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 more than or equal to 30mm(X axis)×30mm(Y axis)×30mm(Z axis) was assessed by measuring 7×7×7 points (or more) under 3GHz and a volume of more than or equal to 28mm(X axis)×28mm(Y axis)×24mm (Z axis) was assessed by measuring 8×8×7 (ratio step method (*1)) points (or more) for 3-6GHz frequency band.
Any additional peaks found in the Step2 which are within 2dB of limit are repeated with this Step3 (Zoom scan).
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.

*1. Ratio step method parameters used; the first measurement point: “1.4mm” from the phantom surface, the initial grid separation: “1.4mm”, subsequent graded grid ratio: “1.4”. These parameters comply with the requirement of the KDB 865664 D01 (v01) and recommended by Schmid & Partner Engineering AG (DASY5 manual).

Appendix 2-2: Measurement data

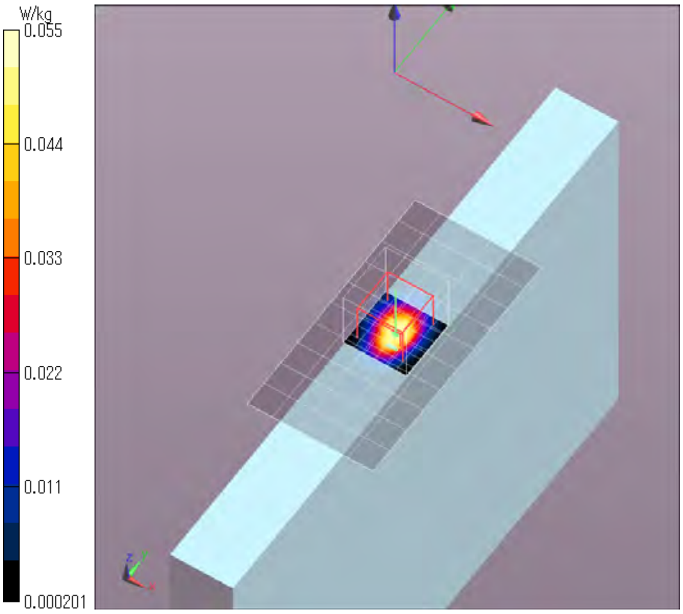
Plot 1-1: (2.4GHz band) Top & touch, 11g (6Mbps), 2417 MHz

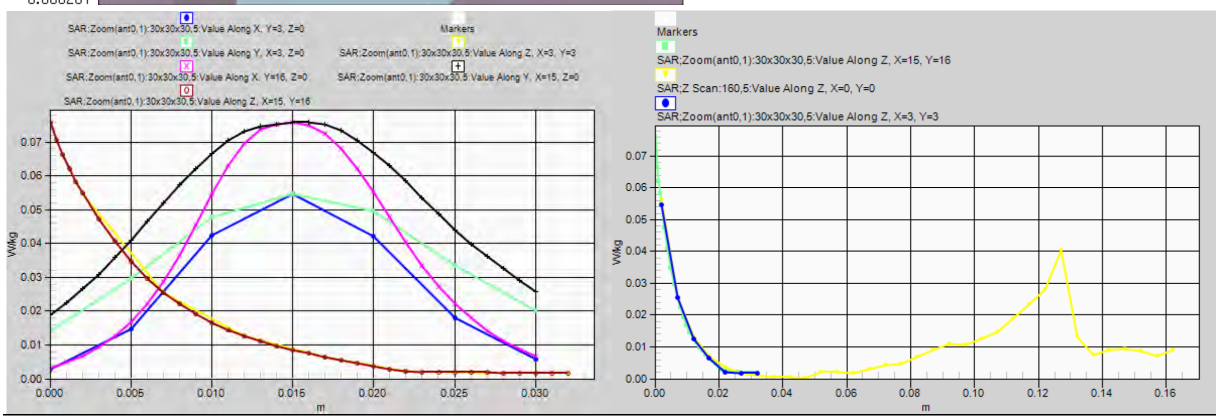
EUT: SDIO Wireless Module (in Platform); Type: SX-SDMAN (Platform: SA-A1); Serial: 0080925B200A (Platform: 11)
Mode: 11g(6Mbps, BPSK/OFDM) (UID 0, Frame Length in ms: 0; PAR: 0; PMF: 1); **Frequency: 2417 MHz; Crest Factor: 1.0**
Medium: M2450; Medium parameters used: f = 2417 MHz; σ = 1.937 S/m; ε_r = 51.88; ρ = 1000 kg/m^3
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:
-Probe: EX3DV4 - SN3679; ConvF(6.88, 6.88, 6.88); Calibrated: 2014/08/19;
-Sensor-Surface: 2mm (Mechanical Surface Detection (Locations From Previous Scan Used)), 2mm (Mechanical Surface Detection), z = 1.0, 31.0, 161.0
-Electronics: DAE4 Sn626; Calibrated: 2014/09/17
-Phantom: ELI v4.0; Type: QDOVA001BA; Serial: 1059; Phantom section: Flat Section
-DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

m245_20150206/03-01_(mod_chk);m2417,11g(6m),top&touch(d0)/
Area Scan:120x60,12 (6x11x1): Measurement grid: dx=12mm, dy=12mm, Maximum value of SAR (measured) = 0.0362 W/kg
Area Scan:120x60,12 (51x101x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm, Maximum value of SAR (interpolated) = 0.0789 W/kg
Z Scan:160,5 (1x1x33): Measurement grid: dx=20mm, dy=20mm, dz=5mm, Maximum value of SAR (measured) = 0.0565 W/kg

Zoom(ant0,1):30x30x30,5 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.646 V/m; Power Drift = -0.20 dB, Maximum value of SAR (measured) = 0.0546 W/kg,; Peak SAR (extrapolated) = 0.0760 W/kg
SAR(1 g) = 0.034 W/kg; SAR(10 g) = 0.014 W/kg





Remarks: *. Date tested: 2015/02/06; Tested by: Tomochika Sato; Tested place:No.7 shielded room,
*. liquid depth: 153mm; Position: distance of EUT to phantom: 0mm (2mm to liquid); ambient: 22.5 ± 1 deg.C. / 40 ± 10 %RH,
*. liquid temperature: 21.6(start)/21.6(end)/21.5(in check) deg.C.; *. White cubic: zoom scan area, Red cubic: big=SAR(10g)/small=SAR(1g)

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

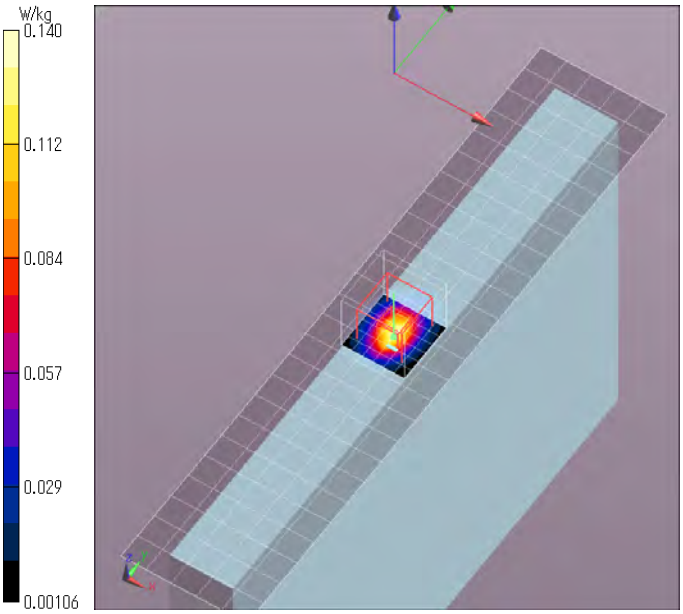
Plot 1-2: (2.4GHz band) Top & touch, 11b (1Mbps), 2437 MHz
->Highest reported SAR(1g) for 2.4GHz band

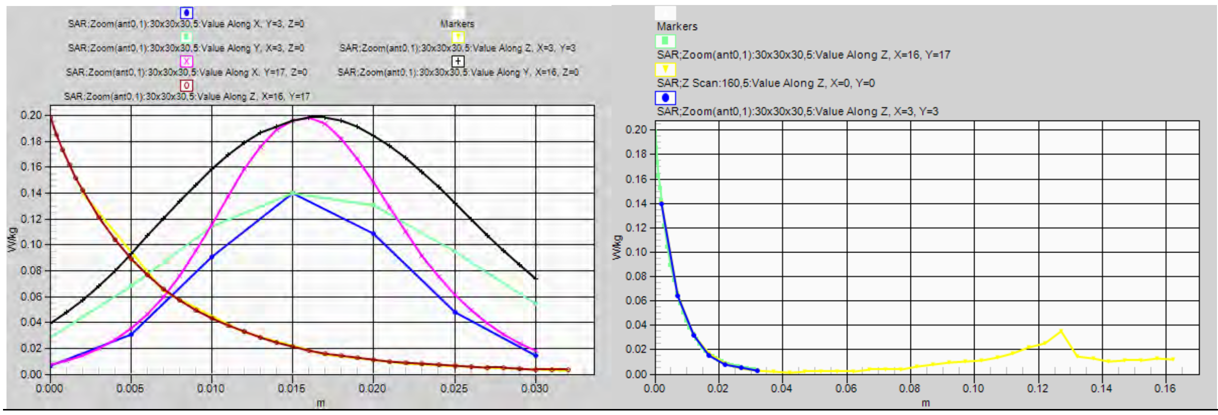
EUT: SDIO Wireless Module (in Platform); Type: SX-SDMAN (Platform: SA-A1); Serial: 0080925B200A (Platform: 11)
Mode: 11b(1Mbps, DBPSK/DSSS) (UID 0, Frame Length in ms: 0; PAR: 0; PMF: 1); **Frequency: 2437 MHz; Crest Factor: 1.0**
Medium: M2450; Medium parameters used: f = 2437 MHz; σ = 1.967 S/m; ε_r = 51.84; ρ = 1000 kg/m^3
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:
-Probe: EX3DV4 - SN3679; ConvF(6.88, 6.88, 6.88); Calibrated: 2014/08/19;
-Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0, 161.0
-Electronics: DAE4 Sn626; Calibrated: 2014/09/17
-Phantom: ELI v4.0; Type: QDOVA001BA; Serial: 1059; Phantom section: Flat Section
-DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

m245_20150206/01-01_(pos_chk);m2437,11b(1m),top&touch(d0)/
Area Scan:300x60,12 (6x26x1): Measurement grid: dx=12mm, dy=12mm, Maximum value of SAR (measured) = 0.0963 W/kg
Area Scan:300x60,12 (51x251x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm, Maximum value of SAR (interpolated) = 0.179 W/kg
Z Scan:160,5 (1x1x33): Measurement grid: dx=20mm, dy=20mm, dz=5mm, Maximum value of SAR (measured) = 0.141 W/kg

Zoom(ant0,1):30x30x30,5 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.549 V/m; Power Drift = 0.02 dB, Maximum value of SAR (measured) = 0.140 W/kg, Peak SAR (extrapolated) = 0.198 W/kg
SAR(1 g) = 0.086 W/kg; SAR(10 g) = 0.035 W/kg





Remarks: *. Date tested: 2015/02/06; Tested by: Tomochika Sato; Tested place:No.7 shielded room,
*. liquid depth: 153mm; Position: distance of EUT to phantom: 0mm (2mm to liquid); ambient: 22.5 ± 1 deg.C. / 40 ± 10 %RH,
*. liquid temperature: 21.6(start)/21.6(end)/21.5(in check) deg.C.; *. White cubic: zoom scan area, Red cubic: big=SAR(10g)/small=SAR(1g)

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

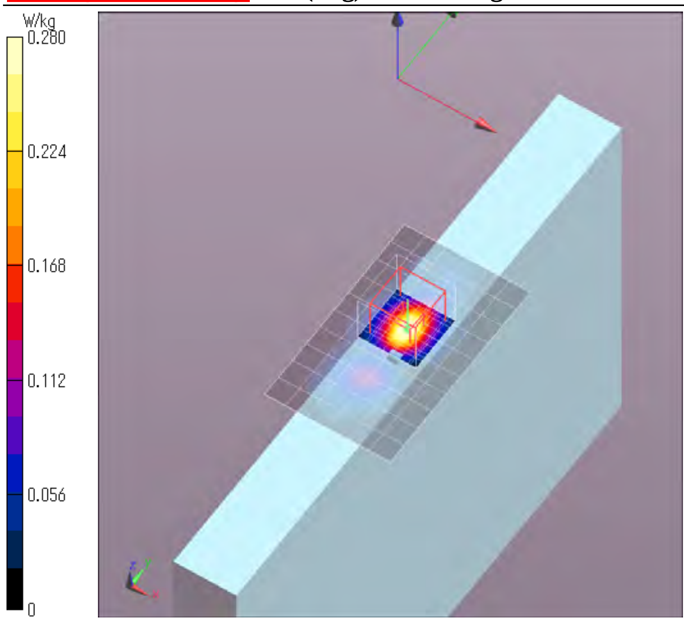
Plot 2-1: (W53 band) Top & touch, 11a (6Mbps), 5300 MHz

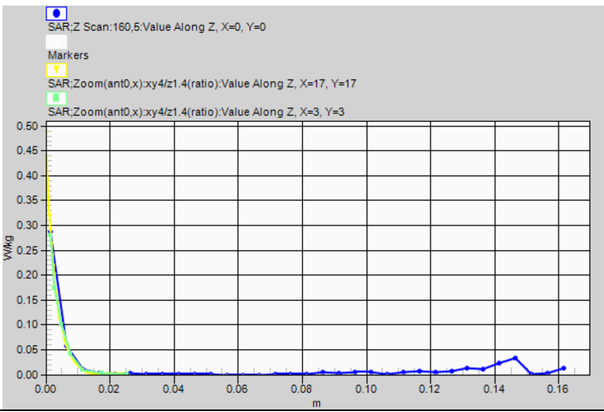
EUT: SDIO Wireless Module (in Platform); Type: SX-SDMAN (Platform: SA-A1); Serial: 0080925B200A (Platform: 11)
Mode: 11a(6Mbps, BPSK/OFDM) (UID 0, Frame Length in ms: 0; PAR: 0; PMF: 1); **Frequency: 5300 MHz; Crest Factor: 1.0**
Medium: MSL5800; Medium parameters used: f = 5300 MHz; σ = 5.594 S/m; ε_r = 47.32; ρ = 1000 kg/m^3
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

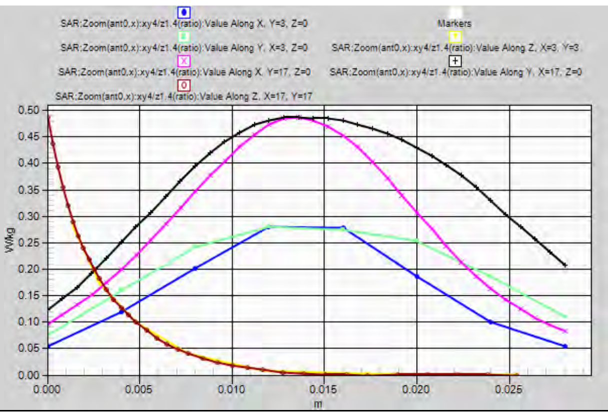
DASY Configuration:
-Probe: EX3DV4 - SN3679; ConvF(4.18, 4.18, 4.18); Calibrated: 2014/08/19;
-Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0, 161.0
-Electronics: DAE4 Sn626; Calibrated: 2014/09/17
-Phantom: ELI v4.0; Type: QDOVA001BA; Serial: 1059; Phantom section: Flat Section
-DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

m53_20150207/01-01_(pos_chk);m5300,11a(6m),top&touch(d0)/
Area Scan:60x100,10 (7x11x1): Measurement grid: dx=10mm, dy=10mm, Maximum value of SAR (measured) = 0.295 W/kg
Area Scan:60x100,10 (61x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm, Maximum value of SAR (interpolated) = 0.302 W/kg
Z Scan:160,5 (1x1x33): Measurement grid: dx=20mm, dy=20mm, dz=5mm, Maximum value of SAR (measured) = 0.287 W/kg

Zoom(ant0,x):xy4/z1.4(ratio) (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 8.051 V/m; Power Drift = 0.13 dB, Maximum value of SAR (measured) = 0.280 W/kg, Peak SAR (extrapolated) = 0.486 W/kg
SAR(1 g) = 0.122 W/kg; SAR(10 g) = 0.040 W/kg







Remarks: *. Date tested: 2015/02/06; Tested by: Tomochika Sato; Tested place:No.7 shielded room,
*. liquid depth: 153mm; Position: distance of EUT to phantom: 0mm (2mm to liquid); ambient: 22.5 ± 1 deg.C. / 39 ± 10 %RH,
*. liquid temperature: 22.1(start)/22.1(end)/22.2(in check) deg.C.; *.White cubic: zoom scan area, Red cubic: big=SAR(10g)/small=SAR(1g)

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

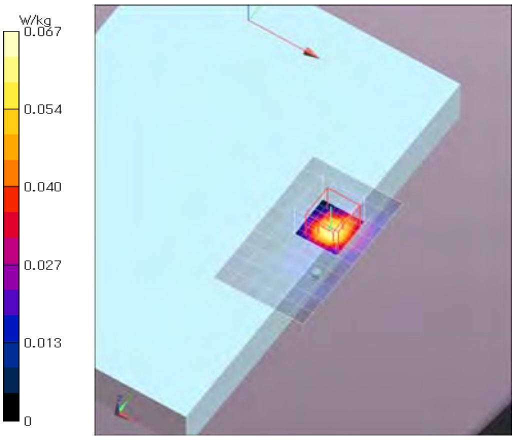
Plot 2-2: (W53 band) Rear & touch, 11a (6Mbps), 5300 MHz

