TCC
Nokia

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

SAR Compliance Test Report

Test report no.:	FCC_RM-781_18	**Date of report:**	2012-07-23
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Measurements made by:	Daniel Albrecht		
Tested device:	RM-781		
FCC ID:	PPIRM-781	**IC:**	661U-RM781
Supplement reports:	FCC_RM-781_02		

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:

Leif Funch Klysner
Test System Manager

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1. SUMMARY OF SAR TEST REPORT

1.1 Test Details

Period of test	2012-07-06 to 2012-07-10
SN, HW and SW numbers of tested device	SN: 352427/05/892599/0, HW: 0330, SW: 07.44, DUT: 70075
Batteries used in testing	BL-4U LG, DUT: 70054, 70055 BL-4U Samsung, DUT: 70077, 70078, 70079
Headsets used in testing	-
Other accessories used in testing	-
State of sample	Prototype unit
Notes	-

1.1.1 Test Details

FCC_RM-781_02: no data has been taken from this earlier report, just information about the maximum SAR test configurations 1 sample device was used in this earlier testing.
The FCC Grant corresponding to this earlier report was granted on 2011-10-11.

1.2 Maximum Results

The maximum measured SAR values for Head configuration and Body Worn configuration are given in section 1.2.1 and 1.2.2 respectively. 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 Head Configuration

Mode	Ch / *f* (MHz)	Conducted power	Position	Measured SAR value (1g avg)	Scaled* SAR value (1g avg)	SAR limit (1g avg)	Result
GSM850	190 / 836.6	32.5 dBm	Right, Cheek	0.997 W/kg	**1.12 W/kg**	1.6 W/kg	PASSED
WCDMA850	4233 / 846.6	23.5 dBm	Right, Cheek	0.928 W/kg	**1.04 W/kg**	1.6 W/kg	PASSED
4-slot GPRS1900	661 / 1880.0	24.5 dBm	Left, Cheek	0.591 W/kg	**0.66 W/kg**	1.6 W/kg	PASSED
WCDMA1900	9538 / 1907.6	21.0 dBm	Left, Cheek	0.717 W/kg	**0.80 W/kg**	1.6 W/kg	PASSED

1.2.2 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
GSM850	190 / 836.6	32.5 dBm	1.5 cm	0.762 W/kg	**0.85 W/kg**	1.6 W/kg	**PASSED**
WCDMA850	4233 / 846.6	23.5 dBm	1.5 cm	0.733 W/kg	**0.82 W/kg**	1.6 W/kg	**PASSED**
4-slot GPRS1900	661 / 1880.0	24.5 dBm	1.5 cm	0.327 W/kg	**0.37 W/kg**	1.6 W/kg	**PASSED**
WCDMA1900	9538 / 1907.6	21.0 dBm	1.5 cm	0.364 W/kg	**0.41 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.

1.2.3 Summary SAR data

		FCC-defined SAR values for the Grants of Equipment Authorization
Maximum Cellular/AWS/PCS Head SAR value		**1.12 W/kg**
Maximum WLAN Head SAR value		-
{Max + Max} Simultaneous Head SAR value	-	
Maximum Cellular/AWS/PCS Body SAR value		**0.85 W/kg**
Maximum WLAN Body SAR value		-
{Max + Max} Simultaneous Body SAR value	-	
Maximum Product Specific (Wireless Router) SAR value		**-**
Maximum Simultaneous SAR value		**-**

1.2.4 Maximum Drift

Maximum drift covered by 12% scaling up of the SAR values	Maximum drift during measurements
0.5dB	0.40dB

1.2.5 Measurement Uncertainty

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

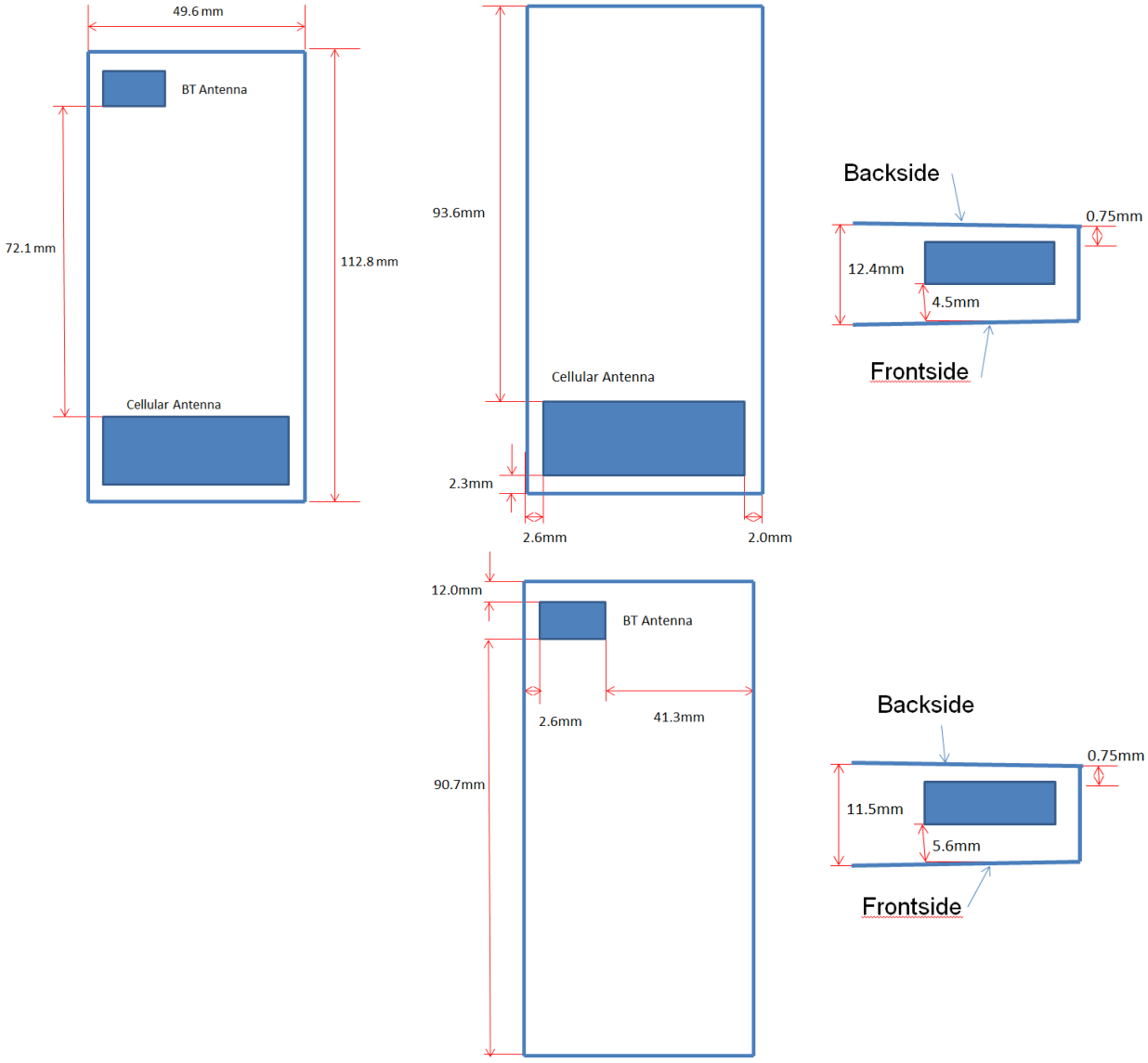
2. DESCRIPTION OF THE DEVICE UNDER TEST

Device category	Portable
Exposure environment	General population / uncontrolled

Modes of Operation	Bands	Modulation Mode	Duty Cycle	Transmitter Frequency Range (MHz)
GSM	850 1900	GMSK	1/8	824 – 849 1850 – 1910
GPRS	850 1900	GMSK	1/8 to 4/8	824 – 849 1850 – 1910
EGPRS	850 1900	GMSK / 8PSK	1/8 to 4/8	824 – 849 1850 – 1910
WCDMA	850 (Band V) 1900 (Band II)		1	826 – 847 1852 – 1908
HSUPA	850 (Band V) 1900 (Band II)		1	826 – 847 1852 – 1908
BT	2450	GFSK	1	2402 – 2480

Outside of USA and Canada, the transmitter of the device is capable of operating also in GSM/GPRS/EGPRS900, GSM/GPRS/EGPRS1800, WCDMA900 and WCDMA2100 bands which are not part of this filing.

2.1 Picture of the Device



2.2 Description of the Antenna

The device has an internal antenna for cellular use. The cellular antenna is located at the bottom underneath the back cover.

3. TEST CONDITIONS

3.1 Temperature and Humidity

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

3.2 Test Signal, Frequencies and Output Power

The device was put into operation by using a call tester. Communication between the device and the call tester was established by air link.

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

The transmission mode of the device in all WCDMA tests was configured to 12.2kbps RMC with all TPC bits set as "1". All WCDMA testing has been carried out in accordance with FCC KDB 941225: SAR Measurement Procedures for 3G Devices.

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 number of test cases reported in this document has been minimised based on the earlier testing in FCC_RM-781_02.

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 DASY near-field scanning system 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 date	Calibration expiry
DAE4	671	2011-09	2012-09
E-field Probe ES3DV3	3289	2012-02	2013-02
Dipole Validation Kit, D835V2	474	2011-06	2013-06
Dipole Validation Kit, D1900V2	5d007	2011-06	2013-06
DASY4 software	Version 4.7	-	-

Additional test equipment used in testing:

Test Equipment	Model	Serial Number	Calibration date	Calibration expiry
Signal Generator	SMIQ03B	100391	2009-10	2012-10
Amplifier	ZHL-42W	D050802-1	-	-
Power Meter	E4417A	GB40320113	2011-11	2012-11
Power Sensor	E9325A	US40420308	2011-11	2012-11
Power Sensor	E9325A	US40420291	2011-11	2012-11
Call Tester	CMU200	117027	-	-
Call Tester	CMU200	100925	-	-
Vector Network Analyzer	8714B	GB36050238	2011-11	2012-11
Dielectric Probe Kit	HP85070B	US01440027	-	-

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 D
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 Head SAR tests i.e. for both system checks and device testing, was the twin-headed "SAM Phantom", manufactured by SPEAG; the SAM phantom conforms to the requirements of IEEE 1528-2003. The phantom used for all Body SAR tests i.e. for both system checks and device testing, was a flat phantom also manufactured by SPEAG; this phantom conform to the requirements of OET Bulletin 65, Supplement C.

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 at least 15.0 cm for all system check and device tests, measured from the ear reference point in the case of the SAM phantom and from the inner surface of the flat phantom.

