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

SAR EVALUATION REPORT

For
Tablet with GSM/GPRS/EDGE, 802.11bgn, BT3.0

Model: GT-P3108
FCC ID: A3LGTP3108

Report Number: 12I14352-5-A
Issue Date: 05/25/2012

Prepared for
Samsung Electronics Co., Ltd
416, Maetan 3-Dong, Yeongtong-Gu
Suwon-City, GyeonGggi-Do 443-742, South Korea

Prepared for
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
--	05/08/2012	Initial Issue	--
A	05/25/2012	Revised section 8 in accordance with FCC comments	D. Weaver

COMPLIANCE CERTIFICATION SERVICES (UL CCS) FORM NO: CCSUP4031B
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL CCS.

Table of Contents

1. Attestation of Test Results 5

2. Test Methodology 6

3. Facilities and Accreditation 6

4. Calibration and Uncertainty 7

4.1. Measuring Instrument Calibration 7

4.2. Measurement Uncertainty 8

5. Measurement System Description and Setup 9

6. SAR Measurement Procedures 10

6.1. Normal SAR Measurement Procedure 10

6.2. Volume Scan Procedures 11

7. Device Under Test 12

7.1. Band and Air Interlaces 12

7.2. Simultaneous Transmission Conditions 12

7.3. Hotspot (Wireless router) Exposure Condition 12

7.4. Power Sensor 13

7.5. Power Reduction Implementation 13

7.6. Summary Table of Power Reduction dB Levels per Mode & Band 14

7.7. Sensor Coverage Area 16

7.7.1. Edge Coverage 16

7.7.2. Vertex Coverage / Top Left Corner 17

8. Summary of Test Configurations 18

8.1. Head Exposure Condition for WWAN & WiFi 18

8.2. Exposure Conditions for WWAN 18

8.3. Exposure Conditions for WiFi 18

9. RF Output Power Measurement 19

9.1. Tune-tolerance and Power Back-off Levels 19

9.2. GSM1900 20

9.3. Wi-Fi 802.11bgn 21

9.4. Bluetooth 21

10. Tissue Dielectric Properties 22

10.1. Composition of Ingredients for the Tissue Material Used in the SAR Tests 23

10.2. Tissue Dielectric Parameter Check Results 24

This report shall not be reproduced except in full, without the written approval of UL CCS.

11. System Performance Check 25
11.1. System Performance Check Measurement Conditions 25
11.2. Reference SAR Values for System Performance Check 25
11.3. System Performance Check Results 26
12. SAR Test Result 27
12.1. GSM1900 27
12.1.1. Head SAR with IR sensor activated 27
12.1.2. Body SAR 27
12.2. Wi-Fi 802.11bgn 28
12.2.1. Head SAR 29
12.2.2. Body SAR 29
13. Summary of Highest SAR Values 30
13.1. SAR Plots (from Summary of Highest SAR Values) 31
14. Simultaneous Transmission SAR Analysis 39
14.1. Sum of the 1g SAR for Head Exposure Condition 39
14.2. SAR to Peak Location Separation Ratio (SPLSR) 39
14.3. Sum of the 1g SAR for Body Exposure Condition 39
14.4. SAR to Peak Location Separation Ratio (SPLSR) 39
14.5. SAR Peak Location Separation Distance 39
15. Appendixes 40
15.1. System Performance Check Plots 40
15.2. SAR Test Plots for GSM1900 40
15.3. SAR Test Plots for WiFi 2.4 GHz Band 40
15.4. Calibration Certificate for E-Field Probe EX3DV3 - SN 3531 40
15.5. Calibration Certificate for D1900V2 - SN 5d043 40
15.6. Calibration Certificate for D2450V2 - SN 748 40
16. External Photos 41
17. Antenna Locations & Separation Distances 42
18. Setup Photos 43
18.1. Setup Photos for WWAN 43
18.2. Setup Photos for Wi-Fi 49

This report shall not be reproduced except in full, without the written approval of UL CCS.

1. Attestation of Test Results

Applicant	Samsung Electronics Co., Ltd.
DUT description	Tablet with GSM/GPRS/EDGE, 802.11bgn, BT3.0
Model	GT-P3108
Test device is	An identical prototype
Device category	Portable devices
Exposure category	General Population/Uncontrolled Exposure
Date tested	4/10/2012 – 4/11/2012 & 4/16/2012 – 4/17/2012

FCC Rule Parts	Freq. Range	Highest 1-g SAR	Limit
24	1850-1910 MHz	0.516 W/kg (Head: Right Tilt) 1.01 W/kg (Body: Edge 1 w/ 5 mm distance)	1.6 W/kg
15.247	2412-2462 MHz	0.186 W/kg (Head: SAR on flat phantom) 0.507 W/kg (Body: Rear with Headset w/ 0 mm distance)	
Simultaneous transmission condition:		1.251 W/kg (The highest SAR across all exposure conditions)	

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
Engineer Leader
Compliance Certification Services (UL CCS)

Tested By:

Chakrit Thammanavarat
SAR Engineer
Compliance Certification Services (UL CCS)

This report shall not be reproduced except in full, without the written approval of 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 KDBs Procedures.

- 447498 D01 Mobile Portable RF Exposure v04
- 648474 D01 SAR Handsets Multi Xmiter and Ant, v01r05
- 941225 D03 SAR Test Reduction GSM GPRS EDGE v01
- 248227 D01 SAR meas for 802 11abg v01r02

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.

This report shall not be reproduced except in full, without the written approval of UL CCS.

4. Calibration and Uncertainty

4.1. Measuring Instrument Calibration

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

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due date		
				MM	DD	Year
Dielectronic Probe kit	HP	85070C	N/A	N/A		
Base Station Simulator	R & S	CMU 200	106291	6	24	2012
ESA Series Network Analyzer	Agilent	E5071B	MY42100131	2	11	2013
Synthesized Signal Generator	HP	83732B	US34490599	5	3	2013
E-Field Probe	SPEAG	EX3DV3	3531	12	19	2012
Thermometer	ERTCO	639-1S	1718	7	19	2012
Data Acquisition Electronics	SPEAG	DAE4	1259	2	13	2013
System Validation Dipole	SPEAG	D1900V2	5d043	11	10	2012
System Validation Dipole	SPEAG	D2450V2	748	2	7	2013
Power Meter	Giga-tronics	8651A	8651404	5	13	2012
Power Sensor	Giga-tronics	80701A	1834588	5	13	2012
Power Meter	HP	437B	3125U16345	5	13	2012
Power Sensor	HP	8481A	2702A60780	5	13	2012
Amplifier	MITEQ	4D00400600-50-30P	1620606	N/A		
Directional coupler	Werlatone	C8060-102	2141	N/A		

This report shall not be reproduced except in full, without the written approval of UL CCS.

4.2. Measurement Uncertainty

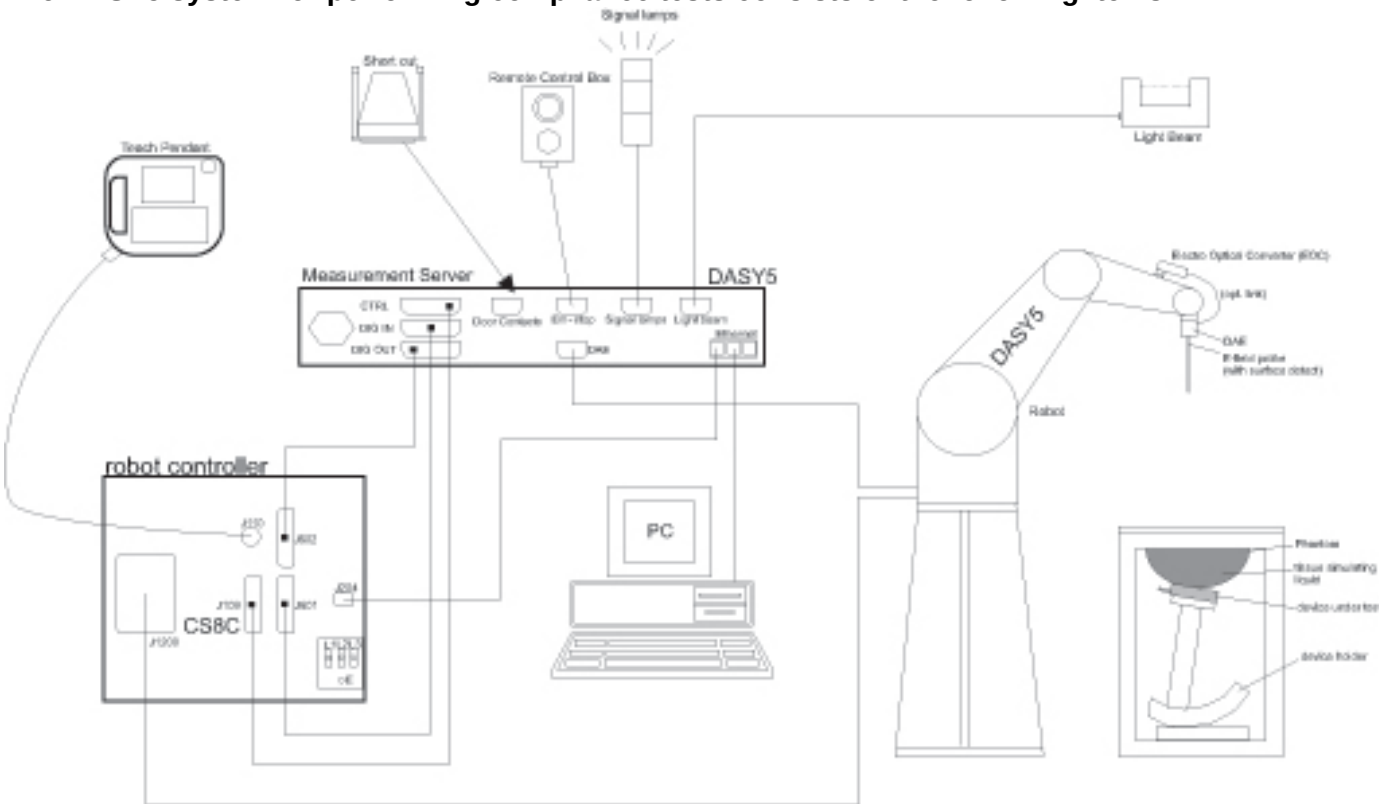
Measurement uncertainty for 300 MHz to 3 GHz averaged over 1 gram

Component	Error, %	Distribution	Divisor	Sensitivity	U (Xi), %
Measurement System					
Probe Calibration (k=1)	**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
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	**4.59**	Normal	1	0.64	2.94
Liquid Permittivity - deviation from target	5.00	Rectangular	1.732	0.6	1.73
Liquid Permittivity - measurement uncertainty	**-4.28**	Normal	1	0.6	-2.57
Combined Standard Uncertainty Uc(y) =					10.49
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				20.99	%
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				1.65	dB

COMPLIANCE CERTIFICATION SERVICES (UL CCS) FORM NO: CCSUP4031B
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL CCS.

