

10_WCDMA Band V_RMC 12.2Kbps_Back_5mm_Ch4233

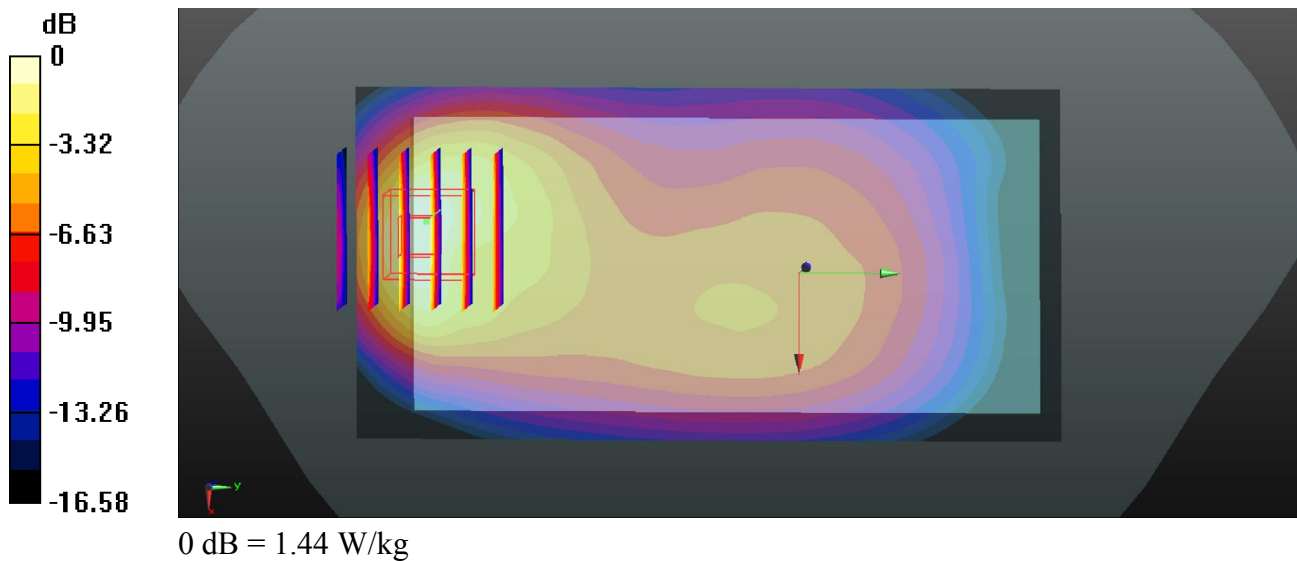
Communication System: UID 0, WCDMA (0); Frequency: 846.6 MHz; Duty Cycle: 1:1
Medium: MSL_835_Medium parameters used: $f = 846.6$ MHz; $\sigma = 1.007$ S/m; $\epsilon_r = 55.076$;
 $\rho = 1000$ kg/m³
Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.6 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(10.33, 10.33, 10.33); Calibrated: 2017/12/14;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2017/10/24
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

Ch4233/Area Scan (61x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.51 W/kg

Ch4233/Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.18 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 1.84 W/kg
SAR(1 g) = 0.940 W/kg; SAR(10 g) = 0.518 W/kg
Maximum value of SAR (measured) = 1.44 W/kg



11_WCDMA Band II_RMC 12.2Kbps_Bottom side_5mm_Ch9538

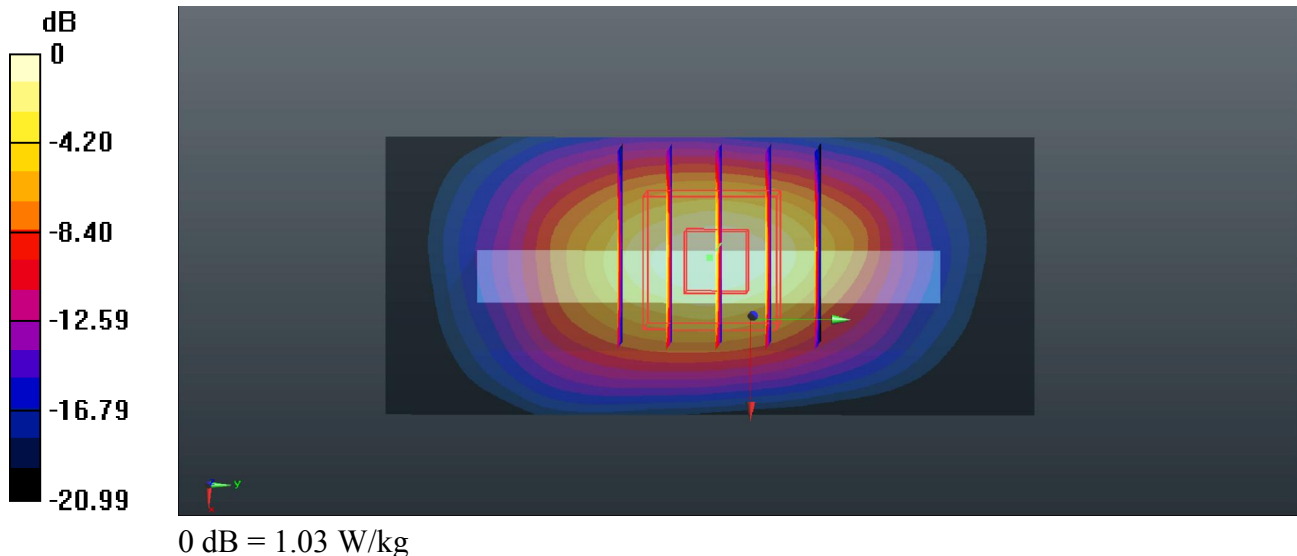
Communication System: UID 0, WCDMA (0); Frequency: 1907.6 MHz; Duty Cycle: 1:1
Medium: MSL_1900_Medium parameters used: $f = 1907.6 \text{ MHz}$; $\sigma = 1.556 \text{ S/m}$; $\epsilon_r = 51.443$;
 $\rho = 1000 \text{ kg/m}^3$
Ambient Temperature : $23.6 \text{ }^\circ\text{C}$; Liquid Temperature : $22.4 \text{ }^\circ\text{C}$

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(8.3, 8.3, 8.3); Calibrated: 2017/12/14;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2017/10/24
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1754
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

Ch9538/Area Scan (31x71x1): Interpolated grid: $dx=1.500 \text{ mm}$, $dy=1.500 \text{ mm}$
Maximum value of SAR (interpolated) = 1.10 W/kg

Ch9538/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$
Reference Value = 21.41 V/m ; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 1.30 W/kg
SAR(1 g) = 0.657 W/kg ; SAR(10 g) = 0.304 W/kg
Maximum value of SAR (measured) = 1.03 W/kg



12_LTE Band 5_10M_QPSK_1RB_0offset_Back_5mm_Ch20525

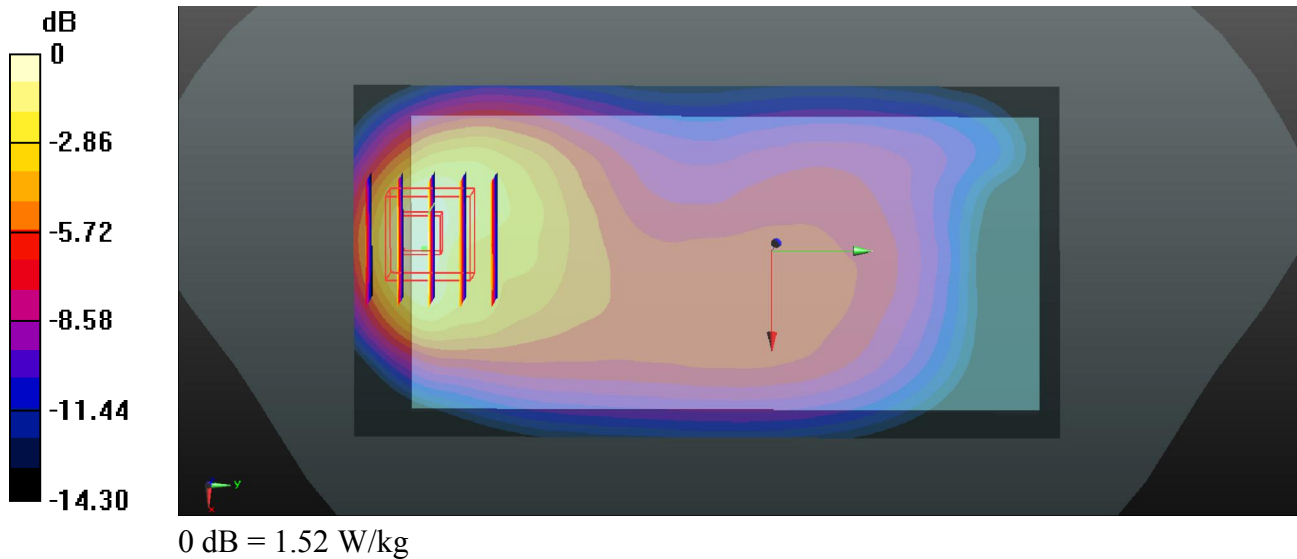
Communication System: UID 0, FDD-LTE (0); Frequency: 836.5 MHz; Duty Cycle: 1:1
Medium: MSL_835_Medium parameters used: $f = 836.5$ MHz; $\sigma = 0.997$ S/m; $\epsilon_r = 55.177$;
 $\rho = 1000$ kg/m³
Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.6 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(10.33, 10.33, 10.33); Calibrated: 2017/12/14;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2017/10/24
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

Ch20525/Area Scan (61x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.54 W/kg

Ch20525/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 17.78 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 1.92 W/kg
SAR(1 g) = 0.983 W/kg; SAR(10 g) = 0.546 W/kg
Maximum value of SAR (measured) = 1.52 W/kg



13_LTE Band 7_20M_QPSK_1RB_49offset_Front_5mm_Ch21350

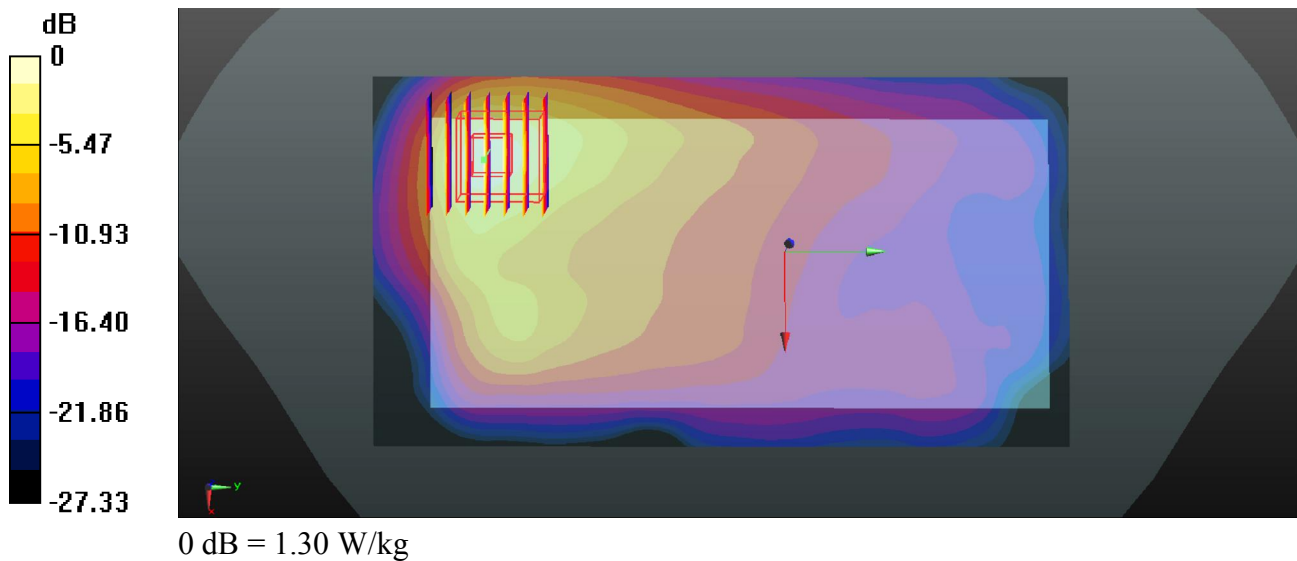
Communication System: UID 0, FDD-LTE (0); Frequency: 2560 MHz; Duty Cycle: 1:1
Medium: MSL_2600_Medium parameters used: $f = 2560$ MHz; $\sigma = 2.116$ S/m; $\epsilon_r = 52.095$;
 $\rho = 1000$ kg/m³
Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.8 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(7.71, 7.71, 7.71); Calibrated: 2017/12/14;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2017/10/24
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

Ch21350/Area Scan (81x151x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 1.28 W/kg

Ch21350/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.208 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 1.62 W/kg
SAR(1 g) = 0.762 W/kg; SAR(10 g) = 0.334 W/kg
Maximum value of SAR (measured) = 1.30 W/kg



14_LTE Band 38_20M_QPSK_1RB_49offset_Front_5mm_Ch37850

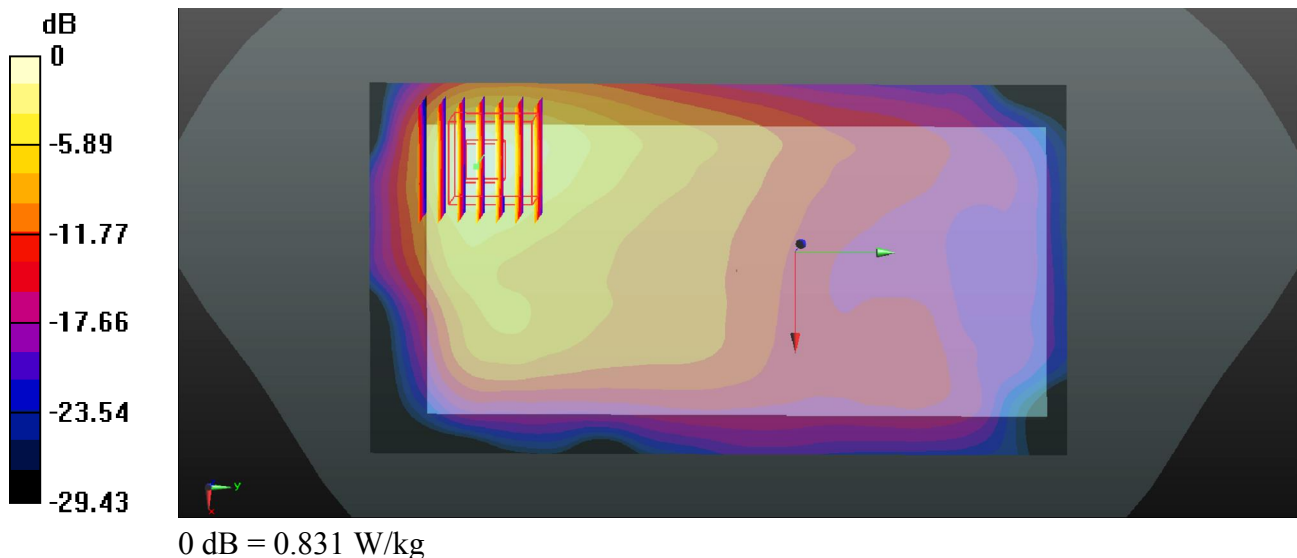
Communication System: UID 0, TDD-LTE (0); Frequency: 2580 MHz; Duty Cycle: 1:1.59
Medium: MSL_2600_Medium parameters used: $f = 2580$ MHz; $\sigma = 2.142$ S/m; $\epsilon_r = 52.022$;
 $\rho = 1000$ kg/m³
Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.8 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(7.71, 7.71, 7.71); Calibrated: 2017/12/14;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2017/10/24
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

