APPENDIX 2: SAR Measurement data

Appendix 2-1: Evaluation procedure

The SAR evaluation was performed with the following procedure:

Step 1: Measurement of the E-field at a fixed location above the central position of flat phantom was used as a reference value for assessing the power drop.

Step 2: The SAR distribution at the exposed side of head or body position was measured at a distance of each device from the inner surface of the shell. The area covered the entire dimension of the antenna of EUT and suitable horizontal grid spacing of EUT. Based on these data, the area of the maximum absorption was determined by splines interpolation.

Step 3: Around this point found in the Step 2 (area scan), a volume of 30mm(X axis)×30mm(Y axis)×30mm(Z axis) was assessed by measuring 7×7×7 points under 3GHz.
And for any secondary peaks found in the Step2 which are within 2dB of maximum peak and not with this Step3 (Zoom scan) is repeated.
On the basis of this data set, the spatial peak SAR value was evaluated under the following procedure:

(1) The data at the surface were extrapolated, since the center of the dipoles is 1mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 2mm. The extrapolation was based on a least square algorithm. A polynomial of the fourth order was calculated through the points in z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip.

(2) The maximum interpolated value was searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1g or 10g) were computed by the 3D-Spline interpolation algorithm. The 3D-Spline is composed of three one-dimensional splines with the "Not a knot"-condition (in x, y and z-directions). The volume was integrated with the trapezoidal-algorithm. One thousand points (10×10×10) were interpolated to calculate the average.

(3) All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

Step 4: Re-measurement of the E-field at the same location as in Step 1 for the assessment of the power drift.

Step 5: Repeat Step 1-Step 4 with other condition or/and setup of EUT.

Appendix 2-2: Measurement data

Step 1: Change the positions

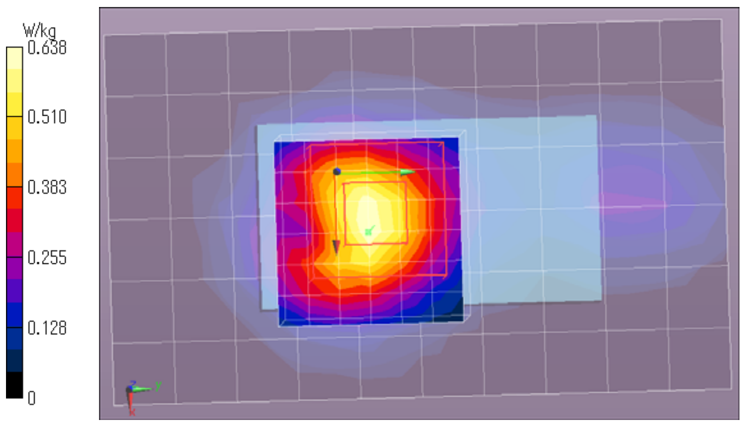
Step 1-1: Horizontal-Down & touch (separation distance=0mm) / 11b(1Mbps), 2412MHz (1ch.)

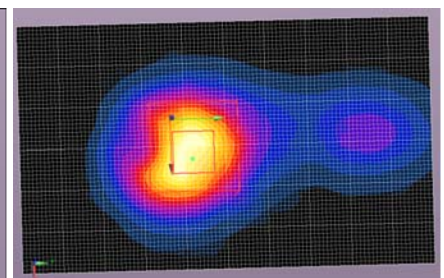
EUT: USB WIRELESS LAN ADAPTOR; Type: UD-WL01; Serial: 4
Communication System: IEEE 802.11b(1Mbps, DBPSK/DSSS); Frequency: 2412 MHz; Crest Factor: 1.0
Medium: M2450; Medium parameters used: f = 2412 MHz; σ = 1.946 S/m; ε_r = 50.72; ρ = 1000 kg/m^3
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration: -Probe: EX3DV4 - SN3679; ConvF(6.77, 6.77, 6.77); Calibrated: 2012/06/21;
-Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0, 161.0 -Electronics: DAE4 Sn518; Calibrated: 2012/10/17
-Phantom: ELI v4.0; Type: QDOVA001BA; Serial: 1059; Phantom section: Flat Section
-DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

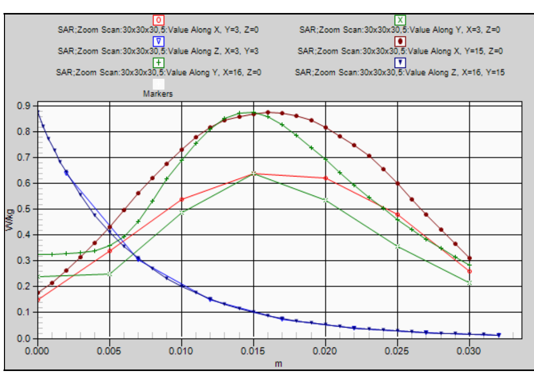
usb-dongle,near-body/f1,pos;hor-down(top)&touch(d0mm),11b(1m),m2412/
Area Scan:60x100,10 (7x11x1): Measurement grid: dx=10mm, dy=10mm; Maximum value of SAR (measured) = 0.622 W/kg
Area Scan:60x100,10 (61x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm; Maximum value of SAR (interpolated) = 0.653 W/kg
Z Scan:160,5 (1x1x33): Measurement grid: dx=20mm, dy=20mm, dz=5mm; Maximum value of SAR (measured) = 0.635 W/kg
Fast SAR(*.Polynomial) : SAR(1 g) = 0.442 mW/g; SAR(10 g) = 0.209 mW/g

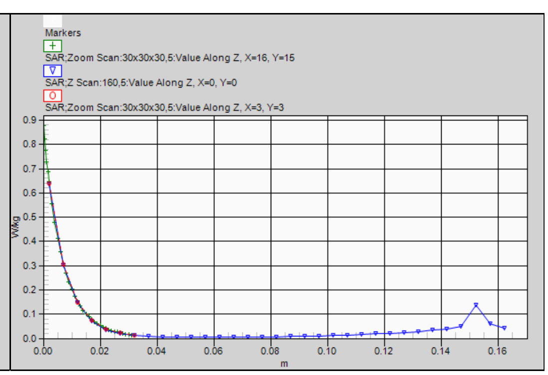
Zoom Scan:30x30x30,5 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm;
Reference Value = 18.343 V/m; Power Drift = -0.02 dB, Maximum value of SAR (measured) = 0.638 W/kg
Peak SAR (extrapolated) = 0.876 mW/g
SAR(1 g) = 0.424 mW/g; SAR(10 g) = 0.198 mW/g





(Shown with no transparency of an area scan and a fast SAR plot.)





Remarks: *. Date tested: 2013/05/08; Tested by: Hiroshi Naka; Tested place:No.7 shielded room,
*.liquid depth: 154mm; Position: distance of EUT to phantom: 0mm (2mm to liquid); ambient: 24.5 ± 0.5deg.C. / 40 ± 5 %RH,
*.liquid temperature: 22.4(start)/22.4(end)/22.8(in check) deg.C.; *.White cubic: zoom scan area, Red cubic: big=SAR(10g)/small=SAR(1g)

Appendix 2-2: Measurement data (cont'd)
Step 1: Change the positions (cont'd)

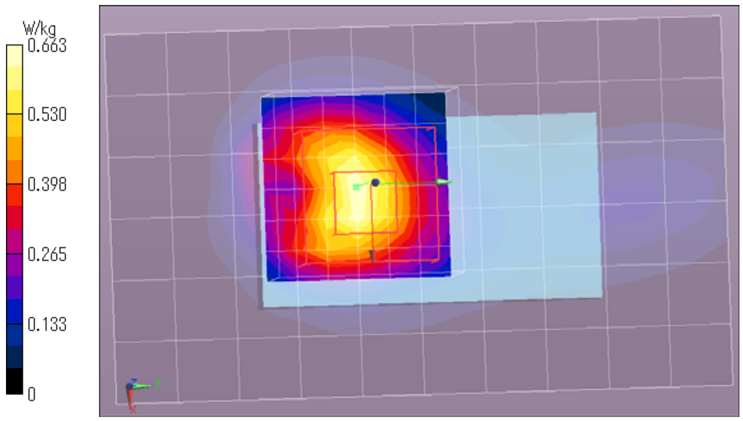
Step 1-2: Horizontal-Up & touch (separation distance=0mm) / 11b(1Mbps), 2412MHz (1ch.)

