SAR Compliance Test Report

Test report no.:	FCC_RM-1090_05	**Date of report:**	2014-09-17
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Responsible test engineer:	Zhang Luwen	**Product contact person:**	Li Craig
Measurements made by:	Yuan Rui, He Ying, Wang Weike		
Tested device:	RM-1090		
FCC ID:	PYARM-1090	**IC:**	-
Supplement reports:	SAR_Photo_RM-1090_06		
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, Issue 4** 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 - 2013** 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 Microsoft.		
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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1. SUMMARY OF SAR TEST REPORT

1.1 Test Details

Period of test	2014-09-15 to 2014-09-16
SN, HW and SW numbers of tested device	SN: 004402/47/971343/4;004402/47/971344/2, HW: 2000, SW: 02038.00000.14325.55001, DUT: 54540 SN: 004402/47/971165/1;004402/47/971166/9, HW: 2000, SW: 02038.00000.14325.55001, DUT: 54543 SN: 004402/47/971163/6;004402/47/971164/4, HW: 2000, SW: 02038.00000.14325.55001, DUT: 54541
Batteries used in testing	BL-L4A, DUT: 54549, 54548, 54547, 54546, 54545
Headsets used in testing	WH-108, DUT: 54083, 54169, 54180
Other accessories used in testing	-
State of sample	Prototype unit
Notes	-

1.2 Maximum Results

The maximum measured SAR values for Head, Body Worn and Wireless Router configuration are given in section 1.2.1, 1.2.2 and 1.2.3 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 #
3-slot GPRS850	251 / 848.8	28.5 dBm	Left, Cheek	0.259 W/kg	**0.28 W/kg**	1.6 W/kg	PASSED	1
4-slot GPRS1900	512 / 1850.2	24.2 dBm	Left, Cheek	0.140 W/kg	**0.15 W/kg**	1.6 W/kg	PASSED	2
WLAN2450	6 / 2437.0	15.4 dBm	Right, Cheek	0.377 W/kg	**0.49 W/kg**	1.6 W/kg	PASSED	3
3-slot GPRS850 + WLAN2450	-	-	Left, Cheek	0.377 W/kg	**0.49 W/kg**	1.6 W/kg	PASSED	3
4-slot GPRS1900 + WLAN2450	-	-	Right, Cheek	0.377 W/kg	**0.49 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 #
3-slot GPRS850	251 / 848.8	28.5 dBm	1.5 cm	0.388 W/kg	**0.43 W/kg**	1.6 W/kg	PASSED	4
4-slot GPRS1900	512 / 1850.2	24.2 dBm	1.5 cm	0.162 W/kg	**0.17 W/kg**	1.6 W/kg	PASSED	5
WLAN2450	11 / 2462.0	15.5 dBm	1.5 cm	0.085 W/kg	**0.11 W/kg**	1.6 W/kg	PASSED	6
3-slot GPRS850 + WLAN2450	-	-	1.5 cm	0.397 W/kg	**0.44 W/kg**	1.6 W/kg	PASSED	-
4-slot GPRS1900 + WLAN2450	-	-	1.5 cm	0.171 W/kg	**0.18 W/kg**	1.6 W/kg	PASSED	-

1.2.3 Wireless Router Configuration

Summary of Maximum Results for Wireless Router mode at 10.0mm

Mode	Ch / *f*(MHz)	Conducted power	Separation distance	Measured SAR value (1g avg)	Reported* SAR value (1g avg)	SAR limit (1g avg)	Result	Plot #
3-slot GPRS850	251 / 848.8	28.5 dBm	10.0 mm	0.562 W/kg	**0.62 W/kg**	1.6 W/kg	PASSED	7
4-slot GPRS1900	512 / 1850.2	24.2 dBm	10.0 mm	0.291 W/kg	**0.31 W/kg**	1.6 W/kg	PASSED	8
WLAN2450	11 / 2462.0	15.5 dBm	10.0 mm	0.151 W/kg	**0.19 W/kg**	1.6 W/kg	PASSED	9
3-slot GPRS850 + WLAN2450	-	-	10.0 mm	0.574 W/kg	**0.63 W/kg**	1.6 W/kg	PASSED	-
4-slot GPRS1900 + WLAN2450	-	-	10.0 mm	0.291 W/kg	**0.31 W/kg**	1.6 W/kg	PASSED	8

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

1.2.4 Summary SAR data

	FCC-defined SAR values for the Grants of Equipment Authorization		
	PCE	**DTS**	**NII**
Maximum Head SAR values	0.28 W/kg	0.49 W/kg	-
{Max + Max} Simultaneous Head SAR value	0.73 W/kg		
Maximum Body SAR values	0.43 W/kg	0.11 W/kg	-
{Max + Max} Simultaneous Body SAR value	0.53 W/kg		
Maximum Product Specific (Wireless Router) SAR values	0.62 W/kg	0.19 W/kg	-
{Max + Max} Simultaneous Product Specific SAR value	0.81 W/kg		
Maximum Simultaneous SAR value **Wireless Router SAR: 3-slot GPRS850 + WLAN2450**	0.81 W/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

1.2.5 Maximum Drift

Maximum drift covered by 5% scaling up of the SAR values	Maximum drift during measurements
0.2dB	0.15dB

1.2.6 Measurement Uncertainty

Expanded Uncertainty (k=2) 95%	± 29.8%

2. DESCRIPTION OF THE DEVICE UNDER TEST

Device category	Portable
Exposure environment	General population / uncontrolled

Modes of Operation	Bands	Modulation Mode	Duty Cycle	Transmitter Frequency Range (MHz)	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	30.0	28.5	27.0	32.9	30.4	28.9	27.4
	1900			1850 – 1910	30.0	27.0	25.5	24.0	30.4	27.4	25.9	24.4
EGPRS	850	GMSK	1/8 to 4/8	824 – 849	27.0	25.5	24.0	22.5	27.4	25.9	24.4	22.9
	1900			1850 – 1910	26.0	24.5	23.0	21.5	26.4	24.9	23.4	21.9
BT	2450	GFSK	1	2402 – 2480	7.0				8.5			
					Ch 1	Ch 2-10	Ch 11		Ch 1	Ch 2-10	Ch 11	
WLAN b-mode	2450	DSSS	1	2412 – 2462	15.0	15.0	15.0		16.5	16.5	16.5	
WLAN g-mode	2450	OFDM	1	2412 – 2462	10.0	10.0	10.0		11.5	11.5	11.5	
WLAN n-mode	2450	OFDM	1	2412 – 2462	10.0	10.0	10.0		11.5	11.5	11.5	

Outside of USA, the transmitter of the device is capable of operating also in GSM/GPRS/EGPRS900 and GSM/GPRS/EGPRS1800, HSUPA/WCDMA900 (Band 8) and HSUPA/WCDMA2100 (Band 1) which are not part of this filing.

This is a dual-SIM device. As both SIMs use the same antenna and transmitter chain, full evaluation of this device has been made by activating a single SIM only.

This device has Voice-over-IP/Dual Transfer Mode capability for use at the ear. Therefore, SAR for multi slot GPRS mode was evaluated against the head profile of the phantom. Dual Transfer Mode is a feature that utilises the multi-slot GPRS capability in this device; it allows simultaneous transmission of voice and data during the same call, using the same transmitter and antenna.

This is a BT Class 1 device and its power tuning target upper limit is 8.5dBm. WLAN2450 power tuning target upper limit is 16.5dBm. Since WLAN2450 and BT use same frequency and antenna, WLAN2450 power is 8.0dB higher, and they cannot transmit simultaneously, the WLAN2450 standalone SAR is conservative estimation of BT SAR. As WLAN2450 SAR result is below limit, also BT SAR can be deemed to comply without further analysis or standalone measurements. Also 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 GSM/GPRS/EGPRS850 and GSM/GPRS/EGPRS1900 bands; a separate single antenna is used for WLAN. Simultaneous transmission of any singular cellular and PCS band is possible with WLAN in Head, Body-worn and Wireless Router use according to the table below.

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

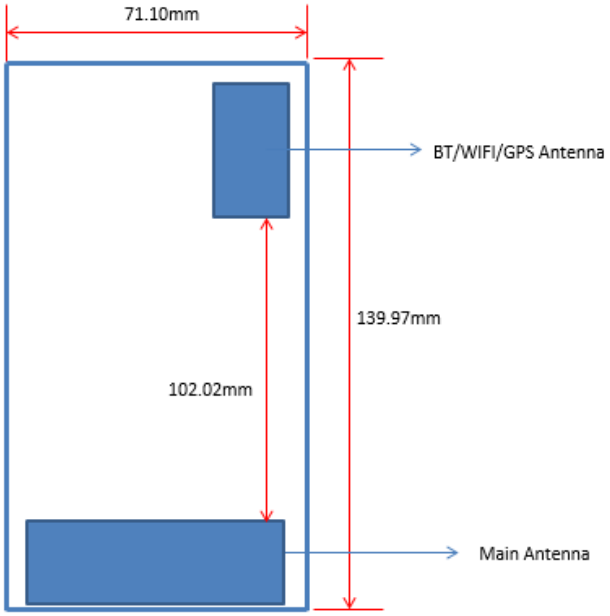
The hotspot mode (Wireless Router mode) may operate concurrently in DTM mode with voice calls. The reported SAR test results are conservative regarding that use case, since output power in hotspot mode is equal to or lower than in normal voice and data modes. This device has no power reduction for hotspot mode. Also simultaneous transmissions with WLANs are already conservatively assessed for head and body-worn exposure conditions due to VoIP capability.

This device has Wireless Router "Hotspot" mode capability.

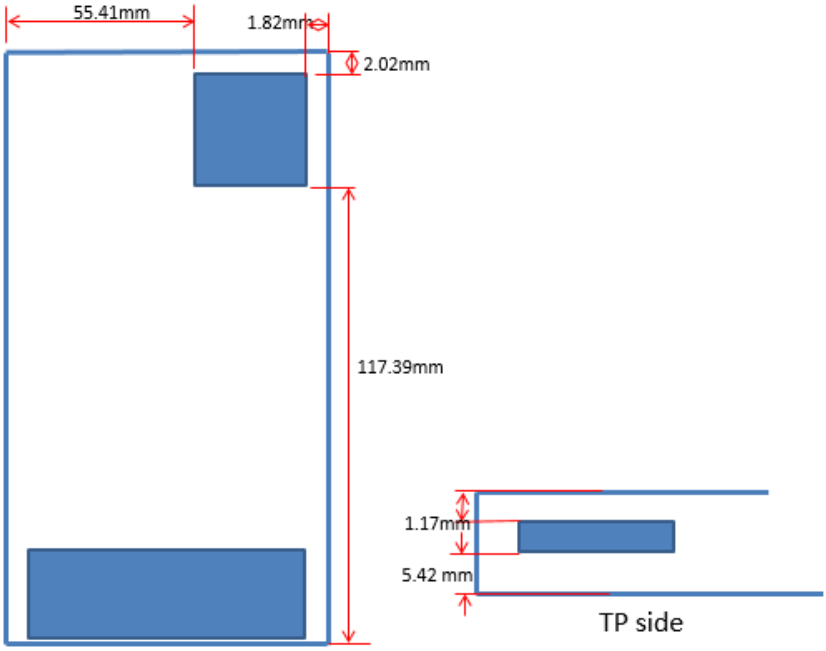
2.1 Description of the Antenna

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.

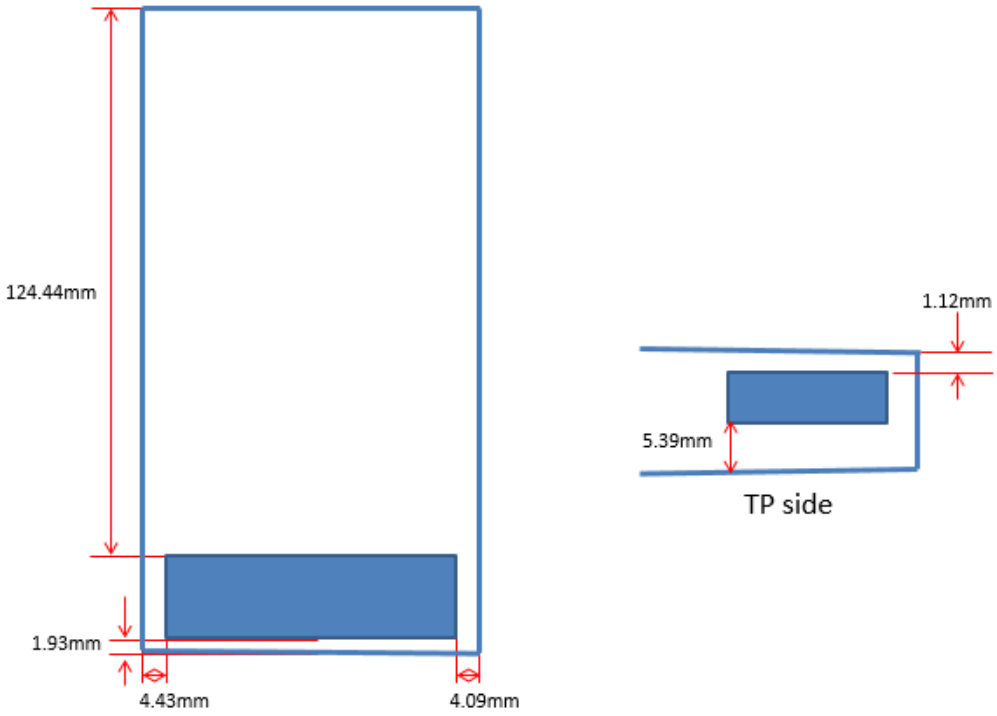
Phone Dimension and Distance Between Main antenna and BT/WIFI/GPS



Distance between Out of Device and BT/WIFI/GPS Antenna



Distance between Out of Device and RX Diversity 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.

A CMU200 call tester was used for all the GSM/GPRS/EGPRS bands, and the MS signal was always set to maximum power.

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

Dual Transfer Mode was not specifically tested as the average power in multi-slot GMSK GPRS mode is always greater than, or equal to, the average power in Dual Transfer Mode in Microsoft devices.

The number of Tx slots in all GSM/GPRS mode tests was based on tuning target/conducted power data, see Appendix H. The number of slots with highest or equal highest time-average power was tested.

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

The conducted output power of the device was measured by a separate test laboratory on the same unit(s) as used for SAR testing. The results are given in the appendixes F-G of this report.

The transmission mode of the device in all WLAN b-mode tests was BPSK 1Mbps. This mode has the highest time-averaged output power of all the WLAN a, b, g and n modulation modes in this device as illustrated in table in Appendix G. All WLAN testing has been carried out in accordance with FCC KDB 248227: SAR Measurement Procedures for 802.11 a/b/g Transmitters.

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	710	2014-03	2015-03
DAE 4	1324	2014-03	2015-03
DAE 4	887	2014-03	2015-03
E-field Probe EX3DV4	3838	2014-03	2015-03
E-field Probe ES3DV3	3280	2014-03	2015-03
E-field Probe ES3DV3	3195	2014-03	2015-03
Dipole Validation Kit, D835V2	4d005	2014-03	2016-03
Dipole Validation Kit, D1900V2	547	2013-09	2015-09
Dipole Validation Kit, D2450V2	883	2014-03	2016-03
DASY5 software	Version 52.8	-	-

Additional test equipment used in testing:

Test Equipment	Model	Serial Number	Calibration date	Calibration expiry
Signal Generator	8648C	3847M00258	2014-04	2015-04
Signal Generator	E4432B	US40052231	2014-04	2015-04
Signal Generator	SME06	829683/005	2014-04	2015-04
Call Tester	CMU200	835352/008	-	-
Call Tester	CMU200	831593/001	-	-
Call Tester	CMU200	110735	-	-
Amplifier	ZHL-42W	QA1252001	-	-
Amplifier	AR 5S1G4M1	306024	-	-
Amplifier	ZHL-4240W	e060204/1	-	-
RF Network Analyzer	E5071C	MY46104578	2014-04	2015-04
RF Network Analyzer	8753ES	US39170317	2014-04	2015-04
RF Network Analyzer	8753ES	My40002096	2014-04	2015-04
Dielectric Probe Kit	DAK-3.5	1065	-	-
Dielectric Probe Kit	85070C	653	-	-
Dielectric Probe Kit	85070C	2577	-	-
Power Meter	NRP	101293	2014-04	2015-04
Power Sensor	NRP-Z51	100410	2014-04	2015-04
Power Meter	E4419B	My41291520	2014-04	2015-04
Power Sensor	8482A	US37295410	2014-04	2015-04
Power Meter	NRVD	840297/008	2014-04	2015-04
Power Sensor	NRV-Z51	101135	2014-04	2015-04

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 D
Frequency	10 MHz to 4 GHz (dosimetry); Linearity: ± 0.2 dB (30 MHz to 4 GHz)
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.3 dB in HSL (rotation normal to probe axis)
Dynamic Range	5 µW/g to > 100 mW/g; Linearity: ± 0.2 dB

Dimensions	Overall length: 330 mm Tip length: 20 mm Body diameter: 12 mm Tip diameter: 3.9 mm Distance from probe tip to dipole centers: 2.0 mm
Application	General dosimetry up to 4 GHz Compliance tests of mobile phones Fast automatic scanning in arbitrary phantoms

4.1.2 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 D
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 µW/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 Distance from probe tip to dipole centers: 1.0 mm
Application	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.

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 and FCC published RF Exposure KDB Procedures. All tests were carried out using simulants whose dielectric parameters were within ± 5% of the recommended values. All tests were carried out within 24 hours of measuring the dielectric parameters.