4.3.1 Tissue Simulant Recipes

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

800MHz band

Ingredient	Head (% by weight)	Body (% by weight)
Deionised Water	39.74	55.97
HEC	0.25	1.21
Sugar	58.31	41.76
Preservative	0.15	0.27
Salt	1.55	0.79

1900MHz band

Ingredient	Head (% by weight)	Body (% by weight)
Deionised Water	54.50	70.25
Tween 20	45.23	29.41
Salt	0.27	0.34

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, head tissue simulant

f[MHz]	Description	SAR [W/kg], 1g	Dielectric Parameters		Temp [°C]
			ε_r	σ [S/m]	
	Reference result	2.33	40.8	0.89	
	± 10% window	2.10 – 2.56			
	IEEE1528 / IEC62209 Standard targets		41.5	0.90	
835	2012-07-06	2.26	40.9	0.88	21.0
	Reference result	9.95	39.0	1.40	
	± 10% window	8.95 – 10.95			
	IEEE1528 / IEC62209 Standard targets		40.0	1.40	
1900	2012-07-10	9.45	39.4	1.42	21.6

System checking, body tissue simulant

f[MHz]	Description	SAR [W/kg], 1g	Dielectric Parameters		Temp [°C]
			ε_r	σ [S/m]	
	Reference result	2.46	53.1	0.99	
	± 10% window	2.21 - 2.71			
	IEEE1528 / IEC62209 Standard targets		55.2	0.97	
835	2012-07-12	2.31	55.2	0.97	21.3
	Reference result	10.1	52.3	1.53	
	± 10% window	9.1 – 11.1			
	IEEE1528 / IEC62209 Standard targets		53.3	1.52	
1900	2012-07-10	9.19	52.9	1.46	21.6
	2012-07-11	9.11	52.8	1.46	21.5

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

4.3.3 Tissue Simulants used in the Measurements

Head tissue simulant measurements

f [MHz]	Description	Dielectric Parameters		Temp [°C]
		ε_r	σ [S/m]	
	Recommended value	41.5	0.90	
	± 5% window	39.4 – 43.6	0.86 – 0.95	
835	2012-07-06	40.9	0.88	21.0
	Recommended value	41.5	0.90	
	± 5% window	39.4 – 43.6	0.86 – 0.95	
836	2012-07-06	40.8	0.88	21.0
	Recommended value	40.0	1.40	
	± 5% window	38.0 – 42.0	1.33 – 1.47	
1880	2012-07-10	39.6	1.40	21.6

Body tissue simulant measurements

f [MHz]	Description	Dielectric Parameters		Temp [°C]
		ε_r	σ [S/m]	
	Recommended value	55.2	0.97	
	± 5% window	52.4 – 58.0	0.92 – 1.02	
835	2012-07-12	55.2	0.97	21.3
	Recommended value	55.2	0.97	
	± 5% window	52.4 – 58.0	0.92 – 1.02	
836	2012-07-12	55.1	0.98	21.3
	Recommended value	53.3	1.52	
	± 5% window	50.6 – 56.0	1.44 – 1.60	
1880	2012-07-10	52.9	1.44	21.6
	2012-07-11	52.8	1.44	21.5

Dielectric parameter data for the band edges is given in Appendix C.

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

A Nokia designed spacer (illustrated below) was used to position the device within the SPEAG holder. The spacer positions the device so that the holder has minimal effect on the test results but still holds the device securely. The spacer was removed before the tests.

Nokia spacer

5.2 Test Positions

5.2.1 Against Phantom Head

Measurements were made in “cheek” position on both the left hand and right hand sides of the phantom.

The positions used in the measurements were according to 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 Techniques".

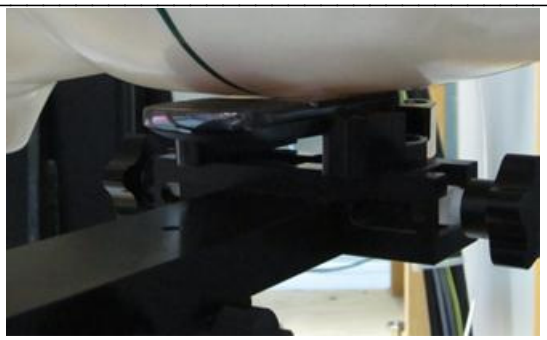


Photo of the Device in "cheek" position

5.2.2 Body Worn Configuration

The device was placed in the SPEAG holder using the Nokia spacer and placed below the flat phantom. The distance between the device and the phantom was kept at the separation distance indicated in the photo below using a separate flat spacer that was removed before the start of the measurements.

Photo of the device positioned for Body SAR measurement.
The spacer was removed for the tests.

Nokia body-worn accessories are commonly available for the separation distance used in this testing.

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 Head SAR values for the test device are tabulated below:

850MHz Head SAR results

Mode	Test configuration		SAR, averaged over 1g (W/kg)		
			Ch 128 824.2 MHz	Ch 190 836.6 MHz	Ch 251 848.8 MHz
GSM	Conducted Power		32.5 dBm	32.5 dBm	32.5 dBm
BL-4U Samsung	Left	Cheek	-	-	-
		Tilt	-	-	-
	Right	Cheek	0.889	**0.997**	0.891
		Tilt	-	-	-

Mode	Test configuration		SAR, averaged over 1g (W/kg)		
			Ch 4132 826.4 MHz	Ch 4175 835.0 MHz	Ch 4233 846.6 MHz
WCDMA	Conducted Power		23.5 dBm	23.5 dBm	23.5 dBm
BL-4U Samsung	Left	Cheek	-	-	-
		Tilt	-	-	-
	Right	Cheek	0.871	0.779	**0.928**
		Tilt	-	-	-

1900MHz Head SAR results

Mode	Test configuration		SAR, averaged over 1g (W/kg)		
			Ch 512 1850.2 MHz	Ch 661 1880.0 MHz	Ch 810 1909.8 MHz
4-slot GPRS	Conducted Power		24.5 dBm	24.5 dBm	24.5 dBm
BL-4U LG	Left	Cheek	0.514	**0.591**	0.566
		Tilt	-	-	-
	Right	Cheek	-	-	-
		Tilt	-	-	-

Mode	Test configuration		SAR, averaged over 1g (W/kg)		
			Ch 9262 1852.4 MHz	Ch 9400 1880.0 MHz	Ch 9538 1907.6 MHz
WCDMA	Conducted Power		21.0 dBm	21.0 dBm	21.0 dBm
BL-4U LG	Left	Cheek	0.625	0.716	**0.717**
		Tilt	-	-	-
	Right	Cheek	-	-	-
		Tilt	-	-	-

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

850MHz Body SAR results

Mode	Device orientation	Test configuration	SAR, averaged over 1g (W/kg)		
			Ch 128 824.2 MHz	Ch 190 836.6 MHz	Ch 251 848.8 MHz
GSM		**Conducted Power**	**32.5 dBm**	**32.5 dBm**	**32.5 dBm**
BL-4U Samsung	Display facing phantom	Without headset	-	-	-
		With Headset	-	-	-
	Back facing phantom	Without headset	0.717	**0.762**	0.728
		With Headset	-	-	-
Mode	**Device orientation**	**Test configuration**	**SAR, averaged over 1g (W/kg)**		
			Ch 4132 826.4 MHz	**Ch 4175 835.0 MHz**	**Ch 4233 846.6 MHz**
WCDMA		**Conducted Power**	**23.5 dBm**	**23.5 dBm**	**23.5 dBm**
BL-4U Samsung	Display facing phantom	Without headset	-	-	-
		With Headset	-	-	-
	Back facing phantom	Without headset	0.703	0.623	**0.733**
		With Headset	-	-	-

1900MHz Body SAR results

Mode	Device orientation	Test configuration	SAR, averaged over 1g (W/kg)		
			Ch 512 1850.2 MHz	Ch 661 1880.0 MHz	Ch 810 1909.8 MHz
4-slot GPRS		**Conducted Power**	**24.5 dBm**	**24.5 dBm**	**24.5 dBm**
BL-4U LG	Display facing phantom	Without headset	-	-	-
		With Headset	-	-	-
	Back facing phantom	Without headset	0.289	**0.327**	0.297
		With Headset	-	-	-
Mode	**Device orientation**	**Test configuration**	**SAR, averaged over 1g (W/kg)**		
			Ch 9262 1852.4 MHz	**Ch 9400 1880.0 MHz**	**Ch 9538 1907.6 MHz**
WCDMA		**Conducted Power**	**21.0 dBm**	**21.0 dBm**	**21.0 dBm**
BL-4U LG	Display facing phantom	Without headset	-	-	-
		With Headset	-	-	-
	Back facing phantom	Without headset	0.314	0.339	**0.364**
		With Headset	-	-	-

Plots of the Measurement scans are given in Appendix B.

APPENDIX A: SYSTEM CHECKING SCANS

See the following pages.

Date/Time: 2012-07-06 08:43:44

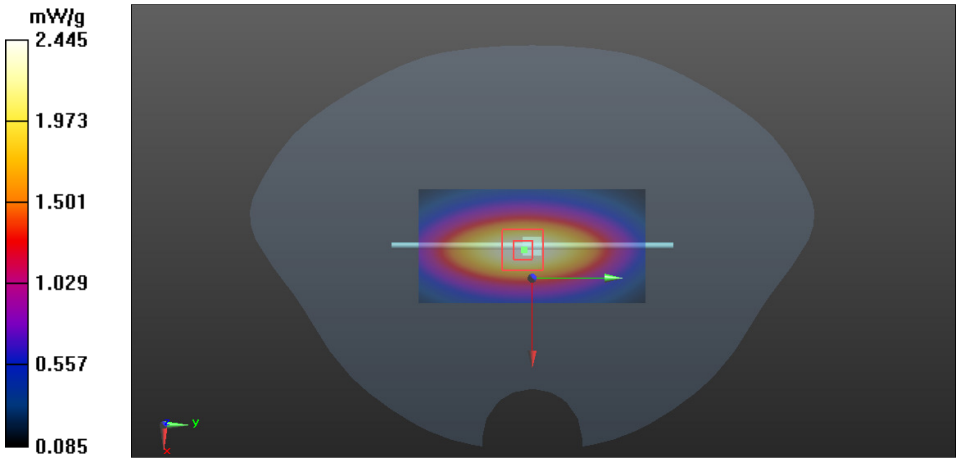
Test Laboratory: TCC Nokia
Type: D835V2; Serial: 474

Communication System: CW835
Frequency: 835 MHz; Duty Cycle: 1:1
Medium: Head 835; Medium Notes: Liquid Temperature: 21.0 C
Medium parameters used: f = 835 MHz; σ = 0.88 mho/m; ε_r = 40.894; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:
- Probe: ES3DV3 - SN3289
- ConvF(6.11, 6.11, 6.11); Calibrated: 2012-02-13;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn671; Calibrated: 2011-09-23
- Phantom: SAM 2; Type: Twin Phantom; Serial: TP-1188
- Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

d=15mm, Pin=250mW/Area Scan (61x121x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 2.44 mW/g

d=15mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 53.272 V/m
Peak SAR (extrapolated) = 3.361 mW/g
SAR(1 g) = 2.26 mW/g
SAR(10 g) = 1.48 mW/g
Power Drift = -0.01 dB
Maximum value of SAR (measured) = 2.44 mW/g



Date/Time: 2012-07-10 10:30:45

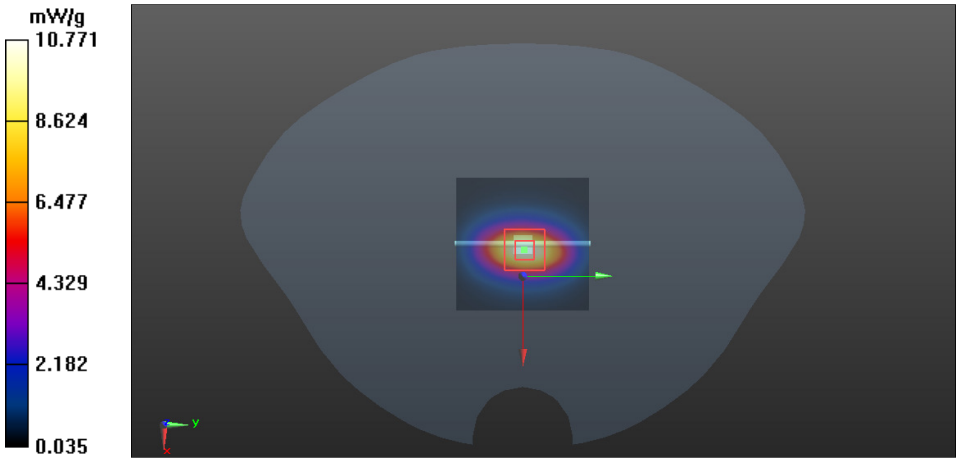
Test Laboratory: TCC Nokia
Type: D1900V2; Serial: 5d007

