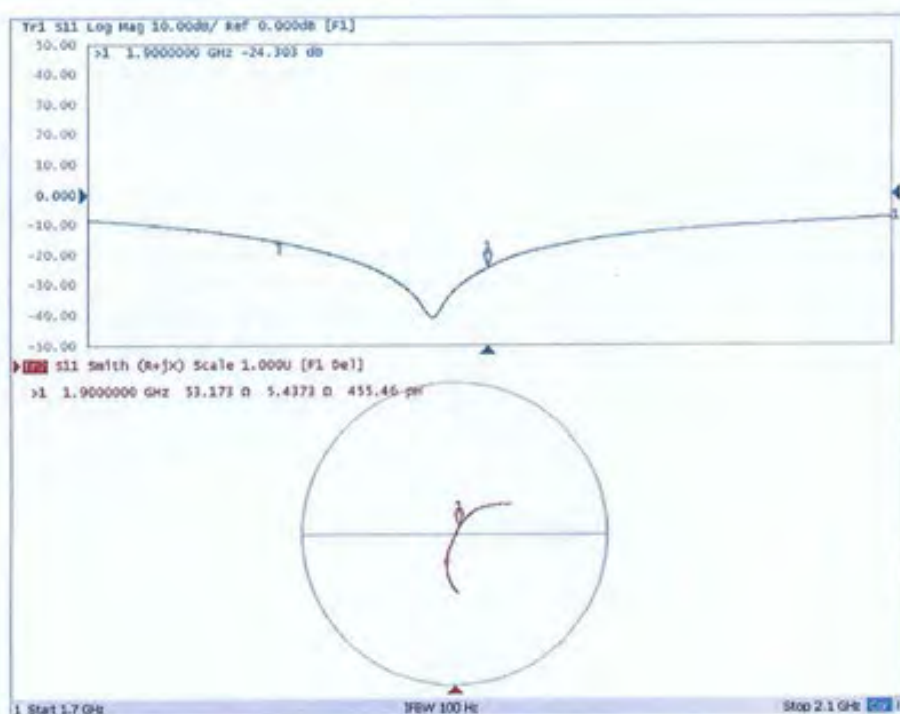




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### Impedance Measurement Plot for Head TSL



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**DASY5 Validation Report for Body TSL**

Date: 06.15.2019

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d175**

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

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.537$  S/m;  $\epsilon_r = 53.34$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Center Section

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

**DASY5 Configuration:**

- Probe: EX3DV4 - SN7307; ConvF(7.67, 7.67, 7.67); Calibrated: 2/19/2019;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2/2/2019
- 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 = 96.11 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 17.8 W/kg

SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.39 W/kg

Maximum value of SAR (measured) = 14.3 W/kg



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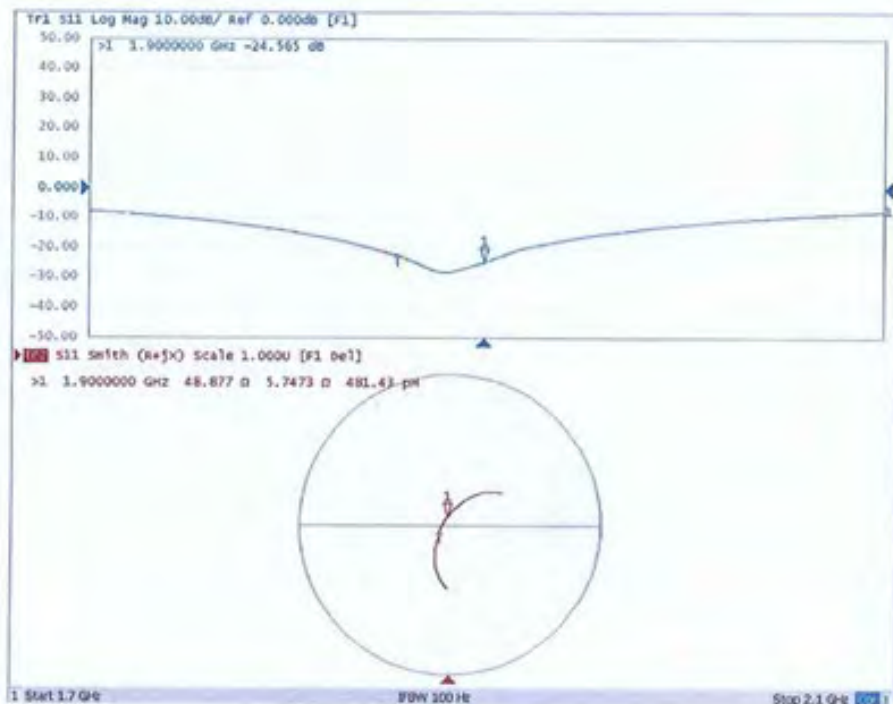




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### Impedance Measurement Plot for Body TSL



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Client: CTTL(South Branch)

Certificate No: Z21-60343

### CALIBRATION CERTIFICATE

Object: D2300V2 - SN: 1059

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

Calibration date: September 22, 2021

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        | 106277     | 23-Sep-20 (CTTL, No.J20X08336)            | Sep-21                |
| Power sensor NRP6S      | 104291     | 23-Sep-20 (CTTL, No.J20X08336)            | Sep-21                |
| Reference Probe EX3DV4  | SN 7317    | 03-Feb-21 (CTTL-SPEAG, No.Z21-60001)      | Feb-22                |
| DAE4                    | SN 1556    | 15-Jan-21 (SPEAG, No.DAE4-1556_Jan21)     | Jan-22                |
| Secondary Standards     | ID #       | Cal Date (Calibrated by: Certificate No.) | Scheduled Calibration |
| Signal Generator E4438C | MY49071430 | 01-Feb-21 (CTTL, No.J21X00593)            | Jan-22                |
| Network Analyzer E5071C | MY46110673 | 14-Jan-21 (CTTL, No.J21X00232)            | Jan-22                |

|                | 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 27, 2021

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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:**

- 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%.





