4.7.4 SAR Measurement Variability

According to KDB 865664 D01, SAR measurement variability was assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media are required for SAR measurements in a frequency band, the variability measurement procedures should be applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. Alternatively, if the highest measured SAR for both head and body tissue-equivalent media are ≤ 1.45 W/kg and the ratio of these highest SAR values, i.e., largest divided by smallest value, is ≤ 1.10, the highest SAR configuration for either head or body tissue-equivalent medium maybe used to perform the repeated measurement. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

Since all the measured 1-g SAR are less than 0.8 W/kg and 10-g extremity SAR are less than 2.0 W/kg, the repeated measurement is not required.

4.7.5 Simultaneous Multi-band Transmission Evaluation

<Estimated SAR Calculation>

According to KDB 447498 D01, when standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR was estimated according to following formula to result in substantially conservative SAR values of <= 0.4 W/kg to determine simultaneous transmission SAR test exclusion.

$$\text{Estimated SAR} = \frac{\text{Max. Tune up Power}_{(\text{mW})}}{\text{Min. Test Separation Distance}_{(\text{mm})}} \times \frac{\sqrt{f_{(\text{GHz})}}}{7.5}$$

If the minimum test separation distance is < 5 mm, a distance of 5 mm is used for estimated SAR calculation. When the test separation distance is > 50 mm, the 0.4 W/kg is used for SAR-1g/ SAR-10g.

<SAR Summation Analysis>

Simultaneous transmission SAR test exclusion is determined for each operating configuration and exposure condition according to the reported standalone SAR of each applicable simultaneous transmitting antenna. When the sum of SAR_{1g}/ SAR_{10g} of all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit(SAR_{1g} 1.6 W/kg and SAR_{0g} 4.0 W/kg), the simultaneous transmission SAR is not required. When the sum of SAR_{1g}/ SAR_{10g} is greater than the SAR limit (SAR_{1g} 1.6 W/kg and SAR_{0g} 4.0 W/kg), SAR test exclusion is determined by the SPLSR.

No.	Conditions (SAR1 + SAR2)	Exposure Condition	Test Position	Max. SAR1	Max. SAR2	SAR Summation	SPLSR Analysis
1	DTS + DTS	Body	Rear Face	0.19	0.09	0.28	∑SAR < 1.6, Not required
		Extremity	Front Face	0.05	0.12	0.17	∑SAR < 4.0, Not required
			Left Side	0.07	0.40	0.47	∑SAR < 4.0, Not required
			Right Side	0.40	0.08	0.47	∑SAR < 4.0, Not required
			Top Side	1.36	1.70	3.06	∑SAR < 4.0, Not required
			Bottom Side	0.40	0.40	0.80	∑SAR < 4.0, Not required -

Test Engineer：Lexian Wu

5. Calibration of Test Equipment

Equipment	Manufacturer	Model	SN	Cal. Date	Cal. Interval
System Validation Dipole	SPEAG	D2450V2	835	Jun. 27, 2017	1 Year
Dosimetric E-Field Probe	SPEAG	EX3DV4	3970	Nov. 02, 2017	1 Year
Data Acquisition Electronics	SPEAG	DAE4	1418	Oct. 09, 2017	1 Year
ENA Series Network Analyzer	Agilent	E5071B	MY42404246	May. 20, 2017	1 Year
Signal Analyzer	Agilent	N9010A	My53470879	May. 21, 2017	1Year
Signal Generator	Agilent	N5181A	MY50145187	May. 21, 2017	1 Year
Power Meter	BOONTON	4232A	10539	May. 21, 2017	1 Year
Power Sensor	BOONTON	51011EMC	34236/34238	May. 21, 2017	1 Year
Temp. & Humi. Recorder	CLOCK	HTC-1	EE-334	Jul. 15, 2017	1 Year
Electronic Thermometer	FeiHong	HY	TP101	May. 20, 2017	1 Year
Coupler	Woken	0110A056020	COM27RW1A3	Sep. 27, 2017	1 Year

6. Measurement Uncertainty

Source of Uncertainty	Tolerance (± %)	Probability Distribution	Divisor	Ci (1g)	Ci (10g)	Standard Uncertainty (± %, 1g)	Standard Uncertainty (± %, 10g)	Vi
Measurement System								
Probe Calibration	6.0	Normal	1	1	1	6.0	6.0	∞
Axial Isotropy	4.7	Rectangular	√3	0.707	0.707	1.9	1.9	∞
Hemispherical Isotropy	9.6	Rectangular	√3	0.707	0.707	3.9	3.9	∞
Boundary Effect	1.0	Rectangular	√3	1	1	0.6	0.6	∞
Linearity	4.7	Rectangular	√3	1	1	2.7	2.7	∞
System Detection Limits	0.25	Rectangular	√3	1	1	0.14	0.14	∞
Readout Electronics	0.3	Normal	1	1	1	0.3	0.3	∞
Response Time	0.0	Rectangular	√3	1	1	0.0	0.0	∞
Integration Time	1.7	Rectangular	√3	1	1	1.0	1.0	∞
RF Ambient Conditions - Noise	3.0	Rectangular	√3	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	3.0	Rectangular	√3	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	0.4	Rectangular	√3	1	1	0.2	0.2	∞
Probe Positioning with Respect to Phantom Shell	2.9	Rectangular	√3	1	1	1.7	1.7	∞
Extrapolation, interpolation, and integration algorithms for max. SAR evaluation	2.0	Rectangular	√3	1	1	1.2	1.2	∞
Test Sample Related								
Test Sample Positioning	1.5 / 0.7	Normal	1	1	1	1.5	0.7	32
Device Holder Uncertainty	4.2 / 1.8	Normal	1	1	1	4.2	1.8	32
Output Power Variation - SAR Drift Measurement	5.0	Rectangular	√3	1	1	2.9	2.9	∞
Phantom and Tissue Parameters								
Phantom Uncertainty (Shape and Thickness Tolerances)	7.2	Rectangular	√3	1	1	4.2	4.2	∞
Liquid Conductivity - Deviation from Target Values	5.0	Rectangular	√3	0.64	0.43	1.8	1.2	∞
Liquid Conductivity - Measurement Uncertainty	1.0	Normal	1	0.64	0.43	0.6	0.4	25
Liquid Permittivity - Deviation from Target Values	5.0	Rectangular	√3	0.60	0.49	1.7	1.4	∞
Liquid Permittivity - Measurement Uncertainty	0.5	Normal	1	0.60	0.49	0.3	0.2	25
Combined Standard Uncertainty						± 11.2 %	± 10.4 %	
Expanded Uncertainty (K=2)						**± 22.4 %**	**± 20.8 %**	