Ch37850/Area Scan (81x151x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.859 W/kg

Ch37850/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.259 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 1.03 W/kg
SAR(1 g) = 0.492 W/kg; SAR(10 g) = 0.218 W/kg
Maximum value of SAR (measured) = 0.831 W/kg



15_GSM850_GPRS (4 Tx slots)_Back_5mm_Ch189

Communication System: UID 0, GPRS (GMSK 4 Tx slot) (0); Frequency: 836.4 MHz; Duty Cycle: 1:2.08

Medium: MSL_835_Medium parameters used: $f = 836.4$ MHz; $\sigma = 0.997$ S/m; $\epsilon_r = 55.178$;

$\rho = 1000$ kg/m³

Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.6 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(10.33, 10.33, 10.33); Calibrated: 2017/12/14;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2017/10/24
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

Ch189/Area Scan (61x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 1.46 W/kg

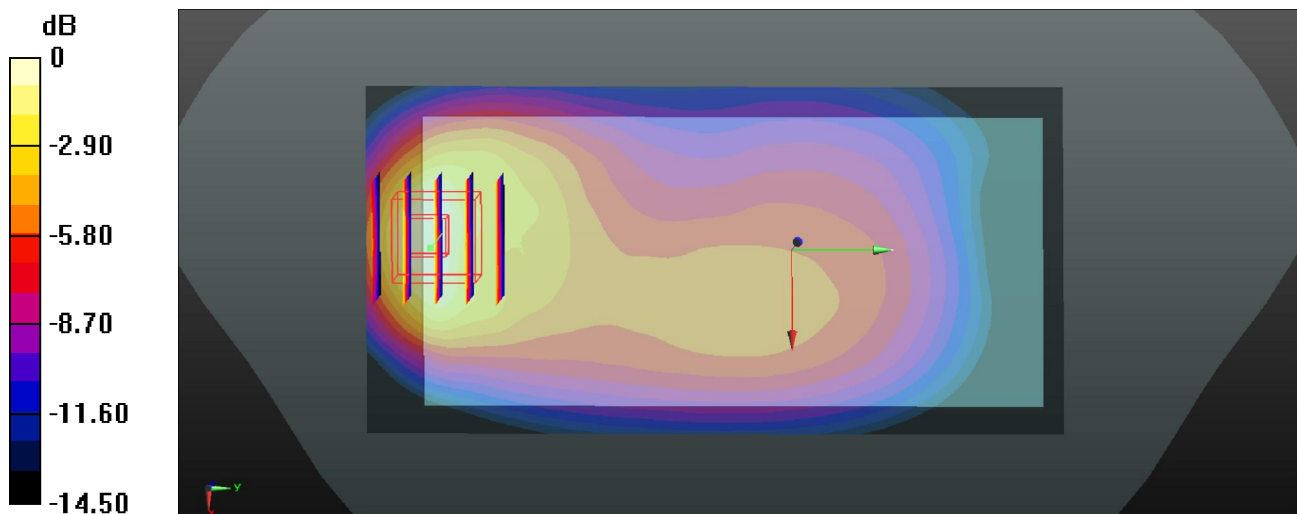
Ch189/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 18.60 V/m; Power Drift = -0.15 dB

Peak SAR (extrapolated) = 1.81 W/kg

SAR(1 g) = 0.926 W/kg; SAR(10 g) = 0.508 W/kg

Maximum value of SAR (measured) = 1.43 W/kg



0 dB = 1.43 W/kg

16_GSM1900_GPRS (4 Tx slots)_Back_5mm_Ch512

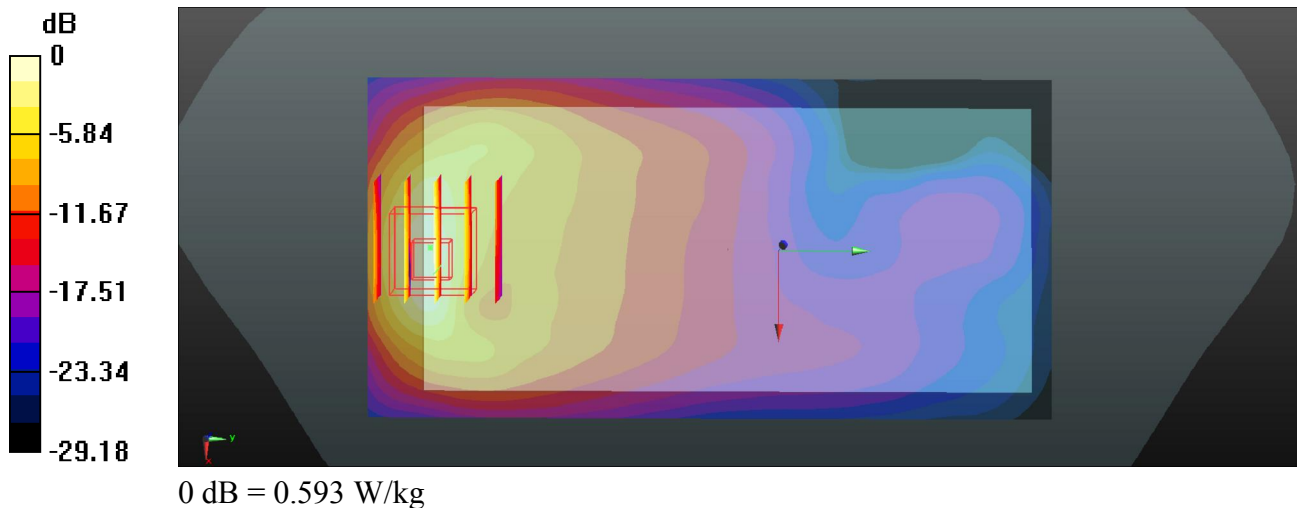
Communication System: UID 0, GPRS (GMSK 4 Tx slot) (0); Frequency: 1850.2 MHz; Duty Cycle: 1:2.08
Medium: MSL_1900_Medium parameters used: $f = 1850.2$ MHz; $\sigma = 1.491$ S/m; $\epsilon_r = 51.605$;
 $\rho = 1000$ kg/m³
Ambient Temperature : 23.6 °C ; Liquid Temperature : 22.4 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(8.3, 8.3, 8.3); Calibrated: 2017/12/14;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2017/10/24
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1754
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

Ch512/Area Scan (61x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.553 W/kg

Ch512/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 3.072 V/m; Power Drift = 0.16 dB
Peak SAR (extrapolated) = 0.701 W/kg
SAR(1 g) = 0.374 W/kg; SAR(10 g) = 0.183 W/kg
Maximum value of SAR (measured) = 0.593 W/kg



17_WCDMA Band V_RMC 12.2Kbps_Back_5mm_Ch4233

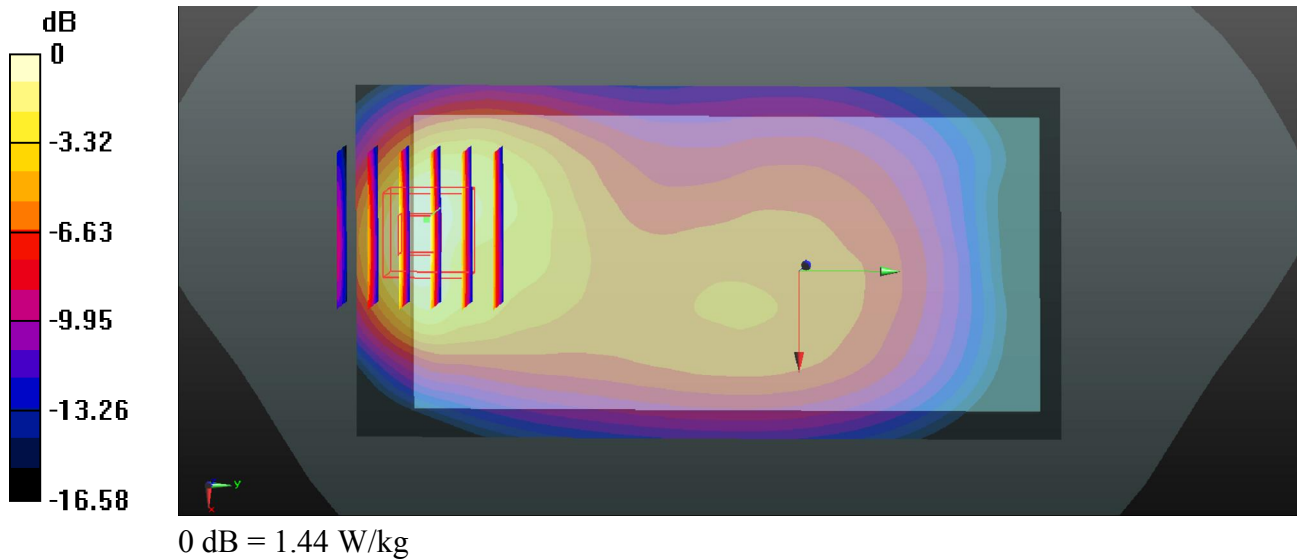
Communication System: UID 0, WCDMA (0); Frequency: 846.6 MHz; Duty Cycle: 1:1
Medium: MSL_835_Medium parameters used: $f = 846.6 \text{ MHz}$; $\sigma = 1.007 \text{ S/m}$; $\epsilon_r = 55.076$;
 $\rho = 1000 \text{ kg/m}^3$
Ambient Temperature : $23.5 \text{ }^\circ\text{C}$; Liquid Temperature : $22.6 \text{ }^\circ\text{C}$

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(10.33, 10.33, 10.33); Calibrated: 2017/12/14;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2017/10/24
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

Ch4233/Area Scan (61x121x1): Interpolated grid: $dx=1.500 \text{ mm}$, $dy=1.500 \text{ mm}$
Maximum value of SAR (interpolated) = 1.51 W/kg

Ch4233/Zoom Scan (6x6x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$
Reference Value = 18.18 V/m ; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 1.84 W/kg
SAR(1 g) = 0.940 W/kg ; SAR(10 g) = 0.518 W/kg
Maximum value of SAR (measured) = 1.44 W/kg



18_WCDMA Band II_RMC 12.2Kbps_Back_5mm_Ch9400

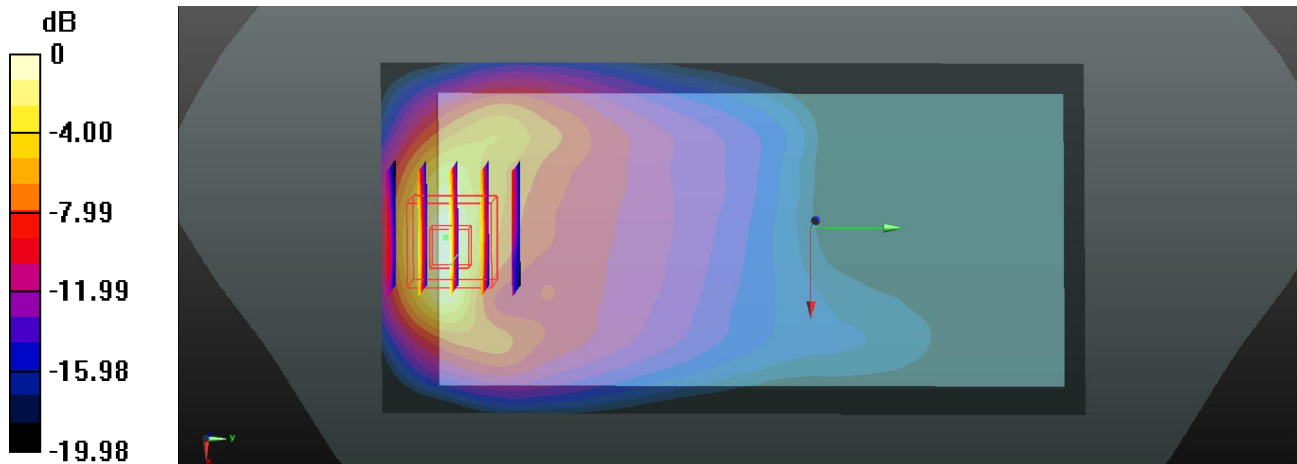
Communication System: UID 0, WCDMA (0); Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: MSL_1900_Medium parameters used: $f = 1880$ MHz; $\sigma = 1.523$ S/m; $\epsilon_r = 51.52$;
 $\rho = 1000$ kg/m³
Ambient Temperature : 23.6 °C ; Liquid Temperature : 22.4 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(8.3, 8.3, 8.3); Calibrated: 2017/12/14;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2017/10/24
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1754
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

Ch9400/Area Scan (61x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.630 W/kg

Ch9400/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 3.416 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 0.827 W/kg
SAR(1 g) = 0.434 W/kg; SAR(10 g) = 0.209 W/kg
Maximum value of SAR (measured) = 0.689 W/kg



0 dB = 0.689 W/kg

19_LTE Band 5_10M_QPSK_1RB_0offset_Back_5mm_Ch20525

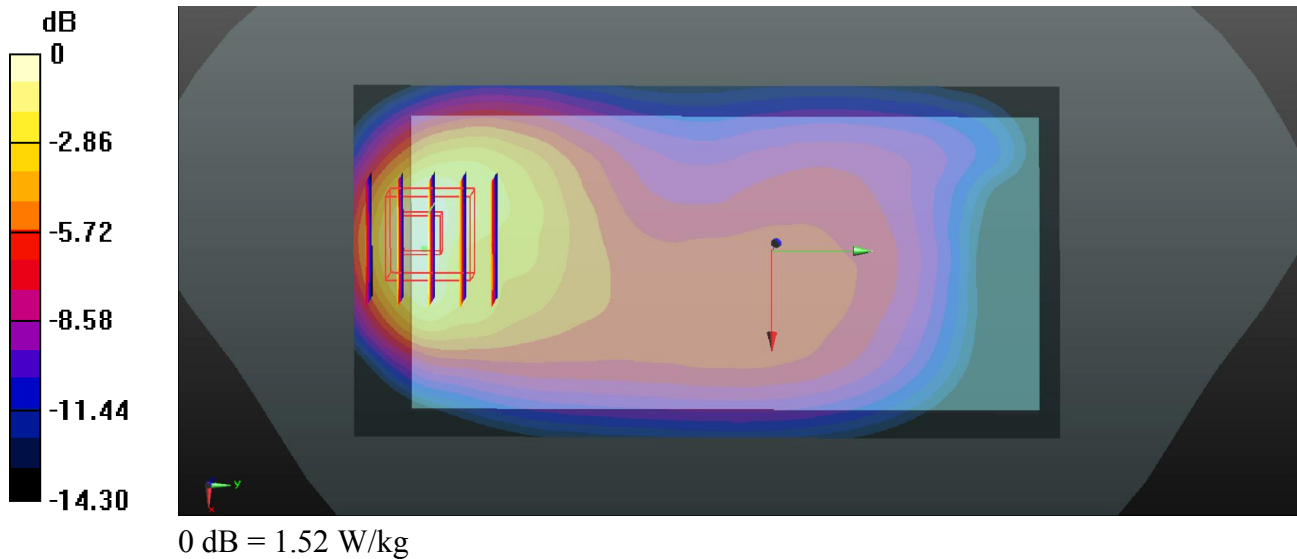
Communication System: UID 0, FDD-LTE (0); Frequency: 836.5 MHz; Duty Cycle: 1:1
Medium: MSL_835_Medium parameters used: $f = 836.5$ MHz; $\sigma = 0.997$ S/m; $\epsilon_r = 55.177$;
 $\rho = 1000$ kg/m³
Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.6 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(10.33, 10.33, 10.33); Calibrated: 2017/12/14;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2017/10/24
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

