

### 16\_GSM1900\_GPRS 4 Tx slots\_Bottom Side\_5mm\_Ch512

Communication System: UID 0, GPRS/EDGE (4 Tx slots) (0); Frequency: 1850.2 MHz; Duty Cycle: 1:2.08

Medium: MSL\_1900 Medium parameters used:  $f = 1850.2$  MHz;  $\sigma = 1.479$  S/m;  $\epsilon_r = 53.659$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.3 °C ; Liquid Temperature : 22.7 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(8.03, 8.03, 8.03); Calibrated: 2018.1.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2017.12.4
- Phantom: SAM3; Type: SAM; Serial: TP-1839
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch512/Area Scan (31x71x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.982 W/kg

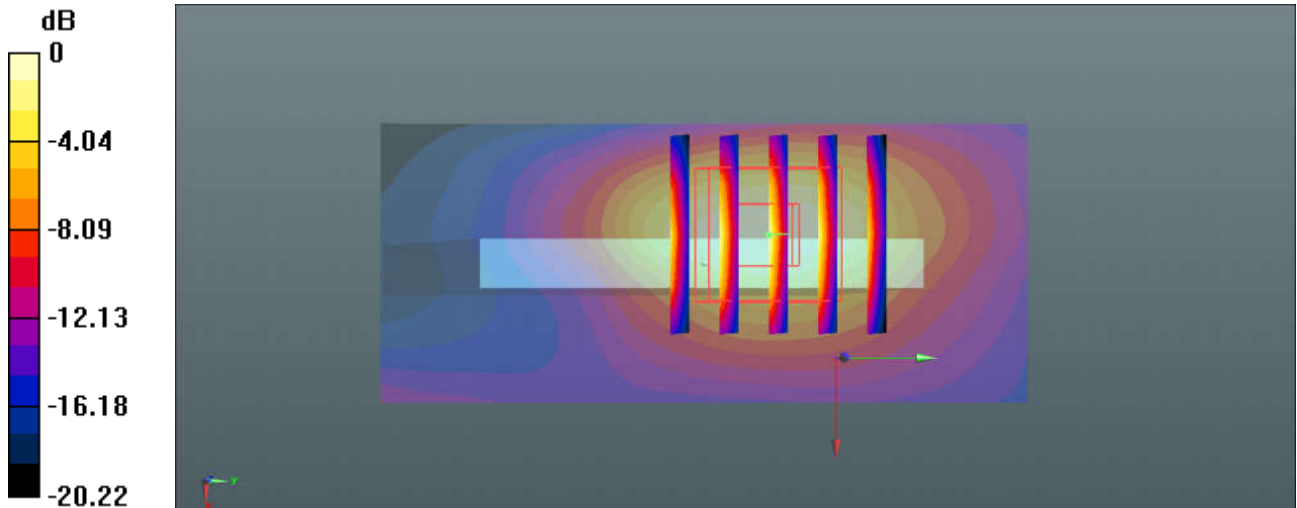
**Ch512/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 23.91 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 1.23 W/kg

**SAR(1 g) = 0.752 W/kg; SAR(10 g) = 0.390 W/kg**

Maximum value of SAR (measured) = 1.06 W/kg



0 dB = 0.982 W/kg = -0.08 dBW/kg

### 17\_WCDMA Band V\_RMC 12.2Kbps\_Back\_5mm\_Ch4132

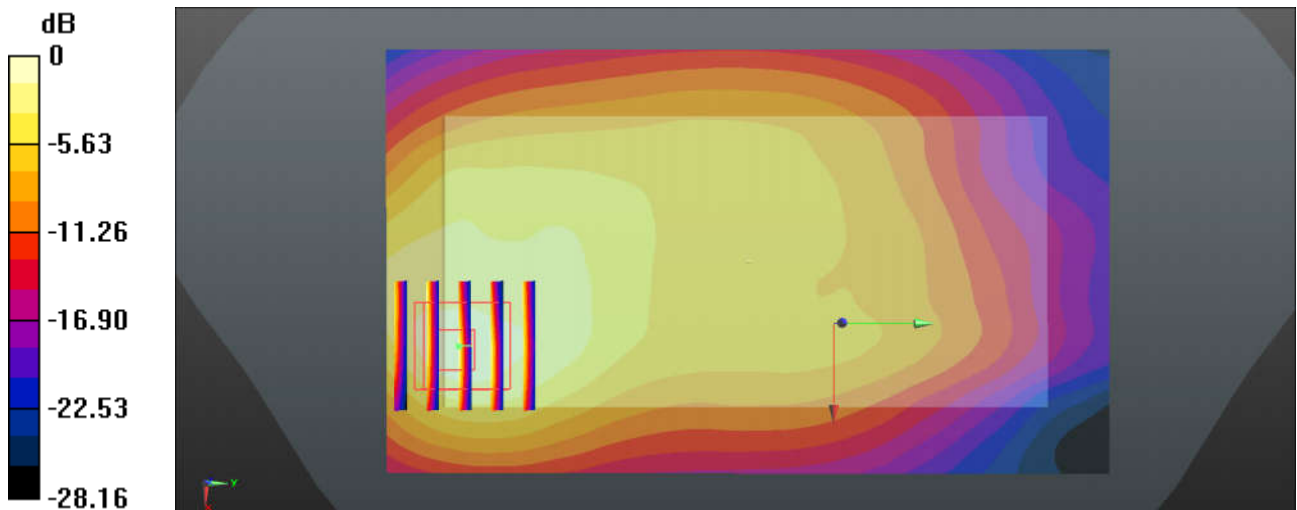
Communication System: UID 0, UMTS (0); Frequency: 826.4 MHz; Duty Cycle: 1:1  
Medium: MSL\_835 Medium parameters used:  $f = 826.4$  MHz;  $\sigma = 0.975$  S/m;  $\epsilon_r = 56.577$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.2 °C ; Liquid Temperature : 22.8 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(10.02, 10.02, 10.02); Calibrated: 2018.1.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2017.12.4
- Phantom: SAM1; Type: SAM; Serial: TP-1842
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch4132/Area Scan (71x121x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
Maximum value of SAR (interpolated) = 0.769 W/kg

**Ch4132/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 13.48 V/m; Power Drift = 0.01 dB  
Peak SAR (extrapolated) = 0.936 W/kg  
**SAR(1 g) = 0.524 W/kg; SAR(10 g) = 0.303 W/kg**  
Maximum value of SAR (measured) = 0.727 W/kg



0 dB = 0.769 W/kg = -1.14 dBW/kg

### 18\_WCDMA Band IV\_RMC 12.2Kbps\_Bottom Side\_5mm\_Ch1513

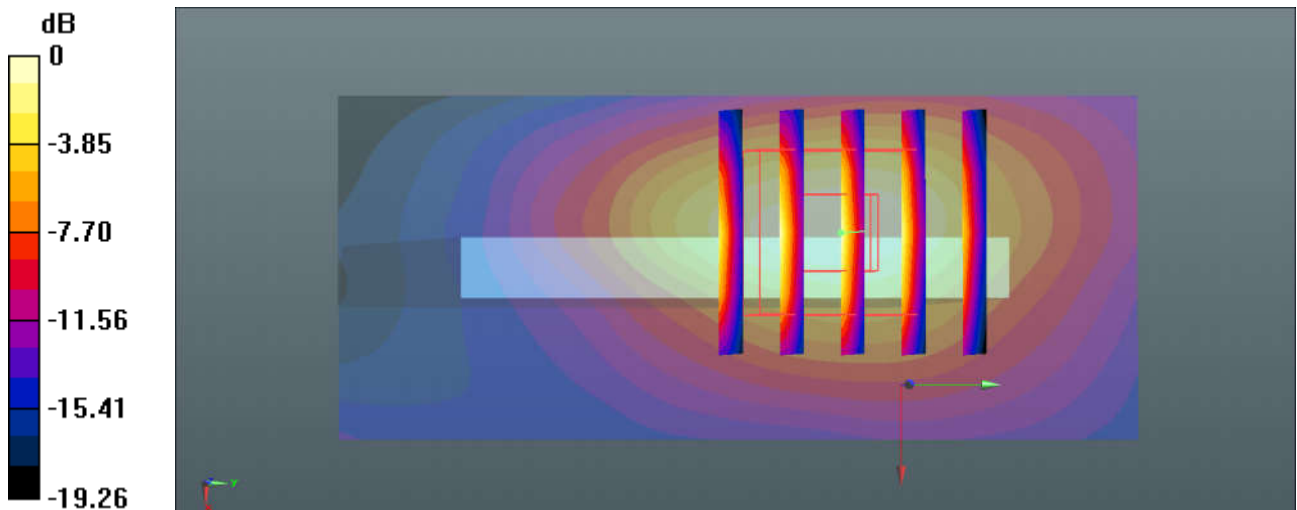
Communication System: UID 0, UMTS (0); Frequency: 1752.6 MHz; Duty Cycle: 1:1  
Medium: MSL\_1750 Medium parameters used:  $f = 1752.6$  MHz;  $\sigma = 1.493$  S/m;  $\epsilon_r = 54.732$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.3 °C ; Liquid Temperature : 22.7 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(8.31, 8.31, 8.31); Calibrated: 2018.1.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2017.12.4
- Phantom: SAM3; Type: SAM; Serial: TP-1839
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch1513/Area Scan (31x71x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
Maximum value of SAR (interpolated) = 1.11 W/kg

**Ch1513/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 24.26 V/m; Power Drift = 0.16 dB  
Peak SAR (extrapolated) = 1.38 W/kg  
**SAR(1 g) = 0.856 W/kg; SAR(10 g) = 0.460 W/kg**  
Maximum value of SAR (measured) = 1.19 W/kg



0 dB = 1.11 W/kg = 0.45 dBW/kg

### 19\_WCDMA Band II\_RMC 12.2Kbps\_Bottom Side\_5mm\_Ch9538

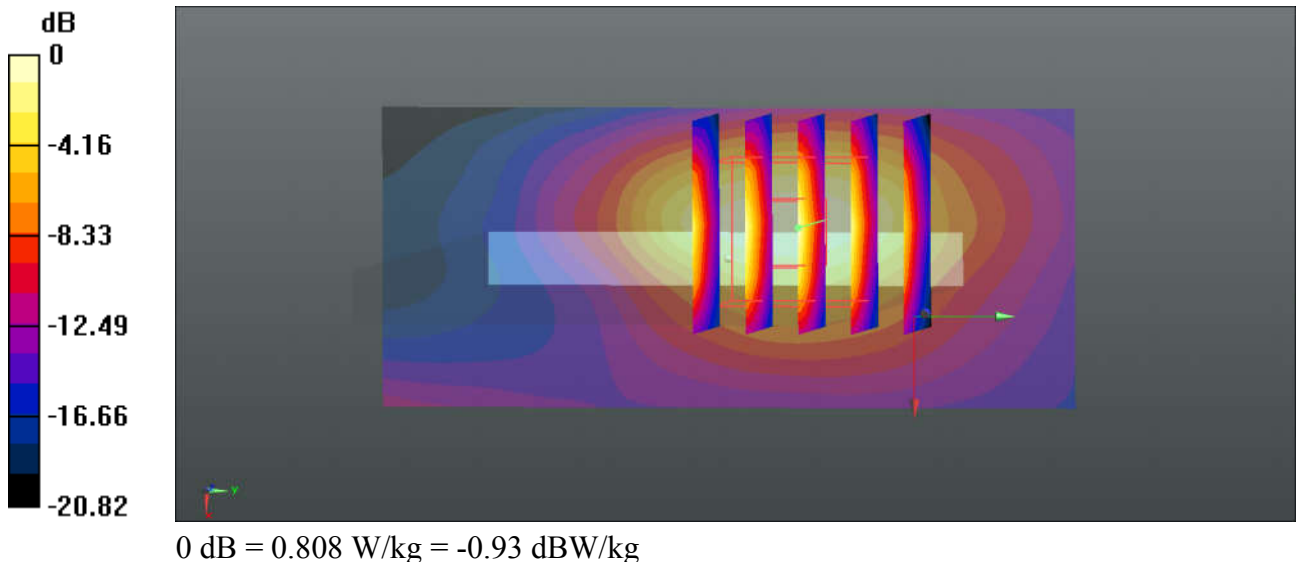
Communication System: UID 0, UMTS (0); Frequency: 1907.6 MHz; Duty Cycle: 1:1  
Medium: MSL\_1900 Medium parameters used:  $f = 1907.6$  MHz;  $\sigma = 1.547$  S/m;  $\epsilon_r = 53.432$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.3 °C; Liquid Temperature : 22.7 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(8.03, 8.03, 8.03); Calibrated: 2018.1.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2017.12.4
- Phantom: SAM3; Type: SAM; Serial: TP-1839
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch9538/Area Scan (31x71x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
Maximum value of SAR (interpolated) = 0.808 W/kg

**Ch9538/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 21.70 V/m; Power Drift = 0.01 dB  
Peak SAR (extrapolated) = 0.998 W/kg  
**SAR(1 g) = 0.600 W/kg; SAR(10 g) = 0.304 W/kg**  
Maximum value of SAR (measured) = 0.844 W/kg



### 20\_LTE Band 5\_10M\_QPSK\_1RB\_25Offset\_Back\_5mm\_Ch20525

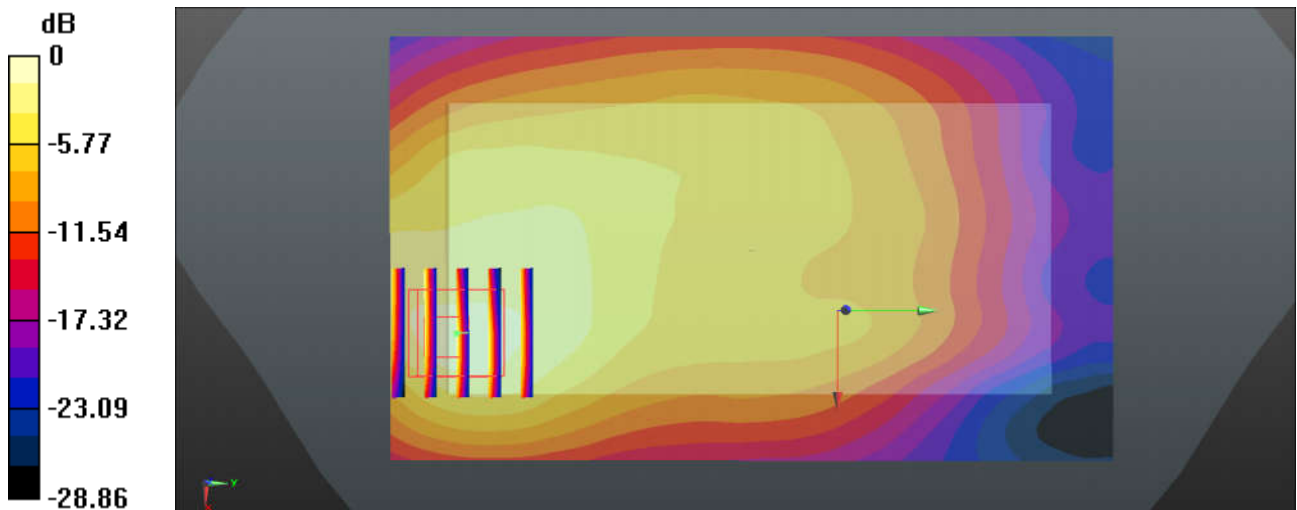
Communication System: UID 0, FDD\_LTE (0); Frequency: 836.5 MHz; Duty Cycle: 1:1  
Medium: MSL\_835 Medium parameters used:  $f = 836.5$  MHz;  $\sigma = 0.986$  S/m;  $\epsilon_r = 56.499$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.2 °C ; Liquid Temperature : 22.8 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(10.02, 10.02, 10.02); Calibrated: 2018.1.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2017.12.4
- Phantom: SAM1; Type: SAM; Serial: TP-1842
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch20525/Area Scan (71x121x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
Maximum value of SAR (interpolated) = 0.799 W/kg

**Ch20525/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 13.85 V/m; Power Drift = -0.10 dB  
Peak SAR (extrapolated) = 1.00 W/kg  
**SAR(1 g) = 0.565 W/kg; SAR(10 g) = 0.326 W/kg**  
Maximum value of SAR (measured) = 0.786 W/kg



0 dB = 0.799 W/kg = -0.97 dBW/kg

### 21\_LTE Band 4\_20M\_QPSK\_1RB\_49Offset\_Bottom Side\_5mm\_Ch20175

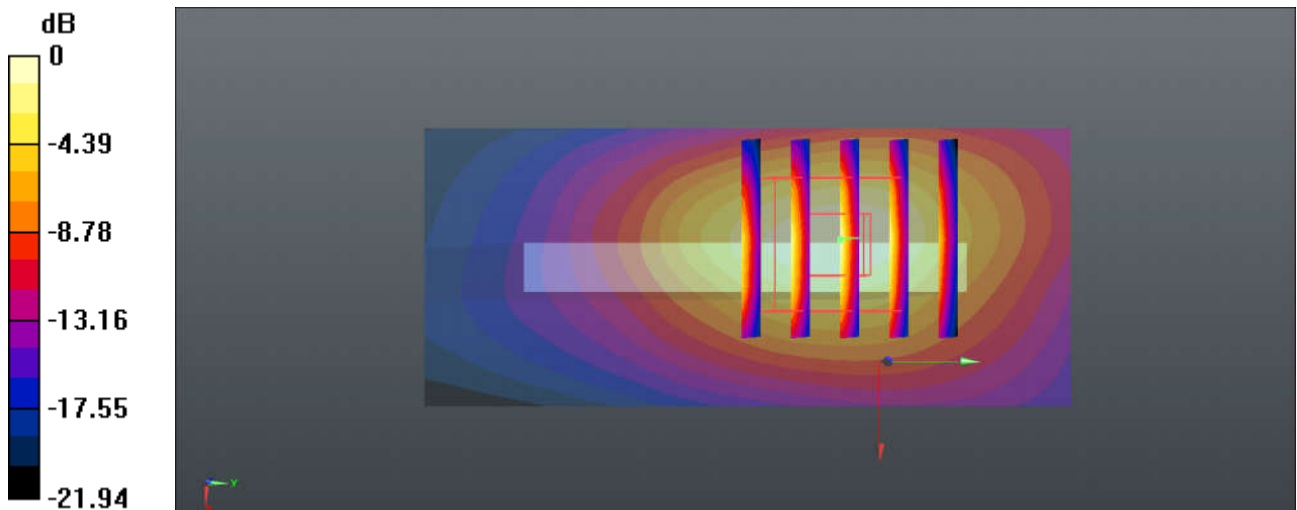
Communication System: UID 0, FDD\_LTE (0); Frequency: 1732.5 MHz; Duty Cycle: 1:1  
Medium: MSL\_1750 Medium parameters used:  $f = 1732.5$  MHz;  $\sigma = 1.47$  S/m;  $\epsilon_r = 54.775$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.3 °C ; Liquid Temperature : 22.7 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(8.31, 8.31, 8.31); Calibrated: 2018.1.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2017.12.4
- Phantom: SAM3; Type: SAM; Serial: TP-1839
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch20175/Area Scan (31x71x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
Maximum value of SAR (interpolated) = 0.854 W/kg

**Ch20175/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 21.92 V/m; Power Drift = -0.08 dB  
Peak SAR (extrapolated) = 1.09 W/kg  
**SAR(1 g) = 0.669 W/kg; SAR(10 g) = 0.357 W/kg**  
Maximum value of SAR (measured) = 0.924 W/kg



0 dB = 0.854 W/kg = -0.69 dBW/kg

## 22\_LTE Band 2\_20M\_QPSK\_50RB\_24Offset\_Bottom Side\_5mm\_Ch19100

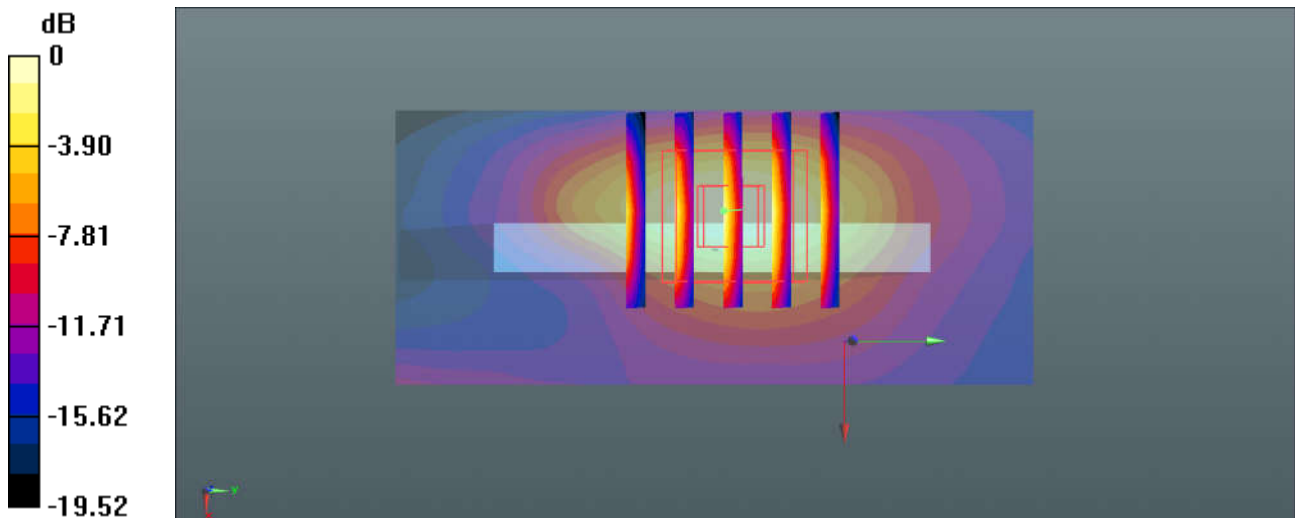
Communication System: UID 0, FDD\_LTE (0); Frequency: 1900 MHz; Duty Cycle: 1:1  
Medium: MSL\_1900 Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.537$  S/m;  $\epsilon_r = 53.469$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.3 °C ; Liquid Temperature : 22.7 °C

