APPENDIX A: SYSTEM CHECKING SCANS

Plot #1

Date/Time: 2014-07-02 07:06:14

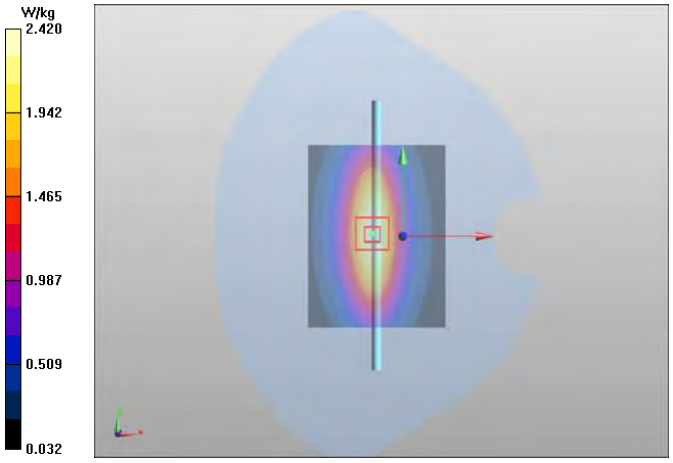
Test Laboratory: TCC Microsoft
Type: D750V3; Serial: D750V3 - SN:1010

Communication System: CW750
Frequency: 750 MHz; Duty Cycle: 1:1
Medium: HSL750; Medium Notes: T=21.5C
Medium parameters used: f = 750 MHz; σ = 0.89 S/m; ε_r = 41.059; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:
- Probe: ES3DV3 - SN3275
- ConvF(6.32, 6.32, 6.32); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn756; Calibrated: 2014-01-10
- Phantom: SAM4 2014-06-13; Type: GF-VE 20; Serial: TP-1701
- Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.9 (7117)

d=15mm, Pin=250mW/Area Scan (61x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 50.407 V/m
Fast SAR: SAR(1 g) = 2.12 W/kg
Fast SAR(10 g) = 1.44 W/kg
Maximum value of SAR (interpolated) = 2.42 W/kg

d=15mm, Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 50.407 V/m
Peak SAR (extrapolated) = 3.15 W/kg
SAR(1 g) = 2.08 W/kg
SAR(10 g) = 1.36 W/kg
Power Drift = -0.01 dB
Maximum value of SAR (measured) = 2.44 W/kg



Plot #2

Date/Time: 2014-07-09 13:50:30

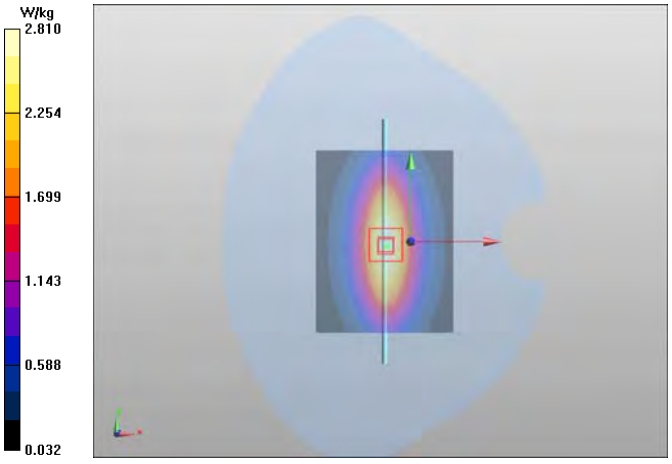
Test Laboratory: TCC Microsoft
Type: D835V2; Serial: D835V2 - SN 4d040

Communication System: CW835
Frequency: 835 MHz; Duty Cycle: 1:1
Medium: HSL800-900; Medium Notes: T=21.5C
Medium parameters used: f = 835 MHz; σ = 0.907 S/m; ε_r = 40.74; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:
- Probe: ES3DV3 - SN3275
- ConvF(6.12, 6.12, 6.12); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn756; Calibrated: 2014-01-10
- Phantom: SAM1 2014-06-13; Type: GF-VE 20; Serial: TP-1725
- Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.9 (7117)

d=15mm, Pin=250mW/Area Scan (61x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 54.472 V/m
Fast SAR: SAR(1 g) = 2.45 W/kg
Fast SAR(10 g) = 1.65 W/kg
Maximum value of SAR (interpolated) = 2.81 W/kg

d=15mm, Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 54.472 V/m
Peak SAR (extrapolated) = 3.56 W/kg
SAR(1 g) = 2.4 W/kg
SAR(10 g) = 1.56 W/kg
Power Drift = -0.12 dB
Maximum value of SAR (measured) = 2.80 W/kg



Plot #3

Date/Time: 2014-07-02 12:56:07

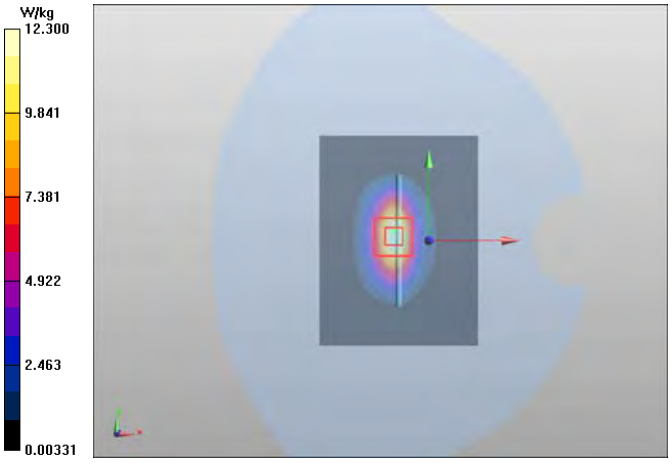
Test Laboratory: TCC Microsoft
Type: D1750V2; Serial: D1750V2 - SN:1081

Communication System: CW1750
Frequency: 1750 MHz; Duty Cycle: 1:1
Medium: HSL1750; Medium Notes:
Medium parameters used: f = 1750 MHz; σ = 1.375 S/m; ε_r = 40.222; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:
- Probe: ES3DV3 - SN3112
- ConvF(5.25, 5.25, 5.25); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1332; Calibrated: 2014-01-16
- Phantom: SAM1 2014-06-16; Type: GF-VE 20; Serial: TP-1735
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

d=10mm, Pin=250mW 2/Area Scan (61x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 86.459 V/m
Fast SAR: SAR(1 g) = 9.57 W/kg
Fast SAR(10 g) = 5.13 W/kg
Maximum value of SAR (interpolated) = 12.3 W/kg

d=10mm, Pin=250mW 2/Zoom Scan (5x6x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 86.459 V/m
Peak SAR (extrapolated) = 16.7 W/kg
SAR(1 g) = 9.35 W/kg
SAR(10 g) = 4.96 W/kg
Power Drift = 0.06 dB
Maximum value of SAR (measured) = 11.6 W/kg



Plot #4

Date/Time: 2014-06-24 11:22:39

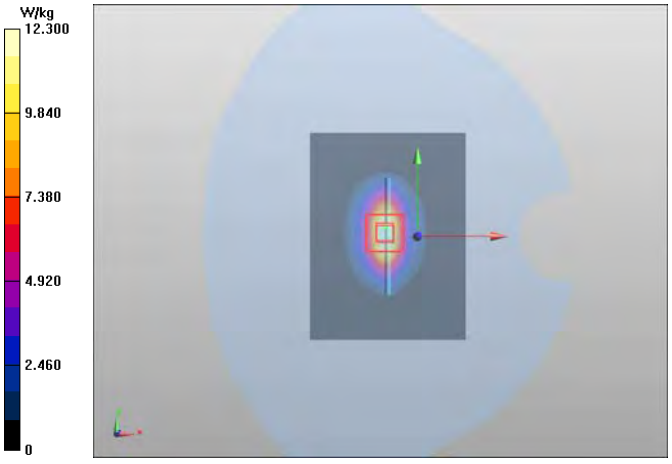
Test Laboratory: TCC Microsoft
Type: D1900V2; Serial: D1900V2 - SN:5d099

Communication System: CW1900
Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: HSL1900; Medium Notes: T= 21.5c
Medium parameters used: f = 1900 MHz; σ = 1.373 S/m; ε_r = 39.785; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:
- Probe: ES3DV3 - SN3112
- ConvF(5.11, 5.11, 5.11); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1332; Calibrated: 2014-01-16
- Phantom: SAM3 2014-06-16; Type: GF-VE 20; Serial: TP-1630
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

d=10mm, Pin=250mW 2/Area Scan (61x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 88.280 V/m
Fast SAR: SAR(1 g) = 9.52 W/kg
Fast SAR(10 g) = 4.89 W/kg
Maximum value of SAR (interpolated) = 12.3 W/kg

d=10mm, Pin=250mW 2/Zoom Scan (5x6x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 88.280 V/m
Peak SAR (extrapolated) = 16.7 W/kg
SAR(1 g) = 9.34 W/kg
SAR(10 g) = 4.91 W/kg
Power Drift = 0.00 dB
Maximum value of SAR (measured) = 11.6 W/kg



Plot #5

Date/Time: 2014-07-10 07:28:25

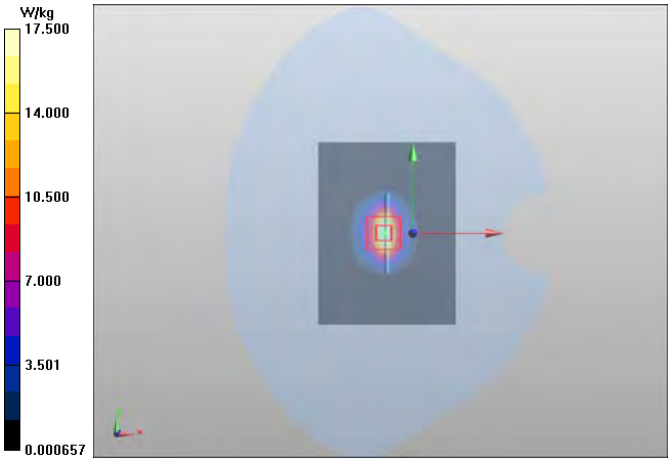
Test Laboratory: TCC Microsoft
Type: D2450V2; Serial: D2450V2 - SN:800

Communication System: CW2450
Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: HSL2450; Medium Notes: T=21.5C
Medium parameters used: f = 2450 MHz; σ = 1.777 S/m; ε_r = 39.481; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:
- Probe: EX3DV4 - SN3817
- ConvF(7.2, 7.2, 7.2); Calibrated: 2014-01-17;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1301; Calibrated: 2014-01-13
- Phantom: SAM4 2014-06-13; Type: GF-VE 20; Serial: TP-1736
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

d=10mm, Pin=250mW/Area Scan (61x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 90.837 V/m
Fast SAR: SAR(1 g) = 13.1 W/kg
Fast SAR(10 g) = 5.66 W/kg
Maximum value of SAR (interpolated) = 17.5 W/kg

d=10mm, Pin=250mW/Zoom Scan (5x6x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 90.837 V/m
Peak SAR (extrapolated) = 27.9 W/kg
SAR(1 g) = 13.5 W/kg
SAR(10 g) = 6.25 W/kg
Power Drift = 0.04 dB
Maximum value of SAR (measured) = 17.8 W/kg



Plot #6

Date/Time: 2014-07-14 16:06:23

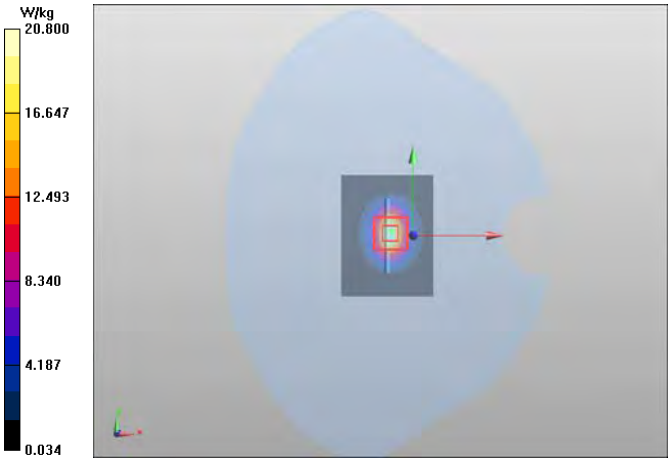
Test Laboratory: TCC Microsoft
Type: D2600V2; Serial: D2600V2 - SN:1064

Communication System: CW2600
Frequency: 2600 MHz; Duty Cycle: 1:1
Medium: HSL2300-2700; Medium Notes: T=21.5C
Medium parameters used: f = 2600 MHz; σ = 1.964 S/m; ε_r = 37.959; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:
- Probe: ES3DV3 - SN3275
- ConvF(4.25, 4.25, 4.25); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn756; Calibrated: 2014-01-10
- Phantom: SAM3 2014-06-13; Type: GF-VE20; Serial: TP-1421
- Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.9 (7117)

d=10mm, Pin=250mW/Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 94.449 V/m
Fast SAR: SAR(1 g) = 15.5 W/kg
Fast SAR(10 g) = 6.94 W/kg
Maximum value of SAR (interpolated) = 20.8 W/kg

d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.449 V/m
Peak SAR (extrapolated) = 31.9 W/kg
SAR(1 g) = 15.2 W/kg
SAR(10 g) = 6.82 W/kg
Power Drift = 0.06 dB
Maximum value of SAR (measured) = 20.0 W/kg



Plot #7

Date/Time: 2014-06-26 06:27:47

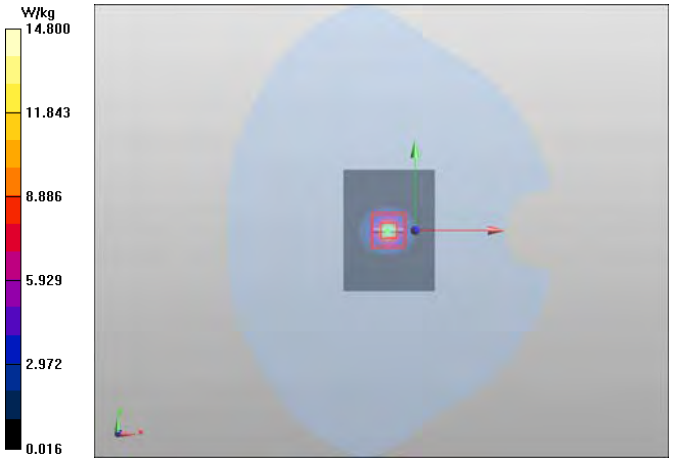
Test Laboratory: TCC Microsoft
Type: D5GHzV2; Serial: D5GHzV2 - SN: 1042

Communication System: CW5200
Frequency: 5200 MHz; Duty Cycle: 1:1
Medium: HSL5000; Medium Notes: T=21.5
Medium parameters used: f = 5200 MHz; σ = 4.451 S/m; ε_r = 36.374; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:
- Probe: EX3DV4 - SN3817
- ConvF(5.36, 5.36, 5.36); Calibrated: 2014-01-17;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1301; Calibrated: 2014-01-13
- Phantom: SAM1 2014-06-13; Type: GF VE 20; Serial: TP-1729
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

d=10mm, Pin=100mW/Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 14.8 W/kg

d=10mm, Pin=100mW/Zoom Scan (8x8x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 60.691 V/m
Peak SAR (extrapolated) = 30.5 W/kg
SAR(1 g) = 7.32 W/kg
SAR(10 g) = 2.1 W/kg
Power Drift = 0.04 dB
Maximum value of SAR (measured) = 14.5 W/kg



Plot #8

Date/Time: 2014-06-27 07:01:29

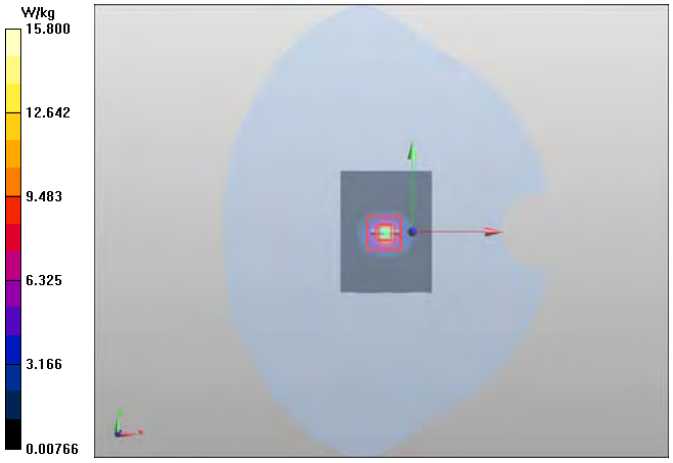
Test Laboratory: TCC Microsoft
Type: D5GHzV2; Serial: D5GHzV2 - SN: 1042

Communication System: CW5300
Frequency: 5300 MHz; Duty Cycle: 1:1
Medium: HSL5000; Medium Notes: T=21.5
Medium parameters used: f = 5300 MHz; σ = 4.579 S/m; ε_r = 36.45; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:
- Probe: EX3DV4 - SN3817
- ConvF(5.18, 5.18, 5.18); Calibrated: 2014-01-17;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1301; Calibrated: 2014-01-13
- Phantom: SAM1 2014-06-13; Type: GF VE 20; Serial: TP-1729
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

d=10mm, Pin=100mW/Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 15.8 W/kg

d=10mm, Pin=100mW/Zoom Scan (8x8x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 61.051 V/m
Peak SAR (extrapolated) = 32.3 W/kg
SAR(1 g) = 7.62 W/kg
SAR(10 g) = 2.17 W/kg
Power Drift = 0.04 dB
Maximum value of SAR (measured) = 15.5 W/kg



Plot #9

Date/Time: 2014-06-30 11:18:53

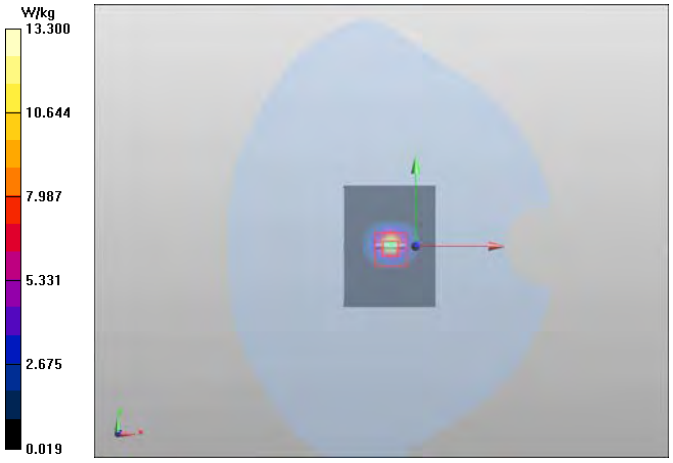
Test Laboratory: TCC Microsoft
Type: D5GHzV2; Serial: D5GHzV2 - SN: 1042

Communication System: CW5500
Frequency: 5500 MHz; Duty Cycle: 1:1
Medium: HSL5000; Medium Notes: T=21.5
Medium parameters used: f = 5500 MHz; σ = 4.74 S/m; ε_r = 35.974; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:
- Probe: EX3DV4 - SN3817
- ConvF(5.05, 5.05, 5.05); Calibrated: 2014-01-17;
- Sensor-Surface: 2mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1301; Calibrated: 2014-01-13
- Phantom: SAM1 2014-06-13; Type: GF VE 20; Serial: TP-1729
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

d=10mm, Pin=100mW/Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 13.3 W/kg

d=10mm, Pin=100mW/Zoom Scan (9x9x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 62.638 V/m
Peak SAR (extrapolated) = 33.7 W/kg
SAR(1 g) = 8.4 W/kg
SAR(10 g) = 2.4 W/kg
Power Drift = -0.01 dB
Maximum value of SAR (measured) = 16.3 W/kg



Plot #10

Date/Time: 2014-07-18 12:01:20

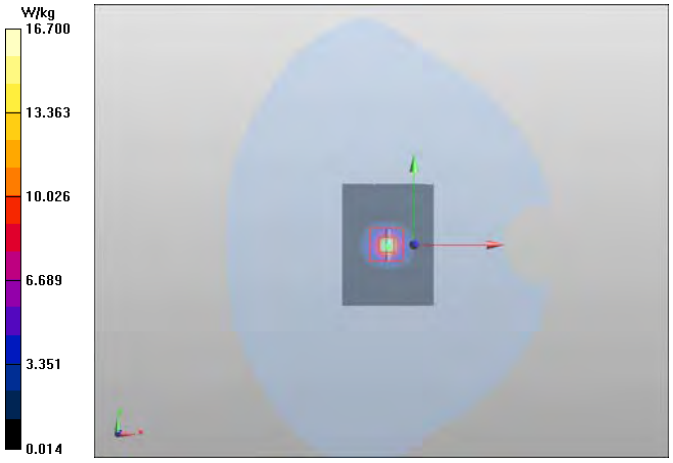
Test Laboratory: TCC Microsoft
Type: D5GHzV2; Serial: D5GHzV2 - SN: 1042

Communication System: CW5600
Frequency: 5600 MHz; Duty Cycle: 1:1
Medium: HSL5000; Medium Notes: T=21.5
Medium parameters used: f = 5600 MHz; σ = 4.884 S/m; ε_r = 36.242; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:
- Probe: EX3DV4 - SN3817
- ConvF(4.92, 4.92, 4.92); Calibrated: 2014-01-17;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1301; Calibrated: 2014-01-13
- Phantom: SAR3 SAM3 07 02 2014; Type: QD000P40CD; Serial: TP:1399
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

d=10mm, Pin=100mW/Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 16.7 W/kg

d=10mm, Pin=100mW/Zoom Scan (8x8x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 61.595 V/m
Peak SAR (extrapolated) = 34.6 W/kg
SAR(1 g) = 7.91 W/kg
SAR(10 g) = 2.24 W/kg
Power Drift = -0.01 dB
Maximum value of SAR (measured) = 16.1 W/kg



Plot #11

Date/Time: 2014-07-02 14:00:03

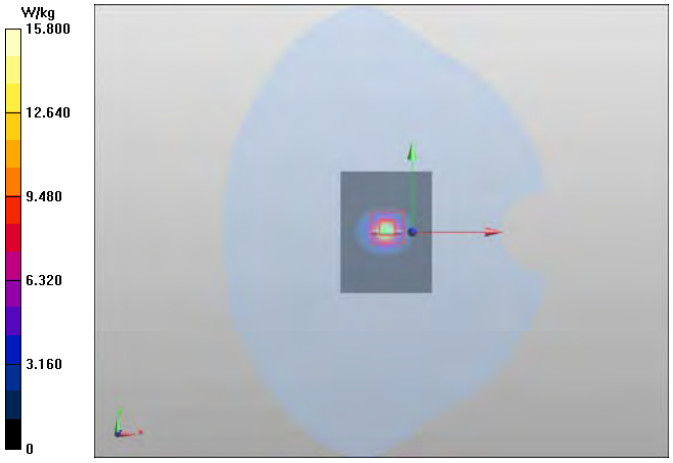
Test Laboratory: TCC Microsoft
Type: D5GHzV2; Serial: D5GHzV2 - SN: 1042

Communication System: CW5800
Frequency: 5800 MHz; Duty Cycle: 1:1
Medium: HSL5000; Medium Notes: T=21.5
Medium parameters used: f = 5800 MHz; σ = 5.214 S/m; ε_r = 36.3; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:
- Probe: EX3DV4 - SN3817
- ConvF(4.78, 4.78, 4.78); Calibrated: 2014-01-17;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1301; Calibrated: 2014-01-13
- Phantom: SAR3 SAM3 07 02 2014; Type: QD000P40CD; Serial: TP:1399
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

d=10mm, Pin=100mW/Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 15.8 W/kg

d=10mm, Pin=100mW/Zoom Scan (8x8x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 58.338 V/m
Peak SAR (extrapolated) = 34.0 W/kg
SAR(1 g) = 7.57 W/kg
SAR(10 g) = 2.14 W/kg
Power Drift = -0.02 dB
Maximum value of SAR (measured) = 15.7 W/kg



Plot #12

Date/Time: 2014-07-14 20:04:13

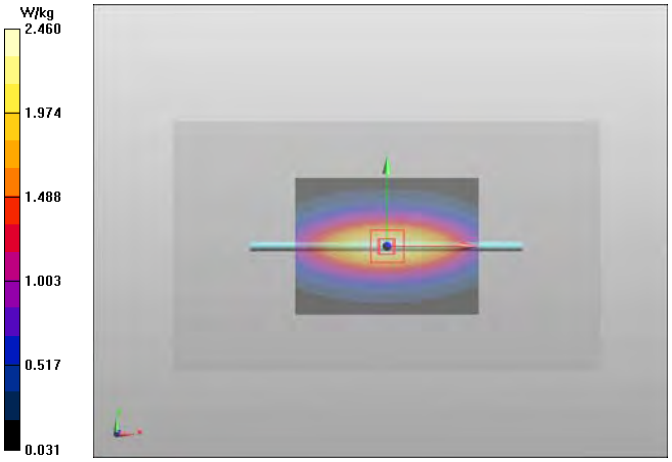
Test Laboratory: TCC Microsoft
Type: D750V3; Serial: D750V3 - SN:1010

Communication System: CW750
Frequency: 750 MHz; Duty Cycle: 1:1
Medium: BSL750; Medium Notes: T=21.5C
Medium parameters used: f = 750 MHz; σ = 0.943 S/m; ε_r = 54.795; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3275
- ConvF(6.03, 6.03, 6.03); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn756; Calibrated: 2014-01-10
- Phantom: TFP 5.1C 2014-06-13; Type: QD 000 P51 CA; Serial: 1128
- Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.9 (7117)

d=15mm, Pin=250mW/Area Scan (61x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 50.129 V/m
Fast SAR: SAR(1 g) = 2.15 W/kg
Fast SAR(10 g) = 1.46 W/kg
Maximum value of SAR (interpolated) = 2.46 W/kg

d=15mm, Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 50.129 V/m
Peak SAR (extrapolated) = 3.08 W/kg
SAR(1 g) = 2.11 W/kg
SAR(10 g) = 1.41 W/kg
Power Drift = -0.05 dB
Maximum value of SAR (measured) = 2.46 W/kg



Plot #13

Date/Time: 2014-07-31 11:32:17

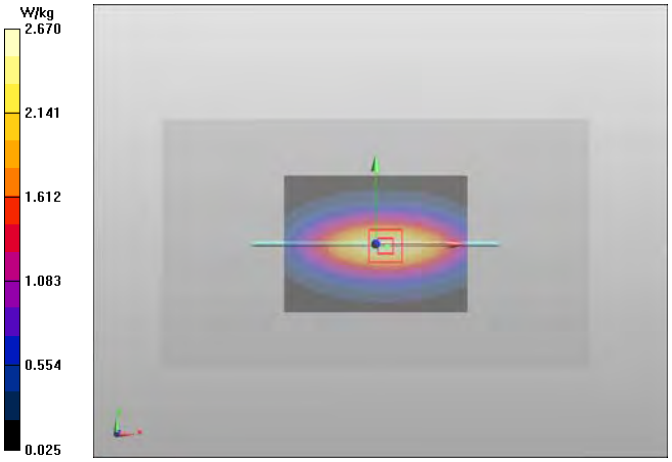
Test Laboratory: TCC Microsoft
Type: D835V2; Serial: D835V2 - SN 4d040

Communication System: CW835
Frequency: 835 MHz; Duty Cycle: 1:1
Medium: BSL800-900; Medium Notes: T=21.5C
Medium parameters used: f = 835 MHz; σ = 0.971 S/m; ε_r = 54.309; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3275
- ConvF(6.01, 6.01, 6.01); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn756; Calibrated: 2014-01-10
- Phantom: TFP 5.1C 2014-06-13; Type: QD 000 P51 CA; Serial: 1128
- Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.9 (7117)

d=10mm, Pin=250mW/Area Scan (81x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 50.859 V/m
Fast SAR: SAR(1 g) = 2.31 W/kg
Fast SAR(10 g) = 1.55 W/kg
Maximum value of SAR (interpolated) = 2.67 W/kg

d=10mm, Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 50.859 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 = -0.03 dB
Maximum value of SAR (measured) = 2.65 W/kg



Plot #14

Date/Time: 2014-07-18 13:55:55

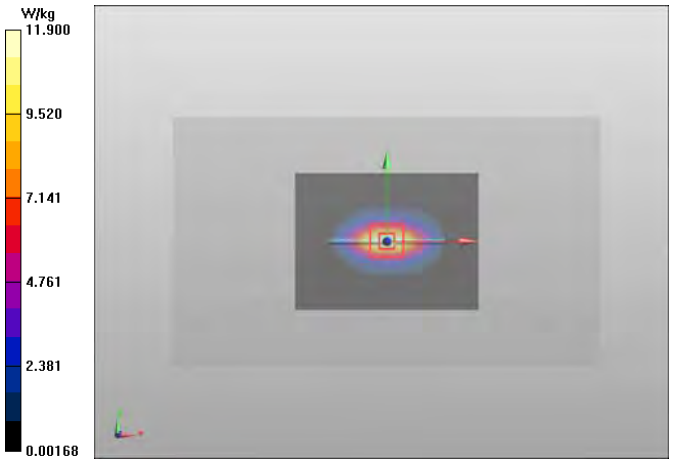
Test Laboratory: TCC Microsoft
Type: D1750V2; Serial: D1750V2 - SN:1081

Communication System: CW1750
Frequency: 1750 MHz; Duty Cycle: 1:1
Medium: BSL1750; Medium Notes: 21.5 C
Medium parameters used: f = 1750 MHz; σ = 1.433 S/m; ε_r = 54.342; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3112
- ConvF(4.9, 4.9, 4.9); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1332; Calibrated: 2014-01-16
- Phantom: TF Phamptom 2014-06-16; Type: QD 000 P51 CA; Serial: 1129
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

d=10mm, Pin=250mW/Area Scan (81x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 88.225 V/m
Fast SAR: SAR(1 g) = 9.5 W/kg
Fast SAR(10 g) = 4.94 W/kg
Maximum value of SAR (interpolated) = 11.9 W/kg

d=10mm, Pin=250mW/Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 88.225 V/m
Peak SAR (extrapolated) = 15.9 W/kg
SAR(1 g) = 9.43 W/kg
SAR(10 g) = 5.11 W/kg
Power Drift = 0.01 dB
Maximum value of SAR (measured) = 11.7 W/kg



Plot #15

Date/Time: 2014-07-11 17:41:05

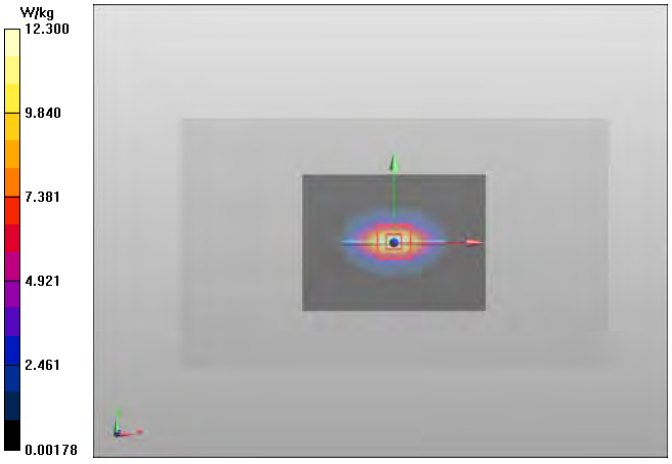
Test Laboratory: TCC Microsoft
Type: D1900V2; Serial: D1900V2 - SN:5d099

Communication System: CW1900
Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: BSL1900; Medium Notes: t= 21.4 C
Medium parameters used: f = 1900 MHz; σ = 1.487 S/m; ε_r = 51.329; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3112
- ConvF(4.73, 4.73, 4.73); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1332; Calibrated: 2014-01-16
- Phantom: TF Phamptom 2014-06-16; Type: QD 000 P51 CA; Serial: 1129
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

d=10mm, Pin=250mW/Area Scan (81x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 87.833 V/m
Fast SAR: SAR(1 g) = 9.7 W/kg
Fast SAR(10 g) = 4.86 W/kg
Maximum value of SAR (interpolated) = 12.3 W/kg

d=10mm, Pin=250mW/Zoom Scan (7x6x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 87.833 V/m
Peak SAR (extrapolated) = 16.8 W/kg
SAR(1 g) = 9.68 W/kg
SAR(10 g) = 5.11 W/kg
Power Drift = 0.00 dB
Maximum value of SAR (measured) = 12.1 W/kg



Plot #16

Date/Time: 2014-07-11 11:56:48

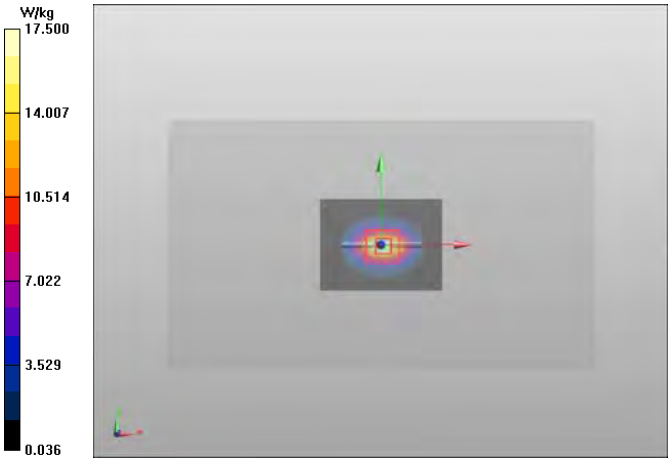
Test Laboratory: TCC Microsoft
Type: D2450V2; Serial: D2450V2 - SN:800

Communication System: CW2450
Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: BSL2450; Medium Notes: T=21.5C
Medium parameters used: f = 2450 MHz; σ = 1.906 S/m; ε_r = 51.093; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: EX3DV4 - SN3817
- ConvF(7.2, 7.2, 7.2); Calibrated: 2014-01-17;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1301; Calibrated: 2014-01-13
- Phantom: TFP 5.1C 2014-07-08; Type: QD 000 P51 CA; Serial: 1128-1
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

d=10mm, Pin=250mW 2/Area Scan (81x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 88.117 V/m
Fast SAR: SAR(1 g) = 13 W/kg
Fast SAR(10 g) = 5.65 W/kg
Maximum value of SAR (interpolated) = 17.5 W/kg

d=10mm, Pin=250mW 2/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 88.117 V/m
Peak SAR (extrapolated) = 26.2 W/kg
SAR(1 g) = 13.1 W/kg
SAR(10 g) = 6.2 W/kg
Power Drift = -0.05 dB
Maximum value of SAR (measured) = 17.0 W/kg



Plot #17

Date/Time: 2014-07-01 10:06:23

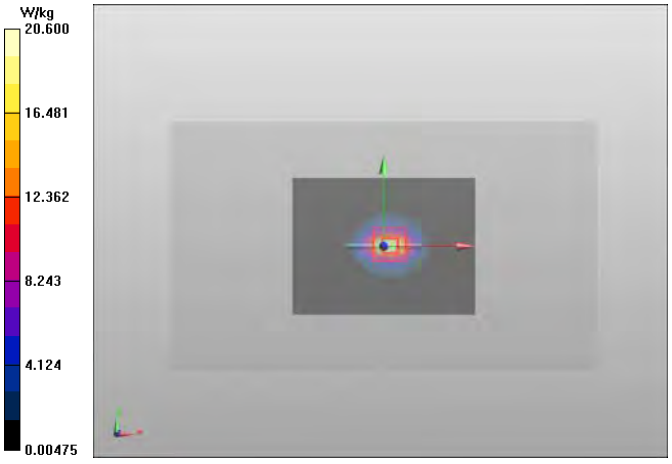
Test Laboratory: TCC Microsoft
Type: D2600V2; Serial: D2600V2 - SN:1064

Communication System: CW2600
Frequency: 2600 MHz; Duty Cycle: 1:1
Medium: BSL2300-2600; Medium Notes: T=21.5C
Medium parameters used: f = 2600 MHz; σ = 2.103 S/m; ε_r = 52.954; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3275
- ConvF(3.98, 3.98, 3.98); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn756; Calibrated: 2014-01-10
- Phantom: TFP 5.1C 2014-06-13; Type: QD 000 P51 CA; Serial: 1128
- Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.9 (7117)

d=10mm, Pin=250mW/Area Scan (81x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 87.798 V/m
Fast SAR: SAR(1 g) = 14.3 W/kg
Fast SAR(10 g) = 6.02 W/kg
Maximum value of SAR (interpolated) = 20.6 W/kg

d=10mm, Pin=250mW/Zoom Scan (6x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 87.798 V/m
Peak SAR (extrapolated) = 31.9 W/kg
SAR(1 g) = 14.5 W/kg
SAR(10 g) = 6.48 W/kg
Power Drift = -0.05 dB
Maximum value of SAR (measured) = 19.0 W/kg



Plot #18

Date/Time: 2014-07-08 07:57:26

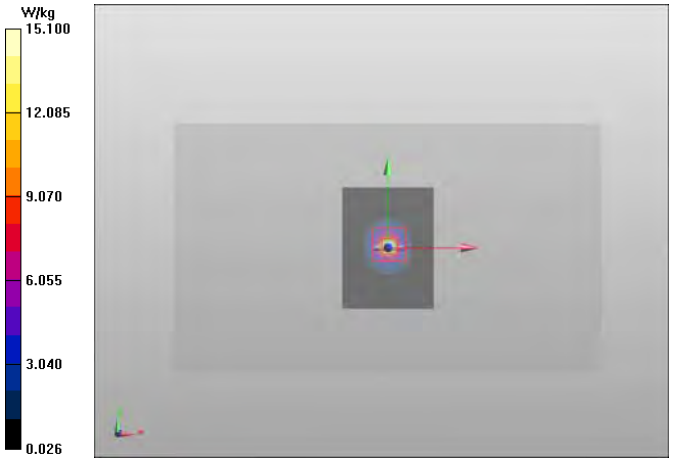
Test Laboratory: TCC Microsoft
Type: D5GHzV2; Serial: D5GHzV2 - SN: 1042

Communication System: CW5200
Frequency: 5200 MHz; Duty Cycle: 1:1
Medium: BSL5000; Medium Notes: T=21.5
Medium parameters used: f = 5200 MHz; σ = 5.376 S/m; ε_r = 48.186; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: EX3DV4 - SN3817
- ConvF(4.73, 4.73, 4.73); Calibrated: 2014-01-17;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1301; Calibrated: 2014-01-13
- Phantom: TFP 5.1C 2014-07-08; Type: QD 000 P51 CA; Serial: 1128-1
- Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.9 (7117)

d=10mm, Pin=100mW/Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 15.1 W/kg

d=10mm, Pin=100mW/Zoom Scan (8x8x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 56.974 V/m
Peak SAR (extrapolated) = 28.0 W/kg
SAR(1 g) = 7.09 W/kg
SAR(10 g) = 2 W/kg
Power Drift = -0.00 dB
Maximum value of SAR (measured) = 14.2 W/kg



Plot #19

Date/Time: 2014-07-08 08:26:58

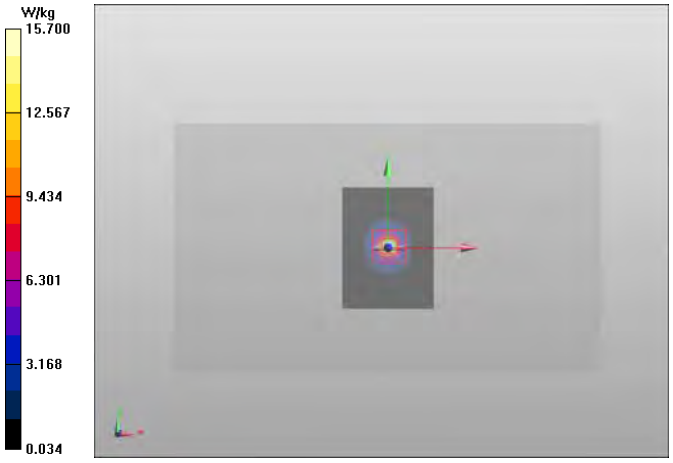
Test Laboratory: TCC Microsoft
Type: D5GHzV2; Serial: D5GHzV2 - SN: 1042

Communication System: CW5300
Frequency: 5300 MHz; Duty Cycle: 1:1
Medium: BSL5000; Medium Notes: T=21.5
Medium parameters used: f = 5300 MHz; σ = 5.51 S/m; ε_r = 48.015; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: EX3DV4 - SN3817
- ConvF(4.53, 4.53, 4.53); Calibrated: 2014-01-17;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1301; Calibrated: 2014-01-13
- Phantom: TFP 5.1C 2014-07-08; Type: QD 000 P51 CA; Serial: 1128-1
- Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.9 (7117)

d=10mm, Pin=100mW/Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 15.7 W/kg

d=10mm, Pin=100mW/Zoom Scan (8x8x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 57.498 V/m
Peak SAR (extrapolated) = 30.3 W/kg
SAR(1 g) = 7.41 W/kg
SAR(10 g) = 2.09 W/kg
Power Drift = -0.04 dB
Maximum value of SAR (measured) = 15.1 W/kg



Plot #20

Date/Time: 2014-07-08 17:32:05

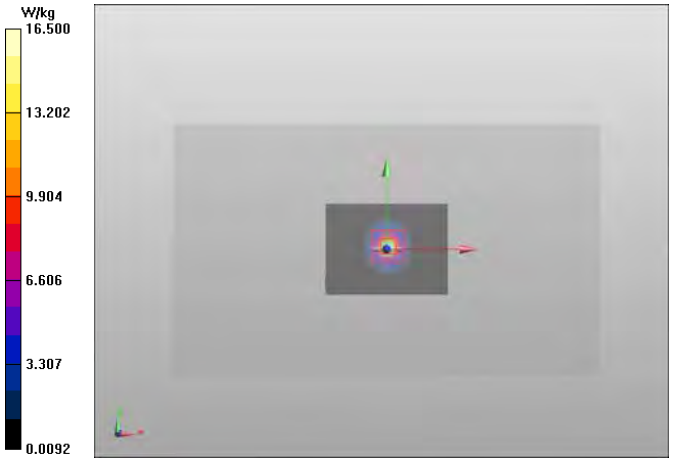
Test Laboratory: TCC Microsoft
Type: D5GHzV2; Serial: D5GHzV2 - SN: 1042

