



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

**SAR EVALUATION REPORT**

*For*  
**GSM & W-CDMA Phone with WLAN+BT**

**Model: LG840G  
FCC ID: ZNFLG840G**

**Report Number: 12U14442-4A1  
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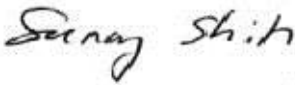

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# 1. Attestation of Test Results

Applicant	LG ELECTRONICS MOBILECOMM U.S.A., INC.		
DUT description	GSM & W-CDMA Phone with WLAN+BT		
Model	LG840G		
Test device is	An identical prototype		
Device category	Portable		
Exposure category	General Population/Uncontrolled Exposure		
Date tested	4/2/2012 (WiFi) 5/21/2012- 5/23/2012 (WWAN)		
FCC Rule Parts	Freq. Range	Highest 1-g SAR	Limit
22	824-849 MHz	Head: 0.602 W/kg (Left Touch) Body: 0.611 W/kg (Rear with 15 mm distance)	1.6 W/kg
24	1850-1910 MHz	Head: 1.150 W/kg (Left Touch) Body: 0.671 W/kg (Rear with 15 mm distance)	
15.247	2412-2462 MHz	Body: 0.080 W/kg (Rear with 15 mm distance)	
Applicable Standards			Test Results
FCC OET Bulletin 65 Supplement C 01-01, IEEE Std 1528-2003			Pass
<p>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.</p> <p><b>Note:</b> 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.</p>			
Approved & Released For UL CCS By:		Tested By:	
			
Sunny Shih Engineering Leader Compliance Certification Services (UL CCS)		Kent Huang SAR Engineer Compliance Certification Services (UL CCS)	

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## 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:

- 648474 D01 SAR Handsets Multi Xmitter and Ant, v01r05
- 248227 D01 SAR meas for 802 11abg v01r02
- 941225 D01 SAR test for 3G devices v02
- 941225 D03 SAR Test Reduction GSM GPRS EDGE 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 used to perform the tests documented in this report has been calibrated in accordance with the manufacturers' 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		
Base Station Simulator	Agilent	8960	GB46160222	6	17	2012
Base Station Simulator	R & S	CMU 200	106291	6	24	2012
Base Station Simulator	Anritsu	MT8820C	6200985430	6	17	2012
ESA Series Network Analyzer	Agilent	E5071B	MY42100131	2	11	2013
Synthesized Signal Generator	HP	83732B	US34490599	7	14	2012
E-Field Probe	SPEAG	EX3DV4	3772	2	16	2013
Thermometer	ERTCO	639-1S	1718	7	19	2012
Data Acquisition Electronics	SPEAG	DAE4	1258	3	8	2013
System Validation Dipole	SPEAG	D835V2	4d002	3	6	2013
System Validation Dipole	SPEAG	D1900V2	5d043	11	10	2012
System Validation Dipole	SPEAG	D2450V2	748	2	7	2013
Power Meter	HP	8481A	2720A66876	8	1	2013
Power Sensor	HP	438A	2822A05684	10	7	2013
Power Meter	HP	8481A	2237A31744	8	17	2013
Power Sensor	HP	438A	3513U04320	9	17	2012
Amplifier	MITEQ	4D00400600-50-30P	1620606	N/A		
Directional coupler	Werlatone	C8060-102	2141	N/A		

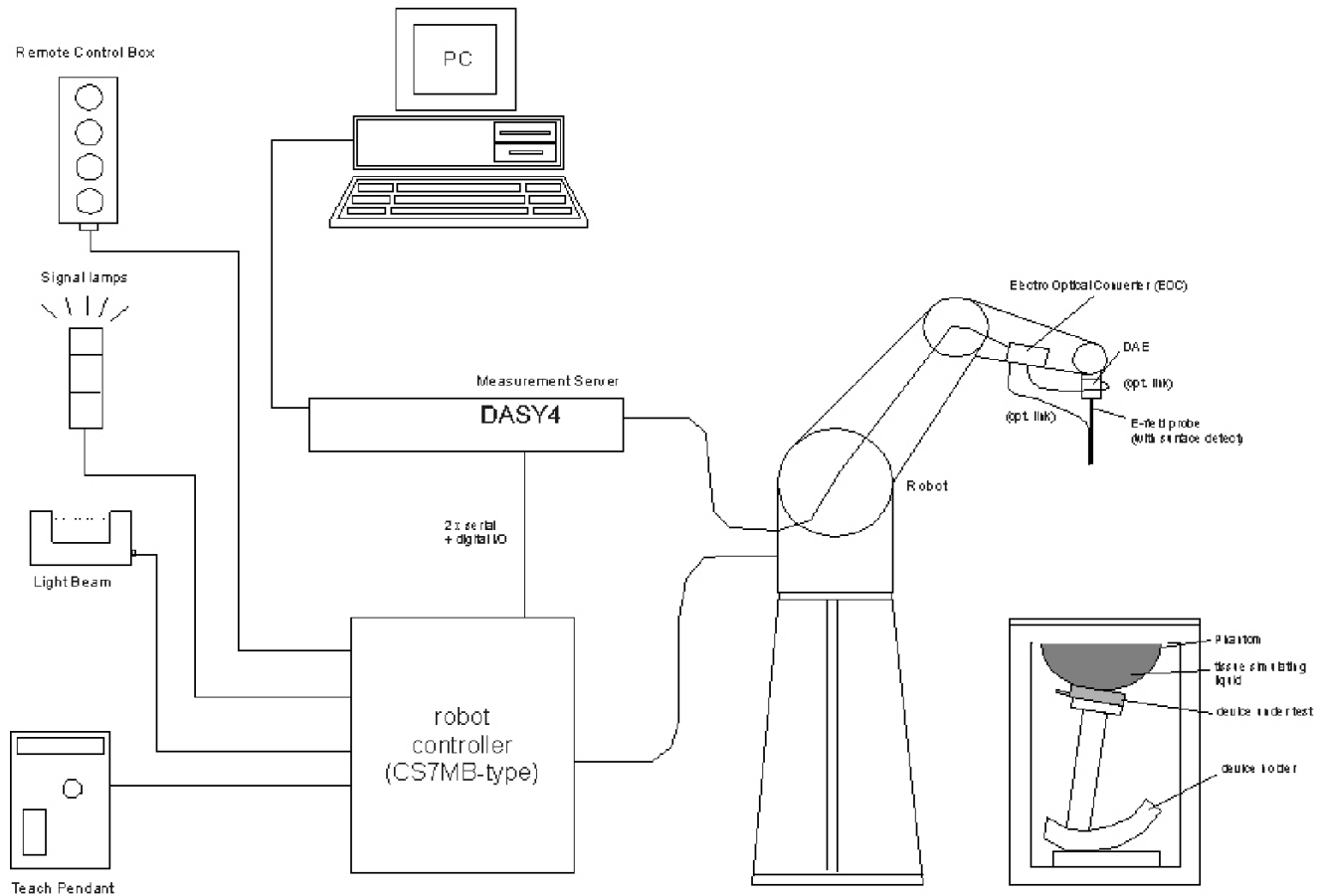


## 4.2. Measurement Uncertainty

Measurement uncertainty for 300 MHz to 3 GHz averaged over 1 gram					
Component	Error, %	Distribution	Divisor	Sensitivity	U (Xi), %
<b>Measurement System</b>					
Probe Calibration (k=1)	6.00	Normal	1	1	6.00
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
<b>Test Sample Related</b>					
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
<b>Phantom and Tissue Parameters</b>					
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	-4.47	Normal	1	0.64	-2.86
Liquid Permittivity - deviation from target	5.00	Rectangular	1.732	0.6	1.73
Liquid Permittivity - measurement uncertainty	-3.84	Normal	1	0.6	-2.30
Combined Standard Uncertainty Uc(y) =					10.41
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				20.82 %	
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				1.64 dB	

## 5. Measurement System Description and Setup

The DASY4 system used 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.
- 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 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.

## 6. SAR Measurement Procedures

### 6.1. Normal SAR Measurement Procedure

#### 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 and 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 (FCC only)

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.

## 6.2. Volume Scan 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 and 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: Volume Scan

Volume Scans are used to assess peak SAR and averaged SAR measurements in largely extended 3-dimensional volumes within any phantom. This measurement does not need any previous area scan. The grid can be anchored to a user specific point or to the current probe location.

### Step 5: 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.

## 7. Device Under Test

GSM & W-CDMA Phone with WLAN+BT Model: LG840G	
Normal operation	<ul style="list-style-type: none"> <li>- Held to head,</li> <li>- Body (Rear and Front sides) with 15 mm separation distance.</li> </ul>
Accessory	<ol style="list-style-type: none"> <li>1. Headset</li> <li>2. Battery Cover                         <ul style="list-style-type: none"> <li>o Normal Battery Cover</li> </ul> </li> </ol>

### 7.1. Air Interfaces and Frequency Ranges

Air Interfaces	<ul style="list-style-type: none"> <li>- GSM, GPRS and EGPRS (EGPRS is Rx only)</li> <li>- UMTS (WCDMA) Rel 99, HSDPA (Rel 5, CAT 8), (HSUPA is not supported)</li> <li>- 802.11b/g</li> <li>- Bluetooth Ver 3.0 with EDR</li> </ul>
Tx Frequency Ranges	<ul style="list-style-type: none"> <li>- GSM850: 824 - 849 MHz</li> <li>- GSM1900: 1850 - 1910 MHz</li> <li>- W-CDMA (UMTS) Band V: 824 - 849 MHz</li> <li>- W-CDMA (UMTS) Band II: 1850 - 1910 MHz</li> <li>- 802.11b/g: 2412 - 2462 MHz</li> <li>- Bluetooth: 2402 - 2480 MHz</li> </ul>

### 7.2. Simultaneous Transmission

No.	Conditions
1	GSM850 Voice + BT
2	GSM1900 Voice + BT
3	GSM850 GPRS + BT
4	GSM1900 GPRS + BT
5	W-CDMA (UMTS) Band V+ BT
6	W-CDMA (UMTS) Band II+ BT

#### Notes:

1. WiFi and BT cannot transmit simultaneously because of shared antenna
2. WiFi and GSM/W-CDMA simultaneously transmission is not supported

### 7.3. Hotspot (Wireless router) Exposure Condition

The device is not capable of personal hotspot mode.

## 8. Summary of Test Configurations

Refer to section 17 for antenna location and separation distance

### 8.1. Head Exposure Condition for WWAN

Test Configurations	SAR Required	Note
Left Touch	Yes	
Left Tilt (15°)	Yes	
Right Touch	Yes	
Right Tilt (15°)	Yes	

### 8.2. Body Exposure Conditions for WWAN and WiFi

Test Configurations	Separation distance	SAR Required	Note
Rear	15 mm	Yes	
Front	15 mm	Yes	

## 9. RF Output Power Measurement

### 9.1. Target Power with Tune-up Tolerance

Mode	Target Power (dBm)			
	GSM850	GSM1900	W-CDMA Band V	W-CDMA Band II
Voice	32.5	30.0	23.0	23.2
GPRS 1 Slot	32.5	30.0	-	-
GPRS 2 Slots	30.0	27.0	-	-
SUBTEST 1, 2	-	-	23.0	23.2
SUBTEST 3, 4	-	-	22.5	22.7

Tune-up Tolerance: -1.5 dBm / +0.7 dBm

## 9.2. GSM850

### GMSK (Voice) Mode

Target Power: 32.5 dBm

Tune-up Tolerance: +0.7 dBm / +1.0 dBm

Band	Ch No.	Freq. (MHz)	Avg burst Pwr (dBm)
850	128	824.2	33.1
	190	836.6	33.1
	251	848.8	33.1

### GMSK (GPRS) Mode - Coding Scheme: CS1

Target Power: 32.5 dBm for 1 slot

30.0 dBm for 2 slots

Tune-up Tolerance: -1.5dBm / +0.7dBm

Band	Ch No.	Freq. (MHz)	Avg burst Pwr (dBm)			
			1 slot	Frame Avg Pwr	2 slots	Frame Avg Pwr
850	128	824.2	33.0	24.0	30.5	24.4
	190	836.6	33.1	24.0	30.5	24.5
	251	848.8	33.1	24.1	30.5	24.5

#### Notes:

The worst-case configuration and mode for SAR testing is determined to be as follows:

- Head: GMSK Voice Mode
- Body: GMSK (GPRS) mode with 2 time slots, based on the output power measurements above

### 8PSK (EGPRS) Mode - Coding Scheme: MCS5

This mode is Rx only



### 9.3. GSM1900

#### GMSK (Voice) Mode

Target Power: 30.0 dBm

Tune-up Tolerance: -1.5dBm / +0.7dBm

Ch No.	Freq. (MHz)	Avg burst Pwr (dBm)
512	1850.2	30.5
661	1880	30.6
810	1909.8	30.5