### DASY5 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(8.03, 8.03, 8.03); Calibrated: 2018.1.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2017.12.4
- Phantom: SAM3; Type: SAM; Serial: TP-1839
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch19100/Area Scan (31x71x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
Maximum value of SAR (interpolated) = 0.899 W/kg

**Ch19100/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 22.28 V/m; Power Drift = 0.02 dB  
Peak SAR (extrapolated) = 1.05 W/kg  
**SAR(1 g) = 0.627 W/kg; SAR(10 g) = 0.321 W/kg**  
Maximum value of SAR (measured) = 0.862 W/kg



0 dB = 0.899 W/kg = -0.46 dBW/kg

**23\_LTE Band 7\_20M\_QPSK\_50RB\_0Offset\_Bottom Side\_5mm\_Ch21350**

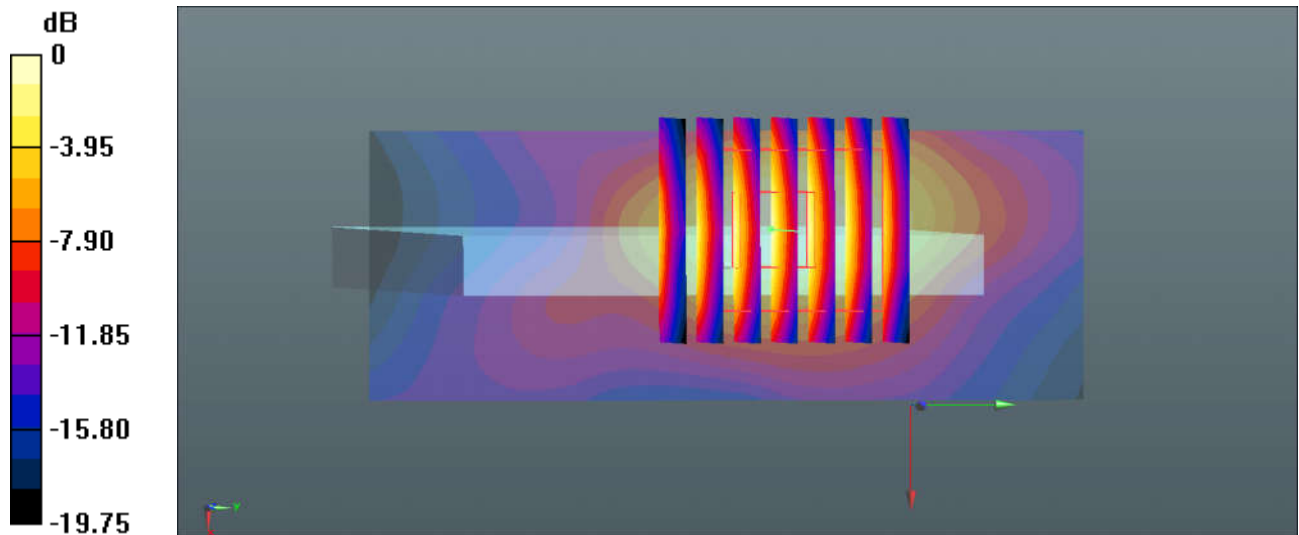
Communication System: UID 0, FDD\_LTE (0); Frequency: 2560 MHz; Duty Cycle: 1:1  
 Medium: MSL\_2600 Medium parameters used:  $f = 2560$  MHz;  $\sigma = 2.173$  S/m;  $\epsilon_r = 52.578$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Ambient Temperature : 23.3 °C; Liquid Temperature : 22.7 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3954; ConvF(6.92, 6.92, 6.92); Calibrated: 2018.1.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2017.12.4
- Phantom: SAM1; Type: SAM; Serial: TP-1842
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch21350/Area Scan (31x81x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm  
 Maximum value of SAR (interpolated) = 1.75 W/kg

**Ch21350/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
 Reference Value = 28.45 V/m; Power Drift = 0.06 dB  
 Peak SAR (extrapolated) = 1.90 W/kg  
**SAR(1 g) = 1.03 W/kg; SAR(10 g) = 0.490 W/kg**  
 Maximum value of SAR (measured) = 1.63 W/kg



0 dB = 1.75 W/kg = 2.43 dBW/kg



### 24\_WLAN2.4GHz\_802.11b 1Mbps\_Back\_5mm\_Ch6

Communication System: UID 0, WIFI (0); Frequency: 2437 MHz; Duty Cycle: 1:1.025

Medium: MSL\_2450 Medium parameters used:  $f = 2437$  MHz;  $\sigma = 1.992$  S/m;  $\epsilon_r = 52.544$ ;  $\rho = 1000$  kg/m<sup>3</sup>

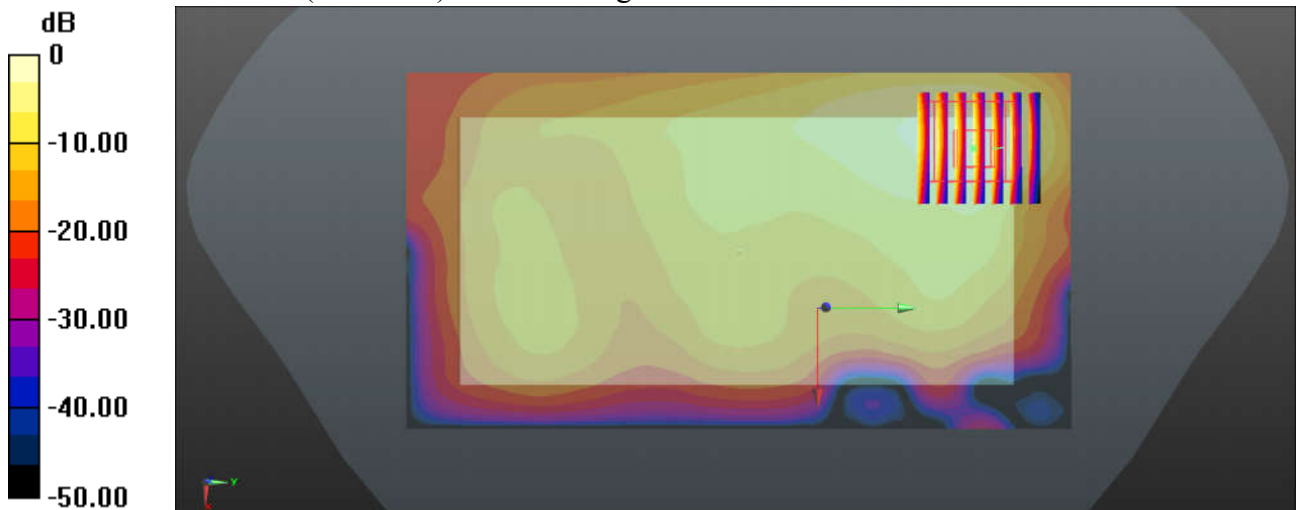
Ambient Temperature : 23.3 °C; Liquid Temperature : 22.8 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(7.53, 7.53, 7.53); Calibrated: 2018.1.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2017.12.4
- Phantom: SAM3; Type: SAM; Serial: TP-1839
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch6/Area Scan (81x151x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm  
Maximum value of SAR (interpolated) = 0.908 W/kg

**Ch6/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 7.030 V/m; Power Drift = -0.07 dB  
Peak SAR (extrapolated) = 1.02 W/kg  
**SAR(1 g) = 0.546 W/kg; SAR(10 g) = 0.293 W/kg**  
Maximum value of SAR (measured) = 0.772 W/kg



0 dB = 0.908 W/kg = -0.42 dBW/kg

### 25\_WLAN5.2GHz\_802.11a 6Mbps\_Back\_5mm\_Ch48

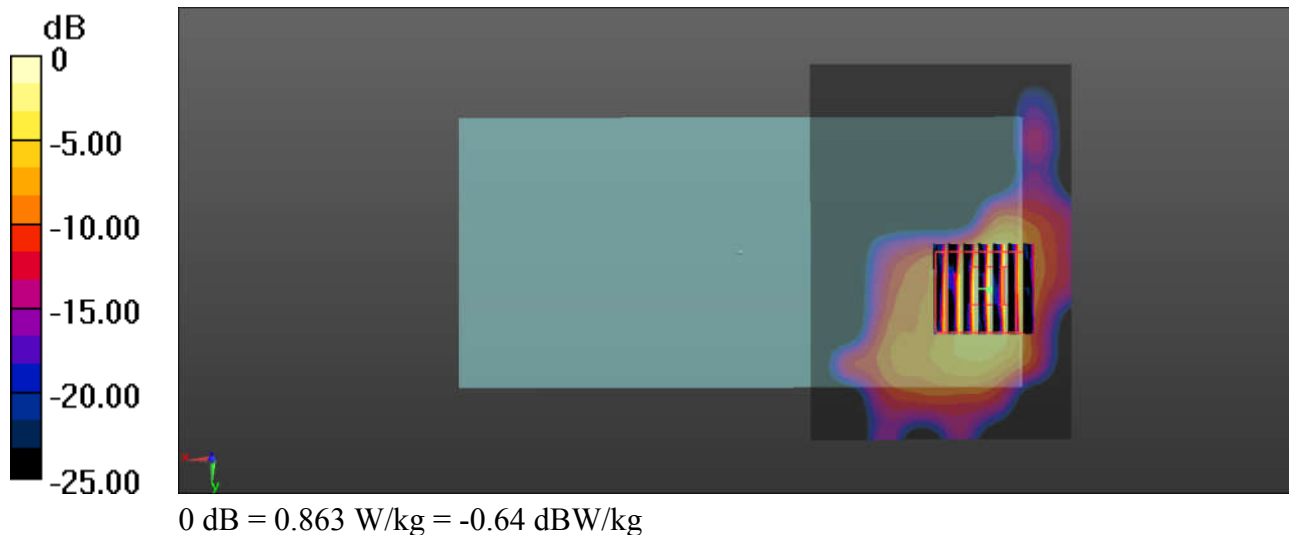
Communication System: UID 0, WIFI (0); Frequency: 5240 MHz; Duty Cycle: 1:1.149  
Medium: MSL\_5000 Medium parameters used:  $f = 5240$  MHz;  $\sigma = 5.537$  S/m;  $\epsilon_r = 47.029$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.3 °C ; Liquid Temperature : 22.6 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(4.62, 4.62, 4.62); Calibrated: 2018.1.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2017.12.4
- Phantom: SAM3; Type: SAM; Serial: TP-1839
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch48/Area Scan (101x71x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm  
Maximum value of SAR (interpolated) = 0.901 W/kg

**Ch48/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm  
Reference Value = 1.058 V/m; Power Drift = -0.03 dB  
Peak SAR (extrapolated) = 2.41 W/kg  
**SAR(1 g) = 0.330 W/kg; SAR(10 g) = 0.094 W/kg**  
Maximum value of SAR (measured) = 0.863 W/kg



### 26\_WLAN5.8GHz\_802.11a 6Mbps\_Back\_5mm\_Ch149

Communication System: UID 0, WIFI (0); Frequency: 5745 MHz; Duty Cycle: 1:1.149

Medium: MSL\_5000 Medium parameters used:  $f = 5745$  MHz;  $\sigma = 6.221$  S/m;  $\epsilon_r = 46.161$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.4 °C; Liquid Temperature : 22.7 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(4.18, 4.18, 4.18); Calibrated: 2018.1.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2017.12.4
- Phantom: SAM3; Type: SAM; Serial: TP-1839
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch149/Area Scan (101x101x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

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

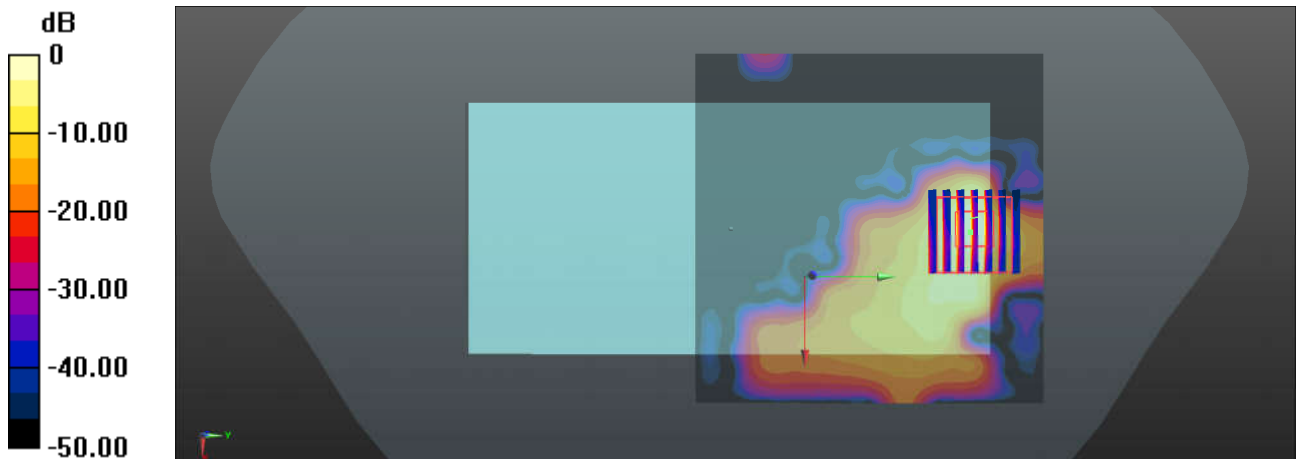
**Ch149/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 1.356 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 1.80 W/kg

**SAR(1 g) = 0.373 W/kg; SAR(10 g) = 0.102 W/kg**

Maximum value of SAR (measured) = 0.972 W/kg



0 dB = 1.10 W/kg = 0.41 dBW/kg

### 27\_Bluetooth\_1Mbps\_Back\_Ch39

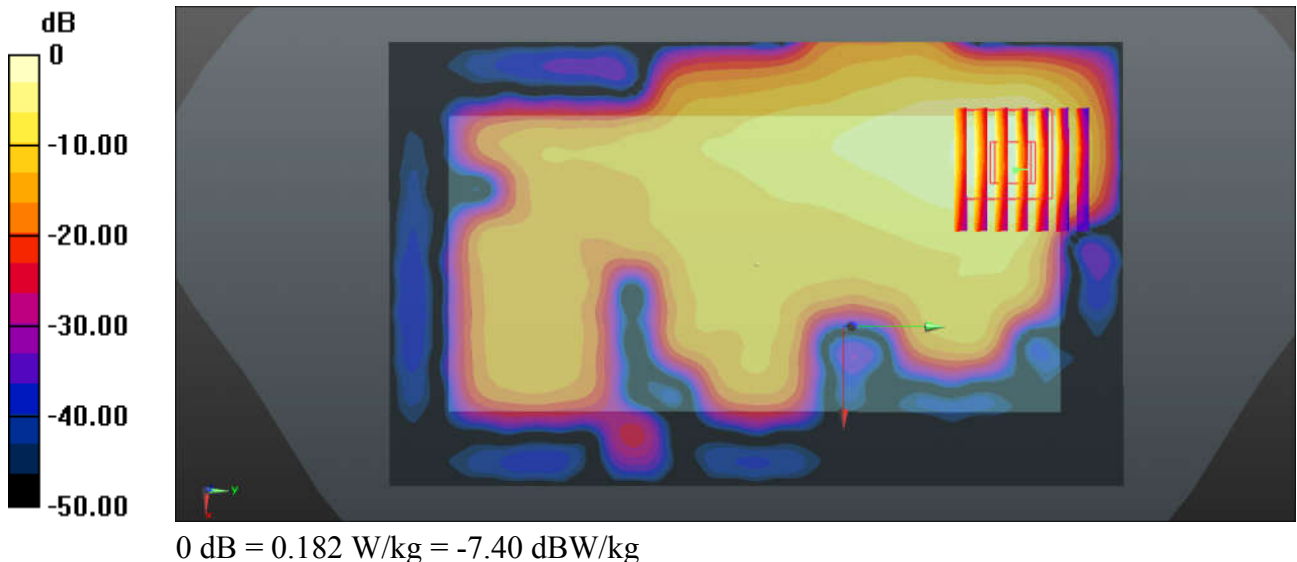
Communication System: UID 0, Bluetooth (0); Frequency: 2441 MHz; Duty Cycle: 1:1.302  
Medium: MSL\_2450 Medium parameters used:  $f = 2441$  MHz;  $\sigma = 1.998$  S/m;  $\epsilon_r = 52.532$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.3 °C ; Liquid Temperature : 22.8 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(7.53, 7.53, 7.53); Calibrated: 2018.1.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2017.12.4
- Phantom: SAM3; Type: SAM; Serial: TP-1839
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch39/Area Scan (91x151x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm  
Maximum value of SAR (interpolated) = 0.182 W/kg

**Ch39/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 2.574 V/m; Power Drift = -0.07 dB  
Peak SAR (extrapolated) = 0.197 W/kg  
**SAR(1 g) = 0.100 W/kg; SAR(10 g) = 0.050 W/kg**  
Maximum value of SAR (measured) = 0.149 W/kg



**28\_GSM850\_GPRS 4 Tx slots\_Front\_5mm\_Ch189**

Communication System: UID 0, GPRS/EDGE (4 Tx slots) (0); Frequency: 836.4 MHz; Duty Cycle: 1:2.08

Medium: MSL\_835 Medium parameters used:  $f = 836.4 \text{ MHz}$ ;  $\sigma = 0.986 \text{ S/m}$ ;  $\epsilon_r = 56.5$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature : 23.2 °C ; Liquid Temperature : 22.8 °C

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3954; ConvF(10.02, 10.02, 10.02); Calibrated: 2018.1.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2017.12.4
- Phantom: SAM1; Type: SAM; Serial: TP-1842
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch189/Area Scan (71x121x1):** Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$

Maximum value of SAR (interpolated) = 0.659 W/kg

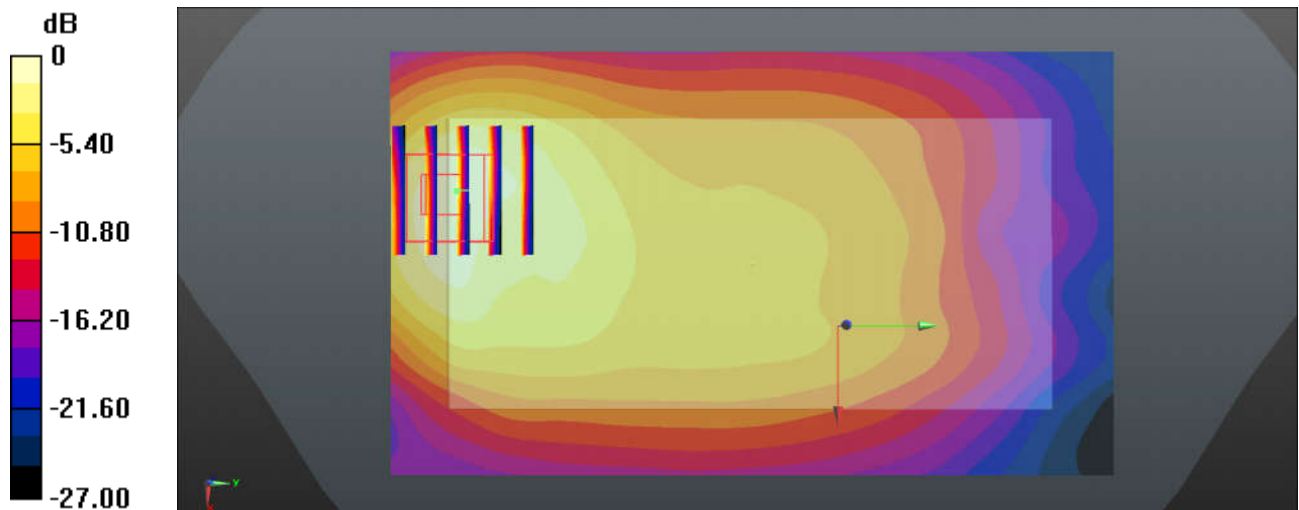
**Ch189/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 12.63 V/m; Power Drift = -0.13 dB

