



**FCC OET BULLETIN 65 SUPPLEMENT C 01-01
IEEE STD 1528:2003**

SAR EVALUATION REPORT

For
BT3.0+EDR, 802.11b/g/n 1x1 HT20, GSM850/1900 & WCDMA850/1900 Bar phone

**MODEL: GT-B5510L
FCC ID: A3LGTB5510L**

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Revision History

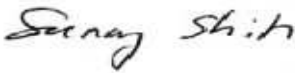
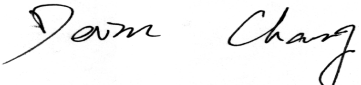
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--	October 6, 2011	Initial Issue	--
A	October 7, 2011	Updated report based on the Reviewer's comments. 1. Sec. 15 Simultaneous Transmission SAR Analysis. - Updated Sec. from "4.1 & 4.2" to "15.1 & 15.2". - Sec. 15.1 & 15.2: Updated Sum of 1g SAR by corrected formula.	Sunny Shih

Table of Contents

1. Attestation of Test Results	5
2. Test Methodology	6
3. Facilities and Accreditation	6
4. Calibration and Uncertainty	7
4.1. <i>Measuring Instrument Calibration.....</i>	<i>7</i>
4.2. <i>Measurement Uncertainty.....</i>	<i>8</i>
5. Equipment Under Test	9
5.1. <i>Band and Air interlaces</i>	<i>9</i>
5.2. <i>Personal Hotspot Mode</i>	<i>9</i>
5.3. <i>Simultaneous Transmission Conditions.....</i>	<i>10</i>
6. System Specifications.....	11
7. Composition of Ingredients for Simulating Liquids	12
8. Liquid Parameters	13
8.1. <i>Liquid Check Results.....</i>	<i>14</i>
9. System Verification	15
9.1. <i>System Check Results.....</i>	<i>16</i>
10. SAR Measurement Procedures.....	17
11. RF Output Power Measurement.....	18
11.1. <i>GSM.....</i>	<i>18</i>
11.2. <i>UMTS (WVDMA) Release 99.....</i>	<i>19</i>
11.3. <i>UMTS (WCDMA) HSDPA</i>	<i>20</i>
11.4. <i>WIFI</i>	<i>21</i>
11.5. <i>Bluetooth.....</i>	<i>21</i>
12. Standalone SAR Test Results	22
12.1. <i>GSM850.....</i>	<i>22</i>
12.2. <i>GSM1900.....</i>	<i>23</i>
12.3. <i>UMTS (WCDMA) Band V.....</i>	<i>24</i>
12.4. <i>UMTS (WCDMA) Band II</i>	<i>25</i>
12.5. <i>WiFi.....</i>	<i>26</i>
13. Summary of Highest 1g SAR.....	27

14. Worst-case SAR Plots.....	28
15. Simultaneous Transmission SAR Analysis (KDB 648474).....	48
15.1. Head Exposure Condition	48
15.2. Body-worn & hotspot exposure condition.....	49
16. Appendixes	50
16.1. Appendix A: System check plots.....	50
16.2. Appendix B: SAR test plots for GSM850.....	50
16.3. Appendix C: SAR test plots for GSM1900	50
16.4. Appendix D: SAR test plots for UMTS (WCDMA) Band V	50
16.5. Appendix E: SAR test plots for UMTS (WCDMA) band II	50
16.6. Appendix F: SAR test plots for WiFi.....	50
16.7. Appendix G: Calibration certificate for E-Field Probe EX3DV4 SN 3749.....	50
16.8. Appendix H: Calibration Certificate for D835V2 - SN 4d117.....	50
16.9. Appendix I: Calibration certificate for D1900V2 SN 5d140	50
16.10. Appendix J: Calibration certificate for D2450V2 SN: 706 w/ extended cal. data.....	50
17. Antenna Locations & Separation Distances.....	51
18. Setup Photos	54
18.1. Head	54
18.2. Body-worn & -hotspot	56
19. External Photos	60

1. Attestation of Test Results

Applicant:	Samsung Electronics Co., Ltd.		
EUT description:	BT3.0+EDR, 802.11b/g/n 1x1 HT20, GSM850/1900 & WCDMA850/1900 Bar phone. W/ hotspots and VOIP supported		
Model number:	GT-B5510L		
Device category:	Portable devices		
Exposure category:	General Population/Uncontrolled Exposure		
Date tested:	August 11 - 22, 2011		
FCC Rule Parts	Freq. Range [MHz]	Highest 1g SAR (W/kg)	Limit (W/kg)
22H	824 - 849	Head: 0.318 W/kg (Right Touch) Body-worn & -hotspot: 0.761 W/kg (Rear w/ 10 mm distance)	1.6
24E	1850 - 1910	Head: 0.88 W/kg (Right Touch) Body-worn & -hotspot: 0.893 W/kg (Rear w/ 10 mm distance)	
15.247	2412 - 2462	Head: 0.100 W/kg (Left Tilt) Body-worn & -hotspot: 0.266 W/kg (Rear w/ 10 mm distance)	
Applicable Standards			Test Results
FCC OET Bulletin 65 Supplement C 01-01, IEEE STD 1528:2003			Pass
Compliance Certification Services, Inc. (UL CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report. Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL CCS will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government (NIST Handbook 150, Annex A). This report is written to support regulatory compliance of the applicable standards stated above.			
Approved & Released For UL CCS By:		Tested By:	
			
Sunny Shih Engineering Team Leader Compliance Certification Services (UL CCS)		DEVIN CHANG EMC Associate Engineer Compliance Certification Services (UL CCS)	

2. Test Methodology

The tests documented in this report were performed in accordance with FCC OET Bulletin 65 Supplement C Edition 01-01, IEEE STD 1528:2003 and the following KDB Procedures.

- o 648474 D01 SAR Handsets Multi Xmitter and Ant, v01r05
- o 248227 D01 SAR meas for 802 11abg v01r02
- o 941225 D01 SAR test for 3G devices v02
- o 941225 D02 Guidance for 3GPP R6 and R7 HSPA v02v01
- o 941225 D06 Hot Spot SAR v01

3. Facilities and Accreditation

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

UL CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.com>.

4. Calibration and Uncertainty

4.1. Measuring Instrument Calibration

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due date		
				MM	DD	Year
Dielectronic Probe kit	HP	85070C	N/A	N/A		
ESA Series Network Analyzer	Agilent	E5071B	MY42100131	8	2	2012
Synthesized Signal Generator	HP	83732B	US34490599	7	14	2012
E-Field Probe	SPEAG	EX3DV4	3749	12	13	2011
Thermometer	ERTCO	639-1S	1718	7	19	2012
Data Acquisition Electronics	SPEAG	DAE4	1259	5	3	2012
System Validation Dipole	SPEAG	D835V2	4d117	4	15	2012
System Validation Dipole	SPEAG	D1900V2	5d140	4	18	2012
System Validation Dipole	SPEAG	*D2450V2	706	4	19	2012
Power Meter	Giga-tronics	8651A	8651404	5	13	2012
Power Sensor	Giga-tronics	80701A	1834588	5	13	2012
Power Meter	HP	437B	3125U16345	5	13	2012
Power Sensor	HP	8481A	2702A60780	5	13	2012
Amplifier	MITEQ	4D00400600-50-30P	1620606	N/A		
Directional coupler	Werlatone	C8060-102	2141	N/A		

Notes:

*Per KDB 450824 D02 requirements for dipole calibration, UL CCS has adopted two years calibration intervals. On annual basis, each measurement dipole has been evaluated and is in compliance with the following criteria:

1. There is no physical damage on the dipole
2. System validation with specific dipole is within 10% of calibrated value.
3. Return-loss is within 20% of calibrated measurement. (See Appendix J_Calibration Certificate for D2450V2 SN 706" with extended cal. data)
4. Impedance is within 5Ω of calibrated measurement (See Appendix J_Calibration Certificate for D2450V2 SN 706" with extended cal. data)

4.2. Measurement Uncertainty

Measurement uncertainty for 300 MHz to 3 GHz averaged over 1 gram					
Component	error, %	Probe Distribution	Divisor	Sensitivity	U (Xi), %
Measurement System					
Probe Calibration (k=1)	5.50	Normal	1	1	5.50
Axial Isotropy	1.15	Rectangular	1.732	0.7071	0.47
Hemispherical Isotropy	2.30	Rectangular	1.732	0.7071	0.94
Boundary Effect	0.90	Rectangular	1.732	1	0.52
Probe Linearity	3.45	Rectangular	1.732	1	1.99
System Detection Limits	1.00	Rectangular	1.732	1	0.58
Readout Electronics	0.30	Normal	1	1	0.30
Response Time	0.80	Rectangular	1.732	1	0.46
Integration Time	2.60	Rectangular	1.732	1	1.50
RF Ambient Conditions - Noise	3.00	Rectangular	1.732	1	1.73
RF Ambient Conditions - Reflections	3.00	Rectangular	1.732	1	1.73
Probe Positioner Mechanical Tolerance	0.40	Rectangular	1.732	1	0.23
Probe Positioning with respect to Phantom	2.90	Rectangular	1.732	1	1.67
Extrapolation, Interpolation and Integration	1.00	Rectangular	1.732	1	0.58
Test Sample Related					
Test Sample Positioning	2.90	Normal	1	1	2.90
Device Holder Uncertainty	3.60	Normal	1	1	3.60
Output Power Variation - SAR Drift	5.00	Rectangular	1.732	1	2.89
Phantom and Tissue Parameters					
Phantom Uncertainty (shape and thickness)	4.00	Rectangular	1.732	1	2.31
Liquid Conductivity - deviation from target	5.00	Rectangular	1.732	0.64	1.85
Liquid Conductivity - measurement (Body 1900 MHz)	-3.62	Normal	1	0.64	-2.32
Liquid Permittivity - deviation from target	5.00	Rectangular	1.732	0.6	1.73
Liquid Permittivity - measurement uncertainty (Head 835 MHz)	4.01	Normal	1	0.6	2.41
Combined Standard Uncertainty Uc(y) =					10.01
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				20.03	%
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				1.59	dB
Measurement uncertainty for 300 MHz to 3 GHz averaged over 10 gram					
Component	error, %	Probe Distribution	Divisor	Sensitivity	U (Xi), %
Measurement System					
Probe Calibration (k=1)	5.50	Normal	1	1	5.50
Axial Isotropy	1.15	Rectangular	1.732	0.7071	0.47
Hemispherical Isotropy	2.30	Rectangular	1.732	0.7071	0.94
Boundary Effect	0.90	Rectangular	1.732	1	0.52
Probe Linearity	3.45	Rectangular	1.732	1	1.99
System Detection Limits	1.00	Rectangular	1.732	1	0.58
Readout Electronics	0.30	Normal	1	1	0.30
Response Time	0.80	Rectangular	1.732	1	0.46
Integration Time	2.60	Rectangular	1.732	1	1.50
RF Ambient Conditions - Noise	3.00	Rectangular	1.732	1	1.73
RF Ambient Conditions - Reflections	3.00	Rectangular	1.732	1	1.73
Probe Positioner Mechanical Tolerance	0.40	Rectangular	1.732	1	0.23
Probe Positioning with respect to Phantom	2.90	Rectangular	1.732	1	1.67
Extrapolation, Interpolation and Integration	1.00	Rectangular	1.732	1	0.58
Test Sample Related					
Test Sample Positioning	2.90	Normal	1	1	2.90
Device Holder Uncertainty	3.60	Normal	1	1	3.60
Output Power Variation - SAR Drift	5.00	Rectangular	1.732	1	2.89
Phantom and Tissue Parameters					
Phantom Uncertainty (shape and thickness)	4.00	Rectangular	1.732	1	2.31
Liquid Conductivity - deviation from target	5.00	Rectangular	1.732	0.43	1.24
Liquid Conductivity - measurement (Body 1900 MHz)	-3.62	Normal	1	0.43	-1.56
Liquid Permittivity - deviation from target	5.00	Rectangular	1.732	0.49	1.41
Liquid Permittivity - measurement uncertainty (Head 835 MHz)	4.01	Normal	1	0.49	1.96
Combined Standard Uncertainty Uc(y), % =					9.62
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				19.24	%
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				1.53	dB

5. Equipment Under Test

BT3.0+EDR, 802.11b/g/n 1x1 HT20, GSM850/1900 & WCDMA850/1900MHz Bar phone w/hotspots, with VOIP supported.

Model: GT-B5510L

Normal operation:	- Held to head, - Body-worn with 10 mm separation to Rear and Front sides - Body-hotspot mode with 10 mm separation to all sides and edges.
Body Worn Accessory	- Headset
Battery:	Li-ion Battery Standard type. manufactured by "Samsung", Model "EB45357VU", rated 3.7 Vdc, 1200 mAh
Antenna-to-antenna and antenna-to-edges' separation distances:	Please refer to section 17 "Antenna Locations & Separation Distances" for details

5.1. Band and Air interlaces

Tx Frequency Bands:	GSM: GSM/GPRS850/1900 UMTS (WCDMA): Band V (850MHz) and band II (1900 MHz) WiFi: 802.11bng (2.4 GHz) Bluetooth: 2.4 GHz
Air Interfaces:	GSM, GPRS and EGPRS (Rx only) UMTS (WCDMA) Rel 99, HSDPA (Rel 6, CAT 8), HSUPA (Not support) 802.11b/g/n Bluetooth Ver 3.0 with EDR
Uplink Modulations:	GSM Modes: GMSK, 8PSK UMTS Modes: BPSK, QPSK 802.11b: DSS CCK 802.11g: OFDM 802.11n: OFDM Bluetooth: DQPSK, 8DPSK, GFSK
GPRS Multi-Slot Class:	12 Note: EGPRS mode support Rx only.
DTM Class:	Not support
GPRS Class:	Class B

5.2. Personal Hotspot Mode

This device is capability to enable wireless router (hotspot mode) functions. The hotspot mode can be enabled by the users. SAR measurements in the Personal hot spot function are performed with 10 m separation distance to all sides and edges to the body phantom.

