



Appendix C. SAR Spot Check Data

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1. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	835MHz System Validation Kit	D835V2	499	Mar. 21, 2016	Mar. 20, 2017
SPEAG	1900MHz System Validation Kit	D1900V2	5d041	Sep. 30, 2016	Sep. 29, 2017
SPEAG	2450MHz System Validation Kit	D2450V2	926	Jul. 25, 2016	Jul. 24, 2017
SPEAG	2600MHz System Validation Kit	D2600V2	1008	Aug. 30, 2016	Aug. 29, 2017
SPEAG	Data Acquisition Electronics	DAE3	495	May. 27, 2016	May. 26, 2017
SPEAG	Data Acquisition Electronics	DAE4	914	Jan. 06, 2017	Jan. 05, 2018
SPEAG	Data Acquisition Electronics	DAE4	1388	Oct. 10, 2016	Oct. 09, 2017
SPEAG	Dosimetric E-Field Probe	EX3DV4	3697	Oct. 25, 2016	Oct. 24, 2017
SPEAG	Dosimetric E-Field Probe	EX3DV4	3925	May. 26, 2016	May. 25, 2017
SPEAG	Dosimetric E-Field Probe	EX3DV4	3578	May. 11, 2016	May. 10, 2017
WonDer	Thermometer	WD-5015	TM642	Oct. 12, 2016	Oct. 11, 2017
WonDer	Thermometer	WD-5015	TM281	Oct. 12, 2016	Oct. 11, 2017
Anritsu	Radio Communication Analyzer	MT8820C	6201381760	May. 10, 2016	May. 09, 2017
Agilent	Wireless Communication Test Set	E5515C	MY50266977	May. 17, 2016	May. 16, 2017
SPEAG	Device Holder	N/A	N/A	N/A	N/A
Anritsu	Signal Generator	MG3710A	6201502524	Dec. 09, 2016	Dec. 08, 2017
Agilent	ENA Network Analyzer	E5071C	MY46316648	Jan. 04, 2017	Jan. 03, 2018
SPEAG	Dielectric Probe Kit	DAK-3.5	1126	Jul. 19, 2016	Jul. 18, 2017
LINE SEIKI	Digital Thermometer	LKMelectronic	DTM3000SPEZIAL	Sep. 05, 2016	Sep. 04, 2017
Anritsu	Power Meter	ML2495A	1419002	May. 10, 2016	May. 09, 2017
Anritsu	Power Sensor	MA2411B	1339124	May. 10, 2016	May. 09, 2017
Agilent	Spectrum Analyzer	E4408B	MY44211028	Aug. 22, 2016	Aug. 21, 2017
Mini-Circuits	Power Amplifier	ZVE-8G+	D120604	Mar. 16, 2016	Mar. 15, 2017
Mini-Circuits	Power Amplifier	ZHL-42W+	QA1344002	Mar. 16, 2016	Mar. 15, 2017
ATM	Dual Directional Coupler	C122H-10	P610410z-02	Note 1	
Woken	Attenuator 1	WK0602-XX	N/A	Note 1	
PE	Attenuator 2	PE7005-10	N/A	Note 1	
PE	Attenuator 3	PE7005- 3	N/A	Note 1	

General Note:

1. Prior to system verification and validation, the path loss from the signal generator to the system check source and the power meter, which includes the amplifier, cable, attenuator and directional coupler, was measured by the network analyzer. The reading of the power meter was offset by the path loss difference between the path to the power meter and the path to the system check source to monitor the actual power level fed to the system check source.

2. System Verification

2.1 Tissue Simulating Liquids

For the measurement of the field distribution inside the SAM phantom with DASY, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 10.1. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 10.2.

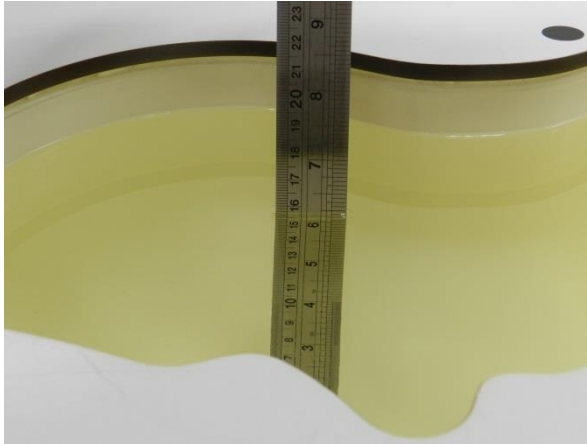


Fig 10.1 Photo of Liquid Height for Head SAR

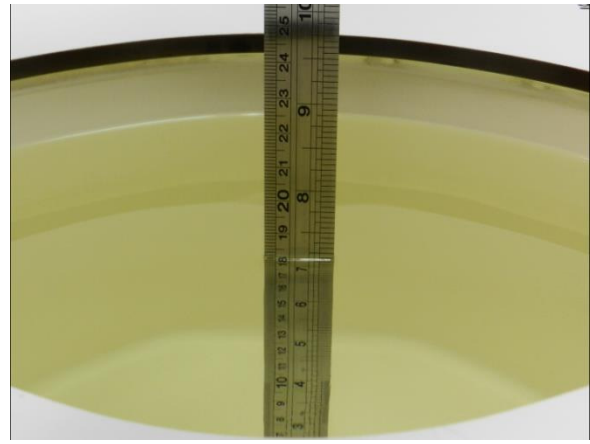


Fig 10.2 Photo of Liquid Height for Body SAR



2.2 Tissue Verification

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (ϵ_r)
For Head								
750	41.1	57.0	0.2	1.4	0.2	0	0.89	41.9
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
900	40.3	57.9	0.2	1.4	0.2	0	0.97	41.5
1800, 1900, 2000	55.2	0	0	0.3	0	44.5	1.40	40.0
2450	55.0	0	0	0	0	45.0	1.80	39.2
2600	54.8	0	0	0.1	0	45.1	1.96	39.0
For Body								
750	51.7	47.2	0	0.9	0.1	0	0.96	55.5
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
900	50.8	48.2	0	0.9	0.1	0	1.05	55.0
1800, 1900, 2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2450	68.6	0	0	0	0	31.4	1.95	52.7
2600	68.1	0	0	0.1	0	31.8	2.16	52.5

Simulating Liquid for 5GHz, Manufactured by SPEAG

Ingredients	(% by weight)
Water	64~78%
Mineral oil	11~18%
Emulsifiers	9~15%
Additives and Salt	2~3%

<Tissue Dielectric Parameter Check Results>

Frequency (MHz)	Tissue Type	Liquid Temp. (°C)	Conductivity (σ)	Permittivity (ϵ_r)	Conductivity Target (σ)	Permittivity Target (ϵ_r)	Delta (σ) (%)	Delta (ϵ_r) (%)	Limit (%)	Date
835	HSL	22.4	0.884	42.834	0.90	41.50	-1.78	3.21	±5	2017/2/11
835	MSL	22.4	0.933	53.826	0.97	55.20	-3.81	-2.49	±5	2017/2/11
1900	HSL	22.4	1.450	39.750	1.40	40.00	3.57	-0.63	±5	2017/2/11
1900	MSL	22.4	1.552	55.169	1.52	53.30	2.11	3.51	±5	2017/2/13
2450	HSL	22.6	1.789	39.045	1.80	39.20	-0.61	-0.40	±5	2017/2/24
2450	MSL	22.3	1.970	54.300	1.95	52.70	1.03	3.04	±5	2017/2/24
2600	HSL	22.3	1.953	39.775	1.96	39.00	-0.36	1.99	±5	2017/2/14
2600	MSL	22.3	2.206	54.200	2.16	52.50	2.13	3.24	±5	2017/2/14

2.3 System Performance Check Results

Comparing to the original SAR value provided by SPEAG, the verification data should be within its specification of 10 %. Below table shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance check can meet the variation criterion and the plots can be referred to section 3.

Date	Frequency (MHz)	Tissue Type	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured 1g SAR (W/kg)	Targeted 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Deviation (%)
2017/2/11	835	HSL	250	D835V2-499	EX3DV4 - SN3925	DAE3 Sn495	2.36	9.14	9.44	3.28
2017/2/11	835	MSL	250	D835V2-499	EX3DV4 - SN3925	DAE3 Sn495	2.42	9.52	9.68	1.68
2017/2/11	1900	HSL	250	D1900V2-5d041	EX3DV4 - SN3697	DAE4 Sn1388	10.40	40.50	41.60	2.72
2017/2/13	1900	MSL	250	D1900V2-5d041	EX3DV4 - SN3925	DAE3 Sn495	10.10	38.80	40.40	4.12
2017/2/24	2450	HSL	250	D2450V2-926	EX3DV4 - SN3578	DAE4 Sn914	13.20	52.80	52.80	0.00
2017/2/24	2450	MSL	250	D2450V2-926	EX3DV4 - SN3925	DAE3 Sn495	12.80	51.20	51.20	0.00
2017/2/14	2600	HSL	250	D2600V2-1008	EX3DV4 - SN3925	DAE3 Sn495	14.20	56.80	56.80	0.00
2017/2/14	2600	MSL	250	D2600V2-1008	EX3DV4 - SN3925	DAE3 Sn495	13.50	55.20	54.00	-2.17

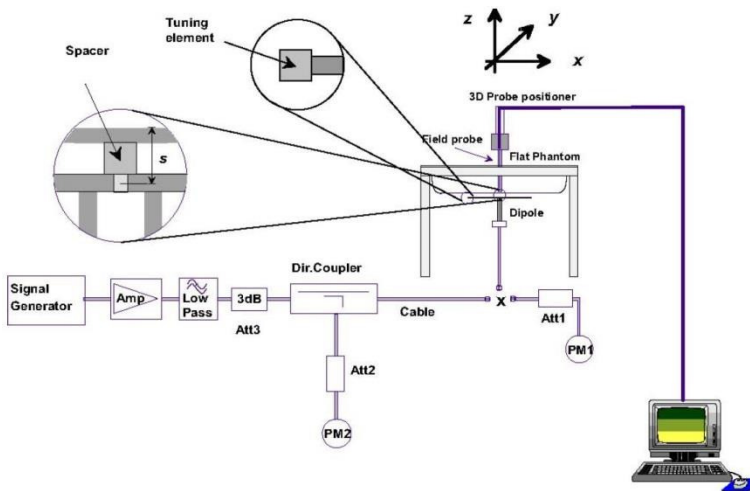


Fig 8.3.1 System Performance Check Setup



Fig 8.3.2 Setup Photo



3. Plots of System Performance Check

The plots are shown as follows.

System Check_Head_835MHz

DUT: D835V2-499

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

Medium: HSL_850_170211 Medium parameters used: $f = 835$ MHz; $\sigma = 0.884$ S/m; $\epsilon_r = 42.834$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.4 °C ; Liquid Temperature : 22.4 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3925; ConvF(9.92, 9.92, 9.92); Calibrated: 2016/5/26;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: SM000T01DA; Serial: TP:1303
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7373)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 3.13 W/kg

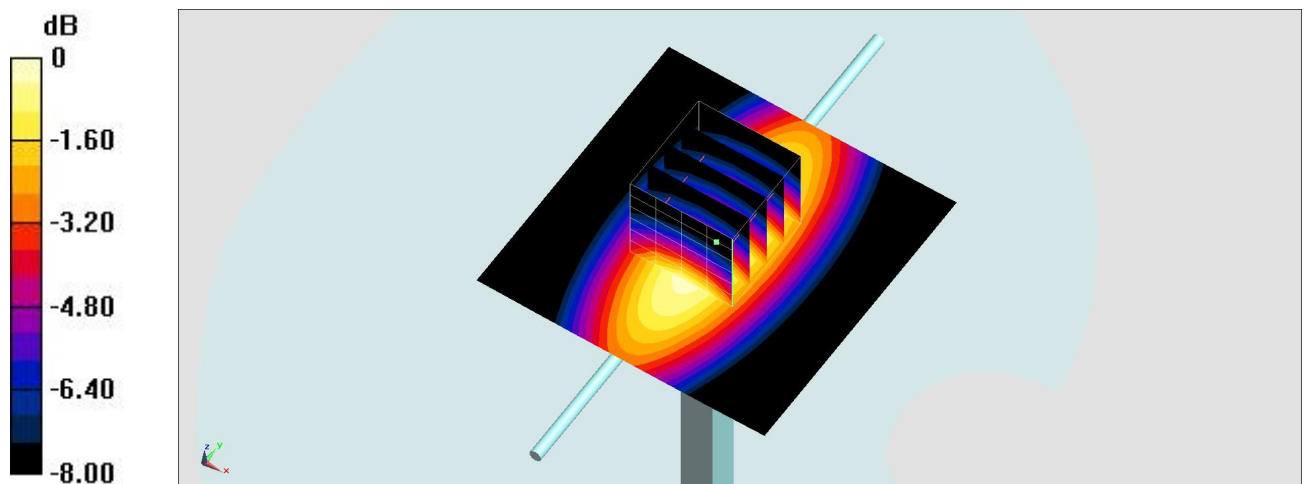
Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 62.24 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 3.51 W/kg

SAR(1 g) = 2.36 W/kg; SAR(10 g) = 1.56 W/kg

Maximum value of SAR (measured) = 3.11 W/kg



0 dB = 3.11 W/kg = 4.93 dBW/kg

System Check_Body_835MHz

DUT: D835V2-499

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

Medium: MSL_850_170211 Medium parameters used: $f = 835$ MHz; $\sigma = 0.933$ S/m; $\epsilon_r = 53.826$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.4 °C; Liquid Temperature : 22.4 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3925; ConvF(9.91, 9.91, 9.91); Calibrated: 2016/5/26;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: SM000T01DA; Serial: TP:1303
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7373)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 3.16 W/kg