Peak SAR (extrapolated) = 0.783 W/kg

**SAR(1 g) = 0.441 W/kg; SAR(10 g) = 0.251 W/kg**

Maximum value of SAR (measured) = 0.604 W/kg



0 dB = 0.659 W/kg = -1.81 dBW/kg

### 29\_GSM1900\_GPRS 4 Tx slots\_Back\_5mm\_Ch512

Communication System: UID 0, GPRS/EDGE (4 Tx slots) (0); Frequency: 1850.2 MHz; Duty Cycle: 1:2.08

Medium: MSL\_1900 Medium parameters used:  $f = 1850.2$  MHz;  $\sigma = 1.479$  S/m;  $\epsilon_r = 53.659$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.3 °C ; Liquid Temperature : 22.7 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(8.03, 8.03, 8.03); Calibrated: 2018.1.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2017.12.4
- Phantom: SAM3; Type: SAM; Serial: TP-1839
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch512/Area Scan (71x121x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.577 W/kg

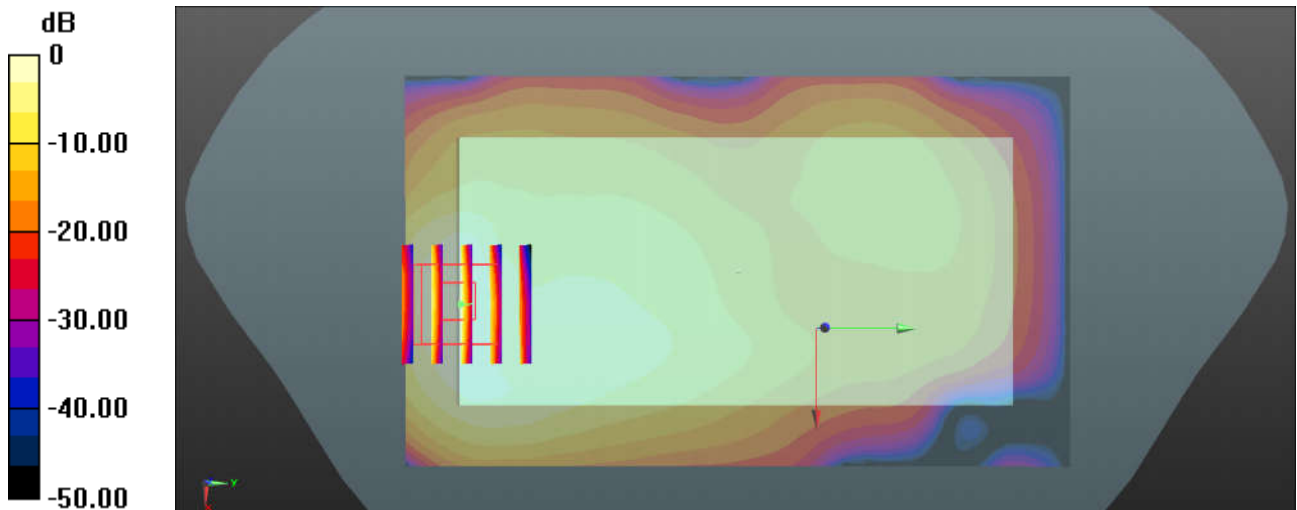
**Ch512/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 5.603 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 0.680 W/kg

**SAR(1 g) = 0.435 W/kg; SAR(10 g) = 0.239 W/kg**

Maximum value of SAR (measured) = 0.568 W/kg



0 dB = 0.577 W/kg = -2.39 dBW/kg

### 30\_WCDMA Band V\_RMC 12.2Kbps\_Back\_5mm\_Ch4132

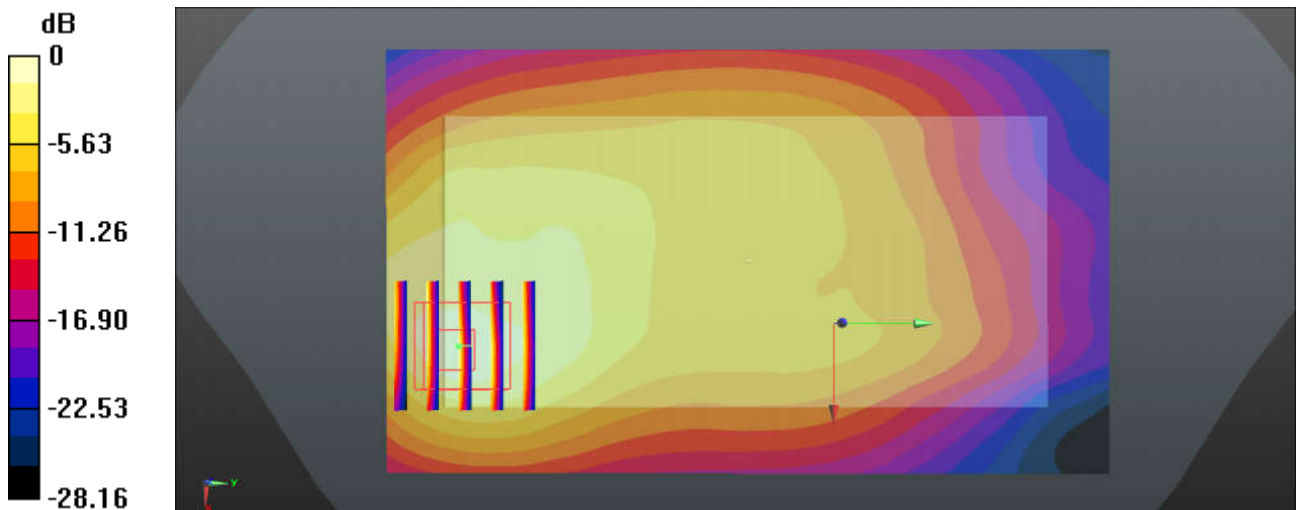
Communication System: UID 0, UMTS (0); Frequency: 826.4 MHz; Duty Cycle: 1:1  
Medium: MSL\_835 Medium parameters used:  $f = 826.4$  MHz;  $\sigma = 0.975$  S/m;  $\epsilon_r = 56.577$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.2 °C ; Liquid Temperature : 22.8 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(10.02, 10.02, 10.02); Calibrated: 2018.1.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2017.12.4
- Phantom: SAM1; Type: SAM; Serial: TP-1842
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch4132/Area Scan (71x121x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
Maximum value of SAR (interpolated) = 0.769 W/kg

**Ch4132/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 13.48 V/m; Power Drift = 0.01 dB  
Peak SAR (extrapolated) = 0.936 W/kg  
**SAR(1 g) = 0.524 W/kg; SAR(10 g) = 0.303 W/kg**  
Maximum value of SAR (measured) = 0.727 W/kg



0 dB = 0.769 W/kg = -1.14 dBW/kg

### 31\_WCDMA Band IV\_RMC 12.2Kbps\_Back\_5mm\_Ch1513

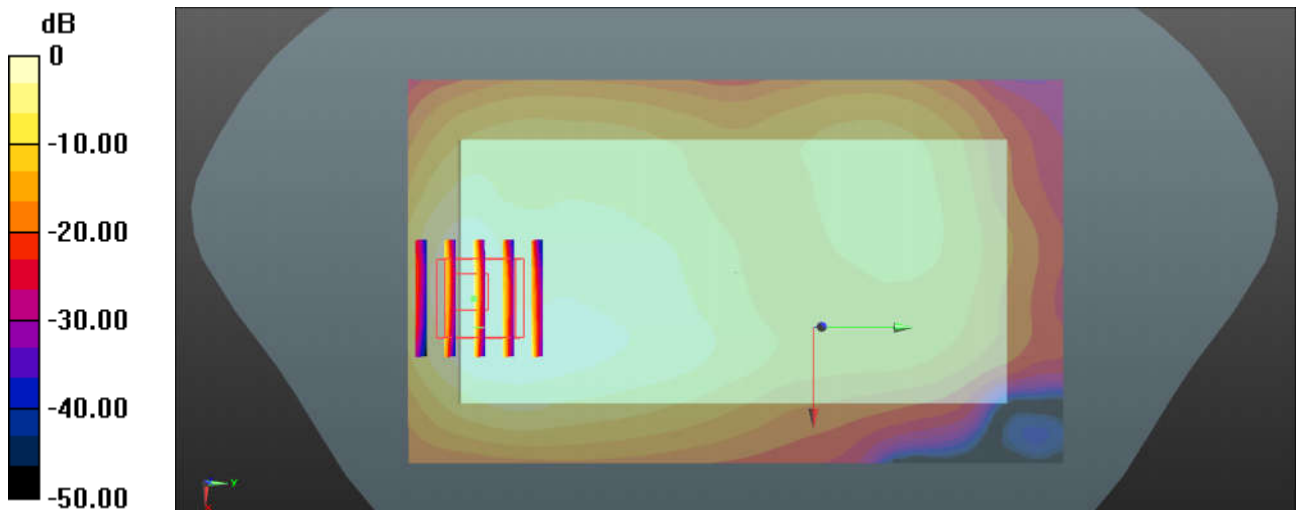
Communication System: UID 0, UMTS (0); Frequency: 1752.6 MHz; Duty Cycle: 1:1  
Medium: MSL\_1750 Medium parameters used:  $f = 1752.6$  MHz;  $\sigma = 1.493$  S/m;  $\epsilon_r = 54.732$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.3 °C ; Liquid Temperature : 22.7 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(8.31, 8.31, 8.31); Calibrated: 2018.1.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2017.12.4
- Phantom: SAM3; Type: SAM; Serial: TP-1839
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch1513/Area Scan (71x121x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
Maximum value of SAR (interpolated) = 0.833 W/kg

**Ch1513/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 8.188 V/m; Power Drift = 0.10 dB  
Peak SAR (extrapolated) = 0.946 W/kg  
**SAR(1 g) = 0.598 W/kg; SAR(10 g) = 0.362 W/kg**  
Maximum value of SAR (measured) = 0.784 W/kg



0 dB = 0.833 W/kg = -0.79 dBW/kg



**32\_WCDMA Band II\_RMC 12.2Kbps\_Back\_5mm\_Ch9538**

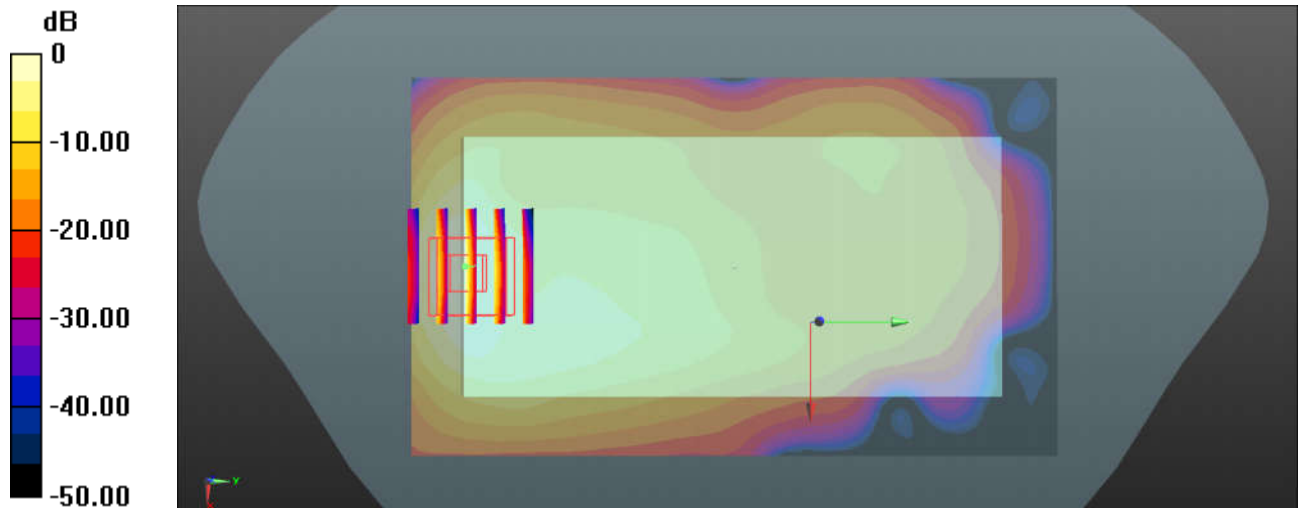
Communication System: UID 0, UMTS (0); Frequency: 1907.6 MHz; Duty Cycle: 1:1  
 Medium: MSL\_1900 Medium parameters used:  $f = 1907.6$  MHz;  $\sigma = 1.547$  S/m;  $\epsilon_r = 53.432$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Ambient Temperature : 23.3 °C ; Liquid Temperature : 22.7 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(8.03, 8.03, 8.03); Calibrated: 2018.1.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2017.12.4
- Phantom: SAM3; Type: SAM; Serial: TP-1839
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch9538/Area Scan (71x121x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
 Maximum value of SAR (interpolated) = 0.645 W/kg

**Ch9538/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
 Reference Value = 5.731 V/m; Power Drift = -0.14 dB  
 Peak SAR (extrapolated) = 0.733 W/kg  
**SAR(1 g) = 0.462 W/kg; SAR(10 g) = 0.251 W/kg**  
 Maximum value of SAR (measured) = 0.627 W/kg



0 dB = 0.645 W/kg = -1.90 dBW/kg

### 33\_LTE Band 5\_10M\_QPSK\_1RB\_25Offset\_Back\_5mm\_Ch20525

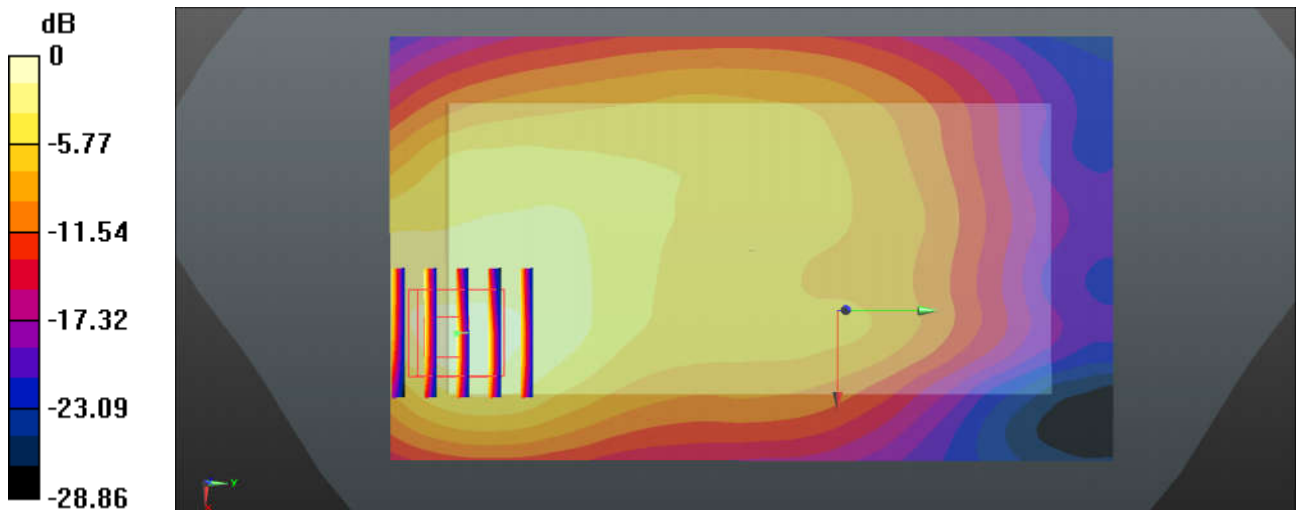
Communication System: UID 0, FDD\_LTE (0); Frequency: 836.5 MHz; Duty Cycle: 1:1  
Medium: MSL\_835 Medium parameters used:  $f = 836.5$  MHz;  $\sigma = 0.986$  S/m;  $\epsilon_r = 56.499$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.2 °C ; Liquid Temperature : 22.8 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(10.02, 10.02, 10.02); Calibrated: 2018.1.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2017.12.4
- Phantom: SAM1; Type: SAM; Serial: TP-1842
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch20525/Area Scan (71x121x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
Maximum value of SAR (interpolated) = 0.799 W/kg

**Ch20525/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 13.85 V/m; Power Drift = -0.10 dB  
Peak SAR (extrapolated) = 1.00 W/kg  
**SAR(1 g) = 0.565 W/kg; SAR(10 g) = 0.326 W/kg**  
Maximum value of SAR (measured) = 0.786 W/kg



0 dB = 0.799 W/kg = -0.97 dBW/kg

### 34\_LTE Band 4\_20M\_QPSK\_1RB\_49Offset\_Back\_5mm\_Ch20175

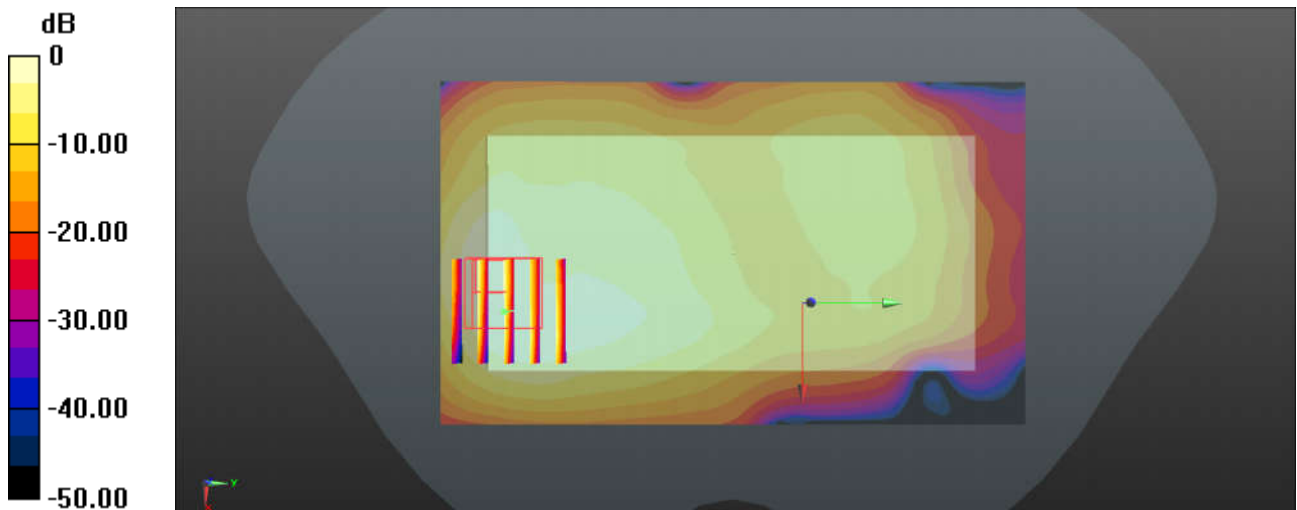
Communication System: UID 0, FDD\_LTE (0); Frequency: 1732.5 MHz; Duty Cycle: 1:1  
Medium: MSL\_1750 Medium parameters used:  $f = 1732.5$  MHz;  $\sigma = 1.47$  S/m;  $\epsilon_r = 54.775$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.3 °C ; Liquid Temperature : 22.7 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(8.31, 8.31, 8.31); Calibrated: 2018.1.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2017.12.4
- Phantom: SAM3; Type: SAM; Serial: TP-1839
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch20175/Area Scan (71x121x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
Maximum value of SAR (interpolated) = 0.653 W/kg

**Ch20175/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 7.080 V/m; Power Drift = 0.02 dB  
Peak SAR (extrapolated) = 0.706 W/kg  
**SAR(1 g) = 0.456 W/kg; SAR(10 g) = 0.284 W/kg**  
Maximum value of SAR (measured) = 0.564 W/kg



0 dB = 0.653 W/kg = -1.85 dBW/kg

### 35\_LTE Band 2\_20M\_QPSK\_50RB\_24Offset\_Back\_5mm\_Ch19100

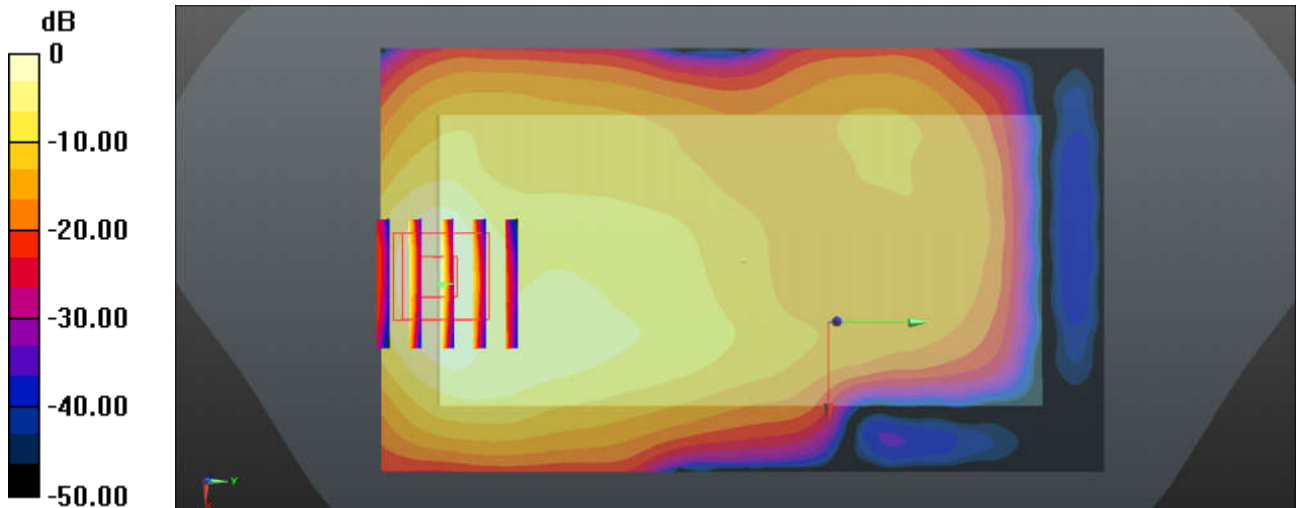
Communication System: UID 0, FDD\_LTE (0); Frequency: 1900 MHz; Duty Cycle: 1:1  
Medium: MSL\_1900 Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.537$  S/m;  $\epsilon_r = 53.469$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.3 °C ; Liquid Temperature : 22.7 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(8.03, 8.03, 8.03); Calibrated: 2018.1.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2017.12.4
- Phantom: SAM3; Type: SAM; Serial: TP-1839
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch19100/Area Scan (71x121x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm  
Maximum value of SAR (interpolated) = 0.537 W/kg

