2FCC OET BULLETIN 65 SUPPLEMENT C 01-01
IEEE Std 1528-2003 and 1528a-2005

SAR EVALUATION REPORT

For
10.1 inch Tablet with LTE+UMTS+WI-FI Bands +BT 4.0+LE

Model: TP00043A
FCC ID: PU5-TP00043ASF

Report Number: 12U14463-2C
Issue Date: 11/19/2012

Prepared for
Lenovo US
1009 Think Place, B2/5E1
Morrisville, NC 27560, United States

Prepared by
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
--	10/12/2012	Initial Issue	--
A	10/24/2012	Section 10.1 – corrected 'without power back-off' to 'with power back-off'. Section 9.2 – added justification for testing at 20° angle. Section 10 – Included tune-up tolerances for Wi-Fi. Section 13 – Corrected scaling of Wi-Fi results based upon tune-up tolerances. Section 15 – Clarified introductory statement to indicate that Bluetooth and Wi-Fi (2.4GHz) cannot simultaneously transmit. Updated scaled Wi-Fi values. Section 7 – Updated table to differentiate between Bluetooth with Wi-Fi (2.4GHz) and Wi-Fi (5GHz) simultaneous transmission conditions. Sections 10 and 13 – added 5MHz Channel Bandwidth test results	Dave Weaver
B	11/15/2012	Section 7.4 – indicated that MPR is mandatory (item 7) Section 7.2 – Corrected simultaneous transmission table Section 7.3 – Justified not performing Hotspot testing Section 10.4 – expanded note explaining why some reduced power levels exceeding the full power levels. Section 15.1 – Corrected incorrect reference in the table.	Dave Weaver
C	11/19/2012	Section 7 – Added accessories section (7.2) Section 7.4 – Expanded Hotspot table.	Dave Weaver

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

Table of Contents

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

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

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

1. Attestation of Test Results

Applicant	Lenovo US		
DUT description	10.1 inch Tablet with LTE+UMTS+WI-FI Bands +BT 4.0 LE		
Model	TP00043A		
Test device is	An identical prototype		
Device category	Portable		
Exposure category	General Population/Uncontrolled Exposure		
Date tested	6/21/2012 – 6/22/2012 8/14/2012-8/27/2012, 8/30/2012		
FCC Rule Parts	Freq. Range	Highest 1-g SAR	Limit
22H	824-849	0.738 W/kg (Body Edge1 w/0 mm distance)	1.6 W/kg
24E	1850-1910	1.44 W/kg (Body Rear w/0 mm distance)	
27 (LTE Band 4)	1715 - 1750	1.42 W/kg (Body Rear w/0 mm distance)	
27 (LTE Band 17)	709 - 711	0.90 W/kg (Body Rear w/0 mm distance)	
15.247	2412 - 2462	1.26 W/kg (Body Rear 20 º Tilt @ Edge 1)	
	5725 - 5850	0.558 W/kg (Body Edge 3 w/0 mm distance)	
15.407	5150-5250	0.429 W/kg (Body Edge 3 w/0 mm distance)	
	5250-5350	0.519 W/kg (Body Edge 3 w/0 mm distance)	
	5500-5700	0.710 W/kg (Body Edge 3 w/0 mm distance)	
Simultaneous transmission condition:		2.490 W/kg (The highest SAR across exposure conditions and SPLSR < 0.3)	
Applicable Standards			Test Results
FCC OET Bulletin 65 Supplement C 01-01, IEEE Std 1528-2003, 1528a-2005			Pass

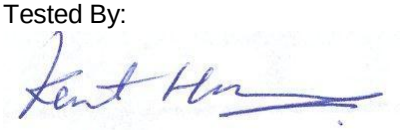
UL CCS tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and 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:

Dave Weaver
Program Manager
UL CCS

Tested By:



Kent Huang
SAR Engineer
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 1528a-2005, and the following KDB Procedures:

- 447498 D01 Mobile Portable RF Exposure v04
- 941225 D01 SAR test for 3G devices v02
- 941225 D02 Guidance for 3GPP R6 and R7 HSPA v02v01
- 941225 D03 SAR Test Reduction GSM GPRS EDGE v01
- 941225 D05 SAR for LTE Devices v01
- 941225 D06 Hot Spot SAR v01
- 248227 D01 SAR meas for 802 11abg v01r02
- 865664 SAR 3 to 6 GHz Rev SAR measurement procedures for transmitters operating in the 3 to 6 GHz range
- Power Reduction by Sensing (April/October 2011 TCB Workshop SAR Updates)

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 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	19	2013
ESA Series Network Analyzer	Agilent	E5071B	MY42100131	2	11	2013
Synthesized Signal Generator	HP	83732B	US34490599	7	14	2012
E-Field Probe	SPEAG	EX3DV4	3772	2	16	2013
E-Field Probe	SPEAG	EX3DV4	3749	1	27	2013
Thermometer	ERTCO	639-1S	1718	7	19	2012
Data Acquisition Electronics	SPEAG	DAE4	1258	3	8	2013
Data Acquisition Electronics	SPEAG	DAE3	500	6	13	2013
System Validation Dipole	SPEAG	D750V3	1024	4	4	2013
System Validation Dipole	SPEAG	D835V2	4d117	4	10	2013
System Validation Dipole	SPEAG	D1750V2	1050	4	19	2013
System Validation Dipole	SPEAG	D1900V2	5d043	11	10	2012
System Validation Dipole	SPEAG	D2450V2	748	2	7	2013
System Validation Dipole	SPEAG	D5GHzV2	1075	2	14	2013
Power Meter	HP	8481A	2720A66876	8	1	2013
Power Sensor	HP	438A	2822A05684	10	7	2013
Power Meter	HP	8481A	2237A31744	8	17	2013
Power Sensor	HP	438A	3513U04320	9	17	2012
Amplifier	MITEQ	4D00400600-50-30P	1620606	N/A		
Directional coupler	Werlatone	C8060-102	2141	N/A		

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	**-3.77**	Normal	1	0.64	-2.41
Liquid Permittivity - deviation from target	5.00	Rectangular	1.732	0.6	1.73
Liquid Permittivity - measurement uncertainty	**-4.46**	Normal	1	0.6	-2.68
				Combined Standard Uncertainty Uc(y) =	10.39
				Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =	20.77 %
				Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =	1.64 dB

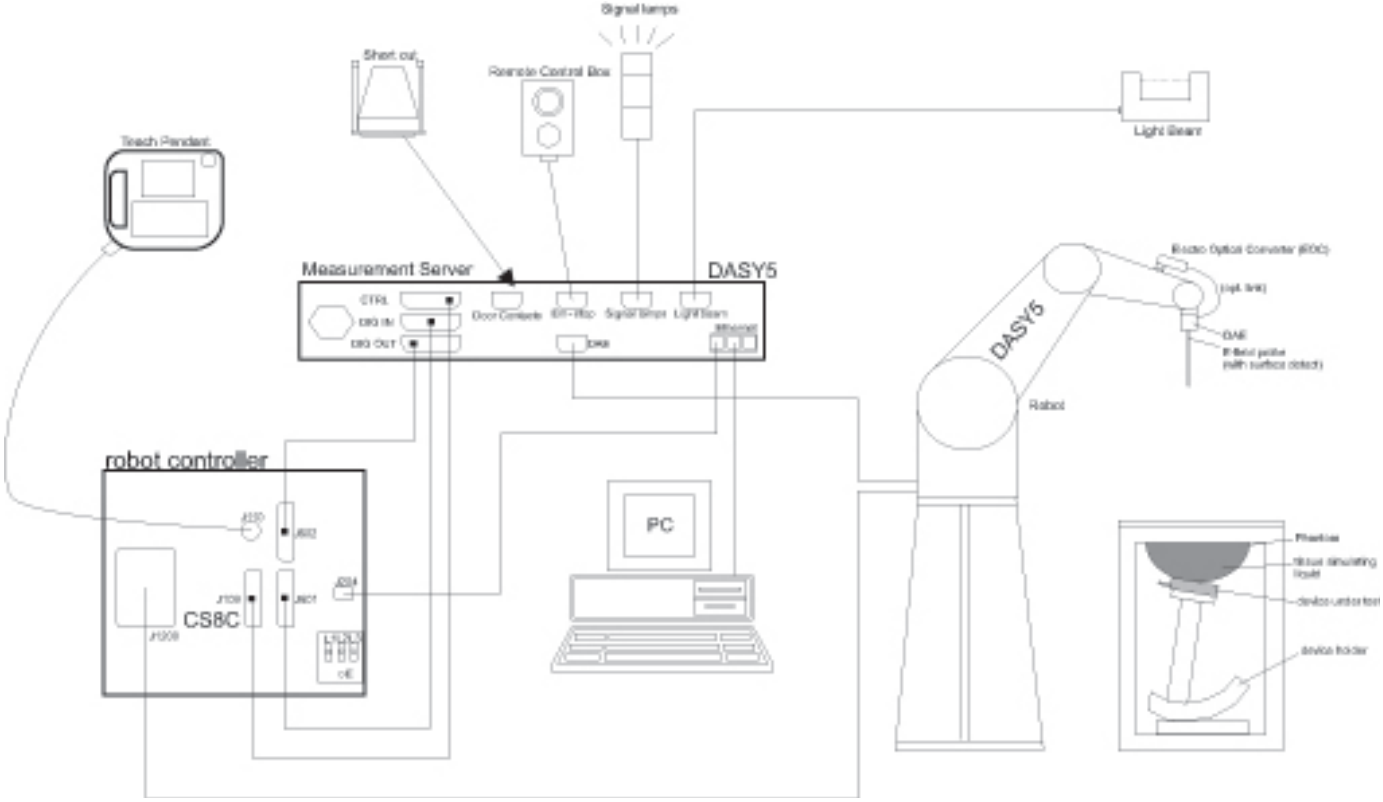
Measurement uncertainty for 3 to 6 GHz averaged over 1 gram

Component	Error, %	Distribution	Divisor	Sensitivity	U (Xi), %
Measurement System					
Probe Calibration (k=1)	**6.55**	Normal	1	1	6.55
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	1.00	Normal	1	1	1.00
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	3.90	Rectangular	1.732	1	2.25
Test Sample Related					
Test Sample Positioning	1.10	Normal	1	1	1.10
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	**4.72**	Normal	1	0.64	3.02
Liquid Permittivity - deviation from target	10.00	Rectangular	1.732	0.6	3.46
Liquid Permittivity - measurement uncertainty	**-3.35**	Normal	1	0.6	-2.01
				Combined Standard Uncertainty Uc(y), %:	11.06
				Expanded Uncertainty U, Coverage Factor = 1.96, > 95 % Confidence =	21.68 %
				Expanded Uncertainty U, Coverage Factor = 1.96, > 95 % Confidence =	1.70 dB

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

5. Measurement System Description and Setup

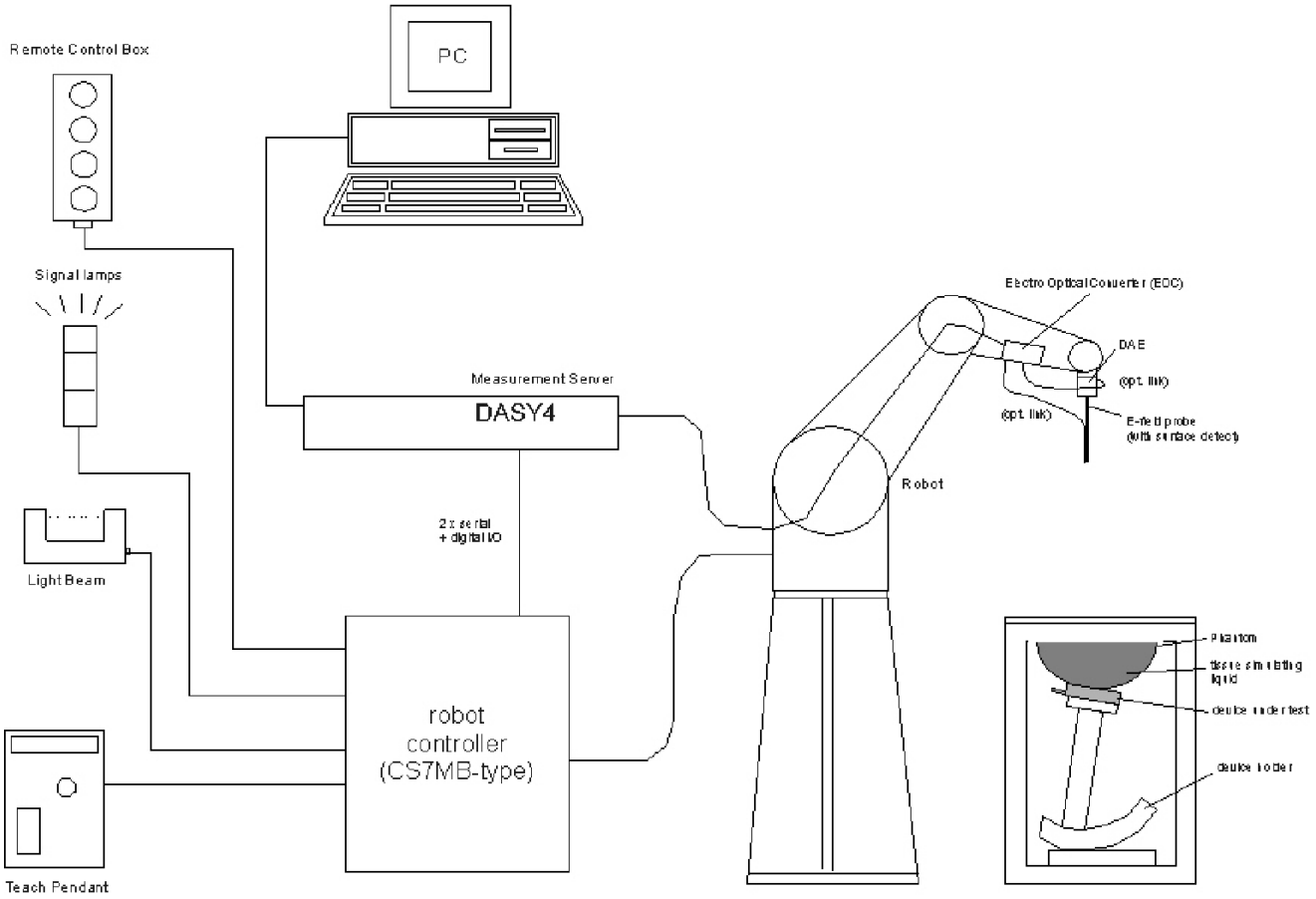
The DASY5 system used for performing compliance tests consists of the following items:



- 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.

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

The DASY4 system used for performing compliance tests consists of the following items:



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

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.

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

10.1 inch Tablet with LTE+UMTS+WI-FI Bands +BT 4.0+LE Models: TP00043A LTE+UMTS transmitter: Sierra Model: EM7700 Wi-Fi+BT transmitter: Broadcom Model: BCM94330LGA	
Normal operation	Body (Rear/bottom and each edge): Multiple display orientations supporting both portrait and landscape configurations
Device Dimension (mm)	266 mm(L) x 163 mm(W) x 8 mm (H)
Antenna tested	Manufactured / Part number Wistron: WWAN Main Ant: 81.EK615.G10 (25.90ADM.001) WWAN Aux Ant: 81.EK615.G11 (25.90ADO.001) Wistron: WLAN Main Ant: 81.EK615.G12 (25.90ADN.001) WLAN Aux. Ant: 81.EK615.G13 (25.90ADP.001)

7.1. Band and Air Interfaces

Air Interfaces	- W-CDMA (UMTS) Rel 99, HSDPA (Rel 6, CAT 14), HSUPA (Rel 6, CAT 6) - LTE Band 4 & 17 (QPSK & 16 QAM) - 802.11a/b/g/n HT20 - Bluetooth Ver 3.0 + LE
Tx Frequency Bands	- W-CDMA (UMTS) Band V: 824 - 849 MHz - W-CDMA (UMTS) Band II: 1850 - 1910 MHz - LTE Band 4: 1715 - 1750 MHz - LTE Band 17: 709 - 711 MHz - 802.11a/b/g/n: 2412 - 2462 MHz - 5180 - 5240 MHz - 5260 - 5320 MHz - 5500 - 5700 MHz - 5745 - 5825 MHz - Bluetooth: 2402 - 2480 MHz Note: There are two antennas for WLAN. Wi-Fi 2.4GHz Band and BT only transmit on the Main antenna. Wi-Fi 5 GHz Bands only transmit on the Aux antenna.

7.2. Accessories

A docking station or keyboard with stand are available for this device.

Both accessories restrict the DUT to being used upright (edge 3 to the user). Use of the docking station or keyboard with stand will increase the separation distance between the edge 3 and the user by the thickness of the accessory. Edge 3 SAR measurements were performed at zero separation distance which constitutes the most conservative scenario. Additional testing with the docking station or keyboard with stand was considered unnecessary.

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

7.3. Simultaneous Transmission

No.	Conditions	Head	Body	Hotspot
1	W-CDMA (UMTS) Band V+ Wi-Fi 2.4GHz	☐	☒	☒
2	W-CDMA (UMTS) Band V+ Wi-Fi 5GHz	☐	☒	☐
3	W-CDMA (UMTS) Band II+ Wi-Fi 2.4GHz	☐	☒	☒
4	W-CDMA (UMTS) Band II+ Wi-Fi 5GHz	☐	☒	☐
5	W-CDMA (UMTS) Band V+ BT	☐	☒	☐
6	W-CDMA (UMTS) Band II+ BT	☐	☒	☐
7	LTE Band 4 + Wi-Fi 2.4GHz	☐	☒	☒
8	LTE Band 4 + Wi-Fi 5GHz	☐	☒	☐
9	LTE Band 17 + Wi-Fi 2.4GHz	☐	☒	☒
10	LTE Band 17 + Wi-Fi 5GHz	☐	☒	☐
11	LTE Band 4 + BT	☐	☒	☐
12	LTE Band 17 + BT	☐	☒	☐
13	Wi-Fi 5GHz Bands + BT	☐	☒	☐

Note(s):

1. 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.
2. Wi-Fi 2.4GHz band and BT cannot simultaneously transmit.

7.4. Hotspot (Wireless router) Exposure Condition

The device is capable of personal hotspot mode. The hotspot mode can be enabled by the user.
As the DUT has a form factor >9 cm x 5 cm the hotspot procedures from 941225 D06 Hot Spot SAR v01 do not apply.

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

7.5. KDB 941225 D05 SAR for LTE Devices v01

As per 3GPP TS 36.101 v10.3.0 (2011-09), Release 10.4

<table>
<tr><th>Item</th><th>Description</th><th colspan="3">Information</th></tr>
<tr><td>1</td><td>Identify the operating frequency range of each LTE transmission band used by the device</td><td colspan="2">Band 17:
Tx: 704 – 716 MHz
Rx: 734 – 746 MHz</td><td>Band 4:
Tx 1710 – 1755 MHz
Rx 2100 – 2155 MHz</td></tr>
<tr><td>2</td><td>Identify the channel bandwidths used in each frequency band; 1.4, 3, 5, 10, 15, 20 MHz etc</td><td colspan="3">Band 4: 10MHz
Band 17: 10 MHz</td></tr>
<tr><td>3</td><td>Identify the high, middle and low (H, M, L) channel numbers and frequencies in each LTE frequency band</td><td colspan="3"><table>
<tr><td rowspan="3">Band 4</td><td colspan="2">Channel Bandwidth</td></tr>
<tr><td>10 MHz</td><td></td></tr>
<tr><td>Ch. # / Freq. (MHz)</td><td></td></tr>
<tr><td>Low</td><td>20000/1715</td><td></td></tr>
<tr><td>Mid</td><td>20175/1732.5</td><td></td></tr>
<tr><td>High</td><td>20350/1750</td><td></td></tr>
<tr><td rowspan="3">Band 17</td><td></td><td></td></tr>
<tr><td>10 MHz</td><td></td></tr>
<tr><td>Ch. # / Freq. (MHz)</td><td></td></tr>
<tr><td>Low</td><td>23780/709</td><td></td></tr>
<tr><td>Mid</td><td>23790/710</td><td></td></tr>
<tr><td>High</td><td>23800/711</td><td></td></tr>
</table></td></tr>
<tr><td>4</td><td>Specify the UE category and uplink modulations used</td><td colspan="3">UE Category: 3
Uplink Modulations: QPSK, 16QAM</td></tr>
<tr><td>5</td><td>Descriptions of the LTE transmitter and antenna implementation & identify whether it is a standalone transmitter operating independently of other wireless transmitters in the device or sharing hardware components and/or antenna(s) with other transmitters etc.</td><td colspan="3">A Single antenna is used for LTE and other wireless modes (GPRS/EGPRS/UMTS) for both Transmit and Receive.</td></tr>
<tr><td>6</td><td>Identify the LTE voice/data requirements in each operating mode and exposure condition with respect to head and body test configurations, antenna locations, handset flip-cover or slide positions, antenna diversity conditions, etc.</td><td colspan="3">Data Only device.
Exposure Conditions:
Body – Rear, Bottom, Left-edge, Top-edge, and Right-edge of the DUT at a separation distance of 0 cm from the flat phantom.
With Proximity Sensor Power back-off disabled
Rear of the DUT at the separation distance of 11 mm to the flat phantom.
Top-edge of the DUT at the separation distance of 14 mm to the flat phantom.
Top-edge/Right Corner of the DUT at the separation angle of 15 degrees to the flat phantom.</td></tr>
<tr><td>7</td><td>Identify if Maximum Power Reduction (MPR) is optional or mandatory, i.e. built-in by design: a) only mandatory MPR may be considered during SAR testing, when the maximum output power is permanently limited by the MPR implemented within the UE; and only for the applicable RB (resource block) configurations specified in LTE standards b) A-MPR (additional MPR) must be disabled.</td><td colspan="3">As per 3GPP TS 36.101 v10.3.0 (2011-09), Release 10.4
Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3<table>
<tr><th rowspan="2">Modulation</th><th colspan="6">Channel bandwidth / Transmission bandwidth (RB)</th><th rowspan="2">MPR (dB)</th></tr>
<tr><th>1.4 MHz</th><th>3.0 MHz</th><th>5 MHz</th><th>10 MHz</th><th>15 MHz</th><th>20 MHz</th></tr>
<tr><td>QPSK</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 1</td></tr>
<tr><td>16 QAM</td><td>≤ 5</td><td>≤ 4</td><td>≤ 8</td><td>≤ 12</td><td>≤ 16</td><td>≤ 18</td><td>≤ 1</td></tr>
<tr><td>16 QAM</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 2</td></tr>
</table>MPR is permanently built-in by design and is mandatory when power reduction due to proximity sensor activation is disabled.
MPR is disabled when power reduction due to proximity sensor activation is enabled.
A-MPR is supported by design, but is disabled for SAR testing.
A-MPR is disabled, by using Network Setting value of NS_01.</td></tr>
</table>

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

KDB 941225 D05 SAR for LTE Devices v01 (Continued)

<table>
<tr><th>Item</th><th>Description</th><th colspan="2">Information</th></tr>
<tr><td>8</td><td>Include the maximum average conducted output power measured on the required test channels for each channel bandwidth and UL modulation used in each frequency band:
a) with 1 RB allocated at the upper edge of a channel
b) with 1 RB allocated at the lower edge of a channel
c) using 50% RB allocation centered within a channel
d) using 100% RB allocation</td><td colspan="2">Refer to section 7.3</td></tr>
<tr><td rowspan="13">9</td><td rowspan="13">Identify all other U.S. wireless operating modes (3G, Wi-Fi, WiMax, Bluetooth etc), device/exposure configurations (head and body, antenna and handset flip-cover or slide positions, antenna diversity conditions etc.) and frequency bands used for these modes</td><td>Band</td><td>Transmit Frequencies</td></tr>
<tr><td>Cellular Band</td><td>824 – 849 MHz</td></tr>
<tr><td>PCS Band</td><td>1850 – 1910 MHz</td></tr>
<tr><td rowspan="2">802.11a/b/g/n</td><td>2412 – 2472 MHz</td></tr>
<tr><td>5150 – 5850 MHz</td></tr>
<tr><td>Bluetooth</td><td>2402 – 2480 MHz</td></tr>
<tr><td>Mode</td><td>Uplink Modulations</td></tr>
<tr><td>UMTS Rel 99</td><td>BPSK, QPSK</td></tr>
<tr><td>HSDPA (Rel 7, CAT 14)</td><td>BPSK, QPSK</td></tr>
<tr><td>HSUPA (Rel 6, CAT 6)</td><td>BPSK, QPSK</td></tr>
<tr><td>DC-HSDPA (Rel 8, CAT 24)</td><td>BPSK, QPSK</td></tr>
<tr><td>HSPA+ (Rel 6, CAT 6)</td><td>BPSK, QPSK</td></tr>
<tr><td>802.11a/b/g/n</td><td>DSSS CCK, OFDM</td></tr>
<tr><td>Bluetooth 3.0 LE</td><td>DQPSK, 8DPSK, GFSK</td></tr>
<tr><td colspan="2">Data Only device.
Exposure Conditions:
• Body – Rear, Bottom, Left-edge, Top-edge, and Right-edge of the DUT at a separation distance of 0 cm from the flat phantom.
• With Proximity Sensor Power back-off disabled
○ Rear surface of the DUT at the separation distance of 11 mm to the flat phantom.
○ Top-edge of the DUT at the separation distance of 14 mm to the flat phantom.
○ Top-edge/Right Corner of the DUT at the separation angle of 15 degrees to the flat phantom</td></tr>
<tr><td>10</td><td>Include the maximum average conducted output power measured for the other wireless mode and frequency bands</td><td colspan="2">Refer to section 7.1, 7.2, 7.4 and 7.5</td></tr>
<tr><td>11</td><td>Identify the simultaneous transmission conditions for the voice and data configurations supported by all wireless modes, device configurations and frequency bands, for the head and body exposure conditions and device operating configurations (handset flip or cover positions, antenna diversity conditions etc.)</td><td colspan="2">• WWAN Radio (GPRS/EGPRS/UMTS/ LTE) can transmit simultaneously with Wi-Fi/BT Radio.
• Wi-Fi 2.4GHz Radio cannot transmit simultaneously with Bluetooth Radio.
• Wi-Fi 5GHz Radio can transmit simultaneously with Bluetooth Radio.</td></tr>
</table>

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

KDB 941225 D05 SAR for LTE Devices v01 (Continued)

Item	Description	Information
12	When power reduction is applied to certain wireless modes to satisfy SAR compliance for simultaneous transmission conditions, other equipment certification or operating requirements, include the maximum average conducted output power measured in each power reduction mode applicable to the simultaneous voice/data transmission configurations for such wireless configurations and frequency bands; and also include details of the power reduction implementation and measurement setup	Yes. A Proximity sensor for cellular power reduction is implemented in the device to address RF exposure compliance when the cellular antenna is positioned close to the user's body or other objects.
13	Include descriptions of the test equipment, test software, built-in test firmware etc. required to support testing the device when power reduction is applied to one or more transmitters/antennas for simultaneous voice/data transmission	The transmit power cap normally enabled by the proximity sensor, can be disabled by using a series of test commands which are only available in development software. The software provided on production units will not allow the proximity sensor or the power cap to be disabled.
14	When appropriate, include a SAR test plan proposal with respect to the above	Included in the KDB 716718
15	If applicable, include preliminary SAR test data and/or supporting information in laboratory testing inquiries to address specific issues and concerns or for requesting further test reduction considerations appropriate for the device; for example, simultaneous transmission configurations	Not applicable

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

7.6. Power Reduction Implementation

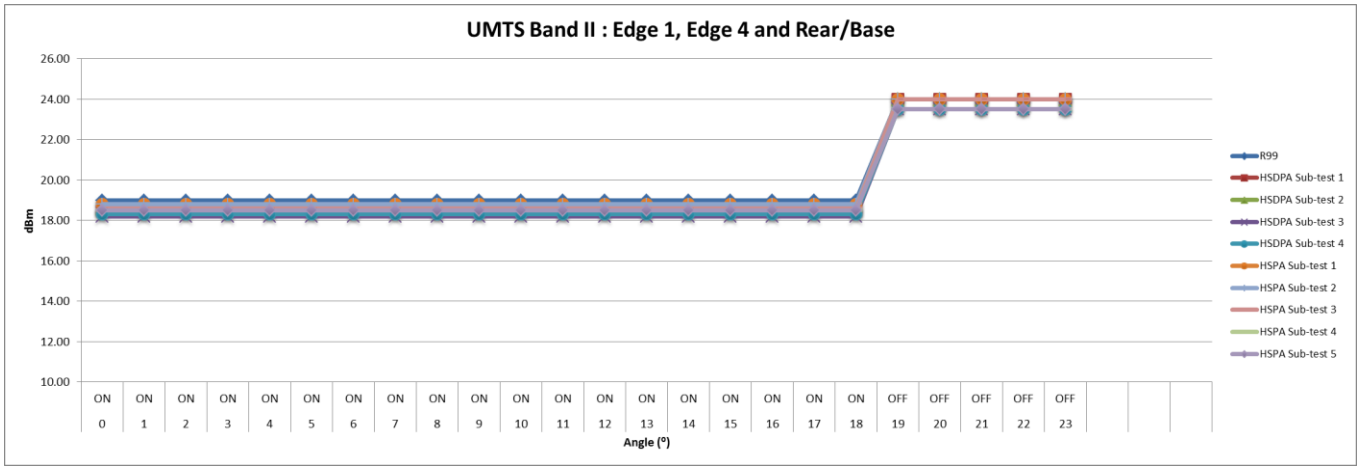
When a proximity sensor is enabled, system will reduce the WWAN module TX power. The proximity sensor convers the Rear/Bottom, Top-edge (Edge 1) and Secondary Portrait (Edge 4) of the DUT and the trigger distances are:

- 18 mm from Bottom (Rear) of the DUT
- 18 mm from Top-edge (Edge 1) of the DUT
- 18 mm from Secondary Portrait (Edge 4) of the DUT