#### GMSK (GPRS) Mode - Coding Scheme: CS1

Target Power: 30.0 dBm for 1 slot

27.0 dBm for 2 slots

Tune-up Tolerance: -1.5dBm / +0.7dBm

Band	Ch No.	Freq. (MHz)	Avg burst Pwr (dBm)			
			1 slot	Frame Avg Pwr	2 slots	Frame Avg Pwr
1900	512	1850.2	30.6	21.5	27.6	21.5
	661	1880	30.6	21.6	27.6	21.5
	810	1909.8	30.5	21.5	27.5	21.4

#### Notes:

The worst-case configuration and mode for SAR testing is determined to be as follows:

- Head: GMSK Voice Mode
- Body: GMSK (GPRS) mode with 2 time slots, based on the output power measurements above

#### 8PSK (EGPRS) Mode - Coding Scheme: MCS5

N/A: This mode is Rx only

### 9.4. W-CDMA (UMTS) Band V

#### Release 99 (RMC, 12.2kbps)

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

Mode	Subtest	Rel99
WCDMA General Settings	Loopback Mode	Test Mode 1
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	$\beta_c/\beta_d$	8/15

Target Power: 23.0 dBm

Tune-up Tolerance: -1.5dBm / +0.7dBm

Band	Ch No.	Freq. (MHz)	Measured Avg. Power (dBm)
850 (Band V)	4132	826.4	23.5
	4183	836.6	23.5
	4233	846.6	23.4

**HSDPA**

The following 4 Sub-tests were completed according to Release 5 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

Mode	HSDPA	HSDPA	HSDPA	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			
	$\beta_c$	2/15	12/15	15/15
$\beta_d$	15/15	15/15	8/15	4/15
Bd (SF)				
64				
$\beta_c/\beta_d$	2/15	12/15	15/8	15/4
$\beta_{hs}$	4/15	24/15	30/15	30/15
CM (dB)	0	1	1.5	1.5
HSDPA Specific Settings	$D_{ACK}$			
	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				
$A_{hs} = \beta_{hs}/\beta_c$				
30/15				

Target Power: 23.0 dBm for Subset 1  
 23.0 dBm for Subset 2  
 22.5 dBm for Subset 3  
 22.5 dBm for Subset 4

Tune-up Tolerance: -1.5dBm / +0.7dBm

Band	Subtest	Ch No.	Freq. (MHz)	Target MPR	Meas. MPR	Measured Avg. Power (dBm)
850 (Band V)	1	4132	826.4	0	0	23.5
		4183	836.6	0	0	23.5
		4233	846.6	0	0	23.5
	2	4132	826.4	0	0	23.5
		4183	836.6	0	0	23.5
		4233	846.6	0	0	23.5
	3	4132	826.4	0.5	0	23.5
		4183	836.6	0.5	0	23.5
		4233	846.6	0.5	0	23.5
	4	4132	826.4	0.5	0	23.5
		4183	836.6	0.5	0	23.5
		4233	846.6	0.5	0	23.5

## 9.5. W-CDMA (UMTS) Band II

### Release 99 (RMC, 12.2kbps)

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

Mode	Subtest	Rel99
WCDMA General Settings	Loopback Mode	Test Mode 1
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	$\beta_c/\beta_d$	8/15

Target Power: 23.2 dBm

Tune-up Tolerance: -1.5dBm / +0.7dBm

Band	Ch No.	Freq. (MHz)	Measured Avg. Power (dBm)
1900 (Band II)	9262	1852.4	23.8
	9400	1880.0	23.8
	9538	1907.6	23.8

**HSDPA**

The following 4 Sub-tests were completed according to Release 5 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

Mode	HSDPA	HSDPA	HSDPA	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			
	$\beta_c$	2/15	12/15	15/15
$\beta_d$	15/15	15/15	8/15	4/15
Bd (SF)				
64				
$\beta_c/\beta_d$	2/15	12/15	15/8	15/4
$\beta_{hs}$	4/15	24/15	30/15	30/15
CM (dB)	0	1	1.5	1.5
HSDPA Specific Settings	$D_{ACK}$			
	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				
$A_{hs} = \beta_{hs}/\beta_c$				
30/15				

Target Power: 23.2 dBm for Subset 1  
 23.2 dBm for Subset 2  
 22.7 dBm for Subset 3  
 22.7 dBm for Subset 4

Tune-up Tolerance: -1.5dBm / +0.7dBm

Band	Subtest	Ch No.	Freq. (MHz)	Target MPR	Meas. MPR	Measured Avg. Power (dBm)
1900 (Band II)	1	9262	1852.4	0	0	23.9
		9400	1880.0	0	0	23.9
		9538	1907.6	0	0	23.9
	2	9262	1852.4	0	0	23.9
		9400	1880.0	0	0	23.9
		9538	1907.6	0	0	23.8
	3	9262	1852.4	0.5	0	23.9
		9400	1880.0	0.5	0	23.9
		9538	1907.6	0.5	0	23.8
	4	9262	1852.4	0.5	0	23.9
		9400	1880.0	0.5	0	23.9
		9538	1907.6	0.5	0	23.9

### 9.6. Wi-Fi (802.11bg)

Required Test Channels per KDB 248227 D01

Mode	Band	GHz	Channel	"Default Test Channels"	
				802.11b	802.11g
802.11b/g	2.4 GHz	2.412	1 <sup>#</sup>	√	∇
		2.437	6	√	∇
		2.462	11 <sup>#</sup>	√	∇

Notes:

√ = "default test channels"

∇ = possible 802.11g channels with maximum average output ¼ dB ≥ the "default test channels"

<sup>#</sup> = when output power is reduced for channel 1 and /or 11 to meet restricted band requirements the highest output channels closest to each of these channels should be tested.

#### Output power table

Band (GHz)	Mode	Data rate (Mbps)	Ch #	Freq. (MHz)	Measured Avg Pwr(dBm)
2.4	802.11b	1	1	2412	15.2
			6	2437	15.4
			11	2462	15.4
	802.11g	6	1	2412	13.1
			6	2437	13.2
			11	2462	13.2

#### Output power for the different modulations and data rate configurations

Band (GHz)	Mode	Ch #	Freq. (MHz)	Data rate (Mbps)	Measured Avg Pwr(dBm)
2.4	802.11b	6	2462	1	15.4
				2	15.4
				5.5	15.4
				11	15.4
	802.11g	6	2462	6	13.2
				9	13.2
				12	13.2
				18	13.2
				24	13.2
				36	13.2
				48	13.2
				54	13.2

#### Note(s):

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

## 9.7. Bluetooth

Version 2.1+EDR, Power class: 1 (100 mW/20 dBm)

Mode	Channel #	Freq. (MHz)	Conducted Avg Power	
			(dBm)	(mW)
V2.1 + EDR, GFSK	0	2402	11.30	13.49
	39	2441	11.50	14.13
	78	2480	11.10	12.88
V2.1 + EDR, $\pi/4$ DQPSK	0	2402	8.90	7.76
	39	2441	9.00	7.94
	78	2480	8.70	7.41
V2.1 + EDR, 8-PSK	0	2402	8.90	7.76
	39	2441	9.10	8.13
	78	2480	8.80	7.59

### Note(s):

According to KDB 648474, Table 2, Unlicensed transmitters

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

- Output  $\leq 2 \cdot P_{Ref}$  (13.8dBm / 24 mW) and antenna is  $\geq 5.0$  cm from other antennas
- Output  $\leq P_{Ref}$  (10.79dBm / 12 mW) and antenna is  $\geq 2.5$  cm from other antennas
- Output  $\leq P_{Ref}$  (10.79dBm / 12 mW) and antenna is  $< 2.5$  cm from other antennas

## 10. Tissue Dielectric Properties

IEEE Std 1528-2003 Table 2

Target Frequency (MHz)	Head	
	$\epsilon_r$	$\sigma$ (S/m)
300	45.3	0.87
450	43.5	0.87
835	41.5	0.90
900	41.5	0.97
1450	40.5	1.20
1800 – 2000	40.0	1.40
2450	39.2	1.80
2600	39.0	1.96
3000	38.5	2.40

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Target Frequency (MHz)	Head		Body	
	$\epsilon_r$	$\sigma$ (S/m)	$\epsilon_r$	$\sigma$ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 – 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5000	36.2	4.45	49.3	5.07
5100	36.1	4.55	49.1	5.18
5200	36.0	4.66	49.0	5.30
5300	35.9	4.76	48.9	5.42
5400	35.8	4.86	48.7	5.53
5500	35.6	4.96	48.6	5.65
5600	35.5	5.07	48.5	5.77
5700	35.4	5.17	48.3	5.88
5800	35.3	5.27	48.2	6.00



### 10.1. Composition of Ingredients for the Tissue Material Used in the SAR Tests

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		915		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

### 10.2. Tissue Dielectric Parameter Check Results

Tissue dielectric parameters were measured at the low, middle and high frequency of each operating frequency range of the test device.

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
4/2/2012	Body 2450	e'	51.5646	Relative Permittivity ( $\epsilon_r$ ):	51.56	52.70	-2.15	5
		e"	14.1082	Conductivity ( $\sigma$ ):	1.92	1.95	-1.44	5
	Body 2410	e'	51.6575	Relative Permittivity ( $\epsilon_r$ ):	51.66	52.76	-2.09	5
		e"	13.9525	Conductivity ( $\sigma$ ):	1.87	1.91	-1.98	5
	Body 2435	e'	51.6035	Relative Permittivity ( $\epsilon_r$ ):	51.60	52.73	-2.13	5
		e"	14.0498	Conductivity ( $\sigma$ ):	1.90	1.93	-1.49	5
	Body 2460	e'	51.5330	Relative Permittivity ( $\epsilon_r$ ):	51.53	52.69	-2.19	5
		e"	14.1463	Conductivity ( $\sigma$ ):	1.93	1.96	-1.48	5
5/21/2012	Head 835	e'	41.3791	Relative Permittivity ( $\epsilon_r$ ):	41.38	41.50	-0.29	5
		e"	19.0515	Conductivity ( $\sigma$ ):	0.88	0.90	-1.72	5
	Head 820	e'	41.5817	Relative Permittivity ( $\epsilon_r$ ):	41.58	41.60	-0.05	5
		e"	19.0861	Conductivity ( $\sigma$ ):	0.87	0.90	-3.14	5
	Head 850	e'	41.1970	Relative Permittivity ( $\epsilon_r$ ):	41.20	41.50	-0.73	5
		e"	19.0075	Conductivity ( $\sigma$ ):	0.90	0.92	-1.82	5
5/21/2012	Body 835	e'	53.2096	Relative Permittivity ( $\epsilon_r$ ):	53.21	55.20	-3.61	5
		e"	21.4391	Conductivity ( $\sigma$ ):	1.00	0.97	2.62	5
	Body 820	e'	53.3685	Relative Permittivity ( $\epsilon_r$ ):	53.37	55.28	-3.45	5
		e"	21.5147	Conductivity ( $\sigma$ ):	0.98	0.97	1.29	5
	Body 830	e'	53.2614	Relative Permittivity ( $\epsilon_r$ ):	53.26	55.24	-3.58	5
		e"	21.4605	Conductivity ( $\sigma$ ):	0.99	0.97	2.19	5
	Body 850	e'	53.0379	Relative Permittivity ( $\epsilon_r$ ):	53.04	55.16	-3.84	5
		e"	21.3692	Conductivity ( $\sigma$ ):	1.01	0.99	2.31	5
5/22/2012	Head 1900	e'	39.1133	Relative Permittivity ( $\epsilon_r$ ):	39.11	40.00	-2.22	5
		e"	13.1630	Conductivity ( $\sigma$ ):	1.39	1.40	-0.67	5
	Head 1850	e'	39.2951	Relative Permittivity ( $\epsilon_r$ ):	39.30	40.00	-1.76	5
		e"	13.0021	Conductivity ( $\sigma$ ):	1.34	1.40	-4.47	5
	Head 1880	e'	39.1696	Relative Permittivity ( $\epsilon_r$ ):	39.17	40.00	-2.08	5
		e"	13.1004	Conductivity ( $\sigma$ ):	1.37	1.40	-2.18	5
	Head 1910	e'	39.0833	Relative Permittivity ( $\epsilon_r$ ):	39.08	40.00	-2.29	5
		e"	13.1878	Conductivity ( $\sigma$ ):	1.40	1.40	0.04	5
5/22/2012	Body 1900	e'	53.3948	Relative Permittivity ( $\epsilon_r$ ):	53.39	53.30	0.18	5
		e"	14.6663	Conductivity ( $\sigma$ ):	1.55	1.52	1.94	5
	Body 1850	e'	53.5223	Relative Permittivity ( $\epsilon_r$ ):	53.52	53.30	0.42	5
		e"	14.4567	Conductivity ( $\sigma$ ):	1.49	1.52	-2.16	5
	Body 1880	e'	53.4436	Relative Permittivity ( $\epsilon_r$ ):	53.44	53.30	0.27	5
		e"	14.5943	Conductivity ( $\sigma$ ):	1.53	1.52	0.37	5
	Body 1910	e'	53.3563	Relative Permittivity ( $\epsilon_r$ ):	53.36	53.30	0.11	5
		e"	14.6984	Conductivity ( $\sigma$ ):	1.56	1.52	2.70	5

## 11. System Performance Check

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  $\pm 10\%$ .