**Ch19100/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 5.118 V/m; Power Drift = -0.06 dB  
Peak SAR (extrapolated) = 0.648 W/kg  
**SAR(1 g) = 0.405 W/kg; SAR(10 g) = 0.218 W/kg**  
Maximum value of SAR (measured) = 0.543 W/kg



0 dB = 0.537 W/kg = -2.70 dBW/kg

### 36\_LTE Band 7\_20M\_QPSK\_1RB\_49Offset\_Back\_5mm\_Ch21350

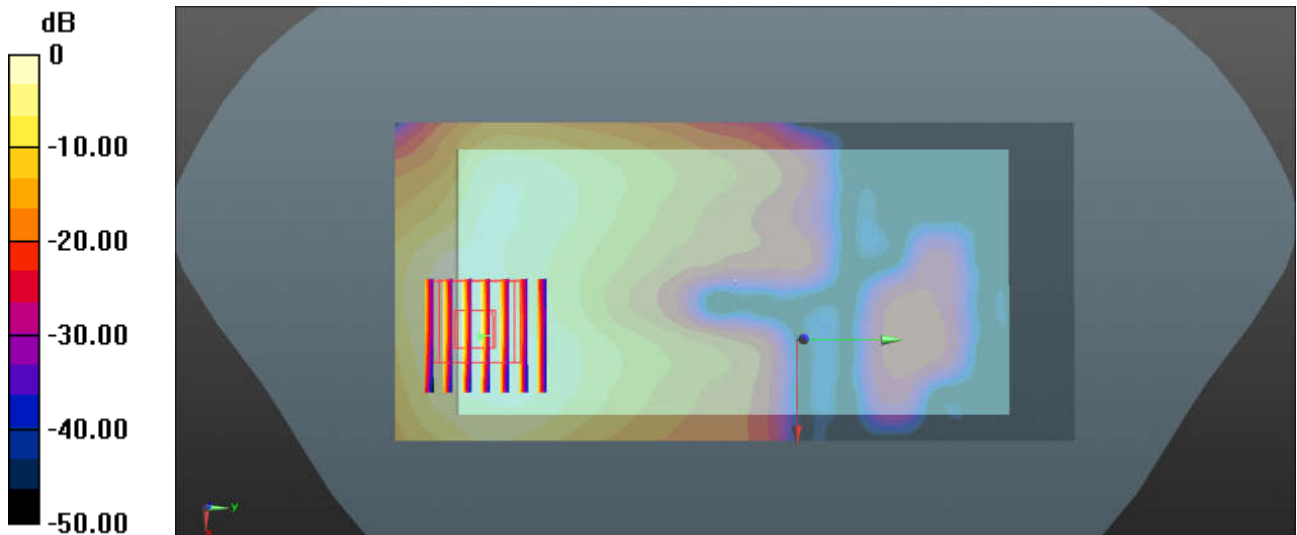
Communication System: UID 0, FDD\_LTE (0); Frequency: 2560 MHz; Duty Cycle: 1:1  
Medium: MSL\_2600 Medium parameters used:  $f = 2560$  MHz;  $\sigma = 2.173$  S/m;  $\epsilon_r = 52.578$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.3 °C; Liquid Temperature : 22.7 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(6.92, 6.92, 6.92); Calibrated: 2018.1.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2017.12.4
- Phantom: SAM1; Type: SAM; Serial: TP-1842
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch21350/Area Scan (71x151x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm  
Maximum value of SAR (interpolated) = 0.832 W/kg

**Ch21350/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 20.91 V/m; Power Drift = -0.02 dB  
Peak SAR (extrapolated) = 1.07 W/kg  
**SAR(1 g) = 0.581 W/kg; SAR(10 g) = 0.296 W/kg**  
Maximum value of SAR (measured) = 0.865 W/kg



0 dB = 0.832 W/kg = -0.80 dBW/kg

### 37\_WLAN2.4GHz\_802.11b 1Mbps\_Back\_5mm\_Ch6

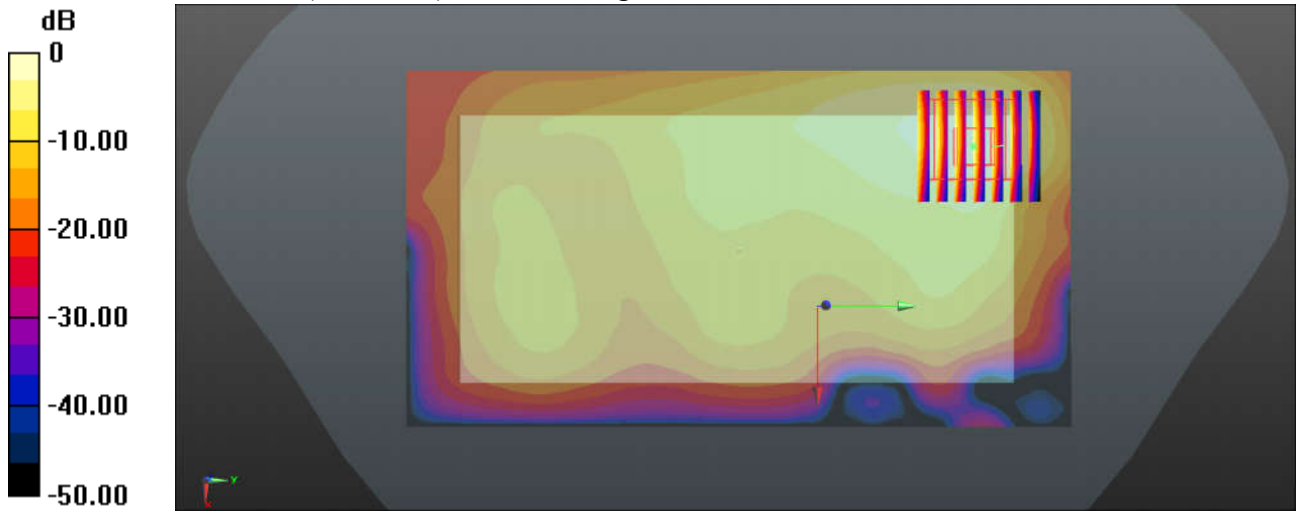
Communication System: UID 0, WIFI (0); Frequency: 2437 MHz; Duty Cycle: 1:1.025  
Medium: MSL\_2450 Medium parameters used:  $f = 2437$  MHz;  $\sigma = 1.992$  S/m;  $\epsilon_r = 52.544$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.3 °C; Liquid Temperature : 22.8 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(7.53, 7.53, 7.53); Calibrated: 2018.1.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2017.12.4
- Phantom: SAM3; Type: SAM; Serial: TP-1839
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch6/Area Scan (81x151x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm  
Maximum value of SAR (interpolated) = 0.908 W/kg

**Ch6/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 7.030 V/m; Power Drift = -0.07 dB  
Peak SAR (extrapolated) = 1.02 W/kg  
**SAR(1 g) = 0.546 W/kg; SAR(10 g) = 0.293 W/kg**  
Maximum value of SAR (measured) = 0.772 W/kg



0 dB = 0.908 W/kg = -0.42 dBW/kg

### 38\_WLAN5.3GHz\_802.11a 6Mbps\_Back\_5mm\_Ch64

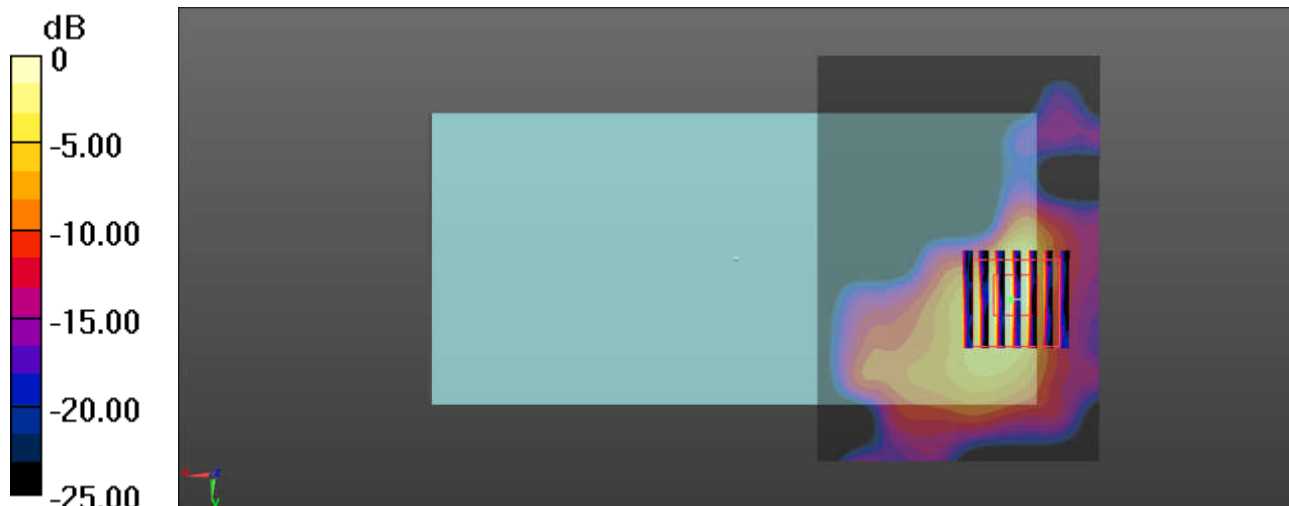
Communication System: UID 0, WIFI (0); Frequency: 5320 MHz; Duty Cycle: 1:1.149  
Medium: MSL\_5000 Medium parameters used:  $f = 5320$  MHz;  $\sigma = 5.59$  S/m;  $\epsilon_r = 47.835$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.3 °C ; Liquid Temperature : 22.6 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(4.62, 4.62, 4.62); Calibrated: 2018.1.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2017.12.4
- Phantom: SAM3; Type: SAM; Serial: TP-1839
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch64/Area Scan (101x71x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm  
Maximum value of SAR (interpolated) = 1.22 W/kg

**Ch64/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm  
Reference Value = 1.176 V/m; Power Drift = -0.01 dB  
Peak SAR (extrapolated) = 1.90 W/kg  
**SAR(1 g) = 0.439 W/kg; SAR(10 g) = 0.128 W/kg**  
Maximum value of SAR (measured) = 1.12 W/kg



0 dB = 1.12 W/kg = 0.49 dBW/kg

### 39\_WLAN5.5GHz\_802.11a 6Mbps\_Back\_5mm\_Ch116

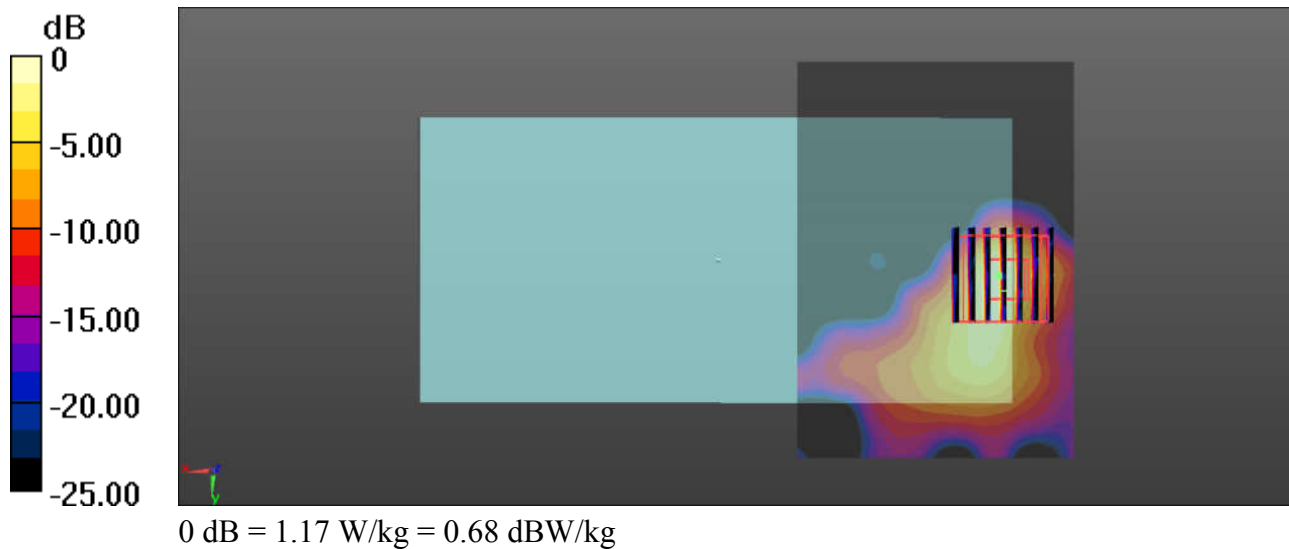
Communication System: UID 0, WIFI (0); Frequency: 5580 MHz; Duty Cycle: 1:1.149  
Medium: MSL\_5000 Medium parameters used:  $f = 5580$  MHz;  $\sigma = 5.764$  S/m;  $\epsilon_r = 46.85$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.2 °C ; Liquid Temperature : 22.6 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(4.05, 4.05, 4.05); Calibrated: 2018.1.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2017.12.4
- Phantom: SAM3; Type: SAM; Serial: TP-1839
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch116/Area Scan (101x71x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm  
Maximum value of SAR (interpolated) = 1.27 W/kg

**Ch116/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm  
Reference Value = 1.237 V/m; Power Drift = -0.09 dB  
Peak SAR (extrapolated) = 2.22 W/kg  
**SAR(1 g) = 0.459 W/kg; SAR(10 g) = 0.116 W/kg**  
Maximum value of SAR (measured) = 1.17 W/kg





### 40\_WLAN5.8GHz\_802.11a 6Mbps\_Back\_5mm\_Ch149

Communication System: UID 0, WIFI (0); Frequency: 5745 MHz; Duty Cycle: 1:1.149

Medium: MSL\_5000 Medium parameters used:  $f = 5745$  MHz;  $\sigma = 6.221$  S/m;  $\epsilon_r = 46.161$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature : 23.4 °C; Liquid Temperature : 22.7 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(4.18, 4.18, 4.18); Calibrated: 2018.1.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2017.12.4
- Phantom: SAM3; Type: SAM; Serial: TP-1839
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch149/Area Scan (101x101x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

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

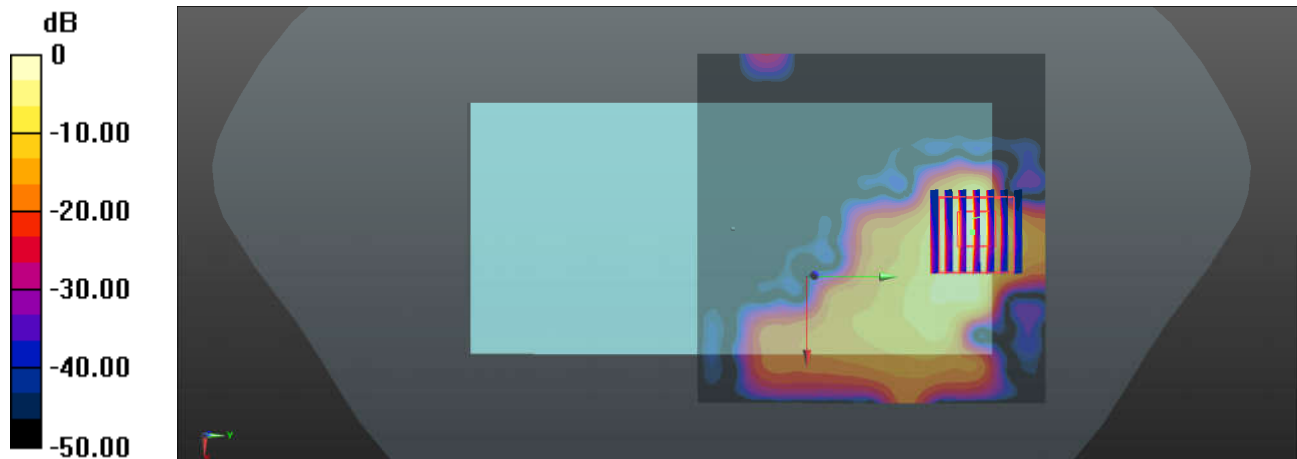
**Ch149/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 1.356 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 1.80 W/kg

**SAR(1 g) = 0.373 W/kg; SAR(10 g) = 0.102 W/kg**

Maximum value of SAR (measured) = 0.972 W/kg



0 dB = 1.10 W/kg = 0.41 dBW/kg

### 41\_Bluetooth\_1Mbps\_Back\_Ch39

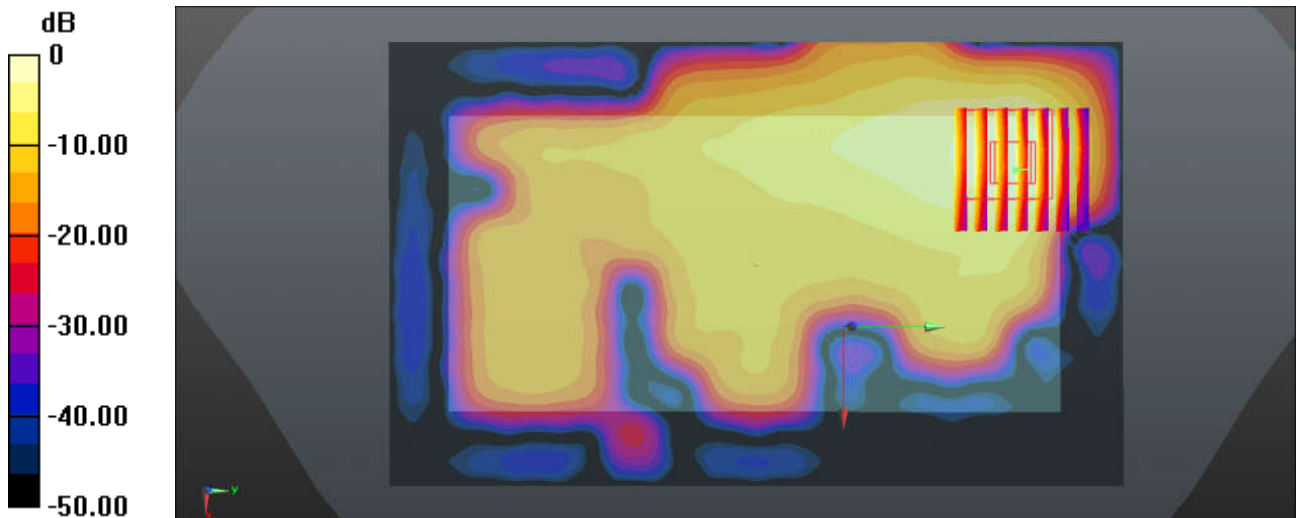
Communication System: UID 0, Bluetooth (0); Frequency: 2441 MHz; Duty Cycle: 1:1.302  
Medium: MSL\_2450 Medium parameters used:  $f = 2441$  MHz;  $\sigma = 1.998$  S/m;  $\epsilon_r = 52.532$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Ambient Temperature : 23.3 °C ; Liquid Temperature : 22.8 °C

#### DASY5 Configuration:

- Probe: EX3DV4 - SN3954; ConvF(7.53, 7.53, 7.53); Calibrated: 2018.1.31;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2017.12.4
- Phantom: SAM3; Type: SAM; Serial: TP-1839
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch39/Area Scan (91x151x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm  
Maximum value of SAR (interpolated) = 0.182 W/kg

**Ch39/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 2.574 V/m; Power Drift = -0.07 dB  
Peak SAR (extrapolated) = 0.197 W/kg  
**SAR(1 g) = 0.100 W/kg; SAR(10 g) = 0.050 W/kg**  
Maximum value of SAR (measured) = 0.149 W/kg



0 dB = 0.182 W/kg = -7.40 dBW/kg



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**Appendix C. DASYS Calibration Certificate**

The DASYS calibration certificates are shown as follows.



