TCC
Nokia

FINAS
Finnish Accreditation Service
T117 (EN ISO/IEC 17025)

SAR Compliance Test Report

Test report no.:	FCC_RX-76_02	**Date of report:**	2009-08-30
Template version:	13.0	**Number of pages:**	31
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Responsible test engineer:	Jesper Nielsen	**Product contact person:**	Petri Visuri
Measurements made by:	Jesper Nielsen		
Tested device:	RX-76		
FCC ID:	Device includes: PDN-AR5B93	**IC:**	Device includes: 661R-AR5B93
Supplement reports:	-		

Testing has been carried out in accordance with:

47CFR §2.1093
Radiofrequency Radiation Exposure Evaluation: Portable Devices

FCC OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01)
Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields

RSS-102
Evaluation Procedure for Mobile and Portable Radio Transmitters with Respect to Health Canada's Safety Code 6 for Exposure of Humans to Radio Frequency Fields

IEEE 1528 - 2003
IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Technique

Documentation: The documentation of the testing performed on the tested devices is archived for 15 years at TCC Nokia.

Test results: **The tested device complies with the requirements in respect of all parameters subject to the test.** The test results and statements relate only to the items tested. The test report shall not be reproduced except in full, without written approval of the laboratory.

Date and signatures:

For the contents:

Jesper Nielsen
Test Engineer

Digitally signed by Jesper M. Nielsen
DN: cn=Jesper M. Nielsen, c=DK, o=Radio Spectrum, ou=CertT, email=jesper.2.nielsen@nokia.com
Reason: I am approving this document
Date: 2009.09.10 19:23:22 +02'00'

CONTENTS

1. SUMMARY OF SAR TEST REPORT

1.1 Test Details

Period of test	2009-08-01 to 2009-08-03
SN, HW and SW numbers of tested device	Main unit : SN: 2190703200003, DUT: 25551 Main unit : SN: 2190702700064, DUT: 25540 Screen unit 1 : DUT: 27662 Screen unit 2 : DUT: 25549
Batteries used in testing	NYU00 (Sanyo), DUT: 27463, 27465, 27466, 27467
Headsets used in testing	-
Other accessories used in testing	-
State of sample	Prototype unit
Notes	-

1.2 Maximum Results

The maximum measured SAR values for Body Worn configuration are given below. The device conforms to the requirements of the standard(s) when the maximum measured SAR value is less than or equal to the limit.

1.2.1 Body Worn Configuration

Mode	Ch / *f* (MHz)	Conducted power	Separation distance	Measured SAR value (1g avg)	Scaled* SAR value (1g avg)	SAR limit (1g avg)	Result
WLAN 2450 b/g	11 / 2462.0	12.0 dBm	0.0 cm	0.00903 W/kg	**0.01 W/kg**	1.6 W/kg	PASSED
WLAN 2450 n 40 MHz	9 / 2452.0	12.0 dBm	0.0 cm	0.00864 W/kg	**0.01 W/kg**	1.6 W/kg	PASSED

* SAR values are scaled up by 12% to cover measurement drift. As a consequence of this upwards correction of the SAR values, the contribution of measurement drift to the overall measurement uncertainty (Section 6) is reduced to zero.

1.2.2 Maximum Drift

Maximum drift covered by 12% scaling up of the SAR values	Maximum drift during measurements
0.5dB	0.46 dB

1.2.3 Measurement Uncertainty

Expanded Uncertainty (k=2) 95%	± 25.8%

2. DESCRIPTION OF THE DEVICE UNDER TEST

Device category	Portable
Exposure environment	General population / uncontrolled

Modes of Operation	Bands	Modulation Mode	Duty Cycle	Transmitter Frequency Range (MHz)
BT	2450	GFSK	1	2402 – 2480
WLAN	2450	11Mbps QPSK	1	2412 – 2462
WLAN	2450	13.5 MCS 64-QAM / 40M	1	2422 – 2452

2.1 Picture of the Device

2.2 Description of the Antenna

The device has internal antennas for WLAN use. These WLAN antennas are located in the frame around the display.

3. TEST CONDITIONS

3.1 Temperature and Humidity

Ambient temperature (°C):	20.5 to 22.5
Ambient humidity (RH %):	35 to 55

3.2 Test Signal, Frequencies and Output Power

The device was put into operation by using control software.

The device output power was set to maximum power level for all tests; a fully charged battery was used for every test sequence.

In all operating bands the measurements were performed on lowest, middle and highest channels.

The radiated output power of the device was measured by a separate test laboratory on the same unit(s) as used for SAR testing. The results are given in the EMC report supporting this application.

The transmission mode of the device in all WLAN tests was DSSS QPSK 11Mbps and 13.5 MCS at 40 MHz BW. These modes have the highest (or equal highest) time-averaged output power of all the WLAN modulation modes in Nokia devices.

The Screen units differ in that the antennas they contain are from different manufacturers. The performance of both Screen units and hence both sets of antennas are reported below.

3.3 Test Cases and Test Minimisation

The tested device examined in this report may not incorporate all of the features described in the text that follows, but its SAR evaluation will have been subjected to the same considerations and test logic described below.

Whilst it's possible to identify the maximum SAR test cases from inspection of the conducted power levels given in the Results tables (Section 7), different modes in the same band and multi-slot transmit GSM/GPRS modes can create some difficulties. Therefore the sequence of the SAR tests made in evaluating this device has used test logic that is based on measured SAR values. Comparison of measured SAR values in this way, can also allow some test minimization (i.e. test elimination) to be made.

For example, when SAR testing multi-slot GSM/GPRS/EGPRS modes, it is an inefficient use of test resources to fully SAR test every test configuration in each of the different modes as these modes have a fixed power relationship between them that is the same, irrespective of the test configuration. In the case of multi-slot GSM/GPRS modes, a single comparative SAR test - using the same test channel and test configuration – is made in each of the n-slot modes; the mode with the highest measured SAR value is then subjected to full SAR testing in all test configurations. These comparative SAR tests (same frequency, same test configuration) are regarded as extremely accurate as they are relative tests in which the tested device changes neither its frequency nor its position between tests. For different modes that operate in the same band and use the same antenna e.g. GSM/GPRS850 and WCDMA850, full SAR testing is carried out in the GSM/GPRS850 mode but WCDMA850 testing is limited to 3 channel testing in the maximum SAR test configuration for GSM/GPRS850.

Multi-slot SAR testing against the Head is always performed whenever such a device offers Push to Talk over cellular with the internal earpiece active, Dual Transfer Mode (i.e. the ability to transmit voice and data simultaneously using the same transmitter) or has WLAN (which enables a Voice over IP call to take place whilst the device can simultaneously transmit data on a cellular band). Whenever a device has an intended multi-slot use against the head, it is also Head SAR tested in EGPRS mode. It should be noted that EGPRS transmit modes can have either GMSK or 8PSK modulation but, when tested, only 8PSK EGPRS will appear explicitly in the results tables, as GMSK EGPRS mode has identical time-averaged power to the reported GPRS mode.