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#### Measurement Conditions

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

|                              |                          |             |
|------------------------------|--------------------------|-------------|
| DASY Version                 | DASY52                   | V52.10.4    |
| 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 | 39.9 $\pm$ 6 % | 1.68 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | <1.0 °C             | ---            | ---                  |

#### SAR result with Head TSL

| SAR averaged over 1 $\text{cm}^3$ (1 g) of Head TSL   | Condition          |                              |
|-------------------------------------------------------|--------------------|------------------------------|
| SAR measured                                          | 250 mW input power | 12.1 W/kg                    |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 48.3 W/kg $\pm$ 18.8 % (k=2) |
| SAR averaged over 10 $\text{cm}^3$ (10 g) of Head TSL | Condition          |                              |
| SAR measured                                          | 250 mW input power | 5.67 W/kg                    |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 22.7 W/kg $\pm$ 18.7 % (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 | 48.6Ω- 4.46jΩ |
| Return Loss                          | -26.5dB       |

##### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.077 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: 09.22.2021

Test Laboratory: CTTTL, Beijing, China

**DUT: Dipole 2300 MHz; Type: D2300V2; Serial: D2300V2 - SN: 1059**

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

Medium parameters used:  $f = 2300$  MHz;  $\sigma = 1.683$  S/m;  $\epsilon_r = 39.91$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7517; ConvP(7.58, 7.58, 7.58) @ 2300 MHz; Calibrated: 2021-02-03
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2021-01-15
- Phantom: MFP\_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

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

Reference Value = 104.8 V/m; Power Drift = -0.01 dB

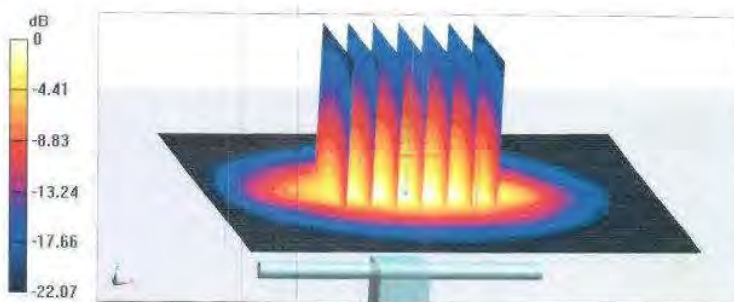
Peak SAR (extrapolated) = 25.1 W/kg

SAR(1 g) = 12.1 W/kg; SAR(10 g) = 5.67 W/kg

Smallest distance from peaks to all points 3 dB below = 9.5 mm

Ratio of SAR at M2 to SAR at M1 = 48.1%

Maximum value of SAR (measured) = 20.3 W/kg



0 dB = 20.3 W/kg = 13.07 dBW/kg

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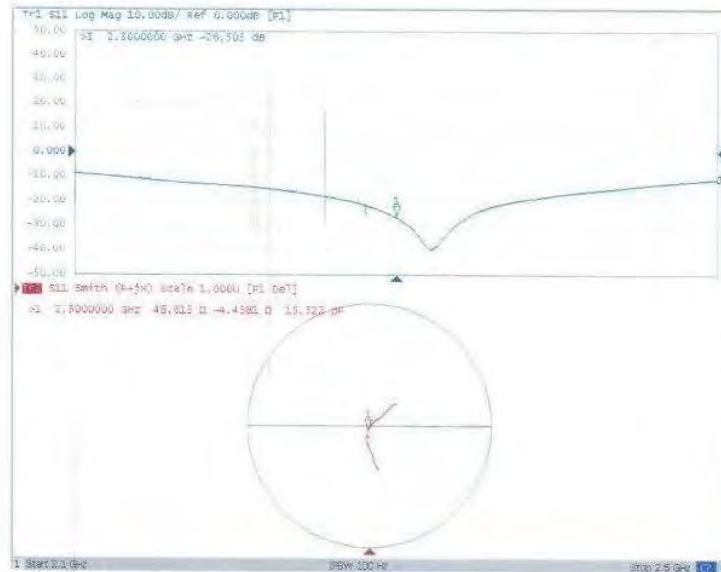




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#### Impedance Measurement Plot for Head TSL





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Client

Anbotek (Auden)

Certificate No: Z21-97091

## CALIBRATION CERTIFICATE

Object D2450V2 - SN: 910

Calibration Procedure(s) FD-Z21-2-003-01  
Calibration Procedures for dipole validation kits