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

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

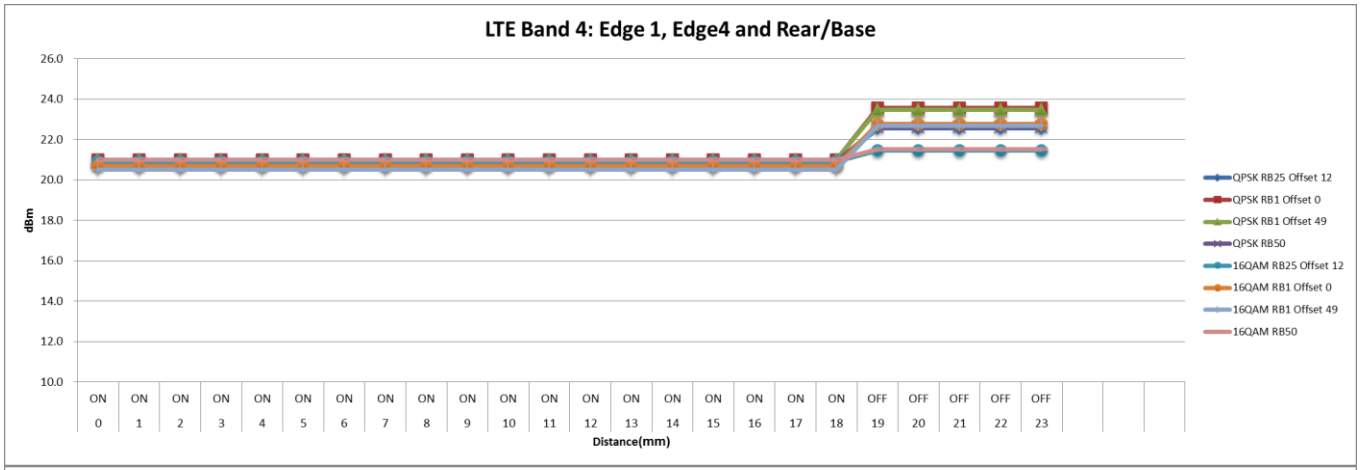
Edge 1, Edge 4 and Rear/Base (UMTS Band II)																								
Distance (mm):	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Proximity sensor with reduced power activation:	ON	ON	ON	ON	ON	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
R99	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	24.00	24.00	24.00	24.00	24.00
HSDPA Sub-test 1	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	24.00	24.00	24.00	24.00	24.00
HSDPA Sub-test 2	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	24.00	24.00	24.00	24.00	24.00
HSDPA Sub-test 3	18.20	18.20	18.20	18.20	18.20	18.20	18.20	18.20	18.20	18.20	18.20	18.20	18.20	18.20	18.20	18.20	18.20	18.20	18.20	23.50	23.50	23.50	23.50	23.50
HSDPA Sub-test 4	18.30	18.30	18.30	18.30	18.30	18.30	18.30	18.30	18.30	18.30	18.30	18.30	18.30	18.30	18.30	18.30	18.30	18.30	18.30	23.50	23.50	23.50	23.50	23.50
HSPA Sub-test 1	18.80	18.80	18.80	18.80	18.80	18.80	18.80	18.80	18.80	18.80	18.80	18.80	18.80	18.80	18.80	18.80	18.80	18.80	18.80	24.00	24.00	24.00	24.00	24.00
HSPA Sub-test 2	18.80	18.80	18.80	18.80	18.80	18.80	18.80	18.80	18.80	18.80	18.80	18.80	18.80	18.80	18.80	18.80	18.80	18.80	18.80	24.00	24.00	24.00	24.00	24.00
HSPA Sub-test 3	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	24.00	24.00	24.00	24.00	24.00
HSPA Sub-test 4	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	23.50	23.50	23.50	23.50	23.50
HSPA Sub-test 5	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	23.50	23.50	23.50	23.50	23.50

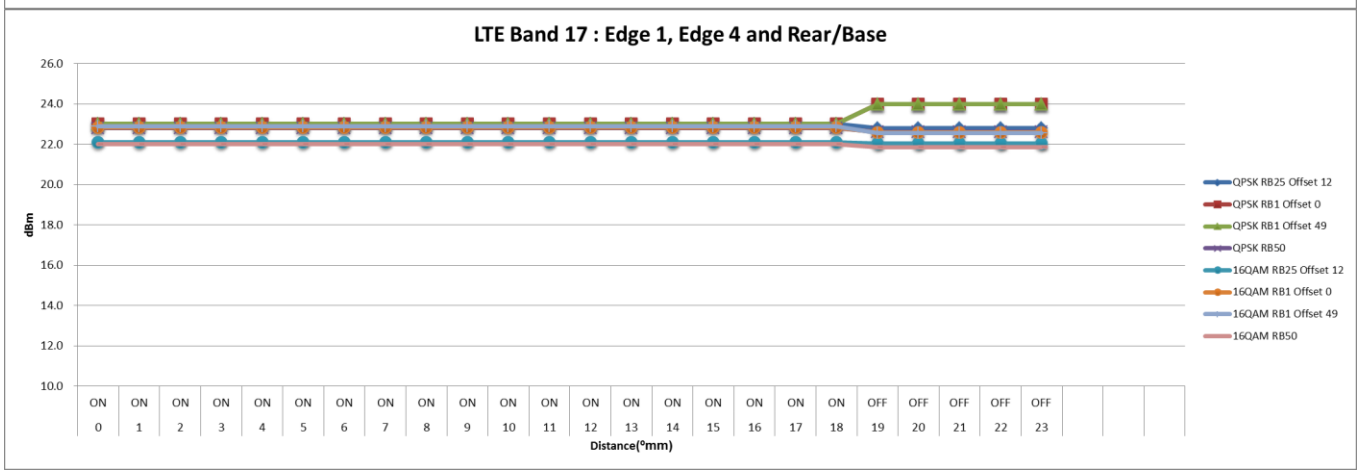


This report shall not be reproduced except in full, without the written approval of UL CCS.

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

Edge 1, Edge 4 and Rear/Base (LTE Band 4)																								
Distance (mm):	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Proximity sensor with reduced power activation:	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	OFF	OFF	OFF	OFF	OFF
QPSK RB25 Offset 12	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	22.6	22.6	22.6	22.6	22.6
QPSK RB1 Offset 0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	23.6	23.6	23.6	23.6	23.6
QPSK RB1 Offset 49	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	23.5	23.5	23.5	23.5	23.5
QPSK RB50	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	22.6	22.6	22.6	22.6	22.6
16QAM RB25 Offset 12	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	21.5	21.5	21.5	21.5	21.5
16QAM RB1 Offset 0	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	22.8	22.8	22.8	22.8	22.8
16QAM RB1 Offset 49	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	22.7	22.7	22.7	22.7	22.7
16QAM RB50	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.5	21.5	21.5	21.5	21.5
Edge 1, Edge 4 and Rear/Base (LTE Band 17)																								
Distance (mm):	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Proximity sensor with reduced power activation:	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	OFF	OFF	OFF	OFF	OFF
QPSK RB25 Offset 12	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	22.8	22.8	22.8	22.8	22.8
QPSK RB1 Offset 0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	24.0	24.0	24.0	24.0	24.0
QPSK RB1 Offset 49	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	24.0	24.0	24.0	24.0	24.0
QPSK RB50	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.6	22.6	22.6	22.6	22.6
16QAM RB25 Offset 12	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.0	22.0	22.0	22.0	22.0
16QAM RB1 Offset 0	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.6	22.6	22.6	22.6	22.6
16QAM RB1 Offset 49	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.6	22.6	22.6	22.6	22.6
16QAM RB50	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	21.8	21.8	21.8	21.8	21.8

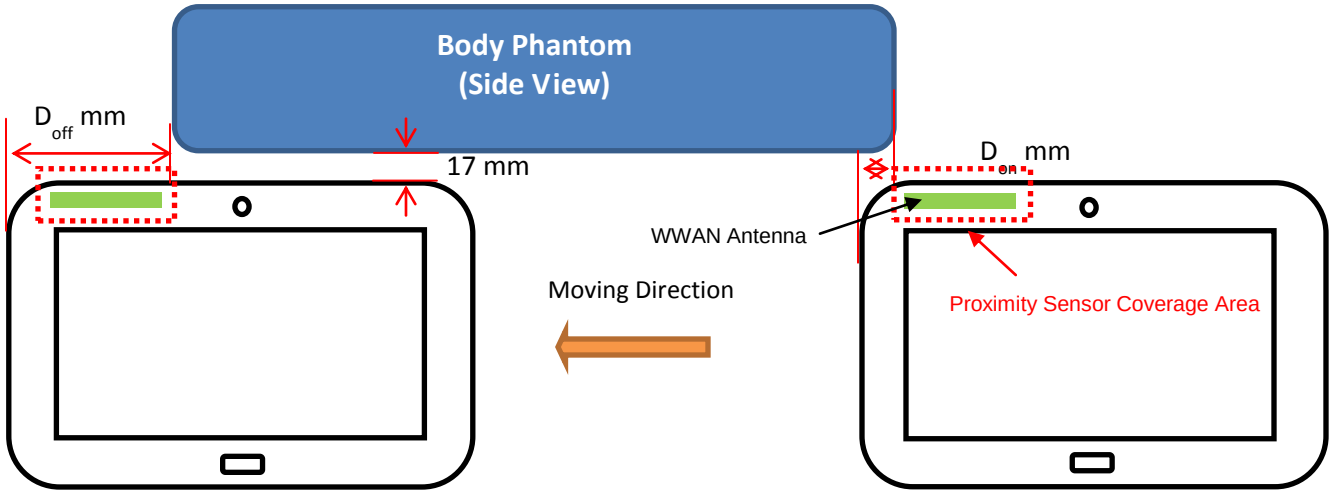




This report shall not be reproduced except in full, without the written approval of UL CCS.

8. Sensor Coverage Area

8.1.1. Edge Coverage

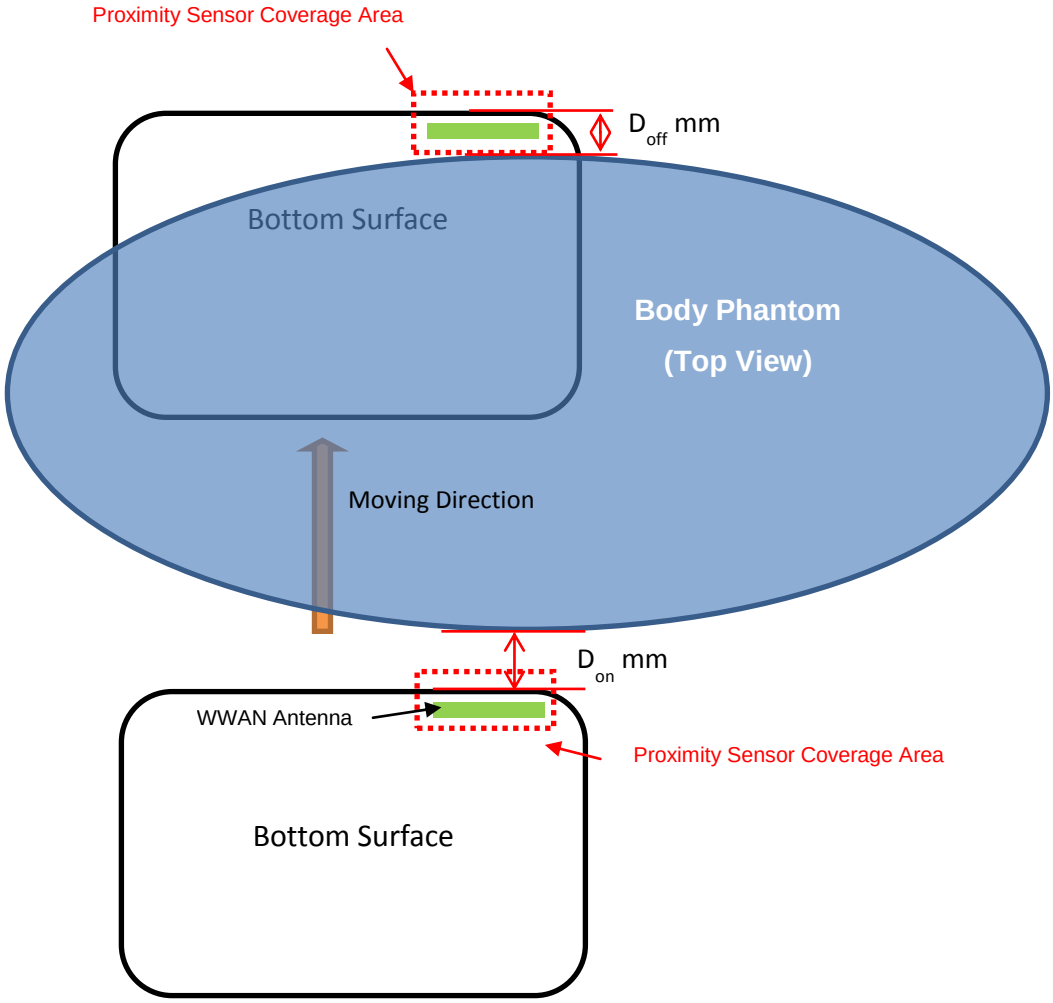


The DUT is positioned perpendicular to the phantom with the test separation distance, 17 mm, away from the phantom. The DUT is moved laterally to find the distance of triggering sensor on and off

- The minimum distance from the secondary portrait (Edge 4) to the edge of body phantom to trigger proximity sensor on, D_{on}, is 0 mm.
- The minimum distance from the secondary portrait (Edge 4) to the edge of body phantom to trigger proximity sensor off, D_{off}, is 120 mm.

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

8.1.2. Rear/Bottom Coverage



The DUT is positioned under the phantom with the test separation distance, 17 mm, away from the phantom. The DUT is moved laterally to find the distance of triggering sensor on and off

- The minimum distance from the secondary landscape (Edge 1) to the edge of body phantom to trigger proximity sensor on, D_{on}, is 0 mm.
- The minimum distance from the secondary landscape (Edge 1) to the edge of body phantom to trigger proximity sensor off, D_{off}, is 50 mm.

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

9. Summary of Test Configurations

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

9.1.1. Body Exposure Conditions for WWAN & LTE

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	4.05 mm	Yes	
Rear Tilt (20° Tilt @Edge1)	< 25 mm	Yes	This is the most conservative antenna-to-user distance at base/bottom mode
Edge 1	2.5 mm	Yes	
Edge 2	168.3 mm	No	This is not the most conservative antenna-to-user distance at edge mode as per KDB 447498 4) b) ii) (2)
Edge 3	152.1 mm	No	This is not the most conservative antenna-to-user distance at edge mode as per KDB 447498 4) b) ii) (2)
Edge 4	24.3 mm	Yes	

9.1.2. Body Exposure Conditions for Wi-Fi 2.4GHz Band (Main Antenna)

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	4.05 mm	Yes	
Rear Tilt (20° Tilt @Edge1)	< 25 mm	Yes	This is the most conservative antenna-to-user distance at base/bottom mode
Edge 1	2.5 mm	Yes	
Edge 2	23.9 mm	Yes	
Edge 3	152.1 mm	No	This is not the most conservative antenna-to-user distance at edge mode as per KDB 447498 4) b) ii) (2)
Edge 4	211.7 mm	No	This is not the most conservative antenna-to-user distance at edge mode as per KDB 447498 4) b) ii) (2)

9.1.3. Body Exposure Conditions for Wi-Fi 5GHz Bands (Aux Antenna)

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	6.45 mm	Yes	
Rear Tilt (20° Tilt @Edge3)	< 25 mm	Yes	This is the most conservative antenna-to-user distance at base/bottom mode
Edge 1	156.1 mm	No	This is not the most conservative antenna-to-user distance at edge mode as per KDB 447498 4) b) ii) (2)
Edge 2	39.5 mm	No	This is not the most conservative antenna-to-user distance at edge mode as per KDB 447498 4) b) ii) (2)
Edge 3	2.5 mm	Yes	
Edge 4	182.6 mm	No	This is not the most conservative antenna-to-user distance at edge mode as per KDB 447498 4) b) ii) (2)

9.2. Rear 20° Tilt testing justification

The rear of the DUT has a 20° bevel along each edge. As a result the most conservative antenna-to-user distance occurs when the beveled edge is placed directly against the user's body. Testing with the beveled edge placed directly against the phantom was considered necessary to ensure compliance.

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

10. RF Output Power Measurement

10.1. WCDMA (UMTS) Band V

Target Power: 23 dBm
Tune-up Tolerance: -1.0dB / +1.0dB

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

Results

Band	Mode	UL Ch No.	Freq. (MHz)	Tx Conducted Pwr (dBm)	
				W/o Pwr back-off	With back-off
W-CDMA (UMTS) Band V	Rel 99 (RMC, 12.2 kbps)	4132	826.4	23.6	N.A.
		4183	836.6	23.5	N.A.
		4233	846.6	23.6	N.A.

UL CCS FORM NO: CCSUP4031G
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.

HSDPA

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

	Mode	HSDPA	HSDPA	HSDPA	HSDPA
	Subtest	1	2	3	4
W-CDMA 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			

Results

Band	Mode	UL Ch No.	Freq. (MHz)	Tx Conducted Pwr (dBm)	
				Without Pwr back-off	With Pwr back-off
W-CDMA (UMTS) Band V	Subtest 1	4132	826.4	23.21	N.A.
		4183	836.6	23.00	N.A.
		4233	846.6	23.24	N.A.
	Subtest 2	4132	826.4	23.25	N.A.
		4183	836.6	23.09	N.A.
		4233	846.6	23.22	N.A.
	Subtest 3	4132	826.4	22.59	N.A.
		4183	836.6	22.34	N.A.
		4233	846.6	22.80	N.A.
	Subtest 4	4132	826.4	22.71	N.A.
		4183	836.6	22.53	N.A.
		4233	846.6	22.69	N.A.

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.

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

HSPA (HSDPA & HSUPA)

The following 5 Sub-tests were completed according to Release 6 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

	Mode	HSPA	HSPA	HSPA	HSPA	HSPA
	Subtest	1	2	3	4	5
WCDMA General Settings	Loopback Mode	Test Mode 1				
	Rel99 RMC	12.2kbps RMC				
	HSDPA FRC	H-Set1				
	HSUPA Test	HSUPA Loopback				
	Power Control Algorithm	Algorithm2				
	βc	11/15	6/15	15/15	2/15	15/15
	βd	15/15	15/15	9/15	15/15	15/15
	βec	209/225	12/15	30/15	2/15	24/15
	βc/βd	11/15	6/15	15/9	2/15	15/15
	βhs	22/15	12/15	30/15	4/15	30/15
	βed	1309/225	94/75	47/15 47/15	56/75	134/15
	CM (dB)	1.0	3.0	2.0	3.0	1.0
	MPR (dB)	0	2	1	2	0
HSDPA Specific Settings	DACK	8				
	DNAK	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				
HSUPA Specific Settings	D E-DPCCH	6	8	8	5	7
	DHARQ	0	0	0	0	0
	AG Index	20	12	15	17	21
	ETFCI (from 34.121 Table C.11.1.3)	75	67	92	71	81
	Associated Max UL Data Rate kbps	242.1	174.9	482.8	205.8	308.9
	Reference E_TFCIs	E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27		E-TFCI 11 E-TFCI PO 4 E-TFCI 92 E-TFCI PO 18	E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27	

UL CCS FORM NO: CCSUP4031G
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.

Results

Band	Mode	UL Ch No.	Freq. (MHz)	Tx Conducted Pwr (dBm)	
				Without Pwr back-off	With Pwr back-off
WCDMA (UMTS) Band II	Subtest 1	4132	826.4	23.2	N.A.
		4183	836.6	23.0	N.A.
		4233	846.6	23.1	N.A.
	Subtest 2	4132	826.4	23.2	N.A.
		4183	836.6	23.0	N.A.
		4233	846.6	23.1	N.A.
	Subtest 3	4132	826.4	23.2	N.A.
		4183	836.6	23.0	N.A.
		4233	846.6	23.2	N.A.
	Subtest 4	4132	826.4	22.7	N.A.
		4183	836.6	22.6	N.A.
		4233	846.6	22.7	N.A.
	Subtest 5	4132	826.4	22.7	N.A.
		4183	836.6	22.7	N.A.
		4233	846.6	22.7	N.A.

Note(s):

- KDB 941225 D01 – 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.

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

10.2. WCDMA (UMTS) Band II

Target Power: 23 dBm (without Power Back-off)
18 dBm (with Power Back-off)
Tune-up Tolerance: -1.0dB / +1.0dB

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

Results

Band	Mode	UL Ch No.	Freq. (MHz)	Tx Conducted Pwr (dBm)	
				W/o Pwr back-off	W/ Pwr back-off
UMTS (WCDMA) Band II	Rel 99 (RMC, 12.2 kbps)	9262	1852.4	24.0	19.0
		9400	1880.0	24.0	19.0
		9538	1907.6	24.0	19.0

UL CCS FORM NO: CCSUP4031G
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.

HSDPA

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

	Mode	HSDPA	HSDPA	HSDPA	HSDPA
	Subtest	1	2	3	4
W-CDMA 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			

Results

Band	Mode	UL Ch No.	Freq. (MHz)	Tx Conducted Pwr (dBm)	
				Without Pwr back-off	With Pwr back-off
W-CDMA (UMTS) Band II	Subtest 1	9262	1852.4	23.7	18.7
		9400	1880.0	23.6	18.6
		9538	1907.6	23.6	18.7
	Subtest 2	9262	1852.4	23.5	18.7
		9400	1880.0	23.6	18.6
		9538	1907.6	23.5	18.6
	Subtest 3	9262	1852.4	23.0	18.2
		9400	1880.0	23.0	18.2
		9538	1907.6	23.0	18.2
	Subtest 4	9262	1852.4	23.1	18.3
		9400	1880.0	23.1	18.2
		9538	1907.6	23.0	18.2

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.

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

HSPA (HSDPA & HSUPA)

The following 5 Sub-tests were completed according to Release 6 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

	Mode	HSPA	HSPA	HSPA	HSPA	HSPA
	Subtest	1	2	3	4	5
WCDMA General Settings	Loopback Mode	Test Mode 1				
	Rel99 RMC	12.2kbps RMC				
	HSDPA FRC	H-Set1				
	HSUPA Test	HSUPA Loopback				
	Power Control Algorithm	Algorithm2				
	βc	11/15	6/15	15/15	2/15	15/15
	βd	15/15	15/15	9/15	15/15	15/15
	βec	209/225	12/15	30/15	2/15	24/15
	βc/βd	11/15	6/15	15/9	2/15	15/15
	βhs	22/15	12/15	30/15	4/15	30/15
	βed	1309/225	94/75	47/15 47/15	56/75	134/15
	CM (dB)	1.0	3.0	2.0	3.0	1.0
	MPR (dB)	0	2	1	2	0
HSDPA Specific Settings	DACK	8				
	DNAK	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				
HSUPA Specific Settings	D E-DPCCH	6	8	8	5	7
	DHARQ	0	0	0	0	0
	AG Index	20	12	15	17	21
	ETFCI (from 34.121 Table C.11.1.3)	75	67	92	71	81
	Associated Max UL Data Rate kbps	242.1	174.9	482.8	205.8	308.9
	Reference E_TFCIs	E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27		E-TFCI 11 E-TFCI PO 4 E-TFCI 92 E-TFCI PO 18	E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27	

UL CCS FORM NO: CCSUP4031G
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.

Results

Mode	UL Ch No.	Freq. (MHz)	Tx Conducted Pwr (dBm)	
			Without Pwr back-off	With Pwr back-off
Subtest 1	9262	1852.4	23.5	18.7
	9400	1880.0	23.4	18.8
	9538	1907.6	23.3	18.6
Subtest 2	9262	1852.4	23.5	18.7
	9400	1880.0	23.3	18.8
	9538	1907.6	23.2	18.6
Subtest 3	9262	1852.4	23.4	18.7
	9400	1880.0	23.4	18.6
	9538	1907.6	23.4	18.6
Subtest 4	9262	1852.4	22.8	18.5
	9400	1880.0	22.8	18.5
	9538	1907.6	22.9	18.4
Subtest 5	9262	1852.4	23.0	18.5
	9400	1880.0	22.9	18.5
	9538	1907.6	22.9	18.4

Note(s):

- KDB 941225 D01 – 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.

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

10.3. LTE Band 4

Target Power: 23 dBm (without Power Back-off)
20 dBm (with Power Back-off)
Tune-up Tolerance: -1.0dB / +1.0dB

The following tests were conducted according to the test requirements outlined in section 6.2 of the 3GPP TS36.101 specification.

UE Power Class: 3 (23 +/- 2dBm). The allowed Maximum Power Reduction (MPR) for the maximum output power due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3-1 of the 3GPP TS36.101.

Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3

Modulation	Channel bandwidth / Transmission bandwidth (RB)						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2

The allowed A-MPR values specified below in Table 6.2.4.-1 of 3GPP TS36.101 are in addition to the allowed MPR requirements. All the measurements below were performed with A-MPR disabled, by using Network Signalling Value of "NS_01".

Table 6.2.4-1: Additional Maximum Power Reduction (A-MPR)

Network Signalling value	Requirements (sub-clause)	E-UTRA Band	Channel bandwidth (MHz)	Resources Blocks (N_{RB})	A-MPR (dB)
NS_01	6.6.2.1.1	Table 5.5-1	1.4, 3, 5, 10, 15, 20	Table 5.6-1	NA
NS_03	6.6.2.2.1	2, 4,10, 23, 25, 35, 36	3	>5	≤ 1
			5	>6	≤ 1
			10	>6	≤ 1
			15	>8	≤ 1
			20	>10	≤ 1
NS_04	6.6.2.2.2	41	5	>6	≤ 1
			10, 15, 20	See Table 6.2.4-4	
NS_05	6.6.3.3.1	1	10,15,20	≥ 50	≤ 1
NS_06	6.6.2.2.3	12, 13, 14, 17	1.4, 3, 5, 10	Table 5.6-1	n/a
NS_07	6.6.2.2.3 6.6.3.3.2	13	10	Table 6.2.4-2	Table 6.2.4-2
NS_08	6.6.3.3.3	19	10, 15	> 44	≤ 3
NS_09	6.6.3.3.4	21	10, 15	> 40	≤ 1
				> 55	≤ 2
NS_10		20	15, 20	Table 6.2.4-3	Table 6.2.4-3
NS_11	6.6.2.2.1	23[1]	1.4, 3, 5, 10	Table 6.2.4-5	Table 6.2.4-5
..					
NS_32	-	-	-	-	-
Note 1: Applies to the lower block of Band 23, i.e. a carrier placed in the 2000-2010 MHz region.					

UL CCS FORM NO: CCSUP4031G
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.

Results

Band	BW (MHz)	Ch	Freq. (MHz)	Mode	UL RB Allocation	UL RB Start	Target MPR	Meas. MPR	Avg Pwr (dBm)	
									W/o Pwr back-off	*W/ Pwr back-off
4	5	19975	1712.5	QPSK	12	6	1	1	22.4	20.8
					1	0	0	0	23.6	20.5
					1	24	0	0	23.6	20.5
					25	0	1	1	22.8	20.8
				16QAM	12	6	2	2	21.7	20.9
					1	0	1	1	22.3	20.8
					1	24	1	1	22.3	20.8
					25	0	2	2	22.0	20.7
		20175	1732.5	QPSK	12	6	1	1	22.9	20.9
					1	0	0	0	23.8	20.9
					1	24	0	0	23.9	20.9
					25	0	1	1	22.8	21.0
				16QAM	12	6	2	2	21.5	21.0
					1	0	1	1	22.4	21.0
					1	24	1	1	22.5	21.0
					25	0	2	1	22.2	20.8
		20375	1752.5	QPSK	12	6	1	1	22.8	20.8
					1	0	0	0	23.8	20.9
					1	24	0	0	23.9	21.0
					25	0	1	1	22.9	20.9
				16QAM	12	6	2	2	22.0	20.9
					1	0	1	2	22.1	21.0
					1	24	1	1	22.8	21.0
					25	0	2	2	21.5	20.7
	10	20000	1715.0	QPSK	25	12	1	1	22.4	20.8
					1	0	0	0	23.5	21.0
					1	49	0	0	23.6	21.0
					50	0	1	1	22.3	20.9
				16QAM	25	12	2	2	21.1	21.0
					1	0	1	1	22.7	21.0
					1	49	1	1	22.9	21.0
					50	0	2	2	21.3	21.0
		20175	1732.5	QPSK	25	12	1	1	22.6	20.8
					1	0	0	0	23.6	21.0
					1	49	0	0	23.5	21.0
					50	0	1	1	22.6	20.9
				16QAM	25	12	2	2	21.5	20.9
					1	0	1	1	22.8	20.7
					1	49	1	1	22.7	20.5
					50	0	2	2	21.5	21.0
		20350	1750.0	QPSK	25	12	1	1	22.5	20.8
					1	0	0	0	23.7	20.9
					1	49	0	0	23.7	20.9
					50	0	1	1	22.4	20.8
				16QAM	25	12	2	2	21.4	20.9
					1	0	1	1	22.9	21.1
					1	49	1	1	22.9	21.1
					50	0	2	2	21.3	20.8

Note(s):

* When the power reduction due to proximity sensor is activated, the maximum conducted power is reduced, but the MPR for different resource block configurations/allocations is disabled.

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

10.4. LTE Band 17

Target Power: 23 dBm (without Power Back-off)
22 dBm (with Power Back-off)
Tune-up Tolerance: -1.0dB / +1.0dB

The following tests were conducted according to the test requirements outlined in section 6.2 of the 3GPP TS36.101 specification.

UE Power Class: 3 (23 +/- 2dBm). The allowed Maximum Power Reduction (MPR) for the maximum output power due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3-1 of the 3GPP TS36.101.

Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3

Modulation	Channel bandwidth / Transmission bandwidth (RB)						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2

The allowed A-MPR values specified below in Table 6.2.4.-1 of 3GPP TS36.101 are in addition to the allowed MPR requirements. All the measurements below were performed with A-MPR disabled, by using Network Signalling Value of “NS_01”.