EUT: SDIO Wireless Module (in Platform); Type: SX-SDMAN (Platform: SA-A1); Serial: 0080925B200A (Platform: 11)
Mode: 11a(6Mbps, BPSK/OFDM) (UID 0, Frame Length in ms: 0; PAR: 0; PMF: 1); **Frequency: 5300 MHz; Crest Factor: 1.0**
Medium: MSL5800; Medium parameters used: f = 5300 MHz; σ = 5.594 S/m; ε_r = 47.32; ρ = 1000 kg/m^3
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration: -Probe: EX3DV4 - SN3679; ConvF(4.18, 4.18, 4.18); Calibrated: 2014/08/19; -Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0, 161.0; -Phantom: ELI v4.0; Type: QDOVA001BA; Serial: 1059; Phantom section: Flat Section; -DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331); -Electronics: DAE4 Sn626; Calibrated: 2014/09/17

m53_20150207/01-02_(pos_chk);m5300,11a(6m),rear&touch(d0)/
Area Scan:60x100,10 (7x11x1): Measurement grid: dx=10mm, dy=10mm, Maximum value of SAR (measured) = 0.0676 W/kg
Area Scan:60x100,10 (61x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm, Maximum value of SAR (interpolated) = 0.116 W/kg
Z Scan:160,5 (1x1x33): Measurement grid: dx=20mm, dy=20mm, dz=5mm, Maximum value of SAR (measured) = 0.0713 W/kg

Zoom(ant0,x):xy4/z1.4(ratio) (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 4.015 V/m; Power Drift = -0.15 dB, Maximum value of SAR (measured) = 0.0672 W/kg, Peak SAR (extrapolated) = 0.110 W/kg
SAR(1 g) = 0.025 W/kg; SAR(10 g) = 0.0084 W/kg



Remarks:
*. Date tested: 2015/02/06; Tested by: Tomochika Sato; Tested place:No.7 shielded room,
*. liquid depth: 153mm;
*. Position: distance of EUT to phantom: 0mm (2mm to liquid);
*. ambient: 22.5 ± 1deg.C. / 39 ± 10 %RH,
*. liquid temperature: 22.1(start)/22.1(end)/22.2(in check) deg.C.;
*. White cubic: zoom scan area, Red cubic: big=SAR(10g)/small=SAR(1g)

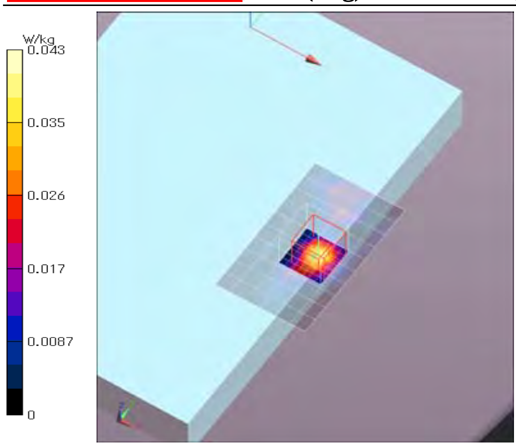
Plot 2-3: (W53 band) Front & touch, 11a (6Mbps), 5300 MHz

EUT: SDIO Wireless Module (in Platform); Type: SX-SDMAN (Platform: SA-A1); Serial: 0080925B200A (Platform: 11)
Mode: 11a(6Mbps, BPSK/OFDM) (UID 0, Frame Length in ms: 0; PAR: 0; PMF: 1); **Frequency: 5300 MHz; Crest Factor: 1.0**
Medium: MSL5800; Medium parameters used: f = 5300 MHz; σ = 5.594 S/m; ε_r = 47.32; ρ = 1000 kg/m^3
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration: -Probe: EX3DV4 - SN3679; ConvF(4.18, 4.18, 4.18); Calibrated: 2014/08/19; -Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0, 161.0; -Phantom: ELI v4.0; Type: QDOVA001BA; Serial: 1059; Phantom section: Flat Section; -DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331); -Electronics: DAE4 Sn626; Calibrated: 2014/09/17

m53_20150207/01-03_(pos_chk);m5300,11a(6m),front&touch(d0)/
Area Scan:60x100,10 (7x11x1): Measurement grid: dx=10mm, dy=10mm, Maximum value of SAR (measured) = 0.0403 W/kg
Area Scan:60x100,10 (61x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm, Maximum value of SAR (interpolated) = 0.119 W/kg
Z Scan:160,5 (1x1x33): Measurement grid: dx=20mm, dy=20mm, dz=5mm, Maximum value of SAR (measured) = 0.0909 W/kg

Zoom(ant0,x):xy4/z1.4(ratio) (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 3.149 V/m; Power Drift = -0.18 dB, Maximum value of SAR (measured) = 0.0435 W/kg, Peak SAR (extrapolated) = 0.101 W/kg
SAR(1 g) = 0.016 W/kg; SAR(10 g) = 0.00502 W/kg



Remarks:
*. Date tested: 2015/02/06; Tested by: Tomochika Sato; Tested place:No.7 shielded room,
*. liquid depth: 153mm;
*. Position: distance of EUT to phantom: 0mm (2mm to liquid);
*. ambient: 22.5 ± 1deg.C. / 39 ± 10 %RH,
*. liquid temperature: 22.1(start)/22.1(end)/22.2(in check) deg.C.;
*. White cubic: zoom scan area, Red cubic: big=SAR(10g)/small=SAR(1g)

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

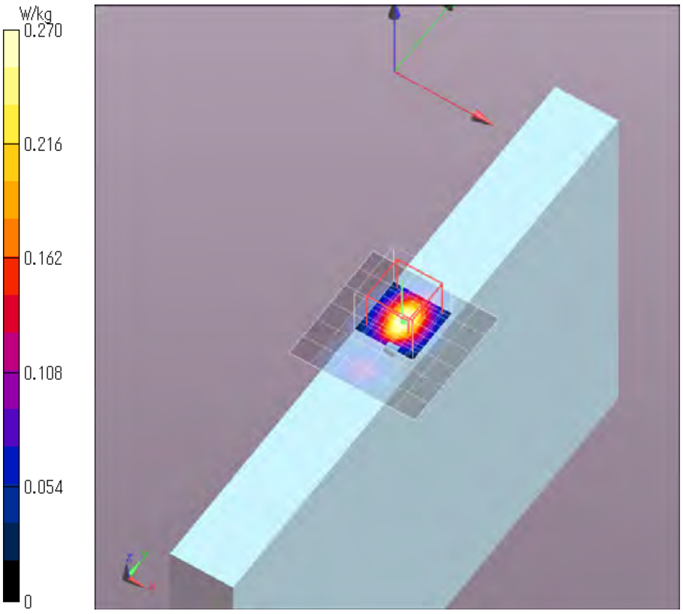
Plot 2-4: (W53 band) Top & touch, 11n(40HT) (MCS0), 5270 MHz
->Highest reported SAR(1g) for W53 band

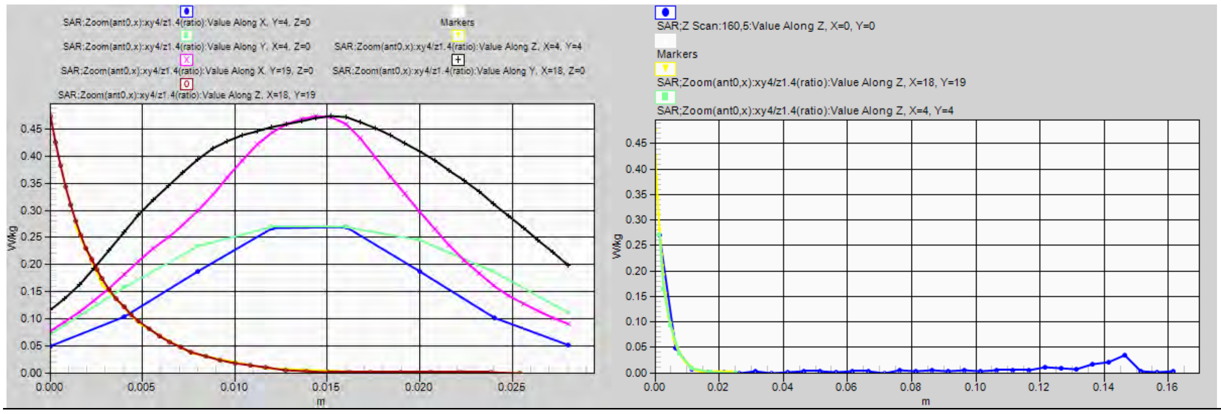
EUT: SDIO Wireless Module (in Platform); Type: SX-SDMAN (Platform: SA-A1); Serial: 0080925B200A (Platform: 11)
Mode: n40(MCS0, BPSK/OFDM) (UID 0, Frame Length in ms: 0; PAR: 0; PMF: 1); **Frequency: 5270 MHz; Crest Factor: 1.0**
Medium: MSL5800; Medium parameters used: f = 5270 MHz; σ = 5.526 S/m; ε_r = 47.29; ρ = 1000 kg/m^3
Medium: MSL5800; Medium parameters used: f = 5300 MHz; σ = 5.594 S/m; ε_r = 47.32; ρ = 1000 kg/m^3
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:
-Probe: EX3DV4 - SN3679; ConvF(4.18, 4.18, 4.18); Calibrated: 2014/08/19;
-Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0, 161.0
-Electronics: DAE4 Sn626; Calibrated: 2014/09/17
-Phantom: ELI v4.0; Type: QDOVA001BA; Serial: 1059; Phantom section: Flat Section
-DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

m53_20150207/03-01_(mod_chk);m5270,11n40(mcs0),top&touch(d0)/
Area Scan:60x60,10 (7x7x1): Measurement grid: dx=10mm, dy=10mm, Maximum value of SAR (measured) = 0.276 W/kg
Area Scan:60x60,10 (61x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm, Maximum value of SAR (interpolated) = 0.281 W/kg
Z Scan:160,5 (1x1x33): Measurement grid: dx=20mm, dy=20mm, dz=5mm, Maximum value of SAR (measured) = 0.271 W/kg

Zoom(ant0,x):xy4/z1.4(ratio) (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 8.124 V/m; Power Drift = -0.08 dB, Maximum value of SAR (measured) = 0.270 W/kg, Peak SAR (extrapolated) = 0.474 W/kg
SAR(1 g) = 0.119 W/kg; SAR(10 g) = 0.038 W/kg





Remarks: *. Date tested: 2015/02/06; Tested by: Tomochika Sato; Tested place:No.7 shielded room,
*. liquid depth: 153mm; Position: distance of EUT to phantom: 0mm (2mm to liquid); *. ambient: 22.5 ± 1 deg.C. / 39 ± 10 %RH,
*. liquid temperature: 22.1(start)/22.1(end)/22.2(in check) deg.C.; *. White cubic: zoom scan area, Red cubic: big=SAR(10g)/small=SAR(1g)

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

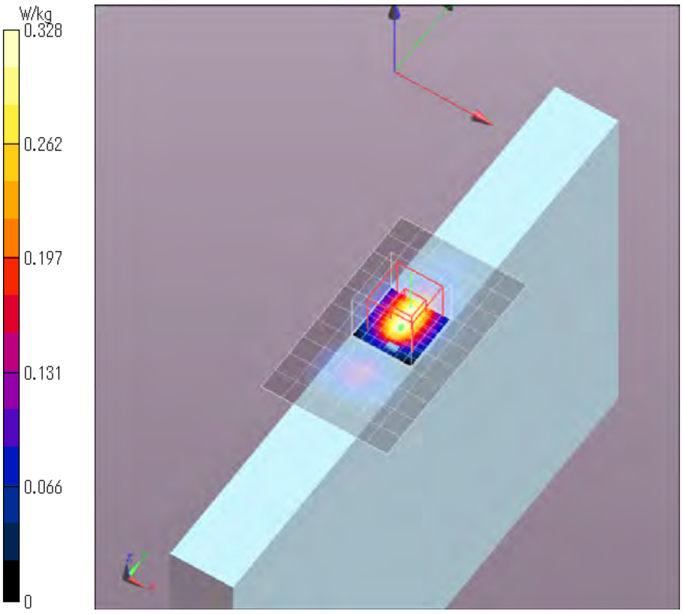
Plot 3-1: (W56 band) Top & touch, 11a (6Mbps), 5600 MHz
->Highest reported SAR(1g) for W56 band

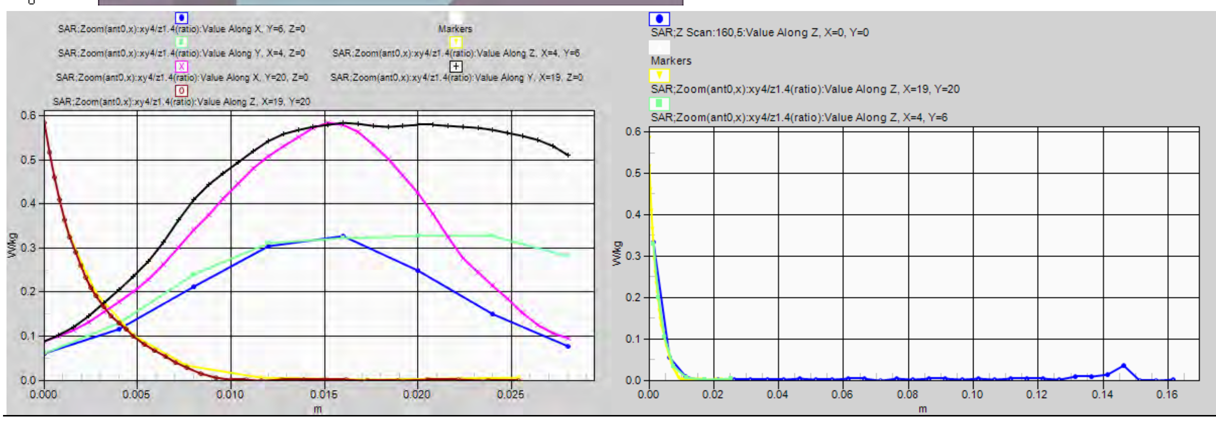
EUT: SDIO Wireless Module (in Platform); Type: SX-SDMAN (Platform: SA-A1); Serial: 0080925B200A (Platform: 11)
Mode: 11a(6Mbps, BPSK/OFDM) (UID 0, Frame Length in ms: 0; PAR: 0; PMF: 1); **Frequency: 5600 MHz; Crest Factor: 1.0**
Medium: MSL5800; Medium parameters used: f = 5600 MHz; σ = 5.972 S/m; ε_r = 46.83; ρ = 1000 kg/m^3
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:
-Probe: EX3DV4 - SN3679; ConvF(3.81, 3.81, 3.81); Calibrated: 2014/08/19;
-Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0, 161.0
-Electronics: DAE4 Sn626; Calibrated: 2014/09/17
-Phantom: ELI v4.0; Type: QDOVA001BA; Serial: 1059; Phantom section: Flat Section
-DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

m56_20150207/01-01_(pos_chk);m5600,11a(6m),top&touch(d0)/
Area Scan:60x100,10 (7x11x1): Measurement grid: dx=10mm, dy=10mm, Maximum value of SAR (measured) = 0.322 W/kg
Area Scan:60x100,10 (61x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm, Maximum value of SAR (interpolated) = 0.334 W/kg
Z Scan:160,5 (1x1x33): Measurement grid: dx=20mm, dy=20mm, dz=5mm, Maximum value of SAR (measured) = 0.334 W/kg

Zoom(ant0,x):xy4/z1.4(ratio) (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 8.298 V/m; Power Drift = -0.00 dB, Maximum value of SAR (measured) = 0.328 W/kg, Peak SAR (extrapolated) = 0.584 W/kg
SAR(1 g) = 0.136 W/kg; SAR(10 g) = 0.046 W/kg





Remarks: *. Date tested: 2015/02/07; Tested by: Tomochika Sato; Tested place:No.7 shielded room,
*. liquid depth: 153mm; Position: distance of EUT to phantom: 0mm (2mm to liquid); *. ambient: 22.5 ± 1 deg.C. / 39 ± 10 %RH,
*. liquid temperature: 22.1(start)/22.1(end)/22.2(in check) deg.C.; *. White cubic: zoom scan area, Red cubic: big=SAR(10g)/small=SAR(1g)

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

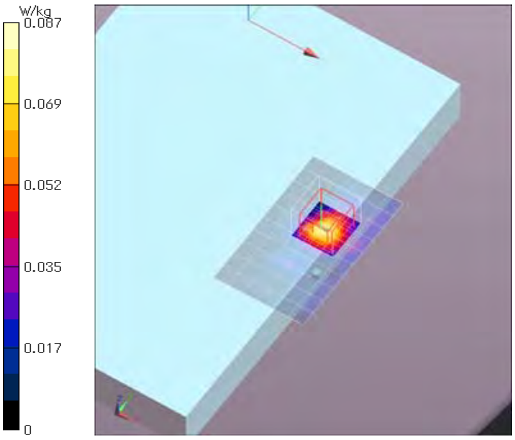
Plot 3-2: (W56 band) Rear & touch, 11a (6Mbps), 5600 MHz