Calibration date: Jun 15, 2021

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     | 01-Jul-20 (CTTL, No.J20X04256)           | Jun-21                |
| Power sensor NRP-Z91    | 101547     | 01-Jul-20 (CTTL, No.J20X04256)           | Jun-21                |
| Reference Probe EX3DVA  | SN 7307    | 19-Feb-21(SPEAG,No.EX3-7307_Feb21)       | Feb-22                |
| DAE4                    | SN 771     | 02-Feb-21(CTTL-SPEAG,No.Z21-97011)       | Feb-22                |
| Secondary Standards     | ID #       | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
| Signal Generator E4438C | MY49071430 | 01-Feb-21 (CTTL, No.J18X00893)           | Jan-22                |
| Network Analyzer E5071C | MY46110673 | 26-Jan-21 (CTTL, No.J18X00894)           | Jan-22                |

|                |             |                                   |           |
|----------------|-------------|-----------------------------------|-----------|
|                | 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: Jun 17, 2021

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**Glossary:**

|       |                                            |
|-------|--------------------------------------------|
| TSL   | tissue simulating liquid                   |
| ConvF | sensitivity in TSL / NORM <sub>x,y,z</sub> |
| 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%.





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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.

|                                     |                          |             |
|-------------------------------------|--------------------------|-------------|
| <b>DASY Version</b>                 | DASY52                   | 52.8.8.1258 |
| <b>Extrapolation</b>                | Advanced Extrapolation   |             |
| <b>Phantom</b>                      | Triple Flat Phantom 5.1C |             |
| <b>Distance Dipole Center - TSL</b> | 10 mm                    | with Spacer |
| <b>Zoom Scan Resolution</b>         | dx, dy, dz = 5 mm        |             |
| <b>Frequency</b>                    | 2450 MHz $\pm$ 1 MHz     |             |

### Head TSL parameters

The following parameters and calculations were applied.

|                                                | Temperature         | Permittivity   | Conductivity         |
|------------------------------------------------|---------------------|----------------|----------------------|
| <b>Nominal Head TSL parameters</b>             | 22.0 °C             | 39.2           | 1.80 mho/m           |
| <b>Measured Head TSL parameters</b>            | (22.0 $\pm$ 0.2) °C | 39.0 $\pm$ 6 % | 1.77 mho/m $\pm$ 6 % |
| <b>Head TSL temperature change during test</b> | <1.0 °C             | ---            | ---                  |

### SAR result with Head TSL

|                                                               |                    |                                                  |
|---------------------------------------------------------------|--------------------|--------------------------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b>   | Condition          |                                                  |
| SAR measured                                                  | 250 mW input power | 13.0 mW / g                                      |
| SAR for nominal Head TSL parameters                           | normalized to 1W   | <b>52.4 mW / g <math>\pm</math> 20.8 % (k=2)</b> |
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b> | Condition          |                                                  |
| SAR measured                                                  | 250 mW input power | 6.06 mW / g                                      |
| SAR for nominal Head TSL parameters                           | normalized to 1W   | <b>24.3 mW / g <math>\pm</math> 20.4 % (k=2)</b> |

### Body TSL parameters

The following parameters and calculations were applied.

|                                                | Temperature         | Permittivity   | Conductivity         |
|------------------------------------------------|---------------------|----------------|----------------------|
| <b>Nominal Body TSL parameters</b>             | 22.0 °C             | 52.7           | 1.95 mho/m           |
| <b>Measured Body TSL parameters</b>            | (22.0 $\pm$ 0.2) °C | 52.9 $\pm$ 6 % | 1.97 mho/m $\pm$ 6 % |
| <b>Body TSL temperature change during test</b> | <1.0 °C             | ---            | ---                  |

### SAR result with Body TSL

|                                                               |                    |                                                  |
|---------------------------------------------------------------|--------------------|--------------------------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Body TSL</b>   | Condition          |                                                  |
| SAR measured                                                  | 250 mW input power | 13.0 mW / g                                      |
| SAR for nominal Body TSL parameters                           | normalized to 1W   | <b>51.8 mW / g <math>\pm</math> 20.8 % (k=2)</b> |
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Body TSL</b> | Condition          |                                                  |
| SAR measured                                                  | 250 mW input power | 6.18 mW / g                                      |
| SAR for nominal Body TSL parameters                           | normalized to 1W   | <b>24.7 mW / g <math>\pm</math> 20.4 % (k=2)</b> |





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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

### Antenna Parameters with Head TSL

|                                      |                            |
|--------------------------------------|----------------------------|
| Impedance, transformed to feed point | $54.6\Omega + 2.77j\Omega$ |
| Return Loss                          | - 25.8dB                   |

### Antenna Parameters with Body TSL

|                                      |                            |
|--------------------------------------|----------------------------|
| Impedance, transformed to feed point | $50.7\Omega + 4.28j\Omega$ |
| Return Loss                          | - 27.3dB                   |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.263 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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Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com Http://www.chinattl.cn

Date: 06.15.2021

**DASY5 Validation Report for Head TSL**

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 910**

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.767$  S/m;  $\epsilon_r = 39.01$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Right Section

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

**DASY5 Configuration:**

- Probe: EX3DV4 - SN7307; ConvF(7.36, 7.36, 7.36); Calibrated: 2/19/2021;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2021-02-02
- 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)

