

SAR Compliance Test Report

Test report no.:	FCC_RM-1017_01	Date of report:	2014-06-17
Template version:	19.7	Number of pages:	41
Testing laboratory:	TCC Microsoft Salo Laboratory P.O.Box 86 Joensuunkatu 7H / Kiila 1B FIN-24101 SALO, FINLAND Tel. +358 (0) 7180 08000 Fax. +358 (0) 7180 45220	Client:	Microsoft Mobile P.O. Box 68 Sinitaival 5 FIN-33721 TAMPERE, FINLAND Tel. +358 (0) 7180 08000 Fax. +358 (0) 7180 46880
Responsible test engineer:	Anni Viitanen	Product contact person:	Tero Huhtala
Measurements made by:	Nina Koskinen, Marko Laaksonen, Teuvo Miettinen, Sami Savela, Eva Lehtinen, Juha-Matti Varjonen		
Tested device:	RM-1017		
FCC ID:	PDNRM-1017	IC:	-
Supplement reports:	-		
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:			
For the contents:			

CONTENTS

1. SUMMARY OF SAR TEST REPORT	4
1.1 TEST DETAILS	4
1.2 MAXIMUM RESULTS	4
1.2.1 Head Configuration	4
1.2.2 Body Worn Configuration	5
1.2.3 Wireless Router Configuration	5
1.2.4 Summary SAR data	6
1.2.5 Maximum Drift	6
1.2.6 Measurement Uncertainty	6
2. DESCRIPTION OF THE DEVICE UNDER TEST	7
2.1 POWER REDUCTIONS IN WIRELESS ROUTER CONFIGURATIONS	9
2.2 DESCRIPTION OF THE ANTENNA	10
3. TEST CONDITIONS	11
3.1 TEMPERATURE AND HUMIDITY	11
3.2 TEST SIGNAL, FREQUENCIES AND OUTPUT POWER	11
4. DESCRIPTION OF THE TEST EQUIPMENT	12
4.1 MEASUREMENT SYSTEM AND COMPONENTS	12
4.1.1 Isotropic E-field Probe Type ES3DV3	14
4.1.2 Isotropic E-field Probe Type EX3DV4	14
4.2 PHANTOMS	15
4.3 TISSUE SIMULANTS	15
4.3.1 Tissue Simulant Recipes	16
4.4 SYSTEM VALIDATION AND SYSTEM CHECKING	17
4.4.1 System validation status	17
4.4.2 System checking	18
4.5 TISSUE SIMULANTS USED IN THE MEASUREMENTS	20
5. DESCRIPTION OF THE TEST PROCEDURE	21
5.1 DEVICE HOLDER	21
5.2 TEST POSITIONS	21
5.2.1 Against Phantom Head	21
5.2.2 Body Worn Configuration	22
5.2.3 Wireless Router Configuration	22
5.3 SCAN PROCEDURES	22
5.4 SAR AVERAGING METHODS	22
6. MEASUREMENT UNCERTAINTY	23
7. RESULTS	25
7.1 THE MEASURED HEAD SAR VALUES FOR THE TEST DEVICE ARE TABULATED BELOW:	25
7.1.1 Combined Head SAR data	31
7.2 THE MEASURED BODY SAR VALUES FOR THE TEST DEVICE ARE TABULATED BELOW:	32
7.2.1 Combined Body SAR data	36
7.3 BODY SAR ASSESSMENT OF WIRELESS ROUTER MODE AT 10.0MM SEPARATION DISTANCE	37
7.3.1 Combined Body SAR data	41

APPENDIX A: SYSTEM CHECK SCANS

APPENDIX B.: HEAD, BODY AND WIRELESS ROUTER MEASUREMENT SCANS

APPENDIX C: DIELECTRIC PARAMETERS OF THE TISSUE SIMULANTS

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

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

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

APPENDIX G: CONDUCTED POWER MEASUREMENTS FOR SUPPORTED WLAN TRANSMISSION MODES

1. SUMMARY OF SAR TEST REPORT

1.1 Test Details

Period of test	2014-05-14 - 2014-05-21
SN, HW and SW numbers of tested device	SN: 004402/47/825354/9, HW: 1560, SW: 01068.00004.14182.20000, DUT: 18334 SN: 004402/47/825353/1, HW: 1560, SW: 01068.00004.14182.04000, DUT: 18335 SN: 004402/47/825355/6, HW: 1560, SW: 01068.00004.14182.20000, DUT: 18336
Batteries used in testing	BL-5J, DUT: 18328,18329, 18330, 18331, 18332, 18333, 18337, 18338, 18339, 18344, 18345, 18346, 18347, 18353, 18354, 18355, 18356, 18357
Headsets used in testing	WH-108, DUT: 17570,17110,17109,17108
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 ("Hotspot") configuration are given in section 1.2.1, 1.2.2 and 1.2.3 respectively. The device conforms to the requirements of the standards when the maximum measured SAR value is less than or equal to the limit.

1.2.1 Head Configuration

Mode	Ch / f(MHz)	Conducted power	Position	Measured SAR value (1g avg)	Reported* SAR value (1g avg)	SAR limit (1g avg)	Result	Plot #
2-slot GPRS850	251 / 848.8	29.8 dBm	Left, Cheek	0.657 W/kg	0.75 W/kg	1.6 W/kg	PASSED	1
2-slot GPRS1900	512 / 1850.2	27.5 dBm	Left, Cheek	0.494 W/kg	0.54 W/kg	1.6 W/kg	PASSED	2
WLAN2450	1 / 2412.0	17.9 dBm	Left, Cheek	0.272 W/kg	0.31 W/kg	1.6 W/kg	PASSED	3
2-slot GPRS850 + WLAN2450	-	-	Left, Cheek	0.668 W/kg	0.77 W/kg	1.6 W/kg	PASSED	-
2-slot GPRS1900 + WLAN2450	-	-	Left, Cheek	0.494 W/kg	0.54 W/kg	1.6 W/kg	PASSED	-