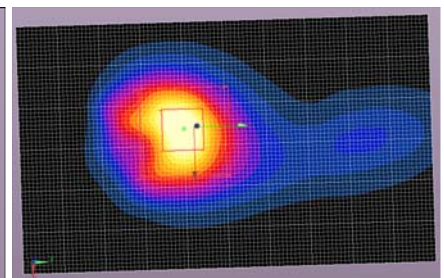
EUT: USB WIRELESS LAN ADAPTOR; Type: UD-WL01; Serial: 4
Communication System: IEEE 802.11b(1Mbps, DBPSK/DSSS); Frequency: 2412 MHz; Crest Factor: 1.0
Medium: M2450; Medium parameters used: f = 2412 MHz; σ = 1.946 S/m; ε_r = 50.72; ρ = 1000 kg/m^3
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration: -Probe: EX3DV4 - SN3679; ConvF(6.77, 6.77, 6.77); Calibrated: 2012/06/21;
-Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0, 161.0 -Electronics: DAE4 Sn518; Calibrated: 2012/10/17
-Phantom: ELI v4.0; Type: QDOVA001BA; Serial: 1059; Phantom section: Flat Section
-DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

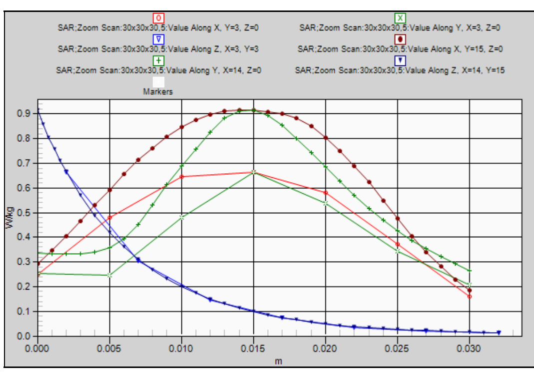
usb-dongle,near-body/f2,pos;hor-up&touch(d0mm),11b(1m),m2412/
Area Scan:60x100,10 (7x11x1): Measurement grid: dx=10mm, dy=10mm; Maximum value of SAR (measured) = 0.676 W/kg
Area Scan:60x100,10 (61x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm; Maximum value of SAR (interpolated) = 0.707 W/kg
Z Scan:160,5 (1x1x33): Measurement grid: dx=20mm, dy=20mm, dz=5mm; Maximum value of SAR (measured) = 0.668 W/kg
Fast SAR(*.Polynomial): SAR(1 g) = 0.473 mW/g; SAR(10 g) = 0.217 mW/g

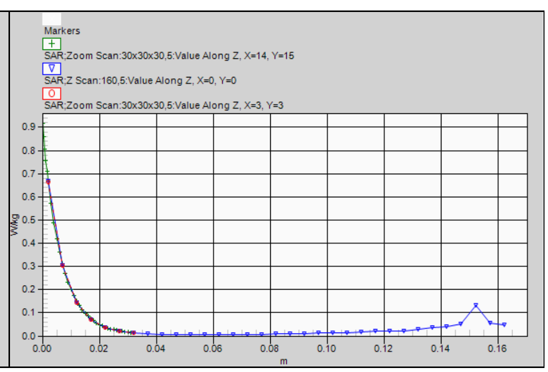
Zoom Scan:30x30x30,5 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm;
Reference Value = 18.833 V/m; Power Drift = -0.08 dB, Maximum value of SAR (measured) = 0.663 W/kg
Peak SAR (extrapolated) = 0.915 mW/g
SAR(1 g) = 0.432 mW/g; SAR(10 g) = 0.201 mW/g





(Shown with no transparency of an area scan and a fast SAR plot.)





Remarks: *. Date tested: 2013/05/08; Tested by: Hiroshi Naka; Tested place:No.7 shielded room,
*.liquid depth: 154mm; Position: distance of EUT to phantom: 0mm (2mm to liquid); ambient: 24.5 ± 0.5deg.C. / 40 ± 5 %RH,
*.liquid temperature: 22.4(start)/22.4(end)/22.8(in check) deg.C.; *.White cubic: zoom scan area, Red cubic: big=SAR(10g)/small=SAR(1g)

Appendix 2-2: Measurement data (cont'd)
Step 1: Change the positions (cont'd)

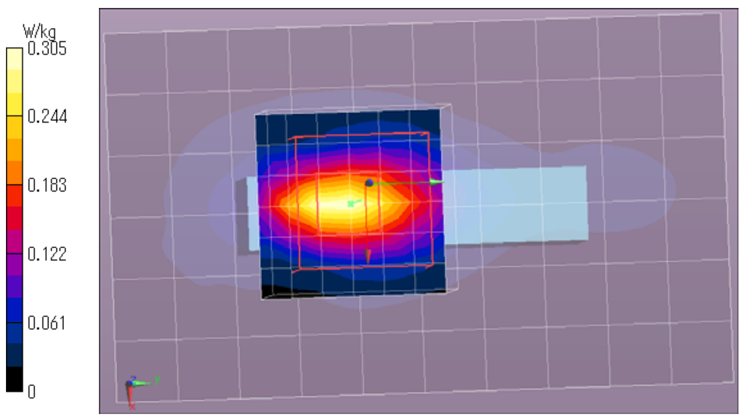
Step 1-3: Vertical-Front & touch (separation distance=0mm) / 11b(1Mbps), 2412MHz (1ch.)

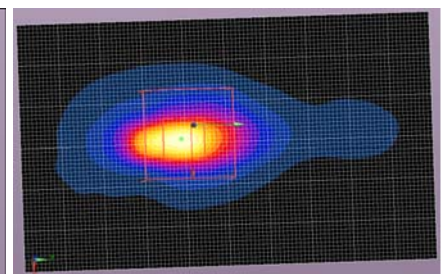
EUT: USB WIRELESS LAN ADAPTOR; Type: UD-WL01; Serial: 4
Communication System: IEEE 802.11b(1Mbps, DBPSK/DSSS); Frequency: 2412 MHz; Crest Factor: 1.0
Medium: M2450; Medium parameters used: f = 2412 MHz; σ = 1.946 S/m; ε_r = 50.72; ρ = 1000 kg/m^3
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

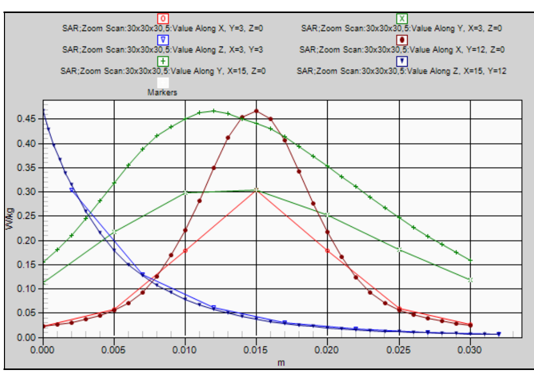
DASY Configuration: -Probe: EX3DV4 - SN3679; ConvF(6.77, 6.77, 6.77); Calibrated: 2012/06/21;
-Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0, 161.0 -Electronics: DAE4 Sn518; Calibrated: 2012/10/17
-Phantom: ELI v4.0; Type: QDOVA001BA; Serial: 1059; Phantom section: Flat Section
-DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

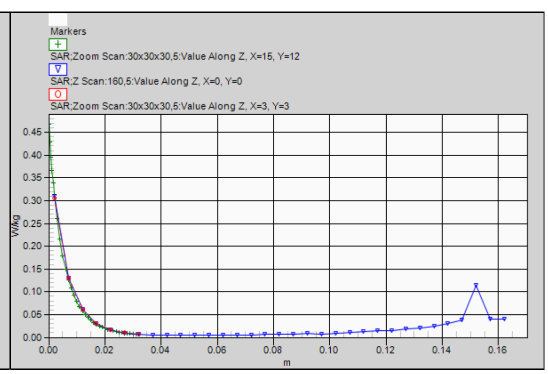
usb-dongle,near-body/f3,pos;ver-front&touch(d0mm),11b(1m),m2412/
Area Scan:60x100,10 (7x11x1): Measurement grid: dx=10mm, dy=10mm; Maximum value of SAR (measured) = 0.298 W/kg
Area Scan:60x100,10 (61x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm; Maximum value of SAR (interpolated) = 0.303 W/kg
Z Scan:160,5 (1x1x33): Measurement grid: dx=20mm, dy=20mm, dz=5mm; Maximum value of SAR (measured) = 0.309 W/kg
Fast SAR(*.Polynomial): SAR(1 g) = 0.174 mW/g; SAR(10 g) = 0.065 mW/g

Zoom Scan:30x30x30,5 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm;
Reference Value = 12.752 V/m; Power Drift = -0.06 dB, Maximum value of SAR (measured) = 0.305 W/kg
Peak SAR (extrapolated) = 0.467 mW/g
SAR(1 g) = 0.173 mW/g; SAR(10 g) = 0.066 mW/g




(Shown with no transparency of an area scan and a fast SAR plot.)