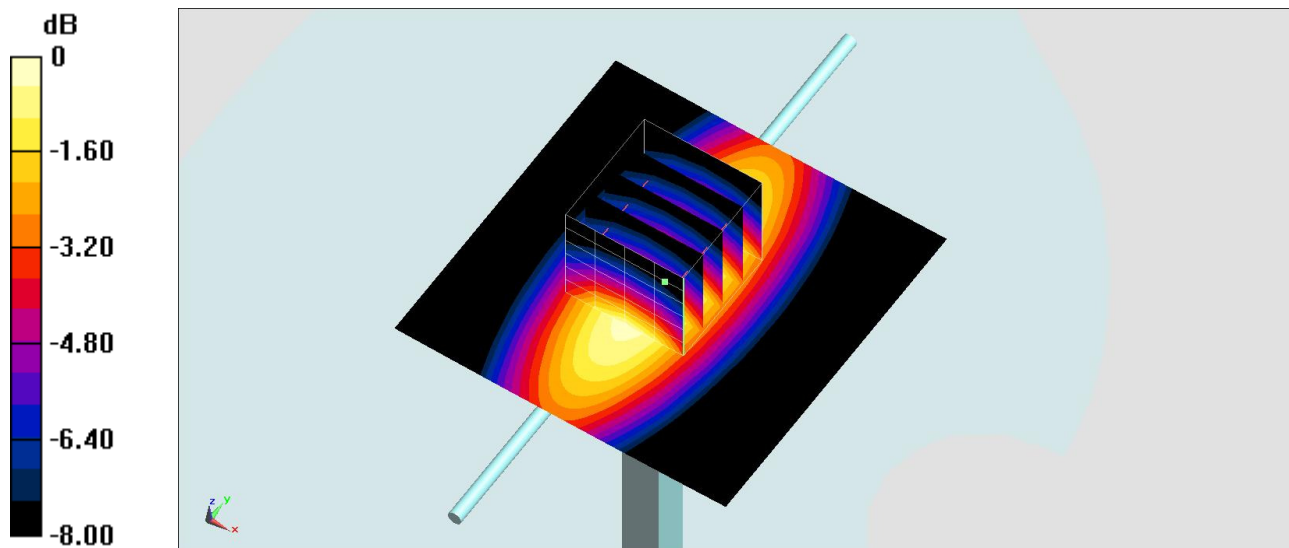
Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 60.79 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 3.55 W/kg

SAR(1 g) = 2.42 W/kg; SAR(10 g) = 1.62 W/kg

Maximum value of SAR (measured) = 3.16 W/kg



0 dB = 3.16 W/kg = 5.00 dBW/kg

System Check_Head_1900MHz

DUT: D1900V2-5d041

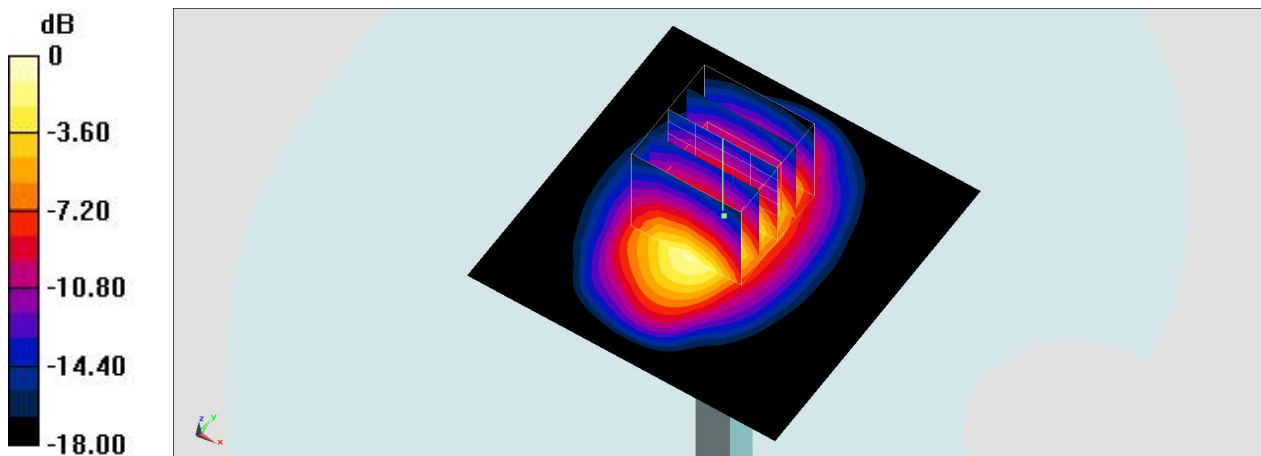
Communication System: CW ; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: HSL1900_170211 Medium parameters used: $f = 1900$ MHz; $\sigma = 1.45$ S/m; $\epsilon_r = 39.75$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.4 °C; Liquid Temperature : 22.4 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3697; ConvF(7.45, 7.45, 7.45); Calibrated: 2016/10/25;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1388; Calibrated: 2016/10/10
- Phantom: SAM LEFT; Type: QD000P40CD; Serial: TP:1718
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7373)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 16.1 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 64.68 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 19.1 W/kg
SAR(1 g) = 10.4 W/kg; SAR(10 g) = 5.37 W/kg
Maximum value of SAR (measured) = 15.8 W/kg



0 dB = 15.8 W/kg = 11.99 dBW/kg

System Check_Body_1900MHz

DUT: D1900V2-5d041

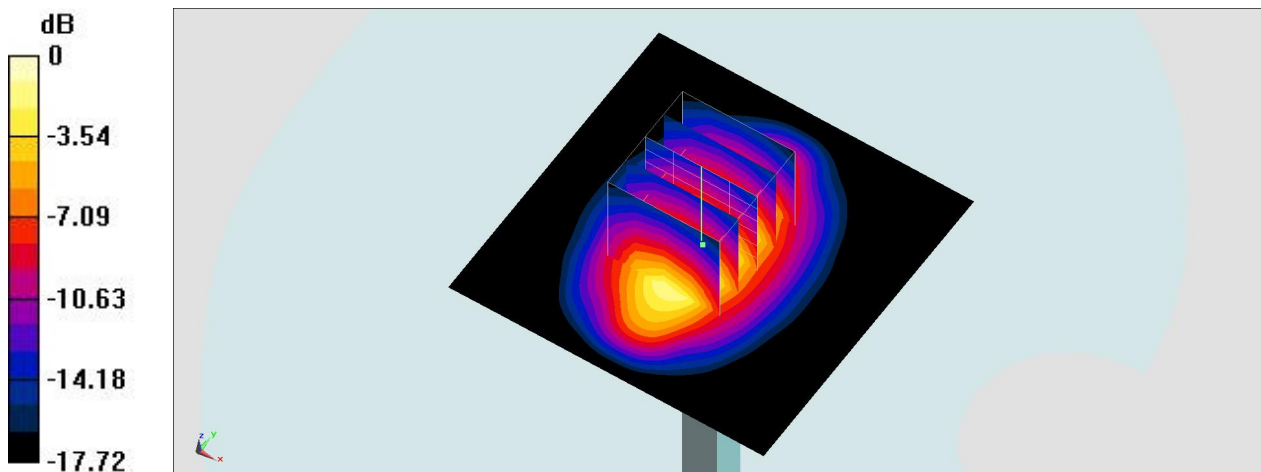
Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: MSL_1900_170213 Medium parameters used: $f = 1900$ MHz; $\sigma = 1.552$ S/m; $\epsilon_r = 55.169$;
 $\rho = 1000$ kg/m³
Ambient Temperature : 23.4 °C; Liquid Temperature : 22.4 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3925; ConvF(8, 8, 8); Calibrated: 2016/5/26;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: SM000T01DA; Serial: TP:1303
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7373)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 16.3 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 105.7 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 18.1 W/kg
SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.26 W/kg
Maximum value of SAR (measured) = 15.3 W/kg



0 dB = 15.3 W/kg = 11.85 dBW/kg

System Check_Head_2450MHz

DUT: D2450V2-926

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

Medium: HSL_2450_170224 Medium parameters used: $f = 2450$ MHz; $\sigma = 1.789$ S/m; $\epsilon_r = 39.045$;

$\rho = 1000$ kg/m³

Ambient Temperature : 23.6 °C ; Liquid Temperature : 22.6 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3578; ConvF(7.28, 7.28, 7.28); Calibrated: 2016/5/11;

- Sensor-Surface: 1.4mm (Mechanical Surface Detection)

- Electronics: DAE4 Sn914; Calibrated: 2017/1/6

- Phantom: SAM_Right; Type: SM000T01DA; Serial: TP:1303

- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7373)

Pin=250mW/Area Scan (81x81x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

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

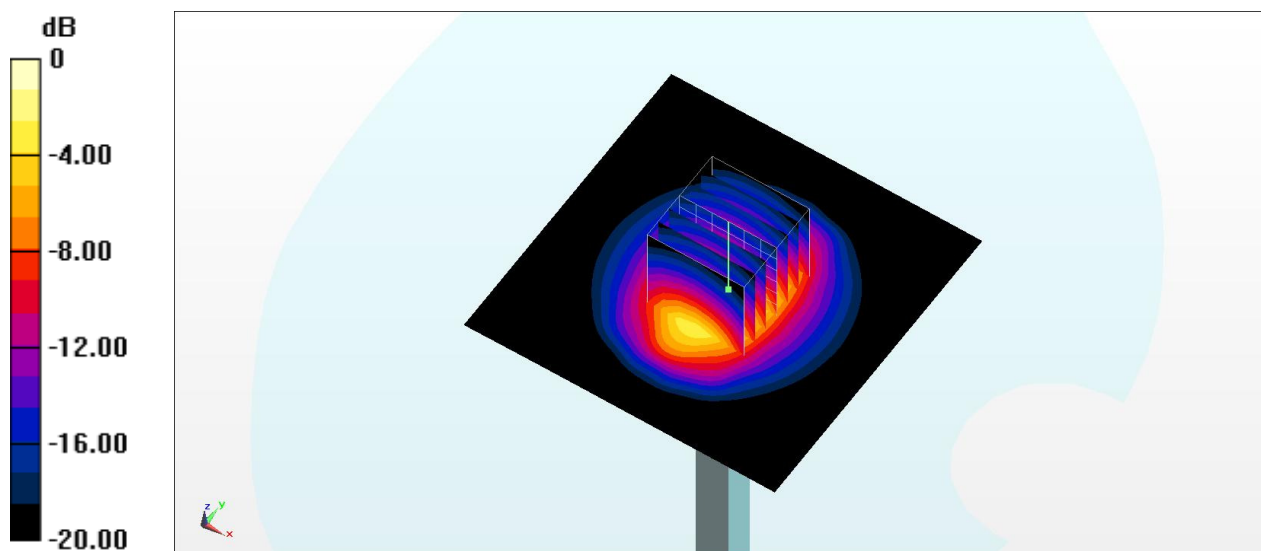
Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 112.4 V/m; Power Drift = -0.16 dB

Peak SAR (extrapolated) = 26.6 W/kg

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

Maximum value of SAR (measured) = 21.9 W/kg



0 dB = 21.9 W/kg = 13.40 dBW/kg

System Check_Body_2450MHz

DUT: D2450V2-926

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

Medium: MSL_2450_170224 Medium parameters used: $f = 2450$ MHz; $\sigma = 1.97$ S/m; $\epsilon_r = 54.332$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.3 °C; Liquid Temperature : 22.3 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3925; ConvF(7.64, 7.64, 7.64); Calibrated: 2016/5/26;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: QD000P40CD; Serial: TP:1383
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7373)

Pin=250mW/Area Scan (71x71x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 21.0 W/kg

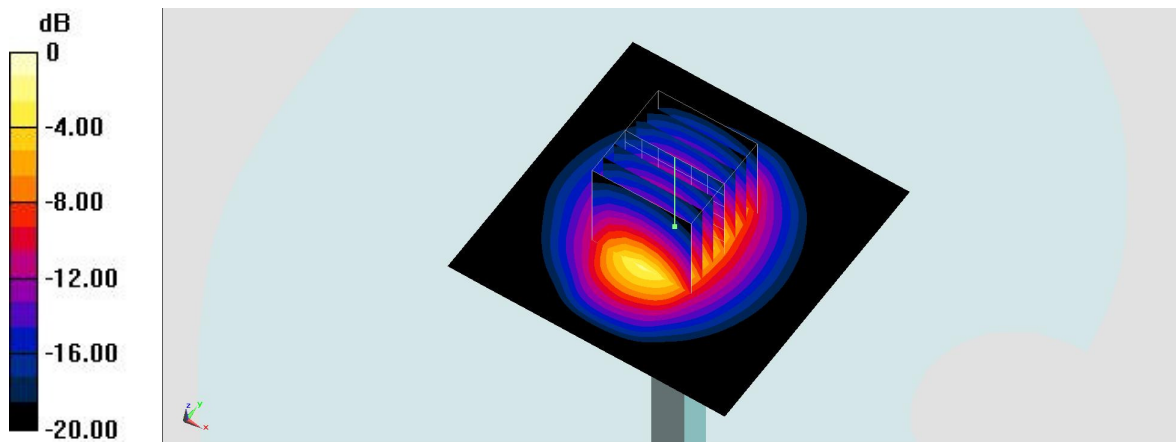
Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 106.0 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 26.3 W/kg

