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

SAR EVALUATION REPORT

For

BT3.0+HS, 802.11BGN 1X1 HT20, GSM850/1900 & WCDMA 850MHz BAR Phone with Hotspot, Edge RX only

Model: GT-S5300B
FCC ID: A3LGTS5300B

Report Number: 12I14311-5-B
Issue Date: March 16, 2012

Prepared for

SAMSUNG ELECTRONICS CO., LTD.
416, MAETAN 3-DONG, YEONGTONG-GU
SUWON-CITY, GYEONGGI-DO 443-742, SOUTH KOREA

Prepared by

COMPLIANCE CERTIFICATION SERVICES (UL CCS)
47173 BENICIA STREET
FREMONT, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888

NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	March 16, 2012	Initial Issue	--
A	March 21, 2012	Removed GPRS Head SAR measurements as VoIP over GPRS is not supported	Dave Weaver
B	March 28, 2012	Completely removed GPRS Head SAR measurements following TCB reviewer comments	Dave Weaver

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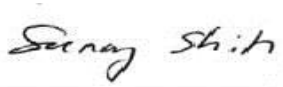
1. Attestation of Test Results

Applicant	Samsung Electronics Co., Ltd.		
DUT description	BT3.0+HS, 802.11BGN 1X1 HT20, GSM850/1900 & WCDMA 850MHz BAR Phone with Hotspot, Edge RX only		
Model	GT-S5300B		
Test device is	An identical prototype		
Device category	Portable		
Exposure category	General Population/Uncontrolled Exposure		
Date tested	February 29 - March 6, 2012		
FCC Rule Parts	Freq. Range	Highest 1-g SAR	Limit
22	824-849 MHz	Head: 0.645 W/kg (Left Touch) Body & Hotspot: 0.725 W/kg (Rear w/ 10mm distance)	1.6 W/kg
24	1850-1910 MHz	Head: 0.874 W/kg (Left Touch) Body & Hotspot: 0.599 W/kg (Rear w/ 10 mm distance)	
15.247	2412-2462 MHz	Head: 0.845 W/kg (Left Touch) Body & Hotspot: 0.247 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:



Sunny Shih
Engineering Team Leader
Compliance Certification Services (UL CCS)

Tested By:

Chakrit Thammanavarat
SAR 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.

- 648474 D01 SAR Handsets Multi Xmiter and Ant, v01r05
- 248227 D01 SAR meas for 802 11abg v01r02
- 941225 D01 SAR test for 3G devices v02
- 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 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	3751	12	19	2012
E-Field Probe	SPEAG	EX3DV4	3531	12	19	2012
Thermometer	ERTCO	639-1S	1718	7	19	2012
Data Acquisition Electronics	SPEAG	DAE4	1259	2	13	2013
Data Acquisition Electronics	SPEAG	DAE3	500	7	14	2012
System Validation Dipole	SPEAG	D835V2	4d117	4	15	2012
System Validation Dipole	SPEAG	D1900V2	5d140	4	18	2012
System Validation Dipole	SPEAG	D2450V2	748	2	7	2013
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		

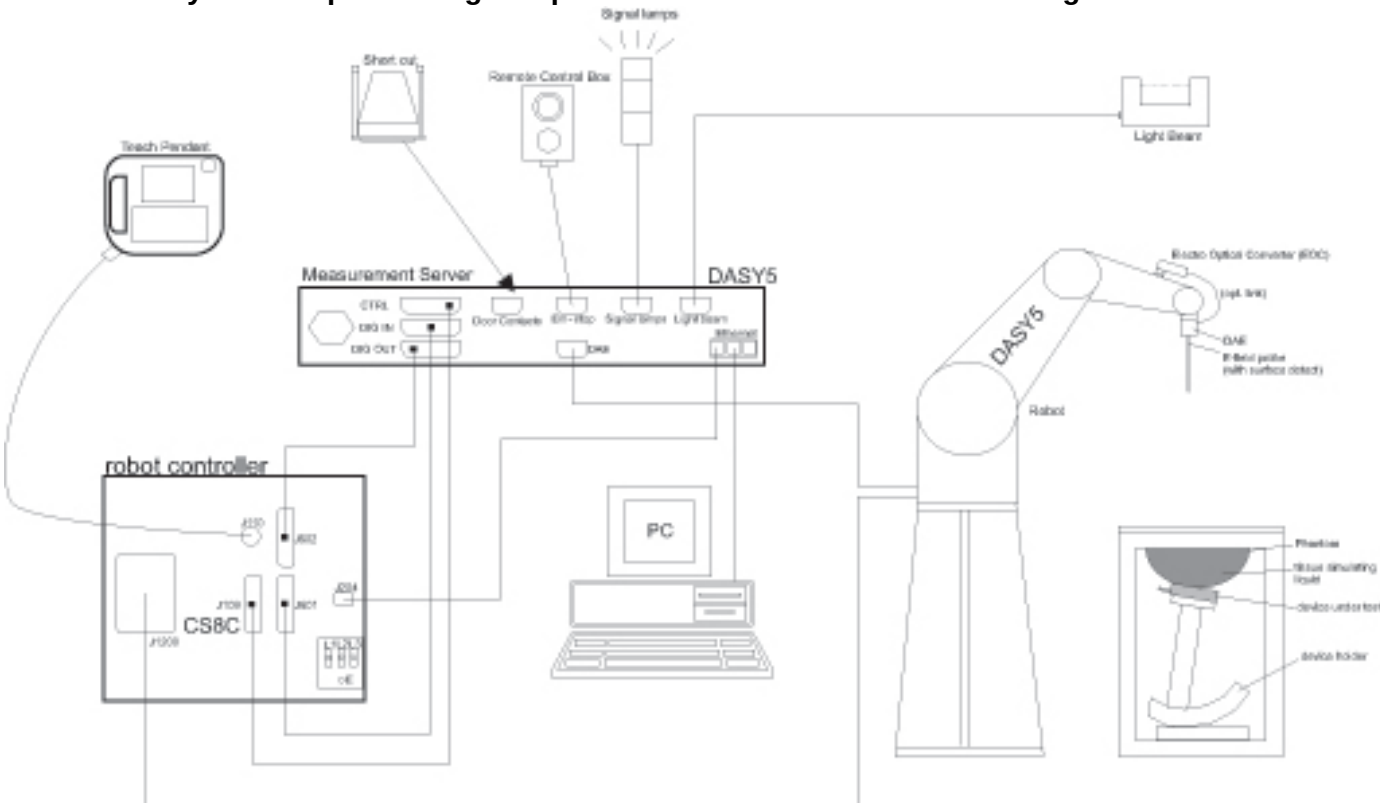
4.2. Measurement Uncertainty

Measurement uncertainty for 300 MHz to 3 GHz averaged over 1 gram

Component	Error, %	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	**-4.88**	Normal	1	0.64	-3.12
Liquid Permittivity - deviation from target	5.00	Rectangular	1.732	0.6	1.73
Liquid Permittivity - measurement uncertainty	**4.65**	Normal	1	0.6	2.79
				Combined Standard Uncertainty Uc(y) =	10.33
				Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence = 20.66 %	
				Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence = 1.63 dB	

5. Measurement System Description and Setup

The DASY5 system for performing compliance tests consists of the following items:



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- 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 Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- 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.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP or Win7 and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

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 ≥ 7x7x9 (above 4.5 GHz) or 5x5x7 (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.

6.2. Volume Scan 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 ≥ 7x7x9 (above 4.5 GHz) or 5x5x7 (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

BT3.0+HS, 802.11BGN 1X1 HT20, GSM850/1900 & WCDMA 850MHz BAR Phone with Hotspot, Edge RX only MODEL: GT-S5300B	
Normal operation	- Held to head, - Body (Rear and Front sides) with 10 mm separation distance. - Hotspot (wireless router) with 10 mm separation distance to all sides and edges.
Accessory	Headset

7.1. Band and Air Interfaces

Tx Frequency Bands	- GSM850: 824 - 849 MHz - GSM1900: 1850 - 1910 MHz - UMTS Band V: 824 - 849 MHz - 802.11b/g/n: 2412 - 2462 MHz, HT20 - Bluetooth: 2402 - 2480 MHz
Air Interfaces	- GSM, GPRS and EGPRS (Rx only) - UMTS (WCDMA) Rel 99, HSDPA (Rel 5, CAT 8), HSUPA (Not support) - 802.11b/g/n - Bluetooth Ver 3.0 with EDR

Note: WiFi and Bluetooth share the same antenna, and WiFi cannot transmit simultaneously with Bluetooth.

7.2. Hotspot (Wireless Router) Exposure Condition

Mode	Band	Tx (MHz)
GPRS + WiFi	835	835/2400
GPRS + WiFi	1900	1900/2400
WCDMA + WiFi	V	835/2400

7.3. Simultaneous Transmission Conditions

No.	Capable TX Configuration	Note
1	GSM 835 Voice + WiFi/BT	
2	GSM 1900 Voice + WiFi/BT	
3	WCDMA Band V Voice + WiFi/BT	

8. Summary of Test Configurations

8.1. Exposure Conditions for WWAN

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	1 mm	Yes	
Front	2 mm	Yes	
Edge 1	87 mm	No	SAR is not required because the distance from the WWAN antenna to this edge is > 2.5 cm as per KDB 941225 D06 Hot Sport SAR v01
Edge 2	0 mm	Yes	
Edge 3	0 mm	Yes	
Edge 4	0 mm	Yes	

8.2. Exposure Conditions for WiFi

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	4 mm	Yes	
Front	2 mm	Yes	
Edge 1	9mm	Yes	
Edge 2	0.5mm	Yes	
Edge 3	81mm	No	SAR is not required because the distance from the WiFi antenna to this edge is > 2.5 cm as per KDB 941225 D06 Hot Sport SAR v01
Edge 4	47 mm	No	SAR is not required because the distance from the WiFi antenna to this edge is > 2.5 cm as per KDB 941225 D06 Hot Sport SAR v01

9. RF Output Power Measurement

9.1. GSM850/1900

GSM (GMSK) Voice Mode

Band	Ch No.	Freq. (MHz)	Avg burst Pwr (dBm)
850	128	824.2	32.8
	190	836.6	32.8
	251	848.8	32.6
1900	512	1850.2	29.9
	661	1880.0	29.8
	810	1909.8	29.6

GPRS (GMSK) - Coding Scheme: CS1

Band	Ch No.	f (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
850	128	824.2	32.7	23.7	31.2	**25.2**	29.2	24.9	27.2	24.2
	190	836.6	32.8	23.7	31.3	**25.2**	29.3	25.0	27.3	24.2
	251	848.8	32.6	23.6	31.1	**25.1**	29.3	25.0	27.3	24.3
1900	512	1850.2	29.8	20.8	28.3	**22.3**	26.3	22.0	24.3	21.3
	661	1880.0	29.8	20.8	28.3	**22.3**	26.2	21.9	24.2	21.2
	810	1909.8	29.6	20.6	28.0	**22.0**	26.0	21.7	24.0	21.0

EGPRS (8PSK) – Coding Scheme: MCS5
This mode is Rx only.

