

In Collaboration with

p e a

CALIBRATION LABORATORY

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

S

#### **Measurement Conditions**

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

| DASY Version                 | DASY52                       | 52.10.2.1495 |  |
|------------------------------|------------------------------|--------------|--|
| Extrapolation                | ation 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                    | 2600 MHz ± 1 MHz             |              |  |

g

#### **Head TSL parameters**

The following parameters and calculations were applied.

|   | Temperature     | Permittivity | Conductivity     |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 39.0         | 1.96 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 39.1 ± 6 %   | 1.93 mho/m ± 6 % |
| Head TSL temperature change during test | <1.0 °C         |              |                  |

#### SAR result with Head TSL

| SAR averaged over 1 $\ {\it Cm}^3$ (1 g) of Head TSL | Condition          |                           |
|--|--------------------|---------------------------|
| SAR measured   | 250 mW input power | 14.3 mW / g               |
| SAR for nominal Head TSL parameters                  | normalized to 1W   | 57.7 mW /g ± 18.8 % (k=2) |
| SAR averaged over 10 $cm^3$ (10 g) of Head TSL       | Condition          |                           |
| SAR measured   | 250 mW input power | 6.45 mW / g               |
| SAR for nominal Head TSL parameters                  | normalized to 1W   | 25.9 mW /g ± 18.7 % (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 ± 0.2) °C | 51.0 ± 6 %   | 2.18 mho/m ± 6 % |
| Body TSL temperature change during test | <1.0 °C         |              |                  |

#### SAR result with Body TSL

| SAR averaged over 1 $cm^3$ (1 g) of Body TSL           | Condition          |                           |
|--|--------------------|---------------------------|
| SAR measured   | 250 mW input power | 13.7 mW / g               |
| SAR for nominal Body TSL parameters                    | normalized to 1W   | 54.2 mW /g ± 18.8 % (k=2) |
| SAR averaged over 10 $\ {\it Cm}^3$ (10 g) of Body TSL | Condition          |                           |
| SAR measured   | 250 mW input power | 6.11 mW / g               |
| SAR for nominal Body TSL parameters                    | normalized to 1W   | 24.3 mW /g ± 18.7 % (k=2) |



 Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China

 Tel: +86-10-62304633-2079
 Fax: +86-10-62304633-2504

 E-mail: cttl@chinattl.com
 http://www.chinattl.cn

#### Appendix(Additional assessments outside the scope of CNAS L0570)

#### Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 49.8Ω- 7.00jΩ |
|--------------------------------------|---------------|
| Return Loss                          | - 23.1dB      |

#### Antenna Parameters with Body TSL

| Impedance, transformed to feed point | 45.6Ω- 5.41jΩ |
|--------------------------------------|---------------|
| Return Loss                          | - 22.8dB      |

#### General Antenna Parameters and Design

| Electrical Delay (one direction) | 1.012 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    |
|------------------|----------|
| Wallardotared by | 01 E/ (0 |



In Collaboration with е а

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

Fax: +86-10-62304633-2504 http://www.chinattl.cn

ALIBRATION LABORATOR

**DASY5 Validation Report for Head TSL** 

Date: 12.06.2018

Test Laboratory: CTTL, Beijing, China DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1061 Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2600 MHz;  $\sigma = 1.926 \text{ S/m}$ ;  $\varepsilon_r = 39.1$ ;  $\rho = 1000 \text{ kg/m}$ 3 Phantom section: Center Section DASY5 Configuration:

- Probe: EX3DV4 SN7514; ConvF(6.92, 6.92, 6.92) @ 2600 MHz; Calibrated: . 8/27/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection) .
- Electronics: DAE4 Sn1555; Calibrated: 8/20/2018
- Phantom: MFP V5.1C; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 • (7450)