Remarks: *. Date tested: 2013/05/08; Tested by: Hiroshi Naka; Tested place:No.7 shielded room,
*.liquid depth: 154mm; Position: distance of EUT to phantom: 0mm (2mm to liquid); ambient: 24.5 ± 0.5deg.C. / 40 ± 5 %RH,
*.liquid temperature: 22.4(start)/22.4(end)/22.8(in check) deg.C.; *.White cubic: zoom scan area, Red cubic: big=SAR(10g)/small=SAR(1g)

Appendix 2-2: Measurement data (cont'd)
Step 1: Change the positions (cont'd)

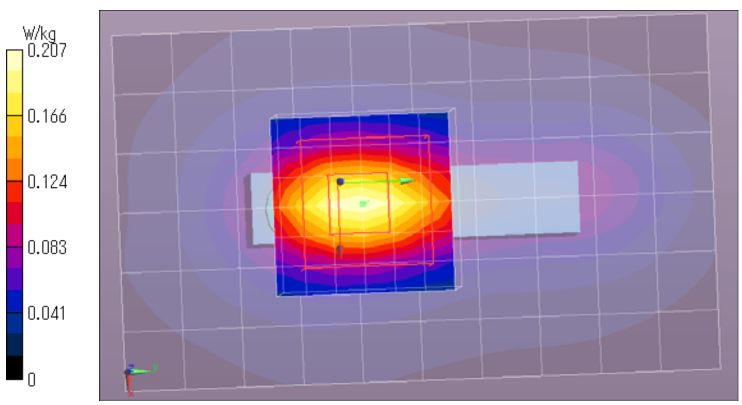
Step 1-4: Vertical-Back & touch (separation distance=0mm) / 11b(1Mbps), 2412MHz (1ch.)

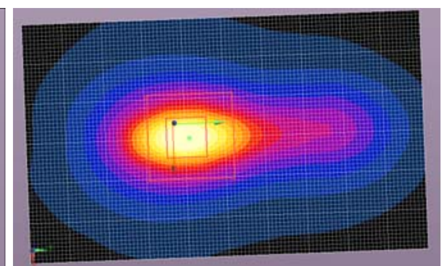
EUT: USB WIRELESS LAN ADAPTOR; Type: UD-WL01; Serial: 4
Communication System: IEEE 802.11b(1Mbps, DBPSK/DSSS); Frequency: 2412 MHz; Crest Factor: 1.0
Medium: M2450; Medium parameters used: f = 2412 MHz; σ = 1.946 S/m; ε_r = 50.72; ρ = 1000 kg/m^3
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration: -Probe: EX3DV4 - SN3679; ConvF(6.77, 6.77, 6.77); Calibrated: 2012/06/21;
-Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0, 161.0 -Electronics: DAE4 Sn518; Calibrated: 2012/10/17
-Phantom: ELI v4.0; Type: QDOVA001BA; Serial: 1059; Phantom section: Flat Section
-DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

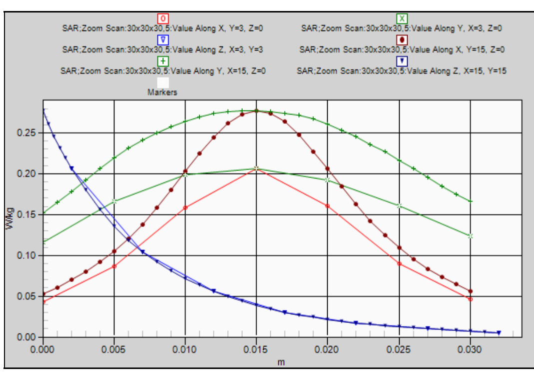
usb-dongle,near-body/f4,pos;ver-bak&touch(d0mm),11b(1m),m2412/
Area Scan:60x100,10 (7x11x1): Measurement grid: dx=10mm, dy=10mm; Maximum value of SAR (measured) = 0.213 W/kg
Area Scan:60x100,10 (61x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm; Maximum value of SAR (interpolated) = 0.214 W/kg
Z Scan:160,5 (1x1x33): Measurement grid: dx=20mm, dy=20mm, dz=5mm; Maximum value of SAR (measured) = 0.208 W/kg
Fast SAR: SAR(1 g) = 0.140 mW/g; SAR(10 g) = 0.063 mW/g

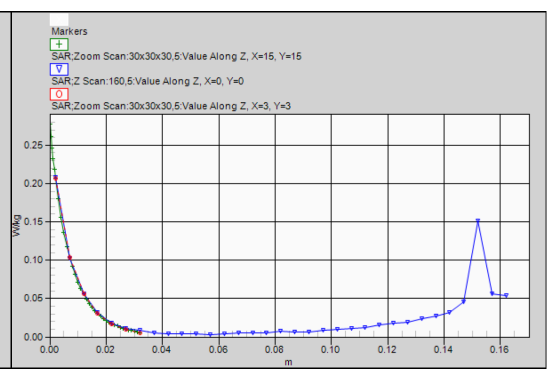
Zoom Scan:30x30x30,5 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm;
Reference Value = 10.601 V/m; Power Drift = -0.05 dB, Maximum value of SAR (measured) = 0.207 W/kg
Peak SAR (extrapolated) = 0.277 mW/g
SAR(1 g) = 0.136 mW/g; SAR(10 g) = 0.065 mW/g





(Shown with no transparency of an area scan and a fast SAR plot.)





Remarks: *. Date tested: 2013/05/08; Tested by: Hiroshi Naka; Tested place:No.7 shielded room,
*.liquid depth: 154mm; Position: distance of EUT to phantom: 0mm (2mm to liquid); ambient: 24.5 ± 0.5deg.C. / 40 ± 5 %RH,
*.liquid temperature: 22.4(start)/22.5(end)/22.8(in check) deg.C.; *.White cubic: zoom scan area, Red cubic: big=SAR(10g)/small=SAR(1g)

Appendix 2-2: Measurement data (cont'd)
Step 1: Change the positions (cont'd)

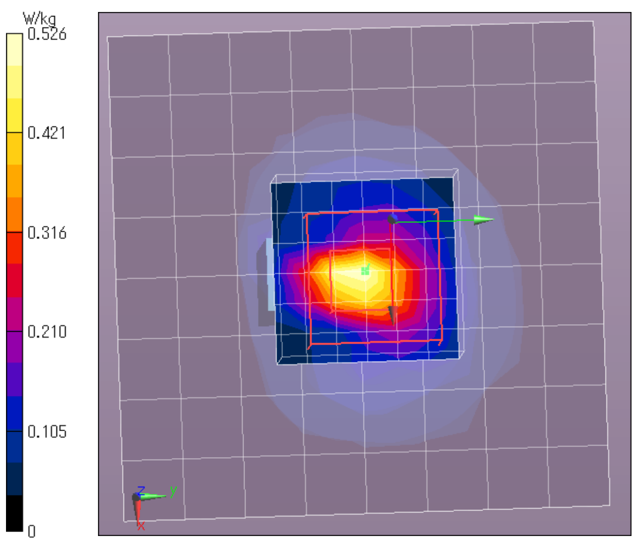
Step 1-5: Tip & touch (separation distance=0mm) / 11b(1Mbps), 2412MHz (1ch.)