EUT: SDIO Wireless Module (in Platform); Type: SX-SDMAN (Platform: SA-A1); Serial: 0080925B200A (Platform: 11)
Mode: 11a(6Mbps, BPSK/OFDM) (UID 0, Frame Length in ms: 0; PAR: 0; PMF: 1); **Frequency: 5600 MHz; Crest Factor: 1.0**
Medium: MSL5800; Medium parameters used: f = 5600 MHz; σ = 5.972 S/m; ε_r = 46.83; ρ = 1000 kg/m^3
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration: -Probe: EX3DV4 - SN3679; ConvF(3.81, 3.81, 3.81); Calibrated: 2014/08/19; -DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)
-Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0, 161.0 -Electronics: DAE4 Sn626; Calibrated: 2014/09/17
-Phantom: ELI v4.0; Type: QDOVA001BA; Serial: 1059; Phantom section: Flat Section

m56_20150207/01-02_(pos_chk);m5600,11a(6m),rear&touch(d0)/
Area Scan:60x100,10 (7x11x1): Measurement grid: dx=10mm, dy=10mm, Maximum value of SAR (measured) = 0.0803 W/kg
Area Scan:60x100,10 (61x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm, Maximum value of SAR (interpolated) = 0.103 W/kg
Z Scan:160,5 (1x1x33): Measurement grid: dx=20mm, dy=20mm, dz=5mm, Maximum value of SAR (measured) = 0.0929 W/kg

Zoom(ant0,x):xy4/z1.4(ratio) (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 4.285 V/m; Power Drift = -0.20 dB, Maximum value of SAR (measured) = 0.0866 W/kg, Peak SAR (extrapolated) = 0.144 W/kg
SAR(1 g) = 0.033 W/kg; SAR(10 g) = 0.011 W/kg



Remarks:
*. Date tested: 2015/02/07; Tested by: Tomochika Sato; Tested place:No.7 shielded room,
*. liquid depth: 153mm;
*. Position: distance of EUT to phantom: 0mm (2mm to liquid);
*. ambient: 22.5 ± 1deg.C. / 39 ± 10 %RH,
*. liquid temperature: 22.1(start)/22.1(end)/22.2(in check) deg.C.;
*. White cubic: zoom scan area, Red cubic: big=SAR(10g)/small=SAR(1g)

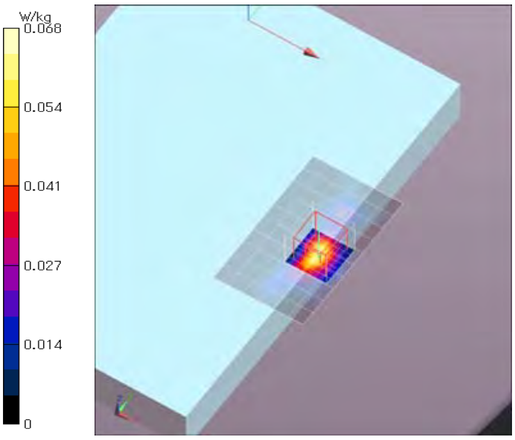
Plot 3-3: (W56 band) Front & touch, 11a (6Mbps), 5600 MHz

EUT: SDIO Wireless Module (in Platform); Type: SX-SDMAN (Platform: SA-A1); Serial: 0080925B200A (Platform: 11)
Mode: 11a(6Mbps, BPSK/OFDM) (UID 0, Frame Length in ms: 0; PAR: 0; PMF: 1); **Frequency: 5600 MHz; Crest Factor: 1.0**
Medium: MSL5800; Medium parameters used: f = 5600 MHz; σ = 5.972 S/m; ε_r = 46.83; ρ = 1000 kg/m^3
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration: -Probe: EX3DV4 - SN3679; ConvF(3.81, 3.81, 3.81); Calibrated: 2014/08/19; -Electronics: DAE4 Sn626; Calibrated: 2014/09/17
-Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0, 161.0
-Phantom: ELI v4.0; Type: QDOVA001BA; Serial: 1059; Phantom section: Flat Section -DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

m56_20150207/01-03_(pos_chk);m5600,11a(6m),front&touch(d0)/
Area Scan:60x100,10 (7x11x1): Measurement grid: dx=10mm, dy=10mm, Maximum value of SAR (measured) = 0.0626 W/kg
Area Scan:60x100,10 (61x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm, Maximum value of SAR (interpolated) = 0.0803 W/kg
Z Scan:160,5 (1x1x33): Measurement grid: dx=20mm, dy=20mm, dz=5mm, Maximum value of SAR (measured) = 0.119 W/kg

Zoom(ant0,x):xy4/z1.4(ratio) (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 3.573 V/m; Power Drift = 0.16 dB, Maximum value of SAR (measured) = 0.0681 W/kg, Peak SAR (extrapolated) = 0.154 W/kg
SAR(1 g) = 0.027 W/kg; SAR(10 g) = 0.00841 W/kg



Remarks:
*. Date tested: 2015/02/07; Tested by: Tomochika Sato; Tested place:No.7 shielded room,
*. liquid depth: 153mm;
*. Position: distance of EUT to phantom: 0mm (2mm to liquid);
*. ambient: 22.5 ± 1deg.C. / 39 ± 10 %RH,
*. liquid temperature: 22.1(start)/22.1(end)/22.2(in check) deg.C.;
*. White cubic: zoom scan area, Red cubic: big=SAR(10g)/small=SAR(1g)

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

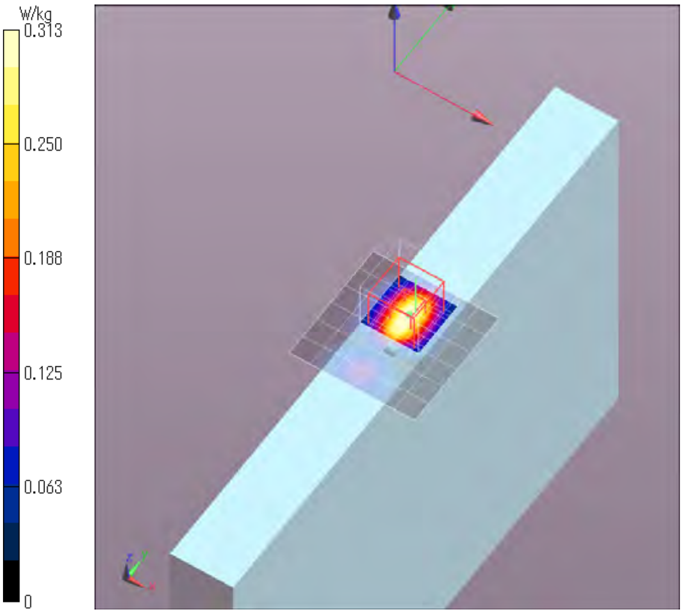
Plot 3-4: (W56 band) Top & touch, 11n(40HT) (MCS0), 5590 MHz

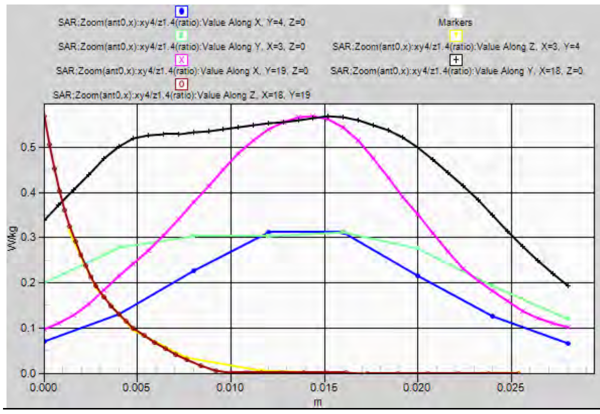
EUT: SDIO Wireless Module (in Platform); Type: SX-SDMAN (Platform: SA-A1); Serial: 0080925B200A (Platform: 11)
Mode: 11a(6Mbps, BPSK/OFDM) (UID 0, Frame Length in ms: 0; PAR: 0; PMF: 1); **Frequency: 5590 MHz; Crest Factor: 1.0**
Medium: MSL5800; Medium parameters used: f = 5590 MHz; σ = 5.947 S/m; ε_r = 46.80; ρ = 1000 kg/m^3
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

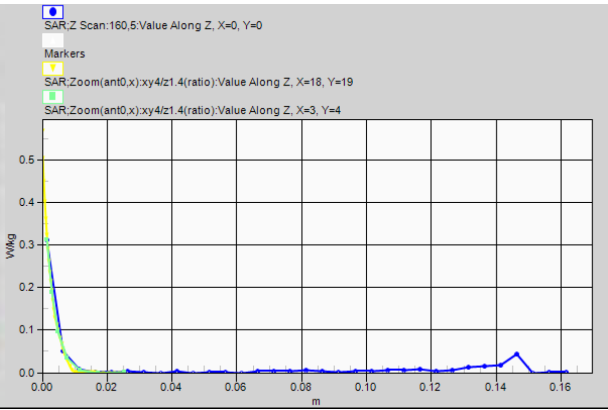
DASY Configuration: -Probe: EX3DV4 - SN3679; ConvF(3.81, 3.81, 3.81); Calibrated: 2014/08/19; -Electronics: DAE4 Sn626; Calibrated: 2014/09/17
-Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0, 161.0
-Phantom: ELI v4.0; Type: QDOVA001BA; Serial: 1059; Phantom section: Flat Section -DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

m56_20150207/03-02_(mod_chk);m5590,11n40(mcs0),top&touch(d0)/
Area Scan:60x60,10 (7x7x1): Measurement grid: dx=10mm, dy=10mm, Maximum value of SAR (measured) = 0.312 W/kg
Area Scan:60x60,10 (61x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm, Maximum value of SAR (interpolated) = 0.315 W/kg
Z Scan:160,5 (1x1x33): Measurement grid: dx=20mm, dy=20mm, dz=5mm, Maximum value of SAR (measured) = 0.313 W/kg

Zoom(ant0,x):xy4/z1.4(ratio) (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 8.357 V/m; Power Drift = -0.03 dB, Maximum value of SAR (measured) = 0.313 W/kg, Peak SAR (extrapolated) = 0.568 W/kg
SAR(1 g) = 0.130 W/kg; SAR(10 g) = 0.044 W/kg







Remarks: *. Date tested: 2015/02/07; Tested by: Tomochika Sato; Tested place:No.7 shielded room,
*. liquid depth: 153mm; Position: distance of EUT to phantom: 0mm (2mm to liquid); *. ambient: 22.5 ± 1 deg.C. / 39 ± 10 %RH,
*. liquid temperature: 22.1(start)/22.1(end)/22.2(in check) deg.C.; *. White cubic: zoom scan area, Red cubic: big=SAR(10g)/small=SAR(1g)

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

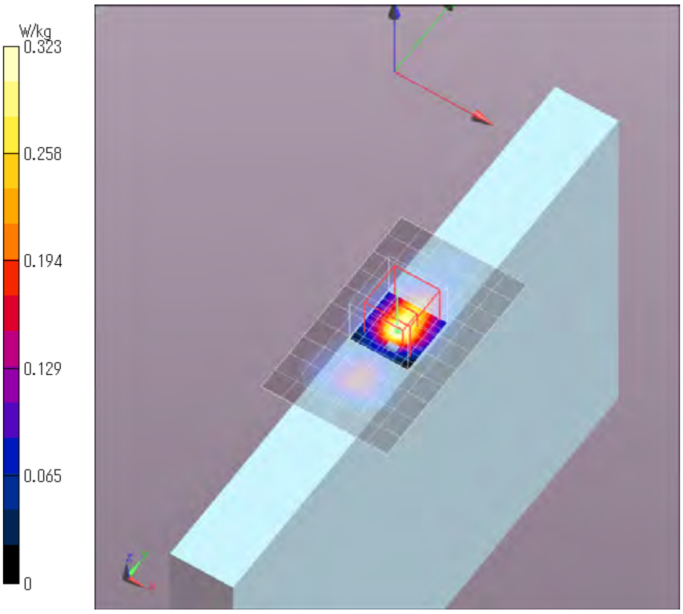
Plot 4-1: (W58 band) Top & touch, 11a (6Mbps), 5785 MHz
->Highest reported SAR(1g) for W58 band

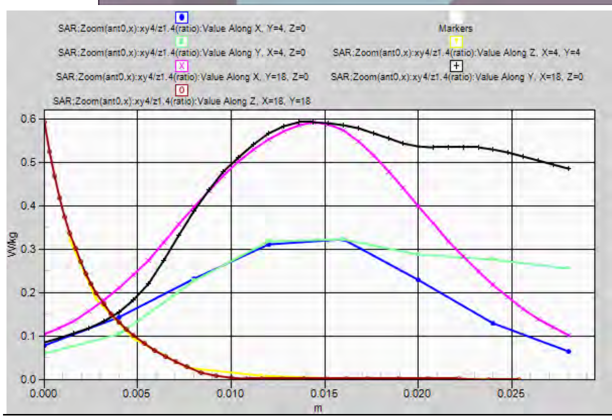
EUT: SDIO Wireless Module (in Platform); Type: SX-SDMAN (Platform: SA-A1); Serial: 0080925B200A (Platform: 11)
Mode: 11a(6Mbps, BPSK/OFDM) (UID 0, Frame Length in ms: 0; PAR: 0; PMF: 1); **Frequency: 5785 MHz; Crest Factor: 1.0**
Medium: MSL5800; Medium parameters used: f = 5785 MHz; σ = 6.237 S/m; ε_r = 46.48; ρ = 1000 kg/m^3
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

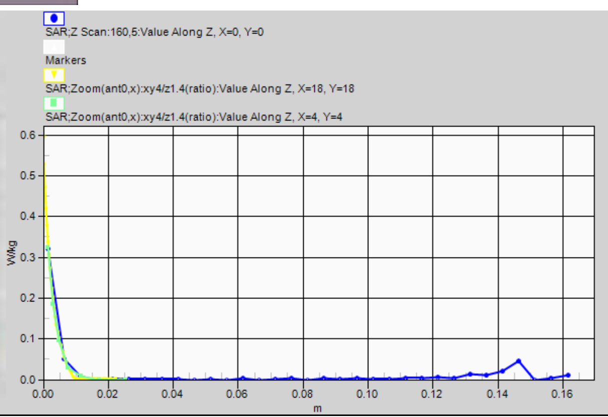
DASY Configuration:
-Probe: EX3DV4 - SN3679; ConvF(4.05, 4.05, 4.05); Calibrated: 2014/08/19;
-Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0, 161.0
-Electronics: DAE4 Sn626; Calibrated: 2014/09/17
-Phantom: ELI v4.0; Type: QDOVA001BA; Serial: 1059; Phantom section: Flat Section
-DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

m58_20150207/01-01_(pos_chk);m5785,11a(6m),top&touch(d0)/
Area Scan:60x100,10 (7x11x1): Measurement grid: dx=10mm, dy=10mm, Maximum value of SAR (measured) = 0.319 W/kg
Area Scan:60x100,10 (61x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm, Maximum value of SAR (interpolated) = 0.367 W/kg
Z Scan:160,5 (1x1x33): Measurement grid: dx=20mm, dy=20mm, dz=5mm, Maximum value of SAR (measured) = 0.321 W/kg

Zoom(ant0,x):xy4/z1.4(ratio) (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm;
Reference Value = 8.574 V/m; Power Drift = -0.20 dB, Maximum value of SAR (measured) = 0.323 W/kg, Peak SAR (extrapolated) = 0.593 W/kg
SAR(1 g) = 0.131 W/kg; SAR(10 g) = 0.044 W/kg







Remarks: *. Date tested: 2015/02/07; Tested by: Tomochika Sato; Tested place:No.7 shielded room,
*. liquid depth: 153mm; Position: distance of EUT to phantom: 0mm (2mm to liquid); *. ambient: 22.5 ± 1 deg.C. / 39 ± 10 %RH,
*. liquid temperature: 22.1(start)/22.1(end)/22.2(in check) deg.C.; *. White cubic: zoom scan area, Red cubic: big=SAR(10g)/small=SAR(1g)

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

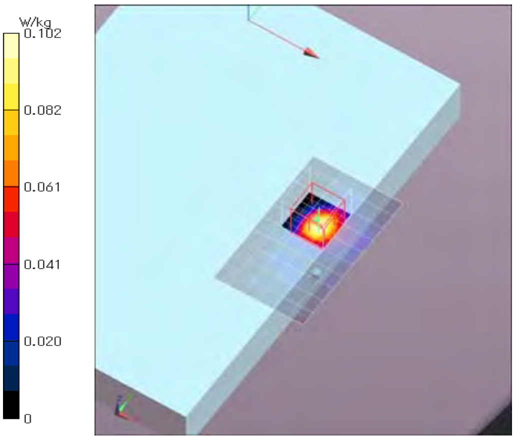
Plot 4-2: (W58 band) Rear & touch, 11a (6Mbps), 5785 MHz

EUT: SDIO Wireless Module (in Platform); Type: SX-SDMAN (Platform: SA-A1); Serial: 0080925B200A (Platform: 11)
Mode: 11a(6Mbps, BPSK/OFDM) (UID 0, Frame Length in ms: 0; PAR: 0; PMF: 1); **Frequency: 5785 MHz; Crest Factor: 1.0**
Medium: MSL5800; Medium parameters used: f = 5785 MHz; σ = 6.237 S/m; ε_r = 46.48; ρ = 1000 kg/m^3
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration: -Probe: EX3DV4 - SN3679; ConvF(4.05, 4.05, 4.05); Calibrated: 2014/08/19; -DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)
-Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0, 161.0 -Electronics: DAE4 Sn626; Calibrated: 2014/09/17
-Phantom: ELI v4.0; Type: QDOVA001BA; Serial: 1059; Phantom section: Flat Section

m58_20150207/01-02_(pos_chk);m5785,11a(6m),rear&touch(d0)/
Area Scan:60x100,10 (7x11x1): Measurement grid: dx=10mm, dy=10mm, Maximum value of SAR (measured) = 0.0977 W/kg
Area Scan:60x100,10 (61x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm, Maximum value of SAR (interpolated) = 0.124 W/kg
Z Scan:160,5 (1x1x33): Measurement grid: dx=20mm, dy=20mm, dz=5mm, Maximum value of SAR (measured) = 0.0970 W/kg