Communication System: CW5500
Frequency: 5500 MHz; Duty Cycle: 1:1
Medium: BSL5000; Medium Notes: T=21.5
Medium parameters used: f = 5500 MHz; σ = 5.772 S/m; ε_r = 47.685; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: EX3DV4 - SN3817
- ConvF(4.15, 4.15, 4.15); Calibrated: 2014-01-17;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1301; Calibrated: 2014-01-13
- Phantom: TFP 5.1C 2014-07-08; Type: QD 000 P51 CA; Serial: 1128-1
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

d=10mm, Pin=100mW/Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 16.5 W/kg

d=10mm, Pin=100mW/Zoom Scan (8x8x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 57.895 V/m
Peak SAR (extrapolated) = 32.0 W/kg
SAR(1 g) = 7.83 W/kg
SAR(10 g) = 2.18 W/kg
Power Drift = 0.03 dB
Maximum value of SAR (measured) = 15.1 W/kg



Plot #21

Date/Time: 2014-07-08 18:12:42

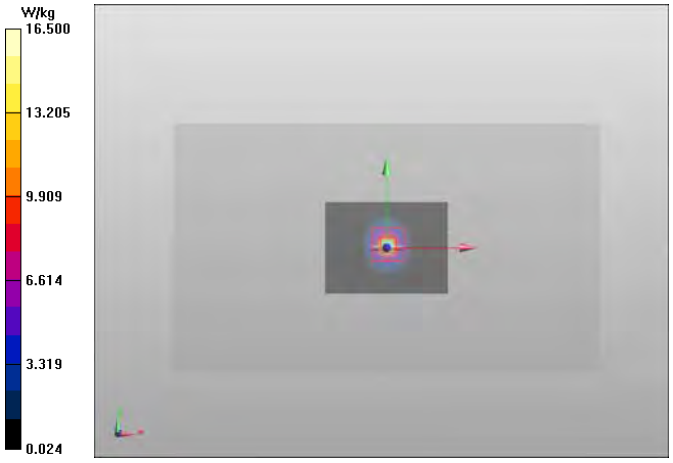
Test Laboratory: TCC Microsoft
Type: D5GHzV2; Serial: D5GHzV2 - SN: 1042

Communication System: CW5600
Frequency: 5600 MHz; Duty Cycle: 1:1
Medium: BSL5000; Medium Notes: T=21.5
Medium parameters used: f = 5600 MHz; σ = 5.916 S/m; ε_r = 47.513; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: EX3DV4 - SN3817
- ConvF(3.98, 3.98, 3.98); Calibrated: 2014-01-17;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1301; Calibrated: 2014-01-13
- Phantom: TFP 5.1C 2014-07-08; Type: QD 000 P51 CA; Serial: 1128-1
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

d=10mm, Pin=100mW/Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 16.5 W/kg

d=10mm, Pin=100mW/Zoom Scan (8x8x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 57.796 V/m
Peak SAR (extrapolated) = 33.4 W/kg
SAR(1 g) = 7.89 W/kg
SAR(10 g) = 2.19 W/kg
Power Drift = 0.01 dB
Maximum value of SAR (measured) = 15.8 W/kg



Plot #22

Date/Time: 2014-07-09 13:46:36

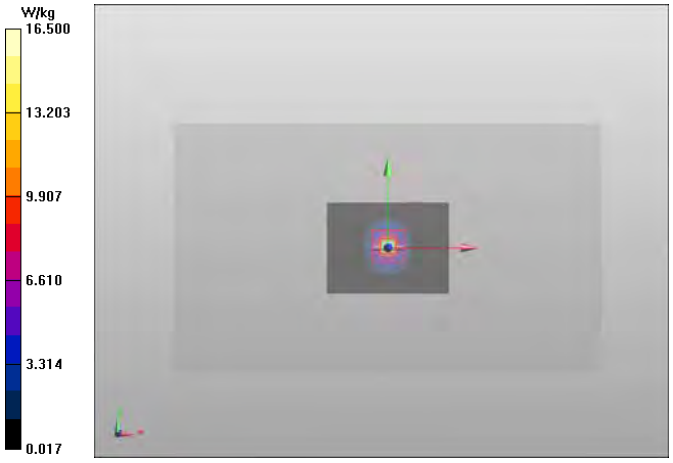
Test Laboratory: TCC Microsoft
Type: D5GHzV2; Serial: D5GHzV2 - SN: 1042

Communication System: CW5800
Frequency: 5800 MHz; Duty Cycle: 1:1
Medium: BSL5000; Medium Notes: T=21.5
Medium parameters used: f = 5800 MHz; σ = 6.131 S/m; ε_r = 46.961; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: EX3DV4 - SN3817
- ConvF(4.28, 4.28, 4.28); Calibrated: 2014-01-17;
- Sensor-Surface: 2mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1301; Calibrated: 2014-01-13
- Phantom: TFP 5.1C 2014-07-08; Type: QD 000 P51 CA; Serial: 1128-1
- Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.9 (7117)

d=10mm, Pin=100mW 2/Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 16.5 W/kg

d=10mm, Pin=100mW 2/Zoom Scan (8x8x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 54.969 V/m
Peak SAR (extrapolated) = 31.4 W/kg
SAR(1 g) = 7.32 W/kg
SAR(10 g) = 2.04 W/kg
Power Drift = -0.09 dB
Maximum value of SAR (measured) = 14.6 W/kg



APPENDIX B: MEASUREMENT SCANS

Plot #1

Date/Time: 2014-07-02 5:41:21 PM

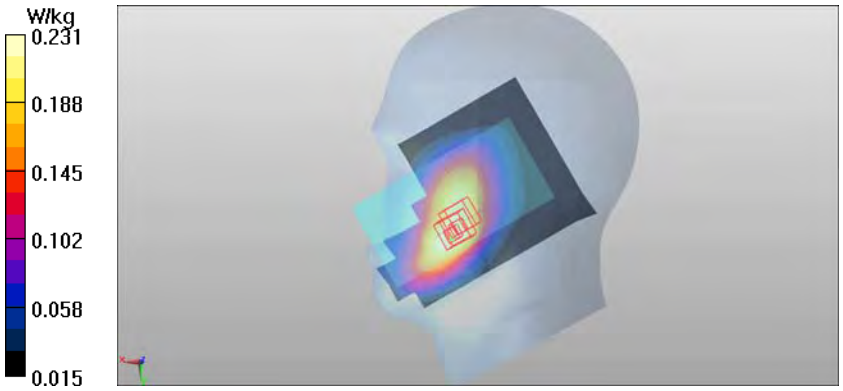
Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000024/0

Communication System: LTE700 (Band 17)
Frequency: 710 MHz; Duty Cycle: 1:1
Medium: HSL750; Medium Notes: T=21.5C
Medium parameters used: f = 710 MHz; σ = 0.864 S/m; ε_r = 41.315; ρ = 1000 kg/m^3
Phantom section: Right Section

DASY Configuration:
- Probe: ES3DV3 - SN3275
- ConvF(6.32, 6.32, 6.32); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn756; Calibrated: 2014-01-10
- Phantom: SAM4 2014-06-13; Type: GF-VE 20; Serial: TP-1701
- Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.10 (7331)

LTE700 (Band 17) - Right/Cheek - Middle – Non-CA and CA with 17UL/DL+2DL - QPSK - 10MHz - 1RB - 100% offset/Area Scan (81x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 16.30 V/m
Fast SAR: SAR(1 g) = 0.209 W/kg
Fast SAR(10 g) = 0.149 W/kg
Maximum value of SAR (interpolated) = 0.238 W/kg

LTE700 (Band 17) - Right/Cheek - Middle - Non-CA and CA with 17UL/DL+2DL - QPSK - 10MHz - 1RB - 100% offset/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 16.22 V/m
Peak SAR (extrapolated) = 0.273 W/kg
SAR(1 g) = 0.209 W/kg
SAR(10 g) = 0.157 W/kg
Power Drift = -0.01 dB
Maximum value of SAR (measured) = 0.231 W/kg



Plot #2

Date/Time: 2014-07-14 10:18:47

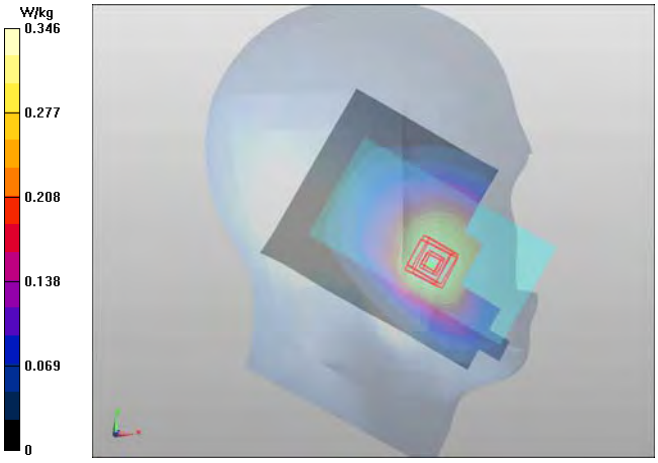
Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000024/0

Communication System: 2-slot GPRS850
Frequency: 844.8 MHz; Duty Cycle: 1:4.19952
Medium: HSL800-900; Medium Notes: T=21.5C
Medium parameters used: f = 845 MHz; σ = 0.914 S/m; ε_r = 40.904; ρ = 1000 kg/m^3
Phantom section: Left Section

DASY Configuration:
- Probe: ES3DV3 - SN3275
- ConvF(6.12, 6.12, 6.12); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn756; Calibrated: 2014-01-10
- Phantom: SAM1 2014-06-13; Type: GF-VE 20; Serial: TP-1725
- Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.9 (7117)

2-slot GPRS850 - Left/Cheek - Sub 3 - Scenario 0 /Area Scan (81x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 19.673 V/m
Fast SAR: SAR(1 g) = 0.305 W/kg
Fast SAR(10 g) = 0.213 W/kg
Maximum value of SAR (interpolated) = 0.346 W/kg

2-slot GPRS850 - Left/Cheek - Sub 3 - Scenario 0 /Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 18.565 V/m
Peak SAR (extrapolated) = 0.351 W/kg
SAR(1 g) = 0.289 W/kg
SAR(10 g) = 0.228 W/kg
Power Drift = 0.01 dB
Maximum value of SAR (measured) = 0.314 W/kg



Plot #3

Date/Time: 2014-07-08 10:08:28 PM

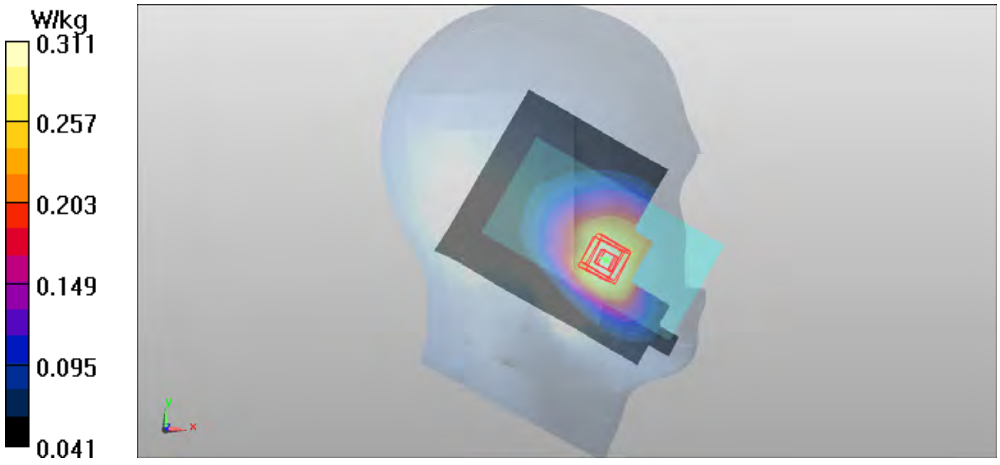
Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000024/0

Communication System: WCDMA850 (Band 5)
Frequency: 843.8 MHz; Duty Cycle: 1:1
Medium: HSL800-900; Medium Notes: T=21.5C
Medium parameters used: f = 844 MHz; σ = 0.9 S/m; ε_r = 40.491; ρ = 1000 kg/m^3
Phantom section: Left Section

DASY Configuration:
- Probe: ES3DV3 - SN3275
- ConvF(6.12, 6.12, 6.12); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn756; Calibrated: 2014-01-10
- Phantom: SAM1 2014-06-13; Type: GF-VE 20; Serial: TP-1725
- Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.10 (7331)

WCDMA850 (Band 5) - Left/Cheek - Sub 3 - Scenario 2/Area Scan (81x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 18.86 V/m
Fast SAR: SAR(1 g) = 0.279 W/kg
Fast SAR(10 g) = 0.197 W/kg
Maximum value of SAR (interpolated) = 0.313 W/kg

WCDMA850 (Band 5) - Left/Cheek - Sub 3 - Scenario 2/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 18.86 V/m
Peak SAR (extrapolated) = 0.346 W/kg
SAR(1 g) = 0.287 W/kg
SAR(10 g) = 0.225 W/kg
Power Drift = -0.03 dB
Maximum value of SAR (measured) = 0.311 W/kg



Plot #4

Date/Time: 2014-07-09 5:42:19 PM

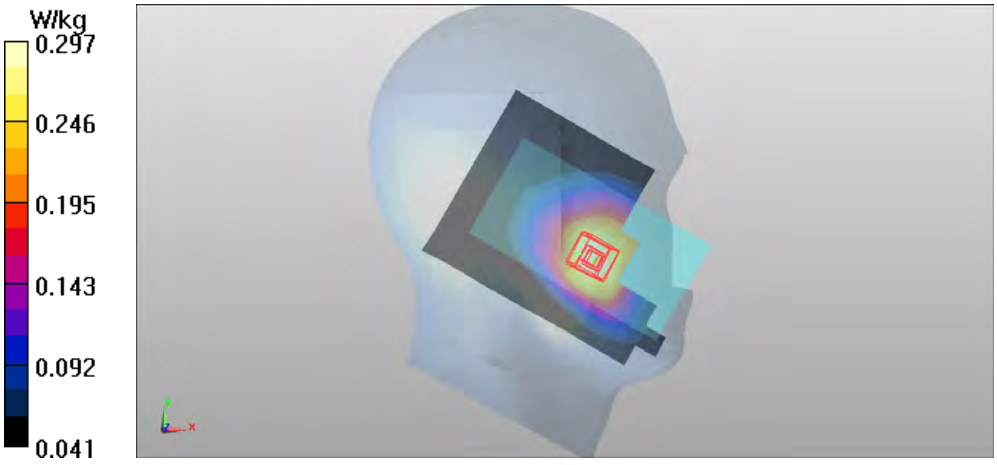
Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000024/0

Communication System: LTE850 (Band 5)
Frequency: 844 MHz; Duty Cycle: 1:1
Medium: HSL800-900; Medium Notes: T=21.5C
Medium parameters used: f = 844 MHz; σ = 0.912 S/m; ε_r = 40.681; ρ = 1000 kg/m^3
Phantom section: Left Section

DASY Configuration:
- Probe: ES3DV3 - SN3275
- ConvF(6.12, 6.12, 6.12); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn756; Calibrated: 2014-01-10
- Phantom: SAM1 2014-06-13; Type: GF-VE 20; Serial: TP-1725
- Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.10 (7331)

LTE 850 (Band 5) - Left/Cheek - Sub 3 - Scenario 0 - QPSK - 10MHz - 1RB - 0% offset/Area Scan (81x121x1):
Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 18.45 V/m
Fast SAR: SAR(1 g) = 0.265 W/kg
Fast SAR(10 g) = 0.187 W/kg
Maximum value of SAR (interpolated) = 0.298 W/kg

LTE 850 (Band 5) - Left/Cheek - Sub 3 - Scenario 0 - QPSK - 10MHz - 1RB - 0% offset/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 18.34 V/m
Peak SAR (extrapolated) = 0.338 W/kg
SAR(1 g) = 0.277 W/kg
SAR(10 g) = 0.218 W/kg
Power Drift = -0.03 dB
Maximum value of SAR (measured) = 0.297 W/kg



Plot #5

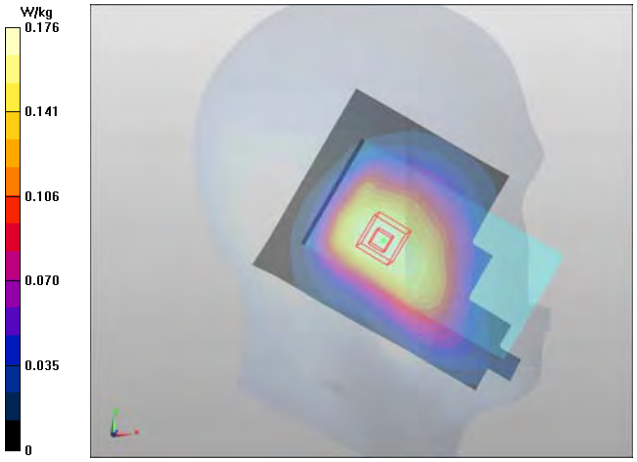
Date/Time: 2014-07-09 17:52:31

Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000024/0

Communication System: LTE850 (Band 5)
Frequency: 844 MHz; Duty Cycle: 1:1
Medium: HSL800-900; Medium Notes: T=21.5C
Medium parameters used: f = 844 MHz; σ = 0.912 S/m; ε_r = 40.681; ρ = 1000 kg/m^3
Phantom section: Left Section

DASY Configuration:
- Probe: ES3DV3 - SN3275
- ConvF(6.12, 6.12, 6.12); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used))
- Electronics: DAE4 Sn756; Calibrated: 2014-01-10
- Phantom: SAM1 2014-06-13; Type: GF-VE 20; Serial: TP-1725
- Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.9 (7117)

LTE 850 (Band 5) - Left/Tilt - Sub 3 - Scenario 0 - QPSK - 10MHz - 1RB - 0% offset/Area Scan (81x121x1):
Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 11.347 V/m
Fast SAR: SAR(1 g) = 0.156 W/kg
Fast SAR(10 g) = 0.111 W/kg
Maximum value of SAR (interpolated) = 0.176 W/kg



Plot #6

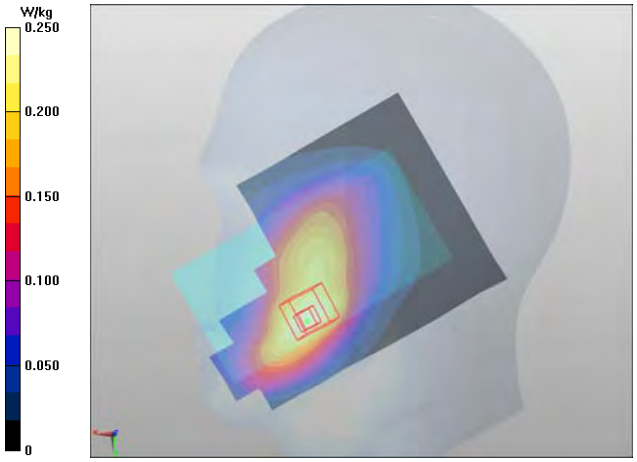
Date/Time: 2014-07-09 19:08:26

Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000024/0

Communication System: LTE850 (Band 5)
Frequency: 844 MHz; Duty Cycle: 1:1
Medium: HSL800-900; Medium Notes: T=21.5C
Medium parameters used: f = 844 MHz; σ = 0.912 S/m; ε_r = 40.681; ρ = 1000 kg/m^3
Phantom section: Right Section

DASY Configuration:
- Probe: ES3DV3 - SN3275
- ConvF(6.12, 6.12, 6.12); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used))
- Electronics: DAE4 Sn756; Calibrated: 2014-01-10
- Phantom: SAM1 2014-06-13; Type: GF-VE 20; Serial: TP-1725
- Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.9 (7117)

LTE850 (Band 5) - Right/Cheek - Sub 3 - Scenario 1 - QPSK - 10MHz - 1RB - 0% offset/Area Scan (81x121x1):
Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 12.476 V/m
Fast SAR: SAR(1 g) = 0.214 W/kg
Fast SAR: SAR(10 g) = 0.148 W/kg
Maximum value of SAR (interpolated) = 0.250 W/kg



Plot #7

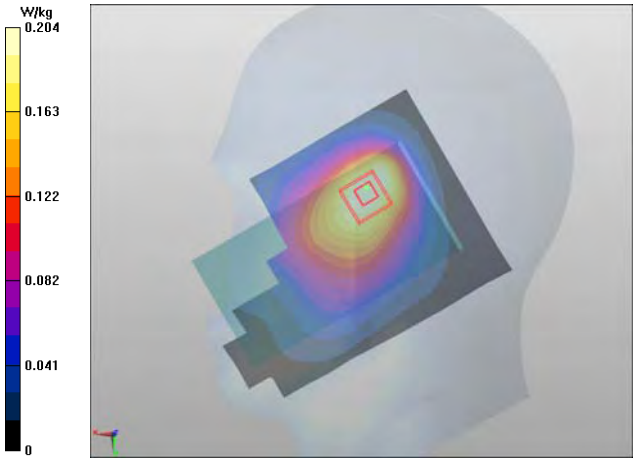
Date/Time: 2014-07-09 18:26:46

Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000024/0

Communication System: LTE850 (Band 5)
Frequency: 844 MHz; Duty Cycle: 1:1
Medium: HSL800-900; Medium Notes: T=21.5C
Medium parameters used: f = 844 MHz; σ = 0.912 S/m; ε_r = 40.681; ρ = 1000 kg/m^3
Phantom section: Right Section

DASY Configuration:
- Probe: ES3DV3 - SN3275
- ConvF(6.12, 6.12, 6.12); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn756; Calibrated: 2014-01-10
- Phantom: SAM1 2014-06-13; Type: GF-VE 20; Serial: TP-1725
- Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.9 (7117)

LTE850 (Band 5) - Right/Tilt - Sub 3 - Scenario 0 - QPSK - 10MHz - 1RB - 0% offset/Area Scan (81x121x1):
Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 15.124 V/m
Fast SAR: SAR(1 g) = 0.180 W/kg
Fast SAR: SAR(10 g) = 0.126 W/kg
Maximum value of SAR (interpolated) = 0.204 W/kg



Plot #8

Date/Time: 2014-07-02 20:40:37

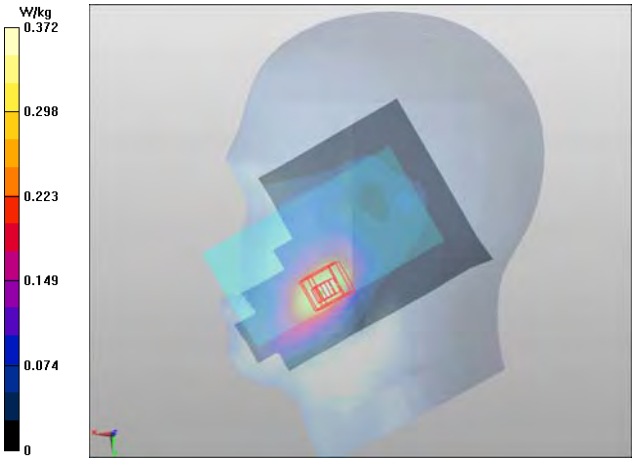
Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000027/3

Communication System: LTE1700/2100 (Band 4)
Frequency: 1720 MHz; Duty Cycle: 1:1
Medium: HSL1750; Medium Notes:
Medium parameters used: f = 1720 MHz; σ = 1.349 S/m; ε_r = 40.311; ρ = 1000 kg/m^3
Phantom section: Right Section

DASY Configuration:
- Probe: ES3DV3 - SN3112
- ConvF(5.25, 5.25, 5.25); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1332; Calibrated: 2014-01-16
- Phantom: SAM1 2014-06-16; Type: GF-VE 20; Serial: TP-1735
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

LTE 1700_2100 (Band 4) - Right/Cheek - Low - CA with 4UL/DL+17DL - QPSK - 20MHz - 1RB - 0% offset/Area Scan (81x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 13.923 V/m
Fast SAR: SAR(1 g) = 0.297 W/kg
Fast SAR(10 g) = 0.175 W/kg
Maximum value of SAR (interpolated) = 0.372 W/kg

LTE 1700_2100 (Band 4) - Right/Cheek - Low - CA with 4UL/DL+17DL - QPSK - 20MHz - 1RB - 0% offset /Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 15.258 V/m
Peak SAR (extrapolated) = 0.542 W/kg
SAR(1 g) = 0.358 W/kg
SAR(10 g) = 0.226 W/kg
Power Drift = 0.12 dB
Maximum value of SAR (measured) = 0.419 W/kg



Plot #9

Date/Time: 2014-06-25 8:38:05 AM

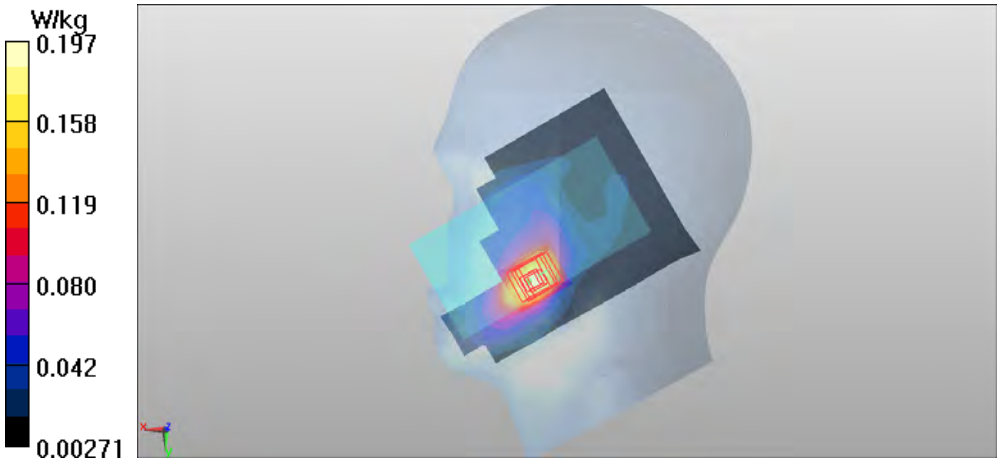
Test Laboratory: TCC Microsoft
Type: RM-984; Serial: 354250/06/000027/3

Communication System: 2-slot GPRS1900
Frequency: 1850.2 MHz; Duty Cycle: 1:4.19952
Medium: HSL1900; Medium Notes: T= 21.5c
Medium parameters used (interpolated): f = 1850.2 MHz; σ = 1.327 S/m; ε_r = 39.97; ρ = 1000 kg/m^3
Phantom section: Right Section

DASY Configuration:
- Probe: ES3DV3 - SN3112
- ConvF(5.11, 5.11, 5.11); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1332; Calibrated: 2014-01-16
- Phantom: SAM3 2014-06-16; Type: GF-VE 20; Serial: TP-1630
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7331)

2-slot GPRS1900 - Right/Cheek - Low/Area Scan (81x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 12.23 V/m
Fast SAR: SAR(1 g) = 0.164 W/kg
Fast SAR(10 g) = 0.095 W/kg
Maximum value of SAR (interpolated) = 0.207 W/kg

2-slot GPRS1900 - Right/Cheek - Low/Zoom Scan (5x6x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 12.25 V/m
Peak SAR (extrapolated) = 0.259 W/kg
SAR(1 g) = 0.172 W/kg
SAR(10 g) = 0.108 W/kg
Power Drift = -0.15 dB
Maximum value of SAR (measured) = 0.197 W/kg



Plot #10

Date/Time: 2014-06-24 6:00:03 PM

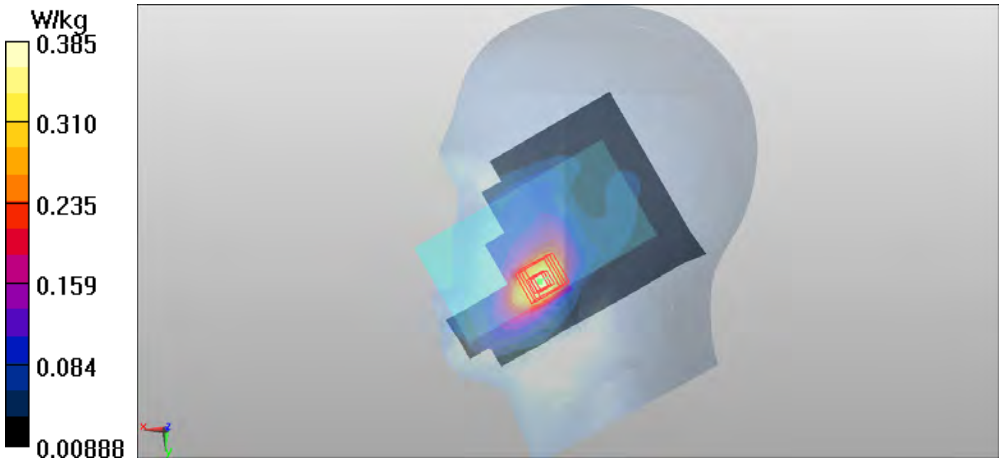
Test Laboratory: TCC Microsoft
Type: RM-984; Serial: 354250/06/000027/3

Communication System: WCDMA1900 (Band 2)
Frequency: 1852.4 MHz; Duty Cycle: 1:1
Medium: HSL1900; Medium Notes: T= 21.5c
Medium parameters used (interpolated): f = 1852.4 MHz; σ = 1.329 S/m; ε_r = 39.963; ρ = 1000 kg/m^3
Phantom section: Right Section

DASY Configuration:
- Probe: ES3DV3 - SN3112
- ConvF(5.11, 5.11, 5.11); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1332; Calibrated: 2014-01-16
- Phantom: SAM3 2014-06-16; Type: GF-VE 20; Serial: TP-1630
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7331)

WCDMA1900 (Band 2) - Right/Cheek - Low/Area Scan (81x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 16.40 V/m
Fast SAR: SAR(1 g) = 0.312 W/kg
Fast SAR(10 g) = 0.180 W/kg
Maximum value of SAR (interpolated) = 0.396 W/kg

WCDMA1900 (Band 2) - Right/Cheek - Low/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 16.31 V/m
Peak SAR (extrapolated) = 0.488 W/kg
SAR(1 g) = 0.325 W/kg
SAR(10 g) = 0.204 W/kg
Power Drift = 0.06 dB
Maximum value of SAR (measured) = 0.385 W/kg



Plot #11

Date/Time: 2014-06-25 3:40:53 PM

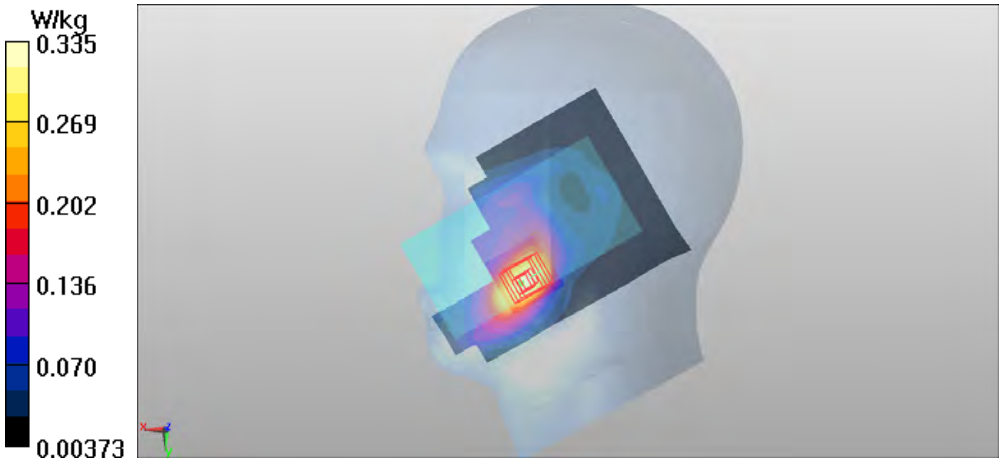
Test Laboratory: TCC Microsoft
Type: RM-984; Serial: 354250/06/000027/3

Communication System: LTE1900 (Band 2)
Frequency: 1860 MHz; Duty Cycle: 1:1
Medium: HSL1900; Medium Notes: T= 21.5c
Medium parameters used: f = 1860 MHz; σ = 1.348 S/m; ε_r = 39.728; ρ = 1000 kg/m^3
Phantom section: Right Section

DASY Configuration:
- Probe: ES3DV3 - SN3112
- ConvF(5.11, 5.11, 5.11); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1332; Calibrated: 2014-01-16
- Phantom: SAM3 2014-06-16; Type: GF-VE 20; Serial: TP-1630
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7331)

LTE1900 (Band 2) - Right/Cheek - Low - Non-CA - QPSK - 20MHz - 1RB - 0% offset/Area Scan (81x121x1):
Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 13.16 V/m
Fast SAR: SAR(1 g) = 0.312 W/kg
Fast SAR(10 g) = 0.177 W/kg
Maximum value of SAR (interpolated) = 0.395 W/kg

LTE1900 (Band 2) - Right/Cheek - Low - Non-CA - QPSK - 20MHz - 1RB - 0% offset/Zoom Scan (6x6x7)/Cube 0:
Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 13.34 V/m
Peak SAR (extrapolated) = 0.432 W/kg
SAR(1 g) = 0.290 W/kg
SAR(10 g) = 0.182 W/kg
Power Drift = 0.11 dB
Maximum value of SAR (measured) = 0.335 W/kg



Plot #12

Date/Time: 2014-06-30 18:13:19

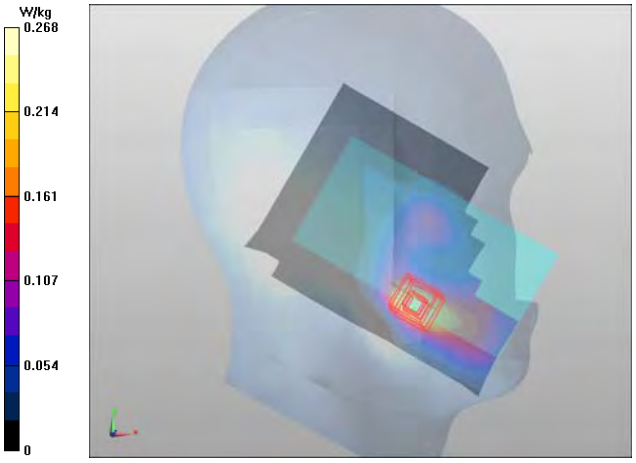
Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000024/0

Communication System: LTE2500 (Band 7)
Frequency: 2510 MHz; Duty Cycle: 1:1
Medium: HSL2300-2600; Medium Notes: T=21.5C
Medium parameters used: f = 2510 MHz; σ = 1.839 S/m; ε_r = 38.342; ρ = 1000 kg/m^3
Phantom section: Left Section

DASY Configuration:
- Probe: ES3DV3 - SN3275
- ConvF(4.25, 4.25, 4.25); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn756; Calibrated: 2014-01-10
- Phantom: SAM3 2014-06-13; Type: GF-VE20; Serial: TP-1421
- Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.9 (7117)

LTE2500 (Band 7) - Left/Cheek - Low - QPSK - 20MHz - 1RB - 0% offset/Area Scan (121x181x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 9.209 V/m
Fast SAR: SAR(1 g) = 0.208 W/kg
Fast SAR(10 g) = 0.106 W/kg
Maximum value of SAR (interpolated) = 0.268 W/kg

LTE2500 (Band 7) - Left/Cheek - Low - QPSK - 20MHz - 1RB - 0% offset/Zoom Scan (8x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.957 V/m
Peak SAR (extrapolated) = 0.369 W/kg
SAR(1 g) = 0.212 W/kg
SAR(10 g) = 0.117 W/kg
Power Drift = 0.04 dB
Maximum value of SAR (measured) = 0.257 W/kg



Plot #13

Date/Time: 2014-07-10 13:13:30

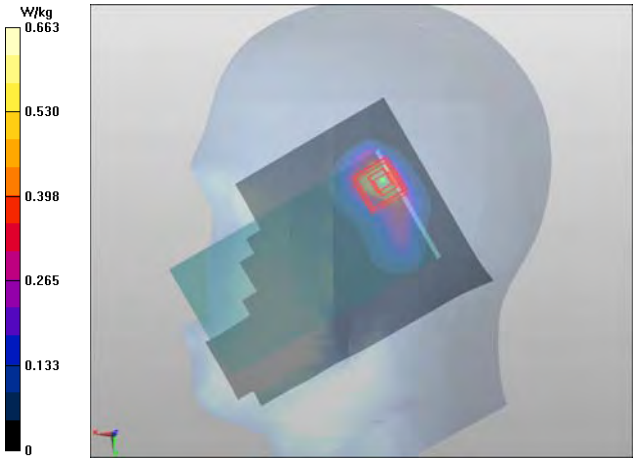
Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000035/6

Communication System: WLAN2450
Frequency: 2437 MHz; Duty Cycle: 1:1
Medium: HSL2450; Medium Notes: T=21.5C
Medium parameters used: f = 2437 MHz; σ = 1.763 S/m; ε_r = 39.535; ρ = 1000 kg/m^3
Phantom section: Right Section

DASY Configuration:
- Probe: EX3DV4 - SN3817
- ConvF(7.2, 7.2, 7.2); Calibrated: 2014-01-17;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1301; Calibrated: 2014-01-13
- Phantom: SAM4 2014-06-13; Type: GF-VE 20; Serial: TP-1736
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

WLAN2450 b-mode - Right/Tilt - Channel 6 - BPSK 1Mbps/Area Scan (121x181x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 16.075 V/m
Fast SAR: SAR(1 g) = 0.453 W/kg
Fast SAR(10 g) = 0.213 W/kg
Maximum value of SAR (interpolated) = 0.663 W/kg

WLAN2450 b-mode - Right/Tilt - Channel 6 - BPSK 1Mbps/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 15.681 V/m
Peak SAR (extrapolated) = 0.855 W/kg
SAR(1 g) = 0.421 W/kg
SAR(10 g) = 0.207 W/kg
Power Drift = 0.10 dB
Maximum value of SAR (measured) = 0.532 W/kg



Plot #14

Date/Time: 2014-07-03 05:59:51

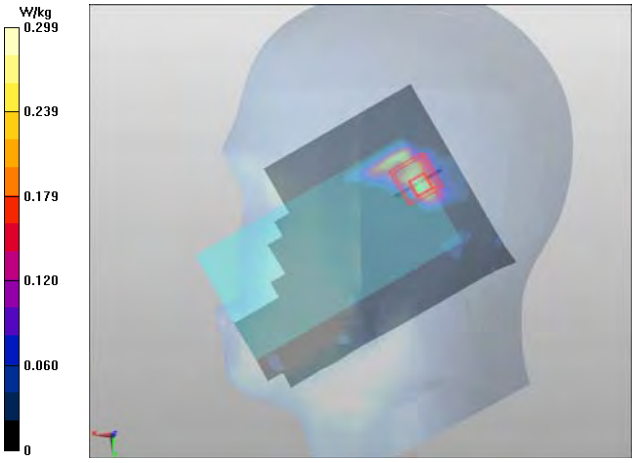
Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000035/6

Communication System: WLAN5000 a-mode
Frequency: 5765 MHz; Duty Cycle: 1:1
Medium: HSL5000; Medium Notes: T=21.5
Medium parameters used: f = 5765 MHz; σ = 5.136 S/m; ε_r = 36.391; ρ = 1000 kg/m^3
Phantom section: Right Section

DASY Configuration:
- Probe: EX3DV4 - SN3817
- ConvF(4.78, 4.78, 4.78); Calibrated: 2014-01-17;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1301; Calibrated: 2014-01-13
- Phantom: SAR3 SAM3 07 02 2014; Type: QD000P40CD; Serial: TP:1399
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

WLAN5000 a-mode - Right/Cheek - Channel 153 - BPSK 6 Mbps/Area Scan (121x181x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.299 W/kg

WLAN5000 a-mode - Right/Cheek - Channel 153 - BPSK 6 Mbps/Zoom Scan (9x9x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 6.085 V/m
Peak SAR (extrapolated) = 0.652 W/kg
SAR(1 g) = 0.142 W/kg
SAR(10 g) = 0.041 W/kg
Power Drift = 0.12 dB
Maximum value of SAR (measured) = 0.352 W/kg



Plot #15

Date/Time: 2014-07-03 16:32:31

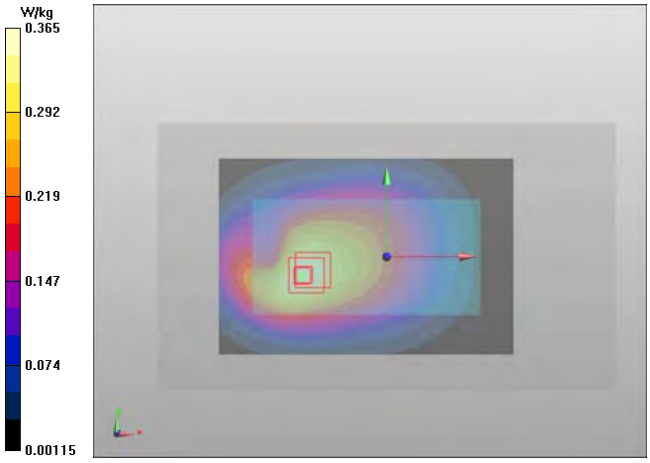
Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000024/0