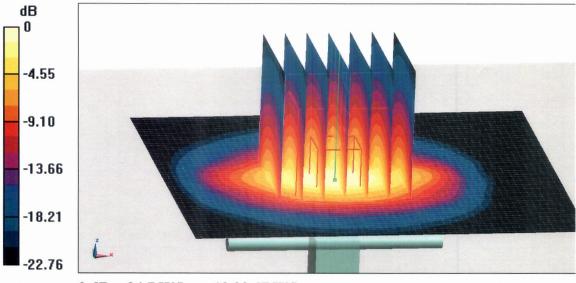
**Dipole Calibration**/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 103.5 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 31.0 W/kg

SAR(1 g) = 14.3 W/kg; SAR(10 g) = 6.45 W/kg

Maximum value of SAR (measured) = 24.7 W/kg



0 dB = 24.7 W/kg = 13.93 dBW/kg

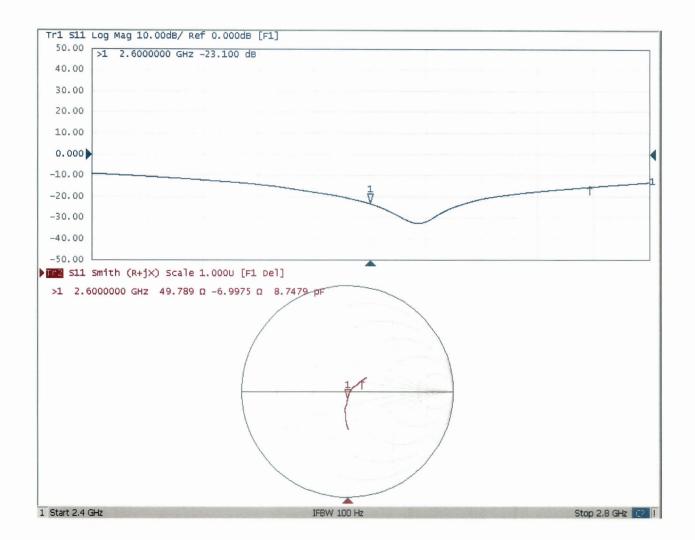


In Collaboration with



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

#### Impedance Measurement Plot for Head TSL





In Collaboration with S D C A G CALIBRATION LABORATORY

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

**DASY5 Validation Report for Body TSL** 

Date: 12.06.2018

Test Laboratory: CTTL, Beijing, China **DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1061** Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2600 MHz;  $\sigma = 2.181$  S/m;  $\varepsilon_r = 51.03$ ;  $\rho = 1000$  kg/m3 Phantom section: Right Section DASY5 Configuration:

- Probe: EX3DV4 SN7514; ConvF(7.06, 7.06, 7.06) @ 2600 MHz; Calibrated: 8/27/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 8/20/2018
- Phantom: MFP\_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

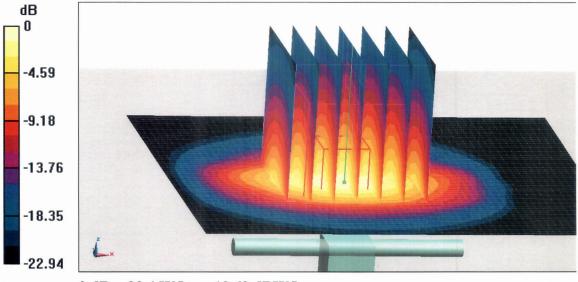
**Dipole Calibration**/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 87.11 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 29.3 W/kg