Communication System: CW1900
Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: Head 1900; Medium Notes: Liquid Temperature: 21.6 C
Medium parameters used: f = 1900 MHz; σ = 1.418 mho/m; ε_r = 39.446; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:
- Probe: ES3DV3 - SN3289
- ConvF(5.28, 5.28, 5.28); Calibrated: 2012-02-13;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn671; Calibrated: 2011-09-23
- Phantom: SAM 1; Type: Twin Phantom; Serial: TP-1421
- Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

d=10mm, Pin=250mW/Area Scan (71x71x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 10.8 mW/g

d=10mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 84.526 V/m
Peak SAR (extrapolated) = 17.723 mW/g
SAR(1 g) = 9.45 mW/g
SAR(10 g) = 4.88 mW/g
Power Drift = 0.09 dB
Maximum value of SAR (measured) = 10.7 mW/g



Date/Time: 2012-07-12 10:15:34

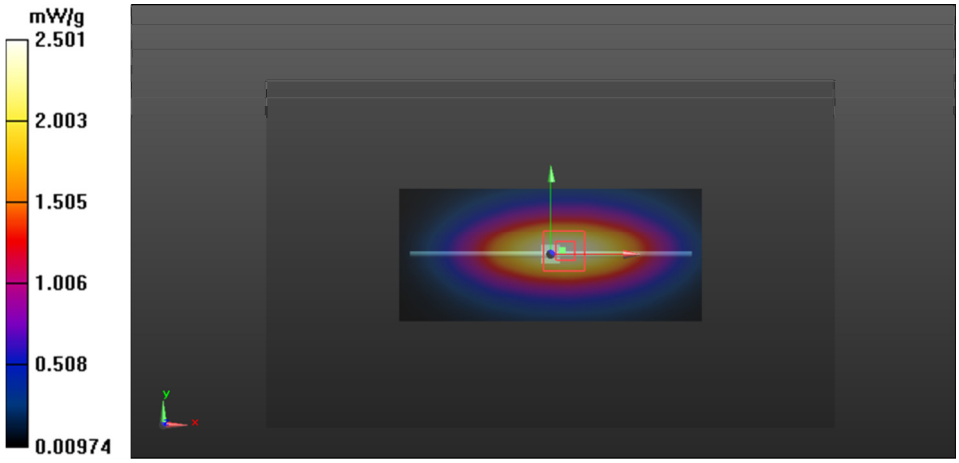
Test Laboratory: TCC Nokia
Type: D835V2; Serial: 474

Communication System: CW835
Frequency: 835 MHz; Duty Cycle: 1:1
Medium: Body 835; Medium Notes: Liquid Temperature: 21.3 C
Medium parameters used: f = 835 MHz; σ = 0.974 mho/m; ε_r = 55.21; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3289
- ConvF(6.13, 6.13, 6.13); Calibrated: 2012-02-13;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn671; Calibrated: 2011-09-23
- Phantom: TFP-1; Type: Triple Flat Phantom 5.1; Serial: 1109
- Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

d=10mm, Pin=250mW/Area Scan (161x71x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 2.50 mW/g

d=10mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 50.781 V/m
Peak SAR (extrapolated) = 3.322 mW/g
SAR(1 g) = 2.31 mW/g
SAR(10 g) = 1.53 mW/g
Power Drift = -0.04 dB
Maximum value of SAR (measured) = 2.51 mW/g



Date/Time: 2012-07-10 11:52:30

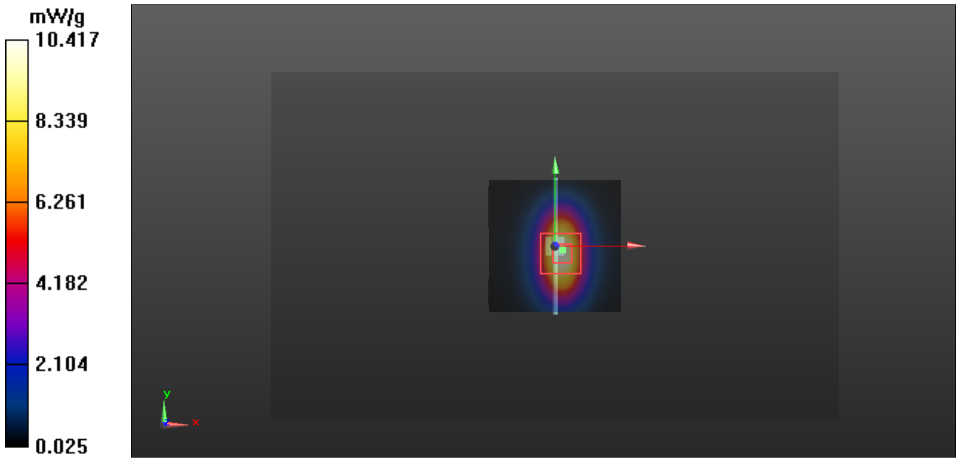
Test Laboratory: TCC Nokia
Type: D1900V2; Serial: 5d007

Communication System: CW1900
Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: Body 1900; Medium Notes: Liquid Temperature: 21.6 C
Medium parameters used: f = 1900 MHz; σ = 1.458 mho/m; ε_r = 52.861; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3289
- ConvF(4.83, 4.83, 4.83); Calibrated: 2012-02-13;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn671; Calibrated: 2011-09-23
- Phantom: TFP-1; Type: Triple Flat Phantom 5.1; Serial: 1109
- Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

d=10mm, Pin=250mW/Area Scan (71x71x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 10.4 mW/g

d=10mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 80.984 V/m
Peak SAR (extrapolated) = 16.239 mW/g
SAR(1 g) = 9.19 mW/g
SAR(10 g) = 4.87 mW/g
Power Drift = 0.09 dB
Maximum value of SAR (measured) = 10.4 mW/g



Date/Time: 2012-07-11 12:02:45

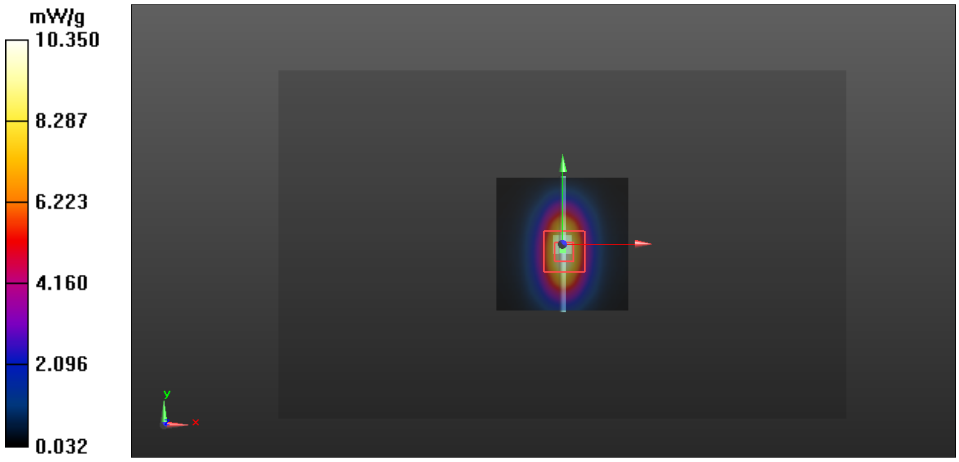
Test Laboratory: TCC Nokia
Type: D1900V2; Serial: 5d007

Communication System: CW1900
Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: Body 1900; Medium Notes: Liquid Temperature: 21.5 C
Medium parameters used: f = 1900 MHz; σ = 1.459 mho/m; ε_r = 52.803; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3289
- ConvF(4.83, 4.83, 4.83); Calibrated: 2012-02-13;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn671; Calibrated: 2011-09-23
- Phantom: TFP-1; Type: Triple Flat Phantom 5.1; Serial: 1109
- Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

d=10mm, Pin=250mW/Area Scan (71x71x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 10.4 mW/g

d=10mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 84.945 V/m
Peak SAR (extrapolated) = 16.163 mW/g
SAR(1 g) = 9.11 mW/g
SAR(10 g) = 4.82 mW/g
Power Drift = -0.00 dB
Maximum value of SAR (measured) = 10.3 mW/g



APPENDIX B: MEASUREMENT SCANS

See the following pages.

Date/Time: 2012-07-06 11:26:04

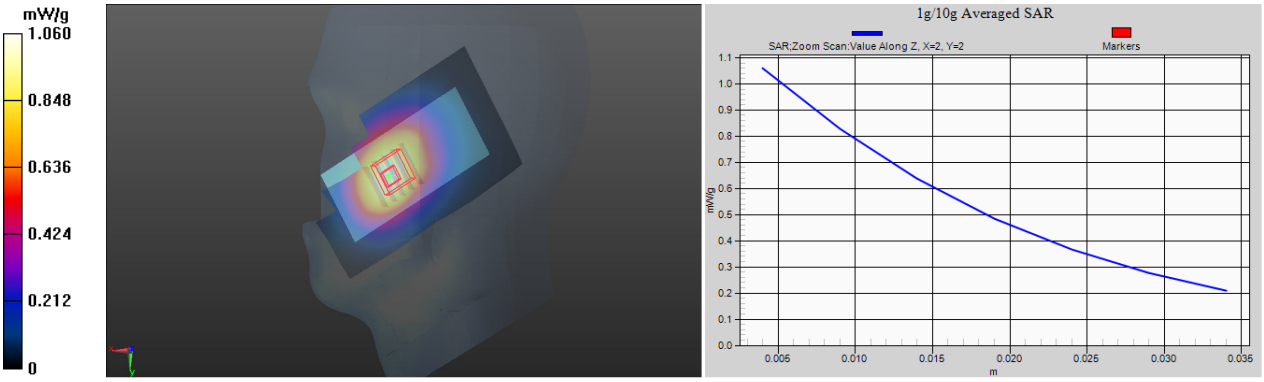
Test Laboratory: TCC Nokia
Type: RM-781; Serial: 352427/05/892599/0

Communication System: GSM850
Frequency: 836.6 MHz; Duty Cycle: 1:8.3
Medium: Head 835; Medium Notes: Liquid Temperature: 21.0 C
Medium parameters used: f = 837 MHz; σ = 0.883 mho/m; ε_r = 40.83; ρ = 1000 kg/m^3
Phantom section: Right Section

DASY Configuration:
- Probe: ES3DV3 - SN3289
- ConvF(6.11, 6.11, 6.11); Calibrated: 2012-02-13;
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn671; Calibrated: 2011-09-23
- Phantom: SAM 2; Type: Twin Phantom; Serial: TP-1188
- Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

Cheek - Middle - BL-4U Samsung/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.06 mW/g

Cheek - Middle - BL-4U Samsung/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 9.888 V/m
Peak SAR (extrapolated) = 1.278 mW/g
SAR(1 g) = 0.997 mW/g
SAR(10 g) = 0.726 mW/g
Power Drift = 0.11 dB
Maximum value of SAR (measured) = 1.06 mW/g