Uncertainty budget for frequency range 300 MHz to 3 GHz

7. Information on the Testing Laboratories

We, EMTEK (SHENZHEN) CO., LTD., were founded in 2000 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

Site Description

EMC Lab. : Accredited by CNAS,2016.10.24
The certificate is valid until 2022.10.28
The Laboratory has been assessed and proved to be in compliance with CNAS-CL01:2006 (identical to ISO/IEC 17025:2005)
The Certificate Registration Number is L2291.

Accredited by TUV Rheinland Shenzhen 2016.5.19
The Laboratory has been assessed according to the requirements ISO/IEC 17025.

Accredited by FCC, August 03, 2017
Designation Number: CN1204
Test Firm Registration Number: 882943
Accredited by A2LA, July 31, 2017
The Certificate Registration Number is 4321.01.

Accredited by Industry Canada, November 24, 2015
The Certificate Registration Number is 4480A

If you have any comments, please feel free to contact us at the following:

Add: Bldg 69, Majialong Industry Zone, Nanshan District, Shenzhen, Guangdong, China
TEL: 86-755-26954280
FAX: 86-755-26954282

Email: csg@emtek.com.cn
Web Site: www.emtek.com.cn

The road map of all our labs can be found in our web site also.

---END---

Appendix A. SAR Plots of System Verification

The plots for system verification with largest deviation for each SAR system combination are shown as follows.

Test Laboratory: Shenzhen EMTEK Co.,Ltd. Date: 2017/11/21

System Check_B2450_171121

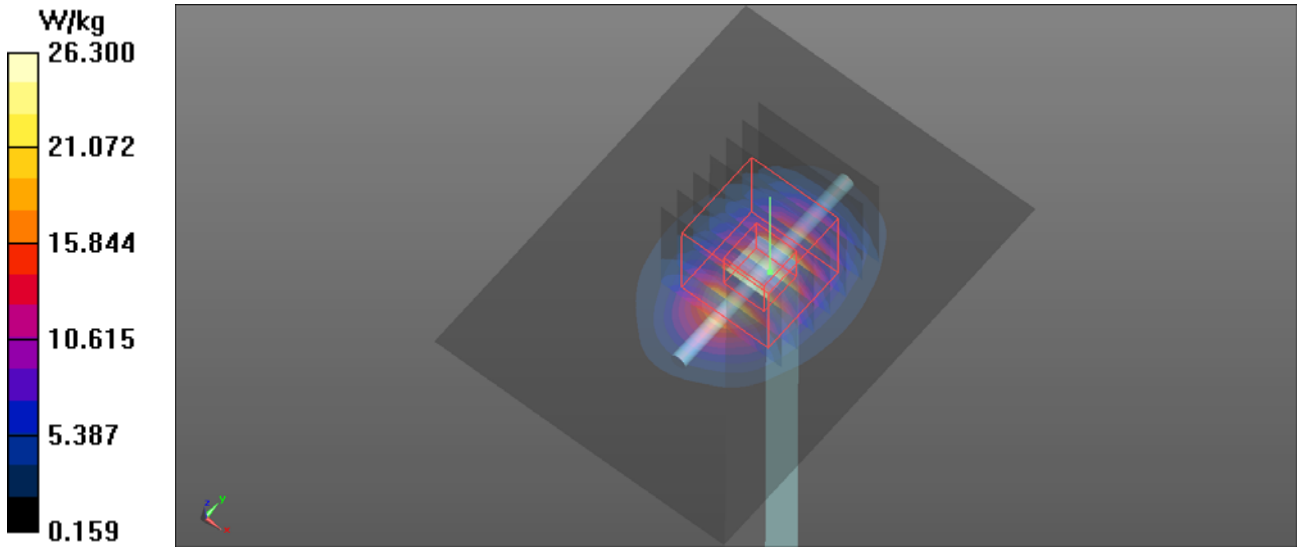
DUT: Dipole 2450 MHz; Type:D2450V2; SN:835

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: B2450_1221 Medium parameters used: f = 2450 MHz; σ = 2.005 S/m; ε_r = 52.826; ρ = 1000 kg/m^3
Ambient Temperature：23.2 ℃； Liquid Temperature：22.1 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3970; ConvF(7.83, 7.83, 7.83); Calibrated: 2017/11/02;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1418; Calibrated: 2017/10/09
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1231
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Pin=250mW/Area Scan (61x81x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 27.2 W/kg

Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 107.3 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 32.3 W/kg
SAR(1 g) = 12.5 W/kg; SAR(10 g) = 5.84 W/kg
Maximum value of SAR (measured) = 26.3 W/kg