Zoom(ant0,x):xy4/z1.4(ratio) (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm;
Reference Value = 4.136 V/m; Power Drift = -0.18 dB, Maximum value of SAR (measured) = 0.102 W/kg, Peak SAR (extrapolated) = 0.173 W/kg
SAR(1 g) = 0.040 W/kg; SAR(10 g) = 0.013 W/kg



Remarks:
*. Date tested: 2015/02/07; Tested by: Tomochika Sato; Tested place:No.7 shielded room,
*. liquid depth: 153mm;
*. Position: distance of EUT to phantom: 0mm (2mm to liquid);
*. ambient: 22.5 ± 1deg.C. / 39 ± 10 %RH,
*. liquid temperature: 22.1(start)/22.1(end)/22.2(in check) deg.C.;
*. White cubic: zoom scan area, Red cubic: big=SAR(10g)/small=SAR(1g)

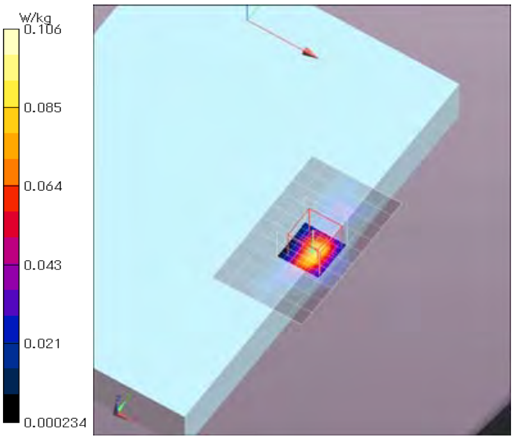
Plot 4-3: (W58 band) Front & touch, 11a (6Mbps), 5785 MHz

EUT: SDIO Wireless Module (in Platform); Type: SX-SDMAN (Platform: SA-A1); Serial: 0080925B200A (Platform: 11)
Mode: 11a(6Mbps, BPSK/OFDM) (UID 0, Frame Length in ms: 0; PAR: 0; PMF: 1); **Frequency: 5785 MHz; Crest Factor: 1.0**
Medium: MSL5800; Medium parameters used: f = 5785 MHz; σ = 6.237 S/m; ε_r = 46.48; ρ = 1000 kg/m^3
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration: -Probe: EX3DV4 - SN3679; ConvF(4.05, 4.05, 4.05); Calibrated: 2014/08/19; -Electronics: DAE4 Sn626; Calibrated: 2014/09/17
-Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0, 161.0
-Phantom: ELI v4.0; Type: QDOVA001BA; Serial: 1059; Phantom section: Flat Section -DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

m58_20150207/01-re03_(pos_chk);m5785,11a(6m),front&touch(d0)/
Area Scan:60x100,10 (7x11x1): Measurement grid: dx=10mm, dy=10mm, Maximum value of SAR (measured) = 0.0890 W/kg
Area Scan:60x100,10 (61x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm, Maximum value of SAR (interpolated) = 0.116 W/kg
Z Scan:160,5 (1x1x33): Measurement grid: dx=20mm, dy=20mm, dz=5mm, Maximum value of SAR (measured) = 0.112 W/kg

Zoom(ant0,x):xy4/z1.4(ratio) (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm;
Reference Value = 4.713 V/m; Power Drift = 0.17 dB, Maximum value of SAR (measured) = 0.106 W/kg, Peak SAR (extrapolated) = 0.173 W/kg
SAR(1 g) = 0.043 W/kg; SAR(10 g) = 0.013 W/kg



Remarks:
*. Date tested: 2015/02/07; Tested by: Tomochika Sato; Tested place:No.7 shielded room,
*. liquid depth: 153mm;
*. Position: distance of EUT to phantom: 0mm (2mm to liquid);
*. ambient: 22.5 ± 1deg.C. / 39 ± 10 %RH,
*. liquid temperature: 22.1(start)/22.1(end)/22.2(in check) deg.C.;
*. White cubic: zoom scan area, Red cubic: big=SAR(10g)/small=SAR(1g)

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

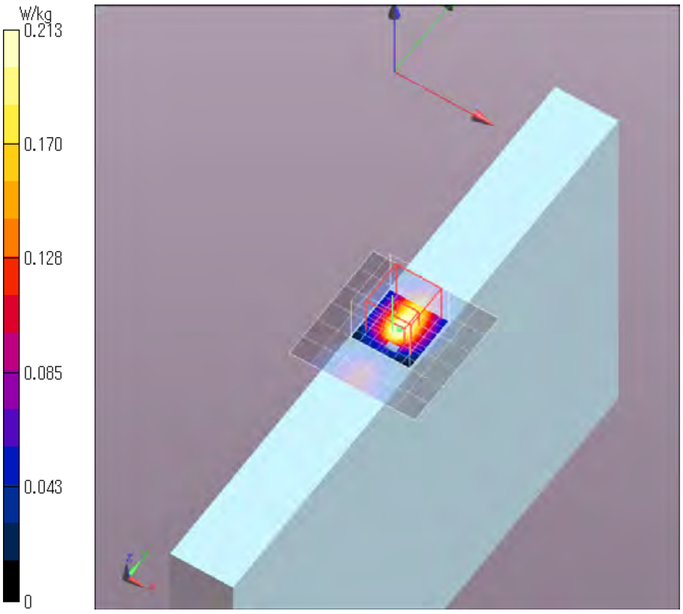
Plot 4-4: (W58 band) Top & touch, 11n(40HT) (MCS0), 5795 MHz

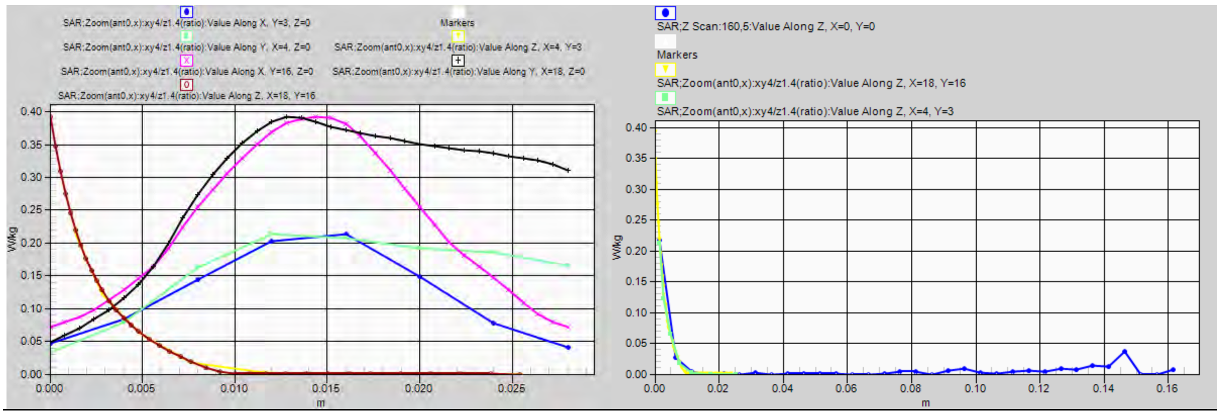
EUT: SDIO Wireless Module (in Platform); Type: SX-SDMAN (Platform: SA-A1); Serial: 0080925B200A (Platform: 11)
Mode: 11a(6Mbps, BPSK/OFDM) (UID 0, Frame Length in ms: 0; PAR: 0; PMF: 1); **Frequency: 5795 MHz; Crest Factor: 1.0**
Medium: MSL5800; Medium parameters used: f = 5795 MHz; σ = 6.237 S/m; ε_r = 46.39; ρ = 1000 kg/m^3
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration: -Probe: EX3DV4 - SN3679; ConvF(4.05, 4.05, 4.05); Calibrated: 2014/08/19; -Electronics: DAE4 Sn626; Calibrated: 2014/09/17
-Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0, 161.0
-Phantom: ELI v4.0; Type: QDOVA001BA; Serial: 1059; Phantom section: Flat Section -DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

m58_20150207/03-01_(mod_chk);m5795,11n40(mcs0),top&touch(d0)/
Area Scan:60x60,10 (7x7x1): Measurement grid: dx=10mm, dy=10mm, Maximum value of SAR (measured) = 0.214 W/kg
Area Scan:60x60,10 (61x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm, Maximum value of SAR (interpolated) = 0.241 W/kg
Z Scan:160,5 (1x1x33): Measurement grid: dx=20mm, dy=20mm, dz=5mm, Maximum value of SAR (measured) = 0.218 W/kg

Zoom(ant0,x):xy4/z1.4(ratio) (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm;
Reference Value = 6.883 V/m; Power Drift = -0.04 dB, Maximum value of SAR (measured) = 0.213 W/kg, Peak SAR (extrapolated) = 0.392 W/kg
SAR(1 g) = 0.084 W/kg; SAR(10 g) = 0.028 W/kg





Remarks: *. Date tested: 2015/02/07; Tested by: Tomochika Sato; Tested place:No.7 shielded room,
*. liquid depth: 153mm; Position: distance of EUT to phantom: 0mm (2mm to liquid); *. ambient: 22.5 ± 1 deg.C. / 39 ± 10 %RH,
*. liquid temperature: 22.1(start)/22.1(end)/22.2(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

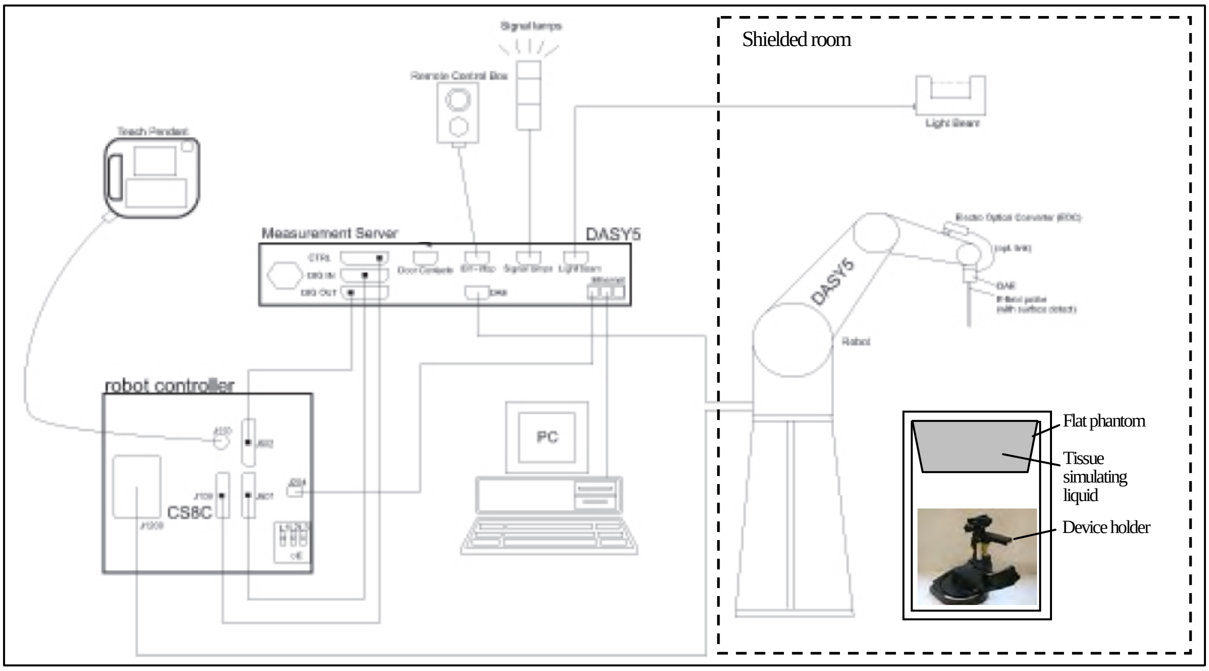
Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
COTS-SSAR-02	DASY52	Schmid&Partner Engineering AG	DASY52(ver.52.8.8(1222))	-	SAR	-
COTS-SSEP-02	Dielectric assessment kit	Schmid&Partner Engineering AG	DAK(ver1.10.317.11)	-	SAR	-
SSAR-02	SAR measurement 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	2014/09/29 * 12
KDAE-01	Data Acquisition Electronics	Schmid&Partner Engineering AG	DAE4	626	SAR	2014/09/17 * 12
KPB-01	Dosimetric E-Field Probe	Schmid&Partner Engineering AG	EX3DV4	3679	SAR	2014/08/19 * 12
KSDA-01	Dipole Antenna	Schmid&Partner Engineering AG	D2450V2	822	SAR(daily)	2015/01/15 * 12
KSDA-02	Dipole Antenna	Schmid&Partner Engineering AG	D5GHzV2	1070	SAR(daily)	2014/03/21 * 12
KPFL-01	Flat Phantom	Schmid&Partner Engineering AG	Oval flat phantom ELI 4.0	1059	SAR	2014/10/01 * 12
SSNA-01	Network Analyzer	Agilent	8753ES	US39171777	SAR	2015/01/16 * 12
SEPP-02	Dielectric probe	Schmid&Partner Engineering AG	DAK3.5	1129	SAR	2014/08/12 * 12
KSG-08	Signal Generator	Rohde & Schwarz	SMT06	100763	SAR(daily)	2014/07/24 * 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)	2014/09/11 * 12
KIU-08	Power sensor	Rohde & Schwarz	NRV-Z4	100372	SAR(daily)	2014/09/11 * 12
KIU-09	Power sensor	Rohde & Schwarz	NRV-Z4	100371	SAR(daily)	2014/09/11 * 12
KAT10-P1	Attenuator	Weinschel	24-10-34	BY5927	SAR(daily)	2014/12/26 * 12
KPM-05	Power meter	Agilent	E4417A	GB41290718	SAR(daily)	2014/05/09 * 12
KPSS-01	Power sensor	Agilent	E9327A	US40440544	SAR(daily)	2014/05/09 * 12
KRU-02	Ruler(150mm,L)	Shinwa	12103	-	SAR	2014/03/27 * 12
KRU-04	Ruler(300mm)	Shinwa	13134	-	SAR	2014/05/13 * 12
KRU-05	Ruler(100x50mm,L)	Shinwa	12101	-	SAR	2014/05/13 * 12
KOS-13	Digital thermometer	HANNA	Checktemp-2	KOS-13	SAR	2014/12/22 * 12
KOS-14	Thermo-Hygrometer data logger	SATO KEIRYOKI	SK-L200THIIα/SK-LTHIIα-2	015246/08169	SAR	2014/12/22 * 12
SOS-11	Humidity Indicator	A&D	AD-5681	4063424	SAR	2014/12/24 * 12
KPM-08	Power meter	Anritsu	ML2495A	6K00003356	Ant.pwr	2014/09/16 * 12
KPSS-04	Power sensor	Anritsu	MA2411B	012088	Ant.pwr	2014/09/16 * 12
KAT10-S3	Attenuator	Agilent	8490D 010	50924	Ant.pwr	2014/12/26 * 12
SSA-04	Spectrum Analyzer	Advantest	R3272	101100994	SAR(moni.)	2014/12/15 * 12
SWTR-03	DI water	MonotaRo	34557433	-	SAR	Pre Check
KSLM245-01	Tissue simulation liquid (2450MHz,body)	Schmid&Partner Engineering AG	MSL2450V2	SL AAM 245 BA	SAR	Pre Check
KSLM580-02	Tissue simulation liquid (5800MHz,body)	Schmid&Partner Engineering AG	MBBL3500-5800V5	SL AAM 501 AB(110520-3)	SAR	Pre Check
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.



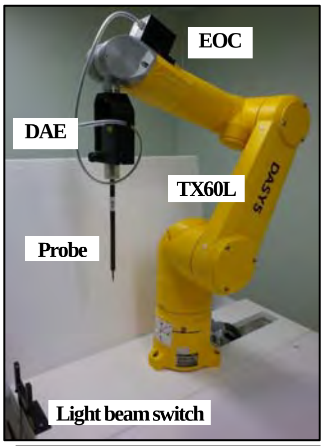
The DASY5 system for performing compliance tests consist of the following items:

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 Lspeag robot/CS8Cspeag-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)

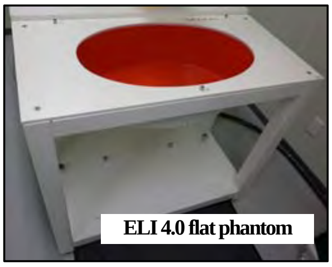
- •Manufacture : Schmid & Partner Engineering AG

SAR measurement software

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

E-Field Probe

- •Model : <u>**EX3DV4 (serial number: 3679)**</u>
- •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, (5750), 5800MHz (Head and Body)
  - *. The EX3DV4(serial no.3679) calibration frequency of 5750MHz was not used for this SAR test.
- •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 : <u>**ELI 4.0 oval flat phantom**</u>
- •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	Body	Body
Control No.	KSLM245-01	KSLM580-02
Model No. / Product No.	MSL2450V2 / SL AAM 245 BA	MBBL3500-5800V5 / SL AAM 501 AB
Ingredient: Mixture (%)	Water:52-75%, DGBE:25-48%, NaCl:<1.0%	Water:60-80%, Ester/Emulsifiers/Inhibitors:20-40%, Sodium salt:0-1.5%
Manufacture	Schmid & Partner Engineering AG	

*. The dielectric parameters were checked prior to assessment using the DAK3.5 dielectric probe kit.

