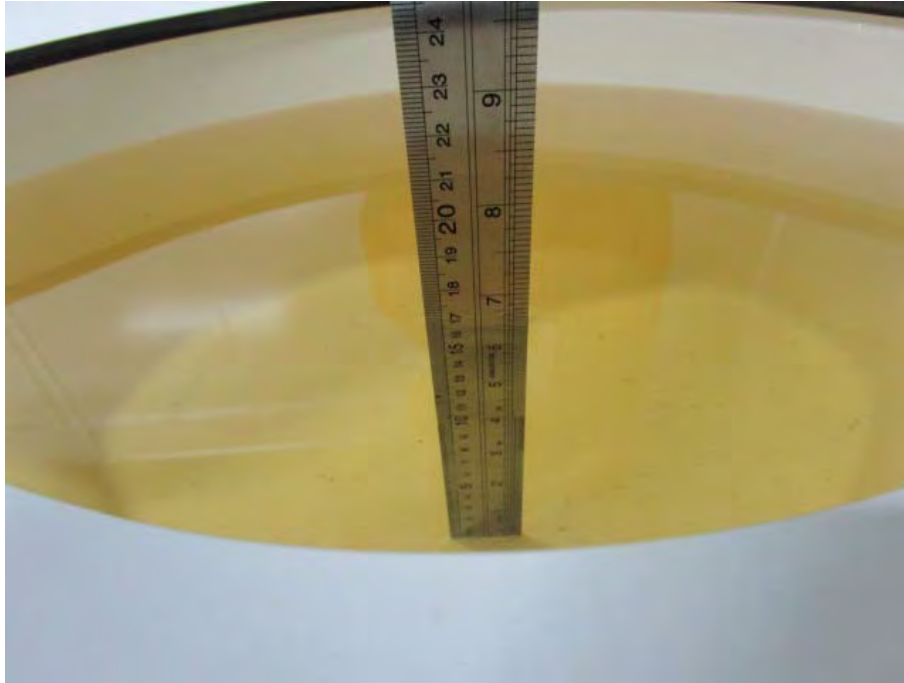
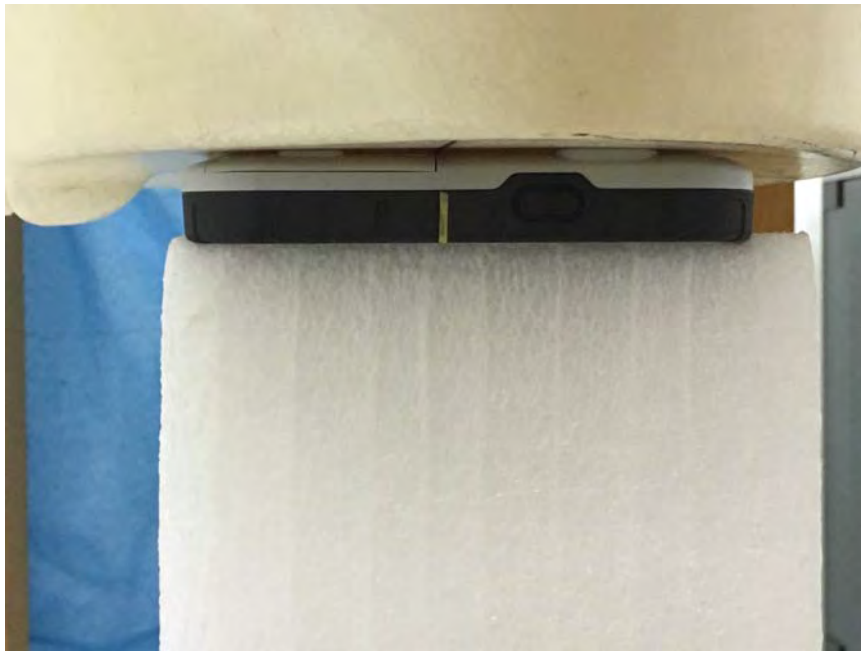


APPENDIX B EUT TEST POSITION PHOTOS

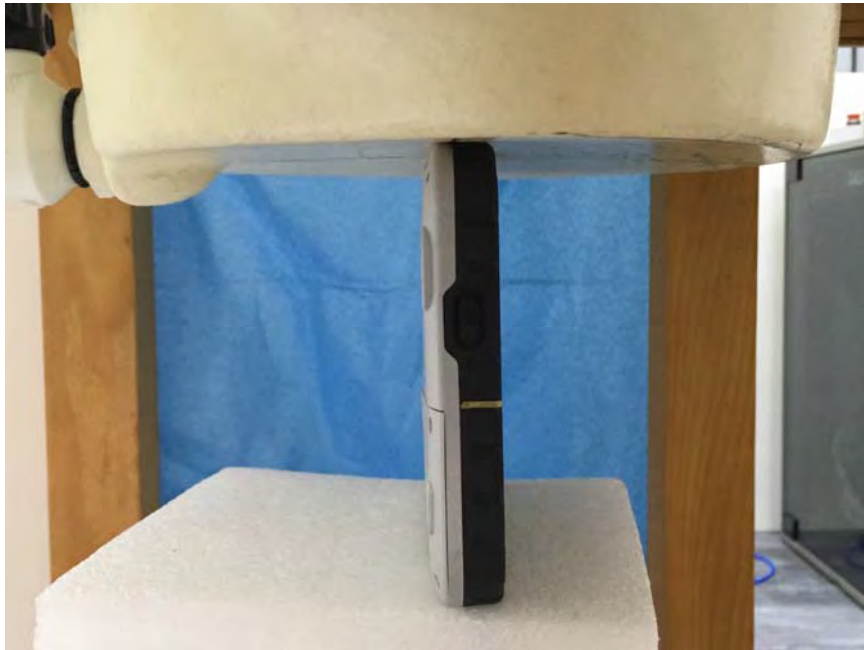
Liquid depth $\geq 15\text{cm}$



Back Photo



Edge 2 Photo



EUT-Front View



EUT-Back View



APPENDIX C SAR PLOTS OF SYSTEM VERIFICATION& SAR PLOTS OF SAR MEASUREMENT

System Check_Body_750MHz**DUT: D750V3-1167**

Communication System: CW; Frequency: 750 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 750 \text{ MHz}$; $\sigma = 0.965 \text{ mho/m}$; $\epsilon_r = 54.7$; $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(10.94, 10.94, 10.94); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Right; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Pin=250mW/Area Scan (61x61x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 2.85 mW/g

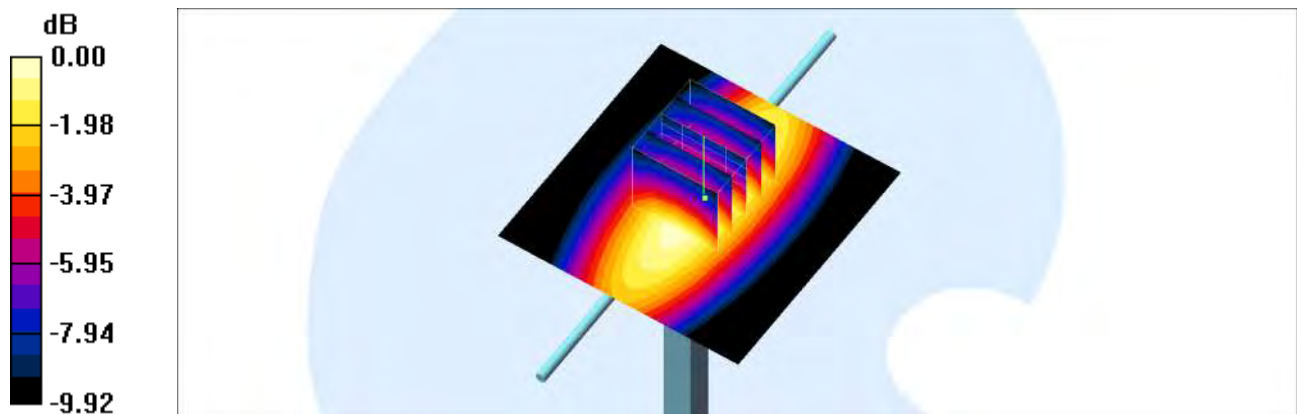
Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 56.5 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 3.18 W/kg

SAR(1 g) = 2.17 mW/g; SAR(10 g) = 1.45 mW/g

Maximum value of SAR (measured) = 2.83 mW/g



0 dB = 2.83mW/g

System Check_Body_835MHz**DUT: D835V2-454**

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.994 \text{ mho/m}$; $\epsilon_r = 57.6$; $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(10.54, 10.54, 10.54); Calibrated: 10/26/2016
- Sensor-Surface: 1.2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Right; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Pin=250mW/Area Scan (61x61x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 2.95 mW/g

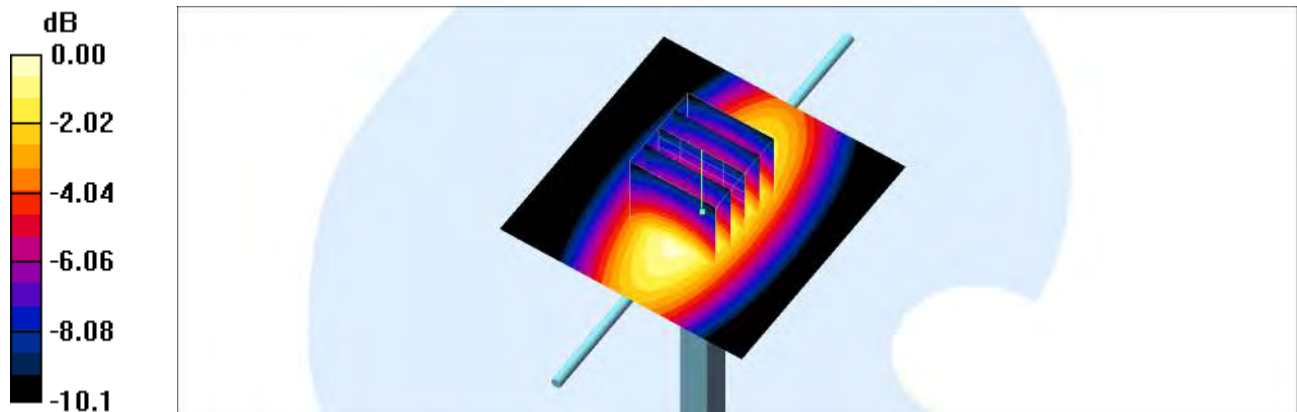
Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 53.8 V/m; Power Drift = 0.011 dB

Peak SAR (extrapolated) = 3.71 W/kg

SAR(1 g) = 2.53 mW/g; SAR(10 g) = 1.68 mW/g

Maximum value of SAR (measured) = 2.94 mW/g



0 dB = 2.94mW/g

System Check_Body_1750MHz

DUT: D1800V2-2d207

Communication System: CW; Frequency: 1750 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1750$ MHz; $\sigma = 1.53$ mho/m; $\epsilon_r = 53.1$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.5 ; Liquid Temperature : 22.5

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(8.65, 8.65, 8.65); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Right; Type: QD000P40CC; Serial: TP:1368
- Postprocessing SW: SEMCAD, V1.8 Build 145

Pin=250mW/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 16.9 mW/g

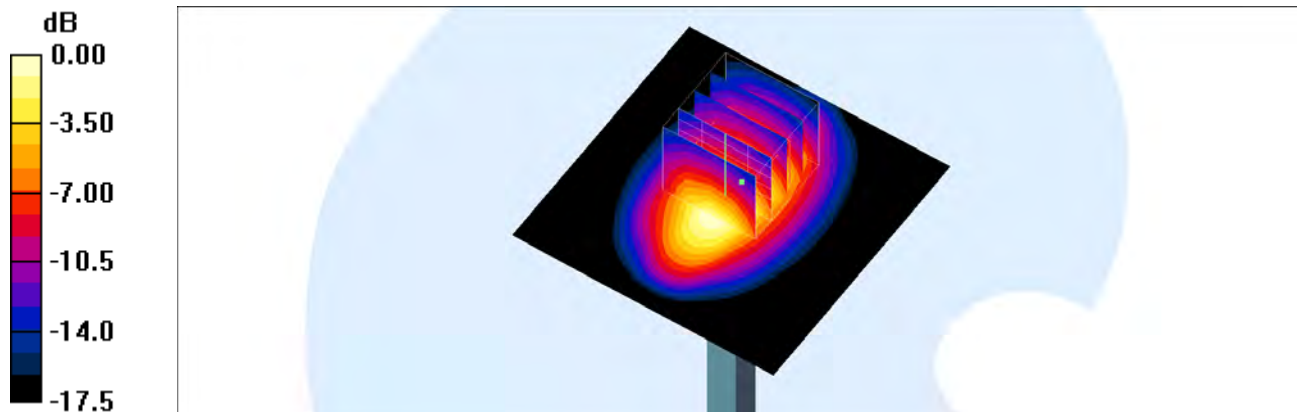
Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 105.0 V/m; Power Drift = -0.036 dB

Peak SAR (extrapolated) = 18.6 W/kg

SAR(1 g) = 10.1 mW/g; SAR(10 g) = 5.39 mW/g

Maximum value of SAR (measured) = 15.5 mW/g



0 dB = 15.5mW/g

System Check_Body_1900MHz**DUT: D1900V2-5d207**

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.58$ mho/m; $\epsilon_r = 51.5$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(8.31, 8.31, 8.31); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Right; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Pin=250mW/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 15.1 mW/g

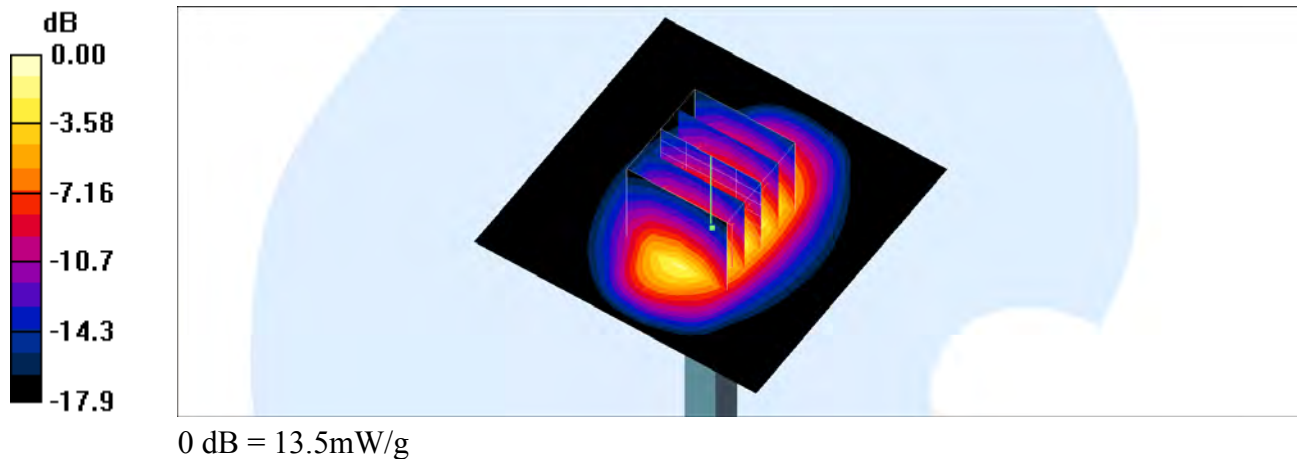
Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 84.7 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 19.5 W/kg

SAR(1 g) = 10.8 mW/g; SAR(10 g) = 5.64 mW/g

Maximum value of SAR (measured) = 13.5 mW/g



System Check_Body_2450MHz

DUT: D2450V2-969

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.96$ mho/m; $\epsilon_r = 51.6$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(7.88, 7.88, 7.88); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Right; Type: QD000P40CC; Serial: TP:1368
- Postprocessing SW: SEMCAD, V1.8 Build 145

Pin=250mW/Area Scan (71x71x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 22.6 mW/g

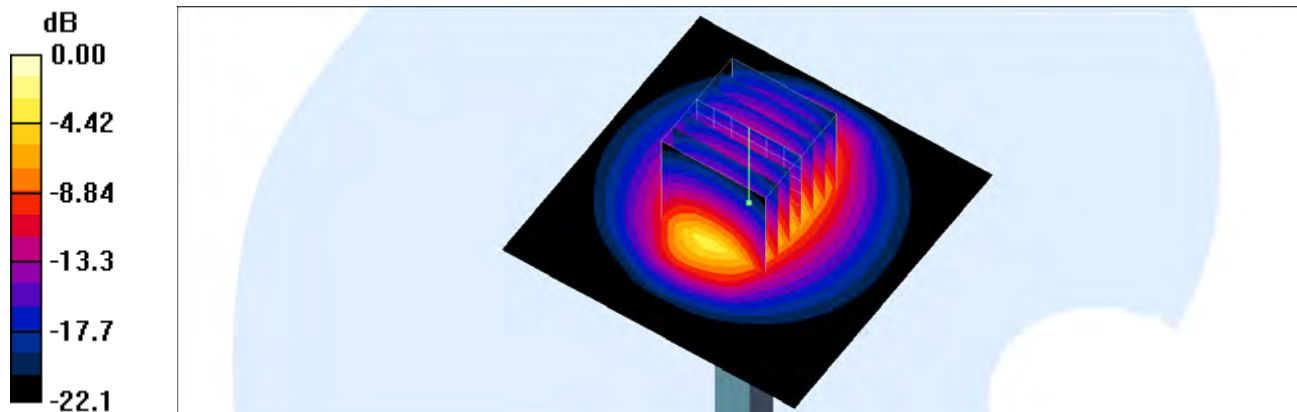
Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 110.9 V/m; Power Drift = -0.091 dB

Peak SAR (extrapolated) = 27.7 W/kg

SAR(1 g) = 13.4 mW/g; SAR(10 g) = 6.2 mW/g

Maximum value of SAR (measured) = 22.4 mW/g



0 dB = 22.4mW/g

#01_ WCDMA V_RMC 12.2Kbps_Back_Ch4132

Communication System: WCDMA; Frequency: 826.4 MHz; Duty Cycle: 1:1

Medium parameters used : $f = 826.4$ MHz; $\sigma = 0.986$ mho/m; $\epsilon_r = 57.7$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(10.54, 10.54, 10.54); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch4132/Area Scan (31x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.46 mW/g

Ch4132/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 22.1 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 1.72 W/kg

SAR(1 g) = 0.830 mW/g; SAR(10 g) = 0.403 mW/g

Maximum value of SAR (measured) = 1.34 mW/g



#02_ WCDMA V_RMC 12.2Kbps_Back_Ch4183

Communication System: WCDMA; Frequency: 836.4 MHz; Duty Cycle: 1:1

Medium parameters used : $f = 836.6$ MHz; $\sigma = 0.996$ mho/m; $\epsilon_r = 57.6$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(10.54, 10.54, 10.54); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch4182/Area Scan (31x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.672 mW/g

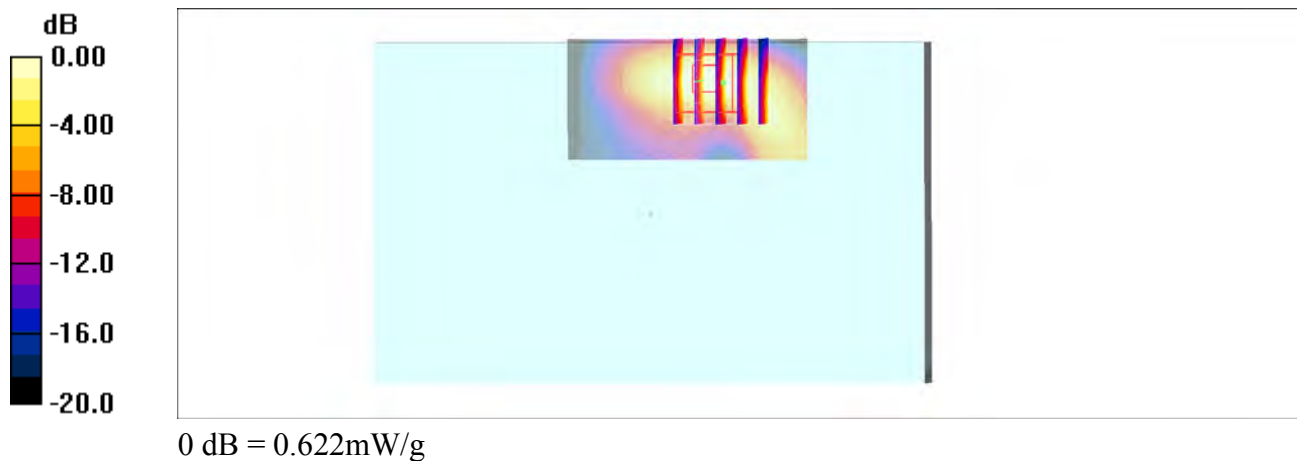
Ch4182/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 14.5 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 0.821 W/kg

SAR(1 g) = 0.393 mW/g; SAR(10 g) = 0.189 mW/g

Maximum value of SAR (measured) = 0.622 mW/g



#03_ WCDMA V_RMC 12.2Kbps_Back_Ch4233

Communication System: WCDMA; Frequency: 846.6 MHz; Duty Cycle: 1:1

Medium parameters used : $f = 846.6$ MHz; $\sigma = 1.01$ mho/m; $\epsilon_r = 57.5$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(10.54, 10.54, 10.54); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch4233/Area Scan (31x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.37 mW/g

