

Test Laboratory: CCIS

Date/Time: 07.22.2018 08:30:59

**DUT: LTE mobile phone; Type: N5501L; Serial: 1#**

Communication System: UID 0, LTE-Fdd(USA) 1RB QPSK (0); Frequency: 2535 MHz;  
 Duty Cycle: 1:1  
 Medium parameters used:  $f = 2535 \text{ MHz}$ ;  $\sigma = 1.966 \text{ S/m}$ ;  $\epsilon_r = 38.749$ ;  $\rho = 1000 \text{ kg/m}^3$   
 Phantom section: Right Section

DASY5 Configuration:

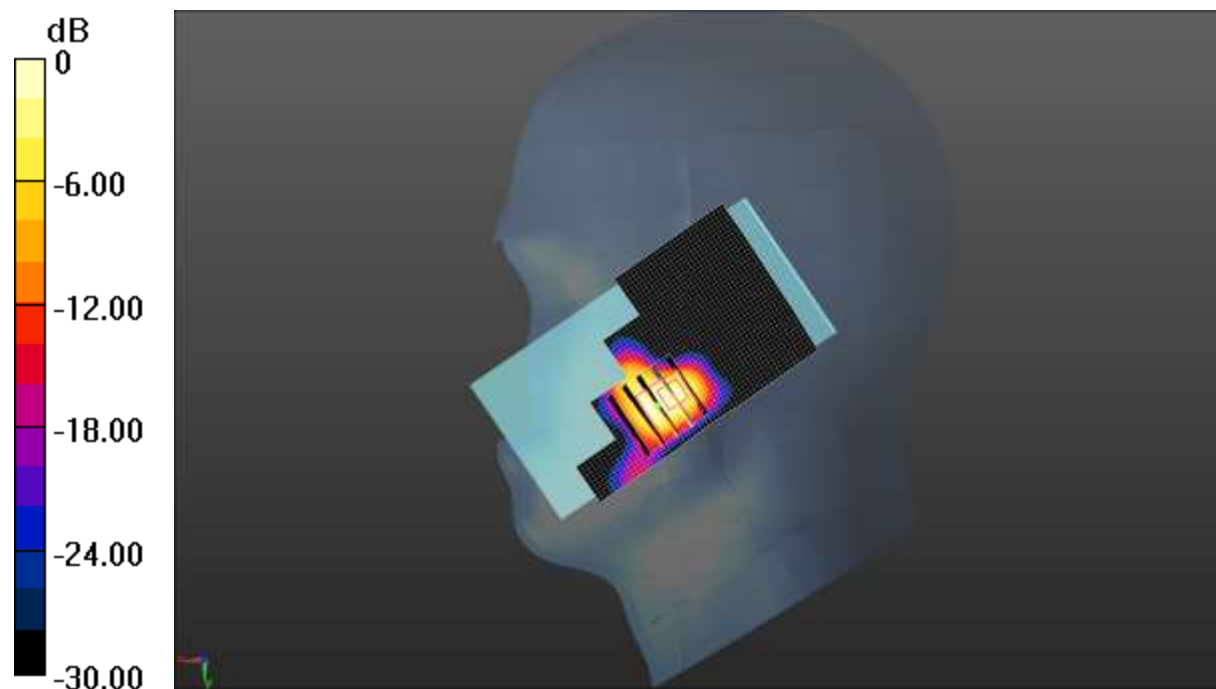
- Probe: EX3DV4 – SN7433; ConvF(7.34, 7.34, 7.34); Calibrated: 09.30.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03.22.2018
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**LTE Band 7 1RB(20MHz) Right Cheek/Middle Channel/Area Scan (41x61x1):**

Interpolated grid:  $dx=1.200 \text{ mm}$ ,  $dy=1.200 \text{ mm}$   
 Maximum value of SAR (interpolated) = 0.123 W/kg

**LTE Band 7 1RB(20MHz) Right Cheek/Middle Channel/Zoom Scan**

**(5x5x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$   
 Reference Value = 1.016 V/m; Power Drift = 0.16 dB  
 Peak SAR (extrapolated) = 0.201 W/kg  
**SAR(1 g) = 0.068 W/kg; SAR(10 g) = 0.035 W/kg**  
 Maximum value of SAR (measured) = 0.0816 W/kg



0 dB = 0.0816 W/kg = -10.88 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.28.2018 08:38:54

**DUT: LTE mobile phone; Type: N5501L; Serial: 1#**

Communication System: UID 0, LTE-Fdd(USA) 1RB QPSK (0); Frequency: 829 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 829$  MHz;  $\sigma = 0.891$  S/m;  $\epsilon_r = 41.487$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Left Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7433; ConvF(9.77, 9.77, 9.77); Calibrated: 09.30.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03.22.2018
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**LTE Band 5 1RB(10MHz) Left Cheek/Low Channel/Zoom Scan (5x5x7)/Cube**

**0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 6.665 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 0.345 W/kg

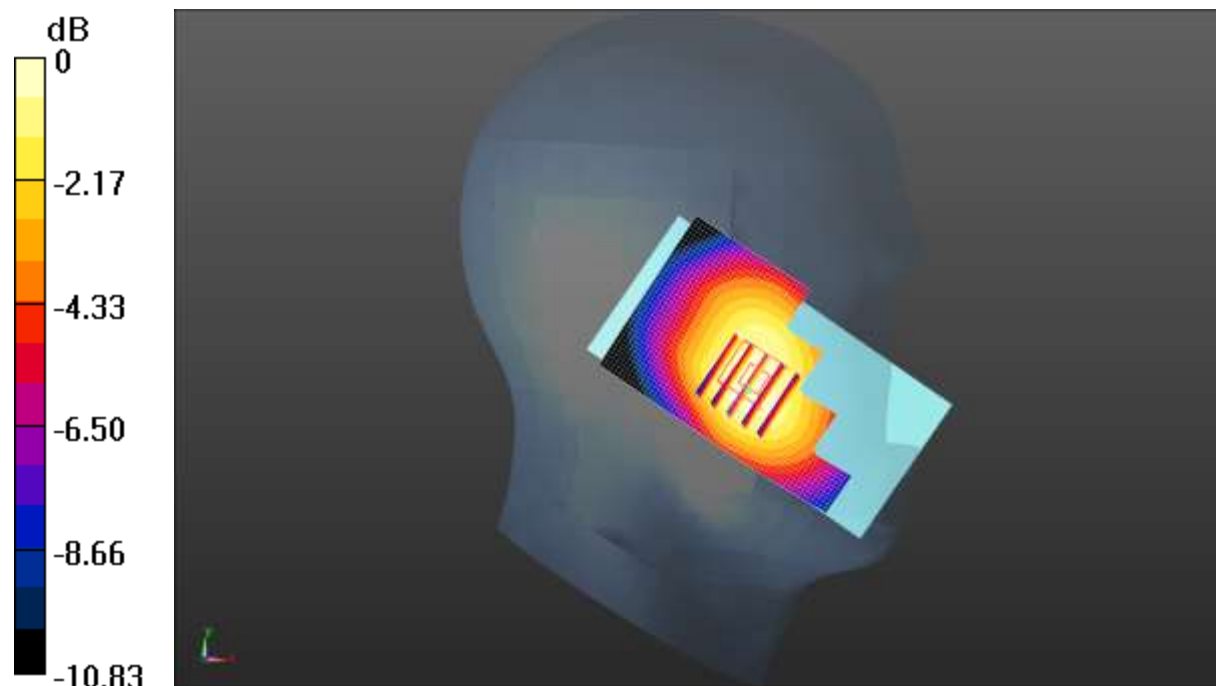
**SAR(1 g) = 0.255 W/kg; SAR(10 g) = 0.190 W/kg**

Maximum value of SAR (measured) = 0.312 W/kg

**LTE Band 5 1RB(10MHz) Left Cheek/Low Channel/Area Scan (41x61x1):**

Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.323 W/kg



0 dB = 0.323 W/kg = -4.91 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.28.2018 16:20:32

**DUT: LTE mobile phone; Type: N5501L; Serial: 1#**

Communication System: UID 0, LTE-Fdd(USA) 1RB QPSK (0); Frequency: 707.5 MHz;

Duty Cycle: 1:1

Medium parameters used:  $f = 707.5$  MHz;  $\sigma = 0.841$  S/m;  $\epsilon_r = 42.365$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7433; ConvF(9.77, 9.77, 9.77); Calibrated: 09.30.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03.22.2018
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

### LTE Band 12 1RB(10MHz) Right Cheek/Middle Channel/Zoom Scan

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

Reference Value = 4.825 V/m; Power Drift = -0.18 dB

Peak SAR (extrapolated) = 0.220 W/kg

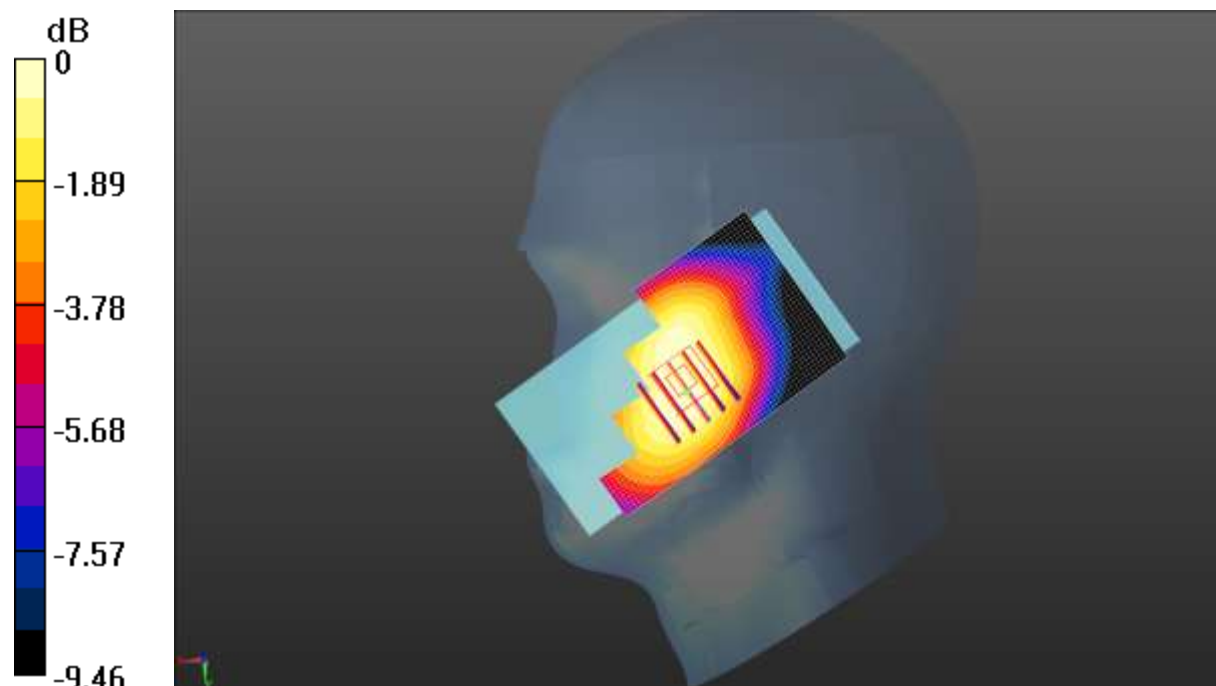
**SAR(1 g) = 0.169 W/kg; SAR(10 g) = 0.130 W/kg**

Maximum value of SAR (measured) = 0.201 W/kg

### LTE Band 12 1RB(10MHz) Right Cheek/Middle Channel/Area Scan

**(41x61x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.202 W/kg



0 dB = 0.202 W/kg = -6.95 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.30.2018 10:15:58

**DUT: LTE mobile phone; Type: N5501L; Serial: 1#**

Communication System: UID 0, LTE-FDD(USA) 20MHz 50%RB QPSK (0); Frequency: 1880 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 1880 \text{ MHz}$ ;  $\sigma = 1.419 \text{ S/m}$ ;  $\epsilon_r = 38.845$ ;  $\rho = 1000 \text{ kg/m}^3$   
Phantom section: Right Section

DASY5 Configuration:

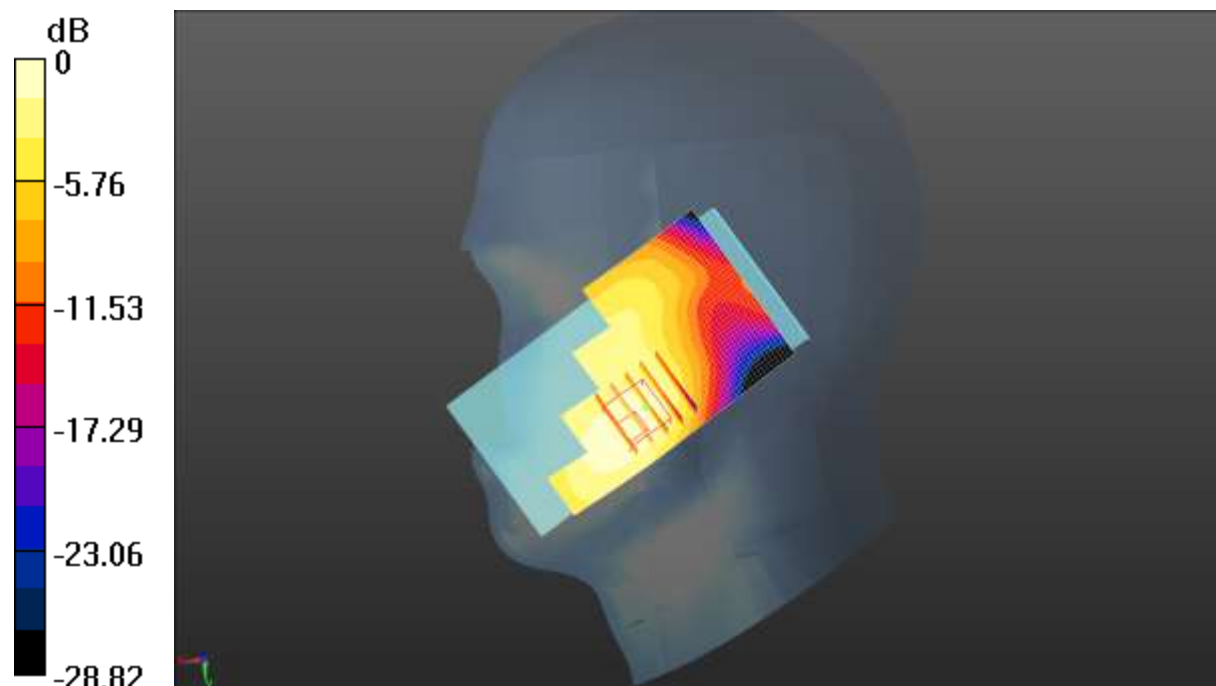
- Probe: EX3DV4 - SN7433; ConvF(7.71, 7.71, 7.71); Calibrated: 09.30.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03.22.2018
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**LTE Band 2 50%RB(10MHz) Right Cheek/Middle Channel/Area Scan**

**(41x61x1):** Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$   
Maximum value of SAR (interpolated) = 0.170 W/kg

**LTE Band 2 50%RB(10MHz) Right Cheek/Middle Channel/Zoom Scan**

**(5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$   
Reference Value = 3.098 V/m; Power Drift = 0.31 dB  
Peak SAR (extrapolated) = 0.214 W/kg  
**SAR(1 g) = 0.128 W/kg; SAR(10 g) = 0.076 W/kg**  
Maximum value of SAR (measured) = 0.173 W/kg



0 dB = 0.173 W/kg = -7.62 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.30.2018 14:19:39

**DUT: LTE mobile phone; Type: N5501L; Serial: 1#**

Communication System: UID 0, LTE-FDD(USA) 20MHz 50%RB QPSK (0); Frequency: 1732.5 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 1732.5$  MHz;  $\sigma = 1.347$  S/m;  $\epsilon_r = 40.169$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Left Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7433; ConvF(7.97, 7.97, 7.97); Calibrated: 09.30.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03.22.2018
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**LTE Band 4 50%RB(10MHz) Left Cheek/Middle Channel/Area Scan**

**(41x61x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.233 W/kg

**LTE Band 4 50%RB(10MHz) Left Cheek/Middle Channel/Zoom Scan**

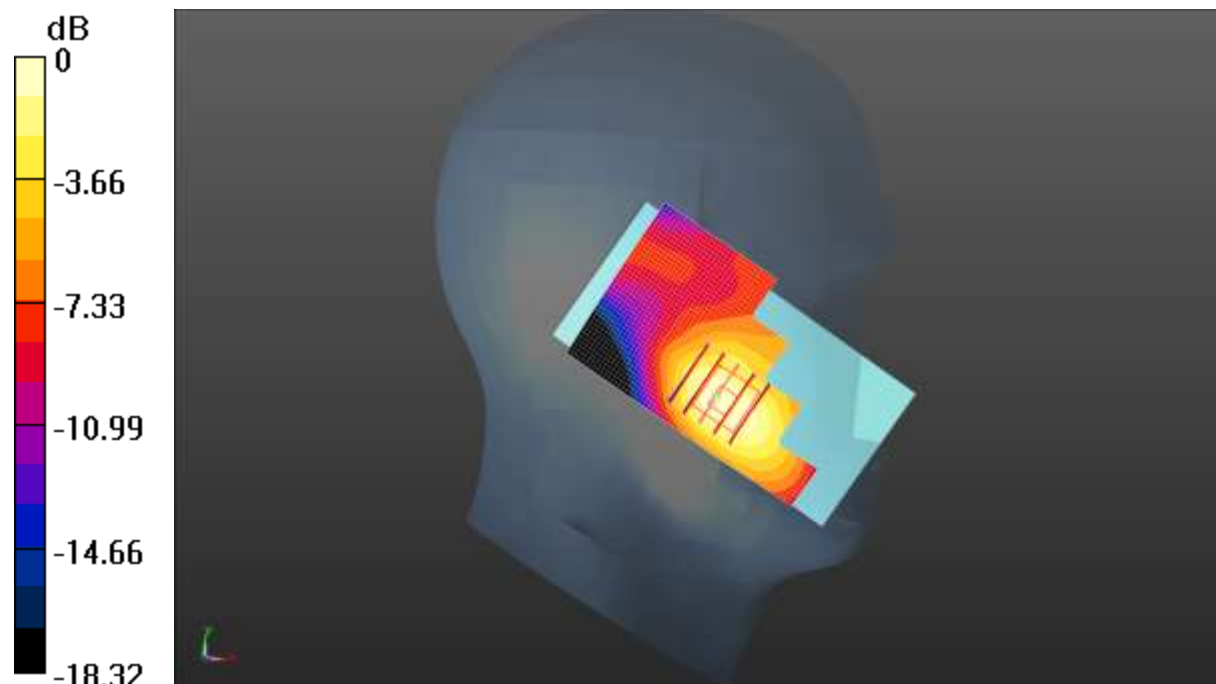
**(5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 4.196 V/m; Power Drift = 0.21 dB

Peak SAR (extrapolated) = 0.275 W/kg

**SAR(1 g) = 0.169 W/kg; SAR(10 g) = 0.102 W/kg**

Maximum value of SAR (measured) = 0.230 W/kg



0 dB = 0.230 W/kg = -6.38 dBW/kg

Test Laboratory: CCIS

Date/Time: 07.22.2018 11:21:23

**DUT: LTE mobile phone; Type: N5501L; Serial: 1#**

Communication System: UID 0, LTE-FDD(USA) 20MHz 50%RB QPSK (0); Frequency: 2560 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 2560$  MHz;  $\sigma = 1.966$  S/m;  $\epsilon_r = 38.749$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Right Section

DASY5 Configuration:

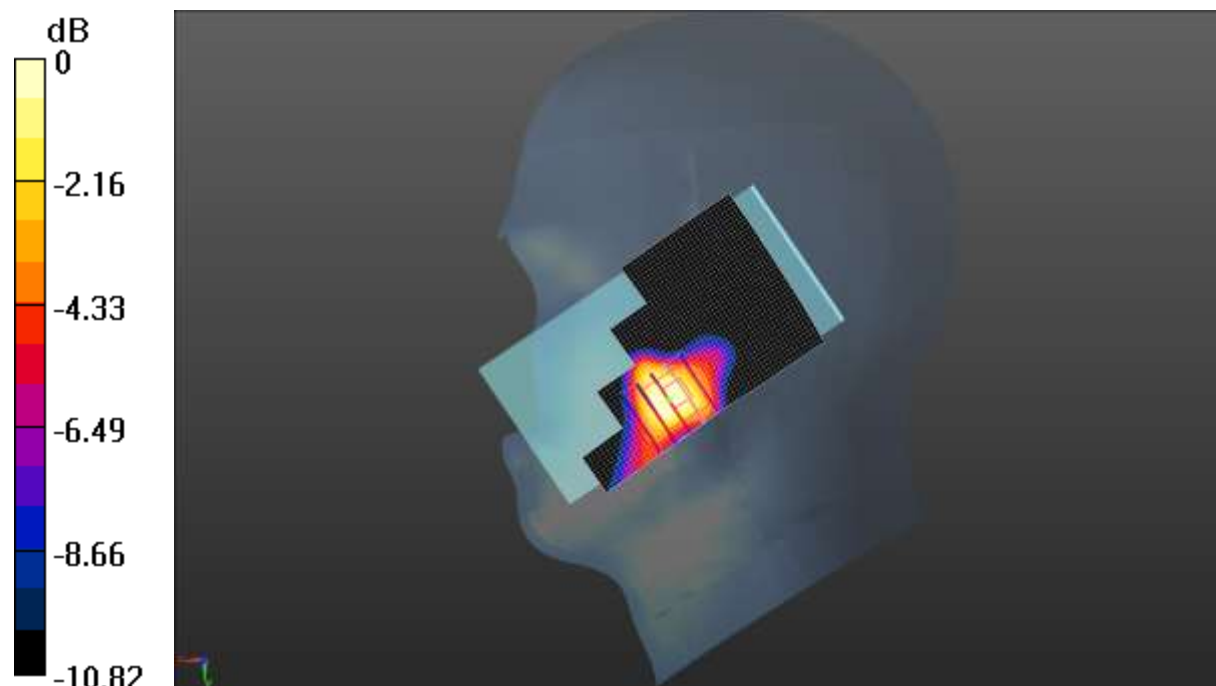
- Probe: EX3DV4 - SN7433; ConvF(6.97, 6.97, 6.97); Calibrated: 09.30.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03.22.2018
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**LTE Band 7 50%RB(20MHz) Right Cheek/High Channel/Area Scan**

**(41x61x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm  
Maximum value of SAR (interpolated) = 0.0985 W/kg

**LTE Band 7 50%RB(20MHz) Right Cheek/High Channel/Zoom Scan**

**(5x5x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 1.105 V/m; Power Drift = -0.12 dB  
Peak SAR (extrapolated) = 0.0840 W/kg  
**SAR(1 g) = 0.071 W/kg; SAR(10 g) = 0.044 W/kg**  
Maximum value of SAR (measured) = 0.0795 W/kg



0 dB = 0.0795 W/kg = -11.00 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.28.2018 10:55:41

**DUT: LTE mobile phone; Type: N5501L; Serial: 1#**

Communication System: UID 0, LTE-FDD (USA) 10MHz 50%RB QPSK (0); Frequency: 829 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 829 \text{ MHz}$ ;  $\sigma = 0.891 \text{ S/m}$ ;  $\epsilon_r = 41.487$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7433; ConvF(9.77, 9.77, 9.77); Calibrated: 09.30.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03.22.2018
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**LTE Band 5 50%RB(10MHz) Left Cheek/Low Channel/Zoom Scan**

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

Reference Value = 5.438 V/m; Power Drift = -0.29 dB

Peak SAR (extrapolated) = 0.395 W/kg

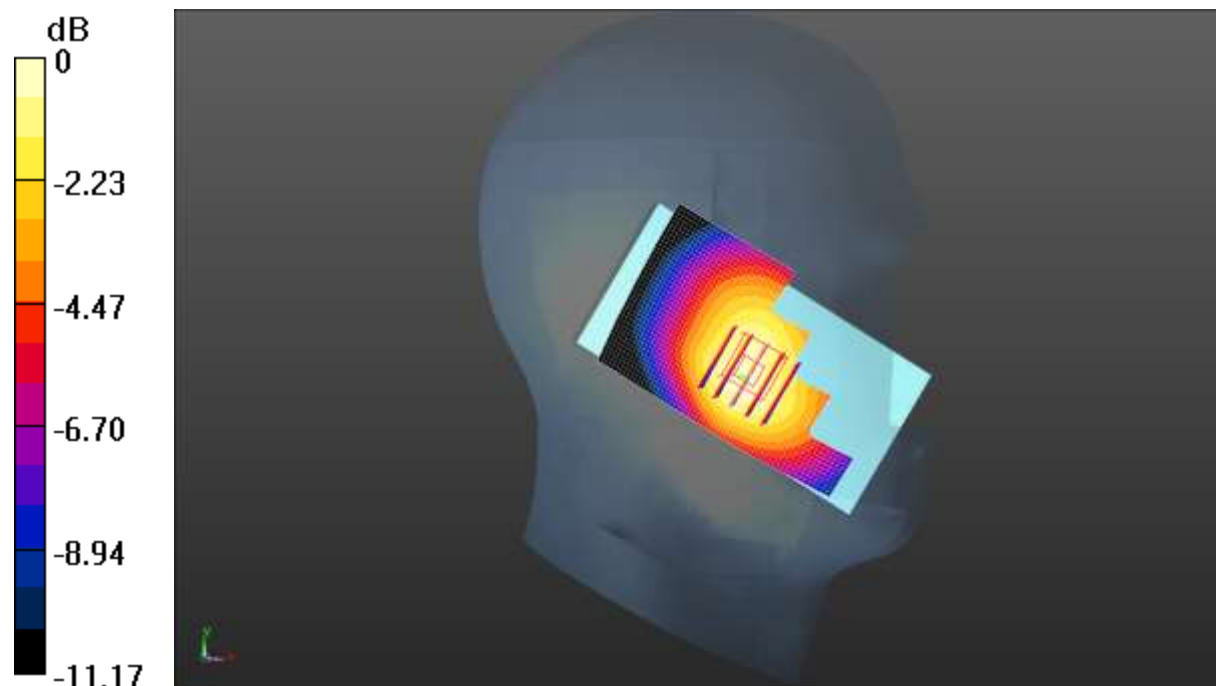
**SAR(1 g) = 0.278 W/kg; SAR(10 g) = 0.202 W/kg**

Maximum value of SAR (measured) = 0.353 W/kg

**LTE Band 5 50%RB(10MHz) Left Cheek/Low Channel/Area Scan (41x61x1):**

Interpolated grid: dx=1.500 mm, dy=1.500 mm

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



0 dB = 0.363 W/kg = -4.40 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.28.2018 17:41:56

**DUT: LTE mobile phone; Type: N5501L; Serial: 1#**

Communication System: UID 0, LTE-FDD (USA) 10MHz 50%RB QPSK (0); Frequency: 707.5 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 707.5 \text{ MHz}$ ;  $\sigma = 0.841 \text{ S/m}$ ;  $\epsilon_r = 42.365$ ;  $\rho = 1000 \text{ kg/m}^3$   
Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7433; ConvF(9.77, 9.77, 9.77); Calibrated: 09.30.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03.22.2018
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**LTE Band 12 50%RB(10MHz) Right Cheek/Middle Channel/Zoom Scan**