The depth of the tissue simulant was at least 15.0 cm 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

Ingredient	Head (% by weight)	Body (% by weight)
Deionised Water	51.50	69.25
Tween 20	47.35	30.00
Salt	1.15	0.75

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-3	V52.8	D835V2 / 4d005	EX3DV4 / 3838	CW	DAE4 / 480	2014-05	2014-04
1900	TCC Beijing / SAR-1	V52.8	D1900V2 / 547	ES3DV3 / 3195	CW	DAE4 / 1324	2014-05	2014-04
2450	TCC Beijing / SAR-4	V52.8	D2450V2 / 883	EX3DV4 / 3280	CW	DAE4 / 887	2014-05	2014-06

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	Scaled 1W SAR 1g [W/kg]	Dielectric Parameters*		SAR 1g Deviation from target	Dielectric Parameters Deviation from target		Temp	Plot #
				dSAR [%]		ε_r	σ [S/m]	dSAR [%]	$d\varepsilon_r$ [%]	dσ [%]	[°C]	
	Tolerances			±3%				±10 %	±5 %	±5 %		
	Target result SN:4d005	-	-	-	9.32	41.5	0.90	TCC Beijing/SAR-3 EX3DV4 SN:3838 Head 835MHz				
835	2014-09-15	2.31	2.29	-0.87	9.24	40.7	0.87	-0.86	-1.93	-3.33	20.7	1
	Target result SN:547	-	-	-	40.9	40.0	1.40	TCC Beijing/SAR-1 ES3DV3 SN:3195 Head 1900MHz				
1900	2014-09-15	10.10	9.96	-1.39	40.40	38.3	1.44	-1.22	-4.25	2.86	21.1	2
	Target result SN:883	-	-	-	53.2	39.2	1.80	TCC Beijing/SAR-4 EX3DV4 SN:3280 Head 2450MHz				
2450	2014-09-15	13.9	13.9	0.00	55.6	37.8	1.77	4.51	-3.57	-1.67	21.5	3

* Dielectric parameter reference data taken from IEEE1528/IEC62209

System checking, body tissue simulant

f [MHz]	Description	SAR 1g [W/kg]	Estimated SAR 1g [W/kg]	Estimated SAR 1g Deviation	Scaled 1W SAR 1g [W/kg]	Dielectric Parameters*		SAR 1g Deviation from target	Dielectric Parameters Deviation from target		Temp	Plot #
				dSAR [%]		ε_r	σ [S/m]	dSAR [%]	$d\varepsilon_r$ [%]	dσ [%]	[°C]	
	Tolerances			±3%				±10 %	±5 %	±5 %		
	Target result SN:4d005	-	-	-	9.31	55.2	0.97	TCC Beijing/SAR-3 EX3DV4 SN:3838 Body 835MHz				
835	2014-09-15	2.37	2.36	-0.42	9.48	54.1	0.95	1.83	-1.99	-2.06	20.7	4
	Target result SN:547	-	-	-	40.9	53.3	1.52	TCC Salo/SAR-1 EX3DV4 SN:3195 Body 1900MHz				
1900	2014-09-16	10.1	10.2	0.99	40.4	50.8	1.51	-1.22	-4.69	-0.66	21.1	5
	Target result SN:883	-	-	-	51.0	52.7	1.95	TCC Beijing/SAR-4 ES3DV3 SN:3280 Body 2450MHz				
2450	2014-09-16	13.4	13.4	0.00	53.6	54.2	1.94	5.10	2.85	-0.51	21.0	6

* Dielectric parameter reference data taken from FCC Published RF Exposure KDB Procedures

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]	$d\varepsilon_r$ [%]	$d\sigma$ [%]	
	Tolerances			±5 %	±5 %	
	Recommended value	41.5	0.90			
836	2014-09-15	40.7	0.87	-1.93	-3.33	20.7
	Recommended value	40.0	1.40			
1880	2014-09-15	38.4	1.42	-4.00	1.43	21.1
	Recommended value	39.2	1.79			
2437	2014-09-15	37.8	1.75	-3.57	-2.23	21.5

Body tissue simulant measurements

f [MHz]	Description	Dielectric Parameters		Dielectric Parameters Deviation from Recommended value		Temp [°C]
		ε_r	σ [S/m]	$d\varepsilon_r$ [%]	$d\sigma$ [%]	
	Tolerances			±5 %	±5 %	
	Recommended value	55.2	0.97			
836	2014-09-15	54.1	0.95	-1.99	-2.06	20.7
	Recommended value	53.3	1.52			
1880	2014-09-16	50.9	1.49	-4.50	-1.97	21.1
	Recommended value	52.7	1.94			
2437	2014-09-16	54.2	1.92	2.85	-1.03	21.0

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 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.

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 "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 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 inSections 1.2.2 and 1.2.3 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.

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

5.2.3 Wireless Router Configuration

The device was placed in the SPEAG holder and, in sequence, the back, display and each of the 4 edges was positioned 10.0mm away from the flat phantom. The spacer was removed before the start of the measurements.

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. Fast SAR is measured according to the KDB 447498 D01 General RF Exposure Guidance v05r01.

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 for 1g Full SAR in 0.3-6GHz range

Uncertainty Component	Section in IEEE 1528	Tol. (%)	Prob Dist	Div	c_i	$c_i . u_i$ (%)	v_i
Measurement System							
Probe Calibration	E2.1	±6.6	N	1	1	±6.6	∞
Axial Isotropy	E2.2	±4.7	R	√3	$(1-c_p)^{1/2}$	±1.9	∞
Hemispherical Isotropy	E2.2	±9.6	R	√3	$(c_p)^{1/2}$	±3.9	∞
Boundary Effect	E2.3	±2.0	R	√3	1	±1.2	∞
Linearity	E2.4	±4.7	R	√3	1	±2.7	∞
System Detection Limits	E2.5	±1.0	R	√3	1	±0.6	∞
Modulation response	E2.5	±2.4	R	√3	1	±1.4	
Readout Electronics	E2.6	±0.3	N	1	1	±0.3	∞
Response Time	E2.7	±0.8	R	√3	1	±0.5	∞
Integration Time	E2.8	±2.6	R	√3	1	±1.5	∞
RF Ambient Conditions - Noise	E6.1	±3.0	R	√3	1	±1.7	∞
RF Ambient Conditions - Reflections	E6.1	±3.0	R	√3	1	±1.7	∞
Probe Positioner Mechanical Tolerance	E6.2	±0.8	R	√3	1	±0.5	∞
Probe Positioning with respect to Phantom Shell	E6.3	±6.7	R	√3	1	±3.9	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E5	±4.0	R	√3	1	±2.3	∞
Test sample Related							
Test Sample Positioning	E4.2	±6.0	N	1	1	±6.0	11
Device Holder Uncertainty	E4.1	±3.6	N	1	1	±3.6	5
Output Power Variation - SAR drift measurement	E2.9	±5.0	R	√3	1	±2.9	∞
Phantom and Tissue Parameters							
Phantom Uncertainty (shape and thickness tolerances)	E3.1	±6.6	R	√3	1	±3.8	∞
SAR correction	E3.2	±1.9	R	√3	1	±1.1	∞
Conductivity Target - tolerance	E3.4	±5.0	R	√3	0.6	±1.8	∞
Conductivity - measurement uncertainty	E3.3	±5.5	N	1	0.6	±3.5	5
Permittivity Target - tolerance	E3.4	±5.0	R	√3	0.6	±1.7	∞
Permittivity - measurement uncertainty	E3.3	±2.9	N	1	0.6	±1.7	5
Combined Standard Uncertainty			RSS			**±14.0**	198
Coverage Factor for 95%			**k=2**				
Expanded Uncertainty						**±28.2**	

Table 6.2 – Measurement uncertainty evaluation for 1g Fast SAR in 0.3-6GHz range

Relative DASY5 Uncertainty Budget for Fast SAR Tests According to IEEE 1528/2011 and IEC 62209-1/2011 (0.3-6 GHz range)						
Uncertainty Component	**Tol. (%)**	**Prob Dist.**	**Div.**	c_i	$c_i . u_i$ (%)	v_i
Measurement System						
Probe Calibration	±6.6	N	1	0		
Axial Isotropy	±4.7	R	√3	$(1-c_p)^{1/2}$	±1.9	∞
Hemispherical Isotropy	±9.6	R	√3	$(c_p)^{1/2}$	±3.9	∞
Boundary Effect	±2.0	R	√3	1	±1.2	∞
Linearity	±4.7	R	√3	1	±2.7	∞
System Detection Limits	±1.0	R	√3	1	±0.6	∞
Modulation Response	±2.4	R	√3	1	±1.4	∞
Readout Electronics	±0.3	N	1	0		
Response Time	±0.8	R	√3	0		
Integration Time	±2.6	R	√3	1	±1.5	∞
RF Ambient Conditions - Noise	±3.0	R	√3	1	±1.7	∞
RF Ambient Conditions - Reflections	±3.0	R	√3	0		
Probe Positioner Mechanical Tolerance	±0.8	R	√3	1	±0.5	∞
Probe Positioning with respect to Phantom Shell	±6.7	R	√3	1	±3.9	∞
Spatial x-y Resolution	±10.0	R	√3	1	±5.8	∞
Fast SAR z Approximation	±14.0	R	√3	1	±8.1	∞
Test sample Related						
Test Sample Positioning	±6.0	N	1	1	±6.0	12
Device Holder Uncertainty	±3.6	N	1	1	±3.6	5
Output Power Variation - SAR drift measurement	±5.0	R	√3	1	±2.9	∞
Power Scaling	±0	R	√3	0		
Phantom and Setup						
Phantom Uncertainty (shape and thickness tolerances)	±6.6	R	√3	1	±3.8	∞
SAR correction	±1.9	R	√3	0		
Conductivity Target - tolerance	±1.9	R	√3	0		
Conductivity - measurement uncertainty	±5.0	R	√3	0		
Permittivity Target - tolerance	±5.5	N	1	0		
Permittivity - measurement uncertainty	±5.0	R	√3	0		
Combined Standard Uncertainty		RSS			**±14.9**	748
Coverage Factor for 95%		**k=2**				
Expanded Uncertainty					**±29.8**	

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]		32.9			Scaling factor*				
	Conducted Slot Average Power [dBm]		32.7	32.6	32.5	0.2	0.3	0.4	dB	
	Time-averaged power [dBm]		23.7	23.6	23.5	1.05	1.07	1.10	Lin	
			No testing required for this slot configuration							
2-slot GPRS	Tuning Target + Tolerance [dBm]		30.4			Scaling factor*				
	Conducted Slot Average Power [dBm]		30.0	30.0	30.0	0.4	0.4	0.4	dB	
	Time-averaged power [dBm]		24.0	24.0	24.0	1.10	1.10	1.10	Lin	
			No testing required for this slot configuration							
3-slot GPRS	Tuning Target + Tolerance [dBm]		28.9			Scaling factor*				
	Conducted Slot Average Power [dBm]		28.4	28.4	28.5	0.5	0.5	0.4	dB	
	Time-averaged power [dBm]		24.1	24.1	24.2	1.12	1.12	1.10	Lin	
	Left Cheek	Estimated SAR	0.198	0.223	0.266	0.222	0.250	0.292	0.01	1
		Full SAR	-	-	0.259	-	-	**0.284**		
	Left Tilt	Estimated SAR	-	0.106	-	-	0.119	-	-	-
		Full SAR	-	-	-	-	-	-		
	Right Cheek	Estimated SAR	-	0.172	-	-	0.193	-	-	-
		Full SAR	-	-	-	-	-	-		
	Right Tilt	Estimated SAR	-	0.109	-	-	0.122	-	-	-
		Full SAR	-	-	-	-	-	-		
4-slot GPRS	Tuning Target + Tolerance [dBm]		32.9			Scaling factor*				
	Conducted Slot Average Power [dBm]		32.7	32.6	32.5	0.2	0.3	0.4	dB	
	Time-averaged power [dBm]		23.7	23.6	23.5	1.05	1.07	1.10	Lin	
			No testing required for this slot configuration							
1-slot 8PSK EGPRS	Tuning Target + Tolerance [dBm]		27.4			Scaling factor*				
	Conducted Slot Average Power [dBm]		26.7	26.6	26.6	0.7	0.8	0.8	dB	
	Time-averaged power [dBm]		17.7	17.6	17.6	1.17	1.20	1.20	Lin	
			No testing required for this slot configuration							

(Table continues)

(Table continues)

2-slot 8PSK EGPRS	Tuning Target + Tolerance [dBm]		25.9			Scaling factor*				
	Conducted Slot Average Power [dBm]		25.5	25.5	25.6	0.4	0.4	0.3	dB	
	Time-averaged power [dBm]		19.5	19.5	19.6	1.10	1.10	1.07	Lin	
			No testing required for this slot configuration							
3-slot 8PSK EGPRS	Tuning Target + Tolerance [dBm]		24.4			Scaling factor*				
	Conducted Slot Average Power [dBm]		24.0	24.0	24.0	0.4	0.4	0.4	dB	
	Time-averaged power [dBm]		19.7	19.7	19.7	1.10	1.10	1.10	Lin	
	Left Cheek	Estimated SAR	-	-	0.102	-	-	0.112	-	-
		Full SAR	-	-	-	-	-	-		
	Left Tilt	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	-	-	-	-	-		
	Right Cheek	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	-	-	-	-	-		
	Right Tilt	Estimated SAR	-	-	-	-	-	-	-	-
		Full SAR	-	-	-	-	-	-		
4-slot 8PSK EGPRS	Tuning Target + Tolerance [dBm]		22.9			Scaling factor*				
	Conducted Slot Average Power [dBm]		22.5	22.5	22.5	0.4	0.4	0.4	dB	
	Time-averaged power [dBm]		19.5	19.5	19.5	1.10	1.10	1.10	Lin	
			No testing required for this slot configuration							

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]		30.4			Scaling factor*				
	Conducted Slot Average Power [dBm]		30.1	30.1	30.1	0.3	0.3	0.3	dB	
	Time-averaged power [dBm]		21.1	21.1	21.1	1.07	1.07	1.07	Lin	
			No testing required for this slot configuration							
2-slot GPRS	Tuning Target + Tolerance [dBm]		27.4			Scaling factor*				
	Conducted Slot Average Power [dBm]		26.7	26.7	26.5	0.7	0.7	0.9	dB	
	Time-averaged power [dBm]		20.7	20.7	20.5	1.17	1.17	1.23	Lin	
			No testing required for this slot configuration							
3-slot GPRS	Tuning Target + Tolerance [dBm]		25.9			Scaling factor*				
	Conducted Slot Average Power [dBm]		25.1	25.0	25.2	0.8	0.9	0.7	dB	
	Time-averaged power [dBm]		20.8	20.7	20.9	1.20	1.23	1.17	Lin	
			No testing required for this slot configuration							
4-slot GPRS	Tuning Target + Tolerance [dBm]		24.4			Scaling factor*				
	Conducted Slot Average Power [dBm]		24.2	23.7	23.8	0.2	0.7	0.6	dB	
	Time-averaged power [dBm]		21.2	20.7	20.8	1.05	1.17	1.15	Lin	
	Left Cheek	Estimated SAR	0.155	0.116	0.099	0.162	0.136	0.114	0.02	2
		Full SAR	0.140	-	-	**0.147**	-	-		
	Left Tilt	Estimated SAR	-	0.057	-	-	0.067	-	-	-
		Full SAR	-	-	-	-	-	-		
	Right Cheek	Estimated SAR	-	0.099	-	-	0.117	-	-	-
		Full SAR	-	-	-	-	-	-		
	Right Tilt	Estimated SAR	-	0.060	-	-	0.070	-	-	-
		Full SAR	-	-	-	-	-	-		
1-slot 8PSK EGPRS	Tuning Target + Tolerance [dBm]		26.4			Scaling factor*				
	Conducted Slot Average Power [dBm]		25.7	25.7	25.5	0.7	0.7	0.9	dB	
	Time-averaged power [dBm]		16.7	16.7	16.5	1.17	1.17	1.23	Lin	
			No testing required for this slot configuration							
2-slot 8PSK EGPRS	Tuning Target + Tolerance [dBm]		24.9			Scaling factor*				
	Conducted Slot Average Power [dBm]		24.5	24.5	24.4	0.4	0.4	0.5	dB	
	Time-averaged power [dBm]		18.5	18.5	18.4	1.10	1.10	1.12	Lin	
			No testing required for this slot configuration							

(Table continues)

(Table continues)

3-slot 8PSK EGPRS	Tuning Target + Tolerance [dBm]		23.4			Scaling factor*					
	Conducted Slot Average Power [dBm]		22.9	22.9	22.8	0.5	0.5	0.6	dB		
	Time-averaged power [dBm]		18.6	18.6	18.5	1.12	1.12	1.15	Lin		
	Left Cheek	Estimated SAR	0.084	-	-	0.094	-	-	-	-	
		Full SAR	-	-	-	-	-	-			
	Left Tilt	Estimated SAR	-	-	-	-	-	-	-	-	
		Full SAR	-	-	-	-	-	-			
	Right Cheek	Estimated SAR	-	-	-	-	-	-	-	-	
		Full SAR	-	-	-	-	-	-			
	Right Tilt	Estimated SAR	-	-	-	-	-	-	-	-	
		Full SAR	-	-	-	-	-	-			
4-slot 8PSK EGPRS	Tuning Target + Tolerance [dBm]		21.9			Scaling factor*					
	Conducted Slot Average Power [dBm]		21.3	21.4	21.2	0.6	0.5	0.7	dB		
	Time-averaged power [dBm]		18.3	18.4	18.2	1.15	1.12	1.17	Lin		
			No testing required for this slot configuration								

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 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 1Mbps	Tuning Target + Tolerance [dBm]		16.5			Scaling factor*				
	Conducted Power [dBm]		15.2	15.4	15.5	1.3	1.1	1.0	dB	
	Time-averaged power [dBm]		15.2	15.4	15.5	1.35	1.29	1.26	Lin	
	Left Cheek	Estimated SAR	-	0.348	-	-	0.448	-	-	-
		Full SAR	-	-	-	-	-	-		
	Left Tilt	Estimated SAR	-	0.332	-	-	0.428	-	-	-
		Full SAR	-	-	-	-	-	-		
	Right Cheek	Estimated SAR	0.283	0.361	0.365	0.382	0.465	0.460	0.02	3
		Full SAR	-	0.377	-	-	**0.486**	-		
	Right Tilt	Estimated SAR	-	0.262	-	-	0.338	-	-	-
		Full SAR	-	-	-	-	-	-		

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

Test configuration	Max. Reported* 1g SAR results		
	WLAN	3-slot GPRS 850	4-slot GPRS 1900
Head: Left, Cheek	0.448	0.284	0.147
Head: Left, Tilt	0.428	0.119	0.067
Head: Right, Cheek	0.486	0.193	0.117
Head: Right, Tilt	0.338	0.122	0.070

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

Test configuration	Max. Reported* 1g SAR results	
	3-slot GPRS850 + WLAN	4-slot GPRS1900 + WLAN
Head: Left, Cheek	**0.732**	0.595
Head: Left, Tilt	0.547	0.495
Head: Right, Cheek	0.679	**0.603**
Head: Right, Tilt	0.460	0.408

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.

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

Test configuration	Max. Reported* 1g SAR results	
	3-slot GPRS850 + WLAN	4-slot GPRS1900 + WLAN
Head: Left, Cheek	**0.481**	-
Head: Left, Tilt	-	-
Head: Right, Cheek	-	**0.482**
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.