Communication System: LTE700 (Band 17)
Frequency: 710 MHz; Duty Cycle: 1:1
Medium: BSL750; Medium Notes: T=21.5C
Medium parameters used: f = 710 MHz; σ = 0.923 S/m; ε_r = 55.402; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3275
- ConvF(6.03, 6.03, 6.03); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn756; Calibrated: 2014-01-10
- Phantom: TFP 5.1C 2014-06-13; Type: QD 000 P51 CA; Serial: 1128
- Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.9 (7117)

LTE700 (Band 17)/Body - Middle - QPSK - 10MHz - 1RB - 100% offset - Spacer 15mm - No Headset - Display Facing Phantom/Area Scan (81x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 12.780 V/m
Fast SAR: SAR(1 g) = 0.321 W/kg
Fast SAR(10 g) = 0.228 W/kg
Maximum value of SAR (interpolated) = 0.365 W/kg

LTE700 (Band 17)/Body - Middle - QPSK - 10MHz - 1RB - 100% offset - Spacer 15mm - No Headset - Display Facing Phantom/Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 12.766 V/m
Peak SAR (extrapolated) = 0.434 W/kg
SAR(1 g) = 0.320 W/kg
SAR(10 g) = 0.235 W/kg
Power Drift = 0.04 dB
Maximum value of SAR (measured) = 0.360 W/kg



Plot #16

Date/Time: 2014-07-15 11:02:59

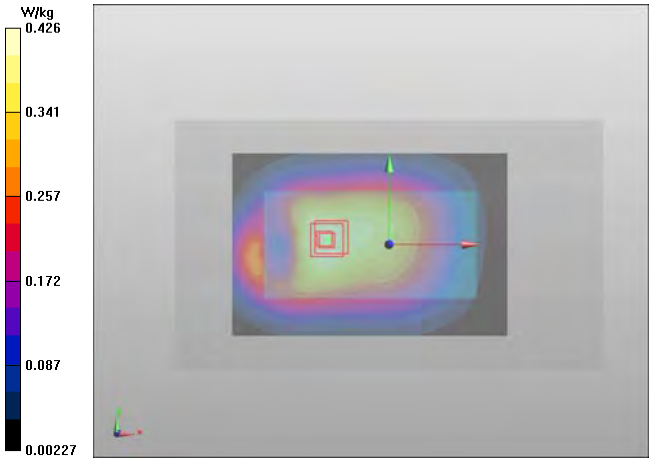
Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000024/0

Communication System: 2-slot GPRS850
Frequency: 844.8 MHz; Duty Cycle: 1:4.19952
Medium: BSL800-900; Medium Notes: T=21.5C
Medium parameters used: f = 845 MHz; σ = 0.977 S/m; ε_r = 54.717; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3275
- ConvF(6.01, 6.01, 6.01); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn756; Calibrated: 2014-01-10
- Phantom: TFP 5.1C 2014-06-13; Type: QD 000 P51 CA; Serial: 1128
- Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.9 (7117)

2-slot GPRS850/Body – Sub 3 – Scenario 0 - Spacer 15mm - No Headset - Display Facing Phantom/Area Scan (81x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 20.320 V/m
Fast SAR: SAR(1 g) = 0.377 W/kg
Fast SAR(10 g) = 0.268 W/kg
Maximum value of SAR (interpolated) = 0.426 W/kg

2-slot GPRS850/Body – Sub 3 – Scenario 0 - Spacer 15mm - No Headset - Display Facing Phantom /Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 20.321 V/m
Peak SAR (extrapolated) = 0.484 W/kg
SAR(1 g) = 0.387 W/kg
SAR(10 g) = 0.295 W/kg
Power Drift = -0.00 dB
Maximum value of SAR (measured) = 0.420 W/kg



Plot #17

Date/Time: 2014-07-10 17:44:07

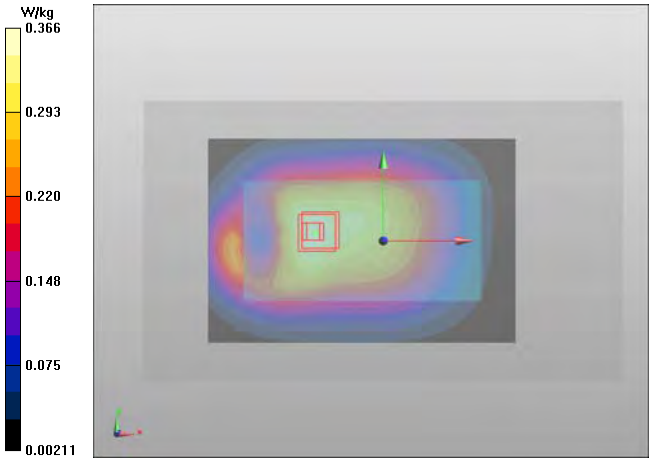
Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000024/0

Communication System: WCDMA850 (Band 5)
Frequency: 843.8 MHz; Duty Cycle: 1:1
Medium: BSL800-900; Medium Notes: T=21.5C
Medium parameters used: f = 844 MHz; σ = 0.978 S/m; ε_r = 54.676; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3275
- ConvF(6.01, 6.01, 6.01); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn756; Calibrated: 2014-01-10
- Phantom: TFP 5.1C 2014-06-13; Type: QD 000 P51 CA; Serial: 1128
- Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.9 (7117)

WCDMA 850 (Band 5)/Body - Sub 3 - Scenario 2 - Spacer 15mm - No Headset - Display Facing Phantom/Area Scan (81x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 19.779 V/m
Fast SAR: SAR(1 g) = 0.322 W/kg
Fast SAR(10 g) = 0.228 W/kg
Maximum value of SAR (interpolated) = 0.366 W/kg

WCDMA 850 (Band 5)/Body - Sub 3 - Scenario 2 - Spacer 15mm - No Headset - Display Facing Phantom/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 19.779 V/m
Peak SAR (extrapolated) = 0.411 W/kg
SAR(1 g) = 0.328 W/kg
SAR(10 g) = 0.250 W/kg
Power Drift = -0.02 dB
Maximum value of SAR (measured) = 0.357 W/kg



Plot #18

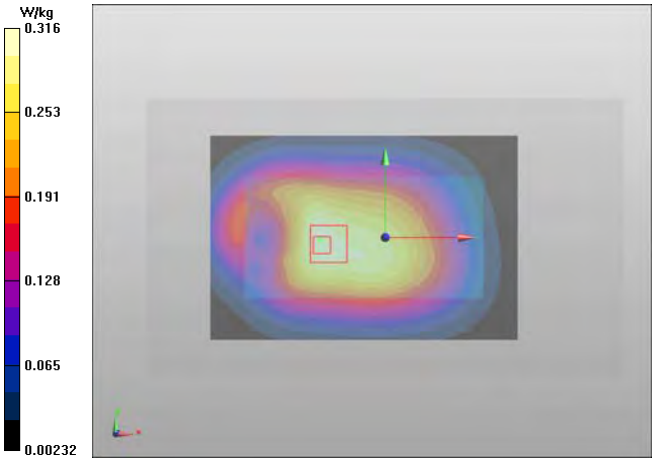
Date/Time: 2014-06-25 10:51:25

Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000024/0

Communication System: LTE850 (Band 5)
Frequency: 844 MHz; Duty Cycle: 1:1
Medium: MSL835; Medium Notes: T =21.5c
Medium parameters used: f = 844 MHz; σ = 0.972 S/m; ε_r = 54.467; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3275
- ConvF(6.01, 6.01, 6.01); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used))
- Electronics: DAE4 Sn756; Calibrated: 2014-01-10
- Phantom: TFP 5.1C 2014-06-13; Type: QD 000 P51 CA; Serial: 1128
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

LTE 850 (Band 5) - Back/Body - Sub 3 - Scenario 1 - Back Facing Phantom - Spacer 15mm - QPSK - 10MHz - 1 RB - 0% offset/Area Scan (81x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 17.996 V/m
Fast SAR: SAR(1 g) = 0.278 W/kg
Fast SAR(10 g) = 0.199 W/kg
Maximum value of SAR (interpolated) = 0.316 W/kg



Plot #19

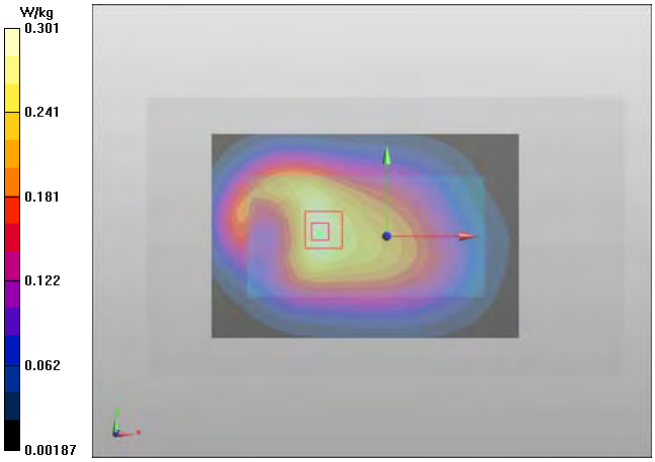
Date/Time: 2014-07-10 10:35:00

Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000024/0

Communication System: LTE850 (Band 5)
Frequency: 844 MHz; Duty Cycle: 1:1
Medium: BSL800-900; Medium Notes: T=21.5C
Medium parameters used: f = 844 MHz; σ = 0.978 S/m; ε_r = 54.676; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3275
- ConvF(6.01, 6.01, 6.01); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used))
- Electronics: DAE4 Sn756; Calibrated: 2014-01-10
- Phantom: TFP 5.1C 2014-06-13; Type: QD 000 P51 CA; Serial: 1128
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

LTE850 (Band 5)/Body - Sub 3 - Scenario 1 - Spacer 15mm - WH-208 - Back Facing Phantom - QPSK - 10MHz - 1RB - 0% offset/Area Scan (81x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 16.167 V/m
Fast SAR: SAR(1 g) = 0.262 W/kg
Fast SAR(10 g) = 0.183 W/kg
Maximum value of SAR (interpolated) = 0.301 W/kg



Plot #20

Date/Time: 2014-07-10 21:24:38

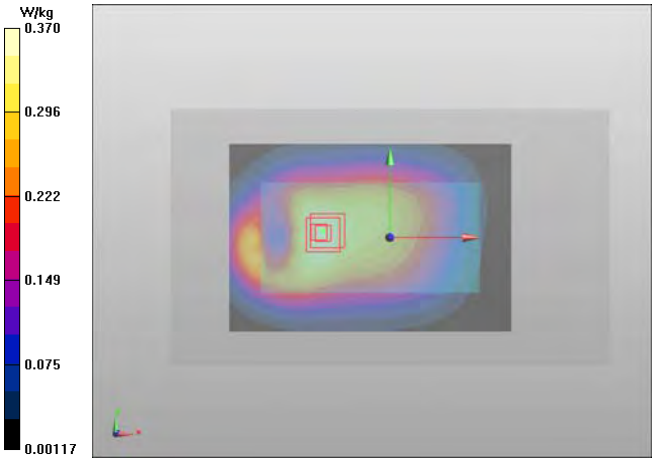
Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000024/0

Communication System: LTE850 (Band 5)
Frequency: 844 MHz; Duty Cycle: 1:1
Medium: BSL800-900; Medium Notes: T=21.5C
Medium parameters used: f = 844 MHz; σ = 0.978 S/m; ε_r = 54.676; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3275
- ConvF(6.01, 6.01, 6.01); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn756; Calibrated: 2014-01-10
- Phantom: TFP 5.1C 2014-06-13; Type: QD 000 P51 CA; Serial: 1128
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

LTE850 (Band 5)/Body - Sub 3 - Scenario 0 - Spacer 15mm - No Headset - Display Facing Phantom - QPSK - 10MHz - 1RB - 0% offset/Area Scan (81x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 20.151 V/m
Fast SAR: SAR(1 g) = 0.328 W/kg
Fast SAR(10 g) = 0.233 W/kg
Maximum value of SAR (interpolated) = 0.370 W/kg

LTE850 (Band 5)/Body - Sub 3 - Scenario 0 - Spacer 15mm - No Headset - Display Facing Phantom - QPSK - 10MHz - 1RB - 0% offset/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 20.151 V/m
Peak SAR (extrapolated) = 0.434 W/kg
SAR(1 g) = 0.341 W/kg
SAR(10 g) = 0.258 W/kg
Power Drift = 0.01 dB
Maximum value of SAR (measured) = 0.370 W/kg



Plot #21

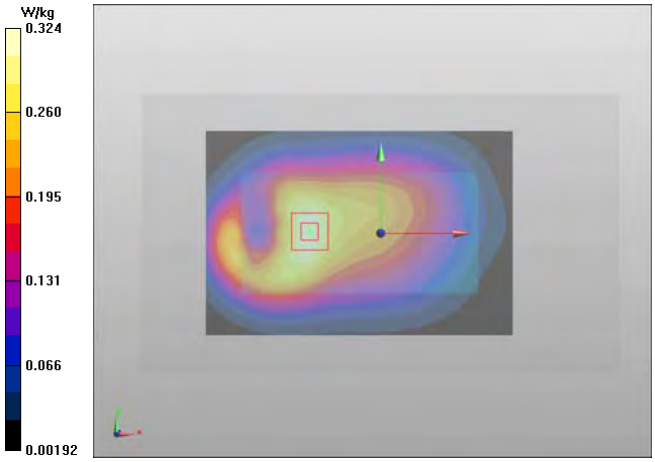
Date/Time: 2014-07-10 11:01:14

Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000024/0

Communication System: LTE850 (Band 5)
Frequency: 844 MHz; Duty Cycle: 1:1
Medium: BSL800-900; Medium Notes: T=21.5C
Medium parameters used: f = 844 MHz; σ = 0.978 S/m; ε_r = 54.676; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3275
- ConvF(6.01, 6.01, 6.01); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used))
- Electronics: DAE4 Sn756; Calibrated: 2014-01-10
- Phantom: TFP 5.1C 2014-06-13; Type: QD 000 P51 CA; Serial: 1128
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

LTE850 (Band 5)/Body - Sub 3 - Scenario 0 - Spacer 15mm - WH-208 - Display Facing Phantom - QPSK - 10MHz - 1RB - 0% offset/Area Scan (81x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 15.762 V/m
Fast SAR: SAR(1 g) = 0.284 W/kg
Fast SAR(10 g) = 0.199 W/kg
Maximum value of SAR (interpolated) = 0.324 W/kg



Plot #22

Date/Time: 2014-07-08 12:45:49

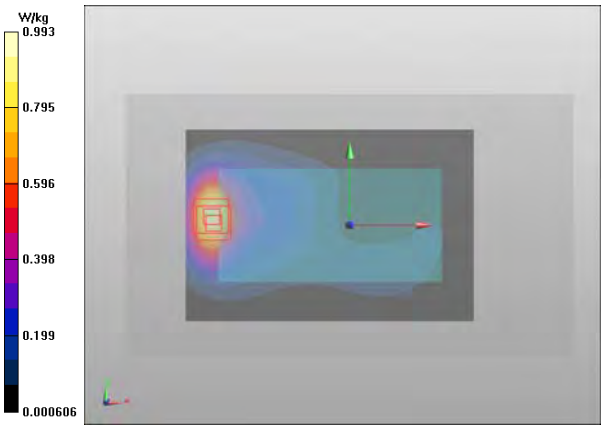
Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000027/3

Communication System: LTE1700/2100 (Band 4)
Frequency: 1720 MHz; Duty Cycle: 1:1
Medium: MSL1750; Medium Notes: 21.5
Medium parameters used: f = 1720 MHz; σ = 1.398 S/m; ε_r = 54.244; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3112
- ConvF(4.9, 4.9, 4.9); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1332; Calibrated: 2014-01-16
- Phantom: TF Phamptom 2014-06-16; Type: QD 000 P51 CA; Serial: 1129
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

LTE1700_2100 (Band 4)/Body - Low - CA with 4UL/DL+17DL - QPSK - 20MHz - 1RB - 0% offset - Spacer 15mm - WH-208 - Display Facing Phantom/Area Scan (81x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 26.773 V/m
Fast SAR: SAR(1 g) = 0.803 W/kg
Fast SAR(10 g) = 0.458 W/kg
Maximum value of SAR (interpolated) = 0.993 W/kg

LTE1700_2100 (Band 4)/Body - Low - CA with 4UL/DL+17DL - QPSK - 20MHz - 1RB - 0% offset - Spacer 15mm - WH-208 - Display Facing Phantom/Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 26.854 V/m
Peak SAR (extrapolated) = 1.25 W/kg
SAR(1 g) = 0.833 W/kg
SAR(10 g) = 0.506 W/kg
Power Drift = -0.01 dB
Maximum value of SAR (measured) = 0.976 W/kg



Plot #23

Date/Time: 2014-06-30 12:48:24

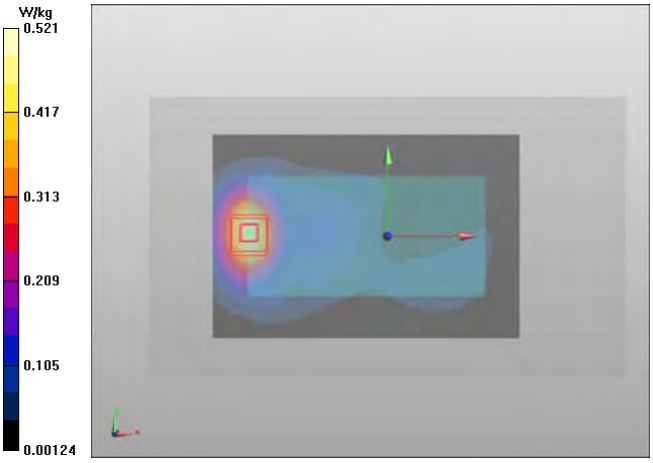
Test Laboratory: TCC Microsoft
Type: RM-984; Serial: 354250/06/000027/3

Communication System: 2-slot GPRS1900
Frequency: 1850.2 MHz; Duty Cycle: 1:4.19952
Medium: BSL1900; Medium Notes: T= 21.5c
Medium parameters used (interpolated): f = 1850.2 MHz; σ = 1.421 S/m; ε_r = 52.169; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3112
- ConvF(4.73, 4.73, 4.73); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1332; Calibrated: 2014-01-16
- Phantom: TF Phamptom 2014-06-16; Type: QD 000 P51 CA; Serial: 1129
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

2-slot GPRS1900/Body - Low - Spacer 15mm - No Headset - Display Facing Phantom/Area Scan (81x121x1):
Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 18.303 V/m
Fast SAR: SAR(1 g) = 0.419 W/kg
Fast SAR(10 g) = 0.239 W/kg
Maximum value of SAR (interpolated) = 0.521 W/kg

2-slot GPRS1900/Body - Low - Spacer 15mm - No Headset - Display Facing Phantom/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 18.210 V/m
Peak SAR (extrapolated) = 0.712 W/kg
SAR(1 g) = 0.466 W/kg
SAR(10 g) = 0.268 W/kg
Power Drift = -0.03 dB
Maximum value of SAR (measured) = 0.538 W/kg



Plot #24

Date/Time: 2014-07-01 07:26:00

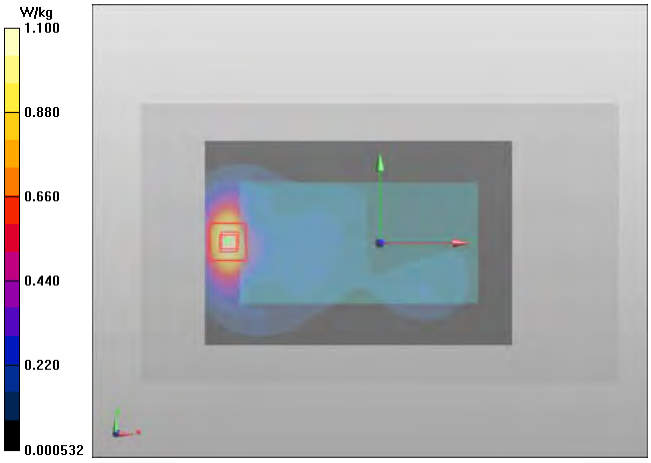
Test Laboratory: TCC Microsoft
Type: RM-984; Serial: 354250/06/000027/3

Communication System: WCDMA1900 (Band 2)
Frequency: 1907.6 MHz; Duty Cycle: 1:1
Medium: HSL1900; Medium Notes: T= 21.5c
Medium parameters used: f = 1908 MHz; σ = 1.474 S/m; ε_r = 52.055; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3112
- ConvF(4.73, 4.73, 4.73); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1332; Calibrated: 2014-01-16
- Phantom: TF Phamptom 2014-06-16; Type: QD 000 P51 CA; Serial: 1129
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

WCDMA1900 (Band 2)/Body - High - Spacer 15mm - WH-208 - Display Facing Phantom - Repeated/Area Scan (81x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 28.063 V/m
Fast SAR: SAR(1 g) = 0.879 W/kg
Fast SAR(10 g) = 0.471 W/kg
Maximum value of SAR (interpolated) = 1.10 W/kg

WCDMA1900 (Band 2)/Body - High - Spacer 15mm - WH-208 - Display Facing Phantom - Repeated/Zoom Scan (5x6x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 28.144 V/m
Peak SAR (extrapolated) = 1.42 W/kg
SAR(1 g) = 0.900 W/kg
SAR(10 g) = 0.518 W/kg
Power Drift = -0.09 dB
Maximum value of SAR (measured) = 1.09 W/kg



Plot #25

Date/Time: 2014-07-01 22:16:11

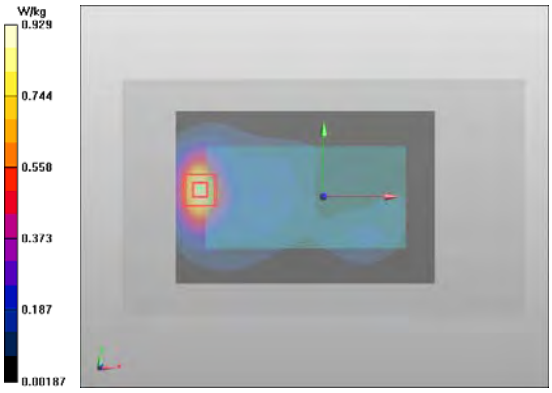
Test Laboratory: TCC Microsoft
Type: RM-984; Serial: 354250/06/6000027/3

Communication System: LTE1900 (Band 2)
Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: HSL1900; Medium Notes: T= 21.5c
Medium parameters used: f = 1900 MHz; σ = 1.472 S/m; ε_r = 51.784; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3112
- ConvF(4.73, 4.73, 4.73); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1332; Calibrated: 2014-01-16
- Phantom: TF Phamptom 2014-06-16; Type: QD 000 P51 CA; Serial: 1129
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

LTE1900 (Band 2)/Body - High - Non-CA - QPSK - 20MHz - 1RB - 0% offset - Spacer 15mm - No Headset - Display Facing Phantom/Area Scan (81x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 24.908 V/m
Fast SAR: SAR(1 g) = 0.741 W/kg
Fast SAR(10 g) = 0.408 W/kg
Maximum value of SAR (interpolated) = 0.929 W/kg

LTE1900 (Band 2)/Body - High - Non-CA - QPSK - 20MHz - 1RB - 0% offset - Spacer 15mm - No Headset - Display Facing Phantom /Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 24.744 V/m
Peak SAR (extrapolated) = 1.21 W/kg
SAR(1 g) = 0.776 W/kg
SAR(10 g) = 0.454 W/kg
Power Drift = -0.02 dB
Maximum value of SAR (measured) = 0.934 W/kg



Plot #26

Date/Time: 2014-07-01 19:06:04

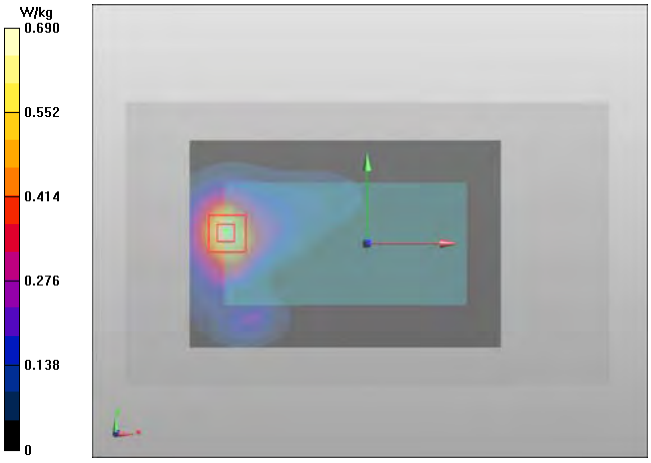
Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000024/0

Communication System: LTE2500 (Band 7)
Frequency: 2510 MHz; Duty Cycle: 1:1
Medium: BSL2300-2600; Medium Notes: T=21.5C
Medium parameters used: f = 2510 MHz; σ = 1.992 S/m; ε_r = 53.211; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3275
- ConvF(3.98, 3.98, 3.98); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn756; Calibrated: 2014-01-10
- Phantom: TFP 5.1C 2014-06-13; Type: QD 000 P51 CA; Serial: 1128
- Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.9 (7117)

LTE2500 (Band 7)/Body - Low - QPSK - 20MHz - 1RB - 0% offset - Spacer 15mm - WH-208 - Display Facing Phantom/Area Scan (121x181x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 12.010 V/m
Fast SAR: SAR(1 g) = 0.543 W/kg
Fast SAR(10 g) = 0.286 W/kg
Maximum value of SAR (interpolated) = 0.690 W/kg

LTE2500 (Band 7)/Body - Low - QPSK - 20MHz - 1RB - 0% offset - Spacer 15mm - WH-208 - Display Facing Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 12.025 V/m
Peak SAR (extrapolated) = 1.04 W/kg
SAR(1 g) = 0.556 W/kg
SAR(10 g) = 0.305 W/kg
Power Drift = 0.08 dB
Maximum value of SAR (measured) = 0.687 W/kg



Plot #27

Date/Time: 2014-07-11 13:48:18

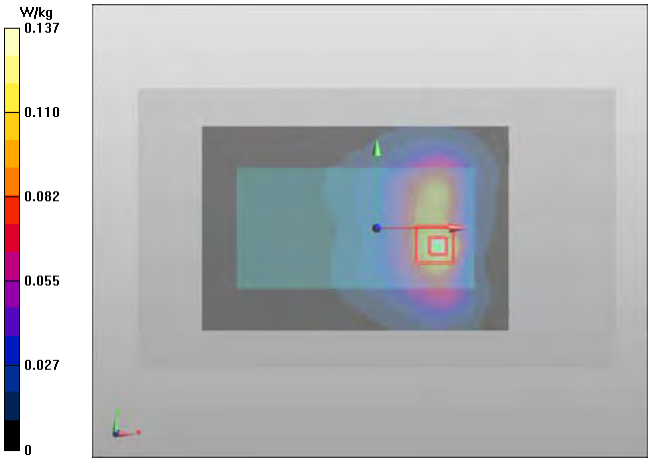
Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000035/6

Communication System: WLAN2450 b-mode
Frequency: 2412 MHz; Duty Cycle: 1:1
Medium: BSL2450; Medium Notes: T=21.5C
Medium parameters used: f = 2412 MHz; σ = 1.863 S/m; ε_r = 51.215; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: EX3DV4 - SN3817
- ConvF(7.2, 7.2, 7.2); Calibrated: 2014-01-17;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1301; Calibrated: 2014-01-13
- Phantom: TFP 5.1C 2014-07-08; Type: QD 000 P51 CA; Serial: 1128-1
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

WLAN2450 b-mode/Body - Channel 1 - 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 = 8.348 V/m
Fast SAR: SAR(1 g) = 0.106 W/kg
Fast SAR(10 g) = 0.053 W/kg
Maximum value of SAR (interpolated) = 0.137 W/kg

WLAN2450 b-mode/Body - Channel 1 - 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 = 8.769 V/m
Peak SAR (extrapolated) = 0.220 W/kg
SAR(1 g) = 0.116 W/kg
SAR(10 g) = 0.061 W/kg
Power Drift = 0.02 dB
Maximum value of SAR (measured) = 0.147 W/kg



Plot #28

Date/Time: 2014-07-09 16:46:18

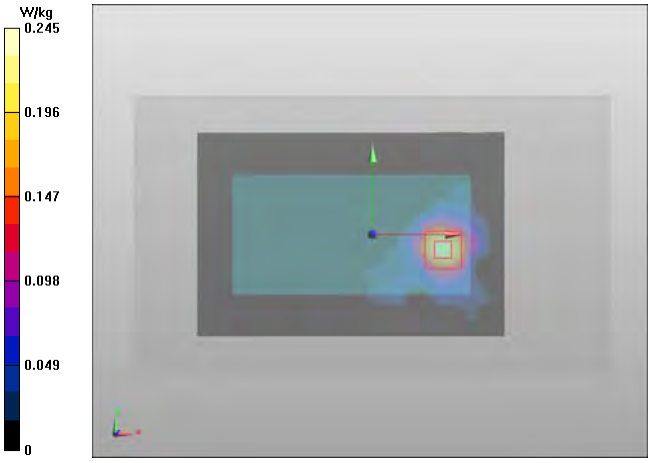
Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000035/6

Communication System: WLAN5000 a-mode
Frequency: 5805 MHz; Duty Cycle: 1:1
Medium: BSL5000; Medium Notes: T=21.5
Medium parameters used: f = 5805 MHz; σ = 6.139 S/m; ε_r = 46.95; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: EX3DV4 - SN3817
- ConvF(4.28, 4.28, 4.28); Calibrated: 2014-01-17;
- Sensor-Surface: 2mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1301; Calibrated: 2014-01-13
- Phantom: TFP 5.1C 2014-07-08; Type: QD 000 P51 CA; Serial: 1128-1
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

WLAN5000 a-mode/Body - Channel 161 - BPSK 6 Mbps - Spacer 15mm - No Headset - Back Facing Phantom/Area Scan (121x181x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.245 W/kg

WLAN5000 a-mode/Body - Channel 161 - BPSK 6 Mbps - Spacer 15mm - No Headset - Back Facing Phantom/Zoom Scan (8x8x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 5.526 V/m
Peak SAR (extrapolated) = 0.489 W/kg
SAR(1 g) = 0.133 W/kg
SAR(10 g) = 0.052 W/kg
Power Drift = 0.14 dB
Maximum value of SAR (measured) = 0.251 W/kg



Plot #29

Date/Time: 2014-07-03 17:37:29

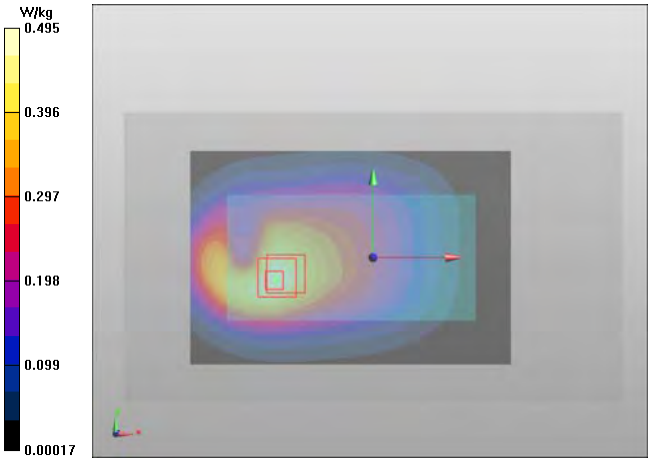
Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000024/0

Communication System: LTE700 (Band 17)
Frequency: 710 MHz; Duty Cycle: 1:1
Medium: BSL750; Medium Notes: T=21.5C
Medium parameters used: f = 710 MHz; σ = 0.923 S/m; ε_r = 55.402; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3275
- ConvF(6.03, 6.03, 6.03); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn756; Calibrated: 2014-01-10
- Phantom: TFP 5.1C 2014-06-13; Type: QD 000 P51 CA; Serial: 1128
- Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.9 (7117)

LTE700 (Band 17)/Body - Middle - QPSK - 10MHz - 1RB - 100% offset - Spacer 10mm - No Headset - Display Facing Phantom/Area Scan (81x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 15.273 V/m
Fast SAR: SAR(1 g) = 0.433 W/kg
Fast SAR(10 g) = 0.302 W/kg
Maximum value of SAR (interpolated) = 0.495 W/kg

LTE700 (Band 17)/Body - Middle - QPSK - 10MHz - 1RB - 100% offset - Spacer 10mm - No Headset - Display Facing Phantom/Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 14.523 V/m
Peak SAR (extrapolated) = 0.613 W/kg
SAR(1 g) = 0.429 W/kg
SAR(10 g) = 0.305 W/kg
Power Drift = 0.04 dB
Maximum value of SAR (measured) = 0.485 W/kg



Plot #30

Date/Time: 2014-07-15 13:53:15

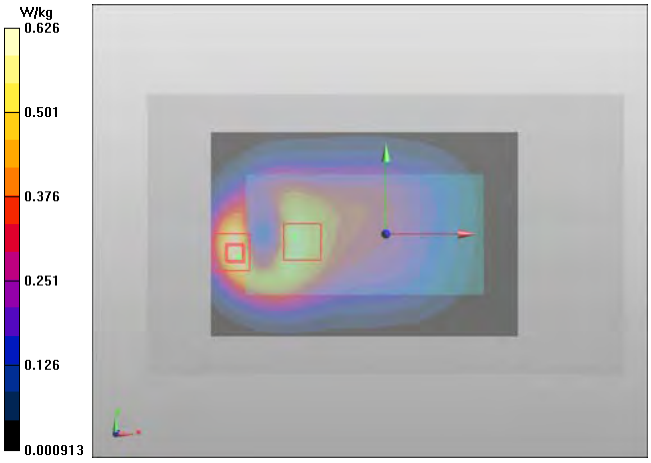
Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000024/0

Communication System: 2-slot GPRS850
Frequency: 844.8 MHz; Duty Cycle: 1:4.19952
Medium: BSL800-900; Medium Notes: T=21.5C
Medium parameters used: f = 845 MHz; σ = 0.977 S/m; ε_r = 54.717; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3275
- ConvF(6.01, 6.01, 6.01); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn756; Calibrated: 2014-01-10
- Phantom: TFP 5.1C 2014-06-13; Type: QD 000 P51 CA; Serial: 1128
- Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.9 (7117)

2-slot GPRS850/Body - Sub 3 - Scenario 0 - Spacer 10mm - No Headset - Display Facing Phantom/Area Scan (81x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 19.462 V/m
Fast SAR: SAR(1 g) = 0.514 W/kg
Fast SAR(10 g) = 0.335 W/kg
Maximum value of SAR (interpolated) = 0.626 W/kg

2-slot GPRS850/Body - Sub 3 - Scenario 0 - Spacer 10mm - No Headset - Display Facing Phantom/Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 18.534 V/m
Peak SAR (extrapolated) = 0.871 W/kg
SAR(1 g) = 0.516 W/kg
SAR(10 g) = 0.295 W/kg
Power Drift = 0.09 dB
Maximum value of SAR (measured) = 0.621 W/kg



Plot #31

Date/Time: 2014-07-10 18:19:06

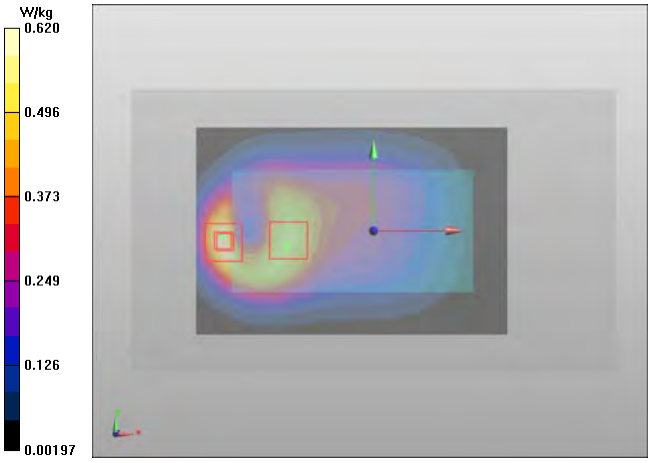
Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000024/0

Communication System: WCDMA850 (Band 5)
Frequency: 843.8 MHz; Duty Cycle: 1:1
Medium: BSL800-900; Medium Notes: T=21.5C
Medium parameters used: f = 844 MHz; σ = 0.978 S/m; ε_r = 54.676; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3275
- ConvF(6.01, 6.01, 6.01); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn756; Calibrated: 2014-01-10
- Phantom: TFP 5.1C 2014-06-13; Type: QD 000 P51 CA; Serial: 1128
- Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.9 (7117)

WCDMA850 (Band 5)/Body - Sub 3 - Scenario 2 - Spacer 10mm - No Headset - Display Facing Phantom/Area Scan (81x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 25.427 V/m
Fast SAR: SAR(1 g) = 0.501 W/kg
Fast SAR(10 g) = 0.320 W/kg
Maximum value of SAR (interpolated) = 0.620 W/kg

WCDMA850 (Band 5)/Body - Sub 3 - Scenario 2 - Spacer 10mm - No Headset - Display Facing Phantom/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 25.427 V/m
Peak SAR (extrapolated) = 0.924 W/kg
SAR(1 g) = 0.547 W/kg
SAR(10 g) = 0.311 W/kg
Power Drift = 0.02 dB
Maximum value of SAR (measured) = 0.636 W/kg



Plot #32

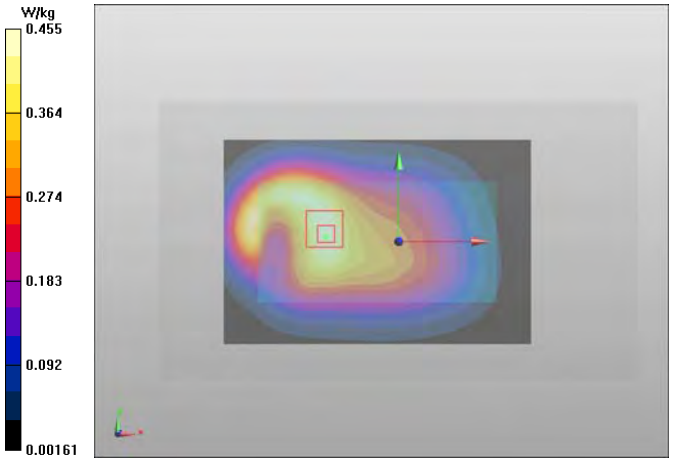
Date/Time: 2014-06-27 12:10:29

Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000024/0

Communication System: LTE850 (Band 5)
Frequency: 844 MHz; Duty Cycle: 1:1
Medium: MSL835; Medium Notes: T =21.5c
Medium parameters used: f = 844 MHz; σ = 0.969 S/m; ε_r = 54.621; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3275
- ConvF(6.01, 6.01, 6.01); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used))
- Electronics: DAE4 Sn756; Calibrated: 2014-01-10
- Phantom: TFP 5.1C 2014-06-13; Type: QD 000 P51 CA; Serial: 1128
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

LTE850 (Band 5)/Body - Sub 3 - Scenario 0 - QPSK - 10MHz - 1 RB - 0% offset - Spacer 10mm - No Headset - Back Facing Phantom /Area Scan (81x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 21.945 V/m
Fast SAR: SAR(1 g) = 0.399 W/kg
Fast SAR(10 g) = 0.279 W/kg
Maximum value of SAR (interpolated) = 0.455 W/kg



Plot #33

Date/Time: 2014-07-11 21:38:54

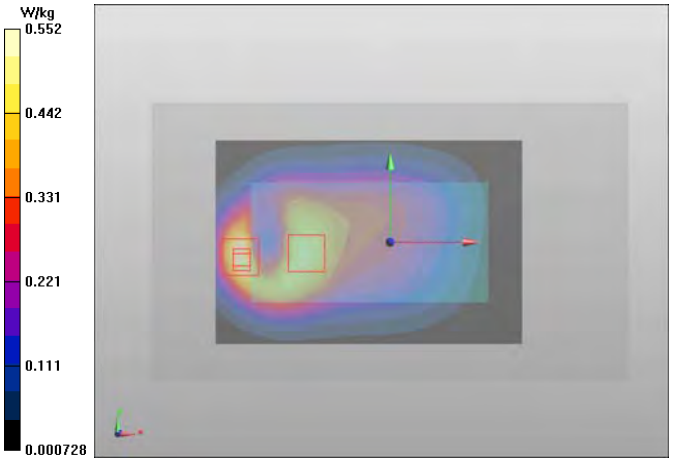
Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000024/0

Communication System: LTE850 (Band 5)
Frequency: 844 MHz; Duty Cycle: 1:1
Medium: MSL800-900; Medium Notes: T=21.5C
Medium parameters used: f = 844 MHz; σ = 0.969 S/m; ε_r = 54.145; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3275
- ConvF(6.01, 6.01, 6.01); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn756; Calibrated: 2014-01-10
- Phantom: TFP 5.1C 2014-06-13; Type: QD 000 P51 CA; Serial: 1128
- Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.9 (7117)

LTE850 (Band 5)/Body - Sub 3 - Scenario 0 - QPSK - 10MHz - 1RB - 0% offset - Spacer 10mm - No Headset - Display Facing Phantom/Area Scan (81x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 24.239 V/m
Fast SAR: SAR(1 g) = 0.450 W/kg
Fast SAR(10 g) = 0.297 W/kg
Maximum value of SAR (interpolated) = 0.552 W/kg

LTE850 (Band 5)/Body - Sub 3 - Scenario 0 - QPSK - 10MHz - 1RB - 0% offset - Spacer 10mm - No Headset - Display Facing Phantom/Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 24.239 V/m
Peak SAR (extrapolated) = 0.778 W/kg
SAR(1 g) = 0.464 W/kg
SAR(10 g) = 0.267 W/kg
Power Drift = -0.02 dB
Maximum value of SAR (measured) = 0.569 W/kg