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中国认可  
国际互认  
校准  
CALIBRATION  
CNAS L0570

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

Client

**Sporton**

Certificate No: **Z17-97259**

## CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d091**

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

Calibration date: **December 5, 2017**

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements(SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)°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 NRVD	102196	02-Mar-17 (CTTL, No.J17X01254)	Mar-18
Power sensor NRV-Z5	100596	02-Mar-17 (CTTL, No.J17X01254)	Mar-18
Reference Probe EX3DV4	SN 3617	23-Jan-17(SPEAG,No.EX3-3617_Jan17)	Jan-18
DAE3	SN 536	09-Oct-17(CTTL-SPEAG,No.Z17-97198)	Oct-18
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	13-Jan-17 (CTTL, No.J17X00286)	Jan-18
Network Analyzer E5071C	MY46110673	13-Jan-17 (CTTL, No.J17X00285)	Jan-18

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

Issued: December 9, 2017

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



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CALIBRATION LABORATORY

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

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

### Measurement Conditions

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

DASY Version	DASY52	52.10.0.1446
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.7 ± 6 %	0.88 mho/m ± 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	2.32 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	9.48 mW / g ± 18.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.53 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	6.22 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	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.7 ± 6 %	0.96 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	---	---

### SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.42 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	9.72 mW / g ± 18.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.60 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	6.42 mW / g ± 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	48.7 $\Omega$ - 3.69j $\Omega$
Return Loss	- 28.1dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.6 $\Omega$ - 4.62j $\Omega$
Return Loss	- 24.5dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.258 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: 12.04.2017

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d091**

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

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.876$  S/m;  $\epsilon_r = 41.67$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Center Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(9.73, 9.73, 9.73); Calibrated: 1/23/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn536; Calibrated: 10/9/2017
- 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 (7417)

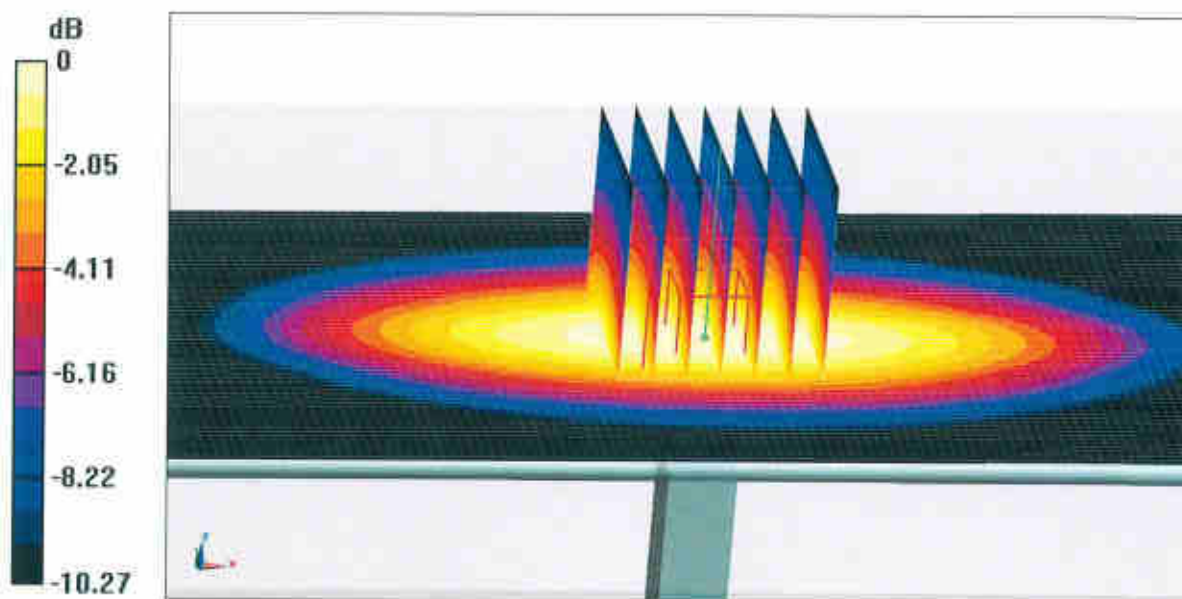
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 58.89V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 3.48 W/kg

**SAR(1 g) = 2.32 W/kg; SAR(10 g) = 1.53 W/kg**

Maximum value of SAR (measured) = 3.10 W/kg



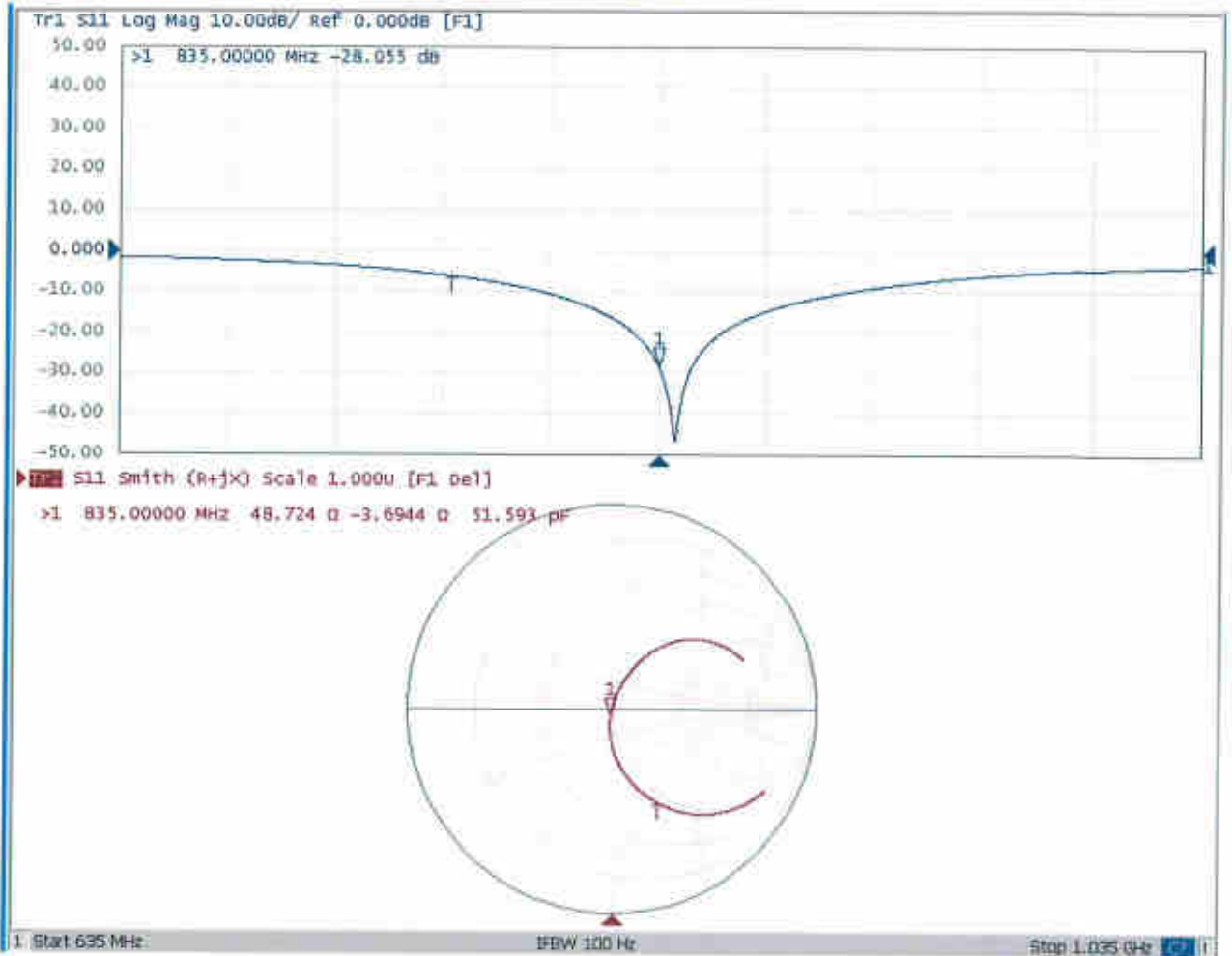
**0 dB = 3.10 W/kg = 4.91 dBW/kg**





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### Impedance Measurement Plot for Head TSL





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### DASY5 Validation Report for Body TSL

Date: 12.05.2017

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d091**

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

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.962$  S/m;  $\epsilon_r = 54.65$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Left Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(9.64, 9.64, 9.64); Calibrated: 1/23/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn536; Calibrated: 10/9/2017
- 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 (7417)

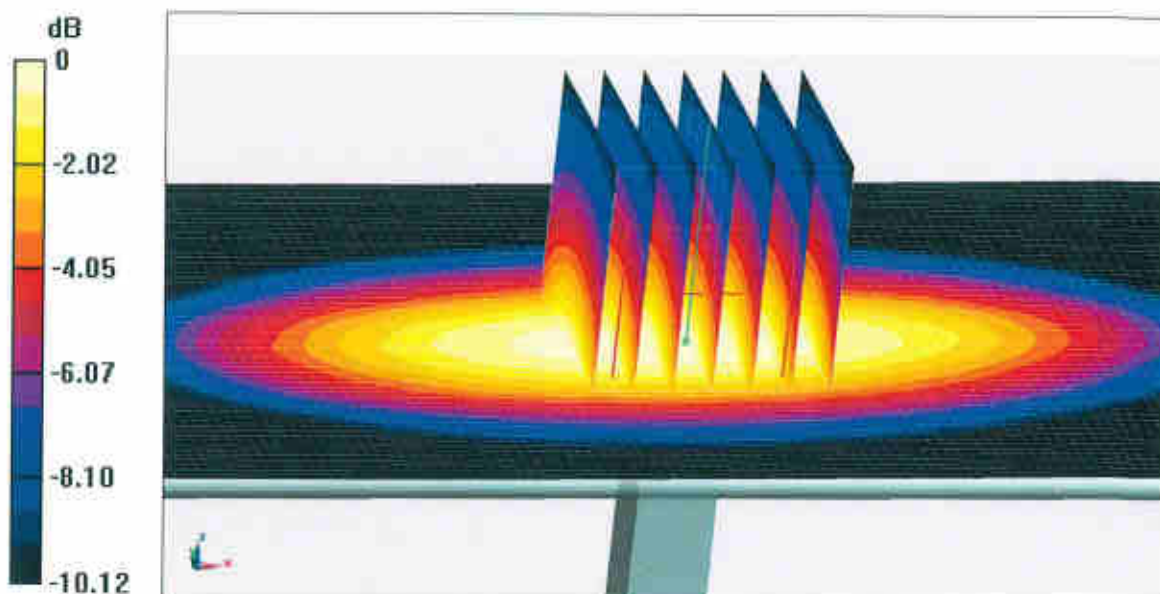
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.88 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 3.59 W/kg

**SAR(1 g) = 2.42 W/kg; SAR(10 g) = 1.6 W/kg**

Maximum value of SAR (measured) = 3.20 W/kg

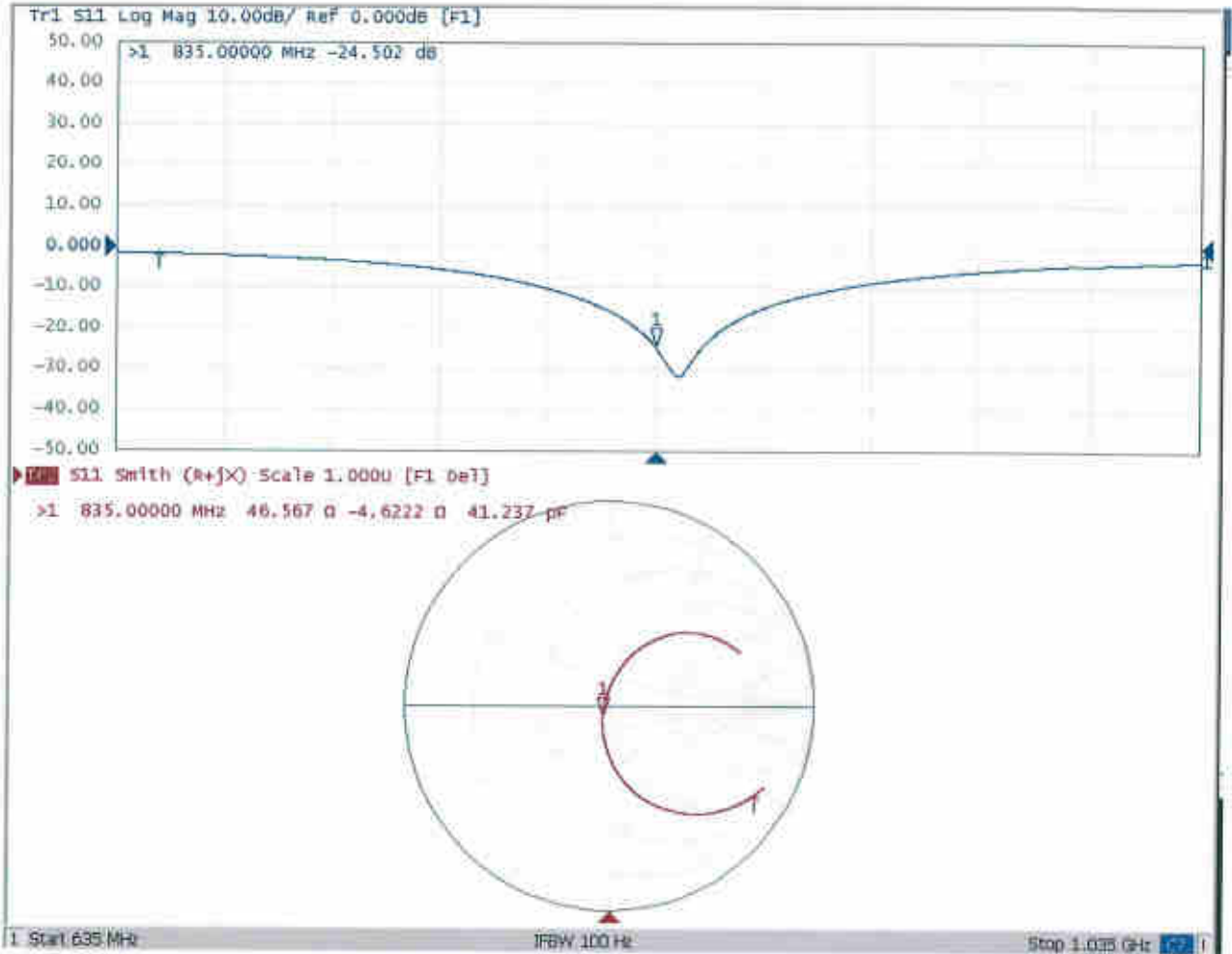


**0 dB = 3.20 W/kg = 5.05 dBW/kg**



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### Impedance Measurement Plot for Body TSL





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Client

**Sporton**

Certificate No:

**Z17-97260**

## CALIBRATION CERTIFICATE

Object: D1750V2 - SN: 1069

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

Calibration date: December 5, 2017

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements(SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)°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 NRVD	102196	02-Mar-17 (CTTL, No.J17X01254)	Mar-18
Power sensor NRV-Z5	100596	02-Mar-17 (CTTL, No.J17X01254)	Mar-18
Reference Probe EX3DV4	SN 3617	23-Jan-17(SPEAG,No.EX3-3617_Jan17)	Jan-18
DAE3	SN 536	09-Oct-17(CTTL-SPEAG,No.Z17-97198)	Oct-18
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	13-Jan-17 (CTTL, No.J17X00286)	Jan-18
Network Analyzer E5071C	MY46110673	13-Jan-17 (CTTL, No.J17X00285)	Jan-18

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

Issued: December 9, 2017

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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%.



### Measurement Conditions

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

DASY Version	DASY52	52.10.0.1446
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	1750 MHz $\pm$ 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	39.5 $\pm$ 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 $cm^3$ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.31 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	37.0 mW / g $\pm$ 18.8 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	4.96 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	19.8 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	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	53.8 $\pm$ 6 %	1.47 mho/m $\pm$ 6 %
Body TSL temperature change during test	<1.0 °C	---	---

### SAR result with Body TSL

SAR averaged over 1 $cm^3$ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.40 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	38.0 mW / g $\pm$ 18.8 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.03 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	20.3 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	49.3Ω+ 1.19 jΩ
Return Loss	- 37.2 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.3Ω+ 0.51 jΩ
Return Loss	- 26.0 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.084 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: 12.05.2017

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1069**

Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 1750$  MHz;  $\sigma = 1.378$  S/m;  $\epsilon_r = 39.46$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Center Section

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

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3617; ConvF(8.49, 8.49, 8.49); Calibrated: 1/23/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn536; Calibrated: 10/9/2017
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/I
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

**System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:**

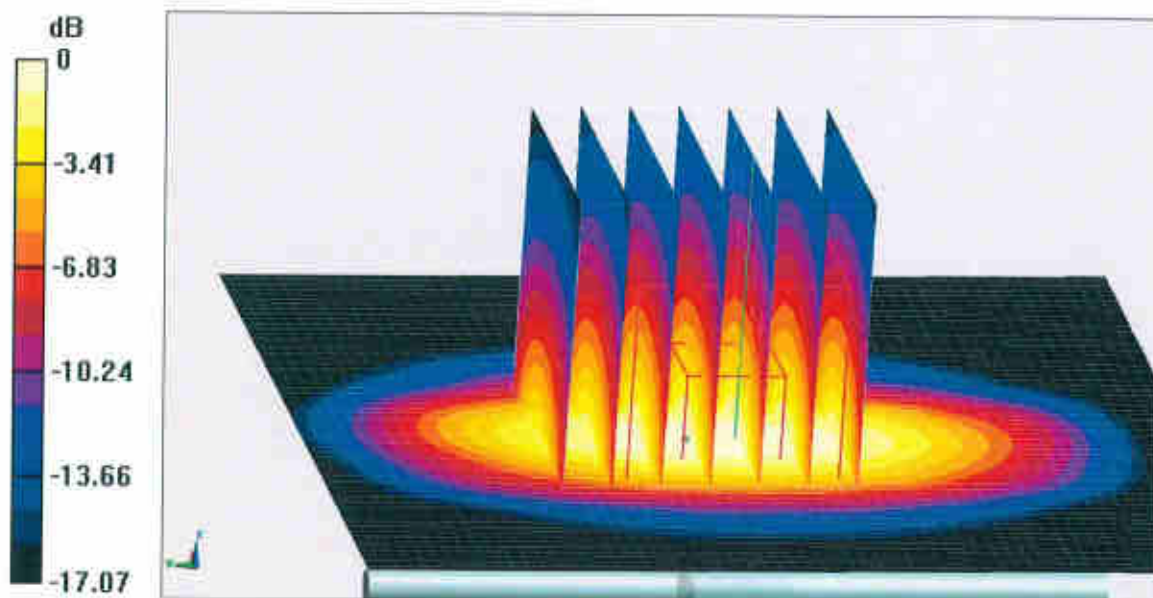
dx=5mm, dy=5mm, dz=5mm

Reference Value = 98.28 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 17.2 W/kg

**SAR(1 g) = 9.31 W/kg; SAR(10 g) = 4.96 W/kg**

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

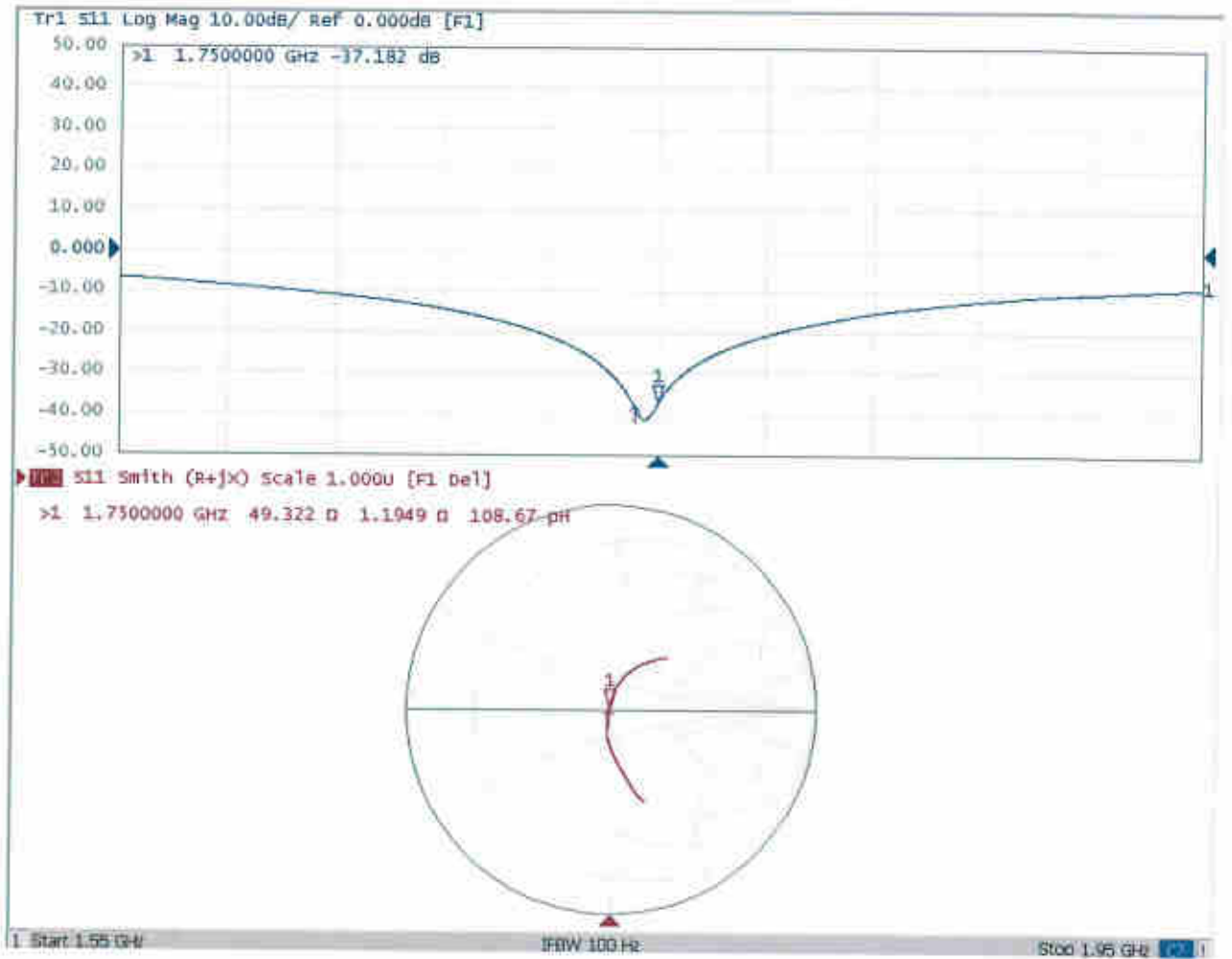
**0 dB = 14.3 W/kg = 11.55 dBW/kg**





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### Impedance Measurement Plot for Head TSL