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 128 824.2 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		
3-slot GPRS	Tuning Target + Tolerance [dBm]			28.9			Scaling factor*				
	Conducted Slot Average Power [dBm]			28.4	28.4	28.5	0.5	0.5	0.4	dB	
	Time-averaged power [dBm]			24.1	24.1	24.2	1.12	1.12	1.10	Lin	
	Back facing phantom	Without headset	Estimated SAR	0.307	0.351	0.386	0.344	0.394	0.423	0.00	4
			Full SAR	-	-	0.388	-	-	**0.425**		
		Headset WH-108	Estimated SAR	-	0.305	-	-	0.342	-	-	
			Full SAR	-	-	-	-	-	-		
	Display facing phantom	Without headset	Estimated SAR	-	0.258	-	-	0.289	-	-	
			Full SAR	-	-	-	-	-	-		
		Headset WH-108	Estimated SAR	-	0.188	-	-	0.211	-	-	
			Full SAR	-	-	-	-	-	-		

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		
4-slot GPRS	Tuning Target + Tolerance [dBm]			24.4			Scaling factor*				
	Conducted Slot Average Power [dBm]			24.2	23.7	23.8	0.2	0.7	0.6	dB	
	Time-averaged power [dBm]			21.2	20.7	20.8	1.05	1.17	1.15	Lin	
	Back facing phantom	Without headset	Estimated SAR	-	0.096	-	-	0.112	-	-	
			Full SAR	-	-	-	-	-	-		
		Headset WH-108	Estimated SAR	0.161	0.129	0.101	0.169	0.152	0.116	0.00	5
			Full SAR	0.162	-	-	**0.170**	-	-		
	Display facing phantom	Without headset	Estimated SAR	-	0.102	-	-	0.120	-	-	
			Full SAR	-	-	-	-	-	-		
		Headset WH-108	Estimated SAR	-	0.111	-	-	0.130	-	-	
			Full SAR	-	-	-	-	-	-		

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]			16.5			Scaling factor*				
	Conducted Power [dBm]			15.2	15.4	15.5	1.3	1.1	1.0	dB	
	Time-averaged power [dBm]			15.2	15.4	15.5	1.35	1.29	1.26	Lin	
	Back facing phantom	Without headset	Estimated SAR	0.048	0.069	0.085	0.065	0.089	0.107	0.00	6
			Full SAR	-	-	0.085	-	-	**0.107**		
		Headset WH-108	Estimated SAR	-	0.049	-	-	0.063	-	-	-
			Full SAR	-	-	-	-	-	-		
	Display facing phantom	Without headset	Estimated SAR	-	0.054	-	-	0.070	-	-	-
			Full SAR	-	-	-	-	-	-		
		Headset WH-108	Estimated SAR	-	0.038	-	-	0.048	-	-	-
			Full SAR	-	-	-	-	-	-		

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

Test configuration	Max. Reported*1g SAR results		
	WLAN	3-slot GPRS 850	4-slot GPRS 1900
Body: Back facing phantom, Without Headset	0.107	0.425	0.112
Body: Back facing phantom, Headset WH-108	0.063	0.342	0.170
Body: Display facing phantom, Without Headset	0.070	0.289	0.120
Body: Display facing phantom, Headset WH-108	0.048	0.211	0.130

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

Test configuration	Max. Reported*1g SAR results	
	3-slot GPRS850 + WLAN	4-slot GPRS1900 + WLAN
Body: Back facing phantom, Without Headset	**0.532**	0.219
Body: Back facing phantom, Headset WH-108	0.405	**0.233**
Body: Display facing phantom, Without Headset	0.359	0.190
Body: Display facing phantom, Headset WH-108	0.259	0.178

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. It is these values that appear in the Summary table in Section 1.2.2.

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

Test configuration	Max. Reported*1g SAR results	
	3-slot GPRS850 + WLAN	4-slot GPRS1900 + WLAN
Body: Back facing phantom, Without Headset	**0.438**	-
Body: Back facing phantom, Headset WH-108	-	**0.182**
Body: Display facing phantom, Without Headset	-	-
Body: Display facing phantom, Headset WH-108	-	-

7.3 Body SAR assessment of Wireless Router mode at 10.0mm separation distance

850MHz Band Wireless Router 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		
3-slot GPRS	Tuning Target + Tolerance [dBm]		28.9			Scaling factor*				
	Conducted Slot Average Power [dBm]		28.4	28.4	28.5	0.5	0.5	0.4	dB	
	Time-averaged power [dBm]		24.1	24.1	24.2	1.12	1.12	1.10	Lin	
	Back facing phantom	Estimated SAR	0.451	0.465	0.556	0.506	0.522	0.610	0.01	7
		Full SAR	-	-	0.562	-	-	**0.616**		
	Display facing phantom	Estimated SAR	-	0.272	-	-	0.305	-	-	-
		Full SAR	-	-	-	-	-	-		
	Top edge facing phantom	Estimated SAR	-	0.015	-	-	0.016	-	-	-
		Full SAR	-	-	-	-	-	-		
	Bottom edge facing phantom	Estimated SAR	-	0.081	-	-	0.091	-	-	-
		Full SAR	-	-	-	-	-	-		
	Left edge facing phantom	Estimated SAR	-	0.262	-	-	0.294	-	-	-
		Full SAR	-	-	-	-	-	-		
	Right edge facing phantom	Estimated SAR	-	0.137	-	-	0.154	-	-	-
		Full SAR	-	-	-	-	-	-		

1900MHz Band Wireless Router 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		
4-slot GPRS	Tuning Target + Tolerance [dBm]		24.4			Scaling factor*				
	Conducted Slot Average Power [dBm]		24.2	23.7	23.8	0.2	0.7	0.6	dB	
	Time-averaged power [dBm]		21.2	20.7	20.8	1.05	1.17	1.15	Lin	
	Back facing phantom	Estimated SAR	-	0.212	-	-	0.249	-	-	-
		Full SAR	-	-	-	-	-	-		
	Display facing phantom	Estimated SAR	-	0.172	-	-	0.202	-	-	-
		Full SAR	-	-	-	-	-	-		
	Top edge facing phantom	Estimated SAR	-	0.024	-	-	0.028	-	-	-
		Full SAR	-	-	-	-	-	-		
	Bottom edge facing phantom	Estimated SAR	0.289	0.227	0.198	0.303	0.267	0.227	0.00	8
		Full SAR	0.291	-	-	**0.305**	-	-		
	Left edge facing phantom	Estimated SAR	-	0.076	-	-	0.090	-	-	-
		Full SAR	-	-	-	-	-	-		
	Right edge facing phantom	Estimated SAR	-	0.087	-	-	0.102	-	-	-
		Full SAR	-	-	-	-	-	-		

2450MHz Wireless Router SAR results

Mode	Test configuration	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]		16.5			Scaling factor*				
	Conducted Power [dBm]		15.2	15.4	15.5	1.3	1.1	1.0	dB	
	Time-averaged power [dBm]		15.2	15.4	15.5	1.35	1.29	1.26	Lin	
	Back facing phantom	Estimated SAR	0.078	0.130	0.150	0.105	0.167	0.189	0.00	9
		Full SAR	-	-	0.151	-	-	**0.190**		
	Display facing phantom	Estimated SAR	-	0.097	-	-	0.125	-	-	-
		Full SAR	-	-	-	-	-	-		
	Top edge facing phantom	Estimated SAR	-	0.129	-	-	0.166	-	-	-
		Full SAR	-	-	-	-	-	-		
	Bottom edge facing phantom	Estimated SAR	-	0.005	-	-	0.007	-	-	-
		Full SAR	-	-	-	-	-	-		
	Left edge facing phantom	Estimated SAR	-	0.052	-	-	0.067	-	-	-
		Full SAR	-	-	-	-	-	-		
	Right edge facing phantom	Estimated SAR	-	0.029	-	-	0.037	-	-	-
		Full SAR	-	-	-	-	-	-		

Simultaneous transmissions: Combined SAR results – Individual band Max results

Test configuration	Max. Reported* 1g SAR results		
	WLAN	3-slot GPRS 850	4-slot GPRS 1900
Back facing phantom	0.190	0.616	0.249
Display facing phantom	0.125	0.305	0.202
Top edge facing phantom	0.166	0.016	0.028
Bottom edge facing phantom	0.007	0.091	0.305
Left edge facing phantom	0.067	0.294	0.090
Right edge facing phantom	0.037	0.154	0.102

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

Test configuration	Max. Reported* 1g SAR results	
	3-slot GPRS850 + WLAN	4-slot GPRS1900 + WLAN
Back facing phantom	**0.806**	**0.439**
Display facing phantom	0.430	0.327
Top edge facing phantom	0.182	0.194
Bottom edge facing phantom	0.098	0.312
Left edge facing phantom	0.361	0.157
Right edge facing phantom	0.191	0.139

7.3.1 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 SAR results – SPEAG Combined Multiband algorithm results

Test configuration	Max. Reported* 1g SAR results	
	3-slot GPRS850 + WLAN	4-slot GPRS1900 + WLAN
Back facing phantom	**0.634**	**0.275**
Display facing phantom	-	-
Top edge facing phantom	-	-
Bottom edge facing phantom	-	-
Left edge facing phantom	-	-
Right edge facing phantom	-	-

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

Plots of the Measurement scans are given in Appendix B.

APPENDIX A: SYSTEM CHECKING SCANS

Plot1:

Date/Time: 2014-09-15 10:17:40 AM

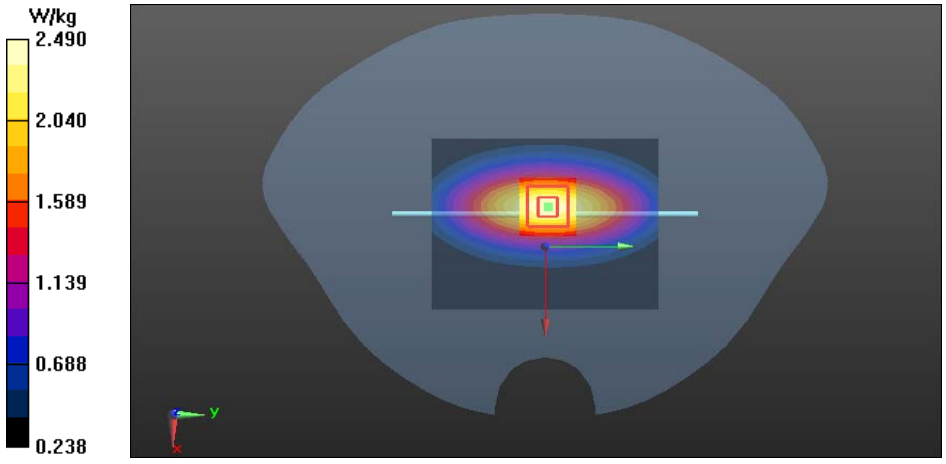
Test Laboratory: TCC Microsoft
Type: D835V2; Serial: 4d005

Communication System: CW835
Frequency: 835 MHz; Duty Cycle: 1:1
Medium: Head 835 SAR3; Medium Notes: Medium Temperature: t=20.7
Medium parameters used: f = 835 MHz; σ = 0.874 S/m; ε_r = 40.68; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:
- Probe: EX3DV4 - SN3838
- ConvF(9.2, 9.2, 9.2); Calibrated: 2014-03-21;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn710; Calibrated: 2014-03-24
- Phantom: SAR3 - SAM3; Type: Not Specified; Serial: Not Specified
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.8 (7028)

d=15mm, Pin=250mW/Area Scan (61x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 53.048 V/m
Fast SAR: SAR(1 g) = 2.29 W/kg
Fast SAR(10 g) = 1.56 W/kg
Maximum value of SAR (interpolated) = 2.47 W/kg

d=15mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 53.048 V/m
Peak SAR (extrapolated) = 3.43 W/kg
SAR(1 g) = 2.31 W/kg
SAR(10 g) = 1.52 W/kg
Power Drift = -0.07 dB
Maximum value of SAR (measured) = 2.49 W/kg



Plot2:

Date/Time: 2014-09-15 2:12:37 PM

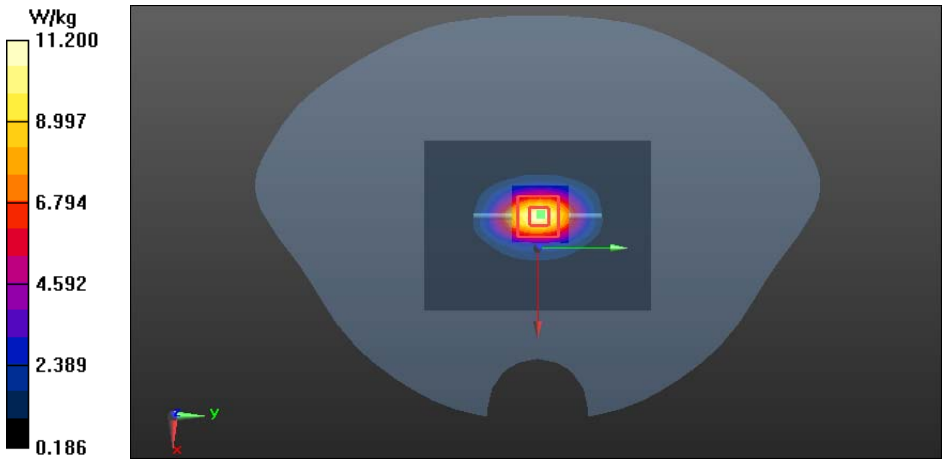
Test Laboratory: TCC Microsoft
Type: D1900V2; Serial: 547

Communication System: CW1900
Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: Head 1900 SAR1; Medium Notes: Medium Temperature: t=21.1 C
Medium parameters used: f = 1900 MHz; σ = 1.441 S/m; ε_r = 38.317; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:
- Probe: ES3DV3 - SN3195
- ConvF(5.08, 5.08, 5.08); Calibrated: 2014-03-20;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1324; Calibrated: 2014-03-12
- Phantom: SAR1 - SAM3; 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=1.500 mm, dy=1.500 mm
Reference Value = 90.608 V/m
Fast SAR: SAR(1 g) = 9.96 W/kg
Fast SAR(10 g) = 5.27 W/kg
Maximum value of SAR (interpolated) = 11.6 W/kg

d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 90.608 V/m
Peak SAR (extrapolated) = 18.9 W/kg
SAR(1 g) = 10.1 W/kg
SAR(10 g) = 5.18 W/kg
Power Drift = -0.02 dB
Maximum value of SAR (measured) = 11.2 W/kg



Plot3:

Date/Time: 2014-09-15 9:42:58 AM

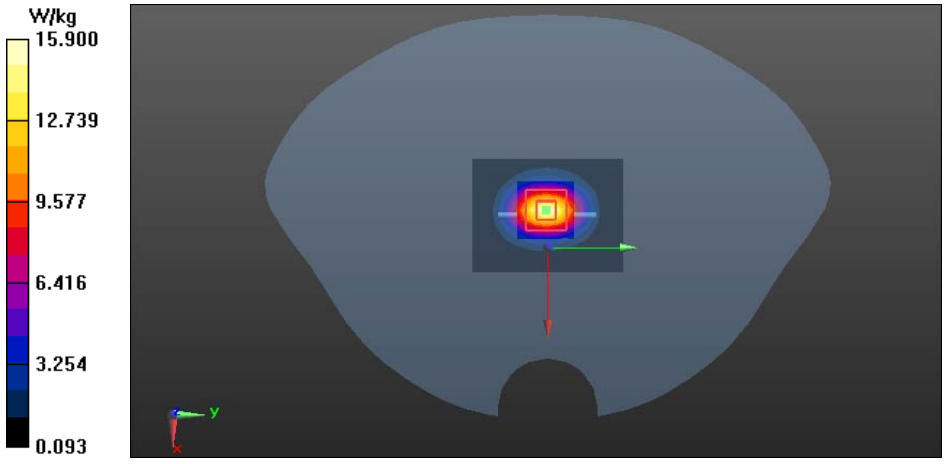
Test Laboratory: TCC Microsoft
Type: D2450V2; Serial: D2450V2 - SN:883

Communication System: CW2450
Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: Head 2450 SAR4; Medium Notes: Medium Temperature: t=21.5C
Medium parameters used: f = 2450 MHz; σ = 1.773 S/m; ε_r = 37.805; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:
- Probe: ES3DV3 - SN3280
- ConvF(4.54, 4.54, 4.54); Calibrated: 2014-03-20;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn887; Calibrated: 2014-03-31
- Phantom: SAR4 - SAM3; 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
Reference Value = 92.945 V/m
Fast SAR: SAR(1 g) = 13.9 W/kg
Fast SAR(10 g) = 6.26 W/kg
Maximum value of SAR (interpolated) = 16.0 W/kg

d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 92.945 V/m
Peak SAR (extrapolated) = 29.6 W/kg
SAR(1 g) = 13.9 W/kg
SAR(10 g) = 6.41 W/kg
Power Drift = 0.04 dB
Maximum value of SAR (measured) = 15.9 W/kg



Plot4:

Date/Time: 2014-09-15 2:39:47 PM

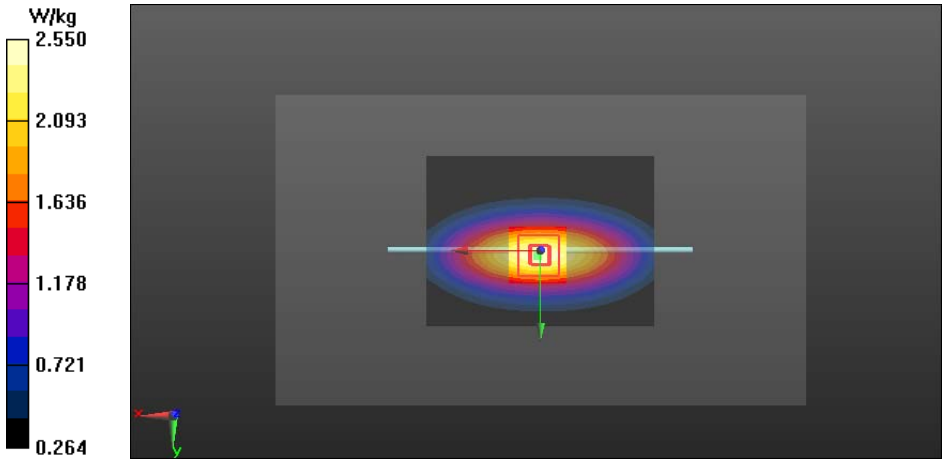
Test Laboratory: TCC Microsoft
Type: D835V2; Serial: 4d005

Communication System: CW835
Frequency: 835 MHz; Duty Cycle: 1:1
Medium: Body 835 SAR3; Medium Notes: Medium Temperature: t=20.7
Medium parameters used: f = 835 MHz; σ = 0.952 S/m; ε_r = 54.09; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: EX3DV4 - SN3838
- ConvF(8.97, 8.97, 8.97); Calibrated: 2014-03-21;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn710; Calibrated: 2014-03-24
- Phantom: SAR3 - TFP; Type: Not Specified; Serial: Not Specified
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.8 (7028)

d=15mm, Pin=250mW/Area Scan (81x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 51.531 V/m
Fast SAR: SAR(1 g) = 2.36 W/kg
Fast SAR(10 g) = 1.6 W/kg
Maximum value of SAR (interpolated) = 2.54 W/kg

d=15mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 51.531 V/m
Peak SAR (extrapolated) = 3.46 W/kg
SAR(1 g) = 2.37 W/kg
Maximum value of SAR (measured) = 2.55 W/kg
Power Drift = 0.01 dB



Plot5:

Date/Time: 2014-09-16 9:37:55 AM

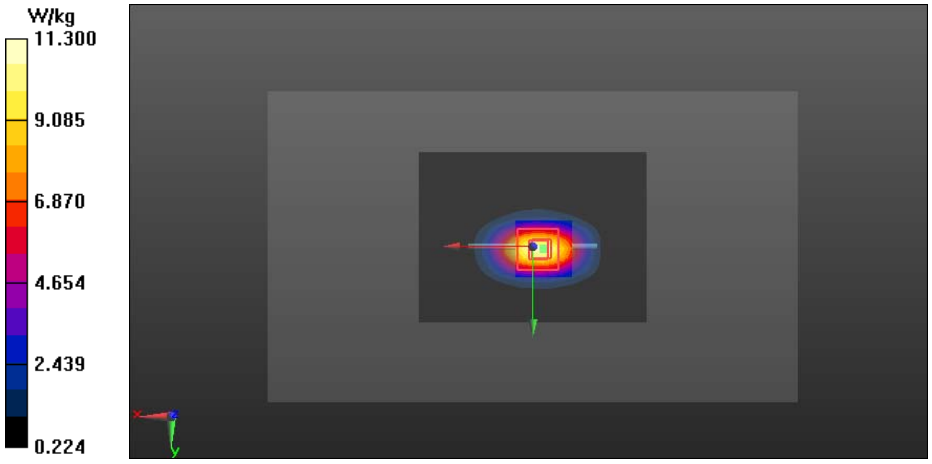
Test Laboratory: TCC Microsoft
Type: D1900V2; Serial: 547

