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 [4]. 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) [4], [5]. 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: Worst position search

Step 1-1: Top (separation distance: 0mm) / 2437MHz, 11b(1Mbps)

EUT: Wireless LAN module; Type: BP3591; Serial: 001D12CF3877
Platform: Mobile Printer; Type: PJ-673; Serial: E71423-E2Z529910
Communication System: IEEE 802.11b(1Mbps, DBPSK/DSSS); Frequency: 2437 MHz; Crest Factor: 1.0
Medium: M2450; Medium parameters used: f = 2437 MHz; σ = 1.97 S/m; ε_r = 51.3; ρ = 1000 kg/m^3

DASY4 Configuration: - Probe: EX3DV4 - SN3679; ConvF(6.77, 6.77, 6.77); Calibrated: 2012/06/21
                        - Sensor-Surface: 2mm (Mechanical Surface Detection)   - Electronics: DAE4 Sn626; Calibrated: 2012/02/15
                        - Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1059; Phantom section: Flat Section
                        - Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

Top(1)&touch(d0mm),11b(1m),m2437/
Area Scan:120x120,15 (9x9x1): Measurement grid: dx=15mm, dy=15mm, Maximum value of SAR (measured) = 0.310 mW/g
Area Scan:120x120,15 (81x81x1): Measurement grid: dx=15mm, dy=15mm, Maximum value of SAR (interpolated) = 0.831 mW/g
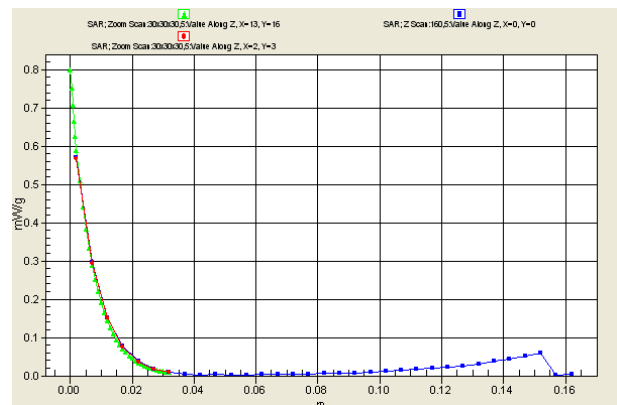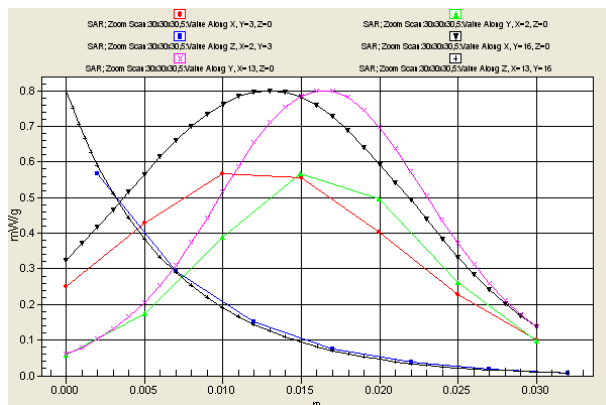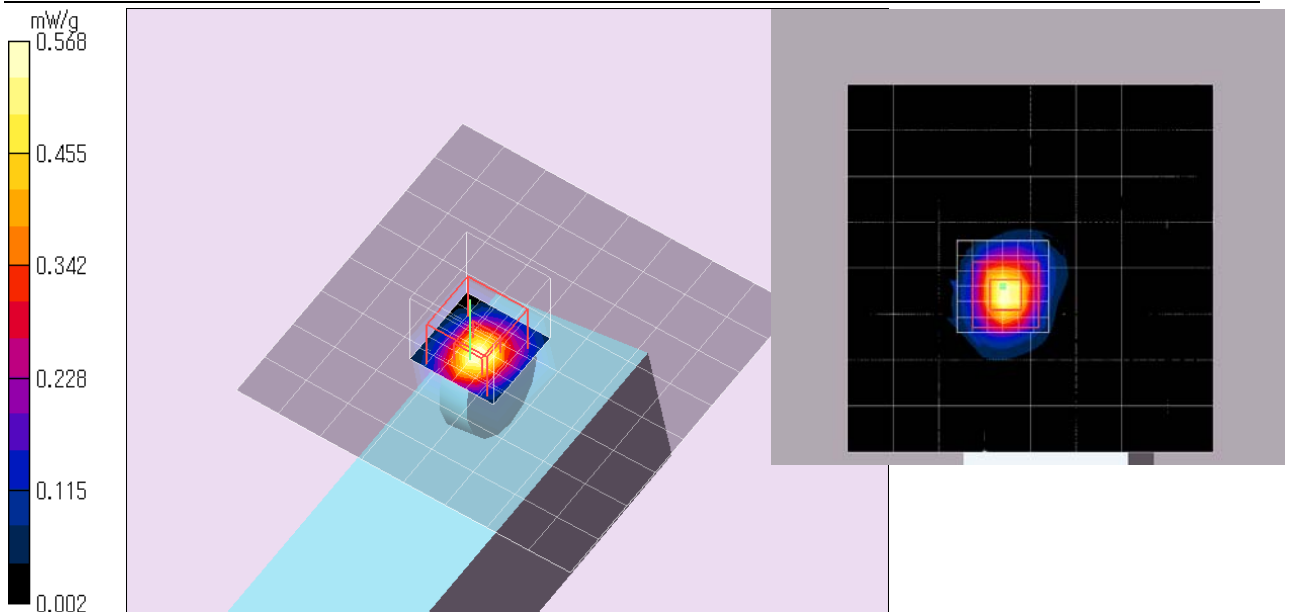**Z Scan:160,5 (1x1x33):** Measurement grid: dx=20mm, dy=20mm, dz=5mm, Maximum value of SAR (measured) = 0.571 mW/g