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### DASY5 Validation Report for Body TSL

Date: 12.05.2017

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1069**

Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 1750$  MHz;  $\sigma = 1.469$  S/m;  $\epsilon_r = 53.75$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Left Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(8.21, 8.21, 8.21); Calibrated: 1/23/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn536; Calibrated: 10/9/2017
- 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 (7417)

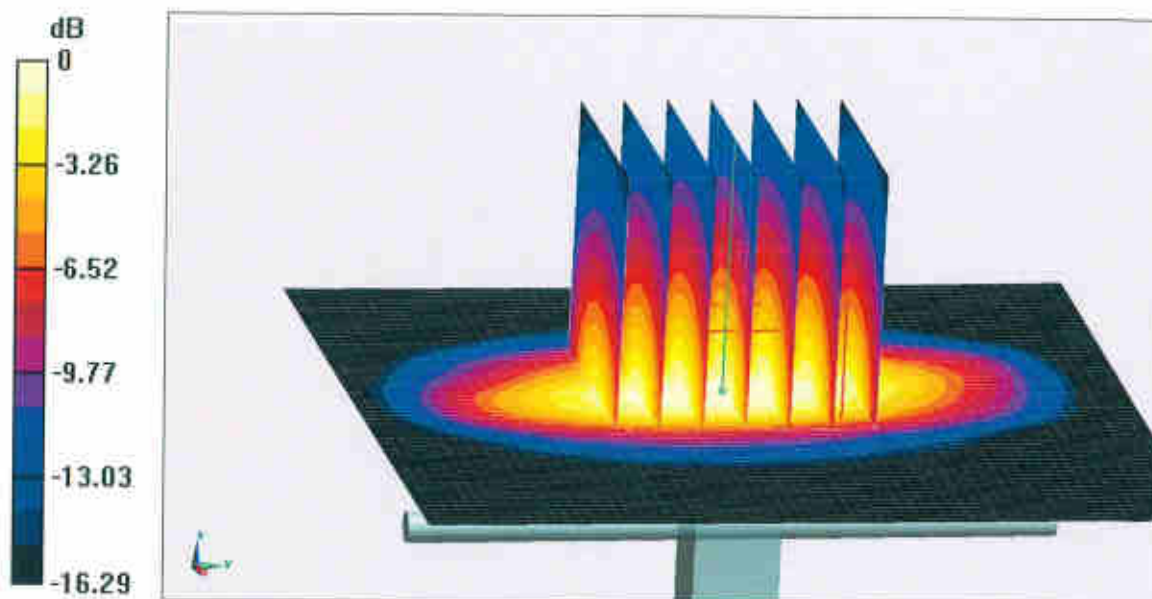
**System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid:  
dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.22 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 16.8 W/kg

**SAR(1 g) = 9.4 W/kg; SAR(10 g) = 5.03 W/kg**

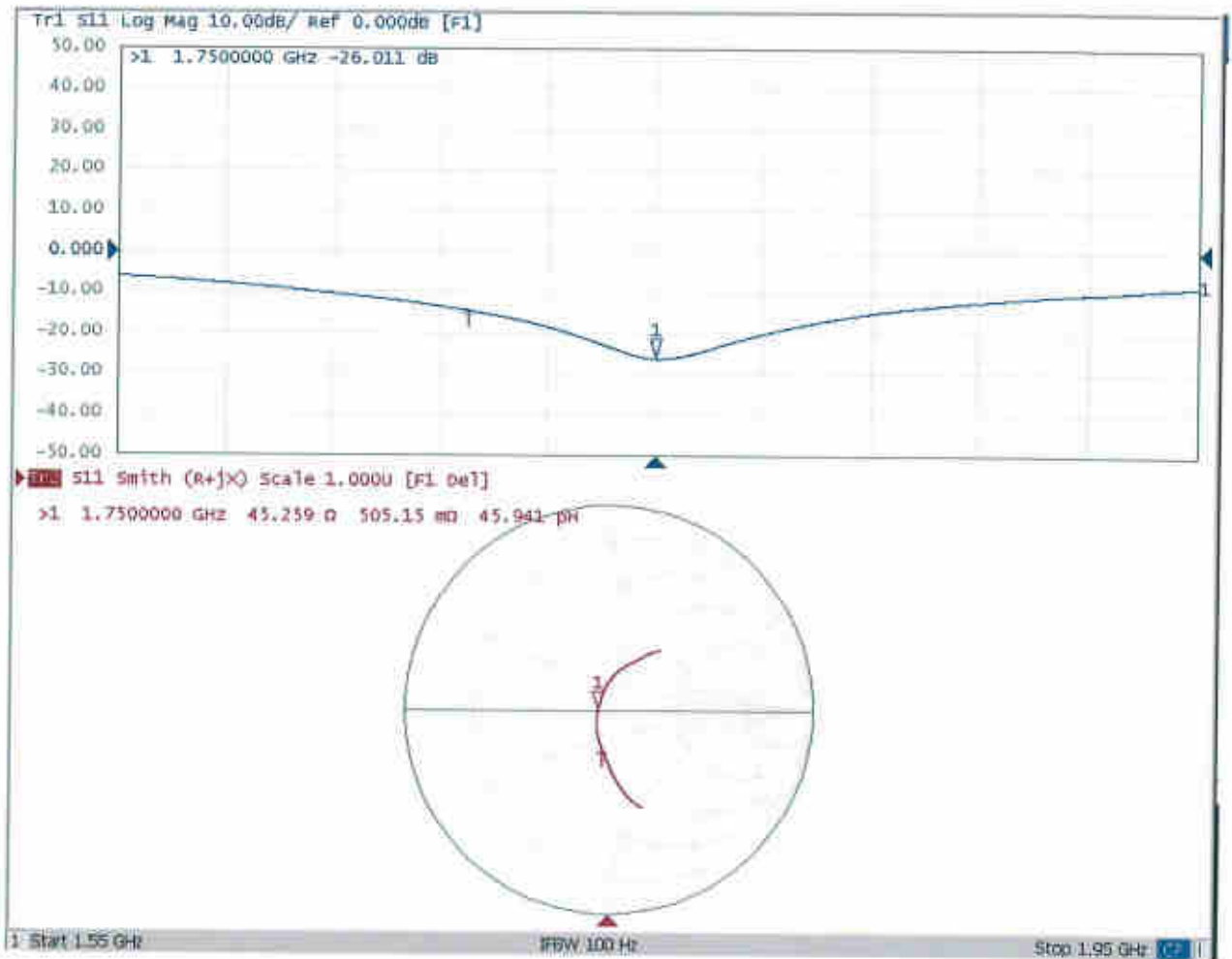
Maximum value of SAR (measured) = 14.3 W/kg





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### Impedance Measurement Plot for Body TSL





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Client

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Certificate No:

**Z17-97262**

## CALIBRATION CERTIFICATE

Object: D1900V2 - SN: 5d118

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

Calibration date: December 6, 2017

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements(SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)°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 NRVD	102196	02-Mar-17 (CTTL, No.J17X01254)	Mar-18
Power sensor NRV-Z5	100596	02-Mar-17 (CTTL, No.J17X01254)	Mar-18
Reference Probe EX3DV4	SN 3617	23-Jan-17(SPEAG,No.EX3-3617_Jan17)	Jan-18
DAE3	SN 536	09-Oct-17(CTTL-SPEAG,No.Z17-97198)	Oct-18
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	13-Jan-17 (CTTL, No.J17X00286)	Jan-18
Network Analyzer E5071C	MY46110673	13-Jan-17 (CTTL, No.J17X00285)	Jan-18

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

Issued: December 10, 2017

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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	52.10.0.1446
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 ± 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 ± 0.2) °C	39.4 ± 6 %	1.41 mho/m ± 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	10.0 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	39.7 mW / g ± 18.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.19 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	20.7 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	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.9 ± 6 %	1.54 mho/m ± 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	10.2 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	40.4 mW / g ± 18.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.30 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	21.1 mW / g ± 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	50.0Ω+ 6.60jΩ
Return Loss	- 23.6dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.6Ω+ 6.11jΩ
Return Loss	- 22.8dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.067 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: 12.06.2017

Test Laboratory: CCTL, Beijing, China

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d118**

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

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.409$  S/m;  $\epsilon_r = 39.36$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Center Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(8.26, 8.26, 8.26); Calibrated: 1/23/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn536; Calibrated: 10/9/2017
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/I
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

**System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:**

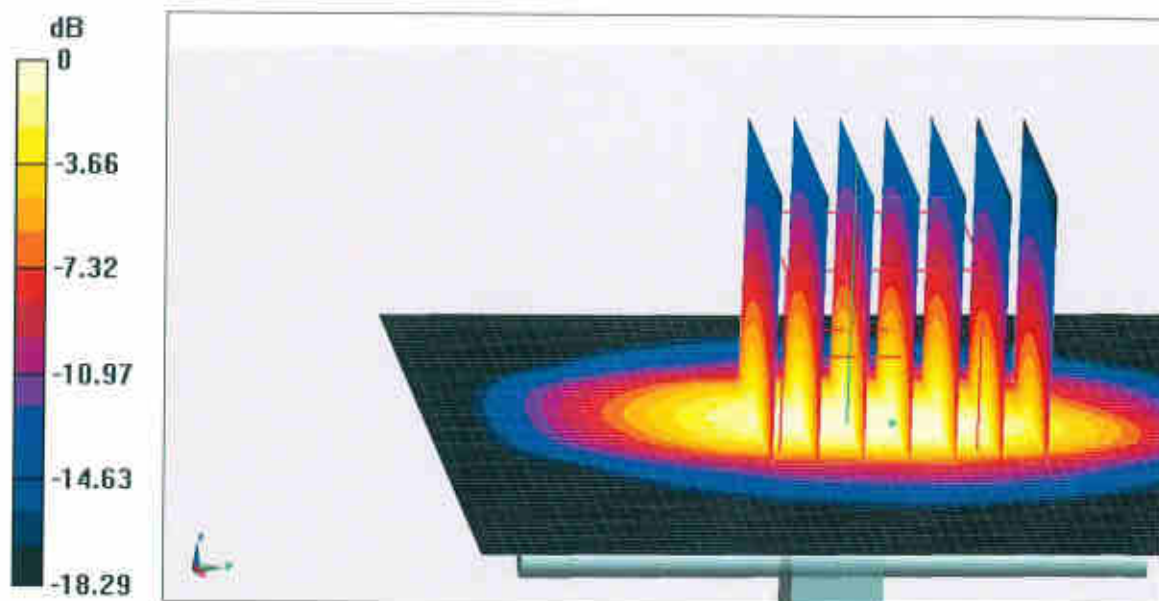
$dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 101.5 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 19.1 W/kg

**SAR(1 g) = 10 W/kg; SAR(10 g) = 5.19 W/kg**

Maximum value of SAR (measured) = 15.6 W/kg



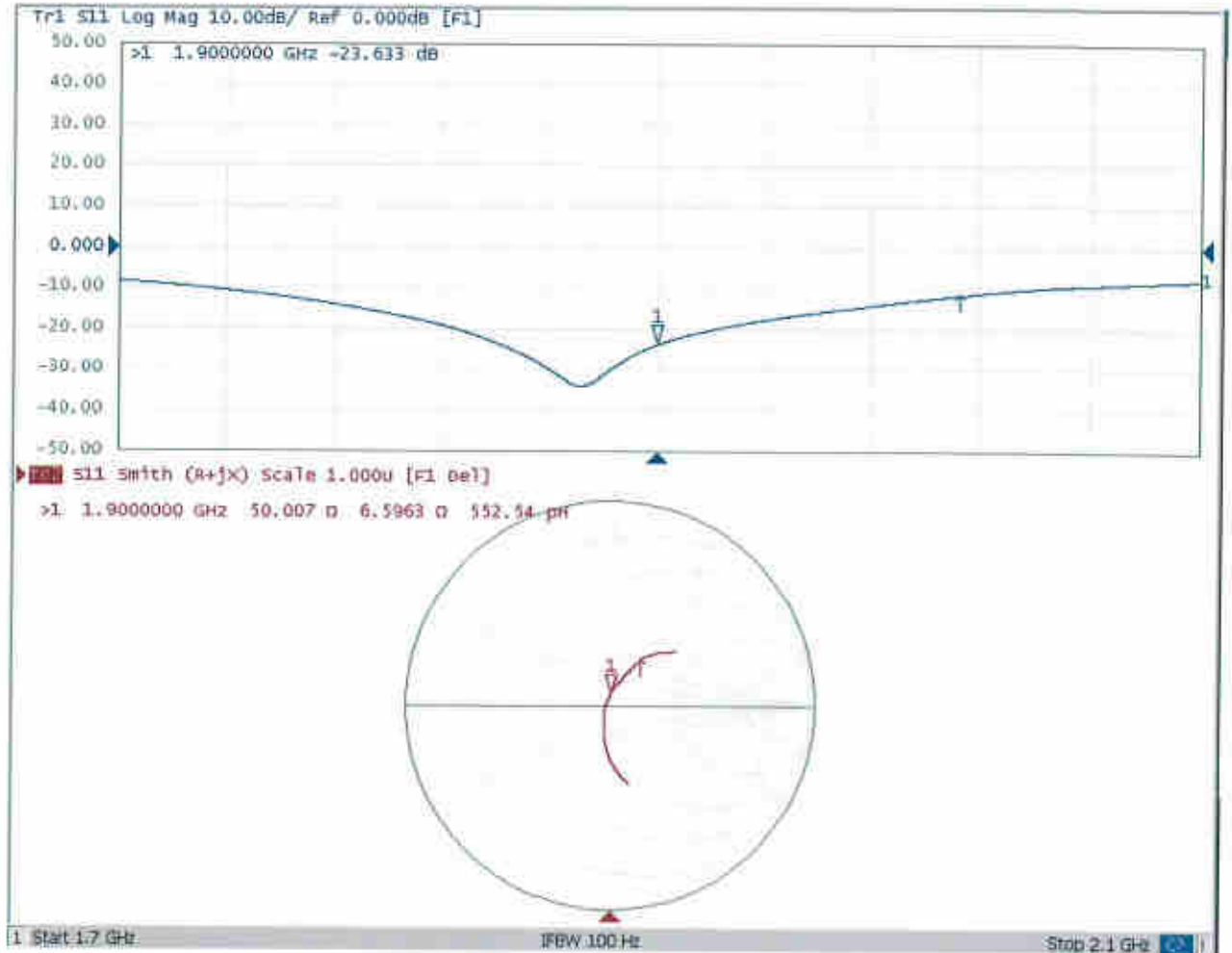
**0 dB = 15.6 W/kg = 11.93 dBW/kg**





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### Impedance Measurement Plot for Head TSL





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### DASY5 Validation Report for Body TSL

Date: 12.06.2017

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d118**

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

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.542$  S/m;  $\epsilon_r = 52.89$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Left Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(7.95, 7.95, 7.95); Calibrated: 1/23/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn536; Calibrated: 10/9/2017
- 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 (7417)

**System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:**

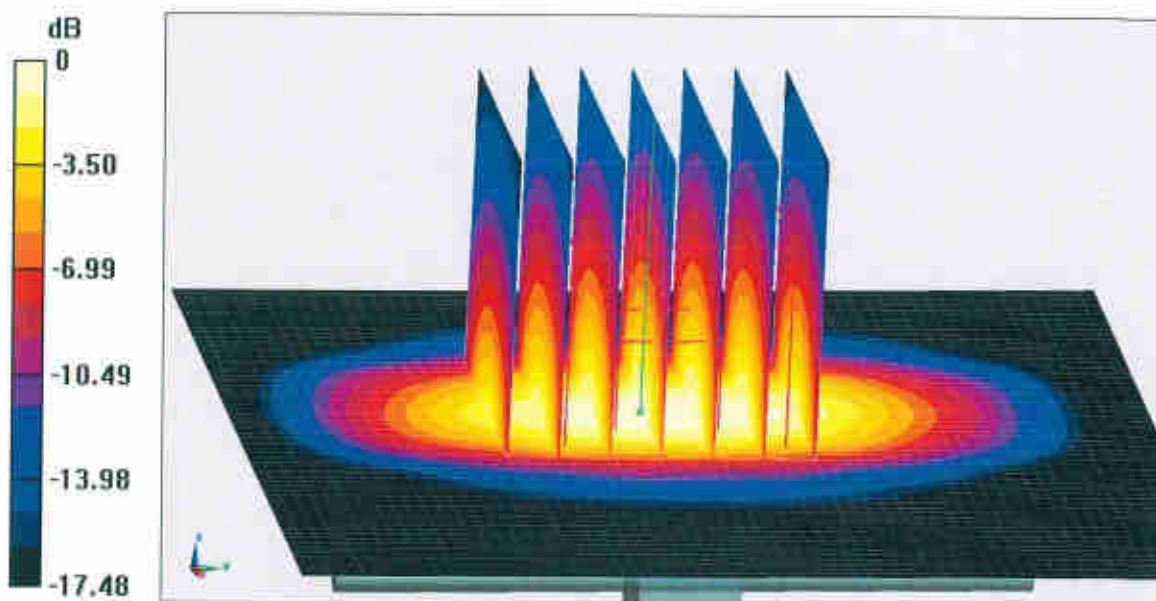
$dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 96.27 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 18.5 W/kg

SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.3 W/kg

Maximum value of SAR (measured) = 15.5 W/kg

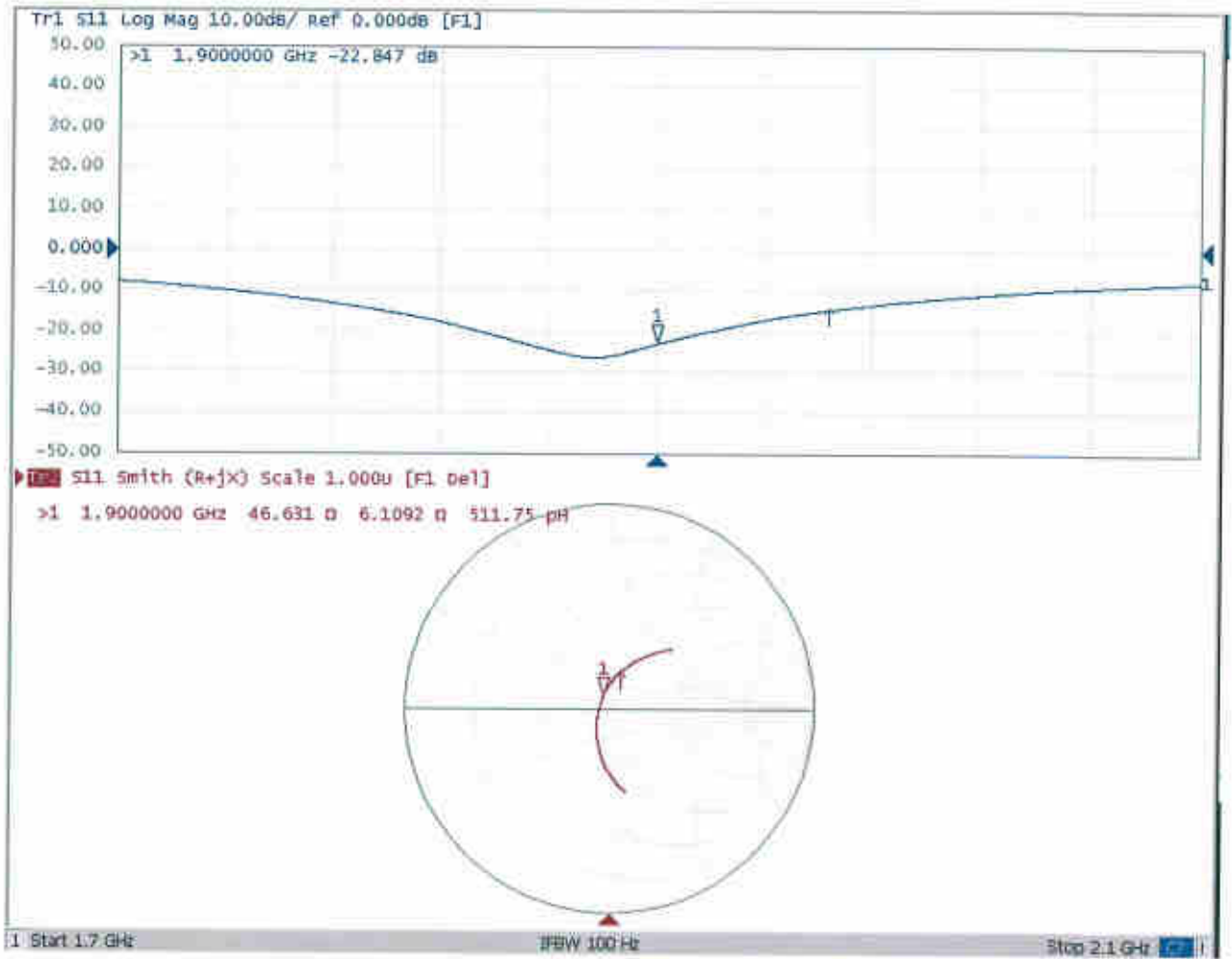


0 dB = 15.5 W/kg = 11.90 dBW/kg



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### Impedance Measurement Plot for Body TSL





