

SAR Compliance Test Report

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Tested device:	RM-959		
FCC ID:	QTLRM-959	IC:	-
Supplement reports:	SAR_Photo_RM-959_02		
Testing has been carried out in accordance with:	47CFR §2.1093 Radiofrequency Radiation Exposure Evaluation: Portable Devices FCC published RF exposure KDB procedures 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:			
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SAR Report

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1. SUMMARY OF SAR TEST REPORT

1.1 Test Details

Period of test	2013-11-04 to 2013-11-11
SN, HW and SW numbers of tested device	SN: 004402/47/520260/6, HW: 0311, SW: 1.1339.1, DUT: 53574 SN: 004402/47/520252/3, HW: 0311, SW: 1.1339.1, DUT: 53575
Batteries used in testing	BL-4U, DUT: 53527, 53528, 53529, 53530
Headsets used in testing	WH-108, DUT: 53214, 53215
Other accessories used in testing	-
State of sample	Prototype unit
Notes	-

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)	Reported* SAR value (1g avg)	SAR limit (1g avg)	Result	Plot #
2-slot GPRS850	251 / 848.8	29.75 dBm	Right, Cheek	0.743 W/kg	0.77 W/kg	1.6 W/kg	PASSED	1
WCDMA850	4233 / 846.6	23.53 dBm	Right, Cheek	0.805 W/kg	0.88 W/kg	1.6 W/kg	PASSED	2
GSM1900	810 / 1909.8	30.16 dBm	Left, Cheek	0.874 W/kg	0.92 W/kg	1.6 W/kg	PASSED	3
WLAN2450	1 / 2412.0	15.28 dBm	Left, Cheek	0.291 W/kg	0.39 W/kg	1.6 W/kg	PASSED	4
2-slot GPRS850 + WLAN2450	-	-	Right, Cheek	0.743 W/kg	0.77 W/kg	1.6 W/kg	PASSED	1
WCDMA850 + WLAN2450	-	-	Right, Cheek	0.805 W/kg	0.88 W/kg	1.6 W/kg	PASSED	2
GSM1900 + WLAN2450	-	-	Left, Cheek	0.874 W/kg	0.92 W/kg	1.6 W/kg	PASSED	3

1.2.2 Body Worn Configuration

Mode	Ch / f(MHz)	Conducted power	Separation distance	Measured SAR value (1g avg)	Reported* SAR value (1g avg)	SAR limit (1g avg)	Result	Plot #
2-slot GPRS850	128 / 824.2	29.72 dBm	1.5 cm	0.631 W/kg	0.66 W/kg	1.6 W/kg	PASSED	8
WCDMA850	4233 / 846.6	23.53 dBm	1.5 cm	0.608 W/kg	0.66 W/kg	1.6 W/kg	PASSED	9
GSM1900	810 / 1909.8	30.16 dBm	1.5 cm	0.265 W/kg	0.28 W/kg	1.6 W/kg	PASSED	10
WLAN2450	1 / 2412.0	15.28 dBm	1.5 cm	0.078 W/kg	0.10 W/kg	1.6 W/kg	PASSED	11
2-slot GPRS850 + WLAN2450	-	-	1.5 cm	0.674 W/kg	0.71 W/kg	1.6 W/kg	PASSED	12
WCDMA850 + WLAN2450	-	-	1.5 cm	0.653 W/kg	0.72 W/kg	1.6 W/kg	PASSED	13
GSM1900 + WLAN2450	-	-	1.5 cm	0.265 W/kg	0.28 W/kg	1.6 W/kg	PASSED	10

* Reported SAR values are scaled to, or measured at, upper limit of power tuning tolerance.

1.2.3 Summary SAR data

	FCC-defined SAR values for the Grants of Equipment Authorization		
	PCE	DTS	NII
Maximum Head SAR values	0.92W/kg	0.39W/kg	-
{Max + Max} Simultaneous Head SAR value	1.31W/kg		
Maximum Body SAR values	0.66W/kg	0.10W/kg	-
{Max + Max} Simultaneous Body SAR value	0.76W/kg		
Maximum Product Specific (Wireless Router) SAR values	-	-	-
{Max + Max} Simultaneous Product Specific SAR value	-		
Maximum Simultaneous SAR value Head SAR: GSM1900 + WLAN2450	1.31W/kg		

Note:

PCE contains the highest results between all cellular modes (cellular, AWS and PCS bands)

DTS contains the highest results between WLAN 2.4GHz + RLAN 5725-5850MHz

NII contains the highest results between RLAN 5150-5250, 5250-5350 and 5470-5725

1.2.4 Maximum Drift

Maximum drift covered by 5% scaling up of the SAR values	Maximum drift during measurements
0.2dB	0.16dB

1.2.5 Measurement Uncertainty

Expanded Uncertainty (k=2) 95%	± 27.1%
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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)	Power Tuning Target (dBm)				Upper Limit of Power Tuning Tolerance (dBm)			
					1-slot	2-slot	3-slot	4-slot	1-slot	2-slot	3-slot	4-slot
GSM / GPRS	850	GMSK	1/8 to 4/8	824 – 849	32.5	29.5	27.7	26.5	32.9	29.9	28.1	26.9
	1900			1850 – 1910	30.0	27.0	25.2	24.0	30.4	27.4	25.6	24.4
WCDMA	850 (Band V)		1	826 – 847	23.5				23.9			
HSUPA	850 (Band V)		1	826 – 847	See Appendix D for details							
BT	2450	GFSK	1	2402 – 2480	6.00				7.50			
					Ch 1	Ch 6	Ch 11		Ch 1	Ch 6	Ch 11	
WLAN b-mode	2450	BPSK	1	2412 – 2472	15.0	15.0	15.0		16.5	16.5	16.5	
WLAN g-mode	2450	OFDM	1	2412 – 2472	11.0	15.0	12.0		12.5	16.5	13.5	
WLAN n-mode	2450	OFDM	1	2412 – 2462 2412 – 2472	11.0	13.0	12.0		12.5	14.5	13.5	

Outside of USA, the transmitter of the device is capable of operating also in GSM/GPRS900, GSM/GPRS1800, and HSUPA/WCDMA2100 bands which are not part of this filing.

SAR for multi slot GPRS mode was evaluated against the head profile of the phantom due to possible VoIP use.

This device has Voice-over-IP capability for use at the ear. Therefore, SAR for multi slot GPRS mode was evaluated against the head profile of the phantom.

This device has also HSUPA capabilities in all WCDMA bands listed above. HSUPA target powers are always lower than or equal to the corresponding WCDMA target power listed above, details of the HSUPA MPR scheme, power targets and power results can be found in Appendix D.

This is a WCDMA HSUPA device, but SAR tests for HSUPA mode have not been performed as no HSUPA Sub-test mode has an average power > 0.25dB above the basic WCDMA 12.2kbps RMC mode. Appendix C of this report gives a summary of the measured WCDMA and HSUPA average powers; a detailed report of these WCDMA and HSUPA conducted power tests is submitted separately.

This is a BT Class 1 device; as its power tuning target is 6dBm (4mW), SAR testing was deemed unnecessary since $(4\text{mW}/5\text{mm}) \cdot \sqrt{2.48\text{GHz}} < 3.0$ (KDB447498 D01 General RF Exposure Guidelines v05 Section 4.3.1 Standalone SAR test exclusion considerations). Since WLAN2450 and BT use same frequency and antenna, WLAN2450 power is 9.0dB higher in minimum, and they can not transmit simultaneously, the WLAN2450+cellular bands combined SAR results can be regarded as conservative estimation of BT+cellular combined SARs. As WLAN2450+cellular combined SAR result are below limit, also BT+cellular combined SAR can be deemed to comply without further analysis and estimations required in KDB 447498 for simultaneous transmission exclusion.

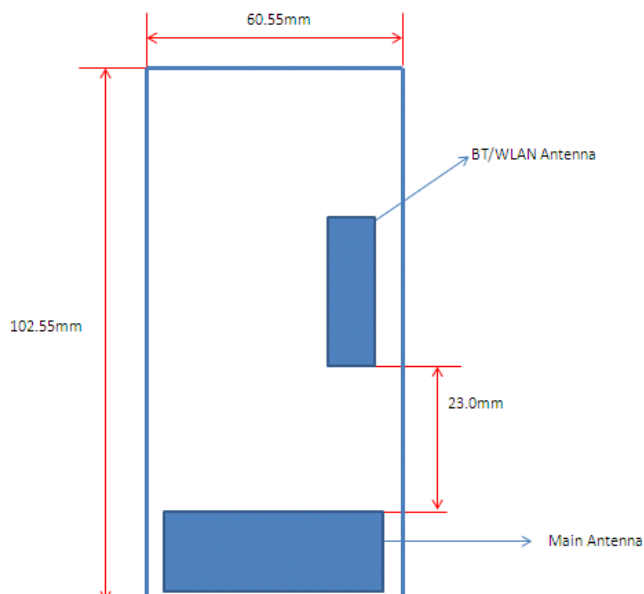
This device uses a single antenna for transmission of GSM/GPRS850 and GSM/GPRS1900 bands; a separate single antenna is used for WLAN. Simultaneous transmission of any singular cellular and PCS band is possible with WLAN in Head and Body-worn use according to the table below.

Simultaneous transmission capabilities in Head and Body-worn use	
	WLAN2450
GSM/GPRS/EGPRS850	✓
WCDMA850	✓
GSM/GPRS/EGPRS1900	✓

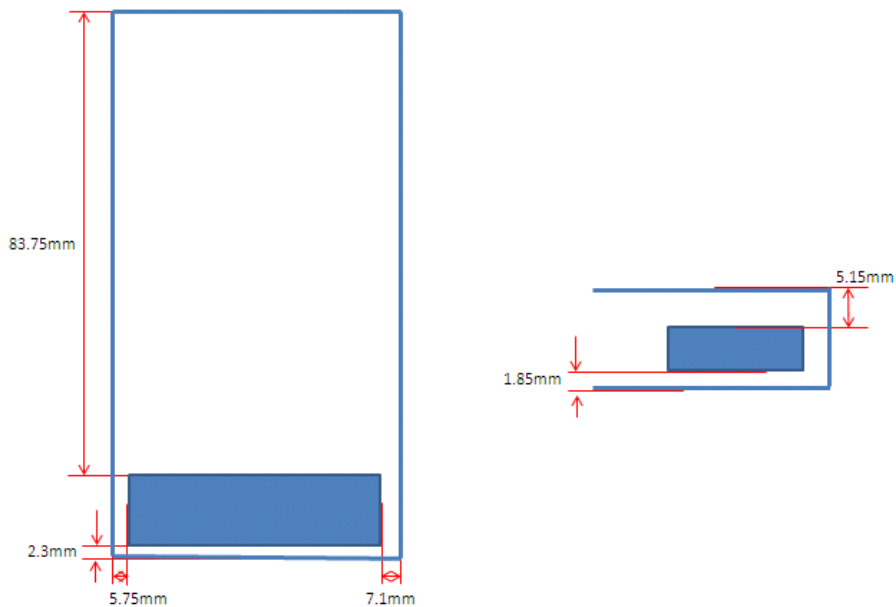
2.1 Description of the Antenna

The device has internal antennas for both cellular and WLAN use. The cellular antenna is located at the bottom underneath the back cover. The WLAN antenna is located at the top underneath the back cover.

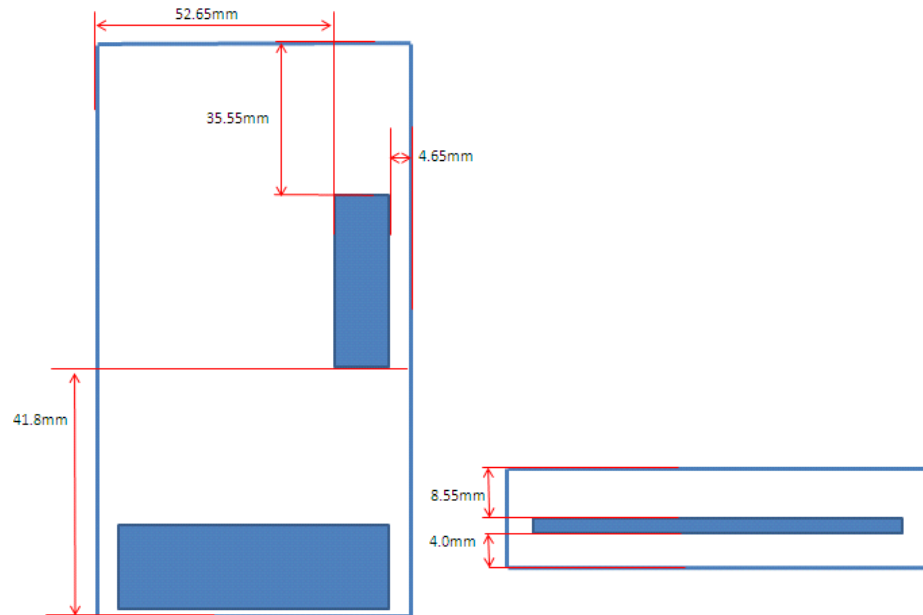
Phone Dimension and Distance Between Main antenna and BT/WLAN Antenna



Distance between Out of Device and Main Antenna



Distance between Out of Device and BT/WLAN Antenna



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 except for testing WLAN2450 where control software was used. 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.

This device was tested in all the available multi-slot GMSK GPRS modes.

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 Appendices G-I of this report.

The transmission mode of the device in all WLAN b-mode tests was BPSK 1Mbps. This mode has the highest (or equal highest) time-averaged output power of all the WLAN b and g modulation modes in Nokia devices. All WLAN testing has been carried out in accordance with FCC KDB 248227: SAR Measurement Procedures for 802.11 a/b/g Transmitters.

Here is a summary list of the KDB documents used in the reported testing:

- KDB 248227: SAR Measurement Procedures for 802.11 a/b/g Transmitters
- KDB 648474 D04 Handset SAR v01r01
- KDB 447498 D01 General RF Exposure Guidance v05
- KDB 690783 D01 SAR Listings on Grants
- KDB 865664 D01 SAR measurements 100MHz to 6GHz v01
- KDB 865664 D02 SAR Reporting v01

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
DAE 4	1324	2013-03	2014-03
DAE 4	887	2013-03	2014-03
DAE 4	858	2013-03	2014-03
E-field Probe EX3DV4	3836	2013-03	2014-03
E-field Probe ES3DV3	3280	2013-03	2014-03
E-field Probe ES3DV3	3195	2013-03	2014-03
Dipole Validation Kit, D835V2	4d005	2012-03	2014-03
Dipole Validation Kit, D1900V2	509	2012-12	2014-12
Dipole Validation Kit, D2450V2	760	2013-03	2015-03
DASY5 software	Version 52.8	-	-

Additional test equipment used in testing:

Test Equipment	Model	Serial Number	Calibration date	Calibration expiry
Signal Generator	SME06	829445	2013-04	2014-04
Signal Generator	E4432B	US40052231	2013-04	2014-04
Call Tester	CMU200	835352/008	-	-
Call Tester	CMU200	110735	-	-
Amplifier	ZHL-42W	QA1252001	-	-
Amplifier	AR 5S1G4M1	306024	-	-
RF Network Analyzer	8753ES	US39170317	2013-04	2014-04
RF Network Analyzer	E5071C	MY46104578	2013-04	2014-04
Dielectric Probe Kit	85070C	653	-	-
Dielectric Probe Kit	DAK-3.5	1065	-	-
Power Meter	R&S NRP	101293	2013-04	2014-04
Power Sensor	R&S NRP-Z51	102842	2013-04	2014-04
Power Meter	Agilent E4419B	My41291520	2013-04	2014-04
Power Sensor	Agilent 8482A	US37295411	2013-04	2014-04

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 E
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 μ W/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
Application	Distance from probe tip to dipole centers: 2.0 mm General dosimetry up to 4 GHz Compliance tests of mobile phones Fast automatic scanning in arbitrary phantoms

4.1.2 Isotropic E-field Probe Type EX3DV4

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	Calibration certificate in Appendix E
Frequency	10 MHz to >6 GHz (dosimetry); Linearity: ± 0.2 dB (30 MHz to 6 GHz)
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)
Dynamic Range	10 μ W/g to > 100 mW/g, Linearity: ± 0.2 dB
Dimensions	Overall length: 330 mm Tip length: 10 mm Body diameter: 12 mm Tip diameter: 2.5 mm
Application	Distance from probe tip to dipole centers: 1.0 mm General dosimetry up to 6 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.

The phantom used for all Body SAR tests i.e. for both system checks and device testing, was a "Triple Flat Phantom", also manufactured by SPEAG; this phantom conform to the requirements of FCC published RF exposure KDB procedures.

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 published RF Exposure KDB Procedures. All tests were carried out using simulants whose dielectric parameters were within $\pm 5\%$ 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 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):

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

2450MHz band

Ingredient	Head (% by weight)	Body (% by weight)
Deionised Water	56.0	70.20
Tween 20	44.0	29.62
Salt	-	0.18

4.4 System validation and System checking

4.4.1 System validation status

Probe Calibration Point f / MHz	Test System	DASY SW	Dipole Type / SN	Probe Type / SN	Calibrated signal type(s)	DAE unit Type / SN	Validation done	
							Head tissue simulant	Body tissue simulant
835	TCC Beijing / SAR-1	V52.8	D835V2 / 4d005	EX3DV4 / 3836	CW	DAE4 / 710	2013-03	2013-03
835	TCC Beijing / SAR-3	V52.8	D835V2 / 479	ES3DV3 / 3195	CW	DAE4 / 887	2013-08	-
1900	TCC Beijing / SAR-3	V52.8	D1900V2 / 509	ES3DV3 / 3195	CW	DAE4 / 887	2013-08	2013-09
2450	TCC Beijing / SAR-2	V52.8	D2450V2 / 760	ES3DV3 / 3280	CW	DAE4 / 1324	2013-09	-
2450	TCC Beijing / SAR-3	V52.8	D2450V2 / 760	ES3DV3 / 3195	CW	DAE4 / 887	-	2013-08

4.4.2 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 for head system checking, and under the flat phantom for body system checking. The system checking results (dielectric parameters and SAR values) are given in the table below.

System checking, head tissue simulant

f [MHz]	Description	SAR 1g [W/kg]	Estimated SAR 1g [W/kg]	Estimated SAR 1g Deviation	Dielectric Parameters		SAR 1g Deviation from target	Dielectric Parameters Deviation from target			Temp [°C]	Plot #
				dSAR [%]	ϵ_r	σ [S/m]		dSAR [%]	d ϵ_r [%]	d σ [%]		
	Tolerances			±3%			±10 %	±5 %	±5 %			
835	IEEE1528 / IEC62209				41.5	0.90						
	Reference result SN:4d005	2.32	-		41.5	0.89	TCC Bej/SAR-1 EX3DV4 SN:3836 Head 835MHz					
	2013-11-05	2.22	-	-	40.5	0.90	-4.31	-2.41	1.12		21.8	1
	Reference result SN:4d005	2.32	-		41.5	0.89	TCC Bej/SAR-3 EX3DV4 SN:3195 Head 835MHz					
	2013-11-11	2.34	-	-	40.4	0.92	0.86	-2.65	3.37		22.5	-
1900	IEEE1528 / IEC62209				40.0	1.40						
	Reference result SN:509	9.63	-		39.5	1.38	TCC Bej/SAR-3 ES3DV4 SN:3195 Head 1900MHz					
	2013-11-04	9.42	-	-	39.1	1.38	-2.18	-1.01	0.00		22.5	2
2450	IEEE1528 / IEC62209				39.2	1.80						
	Reference result SN:760	13.7	-		37.8	1.85	TCC Bej/SAR-2 ES3DV3 SN:3280 Head 2450MHz					
	2013-11-04	13.2	-	-	38.2	1.85	-3.65	1.06	0.00		21.9	3

System checking, body tissue simulant

f [MHz]	Description	SAR 1g [W/kg]	Estimated SAR 1g [W/kg]	Estimated SAR 1g Deviation	Dielectric Parameters		SAR 1g Deviation from target	Dielectric Parameters Deviation from target		Temp [°C]	Plot #
				dSAR [%]	ϵ_r	σ [S/m]	dSAR [%]	d ϵ_r [%]	d σ [%]		
	Tolerances			±3%			±10 %	±5 %	±5 %		
835	IEEE1528 / IEC62209				55.2	0.97					
	Reference result SN:4d005	2.42	-		55.0	1.00	TCC Bej/SAR-1 EX3DV4 SN3836 Body 835MHz				
	2013-11-08	2.47	-	-	54.3	0.96	2.07	-1.27	-4.00	21.9	4
1900	IEEE1528 / IEC62209				53.3	1.52					
	Reference result SN:509	9.84	-		52.2	1.52	TCC Bej/SAR-3 ES3DV4 SN:3195 Body 1900MHz				
	2013-11-06	9.95	-	-	51.9	1.54	1.12	-0.57	1.32	22.5	5
2450	IEEE1528 / IEC62209				52.7	1.95					
	Reference result SN:760	12.8	-		50.7	2.01	TCC Bej/SAR-3 EX3DV4 SN:3195 Body 2450MHz				
	2013-11-07	13.2	-	-	52.1	1.96	3.12	2.76	-2.49	22.5	6

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

4.5 Tissue Simulants used in the Measurements

Head tissue simulant measurements

f [MHz]	Description	Dielectric Parameters		Dielectric Parameters Deviation from recommended value		Temp [°C]
		ϵ_r	σ [S/m]	$d\epsilon_r$ [%]	$d\sigma$ [%]	
	Tolerances			± 5 %	± 5 %	
835	Recommended value	41.5	0.90			
	2013-11-11	40.4	0.92	-2.65	2.22	22.5
836	Recommended value	41.5	0.90			
	2013-11-05	40.5	0.90	-2.41	0.00	21.8
1880	Recommended value	40.0	1.40			
	2013-11-04	39.1	1.36	-2.25	-2.86	22.5
2437	Recommended value	39.2	1.79			
	2013-11-04	38.3	1.84	-2.30	2.79	21.9

Body tissue simulant measurements

f [MHz]	Description	Dielectric Parameters		Dielectric Parameters Deviation from Recommended value		Temp [°C]
		ϵ_r	σ [S/m]	$d\epsilon_r$ [%]	$d\sigma$ [%]	
	Tolerances			± 5 %	± 5 %	
835	Recommended value	55.2	0.97			
	2013-11-08	54.3	0.96	-1.63	-1.03	21.9
836	Recommended value	55.2	0.97			
	2013-11-08	54.2	0.96	-1.81	-1.03	21.9
1880	Recommended value	53.3	1.52			
	2013-11-06	51.9	1.52	-2.63	0.00	22.5
2437	Recommended value	52.7	1.94			
	2013-11-07	52.2	1.94	-0.95	0.00	22.5

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” and “tilt” positions 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".