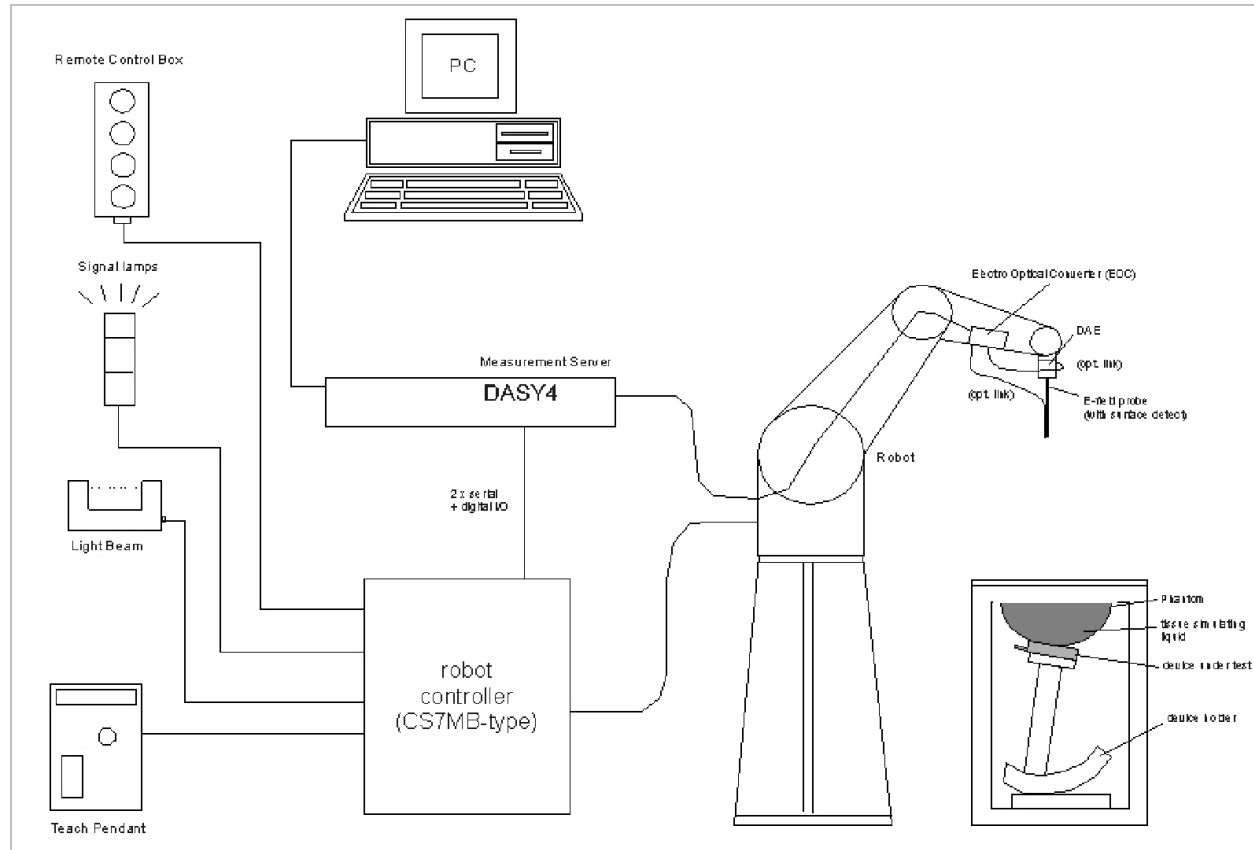
5.3. Simultaneous Transmission Conditions

<u>User usage</u>	<u>Simultaneous Tx</u>
Held to ear	GSM voice + WiFi/BT WCDMA R99 + WiFi/BT WCDMA HSDPA + WiFi/BT
Body-worn	GSM voice + WiFi/BT GPRS (data) + WiFi/BT WCDMA R99 + WiFi/BT WCDMA HSDPA + WiFi/BT
Body-hotspot	GPRS (data) + WiFi/BT WCDMA R99 + WiFi/BT WCDMA HSDPA + WiFi/BT

Note(s):

1. VIOP is not support GPRS mode
2. EGPRS mode is supported RX only
3. HSUPD is not support

6. System Specifications



The DASY system for performing compliance tests consists of the following items:

- A standard high precision 6-axis robot (Stäubli RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 2000 or Windows XP.
- DASY software.
- Remote controls with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits allowing validating the proper functioning of the system.

7. Composition of Ingredients for Simulating Liquids

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

Ingredients (% by weight)	Frequency (MHz)									
	450		835		900		1800 - 1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (NaCl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.8	52.5
Conductivity (S/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78

Salt: 99+% Pure Sodium Chloride

Sugar: 98+% Pure Sucrose

Water: De-ionized, 16 MΩ+ resistivity

HEC: Hydroxyethyl Cellulose

DGBE: 99+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]

Triton X-100 (ultra pure): Polyethylene glycol mono [4-(1,1, 3, 3-tetramethylbutyl)phenyl]ether

Simulating Liquids for 5 GHz, Manufactured by SPEAG

Ingredients	(% by weight)
Water	78
Mineral oil	11
Emulsifiers	9
Additives and Salt	2

8. Liquid Parameters

The simulating liquids should be checked at the beginning of a series of SAR measurements to determine if the dielectric parameters are within the tolerances of the specified target values. For frequencies in 300 MHz to just under 2 GHz, the measured conductivity and relative permittivity should be within $\pm 5\%$ of the target values. For frequencies in the range of 2–3 GHz and above the measured conductivity should be within $\pm 5\%$ of the target values. The measured relative permittivity tolerance can be relaxed to no more than $\pm 10\%$.

Reference Values of Tissue Dielectric Parameters for Head & Body Phantom

The body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations and extrapolated according to the head parameters specified in IEEE Standard 1528.

Target Frequency (MHz)	Head		Body	
	ϵ_r	σ (S/m)	ϵ_r	σ (S/m)
150	52.3	0.76	61.9	0.8
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
750	41.96	0.89	55.6	0.96
835	41.5	0.9	55.2	0.97
900	41.5	0.97	55	1.05
915	41.5	0.98	55	1.06
1450	40.5	1.2	54	1.3
1610	40.3	1.29	53.8	1.4
1750	40.08	1.37	53.44	1.49
1800 – 2000	40	1.4	53.3	1.52
2450	39.2	1.8	52.7	1.95
3000	38.5	2.4	52	2.73

(ϵ_r = relative permittivity, σ = conductivity and $\rho = 1000 \text{ kg/m}^3$)

8.1. Liquid Check Results

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit $\pm$ (%)
8/11/2011	Head 1900	e'	38.4189	Relative Permittivity (ϵ_r):	38.42	40.00	-3.95	5
		e''	13.2816	Conductivity (σ):	1.40	1.40	0.22	5
8/15/2011	Head 2450	e'	40.3382	Relative Permittivity (ϵ_r):	40.34	39.20	2.90	5
		e''	13.0919	Conductivity (σ):	1.78	1.80	-0.92	5
8/16/2011	Head 835	e'	43.1625	Relative Permittivity (ϵ_r):	43.16	41.50	4.01	5
		e''	19.3010	Conductivity (σ):	0.90	0.90	-0.43	5

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit $\pm$ (%)
8/11/2011	Body 1900	e'	52.0009	Relative Permittivity (ϵ_r):	52.00	53.30	-2.44	5
		e"	14.0996	Conductivity (σ):	1.49	1.52	-2.00	5
8/12/2011	Body 1900	e'	53.9131	Relative Permittivity (ϵ_r):	53.91	53.30	1.15	5
		e"	13.8675	Conductivity (σ):	1.47	1.52	-3.62	5
8/14/2011	Body 2450	e'	51.1435	Relative Permittivity (ϵ_r):	51.14	52.70	-2.95	5
		e"	14.4471	Conductivity (σ):	1.97	1.95	0.93	5
8/21/2011	Body 835	e'	54.5474	Relative Permittivity (ϵ_r):	54.55	55.20	-1.18	5
		e"	20.9541	Conductivity (σ):	0.97	0.97	0.30	5
8/22/2011	Body 835	e'	54.4577	Relative Permittivity (ϵ_r):	54.46	55.20	-1.34	5
		e"	21.0976	Conductivity (σ):	0.98	0.97	0.98	5

9. System Verification

The system performance check is performed prior to any usage of the system in order to verify SAR system measurement accuracy. The system performance check verifies that the system operates within its specifications of $\pm 10\%$.

System Performance Check Measurement Conditions

- The measurements were performed in the flat section of the SAM twin phantom filled with Head or Body simulating liquid of the following parameters.
- The DASY system with an E-Field Probe EX3DV4 was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10 mm (above 1 GHz) and 15 mm (below 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 15 mm was aligned with the dipole.
For 5 GHz band - The coarse grid with a grid spacing of 10 mm was aligned with the dipole.
- Special 7x7x7 fine cube was chosen for cube
- Distance between probe sensors and phantom surface was set to 3 mm.
For 5 GHz band - Distance between probe sensors and phantom surface was set to 2.5 mm
- The dipole input power (forward power) was 100 mW
- The results are normalized to 1 W input power.

Reference SAR Values for HEAD & BODY-tissue from calibration certificate of SPEAG.

Cal. certificate #	Validation dipole	Cal. date	Freq. (MHz)	Ref. SAR values (mW/g) (form cal. certificate)		
				Tissue:	Head	Body
D835V2-4d117	D835V2	4/15/11	835	1g SAR:	9.64	10.1
				10g SAR:	6.28	6.6
D1900V2-5d140	D1900V2	4/18/11	1900	1g SAR:	41.6	41.2
				10g SAR:	21.5	21.6
D2450V2-706	D2450V2	4/19/10	2450	1g SAR:	51.6	52.4
				10g SAR:	24.4	24.5

9.1. System Check Results

Date Tested	System validation dipole		Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
08/11/11	Head	D1900V2	1g SAR:	42.0	41.60	0.96	±10
			10g SAR:	21.8	21.50	1.40	
08/12/11	Body	D1900V2	1g SAR:	39.6	41.20	-3.88	±10
			10g SAR:	20.7	21.60	-4.17	
08/14/11	Body	D2450V2	1g SAR:	50.1	52.40	-4.39	±10
			10g SAR:	23.3	24.50	-4.90	
05/15/11	Head	D2450V2	1g SAR:	51.3	51.60	-0.58	±10
			10g SAR:	23.3	24.40	-4.51	
05/16/11	Head	D835V2	1g SAR:	9.66	9.64	0.21	±10
			10g SAR:	6.31	6.28	0.48	
08/21/11	Body	D835V2	1g SAR:	9.85	10.10	-2.48	±10
			10g SAR:	6.46	6.60	-2.12	
08/22/11	Body	D835V2	1g SAR:	9.98	10.10	-1.19	±10
			10g SAR:	6.55	6.60	-0.76	

10. SAR Measurement Procedures

Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The Minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 2.1 mm. This distance cannot be smaller than the Distance of sensor calibration points to probe tip as defined in the probe properties.

Step 2: Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE Standard 1528, IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

Step 3: Zoom Scan

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The Zoom Scan measures $\geq 7 \times 7 \times 9$ (above 4.5 GHz) or $5 \times 5 \times 7$ (below 3 GHz) points within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

Step 4: Power drift measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

Step 5: Z-Scan

The Z Scan measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. In order to get a reasonable extrapolation, the extrapolated distance should not be larger than the step size in Z-direction.

11. RF Output Power Measurement

11.1. GSM

GSM (GMSK) voice mode

Band	Ch No.	Freq. (MHz)	Avg burst Pwr
GSM850	128	824.2	32.6
	190	836.6	32.6
	251	848.8	32.7
GSM1900	512	1850.2	29.8
	661	1880.0	29.9
	810	1909.8	29.9

GPRS (GMSK) - Coding Scheme: CS1

Band	Ch No.	Freq. (MHz)	Avg burst Pwr (dBm)				Avg burst Pwr (dBm)			
			1 slot	Frame Avg Pwr	2 slots	Frame Avg Pwr	3 slots	Frame Avg Pwr	4 slots	Frame Avg Pwr
GSM850	128	824.2	32.5	23.5	31.1	25.1	29.1	24.8	27.0	24.0
	190	836.6	32.6	23.6	31.1	25.1	29.0	24.7	27.0	24.0
	251	848.8	32.7	23.7	31.2	25.2	29.2	24.9	27.1	24.1
GSM1900	512	1850.2	29.8	20.8	28.3	22.3	26.3	22.0	24.2	21.2
	661	1880	29.8	20.8	28.4	22.4	26.3	22.0	24.3	21.3
	810	1909.8	29.8	20.8	28.4	22.4	26.4	22.1	24.3	21.3

Note(s):

- EGPRS mode support Rx only
- Based on output power table above, the following worst-case slot was chosen for Body SAR testing.
 - GPRS850 2 time slots
 - GPRS1900 2 time slots

11.2. UMTS (WVDMA) Release 99

The following tests were completed according to the test requirements outlined in section 5.2 of the 3GPP TS34.121-1 specification. The EUT supports power Class 3, which has a nominal maximum output power of 24 dBm (+1.7/-3.7). RMC 12.2 kbps is used for this testing.