Table 6.2.4-1: Additional Maximum Power Reduction (A-MPR)

Network Signalling value	Requirements (sub-clause)	E-UTRA Band	Channel bandwidth (MHz)	Resources Blocks (N_{RB})	A-MPR (dB)
NS_01	6.6.2.1.1	Table 5.5-1	1.4, 3, 5, 10, 15, 20	Table 5.6-1	NA
NS_03	6.6.2.2.1	2, 4,10, 23, 25, 35, 36	3	>5	≤ 1
			5	>6	≤ 1
			10	>6	≤ 1
			15	>8	≤ 1
			20	>10	≤ 1
NS_04	6.6.2.2.2	41	5	>6	≤ 1
			10, 15, 20	See Table 6.2.4-4	
NS_05	6.6.3.3.1	1	10,15,20	≥ 50	≤ 1
NS_06	6.6.2.2.3	12, 13, 14, 17	1.4, 3, 5, 10	Table 5.6-1	n/a
NS_07	6.6.2.2.3 6.6.3.3.2	13	10	Table 6.2.4-2	Table 6.2.4-2
NS_08	6.6.3.3.3	19	10, 15	> 44	≤ 3
NS_09	6.6.3.3.4	21	10, 15	> 40	≤ 1
				> 55	≤ 2
NS_10		20	15, 20	Table 6.2.4-3	Table 6.2.4-3
NS_11	6.6.2.2.1	23[1]	1.4, 3, 5, 10	Table 6.2.4-5	Table 6.2.4-5
..					
NS_32	-	-	-	-	-
Note 1: Applies to the lower block of Band 23, i.e. a carrier placed in the 2000-2010 MHz region.					

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

Results

Band	BW (MHz)	Ch	Freq. (MHz)	Mode	UL RB Allocation	UL RB Start	Target MPR	Meas. MPR	Avg Pwr (dBm)	
									W/o Pwr back-off	*W/ Pwr back-off
17	5	23755	706.5	QPSK	12	6	1	1	22.5	22.8
					1	0	0	0	23.6	22.7
					1	24	0	0	23.5	22.7
					25	0	1	1	22.6	22.7
				16QAM	12	6	2	2	21.2	21.8
					1	0	1	2	22.0	22.7
					1	24	1	2	22.0	22.6
					25	0	2	2	21.8	22.0
		23790	710.0	QPSK	12	6	1	1	22.5	22.8
					1	0	0	0	23.7	23.0
					1	24	0	0	23.7	23.0
					25	0	1	1	22.5	22.7
				16QAM	12	6	2	2	21.5	21.5
					1	0	1	1	22.4	22.4
					1	24	1	2	22.2	22.2
					25	0	2	2	21.9	22.1
		23825	713.5	QPSK	12	6	1	1	22.5	22.8
					1	0	0	0	23.7	22.9
					1	24	0	0	23.6	22.9
					25	0	1	1	22.6	22.8
				16QAM	12	6	2	2	21.8	22.1
					1	0	1	1	22.6	23.0
					1	24	1	1	22.7	22.8
					25	0	2	2	21.3	21.6
17	10	23780	709.0	QPSK	25	12	1	1	22.7	23.0
					1	0	0	0	24.0	23.0
					1	49	0	0	24.0	23.0
					50	0	1	1	22.6	22.9
				16QAM	25	12	2	2	22.0	22.0
					1	0	1	1	22.6	23.0
					1	49	1	1	22.6	23.0
					50	0	2	2	21.8	22.2
		23790	710.0	QPSK	25	12	1	1	22.8	23.0
					1	0	0	0	24.0	23.0
					1	49	0	0	24.0	23.0
					50	0	1	1	22.6	22.8
				16QAM	25	12	2	2	22.0	22.1
					1	0	1	1	22.6	22.8
					1	49	1	1	22.6	22.9
					50	0	2	2	21.8	22.0
		23800	711.0	QPSK	25	12	1	1	22.9	23.0
					1	0	0	0	24.0	23.0
					1	49	0	0	23.9	23.0
					50	0	1	1	22.5	22.8
				16QAM	25	12	2	2	22.0	22.6
					1	0	1	0	23.2	23.0
					1	49	1	2	22.2	23.0
					50	0	2	2	21.8	22.0

Note(s):

* When the power reduction due to proximity sensor is activated, the maximum conducted power is reduced, but the MPR for different resource block configurations/allocations is disabled. This may result in higher power when the proximity sensor is triggered for MPR at full power is 1 or 2. Under no circumstances does the power exceed the tune-up limit (including tolerance) for either full power or reduced power modes.

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

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

10.5. Wi-Fi (2.4 GHz Band)

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.

Target Power: 802.11b: 15.5 dBm
802.11g: 14.5 dBm
802.11n: 13.5 dBm
Tune-up Tolerance: -2.0dB / +1.0dB

Band (MHz)	Mode	Ch #	Freq. (MHz)	Target Pwr (dBm)	Avg Pwr (dBm)
2.4	802.11b	1	2412	15.5	15.5
		6	2437	15.5	15.5
		11	2462	15.5	15.5
	802.11g	1	2412	14.5	14.5
		6	2437	14.5	14.5
		11	2462	14.5	14.5
	802.11n (HT20)	1	2412	13.5	13.5
		6	2437	13.5	13.5
		11	2462	13.5	13.5

Note(s):
1. SAR is not required for 802.11g/HT20 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11a/b channels. As per KDB 248227

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

10.6. Wi-Fi (5 GHz Bands)

Mode		Band	GHz	Channel	"Default Test Channels"	
					802.11a	
802.11a	UNII (15.407)	5.2 GHz	5.180	36	√	
			5.200	40		*
			2.220	44		*
			5.240	48	√	
		5.3 GHz	5.260	52	√	
			5.280	56		*
			5.300	60		*
			5.320	64	√	
		5.5 GHz	5.500	100		
			5.520	104	√	
			5.540	108		*
			5.560	112		*
			5.580	116	√	
			5.600	120		*
			5.620	124	√	
			5.640	128		*
			5.660	132		*
			5.680	136	√	
			5.700	140		*
	DTS (15.247)	5.8 GHz	5.745	149	√	
			5.765	153		*
			5.785	157	√	
			5.805	161		*
			5.825	165	√	

√ = "default test channels"

* = possible 802.11a channels with maximum average output > 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.

Target Power: 802.11a: 13.0 dBm
802.11n: 12.0 dBm

Tune-up Tolerance: -2.0dB / +1.0dB

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

Band (MHz)	Mode	Ch #	Freq. (MHz)	Target Pwr (dBm)	Avg Pwr (dBm)
5.2	802.11a	36	5180	13.0	13.0
		40	5200	13.0	13.0
		44	5220	13.0	13.0
		48	5240	13.0	13.0
	802.11n (HT20)	36	5180	12.0	12.0
		40	5200	12.0	12.0
		48	5240	12.0	12.0
5.3	802.11a	52	5260	13.0	13.0
		56	5280	13.0	13.0
		60	5300	13.0	13.0
		64	5320	13.0	13.0
	802.11n (HT20)	52	5260	12.0	12.0
		60	5300	12.0	12.0
		64	5320	12.0	12.0
5.5	802.11a	100	5500	13.0	13.0
		104	5520	13.0	13.0
		108	5540	13.0	13.0
		112	5560	13.0	13.0
		116	5580	13.0	13.0
		120	5600	13.0	13.0
		124	5620	13.0	13.0
		128	5640	13.0	13.0
		132	5660	13.0	13.0
		136	5680	13.0	13.0
		140	5700	13.0	13.0
	802.11n (HT20)	100	5500	12.0	12.0
		120	5600	12.0	12.0
		140	5700	12.0	12.0
5.8	802.11a	149	5745	13.0	13.0
		153	5765	13.0	13.0
		157	5785	13.0	13.0
		161	5805	13.0	13.0
		165	5825	13.0	13.0
	802.11n (HT20)	149	5745	12.0	12.0
		157	5785	12.0	12.0
		161	5805	12.0	12.0

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

10.7. Bluetooth

Version 4.0+LE, Power class: 1 (100 mW/20 dBm)

Mode	Channel #	Freq. (MHz)	Measured Avg Pwr(dBm)
V2.1 + EDR GFSK	0	2402	4.63
	39	2441	4.87
	78	2480	4.15
V2.1 + EDR 8-PSK	0	2402	-2.30
	39	2441	-1.84
	78	2480	-1.46
V4.0 LE, GFSK	0	2402	1.86
	39	2441	3.27
	78	2480	3.06

Note(s):

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

☒ Output ≤ $2 \cdot P_{Ref}$ (13.8dBm / 24 mW) and antenna is ≥ 5.0 cm from other antennas
☐ Output ≤ P_{Ref} (10.79dBm / 12 mW) and antenna is ≥ 2.5 cm from other antennas
☐ Output ≤ P_{Ref} (10.79dBm / 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.

11. 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	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 – 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5000	36.2	4.45	49.3	5.07
5100	36.1	4.55	49.1	5.18
5200	36.0	4.66	49.0	5.30
5300	35.9	4.76	48.9	5.42
5400	35.8	4.86	48.7	5.53
5500	35.6	4.96	48.6	5.65
5600	35.5	5.07	48.5	5.77
5700	35.4	5.17	48.3	5.88
5800	35.3	5.27	48.2	6.00

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

11.1. 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

UL CCS FORM NO: CCSUP4031G
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.

11.2. Tissue Dielectric Parameter Check Results

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

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
6/21/2012	Body 2450	e'	51.6469	Relative Permittivity (ϵ_r):	51.65	52.70	-2.00	5
		e''	14.2487	Conductivity (σ):	1.94	1.95	-0.46	5
	Body 2410	e'	51.7770	Relative Permittivity (ϵ_r):	51.78	52.76	-1.86	5
		e''	14.0668	Conductivity (σ):	1.89	1.91	-1.18	5
	Body 2435	e'	51.6686	Relative Permittivity (ϵ_r):	51.67	52.73	-2.01	5
		e''	14.1788	Conductivity (σ):	1.92	1.93	-0.59	5
	Body 2475	e'	51.5664	Relative Permittivity (ϵ_r):	51.57	52.67	-2.09	5
		e''	14.3515	Conductivity (σ):	1.98	1.99	-0.51	5
6/22/2012	Body 5180	e'	47.7199	Relative Permittivity (ϵ_r):	47.72	49.05	-2.71	10
		e''	18.8222	Conductivity (σ):	5.42	5.27	2.84	5
	Body 5200	e'	47.7043	Relative Permittivity (ϵ_r):	47.70	49.02	-2.68	10
		e''	18.8470	Conductivity (σ):	5.45	5.29	2.92	5
	Body 5500	e'	47.1762	Relative Permittivity (ϵ_r):	47.18	48.61	-2.96	10
		e''	19.0826	Conductivity (σ):	5.84	5.64	3.39	5
	Body 5800	e'	46.6080	Relative Permittivity (ϵ_r):	46.61	48.20	-3.30	10
		e''	19.3304	Conductivity (σ):	6.23	6.00	3.90	5
	Body 5825	e'	46.5848	Relative Permittivity (ϵ_r):	46.58	48.20	-3.35	10
		e''	19.3994	Conductivity (σ):	6.28	6.00	4.72	5
8/14/2012	Body 1900	e'	53.4897	Relative Permittivity (ϵ_r):	53.49	53.30	0.36	5
		e''	14.3848	Conductivity (σ):	1.52	1.52	-0.02	5
	Body 1850	e'	53.6041	Relative Permittivity (ϵ_r):	53.60	53.30	0.57	5
		e''	14.2193	Conductivity (σ):	1.46	1.52	-3.77	5
	Body 1880	e'	53.5314	Relative Permittivity (ϵ_r):	53.53	53.30	0.43	5
		e''	14.3100	Conductivity (σ):	1.50	1.52	-1.59	5
	Body 1910	e'	53.4546	Relative Permittivity (ϵ_r):	53.45	53.30	0.29	5
		e''	14.4187	Conductivity (σ):	1.53	1.52	0.74	5
8/15/2012	Body 1900	e'	52.3744	Relative Permittivity (ϵ_r):	52.37	53.30	-1.74	5
		e''	14.5458	Conductivity (σ):	1.54	1.52	1.10	5
	Body 1850	e'	52.4762	Relative Permittivity (ϵ_r):	52.48	53.30	-1.55	5
		e''	14.3929	Conductivity (σ):	1.48	1.52	-2.60	5
	Body 1880	e'	52.3682	Relative Permittivity (ϵ_r):	52.37	53.30	-1.75	5
		e''	14.4575	Conductivity (σ):	1.51	1.52	-0.57	5
	Body 1910	e'	52.3312	Relative Permittivity (ϵ_r):	52.33	53.30	-1.82	5
		e''	14.5595	Conductivity (σ):	1.55	1.52	1.73	5

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

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
08/16/2012	Body 835	e'	54.8169	Relative Permittivity (ϵ_r):	54.82	55.20	-0.69	5
		e''	21.1888	Conductivity (σ):	0.98	0.97	1.42	5
	Body 820	e'	54.8830	Relative Permittivity (ϵ_r):	54.88	55.28	-0.71	5
		e''	21.4177	Conductivity (σ):	0.98	0.97	0.83	5
	Body 850	e'	54.5903	Relative Permittivity (ϵ_r):	54.59	55.16	-1.03	5
		e''	21.4155	Conductivity (σ):	1.01	0.99	2.53	5
08/16/2012	Body 1750	e'	54.4093	Relative Permittivity (ϵ_r):	54.41	53.44	1.81	5
		e''	15.0547	Conductivity (σ):	1.46	1.49	-1.43	5
	Body 1710	e'	54.3527	Relative Permittivity (ϵ_r):	54.35	53.54	1.51	5
		e''	15.0319	Conductivity (σ):	1.43	1.46	-2.21	5
	Body 1715	e'	54.4523	Relative Permittivity (ϵ_r):	54.45	53.53	1.72	5
		e''	15.0316	Conductivity (σ):	1.43	1.46	-2.13	5
	Body 1730	e'	54.4548	Relative Permittivity (ϵ_r):	54.45	53.49	1.80	5
		e''	15.0997	Conductivity (σ):	1.45	1.47	-1.45	5
08/17/2012	Body 1750	e'	54.5944	Relative Permittivity (ϵ_r):	54.59	53.44	2.16	5
		e''	15.4102	Conductivity (σ):	1.50	1.49	0.90	5
	Body 1710	e'	54.5816	Relative Permittivity (ϵ_r):	54.58	53.54	1.94	5
		e''	15.3695	Conductivity (σ):	1.46	1.46	-0.01	5
	Body 1715	e'	54.6542	Relative Permittivity (ϵ_r):	54.65	53.53	2.10	5
		e''	15.4382	Conductivity (σ):	1.47	1.46	0.52	5
	Body 1730	e'	54.4887	Relative Permittivity (ϵ_r):	54.49	53.49	1.86	5
		e''	15.3357	Conductivity (σ):	1.48	1.47	0.09	5
08/19/2012	Body 1750	e'	53.2876	Relative Permittivity (ϵ_r):	53.29	53.44	-0.29	5
		e''	15.4546	Conductivity (σ):	1.50	1.49	1.19	5
	Body 1710	e'	53.3703	Relative Permittivity (ϵ_r):	53.37	53.54	-0.32	5
		e''	15.3177	Conductivity (σ):	1.46	1.46	-0.35	5
	Body 1715	e'	53.3524	Relative Permittivity (ϵ_r):	53.35	53.53	-0.33	5
		e''	15.3259	Conductivity (σ):	1.46	1.46	-0.21	5
	Body 1730	e'	53.2660	Relative Permittivity (ϵ_r):	53.27	53.49	-0.42	5
		e''	15.4181	Conductivity (σ):	1.48	1.47	0.63	5
08/19/2012	Body 750	e'	54.5731	Relative Permittivity (ϵ_r):	54.57	55.55	-1.75	5
		e''	22.4160	Conductivity (σ):	0.93	0.96	-2.94	5
	Body 775	e'	54.1614	Relative Permittivity (ϵ_r):	54.16	55.45	-2.32	5
		e''	22.1679	Conductivity (σ):	0.96	0.97	-1.01	5
	Body 790	e'	54.0492	Relative Permittivity (ϵ_r):	54.05	55.39	-2.42	5
		e''	21.9417	Conductivity (σ):	0.96	0.97	-0.24	5

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

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
08/24/2012	Body 750	e'	55.4276	Relative Permittivity (ϵ_r):	55.43	55.55	-0.21	5
		e''	23.0742	Conductivity (σ):	0.96	0.96	-0.09	5
	Body 775	e'	55.2415	Relative Permittivity (ϵ_r):	55.24	55.45	-0.38	5
		e''	22.8034	Conductivity (σ):	0.98	0.97	1.83	5
	Body 790	e'	55.0873	Relative Permittivity (ϵ_r):	55.09	55.39	-0.55	5
		e''	22.7791	Conductivity (σ):	1.00	0.97	3.57	5
08/27/2012	Body 750	e'	54.8456	Relative Permittivity (ϵ_r):	54.85	55.55	-1.26	5
		e''	22.6644	Conductivity (σ):	0.95	0.96	-1.86	5
	Body 775	e'	54.6183	Relative Permittivity (ϵ_r):	54.62	55.45	-1.50	5
		e''	22.4501	Conductivity (σ):	0.97	0.97	0.25	5
	Body 790	e'	54.4812	Relative Permittivity (ϵ_r):	54.48	55.39	-1.64	5
		e''	22.3688	Conductivity (σ):	0.98	0.97	1.70	5
08/29/2012	Body 1900	e'	50.9538	Relative Permittivity (ϵ_r):	50.95	53.30	-4.40	5
		e''	14.5182	Conductivity (σ):	1.53	1.52	0.91	5
	Body 1850	e'	51.1274	Relative Permittivity (ϵ_r):	51.13	53.30	-4.08	5
		e''	14.3717	Conductivity (σ):	1.48	1.52	-2.74	5
	Body 1880	e'	51.0226	Relative Permittivity (ϵ_r):	51.02	53.30	-4.27	5
		e''	14.4591	Conductivity (σ):	1.51	1.52	-0.56	5
	Body 1910	e'	50.9214	Relative Permittivity (ϵ_r):	50.92	53.30	-4.46	5
		e''	14.5491	Conductivity (σ):	1.55	1.52	1.65	5

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

12. 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%.

12.1. 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.

12.2. 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)	Target Ref. SAR (mW/g)		
				1g/10g	Head	Body
D750V3	1024	4/20/11	750	1g	8.36	8.76
				10g	5.49	5.80
D835V2	4d117	4/10/12	835	1g	9.38	9.52
				10g	6.15	6.31
D1750V2	1050	4/19/11	1750	1g	35.9	36.9
				10g	19.1	19.9
D1900V2	5d043	11/10/11	1900	1g	40.3	41.1
				10g	21.0	21.7
D1900V2	5d140	4/12/12	1900	1g	39.8	40.2
				10g	20.8	21.3
D2450V2	748	2/7/12	2450	1g	52.7	49.9
				10g	24.6	23.4
D5GHzV2	1075	2/14/12	5200	1g	79.4	72.7
				10g	22.8	20.5
			5500	1g	85.7	77.7
				10g	24.3	21.7
			5800	1g	78.9	72.5
				10g	22.5	20.2

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

12.3. 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.						
6/21/2012	D2450V2	748	Body	1g	51.1	49.90	2.40	±10
				10g	24.0	23.40	2.56	
6/22/2012	D5GHzV2 (5.2GHz)	1075	Body	1g	76.0	72.70	4.54	±10
				10g	21.5	20.50	4.88	
6/22/2012	D5GHzV2 (5.5GHz)	1075	Body	1g	75.6	77.70	-2.70	±10
				10g	21.2	21.70	-2.30	
6/22/2012	D5GHzV2 (5.8GHz)	1075	Body	1g	75.1	72.50	3.59	±10
				10g	21.0	20.20	3.96	
8/14/2012	D1900V2	5d043	Body	1g	40.5	42.00	-3.57	±10
				10g	21.2	21.96	-3.46	
8/15/2012	D1900V2	5d043	Body	1g	42.6	42.00	1.43	±10
				10g	22.5	22.00	2.27	
8/16/2012	D835V2	4d117	Body	1g	10.0	9.52	5.04	±10
				10g	6.6	6.31	4.75	
8/16/2012	D1750V2	1050	Body	1g	39.0	36.90	5.69	±10
				10g	20.9	19.90	5.03	
8/17/2012	D1750V2	1050	Body	1g	38.6	36.90	4.61	±10
				10g	20.7	19.90	4.02	
8/19/2012	D1750V2	1050	Body	1g	38.4	36.90	4.07	±10
				10g	20.5	19.90	3.02	
8/24/2012	D750V3	1024	Body	1g	8.52	8.76	-2.74	±10
				10g	5.69	5.80	-1.90	
8/27/2012	D750V3	1024	Body	1g	8.45	8.76	-3.54	±10
				10g	5.64	5.8	-2.76	
8/29/2012	D1900V2	5d140	Body	1g	42.5	40.2	5.72	±10
				10g	22.4	21.3	5.16	

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

13. SAR Test Results

13.1. W-CDMA (UMTS) Band V

Test mode reduction considerations

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

Body SAR

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Frame Avg. Power (dBm)		SAR (mW/g)		Note
					Tune-up limit	Measured	Measured	Scaled	
Rear	Rel 99 RMC 12.2kbps	0	4132	826.40	24.0	23.6			1
			4183	836.60	24.0	23.5	0.494	0.554	
			4233	846.60	24.0	23.6			1
Rear Tilt (20º Tilt @Edge1)	Rel 99 RMC 12.2kbps	0	4132	826.40	24.0	23.6			1
			4183	836.60	24.0	23.5	0.539	0.605	
			4233	846.60	24.0	23.6			1
Edge 1	Rel 99 RMC 12.2kbps	0	4132	826.40	24.0	23.6			1
			4183	836.60	24.0	23.5	**0.738**	**0.828**	
			4233	846.60	24.0	23.6			1
Edge 4	Rel 99 RMC 12.2kbps	0	4132	826.40	24.0	23.6			1
			4183	836.60	24.0	23.5	0.037	0.041	
			4233	846.60	24.0	23.6			

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.

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

13.2. W-CDMA (UMTS) Band II

Test mode reduction considerations

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

Body SAR with Power Back off (Proximity Sensor On)

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Frame Avg. Power (dBm)		SAR (mW/g)		Note
					Tune-up Limit	Measured	Measured	Scaled	
Rear	Rel 99 RMC 12.2kbps	0	9262	1852.40	19.0	19.0	**1.44**	**1.440**	
			9400	1880.00	19.0	19.0	1.37	1.370	
			9538	1907.60	19.0	19.0	1.17	1.170	
	HSUPA		9262	1852.40	18.5	18.5	1.42	1.420	2
Rear Tilt (20º Tilt @Edge1)	Rel 99 RMC 12.2kbps	0	9262	1852.40	19.0	19.0	0.970	0.970	
			9400	1880.00	19.0	19.0	0.934	0.934	
			9538	1907.60	19.0	19.0	0.880	0.880	
Edge 1	Rel 99 RMC 12.2kbps	0	9262	1852.40	19.0	19.0	0.875	0.875	
			9400	1880.00	19.0	19.0	0.956	0.956	
			9538	1907.60	19.0	19.0	1.000	1.000	
Edge 4	Rel 99 RMC 12.2kbps	0	9262	1852.40	19.0	19.0			1
			9400	1880.00	19.0	19.0	0.129	0.129	
			9538	1907.60	19.0	19.0			1

Body SAR with Full Power (Proximity Sensor Off)

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Frame Avg. Power (dBm)		SAR (mW/g)		Note
					Tune-up Limit	Measured	Measured	Scaled	
Rear	Rel 99 RMC 12.2kbps	17	9262	1852.40	24.0	24.0			1
			9400	1880.00	24.0	24.0	0.202	0.202	
			9538	1907.60	24.0	24.0			1
Edge 1	Rel 99 RMC 12.2kbps	17	9262	1852.40	24.0	24.0			1
			9400	1880.00	24.0	24.0	0.217	0.217	
			9538	1907.60	24.0	24.0			1
Edge 4	Rel 99 RMC 12.2kbps	17	9262	1852.40	24.0	24.0			1
			9400	1880.00	24.0	24.0	0.049	0.049	
			9538	1907.60	24.0	24.0			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. Based on KDB941225 D01, body SAR is also measured for HSPA when the maximum average output of each RF channel with HSPA active is at least ¼ dB higher than that measured without HSPA using 12.2 kbps RMC or the maximum SAR for 12.2 kbps RMC is above 75% of the SAR limit. Body SAR for HSPA is measured with E-DCH Sub-test 5, using H-Set 1 and QPSK for FRC and a 12.2 kbps RMC configured in Test Loop Mode 1 with power control algorithm 2

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

13.3. LTE Band 4

Test mode reduction considerations

Test reduction for LTE SAR is based on KDB 941225 D05 SAR for LTE Devices v01.

10MHz Channel Bandwidth

Testing for 100% RB allocation is not required because the measured SAR value for 50% RB allocation is ≤ 1.45 W/kg.

Testing for 1RB was only performed on a single channel because the output power variance over low/middle/high channels is ≤ ½ dB and the measured SAR for the middle channel is ≤ 1.45 W/kg.

5MHz Channel Bandwidth

Testing was not performed at 5MHz Channel Bandwidth as the maximum average power level at 5MHz Channel Bandwidth is within 0.5dB of the maximum average power level at 10MHz Channel Bandwidth and the measured SAR values at 10MHz Channel Bandwidth are ≤ 1.45 W/kg.

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

Body SAR with Power Back off (Proximity Sensor On)

Test Position	Mode	Dist. (mm)	UL Ch #.	Freq. (MHz)	UL RB Allocation	UL RB Start	Power (dBm)		SAR (mW/g)		Note
							Tune-up Limit	Measured	Measured	Scaled	
Rear	QPSK	0	20000	1715.0	25	12	21	20.8	1.170	1.225	
					1	0	21	21.0			1
					1	49	21	21.0			1
					50	0	21	20.9			1
	16QAM	0			25	12	21	21.0			1
					1	0	21	21.0			1
					1	49	21	21.0			1
					50	0	21	21.0			1
	QPSK	0	20175	1732.5	25	12	21	20.8	1.370	1.435	
					1	0	21	21.0	1.360	1.360	
					1	49	21	21.0	1.370	1.370	
					50	0	21	20.9			1
	16QAM	0			25	12	21	20.9	1.370	1.402	
					1	0	21	20.7	1.250	1.339	
					1	49	21	20.5	1.360	1.526	
					50	0	21	21.0			1
	QPSK	0	20350	1750.0	25	12	21	20.8	**1.420**	**1.487**	
					1	0	21	20.9			1
					1	49	21	20.9			1
					50	0	21	20.8			1
	16QAM	0			25	12	21	20.9			1
					1	0	21	21.1			1
					1	49	21	21.1			1
					50	0	21	20.8			1
Rear Tilt (20º Tilt @Edge1)	QPSK	0	20000	1715.0	25	12	21	20.8	0.990	1.037	
					1	0	21	21.0			1
					1	49	21	21.0			1
					50	0	21	20.9			1
	16QAM	0			25	12	21	21.0			1
					1	0	21	21.0			1
					1	49	21	21.0			1
					50	0	21	21.0			1
	QPSK	0	20175	1732.5	25	12	21	20.8	1.090	1.141	
					1	0	21	21.0	1.090	1.090	
					1	49	21	21.0	1.100	1.100	
					50	0	21	20.9			1
	16QAM	0			25	12	21	20.9	1.110	1.136	
					1	0	21	20.7	1.030	1.104	
					1	49	21	20.5	1.070	1.201	
					50	0	21	21.0			1
	QPSK	0	20350	1750.0	25	12	21	20.8	1.130	1.183	
					1	0	21	20.9			1
					1	49	21	20.9			1
					50	0	21	20.8			1
	16QAM	0			25	12	21	20.9			1
					1	0	21	21.1			1
					1	49	21	21.1			1
					50	0	21	20.8			1

Note(s):

1. The test reduction for LTE SAR is based on KDB 941225 D05 SAR for LTE Devices v01.

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

Body SAR with Power Back off (Proximity Sensor On) (Continued)

Test Position	Mode	Dist. (mm)	UL Ch #.	Freq. (MHz)	UL RB Allocation	UL RB Start	Power (dBm)		SAR (mW/g)		Note
							Tune-up Limit	Mesured	Measured	Scaled	
Edge 1	QPSK	0	20000	1715.0	25	12	21	20.8	0.845	0.885	
					1	0	21	21.0			1
					1	49	21	21.0			1
					50	0	21	20.9			1
	16QAM	0			25	12	21	21.0			1
					1	0	21	21.0			1
					1	49	21	21.0			1
					50	0	21	21.0			1
	QPSK	0	20175	1732.5	25	12	21	20.8	0.942	0.986	
					1	0	21	21.0	0.959	0.959	
					1	49	21	21.0	0.966	0.966	
					50	0	21	20.9		0.000	1
	16QAM	0			25	12	21	20.9	0.936	0.958	
					1	0	21	20.7	0.901	0.965	
					1	49	21	20.5	0.897	1.006	
					50	0	21	21.0			1
	QPSK	0	20350	1750.0	25	12	21	20.8	1.010	1.058	
					1	0	21	20.9			1
					1	49	21	20.9			1
					50	0	21	20.8			1
	16QAM	0			25	12	21	20.9			1
					1	0	21	21.1			1
					1	49	21	21.1			1
					50	0	21	20.8			1
Edge 4	QPSK	0	20000	1715.0	25	12	21	20.8			1
					1	0	21	21.0			1
					1	49	21	21.0			1
					50	0	21	20.9			1
	16QAM	0			25	12	21	21.0			1
					1	0	21	21.0			1
					1	49	21	21.0			1
					50	0	21	21.0			1
	QPSK	0	20175	1732.5	25	12	21	20.8	0.055	0.058	
					1	0	21	21.0	0.054	0.054	
					1	49	21	21.0	0.054	0.054	
					50	0	21	20.9			1
	16QAM	0			25	12	21	20.9	0.057	0.059	
					1	0	21	20.7	0.056	0.060	
					1	49	21	20.5	0.050	0.056	
					50	0	21	21.0			1
	QPSK	0	20350	1750.0	25	12	21	20.8			1
					1	0	21	20.9			1
					1	49	21	20.9			1
					50	0	21	20.8			1
	16QAM	0			25	12	21	20.9			1
					1	0	21	21.1			1
					1	49	21	21.1			1
					50	0	21	20.8			1

Note(s):

1. The test reduction for LTE SAR is based on KDB 941225 D05 SAR for LTE Devices v01.

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

Body SAR with Full Power (Proximity Sensor Off)

Test Position	Mode	Dist. (mm)	UL Ch #.	Freq. (MHz)	UL RB Allocation	UL RB Start	Power (dBm)		SAR (mW/g)		Note
							Tune-up Limit	Measured	Measured	Scaled	
Rear	QPSK	17	20000	1715.0	25	12	23	22.4			1
					1	0	24	23.5			1
					1	49	24	23.6			1
					50	0	23	22.3			1
	16QAM	17			25	12	22	21.1			1
					1	0	23	22.7			1
					1	49	23	22.9			1
					50	0	22	21.3			1
	QPSK	17	20175	1732.5	25	12	23	22.6	0.131	0.145	
					1	0	24	23.6	0.156	0.173	
					1	49	24	23.5	0.158	0.178	
					50	0	23	22.6			1
	16QAM	17			25	12	22	21.5	0.110	0.125	
					1	0	23	22.8	0.126	0.133	
					1	49	23	22.7	0.120	0.129	
					50	0	22	21.5			1
	QPSK	17	20350	1750.0	25	12	23	22.5			1
					1	0	24	23.7			1
					1	49	24	23.7			1
					50	0	23	22.4			1
	16QAM	17			25	12	22	21.4			1
					1	0	23	22.9			1
					1	49	23	22.9			1
					50	0	22	21.3			1
Edge 1	QPSK	17	20000	1715.0	25	12	23	22.4			1
					1	0	24	23.5			1
					1	49	24	23.6			1
					50	0	23	22.3			1
	16QAM	17			25	12	22	21.1			1
					1	0	23	22.7			1
					1	49	23	22.9			1
					50	0	22	21.3			1
	QPSK	17	20175	1732.5	25	12	23	22.6	0.113	0.125	
					1	0	24	23.6	0.144	0.160	
					1	49	24	23.5	0.137	0.154	
					50	0	23	22.6			1
	16QAM	17			25	12	22	21.5	0.097	0.109	
					1	0	23	22.8	0.116	0.122	
					1	49	23	22.7	0.103	0.111	
					50	0	22	21.5			1
	QPSK	17	20350	1750.0	25	12	23	22.5			1
					1	0	24	23.7			1
					1	49	24	23.7			1
					50	0	23	22.4			1
	16QAM	17			25	12	22	21.4			1
					1	0	23	22.9			1
					1	49	23	22.9			1
					50	0	22	21.3			1

Note(s):

1. The test reduction for LTE SAR is based on KDB 941225 D05 SAR for LTE Devices v01.

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

Body SAR with Full Power (Proximity Sensor Off) (Continued)

Test Position	Mode	Dist. (mm)	UL Ch #.	Freq. (MHz)	UL RB Allocation	UL RB Start	Power (dBm)		SAR (mW/g)		Note
							Tune-up Limit	Measured	Measured	Scaled	
Edge 4	QPSK	17	20000	1715.0	25	12	23	22.4			1
					1	0	24	23.5			1
					1	49	24	23.6			1
					50	0	23	22.3			1
	16QAM	17			25	12	22	21.1			1
					1	0	23	22.7			1
					1	49	23	22.9			1
					50	0	22	21.3			1
	QPSK	17	20175	1732.5	25	12	23	22.6	0.025	0.028	
					1	0	24	23.6	0.029	0.032	
					1	49	24	23.5	0.027	0.031	
					50	0	23	22.6			1
	16QAM	17			25	12	22	21.5	0.018	0.021	
					1	0	23	22.8	0.023	0.024	
					1	49	23	22.7	0.020	0.022	
					50	0	22	21.5			1
	QPSK	17	20350	1750.0	25	12	23	22.5			1
					1	0	24	23.7			1
					1	49	24	23.7			1
					50	0	23	22.4			1
	16QAM	17			25	12	22	21.4			1
					1	0	23	22.9			1
					1	49	23	22.9			1
					50	0	22	21.3			1

Note(s):

1. The test reduction for LTE SAR is based on KDB 941225 D05 SAR for LTE Devices v01.

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

13.4. LTE Band 17

Test mode reduction considerations

Test reduction for LTE SAR is based on KDB 941225 D05 SAR for LTE Devices v01.