5.2.2 Body Worn Configuration

The device was placed in the SPEAG holder using the Nokia spacer and placed below the flat section of the phantom. The distance between the device and the phantom was kept at the separation distance indicated in Section 1.2.2 using a separate flat spacer that was removed

before the start of the measurements. The device was oriented with both sides facing the phantom to find the highest results.

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	G_i	$G_i \cdot U_i$ (%)	V_i
Measurement System							
Probe Calibration	E2.1	±6.55	N	1	1	±6.55	∞
Axial Isotropy	E2.2	±4.7	R	$\sqrt{3}$	$(1-c_p)^{1/2}$	±1.9	∞
Hemispherical Isotropy	E2.2	±9.6	R	$\sqrt{3}$	$(c_p)^{1/2}$	±3.9	∞
Boundary Effect	E2.3	±1.0	R	$\sqrt{3}$	1	±0.6	∞
Linearity	E2.4	±4.7	R	$\sqrt{3}$	1	±2.7	∞
System Detection Limits	E2.5	±1.0	R	$\sqrt{3}$	1	±0.6	∞
Readout Electronics	E2.6	±1.0	N	1	1	±1.0	∞
Response Time	E2.7	±0.8	R	$\sqrt{3}$	1	±0.5	∞
Integration Time	E2.8	±2.6	R	$\sqrt{3}$	1	±1.5	∞
RF Ambient Conditions - Noise	E6.1	±3.0	R	$\sqrt{3}$	1	±1.7	∞
RF Ambient Conditions - Reflections	E6.1	±3.0	R	$\sqrt{3}$	1	±1.7	∞
Probe Positioner Mechanical Tolerance	E6.2	±0.4	R	$\sqrt{3}$	1	±0.2	∞
Probe Positioning with respect to Phantom Shell	E6.3	±2.9	R	$\sqrt{3}$	1	±1.7	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E5	±3.9	R	$\sqrt{3}$	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	±5.0	R	$\sqrt{3}$	1	±2.9	∞
Phantom and Tissue Parameters							
Phantom Uncertainty (shape and thickness tolerances)	E3.1	±4.0	R	$\sqrt{3}$	1	±2.3	∞
Conductivity Target - tolerance	E3.2	±5.0	R	$\sqrt{3}$	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	$\sqrt{3}$	0.6	±1.7	∞
Permittivity - measurement uncertainty	E3.3	±2.9	N	1	0.6	±1.7	5
Combined Standard Uncertainty			RSS			±13.5	116
Coverage Factor for 95%			k=2				
Expanded Uncertainty						±27.1	

7. RESULTS

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

850MHz Band Head SAR results

Mode	Device orientation	SAR measurement	Measured 1g SAR [W/kg]			Reported* 1g SAR [W/kg]			Max Deviation (Estimated SAR - Full SAR) [W/kg]	Plot #
			Ch 128 824.2 MHz	Ch 190 836.6 MHz	Ch 251 848.8 MHz	Ch 128 824.2 MHz	Ch 190 836.6 MHz	Ch 251 848.8 MHz		
GSM	Tuning Target + Tolerance [dBm]		32.90			Scaling factor*				
	Conducted Slot Average Power [dBm]		32.59	32.75	32.77	0.31	0.15	0.13	dB	
	Time-averaged power [dBm]		23.56	23.72	23.74	1.07	1.04	1.03	Lin	
	Left Cheek	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	0.588	-	-	0.609	-	-	-
	Left Tilt	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	-	-	-	-	-	-	-
	Right Cheek	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	-	-	-	-	-	-	-
	Right Tilt	Estimated SAR	-	-	-	-	-	-	-	-
Full SAR		-	-	-	-	-	-	-	-	
2-slot GPRS	Tuning Target + Tolerance [dBm]		29.90			Scaling factor*				
	Conducted Slot Average Power [dBm]		29.72	29.76	29.75	0.18	0.14	0.15	dB	
	Time-averaged power [dBm]		23.70	23.74	23.73	1.04	1.03	1.04	Lin	
	Left Cheek	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	0.646	-	-	0.667	-	-	-
	Left Tilt	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	0.344	-	-	0.355	-	-	-
	Right Cheek	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	0.673	0.680	0.743	0.701	0.702	0.769	-	1
	Right Tilt	Estimated SAR	-	-	-	-	-	-	-	-
Full SAR		-	0.353	-	-	0.365	-	-	-	
3-slot GPRS	Tuning Target + Tolerance [dBm]		28.10			Scaling factor*				
	Conducted Slot Average Power [dBm]		27.99	28.01	28.02	0.11	0.09	0.08	dB	
	Time-averaged power [dBm]		23.73	23.75	23.76	1.03	1.02	1.02	Lin	
	Left Cheek	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	0.650	-	-	0.664	-	-	-
	Left Tilt	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	-	-	-	-	-	-	-
	Right Cheek	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	-	-	-	-	-	-	-
	Right Tilt	Estimated SAR	-	-	-	-	-	-	-	-
Full SAR		-	-	-	-	-	-	-	-	

(850MHz Head SAR Table continues)

(850MHz Head SAR Table continues)

Mode	Device orientation	SAR measurement	Measured 1g SAR [W/kg]			Reported* 1g SAR [W/kg]			Max Deviation (Estimated SAR - Full SAR) [W/kg]	Plot #
			Ch 128 824.2 MHz	Ch 190 836.6 MHz	Ch 251 848.8 MHz	Ch 128 824.2 MHz	Ch 190 836.6 MHz	Ch 251 848.8 MHz		
4-slot GPRS	Tuning Target + Tolerance [dBm]		26.90			Scaling factor*				
	Conducted Slot Average Power [dBm]		26.59	26.67	26.64	0.31	0.23	0.26	dB	
	Time-averaged power [dBm]		23.58	23.66	23.63	1.07	1.05	1.06	Lin	
	Left Cheek	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	0.619	-	-	0.653	-		
	Left Tilt	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	-	-	-	-	-		
	Right Cheek	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	-	-	-	-	-		
	Right Tilt	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	-	-	-	-	-		
Mode	Device orientation	SAR measurement	Measured 1g SAR [W/kg]			Reported* 1g SAR [W/kg]			Max Deviation (Estimated SAR - Full SAR) [W/kg]	Plot #
			Ch 4132 826.4 MHz	Ch 4175 835.0 MHz	Ch 4233 846.6 MHz	Ch 4132 826.4 MHz	Ch 4175 835.0 MHz	Ch 4233 846.6 MHz		
WCDMA	Tuning Target + Tolerance [dBm]		23.90			Scaling factor*				
	Conducted Slot Average Power [dBm]		23.59	23.56	23.53	0.31	0.34	0.37	dB	
	Time-averaged power [dBm]		23.59	23.56	23.53	1.07	1.08	1.09	Lin	
	Left Cheek	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	0.658	-	-	0.712	-		
	Left Tilt	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	0.338	-	-	0.366	-		
	Right Cheek	Estimated SAR	-	-	-	-	-	-	-	2
		Full SAR	0.663	0.670	0.805	0.712	0.725	0.877		
	Right Tilt	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	0.390	-	-	0.422	-		

1900MHz Band Head SAR results

Mode	Device orientation	SAR measurement	Measured 1g SAR [W/kg]			Reported* 1g SAR [W/kg]			Max Deviation (Estimated SAR - Full SAR) [W/kg]	Plot #
			Ch 512 1850.2 MHz	Ch 661 1880.0 MHz	Ch 810 1909.8 MHz	Ch 512 1850.2 MHz	Ch 661 1880.0 MHz	Ch 810 1909.8 MHz		
GSM	Tuning Target + Tolerance [dBm]		30.40			Scaling factor*				
	Conducted Slot Average Power [dBm]		30.15	30.14	30.16	0.25	0.26	0.24	dB	
	Time-averaged power [dBm]		21.12	21.11	21.13	1.06	1.06	1.06	Lin	
	Left Cheek	Estimated SAR	-	-	-	-	-	-	-	3
		Full SAR	0.827	0.848	0.874	0.876	0.900	0.924		
	Left Tilt	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	0.179	-	-	0.190	-		
	Right Cheek	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	0.480	-	-	0.510	-		
Right Tilt	Estimated SAR	-	-	-	-	-	-	-	-	
	Full SAR	-	0.175	-	-	0.186	-			
2-slot GPRS	Tuning Target + Tolerance [dBm]		27.40			Scaling factor*				
	Conducted Slot Average Power [dBm]		27.17	27.24	27.28	0.23	0.16	0.12	dB	
	Time-averaged power [dBm]		21.15	21.22	21.26	1.05	1.04	1.03	Lin	
	Left Cheek	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	0.767	-	-	0.796	-		
	Left Tilt	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	-	-	-	-	-		
	Right Cheek	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	-	-	-	-	-		
Right Tilt	Estimated SAR	-	-	-	-	-	-	-	-	
	Full SAR	-	-	-	-	-	-			
3-slot GPRS	Tuning Target + Tolerance [dBm]		25.60			Scaling factor*				
	Conducted Slot Average Power [dBm]		25.25	25.44	25.43	0.35	0.16	0.17	dB	
	Time-averaged power [dBm]		20.99	21.18	21.17	1.08	1.04	1.04	Lin	
	Left Cheek	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	0.680	-	-	0.706	-		
	Left Tilt	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	-	-	-	-	-		
	Right Cheek	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	-	-	-	-	-		
Right Tilt	Estimated SAR	-	-	-	-	-	-	-	-	
	Full SAR	-	-	-	-	-	-			

(1900MHz Head SAR Table continues)

(1900MHz Head SAR Table continues)

Mode	Device orientation	SAR measurement	Measured 1g SAR [W/kg]			Reported* 1g SAR [W/kg]			Max Deviation (Estimated SAR - Full SAR) [W/kg]	Plot #
			Ch 512 1850.2 MHz	Ch 661 1880.0 MHz	Ch 810 1909.8 MHz	Ch 512 1850.2 MHz	Ch 661 1880.0 MHz	Ch 810 1909.8 MHz		
4-slot GPRS	Tuning Target + Tolerance [dBm]		24.40			Scaling factor*				
	Conducted Slot Average Power [dBm]		24.04	24.19	24.31	0.36	0.21	0.09	dB	
	Time-averaged power [dBm]		21.03	21.18	21.30	1.09	1.05	1.02	Lin	
	Left Cheek	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	0.694	-	-	0.728	-	-	-
	Left Tilt	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	-	-	-	-	-	-	-
	Right Cheek	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	-	-	-	-	-	-	-
	Right Tilt	Estimated SAR	-	-	-	-	-	-	-	-
Full SAR		-	-	-	-	-	-	-	-	

2450MHz Head SAR results

Mode	Device orientation	SAR measurement	Measured 1g SAR [W/kg]			Reported* 1g SAR [W/kg]			Max Deviation (Estimated SAR - Full SAR) [W/kg]	Plot #
			Ch 1	Ch 6	Ch 11	Ch 1	Ch 6	Ch 11		
			2412.0 MHz	2437.0 MHz	2462.0 MHz	2412.0 MHz	2437.0 MHz	2462.0 MHz		
WLAN b-mode BPSK 1Mbps	Tuning Target + Tolerance [dBm]		16.50			Scaling factor*				
	Conducted Power [dBm]		15.28	15.51	16.01	1.22	0.99	0.49	dB	
	Time-averaged power [dBm]		15.28	15.51	16.01	1.32	1.26	1.12	Lin	
	Left Cheek	Estimated SAR	-	-	-	-	-	-	-	4
		Full SAR	0.291	0.293	0.295	0.385	0.368	0.330		
	Left Tilt	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	0.119	-	-	0.149	-		
	Right Cheek	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	0.149	-	-	0.187	-		
	Right Tilt	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	0.089	-	-	0.112	-		

**Simultaneous transmissions: Combined head SAR results –
Individual band Max results**

Test configuration	Max. Reported* 1g SAR results			
	WLAN	2-slot GPRS850	WCDMA 850	GSM 1900
Head: Left, Cheek	0.385	0.667	0.712	0.924
Head: Left, Tilt	0.149	0.355	0.366	0.190
Head: Right, Cheek	0.187	0.769	0.877	0.510
Head: Right, Tilt	0.112	0.365	0.422	0.186

**Simultaneous transmissions: Combined head SAR results –
Max + Max combined results**

Test configuration	Max. Reported* 1g SAR results		
	2-slot GPRS850 + WLAN	WCDMA 850 + WLAN	GSM 1900 + WLAN
Head: Left, Cheek	1.05	1.10	1.31
Head: Left, Tilt	0.504	0.515	0.339
Head: Right, Cheek	0.956	1.06	0.697
Head: Right, Tilt	0.477	0.534	0.298

Note: Simultaneous Transmission Procedures as described in KDB648474 are not required for this product. The Combined SAR data given in the tables below has been voluntarily calculated.

7.1.1 Combined Head SAR data

The Combined SAR data given in the tables below has been voluntarily calculated and should be ignored for FCC certification.

The following table gives a more accurate assessment of the SAR values for simultaneous transmission. These values have been calculated using the SPEAG Combined Multiband algorithm, which is based on area scans. It a) converts the 2D area scans into 3D volume scans by assuming frequency-dependent decay characteristics for the E-field, b) sums the SAR values for WLAN2450 and the cellular bands point-by-point and c) calculates the combined average SAR values. It is these values that appear in the Summary table in Section 1.2.1.

**Simultaneous transmissions: Combined head SAR results –
SPEAG Combined Multiband algorithm results**

Test configuration	Max. Reported* 1g SAR results		
	2-slot GPRS850 + WLAN	WCDMA 850 + WLAN	GSM 1900 + WLAN
Head: Left, Cheek	0.753	0.826	0.905
Head: Left, Tilt	-	-	-
Head: Right, Cheek	-	-	-
Head: Right, Tilt	-	-	-

All of the Combined SAR values in the above table are less than the maximum SAR values for the contributing cellular band. This is due to a) minimal overlap of the SAR distributions of the cellular band with WLAN2450 and b) uncertainties associated with the different methods of calculation. In these cases, the maximum SAR values given for the combined Modes in the Summary table in Section 1.2 are those for the individual cellular band.

Note:

* Reported SAR values are scaled to, or measured at, upper limit of power tuning tolerance. In addition, SAR values are scaled up by 12% to cover measurement drift. As a consequence of this upward drift correction, the contribution of measurement drift to the overall measurement uncertainty (Section 6) is reduced to zero.

Highest result within individual zoom scan or individual expanded zoom scan results is given in Section 1.2 for each transmitter. Highest result within contributing individual zoom scan, individual expanded zoom scan, Speag combined algorithm or combined expanded zoom scan results are given in Section for each simultaneous transmitter combination.

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

850MHz Band Body SAR results

Mode	Device orientation		SAR measurement	Measured 1g SAR [W/kg]			Reported* 1g SAR [W/kg]			Max Deviation (Estimated SAR - Full SAR) [W/kg]	Plot #		
				Ch 128	Ch 190	Ch 251	Ch 128	Ch 190	Ch 251				
				824.2 MHz	836.6 MHz	848.8 MHz	824.2 MHz	836.6 MHz	848.8 MHz				
2-slot GPRS	Tuning Target + Tolerance [dBm]			29.90			Scaling factor*						
	Conducted Slot Average Power [dBm]			29.72	29.76	29.75	0.18	0.14	0.15	dB			
	Time-averaged power [dBm]			23.70	23.74	23.73	1.04	1.03	1.04	Lin			
	Back facing phantom	Without headset	Estimated SAR	-	-	-	-	-	-	-	-	8	
			Full SAR	0.631	0.580	0.545	0.658	0.599	0.564				
		Headset WH-108	Estimated SAR	-	-	-	-	-	-	-	-	-	-
			Full SAR	-	0.482	-	-	0.498	-				
	Display facing phantom	Without headset	Estimated SAR	-	-	-	-	-	-	-	-	-	-
			Full SAR	-	0.453	-	-	0.468	-				
		Headset WH-108	Estimated SAR	-	-	-	-	-	-	-	-	-	-
Full SAR			-	0.349	-	-	0.360	-					
Mode	Device orientation		SAR measurement	Measured 1g SAR [W/kg]			Reported* 1g SAR [W/kg]			Max Deviation (Estimated SAR - Full SAR) [W/kg]	Plot #		
				Ch 4132	Ch 4175	Ch 4233	Ch 4132	Ch 4175	Ch 4233				
				826.4 MHz	835.0 MHz	846.6 MHz	826.4 MHz	835.0 MHz	846.6 MHz				
WCDMA	Tuning Target + Tolerance [dBm]			23.90			Scaling factor*						
	Conducted Power [dBm]			23.59	23.56	23.53	0.31	0.34	0.37	dB			
	Time-averaged power [dBm]			23.59	23.56	23.53	1.07	1.08	1.09	Lin			
	Back facing phantom	Without headset	Estimated SAR	-	-	-	-	-	-	-	-	9	
			Full SAR	0.590	0.568	0.608	0.634	0.614	0.662				
		Headset WH-108	Estimated SAR	-	-	-	-	-	-	-	-	-	-
			Full SAR	-	0.467	-	-	0.505	-				
	Display facing phantom	Without headset	Estimated SAR	-	-	-	-	-	-	-	-	-	
			Full SAR	-	0.435	-	-	0.470	-				
		Headset WH-108	Estimated SAR	-	-	-	-	-	-	-	-	-	
Full SAR			-	0.362	-	-	0.391	-					

1900MHz Band Body SAR results

Mode	Device orientation		SAR measurement	Measured 1g SAR [W/kg]			Reported* 1g SAR [W/kg]			Max Deviation (Estimated SAR - Full SAR) [W/kg]	Plot #
				Ch 512 1850.2 MHz	Ch 661 1880.0 MHz	Ch 810 1909.8 MHz	Ch 512 1850.2 MHz	Ch 661 1880.0 MHz	Ch 810 1909.8 MHz		
GSM	Tuning Target + Tolerance [dBm]			30.40			Scaling factor*				
	Conducted Slot Average Power [dBm]			30.15	30.14	30.16	0.25	0.26	0.24	dB	
	Time-averaged power [dBm]			21.12	21.11	21.13	1.06	1.06	1.06	Lin	
	Back facing phantom	Without headset	Estimated SAR	-	-	-	-	-	-	-	-
			Full SAR	-	0.217	-	-	0.230	-	-	-
		Headset WH-108	Estimated SAR	-	-	-	-	-	-	-	-
			Full SAR	-	0.214	-	-	0.227	-	-	-
	Display facing phantom	Without headset	Estimated SAR	-	-	-	-	-	-	-	10
			Full SAR	0.242	0.245	0.265	0.256	0.260	0.280	-	-
		Headset WH-108	Estimated SAR	-	-	-	-	-	-	-	-
			Full SAR	-	0.233	-	-	0.247	-	-	-

2450MHz Body SAR results

Mode	Device orientation		SAR measurement	Measured 1g SAR [W/kg]			Reported* 1g SAR [W/kg]			Max Deviation (Estimated SAR - Full SAR) [W/kg]	Plot #
				Ch 1 2412.0 MHz	Ch 6 2437.0 MHz	Ch 11 2462.0 MHz	Ch 1 2412.0 MHz	Ch 6 2437.0 MHz	Ch 11 2462.0 MHz		
WLAN b-mode BPSK 1 Mbps	Tuning Target + Tolerance [dBm]			16.50			Scaling factor*				
	Conducted Power [dBm]			15.28	15.51	16.01	1.22	0.99	0.49	dB	
	Time-averaged power [dBm]			15.28	15.51	16.01	1.32	1.26	1.12	Lin	
	Back facing phantom	Without headset	Estimated SAR	-	-	-	-	-	-	-	-
			Full SAR	-	0.075	-	-	0.094	-	-	-
		Headset WH-108	Estimated SAR	-	-	-	-	-	-	-	11
			Full SAR	0.078	0.081	0.084	0.103	0.102	0.094	-	-
	Display facing phantom	Without headset	Estimated SAR	-	-	-	-	-	-	-	-
			Full SAR	-	0.036	-	-	0.046	-	-	-
		Headset WH-108	Estimated SAR	-	-	-	-	-	-	-	-
			Full SAR	-	0.031	-	-	0.038	-	-	-

**Simultaneous transmissions: Combined body SAR results –
Individual band Max results**

Test configuration	Max. Reported*1g SAR results			
	WLAN	2-slot GPRS850	WCDMA 850	GSM 1900
Body: Back facing phantom, Without Headset	0.094	0.658	0.662	0.230
Body: Back facing phantom, Headset WH-108	0.103	0.498	0.505	0.227
Body: Display facing phantom, Without Headset	0.046	0.468	0.470	0.280
Body: Display facing phantom, Headset WH-108	0.038	0.360	0.391	0.247

**Simultaneous transmissions: Combined body SAR results –
Max + Max combined results**

Test configuration	Max. Reported*1g SAR results		
	2-slot GPRS850 + WLAN	WCDMA 850 + WLAN	GSM 1900 + WLAN
Body: Back facing phantom, Without Headset	0.752	0.756	0.324
Body: Back facing phantom, Headset WH-108	0.601	0.608	0.330
Body: Display facing phantom, Without Headset	0.514	0.516	0.326
Body: Display facing phantom, Headset WH-108	0.398	0.429	0.285

Note: Simultaneous Transmission Procedures as described in KDB648474 are not required for this product. The Combined SAR data given in the tables below has been voluntarily calculated.

7.2.1 Combined Body SAR data

The Combined SAR data given in the tables below has been voluntarily calculated and should be ignored for FCC certification.

The following table gives a more accurate assessment of the SAR values for simultaneous transmission. These values have been calculated using the SPEAG Combined Multiband algorithm, which is based on area scans. It a) converts the 2D area scans into 3D volume scans by assuming frequency-dependent decay characteristics for the E-field, b) sums the SAR values for WLAN2450 and the cellular bands point-by-point and c) calculates the combined average SAR values.