WCDMA General Settings	Mode	Rel99
	Subtest	-
	Loopback Mode	Test Mode 1
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	β_c/β_d	8/15

Results

Rel 99 (12.2kbps RMC)

Band	Mode	UL Ch No.	Freq. (MHz)	Avg Tx Pwr (dBm)
UMTS (WCDMA) Band V	Rel 99 12.2kbps RMC	4132	826.4	23.0
		4183	836.6	23.1
		4233	846.6	23.1
UMTS (WCDMA) Band II	Rel 99 12.2kbps RMC	9262	1852.4	22.5
		9400	1880.0	22.7
		9538	1907.6	22.6

11.3. UMTS (WCDMA) HSDPA

The following 4 Sub-tests were completed according to Release 6 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

	Mode	HSDPA			
	Subtest	1	2	3	4
WCDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set1			
	Power Control Algorithm	Algorithm 2			
	β_c	2/15	12/15	15/15	15/15
	β_d	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	β_c/β_d	2/15	12/15	15/8	15/4
	β_{hs}	4/15	24/15	30/15	30/15
HSDPA Specific Settings	MPR (dB)	0	0	0.5	0.5
	D _{ACK}	8			
	D _{NAK}	8			
	DCQI	8			
	Ack-Nack repetition factor	3			
	CQI Feedback (Table 5.2B.4)	4ms			
	CQI Repetition Factor (Table 5.2B.4)	2			
	A _{hs} = β_{hs}/β_c	30/15			

Results

Band	Mode	UL Ch No.	f (MHz)	MPR	Avg Tx Pwr (dBm)
UMTS (WCDMA) Band V	Subtest 1	4132	826.4	0	22.4
		4183	836.6	0	22.4
		4233	846.6	0	22.6
	Subtest 2	4132	826.4	0	22.4
		4183	836.6	0	22.5
		4233	846.6	0	22.5
	Subtest 3	4132	826.4	0.5	22.0
		4183	836.6	0.5	22.0
		4233	846.6	0.5	22.1
	Subtest 4	4132	826.4	0.5	21.8
		4183	836.6	0.5	21.9
		4233	846.6	0.5	22.0
UMTS (WCDMA) Band II	Subtest 1	9262	1852.4	0	21.5
		9400	1880.0	0	21.7
		9538	1907.6	0	21.7
	Subtest 2	9262	1852.4	0	21.4
		9400	1880.0	0	21.6
		9538	1907.6	0	21.6
	Subtest 3	9262	1852.4	0.5	21.3
		9400	1880.0	0.5	21.5
		9538	1907.6	0.5	21.5
	Subtest 4	9262	1852.4	0.5	21.1
		9400	1880.0	0.5	21.3
		9538	1907.6	0.5	21.3

Note(s):

KDB 941225 D01 – Body SAR is not required for HSDPA when the maximum average output of each RF channel with HSDPA active is less than ¼ dB higher than that measured without HSDPA using 12.2 kbps RMC.

11.4. WIFI

Mode	Channel	Freq. (MHz)	Conducted Avg Power	
			(dBm)	(mW)
802.11b	1	2412	12.94	19.7
	6	2437	12.95	19.7
	11	2462	12.60	18.2
802.11g	1	2412	12.92	19.6
	6	2437	12.77	18.9
	11	2462	12.79	19.0
802.11n (HT20)	1	2412	11.90	15.5
	6	2437	12.50	17.8
	11	2462	12.20	16.6

Note(s):

KDB 248227 - SAR is not required for 802.11g/HT20 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11b channels.

11.5. Bluetooth

Mode	Channel	Freq. (MHz)	Conducted Avg Power	
			(dBm)	(mW)
GFSK	0	2402	5.8	3.8
	39	2441	6.9	4.9
	78	2480	6.3	4.3
8PSK	0	2402	3.5	2.2
	39	2441	4.8	3.0
	78	2480	4.3	2.7

Note(s):

According to KDB 648474, Table 2, Unlicensed transmitters

When there is simultaneous transmission, Stand-alone SAR not required due to

- ☐ Output $\leq 2 \cdot P_{\text{Ref}}$ (24 mW) and antenna is ≥ 5.0 cm from other antennas
- ☐ Output $\leq P_{\text{Ref}}$ (12 mW) and antenna is ≥ 2.5 cm from other antennas
- ☒ Output $\leq P_{\text{Ref}}$ (12 mW) and antenna is < 2.5 cm from other antennas

12. Standalone SAR Test Results

12.1. GSM850

Head SAR

Test position	Mode	Ch No.	Freq. (MHz)	Avg Pwr (dBm)	SAR (mW/g)		Note
					1-g	10-g	
Left Touch	Voice	128	824.2	32.6			1
		190	836.6	32.6	0.251	0.187	
		251	848.8	32.7			1
Left Tilt	Voice	128	824.2	32.6			1
		190	836.6	32.6	0.151	0.116	
		251	848.8	32.7			1
Right Touch	Voice	128	824.2	32.6			1
		190	836.6	32.6	0.318	0.235	
		251	848.8	32.7			1
Right Tilt	Voice	128	824.2	32.6			1
		190	836.6	32.6	0.173	0.131	
		251	848.8	32.7			1

Body-worn & Body-hotspot SAR with 10 mm separation distance

Test position	Mode	Ch No.	Freq. (MHz)	Avg Pwr (dBm)	SAR (mW/g)		Note
					1-g	10-g	
Rear (Back)	GPRS 2 Slot	128	824.2	31.1			1
		190	836.6	31.1	0.761	0.548	
		190	836.6	31.1	0.566	0.408	2
		251	848.8	31.2			1
Front	GPRS 2 Slot	128	824.2	31.1			1
		190	836.6	31.1	0.402	0.295	
		251	848.8	31.2			1
Left	GPRS 2 Slot	128	824.2	31.1			1
		190	836.6	31.1	0.172	0.120	
		251	848.8	31.2			1
Right	GPRS 2 Slot	128	824.2	31.1			1
		190	836.6	31.1	0.308	0.212	
		251	848.8	31.2			1
Bottom	GPRS 2 Slot	128	824.2	31.1			1
		190	836.6	31.1	0.105	0.063	
		251	848.8	31.2			1
Top	GPRS 2 Slot	128	824.2				3
		190	836.6				3
		251	848.8				3

Note(s):

1. SAR test was performed in the middle channel only as the measured level was < 50% of the SAR limit as stated in FCC "Public Notice DA 02-1438" by the SCC-34/SC-2. Testing in the low and high channel is optional.
2. With headset attached
3. SAR is not required due to antenna-to-top edge's separation is greater than 2.5 cm.

12.2. GSM1900

Head SAR

Test position	Mode	Ch No.	Freq. (MHz)	Avg Pwr (dBm)	SAR (mW/g)		Note
					1-g	10-g	
Left Touch	Voice	512	1850.2	29.8			1
		661	1880.0	29.9	0.308	0.187	
		810	1909.8	29.9			1
Left Tilt	Voice	512	1850.2	29.8			1
		661	1880.0	29.9	0.169	0.102	
		810	1909.8	29.9			1
Right Touch	Voice	512	1850.2	29.8			1
		661	1880.0	29.9	0.505	0.283	
		810	1909.8	29.9			1
Right Tilt	Voice	512	1850.2	29.8			1
		661	1880.0	29.9	0.166	0.091	
		810	1909.8	29.9			1

Body-worn & Body-hotspot SAR with 10 mm separation distance

Test position	Mode	Ch No.	Freq. (MHz)	Avg Pwr (dBm)	SAR (mW/g)		Note
					1-g	10-g	
Rear (Back)	GPRS 2 Slot	512	1850.2	28.3			1
		661	1880.0	28.4	0.685	0.381	
		810	1909.8	28.4			1
		661	1880.0	28.4	0.703	0.391	2
Front	GPRS 2 Slot	512	1850.2	28.3			1
		661	1880.0	28.4	0.507	0.305	
		810	1909.8	28.4			1
Left	GPRS 2 Slot	512	1850.2	28.3			1
		661	1880.0	28.4	0.077	0.046	
		810	1909.8	28.4			1
Right	GPRS 2 Slot	512	1850.2	28.3			1
		661	1880.0	28.4	0.142	0.085	
		810	1909.8	28.4			1
Bottom	GPRS 2 Slot	512	1850.2	28.3			1
		661	1880.0	28.4	0.528	0.302	
		810	1909.8	28.4			1
Top	GPRS 2 Slot	512	1850.2				3
		661	1880.0				3
		810	1909.8				3

Note(s):

1. SAR test was performed in the middle channel only as the measured level was < 50% of the SAR limit as stated in FCC "Public Notice DA 02-1438" by the SCC-34/SC-2. Testing in the low and high channel is optional.
2. With headset attached
3. SAR is not required due to antenna-to-top edge's separation is greater than 2.5 cm.

12.3. UMTS (WCDMA) Band V

Head SAR

Test Position	Mode	UL Ch #.	Freq. (MHz)	Avg Pwr (dBm)	SAR (mW/g)		Note
					1-g	10-g	
Left Touch	R99 (RMC, 12.2 kbps)	4132	826.4	23.0			1
		4183	836.6	23.1	0.275	0.203	
		4233	846.4	23.1			1
Left Tilt	R99 (RMC, 12.2 kbps)	4132	826.4	23.0			1
		4183	836.6	23.1	0.155	0.118	
		4233	846.4	23.1			1
Right Touch	R99 (RMC, 12.2 kbps)	4132	826.4	23.0			1
		4183	836.6	23.1	0.317	0.233	
		4233	846.4	23.1			1
Right Tilt	R99 (RMC, 12.2 kbps)	4132	826.4	23.0			1
		4183	836.6	23.1	0.160	0.122	
		4233	846.4	23.1			1

Body-worn & Body-hotspot SAR with 10 mm separation distance

Test Position	Mode	UL Ch #.	Freq. (MHz)	Avg Pwr (dBm)	SAR (mW/g)		Note
					1-g	10-g	
Rear (Back)	R99 (RMC, 12.2 kbps)	4132	826.4	23.0			1
		4183	836.6	23.1	0.494	0.356	
		4233	846.4	23.1			1
		4183	836.6	23.0	0.391	0.269	2
Front	R99 (RMC, 12.2 kbps)	4132	826.4	23.1			1
		4183	836.6	23.1	0.263	0.194	
		4233	846.4	23.0			
Left	R99 (RMC, 12.2 kbps)	4132	826.4	23.1			1
		4183	836.6	23.1	0.117	0.081	
		4233	846.4	22.8			1
Right	R99 (RMC, 12.2 kbps)	4132	826.4	23.0			1
		4183	836.6	23.1	0.205	0.142	
		4233	846.4	23.1			1
Bottom	R99 (RMC, 12.2 kbps)	4132	826.4	23.0			1
		4183	836.6	23.1	0.073	0.046	
		4233	846.4	23.1			1
Top	R99 (RMC, 12.2 kbps)	4132	826.4				3
		4183	836.6				3
		4233	846.4				3

Note(s):

1. SAR test was performed in the middle channel only as the measured level was < 50% of the SAR limit as stated in FCC "Public Notice DA 02-1438" by the SCC-34/SC-2. Testing in the low and high channel is optional.
2. With headset attached.
3. SAR is not required due to antenna-to-top edge's distance is greater than 2.5 cm.

12.4. UMTS (WCDMA) Band II

Head SAR

Test Position	Mode	UL Ch #.	Freq. (MHz)	Avg Pwr (dBm)	SAR (mW/g)		Note
					1-g	10-g	
Left Touch	R99 (RMC, 12.2 kbps)	9262	1852.4	22.5			1
		9400	1880.0	22.7	0.565	0.348	
		9538	1907.6	22.6			1
Left Tilt	R99 (RMC, 12.2 kbps)	9262	1852.4	22.5			1
		9400	1880.0	22.7	0.271	0.167	
		9538	1907.6	22.6			1
Right Touch	R99 (RMC, 12.2 kbps)	9262	1852.4	22.5	0.817	0.455	
		9400	1880.0	22.7	0.880	0.492	
		9538	1907.6	22.6	0.860	0.476	
Right Tilt	R99 (RMC, 12.2 kbps)	9262	1852.4	22.5			1
		9400	1880.0	22.7	0.263	0.146	
		9538	1907.6	22.6			1

Body-worn & Body-hotspot SAR with 10 mm separation distance

Test Position	Mode	UL Ch #.	Freq. (MHz)	Avg Pwr (dBm)	SAR (mW/g)		Note
					1-g	10-g	
Rear (Back)	R99 (RMC, 12.2 kbps)	9262	1852.4	22.5	0.846	0.439	
		9400	1880.0	22.7	0.865	0.450	
		9538	1907.6	22.6	0.823	0.429	
		9400	1880.0	22.7	0.893	0.472	2
Front	R99 (RMC, 12.2 kbps)	9262	1852.4	22.5			1
		9400	1880.0	22.7	0.499	0.286	
		9538	1907.6	22.6			1
Left	R99 (RMC, 12.2 kbps)	9262	1852.4	22.5			1
		9400	1880.0	22.7	0.127	0.077	
		9538	1907.6	22.6			1
Right	R99 (RMC, 12.2 kbps)	9262	1852.4	22.5			1
		9400	1880.0	22.7	0.167	0.100	
		9538	1907.6	22.6			1
Bottom	R99 (RMC, 12.2 kbps)	9262	1852.4	22.5			1
		9400	1880.0	22.7	0.622	0.354	
		9538	1907.6	22.6			1
Top	R99 (RMC, 12.2 kbps)	9262	1852.4				3
		9400	1880.0				3
		9538	1907.6				3

Note(s):

1. SAR test was performed in the middle channel only as the measured level was < 50% of the SAR limit as stated in FCC "Public Notice DA 02-1438" by the SCC-34/SC-2. Testing in the low and high channel is optional.
2. With headset attached.
3. SAR is not required due to antenna-to-top edge's distance is greater than 2.5 cm.