Communication System: CW1900
Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: Body 1900 SAR1; Medium Notes: Medium Temperature: t=21.1C
Medium parameters used: f = 1900 MHz; σ = 1.515 S/m; ε_r = 50.789; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3195
- ConvF(4.64, 4.64, 4.64); Calibrated: 2014-03-20;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1324; Calibrated: 2014-03-12
- Phantom: SAR1 - TFP; 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 (81x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 87.423 V/m
Fast SAR: SAR(1 g) = 10.2 W/kg
Fast SAR(10 g) = 5.28 W/kg
Maximum value of SAR (interpolated) = 12.4 W/kg

d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 87.423 V/m
Peak SAR (extrapolated) = 18.2 W/kg
SAR(1 g) = 10.1 W/kg
Maximum value of SAR (measured) = 11.3 W/kg
Power Drift = 0.00 dB



Plot6:

Date/Time: 2014-09-16 9:52:46 AM

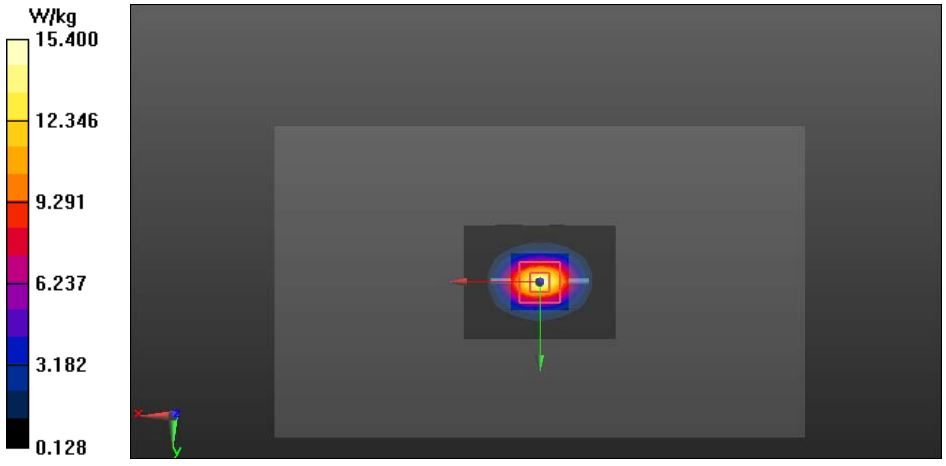
Test Laboratory: TCC Microsoft
Type: D2450V2; Serial: D2450V2 - SN:883

Communication System: CW2450
Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: Body 2450 SAR4; Medium Notes: Medium Temperature: t=21.0C
Medium parameters used: f = 2450 MHz; σ = 1.939 S/m; ε_r = 54.178; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3280
- ConvF(4.2, 4.2, 4.2); Calibrated: 2014-03-20;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn887; Calibrated: 2014-03-31
- Phantom: SAR4 - TFP; 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 (81x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 89.330 V/m
Fast SAR: SAR(1 g) = 13.4 W/kg
Fast SAR(10 g) = 5.89 W/kg
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 = 89.330 V/m
Peak SAR (extrapolated) = 27.6 W/kg
SAR(1 g) = 13.4 W/kg
Maximum value of SAR (measured) = 15.4 W/kg
Power Drift = -0.00 dB



APPENDIX B: MEASUREMENT SCANS

Plot1:

Date/Time: 2014-09-15 11:45:53 AM

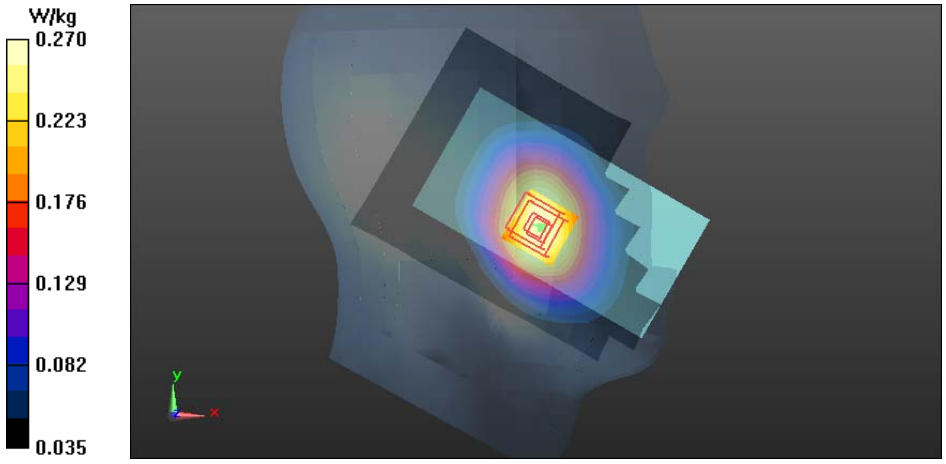
Test Laboratory: TCC Microsoft
Type: RM-1090; Serial: 004402/47/971163/6; 004402/47/971164/4

Communication System: 3-slot GPRS850
Frequency: 848.8 MHz; Duty Cycle: 1:2.80027
Medium: Head 835 SAR3; Medium Notes: Medium Temperature: t=20.7
Medium parameters used: f = 849 MHz; σ = 0.885 S/m; ε_r = 40.583; ρ = 1000 kg/m^3
Phantom section: Left Section

DASY Configuration:
- Probe: EX3DV4 - SN3838
- ConvF(9.2, 9.2, 9.2); Calibrated: 2014-03-21;
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn710; Calibrated: 2014-03-24
- Phantom: SAR3 - SAM3; Type: Not Specified; Serial: Not Specified
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.8 (7028)

3-slot GPRS850 - Left/Cheek - High/Area Scan (81x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 16.908 V/m
Fast SAR: SAR(1 g) = 0.266 W/kg
Fast SAR(10 g) = 0.186 W/kg
Maximum value of SAR (interpolated) = 0.283 W/kg

3-slot GPRS850 - Left/Cheek - High/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 16.908 V/m
Peak SAR (extrapolated) = 0.317 W/kg
SAR(1 g) = 0.259 W/kg
SAR(10 g) = 0.200 W/kg
Power Drift = -0.04 dB
Maximum value of SAR (measured) = 0.270 W/kg



Plot2:

Date/Time: 2014-09-15 4:12:16 PM

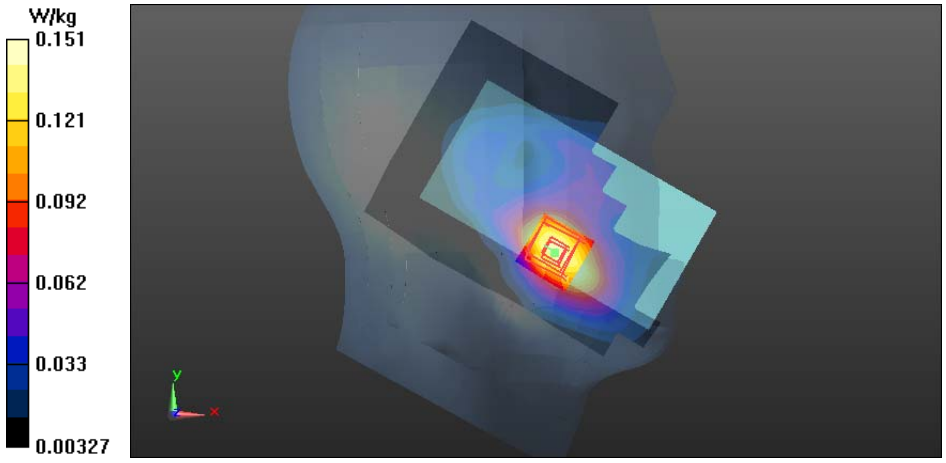
Test Laboratory: TCC Microsoft
Type: RM-1090; Serial: 004402/47/971165/1; 004402/47/971166/9

Communication System: 4-slot GPRS1900
Frequency: 1850.2 MHz; Duty Cycle: 1:2.09991
Medium: Head 1900 SAR1; Medium Notes: Medium Temperature: t=21.1 C
Medium parameters used (interpolated): f = 1850.2 MHz; σ = 1.392 S/m; ε_r = 38.55; ρ = 1000 kg/m^3
Phantom section: Left Section

DASY Configuration:
- Probe: ES3DV3 - SN3195
- ConvF(5.08, 5.08, 5.08); Calibrated: 2014-03-20;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1324; Calibrated: 2014-03-12
- Phantom: SAR1 - SAM3; Type: Not Specified; Serial: Not Specified
- Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.8 (7028)

4-slot GPRS1900 - Left/Cheek - Low/Area Scan (81x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 3.967 V/m
Fast SAR: SAR(1 g) = 0.155 W/kg
Fast SAR(10 g) = 0.090 W/kg
Maximum value of SAR (interpolated) = 0.172 W/kg

4-slot GPRS1900 - Left/Cheek - Low/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 3.967 V/m
Peak SAR (extrapolated) = 0.212 W/kg
SAR(1 g) = 0.140 W/kg
SAR(10 g) = 0.089 W/kg
Power Drift = -0.07 dB
Maximum value of SAR (measured) = 0.151 W/kg



Plot3:

Date/Time: 2014-09-15 11:55:10 AM

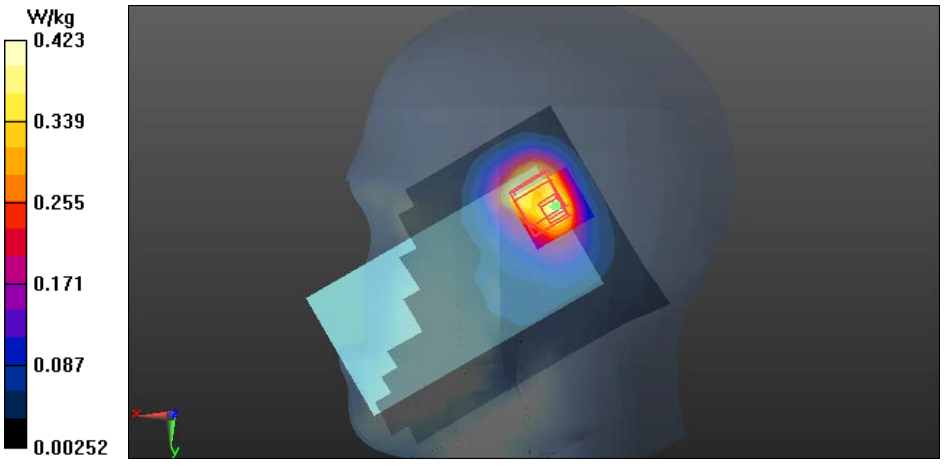
Test Laboratory: TCC Microsoft
Type: RM-1090; Serial: 004402/47/971343/4; 004402/47/971344/2

Communication System: WLAN2450 b-mode
Frequency: 2437 MHz; Duty Cycle: 1:1
Medium: Head 2450 SAR4; Medium Notes: Medium Temperature: t=21.5C
Medium parameters used: f = 2437 MHz; σ = 1.753 S/m; ε_r = 37.821; ρ = 1000 kg/m^3
Phantom section: Right Section

DASY Configuration:
- Probe: ES3DV3 - SN3280
- ConvF(4.54, 4.54, 4.54); Calibrated: 2014-03-20;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn887; Calibrated: 2014-03-31
- Phantom: SAR4 - SAM3; Type: Not Specified; Serial: Not Specified
- Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.8 (7028)

WLAN2450 b-mode - Right/Cheek - Channel 6 - BPSK 1 Mbps/Area Scan (121x181x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 12.971 V/m
Fast SAR: SAR(1 g) = 0.361 W/kg
Fast SAR(10 g) = 0.195 W/kg
Maximum value of SAR (interpolated) = 0.425 W/kg

WLAN2450 b-mode - Right/Cheek - Channel 6 - BPSK 1 Mbps/Zoom Scan (7x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 12.971 V/m
Peak SAR (extrapolated) = 0.837 W/kg
SAR(1 g) = 0.377 W/kg
SAR(10 g) = 0.197 W/kg
Power Drift = 0.15 dB
Maximum value of SAR (measured) = 0.423 W/kg



Plot4:

Date/Time: 2014-09-15 4:05:42 PM

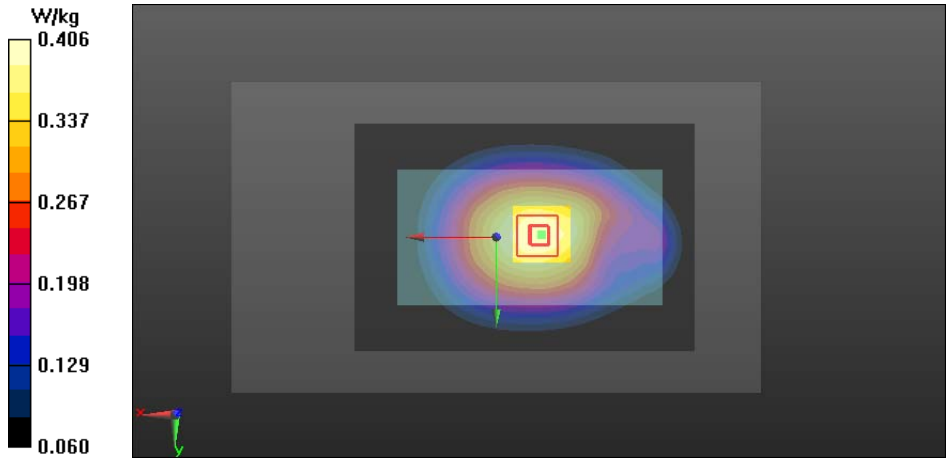
Test Laboratory: TCC Microsoft
Type: RM-1090; Serial: 004402/47/971163/6; 004402/47/971164/4

Communication System: 3-slot GPRS850
Frequency: 848.8 MHz; Duty Cycle: 1:2.80027
Medium: Body 835 SAR3; Medium Notes: Medium Temperature: t=20.7
Medium parameters used: f = 849 MHz; σ = 0.967 S/m; ε_r = 53.956; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: EX3DV4 - SN3838
- ConvF(8.97, 8.97, 8.97); Calibrated: 2014-03-21;
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn710; Calibrated: 2014-03-24
- Phantom: SAR3 - TFP; Type: Not Specified; Serial: Not Specified
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.8 (7028)

3-slot GPRS850/Body - High - Spacer 15mm - No Headset - Back Facing Phantom/Area Scan (81x121x1):
Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 19.212 V/m
Fast SAR: SAR(1 g) = 0.386 W/kg
Fast SAR(10 g) = 0.277 W/kg
Maximum value of SAR (interpolated) = 0.406 W/kg

3-slot GPRS850/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 = 19.212 V/m
Peak SAR (extrapolated) = 0.482 W/kg
SAR(1 g) = 0.388 W/kg
Maximum value of SAR (measured) = 0.406 W/kg
Power Drift = 0.02 dB



Plot5:

Date/Time: 2014-09-16 10:36:53 AM

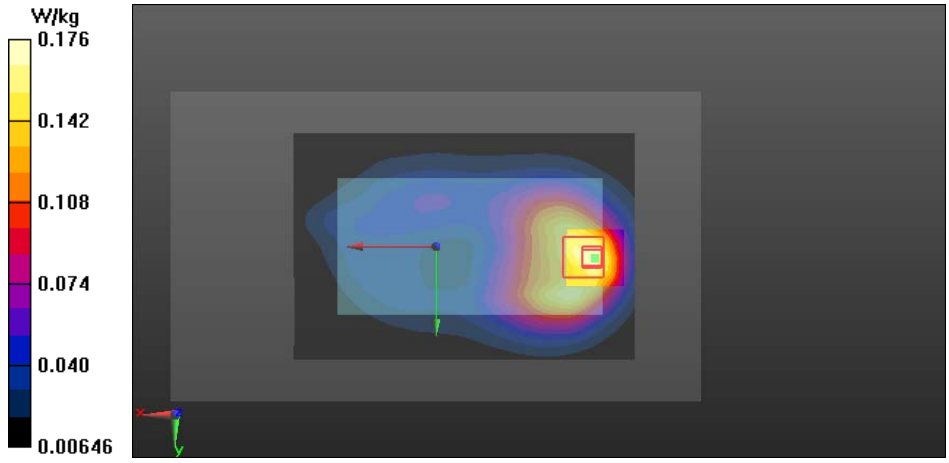
Test Laboratory: TCC Microsoft
Type: RM-1090; Serial: 004402/47/971165/1; 004402/47/971166/9

Communication System: 4-slot GPRS1900
Frequency: 1850.2 MHz; Duty Cycle: 1:2.09991
Medium: Body 1900 SAR1; Medium Notes: Medium Temperature: t=21.1C
Medium parameters used (interpolated): f = 1850.2 MHz; σ = 1.464 S/m; ε_r = 51.008; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3195
- ConvF(4.64, 4.64, 4.64); Calibrated: 2014-03-20;
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1324; Calibrated: 2014-03-12
- Phantom: SAR1 - TFP; Type: Not Specified; Serial: Not Specified
- Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.8 (7028)

4-slot GPRS1900/Body - Low - Spacer 15mm - WH-108 - Back Facing Phantom/Area Scan (81x121x1):
Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 4.454 V/m
Fast SAR: SAR(1 g) = 0.161 W/kg
Fast SAR(10 g) = 0.099 W/kg
Maximum value of SAR (interpolated) = 0.179 W/kg

4-slot GPRS1900/Body - Low - Spacer 15mm - WH-108 - Back Facing Phantom/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 4.454 V/m
Peak SAR (extrapolated) = 0.253 W/kg
SAR(1 g) = 0.162 W/kg
Maximum value of SAR (measured) = 0.176 W/kg
Power Drift = -0.06 dB



Plot6:

Date/Time: 2014-09-16 11:42:34 AM

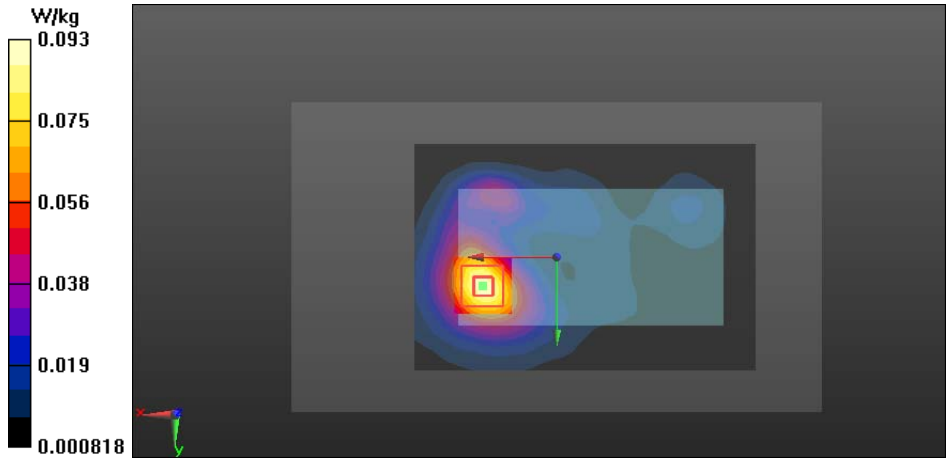
Test Laboratory: TCC Microsoft
Type: RM-1090; Serial: 004402/47/971343/4; 004402/47/971344/2