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

Reference Value = 4.821 V/m; Power Drift = 0.31 dB

Peak SAR (extrapolated) = 0.233 W/kg

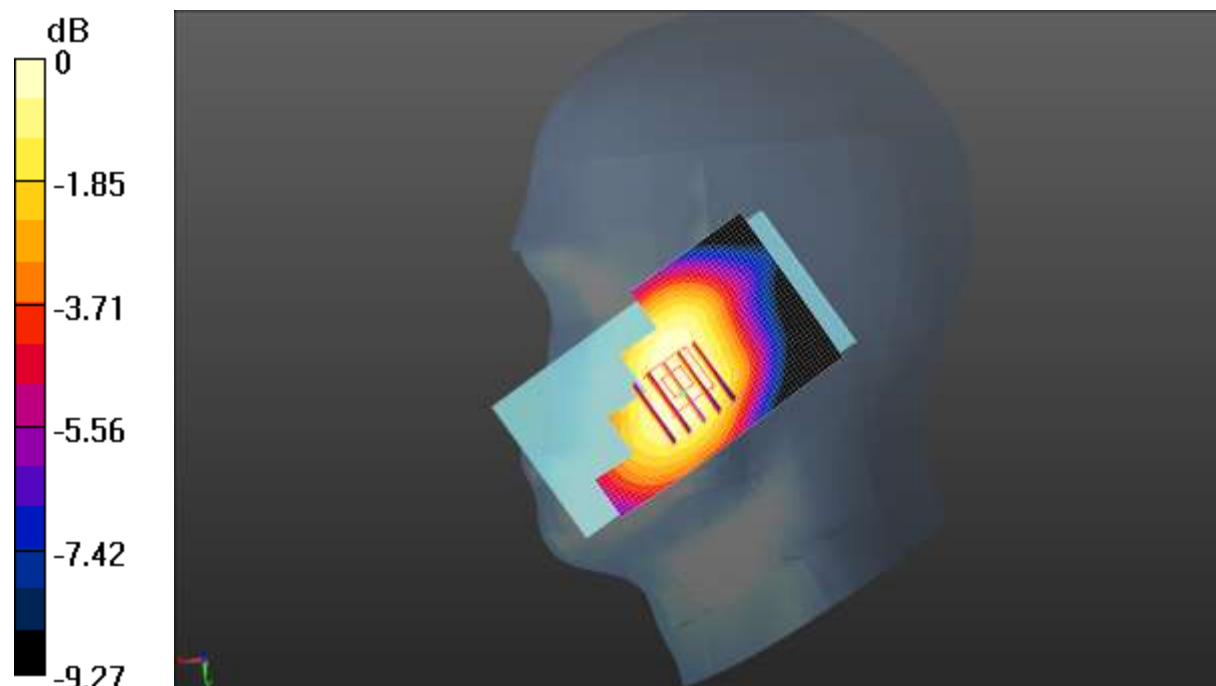
**SAR(1 g) = 0.179 W/kg; SAR(10 g) = 0.138 W/kg**

Maximum value of SAR (measured) = 0.213 W/kg

**LTE Band 12 50%RB(10MHz) Right Cheek/Middle Channel/Area Scan**

**(41x61x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.212 W/kg



0 dB = 0.212 W/kg = -6.74 dBW/kg



Test Laboratory: CCIS

Date/Time: 06.26.2018 16:42:24

**DUT: LTE mobile phone; Type: N5501L; Serial: 1#**

Communication System: UID 0, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps) (0);  
 Frequency: 2412 MHz; Duty Cycle: 1:1  
 Medium parameters used (interpolated):  $f = 2412$  MHz;  $\sigma = 1.789$  S/m;  $\epsilon_r = 39.719$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7433; ConvF(7.34, 7.34, 7.34); Calibrated: 09.30.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03.22.2018
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**WIFI Right Tilted/Low Channel/Area Scan (41x61x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.136 W/kg

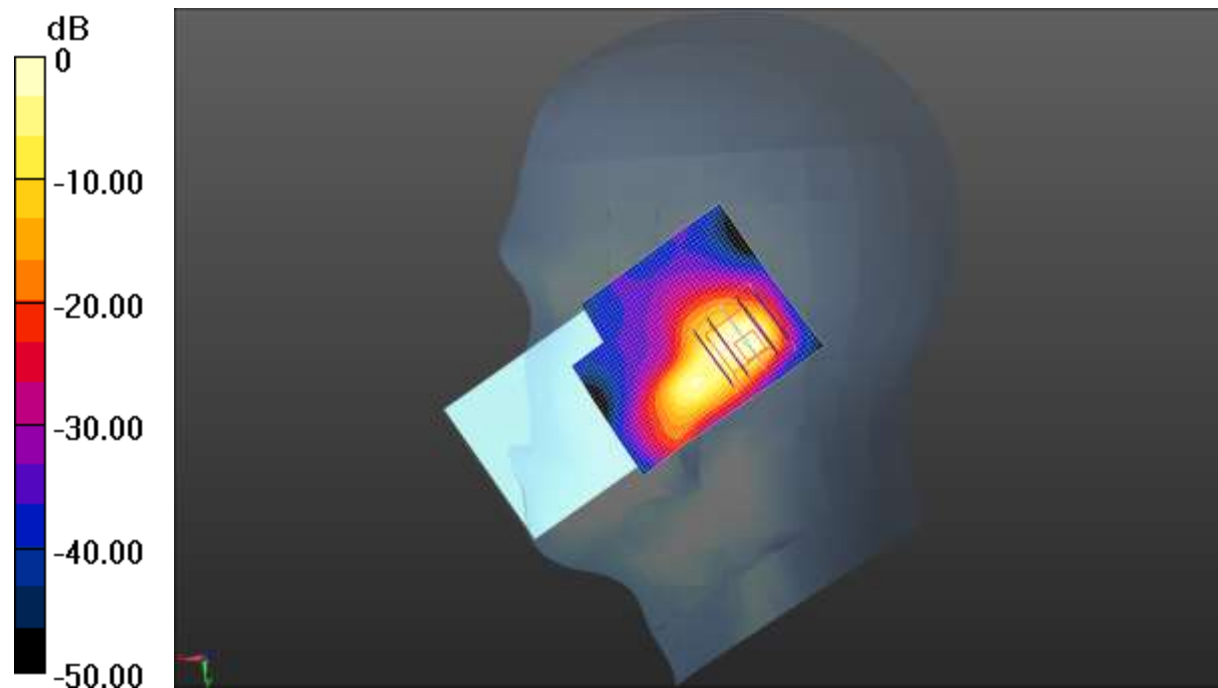
**WIFI Right Tilted/Low Channel/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 5.122 V/m; Power Drift = -0.18 dB

Peak SAR (extrapolated) = 0.188 W/kg

**SAR(1 g) = 0.072 W/kg; SAR(10 g) = 0.030 W/kg**

Maximum value of SAR (measured) = 0.128 W/kg



0 dB = 0.128 W/kg = -8.93 dBW/kg

Test Laboratory: CCIS

Date/Time: 07.01.2018 16:29:56

**DUT: LTE mobile phone; Type: N5501L; Serial: 1#**

Communication System: UID 0, GSM (0); Frequency: 848.8 MHz; Duty Cycle: 1:8.30042  
 Medium parameters used (extrapolated):  $f = 848.8 \text{ MHz}$ ;  $\sigma = 1.009 \text{ S/m}$ ;  $\epsilon_r = 54.688$ ;  $\rho = 1000 \text{ kg/m}^3$   
 Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7433; ConvF(9.68, 9.68, 9.68); Calibrated: 09.30.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03.22.2018
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1208
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**GSM 850 Body Back/High Channel/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 18.06 V/m; Power Drift = 0.03 dB

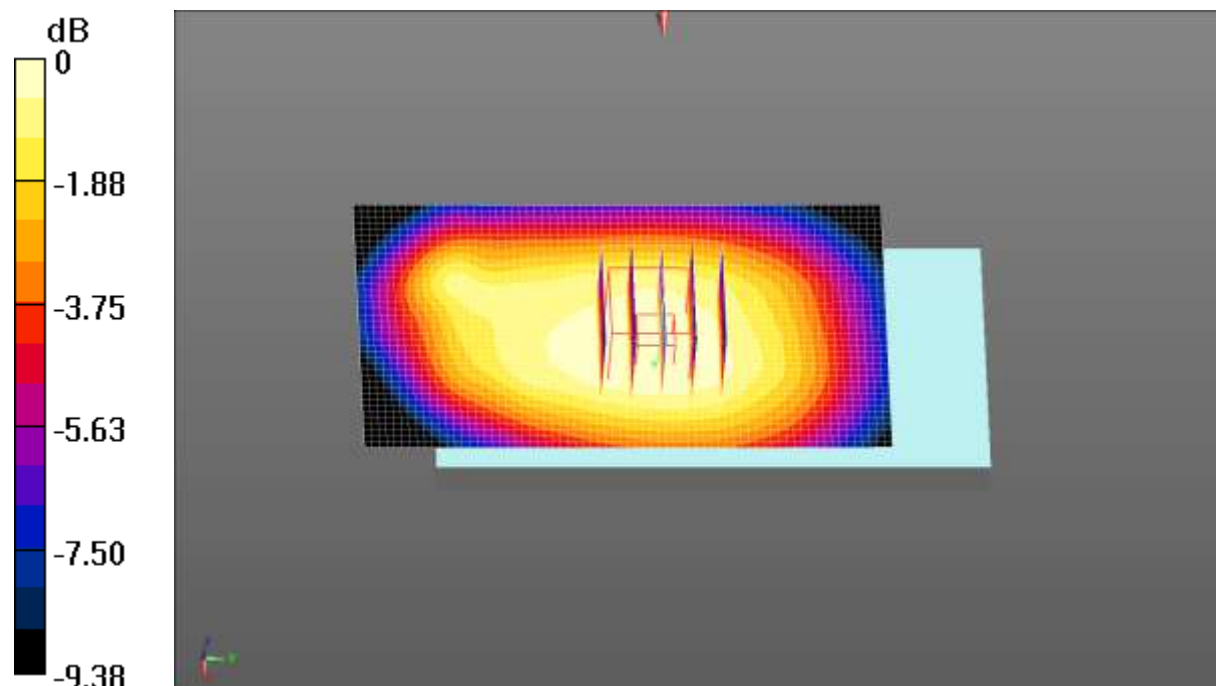
Peak SAR (extrapolated) = 0.374 W/kg

**SAR(1 g) = 0.268 W/kg; SAR(10 g) = 0.200 W/kg**

Maximum value of SAR (measured) = 0.333 W/kg

**GSM 850 Body Back/High Channel/Area Scan (41x71x1):** Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$

Maximum value of SAR (interpolated) = 0.339 W/kg



0 dB = 0.339 W/kg = -4.70 dBW/kg

Test Laboratory: CCIS

Date/Time: 07.07.2018 21:56:48

**DUT: LTE mobile phone; Type: N5501L; Serial: 1#**

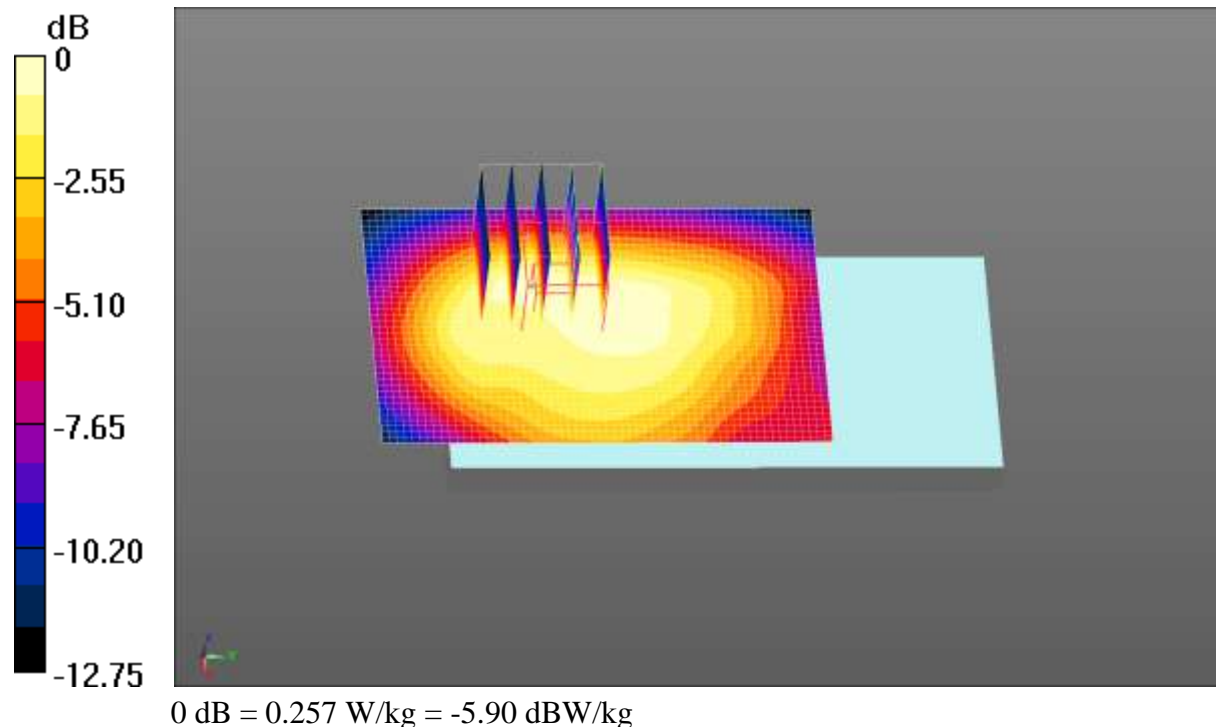
Communication System: UID 0, GSM (0); Frequency: 1909.8 MHz; Duty Cycle: 1:8.30042  
 Medium parameters used:  $f = 1910 \text{ MHz}$ ;  $\sigma = 1.54 \text{ S/m}$ ;  $\epsilon_r = 51.413$ ;  $\rho = 1000 \text{ kg/m}^3$   
 Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7433; ConvF(7.67, 7.67, 7.67); Calibrated: 09.30.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03.22.2018
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1208
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**GSM 1900 Body Back/High Channel/Area Scan (41x61x1):** Interpolated grid:  
 $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$   
 Maximum value of SAR (interpolated) = 0.262 W/kg

**GSM 1900 Body Back/High Channel/Zoom Scan (5x5x7)/Cube 0:** Measurement  
 grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$   
 Reference Value = 14.23 V/m; Power Drift = 0.03 dB  
 Peak SAR (extrapolated) = 0.390 W/kg  
**SAR(1 g) = 0.214 W/kg; SAR(10 g) = 0.129 W/kg**  
 Maximum value of SAR (measured) = 0.257 W/kg



Test Laboratory: CCIS

Date/Time: 07.01.2018 18:31:43

**DUT: LTE mobile phone; Type: N5501L; Serial: 1#**

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

Medium parameters used (extrapolated):  $f = 826.4 \text{ MHz}$ ;  $\sigma = 0.979 \text{ S/m}$ ;  $\epsilon_r = 55.321$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

**DASY5 Configuration:**

- Probe: EX3DV4 – SN7433; ConvF(9.68, 9.68, 9.68); Calibrated: 09.30.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03.22.2018
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1208
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**WCDMA 850 Body Back/Low Channel/Zoom Scan (5x5x7)/Cube 0:**

Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 22.27 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 0.541 W/kg

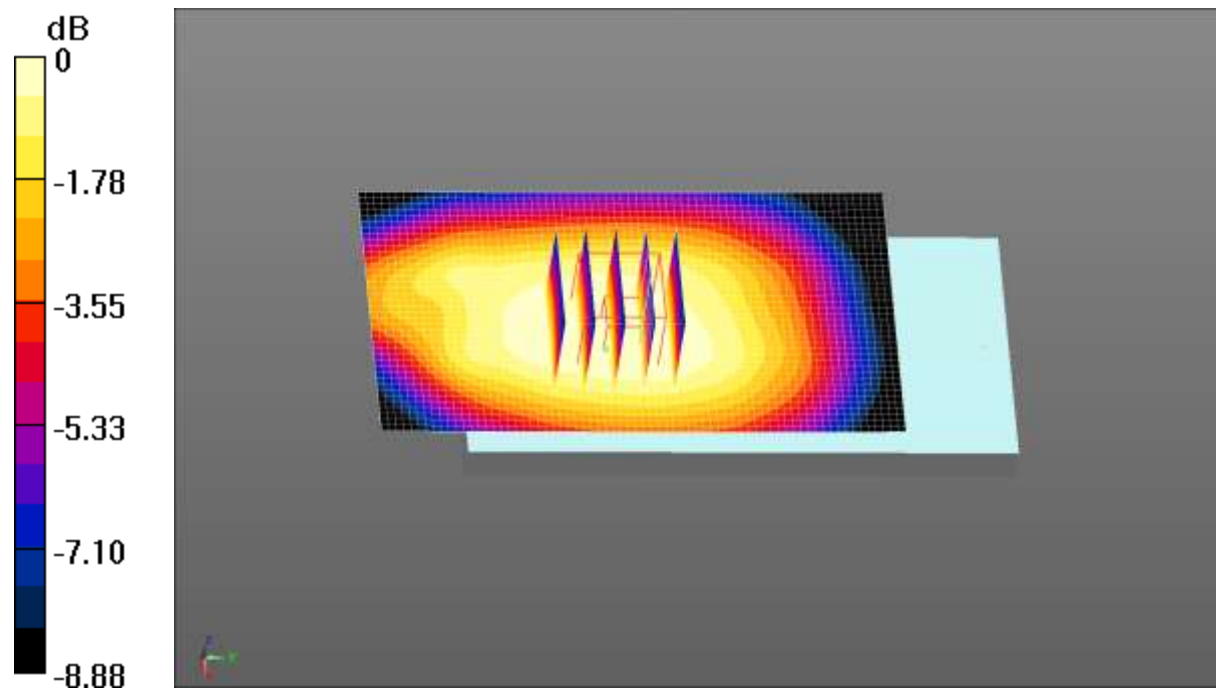
**SAR(1 g) = 0.395 W/kg; SAR(10 g) = 0.298 W/kg**

Maximum value of SAR (measured) = 0.485 W/kg

**WCDMA 850 Body Back/Low Channel/Area Scan (41x71x1): Interpolated grid:**

$dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$

Maximum value of SAR (interpolated) = 0.491 W/kg



0 dB = 0.491 W/kg = -3.09 dBW/kg

Test Laboratory: CCIS

Date/Time: 07.07.2018 20:21:31

**DUT: LTE mobile phone; Type: N5501L; Serial: 1#**

Communication System: UID 0, UMTS-FDD(WCDMA) (0); Frequency: 1712.4 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 1712.4$  MHz;  $\sigma = 1.439$  S/m;  $\epsilon_r = 53.461$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7433; ConvF(7.81, 7.81, 7.81); Calibrated: 09.30.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03.22.2018
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1208
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**WCDMA 1700 Body Back/Low Channel/Area Scan (41x61x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.621 W/kg

**WCDMA 1700 Body Back/Low Channel/Zoom Scan (5x5x7)/Cube 0:**

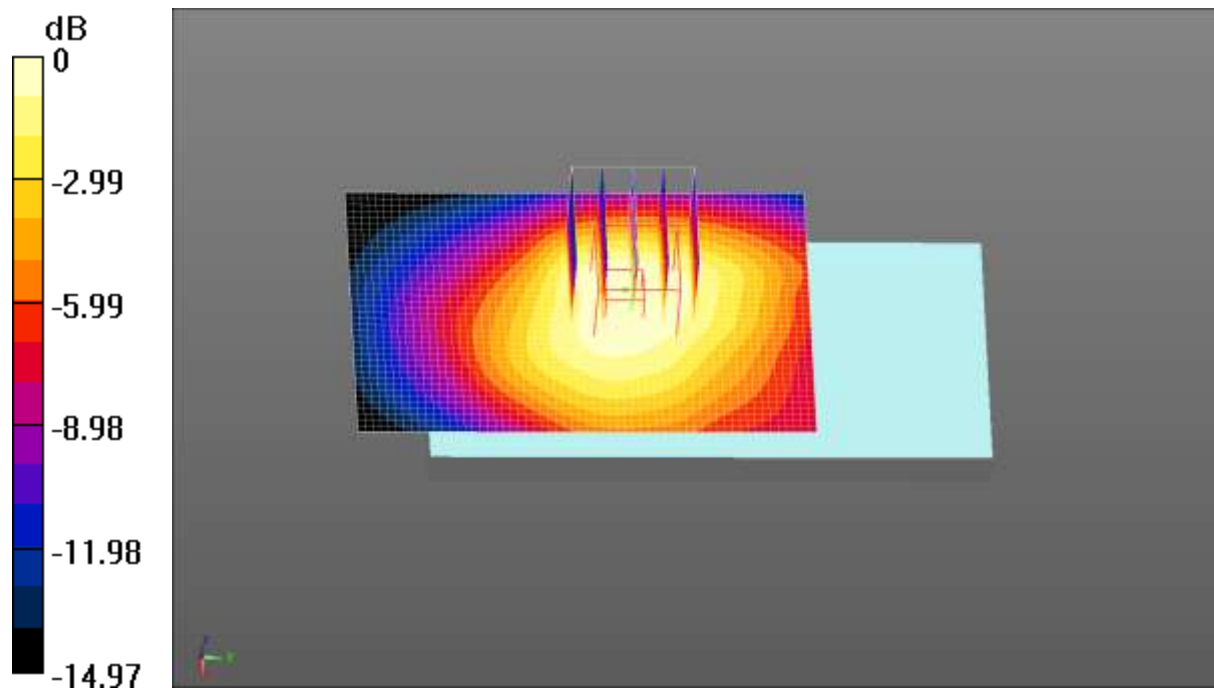
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 20.68 V/m; Power Drift = -0.13 dB

Peak SAR (extrapolated) = 0.811 W/kg

**SAR(1 g) = 0.519 W/kg; SAR(10 g) = 0.329 W/kg**

Maximum value of SAR (measured) = 0.612 W/kg



0 dB = 0.612 W/kg = -2.13 dBW/kg

Test Laboratory: CCIS

Date/Time: 07.07.2018 17:28:07

**DUT: LTE mobile phone; Type: N5501L; Serial: 1#**

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

Medium parameters used (interpolated):  $f = 1852.4$  MHz;  $\sigma = 1.519$  S/m;  $\epsilon_r = 51.885$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7433; ConvF(7.67, 7.67, 7.67); Calibrated: 09.30.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03.22.2018
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1208
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**WCDMA 1900 Body Back/Low Channel/Zoom Scan (5x5x7)/Cube 0:**

Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 12.90 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 0.503 W/kg

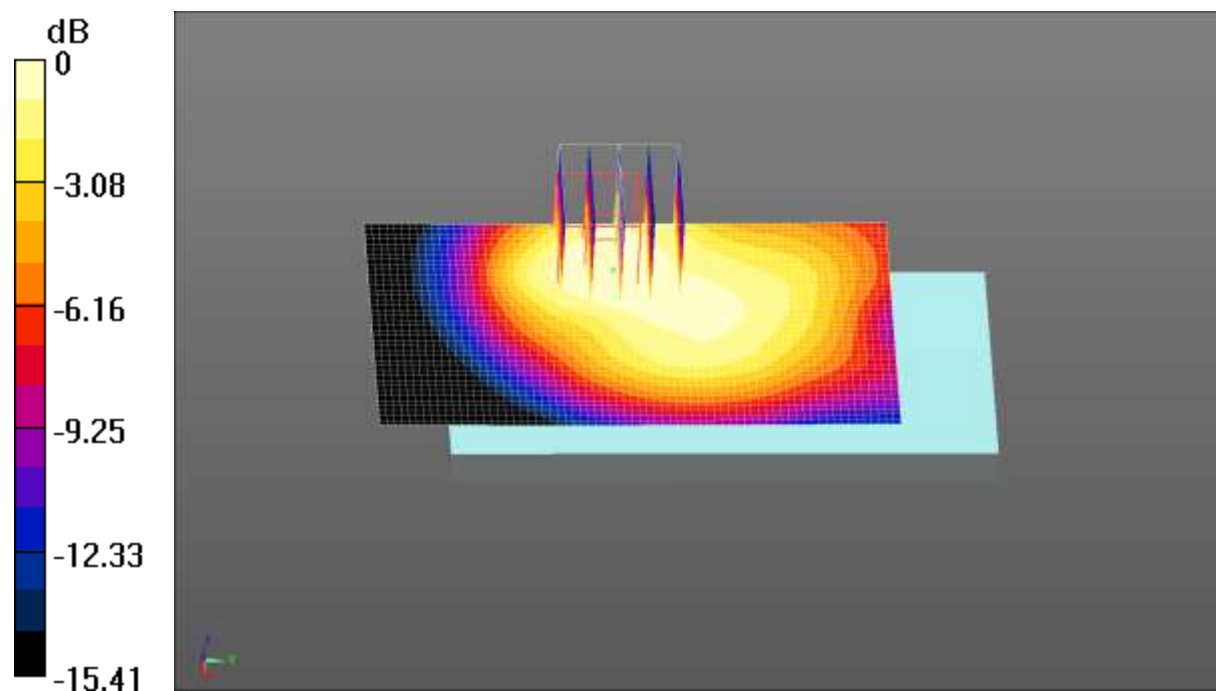
**SAR(1 g) = 0.282 W/kg; SAR(10 g) = 0.163 W/kg**

Maximum value of SAR (measured) = 0.420 W/kg

**WCDMA 1900 Body Back/Low Channel/Area Scan (41x71x1):** Interpolated grid:

dx=1.500 mm, dy=1.500 mm

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



0 dB = 0.359 W/kg = -4.45 dBW/kg

Test Laboratory: CCIS

Date/Time: 07.07.2018 08:35:38

**DUT: LTE mobile phone; Type: N5501L; Serial: 1#**

Communication System: UID 0, LTE-Fdd(USA) 1RB QPSK (0); Frequency: 1880 MHz;  
 Duty Cycle: 1:1  
 Medium parameters used:  $f = 1880 \text{ MHz}$ ;  $\sigma = 1.529 \text{ S/m}$ ;  $\epsilon_r = 51.677$ ;  $\rho = 1000 \text{ kg/m}^3$   
 Phantom section: Flat Section

DASY5 Configuration:

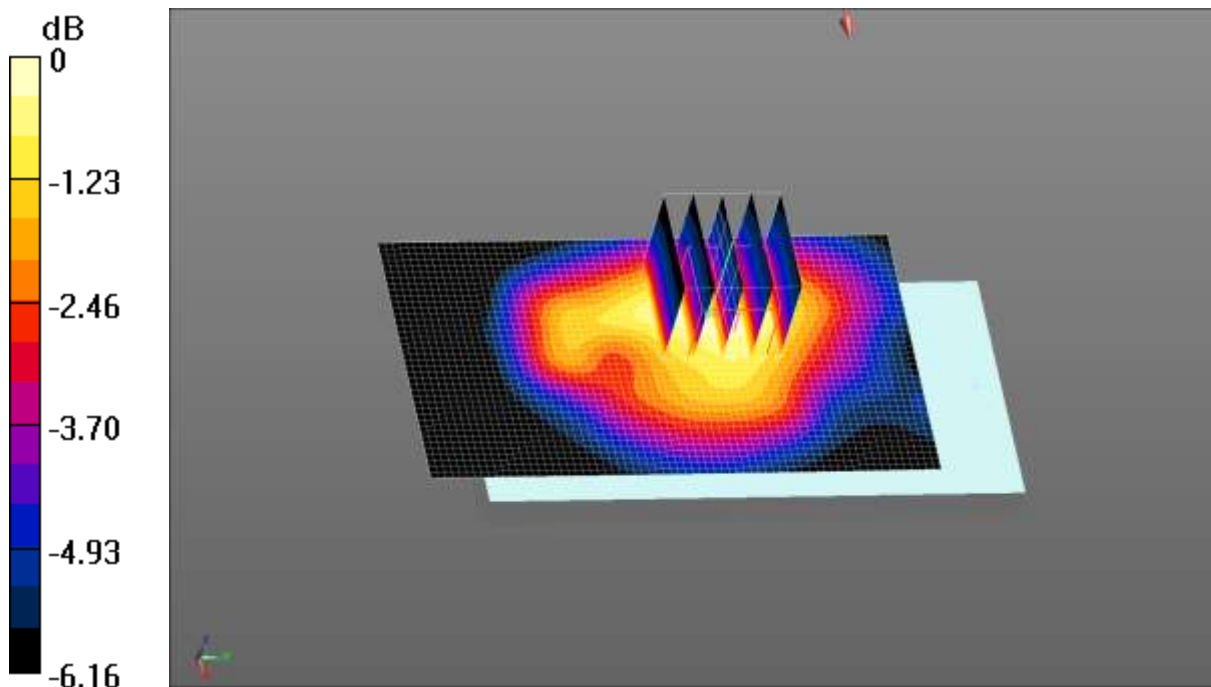
- Probe: EX3DV4 – SN7433; ConvF(7.67, 7.67, 7.67); Calibrated: 09.30.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03.22.2018
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1208
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**LTE Band 2 1RB(20MHz) Body Back/Middle Channel/Zoom Scan**