Ch20525/Area Scan (61x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.54 W/kg

Ch20525/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 17.78 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 1.92 W/kg
SAR(1 g) = 0.983 W/kg; SAR(10 g) = 0.546 W/kg
Maximum value of SAR (measured) = 1.52 W/kg



20_LTE Band 7_20M_QPSK_1RB_49offset_Front_5mm_Ch21350

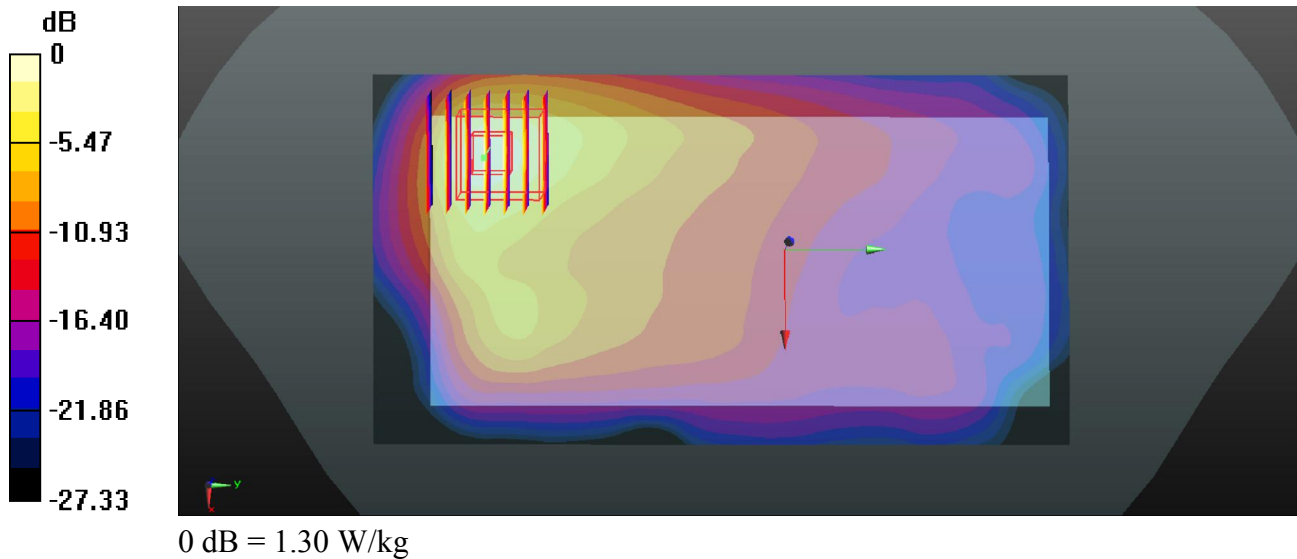
Communication System: UID 0, FDD-LTE (0); Frequency: 2560 MHz; Duty Cycle: 1:1
Medium: MSL_2600_Medium parameters used: $f = 2560$ MHz; $\sigma = 2.116$ S/m; $\epsilon_r = 52.095$;
 $\rho = 1000$ kg/m³
Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.8 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(7.71, 7.71, 7.71); Calibrated: 2017/12/14;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2017/10/24
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

Ch21350/Area Scan (81x151x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 1.28 W/kg

Ch21350/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.208 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 1.62 W/kg
SAR(1 g) = 0.762 W/kg; SAR(10 g) = 0.334 W/kg
Maximum value of SAR (measured) = 1.30 W/kg



21_LTE Band 38_20M_QPSK_1RB_49offset_Front_5mm_Ch37850

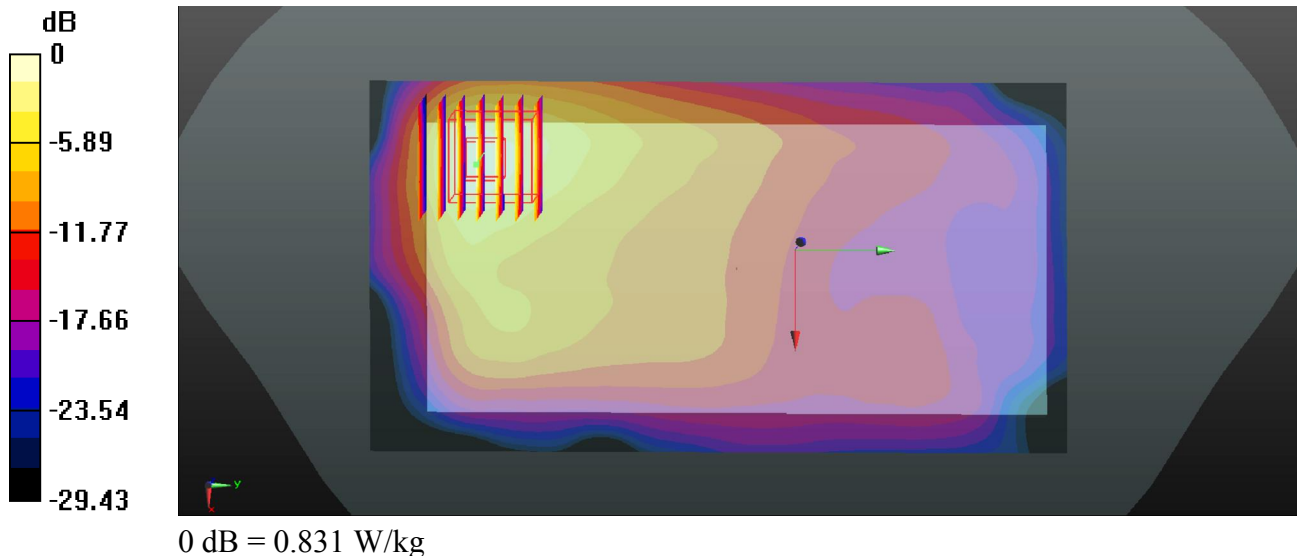
Communication System: UID 0, TDD-LTE (0); Frequency: 2580 MHz; Duty Cycle: 1:1.59
Medium: MSL_2600_Medium parameters used: $f = 2580$ MHz; $\sigma = 2.142$ S/m; $\epsilon_r = 52.022$;
 $\rho = 1000$ kg/m³
Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.8 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(7.71, 7.71, 7.71); Calibrated: 2017/12/14;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2017/10/24
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

Ch37850/Area Scan (81x151x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.859 W/kg

Ch37850/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.259 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 1.03 W/kg
SAR(1 g) = 0.492 W/kg; SAR(10 g) = 0.218 W/kg
Maximum value of SAR (measured) = 0.831 W/kg



22_GSM1900_GPRS (4 Tx slots)_Bottom side_0mm_Ch810

Communication System: UID 0, GPRS (GMSK 4 Tx slot) (0); Frequency: 1909.8 MHz; Duty Cycle: 1:2.08
Medium: MSL_1900_Medium parameters used: $f = 1909.8$ MHz; $\sigma = 1.558$ S/m; $\epsilon_r = 51.436$;
 $\rho = 1000$ kg/m³
Ambient Temperature : 23.6 °C ; Liquid Temperature : 22.4 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(8.3, 8.3, 8.3); Calibrated: 2017/12/14;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2017/10/24
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1754
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

Ch810/Area Scan (31x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 6.07 W/kg

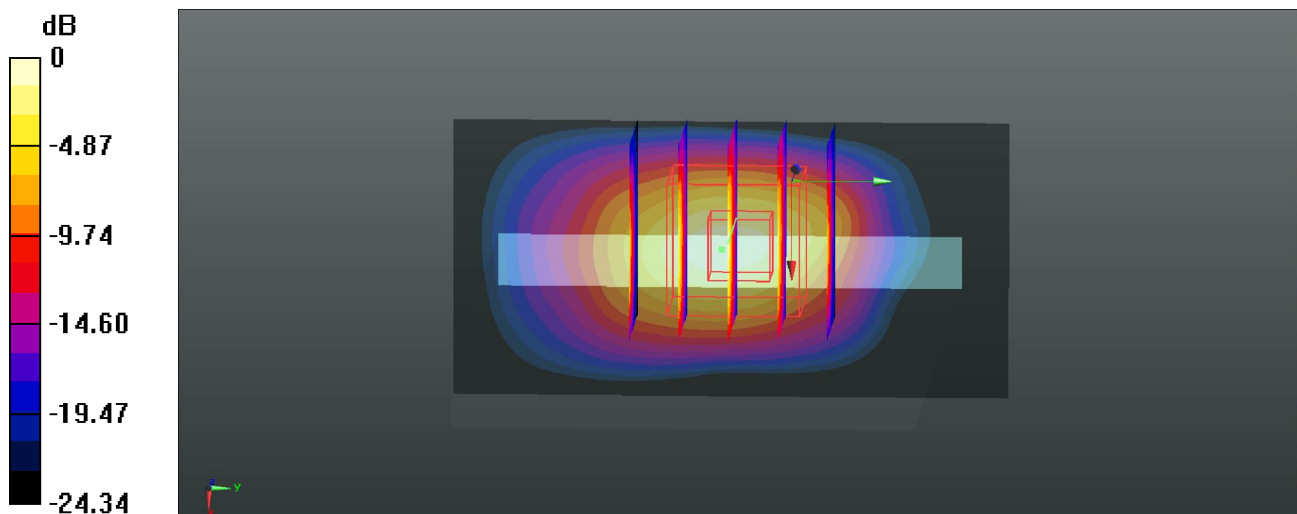
Ch810/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 52.49 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 8.50 W/kg

SAR(1 g) = 3.8 W/kg; SAR(10 g) = 1.56 W/kg

Maximum value of SAR (measured) = 6.72 W/kg



0 dB = 6.72 W/kg

23_WCDMA Band II_RMC 12.2Kbps_Bottom side_0mm_Ch9400

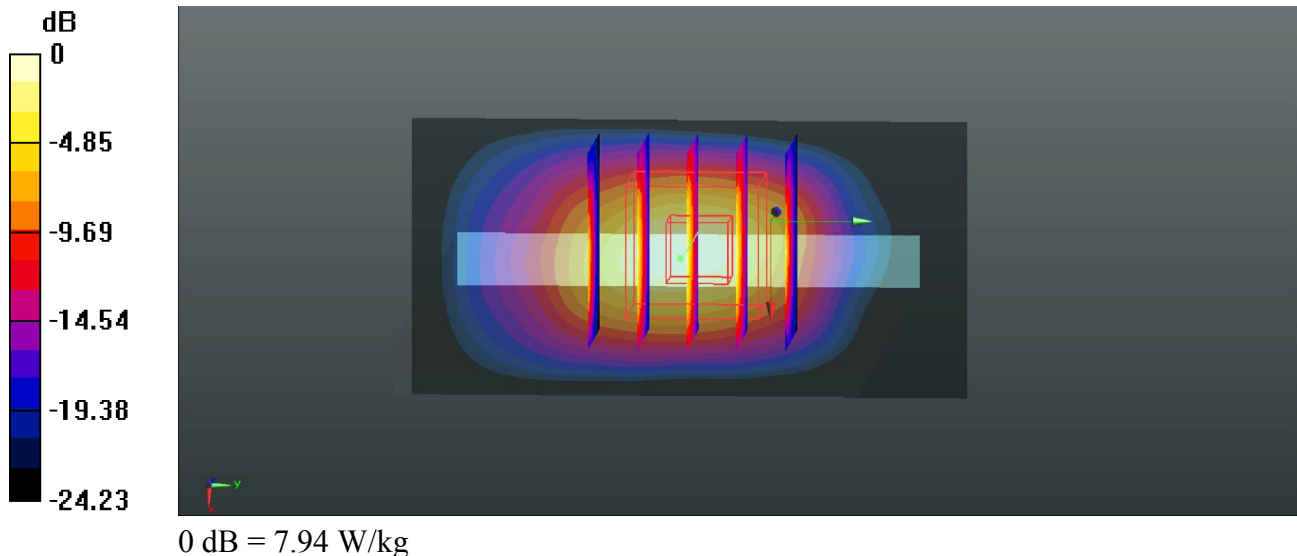
Communication System: UID 0, WCDMA (0); Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: MSL_1900_Medium parameters used: $f = 1880$ MHz; $\sigma = 1.523$ S/m; $\epsilon_r = 51.52$;
 $\rho = 1000$ kg/m³
Ambient Temperature : 23.6 °C ; Liquid Temperature : 22.4 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(8.3, 8.3, 8.3); Calibrated: 2017/12/14;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2017/10/24
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1754
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

Ch9400/Area Scan (31x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 7.44 W/kg

Ch9400/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 57.85 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 9.80 W/kg
SAR(1 g) = 4.39 W/kg; SAR(10 g) = 1.82 W/kg
Maximum value of SAR (measured) = 7.94 W/kg



24_LTE Band 7_20M_QPSK_1RB_49offset_Back_0mm_Ch21350

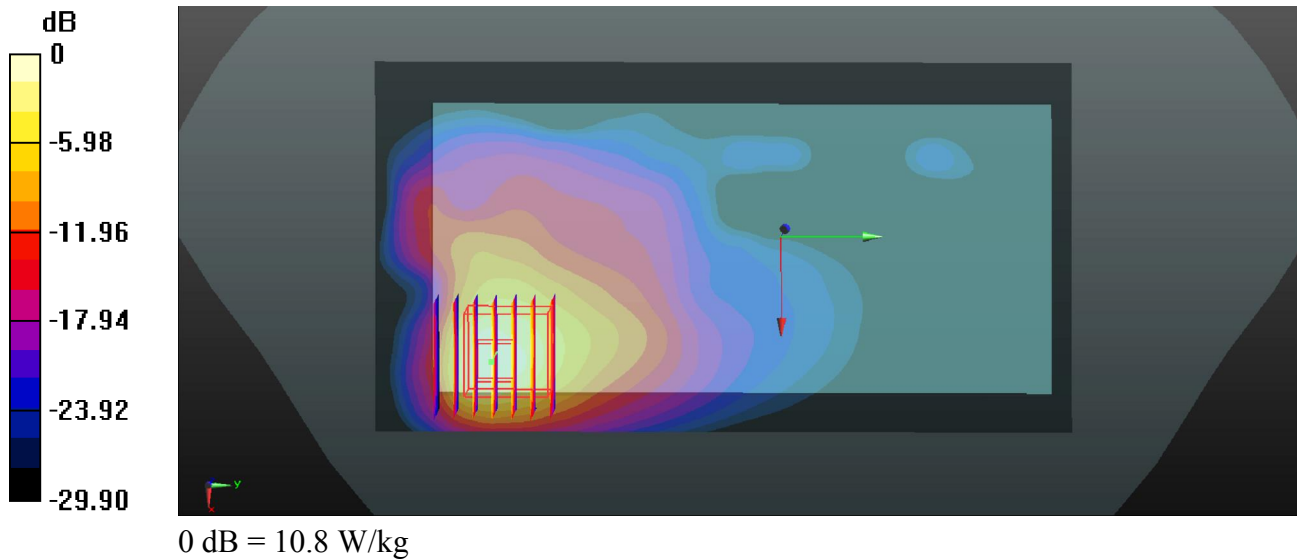
Communication System: UID 0, FDD-LTE (0); Frequency: 2560 MHz; Duty Cycle: 1:1
Medium: MSL_2600_Medium parameters used: $f = 2560$ MHz; $\sigma = 2.116$ S/m; $\epsilon_r = 52.095$;
 $\rho = 1000$ kg/m³
Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.8 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(7.71, 7.71, 7.71); Calibrated: 2017/12/14;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2017/10/24
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