SAR(1 g) = 13.7 W/kg; SAR(10 g) = 6.11 W/kg

Maximum value of SAR (measured) = 23.4 W/kg



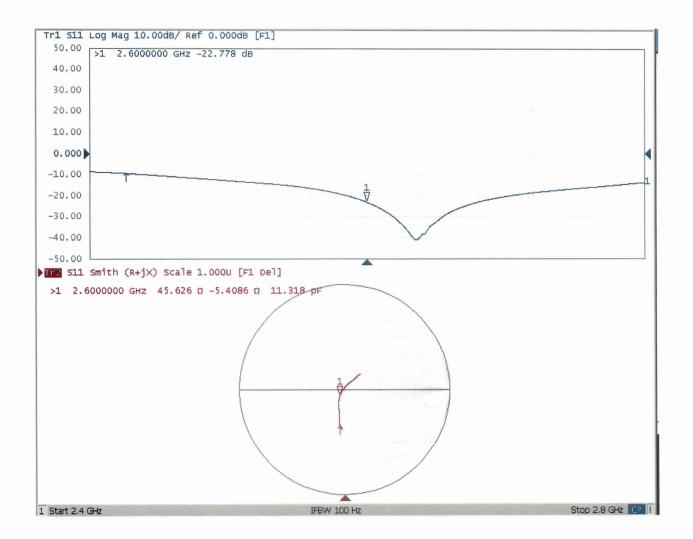
0 dB = 23.4 W/kg = 13.69 dBW/kg



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

Fax: +86-10-62304633-2504 http://www.chinattl.cn

Impedance Measurement Plot for Body TSL



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

Schweizerischer Kalibrierdienst S

- Service suisse d'étalonnage
- С Servizio svizzero di taratura
- S Swiss Calibration Service