10MHz Channel Bandwidth

Testing for 100% RB allocation is not required because the measured SAR value for 50% RB allocation is ≤ 1.45 W/kg.

Testing for 1RB was only performed on a single channel because the output power variance over low/middle/high channels is ≤ ½ dB and the measured SAR for the middle channel is ≤ 1.45 W/kg.

5MHz Channel Bandwidth

Testing was not performed at 5MHz Channel Bandwidth as the maximum average power level at 5MHz Channel Bandwidth is within 0.5dB of the maximum average power level at 10MHz Channel Bandwidth and the measured SAR values at 10MHz Channel Bandwidth are ≤ 1.45 W/kg.

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

Body SAR with Power Back off (Proximity Sensor On)

Test Position	Mode	Dist. (mm)	UL Ch #.	Freq. (MHz)	UL RB Allocation	UL RB Start	Power (dBm)		SAR (mW/g)		Note
							Tune-up Limit	Measured	Measured	Scaled	
Rear	QPSK	0	23780	709.0	25	12	23	23.0			1
					1	0	23	23.0			1
					1	49	23	23.0			1
					50	0	23	22.9			1
	16QAM	0			25	12	23	22.0			1
					1	0	23	23.0			1
					1	49	23	23.0			1
					50	0	23	22.2			1
	QPSK	0	23790	710.0	25	12	23	23.0	0.791	0.791	
					1	0	23	23.0	0.704	0.704	
					1	49	23	23.0	**0.900**	**0.900**	
					50	0	23	22.8			1
	16QAM	0			25	12	23	22.1	0.671	0.827	
					1	0	23	22.8	0.743	0.774	
					1	49	23	22.9	0.893	0.916	
					50	0	23	22.0			1
	QPSK	0	23800	711.0	25	12	23	23.0			1
					1	0	23	23.0			1
					1	49	23	23.0			1
					50	0	23	22.8			1
	16QAM	0			25	12	23	22.6			1
					1	0	23	23.0			1
					1	49	23	23.0			1
					50	0	23	22.0			1
Rear Tilt (20º Tilt @Edge1)	QPSK	0	23780	709.0	25	12	23	23.0			1
					1	0	23	23.0			1
					1	49	23	23.0			1
					50	0	23	22.9			1
	16QAM	0			25	12	23	22.0			1
					1	0	23	23.0			1
					1	49	23	23.0			1
					50	0	23	22.2			1
	QPSK	0	23790	710.0	25	12	23	23.0	0.613	0.613	
					1	0	23	23.0	0.577	0.577	
					1	49	23	23.0	0.675	0.675	
					50	0	23	22.8			1
	16QAM	0			25	12	23	22.1	0.503	0.620	
					1	0	23	22.8	0.572	0.596	
					1	49	23	22.9	0.668	0.685	
					50	0	23	22.0			1
	QPSK	0	23800	711.0	25	12	23	23.0			1
					1	0	23	23.0			1
					1	49	23	23.0			1
					50	0	23	22.8			1
	16QAM	0			25	12	23	22.6			1
					1	0	23	23.0			1
					1	49	23	23.0			1
					50	0	23	22.0			1

Note(s):

1. The test reduction for LTE SAR is based on KDB 941225 D05 SAR for LTE Devices v01.

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

Body SAR with Power Back off (Proximity Sensor On) (Continued)

Test Position	Mode	Dist. (mm)	UL Ch #.	Freq. (MHz)	UL RB Allocation	UL RB Start	Power (dBm)		SAR (mW/g)		Note
							Tun-up Limt	Measured	Measured	Scaled	
Edge 1	QPSK	0	23780	709.0	25	12	23	23.0			1
					1	0	23	23.0			1
					1	49	23	23.0			1
					50	0	23	22.9			1
	16QAM	0			25	12	23	22.0			1
					1	0	23	23.0			1
					1	49	23	23.0			1
					50	0	23	22.2			1
	QPSK	0	23790	710.0	25	12	23	23.0	0.504	0.504	
					1	0	23	23.0	0.498	0.498	
					1	49	23	23.0	0.523	0.523	
					50	0	23	22.8			1
	16QAM	0			25	12	23	22.1	0.418	0.515	
					1	0	23	22.8	0.493	0.514	
					1	49	23	22.9	0.522	0.535	
					50	0	23	22.0			1
	QPSK	0	23800	711.0	25	12	23	23.0			1
					1	0	23	23.0			1
					1	49	23	23.0			1
					50	0	23	22.8			1
	16QAM	0			25	12	23	22.6			1
					1	0	23	23.0			1
					1	49	23	23.0			1
					50	0	23	22.0			1
Edge 4	QPSK	0	23780	709.0	25	12	23	23.0			1
					1	0	23	23.0			1
					1	49	23	23.0			1
					50	0	23	22.9			1
	16QAM	0			25	12	23	22.0			1
					1	0	23	23.0			1
					1	49	23	23.0			1
					50	0	23	22.2			1
	QPSK	0	23790	710.0	25	12	23	23.0	0.024	0.024	
					1	0	23	23.0	0.021	0.021	
					1	49	23	23.0	0.032	0.032	
					50	0	23	22.8			1
	16QAM	0			25	12	23	22.1	0.021	0.026	
					1	0	23	22.8	0.020	0.021	
					1	49	23	22.9	0.029	0.030	
					50	0	23	22.0			1
	QPSK	0	23800	711.0	25	12	23	23.0			1
					1	0	23	23.0			1
					1	49	23	23.0			1
					50	0	23	22.8			1
	16QAM	0			25	12	23	22.6			1
					1	0	23	23.0			1
					1	49	23	23.0			1
					50	0	23	22.0			1

Note(s):

1. The test reduction for LTE SAR is based on KDB 941225 D05 SAR for LTE Devices v01.

UL CCS
FORM NO: CCSUP4031G
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.

Body SAR with Full Power (Proximity Sensor Off)

Test Position	Mode	Dist. (mm)	UL Ch #.	Freq. (MHz)	UL RB Allocation	UL RB Start	Power (dBm)		SAR (mW/g)		Note
							Tune-up Limit	Measured	Measured	Scaled	
Rear	QPSK	17	23780	709.0	25	12	23	22.7			1
					1	0	24	24.0			1
					1	49	24	24.0			1
					50	0	23	22.6			1
	16QAM	17			25	12	22	22.0			1
					1	0	23	22.6			1
					1	49	23	22.6			1
					50	0	22	21.8			1
	QPSK	17	23790	710.0	25	12	23	22.8	0.074	0.077	
					1	0	24	24.0	0.075	0.075	
					1	49	24	24.0	0.103	0.103	
					50	0	23	22.6			1
	16QAM	17			25	12	22	22.0	0.060	0.060	
					1	0	23	22.6	0.056	0.062	
					1	49	23	22.6	0.074	0.082	
					50	0	22	21.8			1
	QPSK	17	23800	711.0	25	12	23	22.9			1
					1	0	24	24.0			1
					1	49	24	23.9			1
					50	0	23	22.5			1
	16QAM	17			25	12	22	22.0			1
					1	0	23	23.2			1
					1	49	23	22.2			1
					50	0	22	21.8			1
Edge 1	QPSK	17	23780	709.0	25	12	23	22.7			1
					1	0	24	24.0			1
					1	49	24	24.0			1
					50	0	23	22.6			1
	16QAM	17			25	12	22	22.0			1
					1	0	23	22.6			1
					1	49	23	22.6			1
					50	0	22	21.8			1
	QPSK	17	23790	710.0	25	12	23	22.8	0.051	0.053	
					1	0	24	24.0	0.055	0.055	
					1	49	24	24.0	0.077	0.077	
					50	0	23	22.6			1
	16QAM	17			25	12	22	22.0	0.042	0.041	
					1	0	23	22.6	0.042	0.046	
					1	49	23	22.6	0.056	0.062	
					50	0	22	21.8			1
	QPSK	17	23800	711.0	25	12	23	22.9			1
					1	0	24	24.0			1
					1	49	24	23.9			1
					50	0	23	22.5			1
	16QAM	17			25	12	22	22.0			1
					1	0	23	23.2			1
					1	49	23	22.2			1
					50	0	22	21.8			1

Note(s):

1. The test reduction for LTE SAR is based on KDB 941225 D05 SAR for LTE Devices v01.

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

Body SAR with Full Power (Proximity Sensor Off) (Continued)

Test Position	Mode	Dist. (mm)	UL Ch #.	Freq. (MHz)	UL RB Allocation	UL RB Start	Power (dBm)		SAR (mW/g)		Note
							Tune-up Limit	Measured	Measured	Scaled	
Edge 4	QPSK	17	23780	709.0	25	12	23	22.7			1
					1	0	24	24.0			1
					1	49	24	24.0			1
					50	0	23	22.6			1
	16QAM	17			25	12	22	22.0			1
					1	0	23	22.6			1
					1	49	23	22.6			1
					50	0	22	21.8			1
	QPSK	17	23790	710.0	25	12	23	22.8	0.016	0.016	
					1	0	24	24.0	0.017	0.017	
					1	49	24	24.0	0.025	0.025	
					50	0	23	22.6			1
	16QAM	17			25	12	22	22.0	0.013	0.013	
					1	0	23	22.6	0.012	0.014	
					1	49	23	22.6	0.017	0.019	
					50	0	22	21.8			1
	QPSK	17	23800	711.0	25	12	23	22.9			1
					1	0	24	24.0			1
					1	49	24	23.9			1
					50	0	23	22.5			1
	16QAM	17			25	12	22	22.0			1
					1	0	23	23.2			1
					1	49	23	22.2			1
					50	0	22	21.8			1

Note(s):

1. The test reduction for LTE SAR is based on KDB 941225 D05 SAR for LTE Devices v01.

UL CCS
FORM NO: CCSUP4031G
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.

13.5. Wi-Fi (2.4GHz Band)

Test Reduction Consideration

SAR is not required for 802.11g/n (HT20/HT40) 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.

Body SAR

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)		SAR (mW/g)		Note
					Tune-up Limit	Measured	Measured	Scaled	
Rear	802.11b	0	1	2412	16.5	15.5	0.440	0.554	
			6	2437	16.5	15.5	0.791	0.996	
			11	2462	16.5	15.5	1.05	1.322	
Rear (20º Tilt @Edge1)	802.11b	0	1	2412	16.5	15.5	0.485	0.611	
			6	2437	16.5	15.5	0.821	1.034	
			11	2462	16.5	15.5	**1.26**	1.586	
Edge 1	802.11b	0	1	2412	16.5	15.5			1
			6	2437	16.5	15.5	0.321	0.404	
			11	2462	16.5	15.5			1
Edge 2	802.11b	0	1	2412	16.5	15.5			1
			6	2437	16.5	15.5	0.138	0.174	
			11	2462	16.5	15.5			1

Note(s):

1. For frequency bands with an operating range of < 100 MHz, when the SAR for the highest output power channel within is ≤ 0.8 W/kg, SAR for the remaining channels is not required. Per KDB 447498 1) e) i)

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

13.6. Wi-Fi (5GHz Bands)

Test Reduction Consideration

SAR is not required for 802.11n (HT20) channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11a channels as per KDB 248227.

5.2GHz Band

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)		SAR (mW/g)		Note
					Tune-up Limit	Measured	Measured	Scaled	
Rear	802.11a	0	36	5180	14.0	13.0	0.161	0.203	
			48	5240	14.0	13.0	0.273	0.344	
Rear (20º Tilt @Edge3)	802.11a	0	36	5180	14.0	13.0	0.080	0.101	
			48	5240	14.0	13.0	0.180	0.227	
Edge 3	802.11a	0	36	5180	14.0	13.0	0.372	0.468	
			48	5240	14.0	13.0	**0.429**	0.540	

5.3GHz Band

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)		SAR (mW/g)		Note
					Tune-up Limit	Measured	Measured	Scaled	
Rear	802.11a	0	52	5260	14.0	13.0	0.414	0.521	
			64	5320	14.0	13.0	0.435	0.548	
Rear (20º Tilt @Edge3)	802.11a	0	52	5260	14.0	13.0	0.252	0.317	
			64	5320	14.0	13.0	0.255	0.321	
Edge 3	802.11a	0	52	5260	14.0	13.0	0.506	0.637	
			64	5320	14.0	13.0	**0.519**	0.653	

5.5GHz Band

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)		SAR (mW/g)		Note
					Tune-up Limit	Measured	1-g	10-g	
Rear	802.11a	0	104	5520	14.0	13.0	0.381	0.480	
			116	5580	14.0	13.0	0.468	0.589	
			124	5620	14.0	13.0	0.567	0.714	
			136	5680	14.0	13.0	0.531	0.668	
Rear (20º Tilt @Edge3)	802.11a	0	104	5520	14.0	13.0	0.332	0.418	
			116	5580	14.0	13.0	0.388	0.488	
			124	5620	14.0	13.0	0.433	0.545	
			136	5680	14.0	13.0	0.447	0.563	
Edge 3	802.11a	0	104	5520	14.0	13.0	0.548	0.690	
			116	5580	14.0	13.0	0.704	0.886	
			124	5620	14.0	13.0	**0.710**	0.894	
			136	5680	14.0	13.0	0.620	0.781	

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

5.8GHz Band

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)		SAR (mW/g)		Note
					Tune-up Limit	Measured	Measured	Scaled	
Rear	802.11a	0	149	5745	14.0	13.0	0.461	0.580	
			157	5785	14.0	13.0	0.434	0.546	
			165	5825	14.0	13.0	0.427	0.538	
Rear (20º Tilt @Edge3)	802.11a	0	149	5745	14.0	13.0	0.315	0.397	
			157	5785	14.0	13.0	0.316	0.398	
			165	5825	14.0	13.0	0.362	0.456	
Edge 3	802.11a	0	149	5745	14.0	13.0	0.402	0.506	
			157	5785	14.0	13.0	0.427	0.538	
			165	5825	14.0	13.0	**0.558**	0.702	

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).

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

14. Summary of Highest SAR Values

Results for highest Body SAR values for each frequency band and mode

Technology/Band	Test configuration	Mode	Highest Measured 1g-SAR (W/kg)
W-CDMA (UMTS) Band V	Edge 1	Rel 99 RMC 12.2kbps	0.738
W-CDMA (UMTS) Band II	Rear	Rel 99 RMC 12.2kbps	1.44
LTE band 4	Rear	10 MHz (QPSK)RB 25/12	1.42
LTE band 17	Rear	10 MHz (QPSK) RB 1/49	0.900
WiFi 2.4 GHz	Rear 20º Tilt @Edge1	802.11b 1Mbps	1.26
WiFi 5.2 GHz	Edge 3	802.11a 6Mbps	0.429
WiFi 5.3 GHz	Edge 3	802.11a 6Mbps	0.519
WiFi 5.5 GHz	Edge 3	802.11a 6Mbps	0.710
WiFi 5.8 GHz	Edge 3	802.11a 6Mbps	0.558

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

14.1. SAR Plots (from Summary of Highest Measured SAR Values)

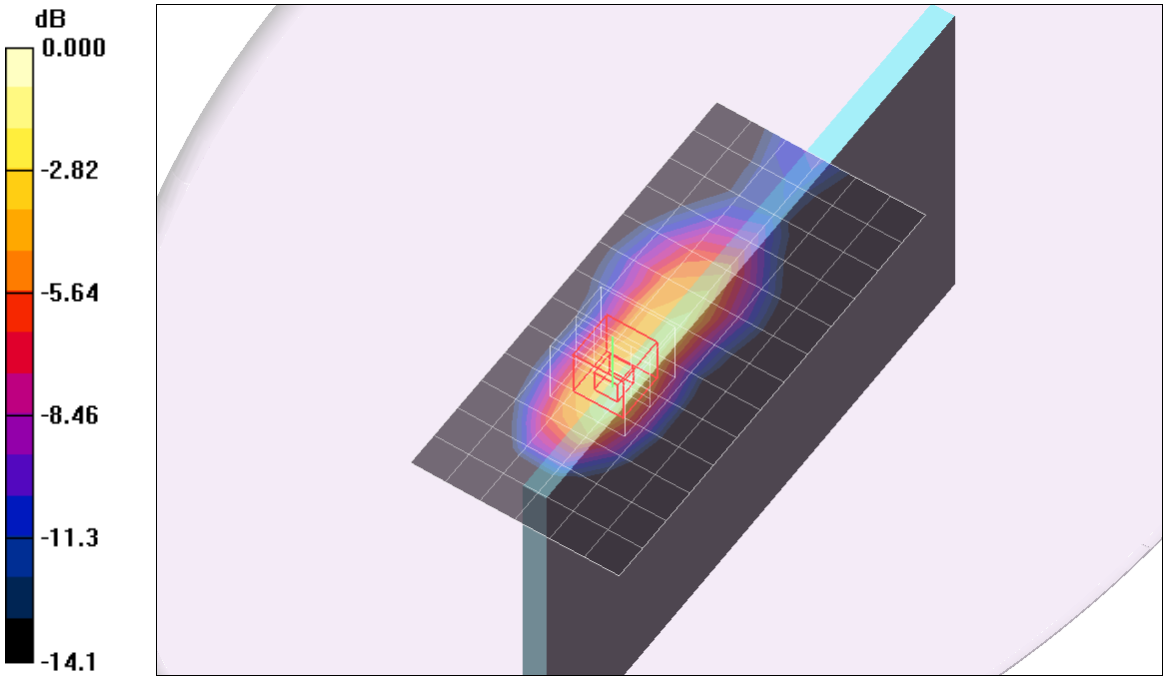
Test Laboratory: UL CCS SAR Lab D Date/Time: 8/16/2012

W-CDMA Band V

Frequency: 836.6 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.99 mho/m; ε_r = 54.8; ρ = 1000 kg/m^3 ;
DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Electronics: DAE3 Sn500; Calibrated: 6/13/2012
- Probe: EX3DV4 - SN3749; ConvF(8.84, 8.84, 8.84); Calibrated: 1/27/2012
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: SN:1017

Edge 1/Rel.99/Ch 4183/Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.770 mW/g

Edge 1/Rel.99/Ch 4183/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 28.2 V/m; Power Drift = 0.152 dB
Peak SAR (extrapolated) = 1.42 W/kg
SAR(1 g) = 0.738 mW/g; SAR(10 g) = 0.405 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.02 mW/g



0 dB = 1.02mW/g

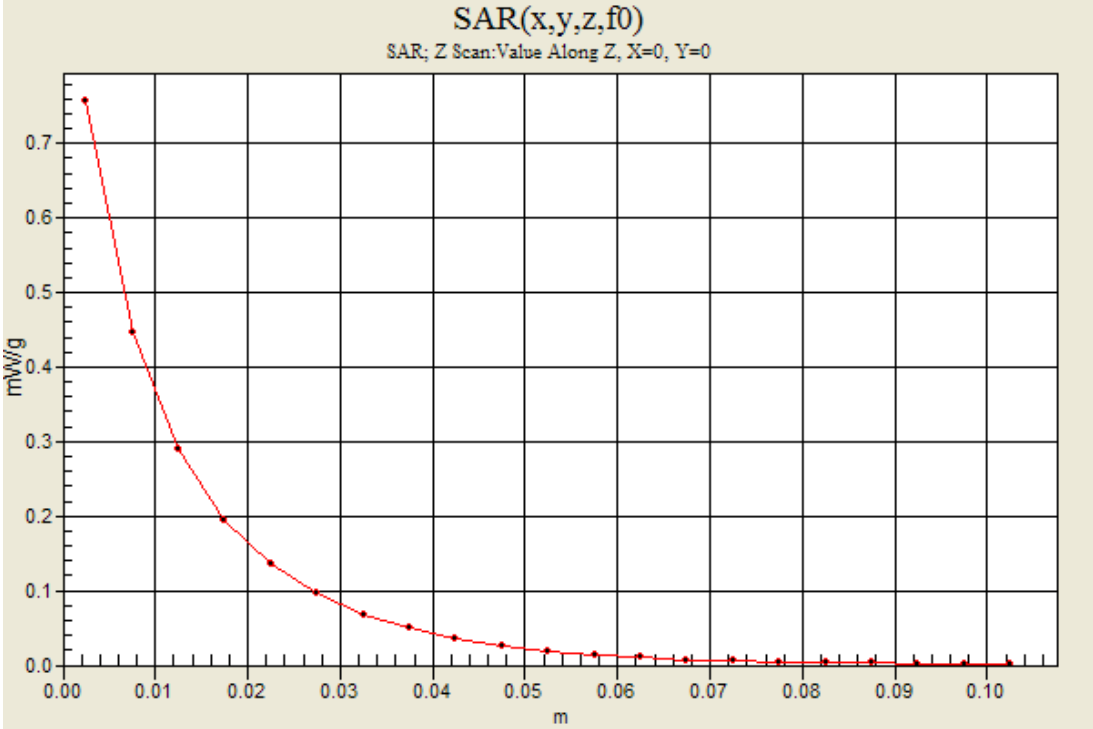
This report shall not be reproduced except in full, without the written approval of UL CCS.

Test Laboratory: UL CCS SAR Lab D
Date/Time: 8/16/2012

W-CDMA Band V

Frequency: 836.6 MHz; Duty Cycle: 1:1

Edge 1/Rel.99/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) = 0.757 mW/g



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

Test Laboratory: UL CCS SAR Lab D
Date/Time: 8/14/2012

W-CDMA Band II

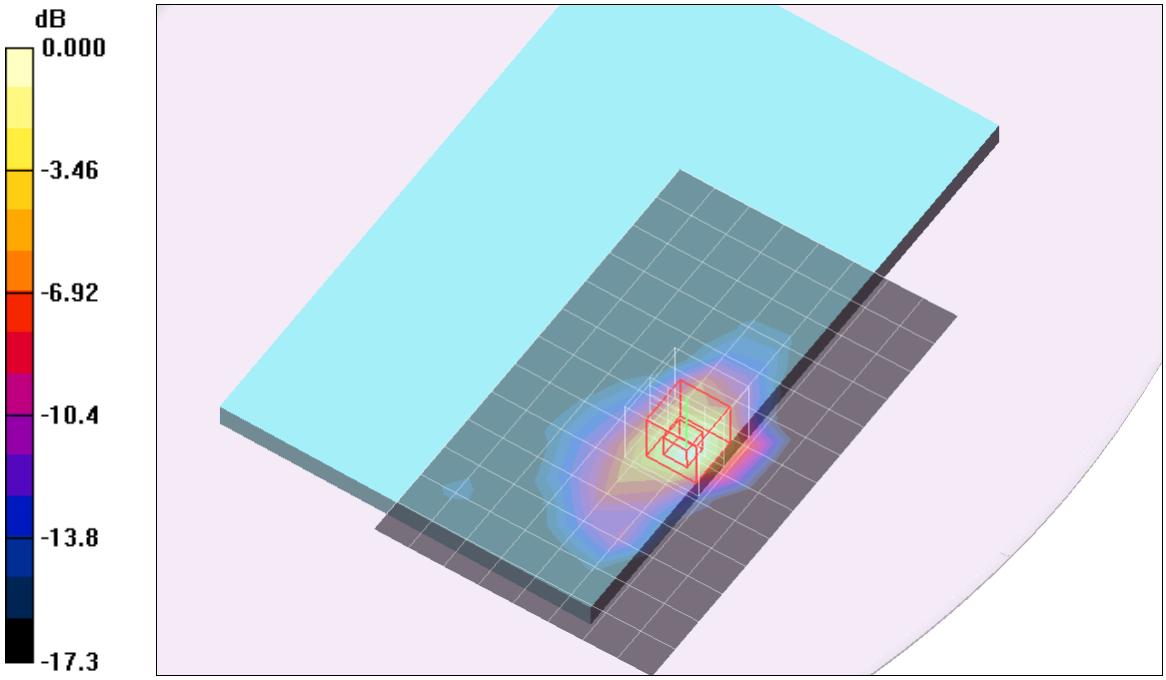
Frequency: 1852.4 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C
Medium parameters used (interpolated): f = 1852.4 MHz; σ = 1.47 mho/m; ε_r = 53.6; ρ = 1000 kg/m^3 ;
DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Electronics: DAE3 Sn500; Calibrated: 6/13/2012
- Probe: EX3DV4 - SN3749; ConvF(6.97, 6.97, 6.97); Calibrated: 1/27/2012
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: SN:1017

Rear/Rel.99/Ch 9262/Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 2.21 mW/g

Rear/Rel.99/Ch 9262/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 35.9 V/m; Power Drift = 0.189 dB
Peak SAR (extrapolated) = 3.06 W/kg
SAR(1 g) = 1.44 mW/g; SAR(10 g) = 0.690 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 2.04 mW/g



0 dB = 2.04mW/g

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

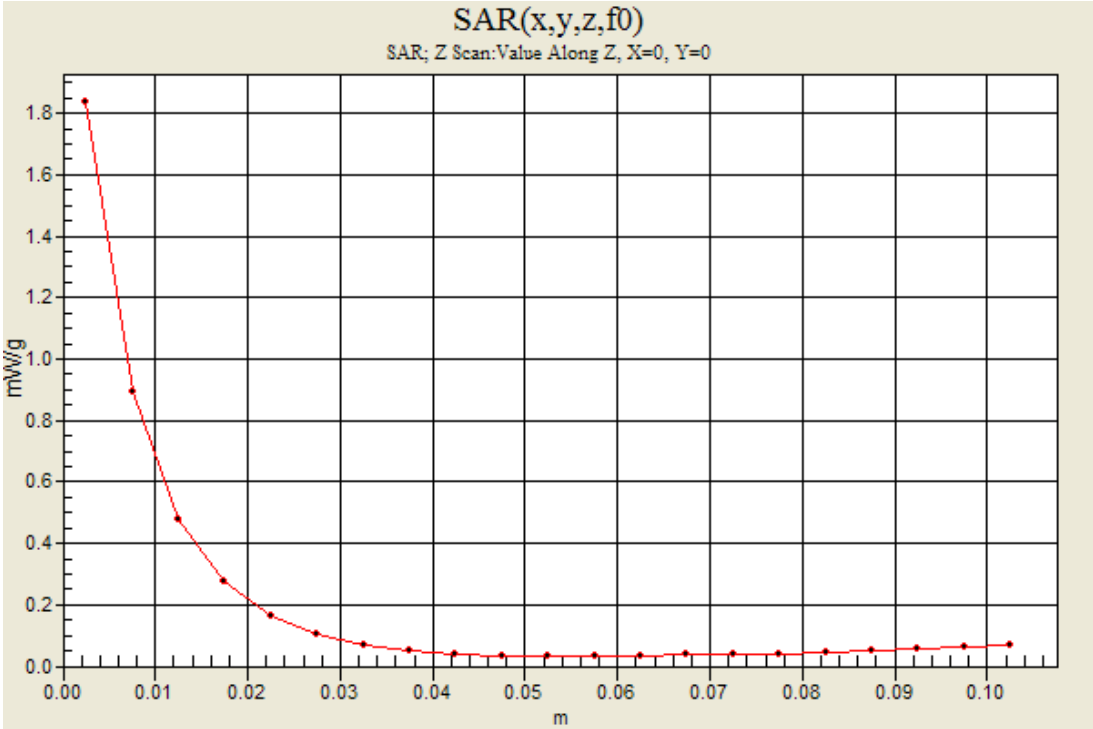
Test Laboratory: UL CCS SAR Lab D
Date/Time: 8/14/2012