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.
- Data acquisition electronics (DAE) which performs the signal amplification, 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.

This report shall not be reproduced except in full, without the written approval of UL CCS.

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 (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.

COMPLIANCE CERTIFICATION SERVICES (UL CCS) FORM NO: CCSUP4031B
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL CCS.

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 ≥ 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.

This report shall not be reproduced except in full, without the written approval of UL CCS.

7. Device Under Test

Tablet with GSM/GPRS/EDGE, 802.11bgn, BT3.0 Model: GT-P3108	
Mode of operation	Held to head Body Bottom face Edges (Edge 1, 2, 3, and 4): Multiple display orientations supporting both portrait and landscape configurations
Device dimensions (mm)	193.7 x 122.4 x 10.5 (length x width x height)

7.1. Band and Air Interlaces

Air Interfaces	GSM, GPRS, EGPRS 1900 MHz WiFi: 802.11bgn: 2.4GHz Bluetooth: 2.4 GHz
Uplink Modulations	GSM Modes: GMSK, 8PSK WiFi: 802.11bgn: 2.4GHz Bluetooth: Ver 3.0
GPRS Multi-Slot Class	GPRS: 12 EGPRS: 10
GPRS Class	B
DTM Class:	Not supported

7.2. Simultaneous Transmission Conditions

No	Simultaneous Transmission	Head	Body	Hot-spot
1	GSM voice + WiFi 2.4 GHz	☒	☒	☒
2	GSM voice + BT	☒	☒	☐
3	GPRS/EGPRS + WiFi 2.4 GHz	☐	☒	☒

Note(s):

As the tablet has been assessed in accordance with KDB 447498, which has more conservative measurement distances than KDB 941225, further assessment in accordance with KDB 941225 is judged unnecessary. This is also in accordance with FCC training provided in October 2011 (TCBC Workshop) which indicates that hotspot mode KDB procedures are not intended for larger tablets.

7.3. Hotspot (Wireless router) Exposure Condition

The device is capable of personal hotspot mode. The hotspot mode can be enabled by the users.

This report shall not be reproduced except in full, without the written approval of UL CCS.

7.4. Power Sensor

The following sensors (functioning as proximity sensor) are used for power reduction.

- Grip sensor 1: Covers the Rear and Top-edge (Edge 1) of the DUT.
- Grip sensor 2: Covers the Rear of the DUT
- 1 IR sensor: Covers the front, located adjacent to receiver at the front of the DUT.

7.5. Power Reduction Implementation

Trigger distances are:

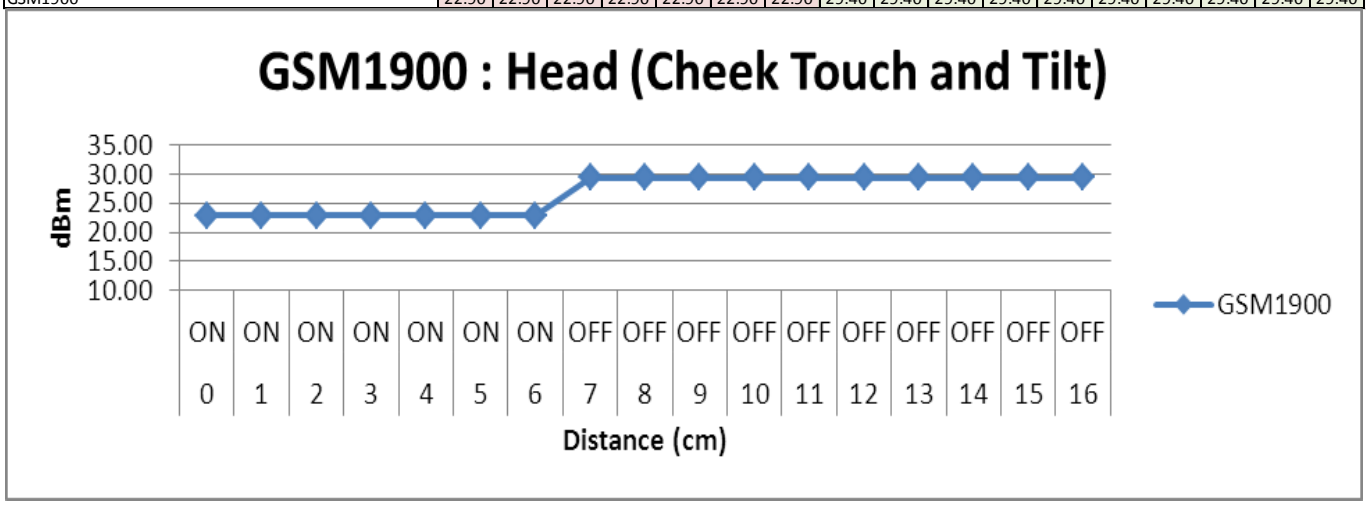
- Grip sensor 1: 8 mm from Rear and 5 mm from Top-edge (Edge 1) of the DUT
- Grip sensor 2: 8 mm from Rear of the DUT
- IR sensor: 60 mm from front of the DUT

Both Grip and IR sensors have the same levels of power reduction.

This report shall not be reproduced except in full, without the written approval of UL CCS.

7.6. Summary Table of Power Reduction dB Levels per Mode & Band

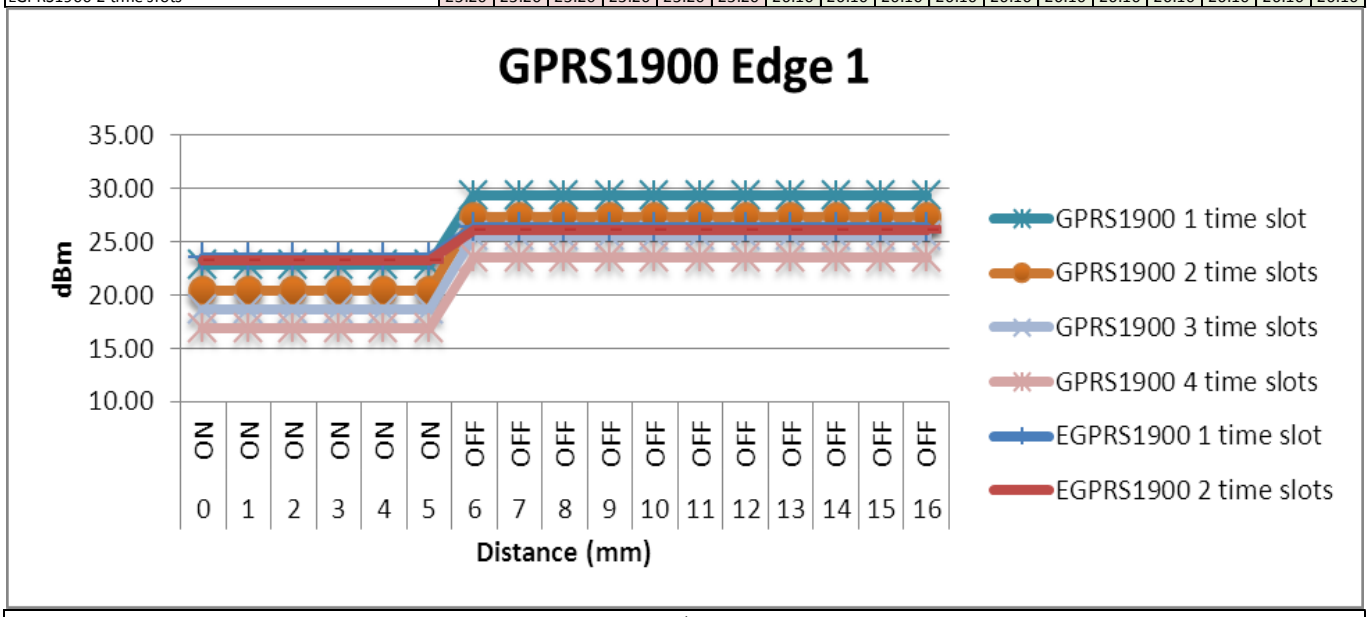
Head (Cheek Touch and Tilt)																	
Distance (cm):	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
IR Sensor with reduced power activation:	ON	ON	ON	ON	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
GSM1900	22.90	22.90	22.90	22.90	22.90	22.90	22.90	29.40	29.40	29.40	29.40	29.40	29.40	29.40	29.40	29.40	29.40



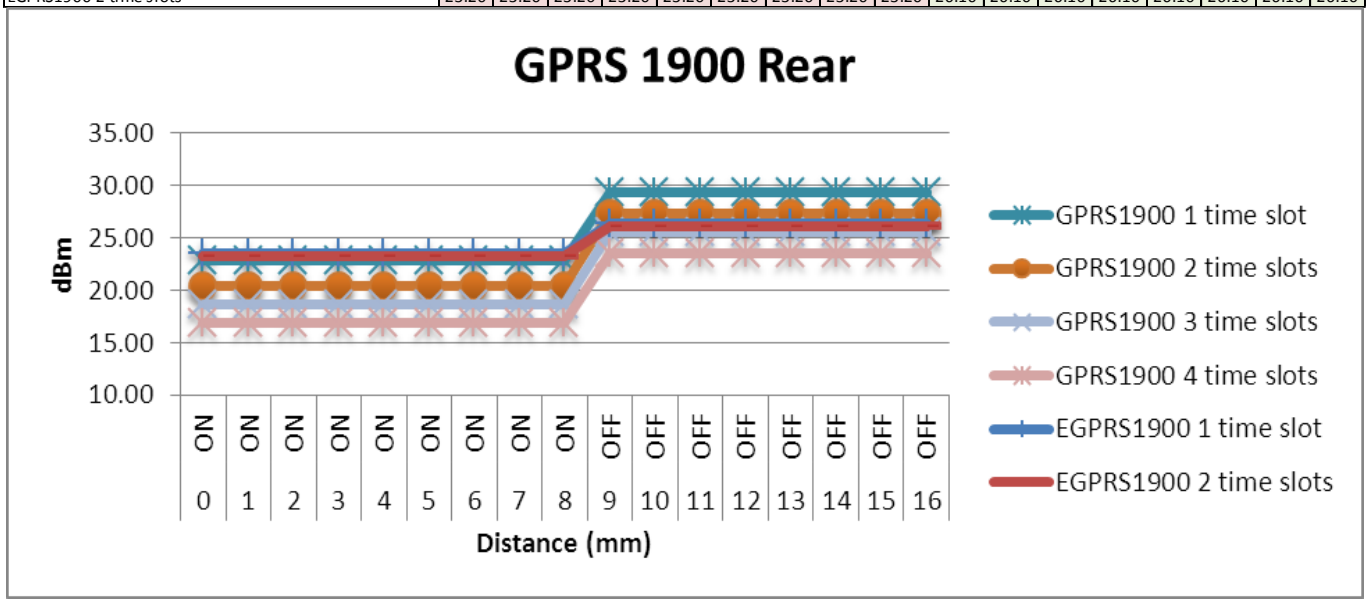
This report shall not be reproduced except in full, without the written approval of UL CCS.