Appendix B. SAR Plots of SAR Measurement

The plots for SAR measurement are shown as follows

Test Laboratory: Shenzhen EMTEK Co.,Ltd. Date: 2017/11/21

P01 802.11b_Rear Face_0cm_Ch11_Antenna-0

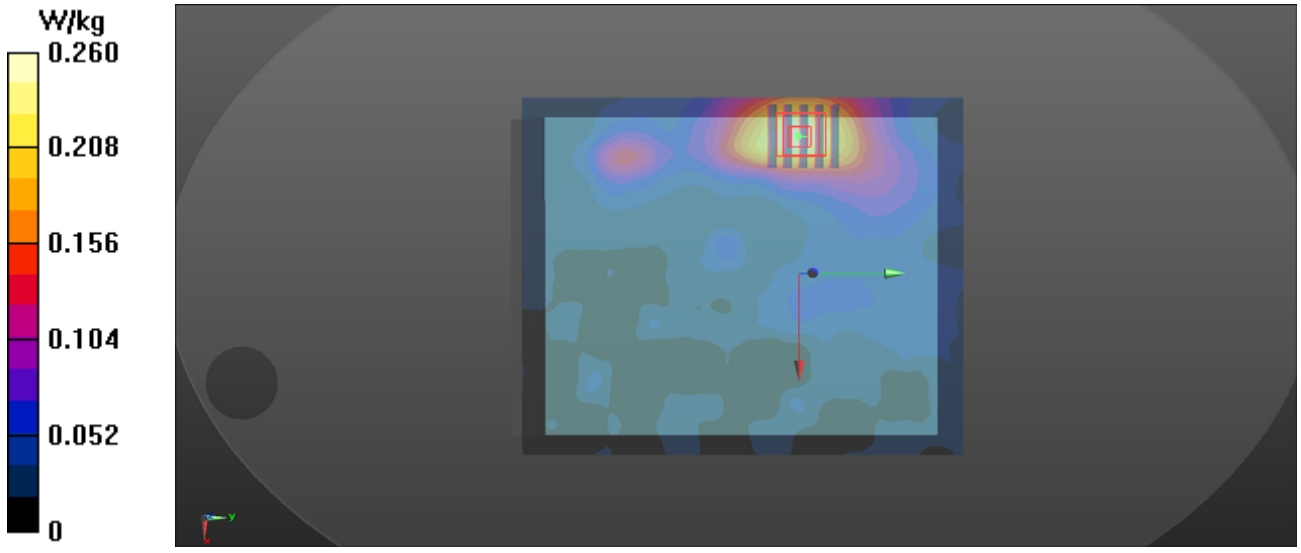
DUT: SKYCONTROLLER 2P

Communication System: 802.11b; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: B2450_1121 Medium parameters used: f = 2462 MHz; σ = 2.023 S/m; ε_r = 52.782; ρ = 1000 kg/m^3
Ambient Temperature：23.2 ℃； Liquid Temperature：22.1 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3970; ConvF(7.83, 7.83, 7.83); Calibrated: 2017/11/02;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1418; Calibrated: 2017/10/09
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1231
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

- Area Scan (151x191x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.260 W/kg

- Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 3.691 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 0.329 W/kg
SAR(1 g) = 0.183 W/kg; SAR(10 g) = 0.110 W/kg
Maximum value of SAR (measured) = 0.269 W/kg



Test Laboratory: Shenzhen EMTEK Co.,Ltd. Date: 2017/11/21

P02 802.11b_Rear Face_0cm_Ch11_Antenna-1

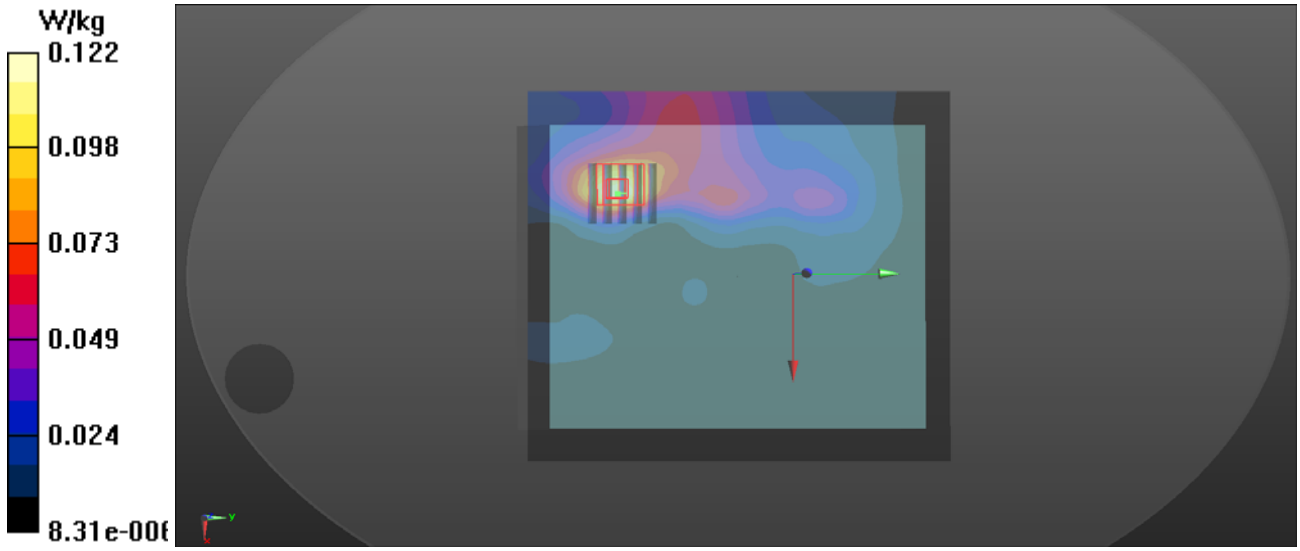
DUT: SKYCONTROLLER 2P

Communication System: 802.11b; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: B2450_1121 Medium parameters used: f = 2462 MHz; σ = 2.023 S/m; ε_r = 52.782; ρ = 1000 kg/m^3
Ambient Temperature：23.2 ℃； Liquid Temperature：22.1 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3970; ConvF(7.83, 7.83, 7.83); Calibrated: 2017/11/02;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1418; Calibrated: 2017/10/09
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1231
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

- Area Scan (161x191x1): Interpolated grid: dx=1.200 mm, dy=1.200 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 = 1.491 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.154 W/kg
SAR(1 g) = 0.079 W/kg; SAR(10 g) = 0.043 W/kg
Maximum value of SAR (measured) = 0.122 W/kg