Plot #34

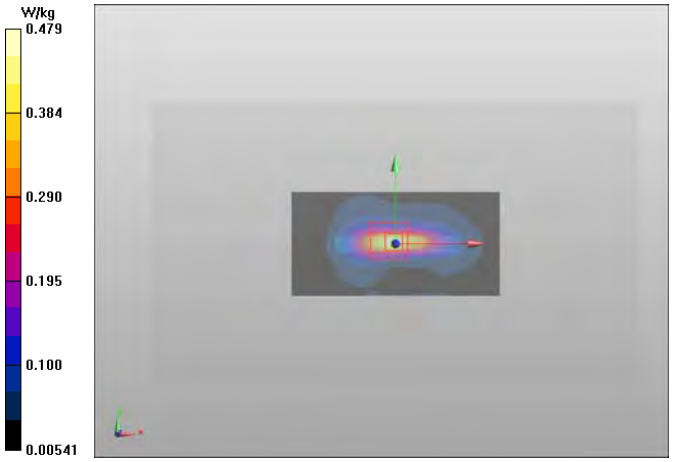
Date/Time: 2014-06-27 18:16:15

Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000024/0

Communication System: LTE850 (Band 5)
Frequency: 844 MHz; Duty Cycle: 1:1
Medium: MSL835; Medium Notes: T =21.5c
Medium parameters used: f = 844 MHz; σ = 0.969 S/m; ε_r = 54.621; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3275
- ConvF(6.01, 6.01, 6.01); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used))
- Electronics: DAE4 Sn756; Calibrated: 2014-01-10
- Phantom: TFP 5.1C 2014-06-13; Type: QD 000 P51 CA; Serial: 1128
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

LTE850 (Band 5)/Body - Sub 3 - QPSK - 10MHz - 1 RB - 0% offset - Scenario 0 - Spacer 10mm - No Headset - Bottom Edge Facing Phantom /Area Scan (41x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 22.873 V/m
Fast SAR: SAR(1 g) = 0.342 W/kg
Fast SAR(10 g) = 0.168 W/kg
Maximum value of SAR (interpolated) = 0.479 W/kg



Plot #35

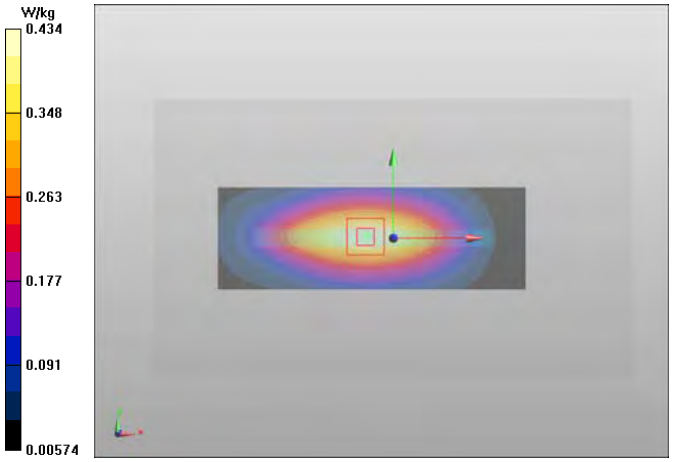
Date/Time: 2014-06-27 16:17:05

Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000024/0

Communication System: LTE850 (Band 5)
Frequency: 844 MHz; Duty Cycle: 1:1
Medium: MSL835; Medium Notes: T =21.5c
Medium parameters used: f = 844 MHz; σ = 0.969 S/m; ε_r = 54.621; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3275
- ConvF(6.01, 6.01, 6.01); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used))
- Electronics: DAE4 Sn756; Calibrated: 2014-01-10
- Phantom: TFP 5.1C 2014-06-13; Type: QD 000 P51 CA; Serial: 1128
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

LTE850 (Band 5)/Body - Sub 3 - Scenario 2 - QPSK - 10MHz - 1 RB - 0% offset - Spacer 10mm - No Headset - Left Edge Facing Phantom/Area Scan (41x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 21.604 V/m
Fast SAR: SAR(1 g) = 0.380 W/kg
Fast SAR(10 g) = 0.260 W/kg
Maximum value of SAR (interpolated) = 0.434 W/kg



Plot #36

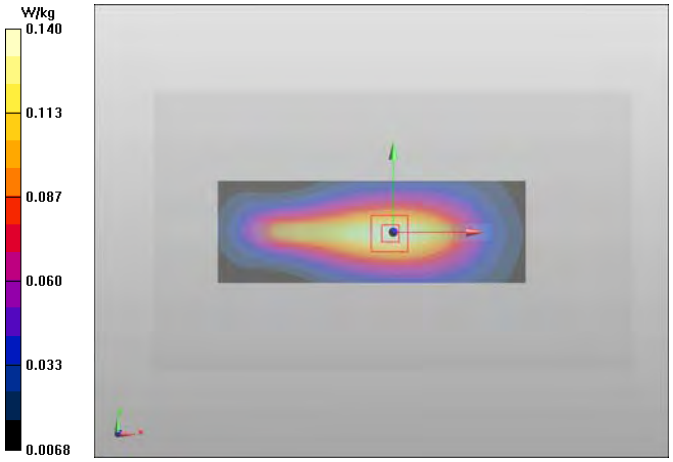
Date/Time: 2014-06-27 14:52:30

Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000024/0

Communication System: LTE850 (Band 5)
Frequency: 829 MHz; Duty Cycle: 1:1
Medium: MSL835; Medium Notes: T =21.5c
Medium parameters used: f = 829 MHz; σ = 0.96 S/m; ε_r = 54.694; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3275
- ConvF(6.01, 6.01, 6.01); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn756; Calibrated: 2014-01-10
- Phantom: TFP 5.1C 2014-06-13; Type: QD 000 P51 CA; Serial: 1128
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

LTE850 (Band 5)/Body - Sub 1 - Scenario 0 - QPSK - 10MHz - 1 RB - 0% offset - Spacer 10mm - No Headset - Right Edge Facing Phantom /Area Scan (41x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 12.330 V/m
Fast SAR: SAR(1 g) = 0.122 W/kg
Fast SAR(10 g) = 0.083 W/kg
Maximum value of SAR (interpolated) = 0.140 W/kg



Plot #37

Date/Time: 2014-07-11 09:42:14

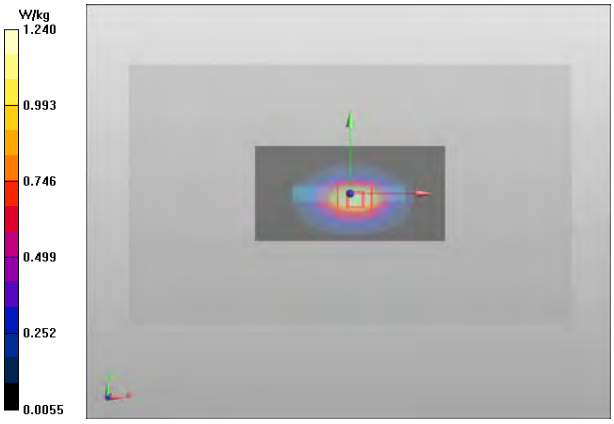
Test Laboratory: TCC Microsoft
Type: RM-984; Serial: 354250/06/000040/6

Communication System: LTE1700/2100 (Band 4)
Frequency: 1745 MHz; Duty Cycle: 1:1
Medium: MSL1750; Medium Notes:
Medium parameters used: f = 1745 MHz; σ = 1.434 S/m; ε_r = 54.693; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3112
- ConvF(4.9, 4.9, 4.9); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1332; Calibrated: 2014-01-16
- Phantom: TF Phamptom 2014-06-16; Type: QD 000 P51 CA; Serial: 1129
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

LTE1900 (Band 4)/Body - High - Non-CA -QPSK - 20MHz - 1RB - 0% offset - Spacer 10mm - No Headset - Bottom Edge Facing Phantom - Repeated/Area Scan (41x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 29.166 V/m
Fast SAR: SAR(1 g) = 0.954 W/kg
Fast SAR(10 g) = 0.493 W/kg
Maximum value of SAR (interpolated) = 1.24 W/kg

LTE1900 (Band 4)/Body - High - Non-CA - QPSK - 20MHz - 1RB - 0% offset - Spacer 10mm - No Headset - Bottom Edge Facing Phantom - Repeated/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 29.214 V/m
Peak SAR (extrapolated) = 1.56 W/kg
SAR(1 g) = 0.968 W/kg
SAR(10 g) = 0.533 W/kg
Power Drift = -0.05 dB
Maximum value of SAR (measured) = 1.18 W/kg



Plot #38

Date/Time: 2014-07-16 12:23:46

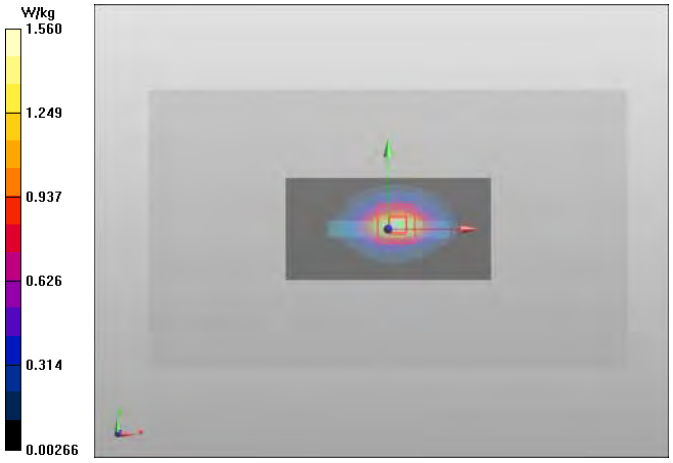
Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000040/6

Communication System: 1-slot GPRS1900
Frequency: 1909.8 MHz; Duty Cycle: 1:8.30042
Medium: BSL1900; Medium Notes: t= 21.4 C
Medium parameters used: f = 1910 MHz; σ = 1.501 S/m; ε_r = 51.601; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3112
- ConvF(4.73, 4.73, 4.73); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1332; Calibrated: 2014-01-16
- Phantom: TF Phamptom 2014-06-16; Type: QD 000 P51 CA; Serial: 1129
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

1-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 = 28.245 V/m
Fast SAR: SAR(1 g) = 1.16 W/kg
Fast SAR(10 g) = 0.573 W/kg
Maximum value of SAR (interpolated) = 1.56 W/kg

1-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 = 28.497 V/m
Peak SAR (extrapolated) = 2.00 W/kg
SAR(1 g) = 1.18 W/kg
SAR(10 g) = 0.626 W/kg
Power Drift = 0.01 dB
Maximum value of SAR (measured) = 1.47 W/kg



Plot #39

Date/Time: 2014-06-30 22:26:08

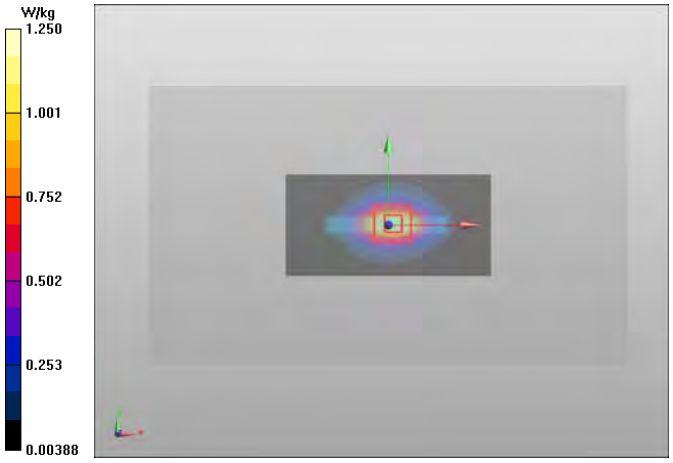
Test Laboratory: TCC Microsoft
Type: RM-984; Serial: 354250/06/000040/6

Communication System: WCDMA1900 (Band 2)
Frequency: 1907.6 MHz; Duty Cycle: 1:1
Medium: BSL1900; Medium Notes: T= 21.5c
Medium parameters used: f = 1908 MHz; σ = 1.474 S/m; ε_r = 52.055; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3112
- ConvF(4.73, 4.73, 4.73); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1332; Calibrated: 2014-01-16
- Phantom: TF Phamptom 2014-06-16; Type: QD 000 P51 CA; Serial: 1129
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

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 = 29.890 V/m
Fast SAR: SAR(1 g) = 0.961 W/kg
Fast SAR(10 g) = 0.473 W/kg
Maximum value of SAR (interpolated) = 1.25 W/kg

WCDMA1900 (Band 2/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 = 29.849 V/m
Peak SAR (extrapolated) = 1.63 W/kg
SAR(1 g) = 0.977 W/kg
SAR(10 g) = 0.524 W/kg
Power Drift = -0.01 dB
Maximum value of SAR (measured) = 1.20 W/kg



Plot #40

Date/Time: 2014-07-16 13:15:37

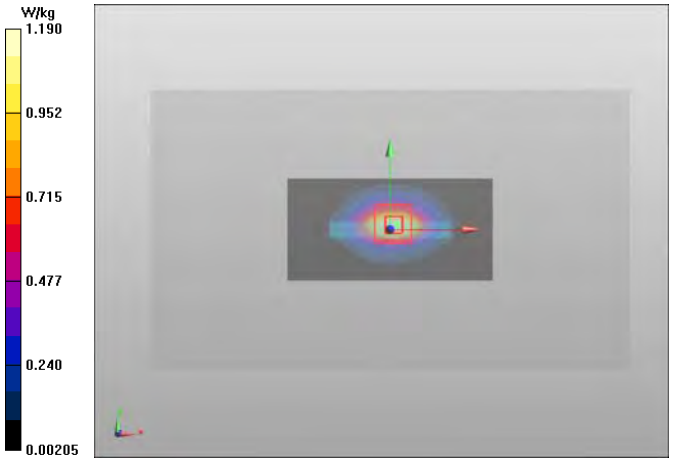
Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000040/6

Communication System: LTE1900 (Band 2)
Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: BSL1900; Medium Notes: t= 21.4 C
Medium parameters used: f = 1900 MHz; σ = 1.491 S/m; ε_r = 51.641; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3112
- ConvF(4.73, 4.73, 4.73); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1332; Calibrated: 2014-01-16
- Phantom: TF Phamptom 2014-06-16; Type: QD 000 P51 CA; Serial: 1129
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

LTE1900 (Band 2)/Body - High – Non-CA - QPSK - 20MHz - 1RB - 50% offset - Spacer 10mm - No Headset - Bottom Edge Facing Phantom/Area Scan (41x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 28.430 V/m
Fast SAR: SAR(1 g) = 0.910 W/kg
Fast SAR(10 g) = 0.455 W/kg
Maximum value of SAR (interpolated) = 1.19 W/kg

LTE1900 (Band 2)/Body - High – Non-CA - QPSK - 20MHz - 1RB - 50% offset - 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 = 28.430 V/m
Peak SAR (extrapolated) = 1.54 W/kg
SAR(1 g) = 0.927 W/kg
SAR(10 g) = 0.500 W/kg
Power Drift = 0.03 dB
Maximum value of SAR (measured) = 1.15 W/kg



Plot #41

Date/Time: 2014-07-01 23:00:49

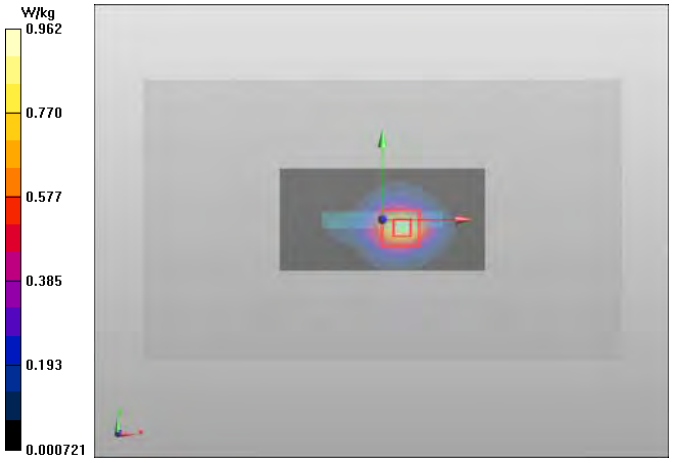
Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000040/6

Communication System: LTE2500 (Band 7)
Frequency: 2535 MHz; Duty Cycle: 1:1
Medium: BSL2300-2600; Medium Notes: T=21.5C
Medium parameters used: f = 2535 MHz; σ = 2.023 S/m; ε_r = 53.146; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3275
- ConvF(3.98, 3.98, 3.98); Calibrated: 2014-01-22;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn756; Calibrated: 2014-01-10
- Phantom: TFP 5.1C 2014-06-13; Type: QD 000 P51 CA; Serial: 1128
- Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.9 (7117)

LTE2500 (Band 7)/Body - Middle - QPSK - 20MHz - 1RB - 100% offset - Spacer 10mm - No Headset - Bottom Edge Facing Phantom/Area Scan (61x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 2.806 V/m
Fast SAR: SAR(1 g) = 0.730 W/kg
Fast SAR(10 g) = 0.345 W/kg
Maximum value of SAR (interpolated) = 0.962 W/kg

LTE2500 (Band 7) /Body - Middle - QPSK - 20MHz - 1RB - 100% offset - Spacer 10mm - No Headset - Bottom Edge Facing Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.676 V/m
Peak SAR (extrapolated) = 1.52 W/kg
SAR(1 g) = 0.752 W/kg
SAR(10 g) = 0.366 W/kg
Power Drift = -0.04 dB
Maximum value of SAR (measured) = 0.971 W/kg



Plot #42

Date/Time: 2014-07-14 09:07:12

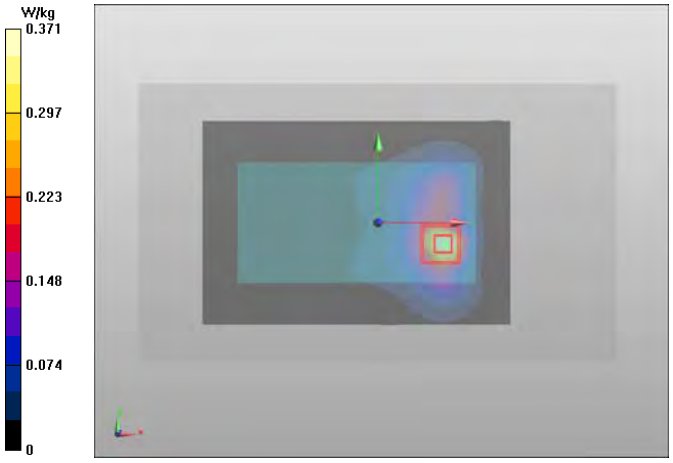
Test Laboratory: TCC Microsoft
Type: RM-983; Serial: 354250/06/000035/6

Communication System: WLAN2450
Frequency: 2437 MHz; Duty Cycle: 1:1
Medium: BSL2450; Medium Notes: T=21.5C
Medium parameters used: f = 2437 MHz; σ = 1.892 S/m; ε_r = 51.253; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: EX3DV4 - SN3817
- ConvF(7.2, 7.2, 7.2); Calibrated: 2014-01-17;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1301; Calibrated: 2014-01-13
- Phantom: TFP 5.1C 2014-07-08; Type: QD 000 P51 CA; Serial: 1128-1
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.9 (7117)

WLAN2450 b-mode/Body - Channel 6 - BPSK 1 Mbps - Spacer 10mm - No Headset - Back Facing Phantom/Area Scan (121x181x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 12.746 V/m
Fast SAR: SAR(1 g) = 0.279 W/kg
Fast SAR(10 g) = 0.128 W/kg
Maximum value of SAR (interpolated) = 0.371 W/kg

WLAN2450 b-mode/Body - Channel 6 - BPSK 1 Mbps - Spacer 10mm - No Headset - Back Facing Phantom/Zoom Scan (7x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 12.399 V/m
Peak SAR (extrapolated) = 0.549 W/kg
SAR(1 g) = 0.266 W/kg
SAR(10 g) = 0.126 W/kg
Power Drift = -0.02 dB
Maximum value of SAR (measured) = 0.354 W/kg



APPENDIX C: DIELECTRIC PARAMETERS OF THE TISSUE SIMULANTS

Head tissue simulant dielectric parameters used in the measurements:

LTE17 f (MHz)	Date	Dielectric Parameters					
		Ch 23780 709.0 MHz		Ch 23790 710.0 MHz		Ch 23800 711.0 MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
710	2014-07-02	41.3	0.86	41.3	0.86	41.3	0.86
	2014-07-14	42.7	0.89	42.7	0.90	42.7	0.90
WCDMA5 f (MHz)	Date	Dielectric Parameters					
		Ch 4147 829.4 MHz		Ch 4183 836.6 MHz		Ch 4219 843.8 MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
837	2014-07-08	40.6	0.89	40.6	0.90	40.5	0.90
GPRS850 f (MHz)	Date	Dielectric Parameters					
		Ch 148 828.2 MHz		Ch 189 836.4 MHz		Ch 231 844.8 MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
836	2014-07-14	41.0	0.90	41.0	0.91	40.9	0.91
LTE5 f (MHz)	Date	Dielectric Parameters					
		Ch 20450 829.0 MHz		Ch 20525 836.5 MHz		Ch 20600 844.0 MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
837	2014-07-09	40.8	0.90	40.7	0.91	40.7	0.91
	2014-07-31	40.9	0.90	40.8	0.91	40.8	0.91
LTE4 f (MHz)	Date	Dielectric Parameters					
		Ch 20050 1720.0 MHz		Ch 20175 1732.5 MHz		Ch 20300 1745.0 MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
1732	2014-06-26	40.9	1.34	40.8	1.35	40.8	1.36
	2014-07-02	40.3	1.35	40.3	1.36	40.2	1.37

(Head tissue simulant table continues)

(Head tissue simulant table continues)

GPRS1900 f (MHz)	Date	Dielectric Parameters					
		Ch 512 1850.2 MHz		Ch 661 1880.0 MHz		Ch 810 1909.8 MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
1900	2014-06-24	40.0	1.33	39.9	1.35	39.8	1.38
WCDMA2 f (MHz)	Date	Dielectric Parameters					
		Ch 9262 1852.4 MHz		Ch 9400 1880.0 MHz		Ch 9538 1907.6 MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
1900	2014-06-24	40.0	1.33	39.9	1.35	39.8	1.38
LTE2 f (MHz)	Date	Dielectric Parameters					
		Ch 18700 1860.0 MHz		Ch 18900 1880.0 MHz		Ch 19100 1900.0 MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
1900	2014-06-25	39.7	1.35	39.6	1.37	39.6	1.39
	2014-07-03	40.3	1.38	40.2	1.40	40.1	1.42
WLAN2450 f (MHz)	Date	Dielectric Parameters					
		Ch 1 2412.0 MHz		Ch 6 2437.0 MHz		Ch 11 2462.0 MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
2437	2014-07-10	39.6	1.74	39.5	1.76	39.4	1.79
LTE7 f (MHz)	Date	Dielectric Parameters					
		Ch 20850 2510.0 MHz		Ch 21100 2535.0 MHz		Ch 21350 2560.0 MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
2535	2014-06-30	38.3	1.84	38.3	1.87	38.2	1.89
	2014-07-14	38.3	1.86	38.2	1.89	38.1	1.92
	2014-07-31	38.2	1.86	38.1	1.89	38.0	1.92

Head tissue simulant dielectric parameters used in the measurements 5200 – 5825 MHz:

f (MHz)	Date	Dielectric Parameters									
		Ch 40 5200.0 MHz		5210.0 MHz		Ch 48 5240.0 MHz		-		-	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
5210	2014-06-26	36.4	4.45	36.4	4.46	36.3	4.49	-	-	-	-
f (MHz)	Date	Dielectric Parameters									
		Ch 52 5260.0 MHz		5290.0 MHz		Ch 60 5300.0 MHz		-		-	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
5290	2014-06-27	36.5	4.54	36.5	4.57	36.5	4.58	-	-	-	-
f (MHz)	Date	Dielectric Parameters									
		Ch 104 5520.0 MHz		Ch 112 5560.0 MHz		Ch 124 5620.0 MHz		Ch 132 5660.0 MHz		-	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]	εr	εr	εr	σ [S/m]
5520 5620	2014-06-30	35.9	4.76	35.9	4.80	35.8	4.87	35.8	4.91	-	-
	2014-07-01	36.7	4.87	36.7	4.91	36.6	4.97	36.5	5.02	-	-
	2014-07-18	36.4	4.80	36.3	4.84	36.2	4.91	36.2	4.96	-	-
f (MHz)	Date	Dielectric Parameters									
		5760.0 MHz		Ch 153 5765.0 MHz		Ch 157 5785.0 MHz		Ch 161 5805.0 MHz		-	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
5760	2014-07-02	36.4	5.13	36.4	5.14	36.4	5.15	36.3	5.18	-	-

Body tissue simulant dielectric parameters used in the measurements:

LTE17 f (MHz)	Date	Dielectric Parameters					
		Ch 23780 709.0 MHz		Ch 23790 710.0 MHz		Ch 23800 711.0 MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
710	2014-07-03	55.4	0.92	55.4	0.92	55.4	0.92
	2014-07-14	55.0	0.92	55.0	0.92	55.0	0.92
WCDMA5 f (MHz)	**Date**	**Dielectric Parameters**					
		Ch 4147 829.4 MHz		**Ch 4183 836.6 MHz**		**Ch 4219 843.8 MHz**	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
837	2014-07-10	54.8	0.97	54.7	0.97	54.7	0.98
	2014-07-14	54.8	0.97	54.8	0.97	54.7	0.98
GPRS f (MHz)	**Date**	**Dielectric Parameters**					
		Ch 148 828.2 MHz		**Ch 189 836.4 MHz**		**Ch 231 844.8 MHz**	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
836	2014-07-14	54.8	0.97	54.8	0.97	54.7	0.98
LTE5 f (MHz)	**Date**	**Dielectric Parameters**					
		Ch 20450 829.0 MHz		**Ch 20525 836.5 MHz**		**Ch 20600 844.0 MHz**	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
837	2014-06-25	54.5	0.96	54.5	0.97	54.5	0.97
	2014-06-27	54.7	0.96	54.7	0.96	54.6	0.97
	2014-07-10	54.8	0.97	54.7	0.97	54.7	0.98
	2014-07-11	54.2	0.96	54.2	0.97	54.2	0.97
	2014-07-31	54.3	0.97	54.3	0.97	54.3	0.98
LTE4 f (MHz)	**Date**	**Dielectric Parameters**					
		Ch 20050 1720.0 MHz		**Ch 20175 1732.5 MHz**		**Ch 20300 1745.0 MHz**	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
1732	2014-07-03	55.2	1.41	55.1	1.43	55.1	1.44
	2014-07-07	54.4	1.40	54.4	1.42	54.4	1.43
	2014-07-08	54.2	1.41	54.2	1.41	54.2	1.42
	2014-07-10	54.7	1.41	54.7	1.42	54.7	1.43
	2014-07-18	54.4	1.40	54.4	1.40	54.4	1.40
	2013-07-31	54.7	1.40	54.7	1.42	54.7	1.43

(Body tissue simulant table continues)

(Body tissue simulant table continues)

GPRS f (MHz)	Date	Dielectric Parameters					
		Ch 512 1850.2 MHz		Ch 661 1880.0 MHz		Ch 810 1909.8 MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
1900	2014-06-30	52.2	1.42	52.1	1.45	52.1	1.48
	2014-07-16	51.8	1.44	51.7	1.47	51.6	1.50
WCDMA f (MHz)	Date	Dielectric Parameters					
		Ch 9262 1852.4 MHz		Ch 9400 1880.0 MHz		Ch 9538 1907.6 MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
1900	2014-06-30	52.2	1.42	52.1	1.45	52.1	1.47
	2014-07-01	51.9	1.43	51.8	1.45	51.8	1.48
	2014-07-02	52.1	1.44	52.0	1.47	51.9	1.50
LTE2 f (MHz)	Date	Dielectric Parameters					
		Ch 18700 1860.0 MHz		Ch 18900 1880.0 MHz		Ch 19100 1900.0 MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
1900	2014-06-30	52.2	1.42	52.1	1.45	52.1	1.47
	2014-07-01	51.9	1.44	51.8	1.45	51.8	1.47
	2014-07-07	51.5	1.44	51.5	1.46	51.4	1.48
	2014-07-11	51.5	1.44	51.4	1.47	51.3	1.49
	2014-07-16	51.8	1.45	51.7	1.47	51.6	1.49
	2013-07-31	51.3	1.45	51.3	1.46	51.2	1.48
WLAN f (MHz)	Date	Dielectric Parameters					
		Ch 1 2412.0 MHz		Ch 6 2437.0 MHz		Ch 11 2462.0 MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
2437	2014-07-11	51.2	1.86	51.1	1.89	51.1	1.92
	2014-07-14	51.3	1.86	51.3	1.89	51.2	1.92
LTE7 f (MHz)	Date	Dielectric Parameters					
		Ch 20850 2510.0 MHz		Ch 21100 2535.0 MHz		Ch 21350 2560.0 MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
2535	2014-07-01	53.2	1.99	53.2	2.02	53.1	2.05
	2014-07-14	51.1	1.98	51.0	2.01	50.9	2.04
	2013-07-31	53.2	2.00	53.1	2.03	53.0	2.06

Body tissue simulant dielectric parameters used in the measurements 5200 – 5825 MHz:

f (MHz)	Date	Dielectric Parameters									
		Ch 40 5200.0 MHz		5210.0 MHz		Ch 48 5240.0 MHz		-		-	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
5210	2014-07-08	48.2	5.38	48.2	5.39	48.1	5.43	-	-	-	-
f (MHz)	Date	Dielectric Parameters									
		Ch 52 5260.0 MHz		5290.0 MHz		Ch 60 5300.0 MHz		-		-	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
5290	2014-07-08	48.1	5.46	48.0	5.50	48.0	5.51	-	-	-	-
f (MHz)	Date	Dielectric Parameters									
		Ch 104 5520.0 MHz		Ch 112 5560.0 MHz		Ch 124 5620.0 MHz		Ch 132 5660.0 MHz		-	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]	εr	εr	εr	σ [S/m]
5520 5620	2014-07-08	47.6	5.80	47.6	5.86	47.5	5.94	-	-	-	-
f (MHz)	Date	Dielectric Parameters									
		5760.0 MHz		Ch 153 5765.0 MHz		Ch 157 5785.0 MHz		Ch 161 5805.0 MHz		-	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
5760	2014-07-08	47.0	6.08	47.0	6.09	47.0	6.11	47.0	6.14	-	-

APPENDIX D: CONDUCTED AVERAGE POWER MEASUREMENTS FOR WCDMA AND HSUPA

Type: RM-983; Serial: 354250/06/000024/0, HW: 0200 SW: 02028.00000.14224.06004

D.1. WCDMA850 (Band 5) Test results

Average power

Ch / *f*(MHz)	P [dBm]
4147	23.4
4183	23.3
4219	23.4

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
4147	21.8	21.2	21.4	22.1	22.5
4183	21.7	21.4	21.5	22.0	22.4
4219	21.8	21.4	20.9	21.9	22.4

Note: In HSUPA operation, the output power is reduced relative to the tuning target power for WCDMA. This device runs MPR power control routines for HSUPA. 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
1.5dB	2.0dB	1.0dB	2.0dB	0.0dB

D.3. WCDMA1900 (Band 2) Test results

Average power

Ch / *f*(MHz)	P [dBm]
9262	23.4
9400	23.7
9538	23.4

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	22.5	21.5	21.4	22.0	22.4
9400	22.3	21.7	21.3	22.3	22.7
9538	22.1	21.3	21.0	22.0	22.4

Note: In HSUPA operation, the output power is reduced relative to the tuning target power for WCDMA. This device runs MPR power control routines for HSUPA. 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
1.5dB	2.0dB	1.0dB	2.0dB	0.0dB

APPENDIX E: RELEVANT PAGES FROM PROBE CALIBRATION REPORTS

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

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

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

Accreditation No.: SCS 108

Client Nokia SD

Certificate No: ES3-3275_Jan14

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3275

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

Calibration date: January 22, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	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	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: January 22, 2014

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

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

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

Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3275

Manufactured: February 25, 2010
Calibrated: January 22, 2014

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3275

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.34	1.16	1.24	± 10.1 %
DCP (mV)[B]	103.3	101.8	102.9	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	155.8	±3.0 %
		Y	0.0	0.0	1.0		155.9	
		Z	0.0	0.0	1.0		155.8	

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:3275

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	6.32	6.32	6.32	0.22	2.29	± 12.0 %
835	41.5	0.90	6.12	6.12	6.12	0.26	1.95	± 12.0 %
1750	40.1	1.37	5.11	5.11	5.11	0.46	1.52	± 12.0 %
1900	40.0	1.40	4.96	4.96	4.96	0.80	1.15	± 12.0 %
2100	39.8	1.49	5.02	5.02	5.02	0.80	1.15	± 12.0 %
2450	39.2	1.80	4.44	4.44	4.44	0.70	1.37	± 12.0 %
2600	39.0	1.96	4.25	4.25	4.25	0.79	1.33	± 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.

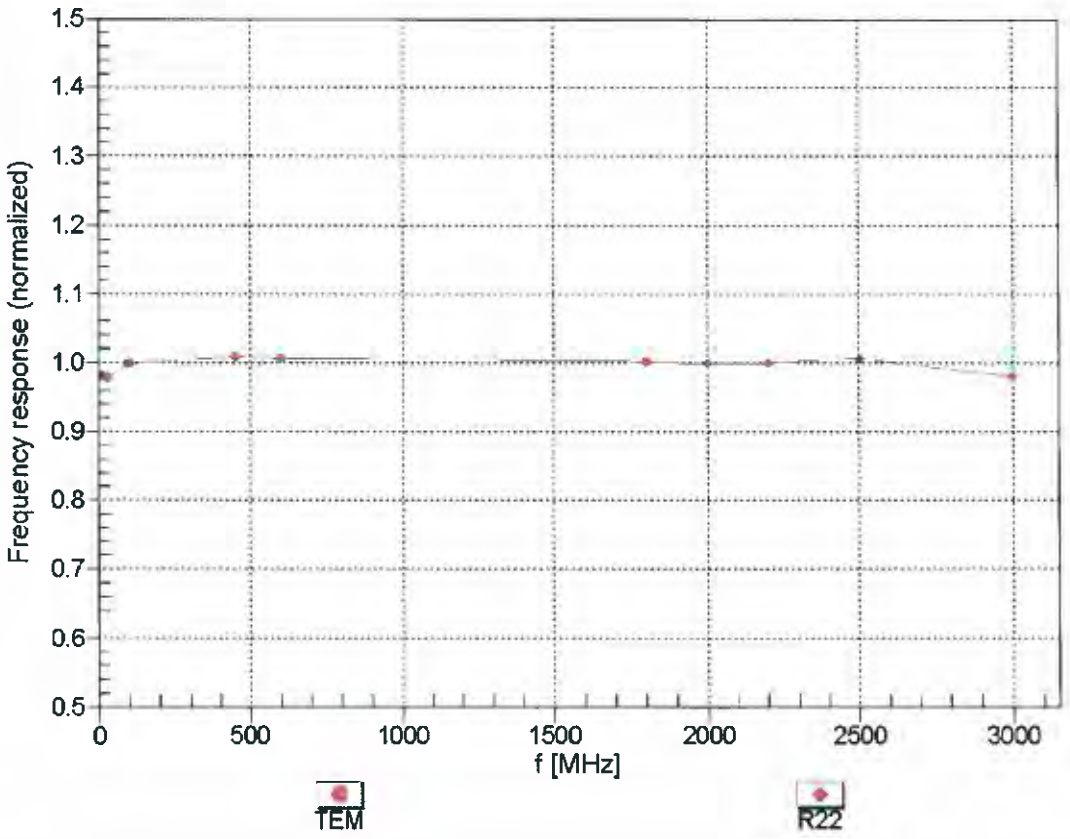
DASY/EASY - Parameters of Probe: ES3DV3 - SN:3275

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	6.03	6.03	6.03	0.60	1.31	± 12.0 %
835	55.2	0.97	6.01	6.01	6.01	0.77	1.21	± 12.0 %
1750	53.4	1.49	4.90	4.90	4.90	0.50	1.60	± 12.0 %
1900	53.3	1.52	4.59	4.59	4.59	0.70	1.41	± 12.0 %
2100	53.2	1.62	4.72	4.72	4.72	0.65	1.45	± 12.0 %
2450	52.7	1.95	4.14	4.14	4.14	0.68	1.19	± 12.0 %
2600	52.5	2.16	3.98	3.98	3.98	0.69	0.98	± 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.