Summary Table of Power Reduction dB Levels per Mode & Band (continued)

Edge 1																	
Distance (mm):	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Proximity sensor with reduced power activation:	ON	ON	ON	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
GPRS1900 1 time slot	22.90	22.90	22.90	22.90	22.90	22.90	29.40	29.40	29.40	29.40	29.40	29.40	29.40	29.40	29.40	29.40	29.40
GPRS1900 2 time slots	20.40	20.40	20.40	20.40	20.40	20.40	27.30	27.30	27.30	27.30	27.30	27.30	27.30	27.30	27.30	27.30	27.30
GPRS1900 3 time slots	18.70	18.70	18.70	18.70	18.70	18.70	25.60	25.60	25.60	25.60	25.60	25.60	25.60	25.60	25.60	25.60	25.60
GPRS1900 4 time slots	16.90	16.90	16.90	16.90	16.90	16.90	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50
EGPRS1900 1 time slot	23.50	23.50	23.50	23.50	23.50	23.50	26.30	26.30	26.30	26.30	26.30	26.30	26.30	26.30	26.30	26.30	26.30
EGPRS1900 2 time slots	23.20	23.20	23.20	23.20	23.20	23.20	26.10	26.10	26.10	26.10	26.10	26.10	26.10	26.10	26.10	26.10	26.10



Rear/Base																	
Distance (mm):	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Proximity sensor with reduced power activation:	ON	ON	ON	ON	ON	ON	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
GPRS1900 1 time slot	22.90	22.90	22.90	22.90	22.90	22.90	22.90	22.90	22.90	29.40	29.40	29.40	29.40	29.40	29.40	29.40	29.40
GPRS1900 2 time slots	20.40	20.40	20.40	20.40	20.40	20.40	20.40	20.40	20.40	27.30	27.30	27.30	27.30	27.30	27.30	27.30	27.30
GPRS1900 3 time slots	18.70	18.70	18.70	18.70	18.70	18.70	18.70	18.70	18.70	25.60	25.60	25.60	25.60	25.60	25.60	25.60	25.60
GPRS1900 4 time slots	16.90	16.90	16.90	16.90	16.90	16.90	16.90	16.90	16.90	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50
EGPRS1900 1 time slot	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	26.30	26.30	26.30	26.30	26.30	26.30	26.30	26.30
EGPRS1900 2 time slots	23.20	23.20	23.20	23.20	23.20	23.20	23.20	23.20	23.20	26.10	26.10	26.10	26.10	26.10	26.10	26.10	26.10

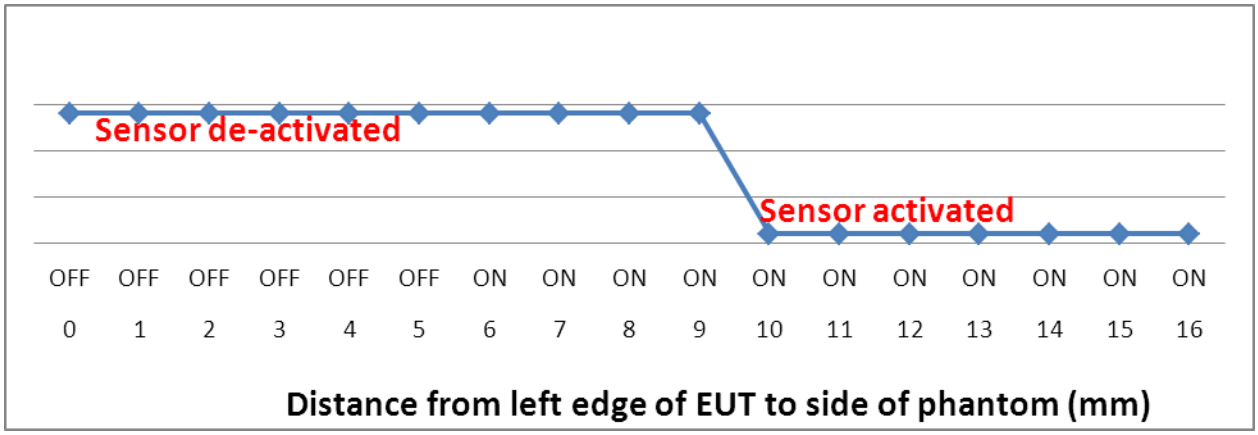


This report shall not be reproduced except in full, without the written approval of UL CCS.

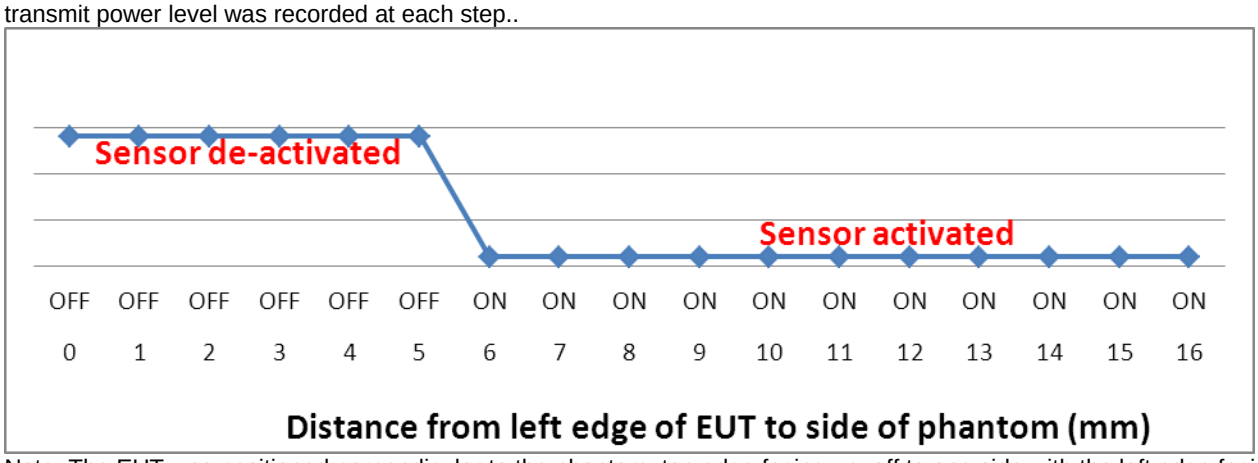
7.7. Sensor Coverage Area

Refer to Sensor Triggering distance of A3LGTP3108

7.7.1. Edge Coverage



Note. The EUT was positioned parallel to the phantom, front facing down, off to one side with the left edge facing the phantom. The vertical separation distance was 8 mm. The EUT was then moved horizontally toward the phantom in 1 mm steps. The transmit power level was recorded at each step..



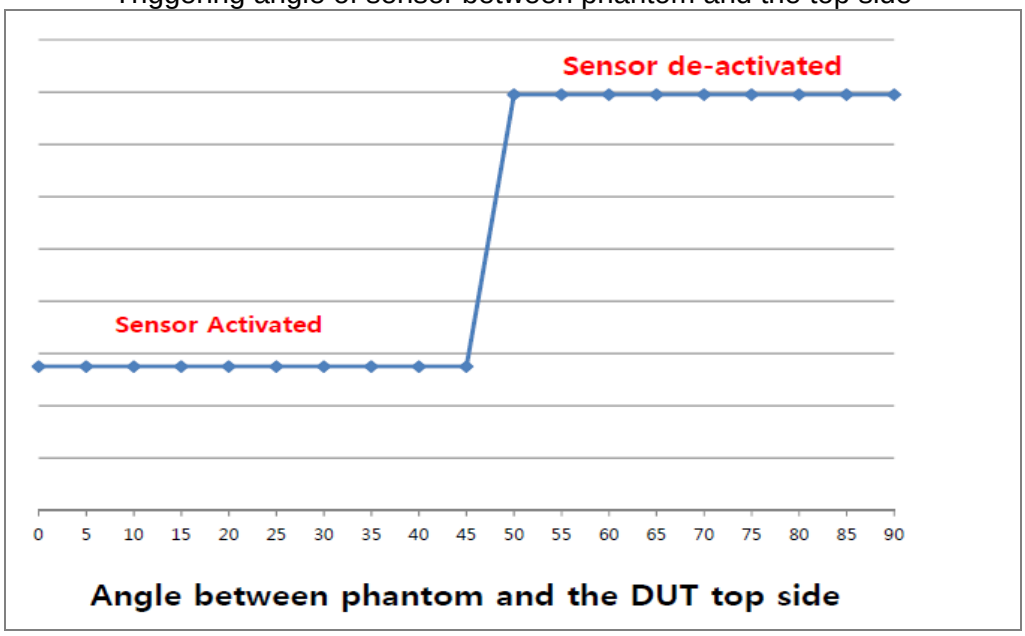
Note. The EUT was positioned perpendicular to the phantom, top edge facing up, off to one side with the left edge facing the phantom. The vertical separation distance was 5 mm. The EUT was then moved horizontally toward the phantom in 1 mm steps. The transmit power level was recorded at each step.