SAR(1 g) = 12.8 W/kg; SAR(10 g) = 5.97 W/kg

Maximum value of SAR (measured) = 21.4 W/kg



0 dB = 21.4 W/kg = 13.30 dBW/kg

System Check_Head_2600MHz

DUT: D2600V2-1008

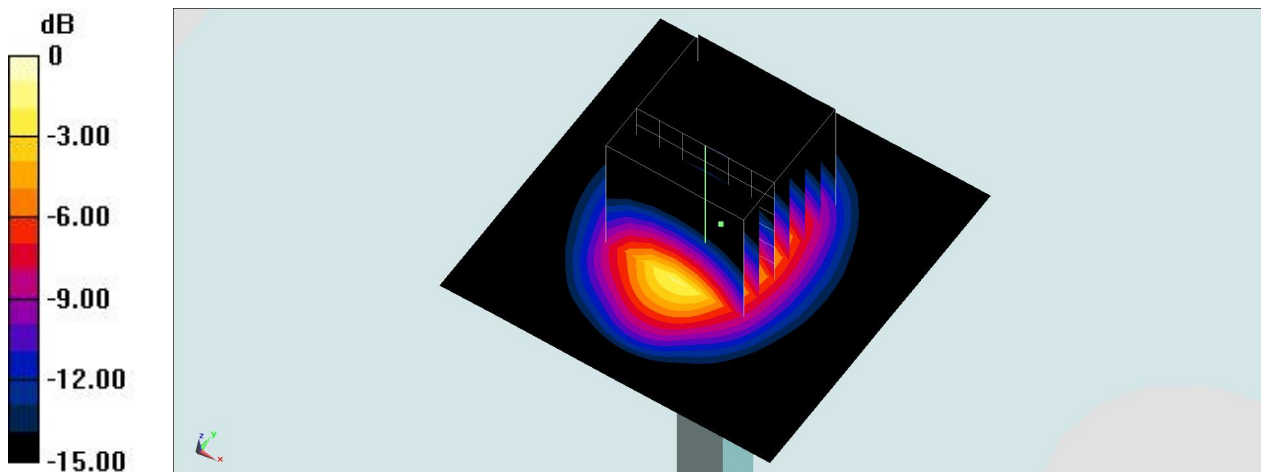
Communication System: CW ; Frequency: 2600 MHz;Duty Cycle: 1:1
Medium: HSL_2600_170214 Medium parameters used: $f = 2600$ MHz; $\sigma = 1.953$ S/m; $\epsilon_r = 39.775$;
 $\rho = 1000$ kg/m³
Ambient Temperature : 23.3 °C ; Liquid Temperature : 22.3 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3925; ConvF(7.28, 7.28, 7.28); Calibrated: 2016/5/26;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: SM000T01DA; Serial: TP:1303
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7373)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 21.8 W/kg

Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 106.7 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 30.3 W/kg
SAR(1 g) = 14.2 W/kg; SAR(10 g) = 6.29 W/kg
Maximum value of SAR (measured) = 22.1 W/kg



0 dB = 22.1 W/kg = 13.44 dBW/kg

System Check_Body_2600MHz

DUT: D2600V2-1008

Communication System: CW ; Frequency: 2600 MHz;Duty Cycle: 1:1

Medium: MSL_2600_170214 Medium parameters used: $f = 2600$ MHz; $\sigma = 2.206$ S/m; $\epsilon_r = 54.2$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.3 °C; Liquid Temperature : 22.3 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3925; ConvF(7.38, 7.38, 7.38); Calibrated: 2016/5/26;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: SM000T01DA; Serial: TP:1303
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7373)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

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

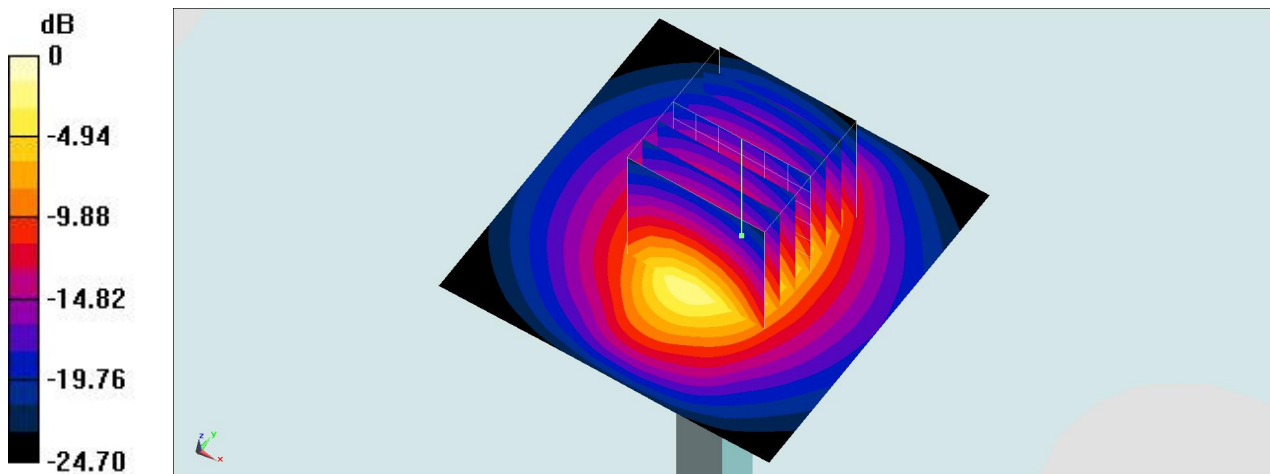
Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 100.8 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 29.8 W/kg

SAR(1 g) = 13.5 W/kg; SAR(10 g) = 5.96 W/kg

Maximum value of SAR (measured) = 23.3 W/kg





4. Plots of Spot Check SAR

The plots are shown as follows.

#01_GSM850_GPRS (4 Tx slots)_Right Cheek_Ch251

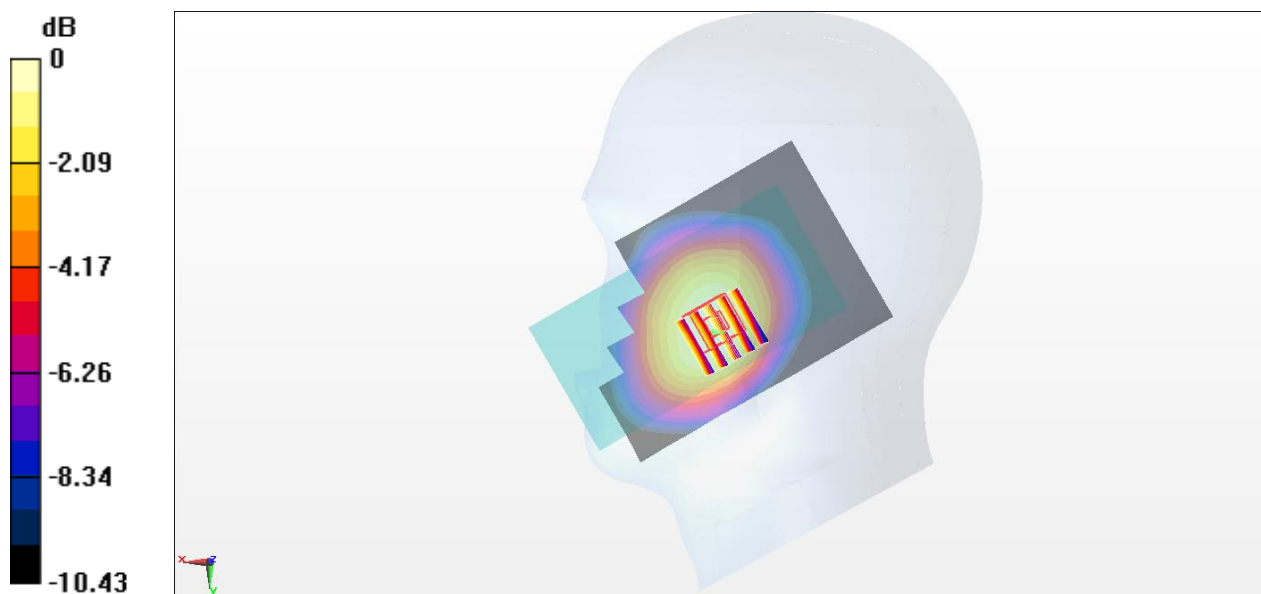
Communication System: GSM850; Frequency: 848.8 MHz; Duty Cycle: 1:2.08
 Medium: HSL_850_170211 Medium parameters used: $f = 849 \text{ MHz}$; $\sigma = 0.896 \text{ S/m}$; $\epsilon_r = 42.659$;
 $\rho = 1000 \text{ kg/m}^3$
 Ambient Temperature : $23.4 \text{ }^\circ\text{C}$; Liquid Temperature : $22.4 \text{ }^\circ\text{C}$

DASY5 Configuration

- Probe: EX3DV4 - SN3925; ConvF(9.92, 9.92, 9.92); Calibrated: 2016/5/26;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: SM000T01DA; Serial: TP:1303
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7373)

Area Scan (71x121x1): Interpolated grid: $dx=1.500 \text{ mm}$, $dy=1.500 \text{ mm}$
 Maximum value of SAR (interpolated) = 0.886 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$
 Reference Value = 32.06 V/m ; Power Drift = 0.02 dB
 Peak SAR (extrapolated) = 0.950 W/kg
SAR(1 g) = 0.662 W/kg ; SAR(10 g) = 0.535 W/kg
 Maximum value of SAR (measured) = 0.887 W/kg



0 dB = 0.887 W/kg = -0.52 dBW/kg

#02_GSM1900_GPRS (4 Tx slots)_Left Cheek_Ch810

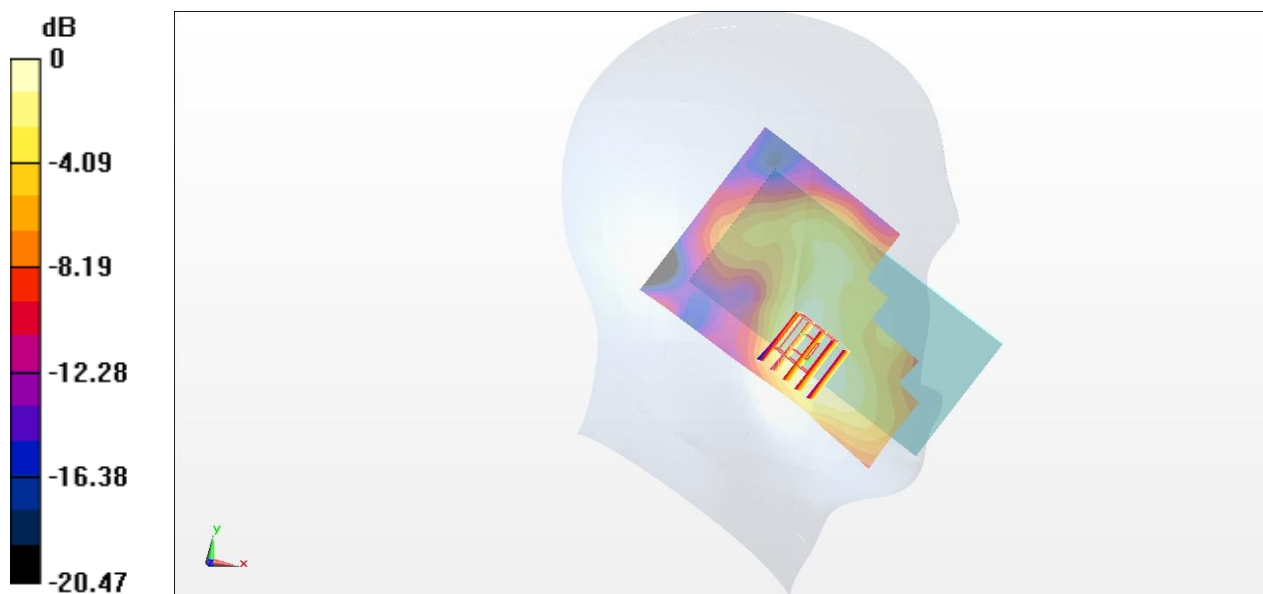
Communication System: PCS ; Frequency: 1909.8 MHz;Duty Cycle: 1:2.08
Medium: HSL1900_170211 Medium parameters used: $f = 1909.8$ MHz; $\sigma = 1.48$ S/m; $\epsilon_r = 39.6$;
 $\rho = 1000$ kg/m³
Ambient Temperature : 23.4 °C; Liquid Temperature : 22.4 °C

DASY5 Configuration

- Probe: EX3DV4 - SN3697; ConvF(7.45, 7.45, 7.45); Calibrated: 2016/10/25;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1388; Calibrated: 2016/10/10
- Phantom: SAM LEFT; Type: QD000P40CD; Serial: TP:1718
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7373)

Area Scan (71x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.125 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.468 V/m; Power Drift = -0.14 dB
Peak SAR (extrapolated) = 0.134 W/kg
SAR(1 g) = 0.125 W/kg; SAR(10 g) = 0.061 W/kg
Maximum value of SAR (measured) = 0.120 W/kg



0 dB = 0.120 W/kg = -9.55 dBW/kg

#03_WCDMA V_RMC 12.2Kbps_Right Cheek_Ch4233

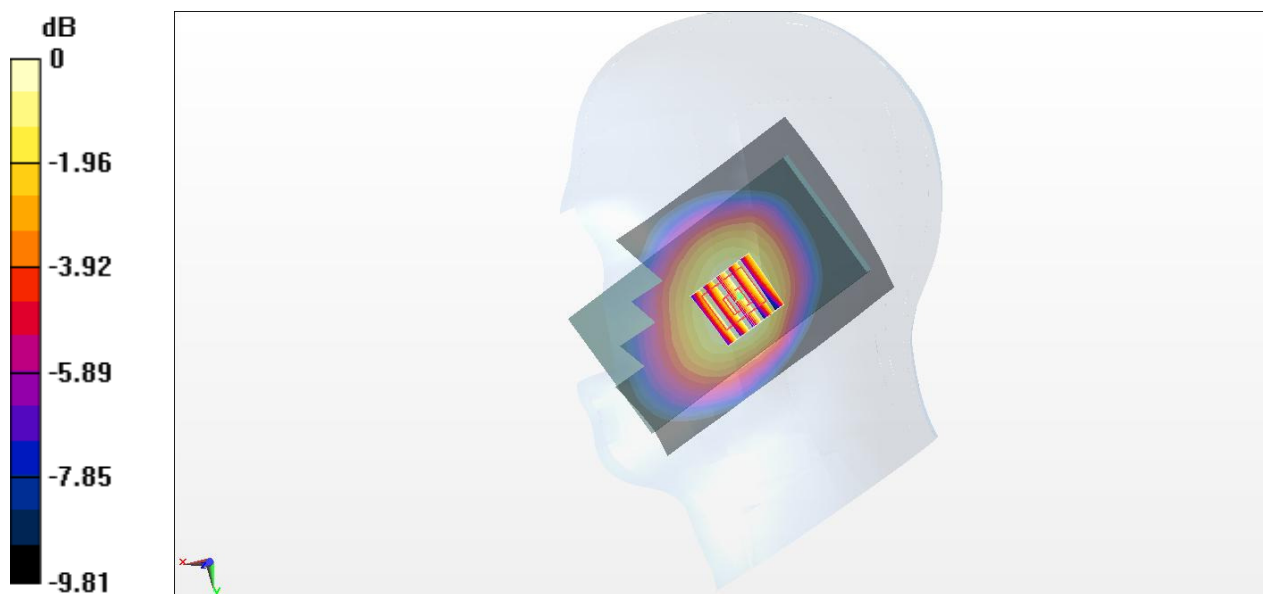
Communication System: WCDMA ; Frequency: 846.6 MHz; Duty Cycle: 1:1
 Medium: HSL_850_170211 Medium parameters used: $f = 847 \text{ MHz}$; $\sigma = 0.894 \text{ S/m}$; $\epsilon_r = 42.684$;
 $\rho = 1000 \text{ kg/m}^3$
 Ambient Temperature : $23.4 \text{ }^\circ\text{C}$; Liquid Temperature : $22.4 \text{ }^\circ\text{C}$