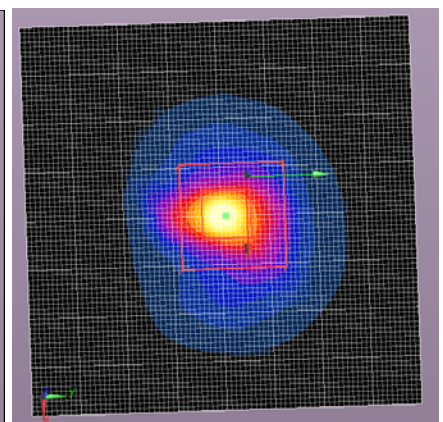
EUT: USB WIRELESS LAN ADAPTOR; Type: UD-WL01; Serial: 4
Communication System: IEEE 802.11b(1Mbps, DBPSK/DSSS); Frequency: 2412 MHz; Crest Factor: 1.0
Medium: M2450; Medium parameters used: f = 2412 MHz; σ = 1.946 S/m; ε_r = 50.72; ρ = 1000 kg/m^3
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration: -Probe: EX3DV4 - SN3679; ConvF(6.77, 6.77, 6.77); Calibrated: 2012/06/21;
-Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0, 161.0 -Electronics: DAE4 Sn518; Calibrated: 2012/10/17
-Phantom: ELI v4.0; Type: QDOVA001BA; Serial: 1059; Phantom section: Flat Section
-DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

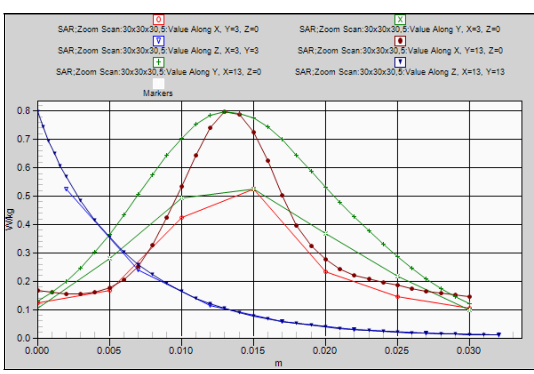
usb-dongle,near-body/f5,pos;tip&touch(d0mm),11b(1m),m2412/
Area Scan:80x80,10 (9x9x1): Measurement grid: dx=10mm, dy=10mm; Maximum value of SAR (measured) = 0.564 W/kg
Area Scan:80x80,10 (81x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm; Maximum value of SAR (interpolated) = 0.564 W/kg
Z Scan:160,5 (1x1x33): Measurement grid: dx=20mm, dy=20mm, dz=5mm; Maximum value of SAR (measured) = 0.521 W/kg
Fast SAR: SAR(1 g) = 0.313 mW/g; SAR(10 g) = 0.119 mW/g

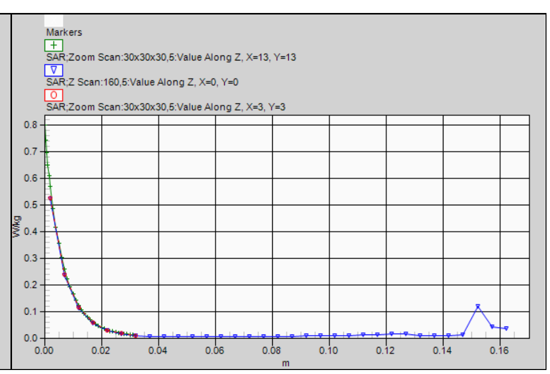
Zoom Scan:30x30x30,5 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm;
Reference Value = 16.803 V/m; Power Drift = -0.20 dB, Maximum value of SAR (measured) = 0.526 W/kg
Peak SAR (extrapolated) = 0.797 mW/g
SAR(1 g) = 0.308 mW/g; SAR(10 g) = 0.114 mW/g





(Shown with no transparency of an area scan and a fast SAR plot.)





Remarks: *. Date tested: 2013/05/08; Tested by: Hiroshi Naka; Tested place:No.7 shielded room,
*.liquid depth: 154mm; Position: distance of EUT to phantom: 0mm (2mm to liquid); ambient: 24.5 ± 0.5deg.C. / 40 ± 5 %RH,
*.liquid temperature: 22.5(start)/22.5(end)/22.8(in check) deg.C.; *.White cubic: zoom scan area, Red cubic: big=SAR(10g)/small=SAR(1g)

Appendix 2-2: Measurement data (cont'd)

Step 2: Change the channels

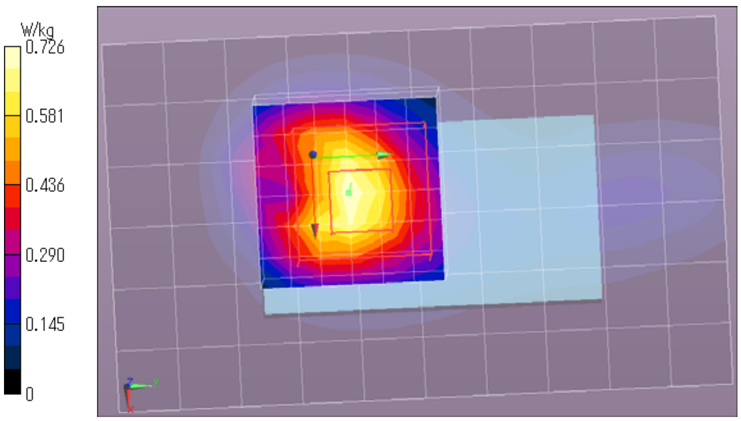
Step 2-1: 2437MHz (6ch) / Vertical-Back & touch (separation distance=0mm), 11b(1Mbps)

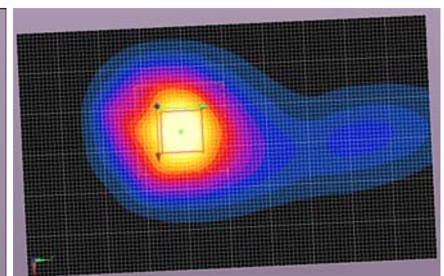
EUT: USB WIRELESS LAN ADAPTOR; Type: UD-WL01; Serial: 4
Communication System: IEEE 802.11b(1Mbps, DBPSK/DSSS); Frequency: 2437 MHz; Crest Factor: 1.0
Medium: M2450; Medium parameters used: f = 2437 MHz; σ = 1.981 S/m; ε_r = 50.60; ρ = 1000 kg/m^3
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

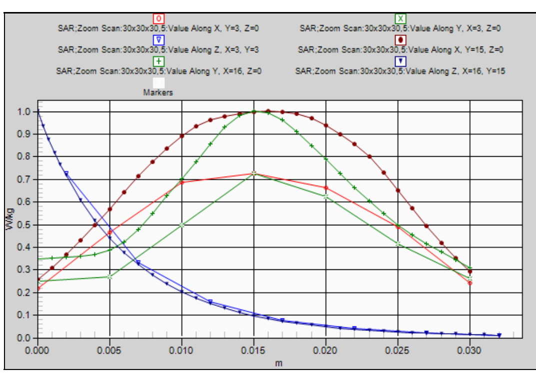
DASY Configuration: -Probe: EX3DV4 - SN3679; ConvF(6.77, 6.77, 6.77); Calibrated: 2012/06/21;
-Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0, 161.0 -Electronics: DAE4 Sn518; Calibrated: 2012/10/17
-Phantom: ELI v4.0; Type: QDOVA001BA; Serial: 1059; Phantom section: Flat Section
-DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

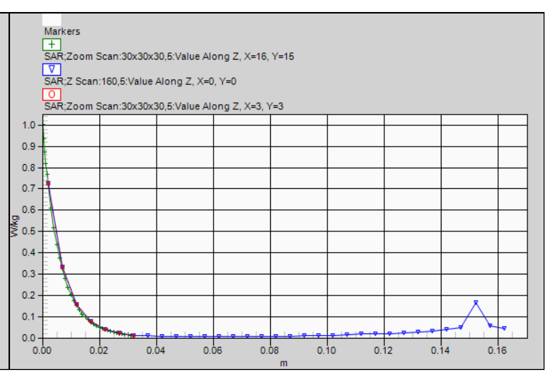
usb-dongle,near-body/f6,ch;hor-up&touch(d0mm),11b(1m),m2437/
Area Scan:60x100,10 (7x11x1): Measurement grid: dx=10mm, dy=10mm; Maximum value of SAR (measured) = 0.713 W/kg
Area Scan:60x100,10 (61x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm; Maximum value of SAR (interpolated) = 0.786 W/kg
Z Scan:160,5 (1x1x33): Measurement grid: dx=20mm, dy=20mm, dz=5mm; Maximum value of SAR (measured) = 0.726 W/kg
Fast SAR: SAR(1 g) = 0.523 mW/g; SAR(10 g) = 0.237 mW/g

Zoom Scan:30x30x30,5 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm;
Reference Value = 19.520 V/m; Power Drift = -0.07 dB, Maximum value of SAR (measured) = 0.726 W/kg
Peak SAR (extrapolated) = 1.001 mW/g
SAR(1 g) = 0.472 mW/g; SAR(10 g) = 0.220 mW/g




(Shown with no transparency of an area scan and a fast SAR plot.)