Measured date	Freq. [MHz]	Liquid type	Ambient [deg.C.] /[%RH]	Liquid temp. [deg.C.] Before/After	Liquid Depth [mm]	Liquid parameters (*1)								ΔSAR (1g) [%] (*2)
						Permittivity (εr) [-]				Conductivity [S/m]				
						Target	Measured		Limit	Target	Measured		Limit	
							Meas.	Δεr[%]	[%]		Meas.	Δσ[%]	[%]	
February. 6, 2015	2450	Body	22.5/38	21.5/21.5	(155)	***52.7***	51.76	-1.8	±5%	***1.95***	1.982	+1.6	±5%	+1.19
February. 6, 2015	5300	Body	22.5/38	22.0/22.0	(154)	***48.88***	47.32	-3.2	±5%	***5.416***	5.594	+3.3	±5%	+0.53
February. 7, 2015	5600	Body	22.5/38	22.0/22.0	(154)	***48.47***	46.83	-3.4	±5%	***5.766***	5.972	+3.6	±5%	+0.52
	5800					***48.20***	46.45	-3.6	±5%	***6.000***	6.261	+4.4	±5%	+0.53

1. The target value is a parameter defined in Appendix A of KDB865664 D01, the dielectric parameters suggested for head and body tissue simulating liquid are given at 2000, 2450, 3000 and 5800 MHz. (.The parameters of the head liquid are the same value as IEC 62209-2.) Parameters for the frequencies between 2000-3000, 3000-5800 MHz were obtained using linear interpolation. Above 5800 MHz were obtained using linear extrapolation

*2. The coefficients are parameters defined in IEEE Std 1528-2013.

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

Appendix 3-5: System check results

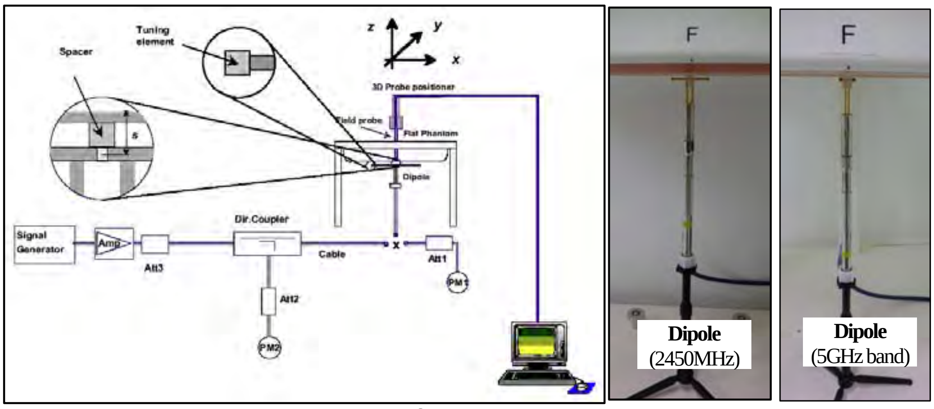
Prior to the SAR assessment of EUT, the system check was performed to test whether the SRA system was operating within its target of ±10%. The System check results are in the table below. (*. Refer to Appendix 3-6 of measurement data.)

System check results															
Date	Freq. [MHz]	Liquid Type	Ambient [deg.C.] /[%RH]	Liquid Temp. [deg.C.] Check/BeforeAfter	Liquid Depth [mm]	Dielectric parameter		Power drift [dB]	System check target & measured						
									SAR (1g) [W/kg] (*3)				Deviation [%]	Limit [%]	Pass?
						εr [-]	σ [S/m]		Measured	ΔSAR-corrected	1W scaled	Target			
February 6, 2015	2450	Body	22.5/40	21.5//21.6/21.6	154	51.76	1.982	-0.03	12.6 (250mW)	12.45	**49.8**	**51.9** (*4)	**-4.0**	±10	Pass
February 6, 2015	5300	Body	22.6/40	22.2/22.2/22.1	153	47.32	5.594	-0.05	7.72 (100mW)	7.68	**76.8**	**77.4** (*4)	**-0.8**	±10	Pass
February 7, 2015	5600	Body	22.5/39	22.2/22.1/22.1	153	46.83	5.972	-0.10	8.14 (100mW)	8.10	**81.0**	**81.4** (*4)	**-0.5**	±10	Pass
February 7, 2015	5800	Body	22.5/39	22.2/22.1/22.1	153	46.45	6.261	-0.05	7.07 (100mW)	7.03	**70.3**	**75.9** (*4)	**-7.4**	±10	Pass

*. Calculating formula: ΔSAR corrected SAR (1g) (W/kg) = (Observed SAR(1g) (W/kg)) × (100 - (ΔSAR(%)) / 100

*3. The measured SAR value of system check was compensated for tissue dielectric deviations (ΔSAR) and scaled to 1W of output power in order to compare with the manufacture's calibration target value which was normalized.

*4. The target value is a parameter defined in the calibration data sheet of D2450V2 (sn:822) and D5GHzV2 (sn:1070) dipole calibrated by Schmid & Partner Engineering AG (Certification No. D2450V2-822_Jan15 / D5GHzV2-1070_Mar14, the data sheet was filed in this report). For 2.45GHz, the manufacture's calibration data of dipole for head liquid were within 1% of IEEE Std 1528 head target value (=52.4W/kg, cal.=52.5W/kg, +0.2% vs. standard). This calibration result is enough, using this dipole as a reference. We decided to use body liquid calibration data of this dipole for the system check target.



Test setup for the system check

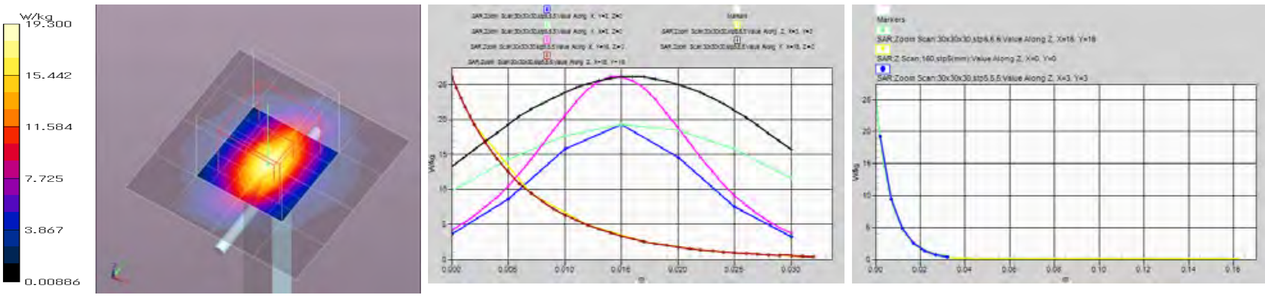
Appendix 3-6: System check measurement data

(February 6, 2015) EUT: Dipole(2.45GHz); Type: D2450V2; Serial: 822; Forward conducted power: 250mW
Communication System: CW (UID 0, Frame Length in ms: 0; PAR: 0; PMF: 1); **Frequency: 2450 MHz; Crest Factor: 1.0**
Medium: M2450; Medium parameters used: f = 2450 MHz; σ = 1.982 S/m; ε_r = 51.76; ρ = 1000 kg/m^3
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration: -Probe: EX3DV4 - SN3679; ConvF(6.88, 6.88, 6.88); Calibrated: 2014/08/19; -DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)
-Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0, 161.0 -Electronics: DAE4 Sn626; Calibrated: 2014/09/17
-Phantom: ELI v4.0; Type: QDOVA001BA; Serial: 1059; Phantom section: Flat Section

Area Scan:60x60,stp15 (5x5x1): Measurement grid: dx=15mm, dy=15mm, Maximum value of SAR (measured) = 19.3 W/kg
Area Scan:60x60,stp15 (41x41x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm, Maximum value of SAR (interpolated) = 19.3 W/kg
Z Scan;160,stp5(mm) (1x1x33): Measurement grid: dx=20mm, dy=20mm, dz=5mm, Maximum value of SAR (interpolated) = 19.3 W/kg

Zoom Scan:30x30x30,stp5,5,5 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm;
Reference Value = 100.1 V/m; Power Drift = -0.03 dB, Maximum value of SAR (interpolated) = 19.3 W/kg,
Peak SAR (extrapolated) = 26.1 W/kg (-7.1 %, vs. speag-cal.=28.1 W/kg)
SAR(1 g) = 12.6 W/kg; SAR(10 g) = 5.81 W/kg



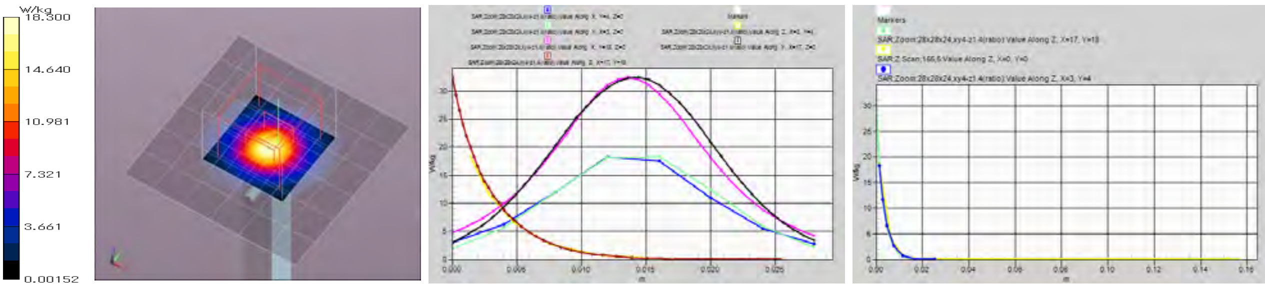
Remarks: *. Date tested: 2015/02/06; Tested by: Tomochika Sato; Tested place:No.7 shielded room,
*. liquid depth: 153mm; Position: distance of dipole to phantom: 8mm (10mm to liquid); ambient: 22.5 deg.C. / 40 %RH,
*. liquid temperature: 21.6(start)/21.6(end)/21.5(in check) deg.C.; *.White cubic: zoom scan area, Red cubic: big=SAR(10g)/small=SAR(1g)

(February 6, 2015) EUT: Dipole(5GHz); Type: D5GHzV2; Serial: 1070; Forward conducted power: 100mW
Communication System: CW (UID 0, Frame Length in ms: 0; PAR: 0; PMF: 1); **Frequency: 5300 MHz; Crest Factor: 1.0**
Medium: MSL5800; Medium parameters used: f = 5300 MHz; σ = 5.594 S/m; ε_r = 47.32; ρ = 1000 kg/m^3
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration: -Probe: EX3DV4 - SN3679; ConvF(4.18, 4.18, 4.18); Calibrated: 2014/08/19; -DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)
-Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0, 156.0 -Electronics: DAE4 Sn626; Calibrated: 2014/09/17
-Phantom: ELI v4.0; Type: QDOVA001BA; Serial: 1059; Phantom section: Flat Section

Area:60x60,stp10 (7x7x1): Measurement grid: dx=10mm, dy=10mm, Maximum value of SAR (measured) = 19.4 W/kg
Area:60x60,stp10 (61x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm, Maximum value of SAR (interpolated) = 19.6 W/kg
Z Scan;155,5 (1x1x32): Measurement grid: dx=20mm, dy=20mm, dz=5mm, Maximum value of SAR (measured) = 18.5 W/kg

Zoom:28x28x24,xy4-z1.4(ratio) (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm;
Reference Value = 66.58 V/m; Power Drift = -0.03 dB, Maximum value of SAR (measured) = 18.3 W/kg,
Peak SAR (extrapolated) = 32.5 W/kg (+3.2 %, vs. speag-cal.=31.5 W/kg)
SAR(1 g) = 7.72 W/kg; SAR(10 g) = 2.16 W/kg



Remarks: *. Date tested: 2015/02/06; Tested by: Tomochika Sato; Tested place:No.7 shielded room,
*. liquid depth: 153mm; Position: distance of dipole to phantom: 8mm (10mm to liquid); ambient: 22.6 deg.C. / 40 %RH,
*. liquid temperature: 22.0(start)/22.0(end)/22.2(in check) deg.C.; *.White cubic: zoom scan area, Red cubic: big=SAR(10g)/small=SAR(1g)

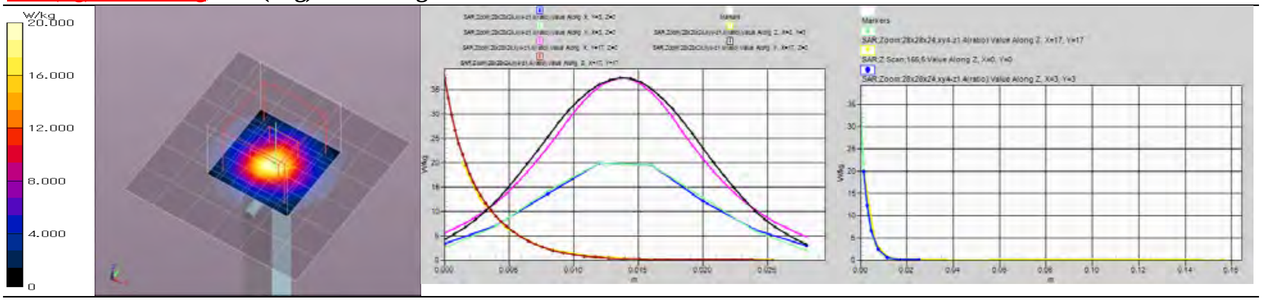
Appendix 3-6: System check measurement data (cont'd)

(February 7, 2015) EUT: Dipole(5GHz); Type: D5GHzV2; Serial: 1070; Forward conducted power: 100mW
Communication System: CW (UID 0, Frame Length in ms: 0; PAR: 0; PMF: 1); **Frequency: 5600 MHz; Crest Factor: 1.0**
Medium: MSL5800; Medium parameters used: f = 5600 MHz; σ = 5.972 S/m; ε_r = 46.83; ρ = 1000 kg/m^3
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration: -Probe: EX3DV4 - SN3679; ConvF(3.81, 3.81, 3.81); Calibrated: 2014/08/19; -Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0, 156.0 -Phantom: ELI v4.0; Type: QDOVA001BA; Serial: 1059; Phantom section: Flat Section -DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331) -Electronics: DAE4 Sn626; Calibrated: 2014/09/17

Area:60x60,stp10 (7x7x1): Measurement grid: dx=10mm, dy=10mm, Maximum value of SAR (measured) = 20.3 W/kg
Area:60x60,stp10 (61x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm, Maximum value of SAR (interpolated) = 21.1 W/kg
Z Scan;155,5 (1x1x32): Measurement grid: dx=20mm, dy=20mm, dz=5mm, Maximum value of SAR (measured) = 20.2 W/kg

Zoom:28x28x24,xy4-z1.4(ratio) (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm;
Reference Value = 65.46 V/m; Power Drift = -0.03 dB, Maximum value of SAR (measured) = 20.0 W/kg,
Peak SAR (extrapolated) = 37.5 W/kg (+3.0 %, vs. speag-cal.=36.4 W/kg)
SAR(1 g) = 8.14 W/kg; SAR(10 g) = 2.26 W/kg



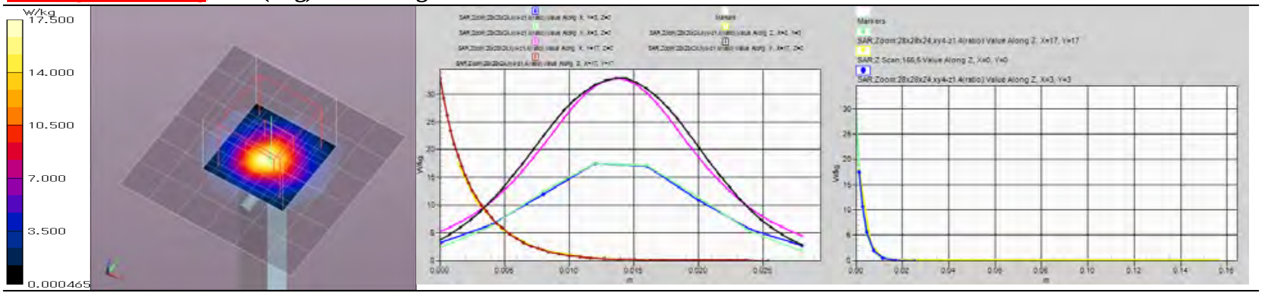
Remarks: *. Date tested: 2015/02/07; Tested by: Tomochika Sato; Tested place:No.7 shielded room,
*. liquid depth: 153mm; Position: distance of dipole to phantom: 8mm (10mm to liquid); ambient: 22.5 deg.C. / 39 %RH,
*. liquid temperature: 22.1(start)/22.1(end)/22.2(in check) deg.C.; *.White cubic: zoom scan area, Red cubic: big=SAR(10g)/small=SAR(1g)

(February 7, 2015) EUT: Dipole(5GHz); Type: D5GHzV2; Serial: 1070; Forward conducted power: 100mW
Communication System: CW (UID 0, Frame Length in ms: 0; PAR: 0; PMF: 1); **Frequency: 5800 MHz; Crest Factor: 1.0**
Medium: MSL5800; Medium parameters used: f = 5800 MHz; σ = 6.261 S/m; ε_r = 46.45; ρ = 1000 kg/m^3
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration: -Probe: EX3DV4 - SN3679; ConvF(4.05, 4.05, 4.05); Calibrated: 2014/08/19; -Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0, 156.0 -Phantom: ELI v4.0; Type: QDOVA001BA; Serial: 1059; Phantom section: Flat Section -DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331) -Electronics: DAE4 Sn626; Calibrated: 2014/09/17

Area:60x60,stp10 (7x7x1): Measurement grid: dx=10mm, dy=10mm, Maximum value of SAR (measured) = 17.6 W/kg
Area:60x60,stp10 (61x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm, Maximum value of SAR (interpolated) = 18.4 W/kg
Z Scan;155,5 (1x1x32): Measurement grid: dx=20mm, dy=20mm, dz=5mm, Maximum value of SAR (measured) = 17.8 W/kg