Date/Time: 2012-07-06 14:06:42

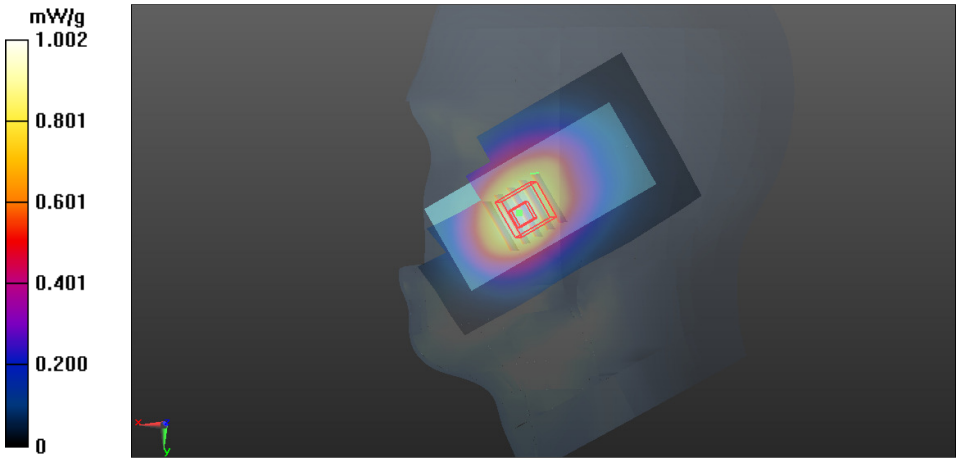
Test Laboratory: TCC Nokia
Type: RM-781; Serial: 352427/05/892599/0

Communication System: WCDMA850
Frequency: 846.6 MHz; Duty Cycle: 1:1
Medium: Head 835; Medium Notes: Liquid Temperature: 21.0 C
Medium parameters used: f = 847 MHz; σ = 0.891 mho/m; ε_r = 40.725; ρ = 1000 kg/m^3
Phantom section: Right Section

DASY Configuration:
- Probe: ES3DV3 - SN3289
- ConvF(6.11, 6.11, 6.11); Calibrated: 2012-02-13;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn671; Calibrated: 2011-09-23
- Phantom: SAM 2; Type: Twin Phantom; Serial: TP-1188
- Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

Cheek - High - BL-4U Samsung/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.00 mW/g

Cheek - High - BL-4U Samsung/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 10.096 V/m
Peak SAR (extrapolated) = 1.214 mW/g
SAR(1 g) = 0.928 mW/g
SAR(10 g) = 0.663 mW/g
Power Drift = -0.01 dB
Maximum value of SAR (measured) = 0.986 mW/g



Date/Time: 2012-07-10 16:14:26

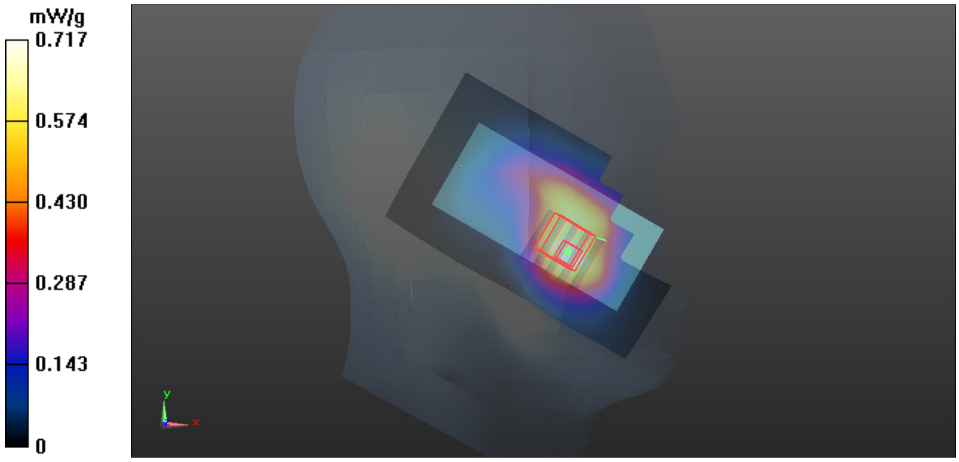
Test Laboratory: TCC Nokia
Type: RM-781; Serial: 352427/05/892599/0

Communication System: 4-slot GPRS1900
Frequency: 1880 MHz; Duty Cycle: 1:2.08
Medium: Head 1900; Medium Notes: Liquid Temperature: 21.6 C
Medium parameters used: f = 1880 MHz; σ = 1.403 mho/m; ε_r = 39.552; ρ = 1000 kg/m^3
Phantom section: Left Section

DASY Configuration:
- Probe: ES3DV3 - SN3289
- ConvF(5.28, 5.28, 5.28); Calibrated: 2012-02-13;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn671; Calibrated: 2011-09-23
- Phantom: SAM 1; Type: Twin Phantom; Serial: TP-1421
- Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

Cheek - Middle - BL-4U LG/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.717 mW/g

Cheek - Middle - BL-4U LG/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 6.478 V/m
Peak SAR (extrapolated) = 0.928 mW/g
SAR(1 g) = 0.591 mW/g
SAR(10 g) = 0.375 mW/g
Power Drift = -0.38 dB
Maximum value of SAR (measured) = 0.643 mW/g



Date/Time: 2012-07-10 17:43:30

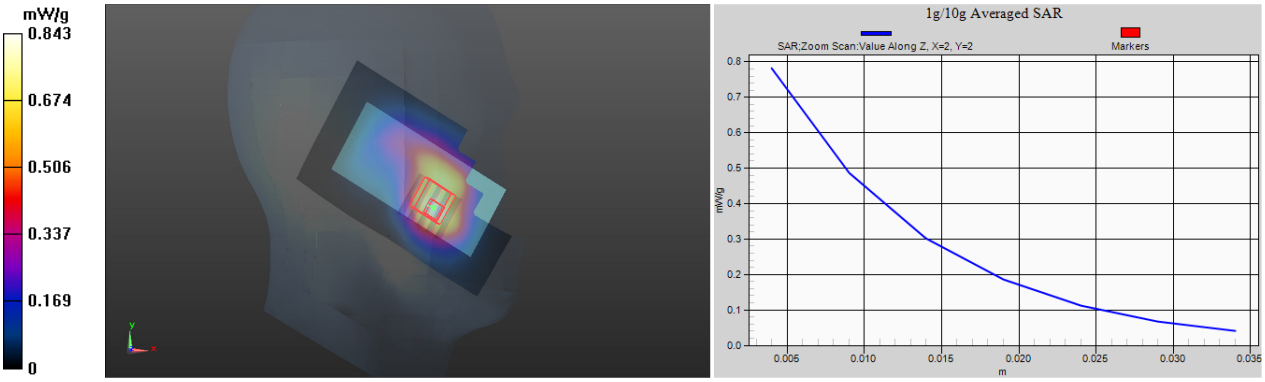
Test Laboratory: TCC Nokia
Type: RM-781; Serial: 352427/05/892599/0

Communication System: WCDMA1900
Frequency: 1907.6 MHz; Duty Cycle: 1:1
Medium: Head 1900; Medium Notes: Liquid Temperature: 21.6 C
Medium parameters used: f = 1908 MHz; σ = 1.425 mho/m; ε_r = 39.452; ρ = 1000 kg/m^3
Phantom section: Left Section

DASY Configuration:
- Probe: ES3DV3 - SN3289
- ConvF(5.28, 5.28, 5.28); Calibrated: 2012-02-13;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn671; Calibrated: 2011-09-23
- Phantom: SAM 1; Type: Twin Phantom; Serial: TP-1421
- Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

Cheek - High - BL-4U LG/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.843 mW/g

Cheek - High - BL-4U LG/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 6.739 V/m
Peak SAR (extrapolated) = 1.156 mW/g
SAR(1 g) = 0.717 mW/g
SAR(10 g) = 0.445 mW/g
Power Drift = 0.28 dB
Maximum value of SAR (measured) = 0.782 mW/g



Date/Time: 2012-07-12 11:57:55

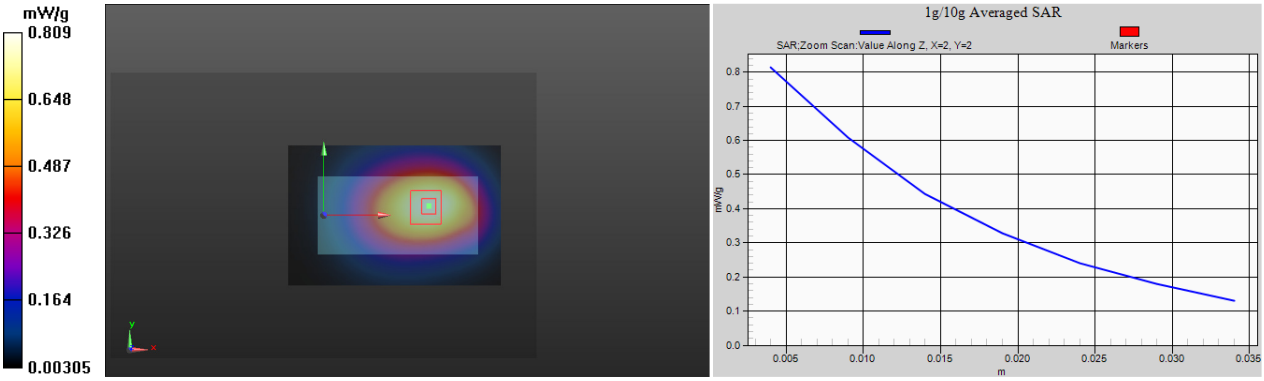
Test Laboratory: TCC Nokia
Type: RM-781; Serial: 352427/05/892599/0

Communication System: GSM850
Frequency: 836.6 MHz; Duty Cycle: 1:8.3
Medium: Body 835; Medium Notes: Liquid Temperature: 21.3 C
Medium parameters used: f = 837 MHz; σ = 0.975 mho/m; ε_r = 55.133; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3289
- ConvF(6.13, 6.13, 6.13); Calibrated: 2012-02-13;
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn671; Calibrated: 2011-09-23
- Phantom: TFP-1; Type: Triple Flat Phantom 5.1; Serial: 1109
- Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

Body - Middle - No Accessory - Back Facing Phantom - BL-4U Samsung/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.809 mW/g

Body - Middle - No Accessory - Back Facing Phantom - BL-4U Samsung/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 8.372 V/m
Peak SAR (extrapolated) = 1.002 mW/g
SAR(1 g) = 0.762 mW/g
SAR(10 g) = 0.541 mW/g
Power Drift = 0.03 dB
Maximum value of SAR (measured) = 0.814 mW/g



Date/Time: 2012-07-12 11:18:51

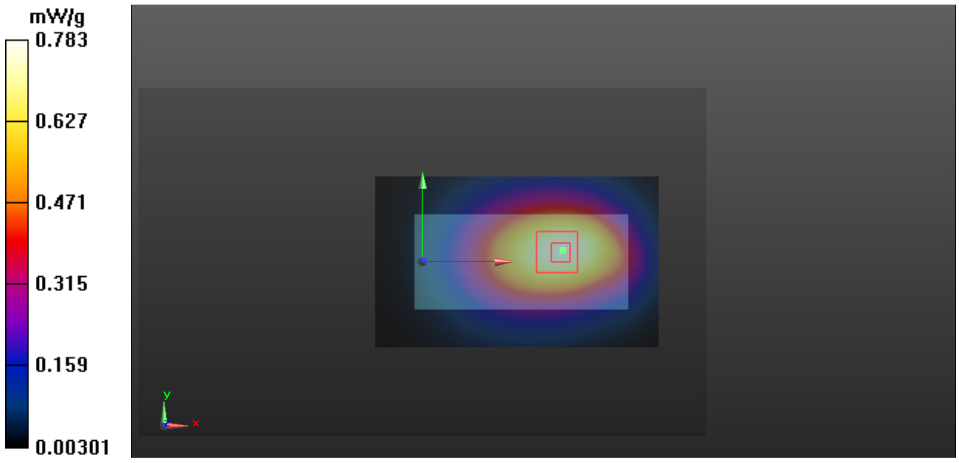
Test Laboratory: TCC Nokia
Type: RM-781; Serial: 352427/05/892599/0