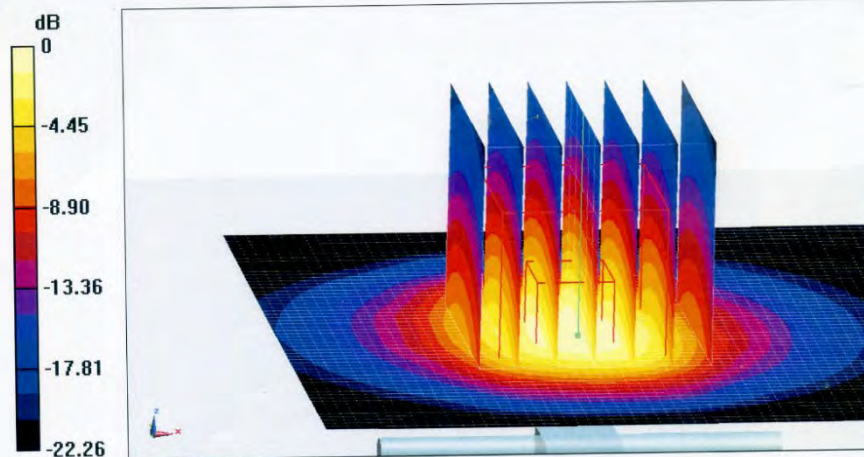
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm,  
dy=5mm, dz=5mm

Reference Value = 106.5 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 26.7 W/kg

**SAR(1 g) = 13 W/kg; SAR(10 g) = 6.06 W/kg**

Maximum value of SAR (measured) = 19.7 W/kg

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

Certificate No: Z21-97091

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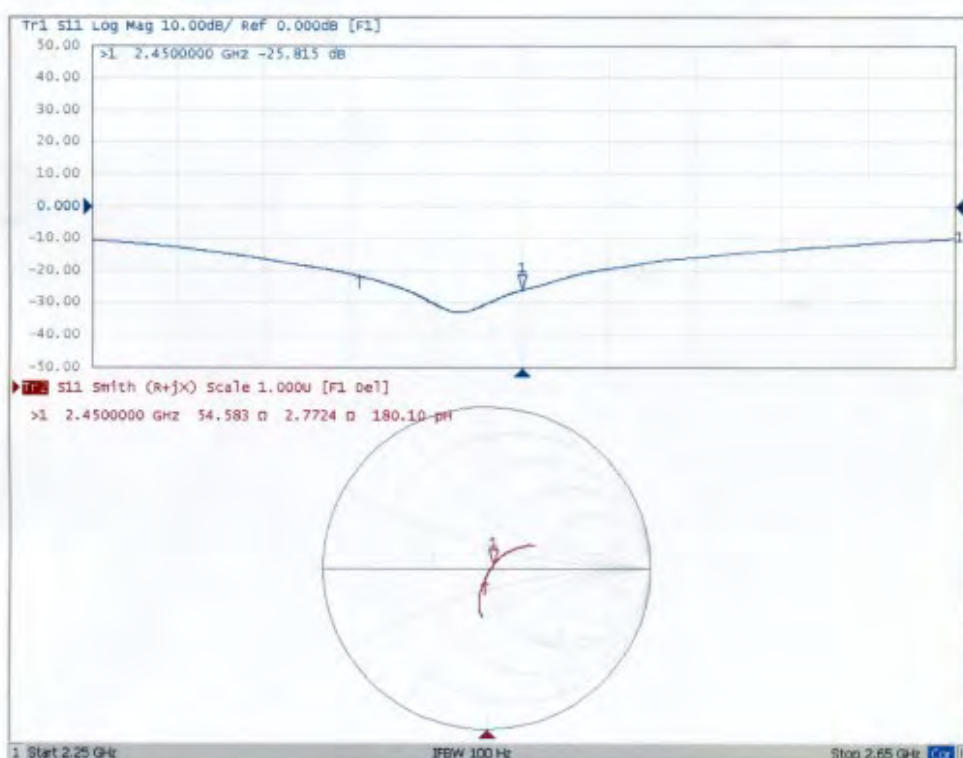




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Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com Http://www.chinattl.cn

## Impedance Measurement Plot for Head TSL





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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: 06.15.2021

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 910**

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.972$  S/m;  $\epsilon_r = 52.92$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Center Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7307; ConvF(7.22, 7.22, 7.22); Calibrated: 2/19/2021;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2021-02-02
- 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)

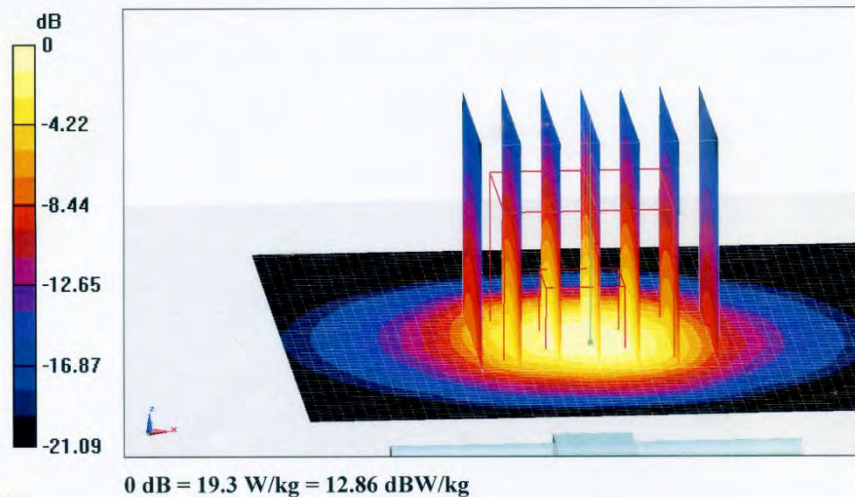
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 98.89 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 25.6 W/kg