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

1.2.2 Body Worn Configuration

Mode	Ch / f(MHz)	Conducted power	Separation distance	Measured SAR value (1g avg)	Reported* SAR value (1g avg)	SAR limit (1g avg)	Result	Plot #
2-slot GPRS850	251 / 848.8	29.8 dBm	1.5 cm	0.809 W/kg	0.93 W/kg	1.6 W/kg	PASSED	4
2-slot GPRS1900	810 / 1909.8	27.3 dBm	1.5 cm	0.673 W/kg	0.77 W/kg	1.6 W/kg	PASSED	5
WLAN2450	1 / 2412.0	17.5 dBm	1.5 cm	0.083 W/kg	0.11 W/kg	1.6 W/kg	PASSED	6
2-slot GPRS850 + WLAN2450	-	-	1.5 cm	0.853 W/kg	0.99 W/kg	1.6 W/kg	PASSED	-
2-slot GPRS1900 + WLAN2450	-	-	1.5 cm	0.637 W/kg	0.80 W/kg	1.6 W/kg	PASSED	-

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

1.2.3 Wireless Router 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 #
4-slot GPRS850	251 / 848.8	26.3 dBm	10 mm	0.989 W/kg	1.14 W/kg	1.6 W/kg	PASSED	7
1-slot GPRS1900	810 / 1909.8	26.5 dBm	10 mm	0.681 W/kg	0.75 W/kg	1.6 W/kg	PASSED	8
WLAN2450	6 / 2437.0	17.3 dBm	10 mm	0.178 W/kg	0.24 W/kg	1.6 W/kg	PASSED	9
4-slot GPRS850 + WLAN2450	-	-	10 mm	1.06 W/kg	1.24 W/kg	1.6 W/kg	PASSED	-
1-slot GPRS1900 + WLAN2450	-	-	10 mm	0.715 W/kg	0.79 W/kg	1.6 W/kg	PASSED	-

* 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	0.75 W/kg	0.31 W/kg	-
{Max + Max} Simultaneous Head SAR value	1.07 W/kg		
Maximum Body SAR values	0.93 W/kg	0.11 W/kg	-
{Max + Max} Simultaneous Body SAR value	1.02 W/kg		
Maximum Product Specific (Wireless Router) SAR values	1.14 W/kg	0.24 W/kg	-
{Max + Max} Simultaneous Product Specific SAR value	1.30 W/kg		
Maximum Simultaneous SAR value Wireless Router SAR: 4-slot GPRS850+ WLAN2450	1.30 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	0.10dB

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	28.2	27.0	32.9	30.4	28.6	27.4
	1900			1850 – 1910	29.5	27.5	25.7	24.5	29.9	27.9	26.1	24.9
EGPRS	850	GMSK	1/8 to 4/8	824 – 849	26.5	26.5	25.7	24.5	26.9	26.9	26.1	24.9
	1900			1850 – 1910	25.5	25.5	25.0	24.5	25.9	25.9	25.4	24.9
BT	2450	GFSK	1	2402 – 2480	10.5				12.0			
					Ch 1	Ch 2-10	Ch 11		Ch 1	Ch 2-10	Ch 11	
WLAN b-mode*	2450	BPSK	1	2412 – 2472	17.0	17.0	17.0		18.5	18.5	18.5	
WLAN g-mode*	2450	OFDM	1	2412 – 2472	16.5	16.5	16.5		18.0	18.0	18.0	
WLAN n-mode*	2450	OFDM	1	2412 – 2462 2412 – 2472	16.5	16.5	16.5		18.0	18.0	18.0	

*Maximum tuning targets are presented above. See full details in Appendix G.

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

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 12.0 dBm. WLAN2450 power tuning target upper limit is 18.5dBm. Since WLAN2450 and BT use same frequency and antenna, WLAN2450 power is 6.5dB 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 has Wireless Router "Hotspot" mode capability.

This device uses a single antenna for transmission of GSM/GPRS/EGPRS850 and GSM/GPRS/EGPRS1900; a separate single antenna is used for transmission of 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 tables below.

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

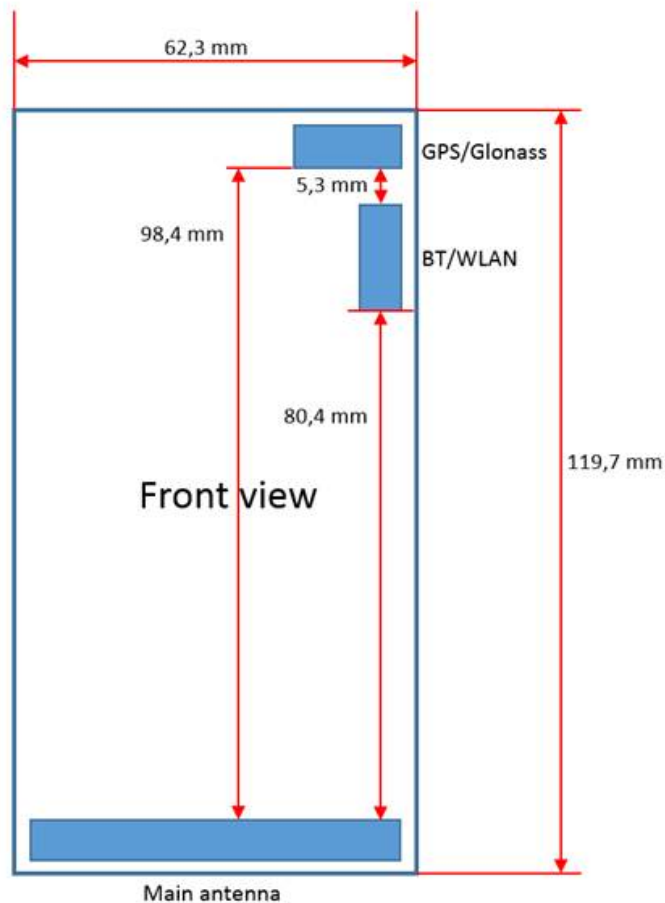
2.1 Power reductions in Wireless Router configurations

The following table details the power reductions active in Wireless Router mode:

Band	Power reduction in WR mode	Target tuning power in WR mode		
GPRS/EGPRS850	1-slot GPRS: 0.5 dBm 2-slot GPRS: 0.5 dBm 3-slot GPRS: 0.5 dBm 4-slot GPRS: 0.5 dBm 1-slot EGPRS: 0.0 dBm 2-slot EGPRS: 0.0 dBm 3-slot EGPRS: 0.0 dBm 4-slot EGPRS: 0.0 dBm	1-slot GPRS: 32.0 dBm 2-slot GPRS: 29.5 dBm 3-slot GPRS: 27.7 dBm 4-slot GPRS: 26.5 dBm 1-slot EGPRS: 26.5 dBm 2-slot EGPRS: 26.5 dBm 3-slot EGPRS: 25.7 dBm 4-slot EGPRS: 24.5 dBm		
GPRS/EGPRS1900	1-slot GPRS: 3.0 dBm 2-slot GPRS: 4.0 dBm 3-slot GPRS: 4.0 dBm 4-slot GPRS: 4.0 dBm 1-slot EGPRS: 0.0 dBm 2-slot EGPRS: 3.0 dBm 3-slot EGPRS: 3.8 dBm 4-slot EGPRS: 4.5 dBm	1-slot GPRS: 26.5 dBm 2-slot GPRS: 23.5 dBm 3-slot GPRS: 21.7 dBm 4-slot GPRS: 20.5 dBm 1-slot EGPRS: 25.5 dBm 2-slot EGPRS: 22.5 dBm 3-slot EGPRS: 21.2 dBm 4-slot EGPRS: 19.5 dBm		
WLAN2450 b-mode (BPSK 1 Mbps)	0 dB	Ch 1: 17.0 dBm	Ch 6: 17.0 dBm	Ch 11: 17.0 dBm
WLAN2450 g-mode (BPSK 6 Mbps)	0 dB	Ch 1: 16.5 dBm	Ch 6: 16.5 dBm	Ch 11: 16.5 dBm
WLAN2450 n-mode 20MHz (BPSK 6.5/7.25 Mbps)	0 dB	Ch 1: 16.5 dBm	Ch 6: 16.5 dBm	Ch 11: 16.5 dBm

2.2 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.



3. TEST CONDITIONS

3.1 Temperature and Humidity

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

3.2 Test Signal, Frequencies and Output Power

The device was put into operation by using a call tester except for testing WLAN2450 where control software was used. Communication between the device and the call tester was established by air link.

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

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

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

In all operating bands the measurements were performed on lowest, middle and highest channels, and/or on all required test channels as defined in Published FCC KDB Procedures.

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

The transmission mode of the device in all WLAN b-mode tests was BPSK 1Mbps; WLAN b-mode QPSK 5.5 Mbps was additionally used for. This mode has the highest (or equal highest) time-averaged output power of all the WLAN b and g modulation modes in Microsoft devices. All WLAN testing has been carried out in accordance with FCC KDB 248227: SAR Measurement Procedures for 802.11 a/b/g Transmitters.

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

KDB 248227: SAR Measurement Procedures for 802.11 a/b/g Transmitters
KDB 648474 D04 Handset SAR v01r01
KDB 941225 D06 v01 Hot Spot SAR
KDB 447498 D01 General RF Exposure Guidance v05r01
KDB 690783 D01 SAR Listings on Grants
KDB 865664 D01 SAR measurements 100MHz to 6GHz v01
KDB 865664 D02 SAR Reporting v01r01

4. DESCRIPTION OF THE TEST EQUIPMENT

4.1 Measurement System and Components

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

The following table lists calibration dates of SPEAG components:

Test Equipment	Serial Number	Calibration date	Calibration expiry
DAE4	793	2013-06	2014-06
DAE4	538	2013-11	2014-11
DAE4	1302	2013-11	2014-11
E-field Probe ES3DV3	3194	2013-11	2014-11
E-field Probe ES3DV3	3131	2013-06	2014-06
E-field Probe EX3DV4	3960	2013-12	2014-12
Dipole Validation Kit, D835V2	480	2012-12	2014-12
Dipole Validation Kit, D1900V2	5d013	2012-12	2014-12
Dipole Validation Kit, D2450V2	749	2012-12	2014-12
DASY5 software	Version 52.8	-	-

Additional test equipment used in testing:

Test Equipment	Model	Serial Number	Calibration date	Calibration expiry
Signal Generator	E4438C	MY42080610	2013-08	2014-08
Signal Generator	SML03	101264	2013-08	2014-08
Signal Generator	E4436B	US39260114	2013-08	2014-08
Amplifier	5S1G4M3	302338	-	-
Amplifier	ZHL-42-SMA	N072095-5	-	-
Amplifier	5S1G4	25583	-	-
Power Meter	NRVS	838624/032	2013-08	2014-08
Power Meter	NRVD	840023/028	2013-08	2014-08
Power Meter	NRVZ	849305/029	2013-08	2014-08
Power Sensor	NRV-Z32	100067	2013-08	2014-08
Power Sensor	NRV-Z32	849745/018	2013-08	2014-08
Power Sensor	NRV-Z32	825600/002	2013-08	2014-08
Call Tester	CMU 200	103293	-	-
Call Tester	CMU 200	104983	-	-
Call Tester	CMU 200	103294	-	-
Network Analyzer	ENA E5071C	MY46213166	2013-08	2014-08
Dielectric Probe Kit	DAK-3.5	1042	-	-

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 μ W/g to > 100 mW/g; Linearity: ± 0.2 dB
Dimensions	Overall length: 330 mm Tip length: 20 mm Body diameter: 12 mm Tip diameter: 3.9 mm
Application	Distance from probe tip to dipole centers: 2.0 mm General dosimetry up to 4 GHz Compliance tests of mobile phones Fast automatic scanning in arbitrary phantoms

4.1.2 Isotropic E-field Probe Type EX3DV4

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	Calibration certificate in Appendix 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 μ W/g to > 100 mW/g, Linearity: ± 0.2 dB
Dimensions	Overall length: 330 mm Tip length: 10 mm Body diameter: 12 mm Tip diameter: 2.5 mm
Application	Distance from probe tip to dipole centers: 1.0 mm General dosimetry up to 6 GHz Compliance tests of mobile phones Fast automatic scanning in arbitrary phantoms

4.2 Phantoms

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

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 $\pm 5\%$ of the recommended values. All tests were carried out within 24 hours of measuring the dielectric parameters.