Devices that have flips or slides are fully SAR tested in all device configurations consistent with their intended usage. For example, flip phones that can receive a call in closed mode are SAR tested against the head in both open and closed configurations. Similarly, slide phones are fully SAR tested in all slide configurations in which calls are intended to be made or received.

In the results tables in Section 7, the maximum SAR value for the ‘basic’ tests (i.e. left cheek, left tilt, right cheek and right tilt in Head SAR testing; with and without headset with the back &/or display side facing the flat phantom in Body SAR testing) is bolded for each band. In some cases, after full testing of the basic SAR test configurations has been completed, additional checking SAR tests are made. These checking tests are always based on the bolded result from the ‘basic’ testing. When the SAR value of a checking test exceeds the maximum value from the basic tests, it is also bolded and used as the basis for any further checking tests that might be needed.

Checking tests are largely voluntary and can cover optional batteries, different camera slide positions, optional covers, etc. In the case of optional batteries, if the construction of the optional battery is significantly different to the battery used in the full testing e.g. if the outer can is floating electrically rather than grounded, then the maximum SAR test configuration in each band is tested with the optional battery in 3 channels. For camera slides, if the slide material is metal, then checking tests in 3 channels are again run for the maximum SAR test configuration in each band. For plastic camera slides, SAR checking is only carried out in the channel that provided the maximum SAR value for the original. Optional front and back covers are tested if their shape differs significantly from the original or if their metallic content varies by more than 15% from the original; in the former case, the testing depends on the extent of the physical differences, whereas in the latter case, 3 channel SAR testing is performed in every band in the max SAR test configuration.

4. DESCRIPTION OF THE TEST EQUIPMENT

4.1 Measurement System and Components

The measurements were performed using an automated near-field scanning system, DASY4, manufactured by Schmid & Partner Engineering AG (SPEAG) in Switzerland. The SAR extrapolation algorithm used in all measurements was the 'advanced extrapolation' algorithm.

The following table lists calibration dates of SPEAG components:

Test Equipment	Serial Number	Calibration interval	Calibration expiry
DAE3	339	12 months	2010-03
E-field Probe ES3DV3	3118	12 months	2009-09
Dipole Validation Kit, D2450V2	750	24 months	2010-03
DASY4 software	Version 4.7	-	-

Additional test equipment used in testing:

Test Equipment	Model	Serial Number	Calibration interval	Calibration expiry
Signal Generator	SME06	829445/008	36 months	2012-02
Amplifier	2100-BBS3Q8CCJ	1003	-	-
Power Meter	NRP	100293	24 months	2010-08
Power Sensor	NRP-Z51	100830	24 months	2010-08
Vector Network Analyzer	AT8753ES	MY40001091	12 months	2009-08
Dielectric Probe Kit	HP85070B	US33020403	-	-

4.1.1 Isotropic E-field Probe Type ES3DV3

Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., butyl diglycol)
Calibration	Calibration certificate in Appendix C
Frequency	10 MHz to 4 GHz (dosimetry); Linearity: ± 0.2 dB (30 MHz to 4 GHz)
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.3 dB in HSL (rotation normal to probe axis)
Dynamic Range	5 µW/g to > 100 mW/g; Linearity: ± 0.2 dB
Dimensions	Overall length: 330 mm Tip length: 20 mm Body diameter: 12 mm Tip diameter: 3.9 mm Distance from probe tip to dipole centers: 2.0 mm
Application	General dosimetry up to 4 GHz Compliance tests of mobile phones Fast automatic scanning in arbitrary phantoms

4.2 Phantoms

The phantom used for all tests i.e. for both system checks and device testing, was the twin-headed "SAM Phantom", manufactured by SPEAG. The phantom conforms to the requirements of IEEE 1528 - 2003.

System checking was performed using the flat section, whilst Head SAR tests used the left and right head profile sections. Body SAR testing also used the flat section between the head profiles.

The SPEAG device holder (see Section 5.1) was used to position the device in all tests whilst a tripod was used to position the validation dipoles against the flat section of phantom.

4.3 Tissue Simulants

Recommended values for the dielectric parameters of the tissue simulants are given in IEEE 1528 - 2003 and FCC Supplement C to OET Bulletin 65. All tests were carried out using simulants whose dielectric parameters were within ± 5% of the recommended values. All tests were carried out within 24 hours of measuring the dielectric parameters.

The depth of the tissue simulant was 15.0 ± 0.5 cm measured from the ear reference point during system checking and device measurements.

4.3.1 Tissue Simulant Recipes

The following recipe(s) were used for Head and Body tissue simulant(s):

2450MHz band

Ingredient	Body (% by weight)
Deionised Water	70.20
Tween 20	29.62
Salt	0.18

4.3.2 System Checking

The manufacturer calibrates the probes annually. Dielectric parameters of the tissue simulants were measured every day using the dielectric probe kit and the network analyser. A system check measurement was made following the determination of the dielectric parameters of the simulant, using the dipole validation kit. A power level of 250 mW was supplied to the dipole antenna, which was placed under the flat section of the twin SAM phantom. The system checking results (dielectric parameters and SAR values) are given in the table below.

System checking, body tissue simulant

f [MHz]	Description	SAR [W/kg], 1g	Dielectric Parameters		Temp [°C]
			ε_r	σ [S/m]	
2450	Reference result	13.2	50.8	1.98	
	± 10% window	11.9 - 14.5			
	2009-08-01	14.3	50.3	1.93	21.2
	2009-08-03	14.1	50.7	1.92	21.1

Plots of the system checking scans are given in Appendix A.

4.3.3 Tissue Simulants used in the Measurements

Body tissue simulant measurements

f [MHz]	Description	Dielectric Parameters		Temp [°C]
		ε_r	σ [S/m]	
2442	Recommended value	52.7	1.94	
	± 5% window	50.1 – 55.3	1.85 – 2.04	
	2009-08-01	50.4	1.92	21.2
	2009-08-03	50.7	1.91	21.1

5. DESCRIPTION OF THE TEST PROCEDURE

5.1 Device Holder

The device was placed in the device holder (illustrated below) that is supplied by SPEAG as an integral part of the Dasy system.

Device holder supplied by SPEAG

5.2 Test Positions

The device was placed in the SPEAG holder and placed below the flat section of the phantom. The device was kept against the phantom as indicated in the photos below oriented with a) its base facing the phantom and b) its front edge facing the phantom. For the base facing the phantom orientations, SAR testing was performed in two halves due to the size limitation imposed by the flat phantom.

Photo of the device in Base Left half position.

Photo of the device in Base Right half position.

Photo of the device Front Edge position.

5.3 Scan Procedures

First, area scans were used for determination of the field distribution. Next, a zoom scan, a minimum of 5x5x7 points covering a volume of at least 30x30x30mm, was performed around the highest E-field value to determine the averaged SAR value. Drift was determined by measuring the same point at the start of the area scan and again at the end of the zoom scan.