### 11.1. System Performance Check Measurement Conditions

- The measurements were performed in the flat section of the TWIN SAM or ELI phantom, shell thickness: 2.0  $\pm 0.2$  mm (bottom plate) filled with Body or Head simulating liquid of the following parameters.
- The DASY system with an E-Field Probe 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 (below 3 GHz) and/or 8x8x7 (above 3 GHz) fine cube was chosen for the 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.

### 11.2. Reference SAR Values for System Performance Check

The reference SAR values can be obtained from the calibration certificate of system validation dipoles

System Dipole	Serial No.	Cal. Date	Freq. (MHz)	SAR Measured (mW/g)		
				1g/10g	Head	Body
D835V2	4d002	3/6/12	835	1g	9.24	9.64
				10g	6.04	6.32
D1900V2	5d043	11/10/11	1900	1g	40.8	42.0
				10g	21.16	21.96
D2450V2	748	2/7/12	2450	1g	53.6	50.8
				10g	24.8	23.64

### 11.3. System Performance Check Results

Date Tested	System Dipole		T.S. Liquid	SAR Measured (Normalized to 1 W)		Target (Ref. Value)	Delta (%)	Tolerance (%)
	Type	Serial No.		1g	10g			
4/2/2012	D2450V2	748	Body	1g	53.80	50.8	5.91	±10
				10g	25.10		23.64	
5/21/2012	D835V2	4d002	Head	1g	9.19	9.24	-0.54	±10
				10g	6.03		6.04	
	D835V2	4d002	Body	1g	10.01	9.64	3.84	±10
				10g	6.63		6.32	
5/22/2012	D1900V2	5d043	Head	1g	41.90	40.80	2.70	±10
				10g	21.80		21.16	
	D1900V2	5d043	Body	1g	44.50	42.00	5.95	±10
				10g	23.70		21.96	

## 12. SAR Test Results

### 12.1. GSM850

#### 12.1.1. Head SAR

Test Position	Mode	Ch #.	Freq. (MHz)	Avg Pwr (dBm)	SAR (mW/g)		Note
					1-g	10-g	
Left Touch	GMSK (Voice)	128	824.20	33.1			1
		190	836.60	33.1	<b>0.602</b>	<b>0.424</b>	
		251	848.80	33.1			1
Left Tilt (15°)	GMSK (Voice)	128	824.20	33.1			1
		190	836.60	33.1	0.304	0.230	
		251	848.80	33.1			1
Right Touch	GMSK (Voice)	128	824.20	33.1			1
		190	836.60	33.1	0.588	0.419	
		251	848.80	33.1			1
Right Tilt (15°)	GMSK (Voice)	128	824.20	33.1			1
		190	836.60	33.1	0.338	0.253	
		251	848.80	33.1			1

#### 12.1.2. Body SAR

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Avg Pwr (dBm)	SAR (mW/g)		Note
						1-g	10-g	
Rear	GPRS 2 slots	15	128	824.20	30.5			1
			190	836.60	30.5	<b>0.611</b>	<b>0.432</b>	
			251	848.80	30.5			1
	GMSK (Voice)	15	190	836.60	33.1	0.417	0.293	2
Front	GPRS 2 slots	15	128	824.20	30.5			1
			190	836.60	30.5	0.385	0.273	
			251	848.80	30.5			1

#### Note(s):

- 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.
- With headset attached.

## 12.2. GSM1900

### 12.2.1. Head SAR

Test Position	Mode	Ch #.	Freq. (MHz)	Avg Pwr (dBm)	SAR (mW/g)		Note
					1-g	10-g	
Left Touch	GMSK (Voice)	512	1850.2	30.5			1
		661	1880.0	30.6	<b>0.494</b>	<b>0.252</b>	
		810	1909.8	30.5			1
Left Tilt (15°)	GMSK (Voice)	512	1850.2	30.5			1
		661	1880.0	30.6	0.078	0.046	
		810	1909.8	30.5			1
Right Touch	GMSK (Voice)	512	1850.2	30.5			1
		661	1880.0	30.6	0.323	0.192	
		810	1909.8	30.5			1
Right Tilt (15°)	GMSK (Voice)	512	1850.2	30.5			1
		661	1880.0	30.6	0.067	0.038	
		810	1909.8	30.5			1

### 12.2.2. Body SAR

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Avg Pwr (dBm)	SAR (mW/g)		Note
						1-g	10-g	
Rear	GPRS 2 slots	15	512	1850.2	27.6			1
			661	1880.0	27.6	<b>0.407</b>	<b>0.236</b>	
			810	1909.8	27.5			1
	GMSK (Voice)	15	661	1880.0	30.6	0.290	0.169	2
Front	GPRS 2 slots	15	512	1850.2	27.6			1
			661	1880.0	27.6	0.202	0.123	
			810	1909.8	27.5			1

#### Note(s):

- 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.
- With headset attached.

### 12.3. WCDMA (UMTS) Band V

#### Test mode reduction considerations

Body SAR is not required for handsets with HSPA capabilities when the maximum average output of each RF channel with HSUPA/HSDPA active is less than ¼ dB higher than that measured without HSUPA/HSDPA using 12.2 kbps RMC and the maximum SAR for 12.2kbps RMC is ≤ 75% of the SAR limit as per KDB 941225 D01

#### 12.3.1. Head SAR

Test Position	Mode	Ch #.	Freq. (MHz)	Avg Pwr (dBm)	SAR (mW/g)		Note
					1-g	10-g	
Left Touch	Rel 99 RMC 12.2kbps	4132	826.4	23.5			1
		4183	836.6	23.5	<b>0.463</b>	<b>0.317</b>	
		4233	846.6	23.4			1
Left Tilt (15°)	Rel 99 RMC 12.2kbps	4132	826.4	23.5			1
		4183	836.6	23.5	0.234	0.177	
		4233	846.6	23.4			1
Right Touch	Rel 99 RMC 12.2kbps	4132	826.4	23.5			1
		4183	836.6	23.5	0.360	0.258	
		4233	846.6	23.4			1
Right Tilt (15°)	Rel 99 RMC 12.2kbps	4132	826.4	23.5			1
		4183	836.6	23.5	0.217	0.162	
		4233	846.6	23.4			1

#### 12.3.2. Body SAR

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Avg Pwr (dBm)	SAR (mW/g)		Note
						1-g	10-g	
Rear	Rel 99 RMC 12.2kbps	15	4132	826.4	23.5			1
			4183	836.6	23.5	<b>0.341</b>	<b>0.244</b>	
			4183	836.6	23.5	0.303	0.213	2
			4233	846.6	23.4			1
Front	Rel 99 RMC 12.2kbps	15	4132	826.4	23.5			1
			4183	836.6	23.5	0.221	0.157	
			4233	846.6	23.4			1

#### Note(s):

- 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.
- With headset attached.

## 12.4. WCDMA (UMTS) Band II

### Test mode reduction considerations

Body SAR is not required for handsets with HSPA capabilities when the maximum average output of each RF channel with HSUPA/HSDPA active is less than ¼ dB higher than that measured without HSUPA/HSDPA using 12.2 kbps RMC and the maximum SAR for 12.2kbps RMC is ≤ 75% of the SAR limit as per KDB 941225 D01

#### 12.4.1. Head SAR

Test Position	Mode	Ch #.	Freq. (MHz)	Avg Pwr (dBm)	SAR (mW/g)		Note
					1-g	10-g	
Left Touch	Rel 99 RMC 12.2kbps	9262	1852.4	23.8	<b>1.150</b>	<b>0.591</b>	
		9400	1880.0	23.8	0.911	0.473	
		9538	1907.6	23.8	0.946	0.494	
Left Tilt (15°)	Rel 99 RMC 12.2kbps	9262	1852.4	23.8			1
		9400	1880.0	23.8	0.174	0.103	
		9538	1907.6	23.8			1
Right Touch	Rel 99 RMC 12.2kbps	9262	1852.4	23.8	1.010	0.593	
		9400	1880.0	23.8	0.855	0.504	
		9538	1907.6	23.8	0.914	0.544	
Right Tilt (15°)	Rel 99 RMC 12.2kbps	9262	1852.4	23.8			1
		9400	1880.0	23.8	0.211	0.118	
		9538	1907.6	23.8			1

#### 12.4.2. Body SAR

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Avg Pwr (dBm)	SAR (mW/g)		Note
						1-g	10-g	
Rear	Rel 99 RMC 12.2kbps	15	9262	1852.4	23.8			1
			9400	1880.0	23.8	0.620	0.360	
			9400	1880.0	23.8	<b>0.671</b>	<b>0.394</b>	2
			9538	1907.6	23.8			1
Front	Rel 99 RMC 12.2kbps	15	9262	1852.4	23.8			1
			9400	1880.0	23.8	0.277	0.169	
			9538	1907.6	23.8			1

#### Note(s):

- 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.
- With headset attached.



## 12.5. Wi-Fi (2.4 GHz Band)

### 12.5.1. Head SAR

N/A: No VoIP and Hotspot supported for this device.

### 12.5.2. Body SAR

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Avg Pwr (dBm)	SAR (mW/g)		Note
						1-g	10-g	
Rear	802.11b	15	1	2412	15.2			1
			6	2437	15.4	<b>0.080</b>	<b>0.045</b>	
			11	2462	15.4			1
Front	802.11b	15	1	2412	15.2			1
			6	2437	15.4	0.055	0.032	
			11	2462	15.4			1

#### Note(s):

1. Testing was performed on the channel with the highest output power only as the SAR was  $\leq 0.8$  W/kg with the operating frequency band having a range of  $< 100$  MHz. Per KDB 447498 1) e) i)

### 13. Summary of Highest SAR Values

Results for highest SAR values for each frequency band and mode

Technology/Band	Test configuration		Mode	Highest 1g SAR (W/kg)
GSM850	Head	Left Touch	GMSK (Voice)	0.602
	Body	Rear	GMSK (GPRS 2 slots)	0.611
GSM1900	Head	Left Touch	GMSK (Voice)	0.494
	Body	Rear	GMSK (GPRS 2 slots)	0.407
WCDMA (UMTS) band V	Head	Left Touch	Rel.99 (RMC, 12.2 kbps)	0.463
	Body	Rear	Rel.99 (RMC, 12.2 kbps)	0.341
WCDMA (UMTS) band II	Head	Left Touch	Rel.99 (RMC, 12.2 kbps)	1.150
	Body	Rear with Headset	Rel.99 (RMC, 12.2 kbps)	0.671
WiFi 2.4 GHz	Body	Rear	802.11b	0.080

### 13.1. SAR Plots (from Summary of Highest SAR Values)

Test Laboratory: UL CCS SAR Lab A

Date: 5/21/2012

#### GSM850

Frequency: 836.6 MHz; Duty Cycle: 1:8; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C  
Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.886$  mho/m;  $\epsilon_r = 41.359$ ;  $\rho = 1000$  kg/m<sup>3</sup>

DASY5 Configuration:

- Electronics: DAE4 Sn1258; Calibrated: 3/8/2012
- Probe: EX3DV4 - SN3772; ConvF(8.67, 8.67, 8.67); Calibrated: 2/16/2012
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: SAM v5.0 (A); Type: QD000P40CC; Serial: 1602