**(5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$   
 Reference Value = 18.60 V/m; Power Drift = -0.30 dB  
 Peak SAR (extrapolated) = 0.529 W/kg  
**SAR(1 g) = 0.354 W/kg; SAR(10 g) = 0.265 W/kg**  
 Maximum value of SAR (measured) = 0.403 W/kg

**LTE Band 2 1RB(20MHz) Body Back/Middle Channel/Area Scan (41x71x1):**

Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$   
 Maximum value of SAR (interpolated) = 0.491 W/kg



0 dB = 0.491 W/kg = -3.09 dBW/kg

Test Laboratory: CCIS

Date/Time: 07.07.2018 11:49:51

**DUT: LTE mobile phone; Type: N5501L; Serial: 1#**

Communication System: UID 0, LTE-Fdd(USA) 1RB QPSK (0); Frequency: 1732.5 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 1732.5$  MHz;  $\sigma = 1.458$  S/m;  $\epsilon_r = 53.216$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7433; ConvF(7.81, 7.81, 7.81); Calibrated: 09.30.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03.22.2018
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1208
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**LTE Band 4 1RB(20MHz) Body Back/Middle Channel/Zoom Scan**

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

Reference Value = 17.38 V/m; Power Drift = 0.12 dB

Peak SAR (extrapolated) = 0.521 W/kg

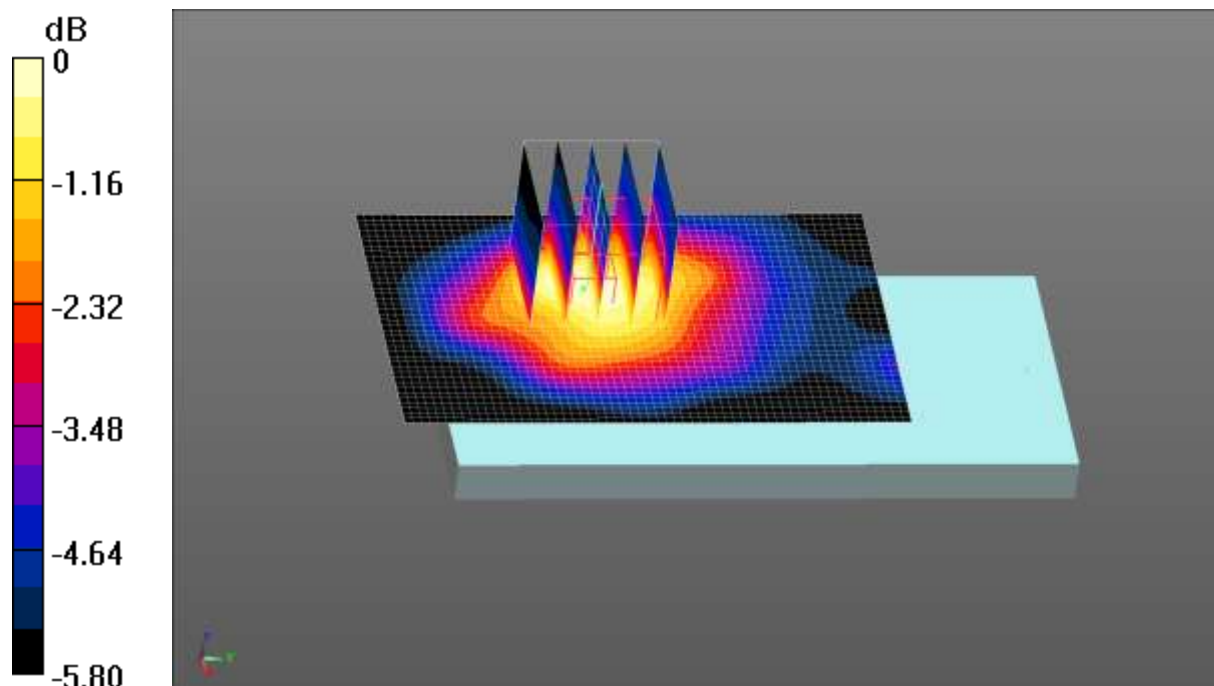
**SAR(1 g) = 0.436 W/kg; SAR(10 g) = 0.321 W/kg**

Maximum value of SAR (measured) = 0.484 W/kg

**LTE Band 4 1RB(20MHz) Body Back/Middle Channel/Area Scan (41x61x1):**

Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.509 W/kg



0 dB = 0.509 W/kg = -2.93 dBW/kg



Test Laboratory: CCIS

Date/Time: 07.23.2018 19:13:16

**DUT: LTE mobile phone; Type: N5501L; Serial: 1#**

Communication System: UID 0, LTE-Fdd(USA) 1RB QPSK (0); Frequency: 2535 MHz;

Duty Cycle: 1:1

Medium parameters used:  $f = 2535 \text{ MHz}$ ;  $\sigma = 2.033 \text{ S/m}$ ;  $\epsilon_r = 52.987$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7433; ConvF(7.23, 7.23, 7.23); Calibrated: 09.30.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03.22.2018
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1208
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

### LTE Band 7 1RB(20MHz) Body Back/Middle Channel/Zoom Scan

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

Reference Value = 9.846 V/m; Power Drift = 0.38 dB

Peak SAR (extrapolated) = 1.53 W/kg

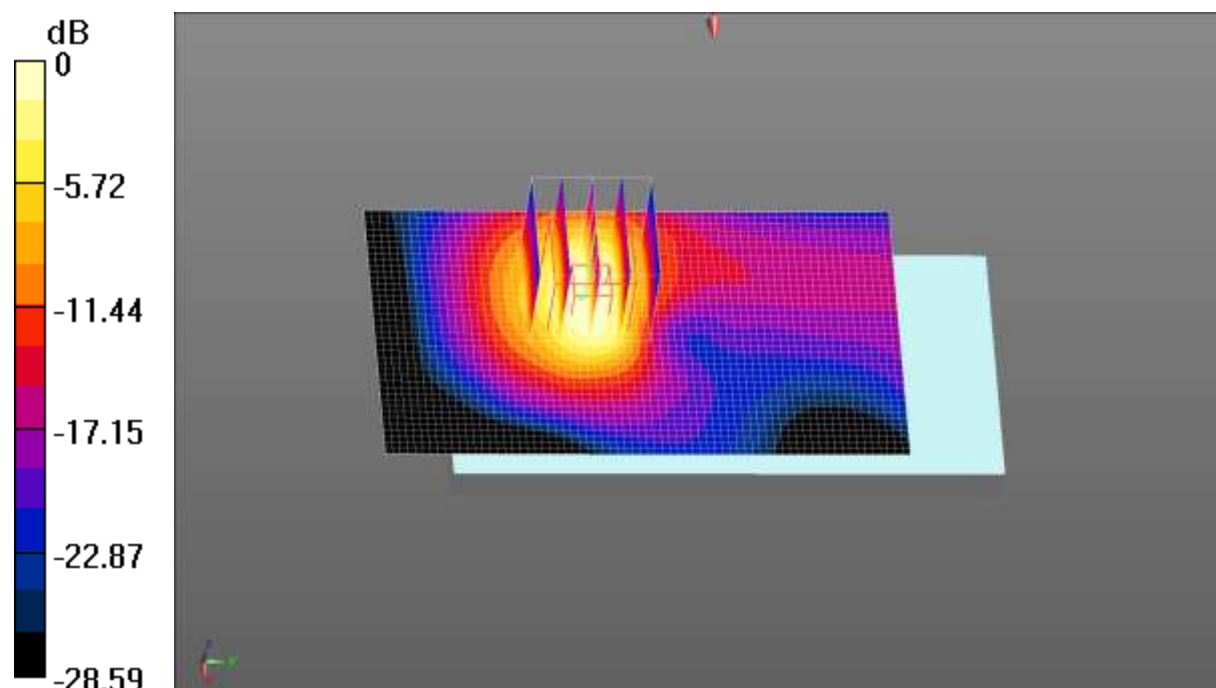
**SAR(1 g) = 0.731 W/kg; SAR(10 g) = 0.330 W/kg**

Maximum value of SAR (measured) = 1.18 W/kg

### LTE Band 7 1RB(20MHz) Body Back/Middle Channel/Area Scan (41x71x1):

Interpolated grid:  $dx=1.200 \text{ mm}$ ,  $dy=1.200 \text{ mm}$

Maximum value of SAR (interpolated) = 1.09 W/kg



0 dB = 1.09 W/kg = 0.37 dBW/kg

Test Laboratory: CCIS

Date/Time: 07.01.2018 11:42:07

**DUT: LTE mobile phone; Type: N5501L; Serial: 1#**

Communication System: UID 0, LTE-Fdd(USA) 1RB QPSK (0); Frequency: 829 MHz; Duty Cycle: 1:1

Medium parameters used (extrapolated):  $f = 829 \text{ MHz}$ ;  $\sigma = 0.984 \text{ S/m}$ ;  $\epsilon_r = 55.206$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7433; ConvF(9.68, 9.68, 9.68); Calibrated: 09.30.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03.22.2018
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1208
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**LTE Band 5 1RB(10MHz) Body Back/Low Channel/Zoom Scan (5x5x7)/Cube**

**0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 25.18 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 0.724 W/kg

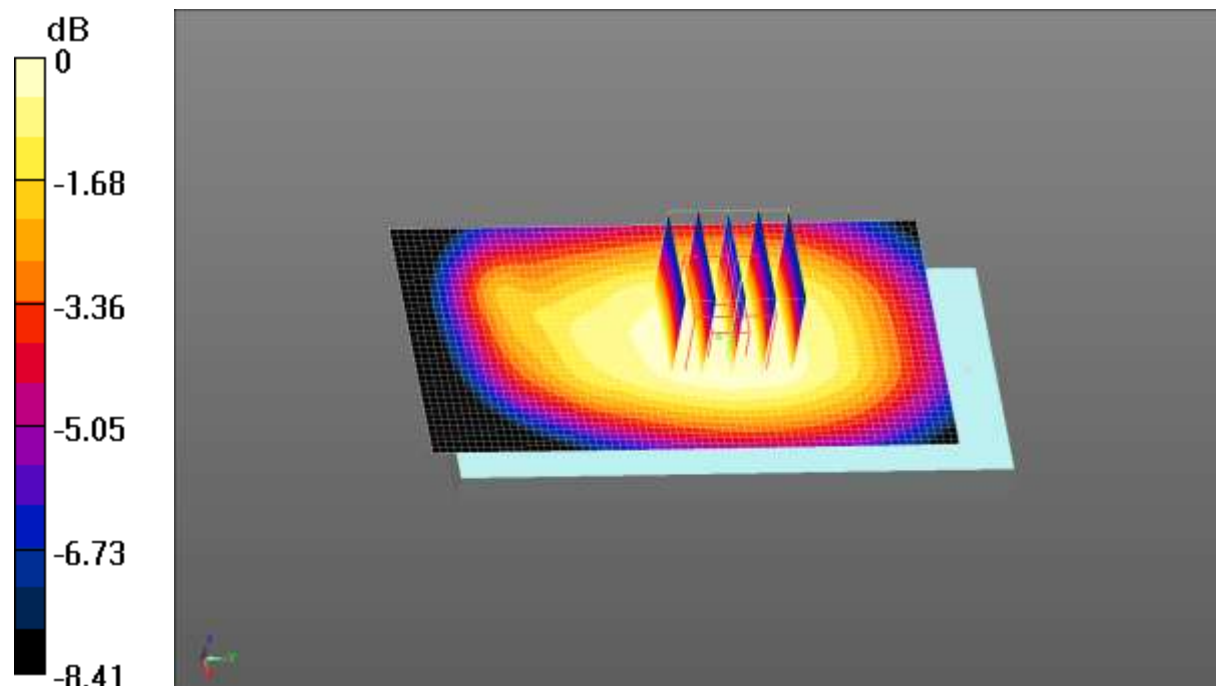
**SAR(1 g) = 0.522 W/kg; SAR(10 g) = 0.389 W/kg**

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

**LTE Band 5 1RB(10MHz) Body Back/Low Channel/Area Scan (41x71x1):**

Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$

Maximum value of SAR (interpolated) = 0.641 W/kg



0 dB = 0.641 W/kg = -1.93 dBW/kg

Test Laboratory: CCIS

Date/Time: 07.01.2018 08:38:41

**DUT: LTE mobile phone; Type: N5501L; Serial: 1#**

Communication System: UID 0, LTE-Fdd(USA) 1RB QPSK (0); Frequency: 707.5 MHz;

Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 707.5$  MHz;  $\sigma = 0.936$  S/m;  $\epsilon_r = 56.108$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7433; ConvF(9.68, 9.68, 9.68); Calibrated: 09.30.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03.22.2018
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1208
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

### LTE Band 12 1RB(10MHz) Body Back/Middle Channel/Zoom Scan

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

Reference Value = 21.16 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 0.474 W/kg

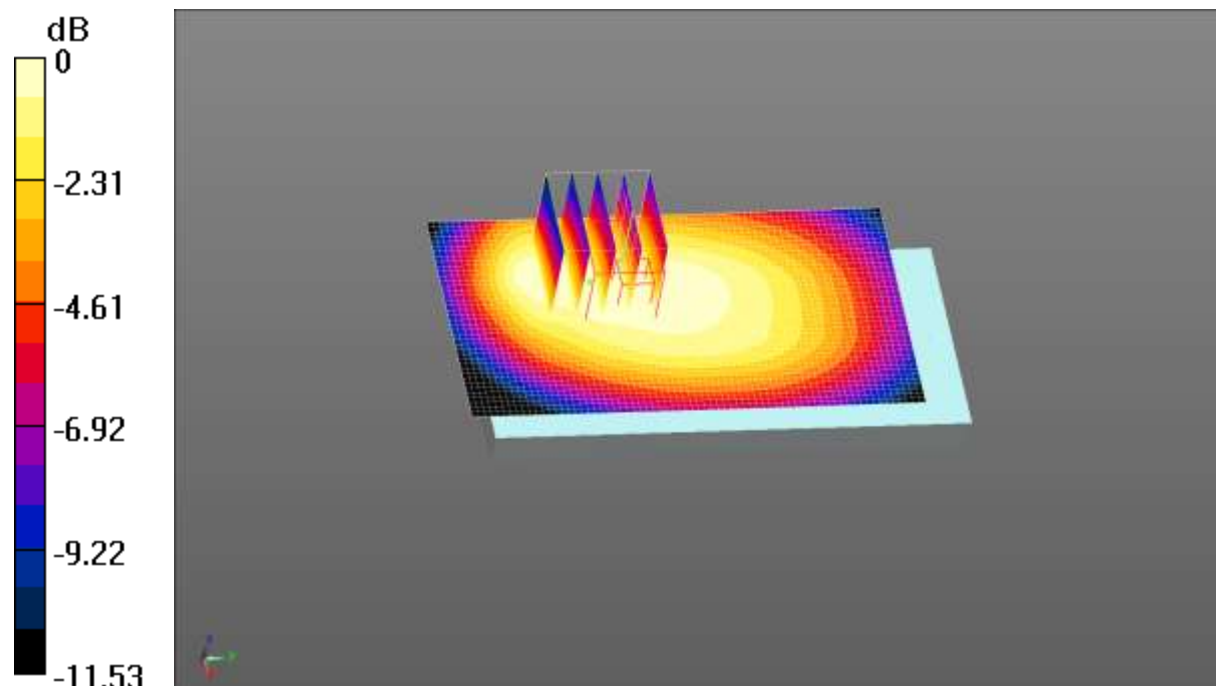
**SAR(1 g) = 0.340 W/kg; SAR(10 g) = 0.249 W/kg**

Maximum value of SAR (measured) = 0.421 W/kg

### LTE Band 12 1RB(10MHz) Body Back/Middle Channel/Area Scan (41x71x1):

Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.427 W/kg



0 dB = 0.427 W/kg = -3.70 dBW/kg

Test Laboratory: CCIS

Date/Time: 07.07.2018 10:11:22

**DUT: LTE mobile phone; Type: N5501L; Serial: 1#**

Communication System: UID 0, LTE-FDD(USA) 20MHz 50%RB QPSK (0); Frequency: 1880 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 1880 \text{ MHz}$ ;  $\sigma = 1.529 \text{ S/m}$ ;  $\epsilon_r = 51.677$ ;  $\rho = 1000 \text{ kg/m}^3$   
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7433; ConvF(7.67, 7.67, 7.67); Calibrated: 09.30.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03.22.2018
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1208
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**LTE Band 2 50%RB(20MHz) Body Back/Middle Channel/Zoom Scan**

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

Reference Value = 18.09 V/m; Power Drift = -0.28 dB

Peak SAR (extrapolated) = 0.454 W/kg

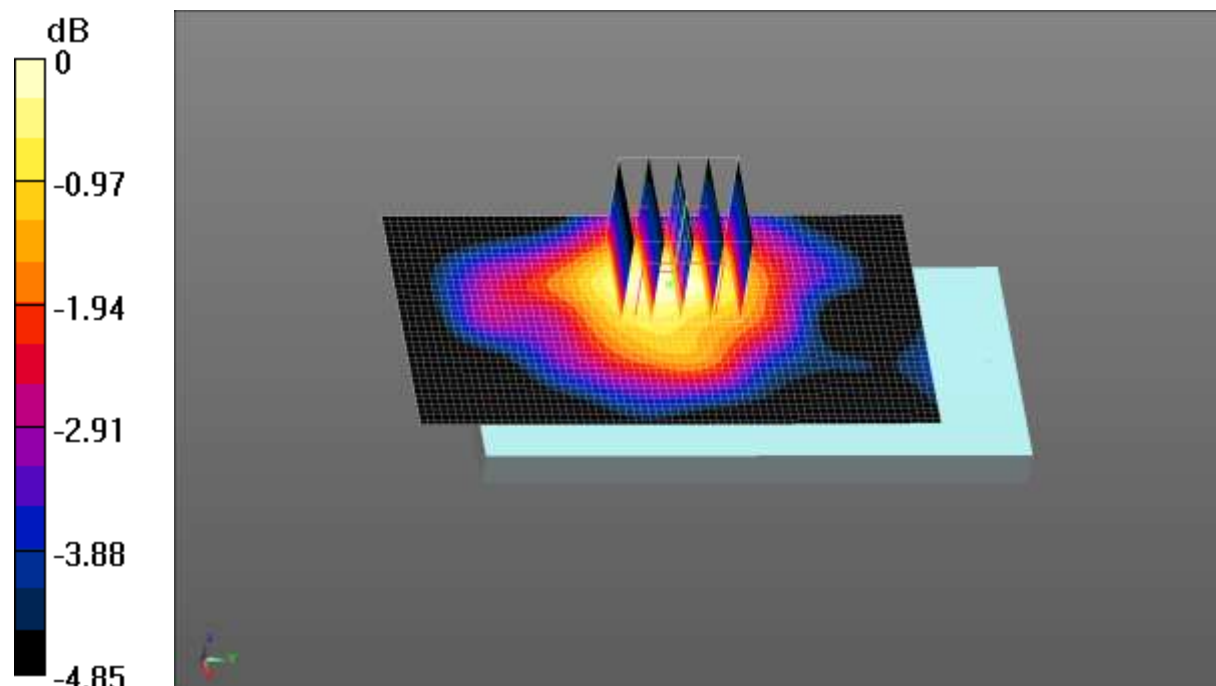
**SAR(1 g) = 0.372 W/kg; SAR(10 g) = 0.293 W/kg**

Maximum value of SAR (measured) = 0.406 W/kg

**LTE Band 2 50%RB(20MHz) Body Back/Middle Channel/Area Scan**

**(41x71x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.487 W/kg



0 dB = 0.487 W/kg = -3.12 dBW/kg

Test Laboratory: CCIS

Date/Time: 07.07.2018 13:42:18

**DUT: LTE mobile phone; Type: N5501L; Serial: 1#**

Communication System: UID 0, LTE-FDD(USA) 20MHz 50%RB QPSK (0); Frequency: 1732.5 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 1732.5$  MHz;  $\sigma = 1.458$  S/m;  $\epsilon_r = 53.216$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7433; ConvF(7.81, 7.81, 7.81); Calibrated: 09.30.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03.22.2018
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1208
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**LTE Band 4 50%RB(20MHz) Body Back/Middle Channel/Zoom Scan**

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

Reference Value = 18.60 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 0.522 W/kg

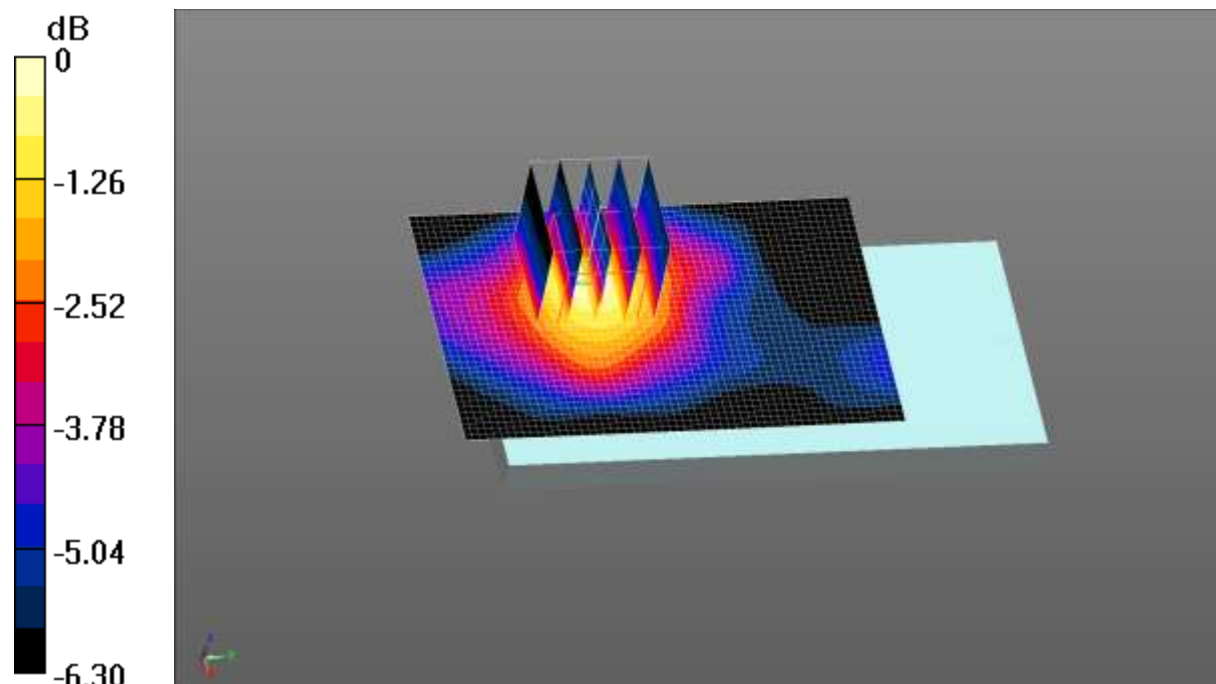
**SAR(1 g) = 0.455 W/kg; SAR(10 g) = 0.333 W/kg**

Maximum value of SAR (measured) = 0.496 W/kg

**LTE Band 4 50%RB(20MHz) Body Back/Middle Channel/Area Scan**

**(41x61x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.596 W/kg



0 dB = 0.596 W/kg = -2.25 dBW/kg

Test Laboratory: CCIS

Date/Time: 07.23.2018 21:02:02

**DUT: LTE mobile phone; Type: N5501L; Serial: 1#**

Communication System: UID 0, LTE-FDD(USA) 20MHz 50%RB QPSK (0); Frequency: 2560 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 2560$  MHz;  $\sigma = 2.092$  S/m;  $\epsilon_r = 52.794$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7433; ConvF(6.97, 6.97, 6.97); Calibrated: 09.30.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03.22.2018
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1208
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**LTE Band 7 50%RB(20MHz) Body Back/High Channel/Zoom Scan**

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

Reference Value = 5.166 V/m; Power Drift = 0.17 dB

Peak SAR (extrapolated) = 1.20 W/kg

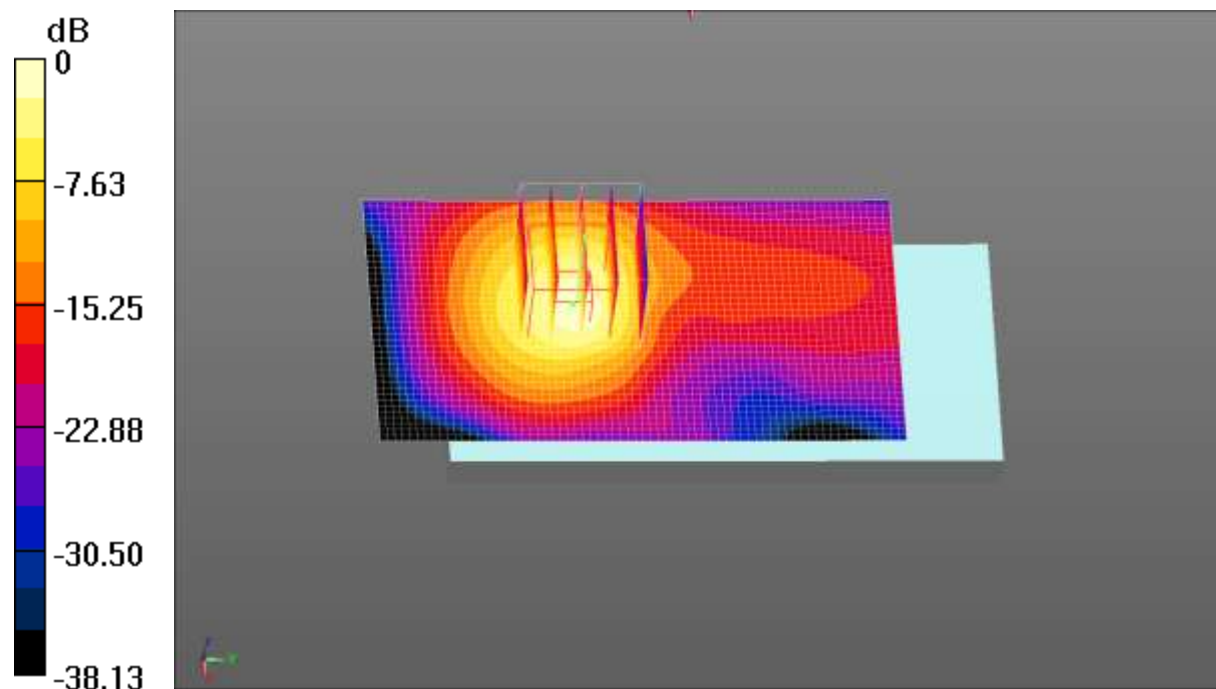
**SAR(1 g) = 0.559 W/kg; SAR(10 g) = 0.251 W/kg**

Maximum value of SAR (measured) = 0.914 W/kg

**LTE Band 7 50%RB(20MHz) Body Back/High Channel/Area Scan (41x71x1):**

Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.732 W/kg



0 dB = 0.914 W/kg = -0.39 dBW/kg

Test Laboratory: CCIS

Date/Time: 07.01.2018 13:16:49

**DUT: LTE mobile phone; Type: N5501L; Serial: 1#**

Communication System: UID 0, LTE-FDD (USA) 10MHz 50%RB QPSK (0); Frequency: 829 MHz; Duty Cycle: 1:1

Medium parameters used (extrapolated):  $f = 829 \text{ MHz}$ ;  $\sigma = 0.984 \text{ S/m}$ ;  $\epsilon_r = 55.206$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7433; ConvF(9.68, 9.68, 9.68); Calibrated: 09.30.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03.22.2018
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1208
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**LTE Band 5 50%RB(10MHz) Body Back/Low Channel/Zoom Scan**

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

Reference Value = 25.38 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 0.731 W/kg