**Simultaneous transmissions: Combined body SAR results –
SPEAG Combined Multiband algorithm results**

Test configuration	Max. Reported*1g SAR results		
	2-slot GPRS850 + WLAN	WCDMA 850 + WLAN	GSM 1900 + WLAN
Body: Back facing phantom, Without Headset	0.711	0.720	-
Body: Back facing phantom, Headset WH-108	-	-	0.280
Body: Display facing phantom, Without Headset	-	-	-
Body: Display facing phantom, Headset WH-108	-	-	-

Some of the Combined SAR values in the above table are less than the maximum SAR values for the contributing cellular band. This is due to a) minimal overlap of the SAR distributions of the cellular band with WLAN2450 and b) uncertainties associated with the different methods of calculation. In these cases, the maximum SAR values given for the combined Modes in the Summary table in Section 1.2 are those for the individual cellular band.

Note:

* Reported SAR values are scaled to, or measured at, upper limit of power tuning tolerance. In addition, SAR values are scaled up by 12% to cover measurement drift. As a consequence of this upward drift correction, the contribution of measurement drift to the overall measurement uncertainty (Section 6) is reduced to zero.

Highest result within individual zoom scan or individual expanded zoom scan results is given in Section 1.2 for each transmitter. Highest result within contributing individual zoom scan, individual expanded zoom scan, Speag combined algorithm or combined expanded zoom scan results are given in Section for each simultaneous transmitter combination.

Plots of the Measurement scans are given in Appendix B.

APPENDIX A: SYSTEM CHECKING SCANS

Plot1:

Date/Time: 2013-11-05 9:18:28

Test Laboratory: TCC Nokia

Type: D835V2; Serial: 4d005

Communication System: CW835

Frequency: 835 MHz; Duty Cycle: 1:1

Medium: Head 835 SAR1; Medium Notes: Medium Temperature: $t=21.8$

Medium parameters used: $f = 835$ MHz; $\sigma = 0.896$ S/m; $\epsilon_r = 40.543$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN3836
- ConvF(9.03, 9.03, 9.03); Calibrated: 2013-03-08;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn858; Calibrated: 2013-03-07
- Phantom: SAR1 - SAM1; Type: Not Specified; Serial: Not Specified
- Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.8 (7028)

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

Maximum value of SAR (interpolated) = 2.34 W/kg

d=15mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 51.537 V/m

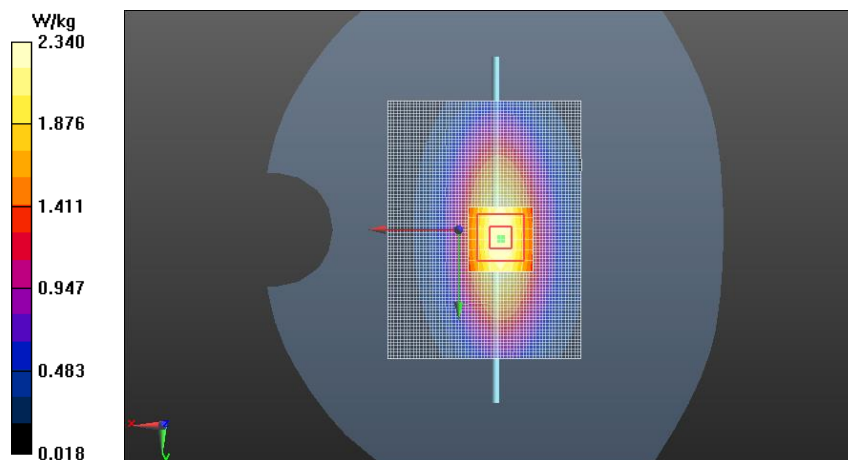
Peak SAR (extrapolated) = 3.35 W/kg

SAR(1 g) = 2.22 W/kg

SAR(10 g) = 1.45 W/kg

Power Drift = -0.04 dB

Maximum value of SAR (measured) = 2.40 W/kg



Plot2:

Date/Time: 2013-11-04 9:43:51

Test Laboratory: TCC Nokia
Type: D1900V2; Serial: 509

Communication System: CW1900

Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: Head 1900 SAR3; Medium Notes: Medium Temperature: t=22.5 C

Medium parameters used: $f = 1900 \text{ MHz}$; $\sigma = 1.38 \text{ S/m}$; $\epsilon_r = 39.05$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY Configuration:

- Probe: ES3DV3 - SN3195
- ConvF(5.14, 5.14, 5.14); Calibrated: 2013-03-08;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn887; Calibrated: 2013-03-07
- Phantom: SAR3 - SAM2 ; Type: Not Specified; Serial: Not Specified
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.8 (7028)

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

Maximum value of SAR (interpolated) = 11.4 W/kg

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

Reference Value = 89.721 V/m

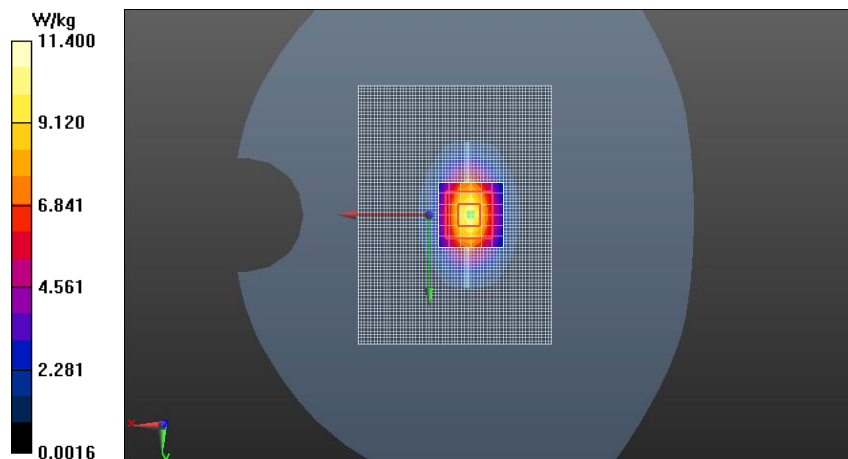
Peak SAR (extrapolated) = 16.9 W/kg

SAR(1 g) = 9.42 W/kg

SAR(10 g) = 4.93 W/kg

Power Drift = -0.07 dB

Maximum value of SAR (measured) = 10.7 W/kg



Plot3:

Date/Time: 2013-11-04 10:05:14

Test Laboratory: TCC Nokia

Type: D2450V2; Serial: D2450V2 - SN:760

Communication System: CW2450

Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: Head 2450 SAR2; Medium Notes: Medium Temperature: t=21.9C

Medium parameters used: f = 2450 MHz; $\sigma = 1.851$ S/m; $\epsilon_r = 38.236$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY Configuration:

- Probe: ES3DV3 - SN3280
- ConvF(4.57, 4.57, 4.57); Calibrated: 2013-03-08;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1324; Calibrated: 2013-03-06
- Phantom: SAR2 - SAM2; Type: Not Specified; Serial: Not Specified
- Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.8 (7028)

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

Maximum value of SAR (interpolated) = 15.4 W/kg

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

Reference Value = 90.532 V/m

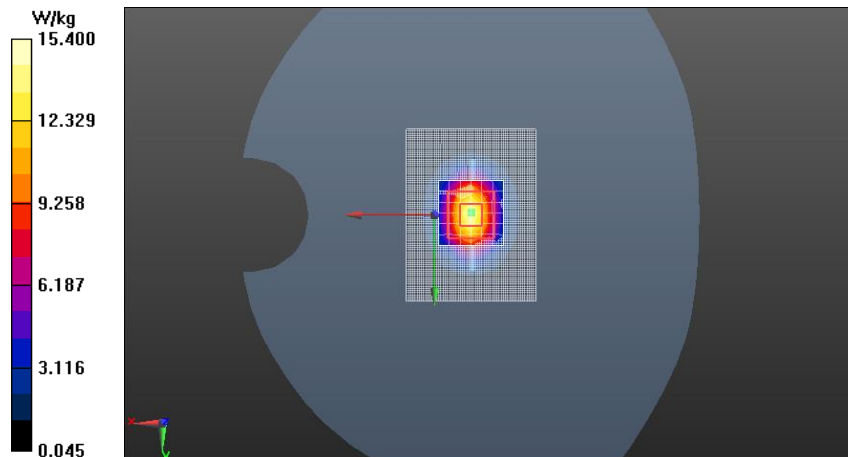
Peak SAR (extrapolated) = 27.5 W/kg

SAR(1 g) = 13.2 W/kg

SAR(10 g) = 6.17 W/kg

Power Drift = 0.16 dB

Maximum value of SAR (measured) = 15.2 W/kg



Plot4:

Date/Time: 2013-11-08 9:40:06

Test Laboratory: TCC Nokia

Type: D835V2; Serial: 4d005

Communication System: CW835

Frequency: 835 MHz; Duty Cycle: 1:1

Medium: Body 835 SAR1; Medium Notes: Medium Temperature: t=21.9

Medium parameters used: f = 835 MHz; $\sigma = 0.962$ S/m; $\epsilon_r = 54.249$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY Configuration:

- Probe: EX3DV4 - SN3836
- ConvF(8.97, 8.97, 8.97); Calibrated: 2013-03-08;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn858; Calibrated: 2013-03-07
- Phantom: SAR1 - TFP; Type: Not Specified; Serial: Not Specified
- Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.8 (7028)

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

Maximum value of SAR (interpolated) = 2.63 W/kg

d=15mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

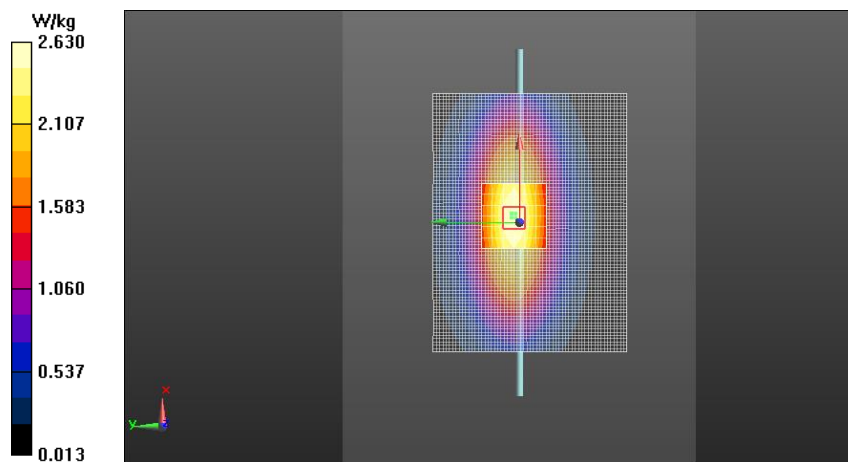
Reference Value = 52.133 V/m

Peak SAR (extrapolated) = 3.66 W/kg

SAR(1 g) = 2.47 W/kg

Maximum value of SAR (measured) = 2.67 W/kg

Power Drift = -0.02 dB



Plot5:

Date/Time: 2013-11-06 9:41:18

Test Laboratory: TCC Nokia
Type: D1900V2; Serial: 509

Communication System: CW1900

Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: Body 1900 SAR3; Medium Notes: Medium Temperature: $t=22.5$ C

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.535$ S/m; $\epsilon_r = 51.894$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY Configuration:

- Probe: ES3DV3 - SN3195
- ConvF(4.73, 4.73, 4.73); Calibrated: 2013-03-08;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn887; Calibrated: 2013-03-07
- Phantom: SAR3 - TFP; Type: Not Specified; Serial: Not Specified
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.8 (7028)

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

Maximum value of SAR (interpolated) = 12.2 W/kg

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

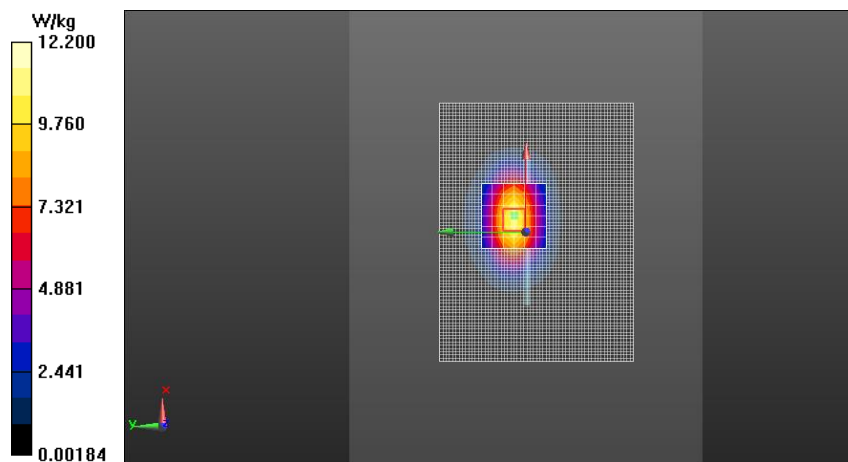
Reference Value = 76.323 V/m

Peak SAR (extrapolated) = 17.4 W/kg

SAR(1 g) = 9.95 W/kg

Maximum value of SAR (measured) = 11.2 W/kg

Power Drift = 0.05 dB



Plot6:

Date/Time: 2013-11-07 9:36:47

Test Laboratory: TCC Nokia

Type: D2450V2; Serial: D2450V2 - SN:760

Communication System: CW2450

Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: Body 2450 SAR3; Medium Notes: Medium Temperature: $t=22.5$ C

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.956$ S/m; $\epsilon_r = 52.106$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY Configuration:

- Probe: ES3DV3 - SN3195
- ConvF(4.31, 4.31, 4.31); Calibrated: 2013-03-08;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn887; Calibrated: 2013-03-07
- Phantom: SAR3 - TFP; Type: Not Specified; Serial: Not Specified
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.8 (7028)

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

Maximum value of SAR (interpolated) = 15.7 W/kg

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

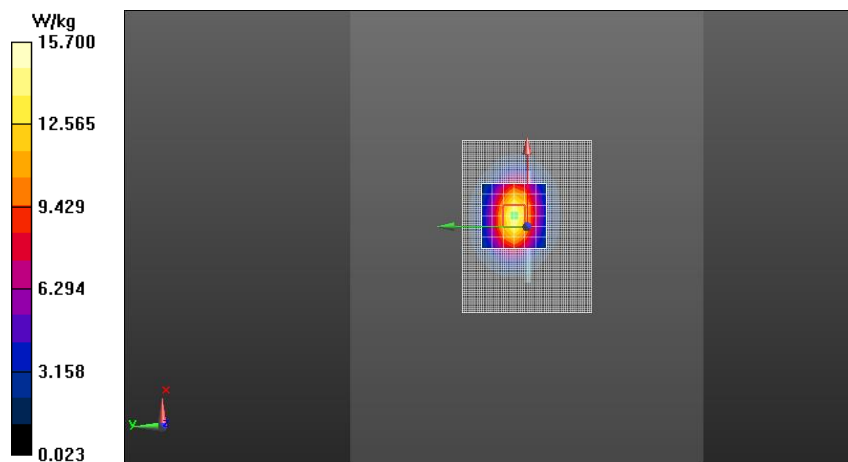
Reference Value = 74.557 V/m

Peak SAR (extrapolated) = 26.7 W/kg

SAR(1 g) = 13.2 W/kg

Maximum value of SAR (measured) = 15.1 W/kg

Power Drift = 0.01 dB



APPENDIX B: MEASUREMENT SCANS

Plot1:

Date/Time: 2013-11-05 12:05:24

Test Laboratory: TCC Nokia

Type: RM-959; Serial: 004402/47/520260/6

Communication System: 2-slot GPRS850

Frequency: 848.8 MHz; Duty Cycle: 1:4.19952

Medium: Head 835 SAR1; Medium Notes: Medium Temperature: t=21.8

Medium parameters used: f = 849 MHz; $\sigma = 0.91$ S/m; $\epsilon_r = 40.377$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY Configuration:

- Probe: EX3DV4 - SN3836
- ConvF(9.03, 9.03, 9.03); Calibrated: 2013-03-08;
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn858; Calibrated: 2013-03-07
- Phantom: SAR1 - SAM1; Type: Not Specified; Serial: Not Specified
- Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.8 (7028)

2-slot GPRS850 - Right/Cheek - High/Area Scan (61x91x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.797 W/kg

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

Reference Value = 11.743 V/m

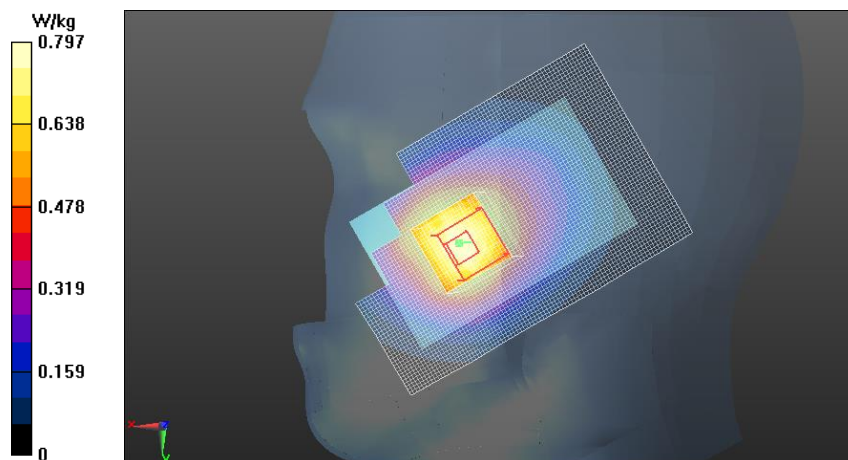
Peak SAR (extrapolated) = 0.959 W/kg

SAR(1 g) = 0.743 W/kg

SAR(10 g) = 0.542 W/kg

Power Drift = 0.04 dB

Maximum value of SAR (measured) = 0.781 W/kg



Plot2:

Date/Time: 2013-11-11 12:41:55

Test Laboratory: TCC Nokia

Type: RM-959; Serial: 004402/47/520260/6

Communication System: WCDMA850

Frequency: 846.6 MHz; Duty Cycle: 1:1

Medium: Head 835 SAR3; Medium Notes: Medium Temperature: t=22.5

Medium parameters used: $f = 847$ MHz; $\sigma = 0.931$ S/m; $\epsilon_r = 40.31$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY Configuration:

- Probe: ES3DV3 - SN3195
- ConvF(6.39, 6.39, 6.39); Calibrated: 2013-03-08;
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn887; Calibrated: 2013-03-07
- Phantom: SAR3 - SAM3; Type: Not Specified; Serial: Not Specified
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.8 (7028)

WCDMA850 (Band 5) - Right/Cheek - High/Area Scan (61x91x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.870 W/kg

WCDMA850 (Band 5) - Right/Cheek - High/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 10.352 V/m

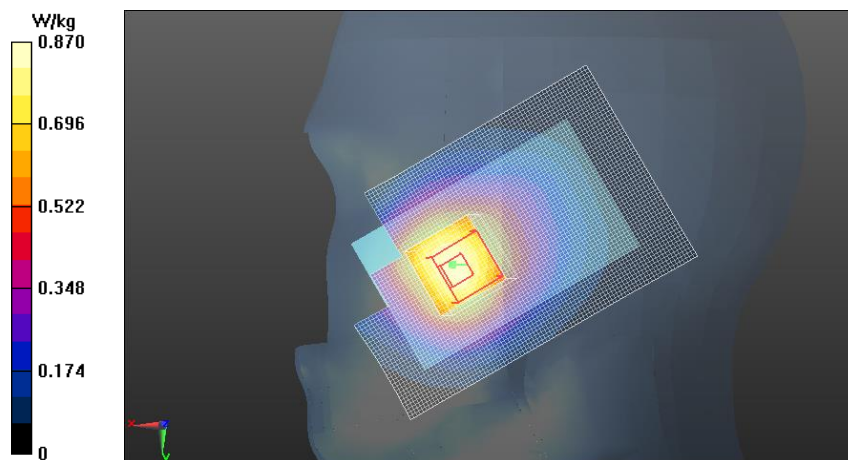
Peak SAR (extrapolated) = 1.01 W/kg

SAR(1 g) = 0.805 W/kg

SAR(10 g) = 0.586 W/kg

Power Drift = 0.09 dB

Maximum value of SAR (measured) = 0.855 W/kg



Plot3:

Date/Time: 2013-11-04 14:02:49

Test Laboratory: TCC Nokia

Type: RM-959; Serial: 004402/47/520260/6

Communication System: GSM1900

Frequency: 1909.8 MHz; Duty Cycle: 1:8.30042

Medium: Head 1900 SAR3; Medium Notes: Medium Temperature: t=22.5 C

Medium parameters used: f = 1910 MHz; σ = 1.389 S/m; ϵ_r = 39.026; ρ = 1000 kg/m³

Phantom section: Left Section

DASY Configuration:

- Probe: ES3DV3 - SN3195
- ConvF(5.14, 5.14, 5.14); Calibrated: 2013-03-08;
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn887; Calibrated: 2013-03-07
- Phantom: SAR3 - SAM2 ; Type: Not Specified; Serial: Not Specified
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.8 (7028)

GSM1900 - Left/Cheek - High/Area Scan (61x91x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.952 W/kg

GSM1900 - Left/Cheek - High/Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 6.764 V/m

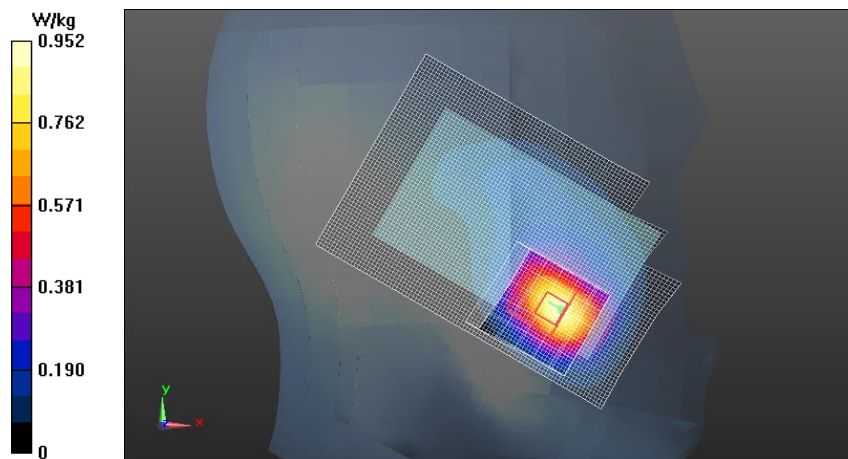
Peak SAR (extrapolated) = 1.59 W/kg

SAR(1 g) = 0.874 W/kg

SAR(10 g) = 0.464 W/kg

Power Drift = 0.10 dB

Maximum value of SAR (measured) = 0.941 W/kg



Plot4:

Date/Time: 2013-11-04 14:00:27

Test Laboratory: TCC Nokia

Type: RM-959; Serial: 004402/47/520252/3

Communication System: WLAN2450 b-mode

Frequency: 2412 MHz; Duty Cycle: 1:1

Medium: Head 2450 SAR2; Medium Notes: Medium Temperature: t=21.9C

Medium parameters used: f = 2412 MHz; σ = 1.813 S/m; ϵ_r = 38.459; ρ = 1000 kg/m³

Phantom section: Left Section

DASY Configuration:

- Probe: ES3DV3 - SN3280
- ConvF(4.57, 4.57, 4.57); Calibrated: 2013-03-08;
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1324; Calibrated: 2013-03-06
- Phantom: SAR2 - SAM2; Type: Not Specified; Serial: Not Specified
- Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.8 (7028)

WLAN2450 b-mode - Left/Cheek - Channel 1 - BPSK 1 Mbps/Area Scan (101x141x1): Interpolated grid:

dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.315 W/kg

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

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

Reference Value = 13.169 V/m

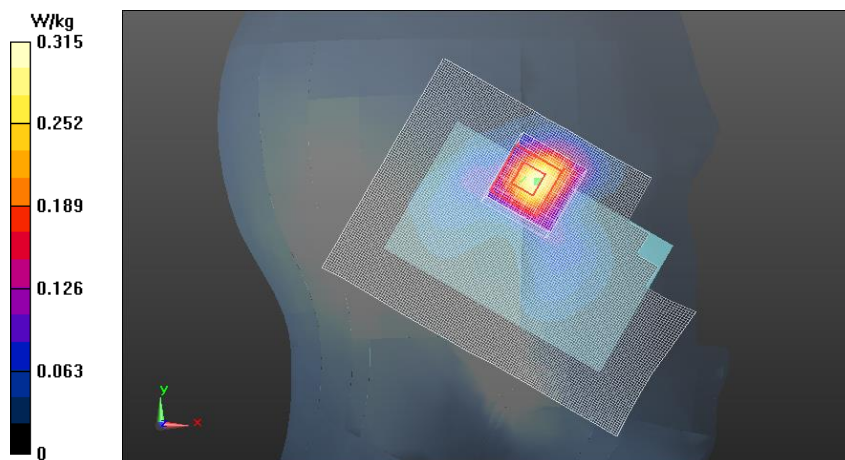
Peak SAR (extrapolated) = 0.663 W/kg

SAR(1 g) = 0.291 W/kg

SAR(10 g) = 0.132 W/kg

Power Drift = 0.07 dB

Maximum value of SAR (measured) = 0.328 W/kg



Plot5:

Date/Time: 2013-11-05 10:10:21

DASY Configuration for 2-slot GPRS850 - Left/Cheek - Middle/Area Scan:

Test Laboratory: TCC Nokia

Type: RM-959; Serial: 004402/47/520260/6

Communication System: 2-slot GPRS850; Frequency: 836.6 MHz; Duty Cycle: 1:4.19952; PMF: 2.04927

Medium: Head 835 SAR1 Medium parameters used: $f = 837$ MHz; $\sigma = 0.898$ S/m; $\epsilon_r = 40.518$; $\rho = 1000$ kg/m³

Phantom section: Left Section

Probe: EX3DV4 - SN3836; ConvF(9.03, 9.03, 9.03); Calibrated: 2013-03-08;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn858; Calibrated: 2013-03-07

Phantom: SAR1 - SAM1; Type: Not Specified; Serial: Not Specified

Measurement SW: DASY52, Version 52.8 (5)

Date/Time: 2013-11-04 14:00:27

DASY Configuration for WLAN2450 b-mode - Left/Cheek - Channel 1 - BPSK 1 Mbps/Area Scan:

Test Laboratory: TCC Nokia

Type: RM-959; Serial: 004402/47/520252/3

Communication System: WLAN2450 b-mode; Frequency: 2412 MHz; Duty Cycle: 1:1; PMF: 1

Medium: Head 2450 SAR2 Medium parameters used: $f = 2412$ MHz; $\sigma = 1.813$ S/m; $\epsilon_r = 38.459$; $\rho = 1000$ kg/m³

Phantom section: Left Section

Probe: ES3DV3 - SN3280; ConvF(4.57, 4.57, 4.57); Calibrated: 2013-03-08;

Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used))

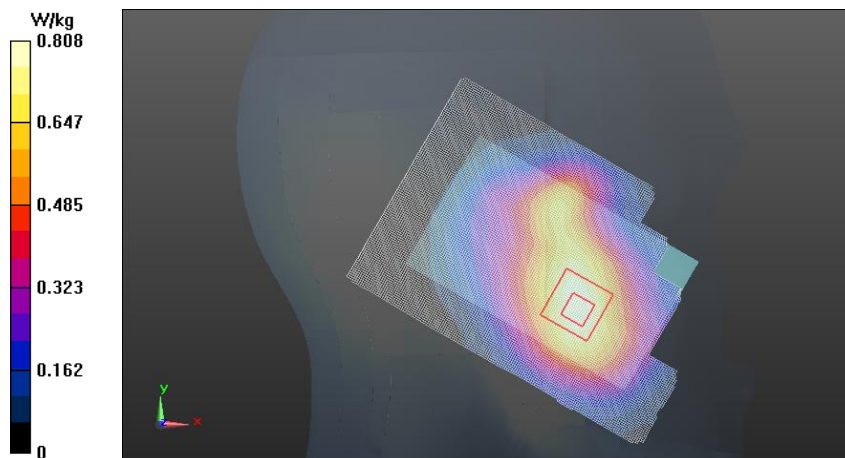
Electronics: DAE4 Sn1324; Calibrated: 2013-03-06

Phantom: SAR2 - SAM2; Type: Not Specified; Serial: Not Specified

Measurement SW: DASY52, Version 52.8 (5)

Fast SAR of Combined Scans: SAR(1 g) = 0.753 W/kg; SAR(10 g) = 0.511 W/kg

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



Note: 2-slot GPRS850 result was scaled by a factor of 1.04, WLAN result was scaled by a factor of 1.32 before combining.

Plot6:

Date/Time: 2013-11-11 10:38:14

DASY Configuration for WCDMA850 (Band 5) - Left/Cheek - Middle/Area Scan:

Test Laboratory: TCC Nokia

Type: RM-959; Serial: 004402/47/520260/6

Communication System: WCDMA850; Frequency: 835 MHz; Duty Cycle: 1:1; PMF: 1

Medium: Head 835 SAR3 Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.922 \text{ S/m}$; $\epsilon_r = 40.4$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Probe: ES3DV3 - SN3195; ConvF(6.39, 6.39, 6.39); Calibrated: 2013-03-08;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn887; Calibrated: 2013-03-07

Phantom: SAR3 - SAM3; Type: Not Specified; Serial: Not Specified

Measurement SW: DASY52, Version 52.8 (7)

Date/Time: 2013-11-04 14:00:27

DASY Configuration for WLAN2450 b-mode - Left/Cheek - Channel 1 - BPSK 1 Mbps/Area Scan:

Test Laboratory: TCC Nokia

Type: RM-959; Serial: 004402/47/520252/3

Communication System: WLAN2450 b-mode; Frequency: 2412 MHz; Duty Cycle: 1:1; PMF: 1

Medium: Head 2450 SAR2 Medium parameters used: $f = 2412 \text{ MHz}$; $\sigma = 1.813 \text{ S/m}$; $\epsilon_r = 38.459$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Probe: ES3DV3 - SN3280; ConvF(4.57, 4.57, 4.57); Calibrated: 2013-03-08;

Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used))

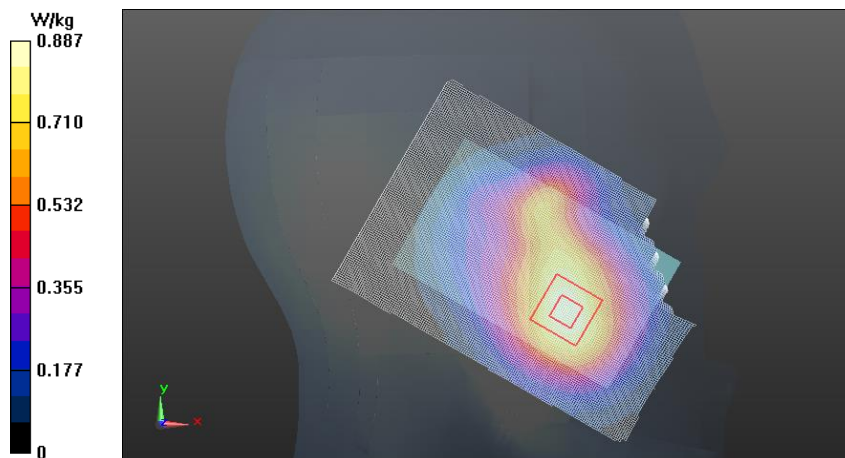
Electronics: DAE4 Sn1324; Calibrated: 2013-03-06

Phantom: SAR2 - SAM2; Type: Not Specified; Serial: Not Specified

Measurement SW: DASY52, Version 52.8 (5)

Fast SAR of Combined Scans: SAR(1 g) = 0.826 W/kg; SAR(10 g) = 0.560 W/kg

Maximum value of SAR (interpolated) = 0.887 W/kg



Note: WCDMA850 result was scaled by a factor of 1.09, WLAN result was scaled by a factor of 1.32 before combining.

Plot7:

Date/Time: 2013-11-04 14:02:49

DASY Configuration for GSM1900 - Left/Cheek - High/Area Scan:

Test Laboratory: TCC Nokia

Type: RM-959; Serial: 004402/47/520260/6

Communication System: GSM1900; Frequency: 1909.8 MHz; Duty Cycle: 1:8.30042; PMF: 2.88104

Medium: Head 1900 SAR3 Medium parameters used: $f = 1910$ MHz; $\sigma = 1.389$ S/m; $\epsilon_r = 39.026$; $\rho = 1000$ kg/m³

Phantom section: Left Section

Probe: ES3DV3 - SN3195; ConvF(5.14, 5.14, 5.14); Calibrated: 2013-03-08;
Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used))
Electronics: DAE4 Sn887; Calibrated: 2013-03-07
Phantom: SAR3 - SAM2; Type: Not Specified; Serial: Not Specified
Measurement SW: DASY52, Version 52.8 (7)

Date/Time: 2013-11-04 14:00:27

DASY Configuration for WLAN2450 b-mode - Left/Cheek - Channel 1 - BPSK 1 Mbps/Area Scan:

Test Laboratory: TCC Nokia

Type: RM-959; Serial: 004402/47/520252/3

Communication System: WLAN2450 b-mode; Frequency: 2412 MHz; Duty Cycle: 1:1; PMF: 1

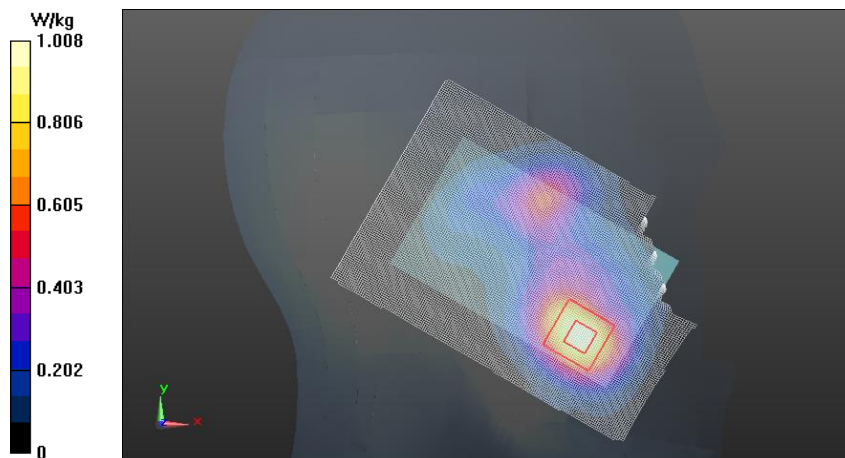
Medium: Head 2450 SAR2 Medium parameters used: $f = 2412$ MHz; $\sigma = 1.813$ S/m; $\epsilon_r = 38.459$; $\rho = 1000$ kg/m³

Phantom section: Left Section

Probe: ES3DV3 - SN3280; ConvF(4.57, 4.57, 4.57); Calibrated: 2013-03-08;
Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used))
Electronics: DAE4 Sn1324; Calibrated: 2013-03-06
Phantom: SAR2 - SAM2; Type: Not Specified; Serial: Not Specified
Measurement SW: DASY52, Version 52.8 (5)

Fast SAR of Combined Scans: SAR(1 g) = 0.905 W/kg; SAR(10 g) = 0.492 W/kg

Maximum value of SAR (interpolated) = 1.01 W/kg



Note: GSM1900 result was scaled by a factor of 1.06, WLAN result was scaled by a factor of 1.32 before combining.

Plot8:

Date/Time: 2013-11-08 10:52:35

Test Laboratory: TCC Nokia

Type: RM-959; Serial: 004402/47/520260/6

Communication System: 2-slot GPRS850

Frequency: 824.2 MHz; Duty Cycle: 1:4.19952

Medium: Body 835 SAR1; Medium Notes: Medium Temperature: t=21.9

Medium parameters used (interpolated): $f = 824.2$ MHz; $\sigma = 0.951$ S/m; $\epsilon_r = 54.332$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY Configuration:

- Probe: EX3DV4 - SN3836
- ConvF(8.97, 8.97, 8.97); Calibrated: 2013-03-08;
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn858; Calibrated: 2013-03-07
- Phantom: SAR1 - TFP; Type: Not Specified; Serial: Not Specified
- Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.8 (7028)

2-slot GPRS850/Body - Low - Spacer 15mm - No Headset - Back Facing Phantom/Area Scan (61x91x1):

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

Maximum value of SAR (interpolated) = 0.667 W/kg

2-slot GPRS850/Body - Low - Spacer 15mm - No Headset - Back Facing Phantom/Zoom Scan (5x5x7)/Cube 0:

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

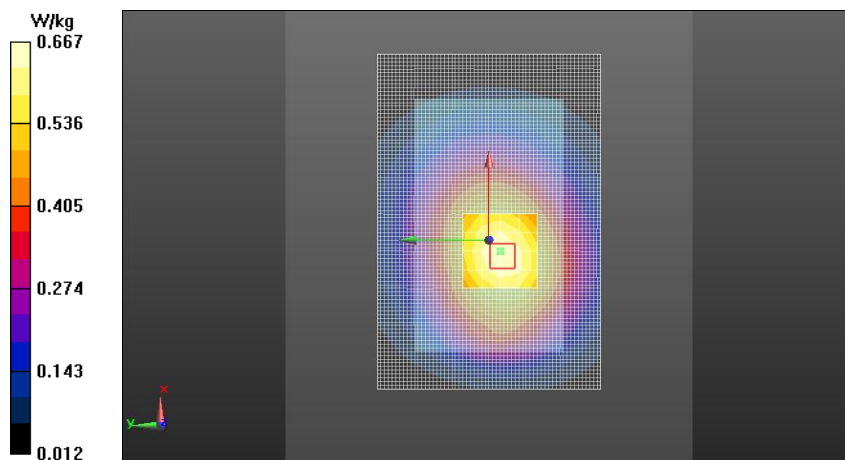
Reference Value = 26.528 V/m

Peak SAR (extrapolated) = 0.836 W/kg

SAR(1 g) = 0.631 W/kg

Maximum value of SAR (measured) = 0.669 W/kg

Power Drift = -0.02 dB



Plot9:

Date/Time: 2013-11-08 12:15:46

Test Laboratory: TCC Nokia

Type: RM-959; Serial: 004402/47/520260/6

Communication System: WCDMA850

Frequency: 846.6 MHz; Duty Cycle: 1:1

Medium: Body 835 SAR1; Medium Notes: Medium Temperature: t=21.9

Medium parameters used: f = 847 MHz; $\sigma = 0.974$ S/m; $\epsilon_r = 54.152$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY Configuration:

- Probe: EX3DV4 - SN3836
- ConvF(8.97, 8.97, 8.97); Calibrated: 2013-03-08;
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn858; Calibrated: 2013-03-07
- Phantom: SAR1 - TFP; Type: Not Specified; Serial: Not Specified
- Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.8 (7028)

WCDMA850 (Band 5)/Body - High - Spacer 15mm - No Headset - Back Facing Phantom/Area Scan (61x91x1):

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

Maximum value of SAR (interpolated) = 0.647 W/kg

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

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

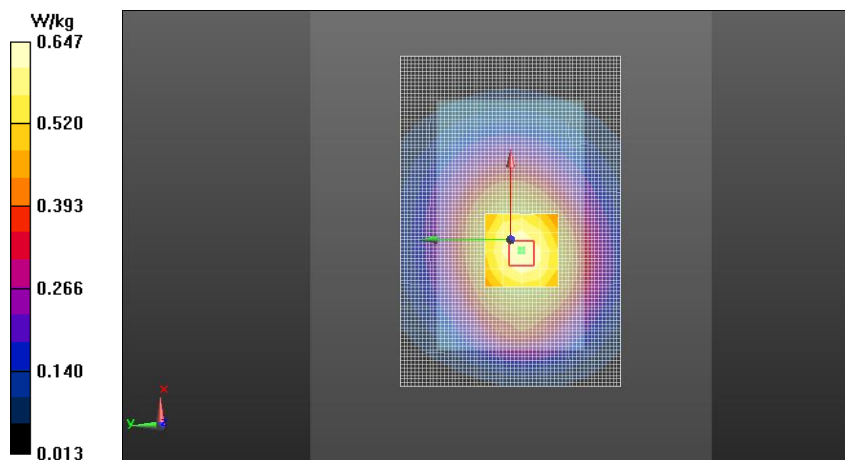
Reference Value = 26.002 V/m

Peak SAR (extrapolated) = 0.812 W/kg

SAR(1 g) = 0.608 W/kg

Maximum value of SAR (measured) = 0.647 W/kg

Power Drift = -0.03 dB



Plot10:

Date/Time: 2013-11-06 14:26:41

Test Laboratory: TCC Nokia

Type: RM-959; Serial: 004402/47/520260/6

Communication System: GSM1900

Frequency: 1909.8 MHz; Duty Cycle: 1:8.30042

Medium: Body 1900 SAR3; Medium Notes: Medium Temperature: t=22.5 C

Medium parameters used: f = 1910 MHz; σ = 1.544 S/m; ϵ_r = 51.869; ρ = 1000 kg/m³

Phantom section: Center Section

DASY Configuration:

- Probe: ES3DV3 - SN3195
- ConvF(4.73, 4.73, 4.73); Calibrated: 2013-03-08;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn887; Calibrated: 2013-03-07
- Phantom: SAR3 - TFP; Type: Not Specified; Serial: Not Specified
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.8 (7028)

GSM1900/Body - High - Spacer 15mm - No Headset - Display Facing Phantom/Area Scan (61x91x1):

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

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

GSM1900/Body - High - Spacer 15mm - No Headset - Display Facing Phantom/Zoom Scan (5x5x7)/Cube 0:

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

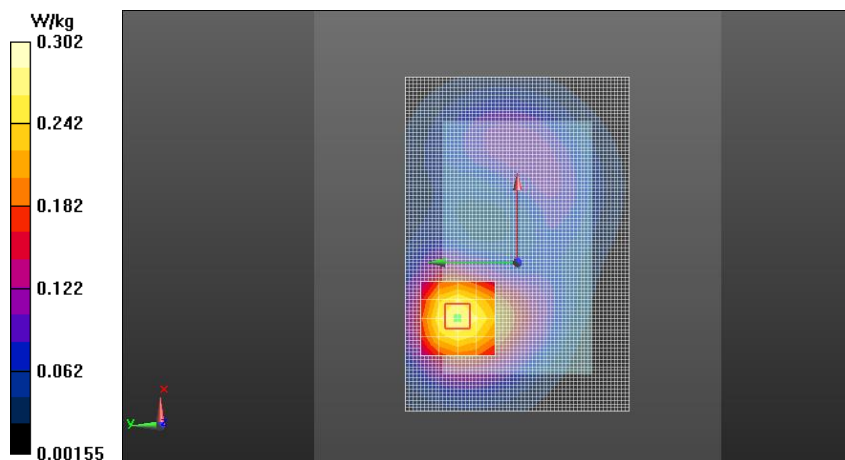
Reference Value = 5.715 V/m

Peak SAR (extrapolated) = 0.415 W/kg

SAR(1 g) = 0.265 W/kg

Maximum value of SAR (measured) = 0.287 W/kg

Power Drift = 0.06 dB



Plot11:

Date/Time: 2013-11-07 16:18:10

Test Laboratory: TCC Nokia

Type: RM-959; Serial: 004402/47/520252/3

Communication System: WLAN2450 b-mode

Frequency: 2412 MHz; Duty Cycle: 1:1

Medium: Body 2450 SAR3; Medium Notes: Medium Temperature: t=22.5 C

Medium parameters used: f = 2412 MHz; $\sigma = 1.907$ S/m; $\epsilon_r = 52.265$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY Configuration:

- Probe: ES3DV3 - SN3195
- ConvF{4.31, 4.31, 4.31}; Calibrated: 2013-03-08;
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn887; Calibrated: 2013-03-07
- Phantom: SAR3 - TFP; Type: Not Specified; Serial: Not Specified
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.8 (7028)

WLAN2450 b-mode/Body - Channel 1 - BPSK 1 Mbps - Spacer 15mm - WH-108 - Back Facing Phantom/Area Scan (101x141x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.0836 W/kg

WLAN2450 b-mode/Body - Channel 1 - BPSK 1 Mbps - Spacer 15mm - WH-108 - Back Facing Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