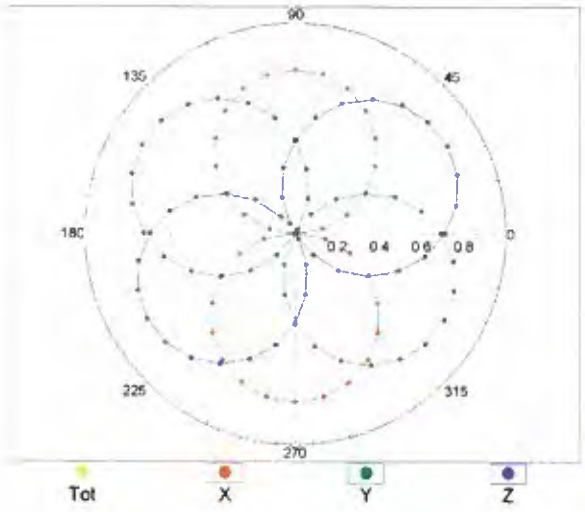
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



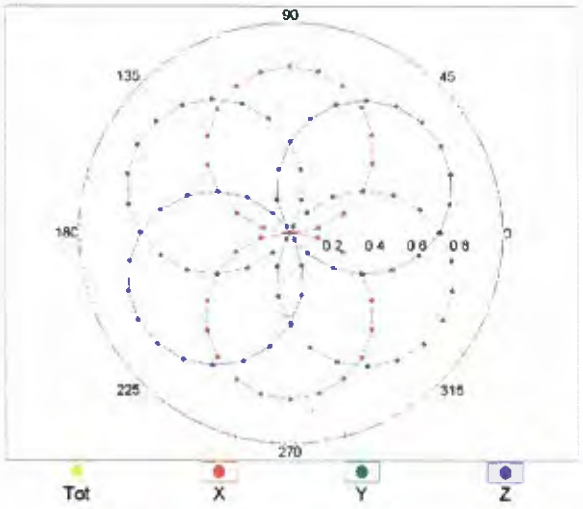
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

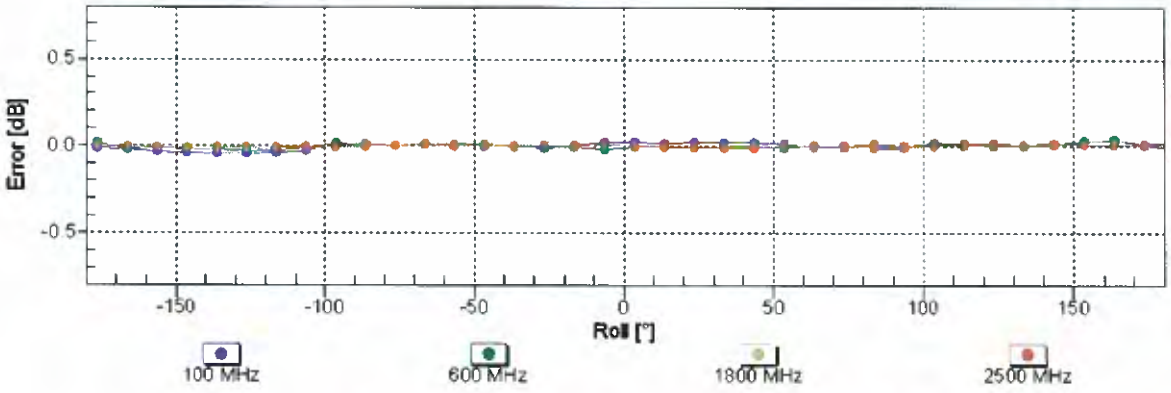
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



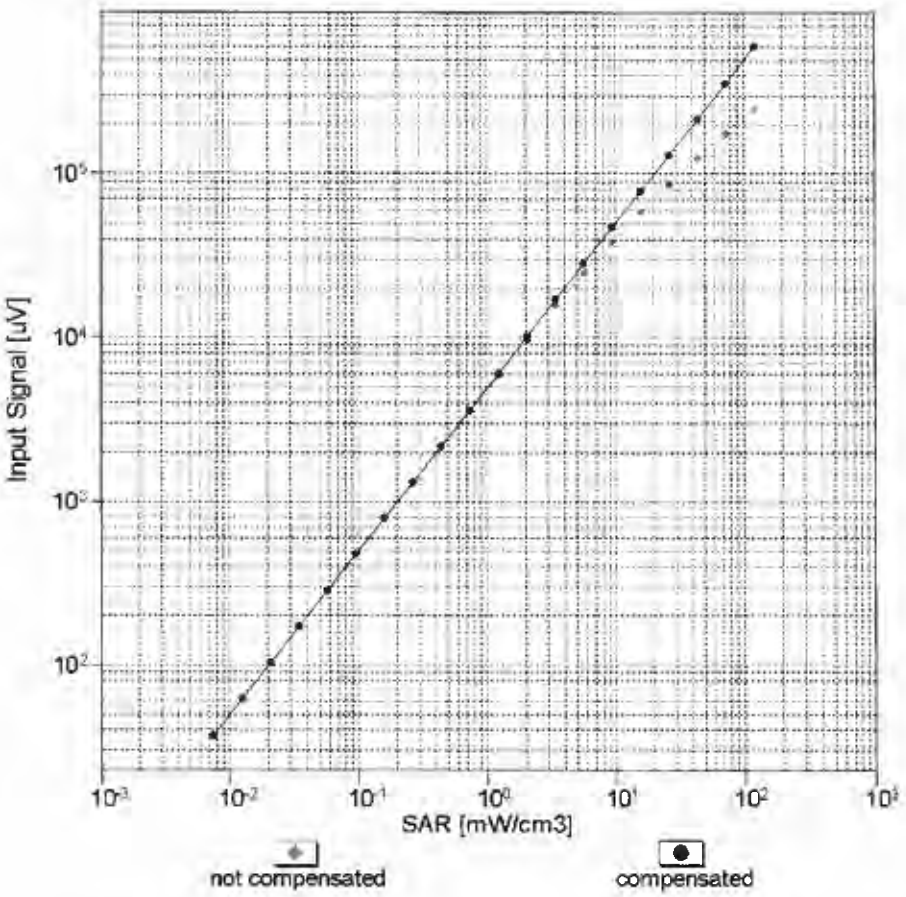
f=1800 MHz,R22

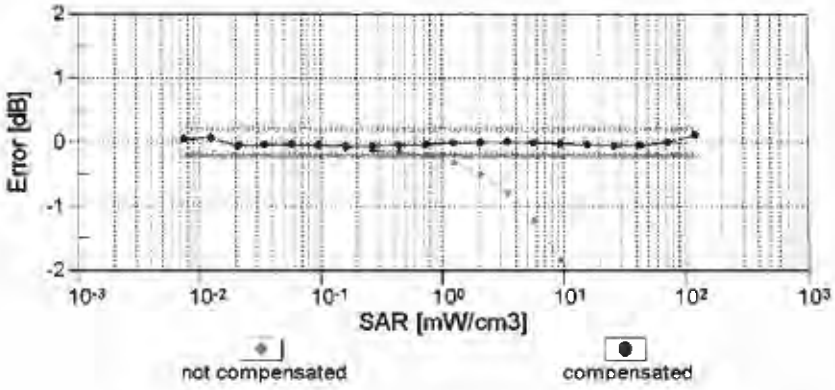




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

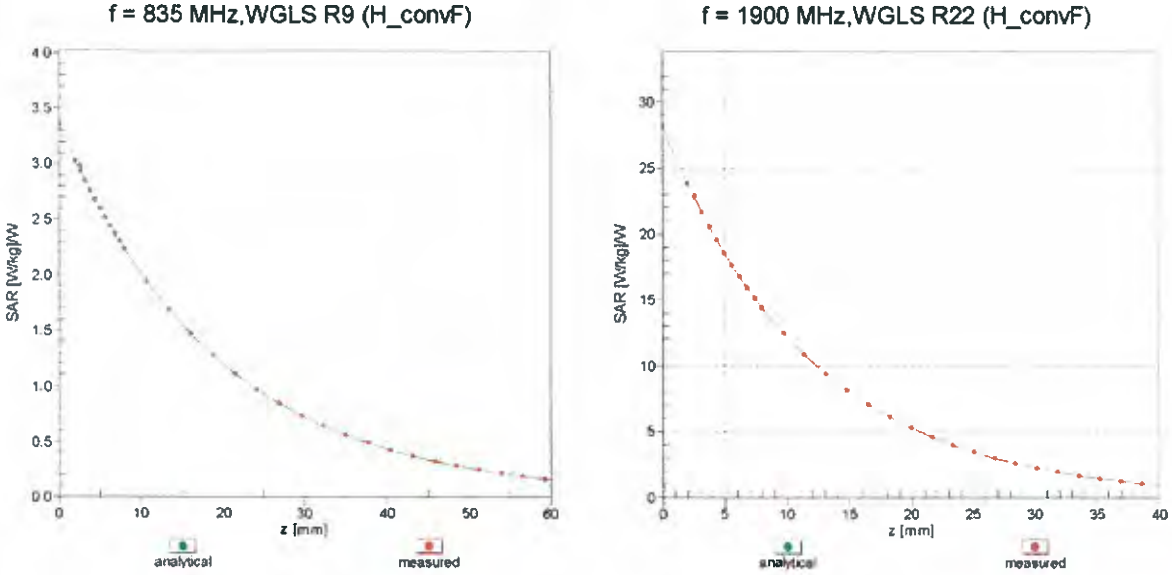
Dynamic Range f(SAR_{head})
(TEM cell , f = 900 MHz)





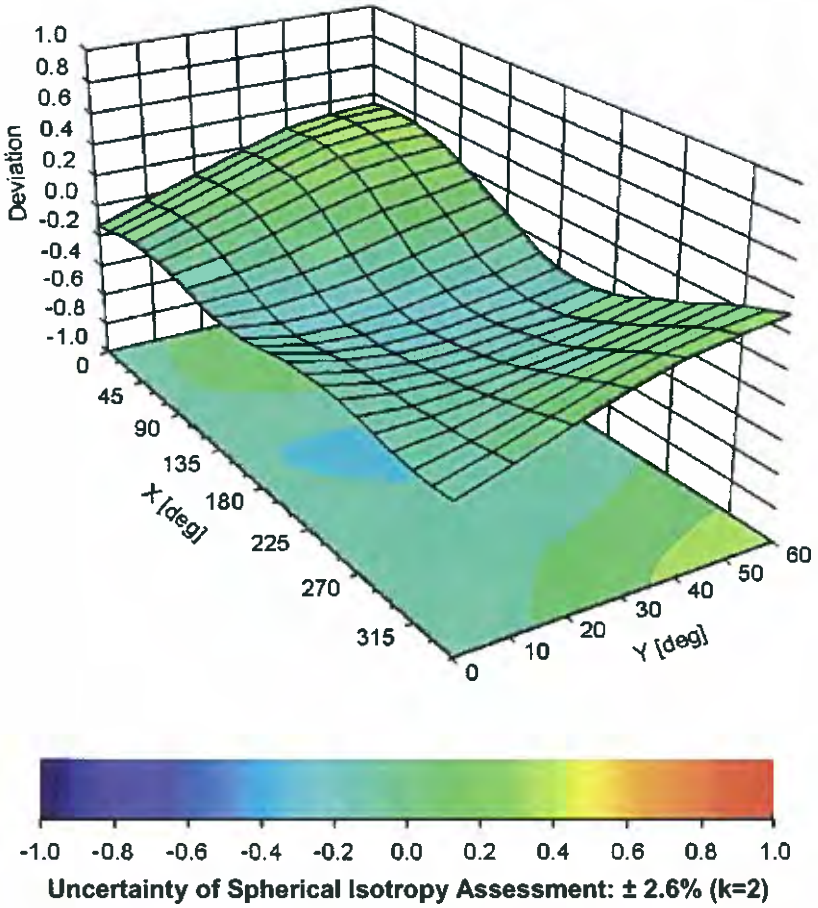
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3275

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-6.4
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

Calibration Laboratory of
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Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
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Accreditation No.: SCS 108

Client Nokia SD

Certificate No: EX3-3817_Jan14

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3817

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: January 17, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	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	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: January 20, 2014

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

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
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The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

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

Probe EX3DV4

SN:3817

Manufactured: September 2, 2011
Calibrated: January 17, 2014

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3817

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.46	0.41	0.50	± 10.1 %
DCP (mV)[B]	103.1	102.0	98.7	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	156.1	±3.0 %
		Y	0.0	0.0	1.0		145.0	
		Z	0.0	0.0	1.0		156.3	

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: EX3DV4 - SN:3817

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
2450	39.2	1.80	7.20	7.20	7.20	0.40	0.77	± 12.0 %
5200	36.0	4.66	5.36	5.36	5.36	0.30	1.80	± 13.1 %
5300	35.9	4.76	5.18	5.18	5.18	0.30	1.80	± 13.1 %
5500	35.6	4.96	5.05	5.05	5.05	0.30	1.80	± 13.1 %
5600	35.5	5.07	4.92	4.92	4.92	0.30	1.80	± 13.1 %
5800	35.3	5.27	4.78	4.78	4.78	0.35	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.

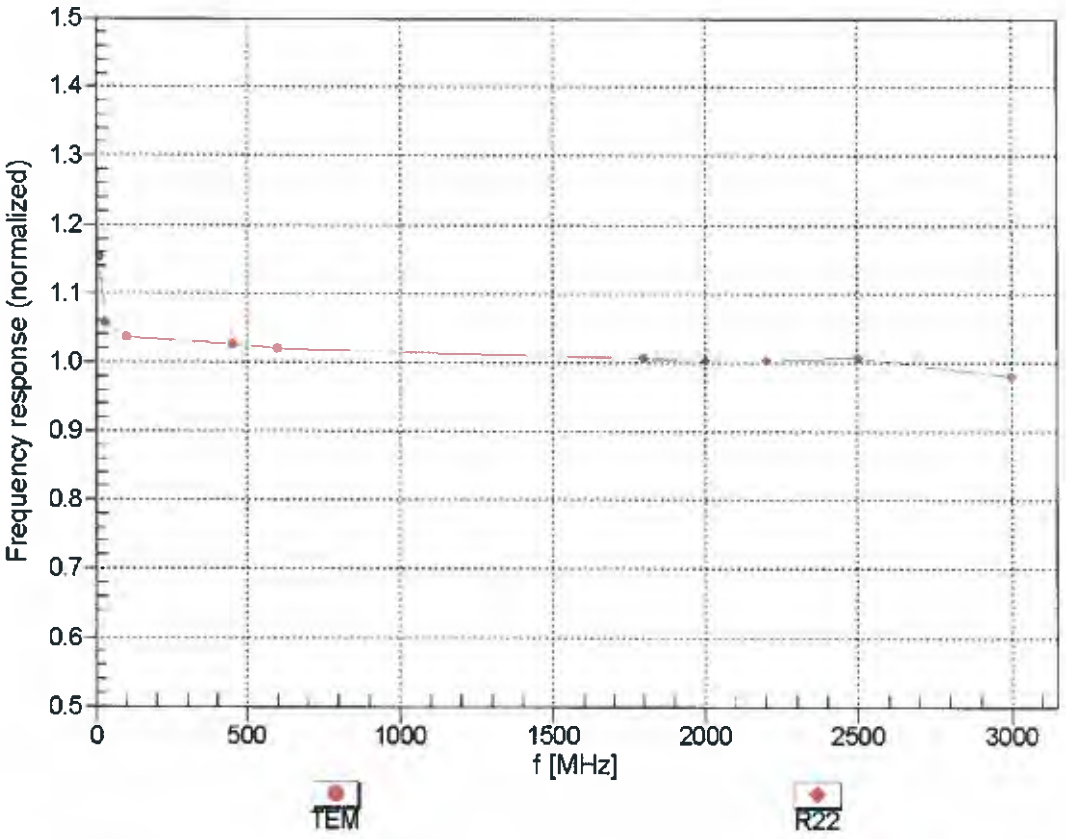
DASY/EASY - Parameters of Probe: EX3DV4 - SN:3817

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
2450	52.7	1.95	7.20	7.20	7.20	0.76	0.55	± 12.0 %
5200	49.0	5.30	4.73	4.73	4.73	0.45	1.90	± 13.1 %
5300	48.9	5.42	4.53	4.53	4.53	0.45	1.90	± 13.1 %
5500	48.6	5.65	4.15	4.15	4.15	0.50	1.90	± 13.1 %
5600	48.5	5.77	3.98	3.98	3.98	0.50	1.90	± 13.1 %
5800	48.2	6.00	4.28	4.28	4.28	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.

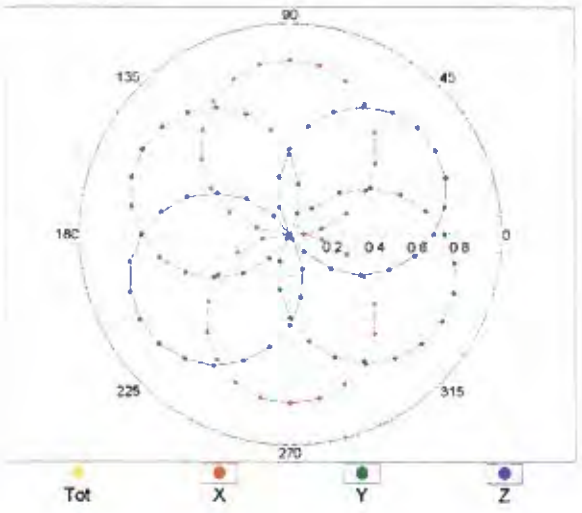
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



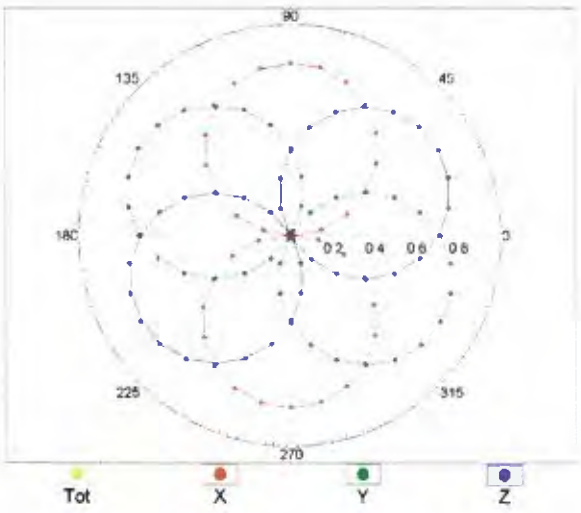
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

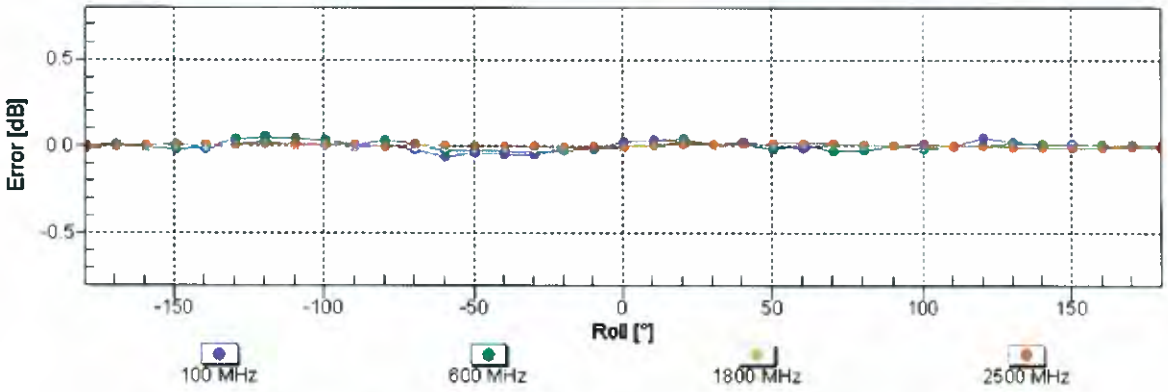
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



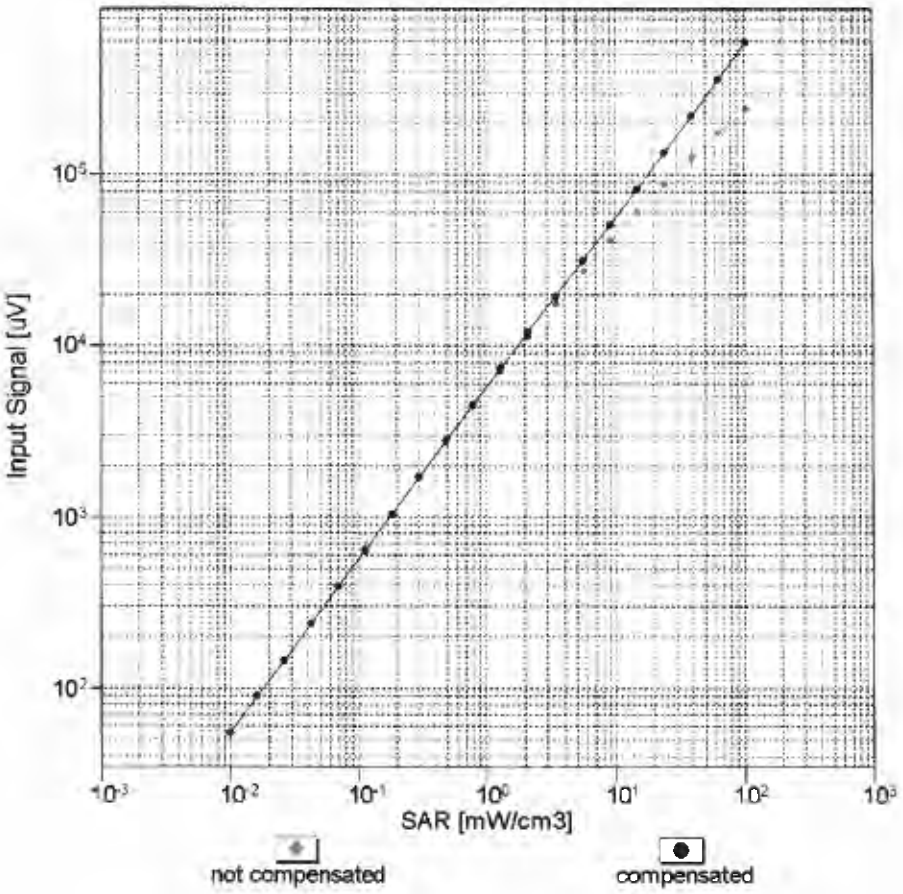
f=1800 MHz,R22

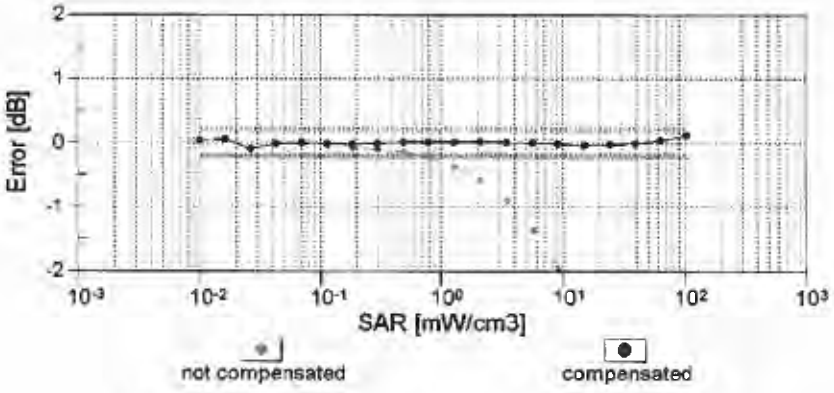




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

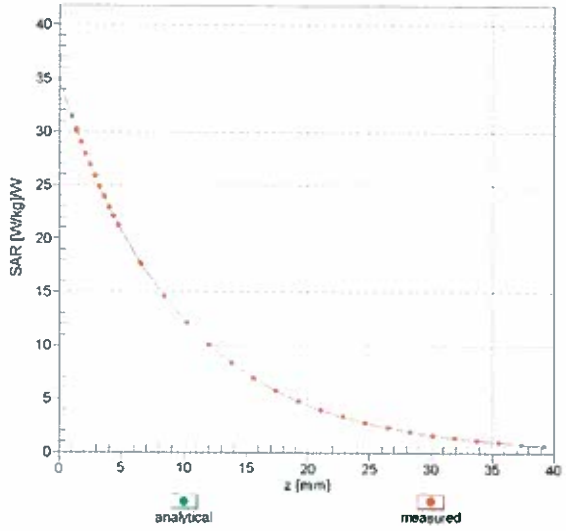




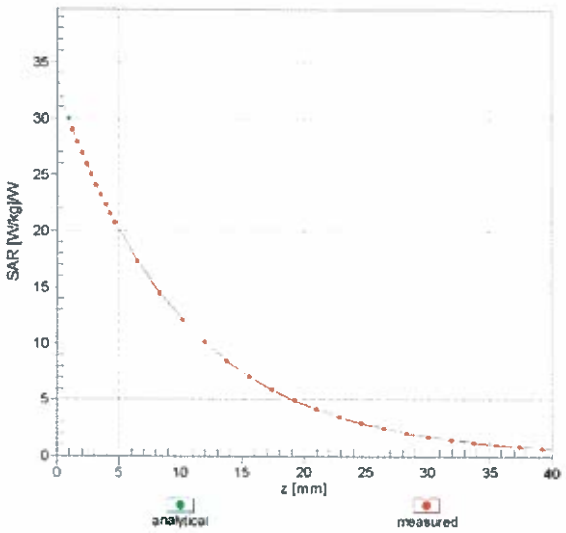
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 2450 MHz,WGLS R22 (H_convF)

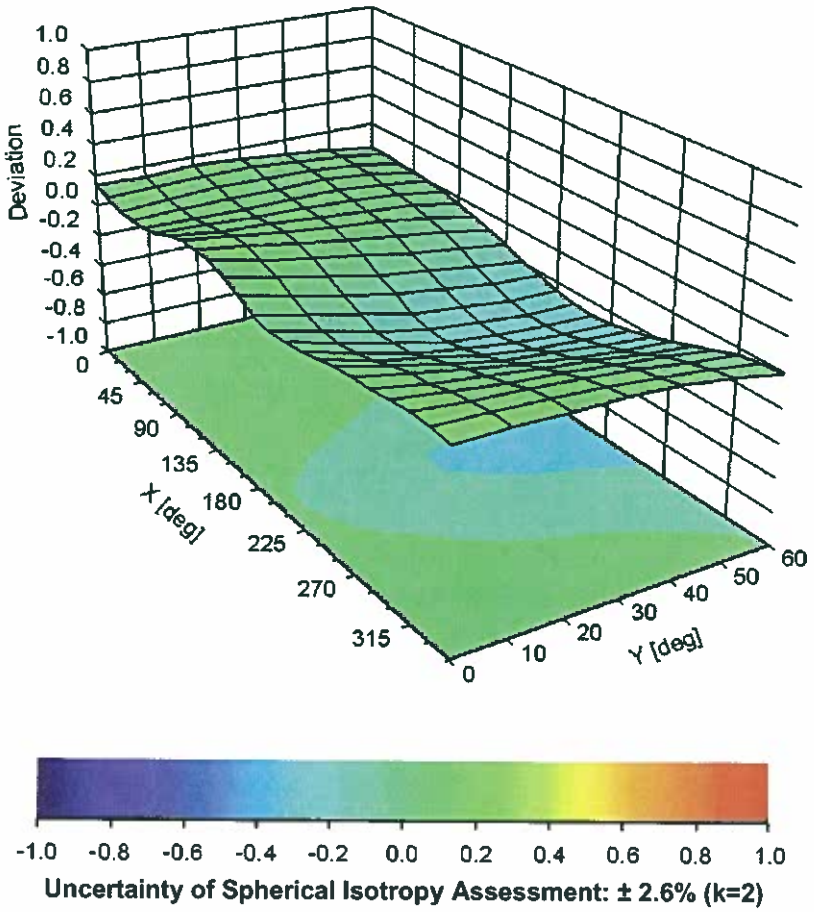


f = 2450 MHz,WGLS R22 (M_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3817

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-99.5
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm

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Swiss Calibration Service

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

Accreditation No.: SCS 108

Client Nokia SD

Certificate No: ES3-3112_Jan14

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3112

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

Calibration date: January 22, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	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	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: January 22, 2014

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

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

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

Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3112

Manufactured: March 9, 2006
Calibrated: January 22, 2014

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3112

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.29	1.32	1.32	± 10.1 %
DCP (mV)[B]	100.8	99.9	99.0	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	158.8	±3.0 %
		Y	0.0	0.0	1.0		163.6	
		Z	0.0	0.0	1.0		157.6	

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:3112

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	6.42	6.42	6.42	0.80	1.13	± 12.0 %
835	41.5	0.90	6.16	6.16	6.16	0.23	2.21	± 12.0 %
1750	40.1	1.37	5.25	5.25	5.25	0.51	1.40	± 12.0 %
1900	40.0	1.40	5.11	5.11	5.11	0.42	1.64	± 12.0 %
2100	39.8	1.49	5.17	5.17	5.17	0.49	1.49	± 12.0 %
2450	39.2	1.80	4.49	4.49	4.49	0.62	1.41	± 12.0 %
2600	39.0	1.96	4.33	4.33	4.33	0.77	1.34	± 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.

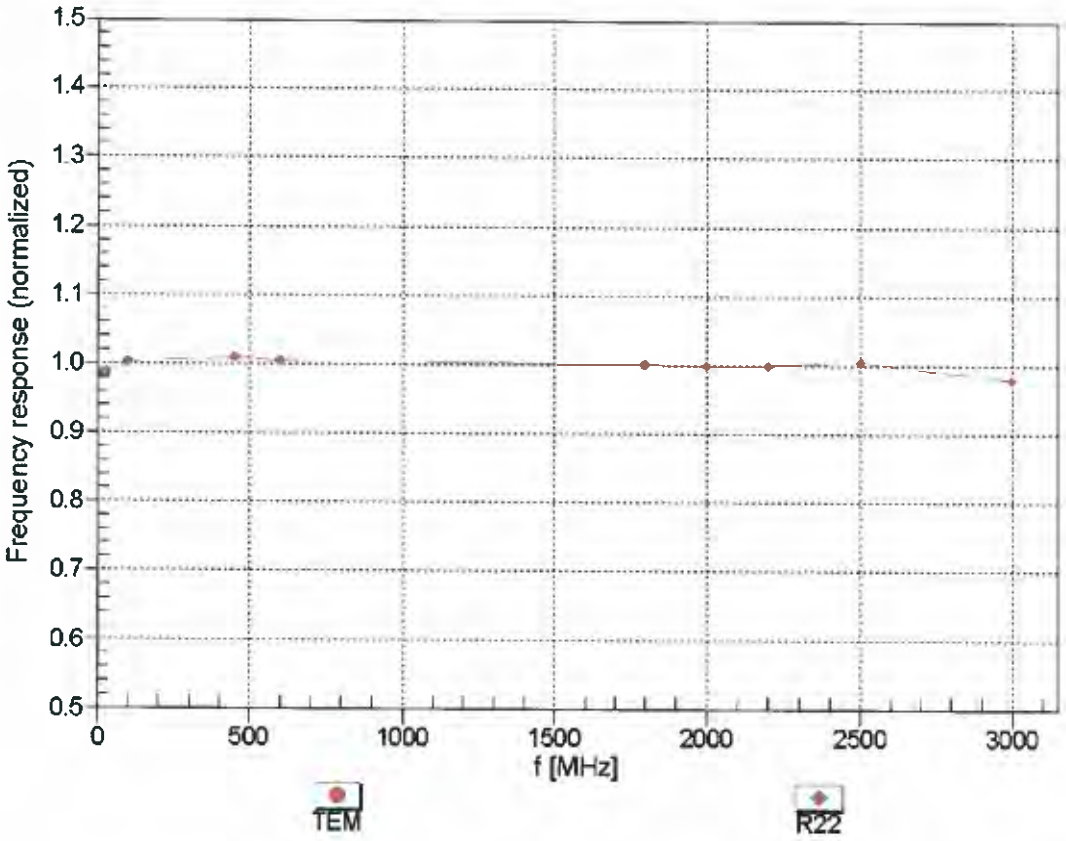
DASY/EASY - Parameters of Probe: ES3DV3 - SN:3112

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	6.32	6.32	6.32	0.79	1.18	± 12.0 %
835	55.2	0.97	6.26	6.26	6.26	0.30	2.01	± 12.0 %
1750	53.4	1.49	4.90	4.90	4.90	0.35	2.00	± 12.0 %
1900	53.3	1.52	4.73	4.73	4.73	0.54	1.55	± 12.0 %
2100	53.2	1.62	4.86	4.86	4.86	0.50	1.66	± 12.0 %
2450	52.7	1.95	4.26	4.26	4.26	0.80	1.03	± 12.0 %
2600	52.5	2.16	4.05	4.05	4.05	0.59	0.83	± 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.

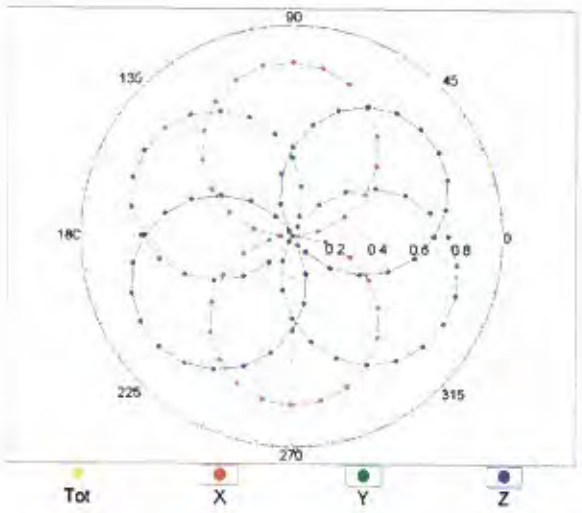
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



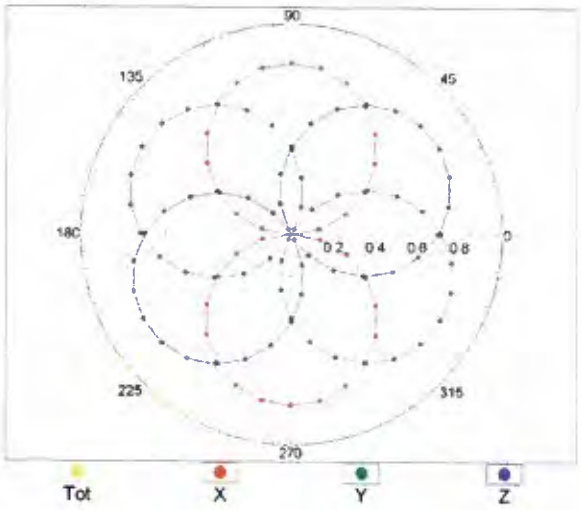
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

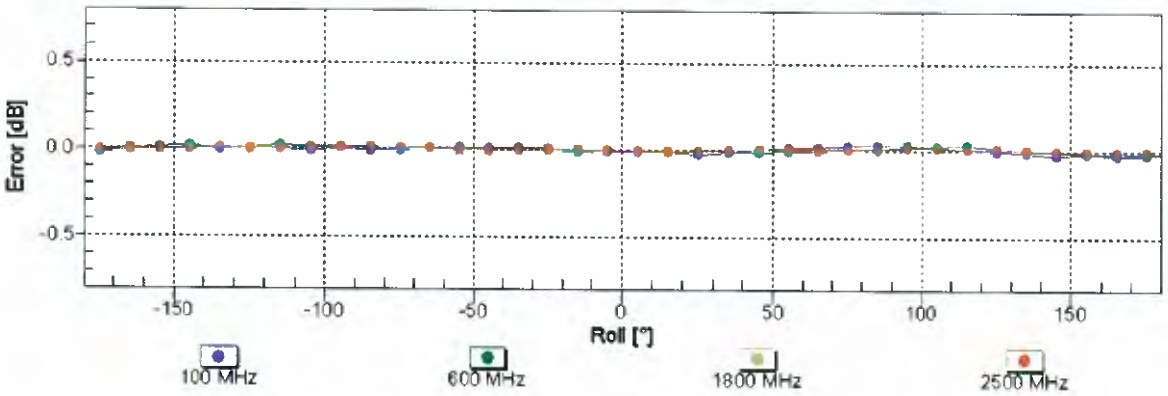
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



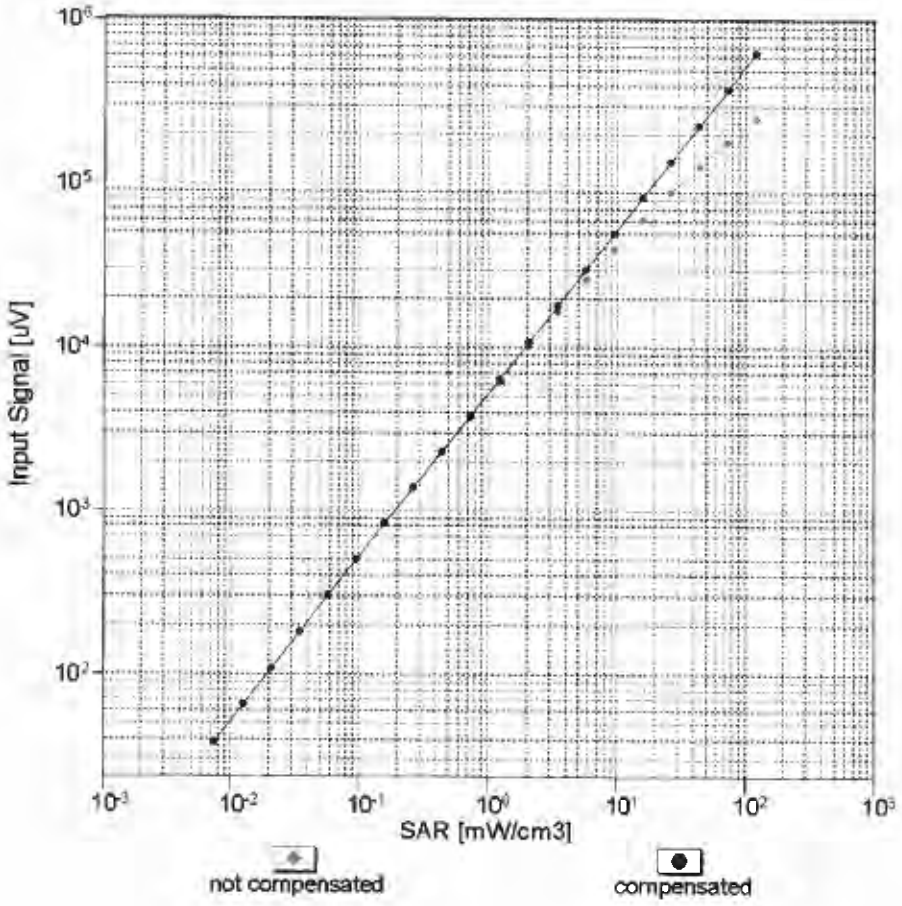
f=1800 MHz,R22

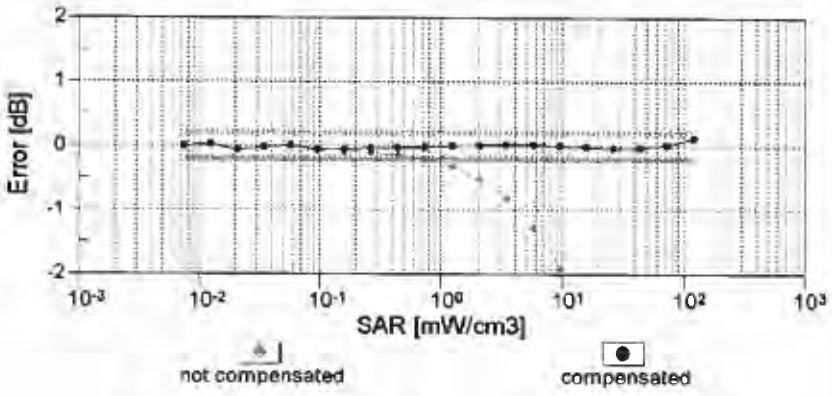




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})
(TEM cell , f = 900 MHz)

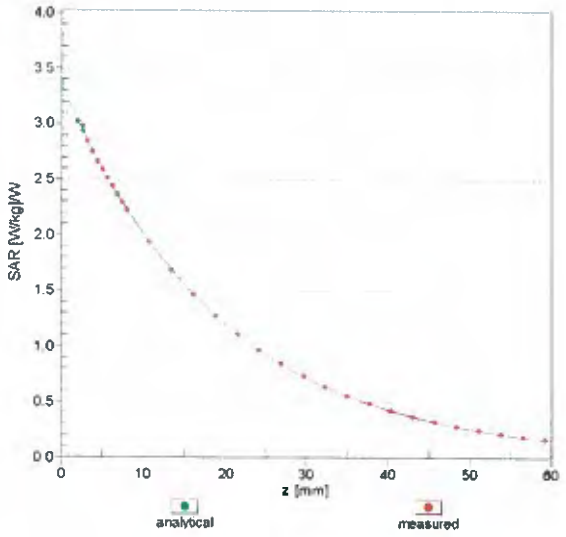




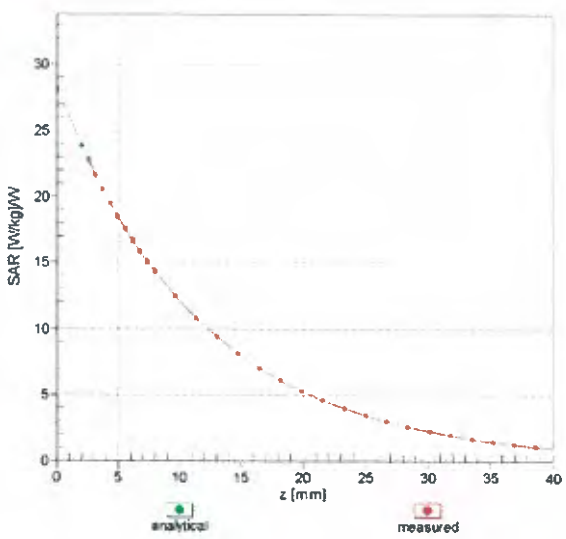
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

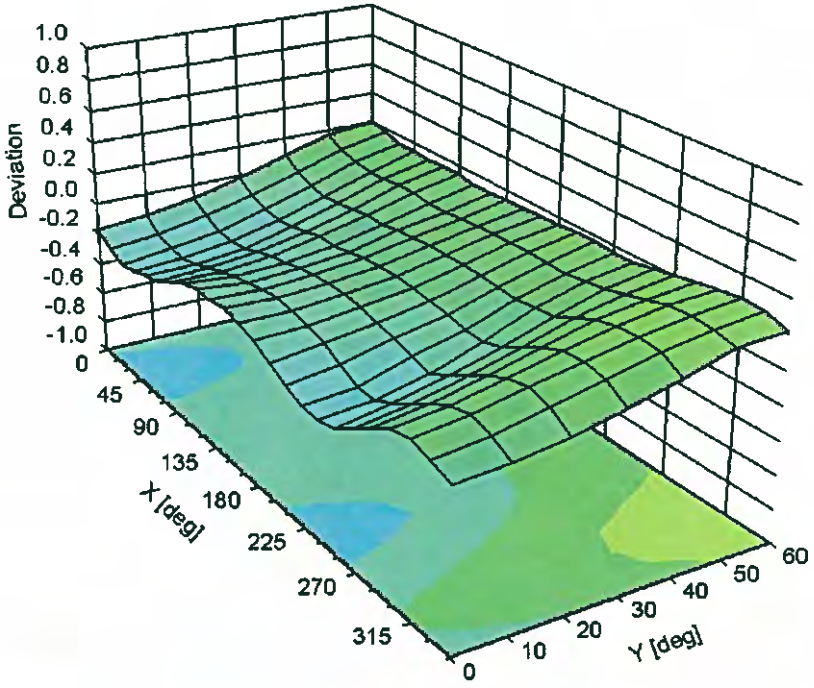


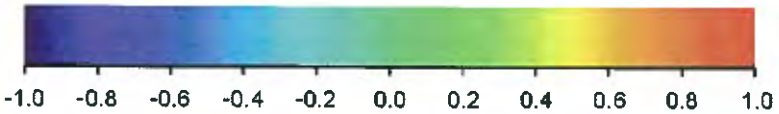
f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz





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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3112

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-134.7
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

APPENDIX F: RELEVANT PAGES FROM DIPOLE CALIBRATION REPORTS

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

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Accreditation No.: SCS 108

Client **Nokia SD**

Certificate No: D750V3-1010_Mar13

CALIBRATION CERTIFICATE

Object	D750V3 - SN: 1010
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	March 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 ± 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	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
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

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

Issued: March 18, 2013

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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:

a) 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
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) 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:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.5
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.1 ± 6 %	0.92 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.19 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**8.50 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.42 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.55 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.2 ± 6 %	1.00 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.25 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**8.68 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.48 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**5.75 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.9 Ω + 1.7 jΩ
Return Loss	- 26.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.7 Ω - 1.5 jΩ
Return Loss	- 36.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.035 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	September 29, 2009

DASY5 Validation Report for Head TSL

Date: 18.03.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1010

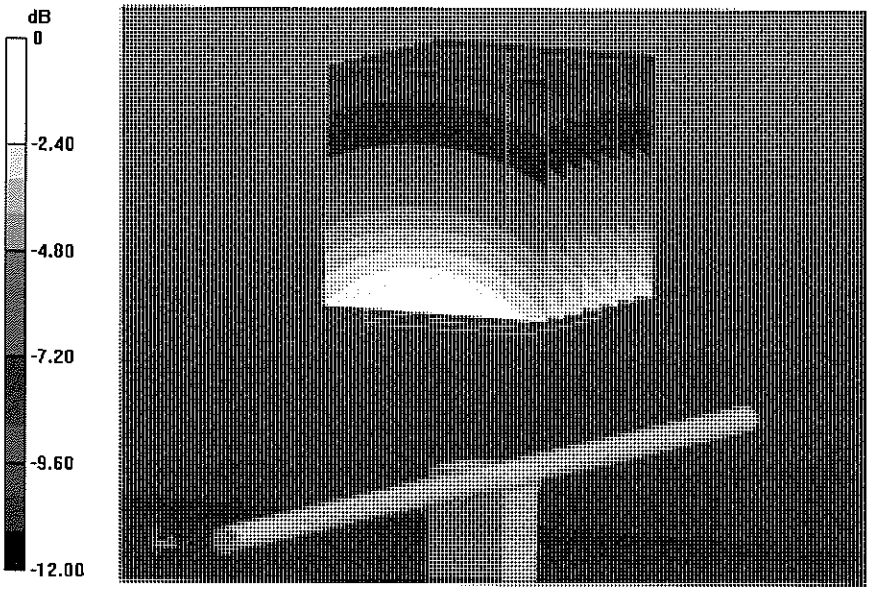
Communication System: CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.92 S/m; ε_r = 41.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.28, 6.28, 6.28); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