Accreditation No.: SCS 0108

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

#### Sporton Client

Certificate No: D5GHzV2-1006\_Sep18

## **CALIBRATION CERTIFICATE**

|   | D5GHzV2 - SN:1   | 006  |  |
|---|--|--|--|
| Calibration procedure(s)  | QA CAL-22.v3<br>Calibration proce  | edure for dipole validation kits bet   | ween 3-6 GHz   |
| Calibration date:   | September 27, 2  | 018  |  |
|   |  | ional standards, which realize the physical un<br>robability are given on the following pages an   |  |
| All calibrations have been conducte<br>Calibration Equipment used (M&TE   |  | ry facility: environment temperature (22 ± 3)°(  | C and humidity < 70%.  |
| Primary Standards   | ID #   | Cal Date (Certificate No.)   | Scheduled Calibration  |
| Power meter NRP   | SN: 104778   | 04-Apr-18 (No. 217-02672/02673)  | Apr-19   |
| Power sensor NRP-Z91  | SN: 103244   | 04-Apr-18 (No. 217-02672)  | Apr-19   |
| Power sensor NRP-Z91  | SN: 103245   | 04-Apr-18 (No. 217-02673)  | Apr-19   |
| leference 20 dB Attenuator  | SN: 5058 (20k)   | 04-Apr-18 (No. 217-02682)  | Apr-19   |
| ype-N mismatch combination  | SN: 5047.2 / 06327   | 04-Apr-18 (No. 217-02683)  | Apr-19   |
| Jeference Drohe EVODVA  | SN: 3503   | 30-Dec-17 (No. EX3-3503_Dec17)   | Dec-18   |
| lelerence Probe EX3DV4  |  |  |  |
|   | SN: 601  | 26-Oct-17 (No. DAE4-601_Oct17)   | Oct-18   |
| DAE4  | SN: 601<br>  ID #  | 26-Oct-17 (No. DAE4-601_Oct17)<br>Check Date (in house)  | Oct-18<br>Scheduled Check  |
| DAE4<br>Secondary Standards   | 1  |  |  |
| DAE4<br>Secondary Standards<br>Power meter EPM-442A   | ID #   | Check Date (in house)  | Scheduled Check  |
| DAE4<br>Secondary Standards<br>Power meter EPM-442A<br>Power sensor HP 8481A  | ID #<br>SN: GB37480704   | Check Date (in house)<br>07-Oct-15 (in house check Oct-16)   | Scheduled Check<br>In house check: Oct-18  |
| DAE4<br>Secondary Standards<br>Power meter EPM-442A<br>Power sensor HP 8481A<br>Power sensor HP 8481A   | ID #<br>SN: GB37480704<br>SN: US37292783   | Check Date (in house)<br>07-Oct-15 (in house check Oct-16)<br>07-Oct-15 (in house check Oct-16)  | Scheduled Check<br>In house check: Oct-18<br>In house check: Oct-18  |
| DAE4<br>Secondary Standards<br>Power meter EPM-442A<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>RF generator R&S SMT-06  | ID #<br>SN: GB37480704<br>SN: US37292783<br>SN: MY41092317   | Check Date (in house)<br>07-Oct-15 (in house check Oct-16)<br>07-Oct-15 (in house check Oct-16)<br>07-Oct-15 (in house check Oct-16)   | Scheduled Check<br>In house check: Oct-18<br>In house check: Oct-18<br>In house check: Oct-18  |
| DAE4<br>Secondary Standards<br>Power meter EPM-442A<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>RF generator R&S SMT-06  | ID #<br>SN: GB37480704<br>SN: US37292783<br>SN: MY41092317<br>SN: 100972                           | Check Date (in house)<br>07-Oct-15 (in house check Oct-16)<br>07-Oct-15 (in house check Oct-16)<br>07-Oct-15 (in house check Oct-16)<br>15-Jun-15 (in house check Oct-16)  | Scheduled Check<br>In house check: Oct-18<br>In house check: Oct-18<br>In house check: Oct-18<br>In house check: Oct-18  |
| DAE4<br>Secondary Standards<br>Power meter EPM-442A<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>RF generator R&S SMT-06<br>Network Analyzer Agilent E8358A   | ID #<br>SN: GB37480704<br>SN: US37292783<br>SN: MY41092317<br>SN: 100972<br>SN: US41080477         | Check Date (in house)<br>07-Oct-15 (in house check Oct-16)<br>07-Oct-15 (in house check Oct-16)<br>07-Oct-15 (in house check Oct-16)<br>15-Jun-15 (in house check Oct-16)<br>31-Mar-14 (in house check Oct-17)             | Scheduled Check<br>In house check: Oct-18<br>In house check: Oct-18<br>In house check: Oct-18<br>In house check: Oct-18<br>In house check: Oct-18              |
| Reference Probe EX3DV4<br>DAE4<br>Secondary Standards<br>Power meter EPM-442A<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>RF generator R&S SMT-06<br>Network Analyzer Agilent E8358A<br>Calibrated by: | ID #<br>SN: GB37480704<br>SN: US37292783<br>SN: MY41092317<br>SN: 100972<br>SN: US41080477<br>Name | Check Date (in house)<br>07-Oct-15 (in house check Oct-16)<br>07-Oct-15 (in house check Oct-16)<br>07-Oct-15 (in house check Oct-16)<br>15-Jun-15 (in house check Oct-16)<br>31-Mar-14 (in house check Oct-17)<br>Function | Scheduled Check<br>In house check: Oct-18<br>In house check: Oct-18<br>In house check: Oct-18<br>In house check: Oct-18<br>In house check: Oct-18<br>Signature |

#### **Calibration Laboratory of**

Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



Schweizerischer Kalibrierdienst

- S Service suisse d'étalonnage
- С 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

#### 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:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- c) 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
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

### Additional Documentation:

e) DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. • No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power. •
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna . connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Accreditation No.: SCS 0108

#### **Measurement Conditions**

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

| DASY Version                 | DASY5  | V52.10.1                         |
|------------------------------|--|----------------------------------|
| Extrapolation                | Advanced Extrapolation                                   |                                  |
| Phantom                      | Modular Flat Phantom V5.0                                |                                  |
| Distance Dipole Center - TSL | 10 mm  | with Spacer                      |
| Zoom Scan Resolution         | dx, dy = 4.0 mm, dz = 1.4 mm                             | Graded Ratio = 1.4 (Z direction) |
| Frequency                    | 5250 MHz ± 1 MHz<br>5600 MHz ± 1 MHz<br>5750 MHz ± 1 MHz |                                  |

Head TSL parameters at 5250 MHz The following parameters and calculations were applied.