DASY5 Configuration

- Probe: EX3DV4 - SN3925; ConvF(9.92, 9.92, 9.92); Calibrated: 2016/5/26;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: SM000T01DA; Serial: TP:1303
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7373)

Area Scan (71x121x1): Interpolated grid: $dx=1.500 \text{ mm}$, $dy=1.500 \text{ mm}$
 Maximum value of SAR (interpolated) = 0.619 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$
 Reference Value = 27.13 V/m ; Power Drift = 0.01 dB
 Peak SAR (extrapolated) = 0.673 W/kg
SAR(1 g) = 0.511 W/kg ; SAR(10 g) = 0.397 W/kg
 Maximum value of SAR (measured) = 0.625 W/kg



0 dB = 0.625 W/kg = -2.04 dBW/kg

#04_LTE Band 7_20M_QPSK_1_0_Left Cheek_Ch20850

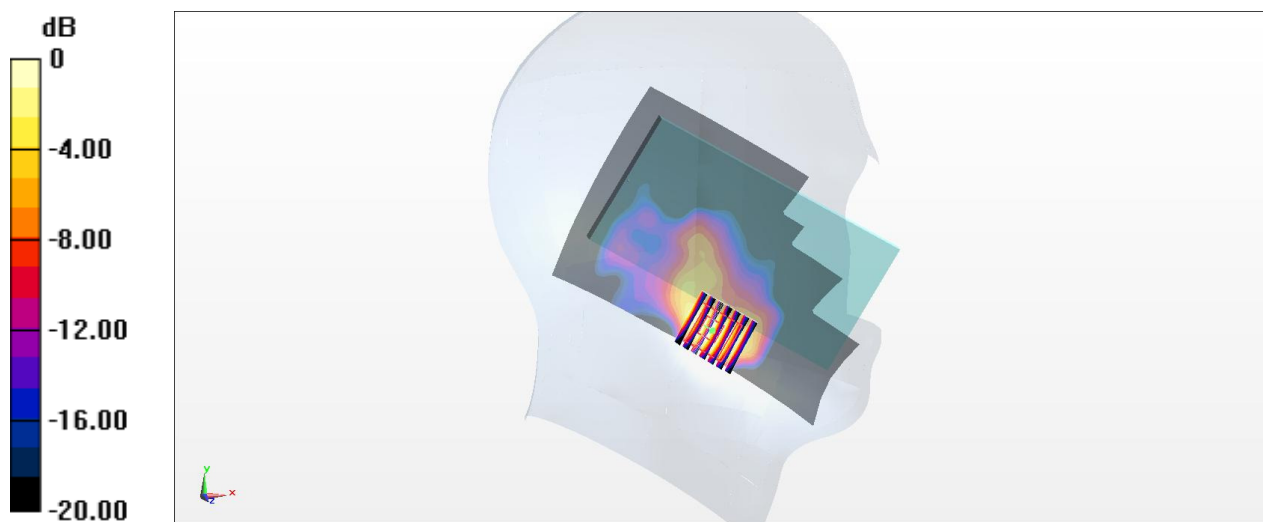
Communication System: LTE ; Frequency: 2510 MHz;Duty Cycle: 1:1
 Medium: HSL_2600_170214 Medium parameters used: $f = 2510 \text{ MHz}$; $\sigma = 1.851 \text{ S/m}$; $\epsilon_r = 40.074$;
 $\rho = 1000 \text{ kg/m}^3$
 Ambient Temperature : $23.3 \text{ }^\circ\text{C}$; Liquid Temperature : $22.3 \text{ }^\circ\text{C}$

DASY5 Configuration:

- Probe: EX3DV4 - SN3925; ConvF(7.28, 7.28, 7.28); Calibrated: 2016/5/26;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: SM000T01DA; Serial: TP:1303
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7373)

Area Scan (91x151x1): Interpolated grid: $dx=1.200 \text{ mm}$, $dy=1.200 \text{ mm}$
 Maximum value of SAR (interpolated) = 0.749 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$
 Reference Value = 19.84 V/m ; Power Drift = -0.16 dB
 Peak SAR (extrapolated) = 0.772 W/kg
SAR(1 g) = 0.495 W/kg ; SAR(10 g) = 0.217 W/kg
 Maximum value of SAR (measured) = 0.642 W/kg



0 dB = 0.642 W/kg = -1.34 dBW/kg

#05_WLAN2.4GHz_802.11b 1Mbps_Right Cheek_Ch6

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

Medium: HSL_2450_170224 Medium parameters used: $f = 2437$ MHz; $\sigma = 1.775$ S/m; $\epsilon_r = 39.099$;

$\rho = 1000$ kg/m³

Ambient Temperature : 23.6 °C ; Liquid Temperature : 22.6 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3578; ConvF(7.28, 7.28, 7.28); Calibrated: 2016/5/11;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn914; Calibrated: 2017/1/6
- Phantom: SAM_Right; Type: SM000T01DA; Serial: TP:1303
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7373)

Area Scan (81x151x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 1.71 W/kg

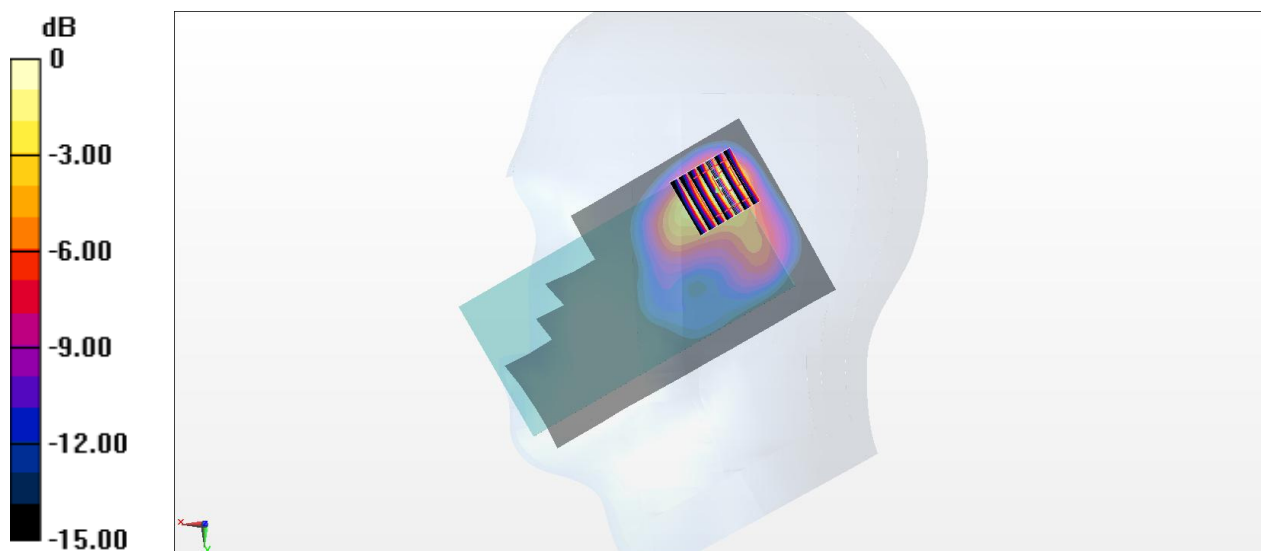
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 18.39 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 2.05 W/kg

SAR(1 g) = 0.940 W/kg; SAR(10 g) = 0.428 W/kg

Maximum value of SAR (measured) = 1.50 W/kg



0 dB = 1.50 W/kg = 1.76 dBW/kg

#06_GSM850_GPRS (4 Tx slots)_Back_10mm_Ch251

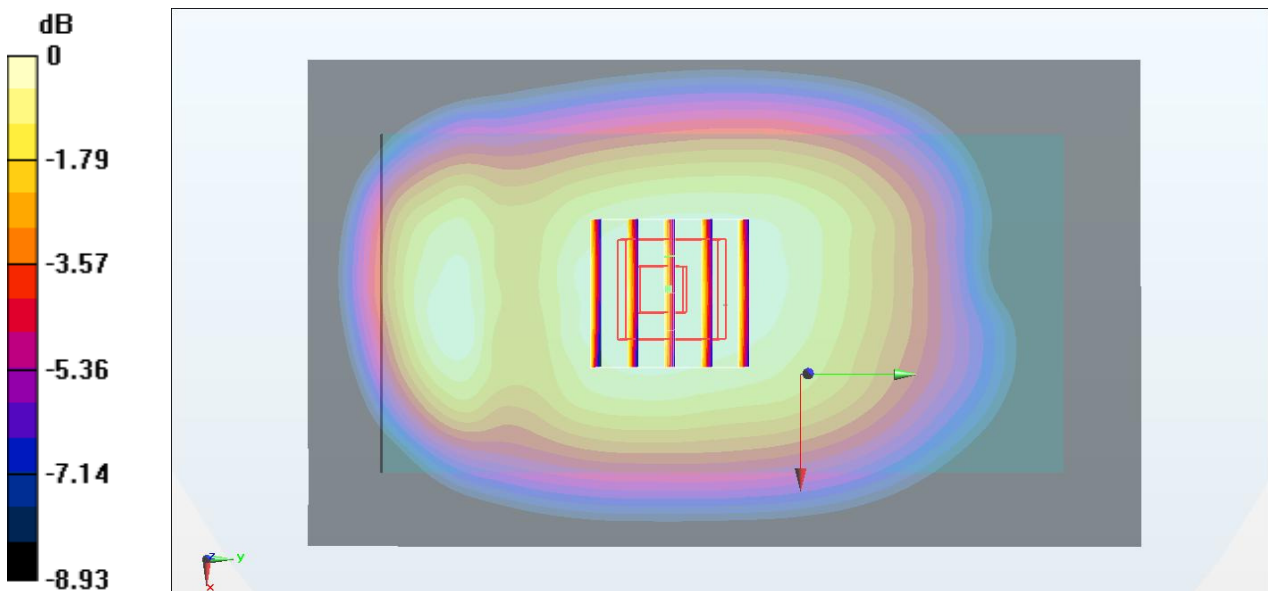
Communication System: GSM850; Frequency: 848.8 MHz; Duty Cycle: 1:2.08
Medium: MSL_850_170211 Medium parameters used: $f = 849$ MHz; $\sigma = 0.946$ S/m; $\epsilon_r = 53.699$;
 $\rho = 1000$ kg/m³
Ambient Temperature : 23.4 °C; Liquid Temperature : 22.4 °C

DASY5 Configuration

- Probe: EX3DV4 - SN3925; ConvF(9.91, 9.91, 9.91); Calibrated: 2016/5/26;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: SM000T01DA; Serial: TP:1303
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7373)

Area Scan (71x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.974 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 33.27 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 1.06 W/kg
SAR(1 g) = 0.790 W/kg; SAR(10 g) = 0.612 W/kg
Maximum value of SAR (measured) = 0.951 W/kg



0 dB = 0.951 W/kg = -0.22 dBW/kg

#07_GSM1900_GPRS (4 Tx slots)_Front_10mm_Ch810

Communication System: PCS ; Frequency: 1909.8 MHz; Duty Cycle: 1:2.08

Medium: MSL_1900_170213 Medium parameters used: $f = 1910$ MHz; $\sigma = 1.563$ S/m; $\epsilon_r = 55.136$;
 $\rho = 1000$ kg/m³

Ambient Temperature : 23.4 °C; Liquid Temperature : 22.4 °C

DASY5 Configuration

- Probe: EX3DV4 - SN3925; ConvF(8, 8, 8); Calibrated: 2016/5/26;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: SM000T01DA; Serial: TP:1303
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7373)

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

Maximum value of SAR (interpolated) = 0.314 W/kg

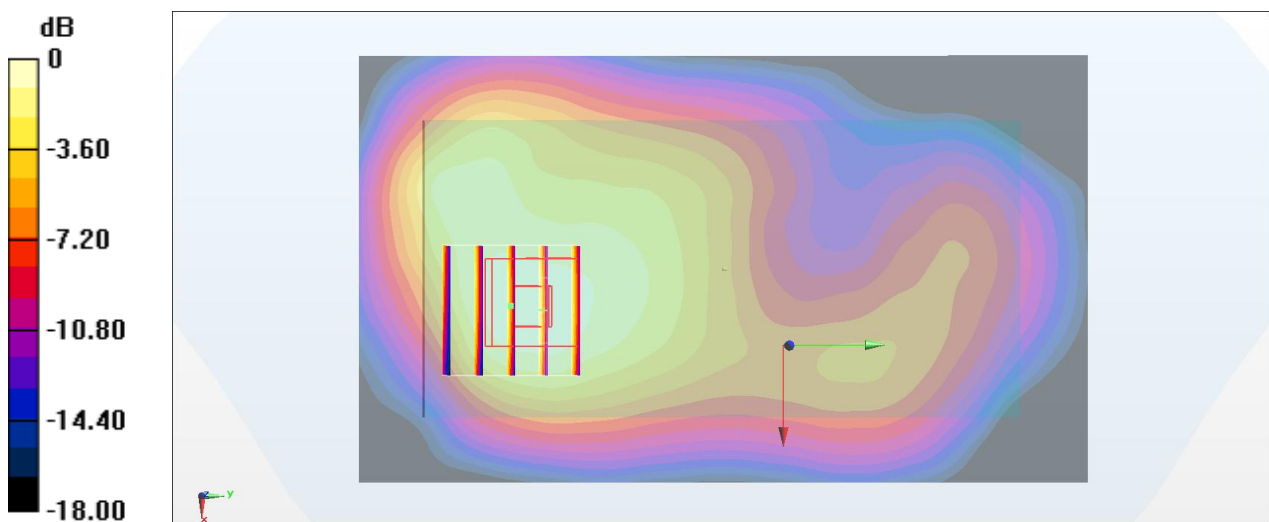
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 14.36 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 0.383 W/kg