**SAR(1 g) = 13 W/kg; SAR(10 g) = 6.18 W/kg**

Maximum value of SAR (measured) = 19.3 W/kg

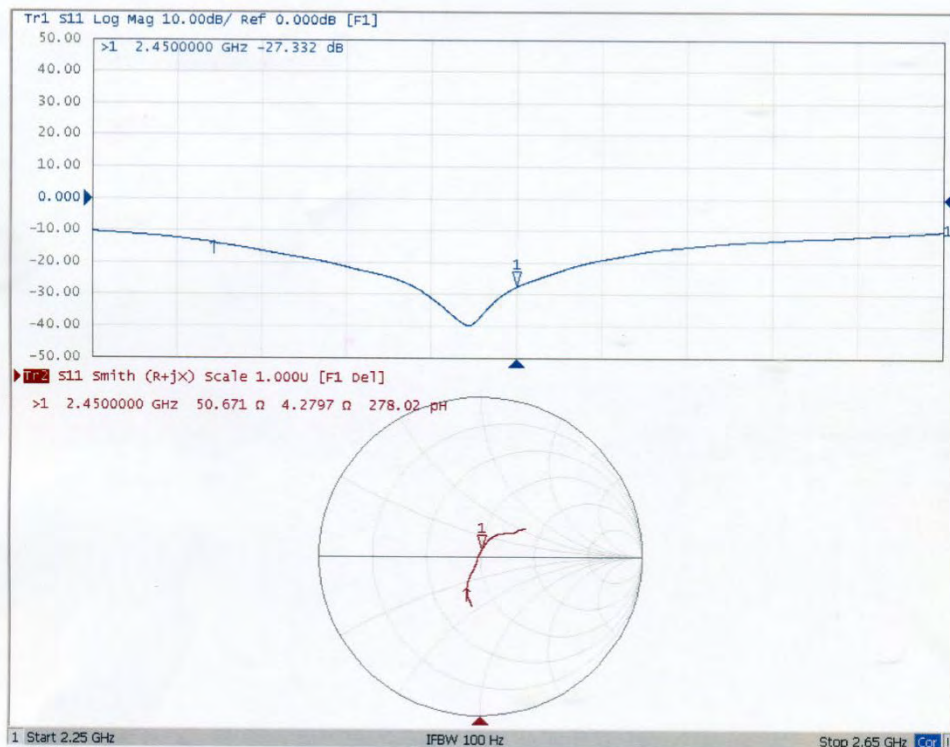




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Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com Http://www.chinattl.cn

### Impedance Measurement Plot for Body TSL



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



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

Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 0108**

The Swiss Accreditation Service is one of the signatories to the EA  
 Multilateral Agreement for the recognition of calibration certificates

Client **Anbotek (Auden)**

Certificate No: **D2600V2-1058\_Jun18**

## CALIBRATION CERTIFICATE

Object **D2600V2 - SN: 1058**

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

Calibration date: **June 19, 2021**

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&T critical for calibration)

| Primary Standards           | ID #               | Cal Date (Certificate No.)        | Scheduled Calibration  |
|-----------------------------|--------------------|-----------------------------------|------------------------|
| Power meter EPM-442A        | GB37480704         | 07-Oct-20 (No. 217-02020)         | Oct-15                 |
| Power sensor HP 8481A       | US37292783         | 07-Oct-20 (No. 217-02020)         | Oct-15                 |
| Power sensor HP 8481A       | MY41092317         | 07-Oct-20 (No. 217-02021)         | Oct-15                 |
| Reference 20 dB Attenuator  | SN: 5058 (20k)     | 01-Apr-21 (No. 217-02131)         | Mar-16                 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 01-Apr-21 (No. 217-02134)         | Mar-16                 |
| Reference Probe ES3DV3      | SN: 3205           | 30-Dec-20 (No. ES3-3205_Dec14)    | Dec-15                 |
| DAE4                        | SN: 601            | 18-Aug-20 (No. DAE4-601_Aug14)    | Aug-15                 |
| Secondary Standards         | ID #               | Check Date (in house)             | Scheduled Check        |
| RF generator R&S SMT-06     | 100005             | 04-Aug-20 (in house check Oct-13) | In house check: Oct-16 |
| Network Analyzer HP 8753E   | US37390585 S4206   | 18-Oct-20 (in house check Oct-14) | In house check: Oct-15 |

Calibrated by: **Name** **Leif Klysner** **Function** **Laboratory Technician**

Signature

Approved by: **Katja Pokovic** **Technical Manager**

Issued: June 22, 2021

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

Certificate No: D2600V2-1058\_Jun18

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



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

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**

#### 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                    | 2600 MHz $\pm$ 1 MHz   |             |

**Head TSL parameters**

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| Nominal Head TSL parameters             | 22.0 °C             | 38.0           | 1.96 mho/m           |
| Measured Head TSL parameters            | (22.0 $\pm$ 0.2) °C | 37.6 $\pm$ 6 % | 2.05 mho/m $\pm$ 6 % |
| Head TSL temperature change during test | < 0.5 °C            | —              | —                    |