Communication System: WCDMA850
Frequency: 846.6 MHz; Duty Cycle: 1:1
Medium: Body 835; Medium Notes: Liquid Temperature: 21.3 C
Medium parameters used: f = 847 MHz; σ = 0.989 mho/m; ε_r = 55.104; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3289
- ConvF(6.13, 6.13, 6.13); Calibrated: 2012-02-13;
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn671; Calibrated: 2011-09-23
- Phantom: TFP-1; Type: Triple Flat Phantom 5.1; Serial: 1109
- Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

Body - High - No Accessory - Back Facing Phantom - BL-4U Samsung/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.783 mW/g

Body - High - No Accessory - Back Facing Phantom - BL-4U Samsung/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 8.452 V/m
Peak SAR (extrapolated) = 0.961 mW/g
SAR(1 g) = 0.733 mW/g
SAR(10 g) = 0.522 mW/g
Power Drift = 0.01 dB
Maximum value of SAR (measured) = 0.780 mW/g



Date/Time: 2012-07-11 12:51:18

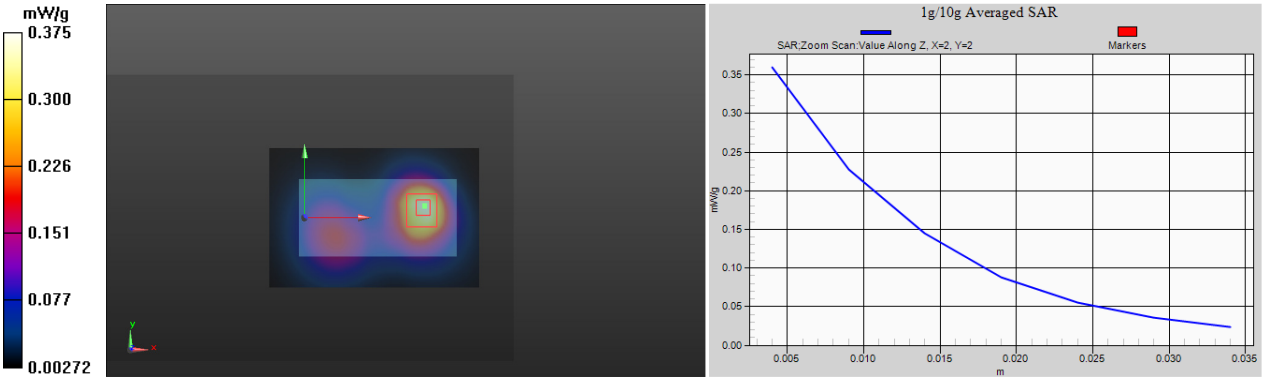
Test Laboratory: TCC Nokia
Type: RM-781; Serial: 352427/05/892599/0

Communication System: 4-slot GPRS1900
Frequency: 1880 MHz; Duty Cycle: 1:2.08
Medium: Body 1900; Medium Notes: Liquid Temperature: 21.5 C
Medium parameters used: f = 1880 MHz; σ = 1.444 mho/m; ε_r = 52.838; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3289
- ConvF(4.83, 4.83, 4.83); Calibrated: 2012-02-13;
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn671; Calibrated: 2011-09-23
- Phantom: TFP-1; Type: Triple Flat Phantom 5.1; Serial: 1109
- Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

Body - Middle - No Accessory - Back Facing Phantom - BL-4U LG/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.375 mW/g

Body - Middle - No Accessory - Back Facing Phantom - BL-4U LG/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 7.969 V/m
Peak SAR (extrapolated) = 0.523 mW/g
SAR(1 g) = 0.327 mW/g
SAR(10 g) = 0.194 mW/g
Power Drift = -0.04 dB
Maximum value of SAR (measured) = 0.360 mW/g



Date/Time: 2012-07-10 19:12:47

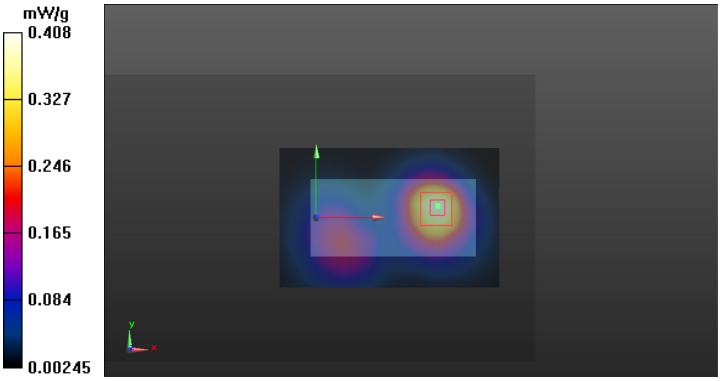
Test Laboratory: TCC Nokia
Type: RM-781; Serial: 352427/05/892599/0

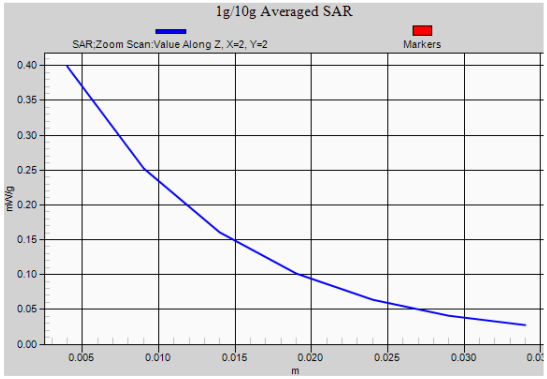
Communication System: WCDMA1900
Frequency: 1907.6 MHz; Duty Cycle: 1:1
Medium: Body 1900; Medium Notes: Liquid Temperature: 21.6 C
Medium parameters used: f = 1908 MHz; σ = 1.465 mho/m; ε_r = 52.878; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3289
- ConvF(4.83, 4.83, 4.83); Calibrated: 2012-02-13;
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn671; Calibrated: 2011-09-23
- Phantom: TFP-1; Type: Triple Flat Phantom 5.1; Serial: 1109
- Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.5 (6469)

Body - High - No Accessory - Back Facing Phantom - BL-4U LG/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.408 mW/g

Body - High - No Accessory - Back Facing Phantom - BL-4U LG/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 8.690 V/m
Peak SAR (extrapolated) = 0.578 mW/g
SAR(1 g) = 0.364 mW/g
SAR(10 g) = 0.219 mW/g
Power Drift = 0.07 dB
Maximum value of SAR (measured) = 0.399 mW/g





APPENDIX C: DIELECTRIC PARAMETERS OF THE TISSUE SIMULANTS

Head tissue simulant dielectric parameters used in the measurements:

f (MHz)	Date	Dielectric Parameters					
		Ch 128 824.2 MHz		Ch 190 836.6 MHz		Ch 251 848.8 MHz	
		ε_r	σ [S/m]	ε_r	σ [S/m]	ε_r	σ [S/m]
GSM/GPRS/ EGPRS850	2012-07-06	41.0	0.87	40.8	0.88	40.7	0.89
f (MHz)	**Date**	**Dielectric Parameters**					
		Ch 4132 826.4 MHz		Ch 4175 835.0 MHz		Ch 4233 846.6 MHz	
		ε_r	σ [S/m]	ε_r	σ [S/m]	ε_r	σ [S/m]
WCDMA850	2012-07-06	41.0	0.87	40.9	0.88	40.7	0.89
f (MHz)	**Date**	**Dielectric Parameters**					
		Ch 512 1850.2 MHz		Ch 661 1880.0 MHz		Ch 810 1909.8 MHz	
		ε_r	σ [S/m]	ε_r	σ [S/m]	ε_r	σ [S/m]
GSM/GPRS/ EGPRS1900	2012-07-10	39.7	1.37	39.6	1.40	39.4	1.43
f (MHz)	**Date**	**Dielectric Parameters**					
		Ch 9262 1852.4 MHz		Ch 9400 1880.0 MHz		Ch 9538 1907.6 MHz	
		ε_r	σ [S/m]	ε_r	σ [S/m]	ε_r	σ [S/m]
WCDMA1900	2012-07-10	39.7	1.37	39.6	1.40	39.4	1.42

Body tissue simulant dielectric parameters used in the measurements:

f (MHz)	Date	Dielectric Parameters					
		Ch 128 824.2 MHz		Ch 190 836.6 MHz		Ch 251 848.8 MHz	
		ε_r	σ [S/m]	ε_r	σ [S/m]	ε_r	σ [S/m]
GSM/GPRS/ EGPRS850	2012-07-12	55.3	0.96	55.1	0.97	55.1	0.99
f (MHz)	**Date**	**Dielectric Parameters**					
		Ch 4132 826.4 MHz		Ch 4175 835.0 MHz		Ch 4233 846.6 MHz	
		ε_r	σ [S/m]	ε_r	σ [S/m]	ε_r	σ [S/m]
WCDMA850	2012-07-12	55.3	0.96	55.2	0.97	55.1	0.99
f (MHz)	**Date**	**Dielectric Parameters**					
		Ch 512 1850.2 MHz		Ch 661 1880.0 MHz		Ch 810 1909.8 MHz	
		ε_r	σ [S/m]	ε_r	σ [S/m]	ε_r	σ [S/m]
GSM/GPRS/ EGPRS1900	2012-07-11	52.9	1.41	52.8	1.44	52.8	1.47
f (MHz)	**Date**	**Dielectric Parameters**					
		Ch 9262 1852.4 MHz		Ch 9400 1880.0 MHz		Ch 9538 1907.6 MHz	
		ε_r	σ [S/m]	ε_r	σ [S/m]	ε_r	σ [S/m]
WCDMA1900	2012-07-10	53.0	1.41	52.9	1.44	52.9	1.46

APPENDIX D: RELEVANT PAGES FROM PROBE CALIBRATION 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
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 GmbH (Ulm)**

Certificate No: **ES3-3289_Feb12**

CALIBRATION CERTIFICATE

Object ES3DV3 - SN:3289

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

Calibration date: February 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 E4419B	GB41293874	31-Mar-11 (No. 217-01372)	Apr-12
Power sensor E4412A	MY41498087	31-Mar-11 (No. 217-01372)	Apr-12
Reference 3 dB Attenuator	SN: S5054 (3c)	29-Mar-11 (No. 217-01369)	Apr-12
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-11 (No. 217-01367)	Apr-12
Reference 30 dB Attenuator	SN: S5129 (30b)	29-Mar-11 (No. 217-01370)	Apr-12
Reference Probe ES3DV2	SN: 3013	29-Dec-11 (No. ES3-3013_Dec11)	Dec-12
DAE4	SN: 654	3-May-11 (No. DAE4-654_May11)	May-12
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

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

Issued: February 21, 2012

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3289

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
835	41.5	0.90	6.11	6.11	6.11	0.40	1.57	± 12.0 %
1750	40.1	1.37	5.49	5.49	5.49	0.62	1.31	± 12.0 %
1900	40.0	1.40	5.28	5.28	5.28	0.79	1.20	± 12.0 %
2450	39.2	1.80	4.53	4.53	4.53	0.71	1.39	± 12.0 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3289

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
835	55.2	0.97	6.13	6.13	6.13	0.28	2.05	± 12.0 %
1750	53.4	1.49	5.12	5.12	5.12	0.45	1.69	± 12.0 %
1900	53.3	1.52	4.83	4.83	4.83	0.51	1.67	± 12.0 %
2450	52.7	1.95	4.30	4.30	4.30	0.73	1.08	± 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.