**Left/Touch\_GMSK (Voice) ch 190/Area Scan (8x10x1):** Measurement grid: dx=15mm, dy=15mm

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

Maximum value of SAR (measured) = 0.697 mW/g

**Left/Touch\_GMSK (Voice) ch 190/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

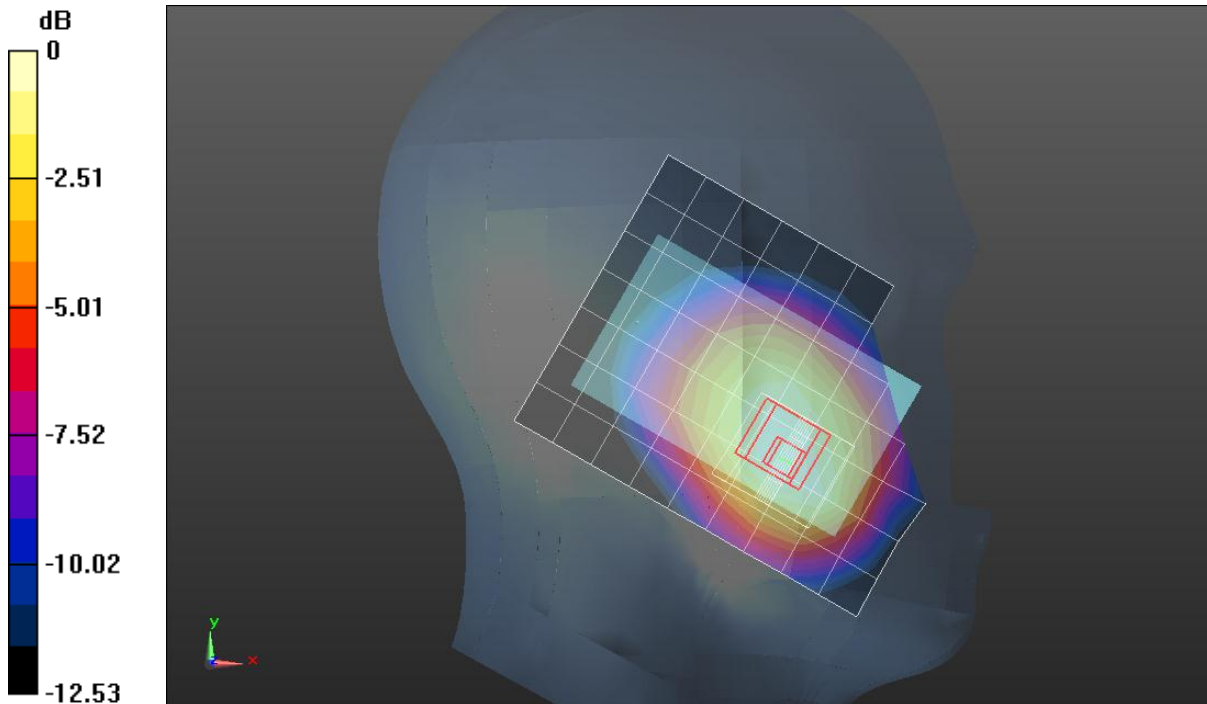
Reference Value = 28.228 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 0.8610

**SAR(1 g) = 0.602 mW/g; SAR(10 g) = 0.424 mW/g**

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

Maximum value of SAR (measured) = 0.714 mW/g



0 dB = 0.710mW/g = -2.97 dB mW/g

Test Laboratory: UL CCS SAR Lab A

Date: 5/21/2012

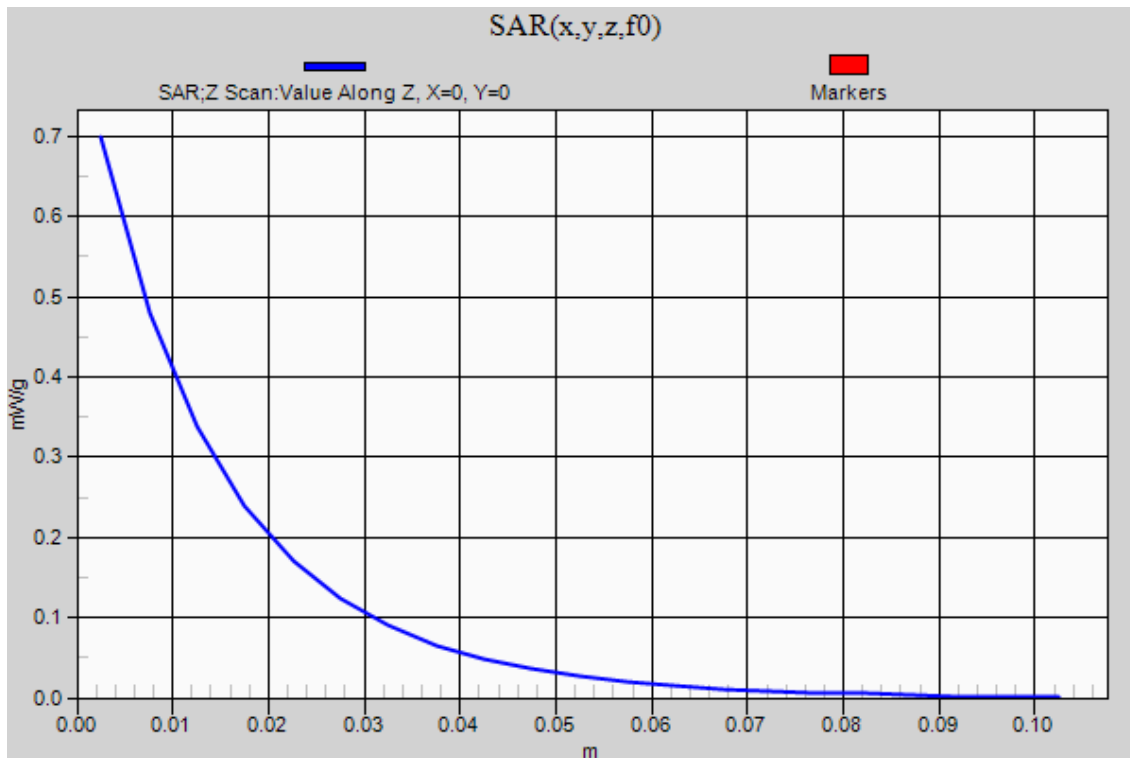
### GSM850

Frequency: 836.6 MHz; Duty Cycle: 1:8

**Left/Touch\_GMSK (Voice) ch 190/Z Scan (1x1x21):** Measurement grid: dx=20mm, dy=20mm, dz=5mm

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.699 mW/g



Test Laboratory: UL CCS SAR Lab A

Date: 5/22/2012

### GSM850

Frequency: 836.6 MHz; Duty Cycle: 1:4; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C  
Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.998$  mho/m;  $\epsilon_r = 53.191$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
DASY5 Configuration:

- Electronics: DAE4 Sn1258; Calibrated: 3/8/2012
- Probe: EX3DV4 - SN3772; ConvF(8.89, 8.89, 8.89); Calibrated: 2/16/2012
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: ELI v5.0 (A); Type: QDOVA001BB; Serial: 1119

#### Rear/GPRS 2 Slots ch 190/Area Scan (8x10x1): Measurement grid: dx=15mm, dy=15mm

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

Maximum value of SAR (measured) = 0.719 mW/g

#### Rear/GPRS 2 Slots ch 190/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

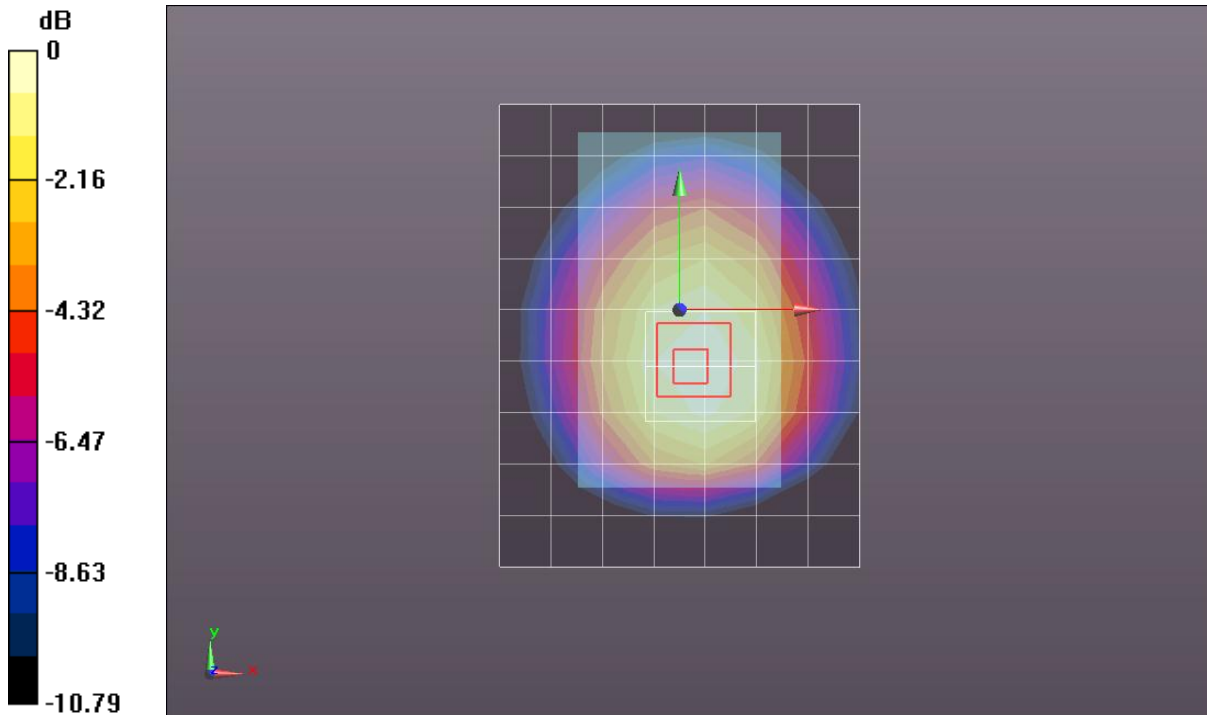
Reference Value = 26.976 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 1.3120