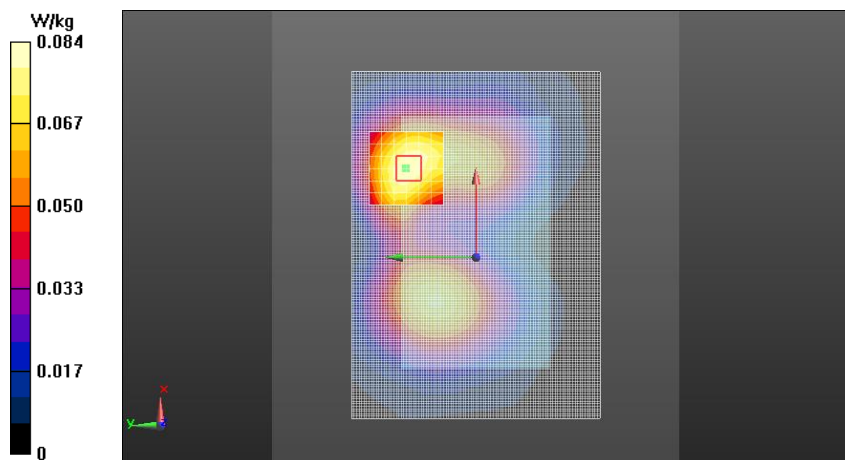
Reference Value = 3.845 V/m

Peak SAR (extrapolated) = 0.139 W/kg

SAR(1 g) = 0.078 W/kg

Maximum value of SAR (measured) = 0.0839 W/kg

Power Drift = 0.13 dB



Plot12:

Date/Time: 2013-11-08 10:52:35

DASY Configuration for 2-slot GPRS850/Body - Low - Spacer 15mm - No Headset - Back Facing Phantom/Area Scan:

Test Laboratory: TCC Nokia

Type: RM-959; Serial: 004402/47/520260/6

Communication System: 2-slot GPRS850; Frequency: 824.2 MHz; Duty Cycle: 1:4.19952; PMF: 2.04927

Medium: Body 835 SAR1 Medium parameters used (interpolated): $f = 824.2$ MHz; $\sigma = 0.951$ S/m; $\epsilon_r = 54.332$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Probe: EX3DV4 - SN3836; ConvF(8.97, 8.97, 8.97); Calibrated: 2013-03-08;
Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used))
Electronics: DAE4 Sn858; Calibrated: 2013-03-07
Phantom: SAR1 - TFP; Type: Not Specified; Serial: Not Specified
Measurement SW: DASY52, Version 52.8 (5)

Date/Time: 2013-11-07 15:49:02

DASY Configuration for WLAN2450 b-mode/Body - Channel 6 - BPSK 1 Mbps - Spacer 15mm - No Headset - Back Facing Phantom/Area Scan:

Test Laboratory: TCC Nokia

Type: RM-959; Serial: 004402/47/520252/3

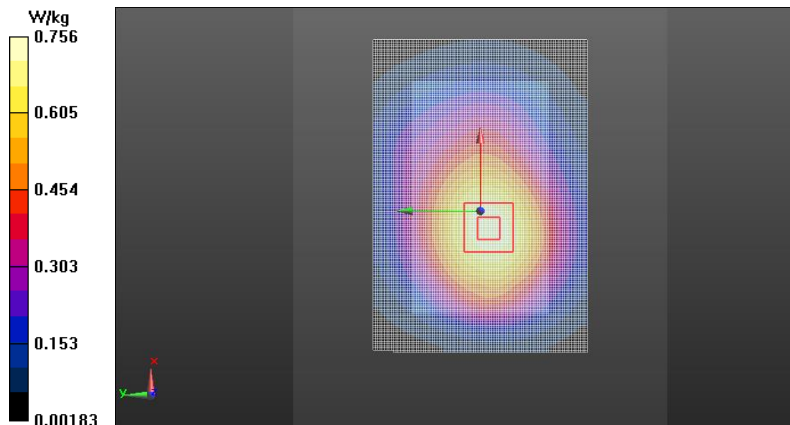
Communication System: WLAN2450 b-mode; Frequency: 2437 MHz; Duty Cycle: 1:1; PMF: 1

Medium: Body 2450 SAR3 Medium parameters used: $f = 2437$ MHz; $\sigma = 1.937$ S/m; $\epsilon_r = 52.161$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Probe: ES3DV3 - SN3195; ConvF(4.31, 4.31, 4.31); Calibrated: 2013-03-08;
Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used))
Electronics: DAE4 Sn887; Calibrated: 2013-03-07
Phantom: SAR3 - TFP; Type: Not Specified; Serial: Not Specified
Measurement SW: DASY52, Version 52.8 (7)

Fast SAR of Combined Scans: SAR(1 g) = 0.711 W/kg; SAR(10 g) = 0.492 W/kg
Maximum value of SAR (interpolated) = 0.756 W/kg



Note: 2-slot GPRS850 result was scaled by a factor of 1.04, WLAN result was scaled by a factor of 1.26 before combining.

Plot13:

Date/Time: 2013-11-08 12:15:46

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

Test Laboratory: TCC Nokia

Type: RM-959; Serial: 004402/47/520260/6

Communication System: WCDMA850; Frequency: 846.6 MHz; Duty Cycle: 1:1; PMF: 1

Medium: Body 835 SAR1 Medium parameters used: $f = 847$ MHz; $\sigma = 0.974$ S/m; $\epsilon_r = 54.152$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Probe: EX3DV4 - SN3836; ConvF(8.97, 8.97, 8.97); Calibrated: 2013-03-08;
Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used))
Electronics: DAE4 Sn858; Calibrated: 2013-03-07
Phantom: SAR1 - TFP; Type: Not Specified; Serial: Not Specified
Measurement SW: DASY52, Version 52.8 (5)

Date/Time: 2013-11-07 15:49:02

DASY Configuration for WLAN2450 b-mode/Body - Channel 6 - BPSK 1 Mbps - Spacer 15mm - No Headset - Back Facing Phantom/Area Scan:

Test Laboratory: TCC Nokia

Type: RM-959; Serial: 004402/47/520252/3

Communication System: WLAN2450 b-mode; Frequency: 2437 MHz; Duty Cycle: 1:1; PMF: 1

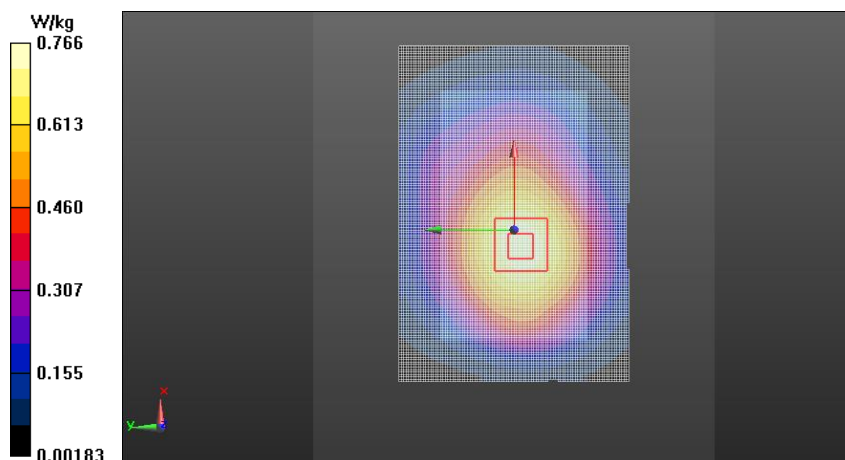
Medium: Body 2450 SAR3 Medium parameters used: $f = 2437$ MHz; $\sigma = 1.937$ S/m; $\epsilon_r = 52.161$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Probe: ES3DV3 - SN3195; ConvF(4.31, 4.31, 4.31); Calibrated: 2013-03-08;
Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used))
Electronics: DAE4 Sn887; Calibrated: 2013-03-07
Phantom: SAR3 - TFP; Type: Not Specified; Serial: Not Specified
Measurement SW: DASY52, Version 52.8 (7)

Fast SAR of Combined Scans: SAR(1 g) = 0.720 W/kg; SAR(10 g) = 0.497 W/kg

Maximum value of SAR (interpolated) = 0.766 W/kg



Note: WCDMA850 result was scaled by a factor of 1.09, WLAN result was scaled by a factor of 1.26 before combining.

Plot14:

Date/Time: 2013-11-06 13:06:24

DASY Configuration for GSM1900/Body - Middle - Spacer 15mm - WH-108 - Back Facing Phantom/Area Scan:

Test Laboratory: TCC Nokia

Type: RM-959; Serial: 004402/47/520260/6

Communication System: GSM1900; Frequency: 1880 MHz; Duty Cycle: 1:8.30042; PMF: 2.88104

Medium: Body 1900 SAR3 Medium parameters used: $f = 1880$ MHz; $\sigma = 1.516$ S/m; $\epsilon_r = 51.925$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Probe: ES3DV3 - SN3195; ConvF(4.73, 4.73, 4.73); Calibrated: 2013-03-08;
Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used))
Electronics: DAE4 Sn887; Calibrated: 2013-03-07
Phantom: SAR3 - TFP; Type: Not Specified; Serial: Not Specified
Measurement SW: DASY52, Version 52.8 (7)

Date/Time: 2013-11-07 16:18:10

DASY Configuration for WLAN2450 b-mode/Body - Channel 1 - BPSK 1 Mbps - Spacer 15mm - WH-108 - Back Facing Phantom/Area Scan:

Test Laboratory: TCC Nokia

Type: RM-959; Serial: 004402/47/520252/3

Communication System: WLAN2450 b-mode (0); Frequency: 2412 MHz; Duty Cycle: 1:1; PMF: 1

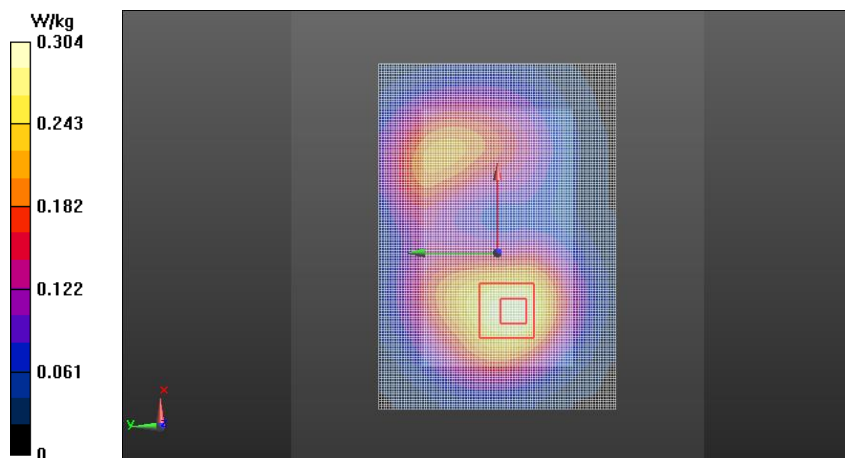
Medium: Body 2450 SAR3 Medium parameters used: $f = 2412$ MHz; $\sigma = 1.907$ S/m; $\epsilon_r = 52.265$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Probe: ES3DV3 - SN3195; ConvF(4.31, 4.31, 4.31); Calibrated: 2013-03-08;
Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used))
Electronics: DAE4 Sn887; Calibrated: 2013-03-07
Phantom: SAR3 - TFP; Type: Not Specified; Serial: Not Specified
Measurement SW: DASY52, Version 52.8 (7)

Fast SAR of Combined Scans: SAR(1 g) = 0.280 W/kg; SAR(10 g) = 0.166 W/kg

Maximum value of SAR (interpolated) = 0.304 W/kg



Note: GSM1900 result was scaled by a factor of 1.06, WLAN result was scaled by a factor of 1.32 before combining.

APPENDIX C: DIELECTRIC PARAMETERS OF THE TISSUE SIMULANTS

Head tissue simulant dielectric parameters used in the measurements:

f (MHz)	Date	Dielectric Parameters					
		824.2MHz		837.0MHz		849.0MHz	
		ϵ_r	σ [S/m]	ϵ_r	σ [S/m]	ϵ_r	σ [S/m]
GSM/GPRS850	2013-11-05	40.7	0.88	40.5	0.90	40.4	0.91
f (MHz)	Date	Dielectric Parameters					
		826.0MHz		835.0MHz		847.0MHz	
		ϵ_r	σ [S/m]	ϵ_r	σ [S/m]	ϵ_r	σ [S/m]
WCDMA850	2013-11-11	40.5	0.92	40.4	0.92	40.3	0.93
f (MHz)	Date	Dielectric Parameters					
		1850.0MHz		1880.0MHz		1910.0MHz	
		ϵ_r	σ [S/m]	ϵ_r	σ [S/m]	ϵ_r	σ [S/m]
GSM/GPRS1900	2013-11-04	39.2	1.33	39.1	1.36	39.0	1.39
f (MHz)	Date	Dielectric Parameters					
		2412.0MHz		2437.0MHz		2462.0MHz	
		ϵ_r	σ [S/m]	ϵ_r	σ [S/m]	ϵ_r	σ [S/m]
WLAN2450	2013-11-04	38.5	1.81	38.33	1.84	38.15	1.86

Body tissue simulant dielectric parameters used in the measurements:

f (MHz)	Date	Dielectric Parameters					
		824.2MHz		837.0MHz		849.0MHz	
		ϵ_r	σ [S/m]	ϵ_r	σ [S/m]	ϵ_r	σ [S/m]
GSM/GPRS850	2013-11-08	54.3	0.95	54.2	0.96	54.1	0.97
f (MHz)	Date	Dielectric Parameters					
		826.0MHz		835.0MHz		847.0MHz	
		ϵ_r	σ [S/m]	ϵ_r	σ [S/m]	ϵ_r	σ [S/m]
WCDMA850	2013-11-08	54.3	0.95	54.2	0.96	54.2	0.97
f (MHz)	Date	Dielectric Parameters					
		1850.0MHz		1880.0MHz		1910.0MHz	
		ϵ_r	σ [S/m]	ϵ_r	σ [S/m]	ϵ_r	σ [S/m]
GSM/GPRS1900	2013-11-06	52.0	1.49	51.9	1.51	51.9	1.54
f (MHz)	Date	Dielectric Parameters					
		2412.0MHz		2442.0MHz		2462.0MHz	
		ϵ_r	σ [S/m]	ϵ_r	σ [S/m]	ϵ_r	σ [S/m]
WLAN2450	2013-11-07	52.3	1.90	52.2	1.93	52.1	1.97

APPENDIX D: CONDUCTED AVERAGE POWER MEASUREMENTS FOR WCDMA AND HSUPA

Type: RM-959; Serial: 004402/47/520260/6, HW: 0309, SW: 1.1339.1

C.1. WCDMA850 Test results

Average power

Ch / f(MHz)	P [dBm]
4132 / 826.4	23.59
4175 / 835.0	23.56
4233 / 846.6	23.53

C.2. HSUPA850 Test results

Average power

Ch / f(MHz)	P [dBm]				
	Subtest mode 1	Subtest mode 2	Subtest mode 3	Subtest mode 4	Subtest mode 5
4132 / 826.4	21.84	20.34	21.34	20.59	21.84
4175 / 835.0	21.81	20.31	21.31	20.56	21.81
4233 / 846.6	21.78	20.28	21.28	20.53	21.78

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

Maximum Power Reduction (MPR)				
Subtest mode 1	Subtest mode 2	Subtest mode 3	Subtest mode 4	Subtest mode 5
1.5dB	2.0dB	1.0dB	2.0dB	0.0dB

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



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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

Client **Nokia Beijing TCC**

Certificate No: **EX3-3836_Mar13**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3836**

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

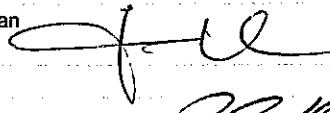
Calibration date: **March 8, 2013**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	31-Jan-13 (No. DAE4-660_Jan13)	Jan-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

Calibrated by:	Name Jeton Kastrati	Function Laboratory Technician	Signature 
Approved by:	Name Katja Pokovic	Function Technical Manager	Signature 
			Issued: March 8, 2013
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3836

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.40	0.47	0.45	$\pm 10.1 \%$
DCP (mV) ^B	89.8	101.7	96.3	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	143.5	$\pm 3.0 \%$
		Y	0.0	0.0	1.0		155.5	
		Z	0.0	0.0	1.0		149.3	

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

^A The uncertainties of NormX,Y,Z do not affect the E²-field uncertainty inside TSL (see Pages 5 and 6).

^B Numerical linearization parameter: uncertainty not required.

^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3836

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	41.9	0.89	9.44	9.44	9.44	0.80	0.60	± 12.0 %
835	41.5	0.90	9.03	9.03	9.03	0.79	0.60	± 12.0 %
1750	40.1	1.37	8.11	8.11	8.11	0.31	0.98	± 12.0 %
1900	40.0	1.40	7.79	7.79	7.79	0.35	0.92	± 12.0 %
2600	39.0	1.96	6.82	6.82	6.82	0.42	0.86	± 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: EX3DV4 - SN:3836

Calibration Parameter Determined in Body Tissue Simulating Media

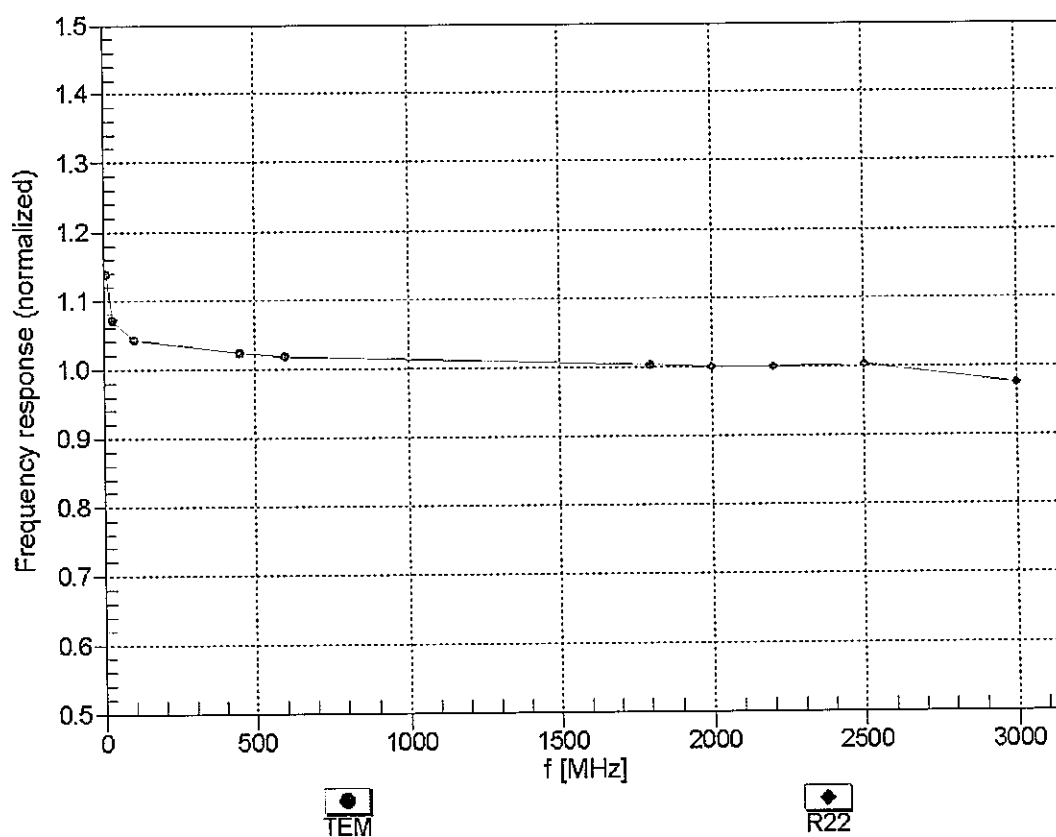
f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	9.07	9.07	9.07	0.80	0.61	± 12.0 %
835	55.2	0.97	8.97	8.97	8.97	0.70	0.67	± 12.0 %
1750	53.4	1.49	7.57	7.57	7.57	0.67	0.67	± 12.0 %
1900	53.3	1.52	7.18	7.18	7.18	0.80	0.61	± 12.0 %
2600	52.5	2.16	6.70	6.70	6.70	0.64	0.50	± 12.0 %

^C Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

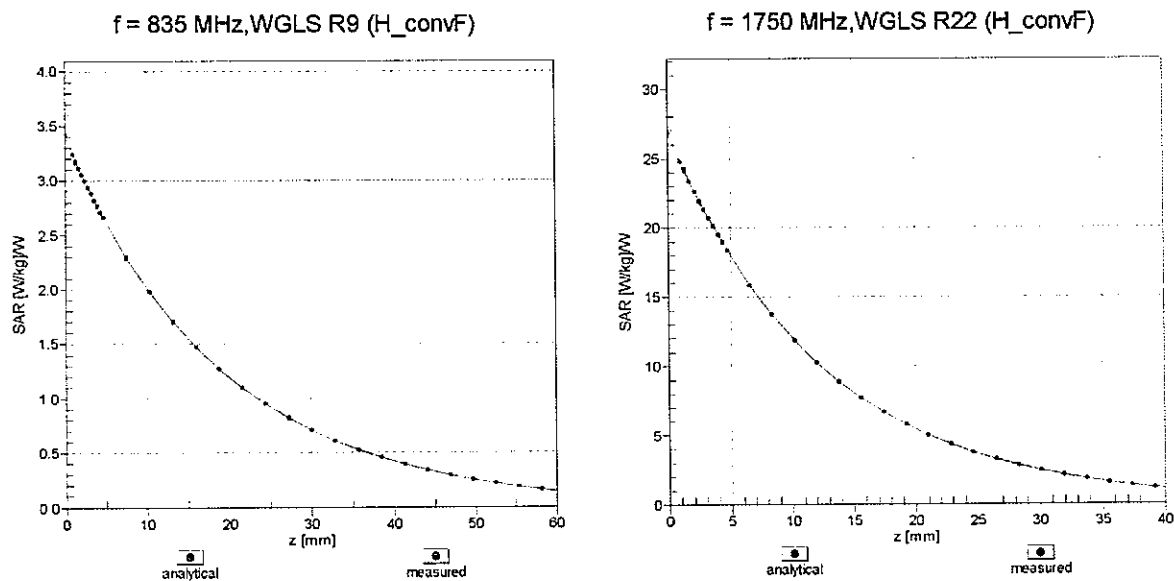
Frequency Response of E-Field

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



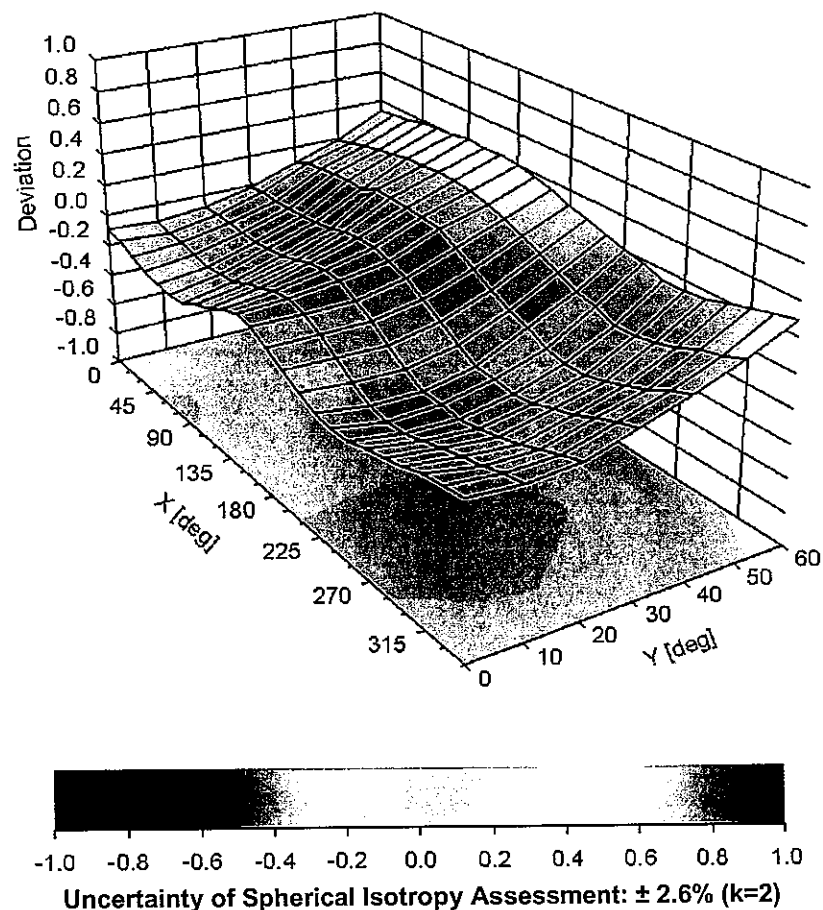
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, θ), $f = 900 \text{ MHz}$





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 Beijing TCC**

Certificate No: **ES3-3280_Mar13**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3280**

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

Calibration date: **March 8, 2013**

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

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	31-Jan-13 (No. DAE4-660_Jan13)	Jan-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	
			Issued: March 8, 2013
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3280

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	1.27	1.31	1.34	± 10.1 %
DCP (mV) ^B	101.4	104.7	101.9	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	167.3	±3.5 %
		Y	0.0	0.0	1.0		165.2	
		Z	0.0	0.0	1.0		161.1	

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

^A The uncertainties of NormX,Y,Z do not affect the E²-field uncertainty inside TSL (see Pages 5 and 6).