W-CDMA Band II

Frequency: 1852.4 MHz; Duty Cycle: 1:1

Rear/Rel.99/Ch 9262/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.84 mW/g



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

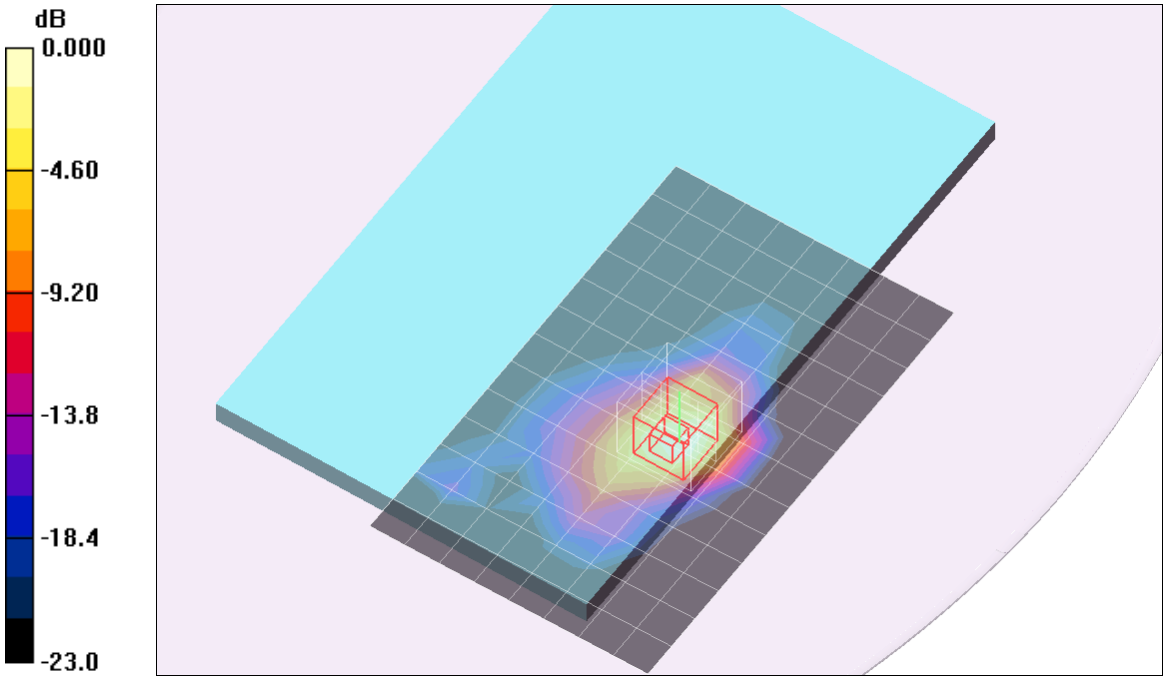
Test Laboratory: UL CCS SAR Lab D
Date/Time: 8/16/2012

LTE Band 4

Frequency: 1750 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C
Medium parameters used: f = 1750 MHz; σ = 1.47 mho/m; ε_r = 54.4; ρ = 1000 kg/m^3 ;
DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Electronics: DAE3 Sn500; Calibrated: 6/13/2012
- Probe: EX3DV4 - SN3749; ConvF(7.23, 7.23, 7.23); Calibrated: 1/27/2012
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: SN:1017

Rear/QPSK RB25_12/Ch 20350/Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.75 mW/g

Rear/QPSK RB25_12/Ch 20350/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 33.5 V/m; Power Drift = 0.199 dB
Peak SAR (extrapolated) = 3.00 W/kg
SAR(1 g) = 1.42 mW/g; SAR(10 g) = 0.674 mW/g
Maximum value of SAR (measured) = 1.87 mW/g



0 dB = 1.87mW/g

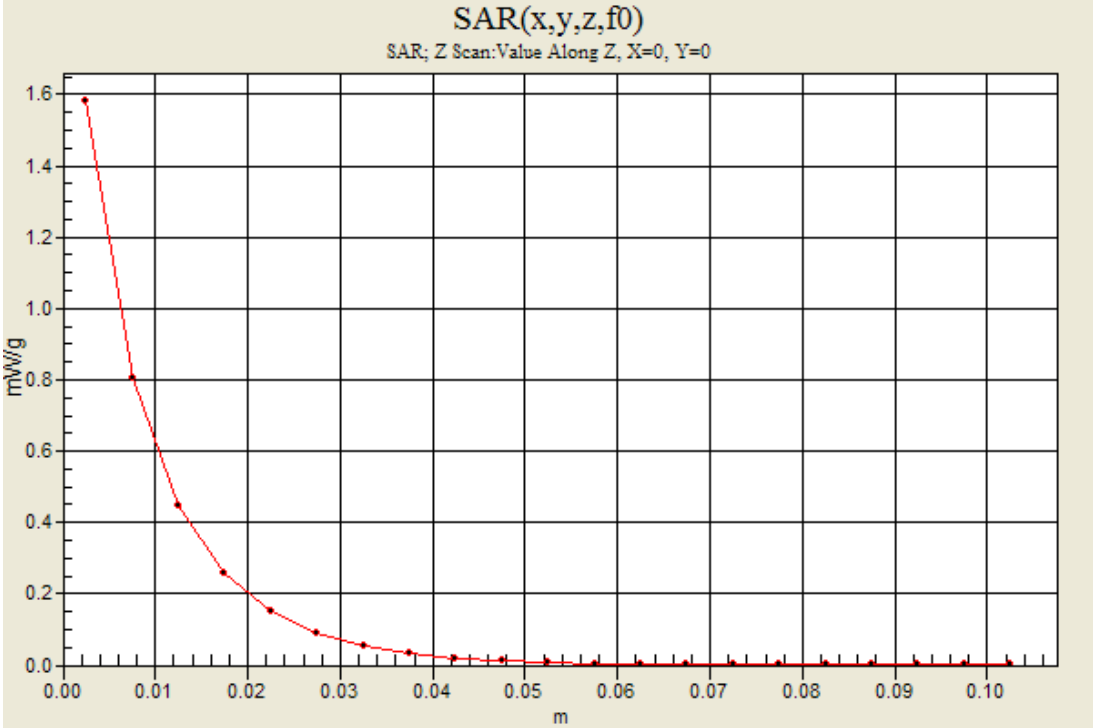
This report shall not be reproduced except in full, without the written approval of UL CCS.

Test Laboratory: UL CCS SAR Lab D
Date/Time: 8/16/2012

LTE Band 4

Frequency: 1750 MHz; Duty Cycle: 1:1

Rear/QPSK RB25_12/Ch 20350/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 1.58 mW/g



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

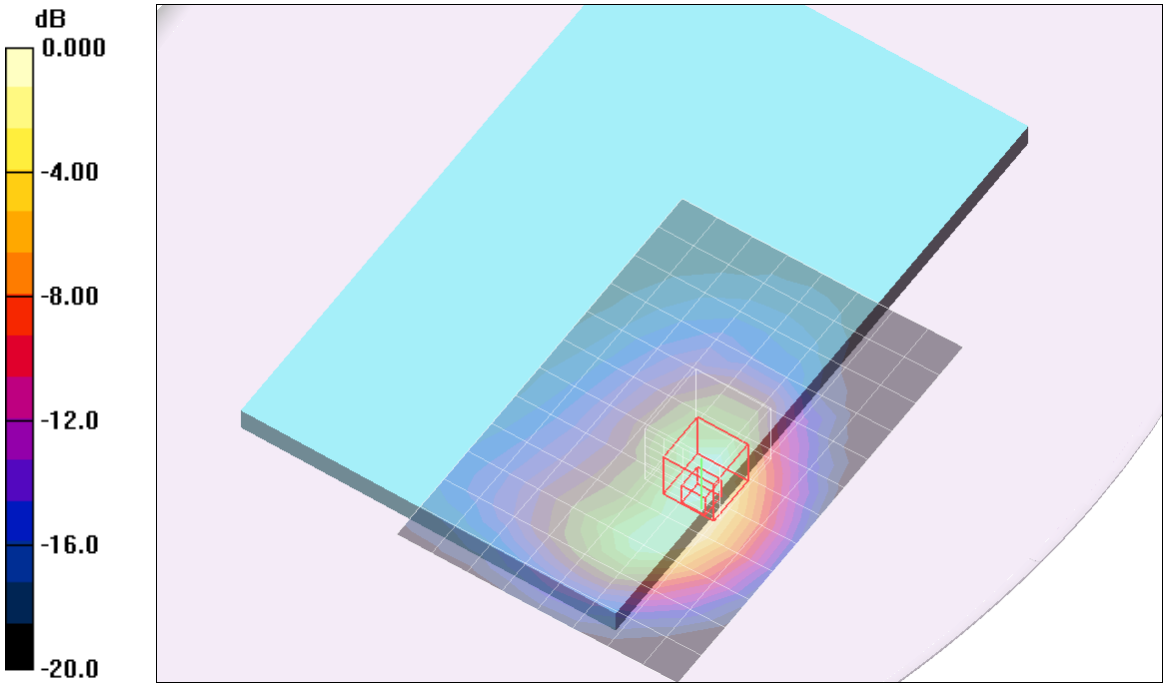
Test Laboratory: UL CCS SAR Lab D
Date/Time: 8/24/2012

LTE Band 17

Frequency: 710 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C
Medium parameters used: f = 710 MHz; σ = 0.929 mho/m; ε_r = 55.7; ρ = 1000 kg/m^3 ;
DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Electronics: DAE3 Sn500; Calibrated: 6/13/2012
- Probe: EX3DV4 - SN3749; ConvF(8.97, 8.97, 8.97); Calibrated: 1/27/2012
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: SN:1017

Rear/QPSK RB1_49/Ch 23790/Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.12 mW/g

Rear/QPSK RB1_49/Ch 23790/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 33.4 V/m; Power Drift = 0.092 dB
Peak SAR (extrapolated) = 1.66 W/kg
SAR(1 g) = 0.900 mW/g; SAR(10 g) = 0.493 mW/g
Maximum value of SAR (measured) = 1.16 mW/g



0 dB = 1.16mW/g

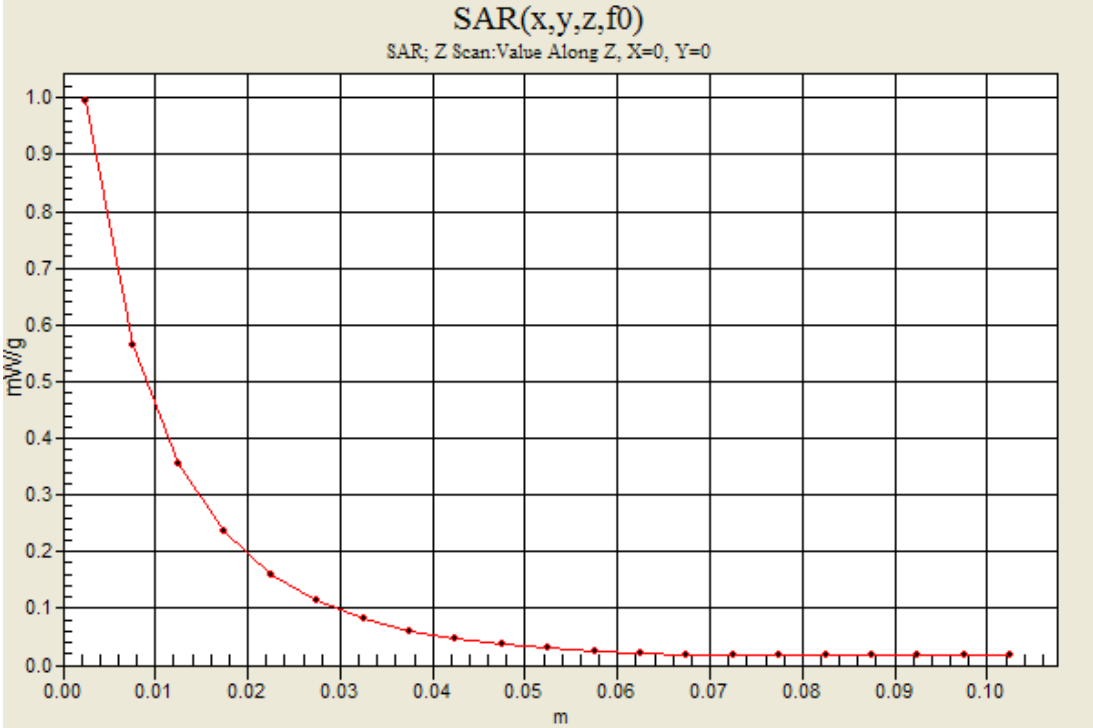
This report shall not be reproduced except in full, without the written approval of UL CCS.

Test Laboratory: UL CCS SAR Lab D
Date/Time: 8/24/2012

LTE Band 17

Frequency: 710 MHz; Duty Cycle: 1:1

Rear/QPSK RB1_49/Ch 23790/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 0.995 mW/g



UL CCS
FORM NO: CCSUP4031G
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.

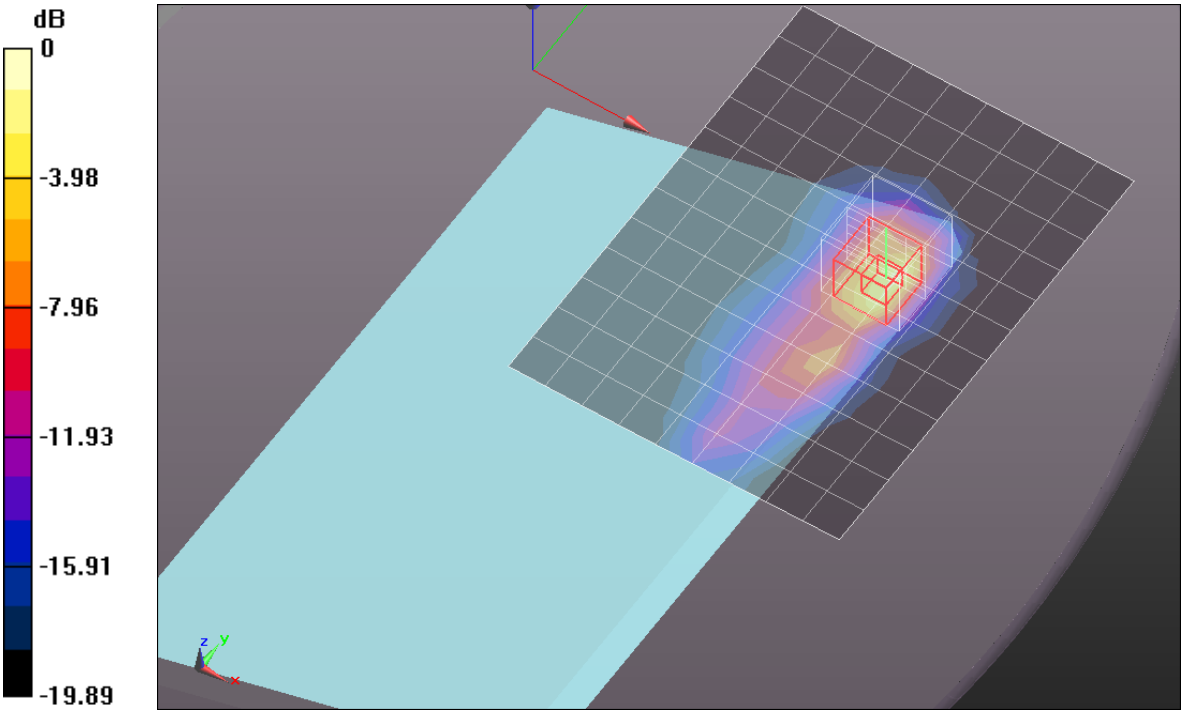
Test Laboratory: UL CCS SAR Lab A
Date: 6/22/2012

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 = 1.958 mho/m; ε_r = 51.617; ρ = 1000 kg/m^3
DASY5 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Electronics: DAE4 Sn1258; Calibrated: 3/8/2012
- Probe: EX3DV4 - SN3772; ConvF(6.65, 6.65, 6.65); Calibrated: 2/16/2012
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: ELI v5.0 (A); Type: QDOVA001BB; Serial: 1120

Rear 20 deg. tilt @ Edge 1/802.11b_Ch 11/Area Scan (10x13x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.267 mW/g

Rear 20 deg. tilt @ Edge 1/802.11b_Ch 11/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 24.792 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 3.1040
SAR(1 g) = 1.26 mW/g; SAR(10 g) = 0.482 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.934 mW/g



0 dB = 1.930mW/g = 5.71 dB mW/g

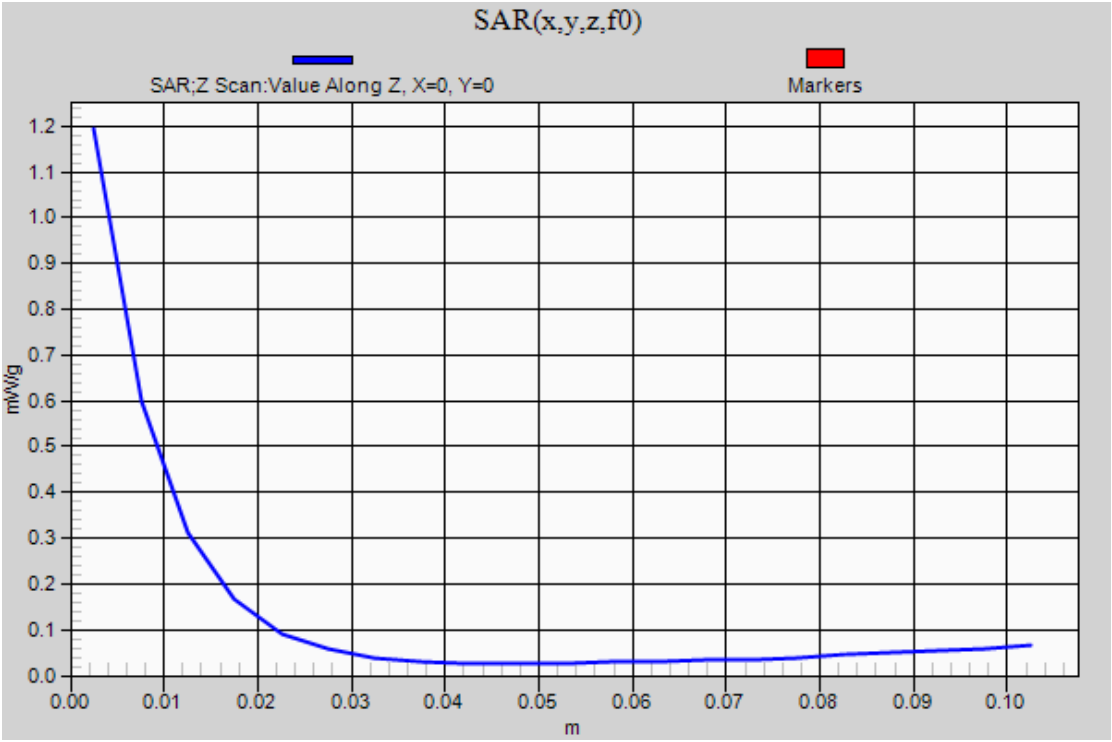
This report shall not be reproduced except in full, without the written approval of UL CCS.

Test Laboratory: UL CCS SAR Lab A
Date: 6/22/2012

WiFi 2.4GHz

Frequency: 2462 MHz; Duty Cycle: 1:1

Rear 20 deg. tilt @ Edge 1/802.11b_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) = 1.194 mW/g



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

Test Laboratory: UL CCS SAR Lab A Date: 6/22/2012

WiFi 5.2 GHz band

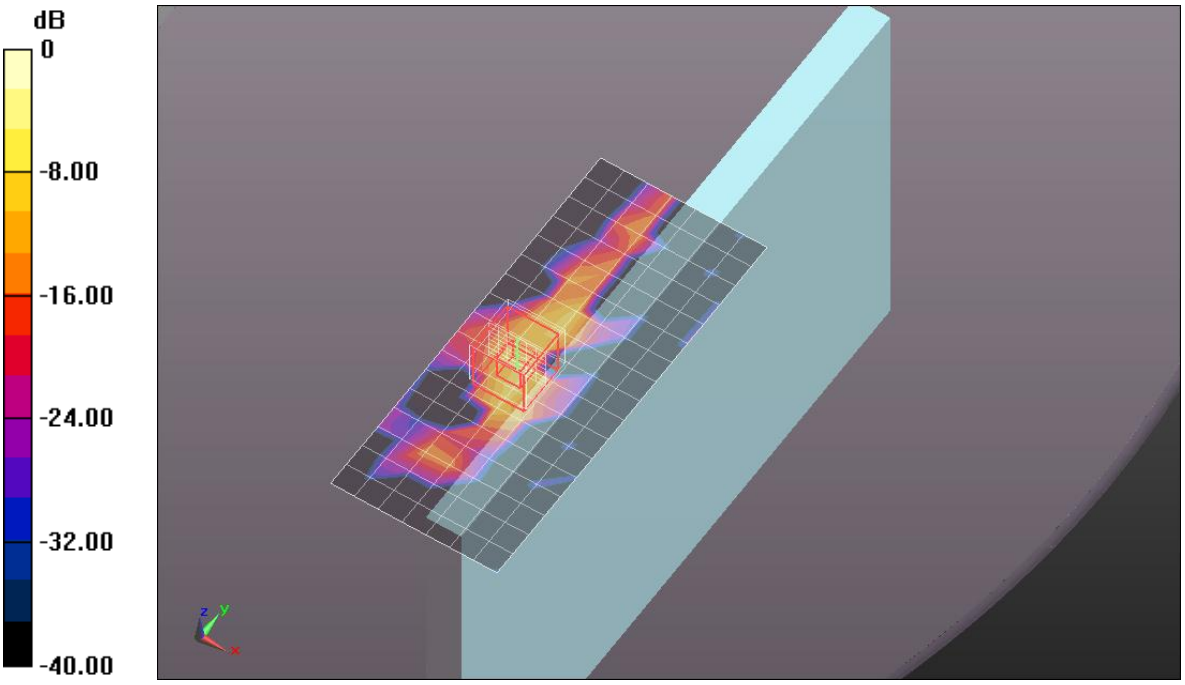
Frequency: 5240 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 25.0°C; Liquid Temperature: 24.0°C
Medium parameters used: f = 5240 MHz; σ = 5.505 mho/m; ε_r = 47.631; ρ = 1000 kg/m^3
DASY5 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Electronics: DAE4 Sn1258; Calibrated: 3/8/2012
- Probe: EX3DV4 - SN3772; ConvF(4.17, 4.17, 4.17); Calibrated: 2/16/2012
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: ELI v5.0 (B); Type: QDOVA001BB; Serial: 1099

Edge 3/Ch 48/Area Scan (8x18x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.424 mW/g

Edge 3/Ch 48/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 9.384 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 3.0760
SAR(1 g) = 0.429 mW/g; SAR(10 g) = 0.078 mW/g
Maximum value of SAR (measured) = 1.146 mW/g



0 dB = 1.150mW/g = 1.21 dB mW/g

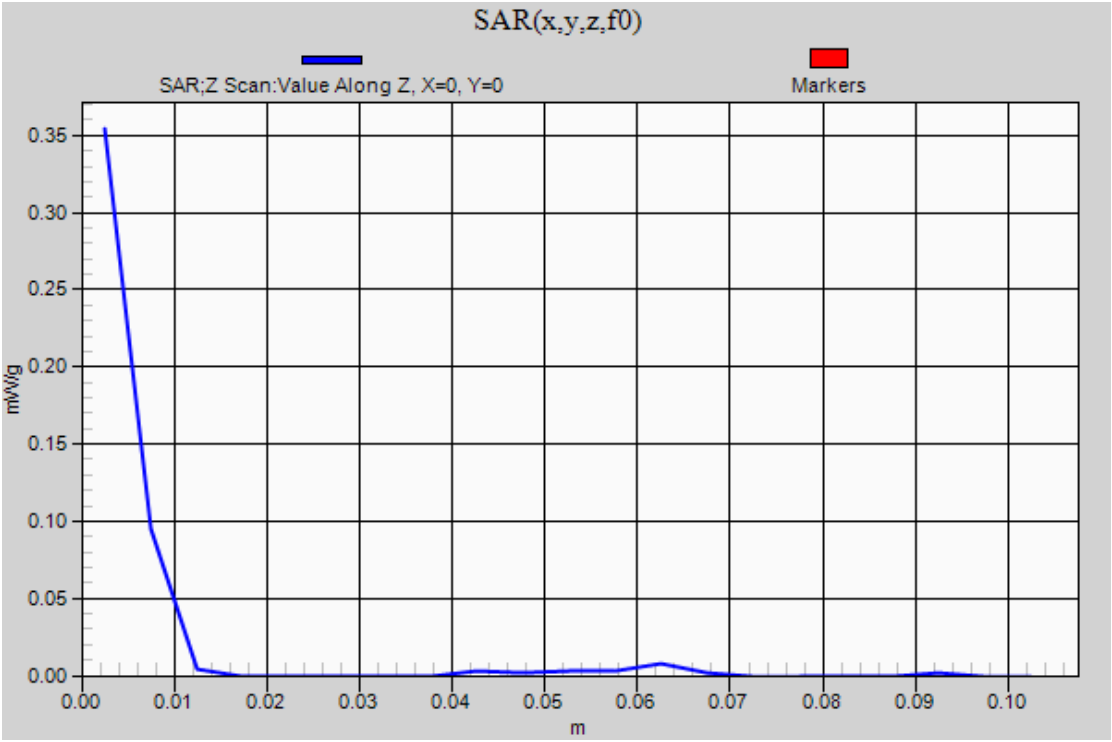
UL CCS FORM NO: CCSUP4031G
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL CCS.

Test Laboratory: UL CCS SAR Lab A
Date: 6/22/2012

WiFi 5.2 GHz band

Frequency: 5240 MHz; Duty Cycle: 1:1

Edge 3/Ch 48/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 0.354 mW/g



UL CCS
FORM NO: CCSUP4031G
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 A
Date: 6/22/2012

WiFi 5.3 GHz band

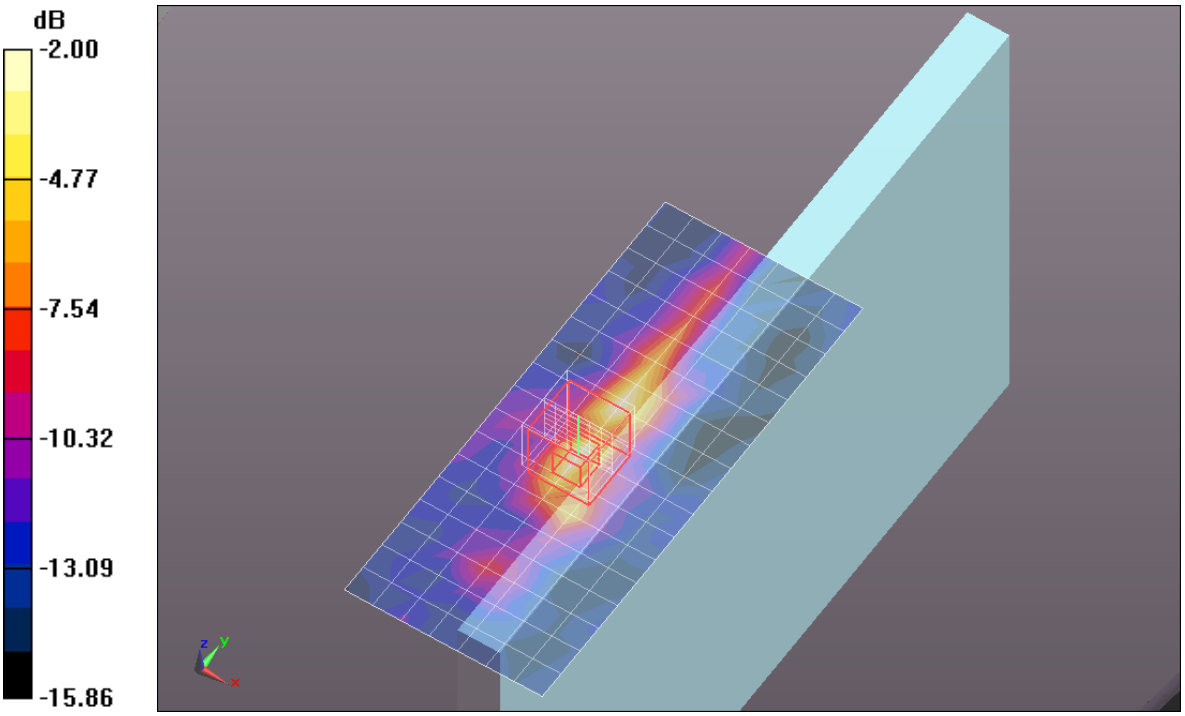
Frequency: 5320 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 25.0°C; Liquid Temperature: 24.0°C
Medium parameters used: f = 5320 MHz; σ = 5.604 mho/m; ε_r = 47.48; ρ = 1000 kg/m^3
DASY5 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Electronics: DAE4 Sn1258; Calibrated: 3/8/2012
- Probe: EX3DV4 - SN3772; ConvF(3.99, 3.99, 3.99); Calibrated: 2/16/2012
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: ELI v5.0 (B); Type: QDOVA001BB; Serial: 1099

Edge 3/Ch 64/Area Scan (8x18x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.767 mW/g

Edge 3/Ch 64/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 13.864 V/m; Power Drift = 0.19 dB
Peak SAR (extrapolated) = 4.7610
SAR(1 g) = 0.519 mW/g; SAR(10 g) = 0.139 mW/g
Maximum value of SAR (measured) = 1.004 mW/g



0 dB = 1.000mW/g = 0 dB mW/g

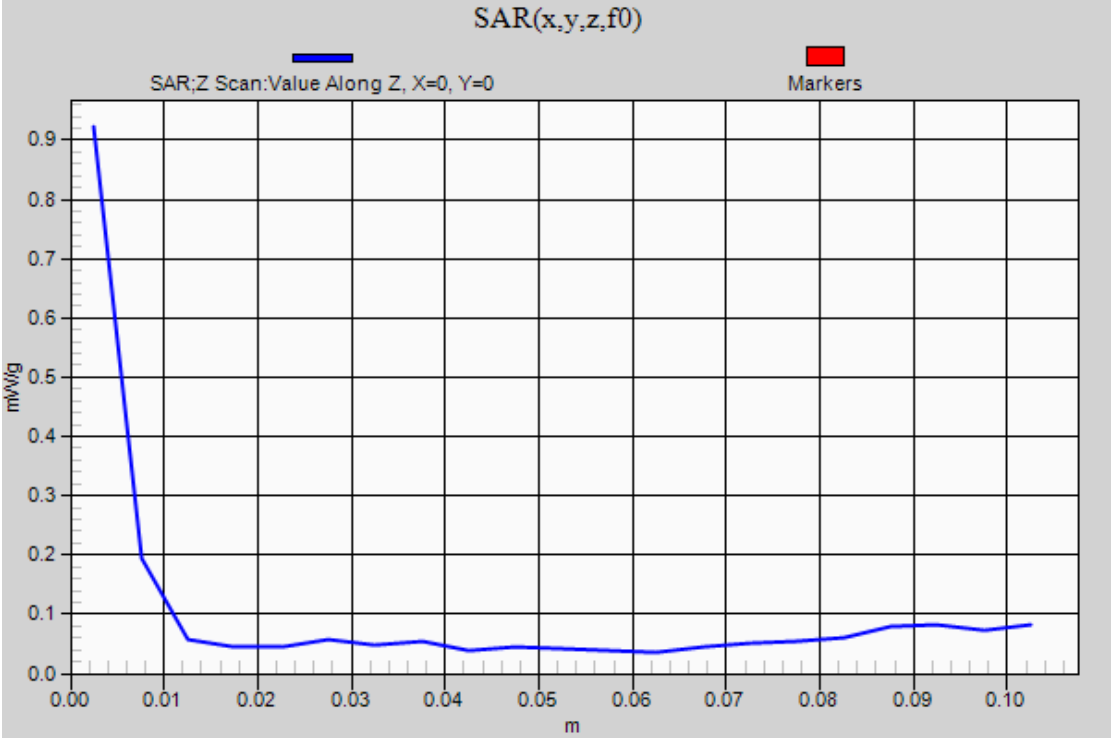
This report shall not be reproduced except in full, without the written approval of UL CCS.