5.4 SAR Averaging Methods

The maximum SAR value was averaged over a cube of tissue using interpolation and extrapolation.

The interpolation, extrapolation and maximum search routines within Dasy4 are all based on the modified Quadratic Shepard's method (Robert J. Renka, "Multivariate Interpolation Of Large Sets Of Scattered Data", University of North Texas ACM Transactions on Mathematical Software, vol. 14, no. 2, June 1988, pp. 139-148).

The interpolation scheme combines a least-square fitted function method with a weighted average method. A trivariate 3-D / bivariate 2-D quadratic function is computed for each measurement point and fitted to neighbouring points by a least-square method. For the zoom scan, inverse distance weighting is incorporated to fit distant points more accurately. The interpolating function is finally calculated as a weighted average of the quadratics.

In the zoom scan, the interpolation function is used to extrapolate the Peak SAR from the deepest measurement points to the inner surface of the phantom.

6. MEASUREMENT UNCERTAINTY

Table 6.1 – Measurement uncertainty evaluation

Uncertainty Component	Section in IEEE 1528	Tol. (%)	Prob Dist	Div	c_i	$c_i . u_i$ (%)	v_i
Measurement System							
Probe Calibration	E2.1	±5.9	N	1	1	±5.9	∞
Axial Isotropy	E2.2	±4.7	R	√3	$(1-c_p)^{1/2}$	±1.9	∞
Hemispherical Isotropy	E2.2	±9.6	R	√3	$(c_p)^{1/2}$	±3.9	∞
Boundary Effect	E2.3	±1.0	R	√3	1	±0.6	∞
Linearity	E2.4	±4.7	R	√3	1	±2.7	∞
System Detection Limits	E2.5	±1.0	R	√3	1	±0.6	∞
Readout Electronics	E2.6	±1.0	N	1	1	±1.0	∞
Response Time	E2.7	±0.8	R	√3	1	±0.5	∞
Integration Time	E2.8	±2.6	R	√3	1	±1.5	∞
RF Ambient Conditions - Noise	E6.1	±3.0	R	√3	1	±1.7	∞
RF Ambient Conditions - Reflections	E6.1	±3.0	R	√3	1	±1.7	∞
Probe Positioner Mechanical Tolerance	E6.2	±0.4	R	√3	1	±0.2	∞
Probe Positioning with respect to Phantom Shell	E6.3	±2.9	R	√3	1	±1.7	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E5	±3.9	R	√3	1	±2.3	∞
Test sample Related							
Test Sample Positioning	E4.2	±6.0	N	1	1	±6.0	11
Device Holder Uncertainty	E4.1	±5.0	N	1	1	±5.0	7
Output Power Variation - SAR drift measurement	6.6.3	±0.0	R	√3	1	±0.0	∞
Phantom and Tissue Parameters							
Phantom Uncertainty (shape and thickness tolerances)	E3.1	±4.0	R	√3	1	±2.3	∞
Conductivity Target - tolerance	E3.2	±5.0	R	√3	0.64	±1.8	∞
Conductivity - measurement uncertainty	E3.3	±5.5	N	1	0.64	±3.5	5
Permittivity Target - tolerance	E3.2	±5.0	R	√3	0.6	±1.7	∞
Permittivity - measurement uncertainty	E3.3	±2.9	N	1	0.6	±1.7	5
Combined Standard Uncertainty			RSS			**±12.9**	116
Coverage Factor for 95%			**k=2**				
Expanded Uncertainty						**±25.8**	

7. RESULTS

The measured Body SAR values for the test device are tabulated below:

2450 MHz Body SAR results

Option used	Device orientation	Test configuration	SAR, averaged over 1g (W/kg)		
			Ch 1 2412.0 MHz	Ch 7 2442.0 MHz	Ch 11 2462.0 MHz
WLAN 802.11b/g		**Conducted Power**	**12.0 dBm**	**12.0 dBm**	**12.0 dBm**
Screen unit 1 / Antenna manufacturer 1	Left half of base facing Phantom	Without headset	-	0.0000	-
		Headset	-	-	-
	Right half of base facing phantom	Without headset	0.00462	0.00676	**0.00903**
		Headset	-	-	-
	Front edge facing phantom	Without headset	-	0.0000	-
		Headset	-	-	-
WLAN 802.11b/g		**Conducted Power**	**12.0 dBm**	**12.0 dBm**	**12.0 dBm**
Screen unit 2 / Antenna manufacturer 2	Left half of base facing Phantom	Without headset	-	-	-
		Headset	-	-	-
	Right half of base facing phantom	Without headset	0.00403	0.00292	0.00435
		Headset	-	-	-
	Front edge facing phantom	Without headset	-	-	-
		Headset	-	-	-

2450 MHz Body SAR results - continued

Option used	Device orientation	Test configuration	SAR, averaged over 1g (W/kg)		
			Ch 3 2422.0 MHz	Ch 7 2442.0 MHz	Ch 9 2452.0 MHz
WLAN 802.11n / 40 MHz		**Conducted Power**	**12.0 dBm**	**12.0 dBm**	**12.0 dBm**
Screen unit 1 / Antenna manufacturer 1	Left half of base facing Phantom	Without headset	-	0.00565	-
		Headset	-	-	-
	Right half of base facing phantom	Without headset	0.00316	0.00745	**0.00864**
		Headset	-	-	-
	Front edge facing phantom	Without headset	-	0.0002	-
		Headset	-	-	-
WLAN 802.11n / 40 MHz		**Conducted Power**	**12.0 dBm**	**12.0 dBm**	**12.0 dBm**
Screen unit 2 / Antenna manufacturer 2	Left half of base facing Phantom	Without headset	-	-	-
		Headset	-	-	-
	Right half of base facing phantom	Without headset	0.00284	0.00238	0.00315
		Headset	-	-	-
	Front edge facing phantom	Without headset	-	-	-
		Headset	-	-	-

Plots of the Measurement scans are given in Appendix B.

APPENDIX A: SYSTEM CHECKING SCANS

See the following pages.