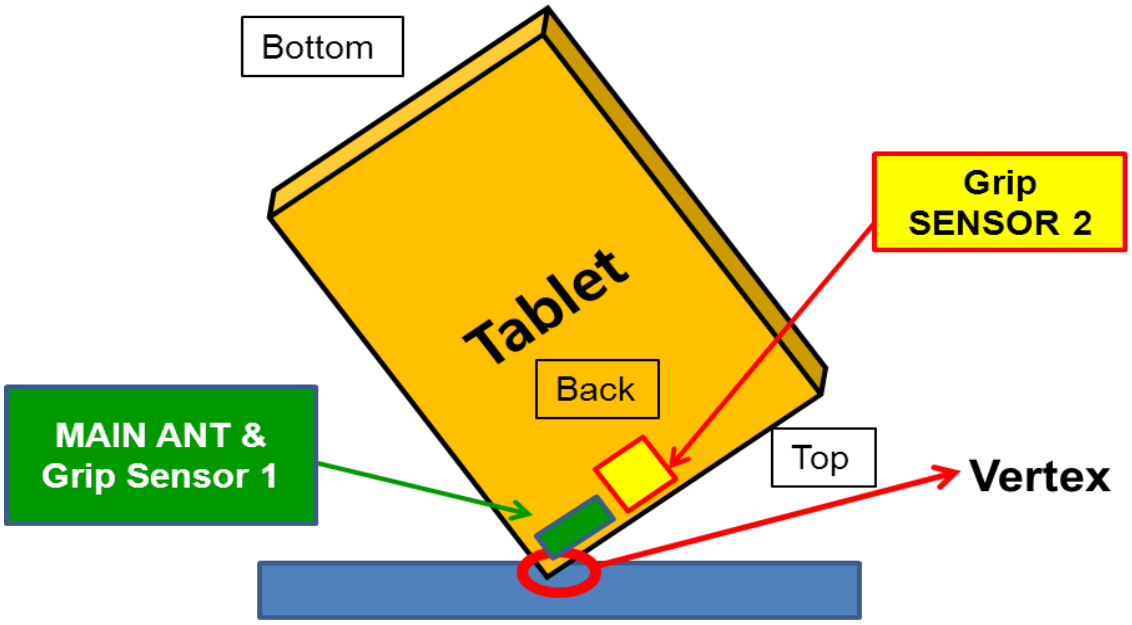
COMPLIANCE CERTIFICATION SERVICES (UL CCS) FORM NO: CCSUP4031B
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL CCS.

7.7.2. Vertex Coverage / Top Left Corner

At the top left corner, top edge and rear sensor are not activated. Taken into the account if the device could be easily be used in such a way that the antenna could be in close proximity to the user without the proximity sensor triggering power reduction; for example, held by the left corner or with the left corner resting on the left knee or leg of the user. Based upon the trigger angle for power reduction as illustrated below, additional Vertex at 45 degree SAR evaluation with full power (no power reduction was performed)

Triggering angle of sensor between phantom and the top side





This report shall not be reproduced except in full, without the written approval of UL CCS.

8. Summary of Test Configurations

The following test configurations are based on KDB 447498 4) b) Tablet Mode

See section 17 for the antenna locations and dimensions.

8.1. Head Exposure Condition for WWAN & WiFi

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

8.2. Exposure Conditions for WWAN

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	1.91 mm	Yes	
Edge 1	5.63 mm	Yes	
Edge 1 at 45° (Vertex)	> 4.9 mm	Yes	With full power
Edge 2	> 78 mm	No	This is not the most conservative antenna-to-user distance at edge mode. According to KDB 447498 4) b) ii) (2), SAR is required only for the edge with the most conservative exposure conditions.
Edge 3	> 193.7 mm	No	ditto
Edge 4	7.67 mm	Yes	

8.3. Exposure Conditions for WiFi

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	< 0.85 mm	Yes	
Edge 1	>133.5mm	No	This is not the most conservative antenna-to-user distance at edge mode. According to KDB 447498 4) b) ii) (2), SAR is required only for the edge with the most conservative exposure conditions.
Edge 2	> 107.8 mm	No	ditto
Edge 3	> 40.7 mm	No	ditto
Edge 4	< 4.3 mm	Yes	
Edge 4 Tilt @ 45°	< 0.85 mm	Yes	ditto

This report shall not be reproduced except in full, without the written approval of UL CCS.

9. RF Output Power Measurement

9.1. Tune-up Tolerance and Power Back-off Levels

GSM/GPRS

GSM1900 without power back off: 29.5 dBm(Tolerance: -1.5dB ~ +0.5dB) , max with tolerance 30 dBm
GSM1900 with power back off: 22.0 dBm(Tolerance: -1.5dB ~ +0.5dB) , max with tolerance 22.5 dBm

Normal		Call	Power Reduction (dB)				Back-Off Level
			1 slot (0)	2 slot (0-3)	3 slot (1.8-4.8)	4 slot (3-6)	
GSM1900	512	29.5	29.5	27.5	25.5	23.5	7
	661	29.5	29.5	27.5	25.5	23.5	
	810	29.5	29.5	27.5	25.5	23.5	
Back-Off		**Call**	**Power Reduction (dB)**				
			1 slot (0)	2 slot (0-3)	3 slot (1.8-4.8)	4 slot (3-6)	
GSM1900	512	22.5	22.5	20.5	18.5	17	
	661	22.5	22.5	20.5	18.5	17	
	810	22.5	22.5	20.5	18.5	17	
Back-Off level		**Call**	**Power Reduction (dB)**				
			1 slot	2 slots	3 slots	4 slots	
GSM1900	512	7	7	7	7	6.5	
	661						
	810						

EGPRS

Normal		Call	Power Reduction (dB)		Back-Off Level
			1 slot (0)	2 slot (0-3)	
GSM1900	512	26	26	26	3
	661	26	26	26	
	810	26	26	26	
Back-Off		**Call**	**Power Reduction (dB)**		
			1 slot (0)	2 slot (0-3)	
GSM1900	512	23	23	23	
	661	23	23	23	
	810	23	23	23	
Back-Off level		**Call**	**Power Reduction (dB)**		
			1 slot	2 slots	
GSM1900	512	3	3	3	
	661				
	810				

COMPLIANCE CERTIFICATION SERVICES (UL CCS) FORM NO: CCSUP4031B
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL CCS.

9.2. GSM1900

GMSK (Voice) Mode

Band	Ch No.	Freq. (MHz)	Avg burst Pwr (dBm)
1900	512	1850.2	29.3
	661	1880.0	29.4
	810	1909.8	29.4

GMSK (Voice) Mode with power back off

Band	Ch No.	Freq. (MHz)	Avg burst Pwr (dBm)
1900	512	1850.2	22.9
	661	1880.0	22.9
	810	1909.8	22.8

GMSK (GPRS) Mode - Coding Scheme: CS1

Band	Ch No.	Freq. (MHz)	Avg burst Pwr (dBm)				Avg burst Pwr (dBm)			
			1 slot	Frame Avg Pwr	2 slots	Frame Avg Pwr	3 slots	Frame Avg Pwr	4 slots	Frame Avg Pwr
1900	512.0	1850.2	29.30	20.27	27.10	21.08	25.40	21.14	23.30	20.29
	661.0	1880.0	29.40	20.37	27.30	21.28	25.60	21.34	23.50	20.49
	810.0	1909.8	29.40	20.37	27.30	21.28	25.60	21.34	23.50	20.49

GMSK (GPRS) Mode - Coding Scheme: CS1 with power back off

Band	Ch No.	Freq. (MHz)	Avg burst Pwr (dBm)				Avg burst Pwr (dBm)			
			1 slot	Frame Avg Pwr	2 slots	Frame Avg Pwr	3 slots	Frame Avg Pwr	4 slots	Frame Avg Pwr
1900	512	1850.2	22.90	13.87	20.40	14.38	18.70	14.44	16.90	13.89
	661	1880.0	22.90	13.87	20.40	14.38	18.70	14.44	16.90	13.89
	810	1909.8	22.80	13.77	20.20	14.18	18.50	14.24	16.80	13.79

8PSK (EGPRS) Mode - Coding Scheme: MCS5

Band	Ch No.	Freq. (MHz)	Avg burst Pwr (dBm)				Avg burst Pwr (dBm)			
			1 slot	Frame Avg Pwr	2 slots	Frame Avg Pwr	3 slots	Frame Avg Pwr	4 slots	Frame Avg Pwr
1900	512.0	1850.2	26.30	17.27	26.10	20.08				
	661.0	1880.0	26.20	17.17	26.00	19.98				
	810.0	1909.8	25.90	16.87	25.60	19.58				

8PSK (EGPRS) Mode - Coding Scheme: MCS5 with power back off

Band	Ch No.	Freq. (MHz)	Avg burst Pwr (dBm)				Avg burst Pwr (dBm)			
			1 slot	Frame Avg Pwr	2 slots	Frame Avg Pwr	3 slots	Frame Avg Pwr	4 slots	Frame Avg Pwr
1900	512	1850.2	23.50	14.47	23.20	17.18				
	661	1880.0	23.30	14.27	23.10	17.08				
	810	1909.8	22.80	13.77	22.60	16.58				

Notes:

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

- Head: GMSK Voice Mode
- Body: GMSK (GPRS) mode with 3 time slots, based on the output power measurements above
- EGPRS mode only supports up to class 10.

COMPLIANCE CERTIFICATION SERVICES (UL CCS) FORM NO: CCSUP4031B
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL CCS.

9.3. Wi-Fi 802.11bgn

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#	√	∇
		2.437	6	√	∇
		2.462	11#	√	∇

Notes:
√ = "default test channels"
∇ = possible 802.11g channels with maximum average output ¼ dB ≥ the "default test channels"
= 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 (MHz)	Mode	Ch #	Freq. (MHz)	Original Target Pwr From Project #12I14206	Measured Avg Pwr(dBm)
2.4	802.11b	1	2412	11.68	11.69
		6	2437	11.69	11.70
		11	2462	11.66	11.69
	802.11g	1	2412	11.52	11.57
		6	2437	11.67	11.67
		11	2462	11.74	11.75
	802.11g	1	2412	11.46	11.57
		6	2437	11.45	11.50
		11	2462	11.46	11.58

Note(s):

1. 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 802.11a/b channels. As per KDB 248227
2. Original target power is from EMC report 12I14206. Please refer to original report (FCC ID: A3LGTP3100) for Average Power information as documented in 3/13/2012 original filing.