|   | Temperature     | Permittivity | Conductivity     |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 35.9         | 4.71 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 36.0 ± 6 %   | 4.61 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        |              |                  |

#### SAR result with Head TSL at 5250 MHz

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 100 mW input power | 8.07 W/kg                |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 80.7 W/kg ± 19.9 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 100 mW input power | 2.32 W/kg                |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 23.2 W/kg ± 19.5 % (k=2) |

# Head TSL parameters at 5600 MHz The following parameters and calculations were applied.

|   | Temperature     | Permittivity | Conductivity     |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 35.5         | 5.07 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 35.4 ± 6 %   | 4.98 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        |              | +                |

#### SAR result with Head TSL at 5600 MHz

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                            |
|---|--------------------|----------------------------|
| SAR measured  | 100 mW input power | 8.34 W/kg                  |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 83.3 W / kg ± 19.9 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 100 mW input power | 2.38 W/kg                |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 23.8 W/kg ± 19.5 % (k=2) |

#### Head TSL parameters at 5750 MHz

The following parameters and calculations were applied.

|   | Temperature     | Permittivity | Conductivity     |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 35.4         | 5.22 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 35.2 ± 6 %   | 5.14 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        |              |                  |

#### SAR result with Head TSL at 5750 MHz

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 100 mW input power | 8.05 W/kg                |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 80.4 W/kg ± 19.9 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 100 mW input power | 2.29 W/kg                |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 22.9 W/kg ± 19.5 % (k=2) |

### Body TSL parameters at 5250 MHz

The following parameters and calculations were applied.

|   | Temperature     | Permittivity | Conductivity        |
|---|-----------------|--------------|---------------------|
| Nominal Body TSL parameters             | 22.0 °C         | 48.9         | 5.36 mh <b>o</b> /m |
| Measured Body TSL parameters            | (22.0 ± 0.2) °C | 46.9 ± 6 %   | 5.46 mho/m ± 6 %    |
| Body TSL temperature change during test | < 0.5 °C        | . <b></b>    |                     |

#### SAR result with Body TSL at 5250 MHz

| SAR averaged over 1 $cm^3$ (1 g) of Body TSL | Condition          |                          |
|--|--------------------|--------------------------|
| SAR measured                                 | 100 mW input power | 7.89 W/kg                |
| SAR for nominal Body TSL parameters          | normalized to 1W   | 78.3 W/kg ± 19.9 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 100 mW input power | 2.19 W/kg                |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 21.7 W/kg ± 19.5 % (k=2) |

#### Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

|   | Temperature     | Permittivity | Conductivity     |
|---|-----------------|--------------|------------------|
| Nominal Body TSL parameters             | 22.0 °C         | 48.5         | 5.77 mho/m       |
| Measured Body TSL parameters            | (22.0 ± 0.2) °C | 46.3 ± 6 %   | 5.93 mho/m ± 6 % |
| Body TSL temperature change during test | < 0.5 °C        |              |                  |

#### SAR result with Body TSL at 5600 MHz

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL | Condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 100 mW input power | 8.17 W/kg                |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 81.0 W/kg ± 19.9 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 100 mW input power | 2.28 W/kg                |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 22.5 W/kg ± 19.5 % (k=2) |

Body TSL parameters at 5750 MHz The following parameters and calculations were applied.

|   | Temperature     | Permittivity | Conductivity     |
|---|-----------------|--------------|------------------|
| Nominal Body TSL parameters             | 22.0 °C         | 48.3         | 5.94 mho/m       |
| Measured Body TSL parameters            | (22.0 ± 0.2) °C | 46.0 ± 6 %   | 6.14 mho/m ± 6 % |
| Body TSL temperature change during test | < 0.5 °C        |              |                  |