SAR(1 g) = 0.279 W/kg; SAR(10 g) = 0.160 W/kg

Maximum value of SAR (measured) = 0.322 W/kg



0 dB = 0.322 W/kg = -4.92 dBW/kg

#08_WCDMA V_RMC 12.2Kbps_Back_10mm_Ch4233

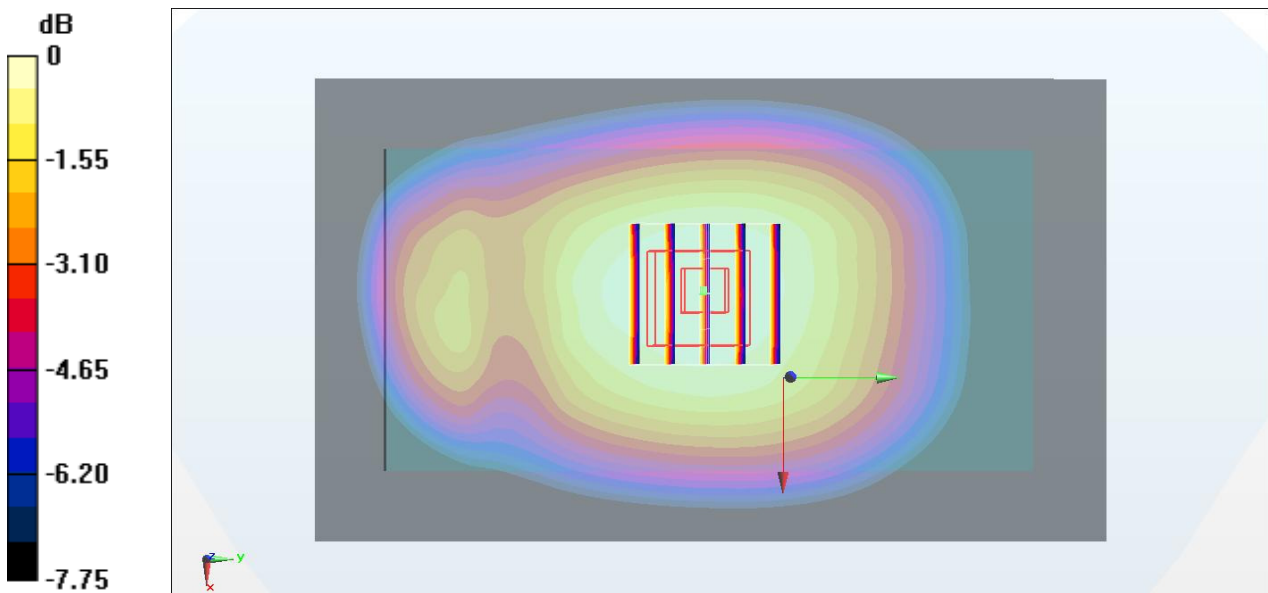
Communication System: WCDMA ; Frequency: 846.6 MHz;Duty Cycle: 1:1
Medium: MSL_850_170211 Medium parameters used: $f = 847$ MHz; $\sigma = 0.944$ S/m; $\epsilon_r = 53.715$;
 $\rho = 1000$ kg/m³
Ambient Temperature : 23.4 °C; Liquid Temperature : 22.4 °C

DASY5 Configuration

- Probe: EX3DV4 - SN3925; ConvF(9.91, 9.91, 9.91); Calibrated: 2016/5/26;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: SM000T01DA; Serial: TP:1303
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7373)

Area Scan (71x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.940 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 32.12 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 1.01 W/kg
SAR(1 g) = 0.715 W/kg; SAR(10 g) = 0.537 W/kg
Maximum value of SAR (measured) = 0.916 W/kg



0 dB = 0.916 W/kg = -0.38 dBW/kg

#09_LTE Band 7_20M_QPSK_50_0_Back_10mm_Ch20850

Communication System: LTE ; Frequency: 2510 MHz;Duty Cycle: 1:1

Medium: MSL_2600_170214 Medium parameters used: $f = 2510$ MHz; $\sigma = 2.077$ S/m; $\epsilon_r = 54.57$;
 $\rho = 1000$ kg/m³

Ambient Temperature : 23.3 °C; Liquid Temperature : 22.3 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3925; ConvF(7.38, 7.38, 7.38); Calibrated: 2016/5/26;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: SM000T01DA; Serial: TP:1303
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7373)

Area Scan (81x151x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.572 W/kg

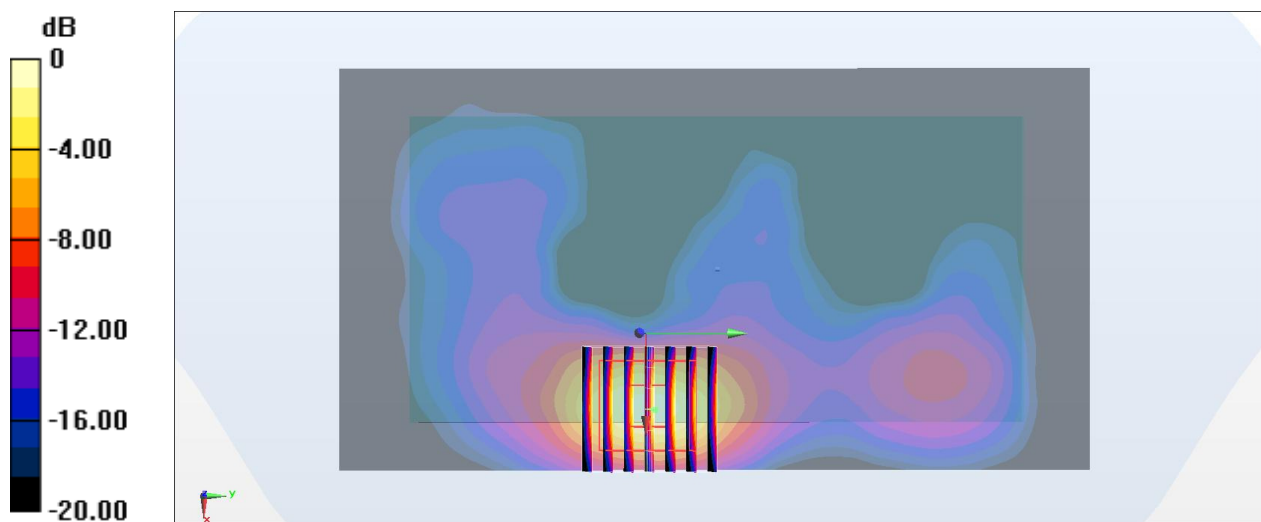
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.121 V/m; Power Drift = 0.18 dB

Peak SAR (extrapolated) = 0.844 W/kg

SAR(1 g) = 0.475 W/kg; SAR(10 g) = 0.198 W/kg

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



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

#10_WLAN2.4GHz_802.11b 1Mbps_Front_10mm_Ch6

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

Medium: MSL_2450_170224 Medium parameters used : $f = 2437$ MHz; $\sigma = 1.954$ S/m; $\epsilon_r = 54.383$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.3 °C ; Liquid Temperature : 22.3 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3925; ConvF(7.64, 7.64, 7.64); Calibrated: 2016/5/26;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: QD000P40CD; Serial: TP:1383
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7373)

Area Scan (81x151x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.196 W/kg

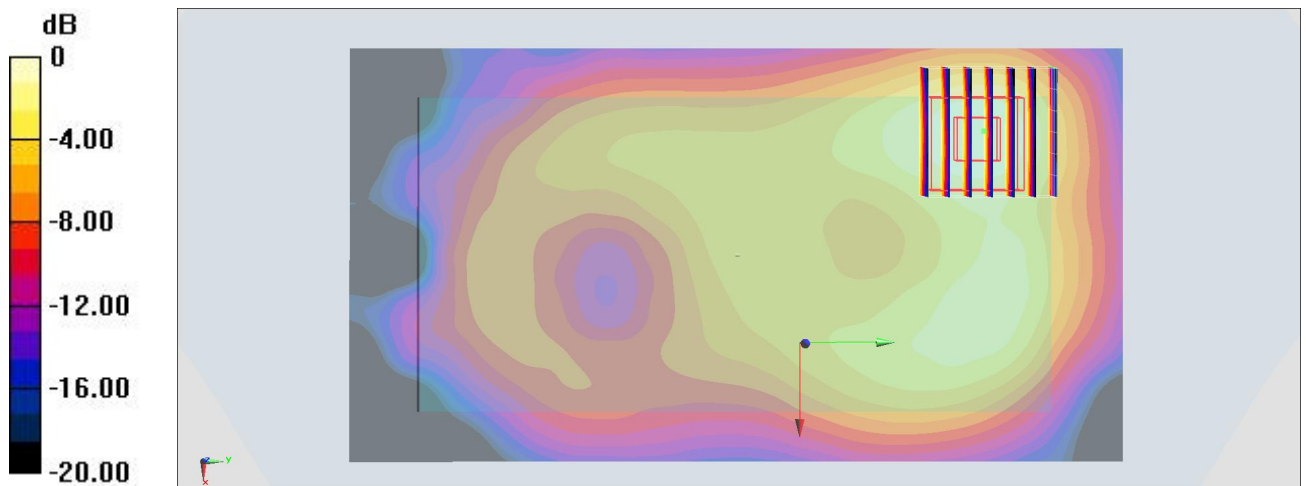
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.297 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 0.245 W/kg

SAR(1 g) = 0.125 W/kg; SAR(10 g) = 0.063 W/kg

Maximum value of SAR (measured) = 0.196 W/kg



0 dB = 0.196 W/kg = -7.08 dBW/kg

#11_GSM850_GPRS (4 Tx slots)_Back_15mm_Ch251

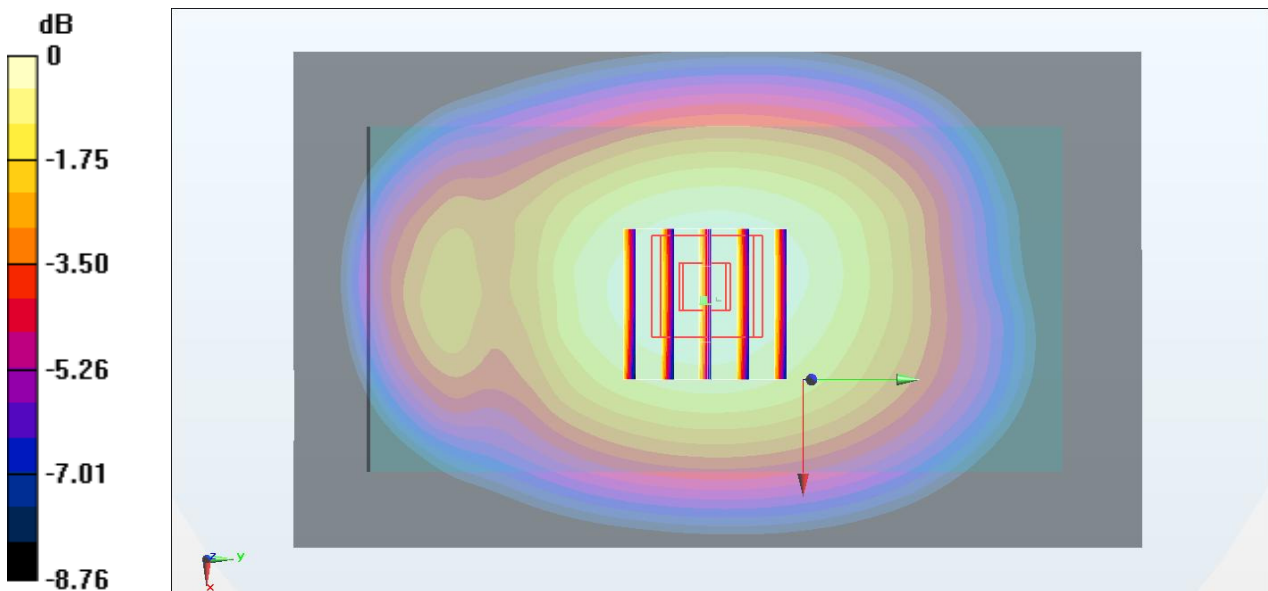
Communication System: GSM850; Frequency: 848.8 MHz; Duty Cycle: 1:2.08
Medium: MSL_850_170211 Medium parameters used: $f = 849$ MHz; $\sigma = 0.946$ S/m; $\epsilon_r = 53.699$;
 $\rho = 1000$ kg/m³
Ambient Temperature : 23.4 °C; Liquid Temperature : 22.4 °C

DASY5 Configuration

- Probe: EX3DV4 - SN3925; ConvF(9.91, 9.91, 9.91); Calibrated: 2016/5/26;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: SM000T01DA; Serial: TP:1303
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7373)

Area Scan (71x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.803 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 29.76 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 0.898 W/kg
SAR(1 g) = 0.657 W/kg; SAR(10 g) = 0.502 W/kg
Maximum value of SAR (measured) = 0.806 W/kg



0 dB = 0.806 W/kg = -0.94 dBW/kg

#12_GSM1900_GPRS (4 Tx slots)_Front_15mm_Ch810

Communication System: PCS ; Frequency: 1909.8 MHz; Duty Cycle: 1:2.08

Medium: MSL_1900_170213 Medium parameters used: $f = 1910$ MHz; $\sigma = 1.563$ S/m; $\epsilon_r = 55.136$;
 $\rho = 1000$ kg/m³

Ambient Temperature : 23.4 °C; Liquid Temperature : 22.4 °C

DASY5 Configuration

- Probe: EX3DV4 - SN3925; ConvF(8, 8, 8); Calibrated: 2016/5/26;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: SM000T01DA; Serial: TP:1303
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7373)