**SAR result with Head TSL**

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                              |
|-------------------------------------------------------|--------------------|------------------------------|
| SAR measured                                          | 250 mW input power | 14.7 W/kg                    |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 57.2 W/kg $\pm$ 17.0 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                              |
|---------------------------------------------------------|--------------------|------------------------------|
| SAR measured                                            | 250 mW input power | 6.57 W/kg                    |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 25.9 W/kg $\pm$ 16.5 % (k=2) |

**Body TSL parameters**

The following parameters and calculations were applied.

|                                         | Temperature         | Permittivity   | Conductivity         |
|-----------------------------------------|---------------------|----------------|----------------------|
| Nominal Body TSL parameters             | 22.0 °C             | 52.5           | 2.16 mho/m           |
| Measured Body TSL parameters            | (22.0 $\pm$ 0.2) °C | 50.4 $\pm$ 6 % | 2.22 mho/m $\pm$ 6 % |
| Body TSL temperature change during test | < 0.5 °C            | —              | —                    |

**SAR result with Body TSL**

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL | Condition          |                              |
|-------------------------------------------------------|--------------------|------------------------------|
| SAR measured                                          | 250 mW input power | 14.5 W/kg                    |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 56.8 W/kg $\pm$ 17.0 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | condition          |                              |
|---------------------------------------------------------|--------------------|------------------------------|
| SAR measured                                            | 250 mW input power | 6.45 W/kg                    |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 25.5 W/kg $\pm$ 16.5 % (k=2) |



**Appendix (Additional assessments outside the scope of SCS 0108)****Antenna Parameters with Head TSL**

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 50.5 $\Omega$ - 6.3 j $\Omega$ |
| Return Loss                          | - 24.0 dB                      |

**Antenna Parameters with Body TSL**

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 46.7 $\Omega$ - 5.2 j $\Omega$ |
| Return Loss                          | - 24.0 dB                      |

**General Antenna Parameters and Design**

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | ± 151 ns |
|----------------------------------|----------|

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

**Additional EUT Data**

|                 |                 |
|-----------------|-----------------|
| Manufactured by | SPEAG           |
| Manufactured on | August 14, 2012 |



**DASY5 Validation Report for Head TSL**

Date: 19.06.2021

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1058**

Communication System: UID 0 - CW; Frequency: 2600 MHz

Medium parameters used:  $f = 2600$  MHz;  $\sigma = 2.05$  S/m;  $\epsilon_r = 37.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.49, 4.49, 4.49); Calibrated: 30.12.2020;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2020
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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

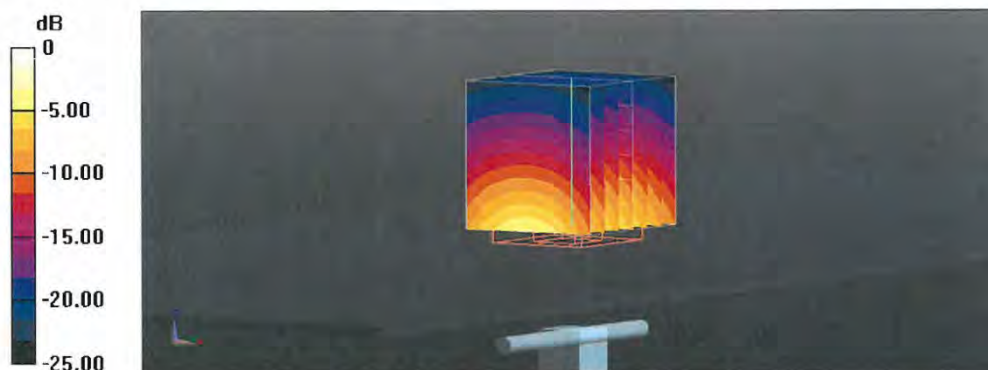
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 102.6 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 30.9 W/kg

**SAR(1 g) = 14.7 W/kg; SAR(10 g) = 6.57 W/kg**

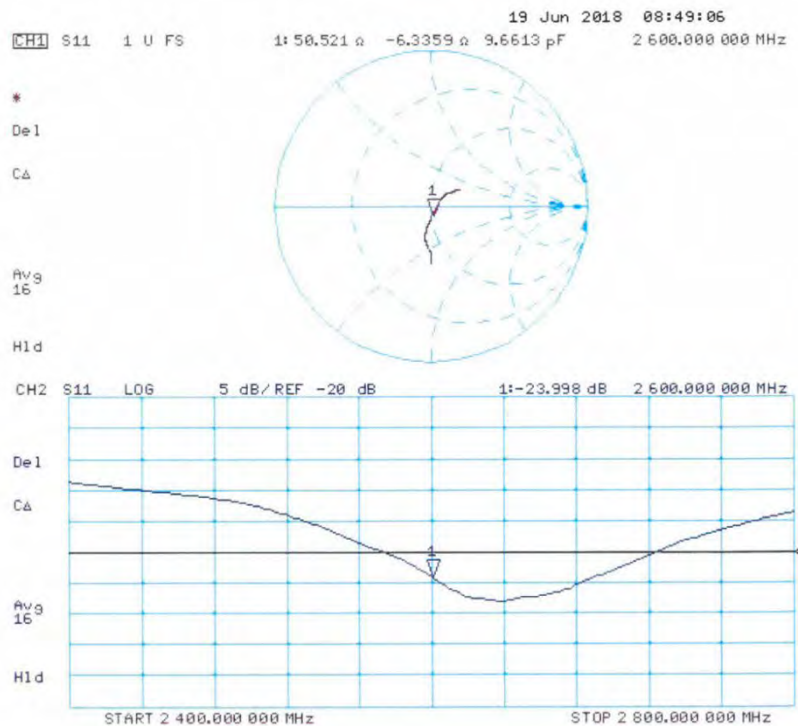
Maximum value of SAR (measured) = 19.6 W/kg