9.4. Bluetooth

Mode	Channel #	Freq. (MHz)	Average output power	
			(dBm)	(mW)
GFSK	0	2402	11.1	12.88
	39	2441	11.3	13.49
	78	2480	11.1	12.88
8PSK	0	2402	8.9	7.76
	39	2441	9.3	8.51
	78	2480	9.2	8.32

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

This report shall not be reproduced except in full, without the written approval of UL CCS.

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

FCC OET Bulletin 65 Supplement C 01-01

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

This report shall not be reproduced except in full, without the written approval of UL CCS.

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

COMPLIANCE CERTIFICATION SERVICES (UL CCS)
FORM NO: CCSUP4031B
47173 BENICIA STREET, FREMONT, CA 94538, USA
TEL: (510) 771-1000
FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL CCS.

10.2. Tissue Dielectric Parameter 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 ±(%)
04/10/2012	Head 1900	e'	39.5305	Relative Permittivity (ε_r):	39.53	40.00	-1.17	5
		e''	13.7623	Conductivity (σ):	1.45	1.40	3.85	5
	Head 1850	e'	39.7236	Relative Permittivity (ε_r):	39.72	40.00	-0.69	5
		e''	13.6034	Conductivity (σ):	1.40	1.40	-0.05	5
	Head 1880	e'	39.6022	Relative Permittivity (ε_r):	39.60	40.00	-0.99	5
		e''	13.6988	Conductivity (σ):	1.43	1.40	2.28	5
	Head 1910	e'	39.4950	Relative Permittivity (ε_r):	39.50	40.00	-1.26	5
		e''	13.7873	Conductivity (σ):	1.46	1.40	4.59	5
04/11/2012	Body 1900	e'	53.1612	Relative Permittivity (ε_r):	53.16	53.30	-0.26	5
		e''	14.6018	Conductivity (σ):	1.54	1.52	1.49	5
	Body 1850	e'	53.3639	Relative Permittivity (ε_r):	53.36	53.30	0.12	5
		e''	14.3954	Conductivity (σ):	1.48	1.52	-2.58	5
	Body 1880	e'	53.2326	Relative Permittivity (ε_r):	53.23	53.30	-0.13	5
		e''	14.5238	Conductivity (σ):	1.52	1.52	-0.12	5
	Body 1910	e'	53.1352	Relative Permittivity (ε_r):	53.14	53.30	-0.31	5
		e''	14.6431	Conductivity (σ):	1.56	1.52	2.31	5
04/16/2012	Head 2450	e'	40.2007	Relative Permittivity (ε_r):	40.20	39.20	2.55	5
		e''	13.7036	Conductivity (σ):	1.87	1.80	3.71	5
	Head 2410	e'	40.3414	Relative Permittivity (ε_r):	40.34	39.28	2.70	5
		e''	13.5987	Conductivity (σ):	1.82	1.76	3.51	5
	Head 2435	e'	40.2635	Relative Permittivity (ε_r):	40.26	39.24	2.62	5
		e''	13.6430	Conductivity (σ):	1.85	1.78	3.63	5
	Head 2475	e'	40.1241	Relative Permittivity (ε_r):	40.12	39.17	2.44	5
		e''	13.7509	Conductivity (σ):	1.89	1.83	3.58	5
04/17/2012	Body 2450	e'	50.5046	Relative Permittivity (ε_r):	50.50	52.70	-4.17	5
		e''	14.1902	Conductivity (σ):	1.93	1.95	-0.87	5
	Body 2410	e'	50.6541	Relative Permittivity (ε_r):	50.65	52.76	-3.99	5
		e''	14.0285	Conductivity (σ):	1.88	1.91	-1.45	5
	Body 2435	e'	50.5595	Relative Permittivity (ε_r):	50.56	52.73	-4.11	5
		e''	14.1276	Conductivity (σ):	1.91	1.93	-0.95	5
	Body 2475	e'	50.4141	Relative Permittivity (ε_r):	50.41	52.67	-4.28	5
		e''	14.3005	Conductivity (σ):	1.97	1.99	-0.86	5

COMPLIANCE CERTIFICATION SERVICES (UL CCS) FORM NO: CCSUP4031B
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL CCS.

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 (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
D1900V2	5d043	11/10/11	1900	1g	40.8	42.0
				10g	21.2	22.0
D2450V2	748	2/7/12	2450	1g	53.6	50.8
				10g	24.8	23.6

COMPLIANCE CERTIFICATION SERVICES (UL CCS) FORM NO: CCSUP4031B
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL CCS.

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.						
4/10/2012	D1900V2	5d043	Head	1g	39.7	40.8	-2.70	±10
				10g	20.6	21.2	-2.83	
4/11/2012	D1900V2	5d043	Body	1g	44.4	42.0	5.71	±10
				10g	23.4	22.0	6.36	
4/16/2012	D2450V2	748	Head	1g	54.8	53.6	2.24	±10
				10g	25.1	24.8	1.21	
4/17/2012	D2450V2	748	Body	1g	53.1	50.8	4.53	±10
				10g	24.6	23.6	4.24	

This report shall not be reproduced except in full, without the written approval of UL CCS.

12. SAR Test Result

12.1. GSM1900

12.1.1. Head SAR with IR sensor activated

Test Position	Pwr back-off	Mode	Ch #.	Freq. (MHz)	Avg Pwr (dBm)	SAR (mW/g)		Note
						1-g	10-g	
Left Touch	Yes	Voice	512	1850.2	22.9			1
			661	1880.0	22.9	0.181	0.094	
			810	1909.8	22.8			1
Left Tilt	Yes	Voice	512	1850.2	22.9			1
			661	1880.0	22.9	0.201	0.104	
			810	1909.8	22.8			1
Right Touch	Yes	Voice	512	1850.2	22.9			1
			661	1880.0	22.9	0.501	0.226	
			810	1909.8	22.8			1
Right Tilt	Yes	Voice	512	1850.2	22.9			1
			661	1880.0	22.9	0.516	0.233	
			810	1909.8	22.8			1

12.1.2. Body SAR

Test position	Distance (mm)	Pwr back-off	Mode	Ch No.	Freq. (MHz)	Avg Pwr (dBm)	SAR (mW/g)		Note
							1-g	10-g	
Rear	0	Yes	GPRS 3 Slot	512	1850.2	18.7			1
				661	1880.0	18.7	0.614	0.281	
				810	1909.8	18.5			1
	8	No	GPRS 3 Slot	512	1850.2	25.4			1
				661	1880.0	25.6	0.690	0.370	
				810	1909.8	25.6			1
				661	1880.0	25.6	0.744	0.394	2
Edge 1	0	Yes	GPRS 3 Slot	512	1850.2	18.7			1
				661	1880.0	18.7	0.612	0.272	
				810	1909.8	18.5			1
	5	No	GPRS 3 Slot	512	1850.2	25.4	0.990	0.518	
				661	1880.0	25.6	1.010	0.524	
				810	1909.8	25.6	0.986	0.512	
Edge 1 @45° (Vertex)	0	No	GPRS 3 Slot	512	1850.2	25.4			1
				661	1880.0	25.6	0.651	0.349	
				810	1909.8	25.6			1
Edge 4	0	No	GPRS 3 Slot	512	1850.2	25.4			1
				661	1880.0	25.6	0.541	0.269	
				810	1909.8	25.6			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.
2. With headset attached.

COMPLIANCE CERTIFICATION SERVICES (UL CCS) FORM NO: CCSUP4031B
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL CCS.

12.2. Wi-Fi 802.11bgn

Justification for using body phantom for measuring head SAR for WiFi Antenna

Due to the size of the DUT and the position of the WiFi antenna, it was impossible to get meaningful data for head SAR.

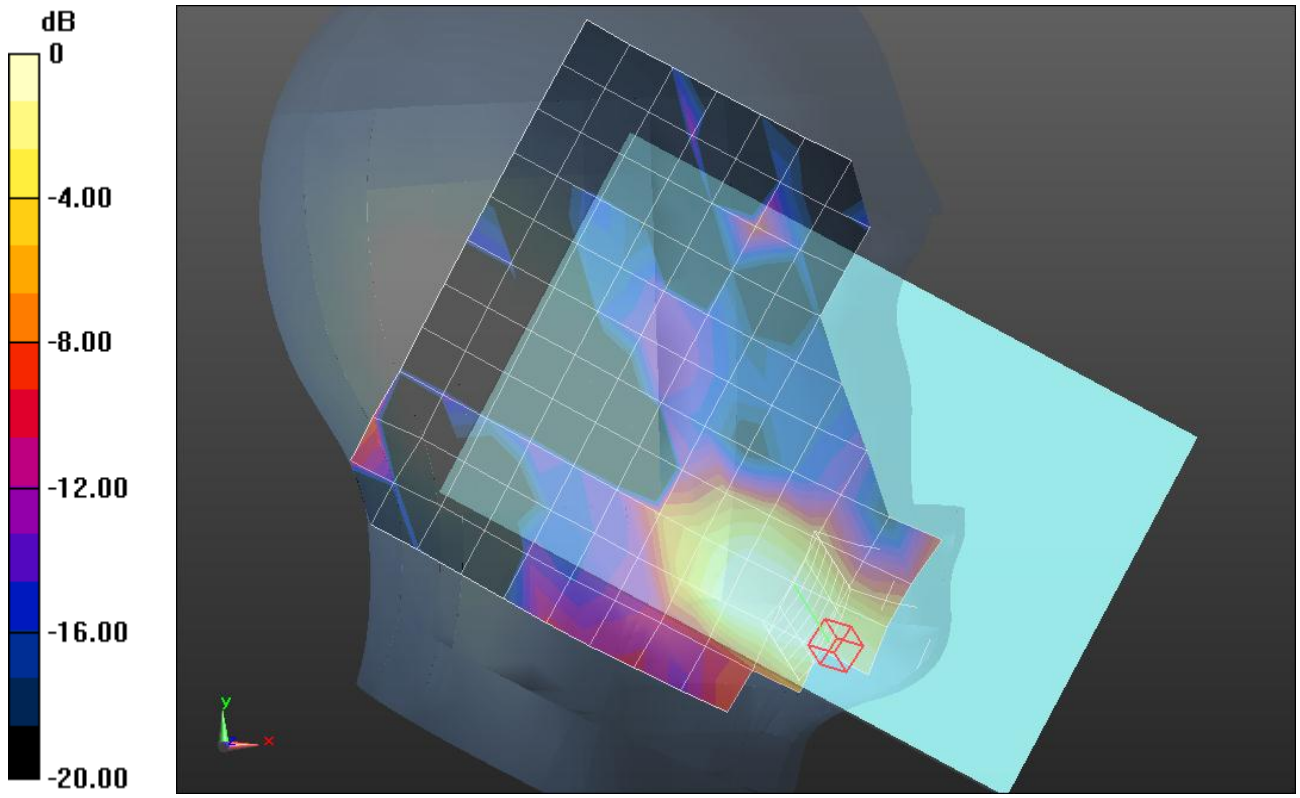
The following procedure was applied (KDB 648474 section on SAR Tests in Mouth and Jaw Regions of the SAM Phantom):

- DUT was positioned with its bottom edge positioned from the flat phantom with the same distance provided by the cheek touching position using SAM.
- The ear reference point (ERP, as defined for SAM) of the device should be positioned ½ cm from the flat phantom shell.
- The lower half of the DUT is secured in the test device holder at a fixed distance below the flat phantom determined by the minimum separation along the lower edge of the DUT in the cheek touching position using SAM.