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

Maximum value of SAR (interpolated) = 0.186 W/kg

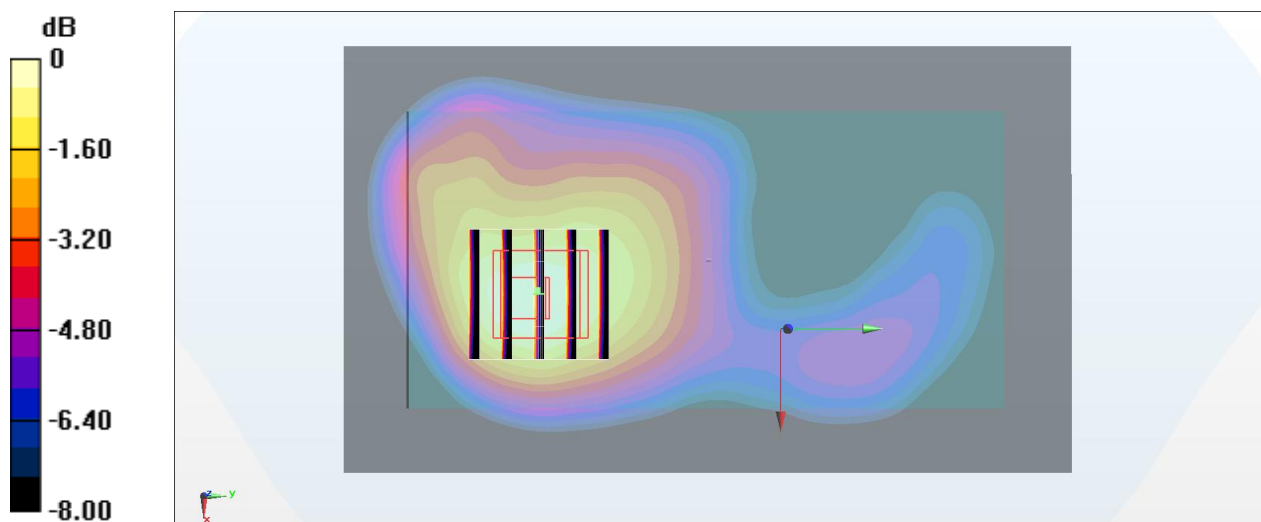
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 11.03 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 0.212 W/kg

SAR(1 g) = 0.164 W/kg; SAR(10 g) = 0.095 W/kg

Maximum value of SAR (measured) = 0.183 W/kg



0 dB = 0.183 W/kg = -7.38 dBW/kg

#13_WCDMA V_RMC 12.2Kbps_Back_15mm_Ch4233

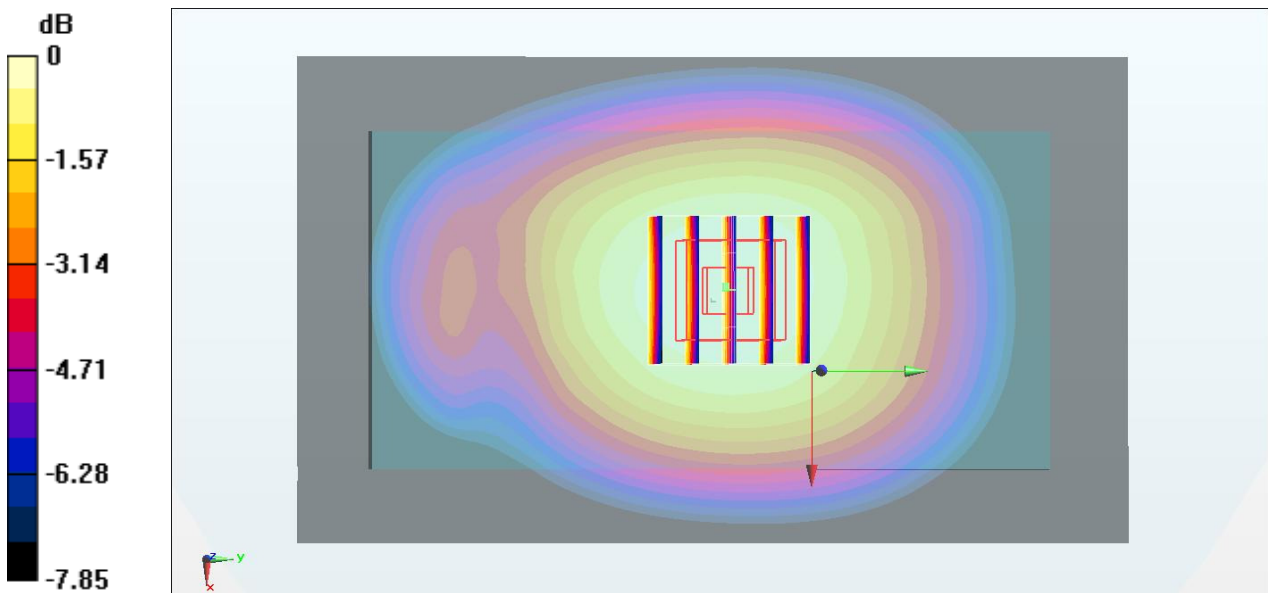
Communication System: WCDMA ; Frequency: 846.6 MHz; Duty Cycle: 1:1
Medium: MSL_850_170211 Medium parameters used: $f = 847$ MHz; $\sigma = 0.944$ S/m; $\epsilon_r = 53.715$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.4 °C; Liquid Temperature : 22.4 °C

DASY5 Configuration

- Probe: EX3DV4 - SN3925; ConvF(9.91, 9.91, 9.91); Calibrated: 2016/5/26;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: SM000T01DA; Serial: TP:1303
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7373)

Area Scan (71x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.759 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 31.80 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 0.832 W/kg
SAR(1 g) = 0.603 W/kg; SAR(10 g) = 0.471 W/kg
Maximum value of SAR (measured) = 0.760 W/kg



0 dB = 0.760 W/kg = -1.19 dBW/kg

#14_LTE Band 7_20M_QPSK_1_0_Back_15mm_Ch21350

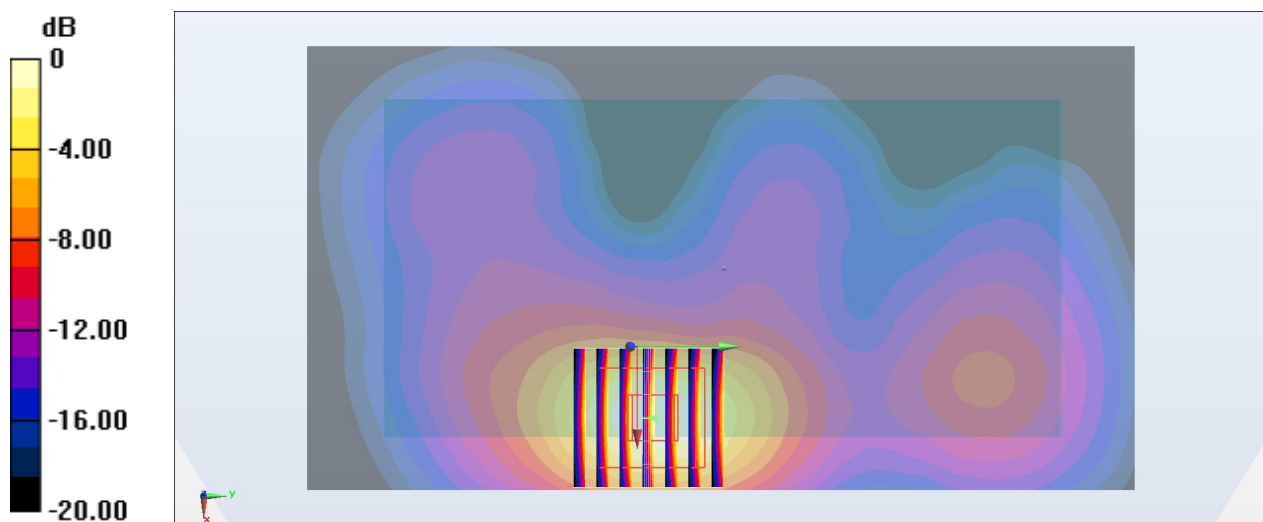
Communication System: LTE ; Frequency: 2560 MHz;Duty Cycle: 1:1
 Medium: MSL_2600_170214 Medium parameters used: $f = 2560$ MHz; $\sigma = 2.148$ S/m; $\epsilon_r = 54.357$;
 $\rho = 1000$ kg/m³
 Ambient Temperature : 23.3 °C; Liquid Temperature : 22.3 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3925; ConvF(7.38, 7.38, 7.38); Calibrated: 2016/5/26;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: SM000T01DA; Serial: TP:1303
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7373)

Area Scan (81x151x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
 Maximum value of SAR (interpolated) = 1.48 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
 Reference Value = 17.15 V/m; Power Drift = 0.08 dB
 Peak SAR (extrapolated) = 1.90 W/kg
SAR(1 g) = 0.965 W/kg; SAR(10 g) = 0.465 W/kg
 Maximum value of SAR (measured) = 1.53 W/kg



0 dB = 1.53 W/kg = 1.85 dBW/kg

#15_WLAN2.4GHz_802.11b 1Mbps_Front_15mm_Ch6

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

Medium: MSL_2450_170224 Medium parameters used $f = 2437$ MHz; $\sigma = 1.954$ S/m; $\epsilon_r = 54.383$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.3 °C ; Liquid Temperature : 22.3 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3925; ConvF(7.64, 7.64, 7.64); Calibrated: 2016/5/26;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: QD000P40CD; Serial: TP:1383
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7373)

Area Scan (81x151x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.0923 W/kg

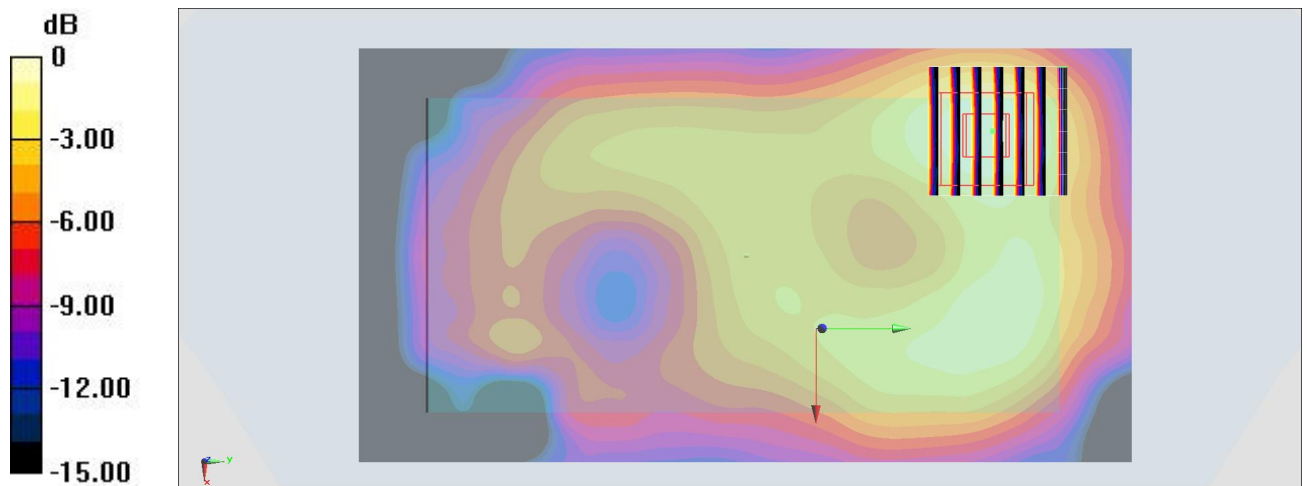
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 4.762 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 0.116 W/kg

SAR(1 g) = 0.059 W/kg; SAR(10 g) = 0.031 W/kg

Maximum value of SAR (measured) = 0.0922 W/kg



0 dB = 0.0922 W/kg = -10.35 dBW/kg



5. DASYS Calibration Certificate

The DASYS calibration certificates are shown as follows.



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

Accreditation No.: **SCS 0108**

Client **Sporton-TW (Auden)**

Certificate No: **D835V2-499_Mar16**

CALIBRATION CERTIFICATE

Object **D835V2 - SN: 499**

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

Calibration date: **March 21, 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 EPM-442A	GB37480704	07-Oct-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	US37292783	07-Oct-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	MY41092317	07-Oct-15 (No. 217-02223)	Oct-16
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 EX3DV4	SN: 7349	31-Dec-15 (No. EX3-7349_Dec15)	Dec-16
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100972	15-Jun-15 (in house check Jun-15)	In house check: Jun-18
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

Calibrated by: **Michael Weber** Name: Michael Weber Function: Laboratory Technician

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

Signature

Issued: March 21, 2016

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



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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	41.7 \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	2.34 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.14 W/kg \pm 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.52 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.97 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	54.5 \pm 6 %	1.01 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	2.46 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	9.52 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	6.28 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	53.1 Ω - 3.2 j Ω
Return Loss	- 27.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.0 Ω - 5.3 j Ω
Return Loss	- 25.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.390 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	July 10, 2003

DASY5 Validation Report for Head TSL

Date: 21.03.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 499

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

Medium parameters used: $f = 835$ MHz; $\sigma = 0.93$ S/m; $\epsilon_r = 41.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(9.83, 9.83, 9.83); Calibrated: 31.12.2015;
- 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 EX-Probe/Pin=250 mW, d=15mm/Zoom Scan