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

4.3.1 Tissue Simulant Recipes

The following recipes were used for Head and Body tissue simulants:

800MHz band

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 Salo / SAR-2	V52.8	D835V2 / 480	ES3DV4 / 3194	CW	DAE4 / 538	2014-02	2013-12
1900	TCC Salo / SAR-1	V52.8	D1900V2 / 5d013	ES3DV3 / 3131	CW	DAE4 / 793	2013-07	2013-07
2450	TCC Salo / SAR-4	V52.8	D2450V2 / 749	EX3DV4 / 3960	CW	DAE4 / 1302	2014 -01	2014 -01

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 [°C]	Plot #
				dSAR [%]		ϵ_r	σ [S/m]		dSAR [%]	d ϵ_r [%]		
	Tolerances			±3%				±10 %	±5 %	±5 %		
835	Reference result SN:480	-	-	-	9.40	41.5	0.90	TCC Salo/SAR-2 ES3DV3 SN:3194 Head 835MHz				
	2014-05-15	2.35	2.41	2.55	9.40	40.1	0.91	0.00	-3.37	1.11	22.0	1
1900	Reference result SN:5d013	-	-	-	40.6	40.0	1.40	TCC Salo/SAR-1 ES3DV3 SN:3131 Head 1900MHz				
	2014-05-14	10.10	10.40	2.97	40.40	38.8	1.39	-0.49	-3.00	-0.71	21.4	2
2450	Reference result SN:749	-	-	-	53.9	39.2	1.80	TCC Salo/SAR-4 EX3DV4 SN:3960 Head 2450MHz				
	2014-05-14	13.70	13.70	0.00	54.80	39.3	1.81	1.67	0.26	0.56	21.2	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 ϵ_r [%]	d σ [%]	
	Tolerances			±3%				±10 %	±5 %	±5 %		
835	Reference result SN:480	-	-	-	9.51	55.2	0.97	TCC Salo/SAR-2 ES3DV3 SN:3194 Body 835MHz				
	2014-05-20	2.30	2.32	0.87	9.20	54.2	0.97	-3.26	-1.81	0.00	21.7	4
	2014-05-21	2.31	2.35	1.73	9.24	54.3	0.97	-2.84	-1.63	0.00	21.5	-
1900	Reference result SN: 5d013	-	-	-	41.0	53.3	1.52	TCC Salo/SAR-1 ES3DV3 SN:3131 Body 1900MHz				
	2014-05-19	9.85	9.83	-0.20	39.40	52.1	1.51	-3.90	-2.25	-0.66	21.0	5
2450	Reference result SN: 749	-	-	-	51.5	52.7	1.95	TCC Salo/SAR-4 ES3DV3 SN:3960 Body 2450MHz				
	2014-05-16	12.40	12.30	-0.81	49.60	52.3	1.94	-3.69	-0.76	-0.51	21.2	-
	2014-05-19	12.40	12.30	-0.81	49.60	52.1	1.93	-3.69	-1.14	-1.03	21.9	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]	$d\epsilon_r$ [%]	$d\sigma$ [%]	
	Tolerances			± 5 %	± 5 %	
836	Recommended value	41.5	0.90			
	2014-05-15	40.1	0.91	-3.37	1.11	22.0
1880	Recommended value	40.0	1.40			
	2014-05-14	38.9	1.37	-2.75	-2.14	21.4
2347	Recommended value	39.2	1.79			
	2014-05-14	39.4	1.80	0.51	0.56	21.2

Body tissue simulant measurements

f [MHz]	Description	Dielectric Parameters		Dielectric Parameters Deviation from Recommended value		Temp [°C]
		ϵ_r	σ [S/m]	$d\epsilon_r$ [%]	$d\sigma$ [%]	
	Tolerances			± 5 %	± 5 %	
836	Recommended value	55.2	0.97			
	2014-05-20	54.2	0.97	-1.81	0.00	21.7
	2014-05-21	54.3	0.97	-1.63	0.00	21.5
1880	Recommended value	53.3	1.52			
	2014-05-19	52.2	1.49	-2.06	-1.97	21.0
2437	Recommended value	52.7	1.94			
	2014-05-16	52.3	1.92	-0.76	-1.03	21.2
	2014-05-19	52.2	1.91	-0.95	-1.55	21.9

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 in section 1.2.2 using a separate flat spacer that was removed before the start of the measurements. The device was oriented with both sides facing the phantom to find the highest results.

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	$C_i \cdot U_i$ (%)	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	$C_i \cdot U_i$ (%)	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		
1-slot GPRS	Tuning Target + Tolerance [dBm]		32.9			Scaling factor*				
	Conducted Slot Average Power [dBm]		32.5	32.5	32.3	0.4	0.4	0.6	dB	
	Time-averaged power [dBm]		23.5	23.5	23.3	1.10	1.10	1.15	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	29.8	0.4	0.4	0.6	dB	
	Time-averaged power [dBm]		24.0	24.0	23.8	1.10	1.10	1.15	Lin	
	Left Cheek	Estimated SAR	0.607	0.624	0.649	0.666	0.684	0.745	0.01	1
		Full SAR	-	-	0.657	-	-	0.754		
	Left Tilt	Estimated SAR		0.374	-	-	0.410	-	-	-
		Full SAR	-	-	-	-	-	-		
	Right Cheek	Estimated SAR		0.601	-	-	0.659	-	-	-
		Full SAR	-	-	-	-	-	-		
	Right Tilt	Estimated SAR		0.363	-	-	0.398	-	-	-
Full SAR		-	-	-	-	-	-			
3-slot GPRS	Tuning Target + Tolerance [dBm]		28.6			Scaling factor*				
	Conducted Slot Average Power [dBm]		28.2	28.1	28.0	0.4	0.5	0.6	dB	
	Time-averaged power [dBm]		23.9	23.8	23.7	1.10	1.12	1.15	Lin	
			No testing required for this slot configuration.							
4-slot GPRS	Tuning Target + Tolerance [dBm]		27.4			Scaling factor*				
	Conducted Slot Average Power [dBm]		26.9	26.9	26.8	0.5	0.5	0.6	dB	
	Time-averaged power [dBm]		23.9	23.9	23.8	1.12	1.12	1.15	Lin	
			No testing required for this slot configuration.							