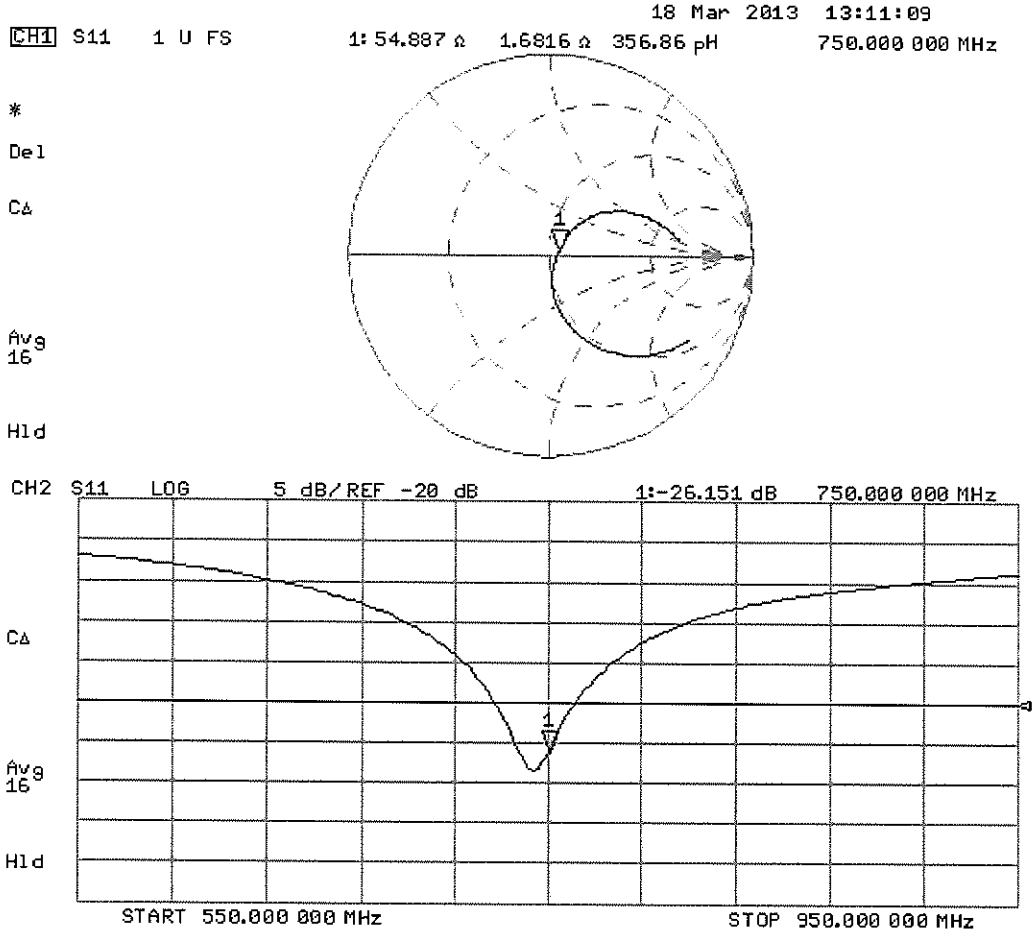
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 52.641 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 3.34 W/kg
SAR(1 g) = 2.19 W/kg; SAR(10 g) = 1.42 W/kg
Maximum value of SAR (measured) = 2.54 W/kg



0 dB = 2.54 W/kg = 4.05 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 18.03.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1010

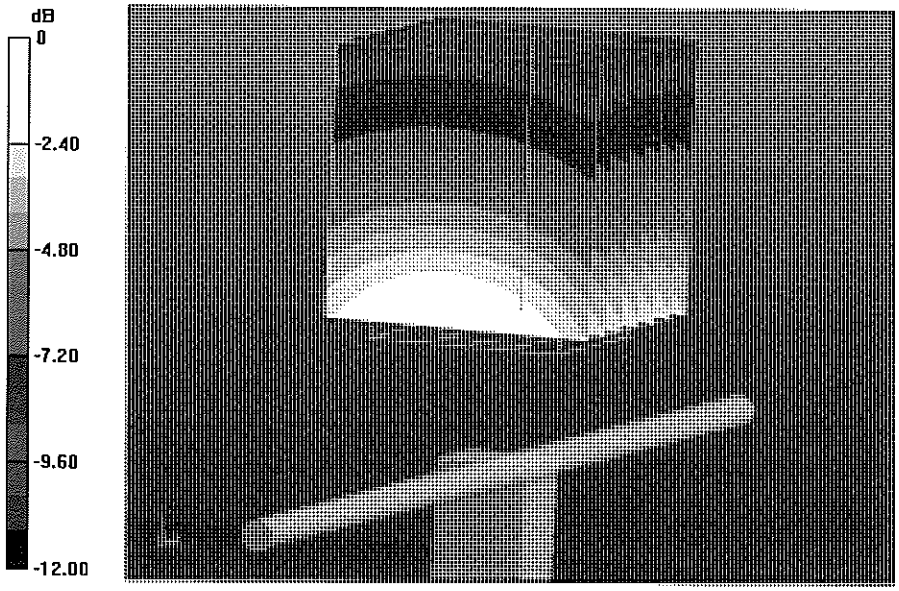
Communication System: CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 1 S/m; ε_r = 54.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.11, 6.11, 6.11); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

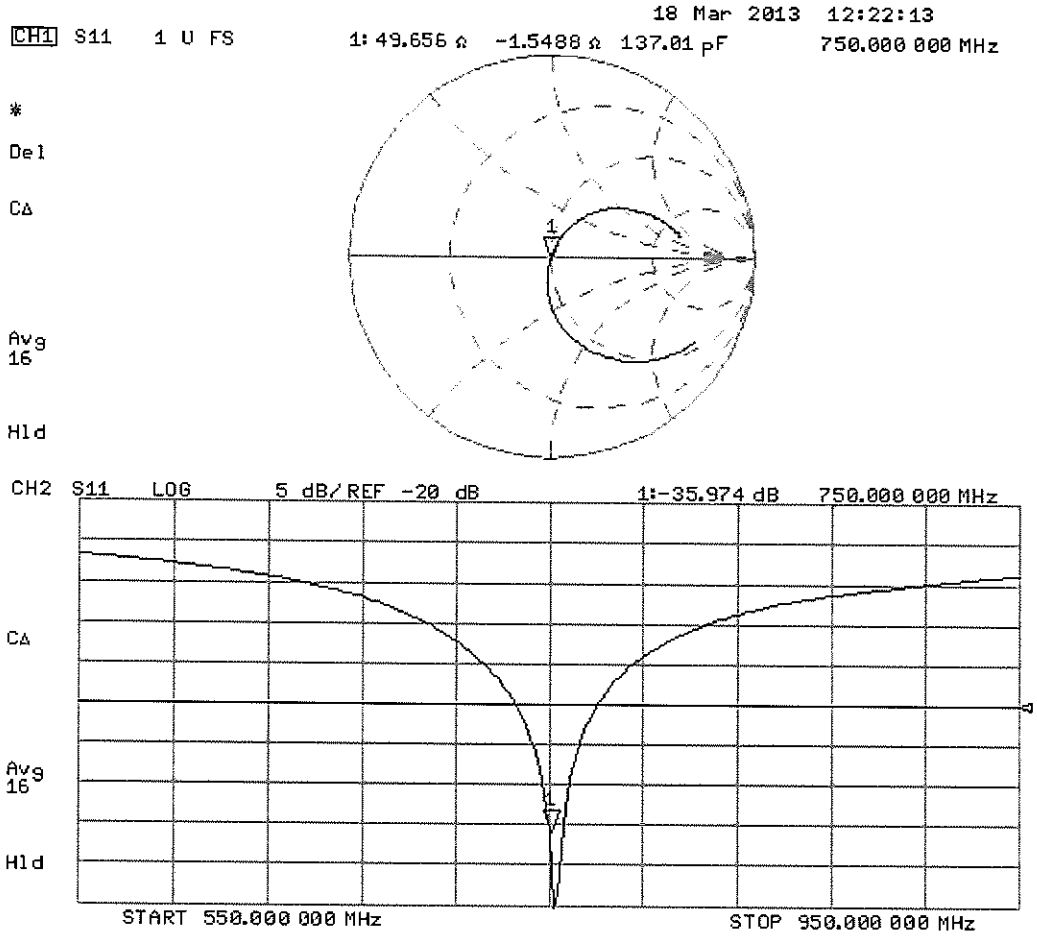
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 52.641 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 3.32 W/kg
SAR(1 g) = 2.25 W/kg; SAR(10 g) = 1.48 W/kg
Maximum value of SAR (measured) = 2.61 W/kg



0 dB = 2.61 W/kg = 4.17 dBW/kg

Impedance Measurement Plot for Body TSL



Dipole D750V3 – SN: 1010 Antenna Parameters measured: 2014-03-20.

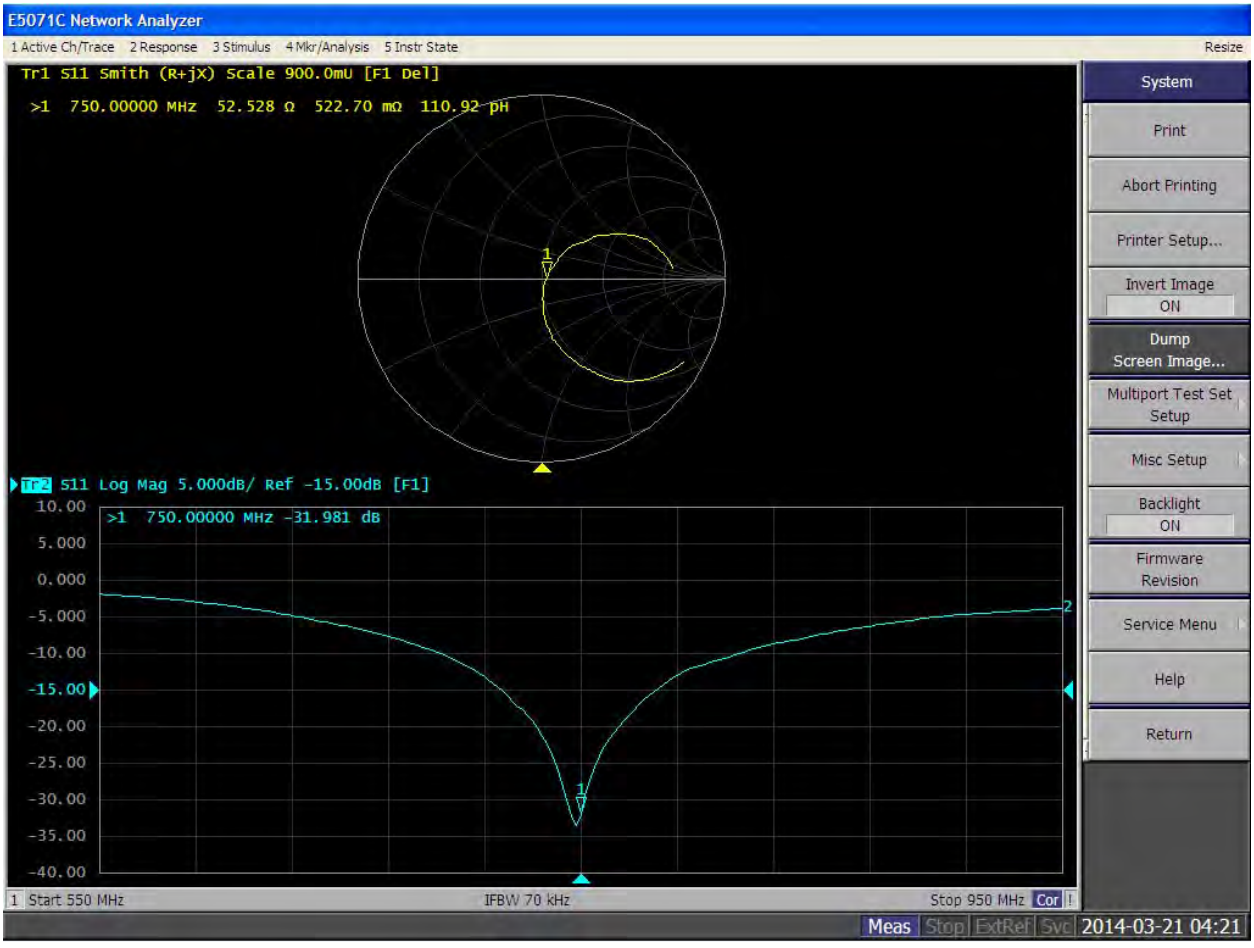
Antenna Parameters with Head TSL

	Calibration certificate	Annual measurement
Impedance, transformed to feed point	54.9 Ω + 1.7 jΩ	52.5 Ω + 0.5 jΩ
Return loss	-26.2 dB	-32.0 dB

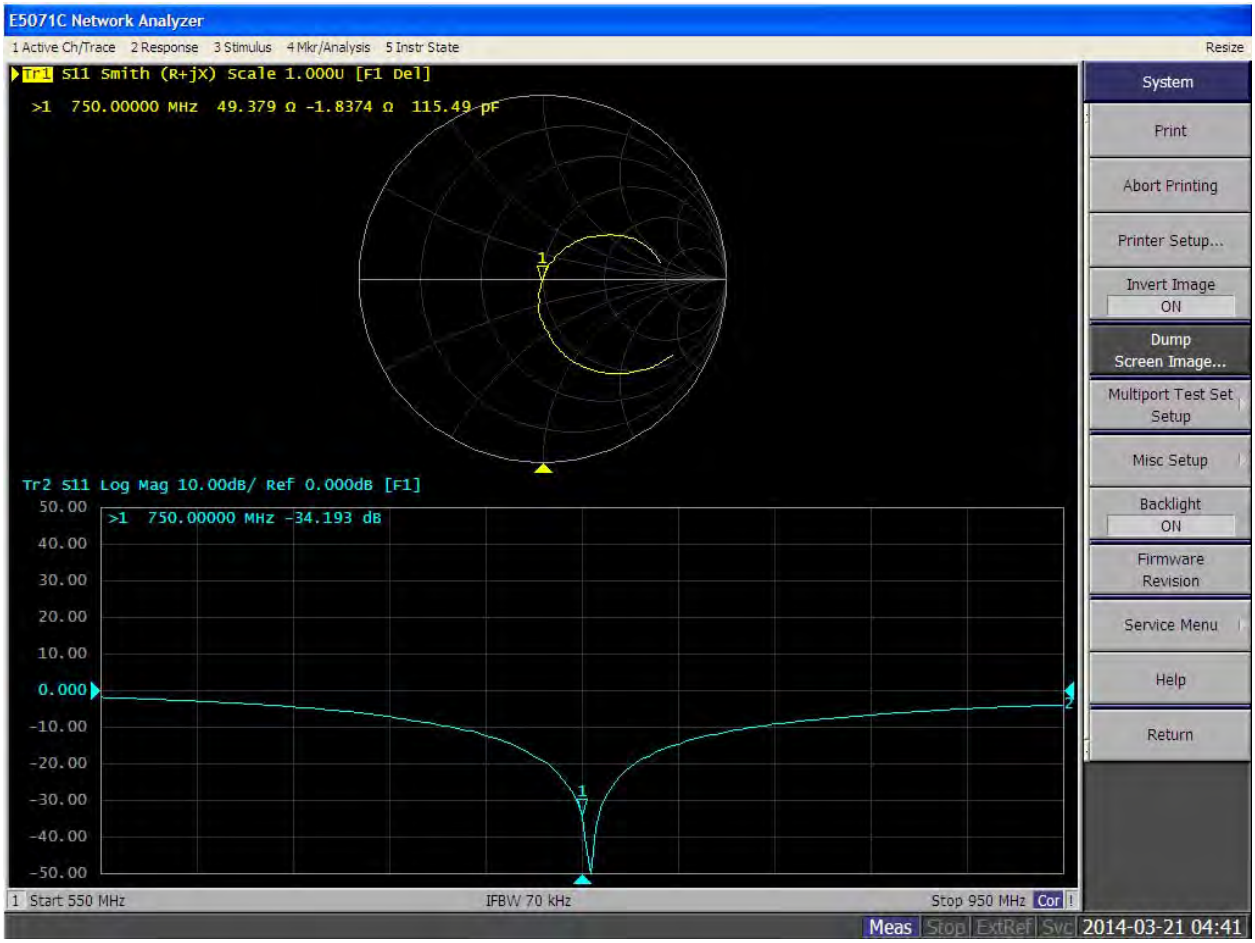
Antenna Parameters with Body TSL

	Calibration certificate	Annual measurement
Impedance, transformed to feed point	49.7 Ω - 1.5 jΩ	49.3 Ω - 1.8 jΩ
Return loss	-36.0 dB	-34.2 dB

Head TSL



Body TSL


E5071C Network Analyzer
1 Active Ch/Trace 2 Response 3 Stimulus 4 Mkr/Analysis 5 Instr State
Resize
Tr1 S11 Smith (R+jX) Scale 1.000U [F1 Del]
>1 750.00000 MHz 49.379 Ω -1.8374 Ω 115.49 pF
Tr2 S11 Log Mag 10.00dB/ Ref 0.000dB [F1]
>1 750.00000 MHz -34.193 dB
50.00
40.00
30.00
20.00
10.00
0.000
-10.00
-20.00
-30.00
-40.00
-50.00
1 Start 550 MHz
IFBW 70 kHz
Stop 950 MHz
Cor
System
Print
Abort Printing
Printer Setup...
Invert Image
ON
Dump
Screen Image...
Multiport Test Set
Setup
Misc Setup
Backlight
ON
Firmware
Revision
Service Menu
Help
Return
Meas
Stop
ExtRef
Svc
2014-03-21 04:41

7022

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Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

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S Swiss Calibration Service

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Accreditation No.: SCS 108

Client **Nokia SD**

Certificate No: D835V2-4d040_Sep12

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 4d040
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	September 12, 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	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 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-11)	In house check: Oct-12

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

Issued: September 12, 2012

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "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
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) 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:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.2
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 ± 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 ± 0.2) °C	41.0 ± 6 %	0.90 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.38 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**9.49 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.56 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**6.23 mW /g ± 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 ± 0.2) °C	53.3 ± 6 %	1.00 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.45 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**9.50 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.61 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**6.29 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.7 Ω - 3.8 jΩ
Return Loss	- 28.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.1 Ω - 5.0 jΩ
Return Loss	- 24.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.393 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	September 20, 2005

DASY5 Validation Report for Head TSL

Date: 12.09.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d040

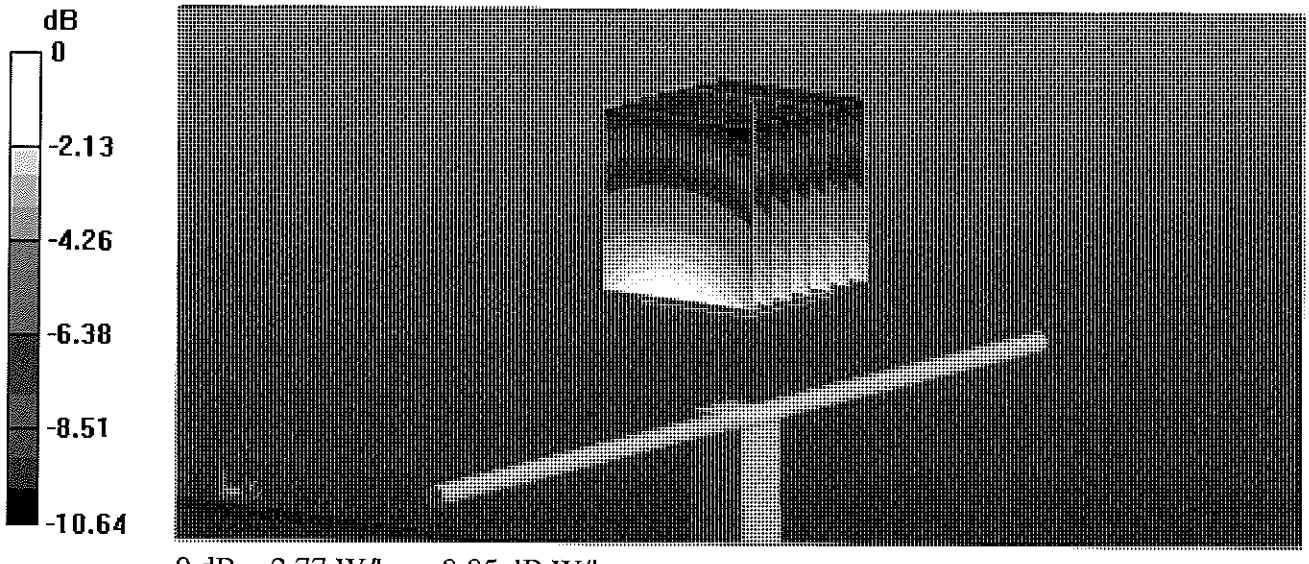
Communication System: CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.9 mho/m; ε_r = 41; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

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 52.8.2(969); SEMCAD X 14.6.6(6824)

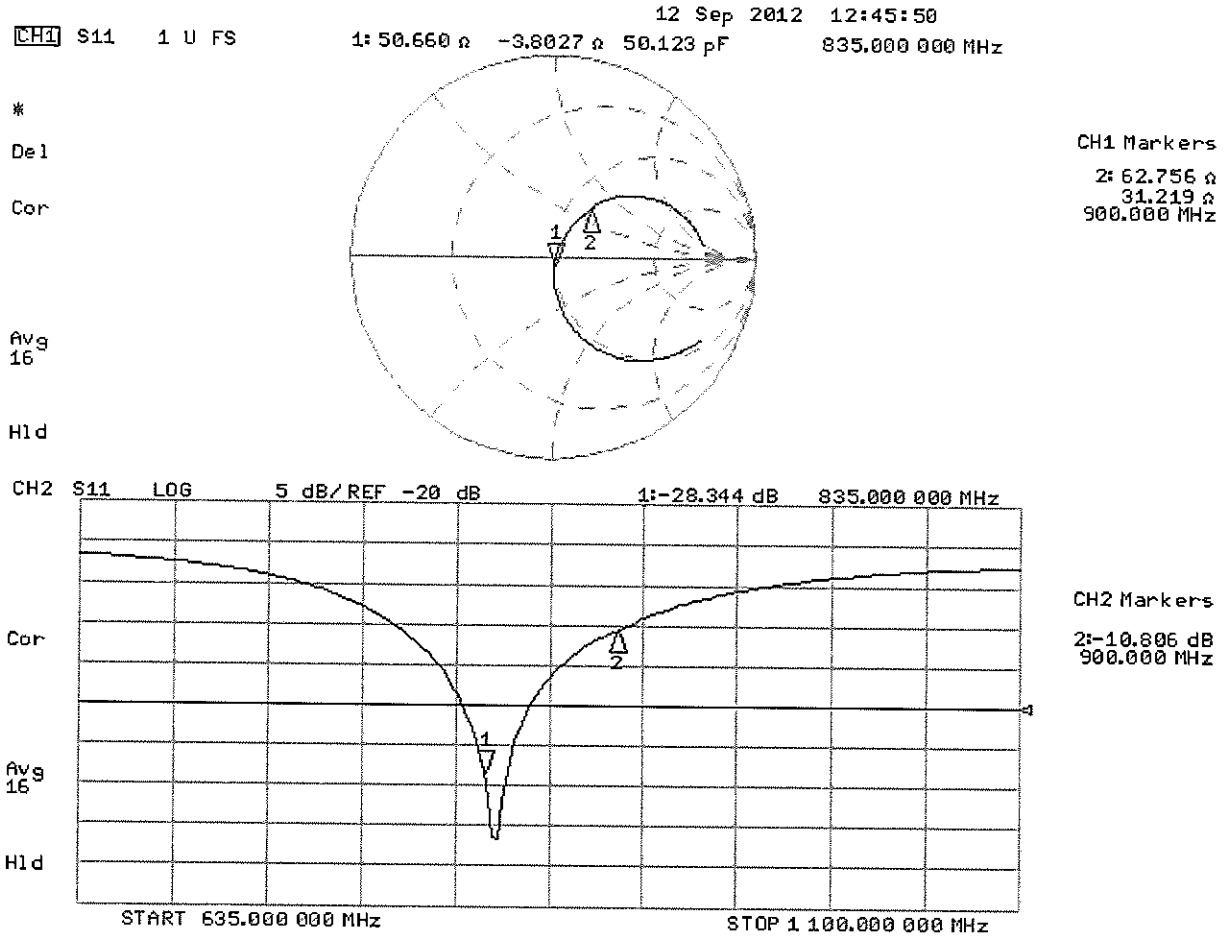
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm 2/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.255 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 3.512 mW/g
SAR(1 g) = 2.38 mW/g; SAR(10 g) = 1.56 mW/g
Maximum value of SAR (measured) = 2.77 W/kg



0 dB = 2.77 W/kg = 8.85 dB W/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 12.09.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d040

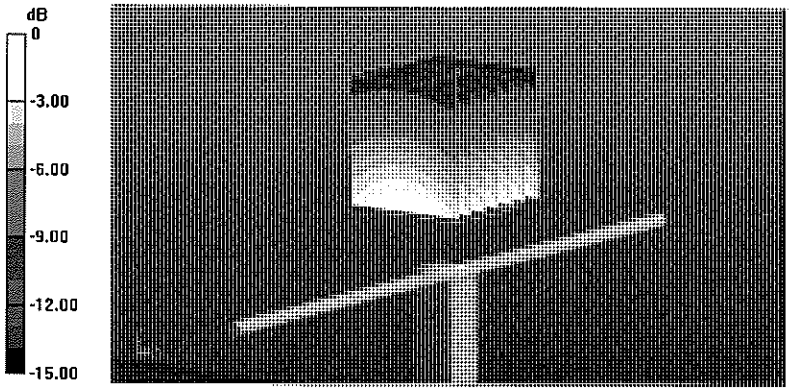
Communication System: CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 1 mho/m; ε_r = 53.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

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 52.8.2(969); SEMCAD X 14.6.6(6824)

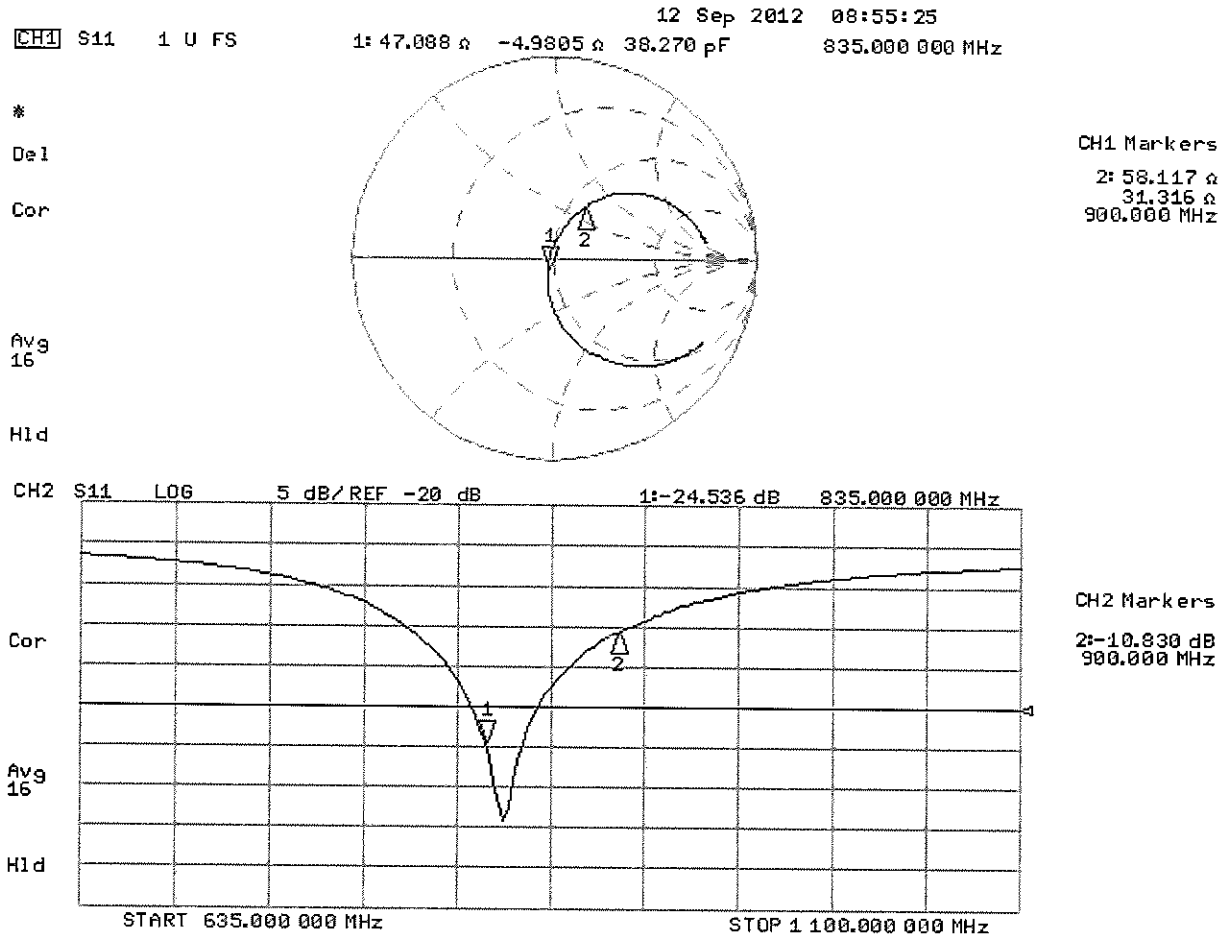
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.248 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.563 mW/g
SAR(1 g) = 2.45 mW/g; SAR(10 g) = 1.61 mW/g
Maximum value of SAR (measured) = 2.85 W/kg



0 dB = 2.85 W/kg = 9.10 dB W/kg

Impedance Measurement Plot for Body TSL



Dipole D835V2 – SN: 4d040 Antenna Parameters measured: 2014-02-21.

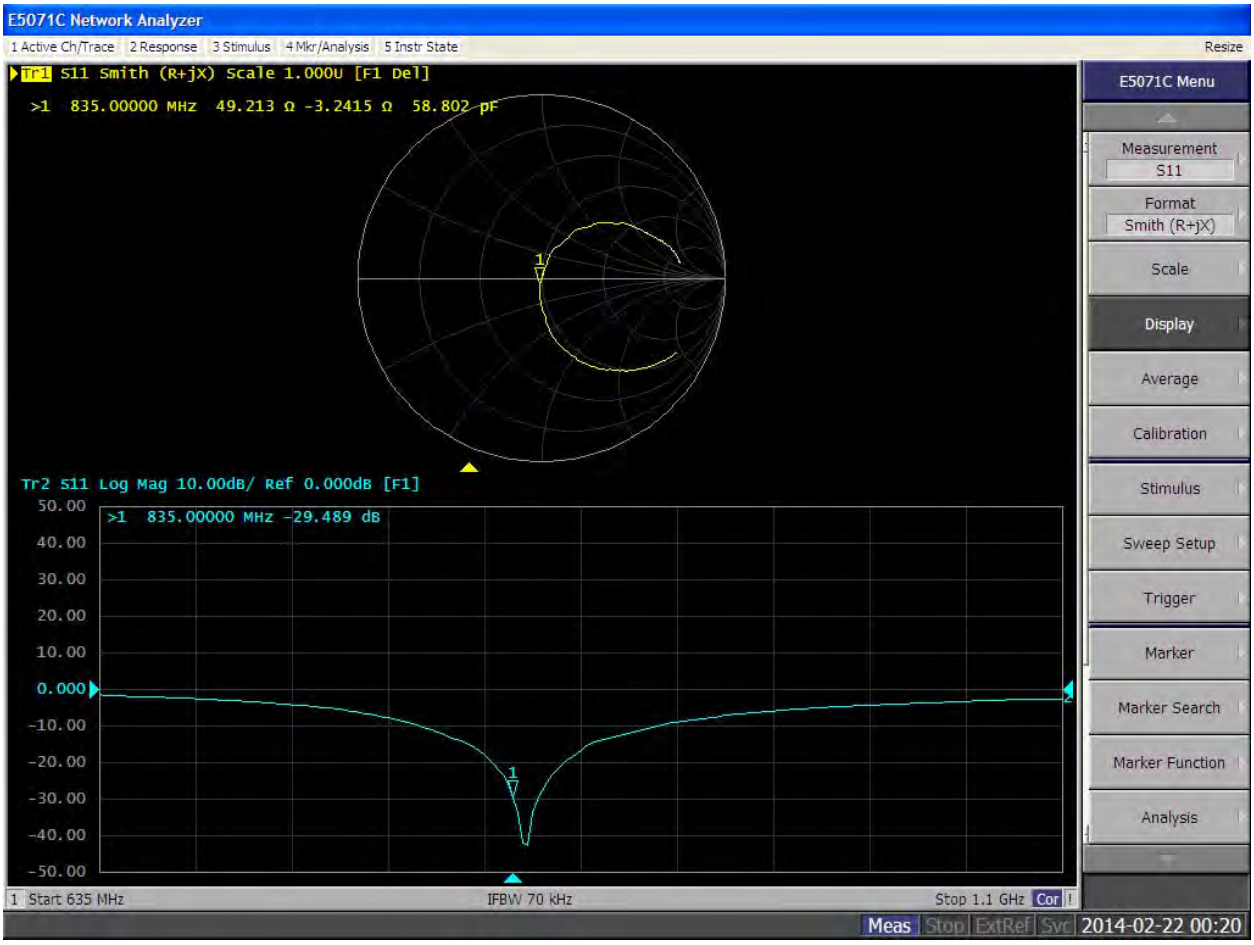
Antenna Parameters with Head TSL

	Calibration certificate	Annual measurement
Impedance, transformed to feed point	50.7 Ω - 3.8 jΩ	49.2 Ω - 3.2 jΩ
Return loss	-28.3 dB	-29.5 dB

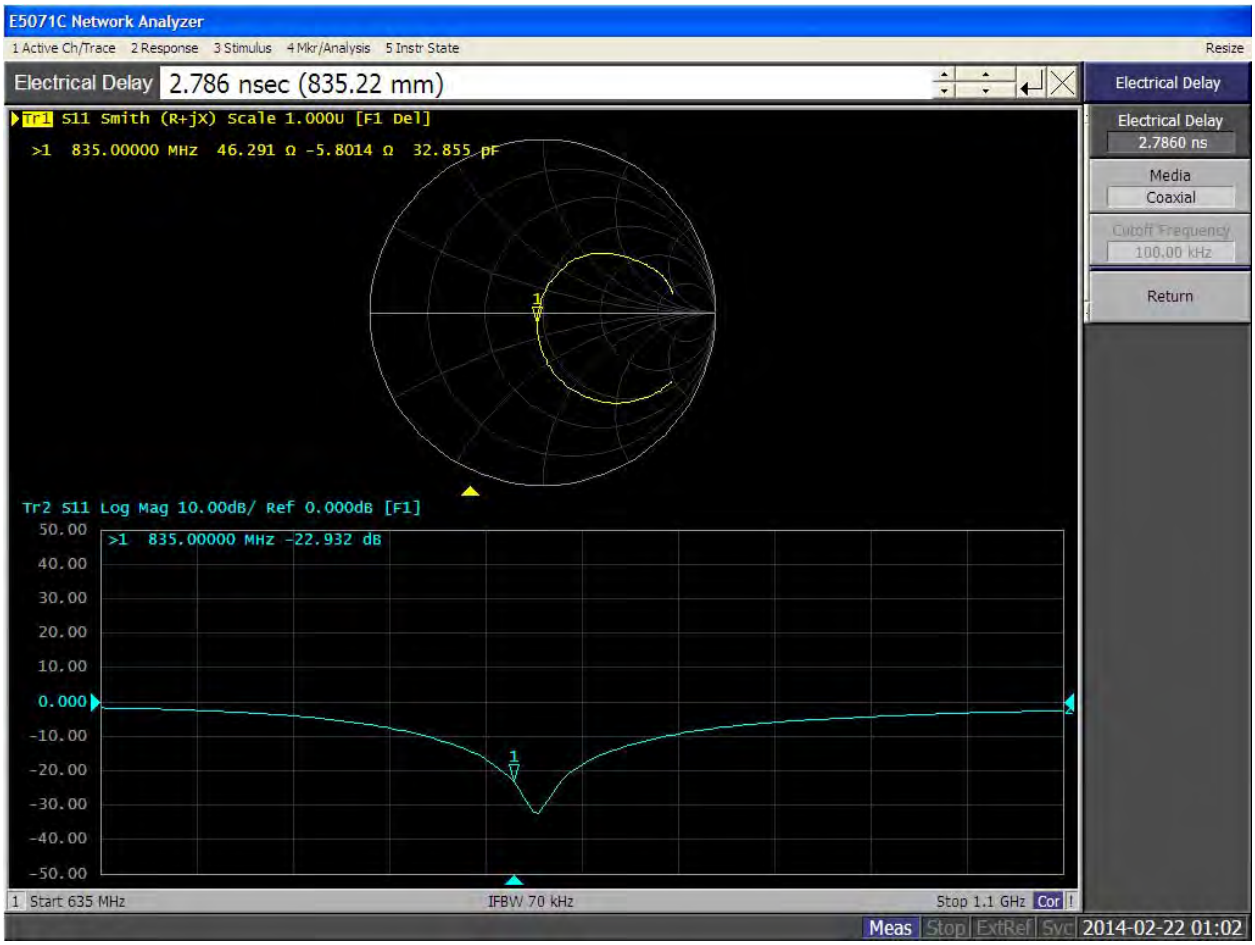
Antenna Parameters with Body TSL

	Calibration certificate	Annual measurement
Impedance, transformed to feed point	47.1 Ω - 5.0 jΩ	46.3 Ω -5.8 jΩ
Return loss	-24.5 dB	-22.9 dB

Head TSL



Body TSL


E5071C Network Analyzer
1 Active Ch/Trace 2 Response 3 Stimulus 4 Mkr/Analysis 5 Instr State
Resize
Electrical Delay 2.786 nsec (835.22 mm)
Tr1 S11 Smith (R+jX) Scale 1.000U [F1 Del]
>1 835.00000 MHz 46.291 Ω -5.8014 Ω 32.855 pF
Tr2 S11 Log Mag 10.00dB/ Ref 0.000dB [F1]
>1 835.00000 MHz -22.932 dB
50.00
40.00
30.00
20.00
10.00
0.000
-10.00
-20.00
-30.00
-40.00
-50.00
1 Start 635 MHz
IFBW 70 kHz
Stop 1.1 GHz
Cor
Meas
Stop
ExtRef
Svc
2014-02-22 01:02
Electrical Delay
Electrical Delay
2.7860 ns
Media
Coaxial
Cutoff Frequency
100.00 kHz
Return

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Engineering AG
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S Swiss Calibration Service

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

Accreditation No.: SCS 108

Client **Nokia SD**

Certificate No: D1750V2-1081_Dec12

CALIBRATION CERTIFICATE

Object	D1750V2 - SN: 1081
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	December 05, 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

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

Issued: December 5, 2012

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "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
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) 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:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

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	1750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.3 ± 6 %	1.34 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.04 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**36.5 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.82 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**19.4 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.8 ± 6 %	1.47 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.31 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**37.3 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.00 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.0 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.4 Ω - 0.2 jΩ
Return Loss	- 44.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.6 Ω + 0.2 jΩ
Return Loss	- 26.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.218 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	January 19, 2011

DASY5 Validation Report for Head TSL

Date: 05.12.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1081

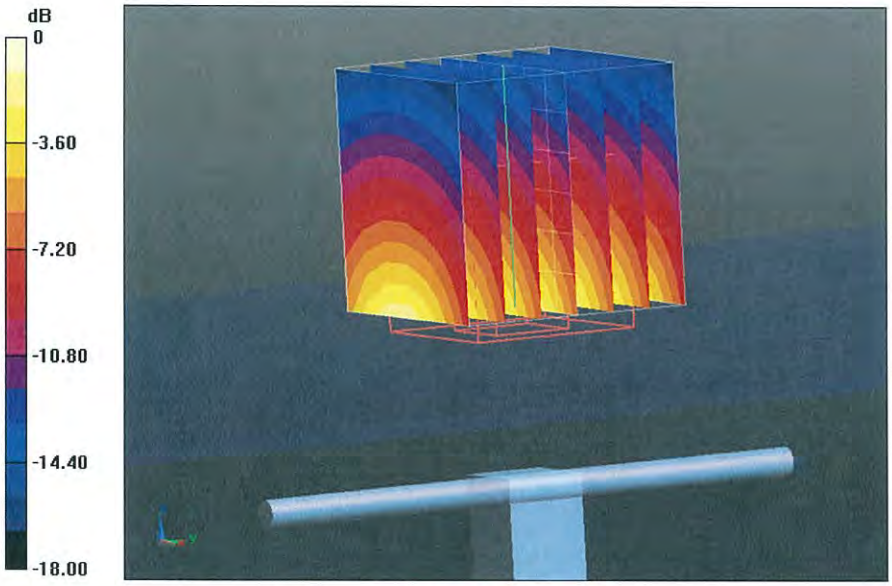
Communication System: CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.34 mho/m; ε_r = 39.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.22, 5.22, 5.22); 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)