Communication System: WLAN2450
Frequency: 2462 MHz; Duty Cycle: 1:1
Medium: Body 2450 SAR4; Medium Notes: Medium Temperature: t=21.0C
Medium parameters used: f = 2462 MHz; σ = 1.96 S/m; ε_r = 54.159; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3280
- ConvF(4.2, 4.2, 4.2); Calibrated: 2014-03-20;
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn887; Calibrated: 2014-03-31
- Phantom: SAR4 - TFP; Type: Not Specified; Serial: Not Specified
- Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.8 (7028)

WLAN2450 b-mode/Body - Channel 11 - BPSK 1 Mbps - Spacer 15mm - No Headset - Back Facing
Phantom/Area Scan (121x181x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 2.041 V/m
Fast SAR: SAR(1 g) = 0.085 W/kg
Fast SAR(10 g) = 0.045 W/kg
Maximum value of SAR (interpolated) = 0.0934 W/kg

WLAN2450 b-mode/Body - Channel 11 - BPSK 1 Mbps - Spacer 15mm - No Headset - Back Facing
Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.041 V/m
Peak SAR (extrapolated) = 0.150 W/kg
SAR(1 g) = 0.085 W/kg
Maximum value of SAR (measured) = 0.0932 W/kg
Power Drift = 0.09 dB



Plot7:

Date/Time: 2014-09-15 6:24:25 PM

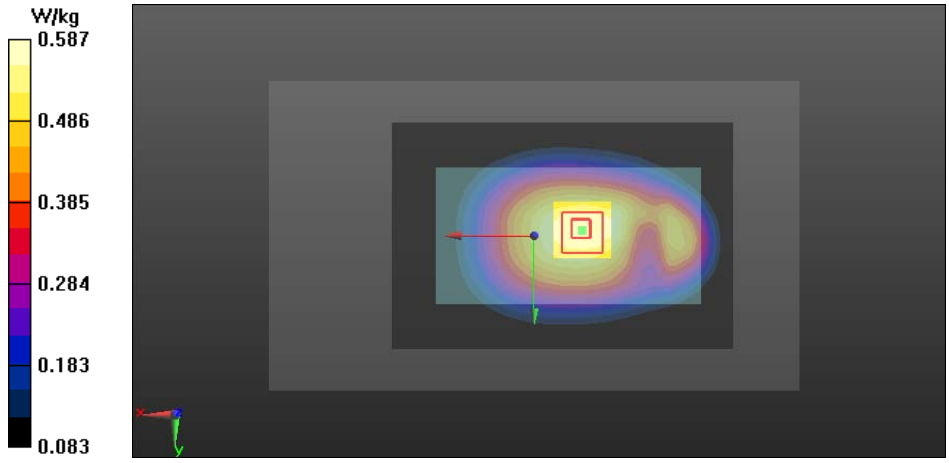
Test Laboratory: TCC Microsoft
Type: RM-1090; Serial: 004402/47/971163/6; 004402/47/971164/4

Communication System: 3-slot GPRS850
Frequency: 848.8 MHz; Duty Cycle: 1:2.80027
Medium: Body 835 SAR3; Medium Notes: Medium Temperature: t=20.7
Medium parameters used: f = 849 MHz; σ = 0.967 S/m; ε_r = 53.956; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: EX3DV4 - SN3838
- ConvF(8.97, 8.97, 8.97); Calibrated: 2014-03-21;
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn710; Calibrated: 2014-03-24
- Phantom: SAR3 - TFP; Type: Not Specified; Serial: Not Specified
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.8 (7028)

3-slot GPRS850/Body - High - Spacer 10mm - No Headset - Back Facing Phantom/Area Scan (81x121x1):
Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 23.044 V/m
Fast SAR: SAR(1 g) = 0.556 W/kg
Fast SAR(10 g) = 0.401 W/kg
Maximum value of SAR (interpolated) = 0.584 W/kg

3-slot GPRSGSM850/Body - High - Spacer 10mm - No Headset - Back Facing Phantom/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 23.044 V/m
Peak SAR (extrapolated) = 0.701 W/kg
SAR(1 g) = 0.562 W/kg
Maximum value of SAR (measured) = 0.587 W/kg
Power Drift = 0.01 dB



Plot8:

Date/Time: 2014-09-16 11:45:00 AM

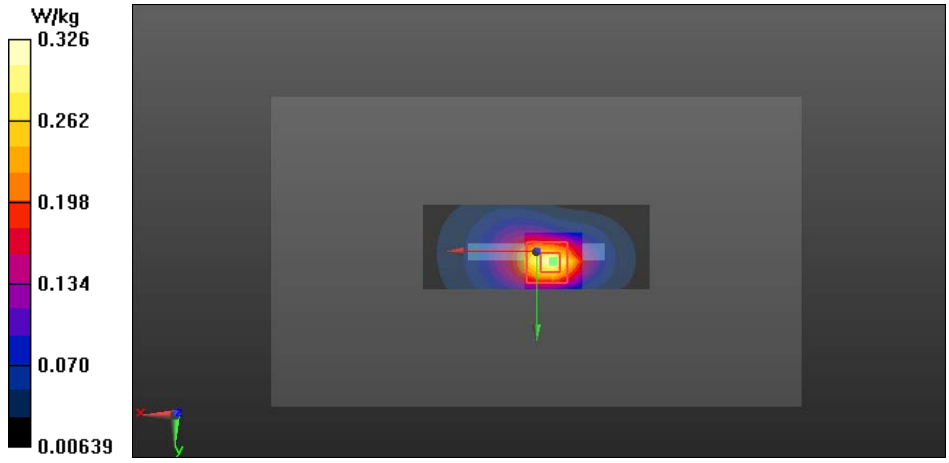
Test Laboratory: TCC Microsoft
Type: RM-1090; Serial: 004402/47/971165/1; 004402/47/971166/9

Communication System: 4-slot GPRS1900
Frequency: 1850.2 MHz; Duty Cycle: 1:2.09991
Medium: Body 1900 SAR1; Medium Notes: Medium Temperature: t=21.1C
Medium parameters used (interpolated): f = 1850.2 MHz; σ = 1.464 S/m; ε_r = 51.008; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3195
- ConvF(4.64, 4.64, 4.64); Calibrated: 2014-03-20;
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1324; Calibrated: 2014-03-12
- Phantom: SAR1 - TFP; Type: Not Specified; Serial: Not Specified
- Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.8 (7028)

4-slot GPRS1900/Body - Low - Spacer 10mm - No Headset - Bottom Facing Phantom/Area Scan (31x81x1):
Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 13.737 V/m
Fast SAR: SAR(1 g) = 0.289 W/kg
Fast SAR(10 g) = 0.154 W/kg
Maximum value of SAR (interpolated) = 0.338 W/kg

4-slot GPRS1900/Body - Low - Spacer 10mm - No Headset - Bottom Facing Phantom/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 13.737 V/m
Peak SAR (extrapolated) = 0.484 W/kg
SAR(1 g) = 0.291 W/kg
Maximum value of SAR (measured) = 0.326 W/kg
Power Drift = -0.09 dB



Plot9:

Date/Time: 2014-09-16 3:08:32 PM

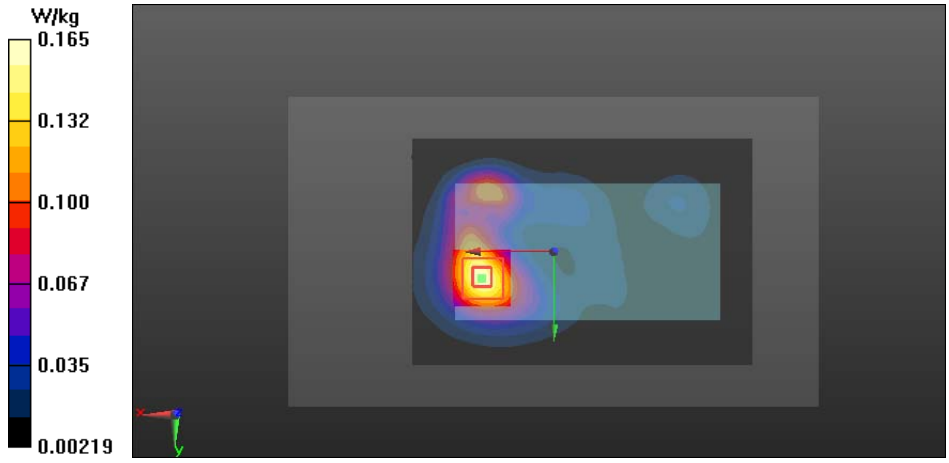
Test Laboratory: TCC Microsoft
Type: RM-1090; Serial: 004402/47/971343/4; 004402/47/971344/2

Communication System: WLAN2450
Frequency: 2462 MHz; Duty Cycle: 1:1
Medium: Body 2450 SAR4; Medium Notes: Medium Temperature: t=21.0C
Medium parameters used: f = 2462 MHz; σ = 1.96 S/m; ε_r = 54.159; ρ = 1000 kg/m^3
Phantom section: Center Section

DASY Configuration:
- Probe: ES3DV3 - SN3280
- ConvF(4.2, 4.2, 4.2); Calibrated: 2014-03-20;
- Sensor-Surface: 4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn887; Calibrated: 2014-03-31
- Phantom: SAR4 - TFP; Type: Not Specified; Serial: Not Specified
- Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.8 (7028)

WLAN 2450 b-mode/Body - Channel 11 - BPSK 1 Mbps - Spacer 10mm - No Headset - Back Facing Phantom/Area Scan (121x181x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 2.591 V/m
Fast SAR: SAR(1 g) = 0.150 W/kg
Fast SAR(10 g) = 0.077 W/kg
Maximum value of SAR (interpolated) = 0.164 W/kg

WLAN 2450 b-mode/Body - Channel 11 - BPSK 1 Mbps - Spacer 10mm - No Headset - Back Facing Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.591 V/m
Peak SAR (extrapolated) = 0.269 W/kg
SAR(1 g) = 0.151 W/kg
Maximum value of SAR (measured) = 0.165 W/kg
Power Drift = 0.07 dB



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	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
GSM/GPRS/ EGPRS850	2014-09-15	40.8	0.87	40.7	0.87	40.6	0.88
f (MHz)	Date	Dielectric Parameters					
		1850.0MHz		1880.0MHz		1910.0MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
GSM/GPRS/ EGPRS1900	2014-09-15	38.5	1.39	38.4	1.42	38.3	1.45
f (MHz)	Date	Dielectric Parameters					
		2412.0MHz		2437.0MHz		2462.0MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
WLAN2450	2014-09-15	37.9	1.72	37.8	1.75	37.8	1.79

Body tissue simulant dielectric parameters used in the measurements:

f (MHz)	Date	Dielectric Parameters					
		824.2MHz		837.0MHz		849.0MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
GSM/GPRS/ EGPRS850	2014-09-15	54.2	0.94	54.1	0.95	54.0	0.97
f (MHz)	Date	Dielectric Parameters					
		1850.0MHz		1880.0MHz		1910.0MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
GSM/GPRS/ EGPRS1900	2014-09-16	51.0	1.46	50.9	1.49	50.7	1.52
f (MHz)	Date	Dielectric Parameters					
		2412.0MHz		2437.0MHz		2462.0MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
WLAN2450	2014-09-16	54.3	1.87	54.2	1.92	54.2	1.96

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

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

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

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

Accreditation No.: SCS 108

Client **Nokia Beijing TCC**

Certificate No: EX3-3838_Mar14

CALIBRATION CERTIFICATE

Object EX3DV4 - SN:3838

Calibration procedure(s) QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

Calibration date: March 21, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-13 (No. 217-01735)	Apr-14
Reference 30 dB Attenuator	SN: S5129 (30b)	04-Apr-13 (No. 217-01738)	Apr-14
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: March 22, 2014

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3838

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.37	0.60	0.53	± 10.1 %
DCP (mV)[B]	107.0	100.2	100.2	

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	163.7	±3.0 %
		Y	0.0	0.0	1.0		161.7	
		Z	0.0	0.0	1.0		171.8	

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

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3838

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
835	41.5	0.90	9.20	9.20	9.20	0.29	1.12	± 12.0 %
1750	40.1	1.37	7.71	7.71	7.71	0.47	0.77	± 12.0 %
1900	40.0	1.40	7.57	7.57	7.57	0.32	0.90	± 12.0 %
5200	36.0	4.66	4.89	4.89	4.89	0.40	1.80	± 13.1 %
5300	35.9	4.76	4.64	4.64	4.64	0.40	1.80	± 13.1 %
5500	35.6	4.96	4.69	4.69	4.69	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.43	4.43	4.43	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.39	4.39	4.39	0.40	1.80	± 13.1 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

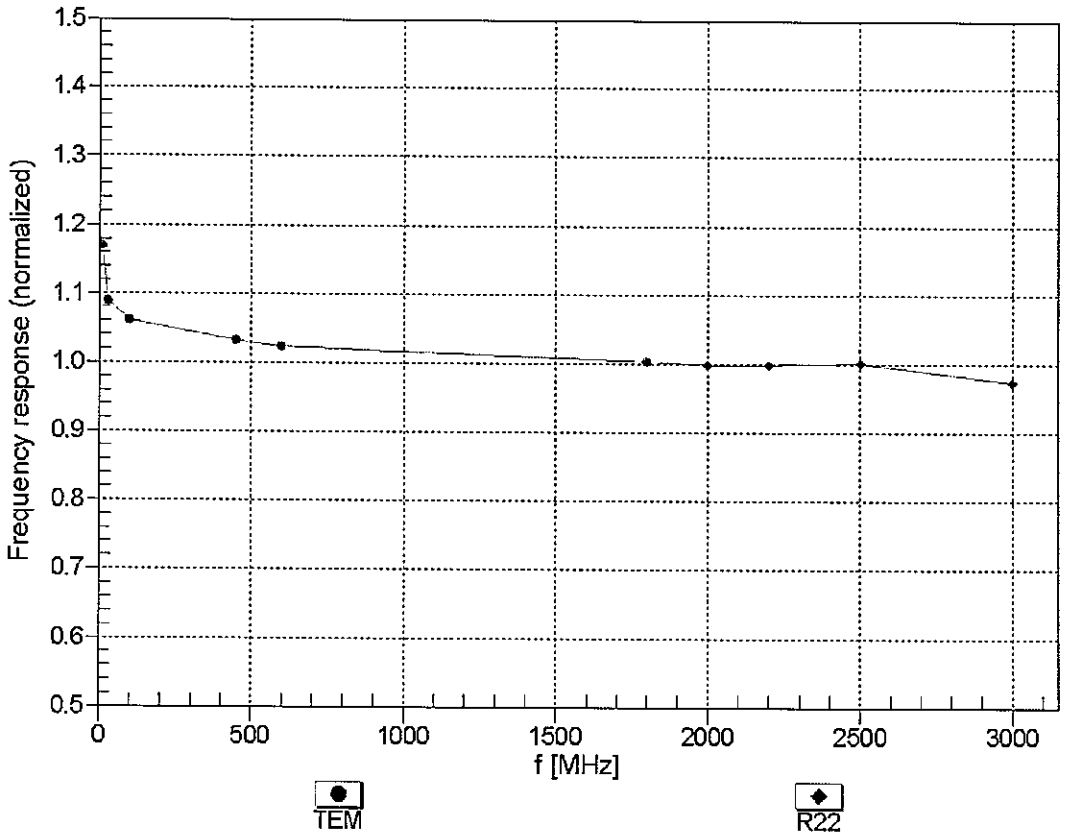
DASY/EASY - Parameters of Probe: EX3DV4 - SN:3838

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
835	55.2	0.97	8.97	8.97	8.97	0.38	0.93	± 12.0 %
1750	53.4	1.49	7.37	7.37	7.37	0.68	0.68	± 12.0 %
1900	53.3	1.52	7.14	7.14	7.14	0.42	0.89	± 12.0 %
5200	49.0	5.30	4.49	4.49	4.49	0.50	1.90	± 13.1 %
5300	48.9	5.42	4.28	4.28	4.28	0.50	1.90	± 13.1 %
5500	48.6	5.65	4.11	4.11	4.11	0.50	1.90	± 13.1 %
5600	48.5	5.77	3.90	3.90	3.90	0.50	1.90	± 13.1 %
5800	48.2	6.00	4.13	4.13	4.13	0.50	1.90	± 13.1 %

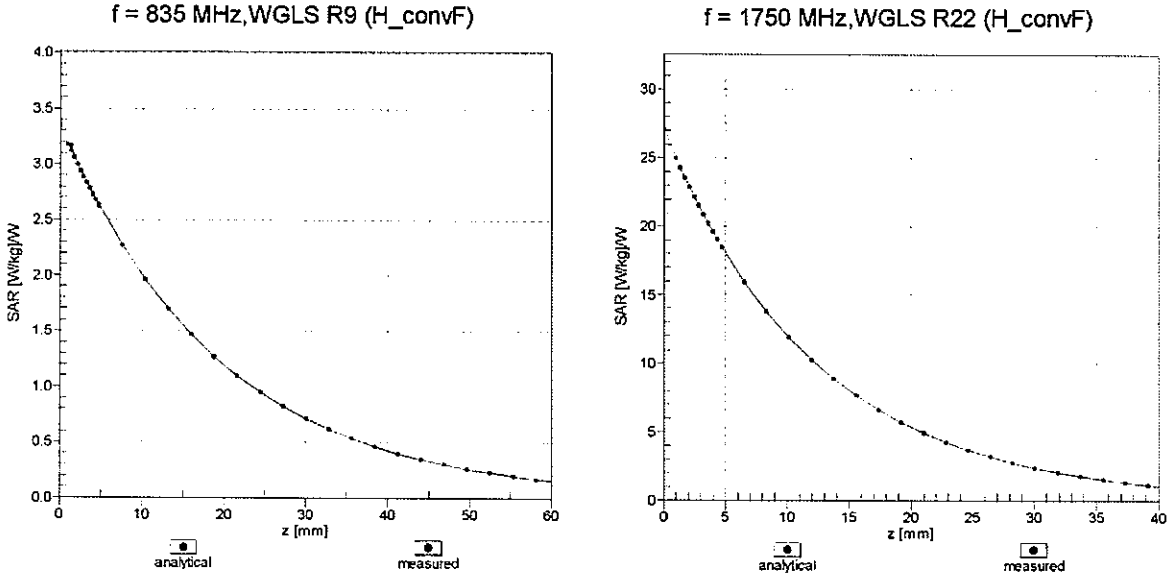
[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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