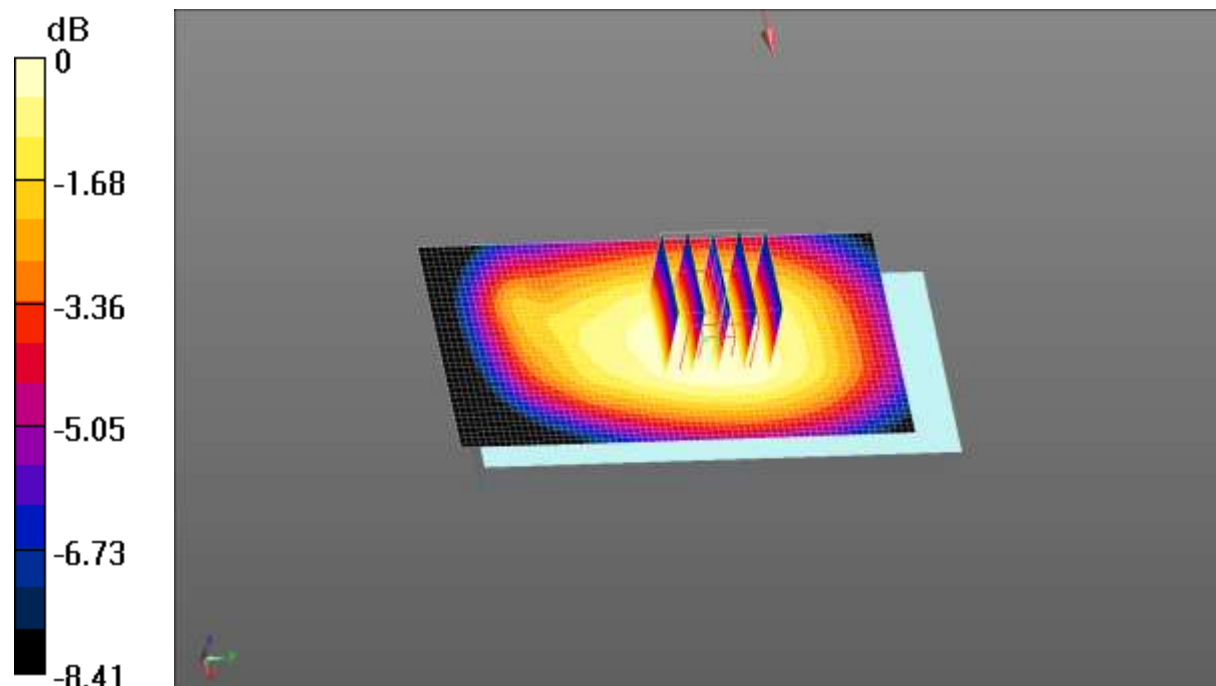
**SAR(1 g) = 0.527 W/kg; SAR(10 g) = 0.393 W/kg**

Maximum value of SAR (measured) = 0.653 W/kg

**LTE Band 5 50%RB(10MHz) Body Back/Low Channel/Area Scan (41x71x1):**

Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.650 W/kg



0 dB = 0.650 W/kg = -1.87 dBW/kg

Test Laboratory: CCIS

Date/Time: 07.01.2018 10:38:12

**DUT: LTE mobile phone; Type: N5501L; Serial: 1#**

Communication System: UID 0, LTE-FDD (USA) 10MHz 50%RB QPSK (0); Frequency: 707.5 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 707.5 \text{ MHz}$ ;  $\sigma = 0.936 \text{ S/m}$ ;  $\epsilon_r = 56.108$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7433; ConvF(9.68, 9.68, 9.68); Calibrated: 09.30.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03.22.2018
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1208
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**LTE Band 12 50%RB(10MHz) Body Back/Middle Channel/Zoom Scan**

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

Reference Value = 21.46 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 0.459 W/kg

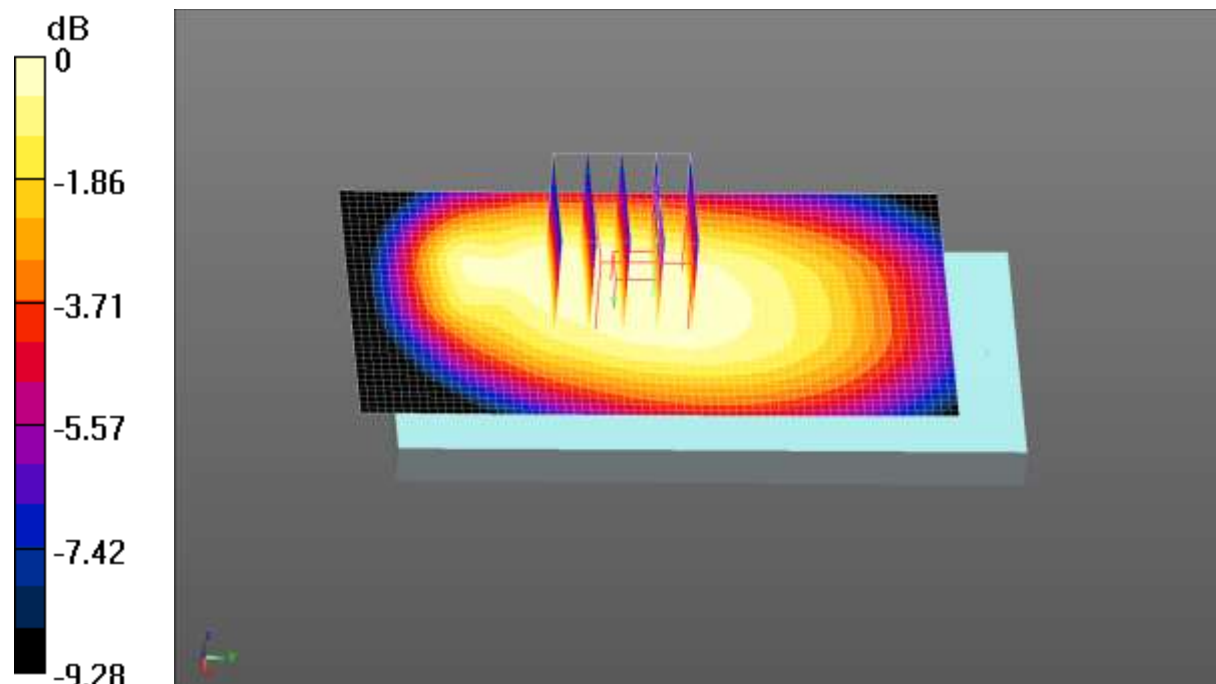
**SAR(1 g) = 0.334 W/kg; SAR(10 g) = 0.252 W/kg**

Maximum value of SAR (measured) = 0.411 W/kg

**LTE Band 12 50%RB(10MHz) Body Back/Middle Channel/Area Scan**

**(41x71x1):** Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$

Maximum value of SAR (interpolated) = 0.410 W/kg



0 dB = 0.410 W/kg = -3.87 dBW/kg



Test Laboratory: CCIS

Date/Time: 06.26.2018 08:40:42

**DUT: LTE mobile phone; Type: N5501L; Serial: 1#**

Communication System: UID 0, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps) (0);  
 Frequency: 2412 MHz; Duty Cycle: 1:1  
 Medium parameters used (interpolated):  $f = 2412$  MHz;  $\sigma = 1.943$  S/m;  $\epsilon_r = 53.394$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7433; ConvF(7.23, 7.23, 7.23); Calibrated: 09.30.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03.22.2018
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1208
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**WIFI Body Back/Low Channel/Area Scan (41x71x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.0347 W/kg

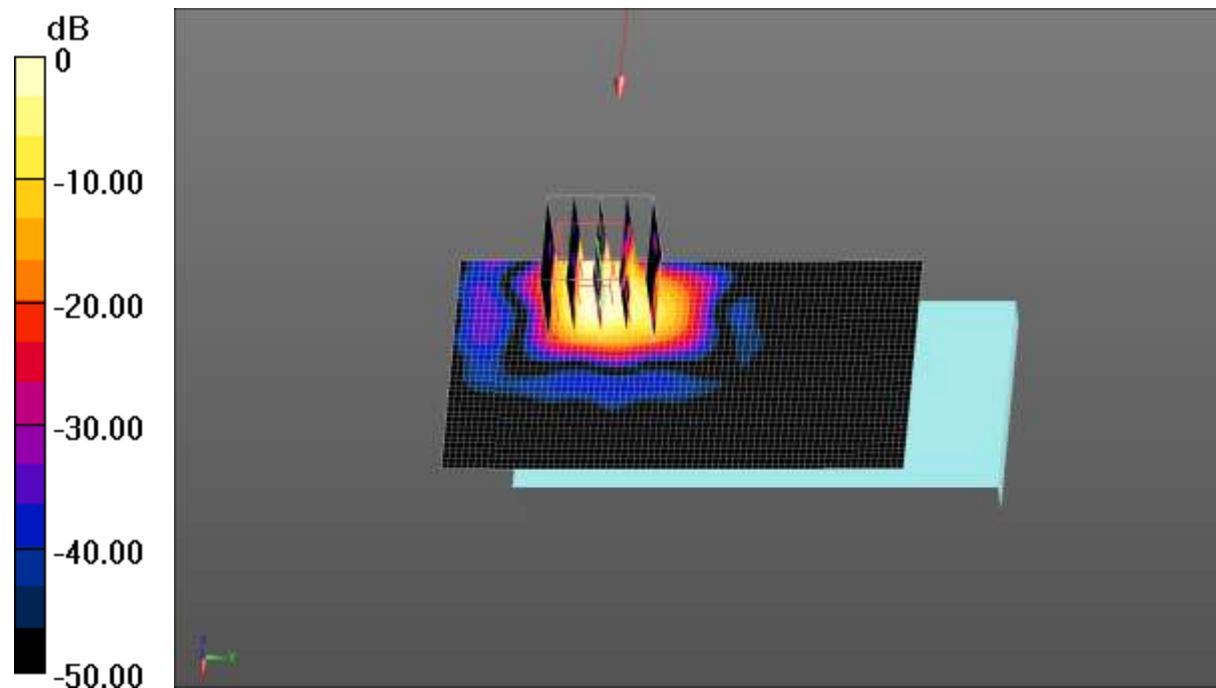
**WIFI Body Back/Low Channel/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 0.6320 V/m; Power Drift = -0.34 dB

Peak SAR (extrapolated) = 0.0600 W/kg

**SAR(1 g) = 0.01727 W/kg; SAR(10 g) = 0.00813 W/kg**

Maximum value of SAR (measured) = 0.0297 W/kg



0 dB = 0.0297 W/kg = -15.27 dBW/kg

Test Laboratory: CCIS

Date/Time: 07.01.2018 16:50:48

**DUT: LTE mobile phone; Type: N5501L; Serial: 1#**

Communication System: UID 0, GPRS(2 Slots) (0); Frequency: 848.8 MHz; Duty Cycle: 1:4.10015

Medium parameters used (extrapolated):  $f = 848.8 \text{ MHz}$ ;  $\sigma = 1.009 \text{ S/m}$ ;  $\epsilon_r = 54.688$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7433; ConvF(9.68, 9.68, 9.68); Calibrated: 09.30.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03.22.2018
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1208
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**GPRS 850 2Slots Body Back/High Channel/Zoom Scan (5x5x7)/Cube 0:**

Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 22.38 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 0.556 W/kg

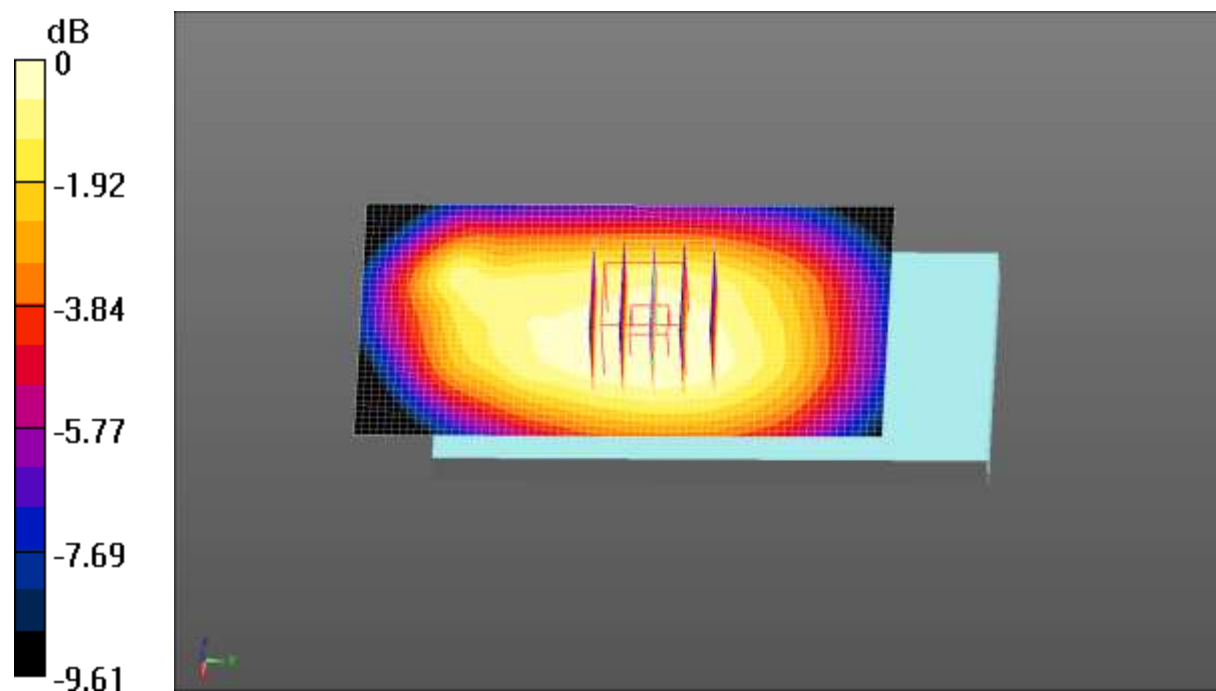
**SAR(1 g) = 0.404 W/kg; SAR(10 g) = 0.302 W/kg**

Maximum value of SAR (measured) = 0.499 W/kg

**GPRS 850 2Slots Body Back/High Channel/Area Scan (41x71x1): Interpolated**

grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$

Maximum value of SAR (interpolated) = 0.509 W/kg



0 dB = 0.509 W/kg = -2.93 dBW/kg

Test Laboratory: CCIS

Date/Time: 07.07.2018 23:28:54

**DUT: LTE mobile phone; Type: N5501L; Serial: 1#**

Communication System: UID 0, GPRS(4 Slots) (0); Frequency: 1909.8 MHz; Duty Cycle: 1:1.99986

Medium parameters used:  $f = 1910 \text{ MHz}$ ;  $\sigma = 1.54 \text{ S/m}$ ;  $\epsilon_r = 51.413$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7433; ConvF(7.67, 7.67, 7.67); Calibrated: 09.30.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03.22.2018
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1208
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**GPRS 1900 4Slots Body Bottom/High Channel/Zoom Scan (5x5x7)/Cube 0:**

Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 17.61 V/m; Power Drift = -0.31 dB

Peak SAR (extrapolated) = 0.707 W/kg

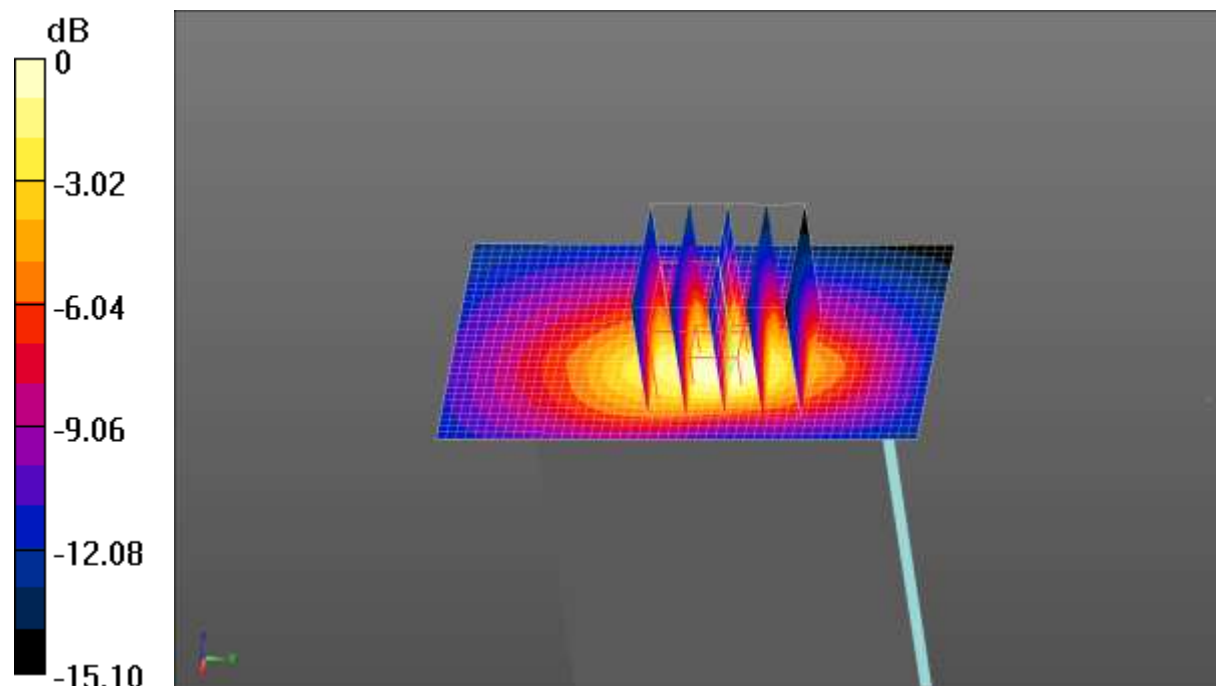
**SAR(1 g) = 0.406 W/kg; SAR(10 g) = 0.211 W/kg**

Maximum value of SAR (measured) = 0.519 W/kg

**GPRS 1900 4Slots Body Bottom/High Channel/Area Scan (31x51x1):**

Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$

Maximum value of SAR (interpolated) = 0.528 W/kg



0 dB = 0.528 W/kg = -2.77 dBW/kg

Test Laboratory: CCIS

Date/Time: 07.07.2018 19:31:04

**DUT: LTE mobile phone; Type: N5501L; Serial: 1#**

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

Medium parameters used (interpolated):  $f = 1852.4$  MHz;  $\sigma = 1.519$  S/m;  $\epsilon_r = 51.885$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7433; ConvF(7.67, 7.67, 7.67); Calibrated: 09.30.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03.22.2018
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1208
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**WCDMA 1900 Body Bottom/Low Channel/Zoom Scan (5x5x7)/Cube 0:**

Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 15.32 V/m; Power Drift = 0.27 dB

Peak SAR (extrapolated) = 0.833 W/kg

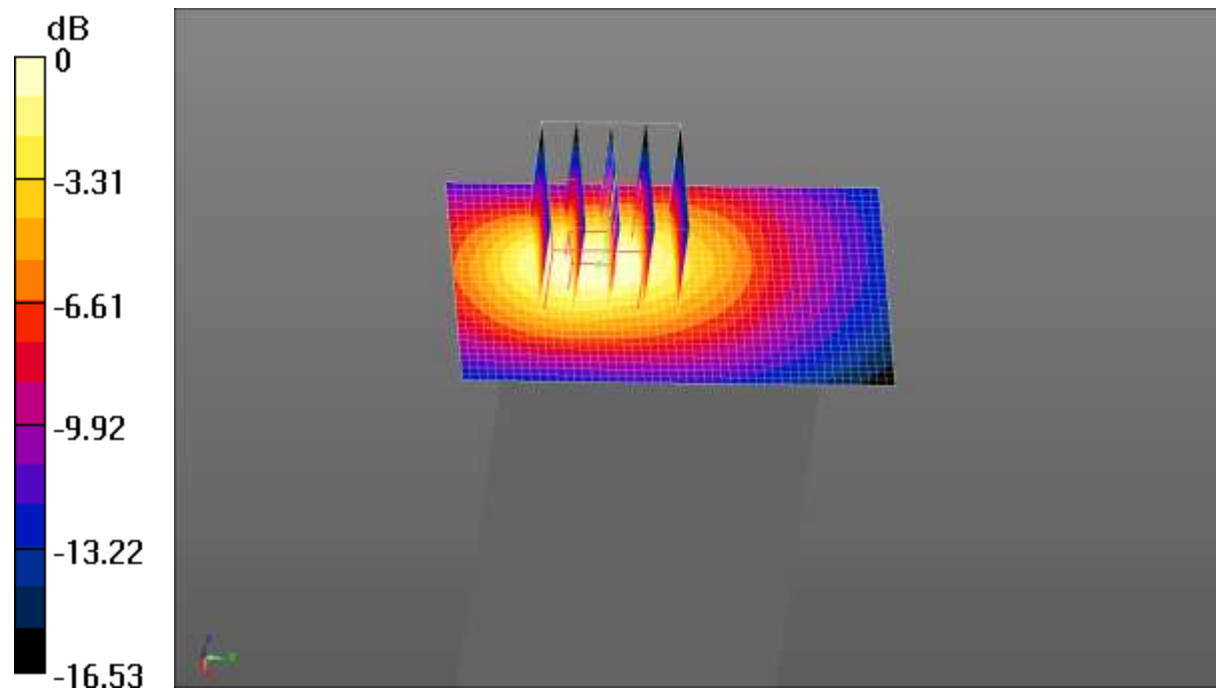
**SAR(1 g) = 0.463 W/kg; SAR(10 g) = 0.241 W/kg**

Maximum value of SAR (measured) = 0.624 W/kg

**WCDMA 1900 Body Bottom/Low Channel/Area Scan (31x51x1):** Interpolated

grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.547 W/kg



0 dB = 0.547 W/kg = -2.62 dBW/kg

Test Laboratory: CCIS

Date/Time: 07.07.2018 09:28:03

**DUT: LTE mobile phone; Type: N5501L; Serial: 1#**

Communication System: UID 0, LTE-Fdd(USA) 1RB QPSK (0); Frequency: 1880 MHz;

Duty Cycle: 1:1

Medium parameters used:  $f = 1880 \text{ MHz}$ ;  $\sigma = 1.529 \text{ S/m}$ ;  $\epsilon_r = 51.677$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7433; ConvF(7.67, 7.67, 7.67); Calibrated: 09.30.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03.22.2018
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1208
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

### LTE Band 2 1RB(20MHz) Body Bottom/Middle Channel/Zoom Scan

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

Reference Value = 18.39 V/m; Power Drift = -0.17 dB

Peak SAR (extrapolated) = 0.585 W/kg

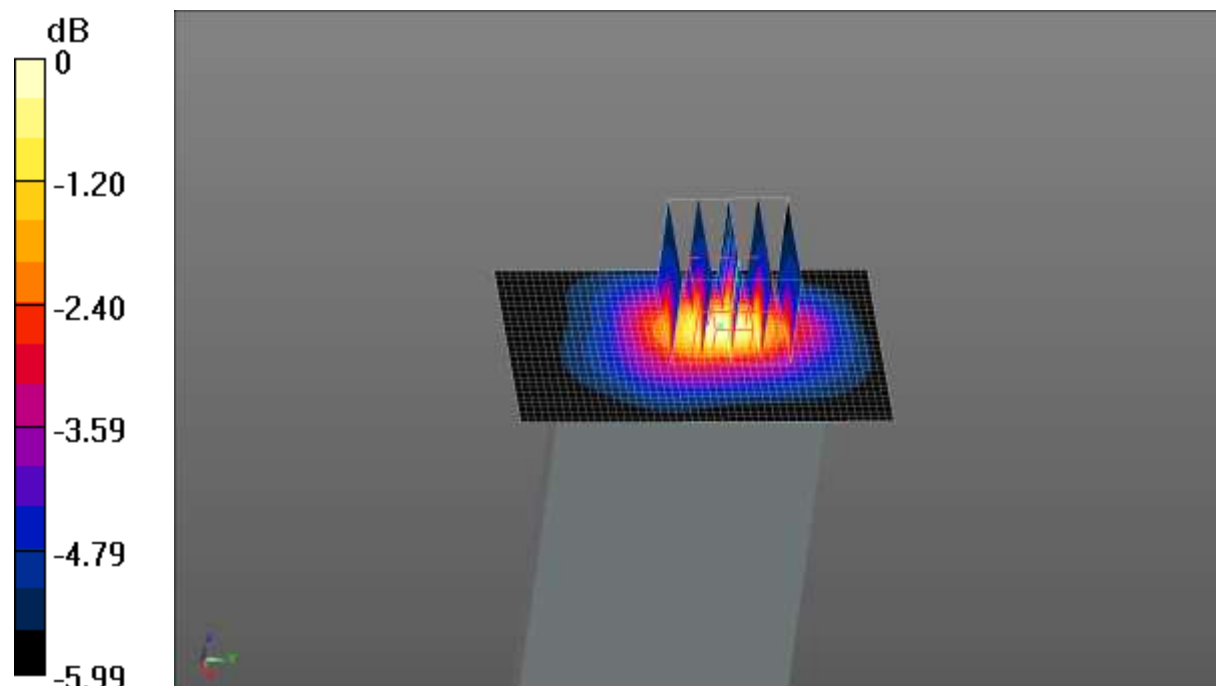
**SAR(1 g) = 0.434 W/kg; SAR(10 g) = 0.270 W/kg**

Maximum value of SAR (measured) = 0.508 W/kg

### LTE Band 2 1RB(20MHz) Body Bottom/Middle Channel/Area Scan (31x51x1):

Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$

Maximum value of SAR (interpolated) = 0.415 W/kg



0 dB = 0.415 W/kg = -3.82 dBW/kg

## Appendix E: System Calibration Certificate

Calibration information for E-field probes



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



中国认可  
国际互认  
校准  
CALIBRATION  
CNAS L0570

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209  
E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

Client

CTTL

Certificate No: Z17-97163

## CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:7433

Calibration Procedure(s): FF-Z11-004-01  
Calibration Procedures for Dosimetric E-field Probes

Calibration date: September 30, 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 NRP2	101919	27-Jun-17 (CTTL, No.J17X05857)	Jun-18
Power sensor NRP-Z91	101547	27-Jun-17 (CTTL, No.J17X05857)	Jun-18
Power sensor NRP-Z91	101548	27-Jun-17 (CTTL, No.J17X05857)	Jun-18
Reference10dBAttenuator	18N50W-10dB	13-Mar-16(CTTL, No.J16X01547)	Mar-18
Reference20dBAttenuator	18N50W-20dB	13-Mar-16(CTTL, No.J16X01548)	Mar-18
Reference Probe EX3DV4	SN 3617	23-Jan-17(SPEAG, No.EX3-3617_Jan17)	Jan-18
DAE4	SN 549	13-Dec-16(SPEAG, No.DAE4-549_Dec16)	Dec -17
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGeneratorMG3700A	6201052605	27-Jun-17 (CTTL, No.J17X05858)	Jun-18
Network Analyzer E5071C	MY46110673	13-Jan-17 (CTTL, No.J17X00285)	Jan -18

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

Issued: October 02, 2017

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



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209  
E-mail: [ttl@chinattl.com](mailto:ttl@chinattl.com) [Http://www.chinattl.cn](http://www.chinattl.cn)

**Glossary:**

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

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

**Calibration is Performed According to the Following Standards:**

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

**Methods Applied and Interpretation of Parameters:**

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





Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209  
E-mail: [ttl@chinatl.com](mailto:ttl@chinatl.com) [Http://www.chinatl.cn](http://www.chinatl.cn)

# Probe EX3DV4

## SN: 7433

Calibrated: September 30, 2017

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209  
E-mail: [ctl@chinattl.com](mailto:ctl@chinattl.com) [Http://www.chinattl.cn](http://www.chinattl.cn)

## DASY/EASY – Parameters of Probe: EX3DV4 – SN: 7433

### Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup>	0.63	0.58	0.62	±10.0%
DCP(mV) <sup>B</sup>	97.7	97.4	97.5	

### Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc <sup>E</sup> (k=2)
0	CW	X	0.0	0.0	1.0	0.00	207.0	±2.0%
		Y	0.0	0.0	1.0		198.6	
		Z	0.0	0.0	1.0		206.0	

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

<sup>A</sup> The uncertainties of Norm X, Y, Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Page 5 and Page 6).  
<sup>B</sup> Numerical linearization parameter: uncertainty not required.  
<sup>E</sup> Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209  
E-mail: ttl@chinattf.com [Http://www.chinattf.cn](http://www.chinattf.cn)

## DASY/EASY – Parameters of Probe: EX3DV4 – SN: 7433

### Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz] <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unct. (k=2)
750	41.9	0.89	9.77	9.77	9.77	0.30	0.85	±12.1%
900	41.5	0.97	9.42	9.42	9.42	0.16	1.32	±12.1%
1750	40.1	1.37	7.97	7.97	7.97	0.24	1.05	±12.1%
1900	40.0	1.40	7.71	7.71	7.71	0.25	0.99	±12.1%
2000	40.0	1.40	7.69	7.69	7.69	0.16	1.31	±12.1%
2300	39.5	1.67	7.58	7.58	7.58	0.59	0.67	±12.1%
2450	39.2	1.80	7.34	7.34	7.34	0.28	1.32	±12.1%
2600	39.0	1.96	6.97	6.97	6.97	0.66	0.67	±12.1%
3500	37.9	2.91	6.86	6.86	6.86	0.43	1.08	±13.3%
5200	36.0	4.66	5.55	5.55	5.55	0.40	1.30	±13.3%
5300	35.9	4.76	5.28	5.28	5.28	0.40	1.35	±13.3%
5500	35.6	4.96	4.83	4.83	4.83	0.40	1.35	±13.3%
5600	35.5	5.07	4.56	4.56	4.56	0.40	1.50	±13.3%
5800	35.3	5.27	4.66	4.66	4.66	0.40	1.50	±13.3%

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

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

<sup>G</sup> Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-8 GHz at any distance larger than half the probe tip diameter from the boundary.