Remarks: *. Date tested: 2013/05/08; Tested by: Hiroshi Naka; Tested place:No.7 shielded room,
*.liquid depth: 154mm; Position: distance of EUT to phantom: 0mm (2mm to liquid); ambient: 24.5 ± 0.5deg.C. / 40 ± 5 %RH,
*.liquid temperature: 22.4(start)/22.5(end)/22.8(in check) deg.C.; *.White cubic: zoom scan area, Red cubic: big=SAR(10g)/small=SAR(1g)

Appendix 2-2: Measurement data (cont'd)
Step 2: Change the channels (cont'd)

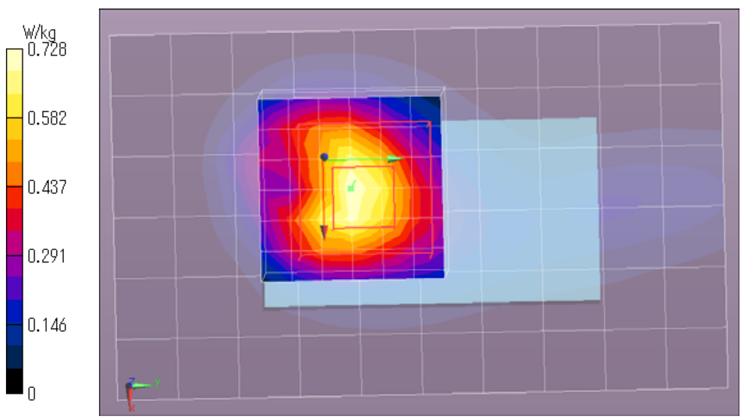
Step 2-2: 2462MHz (11ch) / Vertical-Back & touch (separation distance=0mm), 11b(1Mbps)
-> Worst SAR (1g) of EUT

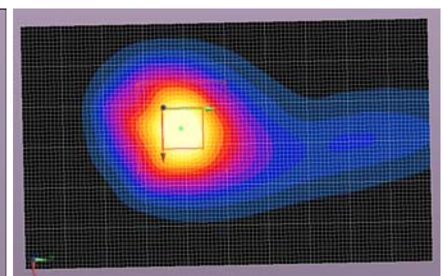
EUT: USB WIRELESS LAN ADAPTOR; Type: UD-WL01; Serial: 4
Communication System: IEEE 802.11b(1Mbps, DBPSK/DSSS); Frequency: 2462 MHz; Crest Factor: 1.0
Medium: M2450; Medium parameters used: f = 2462 MHz; σ = 2.012 S/m; ε_r = 50.49; ρ = 1000 kg/m^3
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration: -Probe: EX3DV4 - SN3679; ConvF(6.77, 6.77, 6.77); Calibrated: 2012/06/21;
-Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0, 161.0 -Electronics: DAE4 Sn518; Calibrated: 2012/10/17
-Phantom: ELI v4.0; Type: QDOVA001BA; Serial: 1059; Phantom section: Flat Section
-DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

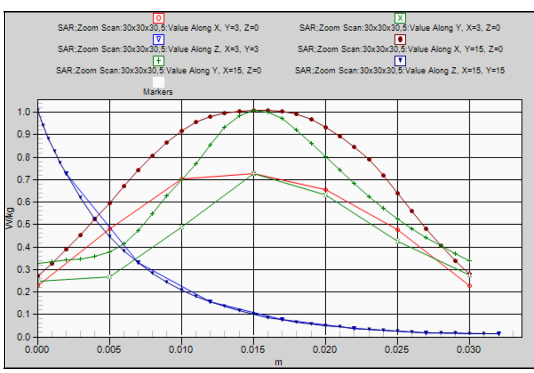
usb-dongle,near-body/f7,ch;hor-up&touch(d0mm),11b(1m),m2462/
Area Scan:60x100,10 (7x11x1): Measurement grid: dx=10mm, dy=10mm; Maximum value of SAR (measured) = 0.731 W/kg
Area Scan:60x100,10 (61x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm; Maximum value of SAR (interpolated) = 0.788 W/kg
Z Scan:160,5 (1x1x33): Measurement grid: dx=20mm, dy=20mm, dz=5mm; Maximum value of SAR (measured) = 0.724 W/kg
Fast SAR: SAR(1 g) = 0.525 mW/g; SAR(10 g) = 0.238 mW/g

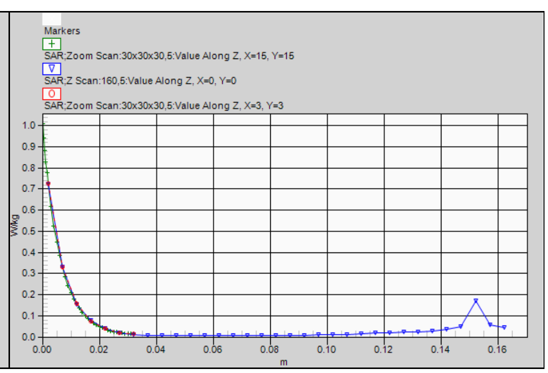
Zoom Scan:30x30x30,5 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm;
Reference Value = 19.317 V/m; Power Drift = -0.07 dB, Maximum value of SAR (measured) = 0.728 W/kg
Peak SAR (extrapolated) = 1.008 mW/g
SAR(1 g) = 0.476 mW/g; SAR(10 g) = 0.220 mW/g





(Shown with no transparency of an area scan and a fast SAR plot.)





Remarks: *. Date tested: 2013/05/08; Tested by: Hiroshi Naka; Tested place:No.7 shielded room,
*.liquid depth: 154mm; Position: distance of EUT to phantom: 0mm (2mm to liquid); ambient: 24.5 ± 0.5deg.C. / 40 ± 5 %RH,
*.liquid temperature: 22.5(start)/22.5(end)/22.8(in check) deg.C.; *.White cubic: zoom scan area, Red cubic: big=SAR(10g)/small=SAR(1g)