APPENDIX E: 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 GmbH (Ulm)

Certificate No: D835V2-474_Jun11

CALIBRATION CERTIFICATE

Object: D835V2 - SN: 474

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

Calibration date: June 14, 2011

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	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-11 (No. 217-01367)	Apr-12
Type-N mismatch combination	SN: 5047.2 / 06327	29-Mar-11 (No. 217-01371)	Apr-12
Reference Probe ES3DV3	SN: 3205	29-Apr-11 (No. ES3-3205_Apr11)	Apr-12
DAE4	SN: 601	8-Jun-11 (No. DAE4-601_Jun11)	Jun-12

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

	Name	Function	Signature
Calibrated by:	Dimce Iliev	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: June 14, 2011

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.4 Ω - 3.0 jΩ
Return Loss	- 28.4 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.0 Ω - 5.4 jΩ
Return Loss	- 24.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.388 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.
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 15, 2002

DASY5 Validation Report for Head TSL

Date: 14.06.2011

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 474

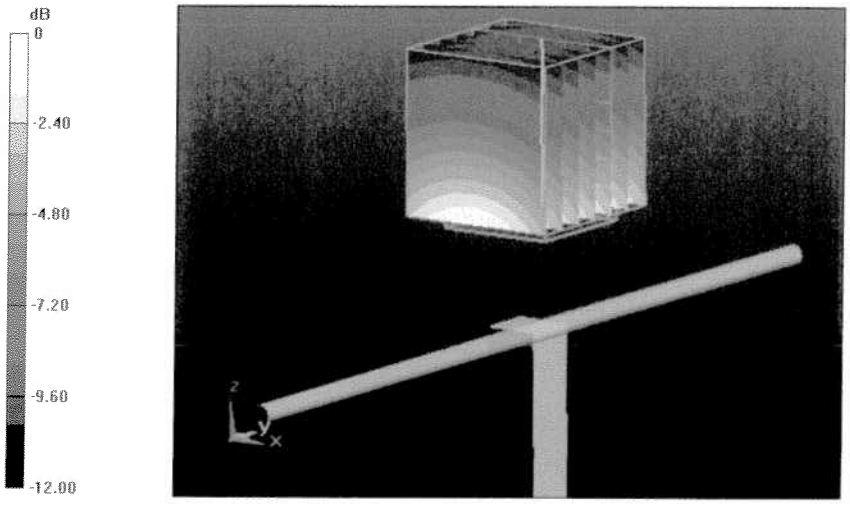
Communication System: CW; Frequency: 835 MHz
Medium: HSL900V2
Medium parameters used: f = 835 MHz; σ = 0.89 mho/m; ε_r = 40.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.07, 6.07, 6.07); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 08.06.2011
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

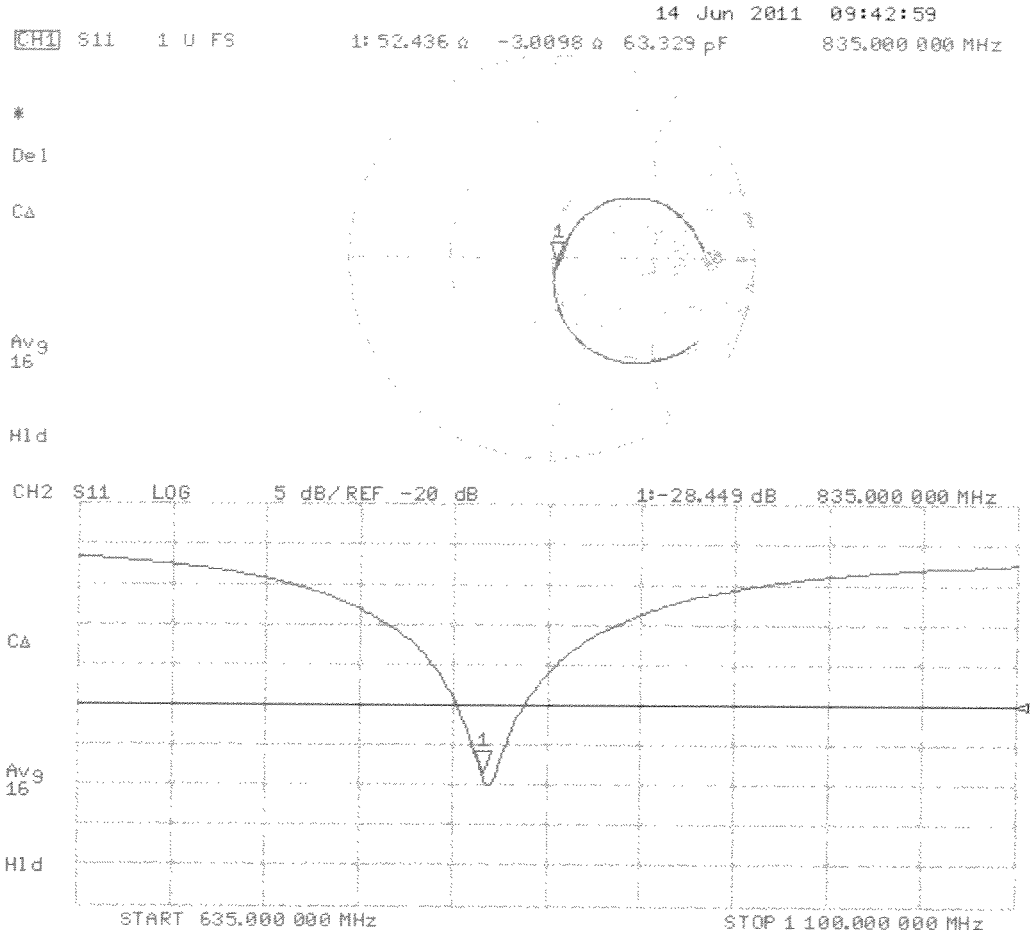
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.048 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 3.439 W/kg
SAR(1 g) = 2.33 mW/g; SAR(10 g) = 1.53 mW/g
Maximum value of SAR (measured) = 2.718 mW/g



0 dB = 2.720mW/g

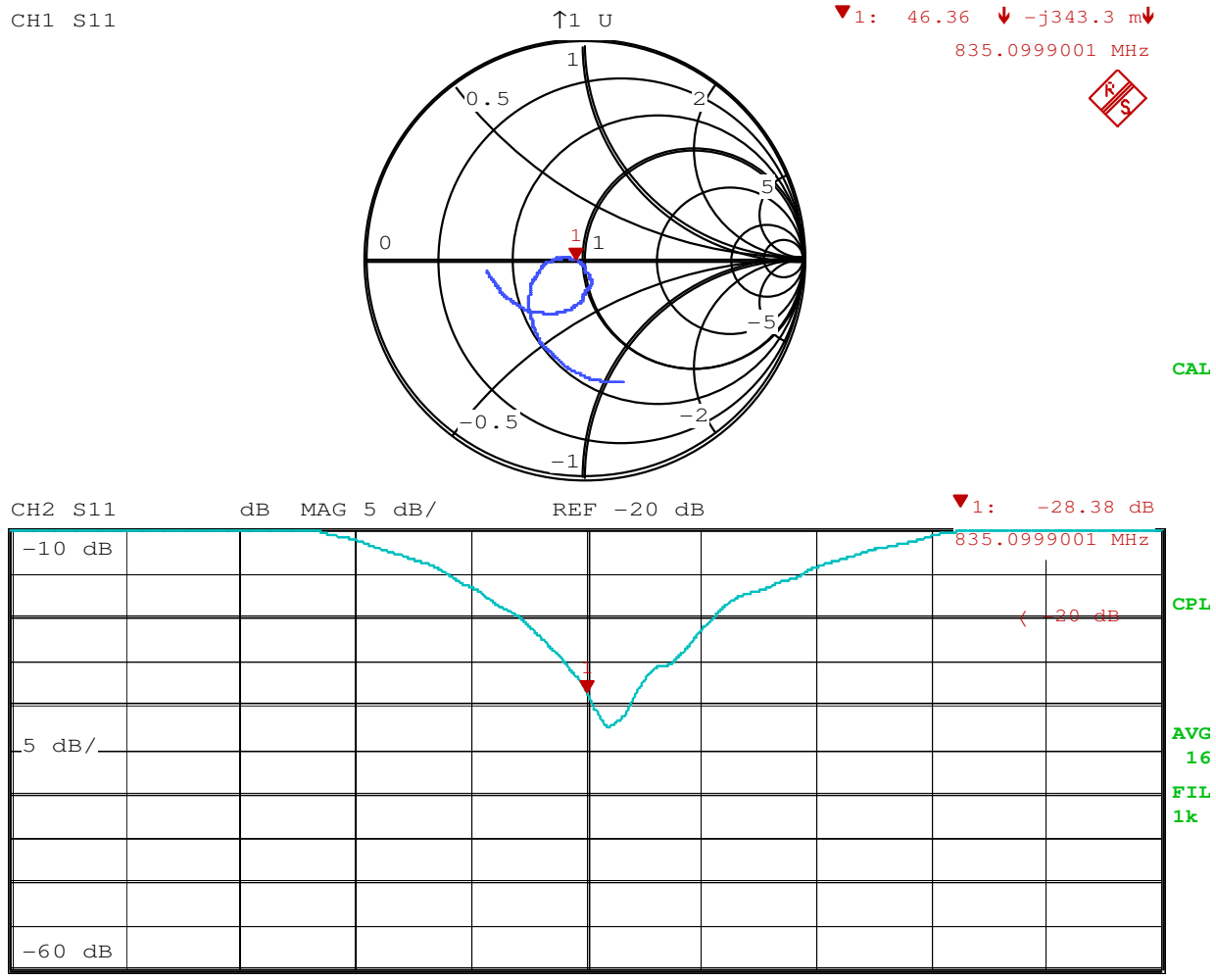
Impedance Measurement Plot for Head TSL



Dipole D835V2 - SN: 474 Antenna Parameters

Antenna Parameters with Head TSL

	Calibration certificate	Annual measurement 2012-03-08
Impedance, transformed to feed point	52.4Ω - 3.0jΩ	46.4Ω - 0.3jΩ
Return loss	-28.4 dB	-28.4 dB



Date: 8.MAR.12 15:54:50

DASY5 Validation Report for Body TSL

Date: 14.06.2011

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 474

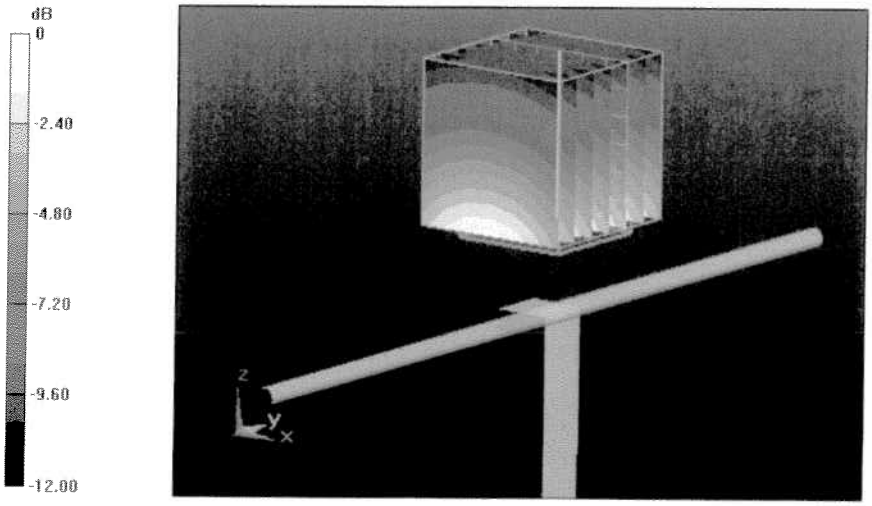
Communication System: CW; Frequency: 835 MHz
Medium: MSL900V2
Medium parameters used: f = 835 MHz; σ = 0.99 mho/m; ε_r = 53.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.02, 6.02, 6.02); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 08.06.2011
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