Zoom Scan:30x30x30,5 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.54 V/m; Power Drift = -0.19 dB, Maximum value of SAR (measured) = 0.568 mW/g
Peak SAR (extrapolated) = 0.801 W/kg
SAR(1 g) = 0.374 mW/g; SAR(10 g) = 0.154 mW/g

Remarks:*. Date tested: Date/Time: 2012/07/25 12:01:05; Tested by: Tomochika Sato; Tested place:No.7 shielded room,
*.liquid depth: 153mm; Position: distance of EUT to phantom: 0mm (2mm to liquid); ambient: 24.0 deg.C. / 55 %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: **Worst position search (cont'd)**

Step 1-2: **Rear (separation distance: 0mm) / 2437MHz, 11b(1Mbps)**

EUT: Wireless LAN module; Type: BP3591; Serial: 001D12CF3877
Platform: Mobile Printer; Type: PJ-673; Serial: E71423-E2Z529910
Communication System: IEEE 802.11b(1Mbps, DBPSK/DSSS); Frequency: 2437 MHz; Crest Factor: 1.0
Medium: M2450; Medium parameters used: f = 2437 MHz; σ = 1.97 S/m; ε_r = 51.3; ρ = 1000 kg/m³

DASY4 Configuration: - Probe: EX3DV4 - SN3679; ConvF(6.77, 6.77, 6.77); Calibrated: 2012/06/21
                        - Sensor-Surface: 2mm (Mechanical Surface Detection)   - Electronics: DAE4 Sn626; Calibrated: 2012/02/15
                        - Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1059; Phantom section: Flat Section
                        - Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