Notes:
Based on output power above and time slots, the following worst-case configurations were chosen for Body SAR testing.
a. GPRS850 2 time slots
b. GPRS1900 2 time slots

9.2. UMTS (WCDMA) Band V

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 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
	βc/βd	8/15

Band	Mode	UL Ch No.	Freq. (MHz)	Measured Avg. Power (dBm)
UMTS (WCDMA) Band V	Rel 99 (RMC, 12.2kbps)	4132	826.4	22.7
		4183	836.6	22.8
		4233	846.6	22.7

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			
	βc	2/15	12/15	15/15	15/15
	βd	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	βc/βd	2/15	12/15	15/8	15/4
	βhs	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			
	Ahs =βhs/βc	30/15			

Band	Mode	UL Ch No.	Freq. (MHz)	Target MPR	Meas. MPR	Measured Avg. Power (dBm)
UMTS (WCDMA) Band V	Subtest 1	4132	826.4	0	0	22.7
		4183	836.6	0	0	22.8
		4233	846.6	0	0	22.7
	Subtest 2	4132	826.4	1	2	20.6
		4183	836.6	1	2	20.5
		4233	846.6	1	2	20.6
	Subtest 3	4132	826.4	1.5	4	19.2
		4183	836.6	1.5	4	19.0
		4233	846.6	1.5	4	19.2
	Subtest 4	4132	826.4	1.5	4	18.7
		4183	836.6	1.5	4	18.5
		4233	846.6	1.5	4	18.6

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 or the maximum SAR for 12.2 kbps RMC is < 75% of the SAR limit.

9.3. Wi-Fi (802.11bgn)

Mode	Channel #	Freq. (MHz)	Conducted Avg Power	
			(dBm)	(mW)
802.11b	1	2412	14.7	29.58
	6	2437	15.0	31.77
	11	2462	15.2	33.11
802.11g	1	2412	14.1	25.88
	6	2437	14.3	26.92
	11	2462	14.6	28.84
802.11n (HT20)	1	2412	12.1	16.07
	6	2437	12.4	17.18
	11	2462	12.6	18.03

9.4. Bluetooth

Mode	Channel #	Freq. (MHz)	Conducted Avg Power	
			(dBm)	(mW)
GFSK	0	2402	5.3	3.37
	39	2441	5.5	3.56
	78	2480	5.0	3.13
8PSK	0	2402	3.5	2.23
	39	2441	3.6	2.26
	78	2480	3.1	2.06

Note(s):

According to KDB 648474, Table 2, Unlicensed transmitters
When there is simultaneous transmission, Stand-alone SAR not required due to

- ☒ Output ≤ 2 · P_{Ref} (24 mW) and antenna is ≥ 5.0 cm from other antennas
- ☐ Output ≤ P_{Ref} (12 mW) and antenna is ≥ 2.5 cm from other antennas
- ☐ Output ≤ P_{Ref} (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	
	ε_r	σ (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	
	ε_r	σ (S/m)	ε_r	σ (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

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 Parameters Check Results

Tissue dielectric parameters 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 ±(%)
2/29/2012	Head 2450	e'	38.4251	Relative Permittivity (ϵ_r):	38.43	39.20	-1.98	5
		e''	13.3362	Conductivity (σ):	1.82	1.80	0.93	5
	Head 2410	e'	38.5571	Relative Permittivity (ϵ_r):	38.56	39.28	-1.84	5
		e''	13.2120	Conductivity (σ):	1.77	1.76	0.57	5
	Head 2435	e'	38.4806	Relative Permittivity (ϵ_r):	38.48	39.24	-1.92	5
		e''	13.2952	Conductivity (σ):	1.80	1.78	0.99	5
	Head 2475	e'	38.3113	Relative Permittivity (ϵ_r):	38.31	39.17	-2.19	5
		e''	13.4065	Conductivity (σ):	1.84	1.83	0.98	5
2/29/2012	Head 835	e'	43.3742	Relative Permittivity (ϵ_r):	43.37	41.50	4.52	5
		e''	19.4697	Conductivity (σ):	0.90	0.90	0.44	5
	Head 820	e'	43.5375	Relative Permittivity (ϵ_r):	43.54	41.60	4.65	5
		e''	19.5022	Conductivity (σ):	0.89	0.90	-1.03	5
	Head 850	e'	43.1571	Relative Permittivity (ϵ_r):	43.16	41.50	3.99	5
		e''	19.4343	Conductivity (σ):	0.92	0.92	0.38	5
3/1/2012	Head 835	e'	41.4291	Relative Permittivity (ϵ_r):	41.43	41.50	-0.17	5
		e''	18.9191	Conductivity (σ):	0.88	0.90	-2.40	5
	Head 820	e'	41.6094	Relative Permittivity (ϵ_r):	41.61	41.60	0.02	5
		e''	18.9850	Conductivity (σ):	0.87	0.90	-3.66	5
	Head 850	e'	41.2615	Relative Permittivity (ϵ_r):	41.26	41.50	-0.57	5
		e''	18.8952	Conductivity (σ):	0.89	0.92	-2.40	5
3/2/2012	Body 835	e'	53.5070	Relative Permittivity (ϵ_r):	53.51	55.20	-3.07	5
		e''	21.1785	Conductivity (σ):	0.98	0.97	1.37	5
	Body 820	e'	53.6827	Relative Permittivity (ϵ_r):	53.68	55.28	-2.88	5
		e''	21.2306	Conductivity (σ):	0.97	0.97	-0.05	5
	Body 850	e'	53.3167	Relative Permittivity (ϵ_r):	53.32	55.16	-3.34	5
		e''	21.1212	Conductivity (σ):	1.00	0.99	1.12	5
3/3/2012	Body 835	e'	53.5120	Relative Permittivity (ϵ_r):	53.51	55.20	-3.06	5
		e''	21.2018	Conductivity (σ):	0.98	0.97	1.48	5
	Body 820	e'	53.6561	Relative Permittivity (ϵ_r):	53.66	55.28	-2.93	5
		e''	21.2585	Conductivity (σ):	0.97	0.97	0.08	5
	Body 850	e'	53.3545	Relative Permittivity (ϵ_r):	53.35	55.16	-3.27	5
		e''	21.1425	Conductivity (σ):	1.00	0.99	1.23	5
3/5/2012	Body 1900	e'	51.5441	Relative Permittivity (ϵ_r):	51.54	53.30	-3.29	5
		e''	14.1661	Conductivity (σ):	1.50	1.52	-1.54	5
	Body 1850	e'	51.7135	Relative Permittivity (ϵ_r):	51.71	53.30	-2.98	5
		e''	14.0550	Conductivity (σ):	1.45	1.52	-4.88	5
	Body 1880	e'	51.6187	Relative Permittivity (ϵ_r):	51.62	53.30	-3.15	5
		e''	14.1272	Conductivity (σ):	1.48	1.52	-2.84	5
	Body 1910	e'	51.5096	Relative Permittivity (ϵ_r):	51.51	53.30	-3.36	5
		e''	14.1916	Conductivity (σ):	1.51	1.52	-0.84	5
3/6/2012	Head 1900	e'	40.3200	Relative Permittivity (ϵ_r):	40.32	40.00	0.80	5
		e''	13.5364	Conductivity (σ):	1.43	1.40	2.15	5
	Head 1850	e'	40.5353	Relative Permittivity (ϵ_r):	40.54	40.00	1.34	5
		e''	13.4088	Conductivity (σ):	1.38	1.40	-1.48	5
	Head 1880	e'	40.4056	Relative Permittivity (ϵ_r):	40.41	40.00	1.01	5
		e''	13.4841	Conductivity (σ):	1.41	1.40	0.68	5
	Head 1910	e'	40.2823	Relative Permittivity (ϵ_r):	40.28	40.00	0.71	5
		e''	13.5631	Conductivity (σ):	1.44	1.40	2.89	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 ±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 ±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 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.

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	4d117	4/15/11	835	1g	9.64	10.1
				10g	6.28	6.60
D1900V2	5d140	4/18/11	1900	1g	41.6	41.2
				10g	21.5	21.6
D2450V2	748	2/7/12	2450	1g	53.6	50.8
				10g	24.8	23.6

11.3. System Performance Check Results

Date Tested	System Dipole		Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
2/29/2012	Head	D2450V2 SN: 748	1g SAR	55.0	53.6	2.61	±10
			10g SAR	25.2	24.8	1.61	
2/29/2012	Head	D835V2 SN: 4d117	1g SAR	9.80	9.64	1.66	±10
			10g SAR	6.44	6.28	2.55	
3/1/2012	Head	D835V2 SN: 4d117	1g SAR	9.98	9.64	3.53	±10
			10g SAR	6.53	6.28	3.98	
3/1/2012	Body	D2450V2 SN: 748	1g SAR	52.5	50.8	3.35	±10
			10g SAR	24.2	23.64	2.37	
3/2/2012	Body	D835V2 SN: 4d117	1g SAR	9.59	10.1	-5.05	±10
			10g SAR	6.32	6.6	-4.24	
3/3/2012	Body	D835V2 SN: 4d117	1g SAR	10.1	10.1	0.00	±10
			10g SAR	6.65	6.6	0.76	
3/5/2012	Body	D1900V2 SN: 5d140	1g SAR	41.1	41.2	-0.24	±10
			10g SAR	21.9	21.6	1.39	
3/6/2012	Head	D1900V2 SN: 5d140	1g SAR	40.9	41.6	-1.68	±10
			10g SAR	21.5	21.5	0.00	
3/6/2012	Head	D1900V2 SN: 5d140	1g SAR	39.4	41.6	-5.29	±10
			10g SAR	20.7	21.5	-3.72	

12. SAR Test Results

12.1. GSM850

Head SAR

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Avg Pwr (dBm)	SAR (mW/g)		Note
						1-g	10-g	
Left Touch	GSM	0	128	824.20	32.8			1
			190	836.60	32.8	0.645	0.449	
			251	848.80	32.6			1
Left Tilt (15°)	GSM	0	128	824.20	32.8			1
			190	836.60	32.8	0.254	0.194	
			251	848.80	32.6			1
Right Touch	GSM	0	128	824.20	32.8			1
			190	836.60	32.8	0.614	0.420	
			251	848.80	32.6			1
Right Tilt (15°)	GSM	0	128	824.20	32.8			1
			190	836.60	32.8	0.255	0.193	
			251	848.80	32.6			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.