(850MHz Head SAR Table continues)

(850MHz Head SAR Table continues)

Mode	Device orientation	SAR measurement	Measured 1g SAR [W/kg]			Reported* 1g SAR [W/kg]			Max Deviation (Estimated SAR - Full SAR) [W/kg]	Plot #
			Ch 128 824.2 MHz	Ch 190 836.6 MHz	Ch 251 848.8 MHz	Ch 128 824.2 MHz	Ch 190 836.6 MHz	Ch 251 848.8 MHz		
1-slot 8PSK EGPRS	Tuning Target + Tolerance [dBm]		26.9			Scaling factor*				
	Conducted Slot Average Power [dBm]		26.6	26.4	26.3	0.3	0.5	0.6	dB	
	Time-averaged power [dBm]		17.6	17.4	17.3	1.07	1.12	1.15	Lin	
			No testing required for this slot configuration.							
2-slot 8PSK EGPRS	Tuning Target + Tolerance [dBm]		26.9			Scaling factor*				
	Conducted Slot Average Power [dBm]		26.6	26.4	26.3	0.3	0.5	0.6	dB	
	Time-averaged power [dBm]		20.6	20.4	20.3	1.07	1.12	1.15	Lin	
			No testing required for this slot configuration.							
3-slot 8PSK EGPRS	Tuning Target + Tolerance [dBm]		26.1			Scaling factor*				
	Conducted Slot Average Power [dBm]		25.7	25.6	25.4	0.4	0.5	0.7	dB	
	Time-averaged power [dBm]		21.4	21.3	21.1	1.10	1.12	1.17	Lin	
			No testing required for this slot configuration.							
4-slot 8PSK EGPRS	Tuning Target + Tolerance [dBm]		24.9			Scaling factor*				
	Conducted Slot Average Power [dBm]		24.4	24.3	24.1	0.5	0.6	0.8	dB	
	Time-averaged power [dBm]		21.4	21.3	21.1	1.12	1.15	1.20	Lin	
	Left Cheek	Estimated SAR	-	-	0.365	-	-	0.439	0.01	-
		Full SAR	-	-	0.375	-	-	0.451		

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		
1-slot GPRS	Tuning Target + Tolerance [dBm]		29.9			Scaling factor*				
	Conducted Slot Average Power [dBm]		29.4	29.4	29.4	0.5	0.5	0.5	dB	
	Time-averaged power [dBm]		20.4	20.4	20.4	1.12	1.12	1.12	Lin	
			No testing required for this slot configuration.							
2-slot GPRS	Tuning Target + Tolerance [dBm]		27.9			Scaling factor*				
	Conducted Slot Average Power [dBm]		27.5	27.4	27.3	0.4	0.5	0.6	dB	
	Time-averaged power [dBm]		21.5	21.4	21.3	1.10	1.12	1.15	Lin	
	Left Cheek	Estimated SAR	0.451	0.433	0.299	0.495	0.486	0.343	0.04	2
		Full SAR	0.494	-	-	0.542	-	-		
	Left Tilt	Estimated SAR	-	0.252	-	-	0.283	-	-	-
		Full SAR	-	-	-	-	-	-		
	Right Cheek	Estimated SAR	-	0.357	-	-	0.401	-	-	-
		Full SAR	-	-	-	-	-	-		
	Right Tilt	Estimated SAR	-	0.328	-	-	0.368	-	-	-
Full SAR		-	-	-	-	-	-			
3-slot GPRS	Tuning Target + Tolerance [dBm]		26.1			Scaling factor*				
	Conducted Slot Average Power [dBm]		25.6	25.5	25.5	0.5	0.6	0.6	dB	
	Time-averaged power [dBm]		21.3	21.2	21.2	1.12	1.15	1.15	Lin	
			No testing required for this slot configuration.							
4-slot GPRS	Tuning Target + Tolerance [dBm]		24.9			Scaling factor*				
	Conducted Slot Average Power [dBm]		24.3	24.3	24.3	0.6	0.6	0.6	dB	
	Time-averaged power [dBm]		21.3	21.3	21.3	1.15	1.15	1.15	Lin	
			No testing required for this slot configuration.							

(1900MHz Head SAR Table continues)

(1900MHz Head SAR Table continues)

Mode	Device orientation	SAR measurement	Measured 1g SAR [W/kg]			Reported* 1g SAR [W/kg]			Max Deviation (Estimated SAR - Full SAR) [W/kg]	Plot #
			Ch 512 1850.2 MHz	Ch 661 1880.0 MHz	Ch 810 1909.8 MHz	Ch 512 1850.2 MHz	Ch 661 1880.0 MHz	Ch 810 1909.8 MHz		
1-slot 8PSK EGPRS	Tuning Target + Tolerance [dBm]		25.9			Scaling factor*				
	Conducted Slot Average Power [dBm]		25.4	25.3	25.2	0.5	0.6	0.7	dB	
	Time-averaged power [dBm]		16.4	16.3	16.2	1.12	1.15	1.17	Lin	
			No testing required for this slot configuration.							
2-slot 8PSK EGPRS	Tuning Target + Tolerance [dBm]		25.9			Scaling factor*				
	Conducted Slot Average Power [dBm]		25.3	25.2	25.1	0.6	0.7	0.8	dB	
	Time-averaged power [dBm]		19.3	19.2	19.1	1.15	1.17	1.20	Lin	
			No testing required for this slot configuration.							
3-slot 8PSK EGPRS	Tuning Target + Tolerance [dBm]		25.4			Scaling factor*				
	Conducted Slot Average Power [dBm]		24.9	24.9	24.7	0.5	0.5	0.7	dB	
	Time-averaged power [dBm]		20.6	20.6	20.4	1.12	1.12	1.17	Lin	
			No testing required for this slot configuration.							
4-slot 8PSK EGPRS	Tuning Target + Tolerance [dBm]		24.4			Scaling factor*				
	Conducted Slot Average Power [dBm]		24.0	23.9	23.8	0.4	0.5	0.6	dB	
	Time-averaged power [dBm]		21.0	20.9	20.8	1.10	1.12	1.15	Lin	
	Left Cheek	Estimated SAR	0.349	-	-	0.383	-	-	-	-
		Full SAR	-	-	-	-	-	-	-	-