^B Numerical linearization parameter: uncertainty not required.

^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3280

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	6.27	6.27	6.27	0.36	1.72	± 12.0 %
1750	40.1	1.37	5.35	5.35	5.35	0.49	1.50	± 12.0 %
1900	40.0	1.40	5.15	5.15	5.15	0.75	1.23	± 12.0 %
1950	40.0	1.40	4.97	4.97	4.97	0.80	1.17	± 12.0 %
2450	39.2	1.80	4.57	4.57	4.57	0.80	1.28	± 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:3280

Calibration Parameter Determined in Body Tissue Simulating Media

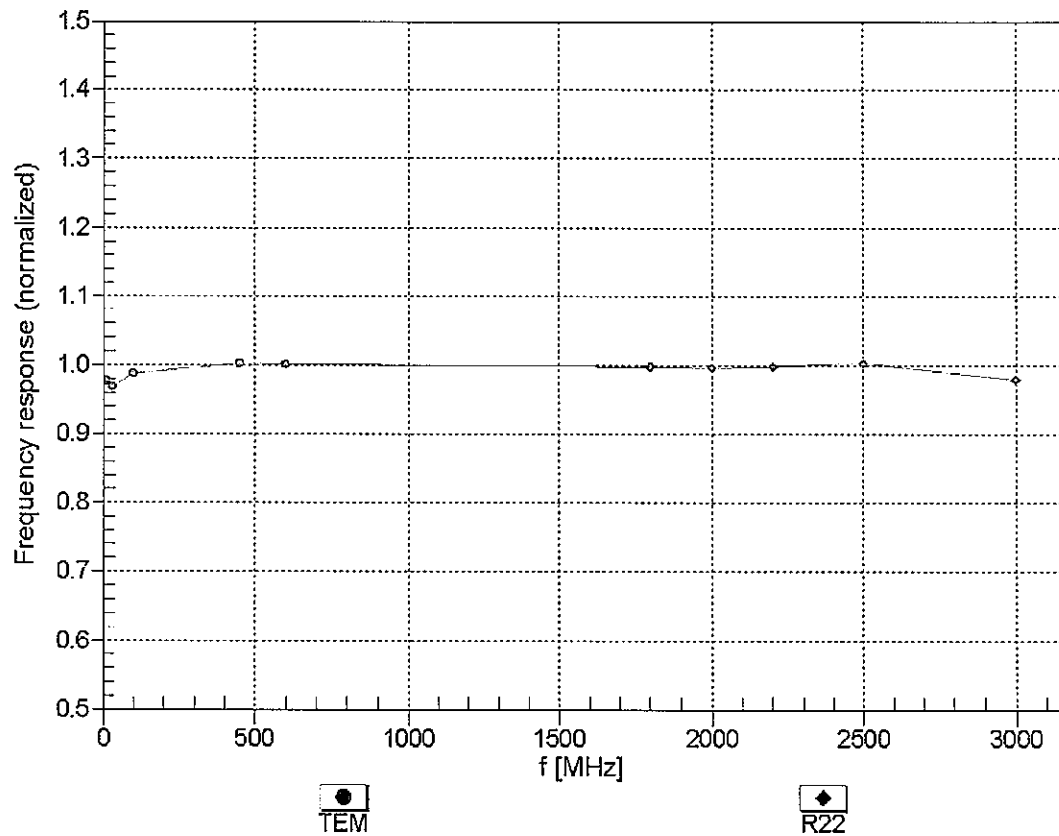
f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
835	55.2	0.97	6.08	6.08	6.08	0.28	2.07	± 12.0 %
1750	53.4	1.49	4.86	4.86	4.86	0.52	1.59	± 12.0 %
1900	53.3	1.52	4.64	4.64	4.64	0.57	1.50	± 12.0 %
1950	53.3	1.52	4.75	4.75	4.75	0.51	1.63	± 12.0 %
2450	52.7	1.95	4.28	4.28	4.28	0.68	1.13	± 12.0 %

^C Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

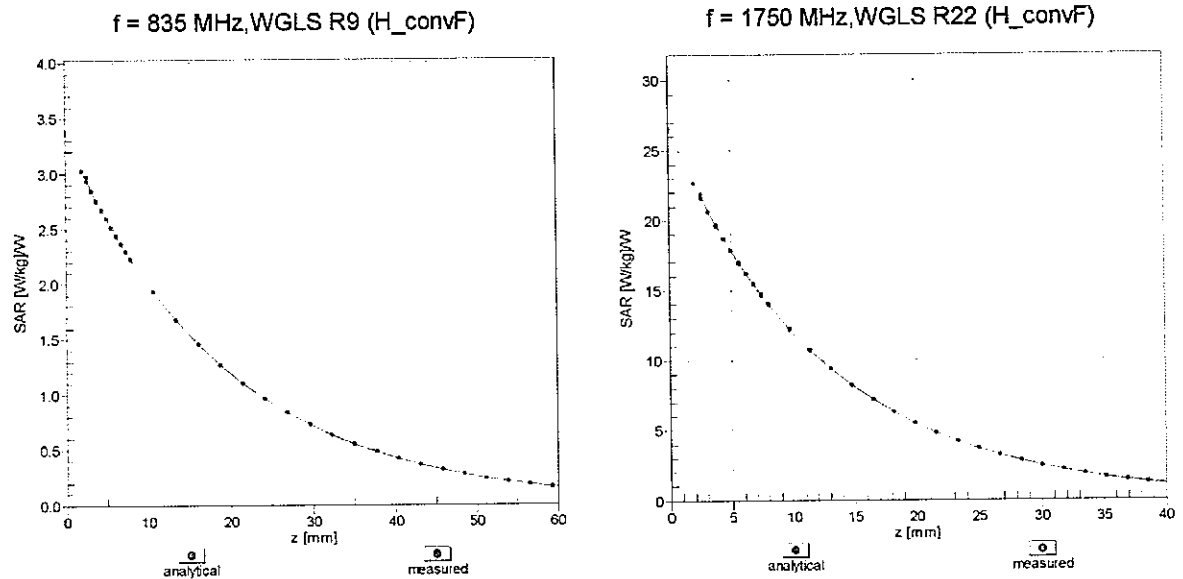
Frequency Response of E-Field

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



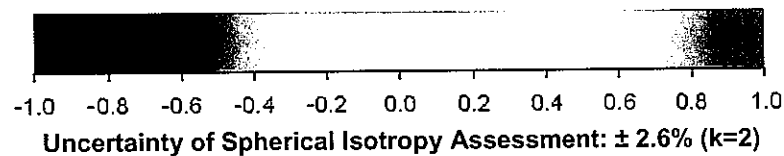
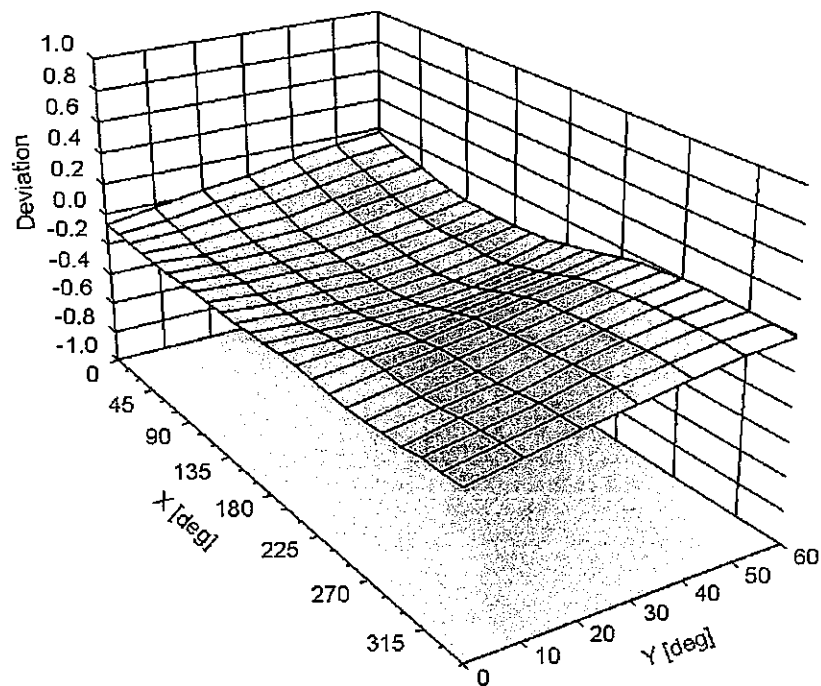
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), $f = 900 \text{ MHz}$





Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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

Client **Nokia Beijing TCC**

Certificate No: **ES3-3195_Mar13**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3195**

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

Calibration date: **March 8, 2013**

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

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	31-Jan-13 (No. DAE4-660_Jan13)	Jan-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

Calibrated by:	Name Jeton Kastrati	Function Laboratory Technician	Signature 
Approved by:	Katja Pokovic	Technical Manager	
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			Issued: March 8, 2013

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3195

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	1.41	1.18	1.43	± 10.1 %
DCP (mV) ^B	102.7	102.8	99.0	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB/ μV	C	D dB	VR mV	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	168.3	±2.7 %
		Y	0.0	0.0	1.0		153.7	
		Z	0.0	0.0	1.0		170.1	

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

^A The uncertainties of NormX,Y,Z do not affect the E²-field uncertainty inside TSL (see Pages 5 and 6).

^B Numerical linearization parameter: uncertainty not required.

^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3195

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	6.39	6.39	6.39	0.30	2.05	± 12.0 %
1750	40.1	1.37	5.34	5.34	5.34	0.68	1.37	± 12.0 %
1900	40.0	1.40	5.14	5.14	5.14	0.53	1.61	± 12.0 %
1950	40.0	1.40	4.94	4.94	4.94	0.48	1.73	± 12.0 %
2300	39.5	1.67	4.73	4.73	4.73	0.72	1.39	± 12.0 %
2450	39.2	1.80	4.43	4.43	4.43	0.80	1.33	± 12.0 %

^C Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3195

Calibration Parameter Determined in Body Tissue Simulating Media

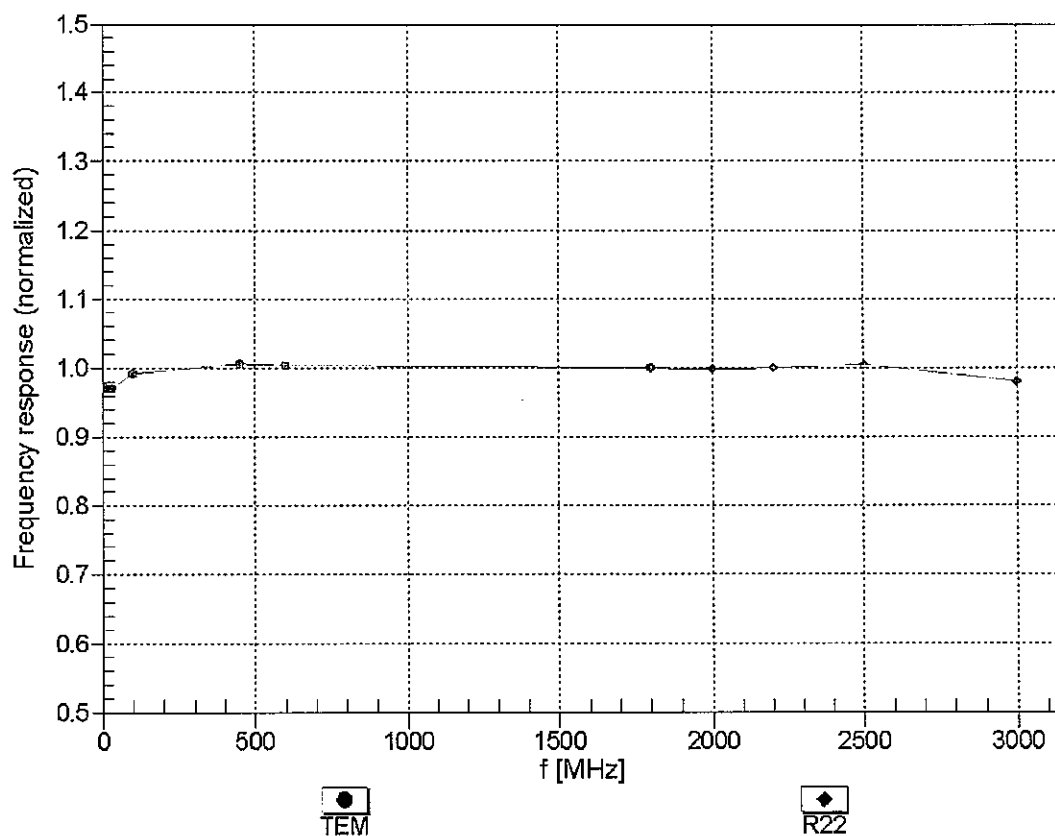
f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
835	55.2	0.97	6.28	6.28	6.28	0.50	1.49	± 12.0 %
1750	53.4	1.49	4.98	4.98	4.98	0.44	1.69	± 12.0 %
1900	53.3	1.52	4.73	4.73	4.73	0.36	1.98	± 12.0 %
1950	53.3	1.52	4.84	4.84	4.84	0.46	1.72	± 12.0 %
2300	52.9	1.81	4.45	4.45	4.45	0.57	1.46	± 12.0 %
2450	52.7	1.95	4.31	4.31	4.31	0.71	1.17	± 12.0 %

^C Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

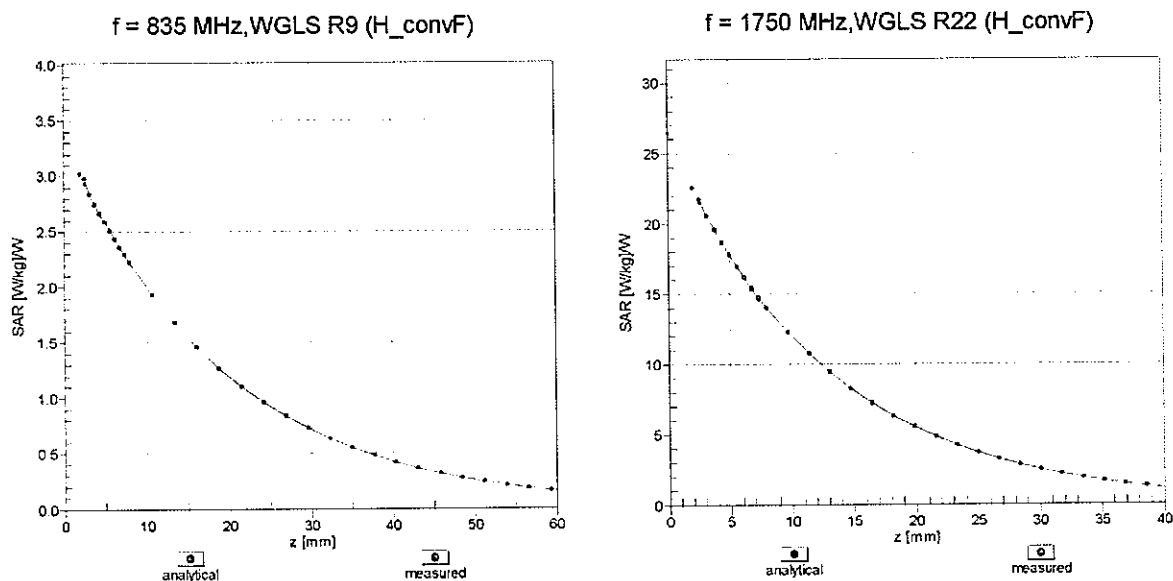
Frequency Response of E-Field

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



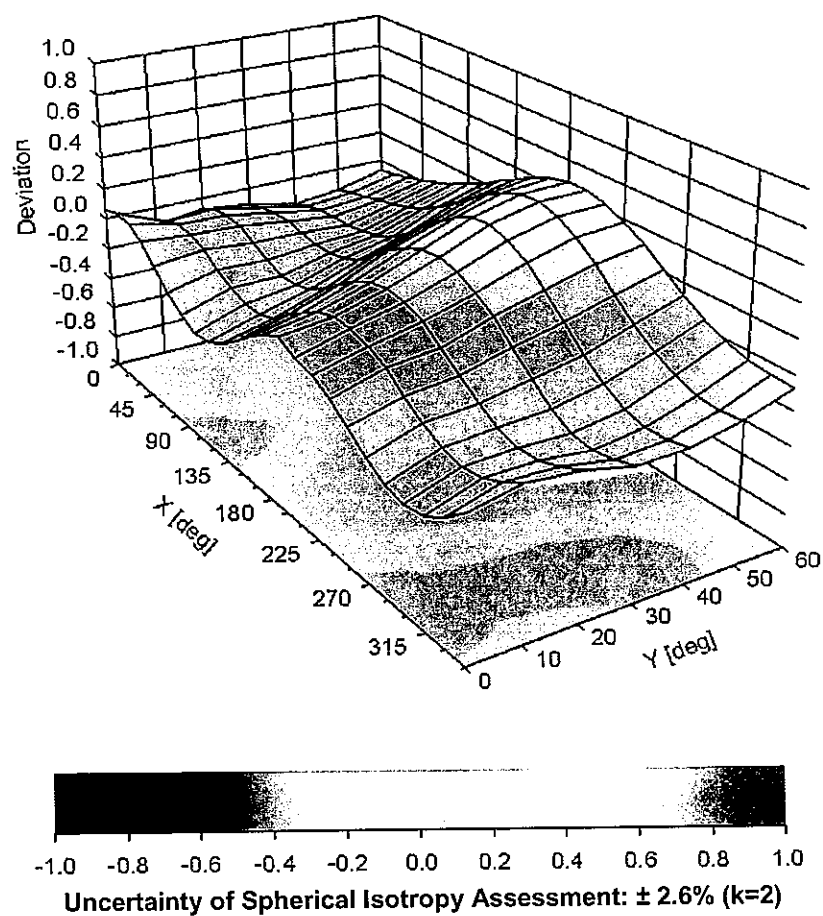
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), $f = 900 \text{ MHz}$



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



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 Beijing TCC**

Certificate No: **D835V2-4d005_Mar12**

CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d005**

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

Calibration date: **March 06, 2012**

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

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5086 (20g)	29-Mar-11 (No. 217-01368)	Apr-12
Type-N mismatch combination	SN: 5047.2 / 06327	29-Mar-11 (No. 217-01371)	Apr-12
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	04-Jul-11 (No. DAE4-601_Jul11)	Jul-12
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

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

Issued: March 6, 2012

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

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.7 Ω - 3.4 j Ω
Return Loss	- 27.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.8 Ω - 5.1 j Ω
Return Loss	- 24.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.394 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 11, 2003

DASY5 Validation Report for Head TSL

Date: 06.03.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d005

Communication System: CW; Frequency: 835 MHz

Medium parameters used: $f = 835$ MHz; $\sigma = 0.89$ mho/m; $\epsilon_r = 41.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.07, 6.07, 6.07); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