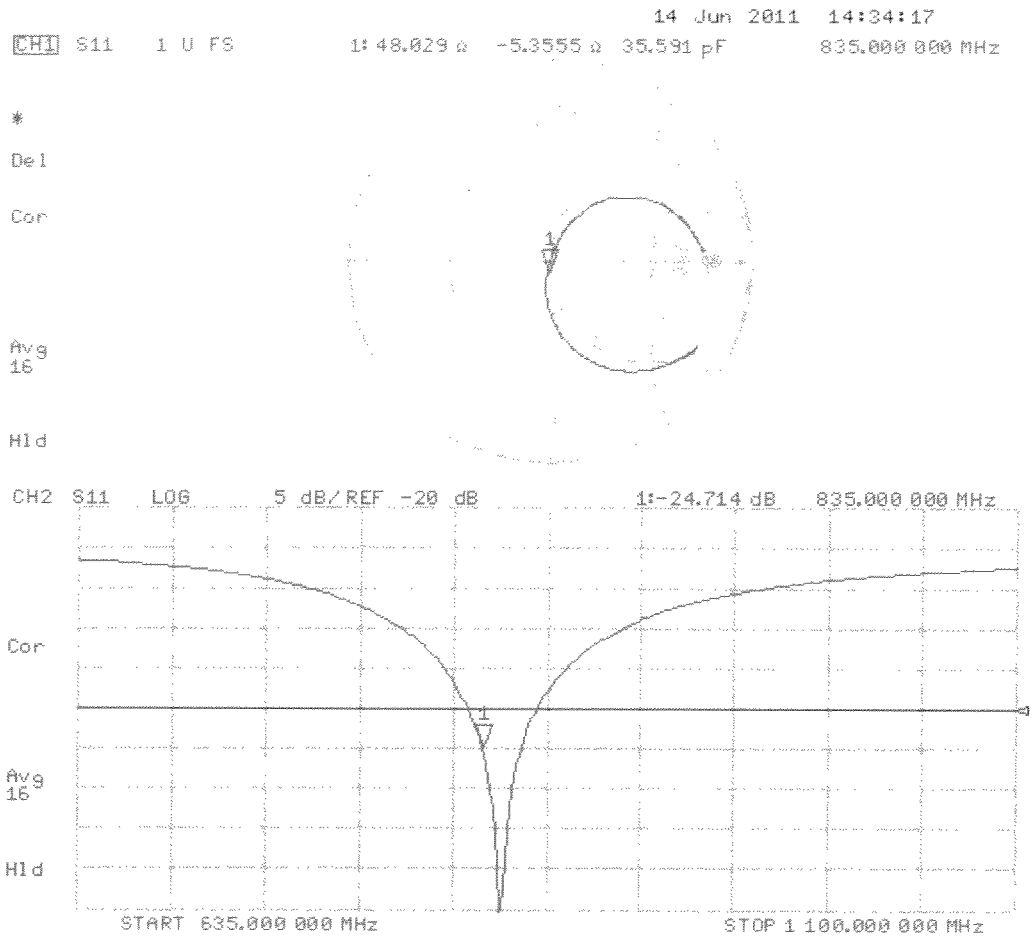
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.624 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 3.578 W/kg
SAR(1 g) = 2.46 mW/g; SAR(10 g) = 1.61 mW/g
Maximum value of SAR (measured) = 2.859 mW/g



0 dB = 2.860mW/g

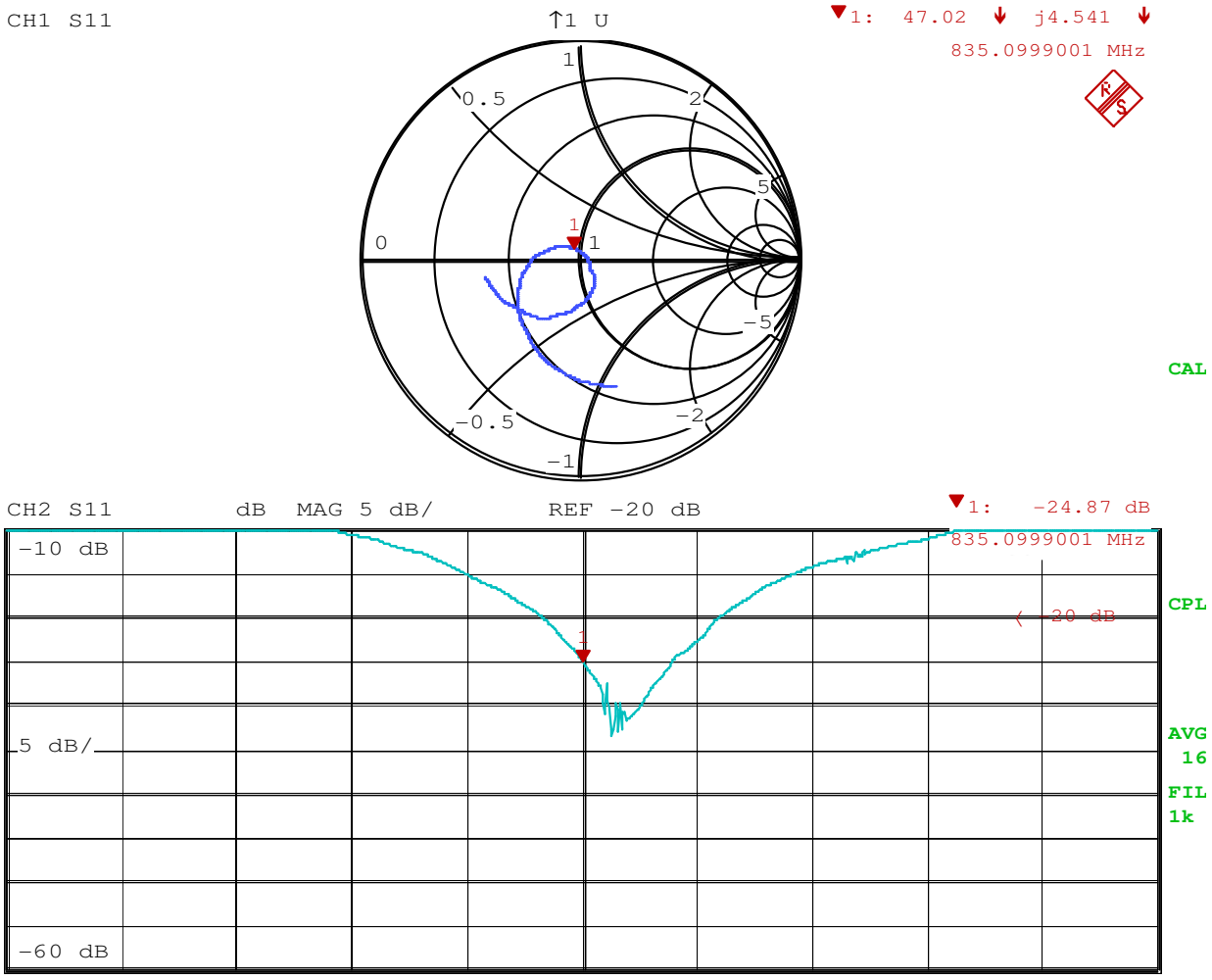
Impedance Measurement Plot for Body TSL



Dipole D835V2 - SN: 474 Antenna Parameters

Antenna Parameters with Body TSL

	Calibration certificate	Annual measurement 2012-03-08
Impedance, transformed to feed point	48.0Ω - 5.4jΩ	47.0Ω + 4.5jΩ
Return loss	-24.7 dB	-24.8 dB



Date: 8.MAR.12 15:50:44

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 GmbH (Ulm)**

Certificate No: D1900V2-5d007_Jun11

CALIBRATION CERTIFICATE

Object	D1900V2 - SN: 5d007
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	June 16, 2011

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	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-11 (No. 217-01367)	Apr-12
Type-N mismatch combination	SN: 5047.2 / 06327	29-Mar-11 (No. 217-01371)	Apr-12
Reference Probe ES3DV3	SN: 3205	29-Apr-11 (No. ES3-3205_Apr11)	Apr-12
DAE4	SN: 601	8-Jun-11 (No. DAE4-601_Jun11)	Jun-12

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

	Name	Function	Signature
Calibrated by:	Dimce Iliev	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: June 16, 2011

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.5 Ω + 1.1 jΩ
Return Loss	- 31.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.2 Ω + 4.0 jΩ
Return Loss	- 24.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.186 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.
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	February 22, 2002

Date: 15.06.2011

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d007

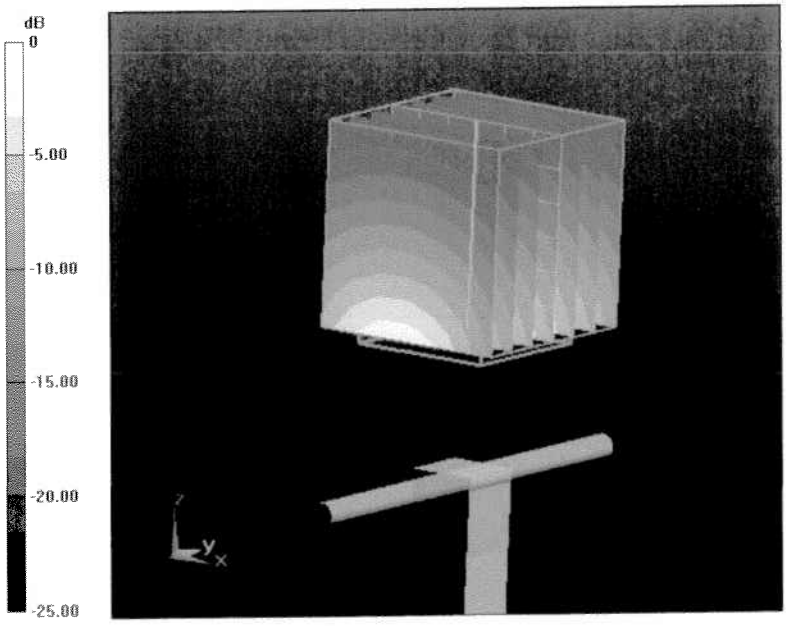
Communication System: CW; Frequency: 1900 MHz
Medium: HSL U12 BB
Medium parameters used: f = 1900 MHz; σ = 1.4 mho/m; ε_r = 39; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.01, 5.01, 5.01); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 08.06.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