Body & Hotspot SAR

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Avg Pwr (dBm)	SAR (mW/g)		Note
						1-g	10-g	
Rear	GPRS 2 slots	10	128	824.20	31.2			1
			190	836.60	31.3	0.725	0.506	
			251	848.80	31.1			1
			190	836.60	31.3	0.559	0.390	2
Front	GPRS 2 slots	10	128	824.20	31.2			1
			190	836.60	31.3	0.593	0.411	
			251	848.80	31.1			1
Edge 1	GPRS 2 slots	10	128	824.20	31.2			3
			190	836.60	31.3			3
			251	848.80	31.1			3
Edge 2	GPRS 2 slots	10	128	824.20	31.2			1
			190	836.60	31.3	0.182	0.127	
			251	848.80	31.1			1
Edge 3	GPRS 2 slots	10	128	824.20	31.2			1
			190	836.60	31.3	0.110	0.068	
			251	848.80	31.1			1
Edge 4	GPRS 2 slots	10	128	824.20	31.2			1
			190	836.60	31.3	0.279	0.194	
			251	848.80	31.1			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-edge's distance is greater than 2.5 cm.

12.2. GSM1900

Head SAR

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Avg Pwr (dBm)	SAR (mW/g)		Note
						1-g	10-g	
Left Touch	GSM	0	512	1850.2	29.9	0.874	0.466	
			661	1880.0	29.8	0.849	0.442	
			810	1909.8	29.6	0.756	0.403	
Left Tilt (15°)	GSM	0	512	1850.2	29.9			1
			661	1880.0	29.8	0.185	0.105	
			810	1909.8	29.6			1
Right Touch	GSM	0	512	1850.2	29.9			1
			661	1880.0	29.8	0.493	0.268	
			810	1909.8	29.6			1
Right Tilt (15°)	GSM	0	512	1850.2	29.9			1
			661	1880.0	29.8	0.194	0.110	
			810	1909.8	29.6			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.

Body & Hotspot SAR with 10 mm separation distance

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Avg Pwr (dBm)	SAR (mW/g)		Note
						1-g	10-g	
Rear	GPRS 2 slots	10	512	1850.2	28.3			1
			661	1880.0	28.3	0.572	0.347	
			810	1909.8	28.0			1
			661	1880.0	28.3	0.599	0.358	2
Front	GPRS 2 slots	10	512	1850.2	28.3			1
			661	1880.0	28.3	0.490	0.294	
			810	1909.8	28.0			1
Edge 1	GPRS 2 slots	10	512	1850.2	28.3			3
			661	1880.0	28.3			3
			810	1909.8	28.0			3
Edge 2	GPRS 2 slots	10	512	1850.2	28.3			1
			661	1880.0	28.3	0.097	0.059	
			810	1909.8	28.0			1
Edge 3	GPRS 2 slots	10	512	1850.2	28.3			1
			661	1880.0	28.3	0.371	0.214	
			810	1909.8	28.0			1
Edge 4	GPRS 2 slots	10	512	1850.2	28.3			1
			661	1880.0	28.3	0.129	0.080	
			810	1909.8	28.0			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-edge’s distance is greater than 2.5 cm.

12.3. UMTS (WCDMA) 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

Head SAR

Test Position	Mode	Ch #.	Freq. (MHz)	Avg Pwr (dBm)	SAR (mW/g)		Note
					1-g	10-g	
Left Touch	Rel 99 RMC, 12.2 kbps	4132	826.4	22.7			1
		4183	836.6	22.8	0.493	0.335	
		4233	846.6	22.7			1
Left Tilt (15°)	Rel 99 RMC, 12.2 kbps	4132	826.4	22.7			1
		4183	836.6	22.8	0.177	0.135	
		4233	846.6	22.7			1
Right Touch	Rel 99 RMC, 12.2 kbps	4132	826.4	22.7			1
		4183	836.6	22.8	0.395	0.276	
		4233	846.6	22.7			1
Right Tilt (15°)	Rel 99 RMC, 12.2 kbps	4132	826.4	22.7			1
		4183	836.6	22.8	0.171	0.130	
		4233	846.6	22.7			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.

Body & Hotspot SAR with 10 mm separation distance

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Avg Pwr (dBm)	SAR (mW/g)		Note
						1-g	10-g	
Rear	Rel 99	10	4357	826.4	22.7			1
			4408	836.6	22.8	0.425	0.297	
			4458	846.6	22.7			1
			4408	836.6	22.8	0.320	0.226	2
Front	Rel 99	10	4357	826.4	22.7			1
			4408	836.6	22.8	0.310	0.216	
			4458	846.6	22.7			1
Edge 1	Rel 99	10	4357	826.4	22.7			3
			4408	836.6	22.8			3
			4458	846.6	22.7			3
Edge 2	Rel 99	10	4357	826.4	22.7			1
			4408	836.6	22.8	0.099	0.069	
			4458	846.6	22.7			1
Edge 3	Rel 99	10	4357	826.4	22.7			1
			4408	836.6	22.8	0.060	0.036	
			4458	846.6	22.7			1
Edge 4	Rel 99	10	4357	826.4	22.7			1
			4408	836.6	22.8	0.135	0.095	
			4458	846.6	22.7			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-edge's distance is greater than 2.5 cm.

12.4. Wi-Fi 11bgn

Test Reduction Consideration

SAR is not required for 802.11g/n (HT20) 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.

Head SAR

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Avg Pwr (dBm)	SAR (mW/g)		Note
						1-g	10-g	
Left Touch	802.11b	0	1	2412	14.7	0.755	0.320	
			6	2437	15.0	0.843	0.370	
			11	2462	15.2	0.845	0.371	
Left Tilt (15°)	802.11b	0	1	2412	14.7			1
			6	2437	15.0			1
			11	2462	15.2	0.556	0.253	
Right Touch	802.11b	0	1	2412	14.7			1
			6	2437	15.0			1
			11	2462	15.2	0.541	0.283	
Right Tilt (15°)	802.11b	0	1	2412	14.7			1
			6	2437	15.0			1
			11	2462	15.2	0.352	0.174	

Body & Hotspot SAR with 10 mm separation distance

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Avg Pwr (dBm)	SAR (mW/g)		Note
						1-g	10-g	
Rear	802.11b	10	1	2412	14.7			1
			6	2437	15.0			1
			11	2462	15.2	0.177	0.094	
Front	802.11b	10	1	2412	14.7			1
			6	2437	15.0			1
			11	2462	15.2	0.218	0.116	
			11	2462	15.2	0.247	0.132	2
Edge 1	802.11b	10	1	2412	14.7			1
			6	2437	15.0			1
			11	2462	15.2	0.068	0.0348	
Edge 2	802.11b	10	1	2412	14.7			1
			6	2437	15.0			1
			11	2462	15.2	0.243	0.12	
Edge 3	802.11b	10	1	2412	14.7			3
			6	2437	15.0			3
			11	2462	15.2			3
Edge 4	802.11b	10	1	2412	14.7			3
			6	2437	15.0			3
			11	2462	15.2			3

Note(s):

1. Testing was performed on the channel with the highest output power only as the SAR was ≤ 0.8 W/kg with the operating frequency band having a range of < 100 MHz. Per KDB 447498 1) e) i)
2. With headset attached.
3. SAR is not required due to antenna-to-edge's distance is greater than 2.5 cm.

13. Summary of Highest SAR Values

The test configuration for each body exposure condition (head, body and Hotspot) is dependent on the applicable voice or data modes, and antenna selected.

Technology/Band	Test configuration		Mode	Separation distance (mm)	Highest 1g SAR (W/kg)
GSM850	Head	Left Touch	GSM	--	0.645
	Body & Hotspot	Rear	GPRS 2 slot	10	0.725
GSM1900	Head	Left Touch	GSM	--	0.874
	Body & Hotspot	Rear	GPRS 2 slot	10	0.599
UMTS band V	Head	Left Touch	Rel 99 RMC 12.2kbps	--	0.493
	Body & Hotspot	Rear	Rel 99 RMC 12.2kbps	10	0.425
WiFi 2.4 GHz	Head	Left Touch	802.11b 1Mbps	--	0.845
	Body & Hotspot	Front	802.11b 1Mbps	10	0.247

14. Worst-Case SAR Plots

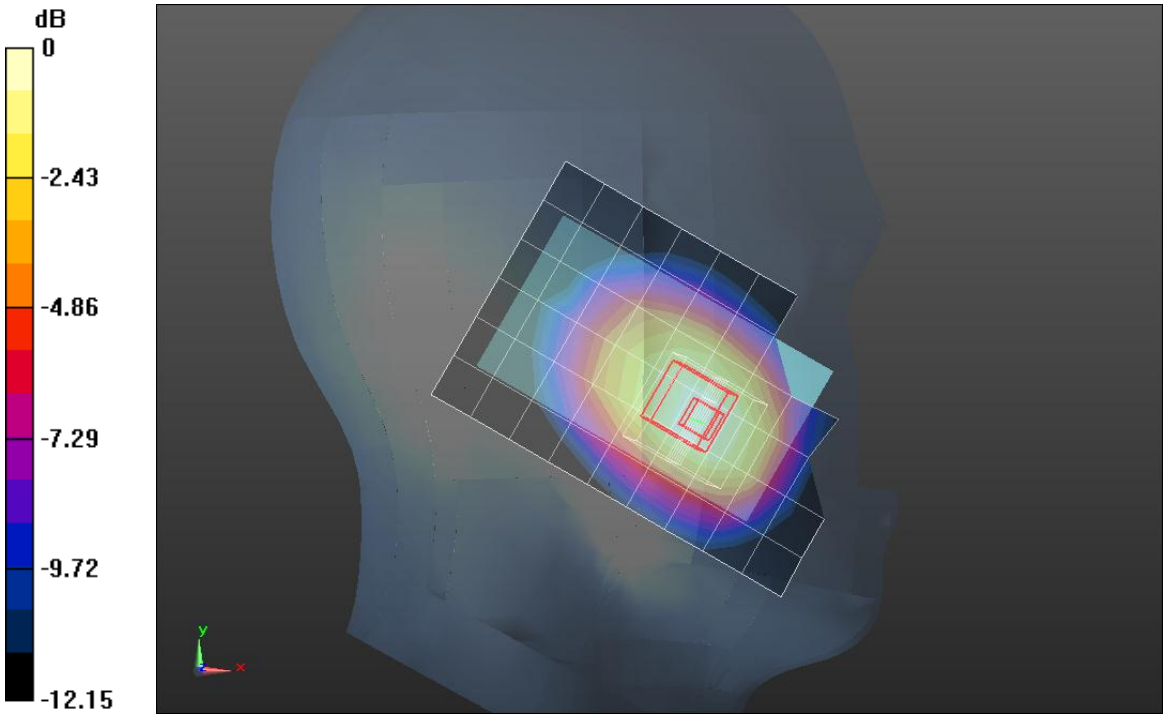
Test Laboratory: UL CCS SAR Lab C Date: 3/2/2012