The DUT protruded too far from the SAM to allow measurement from its bottom edge. The separation distance from the antenna to the phantom was used as a reference. This resulted in the antenna being closer to the phantom when the DUT was mounted on the left. Therefore the left head distance was used as the most conservative.

See section 18.2 Setup Photos for details on device positioning and photographs showing how separation distances are determined.

The following head SAR plot is provided to show the difficulties associated with using the Flat Phantom for measuring head SAR with this DUT.



0 dB = 0.020mW/g = -33.98 dB mW/g

This report shall not be reproduced except in full, without the written approval of UL CCS.

12.2.1. Head SAR

Test Position	Mode	Ch No.	Freq. (MHz)	Avg Pwr (dBm)	SAR (mW/g)		Note
					1-g	10-g	
Under Flat Phantom	802.11b	1	2412	11.69			1
		6	2437	11.70	0.186	0.096	
		11	2462	11.69			1

12.2.2. Body SAR

Test Position	Distance (mm)	Mode	Ch #.	Freq. (MHz)	Avg Pwr (dBm)	SAR (mW/g)		Note
						1-g	10-g	
Rear	0	802.11b	1	2412	11.69			1
			6	2437	11.70	0.503	0.205	
			11	2462	11.69			1
			1	2412	11.70	0.507	0.205	2
Edge 4	0	802.11b	1	2412	11.69			1
			6	2437	11.70	0.335	0.140	
			11	2462	11.69			1
Edge 4 @ 45º	0	802.11b	1	2412	11.69			1
			6	2437	11.70	0.179	0.074	
			11	2462	11.69			1

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.

COMPLIANCE CERTIFICATION SERVICES (UL CCS) FORM NO: CCSUP4031B
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL CCS.

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)
GSM1900	Head: Right Tilt	GPRS 3 Slot, CS1 w/ IR sensor activated	--	0.516
	Body: Edge 1	GPRS 3 Slot, CS1	5	1.010
Wi-Fi 802.11bgn	Head on Flat Phantom	802.11b	--	0.186
	Body: Rear with Headset	802.11b	0	0.507

This report shall not be reproduced except in full, without the written approval of UL CCS.

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

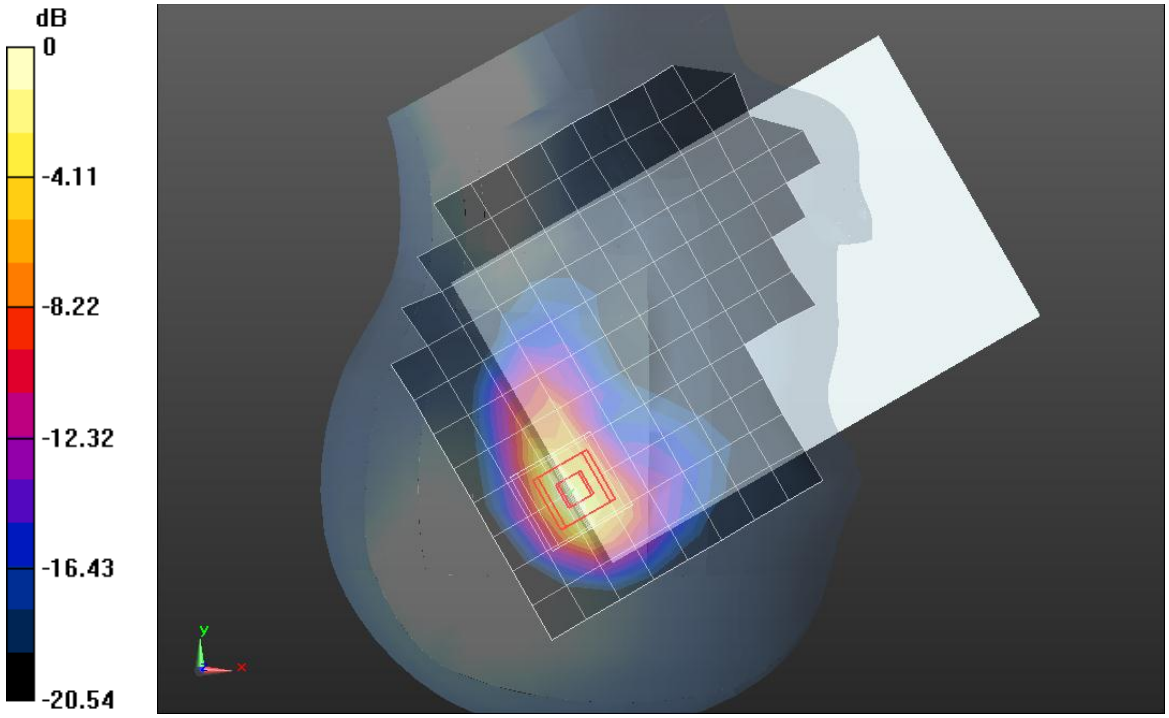
Test Laboratory: UL CCS SAR Lab B Date: 4/10/2012

GSM 1900

Frequency: 1880 MHz; Duty Cycle: 1:8.30042; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C
Medium parameters used: f = 1880 MHz; σ = 1.433 mho/m; ε_r = 39.602; ρ = 1000 kg/m^3
DASY5 Configuration:
- Electronics: DAE4 Sn1259; Calibrated: 2/13/2012
- Probe: EX3DV3 - SN3531; ConvF(8.53, 8.53, 8.53); Calibrated: 12/19/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: SAM; Type: QD000P40CD; Serial: 1629

Right/Tilt_Ch 661/Area Scan (12x16x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.585 mW/g

Right/Tilt_Ch 661/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.645 V/m; Power Drift = -0.15 dB
Peak SAR (extrapolated) = 1.0500
SAR(1 g) = 0.516 mW/g; SAR(10 g) = 0.233 mW/g
Maximum value of SAR (measured) = 0.656 mW/g



0 dB = 0.660mW/g = -3.61 dB mW/g

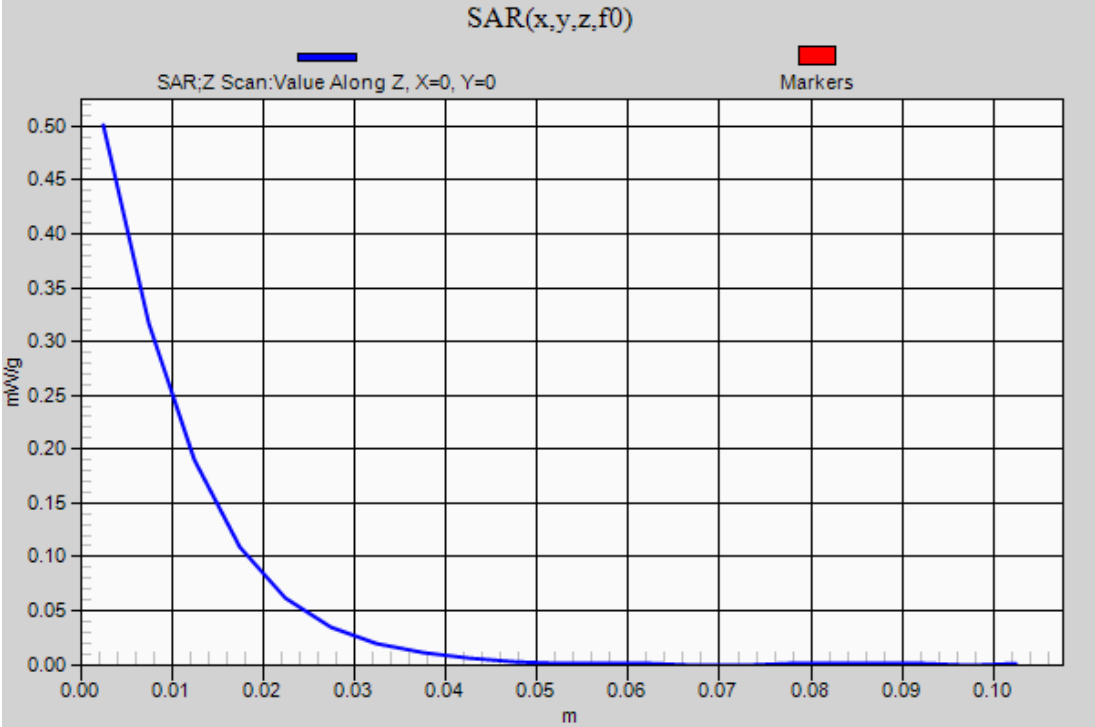
This report shall not be reproduced except in full, without the written approval of UL CCS.

Test Laboratory: UL CCS SAR Lab B Date: 4/10/2012

GSM 1900

Frequency: 1880 MHz; Duty Cycle: 1:8.30042

Right/Tilt_Ch 661/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 0.501 mW/g



This report shall not be reproduced except in full, without the written approval of UL CCS.