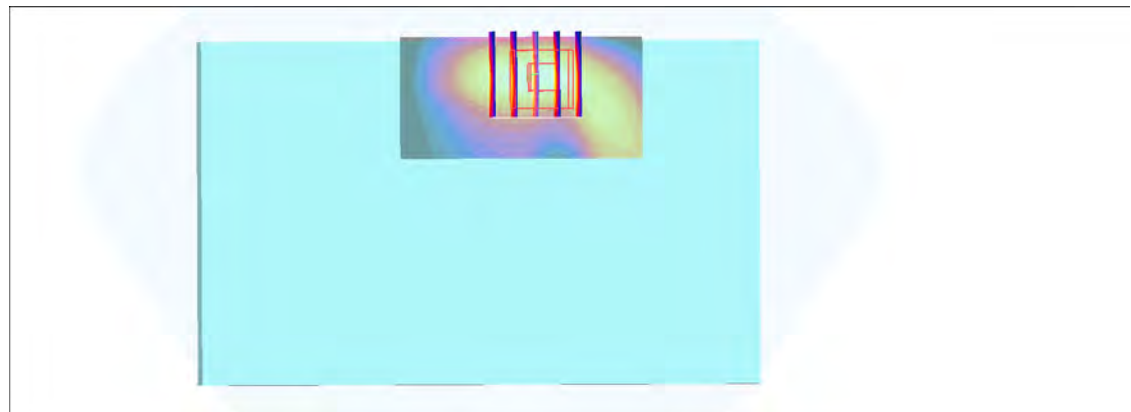
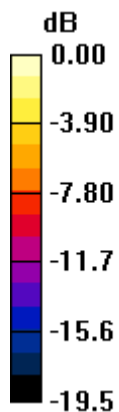
Ch4233/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 19.7 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 1.90 W/kg

SAR(1 g) = 0.831 mW/g; SAR(10 g) = 0.385 mW/g

Maximum value of SAR (measured) = 1.43 mW/g



0 dB = 1.43mW/g

#04_ WCDMA V_RMC 12.2Kbps_Edge 2_Ch4132

Communication System: WCDMA; Frequency: 826.4 MHz; Duty Cycle: 1:1

Medium parameters used : $f = 826.4$ MHz; $\sigma = 0.986$ mho/m; $\epsilon_r = 57.7$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(10.54, 10.54, 10.54); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch4132/Area Scan (51x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.100 mW/g

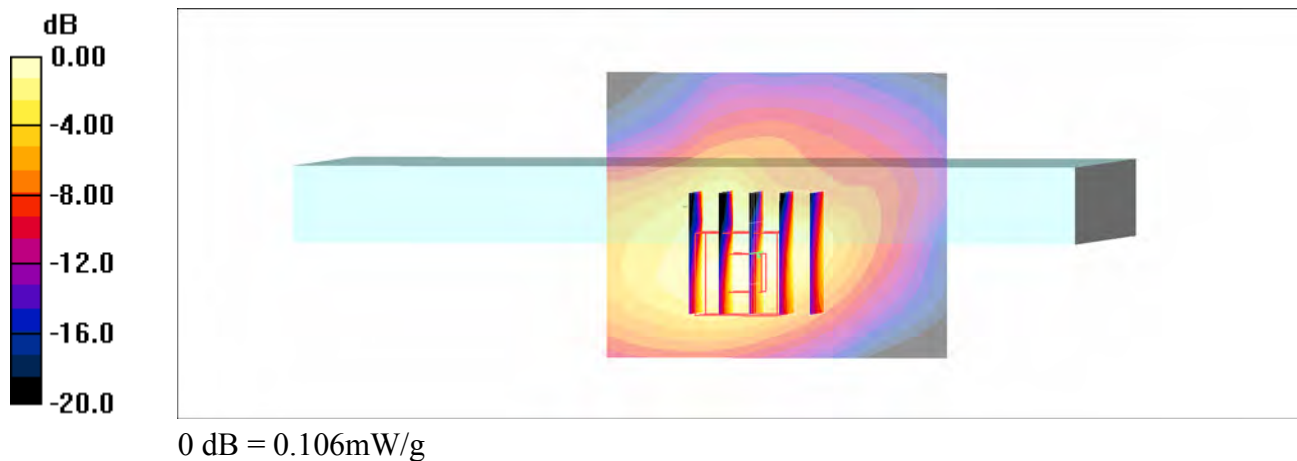
Ch4132/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 5.31 V/m; Power Drift = 0.012 dB

Peak SAR (extrapolated) = 0.144 W/kg

SAR(1 g) = 0.068 mW/g; SAR(10 g) = 0.034 mW/g

Maximum value of SAR (measured) = 0.106 mW/g



#05_ WCDMA II_RMC 12.2Kbps_Back_Ch9400

Communication System: WCDMA; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.56$ mho/m; $\epsilon_r = 51.6$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(8.31, 8.31, 8.31); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch9400/Area Scan (31x61x1): Measurement grid: $dx=15$ mm, $dy=15$ mm

Maximum value of SAR (interpolated) = 0.465 mW/g

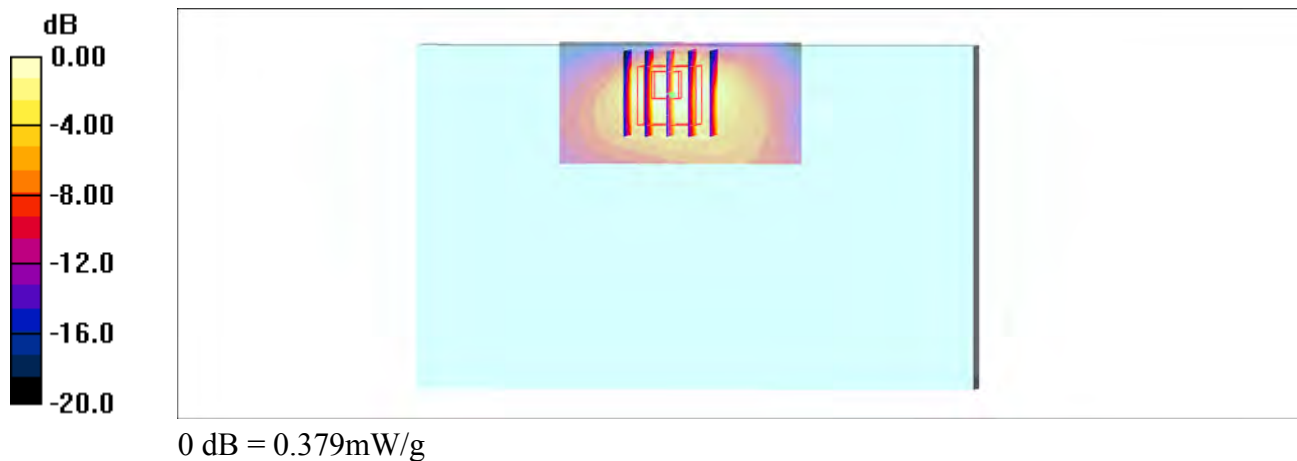
Ch9400/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 10.3 V/m; Power Drift = 0.079 dB

Peak SAR (extrapolated) = 0.552 W/kg

SAR(1 g) = 0.262 mW/g; SAR(10 g) = 0.127 mW/g

Maximum value of SAR (measured) = 0.379 mW/g



#06_ WCDMA II_RMC 12.2Kbps_Edge 2_Ch9400

Communication System: WCDMA; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.56$ mho/m; $\epsilon_r = 51.6$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(8.31, 8.31, 8.31); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch9400/Area Scan (31x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.089 mW/g

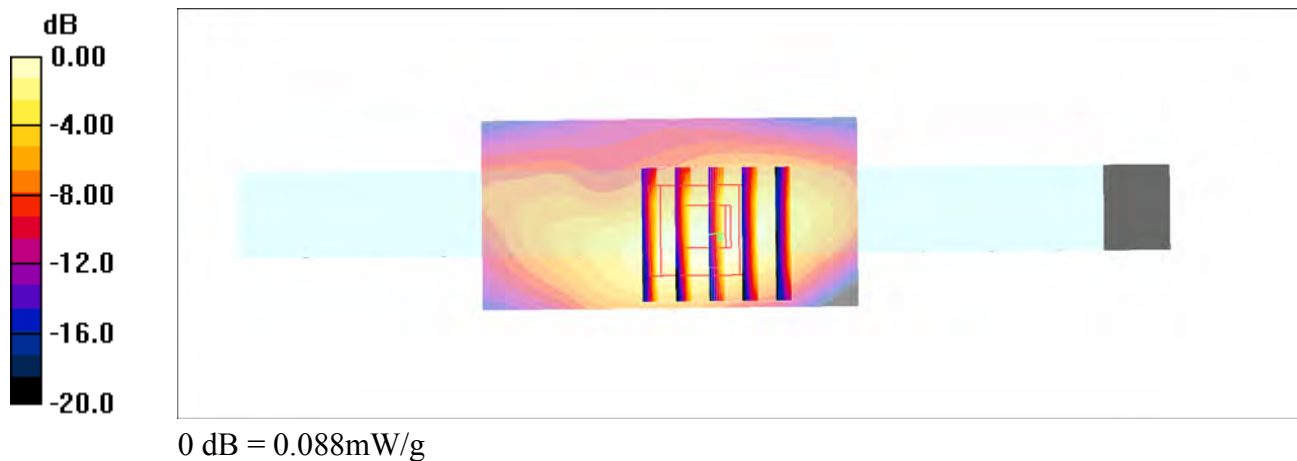
Ch9400/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 6.56 V/m; Power Drift = -0.083 dB

Peak SAR (extrapolated) = 0.110 W/kg

SAR(1 g) = 0.059 mW/g; SAR(10 g) = 0.032 mW/g

Maximum value of SAR (measured) = 0.088 mW/g



#07_LTE Band 13_10M_QPSK_1_0_Back_Ch23230

Communication System: LTE; Frequency: 782 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 782 \text{ MHz}$; $\sigma = 0.996 \text{ mho/m}$; $\epsilon_r = 54.4$; $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(10.94, 10.94, 10.94); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch23230/Area Scan (31x61x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.537 mW/g

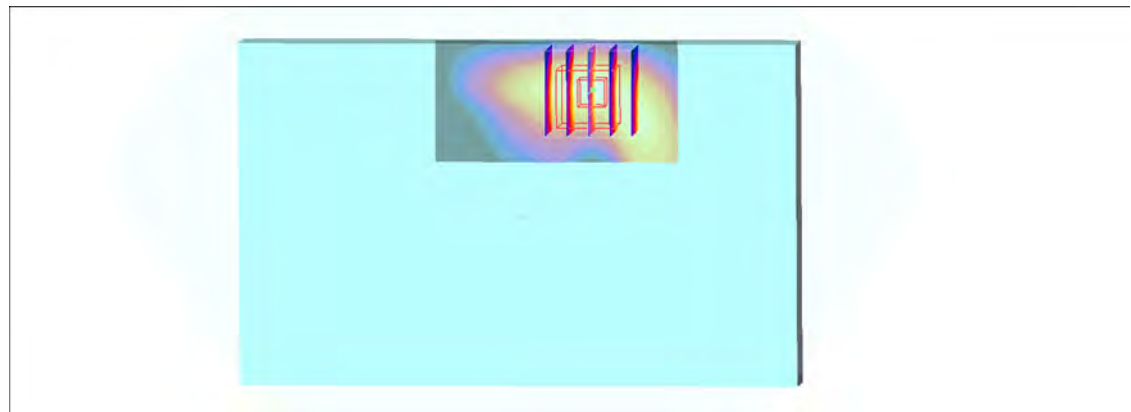
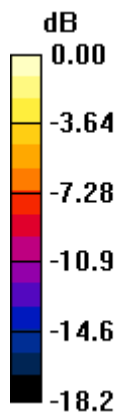
Ch23230/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 16.2 V/m; Power Drift = 0.019 dB

Peak SAR (extrapolated) = 0.653 W/kg

SAR(1 g) = 0.320 mW/g; SAR(10 g) = 0.162 mW/g

Maximum value of SAR (measured) = 0.527 mW/g



0 dB = 0.527mW/g

#08_LTE Band 13_10M_QPSK_25_0_Back_Ch23230

Communication System: LTE; Frequency: 782 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 782 \text{ MHz}$; $\sigma = 0.996 \text{ mho/m}$; $\epsilon_r = 54.4$; $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(10.94, 10.94, 10.94); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch23230/Area Scan (31x61x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.508 mW/g

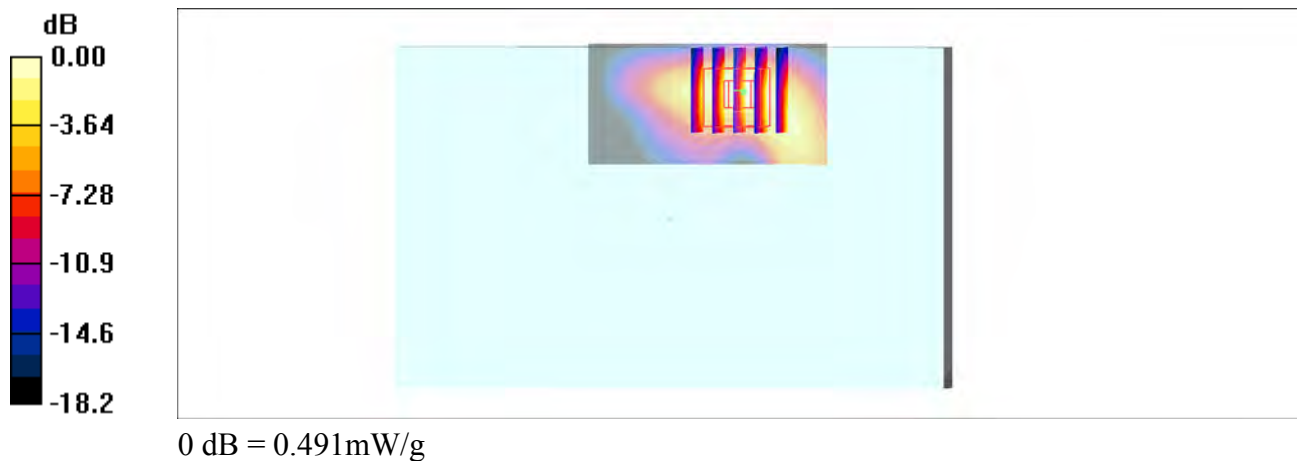
Ch23230/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 15.7 V/m; Power Drift = 0.038 dB

Peak SAR (extrapolated) = 0.610 W/kg

SAR(1 g) = 0.300 mW/g; SAR(10 g) = 0.152 mW/g

Maximum value of SAR (measured) = 0.491 mW/g



#09_LTE Band 13_10M_QPSK_1_0_Edge 2_Ch23230

Communication System: LTE; Frequency: 782 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 782$ MHz; $\sigma = 0.996$ mho/m; $\epsilon_r = 54.4$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(10.94, 10.94, 10.94); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch23230/Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.134 mW/g

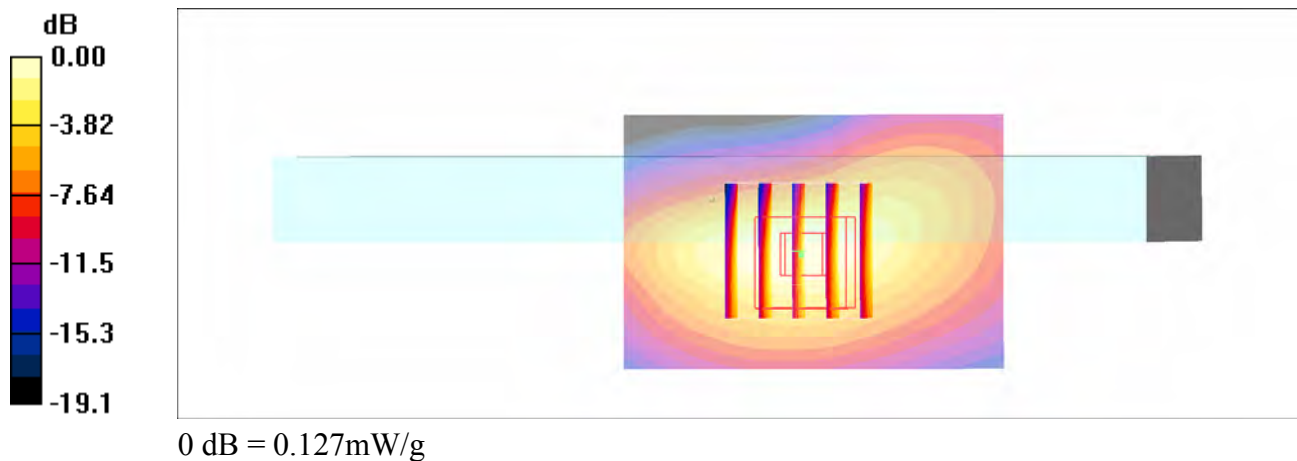
Ch23230/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 6.43 V/m; Power Drift = -0.077 dB

Peak SAR (extrapolated) = 0.152 W/kg

SAR(1 g) = 0.083 mW/g; SAR(10 g) = 0.048 mW/g

Maximum value of SAR (measured) = 0.127 mW/g



#10_LTE Band 13_10M_QPSK_25_0_Edge 2_Ch23230

Communication System: LTE; Frequency: 782 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 782$ MHz; $\sigma = 0.996$ mho/m; $\epsilon_r = 54.4$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(10.94, 10.94, 10.94); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch23230/Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.106 mW/g

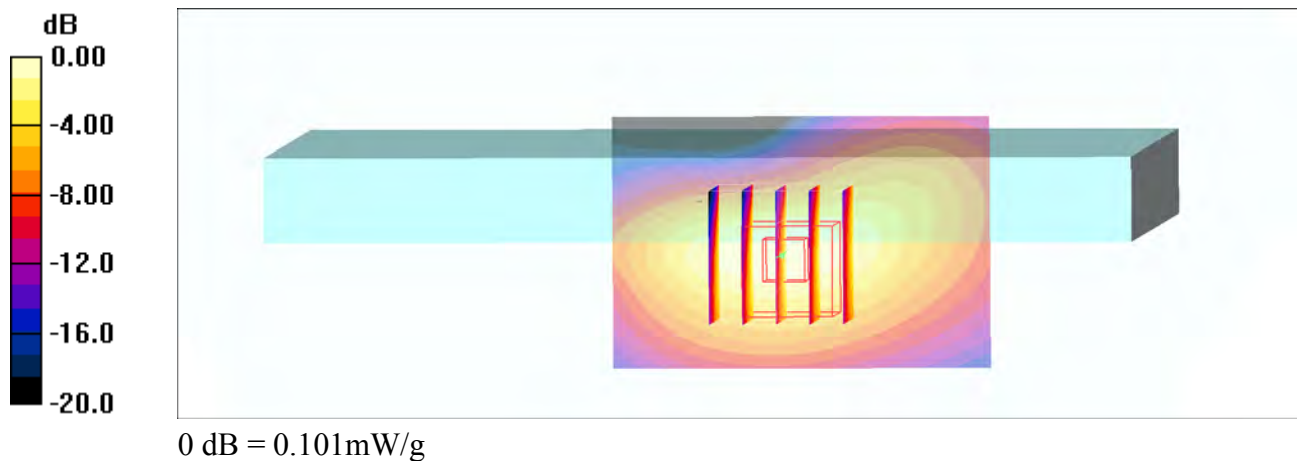
Ch23230/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 5.46 V/m; Power Drift = -0.083 dB

Peak SAR (extrapolated) = 0.121 W/kg

SAR(1 g) = 0.065 mW/g; SAR(10 g) = 0.038 mW/g

Maximum value of SAR (measured) = 0.101 mW/g



#11_LTE Band 17_10M_QPSK_1_0_Back_Ch23800

Communication System: LTE; Frequency: 711 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 711$ MHz; $\sigma = 0.928$ mho/m; $\epsilon_r = 55.1$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(10.94, 10.94, 10.94); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch23800/Area Scan (31x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.486 mW/g

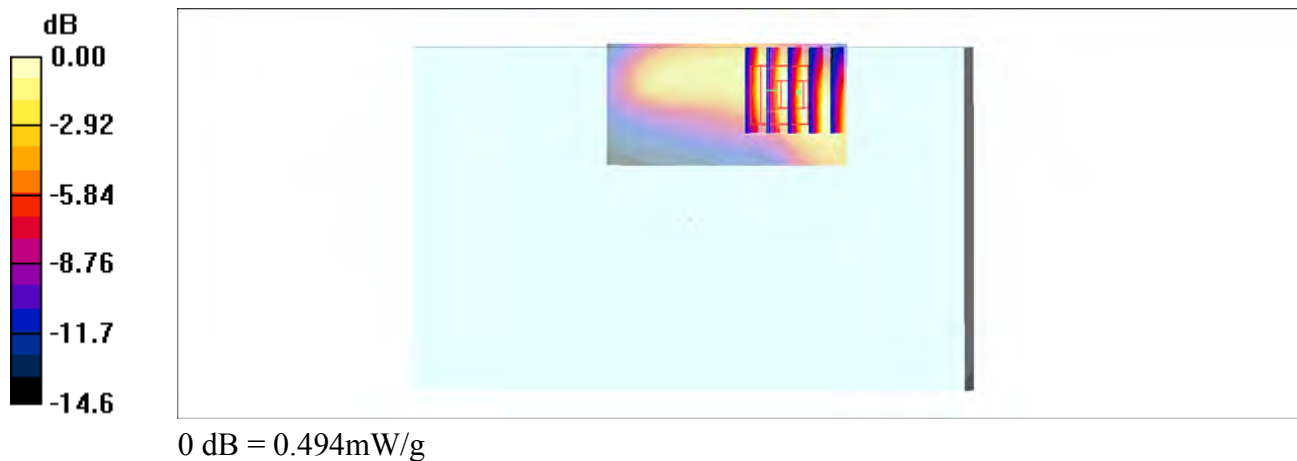
Ch23800/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 15.4 V/m; Power Drift = 0.050 dB