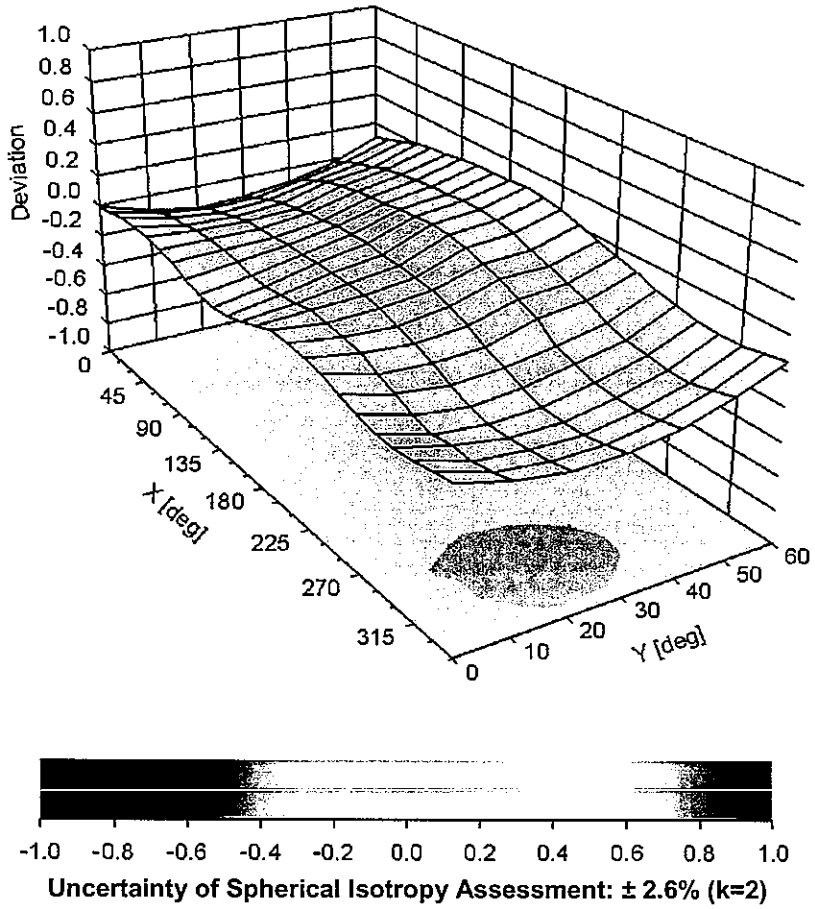
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3838

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-9.9
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm

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

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S Swiss Calibration Service

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

Accreditation No.: SCS 108

Client **Nokia Beijing TCC**

Certificate No: ES3-3280_Mar14

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3280

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

Calibration date: March 20, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-13 (No. 217-01735)	Apr-14
Reference 30 dB Attenuator	SN: S5129 (30b)	04-Apr-13 (No. 217-01738)	Apr-14
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: March 22, 2014

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

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.27	1.31	1.33	± 10.1 %
DCP (mV)[B]	104.3	102.8	104.6	

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	219.4	±3.8 %
		Y	0.0	0.0	1.0		192.4	
		Z	0.0	0.0	1.0		219.9	

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

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: ES3DV3 - SN: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 [G]	Depth [G] (mm)	Unct. (k=2)
835	41.5	0.90	6.07	6.07	6.07	0.44	1.56	± 12.0 %
1750	40.1	1.37	5.25	5.25	5.25	0.41	1.58	± 12.0 %
1900	40.0	1.40	5.06	5.06	5.06	0.80	1.16	± 12.0 %
2450	39.2	1.80	4.54	4.54	4.54	0.78	1.25	± 12.0 %
2600	39.0	1.96	4.35	4.35	4.35	0.80	1.26	± 12.0 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

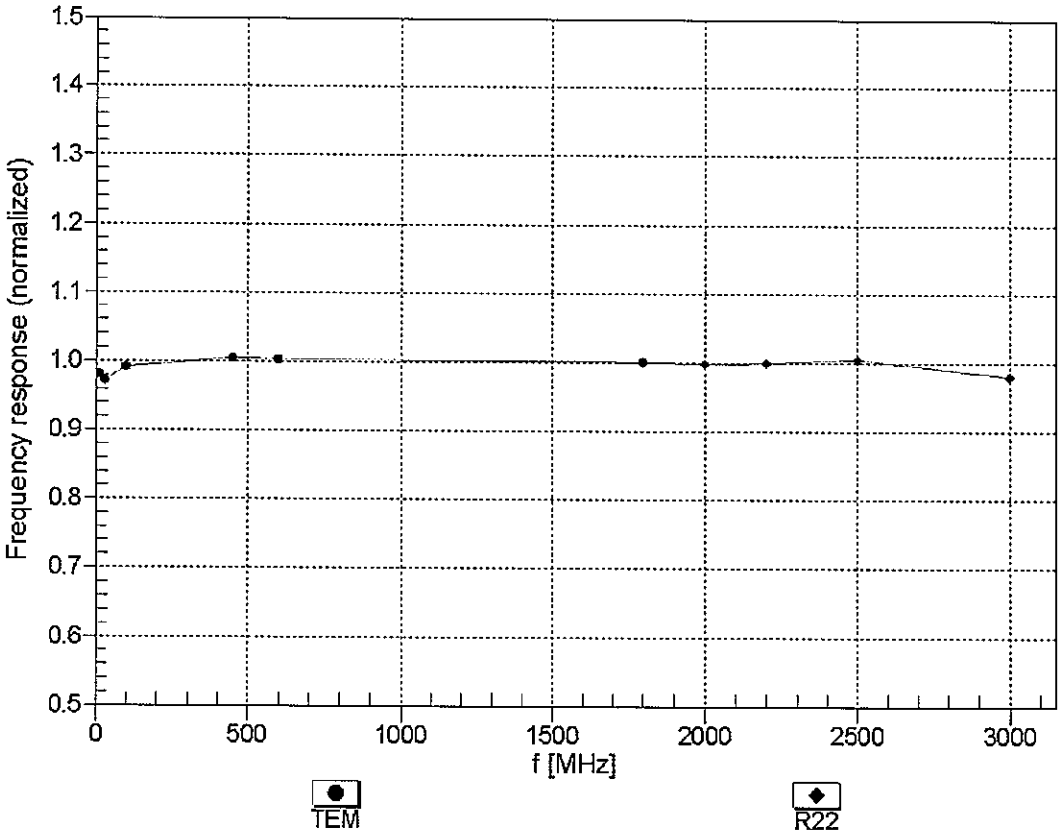
DASY/EASY - Parameters of Probe: ES3DV3 - SN:3280

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 [G]	Depth [G] (mm)	Unct. (k=2)
835	55.2	0.97	6.03	6.03	6.03	0.80	1.16	± 12.0 %
1750	53.4	1.49	4.83	4.83	4.83	0.53	1.52	± 12.0 %
1900	53.3	1.52	4.62	4.62	4.62	0.62	1.47	± 12.0 %
2450	52.7	1.95	4.20	4.20	4.20	0.72	1.13	± 12.0 %
2600	52.5	2.16	3.99	3.99	3.99	0.80	1.04	± 12.0 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

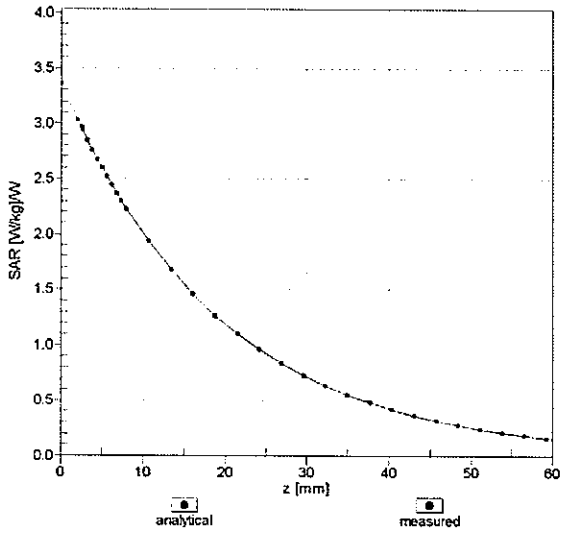
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



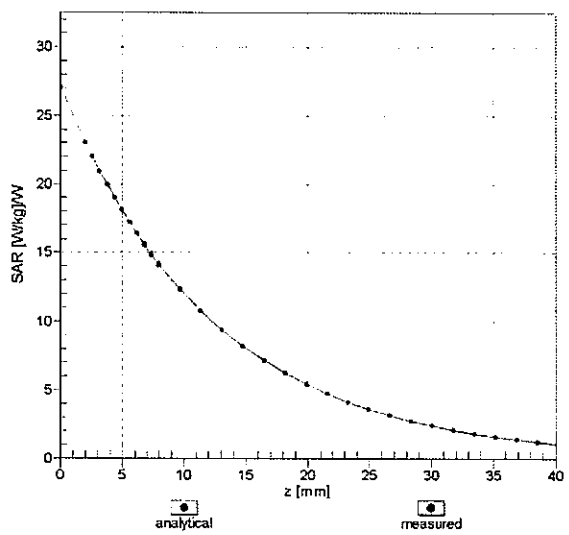
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

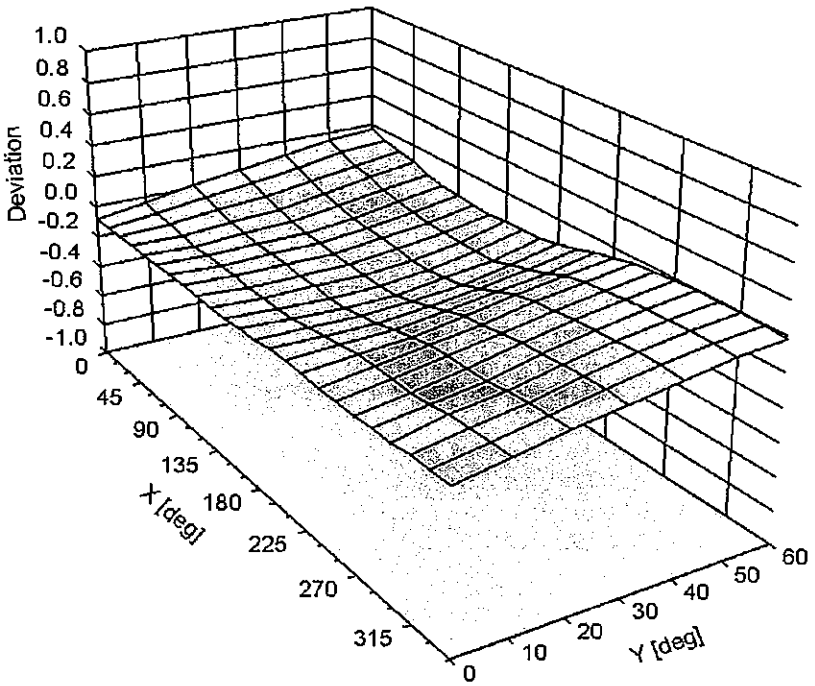


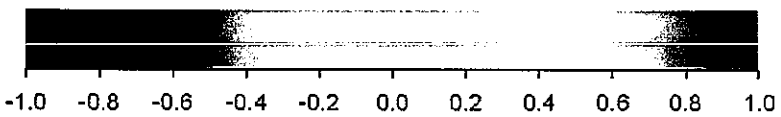
f = 1750 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz





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

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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-75.4
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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Accreditation No.: SCS 108

Client **Nokia Beijing TCC**

Certificate No: ES3-3195_Mar14

CALIBRATION CERTIFICATE

Object ES3DV3 - SN:3195

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

Calibration date: March 20, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-13 (No. 217-01735)	Apr-14
Reference 30 dB Attenuator	SN: S5129 (30b)	04-Apr-13 (No. 217-01738)	Apr-14
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: March 22, 2014

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

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.42	1.19	1.43	± 10.1 %
DCP (mV)[B]	100.9	102.8	99.7	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	195.1	±3.8 %
		Y	0.0	0.0	1.0		209.4	
		Z	0.0	0.0	1.0		203.5	

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

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: ES3DV3 - SN: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 [G]	Depth [G] (mm)	Unct. (k=2)
835	41.5	0.90	6.18	6.18	6.18	0.47	1.46	± 12.0 %
1750	40.1	1.37	5.24	5.24	5.24	0.80	1.11	± 12.0 %
1900	40.0	1.40	5.08	5.08	5.08	0.39	1.67	± 12.0 %
1950	40.0	1.40	4.92	4.92	4.92	0.79	1.21	± 12.0 %
2300	39.5	1.67	4.77	4.77	4.77	0.65	1.35	± 12.0 %
2450	39.2	1.80	4.54	4.54	4.54	0.59	1.46	± 12.0 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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

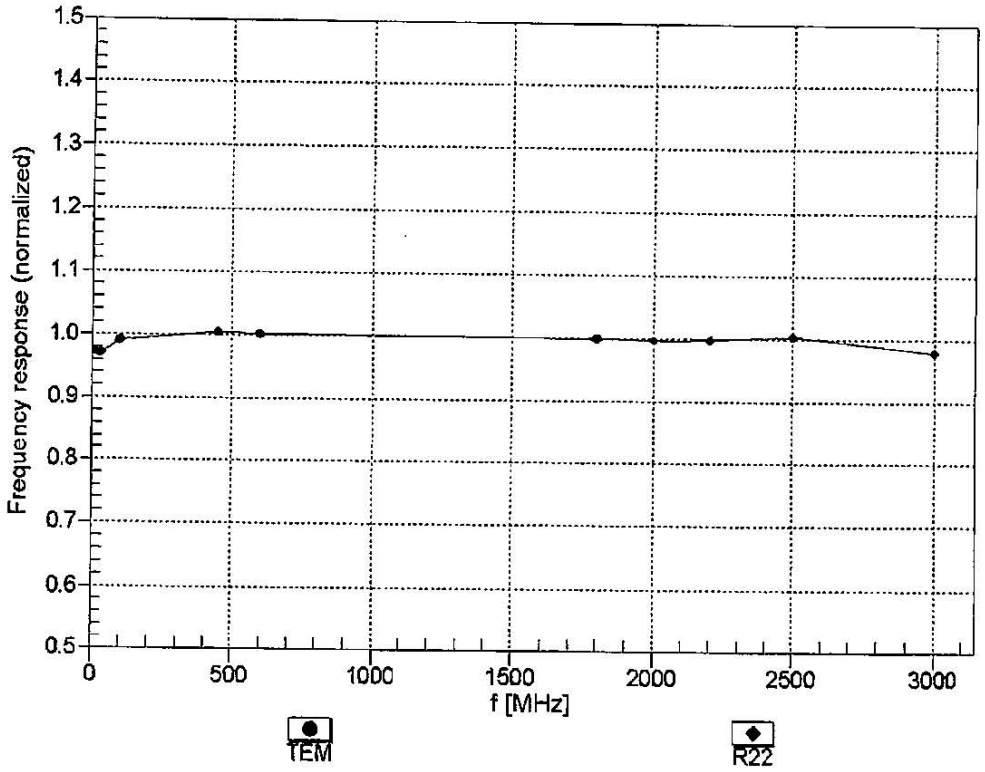
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
835	55.2	0.97	6.12	6.12	6.12	0.38	1.75	± 12.0 %
1750	53.4	1.49	4.80	4.80	4.80	0.40	1.80	± 12.0 %
1900	53.3	1.52	4.64	4.64	4.64	0.56	1.48	± 12.0 %
2450	52.7	1.95	4.21	4.21	4.21	0.67	1.15	± 12.0 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

Frequency Response of E-Field

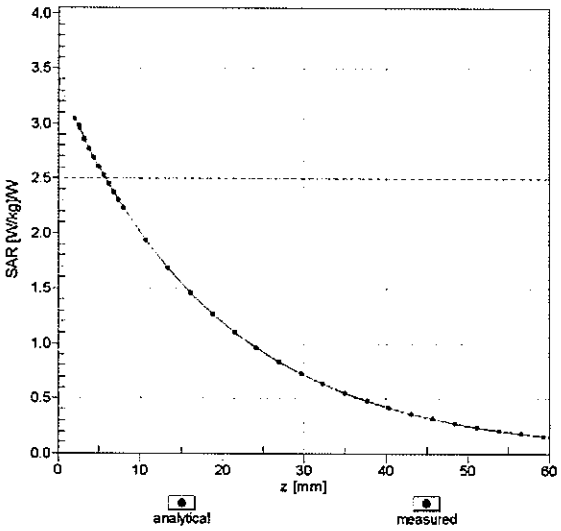
(TEM-Cell:Ifi110 EXX, Waveguide: R22)



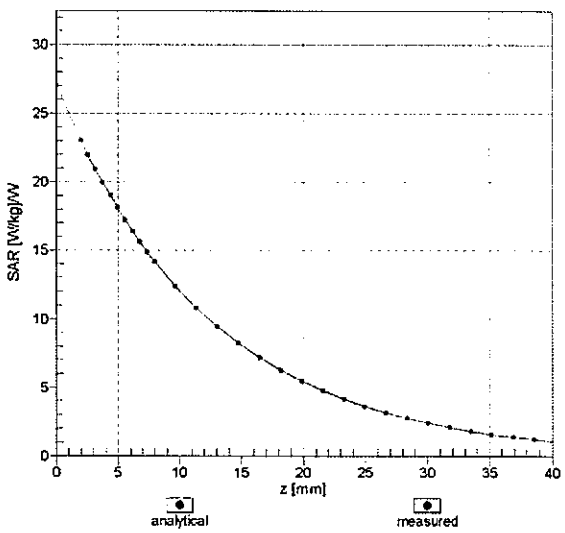
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

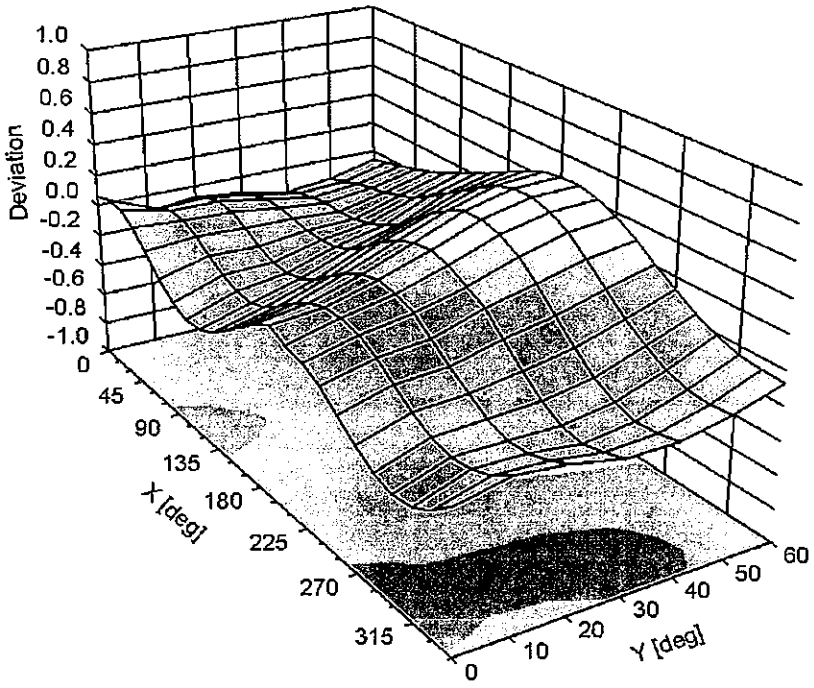


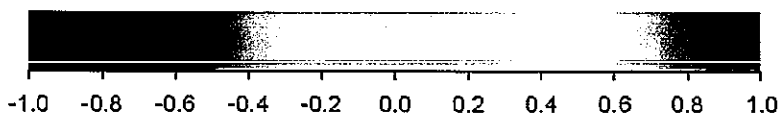
f = 1750 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz





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

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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-92
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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

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

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C Service suisse d'étalonnage
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S Swiss Calibration Service

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

Accreditation No.: SCS 108

Client **Nokia Beijing TCC**

Certificate No: D835V2-4d005_Mar14

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 4d005
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	March 18, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: March 18, 2014