Zoom:28x28x24,xy4-z1.4(ratio) (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm;
Reference Value = 61.26 V/m; Power Drift = -0.05 dB, Maximum value of SAR (measured) = 17.5 W/kg,
Peak SAR (extrapolated) = 32.9 W/kg (-8.1 %, vs. speag-cal.=35.8 W/kg)
SAR(1 g) = 7.07 W/kg; SAR(10 g) = 1.97 W/kg



Remarks: *. Date tested: 2015/02/07; Tested by: Tomochika Sato; Tested place:No.7 shielded room,
*. liquid depth: 153mm; Position: distance of dipole to phantom: 8mm (10mm to liquid); ambient: 22.5 deg.C. / 39 %RH,
*. liquid temperature: 22.1(start)/22.1(end)/22.2(in check) deg.C.; *.White cubic: zoom scan area, Red cubic: big=SAR(10g)/small=SAR(1g)

Appendix 3-7: System check uncertainty

Uncertainty of system check (2.4~6GHz) (*.ε&σ tolerance: ≤ ±5%, DAK3.5, CW) (v08)	1g SAR	10g SAR
Combined measurement uncertainty of the measurement system (k=1)	± 11.0 %	± 10.9 %
Expanded uncertainty (k=2)	± 22.1 %	± 21.8 %

	Error Description (v08)	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 error	±4.7 %	Rectangular	√3	√0.5	√0.5	±1.9 %	±1.9 %	∞
3	Hemispherical isotropy error	±9.6 %	Rectangular	√3	0	0	0 %	0 %	∞
4	Probe linearity	±4.7 %	Rectangular	√3	1	1	±2.7 %	±2.7 %	∞
5	Probe modulation response (CW)	±0.0 %	Rectangular	√3	1	1	0 %	0 %	∞
6	System detection limit	±1.0 %	Rectangular	√3	1	1	±0.6 %	±0.6 %	∞
7	Boundary effects	±4.8 %	Rectangular	√3	1	1	±2.8 %	±2.8 %	∞
8	System readout electronics (DAE)	±0.3 %	Normal	1	1	1	±0.3 %	±0.3 %	∞
9	Response Time Error (<5ms/100ms wait)	±0.0 %	Rectangular	√3	1	1	0 %	0 %	∞
10	Integration Time Error (CW)	±0.0 %	Rectangular	√3	1	1	0 %	0 %	∞
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 (Post-processing)	±4.0 %	Rectangular	√3	1	1	±2.3 %	±2.3 %	∞
B	**Test Sample Related**								
16	Deviation of the experimental source	±3.5 %	Normal	1	1	1	±3.5 %	±3.5 %	∞
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)	±2.3 %	Rectangular	√3	1	1	±1.3 %	±1.3 %	∞
C	**Phantom and Setup**								
19	Phantom uncertainty	±2.0 %	Rectangular	√3	1	1	±1.2 %	±1.2%	∞
20	Algorithm for correcting SAR (e',σ: ≤5%)	±1.2 %	Normal	1	1	0.84	±1.2 %	±0.97 %	∞
21	Liquid conductivity (meas.) (DAK3.5)	±3.0 %	Normal	1	0.78	0.71	±2.3 %	±2.1 %	∞
22	Liquid permittivity (meas.) (DAK3.5)	±3.1 %	Normal	1	0.23	0.26	±0.7 %	±0.8 %	∞
23	Liquid Conductivity-temp.uncertainty (≤2deg.C.)	±5.3 %	Rectangular	√3	0.78	0.71	±2.4 %	±2.2 %	∞
24	Liquid Permittivity-temp.uncertainty (≤2deg.C.)	±0.9 %	Rectangular	√3	0.23	0.26	±0.1 %	±0.1 %	∞
	Combined Standard Uncertainty						**±11.0** %	**±10.9** %	
	Expanded Uncertainty (k=2)						**±22.1** %	**±21.8** %	

*. This measurement uncertainty budget is suggested by IEEE Std. 1528(2013) and determined by Schmid & Partner Engineering AG (DASY5 Uncertainty Budget).

Appendix 3-8: Calibration certificate: E-Field Probe (EX3DV4)

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

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Accreditation No.: **SCS 108**

Client **UL Japan (PTT)**

Certificate No: **EX3-3679_Aug14**

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3679

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

Calibration date: August 19, 2014

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 E4419B	GB41293874	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S5277 (20x)	03-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: August 19, 2014

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

Certificate No: EX3-3679_Aug14 Page 1 of 11

Appendix 3-8: Calibration certificate: E-Field Probe (EX3DV4) (cont'd)

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Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

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, "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

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z: A, B, C, D* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle*: The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

Appendix 3-8: Calibration certificate: E-Field Probe (EX3DV4) (cont'd)

Probe EX3DV4

SN:3679

Manufactured: September 9, 2008
Calibrated: August 19, 2014

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

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Appendix 3-8: Calibration certificate: E-Field Probe (EX3DV4) (cont'd)

EX3DV4– SN:3679 August 19, 2014

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3679

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (μV/(V/m)²)[A]	0.58	0.54	0.53	± 10.1 %
DCP (mV)[B]	96.0	99.0	100.0	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	135.5	±2.7 %
		Y	0.0	0.0	1.0		136.4	
		Z	0.0	0.0	1.0		143.7	

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

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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Appendix 3-8: Calibration certificate: E-Field Probe (EX3DV4) (cont'd)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3679

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
2450	39.2	1.80	6.94	6.94	6.94	0.40	0.79	± 12.0 %
5200	36.0	4.66	5.08	5.08	5.08	0.30	1.80	± 13.1 %
5300	35.9	4.76	4.77	4.77	4.77	0.35	1.80	± 13.1 %
5500	35.6	4.96	4.62	4.62	4.62	0.35	1.80	± 13.1 %
5600	35.5	5.07	4.42	4.42	4.42	0.35	1.80	± 13.1 %
5750	35.4	5.22	4.45	4.45	4.45	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.41	4.41	4.41	0.40	1.80	± 13.1 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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Appendix 3-8: Calibration certificate: E-Field Probe (EX3DV4) (cont'd)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3679

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
2450	52.7	1.95	6.88	6.88	6.88	0.79	0.59	± 12.0 %
5200	49.0	5.30	4.35	4.35	4.35	0.45	1.90	± 13.1 %
5300	48.9	5.42	4.18	4.18	4.18	0.45	1.90	± 13.1 %
5500	48.6	5.65	4.00	4.00	4.00	0.45	1.90	± 13.1 %
5600	48.5	5.77	3.81	3.81	3.81	0.45	1.90	± 13.1 %
5750	48.3	5.94	4.17	4.17	4.17	0.50	1.90	± 13.1 %
5800	48.2	6.00	4.05	4.05	4.05	0.50	1.90	± 13.1 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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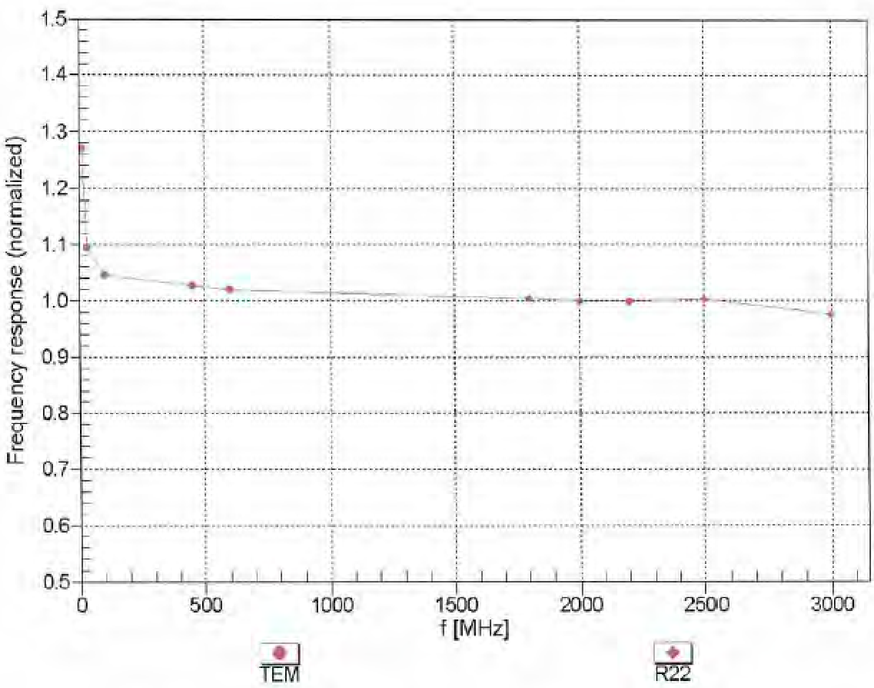
Appendix 3-8: Calibration certificate: E-Field Probe (EX3DV4) (cont'd)

Frequency Response of E-Field

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



Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

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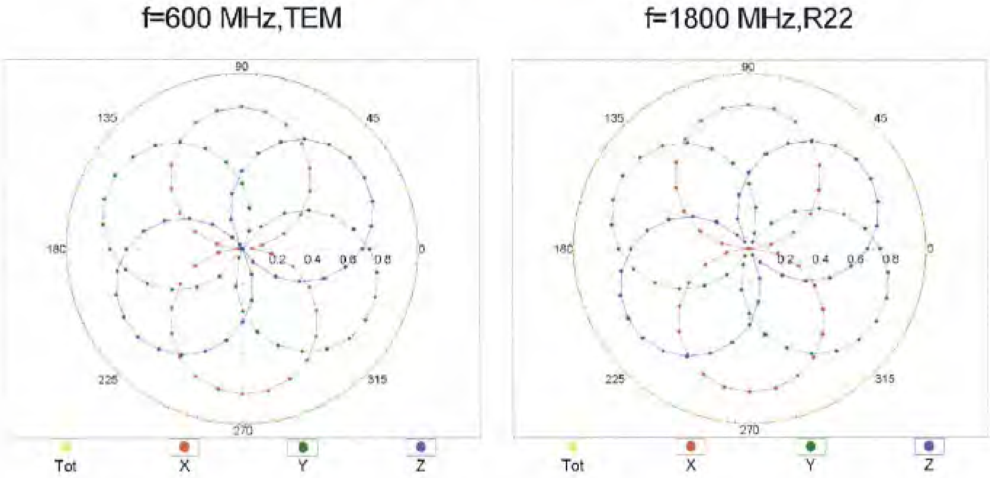
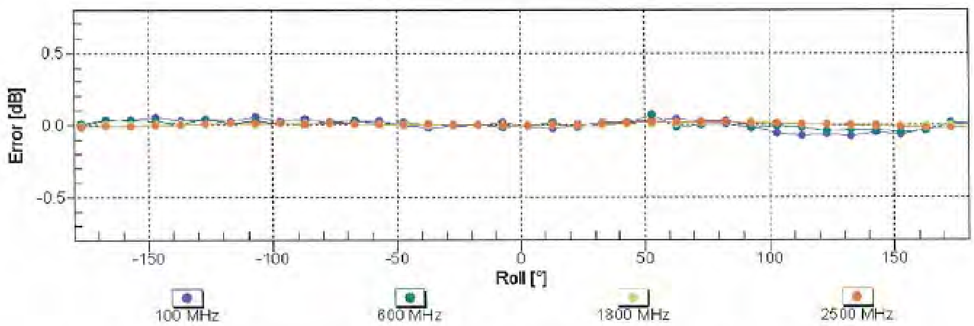
Appendix 3-8: Calibration certificate: E-Field Probe (EX3DV4) (cont'd)

Receiving Pattern (ϕ), ϑ = 0°





Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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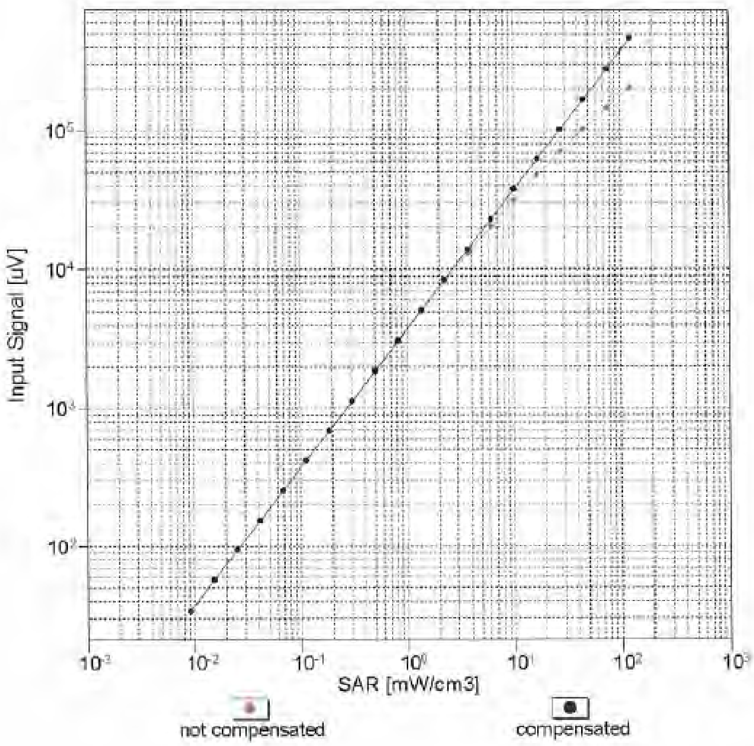
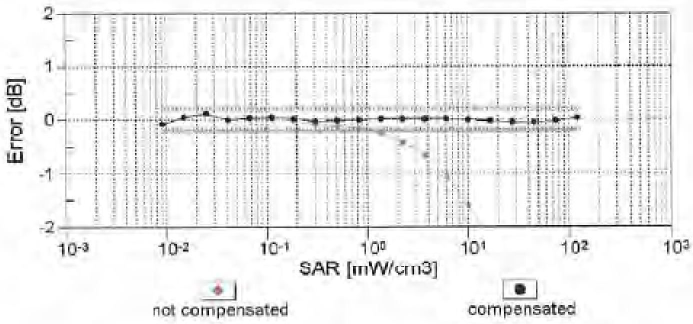
Appendix 3-8: Calibration certificate: E-Field Probe (EX3DV4) (cont'd)

EX3DV4– SN:3679 August 19, 2014

Dynamic Range f(SAR_{head})

(TEM cell , f_{eval}= 1900 MHz)





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

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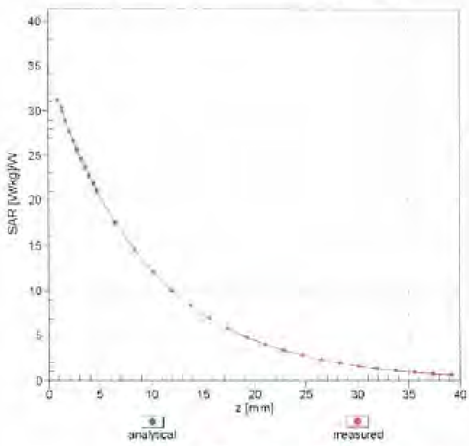
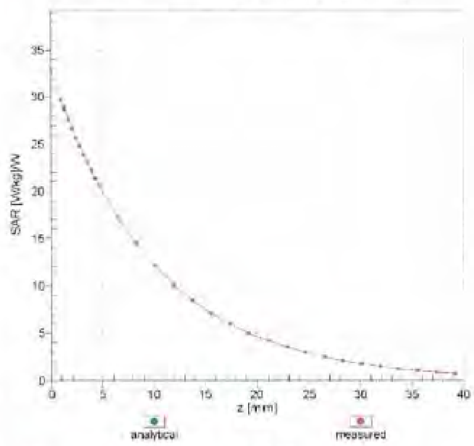
Appendix 3-8: Calibration certificate: E-Field Probe (EX3DV4) (cont'd)

Conversion Factor Assessment

f = 2450 MHz,WGLS R22 (H_convF)

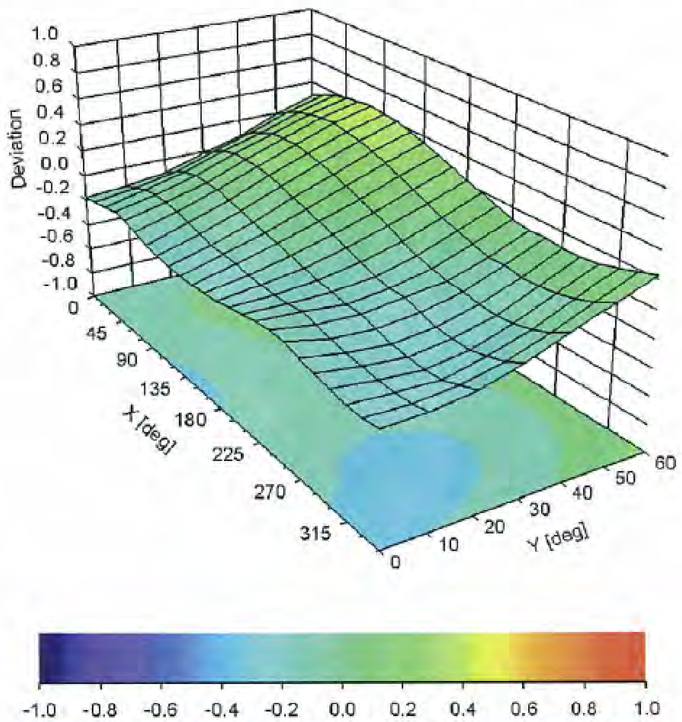


f = 2450 MHz,WGLS R22 (M_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

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Appendix 3-8: Calibration certificate: E-Field Probe (EX3DV4) (cont'd)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3679

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	13
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

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Appendix 3-9: Calibration certificate: Dipole (D2450V2)

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Accreditation No.: **SCS 0108**

Client **UL Japan (Vitec)**

Certificate No: **D2450V2-822_Jan15**

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 822
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	January 15, 2015

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-14 (No. ES3-3205_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

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

Issued: January 16, 2015

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Certificate No: D2450V2-822_Jan15 Page 1 of 8

Appendix 3-9: Calibration certificate: Dipole (D2450V2) (cont'd)

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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:

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, "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
c) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

d) 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%.