Peak SAR (extrapolated) = 0.615 W/kg

SAR(1 g) = 0.329 mW/g; SAR(10 g) = 0.184 mW/g

Maximum value of SAR (measured) = 0.494 mW/g



#12_LTE Band 17_10M_QPSK_25_0_Back_Ch23800

Communication System: LTE; Frequency: 711 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 711$ MHz; $\sigma = 0.928$ mho/m; $\epsilon_r = 55.1$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(10.94, 10.94, 10.94); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch23800/Area Scan (31x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.415 mW/g

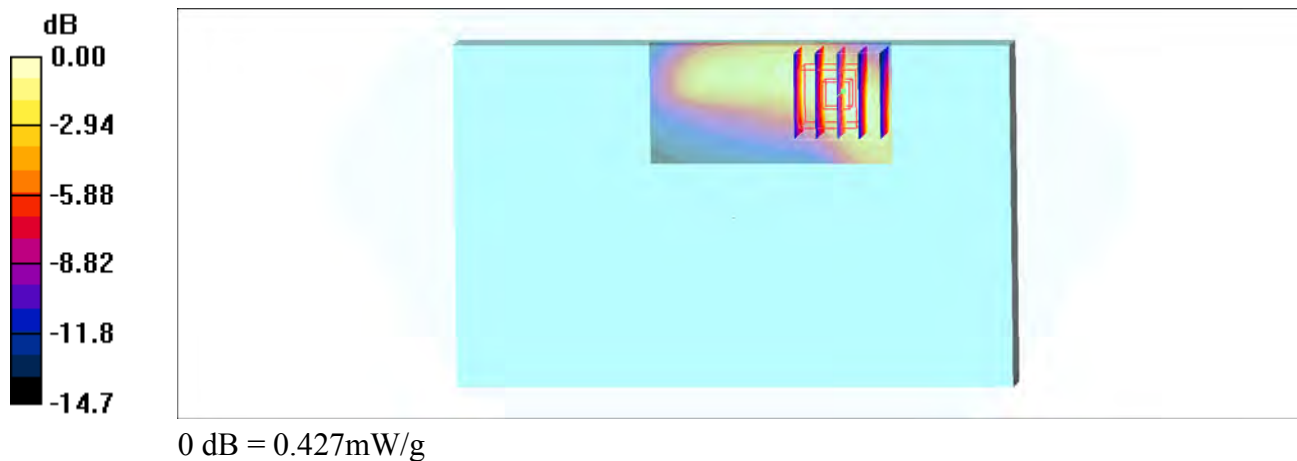
Ch23800/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 14.4 V/m; Power Drift = -0.021 dB

Peak SAR (extrapolated) = 0.540 W/kg

SAR(1 g) = 0.285 mW/g; SAR(10 g) = 0.159 mW/g

Maximum value of SAR (measured) = 0.427 mW/g



#13_LTE Band 17_10M_QPSK_1_0_Edge 2_Ch23800

Communication System: LTE; Frequency: 711 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 711$ MHz; $\sigma = 0.928$ mho/m; $\epsilon_r = 55.1$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(10.94, 10.94, 10.94); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch23800/Area Scan (51x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.119 mW/g

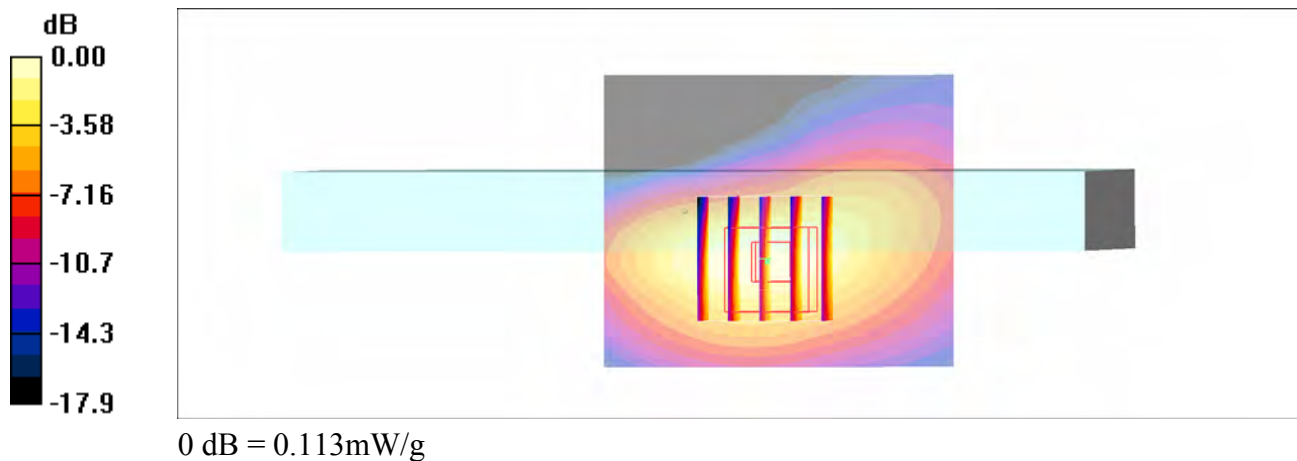
Ch23800/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 6.34 V/m; Power Drift = -0.150 dB

Peak SAR (extrapolated) = 0.134 W/kg

SAR(1 g) = 0.074 mW/g; SAR(10 g) = 0.043 mW/g

Maximum value of SAR (measured) = 0.113 mW/g



#14_LTE Band 17_10M_QPSK_25_0_Edge 2_Ch23800

Communication System: LTE; Frequency: 711 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 711$ MHz; $\sigma = 0.928$ mho/m; $\epsilon_r = 55.1$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(10.94, 10.94, 10.94); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch23800/Area Scan (41x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.095 mW/g

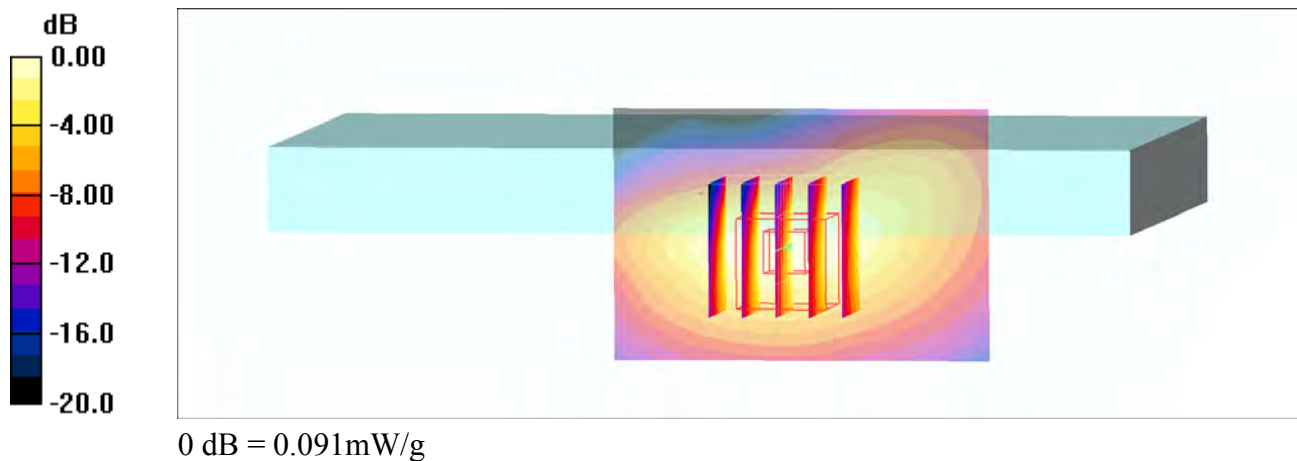
Ch23800/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 5.41 V/m; Power Drift = -0.127 dB

Peak SAR (extrapolated) = 0.111 W/kg

SAR(1 g) = 0.059 mW/g; SAR(10 g) = 0.034 mW/g

Maximum value of SAR (measured) = 0.091 mW/g



#15_LTE Band 5_10M_QPSK_1_0_Back_Ch20450

Communication System: LTE; Frequency: 829 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 829$ MHz; $\sigma = 0.989$ mho/m; $\epsilon_r = 57.6$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(10.54, 10.54, 10.54); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch20450/Area Scan (31x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.60 mW/g

Ch20450/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 25.9 V/m; Power Drift = 0.038 dB

Peak SAR (extrapolated) = 1.92 W/kg

SAR(1 g) = 0.911 mW/g; SAR(10 g) = 0.449 mW/g

Maximum value of SAR (measured) = 1.47 mW/g



#16_LTE Band 5_10M_QPSK_1_0_Back_Ch20525

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

Medium parameters used : $f = 836.5$ MHz; $\sigma = 0.996$ mho/m; $\epsilon_r = 57.6$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(10.54, 10.54, 10.54); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch20525/Area Scan (31x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.793 mW/g

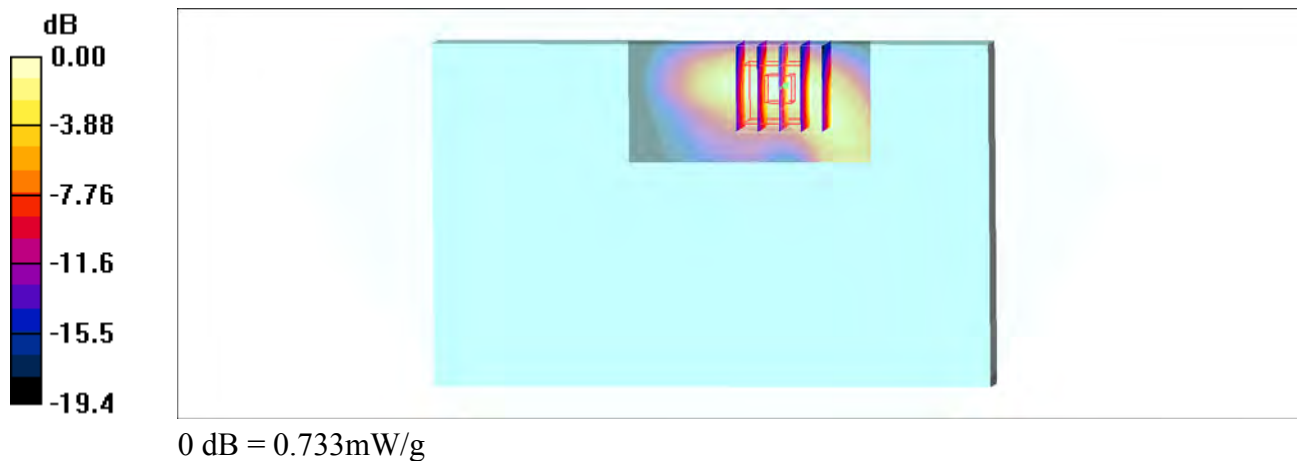
Ch20525/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 17.6 V/m; Power Drift = 0.031 dB

Peak SAR (extrapolated) = 0.956 W/kg

SAR(1 g) = 0.445 mW/g; SAR(10 g) = 0.217 mW/g

Maximum value of SAR (measured) = 0.733 mW/g



#17_LTE Band 5_10M_QPSK_1_0_Back_Ch20600

Communication System: LTE; Frequency: 844 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 844$ MHz; $\sigma = 1$ mho/m; $\epsilon_r = 57.5$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(10.54, 10.54, 10.54); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch20600/Area Scan (31x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.951 mW/g

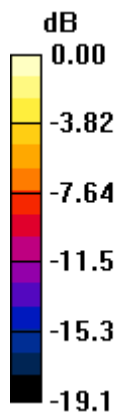
Ch20600/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 19.0 V/m; Power Drift = 0.014 dB

Peak SAR (extrapolated) = 1.12 W/kg

SAR(1 g) = 0.537 mW/g; SAR(10 g) = 0.259 mW/g

Maximum value of SAR (measured) = 0.878 mW/g



0 dB = 0.878mW/g

#18_LTE Band 5_10M_QPSK_25_0_Back_Ch20450

Communication System: LTE; Frequency: 829 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 829$ MHz; $\sigma = 0.989$ mho/m; $\epsilon_r = 57.6$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(10.54, 10.54, 10.54); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch20450/Area Scan (31x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.25 mW/g

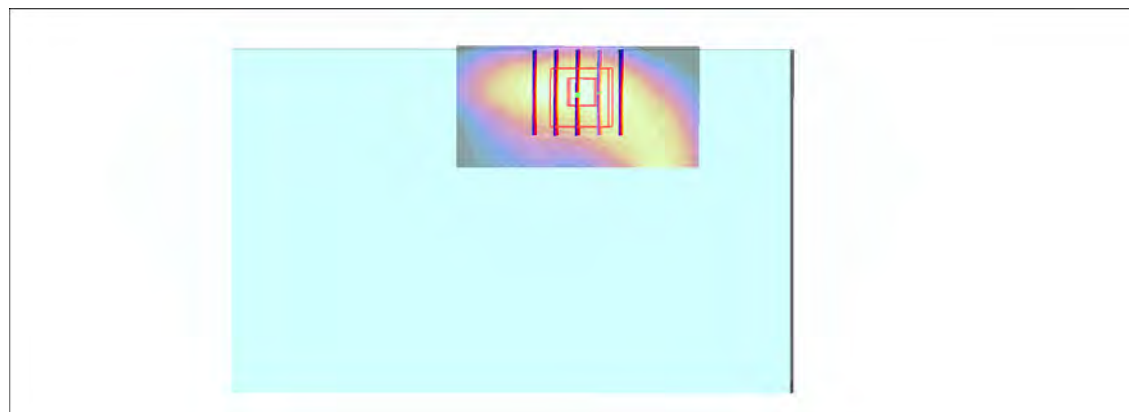
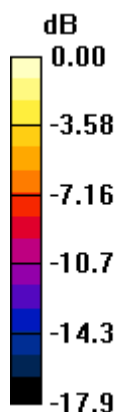
Ch20450/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 23.2 V/m; Power Drift = 0.022 dB

Peak SAR (extrapolated) = 1.49 W/kg

SAR(1 g) = 0.728 mW/g; SAR(10 g) = 0.361 mW/g

Maximum value of SAR (measured) = 1.17 mW/g



0 dB = 1.17mW/g

#19_LTE Band 5_10M_QPSK_50_0_Back_Ch20450

Communication System: LTE; Frequency: 829 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 829$ MHz; $\sigma = 0.989$ mho/m; $\epsilon_r = 57.6$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(10.54, 10.54, 10.54); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch20450/Area Scan (31x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.04 mW/g

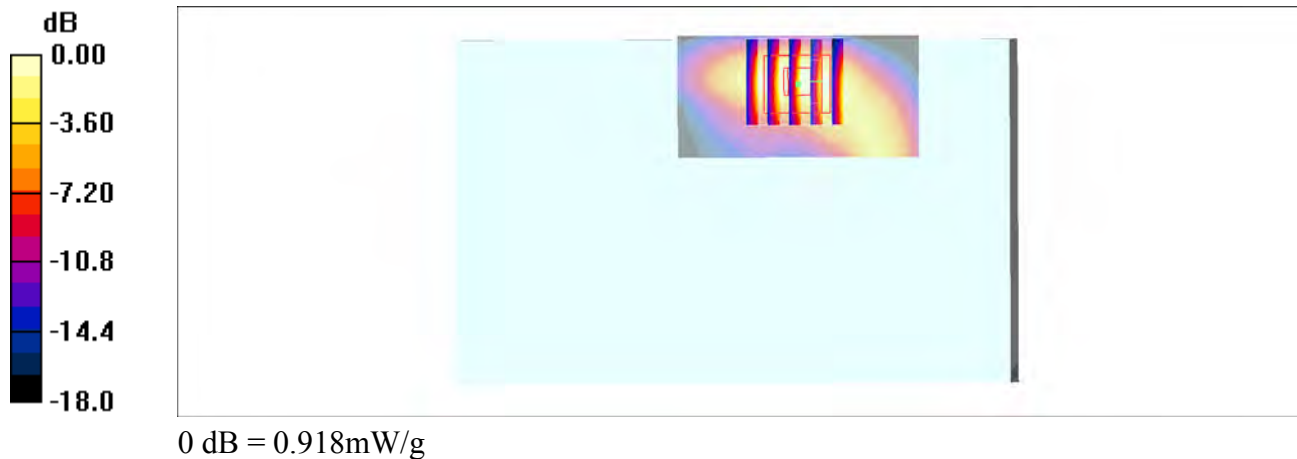
Ch20450/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 20.6 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 1.17 W/kg

SAR(1 g) = 0.577 mW/g; SAR(10 g) = 0.285 mW/g

Maximum value of SAR (measured) = 0.918 mW/g



#20_LTE Band 5_10M_QPSK_1_0_Edge 2_Ch20450

Communication System: LTE; Frequency: 829 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 829$ MHz; $\sigma = 0.989$ mho/m; $\epsilon_r = 57.6$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(10.54, 10.54, 10.54); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch20450/Area Scan (31x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.726 mW/g

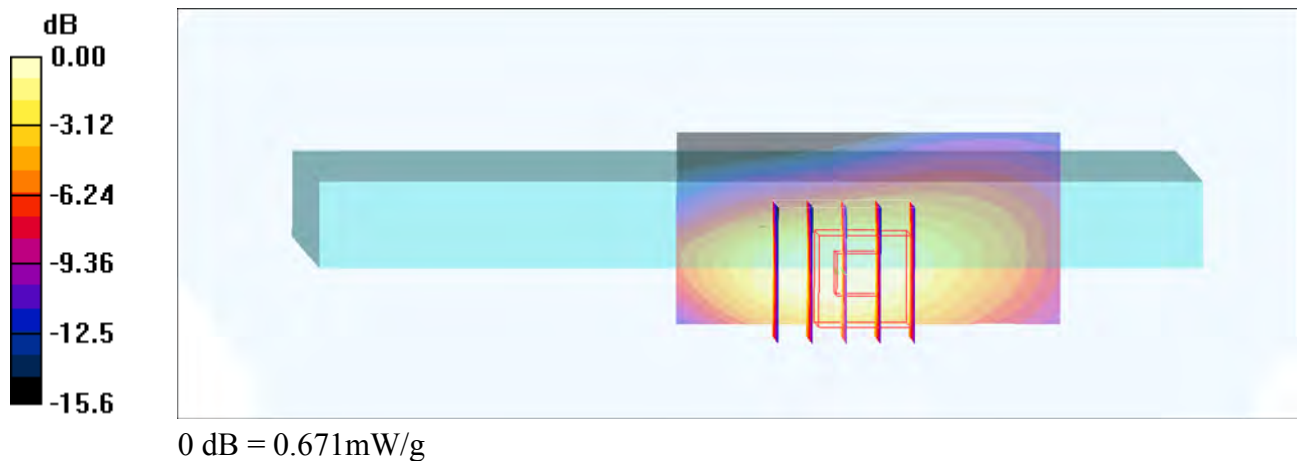
Ch20450/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 16.8 V/m; Power Drift = -0.184 dB

Peak SAR (extrapolated) = 0.819 W/kg

SAR(1 g) = 0.438 mW/g; SAR(10 g) = 0.255 mW/g

Maximum value of SAR (measured) = 0.671 mW/g



#21_LTE Band 5_10M_QPSK_25_0_Edge 2_Ch20450

Communication System: LTE; Frequency: 829 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 829$ MHz; $\sigma = 0.989$ mho/m; $\epsilon_r = 57.6$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(10.54, 10.54, 10.54); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch20450/Area Scan (31x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.595 mW/g

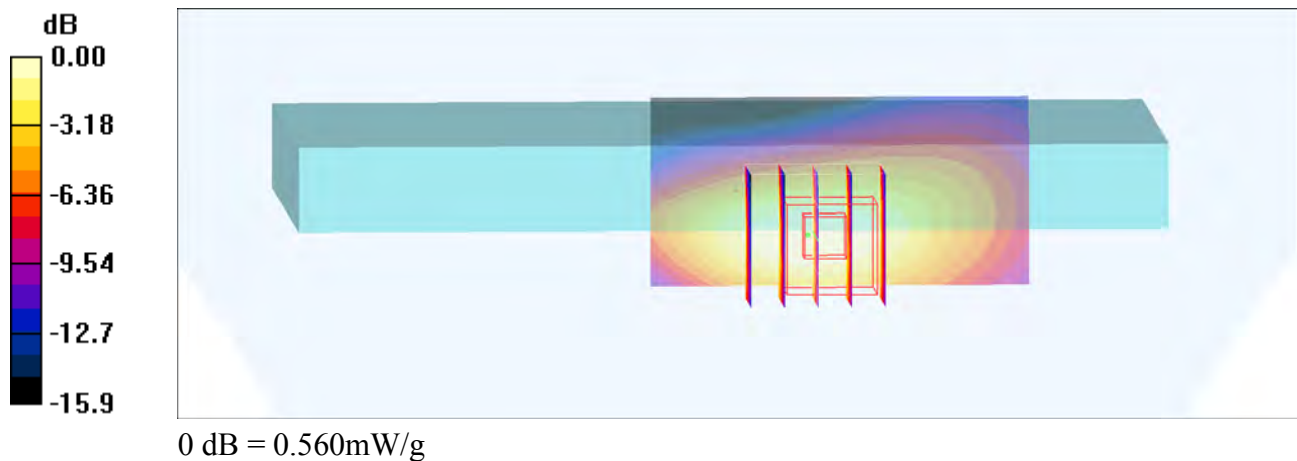
Ch20450/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 15.1 V/m; Power Drift = -0.117 dB