APPENDIX 3: Test instruments

Appendix 3-1: Equipment used

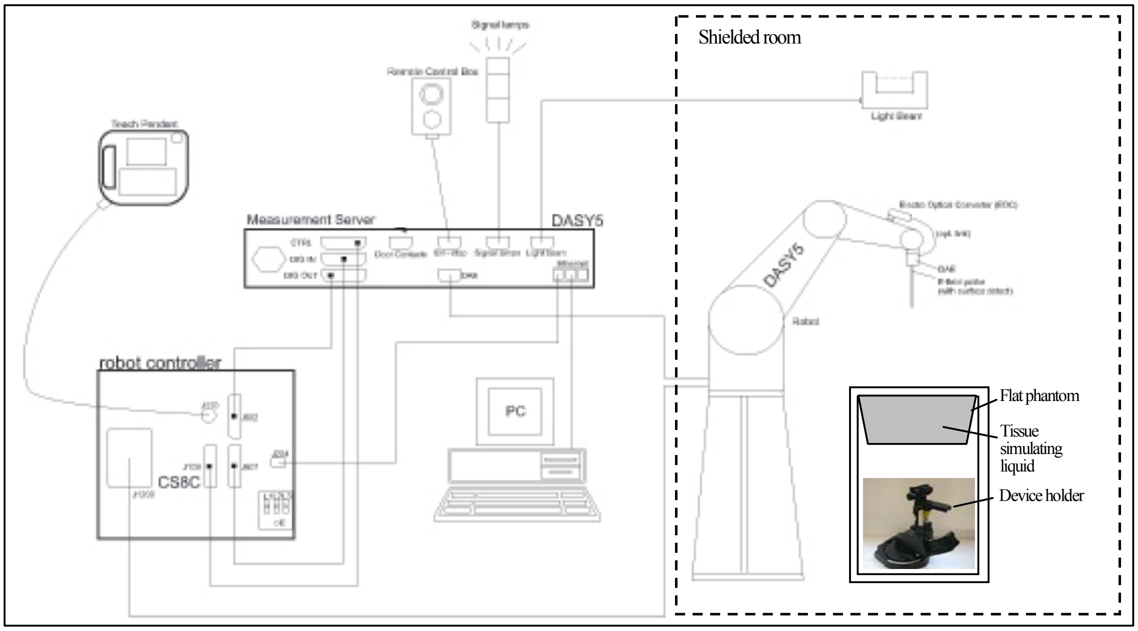
Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
COTS-SSAR-02	DASY52	Schmid&Partner Engineering AG	DASY52 V8.2 B969	-	SAR	-
COTS-KSEP-01	Dielectric measurement	Agilent	85070	1	SAR	-
SSAR-02	SAR measurement system	Schmid&Partner Engineering AG	DASY5	1324	SAR	Pre Check
SSRBT-02	SAR robot	Schmid&Partner Engineering AG	TX60 Lspeag	F12/5L2QA1/A/01	SAR	2012/09/24 * 12
KDAE-R01	Data Acquisition Electronics	Schmid&Partner Engineering AG	DAE4	518	SAR	2012/10/18 * 12
KPB-01	Dosimetric E-Field Probe	Schmid&Partner Engineering AG	EX3DV4	3679	SAR	2012/06/21 * 12
KSDA-01	Dipole Antenna	Schmid&Partner Engineering AG	D2450V2	822	SAR(daily)	2013/01/08 * 12
KPFL-01	Flat Phantom	Schmid&Partner Engineering AG	Oval flat phantom ELI 4.0	1059	SAR	2012/10/31 * 12
SSNA-01	Network Analyzer	Agilent	8753ES	US39171777	SAR	2012/12/29 * 12
KEPP-01	Dielectric probe	Agilent	85070E/8710-2036	2540	SAR	2013/03/05 * 12
KSG-08	Signal Generator	Rohde & Schwarz	SMT06	100763	SAR(daily)	2012/06/26 * 12
KPA-12	RF Power Amplifier	MILMEGA	AS2560-50	1018582	SAR(daily)	Pre Check
KCPL-07	Directional Coupler	Pulsar Microwave Corp.	CCS30-B26	0621	SAR(daily)	Pre Check
KPM-06	Power Meter	Rohde & Schwarz	NRVD	101599	SAR(daily)	2012/09/13 * 12
KIU-08	Power sensor	Rohde & Schwarz	NRV-Z4	100372	SAR(daily)	2012/09/13 * 12
KIU-09	Power sensor	Rohde & Schwarz	NRV-Z4	100371	SAR(daily)	2012/09/13 * 12
KAT10-P1	Attenuator	Weinschel	24-10-34	BY5927	SAR(daily)	2013/02/27 * 12
KPM-05	Power meter	Agilent	E4417A	GB41290718	SAR(daily)	2013/04/18 * 12
KPSS-01	Power sensor	Agilent	E9327A	US40440544	SAR(daily)	2013/04/18 * 12
SAT20-SAR1	Attenuator	TME	SFA-01AXPJ-20	-	SAR(daily)	2013/04/05 * 12
KRU-01	Ruler(300mm)	Shinwa	13134	-	SAR(daily)	2013/03/25 * 12
KRU-02	Ruler(150mm,L)	Shinwa	12103	-	SAR	2013/03/25 * 12
KRU-03	Ruler(150mm,caliper)	Niigata Seiki	SK-M150	806164	SAR	2013/03/25 * 12
KRU-05	Ruler(100x50mm,L)	Shinwa	12101	-	SAR(daily)	2012/05/29 * 12
KOS-13	Digtal thermometer	HANNA	Checktemp-2	KOS-13	SAR	2013/01/31 * 12
KOS-14	Thermo-Hygrometer data logger	SATO KEIRYOKI	SK-L200THIIα / SK-LTHIIα-2	015246/08169	SAR	2013/01/31 * 12
SOS-11	Humidity Indicator	A&D	AD-5681	4063424	SAR	2013/02/27 * 12
KPM-08	Power meter	Anritsu	ML2495A	6K00003356	Ant.pwr	2012/09/14 * 12
KPSS-04	Power sensor	Anritsu	MA2411B	012088	Ant.pwr	2012/09/14 * 12
KAT10-S3	Attenuator	Agilent	8490D 010	50924	Ant.pwr	2013/02/19 * 12
SSA-04	Spectrum Analyzer	Advantest	R3272	101100994	SAR(moni.)	2012/12/17 * 12
KSDH-01	Device holder	Schmid&Partner Engineering AG	Mounting device for transmitter	-	SAR	Pre Check
SWTR-03	DI water	MonotaRo	34557433	-	SAR(daily)	Pre Check
KSLM245-01	Tissue simulation liqud (2450MHz,body)	Schmid&Partner Engineering AG	SL AAM 245	-	SAR	(Daily check) Target value ±5%
No.7 Shielded room	SAR shielded room (2.76m(W)x3.76m(D)x2.4m(H))	TDK	-	-	SAR	*(Daily check) Ambient noise: < 12mW/kg*

The expiration date of calibration is the end of the expired month.
As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.
All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

[Test Item] SAR: Specific Absorption Rate, Ant.pwr: Antenna terminal conducted power

Appendix 3-2: Configuration and peripherals

These measurements were performed with the automated near-field scanning system DASY5 from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision robot), which positions the probes with a positional repeatability of better than ± 0.02 mm. Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines to the data acquisition unit. The SAR measurements were conducted with the dosimetry probes EX3DV4 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation.



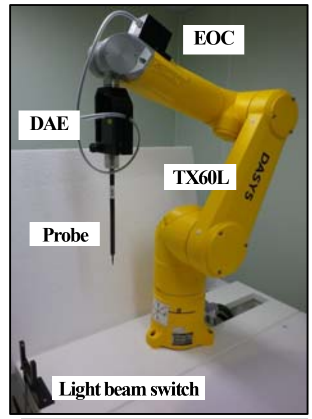
The DASY5 system for performing compliance tests consist of the following items:

1	A standard high precision 6-axis robot (Stäubli TX/RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
2	An isotropic field probe optimized and calibrated for the targeted measurement.
3	A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
4	The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
5	The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
6	The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
7	A computer running Win7 professional operating system and the DASY5 software.
8	R Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
9	The phantom.
10	The device holder for EUT. (low-loss dielectric palette) (*. when it was used.)
11	Tissue simulating liquid mixed according to the given recipes.
12	Validation dipole kits allowing to validate the proper functioning of the system.

Appendix 3-3: Test system specification

TX60 Lsepag robot/CS8Csepag-TX60 robot controller

- •Number of Axes : 6 •Repeatability : ±0.02mm
- •Manufacture : Stäubli Unimation Corp.



DASY5 Measurement server

- •Features : The DASY5 measurement server is based on a PC/104 CPU board with a 400MHz intel ULV Celeron, 128MB chip-disk and 128MB RAM. The necessary circuits for communication with the DAE4 electronics box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY5 I/O board, which is directly connected to the PC/104 bus of the CPU board.
- •Calibration : No calibration required.
- •Manufacture : Schmid & Partner Engineering AG

Data Acquisition Electronic (DAE)

- •Features : Signal amplifier, multiplexer, A/D converter and control logic. Serial optical link for communication with DASY5 embedded system (fully remote controlled). 2 step probe touch detector for mechanical surface detection and emergency robot stop (not in -R version)
- •Measurement Range : 1μV to > 200mV (16bit resolution and 2 range settings: 4mV, 400mV)
- •Input Offset voltage : < 1μV (with auto zero)
- •Input Resistance : 200MΩ
- •Battery Power : > 10hr of operation (with two 9V battery)
- •Manufacture : Schmid & Partner Engineering AG

Electro-Optical Converter (EOC61)

- •Manufacture : Schmid & Partner Engineering AG

Light Beam Switch (LB5/80)

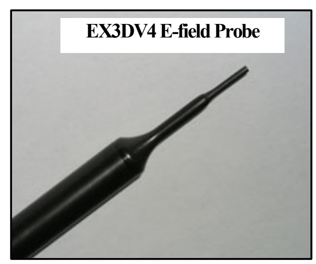
- •Manufacture : Schmid & Partner Engineering AG

SAR measurement software

- •Item : Dosimetric Assessment System DASY5
- •Software version : DASY52, V8.2 B969
- •Manufacture : Schmid & Partner Engineering AG