Rear(2)&touch(d0mm),11b(1m),m2437/
Area Scan:120x120,15 (9x9x1): Measurement grid: dx=15mm, dy=15mm, Maximum value of SAR (measured) = 0.279 mW/g
Area Scan:120x120,15 (81x81x1): Measurement grid: dx=15mm, dy=15mm, Maximum value of SAR (interpolated) = 0.334 mW/g
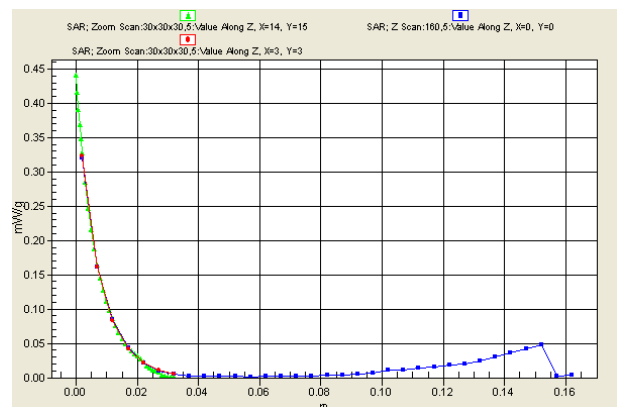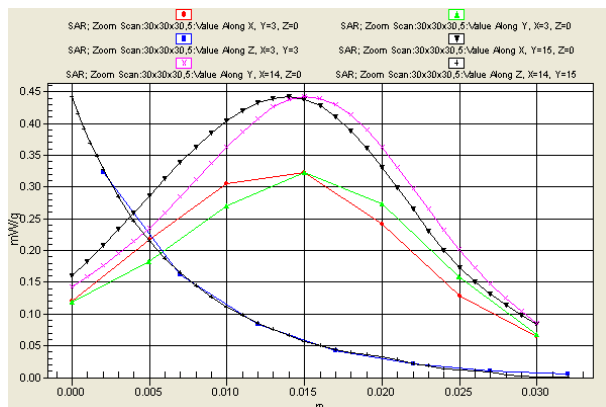**Z Scan:160,5 (1x1x33):** Measurement grid: dx=20mm, dy=20mm, dz=5mm, Maximum value of SAR (measured) = 0.320 mW/g

Zoom Scan:30x30x30,5 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 12.0 V/m; Power Drift = -0.168 dB, Maximum value of SAR (measured) = 0.323 mW/g
Peak SAR (extrapolated) = 0.442 W/kg
SAR(1 g) = 0.212 mW/g; SAR(10 g) = 0.093 mW/g
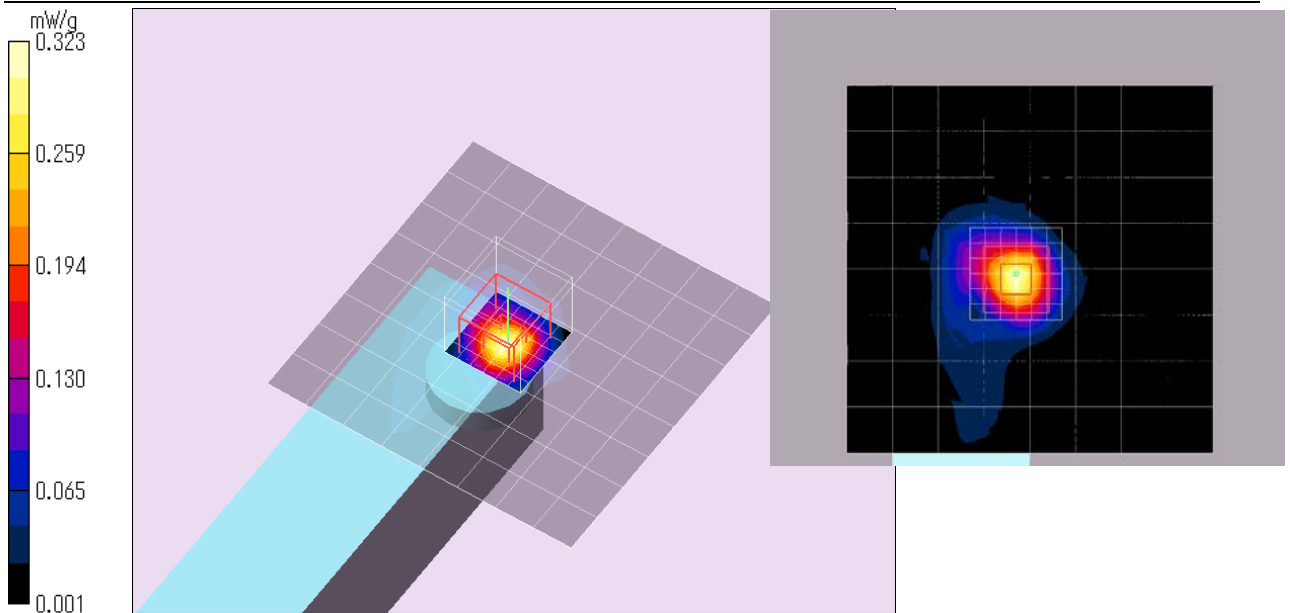
Remarks:*. Date tested: Date/Time: 2012/07/25 13:04:42; Tested by: Tomochika Sato; Tested place:No.7 shielded room,
*.liquid depth: 153mm; Position: distance of EUT to phantom: 0mm (2mm to liquid); ambient: 24.0 deg.C. / 55 %RH,
*.liquid temperature: 22.4(start)/22.4(end)/22.8(in check) deg.C.; *.White cubic: zoom scan area, Red cubic: big=SAR(10g)/small=SAR(1g)