Test Laboratory: Shenzhen EMTEK Co.,Ltd. Date: 2017/11/21

P03 802.11b_Front Face_0cm_Ch11_Antenna-0

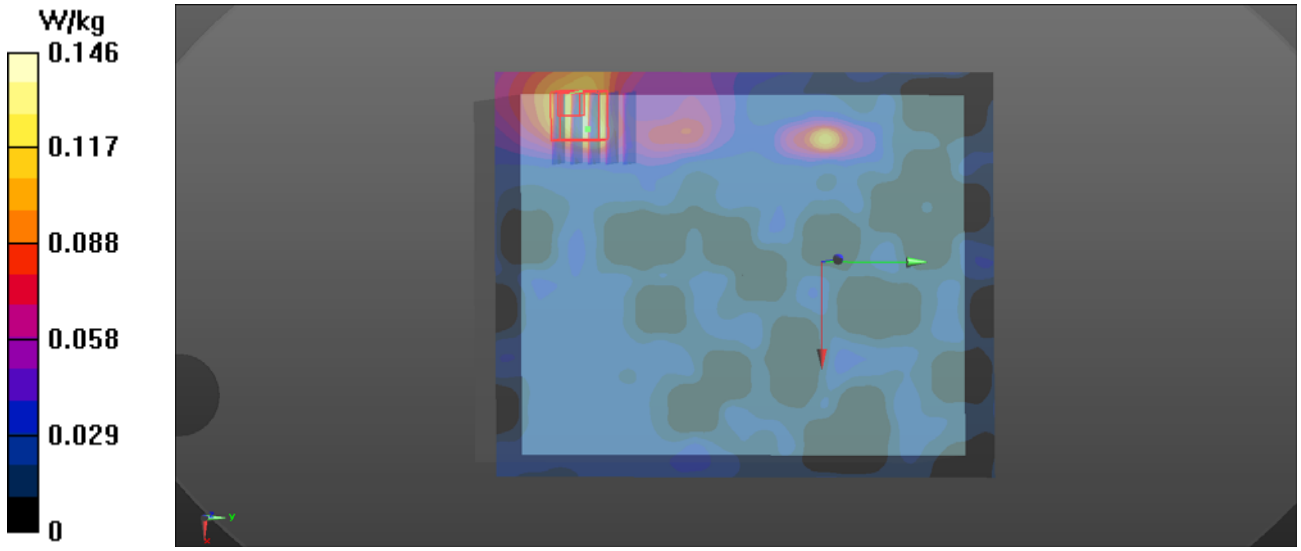
DUT: SKYCONTROLLER 2P

Communication System: 802.11b; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: B2450_1121 Medium parameters used: f = 2462 MHz; σ = 2.023 S/m; ε_r = 52.782; ρ = 1000 kg/m^3
Ambient Temperature：23.2 ℃； Liquid Temperature：22.1 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3970; ConvF(7.83, 7.83, 7.83); Calibrated: 2017/11/02;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1418; Calibrated: 2017/10/09
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1231
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

- Area Scan (151x191x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.146 W/kg

- Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.626 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 0.153 W/kg
SAR(1 g) = 0.086 W/kg; SAR(10 g) = 0.051 W/kg
Maximum value of SAR (measured) = 0.125 W/kg



Test Laboratory: Shenzhen EMTEK Co.,Ltd. Date: 2017/11/21

P04 802.11b_Left Side_0cm_Ch11_Antenna-0

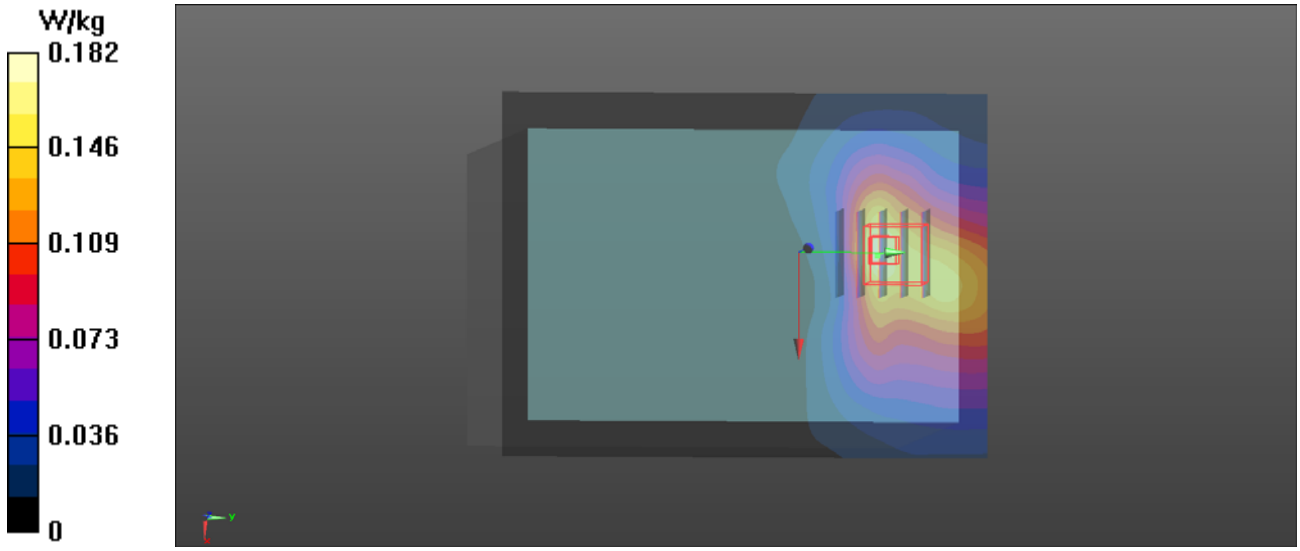
DUT: SKYCONTROLLER 2P

Communication System: 802.11b; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: B2450_1121 Medium parameters used: f = 2462 MHz; σ = 2.023 S/m; ε_r = 52.782; ρ = 1000 kg/m^3
Ambient Temperature：23.2 ℃； Liquid Temperature：22.1 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3970; ConvF(7.83, 7.83, 7.83); Calibrated: 2017/11/02;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1418; Calibrated: 2017/10/09
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1231
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