GSM 850

Frequency: 836.6 MHz; Duty Cycle: 1:8.30042; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.88 mho/m; ε_r = 41.411; ρ = 1000 kg/m^3
DASY5 Configuration:
- Electronics: DAE3 Sn500; Calibrated: 7/14/2011
- Probe: EX3DV4 - SN3751; ConvF(8.35, 8.35, 8.35); Calibrated: 12/19/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: SAM; Type: QD000P40CD; Serial: 1632

Left Touch/GSM_ch 190/Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.675 mW/g

Left Touch/GSM_ch 190/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 27.824 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 0.9070
SAR(1 g) = 0.645 mW/g; SAR(10 g) = 0.449 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.761 mW/g



0 dB = 0.760mW/g = -2.38 dB mW/g

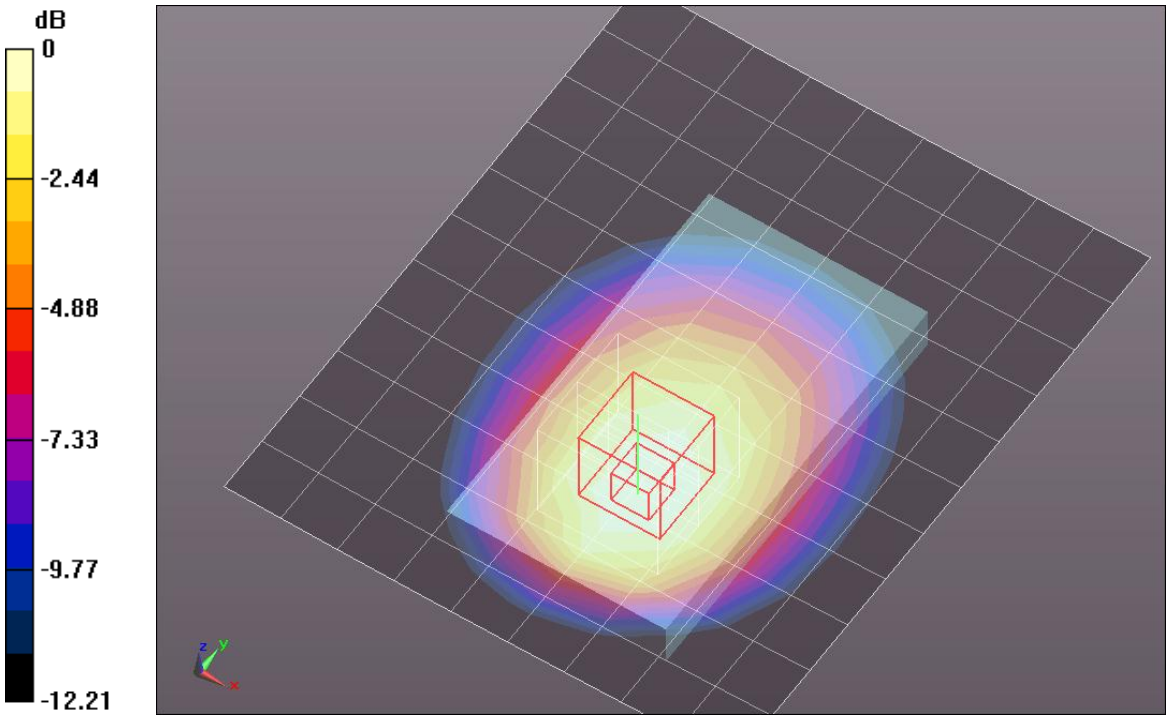
Test Laboratory: UL CCS SAR Lab C
Date: 3/3/2012

GSM 850

Frequency: 836.6 MHz; Duty Cycle: 1:4.00037; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.986 mho/m; ε_r = 53.495; ρ = 1000 kg/m^3
DASY5 Configuration:
- Electronics: DAE3 Sn500; Calibrated: 7/14/2011
- Probe: EX3DV4 - SN3751; ConvF(8.64, 8.64, 8.64); Calibrated: 12/19/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: ELI v5.0 (B); Type: QDOVA001BB; Serial: 1121

Rear/Ch 190/Area Scan (10x12x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.882 mW/g

Rear/Ch 190/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 29.318 V/m; Power Drift = -0.0014 dB
Peak SAR (extrapolated) = 1.0030
SAR(1 g) = 0.725 mW/g; SAR(10 g) = 0.506 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.851 mW/g



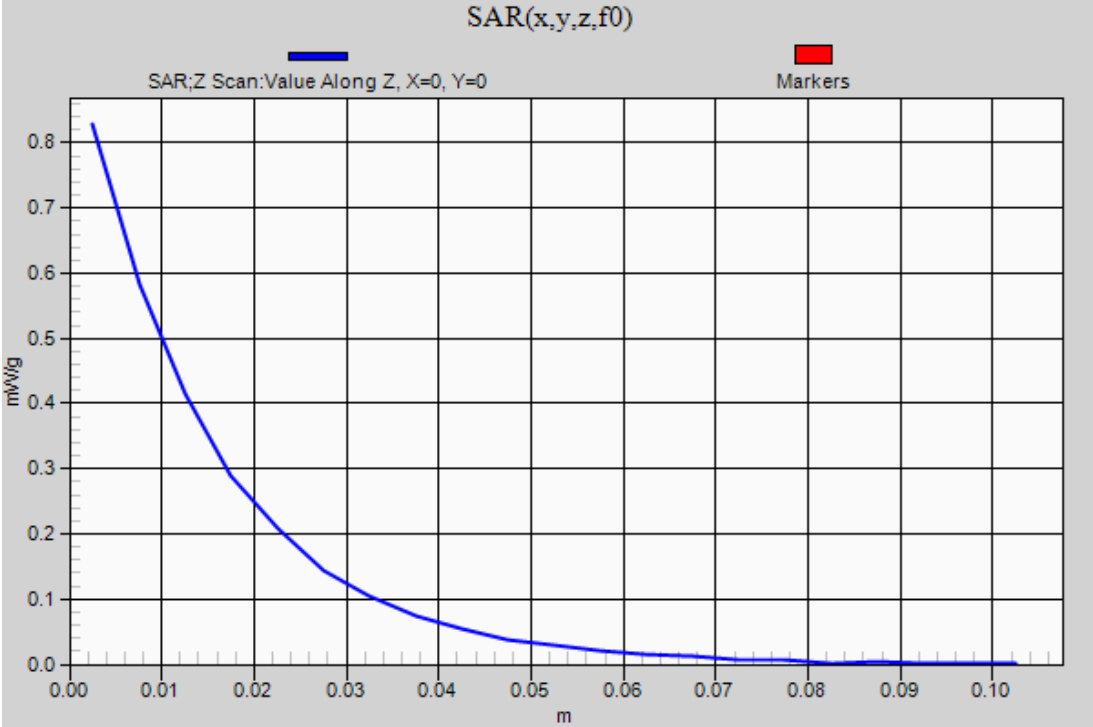
0 dB = 0.850mW/g = -1.41 dB mW/g

Test Laboratory: UL CCS SAR Lab C
Date: 3/3/2012

GSM 850

Frequency: 836.6 MHz; Duty Cycle: 1:4.00037

Rear/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) = 0.828 mW/g



Test Laboratory: UL CCS SAR Lab C
Date: 3/6/2012

GSM 1900

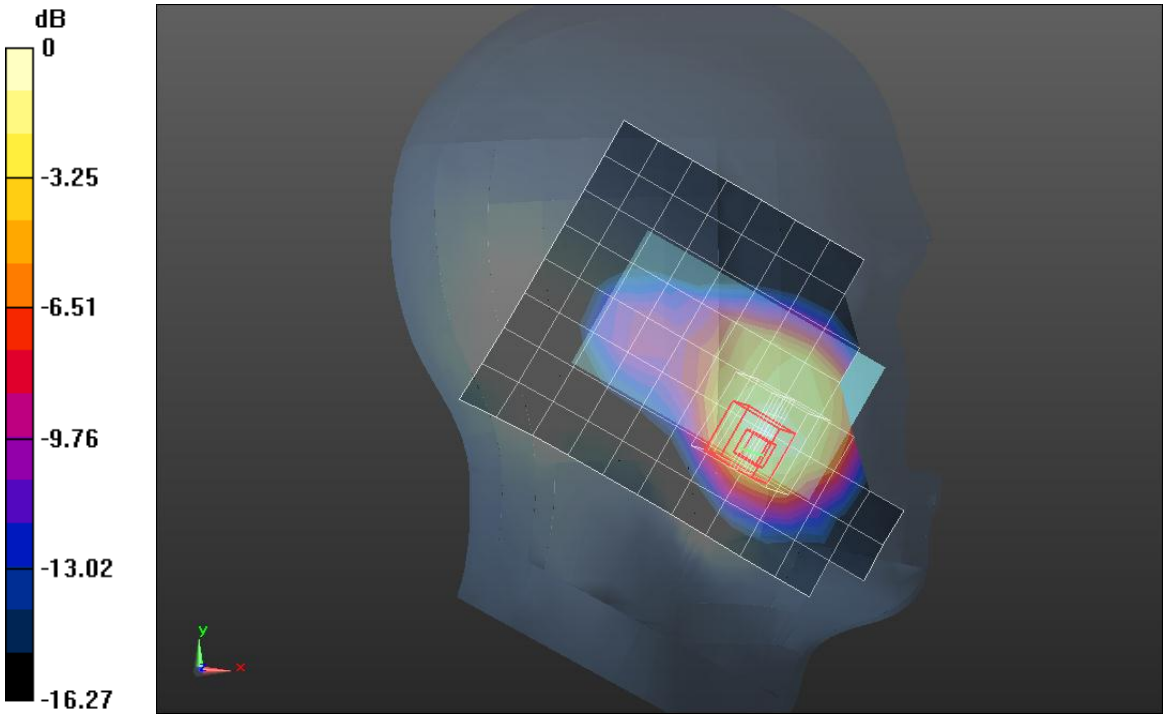
Frequency: 1850.2 MHz; Duty Cycle: 1:8.30042; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C
Medium parameters used (interpolated): f = 1850.2 MHz; σ = 1.38 mho/m; ε_r = 40.534; ρ = 1000 kg/m^3
DASY5 Configuration:
- Electronics: DAE3 Sn500; Calibrated: 7/14/2011
- Probe: EX3DV4 - SN3751; ConvF(7.33, 7.33, 7.33); Calibrated: 12/19/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: SAM; Type: QD000P40CD; Serial: 1629