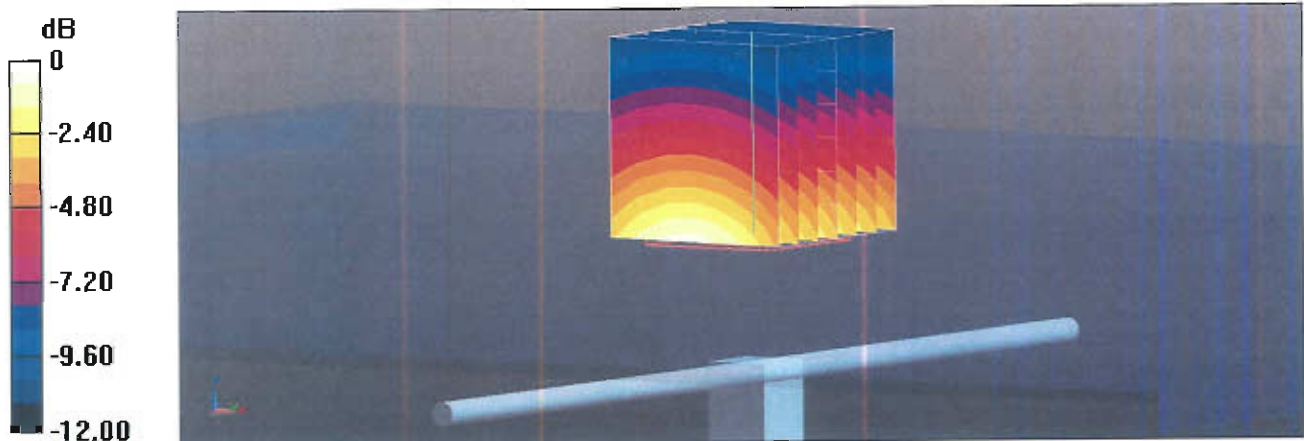
(7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 60.98 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.47 W/kg

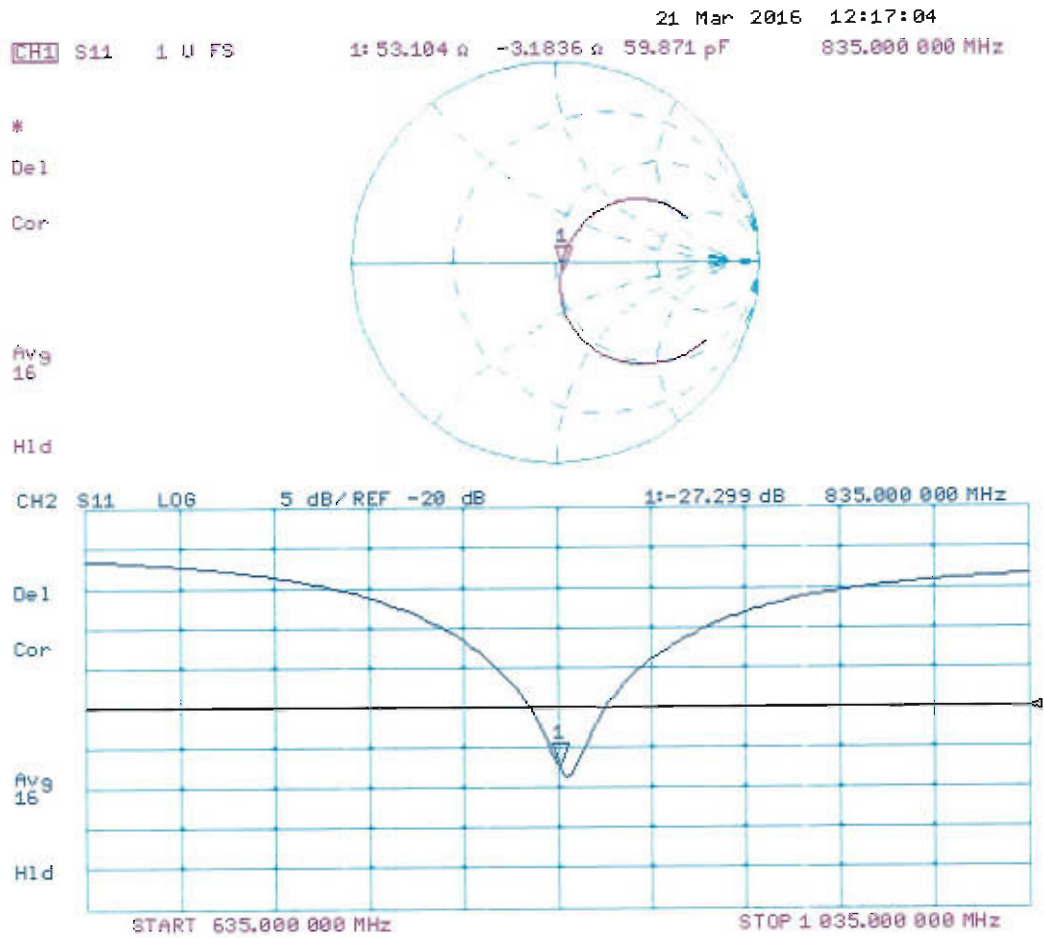
SAR(1 g) = 2.34 W/kg; SAR(10 g) = 1.52 W/kg

Maximum value of SAR (measured) = 3.09 W/kg



0 dB = 3.09 W/kg = 4.90 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 21.03.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 499

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

Medium parameters used: $f = 835$ MHz; $\sigma = 1.01$ S/m; $\epsilon_r = 54.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(9.73, 9.73, 9.73); Calibrated: 31.12.2015;
- 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 EX-Probe/Pin=250 mW, d=15mm/Zoom Scan

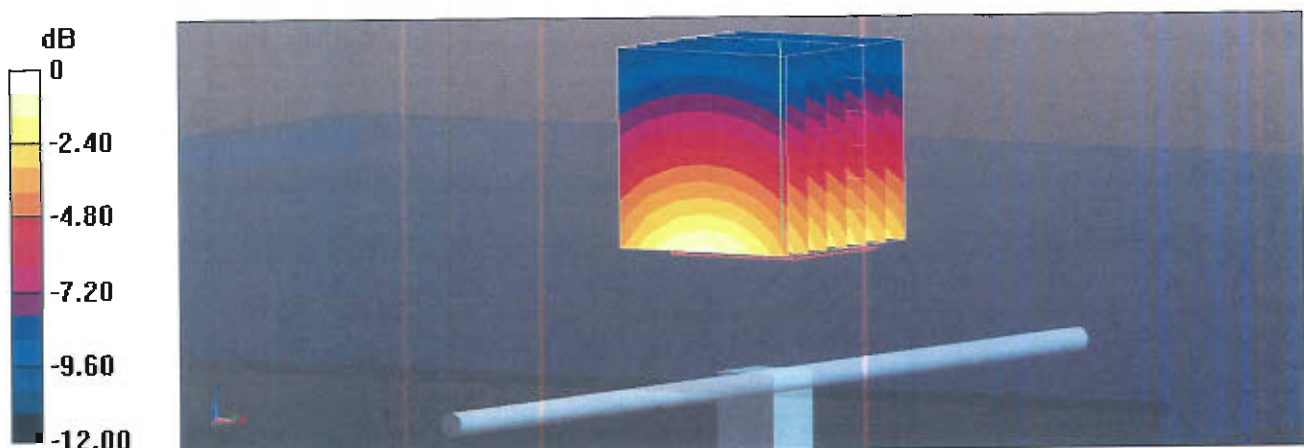
(7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 60.24 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 3.63 W/kg

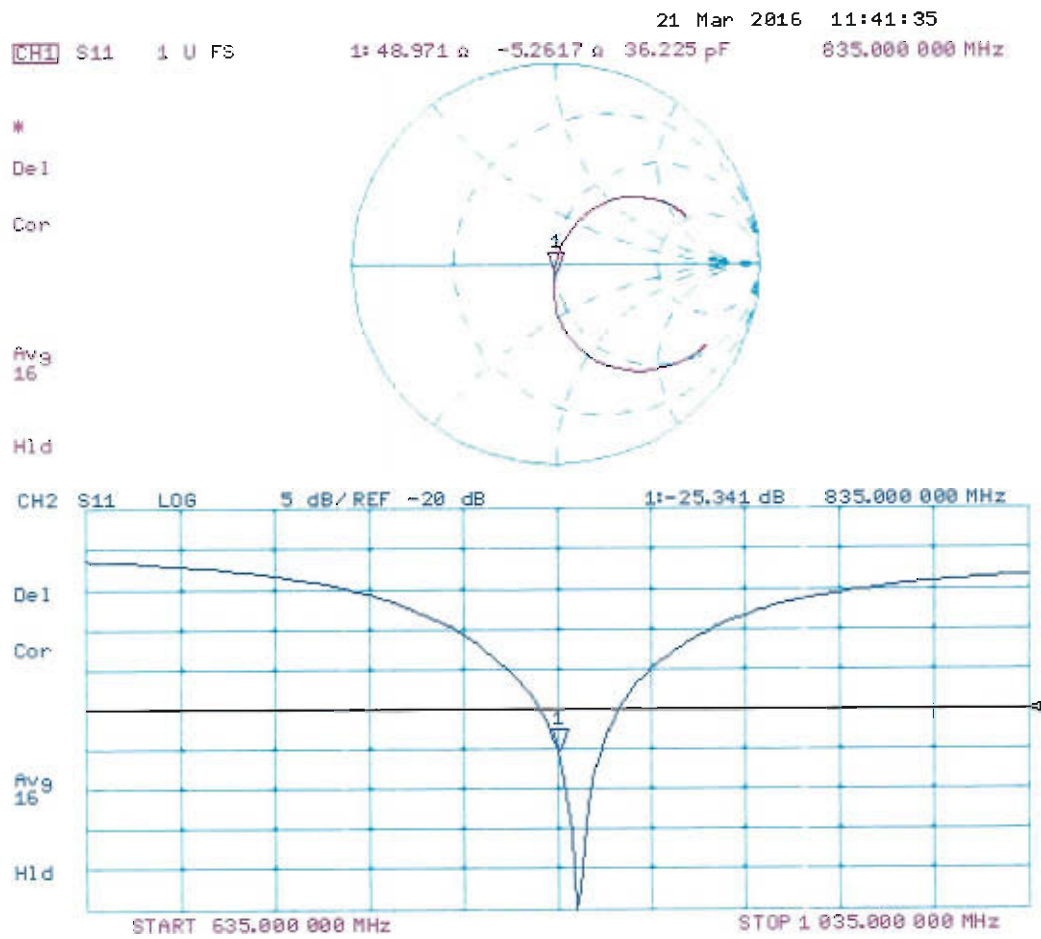
SAR(1 g) = 2.46 W/kg; SAR(10 g) = 1.61 W/kg

Maximum value of SAR (measured) = 3.26 W/kg



0 dB = 3.26 W/kg = 5.13 dBW/kg

Impedance Measurement Plot for Body TSL





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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **Sporton-TW (Auden)**

Certificate No: **D1900V2-5d041_Sep16**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN:5d041**

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

Calibration date: **September 30, 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 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (No. 217-02223)	In house check: Oct-16
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Jun-15)	In house check: Oct-16
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

Calibrated by: **Jeton Kastrati** Name: **Jeton Kastrati** Function: **Laboratory Technician**

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

Signature

Issued: September 30, 2016

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



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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	40.5 \pm 6 %	1.40 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	10.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	40.5 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	5.33 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	21.4 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	53.6 \pm 6 %	1.49 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	9.58 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	38.8 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	5.10 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.6 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	$52.5 \Omega + 8.0 j\Omega$
Return Loss	- 21.8 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$48.7 \Omega + 7.6 j\Omega$
Return Loss	- 22.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.199 ns
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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	July 04, 2003

DASY5 Validation Report for Head TSL

Date: 28.09.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d041

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

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.4$ S/m; $\epsilon_r = 40.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.99, 7.99, 7.99); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

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

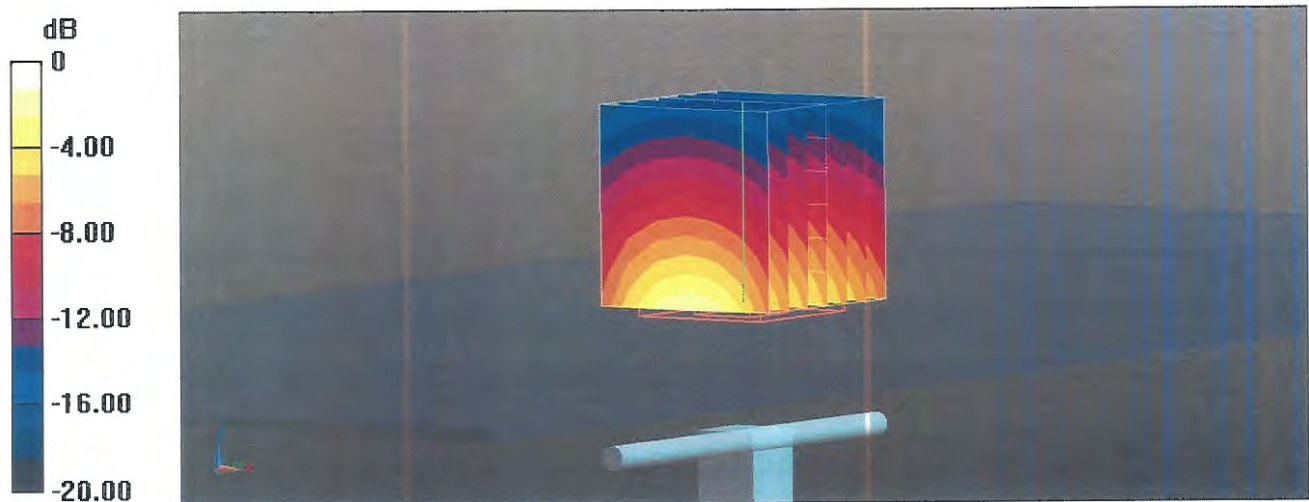
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 108.5 V/m; Power Drift = -0.02 dB