E-Field Probe

- •Model : **EX3DV4 (serial number: 3679)**
- •Construction : Symmetrical design with triangular core. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE).
- •Frequency : 10MHz to 6GHz, Linearity: ±0.2 dB (30MHz to 6GHz)
- •Conversion Factors : 2450, 5200, 5300, 5500, 5600, 5800MHz (Head and Body)
- •Directivity : ±0.3 dB in HSL (rotation around probe axis) ±0.5 dB in tissue material (rotation normal to probe axis)
- •Dynamic Range : 10μW/g to > 100 mW/g; Linearity: ±0.2 dB (noise: typically < 1μW/g)
- •Dimension : Overall length: 330mm (Tip: 20mm) Tip diameter: 2.5mm (Body: 12mm) Typical distance from probe tip to dipole centers: 1mm
- •Application : High precision dosimetric measurement in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6GHz with precision of better 30%.
- •Manufacture : Schmid & Partner Engineering AG



Phantom

- •Type : **ELI 4.0 oval flat phantom**
- •Shell Material : Fiberglass •Shell Thickness : Bottom plate: 2 ±0.2mm
- •Dimensions : Bottom elliptical: 600×400mm, Depth: 190mm (Volume: Approx. 30 liters)
- •Manufacture : Schmid & Partner Engineering AG

Device Holder

☒ Urethane foam
☒ KSDH-01: In combination with the ELI4, the Mounting Device enables the rotation of the mounted transmitter device in spherical coordinates. Transmitter devices can be easily and accurately positioned. The low-loss dielectric urethane foam was used for the mounting section of device holder.
•Material : POM •Manufacture : Schmid & Partner Engineering AG

Appendix 3-4: Simulated tissue composition and parameter confirmation

Liquid type used	☐ used / Head, HSL 2450	☒ used / Body, MSL 2450
M/N / Control No.	SL AAH 245 / KSLH245-01	SL AAM 245 / KSLM245-01
Ingredient	**Mixture (%)**	**Mixture (%)**
Water	52-75 %	52-75 %
$C_8H_{18}O_3$ (DGBE, .Diethylene glycol monobutyl ether)	25-48%	25-48%
NaCl	<1.0%	<1.0%
Manufacture	Schmid&Partner Engineering AG	Schmid&Partner Engineering AG

*. The dielectric parameters were checked prior to assessment using the 85070E dielectric probe kit.

Dielectric parameter measurement results (Body tissue)

Date	Freq. [MHz]	Ambient		Liq.T.[deg.C.]		Liquid Depth [mm]	Parameters Relative permittivity: εr Conductivity: σ	Target value		Measured	ΔSAR (1g) [%] (*3)	Deviation for #1 (Std.)[%]	Limit [%]	Deviation for #2 (Cal.)[%]	Limit [%] (*2)
		Temp [deg.C.]	Humidity [%RH]	Before	After			#1:Std. (*1)	#2:Cal. (*2)						
May 8, 2013	2450	22.6	41	22.8	22.8	(154)	εr [-]	**52.7**	**50.5**	50.56	(+1.94)	**-4.1**	±5	**+0.1**	±5
							σ [S/m]	**1.95**	**2.01**	1.992		**+2.1**	±5	**-0.9**	±5

*1. The target value is a parameter defined in OET65, Supplement C.

*2. The target value is a parameter defined in the calibration data sheet of D2450V2 (sn:822) dipole calibrated by Schmid & Partner Engineering AG (Certification No. D2450V2-822_Jan13, the data sheet was filed in this report.).

*3. The number of ΔSAR(1g) of body simulated tissue was reference purpose only. ΔSAR correction was only applied to head simulated tissue. The coefficients are parameters defined in Annex F, IEC 62209-2:2010. In accordance with clause 6.1.1 of IEC 62209-2; "If the correction ΔSAR has a negative sign, the measured SAR results shall not be corrected", the calculated ΔSAR values of the tested liquid had shown negative correction. Therefore the measured SAR was not required ΔSAR correction.

ΔSAR(1g)= Cεr ×Δεr + Cσ ×Δσ, $C\varepsilon r=-7.854E\text{-}4\times f^3+9.402E\text{-}3\times f^2-2.742E\text{-}2\times f-0.2026$ / $C\sigma=9.804E\text{-}3\times f^3-8.661E\text{-}2\times f^2+2.981E\text{-}2\times f+0.7829$

Decision on Simulated Tissues of 2450MHz; In the current standards (e.g., IEEE 1528, OET 65 Supplement C), the dielectric parameters suggested for head and body tissue simulating liquid are given at 2000, 2450 and 3000MHz. As an intermediate solution, dielectric parameters for the frequencies between 2000-2450 and 2450-3000 were obtained using linear interpolation.

Standard					*Interpolated*				
f (MHz)	Head Tissue		Body Tissue		f (MHz)	Head Tissue		Body Tissue	
	εr	σ [S/m]	εr	σ [S/m]		εr	σ [S/m]	εr	σ [S/m]
(1800-)2000	**40.0**	**1.40**	**53.3**	**1.52**	*2412*	*39.27*	*1.766*	*52.75*	*1.914*
2450	**39.2**	**1.80**	**52.7**	**1.95**	*2437*	*39.22*	*1.788*	*52.72*	*1.938*
3000	**38.5**	**2.40**	**52.0**	**2.73**	*2462*	*39.18*	*1.813*	*52.68*	*1.967*

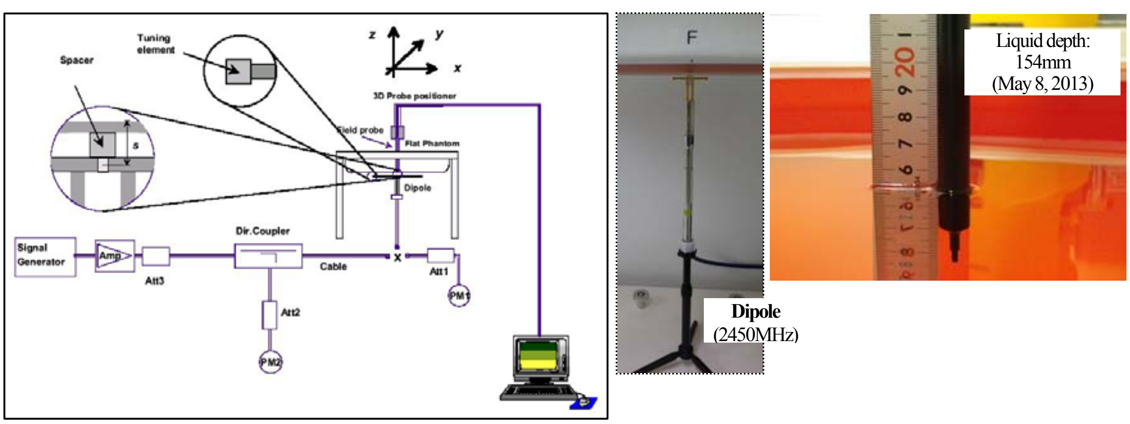
Appendix 3-5: Daily check data

Prior to the SAR assessment of EUT, the system validation kit was used to test whether the system was operating within its specifications of ±10%. The Daily check results are in the table below. (*. Refer to Appendix 3-6 of measurement data.)