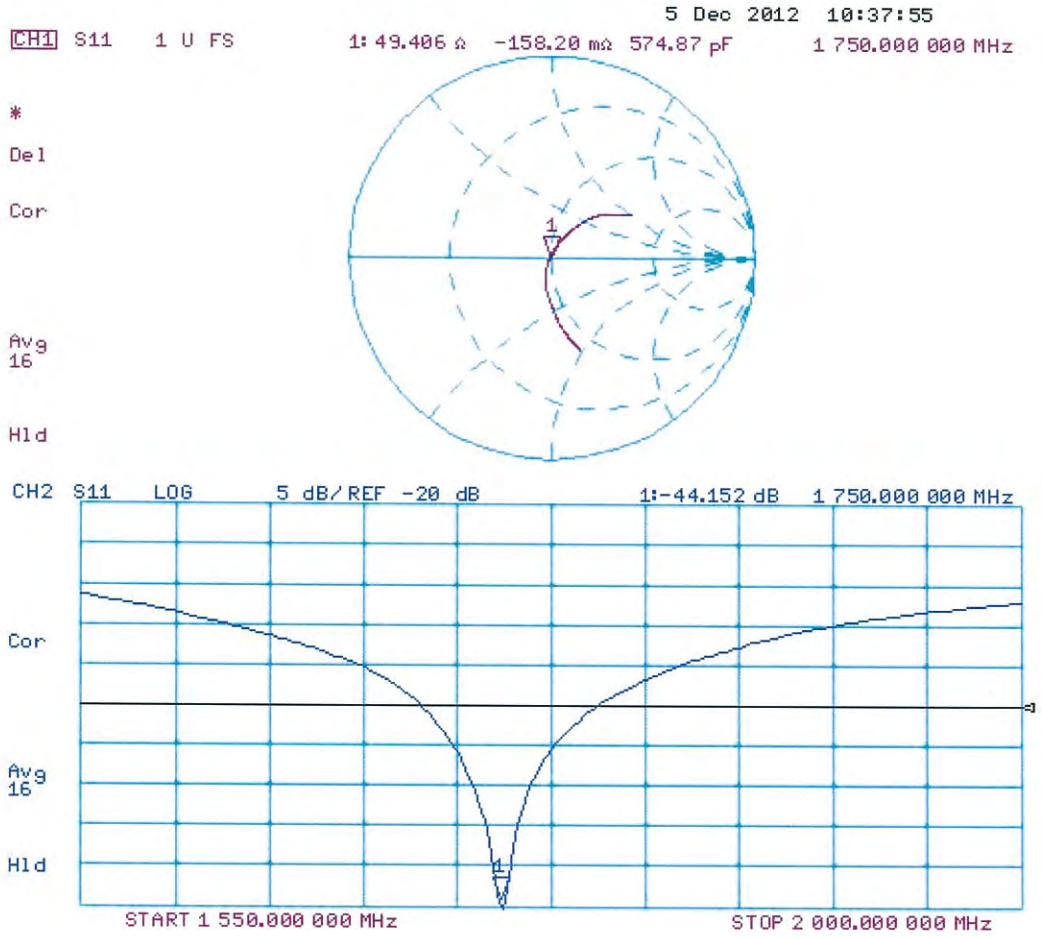
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.123 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 16.1 W/kg
SAR(1 g) = 9.04 W/kg; SAR(10 g) = 4.82 W/kg
Maximum value of SAR (measured) = 11.1 W/kg



0 dB = 11.1 W/kg = 10.45 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 05.12.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1081

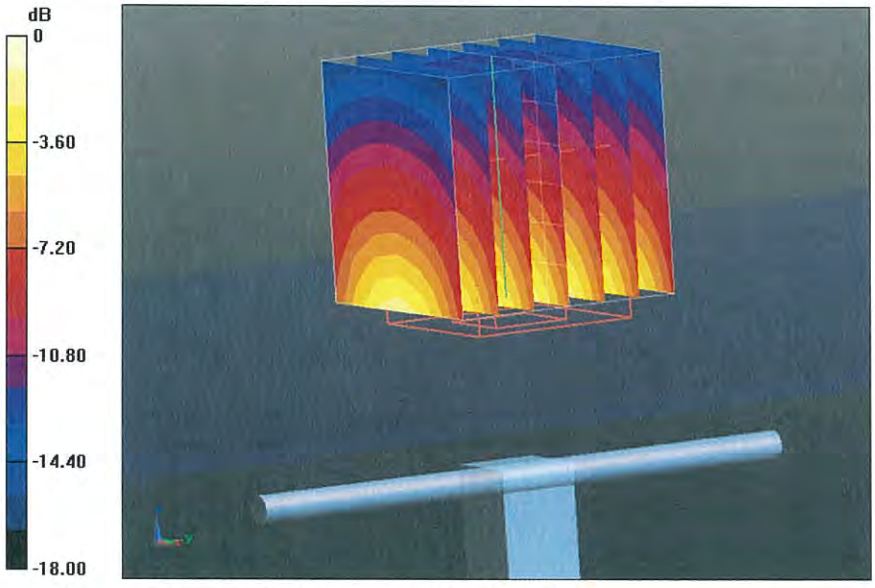
Communication System: CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.47 mho/m; ε_r = 51.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.85, 4.85, 4.85); 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)

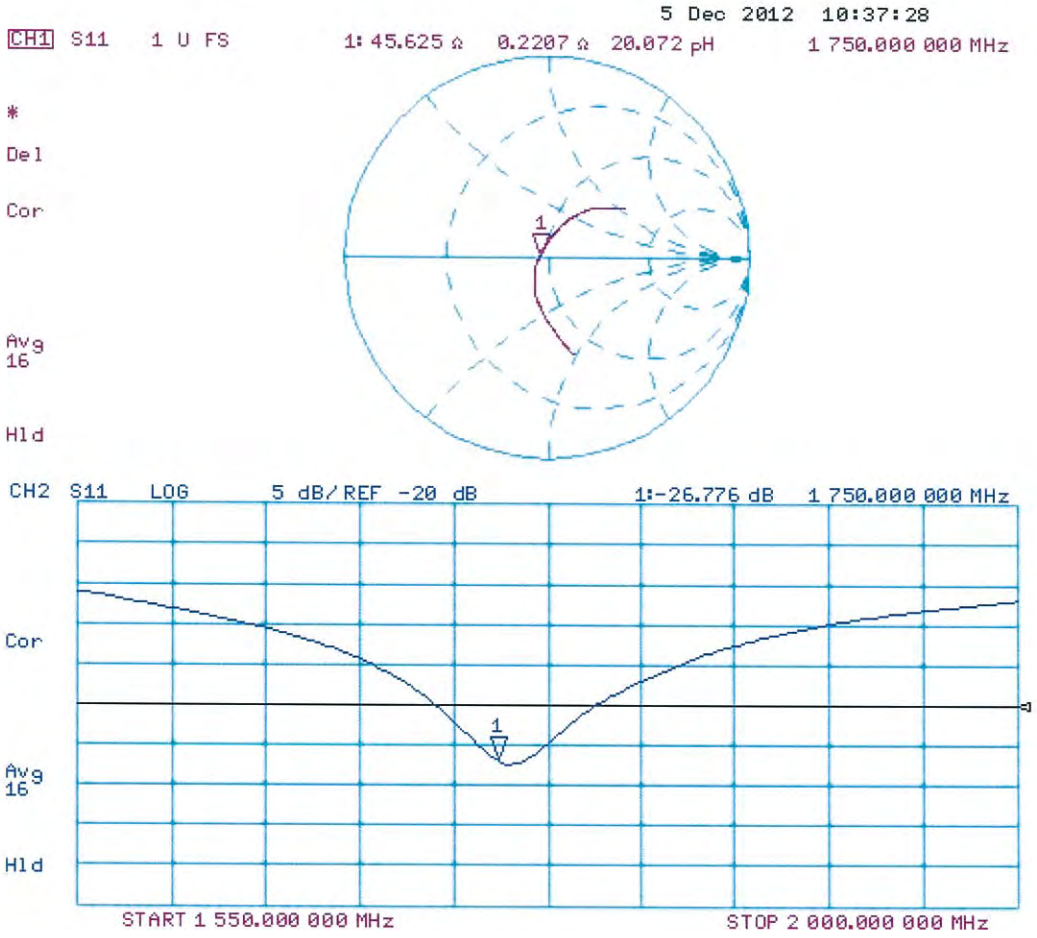
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.123 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 16.1 W/kg
SAR(1 g) = 9.31 W/kg; SAR(10 g) = 5 W/kg
Maximum value of SAR (measured) = 11.7 W/kg



0 dB = 11.7 W/kg = 10.68 dBW/kg

Impedance Measurement Plot for Body TSL



Dipole D1750V2 – SN: 1081 Antenna Parameters measured: 2014-02-21.

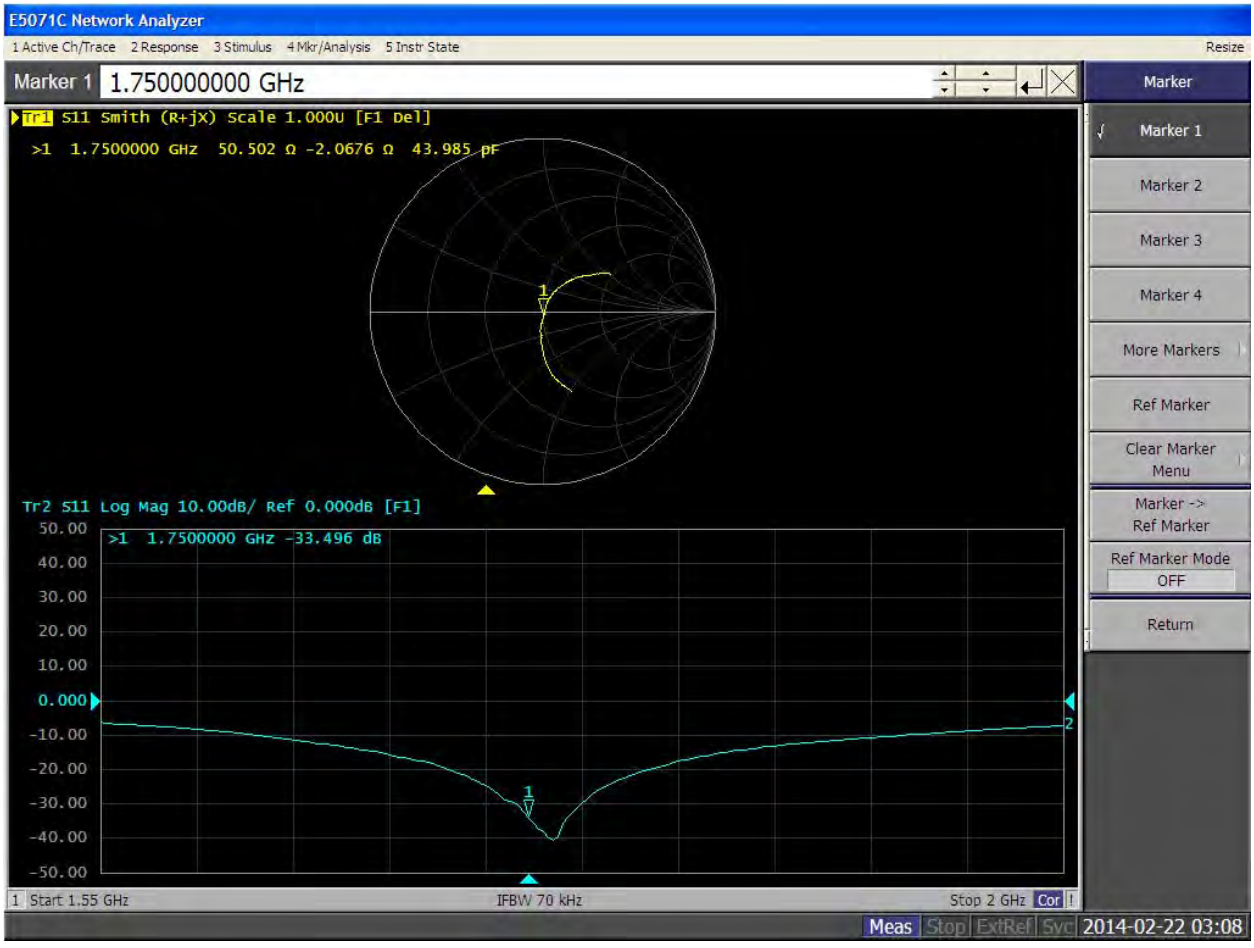
Antenna Parameters with Head TSL

	Calibration certificate	Annual measurement
Impedance, transformed to feed point	49.4 Ω - 0.2 jΩ	50.5 Ω +2.1 jΩ
Return loss	-44.2 dB	-33.5 dB

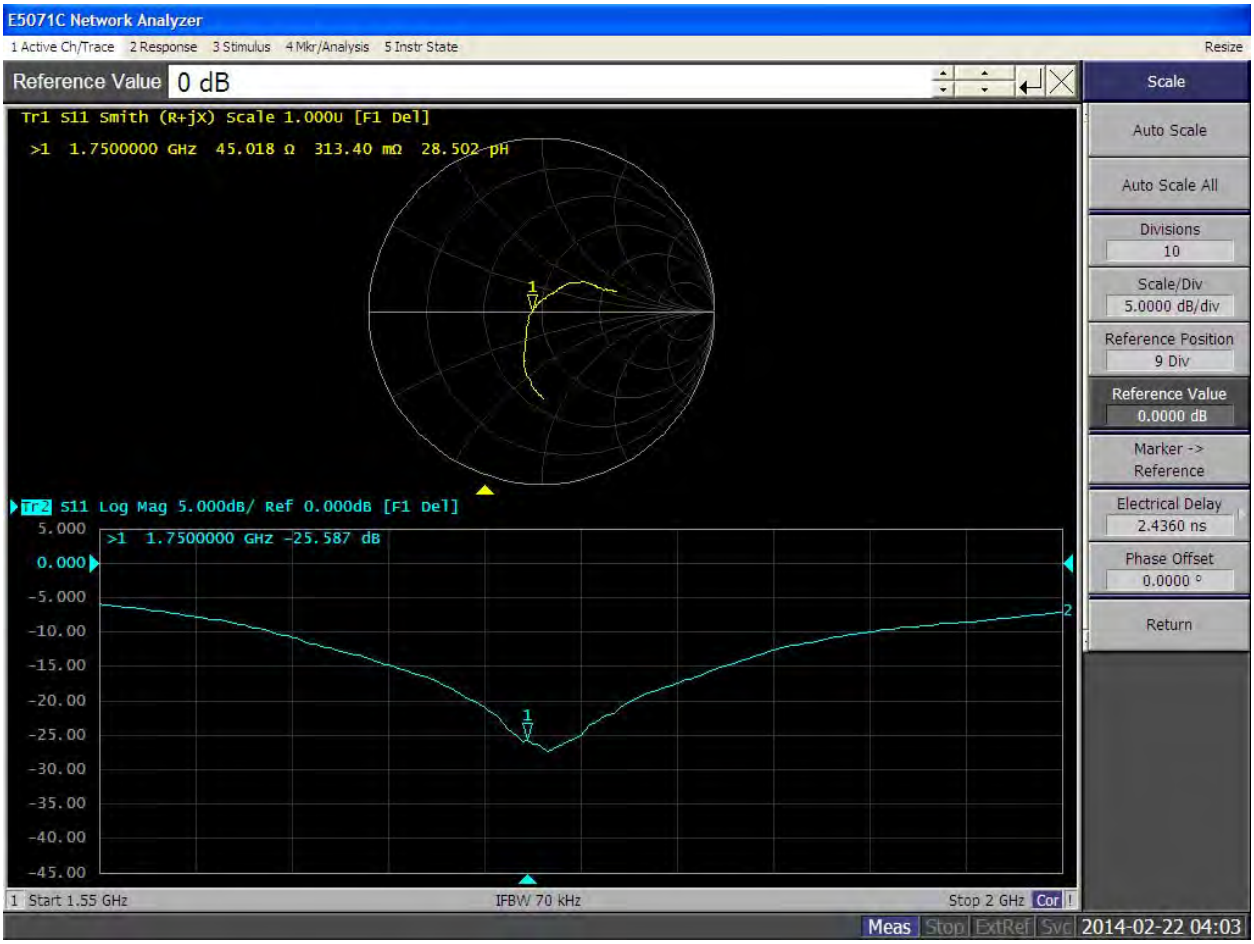
Antenna Parameters with Body TSL

	Calibration certificate	Annual measurement
Impedance, transformed to feed point	45.6 Ω + 0.2 jΩ	45.0 Ω + 0.3 jΩ
Return loss	-26.8 dB	-25.6 dB

Head TSL



Body TSL


E5071C Network Analyzer
1 Active Ch/Trace
2 Response
3 Stimulus
4 Mkr/Analysis
5 Instr State
Resize
Reference Value 0 dB
Tr1 S11 Smith (R+jX) Scale 1.000U [F1 Del]
>1 1.7500000 GHz 45.018 Ω 313.40 mΩ 28.502 pH
Tr2 S11 Log Mag 5.000dB/ Ref 0.000dB [F1 Del]
>1 1.7500000 GHz -25.587 dB
5.000
0.000
-5.000
-10.00
-15.00
-20.00
-25.00
-30.00
-35.00
-40.00
-45.00
1 Start 1.55 GHz
IFBW 70 kHz
Stop 2 GHz
Cor
Scale
Auto Scale
Auto Scale All
Divisions
10
Scale/Div
5.0000 dB/div
Reference Position
9 Div
Reference Value
0.0000 dB
Marker -> Reference
Electrical Delay
2.4360 ns
Phase Offset
0.0000 °
Return
Meas
Stop
ExtRef
Svc
2014-02-22 04:03

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Zeughausstrasse 43, 8004 Zurich, Switzerland

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Accreditation No.: SCS 108

Client Nokia SD

Certificate No: D1900V2-5d099_Jan13

CALIBRATION CERTIFICATE

Object	D1900V2 - SN: 5d099
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	January 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 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	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
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

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

Issued: January 14, 2013

Calibration Laboratory of
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Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

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

Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

a) 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
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) 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:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.5
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 ± 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 ± 0.2) °C	39.4 ± 6 %	1.38 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**40.6 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.3 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

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

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.3 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**41.0 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.42 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.6 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.8 Ω + 5.6 jΩ
Return Loss	- 25.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.9 Ω + 5.6 jΩ
Return Loss	- 22.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.204 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	September 26, 2007

DASY5 Validation Report for Head TSL

Date: 14.01.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d099

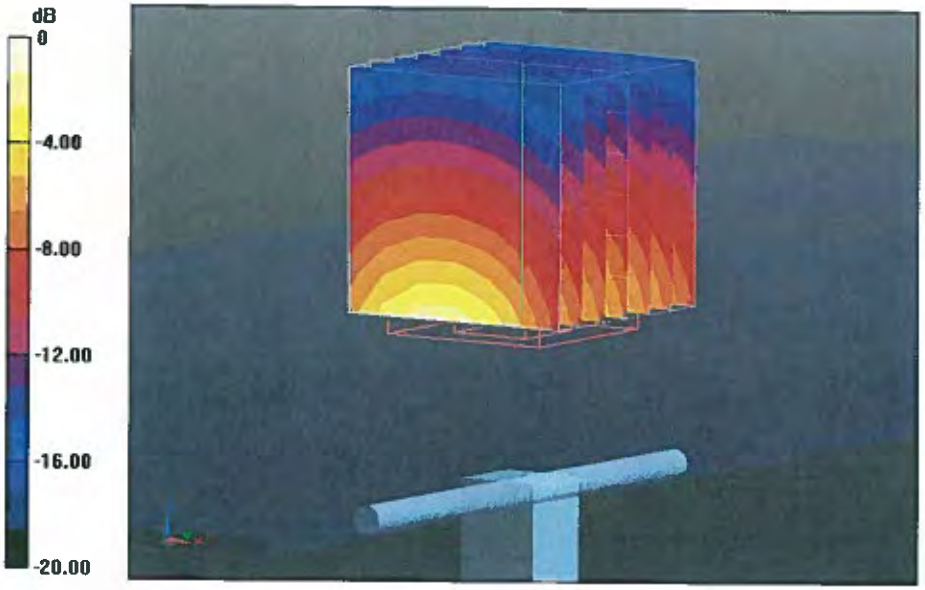
Communication System: CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.38 S/m; ε_r = 39.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.98, 4.98, 4.98); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

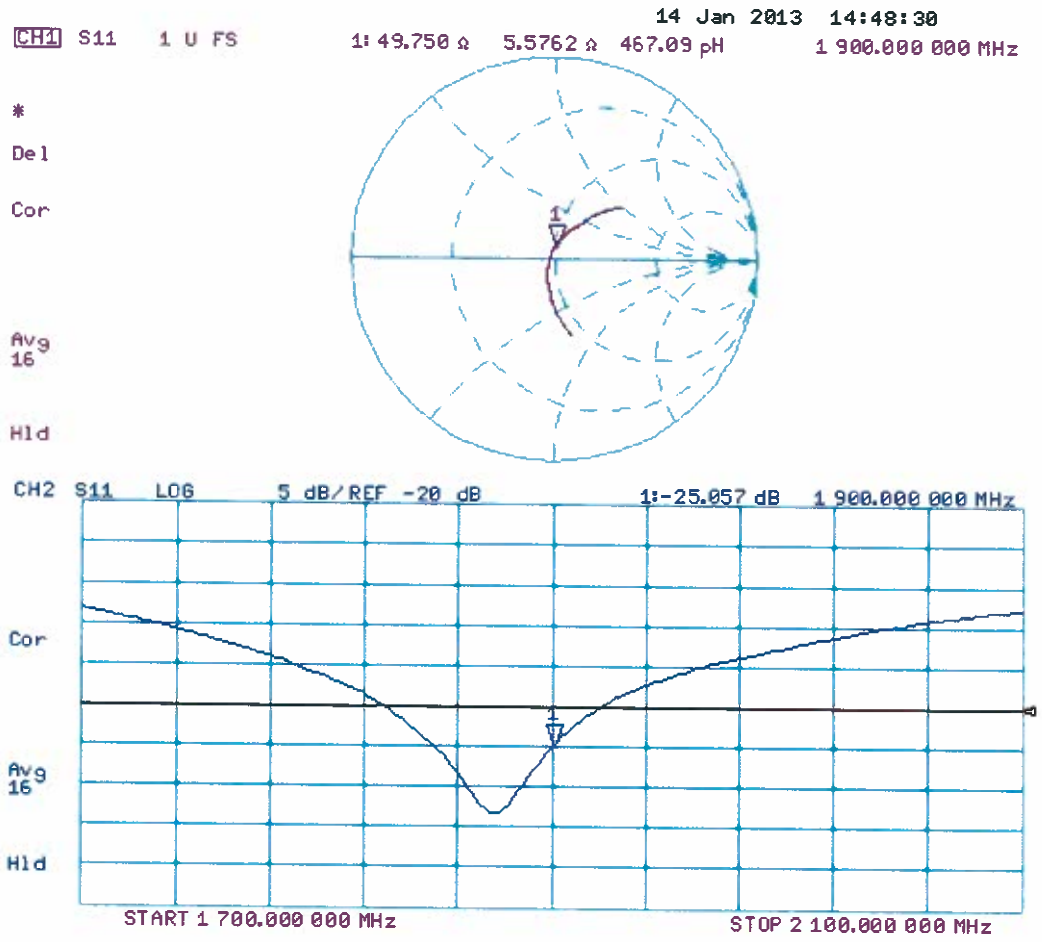
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.160 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 18.3 W/kg
SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.31 W/kg
Maximum value of SAR (measured) = 12.5 W/kg



0 dB = 12.5 W/kg = 10.97 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 14.01.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d099

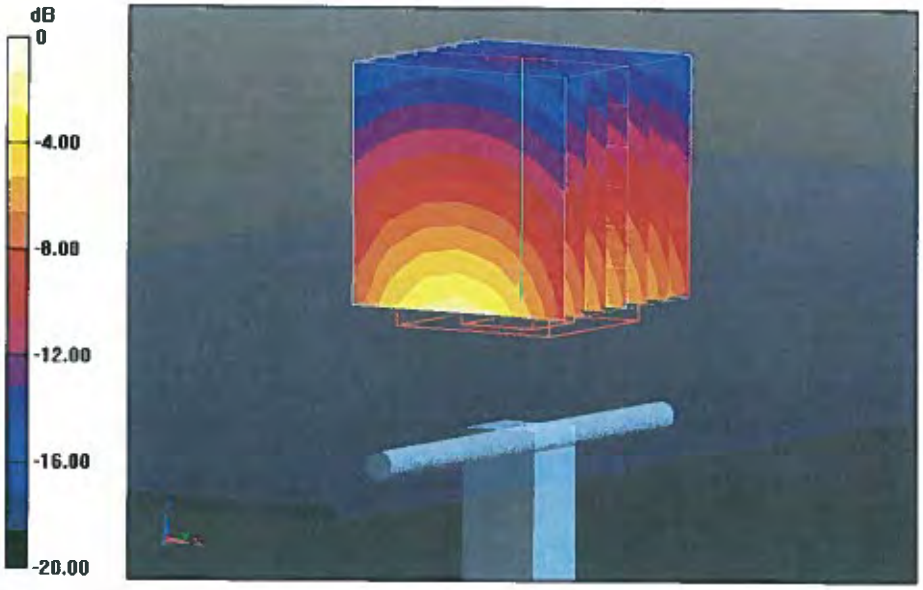
Communication System: CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.52 S/m; ε_r = 52.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.6, 4.6, 4.6); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

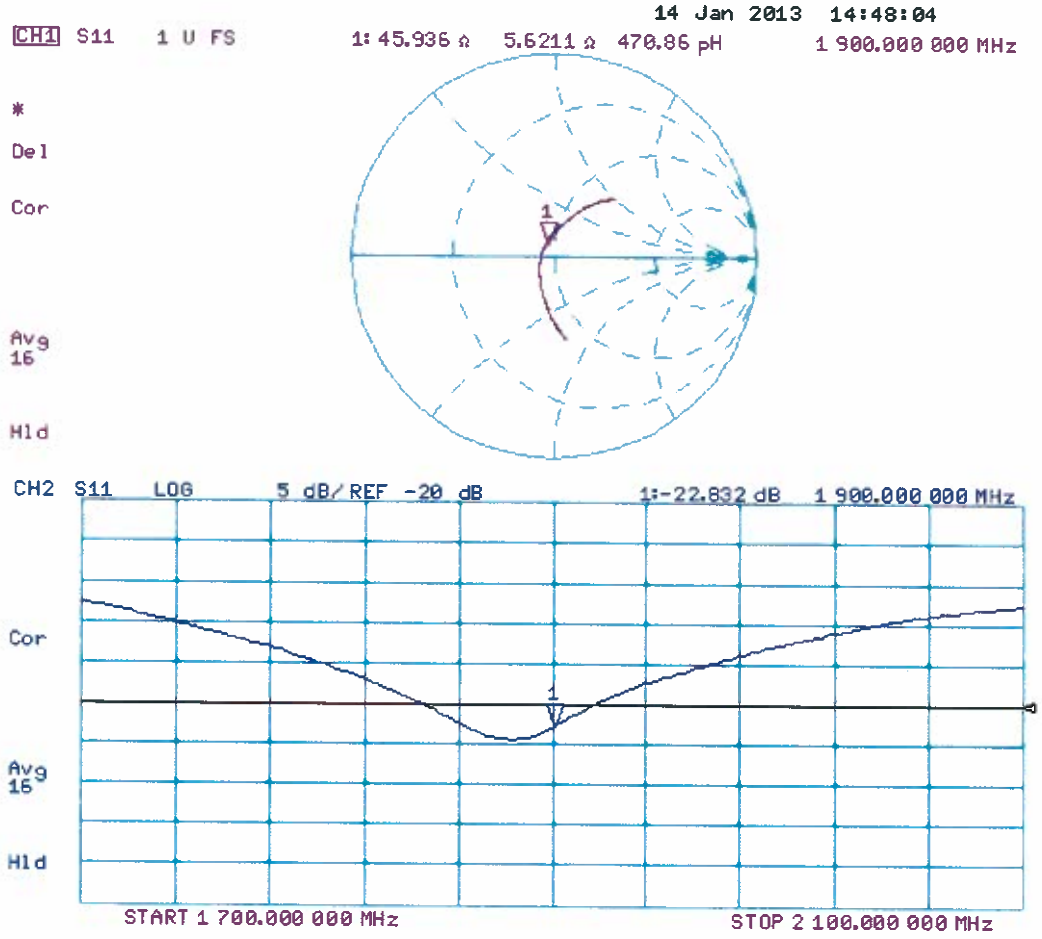
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.160 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 17.8 W/kg
SAR(1 g) = 10.3 W/kg; SAR(10 g) = 5.42 W/kg
Maximum value of SAR (measured) = 12.9 W/kg



0 dB = 12.9 W/kg = 11.11 dBW/kg

Impedance Measurement Plot for Body TSL



Dipole D1900V2 – SN: 5d099 Antenna Parameters measured: 2014-02-14.

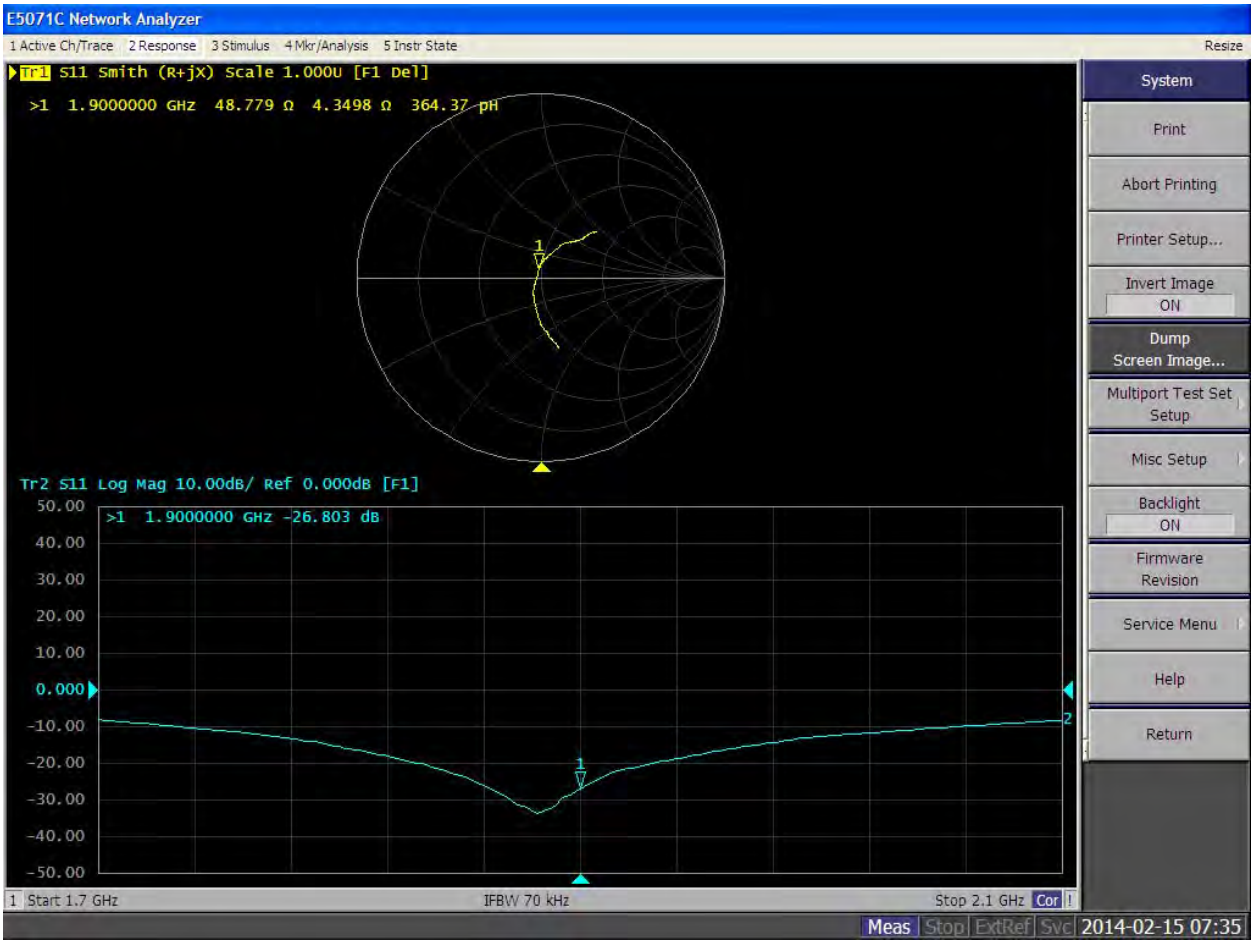
Antenna Parameters with Head TSL

	Calibration certificate	Annual measurement
Impedance, transformed to feed point	50.9 Ω + 6.4 jΩ	48.8 Ω +4.3 jΩ
Return loss	-23.9 dB	-26.8 dB

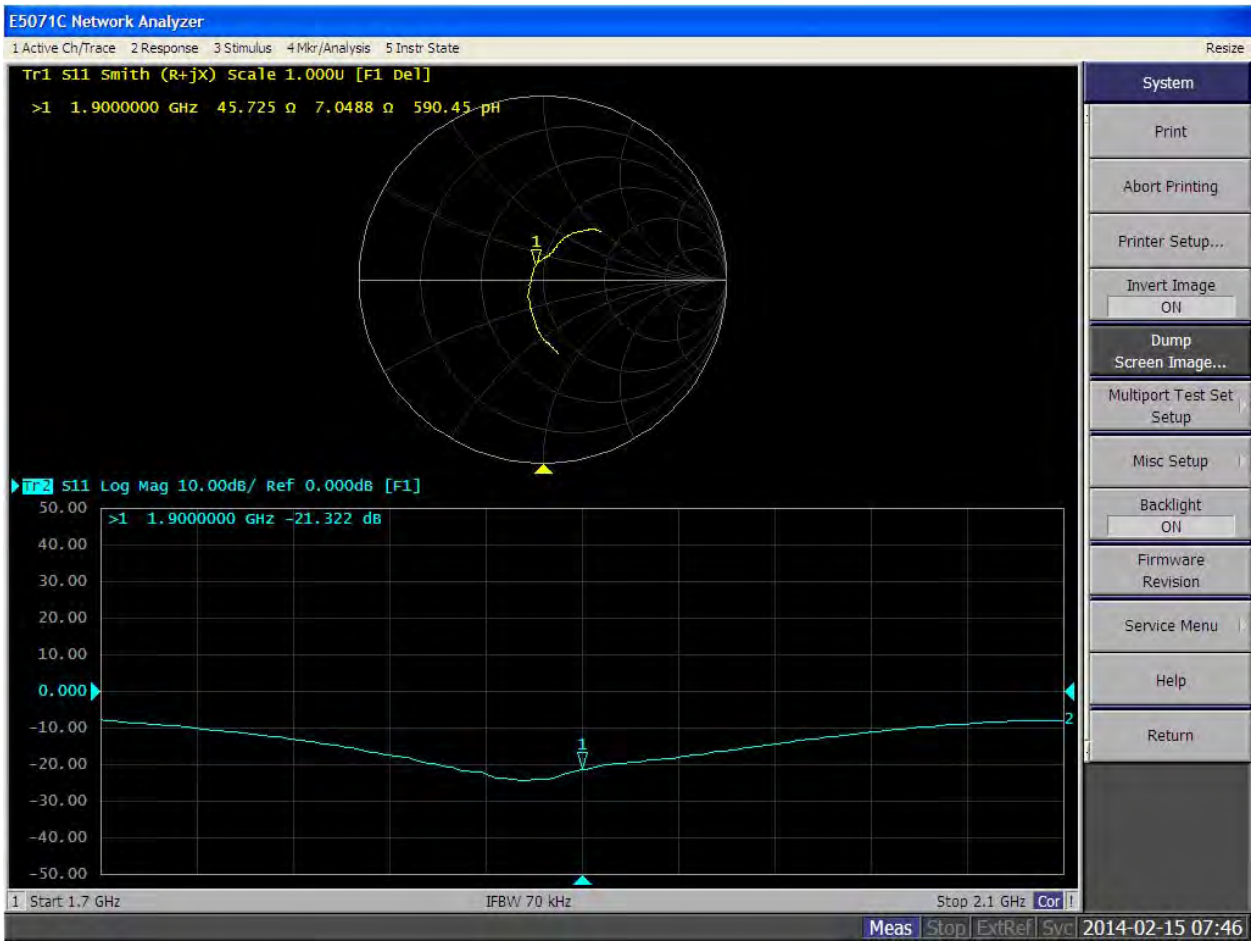
Antenna Parameters with Body TSL

	Calibration certificate	Annual measurement
Impedance, transformed to feed point	46.3 Ω + 6.8 jΩ	45.7 Ω + 7.0 jΩ
Return loss	-22.0 dB	-21.3 dB

Head TSL



Body TSL


E5071C Network Analyzer
1 Active Ch/Trace 2 Response 3 Stimulus 4 Mkr/Analysis 5 Instr State
Resize
Tr1 S11 Smith (R+jX) Scale 1.000U [F1 Del]
>1 1.9000000 GHz 45.725 Ω 7.0488 Ω 590.45 pH
Tr2 S11 Log Mag 10.00dB/ Ref 0.000dB [F1]
>1 1.9000000 GHz -21.322 dB
50.00
40.00
30.00
20.00
10.00
0.000
-10.00
-20.00
-30.00
-40.00
-50.00
1 Start 1.7 GHz
IFBW 70 kHz
Stop 2.1 GHz
Cor
System
Print
Abort Printing
Printer Setup...
Invert Image
ON
Dump
Screen Image...
Multiport Test Set
Setup
Misc Setup
Backlight
ON
Firmware
Revision
Service Menu
Help
Return
Meas
Stop
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2014-02-15 07:46

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Accreditation No.: SCS 108

Client **Nokia SD**

Certificate No: D2450V2-800_Sep12

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 800
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	September 13, 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	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 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-11)	In house check: Oct-12

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

Issued: September 13, 2012

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "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
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) 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:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.9 ± 6 %	1.84 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.4 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**53.2 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.24 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**24.9 mW /g ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.0 ± 6 %	2.01 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.0 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**50.9 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.05 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**23.9 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.9 Ω + 2.2 jΩ
Return Loss	- 25.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	51.4 Ω + 3.7 jΩ
Return Loss	- 28.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.159 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	November 02, 2006

DASY5 Validation Report for Head TSL

Date: 13.09.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 800

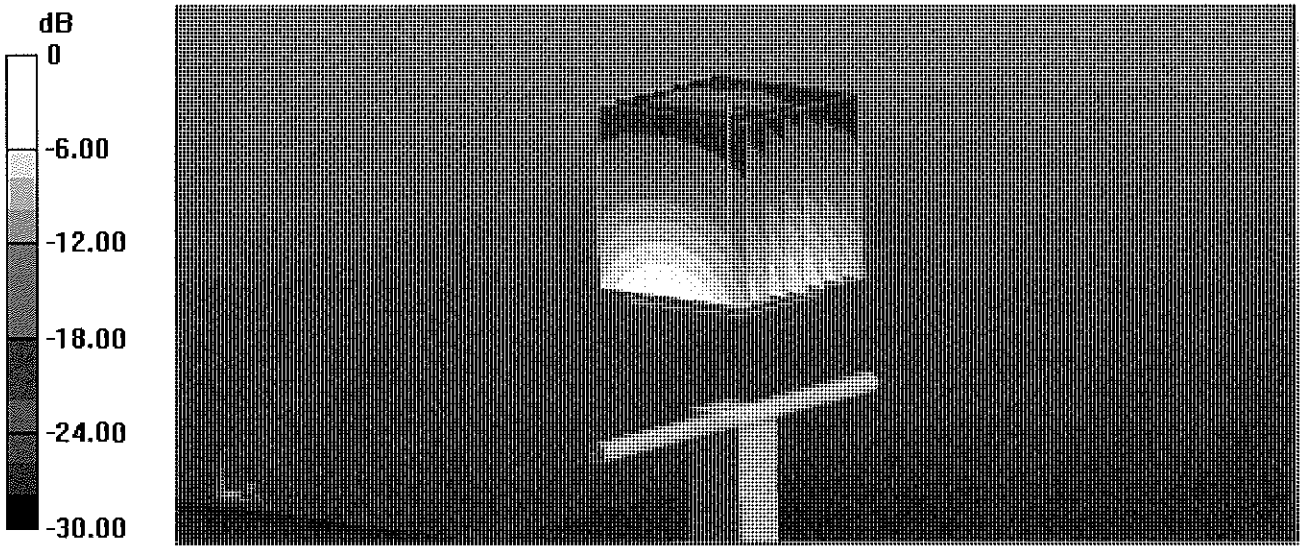
Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.84 mho/m; ε_r = 39.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

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 52.8.2(969); SEMCAD X 14.6.6(6824)

