

APPENDIX A: SYSTEM CHECK SCANS

Plot #1

Date/Time: 2014-05-16 08:35:55

Test Laboratory: TCC Microsoft

Type: D835V2; Serial: D835V2 - SN:480

Communication System: CW835

Frequency: 835 MHz; Duty Cycle: 1:1

Medium: HSL835; Medium Notes: t= 22.0 C

Medium parameters used: f = 835 MHz; $\sigma = 0.908$ S/m; $\epsilon_r = 40.054$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY Configuration:

- Probe: ES3DV3 - SN3194
- ConvF(6.12, 6.12, 6.12); Calibrated: 2013-11-14;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn538; Calibrated: 2013-11-19
- Phantom: SAM 1; Type: Twin SAM 040 CA; Serial: TP-1179
- Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.10 (7331)

d=15mm, Pin=250mW/Area Scan (61x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 54.26 V/m

Fast SAR: SAR(1 g) = 2.42 W/kg

Fast SAR(10 g) = 1.63 W/kg

Maximum value of SAR (interpolated) = 2.78 W/kg

d=15mm, Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 54.26 V/m

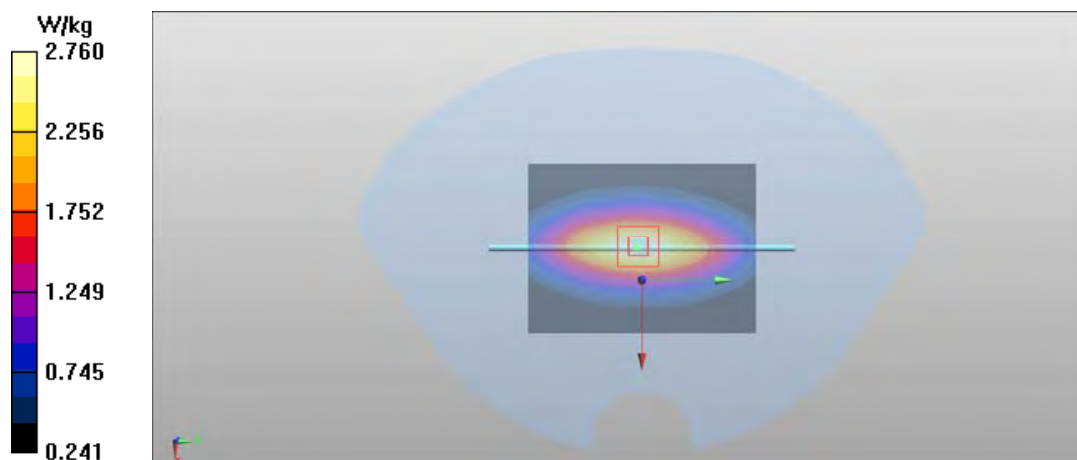
Peak SAR (extrapolated) = 3.50 W/kg

SAR(1 g) = 2.36 W/kg

SAR(10 g) = 1.54 W/kg

Power Drift = -0.08 dB

Maximum value of SAR (measured) = 2.76 W/kg



Plot #2

Date/Time: 2014-05-15 07:39:18

Test Laboratory: TCC Microsoft
Type: D1900V2; Serial: D1900V2 - SN:5d013

Communication System: CW1900

Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: HSL1900; Medium Notes: t= 21.4 C

Medium parameters used: f = 1900 MHz; $\sigma = 1.397$ S/m; $\epsilon_r = 38.663$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY Configuration:

- Probe: ES3DV3 - SN3131
- ConvF(4.98, 4.98, 4.98); Calibrated: 2013-06-18;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn793; Calibrated: 2013-06-10
- Phantom: SAM 1; Type: Twin SAM 040 CA; Serial: TP-1449
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.10 (7331)

d=10mm, Pin=250mW/Area Scan (61x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 93.29 V/m

Fast SAR: SAR(1 g) = 10.6 W/kg

Fast SAR(10 g) = 5.45 W/kg

Maximum value of SAR (interpolated) = 13.5 W/kg

d=10mm, Pin=250mW/Zoom Scan (5x6x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 93.29 V/m

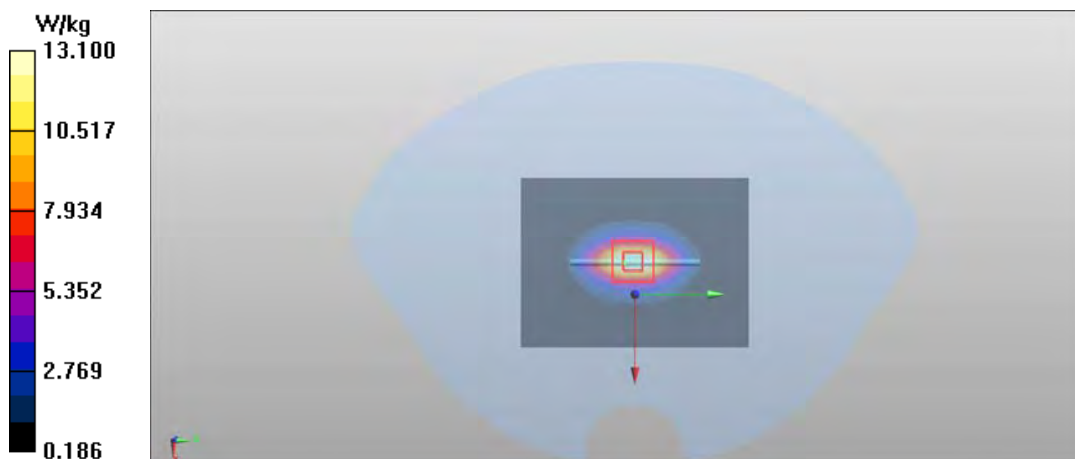
Peak SAR (extrapolated) = 18.7 W/kg

SAR(1 g) = 10.4 W/kg

SAR(10 g) = 5.43 W/kg

Power Drift = -0.01 dB

Maximum value of SAR (measured) = 13.1 W/kg



Plot #3

Date/Time: 2014-06-10 08:55:15

Test Laboratory: TCC Microsoft

Type: D2450V2; Serial: D2450V2 - SN:749

Communication System: CW2450

Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: HSL 2450; Medium Notes: t= 21.1 C

Medium parameters used: f = 2450 MHz; $\sigma = 1.837$ S/m; $\epsilon_r = 38.917$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN3960
- ConvF(7.39, 7.39, 7.39); Calibrated: 2013-12-10;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1302; Calibrated: 2013-11-08
- Phantom: #4 SAM, SAR4 ; Type: QD000P40CD;
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.10 (7331)

d=10mm, Pin=250mW/Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Reference Value = 91.08 V/m

Fast SAR: SAR(1 g) = 13.7 W/kg

Fast SAR(10 g) = 6.09 W/kg

Maximum value of SAR (interpolated) = 18.4 W/kg

d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 91.08 V/m

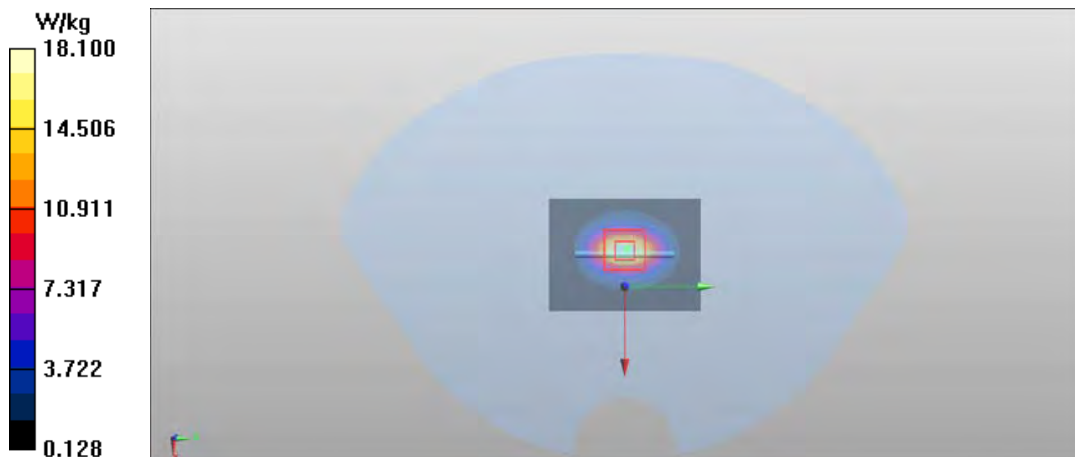
Peak SAR (extrapolated) = 28.6 W/kg

SAR(1 g) = 13.7 W/kg

SAR(10 g) = 6.36 W/kg

Power Drift = 0.00 dB

Maximum value of SAR (measured) = 18.1 W/kg



Plot #4

Date/Time: 2014-05-22 08:26:04

Test Laboratory: TCC Microsoft
Type: D835V2; Serial: D835V2 - SN:480

Communication System: CW835

Frequency: 835 MHz; Duty Cycle: 1:1

Medium: BSL850; Medium Notes: t= 21.6 C

Medium parameters used: f = 835 MHz; σ = 0.973 S/m; ϵ_r = 54.156; ρ = 1000 kg/m³

Phantom section: Center Section

DASY Configuration:

- Probe: ES3DV3 - SN3194
- ConvF(6.05, 6.05, 6.05); Calibrated: 2013-11-14;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn538; Calibrated: 2013-11-19
- Phantom: SAM 3 Triple Phantom 5.1C; Type: QD 000 P51 CA;
- Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.10 (7331)

d=15mm, Pin=250mW/Area Scan (81x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 51.24 V/m

Fast SAR: SAR(1 g) = 2.31 W/kg

Fast SAR(10 g) = 1.55 W/kg

Maximum value of SAR (interpolated) = 2.65 W/kg

d=15mm, Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 51.24 V/m

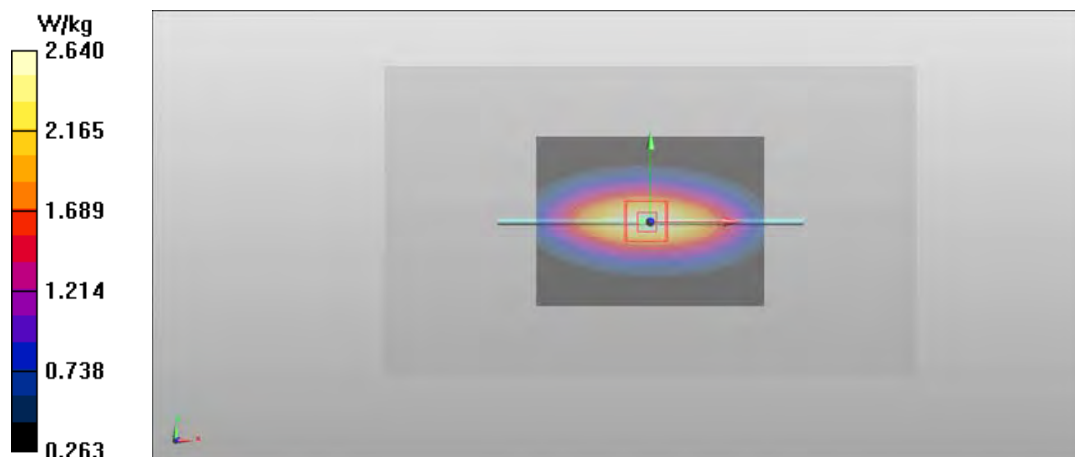
Peak SAR (extrapolated) = 3.29 W/kg

SAR(1 g) = 2.28 W/kg

SAR(10 g) = 1.51 W/kg

Power Drift = -0.01 dB

Maximum value of SAR (measured) = 2.64 W/kg



Plot #5

Date/Time: 2014-05-20 07:51:09

Test Laboratory: TCC Microsoft
Type: D1900V2; Serial: D1900V2 - SN:5d013

Communication System: CW1900

Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: BSL1900; Medium Notes: t= 21.0 C

Medium parameters used: f = 1900 MHz; $\sigma = 1.527$ S/m; $\epsilon_r = 52.159$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY Configuration:

- Probe: ES3DV3 - SN3131
- ConvF(4.62, 4.62, 4.62); Calibrated: 2013-06-18;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn793; Calibrated: 2013-06-10
- Phantom: SAM 3 Triple Phantom 5.1C; Type: QD 000 P51 CA;
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.10 (7331)

d=10mm, Pin=250mW/Area Scan (81x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 85.41 V/m

Fast SAR: SAR(1 g) = 9.44 W/kg

Fast SAR(10 g) = 4.72 W/kg

Maximum value of SAR (interpolated) = 12.3 W/kg

d=10mm, Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 85.41 V/m

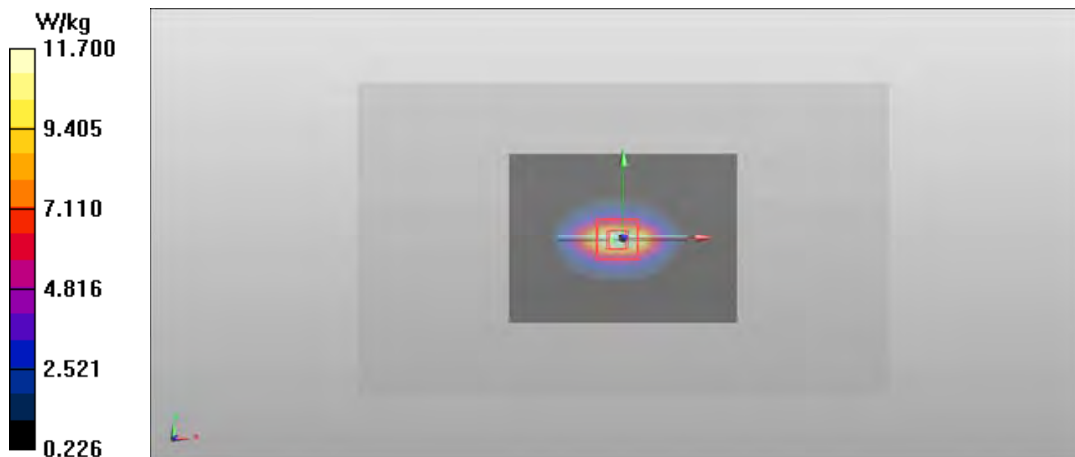
Peak SAR (extrapolated) = 16.2 W/kg

SAR(1 g) = 9.46 W/kg

SAR(10 g) = 4.99 W/kg

Power Drift = 0.04 dB

Maximum value of SAR (measured) = 11.7 W/kg



Plot #6

Date/Time: 2014-05-21 08:25:49

Test Laboratory: TCC Microsoft

Type: D2450V2; Serial: D2450V2 - SN:749

Communication System: CW2450

Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: BSL2450; Medium Notes: t= 21.1 C

Medium parameters used: f = 2450 MHz; σ = 1.927 S/m; ϵ_r = 52.103; ρ = 1000 kg/m³

Phantom section: Center Section

DASY Configuration:

- Probe: EX3DV4 - SN3960
- ConvF(7.44, 7.44, 7.44); Calibrated: 2013-12-10;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1302; Calibrated: 2013-11-08
- Phantom: #2 Triple, SAR4; Type: QD 000 P51 CA;
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.10 (7331)

d=10mm, Pin=250mW/Area Scan (81x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Reference Value = 86.14 V/m

Fast SAR: SAR(1 g) = 12.3 W/kg

Fast SAR(10 g) = 5.35 W/kg

Maximum value of SAR (interpolated) = 16.5 W/kg

d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 86.14 V/m

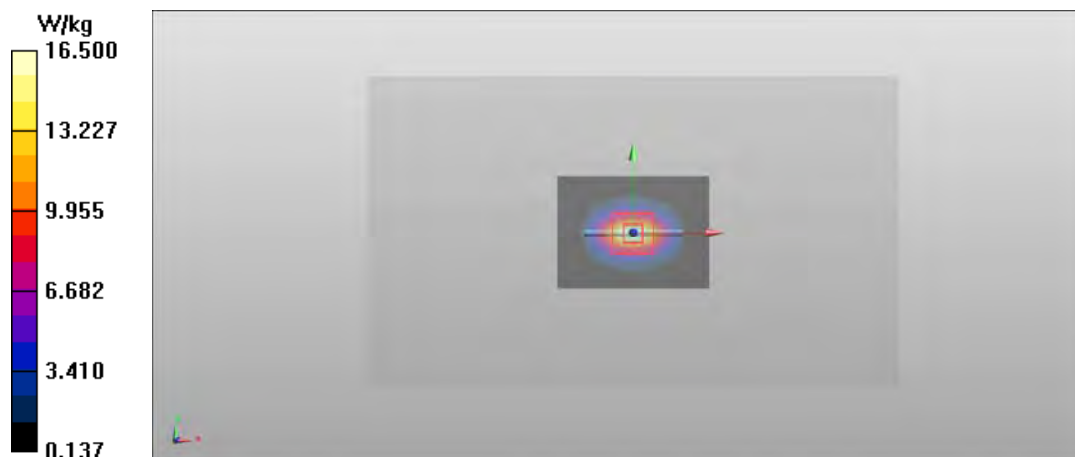
Peak SAR (extrapolated) = 25.4 W/kg

SAR(1 g) = 12.5 W/kg

SAR(10 g) = 5.83 W/kg

Power Drift = -0.00 dB

Maximum value of SAR (measured) = 16.5 W/kg



APPENDIX B: HEAD, BODY AND WIRELESS ROUTER MEASUREMENT SCANS

Plot #1

Date/Time: 2014-05-16 12:45:43

Test Laboratory: TCC Microsoft

Type: RM-1020; Serial: 004402/47/832326/8, 004402/47/832327/6

Communication System: 4-slot GPRS850

Frequency: 848.8 MHz; Duty Cycle: 1:2.09991

Medium: HSL850; Medium Notes: t= 22.0 C

Medium parameters used: f = 849 MHz; σ = 0.917 S/m; ϵ_r = 39.966; ρ = 1000 kg/m³

Phantom section: Right Section

DASY Configuration:

- Probe: ES3DV3 - SN3194
- ConvF(6.12, 6.12, 6.12); Calibrated: 2013-11-14;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn538; Calibrated: 2013-11-19
- Phantom: SAM 1; Type: Twin SAM 040 CA; Serial: TP-1449
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.10 (7331)

4-slot GPRS850 - Right/Cheek - High/Area Scan (81x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 30.14 V/m

Fast SAR: SAR(1 g) = 0.715 W/kg

Fast SAR(10 g) = 0.498 W/kg

Maximum value of SAR (interpolated) = 0.808 W/kg

4-slot GPRS850 - Right/Cheek - High/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 30.47 V/m

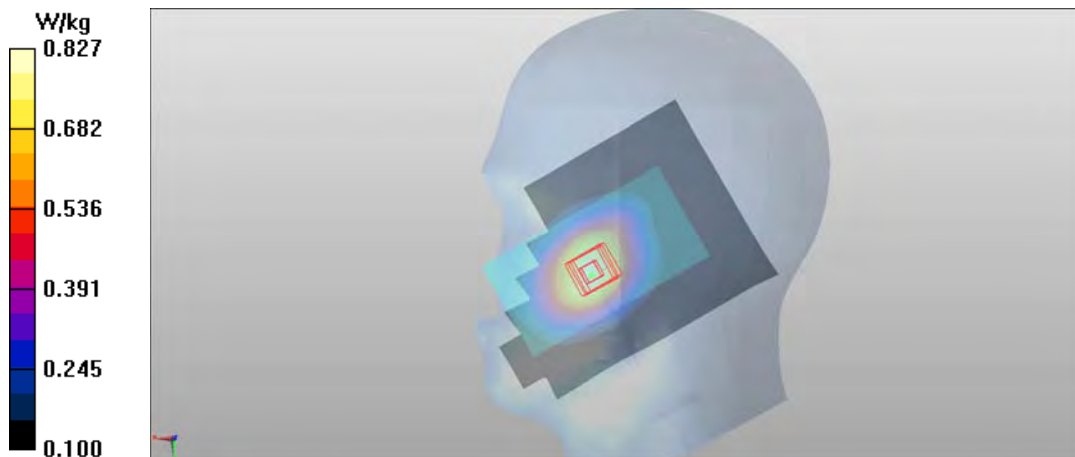
Peak SAR (extrapolated) = 0.937 W/kg

SAR(1 g) = 0.748 W/kg

SAR(10 g) = 0.558 W/kg

Power Drift = 0.02 dB

Maximum value of SAR (measured) = 0.827 W/kg



SAR Report

Appendix B for FCC_RM-1020_01

Applicant: Microsoft Mobile

Type: RM-1020

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Plot #2

Date/Time: 2014-05-16 09:54:01

Test Laboratory: TCC Microsoft

Type: RM-1020; Serial: 004402/47/832326/8, 004402/47/832327/6

Communication System: WCDMA850 (Band 5)