Peak SAR (extrapolated) = 0.682 W/kg

SAR(1 g) = 0.364 mW/g; SAR(10 g) = 0.212 mW/g

Maximum value of SAR (measured) = 0.560 mW/g



#22_LTE Band 4_20M_QPSK_1_0_Back_Ch20175

Communication System: LTE; Frequency: 1732.5 MHz; Duty Cycle: 1:1

Medium parameters used : $f = 1732.5$ MHz; $\sigma = 1.51$ mho/m; $\epsilon_r = 53.2$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(8.65, 8.65, 8.65); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch20175/Area Scan (31x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.22 mW/g

Ch20175/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 19.7 V/m; Power Drift = -0.021 dB

Peak SAR (extrapolated) = 1.51 W/kg

SAR(1 g) = 0.770 mW/g; SAR(10 g) = 0.403 mW/g

Maximum value of SAR (measured) = 1.29 mW/g



#23_LTE Band 4_20M_QPSK_1_0_Back_Ch20050

Communication System: LTE; Frequency: 1720 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1720$ MHz; $\sigma = 1.5$ mho/m; $\epsilon_r = 53.3$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(8.65, 8.65, 8.65); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch20050/Area Scan (31x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.60 mW/g

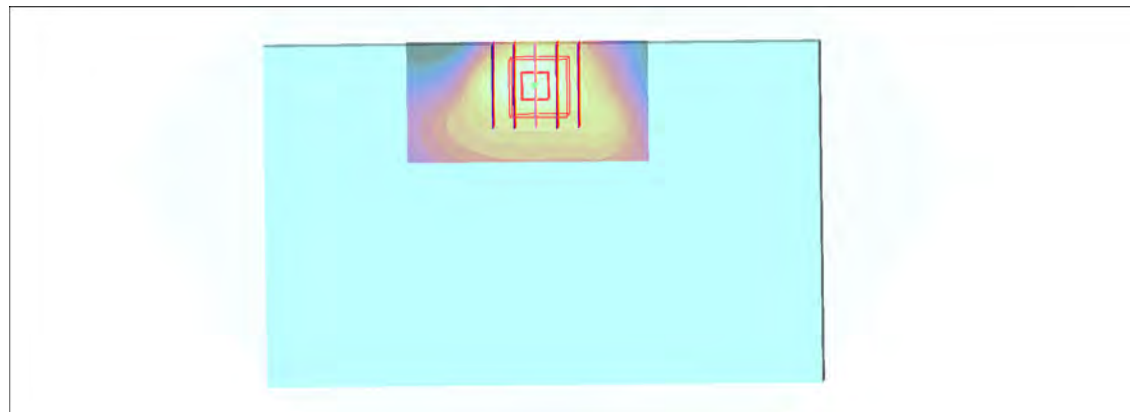
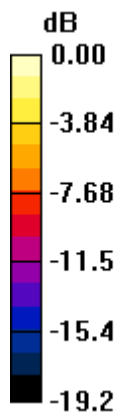
Ch20050/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 21.2 V/m; Power Drift = -0.026 dB

Peak SAR (extrapolated) = 1.85 W/kg

SAR(1 g) = 0.979 mW/g; SAR(10 g) = 0.516 mW/g

Maximum value of SAR (measured) = 1.57 mW/g



0 dB = 1.57mW/g

#24_LTE Band 4_20M_QPSK_1_0_Back_Ch20300

Communication System: LTE; Frequency: 1745 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1745$ MHz; $\sigma = 1.53$ mho/m; $\epsilon_r = 53.1$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(8.65, 8.65, 8.65); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch20300/Area Scan (31x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 2.35 mW/g

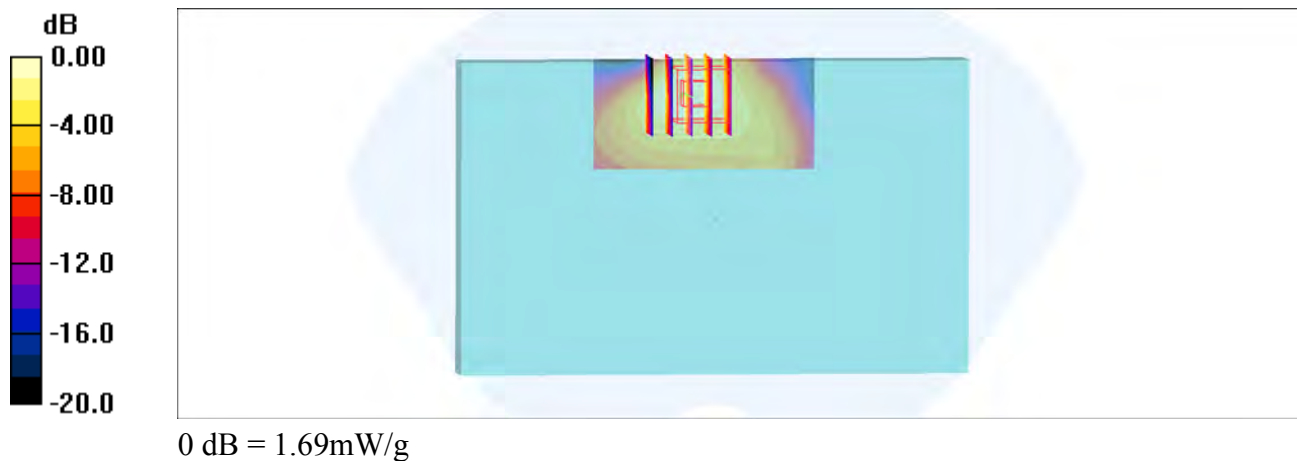
Ch20300/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 23.4 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 2.00 W/kg

SAR(1 g) = 1.03 mW/g; SAR(10 g) = 0.545 mW/g

Maximum value of SAR (measured) = 1.69 mW/g



#25_LTE Band 4_20M_QPSK_50_0_Back_Ch20175

Communication System: LTE; Frequency: 1732.5 MHz; Duty Cycle: 1:1

Medium parameters used : $f = 1732.5$ MHz; $\sigma = 1.51$ mho/m; $\epsilon_r = 53.2$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(8.65, 8.65, 8.65); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch20175/Area Scan (31x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.20 mW/g

Ch20175/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 19.0 V/m; Power Drift = -0.050 dB

Peak SAR (extrapolated) = 1.42 W/kg

SAR(1 g) = 0.733 mW/g; SAR(10 g) = 0.386 mW/g

Maximum value of SAR (measured) = 1.15 mW/g



#26_LTE Band 4_20M_QPSK_100_0_Back_Ch20175

Communication System: LTE; Frequency: 1732.5 MHz; Duty Cycle: 1:1

Medium parameters used : $f = 1732.5$ MHz; $\sigma = 1.51$ mho/m; $\epsilon_r = 53.2$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(8.65, 8.65, 8.65); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch20175/Area Scan (31x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.913 mW/g

Ch20175/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 17.6 V/m; Power Drift = -0.013 dB

Peak SAR (extrapolated) = 1.18 W/kg

SAR(1 g) = 0.589 mW/g; SAR(10 g) = 0.305 mW/g

Maximum value of SAR (measured) = 0.980 mW/g



#27_LTE Band 4_20M_QPSK_1_0_Edge 2_Ch20175

Communication System: LTE; Frequency: 1732.5 MHz; Duty Cycle: 1:1

Medium parameters used : $f = 1732.5$ MHz; $\sigma = 1.51$ mho/m; $\epsilon_r = 53.2$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(8.65, 8.65, 8.65); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch20175/Area Scan (31x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.616 mW/g

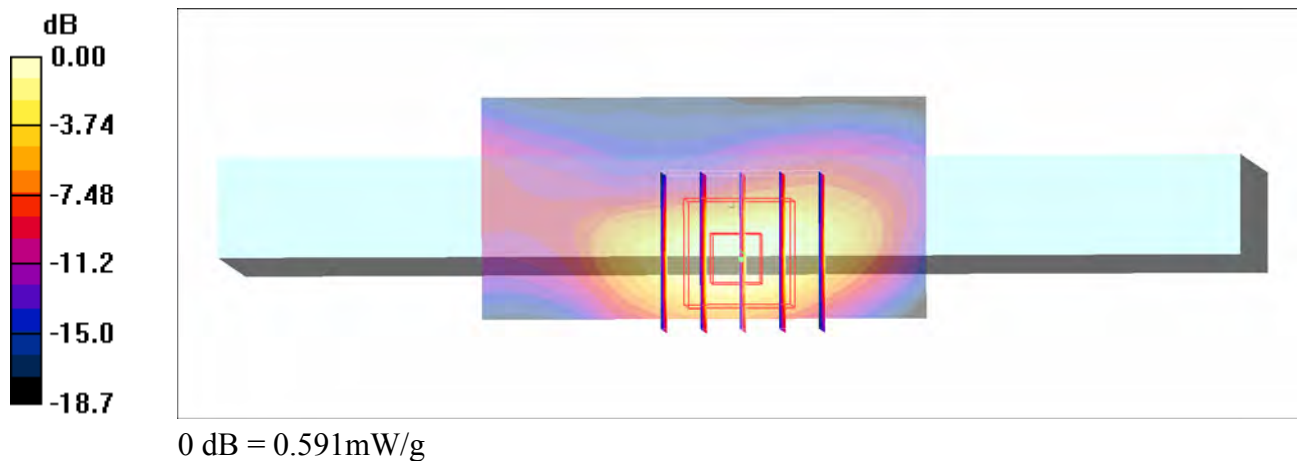
Ch20175/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 10.9 V/m; Power Drift = -0.100 dB

Peak SAR (extrapolated) = 0.720 W/kg

SAR(1 g) = 0.353 mW/g; SAR(10 g) = 0.179 mW/g

Maximum value of SAR (measured) = 0.591 mW/g



#28_LTE Band 4_20M_QPSK_50_0_Edge 2_Ch20175

Communication System: LTE; Frequency: 1732.5 MHz; Duty Cycle: 1:1

Medium parameters used : $f = 1732.5$ MHz; $\sigma = 1.51$ mho/m; $\epsilon_r = 53.2$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(8.65, 8.65, 8.65); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch20175/Area Scan (31x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.350 mW/g

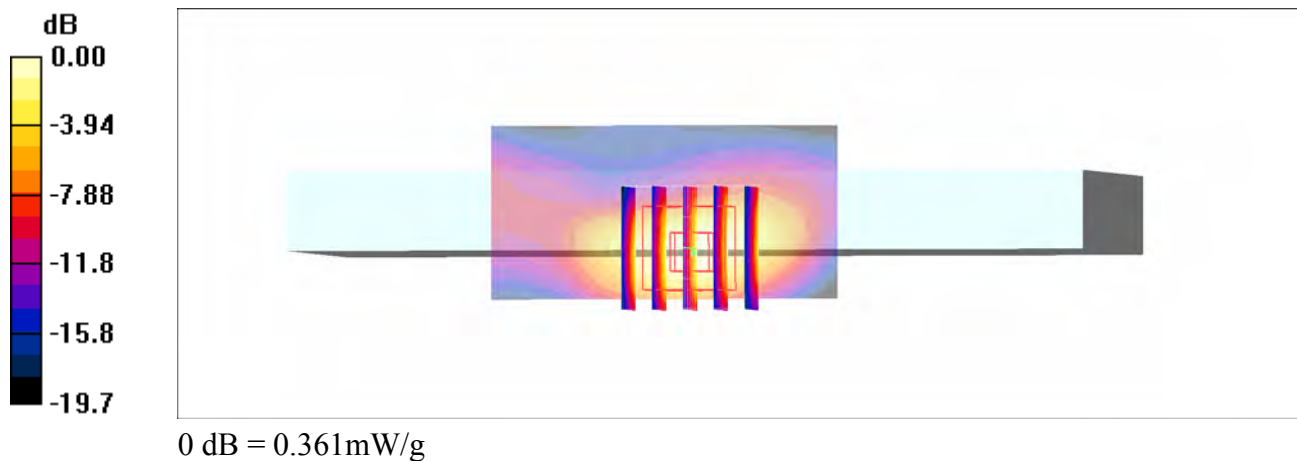
Ch20175/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 8.39 V/m; Power Drift = 0.030 dB

Peak SAR (extrapolated) = 0.441 W/kg

SAR(1 g) = 0.211 mW/g; SAR(10 g) = 0.106 mW/g

Maximum value of SAR (measured) = 0.361 mW/g



#29_LTE Band 2_20M_QPSK_1_0_Back_Ch18900

Communication System: LTE; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.56$ mho/m; $\epsilon_r = 51.6$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(8.31, 8.31, 8.31); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch18900/Area Scan (31x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.622 mW/g

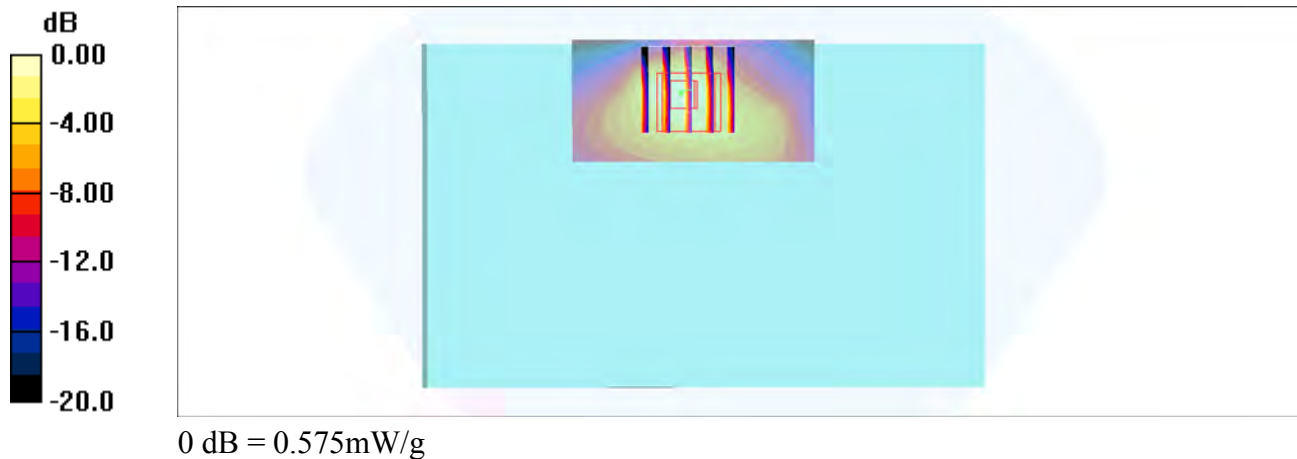
Ch18900/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 14.1 V/m; Power Drift = -0.068 dB

Peak SAR (extrapolated) = 0.741 W/kg

SAR(1 g) = 0.374 mW/g; SAR(10 g) = 0.188 mW/g

Maximum value of SAR (measured) = 0.575 mW/g



#30_LTE Band 2_20M_QPSK_50_0_Back_Ch18900

Communication System: LTE; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.56$ mho/m; $\epsilon_r = 51.6$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(8.31, 8.31, 8.31); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch18900/Area Scan (31x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.415 mW/g

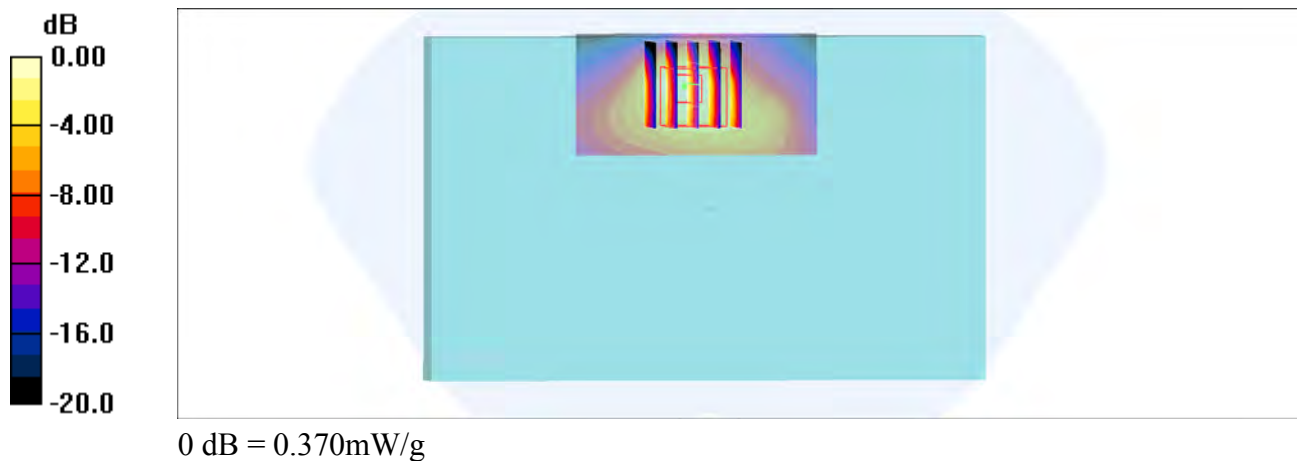
Ch18900/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 11.2 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 0.477 W/kg

SAR(1 g) = 0.240 mW/g; SAR(10 g) = 0.120 mW/g

Maximum value of SAR (measured) = 0.370 mW/g



#31_LTE Band 2_20M_QPSK_1_0_Edge 2_Ch18900

Communication System: LTE; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.56$ mho/m; $\epsilon_r = 51.6$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(8.31, 8.31, 8.31); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch18900/Area Scan (31x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.161 mW/g

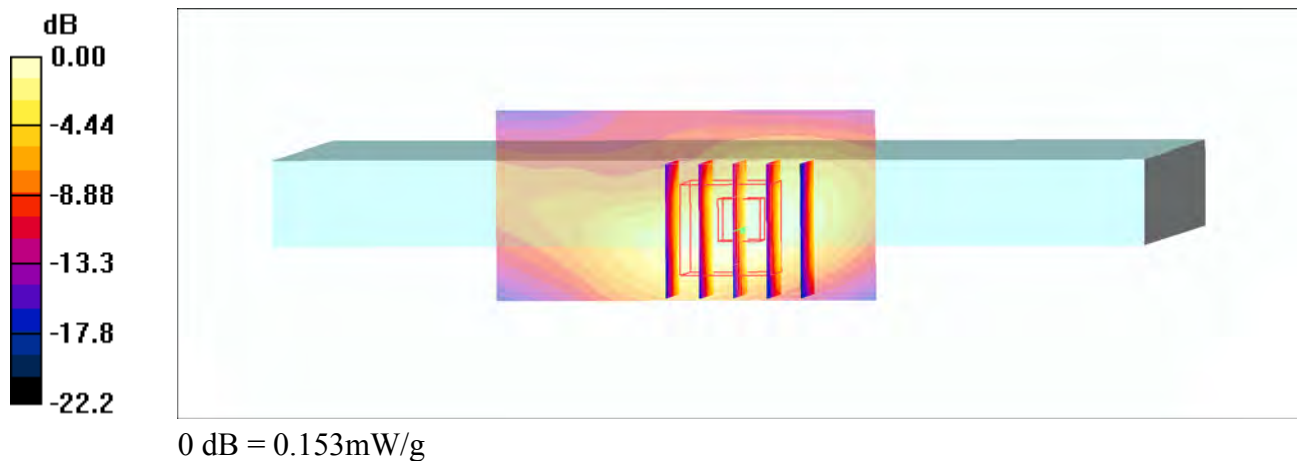
Ch18900/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 8.29 V/m; Power Drift = -0.074 dB

Peak SAR (extrapolated) = 0.192 W/kg

SAR(1 g) = 0.102 mW/g; SAR(10 g) = 0.055 mW/g

Maximum value of SAR (measured) = 0.153 mW/g



#32_LTE Band 2_20M_QPSK_50_0_Edge 2_Ch18900

Communication System: LTE; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.56$ mho/m; $\epsilon_r = 51.6$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(8.31, 8.31, 8.31); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch18900/Area Scan (31x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.099 mW/g

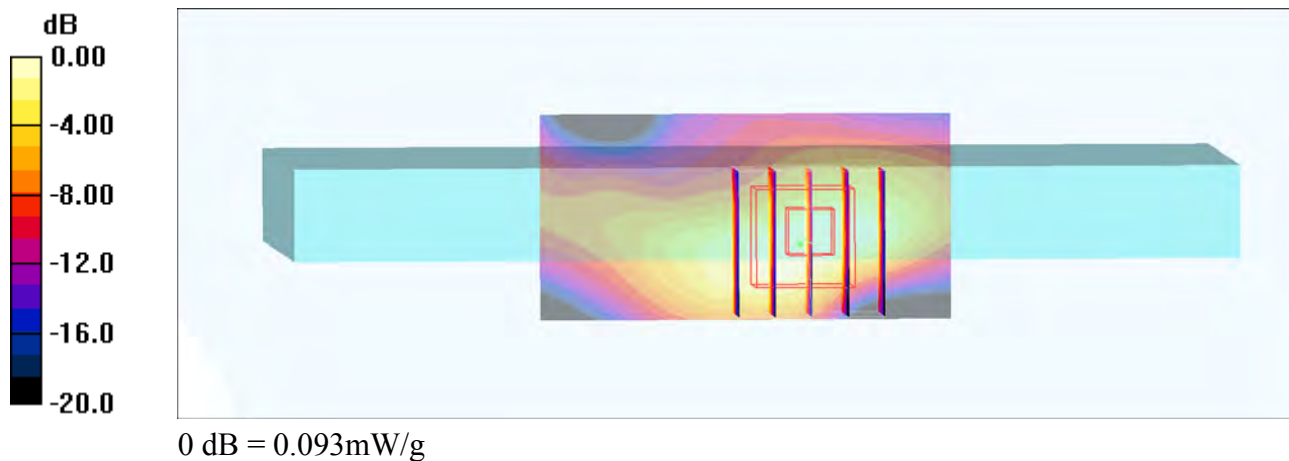
Ch18900/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 6.49 V/m; Power Drift = 0.063 dB