Ch21350/Area Scan (81x151x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 12.4 W/kg

Ch21350/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.885 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 13.6 W/kg
SAR(1 g) = 5.91 W/kg; SAR(10 g) = 2.44 W/kg
Maximum value of SAR (measured) = 10.8 W/kg



25_LTE Band 38_20M_QPSK_1RB_49offset_Front_0mm_Ch37850

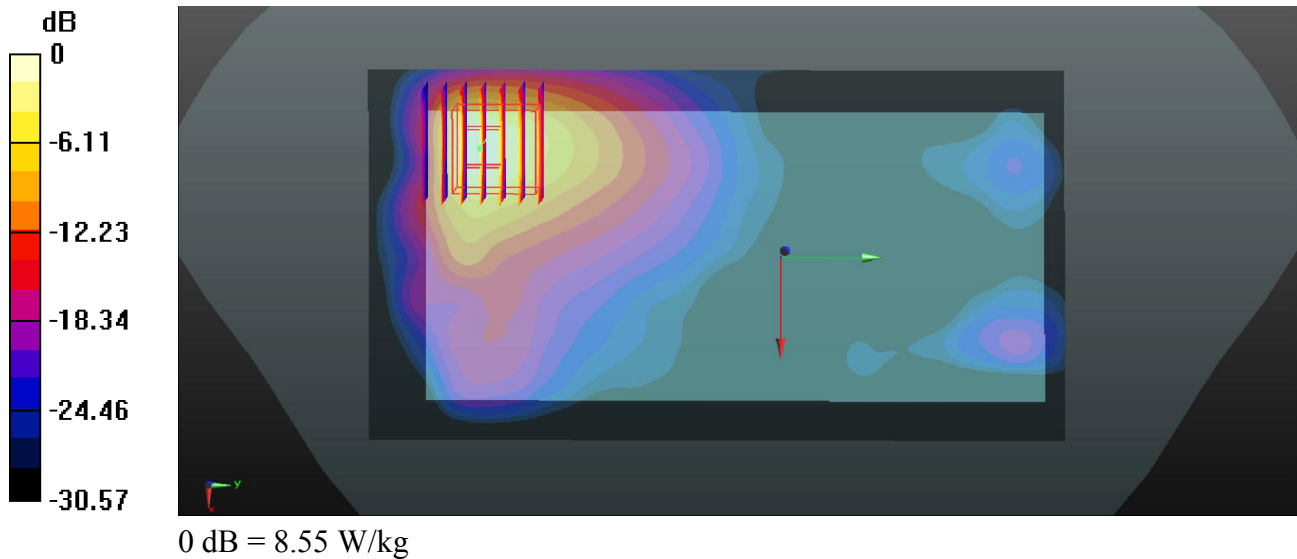
Communication System: UID 0, TDD-LTE (0); Frequency: 2580 MHz; Duty Cycle: 1:1.59
Medium: MSL_2600_Medium parameters used: $f = 2580$ MHz; $\sigma = 2.142$ S/m; $\epsilon_r = 52.022$;
 $\rho = 1000$ kg/m³
Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.8 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(7.71, 7.71, 7.71); Calibrated: 2017/12/14;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2017/10/24
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

Ch37850/Area Scan (81x151x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 8.40 W/kg

Ch37850/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.482 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 11.3 W/kg
SAR(1 g) = 4.49 W/kg; SAR(10 g) = 1.71 W/kg
Maximum value of SAR (measured) = 8.55 W/kg





Appendix C. Supplemental Tuner Head & Body SAR Results

The results are shown as follows.

											Body																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
											Average Value of Time Level (dB)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
Mode	Service/Modification	Frequency (MHz)	Channel	RB Size	RB Offset	Test Position	Spacing	Measured to SAE (dB) (W/Ag)	Auto-Tune (State 1)	Default (State 1)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292																																																																																																																																																																																										
UMTS	SPS/E-TX mode	836.4	1.8	N/A	N/A	Back	5 mm	0.128	0.152	0.128	0.25	0.118	0.134	0.144	0.152	0.16	0.168	0.174	0.18	0.186	0.192	0.198	0.204	0.21	0.216	0.222	0.228	0.234	0.24	0.246	0.252	0.258	0.264	0.27	0.276	0.282	0.288	0.294	0.3	0.306	0.312	0.318	0.324	0.33	0.336	0.342	0.348	0.354	0.36	0.366	0.372	0.378	0.384	0.39	0.396	0.402	0.408	0.414	0.42	0.426	0.432	0.438	0.444	0.45	0.456	0.462	0.468	0.474	0.48	0.486	0.492	0.498	0.504	0.51	0.516	0.522	0.528	0.534	0.54	0.546	0.552	0.558	0.564	0.57	0.576	0.582	0.588	0.594	0.6	0.606	0.612	0.618	0.624	0.63	0.636	0.642	0.648	0.654	0.66	0.666	0.672	0.678	0.684	0.69	0.696	0.702	0.708	0.714	0.72	0.726	0.732	0.738	0.744	0.75	0.756	0.762	0.768	0.774	0.78	0.786	0.792	0.798	0.804	0.81	0.816	0.822	0.828	0.834	0.84	0.846	0.852	0.858	0.864	0.87	0.876	0.882	0.888	0.894	0.9	0.906	0.912	0.918	0.924	0.93	0.936	0.942	0.948	0.954	0.96	0.966	0.972	0.978	0.984	0.99	0.996	1.002	1.008	1.014	1.02	1.026	1.032	1.038	1.044	1.05	1.056	1.062	1.068	1.074	1.08	1.086	1.092	1.098	1.104	1.11	1.116	1.122	1.128	1.134	1.14	1.146	1.152	1.158	1.164	1.17	1.176	1.182	1.188	1.194	1.2	1.206	1.212	1.218	1.224	1.23	1.236	1.242	1.248	1.254	1.26	1.266	1.272	1.278	1.284	1.29	1.296	1.302	1.308	1.314	1.32	1.326	1.332	1.338	1.344	1.35	1.356	1.362	1.368	1.374	1.38	1.386	1.392	1.398	1.404	1.41	1.416	1.422	1.428	1.434	1.44	1.446	1.452	1.458	1.464	1.47	1.476	1.482	1.488	1.494	1.5	1.506	1.512	1.518	1.524	1.53	1.536	1.542	1.548	1.554	1.56	1.566	1.572	1.578	1.584	1.59	1.596	1.602	1.608	1.614	1.62	1.626	1.632	1.638	1.644	1.65	1.656	1.662	1.668	1.674	1.68	1.686	1.692	1.698	1.704	1.71	1.716	1.722	1.728	1.734	1.74	1.746	1.752	1.758	1.764	1.77	1.776	1.782	1.788	1.794	1.8	1.806	1.812	1.818	1.824	1.83	1.836	1.842	1.848	1.854	1.86	1.866	1.872	1.878	1.884	1.89	1.896	1.902	1.908	1.914	1.92	1.926	1.932	1.938	1.944	1.95	1.956	1.962	1.968	1.974	1.98	1.986	1.992	1.998	2.004	2.01	2.016	2.022	2.028	2.034	2.04	2.046	2.052	2.058	2.064	2.07	2.076	2.082	2.088	2.094	2.1	2.106	2.112	2.118	2.124	2.13	2.136	2.142	2.148	2.154	2.16	2.166	2.172	2.178	2.184	2.19	2.196	2.202	2.208	2.214	2.22	2.226	2.232	2.238	2.244	2.25	2.256	2.262	2.268	2.274	2.28	2.286	2.292	2.298	2.304	2.31	2.316	2.322	2.328	2.334	2.34	2.346	2.352	2.358	2.364	2.37	2.376	2.382	2.388	2.394	2.4	2.406	2.412	2.418	2.424	2.43	2.436	2.442	2.448	2.454	2.46	2.466	2.472	2.478	2.484	2.49	2.496	2.502	2.508	2.514	2.52	2.526	2.532	2.538	2.544	2.55	2.556	2.562	2.568	2.574	2.58	2.586	2.592	2.598	2.604	2.61	2.616	2.622	2.628	2.634	2.64	2.646	2.652	2.658	2.664	2.67	2.676	2.682	2.688	2.694	2.7	2.706	2.712	2.718	2.724	2.73	2.736	2.742	2.748	2.754	2.76	2.766	2.772	2.778	2.784	2.79	2.796	2.802	2.808	2.814	2.82	2.826	2.832	2.838	2.844	2.85	2.856	2.862	2.868	2.874	2.88	2.886	2.892	2.898	2.904	2.91	2.916	2.922	2.928	2.934	2.94	2.946	2.952	2.958	2.964	2.97	2.976	2.982	2.988	2.994	3.0
UMTS	SPS/E-TX mode	836.4	1.8	N/A	N/A	Bottom side	5 mm	0.128	0.152	0.128	0.25	0.118	0.134	0.144	0.152	0.16	0.168	0.174	0.18	0.186	0.192	0.198	0.204	0.21	0.216	0.222	0.228	0.234	0.24	0.246	0.252	0.258	0.264	0.27	0.276	0.282	0.288	0.294	0.3	0.306	0.312	0.318	0.324	0.33	0.336	0.342	0.348	0.354	0.36	0.366	0.372	0.378	0.384	0.39	0.396	0.402	0.408	0.414	0.42	0.426	0.432	0.438	0.444	0.45	0.456	0.462	0.468	0.474	0.48	0.486	0.492	0.498	0.504	0.51	0.516	0.522	0.528	0.534	0.54	0.546	0.552	0.558	0.564	0.57	0.576	0.582	0.588	0.594	0.6	0.606	0.612	0.618	0.624	0.63	0.636	0.642	0.648	0.654	0.66	0.666	0.672	0.678	0.684	0.69	0.696	0.702	0.708	0.714	0.72	0.726	0.732	0.738	0.744	0.75	0.756	0.762	0.768	0.774	0.78	0.786	0.792	0.798	0.804	0.81	0.816	0.822	0.828	0.834	0.84	0.846	0.852	0.858	0.864	0.87	0.876	0.882	0.888	0.894	0.9	0.906	0.912	0.918	0.924	0.93	0.936	0.942	0.948	0.954	0.96	0.966	0.972	0.978	0.984	0.99	0.996	1.002	1.008	1.014	1.02	1.026	1.032	1.038	1.044	1.05	1.056	1.062	1.068	1.074	1.08	1.086	1.092	1.098	1.104	1.11	1.116	1.122	1.128	1.134	1.14	1.146	1.152	1.158	1.164	1.17	1.176	1.182	1.188	1.194	1.2	1.206	1.212	1.218	1.224	1.23	1.236	1.242	1.248	1.254	1.26	1.266	1.272	1.278	1.284	1.29	1.296	1.302	1.308	1.314	1.32	1.326	1.332	1.338	1.344	1.35	1.356	1.362	1.368	1.374	1.38	1.386	1.392	1.398	1.404	1.41	1.416	1.422	1.428	1.434	1.44	1.446	1.452	1.458	1.464	1.47	1.476	1.482	1.488	1.494	1.5	1.506	1.512	1.518	1.524	1.53	1.536	1.542	1.548	1.554	1.56	1.566	1.572	1.578	1.584	1.59	1.596	1.602	1.608	1.614	1.62	1.626	1.632	1.638	1.644	1.65	1.656	1.662	1.668	1.674	1.68	1.686	1.692	1.698	1.704	1.71	1.716	1.722	1.728	1.734	1.74	1.746	1.752	1.758	1.764	1.77	1.776	1.782	1.788	1.794	1.8	1.806	1.812	1.818	1.824	1.83	1.836	1.842	1.848	1.854	1.86	1.866	1.872	1.878	1.884	1.89	1.896	1.902	1.908	1.914	1.92	1.926	1.932	1.938	1.944	1.95	1.956	1.962	1.968	1.974	1.98	1.986	1.992	1.998	2.004	2.01	2.016	2.022	2.028	2.034	2.04	2.046	2.052	2.058	2.064	2.07	2.076	2.082	2.088	2.094	2.1	2.106	2.112	2.118	2.124	2.13	2.136	2.142	2.148	2.154	2.16	2.166	2.172	2.178	2.184	2.19	2.196	2.202	2.208	2.214	2.22	2.226	2.232	2.238	2.244	2.25	2.256	2.262	2.268	2.274	2.28	2.286	2.292	2.298	2.304	2.31	2.316	2.322	2.328	2.334	2.34	2.346	2.352	2.358	2.364	2.37	2.376	2.382	2.388	2.394	2.4	2.406	2.412	2.418	2.424	2.43	2.436	2.442	2.448	2.454	2.46	2.466	2.472	2.478	2.484	2.49	2.496	2.502																																																																																			



Appendix D. DASYS Calibration Certificate

The DASYS calibration certificates are shown as follows.