Left Touch/GSM Ch-512/Area Scan (9x12x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.988 mW/g

Left Touch/GSM Ch-512/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 24.783 V/m; Power Drift = 0.14 dB
Peak SAR (extrapolated) = 1.4790
SAR(1 g) = 0.874 mW/g; SAR(10 g) = 0.466 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.127 mW/g



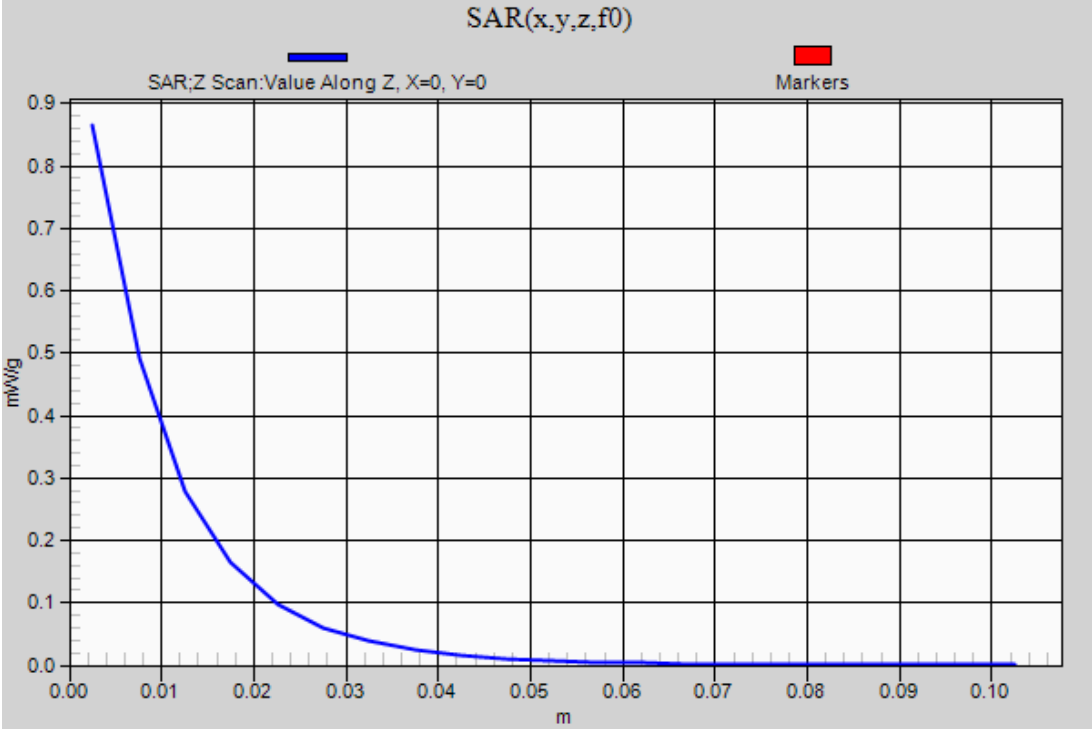
0 dB = 1.130mW/g = 1.06 dB mW/g

Test Laboratory: UL CCS SAR Lab C
Date: 3/6/2012

GSM 1900

Frequency: 1850.2 MHz; Duty Cycle: 1:8.30042

Left Touch/GSM Ch-512/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.865 mW/g



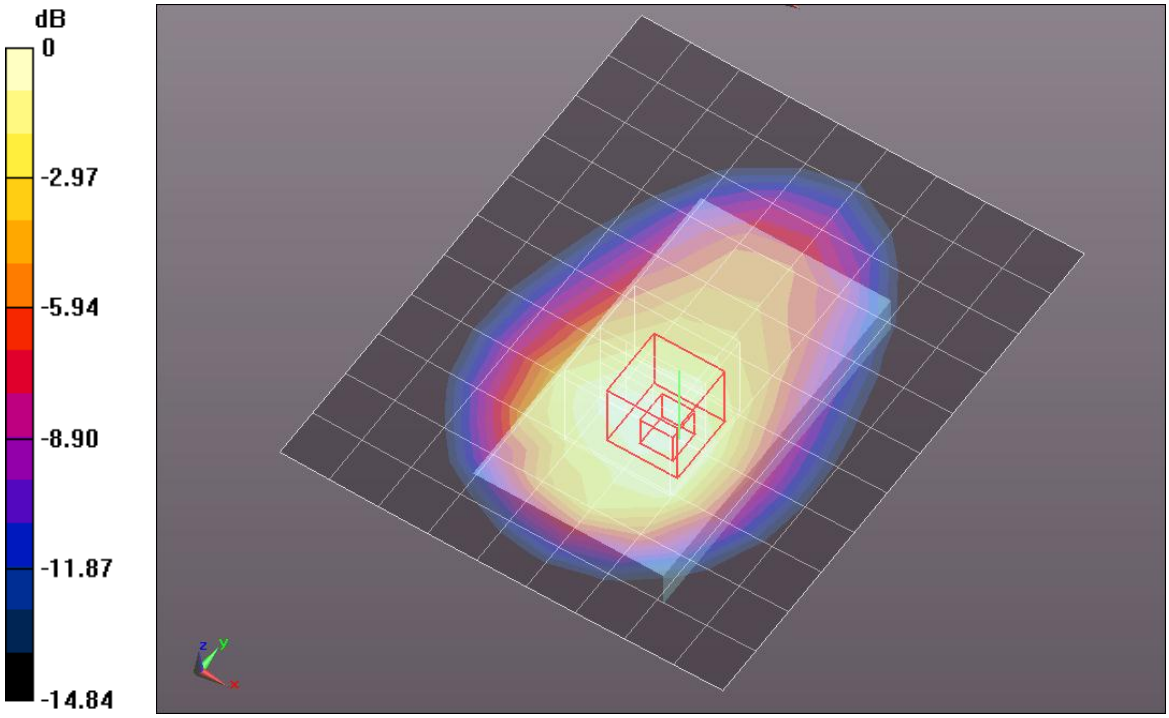
Test Laboratory: UL CCS SAR Lab B
Date: 3/5/2012

GSM 1900

Frequency: 1880 MHz; Duty Cycle: 1:4.00037; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C
Medium parameters used: f = 1880 MHz; σ = 1.478 mho/m; ε_r = 51.619; ρ = 1000 kg/m^3
DASY5 Configuration:
- Electronics: DAE4 Sn1259; Calibrated: 2/13/2012
- Probe: EX3DV3 - SN3531; ConvF(7.91, 7.91, 7.91); Calibrated: 12/19/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: ELI v5.0 (A); Type: QDOVA001BB; Serial: 1120

Rear/Ch 661_w/Headset/Area Scan (10x12x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.743 mW/g

Rear/Ch 661_w/Headset/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.749 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.9890
SAR(1 g) = 0.599 mW/g; SAR(10 g) = 0.358 mW/g



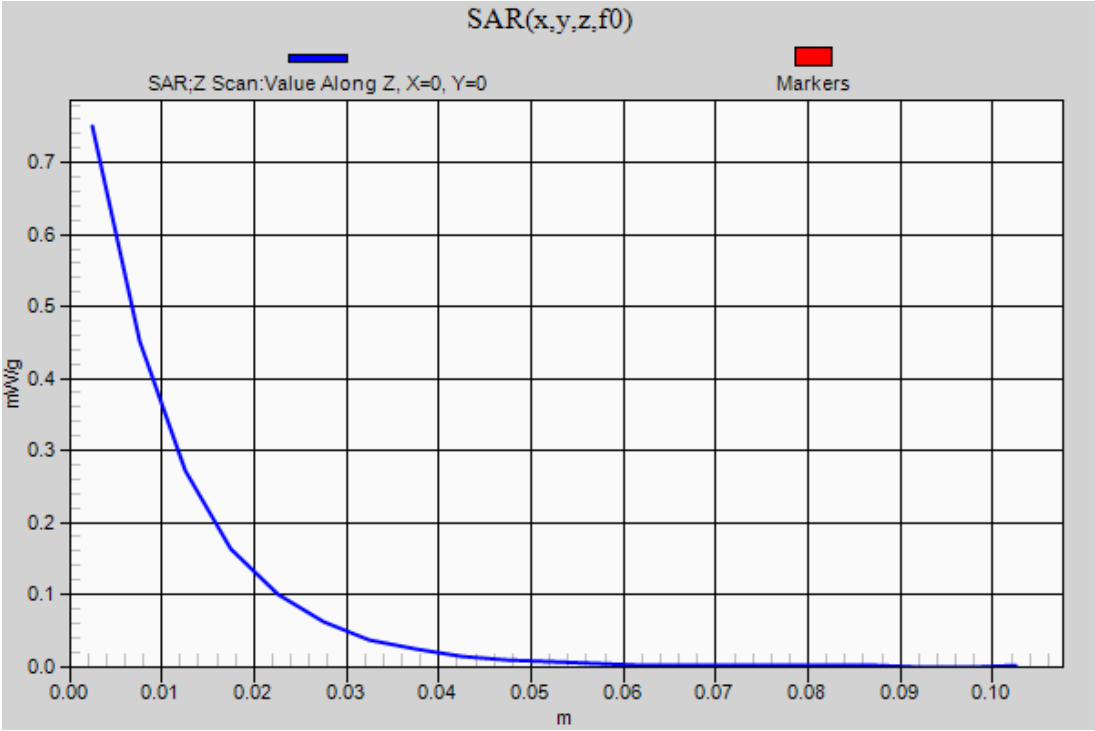
0 dB = 0.740mW/g = -2.62 dB mW/g

Test Laboratory: UL CCS SAR Lab B
Date: 3/5/2012

GSM 1900

Frequency: 1880 MHz; Duty Cycle: 1:4.00037

Rear/Ch 661_w/Headset/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 0.750 mW/g