Appendix 3-9: Calibration certificate: Dipole (D2450V2) (cont'd)

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	39.3 ± 6 %	1.88 mho/m ± 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	13.4 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**52.5 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.20 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	51.6 ± 6 %	2.03 mho/m ± 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	13.3 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**51.9 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.09 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**24.0 W/kg ± 16.5 % (k=2)**

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Appendix 3-9: Calibration certificate: Dipole (D2450V2) (cont'd)

Appendix (Additional assessments outside the scope of SCS0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	55.1 Ω + 3.9 jΩ
Return Loss	- 24.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.3 Ω + 5.2 jΩ
Return Loss	- 25.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.160 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	December 11, 2008

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Appendix 3-9: Calibration certificate: Dipole (D2450V2) (cont'd)

DASY5 Validation Report for Head TSL

Date: 15.01.201

Test Laboratory: SPEAG, Zurich, Switzerland

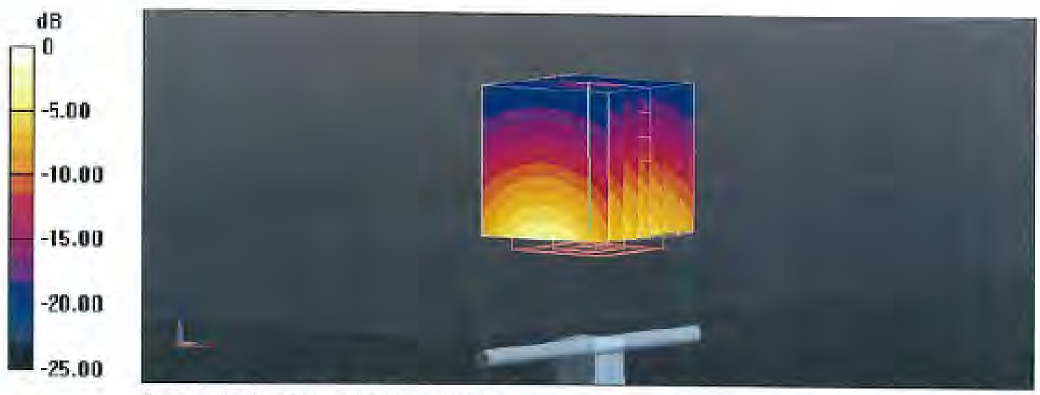
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 822

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.88 S/m; ε_r = 39.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.54, 4.54, 4.54); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 101.0 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 28.1 W/kg
SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.2 W/kg
Maximum value of SAR (measured) = 17.9 W/kg

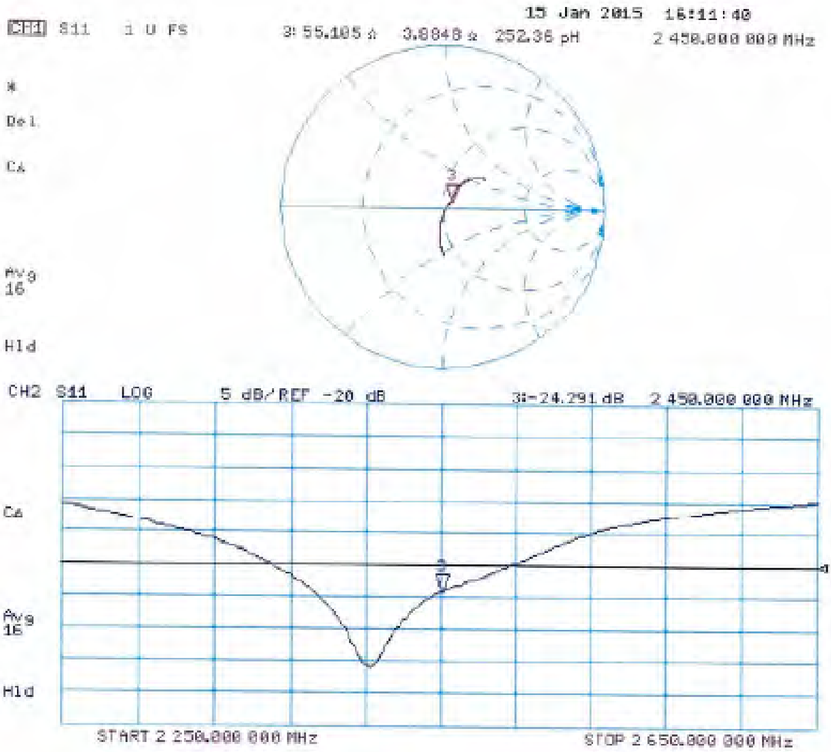


0 dB = 17.9 W/kg = 12.53 dBW/kg

Certificate No: D2450V2-822_Jan15 Page 5 of 8

Appendix 3-9: Calibration certificate: Dipole (D2450V2) (cont'd)

Impedance Measurement Plot for Head TSL



Certificate No: D2450V2-822_Jan15 Page 6 of 8

Appendix 3-9: Calibration certificate: Dipole (D2450V2) (cont'd)

DASY5 Validation Report for Body TSL

Date: 15.01.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 822

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.03 S/m; ε_r = 51.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.32, 4.32, 4.32); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

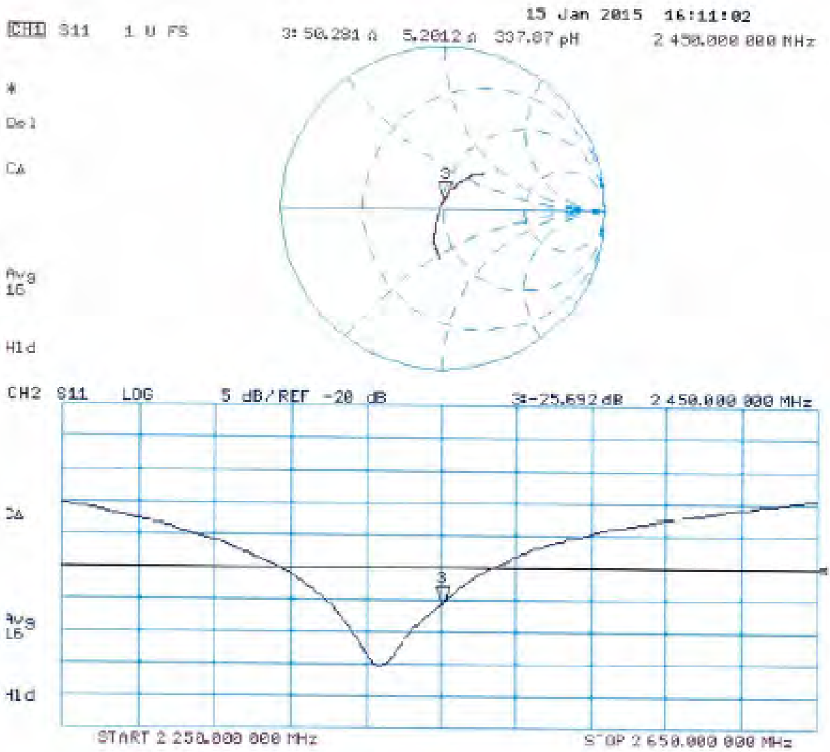
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.74 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 28.1 W/kg
SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.09 W/kg
Maximum value of SAR (measured) = 17.3 W/kg

0 dB = 17.3 W/kg = 12.38 dBW/kg

Certificate No: D2450V2-822_Jan15 Page 7 of 8

Appendix 3-9: Calibration certificate: Dipole (D2450V2) (cont'd)

Impedance Measurement Plot for Body TSL



Certificate No: D2450V2-822_Jan15 Page 8 of 8

Appendix 3-10: Calibration certificate: Dipole (D5GHzV2)

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
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 108**

Client **UL Japan Shanon (PTT)**

Certificate No: **D5GHzV2-1070_Mar14**

CALIBRATION CERTIFICATE

Object: D5GHzV2 - SN: 1070

Calibration procedure(s): QA CAL-22.v2
Calibration procedure for dipole validation kits between 3-6 GHz

Calibration date: March 21, 2014

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	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe EX3DV4	SN: 3503	30-Dec-13 (No. EX3-3503_Dec13)	Dec-14
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: March 21, 2014

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

Appendix 3-10: Calibration certificate: Dipole (D5GHzV2) (cont'd)

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
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 108**

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) IEC 62209-2, "Evaluation of Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices in the Frequency Range of 30 MHz to 6 GHz: Human models, Instrumentation, and Procedures"; Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for including accessories and multiple transmitters", March 2010
b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"
c) 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

Additional Documentation:

d) 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%.

Appendix 3-10: Calibration certificate: Dipole (D5GHzV2) (cont'd)

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with new Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz ± 1 MHz 5300 MHz ± 1 MHz 5500 MHz ± 1 MHz 5600 MHz ± 1 MHz 5800 MHz ± 1 MHz	

Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.7 ± 6 %	4.50 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.75 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**77.7 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.21 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.2 W/kg ± 19.5 % (k=2)**

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Appendix 3-10: Calibration certificate: Dipole (D5GHzV2) (cont'd)

Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.5 ± 6 %	4.61 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5300 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**83.3 W / kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.9 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.2 ± 6 %	4.81 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**83.8 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.8 W/kg ± 19.5 % (k=2)**

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Appendix 3-10: Calibration certificate: Dipole (D5GHzV2) (cont'd)

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.1 ± 6 %	4.92 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.22 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**82.3 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.33 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.4 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.8 ± 6 %	5.13 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.85 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**78.6 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.22 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.3 W/kg ± 19.5 % (k=2)**

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Appendix 3-10: Calibration certificate: Dipole (D5GHzV2) (cont'd)

Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.4 ± 6 %	5.38 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.66 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**76.1 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.13 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.1 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.42 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.2 ± 6 %	5.52 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5300 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.79 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**77.4 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.18 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.6 W/kg ± 19.5 % (k=2)**

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Appendix 3-10: Calibration certificate: Dipole (D5GHzV2) (cont'd)

Body TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.6	5.65 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.9 ± 6 %	5.79 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5500 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.11 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**80.6 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.26 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**22.4 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.7 ± 6 %	5.92 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.19 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**81.4 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.27 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**22.5 W/kg ± 19.5 % (k=2)**

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Appendix 3-10: Calibration certificate: Dipole (D5GHzV2) (cont'd)

Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.4 ± 6 %	6.20 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.64 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**75.9 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.11 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.9 W/kg ± 19.5 % (k=2)**

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Appendix 3-10: Calibration certificate: Dipole (D5GHzV2) (cont'd)

Appendix

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	52.5 Ω - 13.4 jΩ
Return Loss	- 17.6 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	52.6 Ω - 5.8 jΩ
Return Loss	- 24.1 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	50.5 Ω - 7.6 jΩ
Return Loss	- 22.4 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	56.4 Ω - 8.8 jΩ
Return Loss	- 19.8 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	53.5 Ω - 4.9 jΩ
Return Loss	- 24.7 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	51.1 Ω - 11.3 jΩ
Return Loss	- 19.0 dB

Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	51.6 Ω - 4.8 jΩ
Return Loss	- 26.1 dB

Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	49.9 Ω - 5.9 jΩ
Return Loss	- 24.5 dB

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Appendix 3-10: Calibration certificate: Dipole (D5GHzV2) (cont'd)

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	56.0 Ω - 7.3 jΩ
Return Loss	- 21.0 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	54.2 Ω - 1.3 jΩ
Return Loss	- 27.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.202 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	September 26, 2008

UL Japan, Inc.
Shonan EMC Lab.
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Appendix 3-10: Calibration certificate: Dipole (D5GHzV2) (cont'd)

DASY5 Validation Report for Head TSL

Date: 21.03.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1070

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 4.5 S/m; ε_r = 36.7; ρ = 1000 kg/m^3 , Medium parameters used: f = 5300 MHz; σ = 4.61 S/m; ε_r = 36.5; ρ = 1000 kg/m^3 , Medium parameters used: f = 5500 MHz; σ = 4.81 S/m; ε_r = 36.2; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 4.92 S/m; ε_r = 36.1; ρ = 1000 kg/m^3 , Medium parameters used: f = 5800 MHz; σ = 5.13 S/m; ε_r = 35.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.52, 5.52, 5.52); Calibrated: 30.12.2013, ConvF(5.2, 5.2, 5.2); Calibrated: 30.12.2013, ConvF(5.01, 5.01, 5.01); Calibrated: 30.12.2013, ConvF(4.86, 4.86, 4.86); Calibrated: 30.12.2013, ConvF(4.91, 4.91, 4.91); Calibrated: 30.12.2013;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 63.437 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 28.7 W/kg
SAR(1 g) = 7.75 W/kg; SAR(10 g) = 2.21 W/kg
Maximum value of SAR (measured) = 18.1 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 64.614 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 31.6 W/kg
SAR(1 g) = 8.31 W/kg; SAR(10 g) = 2.38 W/kg
Maximum value of SAR (measured) = 19.6 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 63.946 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 33.6 W/kg
SAR(1 g) = 8.37 W/kg; SAR(10 g) = 2.37 W/kg
Maximum value of SAR (measured) = 20.3 W/kg

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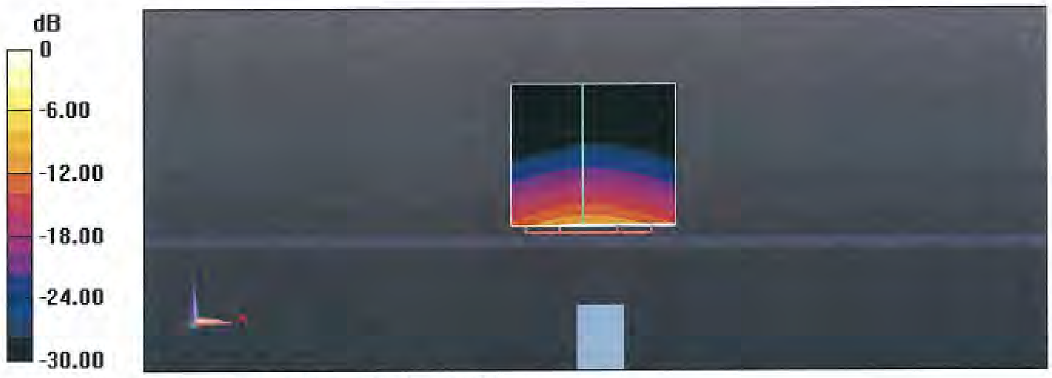
Appendix 3-10: Calibration certificate: Dipole (D5GHzV2) (cont'd)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 63.052 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 33.2 W/kg
SAR(1 g) = 8.22 W/kg; SAR(10 g) = 2.33 W/kg
Maximum value of SAR (measured) = 19.9 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 60.513 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 33.2 W/kg
SAR(1 g) = 7.85 W/kg; SAR(10 g) = 2.22 W/kg
Maximum value of SAR (measured) = 19.3 W/kg



0 dB = 19.3 W/kg = 12.86 dBW/kg

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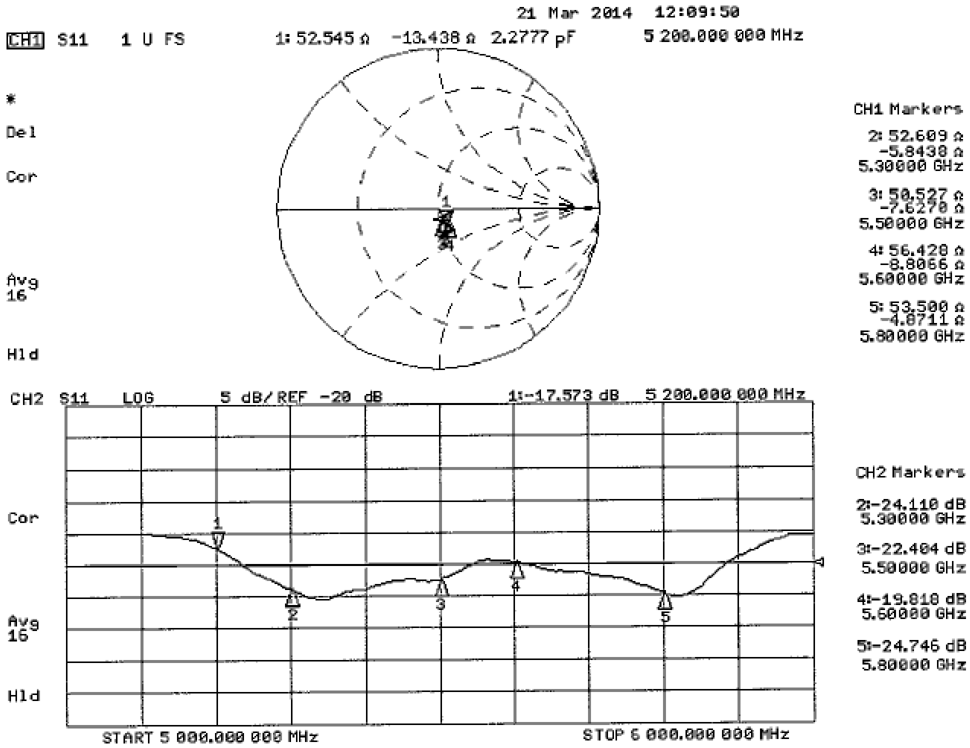
Appendix 3-10: Calibration certificate: Dipole (D5GHzV2) (cont'd)

Impedance Measurement Plot for Head TSL



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Appendix 3-10: Calibration certificate: Dipole (D5GHzV2) (cont'd)