Test Laboratory: UL CCS SAR Lab A
Date: 6/22/2012

WiFi 5.3 GHz band

Frequency: 5320 MHz; Duty Cycle: 1:1

Edge 3/Ch 64/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 0.922 mW/g



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

Test Laboratory: UL CCS SAR Lab A
Date: 6/23/2012

WiFi 5.5 GHz band

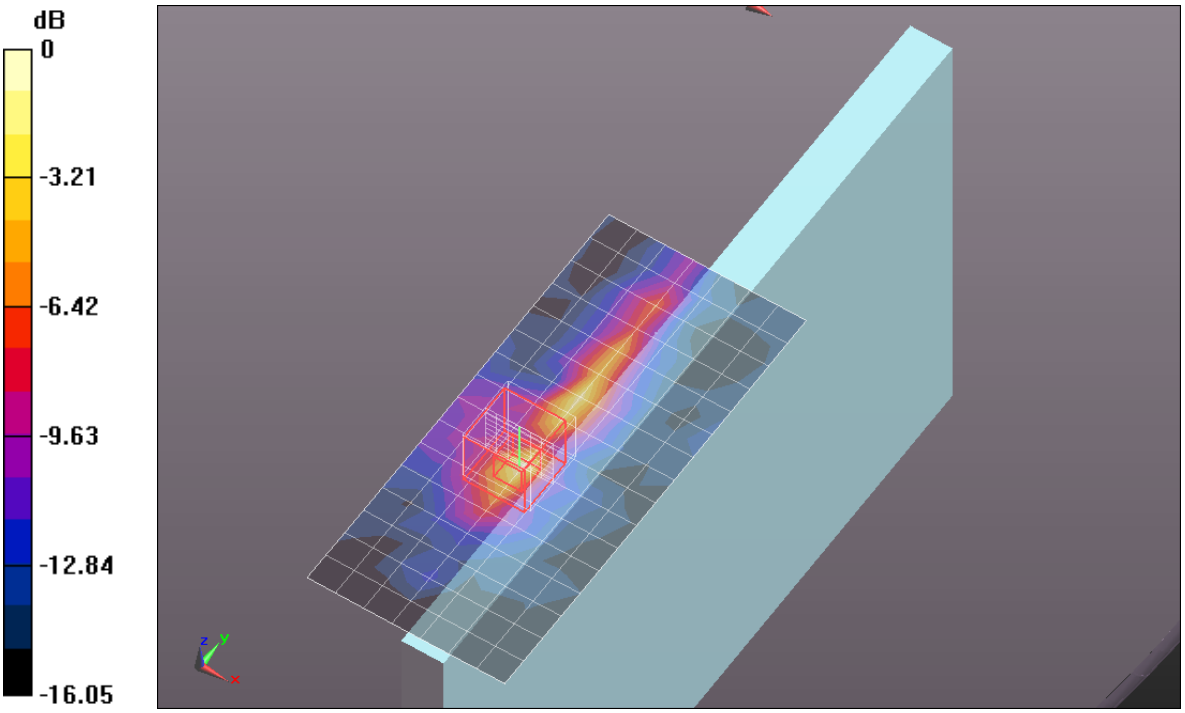
Frequency: 5620 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 25.0°C; Liquid Temperature: 24.0°C
Medium parameters used: f = 5620 MHz; σ = 5.994 mho/m; ε_r = 46.971; ρ = 1000 kg/m^3
DASY5 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Electronics: DAE4 Sn1258; Calibrated: 3/8/2012
- Probe: EX3DV4 - SN3772; ConvF(3.26, 3.26, 3.26); Calibrated: 2/16/2012
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: ELI v5.0 (B); Type: QDOVA001BB; Serial: 1099

Edge 3/Ch 124/Area Scan (8x17x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 1.646 mW/g

Edge 3/Ch 124/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 17.903 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 3.7480
SAR(1 g) = 0.710 mW/g; SAR(10 g) = 0.213 mW/g
Maximum value of SAR (measured) = 1.724 mW/g



0 dB = 1.720mW/g = 4.71 dB mW/g

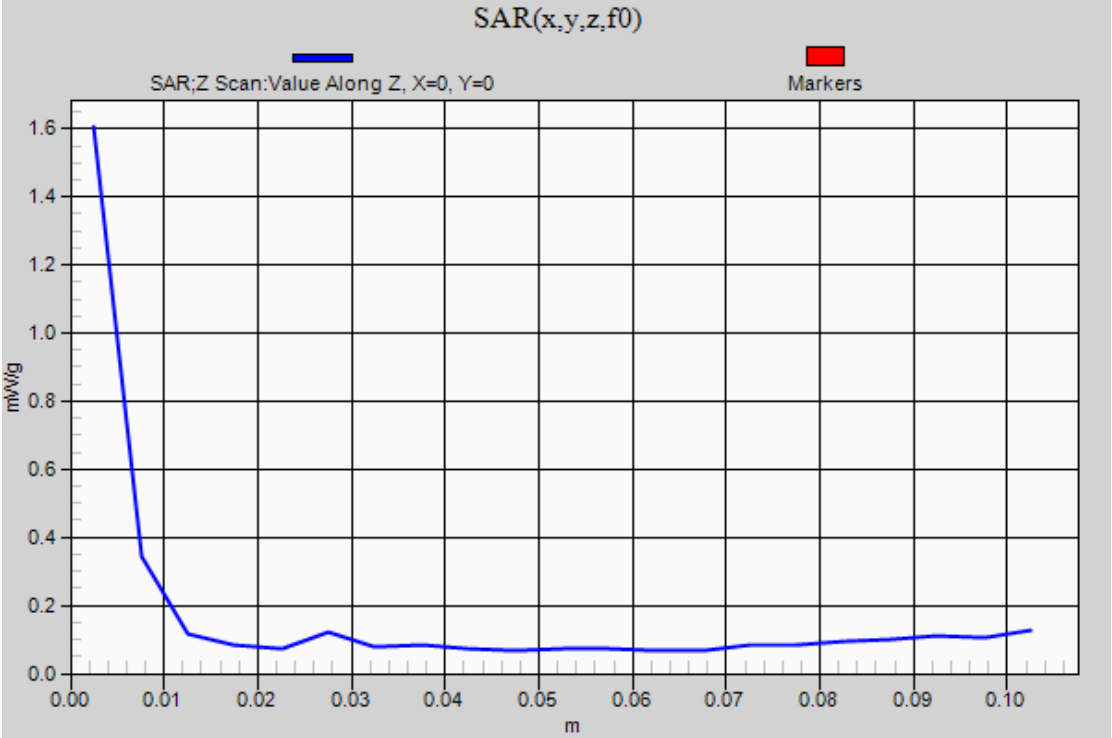
This report shall not be reproduced except in full, without the written approval of UL CCS.

Test Laboratory: UL CCS SAR Lab A
Date: 6/23/2012

WiFi 5.5 GHz band

Frequency: 5620 MHz; Duty Cycle: 1:1

Edge 3/Ch 124/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 1.606 mW/g



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

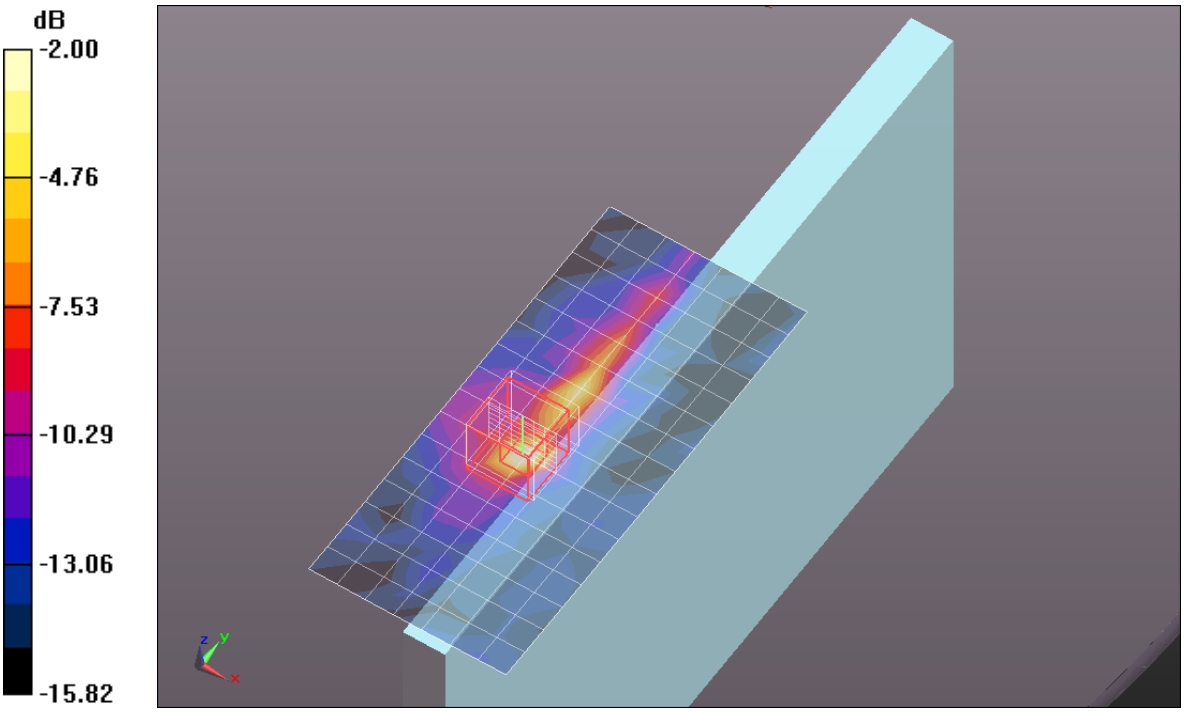
Test Laboratory: UL CCS SAR Lab A
Date: 6/23/2012

WiFi 5.8 GHz band

Frequency: 5825 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 25.0°C; Liquid Temperature: 24.0°C
Medium parameters used: f = 5825 MHz; σ = 6.286 mho/m; ε_r = 46.585; ρ = 1000 kg/m^3
DASY5 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Electronics: DAE4 Sn1258; Calibrated: 3/8/2012
- Probe: EX3DV4 - SN3772; ConvF(3.58, 3.58, 3.58); Calibrated: 2/16/2012
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: ELI v5.0 (B); Type: QDOVA001BB; Serial: 1099

Edge 3/Ch 165/Area Scan (8x17x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.364 mW/g

Edge 3/Ch 165/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 14.521 V/m; Power Drift = 0.11 dB
Peak SAR (extrapolated) = 3.8630
SAR(1 g) = 0.558 mW/g; SAR(10 g) = 0.159 mW/g
Maximum value of SAR (measured) = 1.337 mW/g



0 dB = 1.340mW/g = 2.54 dB mW/g

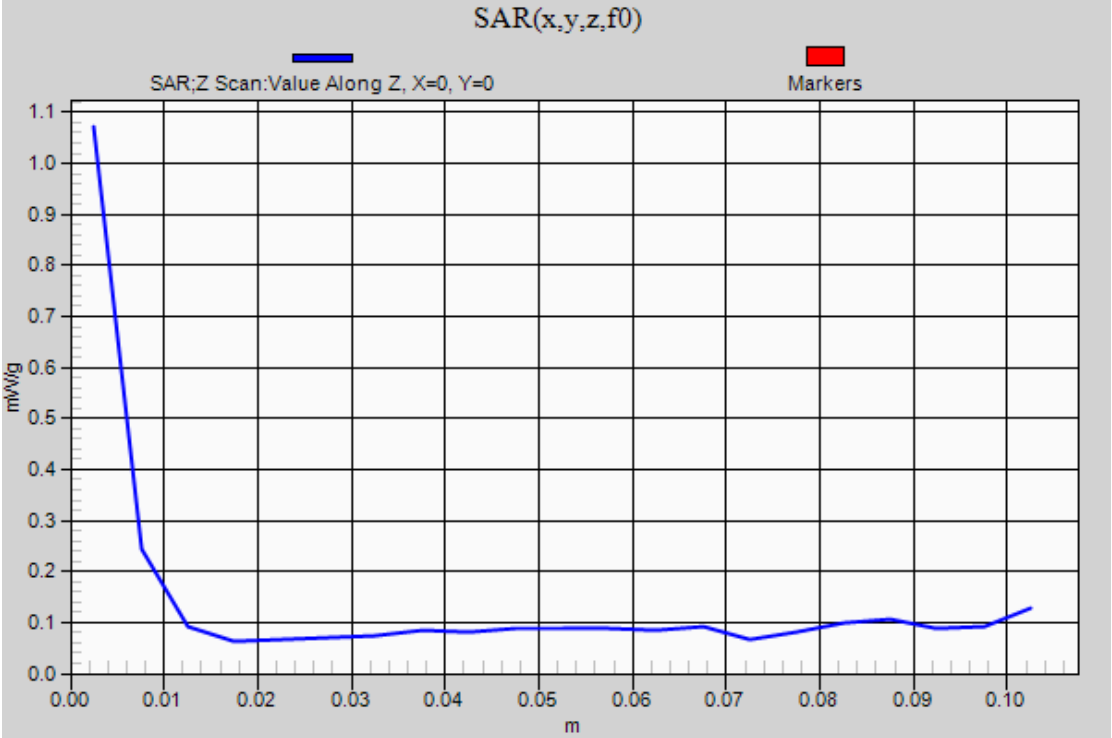
This report shall not be reproduced except in full, without the written approval of UL CCS.

Test Laboratory: UL CCS SAR Lab A
Date: 6/23/2012

WiFi 5.8 GHz band

Frequency: 5825 MHz; Duty Cycle: 1:1

Edge 3/Ch 165/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 1.071 mW/g



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

15. Simultaneous Transmission SAR Analysis

As Bluetooth's max average power is 3 mW [<60/f(GHz) mW] standalone SAR is not required. Therefore, Bluetooth simultaneous transmission SAR evaluation with Wi-Fi (5GHz) and WWAN is not required. Note that BT and Wi-Fi (2.4GHz) cannot transmit simultaneously.

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

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

Sum of the SAR with Measured Values

Test Position	W-CDMA (UMTS) Band V	W-CDMA (UMTS) Band II	LTE Band 4	LTE Band 17	WiFi 2.4GHz Band	∑ 1-g SAR (mW/g)	Note
Rear	0.494				1.050	1.544	1
		1.440			1.050	2.490	1
			1.420		1.050	2.470	1
				0.900	1.050	1.950	1
Rear (20º Tilt@Edge1)	0.539				1.260	1.799	1
		0.970			1.260	2.230	1
			1.130		1.260	2.390	1
				0.675	1.260	1.935	1
Edge 1	0.738				0.321	1.059	
		1.000			0.321	1.321	
			1.010		0.321	1.331	
				0.523	0.321	0.844	
Test Position	W-CDMA (UMTS) Band V	W-CDMA (UMTS) Band II	LTE Band 4	LTE Band 17	WiFi 5.2GHz Band	∑ 1-g SAR (mW/g)	Note
Rear	0.494				0.273	0.767	1
		1.440			0.273	1.713	1
			1.420		0.273	1.693	1
				0.900	0.273	1.173	1
Test Position	W-CDMA (UMTS) Band V	W-CDMA (UMTS) Band II	LTE Band 4	LTE Band 17	WiFi 5.3GHz Band	∑ 1-g SAR (mW/g)	Note
Rear	0.494				0.435	0.929	1
		1.440			0.435	1.875	1
			1.420		0.435	1.855	1
				0.900	0.435	1.335	1
Test Position	W-CDMA (UMTS) Band V	W-CDMA (UMTS) Band II	LTE Band 4	LTE Band 17	WiFi 5.5GHz Band	∑ 1-g SAR (mW/g)	Note
Rear	0.494				0.567	1.061	1
		1.440			0.567	2.007	1
			1.420		0.567	1.987	1
				0.900	0.567	1.467	1
Test Position	W-CDMA (UMTS) Band V	W-CDMA (UMTS) Band II	LTE Band 4	LTE Band 17	WiFi 5.8GHz Band	∑ 1-g SAR (mW/g)	Note
Rear	0.494				0.461	0.955	1
		1.440			0.461	1.901	1
			1.420		0.461	1.881	1
				0.900	0.461	1.361	1

Note:

1. Denotes the select Simultaneous Transmission case(s) for which SAR scaling considerations are applied to

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

Sum of the SAR with Scaled Values for Selected Cases

Test Position	W-CDMA (UMTS) Band V	W-CDMA (UMTS) Band II	LTE Band 4	LTE Band 17	WiFi 2.4GHz Band	∑ 1-g SAR (mW/g)	Note
Rear	0.554				1.322	1.876	1
		1.440			1.322	2.762	1
			1.487		1.322	2.809	1
				0.900	1.322	2.222	1
Rear (20º Tilt@Edge1)	0.605				1.586	2.191	1
		0.970			1.586	2.556	1
			1.201		1.586	2.787	1
				0.675	1.586	2.261	1
Test Position	W-CDMA (UMTS) Band V	W-CDMA (UMTS) Band II	LTE Band 4	LTE Band 17	WiFi 5.2GHz Band	∑ 1-g SAR (mW/g)	Note
Rear	0.554				0.344	0.898	2
		1.440			0.344	1.784	1
			1.487		0.344	1.831	1
				0.900	0.344	1.244	2
Test Position	W-CDMA (UMTS) Band V	W-CDMA (UMTS) Band II	LTE Band 4	LTE Band 17	WiFi 5.3GHz Band	∑ 1-g SAR (mW/g)	Note
Rear	0.554				0.548	1.102	2
		1.440			0.548	1.988	1
			1.487		0.548	2.035	1
				0.900	0.548	1.448	2
Test Position	W-CDMA (UMTS) Band V	W-CDMA (UMTS) Band II	LTE Band 4	LTE Band 17	WiFi 5.5GHz Band	∑ 1-g SAR (mW/g)	Note
Rear	0.554				0.714	1.268	2
		1.440			0.714	2.154	1
			1.487		0.714	2.201	1
				0.900	0.714	1.614	1
Test Position	W-CDMA (UMTS) Band V	W-CDMA (UMTS) Band II	LTE Band 4	LTE Band 17	WiFi 5.8GHz Band	∑ 1-g SAR (mW/g)	Note
Rear	0.554				0.581	1.135	2
		1.440			0.581	2.021	1
			1.487		0.581	2.068	1
				0.900	0.581	1.481	2

Note:

1, Where the ∑ 1-g SAR exceeds 1.6mW/g SPLSR calculations will determine if further Simultaneous transmission SAR measurements (Volume Scan) are required.
2, Simultaneous transmission SAR measurement (Volume Scan) is not required because the ∑ 1-g SAR is < 1.6 mW/g

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

15.2. SAR to Peak Location Separation Ratio (SPLSR) for WWAN and Wi-Fi 2.4GHz

Test Position	Worst-case combination					∑ 1-g SAR (mW/g)	Calculated distance (cm)	SPLSR	Figure
	W-CDMA Band V	W-CDMA Band II	LTE Band 4	LTE Band 17	WiFi 2.4GHz Band				
Rear	0.554				1.322	1.876	16.76	0.112	1
		1.440			1.322	2.762	15.56	0.178	2
			1.487		1.322	2.809	15.9	0.177	3
				0.900	1.322	2.222	17.89	0.124	4
Rear (20º Tilt@Edge1)	0.605				1.586	2.191	16.16	0.136	5
		0.970			1.586	2.556	17.42	0.147	6
			1.201		1.586	2.787	15.16	0.184	7
				0.675	1.586	2.261	16.24	0.139	8

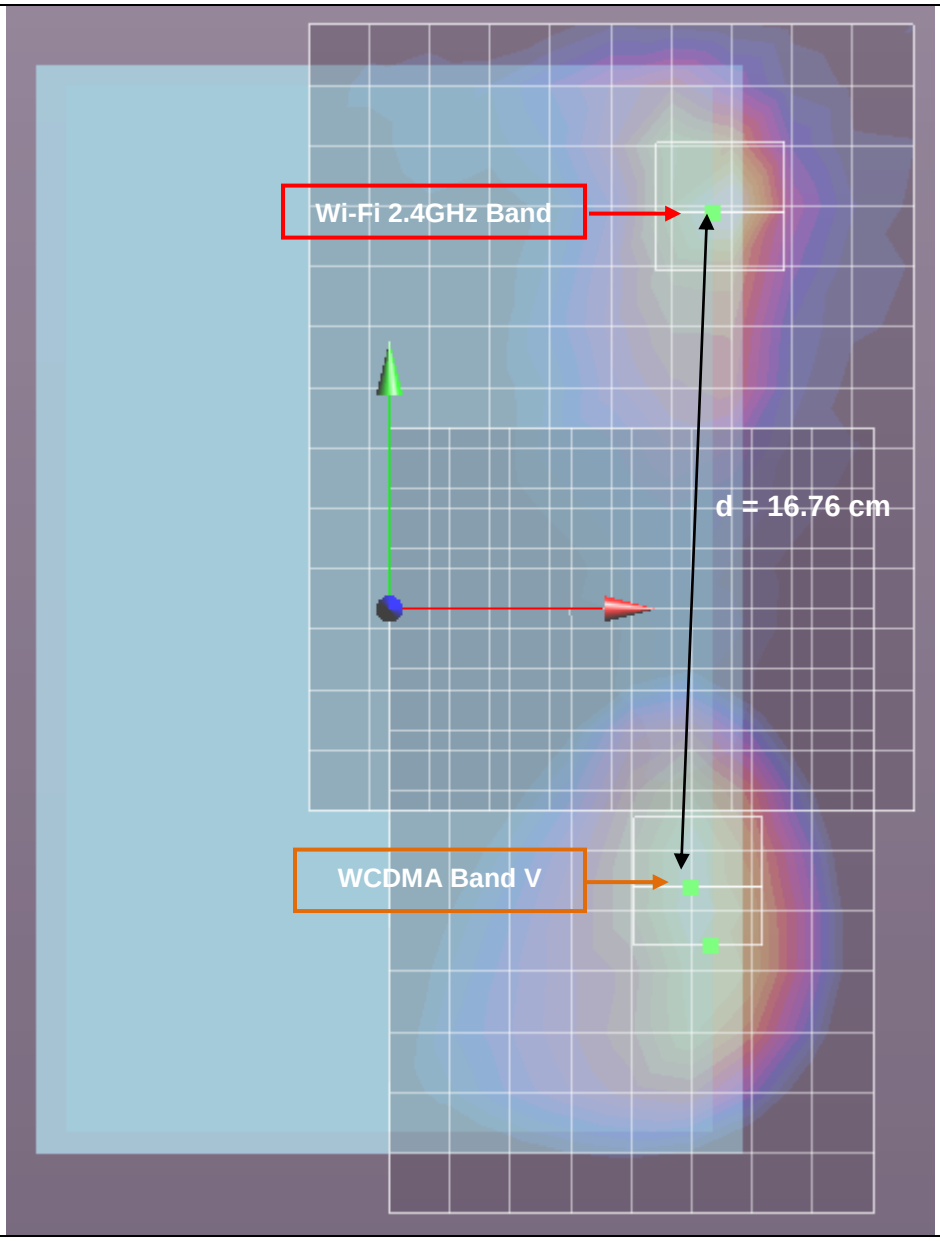
Conclusions:

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

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

SAR Peak Location Separation Distance

Figure (1)



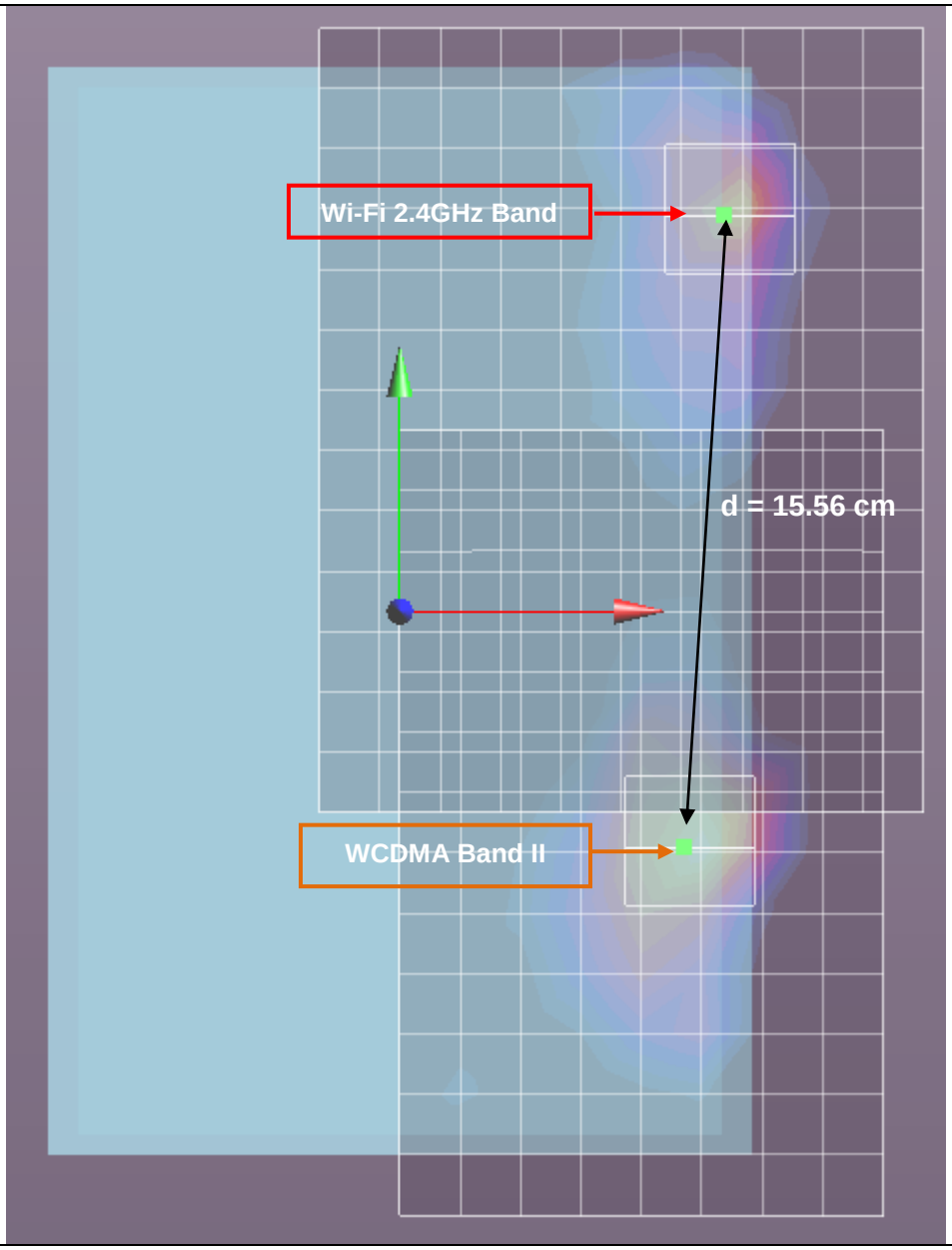
Mode	Peak SAR	X	Y	Z
	mW/g	m	m	m
WCDMA Band V	0.82	0.075	-0.0691	-0.181
WiFi 2.4GHz Band	1.02	0.0789	0.0984	-0.183

Separation distance (cm)
16.76

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

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

Figure (2)