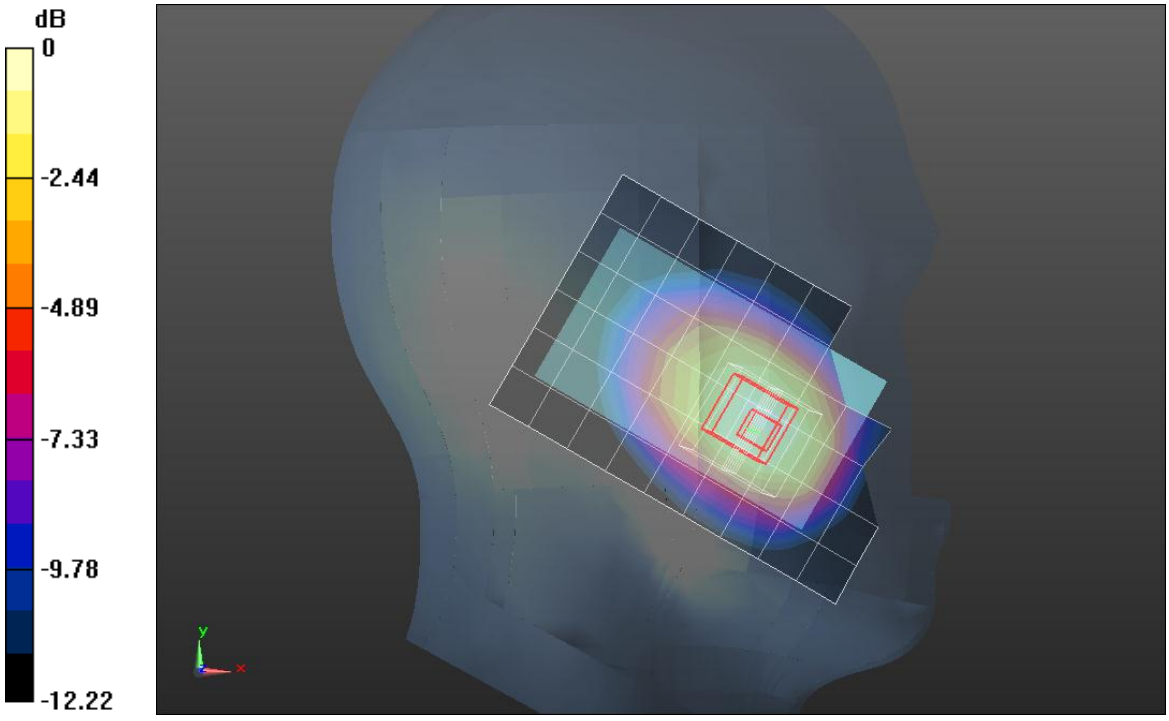
Test Laboratory: UL CCS SAR Lab C
Date: 2/29/2012

UMTS 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; σ = 0.906 mho/m; ε_r = 43.328; ρ = 1000 kg/m^3
DASY5 Configuration:
- Electronics: DAE3 Sn500; Calibrated: 7/14/2011
- Probe: EX3DV4 - SN3751; ConvF(8.35, 8.35, 8.35); Calibrated: 12/19/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: SAM; Type: QD000P40CD; Serial: 1632

Left Touch/R99 RMC_Ch 4183/Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.513 mW/g

Left Touch/R99 RMC_Ch 4183/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 24.458 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 0.7170
SAR(1 g) = 0.493 mW/g; SAR(10 g) = 0.335 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.587 mW/g



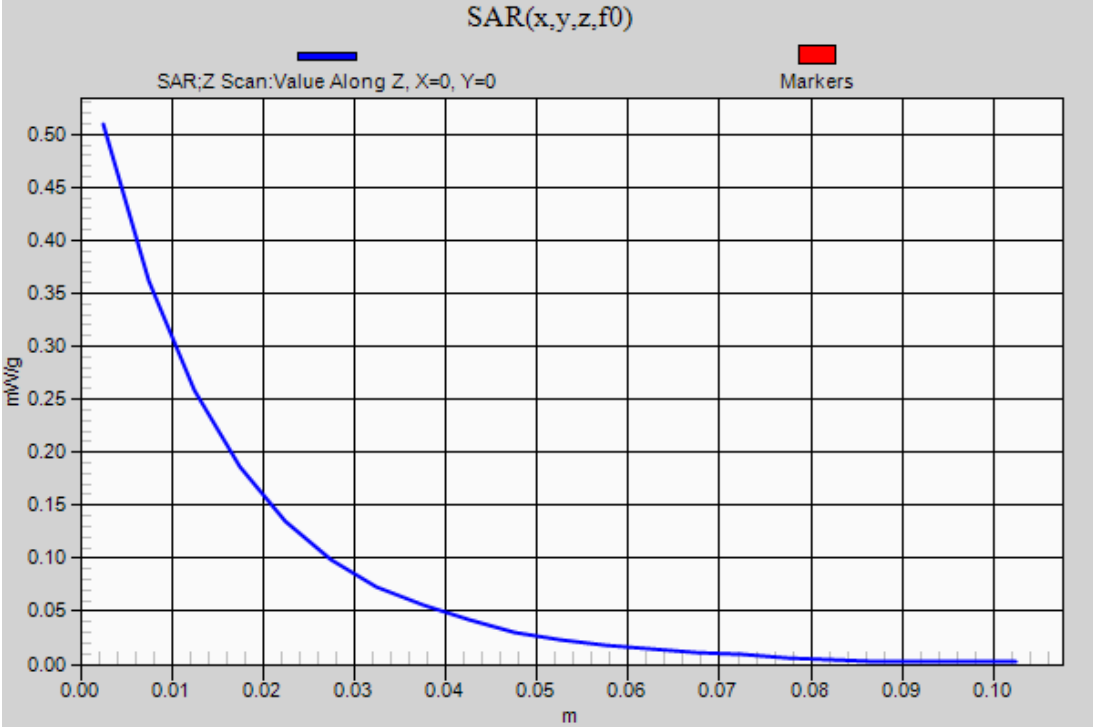
0 dB = 0.590mW/g = -4.58 dB mW/g

Test Laboratory: UL CCS SAR Lab C
Date: 2/29/2012

UMTS Band V

Frequency: 836.6 MHz; Duty Cycle: 1:1

Left Touch/R99 RMC_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) = 0.509 mW/g



Test Laboratory: UL CCS SAR Lab C
Date: 3/2/2012

UMTS Band V

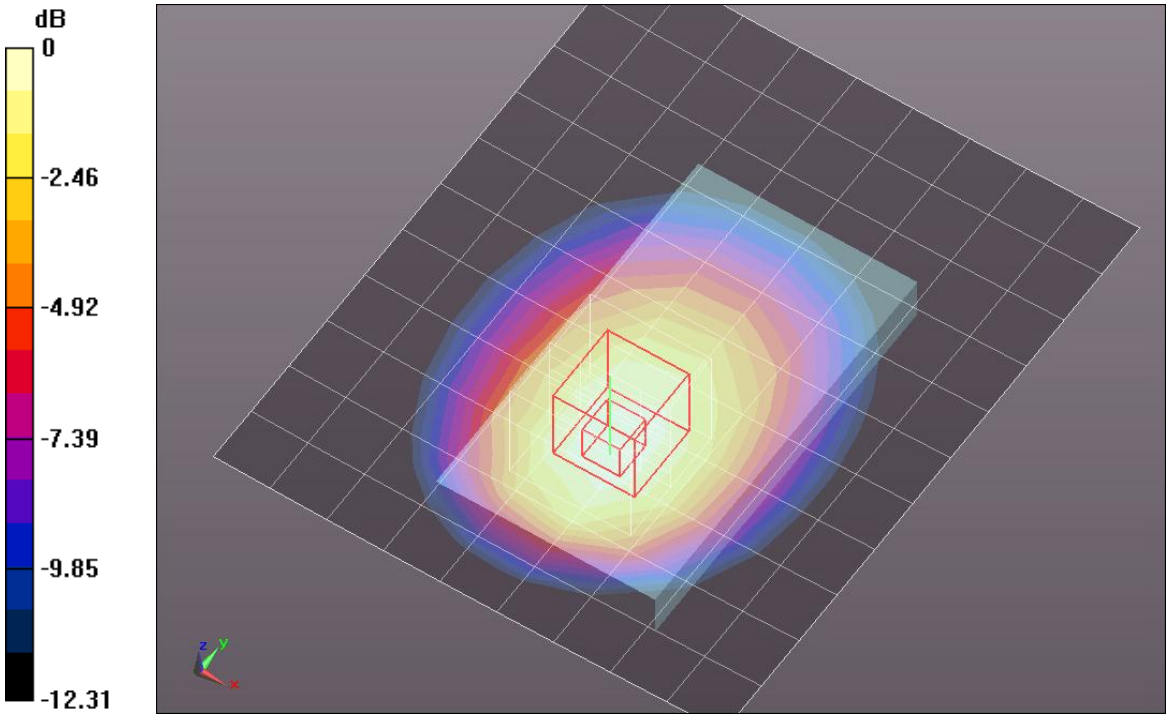
Frequency: 836.6 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.985 mho/m; ε_r = 53.487; ρ = 1000 kg/m^3
DASY5 Configuration:
- Electronics: DAE3 Sn500; Calibrated: 7/14/2011
- Probe: EX3DV4 - SN3751; ConvF(8.64, 8.64, 8.64); Calibrated: 12/19/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: ELI v5.0 (B); Type: QDOVA001BB; Serial: 1121

Rear/Ch 4183/Area Scan (10x12x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.482 mW/g

Rear/Ch 4183/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 22.373 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 0.5900
SAR(1 g) = 0.425 mW/g; SAR(10 g) = 0.297 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.498 mW/g