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Client

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Certificate No:

**Z17-97263**

## CALIBRATION CERTIFICATE

Object: D2450V2 - SN: 840

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

Calibration date: December 7, 2017

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements(SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)°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 NRVD	102196	02-Mar-17 (CTTL, No.J17X01254)	Mar-18
Power sensor NRV-Z5	100596	02-Mar-17 (CTTL, No.J17X01254)	Mar-18
Reference Probe EX3DV4	SN 3617	23-Jan-17(SPEAG,No.EX3-3617_Jan17)	Jan-18
DAE3	SN 536	09-Oct-17(CTTL-SPEAG,No.Z17-97198)	Oct-18
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	13-Jan-17 (CTTL, No.J17X00286)	Jan-18
Network Analyzer E5071C	MY46110673	13-Jan-17 (CTTL, No.J17X00285)	Jan-18

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

Issued: December 10, 2017

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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	52.10.0.1446
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	2450 MHz ± 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.8 ± 6 %	1.83 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	---	---

### SAR result with Head TSL

SAR averaged over 1 $cm^3$ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.2 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	52.6 mW / g ± 18.8 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.14 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	24.5 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	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.5 ± 6 %	1.93 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	12.9 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	51.9 mW / g ± 18.8 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.99 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	24.0 mW / g ± 18.7 % (k=2)



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

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.0Ω+ 4.51jΩ
Return Loss	- 26.3dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	51.1Ω+ 5.09jΩ
Return Loss	- 25.8dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.025 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: 12.06.2017

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 840**

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

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.826$  S/m;  $\epsilon_r = 39.84$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Center Section

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

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3617; ConvF(7.74, 7.74, 7.74); Calibrated: 1/23/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn536; Calibrated: 10/9/2017
- 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 (7417)

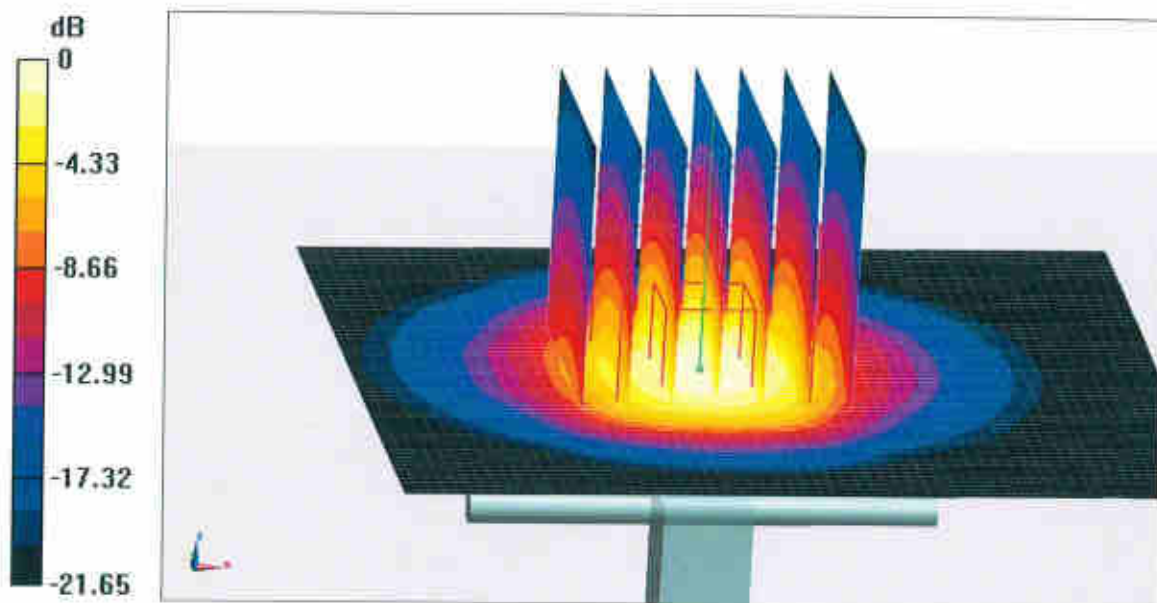
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 106.0 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 27.3 W/kg

**SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.14 W/kg**

Maximum value of SAR (measured) = 22.0 W/kg



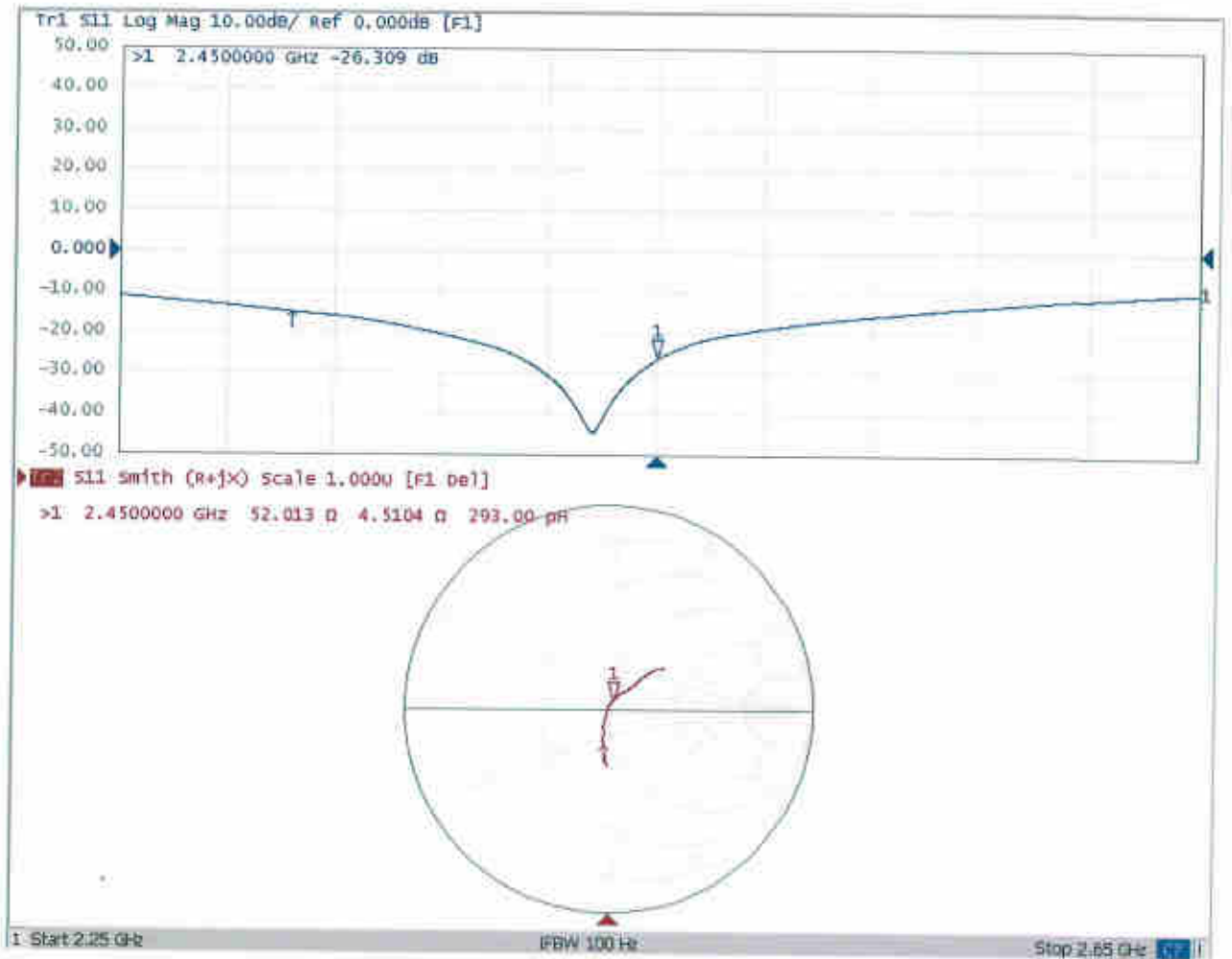
**0 dB = 22.0 W/kg = 13.42 dBW/kg**





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### Impedance Measurement Plot for Head TSL



### DASY5 Validation Report for Body TSL

Date: 12.07.2017

Test Laboratory: CTTL, Beijing, China

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 840**

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

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.926$  S/m;  $\epsilon_r = 52.48$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Left Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(7.8, 7.8, 7.8); Calibrated: 1/23/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn536; Calibrated: 10/9/2017
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/I
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

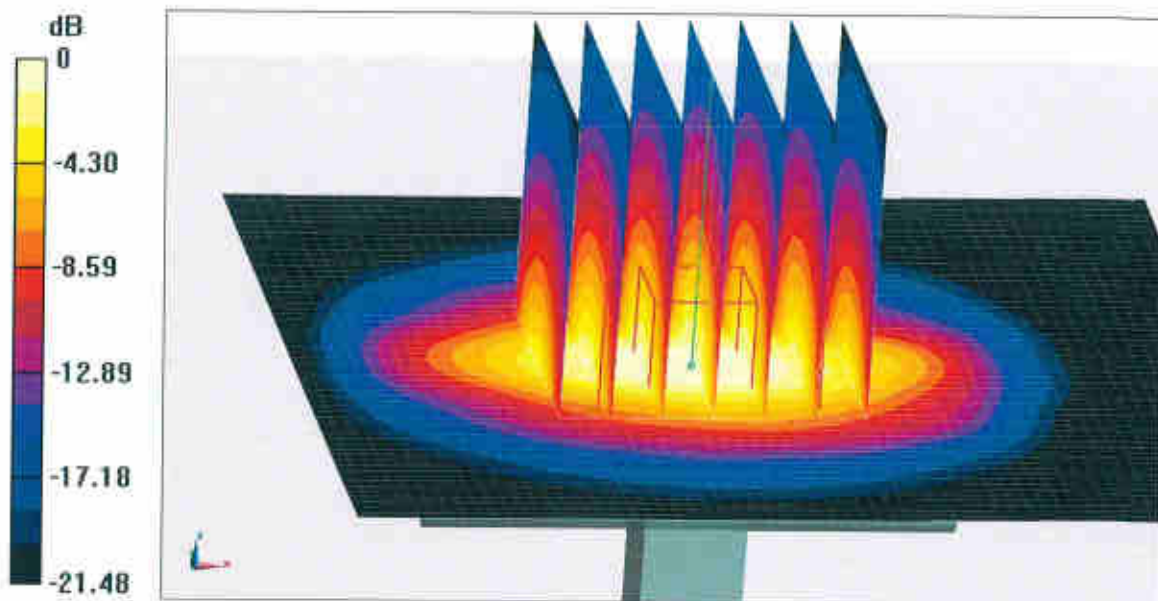
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm**

Reference Value = 99.77 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 26.8 W/kg

**SAR(1 g) = 12.9 W/kg; SAR(10 g) = 5.99 W/kg**

Maximum value of SAR (measured) = 21.7 W/kg

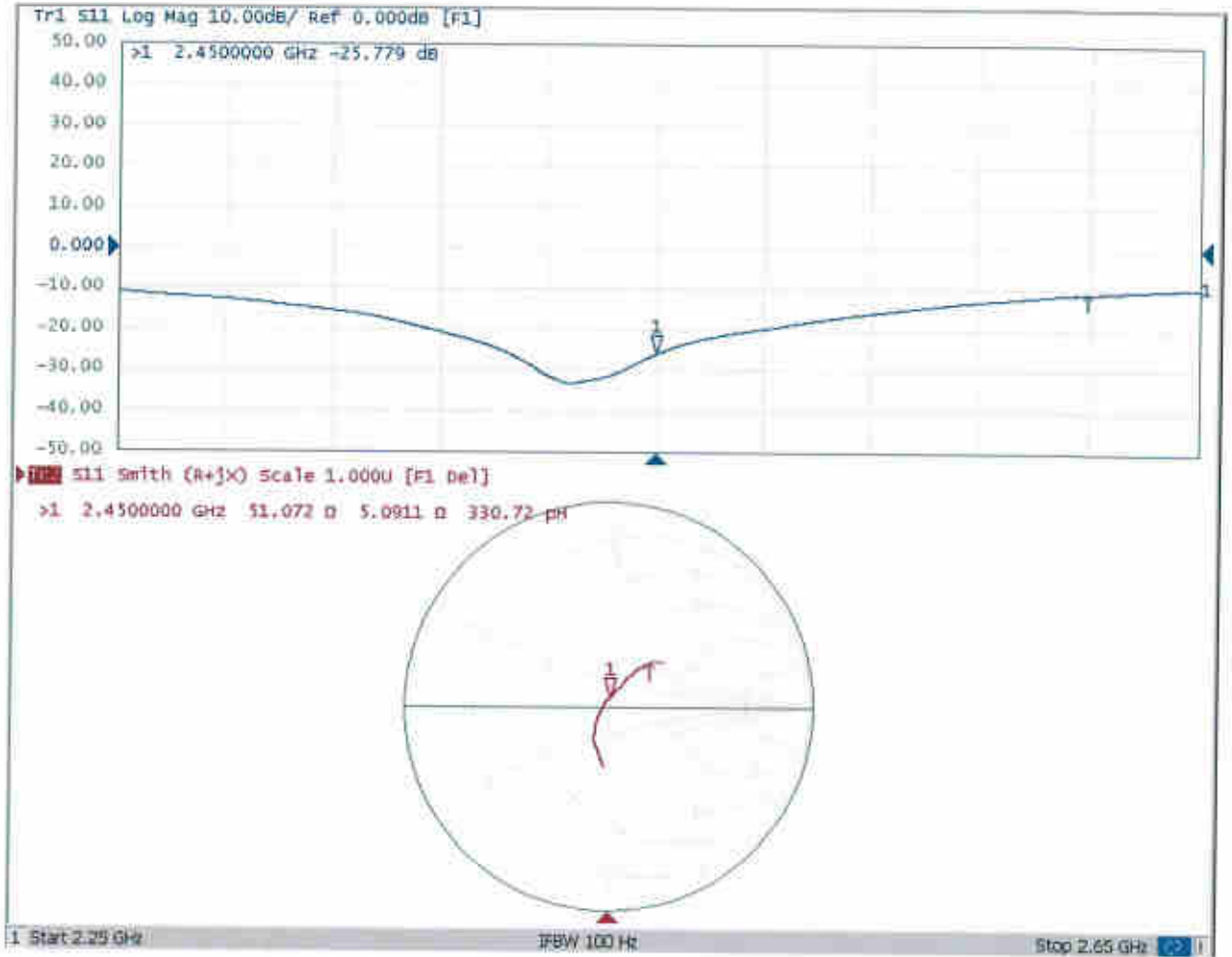


**0 dB = 21.7 W/kg = 13.36 dBW/kg**



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### Impedance Measurement Plot for Body TSL





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Client

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Certificate No: **Z17-97255**

## CALIBRATION CERTIFICATE

Object: **D2600V2 - SN: 1061**

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

Calibration date: **December 7, 2017**

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements(SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)°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 NRVD	102196	02-Mar-17 (CTTL, No.J17X01254)	Mar-18
Power sensor NRV-Z5	100596	02-Mar-17 (CTTL, No.J17X01254)	Mar-18
Reference Probe EX3DV4	SN 3617	23-Jan-17(SPEAG,No.EX3-3617_Jan17)	Jan-18
DAE3	SN 536	09-Oct-17(CTTL-SPEAG,No.Z17-97198)	Oct-18
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	13-Jan-17 (CTTL, No.J17X00286)	Jan-18
Network Analyzer E5071C	MY46110673	13-Jan-17 (CTTL, No.J17X00285)	Jan-18

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

Issued: December 10, 2017

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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%.



### Measurement Conditions

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

DASY Version	DASY52	52.10.0.1446
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	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	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	39.4 $\pm$ 6 %	1.99 mho/m $\pm$ 6 %
Head TSL temperature change during test	<1.0 °C	---	---

### SAR result with Head TSL

SAR averaged over 1 $cm^3$ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.6 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	58.2 mW / g $\pm$ 18.8 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.50 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	26.0 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	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	52.6 $\pm$ 6 %	2.13 mho/m $\pm$ 6 %
Body TSL temperature change during test	<1.0 °C	---	---

### SAR result with Body TSL

SAR averaged over 1 $cm^3$ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	14.0 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	56.4 mW / g $\pm$ 18.8 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	6.23 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	25.0 mW / g $\pm$ 18.7 % (k=2)



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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	49.4Ω- 6.08jΩ
Return Loss	- 24.3dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.2Ω- 5.19jΩ
Return Loss	- 23.5dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.013 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: 12.07.2017

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;  $\sigma = 1.985$  S/m;  $\epsilon_r = 39.42$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Center Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(7.3, 7.3, 7.3); Calibrated: 1/23/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn536; Calibrated: 10/9/2017
- 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 (7417)

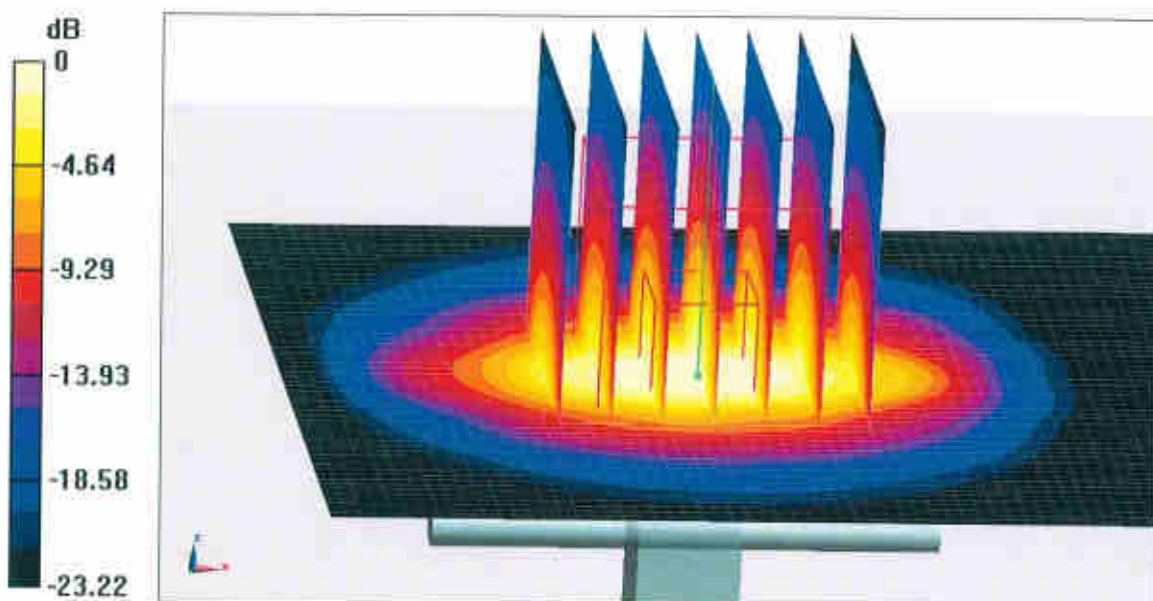
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm**

Reference Value = 107.7 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 31.5 W/kg