0 dB = 19.6 W/kg = 12.92 dBW/kg



## Impedance Measurement Plot for Head TSL



**DASY5 Validation Report for Body TSL**

Date: 19.06.2021

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1058**

Communication System: UID 0 - CW; Frequency: 2600 MHz

Medium parameters used:  $f = 2600$  MHz;  $\sigma = 2.22$  S/m;  $\epsilon_r = 50.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.13, 4.13, 4.13); Calibrated: 30.12.2020;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2020
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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

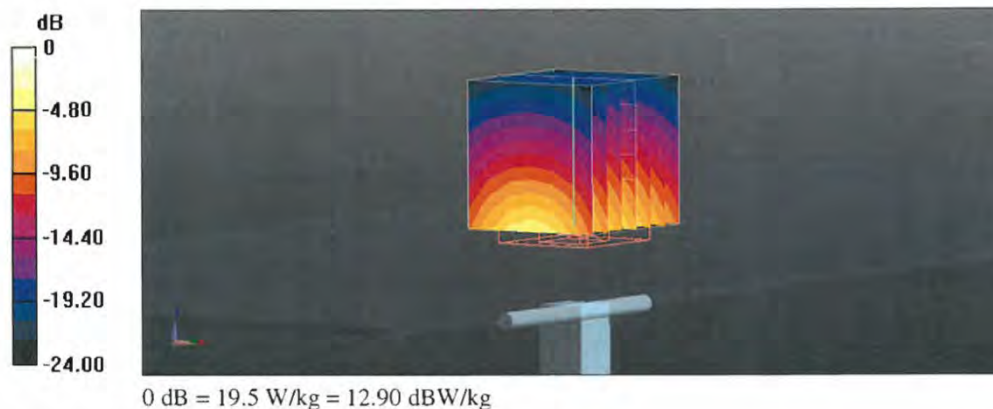
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 97.96 V/m; Power Drift = 0.00 dB

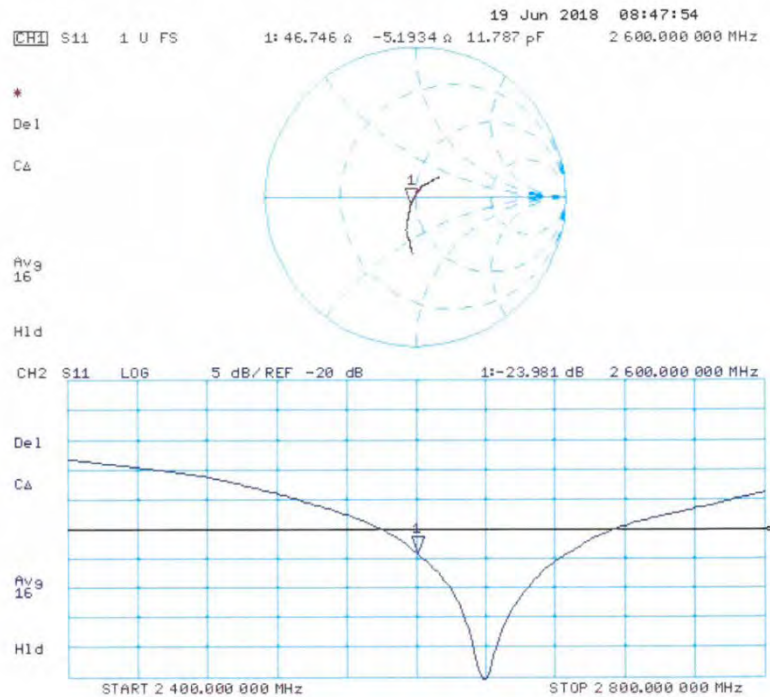
Peak SAR (extrapolated) = 30.1 W/kg

**SAR(1 g) = 14.5 W/kg; SAR(10 g) = 6.45 W/kg**

Maximum value of SAR (measured) = 19.5 W/kg



## Impedance Measurement Plot for Body TSL



## Extended calibration intervals check for Dipoles

## Justification of Extended Calibration SAR Dipole D750V3– serial no. 1118

| Head                |                  |           |                      |             |                            |              |
|---------------------|------------------|-----------|----------------------|-------------|----------------------------|--------------|
| Date of Measurement | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (johm) | Delta (johm) |
| 2021-06-08          | -24.923          | /         | 53.335               | /           | -5.08                      | /            |
| 2022-06-07          | -24.87           | -0.20%    | 53.005               | -0.33       | -4.32                      | -0.76        |
| 2023-06-07          | -25.20           | 1.10%     | 53.145               | -0.19       | -5.05                      | -0.03        |

| Body                |                  |           |                      |             |                            |              |
|---------------------|------------------|-----------|----------------------|-------------|----------------------------|--------------|
| Date of Measurement | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (johm) | Delta (johm) |
| 2021-06-08          | -23.913          | /         | 48.51                | /           | -6.11                      | /            |
| 2022-06-07          | -24.03           | 0.50%     | 47.85                | -0.66       | -5.6                       | -0.51        |
| 2023-06-07          | -23.55           | -1.50%    | 48.41                | -0.1        | -5.87                      | -0.24        |