12.5. WiFi

Head SAR

Test position	Mode	Ch No.	Freq. (MHz)	Avg Pwr (dBm)	SAR (mW/g)		Note
					1-g	10-g	
Left Touch	802.11b	1	2412	12.94			1
		6	2437	12.95	0.087	0.041	
		11	2462	12.60			1
Left Tilt	802.11b	1	2412	12.94			1
		6	2437	12.95	0.100	0.048	
		11	2462	12.60			1
Right Touch	802.11b	1	2412	12.94			1
		6	2437	12.95	0.072	0.036	
		11	2462	12.60			1
Right Tilt	802.11b	1	2412	12.94			1
		6	2437	12.95	0.064	0.032	
		11	2462	12.60			1

Body-worn & Body-hotspot SAR with 10 mm separation distance

Test position	Mode	Ch No.	Freq. (MHz)	Avg Pwr (dBm)	SAR (mW/g)		Note
					1-g	10-g	
Rear (Back)	802.11b	1	2412	12.94			1
		6	2437	12.95	0.266	0.139	
		11	2462	12.60			1
		6	2437	12.95	0.247	0.131	2
Front	802.11b	1	2412	12.94			1
		6	2437	12.95	0.053	0.029	
		11	2462	12.60			1
Left	802.11b	1	2412	12.94			1
		6	2437	12.95	0.00447	0.0014	
		11	2462	12.60			1
Right	802.11b	1	2412	12.94			1
		6	2437	12.95	0.061	0.033	
		11	2462	12.60			1
Bottom	802.11b	1	2412	12.94			3
		6	2437	12.95			3
		11	2462	12.60			3
Top	802.11b	1	2412	12.94			1
		6	2437	12.95	0.113	0.056	
		11	2462	12.60			1

Note(s):

1. SAR test was performed in the middle channel only as the measured level was < 50% of the SAR limit as stated in FCC "Public Notice DA 02-1438" by the SCC-34/SC-2. Testing in the low and high channel is optional.
2. With headset attached.
3. SAR is not required due to antenna-to-bottom edge's distances are greater than 2.5 cm.

13. Summary of Highest 1g SAR

FCC rule part	Technology	Test configuration	Mode	Sep. distance (mm)	Highest 1g SAR (W/kg)
22H	GSM850	Head: Right touch	GSM voice	-	0.318
		Body-worn & -hotspot: Rear	GPRS 2 Slot, CS1	10	0.761
	UMTS (WCDMA) Band V	Head: Right touch	R99 (RMC, 12.2 kbps)	-	0.317
		Body-worn & -hotspot: Rear	R99 (RMC, 12.2 kbps)	10	0.494
24E	GSM1900	Head Right Touch	GSM Voice	-	0.505
		Body-worn & -hotspot: Rear	GPRS 2 Slot, CS1	10	0.703
	UMTS (WCDMA) Band II	Head: Right touch	R99 (RMC, 12.2 kbps)	-	0.880
		Body-worn& -hotspot: Rear	R99 (RMC, 12.2 kbps)	10	0.893
15.247	WiFi 2.4 GHz	Head: Left tilt	802.11b, 1 Mbps	-	0.100
		Body-worn & -hotspot: Rear	802.11b, 1 Mbps	10	0.266

14. Worst-case SAR Plots

Date/Time: 8/16/2011 10:05:11 PM

Test Laboratory: UL CCS SAR Lab D

GSM850_Right Hand Side

Communication System: GSM850; Frequency: 836.6 MHz; Duty Cycle: 1:8
Medium parameters used (interpolated): $f = 836.6$ MHz; $\sigma = 0.898$ mho/m; $\epsilon_r = 43.1$; $\rho = 1000$ kg/m³
Phantom section: Right Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY4 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3749; ConvF(8.82, 8.82, 8.82); Calibrated: 12/13/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used)) Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1259; Calibrated: 5/3/2011
- Phantom: SAM A (Twin); Type: SAM A; Serial: 1050
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Touch_M ch/Area Scan (61x91x1): Measurement grid: dx=15mm, dy=15mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.373 mW/g

Touch_M ch/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

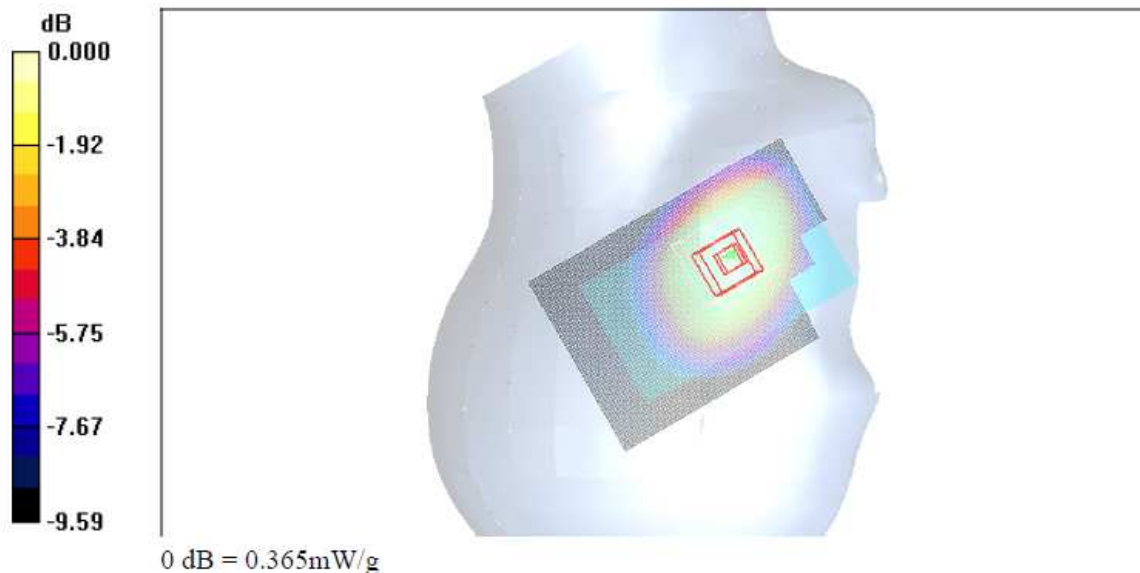
Reference Value = 20.1 V/m; Power Drift = -0.014 dB

Peak SAR (extrapolated) = 0.414 W/kg

SAR(1 g) = 0.318 mW/g; SAR(10 g) = 0.235 mW/g

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.365 mW/g



Date/Time: 8/16/2011 10:14:59 PM

Test Laboratory: UL CCS SAR Lab D

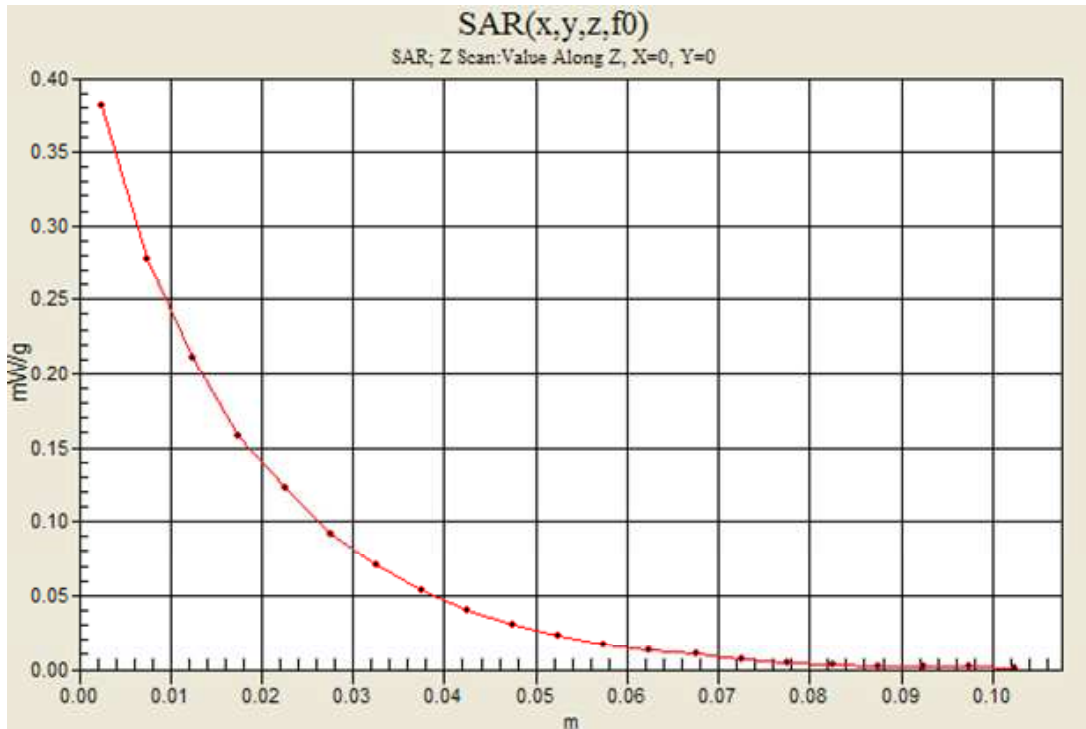
GSM850_Right Hand Side

Communication System: GSM850; Frequency: 836.6 MHz; Duty Cycle: 1:8

Touch_M ch/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.381 mW/g



Date/Time: 8/21/2011 6:58:44 PM

Test Laboratory: UL CCS SAR Lab D

GPRS850 2 slot_Body

Communication System: GSM850; Frequency: 836.6 MHz; Duty Cycle: 1:4
Medium parameters used (interpolated): $f = 836.6$ MHz; $\sigma = 0.975$ mho/m; $\epsilon_r = 54.5$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY4 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3749; ConvF(8.79, 8.79, 8.79); Calibrated: 12/13/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used)) Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1259; Calibrated: 5/3/2011
- Phantom: SAM B (Twin); Type: SAM B; Serial: TP-105
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Back side_M ch_2 solt/Area Scan (61x91x1): Measurement grid: dx=15mm, dy=15mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.917 mW/g

Back side_M ch_2 solt/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

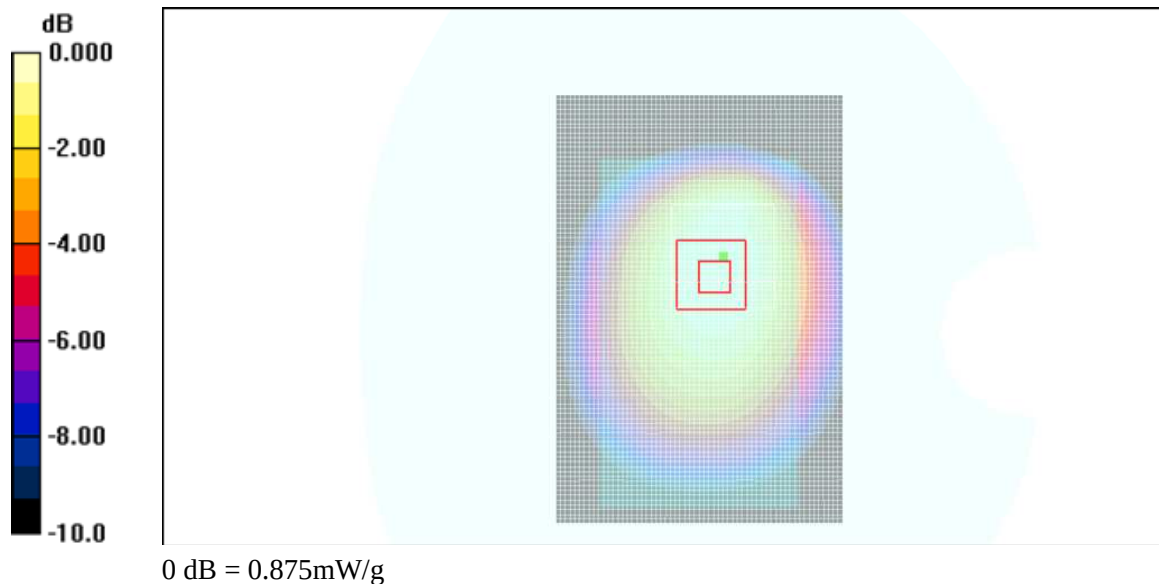
Reference Value = 29.8 V/m; Power Drift = -0.032 dB