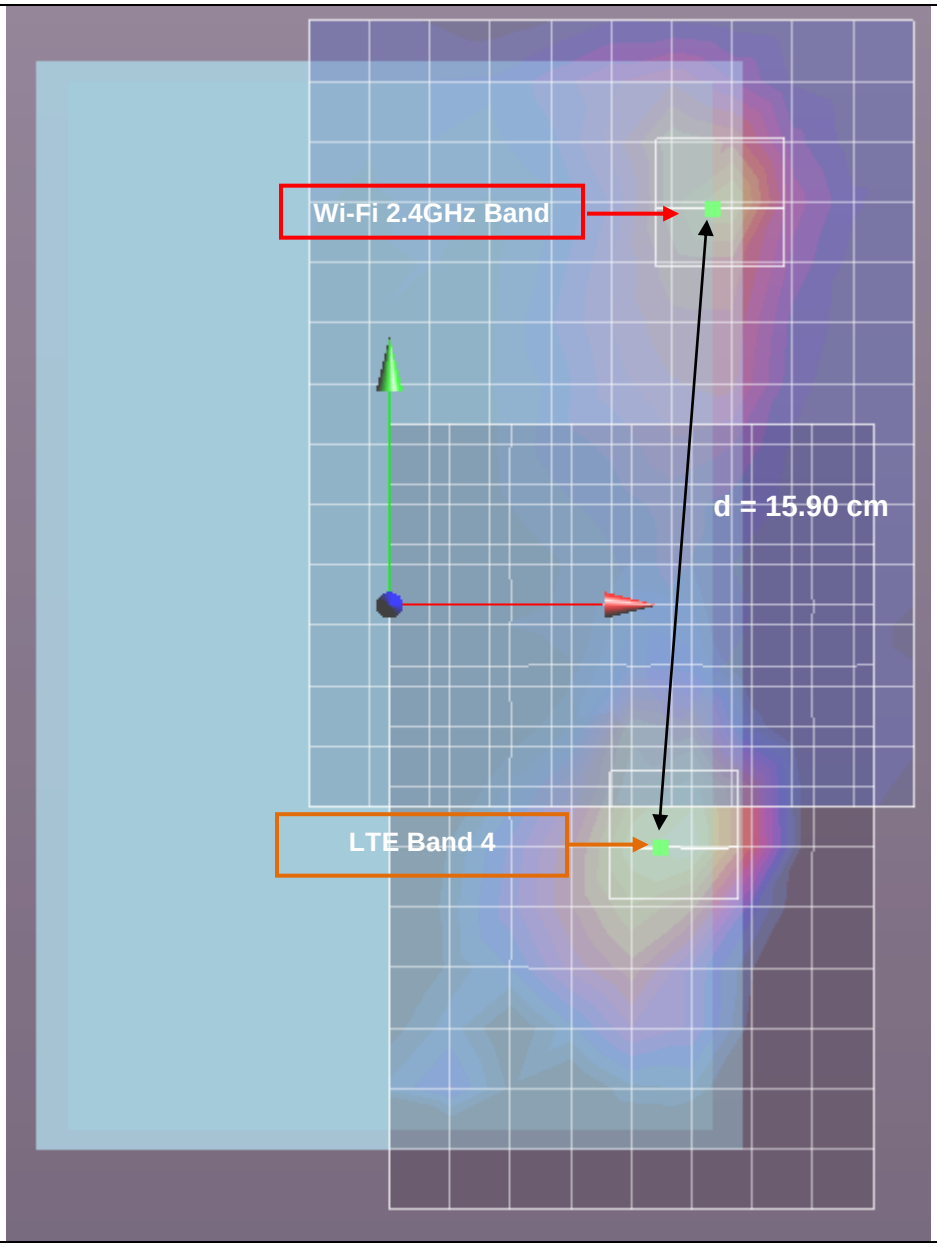
Mode	Peak SAR	X	Y	Z
	mW/g	m	m	m
WCDMA Band II	2.04	0.072	-0.057	-0.178
WiFi 2.4GHz Band	1.02	0.0789	0.0984	-0.183

Separation distance (cm)
15.56

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

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

Figure (3)



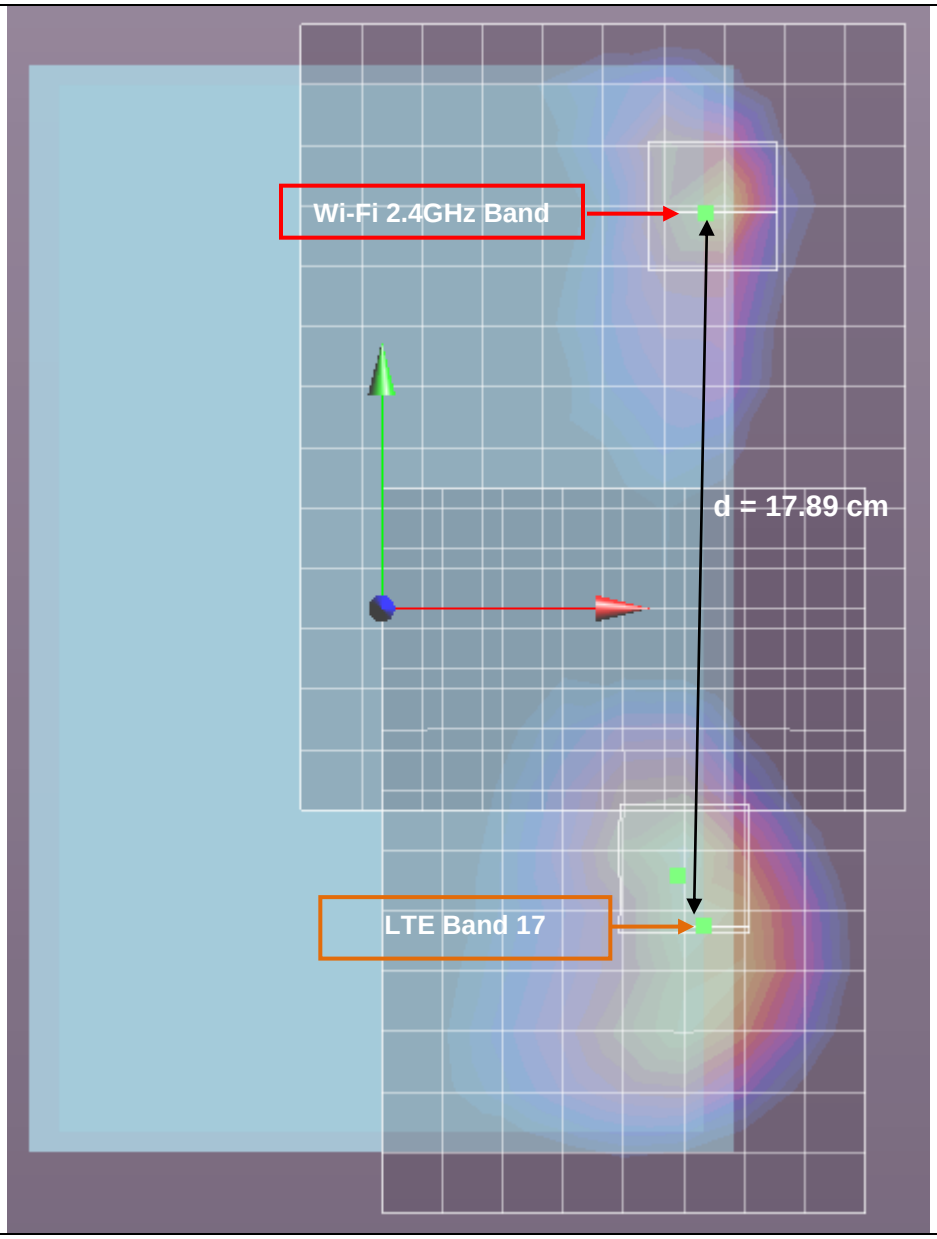
Mode	Peak SAR	X	Y	Z
	mW/g	m	m	m
LTE Band 4	3	0.0674	-0.0602	-0.181
WiFi 2.4GHz Band	1.02	0.0789	0.0984	-0.183

Separation distance (cm)
15.90

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

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

Figure (4)



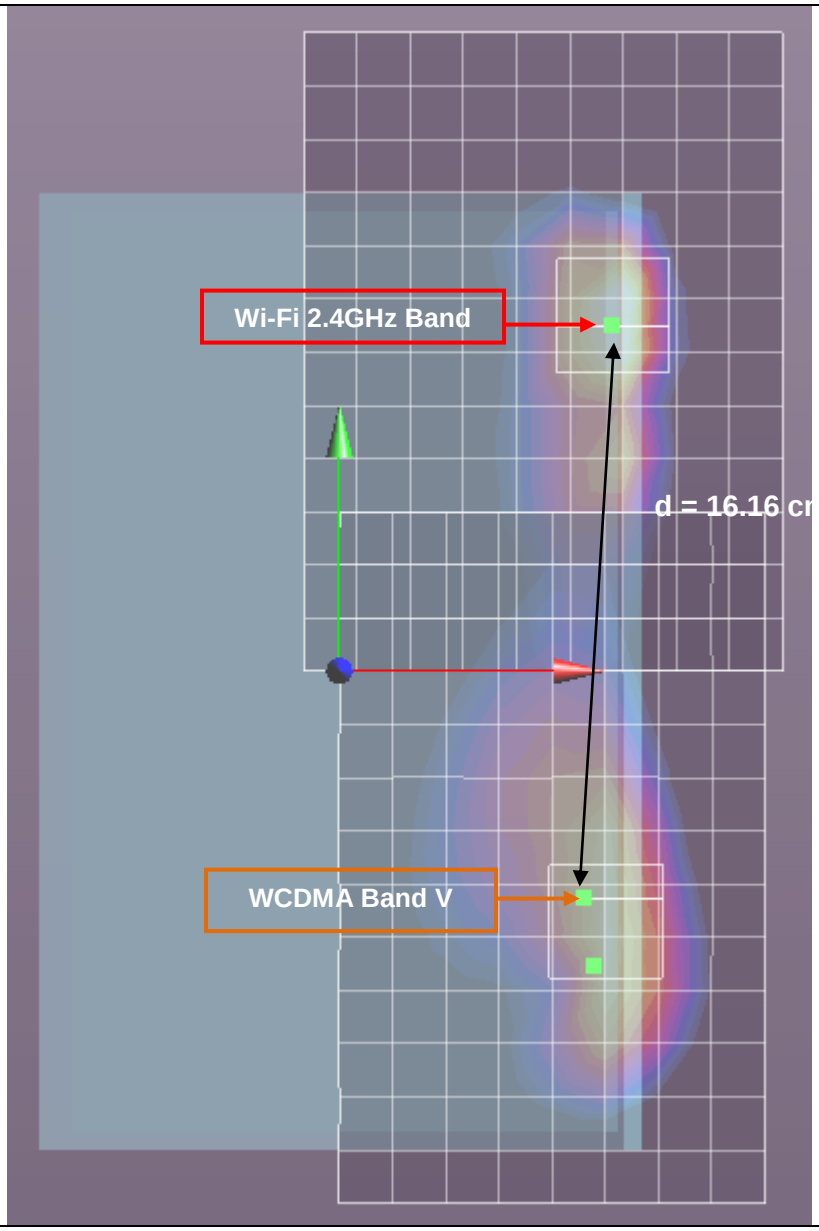
Mode	Peak SAR	X	Y	Z
	mW/g	m	m	m
LTE Band 17	1.66	0.0799	-0.0805	-0.181
WiFi 2.4GHz Band	1.02	0.0789	0.0984	-0.183

Separation distance (cm)
17.89

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

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

Figure (5)



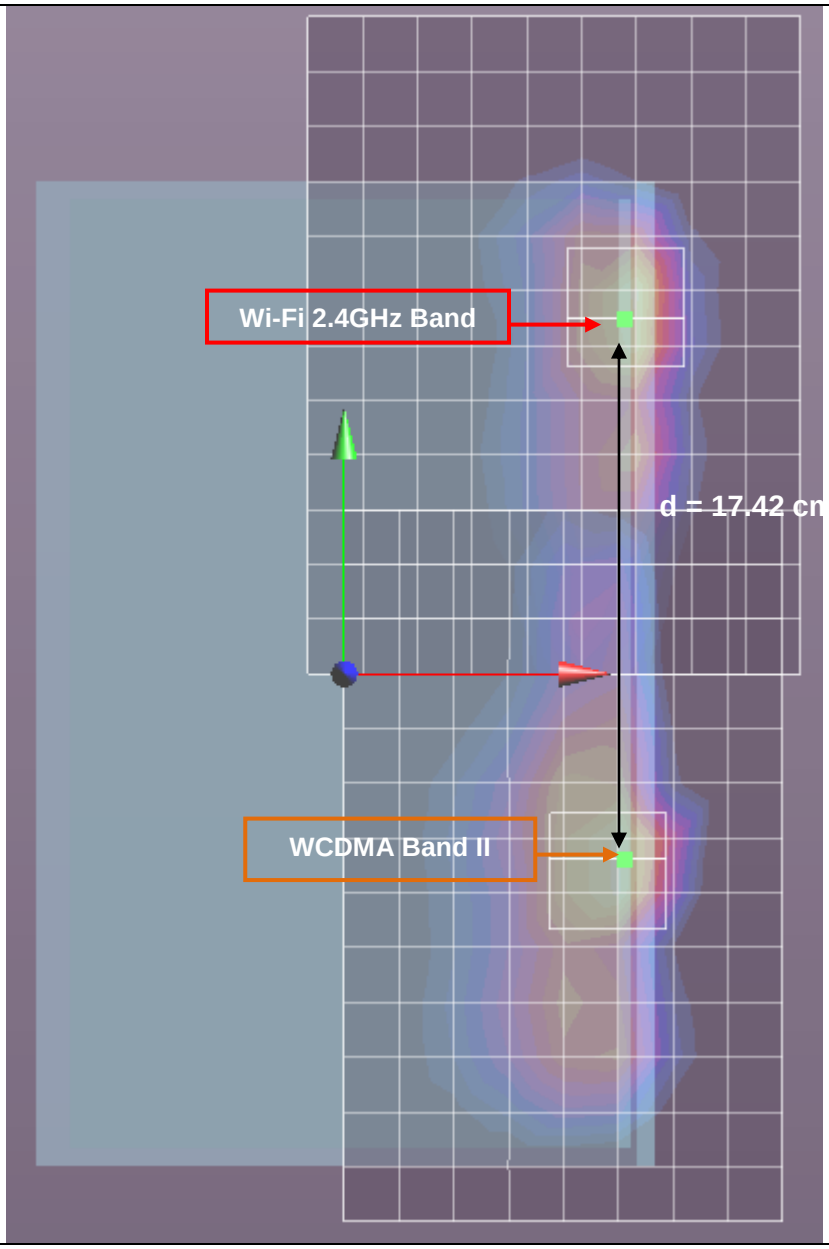
Mode	Peak SAR	X	Y	Z
	mW/g	m	m	m
WCDMA Band V	0.949	0.0687	-0.0641	-0.181
WiFi 2.4GHz Band	3.1	0.077	0.0973	-0.183

Separation distance (cm)
16.16

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

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

Figure (6)



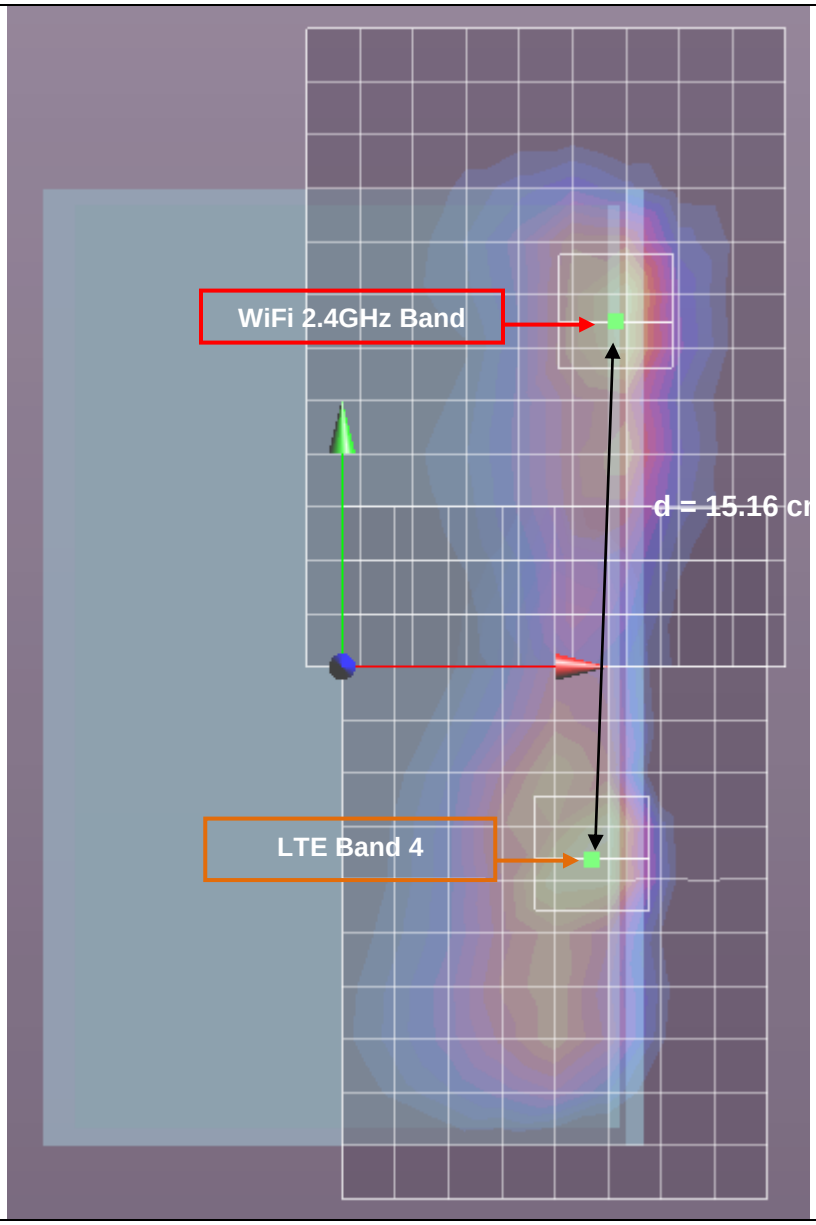
Mode	Peak SAR	X	Y	Z
	mW/g	m	m	m
WCDMA Band II	1.58	0.0625	-0.0763	-0.184
WiFi 2.4GHz Band	3.1	0.077	0.0973	-0.183

Separation distance (cm)
17.42

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

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

Figure (7)



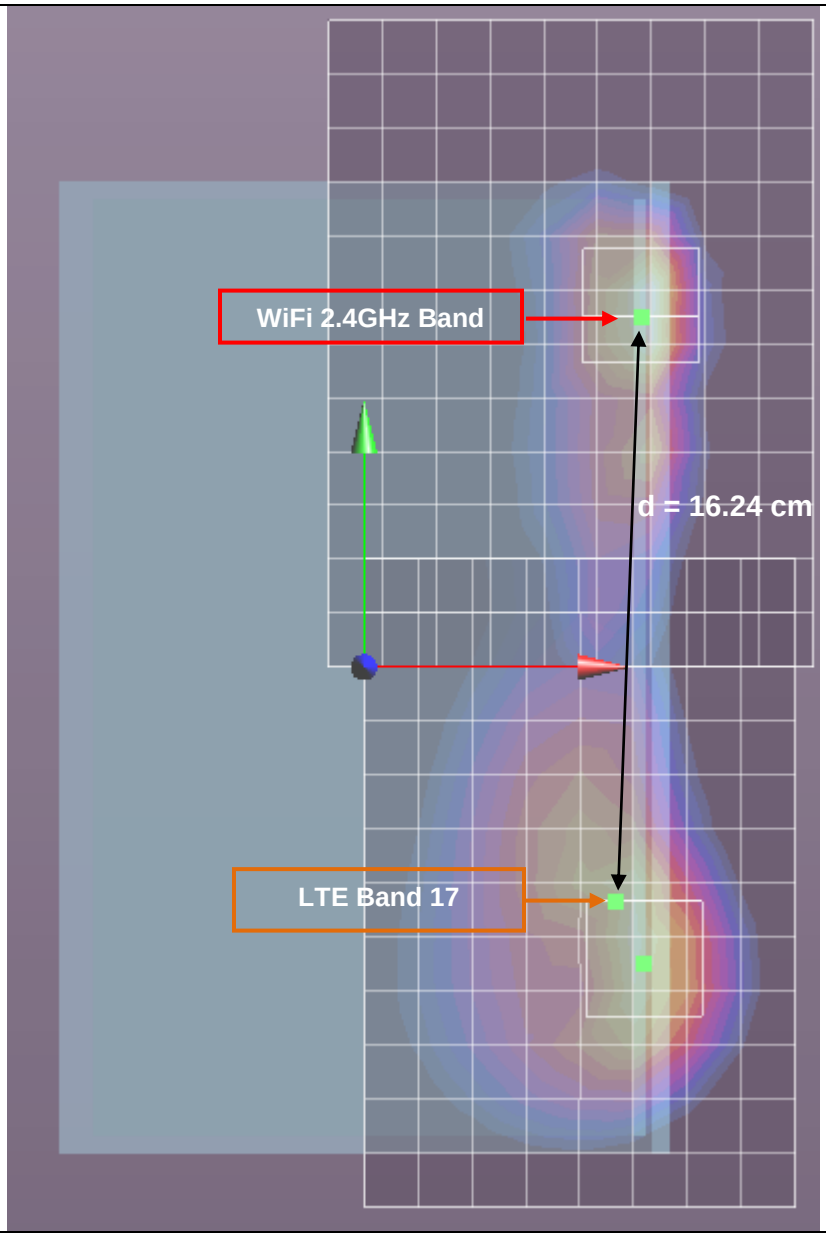
Mode	Peak SAR	X	Y	Z
	mW/g	m	m	m
LTE Band 4	2.5	0.0705	-0.0541	-0.181
WiFi 2.4GHz Band	3.1	0.077	0.0973	-0.183

Separation distance (cm)
15.16

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

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

Figure (8)



Mode	Peak SAR	X	Y	Z
	mW/g	m	m	m
LTE Band 17	1.25	0.0717	-0.065	-0.181
WiFi 2.4GHz Band	3.1	0.077	0.0973	-0.183

Separation distance (cm)
16.24

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

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

15.3. SAR to Peak Location Separation Ratio (SPLSR) for WWAN and Wi-Fi 5.2GHz

Test Position	Worst-case combination					∑ 1-g SAR (mW/g)	Calculated distance (cm)	SPLSR	Figure
	W-CDMA Band V	W-CDMA Band II	LTE Band 4	LTE Band 17	WiFi 5.2GHz Band				
Rear		1.440			0.344	1.784	18.21	0.098	9
			1.487		0.344	1.831	18.08	0.101	10

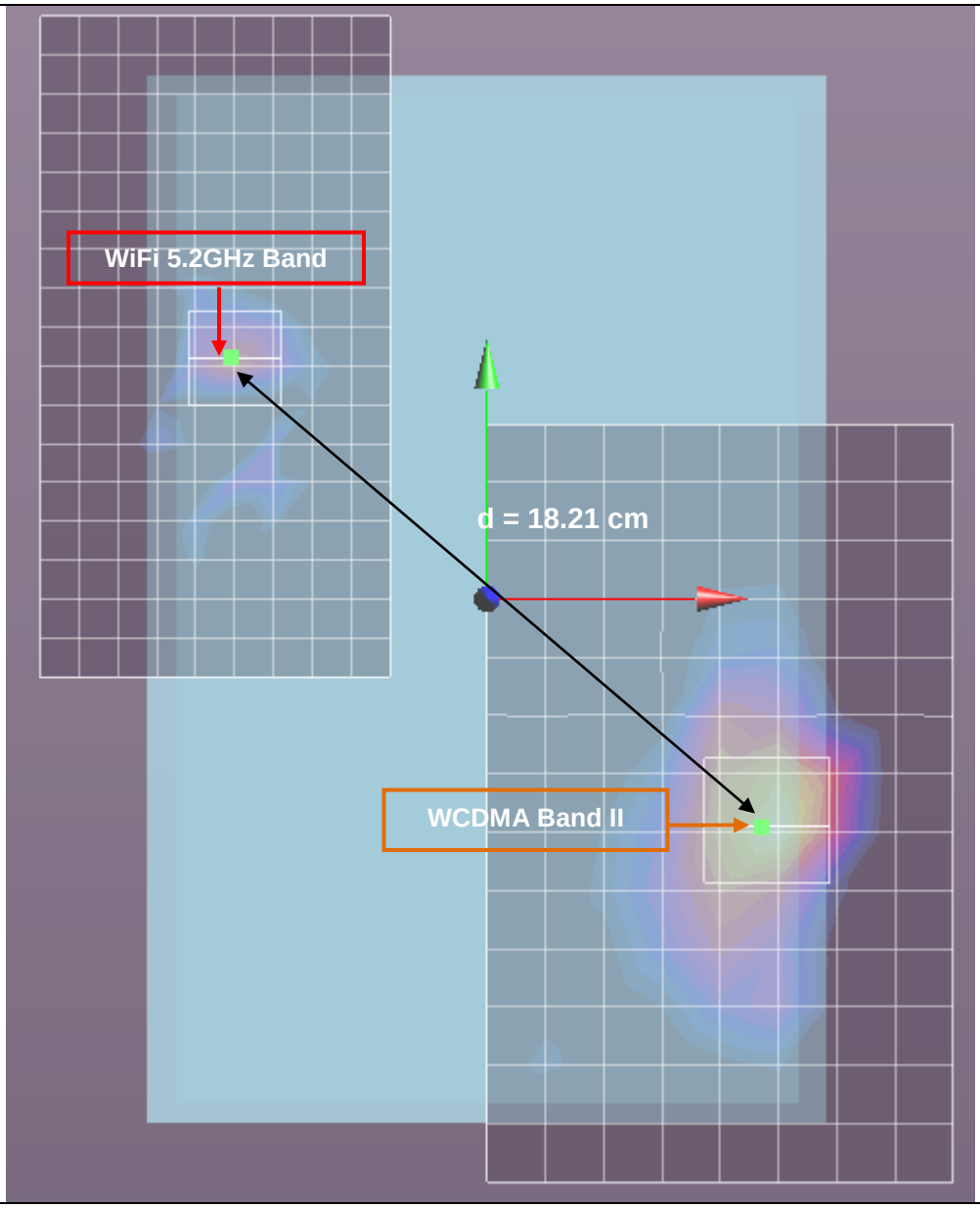
Conclusions:

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

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

SAR Peak Location Separation Distance

Figure (9)



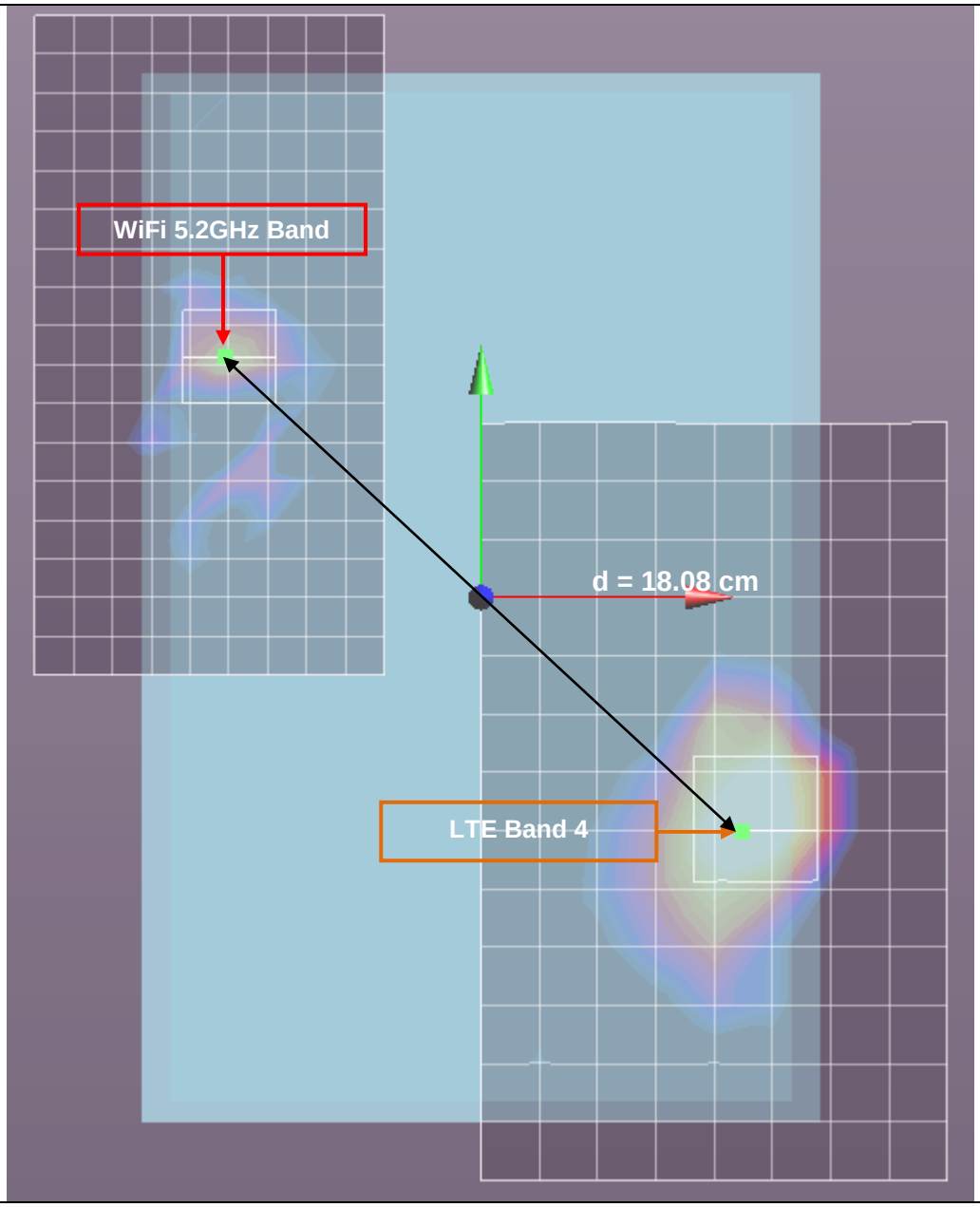
Mode	Peak SAR	X	Y	Z
	mW/g	m	m	m
WCDMA Band II	2.04	0.072	-0.057	-0.178
WiFi 5.2GHz Band	1.02	-0.0658	0.062	-0.181

Separation distance (cm)
18.21

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

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

Figure (10)



Mode	Peak SAR	X	Y	Z
	mW/g	m	m	m
LTE Band 4	3	0.0674	-0.0602	-0.181
WiFi 5.2GHz Band	1.02	-0.0658	0.062	-0.181

Separation distance (cm)
18.08

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

UL CCS
FORM NO: CCSUP4031G
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.