Appendix 2-2:   Measurement data (cont'd)
Step 1:   Worst position search (cont'd)

Step 1-3:   Right (separation distance: 0mm) / 2437MHz, 11b(1Mbps)

EUT: Wireless LAN module; Type: BP3591; Serial: 001D12CF3877
Platform: Mobile Printer; Type: PJ-673; Serial: E71423-E2Z529910
Communication System: IEEE 802.11b(1Mbps, DBPSK/DSSS); Frequency: 2437 MHz; Crest Factor: 1.0
Medium: M2450; Medium parameters used: f = 2437 MHz; σ = 1.97 S/m; ε_r = 51.3; ρ = 1000 kg/m³

DASY4 Configuration: - Probe: EX3DV4 - SN3679; ConvF(6.77, 6.77, 6.77); Calibrated: 2012/06/21
                                    - Sensor-Surface: 2mm (Mechanical Surface Detection)   - Electronics: DAE4 Sn626; Calibrated: 2012/02/15
                                    - Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1059; Phantom section: Flat Section
                                    - Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

Right(3)&touch(d0mm),11b(1m),m2437/
Area Scan:120x120,15 (9x9x1): Measurement grid: dx=15mm, dy=15mm, Maximum value of SAR (measured) = 0.179 mW/g
Area Scan:120x120,15 (81x81x1): Measurement grid: dx=15mm, dy=15mm, Maximum value of SAR (interpolated) = 0.245 mW/g
**Z Scan:160,5 (1x1x33):** Measurement grid: dx=20mm, dy=20mm, dz=5mm, Maximum value of SAR (measured) = 0.215 mW/g

Zoom Scan:30x30x30,5 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 9.76 V/m; Power Drift = -0.034 dB, Maximum value of SAR (measured) = 0.215 mW/g
Peak SAR (extrapolated) = 0.364 W/kg
SAR(1 g) = 0.133 mW/g; SAR(10 g) = 0.065 mW/g

Remarks:*. Date tested: Date/Time: 2012/07/25 13:45:58; Tested by: Tomochika Sato; Tested place:No.7 shielded room,
*.liquid depth: 153mm; Position: distance of EUT to phantom: 0mm (2mm to liquid); ambient: 24.0 deg.C. / 55 %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)

UL Japan, Inc.
Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
Telephone: +81 463 50 6400 / Facsimile: +81 463 50 6401

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

Step 2:   Change the channels

Step 2-1:   2412MHz / 11b(1Mbps), Top (separation distance: 0mm) ->Worst SAR(1g) of EUT

EUT: Wireless LAN module; Type: BP3591; Serial: 001D12CF3877
Platform: Mobile Printer; Type: PJ-673; Serial: E71423-E2Z529910
Communication System: IEEE 802.11b(1Mbps, DBPSK/DSSS); Frequency: 2412 MHz; Crest Factor: 1.0
Medium: M2450; Medium parameters used: f = 2412 MHz; σ = 1.93 S/m; ε_r = 51.4; ρ = 1000 kg/m^3