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

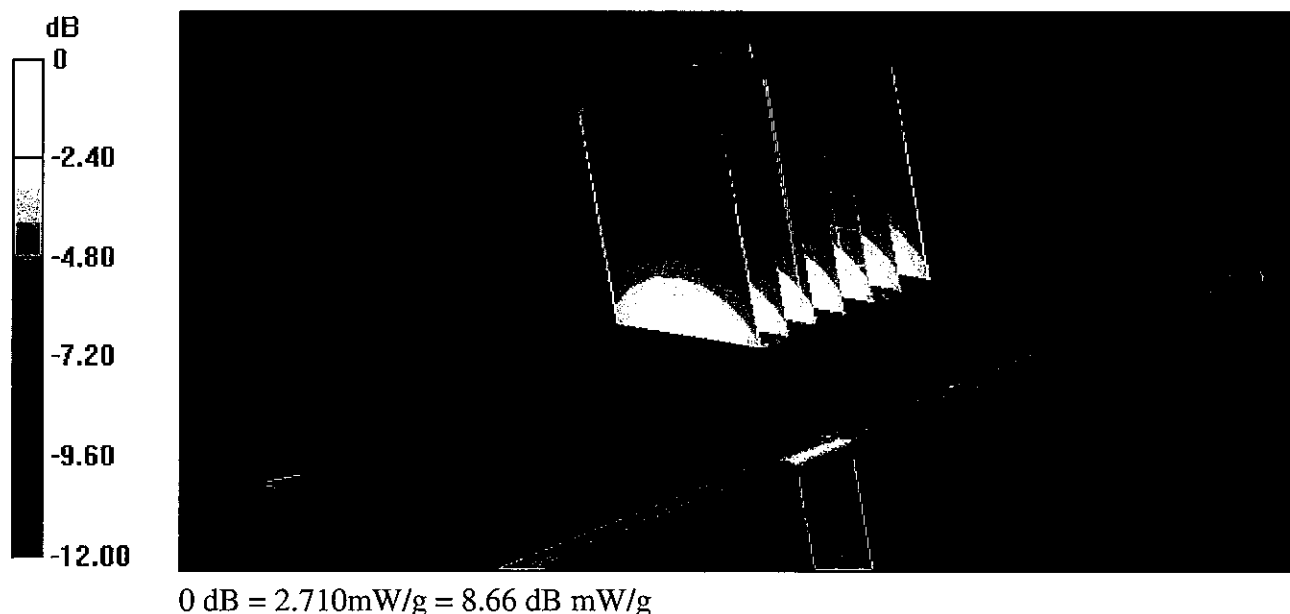
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 57.103 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 3.4310

SAR(1 g) = 2.32 mW/g; SAR(10 g) = 1.52 mW/g

Maximum value of SAR (measured) = 2.709 mW/g



Impedance Measurement Plot for Head TSL

6 Mar 2012 10:16:48
 [CH1] S11 1 U FS 1: 52.680 Ω -3.4238 Ω 55.670 pF 835.000 000 MHz

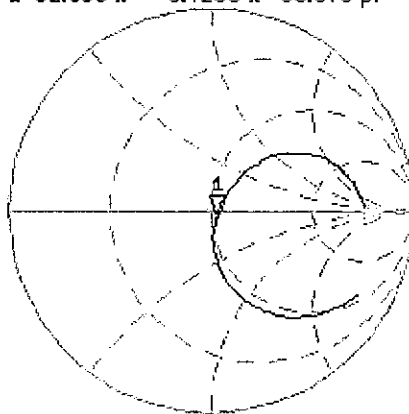
*

De1

Cor

Avg
16

H1d

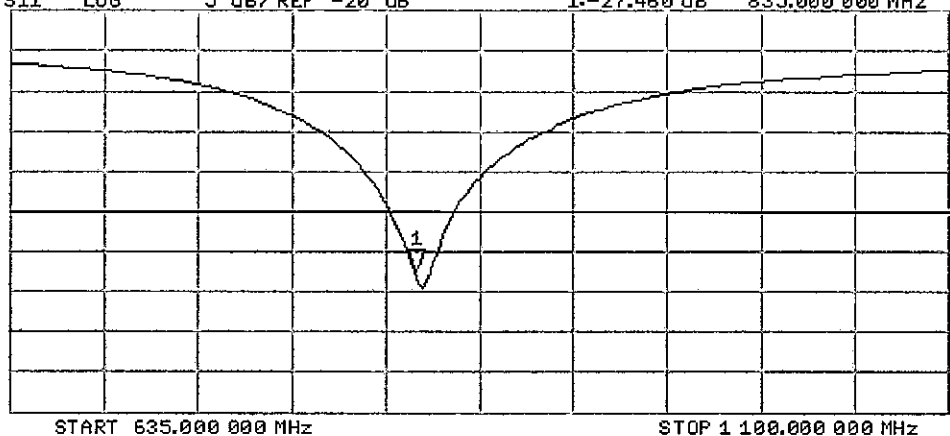


CH2 S11 LOG 5 dB/REF -20 dB 1:-27.460 dB 835.000 000 MHz

Cor

Avg
16

H1d



DASY5 Validation Report for Body TSL

Date: 05.03.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d005

Communication System: CW; Frequency: 835 MHz

Medium parameters used: $f = 835$ MHz; $\sigma = 1$ mho/m; $\epsilon_r = 55$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.02, 6.02, 6.02); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

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

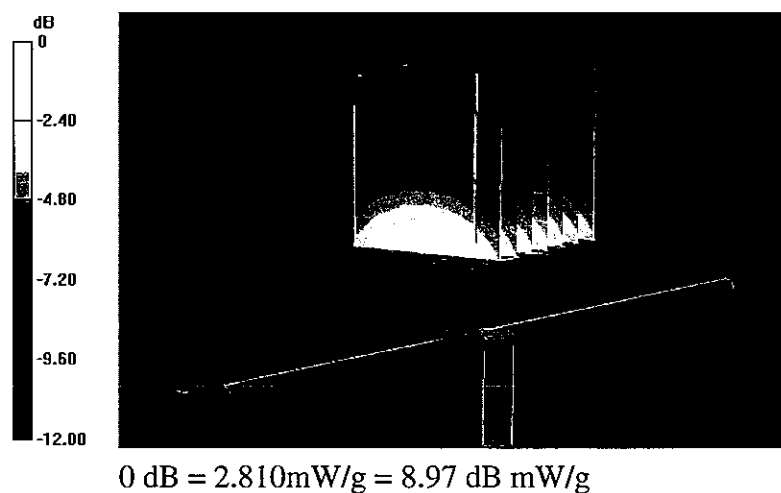
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.011 V/m; Power Drift = 0.0071 dB

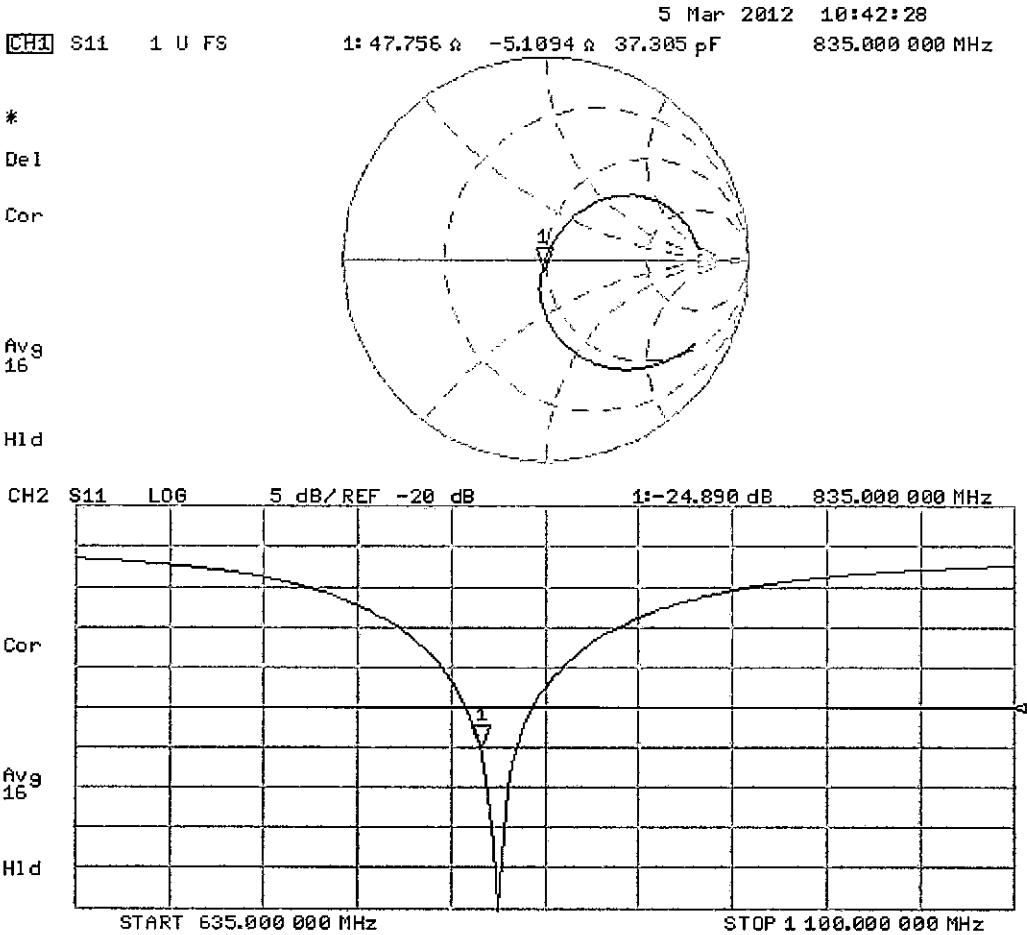
Peak SAR (extrapolated) = 3.4950

SAR(1 g) = 2.42 mW/g; SAR(10 g) = 1.59 mW/g

Maximum value of SAR (measured) = 2.812 mW/g



Impedance Measurement Plot for Body TSL



Dipole D835V2 – SN: 4d005 Antenna Parameters

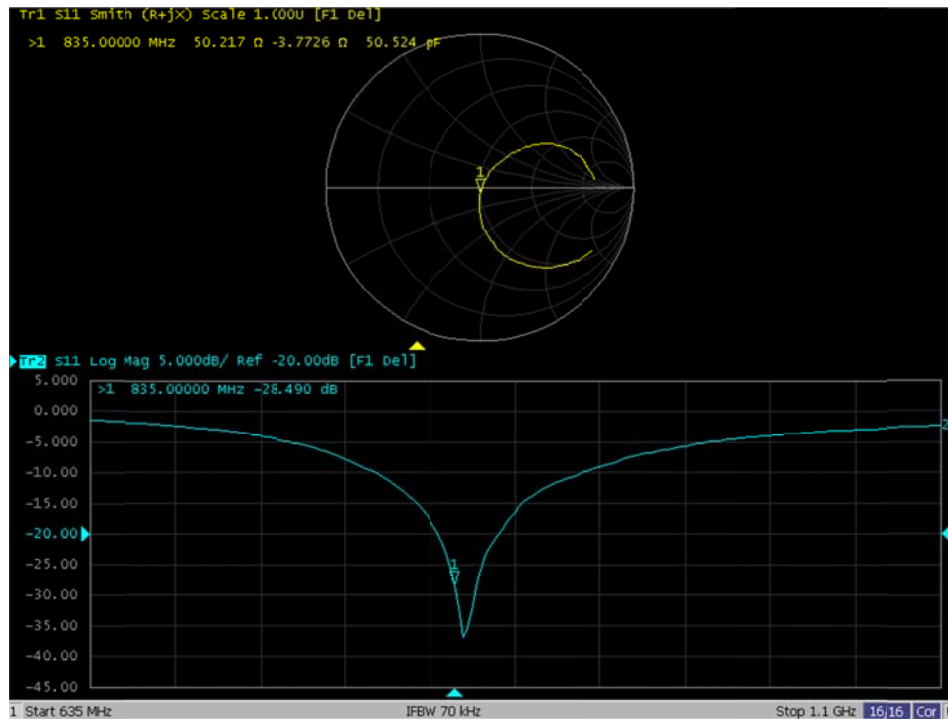
Antenna Parameters with Head TSL

	Calibration certificate	Annual measurement 2013-03-06
Impedance, transformed to feed point	52.7 Ω - 3.4 j Ω	50.2 Ω - 3.8 j Ω
Return loss	- 27.5 dB	- 28.5 dB

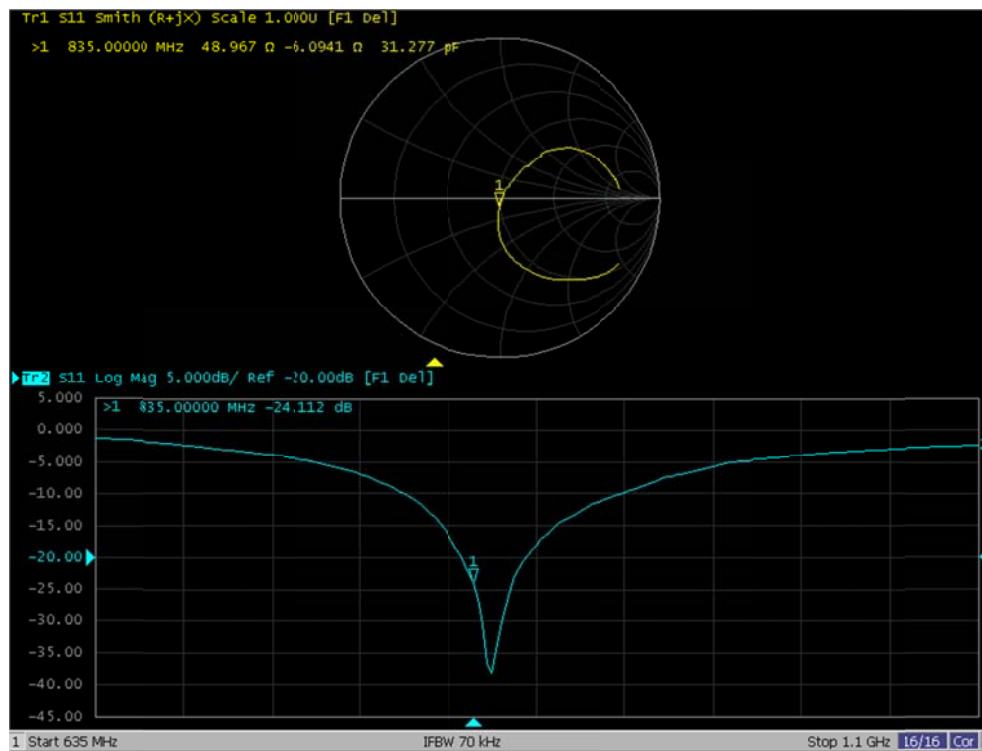
Antenna Parameters with Body TSL

	Calibration certificate	Annual measurement 2013-03-06
Impedance, transformed to feed point	47.8 Ω - 5.1 j Ω	49.0 Ω - 6.1 j Ω
Return loss	- 24.9 dB	- 24.1 dB

Impedance Measurement plot for Head TSL 835



Impedance Measurement plot for Body TSL 835





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 Beijing TCC

Certificate No: D1900V2-509_Dec12

CALIBRATION CERTIFICATE

Object D1900V2 - SN: 509

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

Calibration date: December 06, 2012

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

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.3 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

Calibrated by: Name Israe El-Naouq Function Laboratory Technician

Approved by: Katja Pokovic Technical Manager

Signature

Issued: December 6, 2012

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

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	47.1 Ω - 5.1 j Ω
Return Loss	- 24.4 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	43.7 Ω - 5.2 j Ω
Return Loss	- 21.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.192 ns
----------------------------------	----------

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

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	October 20, 1999

DASY5 Validation Report for Head TSL

Date: 06.12.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 509

Communication System: CW; Frequency: 1900 MHz

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

Phantom section: Flat Section

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

DASY52 Configuration:

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

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

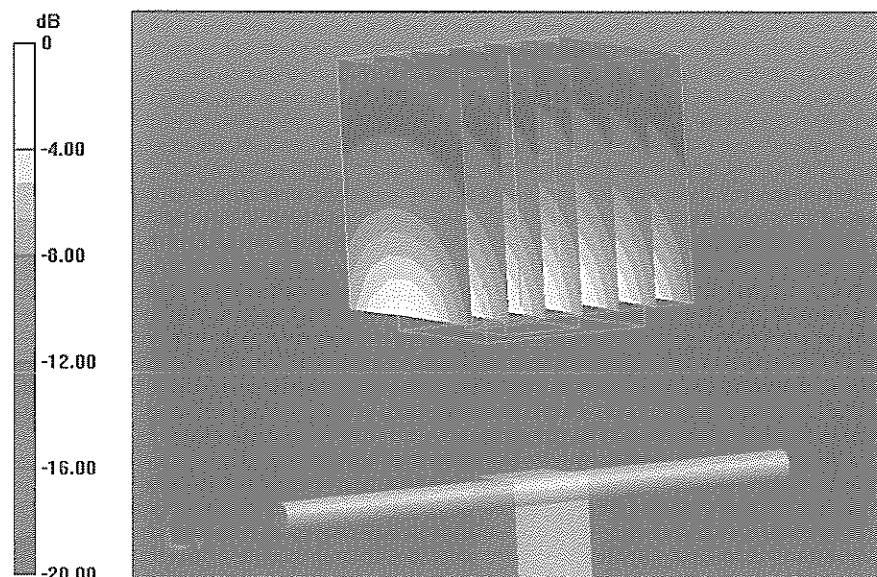
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.248 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 17.2 W/kg

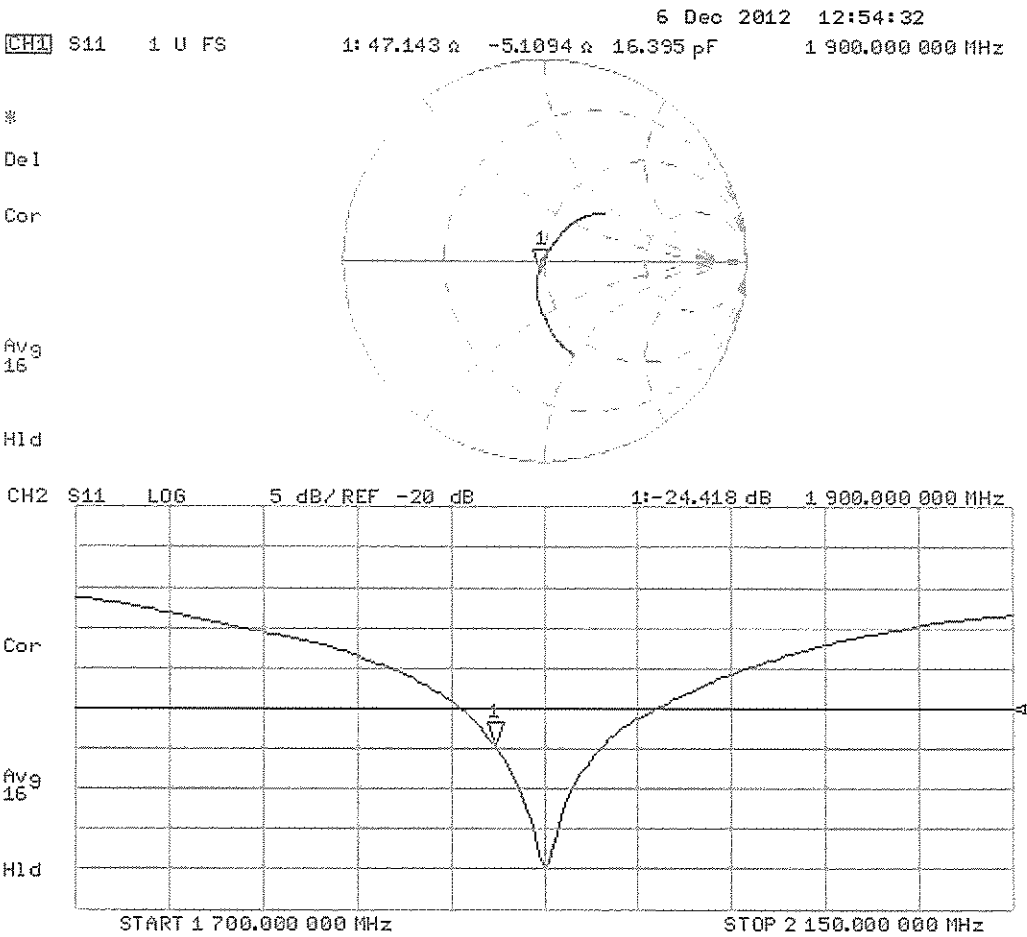
SAR(1 g) = 9.63 W/kg; SAR(10 g) = 5.05 W/kg

Maximum value of SAR (measured) = 11.9 W/kg



0 dB = 11.9 W/kg = 10.76 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 06.12.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 509

Communication System: CW; Frequency: 1900 MHz

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

Phantom section: Flat Section

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

DASY52 Configuration:

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

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

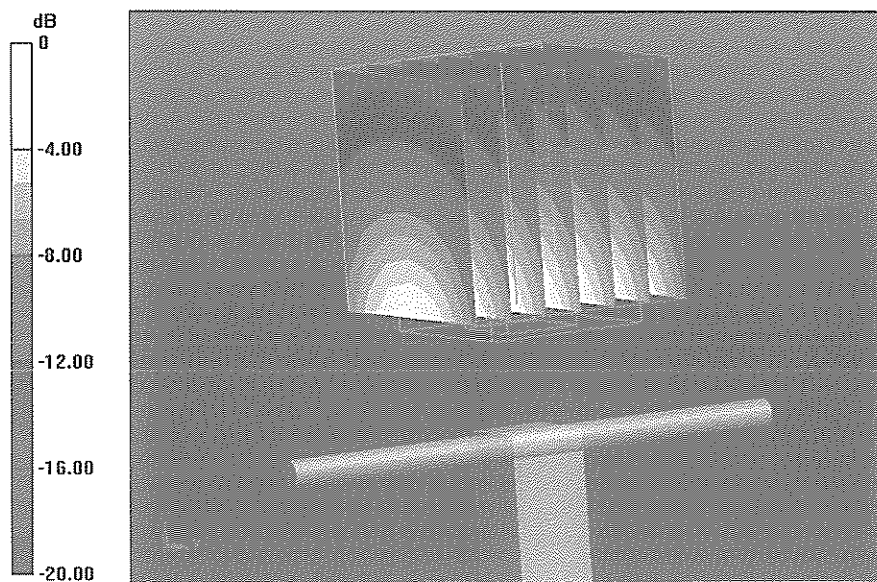
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 94.176 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 17.4 W/kg