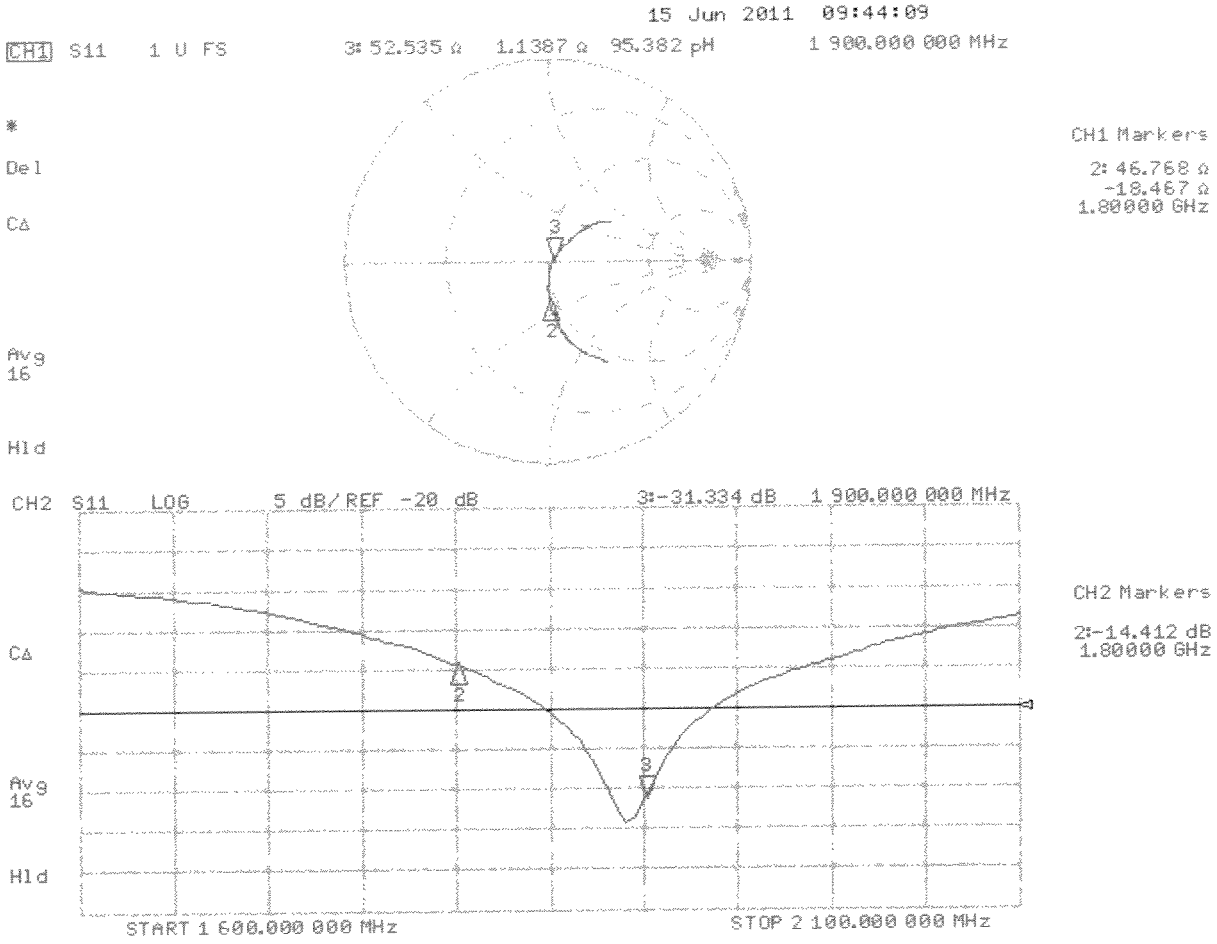
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 97.068 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 18.126 W/kg
SAR(1 g) = 9.95 mW/g; SAR(10 g) = 5.19 mW/g
Maximum value of SAR (measured) = 12.246 mW/g



0 dB = 12.250mW/g

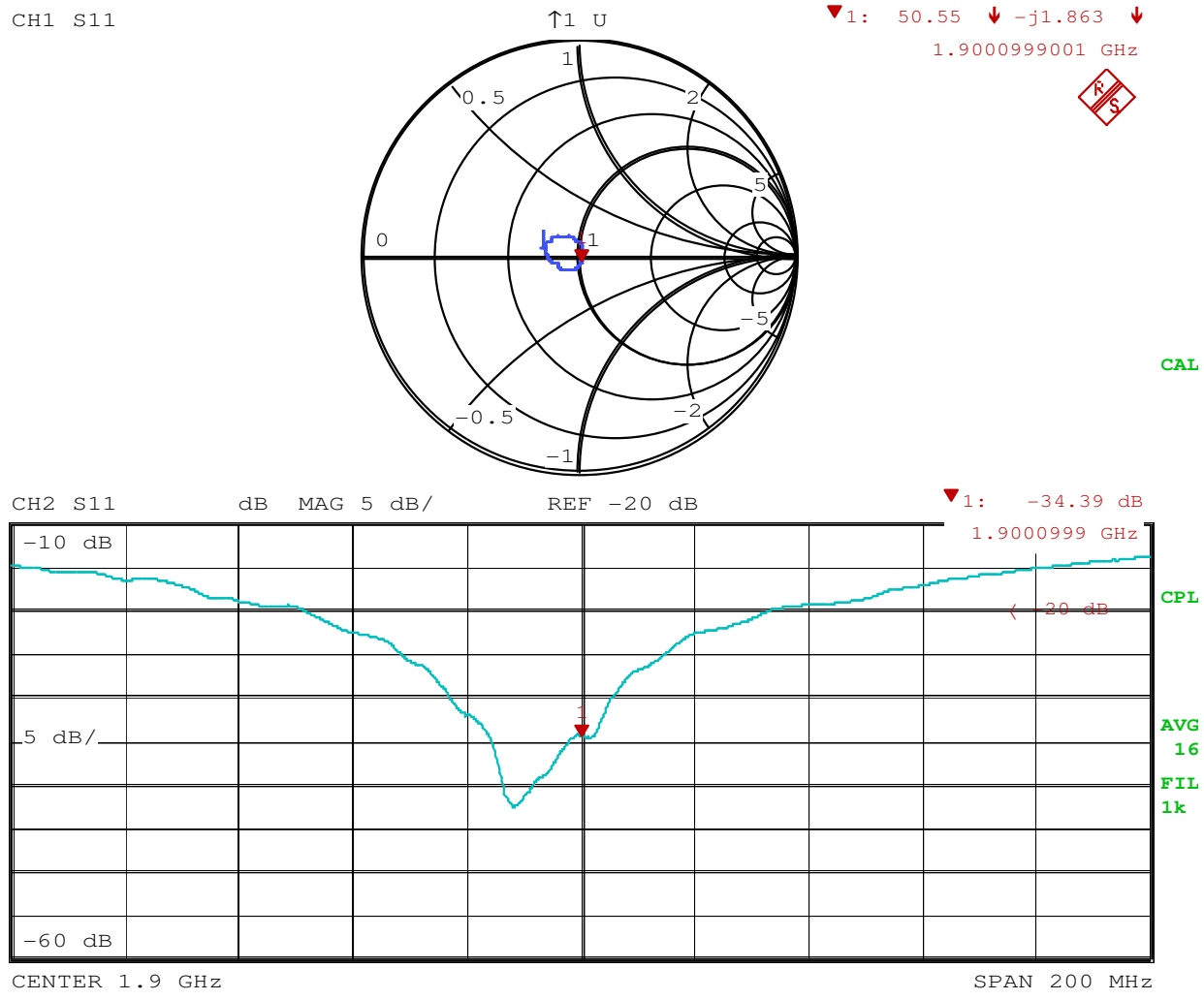
Impedance Measurement Plot for Head TSL



Dipole D1900V2 - SN: 5d007 Antenna Parameters

Antenna Parameters with Head TSL

	Calibration certificate	Annual measurement 2012-03-08
Impedance, transformed to feed point	52.5Ω + 1.1jΩ	50.6Ω - 1.9jΩ
Return loss	-31.3 dB	-34.4 dB



DASY5 Validation Report for Body TSL

Date: 16.06.2011

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d007

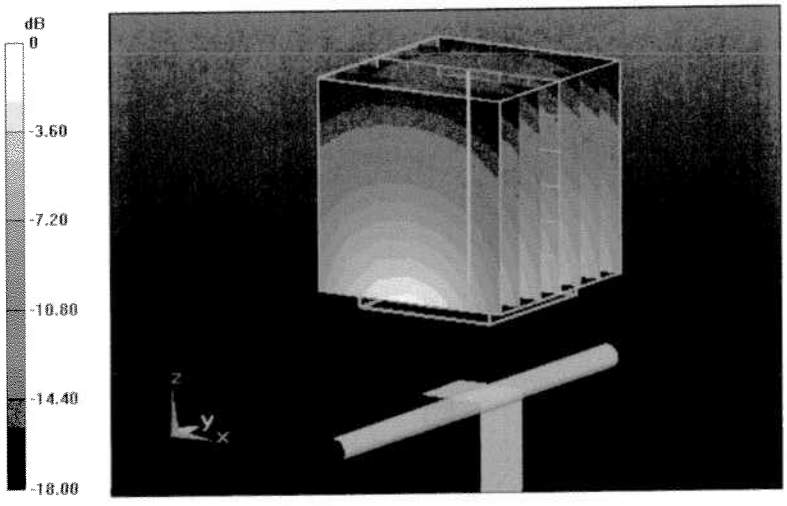
Communication System: CW; Frequency: 1900 MHz
Medium: MSL U12 BB
Medium parameters used: f = 1900 MHz; σ = 1.53 mho/m; ε_r = 52.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.62, 4.62, 4.62); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 08.06.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

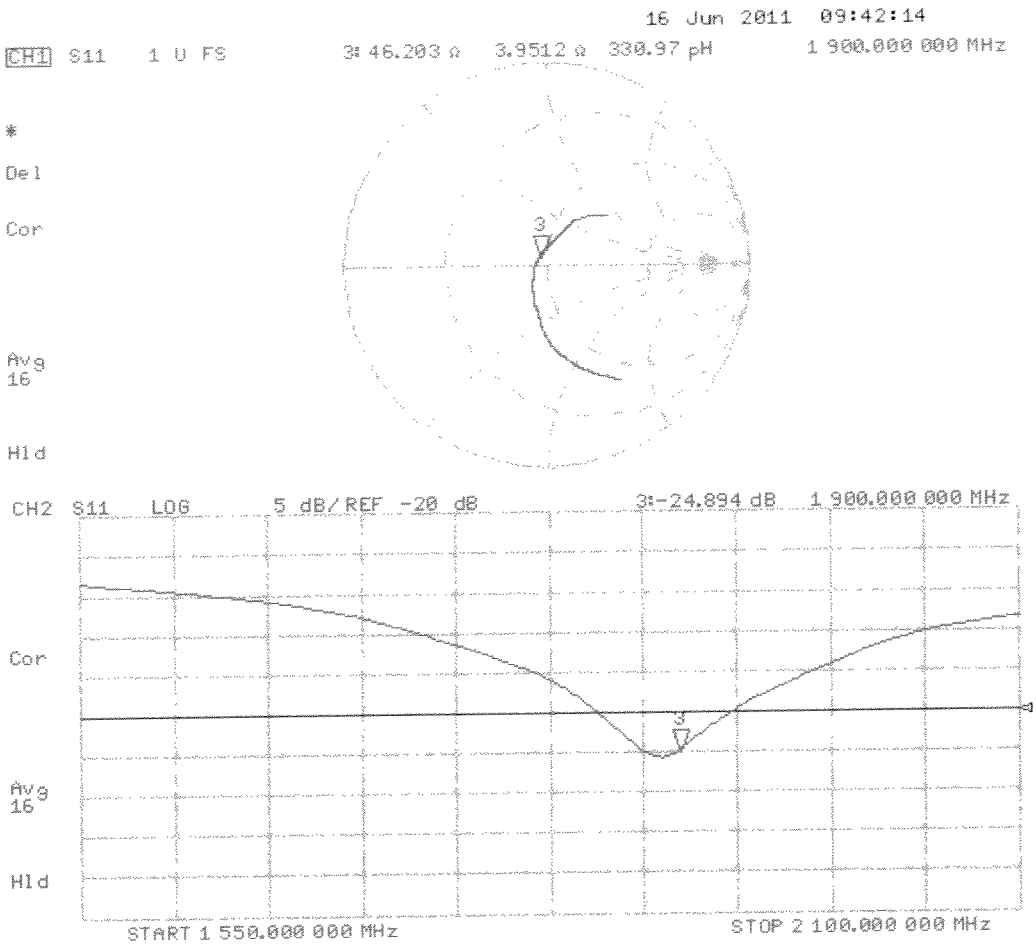
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.029 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 18.022 W/kg
SAR(1 g) = 10.1 mW/g; SAR(10 g) = 5.3 mW/g
Maximum value of SAR (measured) = 12.863 mW/g



0 dB = 12.860mW/g

Impedance Measurement Plot for Body TSL



Dipole D1900V2 - SN: 5d007 Antenna Parameters

Antenna Parameters with Body TSL

	Calibration certificate	Annual measurement 2012-03-08
Impedance, transformed to feed point	46.2Ω + 4.0jΩ	53.4Ω - 3.3jΩ
Return loss	-24.9 dB	-26.7 dB