Peak SAR (extrapolated) = 0.121 W/kg

SAR(1 g) = 0.062 mW/g; SAR(10 g) = 0.033 mW/g

Maximum value of SAR (measured) = 0.093 mW/g



#33_WLAN2.4GHz_802.11b 1Mbps_Back_0mm_Ch11

Communication System: 802.11b ; Frequency: 2462 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2462$ MHz; $\sigma = 1.98$ mho/m; $\epsilon_r = 51.6$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(7.88, 7.88, 7.88); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch11/Area Scan (41x61x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 0.626 mW/g

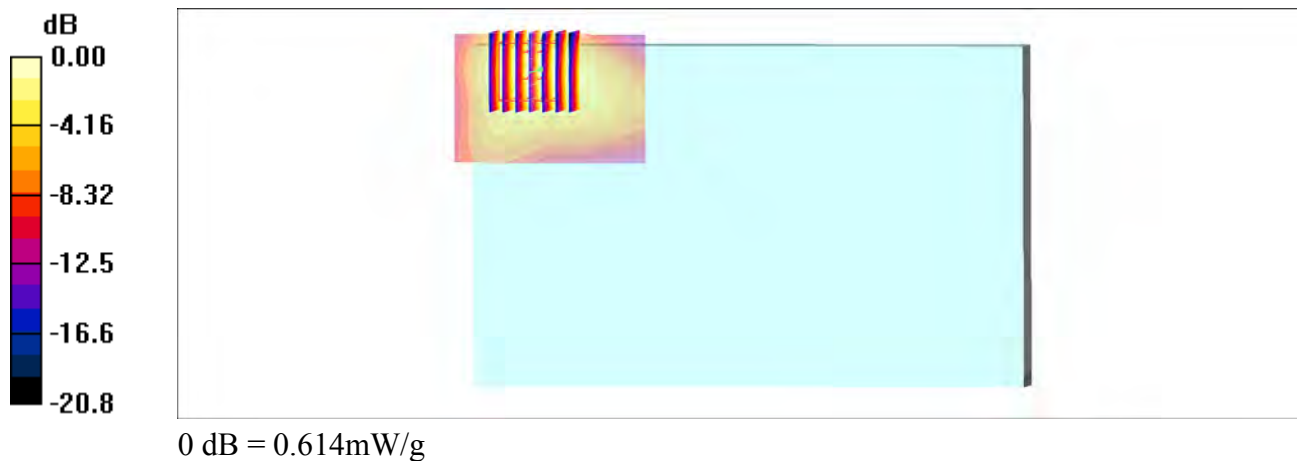
Ch11/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 10.1 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 0.783 W/kg

SAR(1 g) = 0.395 mW/g; SAR(10 g) = 0.203 mW/g

Maximum value of SAR (measured) = 0.614 mW/g



#34_WLAN2.4GHz_802.11b 1Mbps_Edge 2_0mm_Ch11

Communication System: 802.11b ; Frequency: 2462 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2462$ MHz; $\sigma = 1.98$ mho/m; $\epsilon_r = 51.6$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(7.88, 7.88, 7.88); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch11/Area Scan (41x71x1): Measurement grid: $dx=12$ mm, $dy=12$ mm

Maximum value of SAR (interpolated) = 1.37 mW/g

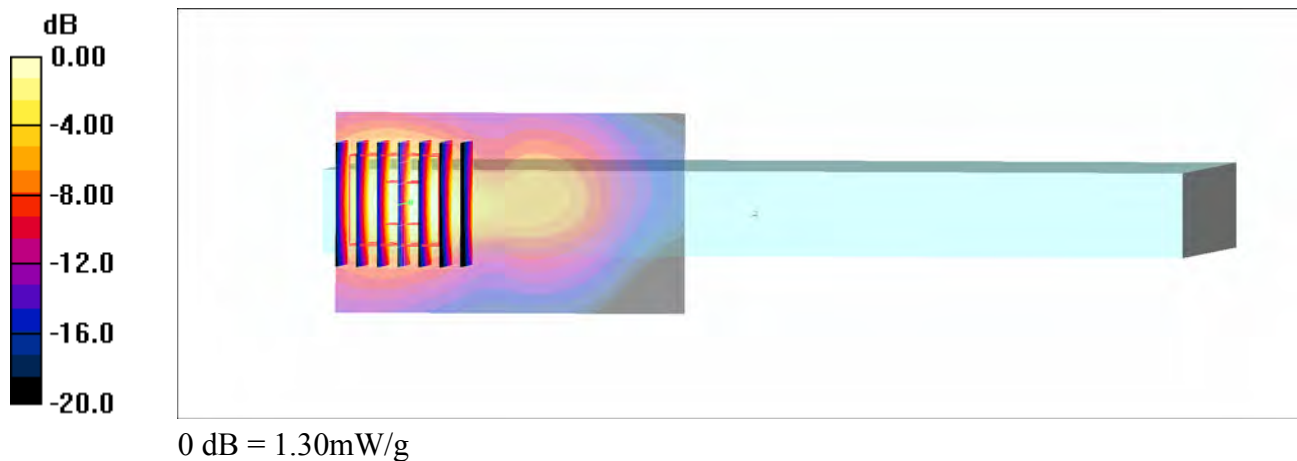
Ch11/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 15.3 V/m; Power Drift = 0.026 dB

Peak SAR (extrapolated) = 1.63 W/kg

SAR(1 g) = 0.775 mW/g; SAR(10 g) = 0.343 mW/g

Maximum value of SAR (measured) = 1.30 mW/g



#35_WLAN2.4GHz_802.11b 1Mbps_Edge 2_0mm_Ch1

Communication System: 802.11b ; Frequency: 2412 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2412$ MHz; $\sigma = 1.91$ mho/m; $\epsilon_r = 51.7$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(7.88, 7.88, 7.88); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch1/Area Scan (41x71x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 0.472 mW/g

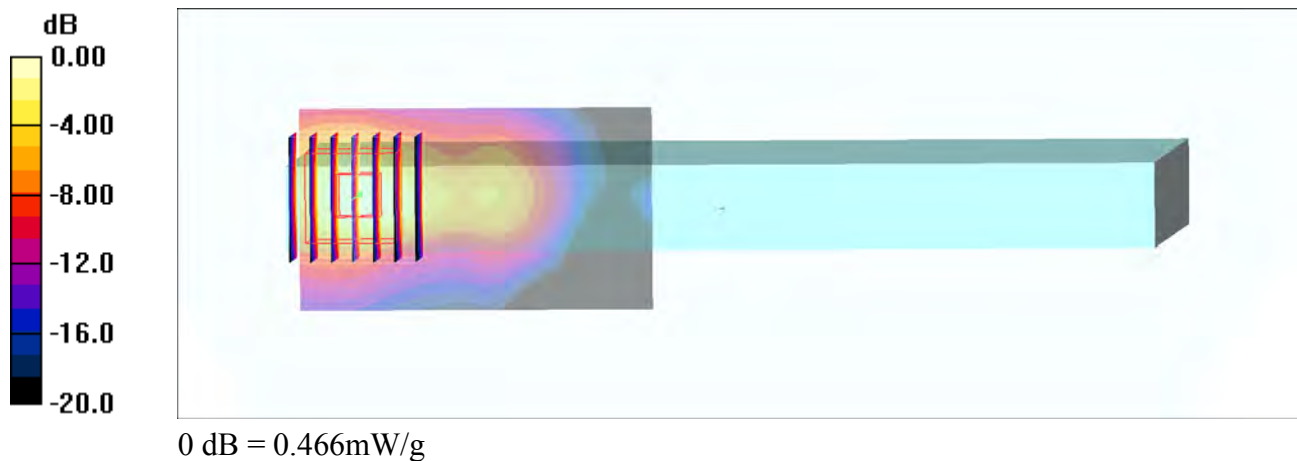
Ch1/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 10.4 V/m; Power Drift = -0.023 dB

Peak SAR (extrapolated) = 0.601 W/kg

SAR(1 g) = 0.286 mW/g; SAR(10 g) = 0.126 mW/g

Maximum value of SAR (measured) = 0.466 mW/g



#36_WLAN2.4GHz_802.11b 1Mbps_Edge 2_0mm_Ch6

Communication System: 802.11b ; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2437$ MHz; $\sigma = 1.95$ mho/m; $\epsilon_r = 51.6$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 ; Liquid Temperature : 22.6

DASY4 Configuration:

- Probe: EX3DV4 - SN7382; ConvF(7.88, 7.88, 7.88); Calibrated: 10/26/2016
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn527; Calibrated: 10/19/2016
- Phantom: SAM_Righjt; Type: QD000P40CC; Serial: TP:1368
- ;Postprocessing SW: SEMCAD, V1.8 Build 145

Ch6/Area Scan (41x71x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 0.519 mW/g

Ch6/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 9.62 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 0.678 W/kg

SAR(1 g) = 0.317 mW/g; SAR(10 g) = 0.141 mW/g

Maximum value of SAR (measured) = 0.534 mW/g



APPENDIX D PROBE& DIPOLE CALIBRATION CERTIFICATES



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 0108**

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

Client **BACL**

Certificate No: **EX3-7382_Oct16**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:7382**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6**
 Calibration procedure for dosimetric E-field probes

Calibration date: **October 26, 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 (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: S5277 (20x)	05-Apr-16 (No. 217-02293)	Apr-17
Reference Probe ES3DV2	SN: 3013	31-Dec-15 (No. ES3-3013_Dec15)	Dec-16
DAE4	SN: 660	23-Dec-15 (No. DAE4-660_Dec15)	Dec-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-16)	In house check: Jun-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-16)	In house check: Oct-17

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	
Issued: October 26, 2016			
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			



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
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), i.e., $\vartheta = 0$ is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E²-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 with CW signal (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}; D_{x,y,z}; VR_{x,y,z}**: A, B, C, D 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 values 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).

Probe EX3DV4

SN:7382

Manufactured: April 13, 2015
Calibrated: October 26, 2016

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7382

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.41	0.43	0.45	± 10.1 %
DCP (mV) ^B	95.9	102.4	92.0	

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	143.4	±3.5 %
		Y	0.0	0.0	1.0		148.9	
		Z	0.0	0.0	1.0		143.3	

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 Pages 5 and 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:7382

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)	Unc (k=2)
750	41.9	0.89	11.04	11.04	11.04	0.51	0.80	± 12.0 %
835	41.5	0.90	10.50	10.50	10.50	0.45	0.80	± 12.0 %
900	41.5	0.97	10.27	10.27	10.27	0.31	1.05	± 12.0 %
1750	40.1	1.37	9.06	9.06	9.06	0.26	0.99	± 12.0 %
1900	40.0	1.40	8.71	8.71	8.71	0.37	0.81	± 12.0 %
2450	39.2	1.80	7.73	7.73	7.73	0.36	0.80	± 12.0 %
2600	39.0	1.96	7.48	7.48	7.48	0.37	0.80	± 12.0 %
5250	35.9	4.71	5.52	5.52	5.52	0.35	1.80	± 13.1 %
5600	35.5	5.07	5.05	5.05	5.05	0.40	1.80	± 13.1 %
5800	35.3	5.27	5.16	5.16	5.16	0.40	1.80	± 13.1 %

^C Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the 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 frequencies 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 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:7382

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)	Unc (k=2)
750	55.5	0.96	10.94	10.94	10.94	0.42	0.95	± 12.0 %
835	55.2	0.97	10.54	10.54	10.54	0.48	0.83	± 12.0 %
900	55.0	1.05	10.42	10.42	10.42	0.46	0.80	± 12.0 %
1750	53.4	1.49	8.65	8.65	8.65	0.34	0.93	± 12.0 %
1900	53.3	1.52	8.31	8.31	8.31	0.24	1.10	± 12.0 %
2450	52.7	1.95	7.88	7.88	7.88	0.41	0.80	± 12.0 %
2600	52.5	2.16	7.59	7.59	7.59	0.32	0.80	± 12.0 %
5250	48.9	5.36	4.91	4.91	4.91	0.40	1.90	± 13.1 %
5600	48.5	5.77	4.09	4.09	4.09	0.50	1.90	± 13.1 %
5800	48.2	6.00	4.36	4.36	4.36	0.50	1.90	± 13.1 %

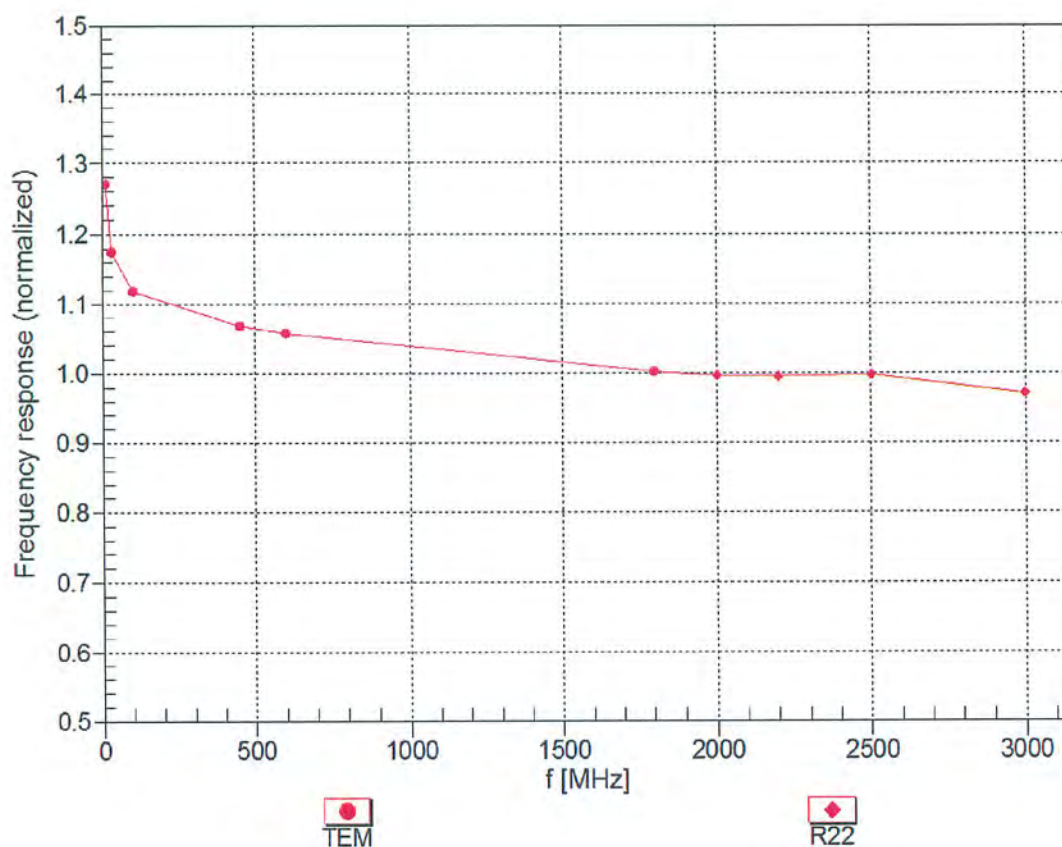
^C Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 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 frequencies 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 frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

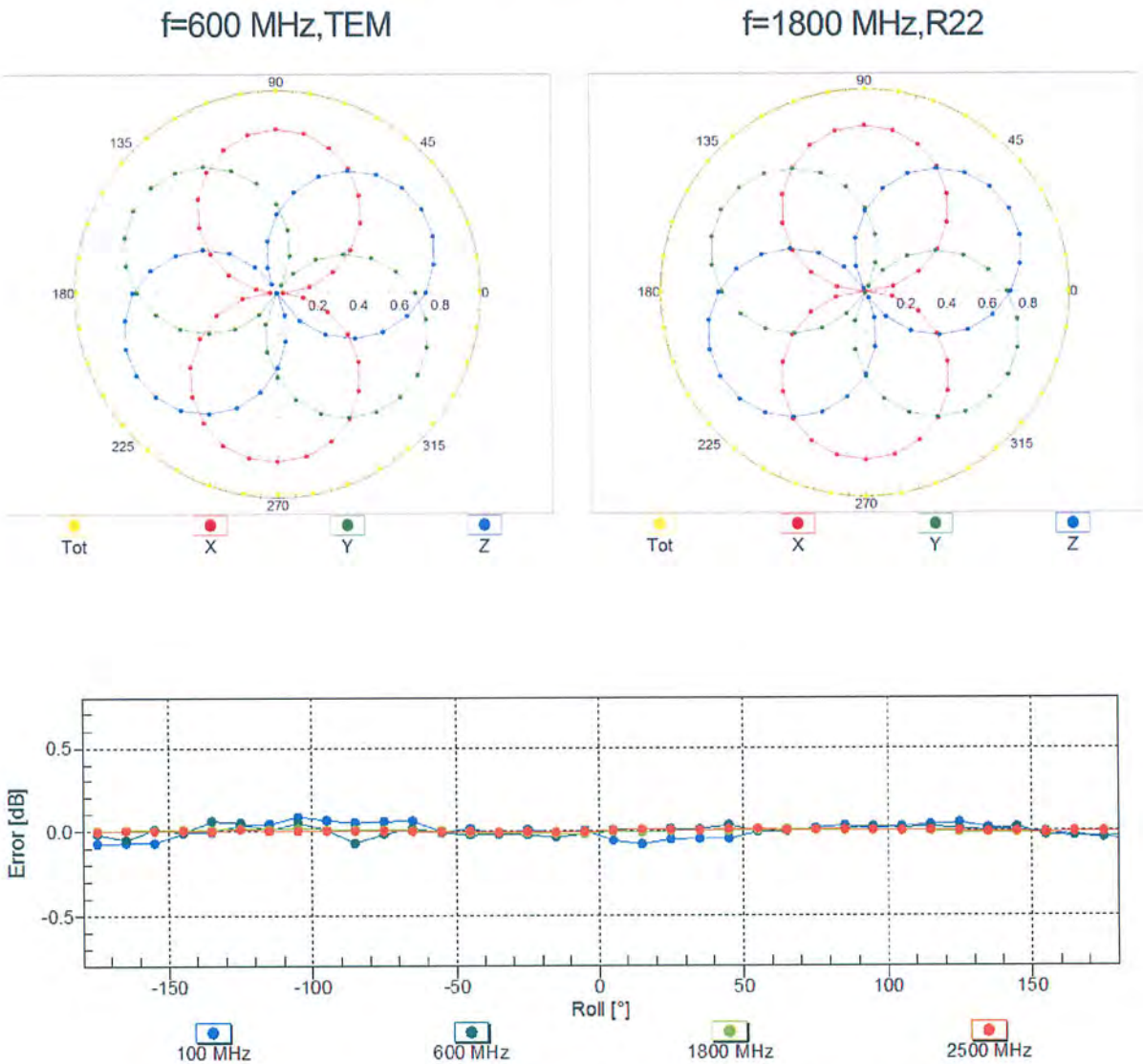
Frequency Response of E-Field

(TEM-Cell:ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

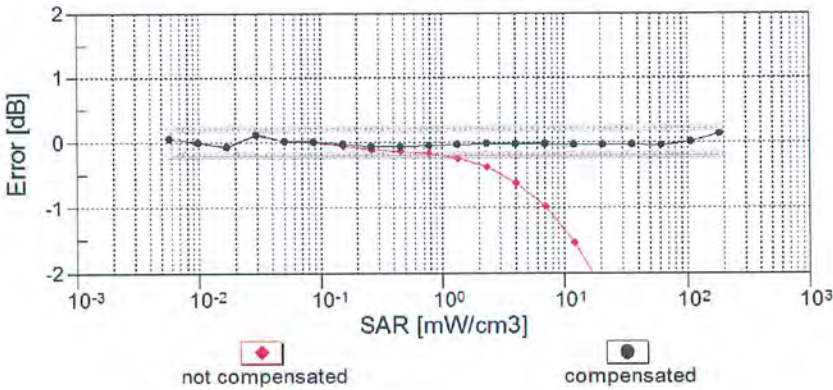
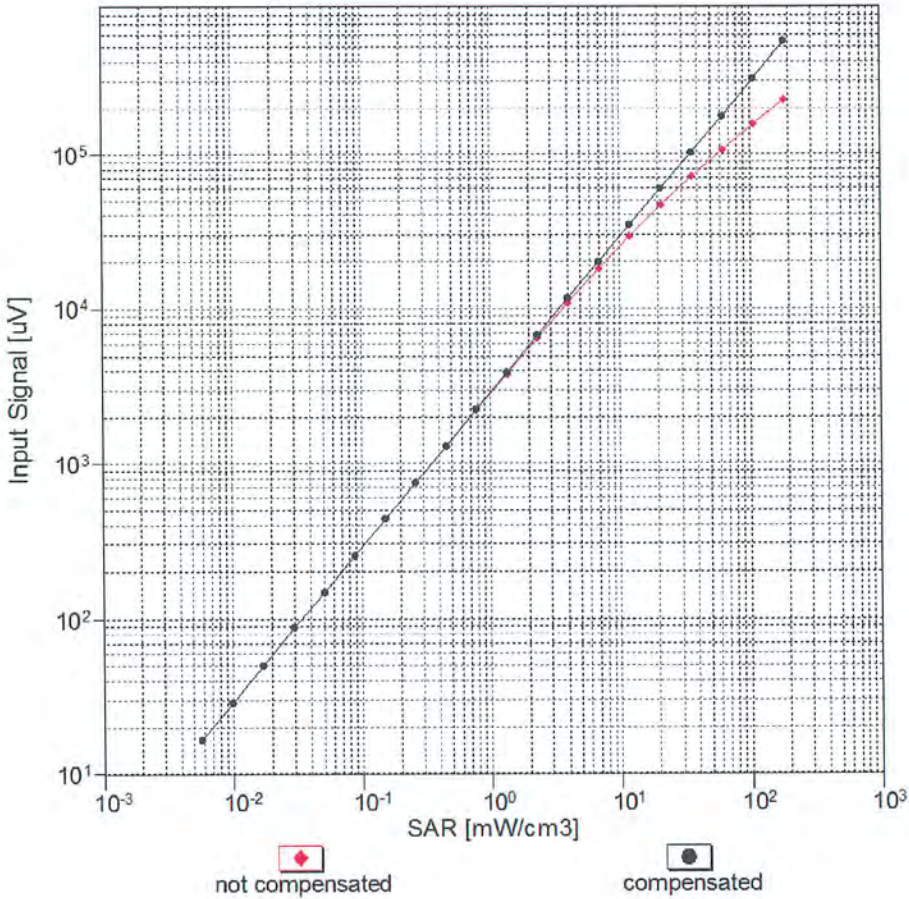
Receiving Pattern (ϕ), $\vartheta = 0^\circ$