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209  
E-mail: ttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

## DASY/EASY – Parameters of Probe: EX3DV4 – SN: 7433

### Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz] <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unct. (k=2)
750	55.5	0.96	9.68	9.68	9.68	0.30	0.95	±12.1%
900	55.0	1.05	9.34	9.34	9.34	0.23	1.17	±12.1%
1750	53.4	1.49	7.81	7.81	7.81	0.23	1.06	±12.1%
1900	53.3	1.52	7.67	7.67	7.67	0.16	1.80	±12.1%
2000	53.3	1.52	7.65	7.65	7.65	0.19	1.22	±12.1%
2300	52.9	1.81	7.40	7.40	7.40	0.55	0.78	±12.1%
2450	52.7	1.95	7.23	7.23	7.23	0.37	1.11	±12.1%
2600	52.5	2.16	6.97	6.97	6.97	0.51	0.82	±12.1%
3500	51.3	3.31	6.35	6.35	6.35	0.57	0.91	±13.3%
5200	49.0	5.30	4.94	4.94	4.94	0.45	1.50	±13.3%
5300	48.9	5.42	4.57	4.57	4.57	0.45	1.50	±13.3%
5500	48.6	5.65	4.23	4.23	4.23	0.50	1.65	±13.3%
5600	48.5	5.77	4.03	4.03	4.03	0.50	1.70	±13.3%
5800	48.2	6.00	4.05	4.05	4.05	0.55	1.65	±13.3%

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

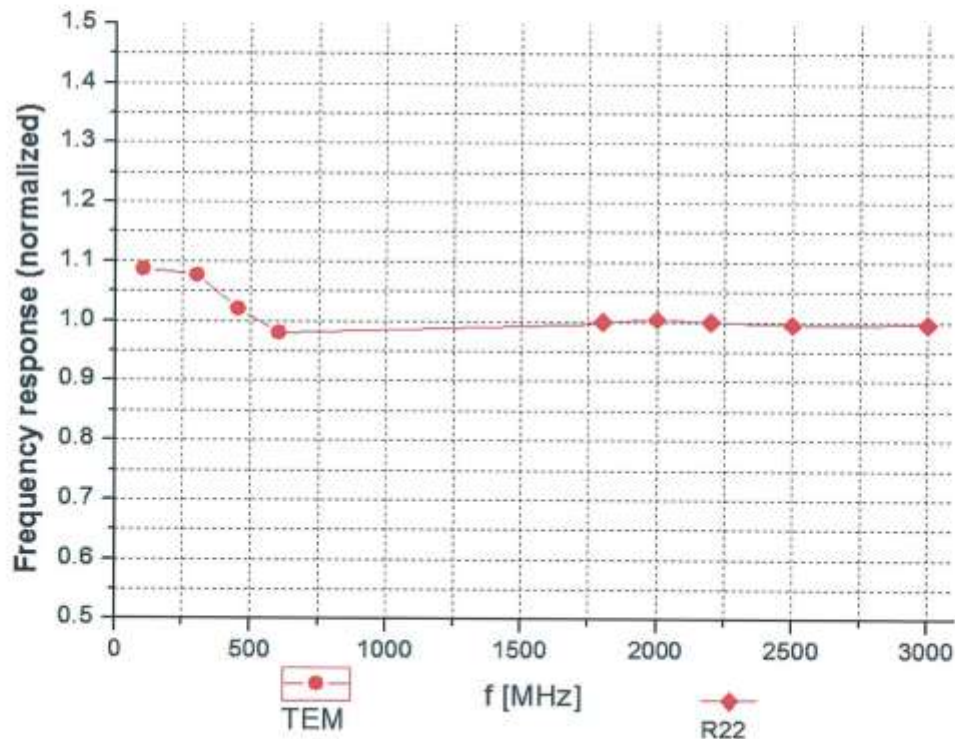
<sup>F</sup> At frequency below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to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

<sup>G</sup> Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-8 GHz at any distance larger than half the probe tip diameter from the boundary.



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209  
E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

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



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

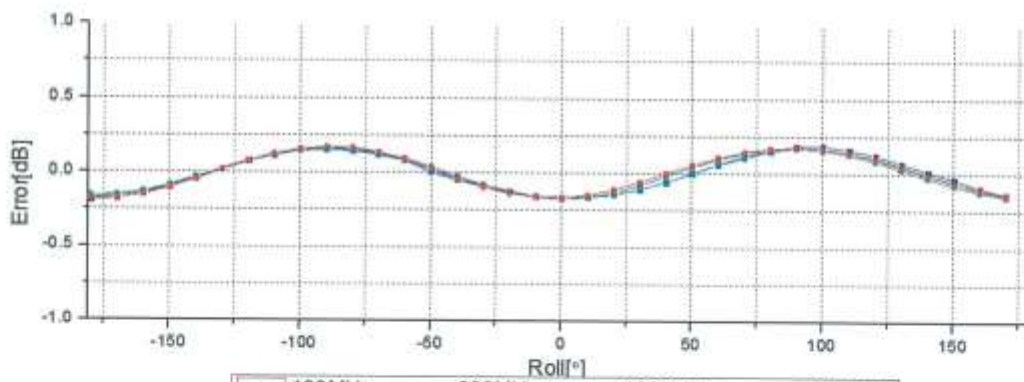
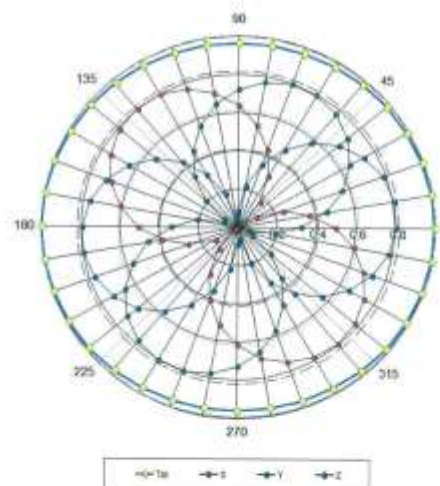
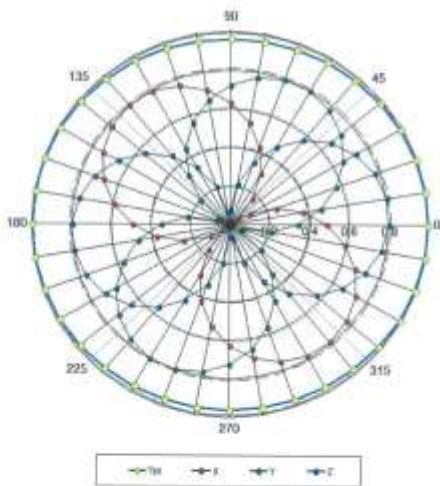


Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209  
E-mail: ttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

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

f=600 MHz, TEM

f=1800 MHz, R22

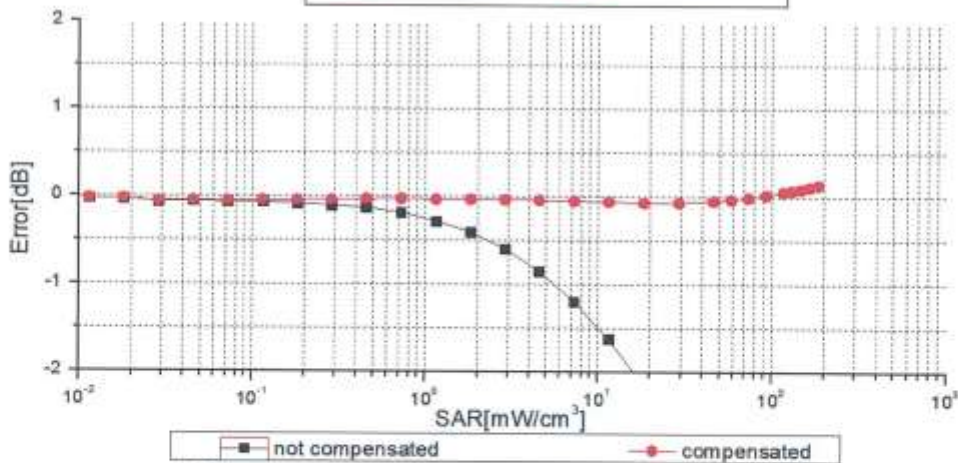
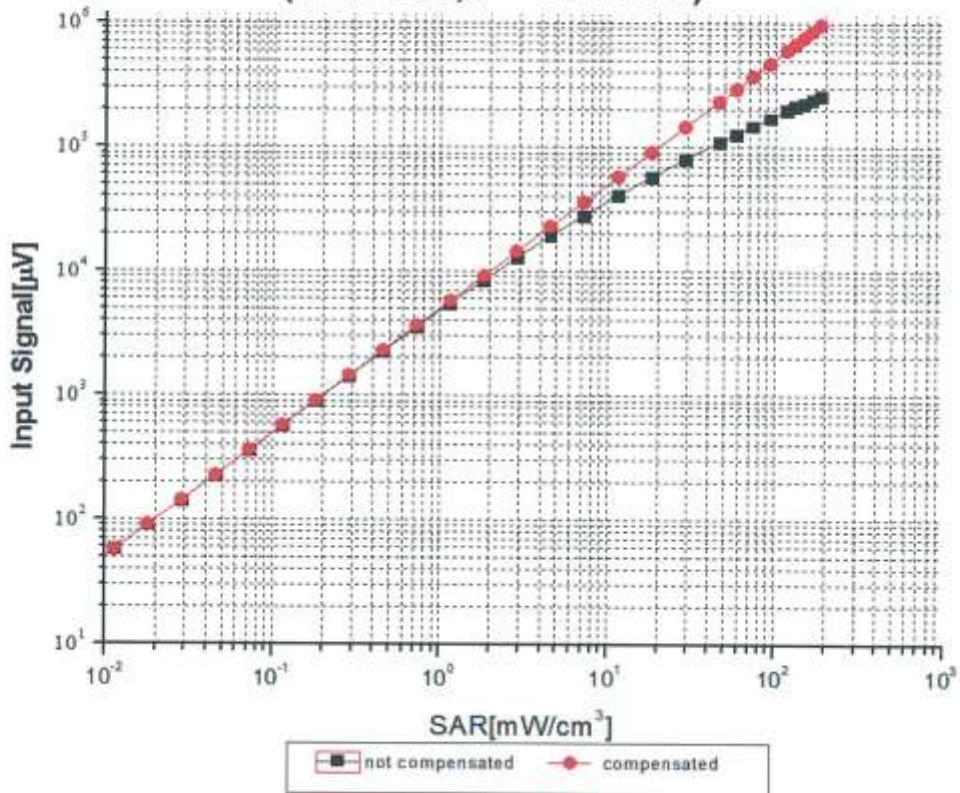


Uncertainty of Axial Isotropy Assessment:  $\pm 1.2\%$  (k=2)



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209  
E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

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



Uncertainty of Linearity Assessment: ±0.9% (k=2)

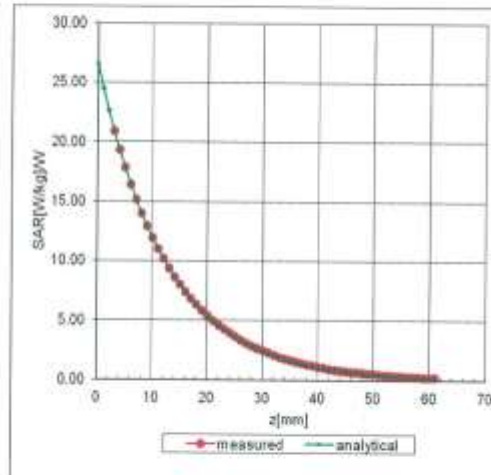
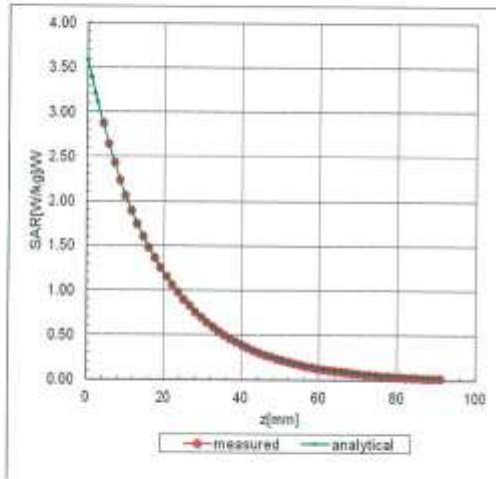


Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209  
E-mail: [ttl@chinattl.com](mailto:ttl@chinattl.com) [Http://www.chinattl.cn](http://www.chinattl.cn)

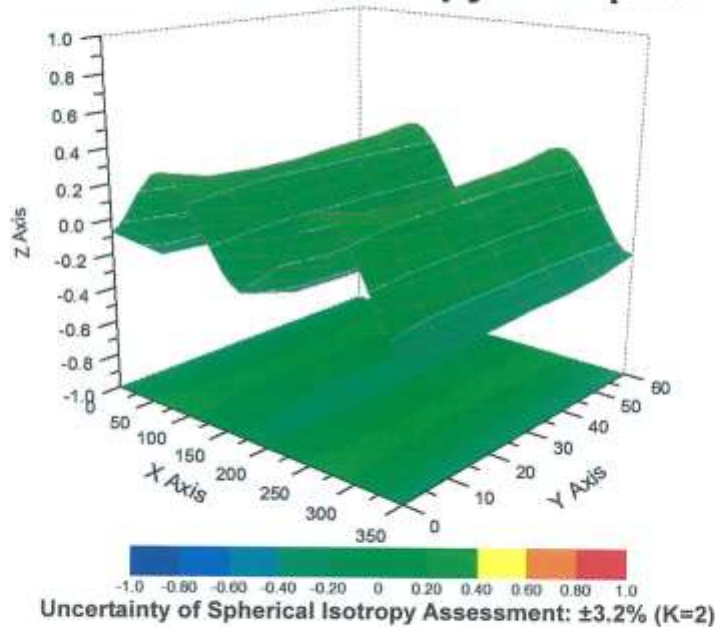
## Conversion Factor Assessment

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

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



## Deviation from Isotropy in Liquid







Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
 Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209  
 E-mail: [cttl@chinattl.com](mailto:cttl@chinattl.com) [Http://www.chinattl.cn](http://www.chinattl.cn)

## DASY/EASY – Parameters of Probe: EX3DV4 – SN: 7433

### Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	106.1
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	9mm
Tip Diameter	2.5mm
Probe Tip to Sensor X Calibration Point	1mm
Probe Tip to Sensor Y Calibration Point	1mm
Probe Tip to Sensor Z Calibration Point	1mm
Recommended Measurement Distance from Surface	1.4mm

## Calibration information for Dipole



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



中国认可  
国际互认  
校准  
CALIBRATION  
CNAS L0570

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

Client

CCIS

Certificate No:

Z17-97076

### CALIBRATION CERTIFICATE

Object: D750V3 - SN: 1118

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

Calibration date: June 08, 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)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	27-Jun-16 (CTTL, No.J16X04771)	Jun-17
Power sensor NRP-Z91	101547	27-Jun-16 (CTTL, No.J16X04771)	Jun-17
Reference Probe EX3DVB4	SN 3617	23-Jan-17(SPEAG,No.EX3-3617_Jan17)	Jan-18
DAE4	SN 1331	19-Jan-17(CTTL-SPEAG,No.Z17-97015)	Jan-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: June 10, 2017

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

Certificate No: Z17-97076

Page 1 of 8



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:**

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for 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
- c) 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
- d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

**Additional Documentation:**

- e) DASY4/5 System Handbook

**Methods Applied and Interpretation of Parameters:**

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

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



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

### Measurement Conditions

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

DASY Version	DASY52	52.10.0.1442
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	42.1 ± 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	2.06 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	8.31 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	1.37 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	5.52 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	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.7 ± 6 %	0.97 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	2.21 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	8.76 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	1.48 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	5.88 mW / g ± 18.7 % (k=2)



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

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

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

**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	53.3Ω- 4.83jΩ
Return Loss	- 24.9dB

**Antenna Parameters with Body TSL**

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

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.135 ns
----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

**Additional EUT Data**

Manufactured by	SPEAG
-----------------	-------



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

**DASY5 Validation Report for Head TSL**

Date: 06.08.2017

Test Laboratory: CTTL, Beijing, China

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

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

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

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(10.05, 10.05, 10.05); Calibrated: 1/23/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 1/19/2017
- 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 (7413)

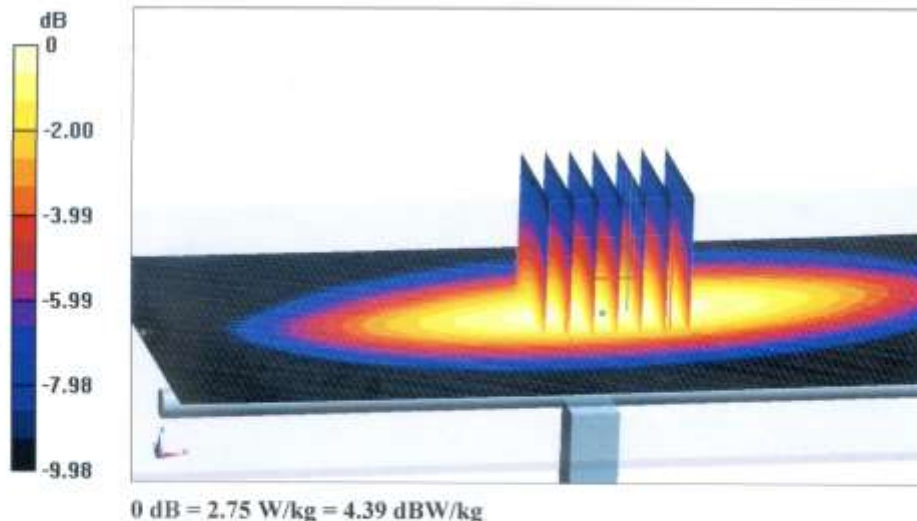
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

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

Peak SAR (extrapolated) = 3.14 W/kg

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

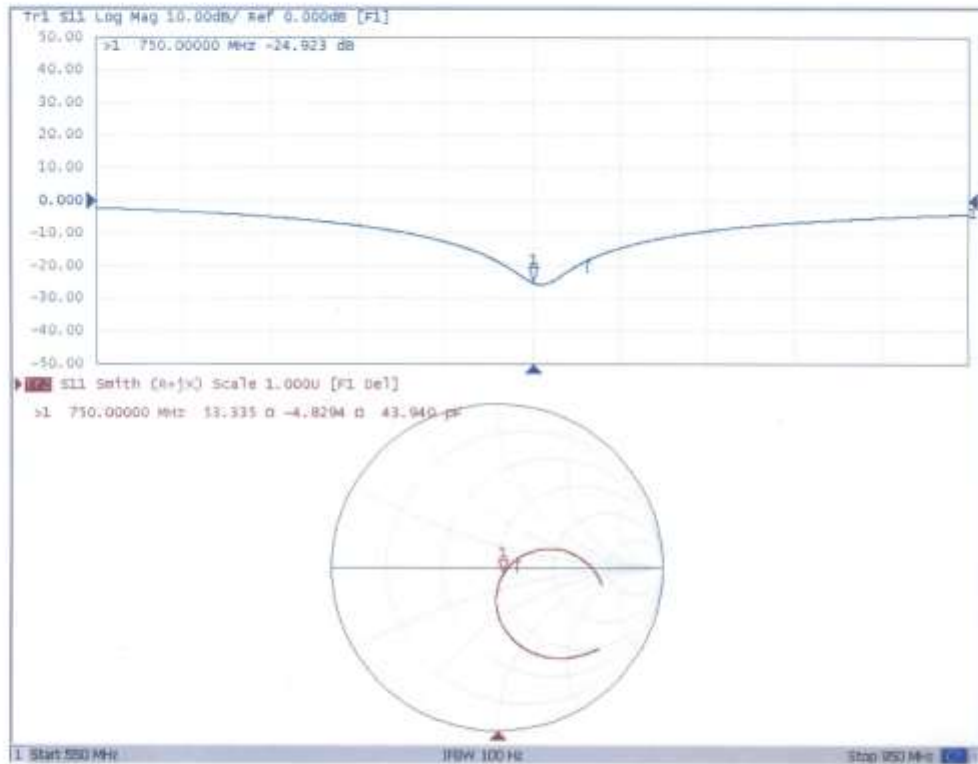
Maximum value of SAR (measured) = 2.75 W/kg





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

### Impedance Measurement Plot for Head TSL





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

**DASY5 Validation Report for Body TSL**

Date: 06.08.2017

Test Laboratory: CTTL, Beijing, China

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

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

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

Phantom section: Center Section

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

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3617; ConvF(9.8, 9.8, 9.8); Calibrated: 1/23/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 1/19/2017
- 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 (7413)

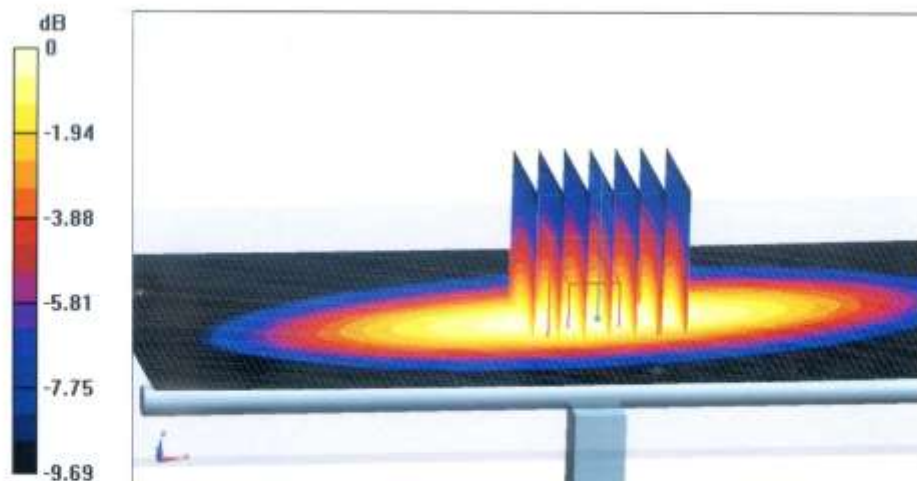
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

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

Peak SAR (extrapolated) = 3.37 W/kg

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

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



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

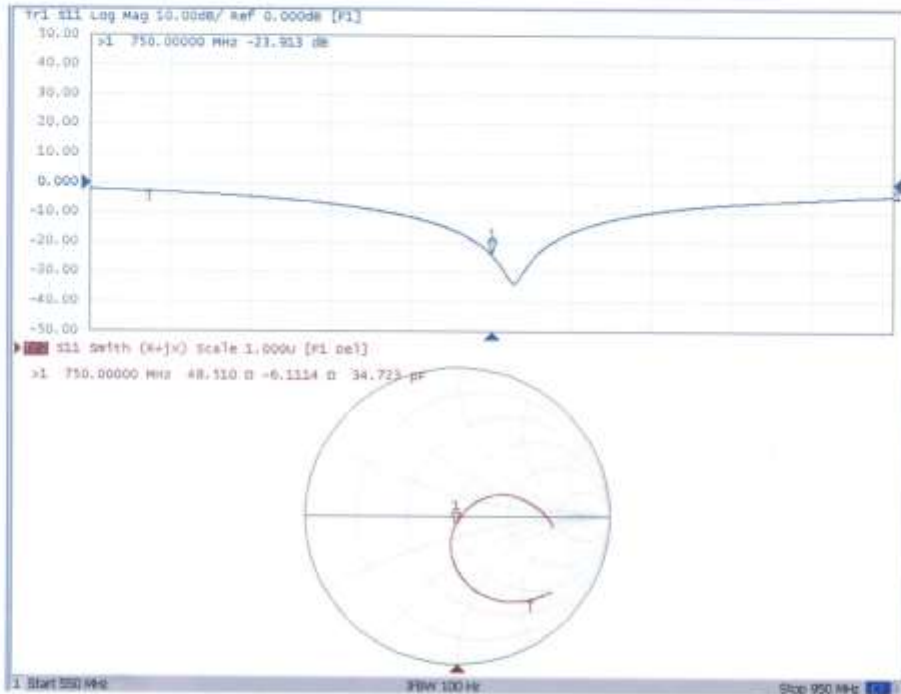




In Collaboration with  
**s p e a g**  
 CALIBRATION LABORATORY

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

### Impedance Measurement Plot for Body TSL



## Dipole Impedance and Return Loss calibration Report

**Object:** D750V3 - SN: 1118  
**Calibration Date:** June 10, 2018  
**Calibration reference:** IEEE Std 1528:2013, IEC 62209-1:2016, FCC KDB 865664 D01

**Calibrated By:** *Janet Wei* (Janet Wei, SAR project engineer)

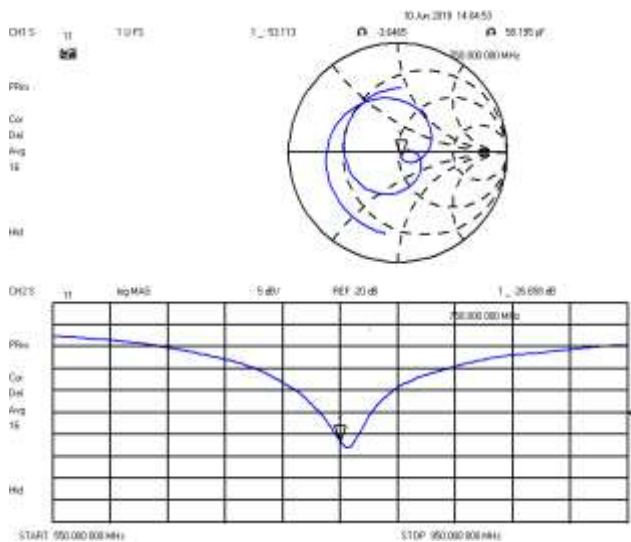
**Reviewed By:** *Bruce Zhang* (Bruce Zhang, Technical manager)

### Environment of Test Site

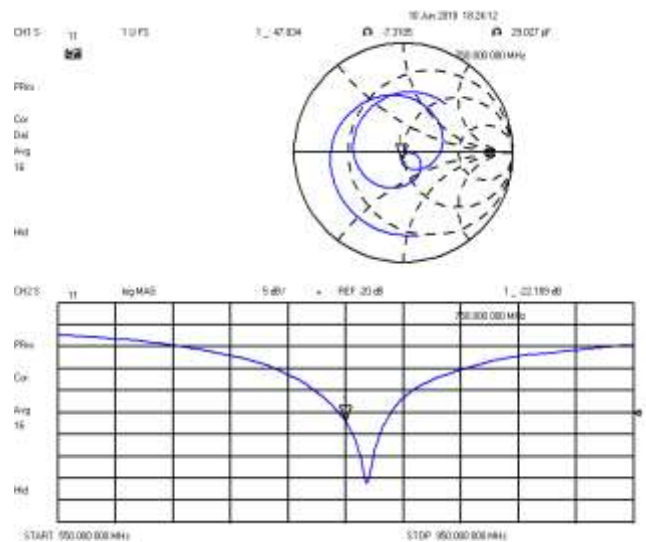
Temperature:	18 ~ 25°C
Humidity:	50~60% RH
Atmospheric Pressure:	1011 mbar