Frequency: 846.6 MHz; Duty Cycle: 1:1

Medium: HSL835; Medium Notes: t= 22.0 C

Medium parameters used: f = 847 MHz; $\sigma = 0.916$ S/m; $\epsilon_r = 39.978$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY Configuration:

- Probe: ES3DV3 - SN3194
- ConvF(6.12, 6.12, 6.12); Calibrated: 2013-11-14;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn538; Calibrated: 2013-11-19
- Phantom: SAM 1; Type: Twin SAM 040 CA; Serial: TP-1179
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7331)

WCDMA850 (Band 5) - Right/Cheek - High/Area Scan (81x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 24.91 V/m

Fast SAR: SAR(1 g) = 0.619 W/kg

Fast SAR(10 g) = 0.430 W/kg

Maximum value of SAR (interpolated) = 0.704 W/kg

WCDMA850 (Band 5) - Right/Cheek - High/Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 24.99 V/m

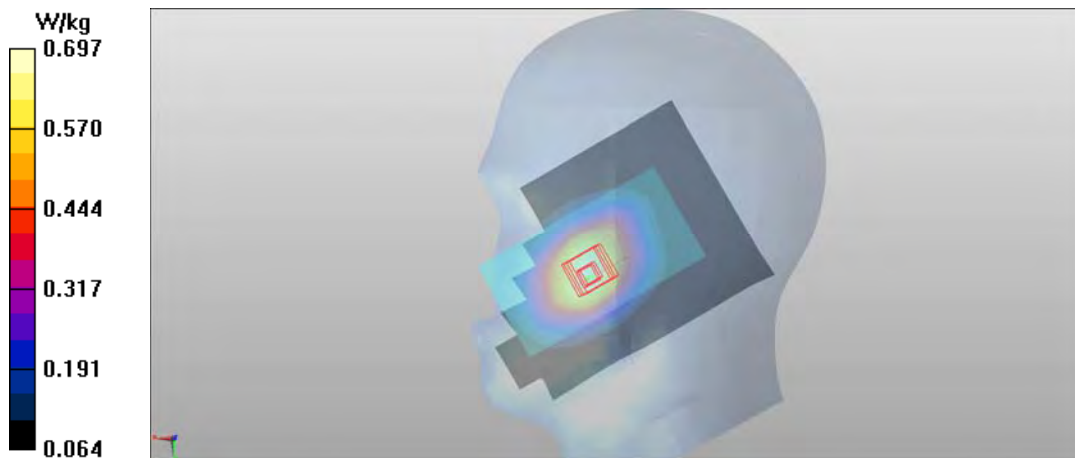
Peak SAR (extrapolated) = 0.804 W/kg

SAR(1 g) = 0.635 W/kg

SAR(10 g) = 0.469 W/kg

Power Drift = -0.05 dB

Maximum value of SAR (measured) = 0.697 W/kg



SAR Report

Appendix B for FCC_RM-1020_01

Applicant: Microsoft Mobile

Type: RM-1020

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Plot #3

Date/Time: 2014-05-15 10:52:53

Test Laboratory: TCC Microsoft

Type: RM-1020 Serial: 004402/47/832288/0; 004402/47/832289/8

Communication System: 3-slot GPRS1900

Frequency: 1850.2 MHz; Duty Cycle: 1:2.80027

Medium: HSL1900; Medium Notes: t= 21.4 C

Medium parameters used (interpolated): f = 1850.2 MHz; $\sigma = 1.351$ S/m; $\epsilon_r = 38.849$; $\rho = 1000$ kg/m³

Phantom section: Left Section

DASY Configuration:

- Probe: ES3DV3 - SN3131
- ConvF(4.98, 4.98, 4.98); Calibrated: 2013-06-18;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn793; Calibrated: 2013-06-10
- Phantom: SAM 1; Type: Twin SAM 040 CA; Serial: TP-1449
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.10 (7331)

3-slot GPRS1900 - Left/Cheek - Low/Area Scan (81x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 21.36 V/m

Fast SAR: SAR(1 g) = 0.487 W/kg

Fast SAR(10 g) = 0.292 W/kg

Maximum value of SAR (interpolated) = 0.588 W/kg

3-slot GPRS1900 - Left/Cheek - Low/Zoom Scan (6x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 21.23 V/m

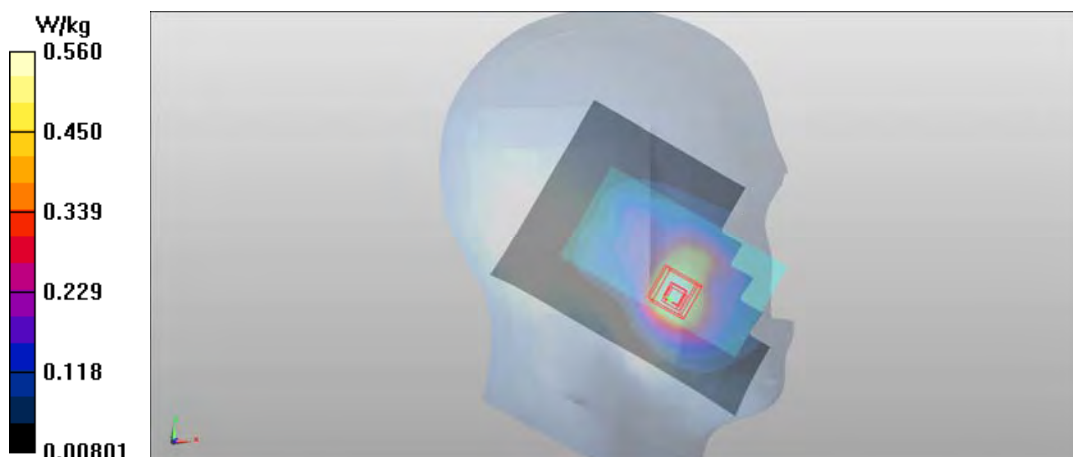
Peak SAR (extrapolated) = 0.765 W/kg

SAR(1 g) = 0.521 W/kg

SAR(10 g) = 0.331 W/kg

Power Drift = -0.06 dB

Maximum value of SAR (measured) = 0.560 W/kg



Plot #4

Date/Time: 2014-05-15 13:00:03

Test Laboratory: TCC Microsoft

Type: RM-1020; Serial 004402/47/832288/0; 004402/47/832289/8

Communication System: WCDMA1900 (Band 2)

Frequency: 1907.6 MHz; Duty Cycle: 1:1

Medium: HSL1900; Medium Notes: $t = 21.4$ C

Medium parameters used: $f = 1908$ MHz; $\sigma = 1.405$ S/m; $\epsilon_r = 38.63$; $\rho = 1000$ kg/m³

Phantom section: Left Section

DASY Configuration:

- Probe: ES3DV3 - SN3131
- ConvF(4.98, 4.98, 4.98); Calibrated: 2013-06-18;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn793; Calibrated: 2013-06-10
- Phantom: SAM 1; Type: Twin SAM 040 CA; Serial: TP-1449
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.10 (7331)

WCDMA1900 (Band 2) - Left/Cheek - High/Area Scan (81x121x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Reference Value = 22.85 V/m

Fast SAR: SAR(1 g) = 0.565 W/kg

Fast SAR(10 g) = 0.338 W/kg

Maximum value of SAR (interpolated) = 0.687 W/kg

WCDMA1900 (Band 2) - Left/Cheek - High/Zoom Scan (6x5x7)/Cube 0: Measurement grid: $dx=7.5$ mm, $dy=7.5$ mm, $dz=5$ mm

Reference Value = 22.81 V/m

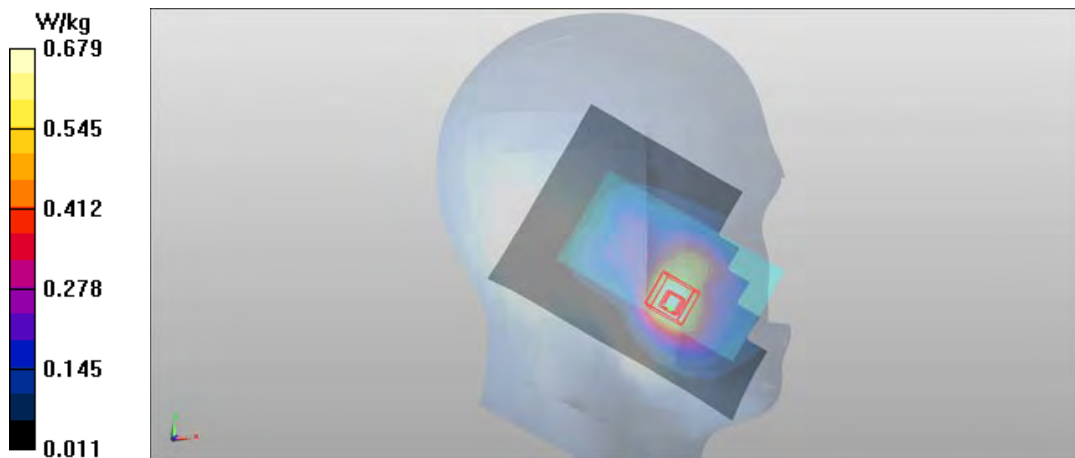
Peak SAR (extrapolated) = 0.934 W/kg

SAR(1 g) = 0.629 W/kg

SAR(10 g) = 0.397 W/kg

Power Drift = -0.00 dB

Maximum value of SAR (measured) = 0.679 W/kg



SAR Report

Appendix B for FCC_RM-1020_01

Applicant: Microsoft Mobile

Type: RM-1020

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Plot #5

Date/Time: 2014-05-15 12:20:46

Test Laboratory: TCC Microsoft

Type: RM-1020; Serial: 004402/47/832332/6, 004402/47/832333/4

Communication System: WLAN2450

Frequency: 2412 MHz; Duty Cycle: 1:1

Medium: HSL2450; Medium Notes: t= 21.1 C

Medium parameters used: f = 2412 MHz; $\sigma = 1.768$ S/m; $\epsilon_r = 38.967$; $\rho = 1000$ kg/m³

Phantom section: Left Section

DASY Configuration:

- Probe: EX3DV4 - SN3960
- ConvF(7.39, 7.39, 7.39); Calibrated: 2013-12-10;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1302; Calibrated: 2013-11-08
- Phantom: #4 SAM, SAR4 ; Type: QD000P40CD;
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.10 (7331)

WLAN2450 b-mode - Left/Cheek - Channel 1 - BPSK 1 Mbps/Area Scan (121x181x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Reference Value = 12.64 V/m

Fast SAR: SAR(1 g) = 0.217 W/kg

Fast SAR(10 g) = 0.103 W/kg

Maximum value of SAR (interpolated) = 0.302 W/kg

WLAN2450 b-mode - Left/Cheek - Channel 1 - BPSK 1 Mbps/Zoom Scan (7x7x7)/Cube 0: Measurement grid:

dx=5mm, dy=5mm, dz=5mm

Reference Value = 12.63 V/m

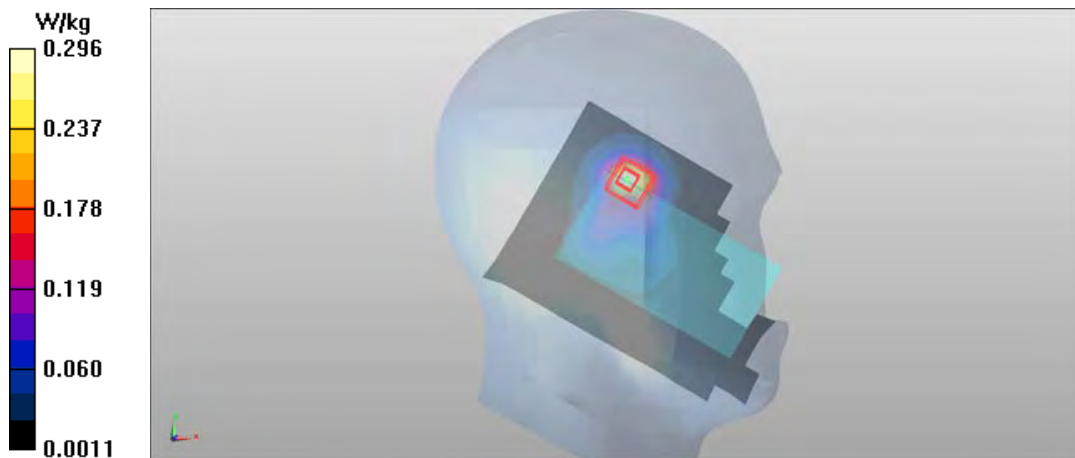
Peak SAR (extrapolated) = 0.467 W/kg

SAR(1 g) = 0.226 W/kg

SAR(10 g) = 0.108 W/kg

Power Drift = 0.05 dB

Maximum value of SAR (measured) = 0.296 W/kg



SAR Report

Appendix B for FCC_RM-1020_01

Applicant: Microsoft Mobile

Type: RM-1020

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Plot #6

Date/Time: 2014-05-22 12:52:02

Test Laboratory: TCC Microsoft

Type: RM-1020; Serial: 004402/47/832326/8, 004402/47/832327/6

Communication System: 4-slot GPRS850

Frequency: 848.8 MHz; Duty Cycle: 1:2.09991

Medium: BSL850; Medium Notes: t= 21.6 C

Medium parameters used: f = 849 MHz; $\sigma = 0.981$ S/m; $\epsilon_r = 54.099$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY Configuration:

- Probe: ES3DV3 - SN3194
- ConvF(6.05, 6.05, 6.05); Calibrated: 2013-11-14;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn538; Calibrated: 2013-11-19
- Phantom: SAM 3 Triple Phantom 5.1C; Type: QD 000 P51 CA;
- Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.10 (7331)

4-slot GPRS850/Body - High - Spacer 15mm - No Headset - Back Facing Phantom - Repeated/Area Scan

(81x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 31.51 V/m

Fast SAR: SAR(1 g) = 0.808 W/kg

Fast SAR(10 g) = 0.571 W/kg

Maximum value of SAR (interpolated) = 0.912 W/kg

4-slot GPRS850/Body - High - Spacer 15mm - No Headset - Back Facing Phantom - Repeated/Zoom Scan

(5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 31.63 V/m

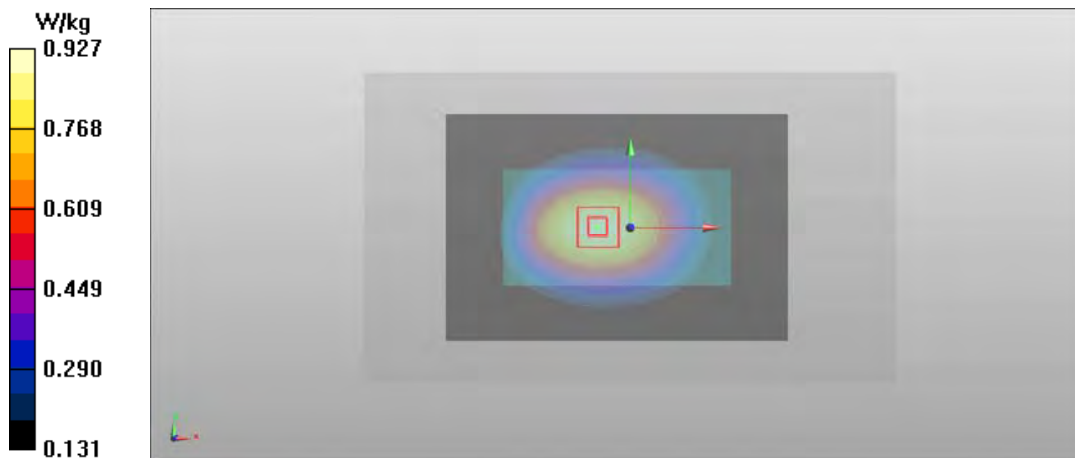
Peak SAR (extrapolated) = 1.07 W/kg

SAR(1 g) = 0.834 W/kg

SAR(10 g) = 0.615 W/kg

Power Drift = 0.08 dB

Maximum value of SAR (measured) = 0.927 W/kg



SAR Report

Appendix B for FCC_RM-1020_01

Applicant: Microsoft Mobile

Type: RM-1020

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Plot #7

Date/Time: 2014-05-22 15:24:56

Test Laboratory: TCC Microsoft

Type: RM-1020; Serial: 004402/47/832326/8, 004402/47/832327/6

Communication System: WCDMA850 (Band 5)

Frequency: 846.6 MHz; Duty Cycle: 1:1

Medium: BSL850; Medium Notes: t= 21.6 C

Medium parameters used: f = 847 MHz; $\sigma = 0.98$ S/m; $\epsilon_r = 54.105$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY Configuration:

- Probe: ES3DV3 - SN3194
- ConvF(6.05, 6.05, 6.05); Calibrated: 2013-11-14;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn538; Calibrated: 2013-11-19
- Phantom: SAM 3 Triple Phantom 5.1C; Type: QD 000 P51 CA;
- Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.10 (7331)

WCDMA850 (Band 5)/Body - High - Spacer 15mm - No Headset - Back Facing Phantom/Area Scan (81x121x1):

Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 29.56 V/m

Fast SAR: SAR(1 g) = 0.712 W/kg

Fast SAR(10 g) = 0.503 W/kg

Maximum value of SAR (interpolated) = 0.804 W/kg

WCDMA850 (Band 5)/Body - High - Spacer 15mm - No Headset - Back Facing Phantom/Zoom Scan (5x5x7)/Cube

0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 29.68 V/m

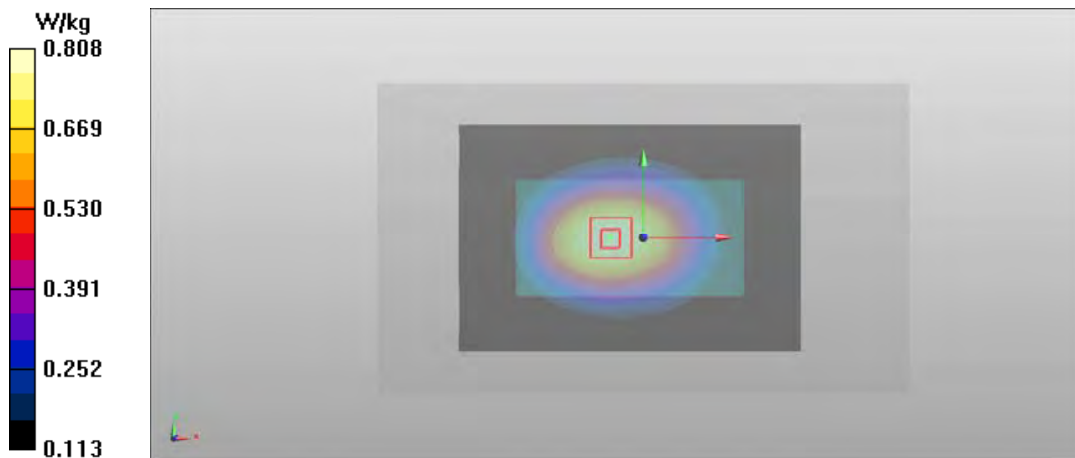
Peak SAR (extrapolated) = 0.932 W/kg

SAR(1 g) = 0.726 W/kg

SAR(10 g) = 0.534 W/kg

Power Drift = -0.05 dB

Maximum value of SAR (measured) = 0.808 W/kg



SAR Report

Appendix B for FCC_RM-1020_01

Applicant: Microsoft Mobile

Type: RM-1020

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Plot #8

Date/Time: 2014-05-20 10:10:02

Test Laboratory: TCC Microsoft

Type: RM-1020; Serial: 004402/47/832288/0, 004402/47/832289/8

Communication System: 3-slot GPRS1900

Frequency: 1909.8 MHz; Duty Cycle: 1:2.80027

Medium: BSL1900; Medium Notes: $t = 21.0$ C

Medium parameters used: $f = 1910$ MHz; $\sigma = 1.536$ S/m; $\epsilon_r = 52.137$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY Configuration:

- Probe: ES3DV3 - SN3131
- ConvF(4.62, 4.62, 4.62); Calibrated: 2013-06-18;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn793; Calibrated: 2013-06-10
- Phantom: SAM 3 Triple Phantom 5.1C; Type: QD 000 P51 CA;
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.10 (7331)

3-slot GPRS1900/Body - High- Spacer 15mm - WH-108 - Back Facing Phantom - Repeated/Area Scan

(81x121x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Reference Value = 23.08 V/m

Fast SAR: SAR(1 g) = 0.762 W/kg

Fast SAR(10 g) = 0.408 W/kg

Maximum value of SAR (interpolated) = 0.988 W/kg

3-slot GPRS1900/Body - High- Spacer 15mm - WH-108 - Back Facing Phantom - Repeated/Zoom Scan

(5x5x7)/Cube 0: Measurement grid: $dx=7.5$ mm, $dy=7.5$ mm, $dz=5$ mm

Reference Value = 23.08 V/m

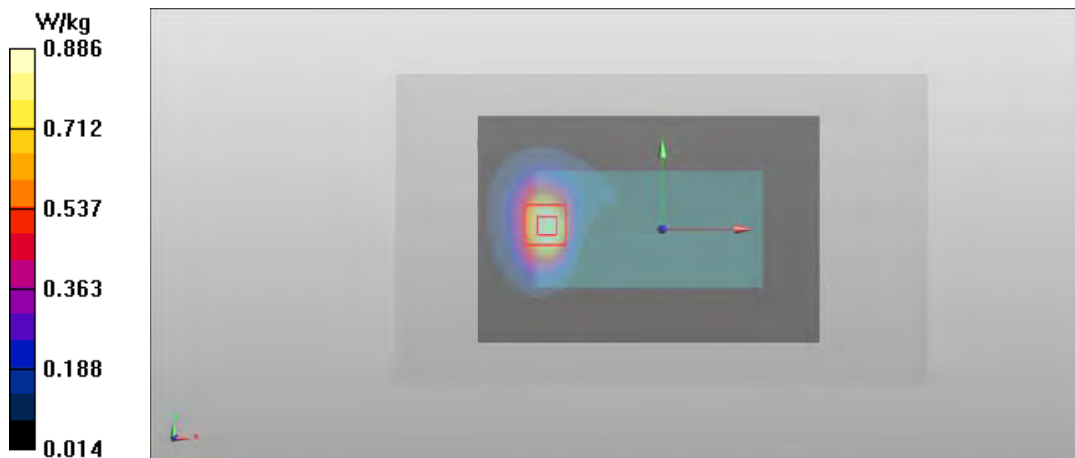
Peak SAR (extrapolated) = 1.26 W/kg

SAR(1 g) = 0.795 W/kg

SAR(10 g) = 0.445 W/kg

Power Drift = 0.07 dB

Maximum value of SAR (measured) = 0.886 W/kg



SAR Report

Appendix B for FCC_RM-1020_01

Applicant: Microsoft Mobile

Type: RM-1020

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Plot #9

Date/Time: 2014-05-20 11:32:41

Test Laboratory: TCC Microsoft

Type: RM-1020; Serial: 004402/47/832288/0, 004402/47/832289/8

Communication System: WCDMA1900 (Band 2)

Frequency: 1907.6 MHz; Duty Cycle: 1:1

Medium: BSL1900; Medium Notes: t= 21.0 C

Medium parameters used: f = 1908 MHz; $\sigma = 1.534$ S/m; $\epsilon_r = 52.142$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY Configuration:

- Probe: ES3DV3 - SN3131
- ConvF(4.62, 4.62, 4.62); Calibrated: 2013-06-18;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn793; Calibrated: 2013-06-10
- Phantom: SAM 3 Triple Phantom 5.1C; Type: QD 000 P51 CA;
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.10 (7331)

WCDMA1900 (Band 2)/Body - High - Spacer 15mm - WH-108 - Back Facing Phantom/Area Scan (81x121x1):

Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 26.50 V/m

Fast SAR: SAR(1 g) = 1.01 W/kg

Fast SAR(10 g) = 0.541 W/kg

Maximum value of SAR (interpolated) = 1.34 W/kg

WCDMA1900 (Band 2)/Body - High - Spacer 15mm - WH-108 - Back Facing Phantom/Zoom Scan (5x5x7)/Cube

0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 26.19 V/m

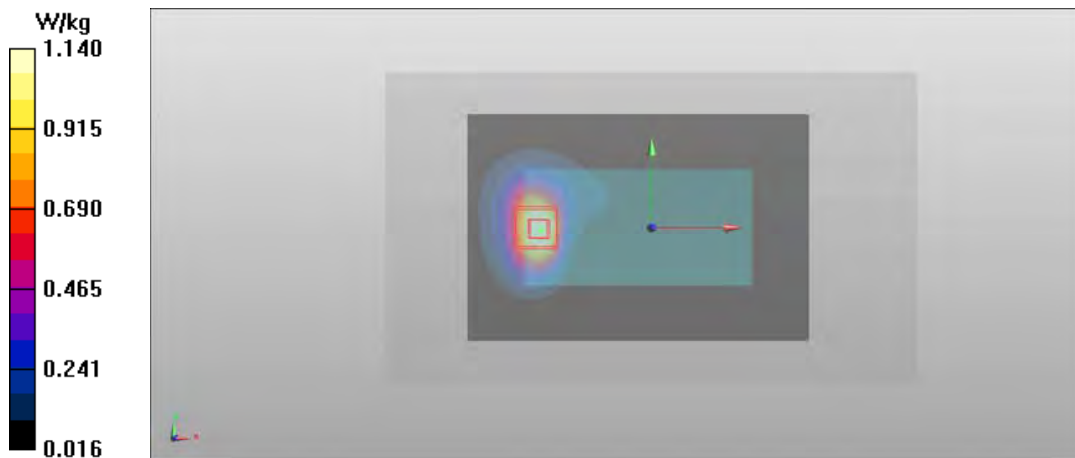
Peak SAR (extrapolated) = 1.65 W/kg

SAR(1 g) = 1.03 W/kg

SAR(10 g) = 0.574 W/kg

Power Drift = 0.06 dB

Maximum value of SAR (measured) = 1.14 W/kg



SAR Report

Appendix B for FCC_RM-1020_01

Applicant: Microsoft Mobile

Type: RM-1020

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Plot #10

Date/Time: 2014-05-20 13:13:53

Test Laboratory: TCC Microsoft

Type: RM-1020; Serial: 004402/47/832332/6, 004402/47/832333/4

Communication System: WLAN2450

Frequency: 2462 MHz; Duty Cycle: 1:1

Medium: BSL2450; Medium Notes: t= 21.0 C

Medium parameters used: f = 2462 MHz; σ = 1.952 S/m; ϵ_r = 52.221; ρ = 1000 kg/m³

Phantom section: Center Section

DASY Configuration:

- Probe: EX3DV4 - SN3960
- ConvF(7.44, 7.44, 7.44); Calibrated: 2013-12-10;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1302; Calibrated: 2013-11-08
- Phantom: #2 Triple, SAR4; Type: QD 000 P51 CA;
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.10 (7331)

WLAN2450 b-mode/Body - Channel 11 - BPSK 1 Mbps - Spacer 15mm - No Headset - Back Facing Phantom/Area Scan (121x181x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Reference Value = 7.288 V/m

Fast SAR: SAR(1 g) = 0.089 W/kg

Fast SAR(10 g) = 0.047 W/kg

Maximum value of SAR (interpolated) = 0.112 W/kg

WLAN2450 b-mode/Body - Channel 11 - BPSK 1 Mbps - Spacer 15mm - No Headset - Back Facing Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 7.295 V/m

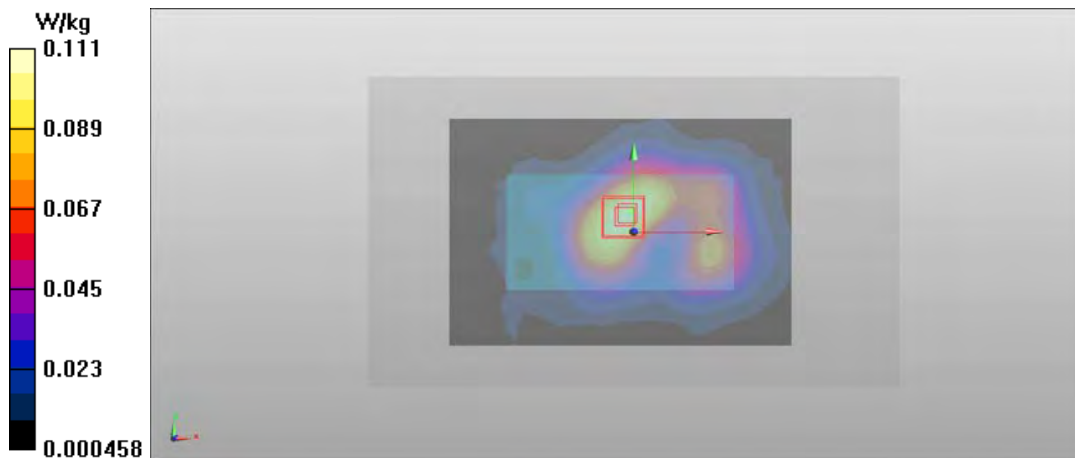
Peak SAR (extrapolated) = 0.159 W/kg

SAR(1 g) = 0.091 W/kg

SAR(10 g) = 0.053 W/kg

Power Drift = -0.05 dB

Maximum value of SAR (measured) = 0.111 W/kg



SAR Report

Appendix B for FCC_RM-1020_01

Applicant: Microsoft Mobile

Type: RM-1020

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Plot #11

Date/Time: 2014-05-23 10:32:52

Test Laboratory: TCC Microsoft

Type: RM-1020; Serial: 004402/47/832294/8, 004402/47/832295/5

Communication System: 4-slot GPRS850

Frequency: 848.8 MHz; Duty Cycle: 1:2.09991

Medium: BSL850; Medium Notes: t= 21.6 C

Medium parameters used: f = 849 MHz; $\sigma = 0.981$ S/m; $\epsilon_r = 53.98$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY Configuration:

- Probe: ES3DV3 - SN3194
- ConvF(6.05, 6.05, 6.05); Calibrated: 2013-11-14;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn538; Calibrated: 2013-11-19
- Phantom: SAM 3 Triple Phantom 5.1C; Type: QD 000 P51 CA;
- Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.10 (7331)

4-slot GPRS850/Body - High - Spacer 10mm - No Headset - Back Facing Phantom/Area Scan (81x121x1):

Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 33.31 V/m

Fast SAR: SAR(1 g) = 0.890 W/kg

Fast SAR(10 g) = 0.628 W/kg

Maximum value of SAR (interpolated) = 1.00 W/kg

4-slot GPRS850/Body - High - Spacer 10mm - No Headset - Back Facing Phantom/Zoom Scan (5x5x7)/Cube 0:

Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 33.26 V/m

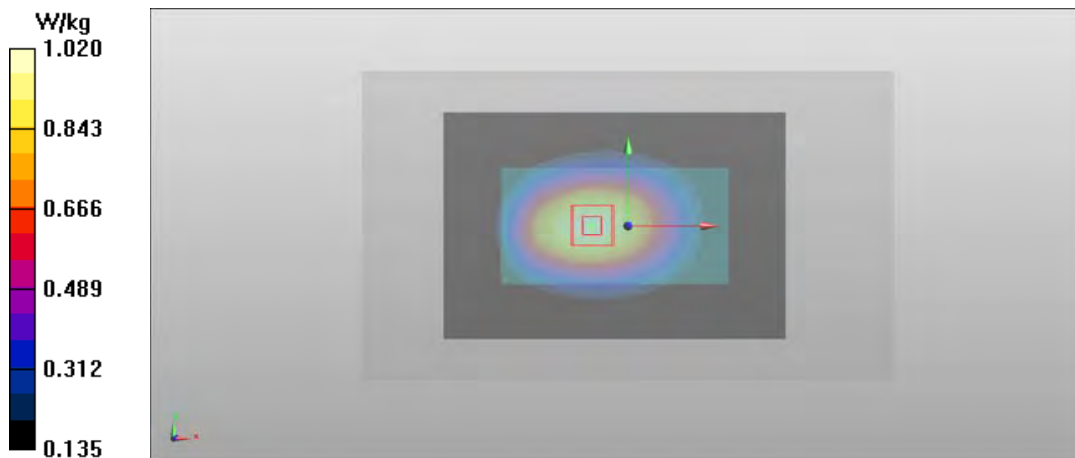
Peak SAR (extrapolated) = 1.16 W/kg

SAR(1 g) = 0.912 W/kg

SAR(10 g) = 0.672 W/kg

Power Drift = -0.01 dB

Maximum value of SAR (measured) = 1.02 W/kg



SAR Report

Appendix B for FCC_RM-1020_01

Applicant: Microsoft Mobile

Type: RM-1020

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Plot #12

Date/Time: 2014-05-22 14:00:30

Test Laboratory: TCC Microsoft

Type: RM-1020; Serial: 004402/47/832326/8, 004402/47/832327/6

Communication System: WCDMA850 (Band 5)

Frequency: 846.6 MHz; Duty Cycle: 1:1

Medium: BSL850; Medium Notes: t= 21.6 C

Medium parameters used: f = 847 MHz; $\sigma = 0.98$ S/m; $\epsilon_r = 54.105$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY Configuration:

- Probe: ES3DV3 - SN3194
- ConvF(6.05, 6.05, 6.05); Calibrated: 2013-11-14;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn538; Calibrated: 2013-11-19
- Phantom: SAM 3 Triple Phantom 5.1C; Type: QD 000 P51 CA;
- Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.10 (7331)

WCDMA850 (Band 5)/Body - High - Spacer 10mm - No Headset - Back Facing Phantom/Area Scan (81x121x1):

Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 34.66 V/m

Fast SAR: SAR(1 g) = 0.947 W/kg

Fast SAR(10 g) = 0.670 W/kg

Maximum value of SAR (interpolated) = 1.07 W/kg

WCDMA850 (Band 5)/Body - High - Spacer 10mm - No Headset - Back Facing Phantom/Zoom Scan (5x5x7)/Cube

0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 35.17 V/m

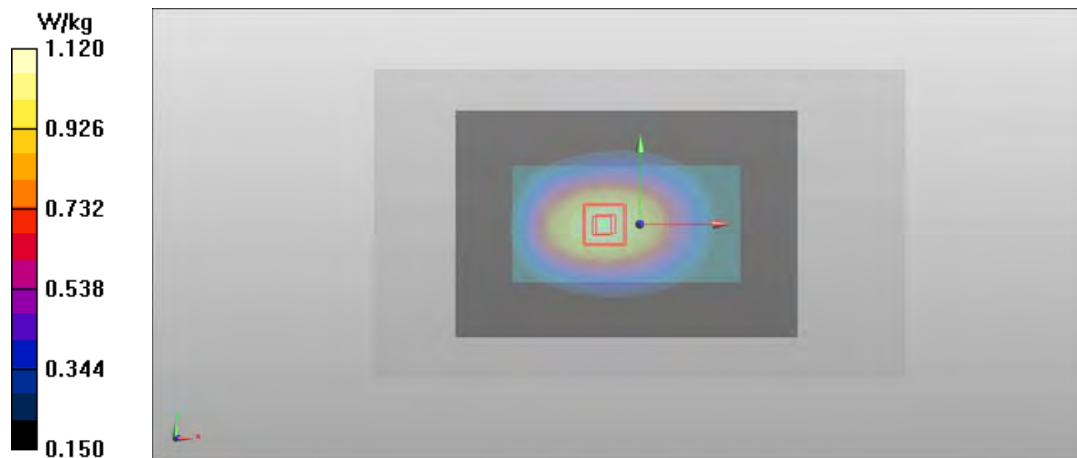
Peak SAR (extrapolated) = 1.29 W/kg

SAR(1 g) = 1.01 W/kg

SAR(10 g) = 0.734 W/kg

Power Drift = -0.10 dB

Maximum value of SAR (measured) = 1.12 W/kg



Plot #13

Date/Time: 2014-05-20 16:14:37

Test Laboratory: TCC Microsoft

Type: RM-1020; Serial: 004402/47/832290/6, 004402/47/832291/4

Communication System: 4-slot GPRS1900

Frequency: 1909.8 MHz; Duty Cycle: 1:2.09991

Medium: BSL1900; Medium Notes: t= 21.0 C

Medium parameters used: f = 1910 MHz; $\sigma = 1.536$ S/m; $\epsilon_r = 52.137$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY Configuration:

- Probe: ES3DV3 - SN3131
- ConvF(4.62, 4.62, 4.62); Calibrated: 2013-06-18;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn793; Calibrated: 2013-06-10
- Phantom: SAM 3 Triple Phantom 5.1C; Type: QD 000 P51 CA;
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.10 (7331)

4-slot GPRS1900/Body - High - Spacer 10mm - No Headset - Bottom Edge Facing Phantom/Area Scan

(41x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 21.23 V/m

Fast SAR: SAR(1 g) = 0.724 W/kg

Fast SAR(10 g) = 0.364 W/kg

Maximum value of SAR (interpolated) = 0.985 W/kg

4-slot GPRS1900/Body - High - Spacer 10mm - No Headset - Bottom Edge Facing Phantom/Zoom Scan

(5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 21.23 V/m

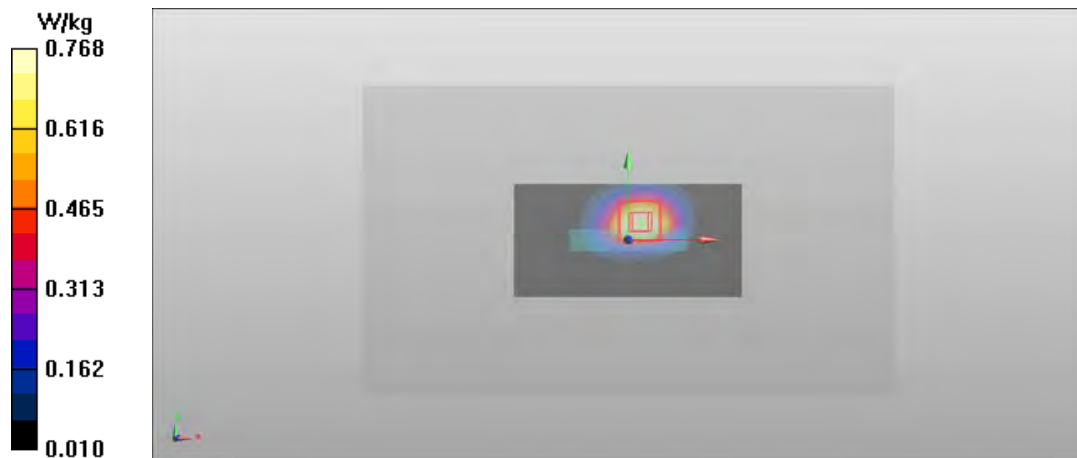
Peak SAR (extrapolated) = 1.12 W/kg

SAR(1 g) = 0.688 W/kg

SAR(10 g) = 0.369 W/kg

Power Drift = -0.08 dB

Maximum value of SAR (measured) = 0.768 W/kg



SAR Report

Appendix B for FCC_RM-1020_01

Applicant: Microsoft Mobile

Type: RM-1020

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Plot #14

Date/Time: 2014-05-20 14:48:54

Test Laboratory: TCC Microsoft

Type: RM-1020; Serial: 004402/47/832290/6, 004402/47/832291/4

Communication System: WCDMA1900 (Band 2)

Frequency: 1907.6 MHz; Duty Cycle: 1:1

Medium: BSL1900; Medium Notes: $t = 21.0$ C

Medium parameters used: $f = 1908$ MHz; $\sigma = 1.534$ S/m; $\epsilon_r = 52.142$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY Configuration:

- Probe: ES3DV3 - SN3131
- ConvF(4.62, 4.62, 4.62); Calibrated: 2013-06-18;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn793; Calibrated: 2013-06-10
- Phantom: SAM 3 Triple Phantom 5.1C; Type: QD 000 P51 CA;
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.10 (7331)

WCDMA1900 (Band 2)/Body - High - Spacer 10mm - No Headset - Bottom Edge Facing Phantom/Area Scan (41x81x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Reference Value = 25.87 V/m

Fast SAR: SAR(1 g) = 1.02 W/kg

Fast SAR(10 g) = 0.516 W/kg

Maximum value of SAR (interpolated) = 1.37 W/kg

WCDMA1900 (Band 2)/Body - High - Spacer 10mm - No Headset - Bottom Edge Facing Phantom/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=7.5$ mm, $dy=7.5$ mm, $dz=5$ mm

Reference Value = 25.87 V/m

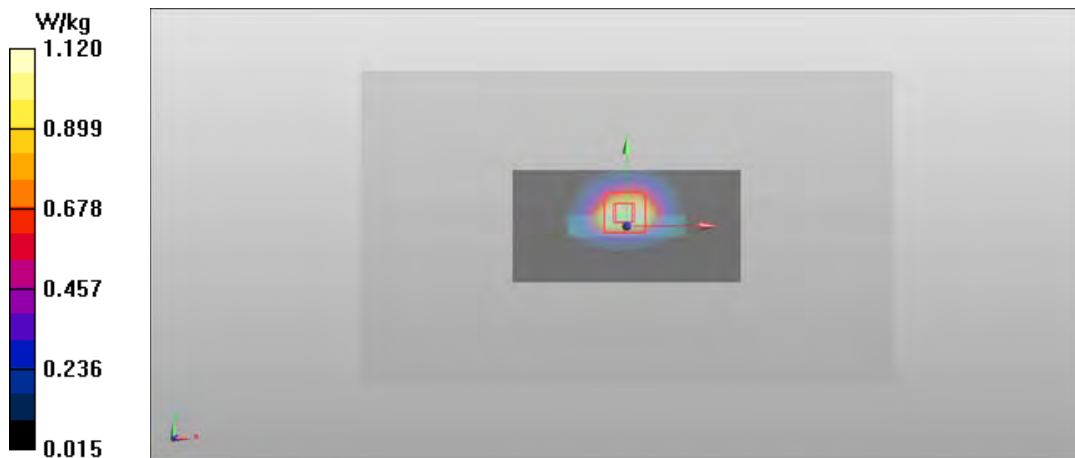
Peak SAR (extrapolated) = 1.63 W/kg

SAR(1 g) = 0.995 W/kg

SAR(10 g) = 0.527 W/kg

Power Drift = 0.01 dB

Maximum value of SAR (measured) = 1.12 W/kg



SAR Report

Appendix B for FCC_RM-1020_01

Applicant: Microsoft Mobile

Type: RM-1020

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Plot #15

Date/Time: 2014-05-22 10:41:47

Test Laboratory: TCC Microsoft

Type: RM-1020; Serial: 004402/47/832332/6, 004402/47/832333/4

Communication System: WLAN2450 b-mode

Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: BSL2450; Medium Notes: $t = 21.2$ C

Medium parameters used: $f = 2437$ MHz; $\sigma = 1.923$ S/m; $\epsilon_r = 52.138$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY Configuration:

- Probe: EX3DV4 - SN3960
- ConvF(7.44, 7.44, 7.44); Calibrated: 2013-12-10;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1302; Calibrated: 2013-11-08
- Phantom: #2 Triple, SAR4; Type: QD 000 P51 CA;
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.10 (7331)

**WLAN2450 b-mode/Body - Channel 6 - QPSK 5.5 Mbps - Spacer 10mm - No Headset - Right Edge Facing
Phantom/Area Scan (61x181x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm**

Reference Value = 8.734 V/m

Fast SAR: SAR(1 g) = 0.170 W/kg

Fast SAR(10 g) = 0.083 W/kg

Maximum value of SAR (interpolated) = 0.222 W/kg

**WLAN2450 b-mode/Body - Channel 6 - QPSK 5.5 Mbps - Spacer 10mm - No Headset - Right Edge Facing
Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm**

Reference Value = 8.734 V/m

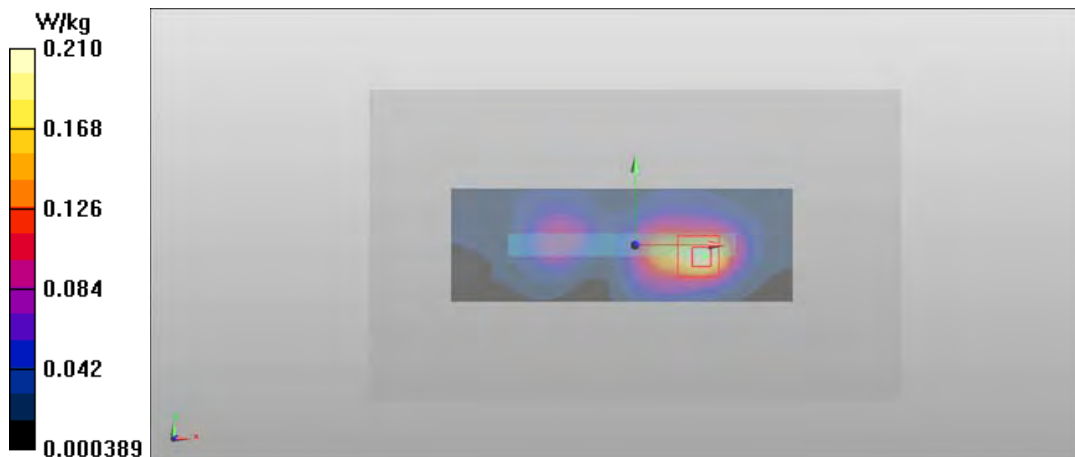
Peak SAR (extrapolated) = 0.307 W/kg

SAR(1 g) = 0.165 W/kg

SAR(10 g) = 0.084 W/kg

Power Drift = 0.03 dB

Maximum value of SAR (measured) = 0.210 W/kg



APPENDIX C: DIELECTRIC PARAMETERS OF THE TISSUE SIMULANTS

Head tissue simulant dielectric parameters used in the measurements:

f (MHz)	Date	Dielectric Parameters					
		Ch 4132 826.4 MHz		Ch 4175 835.0 MHz		Ch 4233 846.6 MHz	
		ϵ_r	σ [S/m]	ϵ_r	σ [S/m]	ϵ_r	σ [S/m]
835	2014-05-16	40.1	0.90	40.1	0.91	40.0	0.91
f (MHz)	Date	Dielectric Parameters					
		Ch 128 824.2 MHz		Ch 190 836.6 MHz		Ch 251 848.8 MHz	
		ϵ_r	σ [S/m]	ϵ_r	σ [S/m]	ϵ_r	σ [S/m]
836	2014-05-16	40.1	0.90	40.0	0.91	40.0	0.92
f (MHz)	Date	Dielectric Parameters					
		Ch 512 1850.2 MHz		Ch 661 1880.0 MHz		Ch 810 1909.8 MHz	
		ϵ_r	σ [S/m]	ϵ_r	σ [S/m]	ϵ_r	σ [S/m]
1880	2014-05-15	38.8	1.35	38.7	1.38	38.6	1.40
f (MHz)	Date	Dielectric Parameters					
		Ch 9262 1852.4 MHz		Ch 9400 1880.0 MHz		Ch 9538 1907.6 MHz	
		ϵ_r	σ [S/m]	ϵ_r	σ [S/m]	ϵ_r	σ [S/m]
1880	2014-05-15	38.8	1.35	38.7	1.38	38.6	1.40
f (MHz)	Date	Dielectric Parameters					
		Ch 1 2412.0 MHz		Ch 6 2437.0 MHz		Ch 11 2462.0 MHz	
		ϵ_r	σ [S/m]	ϵ_r	σ [S/m]	ϵ_r	σ [S/m]
2437	2014-05-15	39.0	1.77	38.9	1.79	38.8	1.82
	2014-06-10	39.1	1.79	39.0	1.82	38.9	1.85

Body tissue simulant dielectric parameters used in the measurements:

f (MHz)	Date	Dielectric Parameters					
		Ch 4132 826.4 MHz		Ch 4175 835.0 MHz		Ch 4233 846.6 MHz	
		ϵ_r	σ [S/m]	ϵ_r	σ [S/m]	ϵ_r	σ [S/m]
835	2014-05-22	54.2	0.97	54.2	0.97	54.1	0.98
	2014-05-23	54.1	0.97	54.0	0.97	54.0	0.98
f (MHz)	Date	Dielectric Parameters					
		Ch 128 824.2 MHz		Ch 190 836.6 MHz		Ch 251 848.8 MHz	
		ϵ_r	σ [S/m]	ϵ_r	σ [S/m]	ϵ_r	σ [S/m]
836	2014-05-22	54.2	0.97	54.1	0.97	54.1	0.98
	2014-05-23	54.1	0.97	54.0	0.97	54.0	0.98
f (MHz)	Date	Dielectric Parameters					
		Ch 512 1850.2 MHz		Ch 661 1880.0 MHz		Ch 810 1909.8 MHz	
		ϵ_r	σ [S/m]	ϵ_r	σ [S/m]	ϵ_r	σ [S/m]
1880	2014-05-20	52.2	1.47	52.2	1.50	52.1	1.53
f (MHz)	Date	Dielectric Parameters					
		Ch 9262 1852.4 MHz		Ch 9400 1880.0 MHz		Ch 9538 1907.6 MHz	
		ϵ_r	σ [S/m]	ϵ_r	σ [S/m]	ϵ_r	σ [S/m]
1880	2014-05-20	52.2	1.47	52.2	1.50	52.1	1.53
f (MHz)	Date	Dielectric Parameters					
		Ch 1 2412.0 MHz		Ch 6 2437.0 MHz		Ch 11 2462.0 MHz	
		ϵ_r	σ [S/m]	ϵ_r	σ [S/m]	ϵ_r	σ [S/m]
2437	2014-05-20	52.4	1.89	52.3	1.92	52.2	1.95
	2014-05-21	52.2	1.88	52.1	1.91	52.1	1.94
	2014-05-22	52.2	1.89	52.1	1.92	52.0	1.95

APPENDIX D: CONDUCTED AVERAGE POWER MEASUREMENTS FOR WCDMA AND HSUPA

Type: RM-1020; Serial: 004402/47/832326/8; 004402/47/832327/6, HW: 1530, SW: 01068.00004.14182.20000

D.1. WCDMA850 (Band 5) Test results

Average power

Ch / f(MHz)	P [dBm]
4132	23.4
4175	23.4
4233	23.5

D.2. HSUPA850 Test results

Average power

Ch / f (MHz)	P [dBm]				
	Subtest mode 1	Subtest mode 2	Subtest mode 3	Subtest mode 4	Subtest mode 5
4132	22.3	21.1	20.8	22.0	22.4
4175	21.8	21.3	21.4	22.0	22.4
4233	21.9	21.3	21.5	21.8	22.4

Note: In HSUPA operation, the output power is reduced relative to the tuning target power for WCDMA. This device runs two separate HSUPA power control routines: MPR, and additional 1dB reduction to ensure PA linearity. As a result, the MPR for each of the Subtest modes is as follows:

Maximum Power Reduction (MPR)				
Subtest mode 1	Subtest mode 2	Subtest mode 3	Subtest mode 4	Subtest mode 5
1.0dB	3.0dB	2.0dB	3.0dB	1.0dB

Type: RM-1020; Serial: 004402/47/832288/0; 004402/47/832289/8, HW: 1530, SW: 01068.00004.14182.20000

D.3. WCDMA1900 (Band 2) Test results

Average power

Ch / f(MHz)	P [dBm]
9262	21.9
9400	22.1
9538	21.9

D.4. HSUPA1900 Test results

Average power

Ch / f (MHz)	P [dBm]				
	Subtest mode 1	Subtest mode 2	Subtest mode 3	Subtest mode 4	Subtest mode 5
9262	20.8	19.7	19.4	20.2	20.8
9400	21.0	19.7	19.4	20.7	21.2
9538	20.3	19.7	19.9	20.3	20.7

Note: In HSUPA operation, the output power is reduced relative to the tuning target power for WCDMA. This device runs two separate HSUPA power control routines: MPR, and additional 1dB reduction to ensure PA linearity. As a result, the MPR for each of the Subtest modes is as follows:

Maximum Power Reduction (MPR)				
Subtest mode 1	Subtest mode 2	Subtest mode 3	Subtest mode 4	Subtest mode 5
1.0dB	3.0dB	2.0dB	3.0dB	1.0dB

Type: RM-1020; Serial: 004402/47/832290/6; 004402/47/832291/4, HW: 1530, SW: 01068.00004.14182.20000

D.5. WCDMA1900 (Band 2) Test results

Average power

Ch / f(MHz)	P [dBm]
9262	17.3
9400	17.5
9538	17.4

D.6. HSUPA1900 Test results

Average power

Ch / f (MHz)	P [dBm]				
	Subtest mode 1	Subtest mode 2	Subtest mode 3	Subtest mode 4	Subtest mode 5
9262	14.6	15.4	15.3	15.8	16.1
9400	16.2	15.4	14.7	15.6	16.5
9538	16.4	15.2	15.0	15.9	16.3

Note: In HSUPA operation, the output power is reduced relative to the tuning target power for WCDMA. This device runs two separate HSUPA power control routines: MPR, and additional 1dB reduction to ensure PA linearity. As a result, the MPR for each of the Subtest modes is as follows:

Maximum Power Reduction (MPR)				
Subtest mode 1	Subtest mode 2	Subtest mode 3	Subtest mode 4	Subtest mode 5
1.0dB	3.0dB	2.0dB	3.0dB	1.0dB

APPENDIX E: RELEVANT PAGES FROM PROBE CALIBRATION REPORTS



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

The Swiss Accreditation Service is one of the signatories to the EA
 Multilateral Agreement for the recognition of calibration certificates

Client **Nokia Salo TCC**

Certificate No: **ES3-3131_Jun13**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3131**

Calibration procedure(s) **QA CAL-01.v8, QA CAL-23.v4, QA CAL-25.v4**
Calibration procedure for dosimetric E-field probes

Calibration date: **June 18, 2013**

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 $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-13 (No. 217-01735)	Apr-14
Reference 30 dB Attenuator	SN: S5129 (30b)	04-Apr-13 (No. 217-01738)	Apr-14
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	31-Jan-13 (No. DAE4-660_Jan13)	Jan-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-15
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

Calibrated by:	Name Israe El-Naouq	Function Laboratory Technician	Signature
Approved by:	Name Katja Pokovic	Function Technical Manager	Signature

Issued: June 18, 2013

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



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,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., $\vartheta = 0$ is normal to probe axis

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- 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:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E^2 -field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z}** = NORM_{x,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.
- DCP_{x,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
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; D_{x,y,z}; VR_{x,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 $f \leq 800$ 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 NORM_{x,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.

Probe ES3DV3

SN:3131

Manufactured: February 6, 2007
Calibrated: June 18, 2013

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3131

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	1.32	1.31	1.26	$\pm 10.1 \%$
DCP (mV) ^B	101.0	101.8	102.6	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	167.0	$\pm 2.7 \%$
		Y	0.0	0.0	1.0		164.9	
		Z	0.0	0.0	1.0		163.7	

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.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3131

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	Depth (mm)	Unct. (k=2)
750	41.9	0.89	6.23	6.23	6.23	0.31	1.83	± 12.0 %
835	41.5	0.90	5.96	5.96	5.96	0.26	1.99	± 12.0 %
1750	40.1	1.37	5.17	5.17	5.17	0.49	1.47	± 12.0 %
1900	40.0	1.40	4.98	4.98	4.98	0.67	1.27	± 12.0 %
2450	39.2	1.80	4.33	4.33	4.33	0.80	1.14	± 12.0 %
2600	39.0	1.96	4.21	4.21	4.21	0.80	1.09	± 12.0 %

^C Frequency validity 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.

^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.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3131

Calibration Parameter Determined in Body Tissue Simulating Media

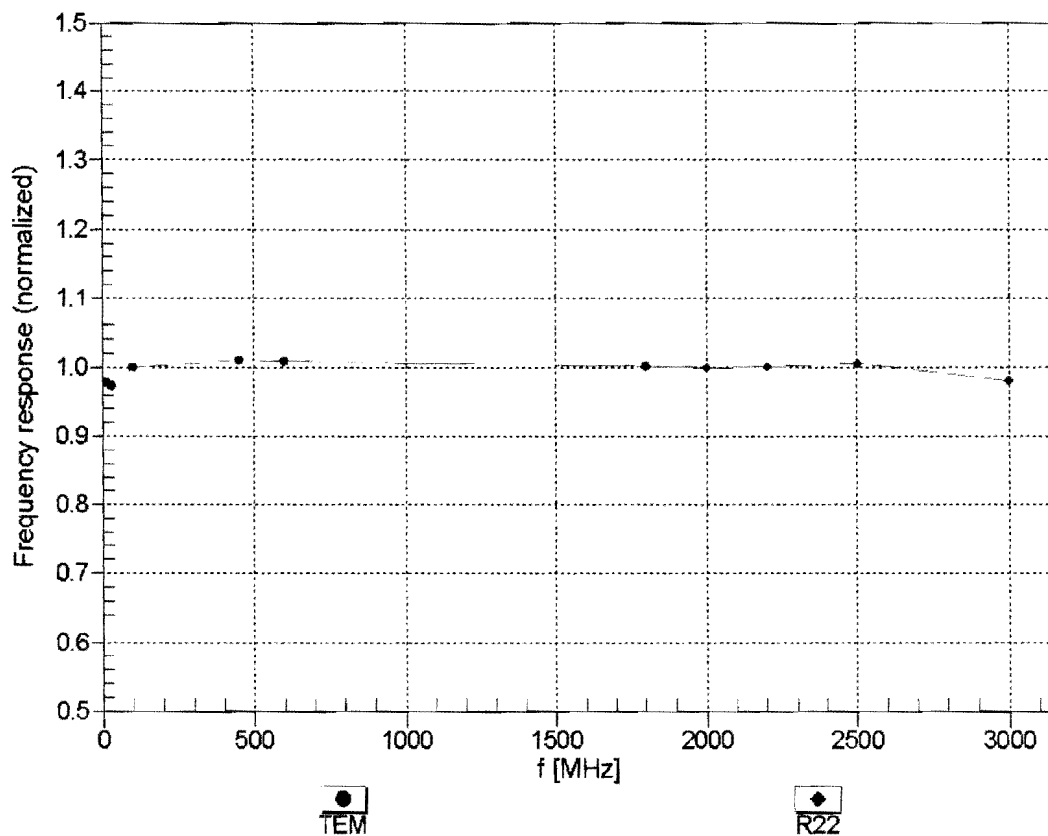
f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	6.10	6.10	6.10	0.30	1.90	± 12.0 %
835	55.2	0.97	6.03	6.03	6.03	0.39	1.68	± 12.0 %
1750	53.4	1.49	4.87	4.87	4.87	0.31	2.53	± 12.0 %
1900	53.3	1.52	4.62	4.62	4.62	0.28	2.70	± 12.0 %
2450	52.7	1.95	4.27	4.27	4.27	0.68	1.20	± 12.0 %
2600	52.5	2.16	4.17	4.17	4.17	0.50	1.10	± 12.0 %

^C Frequency validity 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.

^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.