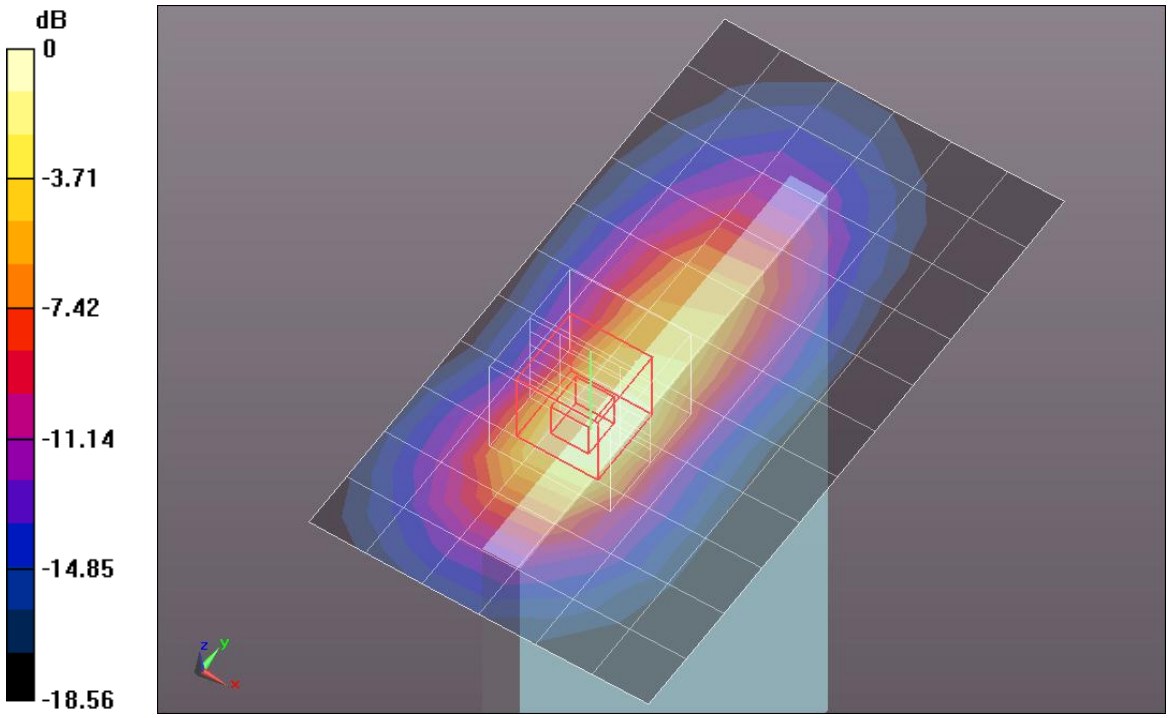
Test Laboratory: UL CCS SAR Lab B Date: 4/12/2012

GSM1900

Frequency: 1880 MHz; Duty Cycle: 1:2.60016; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C
Medium parameters used: f = 1880 MHz; σ = 1.519 mho/m; ε_r = 53.233; 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)
- Phantom: ELI v5.0 (A); Type: QDOVA001BB; Serial: 1120

Edge_1_5mm/GPRS 3 slots_CH 661/Area Scan (7x12x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.933 mW/g

Edge_1_5mm/GPRS 3 slots_CH 661/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 27.101 V/m; Power Drift = -0.18 dB
Peak SAR (extrapolated) = 1.7440
SAR(1 g) = 1.01 mW/g; SAR(10 g) = 0.524 mW/g
Maximum value of SAR (measured) = 1.260 mW/g



0 dB = 1.260mW/g = 2.01 dB mW/g

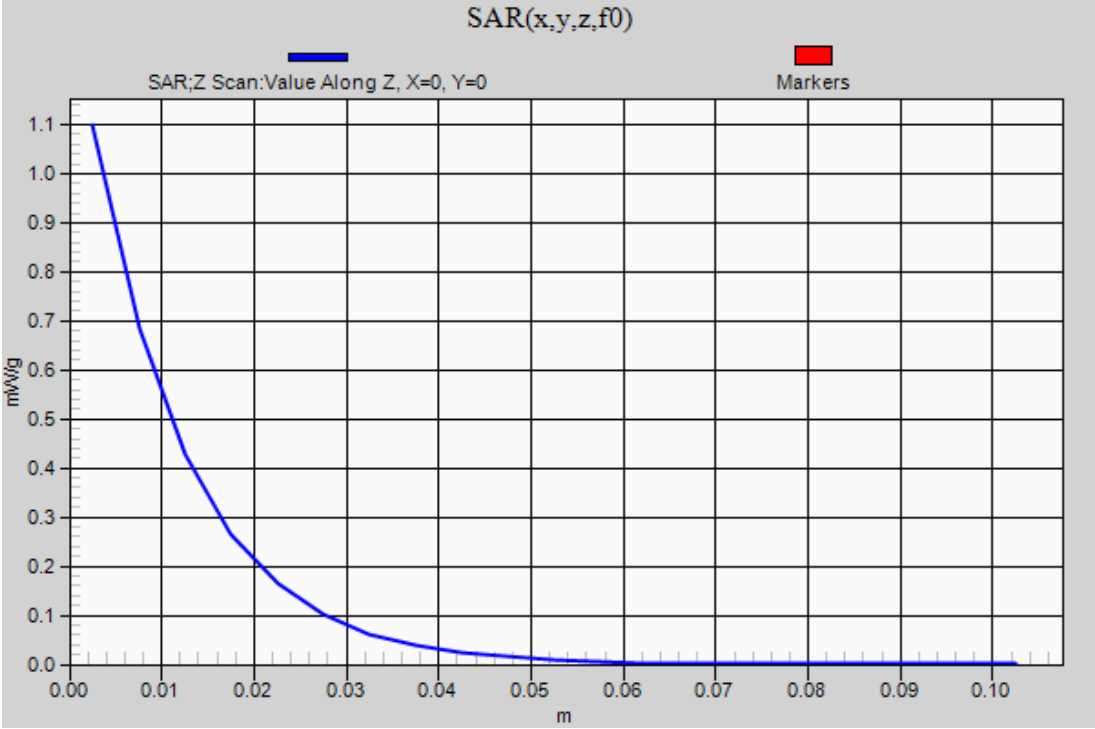
COMPLIANCE CERTIFICATION SERVICES (UL CCS) FORM NO: CCSUP4031B
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL CCS.

Test Laboratory: UL CCS SAR Lab B Date: 4/12/2012

GSM1900

Frequency: 1880 MHz; Duty Cycle: 1:2.60016

Edge_1_5mm/GPRS 3 slots_CH 661/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 1.099 mW/g



This report shall not be reproduced except in full, without the written approval of UL CCS.

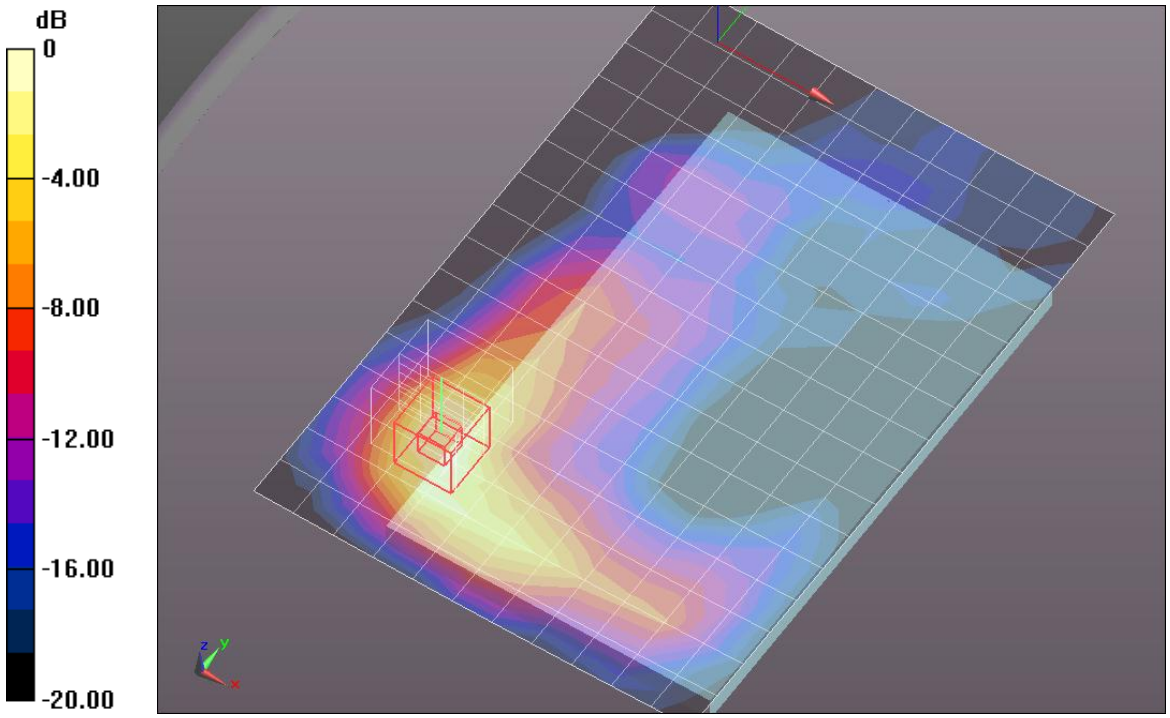
Test Laboratory: UL CCS SAR Lab B Date: 4/16/2012

WiFi 2.4GHz Band

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; σ = 1.851 mho/m; ε_r = 40.254; 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: ELI v5.0 (A); Type: QDOVA001BB; Serial: 1120

Flat Phantom/802.11b, ch 6/Area Scan (12x17x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.212 mW/g

Flat Phantom/802.11b, ch 6/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 10.860 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.3670
SAR(1 g) = 0.186 mW/g; SAR(10 g) = 0.096 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.256 mW/g