- Area Scan (111x151x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.182 W/kg

- Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 1.426 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.217 W/kg
SAR(1 g) = 0.112 W/kg; SAR(10 g) = 0.063 W/kg
Maximum value of SAR (measured) = 0.177 W/kg



Test Laboratory: Shenzhen EMTEK Co.,Ltd. Date: 2017/11/21

P05 802.11b_Top Side-1_0cm_Ch11_Antenna-0

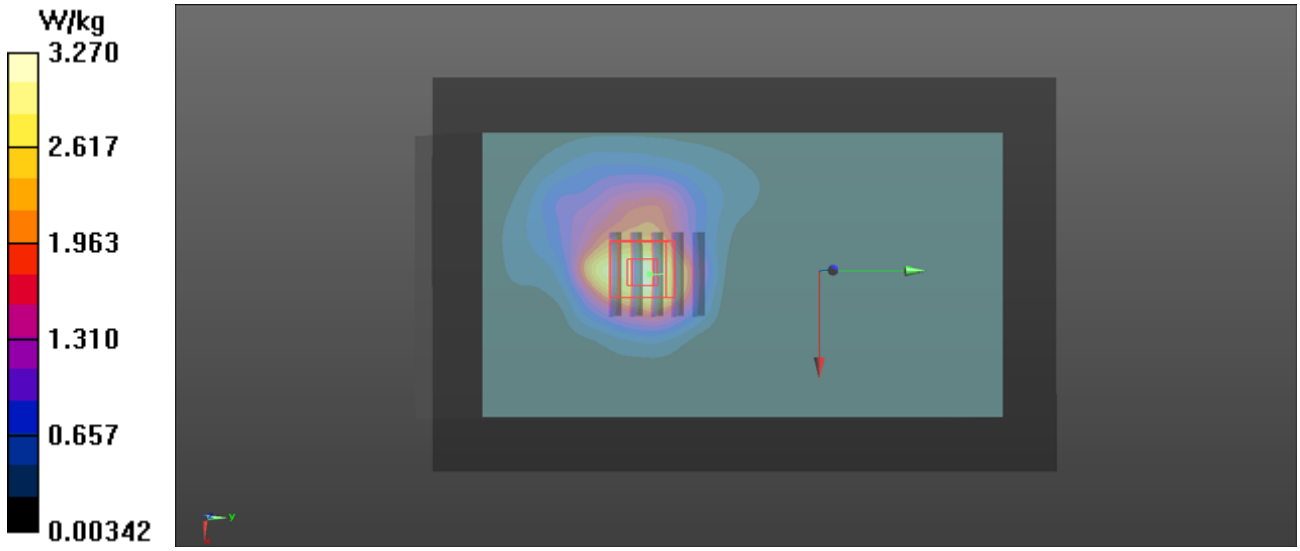
DUT: SKYCONTROLLER 2P

Communication System: 802.11b; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: B2450_1121 Medium parameters used: f = 2462 MHz; σ = 2.023 S/m; ε_r = 52.782; ρ = 1000 kg/m^3
Ambient Temperature：23.2 ℃; Liquid Temperature：22.1 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3970; ConvF(7.83, 7.83, 7.83); Calibrated: 2017/11/02;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1418; Calibrated: 2017/10/09
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1231
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

- Area Scan (131x201x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 3.27 W/kg

- Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.747 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 3.67 W/kg
SAR(1 g) = 2.13 W/kg; SAR(10 g) = 1.26 W/kg
Maximum value of SAR (measured) = 3.09 W/kg



Test Laboratory: Shenzhen EMTEK Co.,Ltd. Date: 2017/11/21

P06 802.11b_Top Side-4_0cm_Ch11_Antenna-0

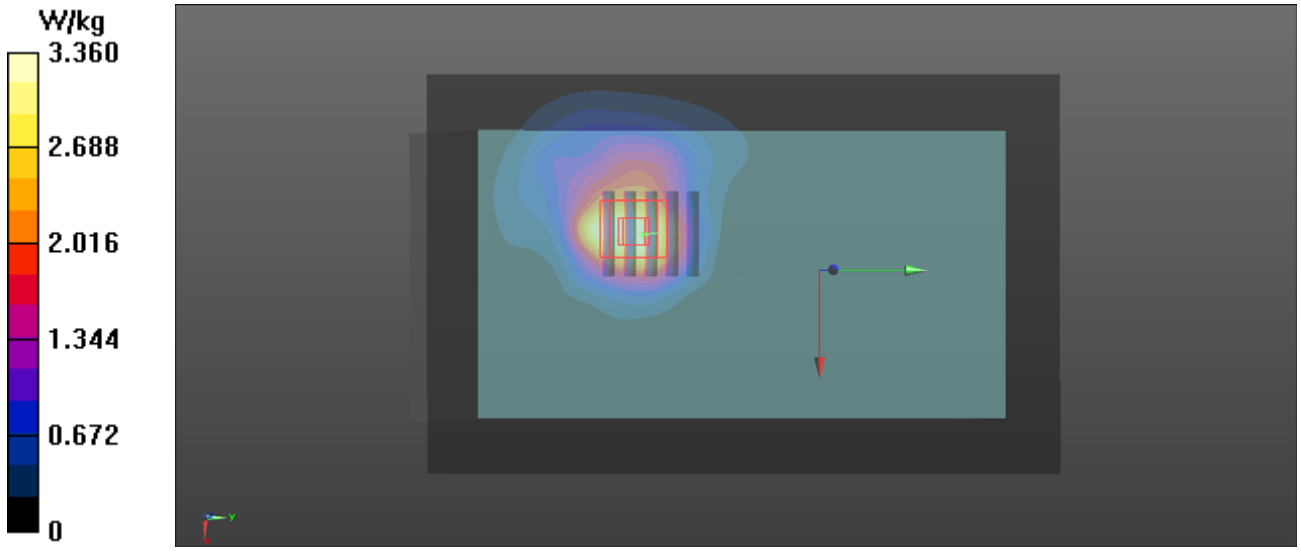
DUT: SKYCONTROLLER 2P

Communication System: 802.11b; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: B2450_1121 Medium parameters used: f = 2462 MHz; σ = 2.023 S/m; ε_r = 52.782; ρ = 1000 kg/m^3
Ambient Temperature：23.2 ℃; Liquid Temperature：22.1 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3970; ConvF(7.83, 7.83, 7.83); Calibrated: 2017/11/02;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1418; Calibrated: 2017/10/09
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1231
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