2450MHz Head SAR results

Mode	Device orientation	SAR measurement	Measured 1g SAR [W/kg]			Reported* 1g SAR [W/kg]			Max Deviation (Estimated SAR - Full SAR) [W/kg]	Plot #
			Ch 1 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]		18.5			Scaling factor*				
	Conducted Power [dBm]		17.5	17.3	17.5	1.0	1.2	1.0	dB	
	Time-averaged power [dBm]		17.5	17.3	17.5	1.26	1.32	1.26	Lin	
	Left Cheek	Estimated SAR	0.236	0.199	0.157	0.297	0.262	0.198	0.00	-
		Full SAR	0.239	-	-	0.301	-	-		
	Left Tilt	Estimated SAR	-	0.102	-	-	0.134	-	-	-
		Full SAR	-	-	-	-	-	-		
	Right Cheek	Estimated SAR	-	0.094	-	-	0.124	-	-	-
		Full SAR	-	-	-	-	-	-		
	Right Tilt	Estimated SAR	-	0.067	-	-	0.089	-	-	-
Full SAR		-	-	-	-	-	-			
Mode	Device orientation	SAR measurement	Measured 1g SAR [W/kg]			Reported* 1g SAR [W/kg]			Max Deviation (Estimated SAR - Full SAR) [W/kg]	Plot #
			Ch 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 QPSK 5.5Mbps	Tuning Target + Tolerance [dBm]		18.5			Scaling factor*				
	Conducted Power [dBm]		17.9	17.7		1.0	1.2		dB	
	Time-averaged power [dBm]		17.9	17.7		1.26	1.32		Lin	
	Worst case Checking Left Cheek	Estimated SAR	0.270	0.229	-	0.310	0.275	-	0.00	3
		Full SAR	0.272	-	-	0.312	-	-		

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

Test configuration	Max. Reported* 1g SAR results		
	WLAN	2-slot GPRS 850	2-slot GPRS 1900
Head: Left, Cheek	0.312	0.754	0.542
Head: Left, Tilt	0.134	0.410	0.283
Head: Right, Cheek	0.124	0.659	0.401
Head: Right, Tilt	0.089	0.398	0.368

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

Test configuration	Max. Reported* 1g SAR results	
	2-slot GPRS850 + WLAN	2-slot GPRS1900 + WLAN
Head: Left, Cheek	1.07	0.854
Head: Left, Tilt	0.544	0.417
Head: Right, Cheek	0.783	0.525
Head: Right, Tilt	0.487	0.457

Note: Simultaneous Transmission Procedures as described in KDB648474 are not required for this product.

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	
	2-slot GPRS850 + WLAN	2-slot GPRS1900 + WLAN
Head: Left, Cheek	0.771	0.509
Head: Left, Tilt	-	-
Head: Right, Cheek	-	-
Head: Right, Tilt	-	-

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

Note:

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

Highest result within individual zoom scans is given in Section 1.2.1 for each transmitter. Highest result within contributing individual zoom scan or Speag combined algorithm results are given in Section 1.2.1 for each simultaneous transmitter combination.

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

850MHz Band Body SAR results

Mode	Device orientation		SAR measurement	Measured 1g SAR [W/kg]			Reported* 1g SAR [W/kg]			Max Deviation (Estimated SAR - Full SAR) [W/kg]	Plot #
				Ch 128 824.2 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		
1-slot GPRS	Tuning Target + Tolerance [dBm]			32.9			Scaling factor*				
	Conducted Slot Average Power [dBm]			32.5	32.5	32.3	0.4	0.4	0.6	dB	
	Time-averaged power [dBm]			23.5	23.5	23.3	1.10	1.10	1.15	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	29.8	0.4	0.4	0.6	dB	
	Time-averaged power [dBm]			24.0	24.0	23.8	1.10	1.10	1.15	Lin	
	Back facing phantom	Without headset	Estimated SAR	0.707	0.708	0.770	0.775	0.776	0.884	0.03	-
		Headset WH-108	Full SAR	-	-	0.801	-	-	0.920		
		Headset WH-108	Estimated SAR	-	0.462	-	-	0.507	-	-	-
	Display facing phantom	Without headset	Full SAR	-	-	-	-	-	-	0.03	-
		Headset WH-108	Estimated SAR	-	0.539	-	-	0.591	-		
		Headset WH-108	Full SAR	-	0.574	-	-	0.629	-	-	-
	Repeated SAR Back facing phantom	Without headset	Estimated SAR	-	0.398	-	-	0.436	-	-	-
		Headset WH-108	Full SAR	-	-	-	-	-	-		
		Headset WH-108	Full SAR	-	-	-	-	-	-	0.01	4
3-slot GPRS	Tuning Target + Tolerance [dBm]			28.6			Scaling factor*				
	Conducted Slot Average Power [dBm]			28.2	28.1	28.0	0.4	0.5	0.6	dB	
	Time-averaged power [dBm]			23.9	23.8	23.7	1.10	1.12	1.15	Lin	
				No testing required for this slot configuration.							
4-slot GPRS	Tuning Target + Tolerance [dBm]			27.4			Scaling factor*				
	Conducted Slot Average Power [dBm]			26.9	26.9	26.8	0.5	0.5	0.6	dB	
	Time-averaged power [dBm]			23.9	23.9	23.8	1.12	1.12	1.15	Lin	
				No testing required for this slot configuration.							