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

Client

Sporton_XA

Certificate No: Z17-97038

CALIBRATION CERTIFICATE

Object

D835V2 - SN: 4d151

Calibration Procedure(s)

FD-Z11-003-01

Calibration Procedures for dipole validation kits

Calibration date:

March 20, 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-16 (CTTL, No.J16X04777)	Jun-17
Power sensor NRP-Z91	101547	27-Jun-16 (CTTL, No.J16X04777)	Jun-17
Reference Probe EX3DV4	SN 3617	23-Jan-17(SPEAG,No.EX3-3617_Jan17)	Jan-18
DAE4	SN 777	22-Aug-16(CTTL-SPEAG,No.Z16-97138)	Aug-17
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:	Qi Dianyuan	SAR Project Leader	
Approved by:	Lu Bingsong	Deputy Director of the laboratory	

Issued: March 24, 2017

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



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

Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) For hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005
- IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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



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

Measurement Conditions

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

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 ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.41 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	9.73 mW / g ± 20.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.57 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	6.33 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	55.6 ± 6 %	0.96 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	---	---

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.41 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	9.72 mW / g ± 20.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.60 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	6.44 mW / g ± 20.4 % (k=2)



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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	48.2Ω- 3.30jΩ
Return Loss	- 28.3dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.0Ω- 3.06jΩ
Return Loss	- 25.6dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.474 ns
----------------------------------	----------

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

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

Additional EUT Data

Manufactured by	SPEAG
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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: 03.20.2017

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d151

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

Medium parameters used: $f = 835$ MHz; $\sigma = 0.886$ S/m; $\epsilon_r = 40.96$; $\rho = 1000$ kg/m³

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(9.73, 9.73, 9.73); Calibrated: 1/23/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn777; Calibrated: 8/22/2016
- 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)

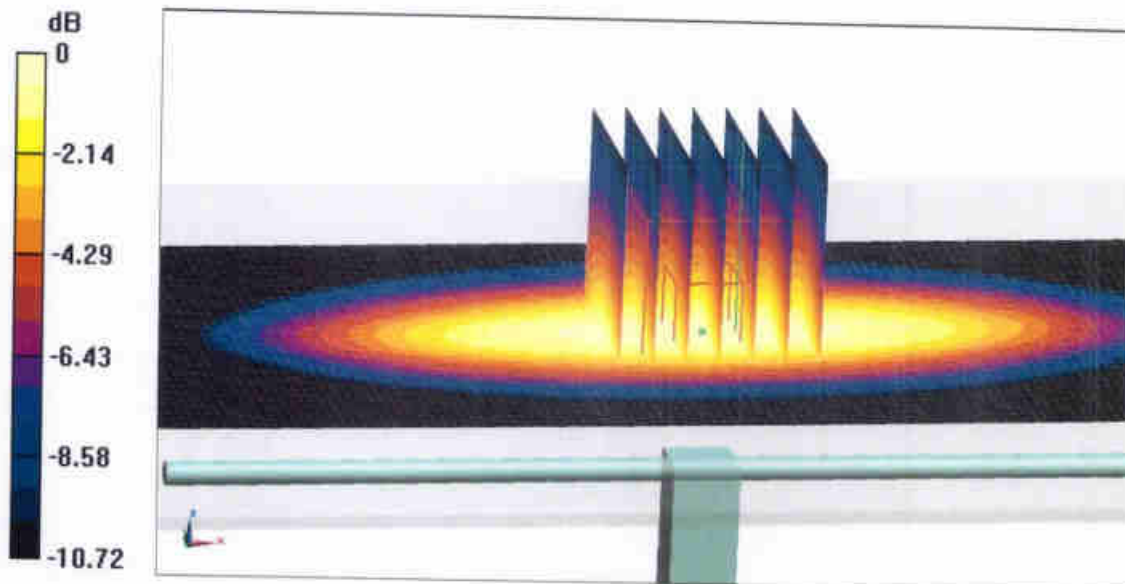
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 59.22V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 3.68 W/kg

SAR(1 g) = 2.41 W/kg; SAR(10 g) = 1.57 W/kg

Maximum value of SAR (measured) = 3.24 W/kg

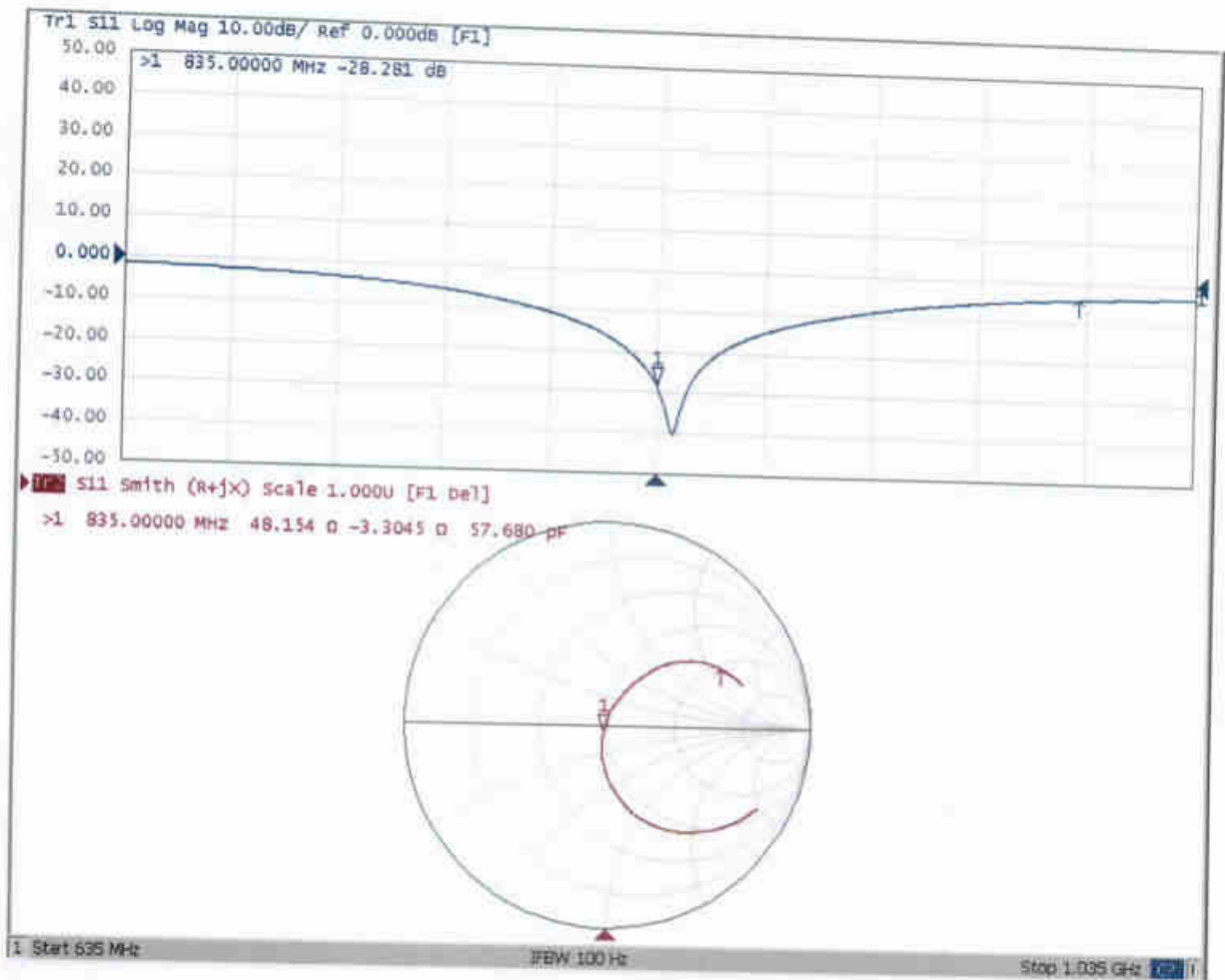


0 dB = 3.24 W/kg = 5.11 dBW/kg



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Impedance Measurement Plot for Head TSL





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DASY5 Validation Report for Body TSL

Date: 03.20.2017

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d151

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

Medium parameters used: $f = 835$ MHz; $\sigma = 0.962$ S/m; $\epsilon_r = 55.58$; $\rho = 1000$ kg/m³

Phantom section: Center Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(9.64,9.64, 9.64); Calibrated: 1/23/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn777; Calibrated: 8/22/2016
- 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)

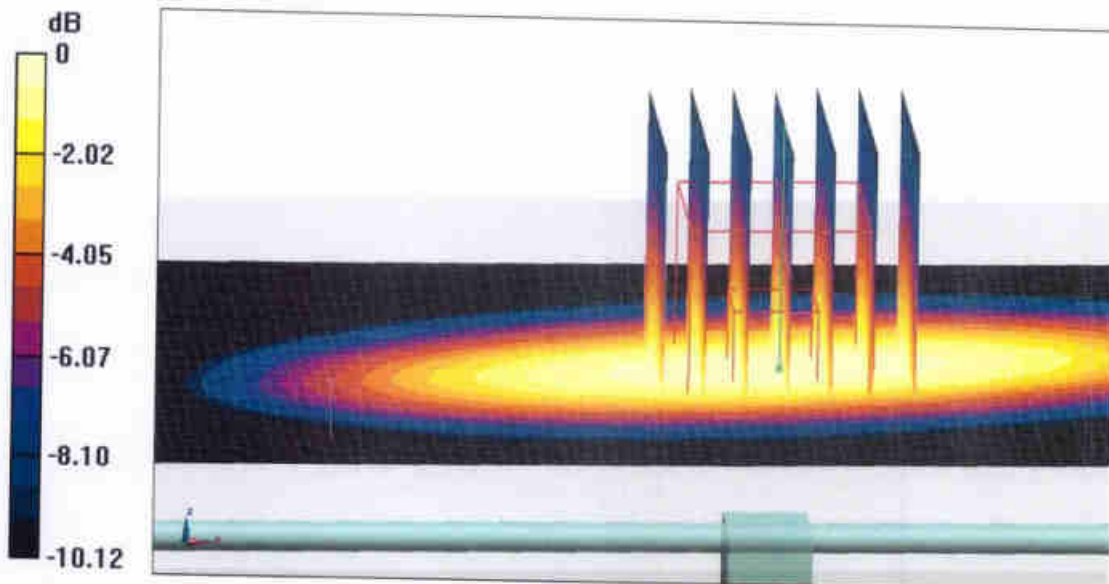
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 57.67 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 3.50 W/kg

SAR(1 g) = 2.41 W/kg; SAR(10 g) = 1.6 W/kg

Maximum value of SAR (measured) = 3.03 W/kg

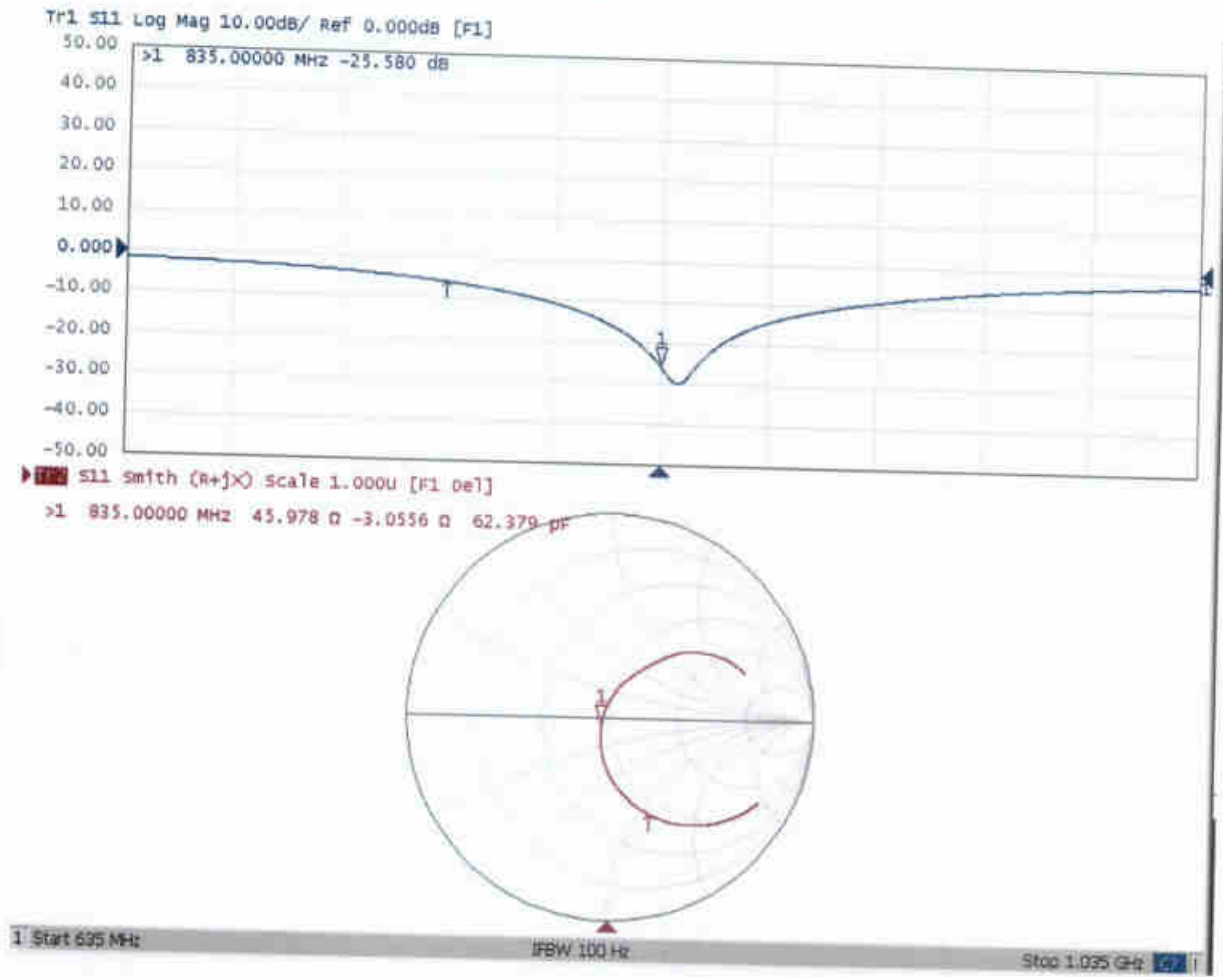


0 dB = 3.03 W/kg = 4.81 dBW/kg



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Impedance Measurement Plot for Body TSL





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Client **Sporton_XA**

Certificate No: **Z17-97041**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d170**

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

Calibration date: **March 22, 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-16 (CTTL, No.J16X04777)	Jun-17
Power sensor NRP-Z91	101547	27-Jun-16 (CTTL, No.J16X04777)	Jun-17
Reference Probe EX3DV4	SN 3617	23-Jan-17(SPEAG,No.EX3-3617_Jan17)	Jan-18
DAE4	SN 777	22-Aug-16(CTTL-SPEAG,No.Z16-97138)	Aug-17
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:	Qi Dianyuan	SAR Project Leader	
Approved by:	Lu Bingsong	Deputy Director of the laboratory	

Issued: March 25, 2017

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



Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) For hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005
- IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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



Measurement Conditions

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

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

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 \pm 0.2) °C	39.9 \pm 6 %	1.38 mho/m \pm 6 %
Head TSL temperature change during test	<1.0 °C	---	---

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.89mW / g
SAR for nominal Head TSL parameters	normalized to 1W	40.0 mW / g \pm 20.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.15 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	20.7 mW / g \pm 20.4 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 \pm 0.2) °C	53.6 \pm 6 %	1.53 mho/m \pm 6 %
Body TSL temperature change during test	<1.0 °C	---	---

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.2 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	40.7 mW / g \pm 20.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.37 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	21.4 mW / g \pm 20.4 % (k=2)



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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.5Ω+ 5.31jΩ
Return Loss	- 25.3dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.2Ω+ 5.61jΩ
Return Loss	- 24.9dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1,307 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

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DASY5 Validation Report for Head TSL

Date: 03.22.2017

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d170

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

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.376$ S/m; $\epsilon_r = 39.92$; $\rho = 1000$ kg/m³

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(8.26, 8.26, 8.26); Calibrated: 1/23/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn777; Calibrated: 8/22/2016
- 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:

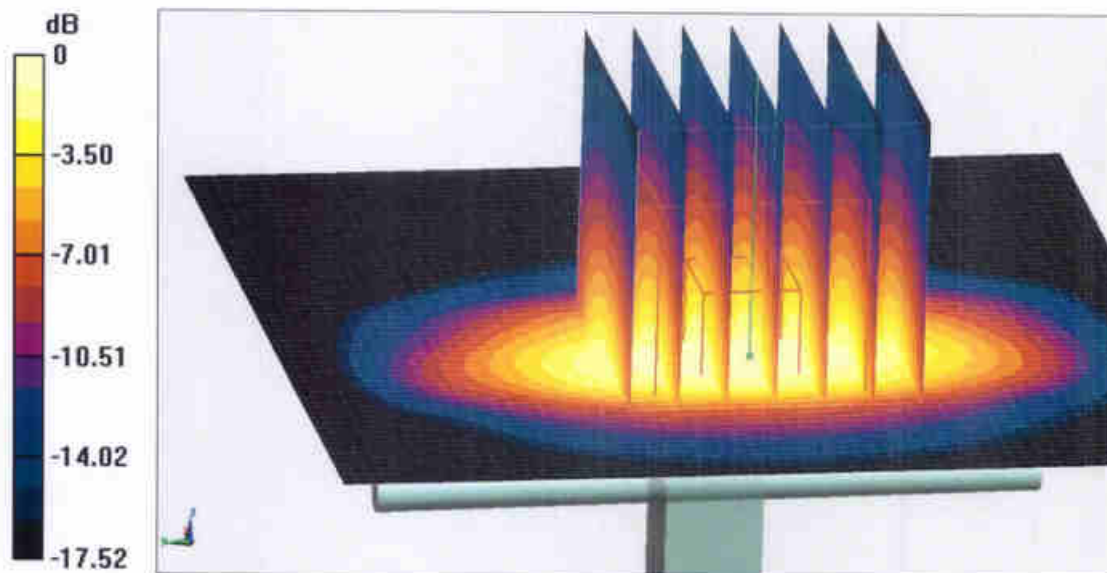
$dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 90.60 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 18.7 W/kg