#### SAR result with Body TSL at 5750 MHz

| SAR averaged over 1 $cm^3$ (1 g) of Body TSL | Condition          |                          |
|--|--------------------|--------------------------|
| SAR measured                                 | 100 mW input power | 7.81 W/kg                |
| SAR for nominal Body TSL parameters          | normalized to 1W   | 77.4 W/kg ± 19.9 % (k=2) |
|  |                    |                          |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 100 mW input power | 2.15 W/kg                |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 21.3 W/kg ± 19.5 % (k=2) |

#### Appendix (Additional assessments outside the scope of SCS 0108)

#### Antenna Parameters with Head TSL at 5250 MHz

| Impedance, transformed to feed point | 54.6 Ω - 7.6 jΩ |
|--------------------------------------|-----------------|
| Return Loss                          | - 21.5 dB       |

#### Antenna Parameters with Head TSL at 5600 MHz

| Impedance, transformed to feed point | 57.2 Ω - 6.3 jΩ |
|--------------------------------------|-----------------|
| Return Loss                          | - 21.0 dB       |

#### Antenna Parameters with Head TSL at 5750 MHz

| Impedance, transformed to feed point | 60.0 Ω + 4.5 jΩ |
|--------------------------------------|-----------------|
| Return Loss                          | - 20.1 dB       |

#### Antenna Parameters with Body TSL at 5250 MHz

| Impedance, transformed to feed point | 54.2 Ω - 5.6 jΩ |
|--------------------------------------|-----------------|
| Return Loss                          | - 23.5 dB       |

#### Antenna Parameters with Body TSL at 5600 MHz

| Impedance, transformed to feed point | 58.2 Ω - 5.3 jΩ |
|--------------------------------------|-----------------|
| Return Loss                          | - 20.9 dB       |

#### Antenna Parameters with Body TSL at 5750 MHz

| Impedance, transformed to feed point | 59.6 Ω + 5.6 jΩ |
|--------------------------------------|-----------------|
| Return Loss                          | - 19.9 dB       |

#### **General Antenna Parameters and Design**

|                                    | 1 001    |
|------------------------------------|----------|
| I Electrical Delay (one direction) | 1.201 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 28, 2003 |

#### **DASY5 Validation Report for Head TSL**

Date: 27.09.2018

Test Laboratory: SPEAG, Zurich, Switzerland

#### DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1006

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz Medium parameters used: f = 5250 MHz;  $\sigma = 4.61$  S/m;  $\varepsilon_r = 36$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used: f = 5600 MHz;  $\sigma = 4.98$  S/m;  $\varepsilon_r = 35.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used: f = 5750 MHz;  $\sigma = 5.14$  S/m;  $\varepsilon_r = 35.2$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

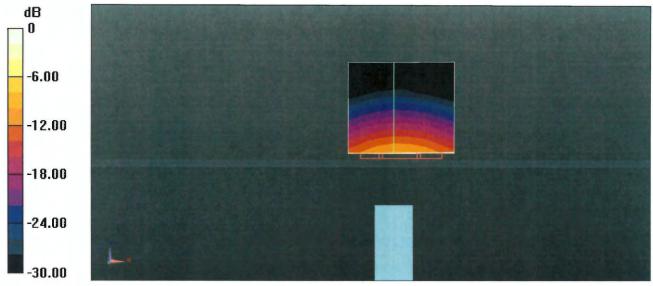
#### DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(5.51, 5.51, 5.51) @ 5250 MHz, ConvF(5.05, 5.05, 5.05) @ 5600 MHz, ConvF(4.98, 4.98, 4.98) @ 5750 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 79.28 V/m; Power Drift = -0.04 dB Peak SAR (extrapolated) = 26.7 W/kg SAR(1 g) = 8.07 W/kg; SAR(10 g) = 2.32 W/kg Maximum value of SAR (measured) = 18.1 W/kg