Peak SAR (extrapolated) = 1.02 W/kg

SAR(1 g) = 0.761 mW/g; SAR(10 g) = 0.548 mW/g

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.875 mW/g



Date/Time: 8/21/2011 7:07:54 PM

Test Laboratory: UL CCS SAR Lab D

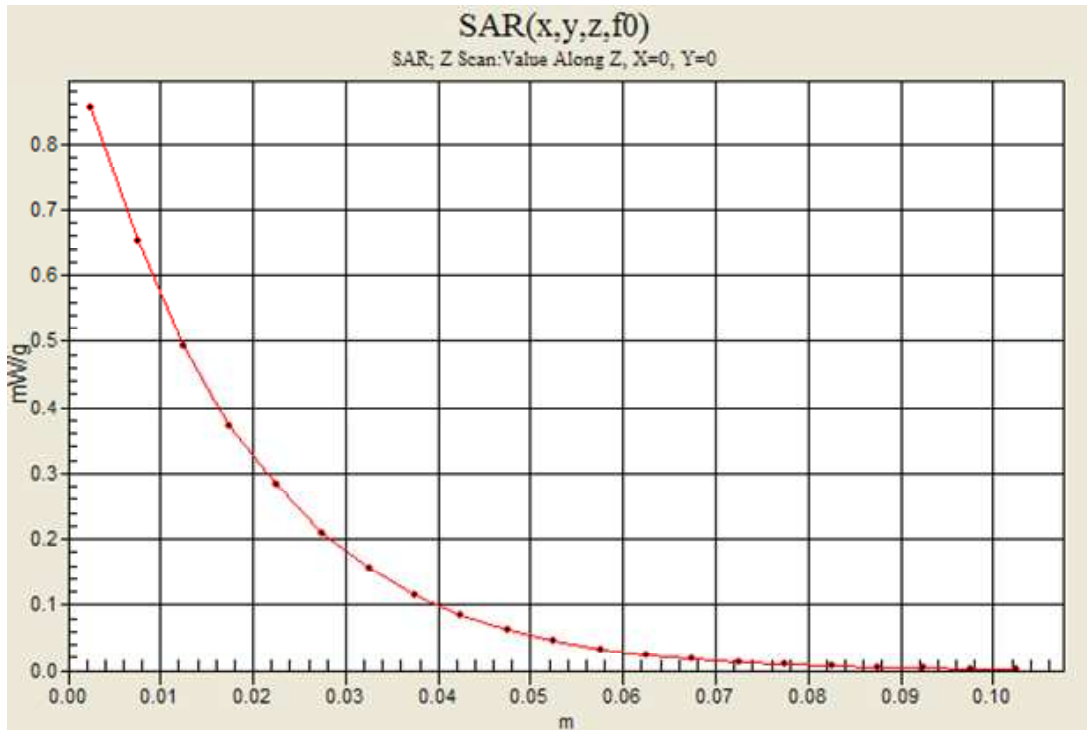
GPRS850 2 slot_Body

Communication System: GSM850; Frequency: 836.6 MHz; Duty Cycle: 1:4

Back side_M ch_2 solt/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

Info: [Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.854 mW/g



Date/Time: 8/16/2011 2:36:12 PM

Test Laboratory: UL CCS SAR Lab D

UMTS band V_Right Hand Side

Communication System: UMTS Band V; Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 836.6$ MHz; $\sigma = 0.898$ mho/m; $\epsilon_r = 43.1$; $\rho = 1000$ kg/m³
Phantom section: Right Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY4 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3749; ConvF(8.82, 8.82, 8.82); Calibrated: 12/13/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1259; Calibrated: 5/3/2011
- Phantom: SAM A (Twin); Type: SAM A; Serial: 1050
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Touch_M ch/Area Scan (61x91x1): Measurement grid: dx=15mm, dy=15mm

Info: [Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.375 mW/g

Touch_M ch/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

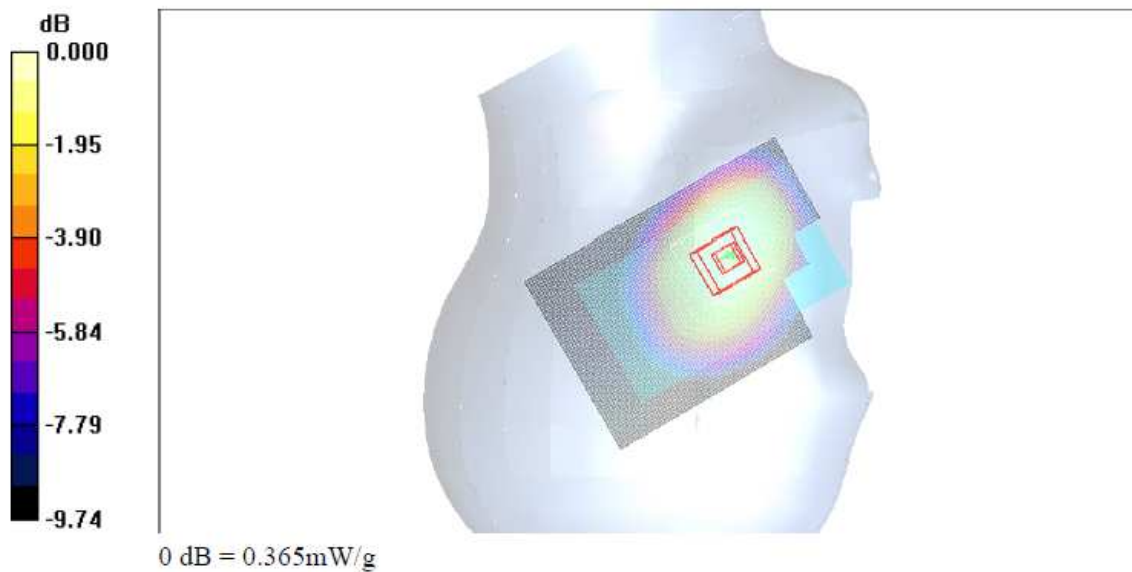
Reference Value = 19.6 V/m; Power Drift = 0.047 dB

Peak SAR (extrapolated) = 0.415 W/kg

SAR(1 g) = 0.317 mW/g; SAR(10 g) = 0.233 mW/g

Info: [Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.365 mW/g



Date/Time: 8/16/2011 2:48:28 PM

Test Laboratory: UL CCS SAR Lab D

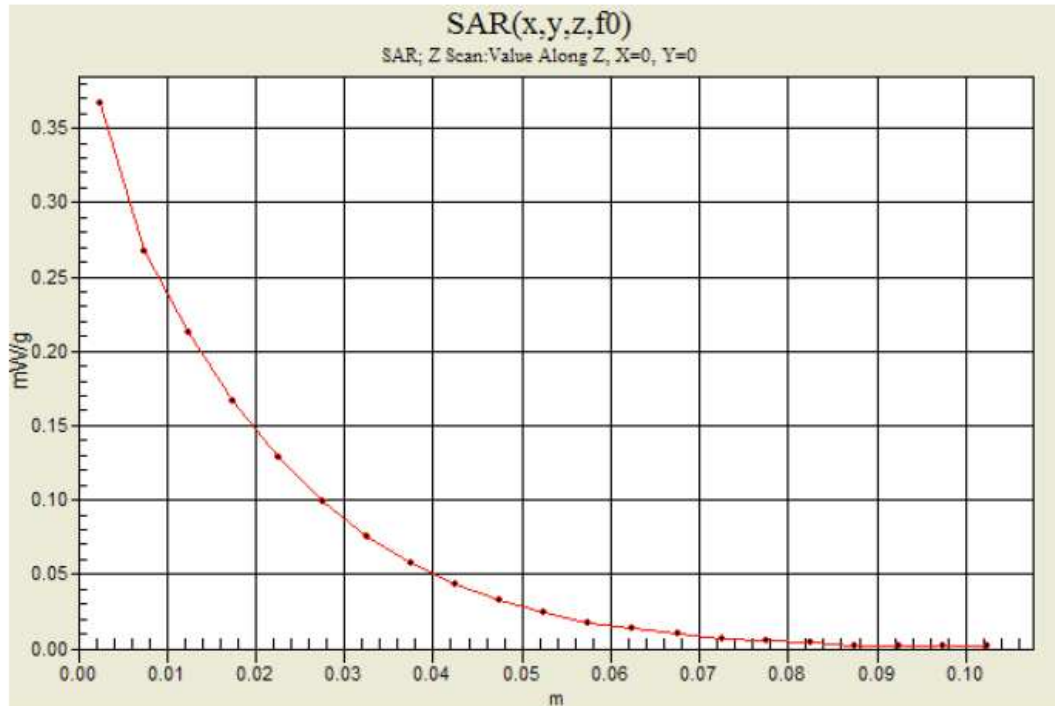
UMTS band V_Right Hand Side

Communication System: UMTS Band V; Frequency: 836.6 MHz;Duty Cycle: 1:1

Touch_M ch/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

Info: [Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.367 mW/g



Date/Time: 8/22/2011 3:08:45 PM

Test Laboratory: UL CCS SAR Lab D

UMTS band V_Body

Communication System: UMTS Band V; Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 836.6$ MHz; $\sigma = 0.982$ mho/m; $\epsilon_r = 54.4$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY4 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3749; ConvF(8.79, 8.79, 8.79); Calibrated: 12/13/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used)) Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1259; Calibrated: 5/3/2011
- Phantom: SAM B (Twin); Type: SAM B; Serial: TP-105
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Back side_M ch/Area Scan (61x91x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (interpolated) = 0.601 mW/g

Back side_M ch/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

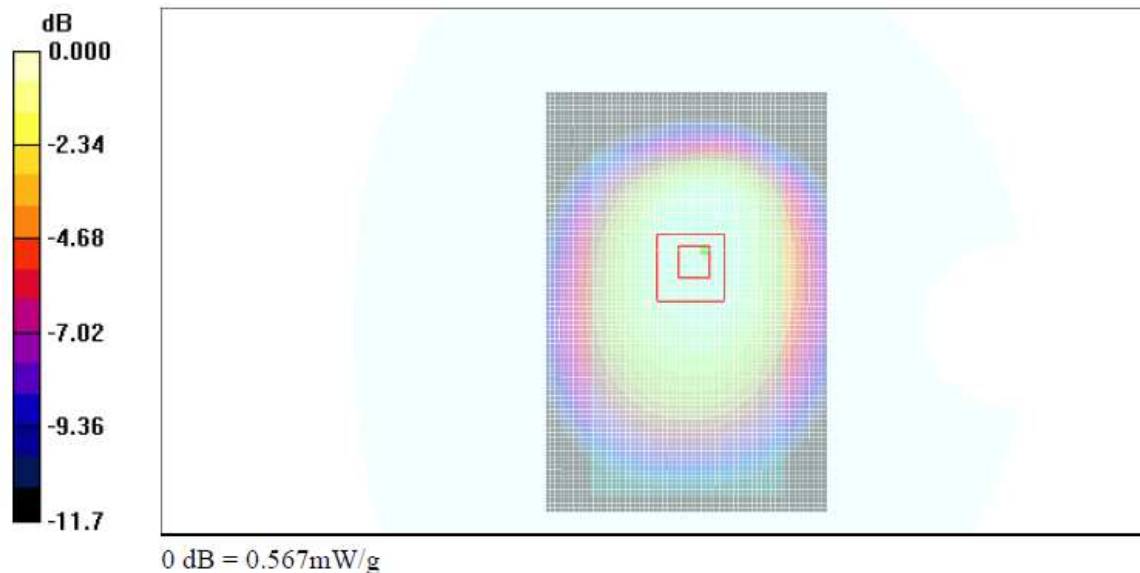
Reference Value = 24.3 V/m; Power Drift = -0.141 dB

Peak SAR (extrapolated) = 0.669 W/kg

SAR(1 g) = 0.494 mW/g; SAR(10 g) = 0.356 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.567 mW/g