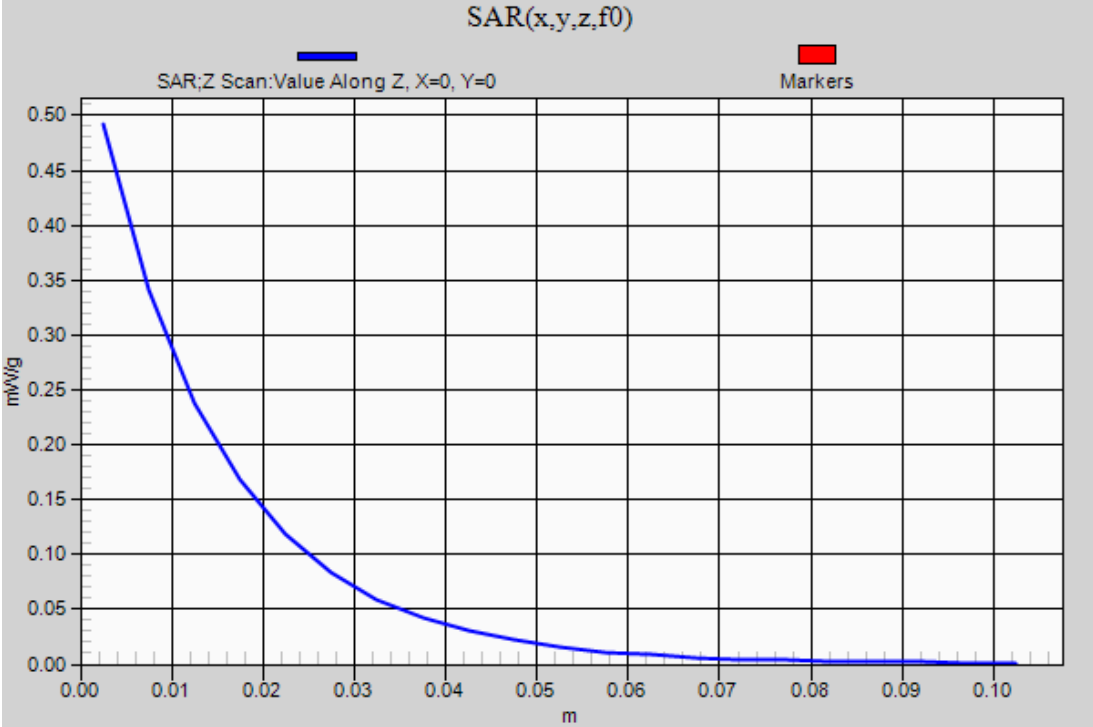
0 dB = 0.500mW/g = -6.02 dB mW/g

Test Laboratory: UL CCS SAR Lab C
Date: 3/2/2012

UMTS Band V

Frequency: 836.6 MHz; Duty Cycle: 1:1

Rear/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) = 0.492 mW/g



Test Laboratory: UL CCS SAR Lab B
Date: 3/7/2012

WiFi 2.4GHz

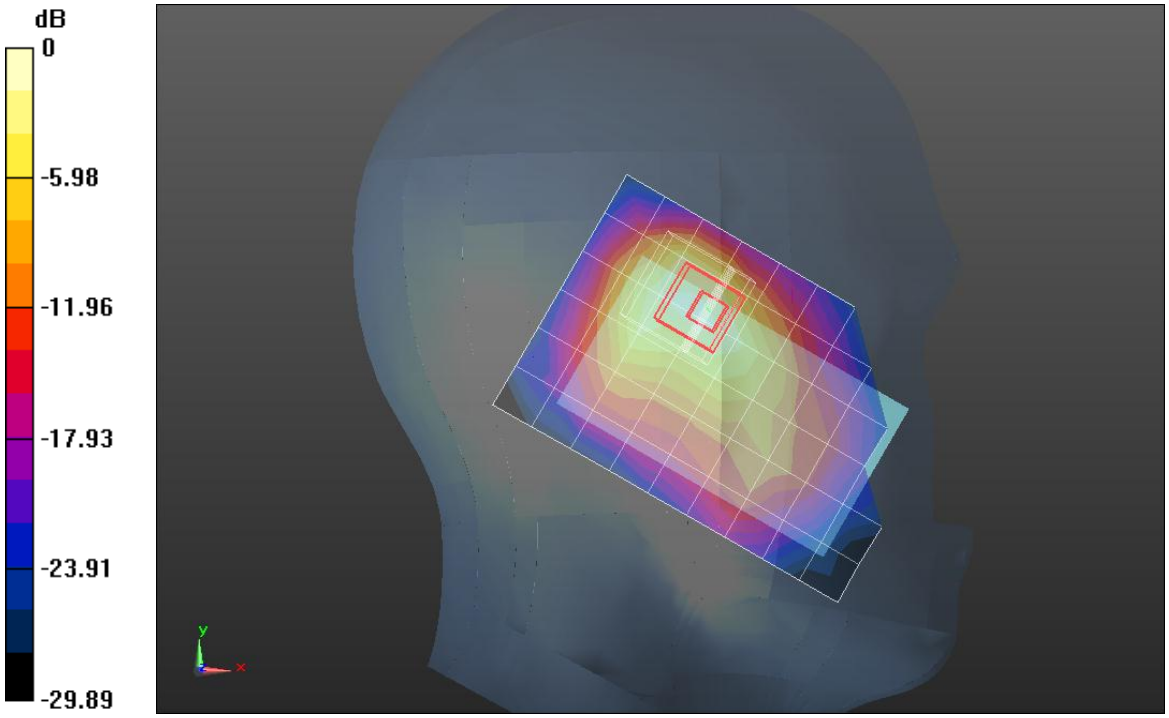
Frequency: 2462 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C
Medium parameters used (interpolated): f = 2462 MHz; σ = 1.864 mho/m; ε_r = 38.502; ρ = 1000 kg/m^3
DASY5 Configuration:
- Electronics: DAE4 Sn1259; Calibrated: 2/13/2012
- Probe: EX3DV3 - SN3531; ConvF(7.4, 7.4, 7.4); Calibrated: 12/19/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: SAM; Type: QD000P40CD; Serial: 1629

Left Touch/Ch 11/Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.109 mW/g

Left Touch/Ch 11/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 24.358 V/m; Power Drift = 0.15 dB
Peak SAR (extrapolated) = 1.9120
SAR(1 g) = 0.845 mW/g; SAR(10 g) = 0.371 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.327 mW/g



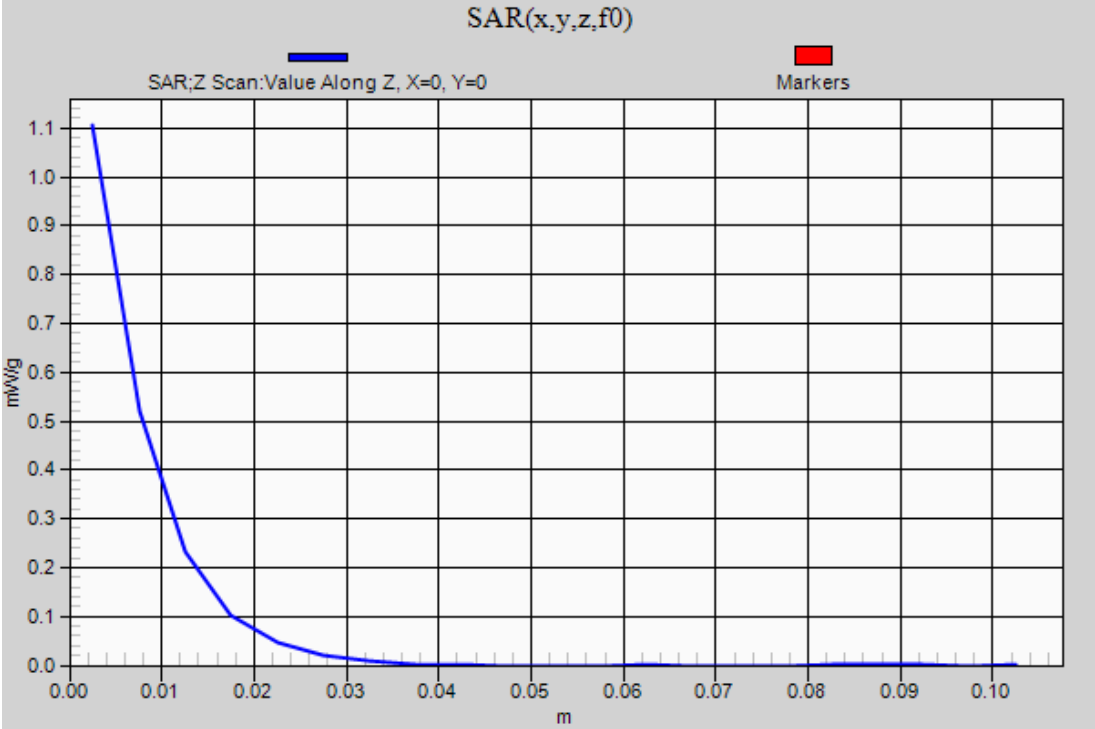
0 dB = 1.330mW/g = 2.48 dB mW/g

Test Laboratory: UL CCS SAR Lab B
Date: 3/7/2012

WiFi 2.4GHz

Frequency: 2462 MHz; Duty Cycle: 1:1

Left Touch/Ch 11/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.105 mW/g



Test Laboratory: UL CCS SAR Lab B
Date: 3/2/2012

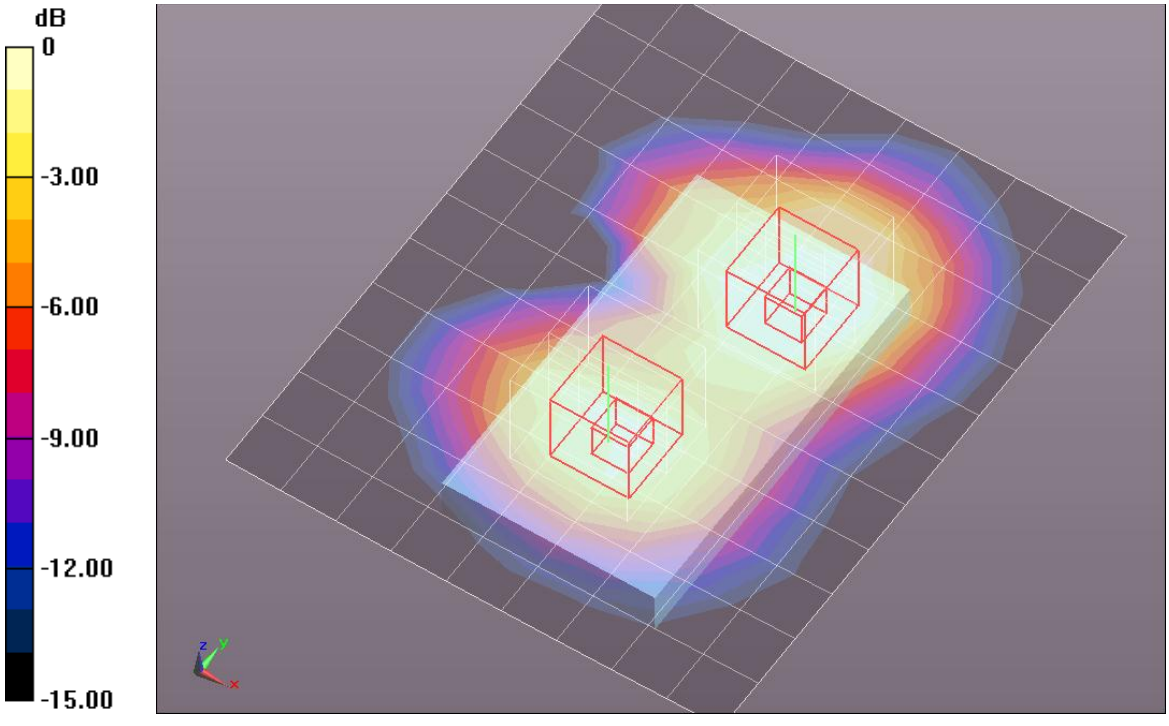
WiFi 2.4GHz

Frequency: 2462 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C
Medium parameters used (interpolated): f = 2462 MHz; σ = 1.992 mho/m; ε_r = 50.77; ρ = 1000 kg/m^3
DASY5 Configuration:
- Electronics: DAE4 Sn1259; Calibrated: 2/13/2012
- Probe: EX3DV3 - SN3531; ConvF(7.44, 7.44, 7.44); Calibrated: 12/19/2011
- 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: 1121