Date/Time: 2009-08-01 12:03:50

Test Laboratory: TCC Nokia
Type: D2450V2; Serial: 750

Communication System: CW2450
Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: Body 2450; Medium Notes: Medium Temperature: 21.2 C
Medium parameters used: f = 2450 MHz; σ = 1.93 mho/m; ε_r = 50.3; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ES3DV3 - SN3118; Probe Notes:
- ConvF(3.89, 3.89, 3.89); Calibrated: 2008-09-23
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn339; Calibrated: 2009-03-12
- Phantom: SAM 4.5; Type: Twin Phantom; Serial: TP-1215
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

d=10mm, Pin=250mW/Area Scan (71x71x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 17.1 mW/g

d=10mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 89.1 V/m
Peak SAR (extrapolated) = 29.3 W/kg
SAR(1 g) = 14.3 mW/g
SAR(10 g) = 6.7 mW/g
Power Drift = 0.069 dB
Maximum value of SAR (measured) = 16.4 mW/g

Date/Time: 2009-08-03 11:04:50

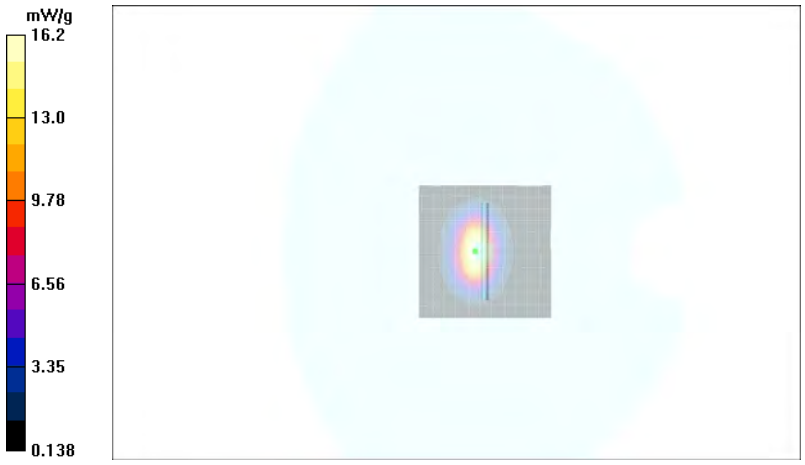
Test Laboratory: TCC Nokia
Type: D2450V2; Serial: 750

Communication System: CW2450
Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: Body 2450; Medium Notes: Medium Temperature: 21.1 C
Medium parameters used: f = 2450 MHz; σ = 1.92 mho/m; ε_r = 50.7; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ES3DV3 - SN3118; Probe Notes:
- ConvF(3.89, 3.89, 3.89); Calibrated: 2008-09-23
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn339; Calibrated: 2009-03-12
- Phantom: SAM 4.5; Type: Twin Phantom; Serial: TP-1215
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

d=10mm, Pin=250mW/Area Scan (71x71x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 17.1 mW/g

d=10mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 85.2 V/m
Peak SAR (extrapolated) = 28.6 W/kg
SAR(1 g) = 14.1 mW/g
SAR(10 g) = 6.6 mW/g
Power Drift = -0.209 dB
Maximum value of SAR (measured) = 16.2 mW/g



APPENDIX B: MEASUREMENT SCANS

See the following pages.

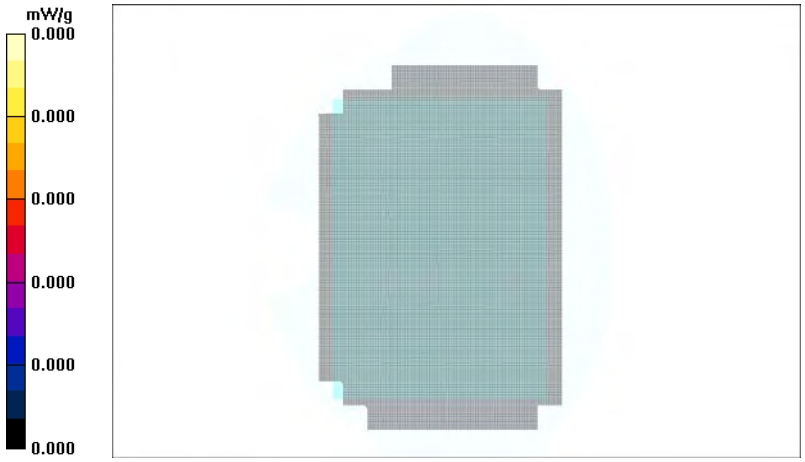
Date/Time: 2009-08-01 14:21:22

Test Laboratory: TCC Nokia
Type: RX-76; Serial: 2190702700064

Communication System: WLAN2450 802.11B/G
Frequency: 2442 MHz; Duty Cycle: 1:1
Medium: Body 2450; Medium Notes: Medium Temperature: 21.2 C
Medium parameters used: f = 2442 MHz; σ = 1.92 mho/m; ε_r = 50.4; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ES3DV3 - SN3118; Probe Notes:
- ConvF(3.89, 3.89, 3.89); Calibrated: 2008-09-23
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn339; Calibrated: 2009-03-12
- Phantom: SAM 4.5; Type: Twin Phantom; Serial: TP-1215
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Body - Middle - No Accessory – Left half of base facing phantom - Screen unit 1/Antenna manufacturer 1/Area Scan (101x151x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.000 mW/g



Date/Time: 2009-08-01 17:37:30

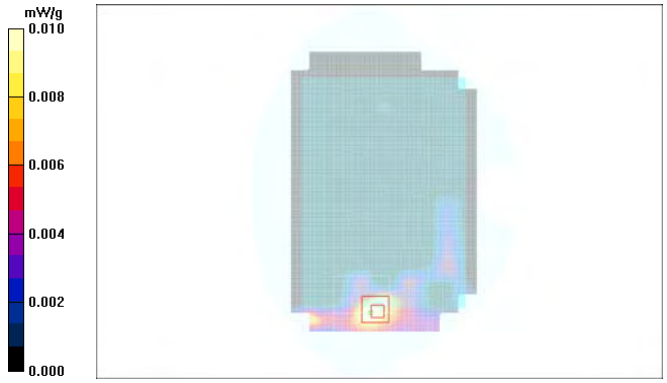
Test Laboratory: TCC Nokia
Type: RX-76; Serial: 2190702700064

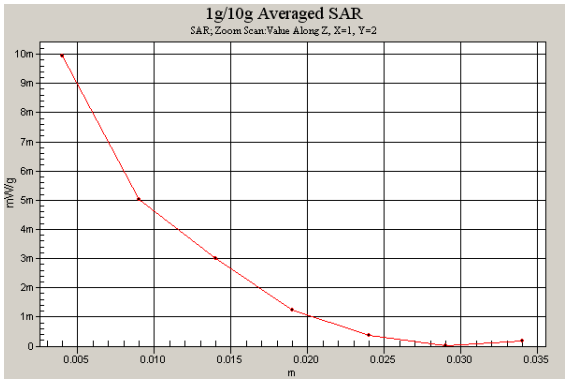
Communication System: WLAN2450 802.11B/G
Frequency: 2462 MHz; Duty Cycle: 1:1
Medium: Body 2450; Medium Notes: Medium Temperature: 21.2 C
Medium parameters used: f = 2462 MHz; σ = 1.94 mho/m; ε_r = 50.3; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ES3DV3 - SN3118; Probe Notes:
- ConvF(3.89, 3.89, 3.89); Calibrated: 2008-09-23
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn339; Calibrated: 2009-03-12
- Phantom: SAM 4.5; Type: Twin Phantom; Serial: TP-1215
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Body - High - No Accessory – Right half of base facing phantom - Screen unit 1/Antenna manufacturer 1/Area Scan (101x151x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.011 mW/g