Frequency Response of E-Field

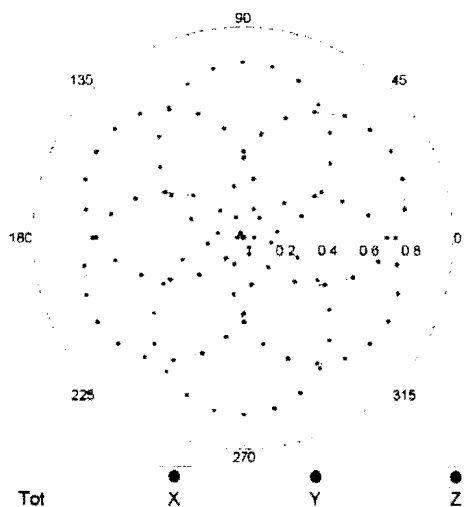
(TEM-Cell:ifi110 EXX, Waveguide: R22)



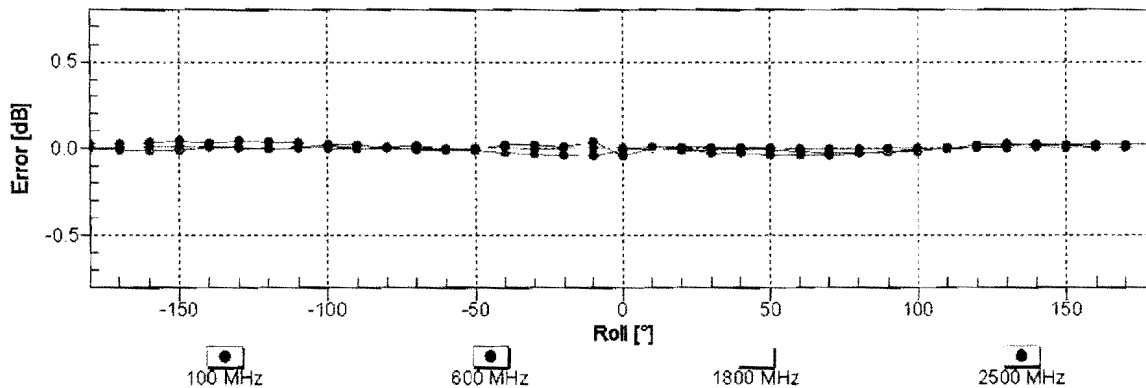
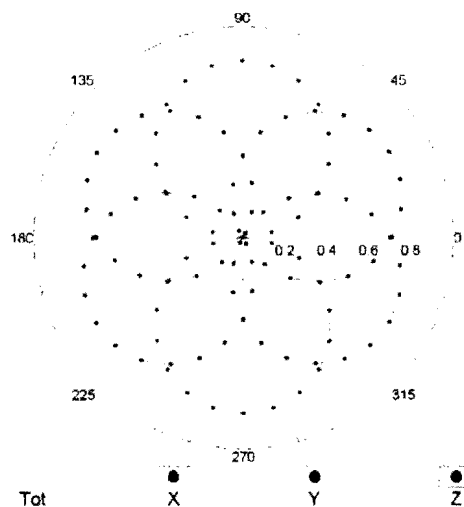
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

Receiving Pattern (ϕ), $\theta = 0^\circ$

f=600 MHz, TEM

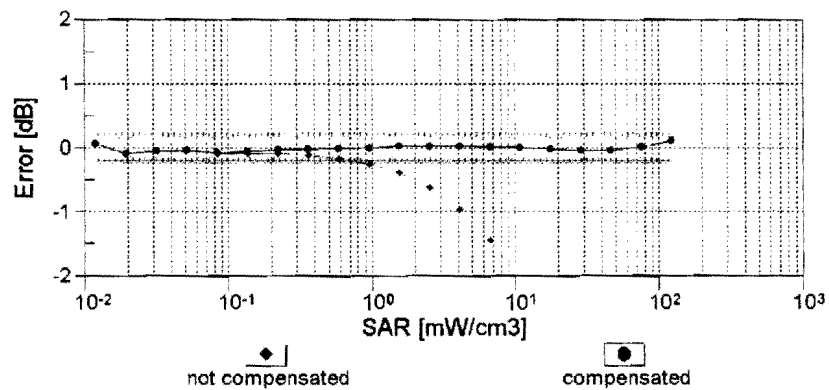
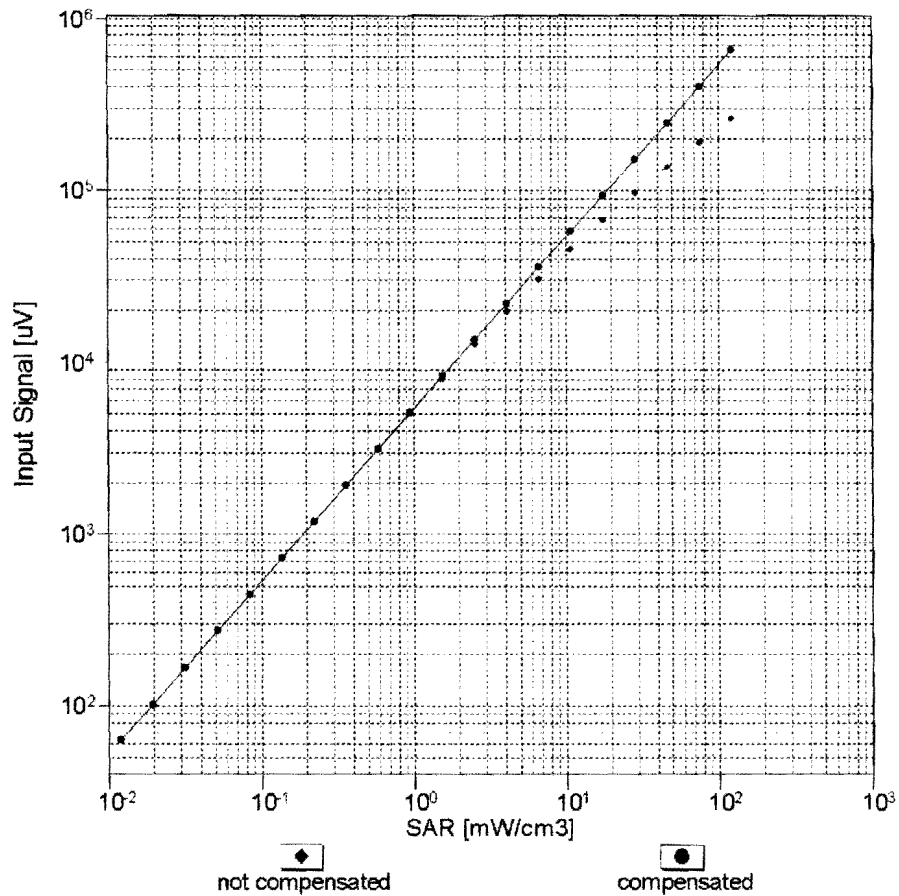


f=1800 MHz, R22



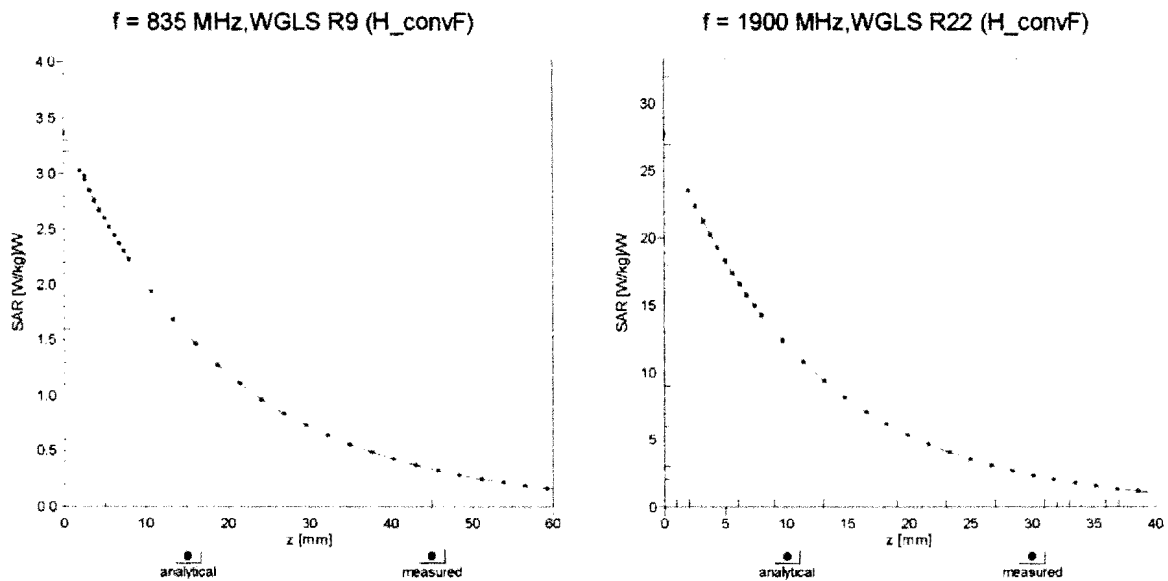
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell , $f = 900 \text{ MHz}$)



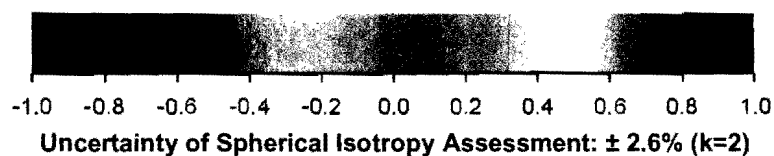
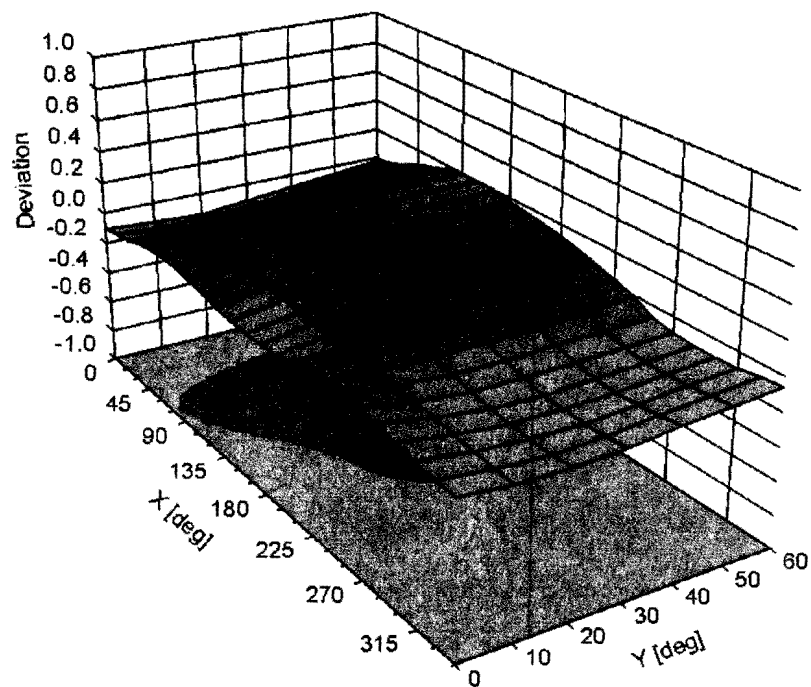
Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, θ), $f = 900 \text{ MHz}$



DASY/EASY - Parameters of Probe: ES3DV3 - SN:3131**Other Probe Parameters**

Sensor Arrangement	Triangular
Connector Angle (°)	-39.9
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm



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Multilateral Agreement for the recognition of calibration certificates

Client **Nokia Salo TCC**

Certificate No: **ES3-3194_Nov13**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3194**

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

Calibration date: **November 14, 2013**

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	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-13 (No. 217-01735)	Apr-14
Reference 30 dB Attenuator	SN: S5129 (30b)	04-Apr-13 (No. 217-01738)	Apr-14
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	4-Sep-13 (No. DAE4-660_Sep13)	Sep-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-15
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Israe El-Naouq	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	
Issued: November 15, 2013			
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3194

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 ^E (mm)	Unct. (k=2)
835	41.5	0.90	6.12	6.12	6.12	0.28	2.07	± 12.0 %

^C Frequency validity 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.

^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.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3194

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)	Uncl. (k=2)
835	55.2	0.97	6.05	6.05	6.05	0.69	1.30	± 12.0 %

^C Frequency validity 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.

^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.



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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Multilateral Agreement for the recognition of calibration certificates

Client **Nokia Salo TCC**

Certificate No: **EX3-3960_Dec13**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3960**

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: **December 10, 2013**

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 $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-13 (No. 217-01735)	Apr-14
Reference 30 dB Attenuator	SN: S5129 (30b)	04-Apr-13 (No. 217-01738)	Apr-14
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	4-Sep-13 (No. DAE4-660_Sep13)	Sep-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-15
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

Calibrated by: **Claudio Leubler** Name: **Claudio Leubler** Function: **Laboratory Technician**

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

Signature

Issued: December 11, 2013

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3960

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)
750	41.9	0.89	10.78	10.78	10.78	0.47	0.86	± 12.0 %
835	41.5	0.90	10.45	10.45	10.45	0.41	0.86	± 12.0 %
1750	40.1	1.37	8.49	8.49	8.49	0.57	0.67	± 12.0 %
1900	40.0	1.40	8.23	8.23	8.23	0.62	0.64	± 12.0 %
2450	39.2	1.80	7.39	7.39	7.39	0.38	0.83	± 12.0 %
2600	39.0	1.96	7.33	7.33	7.33	0.39	0.84	± 12.0 %
5200	36.0	4.66	5.27	5.27	5.27	0.35	1.80	± 13.1 %
5300	35.9	4.76	5.07	5.07	5.07	0.35	1.80	± 13.1 %
5500	35.6	4.96	4.99	4.99	4.99	0.35	1.80	± 13.1 %
5600	35.5	5.07	4.80	4.80	4.80	0.35	1.80	± 13.1 %
5800	35.3	5.27	4.80	4.80	4.80	0.40	1.80	± 13.1 %

^C Frequency validity 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.

^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.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3960

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)
750	55.5	0.96	10.24	10.24	10.24	0.43	0.86	± 12.0 %
835	55.2	0.97	10.08	10.08	10.08	0.34	1.00	± 12.0 %
1750	53.4	1.49	8.33	8.33	8.33	0.52	0.72	± 12.0 %
1900	53.3	1.52	7.88	7.88	7.88	0.62	0.64	± 12.0 %
2450	52.7	1.95	7.44	7.44	7.44	0.62	0.50	± 12.0 %
2600	52.5	2.16	7.14	7.14	7.14	0.59	0.50	± 12.0 %
5200	49.0	5.30	4.60	4.60	4.60	0.45	1.90	± 13.1 %
5300	48.9	5.42	4.33	4.33	4.33	0.50	1.90	± 13.1 %
5500	48.6	5.65	4.12	4.12	4.12	0.50	1.90	± 13.1 %
5600	48.5	5.77	3.97	3.97	3.97	0.50	1.90	± 13.1 %
5800	48.2	6.00	4.14	4.14	4.14	0.55	1.90	± 13.1 %

^C Frequency validity 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.

^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.

APPENDIX F: RELEVANT PAGES FROM DIPOLE VALIDATION KIT REPORTS



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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Multilateral Agreement for the recognition of calibration certificates

Client **Nokia Salo TCC**

Certificate No: **D835V2-480_Dec12**

CALIBRATION CERTIFICATE

Object **D835V2 - SN: 480**

Calibration procedure(s) **QA CAL-05.v8
Calibration procedure for dipole validation kits above 700 MHz**

Calibration date: **December 03, 2012**

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	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.3 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

Calibrated by: **Israe El-Naouq** Laboratory Technician

Signature

Approved by: **Katja Pokovic** Technical Manager

Issued: December 3, 2012

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Accreditation No.: **SCS 108**

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Multilateral Agreement for the recognition of calibration certificates

Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- 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
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.3
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	41.4 $\pm$ 6 %	0.92 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.39 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.40 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.56 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.16 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	54.5 $\pm$ 6 %	0.99 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.42 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	9.51 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.59 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	6.27 W/kg $\pm$ 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.8 Ω - 3.3 j Ω
Return Loss	- 29.4 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.7 Ω - 4.9 j Ω
Return Loss	- 24.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.391 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	January 28, 2003

DASY5 Validation Report for Head TSL

Date: 03.12.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 480

Communication System: CW; Frequency: 835 MHz

Medium parameters used: $f = 835$ MHz; $\sigma = 0.92$ mho/m; $\epsilon_r = 41.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.07, 6.07, 6.07); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

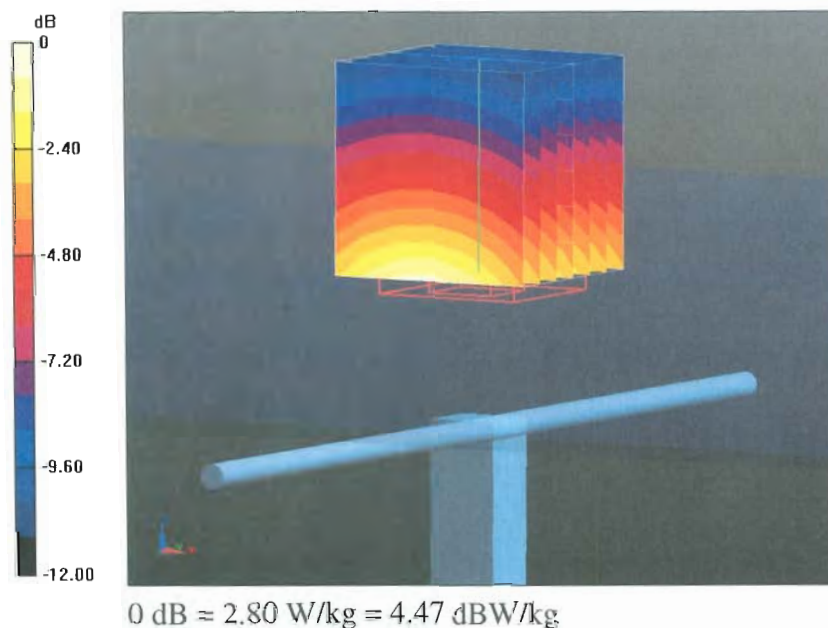
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 56.814 V/m; Power Drift = 0.00 dB

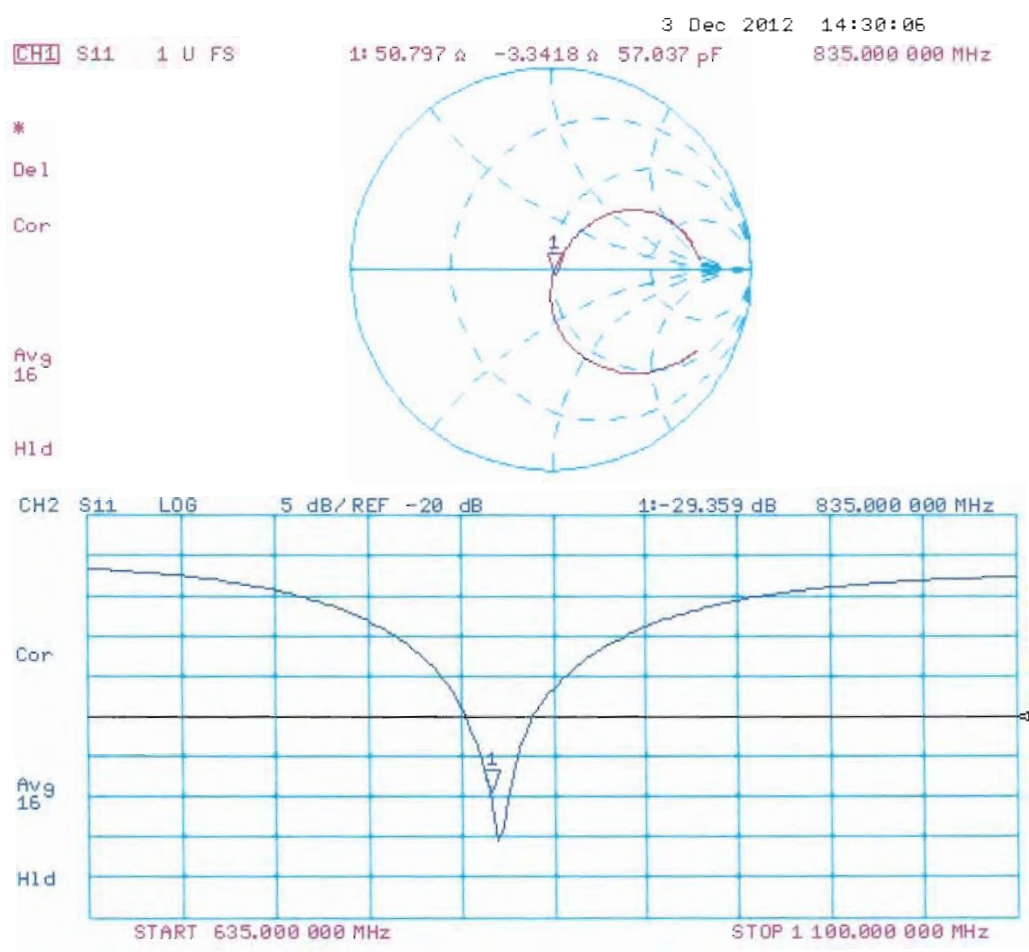
Peak SAR (extrapolated) = 3.60 W/kg

SAR(1 g) = 2.39 W/kg; SAR(10 g) = 1.56 W/kg

Maximum value of SAR (measured) = 2.80 W/kg



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 03.12.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 480