### Test Data

Measurement Plot for Head TSL In 2018



Measurement Plot for Body TSL In 2018



### Comparison with Original report

Items	Calibrated By Speag	Calibrated By CCIS In 2018	Deviation	Limit
Impedence for Head TSL	53.34Ω-4.83jΩ	53.11Ω-3.65jΩ	-0.23Ω+1.18 jΩ	±5Ω
Return Loss for Head TSL	-24.9dB	-26.7dB	7.2%	±20%(No less than 20 dB)
Impedence for Body TSL	48.51Ω-6.11jΩ	47.83Ω-7.3jΩ	-0.68Ω-1.19 jΩ	±5Ω
Return Loss for Body TSL	-23.9dB	-22.2dB	-7.1%	±20%(No less than 20 dB)

### Result

Compliance



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



中国认可  
国际互认  
校准  
CALIBRATION  
CNAS L0570

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

Client **CCIS**

Certificate No: **Z16-97089**

## CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d154**

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

Calibration date: **Jun 16, 2016**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	01-Jul-15 (CTTL, No.J15X04256)	Jun-16
Power sensor NRP-Z91	101547	01-Jul-15 (CTTL, No.J15X04256)	Jun-16
Reference Probe EX3DV4	SN 7307	19-Feb-16(SPEAG,No.EX3-7307_Feb16)	Feb-17
DAE4	SN 771	02-Feb-16(CTTL-SPEAG,No.Z16-97011)	Feb-17
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	01-Feb-16 (CTTL, No.J16X00893)	Jan-17
Network Analyzer E5071C	MY46110673	26-Jan-16 (CTTL, No.J16X00894)	Jan-17

	Name	Function	Signature
Calibrated by:	<b>Zhao Jing</b>	SAR Test Engineer	
Reviewed by:	<b>Qi Dianyuan</b>	SAR Project Leader	
Approved by:	<b>Lu Bingsong</b>	Deputy Director of the laboratory	

Issued: Jun 17, 2016

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

Certificate No: Z16-97089

Page 1 of 8



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:**

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) For hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005
- c) 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
- d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

**Additional Documentation:**

- e) DASY4/5 System Handbook

**Methods Applied and Interpretation of Parameters:**

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

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



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

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

### Measurement Conditions

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

DASY Version	DASY52	52.8.8.1258
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 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	41.0 ± 6 %	0.89 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	2.30 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	9.24 mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.50 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	6.02 mW /g ± 20.4 % (k=2)

### Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.4 ± 6 %	0.99 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	2.43 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	9.57 mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.61 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	6.36 mW /g ± 20.4 % (k=2)



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

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

**Appendix**

**Antenna Parameters with Head TSL**

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

**Antenna Parameters with Body TSL**

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

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.508 ns
----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

**Additional EUT Data**

Manufactured by	SPEAG
-----------------	-------



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

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

**DASY5 Validation Report for Head TSL**

Date: 06.16.2016

Test Laboratory: CTTL, Beijing, China

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

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

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

Phantom section: Right Section

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

**DASY5 Configuration:**

- Probe: EX3DV4 - SN7307; ConvF(10.01, 10.01,10.01); Calibrated: 2/19/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2016-02-02
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

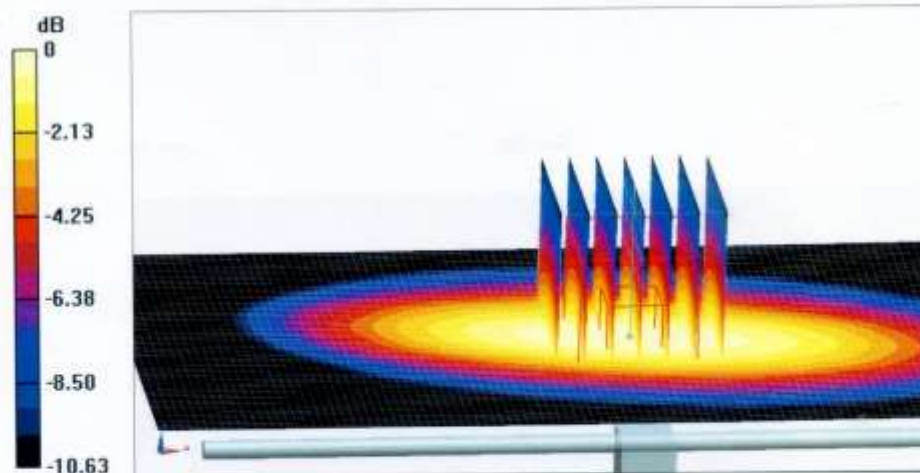
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

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

Peak SAR (extrapolated) = 3.41 W/kg

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

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



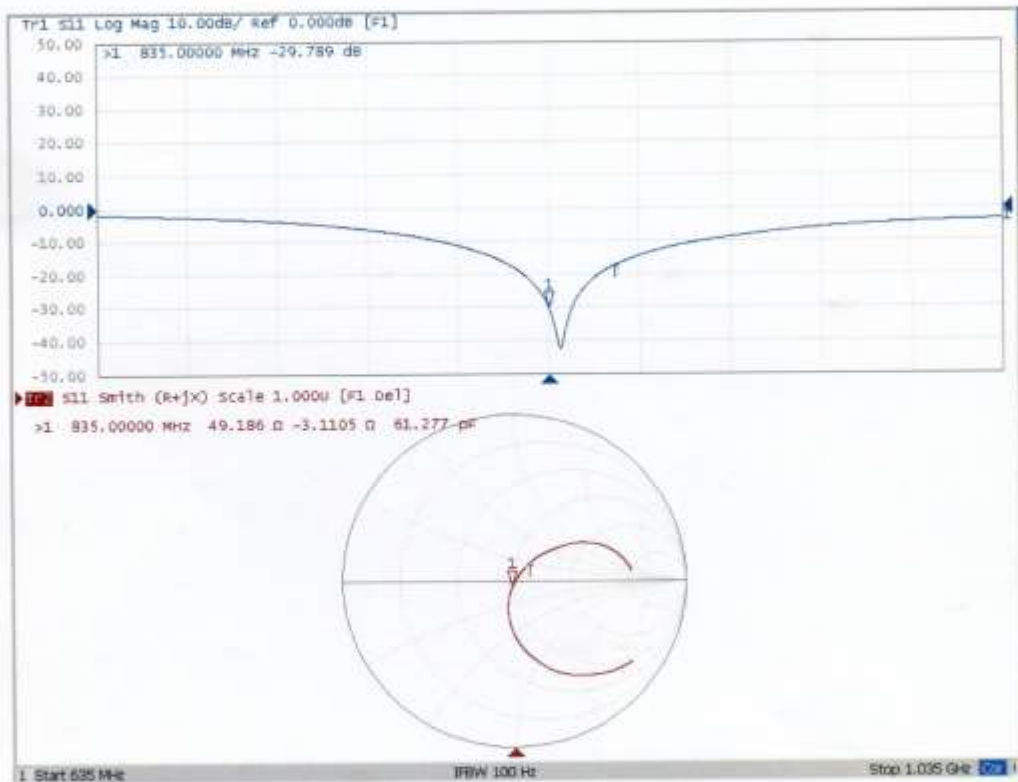
0 dB = 2.91 W/kg = 4.64 dBW/kg



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

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

### Impedance Measurement Plot for Head TSL







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

**DASY5 Validation Report for Body TSL**

Date: 06.16.2016

Test Laboratory: CCTL, Beijing, China

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

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

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

Phantom section: Center Section

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

**DASY5 Configuration:**

- Probe: EX3DV4 - SN7307; ConvF(9.83,9.83, 9.83); Calibrated: 2/19/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2016-02-02
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

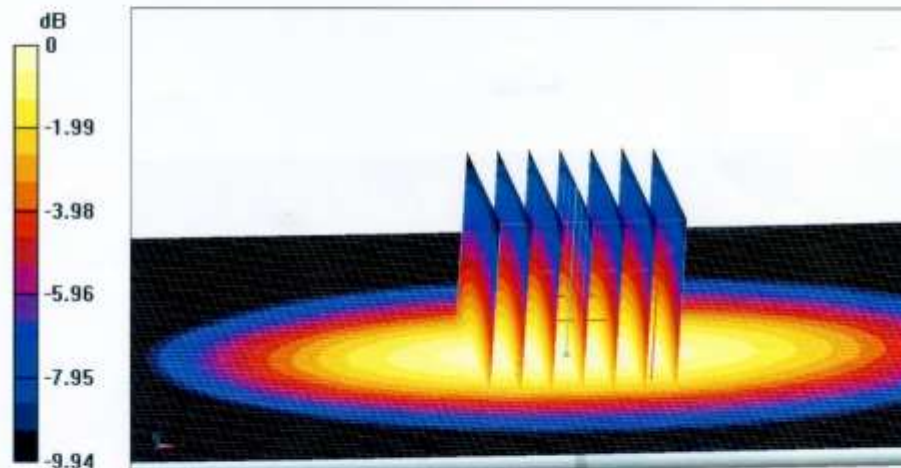
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

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

Peak SAR (extrapolated) = 3.53 W/kg

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

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



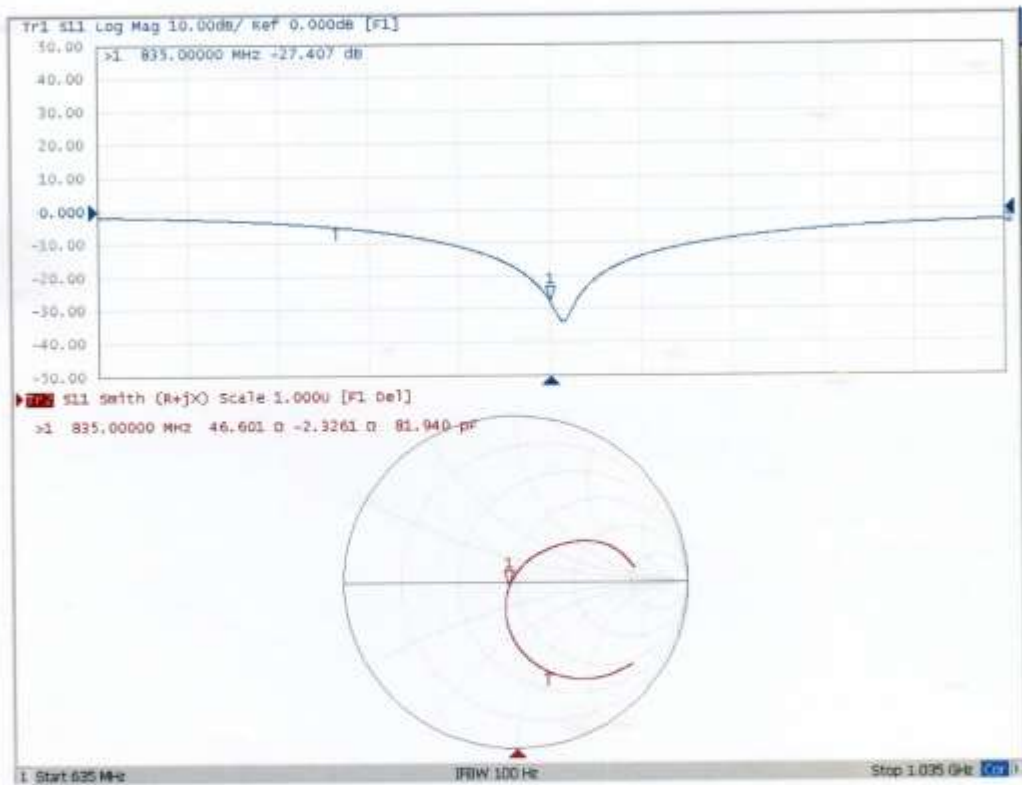
0 dB = 3.04 W/kg = 4.83 dBW/kg



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

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

### Impedance Measurement Plot for Body TSL



## Dipole Impedance and Return Loss calibration Report

**Object:** D835V2 - SN: 4d154  
**Calibration Date:** June 10, 2018  
**Calibration reference:** IEEE Std 1528:2013, IEC 62209-1:2016, FCC KDB 865664 D01

**Calibrated By:** *Janet Wei* (Janet Wei, SAR project engineer)

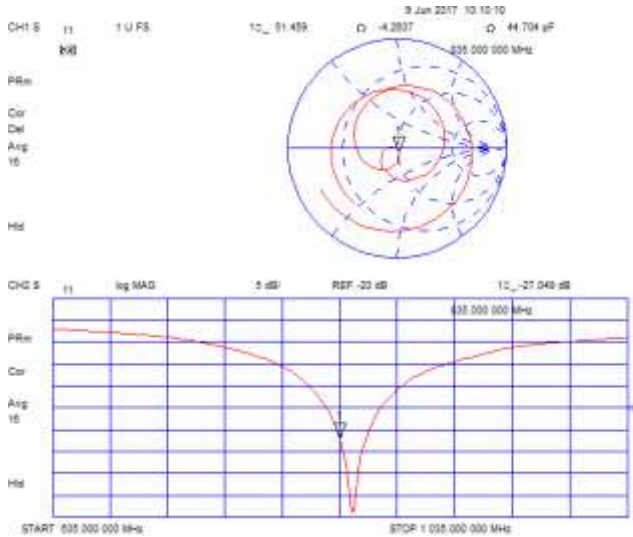
**Reviewed By:** *Bruce Zhang* (Bruce Zhang, Technical manager)

### Environment of Test Site

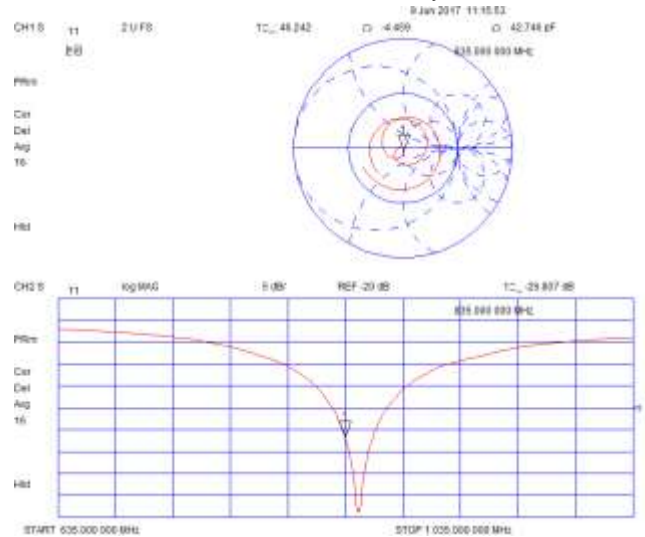
Temperature:	21 ~ 23°C
Humidity:	50~60% RH
Atmospheric Pressure:	1011 mbar

### Test Data

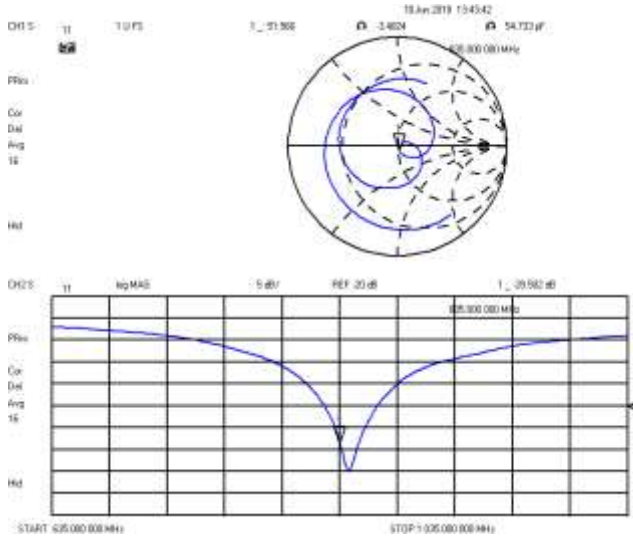
Measurement Plot for Head TSL In 2017



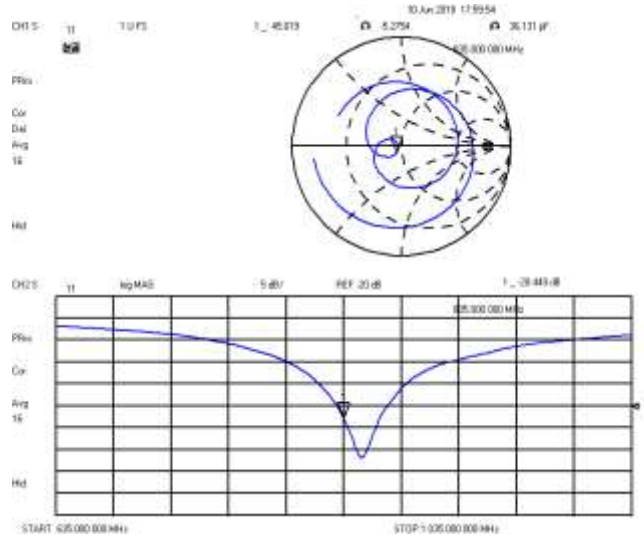
Measurement Plot for Body TSL In 2017



Measurement Plot for Head TSL In 2018



Measurement Plot for Body TSL In 2018



**Comparison with Original report**

Items	Calibrated By CCIS In 2017	Calibrated By CCIS In 2018	Deviation	Limit
Impedence for Head TSL	51.46Ω -4.26jΩ	51.57Ω -3.48jΩ	0.11Ω+0.78jΩ	±5Ω
Return Loss for Head TSL	-27.05dB	-28.5dB	-9.2%	±20%(No less than 20 dB)
Impedence for Body TSL	46.24Ω-4.46 jΩ	45.62Ω-5.28 jΩ	-0.62Ω-0.82 jΩ	±5Ω
Return Loss for Body TSL	-26.8dB	-28.5dB	6.3%	±20%(No less than 20 dB)

**Result**

Compliance



## SAR Reference Dipole Calibration Report

Ref : ACR.93.5.17.SATU.A

**WALTEK SERVICES(SHENZHEN) CO.,LTD**  
**1/F., FUKANGTAI BUILDING,WEST BAIMA ROAD,**  
**SONGGANG STREET**  
**BAOAN DISTRICT,SHENZHEN GUANGDONG**  
**518105,CHINA**  
**MVG COMOSAR REFERENCE DIPOLE**  
**FREQUENCY: 1800 MHZ**  
**SERIAL NO.: SN 09/15 DIP 1G800-360**

**Calibrated at MVG US**  
**2105 Barrett Park Dr. - Kennesaw, GA 30144**



**Calibration Date: 02/28/2018**

*Summary:*

This document presents the method and results from an accredited SAR reference dipole calibration performed in MVG USA using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR\_93.5.17.SATU.A

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Jérôme LUC	Product Manager	3/13/2018	<i>JS</i>
<i>Checked by :</i>	Jérôme LUC	Product Manager	3/13/2018	<i>JS</i>
<i>Approved by :</i>	Kim RUTKOWSKI	Quality Manager	3/13/2018	<i>Kim Rutkowski</i>

	<i>Customer Name</i>
<i>Distribution :</i>	Waltek Services (Shenzhen)Co., Ltd

<i>Issue</i>	<i>Date</i>	<i>Modifications</i>
A	3/13/2018	Initial release

Page: 2/11

*This document shall not be reproduced, except in full or in part, without the written approval of MVG.  
The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of MVG.*



## TABLE OF CONTENTS

1	Introduction.....	4
2	Device Under Test.....	4
3	Product Description.....	4
3.1	General Information.....	4
4	Measurement Method.....	5
4.1	Return Loss Requirements.....	5
4.2	Mechanical Requirements.....	5
5	Measurement Uncertainty.....	5
5.1	Return Loss.....	5
5.2	Dimension Measurement.....	5
5.3	Validation Measurement.....	5
6	Calibration Measurement Results.....	6
6.1	Return Loss and Impedance In Head Liquid.....	6
6.2	Return Loss and Impedance In Body Liquid.....	6
6.3	Mechanical Dimensions.....	6
7	Validation measurement.....	7
7.1	Head Liquid Measurement.....	7
7.2	SAR Measurement Result With Head Liquid.....	8
7.3	Body Liquid Measurement.....	9
7.4	SAR Measurement Result With Body Liquid.....	10
8	List of Equipment.....	11



## 1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528, FCC KDBs and CEI/IEC 62209 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

## 2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 1800 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID1800
Serial Number	SN 09/15 DIP 1G800-360
Product Condition (new / used)	New

A yearly calibration interval is recommended.

## 3 PRODUCT DESCRIPTION

### 3.1 GENERAL INFORMATION

MVG's COMOSAR Validation Dipoles are built in accordance to the IEEE 1528, FCC KDBs and CEI/IEC 62209 standards. The product is designed for use with the COMOSAR test bench only.



Figure 1 – MVG COMOSAR Validation Dipole

Page: 4/11

*This document shall not be reproduced, except in full or in part, without the written approval of MVG. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of MVG.*





## 4 MEASUREMENT METHOD

The IEEE 1528, FCC KDBs and CEI/IEC 62209 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standards.

### 4.1 RETURN LOSS REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a return loss of -20 dB or better. The return loss measurement shall be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards.

### 4.2 MECHANICAL REQUIREMENTS

The IEEE Std. 1528 and CEI/IEC 62209 standards specify the mechanical components and dimensions of the validation dipoles, with the dimensions frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness.

## 5 MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

### 5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.1 dB

### 5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

Length (mm)	Expanded Uncertainty on Length
3 - 300	0.05 mm

### 5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEEE 1528, FCC KDBs, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty
1 g	20.3 %

Page: 5/11

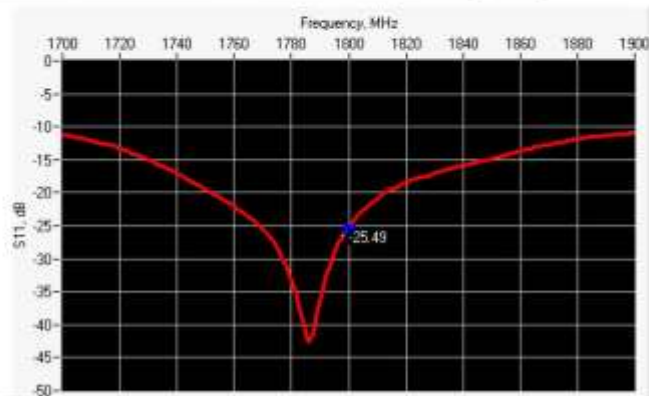
*This document shall not be reproduced, except in full or in part, without the written approval of MVG. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of MVG.*



10 g	20.1 %
------	--------

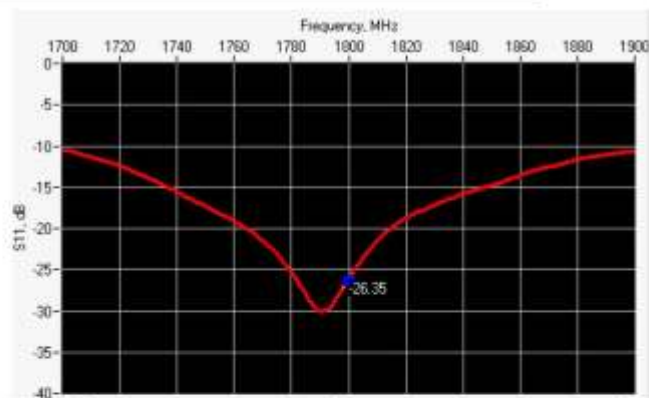
## 6 CALIBRATION MEASUREMENT RESULTS

### 6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
1800	-25.49	-20	45.4 Ω + 2.6 jΩ

### 6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
1800	-26.35	-20	45.4 Ω - 1.5 jΩ

### 6.3 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 ±1 %		250.0 ±1 %		6.35 ±1 %	

Page: 6/11

*This document shall not be reproduced, except in full or in part, without the written approval of MVG. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of MVG.*



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.93.5.17.SATU.A

450	290.0 ±1 %		166.7 ±1 %		6.35 ±1 %	
750	176.0 ±1 %		100.0 ±1 %		6.35 ±1 %	
835	161.0 ±1 %		89.8 ±1 %		3.6 ±1 %	
900	149.0 ±1 %		83.3 ±1 %		3.6 ±1 %	
1450	89.1 ±1 %		51.7 ±1 %		3.6 ±1 %	
1500	80.5 ±1 %		50.0 ±1 %		3.6 ±1 %	
1640	79.0 ±1 %		45.7 ±1 %		3.6 ±1 %	
1750	75.2 ±1 %		42.9 ±1 %		3.6 ±1 %	
1800	72.0 ±1 %	PASS	41.7 ±1 %	PASS	3.6 ±1 %	PASS
1900	68.0 ±1 %		39.5 ±1 %		3.6 ±1 %	
1950	66.3 ±1 %		38.5 ±1 %		3.6 ±1 %	
2000	64.5 ±1 %		37.5 ±1 %		3.6 ±1 %	
2100	61.0 ±1 %		35.7 ±1 %		3.6 ±1 %	
2300	55.5 ±1 %		32.6 ±1 %		3.6 ±1 %	
2450	51.5 ±1 %		30.4 ±1 %		3.6 ±1 %	
2600	48.5 ±1 %		28.8 ±1 %		3.6 ±1 %	
3000	41.5 ±1 %		25.0 ±1 %		3.6 ±1 %	
3500	37.0 ±1 %		26.4 ±1 %		3.6 ±1 %	
3700	34.7 ±1 %		26.4 ±1 %		3.6 ±1 %	

7 VALIDATION MEASUREMENT

The IEEE Std. 1528, FCC KDBs and CEI/IEC 62209 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ε <sub>r</sub> )		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 ±5 %		0.87 ±5 %	
450	43.5 ±5 %		0.87 ±5 %	
750	41.9 ±5 %		0.89 ±5 %	
835	41.5 ±5 %		0.90 ±5 %	
900	41.5 ±5 %		0.97 ±5 %	
1450	40.5 ±5 %		1.20 ±5 %	
1500	40.4 ±5 %		1.23 ±5 %	
1640	40.2 ±5 %		1.31 ±5 %	
1750	40.1 ±5 %		1.37 ±5 %	

Page: 7/11

*This document shall not be reproduced, except in full or in part, without the written approval of MVG. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of MVG.*



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.93.5.17.SATU.A

1800	40.0 ±5 %	PASS	1.40 ±5 %	PASS
1900	40.0 ±5 %		1.40 ±5 %	
1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %		1.40 ±5 %	
2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %		1.80 ±5 %	
2600	39.0 ±5 %		1.96 ±5 %	
3000	38.5 ±5 %		2.40 ±5 %	
3500	37.9 ±5 %		2.91 ±5 %	

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

The IEEE Std. 1528 and CEI/IEC 62209 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: eps' : 41.7 sigma : 1.46
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8mm/dz=5mm
Frequency	1800 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56		6.22	
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4	38.76 (3.88)	20.1	20.29 (2.03)

Page: 8/11

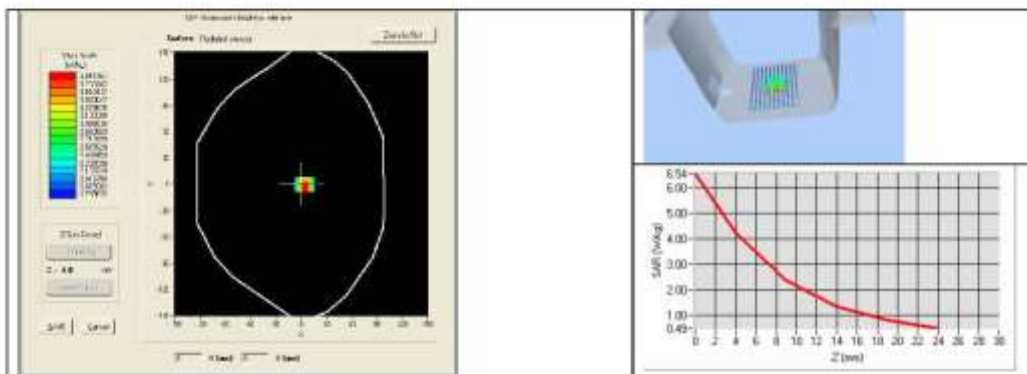
*This document shall not be reproduced, except in full or in part, without the written approval of MVG. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of MVG.*



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR\_93.5.17.SATU.A

1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	
3700	67.4		24.2	



7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity ( $\epsilon_r$ )		Conductivity ( $\sigma$ ) S/m	
	required	measured	required	measured
150	61.9 ±5 %		0.80 ±5 %	
300	58.2 ±5 %		0.92 ±5 %	
450	56.7 ±5 %		0.94 ±5 %	
750	55.5 ±5 %		0.96 ±5 %	
835	55.2 ±5 %		0.97 ±5 %	
900	55.0 ±5 %		1.05 ±5 %	
915	55.0 ±5 %		1.06 ±5 %	
1450	54.0 ±5 %		1.30 ±5 %	
1610	53.8 ±5 %		1.40 ±5 %	
1800	53.3 ±5 %	PASS	1.52 ±5 %	PASS
1900	53.3 ±5 %		1.52 ±5 %	
2000	53.3 ±5 %		1.52 ±5 %	
2100	53.2 ±5 %		1.62 ±5 %	