Body - High - No Accessory – Right half of base facing phantom - Screen unit 1/Antenna manufacturer 1/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 2.06 V/m
Peak SAR (extrapolated) = 0.025 W/kg
SAR(1 g) = 0.00903 mW/g
SAR(10 g) = 0.00394 mW/g
Power Drift = -0.314 dB
Maximum value of SAR (measured) = 0.010 mW/g





Date/Time: 2009-08-01 16:03:25

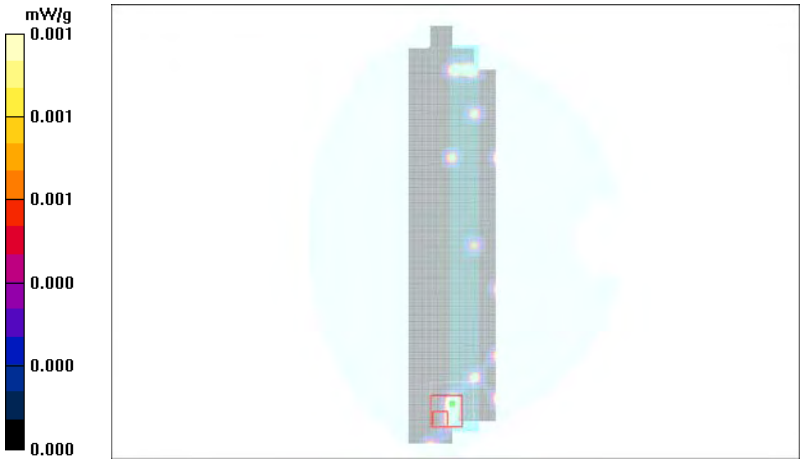
Test Laboratory: TCC Nokia
Type: RX-76; Serial: 2190702700064

Communication System: WLAN2450 802.11B/G
Frequency: 2442 MHz; Duty Cycle: 1:1
Medium: Body 2450; Medium Notes: Medium Temperature: 21.2 C
Medium parameters used: f = 2442 MHz; σ = 1.92 mho/m; ε_r = 50.4; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ES3DV3 - SN3118; Probe Notes:
- ConvF(3.89, 3.89, 3.89); Calibrated: 2008-09-23
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn339; Calibrated: 2009-03-12
- Phantom: SAM 4.5; Type: Twin Phantom; Serial: TP-1215
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Body - Middle - No Accessory – Front edge facing phantom - Screen unit 1/Antenna manufacturer 1/Area Scan (41x191x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.002 mW/g

Body - Middle - No Accessory – Front edge facing phantom - Screen unit 1/Antenna manufacturer 1/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 0.542 V/m
Peak SAR (extrapolated) = 0.001 W/kg
SAR(1 g) = 1.34e-005 mW/g
SAR(10 g) = 2.07e-006 mW/g
Power Drift = 0.265 dB
Warning: Maximum averaged SAR over 1 g is located on the boundary of the measurement cube. This cube might not incorporate the absolute averaged SAR. Please consider a refinement of the Area Scan measurement. Maximum averaged SAR over 10 g is located on the boundary of the measurement cube. This cube might not incorporate the absolute averaged SAR. Please consider a refinement of the Area Scan measurement.
Maximum value of SAR (measured) = 0.001 mW/g



Date/Time: 2009-08-03 20:06:18

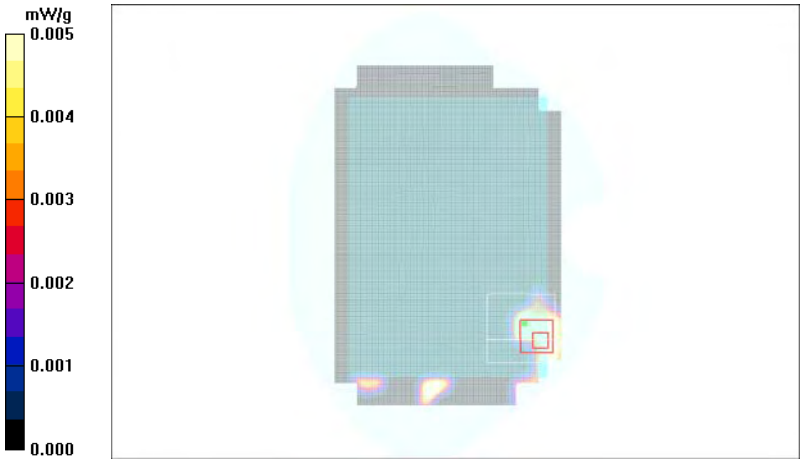
Test Laboratory: TCC Nokia
Type: RX-76; Serial: 2190703200003

Communication System: WLAN2450 802.11B/G
Frequency: 2462 MHz; Duty Cycle: 1:1
Medium: Body 2450; Medium Notes: Medium Temperature: 21.1 C
Medium parameters used: f = 2462 MHz; σ = 1.94 mho/m; ε_r = 50.7; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ES3DV3 - SN3118; Probe Notes:
- ConvF(3.89, 3.89, 3.89); Calibrated: 2008-09-23
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn339; Calibrated: 2009-03-12
- Phantom: SAM 4.5; Type: Twin Phantom; Serial: TP-1215
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Body - High - No Accessory – Right half of base facing phantom - Screen unit 2/Antenna manufacturer 2/Area Scan (101x151x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.011 mW/g

Body - High - No Accessory – Right half of base facing phantom - Screen unit 2/Antenna manufacturer 2/Zoom Scan 2 (7x7x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 1.06 V/m
Peak SAR (extrapolated) = 0.009 W/kg
SAR(1 g) = 0.00435 mW/g
SAR(10 g) = 0.00204 mW/g
Power Drift = -0.001 dB
Maximum value of SAR (measured) = 0.005 mW/g



Date/Time: 2009-08-01 18:40:01

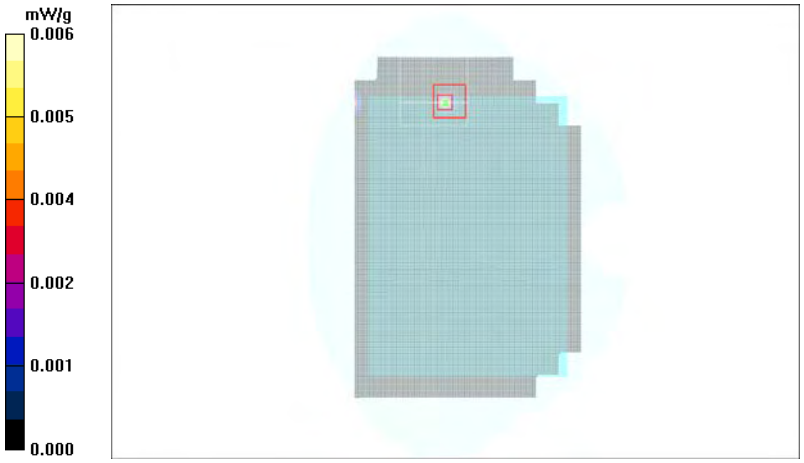
Test Laboratory: TCC Nokia
Type: RX-76; Serial: 2190702700064