Communication System: CW; Frequency: 835 MHz

Medium parameters used: $f = 835$ MHz; $\sigma = 0.99$ mho/m; $\epsilon_r = 54.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.02, 6.02, 6.02); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

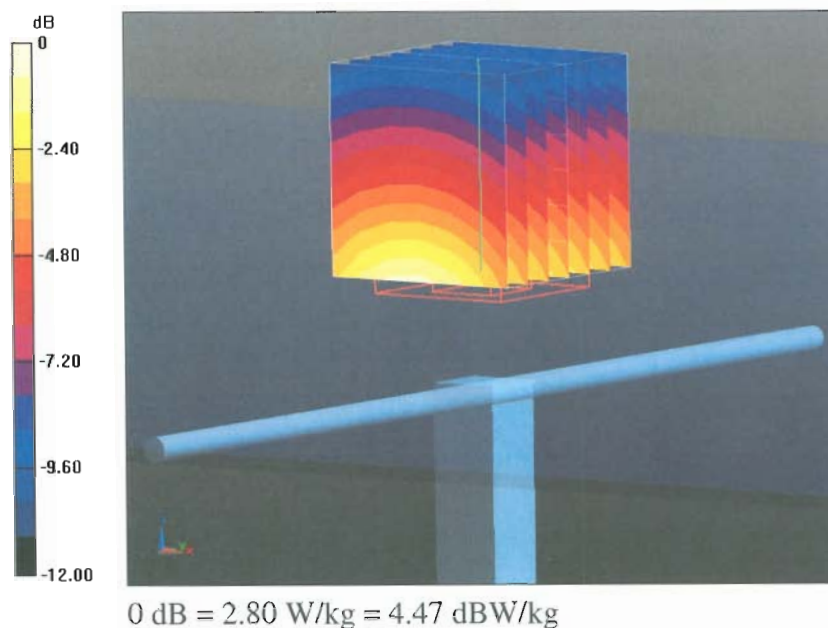
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.301 V/m; Power Drift = 0.00 dB

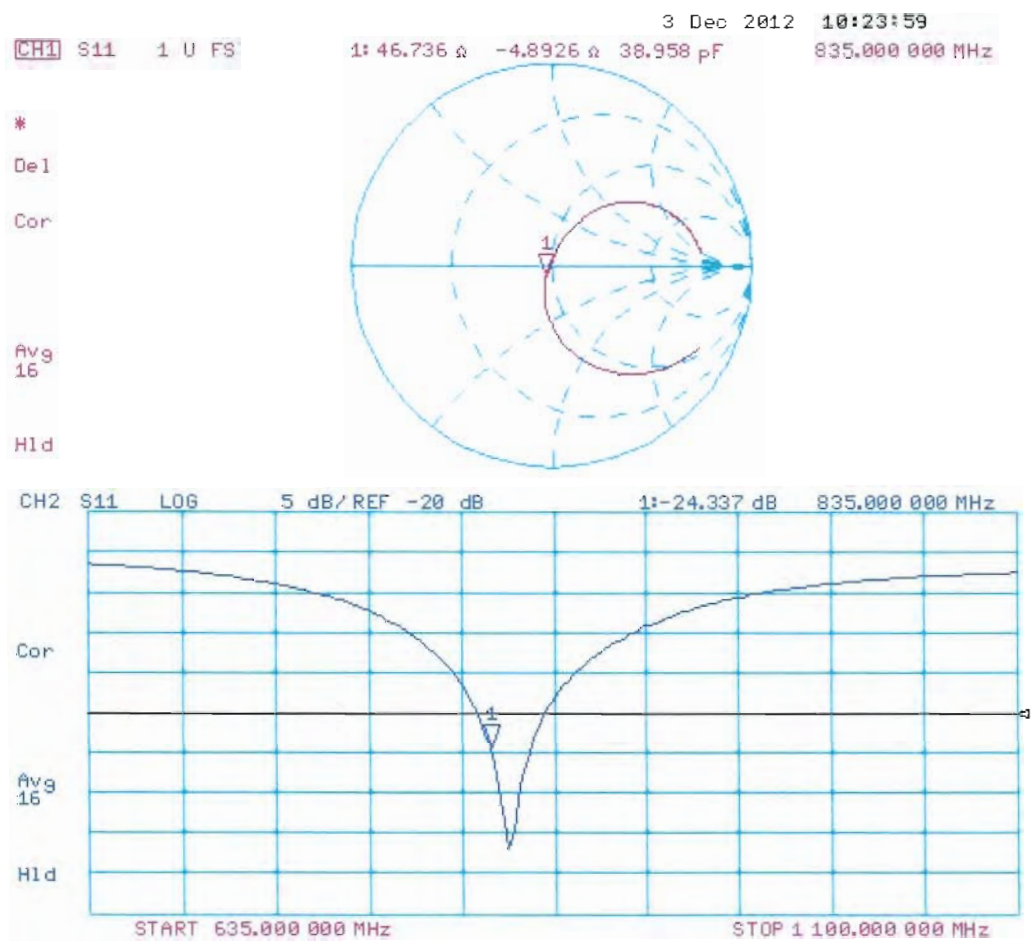
Peak SAR (extrapolated) = 3.53 W/kg

SAR(1 g) = 2.42 W/kg; SAR(10 g) = 1.59 W/kg

Maximum value of SAR (measured) = 2.80 W/kg



Impedance Measurement Plot for Body TSL



Dipole D835V2 – SN: 480 Antenna Parameters measured: 2014-01-31.

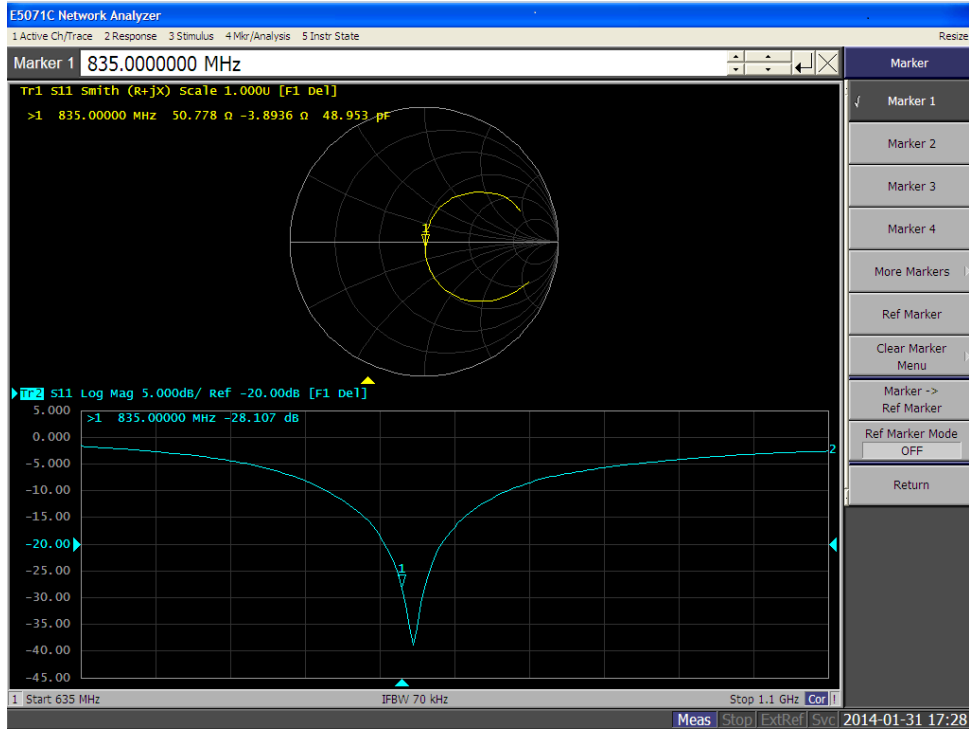
Antenna Parameters with Head TSL

	Calibration certificate	Annual measurement
Impedance, transformed to feed point	50.8 Ω - 3.3 j Ω	50.8 Ω -3.9 j Ω
Return loss	-29.4 dB	-28.1 dB

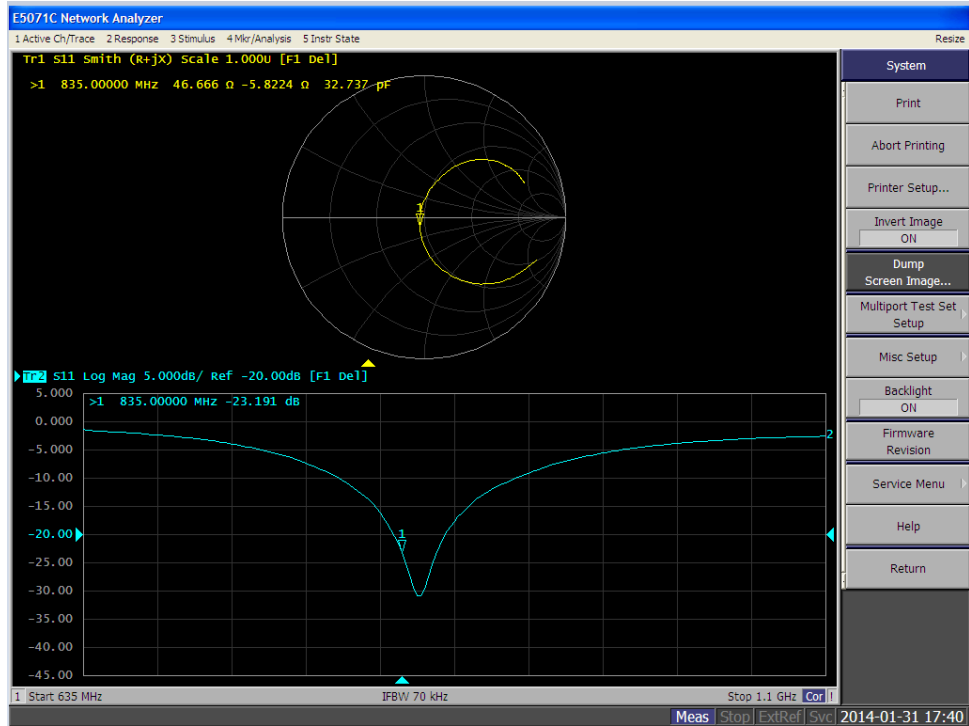
Antenna Parameters with Body TSL

	Calibration certificate	Annual measurement
Impedance, transformed to feed point	47.4 Ω - 3.8 j Ω	46.7 Ω -5.8 j Ω
Return loss	-26.5 dB	-23.2 dB

Impedance Measurement Plot for Head TSL 83



Impedance Measurement Plot for Body TSL 835





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Client **Nokia Salo TCC**

Certificate No: **D1900V2-5d013_Dec12**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d013**

Calibration procedure(s) **QA CAL-05.v8**
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **December 06, 2012**

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 $(22 \pm 3)^\circ\text{C}$ 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	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.3 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

Calibrated by:	Name Israe El-Naouq	Function Laboratory Technician	Signature
Approved by:	Katja Pokovic	Technical Manager	

Issued: December 6, 2012

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Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- 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
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.3
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	39.5 $\pm$ 6 %	1.38 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	40.6 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	21.2 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	52.2 $\pm$ 6 %	1.52 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.3 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	41.0 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.41 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.6 W/kg $\pm$ 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$52.3 \Omega + 6.2 j\Omega$
Return Loss	- 23.8 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$48.4 \Omega + 5.9 j\Omega$
Return Loss	- 24.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.194 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	April 30, 2002

DASY5 Validation Report for Head TSL

Date: 06.12.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d013

Communication System: CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.38$ mho/m; $\epsilon_r = 39.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.01, 5.01, 5.01); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

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

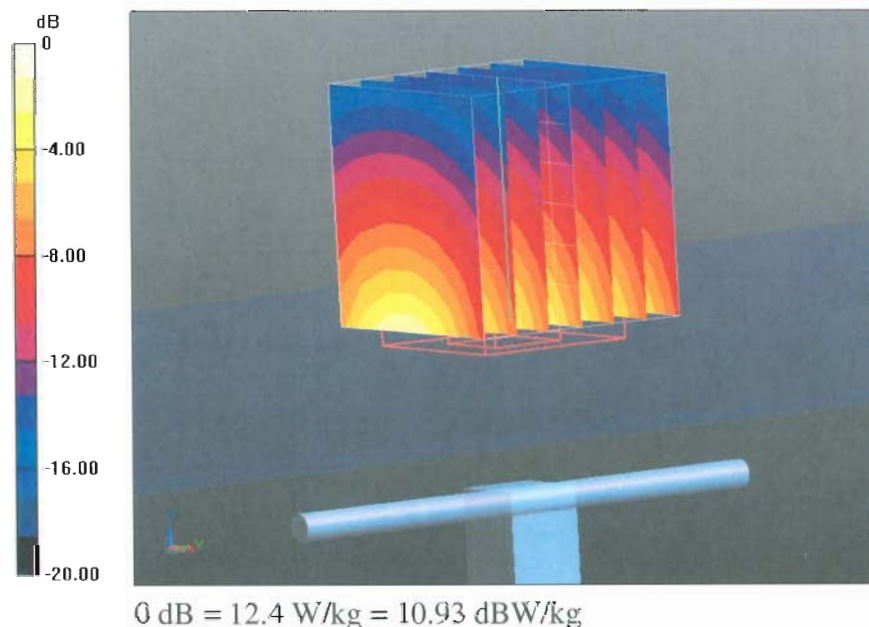
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 97.748 V/m; Power Drift = 0.04 dB

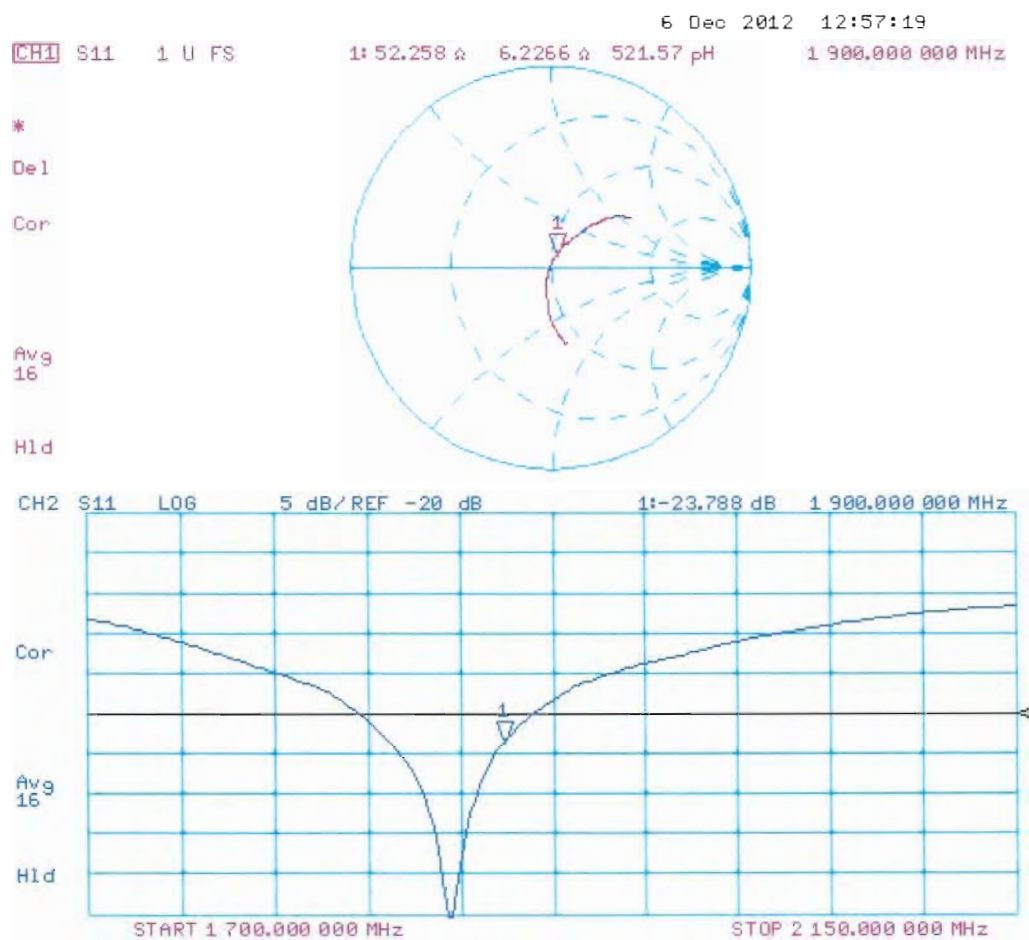
Peak SAR (extrapolated) = 18.0 W/kg

SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.28 W/kg

Maximum value of SAR (measured) = 12.4 W/kg



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 06.12.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d013

Communication System: CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.52$ mho/m; $\epsilon_r = 52.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.62, 4.62, 4.62); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

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

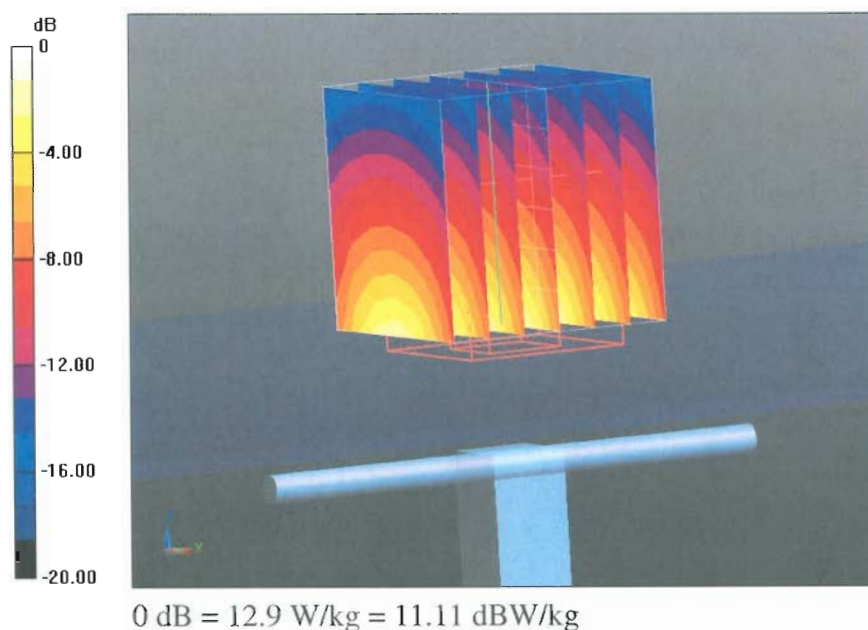
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.039 V/m; Power Drift = 0.04 dB

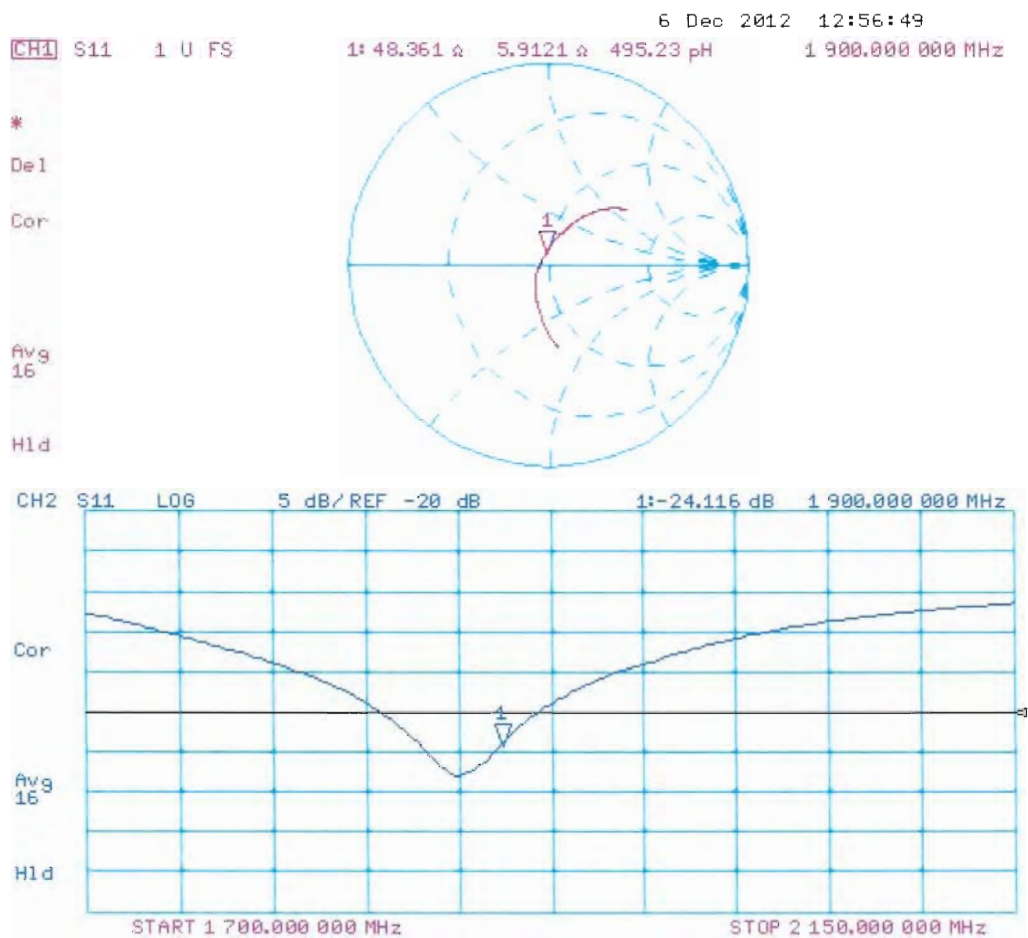
Peak SAR (extrapolated) = 18.0 W/kg

SAR(1 g) = 10.3 W/kg; SAR(10 g) = 5.41 W/kg

Maximum value of SAR (measured) = 12.9 W/kg



Impedance Measurement Plot for Body TSL



Dipole D1900V2 - SN5d013 Antenna Parameters measured: 2014-01-31.