Page: 9/11

*This document shall not be reproduced, except in full or in part, without the written approval of MVG. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of MVG.*



SAR REFERENCE DIPOLE CALIBRATION REPORT

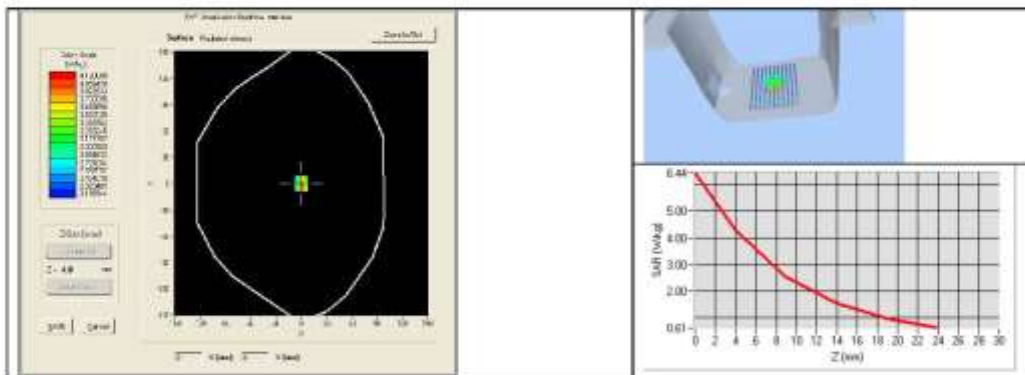
Ref: ACR\_93.5.17.SATU.A

2300	52.9 ±5 %		1.81 ±5 %	
2450	52.7 ±5 %		1.95 ±5 %	
2600	52.5 ±5 %		2.16 ±5 %	
3000	52.0 ±5 %		2.73 ±5 %	
3500	51.3 ±5 %		3.31 ±5 %	
3700	51.0 ±5 %		3.55 ±5 %	
5200	49.0 ±10 %		5.30 ±10 %	
5300	48.9 ±10 %		5.42 ±10 %	
5400	48.7 ±10 %		5.53 ±10 %	
5500	48.6 ±10 %		5.65 ±10 %	
5600	48.5 ±10 %		5.77 ±10 %	
5800	48.2 ±10 %		6.00 ±10 %	

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values: eps' : 53.9 sigma : 1.46
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8mm/dz=5mm
Frequency	1800 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
1800	38.90 (3.89)	20.84 (2.08)



Page: 10/11

*This document shall not be reproduced, except in full or in part, without the written approval of MVG. The information contained herein is to be used only for the purpose for which it is submitted and is not to be released in whole or part without written approval of MVG.*



**8 LIST OF EQUIPMENT**

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	MVG	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2016	02/2019
Calipers	Carrera	CALIPER-01	01/2017	01/2020
Reference Probe	MVG	EPG122 SN 18/11	10/2017	10/2018
Multimeter	Keithley 2000	1188656	01/2017	01/2020
Signal Generator	Agilent E4438C	MY49070581	01/2017	01/2020
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	01/2017	01/2020
Power Sensor	HP ECP-E26A	US37181460	01/2017	01/2020
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	150798832	10/2017	10/2019



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



中国认可  
国际互认  
校准  
CALIBRATION  
CNAS L0570

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

Client **CCIS**

Certificate No: **Z16-97090**

## CALIBRATION CERTIFICATE

Object: **D1900V2 - SN: 5d175**

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

Calibration date: **Jun 15, 2016**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	01-Jul-15 (CTTL, No.J15X04256)	Jun-16
Power sensor NRP-Z91	101547	01-Jul-15 (CTTL, No.J15X04256)	Jun-16
Reference Probe EX3DV4	SN 7307	19-Feb-16(SPEAG,No.EX3-7307_Feb16)	Feb-17
DAE4	SN 771	02-Feb-16(CTTL-SPEAG,No.Z16-97011)	Feb-17
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	01-Feb-16 (CTTL, No.J16X00893)	Jan-17
Network Analyzer E5071C	MY46110673	26-Jan-16 (CTTL, No.J16X00894)	Jan-17

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Lu Bingsong	Deputy Director of the laboratory	

Issued: Jun 17, 2016

This calibration certificate shall not be reproduced except in full without written approval of the 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 / NORMx,y,z
N/A	not applicable or not measured

**Calibration is Performed According to the Following Standards:**

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) For hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005
- c) 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
- d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

**Additional Documentation:**

- e) DASY4/5 System Handbook

**Methods Applied and Interpretation of Parameters:**

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

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



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

### Measurement Conditions

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

<b>DASY Version</b>	DASY52	52.8.8.1258
<b>Extrapolation</b>	Advanced Extrapolation	
<b>Phantom</b>	Triple Flat Phantom 5.1C	
<b>Distance Dipole Center - TSL</b>	10 mm	with Spacer
<b>Zoom Scan Resolution</b>	dx, dy, dz = 5 mm	
<b>Frequency</b>	1900 MHz ± 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Head TSL parameters</b>	22.0 °C	40.0	1.40 mho/m
<b>Measured Head TSL parameters</b>	(22.0 ± 0.2) °C	40.3 ± 6 %	1.38 mho/m ± 6 %
<b>Head TSL temperature change during test</b>	<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	9.99 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>40.4 mW /g ± 20.8 % (k=2)</b>
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.28 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>21.3 mW /g ± 20.4 % (k=2)</b>

### Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Body TSL parameters</b>	22.0 °C	53.3	1.52 mho/m
<b>Measured Body TSL parameters</b>	(22.0 ± 0.2) °C	53.3 ± 6 %	1.54 mho/m ± 6 %
<b>Body TSL temperature change during test</b>	<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	10.1 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	<b>40.1 mW /g ± 20.8 % (k=2)</b>
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.39 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	<b>21.5 mW /g ± 20.4 % (k=2)</b>



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

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

**Appendix**

**Antenna Parameters with Head TSL**

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

**Antenna Parameters with Body TSL**

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

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.304 ns
----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

**Additional EUT Data**

Manufactured by	SPEAG
-----------------	-------



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

**DASY5 Validation Report for Head TSL**

Date: 06.15.2016

Test Laboratory: CTTL, Beijing, China

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

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

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

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7307; ConvF(8.1, 8.1, 8.1); Calibrated: 2/19/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2/2/2016
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

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

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

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

Peak SAR (extrapolated) = 18.0W/kg

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

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

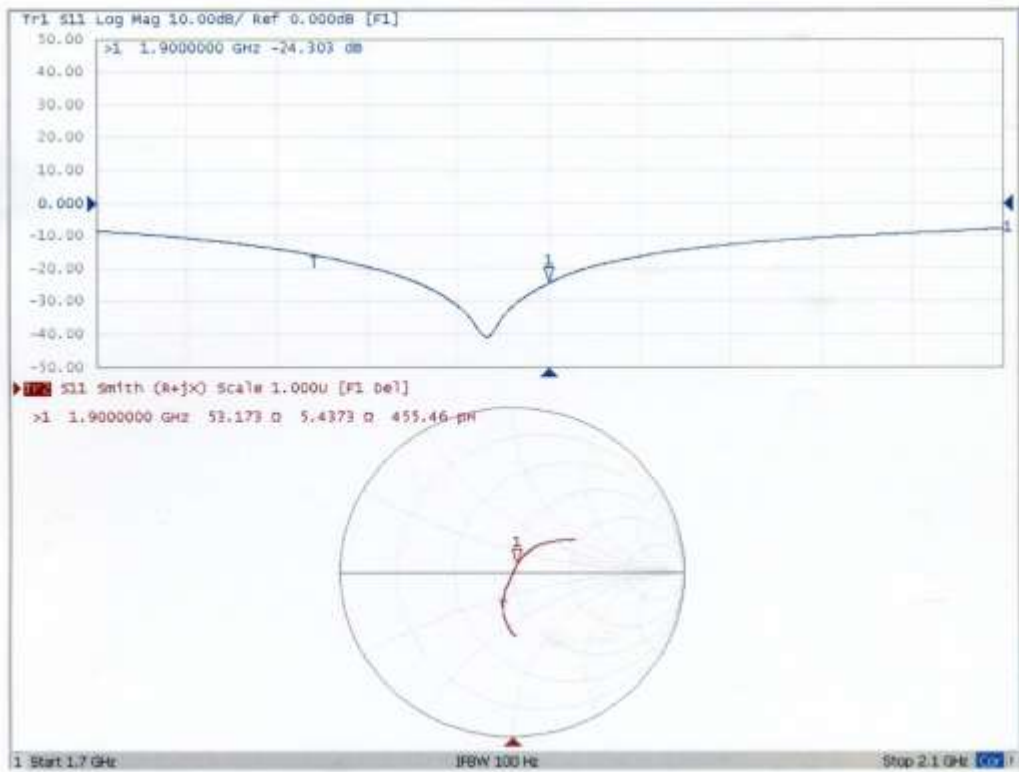


0 dB = 14.1 W/kg = 11.49 dBW/kg



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

### Impedance Measurement Plot for Head TSL





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

**DASY5 Validation Report for Body TSL**

Date: 06.15.2016

Test Laboratory: CTTL, Beijing, China

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

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

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

Phantom section: Center Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7307; ConvF(7.67, 7.67, 7.67); Calibrated: 2/19/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2/2/2016
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

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

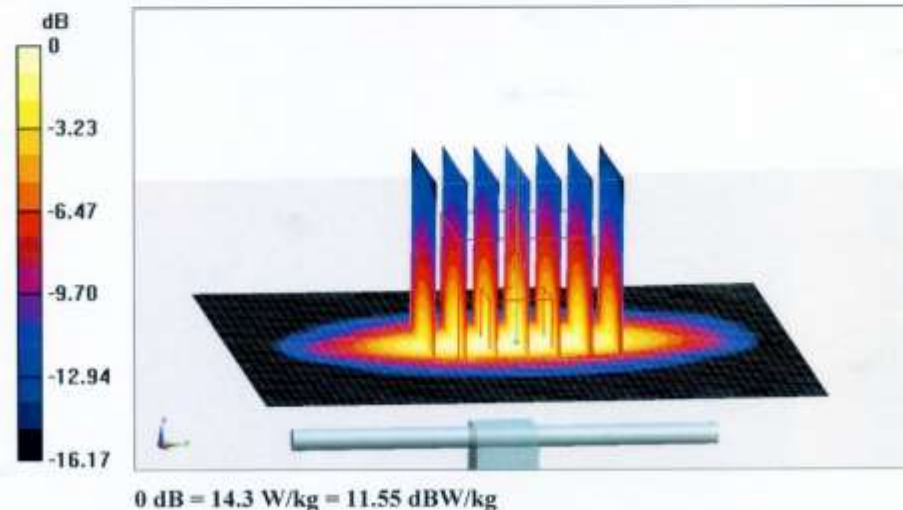
$dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 96.11 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 17.8 W/kg

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

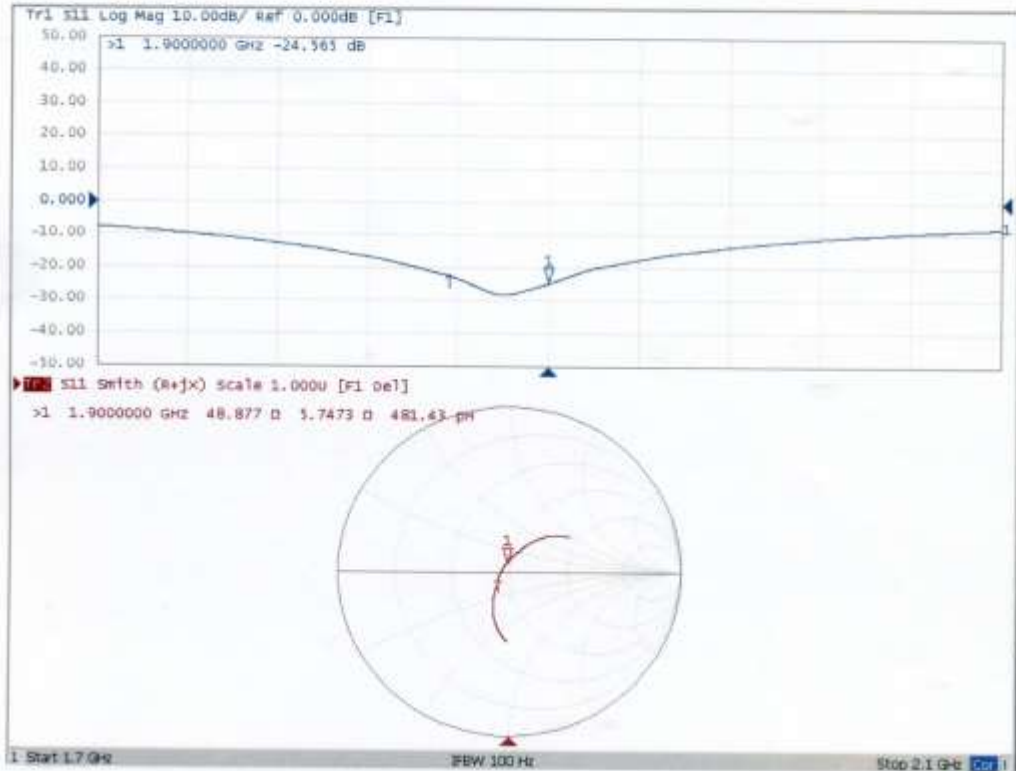
Maximum value of SAR (measured) = 14.3 W/kg





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

### Impedance Measurement Plot for Body TSL



## Dipole Impedance and Return Loss calibration Report

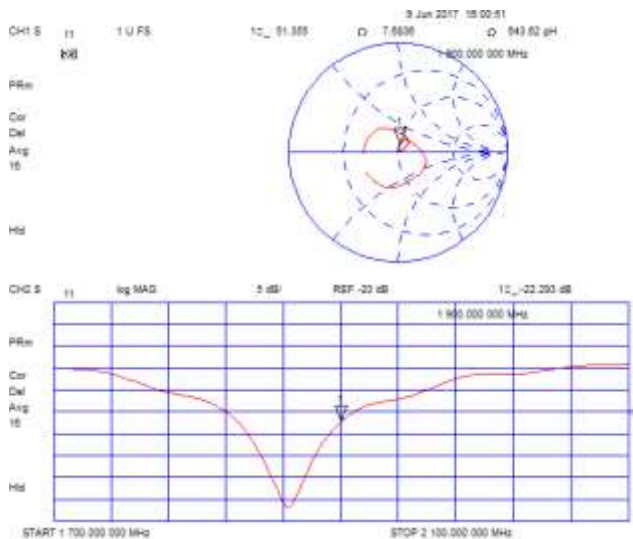
**Object:** D1900V2 - SN: 5d175  
**Calibration Date:** June 10, 2018  
**Calibration reference:** IEEE Std 1528:2013, IEC 62209-1:2016, FCC KDB 865664 D01  
**Calibrated By:** *Janet Wei* (Janet Wei, SAR project engineer)  
**Reviewed By:** *Bruce Zhang* (Bruce Zhang, Technical manager)

### Environment of Test Site

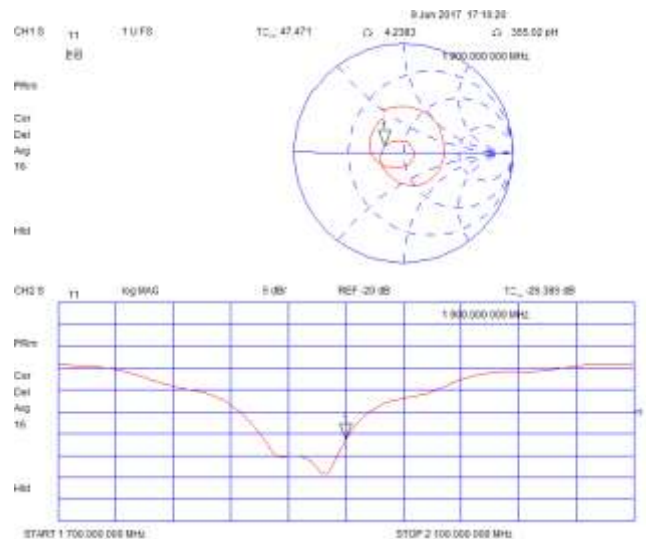
Temperature:	18 ~ 25°C
Humidity:	50~60% RH
Atmospheric Pressure:	1011 mbar

### Test Data

Measurement Plot for Head TSL In 2017

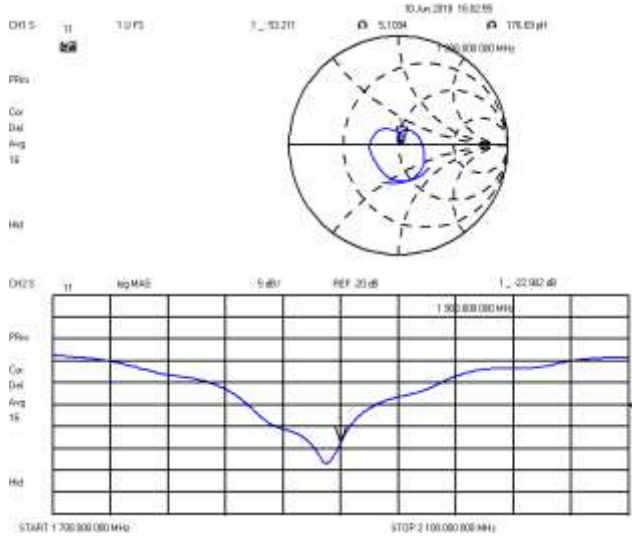


Measurement Plot for Body TSL In 2017

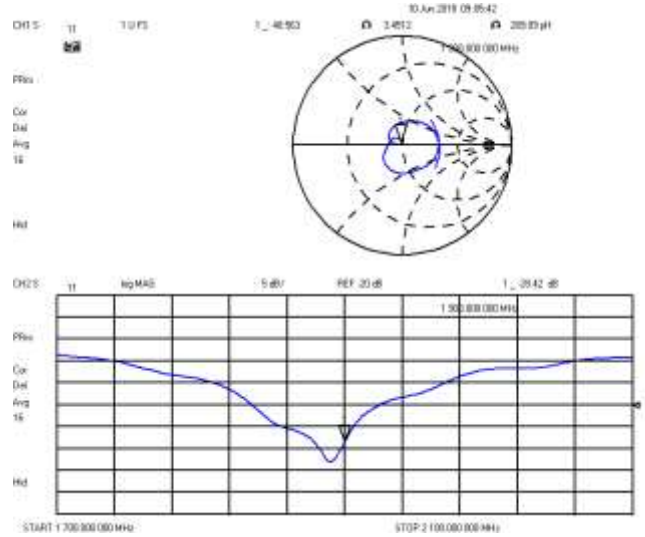




Measurement Plot for Head TSL In 2018



Measurement Plot for Body TSL In 2018



### Comparison with Original report

Items	Calibrated By CCIS In 2017	Calibrated By CCIS In 2018	Deviation	Limit
Impedence for Head TSL	51.36Ω+7.68jΩ	53.21Ω+5.11jΩ	1.85Ω-2.57jΩ	±5Ω
Return Loss for Head TSL	-22.3dB	-22.9dB	2.7%	±20%(No less than 20 dB)
Impedence for Body TSL	47.47Ω+4.24jΩ	48.56Ω+3.45jΩ	1.09Ω-0.79jΩ	±5Ω
Return Loss for Body TSL	-26.4dB	-28.4dB	7.6%	±20%(No less than 20 dB)

### Result

Compliance



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



中国认可  
国际互认  
校准  
CALIBRATION  
CNAS L0570

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

Client **CCIS**

Certificate No: **Z16-97091**

## CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 910**

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

Calibration date: **Jun 15, 2016**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	01-Jul-15 (CTTL, No.J15X04256)	Jun-16
Power sensor NRP-Z91	101547	01-Jul-15 (CTTL, No.J15X04256)	Jun-16
Reference Probe EX3DV4	SN 7307	19-Feb-16(SPEAG,No.EX3-7307_Feb16)	Feb-17
DAE4	SN 771	02-Feb-16(CTTL-SPEAG,No.Z16-97011)	Feb-17
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	01-Feb-16 (CTTL, No.J16X00893)	Jan-17
Network Analyzer E5071C	MY46110673	26-Jan-16 (CTTL, No.J16X00894)	Jan-17

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Lu Bingsong	Deputy Director of the laboratory	

Issued: Jun 17, 2016

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



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

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

**Glossary:**

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM <sub>x,y,z</sub>
N/A	not applicable or not measured

**Calibration is Performed According to the Following Standards:**

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) For hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005
- c) 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
- d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

**Additional Documentation:**

- e) DASY4/5 System Handbook

**Methods Applied and Interpretation of Parameters:**

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

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



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

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

### Measurement Conditions

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

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

### Head TSL parameters

The following parameters and calculations were applied.

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

### SAR result with Head TSL

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

### Body TSL parameters

The following parameters and calculations were applied.

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

### SAR result with Body TSL

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



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

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

**Appendix**

**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	54.6Ω+ 2.77jΩ
Return Loss	- 25.8dB

**Antenna Parameters with Body TSL**

Impedance, transformed to feed point	50.7Ω+ 4.28jΩ
Return Loss	- 27.3dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.263 ns
----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

**Additional EUT Data**

Manufactured by	SPEAG
-----------------	-------



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

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

**DASY5 Validation Report for Head TSL**

Date: 06.15.2016

Test Laboratory: CTTL, Beijing, China

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

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

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

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7307; ConvF(7.36, 7.36, 7.36); Calibrated: 2/19/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2/2/2016
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

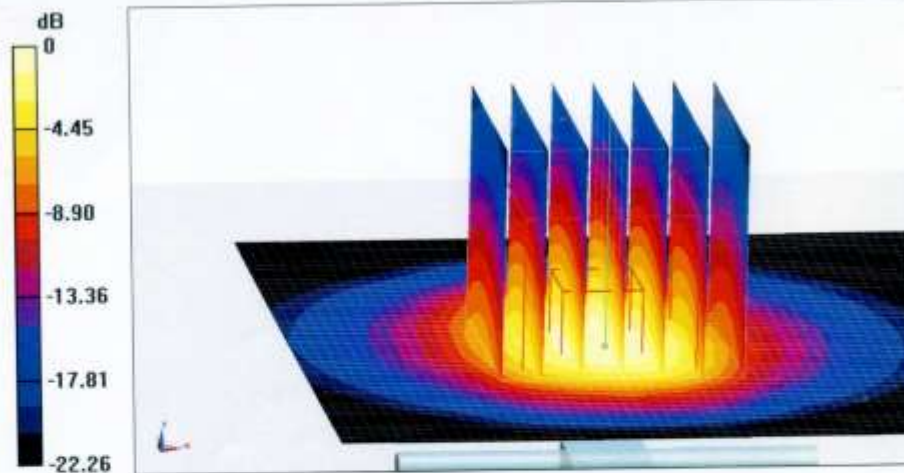
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

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

Peak SAR (extrapolated) = 26.7 W/kg

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

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



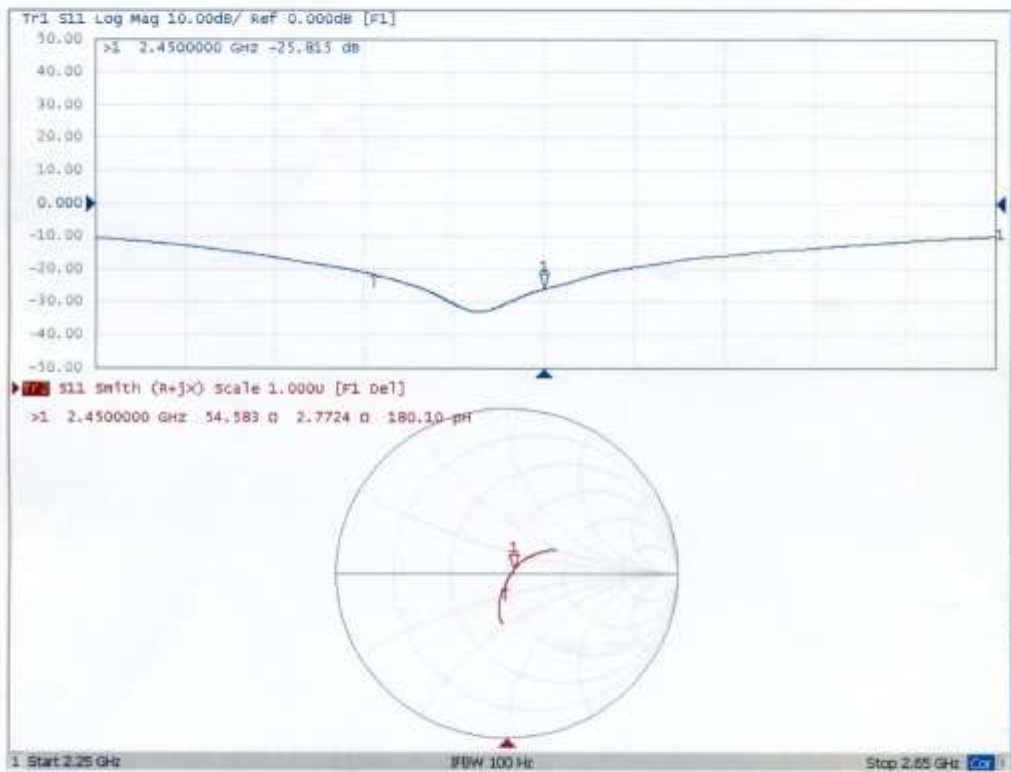
0 dB = 19.7 W/kg = 12.94 dBW/kg



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

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

### Impedance Measurement Plot for Head TSL





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

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

**DASY5 Validation Report for Body TSL**

Date: 06.15.2016

Test Laboratory: CTTL, Beijing, China

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

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

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

Phantom section: Center Section

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

**DASY5 Configuration:**

- Probe: EX3DV4 - SN7307; ConvF(7.22, 7.22, 7.22); Calibrated: 2/19/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2/2/2016
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

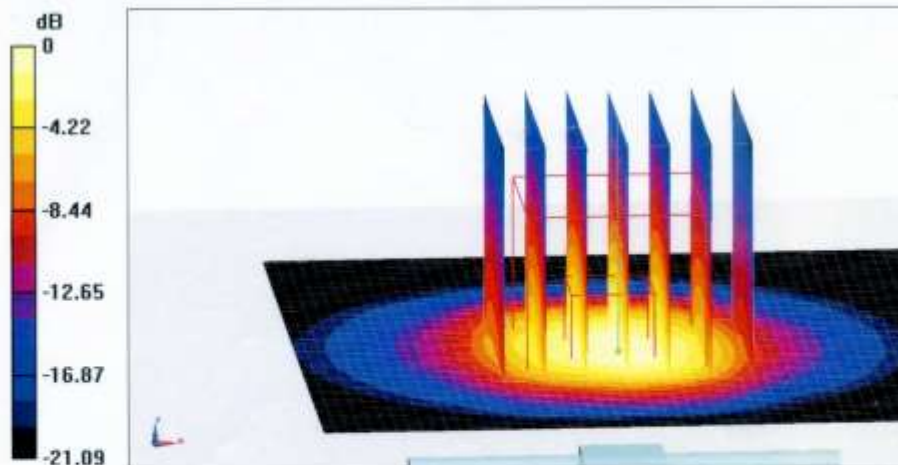
**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm**