- Area Scan (131x201x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 3.36 W/kg

- Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.682 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 3.80 W/kg
SAR(1 g) = 2.22 W/kg; SAR(10 g) = 1.31 W/kg
Maximum value of SAR (measured) = 3.19 W/kg



Test Laboratory: Shenzhen EMTEK Co.,Ltd. Date: 2017/11/21

P07 802.11b_Front Face_0cm_Ch11_Antenna-1

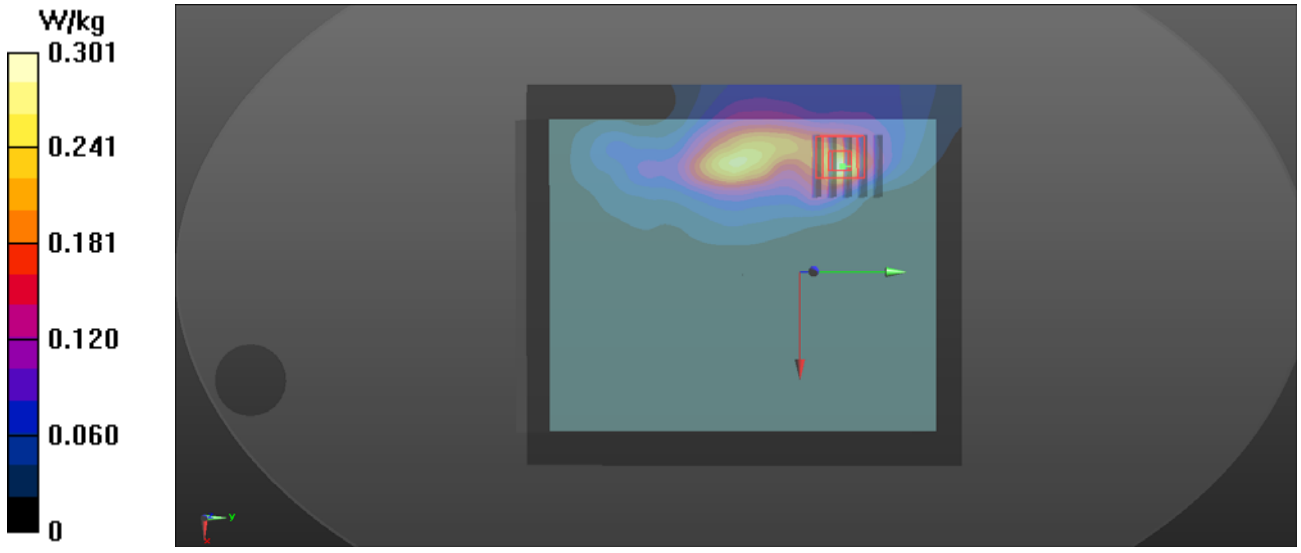
DUT: SKYCONTROLLER 2P

Communication System: 802.11b; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: B2450_1121 Medium parameters used: f = 2462 MHz; σ = 2.023 S/m; ε_r = 52.782; ρ = 1000 kg/m^3
Ambient Temperature：23.2 ℃； Liquid Temperature：22.1 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3970; ConvF(7.83, 7.83, 7.83); Calibrated: 2017/11/02;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1418; Calibrated: 2017/10/09
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1231
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

- Area Scan (161x191x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.301 W/kg

- Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.125 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 0.413 W/kg
SAR(1 g) = 0.201 W/kg; SAR(10 g) = 0.100 W/kg
Maximum value of SAR (measured) = 0.330 W/kg