DASY4 Configuration: - Probe: EX3DV4 - SN3679; ConvF(6.77, 6.77, 6.77); Calibrated: 2012/06/21
　　　　　　　　　　 - Sensor-Surface: 2mm (Mechanical Surface Detection)   - Electronics: DAE4 Sn626; Calibrated: 2012/02/15
　　　　　　　　　　 - Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1059; Phantom section: Flat Section
　　　　　　　　　　 - Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

Top(1)-2&touch(d0mm),11b(1m),m2412/
Area Scan:120x120,15 (9x9x1): Measurement grid: dx=15mm, dy=15mm, Maximum value of SAR (measured) = 0.499 mW/g
Area Scan:120x120,15 (81x81x1): Measurement grid: dx=15mm, dy=15mm, Maximum value of SAR (interpolated) = 0.689 mW/g
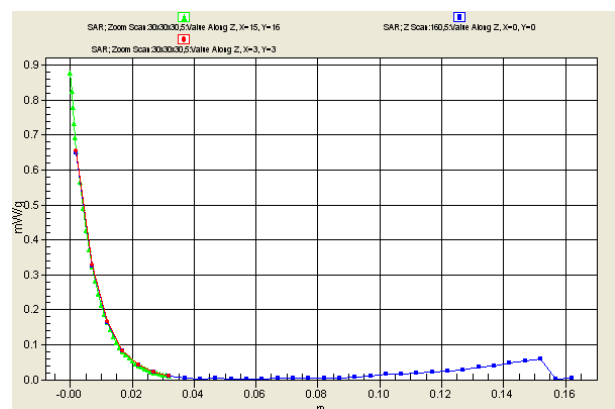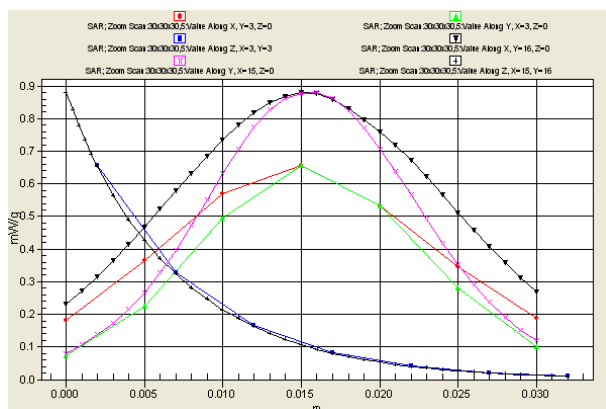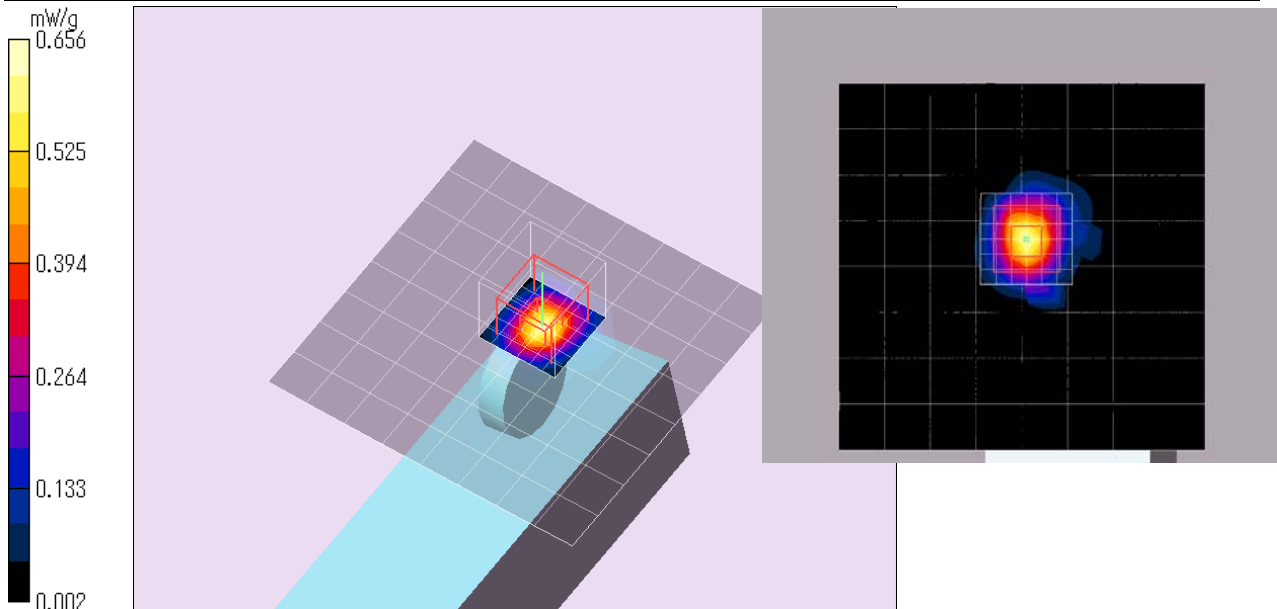**Z Scan:160,5 (1x1x33):** Measurement grid: dx=20mm, dy=20mm, dz=5mm, Maximum value of SAR (measured) = 0.648 mW/g