## Justification of Extended Calibration SAR Dipole D835V2– serial no. 4d154

| Head                |                  |           |                      |             |                            |              |
|---------------------|------------------|-----------|----------------------|-------------|----------------------------|--------------|
| Date of Measurement | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (johm) | Delta (johm) |
| 2021-06-16          | -29.789          | /         | 49.186               | /           | -3.11                      | /            |
| 2022-06-15          | -30.06           | 0.90%     | 48.496               | -0.69       | -3.03                      | -0.08        |
| 2023-06-14          | -29.88           | 0.30%     | 48.446               | -0.74       | -2.57                      | -0.54        |

| Body                |                  |           |                      |             |                            |              |
|---------------------|------------------|-----------|----------------------|-------------|----------------------------|--------------|
| Date of Measurement | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (johm) | Delta (johm) |
| 2021-06-16          | -27.407          | /         | 46.601               | /           | -2.33                      | /            |
| 2022-06-15          | -27.43           | 0.10%     | 46.301               | -0.3        | -1.81                      | -0.52        |
| 2023-06-14          | -27.02           | -1.40%    | 46.051               | -0.55       | -2.29                      | -0.04        |



## Justification of Extended Calibration SAR Dipole D1900V2– serial no.5d175

| Head                |                  |           |                      |             |                            |              |
|---------------------|------------------|-----------|----------------------|-------------|----------------------------|--------------|
| Date of Measurement | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (johm) | Delta (johm) |
| 2022-06-15          | -24.303          | /         | 53.173               | /           | 5.44                       | /            |
| 2023-06-14          | -23.99           | -1.30%    | 53.133               | -0.04       | 5.58                       | -0.14        |

| Body                |                  |           |                      |             |                            |              |
|---------------------|------------------|-----------|----------------------|-------------|----------------------------|--------------|
| Date of Measurement | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (johm) | Delta (johm) |
| 2022-06-15          | -24.565          | /         | 48.877               | /           | 5.75                       | /            |
| 2023-06-14          | -24.59           | 0.10%     | 48.457               | -0.42       | 6.28                       | -0.53        |

## Justification of Extended Calibration SAR Dipole D2300V2– serial no.1059

| Head                |                  |           |                      |             |                            |              |
|---------------------|------------------|-----------|----------------------|-------------|----------------------------|--------------|
| Date of Measurement | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (johm) | Delta (johm) |
| 2021-09-22          | -26.503          | /         | 48.613               | /           | 4.45                       | /            |
| 2022-09-21          | -26.34           | -0.60%    | 48.423               | -0.19       | 4.91                       | -0.46        |
| 2023-09-20          | -26.32           | -0.70%    | 48.503               | -0.11       | 4.97                       | -0.52        |

## Justification of Extended Calibration SAR Dipole D2450V2– serial no. 910

| Head                |                  |           |                      |             |                            |              |
|---------------------|------------------|-----------|----------------------|-------------|----------------------------|--------------|
| Date of Measurement | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (johm) | Delta (johm) |
| 2021-06-15          | -25.815          | /         | 54.583               | /           | 2.77                       | /            |
| 2022-06-14          | -26.10           | 1.10%     | 54.293               | -0.29       | 3.39                       | -0.62        |
| 2023-06-13          | -26.18           | 1.40%     | 54.403               | -0.18       | 3.05                       | -0.28        |

| Body                |                  |           |                      |             |                            |              |
|---------------------|------------------|-----------|----------------------|-------------|----------------------------|--------------|
| Date of Measurement | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (johm) | Delta (johm) |
| 2021-06-15          | -27.332          | /         | 50.671               | /           | 4.28                       | /            |



|            |        |       |        |       |      |       |
|------------|--------|-------|--------|-------|------|-------|
| 2022-06-14 | -27.39 | 0.20% | 50.511 | -0.16 | 4.51 | -0.23 |
| 2023-06-13 | -27.63 | 1.10% | 49.971 | -0.7  | 4.41 | -0.13 |

**Justification of Extended Calibration SAR Dipole D2600V2– serial no. 1058**

| Head                |                  |           |                      |             |                            |              |
|---------------------|------------------|-----------|----------------------|-------------|----------------------------|--------------|
| Date of Measurement | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (johm) | Delta (johm) |
| 2021-06-19          | -23.998          | /         | 50.52                | /           | -6.34                      | /            |
| 2022-06-17          | -23.66           | -1.40%    | 50.08                | -0.44       | -5.76                      | -0.58        |
| 2023-06-13          | -23.73           | -1.10%    | 49.9                 | -0.62       | -5.61                      | -0.73        |

| Body                |                  |           |                      |             |                            |              |
|---------------------|------------------|-----------|----------------------|-------------|----------------------------|--------------|
| Date of Measurement | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (johm) | Delta (johm) |
| 2021-06-19          | -23.981          | /         | 46.746               | /           | -5.19                      | /            |
| 2022-06-17          | -23.84           | -0.60%    | 46.206               | -0.54       | -5.01                      | -0.18        |
| 2023-06-16          | -23.91           | -0.30%    | 46.296               | -0.45       | -4.43                      | -0.76        |

The Return-Loss is <-20dB, and within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the value result should support extended.

\*\*\*\*\*END OF REPORT\*\*\*\*\*