Communication System: WLAN2450 802.11N 40MHz
Frequency: 2442 MHz; Duty Cycle: 1:1
Medium: Body 2450; Medium Notes: Medium Temperature: 21.2 C
Medium parameters used: f = 2442 MHz; σ = 1.92 mho/m; ε_r = 50.4; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ES3DV3 - SN3118; Probe Notes:
- ConvF(3.89, 3.89, 3.89); Calibrated: 2008-09-23
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn339; Calibrated: 2009-03-12
- Phantom: SAM 4.5; Type: Twin Phantom; Serial: TP-1215
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Body - Middle - No Accessory – Left half of base facing phantom - Screen unit 1/Antenna manufacturer 1/Area Scan (101x151x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.006 mW/g

Body - Middle - No Accessory – Left half of base facing phantom - Screen unit 1/Antenna manufacturer 1/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 0.701 V/m
Peak SAR (extrapolated) = 0.014 W/kg
SAR(1 g) = 0.00565 mW/g
SAR(10 g) = 0.00252 mW/g
Power Drift = 0.303 dB
Maximum value of SAR (measured) = 0.006 mW/g



Date/Time: 2009-08-03 15:13:33

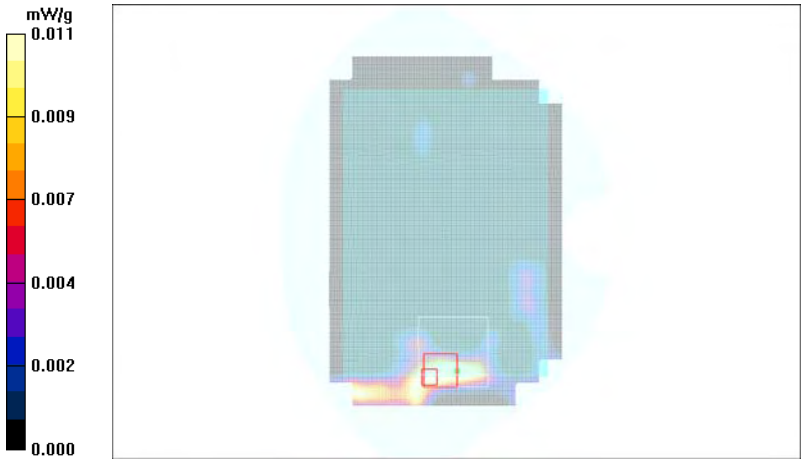
Test Laboratory: TCC Nokia
Type: RX-76; Serial: 2190702700064

Communication System: WLAN2450 802.11N 40MHz
Frequency: 2452 MHz; Duty Cycle: 1:1
Medium: Body 2450; Medium Notes: Medium Temperature: 21.1 C
Medium parameters used: f = 2452 MHz; σ = 1.93 mho/m; ε_r = 50.7; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ES3DV3 - SN3118; Probe Notes:
- ConvF(3.89, 3.89, 3.89); Calibrated: 2008-09-23
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn339; Calibrated: 2009-03-12
- Phantom: SAM 4.5; Type: Twin Phantom; Serial: TP-1215
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Body - High - No Accessory - Right half of base facing phantom - Screen unit 1/Area Scan (101x151x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.017 mW/g

Body - High - No Accessory - Right half of base facing phantom - Screen unit 1/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 1.24 V/m
Peak SAR (extrapolated) = 0.022 W/kg
SAR(1 g) = 0.00864 mW/g
SAR(10 g) = 0.00351 mW/g
Power Drift = -0.086 dB
Warning: Maximum averaged SAR over 10 g is located on the boundary of the measurement cube. This cube might not incorporate the absolute averaged SAR. Please consider a refinement of the Area Scan measurement.
Maximum value of SAR (measured) = 0.011 mW/g



Date/Time: 2009-08-01 20:01:16

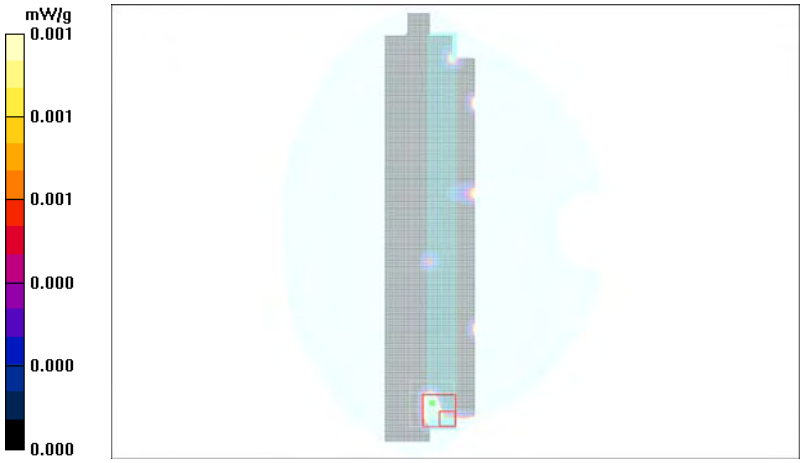
Test Laboratory: TCC Nokia
Type: RX-76; Serial: 2190702700064

Communication System: WLAN2450 802.11N 40MHz
Frequency: 2442 MHz; Duty Cycle: 1:1
Medium: Body 2450; Medium Notes: Medium Temperature: 21.2 C
Medium parameters used: f = 2442 MHz; σ = 1.92 mho/m; ε_r = 50.4; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ES3DV3 - SN3118; Probe Notes:
- ConvF(3.89, 3.89, 3.89); Calibrated: 2008-09-23
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn339; Calibrated: 2009-03-12
- Phantom: SAM 4.5; Type: Twin Phantom; Serial: TP-1215
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Body - Middle - No Accessory – Front edge facing phantom - Screen unit 1/Antenna manufacturer 1/Area Scan (41x191x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.003 mW/g

Body - Middle - No Accessory – Front edge facing phantom - Screen unit 1/Antenna manufacturer 1/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 0.649 V/m
Peak SAR (extrapolated) = 0.004 W/kg
SAR(1 g) = 0.000235 mW/g
SAR(10 g) = 4.82e-005 mW/g
Power Drift = -0.191 dB
Warning: Maximum averaged SAR over 1 g is located on the boundary of the measurement cube. This cube might not incorporate the absolute averaged SAR. Please consider a refinement of the Area Scan measurement. Maximum averaged SAR over 10 g is located on the boundary of the measurement cube. This cube might not incorporate the absolute averaged SAR. Please consider a refinement of the Area Scan measurement.
Maximum value of SAR (measured) = 0.001 mW/g