Daily check results

Date	Freq. [MHz]	Liquid Type	Ambient		Liquid Temp. [deg.C.]			Liquid Depth [mm]	εr [-] measured	σ [S/m] measured	Power drift [dB]	Daily check target & measured			
												SAR 1g [W/kg]		Deviation [%]	Limit [%]
			Temp [deg.C.]	Humidity [%RH]	Check	Before	After					Target	Measured		
May 8, 2013	2450	Body	23.4	41	22.8	22.6	22.5	154	50.56	1.992	-0.05	**12.8**(*4)	13.1 (at 250mW) (ΔSAR corrected: -)	**+2.3**	±10

*4. The target value is a parameter defined in the calibration data sheet of D2450V2 (sn:822) dipole calibrated by Schmid & Partner Engineering AG (Certification No. D2450V2-822_Jan13, the data sheet was filed in this report.).
*. We performed the Daily check based on FCC requirement, "The 1g or 10g SAR values measured using the required tissue dielectric parameters should be within 10% of manufacturer calibrated dipole SAR values. However these manufacturer calibrated dipole target SAR values should be substantially similar to those defined in IEEE Standard 1528." and FCC permits "SAR system verification with the actual liquid used for EUT's SAR measurement, should be the default operating procedures." We confirmed the this dipole manufacture's validation data for head is within 5% against IEEE Standard 1528 (manufacture's cal.: 52.5W/kg (+0.2%, vs. standard=52.4W/kg). so we can only use Body liquid validation data for our Daily check procedure



Test setup for the system performance check

Appendix 3-6: System check measurement data

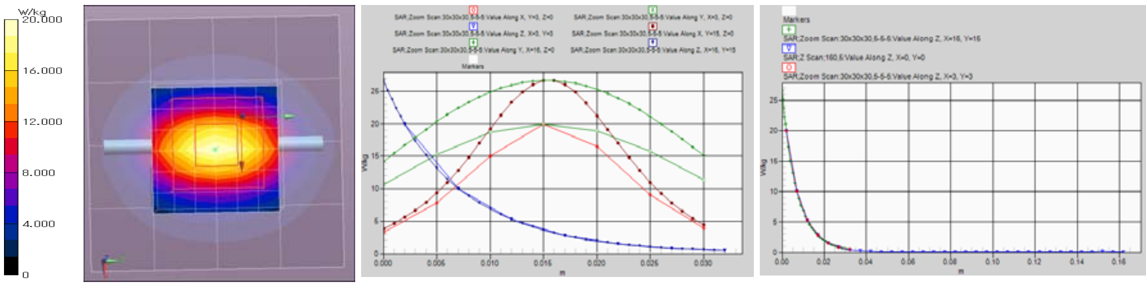
2450MHz System check (Body tissue) / Forward conducted power: 250mW

EUT: Dipole(2.45GHz); Type: D2450V2; Serial: 822
Communication System: CW; Frequency: 2450 MHz; Crest Factor: 1.0
Medium: M2450; Medium parameters used: f = 2450 MHz; σ = 1.992 S/m; ε_r = 50.56; ρ = 1000 kg/m^3
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration: -Probe: EX3DV4 - SN3679; ConvF(6.77, 6.77, 6.77); Calibrated: 2012/06/21; -Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0, 161.0 -Phantom: ELI v4.0; Type: QDOVA001BA; Serial: 1059; Phantom section: Flat Section -DASY52 52.8.2(969); SEMCAD X 14.6.6(6824) -Electronics: DAE4 Sn518; Calibrated: 2012/10/17

Area Scan:60x60,15 (5x5x1): Measurement grid: dx=15mm, dy=15mm; Maximum value of SAR (measured) = 19.9 W/kg
Area Scan:60x60,15 (41x41x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm; Maximum value of SAR (interpolated) = 20.0 W/kg
Z Scan;160,5 (1x1x33): Measurement grid: dx=20mm, dy=20mm, dz=5mm; Maximum value of SAR (measured) = 20.0 W/kg
Fast SAR: SAR(1 g) = 13.1 mW/g; SAR(10 g) = 5.7 mW/g

Zoom Scan:30x30x30,5-5-5 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm;
Reference Value = 101.3 V/m; Power Drift = -0.05 dB, Maximum value of SAR (measured) = 20.0 W/kg
Peak SAR (extrapolated) = 26.644 mW/g (-1.3%, vs.speag-cal.=27.0 W/kg)
SAR(1 g) = 13.1 mW/g (+2.3%, vs.speag-cal.=12.8 W/kg); **SAR(10 g) = 6.11 mW/g**



Remarks: *. Date tested: 2013/05/08; Tested by: Hiroshi Naka; Tested place:No.7 shielded room,
*.liquid depth: 154mm; Position: distance of dipole to phantom: 8mm (10mm to liquid); ambient: 23.4 deg.C. / 41 %RH,
*.liquid temperature: 22.6(start)/22.5(end)/22.8(in check) deg.C.; *.White cubic: zoom scan area, Red cubic: big=SAR(10g)/small=SAR(1g)

Appendix 3-7: Daily check uncertainty

Uncertainty of system daily check (~6GHz) (Body liquid, 2.4-6GHz, e', σ: ≤5%) (v06)	1g SAR	10g SAR
Combined measurement uncertainty of the measurement system (k=1)	± 12.7 %	± 12.4 %
Expanded uncertainty (k=2)	± 25.4 %	± 24.8 %

	Error Description	Uncertainty Value	Probability distribution	Divisor	ci (1g)	ci (10g)	ui (1g)	ui (10g)	Vi, veff
A	**Measurement System** (DASY5)						(std. uncertainty)	(std. uncertainty)	
1	Probe Calibration Error (2.45,5.2,5.3,5.5,5.6,5.8GHz±100MHz)	±6.55 %	Normal	1	1	1	±6.55 %	±6.55 %	∞
2	Axial isotropy	±4.7 %	Rectangular	√3	0.7	0.7	±1.9 %	±1.9 %	∞
3	Hemispherical isotropy (*flat phantom, <5°)	±9.6 %	Rectangular	√3	0.7	0.7	±3.9 %	±3.9 %	∞
4	Boundary effects	±4.8 %	Rectangular	√3	1	1	±2.8 %	±2.8 %	∞
5	Probe linearity	±4.7 %	Rectangular	√3	1	1	±2.7 %	±2.7 %	∞
6	Probe modulation response (CW)	±0.0 %	Rectangular	√3	1	1	±0.0 %	±0.0 %	∞
7	System detection limit	±1.0 %	Rectangular	√3	1	1	±0.6 %	±0.6 %	∞
8	Response Time Error (<5ms/100ms wait)	±0.0 %	Rectangular	√3	1	1	±0.0 %	±0.0 %	∞
9	Integration Time Error (CW)	±0.0 %	Rectangular	√3	1	1	±0.0 %	±0.0 %	∞
10	System readout electronics (DAE)	±0.3 %	Normal	1	1	1	±0.3 %	±0.3 %	∞
11	RF ambient conditions-noise	±3.0 %	Rectangular	√3	1	1	±1.7 %	±1.7 %	∞
12	RF ambient conditions-reflections	±3.0 %	Rectangular	√3	1	1	±1.7 %	±1.7 %	∞
13	Probe positioner mechanical tolerance	±3.3 %	Rectangular	√3	1	1	±1.9 %	±1.9 %	∞
14	Probe positioning with respect to phantom shell	±6.7 %	Rectangular	√3	1	1	±3.9 %	±3.9 %	∞
15	Max.SAR evaluation	±4.0 %	Rectangular	√3	1	1	±2.3 %	±2.3 %	∞
B	**Test Sample Related**								
16	Deviation of the experimental source	±5.5 %	Normal	1	1	1	±5.5 %	±5.5 %	∞
17	Dipole to liquid distance (10mm±0.2mm,<2deg.)	±2.0 %	Rectangular	√3	1	1	±1.2 %	±1.2 %	∞
18	Drift of output power (measured, <0.2dB)	±2.5 %	Rectangular	√3	1	1	±1.4 %	±1.4 %	∞
C	**Phantom and Setup**								
19	Phantom uncertainty	±2.0 %	Rectangular	√3	1	1	±1.2 %	±1.2%	∞
20	Liquid conductivity (target) (≤5%)	±5.0 %	Rectangular	√3	0.64	0.43	±1.8 %	±1.2 %	∞
21	Liquid conductivity (meas.)	±3.0 %	Normal	1	0.64	0.43	±1.9 %	±1.3 %	∞
22	Liquid permittivity (target) (≤5%)	±5.0 %	Rectangular	√3	0.6	0.49	±1.7 %	±1.4 %	∞
23	Liquid permittivity (meas.)	±3.0 %	Normal	1	0.6	0.49	±1.8 %	±1.5 %	∞
24	Liquid Conductivity-temp.uncertainty (≤2deg.C.)	±5.2 %	Rectangular	√3	0.78	0.71	±2.3 %	±2.1 %	∞
25	Liquid Permittivity-temp.uncertainty (≤2deg.C.)	±0.8 %	Rectangular	√3	0.23	0.26	±0.1 %	±0.1 %	∞
	Combined Standard Uncertainty						**±12.7 %**	**±12.4 %**	
	Expanded Uncertainty (k=2)						**±25.4 %**	**±24.8 %**	

*. This measurement uncertainty budget is suggested by IEEE 1528, IEC 62209-2 and determined by Schmid & Partner Engineering AG (DASY5 Uncertainty Budget).