Date/Time: 8/22/2011 3:17:54 PM

Test Laboratory: UL CCS SAR Lab D

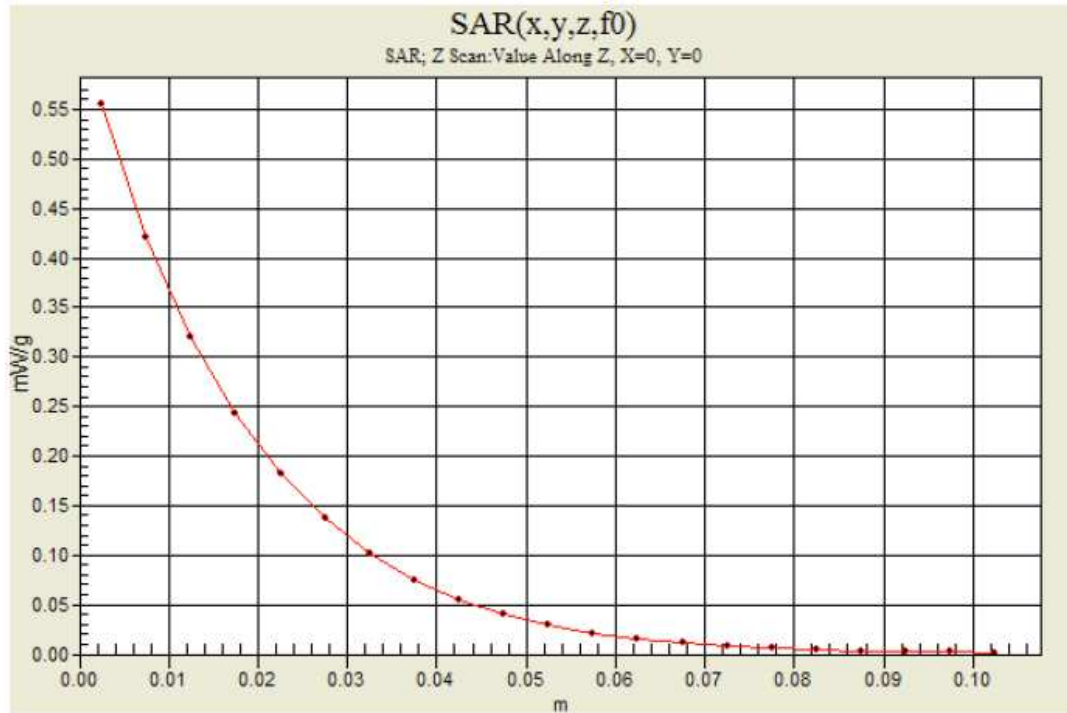
UMTS band V_Body

Communication System: UMTS Band V; Frequency: 836.6 MHz; Duty Cycle: 1:1

Back side_M ch/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.555 mW/g



Date/Time: 8/11/2011 7:16:07 PM

Test Laboratory: UL CCS SAR Lab D

PCS1900_Right Hand Side

Communication System: PCS1900; Frequency: 1880 MHz; Duty Cycle: 1:8
Medium parameters used: $f = 1880$ MHz; $\sigma = 1.38$ mho/m; $\epsilon_r = 38.5$; $\rho = 1000$ kg/m³
Phantom section: Right Section

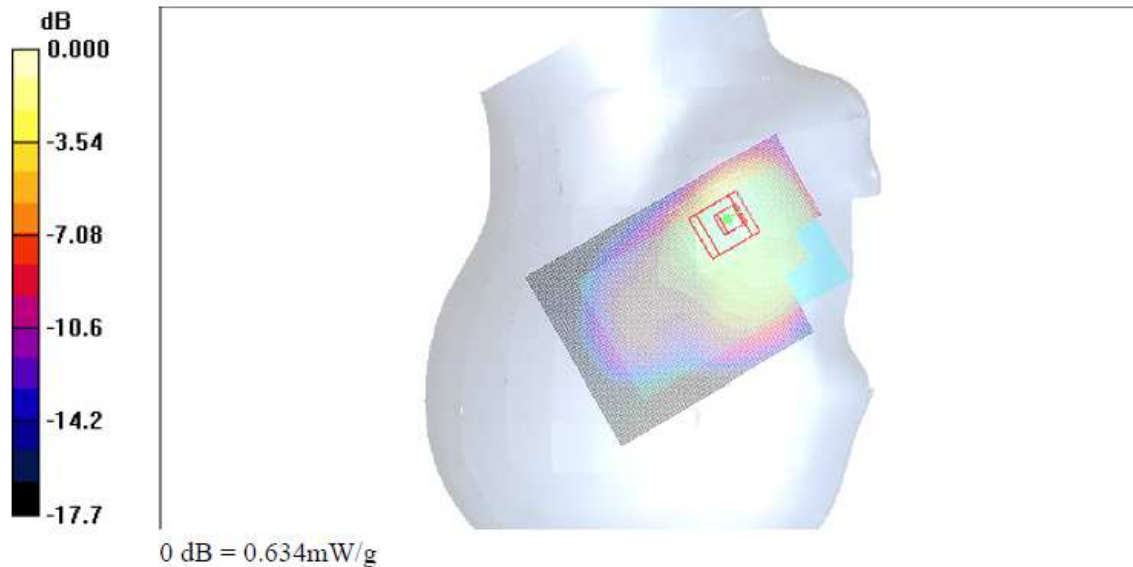
Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY4 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3749; ConvF(7.36, 7.36, 7.36); Calibrated: 12/13/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1259; Calibrated: 5/3/2011
- Phantom: SAM A (Twin); Type: SAM A; Serial: 1050
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Touch_M ch/Area Scan (61x91x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.582 mW/g

Touch_M ch/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 20.1 V/m; Power Drift = 0.070 dB
Peak SAR (extrapolated) = 0.835 W/kg
SAR(1 g) = 0.505 mW/g; SAR(10 g) = 0.283 mW/g
Maximum value of SAR (measured) = 0.634 mW/g



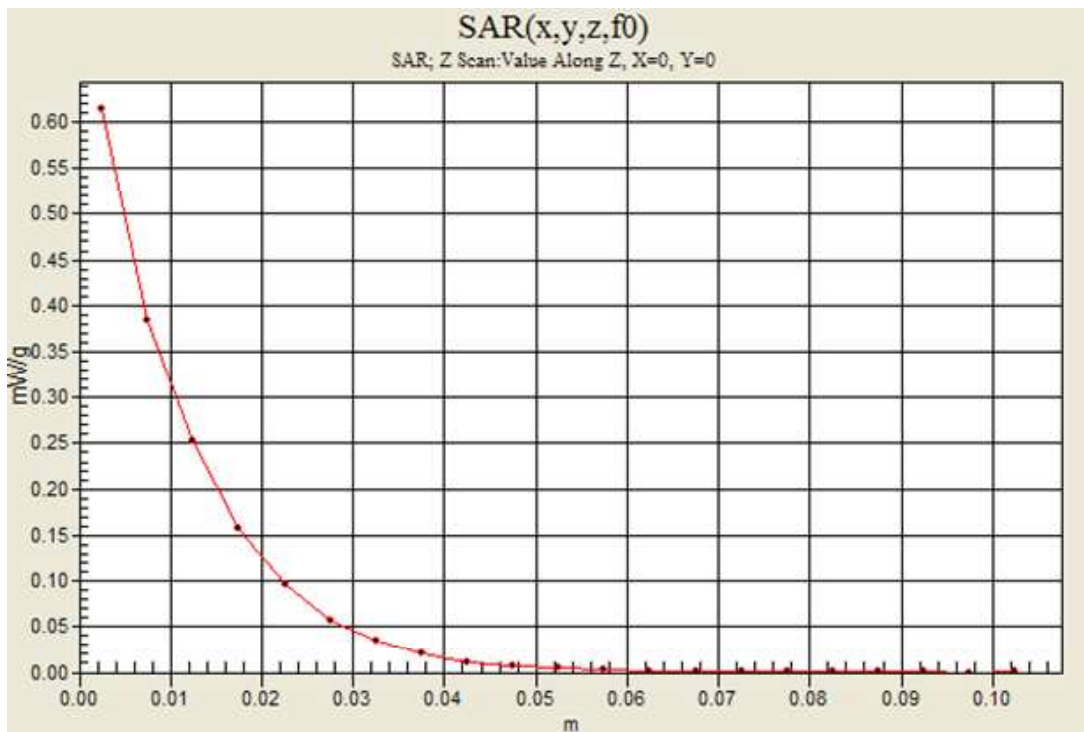
Date/Time: 8/11/2011 7:28:24 PM

Test Laboratory: UL CCS SAR Lab D

PCS1900_Right Hand Side

Communication System: PCS1900; Frequency: 1880 MHz; Duty Cycle: 1:8

Touch_M ch/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 0.614 mW/g



Date/Time: 8/12/2011 4:08:09 PM

Test Laboratory: UL CCS SAR Lab D

GPRS1900_Body

Communication System: GPRS1900; Frequency: 1880 MHz; Duty Cycle: 1:4
Medium parameters used: $f = 1880$ MHz; $\sigma = 1.44$ mho/m; $\epsilon_r = 54$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

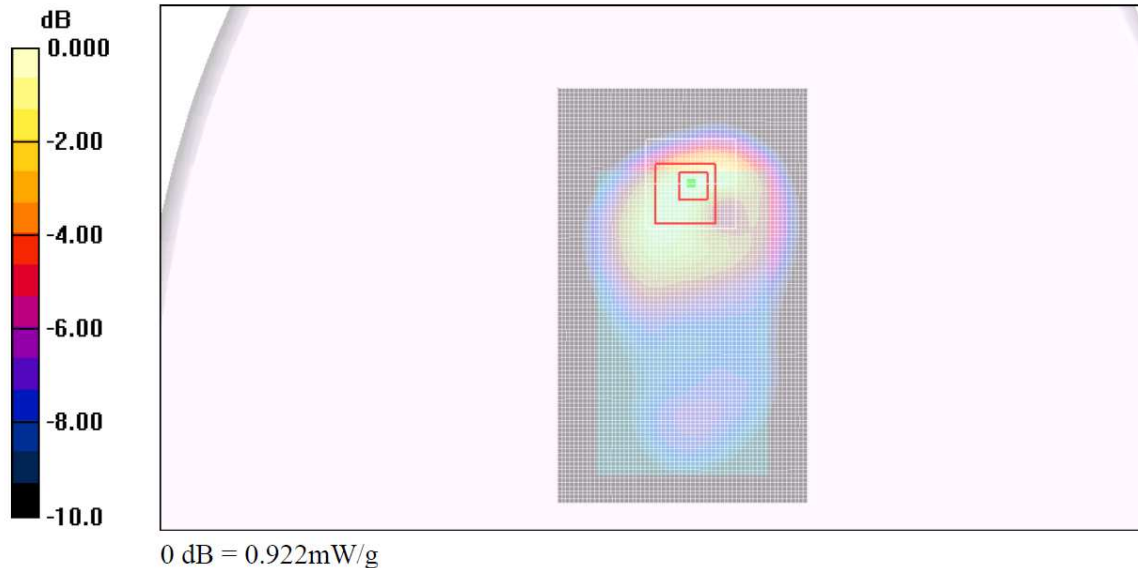
Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY4 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3749; ConvF(7.33, 7.33, 7.33); Calibrated: 12/13/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used)) Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1259; Calibrated: 5/3/2011
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: 1017
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Back side_M ch_2 solt w/headset/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.823 mW/g

Back side_M ch_2 solt w/headset/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 21.8 V/m; Power Drift = 0.148 dB
Peak SAR (extrapolated) = 1.17 W/kg
SAR(1 g) = 0.703 mW/g; SAR(10 g) = 0.391 mW/g
Maximum value of SAR (measured) = 0.922 mW/g



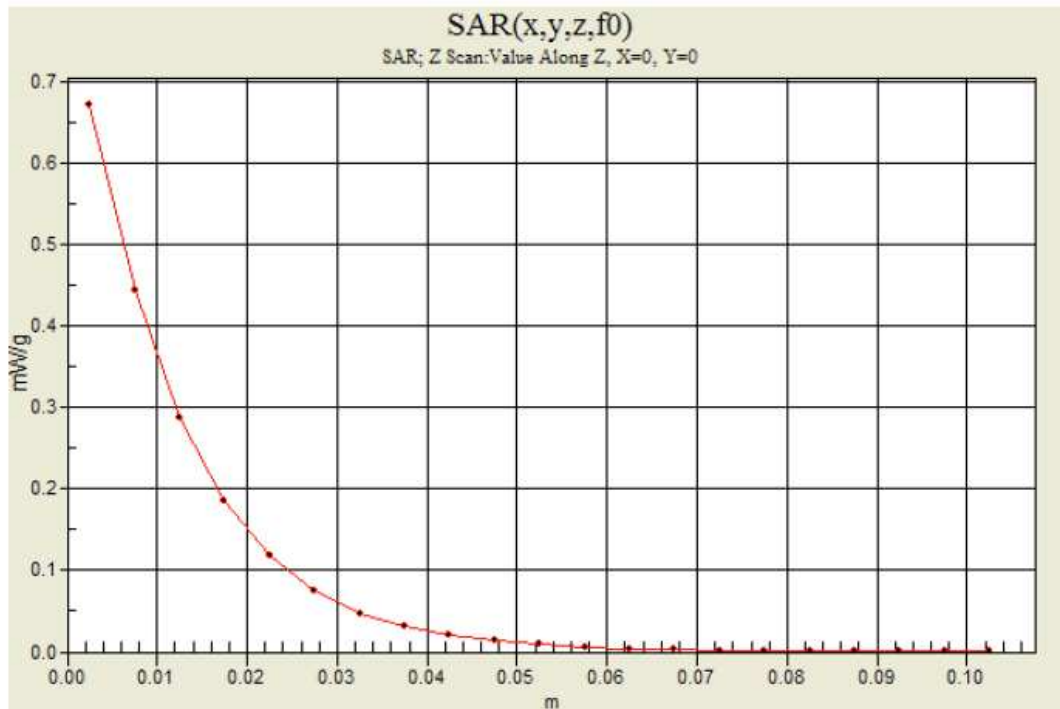
Date/Time: 8/12/2011 4:18:05 PM

Test Laboratory: UL CCS SAR Lab D

GPRS1900_Body

Communication System: GPRS1900; Frequency: 1880 MHz; Duty Cycle: 1:4

Back side_M ch_2 solt w/headset/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 0.672 mW/g