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	Ch 661	Ch 810	Ch 512	Ch 661	Ch 810		
				1850.2 MHz	1880.0 MHz	1909.8 MHz	1850.2 MHz	1880.0 MHz	1909.8 MHz		
1-slot GPRS	Tuning Target + Tolerance [dBm]		29.9			Scaling factor*					
	Conducted Slot Average Power [dBm]		29.4	29.4	29.4	0.5	0.5	0.5	dB		
	Time-averaged power [dBm]		20.4	20.4	20.4	1.12	1.12	1.12	Lin		
			No testing required for this slot configuration.								
2-slot GPRS	Tuning Target + Tolerance [dBm]		27.9			Scaling factor*					
	Conducted Slot Average Power [dBm]		27.5	27.4	27.3	0.4	0.5	0.6	dB		
	Time-averaged power [dBm]		21.5	21.4	21.3	1.10	1.12	1.15	Lin		
	Back facing phantom	Without headset	Estimated SAR	-	0.450	-	-	0.505	-		-
			Full SAR	-	-	-	-	-			
		Headset WH-108	Estimated SAR	0.386	0.459	0.626	0.423	0.515	0.719		5
			Full SAR	-	-	0.673	-	-	0.773		
	Display facing phantom	Without headset	Estimated SAR	-	0.278	-	-	0.312	-		-
			Full SAR	-	-	-	-	-	-		
		Headset WH-108	Estimated SAR	-	0.308	-	-	0.346	-		-
Full SAR			-	-	-	-	-	-			
3-slot GPRS	Tuning Target + Tolerance [dBm]		26.1			Scaling factor*					
	Conducted Slot Average Power [dBm]		25.6	25.5	25.5	0.5	0.6	0.6	dB		
	Time-averaged power [dBm]		21.3	21.2	21.2	1.12	1.15	1.15	Lin		
			No testing required for this slot configuration.								
4-slot GPRS	Tuning Target + Tolerance [dBm]		25.9			Scaling factor*					
	Conducted Slot Average Power [dBm]		24.3	24.3	24.3	1.6	1.6	1.6	dB		
	Time-averaged power [dBm]		21.3	21.3	21.3	1.45	1.45	1.45	Lin		
			No testing required for this slot configuration.								

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]		18.5			Scaling factor*					
	Conducted Power [dBm]		17.5	17.3	17.5	1.0	1.2	1.0	dB		
	Time-averaged power [dBm]		17.5	17.3	17.5	1.26	1.32	1.26	Lin		
	Back facing phantom	Without headset	Estimated SAR	-	0.066	-	-	0.087	-	-	-
			Full SAR	-	-	-	-	-	-	-	
		Headset WH-108	Estimated SAR	0.075	0.068	0.071	0.095	0.090	0.089	0.01	6
			Full SAR	0.083	-	-	0.105	-	-	-	-
	Display facing phantom	Without headset	Estimated SAR	-	0.029	-	-	0.038	-	-	-
			Full SAR	-	-	-	-	-	-	-	
		Headset WH-108	Estimated SAR	-	0.027	-	-	0.035	-	-	-
Full SAR			-	-	-	-	-	-	-	-	
Mode	Device orientation		SAR measurement	Measured 1g SAR [W/kg]			Reported* 1g SAR [W/kg]			Max Deviation (Estimated SAR - Full SAR) [W/kg]	Plot #
				Ch 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 QPSK 5.5Mbps	Tuning Target + Tolerance [dBm]		18.5			Scaling factor*					
	Conducted Power [dBm]		17.9	17.7		0.6	0.8		dB		
	Time-averaged power [dBm]		17.9	17.7		1.15	1.20		Lin		
	Worst case check Back facing phantom with Headset WH-108	Estimated SAR	0.070	0.074	-	0.080	0.089	-	0.01	-	
		Full SAR	-	0.068	-	-	0.082	-			

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

Test configuration	Max. Reported*1g SAR results		
	WLAN	2-slot GPRS850	2-slot GPRS1900
Body: Back facing phantom, Without Headset	0.087	0.929	0.505
Body: Back facing phantom, Headset WH-108	0.105	0.507	0.773
Body: Display facing phantom, Without Headset	0.038	0.629	0.312
Body: Display facing phantom, Headset WH-108	0.035	0.436	0.346

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

Test configuration	Max. Reported*1g SAR results	
	2-slot GPRS 850 + WLAN	2-slot GPRS1900 + WLAN
Body: Back facing phantom, Without Headset	1.02	0.592
Body: Back facing phantom, Headset WH-108	0.612	0.878
Body: Display facing phantom, Without Headset	0.667	0.350
Body: Display facing phantom, Headset WH-108	0.471	0.381

Note: Simultaneous Transmission Procedures as described in KDB648474 are not required for this product.

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.

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

Test configuration	Max. Reported*1g SAR results	
	2-slot GPRS850 + WLAN	2-slot GPRS1900 + WLAN
Body: Back facing phantom, Without Headset	0.990	-
Body: Back facing phantom, Headset WH-108	-	0.802
Body: Display facing phantom, Without Headset	-	-
Body: Display facing phantom, Headset WH-108	-	-

Note:

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

Highest result within individual zoom scans is given in Section 1.2.2 for each transmitter.
Highest result within contributing individual zoom scan or Speag combined algorithm results are given in Section 1.2.2 for each simultaneous transmitter combination.

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

850MHz Band Wireless Router SAR result

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		
1-slot GPRS	Tuning Target + Tolerance [dBm]		32.4			Scaling factor*				
	Conducted Slot Average Power [dBm]		31.9	31.9	31.9	0.5	0.5	0.5	dB	
	Time-averaged power [dBm]		22.9	22.9	22.9	1.12	1.12	1.12	Lin	
			No testing required for this slot configuration.							
2-slot GPRS	Tuning Target + Tolerance [dBm]		29.9			Scaling factor*				
	Conducted Slot Average Power [dBm]		29.4	29.3	29.3	0.5	0.6	0.6	dB	
	Time-averaged power [dBm]		23.4	23.3	23.3	1.12	1.15	1.15	Lin	
			No testing required for this slot configuration.							
3-slot GPRS	Tuning Target + Tolerance [dBm]		28.1			Scaling factor*				
	Conducted Slot Average Power [dBm]		27.7	27.6	27.6	0.4	0.5	0.5	dB	
	Time-averaged power [dBm]		23.4	23.3	23.3	1.10	1.12	1.12	Lin	
			No testing required for this slot configuration.							
4-slot GPRS	Tuning Target + Tolerance [dBm]		26.9			Scaling factor*				
	Conducted Slot Average Power [dBm]		26.3	26.4	26.3	0.6	0.5	0.6	dB	
	Time-averaged power [dBm]		23.3	23.4	23.3	1.15	1.12	1.15	Lin	
	Back facing phantom	Estimated SAR	0.863	0.885	0.962	0.991	0.993	1.11	0.03	7
		Full SAR	-	-	0.989	-	-	1.14		
	Display facing phantom	Estimated SAR	-	0.660	-	-	0.741	-	0.03	-
		Full SAR	-	0.630	-	-	0.707	-		
	Top edge facing phantom	Estimated SAR	-	0.017	-	-	0.019	-	-	-
		Full SAR	-	-	-	-	-	-		
	Bottom edge facing phantom	Estimated SAR	-	0.035	-	-	0.039	-	-	-
		Full SAR	-	-	-	-	-	-		
	Left edge facing phantom	Estimated SAR	-	0.441	-	-	0.495	-	-	-
		Full SAR	-	-	-	-	-	-		
	Right edge facing phantom	Estimated SAR	-	0.494	-	-	0.554	-	-	-
		Full SAR	-	-	-	-	-	-		
	Repeated SAR Back facing phantom	Estimated SAR	-	-	0.969	-	-	1.11	0.02	-
Full SAR		-	-	0.985	-	-	1.13			