Test Laboratory: Shenzhen EMTEK Co.,Ltd. Date: 2017/11/21

P08 802.11b_Right Side_0cm_Ch11_Antenna-1

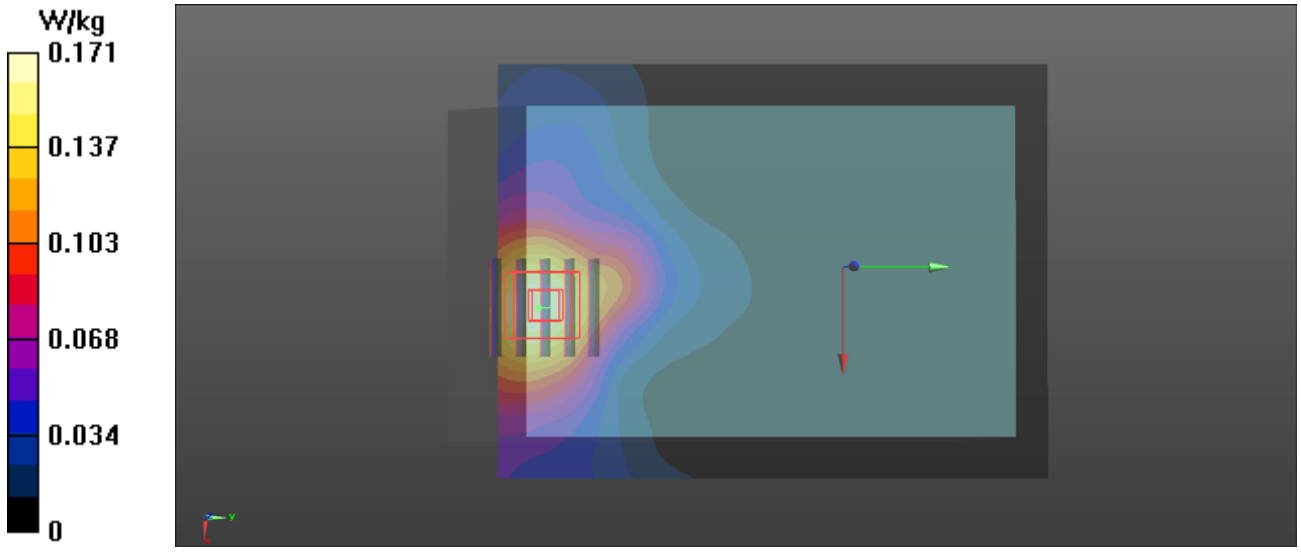
DUT: SKYCONTROLLER 2P

Communication System: 802.11b; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: B2450_1121 Medium parameters used: f = 2462 MHz; σ = 2.023 S/m; ε_r = 52.782; ρ = 1000 kg/m^3
Ambient Temperature：23.2 ℃； Liquid Temperature：22.1 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3970; ConvF(7.83, 7.83, 7.83); Calibrated: 2017/11/02;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1418; Calibrated: 2017/10/09
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1231
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

- Area Scan (111x151x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.171 W/kg

- Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 3.136 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 0.208 W/kg
SAR(1 g) = 0.116 W/kg; SAR(10 g) = 0.068 W/kg
Maximum value of SAR (measured) = 0.172 W/kg



Test Laboratory: Shenzhen EMTEK Co.,Ltd. Date: 2017/11/21

P09 802.11b_Top Side-2_0cm_Ch11_Antenna-1

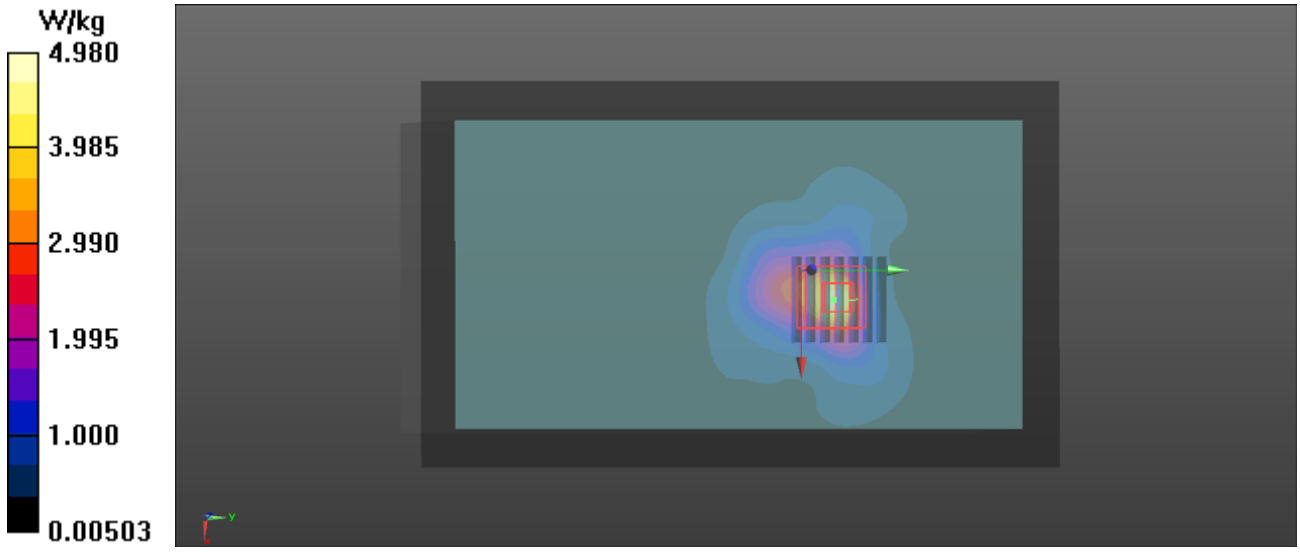
DUT: SKYCONTROLLER 2P

Communication System: 802.11b; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: B2450_1121 Medium parameters used: f = 2462 MHz; σ = 2.023 S/m; ε_r = 52.782; ρ = 1000 kg/m^3
Ambient Temperature：23.2 ℃; Liquid Temperature：22.1 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3970; ConvF(7.83, 7.83, 7.83); Calibrated: 2017/11/02;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1418; Calibrated: 2017/10/09
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1231
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

- Area Scan (111x191x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 4.98 W/kg

- Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 22.773 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 5.50 W/kg
SAR(1 g) = 2.89 W/kg; SAR(10 g) = 1.47 W/kg
Maximum value of SAR (measured) = 4.19 W/kg