**SAR(1 g) = 0.611 mW/g; SAR(10 g) = 0.432 mW/g**

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

Maximum value of SAR (measured) = 0.715 mW/g



0 dB = 0.710mW/g = -2.97 dB mW/g

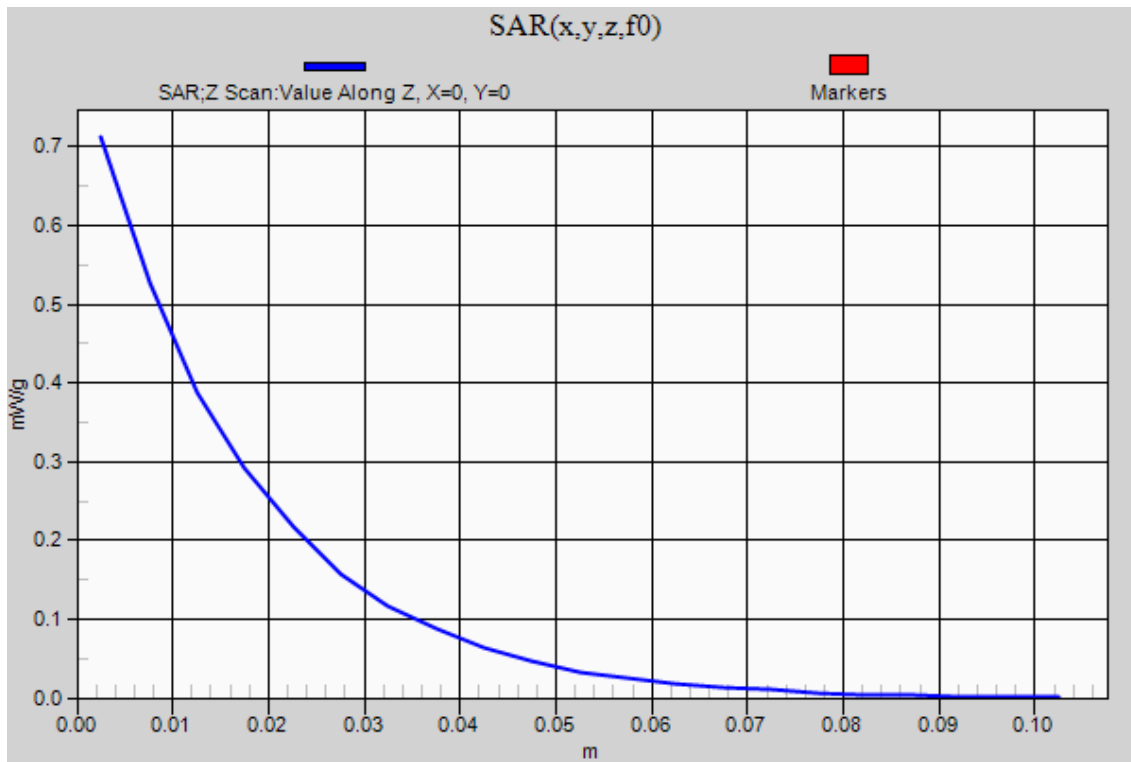
### GSM850

Frequency: 836.6 MHz; Duty Cycle: 1:4

**Rear/GPRS 2 Slots ch 190/Z Scan (1x1x21):** Measurement grid: dx=20mm, dy=20mm, dz=5mm

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.712 mW/g



Test Laboratory: UL CCS SAR Lab A

Date: 5/22/2012

### GSM1900

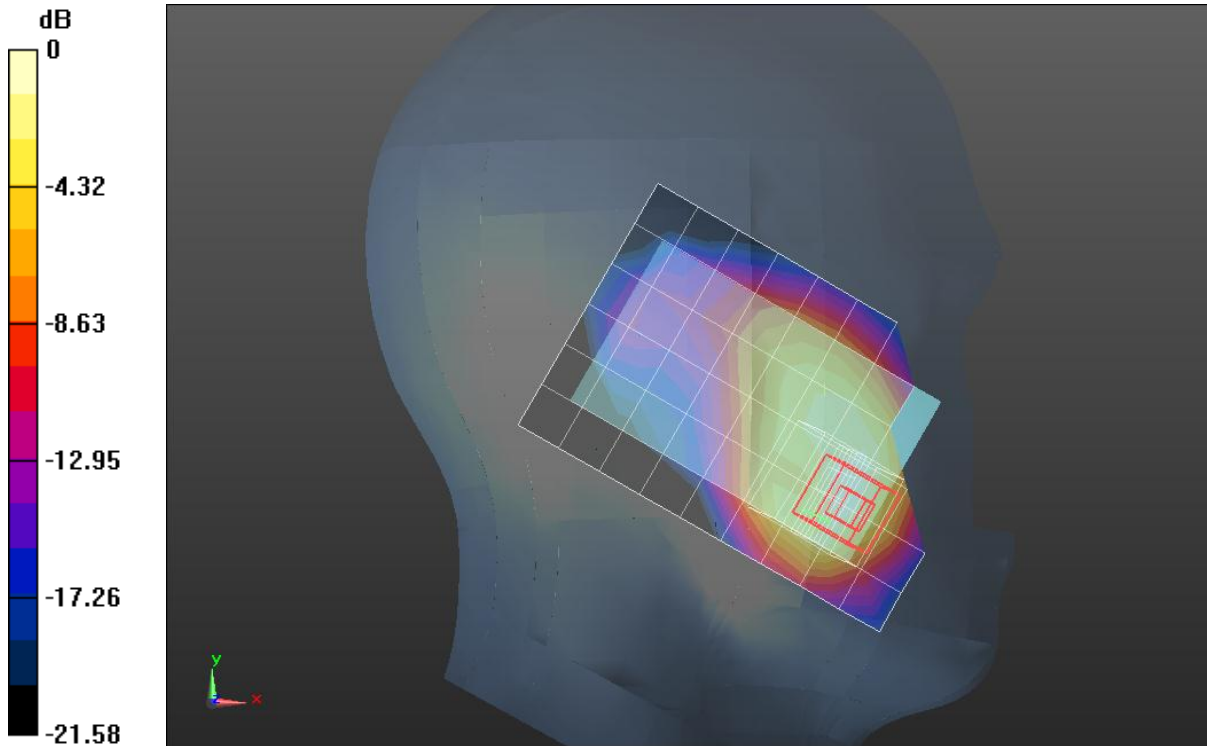
Frequency: 1880 MHz; Duty Cycle: 1:8; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C  
Medium parameters used:  $f = 1880 \text{ MHz}$ ;  $\sigma = 1.37 \text{ mho/m}$ ;  $\epsilon_r = 39.17$ ;  $\rho = 1000 \text{ kg/m}^3$

DASY5 Configuration:

- Electronics: DAE4 Sn1258; Calibrated: 3/8/2012
- Probe: EX3DV4 - SN3772; ConvF(7.59, 7.59); Calibrated: 2/16/2012
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: SAM v5.0 (B); Type: QD000P40CD; Serial: 1628

**Left/Touch\_GMSK (Voice) ch 661/Area Scan (7x10x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$   
Maximum value of SAR (measured) = 0.619 mW/g

**Left/Touch\_GMSK (Voice) ch 661/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$   
Reference Value = 21.513 V/m; Power Drift = -0.03 dB  
Peak SAR (extrapolated) = 0.9190  
**SAR(1 g) = 0.494 mW/g; SAR(10 g) = 0.252 mW/g**  
Maximum value of SAR (measured) = 0.625 mW/g



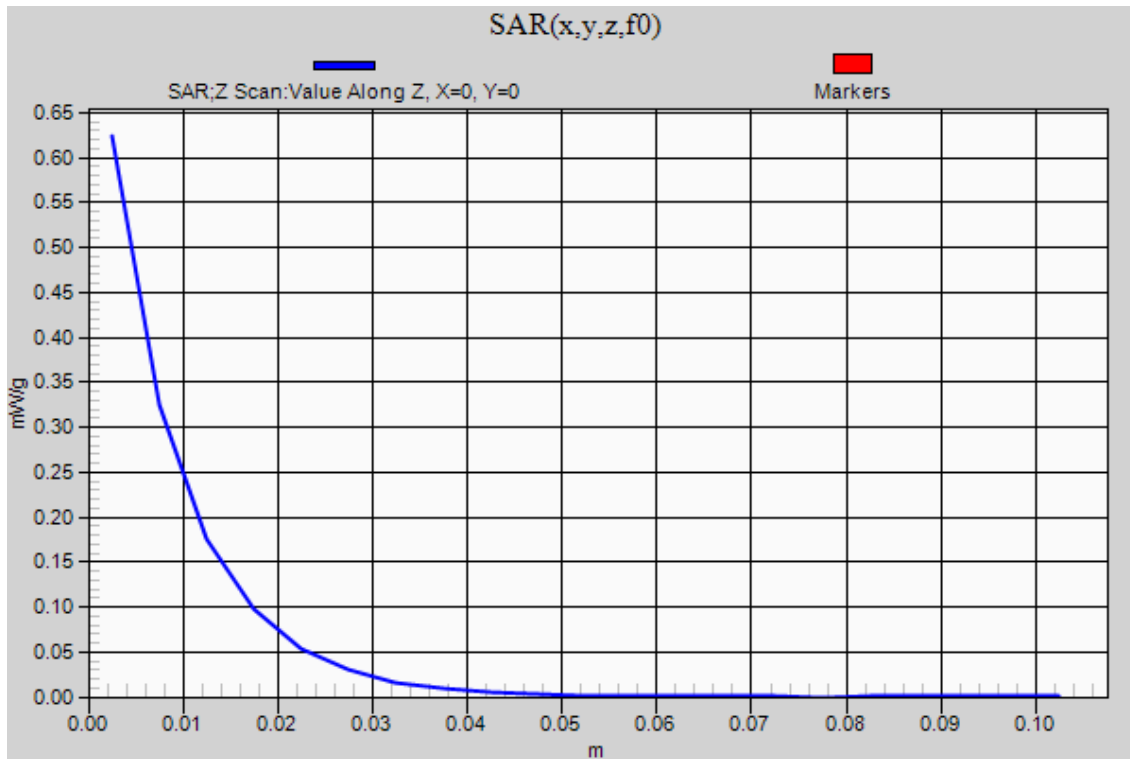
0 dB = 0.630mW/g = -4.01 dB mW/g

### GSM1900

Frequency: 1880 MHz; Duty Cycle: 1:8

**Left/Touch\_GMSK (Voice) ch 661/Z Scan (1x1x21):** Measurement grid: dx=20mm, dy=20mm, dz=5mm

Maximum value of SAR (measured) = 0.624 mW/g





Test Laboratory: UL CCS SAR Lab A

Date: 5/22/2012

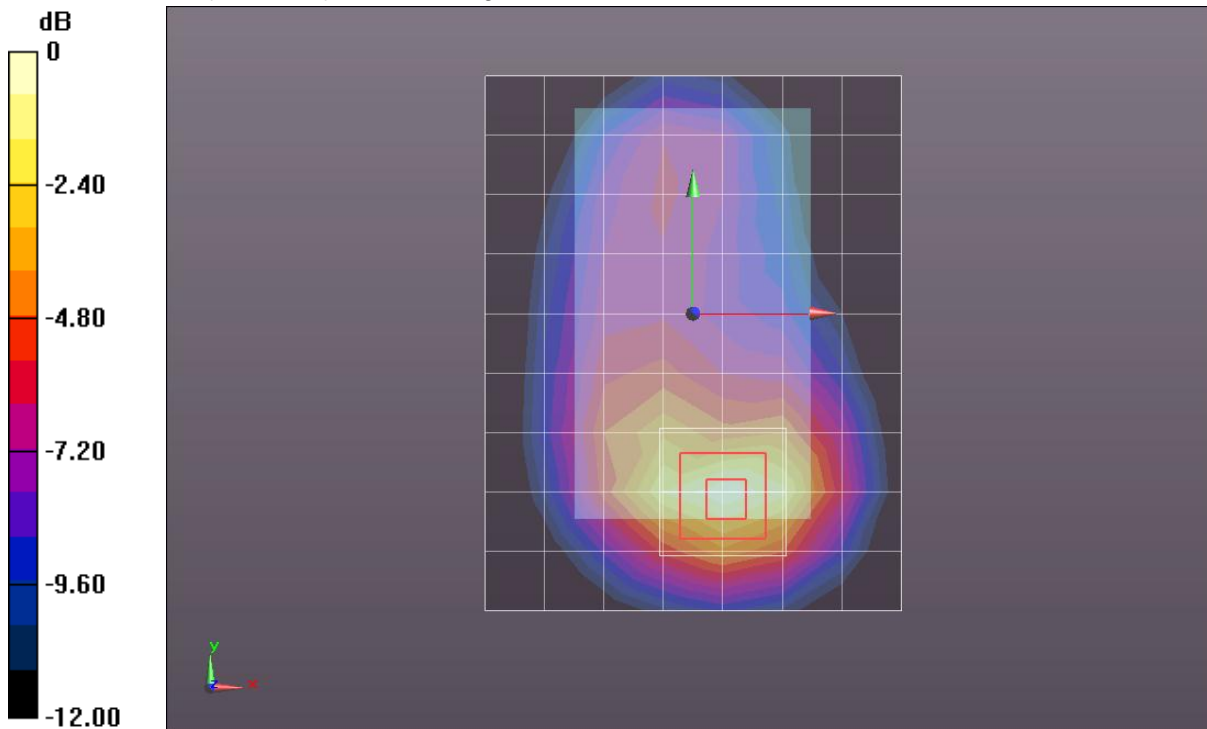
### GSM1900

Frequency: 1880 MHz; Duty Cycle: 1:4; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C  
Medium parameters used:  $f = 1880 \text{ MHz}$ ;  $\sigma = 1.526 \text{ mho/m}$ ;  $\epsilon_r = 53.444$ ;  $\rho = 1000 \text{ kg/m}^3$   
DASY5 Configuration:

- Electronics: DAE4 Sn1258; Calibrated: 3/8/2012
- Probe: EX3DV4 - SN3772; ConvF(7.23, 7.23, 7.23); Calibrated: 2/16/2012
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: ELI v5.0 (B); Type: QDOVA001BB; Serial: 1099

**Rear/GPRS 2 Slots ch 661/Area Scan (8x10x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$   
Maximum value of SAR (measured) = 0.504 mW/g

**Rear/GPRS 2 Slots ch 661/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$   
Reference Value = 18.356 V/m; Power Drift = 0.02 dB  
Peak SAR (extrapolated) = 0.6320  
**SAR(1 g) = 0.407 mW/g; SAR(10 g) = 0.236 mW/g**  
Maximum value of SAR (measured) = 0.510 mW/g



0 dB = 0.510mW/g = -5.85 dB mW/g

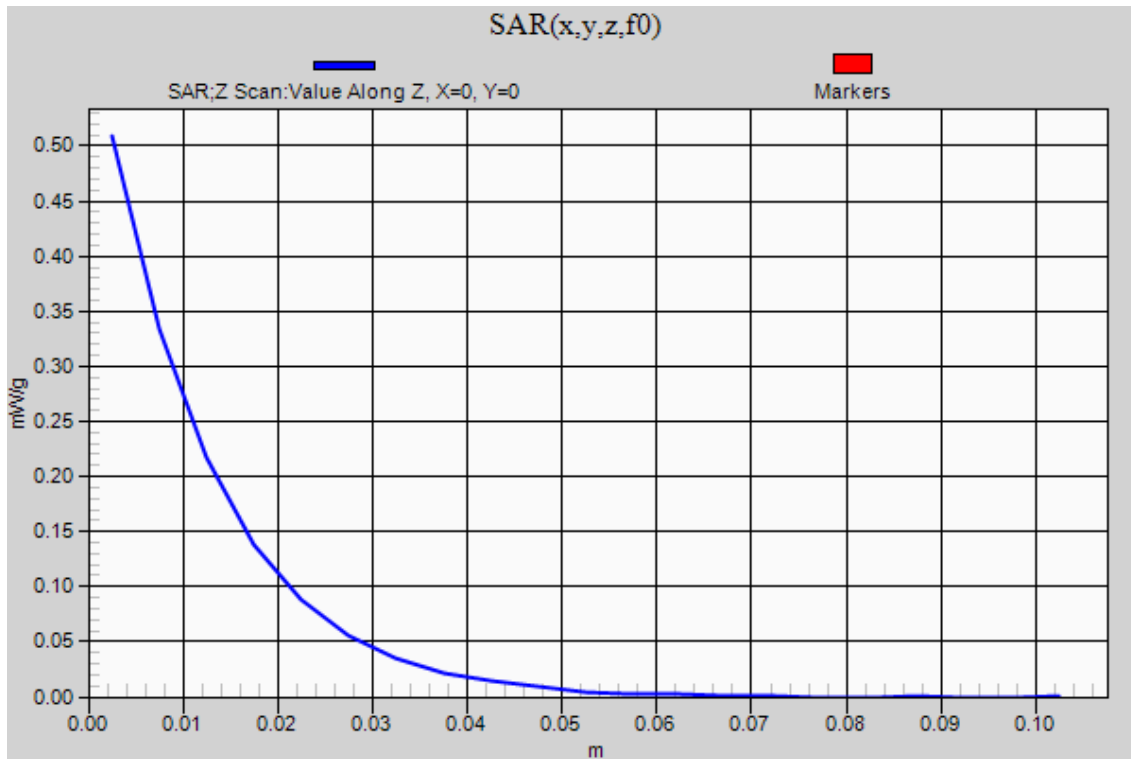
Test Laboratory: UL CCS SAR Lab A

Date: 5/22/2012

### GSM1900

Frequency: 1880 MHz; Duty Cycle: 1:4

**Rear/GPRS 2 Slots ch 661/Z Scan (1x1x21):** Measurement grid: dx=20mm, dy=20mm, dz=5mm  
Maximum value of SAR (measured) = 0.509 mW/g