Date/Time: 8/11/2011 6:15:49 PM

Test Laboratory: UL CCS SAR Lab D

UMTS band II_Right Hand Side

Communication System: UMTS Band II; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 1880$ MHz; $\sigma = 1.38$ mho/m; $\epsilon_r = 38.5$; $\rho = 1000$ kg/m³
Phantom section: Right Section

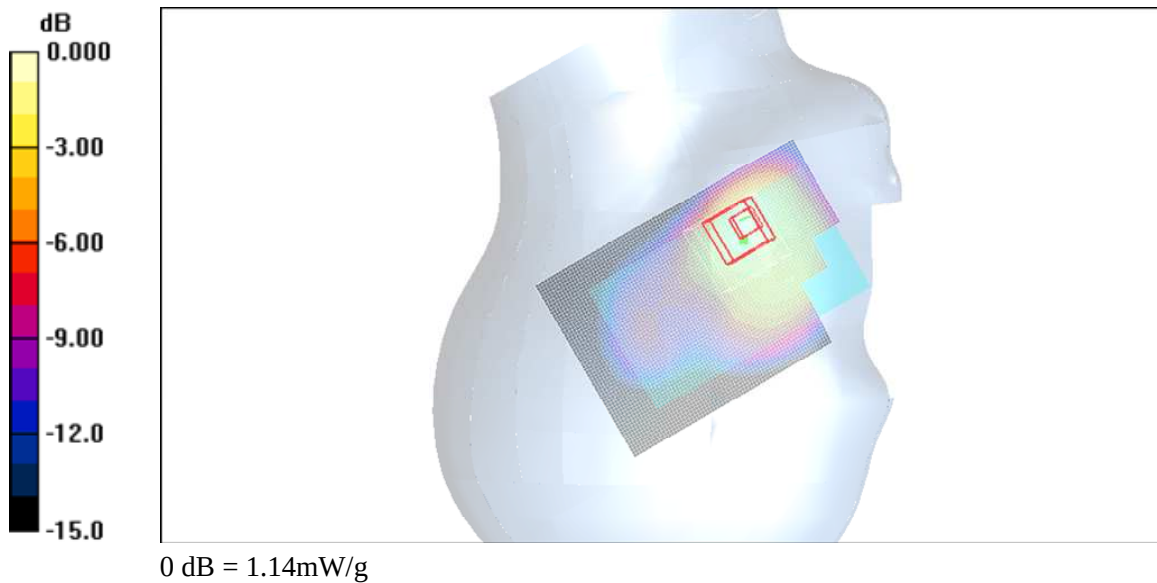
Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY4 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3749; ConvF(7.36, 7.36, 7.36); Calibrated: 12/13/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1259; Calibrated: 5/3/2011
- Phantom: SAM A (Twin); Type: SAM A; Serial: 1050
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Touch_M ch/Area Scan (61x91x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.997 mW/g

Touch_M ch/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 26.9 V/m; Power Drift = 0.082 dB
Peak SAR (extrapolated) = 1.51 W/kg
SAR(1 g) = 0.880 mW/g; SAR(10 g) = 0.492 mW/g
Maximum value of SAR (measured) = 1.14 mW/g



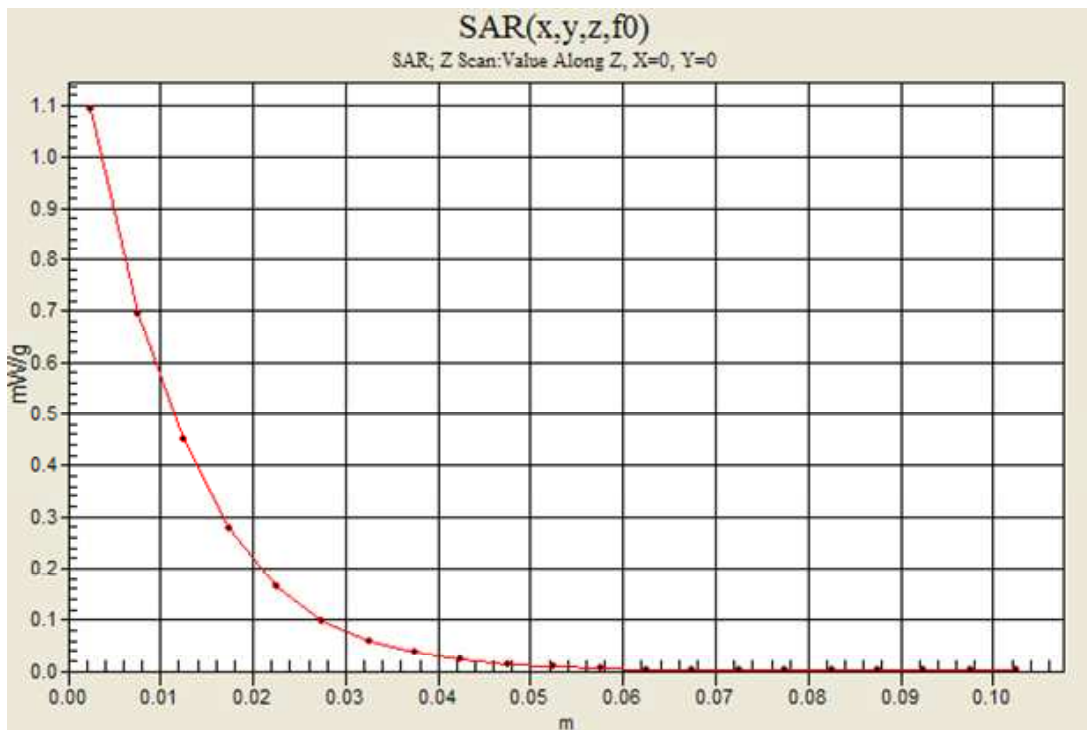
Date/Time: 8/11/2011 6:28:34 PM

Test Laboratory: UL CCS SAR Lab D

UMTS band II_Right Hand Side

Communication System: UMTS Band II; Frequency: 1880 MHz; Duty Cycle: 1:1

Touch_M ch/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 1.09 mW/g



Date/Time: 8/12/2011 7:17:39 PM

Test Laboratory: UL CCS SAR Lab D

UMTS band II_Body

Communication System: UMTS Band II; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 1880$ MHz; $\sigma = 1.44$ mho/m; $\epsilon_r = 54$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY4 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3749; ConvF(7.33, 7.33, 7.33); Calibrated: 12/13/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used)) Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1259; Calibrated: 5/3/2011
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: 1017
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Back side_M ch w/headset/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.947 mW/g

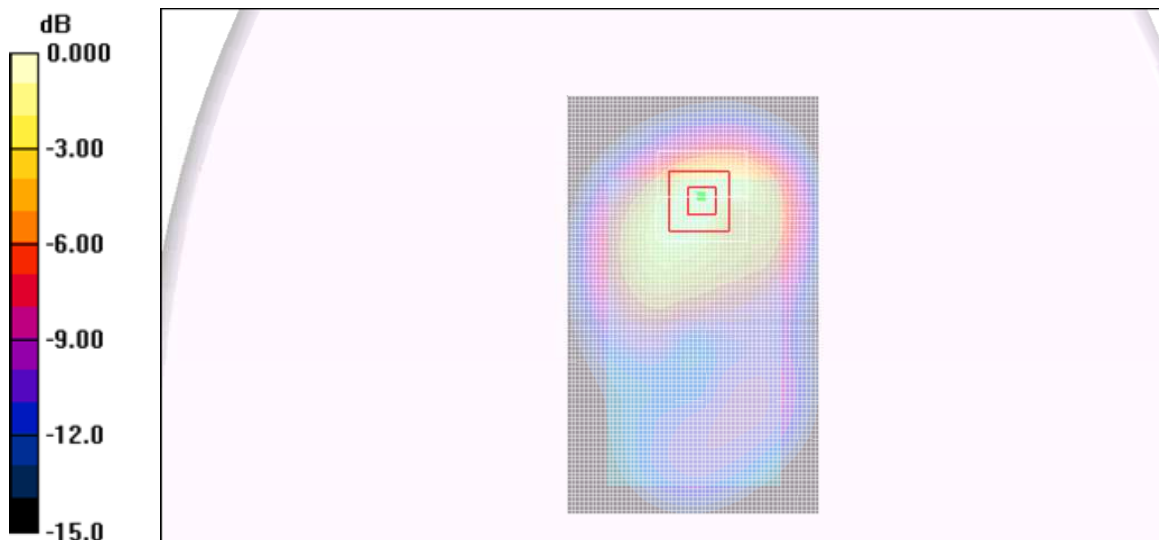
Back side_M ch w/headset/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 25.5 V/m; Power Drift = -0.105 dB

Peak SAR (extrapolated) = 1.52 W/kg

SAR(1 g) = 0.893 mW/g; SAR(10 g) = 0.472 mW/g

Maximum value of SAR (measured) = 1.17 mW/g



0 dB = 1.17mW/g

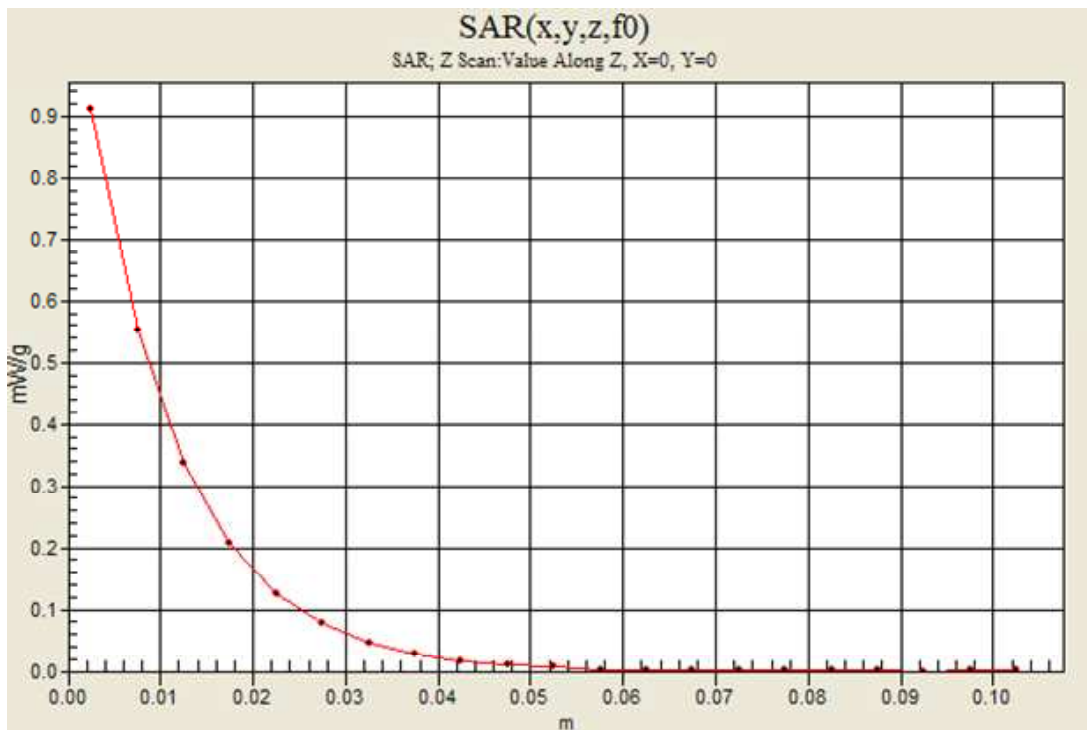
Date/Time: 8/12/2011 7:21:24 PM

Test Laboratory: UL CCS SAR Lab D

UMTS band II_Body

Communication System: UMTS Band II; Frequency: 1880 MHz; Duty Cycle: 1:1

Back side_M ch w/headset/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 0.912 mW/g



Date/Time: 8/15/2011 9:02:24 PM

Test Laboratory: UL CCS SAR Lab D

WiFi_Left Hand Side

Communication System: 802.11b/g 2.4GHz; Frequency: 2437 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 1.77$ mho/m; $\epsilon_r = 40.4$; $\rho = 1000$ kg/m³
Phantom section: Left Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY4 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3749; ConvF(6.69, 6.69, 6.69); Calibrated: 12/13/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used)) Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1259; Calibrated: 5/3/2011
- Phantom: SAM B (Twin); Type: SAM B; Serial: TP-105
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Tilt_M ch/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.134 mW/g