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.5 ± 6 %	0.94 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.42 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.32 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.56 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**6.06 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.0 ± 6 %	1.01 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.40 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**9.31 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.56 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.09 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.0 Ω - 2.9 jΩ
Return Loss	- 29.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.3 Ω - 6.5 jΩ
Return Loss	- 22.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.395 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	July 11, 2003

DASY5 Validation Report for Head TSL

Date: 18.03.2014

Test Laboratory: SPEAG, Zurich, Switzerland

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

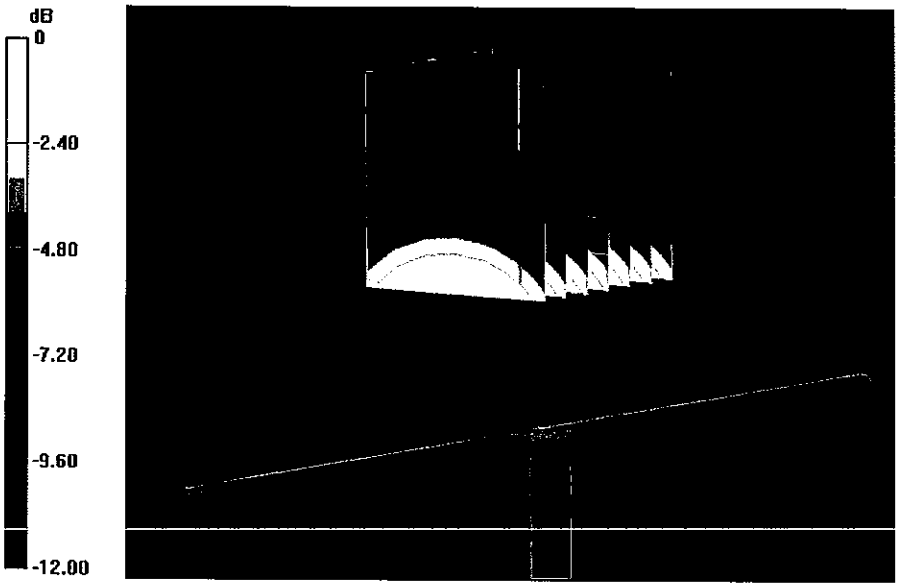
Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.94 S/m; ε_r = 40.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.22, 6.22, 6.22); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

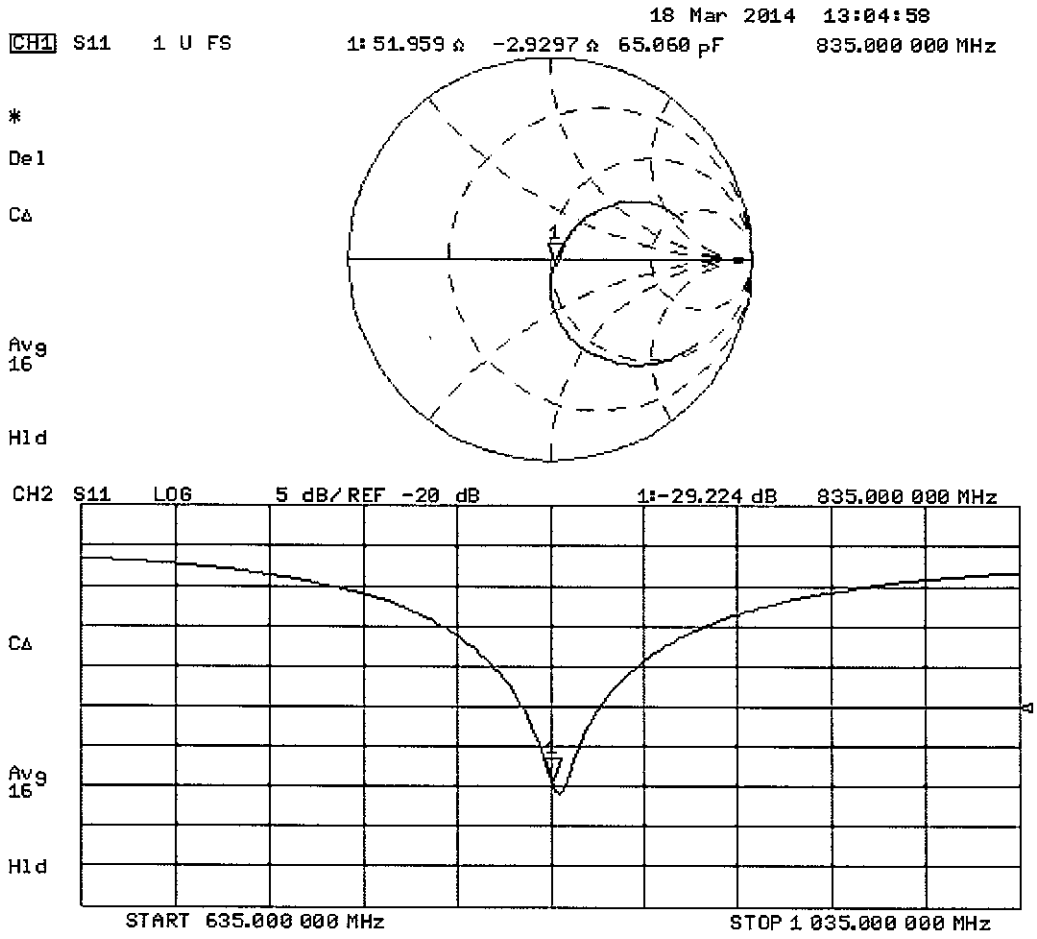
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.167 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 3.67 W/kg
SAR(1 g) = 2.42 W/kg; SAR(10 g) = 1.56 W/kg
Maximum value of SAR (measured) = 2.84 W/kg



0 dB = 2.84 W/kg = 4.53 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 14.03.2014

Test Laboratory: SPEAG, Zurich, Switzerland

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

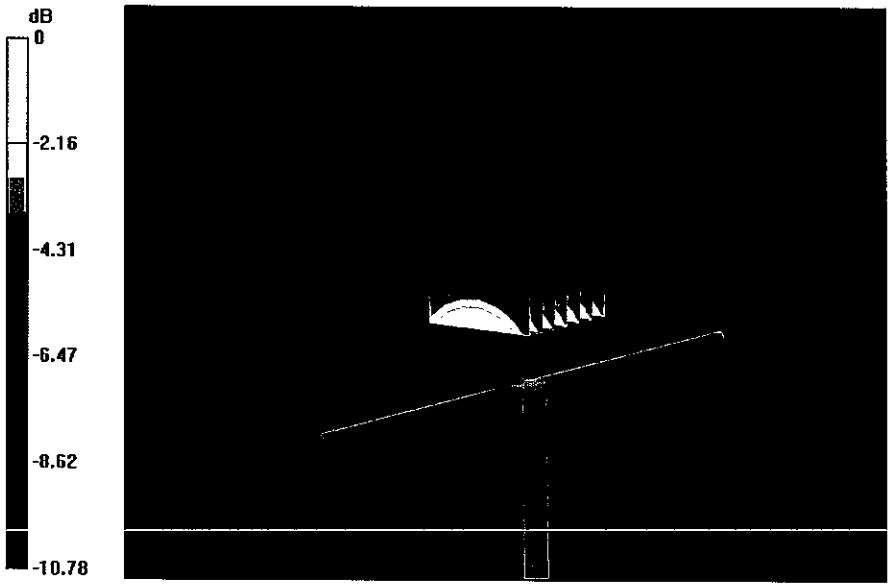
Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 1.01 S/m; ε_r = 55; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.09, 6.09, 6.09); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

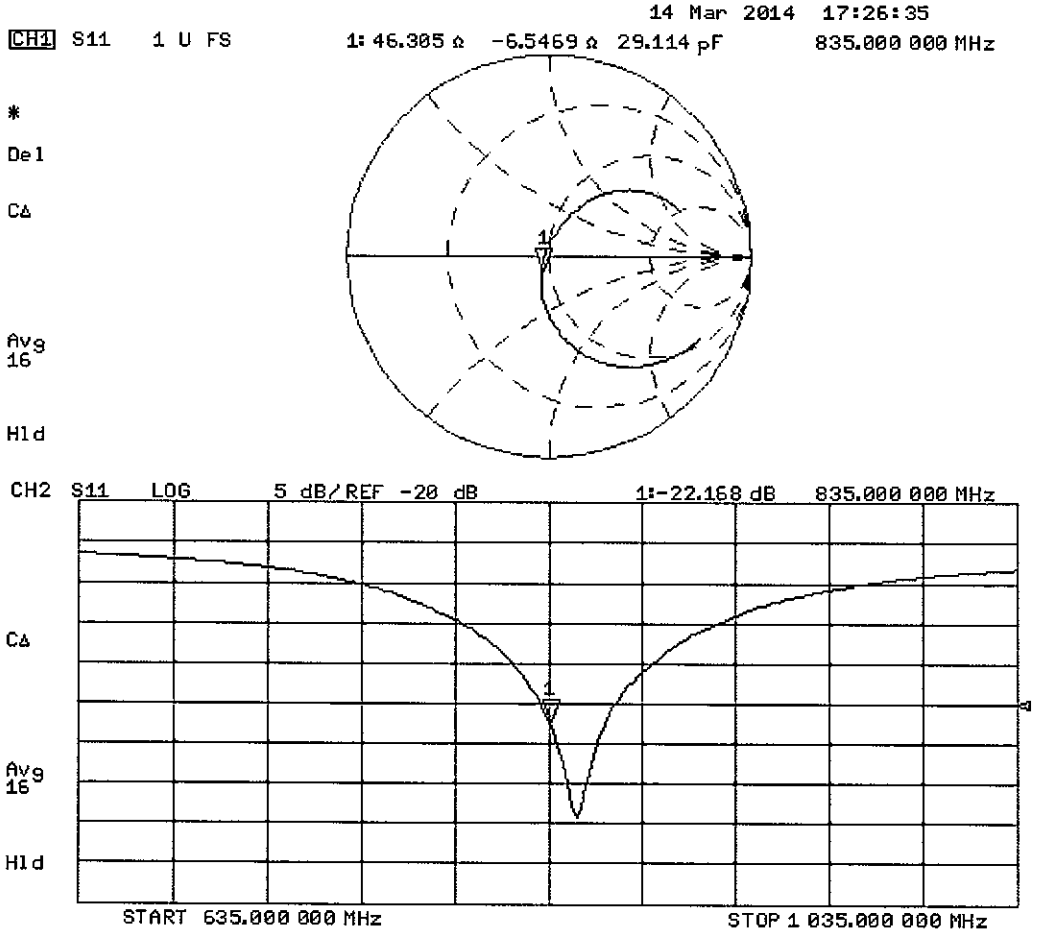
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.814 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 3.56 W/kg
SAR(1 g) = 2.4 W/kg; SAR(10 g) = 1.56 W/kg
Maximum value of SAR (measured) = 2.80 W/kg



0 dB = 2.80 W/kg = 4.47 dBW/kg

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 108

Client **Nokia Beijing TCC**

Certificate No: D1900V2-547_Sep13

CALIBRATION CERTIFICATE

Object	D1900V2 - SN: 547
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	September 17, 2013

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

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

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

Issued: September 18, 2013

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.7 ± 6 %	1.37 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**40.9 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.30 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.3 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.2 ± 6 %	1.49 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**40.9 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.35 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.6 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.0 Ω + 3.8 jΩ
Return Loss	- 28.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.1 Ω + 3.5 jΩ
Return Loss	- 25.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.189 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	November 15, 2001

DASY5 Validation Report for Head TSL

Date: 17.09.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 547

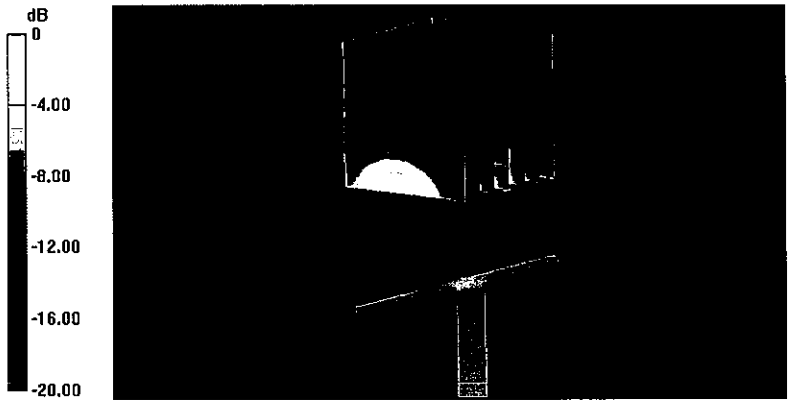
Communication System: UID 0 - CW ; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.37 S/m; ε_r = 39.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.98, 4.98, 4.98); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

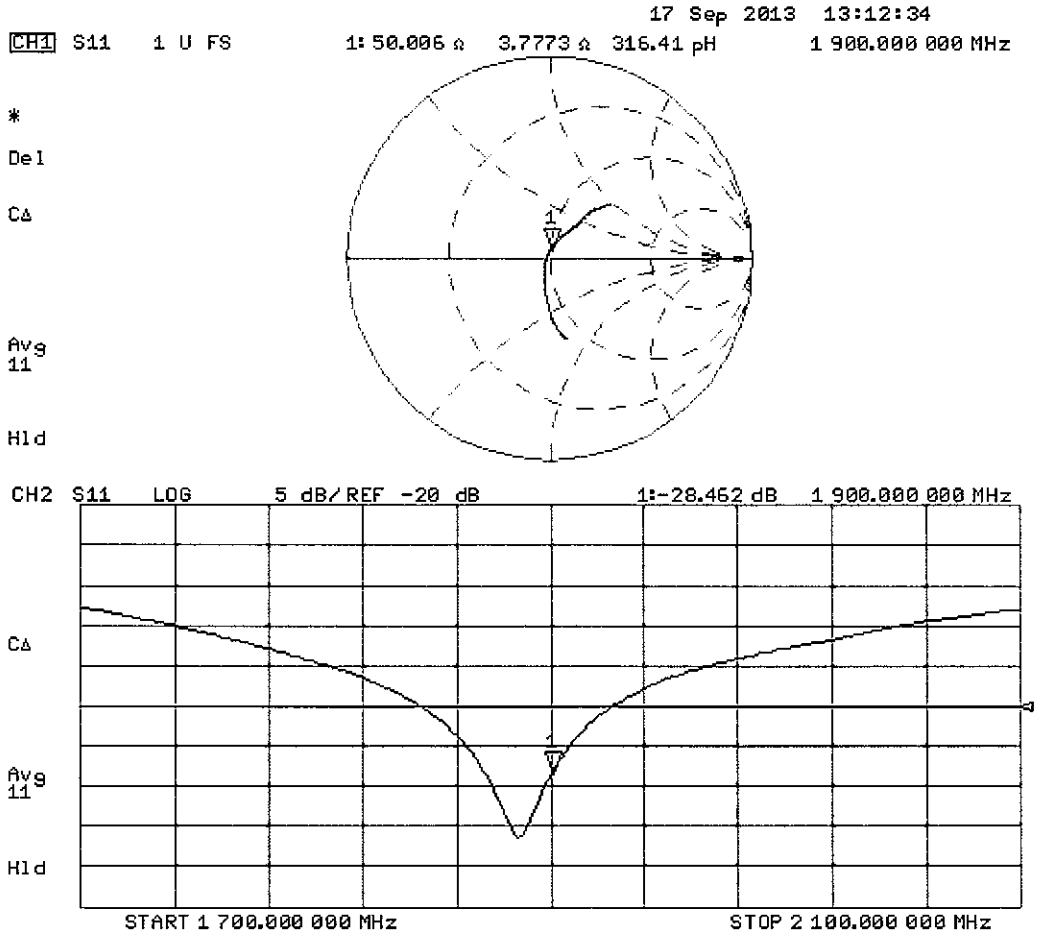
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.940 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 18.5 W/kg
SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.3 W/kg
Maximum value of SAR (measured) = 12.5 W/kg



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

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 17.09.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 547

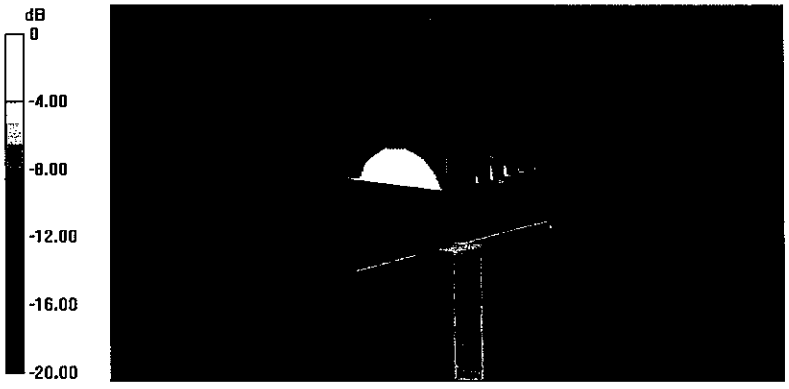
Communication System: UID 0 - CW ; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.49 S/m; ε_r = 53.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.6, 4.6, 4.6); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

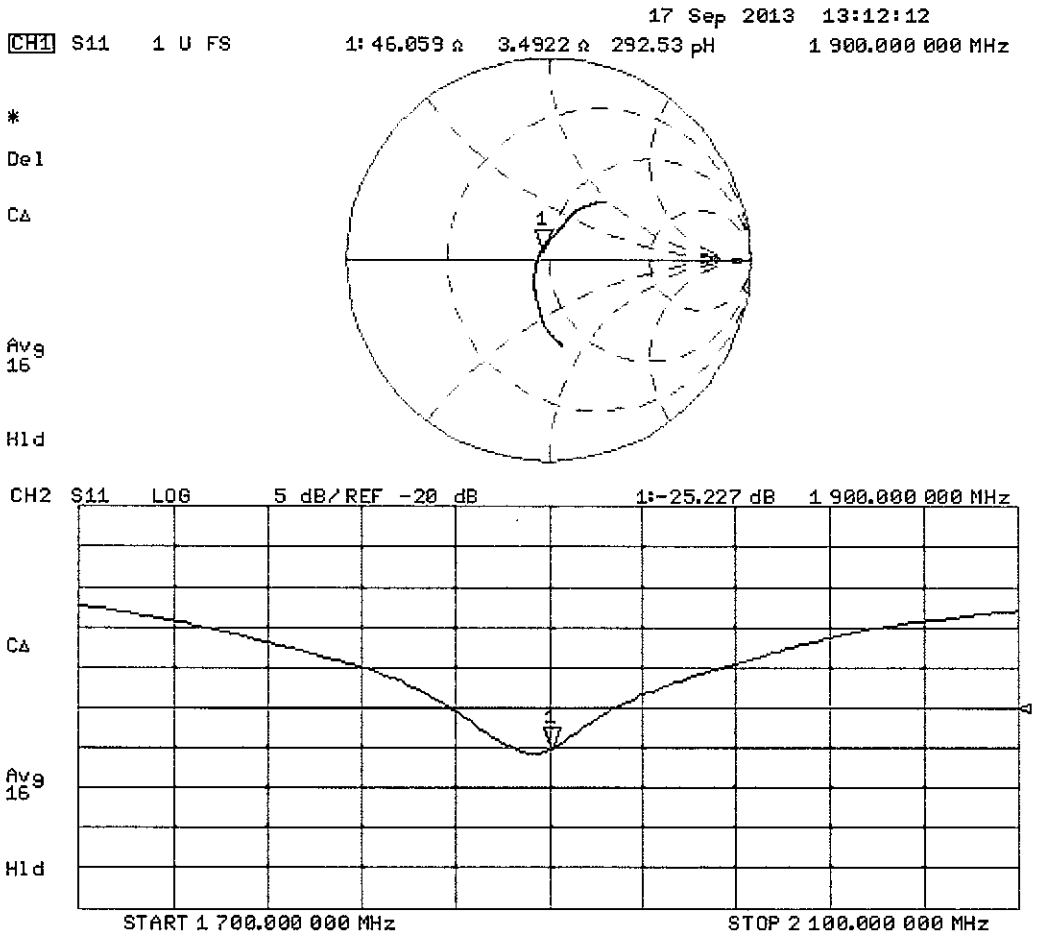
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.940 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 17.3 W/kg
SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.35 W/kg
Maximum value of SAR (measured) = 12.6 W/kg