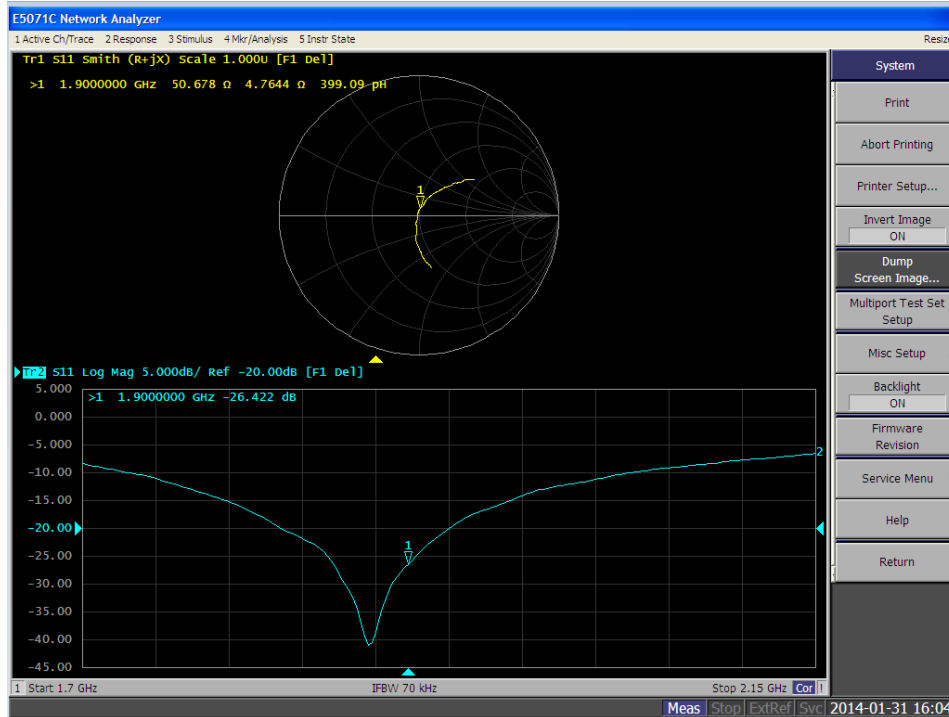
Antenna Parameters with Head TSL

	Calibration certificate	Annual measurement
Impedance, transformed to feed point	52.3 Ω 6.2 j Ω	50.7 Ω 4.8 j Ω
Return loss	-23.8 dB	-26.4 dB

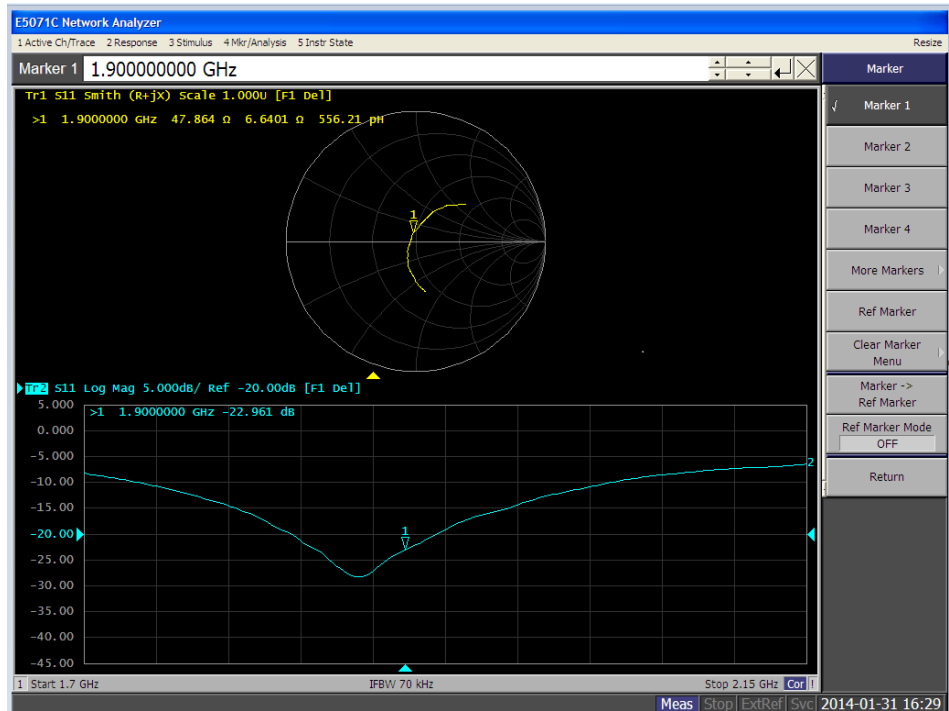
Antenna Parameters with Body TSL

	Calibration certificate	Annual measurement
Impedance, transformed to feed point	48.4 Ω 5.9 j Ω	47.9 Ω 6.6 j Ω
Return loss	-24.1 dB	-23.0 dB

Impedance Measurement Plot for Head TSL 1900



Impedance Measurement Plot for Body TSL 1900





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Client **Nokia Salo TCC**

Certificate No: **D2450V2-749_Dec12**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 749**

Calibration procedure(s) **QA CAL-05.v8**
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **December 07, 2012**

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	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.3 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

Calibrated by: **Name** **Leif Klysner** **Function** **Laboratory Technician**

Signature

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

Issued: December 7, 2012

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



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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:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- 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
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.3
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 $\pm$ 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 $\pm$ 0.2) °C	38.2 $\pm$ 6 %	1.84 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.7 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	53.9 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.35 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	25.2 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	50.7 $\pm$ 6 %	2.02 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.2 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	51.5 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.08 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	24.0 W/kg $\pm$ 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$52.6 \Omega + 3.4 j\Omega$
Return Loss	- 27.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$49.5 \Omega + 4.3 j\Omega$
Return Loss	- 27.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.163 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 01, 2003

DASY5 Validation Report for Head TSL

Date: 07.12.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 749

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.84$ mho/m; $\epsilon_r = 38.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.45, 4.45, 4.45); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

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

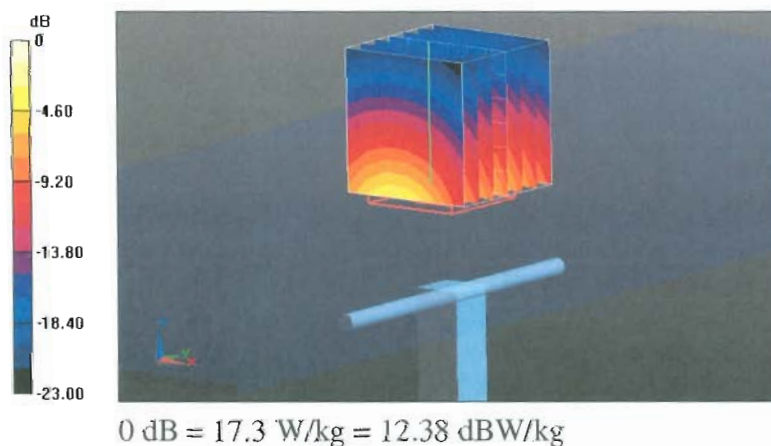
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 99.608 V/m; Power Drift = 0.00 dB

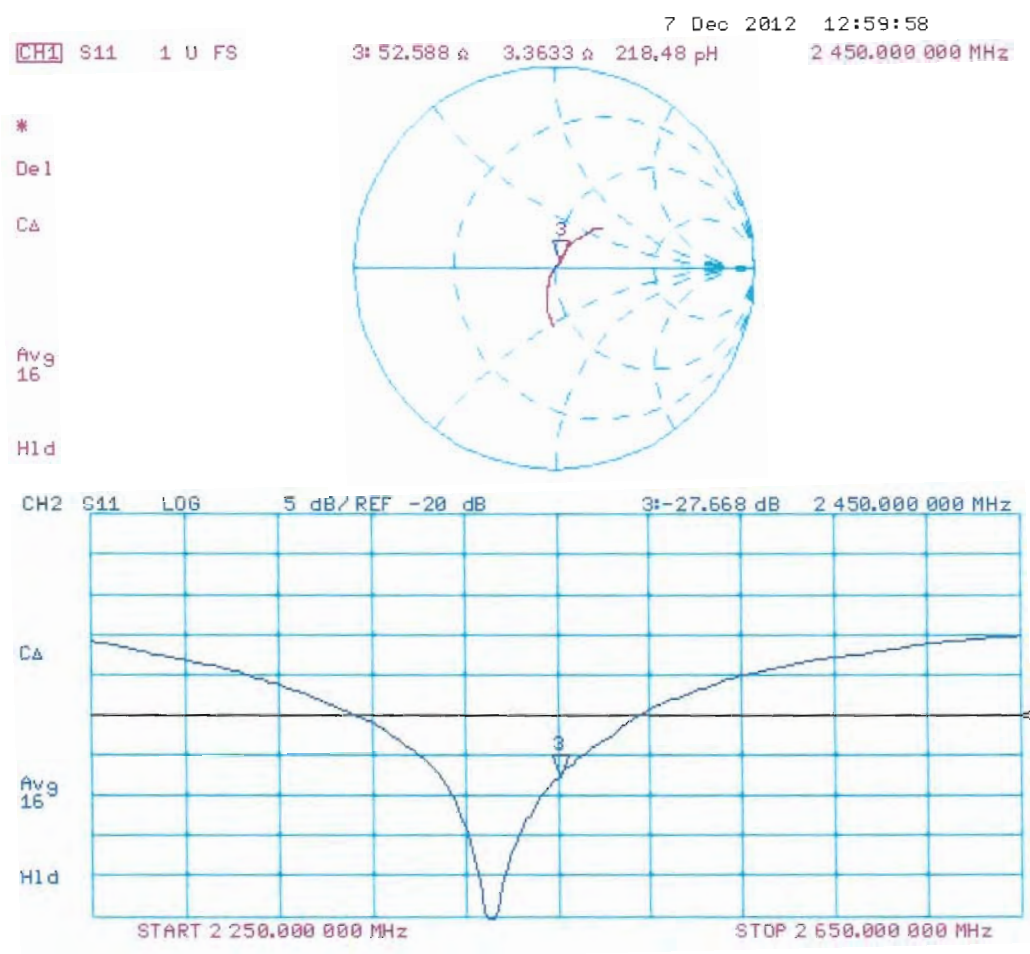
Peak SAR (extrapolated) = 28.2 W/kg

SAR(1 g) = 13.7 W/kg; SAR(10 g) = 6.35 W/kg

Maximum value of SAR (measured) = 17.3 W/kg



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 07.12.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 749

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 2.02$ mho/m; $\epsilon_r = 50.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.26, 4.26, 4.26); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm 2/Zoom Scan (7x7x7)/Cube 0:

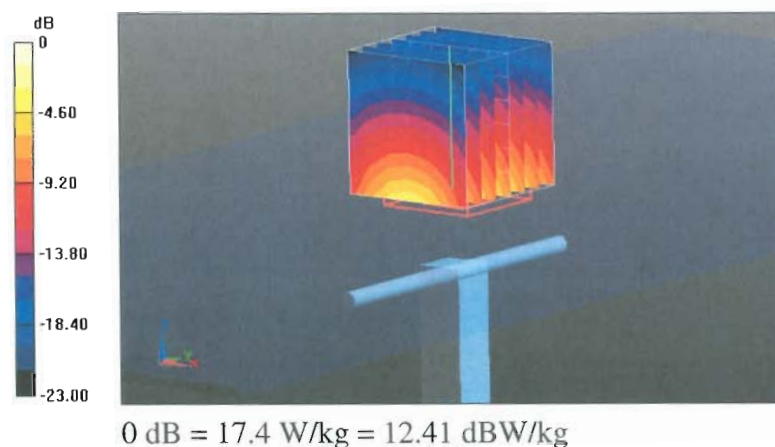
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.139 V/m; Power Drift = -0.00 dB

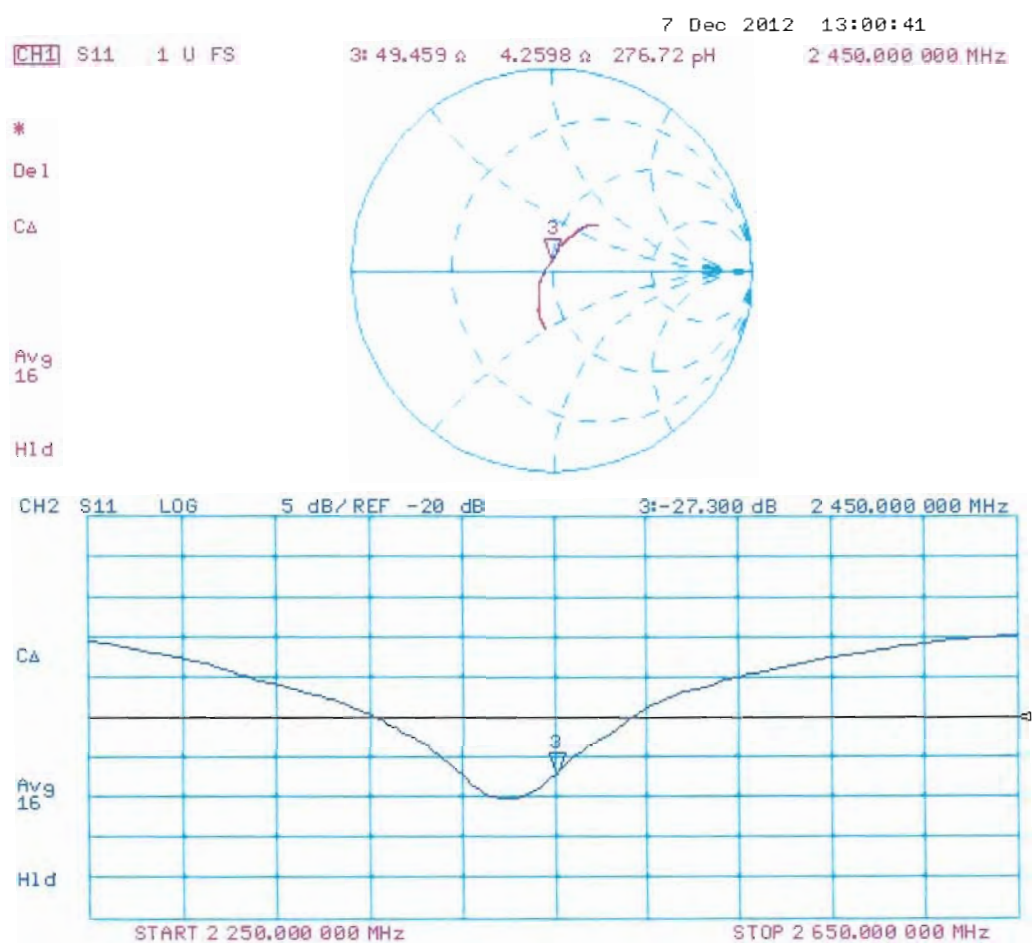
Peak SAR (extrapolated) = 27.4 W/kg

SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.08 W/kg

Maximum value of SAR (measured) = 17.4 W/kg



Impedance Measurement Plot for Body TSL



Dipole D2450V2 – SN:749 Antenna Parameters measured: 2014-01-14.