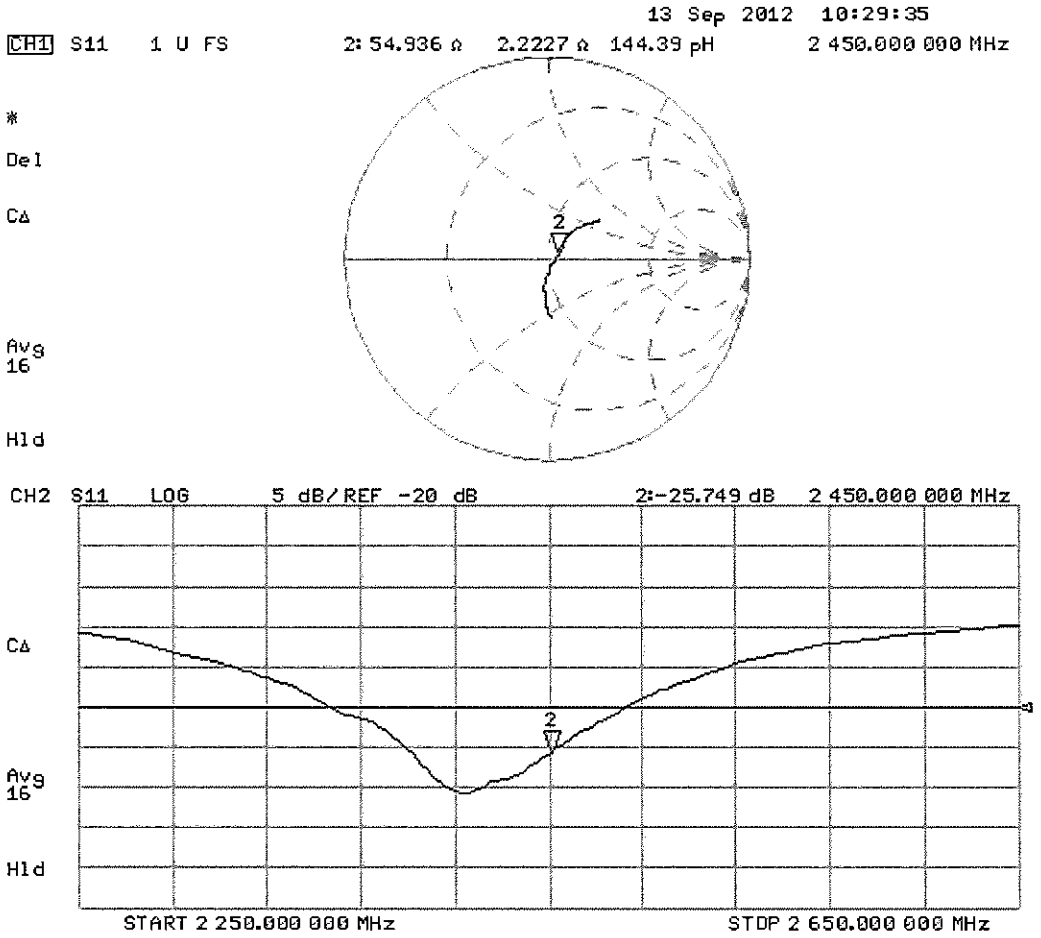
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 100.1 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 27.710 mW/g
SAR(1 g) = 13.4 mW/g; SAR(10 g) = 6.24 mW/g
Maximum value of SAR (measured) = 17.2 W/kg



0 dB = 17.2 W/kg = 24.71 dB W/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 13.09.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 800

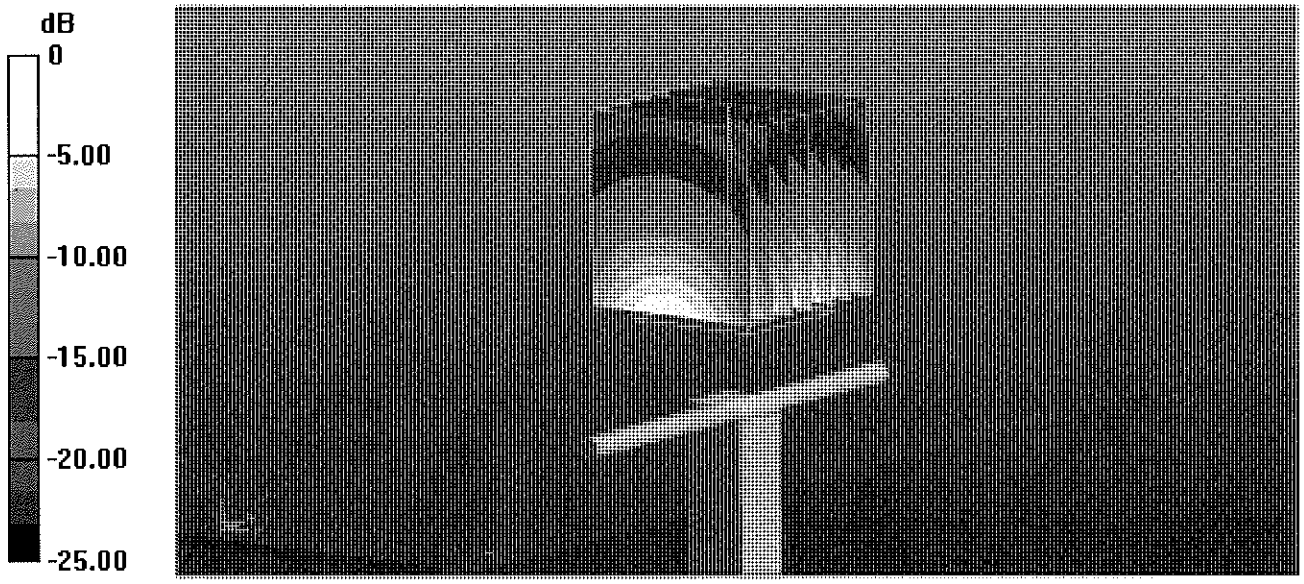
Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.01 mho/m; ε_r = 51; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

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 52.8.2(969); SEMCAD X 14.6.6(6824)

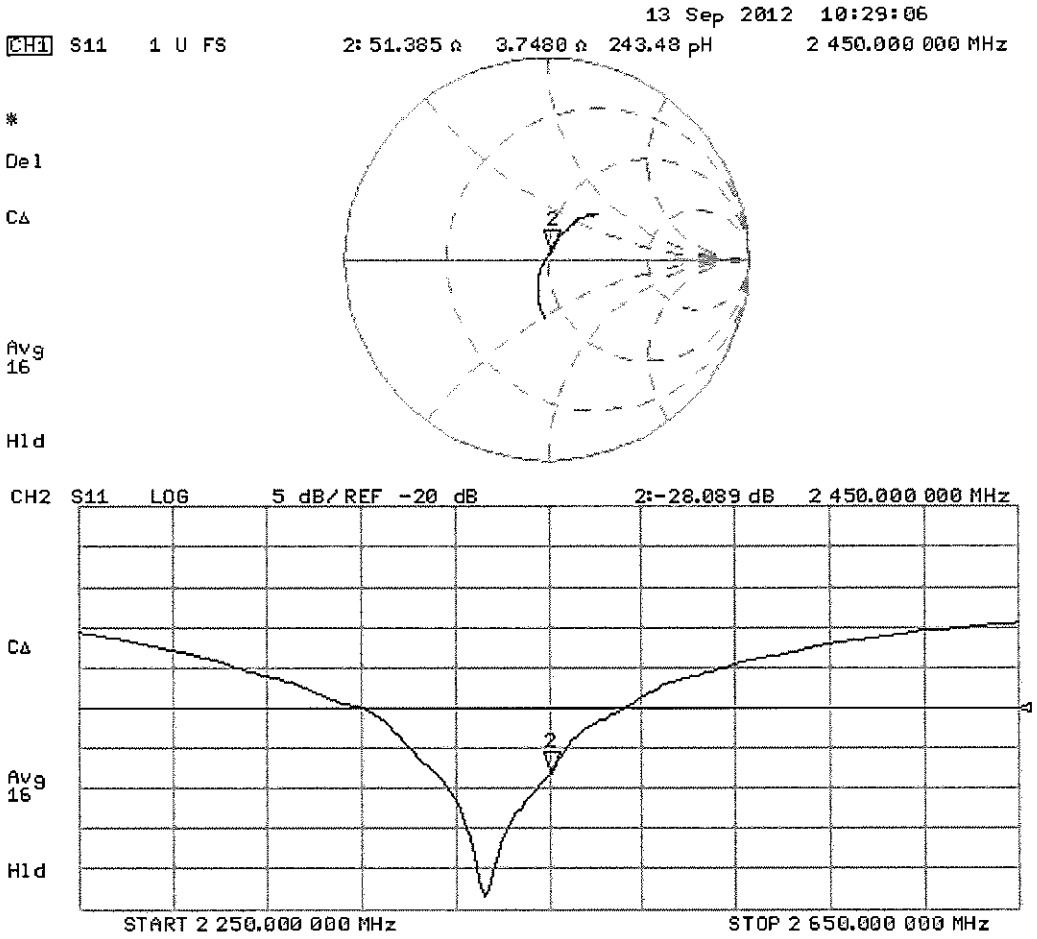
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.223 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 26.601 mW/g
SAR(1 g) = 13 mW/g; SAR(10 g) = 6.05 mW/g
Maximum value of SAR (measured) = 16.9 W/kg



0 dB = 16.9 W/kg = 24.56 dB W/kg

Impedance Measurement Plot for Body TSL



Dipole D2450V2 – SN: 800 Antenna Parameters measured: 2013-10-10.

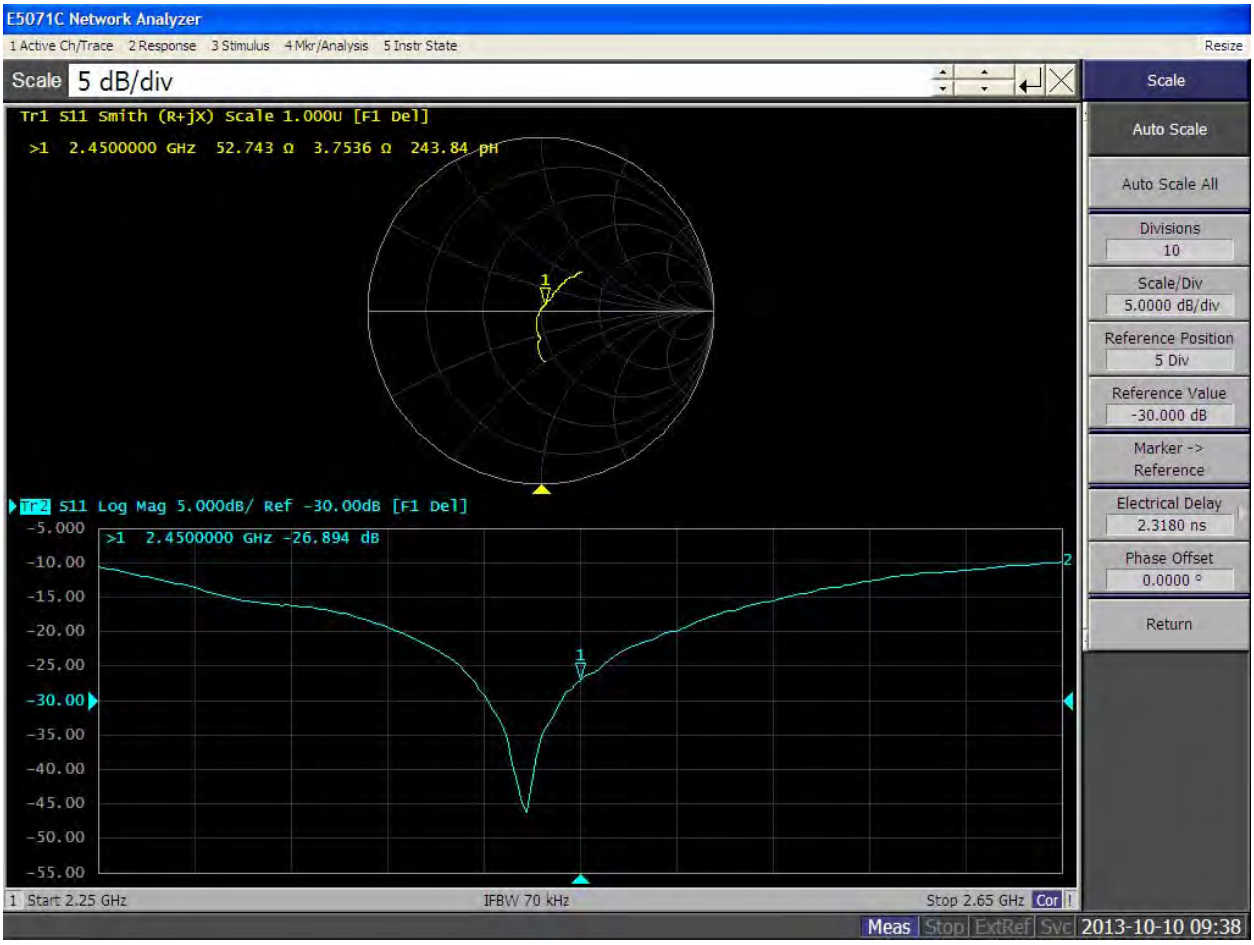
Antenna Parameters with Head TSL

	Calibration certificate	2-year measurement
Impedance, transformed to feed point	54.9Ω + 2.2 jΩ	52.7 Ω + 3.8 jΩ
Return loss	-25.7 dB	-26.9 dB

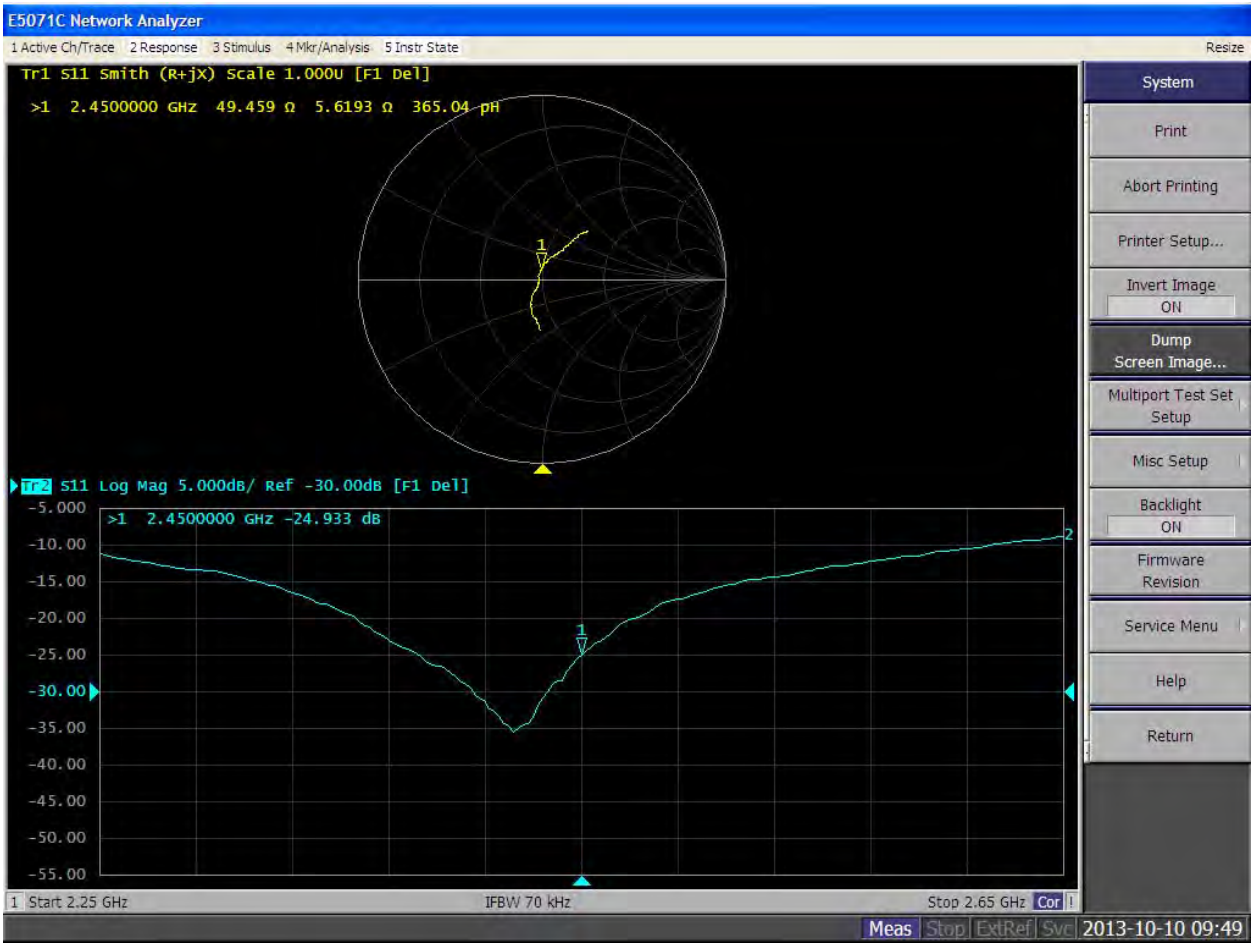
Antenna Parameters with Body TSL

	Calibration certificate	2-year measurement
Impedance, transformed to feed point	51.4 Ω + 3.7 jΩ	49.5 Ω + 5.6 jΩ
Return loss	-28.1 dB	-24.9 dB

Head TSL



Body TSL


E5071C Network Analyzer
1 Active Ch/Trace
2 Response
3 Stimulus
4 Mkr/Analysis
5 Instr State
Resize
Tr1 S11 Smith (R+jX) Scale 1.000U [F1 Del]
>1 2.4500000 GHz 49.459 Ω 5.6193 Ω 365.04 pH
Tr2 S11 Log Mag 5.000dB/ Ref -30.00dB [F1 Del]
>1 2.4500000 GHz -24.933 dB
-5.000
-10.00
-15.00
-20.00
-25.00
-30.00
-35.00
-40.00
-45.00
-50.00
-55.00
1 Start 2.25 GHz
IFBW 70 kHz
Stop 2.65 GHz
Cor
System
Print
Abort Printing
Printer Setup...
Invert Image
ON
Dump
Screen Image...
Multiport Test Set
Setup
Misc Setup
Backlight
ON
Firmware
Revision
Service Menu
Help
Return
Meas
Stop
ExtRef
Svc
2013-10-10 09:49

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

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Accreditation No.: SCS 108

Client Nokia SD

Certificate No: D2600V2-1064_Jul13

CALIBRATION CERTIFICATE

Object	D2600V2 - SN: 1064
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	July 05, 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 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)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

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

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

Issued: July 7, 2013

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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:

a) 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
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) 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:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2600 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.2 ± 6 %	1.97 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.8 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**58.4 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.57 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**26.0 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	50.1 ± 6 %	2.20 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	14.4 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**56.5 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.32 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**25.0 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.7 Ω - 5.7 jΩ
Return Loss	- 25.0 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.2 Ω - 4.5 jΩ
Return Loss	- 25.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.151 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	August 14, 2012

DASY5 Validation Report for Head TSL

Date: 05.07.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1064

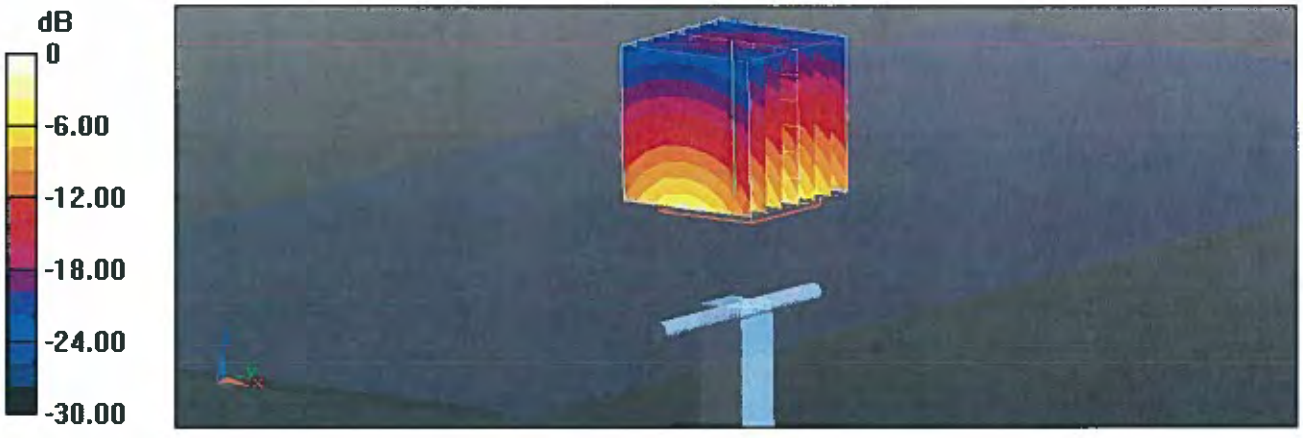
Communication System: UID 0 - CW ; Frequency: 2600 MHz
Medium parameters used: f = 2600 MHz; σ = 1.97 S/m; ε_r = 37.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.45, 4.45, 4.45); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

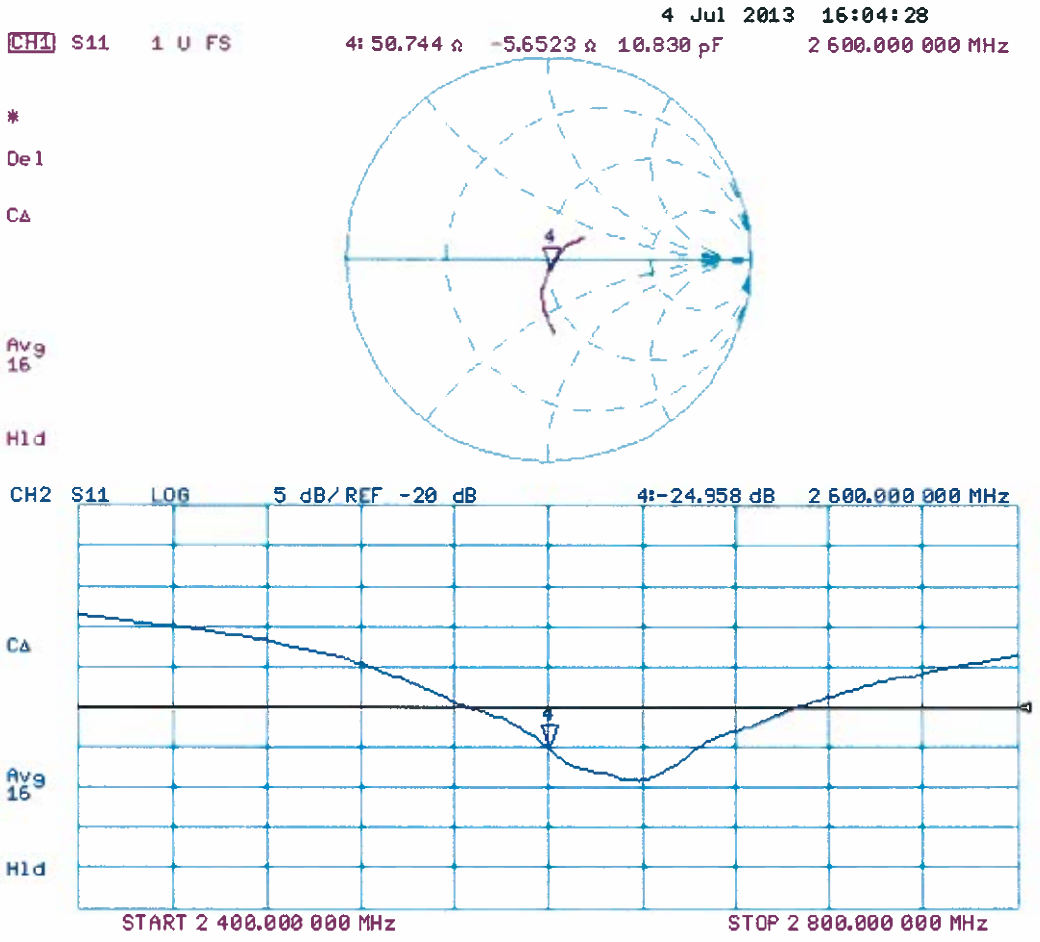
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 102.4 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 32.1 W/kg
SAR(1 g) = 14.8 W/kg; SAR(10 g) = 6.57 W/kg
Maximum value of SAR (measured) = 19.6 W/kg



0 dB = 19.6 W/kg = 12.92 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 05.07.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1064

Communication System: UID 0 - CW ; Frequency: 2600 MHz
Medium parameters used: f = 2600 MHz; σ = 2.2 S/m; ε_r = 50.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

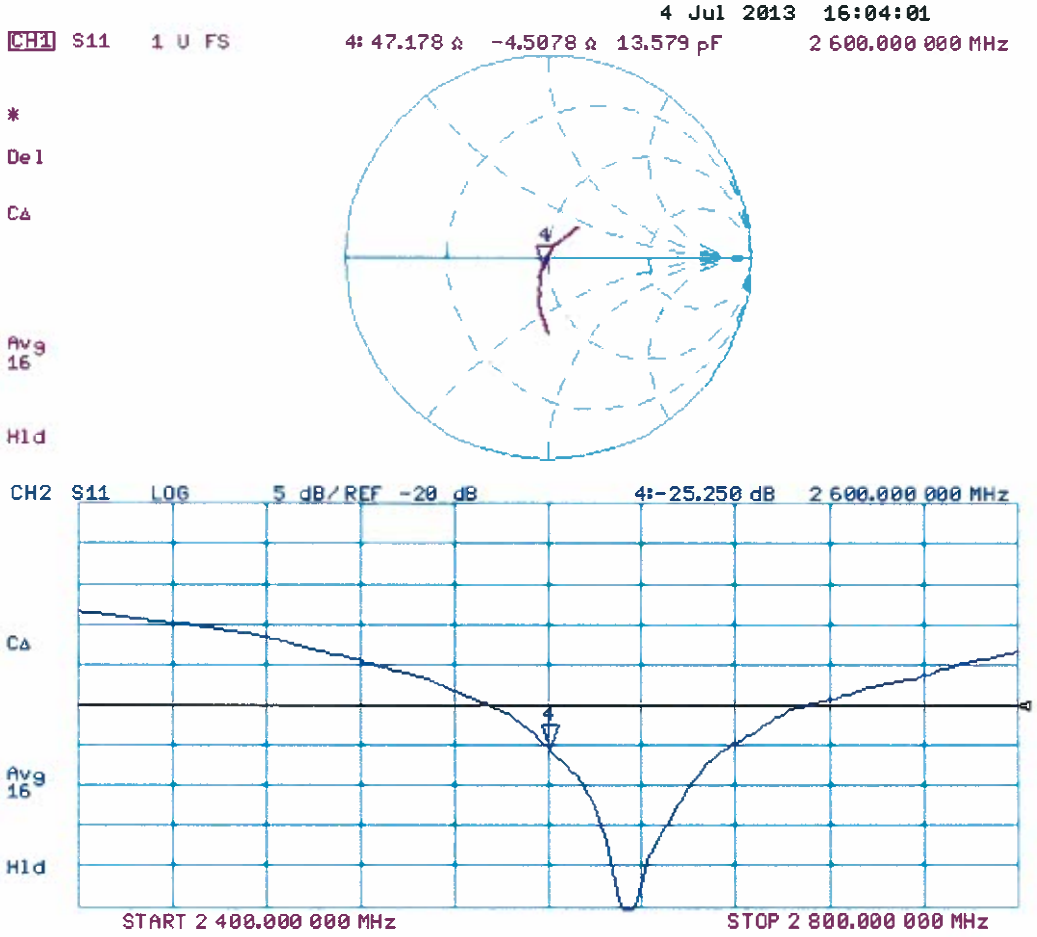
- Probe: ES3DV3 - SN3205; ConvF(4.32, 4.32, 4.32); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

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

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.397 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 31.6 W/kg
SAR(1 g) = 14.4 W/kg; SAR(10 g) = 6.32 W/kg
Maximum value of SAR (measured) = 19.3 W/kg

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

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 108

Client **Nokia SD**

Certificate No: D5GHzV2-1042_Oct13

CALIBRATION CERTIFICATE

Object	D5GHzV2 - SN: 1042
Calibration procedure(s)	QA CAL-22.v2 Calibration procedure for dipole validation kits between 3-6 GHz
Calibration date:	October 07, 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 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe EX3DV4	SN: 3503	28-Dec-12 (No. EX3-3503_Dec12)	Dec-13
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-13)	In house check: Oct-15
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-15
Network Analyzer HP 8753E	US37390585 S4206	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: October 7, 2013

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEC 62209-2, "Evaluation of Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices in the Frequency Range of 30 MHz to 6 GHz: Human models, Instrumentation, and Procedures"; Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for including accessories and multiple transmitters", March 2010
b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"
c) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

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

Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.3 ± 6 %	4.54 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.67 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**76.3 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.20 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.9 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.2 ± 6 %	4.64 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5300 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.10 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**80.6 W / kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.33 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.2 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.9 ± 6 %	4.83 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**82.4 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.36 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.4 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.7 ± 6 %	4.94 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.21 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**81.6 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.33 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.1 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.5 ± 6 %	5.14 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.79 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**77.5 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.22 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.1 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.8 ± 6 %	5.44 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.53 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**75.0 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.10 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.9 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.42 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.6 ± 6 %	5.58 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5300 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.62 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**75.9 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.13 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.2 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.6	5.65 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.3 ± 6 %	5.84 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5500 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.94 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**79.1 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.21 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**22.0 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.1 ± 6 %	5.98 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.00 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**79.7 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.22 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**22.1 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.8 ± 6 %	6.25 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.50 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**74.7 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.08 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.7 W/kg ± 19.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	50.7 Ω - 8.2 jΩ
Return Loss	- 21.8 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	49.7 Ω - 6.7 jΩ
Return Loss	- 23.4 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	55.6 Ω - 4.1 jΩ
Return Loss	- 23.6 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	56.0 Ω - 1.8 jΩ
Return Loss	- 24.5 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	60.3 Ω - 5.2 jΩ
Return Loss	- 19.6 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	49.9 Ω - 6.2 jΩ
Return Loss	- 24.2 dB

Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	49.6 Ω - 3.0 jΩ
Return Loss	- 30.5 dB

Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	52.4 Ω - 1.0 jΩ
Return Loss	- 31.9 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	54.3 Ω - 0.1 jΩ
Return Loss	- 27.7 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	56.1 Ω - 1.2 jΩ
Return Loss	- 24.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.203 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 30, 2005

DASY5 Validation Report for Head TSL

Date: 04.10.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1042

Communication System: UID 0 - CW ; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 4.54 S/m; ε_r = 35.3; ρ = 1000 kg/m^3 , Medium parameters used: f = 5300 MHz; σ = 4.64 S/m; ε_r = 35.2; ρ = 1000 kg/m^3 , Medium parameters used: f = 5500 MHz; σ = 4.83 S/m; ε_r = 34.9; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 4.94 S/m; ε_r = 34.7; ρ = 1000 kg/m^3 , Medium parameters used: f = 5800 MHz; σ = 5.14 S/m; ε_r = 34.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.41, 5.41, 5.41); Calibrated: 28.12.2012, ConvF(5.1, 5.1, 5.1); Calibrated: 28.12.2012, ConvF(4.91, 4.91, 4.91); Calibrated: 28.12.2012, ConvF(4.76, 4.76, 4.76); Calibrated: 28.12.2012, ConvF(4.81, 4.81, 4.81); Calibrated: 28.12.2012;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

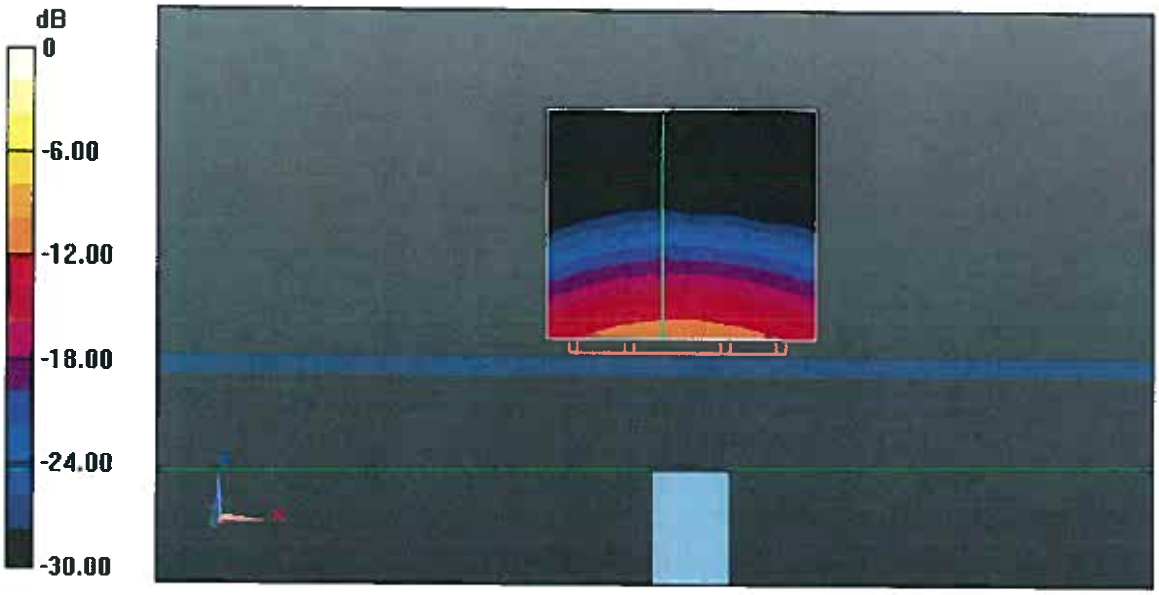
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 64.075 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 27.9 W/kg
SAR(1 g) = 7.67 W/kg; SAR(10 g) = 2.2 W/kg
Maximum value of SAR (measured) = 17.7 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 64.506 V/m; Power Drift = 0.11 dB
Peak SAR (extrapolated) = 30.3 W/kg
SAR(1 g) = 8.1 W/kg; SAR(10 g) = 2.33 W/kg
Maximum value of SAR (measured) = 18.8 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 64.303 V/m; Power Drift = 0.11 dB
Peak SAR (extrapolated) = 32.5 W/kg
SAR(1 g) = 8.28 W/kg; SAR(10 g) = 2.36 W/kg
Maximum value of SAR (measured) = 19.5 W/kg

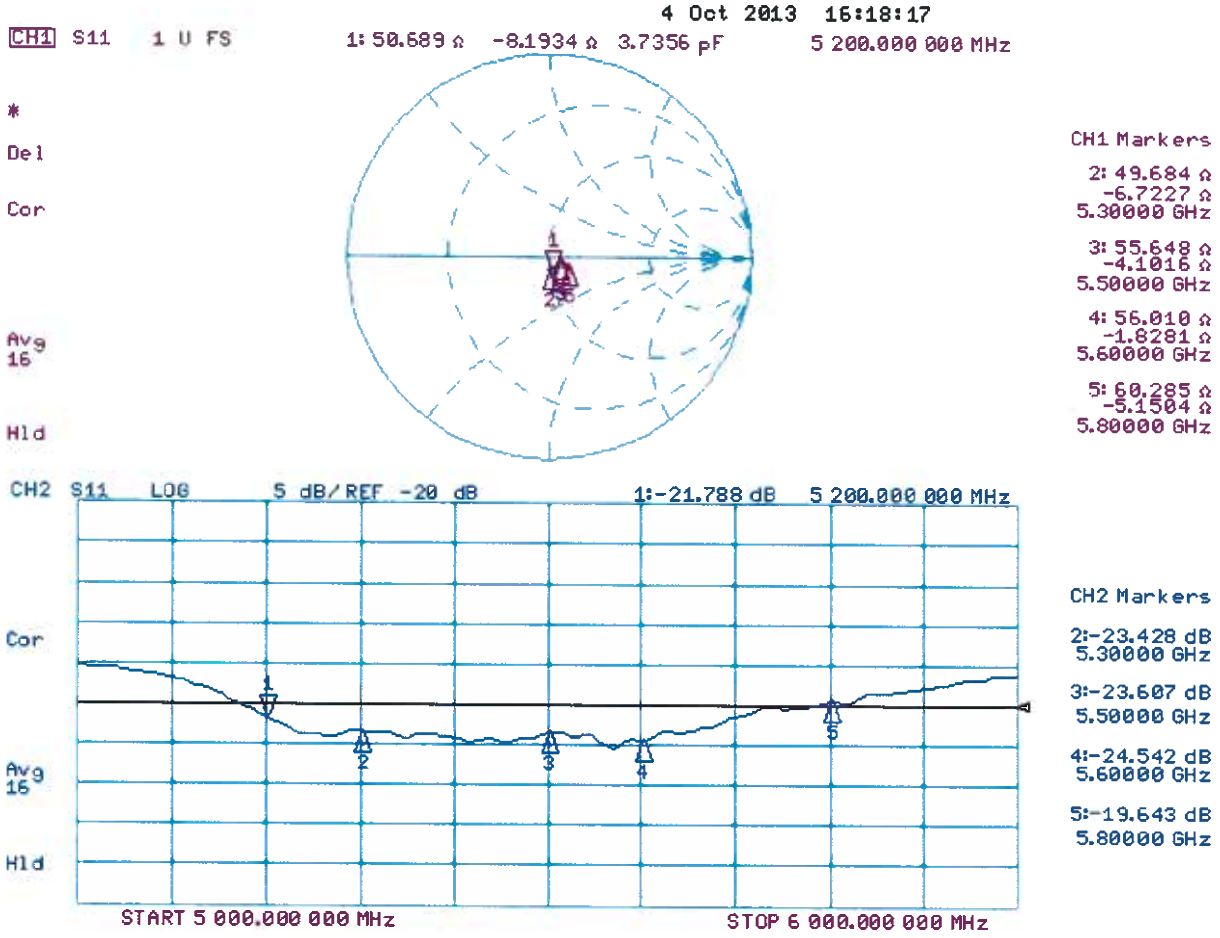
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 64.217 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 32.6 W/kg
SAR(1 g) = 8.21 W/kg; SAR(10 g) = 2.33 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 61.251 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 32.2 W/kg
SAR(1 g) = 7.79 W/kg; SAR(10 g) = 2.22 W/kg



0 dB = 18.8 W/kg = 12.74 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 07.10.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1042

Communication System: UID 0 - CW ; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 5.44 S/m; ε_r = 47.8; ρ = 1000 kg/m^3 , Medium parameters used: f = 5300 MHz; σ = 5.58 S/m; ε_r = 47.6; ρ = 1000 kg/m^3 , Medium parameters used: f = 5500 MHz; σ = 5.84 S/m; ε_r = 47.3; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 5.98 S/m; ε_r = 47.1; ρ = 1000 kg/m^3 , Medium parameters used: f = 5800 MHz; σ = 6.25 S/m; ε_r = 46.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.91, 4.91, 4.91); Calibrated: 28.12.2012, ConvF(4.67, 4.67, 4.67); Calibrated: 28.12.2012, ConvF(4.43, 4.43, 4.43); Calibrated: 28.12.2012, ConvF(4.22, 4.22, 4.22); Calibrated: 28.12.2012, ConvF(4.38, 4.38, 4.38); Calibrated: 28.12.2012;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

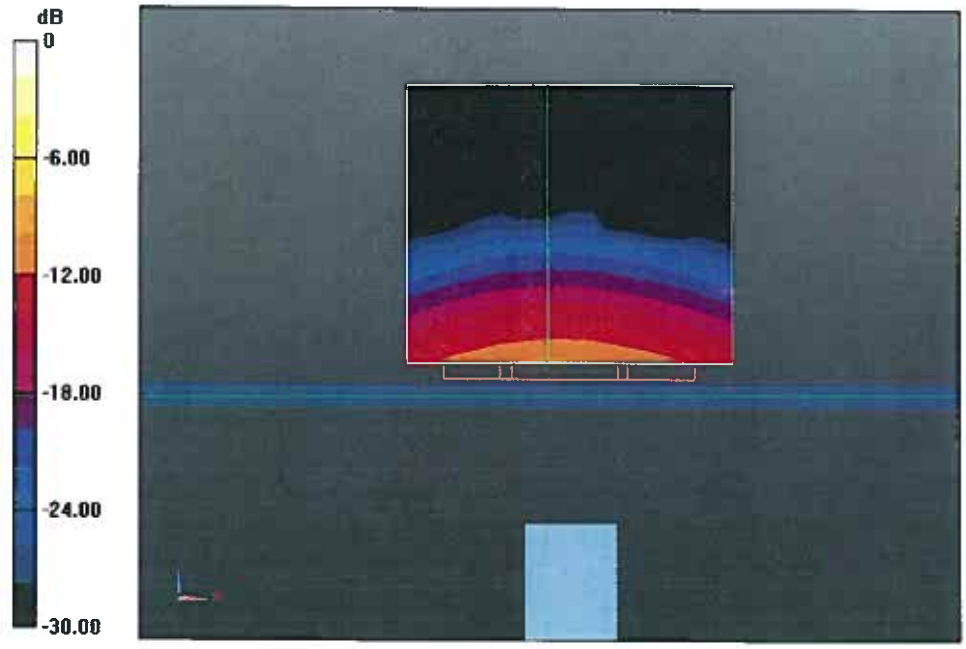
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 59.247 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 29.8 W/kg
SAR(1 g) = 7.53 W/kg; SAR(10 g) = 2.1 W/kg
Maximum value of SAR (measured) = 17.5 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 58.909 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 31.1 W/kg
SAR(1 g) = 7.62 W/kg; SAR(10 g) = 2.13 W/kg
Maximum value of SAR (measured) = 18.0 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 58.934 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 34.2 W/kg
SAR(1 g) = 7.94 W/kg; SAR(10 g) = 2.21 W/kg
Maximum value of SAR (measured) = 19.0 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz 2/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 58.393 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 35.6 W/kg
SAR(1 g) = 8 W/kg; SAR(10 g) = 2.22 W/kg
Maximum value of SAR (measured) = 19.4 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 55.424 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 34.9 W/kg
SAR(1 g) = 7.5 W/kg; SAR(10 g) = 2.08 W/kg
Maximum value of SAR (measured) = 18.6 W/kg



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

Impedance Measurement Plot for Body TSL