Test Laboratory: UL CCS SAR Lab A

Date: 5/22/2012

### W-CDMA Band V

Frequency: 836.6 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C

Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.886$  mho/m;  $\epsilon_r = 41.359$ ;  $\rho = 1000$  kg/m<sup>3</sup>

DASY5 Configuration:

- Electronics: DAE4 Sn1258; Calibrated: 3/8/2012
- Probe: EX3DV4 - SN3772; ConvF(8.67, 8.67, 8.67); Calibrated: 2/16/2012
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: SAM v5.0 (A); Type: QD000P40CC; Serial: 1602

**Left/Touch\_Rel. 99\_RMC 12.2kbps ch 4183/Area Scan (8x10x1):** Measurement grid:  
dx=15mm, dy=15mm

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

Maximum value of SAR (measured) = 0.552 mW/g

**Left/Touch\_Rel. 99\_RMC 12.2kbps ch 4183/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:

dx=8mm, dy=8mm, dz=5mm

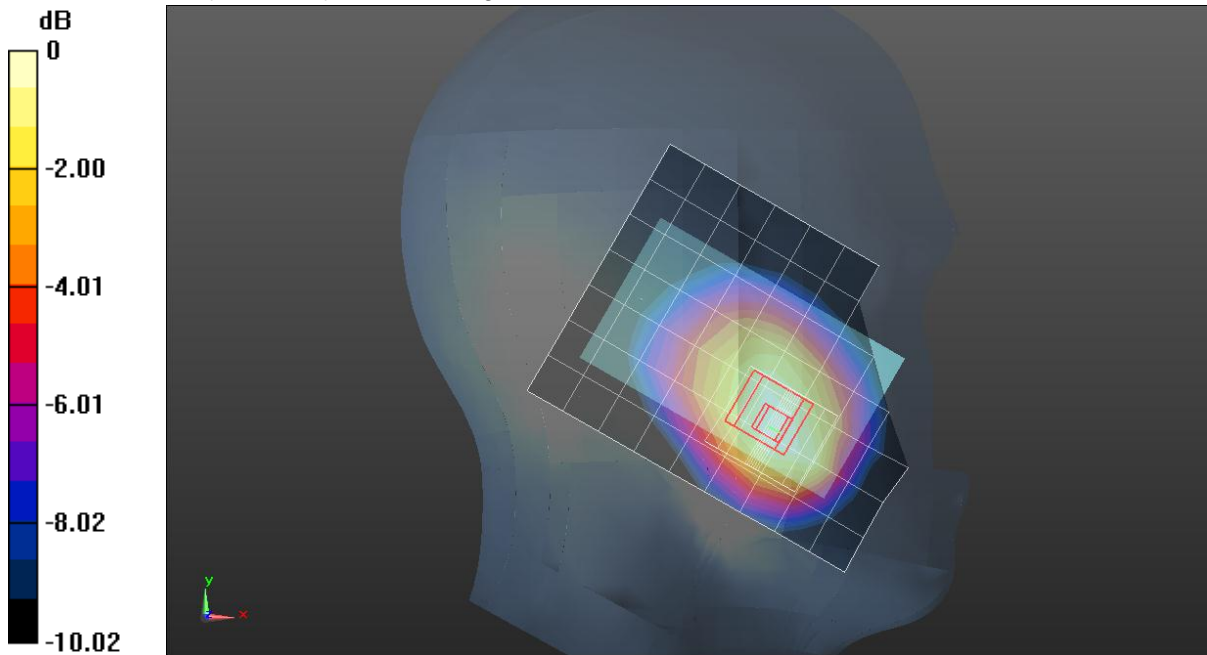
Reference Value = 25.064 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 0.6920

**SAR(1 g) = 0.463 mW/g; SAR(10 g) = 0.317 mW/g**

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

Maximum value of SAR (measured) = 0.554 mW/g



0 dB = 0.550mW/g = -5.19 dB mW/g

Test Laboratory: UL CCS SAR Lab A

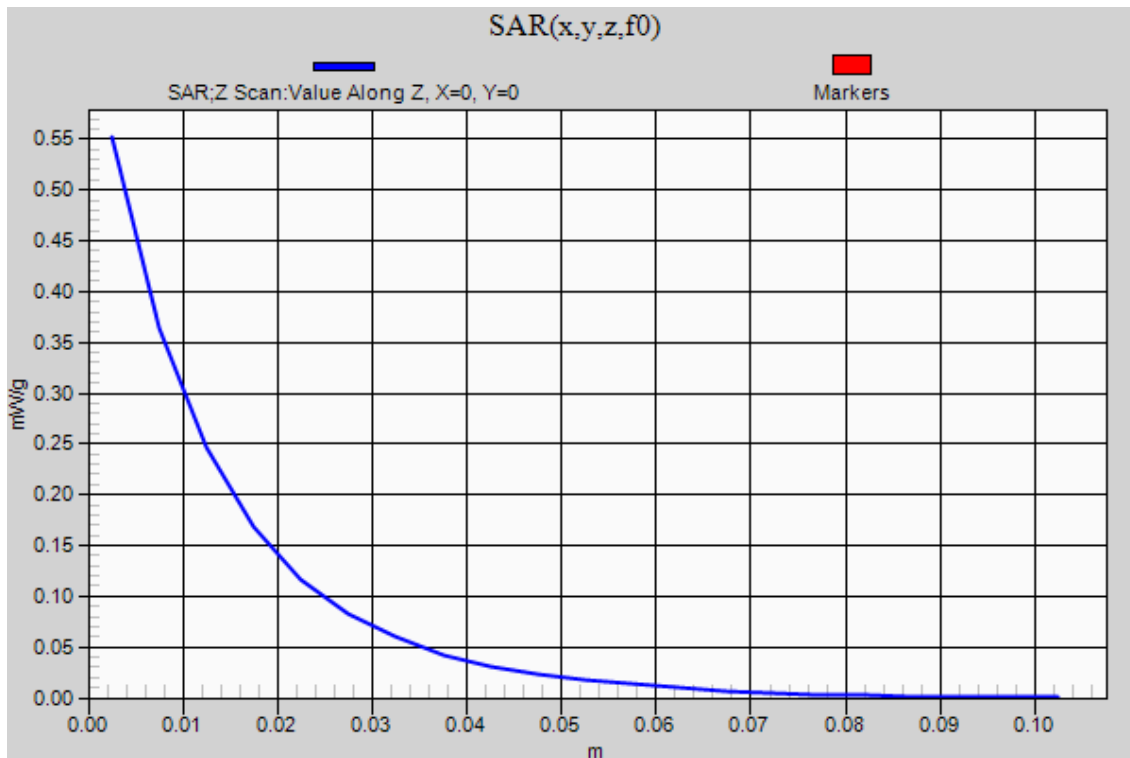
Date: 5/22/2012

### W-CDMA Band V

Frequency: 836.6 MHz; Duty Cycle: 1:1

**Left/Touch\_Rel. 99\_RMC 12.2kbps ch 4183/Z Scan (1x1x21):** Measurement grid: dx=20mm, dy=20mm, dz=5mm

Info: [Interpolated medium parameters used for SAR evaluation.](#)  
Maximum value of SAR (measured) = 0.552 mW/g



### W-CDMA Band V

Frequency: 836.6 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C

Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.886$  mho/m;  $\epsilon_r = 41.359$ ;  $\rho = 1000$  kg/m<sup>3</sup>

DASY5 Configuration:

- Electronics: DAE4 Sn1258; Calibrated: 3/8/2012
- Probe: EX3DV4 - SN3772; ConvF(8.67, 8.67, 8.67); Calibrated: 2/16/2012
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: ELI v5.0 (A); Type: QDOVA001BB; Serial: 1119

**Rear/Rel. 99\_RMC 12.2kbps ch 4183/Area Scan (8x10x1):** Measurement grid: dx=15mm, dy=15mm

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

Maximum value of SAR (measured) = 0.402 mW/g

**Rear/Rel. 99\_RMC 12.2kbps ch 4183/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:

dx=8mm, dy=8mm, dz=5mm

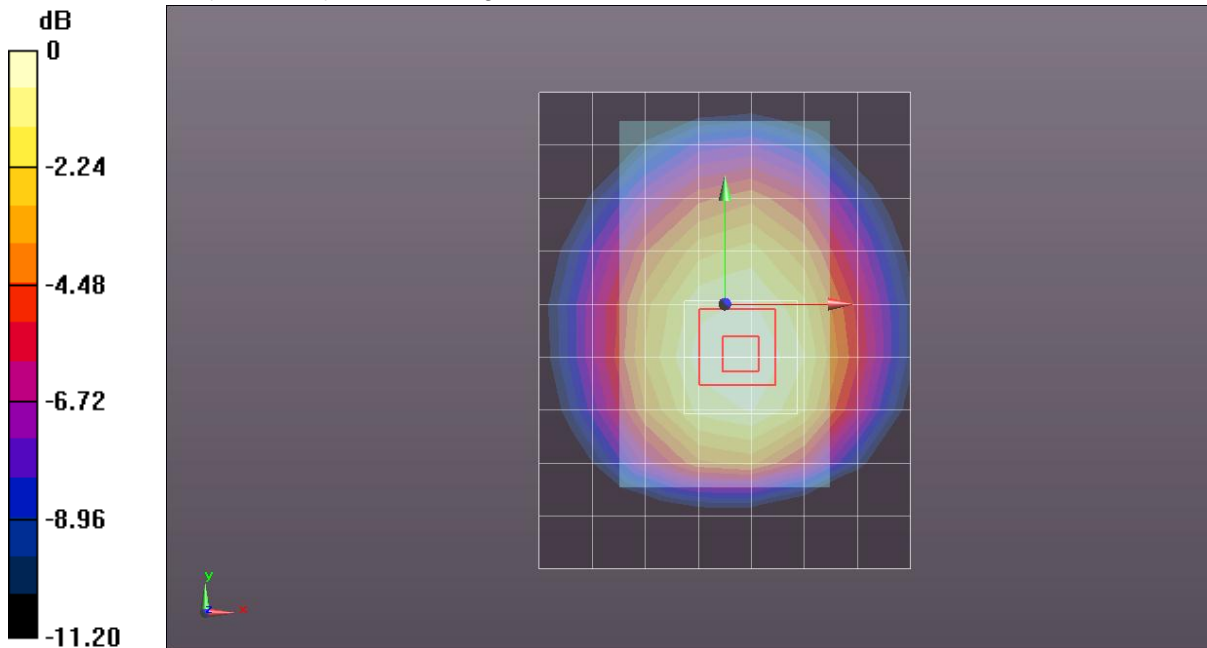
Reference Value = 21.357 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 0.4690