Date/Time: 2009-08-03 17:50:35

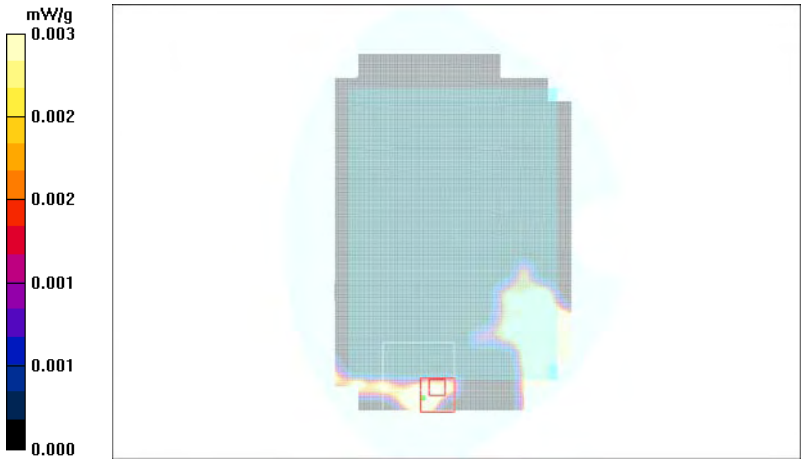
Test Laboratory: TCC Nokia
Type: RX-76; Serial: 2190703200003

Communication System: WLAN2450 802.11N 40MHz
Frequency: 2452 MHz; Duty Cycle: 1:1
Medium: Body 2450; Medium Notes: Medium Temperature: 21.1 C
Medium parameters used: f = 2452 MHz; σ = 1.93 mho/m; ε_r = 50.7; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ES3DV3 - SN3118; Probe Notes:
- ConvF(3.89, 3.89, 3.89); Calibrated: 2008-09-23
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn339; Calibrated: 2009-03-12
- Phantom: SAM 4.5; Type: Twin Phantom; Serial: TP-1215
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Body - High - No Accessory – Right half of base facing phantom - Screen unit 2/Antenna manufacturer 2/Area Scan (101x151x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.010 mW/g

Body - High - No Accessory – Right half of base facing phantom - Screen unit 2/Antenna manufacturer 2/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 1.12 V/m
Peak SAR (extrapolated) = 0.009 W/kg
SAR(1 g) = 0.00315 mW/g
SAR(10 g) = 0.0013 mW/g
Power Drift = 0.233 dB
Warning: Maximum averaged SAR over 10 g is located on the boundary of the measurement cube. This cube might not incorporate the absolute averaged SAR. Please consider a refinement of the Area Scan measurement.
Maximum value of SAR (measured) = 0.003 mW/g



APPENDIX C: RELEVANT PAGES FROM PROBE CALIBRATION REPORT(S)

See the following.

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
S 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 Denmark A/S

Certificate No: ES3-3118_Sep08

CALIBRATION CERTIFICATE

Object	ES3DV3 - SN:3118
Calibration procedure(s)	QA CAL-01.v6 and QA CAL-23.v3 Calibration procedure for dosimetric E-field probes
Calibration date:	September 23, 2008
Condition of the calibrated item	In Tolerance

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)

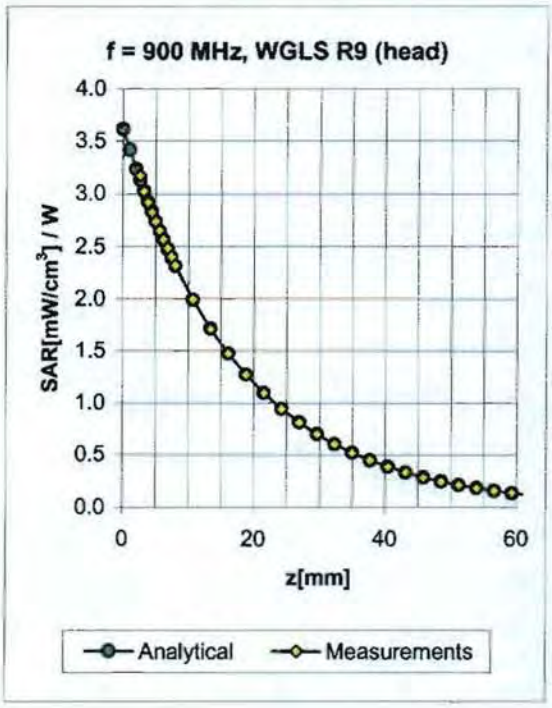
Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41495277	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41498087	1-Apr-08 (No. 217-00788)	Apr-09
Reference 3 dB Attenuator	SN: S5054 (3c)	1-Jul-08 (No. 217-00865)	Jul-09
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-08 (No. 217-00787)	Apr-09
Reference 30 dB Attenuator	SN: S5129 (30b)	1-Jul-08 (No. 217-00866)	Jul-09
Reference Probe ES3DV2	SN: 3013	2-Jan-08 (No. ES3-3013_Jan08)	Jan-09
DAE4	SN: 660	9-Sep-08 (No. DAE4-660_Sep08)	Sep-09

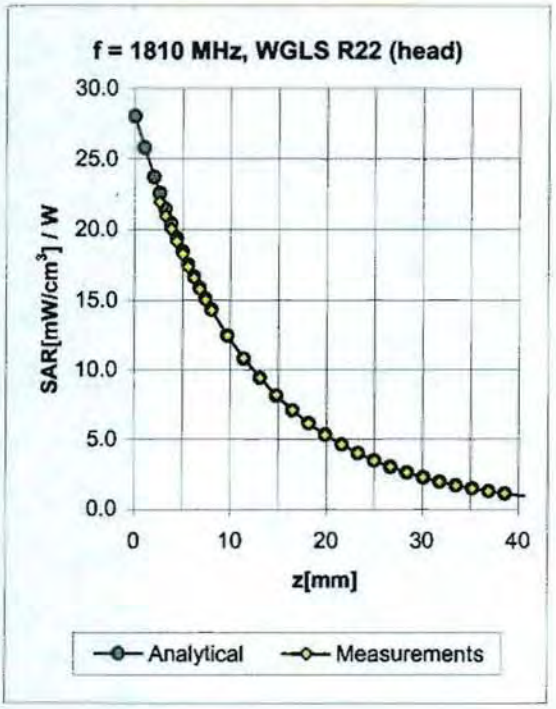
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-07)	In house check: Oct-08

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Technical Manager	
Approved by:	Fin Bomholt	R&D Director	

Issued: September 24, 2008

Conversion Factor Assessment





f [MHz]	Validity [MHz][c]	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.32	1.81	5.71 ± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.60	1.38	4.85 ± 11.0% (k=2)
1950	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.61	1.35	4.68 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.99	1.13	4.34 ± 11.0% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.70	1.26	5.64 ± 11.0% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.44	1.83	4.61 ± 11.0% (k=2)
1950	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.45	1.80	4.52 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.99	1.13	3.89 ± 11.0% (k=2)

[c] **The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.**

APPENDIX D: RELEVANT PAGES FROM DIPOLE VALIDATION KIT REPORT(S)

See the following pages.