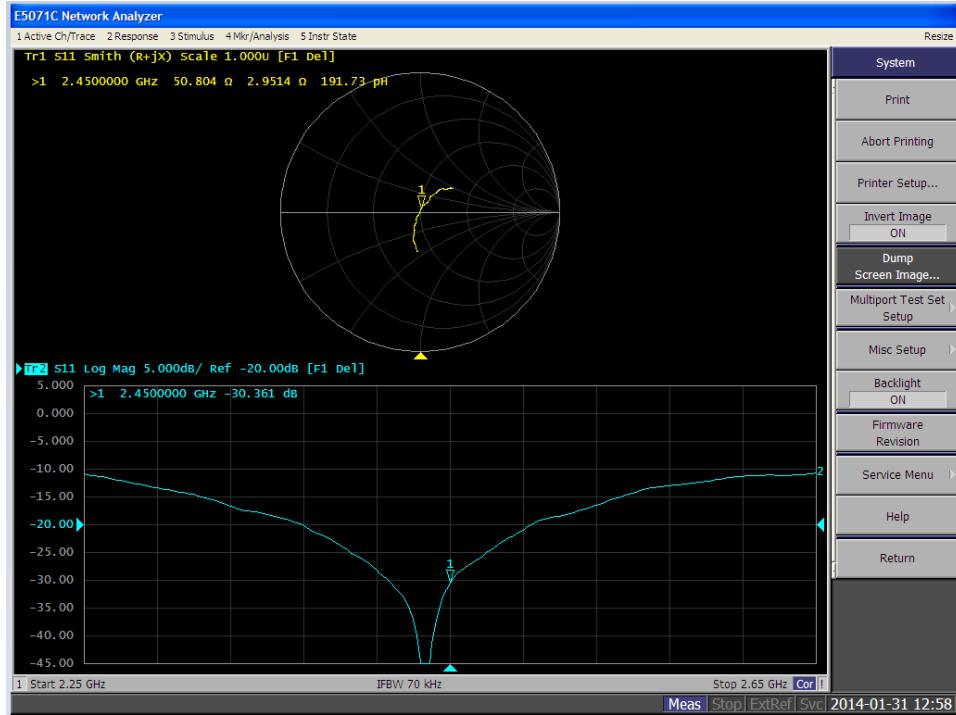
Antenna Parameters with Head TSL

	Calibration certificate	Annual measurement
Impedance, transformed to feed point	52.6 Ω - 3.4 j Ω	50.8 Ω - 3.0 j Ω
Return loss	-27.7 dB	-30.4 dB

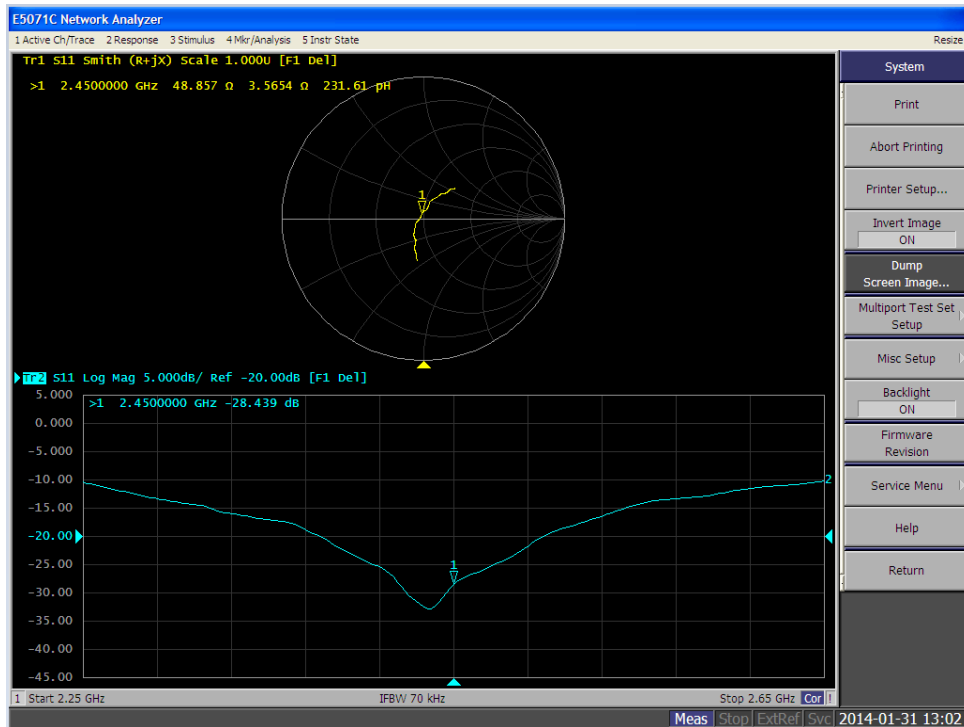
Antenna Parameters with Body TSL

	Calibration certificate	Annual measurement
Impedance, transformed to feed point	49.5 Ω - 4.3 j Ω	48.9 Ω - 3.6 j Ω
Return loss	-27.3 dB	-28.4 dB

Impedance Measurement Plot for Head TSL 2450



Impedance Measurement Plot for Body TSL 2450



APPENDIX G: CONDUCTED POWER MEASUREMENTS FOR SUPPORTED GSM/GPRS/EGPRS TRANSMISSION MODES

G.1 Power Tuning Targets

GSM/GPRS/EGPRS850 Tuning targets for Head and Body-worn			
Slot configuration	Low channel	Mid channel	High channel
GSM 1-slot	32.5	32.5	32.5
GPRS 2-slot	30	30	30
GPRS 3-slot	28.2	28.2	28.2
GPRS 4-slot	27	27	27
EGPRS 1-slot	26.5	26.5	26.5
EGPRS 2-slot	26.5	26.5	26.5
EGPRS 3-slot	25.7	25.7	25.7
EGPRS 4-slot	24.5	24.5	24.5

GSM/GPRS/EGPRS1900 Tuning targets for Head and Body-worn			
Slot configuration	Low channel	Mid channel	High channel
GSM 1-slot	29.5	29.5	29.5
GPRS 2-slot	27.5	27.5	27.5
GPRS 3-slot	25.7	25.7	25.7
GPRS 4-slot	24.5	24.5	24.5
EGPRS 1-slot	25.5	25.5	25.5
EGPRS 2-slot	25.5	25.5	25.5
EGPRS 3-slot	25	25	25
EGPRS 4-slot	24	24	24

GSM/GPRS/EGPRS850 Tuning targets for Wireless Router			
Slot configuration	Low channel	Mid channel	High channel
GSM 1-slot	32	32	32
GPRS 2-slot	29.5	29.5	29.5
GPRS 3-slot	27.7	27.7	27.7
GPRS 4-slot	26.5	26.5	26.5
EGPRS 1-slot	26.5	26.5	26.5
EGPRS 2-slot	26.5	26.5	26.5
EGPRS 3-slot	25.7	25.7	25.7
EGPRS 4-slot	24.5	24.5	24.5

GSM/GPRS/EGPRS1900 Tuning targets for Wireless Router			
Slot configuration	Low channel	Mid channel	High channel
GSM 1-slot	26.5	26.5	26.5
GPRS 2-slot	23.5	23.5	23.5
GPRS 3-slot	21.7	21.7	21.7
GPRS 4-slot	20.5	20.5	20.5
EGPRS 1-slot	25.5	25.5	25.5
EGPRS 2-slot	22.5	22.5	22.5
EGPRS 3-slot	21.2	21.2	21.2
EGPRS 4-slot	19.5	19.5	19.5

G.2 Conducted Power from the Samples used in the Testing

Type: RM-1020; Serial number 004402/47/832326/8; 004402/47/832327/6 used for GSM/GPRS/EGPRS850 SAR Head and Body-worn.

GSM/GPRS/EGPRS850 Conducted powers for Head and Body-worn			
Slot configuration	Low channel	Mid channel	High channel
GSM 1-slot	32.6	32.6	32.6
GPRS 2-slot	30.0	30.0	29.9
GPRS 3-slot	28.2	28.2	28.1
GPRS 4-slot	27.0	27.0	26.9
EGPRS 1-slot	26.6	26.4	26.2
EGPRS 2-slot	26.5	26.3	26.3
EGPRS 3-slot	25.9	25.7	25.7
EGPRS 4-slot	24.3	24.2	24.1

Type: RM-1020; Serial number 004402/47/832288/0; 004402/47/832289/8 used for GSM/GPRS/EGPRS1900 SAR Head and Body-worn measurements.

GSM/GPRS/EGPRS1900 Conducted powers for Head and Body-worn			
Slot configuration	Low channel	Mid channel	High channel
GSM 1-slot	29.5	29.6	29.6
GPRS 2-slot	27.6	27.6	27.6
GPRS 3-slot	25.9	25.8	25.8
GPRS 4-slot	24.4	24.5	24.5
EGPRS 1-slot	25.8	25.5	25.5
EGPRS 2-slot	25.6	25.5	25.5
EGPRS 3-slot	25.2	25.2	25.1
EGPRS 4-slot	24.0	24.0	24.0

Type: RM-1020; Serial number 004402/47/832294/8; 004402/47/832295/5 used for GSM/GPRS/EGPRS850 SAR Wireless Router measurements.

GSM/GPRS/EGPRS850 Conducted powers for Wireless Router			
Slot configuration	Low channel	Mid channel	High channel
GSM 1-slot	32.0	31.9	31.9
GPRS 2-slot	29.4	29.4	29.3
GPRS 3-slot	27.7	27.7	27.6
GPRS 4-slot	26.4	26.3	26.3
EGPRS 1-slot	26.6	26.4	26.4
EGPRS 2-slot	26.6	26.4	26.3
EGPRS 3-slot	25.7	25.5	25.5
EGPRS 4-slot	24.6	24.5	24.5

Type: RM-1020; Serial number 004402/47/832290/6; 004402/47/832291/4 used for GSM/GPRS/EGPRS1900 SAR Wireless Router measurements.

GSM/GPRS/EGPRS1900 Conducted powers for Wireless Router			
Slot configuration	Low channel	Mid channel	High channel
GSM 1-slot	26.1	26.2	26.2
GPRS 2-slot	23.2	23.2	23.1
GPRS 3-slot	21.5	21.6	21.3
GPRS 4-slot	20.3	20.4	20.3
EGPRS 1-slot	25.2	25.1	25.1
EGPRS 2-slot	22.3	22.3	22.3
EGPRS 3-slot	20.9	21.0	20.9
EGPRS 4-slot	19.3	19.4	19.4

APPENDIX H: CONDUCTED POWER MEASUREMENTS FOR SUPPORTED WCDMA TRANSMISSION MODES

H.1 Power Tuning Targets

WCDMA 850 (Band 5) Head, Body-worn and Wireless Router			
Mode	Low channel	Mid channel	High channel
WCDMA	23.5	23.5	23.5

WCDMA1900 (Band 2) Head and Body-worn			
Mode	Low channel	Mid channel	High channel
WCDMA	22.0	22.0	22.0

WCDMA1900 (Band 2) Wireless Router			
Mode	Low channel	Mid channel	High channel
WCDMA	17.5	17.5	17.5

H.2 Conducted Power from the Samples used in the Testing

Type: RM-1020; Serial: 004402/47/832326/8; 004402/47/832327/6, HW: 1530 used for WCDMA850 (Band 5) Head, Body-worn and Wireless router SAR measurements

WCDMA850 (Band 5)				
HW	Mode	Low channel	Mid channel	High channel
1530	WCDMA	23.4	23.4	23.5

Type: RM-1020; Serial: 004402/47/832288/0; 004402/47/832289/8, HW: 1530 used for WCDMA1900 (Band 2) Head and Body-worn measurements

WCDMA1900 (Band 2)				
HW	Mode	Low channel	Mid channel	High channel
1530	WCDMA	21.9	22.1	21.9

Type: RM-1020; Serial: 004402/47/832290/6; 004402/47/832291/4, HW: 1530 used for WCDMA1900 (Band 2) Wireless Router measurements

WCDMA1900 (Band 2)				
HW	Mode	Low channel	Mid channel	High channel
1530	WCDMA	17.3	17.5	17.4

WCDMA and HSUPA Subtest mode conducted powers, measured from a separate, fully representative sample are presented in Appendix D.

APPENDIX I: CONDUCTED POWER MEASUREMENTS FOR SUPPORTED WLAN TRANSMISSION MODES

I.1 Power Tuning Targets

WLAN 2.4GHz: 20MHz channel bandwidth, tuning targets								
Standard	Modulation	Data speed [Mbps]	CH 1	CH 2	CH 3	CH 4	CH 5	CH 6
802.11b	BPSK	1	17	17	17	17	17	17
802.11b	QPSK	2	17	17	17	17	17	17
802.11b	QPSK	5.5	17	17	17	17	17	17
802.11b	QPSK	11	17	17	17	17	17	17
802.11g	BPSK	6	16.5	16.5	16.5	16.5	16.5	16.5
802.11g	BPSK	9	16.5	16.5	16.5	16.5	16.5	16.5
802.11g	QPSK	12	16.5	16.5	16.5	16.5	16.5	16.5
802.11g	QPSK	18	16.5	16.5	16.5	16.5	16.5	16.5
802.11g	16QAM	24	16.5	16.5	16.5	16.5	16.5	16.5
802.11g	16QAM	36	16	16	16	16	16	16
802.11g	64QAM	48	14	14	14	14	14	14
802.11g	64QAM	54	13	13	13	13	13	13
802.11n	BPSK	6.5 / 7.25	16.5	16.5	16.5	16.5	16.5	16.5
802.11n	QPSK	13.0 / 14.4	16.5	16.5	16.5	16.5	16.5	16.5
802.11n	QPSK	19.5 / 21.7	16.5	16.5	16.5	16.5	16.5	16.5
802.11n	16QAM	26.0 / 28.9	16.5	16.5	16.5	16.5	16.5	16.5
802.11n	16QAM	39.0 / 43.3	15	15	15	15	15	15
802.11n	64QAM	52.0 / 57.8	13.5	13.5	13.5	13.5	13.5	13.5
802.11n	64QAM	58.5 / 65.0	12	12	12	12	12	12
802.11n	64QAM	65.0 / 72.2	11	11	11	11	11	11
802.11n	BPSK	13.0 / 14.4	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	QPSK	26.0 / 28.9	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	QPSK	39.0 / 43.3	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	16QAM	52.0 / 57.8	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	16QAM	78.0 / 86.7	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	64QAM	104.0 / 115.6	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	64QAM	117.0 / 13N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	64QAM	13N/A / 144.4	N/A	N/A	N/A	N/A	N/A	N/A

(WLAN 2.4 GHz tuning target table continues)

(WLAN 2.4 GHz tuning target table continues)

WLAN 2.4GHz: 20MHz channel bandwidth, tuning targets							
Standard	Modulation	Data speed [Mbps]	CH 7	CH 8	CH 9	CH 10	CH 11
802.11b	BPSK	1	17	17	17	17	17
802.11b	QPSK	2	17	17	17	17	17
802.11b	QPSK	5.5	17	17	17	17	17
802.11b	QPSK	11	17	17	17	17	17
802.11g	BPSK	6	16.5	16.5	16.5	16.5	16.5
802.11g	BPSK	9	16.5	16.5	16.5	16.5	16.5
802.11g	QPSK	12	16.5	16.5	16.5	16.5	16.5
802.11g	QPSK	18	16.5	16.5	16.5	16.5	16.5
802.11g	16QAM	24	16.5	16.5	16.5	16.5	16.5
802.11g	16QAM	36	16	16	16	16	16
802.11g	64QAM	48	14	14	14	14	14
802.11g	64QAM	54	13	13	13	13	13
802.11n	BPSK	6.5 / 7.25	16.5	16.5	16.5	16.5	16.5
802.11n	QPSK	13.0 / 14.4	16.5	16.5	16.5	16.5	16.5
802.11n	QPSK	19.5 / 21.7	16.5	16.5	16.5	16.5	16.5
802.11n	16QAM	26.0 / 28.9	16.5	16.5	16.5	16.5	16.5
802.11n	16QAM	39.0 / 43.3	15	15	15	15	15
802.11n	64QAM	52.0 / 57.8	13.5	13.5	13.5	13.5	13.5
802.11n	64QAM	58.5 / 65.0	12	12	12	12	12
802.11n	64QAM	65.0 / 72.2	11	11	11	11	11
802.11n	BPSK	13.0 / 14.4	N/A	N/A	N/A	N/A	N/A
802.11n	QPSK	26.0 / 28.9	N/A	N/A	N/A	N/A	N/A
802.11n	QPSK	39.0 / 43.3	N/A	N/A	N/A	N/A	N/A
802.11n	16QAM	52.0 / 57.8	N/A	N/A	N/A	N/A	N/A
802.11n	16QAM	78.0 / 86.7	N/A	N/A	N/A	N/A	N/A
802.11n	64QAM	104.0 / 115.6	N/A	N/A	N/A	N/A	N/A
802.11n	64QAM	117.0 / 13N/A	N/A	N/A	N/A	N/A	N/A
802.11n	64QAM	13N/A / 144.4	N/A	N/A	N/A	N/A	N/A

I.2 Conducted Power from the Sample used in the Testing

Type: RM-1020; Serial number 004402/47/832332/6; 004402/47/832333/4 used for WLAN2450 SAR Head, Body-worn and Wireless Router measurements.

WLAN 2.4GHz: 20MHz channel bandwidth, measured values								
Standard	Modulation	Data speed [Mbps]	CH 1	CH 2 *	CH3	CH 4	CH 5	CH 6
802.11b	BPSK	1	17.5	17.0	17.0	17.0	17.0	17.1
802.11b	QPSK	2	17.4	17.0	17.0	17.0	17.0	17.0
802.11b	QPSK	5.5	17.6	17.7	17.6	17.3	17.3	17.4
802.11b	QPSK	11	17.3	17.5	17.5	17.1	17.2	17.3
802.11g	BPSK	6	13.3	16.7	16.8	16.5	16.5	16.7
802.11g	BPSK	9	13.2	16.7	16.8	16.5	16.6	16.7
802.11g	QPSK	12	13.3	16.7	16.7	16.4	16.6	16.8
802.11g	QPSK	18	13.3	16.8	16.8	16.6	16.7	16.8
802.11g	16QAM	24	13.3	16.8	16.7	16.6	16.7	16.8
802.11g	16QAM	36	13.4	16.7	16.6	16.4	16.6	16.6
802.11g	64QAM	48	13.1	15.0	15.1	14.9	14.9	15.0
802.11g	64QAM	54	13.0	14.0	14.2	13.8	14.0	14.1
802.11n	BPSK	6.5 / 7.25	13.1	16.8	16.8	16.6	16.7	16.8
802.11n	QPSK	13.0 / 14.4	13.1	16.9	17.0	16.7	16.8	16.8
802.11n	QPSK	19.5 / 21.7	13.2	16.9	17.0	16.7	16.8	16.9
802.11n	16QAM	26.0 / 28.9	13.2	16.9	17.0	16.8	16.9	16.9
802.11n	16QAM	39.0 / 43.3	13.3	15.7	15.9	15.6	15.6	15.8
802.11n	64QAM	52.0 / 57.8	13.2	14.6	14.7	14.3	14.4	14.4
802.11n	64QAM	58.5 / 65.0	12.9	13.2	13.4	13.0	13.1	13.2
802.11n	64QAM	65.0 / 72.2	12.0	12.3	12.4	12.2	12.2	12.3
802.11n	BPSK	13.0 / 14.4	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	QPSK	26.0 / 28.9	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	QPSK	39.0 / 43.3	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	16QAM	52.0 / 57.8	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	16QAM	78.0 / 86.7	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	64QAM	104.0 / 115.6	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	64QAM	117.0 / 13N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	64QAM	13N/A / 144.4	N/A	N/A	N/A	N/A	N/A	N/A

(WLAN 2.4 GHz conducted power table continues)

(WLAN 2.4 GHz conducted power table continues)

WLAN 2.4GHz: 20MHz channel bandwidth, measured values									
Standard	Modulation	Data speed [Mbps]	CH 7	CH 8	CH 9	CH 10 *	CH 11	CH 12 *	CH 13
802.11b	BPSK	1	17.1	17.0	17.0	17.2	17.3	17.1	17.0
802.11b	QPSK	2	17.1	17.0	17.0	17.2	17.3	17.1	17.0
802.11b	QPSK	5.5	17.5	17.4	17.0	17.3	17.5	17.5	17.4
802.11b	QPSK	11	17.4	17.3	17.0	17.1	17.4	17.4	17.3
802.11g	BPSK	6	16.7	16.6	16.5	16.6	13.2	16.7	16.6
802.11g	BPSK	9	16.7	16.7	16.5	16.6	13.1	16.7	16.7
802.11g	QPSK	12	16.8	16.6	16.5	16.7	13.2	16.8	16.6
802.11g	QPSK	18	16.8	16.7	16.5	16.7	13.3	16.8	16.7
802.11g	16QAM	24	16.9	16.8	16.5	16.8	13.3	16.9	16.8
802.11g	16QAM	36	16.6	16.5	16.0	16.6	13.2	16.6	16.5
802.11g	64QAM	48	14.9	14.8	14.4	14.8	13.1	14.9	14.8
802.11g	64QAM	54	14.1	14.0	13.4	14.0	13.1	14.1	14.0
802.11n	BPSK	6.5 / 7.25	16.8	16.7	16.5	16.7	13.0	16.8	16.7
802.11n	QPSK	13.0 / 14.4	16.9	16.8	16.5	16.7	13.0	16.9	16.8
802.11n	QPSK	19.5 / 21.7	16.9	16.9	16.5	16.8	13.1	16.9	16.9
802.11n	16QAM	26.0 / 28.9	16.9	16.8	16.5	16.8	13.1	16.9	16.8
802.11n	16QAM	39.0 / 43.3	15.8	15.7	15.2	15.7	13.0	15.8	15.7
802.11n	64QAM	52.0 / 57.8	14.4	14.4	13.8	14.3	13.3	14.4	14.4
802.11n	64QAM	58.5 / 65.0	13.1	12.9	12.4	13.0	12.8	13.1	12.9
802.11n	64QAM	65.0 / 72.2	12.2	12.2	11.6	12.2	11.8	12.2	12.2
802.11n	BPSK	13.0 / 14.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	QPSK	26.0 / 28.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	QPSK	39.0 / 43.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	16QAM	52.0 / 57.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	16QAM	78.0 / 86.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	64QAM	104.0 / 115.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	64QAM	117.0 / 13N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	64QAM	13N/A / 144.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A