Roll [°]	100 MHz Error [dB]	600 MHz Error [dB]	1800 MHz Error [dB]	2500 MHz Error [dB]
-180	-0.05	0.02	0.01	0.00
-150	-0.05	0.02	0.01	0.00
-120	-0.05	0.02	0.01	0.00
-90	-0.05	0.02	0.01	0.00
-60	-0.05	0.02	0.01	0.00
-30	-0.05	0.02	0.01	0.00
0	-0.05	0.02	0.01	0.00
30	-0.05	0.02	0.01	0.00
60	-0.05	0.02	0.01	0.00
90	-0.05	0.02	0.01	0.00
120	-0.05	0.02	0.01	0.00
150	-0.05	0.02	0.01	0.00
180	-0.05	0.02	0.01	0.00

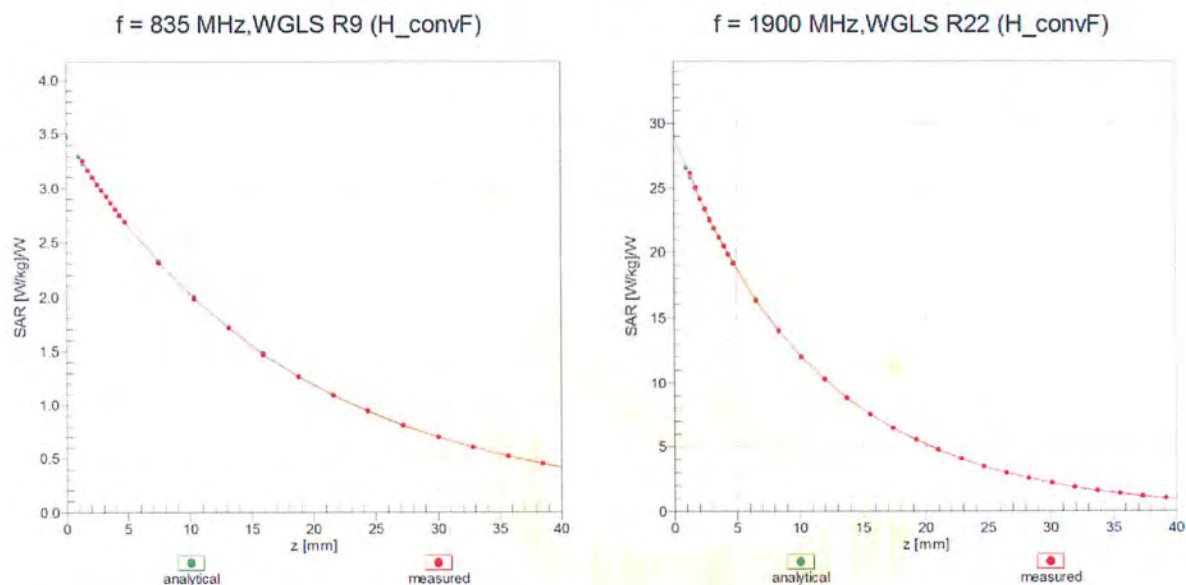
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

Dynamic Range f(SAR_{head})
(TEM cell , f_{eval}= 1900 MHz)



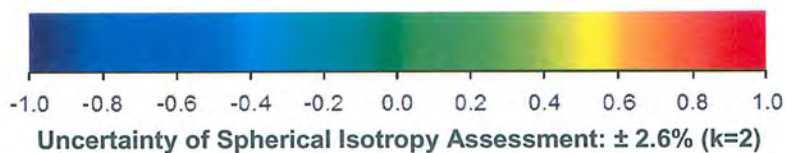
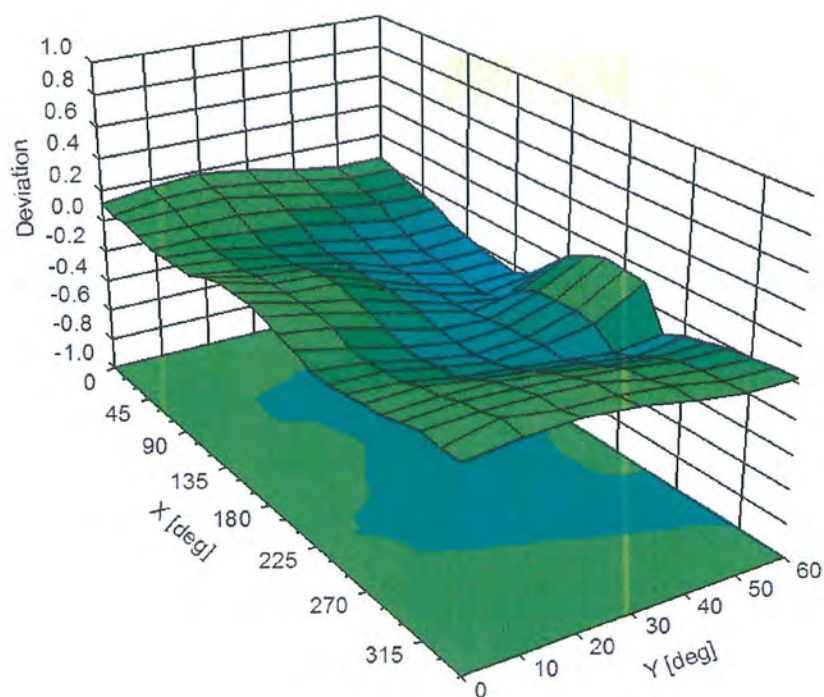
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, θ), $f = 900 \text{ MHz}$



DASY/EASY - Parameters of Probe: EX3DV4 - SN:7382

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	5
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm



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 **BACL**

Certificate No: **D750V3-1167_Nov16**

CALIBRATION CERTIFICATE

Object **D750V3 - SN:1167**

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

Calibration date: **November 08, 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 (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: 5058 (20k)	05-Apr-16 (No. 217-02292)	Apr-17
Type-N mismatch combination	SN: 5047.2 / 06327	05-Apr-16 (No. 217-02295)	Apr-17
Reference Probe EX3DV4	SN: 7349	15-Jun-16 (No. EX3-7349_Jun16)	Jun-17
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-16)	In house check: Oct-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-16)	In house check: Oct-17

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

Signature

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

Issued: November 11, 2016

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



Accredited by the Swiss Accreditation Service (SAS)

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

Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	41.1 $\pm$ 6 %	0.92 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.12 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.23 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.39 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	55.6 $\pm$ 6 %	0.97 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.16 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	8.58 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.43 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	5.69 W/kg $\pm$ 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.1 Ω - 3.7 j Ω
Return Loss	- 25.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.8 Ω - 5.4 j Ω
Return Loss	- 25.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.033 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	October 10, 2016

DASY5 Validation Report for Head TSL

Date: 08.11.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1167

Communication System: UID 0 - CW; Frequency: 750 MHz

Medium parameters used: $f = 750 \text{ MHz}$; $\sigma = 0.92 \text{ S/m}$; $\epsilon_r = 41.1$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.07, 10.07, 10.07); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

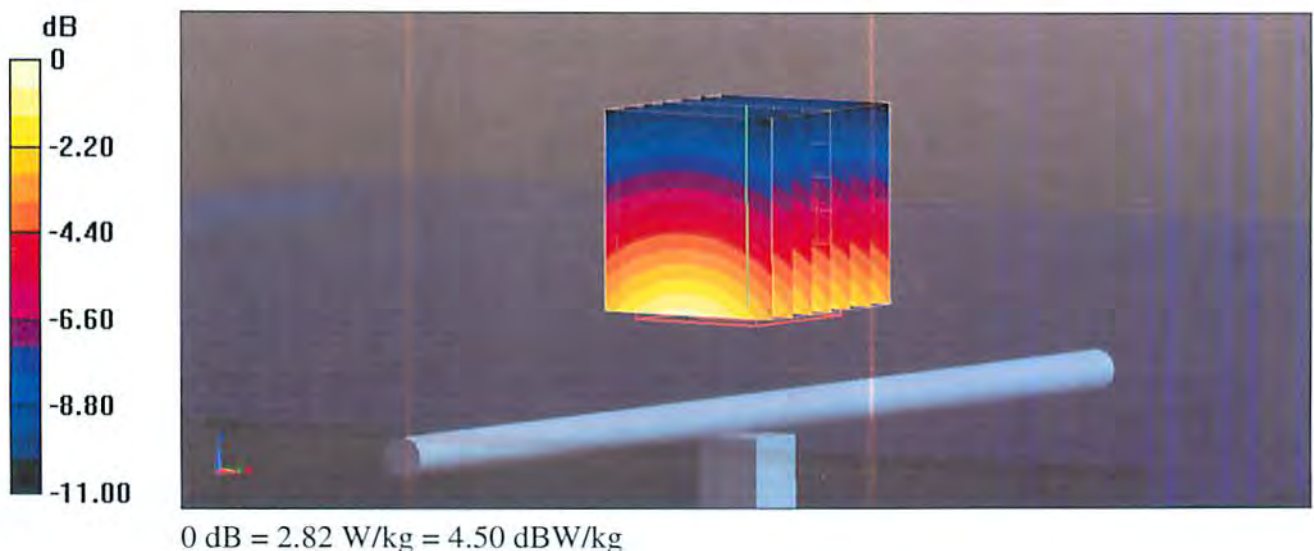
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 58.22 V/m; Power Drift = 0.01 dB

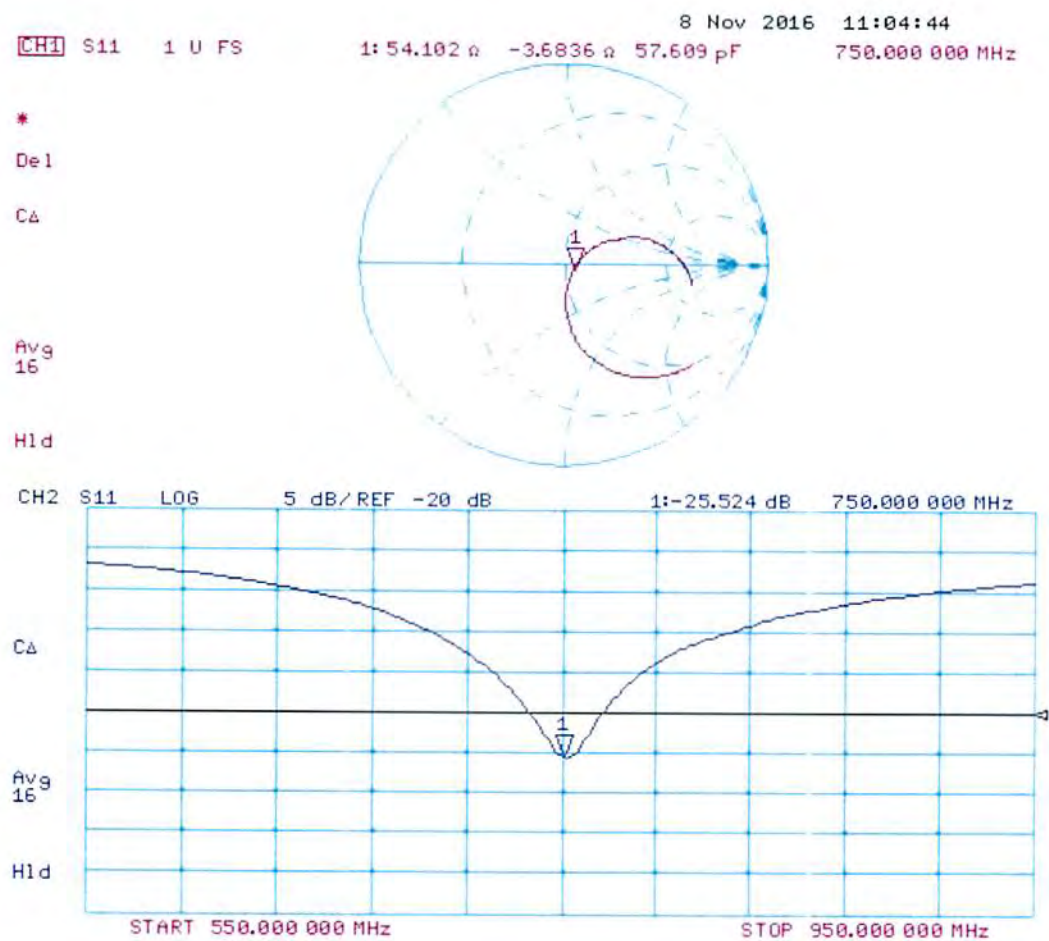
Peak SAR (extrapolated) = 3.17 W/kg

SAR(1 g) = 2.12 W/kg; SAR(10 g) = 1.38 W/kg

Maximum value of SAR (measured) = 2.82 W/kg



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 08.11.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1167

Communication System: UID 0 - CW; Frequency: 750 MHz

Medium parameters used: $f = 750 \text{ MHz}$; $\sigma = 0.97 \text{ S/m}$; $\epsilon_r = 55.6$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(9.99, 9.99, 9.99); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

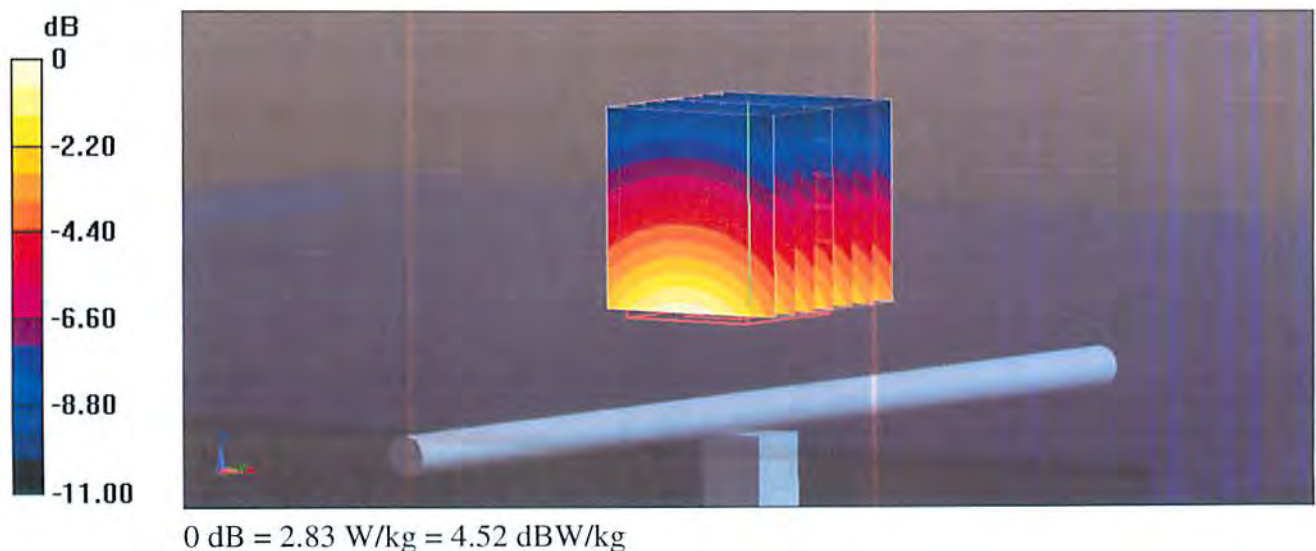
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 56.52 V/m; Power Drift = -0.01 dB

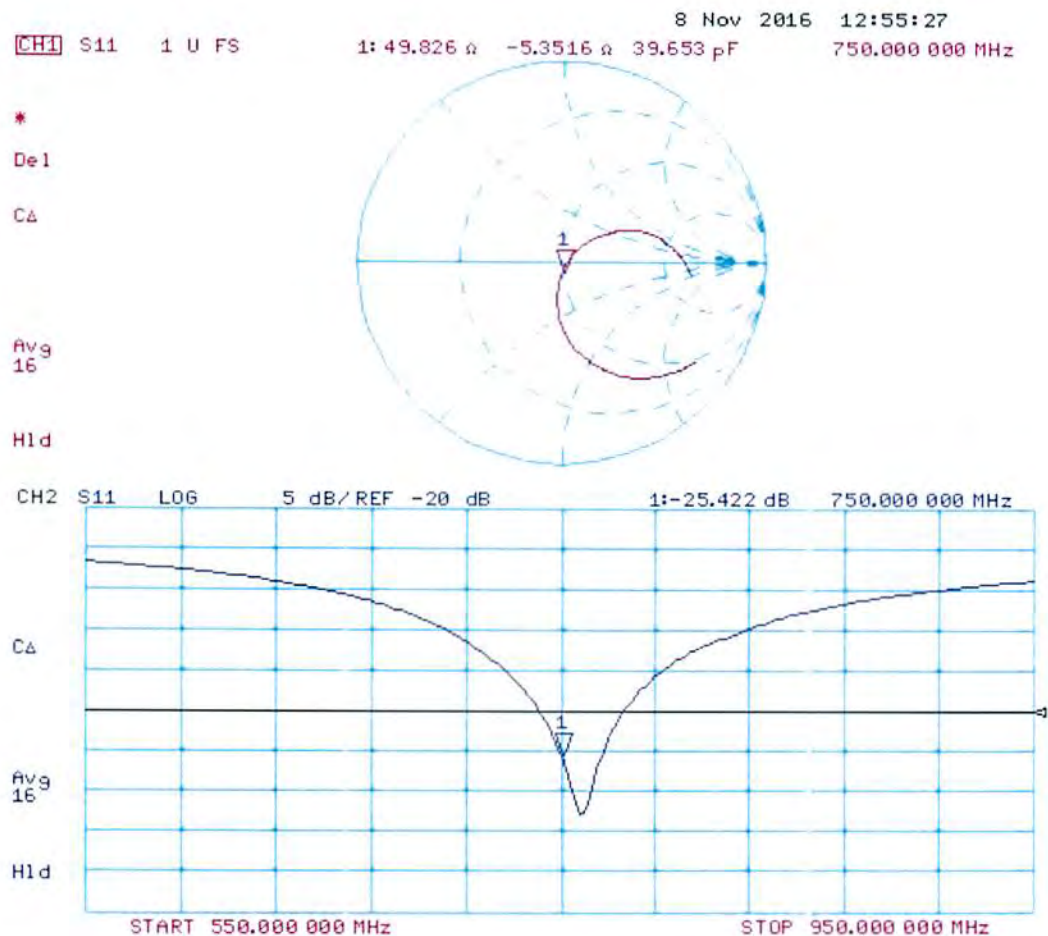
Peak SAR (extrapolated) = 3.20 W/kg

SAR(1 g) = 2.16 W/kg; SAR(10 g) = 1.43 W/kg

Maximum value of SAR (measured) = 2.83 W/kg



Impedance Measurement Plot for Body TSL





Accredited by the Swiss Accreditation Service (SAS)

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

Accreditation No.: **SCS 0108**

Client **BACL**

Certificate No: **D835V2-454_Aug15**

CALIBRATION CERTIFICATE

Object **D835V2 - SN: 454**

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

Calibration date: **August 17, 2015**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter 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: 5058 (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 ES3DV3	SN: 3205	30-Dec-14 (No. ES3-3205_Dec14)	Dec-15
DAE4	SN: 654	08-Jul-15 (No. DAE4-654_Jul15)	Jul-16
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

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

Issued: August 18, 2015

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



Accredited by the Swiss Accreditation Service (SAS)

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

Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	41.9 $\pm$ 6 %	0.93 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.39 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.55 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.09 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	56.1 $\pm$ 6 %	1.02 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.48 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	9.59 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.61 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	6.27 W/kg $\pm$ 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.8 Ω - 2.5 j Ω
Return Loss	- 31.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.1 Ω - 4.5 j Ω
Return Loss	- 25.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.378 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	January 31, 2002

DASY5 Validation Report for Head TSL

Date: 17.08.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 454

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.93 \text{ S/m}$; $\epsilon_r = 41.9$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.2, 6.2, 6.2); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 08.07.2015
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