SAR(1 g) = 9.89 W/kg; SAR(10 g) = 5.15 W/kg

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

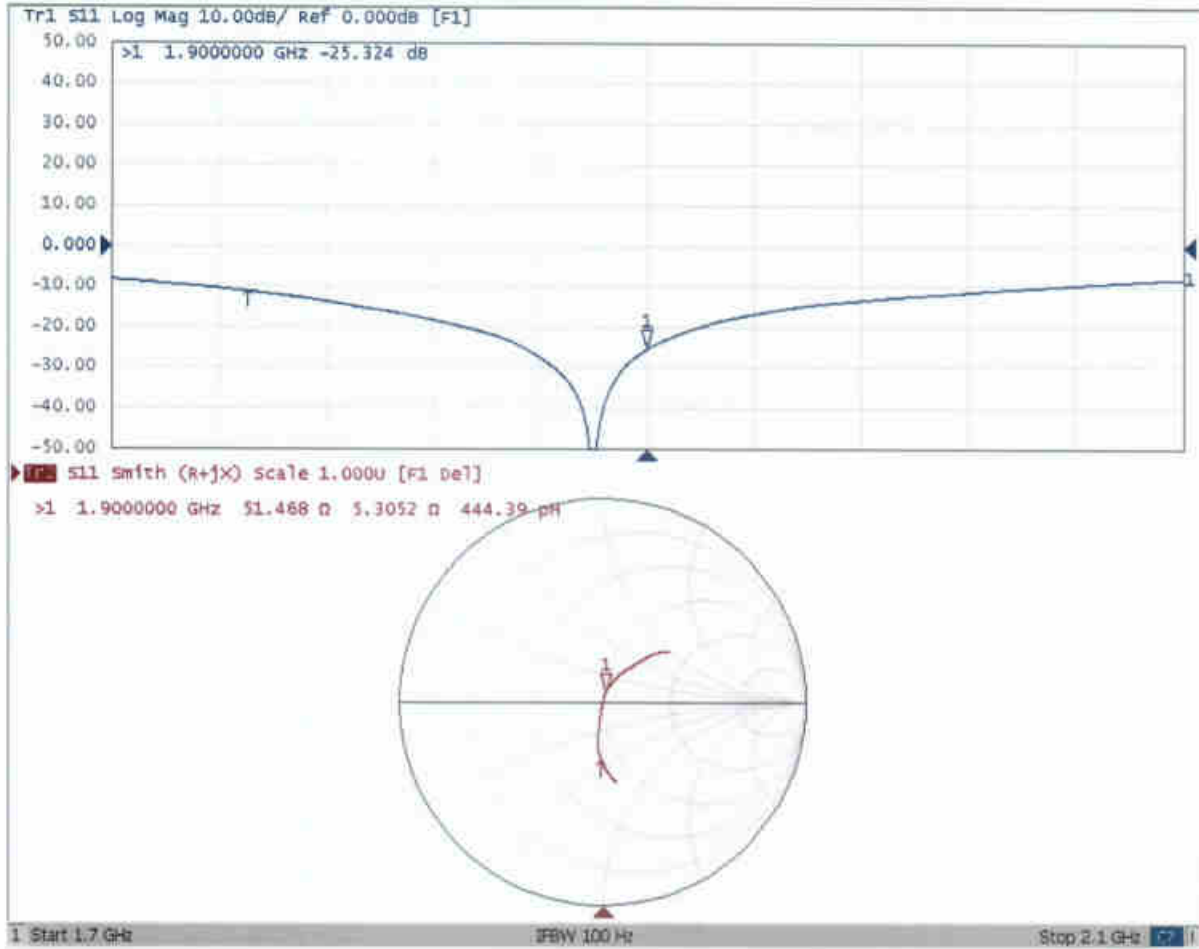


0 dB = 15.5 W/kg = 11.90 dBW/kg



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Impedance Measurement Plot for Head TSL





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DASY5 Validation Report for Body TSL

Date: 03.22.2017

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d170

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

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.532$ S/m; $\epsilon_r = 53.62$; $\rho = 1000$ kg/m³

Phantom section: Center Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(7.95, 7.95, 7.95); Calibrated: 1/23/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn777; Calibrated: 8/22/2016
- 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:

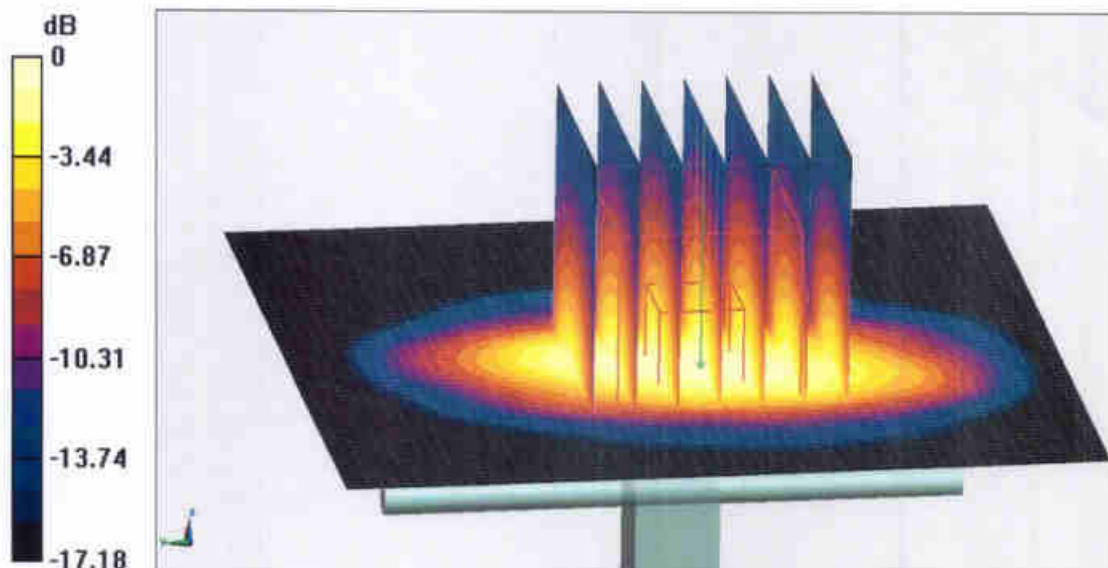
$dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 97.75 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 18.3 W/kg

SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.37 W/kg

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

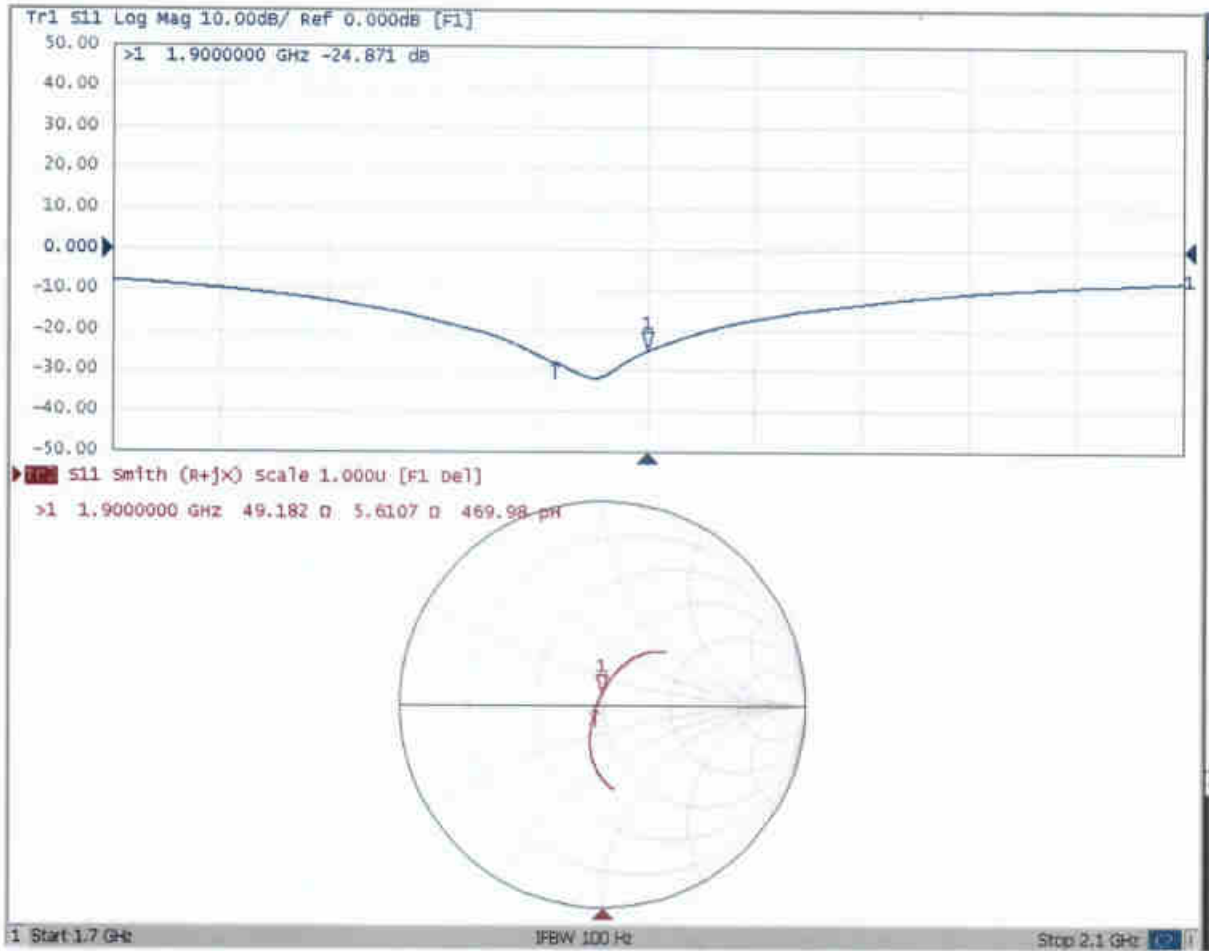


0 dB = 15.5 W/kg = 11.90 dBW/kg



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Impedance Measurement Plot for Body TSL





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Client **Sporton International INC**

Certificate No: **Z17-97161**

CALIBRATION CERTIFICATE

Object **D2600V2 - SN: 1112**

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

Calibration date: **September 18, 2017**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRVD	102196	02-Mar-17 (CTTL, No.J17X01254)	Mar-18
Power sensor NRV-Z5	100596	02-Mar-17 (CTTL, No.J17X01254)	Mar-18
Reference Probe EX3DV4	SN 7433	26-Sep-16(SPEAG,No.EX3-7433_Sep16)	Sep-17
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:	Yu Zongying	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: September 20, 2017

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Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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



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Measurement Conditions

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

DASY Version	DASY52	52.10.0.1446
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	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	39.8 ± 6 %	1.95 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.0 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	56.4 mW / g ± 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.29 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	25.3 mW / g ± 18.7 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.7 ± 6 %	2.15 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.7 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	55.0 mW / g ± 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	6.08 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	24.4 mW / g ± 18.7 % (k=2)



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Appendix(Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.0Ω- 5.12jΩ
Return Loss	- 25.8dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.8Ω- 5.40jΩ
Return Loss	- 23.8dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.258 ns
----------------------------------	----------

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

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

Additional EUT Data

Manufactured by	SPEAG
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DASY5 Validation Report for Head TSL

Date: 09.18.2017

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1112

Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2600$ MHz; $\sigma = 1.947$ S/m; $\epsilon_r = 39.75$; $\rho = 1000$ kg/m³

Phantom section: Left Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7433; ConvF(7.19, 7.19, 7.19); Calibrated: 9/26/2016;
- 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 (7417)

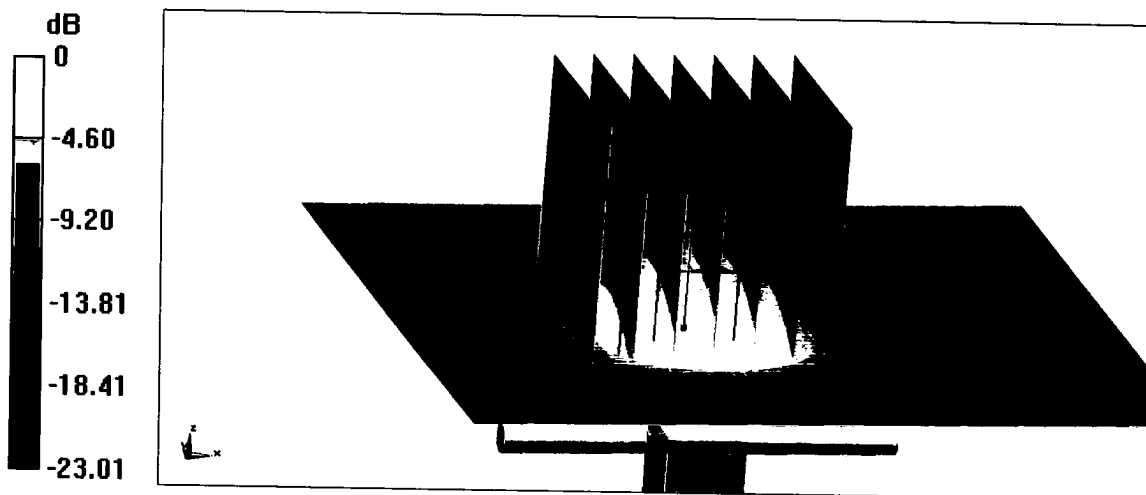
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 97.92 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 30.0 W/kg