DASY5 Validation Report for Body TSL

Date: 20.03.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1070

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 5.38 S/m; ε_r = 47.4; ρ = 1000 kg/m^3 , Medium parameters used: f = 5300 MHz; σ = 5.52 S/m; ε_r = 47.2; ρ = 1000 kg/m^3 , Medium parameters used: f = 5500 MHz; σ = 5.79 S/m; ε_r = 46.9; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 5.92 S/m; ε_r = 46.7; ρ = 1000 kg/m^3 , Medium parameters used: f = 5800 MHz; σ = 6.2 S/m; ε_r = 46.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.01, 5.01, 5.01); Calibrated: 30.12.2013, ConvF(4.76, 4.76, 4.76); Calibrated: 30.12.2013, ConvF(4.52, 4.52, 4.52); Calibrated: 30.12.2013, ConvF(4.3, 4.3, 4.3); Calibrated: 30.12.2013, ConvF(4.47, 4.47, 4.47); Calibrated: 30.12.2013;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 60.027 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 30.6 W/kg
SAR(1 g) = 7.66 W/kg; SAR(10 g) = 2.13 W/kg
Maximum value of SAR (measured) = 17.6 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 59.760 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 31.5 W/kg
SAR(1 g) = 7.79 W/kg; SAR(10 g) = 2.18 W/kg
Maximum value of SAR (measured) = 17.9 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 59.748 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 34.7 W/kg
SAR(1 g) = 8.11 W/kg; SAR(10 g) = 2.26 W/kg
Maximum value of SAR (measured) = 19.2 W/kg

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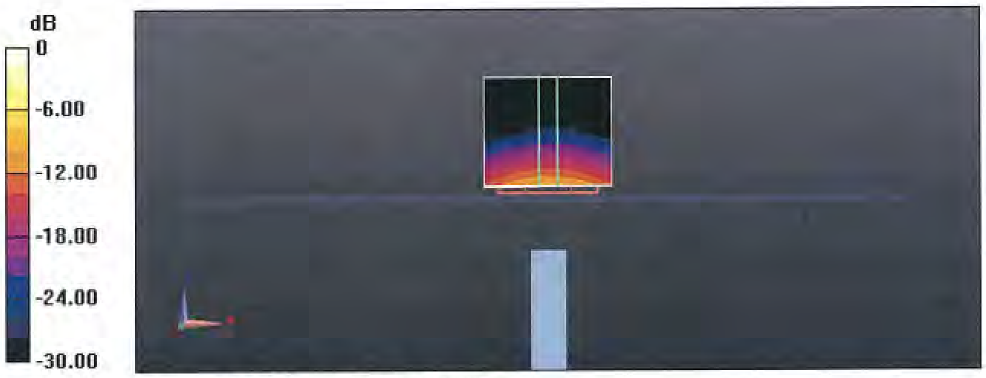
Appendix 3-10: Calibration certificate: Dipole (D5GHzV2) (cont'd)

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 59.269 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 36.4 W/kg
SAR(1 g) = 8.19 W/kg; SAR(10 g) = 2.27 W/kg
Maximum value of SAR (measured) = 19.5 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 56.117 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 35.8 W/kg
SAR(1 g) = 7.64 W/kg; SAR(10 g) = 2.11 W/kg
Maximum value of SAR (measured) = 18.6 W/kg



0 dB = 18.6 W/kg = 12.70 dBW/kg

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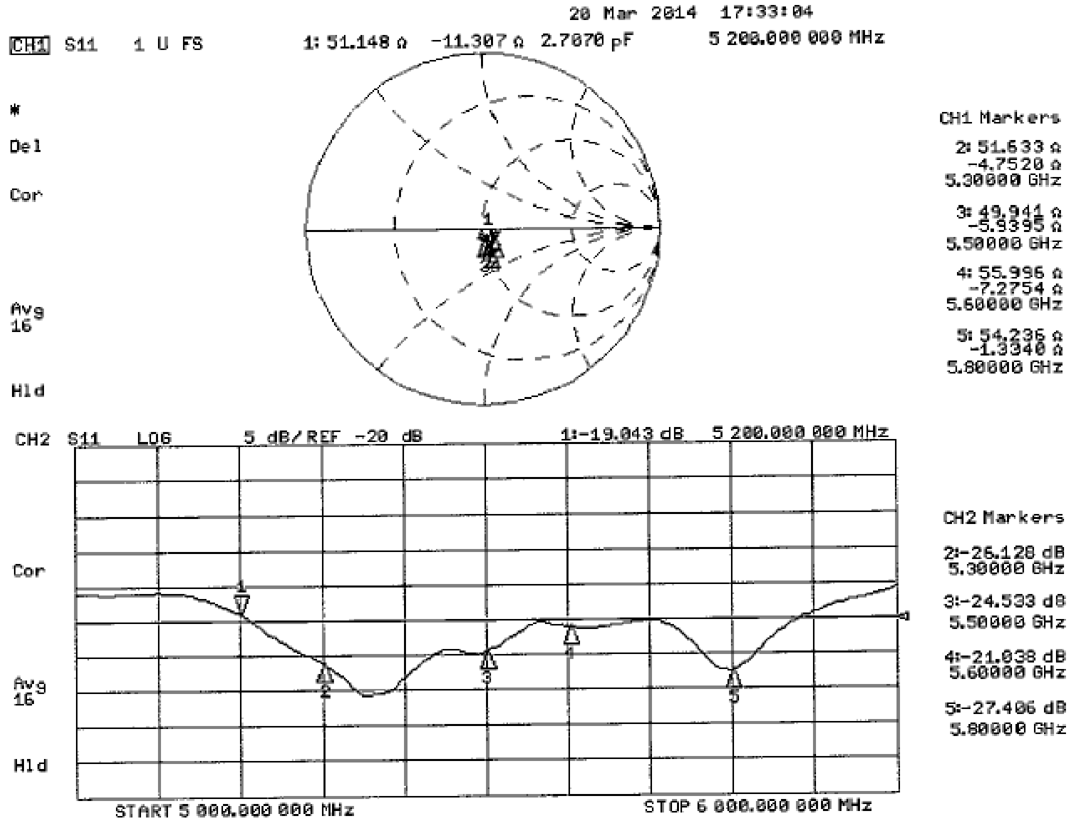
Appendix 3-10: Calibration certificate: Dipole (D5GHzV2) (cont'd)

Impedance Measurement Plot for Body TSL



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Appendix 3-10: Calibration certificate: Dipole (D5GHzV2) (cont'd)

Appendix B: Additional Measurements

Upon customer request, additional return loss measurements were done for Head and Body. Results are summarized on the following pages.

Antenna Parameters with Head TSL at 5200 MHz

New spacer	52.5 Ω - 13.4 jΩ	- 17.6 dB
UL spacer #1	52.6 Ω - 13.5 jΩ	- 17.6 dB
UL spacer #2	52.3 Ω - 13.3 jΩ	- 17.6 dB

Antenna Parameters with Head TSL at 5300 MHz

New spacer	52.6 Ω - 5.8 jΩ	- 24.1 dB
UL spacer #1	52.4 Ω - 5.6 jΩ	- 24.5 dB
UL spacer #2	52.9 Ω - 5.1 jΩ	- 24.9 dB

Antenna Parameters with Head TSL at 5500 MHz

New spacer	50.5 Ω - 7.6 jΩ	- 22.4 dB
UL spacer #1	50.7 Ω - 7.4 jΩ	- 22.6 dB
UL spacer #2	50.6 Ω - 7.0 jΩ	- 23.2 dB

Antenna Parameters with Head TSL at 5600 MHz

New spacer	56.4 Ω - 8.8 jΩ	- 19.8 dB
UL spacer #1	56.5 Ω - 8.5 jΩ	- 19.7 dB
UL spacer #2	56.9 Ω - 8.3 jΩ	- 19.9 dB

Antenna Parameters with Head TSL at 5800 MHz

New spacer	53.5 Ω - 4.9 jΩ	- 24.7 dB
UL spacer #1	53.5 Ω - 4.0 jΩ	- 25.7 dB
UL spacer #2	54.0 Ω - 4.0 jΩ	- 25.3 dB

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Appendix 3-10: Calibration certificate: Dipole (D5GHzV2) (cont'd)

Antenna Parameters with Body TSL at 5200 MHz

New spacer	51.1 Ω - 11.3 jΩ	- 19.0 dB
UL spacer #1	51.2 Ω - 11.4 jΩ	- 19.0 dB
UL spacer #2	51.6 Ω - 11.1 jΩ	- 19.2 dB

Antenna Parameters with Body TSL at 5300 MHz

New spacer	51.6 Ω - 4.8 jΩ	- 26.1 dB
UL spacer #1	51.7 Ω - 5.1 jΩ	- 25.6 dB
UL spacer #2	51.7 Ω - 4.6 jΩ	- 26.4 dB

Antenna Parameters with Body TSL at 5500 MHz

New spacer	49.9 Ω - 5.9 jΩ	- 24.5 dB
UL spacer #1	49.9 Ω - 5.9 jΩ	- 24.5 dB
UL spacer #2	50.1 Ω - 5.6 jΩ	- 25.0 dB

Antenna Parameters with Body TSL at 5600 MHz

New spacer	56.0 Ω - 7.3 jΩ	- 21.0 dB
UL spacer #1	56.0 Ω - 7.6 jΩ	- 20.8 dB
UL spacer #2	56.2 Ω - 6.9 jΩ	- 21.2 dB

Antenna Parameters with Body TSL at 5800 MHz

New spacer	54.2 Ω - 1.3 jΩ	- 27.4 dB
UL spacer #1	54.3 Ω - 1.4 jΩ	- 27.2 dB
UL spacer #2	54.3 Ω - 0.9 jΩ	- 27.4 dB

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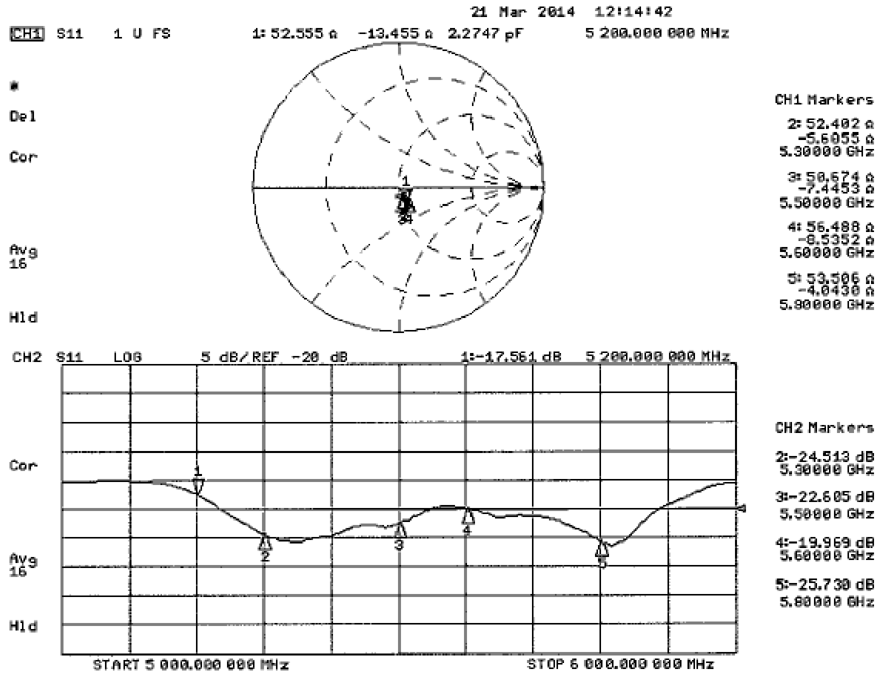
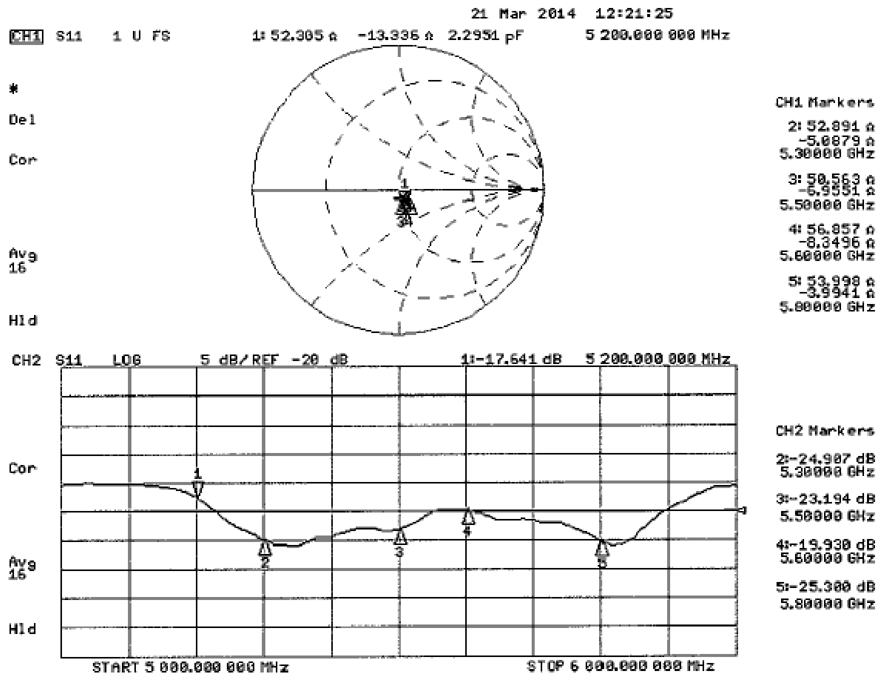
Appendix 3-10: Calibration certificate: Dipole (D5GHzV2) (cont'd)

Impedance Measurement Plot for Head TSL (UL Spacer #1)



Impedance Measurement Plot for Head TSL (UL Spacer #2)



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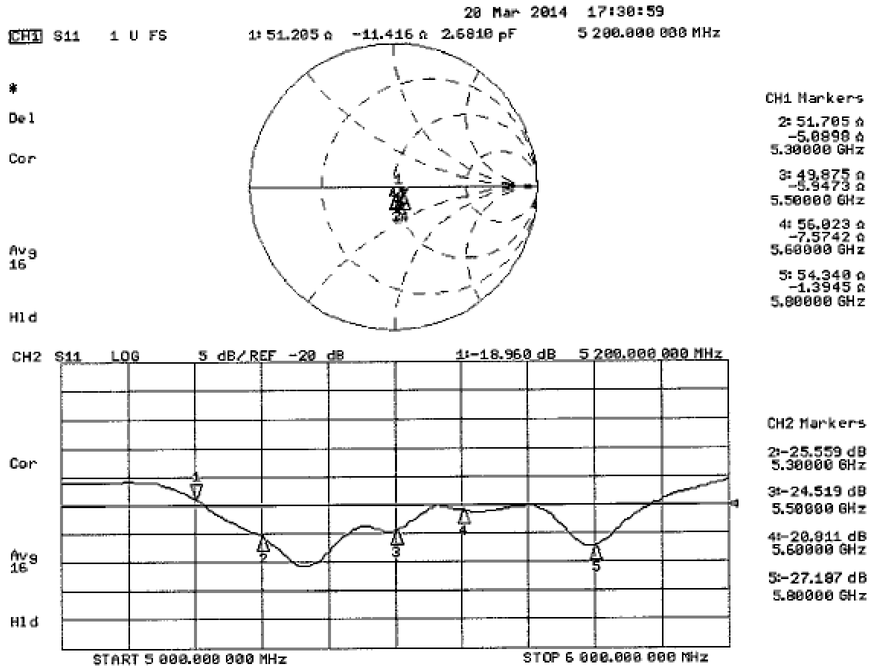
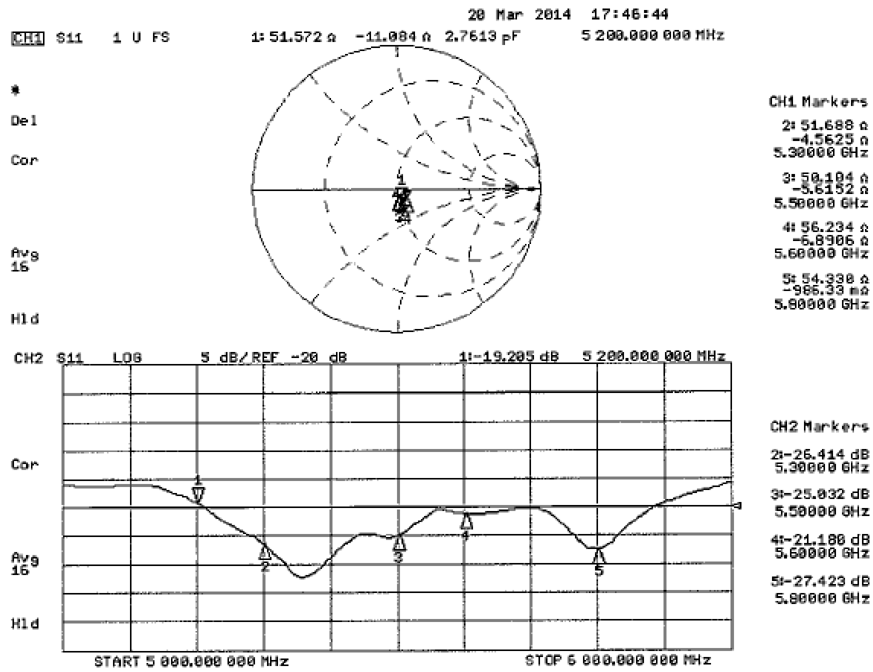
Appendix 3-10: Calibration certificate: Dipole (D5GHzV2) (cont'd)

Impedance Measurement Plot for Body TSL (UL Spacer #1)



Impedance Measurement Plot for Body TSL (UL Spacer #2)



Certificate No: D5GHzV2-1070_Mar14 Page 20 of 20