Test Laboratory: Shenzhen EMTEK Co.,Ltd. Date: 2017/11/21

P10 802.11b_Top Side-3_0cm_Ch11_Antenna-1

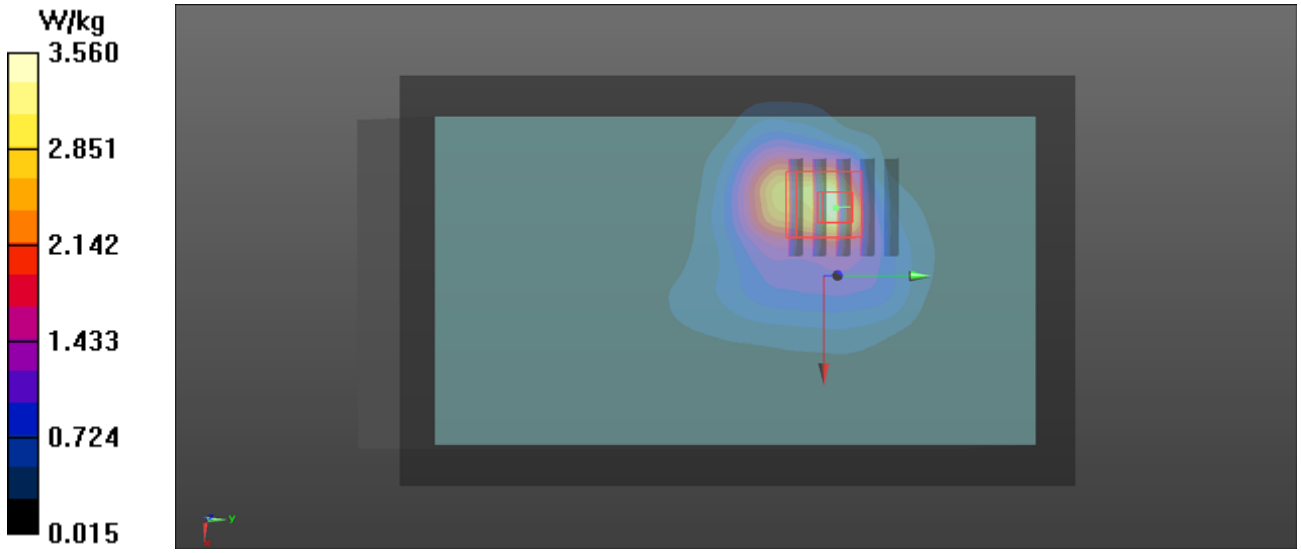
DUT: SKYCONTROLLER 2P

Communication System: 802.11b; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: B2450_1121 Medium parameters used: f = 2462 MHz; σ = 2.023 S/m; ε_r = 52.782; ρ = 1000 kg/m^3
Ambient Temperature：23.2 ℃; Liquid Temperature：22.1 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3970; ConvF(7.83, 7.83, 7.83); Calibrated: 2017/11/02;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1418; Calibrated: 2017/10/09
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1231
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

- Area Scan (111x191x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 3.56 W/kg

- Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 17.868 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 3.73 W/kg
SAR(1 g) = 2.07 W/kg; SAR(10 g) = 1.17 W/kg
Maximum value of SAR (measured) = 3.02 W/kg



Appendix C. Calibration Certificate for Probe and Dipole

The SPEAG calibration certificates are shown as follows.

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

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

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

Accreditation No.: SCS 0108

Client **Auden**

Certificate No: D2450V2-835_Jun17

CALIBRATION CERTIFICATE

Object: D2450V2 - SN:835

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

Calibration date: June 27, 2017

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-17 (No. 217-02521/02522)	Apr-18
Power sensor NRP-Z91	SN: 103244	04-Apr-17 (No. 217-02521)	Apr-18
Power sensor NRP-Z91	SN: 103245	04-Apr-17 (No. 217-02522)	Apr-18
Reference 20 dB Attenuator	SN: 5058 (20k)	07-Apr-17 (No. 217-02528)	Apr-18
Type-N mismatch combination	SN: 5047.2 / 06327	07-Apr-17 (No. 217-02529)	Apr-18
Reference Probe EX3DV4	SN: 7349	31-May-17 (No. EX3-7349_May17)	May-18
DAE4	SN: 601	28-Mar-17 (No. DAE4-601_Mar17)	Mar-18

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-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

	Name	Function	Signature
Calibrated by:	Johannes Kurikka	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: June 27, 2017

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.10.0
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	37.9 ± 6 %	1.85 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	13.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**52.1 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.18 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.4 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.2 ± 6 %	2.04 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	12.9 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**50.4 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	53.9 Ω + 5.9 jΩ
Return Loss	- 23.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.7 Ω + 7.0 jΩ
Return Loss	- 23.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.161 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 20, 2009

DASY5 Validation Report for Head TSL

Date: 27.06.2017

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:835

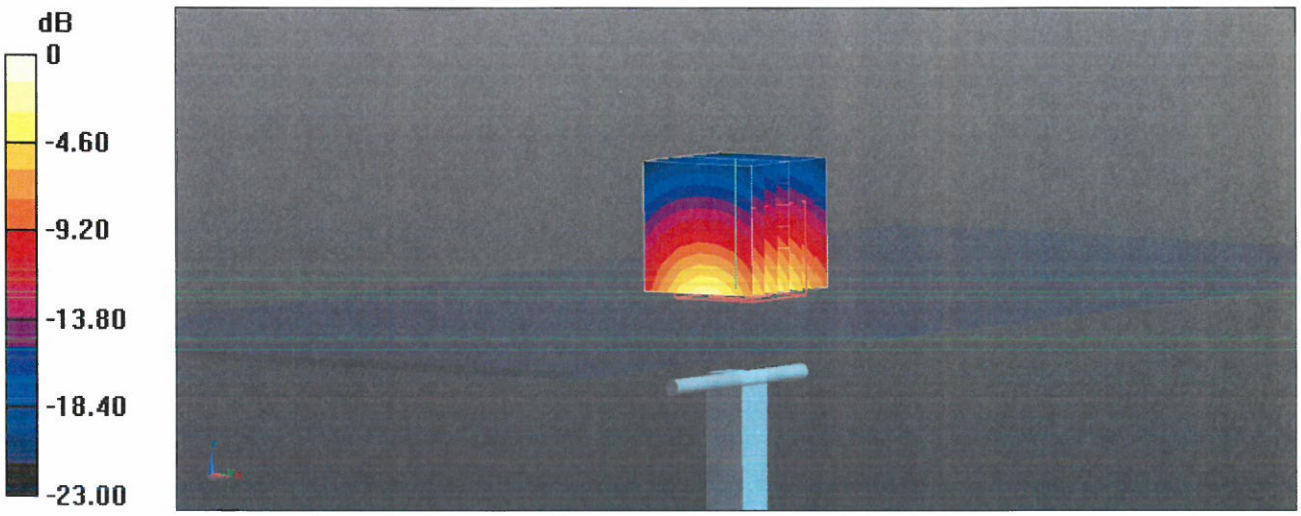
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.85 S/m; ε_r = 37.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.12, 8.12, 8.12); Calibrated: 31.05.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 28.03.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

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 = 112.5 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 26.6 W/kg
SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.18 W/kg
Maximum value of SAR (measured) = 21.2 W/kg



0 dB = 21.2 W/kg = 13.26 dBW/kg

Impedance Measurement Plot for Head TSL