**SAR(1 g) = 14.6 W/kg; SAR(10 g) = 6.5 W/kg**

Maximum value of SAR (measured) = 25.1 W/kg



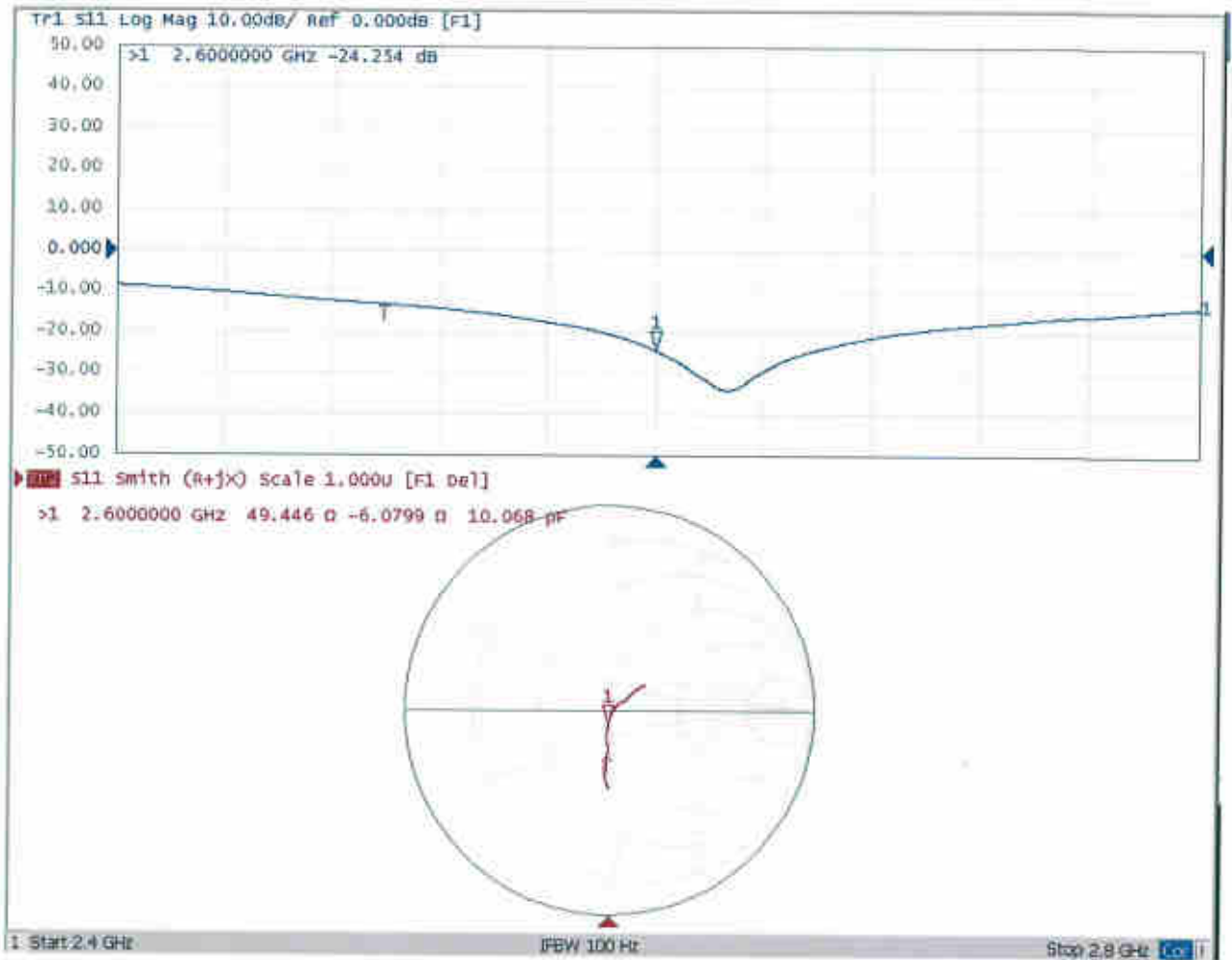
**0 dB = 25.1 W/kg = 14.00 dBW/kg**





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### Impedance Measurement Plot for Head TSL



### DASY5 Validation Report for Body TSL

Date: 12.07.2017

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;  $\sigma = 2.127$  S/m;  $\epsilon_r = 52.63$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Left Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(7.48, 7.48, 7.48); Calibrated: 1/23/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn536; Calibrated: 10/9/2017
- 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 (7417)

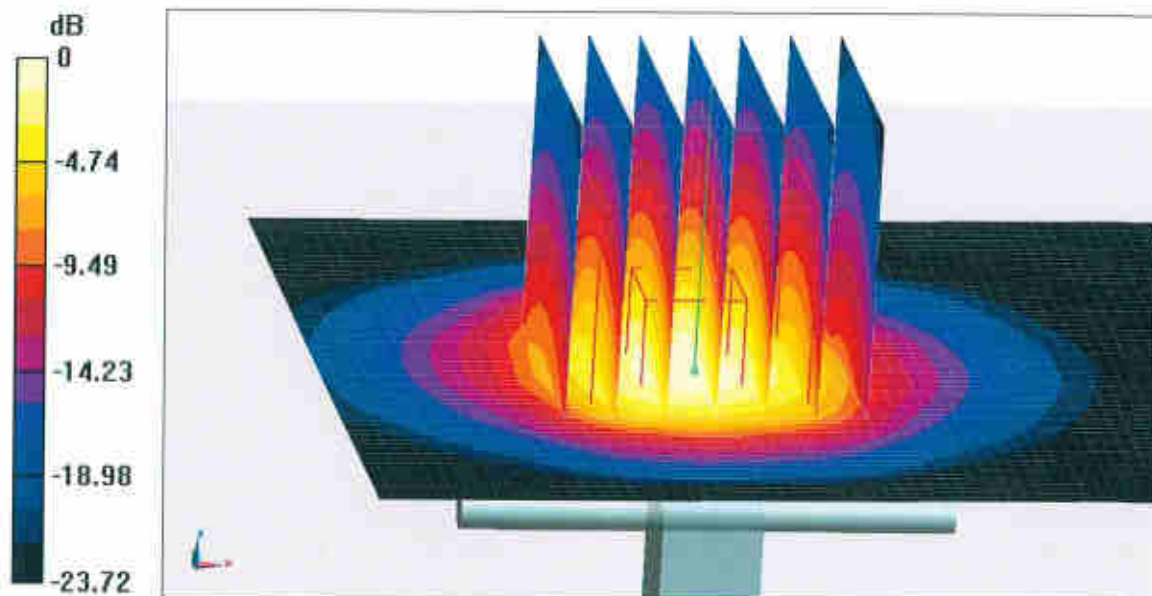
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm**

Reference Value = 96.43 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 30.0 W/kg

**SAR(1 g) = 14 W/kg; SAR(10 g) = 6.23 W/kg**

Maximum value of SAR (measured) = 23.8 W/kg

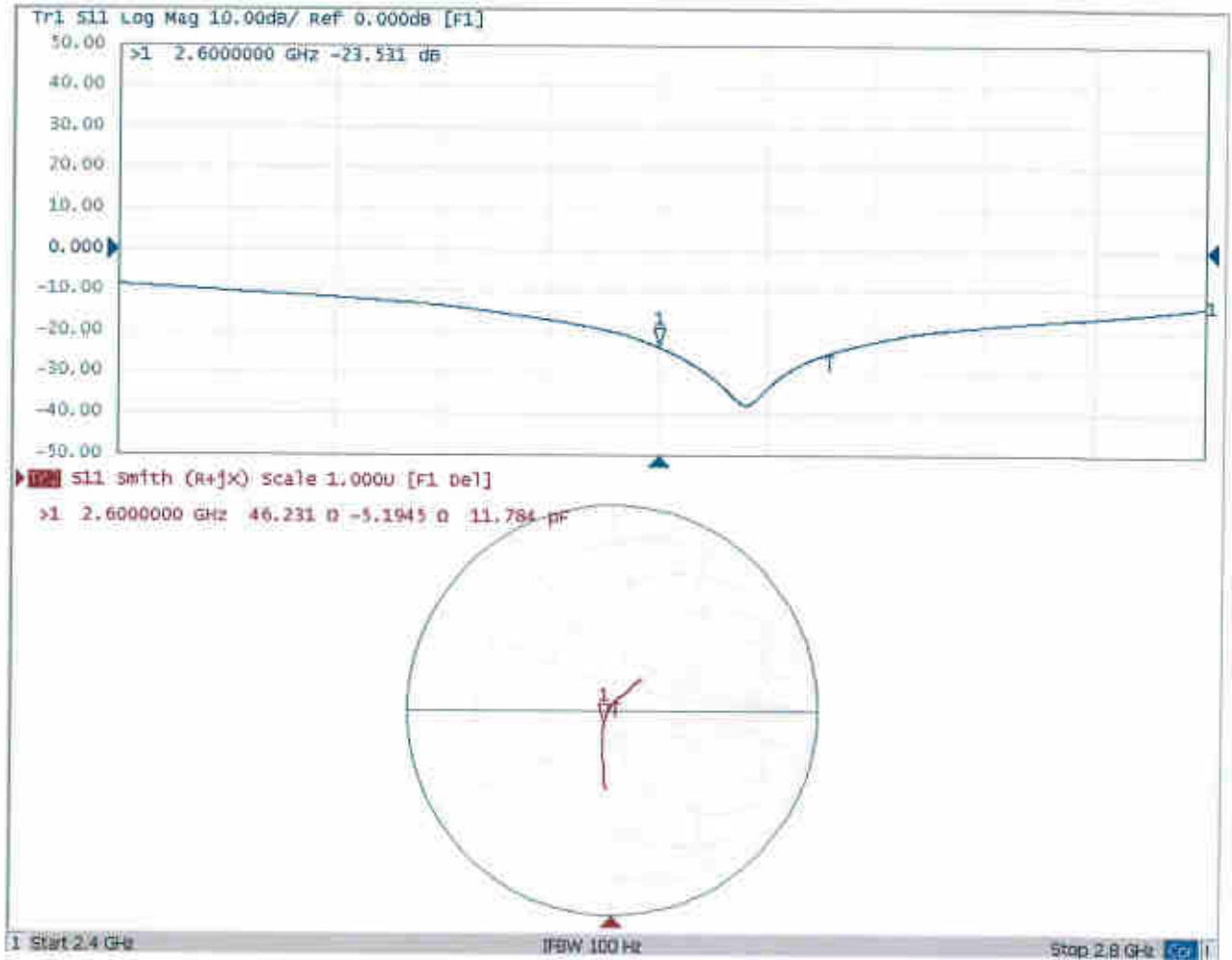


**0 dB = 23.8 W/kg = 13.77 dBW/kg**



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### Impedance Measurement Plot for Body TSL





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**

Client **Sporton (Auden)**

Certificate No: **D5GHzV2-1006\_Sep17**

## CALIBRATION CERTIFICATE

Object **D5GHzV2 - SN:1006**

Calibration procedure(s) **QA CAL-22.v2  
Calibration procedure for dipole validation kits between 3-6 GHz**

Calibration date: **September 26, 2017**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).  
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-17 (No. 217-02521/02522)	Apr-18
Power sensor NRP-Z91	SN: 103244	04-Apr-17 (No. 217-02521)	Apr-18
Power sensor NRP-Z91	SN: 103245	04-Apr-17 (No. 217-02522)	Apr-18
Reference 20 dB Attenuator	SN: 5058 (20k)	07-Apr-17 (No. 217-02528)	Apr-18
Type-N mismatch combination	SN: 5047.2 / 06327	07-Apr-17 (No. 217-02529)	Apr-18
Reference Probe EX3DV4	SN: 3503	31-Dec-16 (No. EX3-3503_Dec16)	Dec-17
DAE4	SN: 601	28-Mar-17 (No. DAE4-601_Mar17)	Mar-18

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-16 (No. 217-02222)	In house check: Oct-18
Power sensor HP 8481A	SN: US37292783	07-Oct-16 (No. 217-02222)	In house check: Oct-18
Power sensor HP 8481A	SN: MY41092317	07-Oct-16 (No. 217-02223)	In house check: Oct-18
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-16)	In house check: Oct-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-16)	In house check: Oct-17

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: September 26, 2017

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



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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, "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
- 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	V52.10.0
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 5600 MHz ± 1 MHz 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	36.7 ± 6 %	4.59 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	7.80 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	78.3 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	2.24 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.5 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	36.2 ± 6 %	4.95 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	8.48 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	85.0 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	2.42 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.3 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	36.0 ± 6 %	5.12 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	7.83 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>78.5 W/kg ± 19.9 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.22 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>22.3 W/kg ± 19.5 % (k=2)</b>

### 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 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.0 ± 6 %	5.49 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

### SAR result with Body TSL at 5250 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.76 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>77.0 W/kg ± 19.9 % (k=2)</b>

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	<b>21.3 W/kg ± 19.5 % (k=2)</b>

### 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	46.4 ± 6 %	5.96 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	8.07 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>80.1 W/kg ± 19.9 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.26 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>22.4 W/kg ± 19.5 % (k=2)</b>



### 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	46.1 ± 6 %	6.17 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 <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.57 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>75.1 W/kg ± 19.9 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.10 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>20.8 W/kg ± 19.5 % (k=2)</b>

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

### Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	53.8 $\Omega$ - 8.4 j $\Omega$
Return Loss	- 21.0 dB

### Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	55.8 $\Omega$ - 6.9 j $\Omega$
Return Loss	- 21.4 dB

### Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	60.0 $\Omega$ + 3.9 j $\Omega$
Return Loss	- 20.2 dB

### Antenna Parameters with Body TSL at 5250 MHz

Impedance, transformed to feed point	54.1 $\Omega$ - 5.2 j $\Omega$
Return Loss	- 24.0 dB

### Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	58.5 $\Omega$ - 4.8 j $\Omega$
Return Loss	- 20.9 dB

### Antenna Parameters with Body TSL at 5750 MHz

Impedance, transformed to feed point	59.8 $\Omega$ + 5.6 j $\Omega$
Return Loss	- 19.7 dB

## General Antenna Parameters and Design

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: 25.09.2017

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;  $\sigma = 4.59$  S/m;  $\epsilon_r = 36.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>,  
Medium parameters used:  $f = 5600$  MHz;  $\sigma = 4.95$  S/m;  $\epsilon_r = 36.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>,  
Medium parameters used:  $f = 5750$  MHz;  $\sigma = 5.12$  S/m;  $\epsilon_r = 36$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Flat Section  
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.58, 5.58, 5.58); Calibrated: 31.12.2016, ConvF(5.09, 5.09, 5.09); Calibrated: 31.12.2016, ConvF(5.02, 5.02, 5.02); Calibrated: 31.12.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 28.03.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

**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 = 67.79 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 28.2 W/kg

**SAR(1 g) = 7.8 W/kg; SAR(10 g) = 2.24 W/kg**

Maximum value of SAR (measured) = 18.0 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 = 69.36 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 32.8 W/kg

**SAR(1 g) = 8.48 W/kg; SAR(10 g) = 2.42 W/kg**

Maximum value of SAR (measured) = 20.0 W/kg

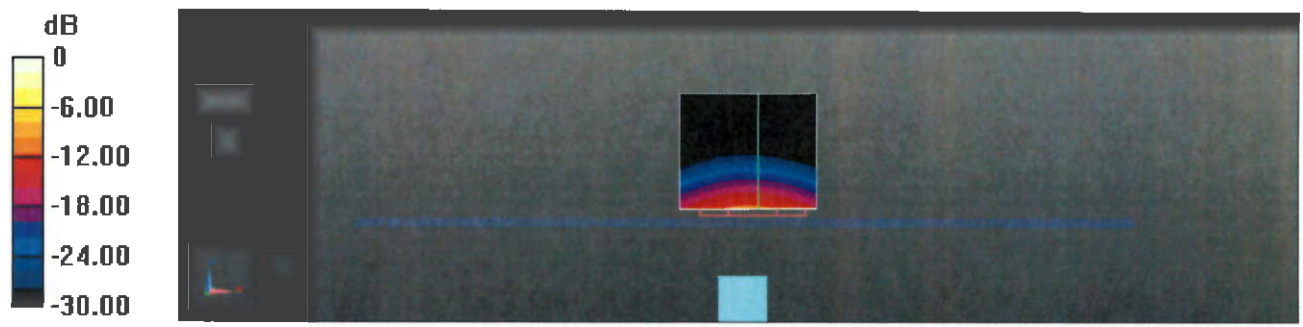
**Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 66.53 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 31.0 W/kg

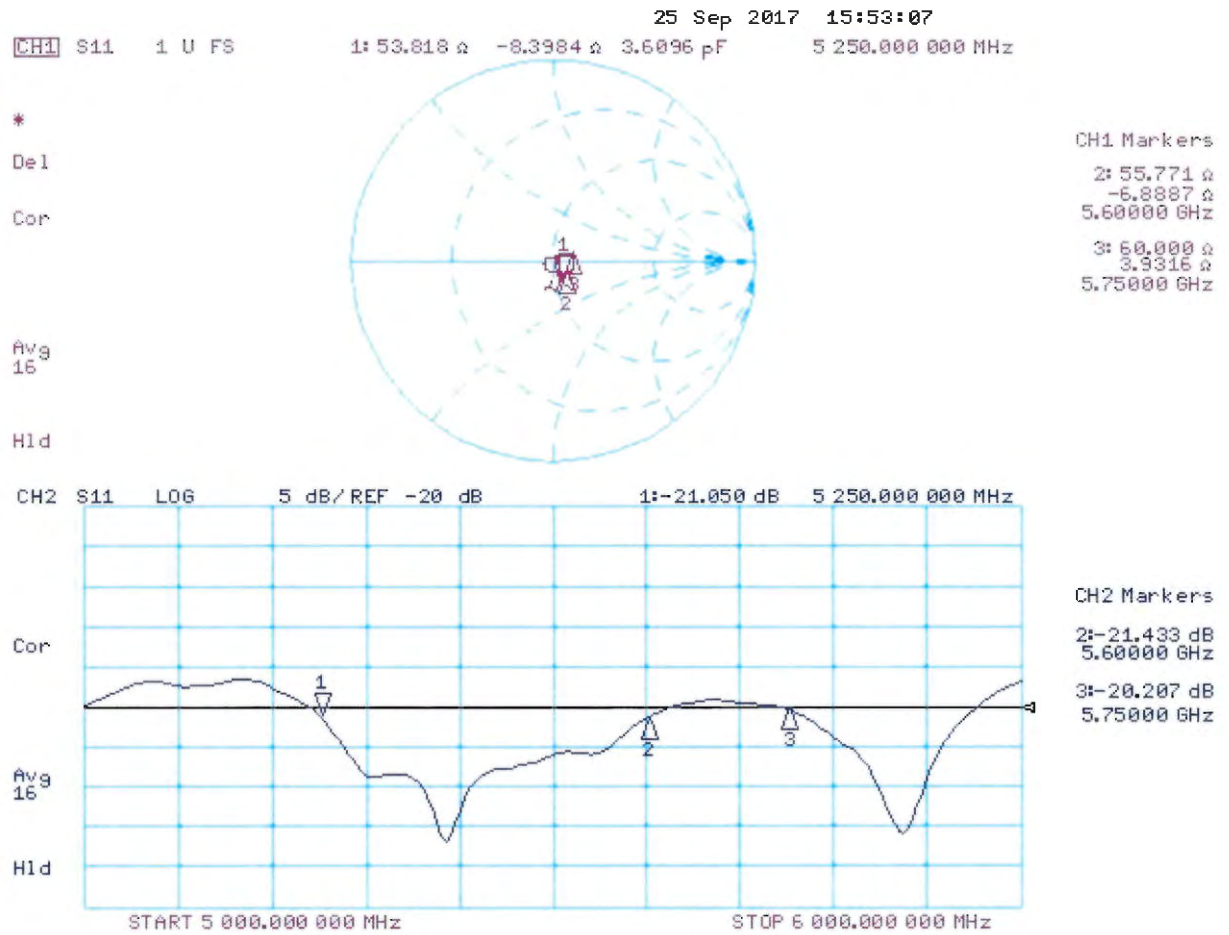
**SAR(1 g) = 7.83 W/kg; SAR(10 g) = 2.22 W/kg**

Maximum value of SAR (measured) = 18.7 W/kg



0 dB = 18.0 W/kg = 12.55 dBW/kg

# Impedance Measurement Plot for Head TSL



## DASY5 Validation Report for Body TSL

Date: 26.09.2017

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;  $\sigma = 5.49$  S/m;  $\epsilon_r = 47$ ;  $\rho = 1000$  kg/m<sup>3</sup>,

Medium parameters used:  $f = 5600$  MHz;  $\sigma = 5.96$  S/m;  $\epsilon_r = 46.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>,

Medium parameters used:  $f = 5750$  MHz;  $\sigma = 6.17$  S/m;  $\epsilon_r = 46.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.14, 5.14, 5.14); Calibrated: 31.12.2016, ConvF(4.57, 4.57, 4.57); Calibrated: 31.12.2016, ConvF(4.51, 4.51, 4.51); Calibrated: 31.12.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 28.03.2017
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

**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 = 64.96 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 30.6 W/kg

**SAR(1 g) = 7.76 W/kg; SAR(10 g) = 2.15 W/kg**

Maximum value of SAR (measured) = 18.7 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 = 64.94 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 34.0 W/kg

**SAR(1 g) = 8.07 W/kg; SAR(10 g) = 2.26 W/kg**

Maximum value of SAR (measured) = 19.9 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 = 61.76 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 33.5 W/kg

**SAR(1 g) = 7.57 W/kg; SAR(10 g) = 2.1 W/kg**

Maximum value of SAR (measured) = 18.9 W/kg