Zoom Scan:30x30x30,5 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 14.5 V/m; Power Drift = -0.213 dB, Maximum value of SAR (measured) = 0.656 mW/g
Peak SAR (extrapolated) = 0.879 W/kg
SAR(1 g) = 0.414 mW/g ->Worst SAR(1g) of EUT ; SAR(10 g) = 0.173 mW/g

Remarks:*. Date tested: Date/Time: 2012/07/25 14:54:14; Tested by: Tomochika Sato; Tested place:No.7 shielded room,
*.liquid depth: 153mm; Position: distance of EUT to phantom: 0mm (2mm to liquid); ambient: 24.0 deg.C. / 55 %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 2: **Change the channels**

Step 2-2: **2462MHz / 11b(1Mbps), Top (separation distance: 0mm)**

EUT: Wireless LAN module; Type: BP3591; Serial: 001D12CF3877
Platform: Mobile Printer; Type: PJ-673; Serial: E71423-E2Z529910
Communication System: IEEE 802.11b(1Mbps, DBPSK/DSSS); Frequency: 2462 MHz; Crest Factor: 1.0
Medium: M2450; Medium parameters used: f = 2462 MHz; σ = 2.01 S/m; ε_r = 51.1; ρ = 1000 kg/m³

DASY4 Configuration: - Probe: EX3DV4 - SN3679; ConvF(6.77, 6.77, 6.77); Calibrated: 2012/06/21
　　　　　　　　　　 - Sensor-Surface: 2mm (Mechanical Surface Detection)　　　 - Electronics: DAE4 Sn626; Calibrated: 2012/02/15
　　　　　　　　　　 - Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1059; Phantom section: Flat Section
　　　　　　　　　　 - Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