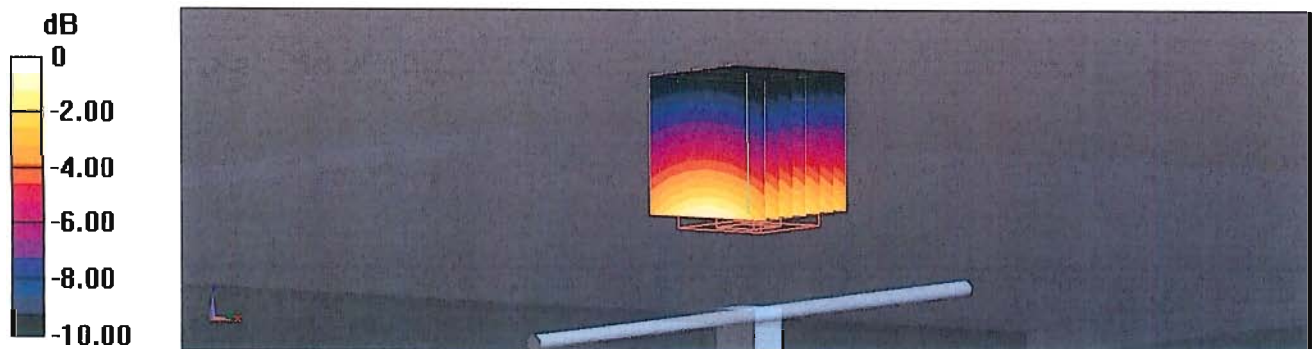
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 56.89 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.63 W/kg

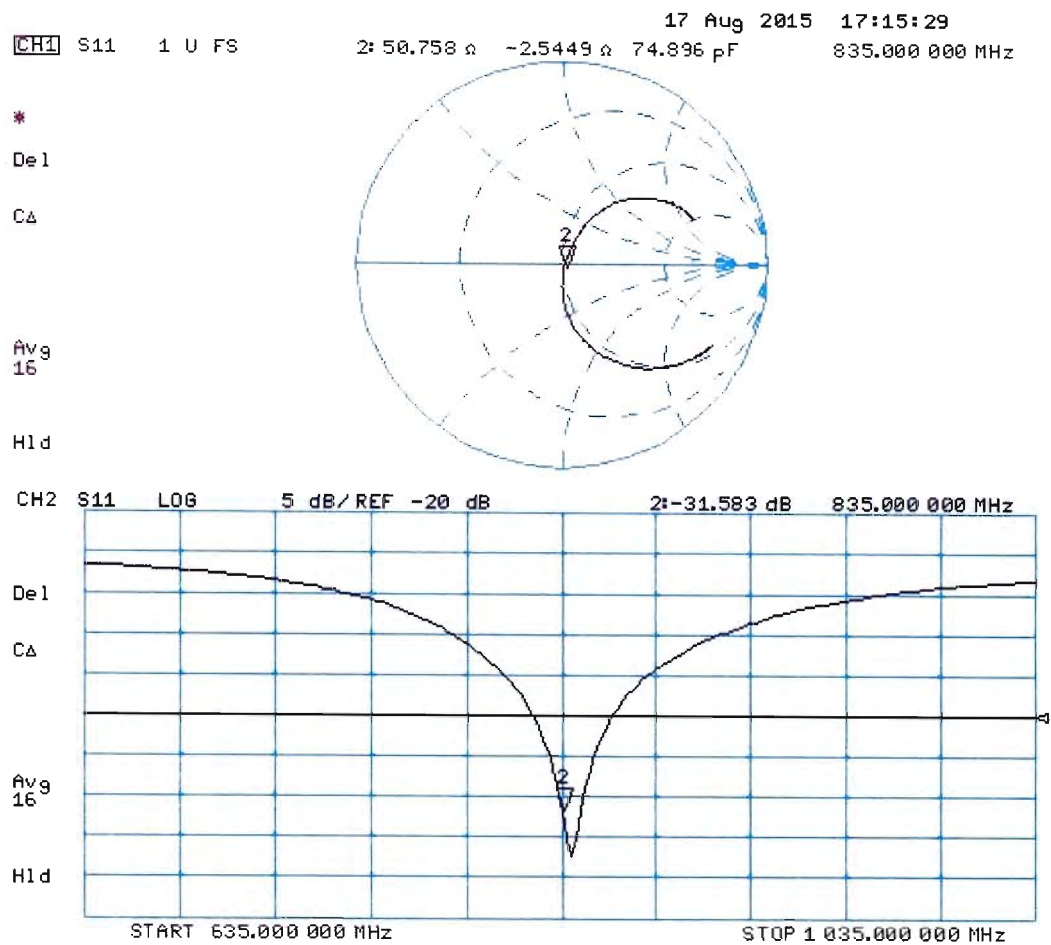
SAR(1 g) = 2.4 W/kg; SAR(10 g) = 1.55 W/kg

Maximum value of SAR (measured) = 2.83 W/kg



0 dB = 2.83 W/kg = 4.52 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 17.08.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 454

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 1.02 \text{ S/m}$; $\epsilon_r = 56.1$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.17, 6.17, 6.17); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 08.07.2015
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/ $P_{in}=250 \text{ mW}$, $d=15\text{mm}$ /Zoom Scan (7x7x7)/Cube 0:

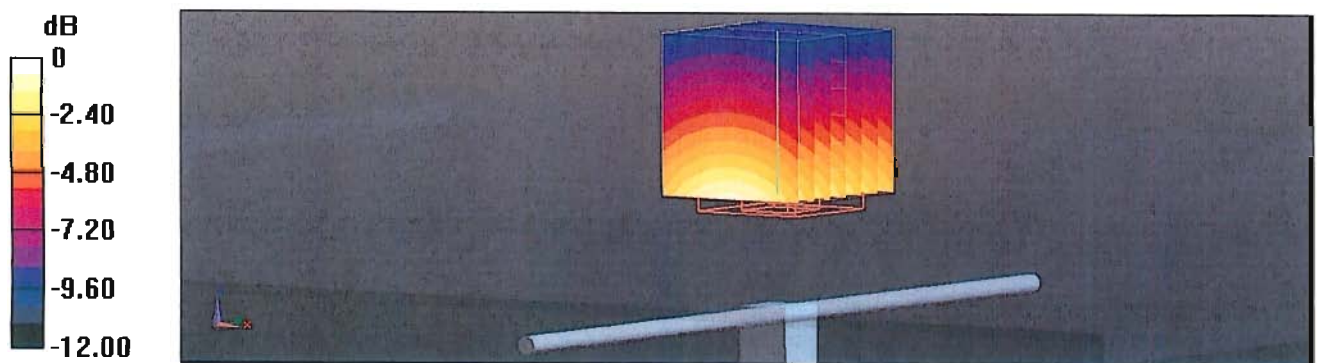
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 55.12 V/m ; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 3.68 W/kg

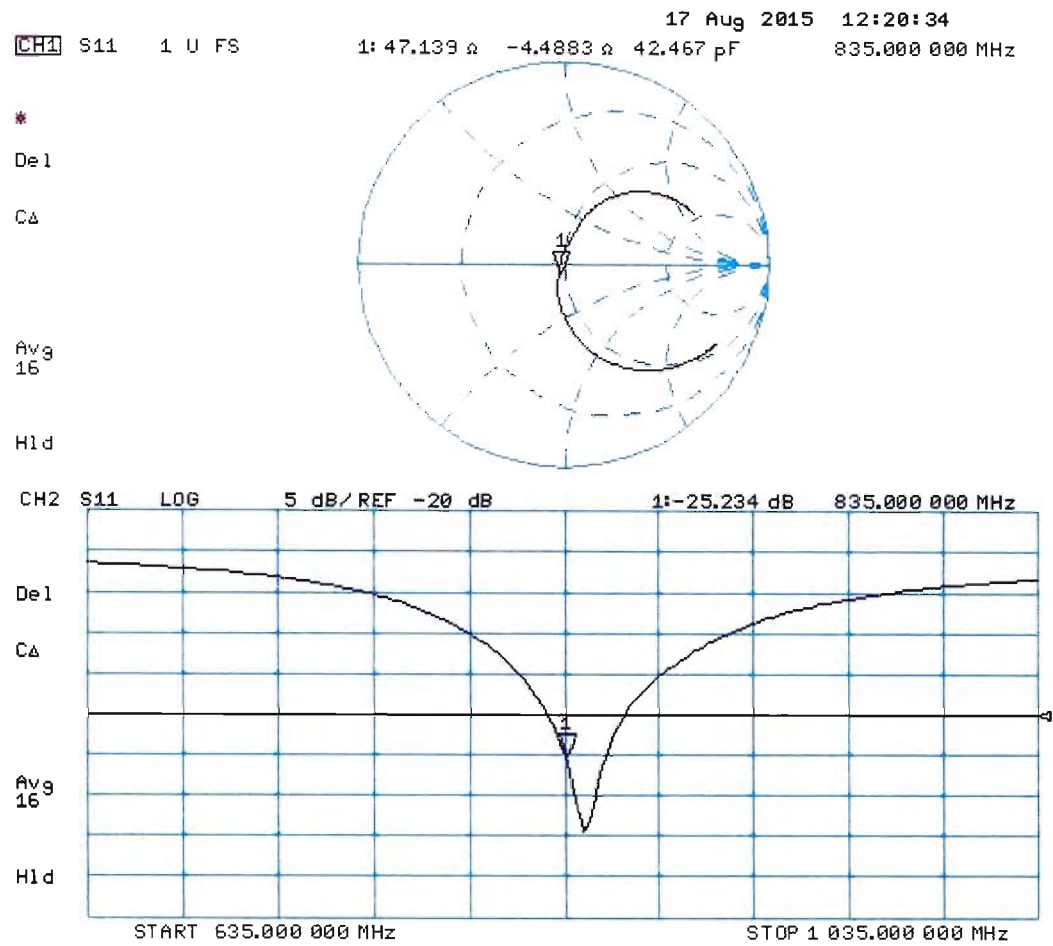
SAR(1 g) = 2.48 W/kg ; SAR(10 g) = 1.61 W/kg

Maximum value of SAR (measured) = 2.90 W/kg



0 dB = 2.90 W/kg = 4.62 dBW/kg

Impedance Measurement Plot for Body TSL





Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 0108**

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

Client

BACL

Certificate No: **D1800V2-2d207_Jul15**

CALIBRATION CERTIFICATE

Object **D1800V2 - SN: 2d207**

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

Calibration date: **July 09, 2015**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter 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: 5058 (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 ES3DV3	SN: 3205	30-Dec-14 (No. ES3-3205_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

Calibrated by: **Claudio Leubler** **Laboratory Technician** **Signature**

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

Issued: July 14, 2015

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



Accredited by the Swiss Accreditation Service (SAS)

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

Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1800 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	38.6 $\pm$ 6 %	1.42 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.84 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	38.7 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.16 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.4 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	52.0 $\pm$ 6 %	1.52 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.35 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	37.2 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	4.94 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	19.7 W/kg $\pm$ 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.5 Ω - 4.2 j Ω
Return Loss	- 27.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.7 Ω - 3.7 j Ω
Return Loss	- 24.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.212 ns
----------------------------------	----------

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

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	August 29, 2013

DASY5 Validation Report for Head TSL

Date: 09.07.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN: 2d207

Communication System: UID 0 - CW; Frequency: 1800 MHz

Medium parameters used: $f = 1800$ MHz; $\sigma = 1.42$ S/m; $\epsilon_r = 38.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.06, 5.06, 5.06); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- 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:

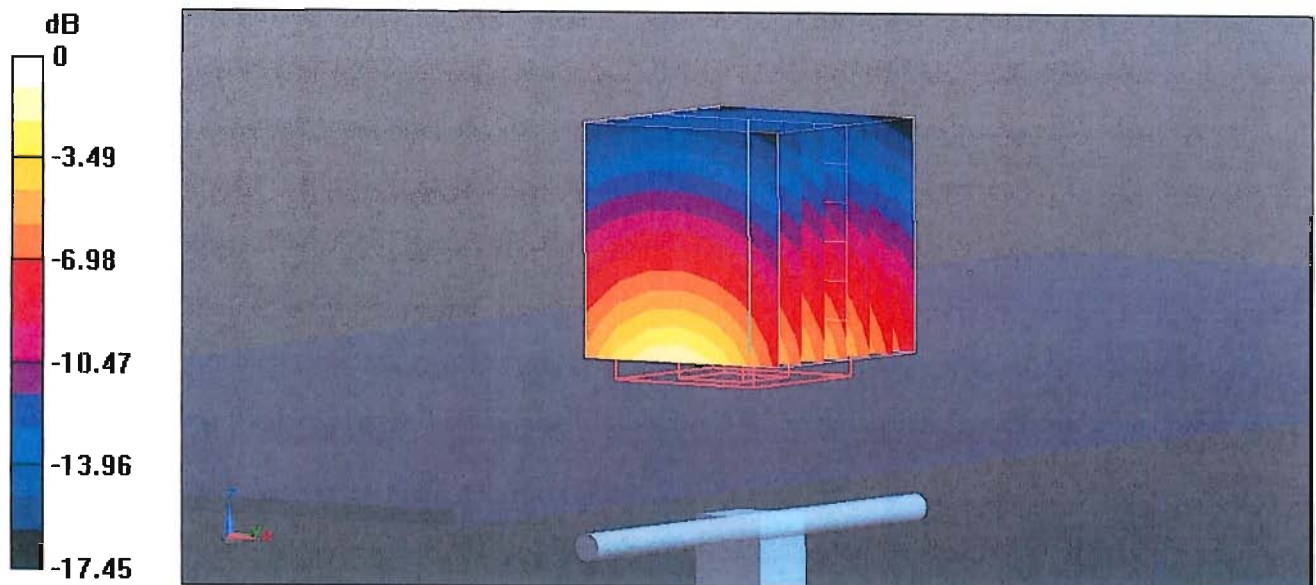
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.67 V/m; Power Drift = 0.04 dB

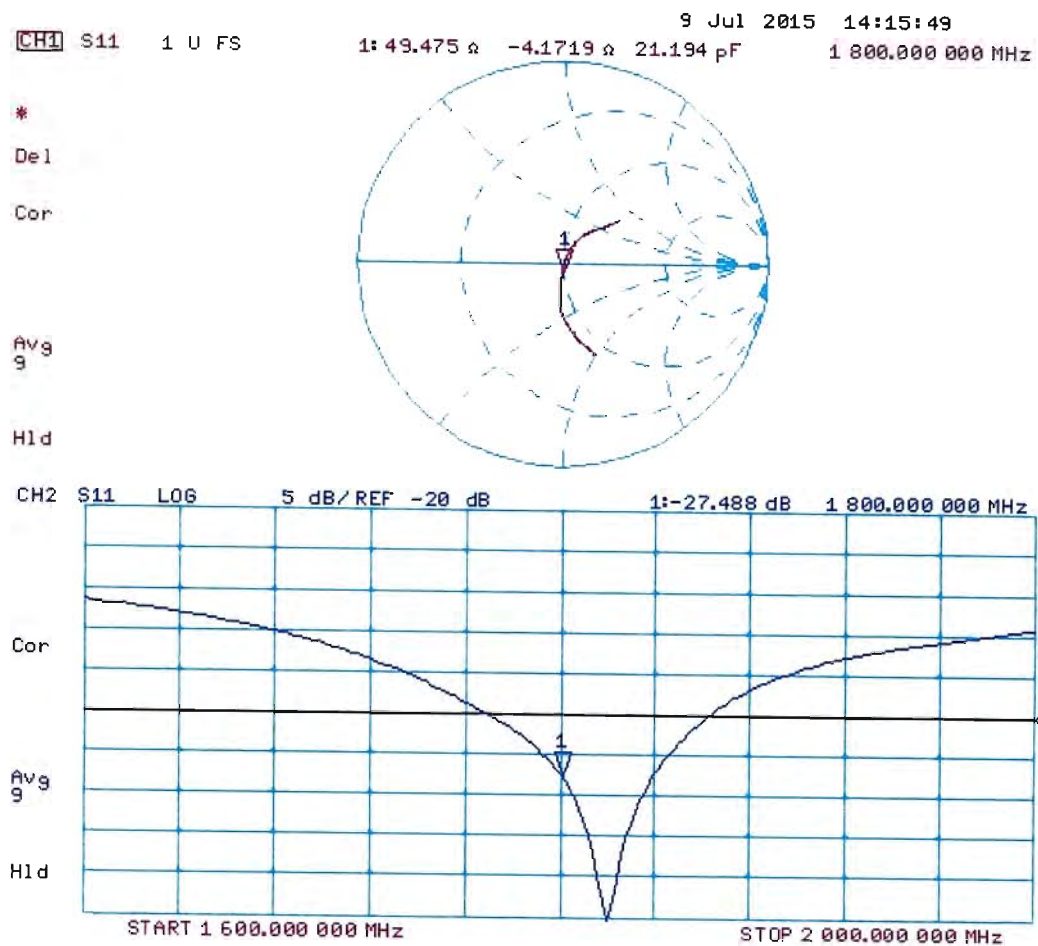
Peak SAR (extrapolated) = 18.1 W/kg

SAR(1 g) = 9.84 W/kg; SAR(10 g) = 5.16 W/kg

Maximum value of SAR (measured) = 12.2 W/kg



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 09.07.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN: 2d207

Communication System: UID 0 - CW; Frequency: 1800 MHz

Medium parameters used: $f = 1800$ MHz; $\sigma = 1.52$ S/m; $\epsilon_r = 52$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.77, 4.77, 4.77); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- 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:

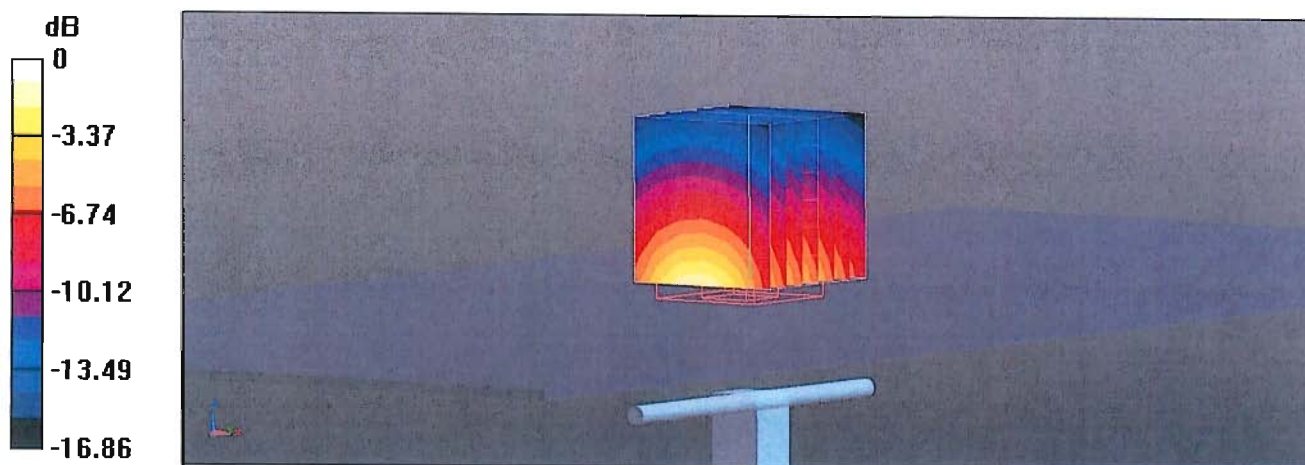
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 90.68 V/m; Power Drift = 0.01 dB

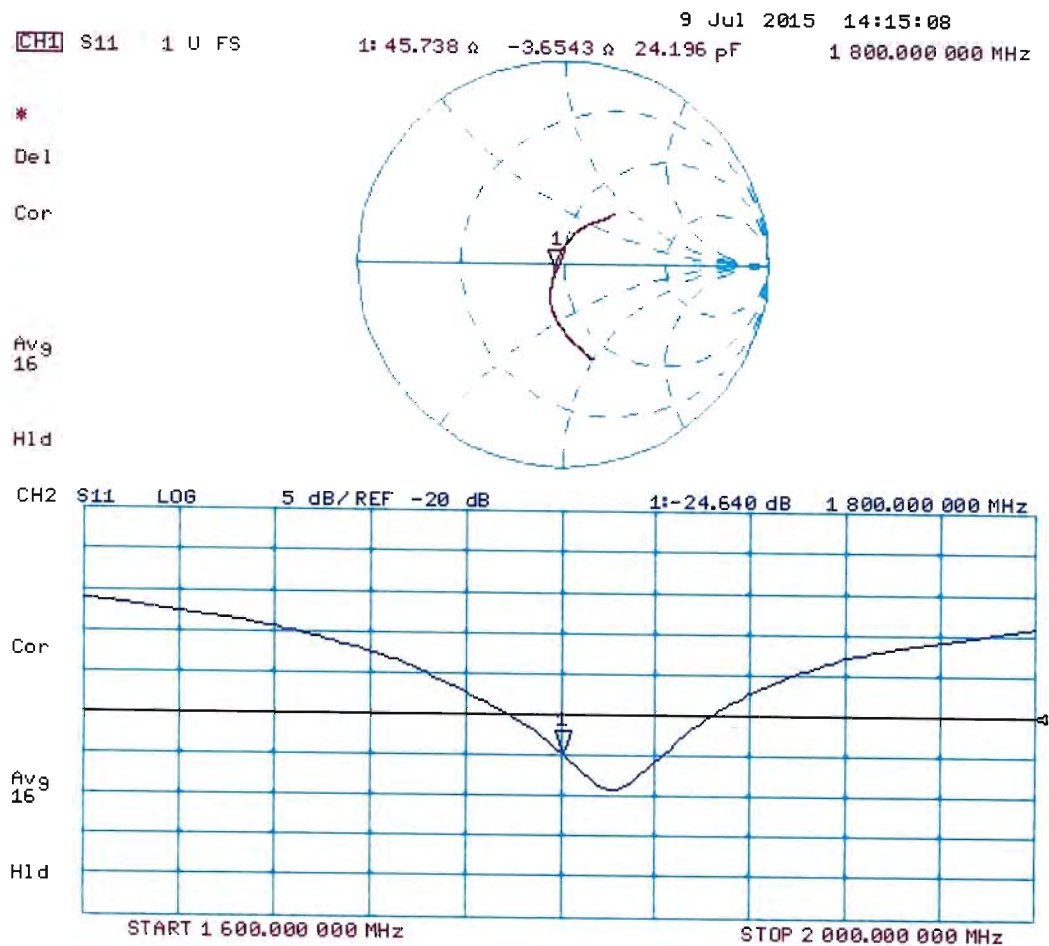
Peak SAR (extrapolated) = 16.9 W/kg

SAR(1 g) = 9.35 W/kg; SAR(10 g) = 4.94 W/kg

Maximum value of SAR (measured) = 11.8 W/kg



Impedance Measurement Plot for Body TSL





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

Accreditation No.: **SCS 0108**

Client **BACL**

Certificate No: **D1900V2-5d207_Jul15**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN:5d207**