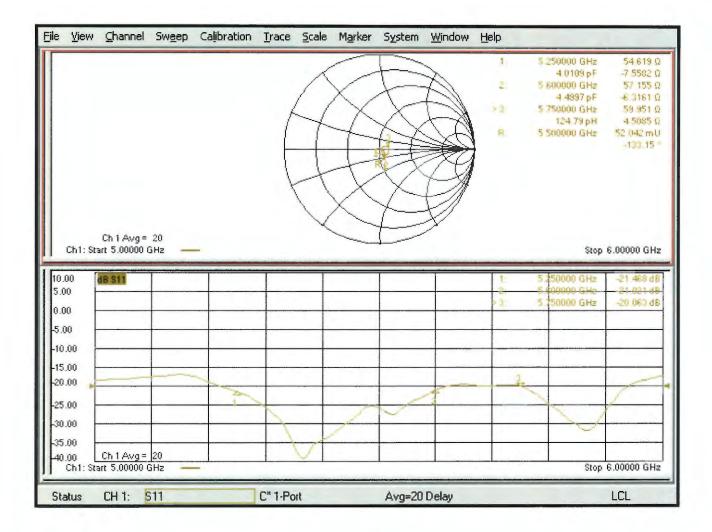
#### Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 76.15 V/m; Power Drift = -0.05 dB Peak SAR (extrapolated) = 30.2 W/kg SAR(1 g) = 8.34 W/kg; SAR(10 g) = 2.38 W/kg Maximum value of SAR (measured) = 19.3 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 74.61 V/m; Power Drift = -0.03 dB Peak SAR (extrapolated) = 29.8 W/kg SAR(1 g) = 8.05 W/kg; SAR(10 g) = 2.29 W/kg Maximum value of SAR (measured) = 18.9 W/kg



0 dB = 18.1 W/kg = 12.58 dBW/kg

#### Impedance Measurement Plot for Head TSL



#### **DASY5 Validation Report for Body TSL**

Date: 25.09.2018

Test Laboratory: SPEAG, Zurich, Switzerland

#### DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1006

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz Medium parameters used: f = 5250 MHz;  $\sigma = 5.46$  S/m;  $\varepsilon_r = 46.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used: f = 5600 MHz;  $\sigma = 5.93$  S/m;  $\varepsilon_r = 46.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used: f = 5750 MHz;  $\sigma = 6.14$  S/m;  $\varepsilon_r = 46$ ; p = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

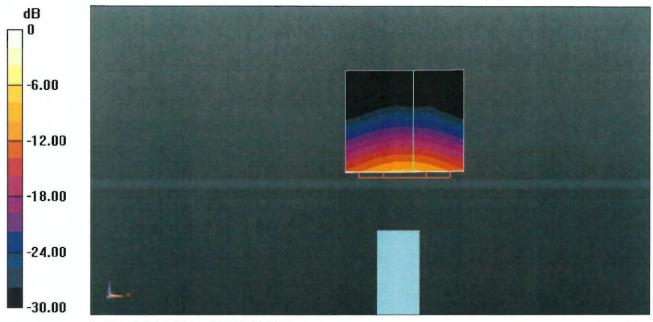
#### DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(5.26, 5.26, 5.26) @ 5250 MHz, ConvF(4.65, 4.65, 4.65) @ 5600 MHz, ConvF(4.57, 4.57) @ 5750 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 69.77 V/m; Power Drift = -0.08 dB Peak SAR (extrapolated) = 30.6 W/kg SAR(1 g) = 7.89 W/kg; SAR(10 g) = 2.19 W/kg Maximum value of SAR (measured) = 18.6 W/kg

#### Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 69.30 V/m; Power Drift = -0.06 dB Peak SAR (extrapolated) = 34.2 W/kg SAR(1 g) = 8.17 W/kg; SAR(10 g) = 2.28 W/kg Maximum value of SAR (measured) = 19.8 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 67.65 V/m; Power Drift = -0.07 dB Peak SAR (extrapolated) = 34.0 W/kg SAR(1 g) = 7.81 W/kg; SAR(10 g) = 2.15 W/kg Maximum value of SAR (measured) = 19.3 W/kg



0 dB = 18.6 W/kg = 12.70 dBW/kg