0 dB = 0.260mW/g = -11.70 dB mW/g

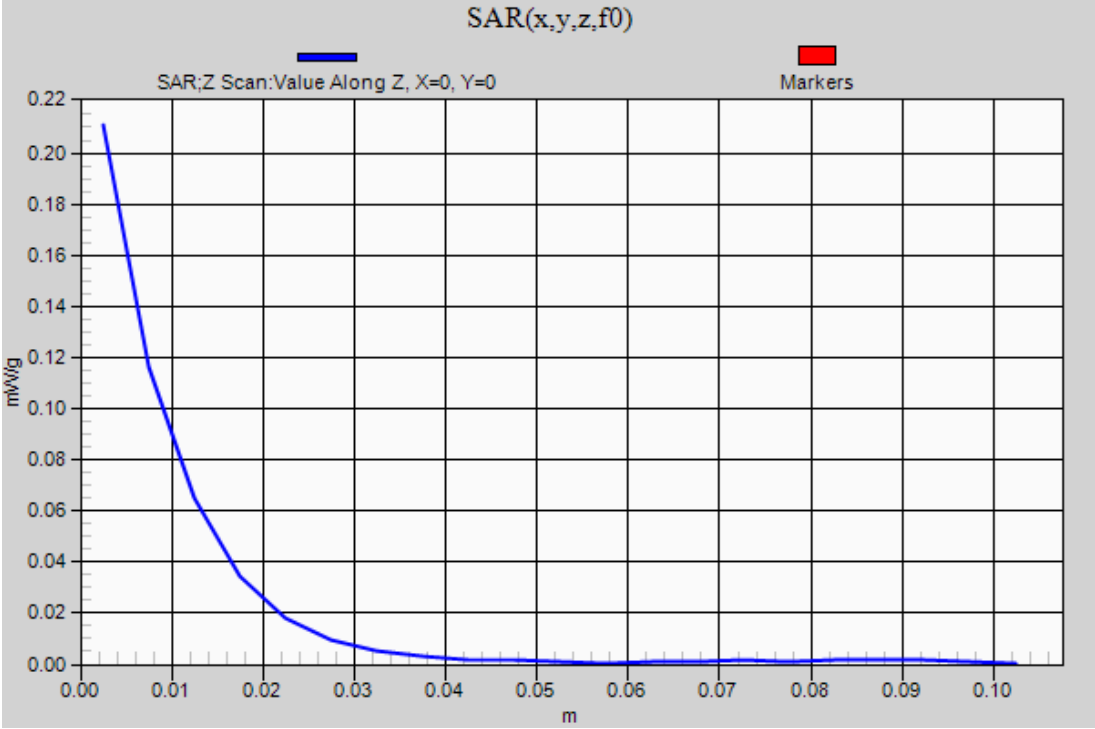
This report shall not be reproduced except in full, without the written approval of UL CCS.

Test Laboratory: UL CCS SAR Lab B Date: 4/16/2012

WiFi 2.4GHz Band

Frequency: 2437 MHz; Duty Cycle: 1:1

Flat Phantom/802.11b, 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) = 0.211 mW/g



COMPLIANCE CERTIFICATION SERVICES (UL CCS) FORM NO: CCSUP4031B
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL CCS.

Test Laboratory: UL CCS SAR Lab B Date: 4/17/2012

WiFi 2.4GHz Band

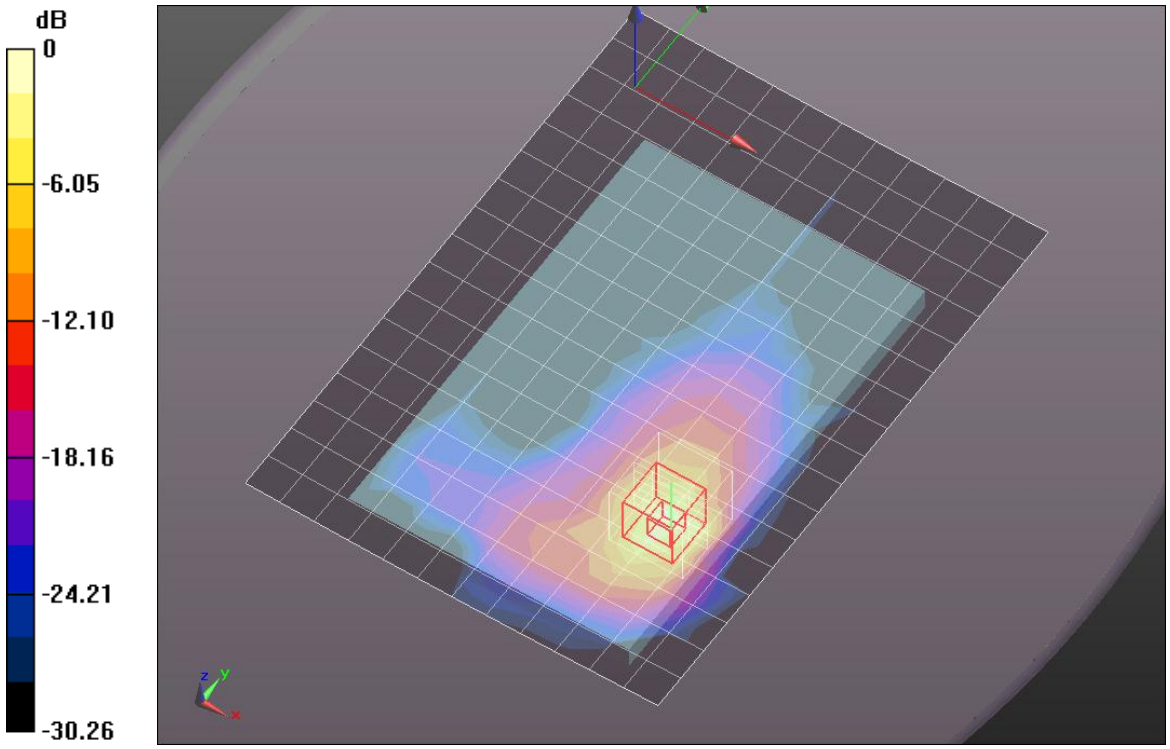
Frequency: 2437 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.916 mho/m; ε_r = 50.552; ρ = 1000 kg/m^3
DASY5 Configuration:
- Electronics: DAE4 Sn1259; Calibrated: 2/13/2012
- Probe: EX3DV3 - SN3531; ConvF(7.44, 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 (A); Type: QDOVA001BB; Serial: 1120

Rear/802.11b, ch 6_headset/Area Scan (13x18x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.490 mW/g

Rear/802.11b, ch 6_headset/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 16.007 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 1.3770
SAR(1 g) = 0.507 mW/g; SAR(10 g) = 0.205 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.845 mW/g



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

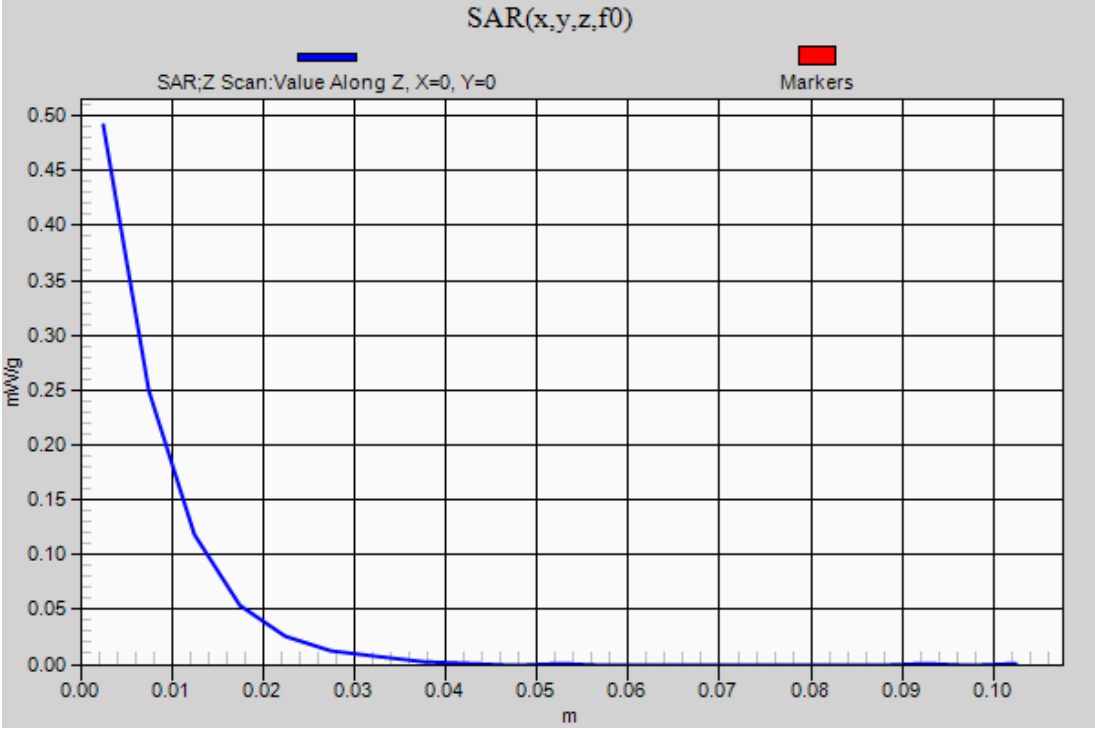
This report shall not be reproduced except in full, without the written approval of UL CCS.

Test Laboratory: UL CCS SAR Lab B Date: 4/17/2012

WiFi 2.4GHz Band

Frequency: 2437 MHz; Duty Cycle: 1:1

Rear/802.11b, ch 6_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) = 0.492 mW/g



This report shall not be reproduced except in full, without the written approval of UL CCS.

14. Simultaneous Transmission SAR Analysis

As Bluetooth's max average power is less than 24 mW (2·PRef) standalone SAR is not required. Therefore, GSM and WiFi simultaneous transmission SAR evaluation is not required with Bluetooth.

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

Test Position	GSM1900	WiFi	Σ 1g SAR (mW/g)
Left Touch	0.181	0.186	0.367
Left Tilt	0.201	0.186	0.387
Right Touch	0.501	0.186	0.687
Right Tilt	0.516	0.186	0.702

14.2. SAR to Peak Location Separation Ratio (SPLSR)

N/A: Sum of the SAR is not greater than 1.6 W/kg, therefore SPLSR does not need to be calculated.

14.3. Sum of the 1g SAR for Body Exposure Condition

Test Position	GSM1900	WiFi	Σ 1g SAR (mW/g)
Rear	0.744	0.507	1.251
Edge 4	0.541	0.335	0.876

14.4. SAR to Peak Location Separation Ratio (SPLSR)

N/A: Sum of the SAR is not greater than 1.6 W/kg, therefore SPLSR does not need to be calculated.

14.5. SAR Peak Location Separation Distance

N/A

This report shall not be reproduced except in full, without the written approval of UL CCS.

15. Appendixes

Refer to separated files for the following appendixes.

15.1. System Performance Check Plots

15.2. SAR Test Plots for GSM1900

15.3. SAR Test Plots for WiFi 2.4 GHz Band

15.4. Calibration Certificate for E-Field Probe EX3DV3 - SN 3531

15.5. Calibration Certificate for D1900V2 - SN 5d043

15.6. Calibration Certificate for D2450V2 - SN 748

This report shall not be reproduced except in full, without the written approval of UL CCS.