**SAR(1 g) = 0.341 mW/g; SAR(10 g) = 0.244 mW/g**

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

Maximum value of SAR (measured) = 0.394 mW/g



0 dB = 0.390mW/g = -8.18 dB mW/g

Test Laboratory: UL CCS SAR Lab A

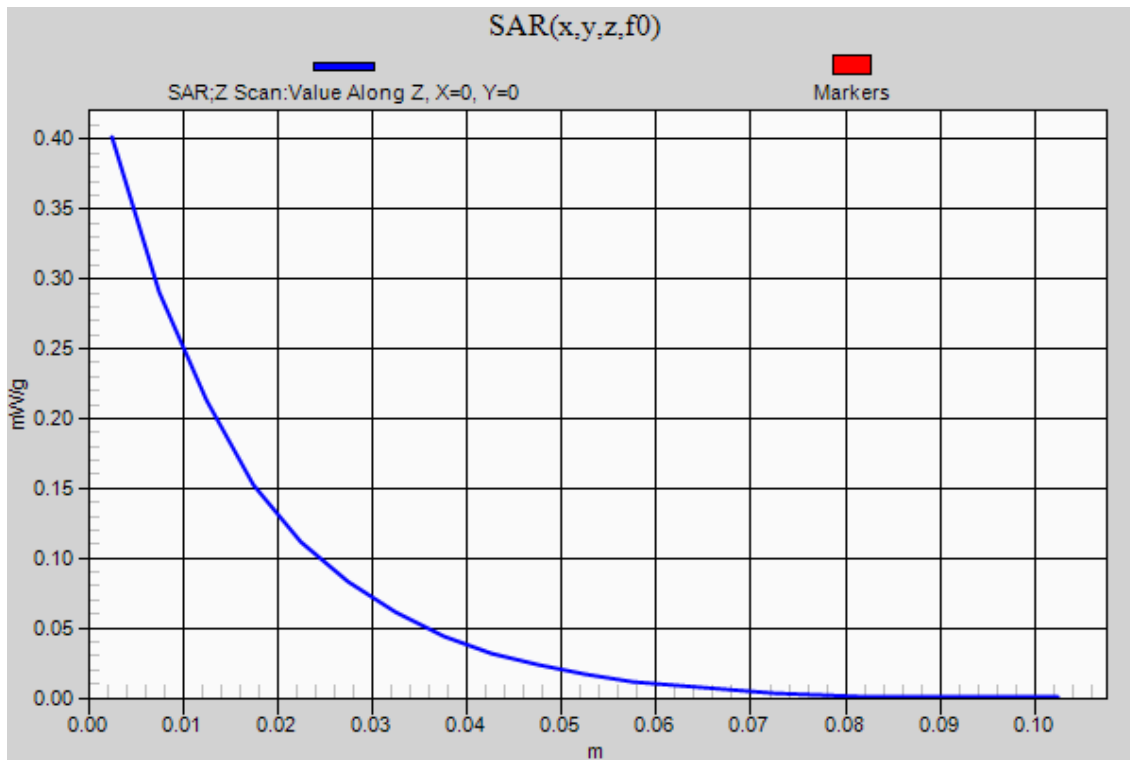
Date: 5/22/2012

### W-CDMA Band V

Frequency: 836.6 MHz; Duty Cycle: 1:1

**Rear/Rel. 99\_RMC 12.2kbps ch 4183/Z Scan (1x1x21):** Measurement grid: dx=20mm, dy=20mm, dz=5mm

Info: [Interpolated medium parameters used for SAR evaluation.](#)  
Maximum value of SAR (measured) = 0.401 mW/g



Test Laboratory: UL CCS SAR Lab A

Date: 5/23/2012

## W-CDMA Band II

Frequency: 1852.4 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C  
Medium parameters used (interpolated):  $f = 1852.4$  MHz;  $\sigma = 1.341$  mho/m;  $\epsilon_r = 39.283$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
DASY5 Configuration:

- Electronics: DAE4 Sn1258; Calibrated: 3/8/2012
- Probe: EX3DV4 - SN3772; ConvF(7.59, 7.59, 7.59); Calibrated: 2/16/2012
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: SAM v5.0 (B); Type: QD000P40CD; Serial: 1628

**Left/Touch\_Rel. 99\_RMC 12.2kbps ch 9262/Area Scan (7x10x1):** Measurement grid:  
dx=15mm, dy=15mm

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

Maximum value of SAR (measured) = 1.124 mW/g

**Left/Touch\_Rel. 99\_RMC 12.2kbps ch 9262/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:

dx=8mm, dy=8mm, dz=5mm

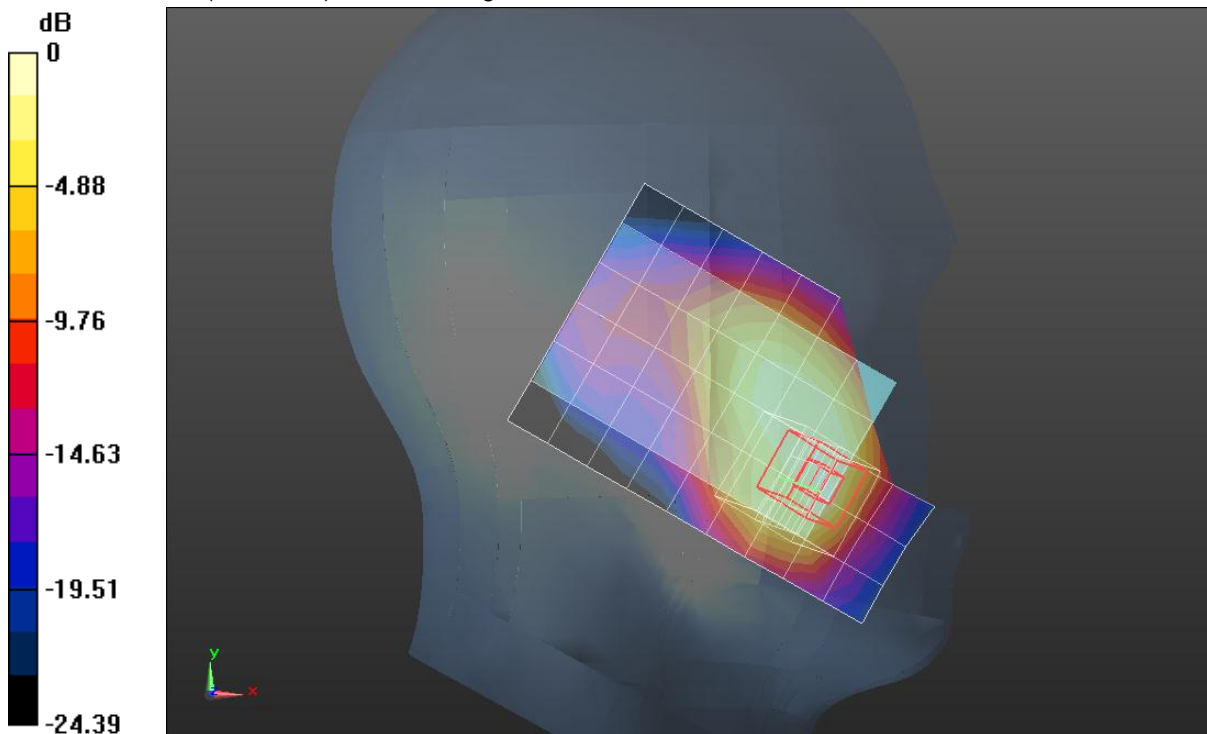
Reference Value = 29.358 V/m; Power Drift = -0.00096 dB

Peak SAR (extrapolated) = 2.0910

**SAR(1 g) = 1.15 mW/g; SAR(10 g) = 0.591 mW/g**

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

Maximum value of SAR (measured) = 1.453 mW/g



0 dB = 1.450mW/g = 3.23 dB mW/g

Test Laboratory: UL CCS SAR Lab A

Date: 5/23/2012

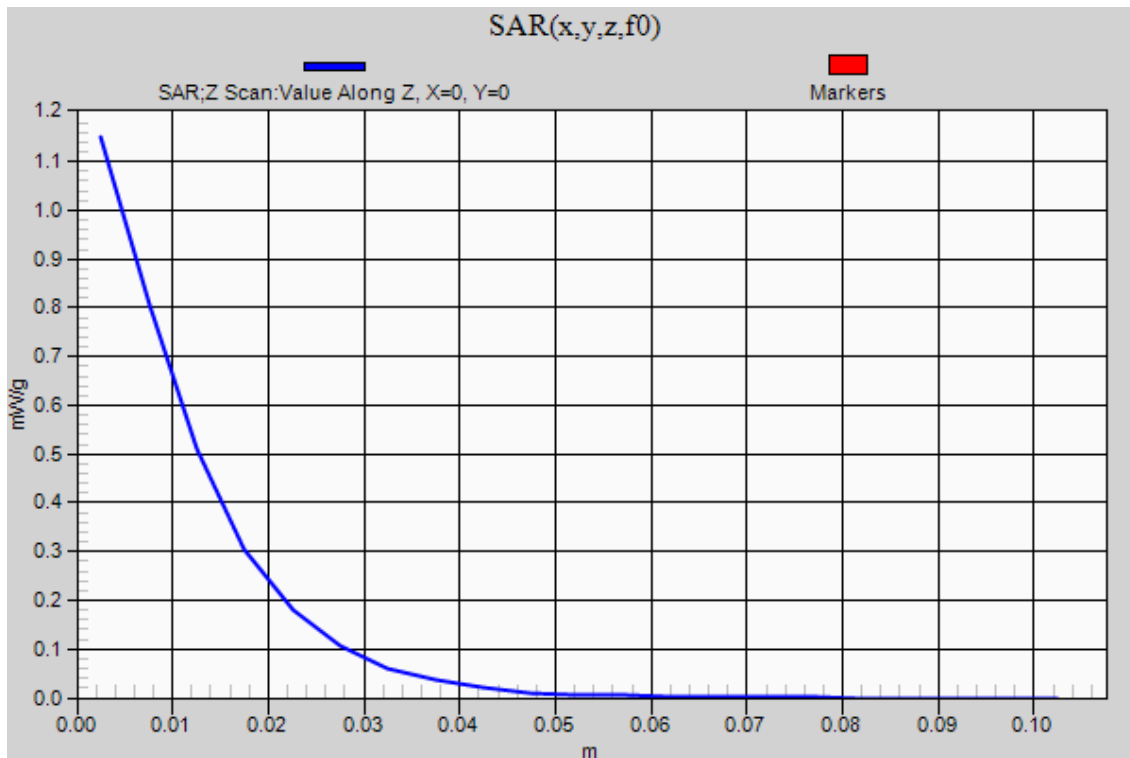
## W-CDMA Band II

Frequency: 1852.4 MHz; Duty Cycle: 1:1

**Left/Touch\_Rel. 99\_RMC 12.2kbps ch 9262/Z Scan (1x1x21):** Measurement grid: dx=20mm, dy=20mm, dz=5mm

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

Maximum value of SAR (measured) = 1.150 mW/g





Test Laboratory: UL CCS SAR Lab A

Date: 5/23/2012

## W-CDMA Band II

Frequency: 1880 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C

Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.526$  mho/m;  $\epsilon_r = 53.444$ ;  $\rho = 1000$  kg/m<sup>3</sup>

DASY5 Configuration:

- Electronics: DAE4 Sn1258; Calibrated: 3/8/2012

- Probe: EX3DV4 - SN3772; ConvF(7.23, 7.23, 7.23); Calibrated: 2/16/2012

- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 2.5mm (Mechanical Surface Detection)

- Phantom: ELI v5.0 (B); Type: QDOVA001BB; Serial: 1099

### Rear/Rel. 99\_RMC 12.2kbps ch 9400 w/ headset/Area Scan (8x10x1): Measurement grid:

$dx=15$ mm,  $dy=15$ mm

Maximum value of SAR (measured) = 0.838 mW/g

### Rear/Rel. 99\_RMC 12.2kbps ch 9400 w/ headset/Zoom Scan (5x5x7)/Cube 0:

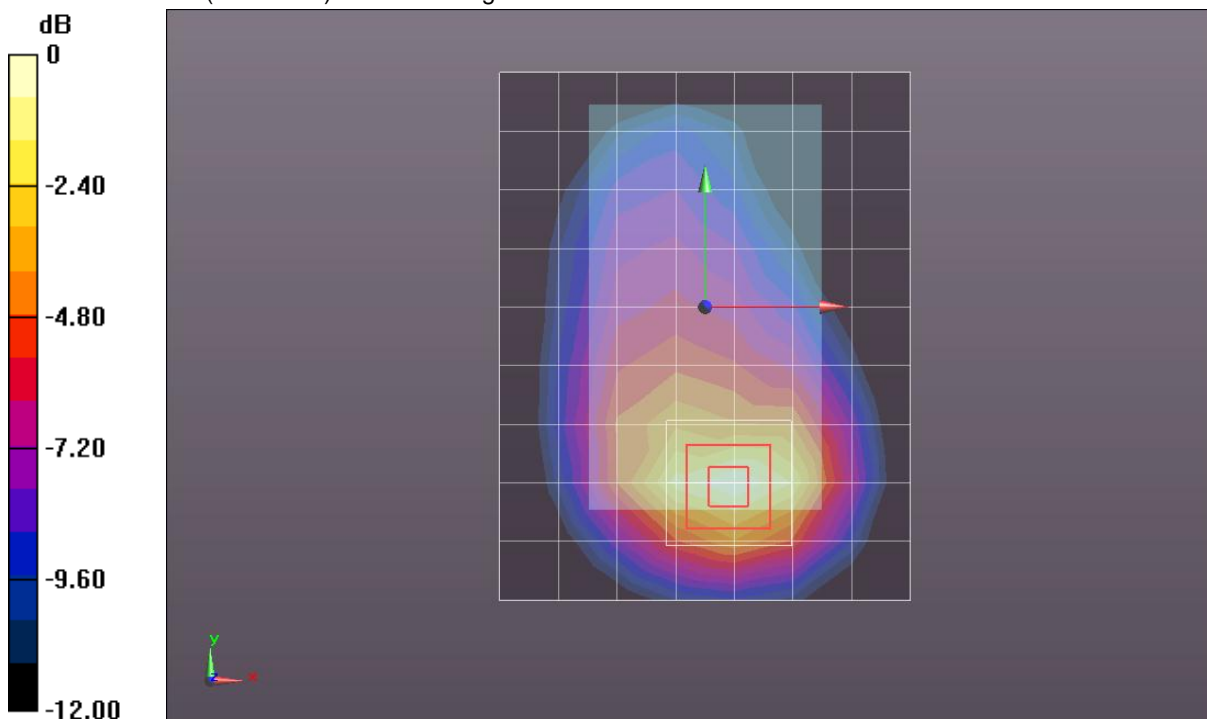
Measurement grid:  $dx=8$ mm,  $dy=8$ mm,  $dz=5$ mm