SAR(1 g) = 14 W/kg; SAR(10 g) = 6.29 W/kg

Maximum value of SAR (measured) = 24.0 W/kg

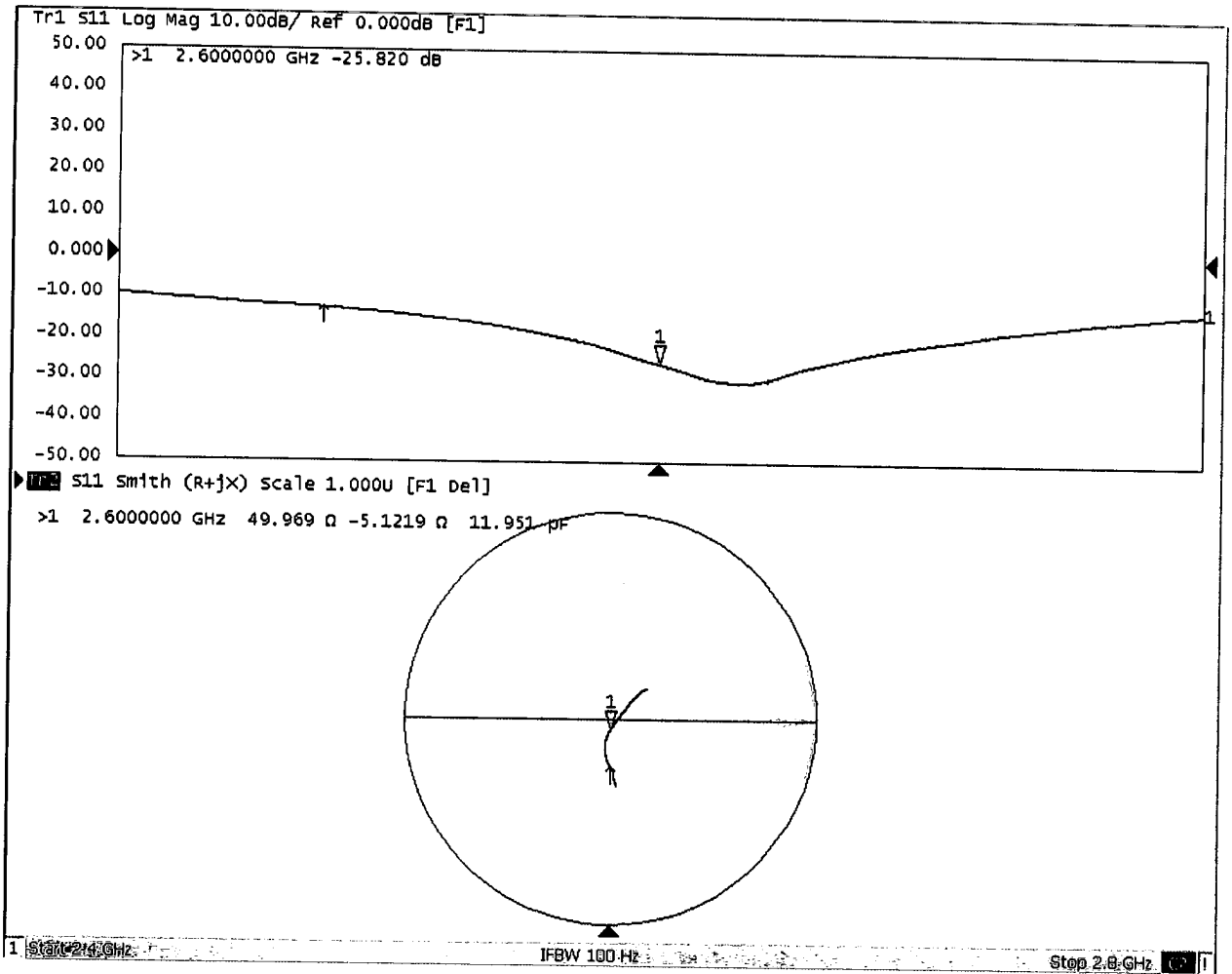


0 dB = 24.0 W/kg = 13.80 dBW/kg



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Impedance Measurement Plot for Head TSL





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DASY5 Validation Report for Body TSL

Date: 09.18.2017

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1112

Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2600$ MHz; $\sigma = 2.147$ S/m; $\epsilon_r = 52.74$; $\rho = 1000$ kg/m³

Phantom section: Center Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7433; ConvF(7.22, 7.22, 7.22); Calibrated: 9/26/2016;
- 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 (7417)

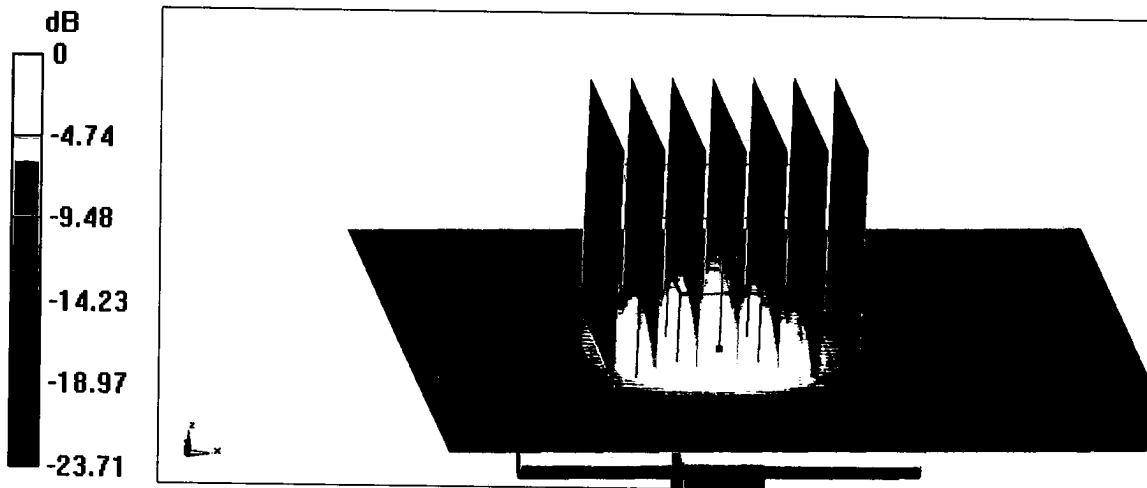
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 98.69 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 30.3 W/kg

SAR(1 g) = 13.7 W/kg; SAR(10 g) = 6.08 W/kg

Maximum value of SAR (measured) = 23.7 W/kg

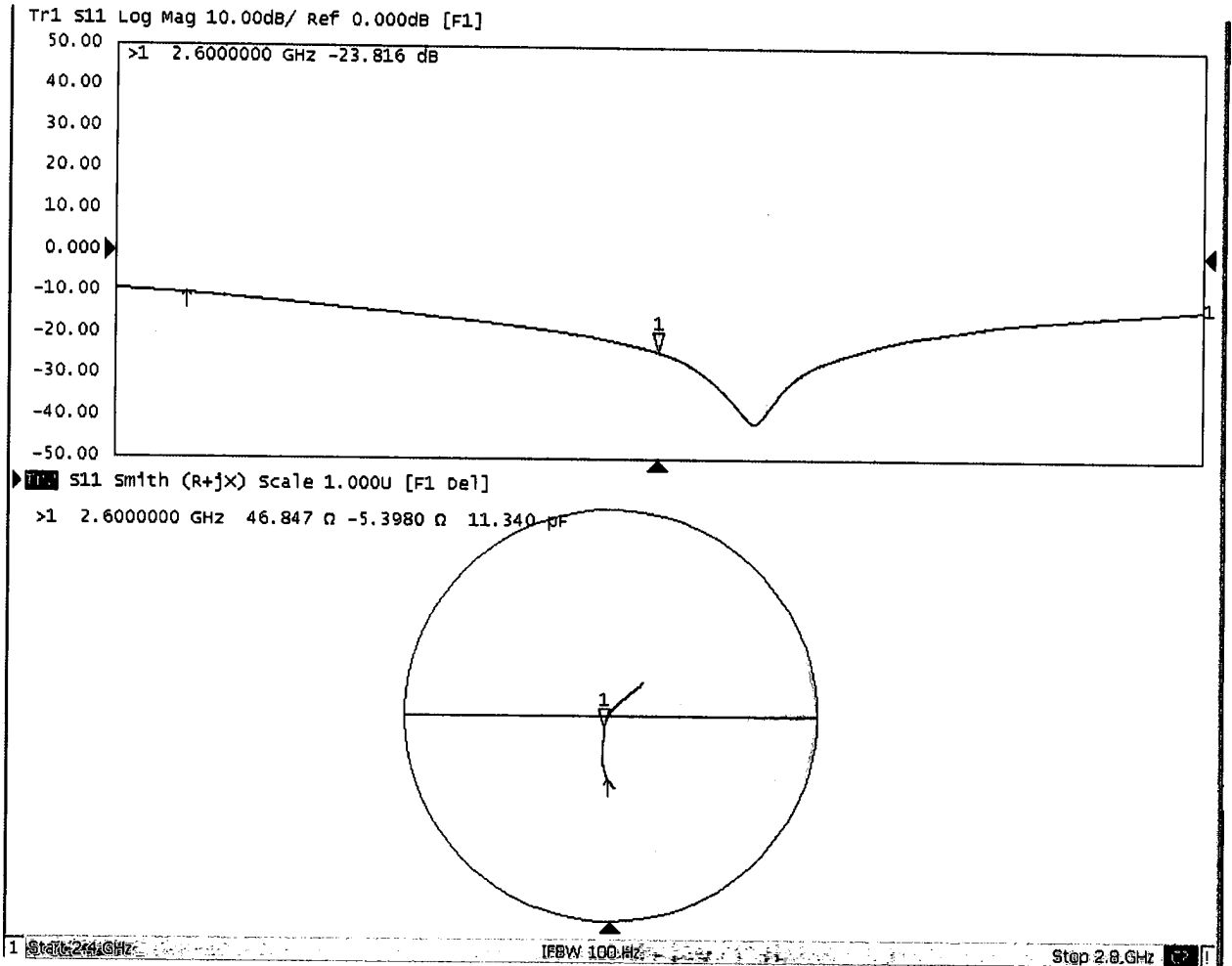


0 dB = 23.7 W/kg = 13.75 dBW/kg



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Impedance Measurement Plot for Body TSL





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Client : **Sporton International INC**

Certificate No: **Z17-97205**

CALIBRATION CERTIFICATE

Object **DAE4 - SN: 1358**

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

Calibration date: **October 24, 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
Process Calibrator 753	1971018	27-Jun-17 (CTTL, No.J17X05859)	June-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 26, 2017

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Glossary:

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

Methods Applied and Interpretation of Parameters:

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



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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	403.474 ± 0.15% (k=2)	403.509 ± 0.15% (k=2)	403.510 ± 0.15% (k=2)
Low Range	3.96147 ± 0.7% (k=2)	3.98783 ± 0.7% (k=2)	3.99209 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	134° ± 1 °
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Client **Sporton International INC**

Certificate No: **Z17-97257**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3935**

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

Calibration date: **December 14, 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 7464	12-Sep-17(SPEAG,No.EX3-7464_Sep17)	Sep-18
DAE4	SN 549	13-Dec-16(SPEAG, No.DAE4-549_Dec16)	Dec -17
DAE4	SN 1524	13-Sep-17(SPEAG, No.DAE4-1524_Sep17)	Sep -18
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: December 16, 2017

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Glossary:

- TSL tissue simulating liquid
- NORM_{x,y,z} sensitivity in free space
- ConvF sensitivity in TSL / NORM_{x,y,z}
- DCP diode compression point
- CF crest factor (1/duty_cycle) of the RF signal
- A,B,C,D modulation dependent linearization parameters
- Polarization Φ Φ rotation around probe axis
- Polarization θ θ rotation around an axis that is in the plane normal to probe axis (at measurement center)
 $\theta=0$ 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_{x,y,z}:** Assessed for E-field polarization $\theta=0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not effect the E^2 -field uncertainty inside TSL (see below ConvF).
- **NORM(f)_{x,y,z} = NORM_{x,y,z} * 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_{x,y,z}:** DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- **PAR:** PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics.
- **A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; VR_{x,y,z}:** 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 $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ 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_{x,y,z} * 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 ± 50 MHz to ± 100 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_x (no uncertainty required).



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Probe EX3DV4

SN: 3935

Calibrated: December 14, 2017

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)



DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3935

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.48	0.54	0.49	±10.0%
DCP(mV) ^B	104.4	104.3	106.1	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB/ μV	C	D dB	VR mV	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	162.8	±2.2%
		Y	0.0	0.0	1.0		176.1	
		Z	0.0	0.0	1.0		165.6	

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%.

^A The uncertainties of Norm X, Y, Z do not affect the E²-field uncertainty inside TSL (see Page 5 and Page 6).
^B Numerical linearization parameter: uncertainty not required.
^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.



DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3935

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz] ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unct. (k=2)
750	41.9	0.89	10.68	10.68	10.68	0.40	0.70	± 12.1%
835	41.5	0.90	10.36	10.36	10.36	0.10	1.67	± 12.1%
900	41.5	0.97	10.22	10.22	10.22	0.16	1.29	± 12.1%
1750	40.1	1.37	8.85	8.85	8.85	0.22	1.08	± 12.1%
1900	40.0	1.40	8.41	8.41	8.41	0.26	0.94	± 12.1%
2000	40.0	1.40	8.41	8.41	8.41	0.28	0.90	± 12.1%
2300	39.5	1.67	8.39	8.39	8.39	0.44	0.79	± 12.1%
2450	39.2	1.80	7.87	7.87	7.87	0.53	0.73	± 12.1%
2600	39.0	1.96	7.67	7.67	7.67	0.60	0.68	± 12.1%
5200	36.0	4.66	5.91	5.91	5.91	0.35	1.50	± 13.3%
5300	35.9	4.76	5.63	5.63	5.63	0.35	1.50	± 13.3%
5500	35.6	4.96	5.29	5.29	5.29	0.35	1.60	± 13.3%
5600	35.5	5.07	5.08	5.08	5.08	0.35	1.60	± 13.3%
5800	35.3	5.27	5.15	5.15	5.15	0.40	1.40	± 13.3%

^C 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.

^F At frequency below 3 GHz, the validity of tissue parameters (ϵ and σ) 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 (ϵ and σ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

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



DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3935

Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz] ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unct. (k=2)
750	55.5	0.96	10.65	10.65	10.65	0.40	0.80	± 12.1%
835	55.2	0.97	10.33	10.33	10.33	0.17	1.41	± 12.1%
1750	53.4	1.49	8.71	8.71	8.71	0.26	0.99	± 12.1%
1900	53.3	1.52	8.30	8.30	8.30	0.16	1.39	± 12.1%
2300	52.9	1.81	8.10	8.10	8.10	0.32	1.16	± 12.1%
2450	52.7	1.95	7.99	7.99	7.99	0.29	1.25	± 12.1%
2600	52.5	2.16	7.71	7.71	7.71	0.39	0.95	± 12.1%
5200	49.0	5.30	5.41	5.41	5.41	0.45	1.30	± 13.3%
5300	48.9	5.42	5.20	5.20	5.20	0.40	1.30	± 13.3%
5500	48.6	5.65	4.62	4.62	4.62	0.40	1.70	± 13.3%
5600	48.5	5.77	4.51	4.51	4.51	0.45	1.55	± 13.3%
5800	48.2	6.00	4.64	4.64	4.64	0.58	1.07	± 13.3%

^C 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.