0 dB = 12.6 W/kg = 11.00 dBW/kg

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 108

Client **Nokia Beijing TCC**

Certificate No: D2450V2-883_Mar14

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 883
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	March 12, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: March 12, 2014

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.2 ± 6 %	1.86 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.6 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**53.2 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.30 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.9 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	50.6 ± 6 %	2.02 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**51.0 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.03 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**23.7 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.1 Ω - 1.1 jΩ
Return Loss	- 27.9 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.5 Ω + 1.0 jΩ
Return Loss	- 38.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.167 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 06, 2011

DASY5 Validation Report for Head TSL

Date: 11.03.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 883

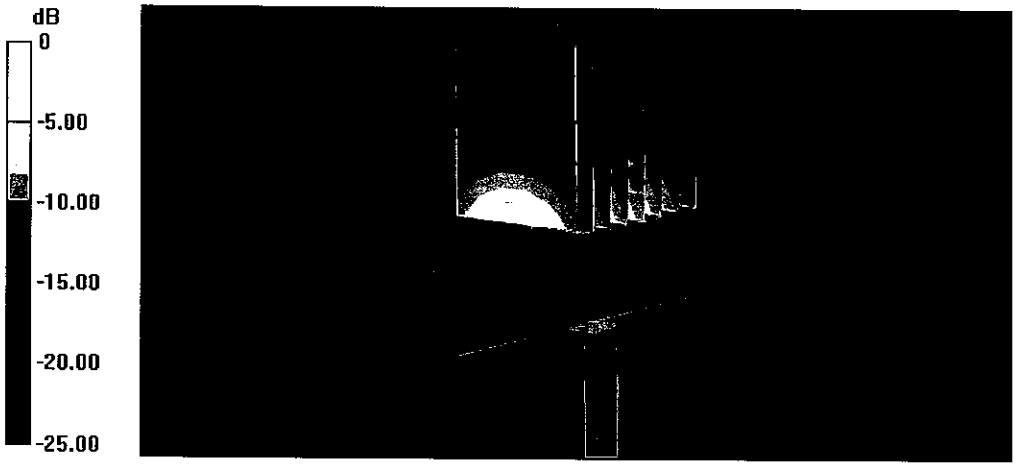
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.86 S/m; ε_r = 38.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.53, 4.53, 4.53); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

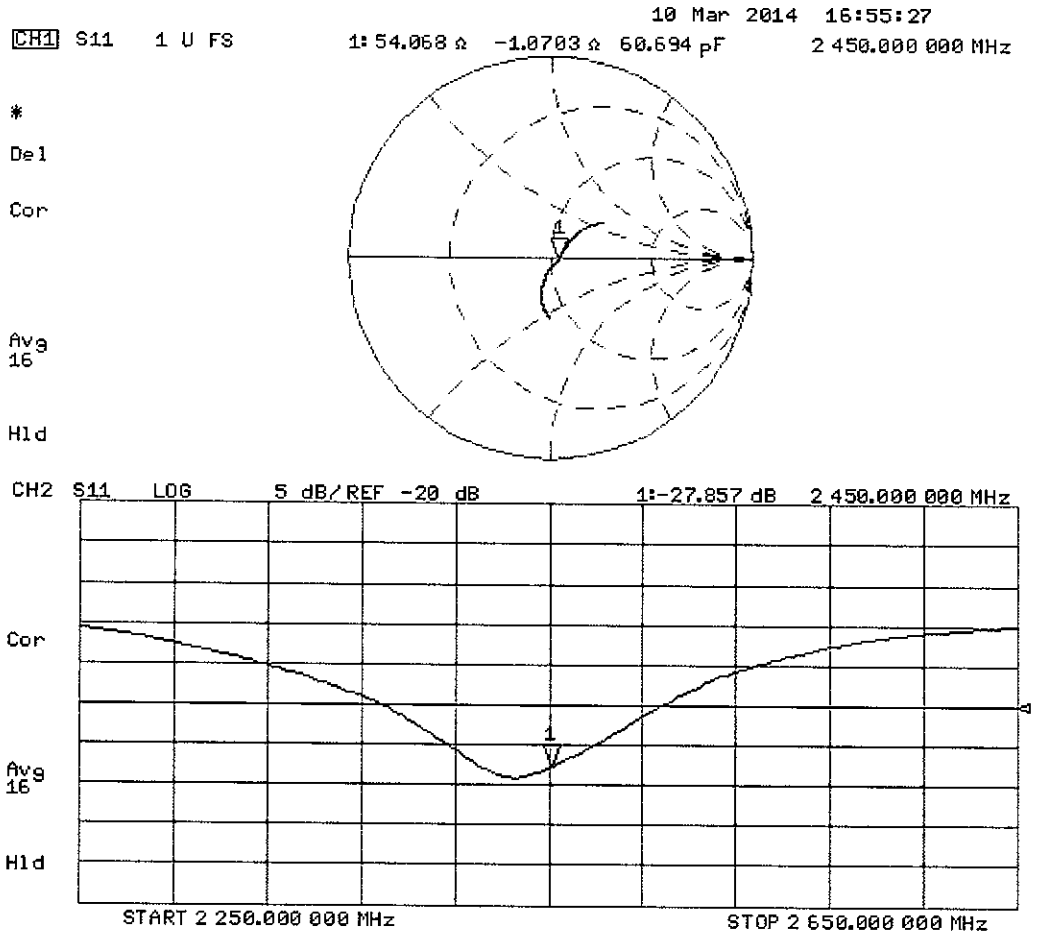
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 100.4 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 28.4 W/kg
SAR(1 g) = 13.6 W/kg; SAR(10 g) = 6.3 W/kg
Maximum value of SAR (measured) = 17.4 W/kg



0 dB = 17.4 W/kg = 12.41 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 12.03.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 883

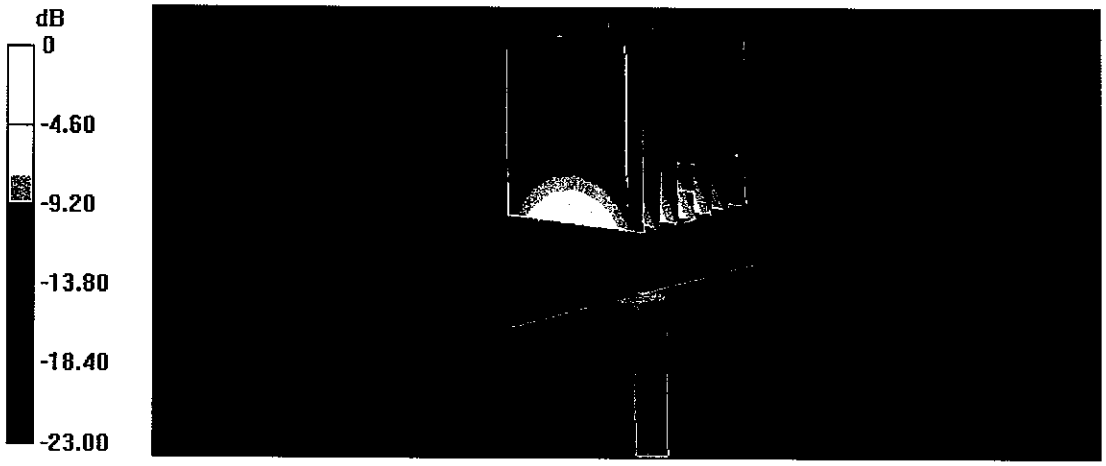
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.02 S/m; ε_r = 50.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.35, 4.35, 4.35); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

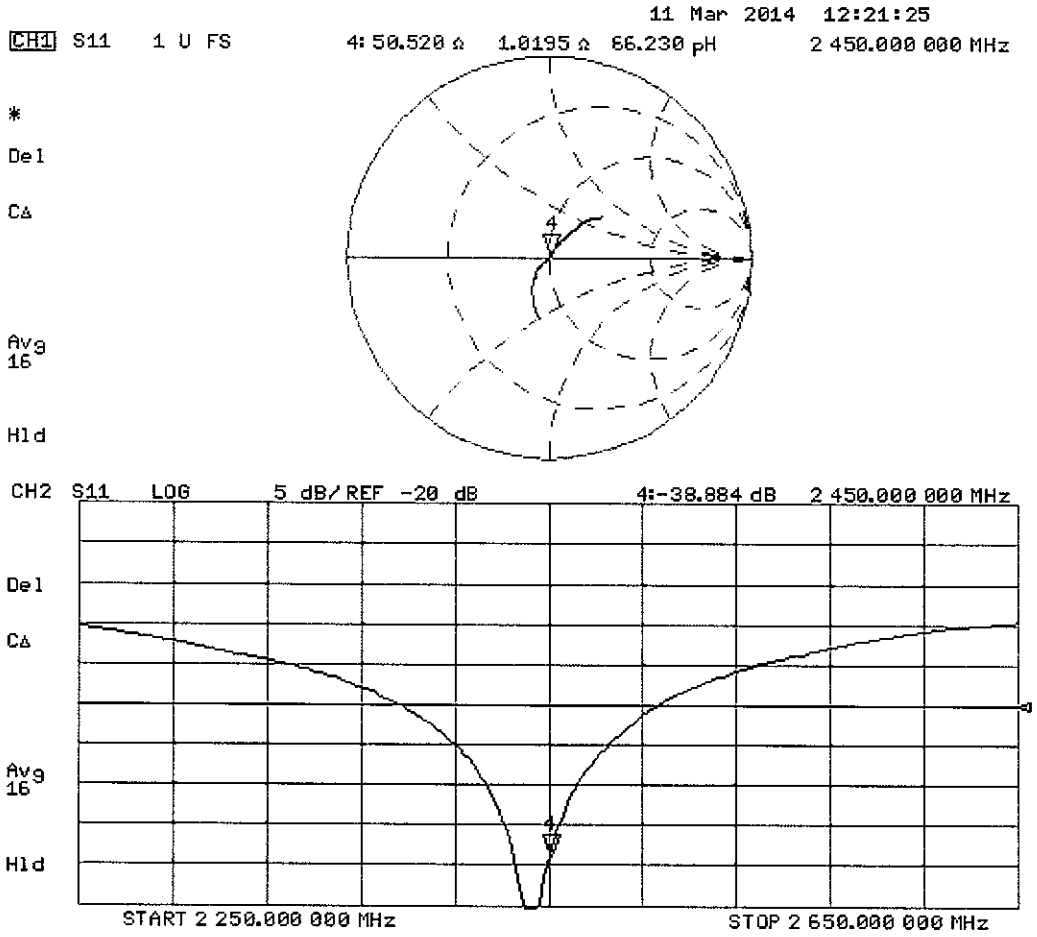
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.054 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 27.6 W/kg
SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6.03 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 Body TSL



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

Type: RM-1090, Serial number 004402/47/971163/6; 004402/47/971164/4, HW: 2000, SW: 02038.00000.14325.55001 used for GSM/GPRS/EGPRS850 SAR Head, Body-worn and Wireless Router measurements.

GSM/GPRS/EGPRS850 / Tuning target (dBm) Head, Body-worn and Wireless Router			
Slot configuration	Ch 128 824.2 MHz	Ch 190 836.6 MHz	Ch 251 848.8 MHz
GSM 1-slot	32.5	32.5	32.5
GPRS 2-slot	30.0	30.0	30.0
GPRS 3-slot	28.5	28.5	28.5
GPRS 4-slot	27.0	27.0	27.0
EGRPS 1-slot	27.0	27.0	27.0
EGPRS 2-slot	25.5	25.5	25.5
EGPRS 3-slot	24.0	24.0	24.0
EGPRS 4-slot	22.5	22.5	22.5
GSM/GPRS/EGPRS850 / Conducted power (dBm) Head, Body-worn and Wireless Router			
Slot configuration	Ch 128 824.2 MHz	Ch 190 836.6 MHz	Ch 251 848.8 MHz
GSM 1-slot	32.7	32.6	32.5
GPRS 2-slot	30.0	30.0	30.0
GPRS 3-slot	28.4	28.4	28.5
GPRS 4-slot	27.0	26.9	26.9
EGRPS 1-slot	26.7	26.6	26.6
EGPRS 2-slot	25.5	25.5	25.6
EGPRS 3-slot	24.0	24.0	24.0
EGPRS 4-slot	22.5	22.5	22.5

Type: RM-1090, Serial number 004402/47/971165/1; 004402/47/971166/9, HW: 2000, SW: 02038.00000.14325.55001 used for GSM/GPRS/EGPRS1900 SAR Head, Body-worn and Wireless Router measurements.

GSM/GPRS/EGPRS1900 / Tuning target (dBm) Head, Body-worn and Wireless Router			
Slot configuration	CH 512 1850.2 MHz	CH 661 1880.0 MHz	CH 810 1909.8 MHz
GSM 1-slot	30.0	30.0	30.0
GPRS 2-slot	27.0	27.0	27.0
GPRS 3-slot	25.5	25.5	25.5
GPRS 4-slot	24.0	24.0	24.0
EGRPS 1-slot	26.0	26.0	26.0
EGPRS 2-slot	24.5	24.5	24.5
EGPRS 3-slot	23.0	23.0	23.0
EGPRS 4-slot	21.5	21.5	21.5
GSM/GPRS/EGPRS1900 / Conducted power (dBm) Head, Body-worn and Wireless Router			
Slot configuration	CH 512 1850.2 MHz	CH 661 1880.0 MHz	CH 810 1909.8 MHz
GSM 1-slot	30.1	30.1	30.1
GPRS 2-slot	26.7	26.7	26.5
GPRS 3-slot	25.1	25.0	25.2
GPRS 4-slot	24.2	23.7	23.8
EGRPS 1-slot	25.7	25.7	25.5
EGPRS 2-slot	24.5	24.5	24.4
EGPRS 3-slot	22.9	22.9	22.8
EGPRS 4-slot	21.3	21.4	21.2

APPENDIX G: CONDUCTED POWER RESULTS FOR WLAN2450

G.1 Power Tuning Targets

WLAN 2.4 GHz: 20 MHz channel bandwidth								
Standard	Modulation	Data speed [MBPS]	CH 1	CH 2	CH 6	CH 7	CH 10	CH 11
802.11b	BPSK	1	15.0	15.0	15.0	15.0	15.0	15.0
802.11b	QPSK	2	15.0	15.0	15.0	15.0	15.0	15.0
802.11b	QPSK	5,5	15.0	15.0	15.0	15.0	15.0	15.0
802.11b	QPSK	11	15.0	15.0	15.0	15.0	15.0	15.0
802.11g	BPSK	6	10.0	10.0	10.0	10.0	10.0	10.0
802.11g	BPSK	9	10.0	10.0	10.0	10.0	10.0	10.0
802.11g	QPSK	12	10.0	10.0	10.0	10.0	10.0	10.0
802.11g	QPSK	18	10.0	10.0	10.0	10.0	10.0	10.0
802.11g	16QAM	24	10.0	10.0	10.0	10.0	10.0	10.0
802.11g	16QAM	36	10.0	10.0	10.0	10.0	10.0	10.0
802.11g	64QAM	48	10.0	10.0	10.0	10.0	10.0	10.0
802.11g	64QAM	54	10.0	10.0	10.0	10.0	10.0	10.0
802.11n	BPSK	6.5 / 7.25	10.0	10.0	10.0	10.0	10.0	10.0
802.11n	QPSK	13.0 / 14.4	10.0	10.0	10.0	10.0	10.0	10.0
802.11n	QPSK	19.5 / 21.7	10.0	10.0	10.0	10.0	10.0	10.0
802.11n	16QAM	26.0 / 28.9	10.0	10.0	10.0	10.0	10.0	10.0
802.11n	16QAM	39.0 / 43.3	10.0	10.0	10.0	10.0	10.0	10.0
802.11n	64QAM	52.0 / 57.8	10.0	10.0	10.0	10.0	10.0	10.0
802.11n	64QAM	58.5 / 65.0	10.0	10.0	10.0	10.0	10.0	10.0
802.11n	64QAM	65.0 / 72.2	10.0	10.0	10.0	10.0	10.0	10.0

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

Type: RM-1090, Serial number 004402/47/971343/4; 004402/47/971344/2, HW: 2000, SW: 02038.00000.14325.55001 used for WLAN2450 SAR Head, Body-worn and Wireless Router measurements.

WLAN 2.4 GHz: 20 MHz channel bandwidth								
Standard	Modulation	Data speed [MBPS]	CH 1	CH 2	CH 6	CH 7	CH 10	CH 11
802.11b	BPSK	1	15.2	15.3	15.4	15.5	15.5	15.5
802.11b	QPSK	2	15.3	15.3	15.5	15.6	15.6	15.4
802.11b	QPSK	5,5	15.4	15.5	15.6	15.7	15.6	15.6
802.11b	QPSK	11	15.4	15.5	15.6	15.7	15.6	15.6
802.11g	BPSK	6	10.4	10.6	11.0	11.0	10.9	10.7
802.11g	BPSK	9	10.5	10.5	11.0	10.9	10.8	10.7
802.11g	QPSK	12	10.5	10.7	10.8	11.0	10.8	10.7
802.11g	QPSK	18	10.3	10.4	10.9	10.8	10.7	10.7
802.11g	16QAM	24	10.4	10.5	10.9	11.1	10.8	10.6
802.11g	16QAM	36	10.5	10.7	11.0	11.0	10.9	10.8
802.11g	64QAM	48	10.5	10.6	11.0	10.9	10.9	10.9
802.11g	64QAM	54	10.6	10.7	11.0	11.1	10.9	10.8
802.11n	BPSK	6.5 / 7.25	10.5	10.6	11.0	10.9	10.8	10.7
802.11n	QPSK	13.0 / 14.4	10.6	10.5	10.9	10.8	10.9	10.9
802.11n	QPSK	19.5 / 21.7	10.6	10.6	10.8	10.9	10.9	11.1
802.11n	16QAM	26.0 / 28.9	10.6	10.7	10.9	10.9	11.0	11.0
802.11n	16QAM	39.0 / 43.3	10.7	10.6	10.9	10.9	10.9	11.0
802.11n	64QAM	52.0 / 57.8	10.7	10.7	11.0	11.0	11.0	10.8
802.11n	64QAM	58.5 / 65.0	10.7	10.9	11.1	11.0	11.0	10.8
802.11n	64QAM	65.0 / 72.2	10.8	10.9	11.3	11.2	11.0	10.8