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
S 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 Denmark A/S

Certificate No: D2450V2-750_Mar08

CALIBRATION CERTIFICATE

Object: D2450V2 - SN: 750

Calibration procedure(s): QA CAL-05.v7
Calibration procedure for dipole validation kits

Calibration date: March 10, 2008

Condition of the calibrated item: In Tolerance

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 (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	04-Oct-07 (METAS, No. 217-00736)	Oct-08
Power sensor HP 8481A	US37292783	04-Oct-07 (METAS, No. 217-00736)	Oct-08
Reference 20 dB Attenuator	SN: 5086 (20g)	07-Aug-07 (METAS, No 217-00718)	Aug-08
Reference 10 dB Attenuator	SN: 5047.2 (10r)	07-Aug-07 (METAS, No 217-00718)	Aug-08
Reference Probe ES3DV2	SN: 3025	01-Mar-08 (SPEAG, No. ES3-3025_Mar08)	Mar-09
DAE4	SN 909	03-Sep-07 (SPEAG, No. DAE4-909_Sep07)	Sep-08

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (SPEAG, in house check Oct-07)	In house check: Oct-09
RF generator R&S SMT-06	100005	4-Aug-99 (SPEAG, in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (SPEAG, in house check Oct-07)	In house check: Oct-08

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: March 11, 2008

DASY4 Validation Report for Head TSL

Date/Time: 10.03.2008 16:24:04

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN750

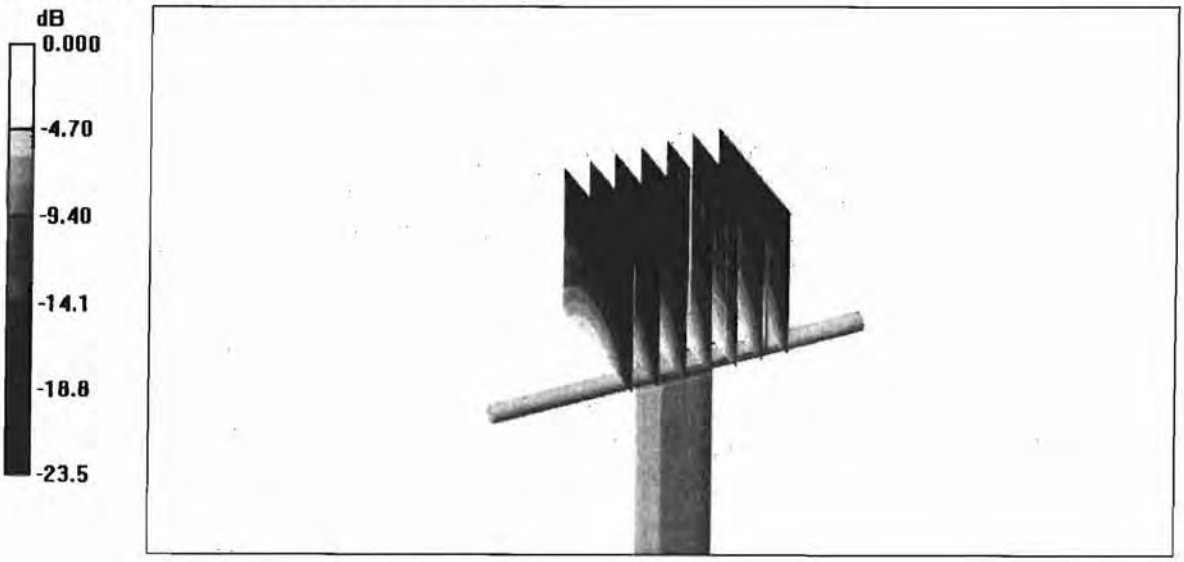
Communication System: CW-2450; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: HSL U10 BB;
Medium parameters used: f = 2450 MHz; σ = 1.81 mho/m; ε_r = 39.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(4.4, 4.4, 4.4); Calibrated: 01.03.2008
- Sensor-Surface: 3.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn909; Calibrated: 03.09.2007
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; ;
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 172

Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 92.8 V/m; Power Drift = 0.046 dB
Peak SAR (extrapolated) = 27.8 W/kg
SAR(1 g) = 13.5 mW/g; SAR(10 g) = 6.25 mW/g
Maximum value of SAR (measured) = 16.4 mW/g



0 dB = 16.4mW/g

DASY4 Validation Report for Body TSL

Date/Time: 10.03.2008 17:55:27

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN750

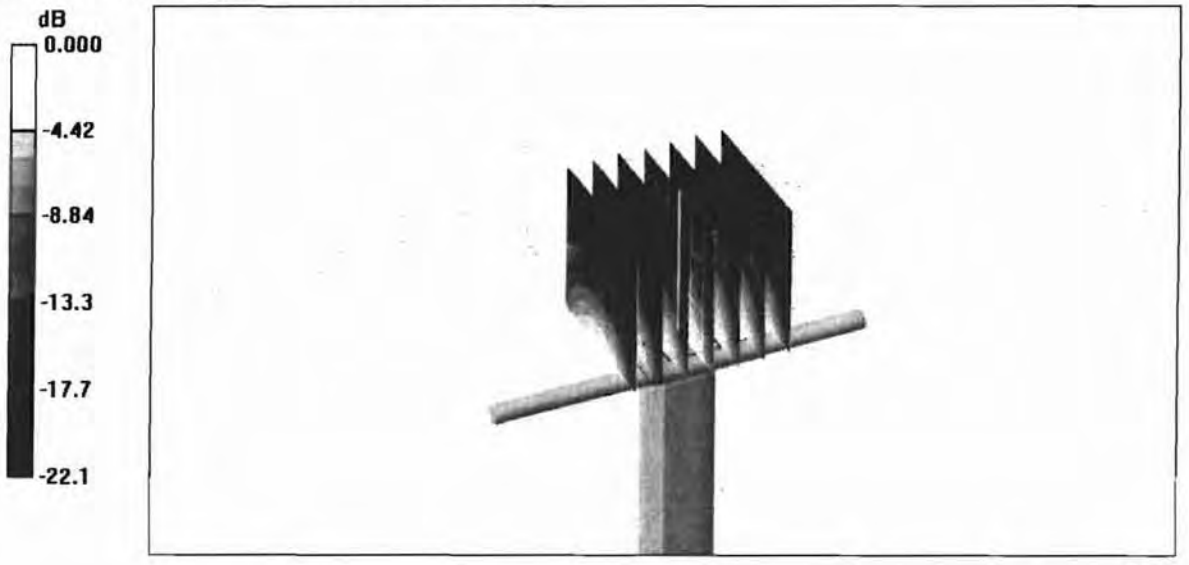
Communication System: CW-2450; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: MSL U10;
Medium parameters used: f = 2450 MHz; σ = 1.98 mho/m; ε_r = 50.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(4.07, 4.07, 4.07); Calibrated: 01.03.2008
- Sensor-Surface: 3.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn909; Calibrated: 03.09.2007
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; ;
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 172

Pin = 250 mW; d = 10 mm 2/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 92.9 V/m; Power Drift = 0.000 dB
Peak SAR (extrapolated) = 27.0 W/kg
SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.14 mW/g
Maximum value of SAR (measured) = 16.0 mW/g



0 dB = 16.0mW/g