Reference Value = 24.000 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 1.0350

**SAR(1 g) = 0.671 mW/g; SAR(10 g) = 0.394 mW/g**

Maximum value of SAR (measured) = 0.843 mW/g



0 dB = 0.840mW/g = -1.51 dB mW/g

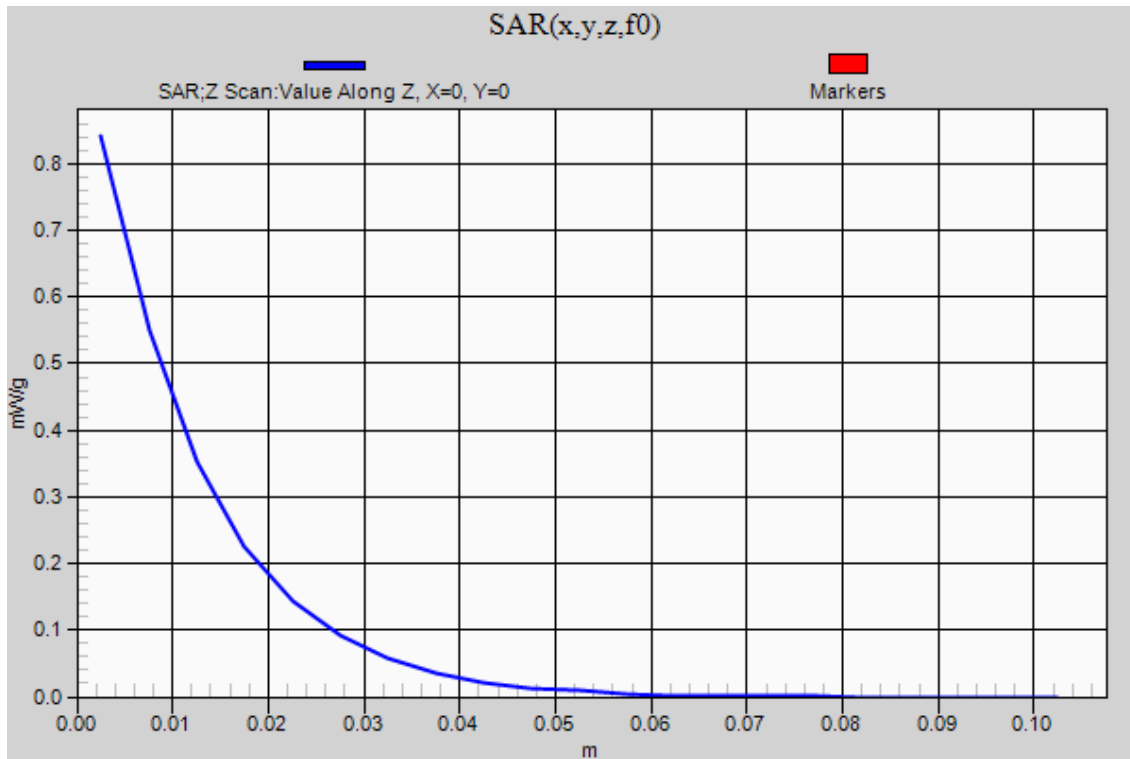
### W-CDMA Band II

Frequency: 1880 MHz; Duty Cycle: 1:1

#### Rear/Rel. 99\_RMC 12.2kbps ch 9400 w/ headset/Z Scan (1x1x21): Measurement grid:

dx=20mm, dy=20mm, dz=5mm

Maximum value of SAR (measured) = 0.841 mW/g



Test Laboratory: UL CCS SAR Lab D

Date: 4/2/2012

## WiFi 2.4GHz

Frequency: 2437 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C

Medium parameters used (interpolated):  $f = 2437$  MHz;  $\sigma = 1.91$  mho/m;  $\epsilon_r = 51.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>;

DASY4 Configuration:

- Electronics: DAE3 Sn427; Calibrated: 1/17/2012
- Probe: EX3DV4 - SN3749; ConvF(6.66, 6.66, 6.66); Calibrated: 1/27/2012
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: SAM B (Twin); Type: SAM B; Serial: TP-105

**Rear/Ch 6/Area Scan (8x11x1):** Measurement grid: dx=15mm, dy=15mm

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

Maximum value of SAR (measured) = 0.103 mW/g

**Rear/Ch 6/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

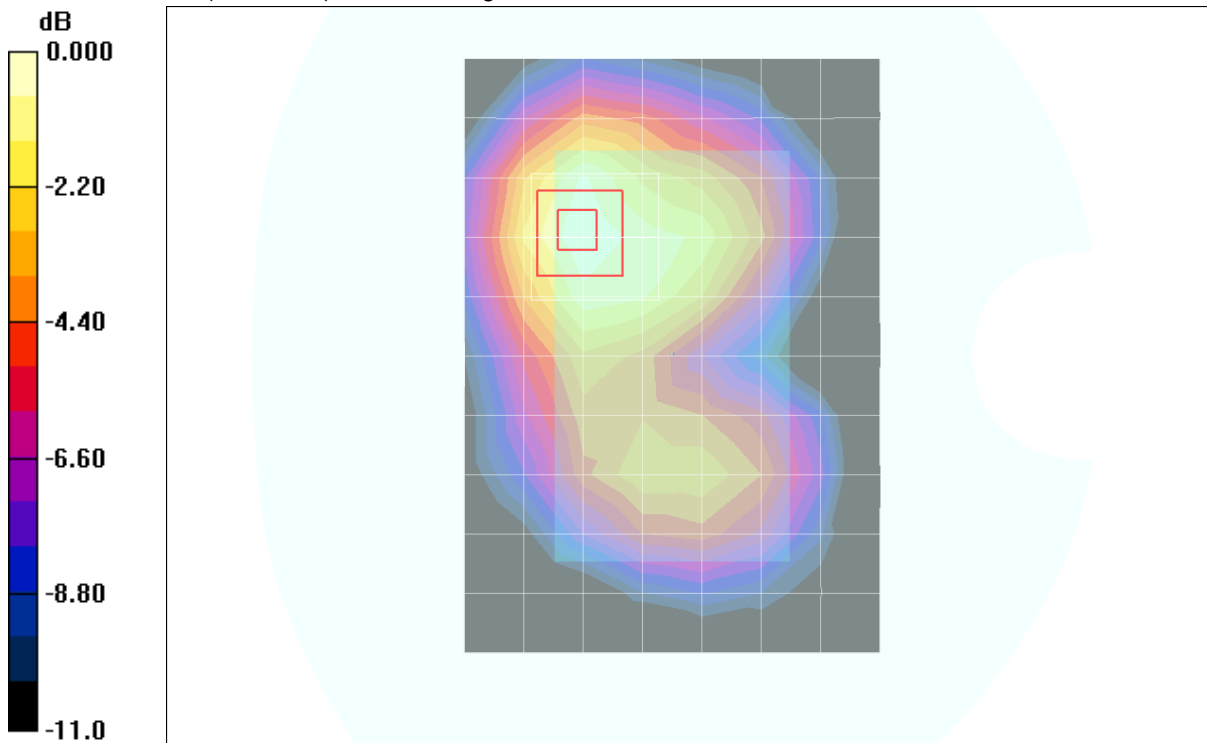
Reference Value = 7.37 V/m; Power Drift = -0.009 dB

Peak SAR (extrapolated) = 0.145 W/kg

**SAR(1 g) = 0.080 mW/g; SAR(10 g) = 0.045 mW/g**

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

Maximum value of SAR (measured) = 0.101 mW/g



0 dB = 0.101mW/g

Test Laboratory: UL CCS SAR Lab D

Date: 4/2/2012

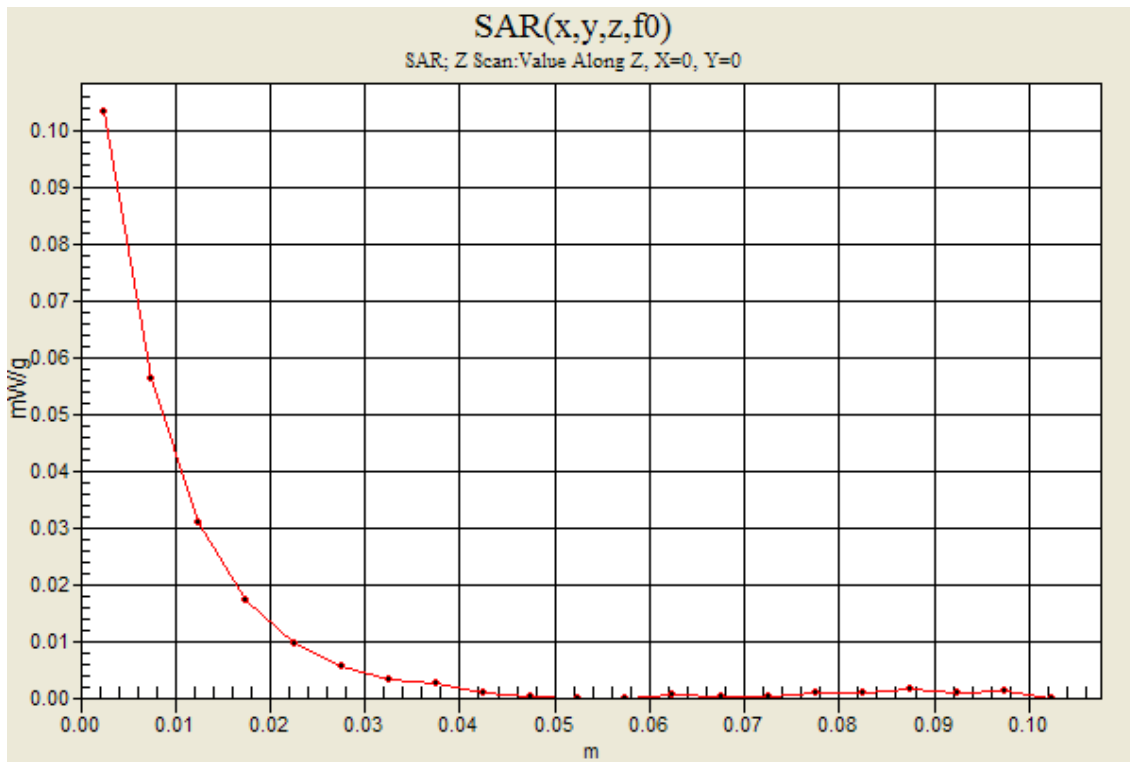
## WiFi 2.4GHz

Frequency: 2437 MHz; Duty Cycle: 1:1

**Rear/Ch 6/Z Scan (1x1x21):** Measurement grid: dx=20mm, dy=20mm, dz=5mm

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.103 mW/g



## 14. Simultaneous Transmission SAR Analysis

Stand-alone SAR evaluation is not required as the Bluetooth output power is  $\leq 2 \cdot P_{\text{Ref}}$  (13.8dBm / 24 mW) and the antenna separation is  $\geq 5$  cm. Therefore, simultaneous transmission SAR evaluation is not required between Bluetooth and any other transmitters.

### 14.1. Sum of the 1g SAR for Head Exposure Condition

N/A: WWAN (GSM/GPRS)/W-CDMA cannot transmit simultaneously with Wi-Fi

### 14.2. Sum of the 1g SAR for Body Exposure Condition

N/A: WWAN (GSM/GPRS)/W-CDMA cannot transmit simultaneously with Wi-Fi

### 14.3. SAR to Peak Location Separation Ratio (SPLSR)

N/A

## 15. Appendixes

Refer to separated files for the following appendixes.

- 15.1. System Performance Check Plots
- 15.2. SAR Test Plots for GSM850
- 15.3. SAR Test Plots for GSM1900
- 15.4. SAR Test Plots for WCDMA (UMTS) Band V
- 15.5. SAR Test Plots for WCDMA (UMTS) Band II
- 15.6. SAR Test Plots for WiFi 2.4 GHz
- 15.7. Calibration Certificate for E-Field Probe EX3DV4 - SN 3772
- 15.8. Calibration Certificate for D835V2 - SN 4d002
- 15.9. Calibration Certificate for D1900V2 - SN 5d043
- 15.10. Calibration Certificate for D2450V2 - SN 748