^F At frequency below 3 GHz, the validity of tissue parameters (ϵ and σ) 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 (ϵ and σ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

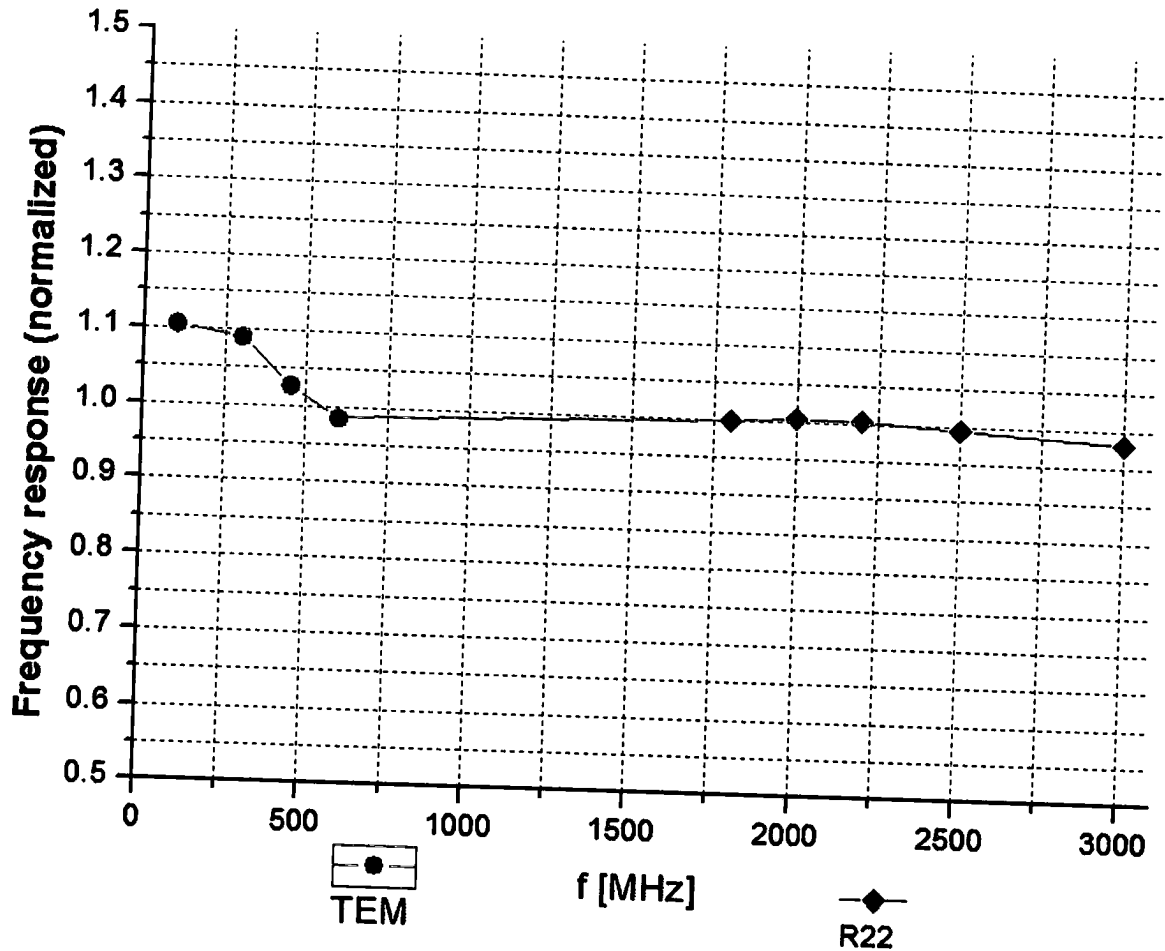
^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from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



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

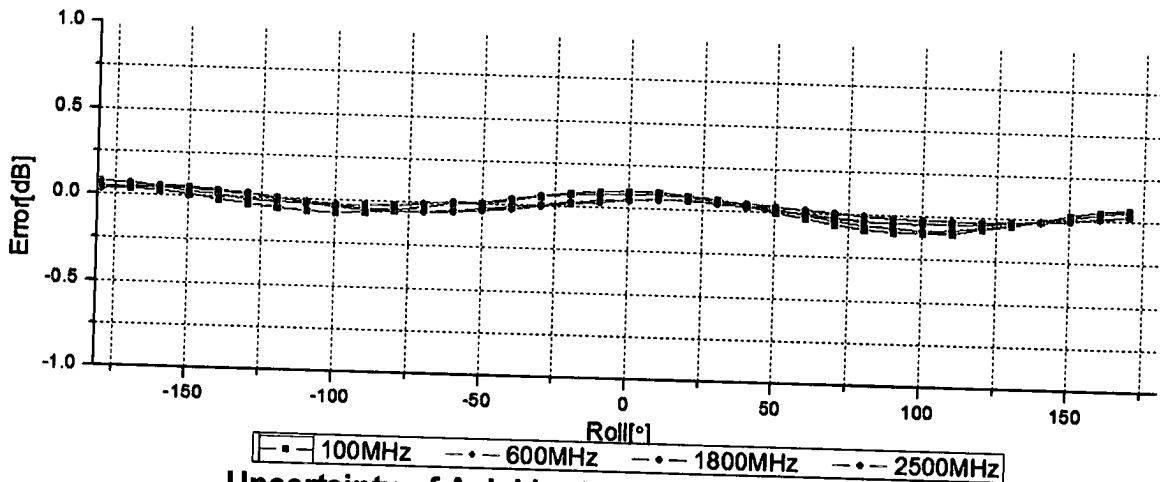
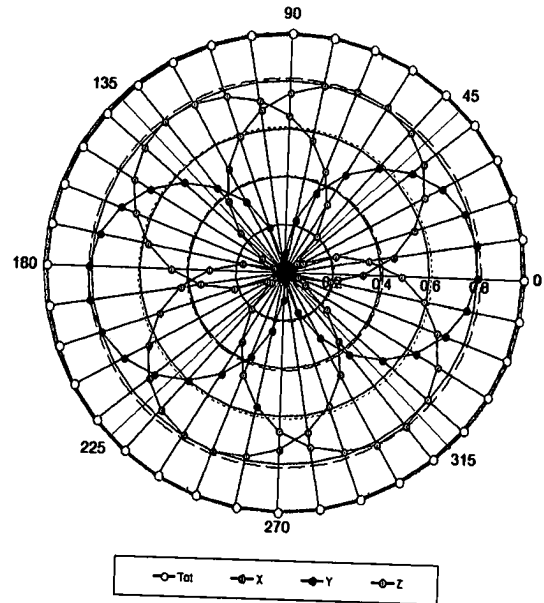
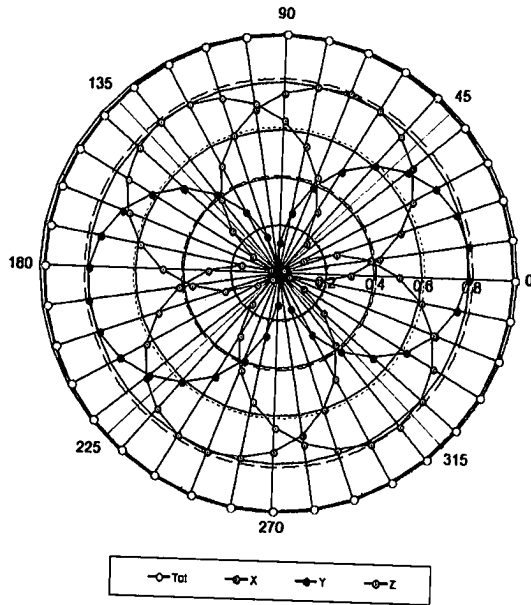


Uncertainty of Frequency Response of E-field: $\pm 7.4\%$ (k=2)

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

f=600 MHz, TEM

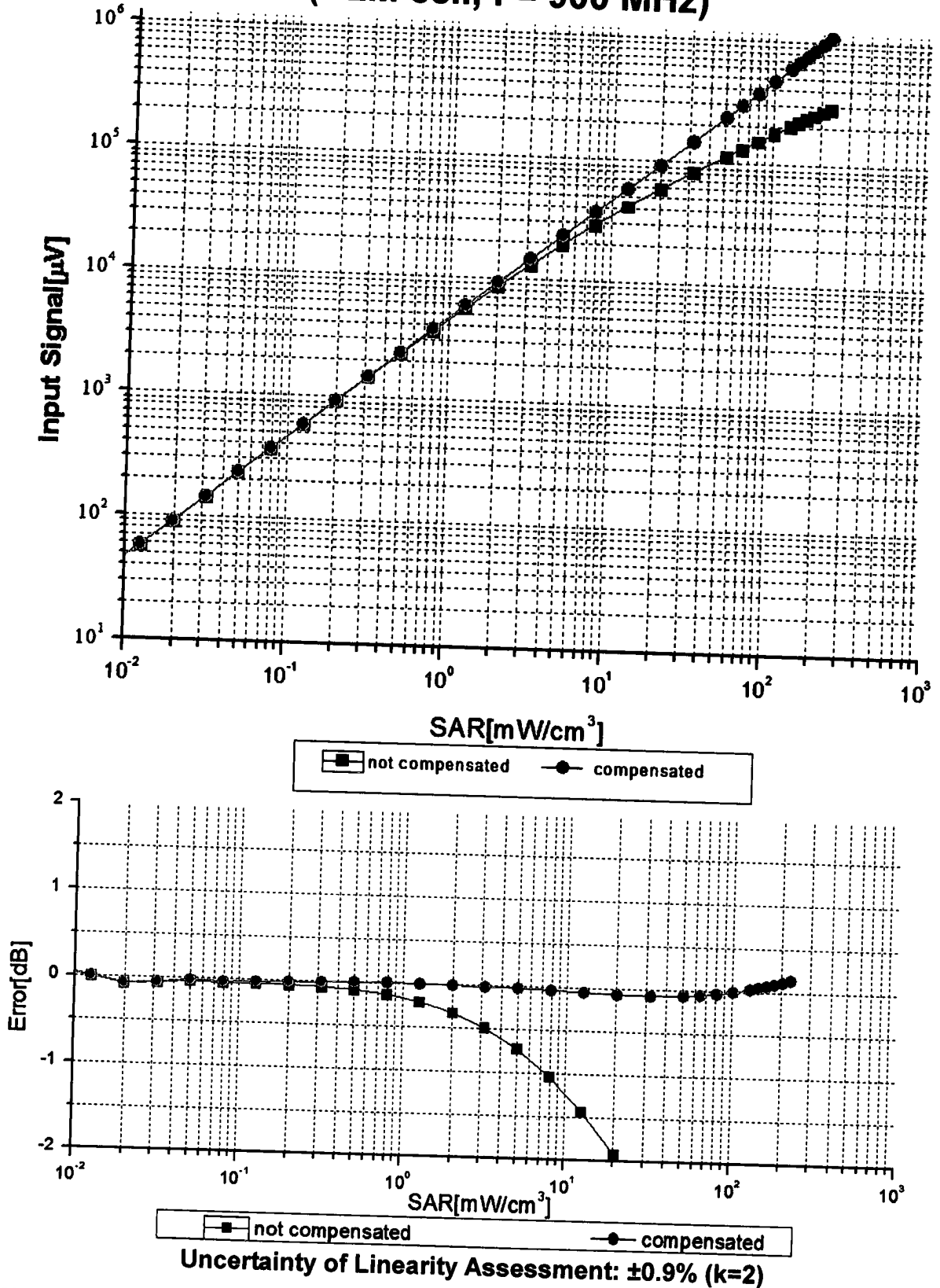
f=1800 MHz, R22



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



Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell, $f = 900 \text{ MHz}$)

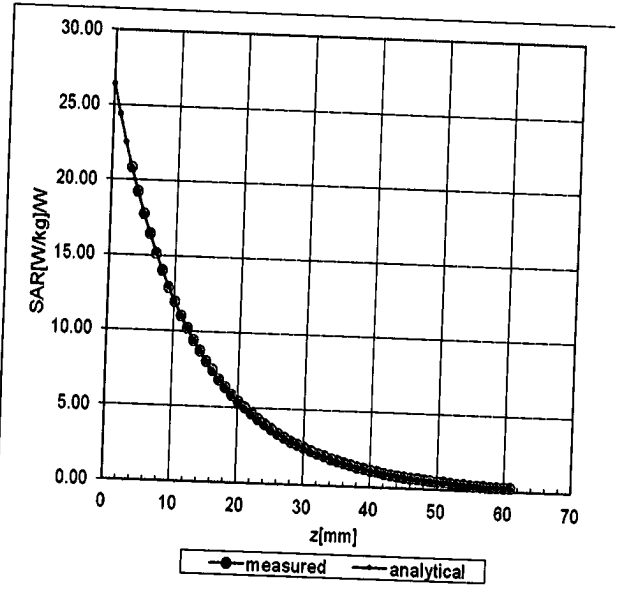
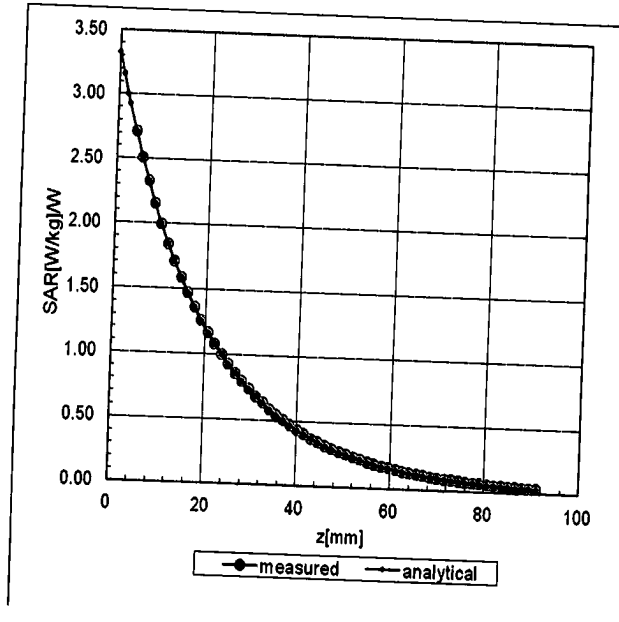




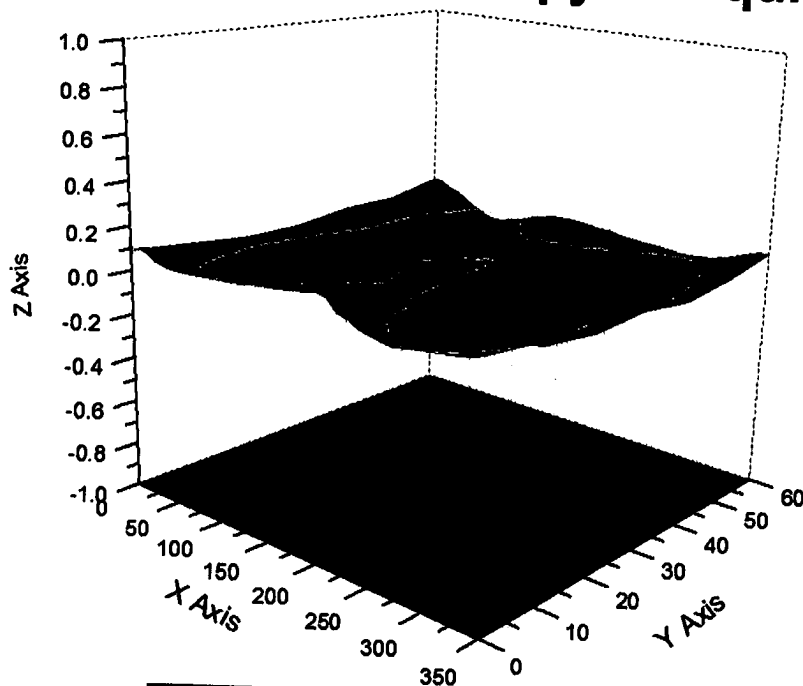
Conversion Factor Assessment

f=850 MHz, WGLS R9(H_convF)

f=1750 MHz, WGLS R22(H_convF)



Deviation from Isotropy in Liquid



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



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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3935

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	42.2
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



Appendix F. Reference Report

Please refer to Sporton report number FA7D2702 which is issued separately.