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		
1-slot GPRS	Tuning Target + Tolerance [dBm]		26.9			Scaling factor*				
	Conducted Slot Average Power [dBm]		26.4	26.6	26.5	0.5	0.3	0.4	dB	
	Time-averaged power [dBm]		17.4	17.6	17.5	1.12	1.07	1.10	Lin	
	Back facing phantom	Estimated SAR	-	0.371	-	-	0.398	-	-	-
		Full SAR	-	-	-	-	-	-	-	-
	Display facing phantom	Estimated SAR	-	0.313	-	-	0.335	-	-	-
		Full SAR	-	-	-	-	-	-	-	-
	Top edge facing phantom	Estimated SAR	-	0.042	-	-	0.045	-	-	-
		Full SAR	-	-	-	-	-	-	-	-
	Bottom edge facing phantom	Estimated SAR	0.321	0.494	0.708	0.360	0.529	0.776	0.03	8
		Full SAR	-	-	0.681	-	-	0.747		
	Left edge facing phantom	Estimated SAR	-	0.072	-	-	0.077	-	-	-
		Full SAR	-	-	-	-	-	-	-	-
	Right edge facing phantom	Estimated SAR	-	0.052	-	-	0.056	-	-	-
		Full SAR	-	-	-	-	-	-	-	-
2-slot GPRS	Tuning Target + Tolerance [dBm]		23.9			Scaling factor*				
	Conducted Slot Average Power [dBm]		23.4	23.5	23.4	0.5	0.4	0.5	dB	
	Time-averaged power [dBm]		17.4	17.5	17.4	1.12	1.10	1.12	Lin	
			No testing required for this slot configuration.							
3-slot GPRS	Tuning Target + Tolerance [dBm]		22.1			Scaling factor*				
	Conducted Slot Average Power [dBm]		21.7	21.7	21.6	0.4	0.4	0.5	dB	
	Time-averaged power [dBm]		17.4	17.4	17.3	1.10	1.10	1.12	Lin	
			No testing required for this slot configuration.							
4-slot GPRS	Tuning Target + Tolerance [dBm]		20.9			Scaling factor*				
	Conducted Slot Average Power [dBm]		23.4	23.5	23.4	0.5	0.4	0.5	dB	
	Time-averaged power [dBm]		17.4	17.5	17.4	1.12	1.10	1.12	Lin	
			No testing required for this slot configuration.							

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]		18.5			Scaling factor*				
	Conducted Power [dBm]		17.5	17.3	17.5	1.0	1.2	1.0	dB	
	Time-averaged power [dBm]		17.5	17.3	17.5	1.26	1.32	1.26	Lin	
	Back facing phantom	Estimated SAR	-	0.122	-	-	0.161	-	-	-
		Full SAR	-	-	-	-	-	-		
	Display facing phantom	Estimated SAR	-	0.040	-	-	0.053	-	-	-
		Full SAR	-	-	-	-	-	-		
	Top edge facing phantom	Estimated SAR	-	0.035	-	-	0.046	-	-	-
		Full SAR	-	-	-	-	-	-		
	Bottom edge facing phantom	Estimated SAR	-	0.007	-	-	0.009	-	-	-
		Full SAR	-	-	-	-	-	-		
	Left edge facing phantom	Estimated SAR	-	0.018	-	-	0.024	-	-	-
Full SAR		-	-	-	-	-	-			
Right edge facing phantom	Estimated SAR	0.166	0.163	0.151	0.209	0.215	0.190	0.02	9	
	Full SAR	-	0.178	-	-	0.235	-			
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 QPSK 5.5 Mbps	Tuning Target + Tolerance [dBm]		18.5			Scaling factor*				
	Conducted Power [dBm]		17.9	17.7					dB	
	Time-averaged power [dBm]		17.9	17.7					Lin	
	Worst case check Right edge facing phantom	Estimated SAR	0.179	0.179	-	0.206	0.215	-	0.01	-
		Full SAR	-	0.189	-	-	0.227	-		

Simultaneous transmissions: Combined SAR results – Individual band Max results

Test configuration	Max. Reported* 1g SAR results		
	WLAN	4-slot GPRS850	1-slot GPRS1900
Back facing phantom	0.161	1.14	0.398
Display facing phantom	0.053	0.707	0.335
Top edge facing phantom	0.046	0.019	0.045
Bottom edge facing phantom	0.009	0.039	0.747
Left edge facing phantom	0.024	0.495	0.077
Right edge facing phantom	0.235	0.554	0.056

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

Test configuration	Max. Reported* 1g SAR results	
	4-slot GPRS850 + WLAN	1-slot GPRS1900 + WLAN
Back facing phantom	1.30	0.559
Display facing phantom	0.760	0.388
Top edge facing phantom	0.065	0.091
Bottom edge facing phantom	0.048	0.756
Left edge facing phantom	0.519	0.101
Right edge facing phantom	0.789	0.291

Note: Simultaneous Transmission Procedures as described in KDB648474 are not required for this product.

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. It is these values that appear in the Summary table in Section 1.2.

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

Test configuration	Max. Reported* 1g SAR results	
	4-slot GPRS850 + WLAN	1-slot GPRS1900 + WLAN
Back facing phantom	1.24	-
Display facing phantom	-	-
Top edge facing phantom	-	-
Bottom edge facing phantom	-	0.788
Left edge facing phantom	-	-
Right edge facing phantom	-	-

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.

Note:

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

Highest result within individual zoom scans is given in Section 1.2.2 for each transmitter.
Highest result within contributing individual zoom scan or Speag combined algorithm results are given in Section 1.2.2 for each simultaneous transmitter combination.