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

Peak SAR (extrapolated) = 25.6 W/kg

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

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



0 dB = 19.3 W/kg = 12.86 dBW/kg

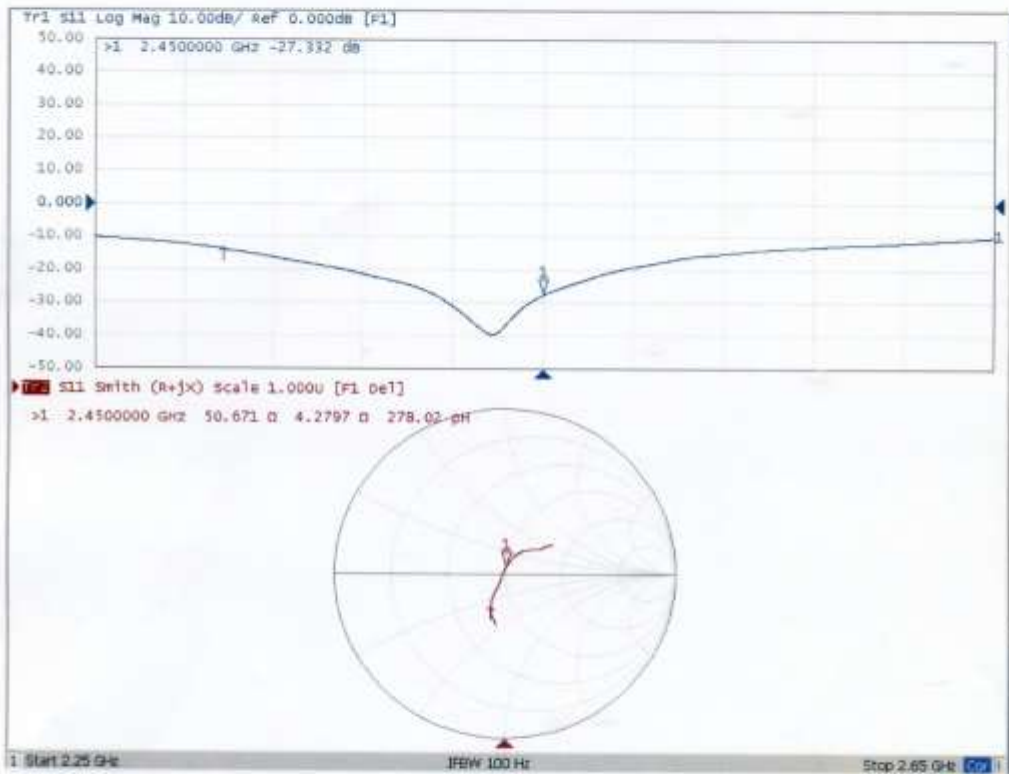




In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY

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

### Impedance Measurement Plot for Body TSL



## Dipole Impedance and Return Loss calibration Report

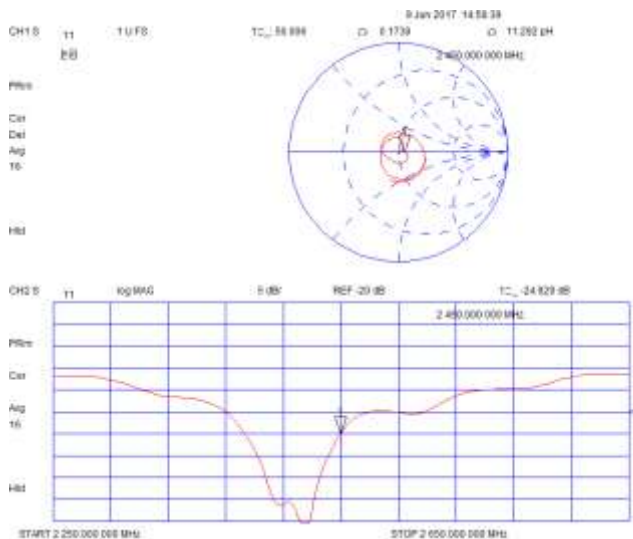
**Object:** D2450V2 - SN: 910  
**Calibration Date:** June 10, 2018  
**Calibration reference:** IEEE Std 1528:2013, IEC 62209-1:2016, FCC KDB 865664 D01  
**Calibrated By:** *Janet Wei* (Janet Wei, SAR project engineer)  
**Reviewed By:** *Bruce Zhang* (Bruce Zhang, Technical manager)

### Environment of Test Site

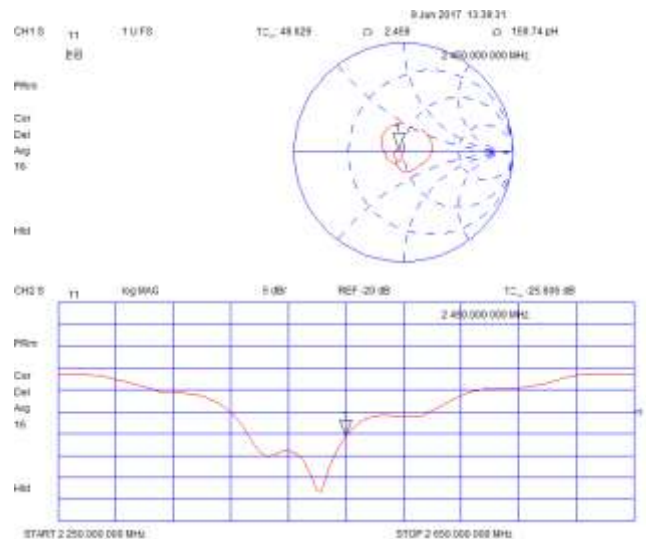
Temperature:	18 ~ 25°C
Humidity:	50~60% RH
Atmospheric Pressure:	1011 mbar

### Test Data

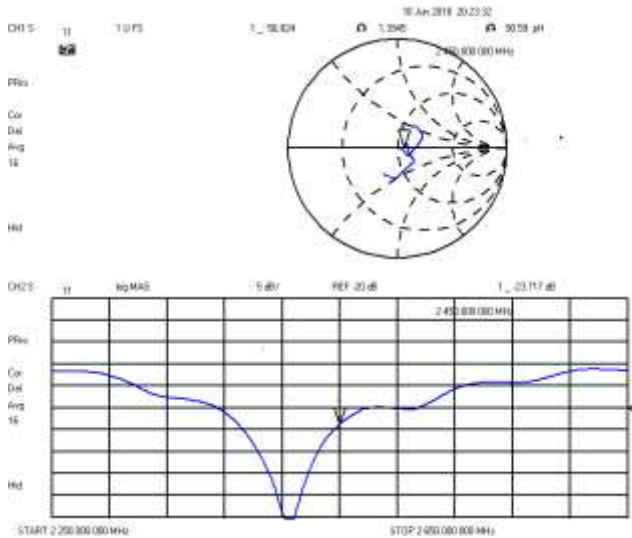
Measurement Plot for Head TSL In 2017



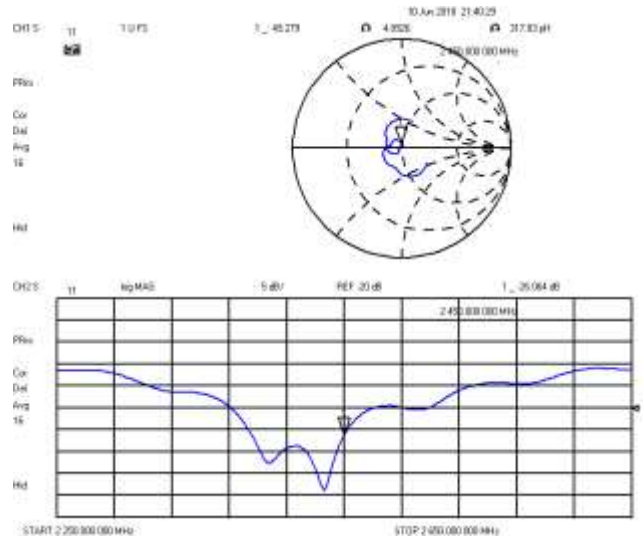
Measurement Plot for Body TSL In 2017



Measurement Plot for Head TSL In 2018



Measurement Plot for Body TSL In 2018



### Comparison with Original report

Items	Calibrated By CCIS In 2017	Calibrated By CCIS In 2018	Deviation	Limit
Impedence for Head TSL	56.0Ω+0.17jΩ	56.82Ω+1.39jΩ	0.82Ω-1.22 jΩ	±5Ω
Return Loss for Head TSL	-24.9dB	-23.7dB	-4.8%	±20%(No less than 20 dB)
Impedence for Body TSL	49.63Ω+2.46jΩ	49.28Ω+4.89jΩ	-0.35Ω+2.43 jΩ	±5Ω
Return Loss for Body TSL	-25.6dB	-26.1dB	1.95%	±20%(No less than 20 dB)

### Result

Compliance

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



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

Accredited by the Swiss Accreditation Service (SAS)  
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 **CCIS-CN (Auden)**

Certificate No: **D2600V2-1114\_Sep15**

CALIBRATION CERTIFICATE																																															
Object	D2600V2 - SN: 1114																																														
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz																																														
Calibration date:	September 21, 2015																																														
<p>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.</p> <p>All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity &lt; 70%.</p> <p>Calibration Equipment used (M&amp;TE critical for calibration)</p> <table border="1"> <thead> <tr> <th>Primary Standards</th> <th>ID #</th> <th>Cal Date (Certificate No.)</th> <th>Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>Power meter EPM-442A</td> <td>GB37480704</td> <td>07-Oct-14 (No. 217-02020)</td> <td>Oct-15</td> </tr> <tr> <td>Power sensor HP 8481A</td> <td>US37292783</td> <td>07-Oct-14 (No. 217-02020)</td> <td>Oct-15</td> </tr> <tr> <td>Power sensor HP 8481A</td> <td>MY41092317</td> <td>07-Oct-14 (No. 217-02021)</td> <td>Oct-15</td> </tr> <tr> <td>Reference 20 dB Attenuator</td> <td>SN: 5056 (20k)</td> <td>01-Apr-15 (No. 217-02131)</td> <td>Mar-16</td> </tr> <tr> <td>Type-N mismatch combination</td> <td>SN: 5047.2 / 06327</td> <td>01-Apr-15 (No. 217-02134)</td> <td>Mar-16</td> </tr> <tr> <td>Reference Probe EX3DV4</td> <td>SN: 7349</td> <td>30-Dec-14 (No. EX3-7349_Dec14)</td> <td>Dec-15</td> </tr> <tr> <td>DAE4</td> <td>SN: 601</td> <td>17-Aug-15 (No. DAE4-601_Aug15)</td> <td>Aug-16</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Secondary Standards</th> <th>ID #</th> <th>Check Date (in house)</th> <th>Scheduled Check</th> </tr> </thead> <tbody> <tr> <td>RF generator R&amp;S SMT-06</td> <td>100972</td> <td>15-Jun-15 (in house check Jun-15)</td> <td>In house check; Jun-16</td> </tr> <tr> <td>Network Analyzer HP 8753E</td> <td>US37390585 S4206</td> <td>18-Oct-01 (in house check Oct-14)</td> <td>In house check; Oct-15</td> </tr> </tbody> </table>				Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration	Power meter EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15	Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15	Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15	Reference 20 dB Attenuator	SN: 5056 (20k)	01-Apr-15 (No. 217-02131)	Mar-16	Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16	Reference Probe EX3DV4	SN: 7349	30-Dec-14 (No. EX3-7349_Dec14)	Dec-15	DAE4	SN: 601	17-Aug-15 (No. DAE4-601_Aug15)	Aug-16	Secondary Standards	ID #	Check Date (in house)	Scheduled Check	RF generator R&S SMT-06	100972	15-Jun-15 (in house check Jun-15)	In house check; Jun-16	Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check; Oct-15
Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration																																												
Power meter EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15																																												
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15																																												
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15																																												
Reference 20 dB Attenuator	SN: 5056 (20k)	01-Apr-15 (No. 217-02131)	Mar-16																																												
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16																																												
Reference Probe EX3DV4	SN: 7349	30-Dec-14 (No. EX3-7349_Dec14)	Dec-15																																												
DAE4	SN: 601	17-Aug-15 (No. DAE4-601_Aug15)	Aug-16																																												
Secondary Standards	ID #	Check Date (in house)	Scheduled Check																																												
RF generator R&S SMT-06	100972	15-Jun-15 (in house check Jun-15)	In house check; Jun-16																																												
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check; Oct-15																																												
Calibrated by:	Name Michael Weber	Function Laboratory Technician	Signature 																																												
Approved by:	Name Katja Pokovic	Function Technical Manager																																													
			Issued: September 23, 2015																																												
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.																																															

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



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

Accredited by the Swiss Accreditation Service (SAS)  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

**Glossary:**

TSL tissue simulating liquid  
ConvF sensitivity in TSL / NORM x,y,z  
N/A not applicable or not measured

**Calibration is Performed According to the Following Standards:**

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

**Additional Documentation:**

- e) DASY4/5 System Handbook

**Methods Applied and Interpretation of Parameters:**

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

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

### Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2600 MHz ± 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 ± 0.2) °C	38.6 ± 6 %	2.04 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.5 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	56.9 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.41 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	25.4 W/kg ± 16.5 % (k=2)

### Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.8 ± 6 %	2.19 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

### SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.7 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	54.5 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.12 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	24.4 W/kg ± 16.5 % (k=2)

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

**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	49.8 Ω - 7.0 jΩ
Return Loss	- 23.1 dB

**Antenna Parameters with Body TSL**

Impedance, transformed to feed point	45.7 Ω - 5.0 jΩ
Return Loss	- 23.3 dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.154 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	September 10, 2015

## DASY5 Validation Report for Head TSL

Date: 21.09.2015

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1114**

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

Medium parameters used:  $f = 2600$  MHz;  $\sigma = 2.04$  S/m;  $\epsilon_r = 38.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.4, 7.4, 7.4); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 17.08.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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

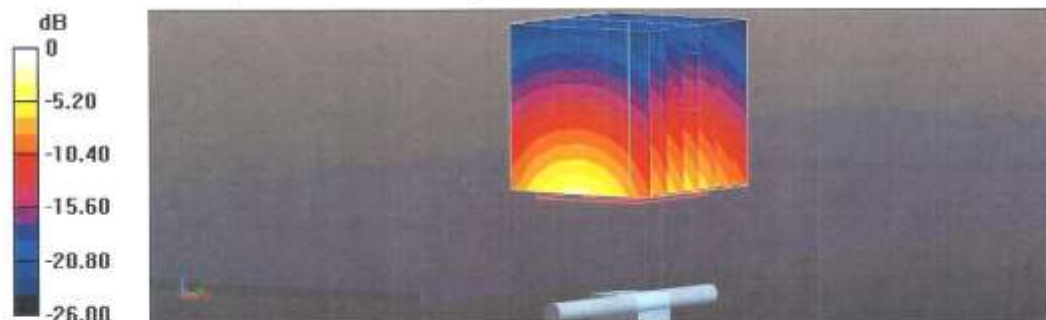
Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 115.6 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 30.9 W/kg

**SAR(1 g) = 14.5 W/kg; SAR(10 g) = 6.41 W/kg**

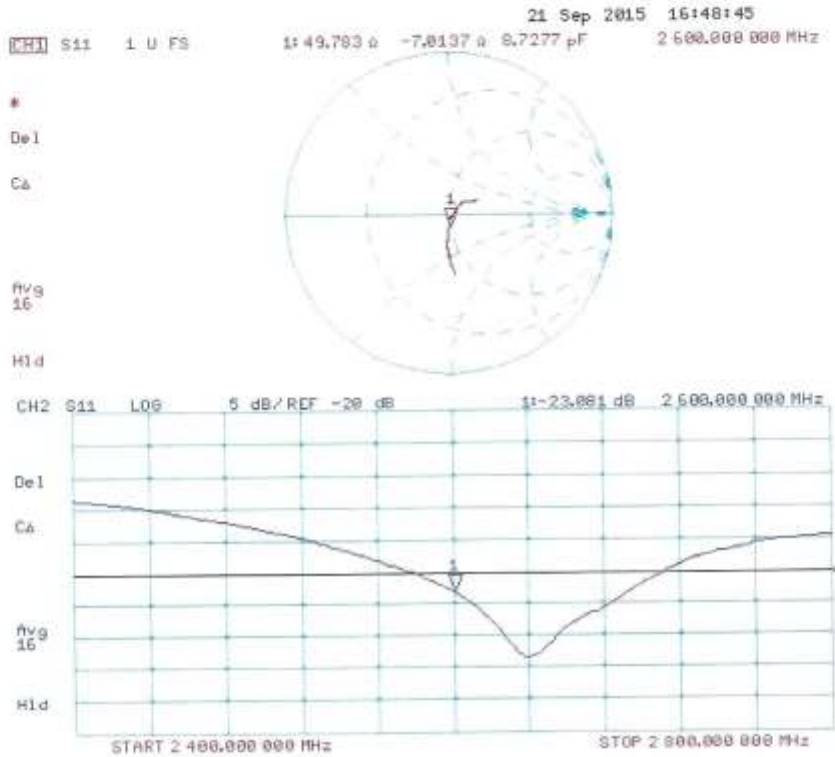
Maximum value of SAR (measured) = 24.7 W/kg



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



## Impedance Measurement Plot for Head TSL



## DASY5 Validation Report for Body TSL

Date: 17.09.2015

Test Laboratory: The name of your organization

**DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1114**

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

Medium parameters used:  $f = 2600$  MHz;  $\sigma = 2.19$  S/m;  $\epsilon_r = 52.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.52, 7.52, 7.52); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 17.08.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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

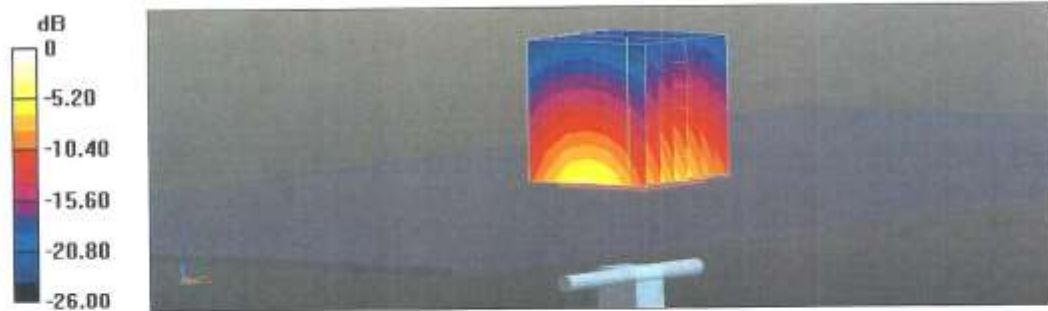
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 107.6 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 28.3 W/kg

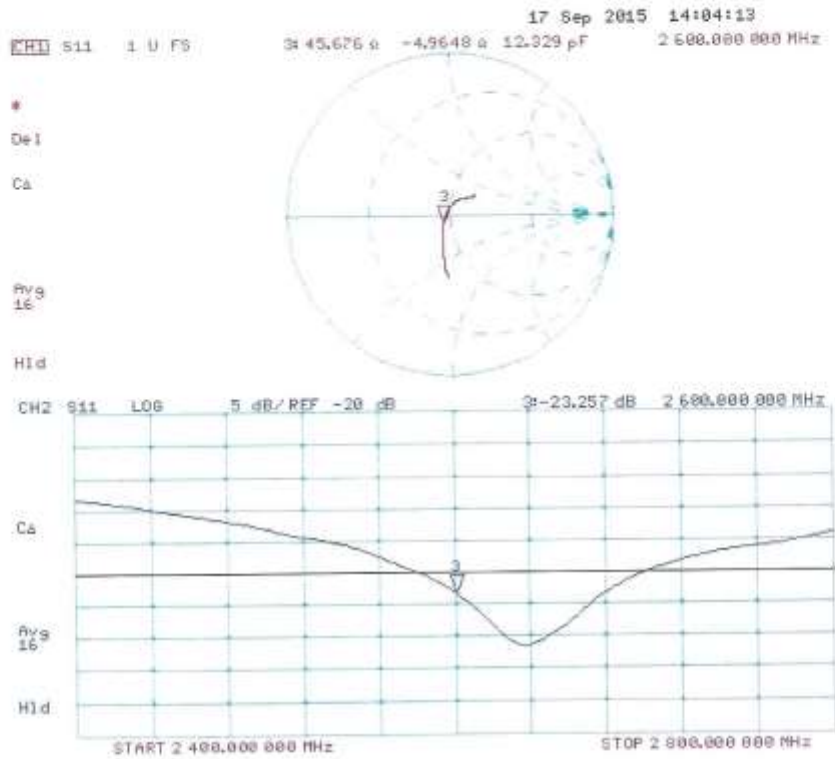
**SAR(1 g) = 13.7 W/kg; SAR(10 g) = 6.12 W/kg**

Maximum value of SAR (measured) = 23.0 W/kg



0 dB = 23.0 W/kg = 13.62 dBW/kg

## Impedance Measurement Plot for Body TSL



## Dipole Impedance and Return Loss calibration Report

**Object:** D2600V2 - SN: 1116

**Calibration Date:** September 17, 2017

**Calibration reference:** IEEE Std 1528:2013, IEC 62209-1:2006, FCC KDB 865664 D01

**Calibrated By:** *Janet Wei* (Janet Wei, SAR project engineer)

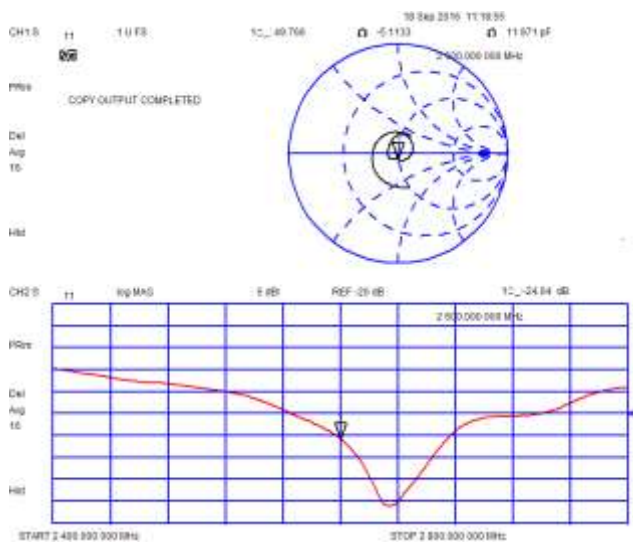
**Reviewed By:** *Bruce Zhang* (Bruce Zhang, Technical manager)

### Environment of Test Site

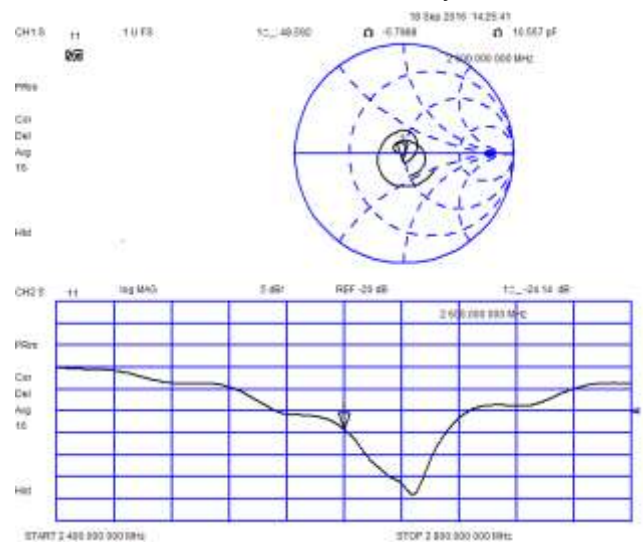
Temperature:	18 ~ 25°C
Humidity:	50~60% RH
Atmospheric Pressure:	1011 mbar

### Test Data

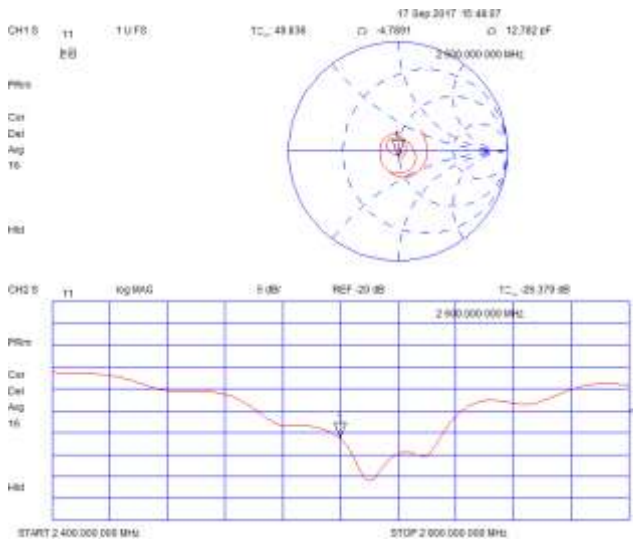
Measurement Plot for Head TSL In 2016



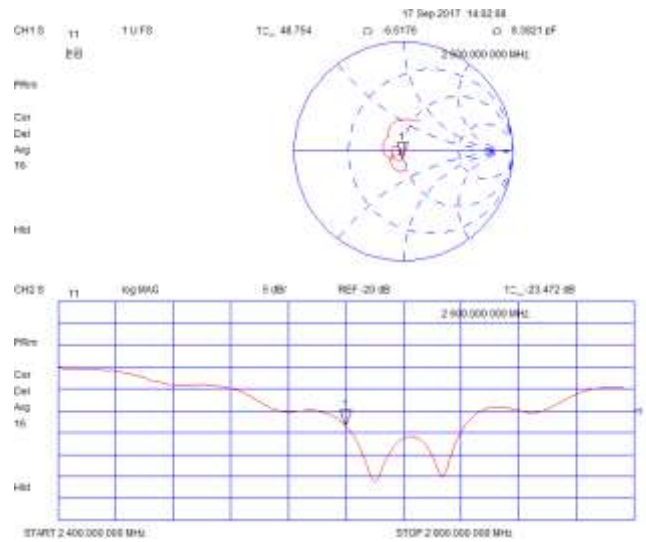
Measurement Plot for Body TSL In 2016



Measurement Plot for Head TSL In 2017



Measurement Plot for Body TSL In 2017



**Comparison with Original report**

Items	Calibrated By CCIS In 2016	Calibrated By CCIS In 2017	Deviation	Limit
Impedence for Head TSL	49.8Ω-5.1jΩ	49.8Ω-4.79jΩ	0.0Ω+0.31 jΩ	±5Ω
Return Loss for Head TSL	-24.0dB	-26.4dB	10%	±20%(No less than 20 dB)
Impedence for Body TSL	48.6Ω-5.8jΩ	48.8Ω-6.5jΩ	0.2Ω-0.7 jΩ	±5Ω
Return Loss for Body TSL	-24.1dB	-23.5dB	-2.5%	±20%(No less than 20 dB)

**Result**

Compliance

Calibration information for DAE



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



中国认可  
国际互认  
校准  
CALIBRATION  
CNAS L0570

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

Client : **CCIS**

Certificate No: Z18-97054

CALIBRATION CERTIFICATE											
Object	DAE4 - SN: 1373										
Calibration Procedure(s)	FF-Z11-002-01 Calibration Procedure for the Data Acquisition Electronics (DAEx)										
Calibration date:	March 22, 2018										
<p>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.</p> <p>All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)°C and humidity&lt;70%.</p> <p>Calibration Equipment used (M&amp;TE critical for calibration)</p> <table border="1"> <thead> <tr> <th>Primary Standards</th> <th>ID #</th> <th>Cal Date(Calibrated by, Certificate No.)</th> <th>Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>Process Calibrator 753</td> <td>1971018</td> <td>27-Jun-17 (CTTL, No.J17X05859)</td> <td>June-18</td> </tr> </tbody> </table>				Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration	Process Calibrator 753	1971018	27-Jun-17 (CTTL, No.J17X05859)	June-18
Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration								
Process Calibrator 753	1971018	27-Jun-17 (CTTL, No.J17X05859)	June-18								
Calibrated by:	Name	Function	Signature								
	Yu Zongying	SAR Test Engineer									
Reviewed by:	Lin Hao	SAR Test Engineer									
Approved by:	Qi Dianyuan	SAR Project Leader									
Issued: March 23, 2018											
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.											



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

**Glossary:**

DAE data acquisition electronics  
Connector angle information used in DASY system to align probe sensor X to the robot coordinate system.

**Methods Applied and Interpretation of Parameters:**

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



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

### DC Voltage Measurement

A/D - Converter Resolution nominal  
High Range: 1LSB = 6.1μV, full range = -100...+300 mV  
Low Range: 1LSB = 61nV, full range = -1.....+3mV  
DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	403.902 ± 0.15% (k=2)	403.864 ± 0.15% (k=2)	404.160 ± 0.15% (k=2)
Low Range	3.98605 ± 0.7% (k=2)	4.00729 ± 0.7% (k=2)	4.01146 ± 0.7% (k=2)

### Connector Angle

Connector Angle to be used in DASY system	219.5° ± 1°
---	-------------

-----End of Report-----