Top(1)-3&touch(d0mm),11b(1m),m2462/
Area Scan:120x120,15 (9x9x1): Measurement grid: dx=15mm, dy=15mm, Maximum value of SAR (measured) = 0.432 mW/g
Area Scan:120x120,15 (81x81x1): Measurement grid: dx=15mm, dy=15mm, Maximum value of SAR (interpolated) = 0.622 mW/g
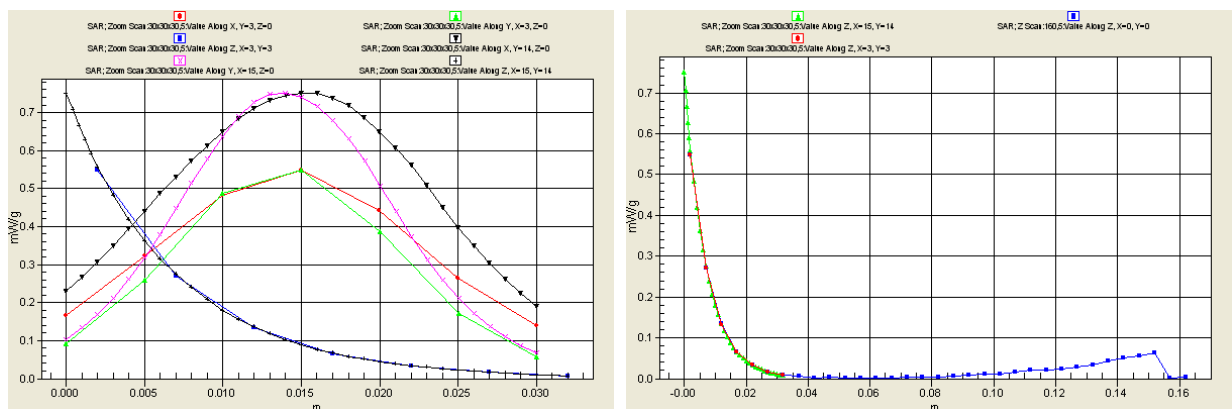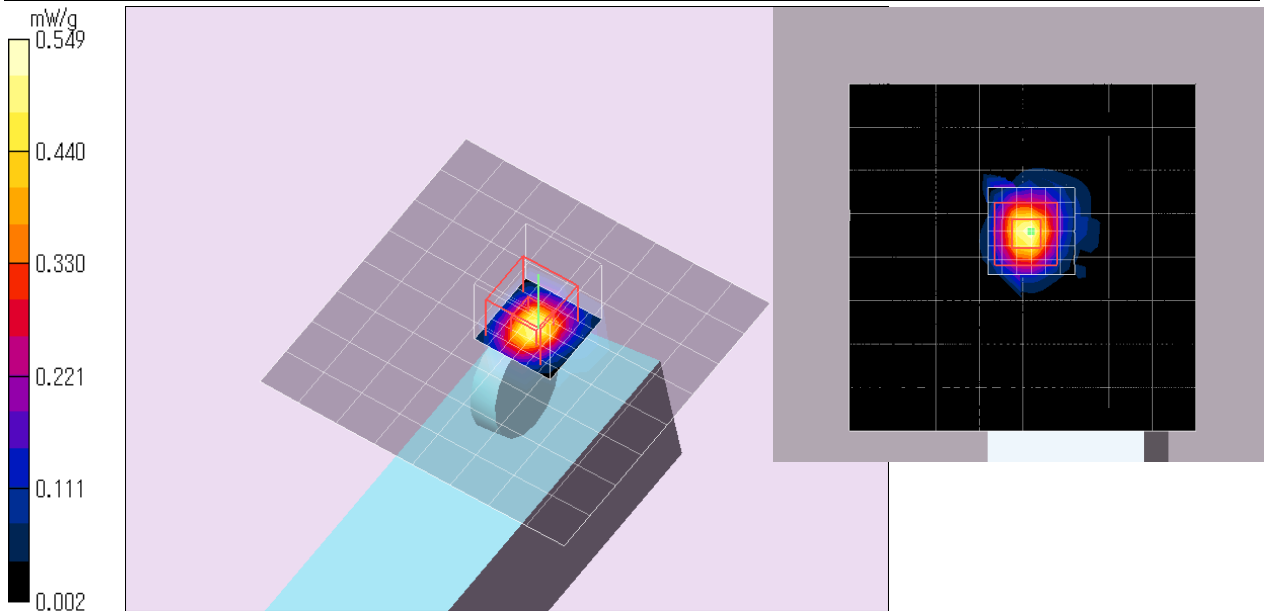**Z Scan:160,5 (1x1x33):** Measurement grid: dx=20mm, dy=20mm, dz=5mm, Maximum value of SAR (measured) = 0.549 mW/g

Zoom Scan:30x30x30,5 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 13.1 V/m; Power Drift = 0.1 dB, Maximum value of SAR (measured) = 0.548 mW/g
Peak SAR (extrapolated) = 0.752 W/kg
SAR(1 g) = 0.354 mW/g; SAR(10 g) = 0.146 mW/g

Remarks:*. Date tested: Date/Time: 2012/07/25 15:15:41; Tested by: Tomochika Sato; Tested place:No.7 shielded room,
*.liquid depth: 153mm; Position: distance of EUT to phantom: 0mm (2mm to liquid); ambient: 24.0 deg.C. / 55 %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)