SAR(1 g) = 9.84 W/kg; SAR(10 g) = 5.16 W/kg

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

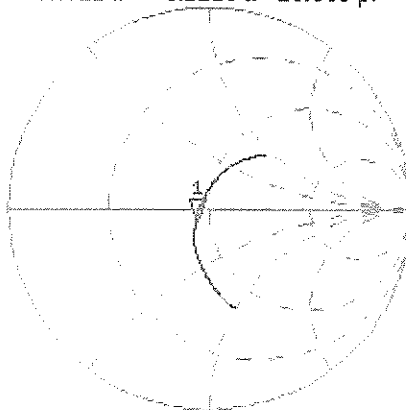


0 dB = 12.4 W/kg = 10.93 dBW/kg

Impedance Measurement Plot for Body TSL

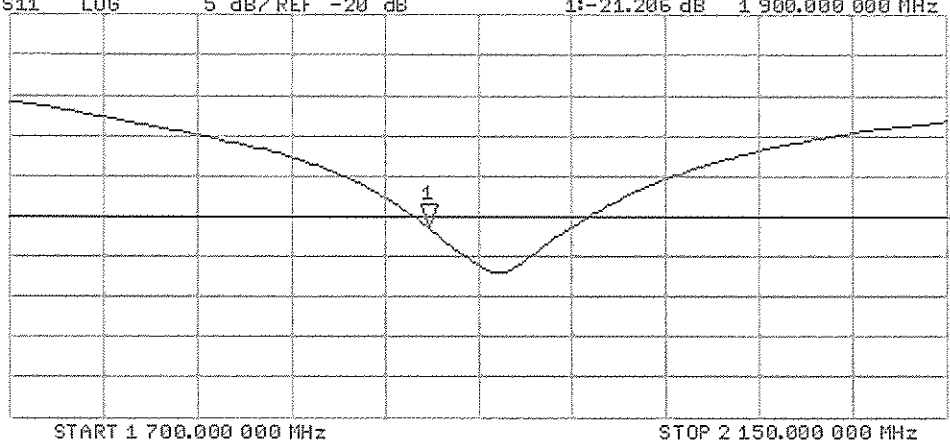
6 Dec 2012 12:54:05
 CH1 S11 1 U FS 1: 43.711 Ω -5.2129 Ω 16.069 pF 1 900.000 000 MHz

*
 De1
 Cor
 Avg
 16
 H1d



CH2 S11 LOG 5 dB/REF -20 dB 1:-21.206 dB 1 900.000 000 MHz

Cor
 Avg
 16
 H1d



Dipole D1900V2 – SN: 509 Antenna Parameters

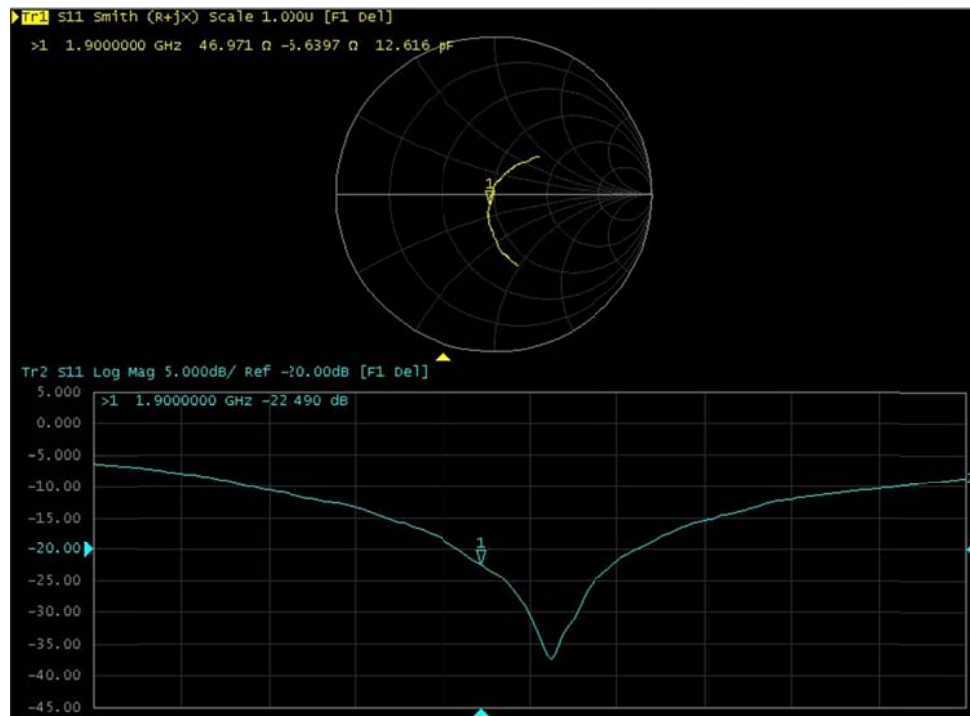
Antenna Parameters with Head TSL

	Calibration certificate	Annual measurement 2013-02-20
Impedance, transformed to feed point	47.1 Ω - 5.1 j Ω	47.0 Ω - 6.6 j Ω
Return loss	- 24.4 dB	- 22.5 dB

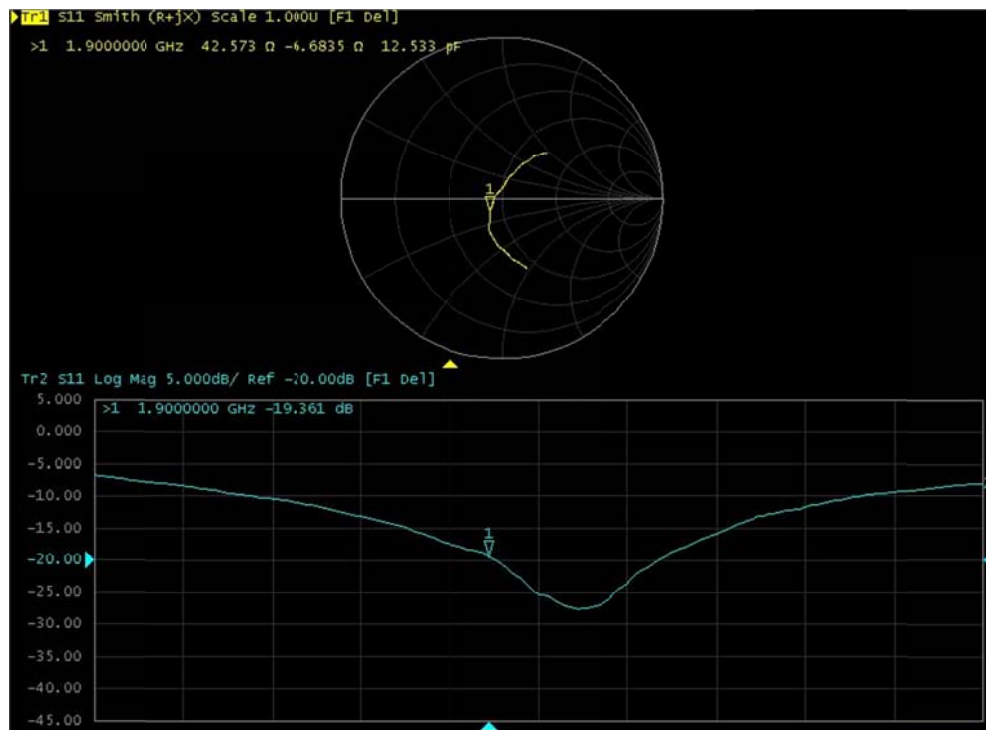
Antenna Parameters with Body TSL

	Calibration certificate	Annual measurement 2013-02-20
Impedance, transformed to feed point	43.7 Ω - 5.2 j Ω	42.6 Ω - 6.7 j Ω
Return loss	- 21.2 dB	- 19.4 dB

Impedance Measurement plot for Head TSL 1900



Impedance Measurement plot for Body TSL 1900





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

Accreditation No.: **SCS 108**

Client **Nokia Beijing TCC**

Certificate No: **D2450V2-760_Mar13**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 760**

Calibration procedure(s) **QA CAL-05.v9**
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **March 06, 2013**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.3 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

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

Signature

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

Issued: March 6, 2013

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

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	55.5 Ω + 4.3 j Ω
Return Loss	- 23.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	51.8 Ω + 5.0 j Ω
Return Loss	- 25.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.156 ns
----------------------------------	----------

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

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	April 22, 2004

DASY5 Validation Report for Head TSL

Date: 06.03.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 760

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.85$ S/m; $\epsilon_r = 37.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.52, 4.52, 4.52); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

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

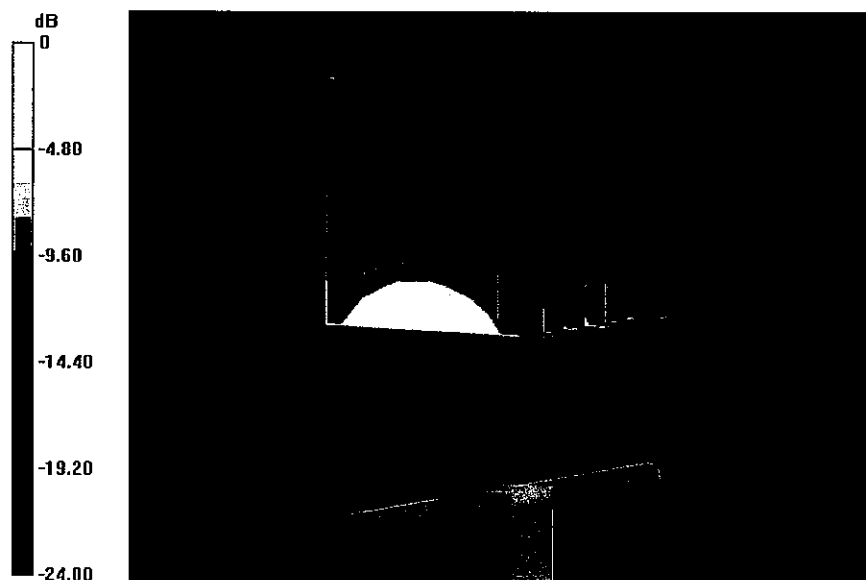
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 94.711 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 28.7 W/kg

SAR(1 g) = 13.7 W/kg; SAR(10 g) = 6.3 W/kg

Maximum value of SAR (measured) = 17.5 W/kg



0 dB = 17.5 W/kg = 12.43 dBW/kg

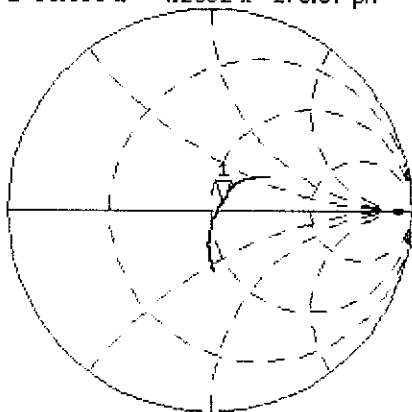
Impedance Measurement Plot for Head TSL

5 Mar 2013 10:07:43
 CH1 S11 1 U FS 1: 55.539 Ω 4.2852 Ω 278.37 pF 2 450.000 000 MHz

*
 De1
 CA

Avg
 16

H1d

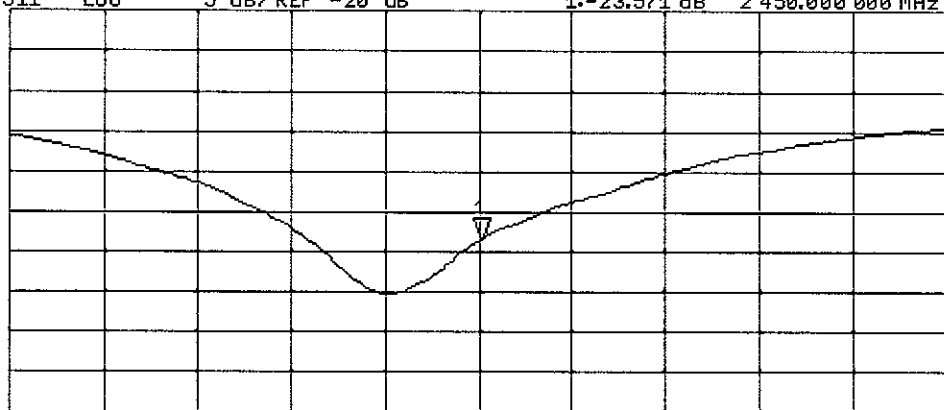


CH2 S11 LOG 5 dB/REF -20 dB 1:-23.571 dB 2 450.000 000 MHz

CA

Avg
 16

H1d



START 2 250.000 000 MHz

STOP 2 650.000 000 MHz

DASY5 Validation Report for Body TSL

Date: 06.03.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 760

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 2.01$ S/m; $\epsilon_r = 50.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.42, 4.42, 4.42); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

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

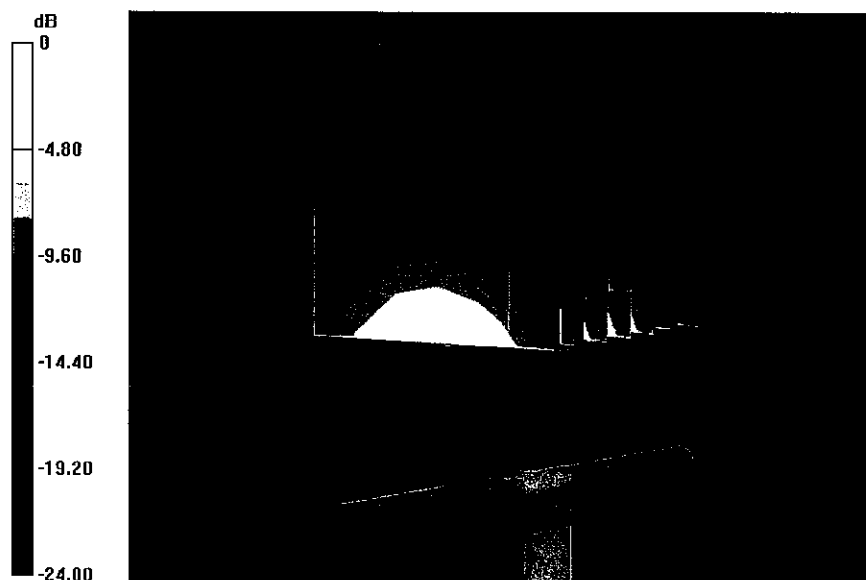
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 94.711 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 26.9 W/kg

SAR(1 g) = 12.8 W/kg; SAR(10 g) = 5.92 W/kg

Maximum value of SAR (measured) = 16.9 W/kg

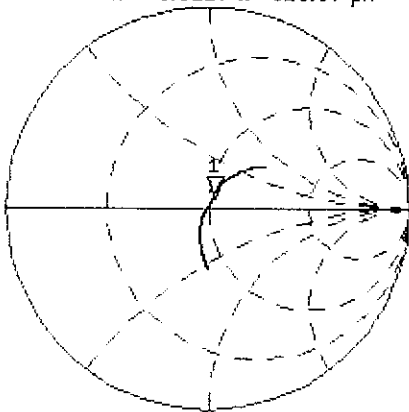


0 dB = 16.9 W/kg = 12.28 dBW/kg

Impedance Measurement Plot for Body TSL

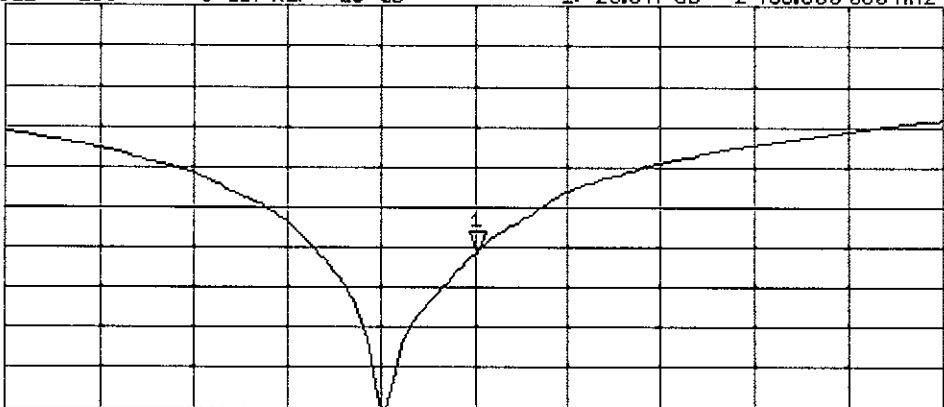
CH1 S11 1 U FS 1: 51.783 Ω 5.0117 Ω 325.57 pF 2 450.000 000 MHz 6 Mar 2013 10:06:44

*
Del
CA
Avg
16
H1d



CH2 S11 LOG 5 dB/REF -20 dB 1:-25.647 dB 2 450.000 000 MHz

CA
Avg
16
H1d



START 2 250.000 000 MHz STOP 2 650.000 000 MHz

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

G.1 Power Tuning Targets for Head and Body-worn measurements

GSM 850			
Slot configuration	Low channel	Mid channel	High channel
GSM 1-slot	32.5	32.5	32.5
GPRS 2-slot	29.5	29.5	29.5
GPRS 3-slot	27.7	27.7	27.7
GPRS 4-slot	26.5	26.5	26.5

GSM 1900			
Slot configuration	Low channel	Mid channel	High channel
GSM 1-slot	30.0	30.0	30.0
GPRS 2-slot	27.0	27.0	27.0
GPRS 3-slot	25.2	25.2	25.2
GPRS 4-slot	24.0	24.0	24.0

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

Type: RM-959; Serial number 004402/47/520260/6 used for GSM/GPRS850 and 1900 SAR Head and Body-worn measurements.

GSM 850			
Slot configuration	Low channel	Mid channel	High channel
GSM 1-slot	32.59	32.75	32.77
GPRS 2-slot	29.72	29.76	29.75
GPRS 3-slot	27.99	28.01	28.02
GPRS 4-slot	26.59	26.67	26.64

GSM 1900			
Slot configuration	Low channel	Mid channel	High channel
GSM 1-slot	30.15	30.14	30.16
GPRS 2-slot	27.17	27.24	27.28
GPRS 3-slot	25.25	25.44	25.43
GPRS 4-slot	24.04	24.19	24.31

APPENDIX H: CONDUCTED POWER MEASUREMENTS FOR SUPPORTED WCDMA TRANSMISSION MODES

H.1 Power Tuning Targets

Tuning targets			
Mode	Low channel	Mid channel	High channel
WCDMA850	23.50	23.50	23.50

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

Type: RM-959; Serial: 004402/47/520260/6 used for WCDMA850 SAR Head and Body-worn measurements.

WCDMA 850 (band 5)			
Mode	Low channel	Mid channel	High channel
WCDMA	23.59	23.56	23.53

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

APPENDIX I: CONDUCTED POWER MEASUREMENTS FOR WLAN

I.1 Power Tuning Targets

WLAN 2.4 GHz: 20 MHz channel bandwidth							
			Tuning target				
Standard	Modulation	Data speed [Mbps]	CH 1	CH 2	CH 6	CH 10	CH 11
802.11b	BPSK	1	15	15	15	15	15
802.11b	QPSK	2	15	15	15	15	15
802.11b	QPSK	5.5	15	15	15	15	15
802.11b	QPSK	11	15	15	15	15	15
802.11g	BPSK	6	11	15	15	15	12
802.11g	BPSK	9	11	15	15	15	12
802.11g	QPSK	12	11	15	15	15	12
802.11g	QPSK	18	11	15	15	15	12
802.11g	16QAM	24	11	15	15	15	12
802.11g	16QAM	36	11	15	15	15	12
802.11g	64QAM	48	11	13	13	13	12
802.11g	64QAM	54	11	13	13	13	12
802.11n	BPSK	6.5 / 7.25	11	13	13	13	12
802.11n	QPSK	13.0 / 14.4	11	13	13	13	12
802.11n	QPSK	19.5 / 21.7	11	13	13	13	12
802.11n	16QAM	26.0 / 28.9	11	13	13	13	12
802.11n	16QAM	39.0 / 43.3	11	13	13	13	12
802.11n	64QAM	52.0 / 57.8	11	13	13	13	12
802.11n	64QAM	58.5 / 65.0	11	12	12	12	12
802.11n	64QAM	65.0 / 72.2	11	12	12	12	12

I.2 Conducted Power measurements from the Samples used in the Testing

Type: RM-959; Serial number: 004402/47/520252/3 used for WLAN for SAR Head and Body-worn measurements.

Standard	Modulation	Data speed [Mbps]	Measured value				
			CH 1	CH 2	CH 6	CH 10	CH 11
802.11b	BPSK	1	15.28	15.37	15.51	15.92	16.01
802.11b	QPSK	2	15.33	15.39	15.54	15.85	15.99
802.11b	QPSK	5.5	15.27	15.37	15.68	15.95	16.02
802.11b	QPSK	11	15.34	15.38	15.62	15.99	16.02
802.11g	BPSK	6	11.52	15.14	15.39	15.76	12.21
802.11g	BPSK	9	11.43	15.17	15.36	15.78	12.16
802.11g	QPSK	12	11.42	15.18	15.37	15.75	12.37
802.11g	QPSK	18	11.39	15.08	15.41	15.71	12.19
802.11g	16QAM	24	11.34	15.21	15.37	15.75	12.22
802.11g	16QAM	36	11.62	15.20	15.43	15.74	12.27
802.11g	64QAM	48	11.55	13.58	13.77	14.12	12.25
802.11g	64QAM	54	11.44	13.64	13.76	14.15	12.23
802.11n	BPSK	6.5 / 7.25	11.35	13.42	13.71	14.04	12.14
802.11n	QPSK	13.0 / 14.4	11.34	13.51	13.76	14.05	12.10
802.11n	QPSK	19.5 / 21.7	11.29	13.49	13.79	14.10	12.07
802.11n	16QAM	26.0 / 28.9	11.36	13.42	13.80	14.19	12.15
802.11n	16QAM	39.0 / 43.3	11.40	13.49	13.66	14.08	12.19
802.11n	64QAM	52.0 / 57.8	11.37	13.55	13.75	14.10	12.04
802.11n	64QAM	58.5 / 65.0	11.47	13.41	13.77	14.01	12.18
802.11n	64QAM	65.0 / 72.2	11.42	12.02	12.17	12.47	12.22