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

Calibration date: **July 14, 2015**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter 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: 5058 (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 ES3DV3	SN: 3205	30-Dec-14 (No. ES3-3205_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

Calibrated by:	Name Leif Klysner	Function Laboratory Technician	Signature
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 14, 2015

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



Accredited by the Swiss Accreditation Service (SAS)

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

Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	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	39.7 $\pm$ 6 %	1.38 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	40.7 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.34 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	21.5 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	52.7 $\pm$ 6 %	1.54 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.2 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	40.4 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.47 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.7 W/kg $\pm$ 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$52.7 \Omega + 5.8 j\Omega$
Return Loss	- 24.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$48.9 \Omega + 6.4 j\Omega$
Return Loss	- 23.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.203 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	October 21, 2014

DASY5 Validation Report for Head TSL

Date: 14.07.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d207

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.38$ S/m; $\epsilon_r = 39.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5, 5, 5); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- 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:

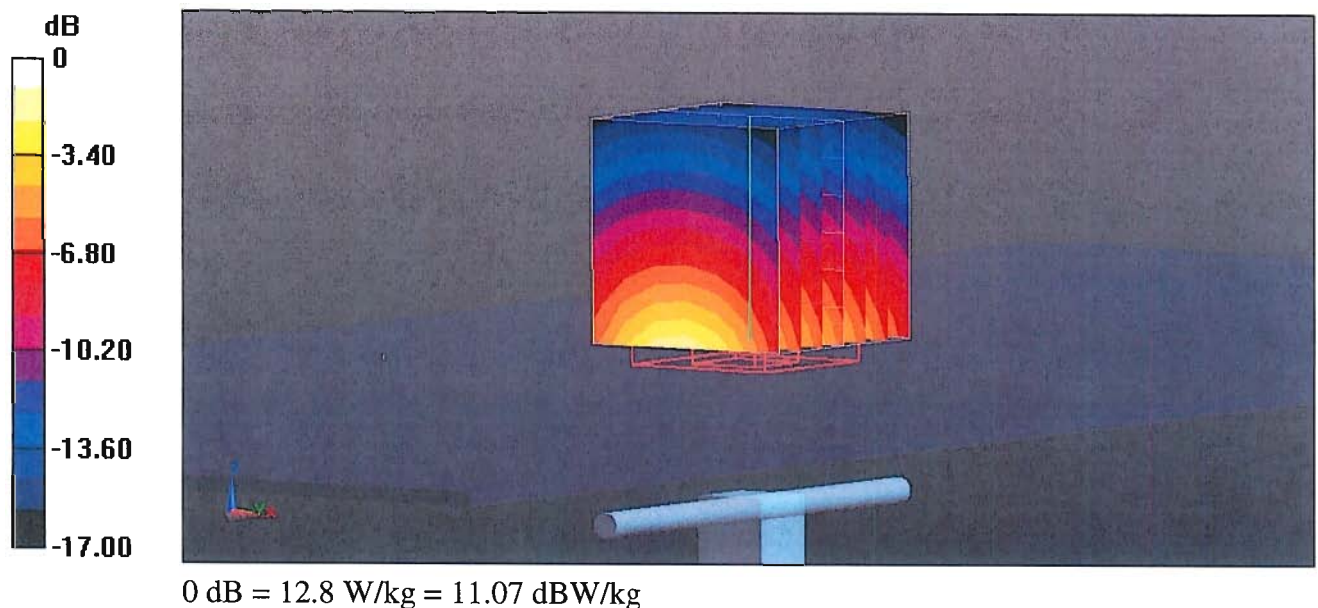
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 99.21 V/m; Power Drift = 0.01 dB

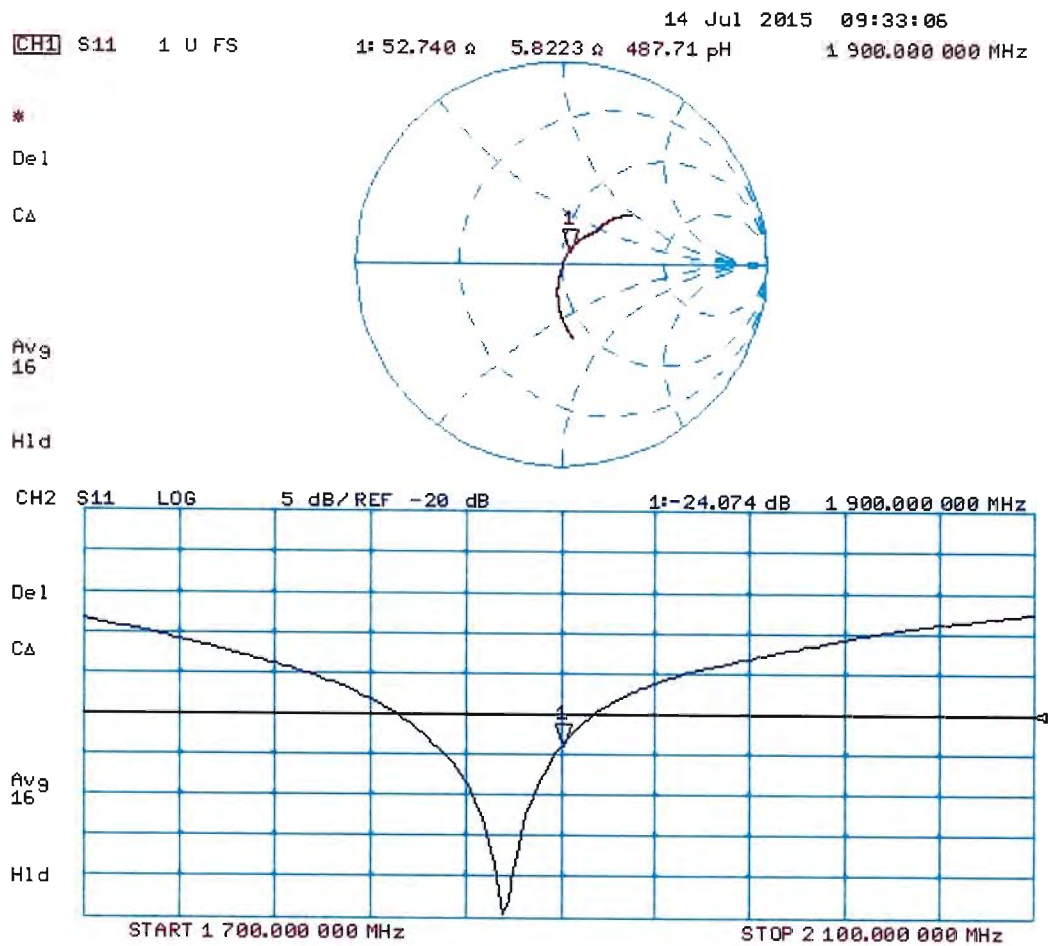
Peak SAR (extrapolated) = 18.5 W/kg

SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.34 W/kg

Maximum value of SAR (measured) = 12.8 W/kg



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 14.07.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d207

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.54$ S/m; $\epsilon_r = 52.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.65, 4.65, 4.65); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- 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:

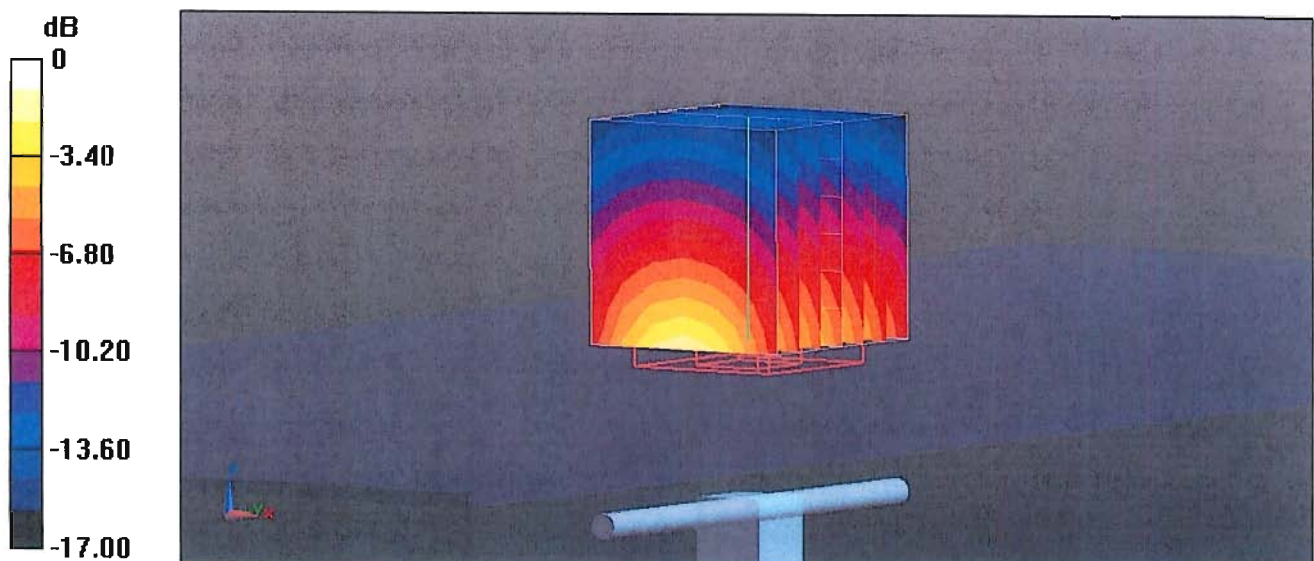
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.84 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 17.2 W/kg

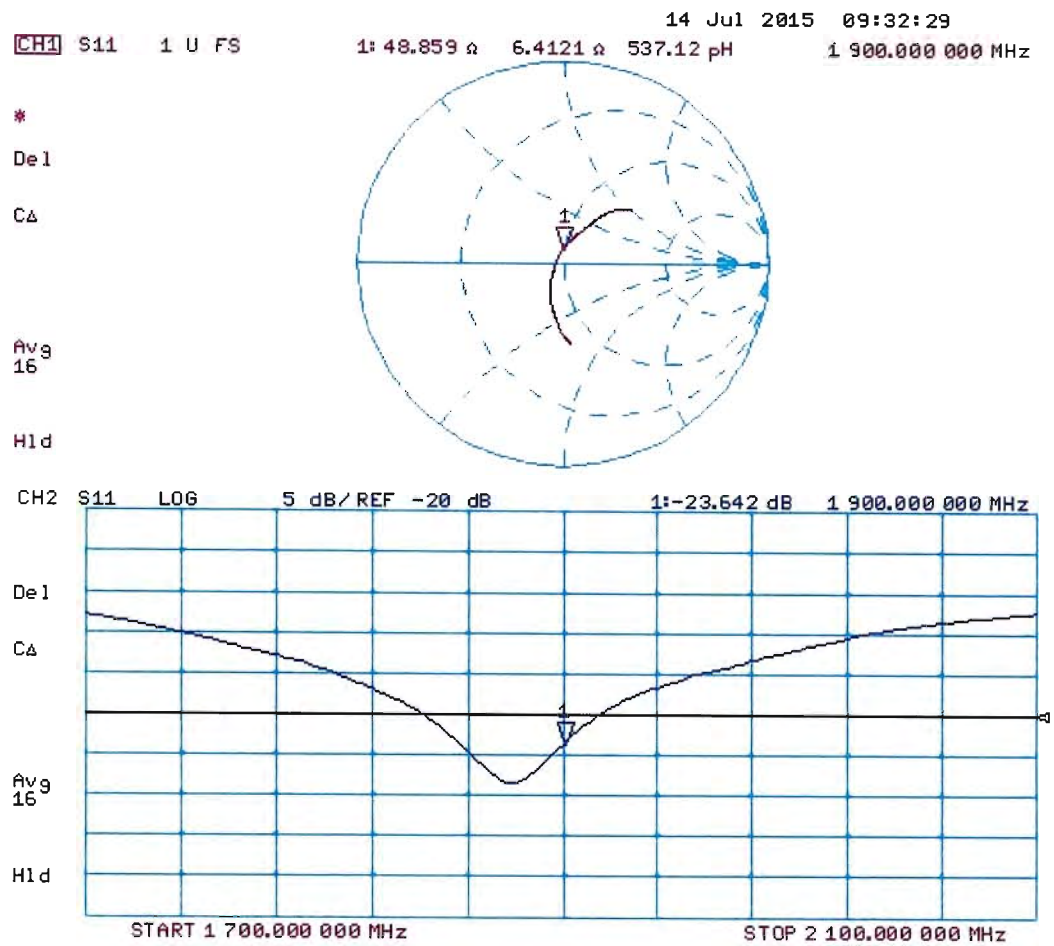
SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.47 W/kg

Maximum value of SAR (measured) = 12.9 W/kg



0 dB = 12.9 W/kg = 11.11 dBW/kg

Impedance Measurement Plot for Body TSL





Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 0108**

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

Client **BACL**

Certificate No: **D2450V2-969_Jul15**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN:969**

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

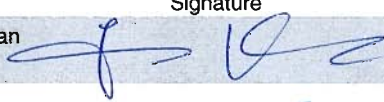
Calibration date: **July 08, 2015**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter 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: 5058 (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 ES3DV3	SN: 3205	30-Dec-14 (No. ES3-3205_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

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

Issued: July 9, 2015

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



Accredited by the Swiss Accreditation Service (SAS)

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

Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	37.9 $\pm$ 6 %	1.88 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.7 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	53.3 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (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	25.2 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	52.4 $\pm$ 6 %	2.03 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.2 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	51.7 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.15 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	24.3 W/kg $\pm$ 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$54.2 \Omega + 1.3 j\Omega$
Return Loss	- 27.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$50.9 \Omega + 3.1 j\Omega$
Return Loss	- 29.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.156 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	November 19, 2014

DASY5 Validation Report for Head TSL

Date: 08.07.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:969

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.88$ S/m; $\epsilon_r = 37.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.54, 4.54, 4.54); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- 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:

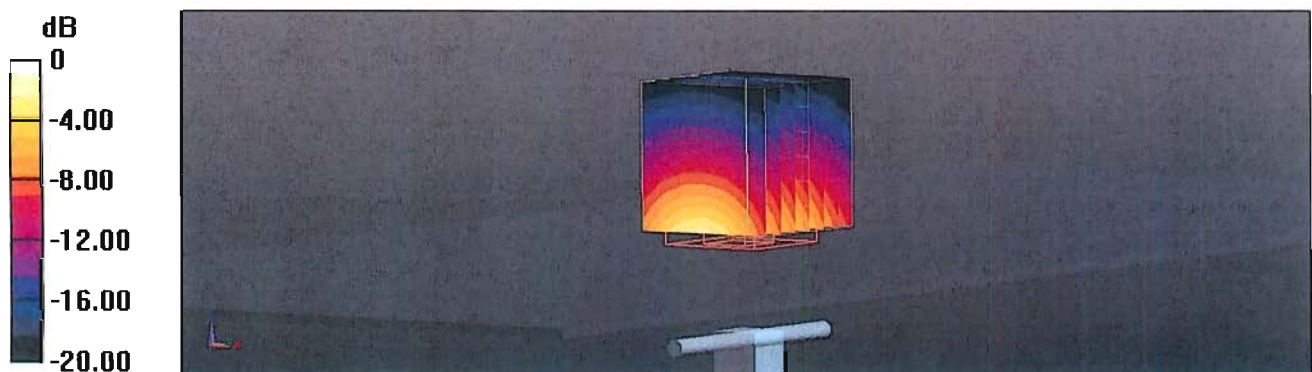
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 100.8 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 28.0 W/kg

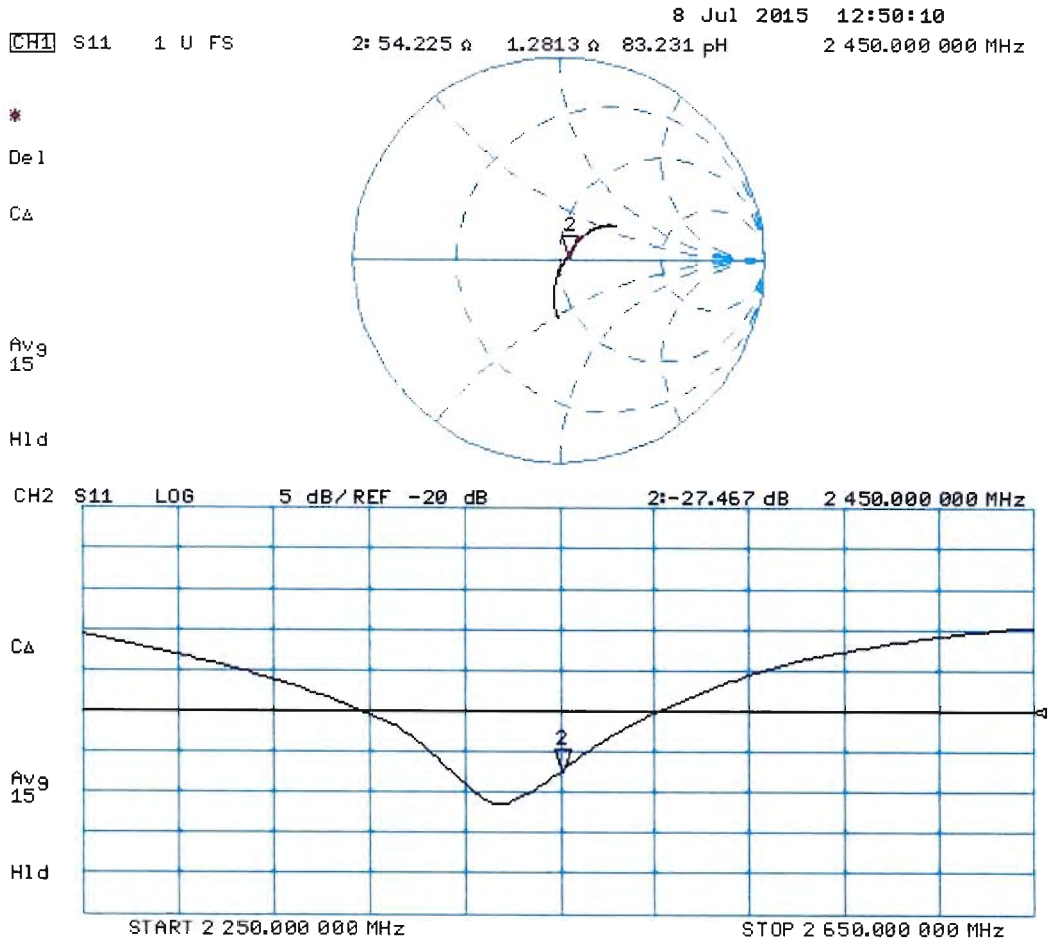
SAR(1 g) = 13.7 W/kg; SAR(10 g) = 6.41 W/kg

Maximum value of SAR (measured) = 17.8 W/kg



0 dB = 17.8 W/kg = 12.50 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 08.07.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:969

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 2.03$ S/m; $\epsilon_r = 52.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.32, 4.32, 4.32); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- 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:

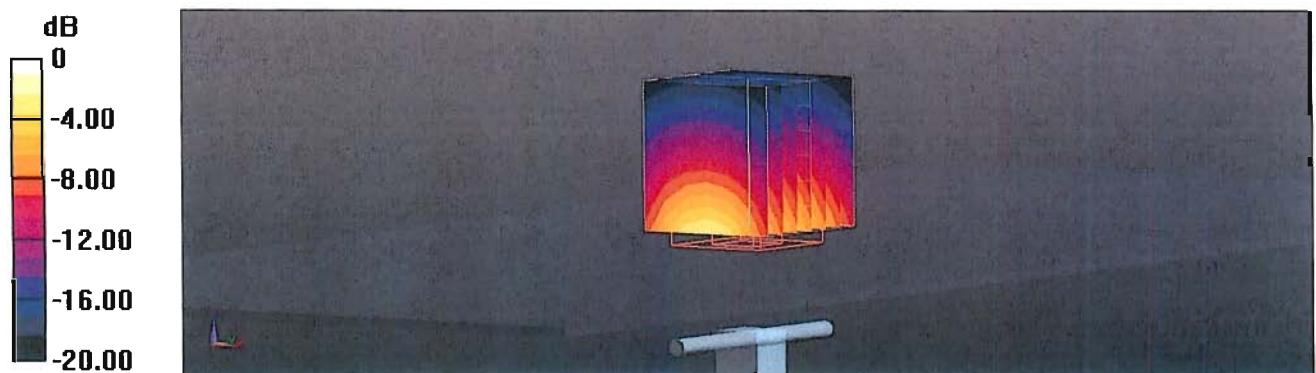
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.22 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 27.0 W/kg

SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.15 W/kg

Maximum value of SAR (measured) = 17.4 W/kg



0 dB = 17.4 W/kg = 12.41 dBW/kg

Impedance Measurement Plot for Body TSL