Tilt_M ch/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

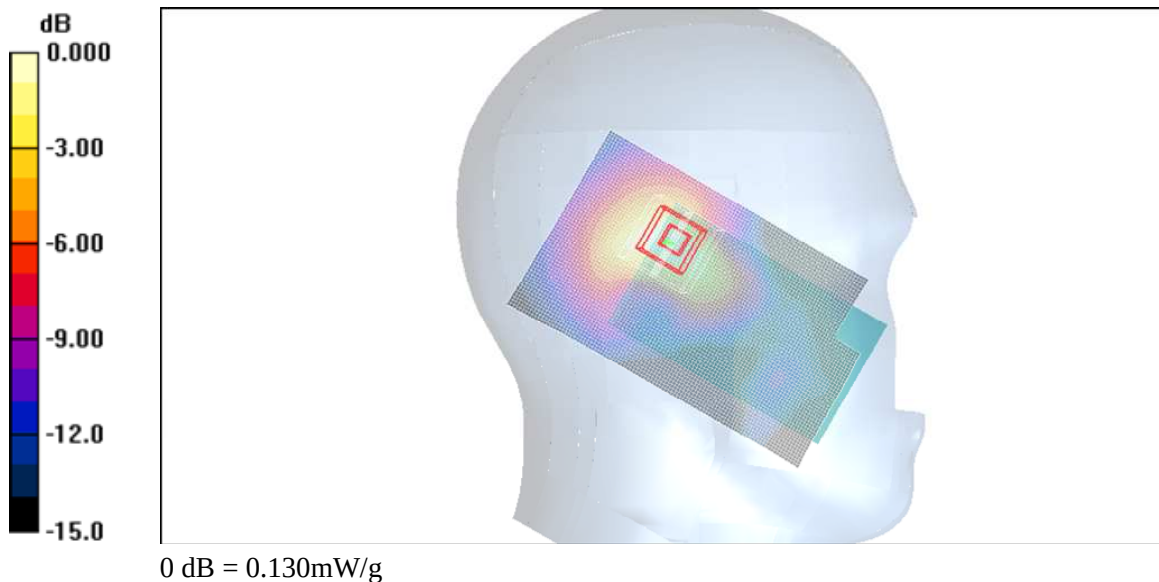
Reference Value = 8.73 V/m; Power Drift = 0.033 dB

Peak SAR (extrapolated) = 0.196 W/kg

SAR(1 g) = 0.100 mW/g; SAR(10 g) = 0.048 mW/g

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.130 mW/g



Date/Time: 8/15/2011 9:12:50 PM

Test Laboratory: UL CCS SAR Lab D

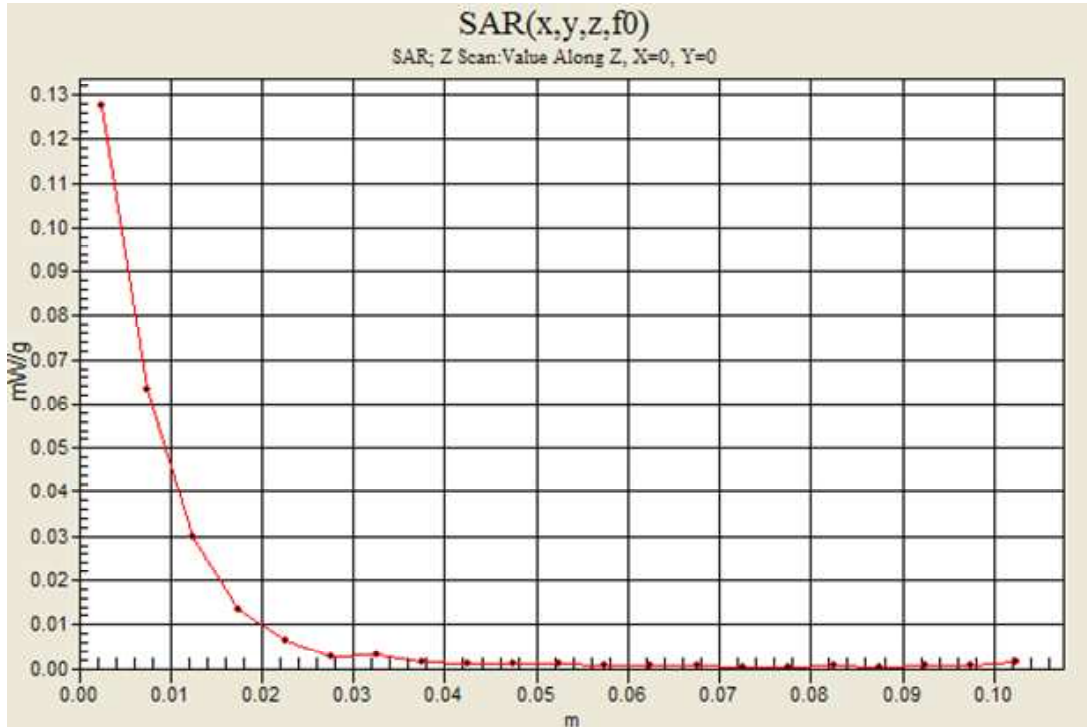
WiFi_Left Hand Side

Communication System: 802.11b/g 2.4GHz; Frequency: 2437 MHz;Duty Cycle: 1:1

Tilt_M ch/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

Info: [Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.128 mW/g



Date/Time: 8/14/2011 5:11:22 PM

Test Laboratory: UL CCS SAR Lab D

WiFi_Body

Communication System: 802.11b/g 2.4GHz; Frequency: 2437 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 1.95$ mho/m; $\epsilon_r = 51.2$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY4 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3749; ConvF(6.9, 6.9, 6.9); Calibrated: 12/13/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1259; Calibrated: 5/3/2011
- Phantom: SAM B (Twin); Type: SAM B; Serial: TP-105
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Back side_M ch/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.328 mW/g

Back side_M ch/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

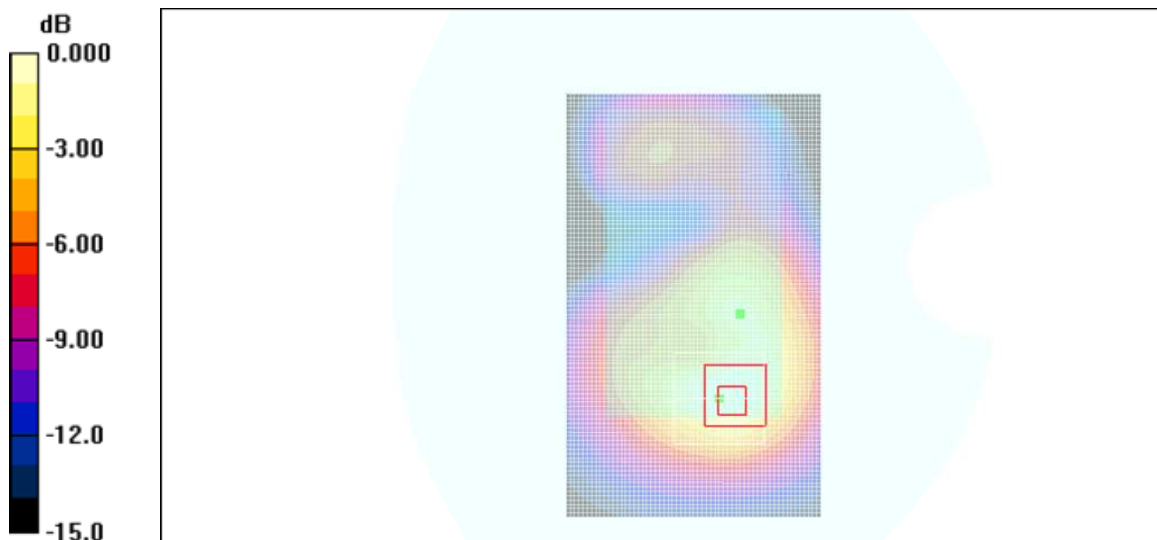
Reference Value = 12.9 V/m; Power Drift = -0.139 dB

Peak SAR (extrapolated) = 0.504 W/kg

SAR(1 g) = 0.266 mW/g; SAR(10 g) = 0.139 mW/g

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.353 mW/g



0 dB = 0.353mW/g

Date/Time: 8/14/2011 5:24:06 PM

Test Laboratory: UL CCS SAR Lab D

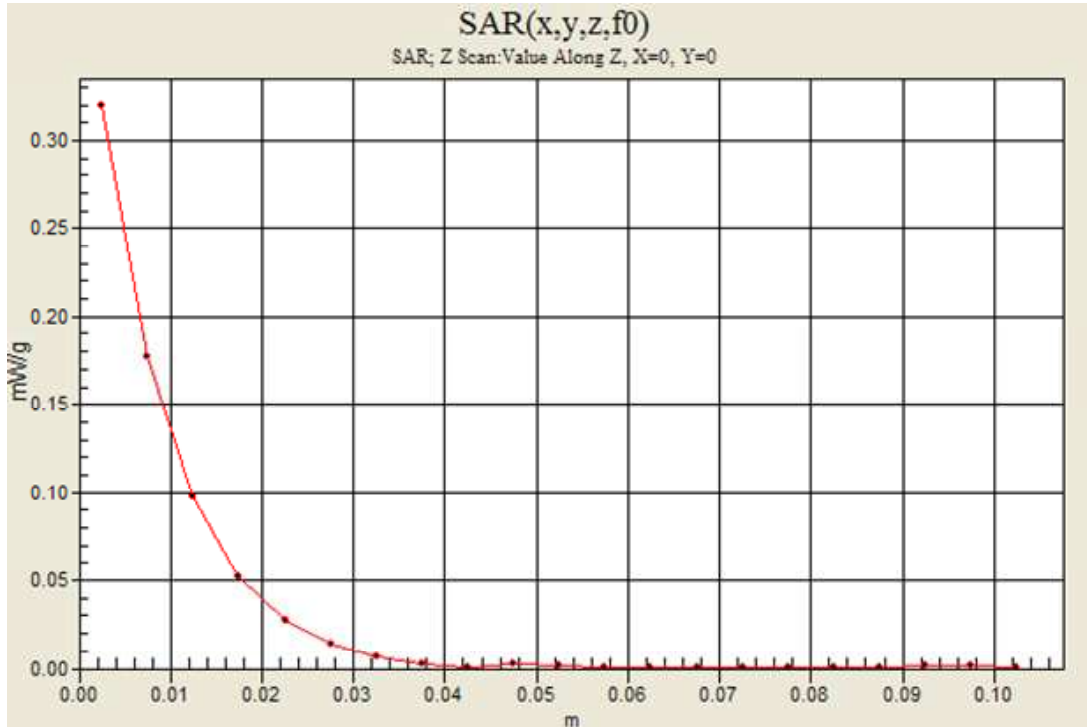
WiFi_Body

Communication System: 802.11b/g 2.4GHz; Frequency: 2437 MHz; Duty Cycle: 1:1

Back side_M ch/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

Info: [Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.320 mW/g



15. Simultaneous Transmission SAR Analysis (KDB 648474)

15.1. Head Exposure Condition

Test configuration	(1) GSM850	(2) GSM1900	(3) UMTS (WCDMA) Band V	(4) UMTS (WCDMA) Band II	(5) WiFi	Sum of 1g SAR (mW/g)
Left Touch	0.251				0.087	0.338
		0.308			0.087	0.395
			0.275		0.087	0.362
				0.565	0.087	0.652
Left Tilt	0.151				0.100	0.251
		0.169			0.100	0.269
			0.155		0.100	0.255
				0.271	0.100	0.371
Right Touch	0.318				0.072	0.390
		0.505			0.072	0.577
			0.317		0.072	0.389
				0.880	0.072	0.952
Right Tilt	0.173				0.064	0.237
		0.166			0.064	0.230
			0.160		0.064	0.224
				0.263	0.064	0.327

Conclusions:

- ☒ Simultaneous transmission SAR is not required because the sum of the 1-g SAR is < 1.6 W/kg
- ☐ Simultaneous transmission SAR is not required because the SAR to peak location separation ratios (SPLSR) is < 0.3 for WiFi and WWAN antenna pairs.

15.2. Body-worn & hotspot exposure condition

Test configuration	(1) GSM850	(2) GSM1900	(3) UMTS (WCDMA) Band V	(4) UMTS (WCDMA) Band II	(5) WiFi	Sum of 1g SAR (mW/g)
Rear	0.761				0.266	1.027
		0.703			0.266	0.969
			0.494		0.266	0.760
				0.893	0.266	1.159
Front	0.402				0.053	0.455
		0.507			0.053	0.560
			0.263		0.053	0.316
				0.499	0.053	0.552
Left	0.172				0.004	0.176
		0.077			0.004	0.081
			0.117		0.004	0.121
				0.127	0.004	0.131
Right	0.308				0.061	0.369
		0.142			0.061	0.203
			0.205		0.061	0.266
				0.167	0.061	0.228
Bottom	0.105				0.000	0.105
		0.528			0.000	0.528
			0.073		0.000	0.073
				0.622	0.000	0.622
Top	0.000				0.113	0.113
		0.000			0.113	0.113
			0.000		0.113	0.113
				0.000	0.113	0.113

Conclusions:

- ☒ Simultaneous transmission SAR is not required because the sum of the 1-g SAR is < 1.6 W/kg
- ☐ Simultaneous transmission SAR is not required because the SAR to peak location separation ratios (SPLSR) is < 0.3 for WiFi and WWAN antenna pairs.

16. Appendixes

Refer to separated files for the following appendixes.

- 16.1. Appendix A: System check plots**
- 16.2. Appendix B: SAR test plots for GSM850**
- 16.3. Appendix C: SAR test plots for GSM1900**
- 16.4. Appendix D: SAR test plots for UMTS (WCDMA) Band V**
- 16.5. Appendix E: SAR test plots for UMTS (WCDMA) band II**
- 16.6. Appendix F: SAR test plots for WiFi**
- 16.7. Appendix G: Calibration certificate for E-Field Probe EX3DV4 SN 3749**
- 16.8. Appendix H: Calibration Certificate for D835V2 - SN 4d117**
- 16.9. Appendix I: Calibration certificate for D1900V2 SN 5d140**
- 16.10. Appendix J: Calibration certificate for D2450V2 SN: 706 w/ extended cal. data**