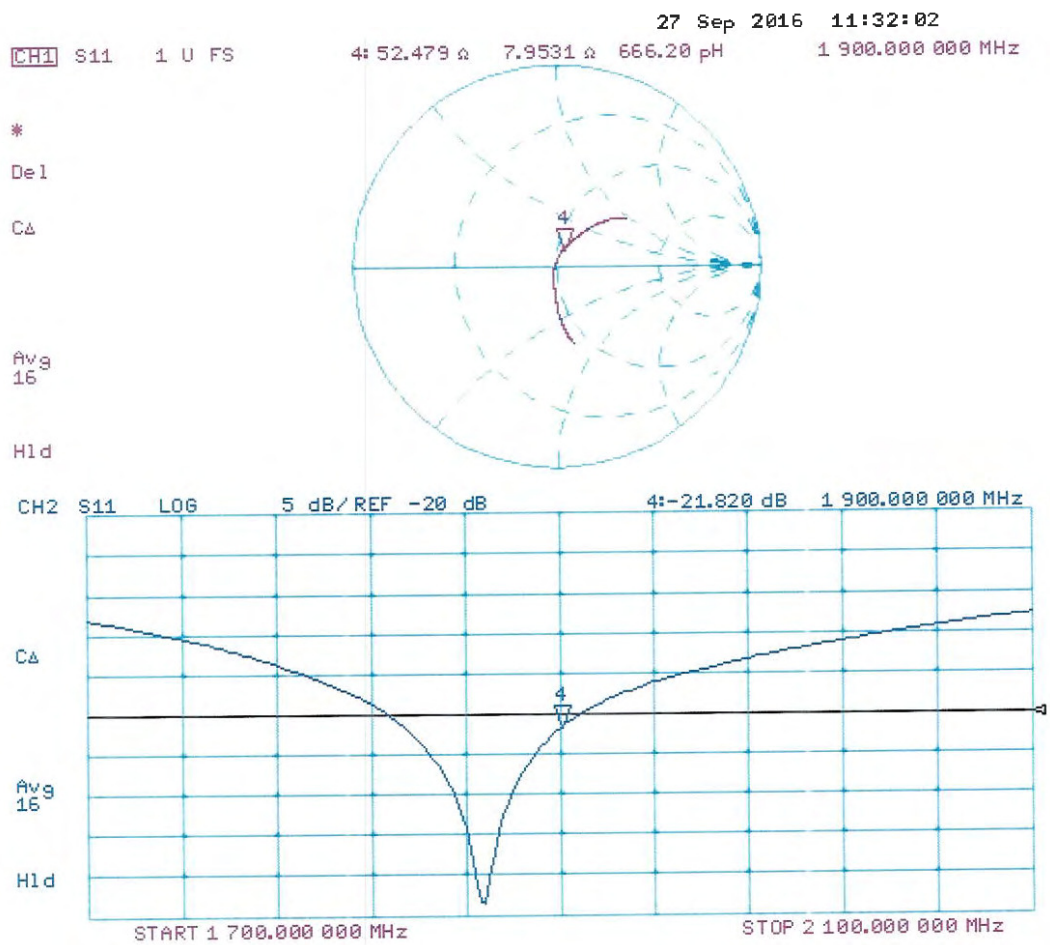
Peak SAR (extrapolated) = 19.0 W/kg

SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.33 W/kg

Maximum value of SAR (measured) = 15.7 W/kg



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 30.09.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d041

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

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.49$ S/m; $\epsilon_r = 53.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.03, 8.03, 8.03); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

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

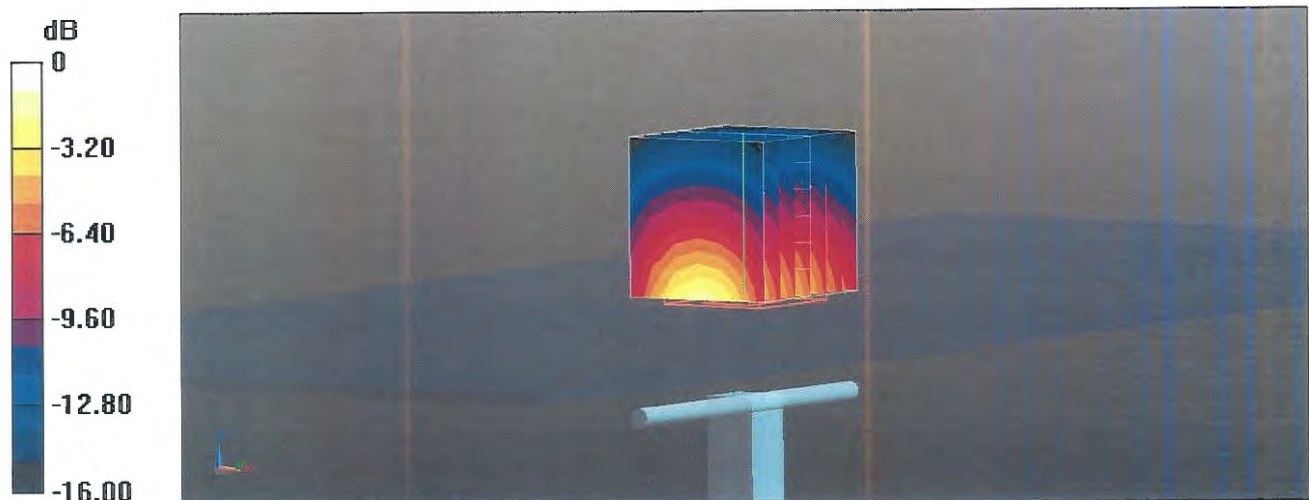
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 102.7 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 16.7 W/kg

SAR(1 g) = 9.58 W/kg; SAR(10 g) = 5.1 W/kg

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



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

Impedance Measurement Plot for Body TSL

22 Oct 2015 09:52:04

[CH1] S11 1 U FS

1: 48.795 Ω 7.6973 Ω 644.77 pF

1 900.000 000 MHz

*

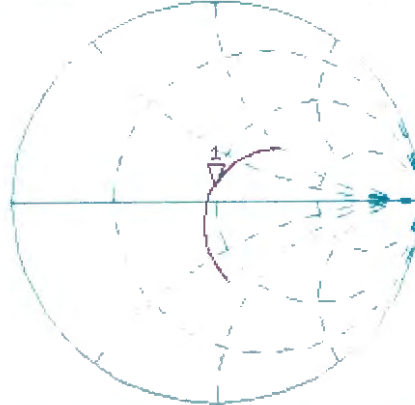
Del

Cor

Avg

16

H1d



CH2 S11 LOG

5 dB/REF -20 dB

1:-22.089 dB

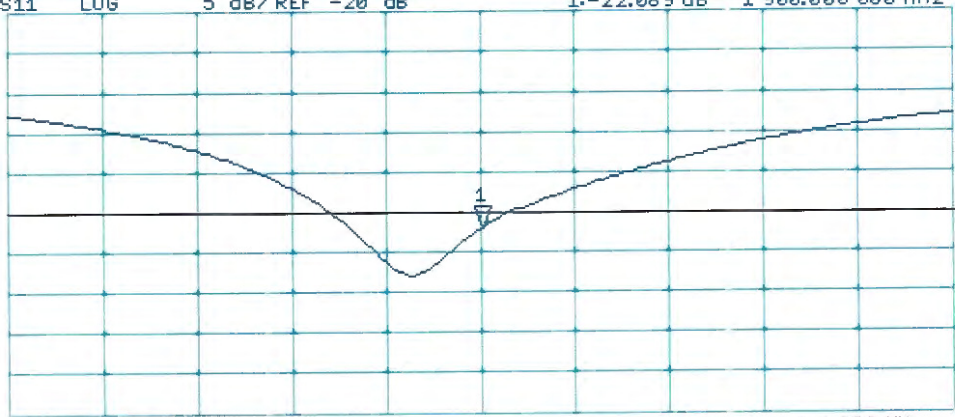
1 900.000 000 MHz

Cor

Avg

16

H1d



START 1 700.000 000 MHz

STOP 2 100.000 000 MHz



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Accreditation No.: **SCS 0108**

Client **Sporton-TW (Auden)**

Certificate No: **D2450V2-926_Jul16**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN:926**

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

Calibration date: **July 25, 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 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (No. 217-02223)	In house check: Oct-16
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Jun-15)	In house check: Oct-16
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

Calibrated by: **Michael Weber** Name Function
Laboratory Technician

Signature

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

Issued: July 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)

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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 ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.0 ± 6 %	1.86 mho/m ± 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	13.5 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	52.8 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.22 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.5 W/kg ± 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.8 ± 6 %	2.03 mho/m ± 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	13.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	51.2 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.07 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	24.0 W/kg ± 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.3 Ω + 3.7 j Ω
Return Loss	- 25.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.3 Ω + 5.0 j Ω
Return Loss	- 26.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.155 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	September 26, 2013

DASY5 Validation Report for Head TSL

Date: 25.07.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:926

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

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.86$ S/m; $\epsilon_r = 38$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.72, 7.72, 7.72); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

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 = 114.2 V/m; Power Drift = 0.01 dB

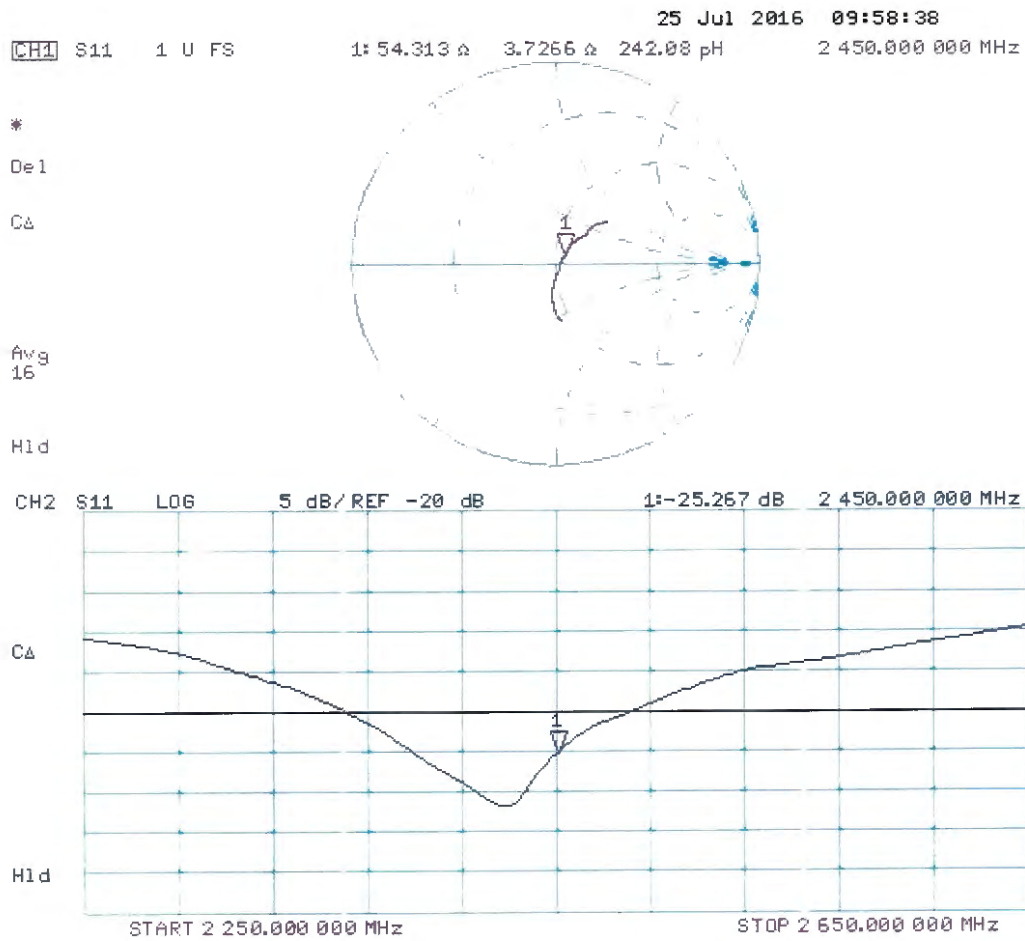
Peak SAR (extrapolated) = 27.6 W/kg

SAR(1 g) = 13.5 W/kg; SAR(10 g) = 6.22 W/kg

Maximum value of SAR (measured) = 22.3 W/kg



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 25.07.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:926

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

Medium parameters used: $f = 2450$ MHz; $\sigma = 2.03$ S/m; $\epsilon_r = 51.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.79, 7.79, 7.79); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

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

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

Reference Value = 107.2 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 26.3 W/kg

SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6.07 W/kg

Maximum value of SAR (measured) = 21.4 W/kg



0 dB = 21.4 W/kg = 13.30 dBW/kg

Impedance Measurement Plot for Body TSL

25 Jul 2016 09:58:03

CH1 S11 1 U FS

1: 50.256 Δ 5.0469 Δ 327.85 p Ω

2 450.000 000 MHz

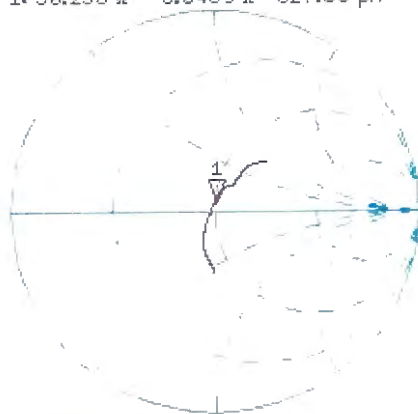
*

De1

Ca

Avg
16

H1d



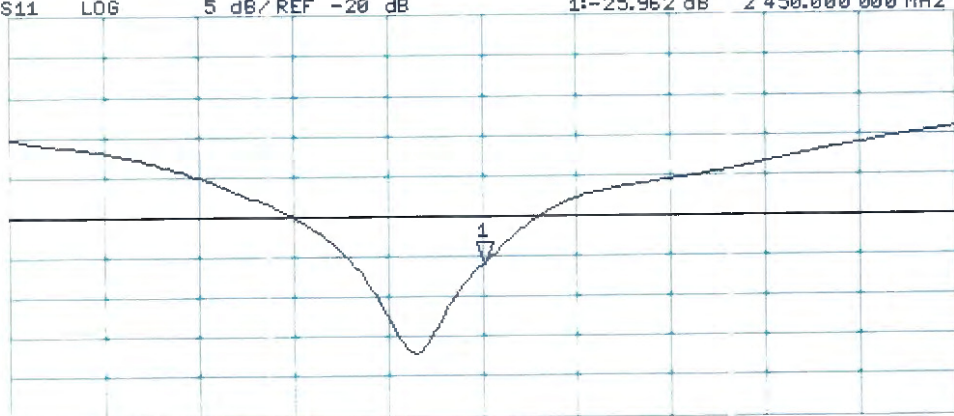
CH2 S11 LOG

5 dB/REF -20 dB

1: -25.962 dB 2 450.000 000 MHz

Ca

H1d



START 2 250.000 000 MHz

STOP 2 650.000 000 MHz