15.4. SAR to Peak Location Separation Ratio (SPLSR) for WWAN and Wi-Fi 5.3GHz

Test Position	Worst-case combination					∑ 1-g SAR (mW/g)	Calculated distance (cm)	SPLSR	Figure
	W-CDMA Band V	W-CDMA Band II	LTE Band 4	LTE Band 17	WiFi 5.3GHz Band				
Rear		1.440			0.548	1.988	18.55	0.107	11
			1.487		0.548	2.035	18.4	0.111	12

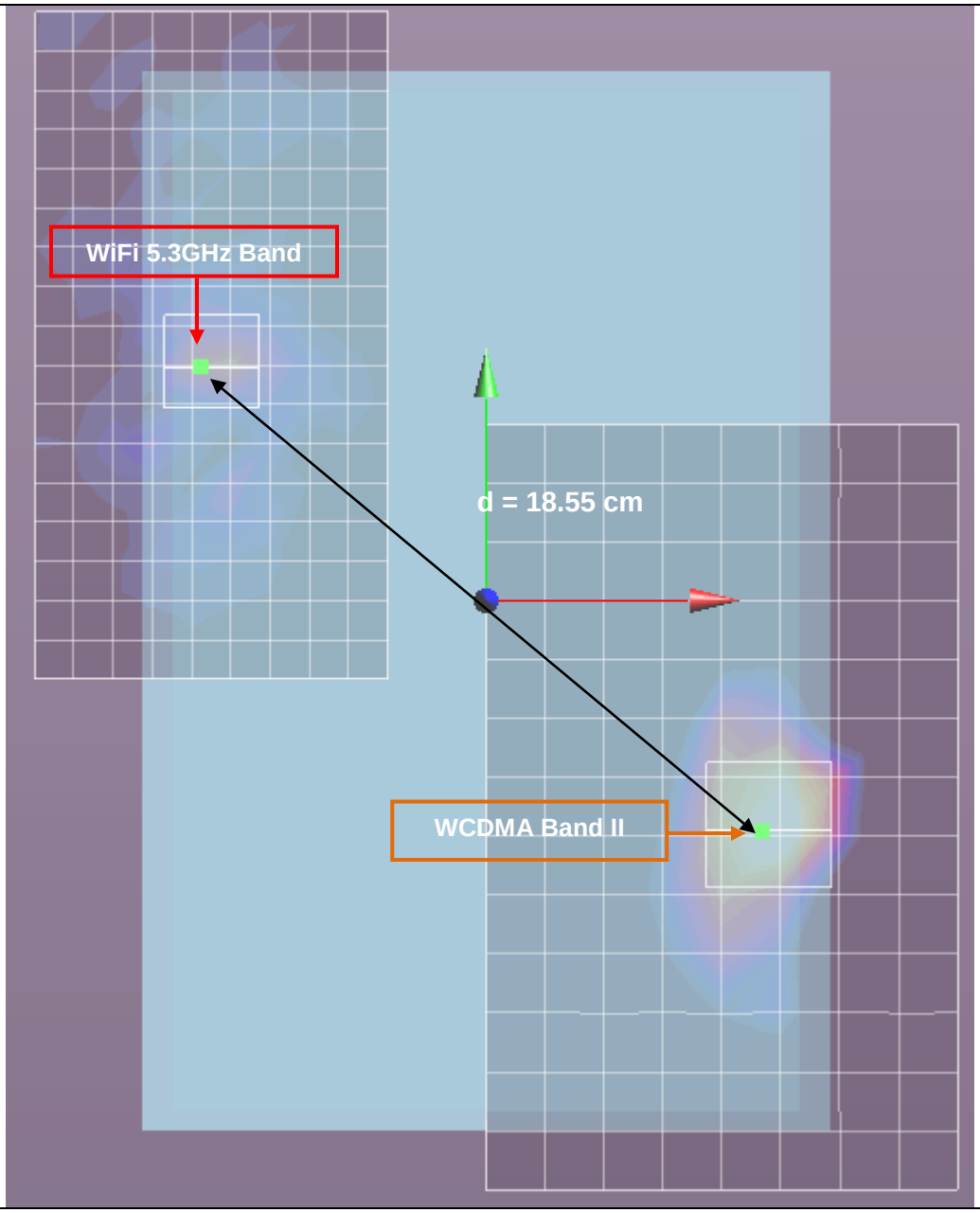
Conclusions:

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

UL CCS FORM NO: CCSUP4031G
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.

SAR Peak Location Separation Distance

Figure (11)



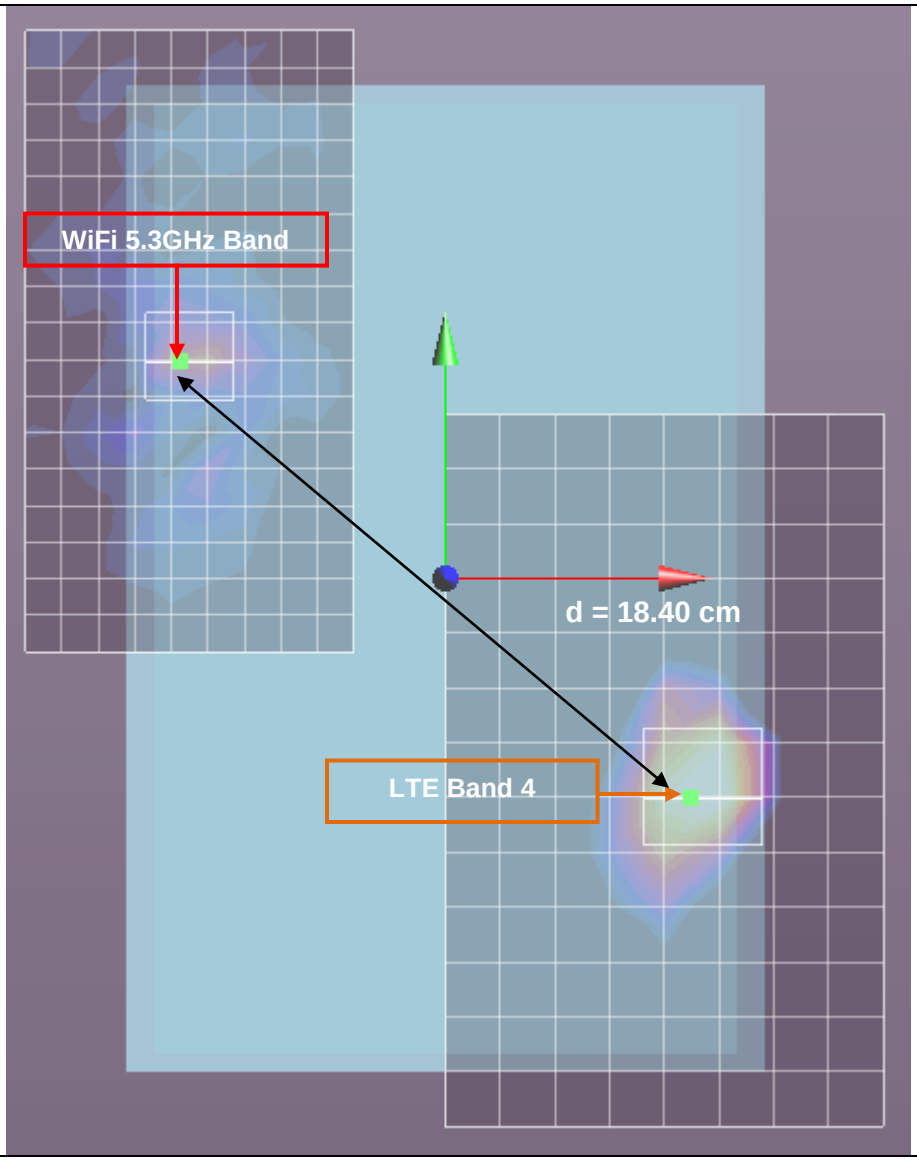
Mode	Peak SAR	X	Y	Z
	mW/g	m	m	m
WCDMA Band II	2.04	0.072	-0.057	-0.178
WiFi 5.3GHz Band	1.47	-0.0724	0.0594	-0.181

Separation distance (cm)
18.55

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

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

Figure (12)



Mode	Peak SAR	X	Y	Z
	mW/g	m	m	m
LTE Band 4	3	0.0674	-0.0602	-0.181
WiFi 5.3GHz Band	1.47	-0.0724	0.0594	-0.181

Separation distance (cm)
18.40

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

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

15.5. SAR to Peak Location Separation Ratio (SPLSR) for WWAN and Wi-Fi 5.5GHz

Test Position	Worst-case combination					∑ 1-g SAR (mW/g)	Calculated distance (cm)	SPLSR	Figure
	W-CDMA Band V	W-CDMA Band II	LTE Band 4	LTE Band 17	WiFi 5.5GHz Band				
Rear		1.440			0.714	2.154	19.32	0.111	13
			1.487		0.714	2.201	19.24	0.114	14
				0.900	0.714	1.614	21.59	0.075	15

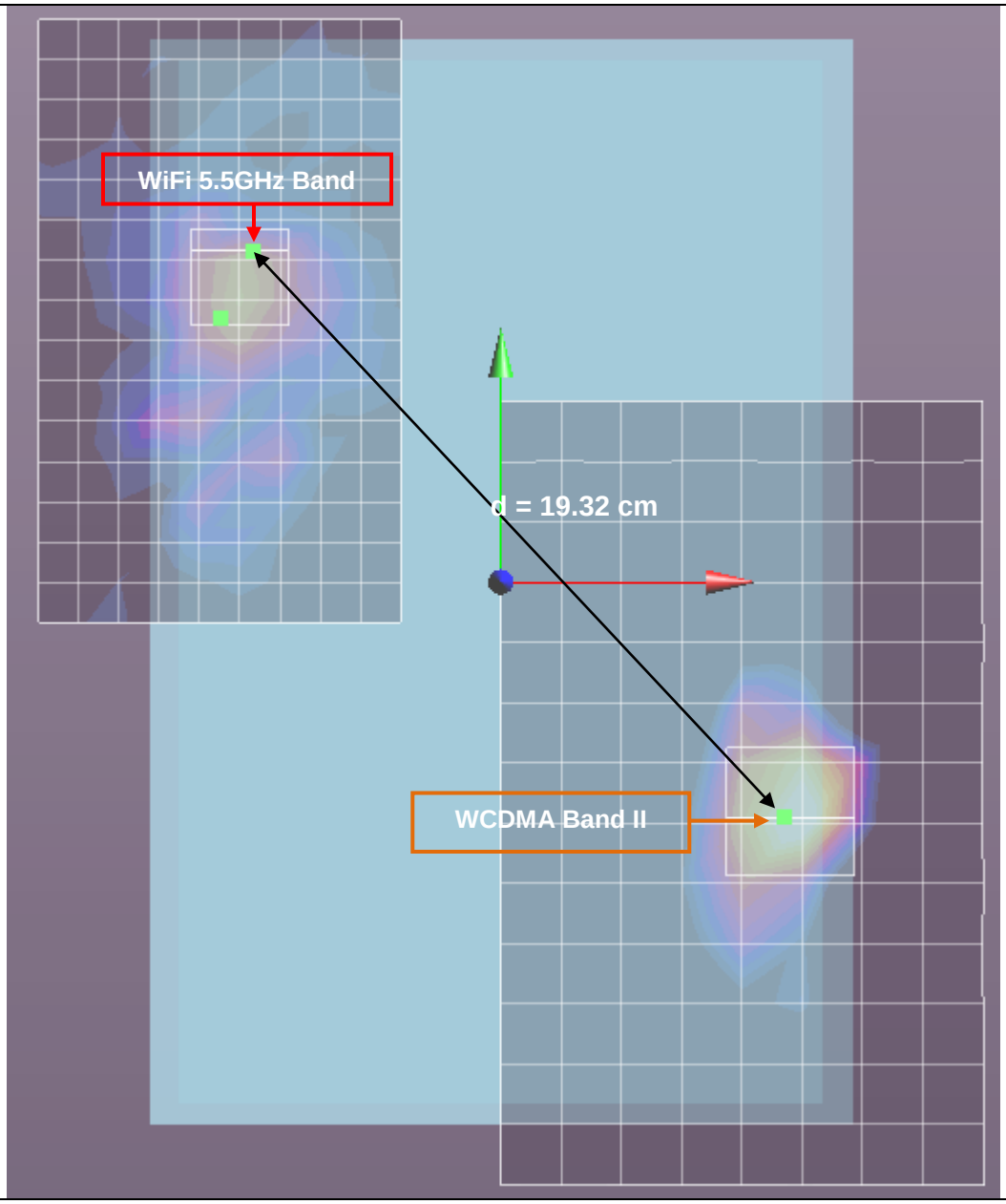
Conclusions:

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

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

SAR Peak Location Separation Distance

Figure (13)



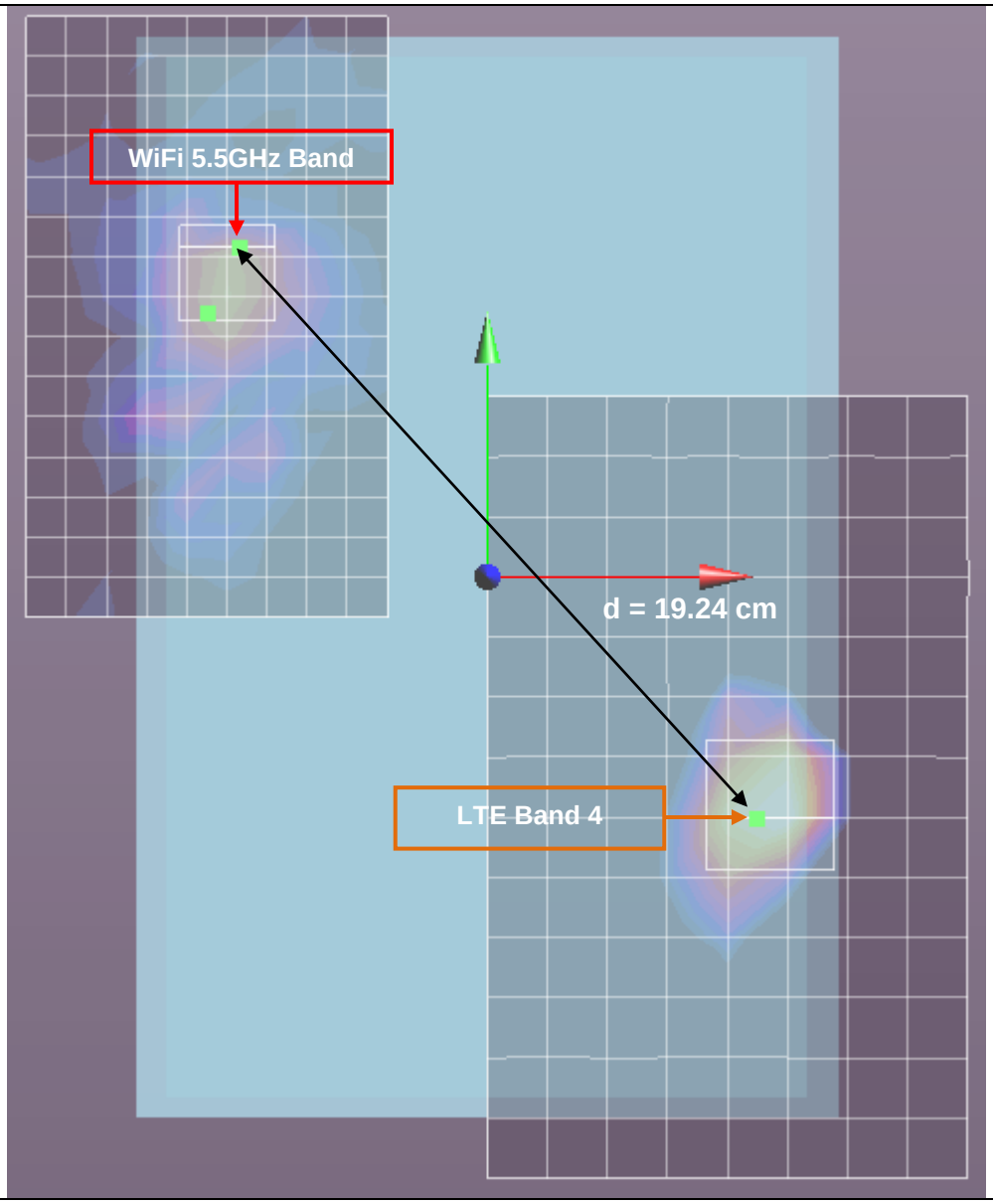
Mode	Peak SAR	X	Y	Z
	mW/g	m	m	m
WCDMA Band II	2.04	0.072	-0.057	-0.178
WiFi 5.5GHz Band	1.62	-0.0618	0.0824	-0.181

Separation distance (cm)
19.32

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

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

Figure (14)



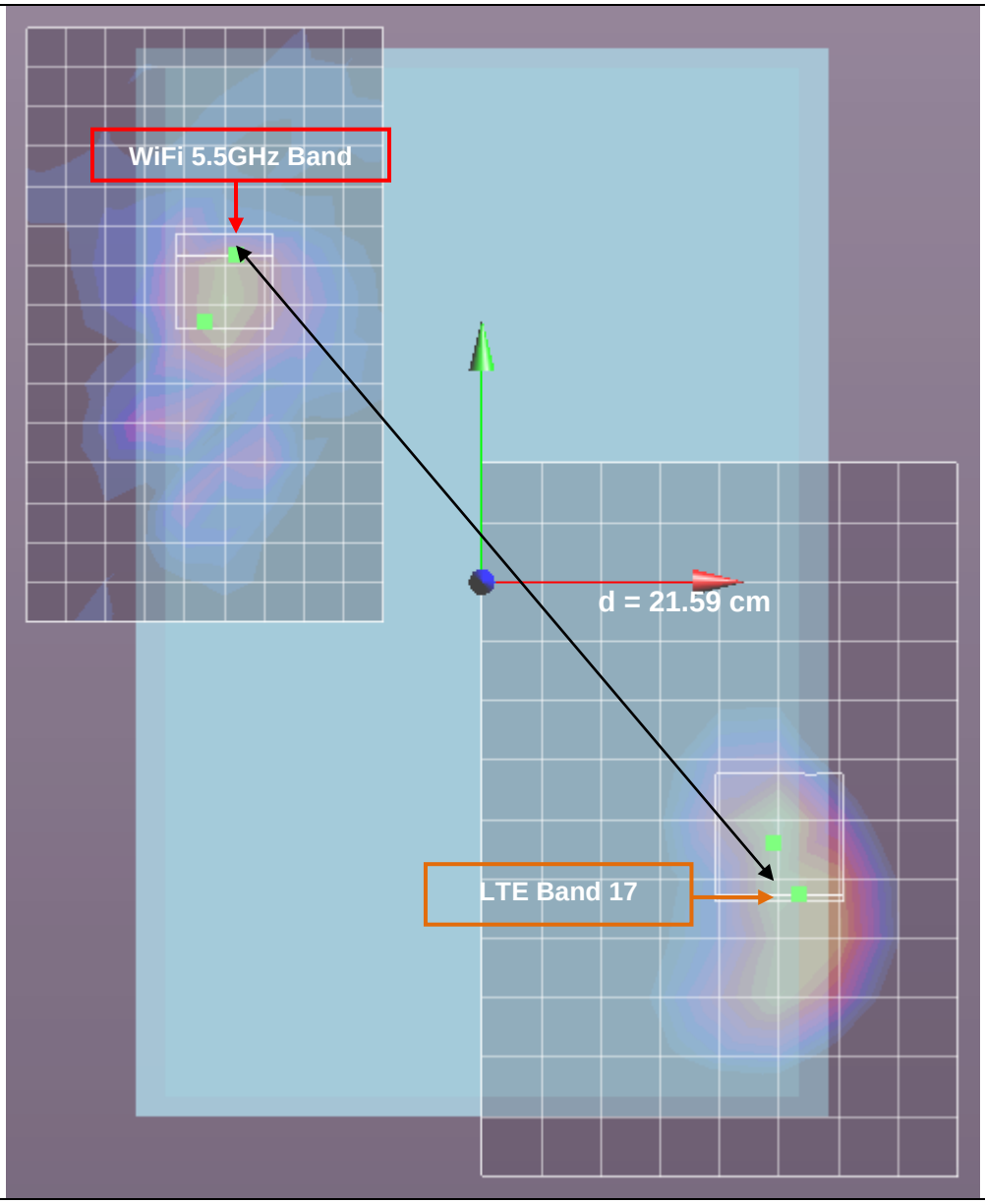
Mode	Peak SAR	X	Y	Z
	mW/g	m	m	m
LTE Band 4	3	0.0674	-0.0602	-0.181
WiFi 5.5GHz Band	1.62	-0.0618	0.0824	-0.181

Separation distance (cm)
19.24

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

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

Figure (15)



Mode	Peak SAR	X	Y	Z
	mW/g	m	m	m
LTE Band 17	1.66	0.0799	-0.0805	-0.181
WiFi 5.5GHz Band	1.62	-0.0618	0.0824	-0.181

Separation distance (cm)
21.59

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

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

15.6. SAR to Peak Location Separation Ratio (SPLSR) for WWAN and Wi-Fi 5.8GHz

Test Position	Worst-case combination					∑ 1-g SAR (mW/g)	Calculated distance (cm)	SPLSR	Figure
	W-CDMA Band V	W-CDMA Band II	LTE Band 4	LTE Band 17	WiFi 2.4GHz Band				
Rear		1.440			0.581	2.021	18.8	0.108	16
			1.487		0.581	2.068	18.66	0.111	17

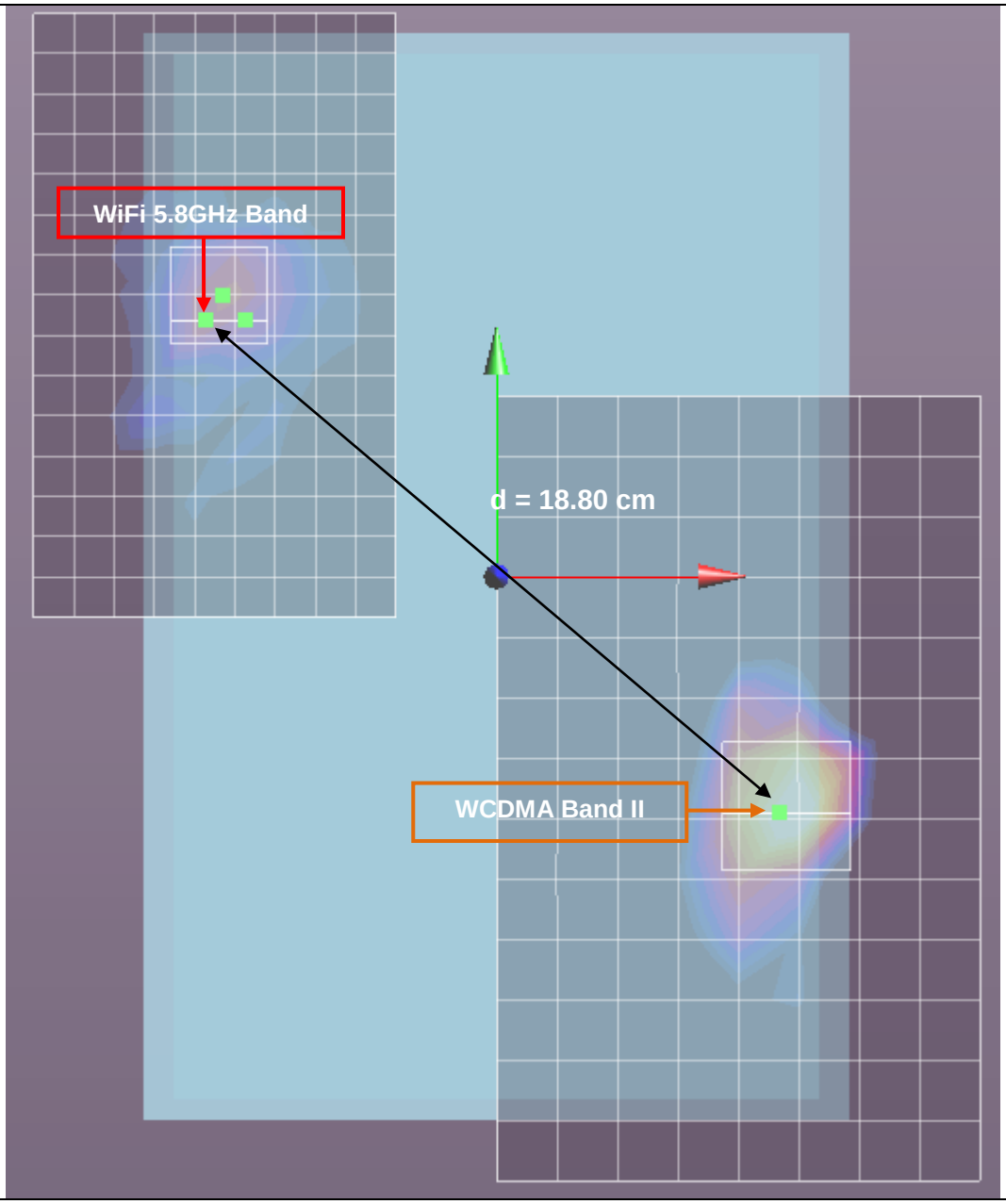
Conclusions:

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

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

SAR Peak Location Separation Distance

Figure (16)



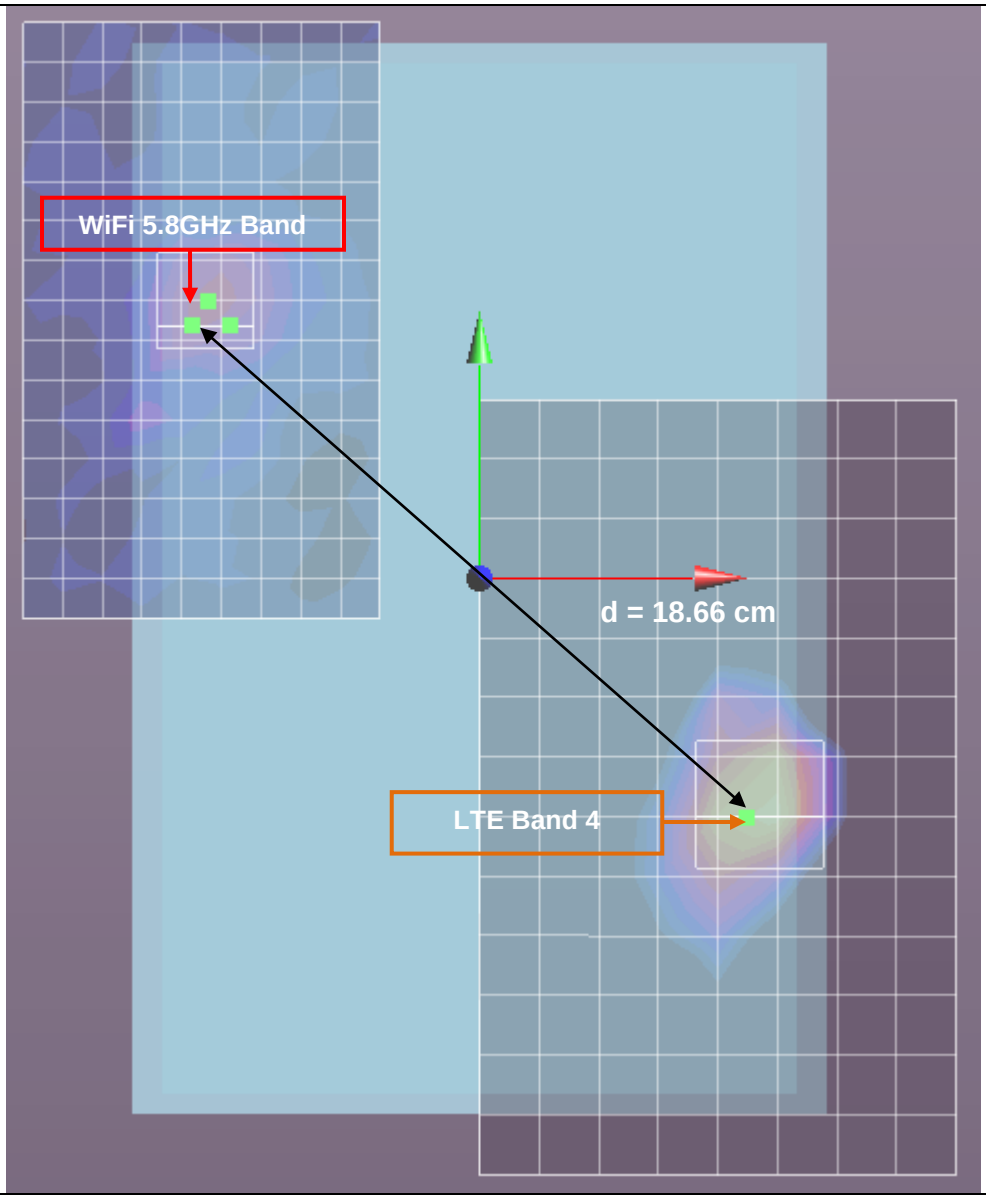
Mode	Peak SAR	X	Y	Z
	mW/g	m	m	m
WCDMA Band II	2.04	0.072	-0.057	-0.178
WiFi 5.8GHz Band	1.57	-0.0722	0.0636	-0.181

Separation distance (cm)
18.80

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

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

Figure (17)



Mode	Peak SAR	X	Y	Z
	mW/g	m	m	m
LTE Band 4	3	0.0674	-0.0602	-0.181
WiFi 5.8GHz Band	1.57	-0.0722	0.0636	-0.181

Separation distance (cm)
18.66

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

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

16. Appendixes

Refer to separated files for the following appendixes.

16.1. System Performance Check Plots

16.2. SAR Test Plots for WCDMA (UMTS) Band V

16.3. SAR Test Plots for WCDMA (UMTS) Band II

16.4. SAR Test Plots for LTE Band 4

16.5. SAR Test Plots for LTE Band 17

16.6. SAR Test Plots for Wi-Fi 2.4 GHz Band

16.7. SAR Test Plots for Wi-Fi 5 GHz Bands

16.8. Calibration Certificate for E-Field Probe EX3DV4 - SN 3772

16.9. Calibration Certificate for E-Field Probe EX3DV4 - SN 3749

16.10. Calibration Certificate for D750V3 - SN 1024

16.11. Calibration Certificate for D835V2 - SN 4d002

16.12. Calibration Certificate for D1750V2 - SN 1050

16.13. Calibration Certificate for D1900V2 - SN 5d043

16.14. Calibration Certificate for D2450V2 - SN 748

16.15. Calibration Certificate for D5GHzV2 - SN 1075

16.16. Calibration Certificate for D1900V2 - SN 5d140

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