Front/802.11b_Ch 11_w/Headset/Area Scan (10x12x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.282 mW/g

Front/802.11b_Ch 11_w/Headset/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.133 V/m; Power Drift = -0.15 dB
Peak SAR (extrapolated) = 0.4580
SAR(1 g) = 0.247 mW/g; SAR(10 g) = 0.132 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.324 mW/g

Front/802.11b_Ch 11_w/Headset/Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.133 V/m; Power Drift = -0.15 dB
Peak SAR (extrapolated) = 0.2910
SAR(1 g) = 0.160 mW/g; SAR(10 g) = 0.090 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.207 mW/g



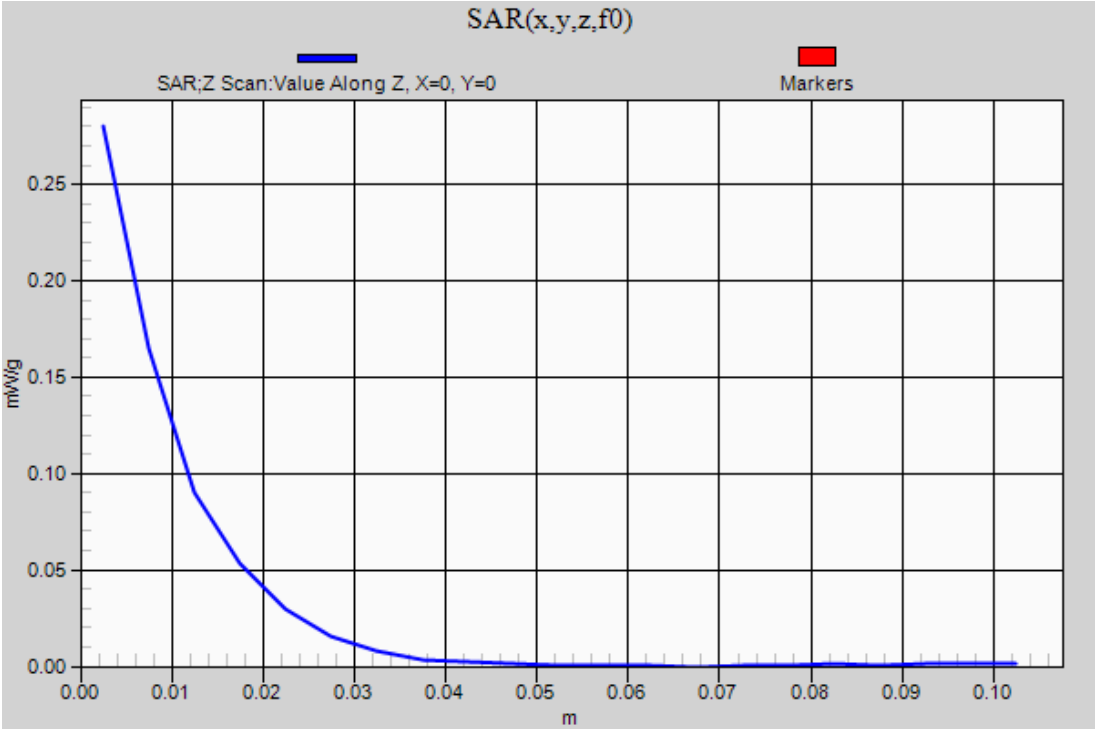
0 dB = 0.210mW/g = -13.56 dB mW/g

Test Laboratory: UL CCS SAR Lab B
Date: 3/2/2012

WiFi 2.4GHz

Frequency: 2462 MHz; Duty Cycle: 1:1

Front/802.11b_Ch 11_w/Headset/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.280 mW/g



15. Simultaneous Transmission SAR Analysis

15.1. Head Exposure Condition

Test Position	GSM850	GSM1900	UMTS (WCDMA) Band V	WiFi	∑ 1-g SAR (mW/g)
Left Touch	0.645			0.845	1.490
		0.874		0.845	1.719
			0.493	0.845	1.338
Left Tilt	0.254			0.556	0.810
		0.185		0.556	0.741
			0.177	0.556	0.733
Right Touch	0.614			0.541	1.155
		0.493		0.541	1.034
			0.395	0.541	0.936
Right Tilt	0.255			0.352	0.607
		0.194		0.352	0.546
			0.171	0.352	0.523

15.2. Body Exposure Condition

Test Position	GSM850	GSM1900	UMTS (WCDMA) Band V	WiFi	∑ 1-g SAR (mW/g)
Rear	0.725			0.177	0.902
		0.599		0.177	0.776
			0.425	0.177	0.602
Front	0.593			0.247	0.840
		0.490		0.247	0.737
			0.32	0.247	0.567
Edge 1	0.000			0.068	0.068
		0.000		0.068	0.068
			0.000	0.068	0.068
Edge 2	0.182			0.243	0.425
		0.097		0.243	0.340
			0.099	0.243	0.342
Edge 3	0.110			0.000	0.110
		0.371		0.000	0.371
			0.060	0.000	0.060
Edge 4	0.279			0.000	0.279
		0.129		0.000	0.129
			0.135	0.000	0.135

15.3. SAR to Peak Location Separation Ratio (SPLSR)

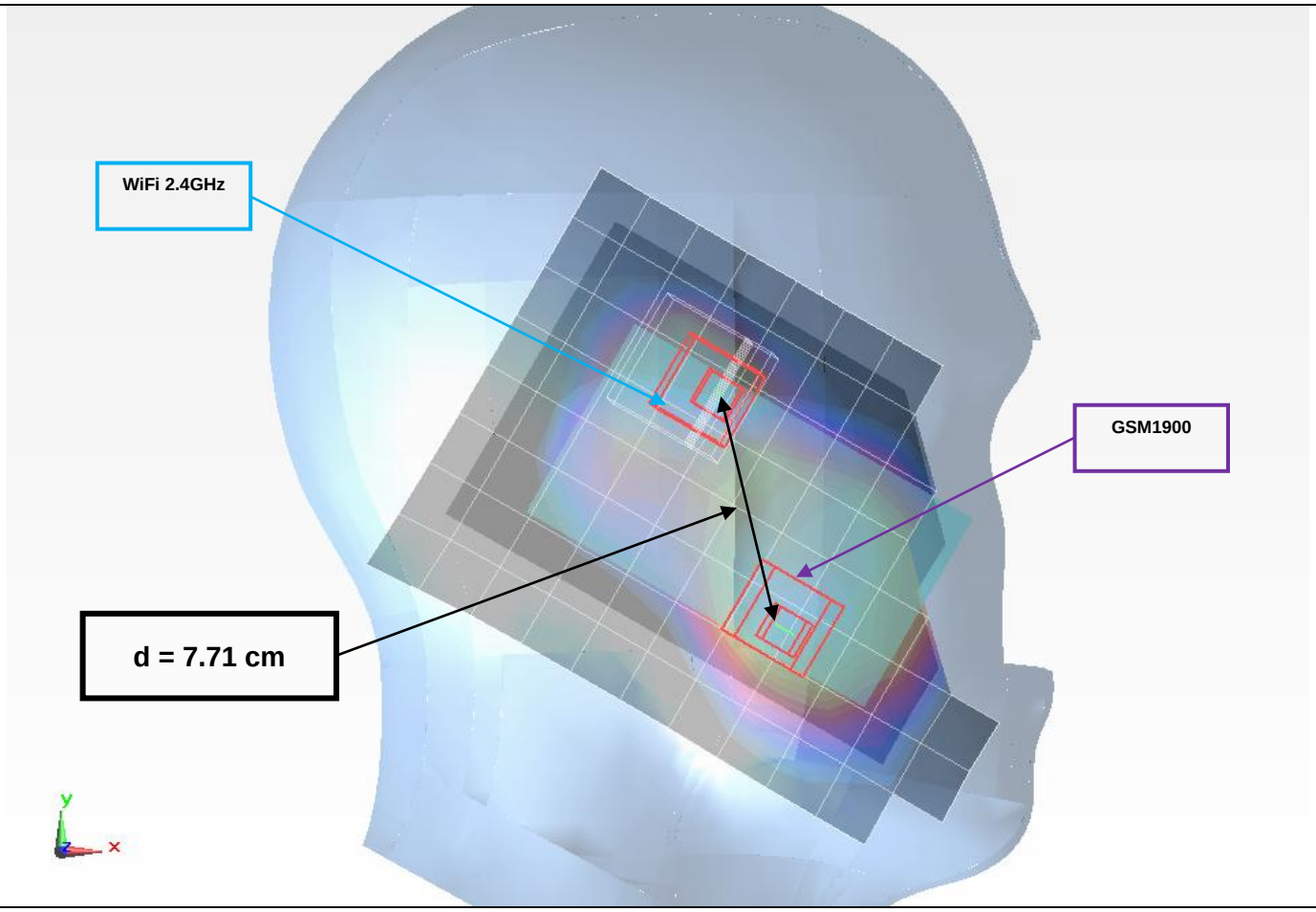
Test Position	Worst-case combination			∑ 1-g SAR (mW/g)	Calculated distance (cm)	SPLSR	Figure
	GSM850	GSM1900	WiFi				
Left Touch		0.874	0.845	1.719	7.71	0.223	1

Conclusions:

Simultaneous transmission SAR measurement (Volume Scan) is not required because the SAR to peak location separation ratios is < 0.3.

SAR Peak Location Separation Distance

Figure 1



Mode	Peak SAR	X	Y	Z
	mW/g	m	m	m
Left Touch GSM1900	1.48	0.0663	0.254	-0.174
Left Touch WiFi	1.91	0.0449	0.328	-0.177

d: Calculated distance (cm)
7.71

Note: SQRT((X1-X2)^2+(Y1-Y2)^2+(Z1-Z2)^2)

16. Appendixes

Refer to separated files for the following appendixes.

16.1. System Performance Check Plots

16.2. SAR Test plots for GSM850

16.3. SAR Test plots for GSM1900

16.4. SAR Test plots for UMTS (WCDMA) band V

16.5. SAR test plots for WiFi 2.4 GHz band

16.6. Calibration certificate for E-Field Probe EX3DV4 SN 3751

16.7. Calibration certificate for E-Field Probe EX3DV3 SN 3531

16.8. Calibration certificate for D835V2 - SN 4d117

16.9. Calibration certificate for D1900V2 SN 5d140

16.10. Calibration certificate for D2450V2 SN: 748